The possibility of applying unfolding techniques to photo-nuclear reactions

N. Jovancevic[1], Z. Medic[2], M. Krmar[1], D. Maletic[2], D. Knezevic[2], Y. Teterev[3], S. Mitrofanov[3], A. Belov[3], Alexey Zhemchugov[3], S. Abou El-Azm[3], M. Gostkin[3], V. Kobets[3], U. Kruchonak[3], A. Nozdrin[3], S. Porokhovoy[3], M. Demichev[3]

[1]Physics Department, Faculty of Sciences, University of Novi Sad, Novi Sad, Serbia
[2]Institute of Physics, Belgrade, Serbia
[3]Joint Institute for Nuclear Research, Dubna, Russia

Unfolding techniques

$$A = \int_{E_{th}}^{E_{max}} \sigma(E) \cdot \Phi(E) \cdot dE$$

Cross section measurement

- Activations with known photon spectra with different end point energy

- Gamma spectroscopy measurement

- Unfolding procedure

Cross-section function for the ^{115}In(γ,γ')^{115m}In

Photon spectra determination

- Using of different photo-induced nuclear reactions with well known cross section

- Gamma spectroscopy measurement

- Unfolding procedures

Bremsstrahlung spectra of LINAC200

The cross-section function for the $^{115}In(\gamma,\gamma)^{115m}In$ reaction in the energy range up to 10 MeV

- Irradiation

MT25 Microtron (FLNR-JINR)

6 In disks were irradiated

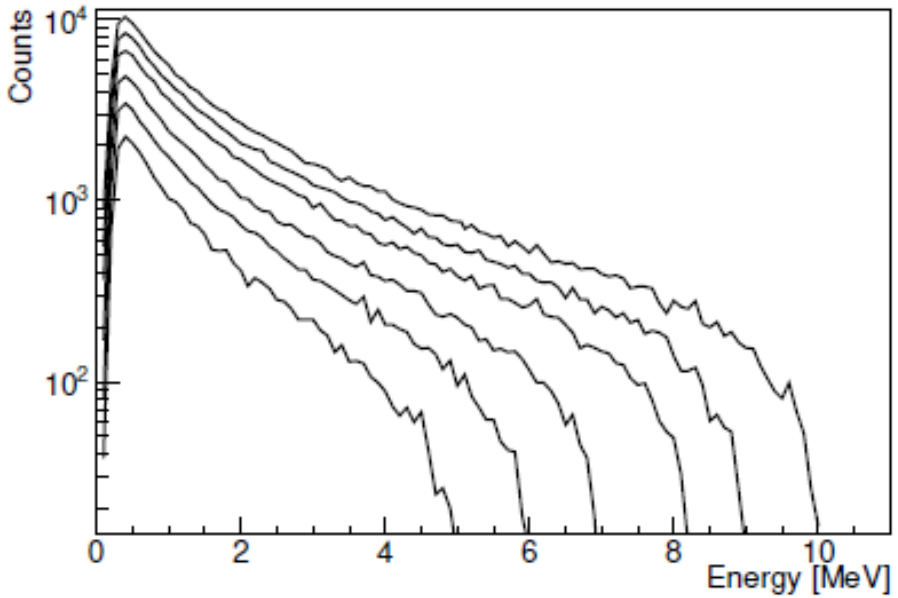
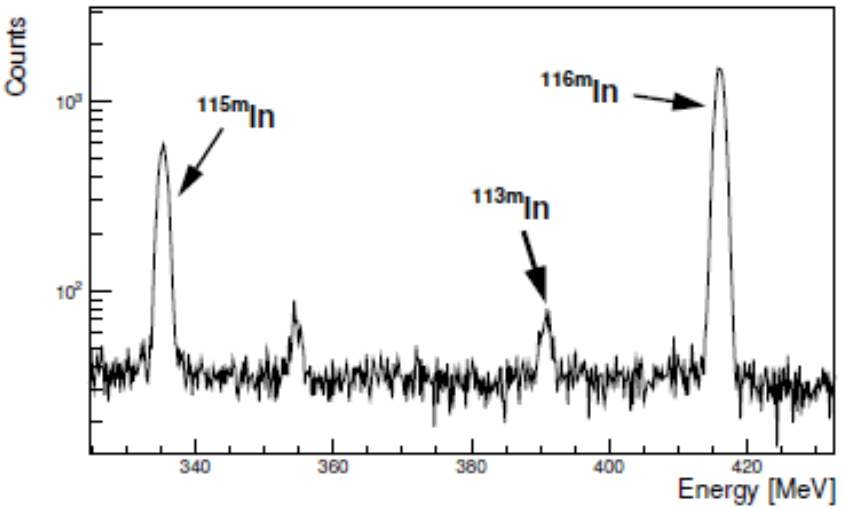


FIG. 3: Spectra of photon flux on the indium disks for all electrons energies incident on the tungsten radiator.

- Gamma spectroscopy measurement

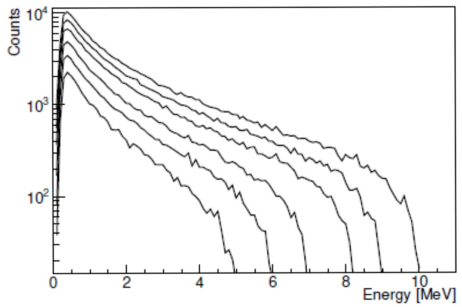
Saturated activity

Disk No.	Energy [MeV]	$A_k[10^{-18}$ Bq/atom]
1	5.00(5)	0.0090(9)
2	6.00(5)	0.044(5)
3	7.00(5)	0.161(7)
4	8.20(5)	0.191(5)
5	9.00(5)	0.87(3)
6	10.00(5)	1.33(3)



The cross-section function for the ^{115}In(γ,γ)^{115m}In reaction in the energy range up to 10 MeV

Unfolding procedure



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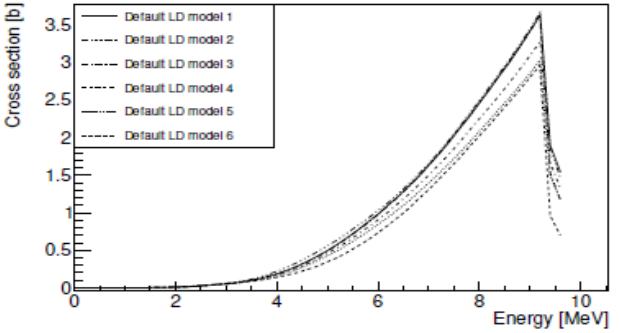


FIG. 6: Default functions for the ^{115}In(γ, γ')^{115m}In cross-section obtained by TALYS 1.9 for six different level density models (for details see text).

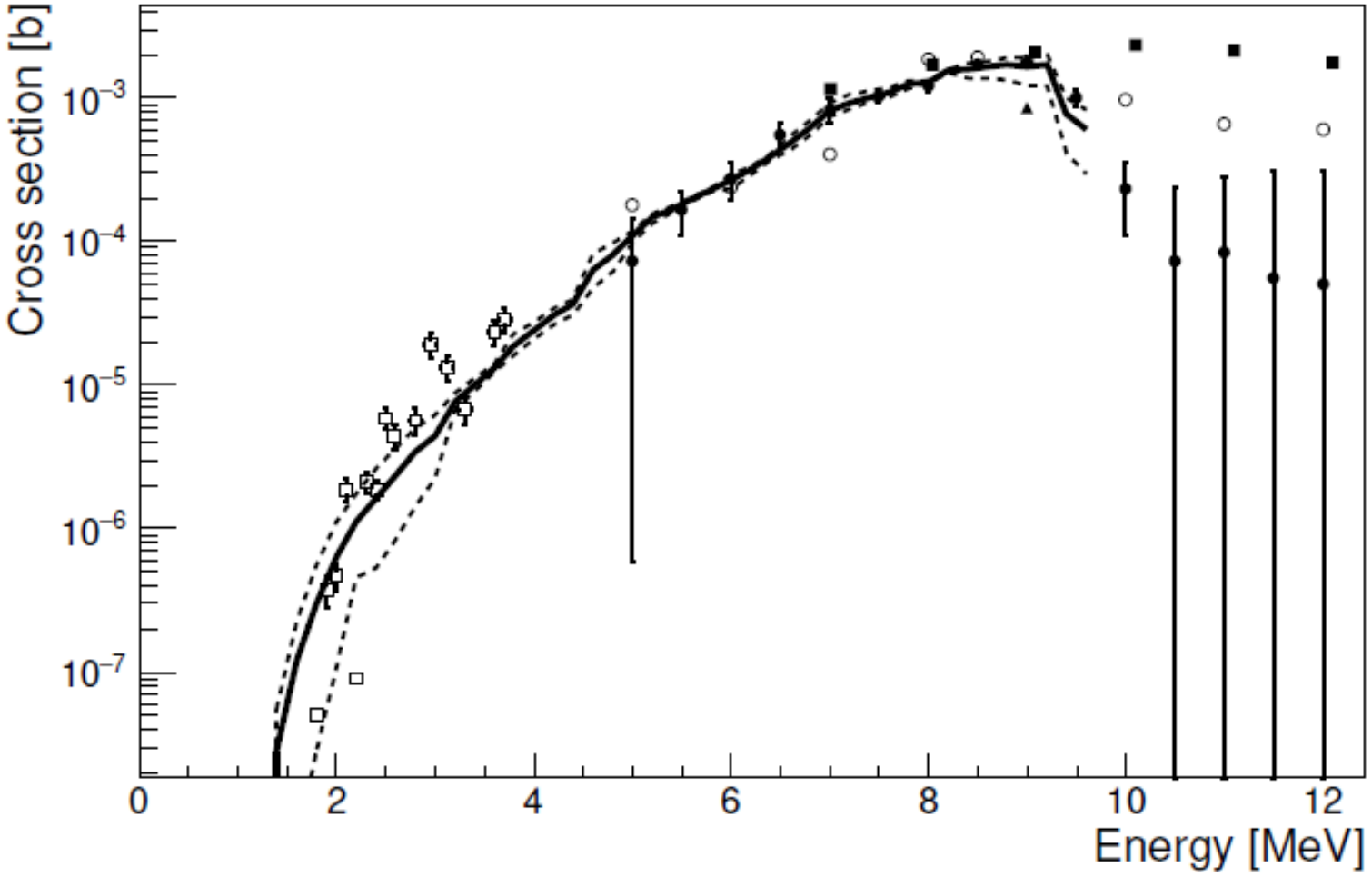
Photon spectra — **Saturated activity** — **Default function**

Unfolding algorithm (SANDII, GRAVEL, MAXED)

The cross-section function

The cross-section function for the $^{115}In(\gamma,\gamma)^{115m}In$ reaction in the energy range up to 10 MeV

Unfolding resluts

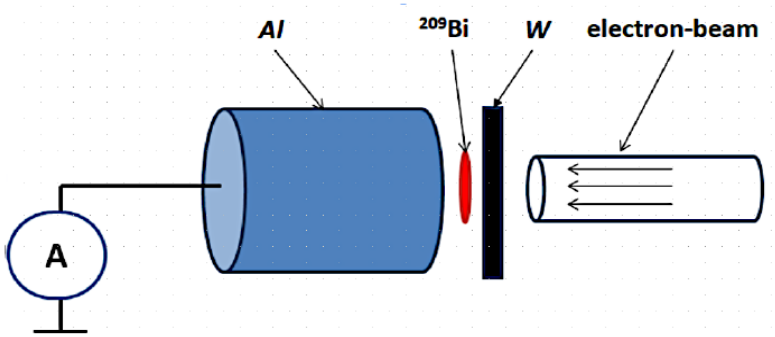


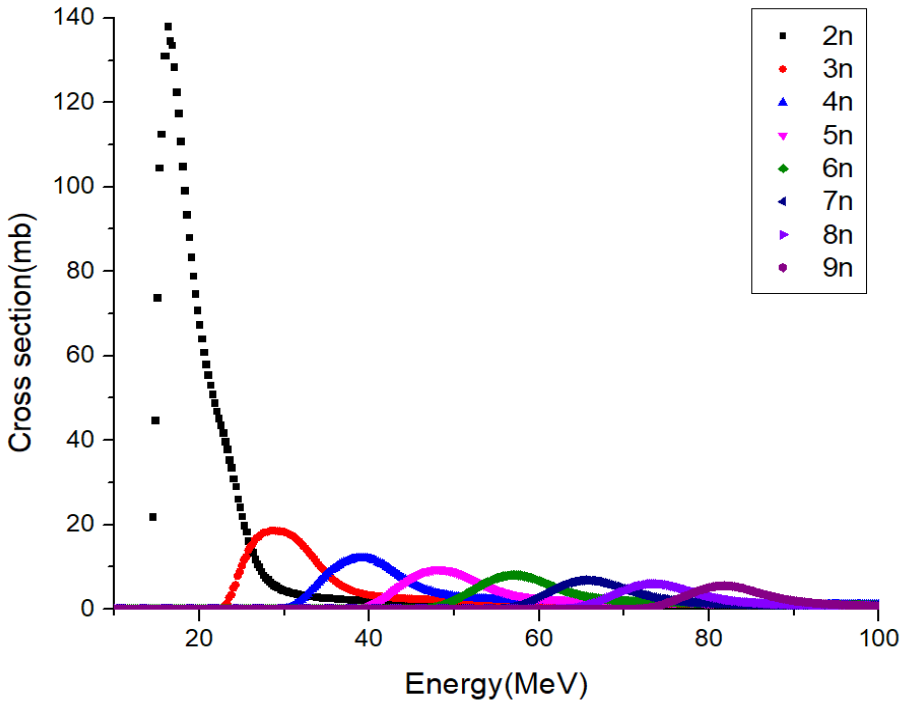
Determination of the photon spectrum

- Irradiation

LINAC200 (JINR)
Bi disk was irradiated (^{209}Bi(g,xn))

- 80 MeV and 100 MeV end point energy





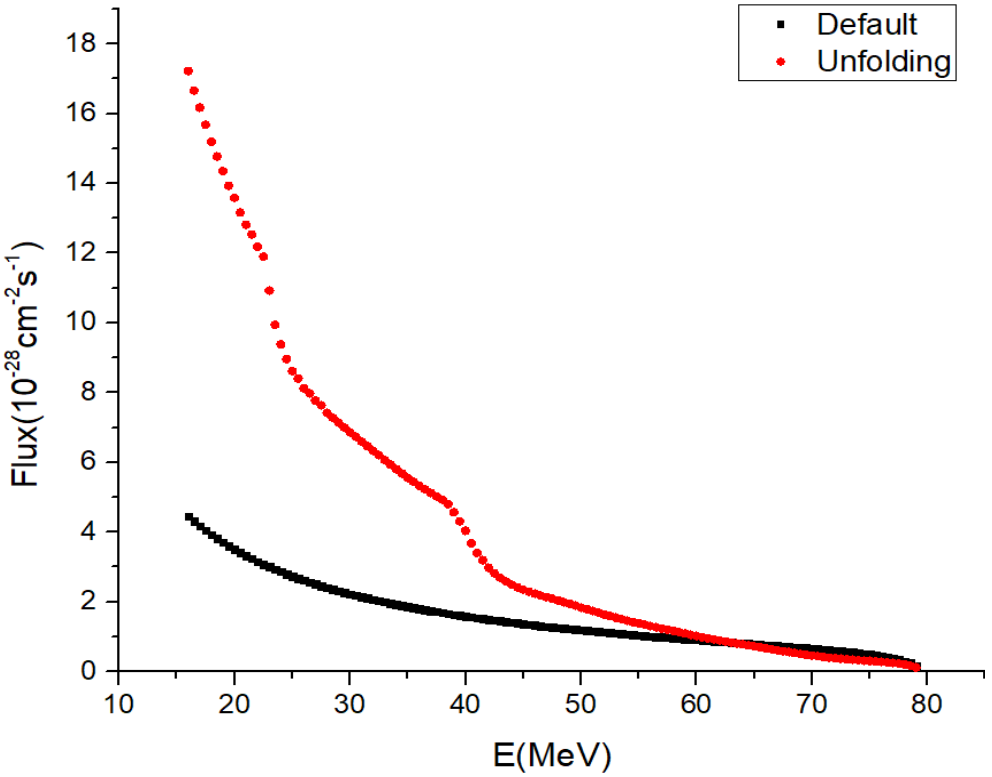
- Gamma spectroscopy measurement

Saturated activity

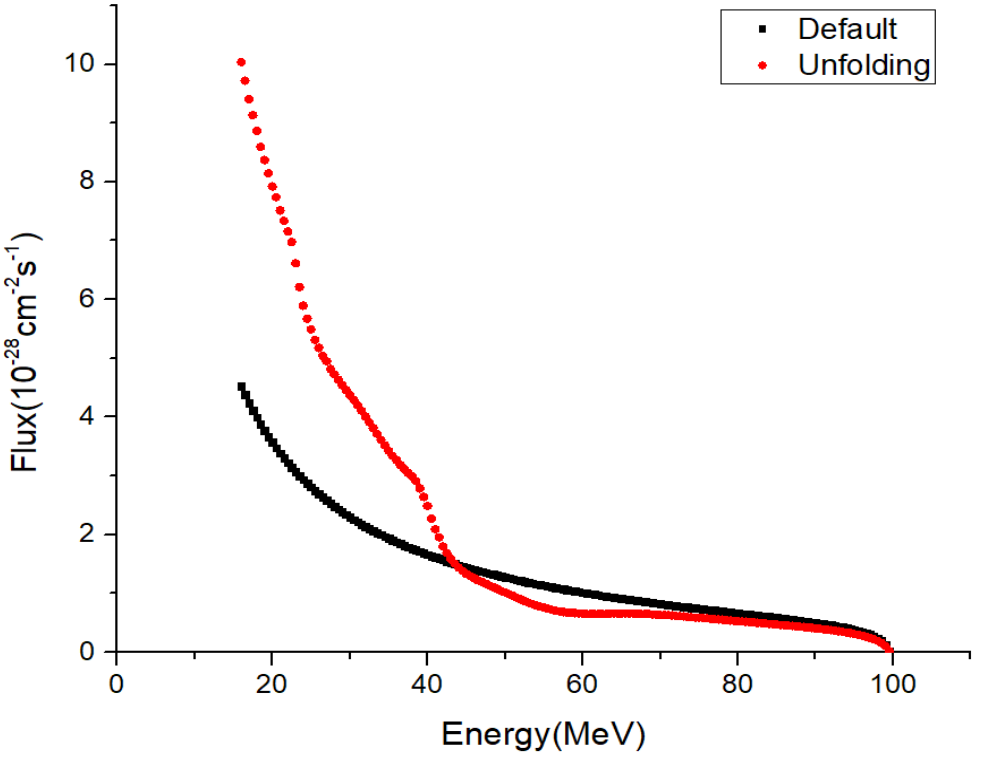
Isotope	Activity (80 MeV)	Activity (100 MeV)
207	7.3(4)	6.7(3)
206	1.00(3)	1.00(3)
205	0.45(2)	0.45(2)
204	0.173(4)	0.177(5)
203	0.087(3)	0.097(4)
202	0.038(2)	0.046(2)
201	0.013(1)	0.020(1)
200	0.0025(5)	**0.0059(7)**

Determination of the photon spectrum

Unfolding resluts



80 MeV endpoint energy



100 MeV endpoint energy