Determination of ^{170,172}Yb(α,n)^{173,175}Hf cross sections in a stacked target experiment

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18th Russbach School on Nuclear Astrophysics (2023)

Supported by DFG (ZI 510/8-2) and ChETEC-INFRA (101008324)

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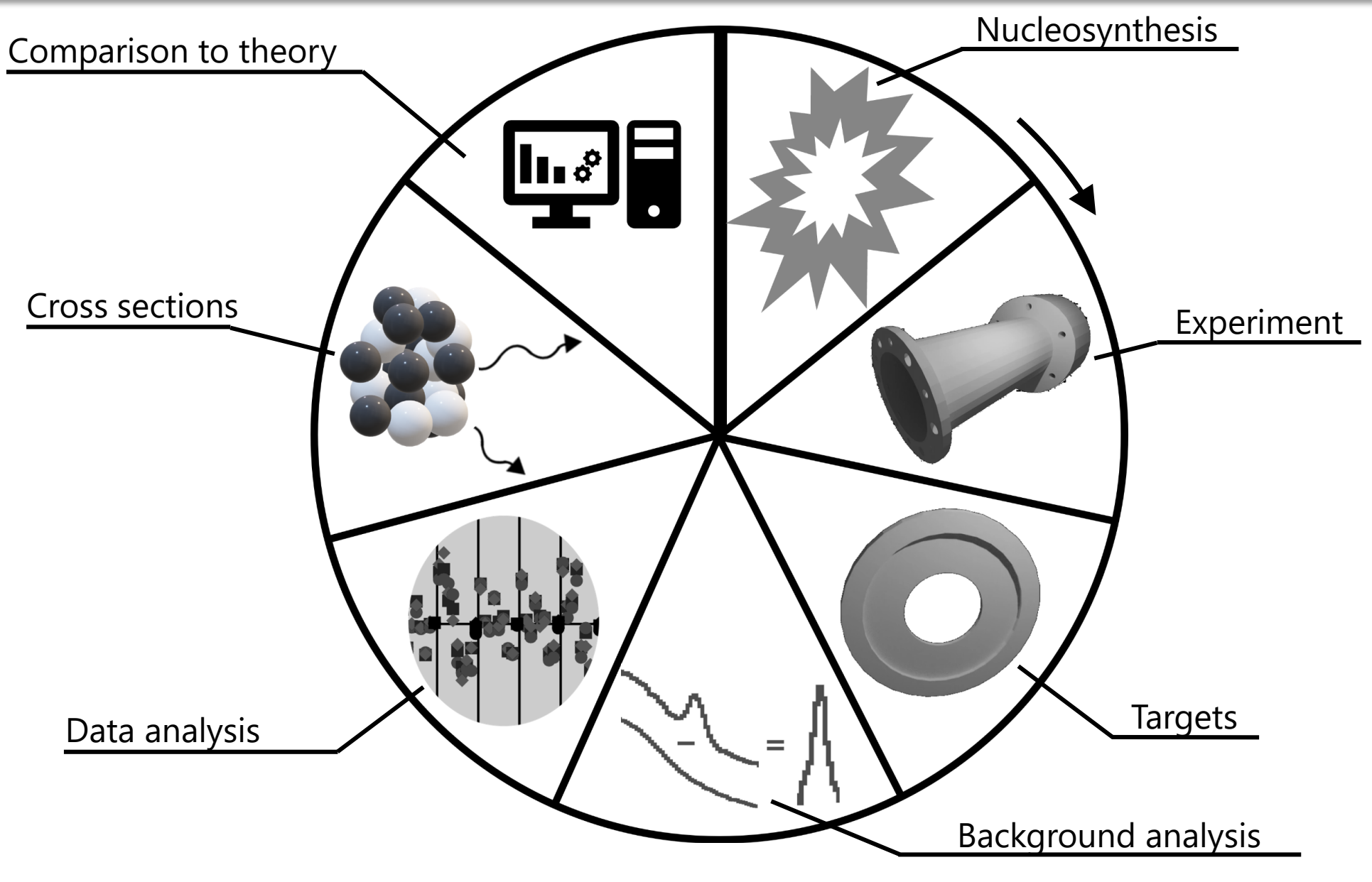
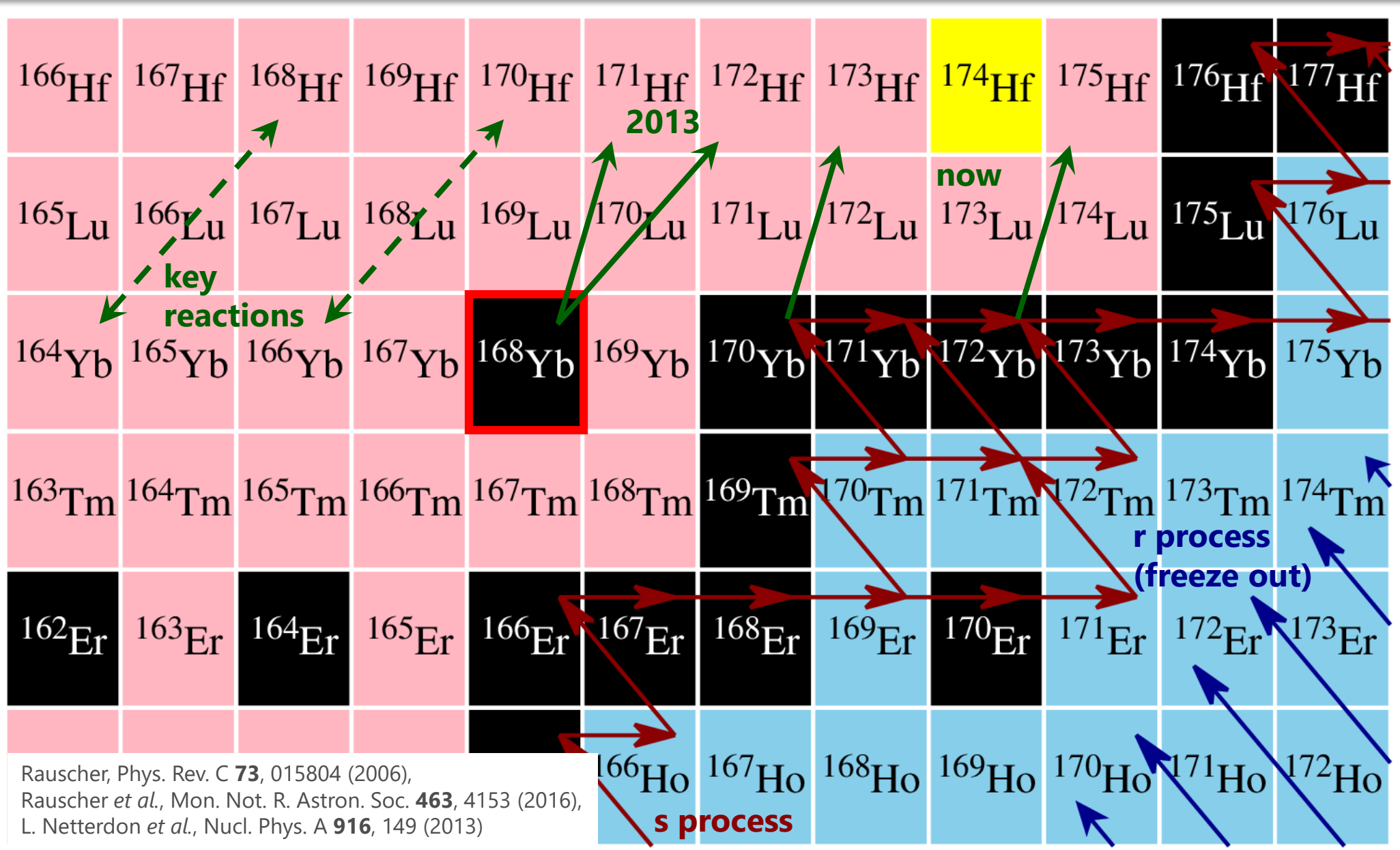
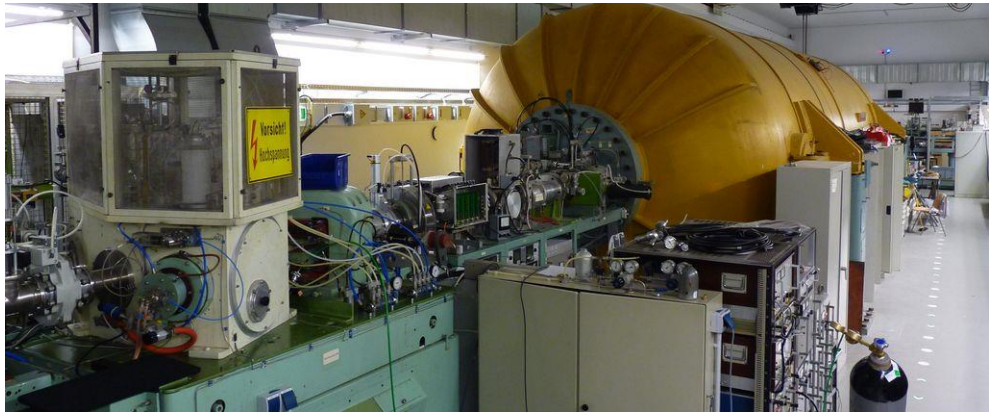

Nucleosynthesis
Experiment
Targets
Background analysis
Data analysis
Cross sections
Comparison to theory

Production of ^{168}Yb



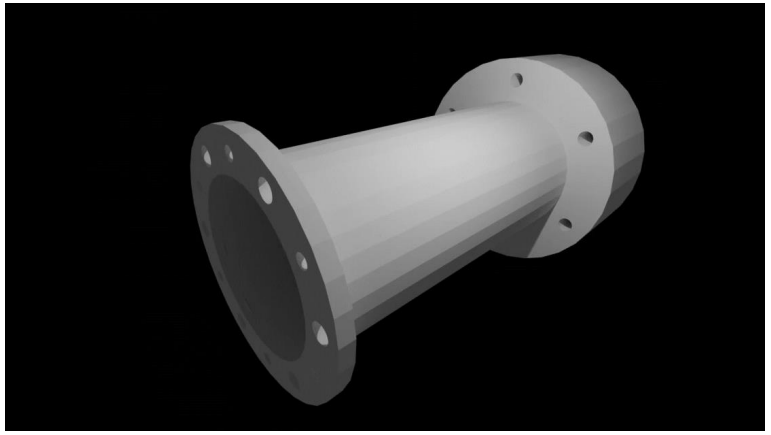
Rauscher, Phys. Rev. C **73**, 015804 (2006),
Rauscher *et al.*, Mon. Not. R. Astron. Soc. **463**, 4153 (2016),
L. Netterdon *et al.*, Nucl. Phys. A **916**, 149 (2013)

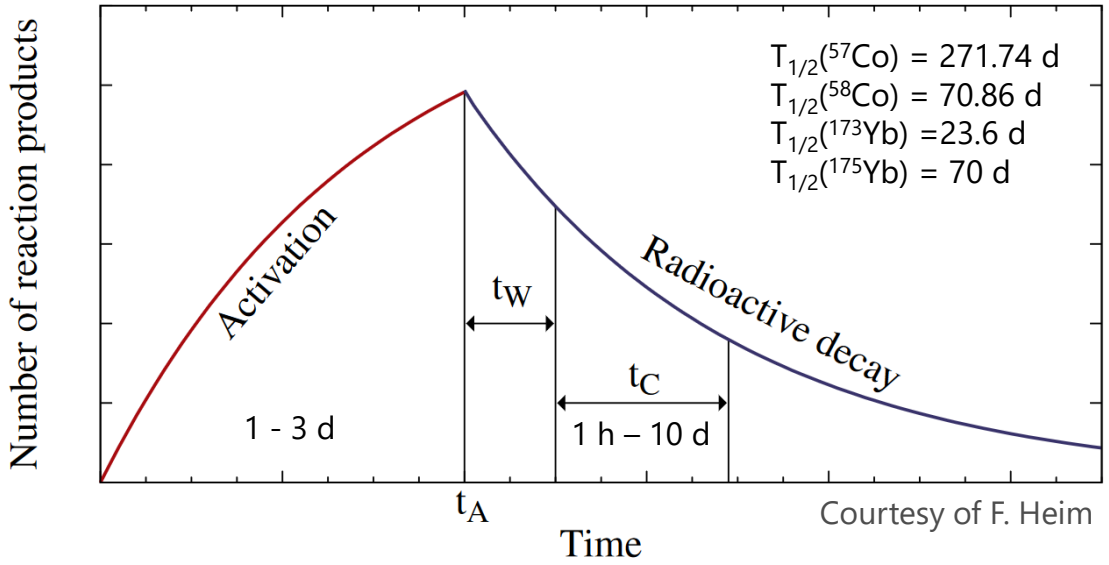
Activation technique and setup

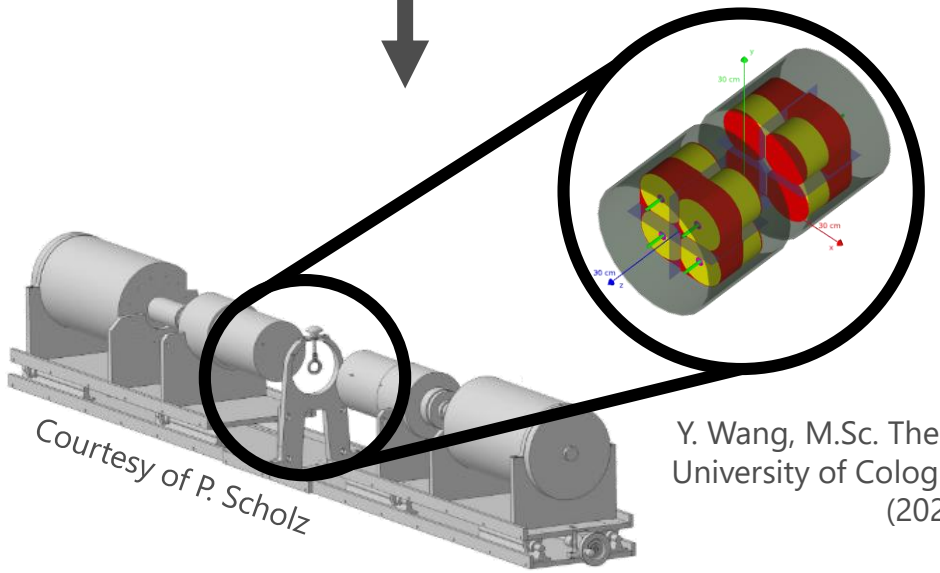


14.5 & 17 MeV

~200 nA







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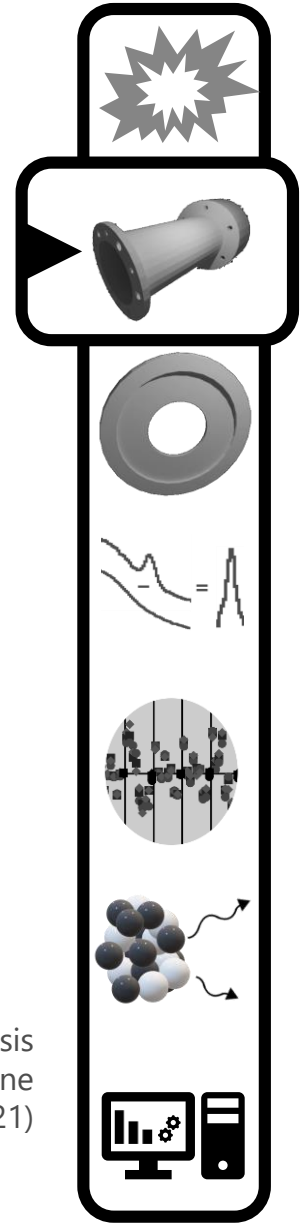
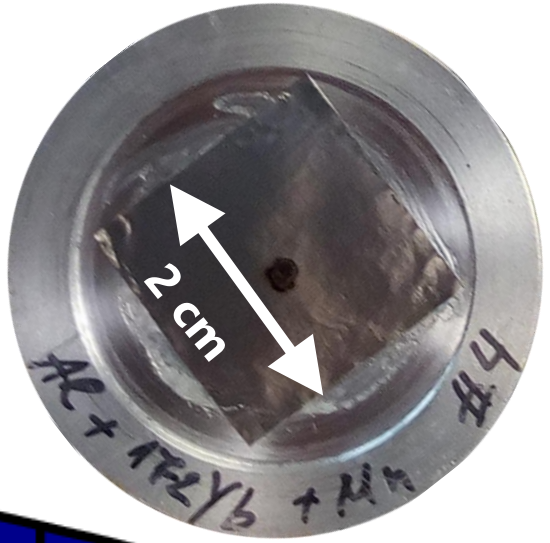
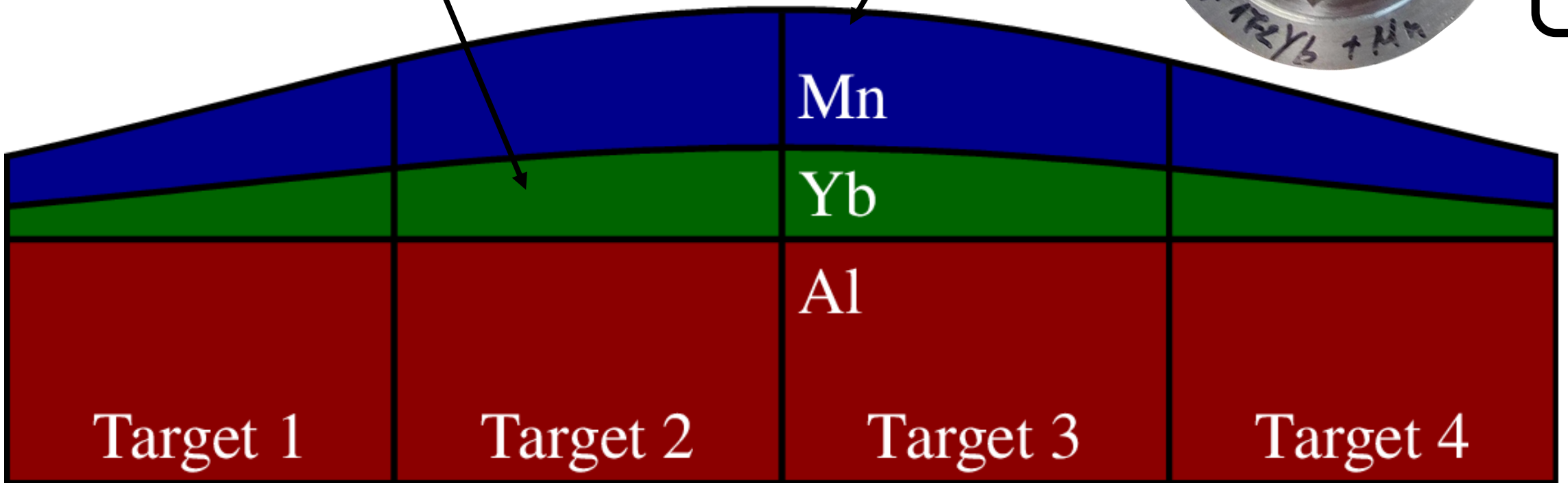


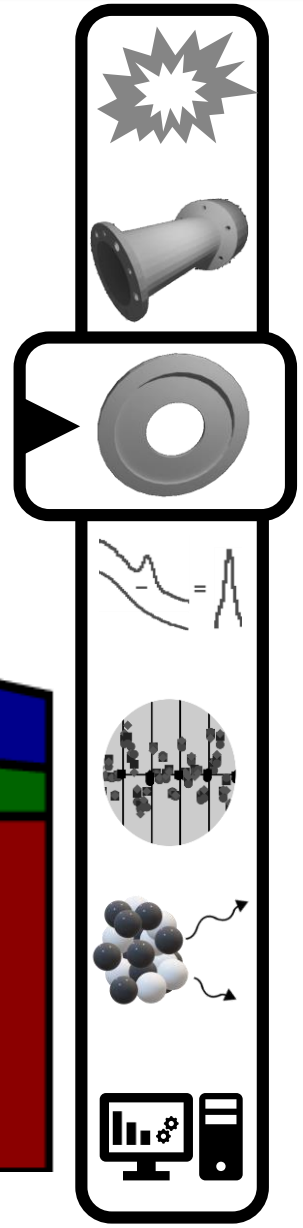
Target production

^{170}Yb enrichment: 83.2 %
^{172}Yb enrichment: 97.1 %

^{55}Mn(α,(2)n)^{57,58}Co

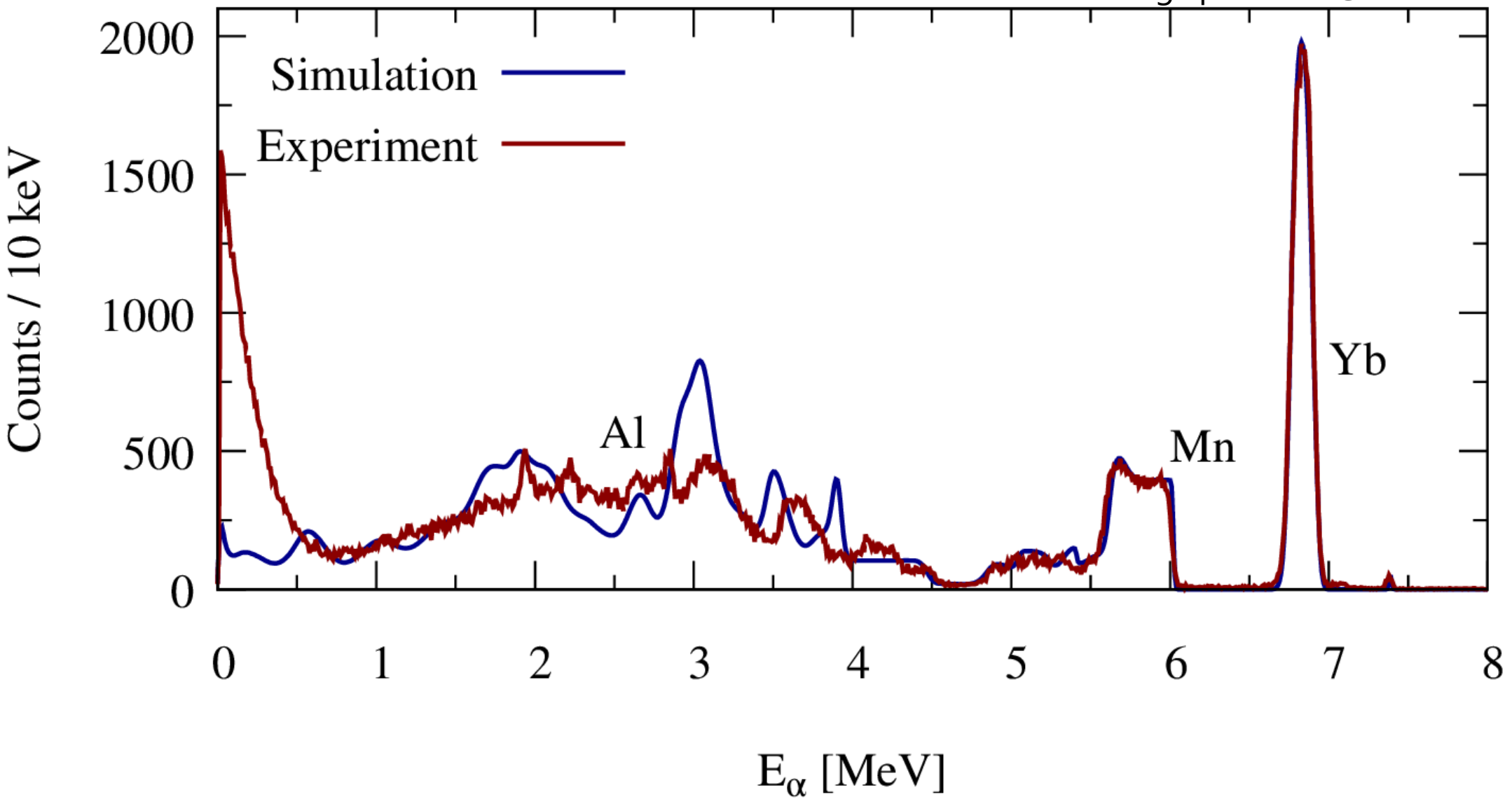


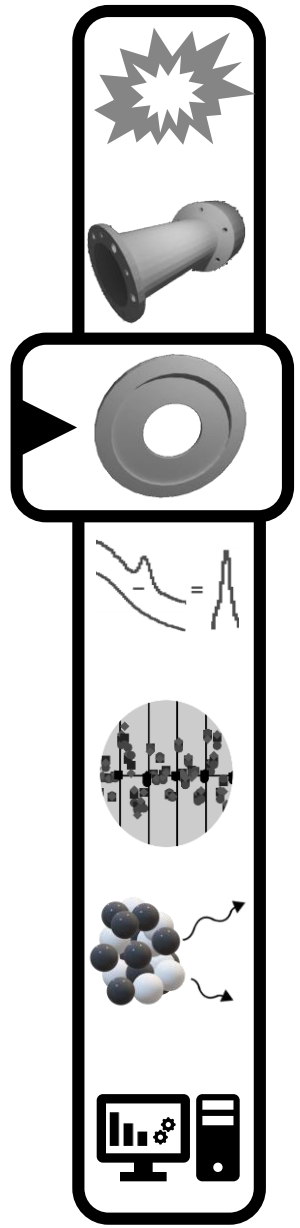




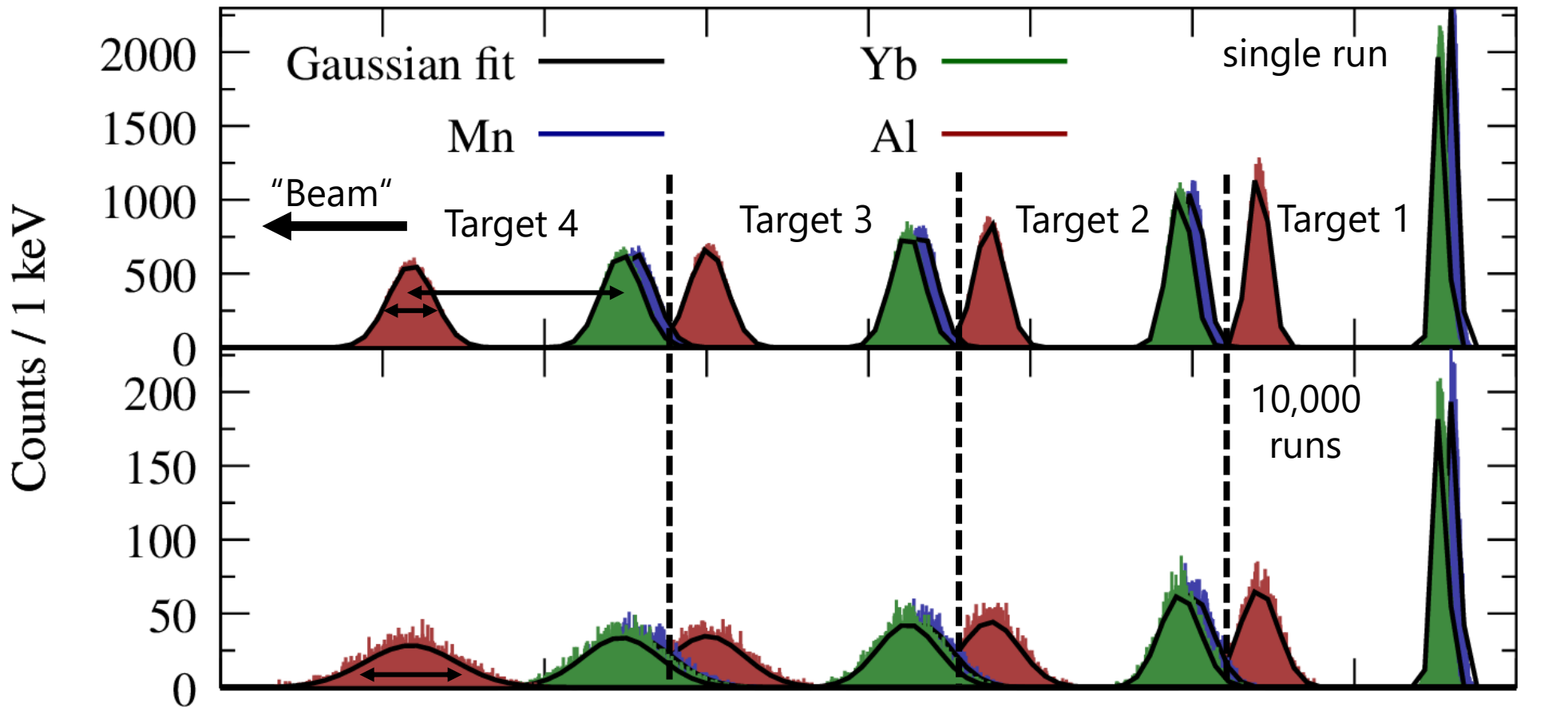
Target composition

Rutherford backscattering spectrum @RUBION

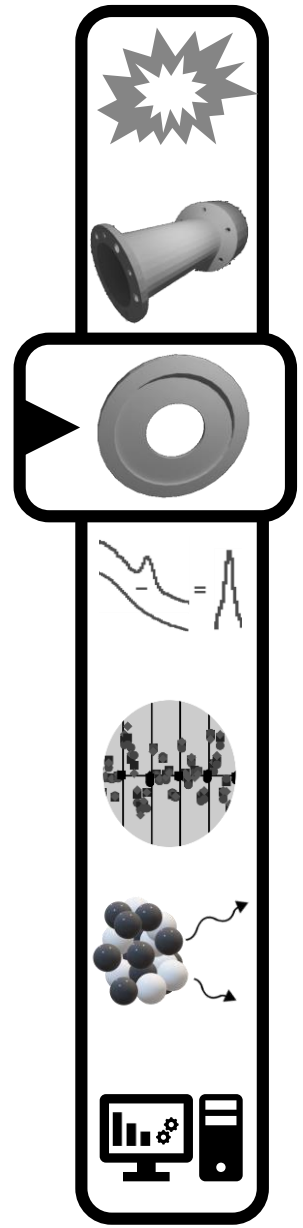




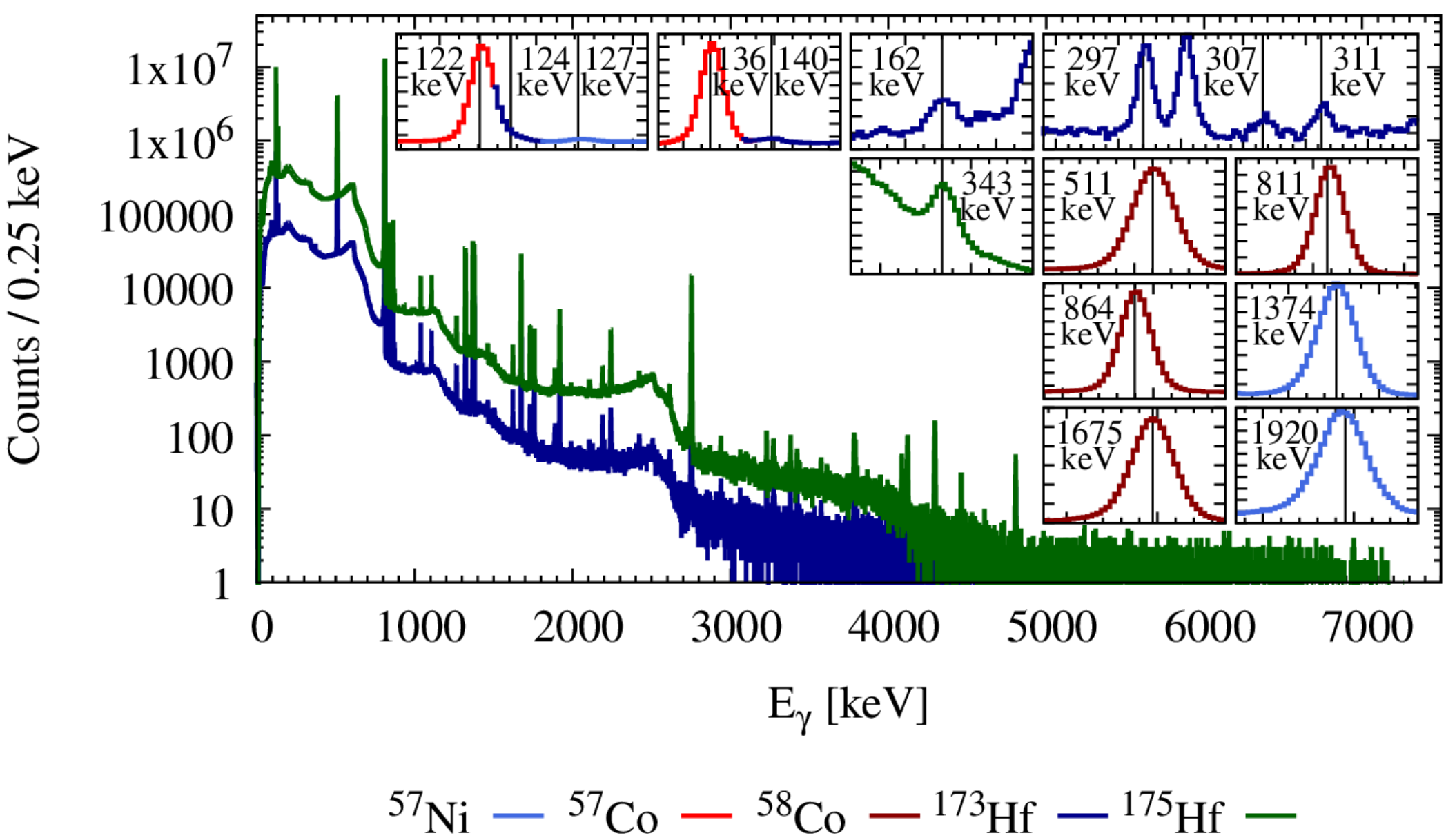
Energy loss simulation

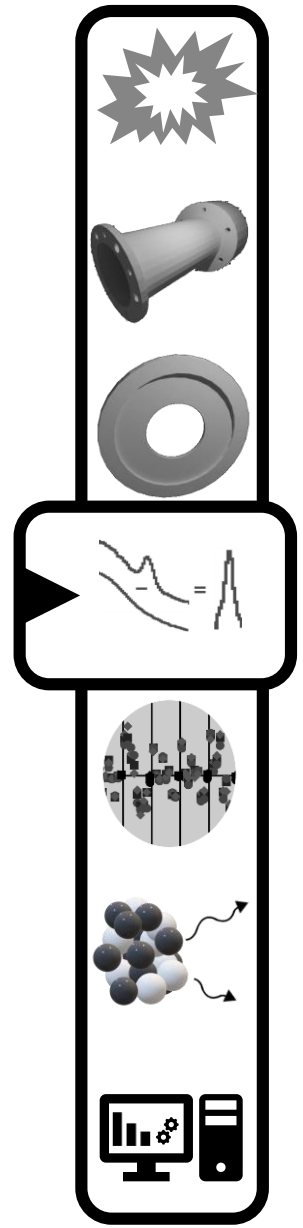


$$\Delta E_i = \sqrt{\Delta E_{width,i}^2 + \Delta E_{thick,i}^2 + \left(\frac{\Delta E_{loss,i}}{2}\right)^2}$$

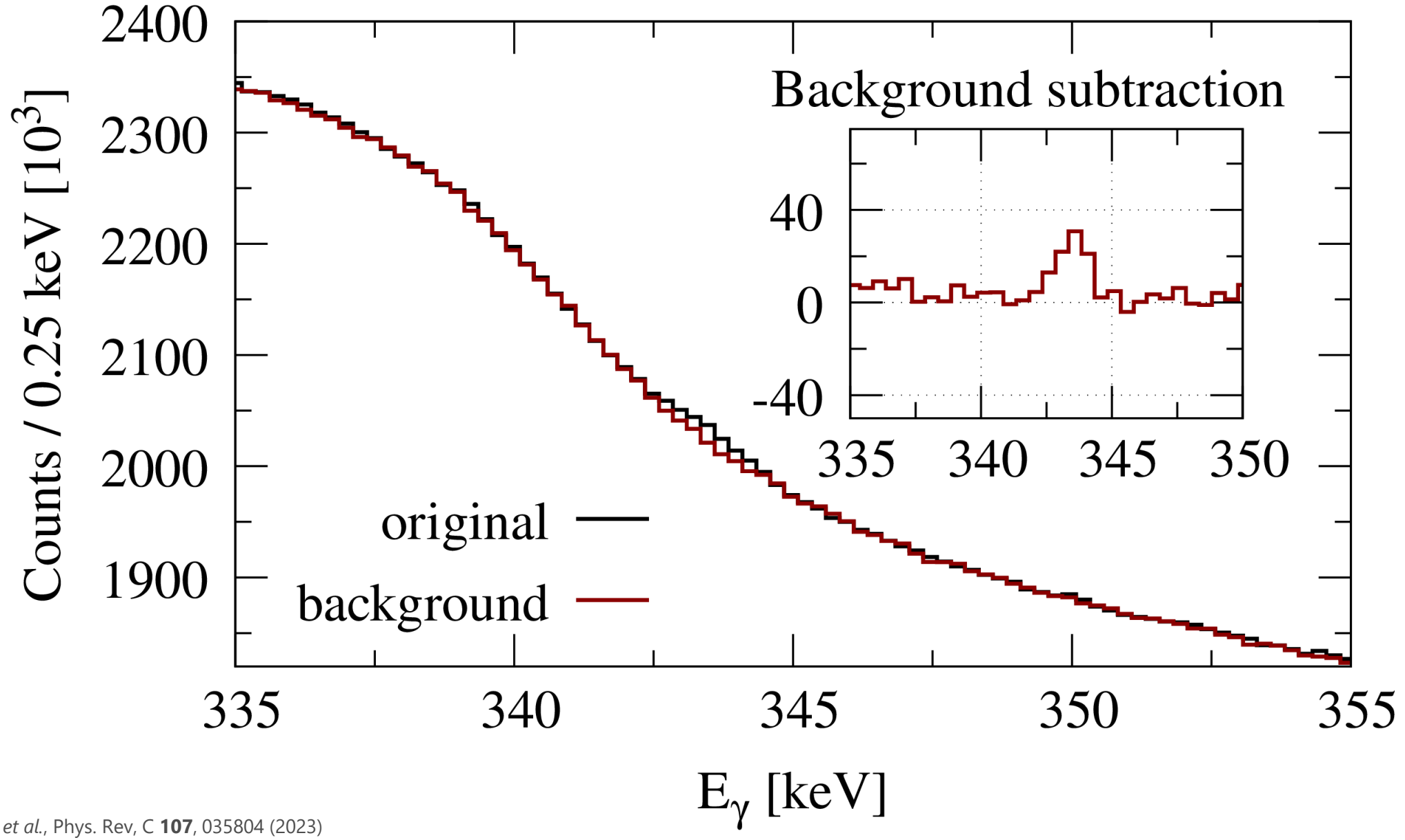


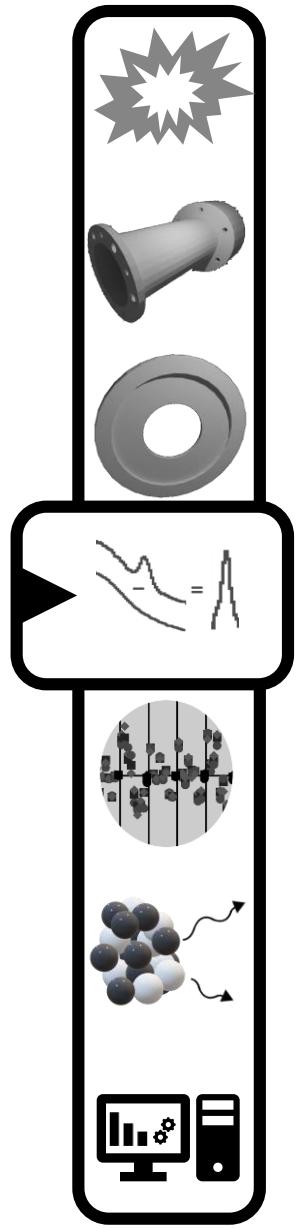
Spectra


Counts / 0.25 keV
1x10^7
1x10^6
100000
10000
1000
100
10
1
0
1000
2000
3000
4000
5000
6000
7000
E_γ [keV]
122 keV
124 keV
127 keV
136 keV
140 keV
162 keV
297 keV
307 keV
311 keV
343 keV
511 keV
811 keV
864 keV
1374 keV
1675 keV
1920 keV
57Ni
57Co
58Co
173Hf
175Hf



Background subtraction





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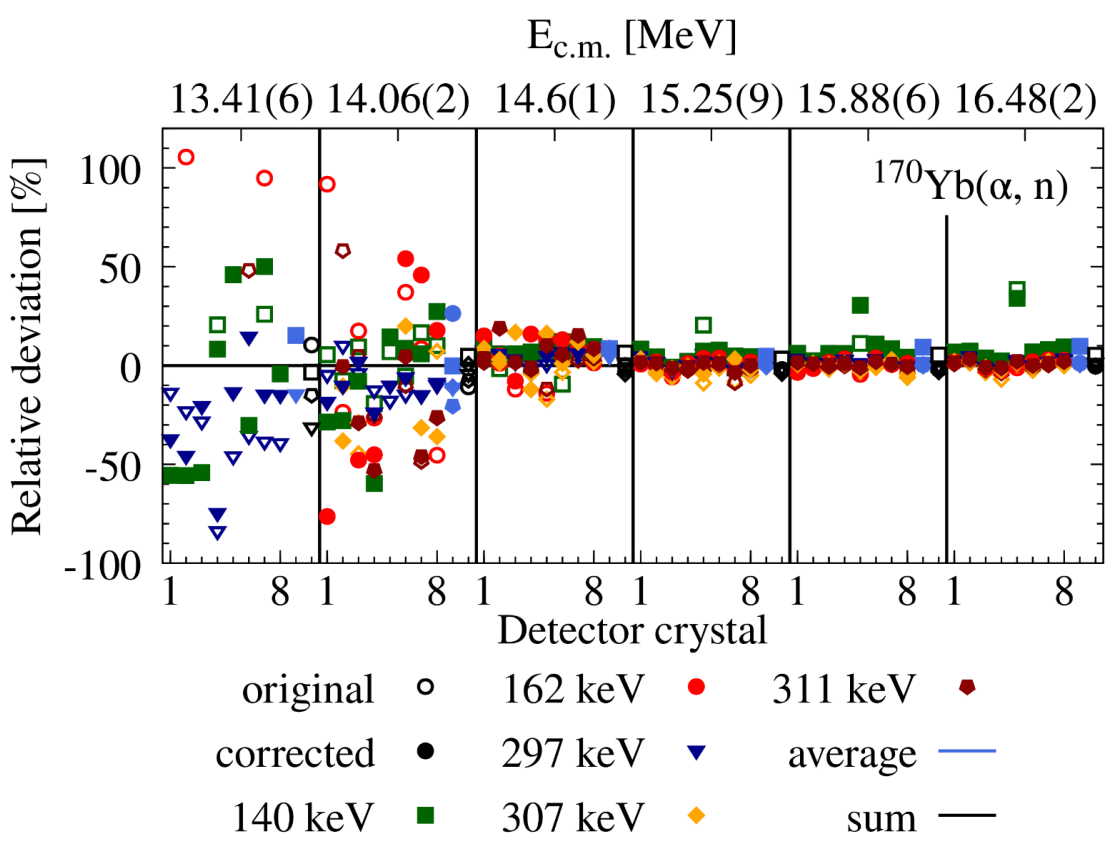
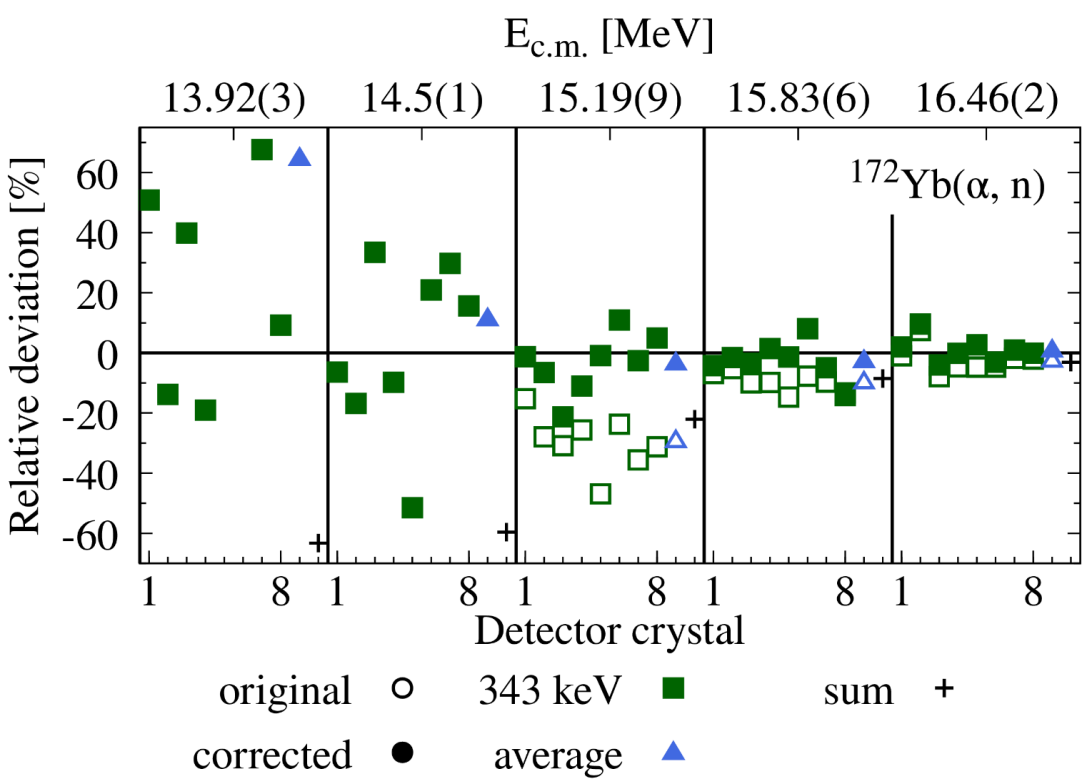
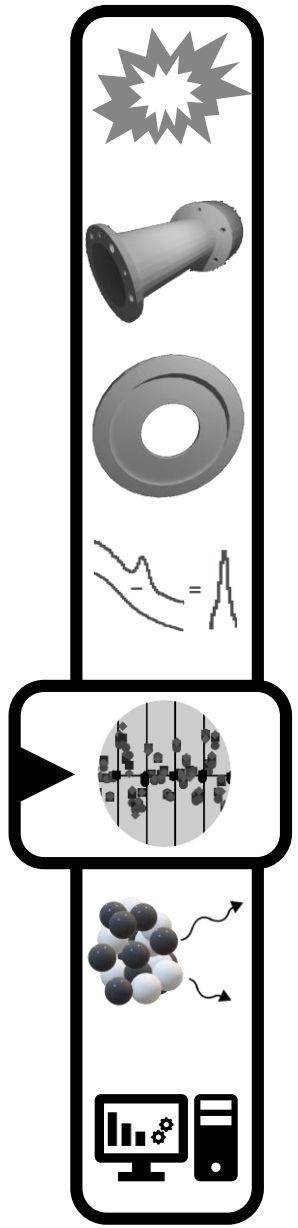
^{170,172}Yb(α,n)^{173,175}Hf reaction yield deviations







Determine reaction yield from:
- individual detector segments
- different γ–ray lines
- sum of detector segments

- averaging
- original spectra
- background spectra

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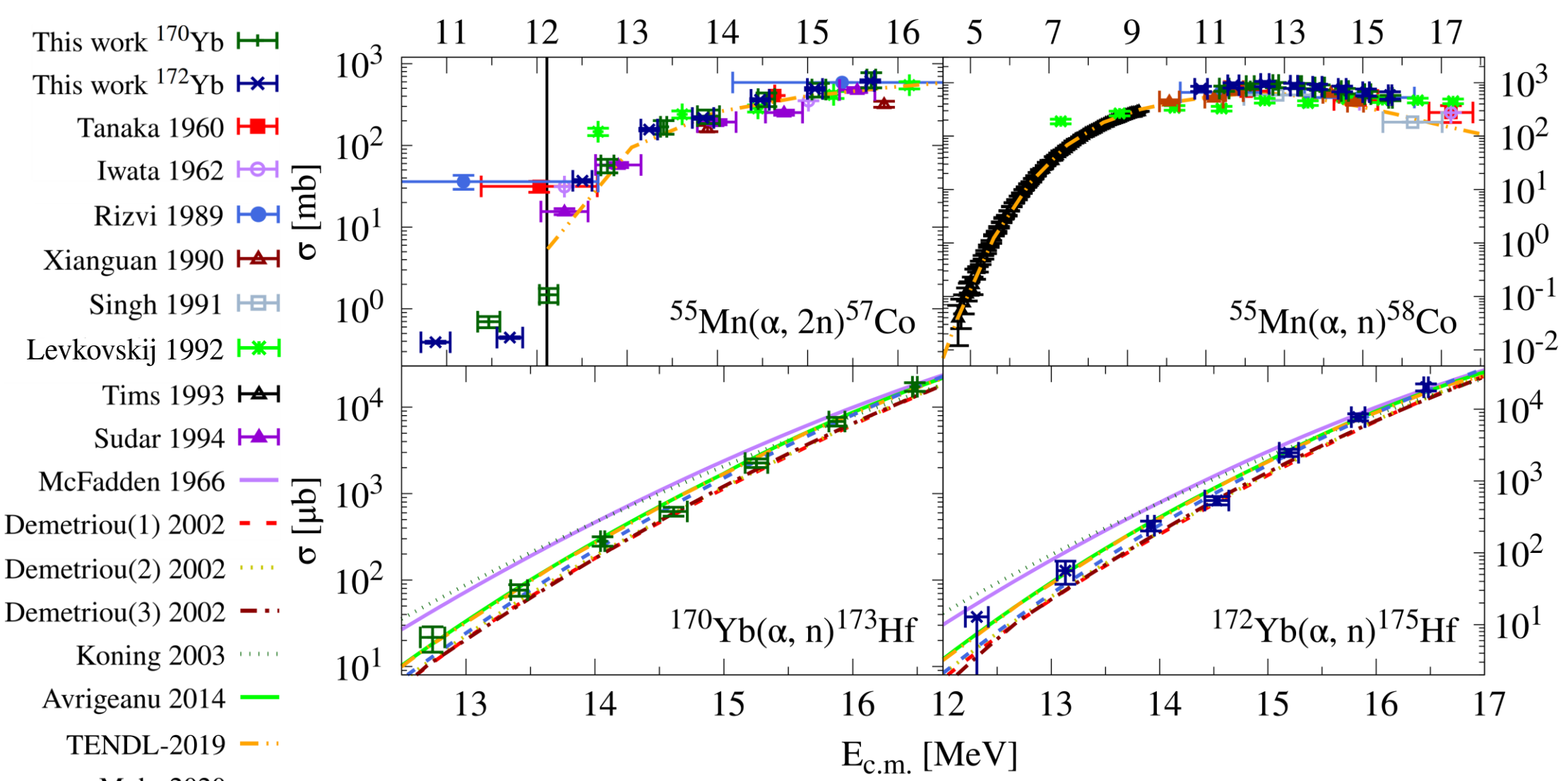
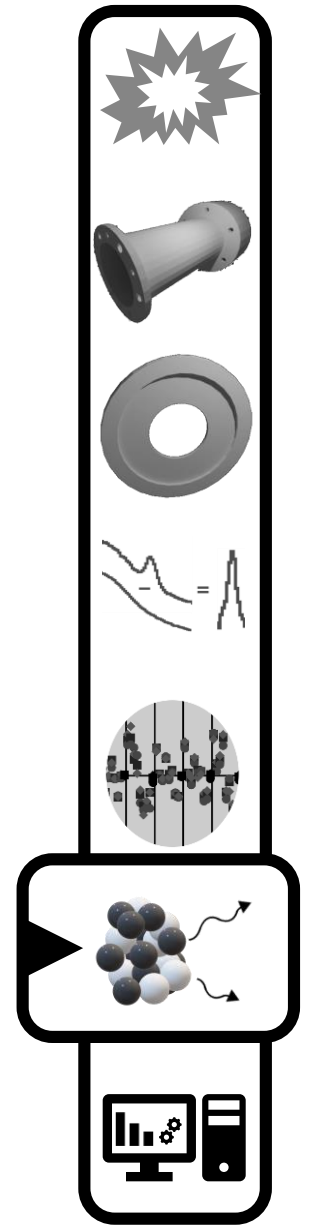
Cross sections





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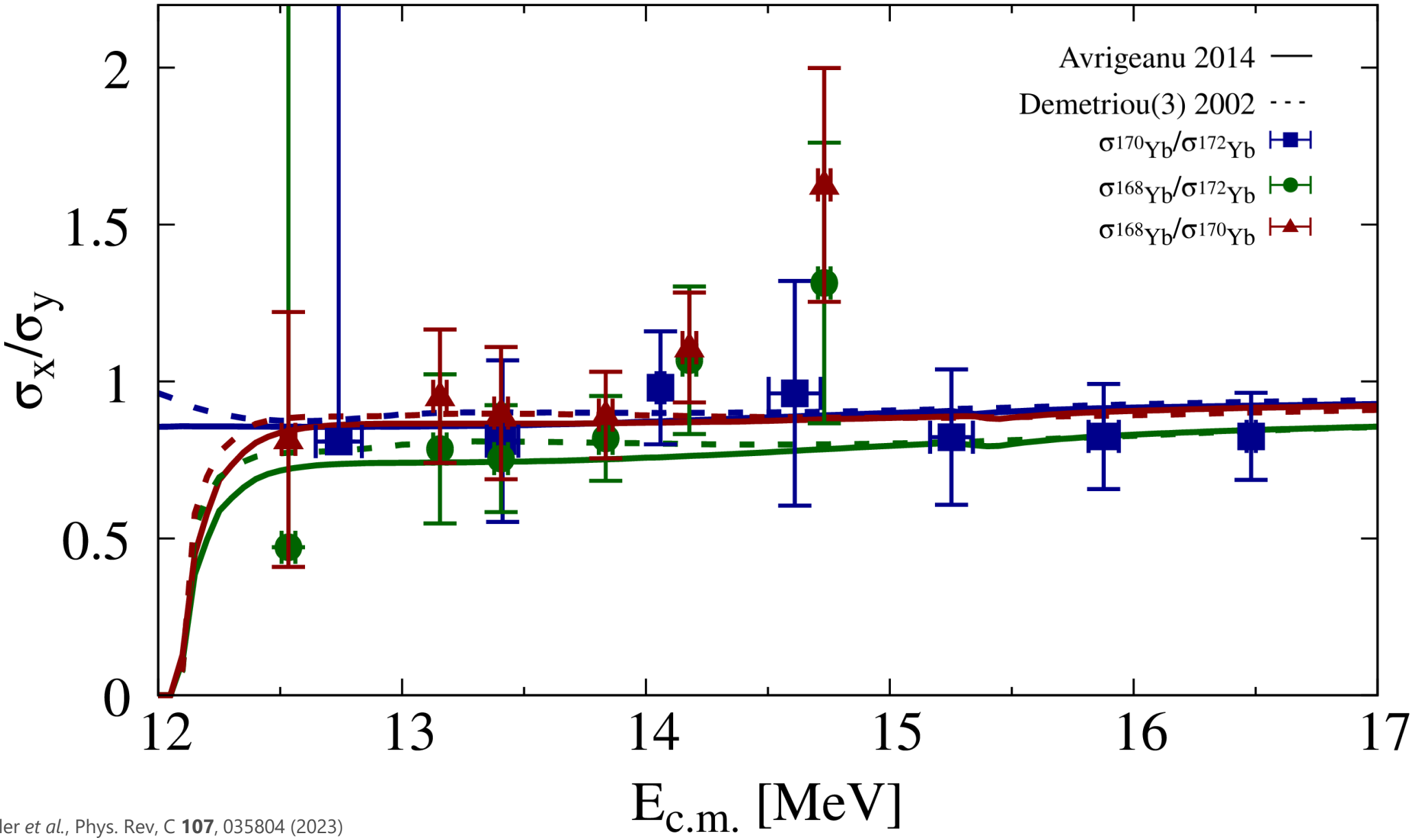
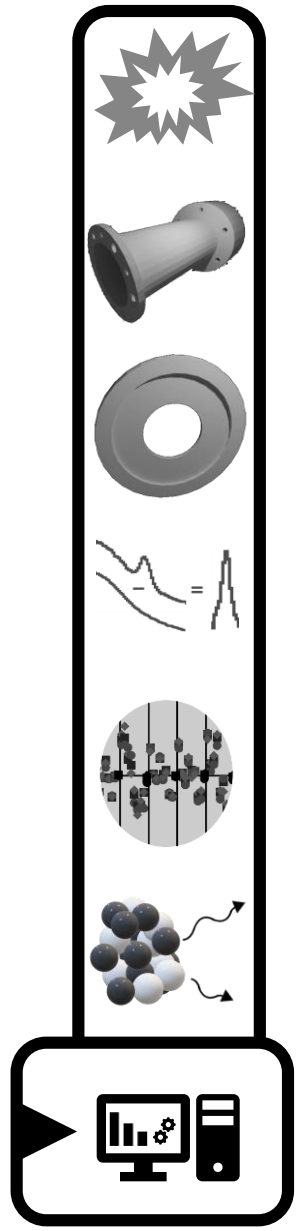
Cross section ratios





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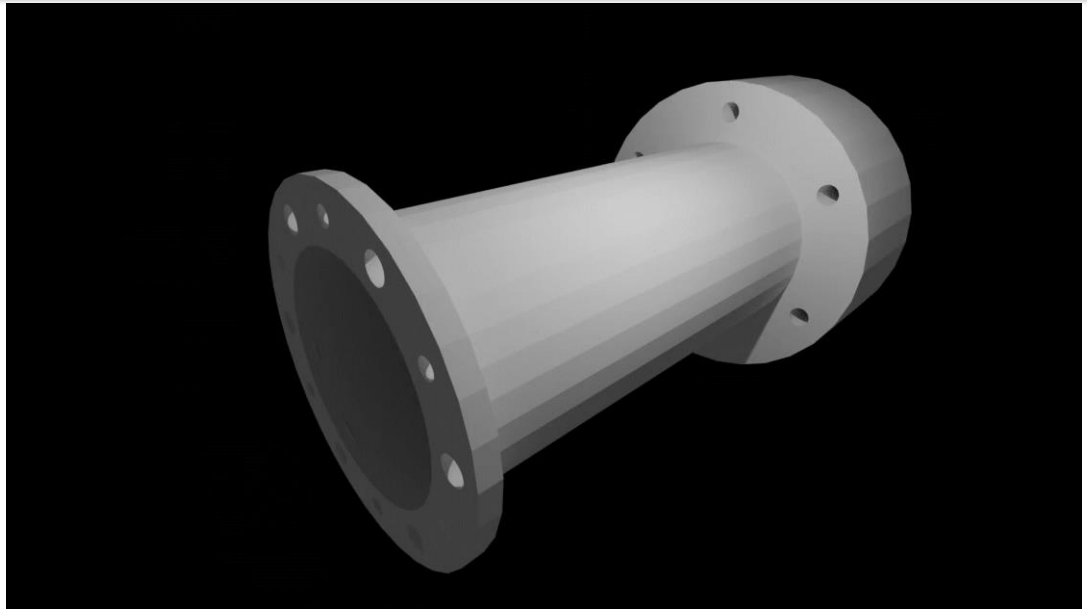
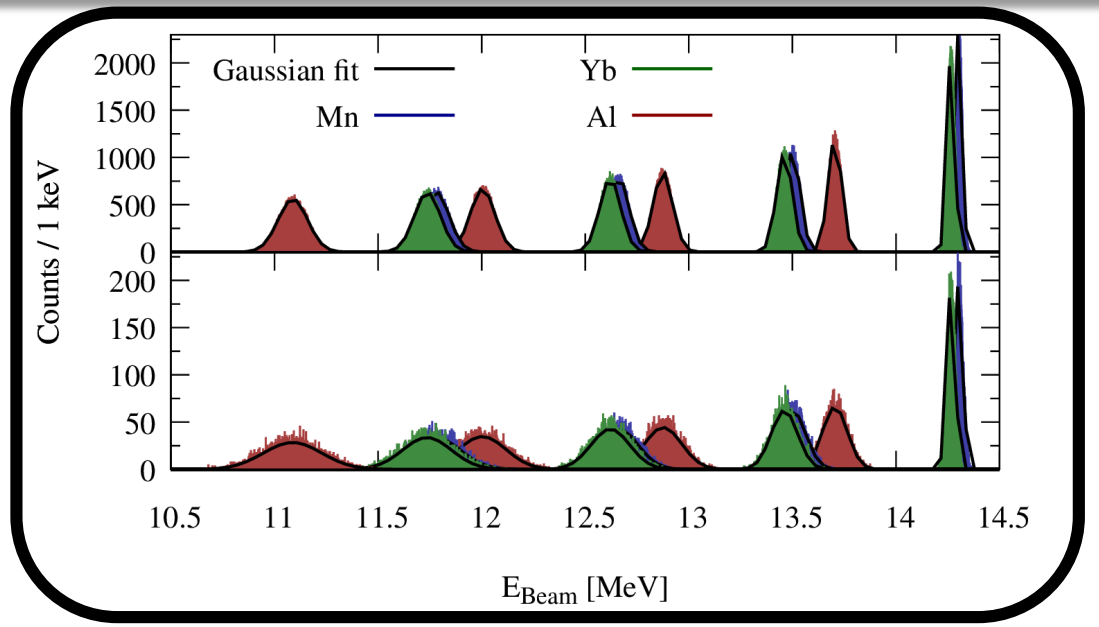
Summary

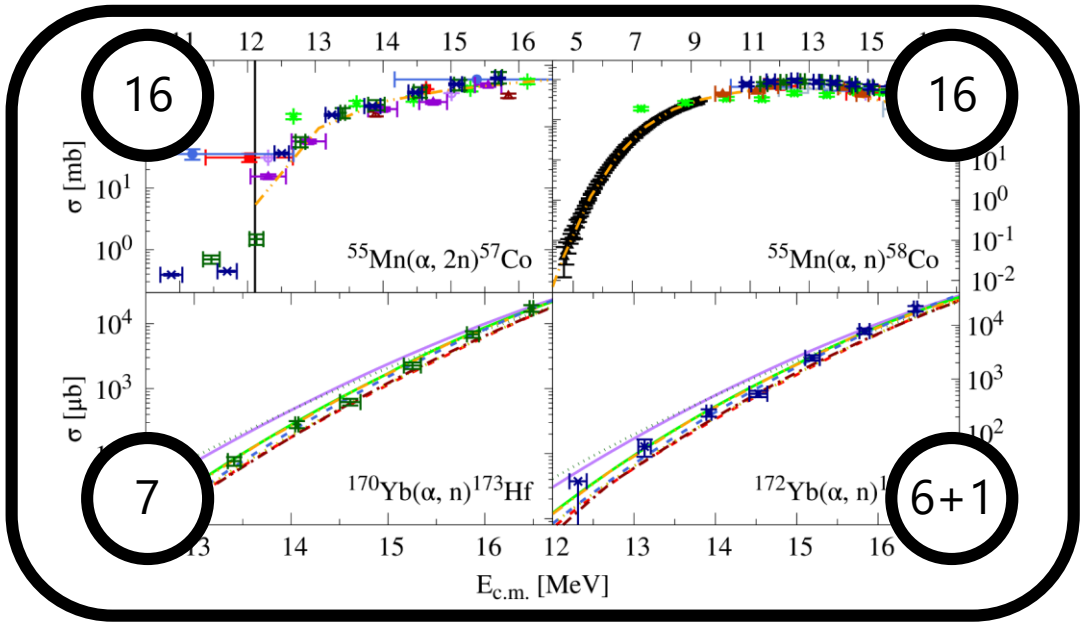
Target chamber



Energy loss simulation



Cross sections



Cross section ratios