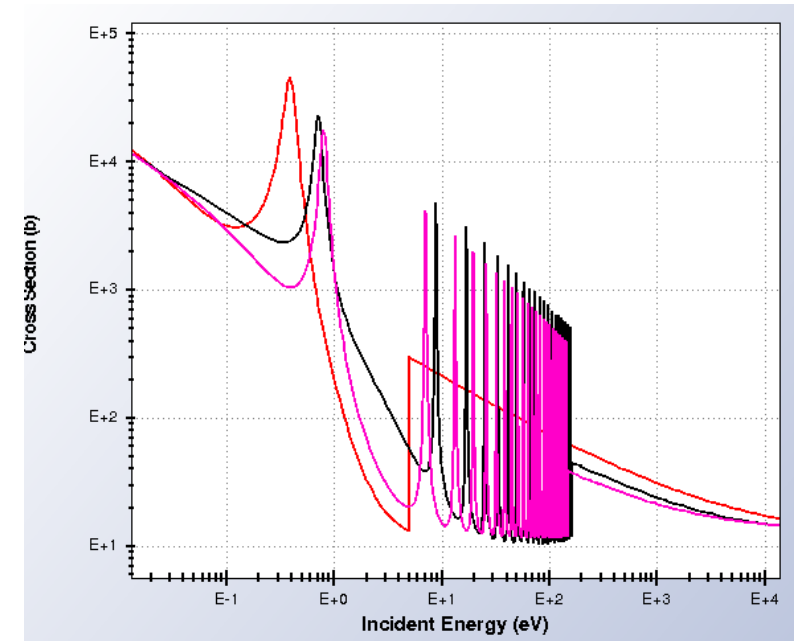
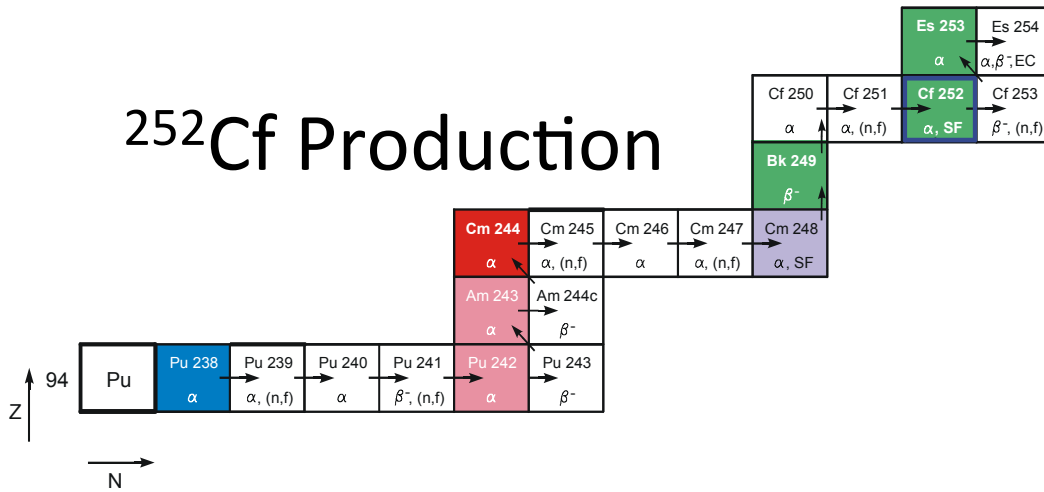


# High uncertainties in many actinide cross sections

## $^{252}\text{Cf}$ Production



- ~5-10% uncertainty in absorption cross sections of most Cm-Cf isotopes
- Uncertain resonance energies
- High resonance and fast flux in HFIR, strong absorbers, many overlapping resonances
- Developed target specific effective cross sections and experimentally calibrated parameterizations

Data-Induced Uncertainty in Curium Capture-to-Fission Ratios in HFIR $^{252}\text{Cf}$ Production Targets	
Curium Isotope	Uncertainty
$^{244}\text{Cm}$	<b>18.33% <math>\pm</math> 0.02%</b>
$^{245}\text{Cm}$	<b>5.38% <math>\pm</math> 0.02%</b>
$^{246}\text{Cm}$	<b>14.80% <math>\pm</math> 0.24%</b>
$^{247}\text{Cm}$	<b>21.08% <math>\pm</math> 0.08%</b>
$^{248}\text{Cm}$	<b>20.40% <math>\pm</math> 0.57%</b>

# $^{238}\text{Pu}$ Production

- DOE goal is to produce 1.5 to 2 kilograms of  $^{238}\text{Pu}$ /year within the DOE complex (at HFIR and ATR) by 2018

- (1) Radioisotope Thermoelectric Generators to generate electrical power
- (2) Radioisotope Heater Units to produce heat for electronics and environmental control for deep space missions

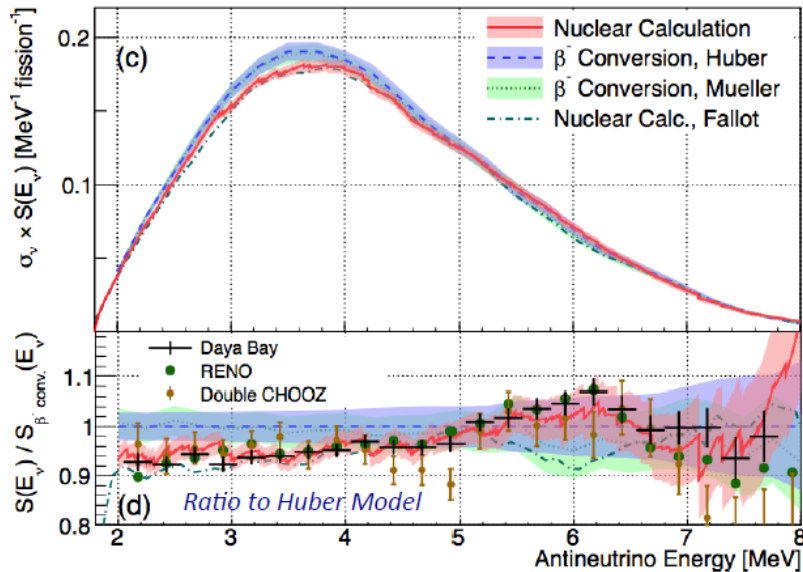


- Radiochemical measurements of fission products in irradiated 1-cycle targets found large discrepancies between predictions and measurements (> 30%) in fission products **suggesting possible overestimate of fission rates**
- However, validation of calculated fission rates used in the safety analysis is difficult due to uncertainties in nuclear data

Needs:

- Fission rates
- Fission yields

# Reactor $\bar{\nu}_e$ Spectrum



## Improve characterization of prominent isotopes:

- Priority given by contribution to detected rate:

$$R_{\text{det}} \propto R_{\text{decay}} \int S(E_\nu) \sigma_{\text{IBD}}$$

- $R_{\text{decay}}$ : Requires improved fission yields
- $S(E_\nu)$ : Requires precision beta spectra and/or total absorption spectrometry

### Normalization:

Now: 5-10%

Potential: 2-3%?

### Hardness/Slope:

Now:  $\sim 2\%$  / MeV

Potential: 0.2-0.5%?

### Non-smooth Shape:

Now:  $\sim <1\%$  bin-to-bin

Potential: ?