

### Solution and methods:

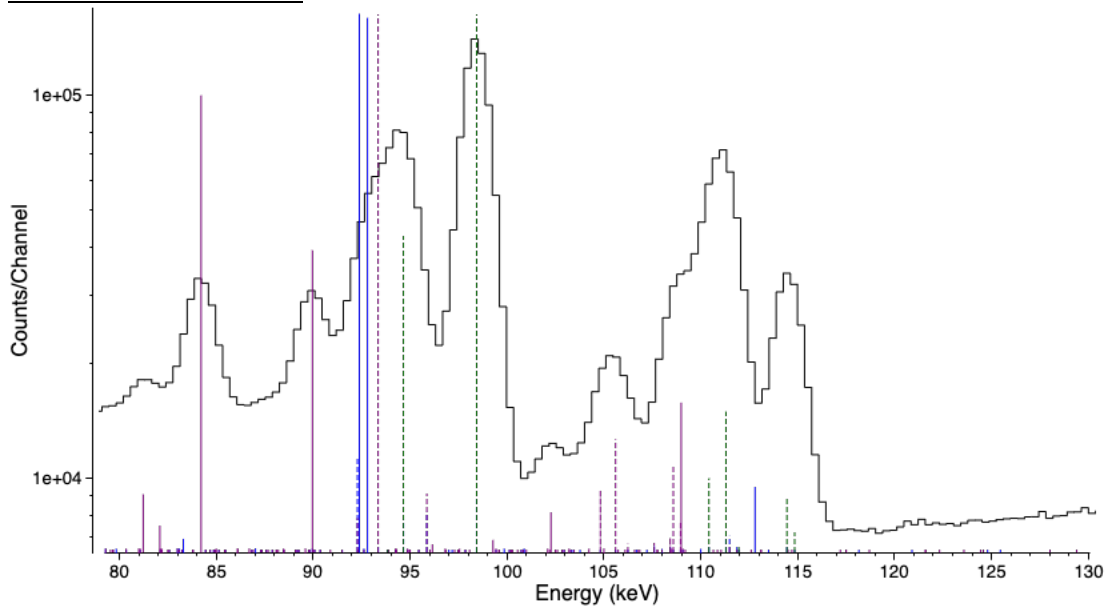


Figure 2 The Uranium x-ray region of the spectrum. Green dotted lines are uranium fluorescent x-rays, blue solid lines are U-238 gammas, blue dotted lines are U-238 decay x-rays, purple solid lines are U-235 gammas, and the dashed purple lines are U-235 decay x-rays

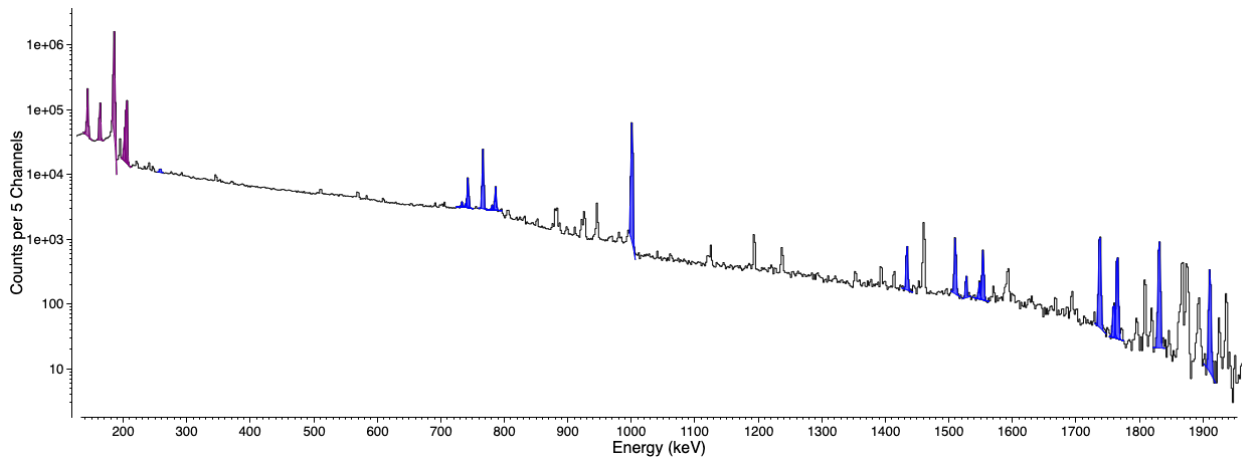


Figure 3 Peaks chosen for use in fitting enrichment and mass. The dominant U-235 and U-238 peaks were chosen, more-or-less arbitrarily.

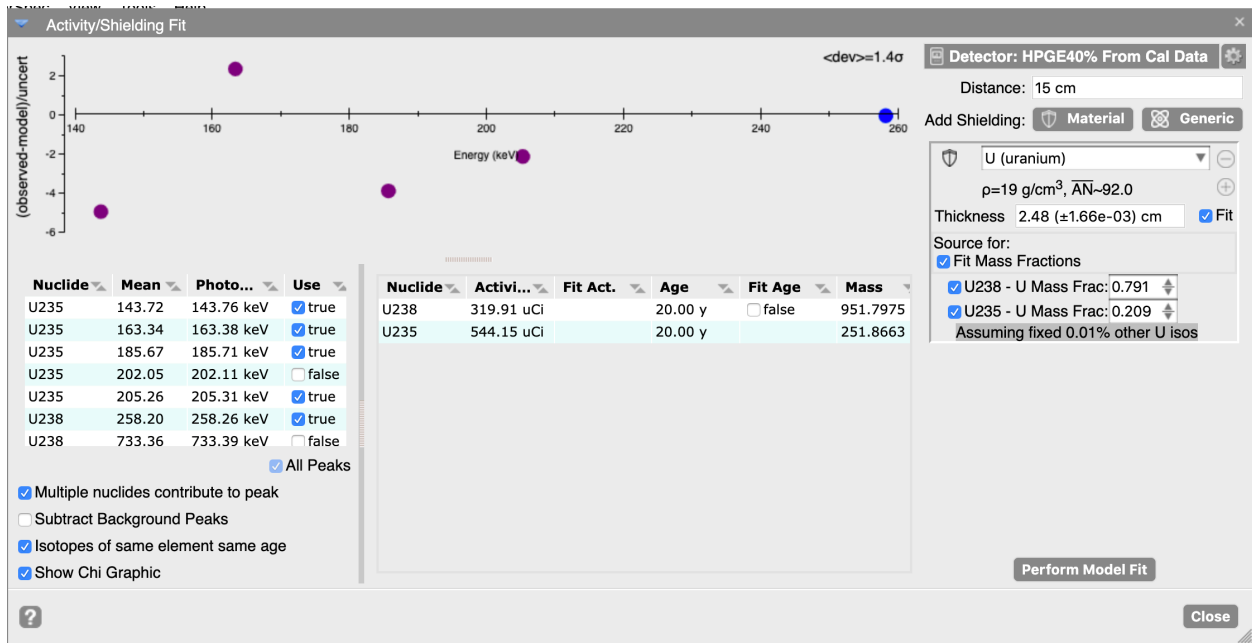


Figure 4 Fit for uranium enrichment and mass in InterSpec using only lower energy (258 keV and below) peaks.

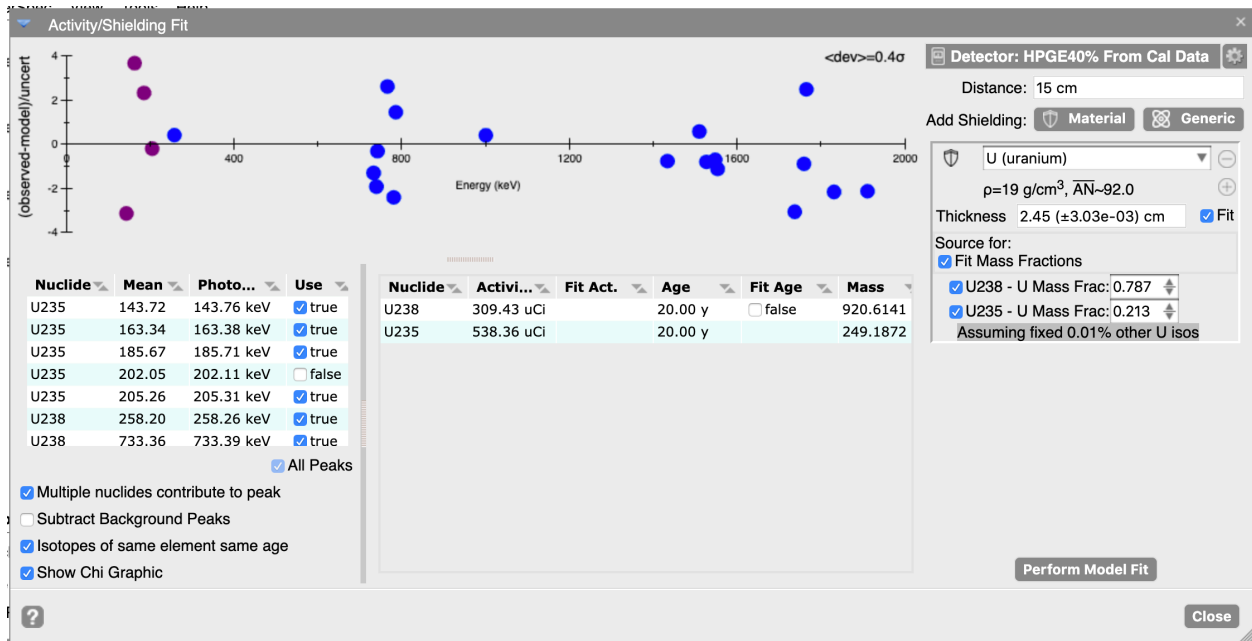


Figure 5 Fit for uranium enrichment and mass using peaks of all energies. A few peaks that caused outlier points on the Chi graphics where removed from the fit.

- a) As shown in Figure 2, the uranium x-rays are clearly visible which indicates little to no shielding. Additionally, fits for shielding around the uranium result in nearly zero thicknesses, so the next parts of the solution assume no shielding.

- b) Figure 3 shows peaks you can select to determine both enrichment and mass. For determining enrichment, the 258.26 keV U-238 gamma peak (hard to see in the figure) is critical to use since it is the U-238 line closest to the U-235 lines. Using the 143.76, 163.38, 185.71 and 205.31 keV lines of U-235 and the 258.26 keV line of U-238 gives an enrichment of  $20.9\% \pm 0.2\%$  (statistical only) U-235, as shown in Figure 4. If peaks of all energies are used, an enrichment of  $21.3\% \pm 0.05\%$  (statistical only) U-235 is fit for. The x-ray region is not used since this tends to be highly sensitive to geometry, shielding, and other effects making it not reliable.  
The truth-level answer is the uranium is 20% enriched.
- c) Using just the low-energy peaks InterSpec fit for 1.2 kg total uranium mass, and when the full energy range of peaks is used a value of 1.17 kg is found.  
The truth-level answer is 1 kg of uranium.