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Improvements to Contributions from Neutron Inelastic Scattering for Next-Event Estimators in MCNP® Software

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Abstract

An improvement to the handling of contributions from neutron inelastic scattering to next-event estimators has been implemented in the MCNP6® software for release with version 6.3.1. The kinematic equations that govern the outgoing energy of inelastic neutron scattering contributions to next-event estimators have two roots. Historically, the implementation in the MCNP coding has only used the upper root to the quadratic equation. This includes all versions predating version 6.3.1 including all versions of MCNP5 and MCNPX software. However, a review of the neutron next-event estimator physics has shown that this does not reproduce the track-length estimator results at low energies. Several examples are presented that test single neutron inelastic scattering reaction types, Level Scattering (Law 3), Tabulated Energy Angle (Law 61), and Kalbach-Mann distribution (Law 44). The test problems compare the track-length estimator (`f4` tally) in the MCNP software, with the existing implementation of the neutron next-event estimator (`f5` tally), and the modified changes to the neutron next-event estimator implementation. As the MCNP implementation ignores the lower root, the unmodified neutron next-event estimators will generally underestimate the lower energy contribution. However, a second issue with the Kalbach-Mann distribution (Law 44) implementation allows contributions to backward scattering in the center-of-mass frame that is not kinematically possible, thus overestimating backward scattering contributions. A third issue with the way the MCNP implementation handles floating point comparison for scattering directly ahead or directly backward in the center-of-mass frame generally leads to underestimation (except for backwards scattering for Law 44).

1 Kinematics of Neutron Inelastic Scattering

The implementation of contributions from neutron inelastic scattering to next-event estimators [1] (NEEs) in MCNP® coding is taken from Eq. 5.14 in the canonical Monte Carlo text of Carter and Cashwell[2]. Carter and Cashwell states

"... the lower root E'_- can usually be ignored without introducing appreciable error."

While this may be true for specific applications, this is not true for all applications. As the MCNP software is intended as a general purpose radiation transport solver this is a poor assumption. Additionally, treating only the upper root is not consistent with the implementation in MCNP coding for neutron elastic scattering with a moving target in the case of the free gas thermal treatment. For the free gas thermal treatment of a neutron scattering elastically off a moving isotope due to temperature effects, the implementation considers both the upper and lower roots by sampling both with equal probability.

A recent review of the neutron next-event kinematics[3] provides the outgoing neutron energy, $E'_\pm$ and the Jacobian $(\partial\mu_c/\partial\mu_l)$ for all cases of inelastic and elastic scattering with moving and stationary targets. The Jacobian $(\partial\mu_c/\partial\mu_l)$ is used for conversion of the differential angular probabilities from the center-of-mass (COM) to laboratory frame (LAB), $p(\mu_l) = p(\mu_c)\partial\mu_c/\partial\mu_l$.

The expression for the outgoing neutron energy in the LAB frame, $E'_\pm$, is

$$E'_{l\pm} = E_{cm}\left[\mu_l \pm D\right]^2 , \tag{1}$$

where E_{cm} is energy of a neutron traveling at the speed of the COM frame, μ_l is the scattering angle in the LAB frame, and D is the square root of the discriminate of the quadratic equation. Note that with the notation used here, E_{cm} is NOT the incoming neutron energy in the COM frame, that would be denoted in the current notation as E_c. D is

$$D = \sqrt{\mu_l^2 - \left(1 - \frac{E'_c}{E_{cm}}\right)} , \tag{2}$$

where E'_c is the outgoing neutron energy in the COM frame. For inelastic neutron scattering, E'_c is provided by the nuclear data. For inelastic neutron scattering with a stationary target, the energy of a neutron traveling at the speed of the COM frame, E_{cm}, is

$$E_{cm} = \frac{E_l}{(A+1)^2} , \tag{3}$$

where E_l is the incoming neutron energy in the LAB frame and A is the ratio of the target's mass to the mass of the neutron. And an expression for the Jacobian $(\partial\mu_c/\partial\mu_l)$ that is valid for both roots is

$$\frac{\partial\mu_c}{\partial\mu_l} = E'_l \frac{1}{\sqrt{E'_c E_{cm} D^2}} . \tag{4}$$

Eqs. (1) and (4) can be plotted by using Q value of reactions to obtain E'_c, which is normally provided by the nuclear data. E'_c is related to Q value by the expression

$$E'_c = Q\left(\frac{A}{A+1}\right) + E_l\left(\frac{A}{A+1}\right)^2 . \tag{5}$$

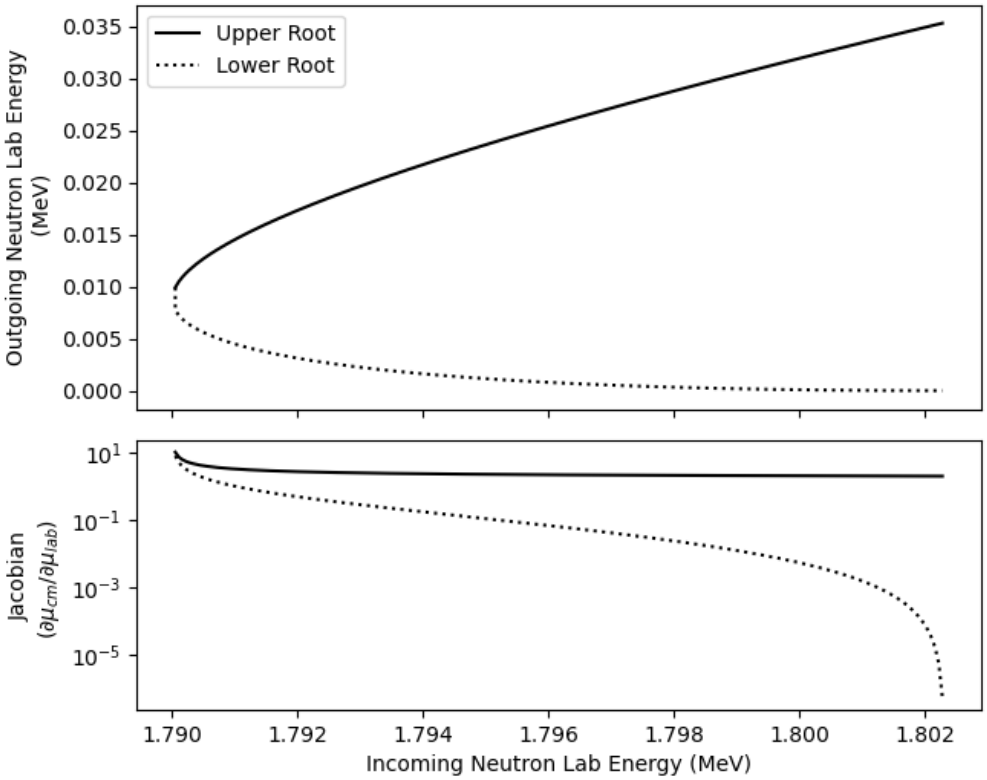

Figure 1: Outgoing neutron energy and Jacobian as a function of incoming neutron energy at a scattering cosine angle of $\mu_l = 0.9$ for inelastic (n,2n) scattering on Deuterium (A=1.9968, Q=−2.225 MeV). Upper root depicted with a solid line (——) and lower root depicted with a dotted line (·····).

The outgoing neutron energy and the Jacobian as a function of incoming neutron energy are plotted in Figure 1 for (n,2n) inelastic scattering on Deuterium (A=1.9968, Q=−2.225 MeV) for a cosine scattering angle of $\mu_l = 0.9$. It can be seen that ignoring the lower root will produce a neutron spectrum missing the lower energy neutrons. Although the Jacobian for these neutron from the lower root is small, these neutrons may be important for some applications. In most simulations however, the signal from such inelastic reactions will be overwhelmed by contributions due to elastic scattering due to its generally higher cross section.

At the lower bound where threshold of the reaction is just met, the Jacobian spikes to a large value. This becomes more pronounced as μ_l approaches 1.0 (i.e. scattering straight ahead). This is similar to the situation with photon coherent scattering (Thomson scattering) at $\mu_l = 1.0$ when the next-event estimator scores can approach infinity (See MCNP6.3 Manual Section 2.4.4.2.5 [4]). We can see this mathematically by replacing μ_l with unity in Eqs. (1) and (4)

$$\frac{\partial \mu_c}{\partial \mu_l} = \left[\frac{1}{A+1} \sqrt{\frac{E_l}{E'_c}} \pm 1 \right]^2 . \tag{6}$$

Near the limit of the reaction where the threshold is just met, E'_c approaches zero, and thus the Jacobian approaches infinity. However, sampling a scattering at exactly $\mu_l = 1.0$ and near the threshold of the inelastic reaction is generally a rare event.

The roots of Eq. (1) are limited by the following constraints.

1. If $E_c' \leq 0$, no roots are valid.
2. If $E_c' > E_l/(A+1)^2$, only the root with the + sign is valid.
3. If $0 < E_c' < E_l/(A+1)^2$ and $\sqrt{1-(A+1)^2 E_c'/E_l} < \mu_l < 1$, both roots are valid.

Replacing E_c' with Eq. (5) allows this limits to be expressed in terms of Q-value.

1. If $E_l \leq -Q(A+1)/A$, no roots are valid.
2. If $E_l > -QA/(A-1)$, only the root with the + sign is valid.
3. If $-Q(A+1)/A < E_l < -QA/(A-1)$ and $\sqrt{1-A^2-QA(A+1)/E_l} < \mu_l < 1$, both roots are valid.

2 The MCNP Implementation of Neutron Inelastic Scatter for NEEs

In this section, the implementation of neutron next-event estimators for inelastic scattering in the MCNP code will be compared to the kinematic equations and limits derived so far. Note that the coding presented here has been simplified for readability by removing the notation for the Fortran derived types. In the MCNP software, the point detector tally routine, `tallyd.F90` calls `calcps.F90`, which calculates the probability of scatter toward the detector and the energy of the out-going neutron in the LAB frame.

The suggested changes to `calcps.F90` are listed in Appendix J .

2.1 Inelastic Level Scattering

The MCNP `calcps.F90` coding for next-event estimator contributions for general inelastic scattering with a stationary target is given in Listing 1.

Listing 1: The MCNP existing coding for inelastic level scattering with a stationary target

```
1  !  >>>>> Law 3,  ipsc=5 -- neutron or photon from collision with stationary target.
2  if( mcal/=0 )  goto 100
3  if( ixcos==0 .and. ntyn>=0 ) goto 999 ! Return
4  cs = uold(1)*u + uold(2)*v + uold(3)*w
5  aw = awn(iex)
6
7  ! inelastic scattering case.  see carter & cashwell eqn. 5.9,5.10
8  if( ntyn>=0 )  goto 60
9  t3 = one-ergace*(one+aw)**2/ergp
10 if( t3>zero ) then
11 psc = zero
12 goto 999 ! Return
13 endif
14
15 t1 = one/(one+aw)
16 erg = ergp*(t1*(cs+sqrt(cs**2-t3)))**2
17 if(  erg< elc(neutron) ) goto 999 ! Return
18 t2 = sqrt(erg/ergace)
19 t4 = t1*sqrt(ergp/erg)
20 psc = half*t2/(one-cs*t4)
21 if( xcos==0 ) goto 999 ! Retunr
22 cs = t2*(cs-t4).
23 goto 60
```

`t3` on line 9 is

$$\texttt{t3} = 1 - \frac{E'_c}{E_l}(1+A)^2 = 1 - \frac{E'_c}{E_{cm}}\,. \tag{7}$$

The first obvious issue, on line 16, is that only the positive root of Eq. (1) is considered. This has been corrected in the modified code by performing equal sampling of the upper and lower roots.

A second less obvious issue is on line 11, where a zero probability (`psc`=0.0), or no-contribution, is returned. This case is invoked on line 10 when `t3` is greater than 0.0. Here `t3` is the term in the second (2) and third (3) limits, $E'_c > E_l/(A+1)^2$ and $E'_c < E_l/(A+1)^2$. If `t3 > 0` then third limit is met and implies that the upper root is valid and the lower root is not valid. However the coding in MCNP returns a zero probability (`psc`=0.0) in this case, even though the upper root is valid. It is possible that this has been implemented in the MCNP coding in order to stay far away from large contributions when the threshold of the reaction is just met, i.e. E'_c is near 0.0. But this is not consistent with the other two implementations of inelastic scattering for Laws 44 and 61. This second issue has been corrected in the modified coding to be consistent for all inelastic scattering laws.

A third issue resulting from floating point precision occurs on line 22. If during the course of looking up the nuclear data from the cosine scattering angle (`cs`), calculated on line 22, is greater than 1.0 or less than -1.0 then a zero probability is returned. However, due to floating point math μ_c, may be less to -1.0 such that $-1.0 - \epsilon < \mu_c < -1.0$, which is equivalent to $\mu_c = -1.0$. Alternatively μ_c may greater than 1.0 and is still be valid if $1.0 < \mu_c < 1.0 + \epsilon$. In other words μ_c is in fact -1.0 or 1.0 but a zero probability is returned. This is one of the perils of floating point comparison which computational physics are warned[5]. In order to correct this, a test for μ_c within an epsilon value of -1.0 or 1.0 has been added to the modified MCNP code.

2.2 Law 44 - Kalbach 87

The MCNP coding for Law 44 (Kalbach-87) in `calcps.F90` is nearly identical to level scattering except the probability of scattering into a specific center-of-mass angle is not provided in tabular form, instead it is provided in functional form

$$p(\mu, E_{in}, E_{out}) = \frac{1}{2}\frac{A}{\sinh(A)}\left[\cosh(A\mu) + R\sinh(A\mu)\right] . \tag{8}$$

The existing implementation of Law 44 (Kalbach-87) in the MCNP coding is provided in Listing 2.

Listing 2: The existing MCNP coding for Law 44 - Kalbach 87

```
1  !  >>>>>  ipsc=14 -- neutron from kalbach-87 endf/b-vi coupled energy-
2  ! angle collision (law 44).  similar to ipsc=5 inelastic scatter.
3  cs = uold(1)*u + uold(2)*v + uold(3)*w
4  a1 = one+awn(iex)
5
6  t3 = one - ergace * a1**2 / ergp
7  if( t3 >= cs**2 ) then
8    psc = zero
9    goto 999 ! Return
10 endif
11
12 t1 = one/a1
13
14 ! erg from carter and cashwell eqn. 5.14
15 erg = ergp*( t1 * (cs + sqrt(cs**2-t3) ) )**2
16 if( erg<elc(ipt) ) goto 999 ! Return
17
18 t2 = sqrt(erg/ergace)
19 t4 = t1*sqrt(ergp / erg)
```

```
20
21 ! cm from carter and cashwell eqn. 5.10
22 cm = t2*(cs-t4)
23
24 ! limit cm
25 if( cm < -1.0_DKND ) cm = -1.0_DKND
26 if( cm >  1.0_DKND ) cm =  1.0_DKND
27
28 t5 = sinh( tpd(2) ) * ( one - cs*t4 )
29 if( t5<=zero ) then
30   psc = zero
31   goto 999 ! Return
32 endif
33
34 ! kalbach-87 psc=(.5*a/sinh(a))*(cosh(a*cm)+r*sinh(a*cm))
35 ! d cm/d cs = t2/(1 - cs*t4)  carter and cashwell eqn 5.13
36 psc = half*( cosh(tpd(2)*cm) + tpd(1)*sinh( tpd(2)*cm) ) * tpd(2)*t2/t5
37 goto 999 ! Return
```

Unlike level scattering, the test of `t3` for Kalbach-87 on line 7 does allow the upper root of Eq. (1) in the range of $-Q(A+1)/A < E_l < -QA/(A-1)$. But like level scattering, the implementation (line 15) does not provide for the solution of the lower root in this range.

The existing coding for Kalbach 87 also has conditions for cosine scattering angles with $\mu < -1.0$ and $\mu > 1.0$ on lines 25 and 26 . The existing coding of reseting the out-of-range values to either -1.0 or 1.0 is not correct as values much less than -1.0 or much greater than 1.0 are not valid. The modified implementation corrects both of these issues.

2.3 Law 61 - Tabulated Energy Angle Data

The existing implementation in `calcps.F90` for Law 61, Tabulated Energy Angle Data, which is listed in Listing 3, is very similar to the implement for Kalbach 87.

Listing 3: The existing MCNP coding for Law 61

```
1  !  >>>>>  ipsc=16 -- neutron from law 61 (tabulated energies / angles).
2
3  ! cs is laboratory cosine to next event estimator.
4  cs = uold(1)*u + uold(2)*v + uold(3)*w
5
6  ! if lab system, but anisotropic, go to table lookup for psc.
7  ! since we're in the lab system, erg for next-event direction
8  ! is no different than erg in actual as-sampled direction.
9  if( ntyn>=0 )  goto 60
10 a1 = one+awn(iex)
11
12 ! scattering distributions are in the cm system.
13 ! ergace is previously-sampled cm energy.  ergp is incident energy.
14 !
15 ! to find valid lab cosines, start with eq. in case 3 of p. 69
16 ! from carter and cashwell.  substitute in for q based on
17 ! their eq. 5.8.  then wind up with following condition,
18 ! which is identical to that used by hendricks later in
19 ! this routine for ipsc=14.  if t3 > cs**2, cannot scatter
20 ! toward next-event position.
```

```
21 t3 = one - ergace * a1**2 / ergp
22 if( t3>cs**2 ) then
23   psc = zero
24   goto 999 ! Return
25 endif
26
27 ! scattering is valid.  calculate lab energy (erg) via following
28 ! equation as in ipsc=14 code (equivalent to eq. 5.14 of carter
29 ! and cashwell).
30 t1 = one / a1
31 erg = ergp * ( t1* (cs + sqrt(cs**2-t3) ) )**2
32
33 ! return if this energy is below particle's energy cutoff.
34 if( erg < elc(ipt) ) goto 999 ! Return
35
36 ! now, we need to calculate the d-cm cosine by d-lab cosine
37 ! and apply this factor to the psc.  start with eq. 5.13 of
38 ! carter and cashwell, which reduces to the following for
39 ! psc (the extra 0.5 is a starting assumption of isotropy).
40 ! formalism is identical to ipsc=14 and ipsc=5.
41 t2 = sqrt( erg / ergace)
42 t4 = t1 * sqrt( ergp / erg )
43 psc = half * t2 / ( one - cs * t4 )
44
45 ! if isotropic in cm, return.
46 if( ixcos==0 ) goto 999 ! Return
47
48 ! otherwise, determine cm cosine (overwrite cs with it).  start
49 ! with eq. 5.10 of cashwell and carter.  formalism is same as
50 ! for ipsc=5 and ipsc=14.
51 cs = t2 * ( cs - t4 )
52
53 ! now (finally) go to table lookup to actually determine psc
54 goto 60
```

Like the implementation of Kalbach 87, the comparison of `t3` on line 22 allows the upper root of Eq. (1) in the range of $-Q(A+1)/A < E_l < -QA/(A-1)$. And like level scattering and Kalbach 87, the existing implementation does not provide for the solution of the lower root in this range (line 31). There is no correction for the cosine scattering angle for values numerically close to -1.0 and 1.0 (line 51). The modified implementation of the MCNP coding corrects both of these issues and uses a common implementation with level scattering and Kalbach 87.

3 Testing

To test the improvements to the MCNP software for contributions to neutron next-event estimators from inelastic scatter, the unmodified neutron next-event estimator (`f5`) and modified neutron next-event estimator (`f5`) were compared with the track-length estimator (`f4`), in several tests. For these tests, mono-directional neutron beams impinged on a small dense cylindrical target surrounded by a large volume of void region. Volumetric toroidal tally regions were created at the same locations as next-event estimators to measure the track-length estimator response at various scattering angles. Only particles that had a single collision were tallied. Special ACE cross-section files were created using the ACETK [6] software library to set all cross-sections to zero, except the

inelastic cross-section reaction to be tested.

3.1 Inelastic Level Scattering

Testing of inelastic level scattering was performed by creating a special ACE cross-section file for Li-6 to exercise only level 1 inelastic scattering, MT=51. All other reaction cross-sections were set to zero. With a Q-value of -1.5 MeV, the energy range of the incoming neutron where both roots of Eq. (1) are valid is 1.7516 to 1.8023 MeV. Two problems with different source energies were used to test the regimes within and above the energy range where both roots are valid: 1.79 MeV (within the energy range where the negative root is valid) and 1.81 MeV (just above the energy range where the negative root is valid).

The input for the MCNP software for the case with a 1.79 MeV source is listed in Appendix A . The results for the track-length tally (`f4`), unmodified next-event estimator (`f5`), and modified next-event estimators (`f5`), for the 1.79 MeV case, is given in Appendix B . The next-event estimator results from the unmodified MCNP software has no contributions as line 10 of Listing 1 specifically disregards all contributions from incoming neutron energies below $E < -QA/(A-1)$ where both roots of Eq. (1) are valid. For this problem $-QA/(A-1)$ is 1.8023 MeV and the source energy of 1.79 MeV is below this value, therefore the inability of the MCNP software to capture the next-event estimator response in this simulation is not surprising. The results of the modifications to the neutron next-event estimator for inelastic level scattering are also shown compared with the track-length estimator in Appendix B . The modified estimator generally compares well except at a cosine angle of $\mu_l = 0.5$, which is near the angular cutoff of $\mu_l = 0.4874$. Near the angular scattering cutoff there is a large spike in the Jacobian ($\partial\mu_{cm}/\partial\mu_{lab}$) term, see Figure 2 for a plot of the outgoing neutron energy and Jacobian as a function of angle for a fixed incoming energy. As the track-length estimator is estimated over a finite volume, it averages the response over a range of μ_l values where the Jacobian is changing rapidly. However, the next-event estimator is estimating the response at a singular cosine angle, μ_l.

The results from the unmodified and modified MCNP code, for the 1.81 MeV source case where only the upper root of Eq. (1) is valid, are given in Appendix C . The unmodified `f5` tallies generally compare well with the `f4` tallies. However, the unmodified next-event results show an issue at $\mu_l = -1.0$ and $\mu_l = 1.0$. This is due to the floating point comparison issue for μ_l values slightly small than -1.0 and slightly larger than $+1.0$. This floating point issue leads to an underestimation of the neutron fluence at the -1.0 and 1.0 COM frame cosine scattering angles, due to valid cosine angles ($-1.0 + \epsilon < \mu_l < -1.0$ and $1.0 < \mu_l < 1.0 + \epsilon$) being discarded. The modified `f5` results match the unmodified `f5` results within statistics, except at $\mu_l = -1.0$ and $\mu_l = 1.0$, where the modified `f5` results correctly match the `f4` tallies.

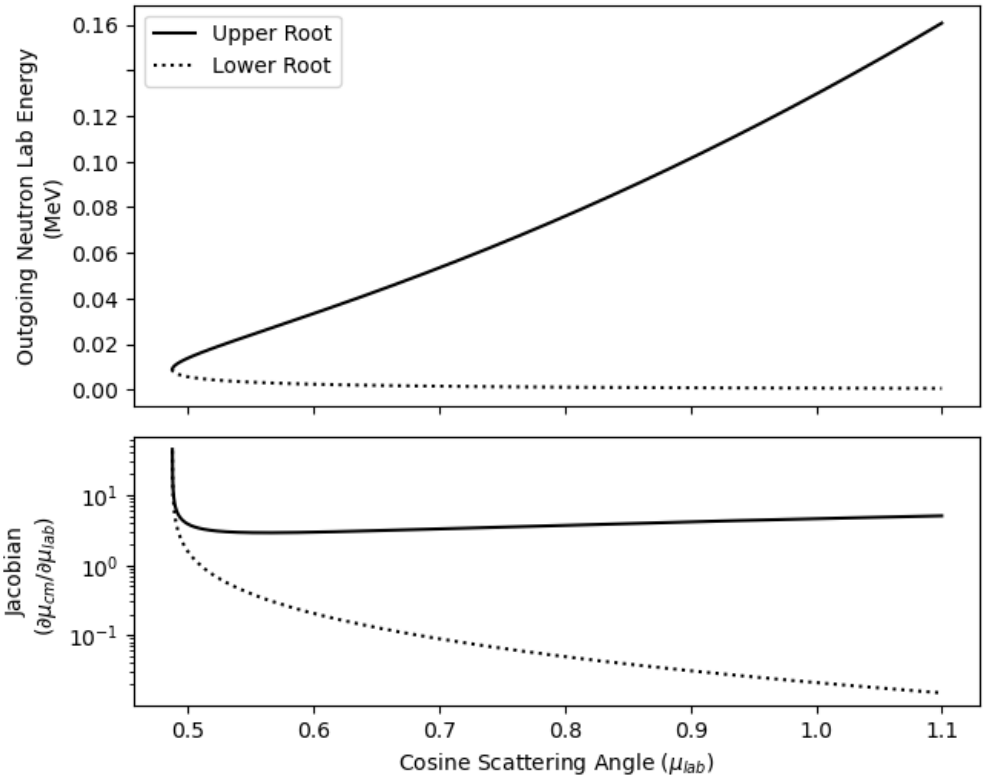

Figure 2: Outgoing neutron energy and Jacobian as a function of outgoing LAB frame cosine scattering angle at an incoming LAB frame energy of 1.79 MeV for Level 1 (n,n') scattering on Li-6 (A=5.961817, Q=−1.5 MeV). Upper root depicted with a solid line (—) and lower root depicted with a dotted line (·····).

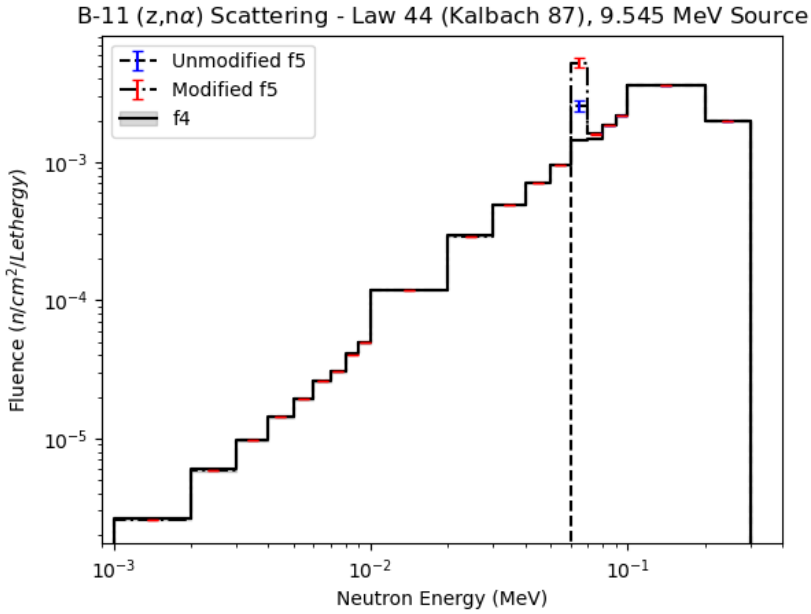

Figure 3: Outgoing neutron spectrum estimated by the MCNP software using `f4`, unmodified `f5`, and modified `f5` tallies at a LAB frame cosine scattering angle, μ_l, of 1.0 for 9.535 MeV neutrons scattering on B-11 MT 22 (z,nα) using Law 44.

3.2 Law 44 - Kalbach 87

Tests of Law 44 were created by zeroing all reactions in the ACE file for Boron-11, 5011.800nc, except MT 22 $(z, n\alpha)$, which uses law 44. This is a three body reaction, so the outgoing COM neutron energy is sampled from a distribution instead of being easily calculated from the Q value. But using the Q value of this reaction, -8.6637 MeV, provides a minimum energy range of 9.4575 MeV to 9.5375 MeV, where the two roots of Eq. (1) are valid. Two tests were performed. One test where the source energy was within the minimum range where the two roots are valid, 9.535 MeV. The other test was performed above the minimum range of the two roots using a source energy of 10.0 MeV. For this higher energy, the outgoing COM energy is sampled. So depending on the sampled outgoing energy, both roots may be valid or only the upper root may be valid.

The results of the test with a source energy of 9.535 MeV is given in Appendix D . The results of the unmodified next-event estimator (`f5`) for Law 44 shows significant problems for negative angles caused by line 25 of Listing 2. These negative angles are not possible as scattering is limited to positive angles for the source energy. The modified next-event estimator (`f5`) for Law 44 matches the track-length estimator (`f4`) well. A comparison of the modified and unmodified next-event estimator with the track-length estimator for $\mu_l = 1.0$ is given in Figure 3. The failure of the unmodified next-event estimator to provide the results of the lower root of Eq. (1) is obvious, resulting in no neutrons below 0.06 MeV. Figure 3 shows that there are large uncertainties in the results near the threshold of the reaction ($E_l = 0.06 - 0.07$ MeV) for the modified and unmodified next-event estimators for $\mu_l = 1.0$. Again this is largely due to the track-length tally spanning a range of angles, while the next-event estimator is located only at $\mu_l = 1.0$.

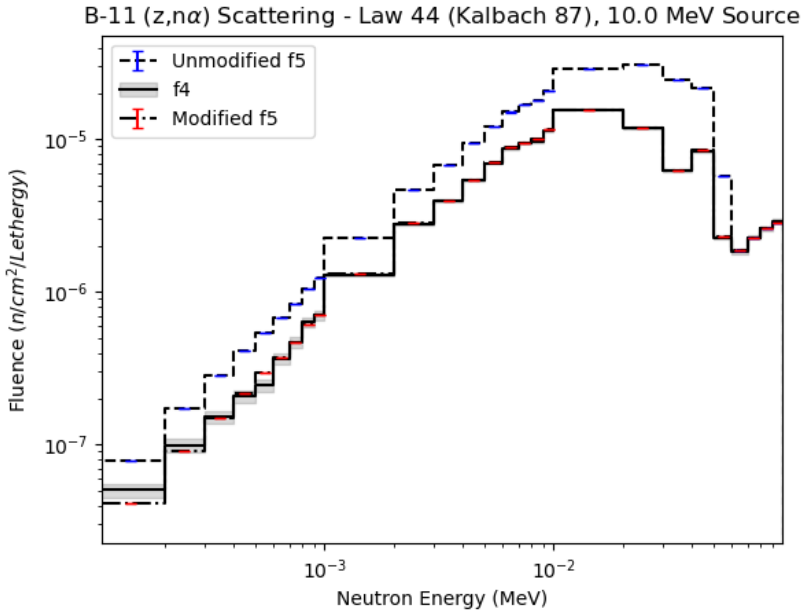

Figure 4: Outgoing neutron spectrum estimated with the MCNP software using `f4`, unmodified `f5`, and modified `f5` tallies at a LAB frame cosine scattering angle, μ_l, of -0.9 for 10.0 MeV neutrons scattering on B-11 MT 22 using Law 44.

The results of the test with a source energy of 10.0 MeV are given in Appendix E . The forward angles results are very similar to the 9.535 MeV results. But when the lower root is not valid due to sampling of E'_c, negative angles become possible. The results for $\mu_l = -0.9$ are plotted in Figure 4. For negative LAB frame angles we can again see that line 25 of Listing 2 is again causing the results of the unmodified next-event estimator to be too high.

3.3 Law 61 - Tabulated Energy Angle Data

To test Law 61, an ACE file for Al-26 containing only MT 91, continuum scattering, was created. The minimum Q value for this reaction is -4.723995 MeV. This provides a minimum range where two roots are possible as 5.02367 to 5.04397 MeV.

For Law 61, a single test was created with a source within the minimum range where two roots are possible, 5.035 MeV. The input to the MCNP software for this test is listed in Appendix F . The results are tabulated in Appendix G . While unmodified `f5` tallies generally match the `f4` tallies for negative LAB frame angles, the forward LAB frame angles clearly demonstrate the effect of not including the lower root of Eq. (1). This can be seen in Figure 5 where the unmodified `f5` tally excludes the lower neutron energies below 5×10^{-3} MeV.

The effects of improperly handling values of COM frame cosine scattering angles, μ_c, slightly less than -1.0 and slightly greater than 1.0 can be seen in the unmodified `f5` tally results at $\mu = 1.0$ and $\mu = -1.0$ which are plotted in Figures 6 and 7. Both of these results show that the unmodified `f5` tally slightly underestimates the neutron fluence when scattering directly ahead or directly

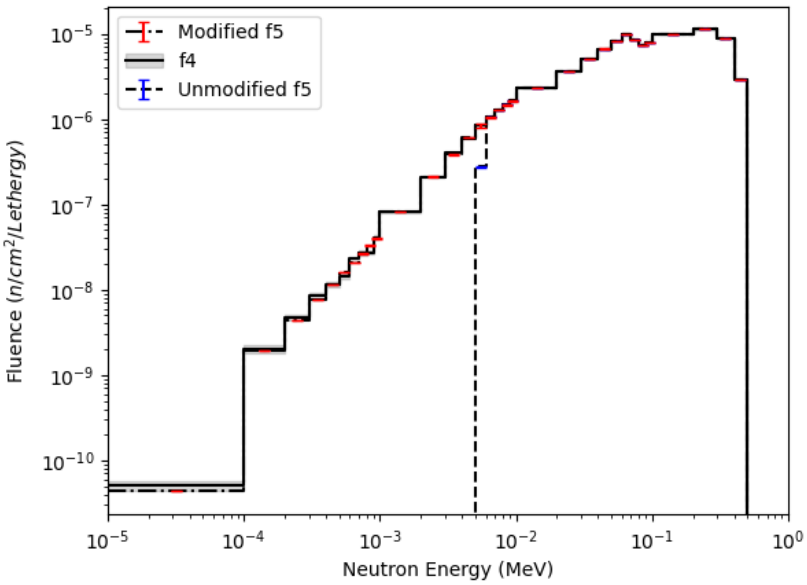

Figure 5: Outgoing neutron spectrum estimated with the MCNP software using `f4`, unmodified `f5`, and modified `f5` tallies at a LAB frame cosine scattering angle, μ_l, of 0.9 for 5.035 MeV neutron on Al-26 MT 91 using Law 61.

backwards. It is interesting to note that the `f4` results in Figure 6 show that the peak at 7×10^{-3} MeV, caused by E'_c approaching zero, is not just an artifact of sampling the Jacobian, $\partial\mu_c/\partial\mu_l$, for the `f5` estimations.

3.4 Integral Test

As the neutron inelastic scattering cross section is generally much smaller than the elastic scattering cross section, we are left to wonder about the impact of neglecting the lower root of Eq. (1) in the presence of elastic scattering. Seven experiments from the Livermore pulsed sphere experiments [7] were simulated with the unmodified and modified MCNP code. The MCNP models of these tests have historically used next-event estimators for comparison with experimental values. For each of these tests the neutron source is a 14-MeV fusion source. The source was located at the center of the spheres and neutron time of flight measurements were made a fixed angles (30 or 120 degrees) with respect to the axis of the neutron source. These tests included all of the experiments from the MCNP verification and validation test suite [8] plus an additional 1.2 MFP (10.48 cm outer radius) heavy water sphere. The geometry of the heavy water sphere is provided in Fig. [**fig:hwt1-2**]. The tests from the MCNP verification and validation test suite are a 0.8 MFP beryllium sphere, 2.9 MFP carbon sphere, 2.0 MFP concrete sphere, 0.9 MFP iron sphere, 1.6 MFP lithium-6 sphere, and 1.9 MFP water sphere.

The six pulsed spheres used in the MCNP verification and validation test suite showed no difference between the unmodified and modified MCNP code. However, the heavy water sphere

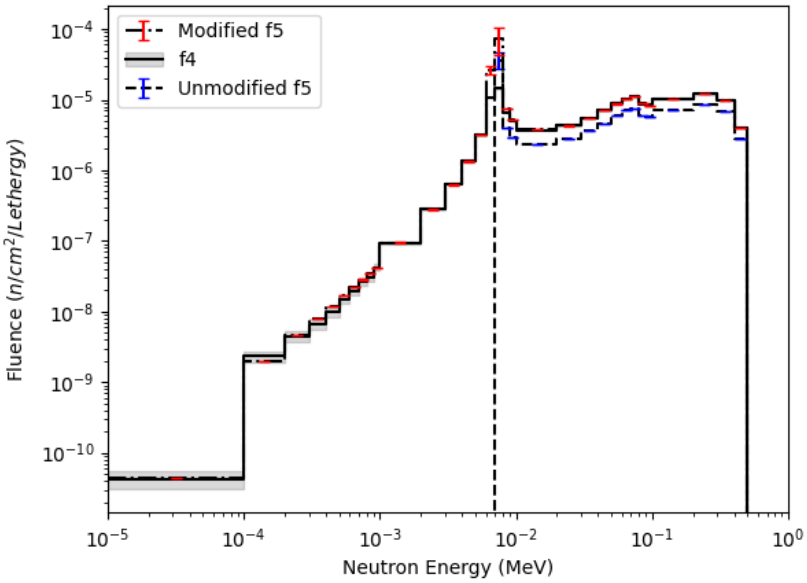

Figure 6: Outgoing neutron spectrum estimated with the MCNP software using `f4`, unmodified `f5`, and modified `f5` tallies at a LAB frame cosine scattering angle, μ_l, of 1.0 for 5.035 MeV neutron on Al-26 MT 91 using Law 61.

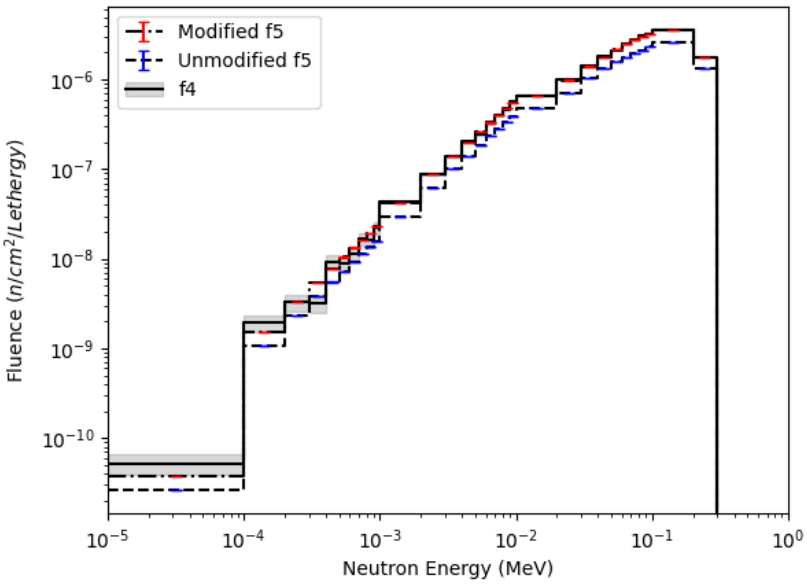

Figure 7: Outgoing neutron spectrum estimated with the MCNP software using `f4`, unmodified `f5`, and modified `f5` tallies at a LAB frame cosine scattering angle, μ_l, of -1.0 for 5.035 MeV neutron on Al-26 MT 91 using Law 61.

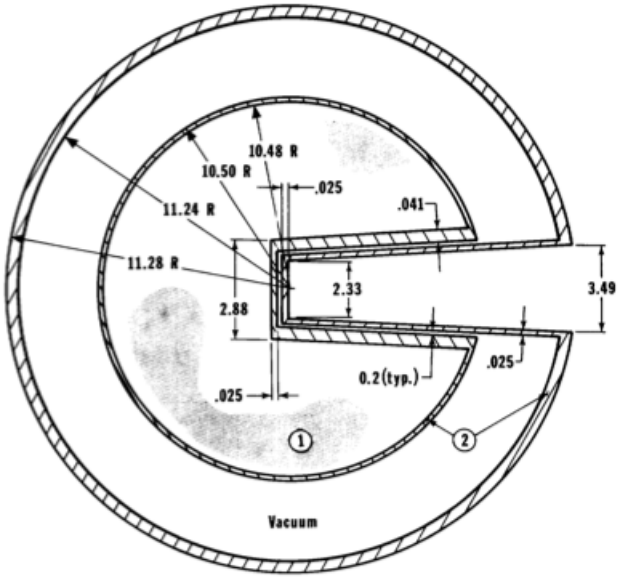

Figure 8: Heavy water sphere geometry from the Lawerence Livermore Laboratory pulsed sphere experiments from [7] (dimensions are in centimeters). ① indicates heavy water and ② indicates stainless steel.

results did have a significant improvement as compared to the measured data, see Figure 9. The results from unmodified MCNP code had an average ratio of calculated to measured results of $0.9413 \pm 5.43\%$ and the results from modified code had an average ratio of $1.0011 \pm 5.85\%$.

4 Conclusions

The addition of the lower root to the solution of the outgoing LAB frame neutron energy, Eq. (1), to the MCNP coding allows for more accurate estimation of next-event estimators. This modification to the MCNP coding allows these estimators to more closely match track-length and surface crossing tallies. This will also improve simulations using DXTRAN. Additional modifications have been made to correct improper handling of COM frame cosine scattering angles, μ_c, less than -1.0 and greater than $+1.0$. The modifications will be most important for angular dependent problems, with low Z-material and a small number of scattering events.

5 Acknowledgements

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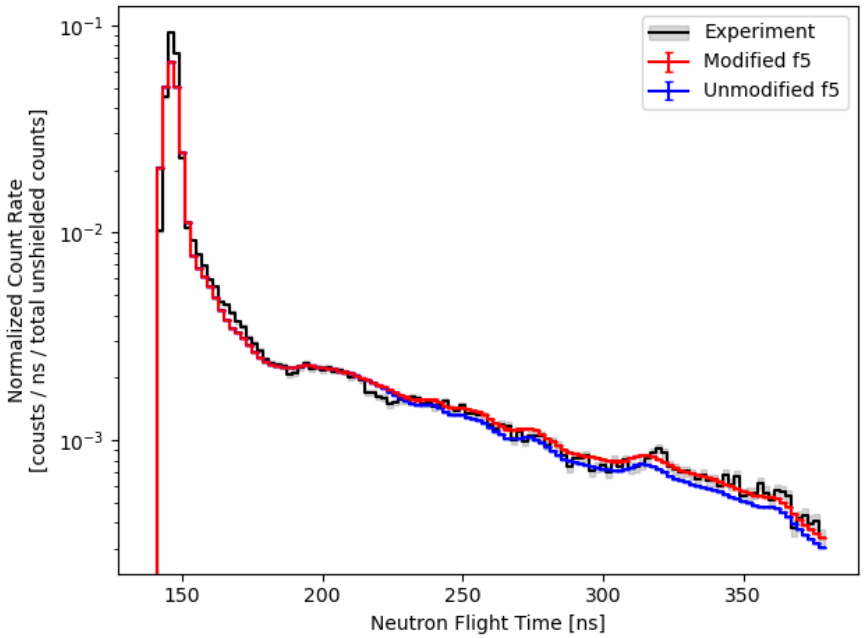

Figure 9: Time-of-Flight neutron measurement and calculations for 1.2 MFP thick heavy water sphere from the Livermore pulsed sphere experiments. The calculations were performed with the MCNP software using unmodified `f5` and modified `f5` tallies.

tration through the Los Alamos National Laboratory MCNP Site Support program. Los Alamos National Laboratory is operated by Triad National Security, LLC, for the National Nuclear Security Administration of U.S. Department of Energy (Contract No. 89233218CNA000001).

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Appendix A Input to MCNP Software for Law 3 Inelastic Level Scatter on Li-6 Test

```
Test with thin broomstick
1 1 -1000.0 -1 imp:n=1 $ broomstick
10 0 -10      imp:n=1 $ f4 tally region
11 0 -11      imp:n=1 $ f4 tally region
12 0 -12      imp:n=1 $ f4 tally region
13 0 -13      imp:n=1 $ f4 tally region
14 0 -14      imp:n=1 $ f4 tally region
15 0 -15      imp:n=1 $ f4 tally region
16 0 -16      imp:n=1 $ f4 tally region
20 0 -20      imp:n=1 $ f4 tally region
21 0 -21      imp:n=1 $ f4 tally region
22 0 -22      imp:n=1 $ f4 tally region
23 0 -23      imp:n=1 $ f4 tally region
24 0 -24      imp:n=1 $ f4 tally region
25 0 -25      imp:n=1 $ f4 tally region
26 0 -26      imp:n=1 $ f4 tally region
c
100 0 1 10 11 12 13 14 15 16
        20 21 22 23 24 25 26
           -100  imp:n=1 $ void around broomstick and tally region
c
200 0 100       imp:n=0

1 rcc 0.0 0.0 0.0  0.1 0.0 0.0  1.0e-8 $ broomstick
10 s -10.0 0.0 0.0 0.5                    $ mu=-1.0 tally region covers -1.0 < mu < -0.995
11 tx -9.75 0.0 0.0 2.2220486043288985 0.05 0.05       $ mu=-0.975 tally region covers
12 tx -9.0  0.0 0.0 4.358898943540673  0.05 0.05       $ mu=-0.9 tally region covers
13 tx -7.5  0.0 0.0 6.614378277661476  0.05 0.05       $ mu=-0.75 tally region covers
14 tx -5.0  0.0 0.0 8.660254037844386  0.05 0.05       $ mu=-0.5 tally region covers
15 tx -3.0  0.0 0.0 9.539392014169456  0.05 0.05       $ mu=-0.3 tally region covers
16 tx -1.0  0.0 0.0 9.9498743710662    0.05 0.05         $ mu=-0.1 tally region covers
c
20 s  10.0 0.0 0.0 0.5                    $ mu= 1.0 tally region covers 1.0 < mu < 0.995
21 tx  9.75 0.0 0.0  2.2220486043288985 0.05 0.05       $ mu= 0.975 tally region covers
22 tx  9.0  0.0 0.0 4.358898943540673   0.05 0.05       $ mu= 0.9 tally region covers
23 tx  7.5  0.0 0.0 6.614378277661476   0.05 0.05       $ mu= 0.75 tally region covers
24 tx  5.0  0.0 0.0 8.660254037844386   0.05 0.05       $ mu= 0.5 tally region covers
25 tx  3.0  0.0 0.0 9.539392014169456   0.05 0.05       $ mu= 0.3 tally region covers
26 tx  1.0  0.0 0.0 9.9498743710662     0.05 0.05       $ mu= 0.1 tally region covers
100 so 2000.0

mode n
c
c Li-6 - Inelastic Scatter Level 1 between 1.75 and 1.80 MeV, Q=-1.5 MeV
```

```
sdef erg=1.79 pos=-0.01 0.0 0.0 dir=1.0 vec=1.0 0.0 0.0 ara=1.0 par=n
c
m1 3006.51c 1.0
dbcn 49j 1
prdmp j j 1 3
c
dd0 0 0
e0    0.0001 8i 0.001 8i 0.01 8i 0.1 8i 1.0
      1.01 1.18 1.19 1.20 7i 2.0 7i 10.0 20.0
c
f104:n 10
f114:n 11
f124:n 12
f134:n 13
f144:n 14
f154:n 15
f164:n 16
c
f204:n 20
f214:n 21
f224:n 22
f234:n 23
f244:n 24
f254:n 25
f264:n 26
c
f105:n -10.0 0.0 0.0 0.0                    $mu=-1.0
f115:n -9.75 2.2220486043288985 0.0 1.0     $ mu=-0.975
f125:n -9.0  4.358898943540673 0.0 1.0      $ mu=-0.9
f135:n -7.5  6.614378277661476 0.0 1.0      $ mu=-0.75
f145:n -5.0  8.660254037844386 0.0 1.0      $ mu=-0.5
f155:n -3.0  9.539392014169456 0.0 1.0      $ mu=-0.3
f165:n -1.0  9.9498743710662 0.0 1.0        $ mu=-0.1
c
f205:n  10.0 0.0 0.0 0.0                    $ mu= 1.0
f215:n  9.75 2.2220486043288985 0.0 1.0     $ mu= 0.975
f225:n  9.0  4.358898943540673 0.0 1.0      $ mu= 0.9
f235:n  7.5  6.614378277661476 0.0 1.0      $ mu= 0.75
f245:n  5.0  8.660254037844386 0.0 1.0      $ mu= 0.5
f255:n  3.0  9.539392014169456 0.0 1.0      $ mu= 0.3
f265:n  1.0  9.9498743710662 0.0 1.0        $ mu= 0.1
c
c nps 1e7
nps 1e8
c dbcn j 1 1 100 10000
c print +20
c
unc:n 0 16j
```

```
c
ft104 inc
fu104 0 1 2 1000
c
ft105 inc
fu105 0 1 2 1000
c
ft114 inc
fu114 0 1 2 1000
c
ft115 inc
fu115 0 1 2 1000
c
ft124 inc
fu124 0 1 2 1000
c
ft125 inc
fu125 0 1 2 1000
c
ft134 inc
fu134 0 1 2 1000
c
ft135 inc
fu135 0 1 2 1000
c
ft144 inc
fu144 0 1 2 1000
c
ft145 inc
fu145 0 1 2 1000
c
ft154 inc
fu154 0 1 2 1000
c
ft155 inc
fu155 0 1 2 1000
c
ft164 inc
fu164 0 1 2 1000
c
ft165 inc
fu165 0 1 2 1000
c
c
ft204 inc
fu204 0 1 2 1000
c
ft205 inc
```

```
fu205 0 1 2 1000
c
ft214 inc
fu214 0 1 2 1000
c
ft215 inc
fu215 0 1 2 1000
c
ft224 inc
fu224 0 1 2 1000
c
ft225 inc
fu225 0 1 2 1000
c
ft234 inc
fu234 0 1 2 1000
c
ft235 inc
fu235 0 1 2 1000
c
ft244 inc
fu244 0 1 2 1000
c
ft245 inc
fu245 0 1 2 1000
c
ft254 inc
fu254 0 1 2 1000
c
ft255 inc
fu255 0 1 2 1000
c
ft264 inc
fu264 0 1 2 1000
c
ft265 inc
fu265 0 1 2 1000
c
```

Appendix B MCNP Software Results for Test Problem for Law 3 Inelastic Level Scatter on Li-6 for a source energy of 1.79 MeV

Table 1: Results of the MCNP path-length tally (`f4`) and next-event tally (`f5`) results as a function of scattering angle for incident neutrons on Li-6 with only Law 3 level scattering with source energy of 1.79 MeV.

	Energy Bins		F4		Unmodified F5			Modified F5		
Cosine Angle (μ)	Lower Bin Energy (MeV)	Upper Bin Energy (MeV)	Flux (n/cm^2) (n/cm^2)	Fract. Std. Dev.	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4
-1.0	-	-	-	-	-	-	-	-	-	-
-0.975	-	-	-	-	-	-	-	-	-	-
-0.9	-	-	-	-	-	-	-	-	-	-
-0.75	-	-	-	-	-	-	-	-	-	-
-0.5	-	-	-	-	-	-	-	-	-	-
-0.3	-	-	-	-	-	-	-	-	-	-
-0.1	-	-	-	-	-	-	-	-	-	-
0.1	-	-	-	-	-	-	-	-	-	-
0.3	-	-	-	-	-	-	-	-	-	-
0.5	5.0×10^{-3}	6.0×10^{-3}	2.6796×10^{-5}	0.0009	-	-	>10.0	2.7736×10^{-5}	0.0010	>10.0
	6.0×10^{-3}	7.0×10^{-3}	3.6282×10^{-5}	0.0007	-	-	>10.0	3.6146×10^{-5}	0.0010	3.07
	7.0×10^{-3}	8.0×10^{-3}	4.2284×10^{-6}	0.0018	-	-	>10.0	-	-	>10.0
	9.0×10^{-3}	1.0×10^{-2}	7.6203×10^{-8}	0.0087	-	-	>10.0	-	-	>10.0
	1.0×10^{-2}	2.0×10^{-2}	1.3776×10^{-4}	0.0004	-	-	>10.0	1.3463×10^{-4}	0.0007	>10.0
0.75	1.0×10^{-3}	2.0×10^{-3}	2.0522×10^{-6}	0.0036	-	-	>10.0	2.0513×10^{-6}	0.0007	0.11
	6.0×10^{-2}	7.0×10^{-2}	1.0875×10^{-4}	0.0005	-	-	>10.0	1.0871×10^{-4}	0.0007	0.37
0.9	7.0×10^{-4}	8.0×10^{-4}	9.7755×10^{-7}	0.0064	-	-	>10.0	9.7457×10^{-7}	0.0007	0.47
	1.0×10^{-1}	2.0×10^{-1}	1.2945×10^{-4}	0.0006	-	-	>10.0	1.2935×10^{-4}	0.0007	0.80
0.975	6.0×10^{-4}	7.0×10^{-4}	7.2311×10^{-7}	0.0104	-	-	>10.0	7.2179×10^{-7}	0.0007	0.17
	1.0×10^{-1}	2.0×10^{-1}	1.4020×10^{-4}	0.0007	-	-	>10.0	1.4010×10^{-4}	0.0007	0.75
1.0	5.0×10^{-4}	6.0×10^{-4}	6.7247×10^{-7}	0.0146	-	-	>10.0	6.5786×10^{-7}	0.0007	1.49
	1.0×10^{-1}	2.0×10^{-1}	1.4386×10^{-4}	0.0010	-	-	>10.0	1.4373×10^{-4}	0.0007	0.73

Appendix C MCNP Software Results for Test Problem for Law 3 Inelastic Level Scatter on Li-6 for a source energy of 1.81 MeV

Table 2: Results of the MCNP path-length tally (`f4`) and next-event tally (`f5`) results as a function of scattering angle for incident neutrons on Li-6 with only Law 3 level scattering with source energy of 1.81 MeV.

	Energy Bins		F4		Unmodified F5			Modified F5		
Cosine Angle (μ)	Lower Bin Energy (MeV)	Upper Bin Energy (MeV)	Flux (n/cm^2) (n/cm^2)	Fract. Std. Dev.	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4
-1.0	1.0×10^{-4}	2.0×10^{-4}	1.9543×10^{-7}	0.0327	1.9163×10^{-8}	0.0013	>10.0	1.8791×10^{-7}	0.0004	1.18
-0.975	1.0×10^{-4}	2.0×10^{-4}	2.1012×10^{-7}	0.0232	2.0129×10^{-7}	0.0004	1.81	2.0129×10^{-7}	0.0004	1.81
-0.9	2.0×10^{-4}	3.0×10^{-4}	2.5177×10^{-7}	0.0151	2.4966×10^{-7}	0.0004	0.55	2.4966×10^{-7}	0.0004	0.55
-0.75	3.0×10^{-4}	4.0×10^{-4}	3.9720×10^{-7}	0.0098	4.0223×10^{-7}	0.0004	1.29	4.0223×10^{-7}	0.0004	1.29
-0.5	6.0×10^{-4}	7.0×10^{-4}	1.0633×10^{-6}	0.0052	1.0609×10^{-6}	0.0004	0.42	1.0609×10^{-6}	0.0004	0.42
-0.3	1.0×10^{-3}	2.0×10^{-3}	2.8289×10^{-6}	0.0030	2.8175×10^{-6}	0.0004	1.33	2.8175×10^{-6}	0.0004	1.33
-0.1	3.0×10^{-3}	4.0×10^{-3}	8.6985×10^{-6}	0.0017	8.6939×10^{-6}	0.0004	0.30	8.6939×10^{-6}	0.0004	0.30
0.1	8.0×10^{-3}	9.0×10^{-3}	1.4229×10^{-5}	0.0013	1.4253×10^{-5}	0.0006	1.15	1.4253×10^{-5}	0.0006	1.15
	9.0×10^{-3}	1.0×10^{-2}	1.0408×10^{-5}	0.0016	1.0357×10^{-5}	0.0007	2.80	1.0357×10^{-5}	0.0007	2.80
0.3	2.0×10^{-2}	3.0×10^{-2}	5.0886×10^{-5}	0.0007	5.0921×10^{-5}	0.0004	0.84	5.0921×10^{-5}	0.0004	0.84
0.5	4.0×10^{-2}	5.0×10^{-2}	8.1786×10^{-5}	0.0006	8.1795×10^{-5}	0.0004	0.15	8.1795×10^{-5}	0.0004	0.15
0.75	9.0×10^{-2}	1.0×10^{-1}	1.2232×10^{-4}	0.0006	1.2231×10^{-4}	0.0004	0.10	1.2231×10^{-4}	0.0004	0.10
0.9	1.0×10^{-1}	2.0×10^{-1}	1.4713×10^{-4}	0.0006	1.4702×10^{-4}	0.0004	1.05	1.4702×10^{-4}	0.0004	1.05
0.975	1.0×10^{-1}	2.0×10^{-1}	1.5987×10^{-4}	0.0008	1.5945×10^{-4}	0.0004	2.92	1.5945×10^{-4}	0.0004	2.92
1.0	1.0×10^{-1}	2.0×10^{-1}	1.6372×10^{-4}	0.0011	1.6008×10^{-5}	0.0014	>10.0	1.6360×10^{-4}	0.0004	0.63

Appendix D MCNP Software Results for Test Problem for Law 44 (Kalbach-87) on B-11 for a source energy of 9.535 MeV

Table 3: Results of the MCNP path-length tally (`f4`) and next-event tally (`f5`) results as a function of scattering angle for incident neutrons on B-11 with only Law 44 (Kalbach-87) with source energy of 9.535 MeV.

	Energy Bins		F4		Unmodified F5			Modified F5		
Cosine Angle (μ)	Lower Bin Energy (MeV)	Upper Bin Energy (MeV)	Flux (n/cm^2) (n/cm^2)	Fract. Std. Dev.	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4
-1.0	1.0×10^{-3}	2.0×10^{-3}	0.0000	0.0000	1.3007×10^{-6}	0.0001	>10.0	-	-	0.00
	2.0×10^{-3}	3.0×10^{-3}	0.0000	0.0000	1.5784×10^{-6}	0.0001	>10.0	-	-	0.00
	3.0×10^{-3}	4.0×10^{-3}	0.0000	0.0000	1.7303×10^{-6}	0.0002	>10.0	-	-	0.00
	4.0×10^{-3}	5.0×10^{-3}	0.0000	0.0000	1.8706×10^{-6}	0.0002	>10.0	-	-	0.00
	5.0×10^{-3}	6.0×10^{-3}	0.0000	0.0000	1.9384×10^{-6}	0.0002	>10.0	-	-	0.00
	6.0×10^{-3}	7.0×10^{-3}	0.0000	0.0000	2.0671×10^{-6}	0.0002	>10.0	-	-	0.00
	7.0×10^{-3}	8.0×10^{-3}	0.0000	0.0000	2.0100×10^{-6}	0.0002	>10.0	-	-	0.00
	8.0×10^{-3}	9.0×10^{-3}	0.0000	0.0000	2.2028×10^{-6}	0.0002	>10.0	-	-	0.00
	9.0×10^{-3}	1.0×10^{-2}	0.0000	0.0000	2.3065×10^{-6}	0.0002	>10.0	-	-	0.00
	1.0×10^{-2}	2.0×10^{-2}	0.0000	0.0000	2.8198×10^{-5}	0.0001	>10.0	-	-	0.00
	2.0×10^{-2}	3.0×10^{-2}	0.0000	0.0000	2.8179×10^{-5}	0.0001	>10.0	-	-	0.00
	3.0×10^{-2}	4.0×10^{-2}	0.0000	0.0000	2.2275×10^{-5}	0.0002	>10.0	-	-	0.00
	4.0×10^{-2}	5.0×10^{-2}	0.0000	0.0000	1.5604×10^{-5}	0.0003	>10.0	-	-	0.00
	5.0×10^{-2}	6.0×10^{-2}	0.0000	0.0000	8.5135×10^{-6}	0.0007	>10.0	-	-	0.00
	6.0×10^{-2}	7.0×10^{-2}	0.0000	0.0000	2.5238×10^{-6}	0.0038	>10.0	-	-	0.00

Table 3 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
−0.975	1.0×10^{-3}	2.0×10^{-3}	0.0000	0.0000	1.2177×10^{-6}	0.0001	>10.0	-	-	0.00
	2.0×10^{-3}	3.0×10^{-3}	0.0000	0.0000	1.5739×10^{-6}	0.0001	>10.0	-	-	0.00
	3.0×10^{-3}	4.0×10^{-3}	0.0000	0.0000	1.6936×10^{-6}	0.0002	>10.0	-	-	0.00
	4.0×10^{-3}	5.0×10^{-3}	0.0000	0.0000	1.8649×10^{-6}	0.0002	>10.0	-	-	0.00
	5.0×10^{-3}	6.0×10^{-3}	0.0000	0.0000	1.8818×10^{-6}	0.0002	>10.0	-	-	0.00
	6.0×10^{-3}	7.0×10^{-3}	0.0000	0.0000	1.9998×10^{-6}	0.0002	>10.0	-	-	0.00
	7.0×10^{-3}	8.0×10^{-3}	0.0000	0.0000	2.0295×10^{-6}	0.0002	>10.0	-	-	0.00
	8.0×10^{-3}	9.0×10^{-3}	0.0000	0.0000	2.0152×10^{-6}	0.0002	>10.0	-	-	0.00
	9.0×10^{-3}	1.0×10^{-2}	0.0000	0.0000	2.2437×10^{-6}	0.0002	>10.0	-	-	0.00
	1.0×10^{-2}	2.0×10^{-2}	0.0000	0.0000	2.6025×10^{-5}	0.0001	>10.0	-	-	0.00
	2.0×10^{-2}	3.0×10^{-2}	0.0000	0.0000	2.6799×10^{-5}	0.0001	>10.0	-	-	0.00
	3.0×10^{-2}	4.0×10^{-2}	0.0000	0.0000	2.0563×10^{-5}	0.0002	>10.0	-	-	0.00
	4.0×10^{-2}	5.0×10^{-2}	0.0000	0.0000	1.3678×10^{-5}	0.0003	>10.0	-	-	0.00
	5.0×10^{-2}	6.0×10^{-2}	0.0000	0.0000	6.4797×10^{-6}	0.0005	>10.0	-	-	0.00
	6.0×10^{-2}	7.0×10^{-2}	0.0000	0.0000	5.5300×10^{-7}	0.0018	>10.0	-	-	0.00

Table 3 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
−0.9	1.0×10^{-3}	2.0×10^{-3}	0.0000	0.0000	9.2194×10^{-7}	0.0002	>10.0	-	-	0.00
	2.0×10^{-3}	3.0×10^{-3}	0.0000	0.0000	1.5253×10^{-6}	0.0001	>10.0	-	-	0.00
	3.0×10^{-3}	4.0×10^{-3}	0.0000	0.0000	1.6319×10^{-6}	0.0002	>10.0	-	-	0.00
	4.0×10^{-3}	5.0×10^{-3}	0.0000	0.0000	1.7233×10^{-6}	0.0002	>10.0	-	-	0.00
	5.0×10^{-3}	6.0×10^{-3}	0.0000	0.0000	1.8352×10^{-6}	0.0002	>10.0	-	-	0.00
	6.0×10^{-3}	7.0×10^{-3}	0.0000	0.0000	1.8362×10^{-6}	0.0002	>10.0	-	-	0.00
	7.0×10^{-3}	8.0×10^{-3}	0.0000	0.0000	1.8729×10^{-6}	0.0002	>10.0	-	-	0.00
	8.0×10^{-3}	9.0×10^{-3}	0.0000	0.0000	1.9311×10^{-6}	0.0002	>10.0	-	-	0.00
	9.0×10^{-3}	1.0×10^{-2}	0.0000	0.0000	1.9472×10^{-6}	0.0003	>10.0	-	-	0.00
	1.0×10^{-2}	2.0×10^{-2}	0.0000	0.0000	2.0353×10^{-5}	0.0001	>10.0	-	-	0.00
	2.0×10^{-2}	3.0×10^{-2}	0.0000	0.0000	1.9677×10^{-5}	0.0001	>10.0	-	-	0.00
	3.0×10^{-2}	4.0×10^{-2}	0.0000	0.0000	1.5181×10^{-5}	0.0002	>10.0	-	-	0.00
	4.0×10^{-2}	5.0×10^{-2}	0.0000	0.0000	7.5133×10^{-6}	0.0003	>10.0	-	-	0.00
	5.0×10^{-2}	6.0×10^{-2}	0.0000	0.0000	7.8420×10^{-7}	0.0010	>10.0	-	-	0.00
−0.75	1.0×10^{-3}	2.0×10^{-3}	0.0000	0.0000	1.6880×10^{-10}	0.0132	>10.0	-	-	0.00
	2.0×10^{-3}	3.0×10^{-3}	0.0000	0.0000	1.3241×10^{-6}	0.0002	>10.0	-	-	0.00
	3.0×10^{-3}	4.0×10^{-3}	0.0000	0.0000	1.4725×10^{-6}	0.0002	>10.0	-	-	0.00
	4.0×10^{-3}	5.0×10^{-3}	0.0000	0.0000	1.5598×10^{-6}	0.0002	>10.0	-	-	0.00
	5.0×10^{-3}	6.0×10^{-3}	0.0000	0.0000	1.5755×10^{-6}	0.0002	>10.0	-	-	0.00
	6.0×10^{-3}	7.0×10^{-3}	0.0000	0.0000	1.5187×10^{-6}	0.0002	>10.0	-	-	0.00
	7.0×10^{-3}	8.0×10^{-3}	0.0000	0.0000	1.5374×10^{-6}	0.0003	>10.0	-	-	0.00
	8.0×10^{-3}	9.0×10^{-3}	0.0000	0.0000	1.5446×10^{-6}	0.0003	>10.0	-	-	0.00
	9.0×10^{-3}	1.0×10^{-2}	0.0000	0.0000	1.5422×10^{-6}	0.0003	>10.0	-	-	0.00
	1.0×10^{-2}	2.0×10^{-2}	0.0000	0.0000	1.3192×10^{-5}	0.0001	>10.0	-	-	0.00
	2.0×10^{-2}	3.0×10^{-2}	0.0000	0.0000	7.8471×10^{-6}	0.0002	>10.0	-	-	0.00
	3.0×10^{-2}	4.0×10^{-2}	0.0000	0.0000	1.9043×10^{-6}	0.0005	>10.0	-	-	0.00
−0.5	7.0×10^{-3}	8.0×10^{-3}	0.0000	0.0000	4.3463×10^{-9}	0.0054	>10.0	-	-	0.00
	8.0×10^{-3}	9.0×10^{-3}	0.0000	0.0000	4.6851×10^{-7}	0.0005	>10.0	-	-	0.00
	9.0×10^{-3}	1.0×10^{-2}	0.0000	0.0000	6.3525×10^{-7}	0.0005	>10.0	-	-	0.00
	1.0×10^{-2}	2.0×10^{-2}	0.0000	0.0000	2.1214×10^{-6}	0.0003	>10.0	-	-	0.00
−0.3	-	-	-	-	-	-	-	-	-	-
−0.1	-	-	-	-	-	-	-	-	-	-

Table 3 Continued:

Cosine Angle (μ)	Energy Bins		F4		Unmodified F5			Modified F5		
	Lower Bin Energy (MeV)	Upper Bin Energy (MeV)	Flux (n/cm^2) (n/cm^2)	Fract. Std. Dev.	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4
0.1	-	-	-	-	-	-	-	-	-	-
0.3	-	-	-	-	-	-	-	-	-	-
0.5	8.0×10^{-3}	9.0×10^{-3}	4.2297×10^{-7}	0.0207	-	-	>10.0	2.5809×10^{-7}	0.0027	>10.0
	9.0×10^{-3}	1.0×10^{-2}	3.2546×10^{-6}	0.0079	-	-	>10.0	3.4386×10^{-6}	0.0008	7.11
	1.0×10^{-2}	2.0×10^{-2}	5.5106×10^{-5}	0.0019	2.1016×10^{-5}	0.0015	>10.0	5.5279×10^{-5}	0.0011	1.43
	2.0×10^{-2}	3.0×10^{-2}	4.2042×10^{-5}	0.0022	4.2164×10^{-5}	0.0003	1.30	4.2163×10^{-5}	0.0004	1.28
0.75	2.0×10^{-3}	3.0×10^{-3}	2.1810×10^{-6}	0.0109	-	-	>10.0	2.2119×10^{-6}	0.0002	1.30
	3.0×10^{-3}	4.0×10^{-3}	2.7773×10^{-6}	0.0097	-	-	>10.0	2.7872×10^{-6}	0.0003	0.37
	4.0×10^{-3}	5.0×10^{-3}	3.2271×10^{-6}	0.0090	-	-	>10.0	3.2309×10^{-6}	0.0003	0.13
	5.0×10^{-3}	6.0×10^{-3}	3.6102×10^{-6}	0.0085	-	-	>10.0	3.5726×10^{-6}	0.0003	1.23
	6.0×10^{-3}	7.0×10^{-3}	3.6532×10^{-6}	0.0084	-	-	>10.0	3.6948×10^{-6}	0.0004	1.35
	7.0×10^{-3}	8.0×10^{-3}	4.0444×10^{-6}	0.0080	-	-	>10.0	4.0282×10^{-6}	0.0004	0.50
	8.0×10^{-3}	9.0×10^{-3}	4.3639×10^{-6}	0.0077	-	-	>10.0	4.3515×10^{-6}	0.0004	0.37
	9.0×10^{-3}	1.0×10^{-2}	4.5993×10^{-6}	0.0075	-	-	>10.0	4.6594×10^{-6}	0.0004	1.74
	1.0×10^{-2}	2.0×10^{-2}	5.8224×10^{-5}	0.0021	-	-	>10.0	5.8288×10^{-5}	0.0002	0.52
	2.0×10^{-2}	3.0×10^{-2}	7.5322×10^{-5}	0.0019	-	-	>10.0	7.5370×10^{-5}	0.0003	0.34
	3.0×10^{-2}	4.0×10^{-2}	8.6394×10^{-5}	0.0017	2.1952×10^{-5}	0.0030	>10.0	8.6507×10^{-5}	0.0015	0.58
	4.0×10^{-2}	5.0×10^{-2}	9.7271×10^{-5}	0.0016	9.7179×10^{-5}	0.0004	0.58	9.7124×10^{-5}	0.0005	0.90
	5.0×10^{-2}	6.0×10^{-2}	1.1220×10^{-4}	0.0015	1.1222×10^{-4}	0.0002	0.07	1.1226×10^{-4}	0.0003	0.31
	6.0×10^{-2}	7.0×10^{-2}	1.1963×10^{-4}	0.0015	1.1962×10^{-4}	0.0002	0.07	1.1960×10^{-4}	0.0003	0.17
	7.0×10^{-2}	8.0×10^{-2}	1.2610×10^{-4}	0.0014	1.2626×10^{-4}	0.0002	0.91	1.2621×10^{-4}	0.0002	0.66
	8.0×10^{-2}	9.0×10^{-2}	1.3414×10^{-4}	0.0014	1.3449×10^{-4}	0.0002	1.83	1.3448×10^{-4}	0.0002	1.81
	9.0×10^{-2}	1.0×10^{-1}	1.3955×10^{-4}	0.0014	1.3954×10^{-4}	0.0001	0.02	1.3954×10^{-4}	0.0002	0.03
	1.0×10^{-1}	2.0×10^{-1}	2.5886×10^{-4}	0.0010	2.5926×10^{-4}	0.0001	1.57	2.5930×10^{-4}	0.0001	1.72

Table 3 Continued:

Cosine Angle (μ)	Energy Bins		F4		Unmodified F5			Modified F5		
	Lower Bin Energy (MeV)	Upper Bin Energy (MeV)	Flux (n/cm^2) (n/cm^2)	Fract. Std. Dev.	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4
0.9	1.0×10^{-3}	2.0×10^{-3}	1.2939×10^{-6}	0.0175	-	-	>10.0	1.3214×10^{-6}	0.0002	1.21
	2.0×10^{-3}	3.0×10^{-3}	2.4037×10^{-6}	0.0128	-	-	>10.0	2.3939×10^{-6}	0.0002	0.32
	3.0×10^{-3}	4.0×10^{-3}	2.7899×10^{-6}	0.0119	-	-	>10.0	2.7834×10^{-6}	0.0002	0.19
	4.0×10^{-3}	5.0×10^{-3}	3.1285×10^{-6}	0.0112	-	-	>10.0	3.1593×10^{-6}	0.0003	0.88
	5.0×10^{-3}	6.0×10^{-3}	3.6485×10^{-6}	0.0104	-	-	>10.0	3.5945×10^{-6}	0.0003	1.42
	6.0×10^{-3}	7.0×10^{-3}	3.8144×10^{-6}	0.0102	-	-	>10.0	3.8333×10^{-6}	0.0003	0.49
	7.0×10^{-3}	8.0×10^{-3}	4.1031×10^{-6}	0.0098	-	-	>10.0	4.1369×10^{-6}	0.0003	0.84
	8.0×10^{-3}	9.0×10^{-3}	4.4806×10^{-6}	0.0094	-	-	>10.0	4.5081×10^{-6}	0.0003	0.65
	9.0×10^{-3}	1.0×10^{-2}	4.8077×10^{-6}	0.0091	-	-	>10.0	4.8199×10^{-6}	0.0004	0.28
	1.0×10^{-2}	2.0×10^{-2}	6.6814×10^{-5}	0.0024	-	-	>10.0	6.6693×10^{-5}	0.0001	0.75
	2.0×10^{-2}	3.0×10^{-2}	1.0295×10^{-4}	0.0020	-	-	>10.0	1.0312×10^{-4}	0.0002	0.80
	3.0×10^{-2}	4.0×10^{-2}	1.3733×10^{-4}	0.0017	-	-	>10.0	1.3697×10^{-4}	0.0003	1.51
	4.0×10^{-2}	5.0×10^{-2}	1.5640×10^{-4}	0.0016	-	-	>10.0	1.5673×10^{-4}	0.0005	1.26
	5.0×10^{-2}	6.0×10^{-2}	1.6894×10^{-4}	0.0015	9.7928×10^{-5}	0.0015	>10.0	1.6842×10^{-4}	0.0017	1.38
	6.0×10^{-2}	7.0×10^{-2}	1.8589×10^{-4}	0.0015	1.8636×10^{-4}	0.0003	1.65	1.8643×10^{-4}	0.0005	1.83
	7.0×10^{-2}	8.0×10^{-2}	1.9693×10^{-4}	0.0014	1.9683×10^{-4}	0.0002	0.34	1.9683×10^{-4}	0.0004	0.35
	8.0×10^{-2}	9.0×10^{-2}	2.0083×10^{-4}	0.0014	2.0150×10^{-4}	0.0002	2.37	2.0153×10^{-4}	0.0003	2.45
	9.0×10^{-2}	1.0×10^{-1}	1.9791×10^{-4}	0.0014	1.9788×10^{-4}	0.0002	0.10	1.9784×10^{-4}	0.0003	0.24
	1.0×10^{-1}	2.0×10^{-1}	1.5590×10^{-3}	0.0005	1.5594×10^{-3}	0.0000	0.44	1.5594×10^{-3}	0.0001	0.53

Table 3 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
0.975	1.0×10^{-3}	2.0×10^{-3}	1.6746×10^{-6}	0.0215	-	-	>10.0	1.6938×10^{-6}	0.0002	0.53
	2.0×10^{-3}	3.0×10^{-3}	2.3503×10^{-6}	0.0181	-	-	>10.0	2.3909×10^{-6}	0.0002	0.95
	3.0×10^{-3}	4.0×10^{-3}	2.7806×10^{-6}	0.0167	-	-	>10.0	2.7767×10^{-6}	0.0002	0.08
	4.0×10^{-3}	5.0×10^{-3}	3.2804×10^{-6}	0.0154	-	-	>10.0	3.2690×10^{-6}	0.0002	0.23
	5.0×10^{-3}	6.0×10^{-3}	3.5365×10^{-6}	0.0148	-	-	>10.0	3.5027×10^{-6}	0.0003	0.64
	6.0×10^{-3}	7.0×10^{-3}	3.9346×10^{-6}	0.0140	-	-	>10.0	3.9382×10^{-6}	0.0003	0.06
	7.0×10^{-3}	8.0×10^{-3}	4.1865×10^{-6}	0.0136	-	-	>10.0	4.2137×10^{-6}	0.0003	0.48
	8.0×10^{-3}	9.0×10^{-3}	4.3815×10^{-6}	0.0133	-	-	>10.0	4.4005×10^{-6}	0.0003	0.33
	9.0×10^{-3}	1.0×10^{-2}	5.0713×10^{-6}	0.0123	-	-	>10.0	5.1389×10^{-6}	0.0003	1.08
	1.0×10^{-2}	2.0×10^{-2}	7.7353×10^{-5}	0.0032	-	-	>10.0	7.7125×10^{-5}	0.0001	0.92
	2.0×10^{-2}	3.0×10^{-2}	1.1752×10^{-4}	0.0026	-	-	>10.0	1.1805×10^{-4}	0.0002	1.71
	3.0×10^{-2}	4.0×10^{-2}	1.3935×10^{-4}	0.0024	-	-	>10.0	1.3895×10^{-4}	0.0003	1.19
	4.0×10^{-2}	5.0×10^{-2}	1.5642×10^{-4}	0.0022	-	-	>10.0	1.5651×10^{-4}	0.0004	0.24
	5.0×10^{-2}	6.0×10^{-2}	1.7140×10^{-4}	0.0021	-	-	>10.0	1.7163×10^{-4}	0.0007	0.60
	6.0×10^{-2}	7.0×10^{-2}	1.8608×10^{-4}	0.0020	1.1643×10^{-4}	0.0021	>10.0	1.8558×10^{-4}	0.0026	0.82
	7.0×10^{-2}	8.0×10^{-2}	1.9838×10^{-4}	0.0020	1.9828×10^{-4}	0.0005	0.26	1.9836×10^{-4}	0.0007	0.05
	8.0×10^{-2}	9.0×10^{-2}	2.1082×10^{-4}	0.0019	2.1122×10^{-4}	0.0003	0.97	2.1116×10^{-4}	0.0005	0.82
	9.0×10^{-2}	1.0×10^{-1}	2.2459×10^{-4}	0.0019	2.2548×10^{-4}	0.0003	2.08	2.2547×10^{-4}	0.0004	2.04
	1.0×10^{-1}	2.0×10^{-1}	2.2945×10^{-3}	0.0006	2.2935×10^{-3}	0.0000	0.73	2.2933×10^{-3}	0.0001	0.86
	2.0×10^{-1}	3.0×10^{-1}	5.0017×10^{-4}	0.0012	5.0013×10^{-4}	0.0001	0.06	5.0015×10^{-4}	0.0001	0.05

Table 3 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
1.0	1.0×10^{-3}	2.0×10^{-3}	1.8190×10^{-6}	0.0281	-	-	>10.0	1.7928×10^{-6}	0.0002	0.51
	2.0×10^{-3}	3.0×10^{-3}	2.4127×10^{-6}	0.0243	-	-	>10.0	2.3741×10^{-6}	0.0002	0.66
	3.0×10^{-3}	4.0×10^{-3}	2.8023×10^{-6}	0.0226	-	-	>10.0	2.8041×10^{-6}	0.0002	0.03
	4.0×10^{-3}	5.0×10^{-3}	3.2038×10^{-6}	0.0212	-	-	>10.0	3.2331×10^{-6}	0.0002	0.43
	5.0×10^{-3}	6.0×10^{-3}	3.5011×10^{-6}	0.0203	-	-	>10.0	3.5551×10^{-6}	0.0003	0.76
	6.0×10^{-3}	7.0×10^{-3}	4.0258×10^{-6}	0.0188	-	-	>10.0	4.0052×10^{-6}	0.0003	0.27
	7.0×10^{-3}	8.0×10^{-3}	4.0977×10^{-6}	0.0187	-	-	>10.0	4.0999×10^{-6}	0.0003	0.03
	8.0×10^{-3}	9.0×10^{-3}	4.8939×10^{-6}	0.0171	-	-	>10.0	4.7217×10^{-6}	0.0003	2.06
	9.0×10^{-3}	1.0×10^{-2}	5.1858×10^{-6}	0.0166	-	-	>10.0	5.1774×10^{-6}	0.0003	0.10
	1.0×10^{-2}	2.0×10^{-2}	8.1751×10^{-5}	0.0042	-	-	>10.0	8.1231×10^{-5}	0.0001	1.51
	2.0×10^{-2}	3.0×10^{-2}	1.1886×10^{-4}	0.0035	-	-	>10.0	1.1848×10^{-4}	0.0002	0.92
	3.0×10^{-2}	4.0×10^{-2}	1.4156×10^{-4}	0.0032	-	-	>10.0	1.4043×10^{-4}	0.0003	2.50
	4.0×10^{-2}	5.0×10^{-2}	1.5956×10^{-4}	0.0030	-	-	>10.0	1.5913×10^{-4}	0.0005	0.89
	5.0×10^{-2}	6.0×10^{-2}	1.7380×10^{-4}	0.0029	-	-	>10.0	1.7196×10^{-4}	0.0010	3.45
	6.0×10^{-2}	7.0×10^{-2}	2.2416×10^{-4}	0.0026	3.9196×10^{-4}	0.0891	4.80	8.0928×10^{-4}	0.0751	9.63
	7.0×10^{-2}	8.0×10^{-2}	1.9740×10^{-4}	0.0027	2.1428×10^{-4}	0.0016	>10.0	2.1356×10^{-4}	0.0022	>10.0
	8.0×10^{-2}	9.0×10^{-2}	2.1769×10^{-4}	0.0026	2.1896×10^{-4}	0.0006	2.18	2.1897×10^{-4}	0.0008	2.15
	9.0×10^{-2}	1.0×10^{-1}	2.3102×10^{-4}	0.0025	2.3111×10^{-4}	0.0004	0.15	2.3105×10^{-4}	0.0005	0.04
	1.0×10^{-1}	2.0×10^{-1}	2.4835×10^{-3}	0.0008	2.4866×10^{-3}	0.0001	1.59	2.4865×10^{-3}	0.0001	1.52
	2.0×10^{-1}	3.0×10^{-1}	8.0692×10^{-4}	0.0013	8.1304×10^{-4}	0.0001	5.82	8.1304×10^{-4}	0.0001	5.81

Appendix E MCNP Software Results for Test Problem for Law 44 (Kalbach-87) on B-11 for a source energy of 10.0 MeV

Table 4: Results of the MCNP path-length tally (`f4`) and next-event tally (`f5`) results as a function of scattering angle for incident neutrons on B-11 with only Law 44 (Kalbach-87) with source energy of 10.0 MeV.

	Energy Bins		F4		Unmodified F5			Modified F5		
Cosine Angle (μ)	Lower Bin Energy (MeV)	Upper Bin Energy (MeV)	Flux (n/cm^2) (n/cm^2)	Fract. Std. Dev.	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4
-1.0	1.0×10^{-11}	1.0×10^{-4}	2.9205×10^{-8}	0.2229	3.0686×10^{-8}	0.0001	0.23	1.6008×10^{-8}	0.0002	2.03
	1.0×10^{-4}	2.0×10^{-4}	1.9005×10^{-8}	0.2592	5.5147×10^{-8}	0.0002	7.34	2.8763×10^{-8}	0.0002	1.98
	2.0×10^{-4}	3.0×10^{-4}	4.2693×10^{-8}	0.1776	7.0488×10^{-8}	0.0002	3.67	3.6785×10^{-8}	0.0003	0.78
	3.0×10^{-4}	4.0×10^{-4}	3.4228×10^{-8}	0.2060	8.2640×10^{-8}	0.0002	6.87	4.3118×10^{-8}	0.0003	1.26
	4.0×10^{-4}	5.0×10^{-4}	4.1649×10^{-8}	0.1845	9.0151×10^{-8}	0.0002	6.31	4.8467×10^{-8}	0.0003	0.89
	5.0×10^{-4}	6.0×10^{-4}	4.7273×10^{-8}	0.1773	9.7908×10^{-8}	0.0002	6.04	5.3189×10^{-8}	0.0003	0.71
	6.0×10^{-4}	7.0×10^{-4}	6.1755×10^{-8}	0.1514	1.0789×10^{-7}	0.0003	4.93	5.9590×10^{-8}	0.0003	0.23
	7.0×10^{-4}	8.0×10^{-4}	7.5769×10^{-8}	0.1400	1.1840×10^{-7}	0.0003	4.02	6.6863×10^{-8}	0.0003	0.84
	8.0×10^{-4}	9.0×10^{-4}	7.1819×10^{-8}	0.1442	1.2531×10^{-7}	0.0003	5.17	7.0768×10^{-8}	0.0003	0.10
	9.0×10^{-4}	1.0×10^{-3}	7.0787×10^{-8}	0.1400	1.3172×10^{-7}	0.0003	6.15	7.4392×10^{-8}	0.0003	0.36
	1.0×10^{-3}	2.0×10^{-3}	8.6797×10^{-7}	0.0408	1.5829×10^{-6}	0.0001	>10.0	9.0547×10^{-7}	0.0001	1.06
	2.0×10^{-3}	3.0×10^{-3}	1.0403×10^{-6}	0.0370	1.8663×10^{-6}	0.0001	>10.0	1.0666×10^{-6}	0.0001	0.68
	3.0×10^{-3}	4.0×10^{-3}	1.0776×10^{-6}	0.0367	1.9466×10^{-6}	0.0001	>10.0	1.0623×10^{-6}	0.0002	0.39
	4.0×10^{-3}	5.0×10^{-3}	1.1231×10^{-6}	0.0356	2.1106×10^{-6}	0.0001	>10.0	1.1761×10^{-6}	0.0002	1.33
	5.0×10^{-3}	6.0×10^{-3}	1.2933×10^{-6}	0.0335	2.2738×10^{-6}	0.0001	>10.0	1.2730×10^{-6}	0.0002	0.47
	6.0×10^{-3}	7.0×10^{-3}	1.1492×10^{-6}	0.0354	2.1424×10^{-6}	0.0002	>10.0	1.1529×10^{-6}	0.0002	0.09
	7.0×10^{-3}	8.0×10^{-3}	1.1169×10^{-6}	0.0360	2.1494×10^{-6}	0.0002	>10.0	1.1044×10^{-6}	0.0002	0.31
	8.0×10^{-3}	9.0×10^{-3}	1.1460×10^{-6}	0.0355	2.2090×10^{-6}	0.0002	>10.0	1.1575×10^{-6}	0.0002	0.28
	9.0×10^{-3}	1.0×10^{-2}	1.2289×10^{-6}	0.0341	2.2517×10^{-6}	0.0002	>10.0	1.2058×10^{-6}	0.0002	0.55
	1.0×10^{-2}	2.0×10^{-2}	8.7170×10^{-6}	0.0128	1.9351×10^{-5}	0.0001	>10.0	8.7964×10^{-6}	0.0001	0.71
	2.0×10^{-2}	3.0×10^{-2}	3.0481×10^{-6}	0.0216	1.2454×10^{-5}	0.0002	>10.0	3.0708×10^{-6}	0.0002	0.34
	3.0×10^{-2}	4.0×10^{-2}	1.7409×10^{-6}	0.0288	9.3485×10^{-6}	0.0003	>10.0	1.7462×10^{-6}	0.0003	0.11
	4.0×10^{-2}	5.0×10^{-2}	1.1703×10^{-6}	0.0350	6.6749×10^{-6}	0.0004	>10.0	1.1242×10^{-6}	0.0004	1.13
	5.0×10^{-2}	6.0×10^{-2}	2.5729×10^{-7}	0.0741	3.6775×10^{-6}	0.0009	>10.0	2.7160×10^{-7}	0.0008	0.75
	6.0×10^{-2}	7.0×10^{-2}	2.7621×10^{-7}	0.0720	1.5014×10^{-6}	0.0024	>10.0	2.8353×10^{-7}	0.0008	0.37
	7.0×10^{-2}	8.0×10^{-2}	2.9867×10^{-7}	0.0700	3.1162×10^{-7}	0.0083	0.61	2.9388×10^{-7}	0.0008	0.23
	8.0×10^{-2}	9.0×10^{-2}	2.8854×10^{-7}	0.0711	3.0355×10^{-7}	0.0009	0.73	3.0355×10^{-7}	0.0009	0.73

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
	9.0×10^{-2}	1.0×10^{-1}	2.4551×10^{-8}	0.2480	1.5307×10^{-8}	0.0039	1.52	1.5307×10^{-8}	0.0039	1.52

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
−0.975	1.0×10^{-11}	1.0×10^{-4}	1.3041×10^{-8}	0.2476	3.0668×10^{-8}	0.0001	5.46	1.6020×10^{-8}	0.0002	0.92
	1.0×10^{-4}	2.0×10^{-4}	2.6917×10^{-8}	0.1699	5.5083×10^{-8}	0.0002	6.16	2.8795×10^{-8}	0.0002	0.41
	2.0×10^{-4}	3.0×10^{-4}	3.3222×10^{-8}	0.1491	7.0393×10^{-8}	0.0002	7.50	3.6839×10^{-8}	0.0003	0.73
	3.0×10^{-4}	4.0×10^{-4}	5.3077×10^{-8}	0.1211	8.2486×10^{-8}	0.0002	4.58	4.3191×10^{-8}	0.0003	1.54
	4.0×10^{-4}	5.0×10^{-4}	4.9494×10^{-8}	0.1258	9.0841×10^{-8}	0.0002	6.64	4.8561×10^{-8}	0.0003	0.15
	5.0×10^{-4}	6.0×10^{-4}	5.4256×10^{-8}	0.1198	9.7700×10^{-8}	0.0002	6.68	5.3292×10^{-8}	0.0003	0.15
	6.0×10^{-4}	7.0×10^{-4}	5.7538×10^{-8}	0.1153	1.0599×10^{-7}	0.0003	7.30	5.8062×10^{-8}	0.0003	0.08
	7.0×10^{-4}	8.0×10^{-4}	6.9679×10^{-8}	0.1062	1.1809×10^{-7}	0.0003	6.54	6.6992×10^{-8}	0.0003	0.36
	8.0×10^{-4}	9.0×10^{-4}	7.5837×10^{-8}	0.1015	1.2497×10^{-7}	0.0003	6.38	7.0937×10^{-8}	0.0003	0.64
	9.0×10^{-4}	1.0×10^{-3}	7.0554×10^{-8}	0.1052	1.3134×10^{-7}	0.0003	8.19	7.4539×10^{-8}	0.0003	0.54
	1.0×10^{-3}	2.0×10^{-3}	9.5496×10^{-7}	0.0286	1.5835×10^{-6}	0.0001	>10.0	9.0811×10^{-7}	0.0001	1.72
	2.0×10^{-3}	3.0×10^{-3}	1.0669×10^{-6}	0.0269	1.8817×10^{-6}	0.0001	>10.0	1.0956×10^{-6}	0.0001	1.00
	3.0×10^{-3}	4.0×10^{-3}	1.0756×10^{-6}	0.0270	1.9505×10^{-6}	0.0001	>10.0	1.0661×10^{-6}	0.0002	0.33
	4.0×10^{-3}	5.0×10^{-3}	1.1759×10^{-6}	0.0256	2.0925×10^{-6}	0.0001	>10.0	1.1809×10^{-6}	0.0002	0.17
	5.0×10^{-3}	6.0×10^{-3}	1.3247×10^{-6}	0.0243	2.2614×10^{-6}	0.0001	>10.0	1.2785×10^{-6}	0.0002	1.44
	6.0×10^{-3}	7.0×10^{-3}	1.2433×10^{-6}	0.0251	2.2210×10^{-6}	0.0002	>10.0	1.2364×10^{-6}	0.0002	0.22
	7.0×10^{-3}	8.0×10^{-3}	1.1164×10^{-6}	0.0264	2.1176×10^{-6}	0.0002	>10.0	1.1097×10^{-6}	0.0002	0.23
	8.0×10^{-3}	9.0×10^{-3}	1.1801×10^{-6}	0.0256	2.2147×10^{-6}	0.0002	>10.0	1.1628×10^{-6}	0.0002	0.57
	9.0×10^{-3}	1.0×10^{-2}	1.2258×10^{-6}	0.0251	2.2329×10^{-6}	0.0002	>10.0	1.2117×10^{-6}	0.0002	0.46
	1.0×10^{-2}	2.0×10^{-2}	9.1542×10^{-6}	0.0092	1.9485×10^{-5}	0.0001	>10.0	9.2530×10^{-6}	0.0001	1.17
	2.0×10^{-2}	3.0×10^{-2}	3.5023×10^{-6}	0.0148	1.2426×10^{-5}	0.0002	>10.0	3.4675×10^{-6}	0.0002	0.67
	3.0×10^{-2}	4.0×10^{-2}	1.7859×10^{-6}	0.0208	8.8026×10^{-6}	0.0003	>10.0	1.7565×10^{-6}	0.0003	0.79
	4.0×10^{-2}	5.0×10^{-2}	1.3332×10^{-6}	0.0243	6.2818×10^{-6}	0.0004	>10.0	1.3404×10^{-6}	0.0003	0.22
	5.0×10^{-2}	6.0×10^{-2}	2.6725×10^{-7}	0.0536	2.9914×10^{-6}	0.0007	>10.0	2.7312×10^{-7}	0.0008	0.41
	6.0×10^{-2}	7.0×10^{-2}	2.6885×10^{-7}	0.0539	8.2780×10^{-7}	0.0012	>10.0	2.8538×10^{-7}	0.0008	1.14
	7.0×10^{-2}	8.0×10^{-2}	2.7956×10^{-7}	0.0527	2.9528×10^{-7}	0.0009	1.07	2.9528×10^{-7}	0.0009	1.07
	8.0×10^{-2}	9.0×10^{-2}	2.9761×10^{-7}	0.0512	3.0566×10^{-7}	0.0009	0.53	3.0566×10^{-7}	0.0009	0.53
	9.0×10^{-2}	1.0×10^{-1}	9.0536×10^{-8}	0.0919	8.1857×10^{-8}	0.0017	1.04	8.1857×10^{-8}	0.0017	1.04

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
−0.9	1.0×10^{-11}	1.0×10^{-4}	1.5320×10^{-8}	0.1628	3.0606×10^{-8}	0.0002	6.13	1.6056×10^{-8}	0.0002	0.30
	1.0×10^{-4}	2.0×10^{-4}	3.4939×10^{-8}	0.1056	5.4888×10^{-8}	0.0002	5.41	2.8894×10^{-8}	0.0002	1.64
	2.0×10^{-4}	3.0×10^{-4}	4.0227×10^{-8}	0.0981	7.0064×10^{-8}	0.0002	7.56	3.6992×10^{-8}	0.0003	0.82
	3.0×10^{-4}	4.0×10^{-4}	4.3560×10^{-8}	0.0956	8.1985×10^{-8}	0.0002	9.23	4.3400×10^{-8}	0.0003	0.04
	4.0×10^{-4}	5.0×10^{-4}	4.6537×10^{-8}	0.0930	9.2103×10^{-8}	0.0002	>10.0	4.8839×10^{-8}	0.0003	0.53
	5.0×10^{-4}	6.0×10^{-4}	4.4954×10^{-8}	0.0935	9.8353×10^{-8}	0.0003	>10.0	5.3580×10^{-8}	0.0003	2.05
	6.0×10^{-4}	7.0×10^{-4}	5.6052×10^{-8}	0.0838	1.0466×10^{-7}	0.0003	>10.0	5.7918×10^{-8}	0.0003	0.40
	7.0×10^{-4}	8.0×10^{-4}	6.2527×10^{-8}	0.0795	1.1175×10^{-7}	0.0003	9.90	6.1996×10^{-8}	0.0004	0.11
	8.0×10^{-4}	9.0×10^{-4}	7.5103×10^{-8}	0.0728	1.2392×10^{-7}	0.0003	8.93	7.1406×10^{-8}	0.0004	0.68
	9.0×10^{-4}	1.0×10^{-3}	7.4449×10^{-8}	0.0727	1.3017×10^{-7}	0.0003	>10.0	7.5106×10^{-8}	0.0004	0.12
	1.0×10^{-3}	2.0×10^{-3}	9.0421×10^{-7}	0.0209	1.5784×10^{-6}	0.0001	>10.0	9.1594×10^{-7}	0.0001	0.62
	2.0×10^{-3}	3.0×10^{-3}	1.1367×10^{-6}	0.0186	1.9014×10^{-6}	0.0001	>10.0	1.1467×10^{-6}	0.0001	0.47
	3.0×10^{-3}	4.0×10^{-3}	1.1474×10^{-6}	0.0186	1.9721×10^{-6}	0.0001	>10.0	1.1288×10^{-6}	0.0002	0.87
	4.0×10^{-3}	5.0×10^{-3}	1.2126×10^{-6}	0.0180	2.0912×10^{-6}	0.0001	>10.0	1.1958×10^{-6}	0.0002	0.77
	5.0×10^{-3}	6.0×10^{-3}	1.2765×10^{-6}	0.0176	2.1943×10^{-6}	0.0002	>10.0	1.2954×10^{-6}	0.0002	0.84
	6.0×10^{-3}	7.0×10^{-3}	1.3326×10^{-6}	0.0172	2.3275×10^{-6}	0.0002	>10.0	1.3830×10^{-6}	0.0002	2.20
	7.0×10^{-3}	8.0×10^{-3}	1.2606×10^{-6}	0.0177	2.2521×10^{-6}	0.0002	>10.0	1.2696×10^{-6}	0.0002	0.40
	8.0×10^{-3}	9.0×10^{-3}	1.1354×10^{-6}	0.0186	2.1128×10^{-6}	0.0002	>10.0	1.1801×10^{-6}	0.0002	2.11
	9.0×10^{-3}	1.0×10^{-2}	1.1998×10^{-6}	0.0181	2.1837×10^{-6}	0.0002	>10.0	1.2299×10^{-6}	0.0002	1.39
	1.0×10^{-2}	2.0×10^{-2}	1.0850×10^{-5}	0.0060	2.0031×10^{-5}	0.0001	>10.0	1.0814×10^{-5}	0.0001	0.55
	2.0×10^{-2}	3.0×10^{-2}	4.8004×10^{-6}	0.0091	1.2413×10^{-5}	0.0001	>10.0	4.8154×10^{-6}	0.0002	0.34
	3.0×10^{-2}	4.0×10^{-2}	1.7935×10^{-6}	0.0149	7.1395×10^{-6}	0.0002	>10.0	1.7879×10^{-6}	0.0003	0.21
	4.0×10^{-2}	5.0×10^{-2}	1.8588×10^{-6}	0.0146	4.8374×10^{-6}	0.0003	>10.0	1.9221×10^{-6}	0.0003	2.33
	5.0×10^{-2}	6.0×10^{-2}	4.1644×10^{-7}	0.0307	1.0460×10^{-6}	0.0007	>10.0	4.1983×10^{-7}	0.0007	0.26
	6.0×10^{-2}	7.0×10^{-2}	2.8503×10^{-7}	0.0373	2.9060×10^{-7}	0.0009	0.52	2.9060×10^{-7}	0.0009	0.52
	7.0×10^{-2}	8.0×10^{-2}	3.0422×10^{-7}	0.0360	3.0094×10^{-7}	0.0009	0.30	3.0094×10^{-7}	0.0009	0.30
	8.0×10^{-2}	9.0×10^{-2}	3.0512×10^{-7}	0.0358	3.1027×10^{-7}	0.0009	0.47	3.1027×10^{-7}	0.0009	0.47
	9.0×10^{-2}	1.0×10^{-1}	3.0754×10^{-7}	0.0360	3.0167×10^{-7}	0.0009	0.53	3.0167×10^{-7}	0.0009	0.53

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
−0.75	1.0×10^{-11}	1.0×10^{-4}	1.3954×10^{-8}	0.1341	3.0437×10^{-8}	0.0002	8.81	1.6123×10^{-8}	0.0002	1.16
	1.0×10^{-4}	2.0×10^{-4}	3.0289×10^{-8}	0.0921	5.4376×10^{-8}	0.0002	8.63	2.9096×10^{-8}	0.0003	0.43
	2.0×10^{-4}	3.0×10^{-4}	3.7062×10^{-8}	0.0846	6.9236×10^{-8}	0.0002	>10.0	3.7317×10^{-8}	0.0003	0.08
	3.0×10^{-4}	4.0×10^{-4}	4.5424×10^{-8}	0.0761	8.0838×10^{-8}	0.0002	>10.0	4.3826×10^{-8}	0.0003	0.46
	4.0×10^{-4}	5.0×10^{-4}	4.7594×10^{-8}	0.0735	9.0537×10^{-8}	0.0003	>10.0	4.9372×10^{-8}	0.0003	0.51
	5.0×10^{-4}	6.0×10^{-4}	5.7088×10^{-8}	0.0671	9.9075×10^{-8}	0.0003	>10.0	5.4258×10^{-8}	0.0004	0.74
	6.0×10^{-4}	7.0×10^{-4}	5.4527×10^{-8}	0.0688	1.0665×10^{-7}	0.0003	>10.0	5.8660×10^{-8}	0.0004	1.10
	7.0×10^{-4}	8.0×10^{-4}	6.0688×10^{-8}	0.0655	1.1351×10^{-7}	0.0003	>10.0	6.2661×10^{-8}	0.0004	0.50
	8.0×10^{-4}	9.0×10^{-4}	7.3536×10^{-8}	0.0597	1.1580×10^{-7}	0.0003	9.63	6.6384×10^{-8}	0.0004	1.63
	9.0×10^{-4}	1.0×10^{-3}	8.0743×10^{-8}	0.0568	1.2107×10^{-7}	0.0003	8.79	6.9864×10^{-8}	0.0004	2.37
	1.0×10^{-3}	2.0×10^{-3}	9.1239×10^{-7}	0.0169	1.5288×10^{-6}	0.0001	>10.0	9.2612×10^{-7}	0.0001	0.89
	2.0×10^{-3}	3.0×10^{-3}	1.1887×10^{-6}	0.0148	1.8869×10^{-6}	0.0001	>10.0	1.1711×10^{-6}	0.0001	1.00
	3.0×10^{-3}	4.0×10^{-3}	1.3556×10^{-6}	0.0138	2.1067×10^{-6}	0.0001	>10.0	1.3534×10^{-6}	0.0002	0.12
	4.0×10^{-3}	5.0×10^{-3}	1.2787×10^{-6}	0.0142	2.0658×10^{-6}	0.0002	>10.0	1.2996×10^{-6}	0.0002	1.15
	5.0×10^{-3}	6.0×10^{-3}	1.3187×10^{-6}	0.0140	2.1280×10^{-6}	0.0002	>10.0	1.3315×10^{-6}	0.0002	0.70
	6.0×10^{-3}	7.0×10^{-3}	1.4236×10^{-6}	0.0135	2.2402×10^{-6}	0.0002	>10.0	1.4235×10^{-6}	0.0002	0.00
	7.0×10^{-3}	8.0×10^{-3}	1.5373×10^{-6}	0.0130	2.3331×10^{-6}	0.0002	>10.0	1.5055×10^{-6}	0.0002	1.59
	8.0×10^{-3}	9.0×10^{-3}	1.6000×10^{-6}	0.0128	2.3685×10^{-6}	0.0002	>10.0	1.5798×10^{-6}	0.0002	0.99
	9.0×10^{-3}	1.0×10^{-2}	1.5213×10^{-6}	0.0131	2.2594×10^{-6}	0.0002	>10.0	1.4944×10^{-6}	0.0002	1.35
	1.0×10^{-2}	2.0×10^{-2}	1.3115×10^{-5}	0.0045	1.9931×10^{-5}	0.0001	>10.0	1.3104×10^{-5}	0.0001	0.19
	2.0×10^{-2}	3.0×10^{-2}	9.1091×10^{-6}	0.0053	1.3357×10^{-5}	0.0001	>10.0	9.0848×10^{-6}	0.0001	0.50
	3.0×10^{-2}	4.0×10^{-2}	3.1322×10^{-6}	0.0091	4.5436×10^{-6}	0.0002	>10.0	3.1192×10^{-6}	0.0002	0.46
	4.0×10^{-2}	5.0×10^{-2}	1.9972×10^{-6}	0.0114	1.9984×10^{-6}	0.0003	0.05	1.9984×10^{-6}	0.0003	0.05
	5.0×10^{-2}	6.0×10^{-2}	2.1010×10^{-6}	0.0111	2.1099×10^{-6}	0.0003	0.38	2.1099×10^{-6}	0.0003	0.38
	6.0×10^{-2}	7.0×10^{-2}	3.8554×10^{-7}	0.0260	4.0042×10^{-7}	0.0008	1.48	4.0042×10^{-7}	0.0008	1.48
	7.0×10^{-2}	8.0×10^{-2}	3.2029×10^{-7}	0.0284	3.1296×10^{-7}	0.0009	0.81	3.1296×10^{-7}	0.0009	0.81
	8.0×10^{-2}	9.0×10^{-2}	3.1481×10^{-7}	0.0288	3.2235×10^{-7}	0.0009	0.83	3.2235×10^{-7}	0.0009	0.83
	9.0×10^{-2}	1.0×10^{-1}	3.3352×10^{-7}	0.0279	3.3025×10^{-7}	0.0009	0.35	3.3025×10^{-7}	0.0009	0.35
	1.0×10^{-1}	2.0×10^{-1}	5.1616×10^{-7}	0.0225	5.1153×10^{-7}	0.0008	0.40	5.1153×10^{-7}	0.0008	0.40

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
−0.5	1.0×10^{-11}	1.0×10^{-4}	1.8275×10^{-8}	0.1042	2.9928×10^{-8}	0.0002	6.12	1.6226×10^{-8}	0.0003	1.08
	1.0×10^{-4}	2.0×10^{-4}	3.3931×10^{-8}	0.0775	5.2937×10^{-8}	0.0002	7.23	2.9445×10^{-8}	0.0003	1.71
	2.0×10^{-4}	3.0×10^{-4}	3.2643×10^{-8}	0.0768	6.6901×10^{-8}	0.0003	>10.0	3.7879×10^{-8}	0.0004	2.09
	3.0×10^{-4}	4.0×10^{-4}	4.6558×10^{-8}	0.0655	7.7601×10^{-8}	0.0003	>10.0	4.4561×10^{-8}	0.0004	0.65
	4.0×10^{-4}	5.0×10^{-4}	4.7740×10^{-8}	0.0642	8.6566×10^{-8}	0.0003	>10.0	5.0326×10^{-8}	0.0004	0.84
	5.0×10^{-4}	6.0×10^{-4}	5.5288×10^{-8}	0.0593	9.4182×10^{-8}	0.0003	>10.0	5.5368×10^{-8}	0.0004	0.02
	6.0×10^{-4}	7.0×10^{-4}	6.0767×10^{-8}	0.0571	1.0103×10^{-7}	0.0003	>10.0	5.9942×10^{-8}	0.0004	0.24
	7.0×10^{-4}	8.0×10^{-4}	5.5592×10^{-8}	0.0599	1.0712×10^{-7}	0.0004	>10.0	6.4153×10^{-8}	0.0005	2.57
	8.0×10^{-4}	9.0×10^{-4}	6.5576×10^{-8}	0.0552	1.1268×10^{-7}	0.0004	>10.0	6.8064×10^{-8}	0.0005	0.69
	9.0×10^{-4}	1.0×10^{-3}	7.2265×10^{-8}	0.0524	1.1778×10^{-7}	0.0004	>10.0	7.1703×10^{-8}	0.0005	0.15
	1.0×10^{-3}	2.0×10^{-3}	8.8274×10^{-7}	0.0150	1.3938×10^{-6}	0.0001	>10.0	8.8169×10^{-7}	0.0002	0.08
	2.0×10^{-3}	3.0×10^{-3}	1.2012×10^{-6}	0.0129	1.7341×10^{-6}	0.0001	>10.0	1.2071×10^{-6}	0.0002	0.38
	3.0×10^{-3}	4.0×10^{-3}	1.3870×10^{-6}	0.0120	1.9317×10^{-6}	0.0002	>10.0	1.4118×10^{-6}	0.0002	1.48
	4.0×10^{-3}	5.0×10^{-3}	1.5863×10^{-6}	0.0112	2.0845×10^{-6}	0.0002	>10.0	1.5738×10^{-6}	0.0002	0.70
	5.0×10^{-3}	6.0×10^{-3}	1.7574×10^{-6}	0.0106	2.2041×10^{-6}	0.0002	>10.0	1.7135×10^{-6}	0.0002	2.36
	6.0×10^{-3}	7.0×10^{-3}	1.7992×10^{-6}	0.0105	2.3004×10^{-6}	0.0002	>10.0	1.8367×10^{-6}	0.0002	1.98
	7.0×10^{-3}	8.0×10^{-3}	1.7328×10^{-6}	0.0107	2.1660×10^{-6}	0.0002	>10.0	1.7344×10^{-6}	0.0002	0.09
	8.0×10^{-3}	9.0×10^{-3}	1.6587×10^{-6}	0.0109	2.0661×10^{-6}	0.0002	>10.0	1.6702×10^{-6}	0.0002	0.64
	9.0×10^{-3}	1.0×10^{-2}	1.7729×10^{-6}	0.0106	2.1033×10^{-6}	0.0002	>10.0	1.7459×10^{-6}	0.0002	1.43
	1.0×10^{-2}	2.0×10^{-2}	1.8227×10^{-5}	0.0033	1.9682×10^{-5}	0.0001	>10.0	1.8358×10^{-5}	0.0001	2.17
	2.0×10^{-2}	3.0×10^{-2}	1.6060×10^{-5}	0.0035	1.6066×10^{-5}	0.0001	0.10	1.6066×10^{-5}	0.0001	0.10
	3.0×10^{-2}	4.0×10^{-2}	1.1753×10^{-5}	0.0041	1.1811×10^{-5}	0.0001	1.21	1.1811×10^{-5}	0.0001	1.21
	4.0×10^{-2}	5.0×10^{-2}	6.5205×10^{-6}	0.0055	6.5460×10^{-6}	0.0002	0.71	6.5460×10^{-6}	0.0002	0.71
	5.0×10^{-2}	6.0×10^{-2}	2.2457×10^{-6}	0.0094	2.2702×10^{-6}	0.0003	1.16	2.2702×10^{-6}	0.0003	1.16
	6.0×10^{-2}	7.0×10^{-2}	2.3631×10^{-6}	0.0092	2.3722×10^{-6}	0.0004	0.42	2.3722×10^{-6}	0.0004	0.42
	7.0×10^{-2}	8.0×10^{-2}	2.4272×10^{-6}	0.0091	2.4562×10^{-6}	0.0004	1.31	2.4562×10^{-6}	0.0004	1.31
	8.0×10^{-2}	9.0×10^{-2}	8.1872×10^{-7}	0.0156	8.3176×10^{-7}	0.0006	1.02	8.3176×10^{-7}	0.0006	1.02
	9.0×10^{-2}	1.0×10^{-1}	3.5166×10^{-7}	0.0238	3.5528×10^{-7}	0.0010	0.43	3.5528×10^{-7}	0.0010	0.43
	1.0×10^{-1}	2.0×10^{-1}	1.8263×10^{-6}	0.0104	1.7952×10^{-6}	0.0005	1.64	1.7952×10^{-6}	0.0005	1.64

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
−0.3	1.0×10^{-11}	1.0×10^{-4}	1.7913×10^{-8}	0.0999	2.8854×10^{-8}	0.0003	6.11	1.6202×10^{-8}	0.0004	0.96
	1.0×10^{-4}	2.0×10^{-4}	3.2322×10^{-8}	0.0748	5.0318×10^{-8}	0.0003	7.44	2.9734×10^{-8}	0.0004	1.07
	2.0×10^{-4}	3.0×10^{-4}	3.4018×10^{-8}	0.0727	6.2759×10^{-8}	0.0004	>10.0	3.8356×10^{-8}	0.0005	1.75
	3.0×10^{-4}	4.0×10^{-4}	4.3472×10^{-8}	0.0646	7.2062×10^{-8}	0.0004	>10.0	4.5199×10^{-8}	0.0005	0.62
	4.0×10^{-4}	5.0×10^{-4}	4.7712×10^{-8}	0.0608	7.9661×10^{-8}	0.0004	>10.0	5.1106×10^{-8}	0.0005	1.17
	5.0×10^{-4}	6.0×10^{-4}	5.5273×10^{-8}	0.0576	8.6124×10^{-8}	0.0004	9.69	5.6320×10^{-8}	0.0005	0.33
	6.0×10^{-4}	7.0×10^{-4}	6.3838×10^{-8}	0.0535	9.1718×10^{-8}	0.0005	8.16	6.1096×10^{-8}	0.0005	0.80
	7.0×10^{-4}	8.0×10^{-4}	7.1162×10^{-8}	0.0503	9.6688×10^{-8}	0.0005	7.13	6.5416×10^{-8}	0.0006	1.61
	8.0×10^{-4}	9.0×10^{-4}	7.3186×10^{-8}	0.0496	1.0120×10^{-7}	0.0005	7.72	6.9440×10^{-8}	0.0006	1.03
	9.0×10^{-4}	1.0×10^{-3}	7.4357×10^{-8}	0.0495	1.0518×10^{-7}	0.0005	8.37	7.3250×10^{-8}	0.0006	0.30
	1.0×10^{-3}	2.0×10^{-3}	8.8990×10^{-7}	0.0142	1.2196×10^{-6}	0.0002	>10.0	9.0516×10^{-7}	0.0002	1.21
	2.0×10^{-3}	3.0×10^{-3}	1.1443×10^{-6}	0.0126	1.4238×10^{-6}	0.0002	>10.0	1.1512×10^{-6}	0.0002	0.48
	3.0×10^{-3}	4.0×10^{-3}	1.3739×10^{-6}	0.0114	1.5536×10^{-6}	0.0002	>10.0	1.3430×10^{-6}	0.0002	1.98
	4.0×10^{-3}	5.0×10^{-3}	1.6226×10^{-6}	0.0105	1.7704×10^{-6}	0.0002	8.67	1.6294×10^{-6}	0.0002	0.40
	5.0×10^{-3}	6.0×10^{-3}	1.7700×10^{-6}	0.0101	1.8568×10^{-6}	0.0002	4.85	1.7893×10^{-6}	0.0002	1.08
	6.0×10^{-3}	7.0×10^{-3}	1.9555×10^{-6}	0.0096	1.9285×10^{-6}	0.0002	1.44	1.9220×10^{-6}	0.0002	1.78
	7.0×10^{-3}	8.0×10^{-3}	2.0809×10^{-6}	0.0093	2.0424×10^{-6}	0.0002	1.99	2.0424×10^{-6}	0.0002	1.99
	8.0×10^{-3}	9.0×10^{-3}	2.1642×10^{-6}	0.0091	2.1509×10^{-6}	0.0002	0.68	2.1509×10^{-6}	0.0002	0.68
	9.0×10^{-3}	1.0×10^{-2}	2.2508×10^{-6}	0.0090	2.2515×10^{-6}	0.0002	0.03	2.2515×10^{-6}	0.0002	0.03
	1.0×10^{-2}	2.0×10^{-2}	2.2992×10^{-5}	0.0028	2.2949×10^{-5}	0.0001	0.67	2.2949×10^{-5}	0.0001	0.67
	2.0×10^{-2}	3.0×10^{-2}	2.2534×10^{-5}	0.0028	2.2552×10^{-5}	0.0001	0.28	2.2552×10^{-5}	0.0001	0.28
	3.0×10^{-2}	4.0×10^{-2}	2.0226×10^{-5}	0.0030	2.0156×10^{-5}	0.0001	1.15	2.0156×10^{-5}	0.0001	1.15
	4.0×10^{-2}	5.0×10^{-2}	1.6839×10^{-5}	0.0033	1.6844×10^{-5}	0.0001	0.08	1.6844×10^{-5}	0.0001	0.08
	5.0×10^{-2}	6.0×10^{-2}	1.0371×10^{-5}	0.0042	1.0386×10^{-5}	0.0002	0.35	1.0386×10^{-5}	0.0002	0.35
	6.0×10^{-2}	7.0×10^{-2}	5.2410×10^{-6}	0.0059	5.2573×10^{-6}	0.0003	0.52	5.2573×10^{-6}	0.0003	0.52
	7.0×10^{-2}	8.0×10^{-2}	2.5882×10^{-6}	0.0083	2.6278×10^{-6}	0.0004	1.84	2.6278×10^{-6}	0.0004	1.84
	8.0×10^{-2}	9.0×10^{-2}	2.7214×10^{-6}	0.0081	2.7081×10^{-6}	0.0004	0.60	2.7081×10^{-6}	0.0004	0.60
	9.0×10^{-2}	1.0×10^{-1}	2.7416×10^{-6}	0.0081	2.7730×10^{-6}	0.0004	1.41	2.7730×10^{-6}	0.0004	1.41
	1.0×10^{-1}	2.0×10^{-1}	4.8428×10^{-6}	0.0061	4.8968×10^{-6}	0.0003	1.82	4.8968×10^{-6}	0.0003	1.82

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
−0.1	1.0×10^{-11}	1.0×10^{-4}	1.7028×10^{-8}	0.1007	2.3749×10^{-8}	0.0005	3.92	1.5076×10^{-8}	0.0006	1.14
	1.0×10^{-4}	2.0×10^{-4}	2.8225×10^{-8}	0.0777	3.9311×10^{-8}	0.0005	5.05	2.8872×10^{-8}	0.0006	0.29
	2.0×10^{-4}	3.0×10^{-4}	4.0328×10^{-8}	0.0657	4.8250×10^{-8}	0.0006	2.99	3.8817×10^{-8}	0.0007	0.57
	3.0×10^{-4}	4.0×10^{-4}	4.1640×10^{-8}	0.0635	5.3638×10^{-8}	0.0007	4.54	4.5864×10^{-8}	0.0007	1.60
	4.0×10^{-4}	5.0×10^{-4}	4.9722×10^{-8}	0.0587	5.7793×10^{-8}	0.0007	2.76	5.1975×10^{-8}	0.0007	0.77
	5.0×10^{-4}	6.0×10^{-4}	5.6924×10^{-8}	0.0549	6.1129×10^{-8}	0.0007	1.35	5.7344×10^{-8}	0.0008	0.13
	6.0×10^{-4}	7.0×10^{-4}	5.9338×10^{-8}	0.0538	6.3876×10^{-8}	0.0008	1.42	6.2179×10^{-8}	0.0008	0.89
	7.0×10^{-4}	8.0×10^{-4}	6.5555×10^{-8}	0.0515	6.6921×10^{-8}	0.0008	0.40	6.6757×10^{-8}	0.0008	0.36
	8.0×10^{-4}	9.0×10^{-4}	7.0132×10^{-8}	0.0498	7.1075×10^{-8}	0.0008	0.27	7.1074×10^{-8}	0.0008	0.27
	9.0×10^{-4}	1.0×10^{-3}	7.7785×10^{-8}	0.0477	7.5005×10^{-8}	0.0008	0.75	7.5005×10^{-8}	0.0008	0.75
	1.0×10^{-3}	2.0×10^{-3}	9.4265×10^{-7}	0.0136	9.3058×10^{-7}	0.0003	0.94	9.3058×10^{-7}	0.0003	0.94
	2.0×10^{-3}	3.0×10^{-3}	1.2042×10^{-6}	0.0120	1.1917×10^{-6}	0.0003	0.86	1.1917×10^{-6}	0.0003	0.86
	3.0×10^{-3}	4.0×10^{-3}	1.4294×10^{-6}	0.0110	1.3969×10^{-6}	0.0003	2.07	1.3969×10^{-6}	0.0003	2.07
	4.0×10^{-3}	5.0×10^{-3}	1.5535×10^{-6}	0.0106	1.5697×10^{-6}	0.0003	0.98	1.5697×10^{-6}	0.0003	0.98
	5.0×10^{-3}	6.0×10^{-3}	1.7048×10^{-6}	0.0101	1.7197×10^{-6}	0.0003	0.86	1.7197×10^{-6}	0.0003	0.86
	6.0×10^{-3}	7.0×10^{-3}	1.8449×10^{-6}	0.0097	1.8529×10^{-6}	0.0003	0.45	1.8529×10^{-6}	0.0003	0.45
	7.0×10^{-3}	8.0×10^{-3}	1.9794×10^{-6}	0.0093	1.9739×10^{-6}	0.0003	0.30	1.9739×10^{-6}	0.0003	0.30
	8.0×10^{-3}	9.0×10^{-3}	2.0764×10^{-6}	0.0091	2.0855×10^{-6}	0.0003	0.48	2.0855×10^{-6}	0.0003	0.48
	9.0×10^{-3}	1.0×10^{-2}	2.3473×10^{-6}	0.0086	2.3588×10^{-6}	0.0003	0.57	2.3588×10^{-6}	0.0003	0.57
	1.0×10^{-2}	2.0×10^{-2}	2.8562×10^{-5}	0.0025	2.8602×10^{-5}	0.0001	0.56	2.8602×10^{-5}	0.0001	0.56
	2.0×10^{-2}	3.0×10^{-2}	2.9742×10^{-5}	0.0024	2.9738×10^{-5}	0.0001	0.06	2.9738×10^{-5}	0.0001	0.06
	3.0×10^{-2}	4.0×10^{-2}	3.0291×10^{-5}	0.0024	3.0354×10^{-5}	0.0001	0.86	3.0354×10^{-5}	0.0001	0.86
	4.0×10^{-2}	5.0×10^{-2}	2.6347×10^{-5}	0.0026	2.6447×10^{-5}	0.0001	1.46	2.6447×10^{-5}	0.0001	1.46
	5.0×10^{-2}	6.0×10^{-2}	2.3239×10^{-5}	0.0027	2.3217×10^{-5}	0.0001	0.34	2.3217×10^{-5}	0.0001	0.34
	6.0×10^{-2}	7.0×10^{-2}	2.0479×10^{-5}	0.0029	2.0499×10^{-5}	0.0001	0.34	2.0499×10^{-5}	0.0001	0.34
	7.0×10^{-2}	8.0×10^{-2}	1.2964×10^{-5}	0.0037	1.2966×10^{-5}	0.0002	0.03	1.2966×10^{-5}	0.0002	0.03
	8.0×10^{-2}	9.0×10^{-2}	1.0260×10^{-5}	0.0041	1.0204×10^{-5}	0.0002	1.32	1.0204×10^{-5}	0.0002	1.32
	9.0×10^{-2}	1.0×10^{-1}	2.9900×10^{-6}	0.0076	3.0016×10^{-6}	0.0004	0.51	3.0016×10^{-6}	0.0004	0.51
	1.0×10^{-1}	2.0×10^{-1}	1.4742×10^{-5}	0.0034	1.4848×10^{-5}	0.0002	2.11	1.4848×10^{-5}	0.0002	2.11
	2.0×10^{-1}	3.0×10^{-1}	1.1470×10^{-6}	0.0123	1.1555×10^{-6}	0.0007	0.60	1.1555×10^{-6}	0.0007	0.60

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
0.1	1.0×10^{-11}	1.0×10^{-4}	1.0681×10^{-8}	0.1284	-	-	>10.0	1.5198×10^{-8}	0.0012	3.29
	1.0×10^{-4}	2.0×10^{-4}	2.6886×10^{-8}	0.0808	-	-	>10.0	2.7857×10^{-8}	0.0016	0.45
	2.0×10^{-4}	3.0×10^{-4}	4.4326×10^{-8}	0.0629	-	-	>10.0	3.6008×10^{-8}	0.0021	2.98
	3.0×10^{-4}	4.0×10^{-4}	4.0549×10^{-8}	0.0646	-	-	>10.0	4.2533×10^{-8}	0.0027	0.76
	4.0×10^{-4}	5.0×10^{-4}	4.9775×10^{-8}	0.0585	-	-	>10.0	4.8593×10^{-8}	0.0035	0.41
	5.0×10^{-4}	6.0×10^{-4}	5.3411×10^{-8}	0.0568	1.2047×10^{-10}	0.3668	>10.0	5.3622×10^{-8}	0.0056	0.07
	6.0×10^{-4}	7.0×10^{-4}	5.7485×10^{-8}	0.0550	1.2263×10^{-8}	0.0352	>10.0	5.6844×10^{-8}	0.0172	0.19
	7.0×10^{-4}	8.0×10^{-4}	7.2142×10^{-8}	0.0489	6.2590×10^{-8}	0.0068	2.69	6.3138×10^{-8}	0.0097	2.51
	8.0×10^{-4}	9.0×10^{-4}	6.3930×10^{-8}	0.0521	6.6545×10^{-8}	0.0036	0.78	6.6813×10^{-8}	0.0051	0.86
	9.0×10^{-4}	1.0×10^{-3}	6.5594×10^{-8}	0.0509	7.0667×10^{-8}	0.0030	1.52	7.0677×10^{-8}	0.0042	1.52
	1.0×10^{-3}	2.0×10^{-3}	8.6487×10^{-7}	0.0141	8.7853×10^{-7}	0.0007	1.12	8.7856×10^{-7}	0.0009	1.12
	2.0×10^{-3}	3.0×10^{-3}	1.1459×10^{-6}	0.0123	1.1349×10^{-6}	0.0005	0.78	1.1357×10^{-6}	0.0007	0.73
	3.0×10^{-3}	4.0×10^{-3}	1.3275×10^{-6}	0.0114	1.3371×10^{-6}	0.0005	0.63	1.3371×10^{-6}	0.0005	0.63
	4.0×10^{-3}	5.0×10^{-3}	1.6654×10^{-6}	0.0102	1.6220×10^{-6}	0.0005	2.56	1.6220×10^{-6}	0.0005	2.56
	5.0×10^{-3}	6.0×10^{-3}	1.8209×10^{-6}	0.0097	1.8127×10^{-6}	0.0004	0.46	1.8127×10^{-6}	0.0004	0.46
	6.0×10^{-3}	7.0×10^{-3}	1.9650×10^{-6}	0.0094	1.9606×10^{-6}	0.0004	0.24	1.9606×10^{-6}	0.0004	0.24
	7.0×10^{-3}	8.0×10^{-3}	2.1256×10^{-6}	0.0090	2.0954×10^{-6}	0.0004	1.58	2.0954×10^{-6}	0.0004	1.58
	8.0×10^{-3}	9.0×10^{-3}	2.2344×10^{-6}	0.0088	2.2178×10^{-6}	0.0004	0.85	2.2178×10^{-6}	0.0004	0.85
	9.0×10^{-3}	1.0×10^{-2}	2.3430×10^{-6}	0.0086	2.3327×10^{-6}	0.0004	0.51	2.3327×10^{-6}	0.0004	0.51
	1.0×10^{-2}	2.0×10^{-2}	2.8330×10^{-5}	0.0025	2.8286×10^{-5}	0.0001	0.63	2.8286×10^{-5}	0.0001	0.63
	2.0×10^{-2}	3.0×10^{-2}	3.7349×10^{-5}	0.0022	3.7331×10^{-5}	0.0001	0.22	3.7331×10^{-5}	0.0001	0.22
	3.0×10^{-2}	4.0×10^{-2}	4.2815×10^{-5}	0.0020	4.2759×10^{-5}	0.0001	0.65	4.2759×10^{-5}	0.0001	0.65
	4.0×10^{-2}	5.0×10^{-2}	3.8518×10^{-5}	0.0021	3.8511×10^{-5}	0.0001	0.09	3.8511×10^{-5}	0.0001	0.09
	5.0×10^{-2}	6.0×10^{-2}	3.9973×10^{-5}	0.0021	4.0040×10^{-5}	0.0001	0.79	4.0040×10^{-5}	0.0001	0.79
	6.0×10^{-2}	7.0×10^{-2}	3.3717×10^{-5}	0.0023	3.3707×10^{-5}	0.0001	0.13	3.3707×10^{-5}	0.0001	0.13
	7.0×10^{-2}	8.0×10^{-2}	3.3390×10^{-5}	0.0023	3.3336×10^{-5}	0.0001	0.70	3.3336×10^{-5}	0.0001	0.70
	8.0×10^{-2}	9.0×10^{-2}	2.5890×10^{-5}	0.0026	2.5934×10^{-5}	0.0002	0.65	2.5934×10^{-5}	0.0002	0.65
	9.0×10^{-2}	1.0×10^{-1}	2.4583×10^{-5}	0.0027	2.4602×10^{-5}	0.0002	0.29	2.4602×10^{-5}	0.0002	0.29
	1.0×10^{-1}	2.0×10^{-1}	5.5668×10^{-5}	0.0018	5.5656×10^{-5}	0.0001	0.13	5.5656×10^{-5}	0.0001	0.13
	2.0×10^{-1}	3.0×10^{-1}	3.9781×10^{-6}	0.0066	4.0020×10^{-6}	0.0004	0.91	4.0020×10^{-6}	0.0004	0.91

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
0.3	1.0×10^{-11}	1.0×10^{-4}	1.4962×10^{-8}	0.1102	-	-	>10.0	1.5287×10^{-8}	0.0006	0.20
	1.0×10^{-4}	2.0×10^{-4}	2.9296×10^{-8}	0.0787	-	-	>10.0	2.8110×10^{-8}	0.0007	0.51
	2.0×10^{-4}	3.0×10^{-4}	4.0022×10^{-8}	0.0675	-	-	>10.0	3.6513×10^{-8}	0.0008	1.30
	3.0×10^{-4}	4.0×10^{-4}	4.4507×10^{-8}	0.0636	-	-	>10.0	4.3339×10^{-8}	0.0009	0.41
	4.0×10^{-4}	5.0×10^{-4}	5.6381×10^{-8}	0.0565	-	-	>10.0	4.9194×10^{-8}	0.0010	2.26
	5.0×10^{-4}	6.0×10^{-4}	5.2561×10^{-8}	0.0585	-	-	>10.0	5.4679×10^{-8}	0.0011	0.69
	6.0×10^{-4}	7.0×10^{-4}	5.9541×10^{-8}	0.0549	-	-	>10.0	5.9421×10^{-8}	0.0011	0.04
	7.0×10^{-4}	8.0×10^{-4}	6.4115×10^{-8}	0.0529	-	-	>10.0	6.3912×10^{-8}	0.0012	0.06
	8.0×10^{-4}	9.0×10^{-4}	6.7844×10^{-8}	0.0515	-	-	>10.0	6.8140×10^{-8}	0.0013	0.08
	9.0×10^{-4}	1.0×10^{-3}	7.4817×10^{-8}	0.0490	-	-	>10.0	7.2016×10^{-8}	0.0013	0.76
	1.0×10^{-3}	2.0×10^{-3}	9.1776×10^{-7}	0.0140	-	-	>10.0	9.0666×10^{-7}	0.0005	0.86
	2.0×10^{-3}	3.0×10^{-3}	1.1885×10^{-6}	0.0123	-	-	>10.0	1.1803×10^{-6}	0.0007	0.56
	3.0×10^{-3}	4.0×10^{-3}	1.4057×10^{-6}	0.0113	-	-	>10.0	1.4006×10^{-6}	0.0009	0.32
	4.0×10^{-3}	5.0×10^{-3}	1.5713×10^{-6}	0.0107	-	-	>10.0	1.5912×10^{-6}	0.0013	1.18
	5.0×10^{-3}	6.0×10^{-3}	1.7498×10^{-6}	0.0102	-	-	>10.0	1.7644×10^{-6}	0.0023	0.80
	6.0×10^{-3}	7.0×10^{-3}	1.9155×10^{-6}	0.0097	1.4082×10^{-6}	0.0044	>10.0	1.8971×10^{-6}	0.0062	0.84
	7.0×10^{-3}	8.0×10^{-3}	2.1043×10^{-6}	0.0093	2.0544×10^{-6}	0.0013	2.53	2.0562×10^{-6}	0.0018	2.41
	8.0×10^{-3}	9.0×10^{-3}	2.1715×10^{-6}	0.0091	2.1864×10^{-6}	0.0010	0.75	2.1896×10^{-6}	0.0014	0.91
	9.0×10^{-3}	1.0×10^{-2}	2.3003×10^{-6}	0.0088	2.3050×10^{-6}	0.0009	0.23	2.3092×10^{-6}	0.0012	0.43
	1.0×10^{-2}	2.0×10^{-2}	2.8325×10^{-5}	0.0025	2.8370×10^{-5}	0.0002	0.63	2.8364×10^{-5}	0.0003	0.54
	2.0×10^{-2}	3.0×10^{-2}	3.6580×10^{-5}	0.0022	3.6586×10^{-5}	0.0002	0.08	3.6586×10^{-5}	0.0002	0.08
	3.0×10^{-2}	4.0×10^{-2}	4.3857×10^{-5}	0.0020	4.3973×10^{-5}	0.0001	1.32	4.3973×10^{-5}	0.0001	1.32
	4.0×10^{-2}	5.0×10^{-2}	4.8155×10^{-5}	0.0019	4.8075×10^{-5}	0.0001	0.87	4.8075×10^{-5}	0.0001	0.87
	5.0×10^{-2}	6.0×10^{-2}	5.5387×10^{-5}	0.0018	5.5437×10^{-5}	0.0001	0.50	5.5437×10^{-5}	0.0001	0.50
	6.0×10^{-2}	7.0×10^{-2}	5.8053×10^{-5}	0.0018	5.7962×10^{-5}	0.0001	0.87	5.7962×10^{-5}	0.0001	0.87
	7.0×10^{-2}	8.0×10^{-2}	5.2484×10^{-5}	0.0019	5.2391×10^{-5}	0.0001	0.93	5.2391×10^{-5}	0.0001	0.93
	8.0×10^{-2}	9.0×10^{-2}	5.0365×10^{-5}	0.0019	5.0285×10^{-5}	0.0001	0.84	5.0285×10^{-5}	0.0001	0.84
	9.0×10^{-2}	1.0×10^{-1}	4.9335×10^{-5}	0.0019	4.9337×10^{-5}	0.0001	0.03	4.9337×10^{-5}	0.0001	0.03
	1.0×10^{-1}	2.0×10^{-1}	2.1104×10^{-4}	0.0009	2.1124×10^{-4}	0.0001	1.06	2.1124×10^{-4}	0.0001	1.06
	2.0×10^{-1}	3.0×10^{-1}	1.8235×10^{-5}	0.0031	1.8304×10^{-5}	0.0002	1.21	1.8304×10^{-5}	0.0002	1.21
	3.0×10^{-1}	4.0×10^{-1}	2.4933×10^{-6}	0.0085	2.4775×10^{-6}	0.0006	0.74	2.4775×10^{-6}	0.0006	0.74

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
0.5	1.0×10^{-11}	1.0×10^{-4}	1.5840×10^{-8}	0.1124	-	-	>10.0	1.5387×10^{-8}	0.0004	0.25
	1.0×10^{-4}	2.0×10^{-4}	2.6771×10^{-8}	0.0852	-	-	>10.0	2.8387×10^{-8}	0.0005	0.71
	2.0×10^{-4}	3.0×10^{-4}	3.8512×10^{-8}	0.0727	-	-	>10.0	3.6992×10^{-8}	0.0006	0.54
	3.0×10^{-4}	4.0×10^{-4}	4.6115×10^{-8}	0.0654	-	-	>10.0	4.4025×10^{-8}	0.0007	0.69
	4.0×10^{-4}	5.0×10^{-4}	4.7897×10^{-8}	0.0641	-	-	>10.0	5.0142×10^{-8}	0.0007	0.73
	5.0×10^{-4}	6.0×10^{-4}	5.3872×10^{-8}	0.0606	-	-	>10.0	5.5619×10^{-8}	0.0008	0.53
	6.0×10^{-4}	7.0×10^{-4}	6.2392×10^{-8}	0.0564	-	-	>10.0	6.0652×10^{-8}	0.0008	0.49
	7.0×10^{-4}	8.0×10^{-4}	6.4387×10^{-8}	0.0554	-	-	>10.0	6.5502×10^{-8}	0.0008	0.31
	8.0×10^{-4}	9.0×10^{-4}	6.4020×10^{-8}	0.0557	-	-	>10.0	6.9739×10^{-8}	0.0009	1.60
	9.0×10^{-4}	1.0×10^{-3}	7.5773×10^{-8}	0.0511	-	-	>10.0	7.4028×10^{-8}	0.0009	0.45
	1.0×10^{-3}	2.0×10^{-3}	9.3999×10^{-7}	0.0145	-	-	>10.0	9.3693×10^{-7}	0.0003	0.22
	2.0×10^{-3}	3.0×10^{-3}	1.1840×10^{-6}	0.0130	-	-	>10.0	1.1669×10^{-6}	0.0004	1.11
	3.0×10^{-3}	4.0×10^{-3}	1.3503×10^{-6}	0.0121	-	-	>10.0	1.3543×10^{-6}	0.0005	0.25
	4.0×10^{-3}	5.0×10^{-3}	1.5597×10^{-6}	0.0113	-	-	>10.0	1.5497×10^{-6}	0.0006	0.57
	5.0×10^{-3}	6.0×10^{-3}	1.6967×10^{-6}	0.0108	-	-	>10.0	1.7254×10^{-6}	0.0006	1.57
	6.0×10^{-3}	7.0×10^{-3}	1.8865×10^{-6}	0.0103	-	-	>10.0	1.8897×10^{-6}	0.0007	0.16
	7.0×10^{-3}	8.0×10^{-3}	2.0343×10^{-6}	0.0099	-	-	>10.0	2.0391×10^{-6}	0.0007	0.24
	8.0×10^{-3}	9.0×10^{-3}	2.1575×10^{-6}	0.0096	-	-	>10.0	2.1748×10^{-6}	0.0008	0.83
	9.0×10^{-3}	1.0×10^{-2}	2.3109×10^{-6}	0.0093	-	-	>10.0	2.3097×10^{-6}	0.0009	0.05
	1.0×10^{-2}	2.0×10^{-2}	2.9010×10^{-5}	0.0026	8.1216×10^{-6}	0.0023	>10.0	2.9064×10^{-5}	0.0013	0.64
	2.0×10^{-2}	3.0×10^{-2}	3.7137×10^{-5}	0.0023	3.7257×10^{-5}	0.0003	1.40	3.7274×10^{-5}	0.0004	1.59
	3.0×10^{-2}	4.0×10^{-2}	4.2956×10^{-5}	0.0021	4.3001×10^{-5}	0.0002	0.49	4.2998×10^{-5}	0.0003	0.45
	4.0×10^{-2}	5.0×10^{-2}	4.8656×10^{-5}	0.0020	4.8673×10^{-5}	0.0002	0.18	4.8677×10^{-5}	0.0003	0.21
	5.0×10^{-2}	6.0×10^{-2}	5.5006×10^{-5}	0.0019	5.4869×10^{-5}	0.0002	1.31	5.4879×10^{-5}	0.0002	1.21
	6.0×10^{-2}	7.0×10^{-2}	5.7346×10^{-5}	0.0019	5.7472×10^{-5}	0.0002	1.15	5.7470×10^{-5}	0.0002	1.13
	7.0×10^{-2}	8.0×10^{-2}	6.3995×10^{-5}	0.0018	6.3965×10^{-5}	0.0002	0.26	6.3966×10^{-5}	0.0002	0.25
	8.0×10^{-2}	9.0×10^{-2}	6.6631×10^{-5}	0.0017	6.6542×10^{-5}	0.0001	0.78	6.6542×10^{-5}	0.0001	0.78
	9.0×10^{-2}	1.0×10^{-1}	6.9795×10^{-5}	0.0017	7.0029×10^{-5}	0.0001	1.96	7.0029×10^{-5}	0.0001	1.96
	1.0×10^{-1}	2.0×10^{-1}	5.6421×10^{-4}	0.0006	5.6398×10^{-4}	0.0000	0.66	5.6398×10^{-4}	0.0000	0.66
	2.0×10^{-1}	3.0×10^{-1}	1.0209×10^{-4}	0.0014	1.0202×10^{-4}	0.0001	0.43	1.0202×10^{-4}	0.0001	0.43
	3.0×10^{-1}	4.0×10^{-1}	8.3128×10^{-6}	0.0049	8.3333×10^{-6}	0.0004	0.50	8.3333×10^{-6}	0.0004	0.50
	4.0×10^{-1}	5.0×10^{-1}	1.4076×10^{-6}	0.0119	1.4247×10^{-6}	0.0009	1.02	1.4247×10^{-6}	0.0009	1.02

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
0.75	1.0×10^{-11}	1.0×10^{-4}	1.4268×10^{-8}	0.1348	-	-	>10.0	1.5522×10^{-8}	0.0004	0.65
	1.0×10^{-4}	2.0×10^{-4}	3.2495×10^{-8}	0.0900	-	-	>10.0	2.8766×10^{-8}	0.0004	1.28
	2.0×10^{-4}	3.0×10^{-4}	3.4740×10^{-8}	0.0860	-	-	>10.0	3.7642×10^{-8}	0.0005	0.97
	3.0×10^{-4}	4.0×10^{-4}	4.4845×10^{-8}	0.0748	-	-	>10.0	4.4952×10^{-8}	0.0005	0.03
	4.0×10^{-4}	5.0×10^{-4}	5.2542×10^{-8}	0.0701	-	-	>10.0	5.1265×10^{-8}	0.0006	0.35
	5.0×10^{-4}	6.0×10^{-4}	6.1481×10^{-8}	0.0653	-	-	>10.0	5.7133×10^{-8}	0.0006	1.08
	6.0×10^{-4}	7.0×10^{-4}	5.9074×10^{-8}	0.0666	-	-	>10.0	6.2423×10^{-8}	0.0006	0.85
	7.0×10^{-4}	8.0×10^{-4}	6.8216×10^{-8}	0.0613	-	-	>10.0	6.7430×10^{-8}	0.0007	0.19
	8.0×10^{-4}	9.0×10^{-4}	6.6725×10^{-8}	0.0624	-	-	>10.0	6.6986×10^{-8}	0.0007	0.06
	9.0×10^{-4}	1.0×10^{-3}	7.7423×10^{-8}	0.0586	-	-	>10.0	7.0246×10^{-8}	0.0007	1.58
	1.0×10^{-3}	2.0×10^{-3}	8.8953×10^{-7}	0.0171	-	-	>10.0	8.9979×10^{-7}	0.0003	0.67
	2.0×10^{-3}	3.0×10^{-3}	1.1831×10^{-6}	0.0148	-	-	>10.0	1.2016×10^{-6}	0.0003	1.06
	3.0×10^{-3}	4.0×10^{-3}	1.4008×10^{-6}	0.0137	-	-	>10.0	1.3965×10^{-6}	0.0004	0.22
	4.0×10^{-3}	5.0×10^{-3}	1.5343×10^{-6}	0.0130	-	-	>10.0	1.5495×10^{-6}	0.0004	0.77
	5.0×10^{-3}	6.0×10^{-3}	1.7290×10^{-6}	0.0122	-	-	>10.0	1.7458×10^{-6}	0.0004	0.80
	6.0×10^{-3}	7.0×10^{-3}	1.9200×10^{-6}	0.0117	-	-	>10.0	1.9313×10^{-6}	0.0005	0.50
	7.0×10^{-3}	8.0×10^{-3}	2.0914×10^{-6}	0.0111	-	-	>10.0	2.1042×10^{-6}	0.0005	0.55
	8.0×10^{-3}	9.0×10^{-3}	2.1601×10^{-6}	0.0110	-	-	>10.0	2.1606×10^{-6}	0.0005	0.02
	9.0×10^{-3}	1.0×10^{-2}	2.2496×10^{-6}	0.0108	-	-	>10.0	2.2314×10^{-6}	0.0006	0.75
	1.0×10^{-2}	2.0×10^{-2}	2.8648×10^{-5}	0.0030	-	-	>10.0	2.8608×10^{-5}	0.0002	0.46
	2.0×10^{-2}	3.0×10^{-2}	3.6949×10^{-5}	0.0027	-	-	>10.0	3.6887×10^{-5}	0.0004	0.62
	3.0×10^{-2}	4.0×10^{-2}	4.4523×10^{-5}	0.0024	2.1989×10^{-6}	0.0178	>10.0	4.4543×10^{-5}	0.0020	0.14
	4.0×10^{-2}	5.0×10^{-2}	5.0204×10^{-5}	0.0023	5.0190×10^{-5}	0.0007	0.12	5.0142×10^{-5}	0.0010	0.49
	5.0×10^{-2}	6.0×10^{-2}	5.4080×10^{-5}	0.0022	5.4262×10^{-5}	0.0004	1.50	5.4272×10^{-5}	0.0005	1.57
	6.0×10^{-2}	7.0×10^{-2}	5.7041×10^{-5}	0.0021	5.7193×10^{-5}	0.0003	1.26	5.7192×10^{-5}	0.0004	1.24
	7.0×10^{-2}	8.0×10^{-2}	6.3714×10^{-5}	0.0020	6.3691×10^{-5}	0.0003	0.18	6.3671×10^{-5}	0.0004	0.33
	8.0×10^{-2}	9.0×10^{-2}	6.6097×10^{-5}	0.0020	6.5997×10^{-5}	0.0002	0.75	6.5986×10^{-5}	0.0003	0.83
	9.0×10^{-2}	1.0×10^{-1}	7.0833×10^{-5}	0.0019	7.0761×10^{-5}	0.0002	0.53	7.0773×10^{-5}	0.0003	0.44
	1.0×10^{-1}	2.0×10^{-1}	8.7971×10^{-4}	0.0005	8.7946×10^{-4}	0.0000	0.57	8.7940×10^{-4}	0.0001	0.68
	2.0×10^{-1}	3.0×10^{-1}	6.9559×10^{-4}	0.0006	6.9535×10^{-4}	0.0000	0.57	6.9535×10^{-4}	0.0000	0.57
	3.0×10^{-1}	4.0×10^{-1}	1.2767×10^{-4}	0.0014	1.2766×10^{-4}	0.0001	0.02	1.2766×10^{-4}	0.0001	0.02
	4.0×10^{-1}	5.0×10^{-1}	1.4654×10^{-5}	0.0042	1.4554×10^{-5}	0.0003	1.62	1.4554×10^{-5}	0.0003	1.62
	5.0×10^{-1}	6.0×10^{-1}	3.1185×10^{-6}	0.0091	3.2070×10^{-6}	0.0007	3.11	3.2070×10^{-6}	0.0007	3.11

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
0.9	1.0×10^{-11}	1.0×10^{-4}	1.7383×10^{-8}	0.1500	-	-	>10.0	1.5603×10^{-8}	0.0003	0.68
	1.0×10^{-4}	2.0×10^{-4}	2.7913×10^{-8}	0.1188	-	-	>10.0	2.8997×10^{-8}	0.0004	0.33
	2.0×10^{-4}	3.0×10^{-4}	3.5227×10^{-8}	0.1069	-	-	>10.0	3.8031×10^{-8}	0.0004	0.74
	3.0×10^{-4}	4.0×10^{-4}	4.5023×10^{-8}	0.0927	-	-	>10.0	4.5443×10^{-8}	0.0005	0.10
	4.0×10^{-4}	5.0×10^{-4}	5.4128×10^{-8}	0.0855	-	-	>10.0	5.2054×10^{-8}	0.0005	0.45
	5.0×10^{-4}	6.0×10^{-4}	5.5097×10^{-8}	0.0842	-	-	>10.0	5.4917×10^{-8}	0.0006	0.04
	6.0×10^{-4}	7.0×10^{-4}	6.4127×10^{-8}	0.0787	-	-	>10.0	5.8276×10^{-8}	0.0006	1.16
	7.0×10^{-4}	8.0×10^{-4}	6.8832×10^{-8}	0.0753	-	-	>10.0	6.3088×10^{-8}	0.0006	1.11
	8.0×10^{-4}	9.0×10^{-4}	6.7528×10^{-8}	0.0764	-	-	>10.0	6.7562×10^{-8}	0.0006	0.01
	9.0×10^{-4}	1.0×10^{-3}	7.4248×10^{-8}	0.0727	-	-	>10.0	7.1897×10^{-8}	0.0007	0.44
	1.0×10^{-3}	2.0×10^{-3}	9.4430×10^{-7}	0.0205	-	-	>10.0	9.2624×10^{-7}	0.0002	0.93
	2.0×10^{-3}	3.0×10^{-3}	1.1560×10^{-6}	0.0185	-	-	>10.0	1.1621×10^{-6}	0.0003	0.28
	3.0×10^{-3}	4.0×10^{-3}	1.4153×10^{-6}	0.0167	-	-	>10.0	1.4072×10^{-6}	0.0003	0.34
	4.0×10^{-3}	5.0×10^{-3}	1.5934×10^{-6}	0.0157	-	-	>10.0	1.6042×10^{-6}	0.0004	0.43
	5.0×10^{-3}	6.0×10^{-3}	1.7275×10^{-6}	0.0151	-	-	>10.0	1.7175×10^{-6}	0.0004	0.38
	6.0×10^{-3}	7.0×10^{-3}	1.8960×10^{-6}	0.0144	-	-	>10.0	1.9162×10^{-6}	0.0004	0.74
	7.0×10^{-3}	8.0×10^{-3}	2.1107×10^{-6}	0.0137	-	-	>10.0	2.1105×10^{-6}	0.0004	0.01
	8.0×10^{-3}	9.0×10^{-3}	2.1286×10^{-6}	0.0136	-	-	>10.0	2.1176×10^{-6}	0.0005	0.38
	9.0×10^{-3}	1.0×10^{-2}	2.2630×10^{-6}	0.0132	-	-	>10.0	2.2770×10^{-6}	0.0005	0.47
	1.0×10^{-2}	2.0×10^{-2}	2.8839×10^{-5}	0.0037	-	-	>10.0	2.8712×10^{-5}	0.0002	1.19
	2.0×10^{-2}	3.0×10^{-2}	3.7210×10^{-5}	0.0033	-	-	>10.0	3.7304×10^{-5}	0.0003	0.77
	3.0×10^{-2}	4.0×10^{-2}	4.3629×10^{-5}	0.0030	-	-	>10.0	4.3754×10^{-5}	0.0005	0.94
	4.0×10^{-2}	5.0×10^{-2}	4.8392×10^{-5}	0.0029	-	-	>10.0	4.8267×10^{-5}	0.0007	0.87
	5.0×10^{-2}	6.0×10^{-2}	5.4116×10^{-5}	0.0027	1.6791×10^{-5}	0.0053	>10.0	5.4413×10^{-5}	0.0034	1.26
	6.0×10^{-2}	7.0×10^{-2}	5.8387×10^{-5}	0.0026	5.8342×10^{-5}	0.0007	0.28	5.8382×10^{-5}	0.0010	0.03
	7.0×10^{-2}	8.0×10^{-2}	6.1957×10^{-5}	0.0025	6.1816×10^{-5}	0.0005	0.90	6.1829×10^{-5}	0.0007	0.80
	8.0×10^{-2}	9.0×10^{-2}	6.6621×10^{-5}	0.0024	6.6635×10^{-5}	0.0004	0.09	6.6612×10^{-5}	0.0005	0.05
	9.0×10^{-2}	1.0×10^{-1}	7.0763×10^{-5}	0.0024	7.0652×10^{-5}	0.0003	0.64	7.0620×10^{-5}	0.0005	0.82
	1.0×10^{-1}	2.0×10^{-1}	8.8507×10^{-4}	0.0007	8.8534×10^{-4}	0.0001	0.43	8.8534×10^{-4}	0.0001	0.43
	2.0×10^{-1}	3.0×10^{-1}	1.1102×10^{-3}	0.0006	1.1103×10^{-3}	0.0000	0.14	1.1102×10^{-3}	0.0000	0.06
	3.0×10^{-1}	4.0×10^{-1}	5.9886×10^{-4}	0.0008	5.9900×10^{-4}	0.0001	0.29	5.9900×10^{-4}	0.0001	0.29
	4.0×10^{-1}	5.0×10^{-1}	7.8777×10^{-5}	0.0022	7.8794×10^{-5}	0.0002	0.10	7.8794×10^{-5}	0.0002	0.10
	5.0×10^{-1}	6.0×10^{-1}	8.3498×10^{-6}	0.0069	8.2527×10^{-6}	0.0005	1.68	8.2527×10^{-6}	0.0005	1.68

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
	6.0×10^{-1}	7.0×10^{-1}	2.3418×10^{-6}	0.0130	2.3382×10^{-6}	0.0008	0.12	2.3382×10^{-6}	0.0008	0.12

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
0.975	1.0×10^{-11}	1.0×10^{-4}	1.8178×10^{-8}	0.2016	-	-	>10.0	1.5638×10^{-8}	0.0003	0.69
	1.0×10^{-4}	2.0×10^{-4}	3.2744×10^{-8}	0.1535	-	-	>10.0	2.9109×10^{-8}	0.0004	0.72
	2.0×10^{-4}	3.0×10^{-4}	4.5397×10^{-8}	0.1337	-	-	>10.0	3.8206×10^{-8}	0.0004	1.18
	3.0×10^{-4}	4.0×10^{-4}	5.7357×10^{-8}	0.1172	-	-	>10.0	4.5745×10^{-8}	0.0005	1.73
	4.0×10^{-4}	5.0×10^{-4}	5.5956×10^{-8}	0.1176	-	-	>10.0	5.0200×10^{-8}	0.0005	0.87
	5.0×10^{-4}	6.0×10^{-4}	5.8817×10^{-8}	0.1165	-	-	>10.0	5.3624×10^{-8}	0.0005	0.76
	6.0×10^{-4}	7.0×10^{-4}	6.2202×10^{-8}	0.1119	-	-	>10.0	5.8846×10^{-8}	0.0006	0.48
	7.0×10^{-4}	8.0×10^{-4}	6.6616×10^{-8}	0.1063	-	-	>10.0	6.3632×10^{-8}	0.0006	0.42
	8.0×10^{-4}	9.0×10^{-4}	5.9301×10^{-8}	0.1131	-	-	>10.0	6.8294×10^{-8}	0.0006	1.34
	9.0×10^{-4}	1.0×10^{-3}	7.5546×10^{-8}	0.1009	-	-	>10.0	7.2641×10^{-8}	0.0006	0.38
	1.0×10^{-3}	2.0×10^{-3}	9.5469×10^{-7}	0.0285	-	-	>10.0	9.2051×10^{-7}	0.0002	1.26
	2.0×10^{-3}	3.0×10^{-3}	1.1493×10^{-6}	0.0259	-	-	>10.0	1.1720×10^{-6}	0.0003	0.76
	3.0×10^{-3}	4.0×10^{-3}	1.4663×10^{-6}	0.0231	-	-	>10.0	1.4186×10^{-6}	0.0003	1.41
	4.0×10^{-3}	5.0×10^{-3}	1.5764×10^{-6}	0.0222	-	-	>10.0	1.5613×10^{-6}	0.0003	0.43
	5.0×10^{-3}	6.0×10^{-3}	1.7988×10^{-6}	0.0208	-	-	>10.0	1.7852×10^{-6}	0.0004	0.37
	6.0×10^{-3}	7.0×10^{-3}	1.8915×10^{-6}	0.0202	-	-	>10.0	1.8886×10^{-6}	0.0004	0.08
	7.0×10^{-3}	8.0×10^{-3}	2.0455×10^{-6}	0.0195	-	-	>10.0	2.0359×10^{-6}	0.0004	0.24
	8.0×10^{-3}	9.0×10^{-3}	2.2235×10^{-6}	0.0187	-	-	>10.0	2.2311×10^{-6}	0.0005	0.18
	9.0×10^{-3}	1.0×10^{-2}	2.3285×10^{-6}	0.0182	-	-	>10.0	2.2711×10^{-6}	0.0005	1.35
	1.0×10^{-2}	2.0×10^{-2}	2.8721×10^{-5}	0.0052	-	-	>10.0	2.8843×10^{-5}	0.0002	0.82
	2.0×10^{-2}	3.0×10^{-2}	3.7436×10^{-5}	0.0045	-	-	>10.0	3.7269×10^{-5}	0.0003	0.99
	3.0×10^{-2}	4.0×10^{-2}	4.3873×10^{-5}	0.0042	-	-	>10.0	4.3823×10^{-5}	0.0004	0.27
	4.0×10^{-2}	5.0×10^{-2}	4.9426×10^{-5}	0.0040	-	-	>10.0	4.9489×10^{-5}	0.0007	0.32
	5.0×10^{-2}	6.0×10^{-2}	5.4325×10^{-5}	0.0038	-	-	>10.0	5.4386×10^{-5}	0.0011	0.28
	6.0×10^{-2}	7.0×10^{-2}	5.7306×10^{-5}	0.0037	1.8117×10^{-5}	0.0072	>10.0	5.7579×10^{-5}	0.0046	0.80
	7.0×10^{-2}	8.0×10^{-2}	6.2378×10^{-5}	0.0035	6.2232×10^{-5}	0.0011	0.64	6.2173×10^{-5}	0.0015	0.86
	8.0×10^{-2}	9.0×10^{-2}	6.6568×10^{-5}	0.0034	6.6313×10^{-5}	0.0007	1.10	6.6311×10^{-5}	0.0010	1.09
	9.0×10^{-2}	1.0×10^{-1}	7.1114×10^{-5}	0.0033	7.1116×10^{-5}	0.0005	0.01	7.1063×10^{-5}	0.0007	0.22
	1.0×10^{-1}	2.0×10^{-1}	9.0042×10^{-4}	0.0009	8.9976×10^{-4}	0.0001	0.81	8.9977×10^{-4}	0.0001	0.80
	2.0×10^{-1}	3.0×10^{-1}	1.1752×10^{-3}	0.0008	1.1723×10^{-3}	0.0000	3.03	1.1723×10^{-3}	0.0001	3.02
	3.0×10^{-1}	4.0×10^{-1}	9.7030×10^{-4}	0.0009	9.6960×10^{-4}	0.0000	0.80	9.6960×10^{-4}	0.0000	0.80
	4.0×10^{-1}	5.0×10^{-1}	2.3154×10^{-4}	0.0018	2.3189×10^{-4}	0.0001	0.83	2.3189×10^{-4}	0.0001	0.83
	5.0×10^{-1}	6.0×10^{-1}	3.0421×10^{-5}	0.0050	3.0511×10^{-5}	0.0003	0.59	3.0511×10^{-5}	0.0003	0.59

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
	6.0×10^{-1}	7.0×10^{-1}	6.4035×10^{-6}	0.0110	6.4536×10^{-6}	0.0005	0.71	6.4536×10^{-6}	0.0005	0.71

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
1.0	1.0×10^{-11}	1.0×10^{-4}	1.2977×10^{-8}	0.3150	-	-	>10.0	1.5653×10^{-8}	0.0003	0.65
	1.0×10^{-4}	2.0×10^{-4}	3.0962×10^{-8}	0.2150	-	-	>10.0	2.9160×10^{-8}	0.0004	0.27
	2.0×10^{-4}	3.0×10^{-4}	4.2016×10^{-8}	0.1820	-	-	>10.0	3.8259×10^{-8}	0.0004	0.49
	3.0×10^{-4}	4.0×10^{-4}	4.5140×10^{-8}	0.1796	-	-	>10.0	4.5861×10^{-8}	0.0005	0.09
	4.0×10^{-4}	5.0×10^{-4}	5.7624×10^{-8}	0.1567	-	-	>10.0	4.9329×10^{-8}	0.0005	0.92
	5.0×10^{-4}	6.0×10^{-4}	4.6375×10^{-8}	0.1750	-	-	>10.0	5.3790×10^{-8}	0.0005	0.91
	6.0×10^{-4}	7.0×10^{-4}	4.2579×10^{-8}	0.1778	-	-	>10.0	5.8996×10^{-8}	0.0006	2.17
	7.0×10^{-4}	8.0×10^{-4}	7.9197×10^{-8}	0.1343	-	-	>10.0	6.3901×10^{-8}	0.0006	1.44
	8.0×10^{-4}	9.0×10^{-4}	8.2791×10^{-8}	0.1312	-	-	>10.0	6.8509×10^{-8}	0.0006	1.31
	9.0×10^{-4}	1.0×10^{-3}	7.2516×10^{-8}	0.1427	-	-	>10.0	7.2921×10^{-8}	0.0006	0.04
	1.0×10^{-3}	2.0×10^{-3}	9.4269×10^{-7}	0.0388	-	-	>10.0	9.1638×10^{-7}	0.0002	0.72
	2.0×10^{-3}	3.0×10^{-3}	1.2076×10^{-6}	0.0343	-	-	>10.0	1.1807×10^{-6}	0.0003	0.65
	3.0×10^{-3}	4.0×10^{-3}	1.4104×10^{-6}	0.0319	-	-	>10.0	1.4013×10^{-6}	0.0003	0.20
	4.0×10^{-3}	5.0×10^{-3}	1.5637×10^{-6}	0.0301	-	-	>10.0	1.5797×10^{-6}	0.0003	0.34
	5.0×10^{-3}	6.0×10^{-3}	1.7926×10^{-6}	0.0282	-	-	>10.0	1.7901×10^{-6}	0.0004	0.05
	6.0×10^{-3}	7.0×10^{-3}	1.8386×10^{-6}	0.0280	-	-	>10.0	1.8672×10^{-6}	0.0004	0.55
	7.0×10^{-3}	8.0×10^{-3}	2.0512×10^{-6}	0.0263	-	-	>10.0	2.0723×10^{-6}	0.0004	0.39
	8.0×10^{-3}	9.0×10^{-3}	2.2132×10^{-6}	0.0254	-	-	>10.0	2.1857×10^{-6}	0.0005	0.49
	9.0×10^{-3}	1.0×10^{-2}	2.3084×10^{-6}	0.0250	-	-	>10.0	2.2774×10^{-6}	0.0005	0.54
	1.0×10^{-2}	2.0×10^{-2}	2.8989×10^{-5}	0.0070	-	-	>10.0	2.8907×10^{-5}	0.0002	0.40
	2.0×10^{-2}	3.0×10^{-2}	3.7026×10^{-5}	0.0062	-	-	>10.0	3.7350×10^{-5}	0.0003	1.41
	3.0×10^{-2}	4.0×10^{-2}	4.3814×10^{-5}	0.0057	-	-	>10.0	4.4252×10^{-5}	0.0005	1.74
	4.0×10^{-2}	5.0×10^{-2}	5.0117×10^{-5}	0.0053	-	-	>10.0	5.0134×10^{-5}	0.0007	0.06
	5.0×10^{-2}	6.0×10^{-2}	5.5907×10^{-5}	0.0051	-	-	>10.0	5.5469×10^{-5}	0.0014	1.48
	6.0×10^{-2}	7.0×10^{-2}	5.9321×10^{-5}	0.0049	-	-	>10.0	6.8939×10^{-5}	0.0148	9.07
	7.0×10^{-2}	8.0×10^{-2}	6.4117×10^{-5}	0.0047	1.0070×10^{-4}	0.1623	2.24	1.3320×10^{-4}	0.2453	2.11
	8.0×10^{-2}	9.0×10^{-2}	6.9426×10^{-5}	0.0045	6.8953×10^{-5}	0.0013	1.46	6.9073×10^{-5}	0.0018	1.05
	9.0×10^{-2}	1.0×10^{-1}	7.2792×10^{-5}	0.0044	7.2846×10^{-5}	0.0008	0.17	7.2750×10^{-5}	0.0011	0.13
	1.0×10^{-1}	2.0×10^{-1}	9.1379×10^{-4}	0.0013	9.1337×10^{-4}	0.0001	0.36	9.1351×10^{-4}	0.0001	0.24
	2.0×10^{-1}	3.0×10^{-1}	1.1817×10^{-3}	0.0011	1.1830×10^{-3}	0.0000	1.02	1.1830×10^{-3}	0.0001	0.98
	3.0×10^{-1}	4.0×10^{-1}	1.0917×10^{-3}	0.0011	1.0929×10^{-3}	0.0000	1.02	1.0929×10^{-3}	0.0000	1.02
	4.0×10^{-1}	5.0×10^{-1}	3.1611×10^{-4}	0.0021	3.1728×10^{-4}	0.0001	1.77	3.1728×10^{-4}	0.0001	1.77
	5.0×10^{-1}	6.0×10^{-1}	3.9721×10^{-5}	0.0060	4.0091×10^{-5}	0.0002	1.55	4.0091×10^{-5}	0.0002	1.55

Table 4 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
	6.0×10^{-1}	7.0×10^{-1}	8.1040×10^{-6}	0.0133	7.9884×10^{-6}	0.0005	1.07	7.9884×10^{-6}	0.0005	1.07

Appendix F Input to MCNP Software for Law 61 Continuum Inelastic Scatter on Al-26 Test

```
Test of Law 61 neutron inelastic scattering contribution to NNEE with thin broomstick
1 1 -1000.0 -1 imp:n=1 $ broomstick
10 0 -10      imp:n=1 $ f4 tally region
11 0 -11      imp:n=1 $ f4 tally region
12 0 -12      imp:n=1 $ f4 tally region
13 0 -13      imp:n=1 $ f4 tally region
14 0 -14      imp:n=1 $ f4 tally region
15 0 -15      imp:n=1 $ f4 tally region
16 0 -16      imp:n=1 $ f4 tally region
20 0 -20      imp:n=1 $ f4 tally region
21 0 -21      imp:n=1 $ f4 tally region
22 0 -22      imp:n=1 $ f4 tally region
23 0 -23      imp:n=1 $ f4 tally region
24 0 -24      imp:n=1 $ f4 tally region
25 0 -25      imp:n=1 $ f4 tally region
26 0 -26      imp:n=1 $ f4 tally region
c
100 0 1 10 11 12 13 14 15 16
        20 21 22 23 24 25 26
           -100  imp:n=1 $ void around broomstick and tally region
c
200 0 100       imp:n=0

1 rcc 0.0 0.0 0.0  0.1 0.0 0.0  1.0e-8 $ broomstick
10 s -10.0 0.0 0.0 0.5                    $ mu=-1.0 tally region covers -1.0 < mu < -0.995
11 tx -9.75 0.0 0.0 2.2220486043288985 0.05 0.05       $ mu=-0.975 tally region covers
12 tx -9.0  0.0 0.0 4.358898943540673  0.05 0.05       $ mu=-0.9 tally region covers
13 tx -7.5  0.0 0.0 6.614378277661476  0.05 0.05       $ mu=-0.75 tally region covers
14 tx -5.0  0.0 0.0 8.660254037844386  0.05 0.05       $ mu=-0.5 tally region covers
15 tx -3.0  0.0 0.0 9.539392014169456  0.05 0.05       $ mu=-0.3 tally region covers
16 tx -1.0  0.0 0.0 9.9498743710662    0.05 0.05         $ mu=-0.1 tally region covers
c
20 s  10.0 0.0 0.0 0.5                    $ mu= 1.0 tally region covers 1.0 < mu < 0.995
21 tx  9.75 0.0 0.0  2.2220486043288985 0.05 0.05       $ mu= 0.975 tally region covers
22 tx  9.0  0.0 0.0 4.358898943540673   0.05 0.05       $ mu= 0.9 tally region covers
23 tx  7.5  0.0 0.0 6.614378277661476   0.05 0.05       $ mu= 0.75 tally region covers
24 tx  5.0  0.0 0.0 8.660254037844386   0.05 0.05       $ mu= 0.5 tally region covers
25 tx  3.0  0.0 0.0 9.539392014169456   0.05 0.05       $ mu= 0.3 tally region covers
26 tx  1.0  0.0 0.0 9.9498743710662     0.05 0.05       $ mu= 0.1 tally region covers
100 so 2000.0

mode n
c
c Al-26 - Double roots between 5.02367 and 5.04297 MeV, Q=-4.723995 MeV
```

```
sdef erg=5.035 pos=-0.01 0.0 0.0 dir=1.0 vec=1.0 0.0 0.0 ara=1.0 par=n
c
m1 13426.91c 1.0
c
dbcn 49j 1
prdmp j j 1 3
c
dd0 0 0
e0    0.0001 8i 0.001 8i 0.01 8i 0.1 8i 1.0
      1.01 1.18 1.19 1.20 7i 2.0 7i 10.0 20.0
c
f104:n 10
f114:n 11
f124:n 12
f134:n 13
f144:n 14
f154:n 15
f164:n 16
c
f204:n 20
f214:n 21
f224:n 22
f234:n 23
f244:n 24
f254:n 25
f264:n 26
c
f105:n -10.0 0.0 0.0 0.0                    $mu=-1.0
f115:n -9.75 2.2220486043288985 0.0 1.0     $ mu=-0.975
f125:n -9.0  4.358898943540673 0.0 1.0      $ mu=-0.9
f135:n -7.5  6.614378277661476 0.0 1.0      $ mu=-0.75
f145:n -5.0  8.660254037844386 0.0 1.0      $ mu=-0.5
f155:n -3.0  9.539392014169456 0.0 1.0      $ mu=-0.3
f165:n -1.0  9.9498743710662 0.0 1.0        $ mu=-0.1
c
f205:n  10.0 0.0 0.0 0.0                    $ mu= 1.0
f215:n  9.75 2.2220486043288985 0.0 1.0     $ mu= 0.975
f225:n  9.0  4.358898943540673 0.0 1.0      $ mu= 0.9
f235:n  7.5  6.614378277661476 0.0 1.0      $ mu= 0.75
f245:n  5.0  8.660254037844386 0.0 1.0      $ mu= 0.5
f255:n  3.0  9.539392014169456 0.0 1.0      $ mu= 0.3
f265:n  1.0  9.9498743710662 0.0 1.0        $ mu= 0.1
c
c nps 1e7
nps 1e9
c dbcn j 1 1 100 10000
c print +20
c
```

```
unc:n 0 16j
c
ft104 inc
fu104 0 1 2 1000
c
ft105 inc
fu105 0 1 2 1000
c
ft114 inc
fu114 0 1 2 1000
c
ft115 inc
fu115 0 1 2 1000
c
ft124 inc
fu124 0 1 2 1000
c
ft125 inc
fu125 0 1 2 1000
c
ft134 inc
fu134 0 1 2 1000
c
ft135 inc
fu135 0 1 2 1000
c
ft144 inc
fu144 0 1 2 1000
c
ft145 inc
fu145 0 1 2 1000
c
ft154 inc
fu154 0 1 2 1000
c
ft155 inc
fu155 0 1 2 1000
c
ft164 inc
fu164 0 1 2 1000
c
ft165 inc
fu165 0 1 2 1000
c
c
ft204 inc
fu204 0 1 2 1000
c
```

```
ft205 inc
fu205 0 1 2 1000
c
ft214 inc
fu214 0 1 2 1000
c
ft215 inc
fu215 0 1 2 1000
c
ft224 inc
fu224 0 1 2 1000
c
ft225 inc
fu225 0 1 2 1000
c
ft234 inc
fu234 0 1 2 1000
c
ft235 inc
fu235 0 1 2 1000
c
ft244 inc
fu244 0 1 2 1000
c
ft245 inc
fu245 0 1 2 1000
c
ft254 inc
fu254 0 1 2 1000
c
ft255 inc
fu255 0 1 2 1000
c
ft264 inc
fu264 0 1 2 1000
c
ft265 inc
fu265 0 1 2 1000
c
```

Appendix G MCNP Software Results for Test Problem for Law 61 Continuum Scatter on Al-26

Table 5: Results of the MCNP path-length tally (`f4`) and next-event tally (`f5`) results as a function of scattering angle for incident neutrons on Al-26 with only Law 61 continuum scattering with source energy of 5.035 MeV.

	Energy Bins		F4		Unmodified F5			Modified F5		
Cosine Angle (μ)	Lower Bin Energy (MeV)	Upper Bin Energy (MeV)	Flux (n/cm^2) (n/cm^2)	Fract. Std. Dev.	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4
-1.0	1.0×10^{-11}	1.0×10^{-4}	8.3486×10^{-10}	0.2620	4.1924×10^{-10}	0.0007	1.90	6.0668×10^{-10}	0.0030	1.04
	1.0×10^{-4}	2.0×10^{-4}	1.3423×10^{-9}	0.2055	7.3887×10^{-10}	0.0008	2.19	1.0704×10^{-9}	0.0035	0.99
	2.0×10^{-4}	3.0×10^{-4}	1.3417×10^{-9}	0.2046	9.3348×10^{-10}	0.0009	1.49	1.3507×10^{-9}	0.0038	0.03
	3.0×10^{-4}	4.0×10^{-4}	9.2332×10^{-10}	0.2334	1.1042×10^{-9}	0.0010	0.84	1.5583×10^{-9}	0.0041	2.95
	4.0×10^{-4}	5.0×10^{-4}	2.0857×10^{-9}	0.1657	1.2314×10^{-9}	0.0010	2.47	1.7449×10^{-9}	0.0043	0.99
	5.0×10^{-4}	6.0×10^{-4}	1.6495×10^{-9}	0.1804	1.3281×10^{-9}	0.0010	1.08	1.9040×10^{-9}	0.0044	0.85
	6.0×10^{-4}	7.0×10^{-4}	1.7807×10^{-9}	0.1742	1.4236×10^{-9}	0.0011	1.15	2.0508×10^{-9}	0.0046	0.87
	7.0×10^{-4}	8.0×10^{-4}	2.2016×10^{-9}	0.1587	1.5060×10^{-9}	0.0011	1.99	2.1723×10^{-9}	0.0047	0.08
	8.0×10^{-4}	9.0×10^{-4}	1.8907×10^{-9}	0.1704	1.5798×10^{-9}	0.0011	0.97	2.2865×10^{-9}	0.0048	1.23
	9.0×10^{-4}	1.0×10^{-3}	2.3516×10^{-9}	0.1536	1.6623×10^{-9}	0.0012	1.91	2.4109×10^{-9}	0.0049	0.16
	1.0×10^{-3}	2.0×10^{-3}	3.0239×10^{-8}	0.0430	2.0267×10^{-8}	0.0004	7.67	2.8690×10^{-8}	0.0017	1.19
	2.0×10^{-3}	3.0×10^{-3}	3.5856×10^{-8}	0.0395	2.5082×10^{-8}	0.0004	7.61	3.5422×10^{-8}	0.0018	0.31
	3.0×10^{-3}	4.0×10^{-3}	4.0078×10^{-8}	0.0371	2.8758×10^{-8}	0.0004	7.61	4.0546×10^{-8}	0.0018	0.31
	4.0×10^{-3}	5.0×10^{-3}	4.5597×10^{-8}	0.0350	3.1471×10^{-8}	0.0004	8.85	4.4897×10^{-8}	0.0019	0.44
	5.0×10^{-3}	6.0×10^{-3}	4.4033×10^{-8}	0.0353	3.3836×10^{-8}	0.0004	6.56	4.7985×10^{-8}	0.0019	2.54
	6.0×10^{-3}	7.0×10^{-3}	5.0568×10^{-8}	0.0331	3.5918×10^{-8}	0.0005	8.75	5.1060×10^{-8}	0.0019	0.29
	7.0×10^{-3}	8.0×10^{-3}	5.3475×10^{-8}	0.0322	3.7353×10^{-8}	0.0005	9.36	5.3731×10^{-8}	0.0019	0.15
	8.0×10^{-3}	9.0×10^{-3}	5.4577×10^{-8}	0.0320	3.9263×10^{-8}	0.0005	8.77	5.6173×10^{-8}	0.0020	0.91
	9.0×10^{-3}	1.0×10^{-2}	6.1246×10^{-8}	0.0301	4.1122×10^{-8}	0.0005	>10.0	5.8392×10^{-8}	0.0020	1.54
	1.0×10^{-2}	2.0×10^{-2}	4.6101×10^{-7}	0.0110	3.2963×10^{-7}	0.0002	>10.0	4.6026×10^{-7}	0.0008	0.15
	2.0×10^{-2}	3.0×10^{-2}	4.0695×10^{-7}	0.0117	2.8867×10^{-7}	0.0002	>10.0	4.0000×10^{-7}	0.0009	1.45
	3.0×10^{-2}	4.0×10^{-2}	4.0855×10^{-7}	0.0116	2.9824×10^{-7}	0.0002	>10.0	4.0406×10^{-7}	0.0010	0.94
	4.0×10^{-2}	5.0×10^{-2}	4.0355×10^{-7}	0.0117	2.9463×10^{-7}	0.0002	>10.0	4.0066×10^{-7}	0.0010	0.61
	5.0×10^{-2}	6.0×10^{-2}	3.9012×10^{-7}	0.0119	2.9035×10^{-7}	0.0002	>10.0	3.9261×10^{-7}	0.0010	0.54
	6.0×10^{-2}	7.0×10^{-2}	3.8157×10^{-7}	0.0120	2.7535×10^{-7}	0.0003	>10.0	3.8161×10^{-7}	0.0011	0.01
	7.0×10^{-2}	8.0×10^{-2}	3.6772×10^{-7}	0.0123	2.6399×10^{-7}	0.0003	>10.0	3.6928×10^{-7}	0.0011	0.34
	8.0×10^{-2}	9.0×10^{-2}	3.6778×10^{-7}	0.0123	2.5198×10^{-7}	0.0003	>10.0	3.5586×10^{-7}	0.0012	2.62

Table 5 Continued:

Cosine Angle (μ)	Energy Bins		F4		Unmodified F5			Modified F5		
	Lower Bin Energy (MeV)	Upper Bin Energy (MeV)	Flux (n/cm^2) (n/cm^2)	Fract. Std. Dev.	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4
	9.0×10^{-2}	1.0×10^{-1}	3.4322×10^{-7}	0.0127	2.4375×10^{-7}	0.0003	>10.0	3.4129×10^{-7}	0.0012	0.44
	1.0×10^{-1}	2.0×10^{-1}	2.5208×10^{-6}	0.0047	1.8187×10^{-6}	0.0001	>10.0	2.5088×10^{-6}	0.0005	1.01
	2.0×10^{-1}	3.0×10^{-1}	7.1986×10^{-7}	0.0088	5.3390×10^{-7}	0.0002	>10.0	7.2149×10^{-7}	0.0009	0.26

Table 5 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
−0.975	1.0×10^{-11}	1.0×10^{-4}	4.4044×10^{-10}	0.2556	6.0810×10^{-10}	0.0006	1.49	6.0791×10^{-10}	0.0031	1.49
	1.0×10^{-4}	2.0×10^{-4}	1.1600×10^{-9}	0.1607	1.0707×10^{-9}	0.0007	0.48	1.0702×10^{-9}	0.0035	0.48
	2.0×10^{-4}	3.0×10^{-4}	1.1242×10^{-9}	0.1630	1.3505×10^{-9}	0.0008	1.23	1.3545×10^{-9}	0.0039	1.26
	3.0×10^{-4}	4.0×10^{-4}	1.2960×10^{-9}	0.1508	1.5681×10^{-9}	0.0008	1.39	1.5660×10^{-9}	0.0041	1.38
	4.0×10^{-4}	5.0×10^{-4}	2.1609×10^{-9}	0.1187	1.7511×10^{-9}	0.0009	1.60	1.7427×10^{-9}	0.0043	1.63
	5.0×10^{-4}	6.0×10^{-4}	1.9402×10^{-9}	0.1275	1.9093×10^{-9}	0.0009	0.12	1.9112×10^{-9}	0.0045	0.12
	6.0×10^{-4}	7.0×10^{-4}	2.1555×10^{-9}	0.1179	2.0510×10^{-9}	0.0009	0.41	2.0557×10^{-9}	0.0046	0.39
	7.0×10^{-4}	8.0×10^{-4}	2.4738×10^{-9}	0.1110	2.1803×10^{-9}	0.0009	1.07	2.1799×10^{-9}	0.0047	1.07
	8.0×10^{-4}	9.0×10^{-4}	2.2728×10^{-9}	0.1152	2.2971×10^{-9}	0.0010	0.09	2.3070×10^{-9}	0.0048	0.13
	9.0×10^{-4}	1.0×10^{-3}	2.7168×10^{-9}	0.1035	2.4009×10^{-9}	0.0010	1.12	2.4032×10^{-9}	0.0049	1.11
	1.0×10^{-3}	2.0×10^{-3}	2.9073×10^{-8}	0.0322	2.8834×10^{-8}	0.0003	0.26	2.8801×10^{-8}	0.0017	0.29
	2.0×10^{-3}	3.0×10^{-3}	3.5049×10^{-8}	0.0293	3.5546×10^{-8}	0.0004	0.48	3.5569×10^{-8}	0.0018	0.51
	3.0×10^{-3}	4.0×10^{-3}	4.1914×10^{-8}	0.0269	4.0668×10^{-8}	0.0004	1.10	4.0616×10^{-8}	0.0018	1.15
	4.0×10^{-3}	5.0×10^{-3}	4.3835×10^{-8}	0.0260	4.4926×10^{-8}	0.0004	0.96	4.5057×10^{-8}	0.0019	1.07
	5.0×10^{-3}	6.0×10^{-3}	4.8224×10^{-8}	0.0250	4.8280×10^{-8}	0.0004	0.05	4.8321×10^{-8}	0.0019	0.08
	6.0×10^{-3}	7.0×10^{-3}	5.1167×10^{-8}	0.0242	5.1269×10^{-8}	0.0004	0.08	5.1197×10^{-8}	0.0019	0.02
	7.0×10^{-3}	8.0×10^{-3}	5.3133×10^{-8}	0.0237	5.3890×10^{-8}	0.0004	0.60	5.3818×10^{-8}	0.0020	0.54
	8.0×10^{-3}	9.0×10^{-3}	5.6078×10^{-8}	0.0231	5.6373×10^{-8}	0.0004	0.23	5.6509×10^{-8}	0.0020	0.33
	9.0×10^{-3}	1.0×10^{-2}	5.8612×10^{-8}	0.0226	5.8614×10^{-8}	0.0004	0.00	5.8571×10^{-8}	0.0020	0.03
	1.0×10^{-2}	2.0×10^{-2}	4.7070×10^{-7}	0.0080	4.7111×10^{-7}	0.0002	0.11	4.7070×10^{-7}	0.0008	0.00
	2.0×10^{-2}	3.0×10^{-2}	4.0790×10^{-7}	0.0086	4.0345×10^{-7}	0.0002	1.27	4.0318×10^{-7}	0.0009	1.34
	3.0×10^{-2}	4.0×10^{-2}	4.1197×10^{-7}	0.0085	4.0723×10^{-7}	0.0002	1.35	4.0739×10^{-7}	0.0010	1.30
	4.0×10^{-2}	5.0×10^{-2}	4.0442×10^{-7}	0.0086	4.0353×10^{-7}	0.0002	0.26	4.0406×10^{-7}	0.0010	0.10
	5.0×10^{-2}	6.0×10^{-2}	3.9359×10^{-7}	0.0087	3.9580×10^{-7}	0.0002	0.64	3.9594×10^{-7}	0.0010	0.68
	6.0×10^{-2}	7.0×10^{-2}	3.8587×10^{-7}	0.0088	3.8531×10^{-7}	0.0002	0.16	3.8487×10^{-7}	0.0011	0.29
	7.0×10^{-2}	8.0×10^{-2}	3.7296×10^{-7}	0.0090	3.7319×10^{-7}	0.0002	0.07	3.7283×10^{-7}	0.0011	0.04
	8.0×10^{-2}	9.0×10^{-2}	3.6250×10^{-7}	0.0091	3.5941×10^{-7}	0.0002	0.94	3.5934×10^{-7}	0.0012	0.95
	9.0×10^{-2}	1.0×10^{-1}	3.3972×10^{-7}	0.0094	3.4507×10^{-7}	0.0002	1.68	3.4440×10^{-7}	0.0012	1.45
	1.0×10^{-1}	2.0×10^{-1}	2.5305×10^{-6}	0.0034	2.5421×10^{-6}	0.0001	1.36	2.5437×10^{-6}	0.0005	1.52
	2.0×10^{-1}	3.0×10^{-1}	7.4660×10^{-7}	0.0063	7.5274×10^{-7}	0.0002	1.31	7.5333×10^{-7}	0.0009	1.42

Table 5 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
−0.9	1.0×10^{-11}	1.0×10^{-4}	4.5237×10^{-10}	0.1788	6.1105×10^{-10}	0.0006	1.96	6.0987×10^{-10}	0.0032	1.95
	1.0×10^{-4}	2.0×10^{-4}	9.4681×10^{-10}	0.1254	1.0781×10^{-9}	0.0007	1.11	1.0828×10^{-9}	0.0036	1.14
	2.0×10^{-4}	3.0×10^{-4}	1.3078×10^{-9}	0.1070	1.3623×10^{-9}	0.0008	0.39	1.3587×10^{-9}	0.0040	0.36
	3.0×10^{-4}	4.0×10^{-4}	1.5459×10^{-9}	0.0983	1.5823×10^{-9}	0.0008	0.24	1.5871×10^{-9}	0.0043	0.27
	4.0×10^{-4}	5.0×10^{-4}	1.7581×10^{-9}	0.0937	1.7658×10^{-9}	0.0009	0.05	1.7651×10^{-9}	0.0045	0.04
	5.0×10^{-4}	6.0×10^{-4}	1.9985×10^{-9}	0.0874	1.9268×10^{-9}	0.0009	0.41	1.9255×10^{-9}	0.0046	0.42
	6.0×10^{-4}	7.0×10^{-4}	2.0961×10^{-9}	0.0853	2.0706×10^{-9}	0.0009	0.14	2.0653×10^{-9}	0.0048	0.17
	7.0×10^{-4}	8.0×10^{-4}	2.2105×10^{-9}	0.0838	2.2012×10^{-9}	0.0010	0.05	2.2083×10^{-9}	0.0049	0.01
	8.0×10^{-4}	9.0×10^{-4}	2.3852×10^{-9}	0.0799	2.3207×10^{-9}	0.0010	0.34	2.3161×10^{-9}	0.0050	0.36
	9.0×10^{-4}	1.0×10^{-3}	2.4970×10^{-9}	0.0780	2.4305×10^{-9}	0.0010	0.34	2.4364×10^{-9}	0.0051	0.31
	1.0×10^{-3}	2.0×10^{-3}	2.9769×10^{-8}	0.0227	2.9143×10^{-8}	0.0003	0.93	2.9134×10^{-8}	0.0017	0.94
	2.0×10^{-3}	3.0×10^{-3}	3.5930×10^{-8}	0.0206	3.5929×10^{-8}	0.0004	0.00	3.5927×10^{-8}	0.0018	0.00
	3.0×10^{-3}	4.0×10^{-3}	4.1763×10^{-8}	0.0191	4.1079×10^{-8}	0.0004	0.86	4.1016×10^{-8}	0.0019	0.93
	4.0×10^{-3}	5.0×10^{-3}	4.5476×10^{-8}	0.0183	4.5379×10^{-8}	0.0004	0.12	4.5520×10^{-8}	0.0019	0.05
	5.0×10^{-3}	6.0×10^{-3}	4.9480×10^{-8}	0.0176	4.8934×10^{-8}	0.0004	0.63	4.9006×10^{-8}	0.0020	0.54
	6.0×10^{-3}	7.0×10^{-3}	5.1008×10^{-8}	0.0173	5.1877×10^{-8}	0.0004	0.98	5.1768×10^{-8}	0.0020	0.86
	7.0×10^{-3}	8.0×10^{-3}	5.5022×10^{-8}	0.0167	5.4546×10^{-8}	0.0004	0.52	5.4553×10^{-8}	0.0020	0.51
	8.0×10^{-3}	9.0×10^{-3}	5.5469×10^{-8}	0.0166	5.6995×10^{-8}	0.0004	1.66	5.6982×10^{-8}	0.0020	1.63
	9.0×10^{-3}	1.0×10^{-2}	5.8639×10^{-8}	0.0161	5.9284×10^{-8}	0.0004	0.68	5.9366×10^{-8}	0.0020	0.76
	1.0×10^{-2}	2.0×10^{-2}	5.0346×10^{-7}	0.0055	5.0461×10^{-7}	0.0001	0.42	5.0424×10^{-7}	0.0008	0.28
	2.0×10^{-2}	3.0×10^{-2}	4.1572×10^{-7}	0.0061	4.1330×10^{-7}	0.0002	0.95	4.1271×10^{-7}	0.0009	1.17
	3.0×10^{-2}	4.0×10^{-2}	4.1671×10^{-7}	0.0061	4.1732×10^{-7}	0.0002	0.24	4.1754×10^{-7}	0.0010	0.32
	4.0×10^{-2}	5.0×10^{-2}	4.1401×10^{-7}	0.0061	4.1385×10^{-7}	0.0002	0.06	4.1431×10^{-7}	0.0010	0.12
	5.0×10^{-2}	6.0×10^{-2}	4.0701×10^{-7}	0.0061	4.0601×10^{-7}	0.0002	0.40	4.0636×10^{-7}	0.0010	0.25
	6.0×10^{-2}	7.0×10^{-2}	3.9493×10^{-7}	0.0062	3.9568×10^{-7}	0.0002	0.31	3.9502×10^{-7}	0.0011	0.04
	7.0×10^{-2}	8.0×10^{-2}	3.8579×10^{-7}	0.0063	3.8362×10^{-7}	0.0002	0.89	3.8373×10^{-7}	0.0011	0.84
	8.0×10^{-2}	9.0×10^{-2}	3.7150×10^{-7}	0.0064	3.6985×10^{-7}	0.0002	0.69	3.6908×10^{-7}	0.0012	1.00
	9.0×10^{-2}	1.0×10^{-1}	3.5562×10^{-7}	0.0066	3.5546×10^{-7}	0.0002	0.07	3.5542×10^{-7}	0.0012	0.08
	1.0×10^{-1}	2.0×10^{-1}	2.6525×10^{-6}	0.0024	2.6484×10^{-6}	0.0001	0.65	2.6495×10^{-6}	0.0005	0.47
	2.0×10^{-1}	3.0×10^{-1}	8.5760×10^{-7}	0.0042	8.5384×10^{-7}	0.0002	1.04	8.5470×10^{-7}	0.0008	0.79

Table 5 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
−0.75	1.0×10^{-11}	1.0×10^{-4}	6.3023×10^{-10}	0.1280	6.1716×10^{-10}	0.0007	0.16	6.1690×10^{-10}	0.0034	0.17
	1.0×10^{-4}	2.0×10^{-4}	9.9230×10^{-10}	0.0999	1.0938×10^{-9}	0.0008	1.02	1.0949×10^{-9}	0.0039	1.03
	2.0×10^{-4}	3.0×10^{-4}	1.4589×10^{-9}	0.0840	1.3843×10^{-9}	0.0009	0.61	1.3813×10^{-9}	0.0043	0.63
	3.0×10^{-4}	4.0×10^{-4}	1.6674×10^{-9}	0.0785	1.6118×10^{-9}	0.0009	0.42	1.6134×10^{-9}	0.0046	0.41
	4.0×10^{-4}	5.0×10^{-4}	1.9763×10^{-9}	0.0718	1.7996×10^{-9}	0.0009	1.24	1.8113×10^{-9}	0.0048	1.16
	5.0×10^{-4}	6.0×10^{-4}	1.9487×10^{-9}	0.0726	1.9641×10^{-9}	0.0010	0.11	1.9545×10^{-9}	0.0050	0.04
	6.0×10^{-4}	7.0×10^{-4}	2.2134×10^{-9}	0.0676	2.1138×10^{-9}	0.0010	0.67	2.0997×10^{-9}	0.0051	0.76
	7.0×10^{-4}	8.0×10^{-4}	2.1263×10^{-9}	0.0690	2.2458×10^{-9}	0.0010	0.81	2.2583×10^{-9}	0.0052	0.90
	8.0×10^{-4}	9.0×10^{-4}	2.3254×10^{-9}	0.0666	2.3708×10^{-9}	0.0011	0.29	2.3669×10^{-9}	0.0054	0.27
	9.0×10^{-4}	1.0×10^{-3}	2.6347×10^{-9}	0.0620	2.4832×10^{-9}	0.0011	0.93	2.4778×10^{-9}	0.0054	0.96
	1.0×10^{-3}	2.0×10^{-3}	2.9964×10^{-8}	0.0183	2.9843×10^{-8}	0.0004	0.22	2.9880×10^{-8}	0.0018	0.15
	2.0×10^{-3}	3.0×10^{-3}	3.7351×10^{-8}	0.0164	3.6728×10^{-8}	0.0004	1.02	3.6700×10^{-8}	0.0019	1.06
	3.0×10^{-3}	4.0×10^{-3}	4.2216×10^{-8}	0.0155	4.2004×10^{-8}	0.0004	0.32	4.1979×10^{-8}	0.0020	0.36
	4.0×10^{-3}	5.0×10^{-3}	4.6963×10^{-8}	0.0146	4.6362×10^{-8}	0.0004	0.88	4.6298×10^{-8}	0.0020	0.96
	5.0×10^{-3}	6.0×10^{-3}	4.9425×10^{-8}	0.0143	5.0131×10^{-8}	0.0004	1.00	5.0279×10^{-8}	0.0021	1.19
	6.0×10^{-3}	7.0×10^{-3}	5.3610×10^{-8}	0.0137	5.3314×10^{-8}	0.0004	0.40	5.3443×10^{-8}	0.0021	0.23
	7.0×10^{-3}	8.0×10^{-3}	5.5461×10^{-8}	0.0135	5.5963×10^{-8}	0.0004	0.67	5.5798×10^{-8}	0.0021	0.44
	8.0×10^{-3}	9.0×10^{-3}	5.8240×10^{-8}	0.0132	5.8459×10^{-8}	0.0004	0.28	5.8431×10^{-8}	0.0021	0.25
	9.0×10^{-3}	1.0×10^{-2}	6.2086×10^{-8}	0.0127	6.0718×10^{-8}	0.0004	1.73	6.0691×10^{-8}	0.0021	1.75
	1.0×10^{-2}	2.0×10^{-2}	5.8437×10^{-7}	0.0042	5.8139×10^{-7}	0.0001	1.21	5.8151×10^{-7}	0.0007	1.15
	2.0×10^{-2}	3.0×10^{-2}	4.3058×10^{-7}	0.0048	4.3458×10^{-7}	0.0002	1.93	4.3383×10^{-7}	0.0009	1.54
	3.0×10^{-2}	4.0×10^{-2}	4.3745×10^{-7}	0.0048	4.3893×10^{-7}	0.0002	0.71	4.3911×10^{-7}	0.0010	0.78
	4.0×10^{-2}	5.0×10^{-2}	4.3629×10^{-7}	0.0048	4.3569×10^{-7}	0.0002	0.29	4.3609×10^{-7}	0.0010	0.09
	5.0×10^{-2}	6.0×10^{-2}	4.2673×10^{-7}	0.0049	4.2791×10^{-7}	0.0002	0.56	4.2800×10^{-7}	0.0011	0.59
	6.0×10^{-2}	7.0×10^{-2}	4.1735×10^{-7}	0.0049	4.1771×10^{-7}	0.0002	0.17	4.1767×10^{-7}	0.0011	0.15
	7.0×10^{-2}	8.0×10^{-2}	4.0461×10^{-7}	0.0050	4.0551×10^{-7}	0.0002	0.44	4.0481×10^{-7}	0.0011	0.09
	8.0×10^{-2}	9.0×10^{-2}	3.9038×10^{-7}	0.0051	3.9197×10^{-7}	0.0002	0.80	3.9197×10^{-7}	0.0012	0.78
	9.0×10^{-2}	1.0×10^{-1}	3.7585×10^{-7}	0.0052	3.7737×10^{-7}	0.0002	0.78	3.7722×10^{-7}	0.0012	0.68
	1.0×10^{-1}	2.0×10^{-1}	2.8635×10^{-6}	0.0019	2.8696×10^{-6}	0.0001	1.11	2.8699×10^{-6}	0.0004	1.15
	2.0×10^{-1}	3.0×10^{-1}	1.0796×10^{-6}	0.0031	1.0777×10^{-6}	0.0001	0.57	1.0789×10^{-6}	0.0008	0.18
	3.0×10^{-1}	4.0×10^{-1}	6.3545×10^{-9}	0.0399	6.0004×10^{-9}	0.0020	1.40	6.0502×10^{-9}	0.0102	1.17

Table 5 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
−0.5	1.0×10^{-11}	1.0×10^{-4}	6.7025×10^{-10}	0.1082	6.2826×10^{-10}	0.0008	0.58	6.3011×10^{-10}	0.0041	0.55
	1.0×10^{-4}	2.0×10^{-4}	1.1063×10^{-9}	0.0829	1.1210×10^{-9}	0.0009	0.16	1.1173×10^{-9}	0.0047	0.12
	2.0×10^{-4}	3.0×10^{-4}	1.4403×10^{-9}	0.0732	1.4266×10^{-9}	0.0010	0.13	1.4256×10^{-9}	0.0051	0.14
	3.0×10^{-4}	4.0×10^{-4}	1.6351×10^{-9}	0.0690	1.6626×10^{-9}	0.0011	0.24	1.6682×10^{-9}	0.0054	0.29
	4.0×10^{-4}	5.0×10^{-4}	2.1117×10^{-9}	0.0608	1.8675×10^{-9}	0.0011	1.90	1.8685×10^{-9}	0.0056	1.89
	5.0×10^{-4}	6.0×10^{-4}	2.1731×10^{-9}	0.0596	2.0403×10^{-9}	0.0011	1.02	2.0422×10^{-9}	0.0058	1.01
	6.0×10^{-4}	7.0×10^{-4}	2.2365×10^{-9}	0.0586	2.1937×10^{-9}	0.0012	0.33	2.1877×10^{-9}	0.0059	0.37
	7.0×10^{-4}	8.0×10^{-4}	2.1004×10^{-9}	0.0605	2.3341×10^{-9}	0.0012	1.84	2.3539×10^{-9}	0.0060	1.98
	8.0×10^{-4}	9.0×10^{-4}	2.5425×10^{-9}	0.0549	2.4690×10^{-9}	0.0012	0.53	2.4622×10^{-9}	0.0061	0.57
	9.0×10^{-4}	1.0×10^{-3}	2.3874×10^{-9}	0.0570	2.5809×10^{-9}	0.0012	1.42	2.5687×10^{-9}	0.0062	1.32
	1.0×10^{-3}	2.0×10^{-3}	3.1722×10^{-8}	0.0155	3.1190×10^{-8}	0.0004	1.08	3.1207×10^{-8}	0.0021	1.04
	2.0×10^{-3}	3.0×10^{-3}	3.8098×10^{-8}	0.0142	3.8440×10^{-8}	0.0004	0.63	3.8460×10^{-8}	0.0022	0.66
	3.0×10^{-3}	4.0×10^{-3}	4.3785×10^{-8}	0.0133	4.3839×10^{-8}	0.0004	0.09	4.3759×10^{-8}	0.0022	0.04
	4.0×10^{-3}	5.0×10^{-3}	4.8018×10^{-8}	0.0127	4.8375×10^{-8}	0.0004	0.58	4.8342×10^{-8}	0.0023	0.52
	5.0×10^{-3}	6.0×10^{-3}	5.2499×10^{-8}	0.0121	5.2192×10^{-8}	0.0005	0.48	5.2161×10^{-8}	0.0023	0.52
	6.0×10^{-3}	7.0×10^{-3}	5.5565×10^{-8}	0.0118	5.5619×10^{-8}	0.0005	0.08	5.5624×10^{-8}	0.0023	0.09
	7.0×10^{-3}	8.0×10^{-3}	5.9104×10^{-8}	0.0114	5.8725×10^{-8}	0.0005	0.56	5.8957×10^{-8}	0.0023	0.21
	8.0×10^{-3}	9.0×10^{-3}	6.1428×10^{-8}	0.0112	6.1424×10^{-8}	0.0005	0.01	6.1557×10^{-8}	0.0023	0.18
	9.0×10^{-3}	1.0×10^{-2}	6.4764×10^{-8}	0.0109	6.3708×10^{-8}	0.0005	1.49	6.3622×10^{-8}	0.0023	1.58
	1.0×10^{-2}	2.0×10^{-2}	7.0276×10^{-7}	0.0033	7.0419×10^{-7}	0.0001	0.62	7.0412×10^{-7}	0.0008	0.57
	2.0×10^{-2}	3.0×10^{-2}	5.1900×10^{-7}	0.0039	5.1744×10^{-7}	0.0002	0.77	5.1681×10^{-7}	0.0009	1.06
	3.0×10^{-2}	4.0×10^{-2}	4.8136×10^{-7}	0.0040	4.8031×10^{-7}	0.0002	0.54	4.7983×10^{-7}	0.0010	0.77
	4.0×10^{-2}	5.0×10^{-2}	4.8292×10^{-7}	0.0040	4.7695×10^{-7}	0.0002	3.09	4.7700×10^{-7}	0.0011	2.96
	5.0×10^{-2}	6.0×10^{-2}	4.6996×10^{-7}	0.0040	4.6911×10^{-7}	0.0002	0.45	4.7005×10^{-7}	0.0011	0.04
	6.0×10^{-2}	7.0×10^{-2}	4.5564×10^{-7}	0.0041	4.5841×10^{-7}	0.0002	1.48	4.5851×10^{-7}	0.0011	1.49
	7.0×10^{-2}	8.0×10^{-2}	4.4534×10^{-7}	0.0042	4.4615×10^{-7}	0.0002	0.43	4.4600×10^{-7}	0.0011	0.34
	8.0×10^{-2}	9.0×10^{-2}	4.3412×10^{-7}	0.0042	4.3247×10^{-7}	0.0002	0.90	4.3191×10^{-7}	0.0012	1.17
	9.0×10^{-2}	1.0×10^{-1}	4.1944×10^{-7}	0.0043	4.1789×10^{-7}	0.0002	0.86	4.1764×10^{-7}	0.0012	0.96
	1.0×10^{-1}	2.0×10^{-1}	3.2645×10^{-6}	0.0015	3.2682×10^{-6}	0.0001	0.75	3.2690×10^{-6}	0.0004	0.89
	2.0×10^{-1}	3.0×10^{-1}	1.4749×10^{-6}	0.0023	1.4771×10^{-6}	0.0001	0.66	1.4778×10^{-6}	0.0007	0.83
	3.0×10^{-1}	4.0×10^{-1}	8.2596×10^{-8}	0.0097	8.1475×10^{-8}	0.0006	1.40	8.1575×10^{-8}	0.0029	1.22

Table 5 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
−0.3	1.0×10^{-11}	1.0×10^{-4}	6.9010×10^{-10}	0.1007	6.3709×10^{-10}	0.0010	0.76	6.3577×10^{-10}	0.0050	0.78
	1.0×10^{-4}	2.0×10^{-4}	1.1264×10^{-9}	0.0782	1.1463×10^{-9}	0.0011	0.23	1.1536×10^{-9}	0.0056	0.31
	2.0×10^{-4}	3.0×10^{-4}	1.5763×10^{-9}	0.0668	1.4647×10^{-9}	0.0012	1.06	1.4601×10^{-9}	0.0061	1.10
	3.0×10^{-4}	4.0×10^{-4}	1.7016×10^{-9}	0.0641	1.7109×10^{-9}	0.0012	0.08	1.7037×10^{-9}	0.0064	0.02
	4.0×10^{-4}	5.0×10^{-4}	1.8807×10^{-9}	0.0610	1.9255×10^{-9}	0.0013	0.39	1.9280×10^{-9}	0.0065	0.41
	5.0×10^{-4}	6.0×10^{-4}	2.1298×10^{-9}	0.0569	2.1064×10^{-9}	0.0013	0.19	2.1027×10^{-9}	0.0067	0.22
	6.0×10^{-4}	7.0×10^{-4}	2.1732×10^{-9}	0.0566	2.2725×10^{-9}	0.0013	0.81	2.2768×10^{-9}	0.0068	0.84
	7.0×10^{-4}	8.0×10^{-4}	2.4014×10^{-9}	0.0537	2.4224×10^{-9}	0.0014	0.16	2.4782×10^{-9}	0.0069	0.59
	8.0×10^{-4}	9.0×10^{-4}	2.5459×10^{-9}	0.0527	2.5632×10^{-9}	0.0014	0.13	2.5174×10^{-9}	0.0071	0.21
	9.0×10^{-4}	1.0×10^{-3}	2.9068×10^{-9}	0.0493	2.6868×10^{-9}	0.0014	1.53	2.7005×10^{-9}	0.0071	1.43
	1.0×10^{-3}	2.0×10^{-3}	3.2222×10^{-8}	0.0147	3.2469×10^{-8}	0.0005	0.52	3.2458×10^{-8}	0.0024	0.49
	2.0×10^{-3}	3.0×10^{-3}	3.9558×10^{-8}	0.0133	4.0176×10^{-8}	0.0005	1.17	4.0201×10^{-8}	0.0024	1.20
	3.0×10^{-3}	4.0×10^{-3}	4.6631×10^{-8}	0.0123	4.5821×10^{-8}	0.0005	1.41	4.5799×10^{-8}	0.0025	1.42
	4.0×10^{-3}	5.0×10^{-3}	4.9903×10^{-8}	0.0118	5.0377×10^{-8}	0.0005	0.80	5.0408×10^{-8}	0.0025	0.84
	5.0×10^{-3}	6.0×10^{-3}	5.4353×10^{-8}	0.0113	5.4358×10^{-8}	0.0005	0.01	5.4314×10^{-8}	0.0025	0.06
	6.0×10^{-3}	7.0×10^{-3}	5.8573×10^{-8}	0.0109	5.7862×10^{-8}	0.0005	1.11	5.7844×10^{-8}	0.0025	1.11
	7.0×10^{-3}	8.0×10^{-3}	6.1685×10^{-8}	0.0107	6.0942×10^{-8}	0.0005	1.12	6.0831×10^{-8}	0.0025	1.26
	8.0×10^{-3}	9.0×10^{-3}	6.5315×10^{-8}	0.0104	6.3812×10^{-8}	0.0005	2.21	6.3799×10^{-8}	0.0025	2.17
	9.0×10^{-3}	1.0×10^{-2}	6.7534×10^{-8}	0.0102	6.6484×10^{-8}	0.0005	1.52	6.6616×10^{-8}	0.0025	1.30
	1.0×10^{-2}	2.0×10^{-2}	7.7051×10^{-7}	0.0030	7.6754×10^{-7}	0.0002	1.28	7.6775×10^{-7}	0.0008	1.15
	2.0×10^{-2}	3.0×10^{-2}	6.6750×10^{-7}	0.0032	6.6954×10^{-7}	0.0002	0.96	6.6924×10^{-7}	0.0009	0.78
	3.0×10^{-2}	4.0×10^{-2}	5.1739×10^{-7}	0.0037	5.1933×10^{-7}	0.0002	1.01	5.1867×10^{-7}	0.0011	0.64
	4.0×10^{-2}	5.0×10^{-2}	5.1637×10^{-7}	0.0037	5.1545×10^{-7}	0.0002	0.48	5.1547×10^{-7}	0.0011	0.45
	5.0×10^{-2}	6.0×10^{-2}	5.0446×10^{-7}	0.0037	5.0712×10^{-7}	0.0002	1.42	5.0703×10^{-7}	0.0011	1.32
	6.0×10^{-2}	7.0×10^{-2}	4.9196×10^{-7}	0.0038	4.9599×10^{-7}	0.0002	2.16	4.9649×10^{-7}	0.0011	2.33
	7.0×10^{-2}	8.0×10^{-2}	4.8304×10^{-7}	0.0038	4.8297×10^{-7}	0.0002	0.04	4.8366×10^{-7}	0.0012	0.32
	8.0×10^{-2}	9.0×10^{-2}	4.6516×10^{-7}	0.0039	4.6901×10^{-7}	0.0002	2.12	4.6855×10^{-7}	0.0012	1.78
	9.0×10^{-2}	1.0×10^{-1}	4.5418×10^{-7}	0.0039	4.5415×10^{-7}	0.0002	0.02	4.5327×10^{-7}	0.0012	0.49
	1.0×10^{-1}	2.0×10^{-1}	3.6222×10^{-6}	0.0014	3.6191×10^{-6}	0.0001	0.61	3.6200×10^{-6}	0.0004	0.42
	2.0×10^{-1}	3.0×10^{-1}	1.8186×10^{-6}	0.0020	1.8207×10^{-6}	0.0001	0.58	1.8213×10^{-6}	0.0006	0.72
	3.0×10^{-1}	4.0×10^{-1}	2.1502×10^{-7}	0.0057	2.1455×10^{-7}	0.0004	0.38	2.1478×10^{-7}	0.0018	0.19

Table 5 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
−0.1	1.0×10^{-11}	1.0×10^{-4}	6.9808×10^{-10}	0.0978	6.4550×10^{-10}	0.0014	0.77	6.4305×10^{-10}	0.0072	0.80
	1.0×10^{-4}	2.0×10^{-4}	1.1812×10^{-9}	0.0740	1.1702×10^{-9}	0.0015	0.13	1.1668×10^{-9}	0.0075	0.16
	2.0×10^{-4}	3.0×10^{-4}	1.5776×10^{-9}	0.0649	1.5062×10^{-9}	0.0015	0.70	1.5045×10^{-9}	0.0079	0.71
	3.0×10^{-4}	4.0×10^{-4}	1.5194×10^{-9}	0.0655	1.7709×10^{-9}	0.0016	2.53	1.7686×10^{-9}	0.0081	2.48
	4.0×10^{-4}	5.0×10^{-4}	1.8257×10^{-9}	0.0604	1.9947×10^{-9}	0.0016	1.53	2.0227×10^{-9}	0.0082	1.77
	5.0×10^{-4}	6.0×10^{-4}	1.9979×10^{-9}	0.0580	2.1882×10^{-9}	0.0016	1.64	2.1839×10^{-9}	0.0083	1.59
	6.0×10^{-4}	7.0×10^{-4}	2.4828×10^{-9}	0.0520	2.3641×10^{-9}	0.0017	0.92	2.3678×10^{-9}	0.0084	0.88
	7.0×10^{-4}	8.0×10^{-4}	2.2518×10^{-9}	0.0542	2.5231×10^{-9}	0.0017	2.22	2.5128×10^{-9}	0.0085	2.11
	8.0×10^{-4}	9.0×10^{-4}	2.8445×10^{-9}	0.0484	2.6659×10^{-9}	0.0017	1.30	2.6488×10^{-9}	0.0086	1.40
	9.0×10^{-4}	1.0×10^{-3}	2.7663×10^{-9}	0.0495	2.8140×10^{-9}	0.0017	0.35	2.7959×10^{-9}	0.0086	0.21
	1.0×10^{-3}	2.0×10^{-3}	3.4521×10^{-8}	0.0139	3.4092×10^{-8}	0.0005	0.89	3.4178×10^{-8}	0.0028	0.70
	2.0×10^{-3}	3.0×10^{-3}	4.2521×10^{-8}	0.0126	4.2279×10^{-8}	0.0006	0.45	4.2205×10^{-8}	0.0028	0.58
	3.0×10^{-3}	4.0×10^{-3}	4.8281×10^{-8}	0.0118	4.8343×10^{-8}	0.0006	0.11	4.8429×10^{-8}	0.0028	0.25
	4.0×10^{-3}	5.0×10^{-3}	5.3191×10^{-8}	0.0112	5.3178×10^{-8}	0.0006	0.02	5.3228×10^{-8}	0.0028	0.06
	5.0×10^{-3}	6.0×10^{-3}	5.7043×10^{-8}	0.0108	5.7206×10^{-8}	0.0006	0.27	5.7169×10^{-8}	0.0028	0.20
	6.0×10^{-3}	7.0×10^{-3}	5.9688×10^{-8}	0.0106	6.0712×10^{-8}	0.0005	1.62	6.0802×10^{-8}	0.0028	1.70
	7.0×10^{-3}	8.0×10^{-3}	6.3353×10^{-8}	0.0103	6.3870×10^{-8}	0.0005	0.79	6.3545×10^{-8}	0.0028	0.28
	8.0×10^{-3}	9.0×10^{-3}	6.6910×10^{-8}	0.0100	6.6826×10^{-8}	0.0005	0.13	6.7009×10^{-8}	0.0028	0.14
	9.0×10^{-3}	1.0×10^{-2}	6.8877×10^{-8}	0.0099	6.9447×10^{-8}	0.0005	0.83	6.9437×10^{-8}	0.0028	0.79
	1.0×10^{-2}	2.0×10^{-2}	8.0666×10^{-7}	0.0029	8.0437×10^{-7}	0.0002	0.98	8.0430×10^{-7}	0.0009	0.96
	2.0×10^{-2}	3.0×10^{-2}	8.6618×10^{-7}	0.0028	8.6540×10^{-7}	0.0002	0.32	8.6571×10^{-7}	0.0009	0.19
	3.0×10^{-2}	4.0×10^{-2}	6.1052×10^{-7}	0.0033	6.0776×10^{-7}	0.0002	1.37	6.0691×10^{-7}	0.0010	1.72
	4.0×10^{-2}	5.0×10^{-2}	5.5917×10^{-7}	0.0035	5.6067×10^{-7}	0.0002	0.76	5.5987×10^{-7}	0.0011	0.34
	5.0×10^{-2}	6.0×10^{-2}	5.5496×10^{-7}	0.0035	5.5092×10^{-7}	0.0002	2.08	5.5159×10^{-7}	0.0011	1.66
	6.0×10^{-2}	7.0×10^{-2}	5.3809×10^{-7}	0.0035	5.3890×10^{-7}	0.0002	0.43	5.3889×10^{-7}	0.0011	0.41
	7.0×10^{-2}	8.0×10^{-2}	5.3039×10^{-7}	0.0036	5.2503×10^{-7}	0.0002	2.80	5.2580×10^{-7}	0.0012	2.28
	8.0×10^{-2}	9.0×10^{-2}	5.1103×10^{-7}	0.0036	5.1024×10^{-7}	0.0002	0.43	5.1065×10^{-7}	0.0012	0.19
	9.0×10^{-2}	1.0×10^{-1}	4.9263×10^{-7}	0.0037	4.9462×10^{-7}	0.0002	1.09	4.9400×10^{-7}	0.0012	0.72
	1.0×10^{-1}	2.0×10^{-1}	4.0050×10^{-6}	0.0013	4.0042×10^{-6}	0.0001	0.16	4.0044×10^{-6}	0.0004	0.11
	2.0×10^{-1}	3.0×10^{-1}	2.1916×10^{-6}	0.0017	2.1890×10^{-6}	0.0001	0.68	2.1892×10^{-6}	0.0006	0.60
	3.0×10^{-1}	4.0×10^{-1}	4.2655×10^{-7}	0.0040	4.2488×10^{-7}	0.0003	0.97	4.2542×10^{-7}	0.0013	0.63

Table 5 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
0.1	1.0×10^{-11}	1.0×10^{-4}	6.7956×10^{-10}	0.0999	3.2066×10^{-10}	0.0126	5.28	6.7173×10^{-10}	0.0509	0.10
	1.0×10^{-4}	2.0×10^{-4}	1.0968×10^{-9}	0.0781	1.1960×10^{-9}	0.0034	1.16	1.2126×10^{-9}	0.0239	1.28
	2.0×10^{-4}	3.0×10^{-4}	1.5675×10^{-9}	0.0658	1.5555×10^{-9}	0.0028	0.12	1.5667×10^{-9}	0.0173	0.01
	3.0×10^{-4}	4.0×10^{-4}	1.8532×10^{-9}	0.0599	1.8319×10^{-9}	0.0026	0.19	1.8790×10^{-9}	0.0128	0.23
	4.0×10^{-4}	5.0×10^{-4}	2.0873×10^{-9}	0.0570	2.0663×10^{-9}	0.0025	0.18	2.0548×10^{-9}	0.0125	0.27
	5.0×10^{-4}	6.0×10^{-4}	2.4416×10^{-9}	0.0525	2.2741×10^{-9}	0.0024	1.31	2.2805×10^{-9}	0.0121	1.23
	6.0×10^{-4}	7.0×10^{-4}	2.4036×10^{-9}	0.0526	2.4686×10^{-9}	0.0023	0.51	2.4497×10^{-9}	0.0119	0.35
	7.0×10^{-4}	8.0×10^{-4}	2.6330×10^{-9}	0.0508	2.6404×10^{-9}	0.0023	0.06	2.6039×10^{-9}	0.0117	0.21
	8.0×10^{-4}	9.0×10^{-4}	2.7022×10^{-9}	0.0496	2.7964×10^{-9}	0.0023	0.70	2.8146×10^{-9}	0.0115	0.82
	9.0×10^{-4}	1.0×10^{-3}	3.1941×10^{-9}	0.0458	2.9549×10^{-9}	0.0022	1.63	2.9364×10^{-9}	0.0114	1.72
	1.0×10^{-3}	2.0×10^{-3}	3.6127×10^{-8}	0.0136	3.6180×10^{-8}	0.0007	0.11	3.6249×10^{-8}	0.0035	0.24
	2.0×10^{-3}	3.0×10^{-3}	4.5618×10^{-8}	0.0121	4.5107×10^{-8}	0.0007	0.92	4.5126×10^{-8}	0.0034	0.86
	3.0×10^{-3}	4.0×10^{-3}	5.1645×10^{-8}	0.0114	5.1690×10^{-8}	0.0006	0.08	5.1678×10^{-8}	0.0033	0.05
	4.0×10^{-3}	5.0×10^{-3}	5.6038×10^{-8}	0.0109	5.6814×10^{-8}	0.0006	1.27	5.6815×10^{-8}	0.0032	1.22
	5.0×10^{-3}	6.0×10^{-3}	5.9919×10^{-8}	0.0106	6.1143×10^{-8}	0.0006	1.92	6.1128×10^{-8}	0.0032	1.82
	6.0×10^{-3}	7.0×10^{-3}	6.4526×10^{-8}	0.0102	6.4879×10^{-8}	0.0006	0.54	6.4978×10^{-8}	0.0031	0.66
	7.0×10^{-3}	8.0×10^{-3}	6.7548×10^{-8}	0.0100	6.7993×10^{-8}	0.0006	0.66	6.7978×10^{-8}	0.0031	0.61
	8.0×10^{-3}	9.0×10^{-3}	7.1739×10^{-8}	0.0097	7.0944×10^{-8}	0.0006	1.14	7.0983×10^{-8}	0.0031	1.04
	9.0×10^{-3}	1.0×10^{-2}	7.2725×10^{-8}	0.0096	7.3510×10^{-8}	0.0006	1.12	7.3730×10^{-8}	0.0031	1.37
	1.0×10^{-2}	2.0×10^{-2}	8.4841×10^{-7}	0.0028	8.4884×10^{-7}	0.0002	0.18	8.4901×10^{-7}	0.0009	0.24
	2.0×10^{-2}	3.0×10^{-2}	9.8212×10^{-7}	0.0026	9.8555×10^{-7}	0.0002	1.34	9.8542×10^{-7}	0.0009	1.22
	3.0×10^{-2}	4.0×10^{-2}	8.4703×10^{-7}	0.0028	8.4760×10^{-7}	0.0002	0.24	8.4736×10^{-7}	0.0010	0.13
	4.0×10^{-2}	5.0×10^{-2}	6.1748×10^{-7}	0.0033	6.1793×10^{-7}	0.0002	0.22	6.1695×10^{-7}	0.0011	0.25
	5.0×10^{-2}	6.0×10^{-2}	6.0102×10^{-7}	0.0033	6.0278×10^{-7}	0.0002	0.88	6.0164×10^{-7}	0.0012	0.29
	6.0×10^{-2}	7.0×10^{-2}	5.8307×10^{-7}	0.0034	5.8870×10^{-7}	0.0002	2.83	5.8932×10^{-7}	0.0012	2.97
	7.0×10^{-2}	8.0×10^{-2}	5.7606×10^{-7}	0.0034	5.7370×10^{-7}	0.0002	1.20	5.7429×10^{-7}	0.0012	0.85
	8.0×10^{-2}	9.0×10^{-2}	5.5959×10^{-7}	0.0035	5.5733×10^{-7}	0.0002	1.16	5.5809×10^{-7}	0.0012	0.73
	9.0×10^{-2}	1.0×10^{-1}	5.3757×10^{-7}	0.0035	5.4072×10^{-7}	0.0002	1.67	5.4102×10^{-7}	0.0012	1.74
	1.0×10^{-1}	2.0×10^{-1}	4.4349×10^{-6}	0.0012	4.4300×10^{-6}	0.0001	0.92	4.4299×10^{-6}	0.0004	0.90
	2.0×10^{-1}	3.0×10^{-1}	2.5864×10^{-6}	0.0016	2.5860×10^{-6}	0.0001	0.10	2.5858×10^{-6}	0.0006	0.13
	3.0×10^{-1}	4.0×10^{-1}	7.2760×10^{-7}	0.0030	7.2643×10^{-7}	0.0002	0.53	7.2709×10^{-7}	0.0011	0.22

Table 5 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
0.3	1.0×10^{-11}	1.0×10^{-4}	6.3580×10^{-10}	0.1051	-	-	>10.0	6.6299×10^{-10}	0.0104	0.40
	1.0×10^{-4}	2.0×10^{-4}	1.3123×10^{-9}	0.0721	-	-	>10.0	1.2365×10^{-9}	0.0142	0.79
	2.0×10^{-4}	3.0×10^{-4}	1.4476×10^{-9}	0.0697	-	-	>10.0	1.5830×10^{-9}	0.0190	1.29
	3.0×10^{-4}	4.0×10^{-4}	1.7263×10^{-9}	0.0636	-	-	>10.0	1.8788×10^{-9}	0.0252	1.28
	4.0×10^{-4}	5.0×10^{-4}	2.2948×10^{-9}	0.0549	-	-	>10.0	2.0896×10^{-9}	0.0354	1.40
	5.0×10^{-4}	6.0×10^{-4}	2.2343×10^{-9}	0.0556	8.5712×10^{-12}	0.7254	>10.0	2.2709×10^{-9}	0.0757	0.17
	6.0×10^{-4}	7.0×10^{-4}	2.3842×10^{-9}	0.0535	2.2550×10^{-9}	0.0165	0.97	2.6973×10^{-9}	0.1183	0.91
	7.0×10^{-4}	8.0×10^{-4}	2.5438×10^{-9}	0.0528	2.7720×10^{-9}	0.0065	1.68	2.6722×10^{-9}	0.0472	0.70
	8.0×10^{-4}	9.0×10^{-4}	3.0428×10^{-9}	0.0477	2.9772×10^{-9}	0.0050	0.45	3.0565×10^{-9}	0.0357	0.08
	9.0×10^{-4}	1.0×10^{-3}	3.1856×10^{-9}	0.0465	3.1385×10^{-9}	0.0044	0.32	3.0243×10^{-9}	0.0322	0.91
	1.0×10^{-3}	2.0×10^{-3}	3.9789×10^{-8}	0.0133	3.8735×10^{-8}	0.0010	1.99	3.8755×10^{-8}	0.0075	1.71
	2.0×10^{-3}	3.0×10^{-3}	4.8755×10^{-8}	0.0120	4.9001×10^{-8}	0.0009	0.42	4.9236×10^{-8}	0.0053	0.75
	3.0×10^{-3}	4.0×10^{-3}	5.5540×10^{-8}	0.0112	5.6469×10^{-8}	0.0008	1.49	5.6611×10^{-8}	0.0041	1.61
	4.0×10^{-3}	5.0×10^{-3}	6.2311×10^{-8}	0.0106	6.2174×10^{-8}	0.0008	0.21	6.1945×10^{-8}	0.0039	0.52
	5.0×10^{-3}	6.0×10^{-3}	6.6867×10^{-8}	0.0102	6.6814×10^{-8}	0.0007	0.08	6.7119×10^{-8}	0.0038	0.35
	6.0×10^{-3}	7.0×10^{-3}	7.1676×10^{-8}	0.0099	7.0761×10^{-8}	0.0007	1.29	7.0645×10^{-8}	0.0037	1.36
	7.0×10^{-3}	8.0×10^{-3}	7.3395×10^{-8}	0.0098	7.4087×10^{-8}	0.0007	0.96	7.4053×10^{-8}	0.0036	0.86
	8.0×10^{-3}	9.0×10^{-3}	7.5971×10^{-8}	0.0096	7.7028×10^{-8}	0.0007	1.45	7.7083×10^{-8}	0.0035	1.43
	9.0×10^{-3}	1.0×10^{-2}	7.8640×10^{-8}	0.0094	7.9755×10^{-8}	0.0007	1.50	7.9696×10^{-8}	0.0035	1.34
	1.0×10^{-2}	2.0×10^{-2}	9.0619×10^{-7}	0.0028	9.0568×10^{-7}	0.0002	0.20	9.0514×10^{-7}	0.0010	0.39
	2.0×10^{-2}	3.0×10^{-2}	1.0485×10^{-6}	0.0026	1.0468×10^{-6}	0.0002	0.61	1.0477×10^{-6}	0.0010	0.24
	3.0×10^{-2}	4.0×10^{-2}	1.1072×10^{-6}	0.0025	1.1065×10^{-6}	0.0002	0.25	1.1064×10^{-6}	0.0009	0.27
	4.0×10^{-2}	5.0×10^{-2}	8.3350×10^{-7}	0.0029	8.3065×10^{-7}	0.0002	1.18	8.3024×10^{-7}	0.0011	1.26
	5.0×10^{-2}	6.0×10^{-2}	6.6326×10^{-7}	0.0032	6.6519×10^{-7}	0.0002	0.91	6.6398×10^{-7}	0.0012	0.32
	6.0×10^{-2}	7.0×10^{-2}	6.5113×10^{-7}	0.0033	6.4824×10^{-7}	0.0002	1.34	6.4783×10^{-7}	0.0012	1.45
	7.0×10^{-2}	8.0×10^{-2}	6.3216×10^{-7}	0.0033	6.3041×10^{-7}	0.0002	0.84	6.3083×10^{-7}	0.0012	0.60
	8.0×10^{-2}	9.0×10^{-2}	6.1177×10^{-7}	0.0034	6.1249×10^{-7}	0.0002	0.35	6.1274×10^{-7}	0.0012	0.44
	9.0×10^{-2}	1.0×10^{-1}	5.9590×10^{-7}	0.0034	5.9387×10^{-7}	0.0002	1.00	5.9471×10^{-7}	0.0012	0.55
	1.0×10^{-1}	2.0×10^{-1}	4.9022×10^{-6}	0.0012	4.9059×10^{-6}	0.0001	0.64	4.9054×10^{-6}	0.0004	0.51
	2.0×10^{-1}	3.0×10^{-1}	3.0120×10^{-6}	0.0015	3.0162×10^{-6}	0.0001	0.92	3.0169×10^{-6}	0.0005	1.03
	3.0×10^{-1}	4.0×10^{-1}	1.1255×10^{-6}	0.0025	1.1267×10^{-6}	0.0002	0.43	1.1273×10^{-6}	0.0009	0.63
	4.0×10^{-1}	5.0×10^{-1}	8.6170×10^{-9}	0.0284	8.8860×10^{-9}	0.0019	1.10	8.9884×10^{-9}	0.0098	1.43

Table 5 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
0.5	1.0×10^{-11}	1.0×10^{-4}	6.1134×10^{-10}	0.1120	-	-	>10.0	6.7842×10^{-10}	0.0073	0.98
	1.0×10^{-4}	2.0×10^{-4}	1.3062×10^{-9}	0.0761	-	-	>10.0	1.2579×10^{-9}	0.0093	0.48
	2.0×10^{-4}	3.0×10^{-4}	1.5423×10^{-9}	0.0704	-	-	>10.0	1.6450×10^{-9}	0.0111	0.93
	3.0×10^{-4}	4.0×10^{-4}	1.8434×10^{-9}	0.0642	-	-	>10.0	1.9858×10^{-9}	0.0128	1.18
	4.0×10^{-4}	5.0×10^{-4}	2.2544×10^{-9}	0.0581	-	-	>10.0	2.2532×10^{-9}	0.0145	0.01
	5.0×10^{-4}	6.0×10^{-4}	2.6054×10^{-9}	0.0545	-	-	>10.0	2.5872×10^{-9}	0.0158	0.12
	6.0×10^{-4}	7.0×10^{-4}	2.8046×10^{-9}	0.0523	-	-	>10.0	2.7196×10^{-9}	0.0179	0.55
	7.0×10^{-4}	8.0×10^{-4}	2.9115×10^{-9}	0.0512	-	-	>10.0	3.0586×10^{-9}	0.0193	0.92
	8.0×10^{-4}	9.0×10^{-4}	3.2044×10^{-9}	0.0488	-	-	>10.0	3.1505×10^{-9}	0.0217	0.32
	9.0×10^{-4}	1.0×10^{-3}	3.1375×10^{-9}	0.0496	-	-	>10.0	3.4737×10^{-9}	0.0235	1.91
	1.0×10^{-3}	2.0×10^{-3}	4.3088×10^{-8}	0.0134	1.2802×10^{-8}	0.0114	>10.0	4.3424×10^{-8}	0.0299	0.24
	2.0×10^{-3}	3.0×10^{-3}	5.4157×10^{-8}	0.0119	5.4841×10^{-8}	0.0016	1.05	5.4765×10^{-8}	0.0115	0.67
	3.0×10^{-3}	4.0×10^{-3}	6.3377×10^{-8}	0.0110	6.3801×10^{-8}	0.0011	0.60	6.4201×10^{-8}	0.0082	0.94
	4.0×10^{-3}	5.0×10^{-3}	7.1231×10^{-8}	0.0104	7.0575×10^{-8}	0.0010	0.88	7.0541×10^{-8}	0.0072	0.77
	5.0×10^{-3}	6.0×10^{-3}	7.5605×10^{-8}	0.0101	7.5921×10^{-8}	0.0009	0.41	7.5259×10^{-8}	0.0067	0.38
	6.0×10^{-3}	7.0×10^{-3}	8.0020×10^{-8}	0.0098	8.0318×10^{-8}	0.0009	0.38	8.0326×10^{-8}	0.0062	0.33
	7.0×10^{-3}	8.0×10^{-3}	8.2966×10^{-8}	0.0096	8.3943×10^{-8}	0.0008	1.22	8.3790×10^{-8}	0.0043	0.94
	8.0×10^{-3}	9.0×10^{-3}	8.6279×10^{-8}	0.0095	8.7195×10^{-8}	0.0008	1.11	8.7330×10^{-8}	0.0042	1.17
	9.0×10^{-3}	1.0×10^{-2}	8.9894×10^{-8}	0.0093	8.9708×10^{-8}	0.0008	0.22	8.9645×10^{-8}	0.0041	0.27
	1.0×10^{-2}	2.0×10^{-2}	9.9246×10^{-7}	0.0028	9.9579×10^{-7}	0.0002	1.20	9.9629×10^{-7}	0.0012	1.27
	2.0×10^{-2}	3.0×10^{-2}	1.1221×10^{-6}	0.0026	1.1225×10^{-6}	0.0002	0.12	1.1226×10^{-6}	0.0011	0.14
	3.0×10^{-2}	4.0×10^{-2}	1.2064×10^{-6}	0.0025	1.2102×10^{-6}	0.0002	1.28	1.2100×10^{-6}	0.0010	1.11
	4.0×10^{-2}	5.0×10^{-2}	1.2059×10^{-6}	0.0025	1.2050×10^{-6}	0.0002	0.30	1.2052×10^{-6}	0.0010	0.23
	5.0×10^{-2}	6.0×10^{-2}	8.7070×10^{-7}	0.0030	8.6753×10^{-7}	0.0002	1.21	8.6698×10^{-7}	0.0011	1.34
	6.0×10^{-2}	7.0×10^{-2}	7.2269×10^{-7}	0.0033	7.2099×10^{-7}	0.0002	0.71	7.1967×10^{-7}	0.0012	1.19
	7.0×10^{-2}	8.0×10^{-2}	7.0040×10^{-7}	0.0033	6.9902×10^{-7}	0.0002	0.59	6.9819×10^{-7}	0.0012	0.90
	8.0×10^{-2}	9.0×10^{-2}	6.7637×10^{-7}	0.0034	6.7749×10^{-7}	0.0002	0.49	6.7864×10^{-7}	0.0012	0.93
	9.0×10^{-2}	1.0×10^{-1}	6.5632×10^{-7}	0.0034	6.5635×10^{-7}	0.0002	0.01	6.5610×10^{-7}	0.0013	0.09
	1.0×10^{-1}	2.0×10^{-1}	5.4450×10^{-6}	0.0012	5.4450×10^{-6}	0.0001	0.00	5.4438×10^{-6}	0.0004	0.16
	2.0×10^{-1}	3.0×10^{-1}	3.4821×10^{-6}	0.0015	3.4856×10^{-6}	0.0001	0.68	3.4870×10^{-6}	0.0005	0.90
	3.0×10^{-1}	4.0×10^{-1}	1.5700×10^{-6}	0.0022	1.5704×10^{-6}	0.0002	0.10	1.5720×10^{-6}	0.0008	0.52
	4.0×10^{-1}	5.0×10^{-1}	1.0232×10^{-7}	0.0087	1.0144×10^{-7}	0.0006	0.98	1.0162×10^{-7}	0.0030	0.74

Table 5 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
0.75	1.0×10^{-11}	1.0×10^{-4}	6.9441×10^{-10}	0.1199	-	-	>10.0	6.8424×10^{-10}	0.0058	0.12
	1.0×10^{-4}	2.0×10^{-4}	1.3115×10^{-9}	0.0877	-	-	>10.0	1.3304×10^{-9}	0.0070	0.16
	2.0×10^{-4}	3.0×10^{-4}	1.9315×10^{-9}	0.0729	-	-	>10.0	1.7440×10^{-9}	0.0083	1.32
	3.0×10^{-4}	4.0×10^{-4}	2.1639×10^{-9}	0.0685	-	-	>10.0	2.1234×10^{-9}	0.0092	0.27
	4.0×10^{-4}	5.0×10^{-4}	2.4123×10^{-9}	0.0644	-	-	>10.0	2.4334×10^{-9}	0.0102	0.13
	5.0×10^{-4}	6.0×10^{-4}	2.8405×10^{-9}	0.0596	-	-	>10.0	2.7130×10^{-9}	0.0110	0.74
	6.0×10^{-4}	7.0×10^{-4}	3.1706×10^{-9}	0.0561	-	-	>10.0	2.9735×10^{-9}	0.0119	1.09
	7.0×10^{-4}	8.0×10^{-4}	3.3304×10^{-9}	0.0546	-	-	>10.0	3.2756×10^{-9}	0.0126	0.29
	8.0×10^{-4}	9.0×10^{-4}	3.6555×10^{-9}	0.0526	-	-	>10.0	3.5571×10^{-9}	0.0133	0.50
	9.0×10^{-4}	1.0×10^{-3}	3.4669×10^{-9}	0.0538	-	-	>10.0	3.8372×10^{-9}	0.0139	1.91
	1.0×10^{-3}	2.0×10^{-3}	4.9274×10^{-8}	0.0143	-	-	>10.0	5.0043×10^{-8}	0.0060	1.00
	2.0×10^{-3}	3.0×10^{-3}	6.9169×10^{-8}	0.0121	-	-	>10.0	6.7777×10^{-8}	0.0095	1.32
	3.0×10^{-3}	4.0×10^{-3}	8.2271×10^{-8}	0.0111	5.9557×10^{-9}	0.0610	>10.0	8.4737×10^{-8}	0.0389	0.72
	4.0×10^{-3}	5.0×10^{-3}	9.1321×10^{-8}	0.0105	9.3181×10^{-8}	0.0030	1.86	9.3057×10^{-8}	0.0214	0.79
	5.0×10^{-3}	6.0×10^{-3}	9.9778×10^{-8}	0.0100	1.0122×10^{-7}	0.0016	1.42	1.0064×10^{-7}	0.0117	0.56
	6.0×10^{-3}	7.0×10^{-3}	1.0862×10^{-7}	0.0096	1.0759×10^{-7}	0.0013	0.98	1.0950×10^{-7}	0.0096	0.59
	7.0×10^{-3}	8.0×10^{-3}	1.1345×10^{-7}	0.0094	1.1198×10^{-7}	0.0012	1.36	1.1251×10^{-7}	0.0086	0.65
	8.0×10^{-3}	9.0×10^{-3}	1.1513×10^{-7}	0.0094	1.1519×10^{-7}	0.0011	0.06	1.1644×10^{-7}	0.0079	0.92
	9.0×10^{-3}	1.0×10^{-2}	1.1775×10^{-7}	0.0093	1.1759×10^{-7}	0.0010	0.15	1.1761×10^{-7}	0.0075	0.10
	1.0×10^{-2}	2.0×10^{-2}	1.2257×10^{-6}	0.0029	1.2311×10^{-6}	0.0003	1.51	1.2314×10^{-6}	0.0018	1.37
	2.0×10^{-2}	3.0×10^{-2}	1.2818×10^{-6}	0.0028	1.2816×10^{-6}	0.0002	0.06	1.2817×10^{-6}	0.0012	0.04
	3.0×10^{-2}	4.0×10^{-2}	1.3377×10^{-6}	0.0027	1.3385×10^{-6}	0.0002	0.21	1.3374×10^{-6}	0.0011	0.09
	4.0×10^{-2}	5.0×10^{-2}	1.3911×10^{-6}	0.0027	1.3928×10^{-6}	0.0002	0.45	1.3933×10^{-6}	0.0010	0.55
	5.0×10^{-2}	6.0×10^{-2}	1.4102×10^{-6}	0.0027	1.4086×10^{-6}	0.0002	0.41	1.4091×10^{-6}	0.0010	0.28
	6.0×10^{-2}	7.0×10^{-2}	1.0911×10^{-6}	0.0030	1.0967×10^{-6}	0.0002	1.69	1.0965×10^{-6}	0.0011	1.53
	7.0×10^{-2}	8.0×10^{-2}	8.1794×10^{-7}	0.0035	8.1466×10^{-7}	0.0002	1.14	8.1297×10^{-7}	0.0013	1.63
	8.0×10^{-2}	9.0×10^{-2}	7.8362×10^{-7}	0.0036	7.8028×10^{-7}	0.0003	1.18	7.7946×10^{-7}	0.0013	1.39
	9.0×10^{-2}	1.0×10^{-1}	7.5734×10^{-7}	0.0036	7.5264×10^{-7}	0.0003	1.72	7.5285×10^{-7}	0.0013	1.55
	1.0×10^{-1}	2.0×10^{-1}	6.2310×10^{-6}	0.0013	6.2351×10^{-6}	0.0001	0.51	6.2338×10^{-6}	0.0004	0.33
	2.0×10^{-1}	3.0×10^{-1}	4.1408×10^{-6}	0.0016	4.1393×10^{-6}	0.0001	0.21	4.1419×10^{-6}	0.0005	0.17
	3.0×10^{-1}	4.0×10^{-1}	2.1747×10^{-6}	0.0022	2.1739×10^{-6}	0.0001	0.18	2.1746×10^{-6}	0.0007	0.03
	4.0×10^{-1}	5.0×10^{-1}	3.8090×10^{-7}	0.0051	3.8278×10^{-7}	0.0003	0.96	3.8335×10^{-7}	0.0016	1.20

Table 5 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
0.9	1.0×10^{-11}	1.0×10^{-4}	8.1279×10^{-10}	0.1402	-	-	>10.0	7.0573×10^{-10}	0.0052	0.94
	1.0×10^{-4}	2.0×10^{-4}	1.4123×10^{-9}	0.1044	-	-	>10.0	1.3358×10^{-9}	0.0063	0.52
	2.0×10^{-4}	3.0×10^{-4}	1.9185×10^{-9}	0.0898	-	-	>10.0	1.7966×10^{-9}	0.0074	0.71
	3.0×10^{-4}	4.0×10^{-4}	2.4339×10^{-9}	0.0803	-	-	>10.0	2.2142×10^{-9}	0.0082	1.12
	4.0×10^{-4}	5.0×10^{-4}	2.5615×10^{-9}	0.0776	-	-	>10.0	2.5932×10^{-9}	0.0089	0.16
	5.0×10^{-4}	6.0×10^{-4}	2.6038×10^{-9}	0.0765	-	-	>10.0	2.9482×10^{-9}	0.0095	1.71
	6.0×10^{-4}	7.0×10^{-4}	3.5509×10^{-9}	0.0659	-	-	>10.0	3.2228×10^{-9}	0.0103	1.39
	7.0×10^{-4}	8.0×10^{-4}	3.6109×10^{-9}	0.0655	-	-	>10.0	3.5622×10^{-9}	0.0108	0.20
	8.0×10^{-4}	9.0×10^{-4}	3.2422×10^{-9}	0.0683	-	-	>10.0	3.8846×10^{-9}	0.0114	2.84
	9.0×10^{-4}	1.0×10^{-3}	4.3520×10^{-9}	0.0594	-	-	>10.0	4.1691×10^{-9}	0.0119	0.69
	1.0×10^{-3}	2.0×10^{-3}	5.6196×10^{-8}	0.0165	-	-	>10.0	5.7756×10^{-8}	0.0049	1.61
	2.0×10^{-3}	3.0×10^{-3}	8.5822×10^{-8}	0.0134	-	-	>10.0	8.5555×10^{-8}	0.0066	0.21
	3.0×10^{-3}	4.0×10^{-3}	1.1532×10^{-7}	0.0115	-	-	>10.0	1.1118×10^{-7}	0.0091	2.48
	4.0×10^{-3}	5.0×10^{-3}	1.3295×10^{-7}	0.0107	-	-	>10.0	1.3639×10^{-7}	0.0137	1.47
	5.0×10^{-3}	6.0×10^{-3}	1.5407×10^{-7}	0.0100	5.0531×10^{-8}	0.0142	>10.0	1.5275×10^{-7}	0.0490	0.17
	6.0×10^{-3}	7.0×10^{-3}	1.6384×10^{-7}	0.0097	1.6383×10^{-7}	0.0027	0.01	1.6211×10^{-7}	0.0193	0.49
	7.0×10^{-3}	8.0×10^{-3}	1.6883×10^{-7}	0.0095	1.7057×10^{-7}	0.0018	1.07	1.7121×10^{-7}	0.0129	0.88
	8.0×10^{-3}	9.0×10^{-3}	1.7621×10^{-7}	0.0093	1.7369×10^{-7}	0.0015	1.51	1.7151×10^{-7}	0.0109	1.89
	9.0×10^{-3}	1.0×10^{-2}	1.7172×10^{-7}	0.0094	1.7320×10^{-7}	0.0013	0.91	1.7348×10^{-7}	0.0097	0.76
	1.0×10^{-2}	2.0×10^{-2}	1.6130×10^{-6}	0.0031	1.6131×10^{-6}	0.0003	0.03	1.6102×10^{-6}	0.0024	0.44
	2.0×10^{-2}	3.0×10^{-2}	1.4723×10^{-6}	0.0032	1.4801×10^{-6}	0.0003	1.66	1.4792×10^{-6}	0.0016	1.31
	3.0×10^{-2}	4.0×10^{-2}	1.4637×10^{-6}	0.0032	1.4605×10^{-6}	0.0002	0.68	1.4601×10^{-6}	0.0012	0.71
	4.0×10^{-2}	5.0×10^{-2}	1.4864×10^{-6}	0.0032	1.4907×10^{-6}	0.0002	0.90	1.4917×10^{-6}	0.0011	1.05
	5.0×10^{-2}	6.0×10^{-2}	1.5170×10^{-6}	0.0032	1.5202×10^{-6}	0.0002	0.66	1.5198×10^{-6}	0.0011	0.54
	6.0×10^{-2}	7.0×10^{-2}	1.4982×10^{-6}	0.0032	1.4988×10^{-6}	0.0002	0.12	1.4988×10^{-6}	0.0010	0.11
	7.0×10^{-2}	8.0×10^{-2}	1.1348×10^{-6}	0.0037	1.1319×10^{-6}	0.0002	0.68	1.1319×10^{-6}	0.0012	0.65
	8.0×10^{-2}	9.0×10^{-2}	8.6706×10^{-7}	0.0042	8.6025×10^{-7}	0.0003	1.86	8.5816×10^{-7}	0.0013	2.34
	9.0×10^{-2}	1.0×10^{-1}	8.2661×10^{-7}	0.0043	8.2522×10^{-7}	0.0003	0.39	8.2450×10^{-7}	0.0013	0.57
	1.0×10^{-1}	2.0×10^{-1}	6.7945×10^{-6}	0.0015	6.7918×10^{-6}	0.0001	0.27	6.7915×10^{-6}	0.0004	0.29
	2.0×10^{-1}	3.0×10^{-1}	4.5638×10^{-6}	0.0018	4.5747×10^{-6}	0.0001	1.33	4.5758×10^{-6}	0.0005	1.42
	3.0×10^{-1}	4.0×10^{-1}	2.5697×10^{-6}	0.0024	2.5667×10^{-6}	0.0001	0.49	2.5681×10^{-6}	0.0006	0.25
	4.0×10^{-1}	5.0×10^{-1}	6.5689×10^{-7}	0.0048	6.5638×10^{-7}	0.0002	0.16	6.5707×10^{-7}	0.0012	0.05

Table 5 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
0.975	1.0×10^{-11}	1.0×10^{-4}	6.6823×10^{-10}	0.2074	-	-	>10.0	7.0924×10^{-10}	0.0050	0.30
	1.0×10^{-4}	2.0×10^{-4}	1.3582×10^{-9}	0.1479	-	-	>10.0	1.3573×10^{-9}	0.0061	0.00
	2.0×10^{-4}	3.0×10^{-4}	1.7339×10^{-9}	0.1315	-	-	>10.0	1.8305×10^{-9}	0.0070	0.42
	3.0×10^{-4}	4.0×10^{-4}	2.2245×10^{-9}	0.1147	-	-	>10.0	2.2493×10^{-9}	0.0078	0.10
	4.0×10^{-4}	5.0×10^{-4}	2.2666×10^{-9}	0.1148	-	-	>10.0	2.6217×10^{-9}	0.0085	1.36
	5.0×10^{-4}	6.0×10^{-4}	2.8626×10^{-9}	0.1038	-	-	>10.0	2.9902×10^{-9}	0.0091	0.43
	6.0×10^{-4}	7.0×10^{-4}	3.3199×10^{-9}	0.0952	-	-	>10.0	3.4003×10^{-9}	0.0096	0.25
	7.0×10^{-4}	8.0×10^{-4}	3.2750×10^{-9}	0.0953	-	-	>10.0	3.7381×10^{-9}	0.0102	1.47
	8.0×10^{-4}	9.0×10^{-4}	4.9604×10^{-9}	0.0776	-	-	>10.0	4.0759×10^{-9}	0.0107	2.28
	9.0×10^{-4}	1.0×10^{-3}	4.4466×10^{-9}	0.0827	-	-	>10.0	4.3901×10^{-9}	0.0112	0.15
	1.0×10^{-3}	2.0×10^{-3}	6.3453×10^{-8}	0.0217	-	-	>10.0	6.2957×10^{-8}	0.0046	0.35
	2.0×10^{-3}	3.0×10^{-3}	1.0050×10^{-7}	0.0173	-	-	>10.0	1.0404×10^{-7}	0.0059	1.92
	3.0×10^{-3}	4.0×10^{-3}	1.5140×10^{-7}	0.0141	-	-	>10.0	1.5278×10^{-7}	0.0077	0.57
	4.0×10^{-3}	5.0×10^{-3}	2.1092×10^{-7}	0.0119	-	-	>10.0	2.0661×10^{-7}	0.0104	1.30
	5.0×10^{-3}	6.0×10^{-3}	2.6934×10^{-7}	0.0106	-	-	>10.0	2.7030×10^{-7}	0.0154	0.19
	6.0×10^{-3}	7.0×10^{-3}	3.1813×10^{-7}	0.0097	1.0650×10^{-7}	0.0175	>10.0	3.4182×10^{-7}	0.0578	1.18
	7.0×10^{-3}	8.0×10^{-3}	3.2996×10^{-7}	0.0095	3.2959×10^{-7}	0.0029	0.11	3.2710×10^{-7}	0.0210	0.38
	8.0×10^{-3}	9.0×10^{-3}	3.2373×10^{-7}	0.0096	3.1951×10^{-7}	0.0019	1.33	3.1388×10^{-7}	0.0141	1.82
	9.0×10^{-3}	1.0×10^{-2}	3.0012×10^{-7}	0.0100	2.9669×10^{-7}	0.0016	1.13	3.0645×10^{-7}	0.0114	1.37
	1.0×10^{-2}	2.0×10^{-2}	2.1549×10^{-6}	0.0037	2.1627×10^{-6}	0.0004	0.97	2.1672×10^{-6}	0.0027	1.24
	2.0×10^{-2}	3.0×10^{-2}	1.6521×10^{-6}	0.0043	1.6579×10^{-6}	0.0003	0.81	1.6594×10^{-6}	0.0019	0.94
	3.0×10^{-2}	4.0×10^{-2}	1.5553×10^{-6}	0.0044	1.5553×10^{-6}	0.0003	0.00	1.5561×10^{-6}	0.0013	0.12
	4.0×10^{-2}	5.0×10^{-2}	1.5566×10^{-6}	0.0044	1.5499×10^{-6}	0.0002	0.98	1.5486×10^{-6}	0.0012	1.13
	5.0×10^{-2}	6.0×10^{-2}	1.5839×10^{-6}	0.0044	1.5760×10^{-6}	0.0002	1.13	1.5773×10^{-6}	0.0011	0.92
	6.0×10^{-2}	7.0×10^{-2}	1.6012×10^{-6}	0.0043	1.5932×10^{-6}	0.0002	1.17	1.5935×10^{-6}	0.0010	1.09
	7.0×10^{-2}	8.0×10^{-2}	1.3717×10^{-6}	0.0047	1.3875×10^{-6}	0.0002	2.45	1.3871×10^{-6}	0.0011	2.32
	8.0×10^{-2}	9.0×10^{-2}	9.7380×10^{-7}	0.0055	9.7759×10^{-7}	0.0002	0.71	9.7647×10^{-7}	0.0013	0.49
	9.0×10^{-2}	1.0×10^{-1}	8.6829×10^{-7}	0.0059	8.6663×10^{-7}	0.0003	0.32	8.6553×10^{-7}	0.0013	0.53
	1.0×10^{-1}	2.0×10^{-1}	7.1381×10^{-6}	0.0021	7.1001×10^{-6}	0.0001	2.53	7.1001×10^{-6}	0.0004	2.49
	2.0×10^{-1}	3.0×10^{-1}	4.8321×10^{-6}	0.0025	4.8069×10^{-6}	0.0001	2.09	4.8076×10^{-6}	0.0005	1.99
	3.0×10^{-1}	4.0×10^{-1}	2.7735×10^{-6}	0.0033	2.7729×10^{-6}	0.0001	0.07	2.7735×10^{-6}	0.0006	0.00
	4.0×10^{-1}	5.0×10^{-1}	8.2561×10^{-7}	0.0060	8.2700×10^{-7}	0.0002	0.28	8.2809×10^{-7}	0.0011	0.49

Table 5 Continued:

Cosine Angle (μ)	Energy Bins: Lower Bin Energy (MeV)	Energy Bins: Upper Bin Energy (MeV)	F4: Flux (n/cm^2) (n/cm^2)	F4: Fract. Std. Dev.	Unmodified F5: Flux (n/cm^2) from F4	Unmodified F5: Fract. Std. Dev.	Unmodified F5: # Std. Devs. from F4	Modified F5: Flux (n/cm^2) from F4	Modified F5: Fract. Std. Dev.	Modified F5: # Std. Devs. from F4
1.0	1.0×10^{-11}	1.0×10^{-4}	6.7965×10^{-10}	0.2825	-	-	>10.0	7.1572×10^{-10}	0.0049	0.19
	1.0×10^{-4}	2.0×10^{-4}	1.6151×10^{-9}	0.1846	-	-	>10.0	1.3740×10^{-9}	0.0059	0.81
	2.0×10^{-4}	3.0×10^{-4}	1.8124×10^{-9}	0.1750	-	-	>10.0	1.8647×10^{-9}	0.0069	0.16
	3.0×10^{-4}	4.0×10^{-4}	1.9495×10^{-9}	0.1685	-	-	>10.0	2.2748×10^{-9}	0.0077	0.99
	4.0×10^{-4}	5.0×10^{-4}	2.2087×10^{-9}	0.1573	-	-	>10.0	2.6370×10^{-9}	0.0084	1.23
	5.0×10^{-4}	6.0×10^{-4}	2.7254×10^{-9}	0.1425	-	-	>10.0	3.0818×10^{-9}	0.0089	0.92
	6.0×10^{-4}	7.0×10^{-4}	3.0443×10^{-9}	0.1365	-	-	>10.0	3.4637×10^{-9}	0.0094	1.01
	7.0×10^{-4}	8.0×10^{-4}	3.5551×10^{-9}	0.1249	-	-	>10.0	3.7772×10^{-9}	0.0100	0.50
	8.0×10^{-4}	9.0×10^{-4}	3.5650×10^{-9}	0.1252	-	-	>10.0	4.1224×10^{-9}	0.0105	1.24
	9.0×10^{-4}	1.0×10^{-3}	4.4708×10^{-9}	0.1119	-	-	>10.0	4.3610×10^{-9}	0.0112	0.22
	1.0×10^{-3}	2.0×10^{-3}	6.4623×10^{-8}	0.0293	-	-	>10.0	6.5765×10^{-8}	0.0045	0.60
	2.0×10^{-3}	3.0×10^{-3}	1.1333×10^{-7}	0.0221	-	-	>10.0	1.1315×10^{-7}	0.0058	0.07
	3.0×10^{-3}	4.0×10^{-3}	1.8711×10^{-7}	0.0172	-	-	>10.0	1.8061×10^{-7}	0.0074	1.86
	4.0×10^{-3}	5.0×10^{-3}	2.9976×10^{-7}	0.0136	-	-	>10.0	2.9952×10^{-7}	0.0098	0.05
	5.0×10^{-3}	6.0×10^{-3}	5.7029×10^{-7}	0.0099	-	-	>10.0	5.8300×10^{-7}	0.0144	1.26
	6.0×10^{-3}	7.0×10^{-3}	1.6682×10^{-6}	0.0059	-	-	>10.0	4.0411×10^{-6}	0.1261	4.66
	7.0×10^{-3}	8.0×10^{-3}	1.9207×10^{-6}	0.0055	4.8849×10^{-6}	0.2543	2.39	9.7675×10^{-6}	0.4098	1.96
	8.0×10^{-3}	9.0×10^{-3}	7.8566×10^{-7}	0.0084	4.7351×10^{-7}	0.0031	>10.0	8.7665×10^{-7}	0.0163	5.78
	9.0×10^{-3}	1.0×10^{-2}	5.2261×10^{-7}	0.0103	3.0521×10^{-7}	0.0023	>10.0	5.4632×10^{-7}	0.0126	2.71
	1.0×10^{-2}	2.0×10^{-2}	2.5887×10^{-6}	0.0046	1.5999×10^{-6}	0.0005	>10.0	2.6334×10^{-6}	0.0030	3.13
	2.0×10^{-2}	3.0×10^{-2}	1.7397×10^{-6}	0.0057	1.1145×10^{-6}	0.0004	>10.0	1.7364×10^{-6}	0.0020	0.32
	3.0×10^{-2}	4.0×10^{-2}	1.5871×10^{-6}	0.0059	1.0288×10^{-6}	0.0003	>10.0	1.5948×10^{-6}	0.0013	0.80
	4.0×10^{-2}	5.0×10^{-2}	1.5649×10^{-6}	0.0060	1.0396×10^{-6}	0.0003	>10.0	1.5728×10^{-6}	0.0012	0.82
	5.0×10^{-2}	6.0×10^{-2}	1.6009×10^{-6}	0.0059	1.0776×10^{-6}	0.0003	>10.0	1.5968×10^{-6}	0.0011	0.43
	6.0×10^{-2}	7.0×10^{-2}	1.5986×10^{-6}	0.0059	1.1047×10^{-6}	0.0003	>10.0	1.6106×10^{-6}	0.0011	1.25
	7.0×10^{-2}	8.0×10^{-2}	1.4687×10^{-6}	0.0061	1.0202×10^{-6}	0.0003	>10.0	1.4709×10^{-6}	0.0011	0.24
	8.0×10^{-2}	9.0×10^{-2}	1.0281×10^{-6}	0.0073	7.0582×10^{-7}	0.0003	>10.0	1.0418×10^{-6}	0.0012	1.80
	9.0×10^{-2}	1.0×10^{-1}	8.8191×10^{-7}	0.0079	6.0451×10^{-7}	0.0003	>10.0	8.7964×10^{-7}	0.0013	0.32
	1.0×10^{-1}	2.0×10^{-1}	7.1990×10^{-6}	0.0028	4.9465×10^{-6}	0.0001	>10.0	7.2078×10^{-6}	0.0004	0.43
	2.0×10^{-1}	3.0×10^{-1}	4.8615×10^{-6}	0.0034	3.5020×10^{-6}	0.0001	>10.0	4.8880×10^{-6}	0.0005	1.58
	3.0×10^{-1}	4.0×10^{-1}	2.8529×10^{-6}	0.0044	1.9998×10^{-6}	0.0001	>10.0	2.8428×10^{-6}	0.0006	0.80
	4.0×10^{-1}	5.0×10^{-1}	8.8518×10^{-7}	0.0079	6.2701×10^{-7}	0.0003	>10.0	8.9057×10^{-7}	0.0011	0.76

Appendix H Input to MCNP Software for Integral Leakage from 4.4 MeV Source in a D2O Sphere

```
Spherical D2O sphere similiar to Livermore pulsed sphere but simple
1  1 -10.0 -1 imp:n=1 $ spherical d2O
20 0        1 -2 imp:n=1 $ volid
30 0        2    imp:n=0

1 so 0.9357 $ sphere of scattering material r=2 MFP
2 so 1000.0 $ tally surface

mode n
c
c H-2 (n,2n) two root range 3.339285 to 4.4571468
sdef erg=4.4 pos=0.0 0.0 0.0 par=n
c
m1   1002.00c 2.0
     8016.00c 1.0
dbcn 49j 1
prdmp j j 0 3
c
dd0 0 0
e0    0.0001 8i 0.001 8i 0.01 8i 0.1 8i 1.0
      1.01 1.18 1.19 1.20 7i 2.0 7i 10.0 20.0
c
f2:n 2
f5:n 1000.0 0.0 0.0 0.0
nps 1e8
rand gen=2
c
```

Appendix I MCNP Software Results for Integral Leakage from 4.4 MeV Source in a D2O Sphere

Table 6: Leakage spectrum from a sphere of D2O with a 4.4 MeV isotropic neutron source at the origin. Results calculated with the MCNP surface crossing tally (`f2`) and modified and unmodified next-event tally (`f5`).

Energy Bins		F2		Unmodified F5			Modified F5		
Lower Bin Energy (MeV)	Upper Bin Energy (MeV)	Flux (n/cm^2) (n/cm^2)	Fract. Std. Dev.	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4
1.0×10^{-11}	1.0×10^{-4}	1.2403×10^{-9}	0.0008	1.2412×10^{-9}	0.0013	0.49	1.2411×10^{-9}	0.0013	0.40
1.0×10^{-4}	2.0×10^{-4}	3.7973×10^{-10}	0.0014	3.7859×10^{-10}	0.0014	1.52	3.7849×10^{-10}	0.0014	1.66
2.0×10^{-4}	3.0×10^{-4}	2.7200×10^{-10}	0.0017	2.7211×10^{-10}	0.0015	0.16	2.7212×10^{-10}	0.0015	0.18
3.0×10^{-4}	4.0×10^{-4}	2.2101×10^{-10}	0.0019	2.2043×10^{-10}	0.0016	1.06	2.2046×10^{-10}	0.0016	1.00
4.0×10^{-4}	5.0×10^{-4}	1.8812×10^{-10}	0.0020	1.8837×10^{-10}	0.0017	0.51	1.8834×10^{-10}	0.0017	0.45
5.0×10^{-4}	6.0×10^{-4}	1.6632×10^{-10}	0.0022	1.6646×10^{-10}	0.0018	0.30	1.6644×10^{-10}	0.0018	0.25
6.0×10^{-4}	7.0×10^{-4}	1.5001×10^{-10}	0.0023	1.4906×10^{-10}	0.0019	2.13	1.4906×10^{-10}	0.0019	2.14
7.0×10^{-4}	8.0×10^{-4}	1.3627×10^{-10}	0.0024	1.3664×10^{-10}	0.0019	0.89	1.3663×10^{-10}	0.0019	0.86
8.0×10^{-4}	9.0×10^{-4}	1.2649×10^{-10}	0.0025	1.2638×10^{-10}	0.0020	0.27	1.2634×10^{-10}	0.0020	0.36
9.0×10^{-4}	1.0×10^{-3}	1.1765×10^{-10}	0.0026	1.1788×10^{-10}	0.0021	0.60	1.1793×10^{-10}	0.0021	0.72
1.0×10^{-3}	2.0×10^{-3}	8.9794×10^{-10}	0.0009	8.9873×10^{-10}	0.0009	0.69	8.9842×10^{-10}	0.0009	0.43
2.0×10^{-3}	3.0×10^{-3}	6.4171×10^{-10}	0.0011	6.4131×10^{-10}	0.0010	0.41	6.4121×10^{-10}	0.0010	0.53
3.0×10^{-3}	4.0×10^{-3}	5.1450×10^{-10}	0.0012	5.1457×10^{-10}	0.0011	0.08	5.1453×10^{-10}	0.0011	0.04
4.0×10^{-3}	5.0×10^{-3}	4.3645×10^{-10}	0.0013	4.3740×10^{-10}	0.0011	1.27	4.3740×10^{-10}	0.0011	1.27
5.0×10^{-3}	6.0×10^{-3}	3.8404×10^{-10}	0.0014	3.8405×10^{-10}	0.0012	0.02	3.8406×10^{-10}	0.0012	0.03
6.0×10^{-3}	7.0×10^{-3}	3.4314×10^{-10}	0.0015	3.4334×10^{-10}	0.0012	0.30	3.4334×10^{-10}	0.0012	0.30
7.0×10^{-3}	8.0×10^{-3}	3.1257×10^{-10}	0.0016	3.1256×10^{-10}	0.0013	0.00	3.1255×10^{-10}	0.0013	0.03
8.0×10^{-3}	9.0×10^{-3}	2.8839×10^{-10}	0.0017	2.8803×10^{-10}	0.0013	0.58	2.8808×10^{-10}	0.0013	0.50
9.0×10^{-3}	1.0×10^{-2}	2.6771×10^{-10}	0.0017	2.6741×10^{-10}	0.0014	0.50	2.6745×10^{-10}	0.0014	0.44
1.0×10^{-2}	2.0×10^{-2}	2.0104×10^{-9}	0.0006	2.0099×10^{-9}	0.0006	0.31	2.0104×10^{-9}	0.0006	0.04
2.0×10^{-2}	3.0×10^{-2}	1.3894×10^{-9}	0.0007	1.3902×10^{-9}	0.0006	0.63	1.3906×10^{-9}	0.0006	0.94
3.0×10^{-2}	4.0×10^{-2}	1.0888×10^{-9}	0.0008	1.0897×10^{-9}	0.0007	0.77	1.0904×10^{-9}	0.0007	1.39
4.0×10^{-2}	5.0×10^{-2}	9.0563×10^{-10}	0.0009	9.0466×10^{-10}	0.0007	0.94	9.0533×10^{-10}	0.0007	0.28
5.0×10^{-2}	6.0×10^{-2}	7.8169×10^{-10}	0.0010	7.8230×10^{-10}	0.0008	0.61	7.8328×10^{-10}	0.0008	1.59
6.0×10^{-2}	7.0×10^{-2}	6.9623×10^{-10}	0.0011	6.9446×10^{-10}	0.0008	1.87	6.9547×10^{-10}	0.0008	0.81
7.0×10^{-2}	8.0×10^{-2}	6.2388×10^{-10}	0.0011	6.2345×10^{-10}	0.0008	0.51	6.2464×10^{-10}	0.0009	0.85
8.0×10^{-2}	9.0×10^{-2}	5.6507×10^{-10}	0.0012	5.6420×10^{-10}	0.0009	1.02	5.6543×10^{-10}	0.0009	0.43

Table 6 Continued:

Energy Bins		F2		Unmodified F5			Modified F5		
Lower Bin Energy (MeV)	Upper Bin Energy (MeV)	Flux (n/cm^2) (n/cm^2)	Fract. Std. Dev.	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4	Flux (n/cm^2) from F4	Fract. Std. Dev.	# Std. Devs. from F4
9.0×10^{-2}	1.0×10^{-1}	5.1573×10^{-10}	0.0012	5.1365×10^{-10}	0.0009	2.70	5.1492×10^{-10}	0.0009	1.05
1.0×10^{-1}	2.0×10^{-1}	3.4498×10^{-9}	0.0005	3.4309×10^{-9}	0.0004	8.58	3.4502×10^{-9}	0.0004	0.19
2.0×10^{-1}	3.0×10^{-1}	2.0531×10^{-9}	0.0006	2.0288×10^{-9}	0.0005	>10.0	2.0538×10^{-9}	0.0006	0.39
3.0×10^{-1}	4.0×10^{-1}	1.4618×10^{-9}	0.0007	1.4330×10^{-9}	0.0005	>10.0	1.4591×10^{-9}	0.0009	1.61
4.0×10^{-1}	5.0×10^{-1}	9.4306×10^{-10}	0.0009	9.2481×10^{-10}	0.0008	>10.0	9.4287×10^{-10}	0.0015	0.12
5.0×10^{-1}	6.0×10^{-1}	1.1917×10^{-9}	0.0008	1.1628×10^{-9}	0.0006	>10.0	1.1941×10^{-9}	0.0010	1.57
6.0×10^{-1}	7.0×10^{-1}	1.0193×10^{-9}	0.0009	9.8804×10^{-10}	0.0006	>10.0	1.0201×10^{-9}	0.0009	0.62
7.0×10^{-1}	8.0×10^{-1}	9.2195×10^{-10}	0.0009	8.9073×10^{-10}	0.0006	>10.0	9.2098×10^{-10}	0.0009	0.82
8.0×10^{-1}	9.0×10^{-1}	7.5702×10^{-10}	0.0010	7.2927×10^{-10}	0.0007	>10.0	7.5667×10^{-10}	0.0010	0.33
9.0×10^{-1}	1.0	4.9346×10^{-10}	0.0013	4.7306×10^{-10}	0.0009	>10.0	4.9270×10^{-10}	0.0012	0.87
1.0	1.0	3.5747×10^{-11}	0.0047	3.4437×10^{-11}	0.0036	6.27	3.5929×10^{-11}	0.0046	0.77
1.0	1.2	8.0539×10^{-10}	0.0010	7.7578×10^{-10}	0.0007	>10.0	8.0568×10^{-10}	0.0009	0.27
1.2	1.2	5.2892×10^{-11}	0.0039	5.0999×10^{-11}	0.0026	7.72	5.2870×10^{-11}	0.0034	0.08
1.2	1.2	5.3019×10^{-11}	0.0039	5.1348×10^{-11}	0.0026	6.79	5.3150×10^{-11}	0.0033	0.49
1.2	1.3	5.1483×10^{-10}	0.0012	4.9901×10^{-10}	0.0009	>10.0	5.1456×10^{-10}	0.0011	0.32
1.3	1.4	4.3003×10^{-10}	0.0014	4.1799×10^{-10}	0.0011	>10.0	4.2913×10^{-10}	0.0013	1.09
1.4	1.5	4.8262×10^{-10}	0.0013	4.7257×10^{-10}	0.0010	>10.0	4.8255×10^{-10}	0.0011	0.09
1.5	1.6	4.7289×10^{-10}	0.0013	4.6520×10^{-10}	0.0010	9.97	4.7295×10^{-10}	0.0011	0.07
1.6	1.7	4.5921×10^{-10}	0.0013	4.5535×10^{-10}	0.0010	5.14	4.5983×10^{-10}	0.0011	0.79
1.7	1.8	4.9674×10^{-10}	0.0013	4.9343×10^{-10}	0.0010	4.07	4.9593×10^{-10}	0.0010	1.00
1.8	1.9	4.8442×10^{-10}	0.0013	4.8196×10^{-10}	0.0010	3.10	4.8278×10^{-10}	0.0011	2.00
1.9	2.0	4.8830×10^{-10}	0.0013	4.8804×10^{-10}	0.0011	0.32	4.8804×10^{-10}	0.0011	0.31
2.0	3.0	7.3963×10^{-9}	0.0003	7.3937×10^{-9}	0.0003	0.84	7.3937×10^{-9}	0.0003	0.84
3.0	4.0	1.1783×10^{-8}	0.0002	1.1784×10^{-8}	0.0003	0.35	1.1784×10^{-8}	0.0003	0.35
4.0	5.0	2.7447×10^{-8}	0.0001	2.7443×10^{-8}	0.0001	0.93	2.7443×10^{-8}	0.0001	0.93

Appendix J Unified Diff File for Modifications to the `calcps` Subroutine

```
diff --git a/Source/src/calcps.F90 b/Source/src/calcps.F90
index 9f2ae3302d..6933e3392f 100644
--- a/Source/src/calcps.F90
+++ b/Source/src/calcps.F90
@@ -53,8 +53,8 @@ subroutine calcps( i_reaction )
   integer, intent(in) :: i_reaction ! reaction to calculate psc

   ! .. Local Scalars ..
-  real(dknd) :: a0, a1, alpha, am, aw, b, b0, b1, cm, cs, da, db, dx, f, &
-    & r, ri, t1, t2, t3, t4, t5, ut(3)
+  real(dknd) :: a, a0, a1, alpha, am, aw, b, b0, b1, cm, cs, da, db, dx, f, g, &
+    & r, ri, t1, t2, t3, t4, t5, t6, t7, ut(3)
   real(DKND) :: v_cs  ! Independent variable for form factors =
      Kappa_form_fact*alpha*sqrt(one-cs)
   real(DKND) :: psc_factor  !  A convenience for arithmetic.

@@ -70,6 +70,14 @@ subroutine calcps( i_reaction )
   ! .. Intrinsic Functions ..
   intrinsic abs, cosh, exp, int, max, min, nint, sign, sinh, sqrt

+  real(DKND) :: q ! DEBUG
+  real(DKND) :: b2 ! mu^2 + E_c^\prime/E_l\^prime * (1+A)**2 - 1 -- for neutron
    inelastic scattering
+  real(DKND) :: cs_pm_b ! LAB cosine angle \pm sqrt(b2) -- for neutron inelastic
    scattering
+
+  real(DKND) :: mult ! one or half, multiplier for multiple root solve
+
+  logical :: no_contrib  ! flag to indicate no contribution to detector
+
   select case( i_reaction )

     case default
@@ -172,54 +180,26 @@ subroutine calcps( i_reaction )

       ! cs is laboratory cosine to next event estimator.
       cs = pbl%r%uold(1)*pbl%r%u + pbl%r%uold(2)*pbl%r%v + pbl%r%uold(3)*pbl%r%w
-      !
+
       ! if lab system, but anisotropic, go to table lookup for psc.
       ! since we're in the lab system, erg for next-event direction
       ! is no different than erg in actual as-sampled direction.
       if( matxs_thread%ntyn>=0 )  goto 60
-      a1 = one+awn(pbl%i%iex)
-      !
+
       ! scattering distributions are in the cm system.
       ! matxs_thread%ergace is previously-sampled cm energy. pbl%r%ergp is
          incident energy.
-      !
-      ! to find valid lab cosines, start with eq. in case 3 of p. 69
-      ! from carter and cashwell.  substitute in for q based on
-      ! their eq. 5.8.  then wind up with following condition,
-      ! which is identical to that used by hendricks later in
-      ! this routine for ipsc=14.  if t3 > cs**2, cannot scatter
```

```
-       ! toward next-event position.
-       t3 = one-matxs_thread%ergace*a1**2/pbl%r%ergp
-       if( t3>cs**2 ) then
-         var_reduce_thread%psc = zero
-         goto 999 ! Return
-       endif
-       !
-       ! scattering is valid.  calculate lab energy (erg) via following
-       ! equation as in ipsc=14 code (equivalent to eq. 5.14 of carter
-       ! and cashwell).
-       t1 = one/a1
-       pbl%r%erg = pbl%r%ergp*(t1*(cs+sqrt(cs**2-t3)))**2
-       !
-       ! return if this energy is below particle's energy cutoff.
-       if( pbl%r%erg<pbl%r%elc(pbl%i%ipt) ) goto 999 ! Return
-       !
-       ! now, we need to calculate the d-cm cosine by d-lab cosine
-       ! and apply this factor to the psc.  start with eq. 5.13 of
-       ! carter and cashwell, which reduces to the following for
-       ! psc (the extra 0.5 is a starting assumption of isotropy).
-       ! formalism is identical to ipsc=14 and ipsc=5.
-       t2 = sqrt(pbl%r%erg/matxs_thread%ergace)
-       t4 = t1*sqrt(pbl%r%ergp/pbl%r%erg)
-       var_reduce_thread%psc = half*t2/(one-cs*t4)
-       !
+
+       ! neutron_inelastic( psc, e_out, e_in, e_cm, e_cut, cs_lab, cs_cm,
    target_mass, no_contrib)
+       call neutron_inelastic( var_reduce_thread%psc, pbl%r%erg ,pbl%r%ergp, &
+                               matxs_thread%ergace, pbl%r%elc(pbl%i%ipt),    &
+                               cs, cm, awn(pbl%i%iex), no_contrib )
+       if( no_contrib ) goto 999 ! return without contribution
+       cs = cm
+
        ! if isotropic in cm, return.
        if( matxs_thread%ixcos==0 ) goto 999 ! Return
-       !
-       ! otherwise, determine cm cosine (overwrite cs with it).  start
-       ! with eq. 5.10 of cashwell and carter.  formalism is same as
-       ! for ipsc=5 and ipsc=14.
-       cs = t2*(cs-t4)
-       !
+
+
        ! now (finally) go to table lookup to actually determine psc
        ! for scattering toward the next-event estimator.
        goto 60
@@ -228,30 +208,39 @@ subroutine calcps( i_reaction )
       !  >>>>>  ipsc=5 -- neutron or photon from collision with stationary target.
       if( mcal/=0 )  goto 100
       if( matxs_thread%ixcos==0 .and. matxs_thread%ntyn>=0 ) goto 999 ! Return
+
+
       cs = pbl%r%uold(1)*pbl%r%u + pbl%r%uold(2)*pbl%r%v + pbl%r%uold(3)*pbl%r%w
       aw = awn(pbl%i%iex)
       if( matxs_thread%ntyn==-99 )  goto 40
-      !
-      ! inelastic scattering case.  see carter & cashwell eqn. 5.9,5.10
+      !*******************************
```

```
+
        if( matxs_thread%ntyn>=0 )  goto 60
-       t3 = one-matxs_thread%ergace*(one+aw)**2/pbl%r%ergp
-       if( t3>zero ) then
-         var_reduce_thread%psc = zero
-         goto 999 ! Return
-       endif
-       t1 = one/(one+aw)
-       pbl%r%erg = pbl%r%ergp*(t1*(cs+sqrt(cs**2-t3)))**2
-       if( pbl%r%erg<pbl%r%elc(neutron) ) goto 999 ! Return
-       t2 = sqrt(pbl%r%erg/matxs_thread%ergace)
-       t4 = t1*sqrt(pbl%r%ergp/pbl%r%erg)
-       var_reduce_thread%psc = half*t2/(one-cs*t4)
+
+       !*******************************
+       ! inelastic scattering case
+       !   includes the following laws:
+       !     - Law 3, Level Scattering
+       !     - Law 66, NBodyData
+
+       !   neutron_inelastic( psc, e_out, e_in, e_cm, e_cut, cs_lab, cs_cm,
    target_mass, no_contrib)
+       call neutron_inelastic( var_reduce_thread%psc, pbl%r%erg ,pbl%r%ergp, &
+                               matxs_thread%ergace, pbl%r%elc(pbl%i%ipt),    &
+                               cs, cm, awn(pbl%i%iex), no_contrib )
+       if( no_contrib ) goto 999 ! return without contribution
+       cs = cm
+
+       ! if isotropic in cm, return.
        if( matxs_thread%ixcos==0 ) goto 999 ! Return
-       cs = t2*(cs-t4)
+
+
        goto 60
-       !
+
+       !*******************************
        ! elastic scattering case
 40     continue
        if( aw>=1.5_dknd )  goto 50
+
        ! elastic scattering off hydrogen.  no backscattering.
        if( cs<zero ) then
         var_reduce_thread%psc = zero
@@ -263,17 +252,18 @@ subroutine calcps( i_reaction )
        if( matxs_thread%ixcos==0 ) goto 999 ! Return
        cs = two*cs**2-one
        goto 60
+
        ! other elastic scattering.
-50      continue
-       t3 = sqrt(cs**2-one+aw**2)
+50     continue
+       t3 = sqrt( (cs**2-one) + aw**2)
        pbl%r%erg = pbl%r%ergp*(cs+t3)**2/(one+aw)**2
        if( pbl%r%erg<pbl%r%elc(neutron) ) goto 999 ! Return
        var_reduce_thread%psc = half*(cs+t3)**2/(aw*t3)
        if( matxs_thread%ixcos==0 ) goto 999 ! Return
        cs = (cs**2-one+cs*t3)/aw
```

```
168 -       !
169 +
170         goto 60
171 -       !
172 +
173         ! multigroup cross sections case.
174  100    continue
175         if( nxs(3,pbl%i%iex)<=0 ) goto 999 ! Return
176 @@ -766,36 +756,31 @@ subroutine calcps( i_reaction )
177       case( N_FROM_COLLISION_LAW44 )
178         !  >>>>>  ipsc=14 -- neutron from kalbach-87 endf/b-vi coupled energy-
179         ! angle collision (law 44).  similar to ipsc=5 inelastic scatter.
180 +
181         cs = pbl%r%uold(1)*pbl%r%u + pbl%r%uold(2)*pbl%r%v + pbl%r%uold(3)*pbl%r%w
182 -       a1 = one+awn(pbl%i%iex)
183 -       t3 = one-matxs_thread%ergace*a1**2/pbl%r%ergp
184 -       if( t3>=cs**2 ) then
185 -         var_reduce_thread%psc = zero
186 -         goto 999 ! Return
187 -       endif
188 -       t1 = one/a1
189 -       ! erg from carter and cashwell eqn. 5.14
190 -       pbl%r%erg = pbl%r%ergp*(t1*(cs+sqrt(cs**2-t3)))**2
191 -       if( pbl%r%erg<pbl%r%elc(pbl%i%ipt) ) goto 999 ! Return
192 -       t2 = sqrt(pbl%r%erg/matxs_thread%ergace)
193 -       t4 = t1*sqrt(pbl%r%ergp/pbl%r%erg)
194 -       ! cm from carter and cashwell eqn. 5.10
195 -       cm = t2*(cs-t4)
196 -
197 -       ! limit cm
198 -       if( cm < -1.0_DKND ) cm = -1.0_DKND
199 -       if( cm >  1.0_DKND ) cm =  1.0_DKND
200 -
201 -       t5 = sinh(event_thread%tpd(2))*(one-cs*t4)
202 -       if( t5<=zero ) then
203 +
204 +       ! neutron_inelastic( psc, e_out, e_in, e_cm, e_cut, cs_lab, cs_cm,
    target_mass, no_contrib)
205 +       call neutron_inelastic( var_reduce_thread%psc, pbl%r%erg ,pbl%r%ergp, &
206 +                               matxs_thread%ergace, pbl%r%elc(pbl%i%ipt),    &
207 +                               cs, cm, awn(pbl%i%iex), no_contrib )
208 +       if( no_contrib ) goto 999 ! return without contribution
209 +
210 +       a = event_thread%tpd(2)
211 +       r = event_thread%tpd(1)
212 +       if( a <= ZERO ) then ! if a <= 0 sinh(a) <= 0
213           var_reduce_thread%psc = zero
214           goto 999 ! Return
215         endif
216 +
217         ! kalbach-87 psc=(.5*a/sinh(a))*(cosh(a*cm)+r*sinh(a*cm))
218         ! d cm/d cs = t2/(1 - cs*t4)  carter and cashwell eqn 5.13
219 -       var_reduce_thread%psc = (cosh(event_thread%tpd(2)*cm) + &
220 -              event_thread%tpd(1)*sinh(event_thread%tpd(2)*cm)) * &
221 -            half*event_thread%tpd(2)*t2/t5
222 +       var_reduce_thread%psc = var_reduce_thread%psc * &
223 +         (a/sinh(a))*( cosh(a*cm) + r*sinh(a*cm) )
224 +
225 +       if( var_reduce_thread%psc < ZERO ) then
```

```
226 +         write(jtty,fmt='(" Error: PSC is negative for Kalbach-87 contribution to
    point detector")')
227 +         call expirx(1,'calcps','PSC is negative for Kalback-87 contribution to
    point detector.')
228 +       endif
229         goto 999 ! Return
230
231       case( PARTICLE_FROM_PN_LAW44 )
232 @@ -859,3 +844,107 @@ subroutine calcps( i_reaction )
233       return
234
235  end subroutine calcps
236 +
237 +!-----------------------------------------------------------------------
238 +
239 +subroutine neutron_inelastic( psc, e_out, e_in, e_cm, e_cut, cs_lab, cs_cm,
    target_mass, no_contrib)
240 +
241 +  ! .. used parameters
242 +  use mcnp_params, only : DKND, HALF, ONE, ZERO
243 +
244 +  ! .. used procedures
245 +  use mcnp_random, only : rng_history
246 +
247 +  implicit none
248 +  real(dknd), intent(out)  :: psc         ! probability of scatter toward cs_lab
249 +  real(dknd), intent(out)  :: e_out       ! out-going neutron energy in the LAB
    system
250 +  real(dknd), intent(in)   :: e_in        ! in-coming neutron energy in the LAB
    system
251 +  real(dknd), intent(in)   :: e_cm        ! out-going neutron energy in the CM
    system from ACE law
252 +  real(dknd), intent(in)   :: e_cut       ! neutron energy cutoff
253 +  real(dknd), intent(in)   :: cs_lab      ! scattering angle toward detector in
    the LAB system
254 +  real(dknd), intent(out)  :: cs_cm       ! scattering angle toward detector in
    the CM system
255 +  real(dknd), intent(in)   :: target_mass ! mass of the target isotope
256 +  logical,    intent(out)  :: no_contrib  ! flag to indicate no contribution to
    detector
257 +
258 +  real(dknd) :: a, a1, r1, t1, t2, t3, t4, b2, b, g
259 +  real(dknd) :: mult ! multiplier for psc
260 +  logical :: pos_root
261 +
262 +  no_contrib = .false.
263 +  psc = ZERO
264 +
265 +  a1 = ONE + target_mass
266 +  r1 = e_cm*(a1)**2 / e_in
267 +  t3 = ONE - r1
268 +
269 +  ! explicitly re-write to perform (cs**2 - one)
270 +  b2 = ( cs_lab**2 - ONE ) + r1
271 +  if( b2 <= zero ) then
272 +    goto 9992 ! No contribution return
273 +  endif
274 +  b = sqrt(b2)
275 +
```

```
+  ! set assuming positive root coding is used most often
+  mult = HALF
+  pos_root = .true.
+
+  ! test of possible neg root
+  if( cs_lab > ZERO .and. t3 > ZERO ) then
+    ! neg root only possible for positive angles
+    ! AND
+    ! neg root only possible when E < -QA/(A-1) ie t3 > 0
+    mult = ONE
+    if( rng_history%rn() >= HALF ) then
+      pos_root = .false.
+    endif
+  endif
+
+  t1 = ONE / a1
+
+  ! erg from carter and cashwell eqn. 5.14
+  ! numerical recipes quadratic solution
+  g = cs_lab + sign(b,cs_lab)
+  if( cs_lab >= ZERO .and. pos_root ) then
+    e_out =  e_in * (g/a1)**2
+  else
+    a = sqrt(e_in)/a1
+    e_out = ( (a - e_cm/a )/g )**2
+  endif
+
+  ! return if this energy is below particle's energy cutoff.
+  if( e_out < e_cut ) goto 9992 ! return with no contribution
+
+  t2 = sqrt( e_out / e_cm )
+  t4 = t1*sqrt( e_in / e_out )
+
+  ! Use eq. 44 from Sweezy "Kinematics of Neutron
+  ! Inelastic Scattering for Next-Event Estimators"
+  psc = mult * e_out * a1 / sqrt( e_cm * e_in * b2 )
+
+  ! cosine scattering angle in CM frame from carter and cashwell eqn. 5.10
+  cs_cm = t2*(cs_lab-t4)
+
+  ! limit cm angles with floating point comparison to -1.0 and 1.0
+  if( abs(cs_cm) > 1.0_DKND ) then
+    if( abs(cs_cm) >  1.0_DKND + 1E-10 ) then
+      goto 9992 ! return with no contribution
+    else
+      if( cs_cm < 0.0_DKND ) then
+        cs_cm = -1.0_DKND
+      else
+        cs_cm = 1.0_DKND
+      endif
+    endif
+  endif
+
+  ! successful - return with positive psc
+9991 return
+
+  ! unsucessful - return with psc = 0.0
+9992 continue
+  psc = ZERO
```

```
+  no_contrib = .true.
+  return
+
+end subroutine neutron_inelastic
+
```