

MCNPX Capabilities

<http://mcnpx.lanl.gov>

MCNPX is a Los Alamos 3-D Monte Carlo radiation transport code (superset of MCNP) capable of tracking 34 particle types (nucleons and light ions) and 2000+ heavy ions at nearly all energies. It uses standard evaluated data libraries mixed with physics models where libraries are not available. MCNPX is in FORTRAN90, supported on all UNIX, Linux and PC platforms, and can be multi-processed with PVM or MPI. Capabilities beyond MCNP4C3/ MCNPX2.3.0:

(Red indicates new or upgraded capabilities in MCNPX2.6 --- since MCNPX 2.5.0 released April 2005)

Physics

- Seamless transport of 34-particle types at nearly all energies by mixing and matching of nuclear data table and model physics;
- **Heavy-ion ($Z>2$) transport for all 2000+ ions;**
- **CEM03, LAQGSM, and INCL4/ABLA physics models in addition to older FLUKA, Bertini, HETC, and Isabel models;**
- **Burnup / depletion with full integration of CINDER90;**
- **Delayed neutrons and gammas from CINDER90 radioactive decay products from data libraries and/or physics models;**
- **Muon capture interactions;**
- Fission multiplicity;
- Light-ion recoil;
- **Charged ions from neutron capture;**
- Inline generation of double differential cross sections and residuals;
- Photon Doppler broadening (MCNP5);
- Improved $S(\alpha,\beta)$ physics.

Variance Reduction

- **Criticality source convergence acceleration;**
- Pulse-height tallies with variance reduction;
- **Spherical mesh weight windows;**
- **Energy-time weight windows;**
- **Weight window generator bound limiter.**

Tallies

- Default dose functions;
- Pulse-height light tally with anticoincidence;
- Coincidence capture tally;
- **Residual nuclei tally;**
- Lattice tally speedup by orders of magnitude;
- Proton and photonuclear reaction multipliers;
- Expanded radiography tally specification;

- Cosine bins specified in degrees.

Sources

- Spontaneous fission, **spontaneous photons;**
- Multiple source particle types;
- Positron sources;
- Improved source specification (par,cel,tr).

Compiling, Configuration, and Installation

- FORTRAN90 modularity and dynamic memory allocation;
- F90 autoconfiguration;
- 64-bit integer support;
- NAG / IBM / INTEL compiler extensions.

Other Input File Extensions

- **File names > 8 characters and as paths;**
- Weight-window generator / exponential transform for model physics;
- Logarithmic interpolation on input cards;
- Auxiliary input files;
- PTRAC file for coincidence counting;
- **STOP card: terminate run on precision.**

Graphics

- Mesh tallies (xyz, rzt, **rpt**, tally grid superimposed over geometry) plotted within MCNPX;
- Two-dimensional (2D) color contour tally plots for lattices and radiography;
- Geometry plot of WWG mesh;
- i,j,k lattice indexing in geometry plots;
- Proton/photonuclear cross-section plots;
- Pause command.

Parallel Processing

- MPI multiprocessing for all particles/energies;
- Significant speedup of criticality problems run with MPI.