^{nat}La(p,x) XS Review

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Methodology

- Fitting calibration peaks
- Detector calibration
- Fitting monitor and target peaks
- Determining end-of-beam activities (A_0)
- Determining beam current and energies
- Generate cross-sections
- Compare results to EXFOR, TALYS and EMPIRE

Cross-section Equations

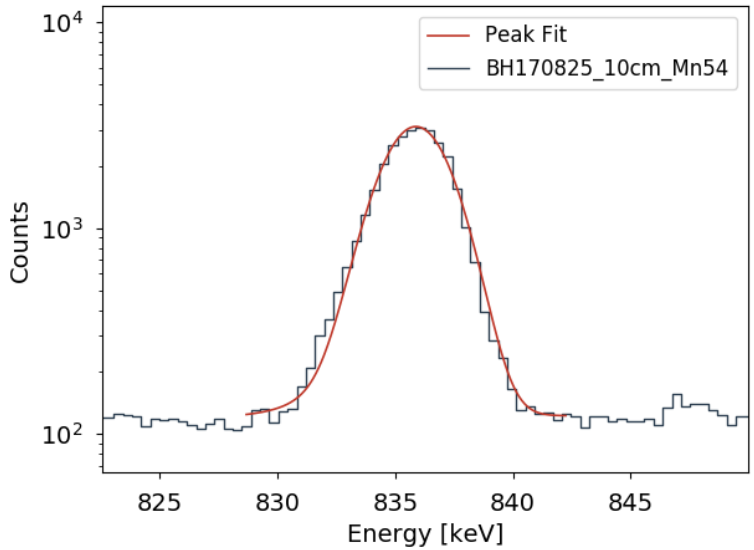
$$A_0 = \frac{\lambda N_c}{(1-e^{-\lambda t_m})e^{-\lambda t_c} I_\gamma \epsilon}$$
$$A_0 = \sigma I_p \rho \Delta r (1 - e^{-\lambda t_i})$$

A_0: End-of-beam activity
t_m: Measurement time
t_c: Cooling time
t_i: Irradiation time
I_p: Beam current
$\rho\Delta r$: Areal density

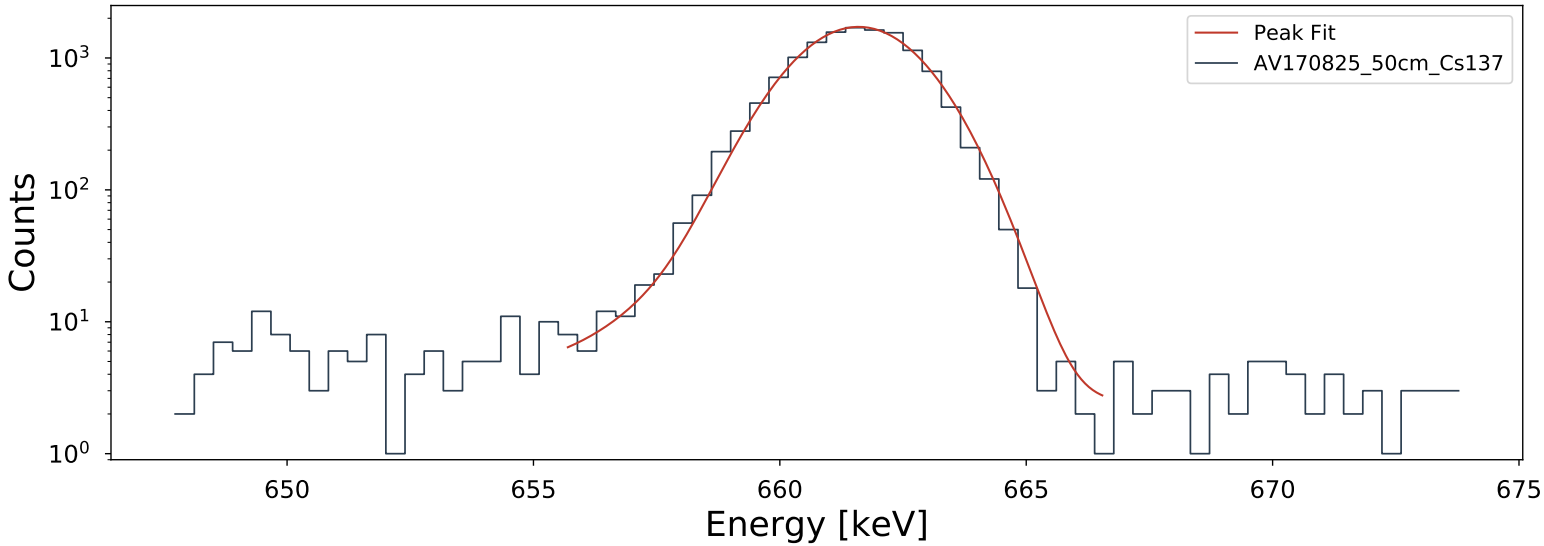
Peak Fitting

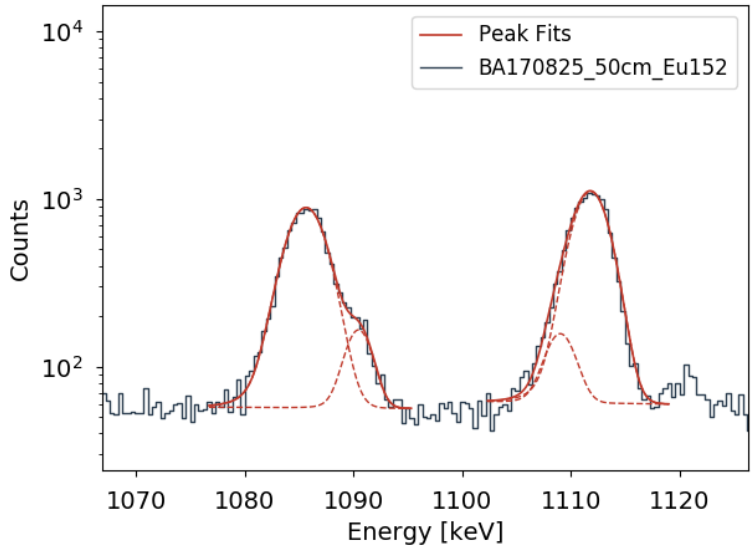
Fit to a skewed Gaussian

$$F_{peak}(i) = m \cdot i + b + A \cdot [\exp(-\frac{(i-\mu)^2}{2\sigma^2}) + R \cdot \exp(\frac{i-\mu}{\alpha\sigma}) \operatorname{erfc}(\frac{i-\mu}{\sqrt{2}\sigma} + \frac{1}{\sqrt{2}\alpha})]$$

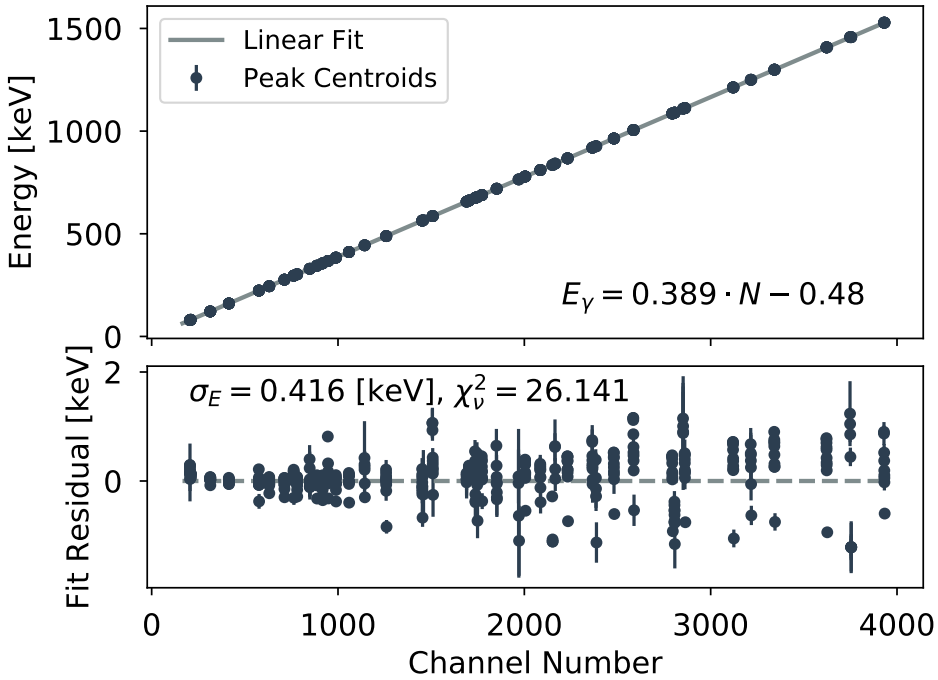


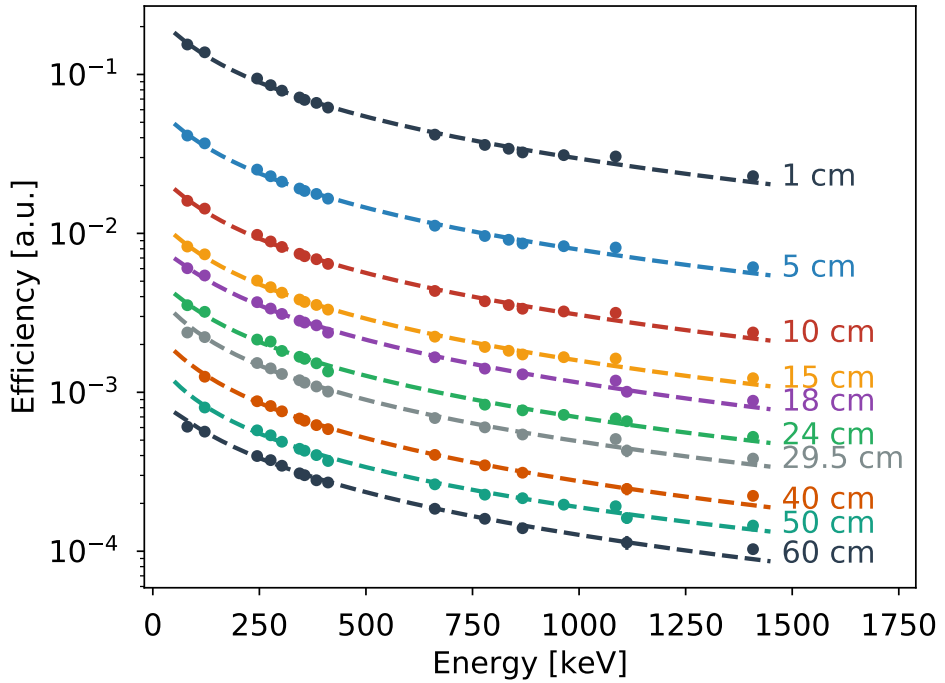
Other Peak Examples





Calibration

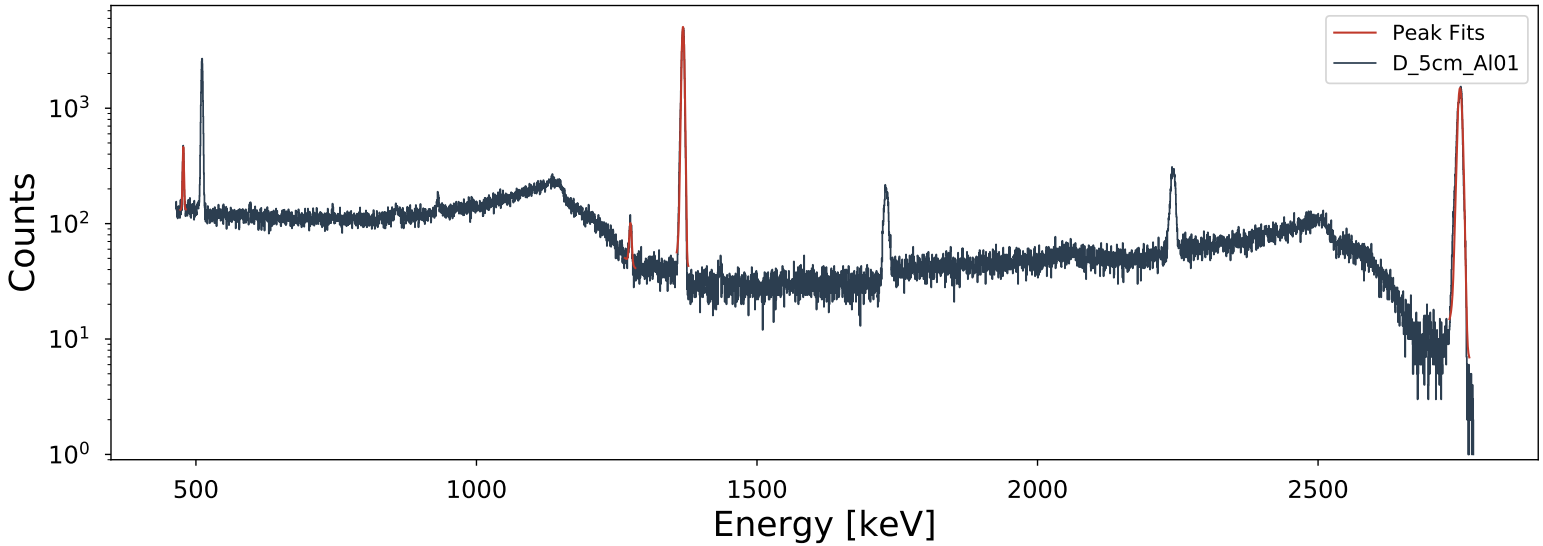


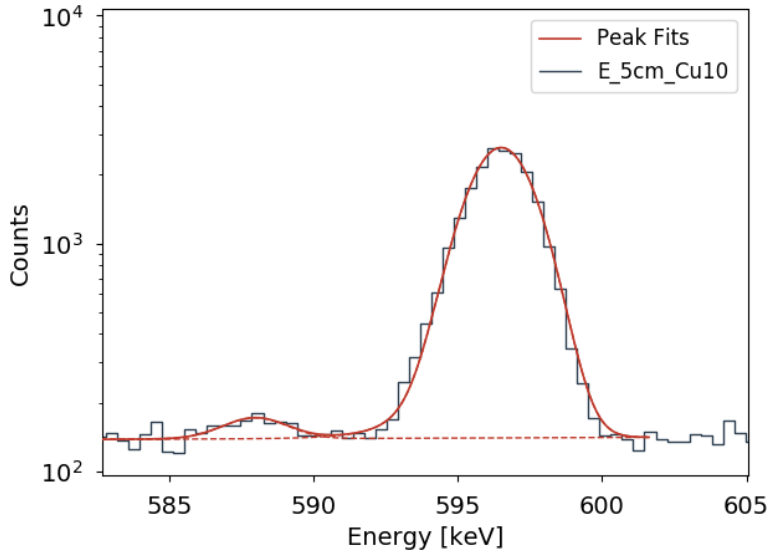


$$E = m \cdot i + b$$

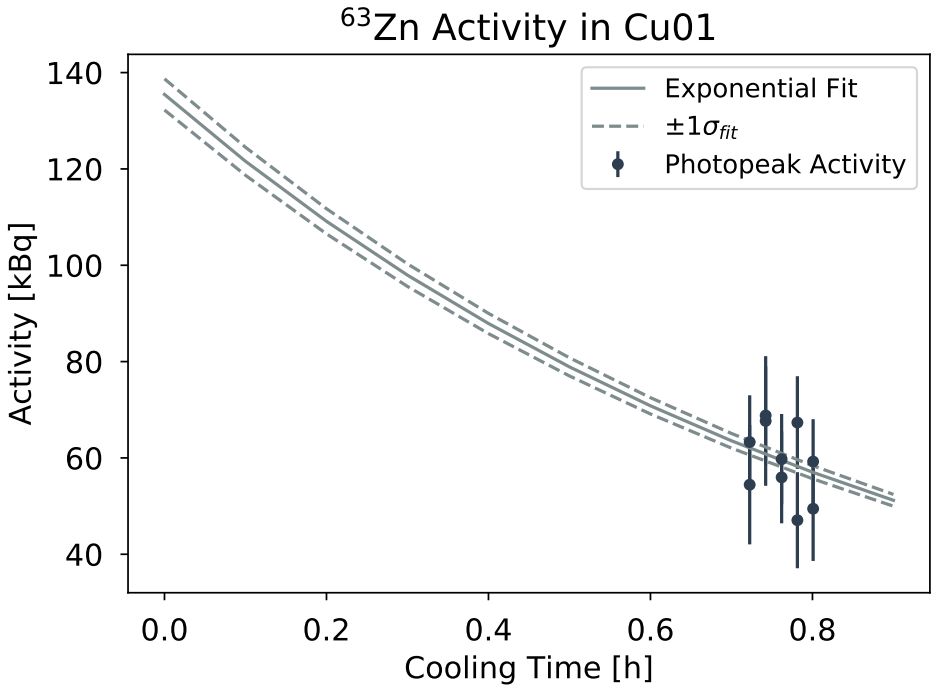
$$\epsilon(E) = exp[a \cdot ln(E)^2 + b \cdot ln(E) + c]$$

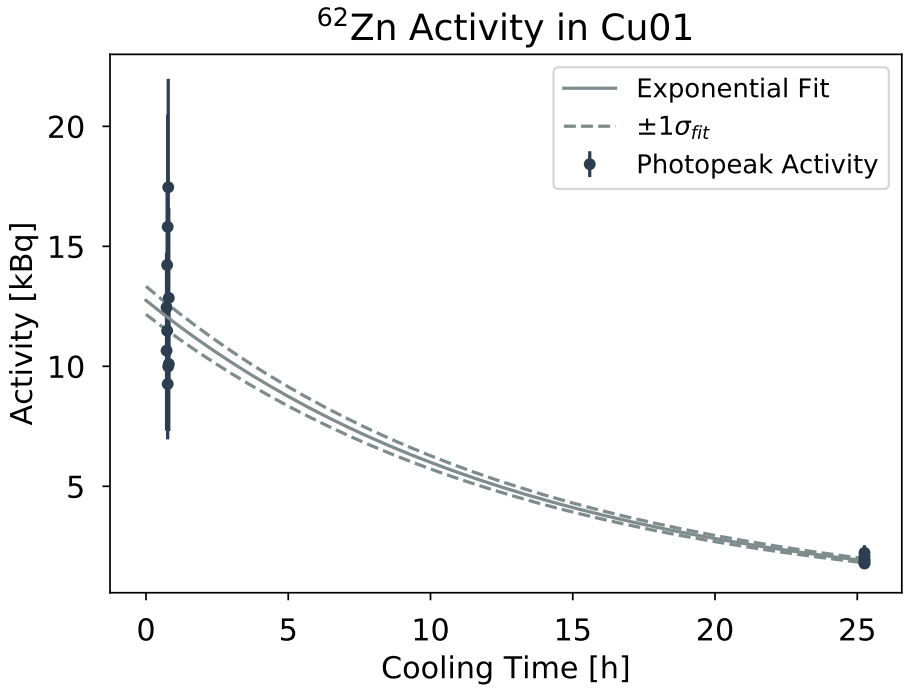
Fitting Monitor Peaks



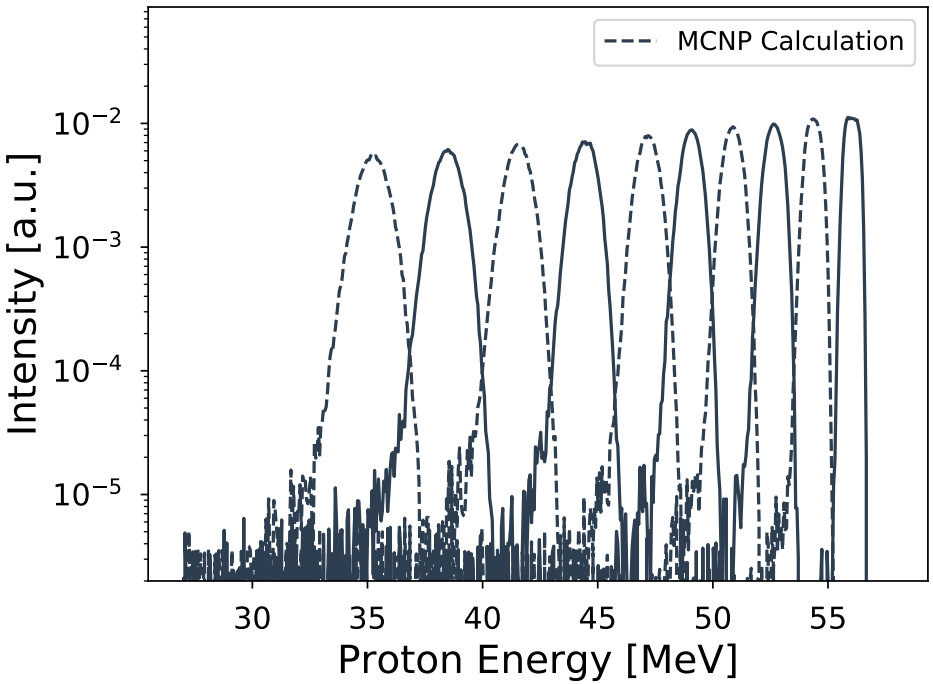


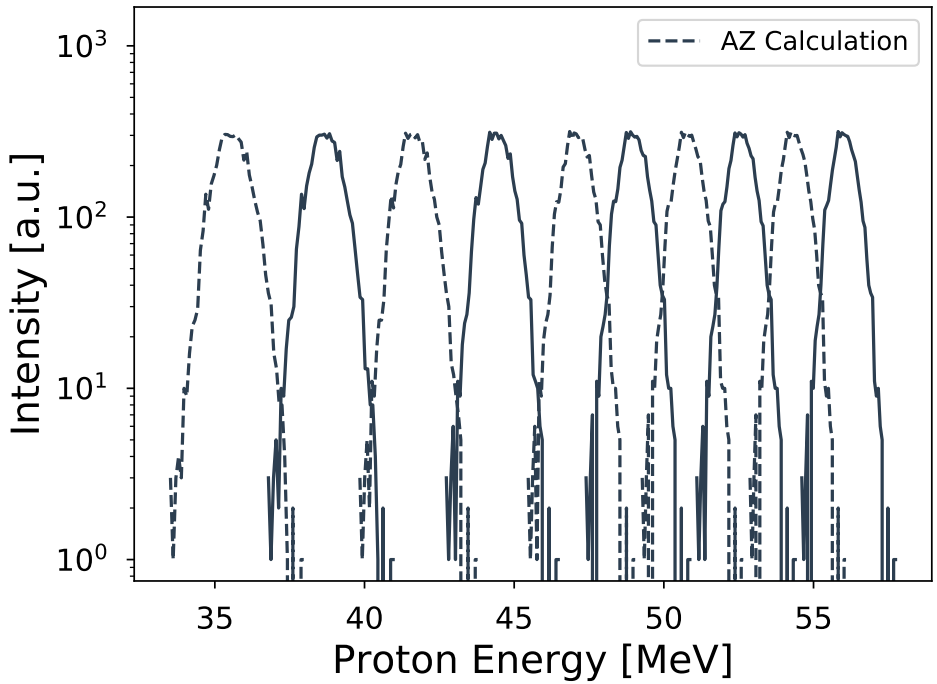
End-of-Beam Activities



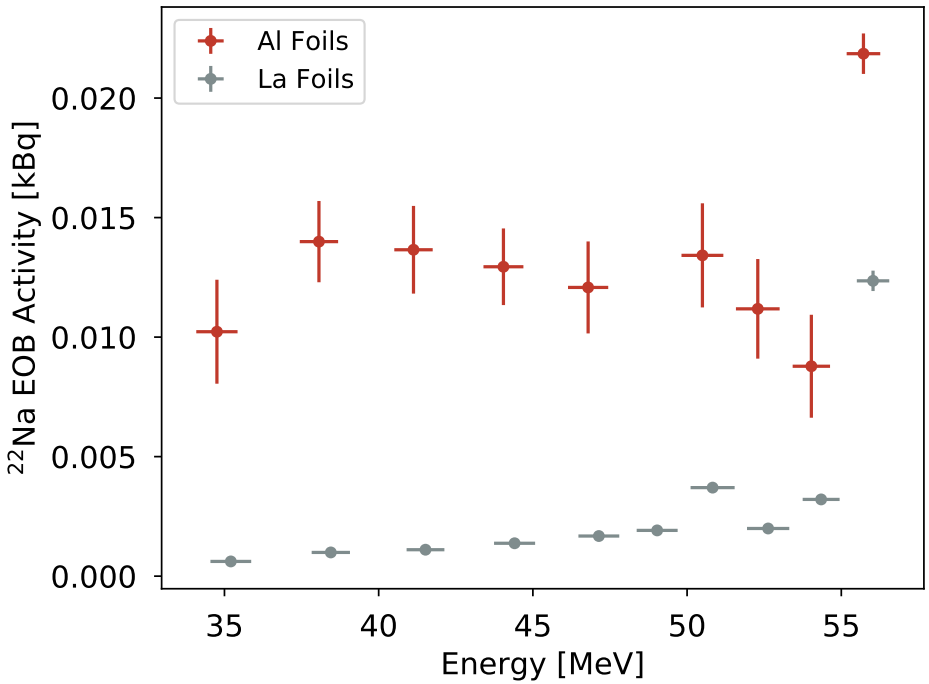


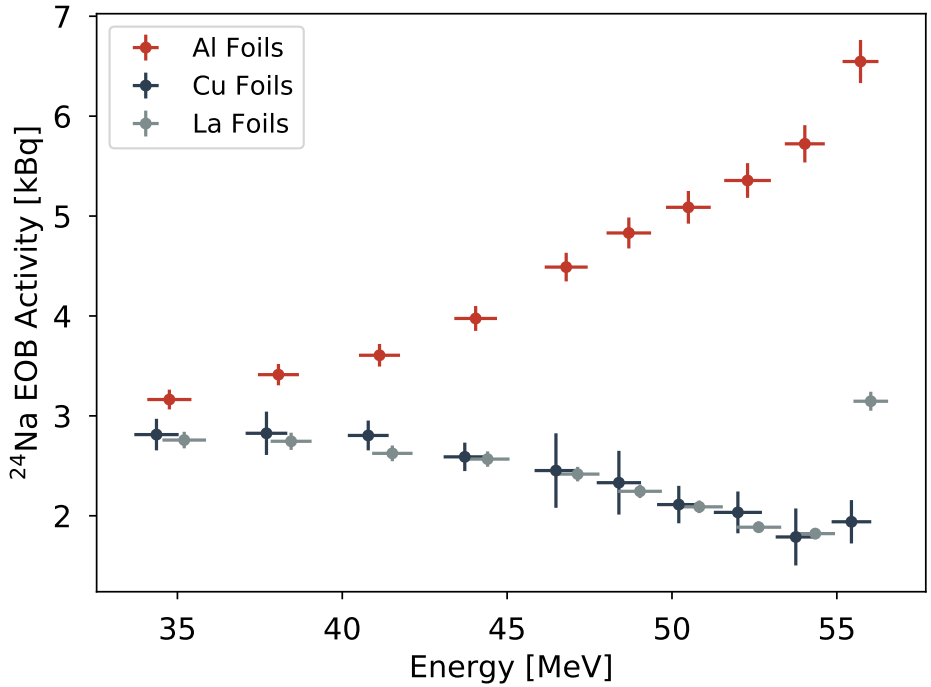
MCNP - Anderson Ziegler Comparison



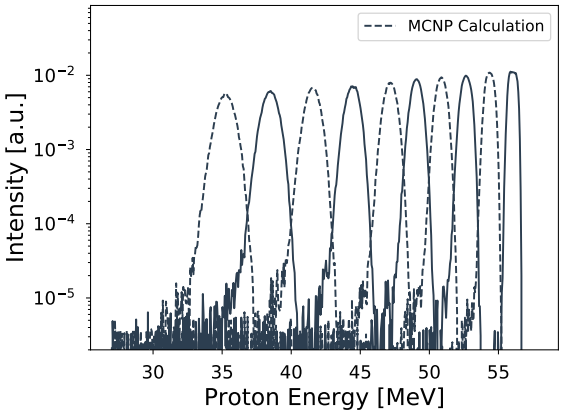


Aluminum Monitor Corrections

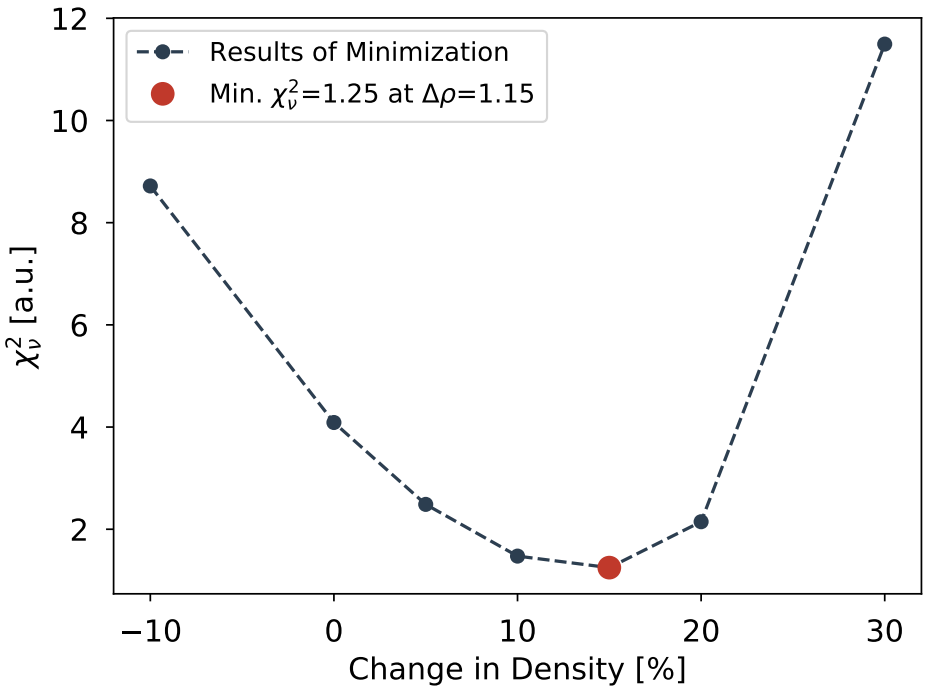




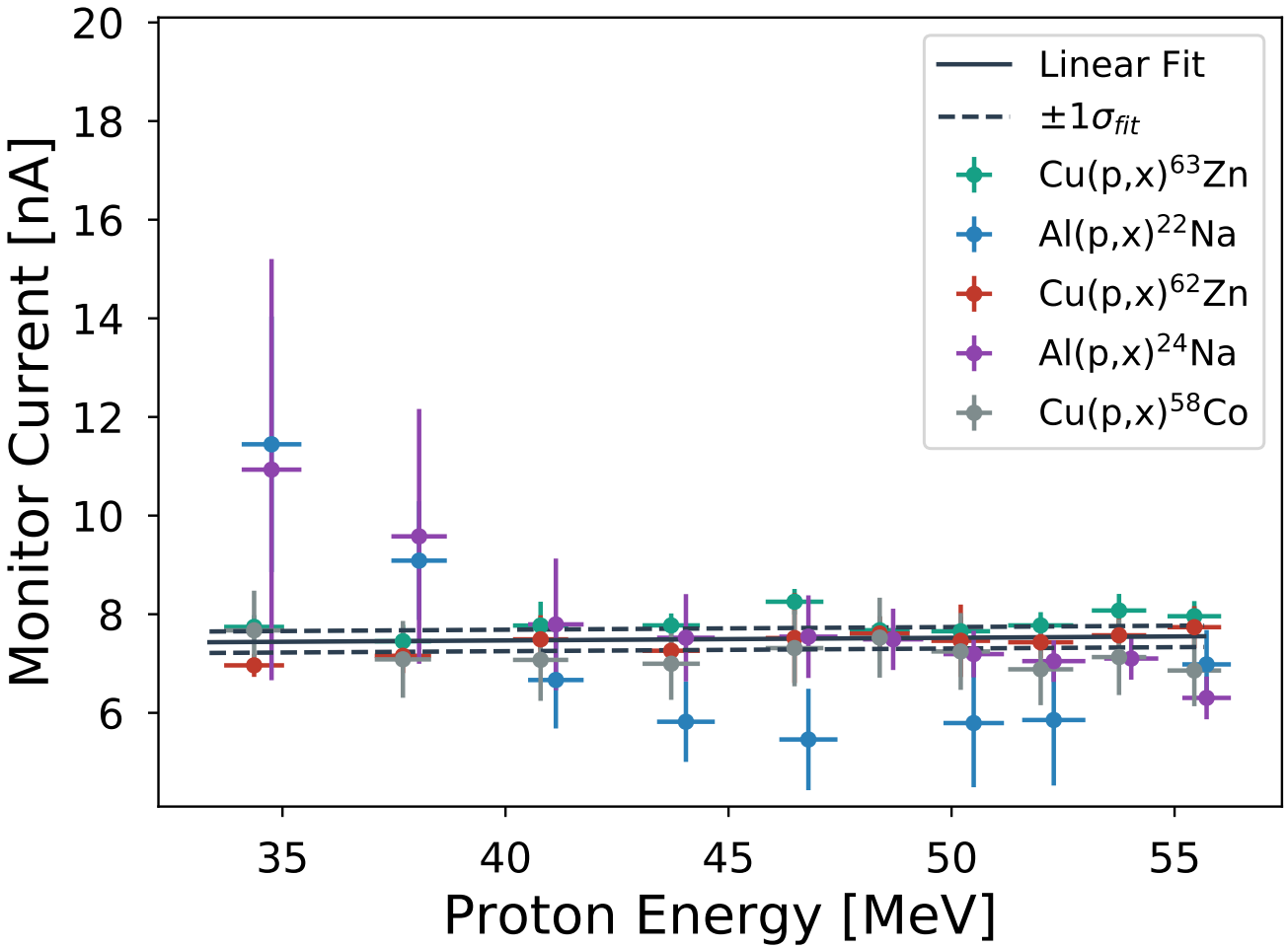
Determining Beam Current



Optimum $\Delta\rho$ determined by χ^2 minimization using MCNP

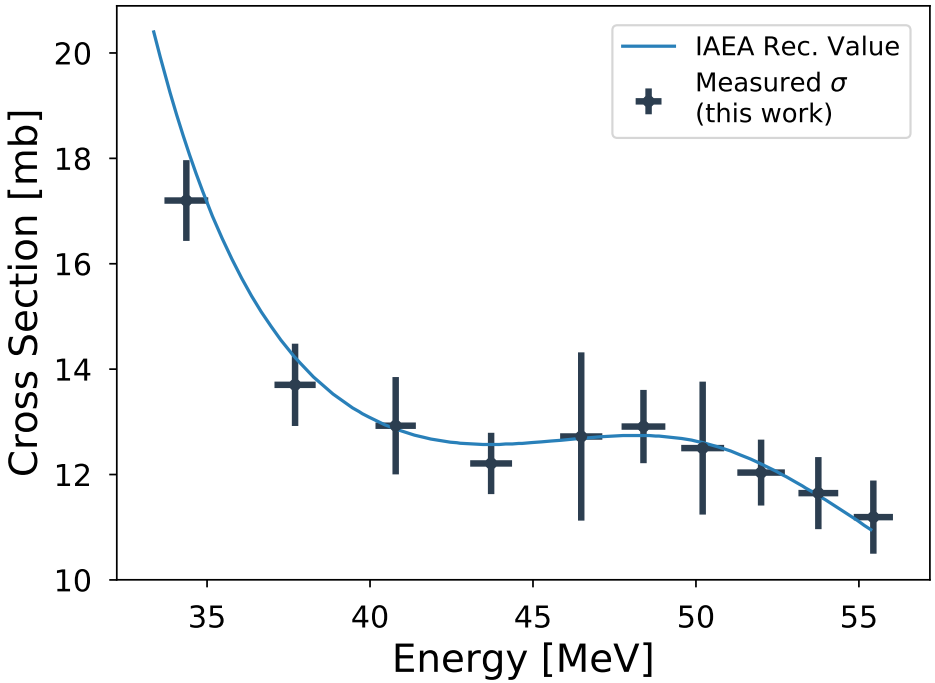


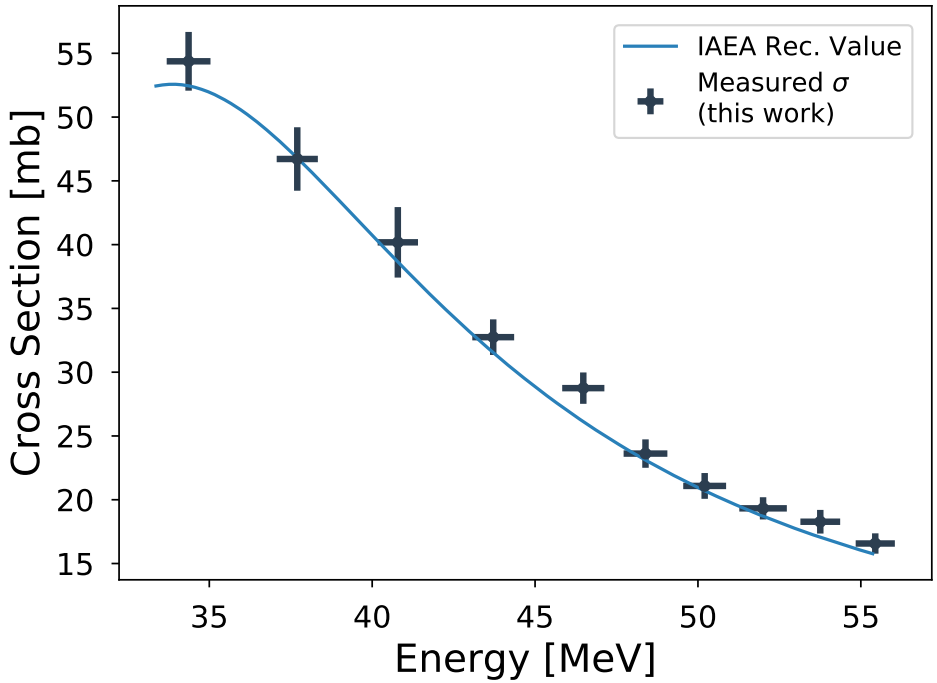
Optimized Beam Current

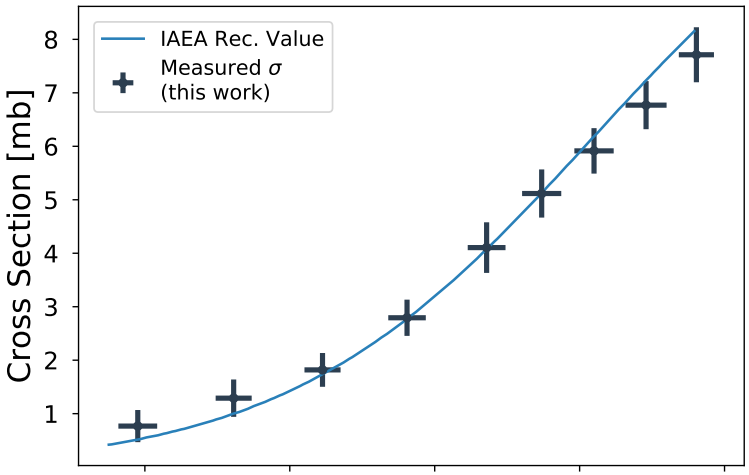


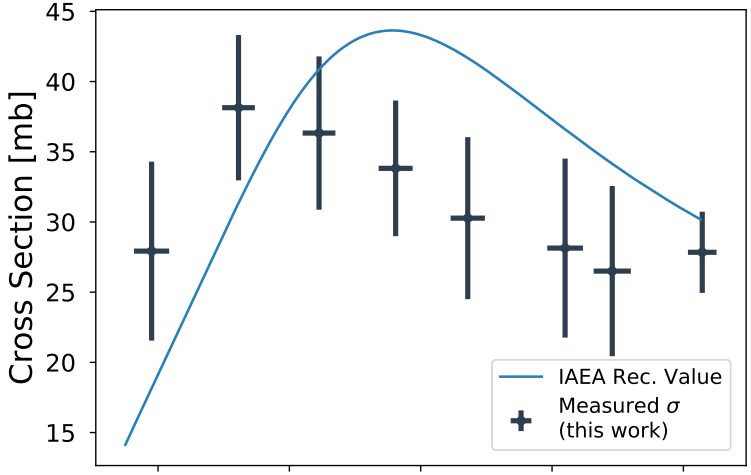
Optimum value of $\Delta\rho$: 1.15

Monitor Cross-Sections

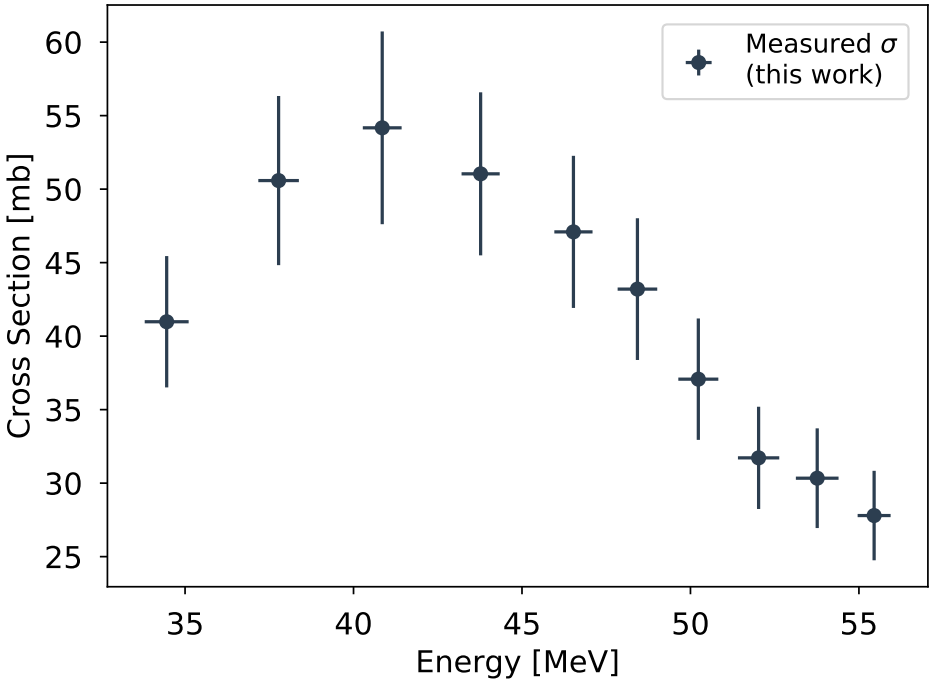


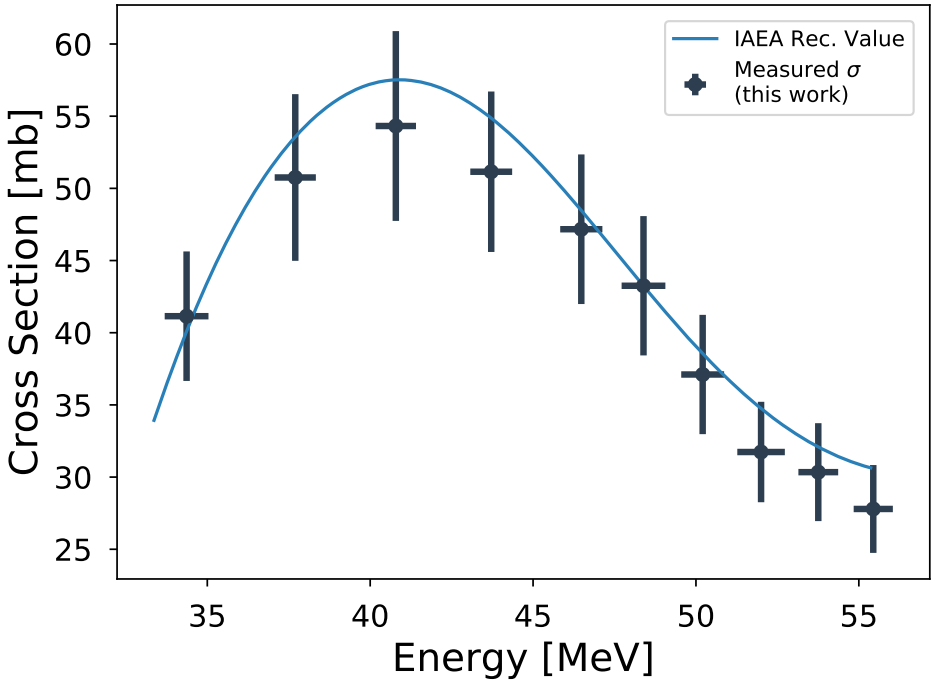




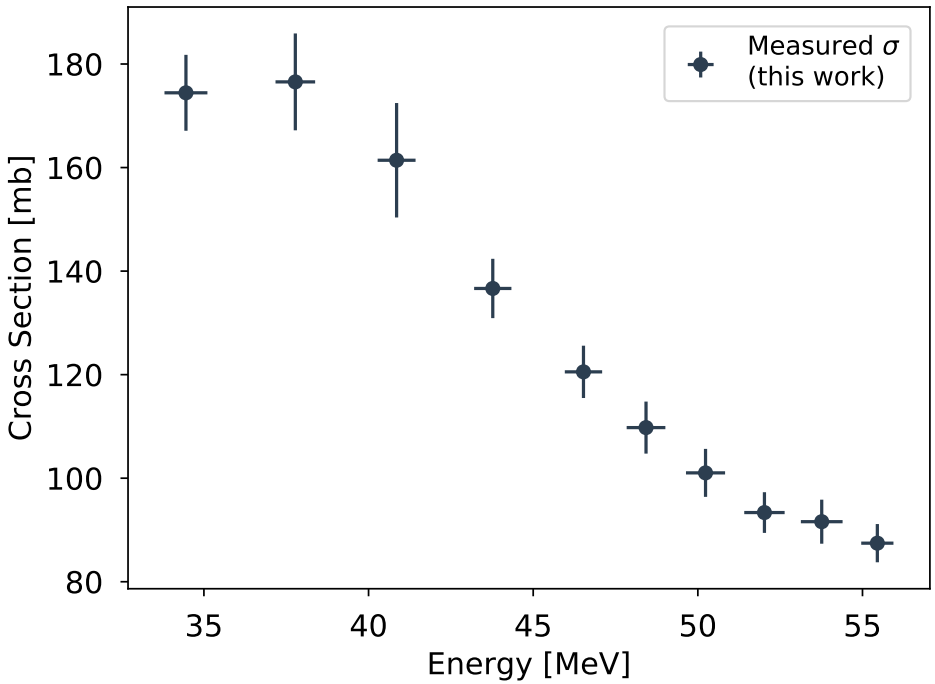


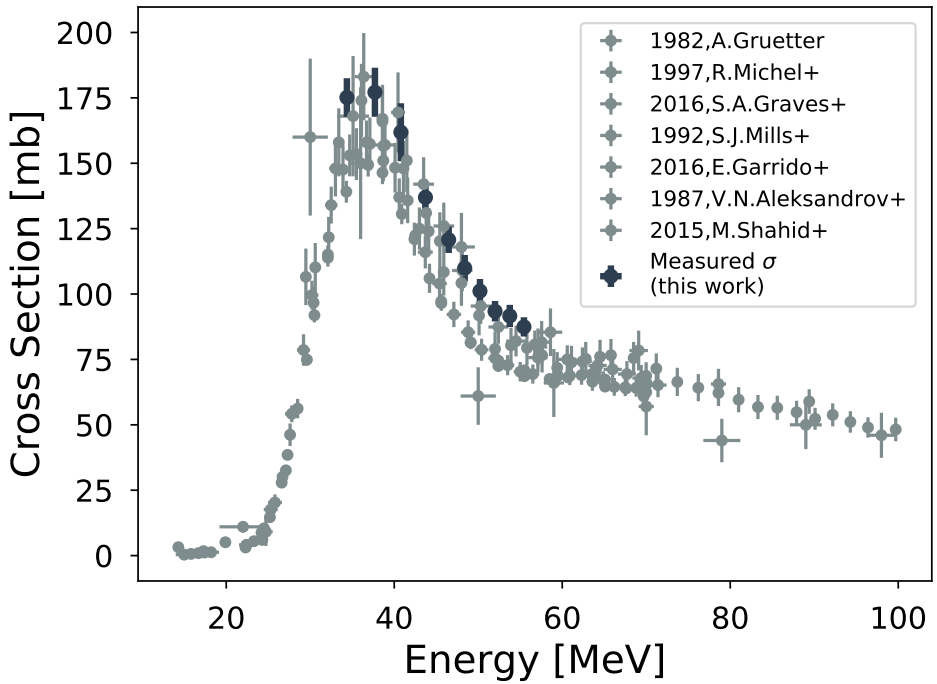
Comparison to EXFOR Data



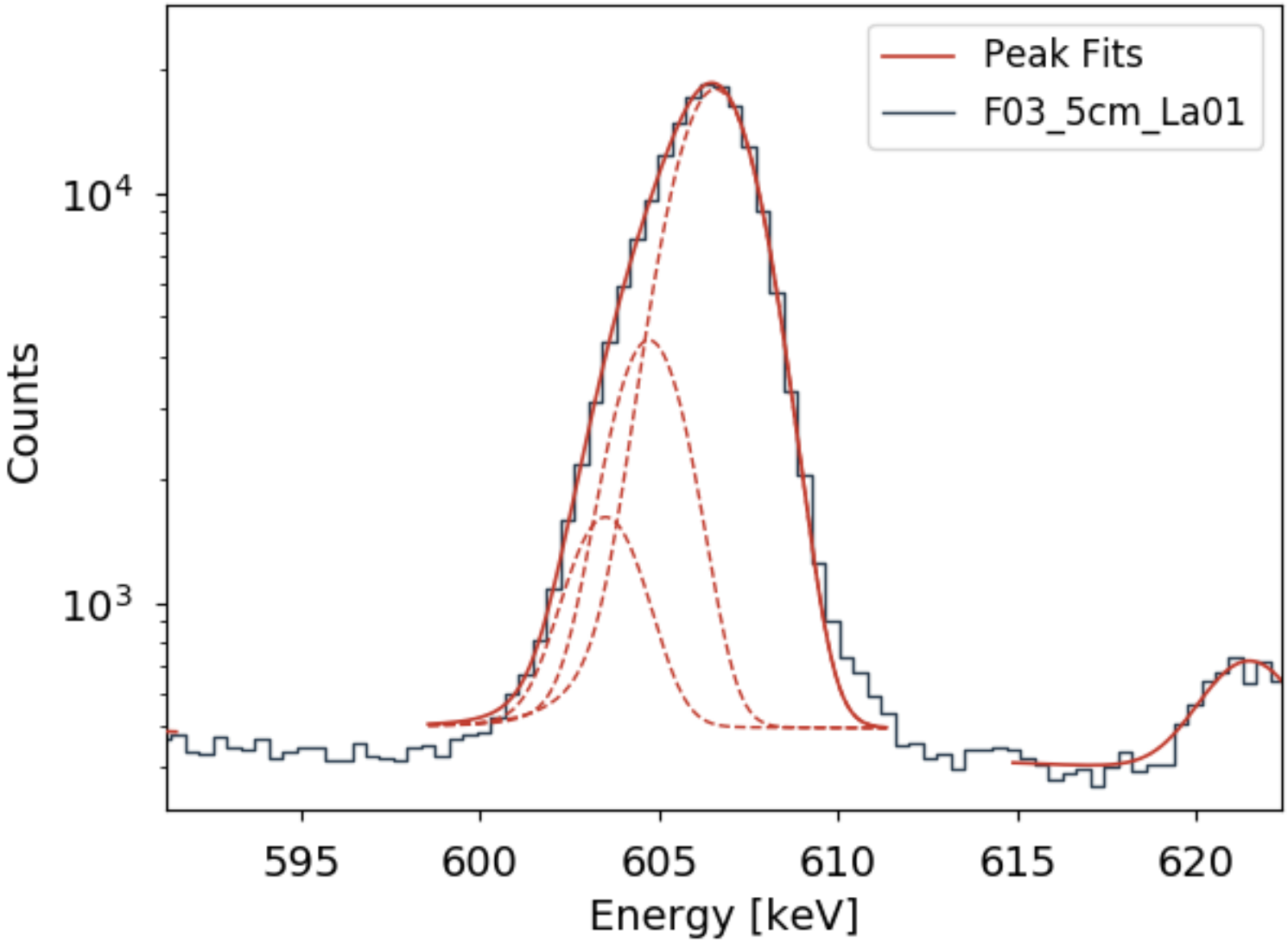


Comparison to EXFOR Data

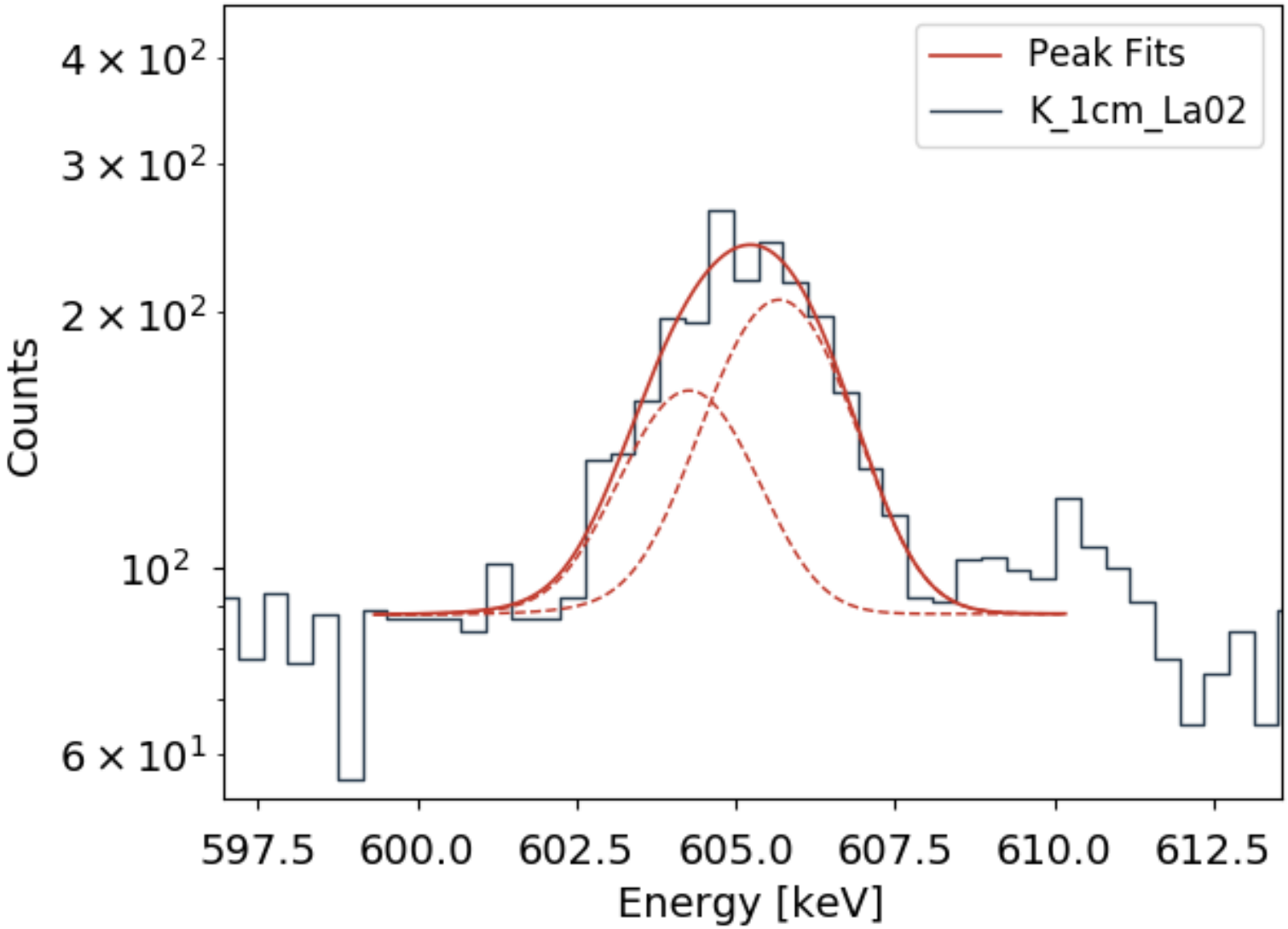




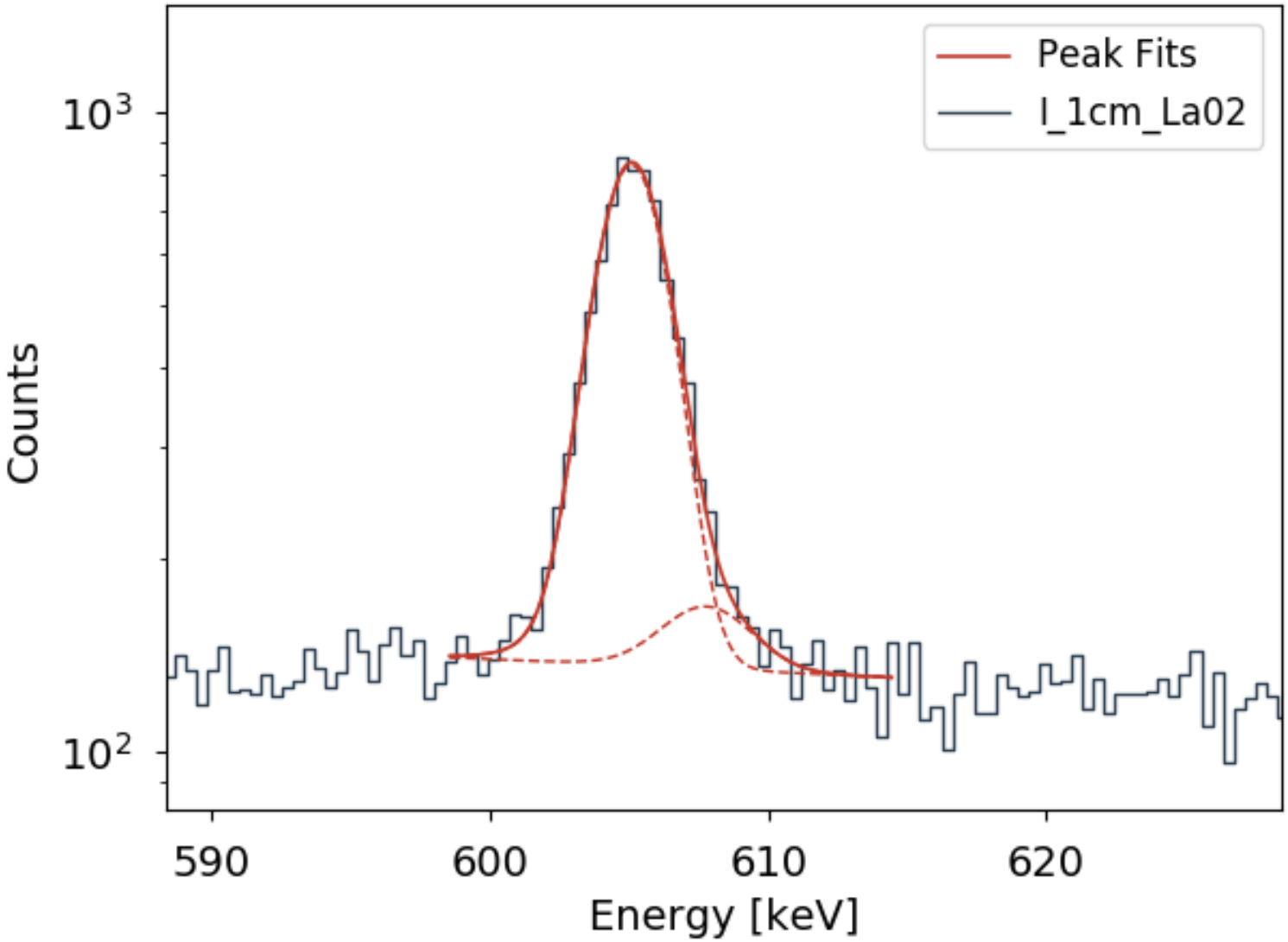
Peak Fitting of Lanthanum Data



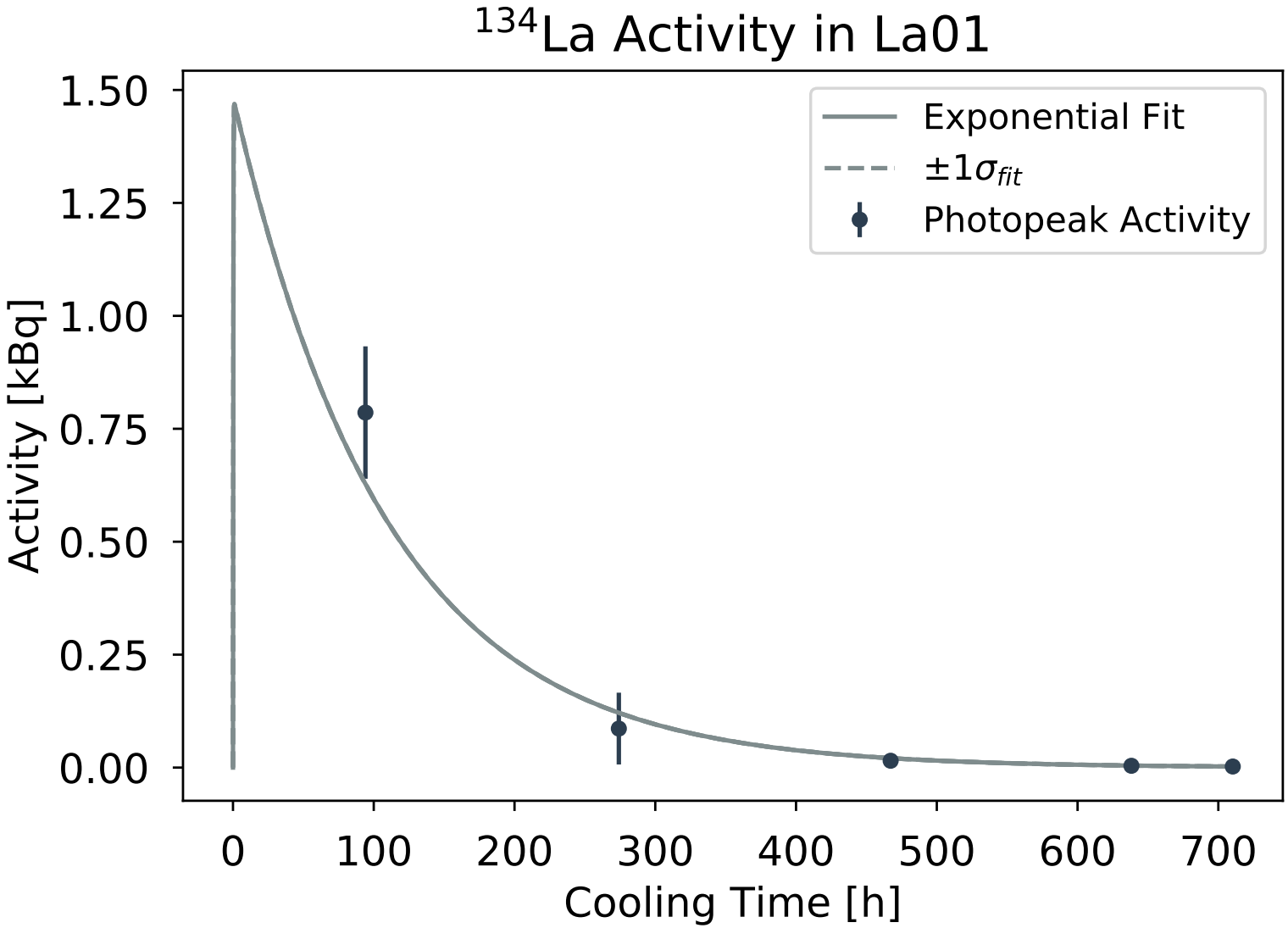
Peak Fitting of Lanthanum Data



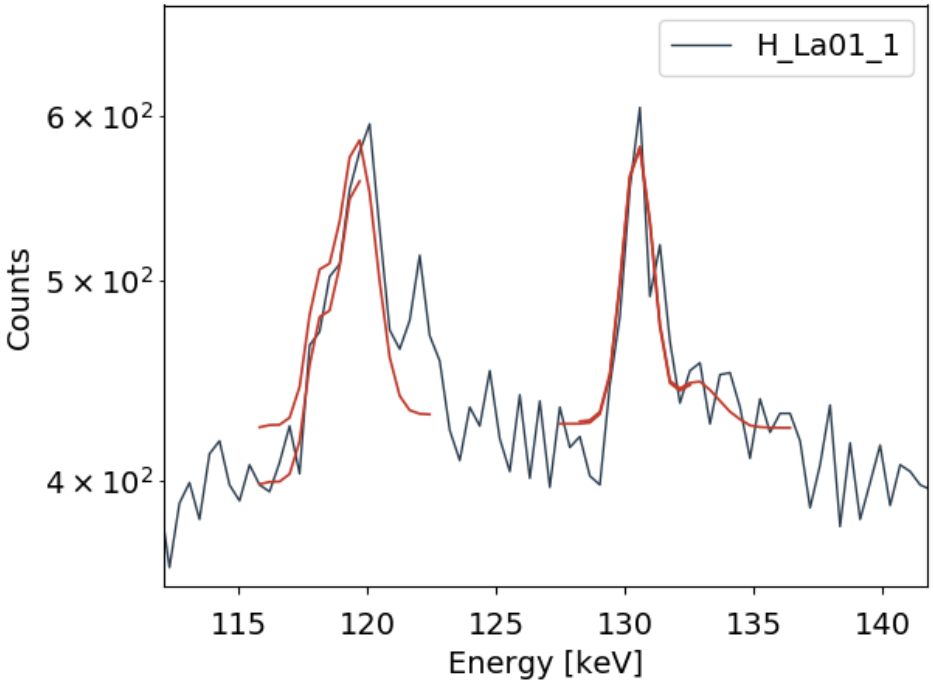
Peak Fitting of Lanthanum Data

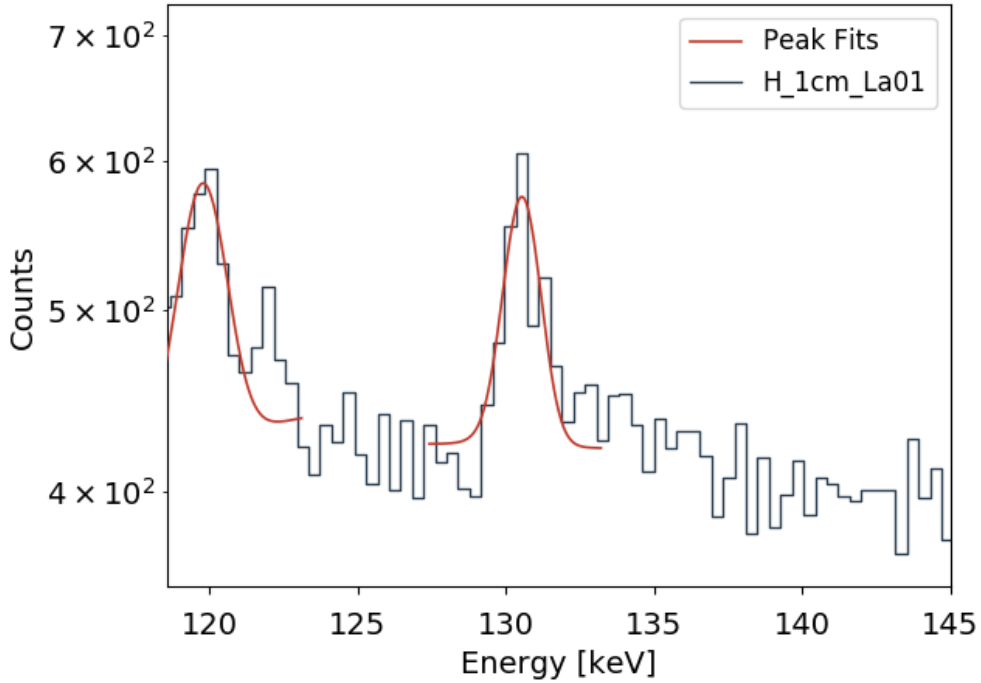


Calculate ^{134}Ce A_0 from ^{134}La $A(t_c)$

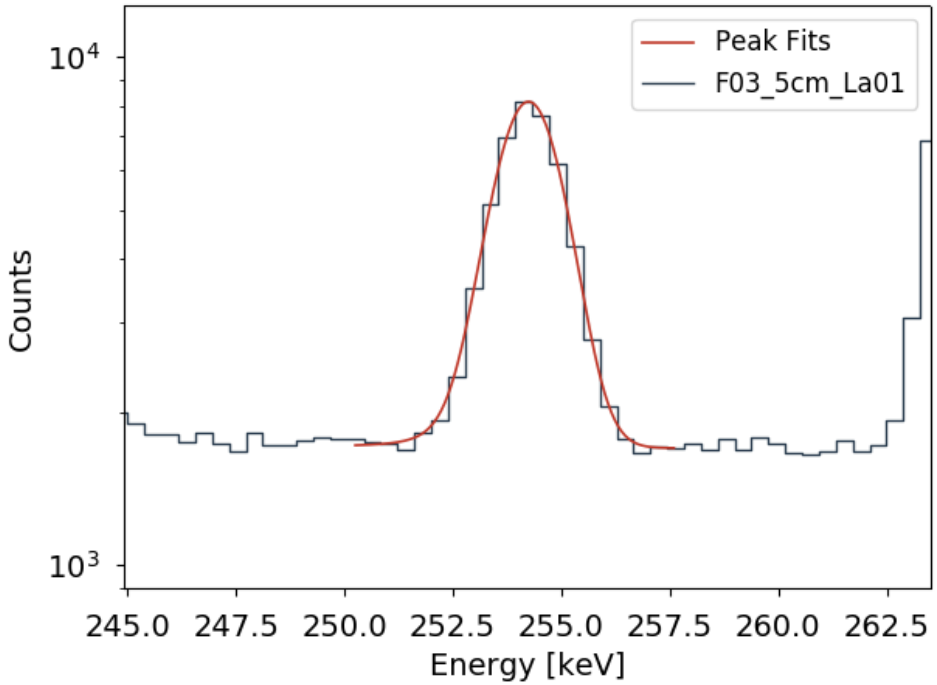


Comparison to previous analysis

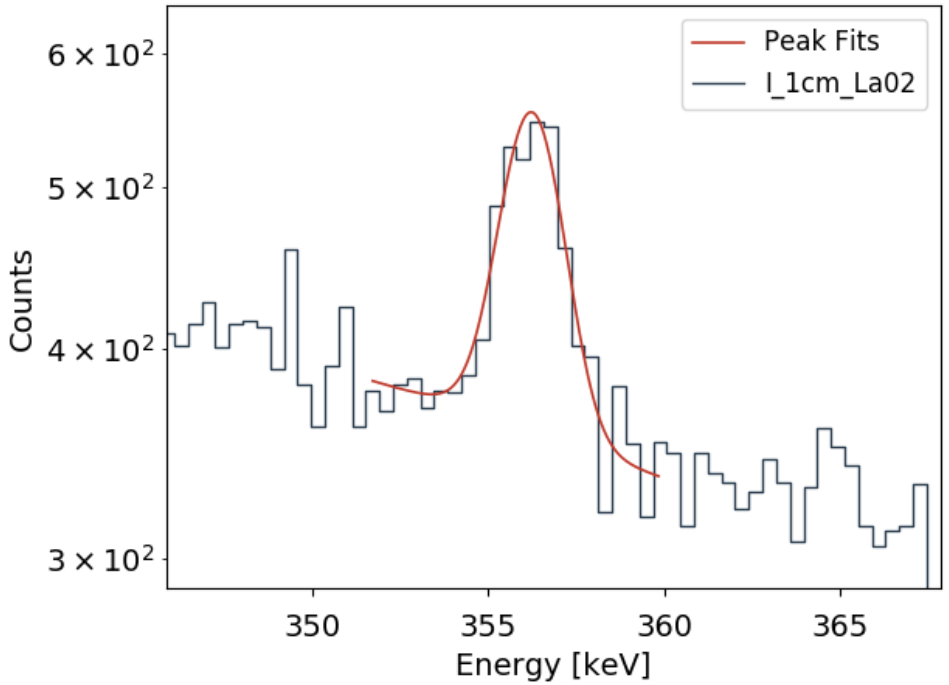




Other Peak Fits



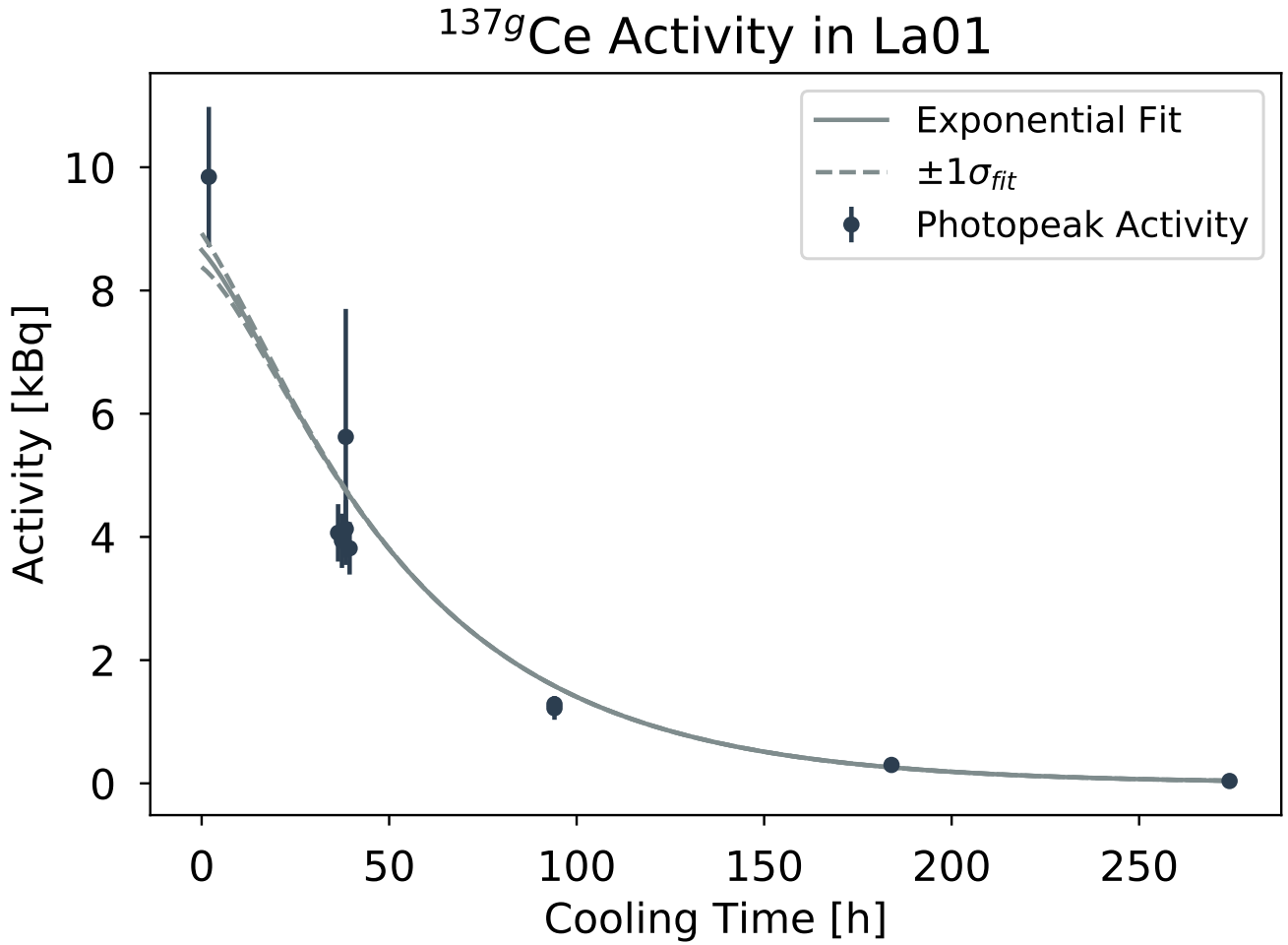
^{137m}Ce: E=254.29 [keV]
I_γ=11.1%
χ^2_ν=1.097



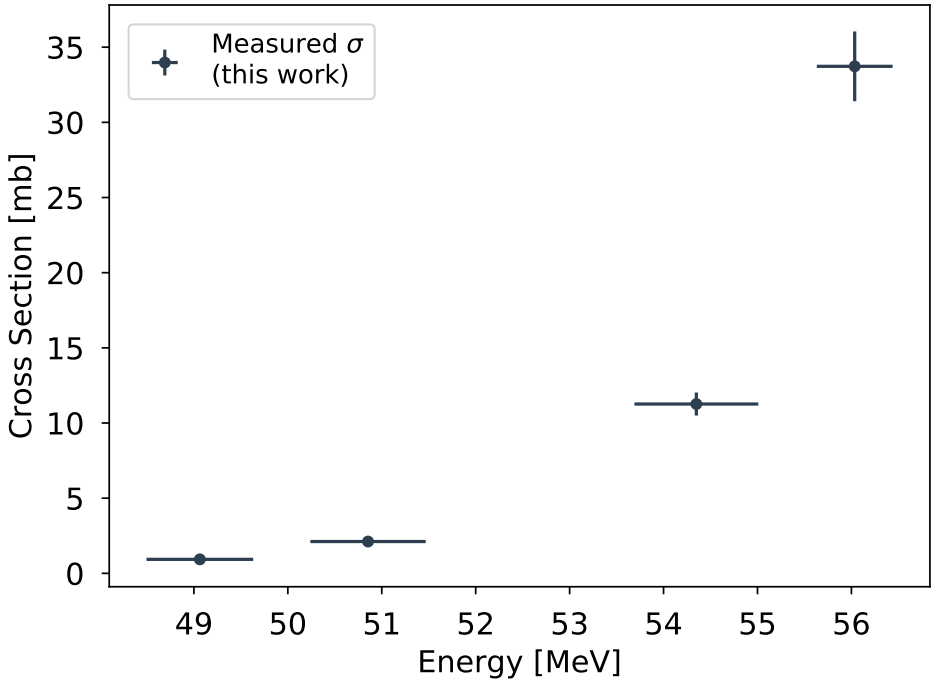
^{133g}Ba: E=356.01 [keV]
I_γ=62.05%
χ^2_ν=1.003

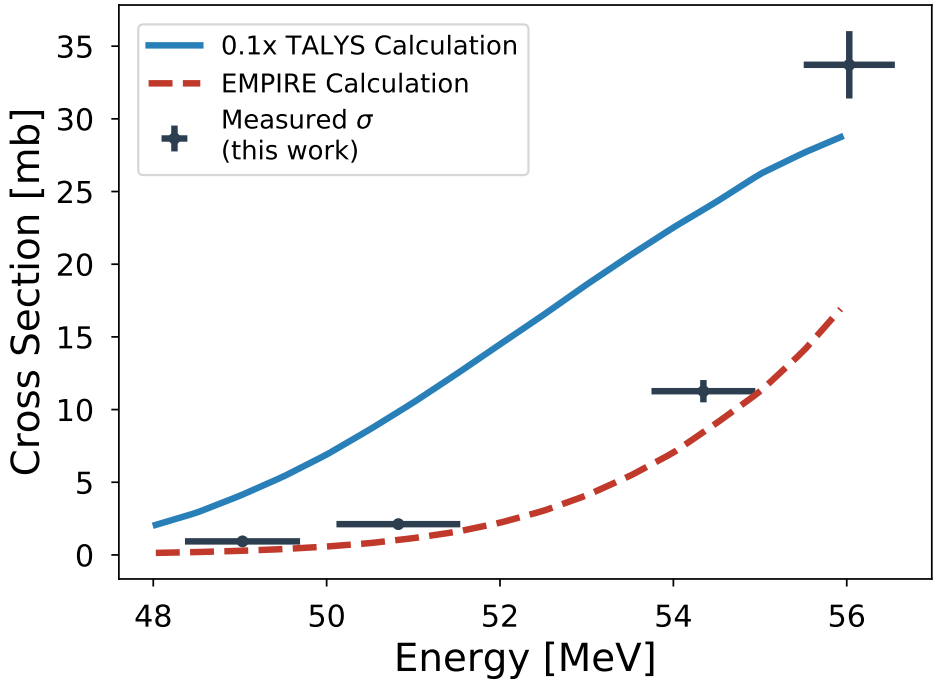
Daughter Nuclide Initial Activities

$$A_D(t_c) = A_{p0}\frac{\lambda_D}{\lambda_D - \lambda_p}\left(e^{-\lambda_p t_c} - e^{-\lambda_D t_c}\right) + A_{D0}e^{-\lambda_D t_c}$$

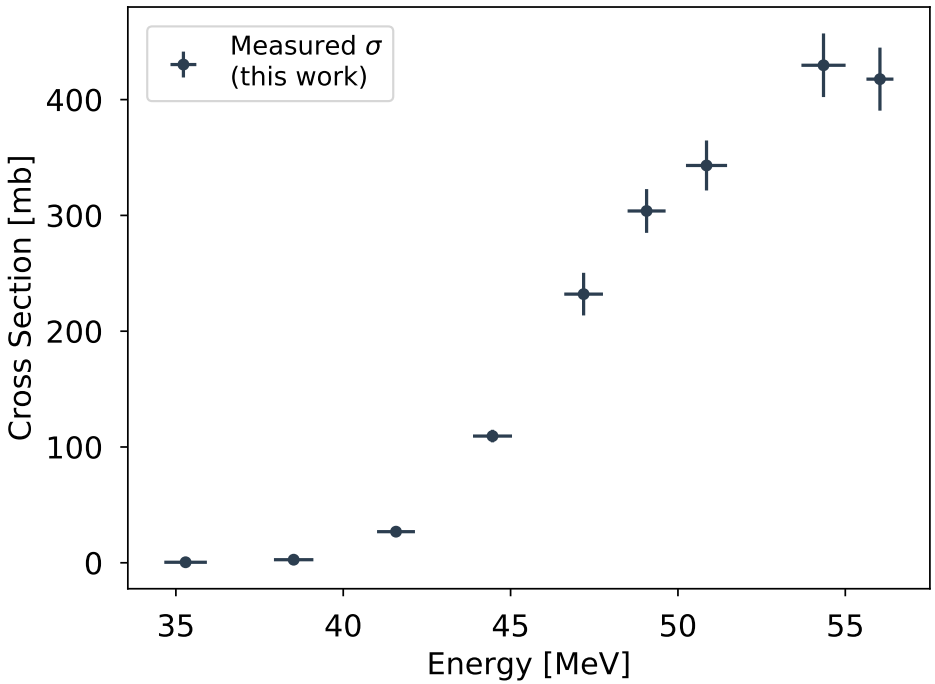


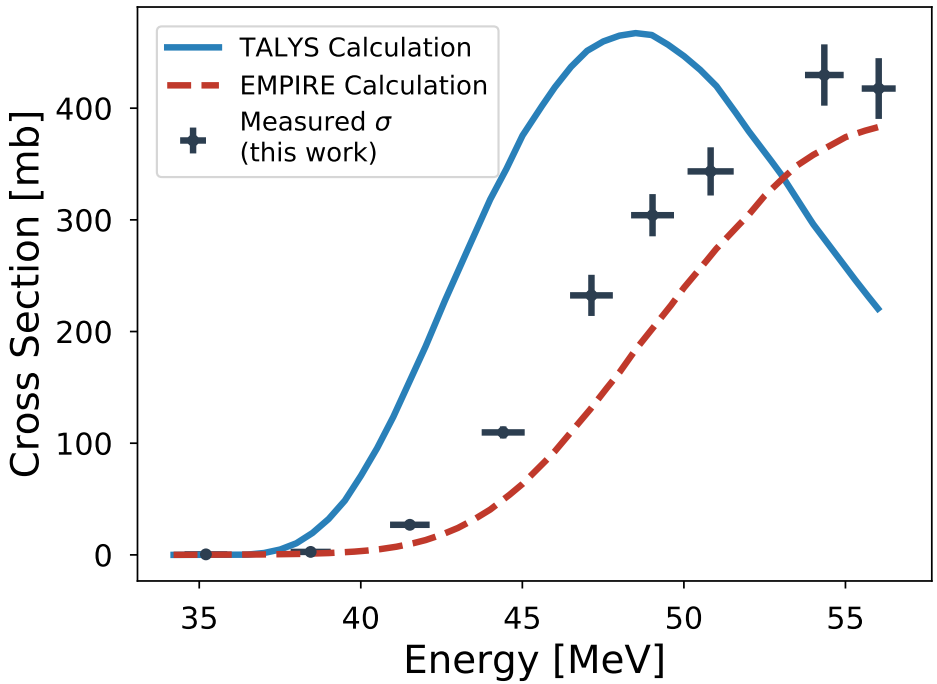
^{134}Ce Cross-Section



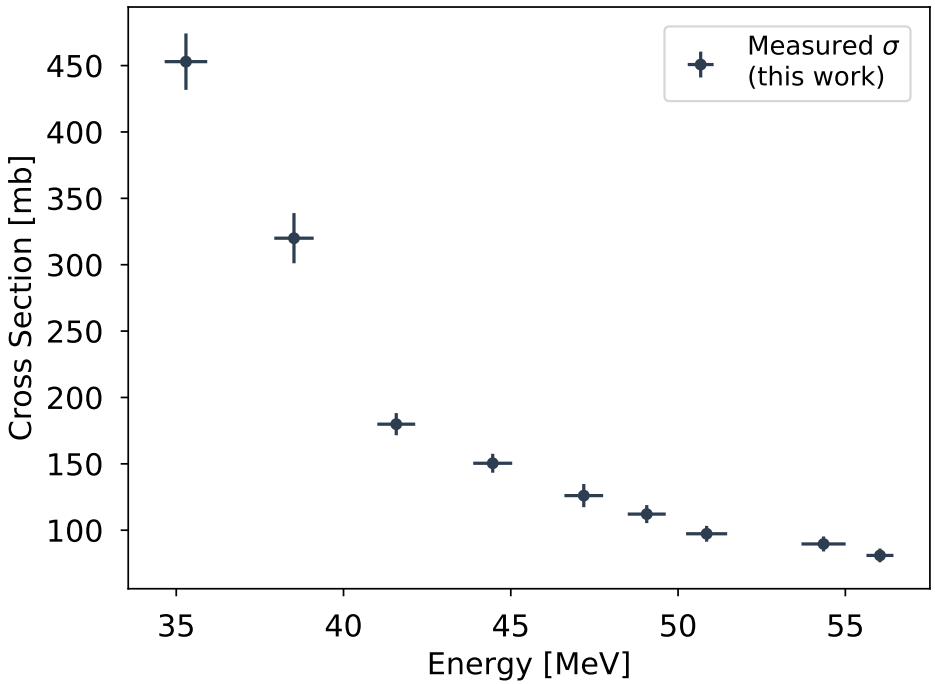


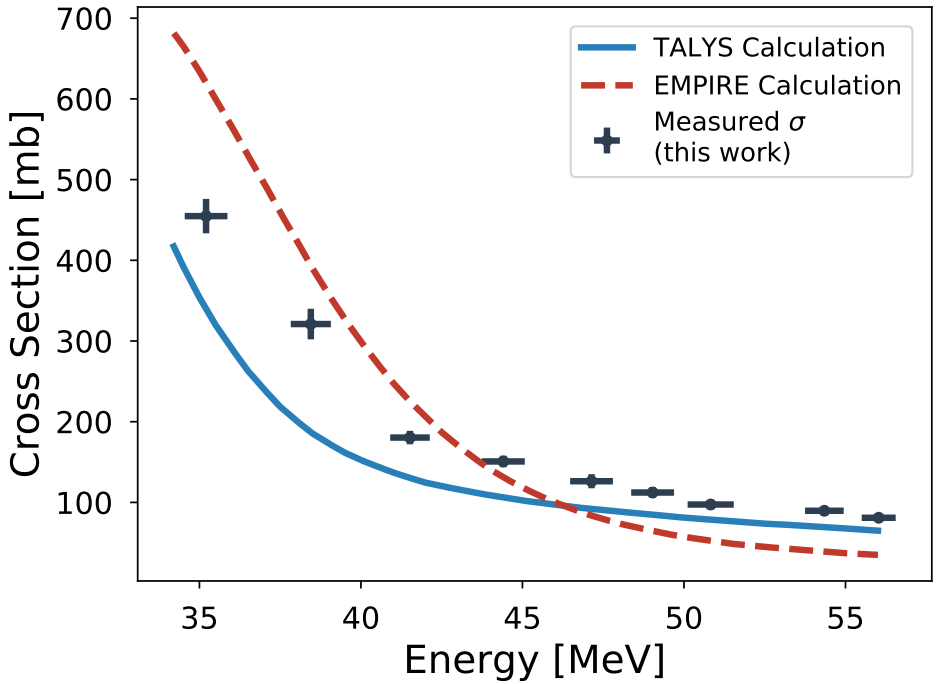
^{135}Ce Cross-Section



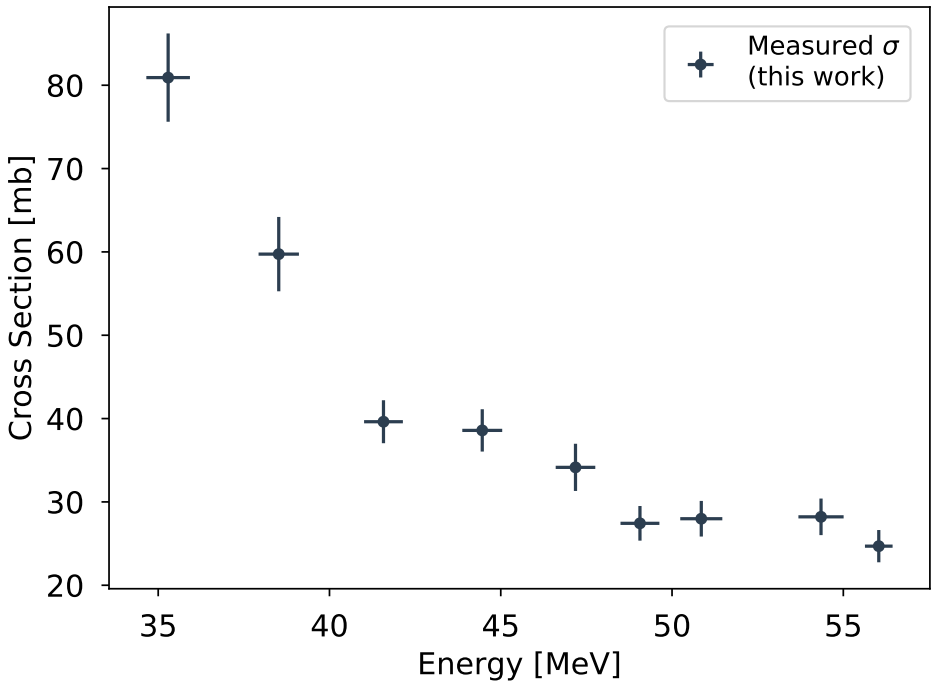


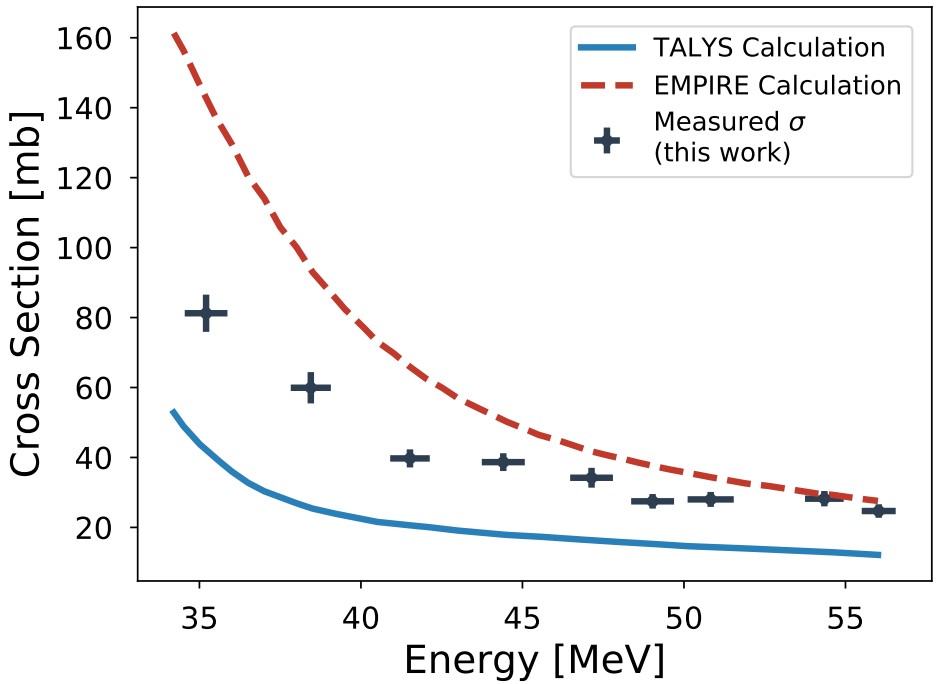
^{137m}Ce Cross-Section



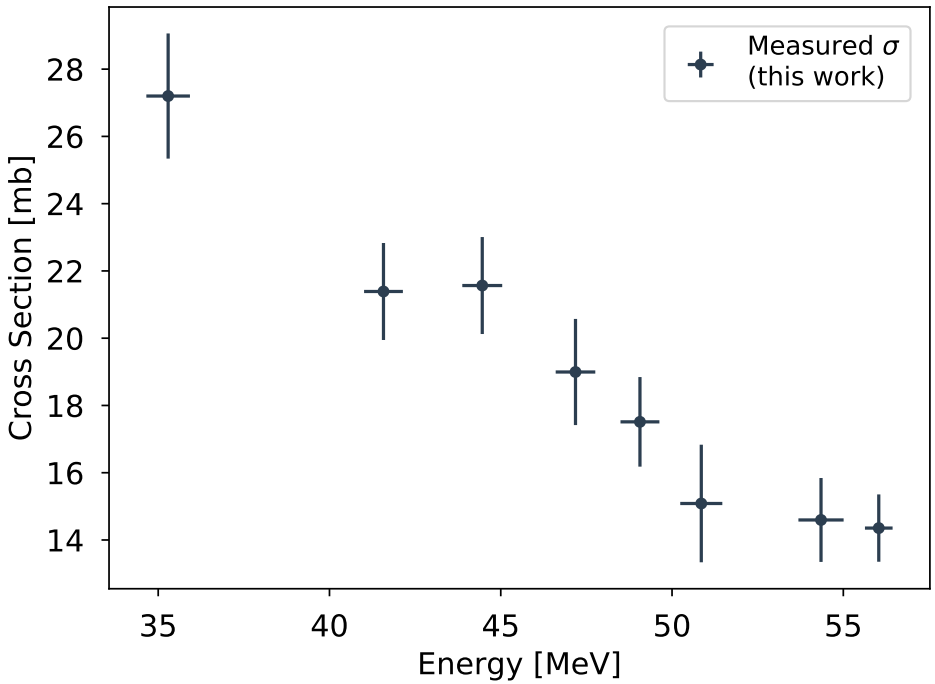


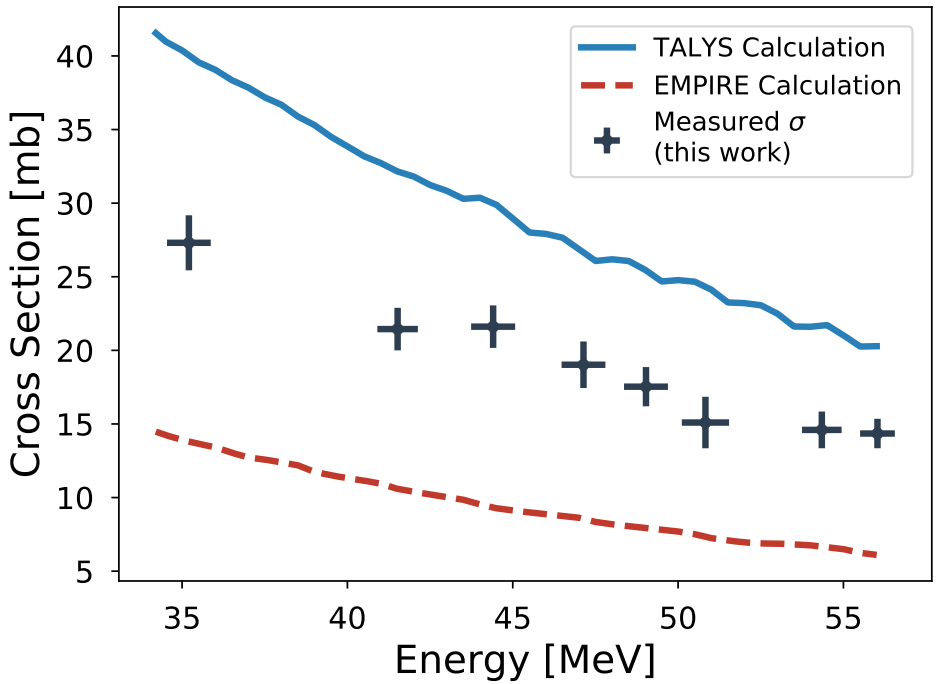
^{137g}Ce Cross-Section



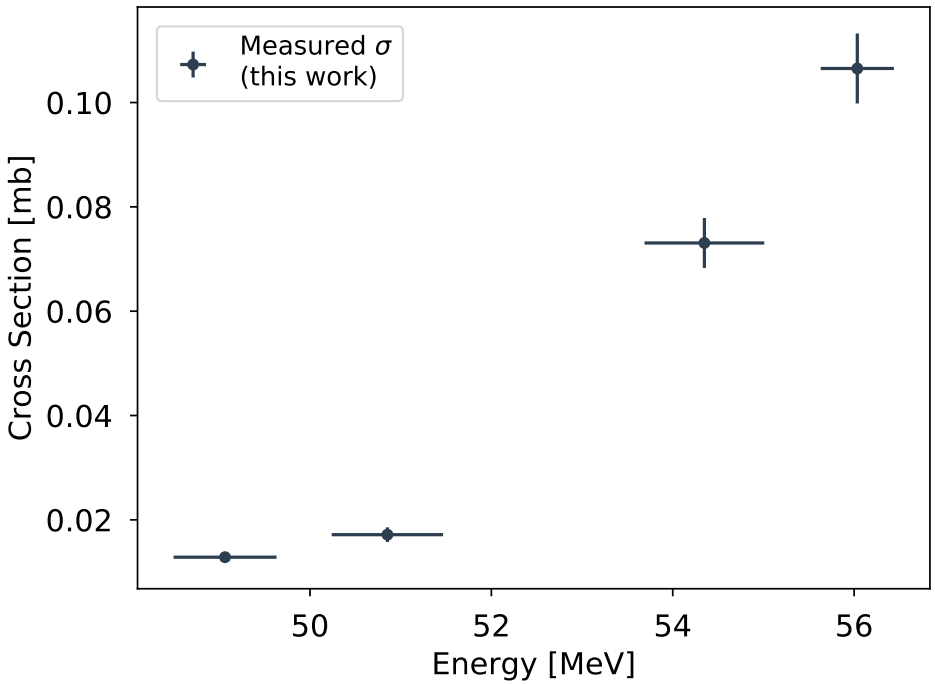


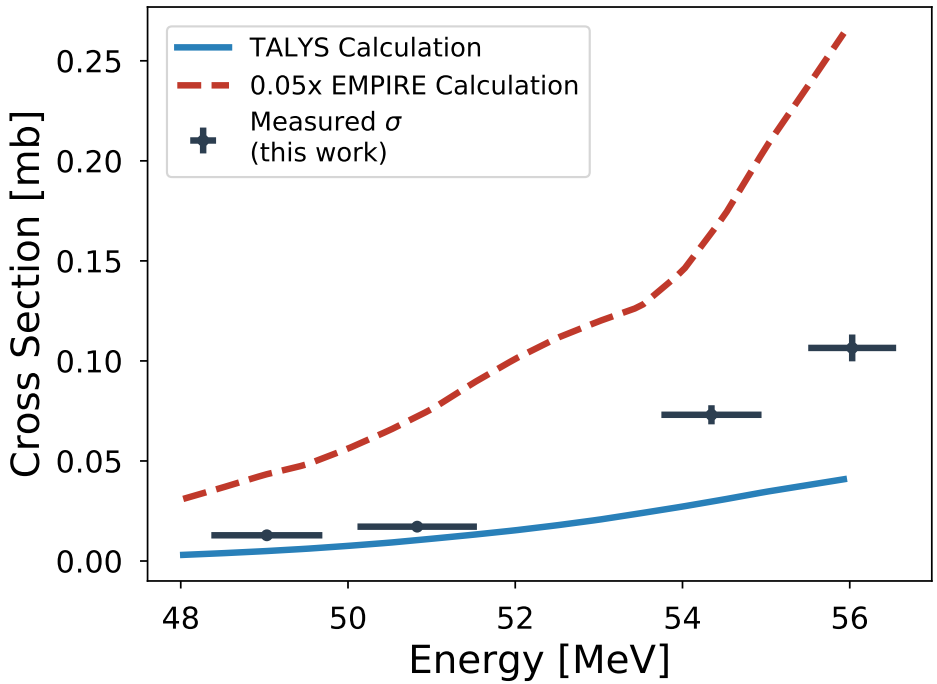
^{139}Ce Cross-Section



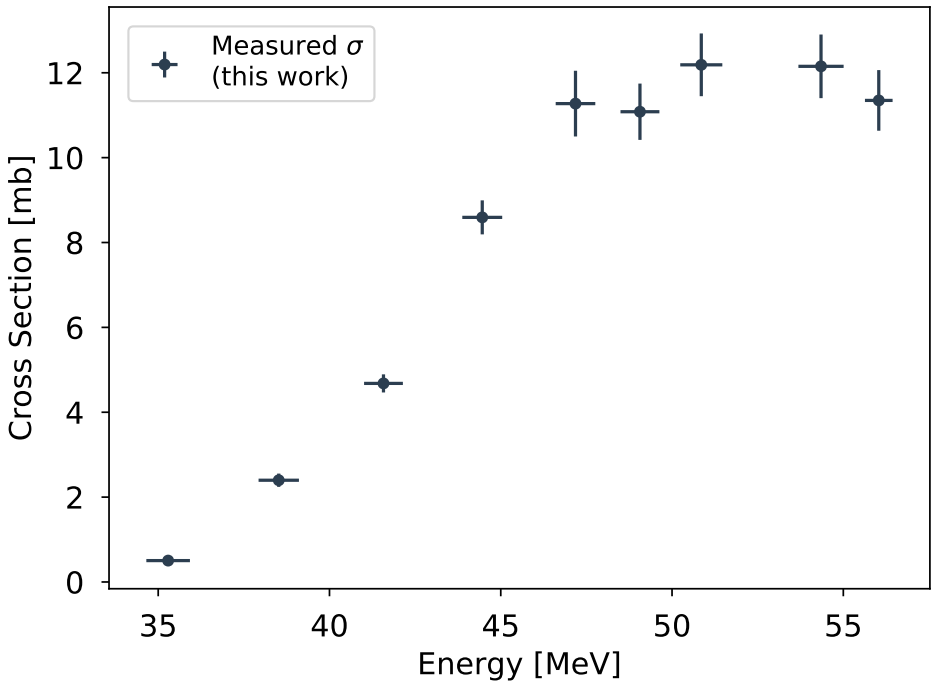


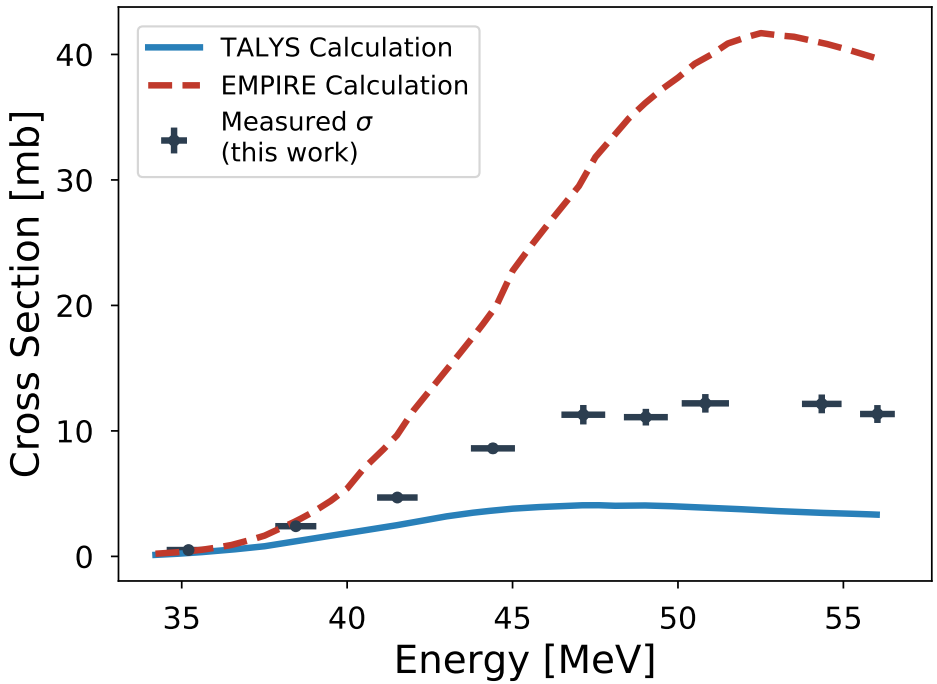
^{132}Cs Cross-Section





^{133m}Ba Cross-Section





^{133g}Ba Cross-Section