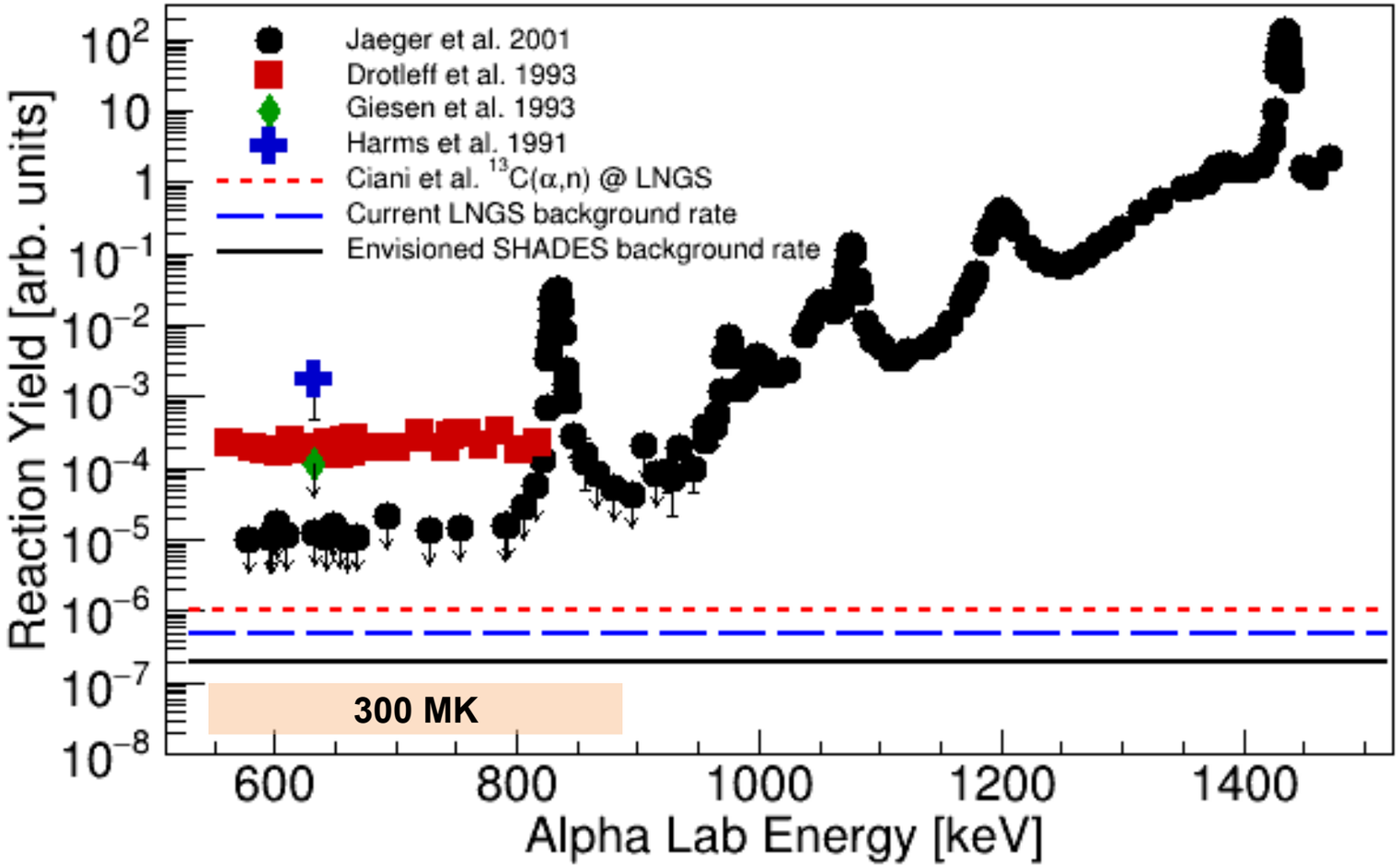
A Prototype Neutron Detector Array for *s*-process Measurements

T. Chillery, D. Rapagnani, C. Ananna, D. Mercogliano, J. Skowronski, A. Best
For the LUNA Collaboration

- **^{22}Ne(α,n)^{25}Mg** weakly constrained at Massive Star (8$M_\odot$) and AGB temperatures, 100 – 300 MK

- New experiment:
  - **n-detector array**
  - Low natural background
  - BPE shielding
  - Enriched ^{22}Ne gas

- **This poster**: neutron-detection capabilities of prototype array



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This research was supported by ERC-StG 2019 #852016 “SHADES” and Horizon 2020 No 101008324 (CHETEC-INFRA)

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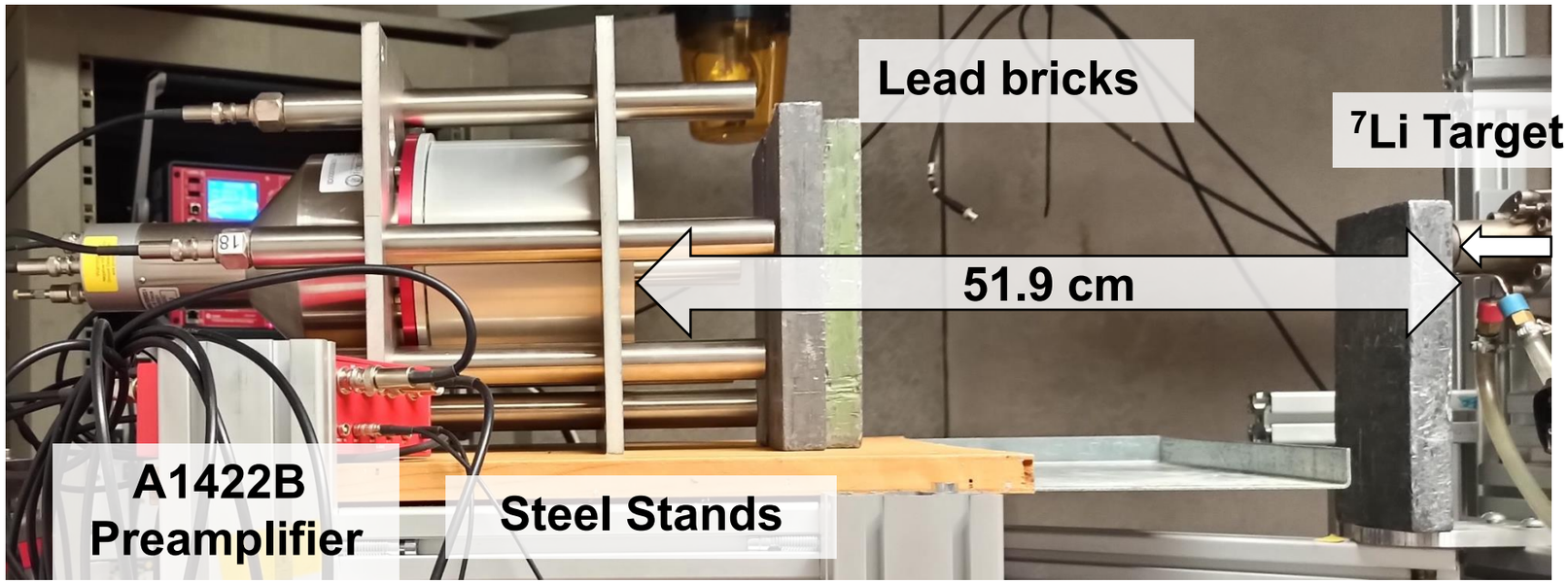
- Goethe University Frankfurt "FRANZ"
  - ^{7}Li(p,n$_0$)^{7}Be
  - $E_{\mathrm{lab}}^{\mathrm{p}}$ adjusted
  - E_{n} = 50 – 720 keV
- CoMPASS DAQ & CAEN 14-bit DT5725B, 250 MSamples/s
- Waveforms, timestamps, channel written to disk

6x ^{3}He Counters – thermal n det.

EJ-309 Scintillator (8.4° coverage) n/γ disc. & n-mod



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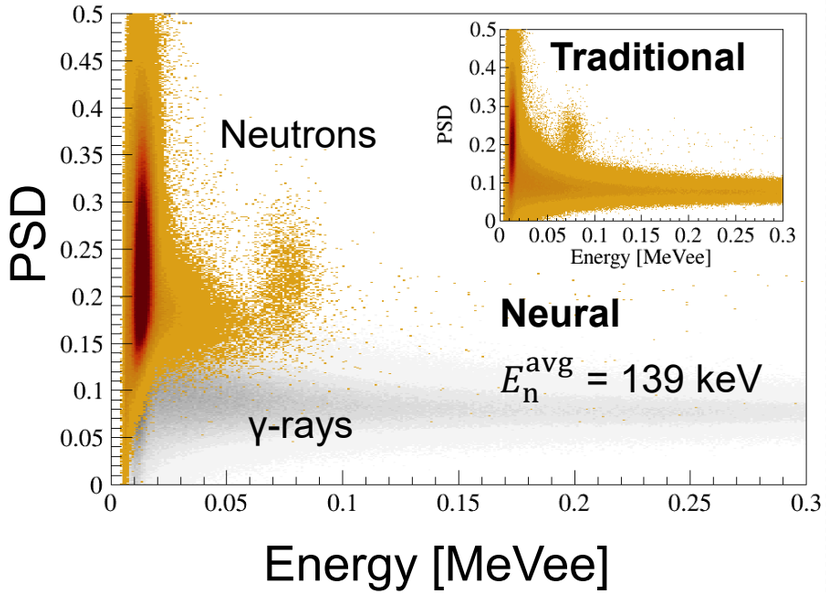
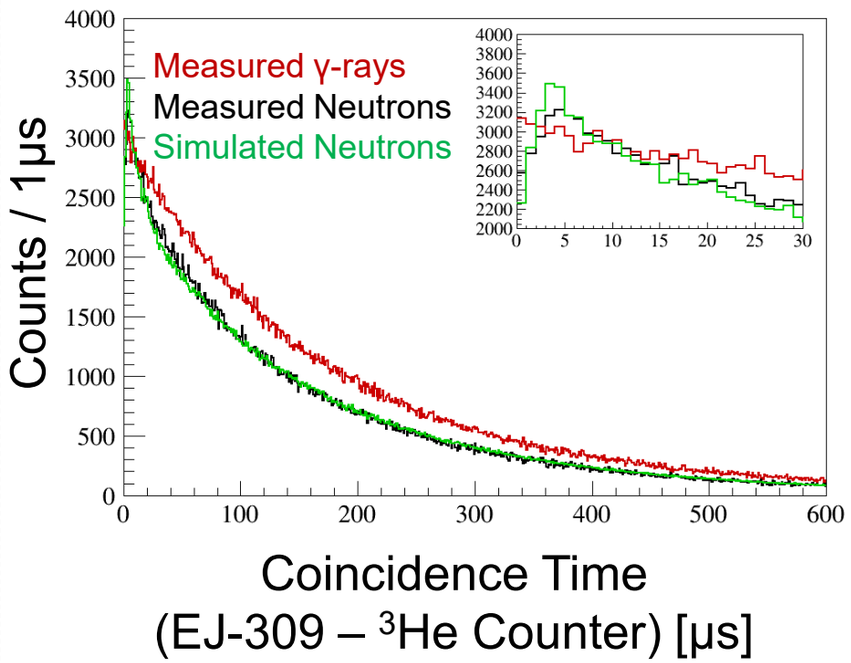
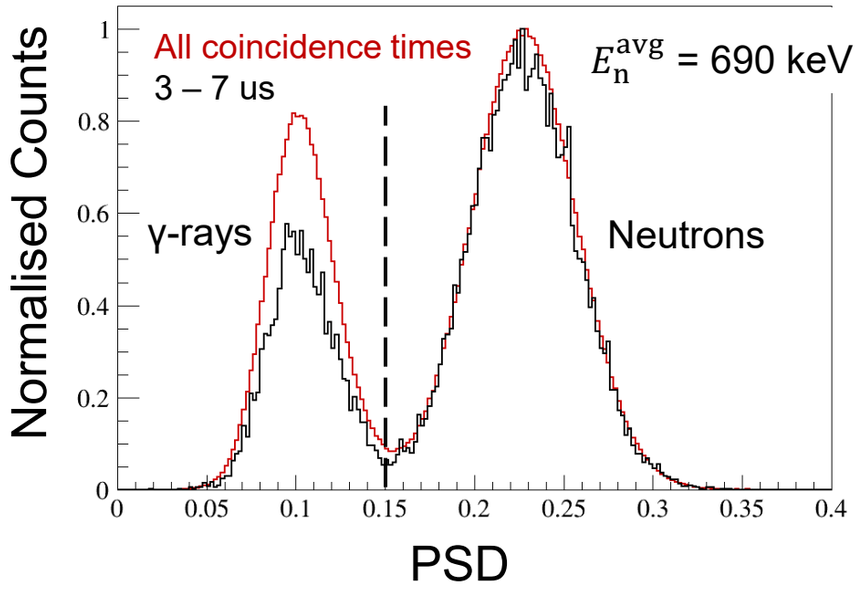
EJ-309 pulse shape discrimination
Traditional Vs Machine-learning



EJ-309 – ^{3}He counter coincidences
<-> Geant4 v11 simulation



PSD gated on coincidences ->
Distinct preference towards neutrons



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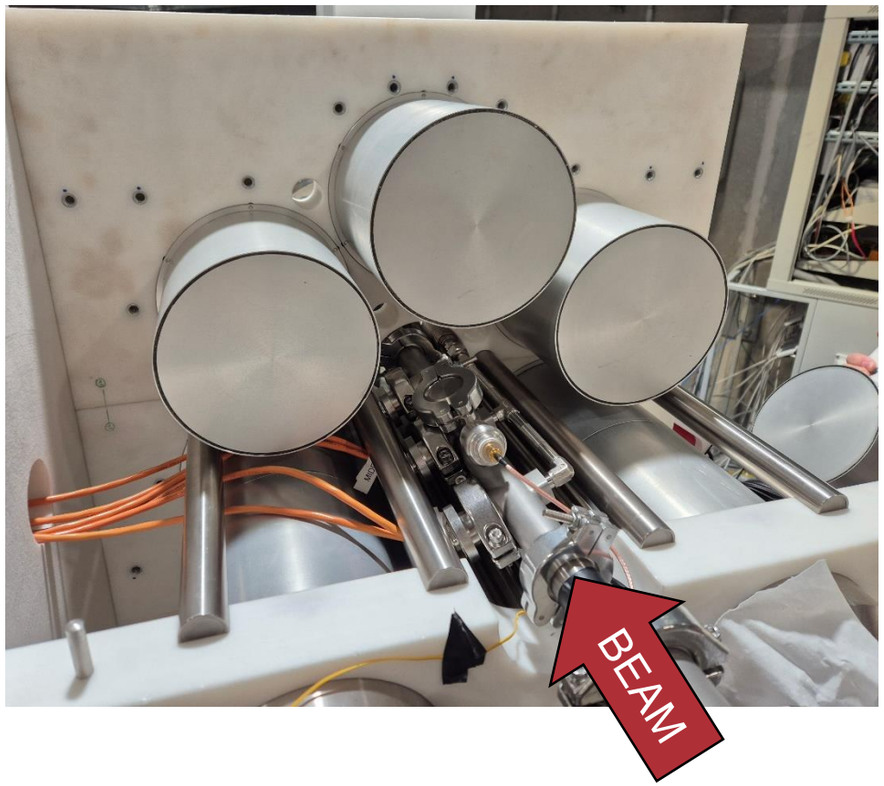
Neutron source measurements:
A. Best Talk Tuesday afternoon

Gas target + competing reaction:
D. Mercogliano Talk Thursday morning

SHADES: D. Rapagnani Poster (9)



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Backup Slides

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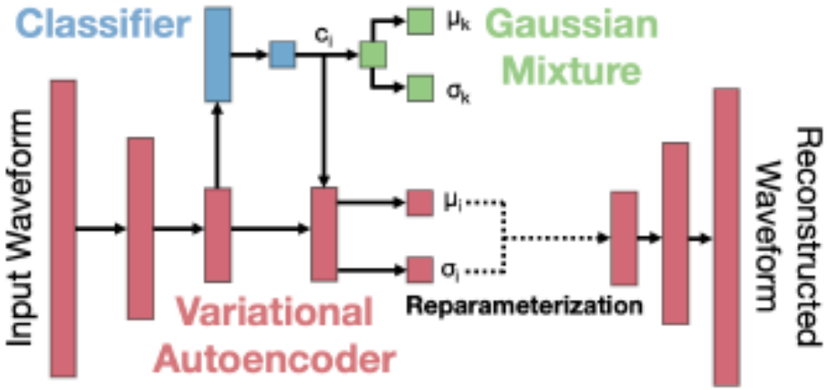

Figure 7: The architecture of the GMVAE developed for the purpose of PSD discrimination of the waveforms.

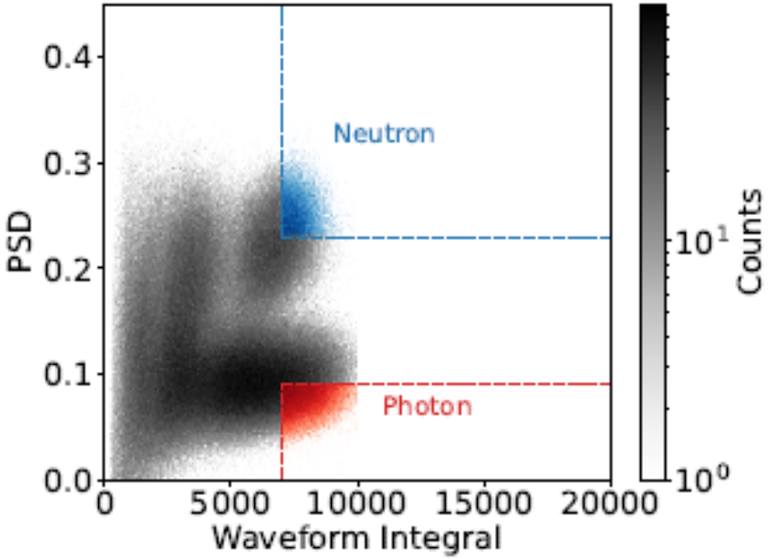

Figure 8: The data used to train the GMVAE model. The colored regions are the pre-tagged part of the data. (Refer to online plots for color).

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