



White Source n - γ Coincidence Measurements of γ -Production Cross Sections at LANSCE: Project Update

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WANDA 2024: NA-22 Project Update

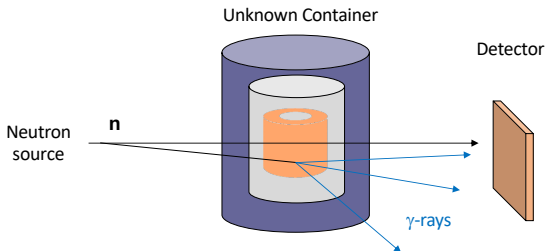
Outline

- Active Interrogation Motivation
- The Los Alamos Neutron Science Center
- Demonstration of CoGNAC γ -only and n - γ Analysis with $^{12}\text{C}(n,n'\gamma)$
- n - γ Results for $^{27}\text{Al}(n,n'\gamma)$
- γ -only Results for $^{16}\text{O}(n,n'\gamma)$
- γ -only and n - γ Results for $^{28}\text{Si}(n,n'\gamma)$
- Future Plans

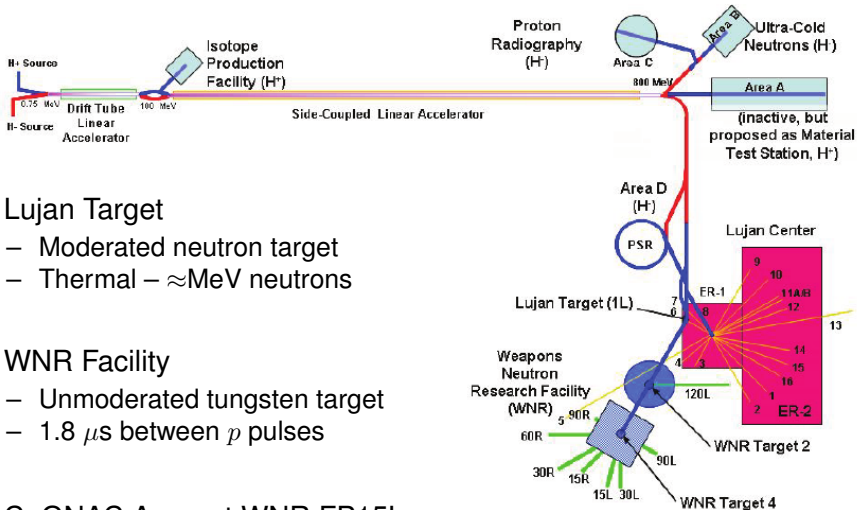


Motivation: Active Interrogation

- Identify contents of a container via neutron irradiation
- γ -ray emission used for ID
- Requires knowledge of γ -prod. XS
 - Effectively equal to $(n, n'\gamma)$ XS for many nuclei
- Require accurate neutron transport for prediction of reactions



The LANSCE Facility: Pulsed White n Source

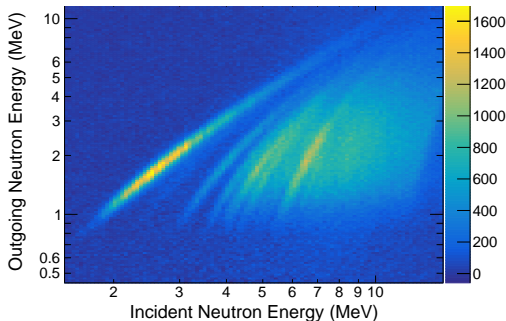
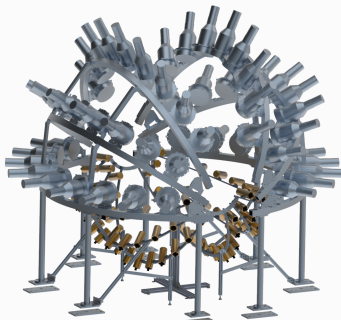


- Lujan Target
 - Moderated neutron target
 - Thermal – \approx MeV neutrons
- WNR Facility
 - Unmoderated tungsten target
 - 1.8 μ s between p pulses
- CoGNAC Array at WNR FP15L

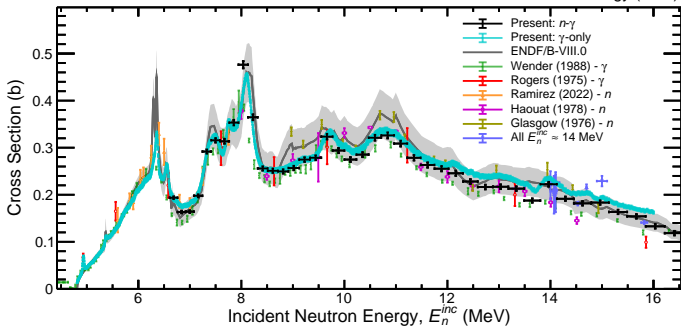
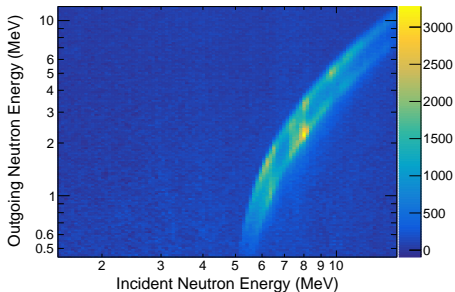
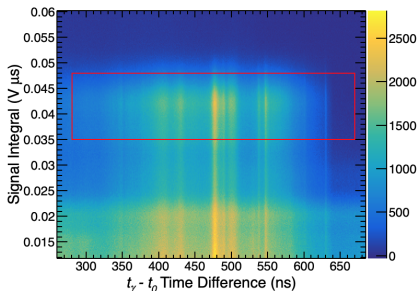


CoGNAC Coincident n - γ Measurements

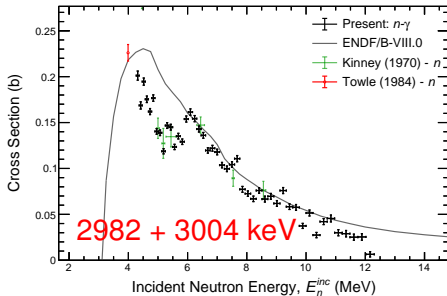
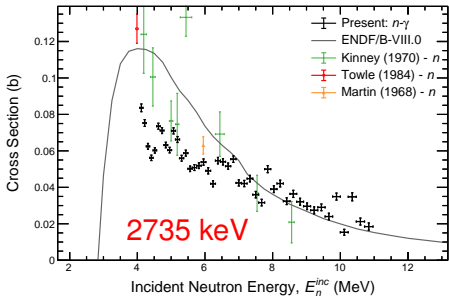
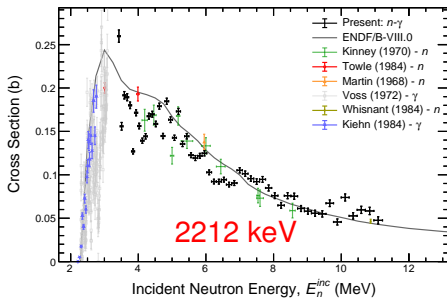
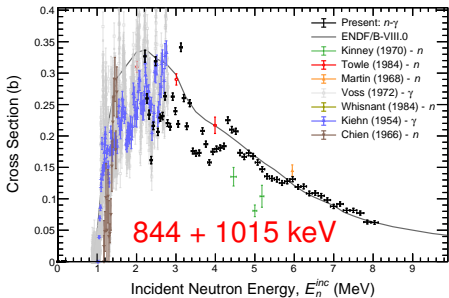
- PSD n - γ separation \Rightarrow treat each detector as both n and γ detector
 - E_n^{inc} , from t_0 - t_γ time difference, E_n^{out} , from t_γ - t_n
- Map n - γ coincidences, unfold n response, remove random coins
- See, e.g.: Kelly *et al.* PRC **108** (2023) 014603,
Kelly *et al.* EPJ WoC **284** (2023) 01004



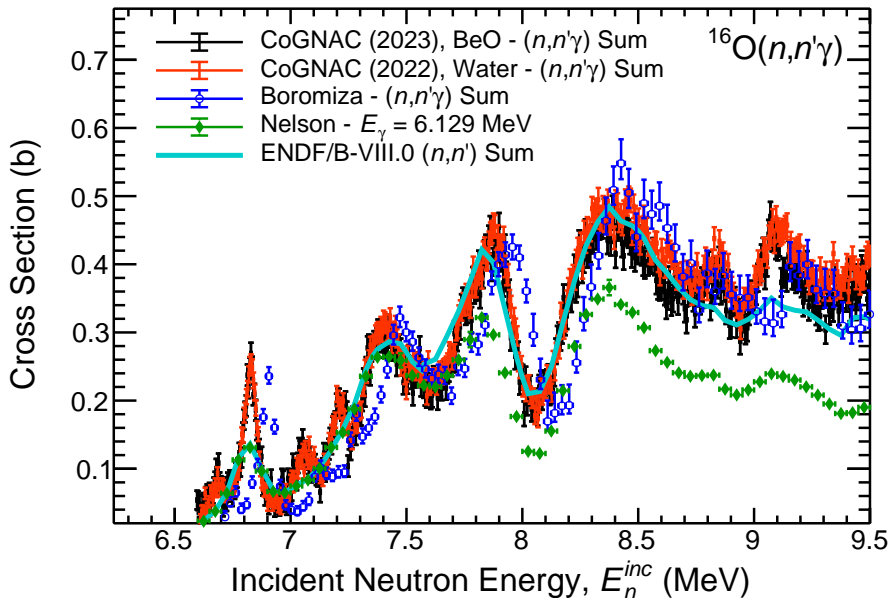
γ -only and n - γ $^{12}\text{C}(n,n'\gamma)$ Analysis



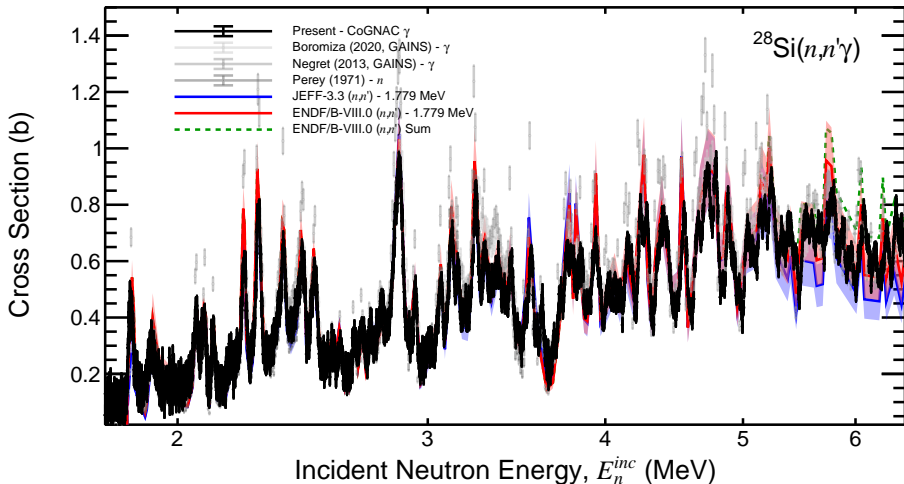
$n-\gamma$ $^{27}\text{Al}(n,n'\gamma)$ Results



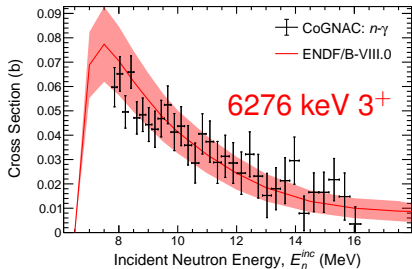
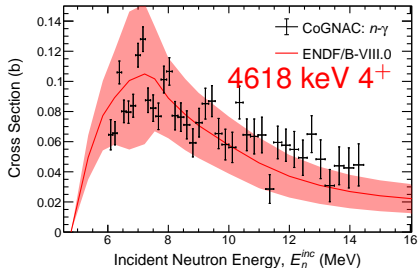
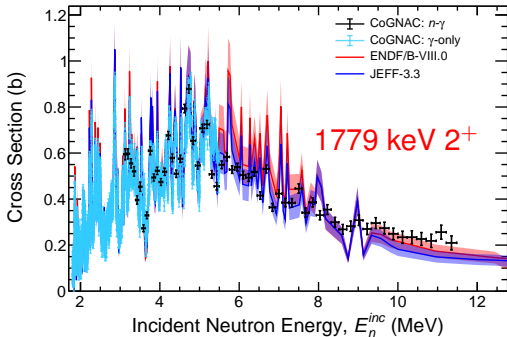
γ -only $^{16}\text{O}(n,n'\gamma)$ H₂O and BeO Results



γ -only and n - γ $^{28}\text{Si}(n,n'\gamma)$ Results



γ -only and n - γ $^{28}\text{Si}(n,n'\gamma)$ Results



Conclusions and Future Project Plans

- This project has produced ground-breaking new measurements for ^{27}Al , ^{16}O and ^{28}Si γ production via $(n,n'\gamma)$ reactions
- Data are being communicated to ENDF/B-VIII.0 evaluators and will be included in upcoming evaluations
- Follow-on work measuring $^7\text{Li}(n,n'\gamma)$ 477 keV γ production and systematic studies of analysis procedures will be proposed

This work was funded by NNSA Defense Nuclear Nonproliferation Research and Development (DNN R&D, NA-22)

