

MCNPX Capabilities

<http://mcnpx.lanl.gov>

MCNPX is a Los Alamos 3-D Monte Carlo radiation transport code capable of tracking 34 particle types (including 4 light ions) at all energies. The code uses standard evaluated data libraries (proton, neutron, photonuclear, many extended to 150 MeV), along with physics models where libraries are not available. MCNPX is supported on all UNIX, Linux and PC platforms, and can be multi-processed with PVM or MPI. MCNPX is written in FORTRAN90 and is modernized for new hardware, operating systems, and compilers. The capabilities of MCNPX beyond MCNP4C3 and MCNPX2.3.0 are listed below:

Physics

- Mix and match of nuclear data table and model physics;
- CEM2k physics models;
- INCL4/ABLA physics models;
- Extension of neutron model physics below 20 MeV;
- Fission multiplicity;
- Light-ion recoil;
- Inline generation of double differential cross sections and residuals;
- Photon Doppler broadening (from MCNP5);
- Weight-window generator and exponential transform for model physics;
- Improved $S(\alpha,\beta)$ physics.

Sources

- Spontaneous fission;
- Multiple source particle types;
- Repeated structures source-path specification improvement;
- Positron sources;
- Sources on cylindrical surfaces;
- Source particles that may be specified by character descriptors.

Tallies

- Default dose functions;
- Pulse-height light tally with anticoincidence: FT8 PHL;
- Coincidence capture tally and PTRAC file: FT8 CAP;
- Residual nuclei tally: FT8 RES;
- Lattice tally speedup by orders of magnitude;
- Proton reaction and photonuclear reaction multipliers (with FM cards);
- Expanded radiography tally specification;
- Cosine bins that may be specified in degrees and for F2 tallies.

Other Input File Extensions

- Logarithmic interpolation on input cards;
- Auxiliary input files;
- DXTRAN/detector underflow control;
- PTRAC file for coincidence counting.

Graphics

- Enhanced color geometry plots;
- Two-dimensional (2D) color tally contour plots for lattices and radiography;
- Geometry plot of WWG superimposed mesh;
- i,j,k lattice indexing in geometry plots;
- Proton and photonuclear cross-section plots;
- Pause command for tally and cross-section plots.

Parallel Processing

- Distributed memory multiprocessing for all particles and energies;
- Message passing interface (MPI) multiprocessing;
- Significant speedup of criticality problems run with MPI.

Compiling, Configuration, and Installation

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

Future MCNPX development

- Cinder'90 capabilities for transmutation, delayed neutrons and photons;
- Pulse height tallies with variance reduction;
- Mesh tally plotting directly in MCNPX;
- Heavy-ion tracking and interactions;
- Criticality - externally driven sources, improved eigenfunction stability, enhanced efficiency for parallel KCODE calculations;
- CAD link;
- Magnetic field tracking.