Neutron detector efficiency defined by the relative neutron yield in the deuteron photodisintergation prosess.
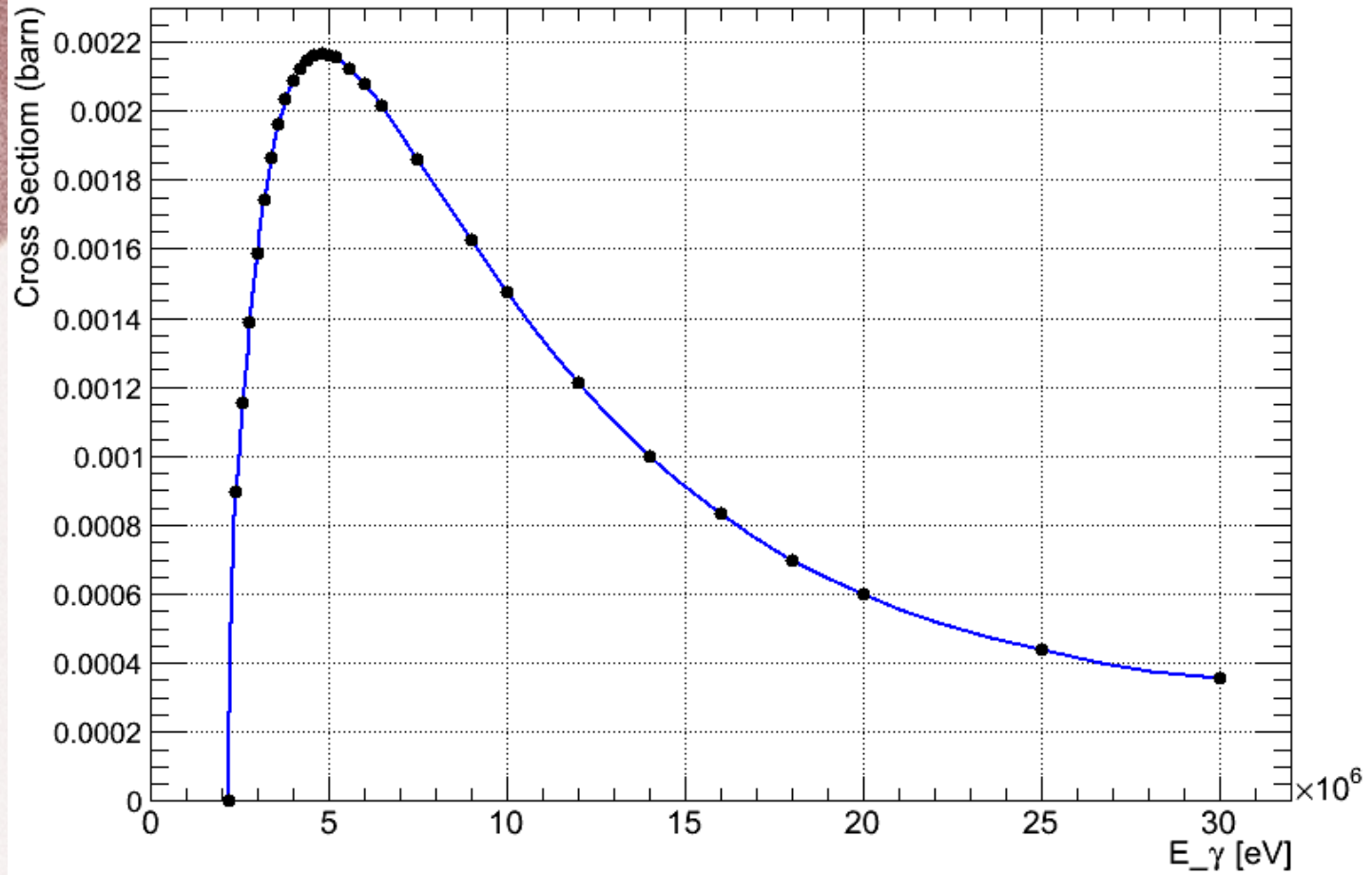
Fig. 1. Total cross section of H-2(γ,absorption). ENDF /B-VII.1.
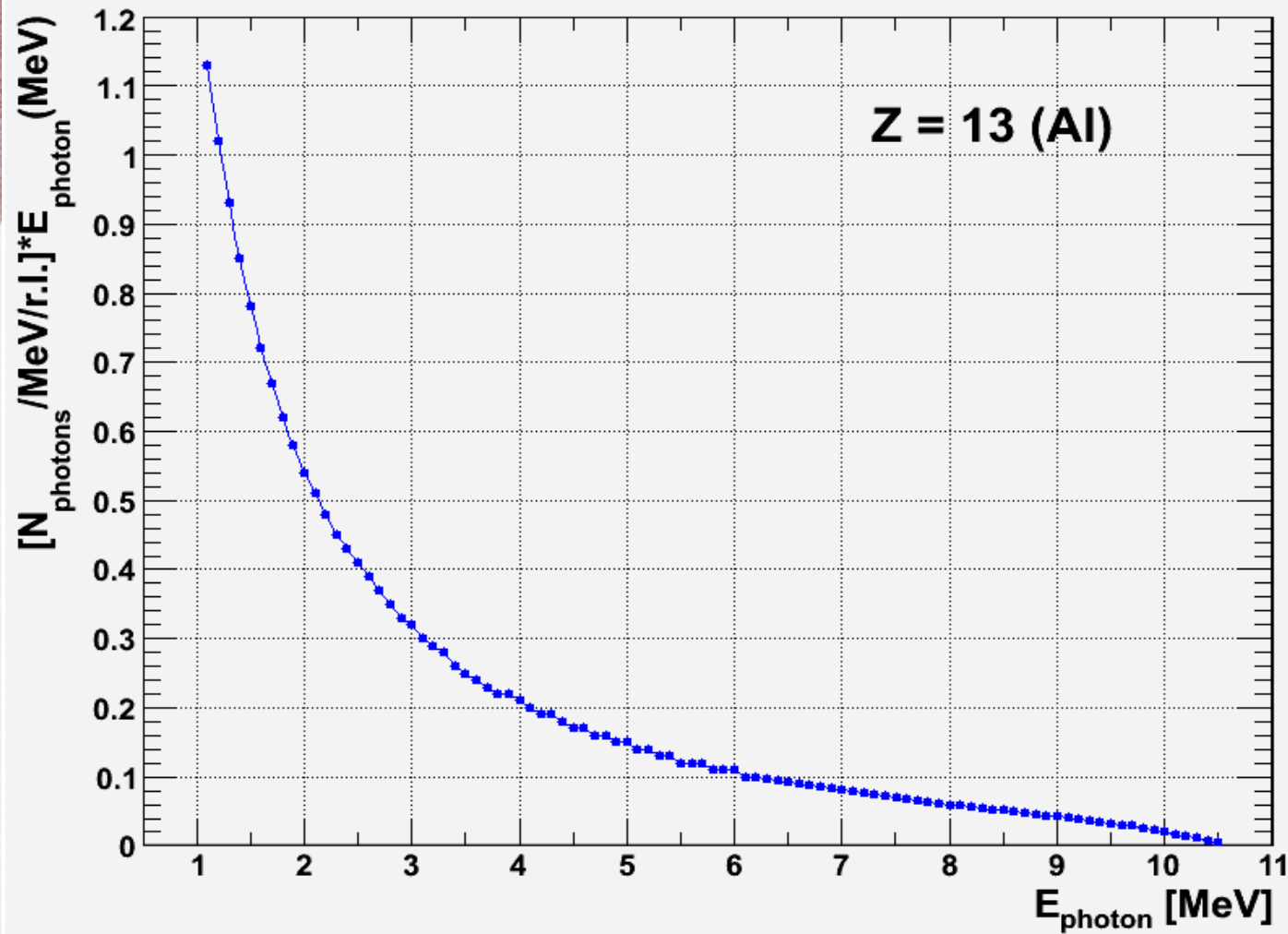
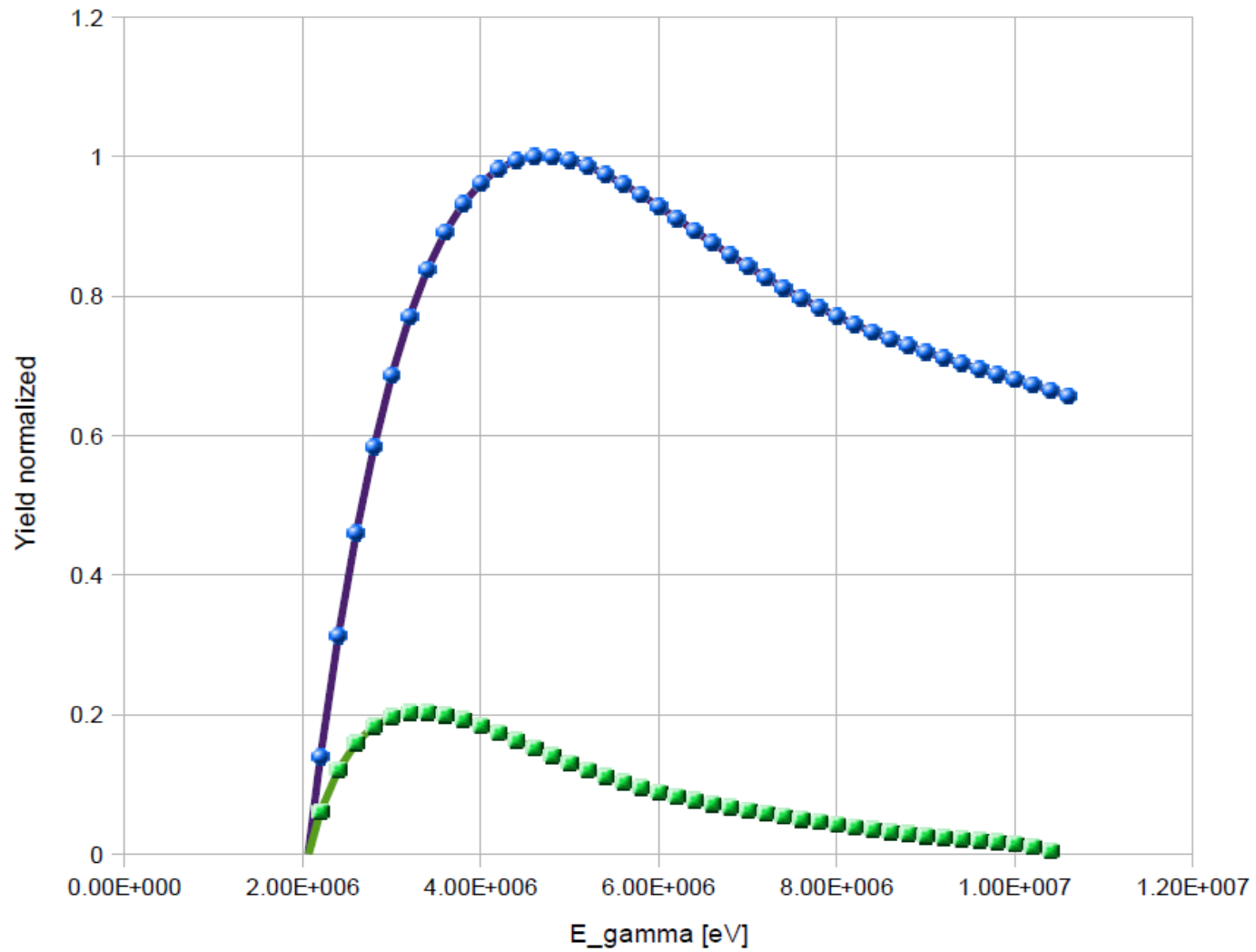**Fig. 2.** Bremsstrahlung spectrum created by electrons with energy 10.5 MeV in aluminium converter [by Dr. Dale]

Fig. 3. Total crossection of H-2(γ,absorption) reaction weighted by the bremsstrahlung spectrum (green curve) .
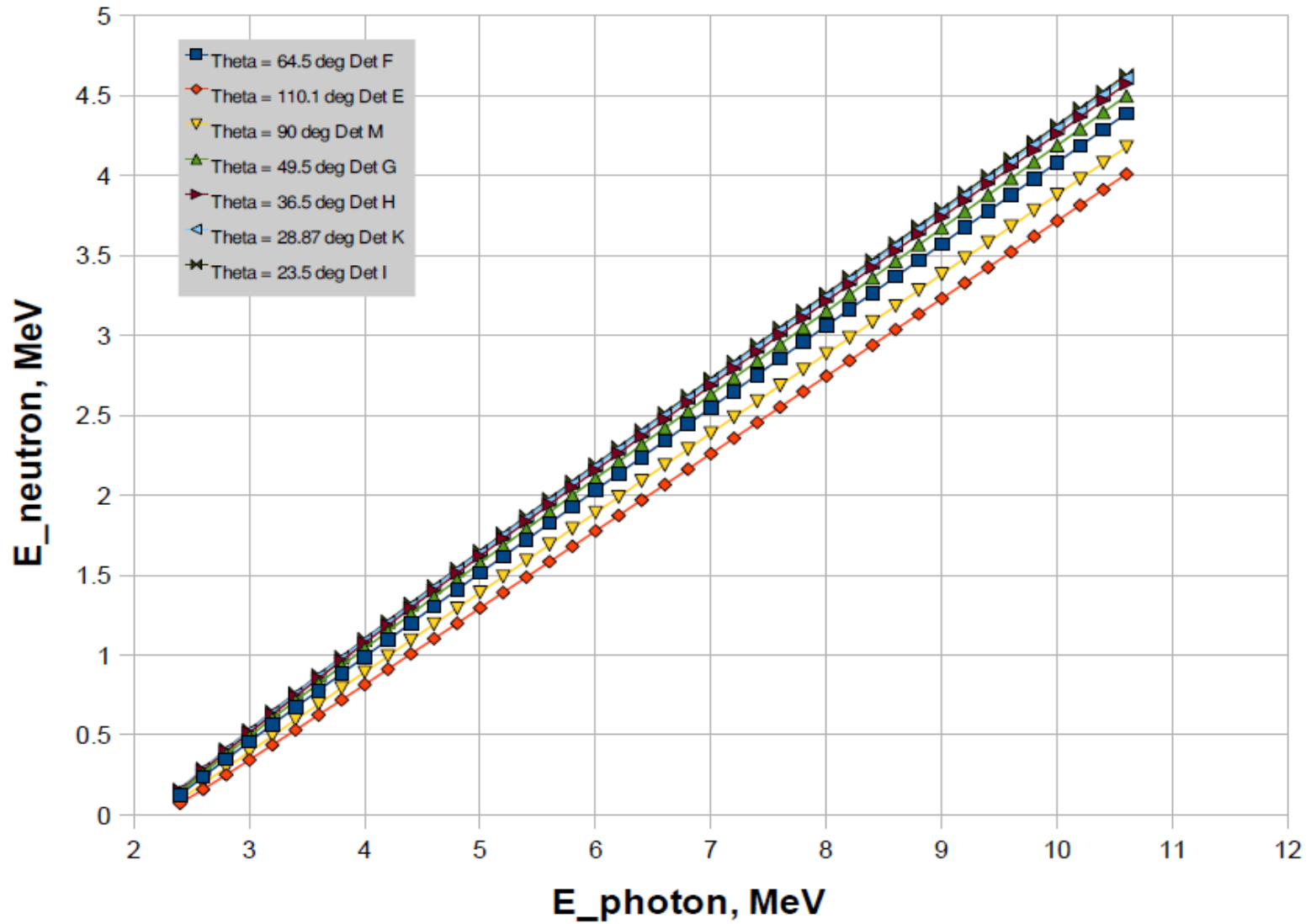
Fig. 4. Neutron energy vs. photon energy in the lab frame calculated using kinematics of the photodisintegration reaction.

$$\frac{d\sigma}{d\Omega} = A_\gamma + B_\gamma \sin^2(\theta) + C_\gamma \sin^2(\theta)\cos(\theta) + D_\gamma \sin^2(\theta)\cos^2(\theta)$$
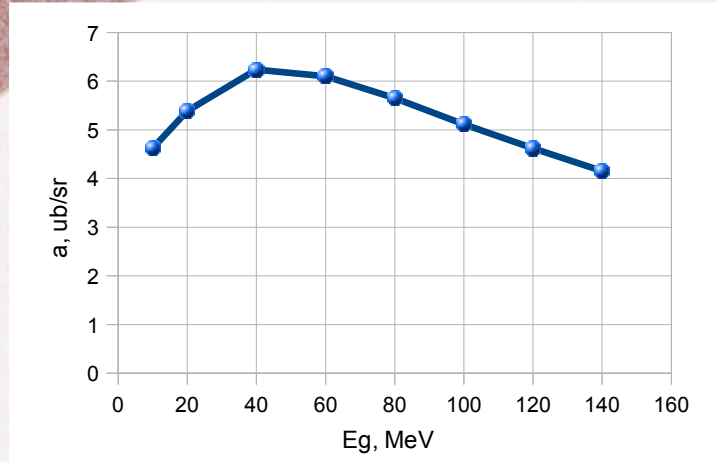
E1, E2, M1 multipolarities are included [*]

Fig. 5a. Coefficient A$_\gamma$ [**] F. Partovi, Ann. Phys. 27, 79 (1964)
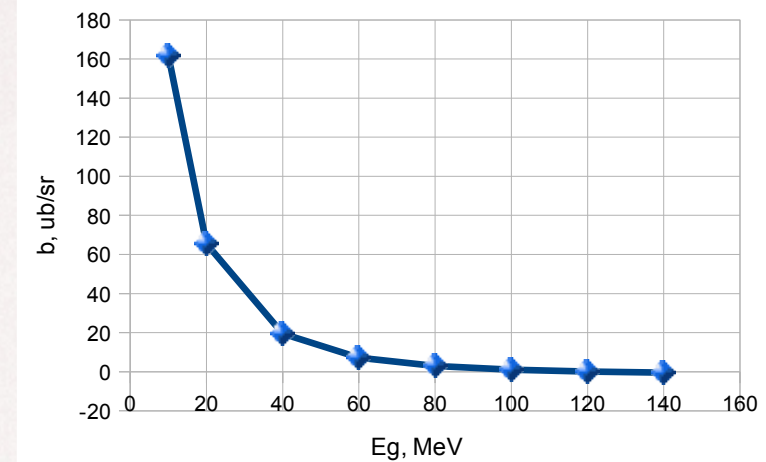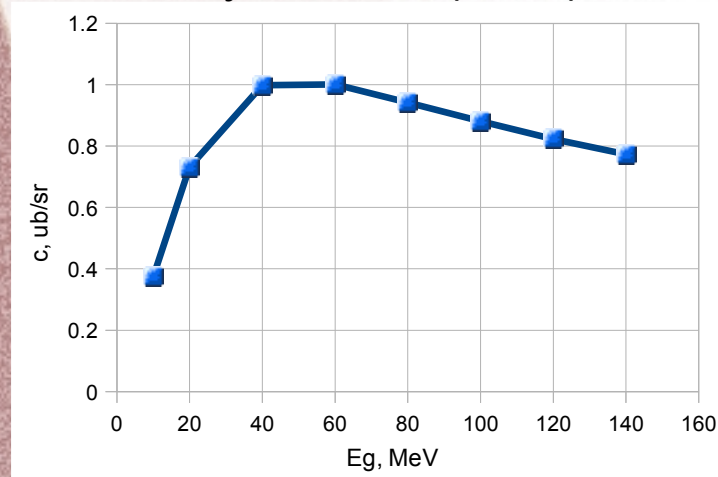
Fig. 5b. Coefficient B$_\gamma$ [**]

Fig. 5c. Coefficient C$_\gamma$ [**]
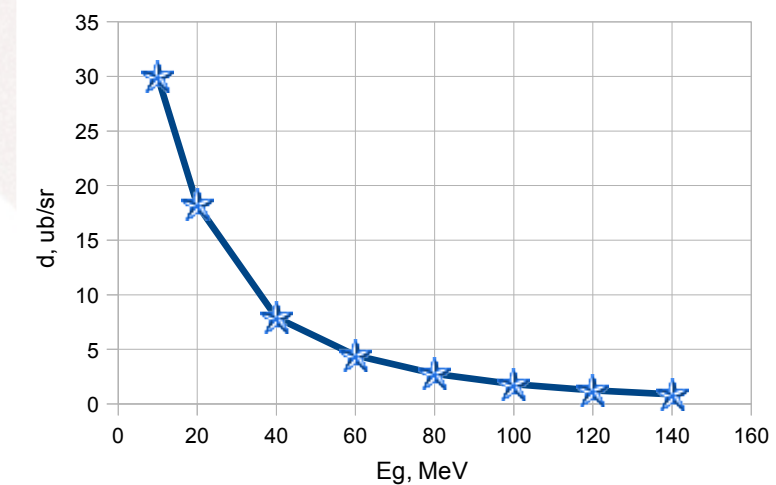
Fig. 5d. Coefficient D$_\gamma$ [**]

Partovi's coefficients after fitting
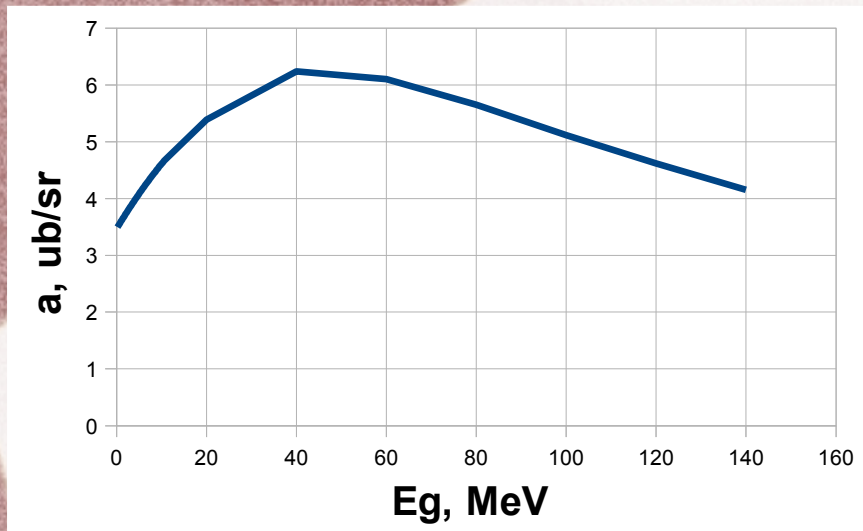
Fig. 6a. Coefficient A_γ.
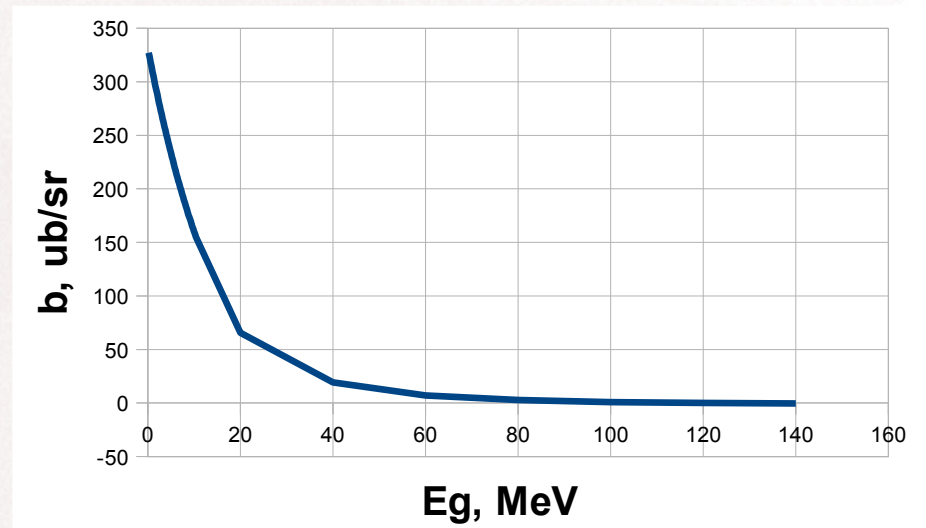
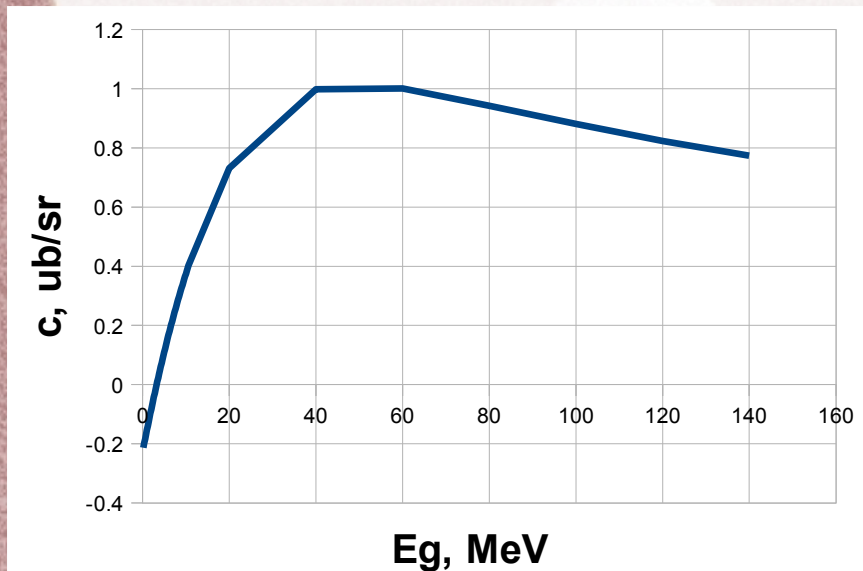**Fig. 6b.** Coefficient B_γ.

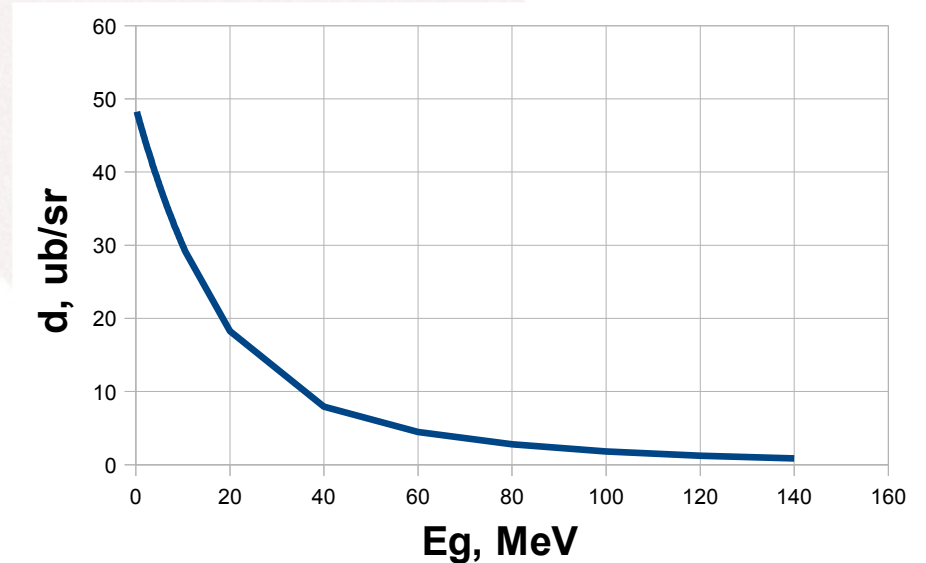**Fig. 6c.** Coefficient C_γ.

Fig. 6d. Coefficient D_γ.

Comparison with the experiment
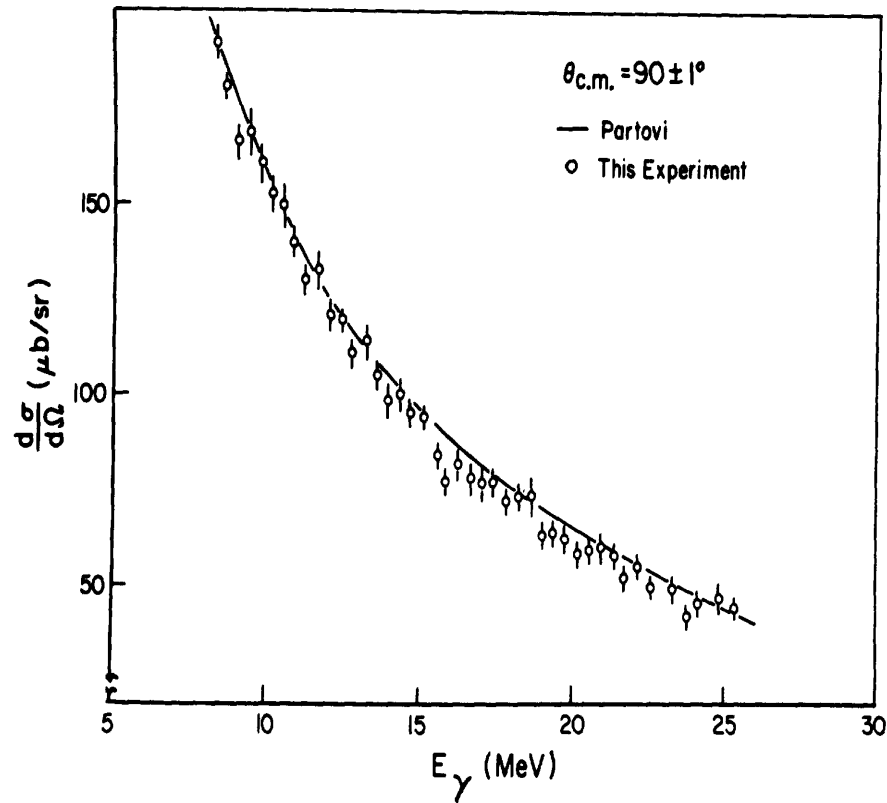

FIG. 7. Differential cross section at a c.m. angle of $90 \pm 1°$. The errors shown are statistical only.
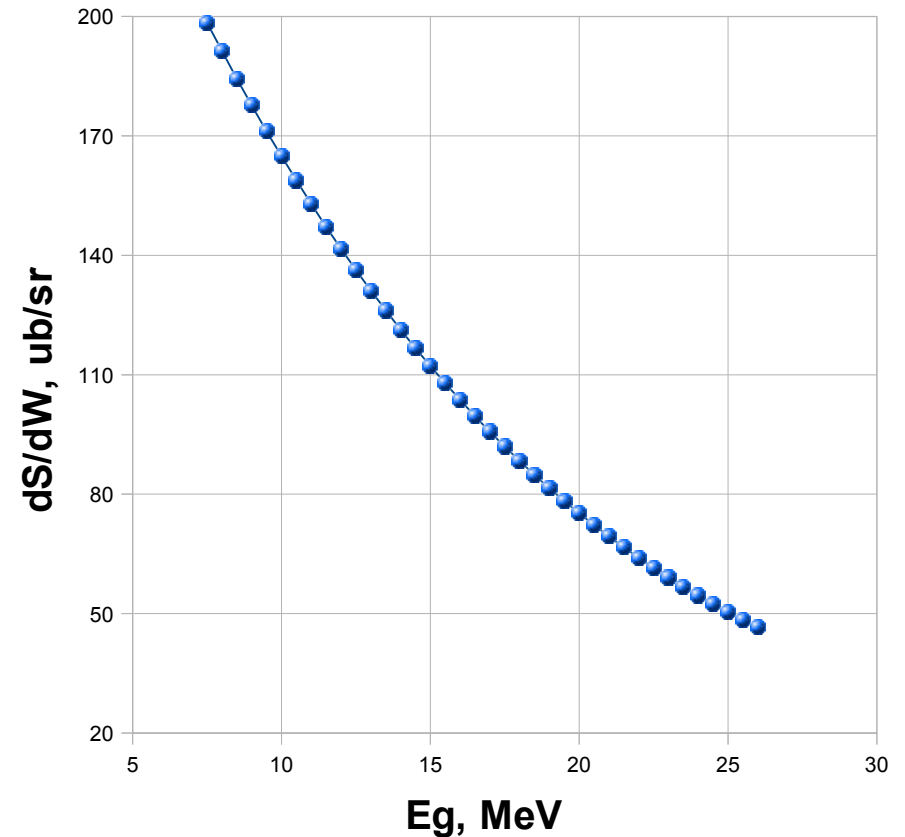
Fig. 8. Reproduction of the data plotted in Fig. 7 using fitted Partovi's coefficients.

[*] D. M. Skopik, Y. M. Shin, M. C. Phenneger, J. J. Murphy, *Photodisintegration of deuteron determined from the electrodisintegration process*, Phys. Rev. C, Vol. 9, 2, February 1974.

Comparison with the experiment cntd.

FIG. 5. Angular distribution of protons at $E_\gamma = 20.0 \pm 0.25$ MeV. The solid line is the prediction of Partovi.

Reproduction of the angular distribution using Partovi's coefficients.

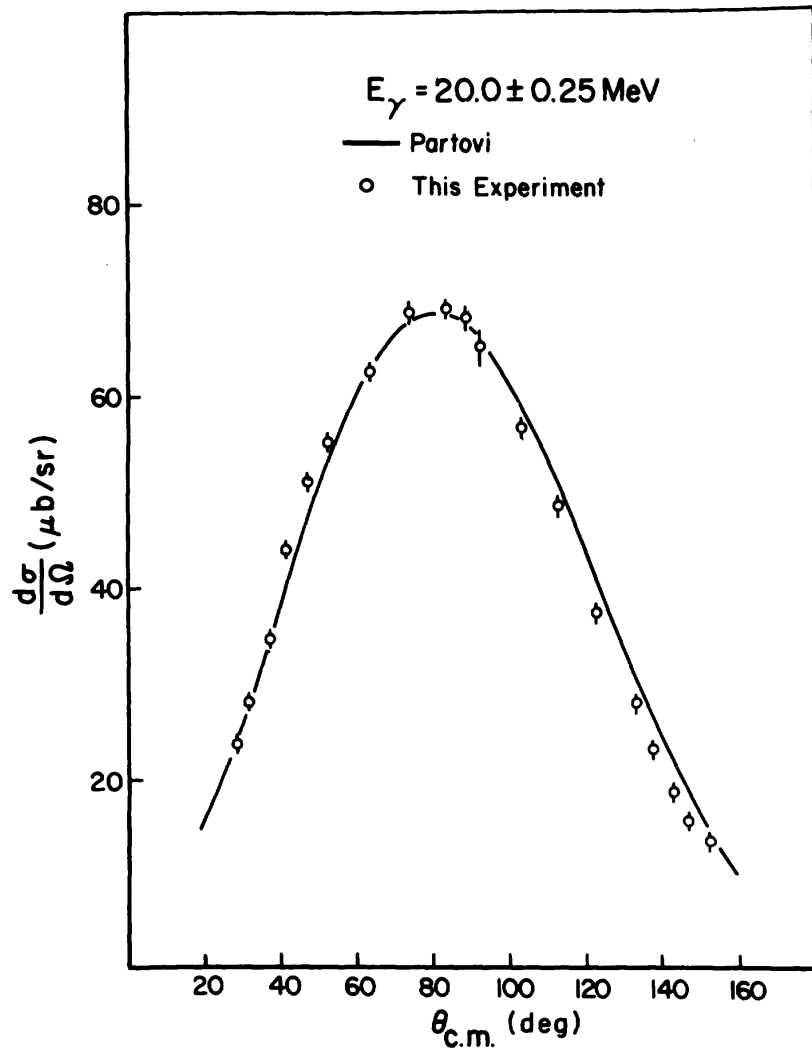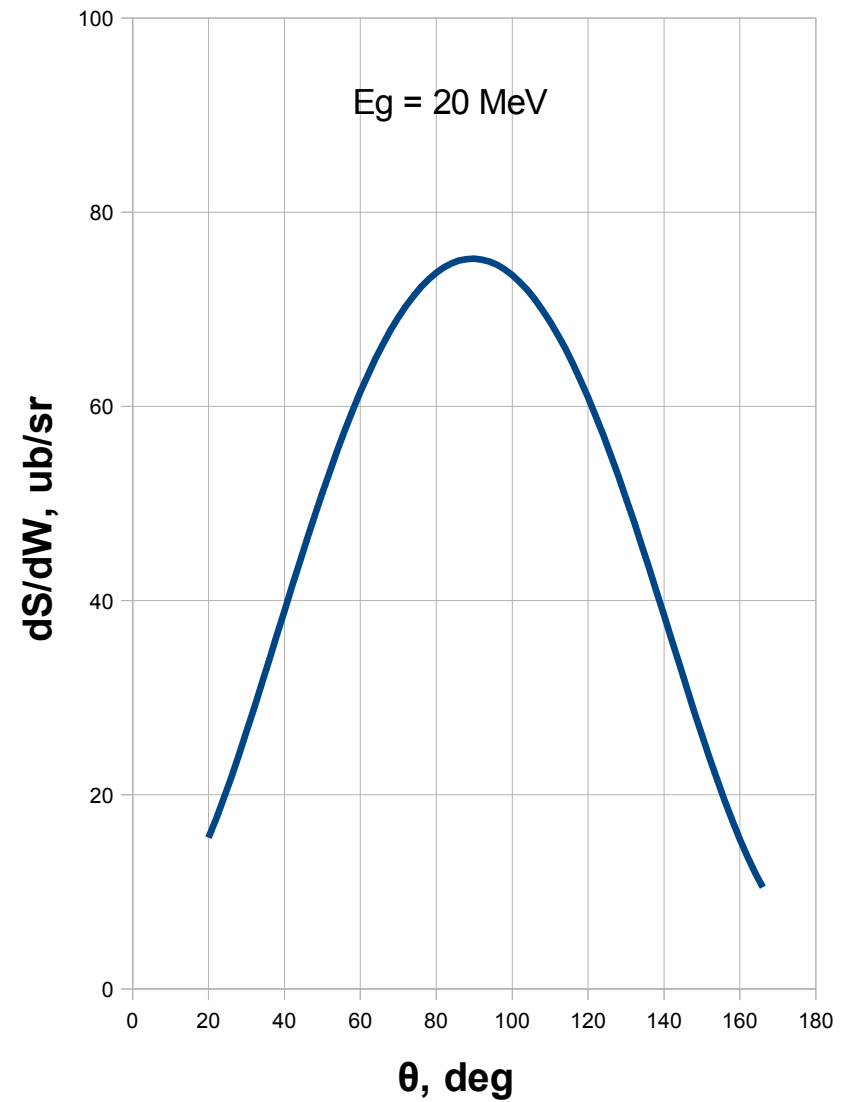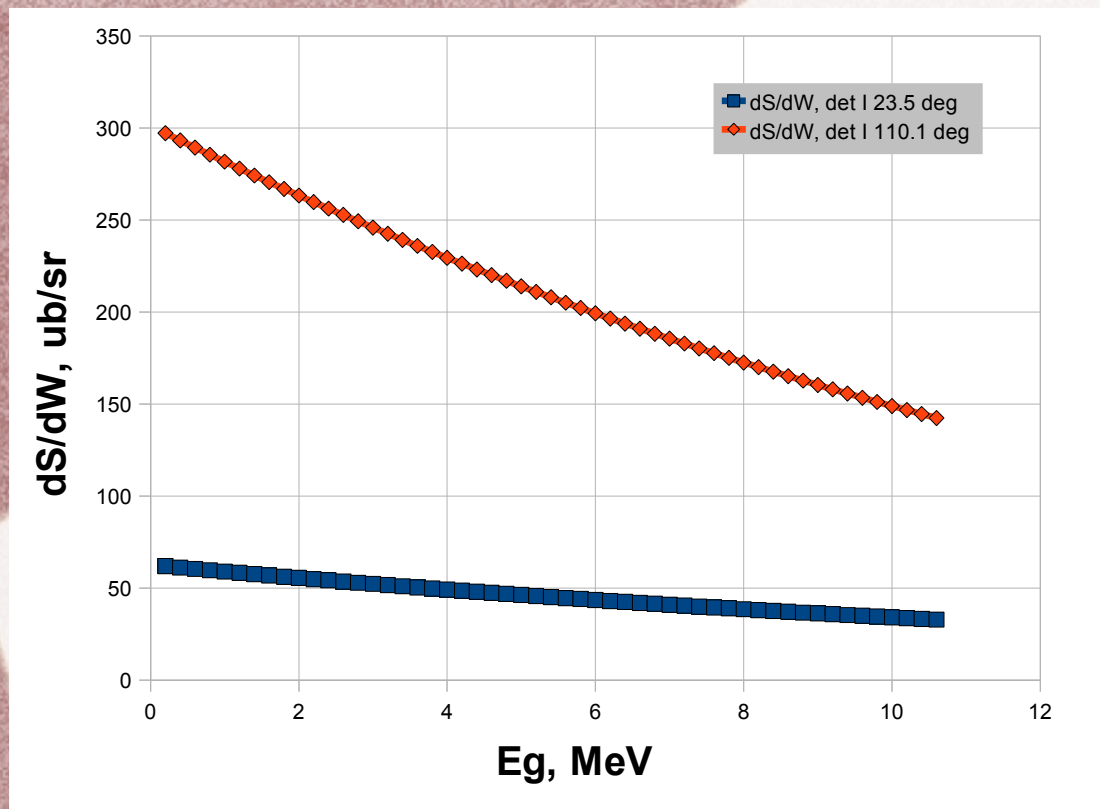**Fig. 9.** Differential crossection of photodisintgration obtained with fitted coefficients form Patrovi's paper.

[***] V. P. Likhachev, M. N. Martins, Yu. A. Kasatkin, M. T. F. da Cruz, J. D. T. Arruda-Neto, R. Guarino, V. B. Shostak, *Disintegration of the Deuteron by Tagged, Linearly-Polarized Photons: Sensitivity of the Differential Cross Sections*, Braz. J. Phys. vol. 27 no. 3 São Paulo Sept. 1997
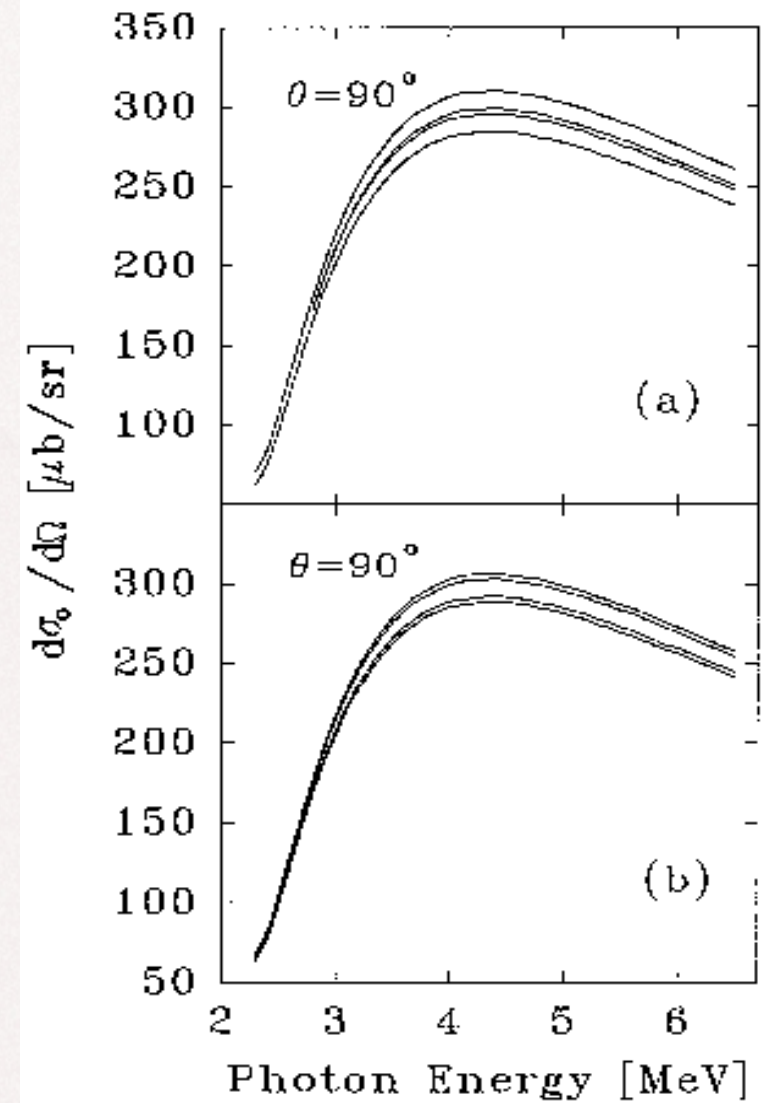
Fig. 10. Differential crossection of photodisintgration around the reaction threshold [***].

[***]

- "This work shows that, <u>in the near-threshold energy region, where discrepancies between different models do exist</u>, there are no experimental data with enough accuracy to resolve those discrepancies."

- "Angular distributions of differential cross sections, which contain information about the multipolarity of the transitions, are also completely absent."

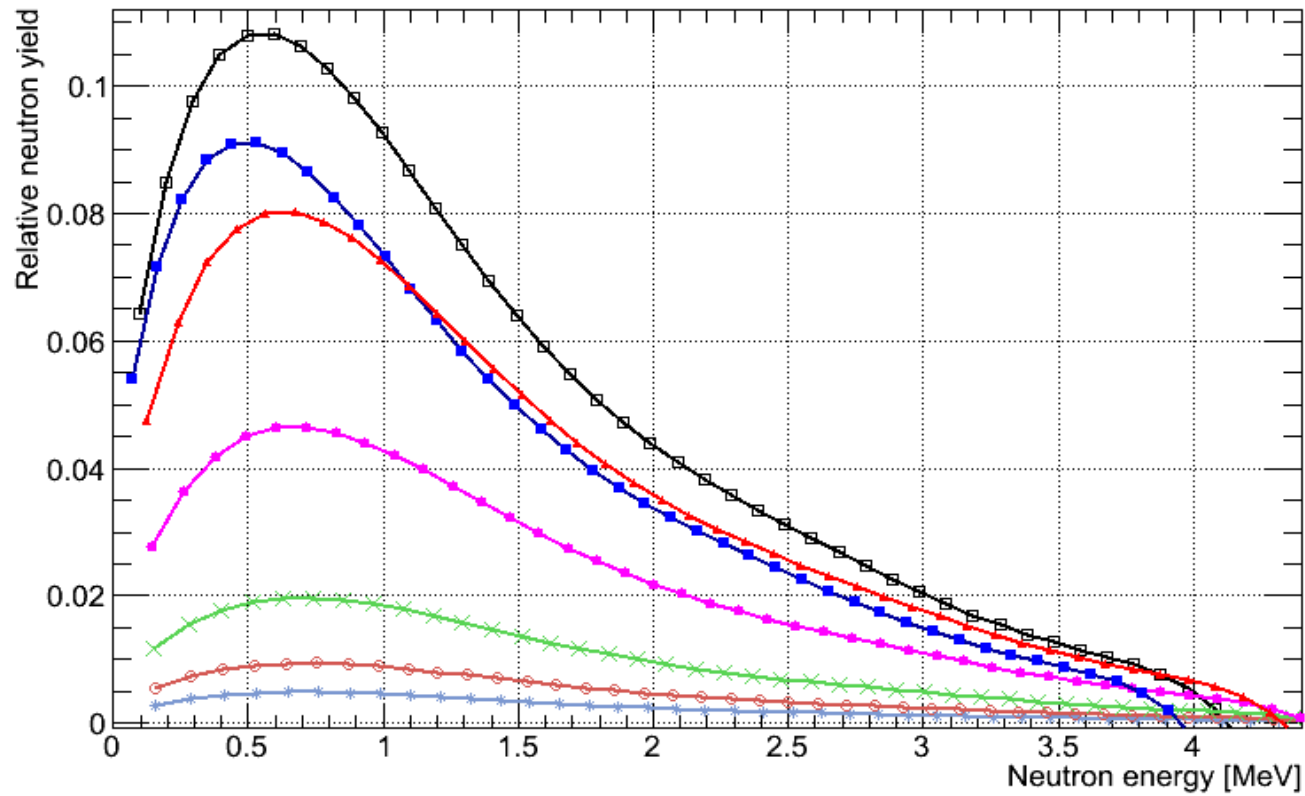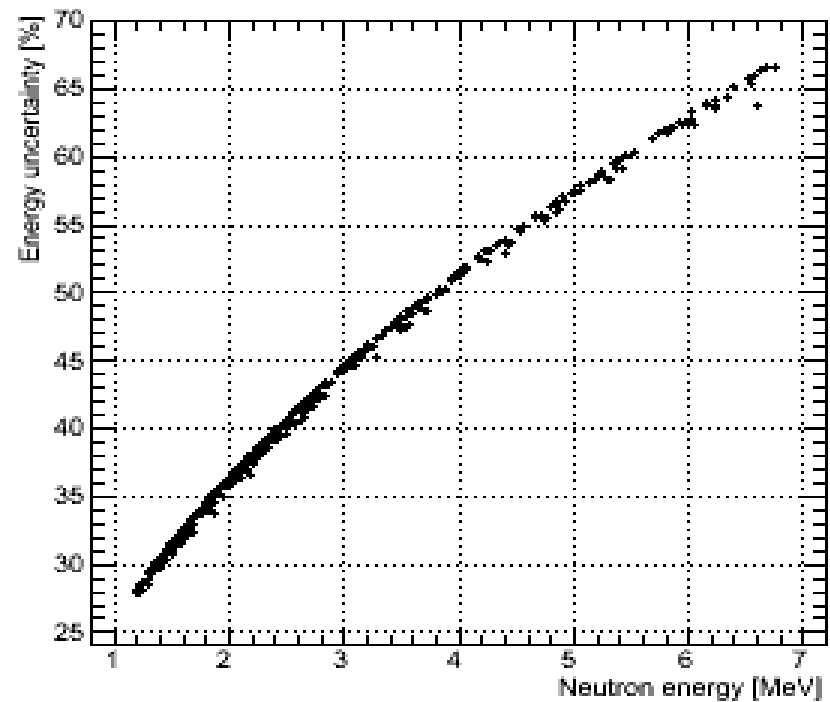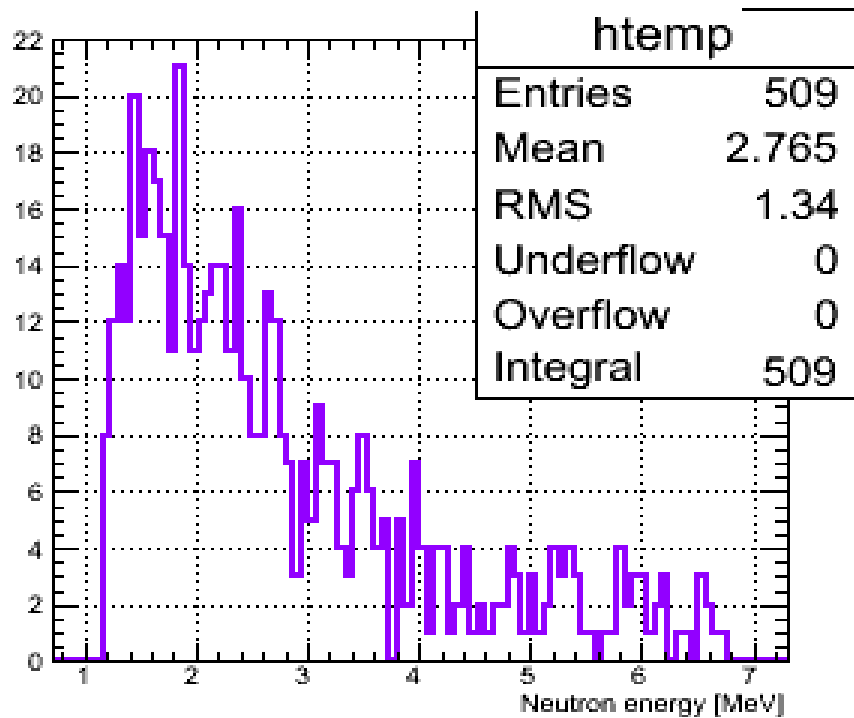**Fig. 11.** Relative neutron yield for each of the neutron detectors obtained by weighting the neutron spectra with flux weighted total disintegration crossection and solid angles.

Experimental neutron energy spectrum for Det E (left picture) and corresponding uncertainties (right picture) .

$$N_{detected}^{Det\,i} = N_{incident}^{Det\,i} \cdot \epsilon_i$$

$$N_{detected}^{Det\,j} = N_{incident}^{Det\,j} \cdot \epsilon_j$$

$$\frac{N_{incident}^{Det\,i}}{N_{incident}^{Det\,j}} = \frac{Area_i}{Area_j}$$

$$\frac{N_{detected}^{Det\,i}}{N_{detected}^{Det\,j}} = \frac{Area_i}{Area_j} \cdot \frac{\epsilon_i}{\epsilon_j}$$

$$\frac{\epsilon_i}{\epsilon_j} = \frac{N_{detected}^{Det\,i}}{N_{detected}^{Det\,j}} \cdot \frac{Area_j}{Area_i} = k_{ij}$$

$$\epsilon_i = k_{ij} \cdot \epsilon_j$$

The absolute efficiency of Det E was measured to be $\epsilon_E = 14\%$,hence the rest of the efficiencies can be found.

- Partovi's calculation works well in the photon energy region above threshold value of photon energy in the photodisintegration reaction of D2.

- Different model describing differential cross section of D2 photodisintegration reaction near threshold value is needed.

- The efficiency can be defined once the differential cross section is known.