Comparison Between Experimental and Calculation Neutron Spectra of the ^{197}Au (ɣ,n) Reaction for 17 MeV Polarized Photon

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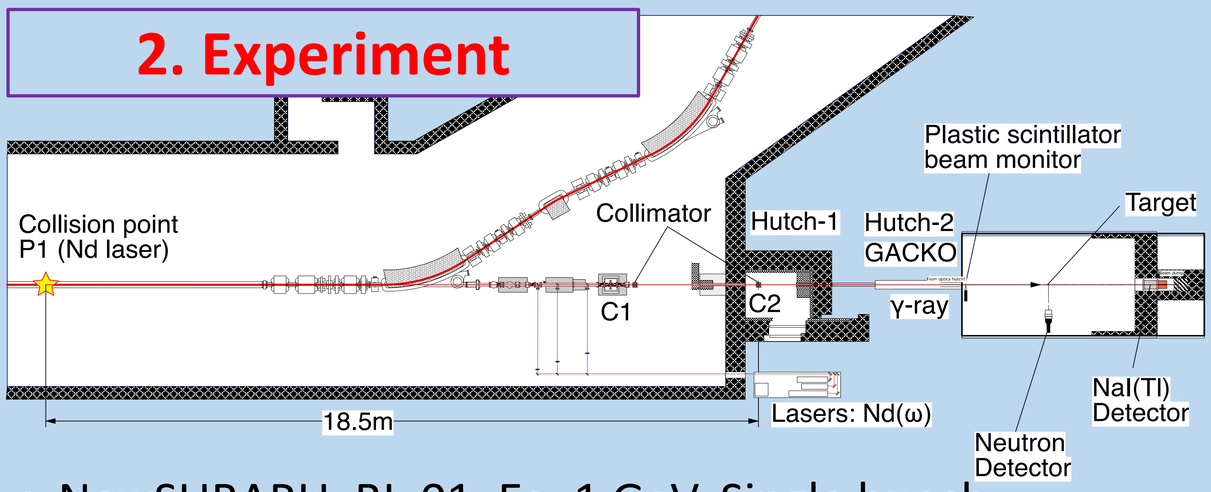
1. Introduction

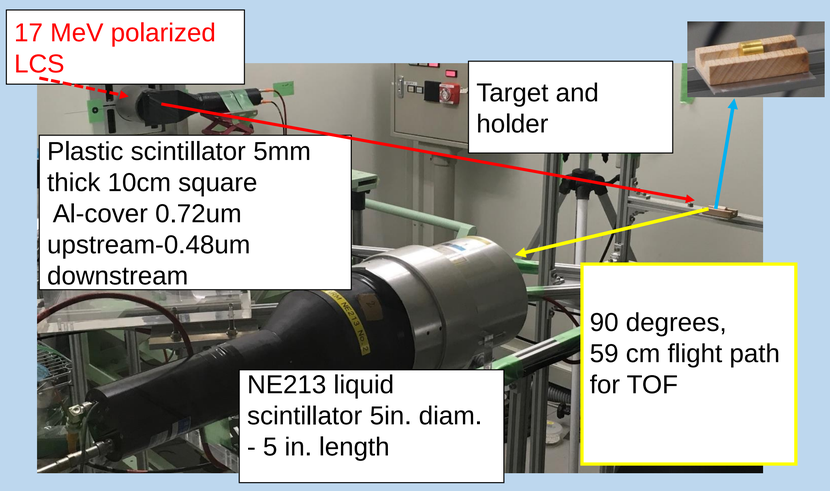
- Neutron spectra for 17 MeV polarized photons on a thick Au target at angles from 30 to 150 degrees [1,2]
- Two components of neutrons, evaporation and direct, with different angular dependence
- To evaluate models and parameters in theoretical calculation, DDX data are required

DDX of the ^{197}Au(γ,n) for 17 MeV polarized photons on a thin target and compared the calculation results

2. Experiment



- NewSUBARU, BL-01, Ee=1 GeV, Single bunch
- 1064 nm – 20W NdYAG laser
- Mono-energy, 17 MeV, polarized (Horizontal)



Target	Thickness	Mass	Q_value (MeV)
Au	1 cm	197	8.07

3. Data Analysis

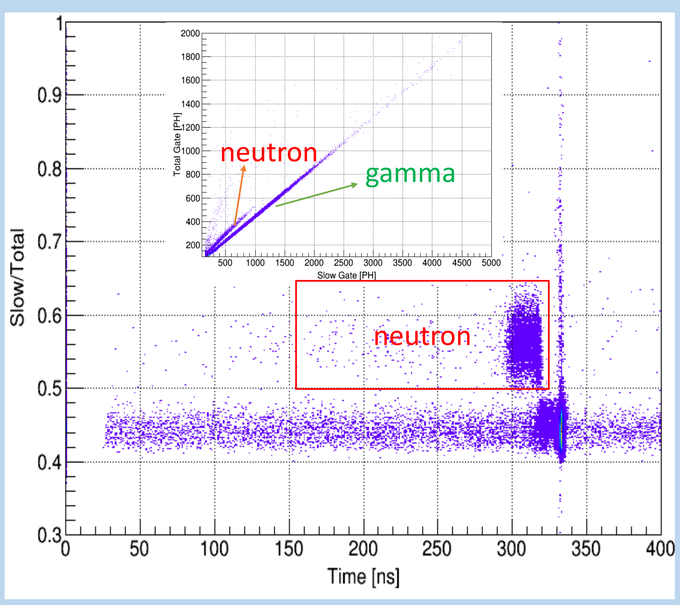
1. Bias level: 0.25 MeVee (Cs)
2. Time walk : 0.76 ns Δt
3. n-γ separation:
4. Neutron energy: TOF, ΔE < 10%

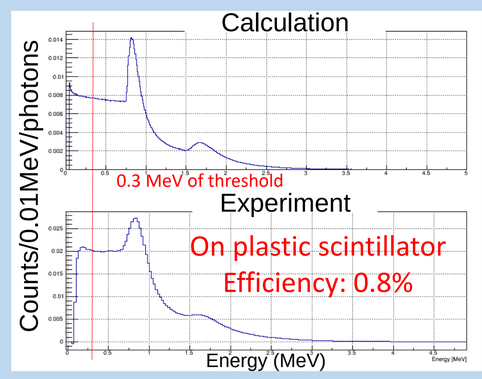
Number of photon:

- EGS5 calculation : eff.=0.8 %

Neutron detection efficiency

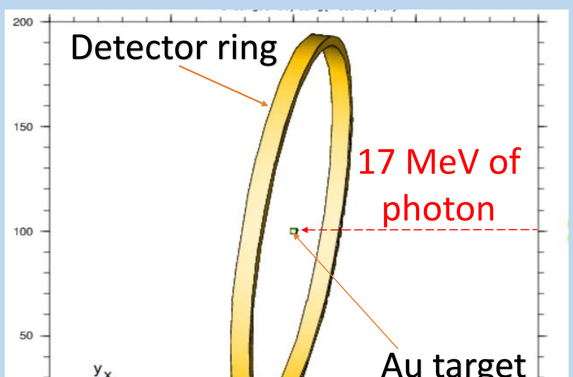
- SCINFULQMD: (15.8% for 0.25 MeVee)

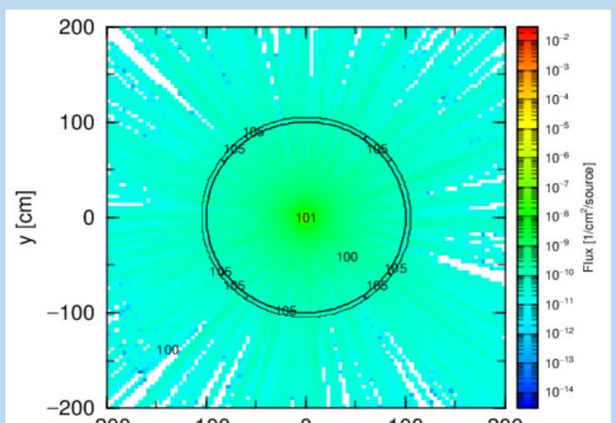




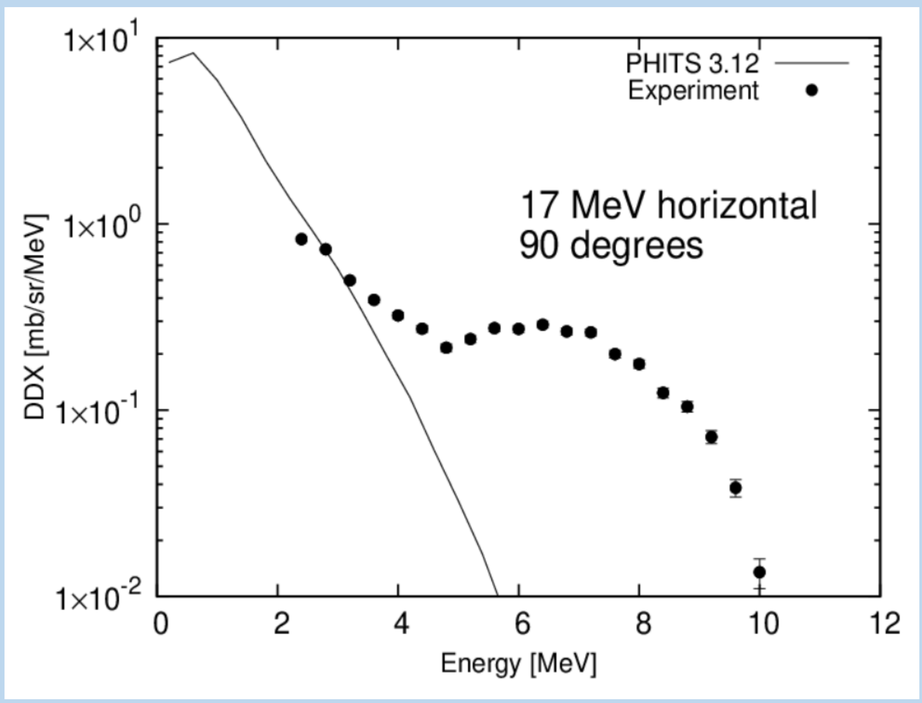
4. Calculation

- DDX based on theory : PHITS, version 3.12
- Ideal geometry: Ring is 5cm of width and 100 cm in rad.
- Au target is cylinder, 5 μm of thickness
  => No attenuation photon, no thickness effect
- 17 MeV photon is pencil beam.





5. Result



- The experimental spectrum, two components have been observed, evaporation and direct .
- The evaporation component was identified from the calculation result
- The model to reproduce direct component should be included in physics model of simulation for photo nuclear reaction

References

[1] Y.Kirihara at al., EPJ Web of Conferences **153**, 01019 (2017)

[2]Y.Kirihara at al., Neutron emission spectrum from gold excited with 16.6 MeV linearly polarized mono energetic photons, Journal of Nuclear Science and Technology, https://doi.org/10.1080/00223131.2019.1691073