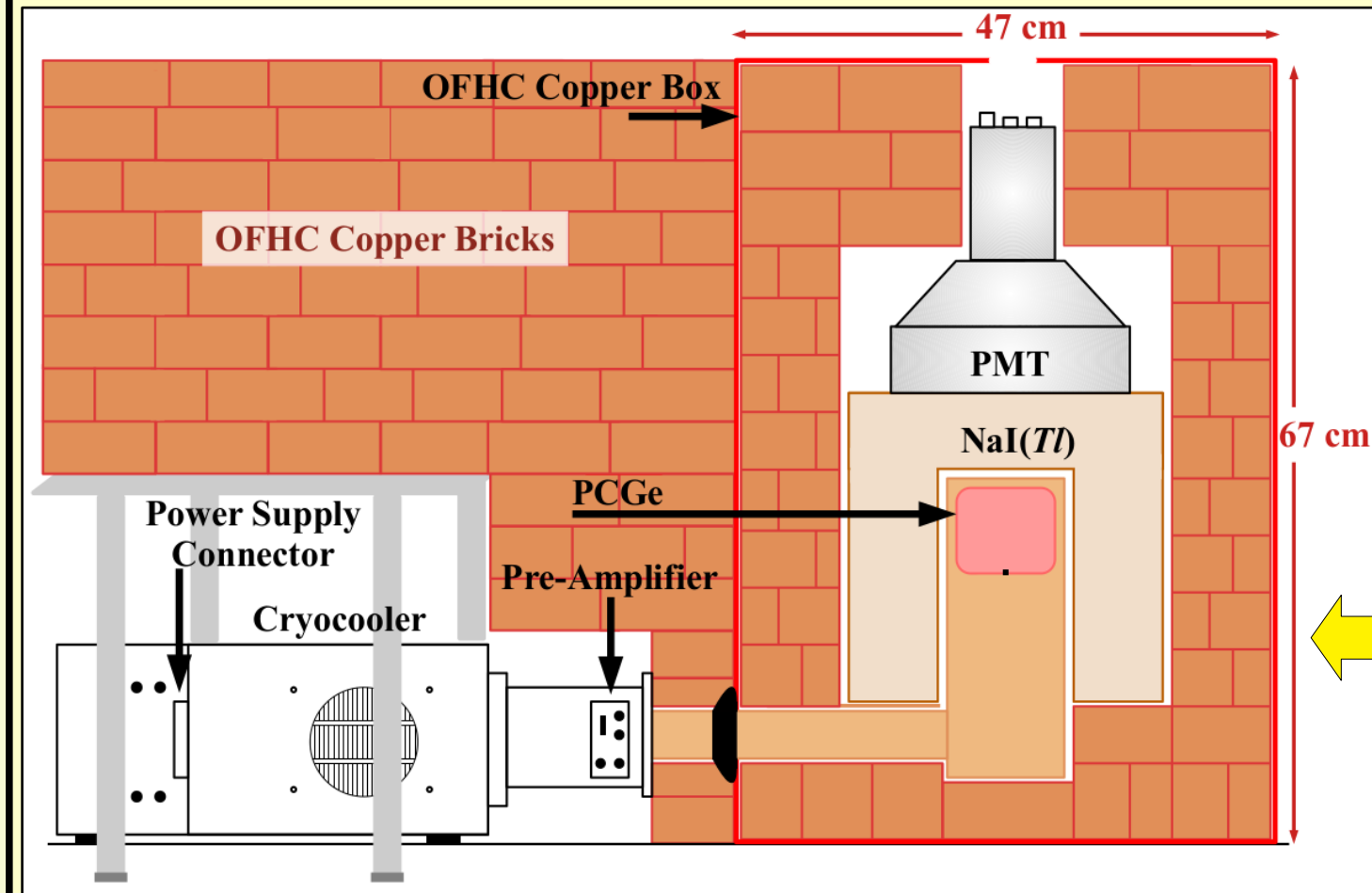
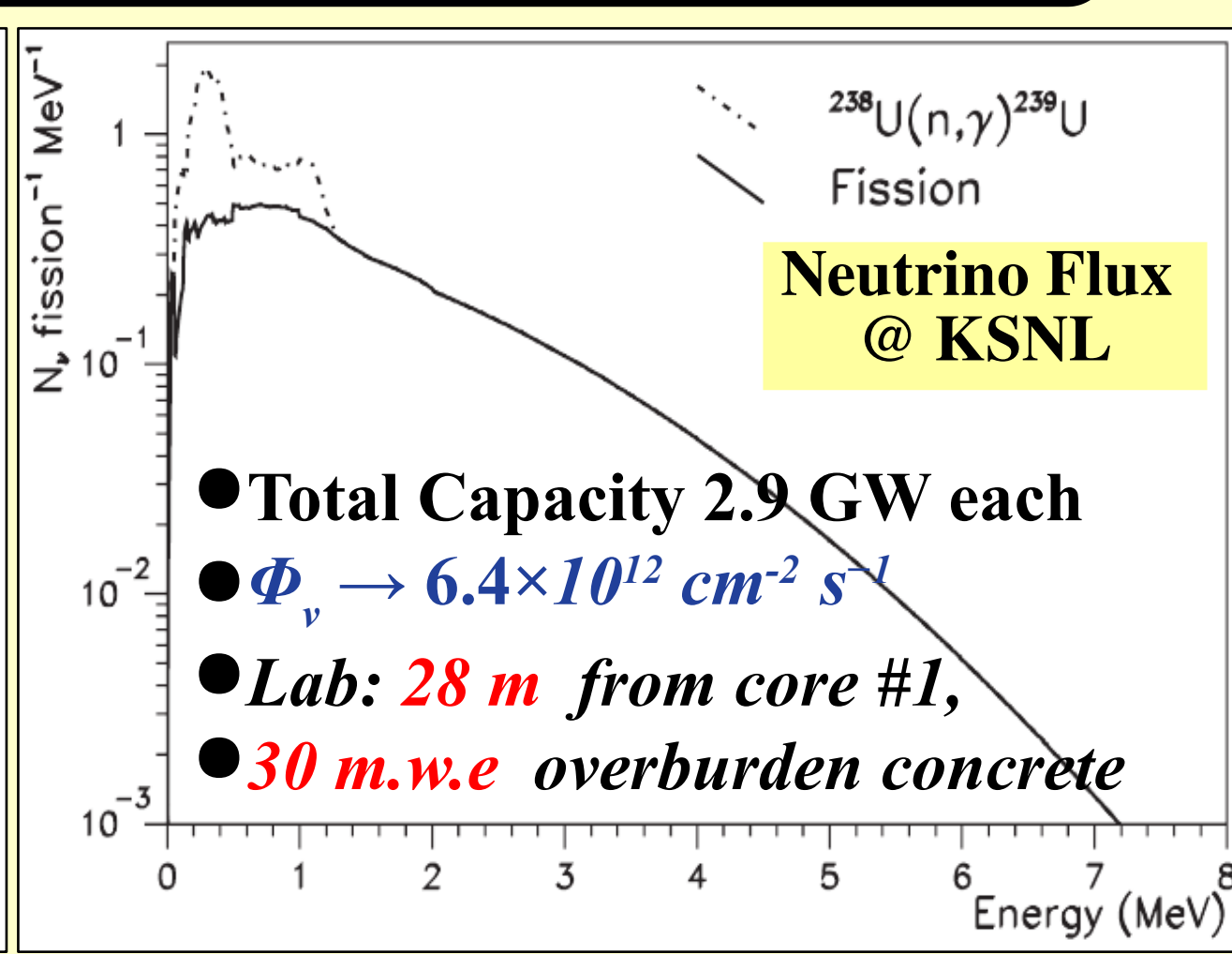
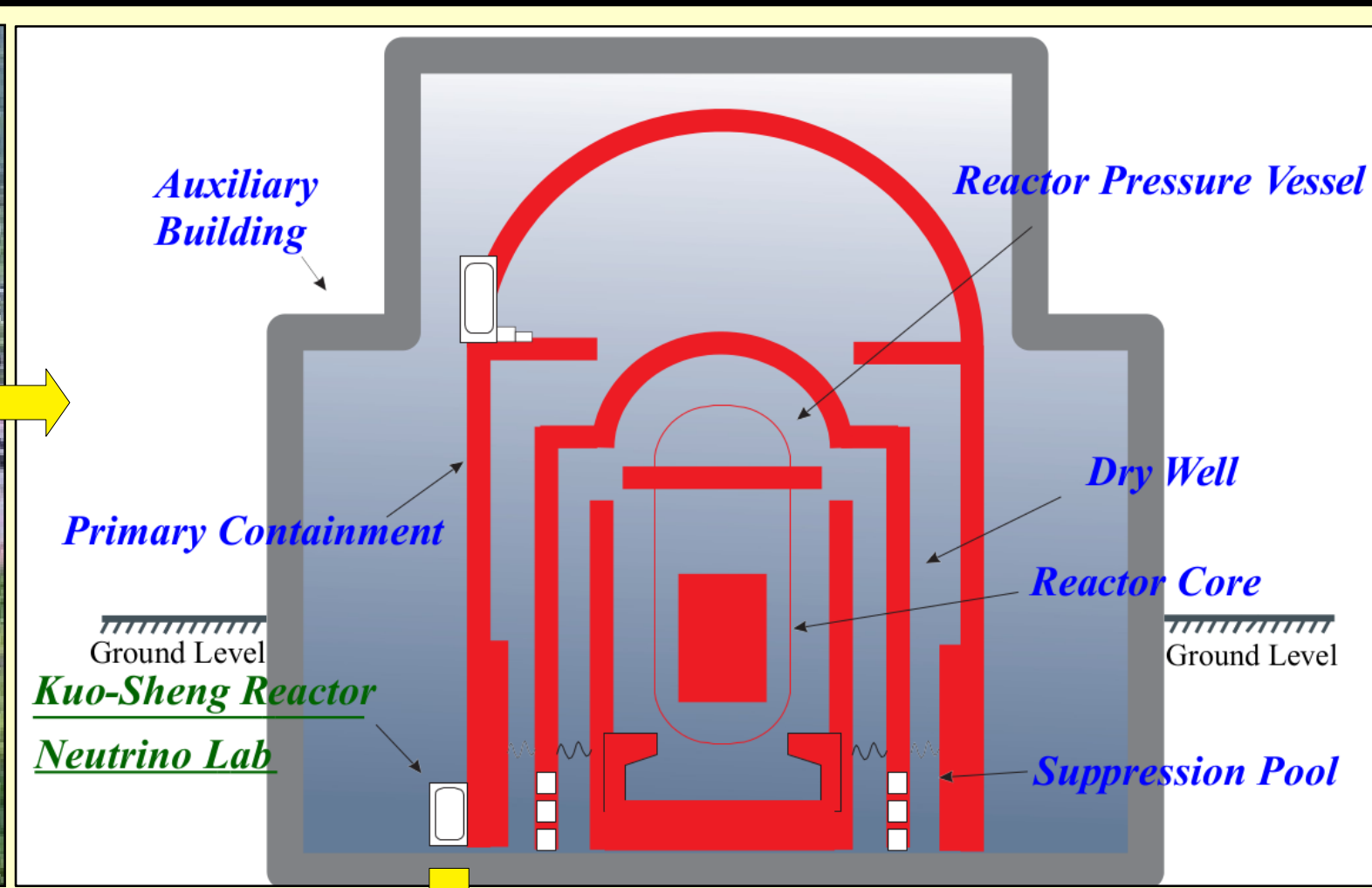
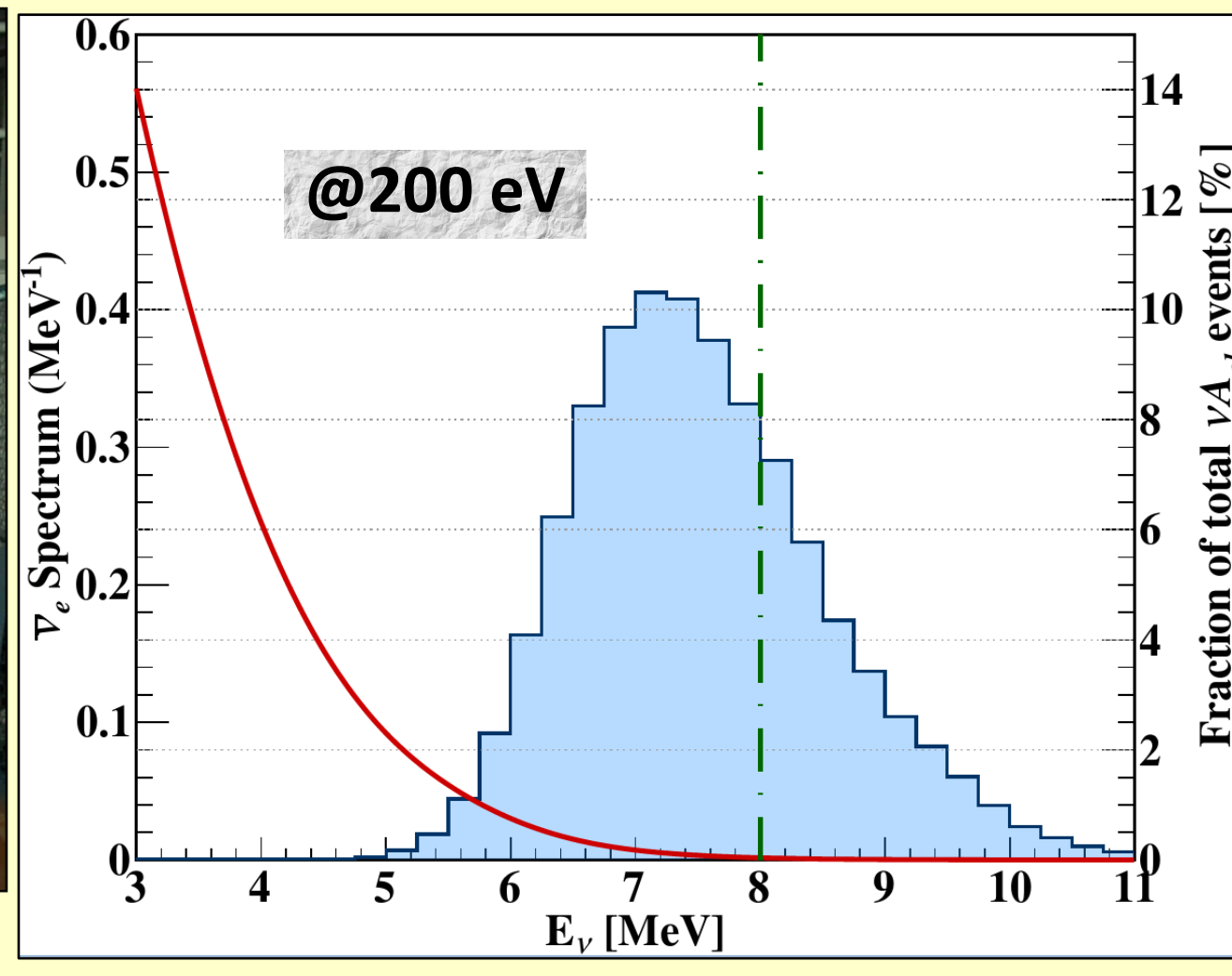
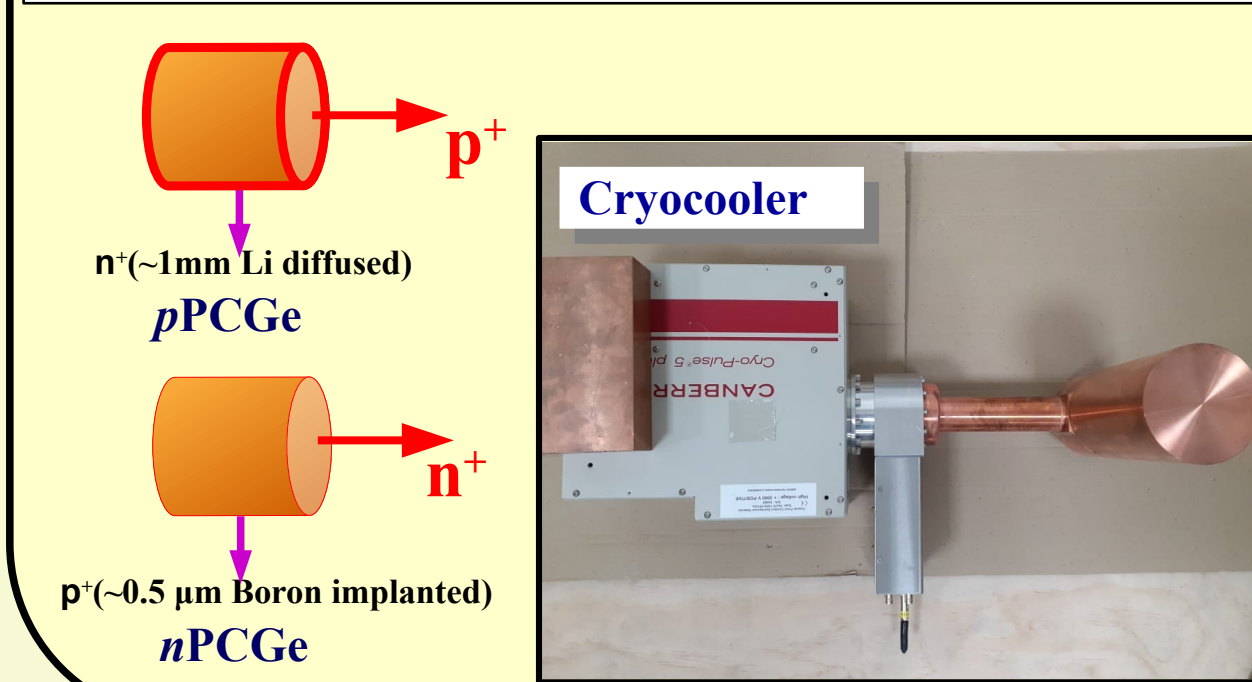


### TEXONO Program and Kuo-Sheng Reactor Neutrino Lab

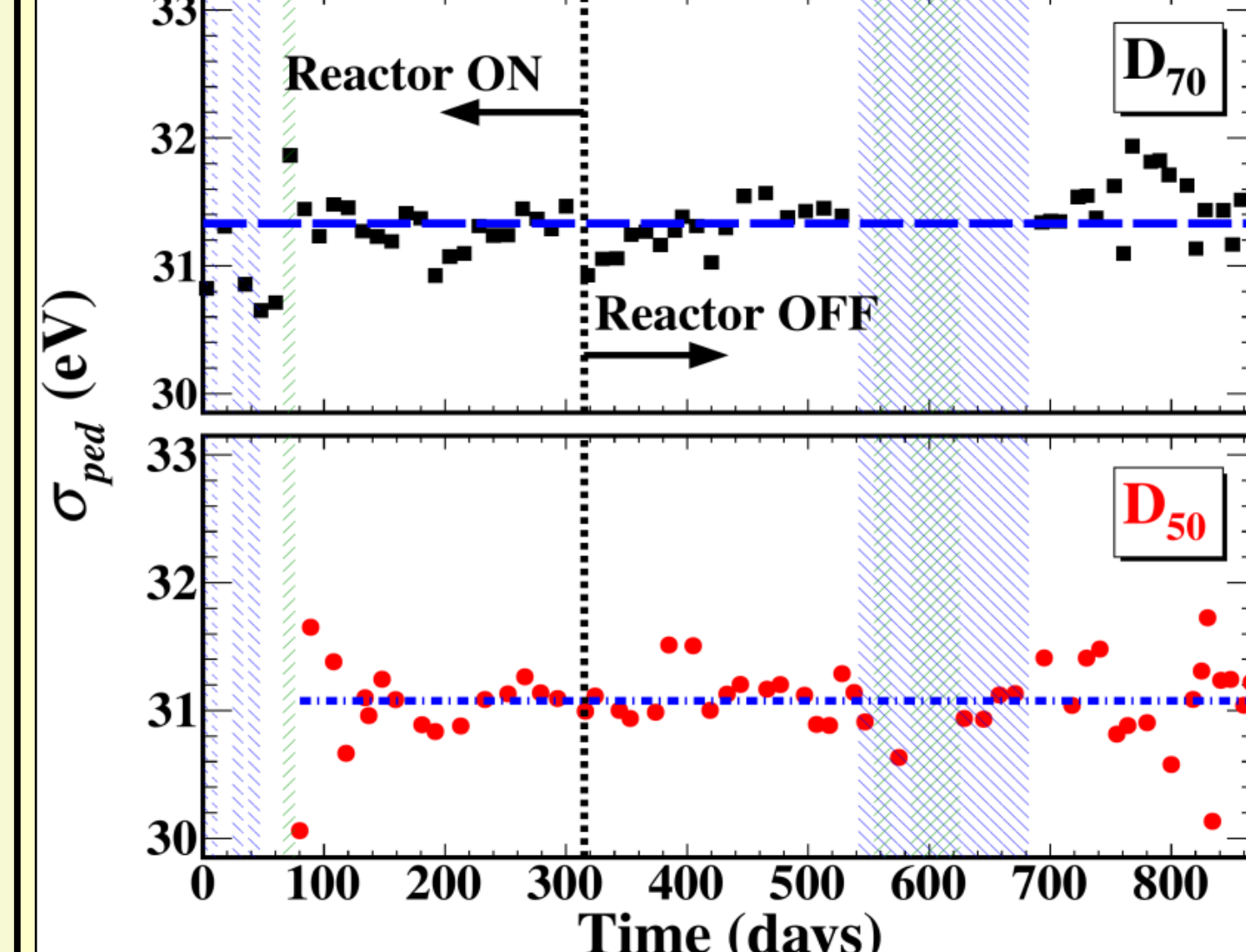


New Generation Detectors @ KSNL

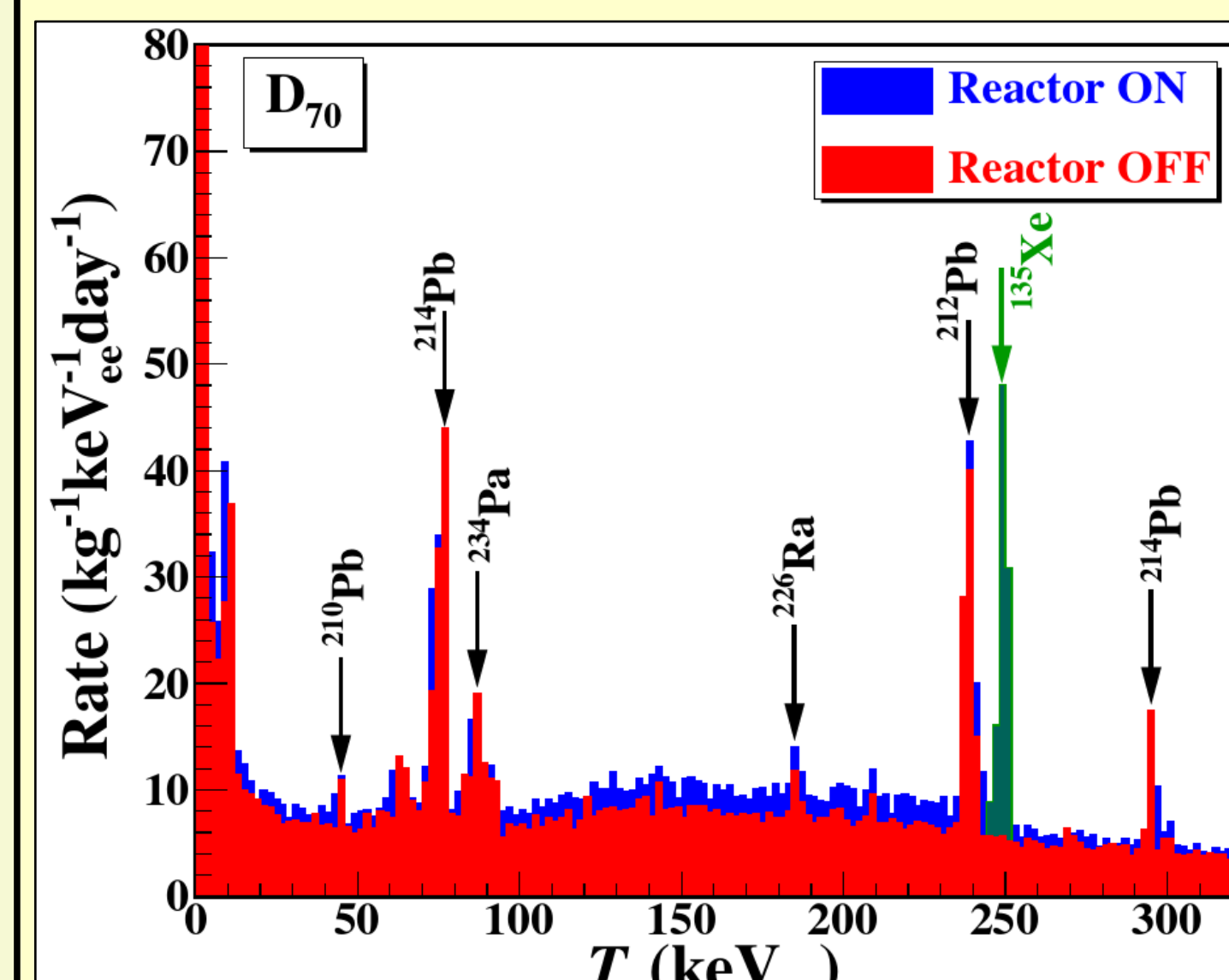
| Generation | Mass (g) | Pulsar FWHM (eV <sub>ee</sub> ) | Threshold (eV <sub>ee</sub> ) |
|------------|----------|---------------------------------|-------------------------------|
| G1         | 500      | 130                             | 500                           |
| G2         | 900      | 100                             | 300                           |
| G3         | 500      | 70                              | 200                           |
| G4         | 1430     | 70                              | 200                           |
| G4         | 900      | 50                              | 140                           |



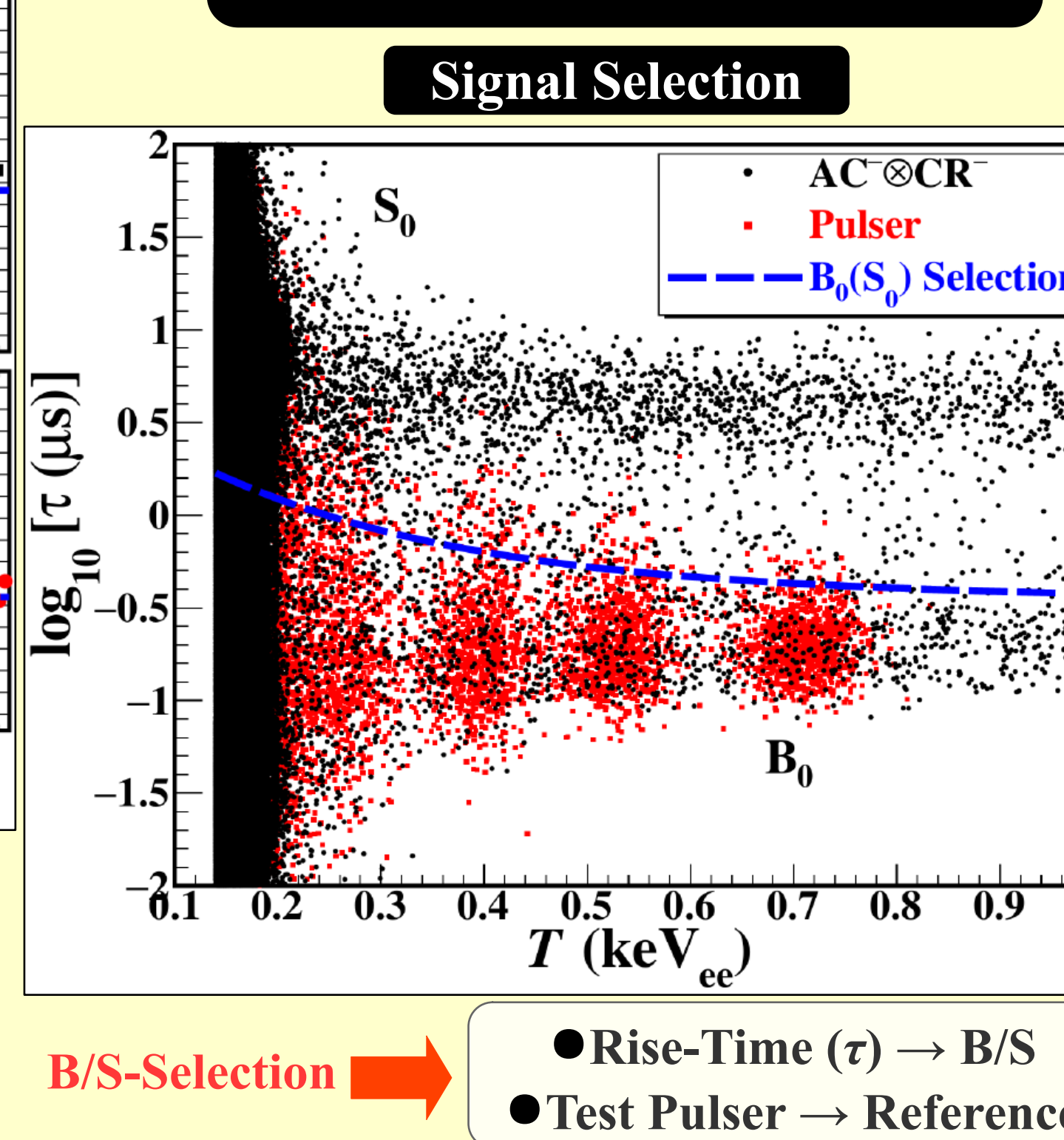
### Stability



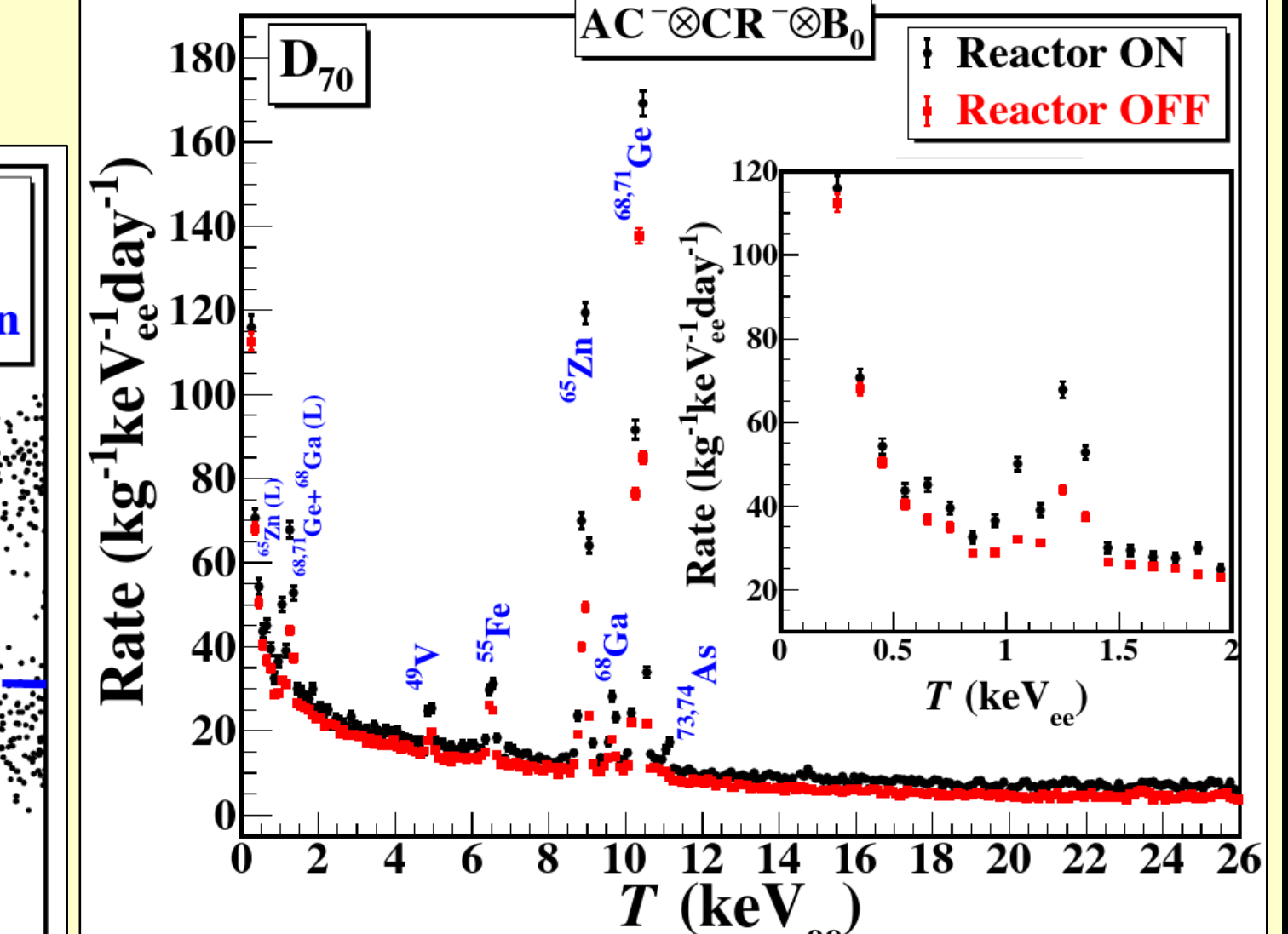
Reactor ON <sup>135</sup>Xe Background



### Data Filtration



### Candidate spectra

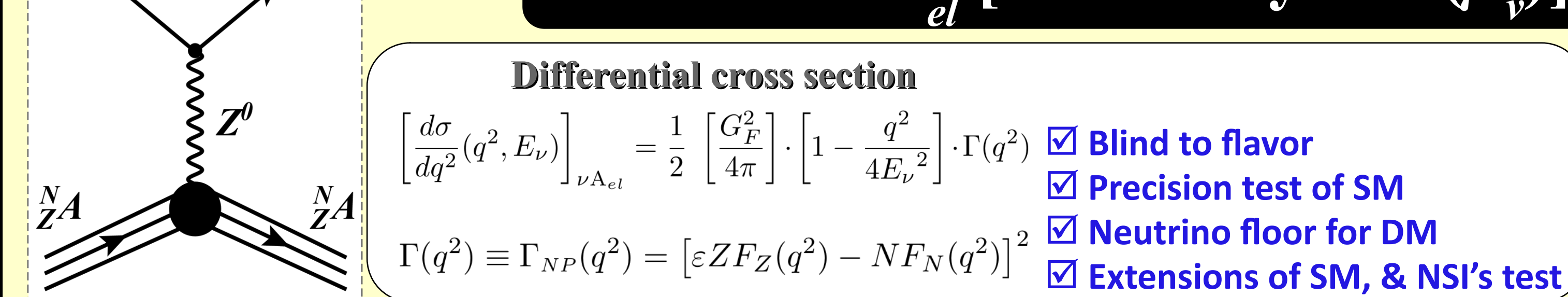


**G3 EC-pPCGe**

- D<sub>70</sub> = 1434 g
- D<sub>50</sub> = 523 g
- Exposure: 404(814) kg-days ON(OFF)
- Threshold: 200 eV

- ☑ A Decay Product of <sup>235</sup>U
  - ☑ <sup>135</sup>Xe → <sup>135</sup>Cs + anti- $\nu_e$  + e
  - ☑ <sup>135</sup>Cs\* → <sup>135</sup>Cs + γ (249.8 keV)
  - ☑ t<sub>1/2</sub> = 9.14 h
  - ☑ Good Neutron Absorber
  - ☑ Poison For Reactor
  - ☑ Contribute ~1.72 ± 0.03 cpkdd
  - ☑ @ [Sub-keV Region]
- Phys. Rev. Lett. 134, 121802 (2025)

### Coherent $\nu A_{el}$ [SM + Beyond ( $\mu_\nu$ )]



- **Coherent:** Outgoing nucleon wave-functions IN phase [ $E_\nu < \mathcal{O}(10)$  MeV]
- **Elastic:** Target remains in the same energy state

- Neutrino- $\gamma$  Couplings → Consequence of Neutrino Mass
- Constitute Intrinsic **Neutrino Properties BSM**
- Among these::
  - NMM ( $\mu_\nu$ ) → Sensitive probe in LE Experiments including  $\nu A_{el}$
  - $\nu A_{el}$  Process → Induced by  $\mu_\nu$  is Coherent ( $F_{em}(q^2 \rightarrow 0) \approx 1$ )
  - Cross Section → Scales as  $Z^2$

Phys. Rev. D 39, 3378 (1989)

**Even-A Nuclei**

$$\left[ \frac{d\sigma_{\nu A_{el}}}{dT_{nr}} \right]_{\text{spin-zero}} = \frac{\pi \alpha_{em}^2 \mu_\nu^2}{m_e^2} \left[ \frac{1 - T_{nr}/E_\nu}{T_{nr}} Z^2 - \frac{T_{nr}}{2E_\nu^2} \mu_N Z \right]$$

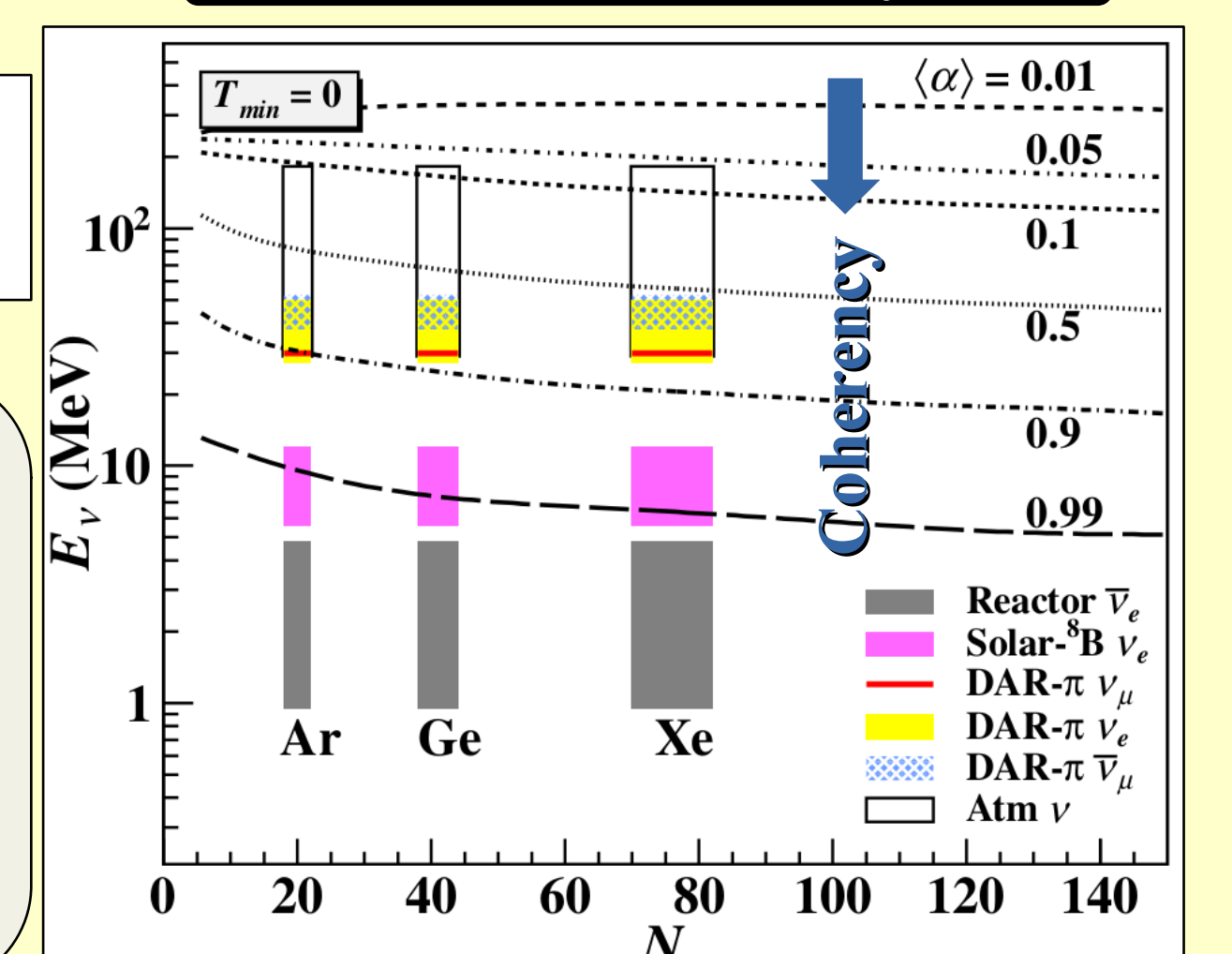
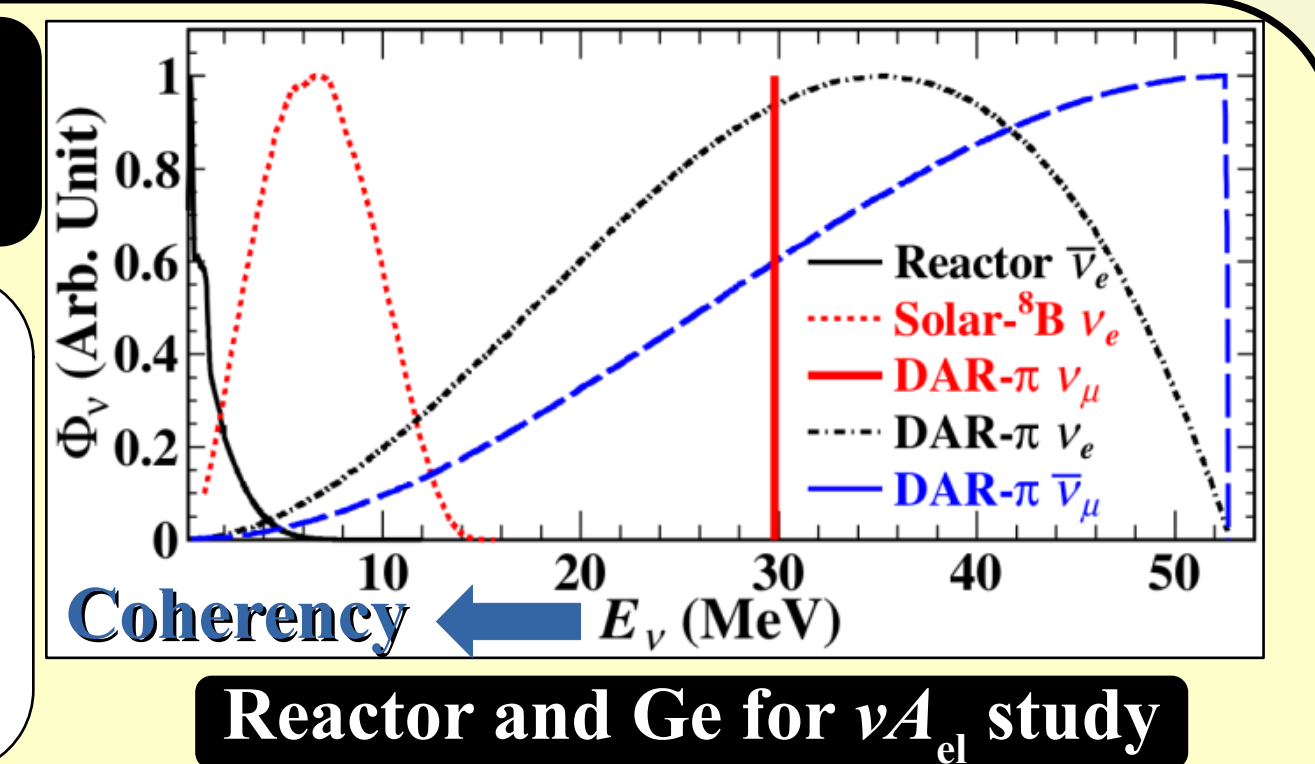
**Odd-A Nuclei**

$$\left[ \frac{d\sigma_{\nu A_{el}}}{dT_{nr}} \right]_{\text{odd-A}} = \frac{\pi \alpha_{em}^2 \mu_\nu^2}{m_e^2} \left[ \frac{1 - T_{nr}/E_\nu}{T_{nr}} Z^2 - \frac{T_{nr}}{2E_\nu^2} \mu_N Z + \frac{(2 - T_{nr}/E_\nu)^2 - 2MT_{nr}/E_\nu^2}{8M} \right]$$

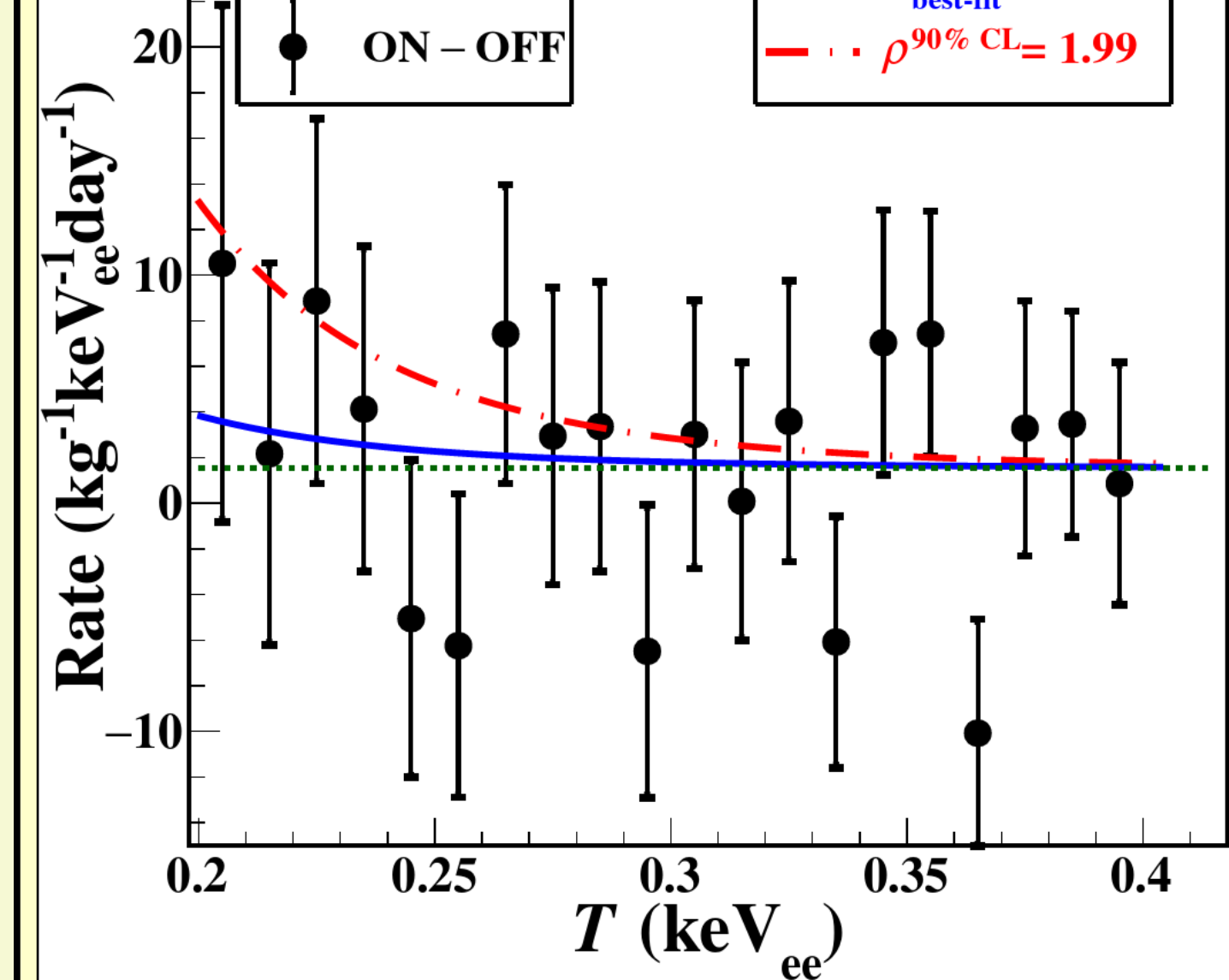
Phys. Rev. D 103, 092002 (2021)  
Phys. Rev. D 93, 113006 (2016)

**@ Low Recoil Energy regime ( $T_{nr}/E_\nu \ll 1$ )**

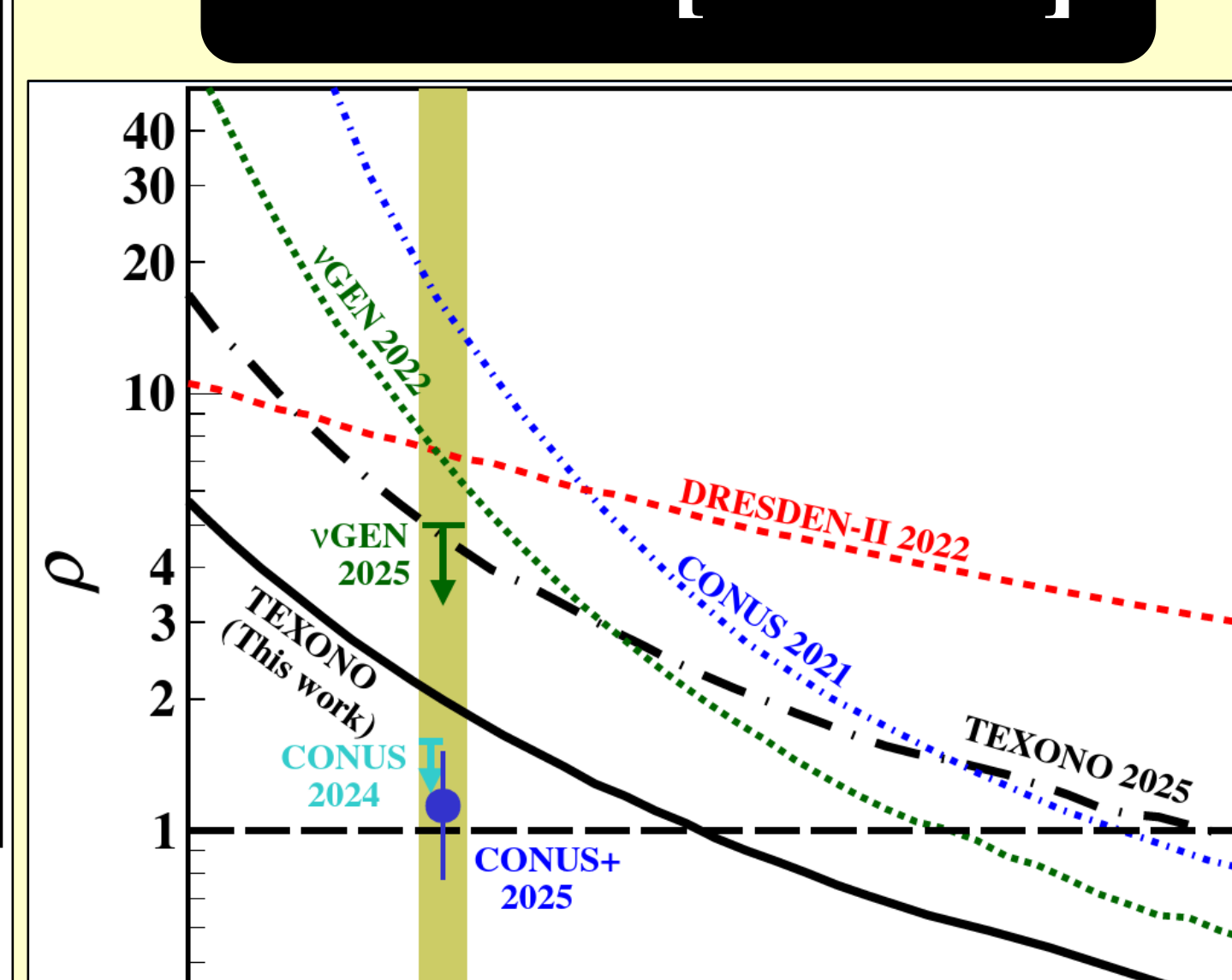
$$\frac{d\sigma_{\nu A_{el}}}{dT_{nr}} \approx \frac{\pi \alpha_{em}^2 \mu_\nu^2 Z^2}{m_e^2 T_{nr}}$$



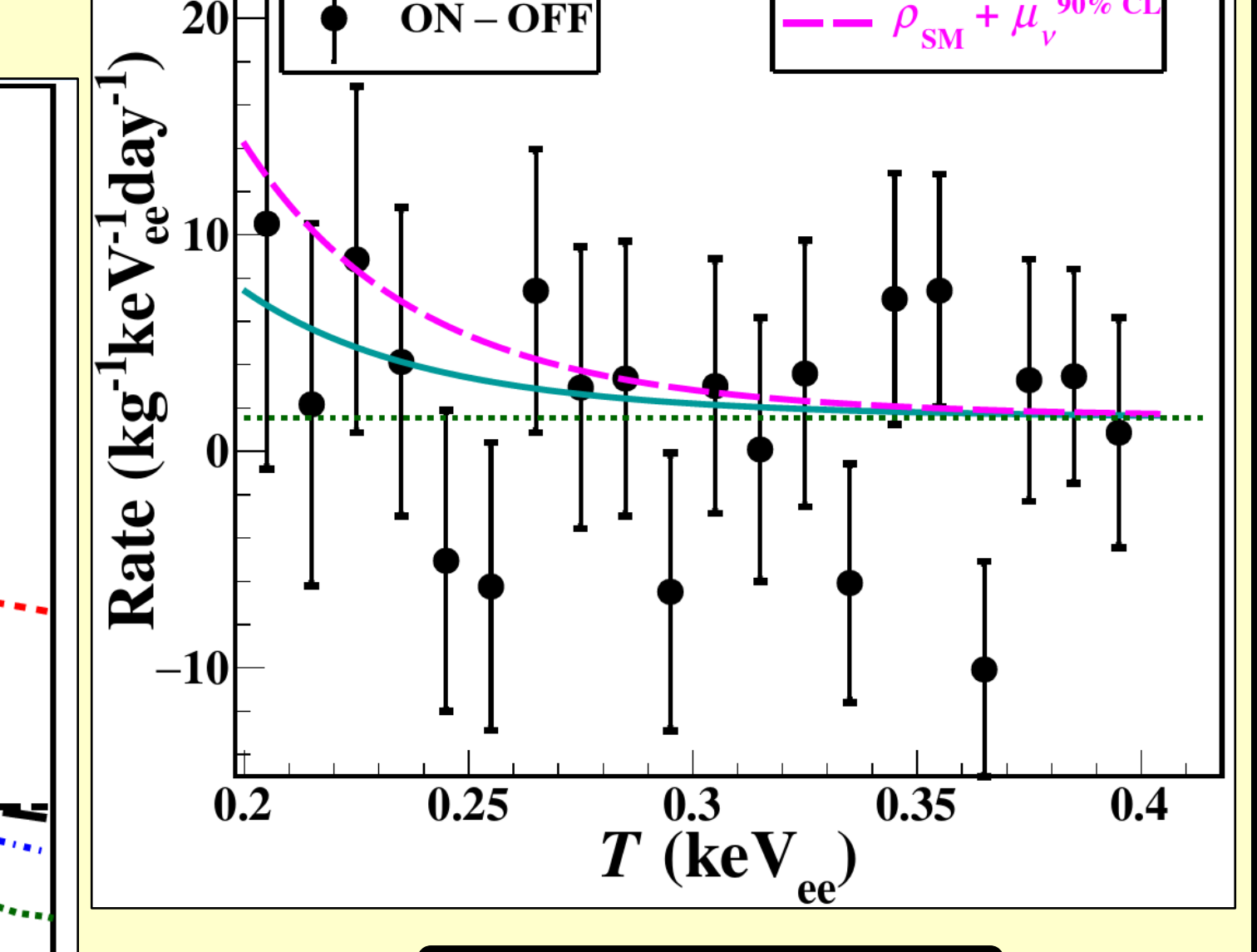
### Residual Spectra



### Results [Limits]



### Residual Spectra



$$\chi^2(\rho, \beta, \mu_\nu; k) = \sum_i \left[ \frac{N_i - (\rho \nu_i^{SM}(k) + \nu_i^{BSM}(\mu_\nu)) - \beta}{\Delta_i} \right]^2 + \left[ \frac{\beta_{\text{comb}} - \beta_{\text{Cmpt}}}{\Delta_{\text{comb}}} \right]^2$$