Thermal Neutron Flux Calculations at a Lead Spallation Target

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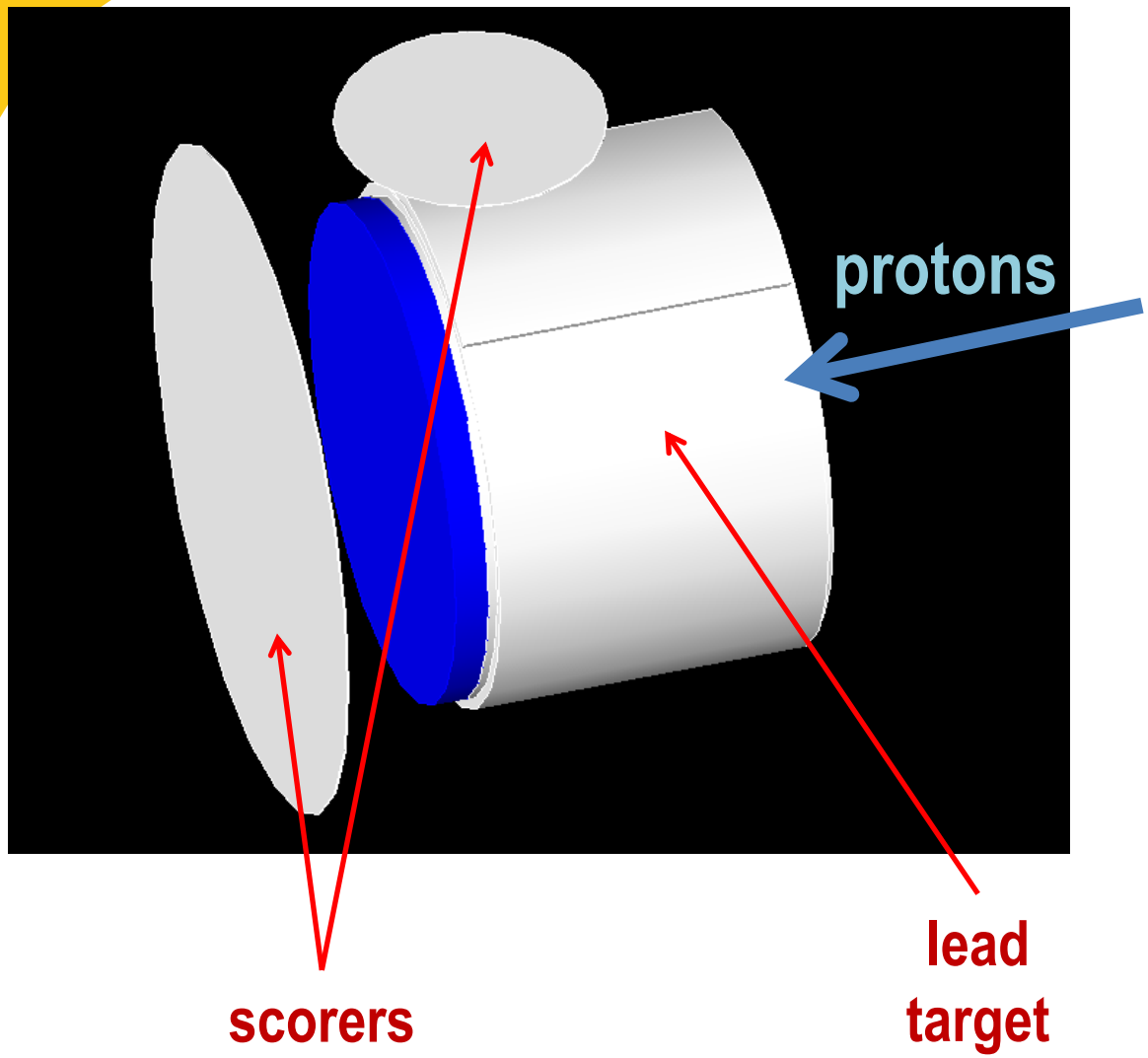
Geant4 Hadronic Working Group Meeting

January 28th, 2015

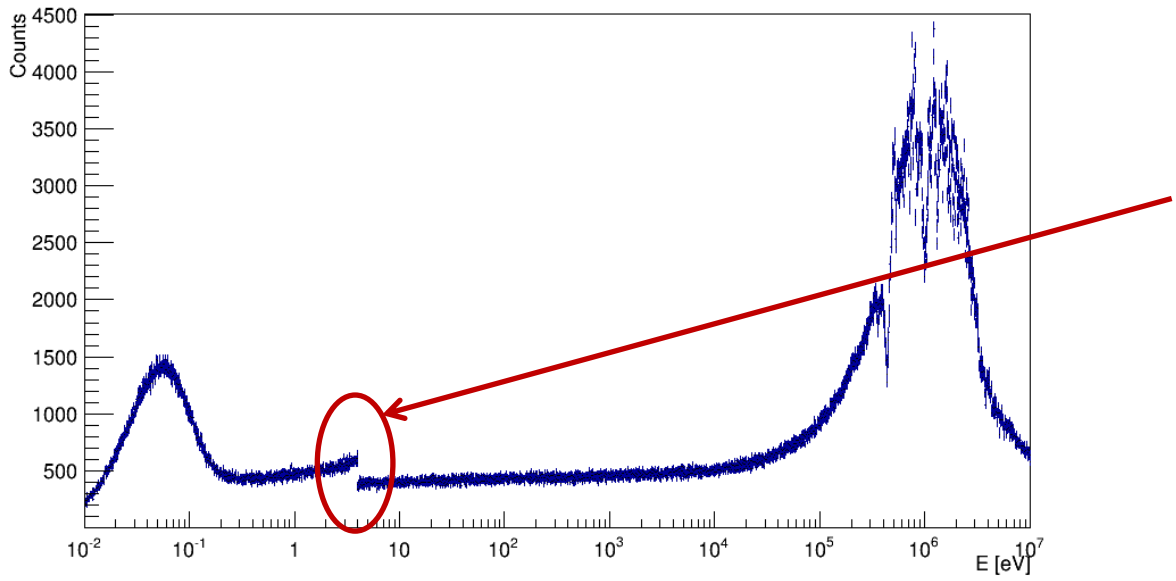
Simulation setup

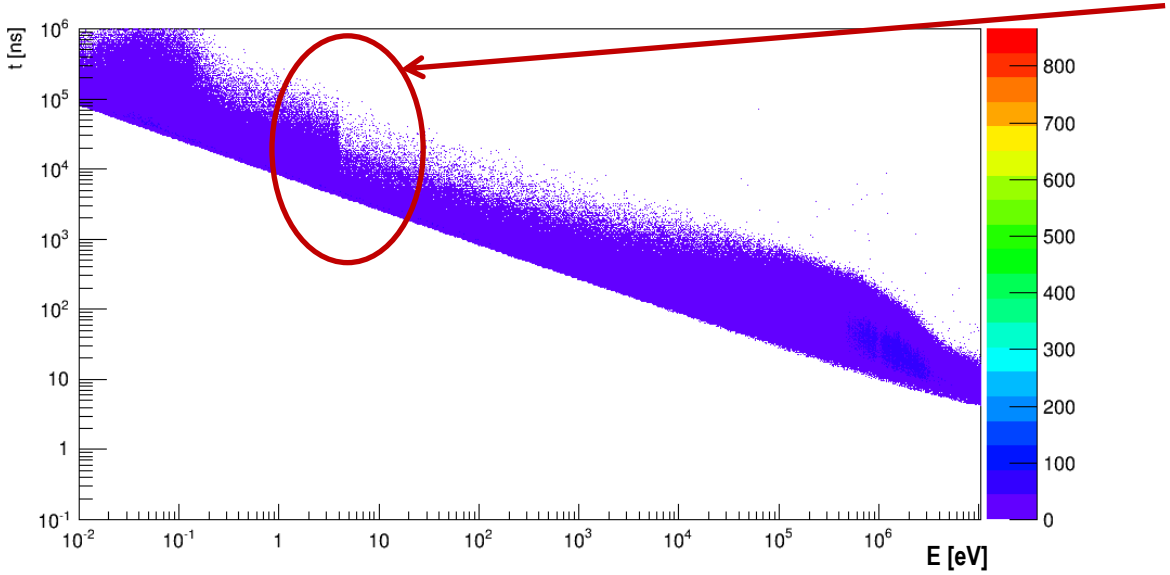


- 20 GeV/c protons
- Water-cooled lead thick target.
- Scoring cylinders placed roughly at 0 and 90 deg w.r.t. beam direction.
- Angular acceptance limited to 4 deg in both scorers.

G4NDL4.2
(NeutronHP with ThermalScattering)

Geant4-9.6.2 – G4NDL4.2 – Scoring at 0 deg

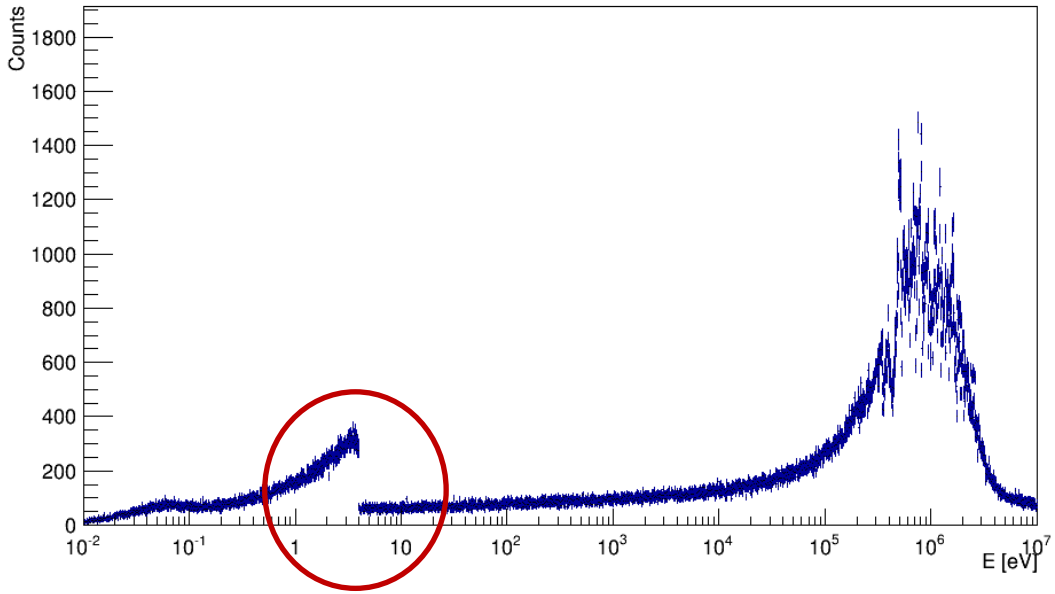


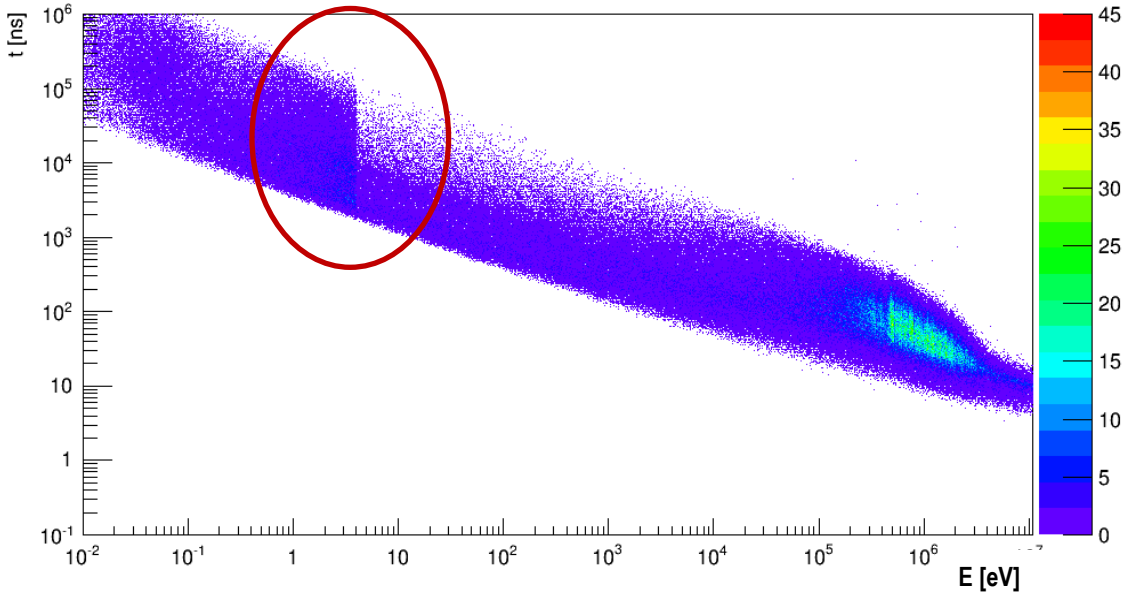


- Non-physical “jump” at 4 eV (transition to HP Thermal Scattering Models and XS).
- Maybe neutron elastic scattering XS is too high (?)

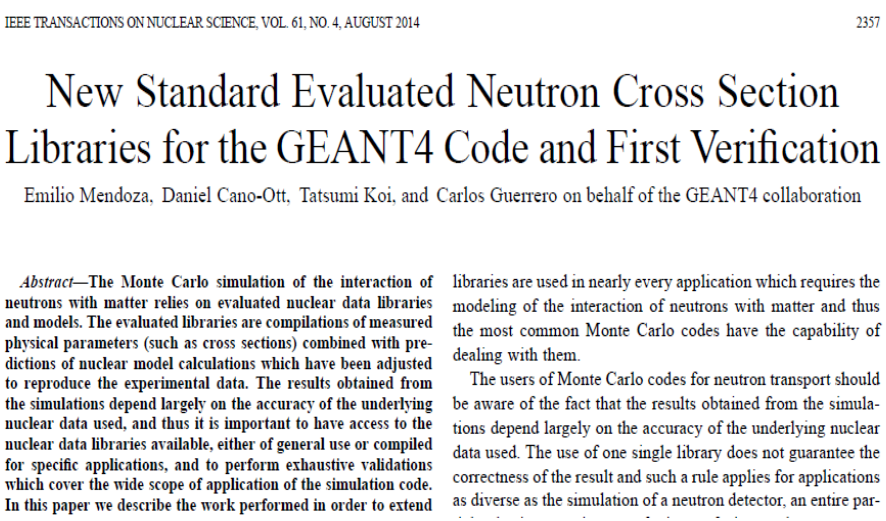
Geant 4

Geant4-9.6.2 – G4NDL4.2 – Scoring at 90 deg





With CIEMAT's translation from ENDF-VI8 (NeutronHP with ThermalScattering)



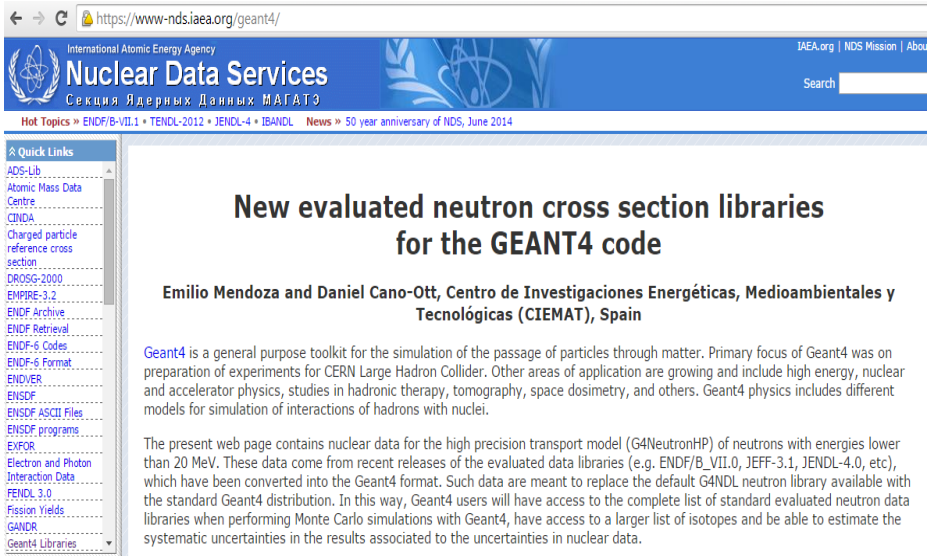
IEEE TRANSACTIONS ON NUCLEAR SCIENCE, VOL. 61, NO. 4, AUGUST 2014 2357

New Standard Evaluated Neutron Cross Section Libraries for the GEANT4 Code and First Verification

Emilio Mendoza, Daniel Cano-Ott, Tatsumi Koi, and Carlos Guerrero on behalf of the GEANT4 collaboration

Abstract—The Monte Carlo simulation of the interaction of neutrons with matter relies on evaluated nuclear data libraries and models. The evaluated libraries are compilations of measured physical parameters (such as cross sections) combined with predictions of nuclear model calculations which have been adjusted to reproduce the experimental data. The results obtained from the simulations depend largely on the accuracy of the underlying nuclear data used, and thus it is important to have access to the nuclear data libraries available, either of general use or compiled for specific applications, and to perform exhaustive validations which cover the wide scope of application of the simulation code. In this paper we describe the work performed in order to extend libraries are used in nearly every application which requires the modeling of the interaction of neutrons with matter and thus the most common Monte Carlo codes have the capability of dealing with them.

The users of Monte Carlo codes for neutron transport should be aware of the fact that the results obtained from the simulations depend largely on the accuracy of the underlying nuclear data used. The use of one single library does not guarantee the correctness of the result and such a rule applies for applications as diverse as the simulation of a neutron detector, an entire par-



https://www-nds.iaea.org/geant4/

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Geant4 Libraries

New evaluated neutron cross section libraries for the GEANT4 code

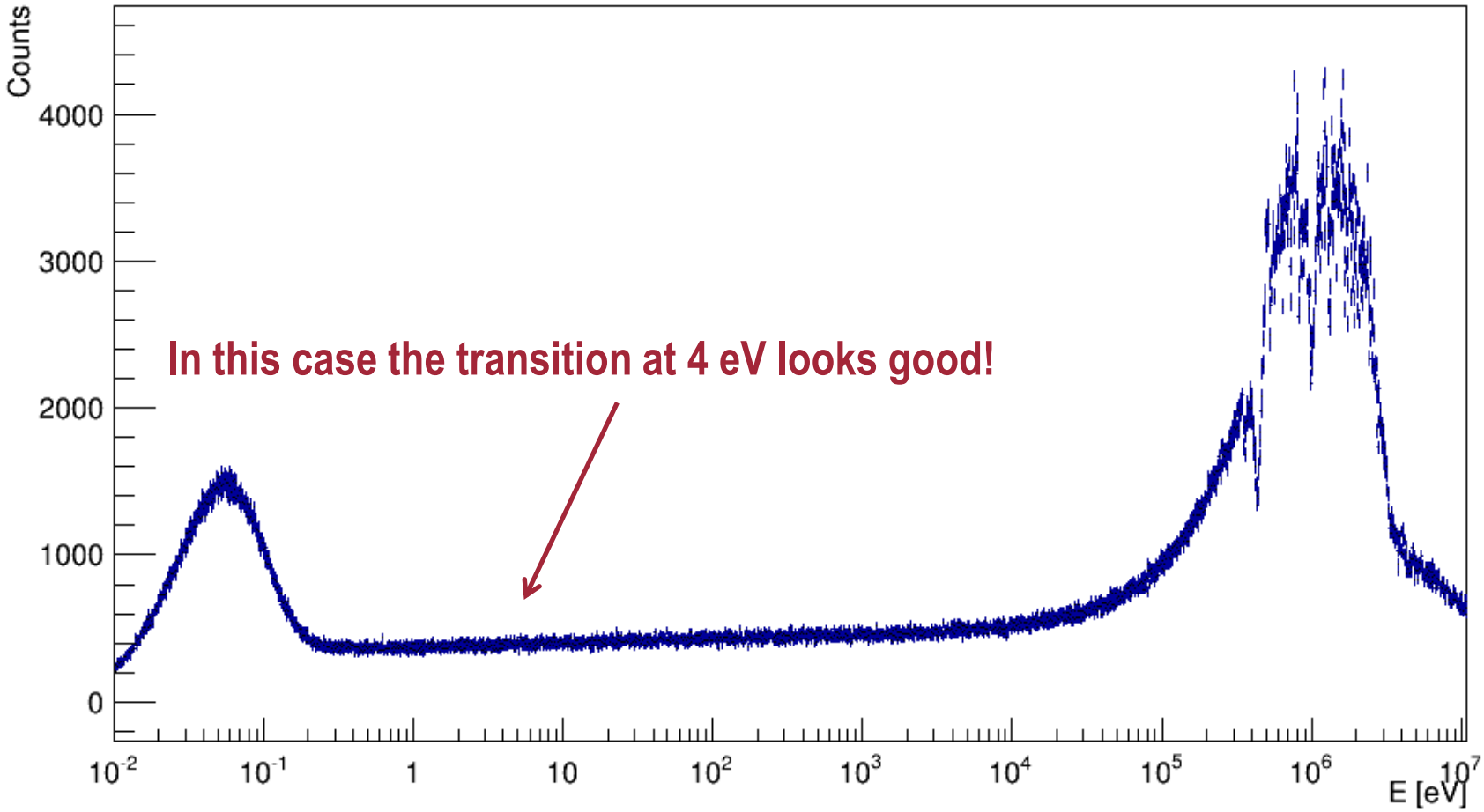
Emilio Mendoza and Daniel Cano-Ott, Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT), Spain

Geant4 is a general purpose toolkit for the simulation of the passage of particles through matter. Primary focus of Geant4 was on preparation of experiments for CERN Large Hadron Collider. Other areas of application are growing and include high energy, nuclear and accelerator physics, studies in hadronic therapy, tomography, space dosimetry, and others. Geant4 physics includes different models for simulation of interactions of hadrons with nuclei.

The present web page contains nuclear data for the high precision transport model (G4NeutronHP) of neutrons with energies lower than 20 MeV. These data come from recent releases of the evaluated data libraries (e.g. ENDF/B_VII.0, JEFF-3.1, JENDL-4.0, etc), which have been converted into the Geant4 format. Such data are meant to replace the default G4NDL neutron library available with the standard Geant4 distribution. In this way, Geant4 users will have access to the complete list of standard evaluated neutron data libraries when performing Monte Carlo simulations with Geant4, have access to a larger list of isotopes and be able to estimate the systematic uncertainties in the results associated to the uncertainties in nuclear data.

(Details in E. Mendoza et al., IEEE-TNS 61: 2357 (2014)

Geant4-9.6.2 – ENDF-VI8 – Scoring at 0 deg



Geant4-9.6.2 – ENDF-VI8 – Scoring at 90 deg