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# Geant4 simulations of a Proton Recoil Telescope for the measurement of the n_TOF neutron flux between 100 and 1000 MeV

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## Summary

The 235U(n,f) cross section is one of the most important cross-section standards for measurements of neutron-induced reaction cross-sections. At the n_TOF (neutron time of flight) facility at CERN, fission detectors equipped with a 235U sample are used for the measurement of the neutron flux and the 235U(n,f) cross section is used as a reference for all other fission cross section measurements. The 235U(n,f) cross section is adopted as a standard at thermal neutron energy and between 0.15 MeV and 200 MeV. Despite the importance of the high-energy region, at present no data exist on neutron-induced fission above 200 MeV, and one has to rely on theoretical estimates. Therefore a measurement of the 235U(n,f) cross section above 200 MeV would be highly desiderable. Thanks to its very wide neutron energy spectrum, which extends from thermal energies up to more than 1 GeV, the n_TOF facility offers the unique opportunity to perform such a measurement for the first time ever, relative to the n-p elastic scattering reaction. The prerequisite for this measurements is the availability of a Proton Recoil Telescope (PRT) for the detection of high-energy recoil protons. The PRT should have a fast time response and allow for good background rejection.
The best configuration for the Proton Recoil Telescope (PRT) has been investigated by means of dedicated Monte Carlo simulations performed with the GEANT4 tool.
The neutron-induced background of neutrons in the radiator (typically polyethilene) and in the PRT detector itself has been studied, together with the background related to multiple scattering of recoil protons inside the detector.
Finally the efficiency of the PRT as a function of the energy of the neutron beam impinging on the radiator has been studied. The simulations demonstrate that the measurement is feasible at n_TOF, by using suitable detectors (fast scintillators) and analysis conditions.
In this contribution, the results of the GEANT4 simulations will be compared with experimental data obtained from a test of the detector performance under the n_TOF neutron beam.

**Primary author:** DAMONE, Lucia Anna (BA)

**Presenter:** DAMONE, Lucia Anna (BA)

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