

Why zero asymmetry?

- Composition of depleted uranium (fraction by mass):

U-238 -- 99.8%

U-235 -- 0.2%

U-234 -- 0.001%

- Notation used:

$\sigma(\gamma, F)$ is total photofission cross section;

$\sigma(\gamma, xn)$ is photoneutron yield or production cross section;

$\sigma(\gamma, 1nx)$ is the sum of cross sections that have a single neutron in the final state ($1n + 1np + 1n\alpha + 1n + \dots$).

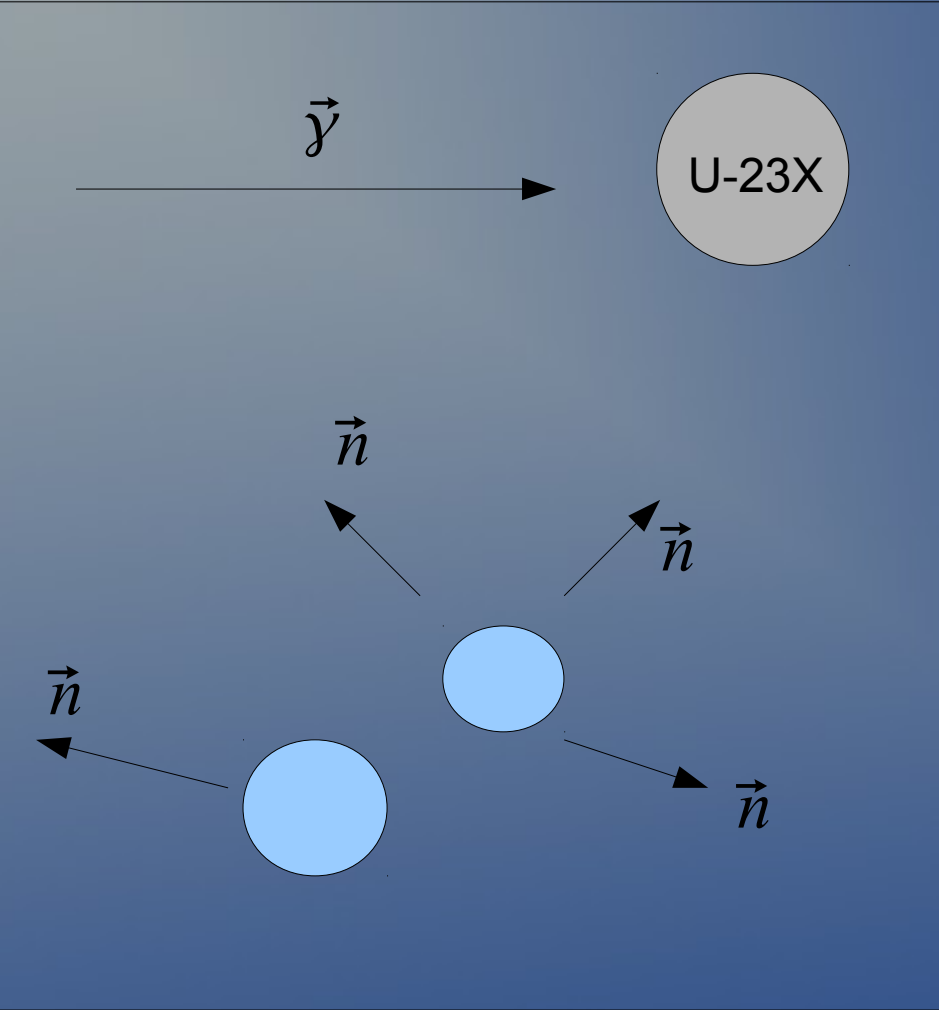


Fig. 1. Photofission process.

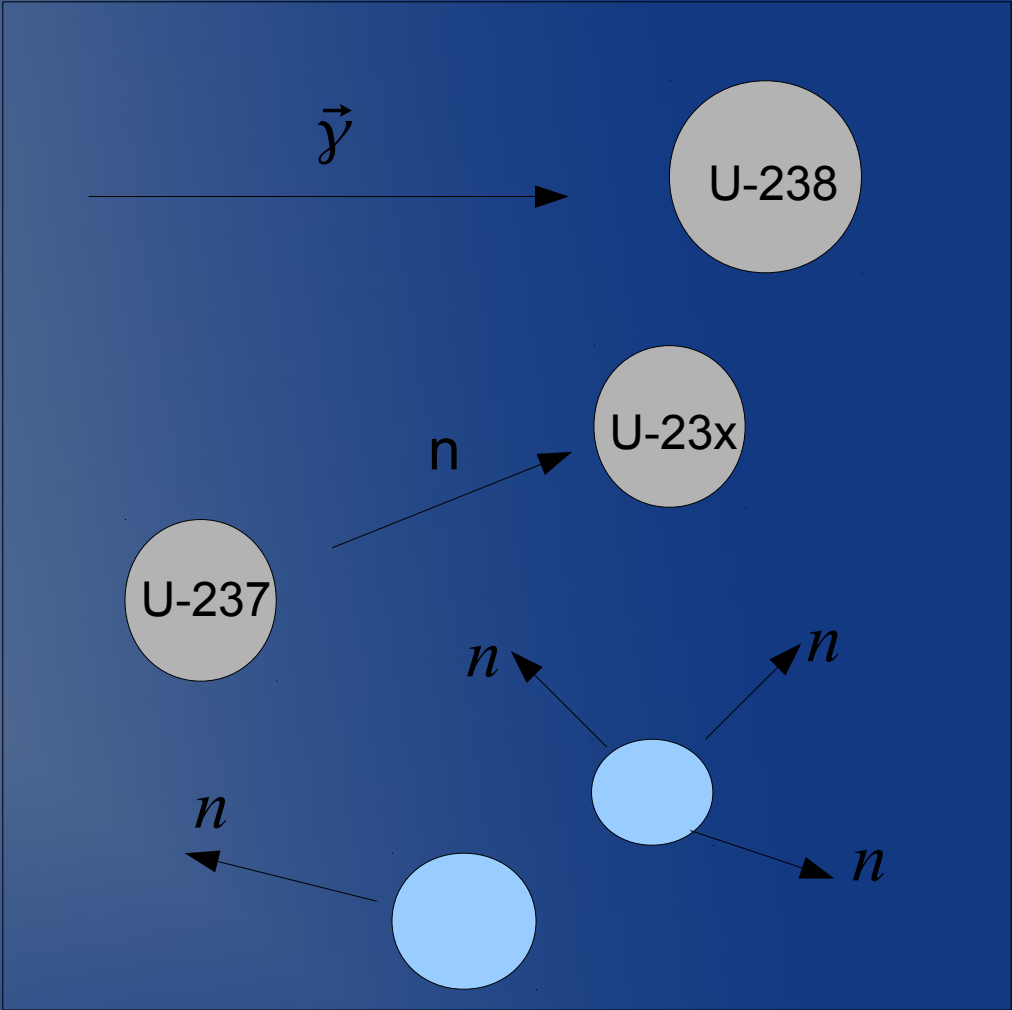


Fig. 2. Neutron knock out and neutron fission.

U-238

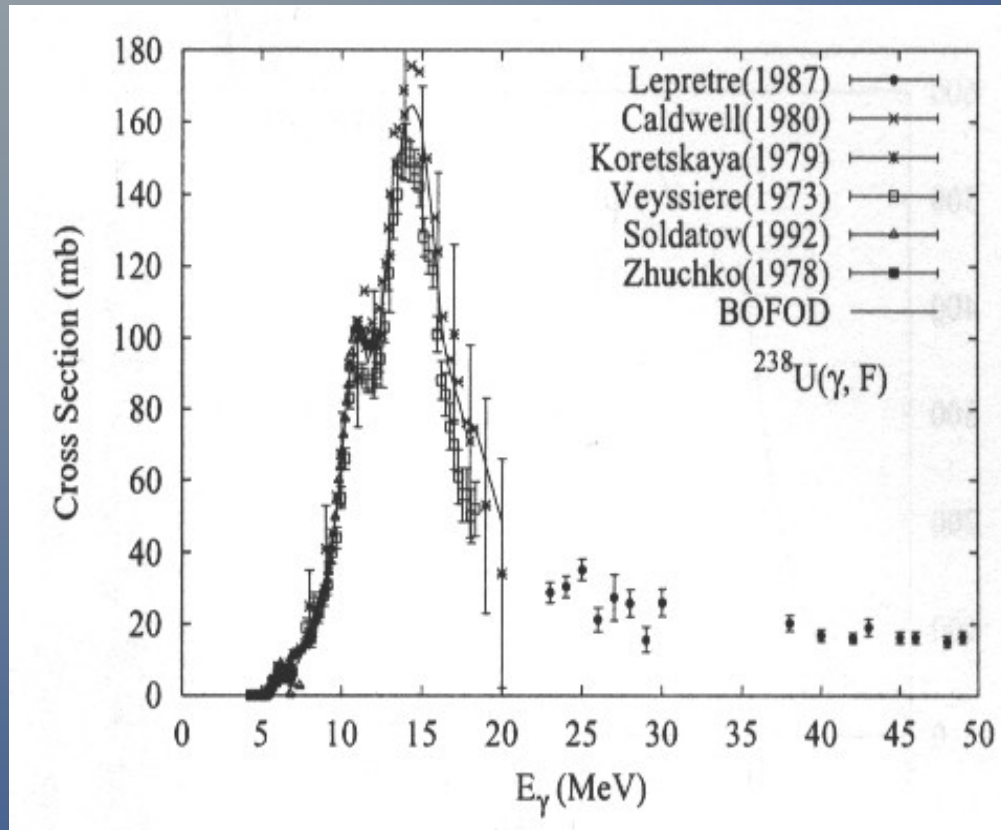


Fig. 3. Photofission cross section for U-238 [*].

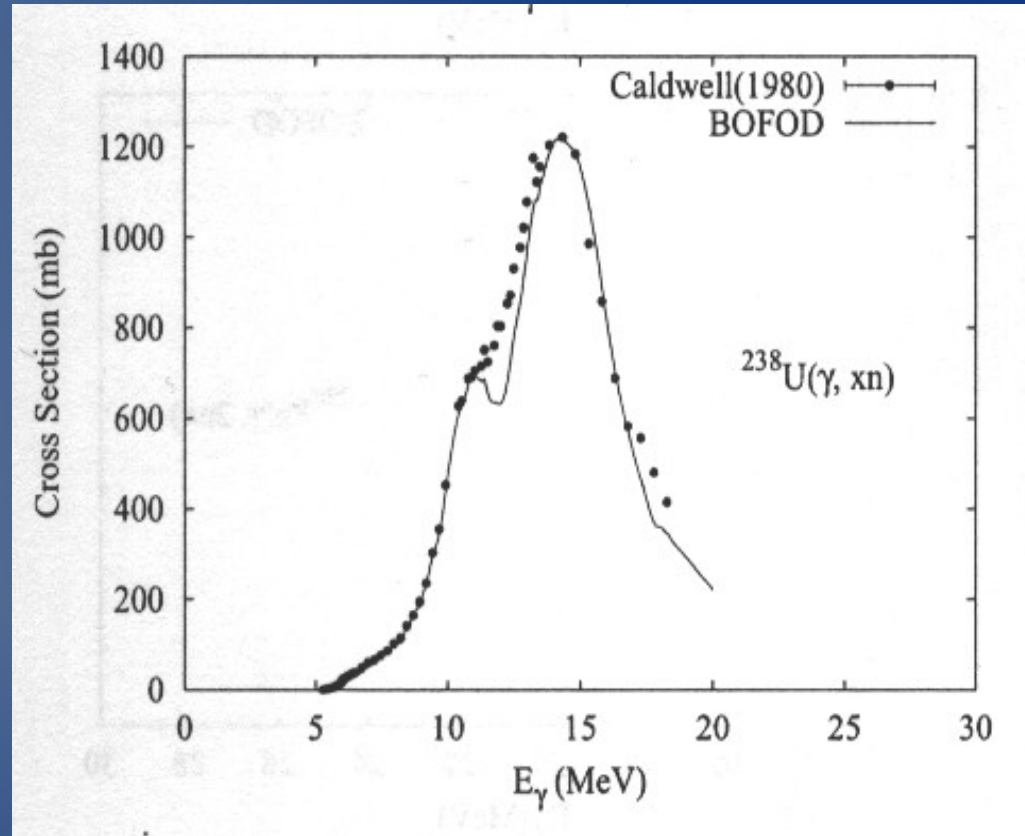


Fig. 4. Neutron photoproduction cross section for U-238 [*].

U-235

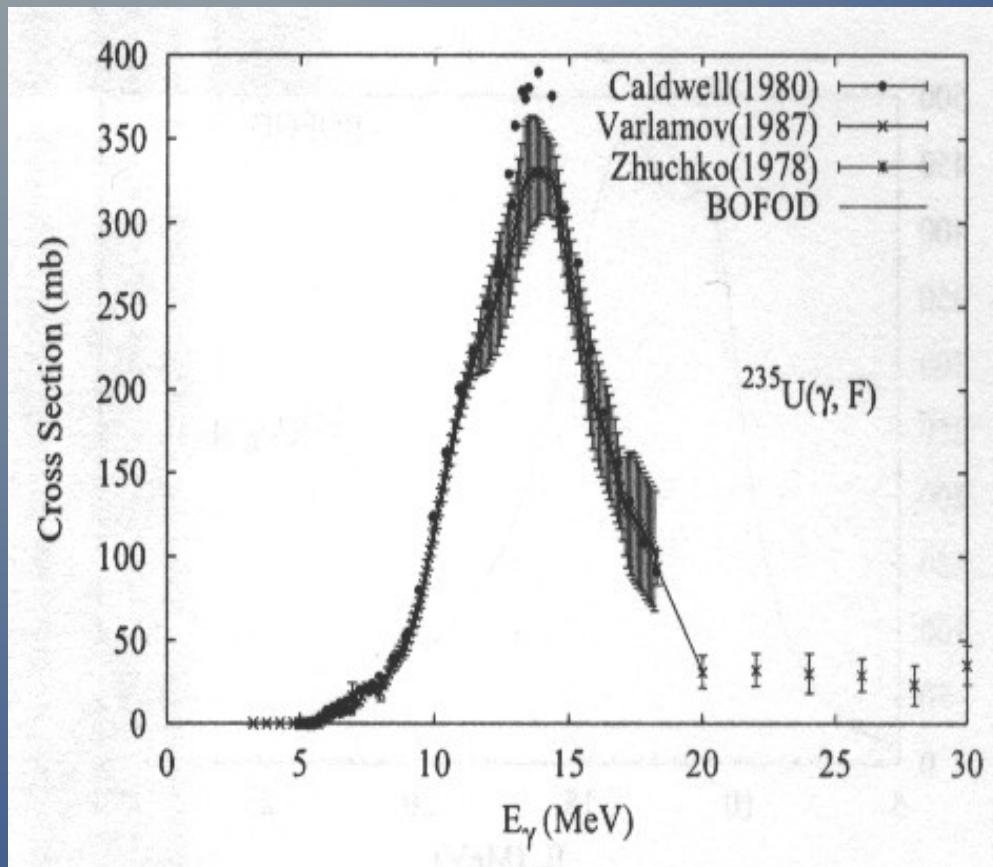


Fig. 5. Photofission cross section for U-235 [*].

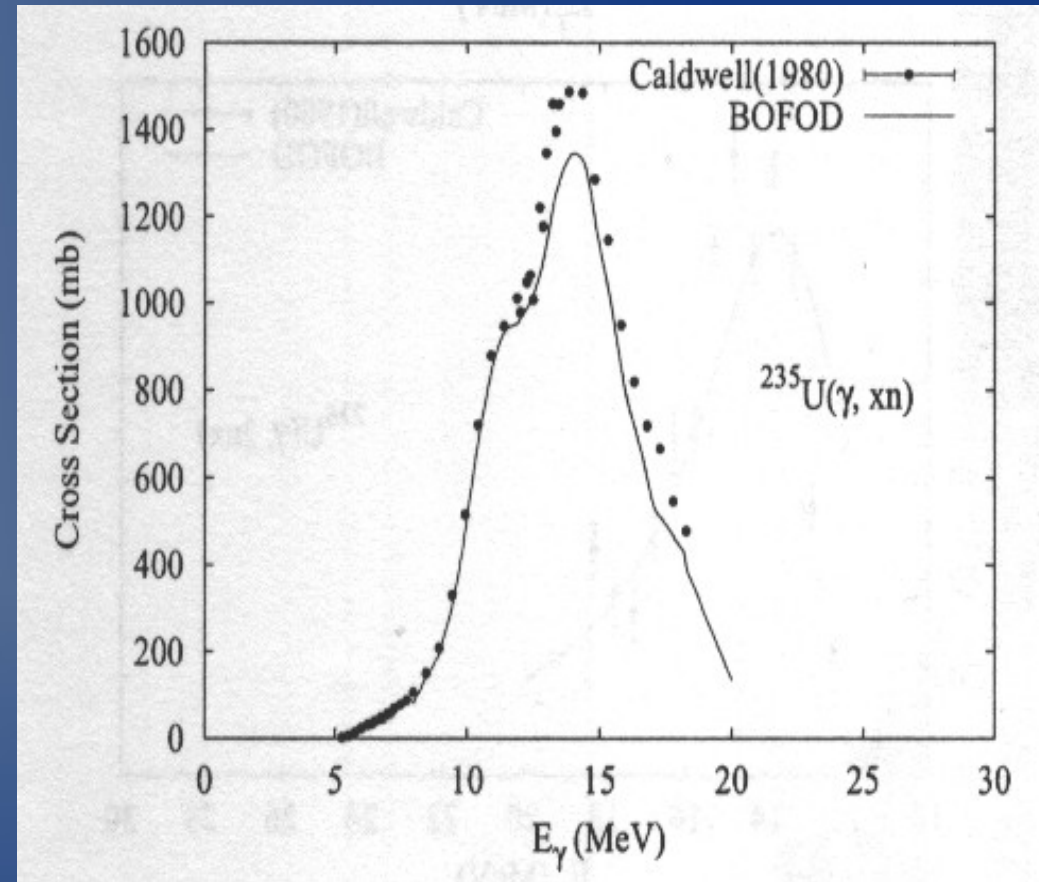


Fig. 6. Neutron photoproduction cross section for U-235 [*].

U-234

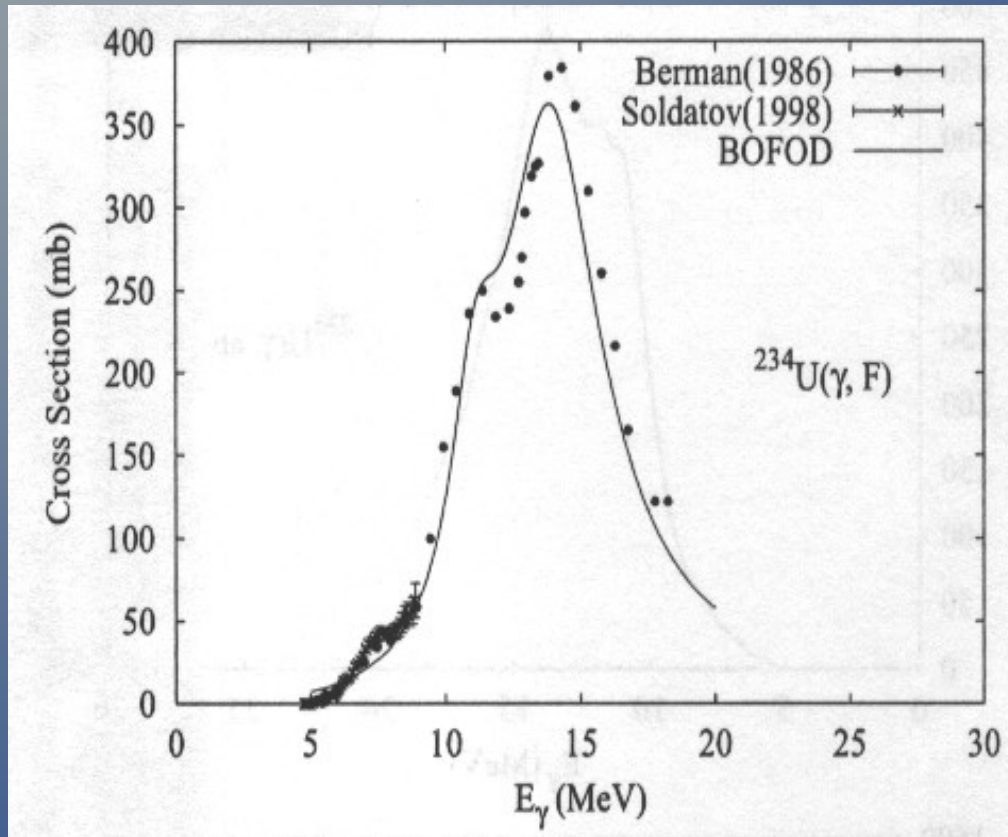


Fig. 7. Photofission cross section for U-234 [*].

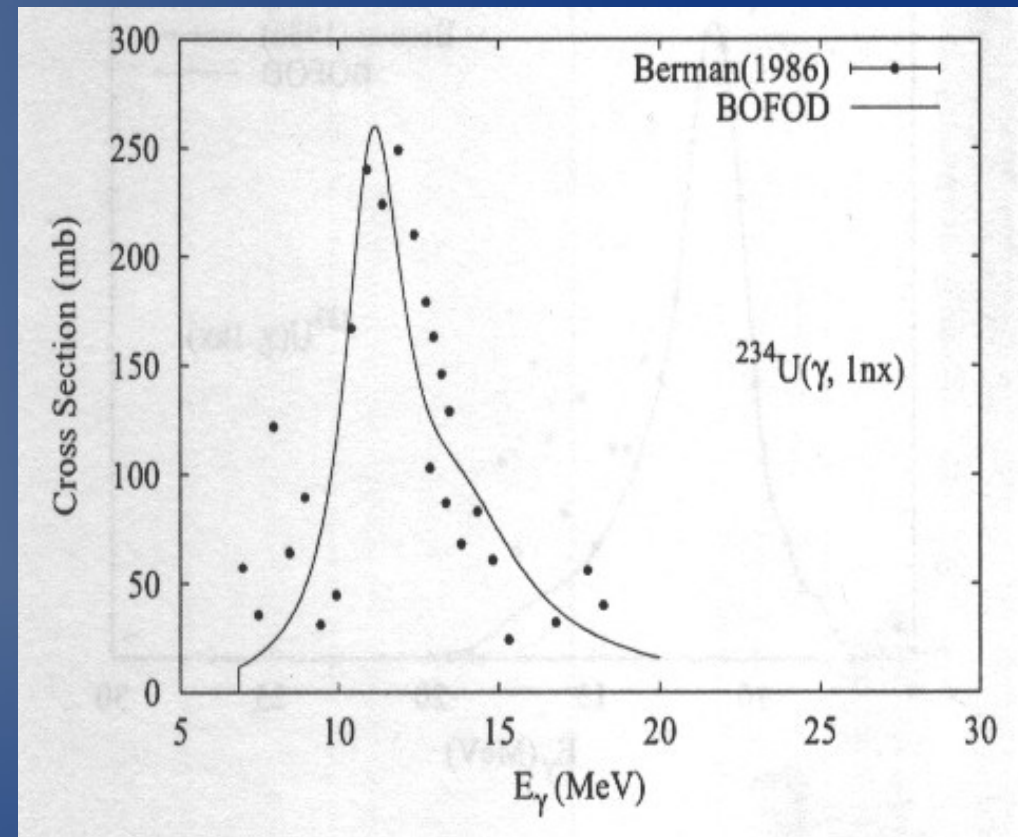


Fig. 8. Neutron photoproduction cross section for U-234 [*].

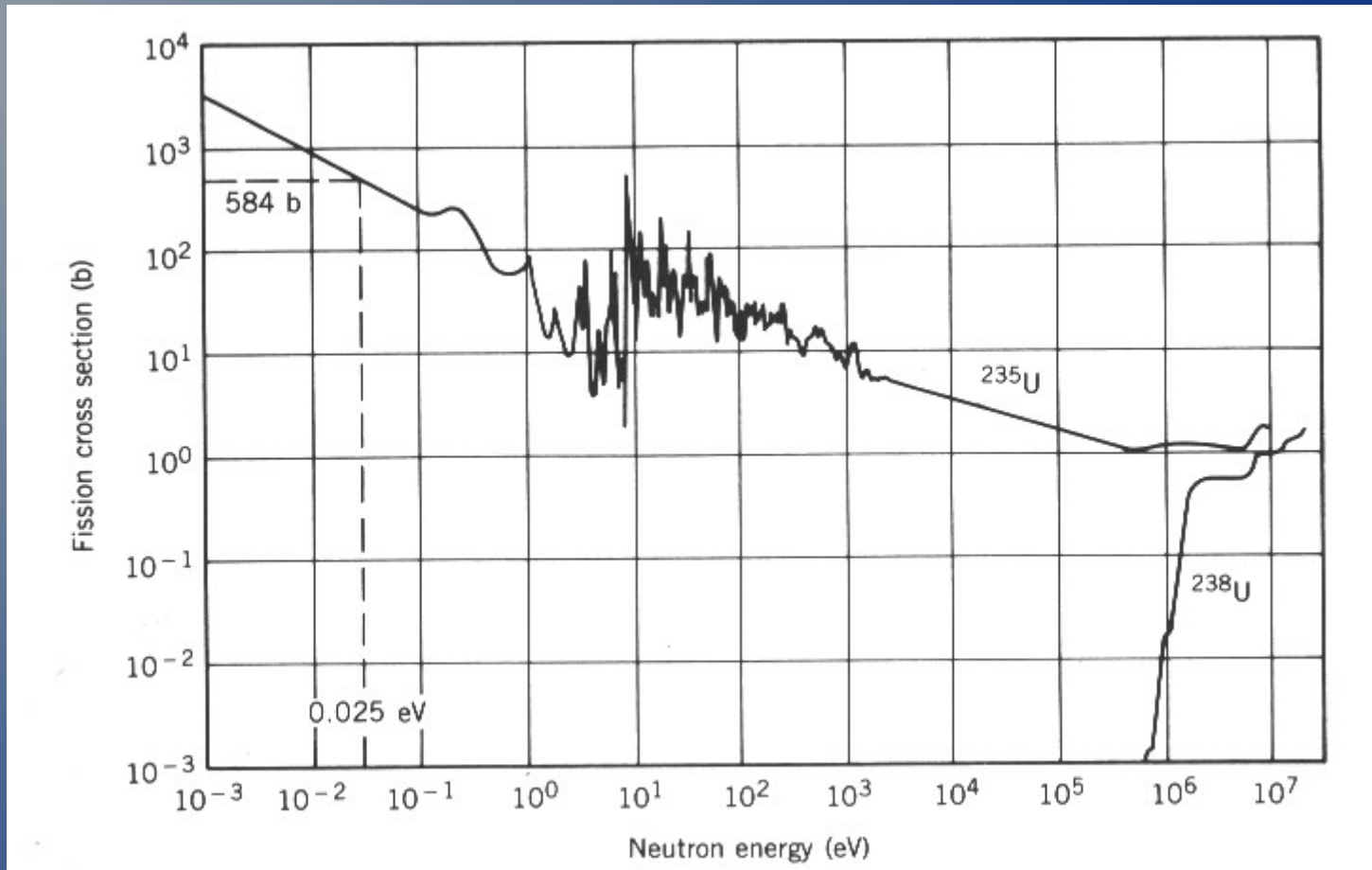


Fig. 9. Neutron fission cross section for U-235 and U-238 [***].

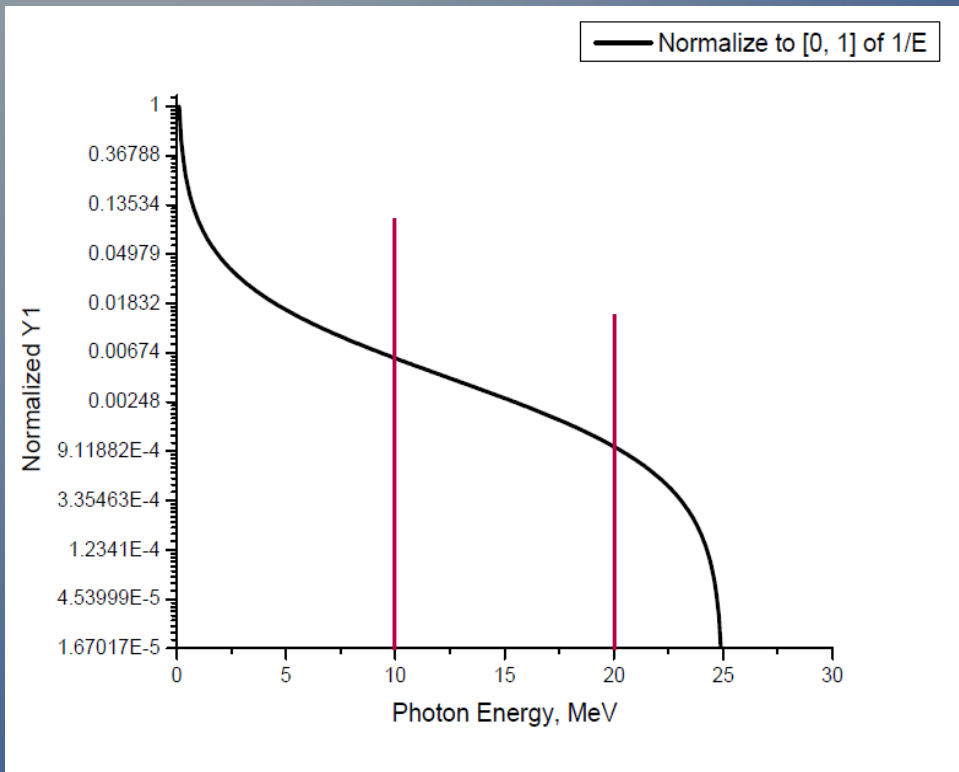


Fig. 10. Bremsstrahlung spectrum with 25 MeV end-point.

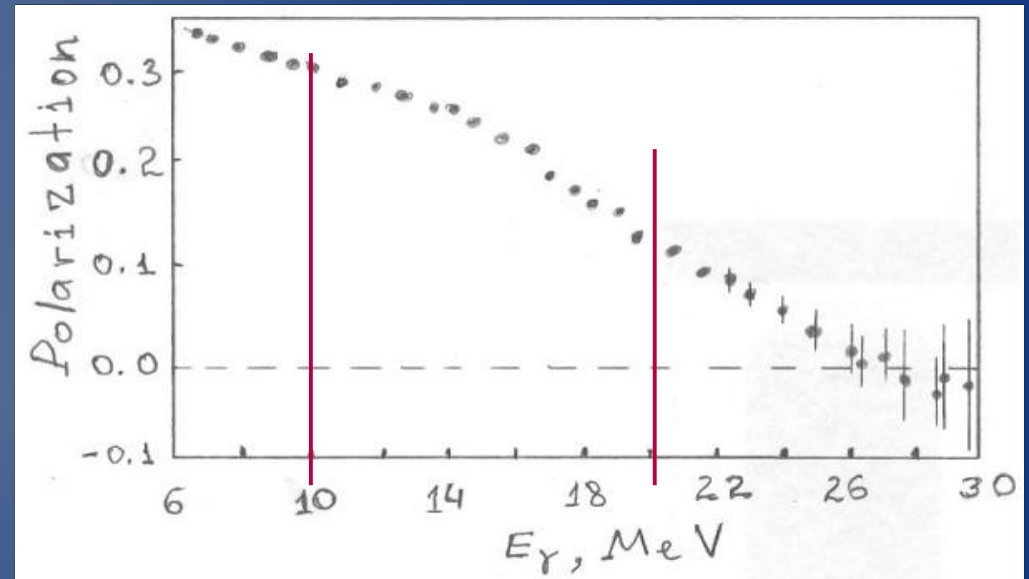


Fig. 11. Polarization of photons VS photon energy [**].

Conclusions:

- Neutron yield from $\sigma(\gamma, xn)$ reaction is ~ 10 times higher than $\sigma(\gamma, F)$ reaction for all the components of DU;
- The neutrons from $\sigma(\gamma, xn)$ reaction do not carry the information on the photon polarization;
- Hence, our neutron angular asymmetry may not show visible asymmetry;
- Polarization degree changes in the whole range of photon energies which may lead to smearing the asymmetry;
- One of the possible ways to overcome the problem is to use fission chamber and trigger the DAQ system on the event of photofission.

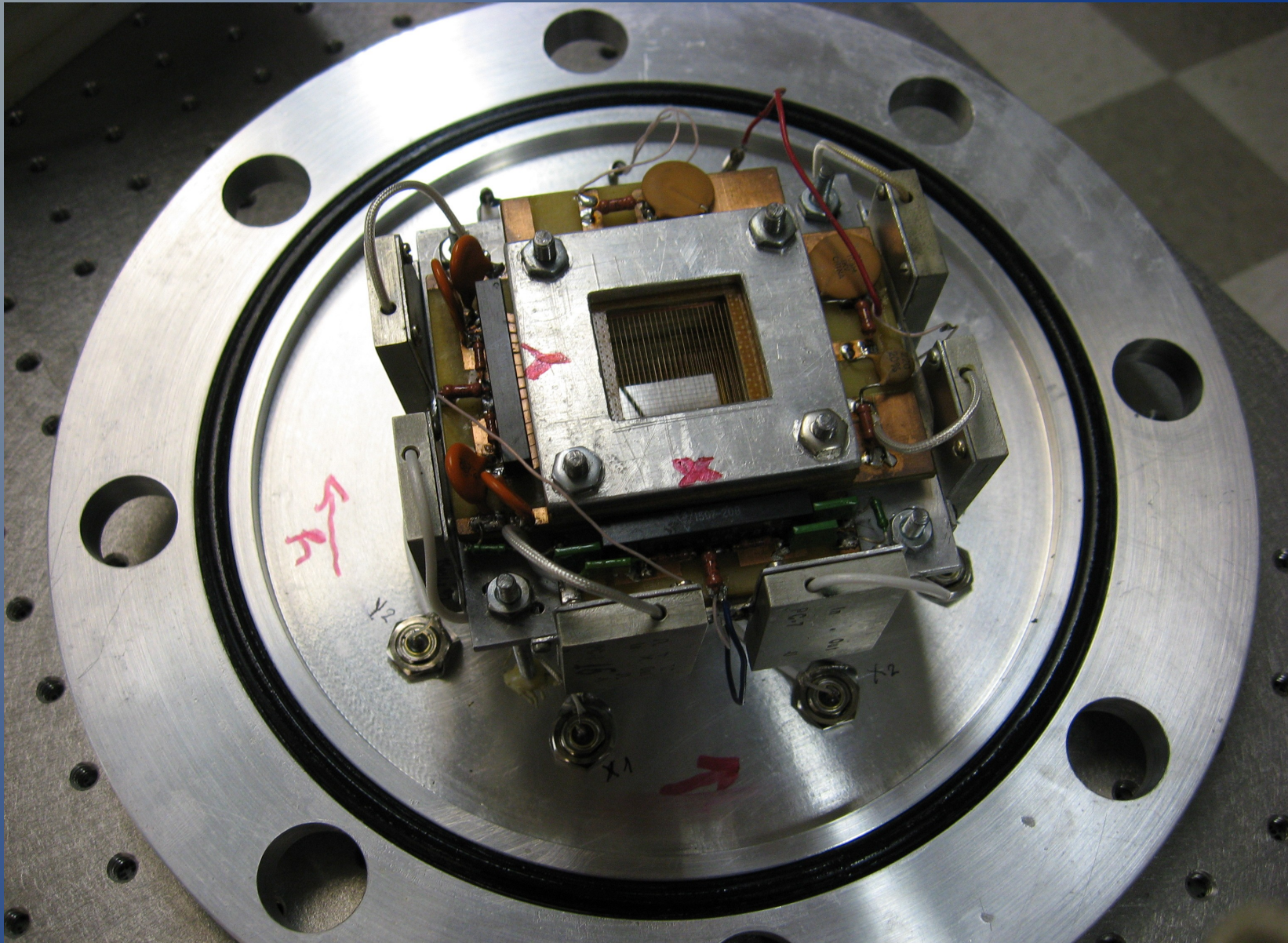


Fig. 12. Wire chamber used to detect fission fragments. The detector built by Armenian group from ERPHI.

Experiment performed at IAC in August, 2007 together with the group from ERPHI.

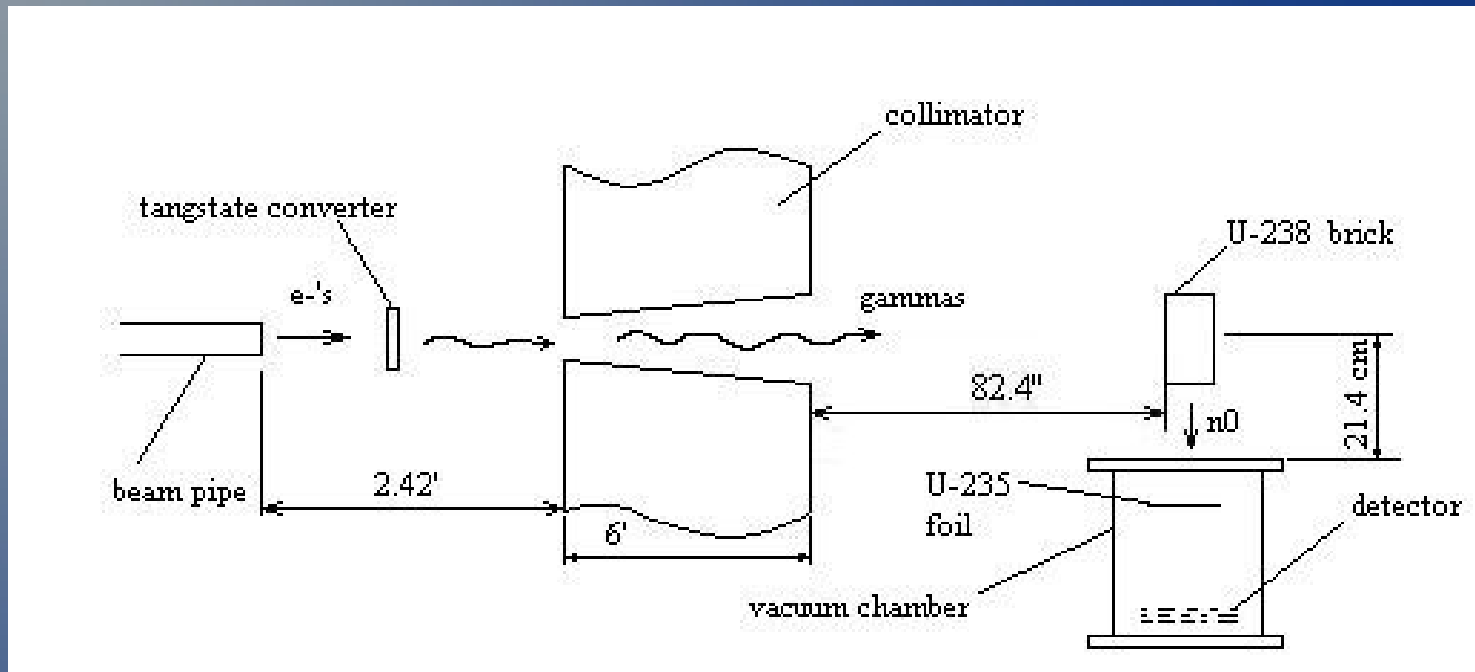


Fig. 12. Experimental setup on detection fission of U-235 by neutrons produced in photofission of U-238 (DU).

References

[*]. *Handbook on photonuclear data for applications. Cross-sections and spectra.* IAEA, 2000.

[**]. Ulrich E. P. Berg and Ulrich Kneissl, *Recent Progress on Nuclear Magnetic Dipole Excitations*, *Ann. Rev. Nucl. Part. Sci.* 1987.37:33-69.

[***]. Kenneth S. Krane, *Introductory Nuclear Physics*, WILEY.