

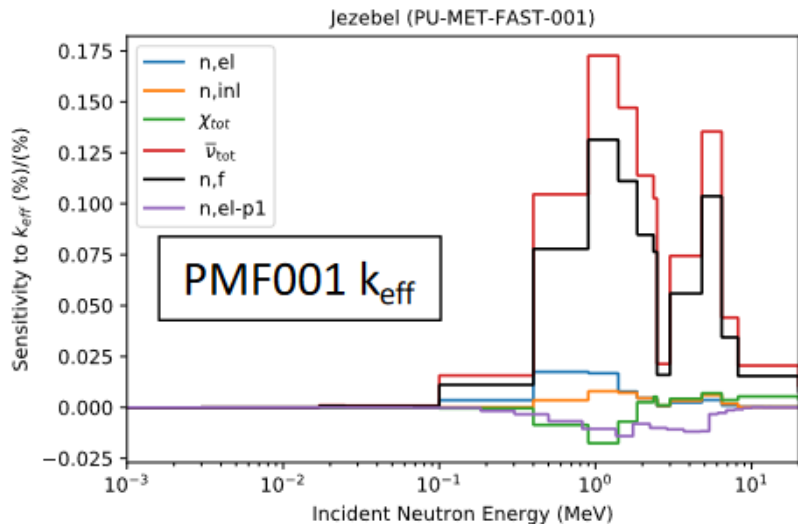
# Fission cross sections: We know those to <1%, right? – Sorry, no!

D. Neudecker  
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# Fission cs: 2<sup>nd</sup> most sensitive ND observable for $k_{\text{eff}} \rightarrow$ large fission cs unc. result in large application quantity unc.

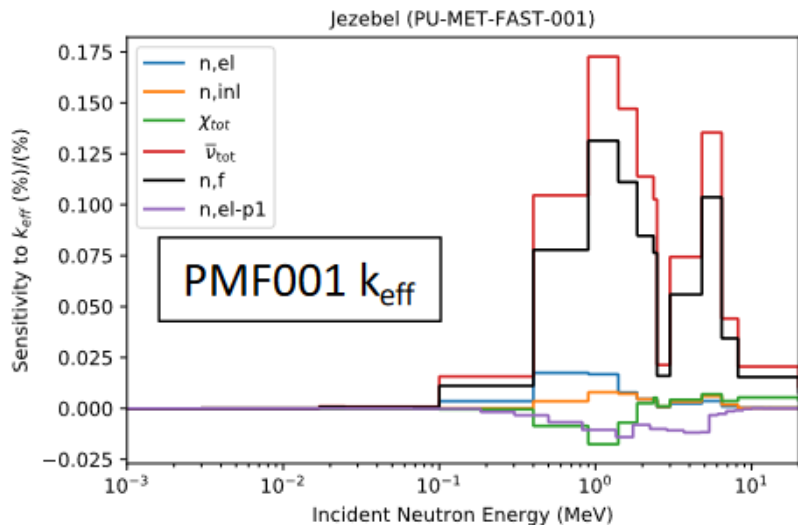


$\sim 1\%$  change in  $^{239}\text{Pu}(n,f)$  cs leads to  $\sim 900$  pcm change in Jezebel (PMF001)  $k_{\text{eff}}$ .\*

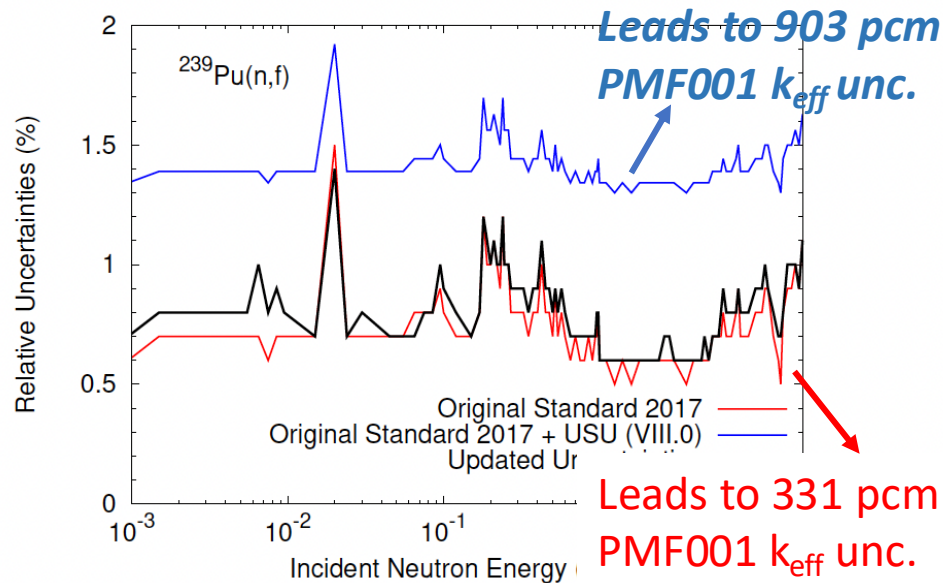


\*210 pcm is difference between delayed and prompt critical for PMF001.

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For VIII.0, visible  $^{239}\text{Pu}(n,f)$  cs discrepancies were quantified via additional unc. **Source of these unc./ discrepancies was unknown.**



\*210 pcm is difference between delayed and prompt critical for PMF001.

# Templates of expected measurement unc. created to quantify known, but missing, experiment unc, for fission cs eval.

	Unc. source	Absolute
Normalization	$\delta N_{(a/b&c)}$	See Table 1
Counting	$\delta c$	Eqs. (3) and (5)
Statistics	$\delta\beta$ & $\delta m$ ; $\delta m$	0.2–2%
Multiple	$\delta\beta$ & $\delta m$ ; $\delta\beta$	0.2–1%
scattering	$\delta\varepsilon$ & $\delta\alpha$ ; $\delta\varepsilon$	1.1–4%
Efficiency	$\delta\varepsilon$ & $\delta\alpha$ ; $\delta\alpha$	Compare to nuclear data
Background	$\delta b$	0.2–>10%
Energy	$\delta E$	1%, 1-3 ns
Flux	$\delta\phi$	>1%
Impurity	$\delta\zeta$	See Table 3
Deadtime	$\delta d$	>0.1%

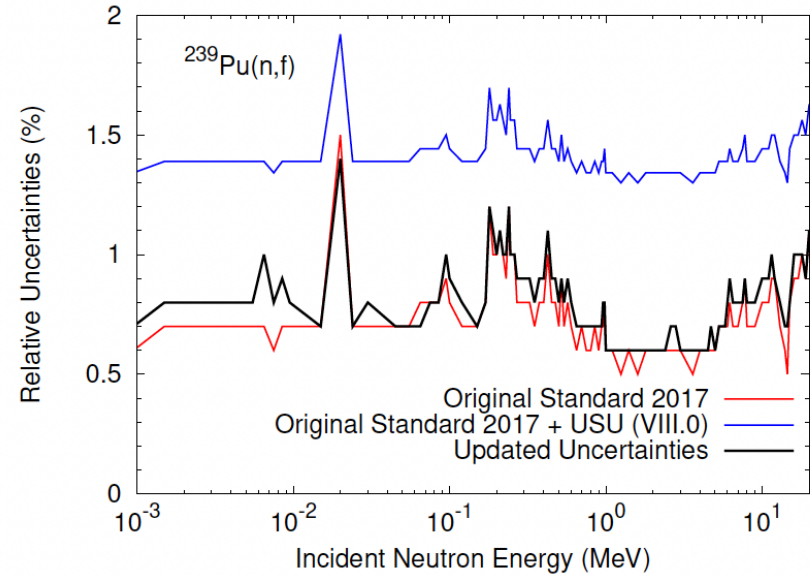
Templates enable consistently quantifying all pertinent, known fission cross section unc.



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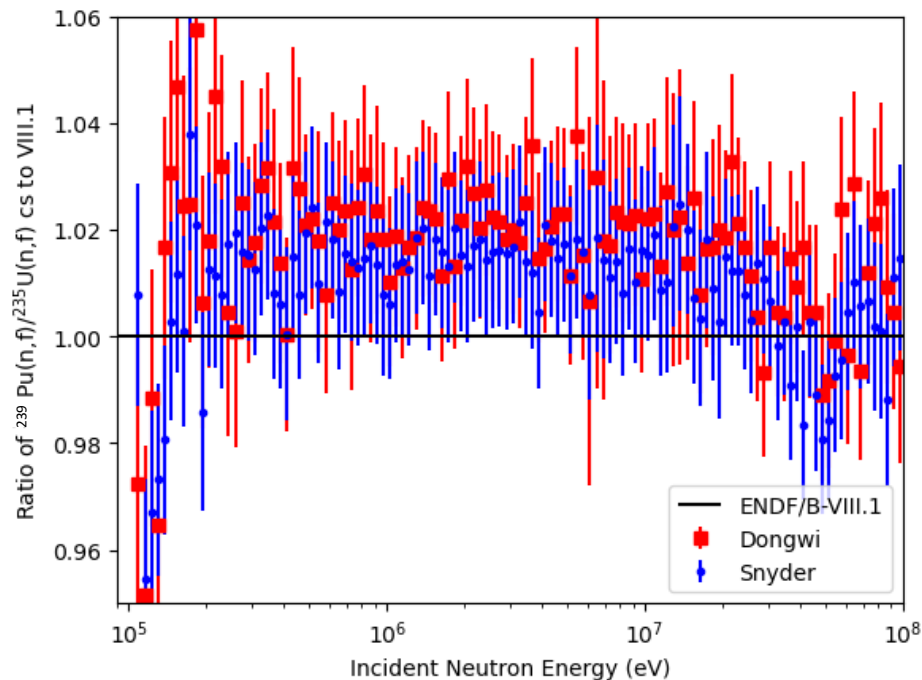


Using templates increased  $^{239}\text{Pu}(n,f)$  unc. 30%. Part of missed unc. due to poor exp. reporting.



**We need to encourage experimenters to provide detailed unc. for new (n,f) measurements to obtain realistic evaluated covariances of fission observables.**

# New fissionTPC $^{239}\text{Pu}(n,f)$ cs high-precision exp. show $>1.5\%$ systematic offset ( $\rightarrow +>1000$ pcm in PMF001 $k_{\text{eff}}$ ) from VIII.1!!!



- fissionTPC was decade-long project with the aim to measure  $(n,f)$  cs with  $<1\%$  unc. *with a different detector than traditionally used fission chambers.*
- **We do NOT understand the physics reason why data are  $>1.5\%$  systematically offset** but it does highlight that VIII.0 unc. is realistic ...

Dongwi, NDS 202, 30 (2025).  
Snyder, NDS 178, 1 (2021).

**We need  $(n,f)$  cs measurements with the specific aim to help us understand WHAT is wrong in PAST data. Only when we know which past data to trust, we can reduce unc.**

# Take-aways: please provide complete exp. unc. & targeted experiments needed to understand discrepant historical data.

- We need a commitment of the experiment (n,f) cs community to provide detailed uncertainties of new (n,f) measurements for realistic evaluated covariances of fission observables.
- We need measurements of (n,f) cs with the specific aim to help us understand WHAT IS WRONG IN PAST EXPERIMENTAL DATA. If we do not have such experiments, we will be left with discrepant historical database and cannot reduce evaluated uncertainties.

