Report of the Activities of the Neutron Physics Unit with regard to neutron fluence intercomparisons and measurements for standard cross sections

A.J.M. Plompen, 25 May 2001

CCRI(III) Meeting of 28 and 29 May 2001

1. Participation in the "CCRI Key comparisons of neutron fluence measurements in the energy range between 144 keV and 19 MeV".

IRMM (G. Lövestam) participated at 1.2, 5 and 14.8 MeV using the Recoil-proton telescope of the laboratory. This implies two unconventional aspects:
The use of the recoil telescope at 1.2 MeV, and the use of a Silicon SBD detector at 14.8 MeV. In the latter case the institute's instrument is still a recoil-proton telescope but with a CsI scintillator. The use of the telescope at 1.2 MeV was necessary since no comparison at 2.5 MeV was included in the present campaign and IRMM has no portable instrument for 1.2 MeV. Due to the common use of this energy range at our lab we nevertheless found it necessary to participate to the best of our abilities.
The spectra taken in coincidence (ΔE-ΔE-E) look excellent and analysis is in progress.
IRMM remains interested in a similar exercise at 2.5 and 19 MeV.

2. Participation in the CCRI Key comparison "Neutron Fluence measurement in mono-energetic neutron fields"

Following the previous CCRI meeting, the IRMM Neutron Physics Unit agreed that it would be of interest to participate in this intercomparison at GELINA. To eliminate problems with overlap neutrons GELINA needs to run at 100 Hz (contrary to the typical 800 Hz). This is done regularly to normalize resonance range data at thermal energies or to measure excitation curves in the range from a few meV to a few hundred meV.
Due to large maintenance projects and a shortage of manpower we may only participate starting in the fall of 2002. However, we even strongly prefer the spring of 2003.

3. Measurements with regard to the ^{10}B(n,α) standard cross section.

Two sets of measurements are ongoing. Both are branching ratio measurements that may be extended to cross section measurements following proper understanding of the processes at hand. Both measurements use Frisch-gridded ionization chambers for optimal pulse-amplitude resolution and the simultaneous measurement of pulse-amplitude and the cosine of the angle of the alpha particle. One uses conventional electronics and the

continuous energy spectrum at GELINA. The other uses detailed analysis of the signal's rise-times with a 200 MHz digitizer at single energies with the VG. The energy range studied is from 10 keV to a few MeV.
Important anisotropy effects are observed in both measurements and are currently being investigated further.

4. Measurements of the $^{59}Co(n,2n)^{58m+g}Co$ standard cross section

This cross section is an ENDF/B-VI standard cross section from threshold to 20 MeV. The ENDF/B-VI evaluation was performed by the Vienna group (M. Wagner et al.). At about the same time a second evaluation was done by the Argonne group that considered essentially the same data base. The evaluations differ significantly in the treatment of one data set from Paulsen et al. At Geel we remeasured from 14 to 21 MeV using the Al(n,alpha) and Nb(n,2n) ENDF/B-VI activation standards as a reference. Good agreement is obtained with the Wagner evaluation. Isomer ratios and isomer cross sections have also been obtained and are of interest to further investigations on the role of the effective moment of inertia in the level density model.