GEANT simulations of NIMROD

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NIMROD is a 4π array of ionization chambers, silicon detectors and CsI crystals designed to study reaction mechanisms of heavy ion collisions [1]. In order to fully exploit the physics potential of NIMROD a GEANT simulation of the detector has been created, [2]. This will allow us to study the effects of shadowing, resolution and granularity upon our measurements and can also provide guidance in the placement of ancillary detectors, such as the DEMON neutron detectors [3] or photon detectors. In order to predict the response of the detectors to low energy neutrons the MICAP package is used within GEANT. The simulation includes a detailed description of the inner charged particle array, vacuum pipes, the neutron ball and the DEMON counters. Figure 1 shows a side view of the inner charged particle array as currently configured for the calculation. Work is in progress to connect the simulation to physics event generators. It is hoped to write the output as ROOT [4] files. This will allow us to analyse data from event generators with the same software as for real data.

Figure 2 shows the effect of scattering on the number of neutrons entering neutron counters placed at different angles. While the most significant effect is scattering out of the acceptance their are some neutrons that scatter into the acceptance mainly due to interactions with the CsI crystals, light guides, phototubes and the vacuum tubes. The energy of these inscattered neutrons can be different

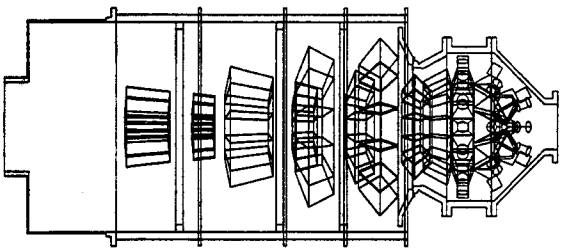

Figure 1: The inner charged particle array of NIMROD. as currently configured for the calculation.

from the initial energy and so it is important to correct for this when creating neutron energy spectra. The scattering out of the acceptance is worse at 90° due to the large hydrogen content of the light guides through which the neutrons pass. This effect is more pronounced at low energy.

Recently we have added an array of permanant magnets just forward of the target in order to suppress electrons. We have also put the target at a potential of 20KV for the same reason. These modified structures will have to be added to the description of the detector. While the GEANT simulation is still a work in progress it is already being used to understand NIMROD. During the next year it should enable us to make detailed comparisons between our data and physics generators.

References

[1] "NIMROD", T. Keutgen *et al.*, this report and cyclotron.tamu.edu/NIMROD/

[2] "GEANT: Detector Description and Simulation Tool", wwwinfo.cern.ch/asdoc/geant_html3/

[3] "DEMON: A Modular Neutron Detector", www.fynu.ucl.ac.be/projects/demon S. Mouarassim *et al.*, Nucl. Instr. and Meth., A **359** 530 (1995). I. Tilquin *et al.*, *ibid.*, **365** 446 (1995).

[4] "ROOT: An Object Oriented Data Analysis Framework", root.cern.ch

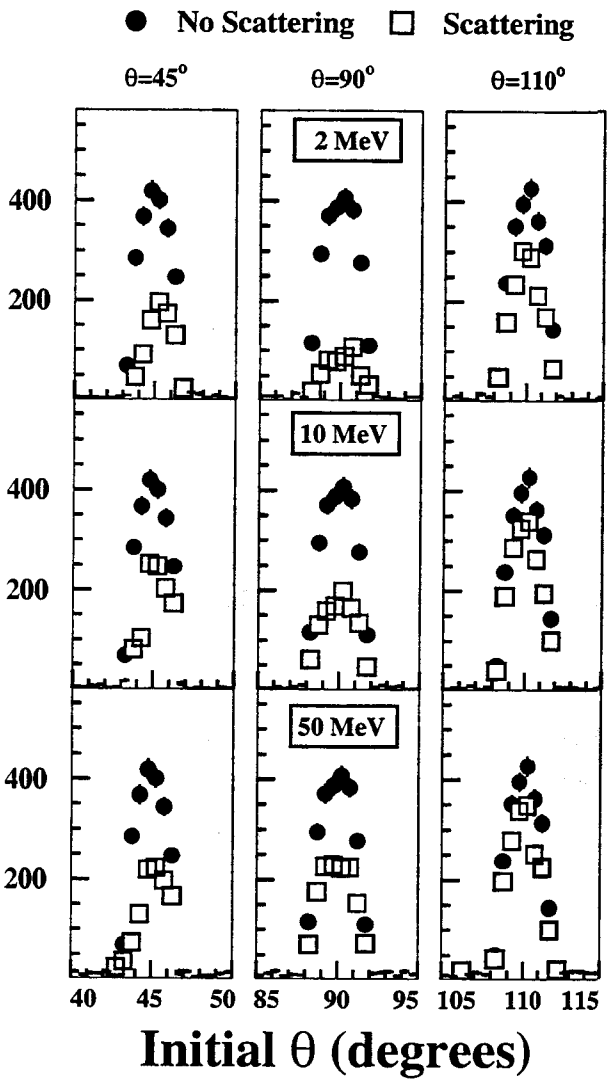

Figure 2: The effect of scattering into and out of three neutron detectors placed at different angles and energies. The scattering out of the acceptance is worse at 90° due to the large hydrogen content of the light guides through which the neutrons pass.