

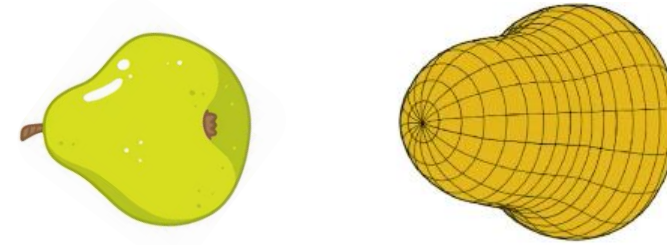
Identification of excited states in ^{114}Ba using recoil-decay tagging

Ben Hogg

IoP Nuclear Physics Conference 2025
23rd – 25th April 2025



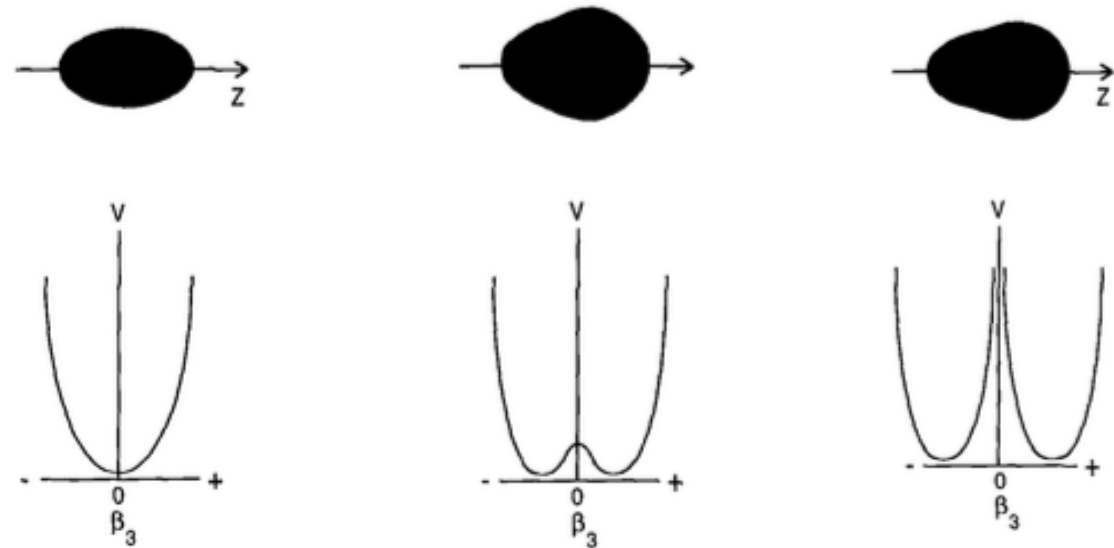
Reflection-asymmetric nuclei



Octupole-deformed nucleus (a_{30})

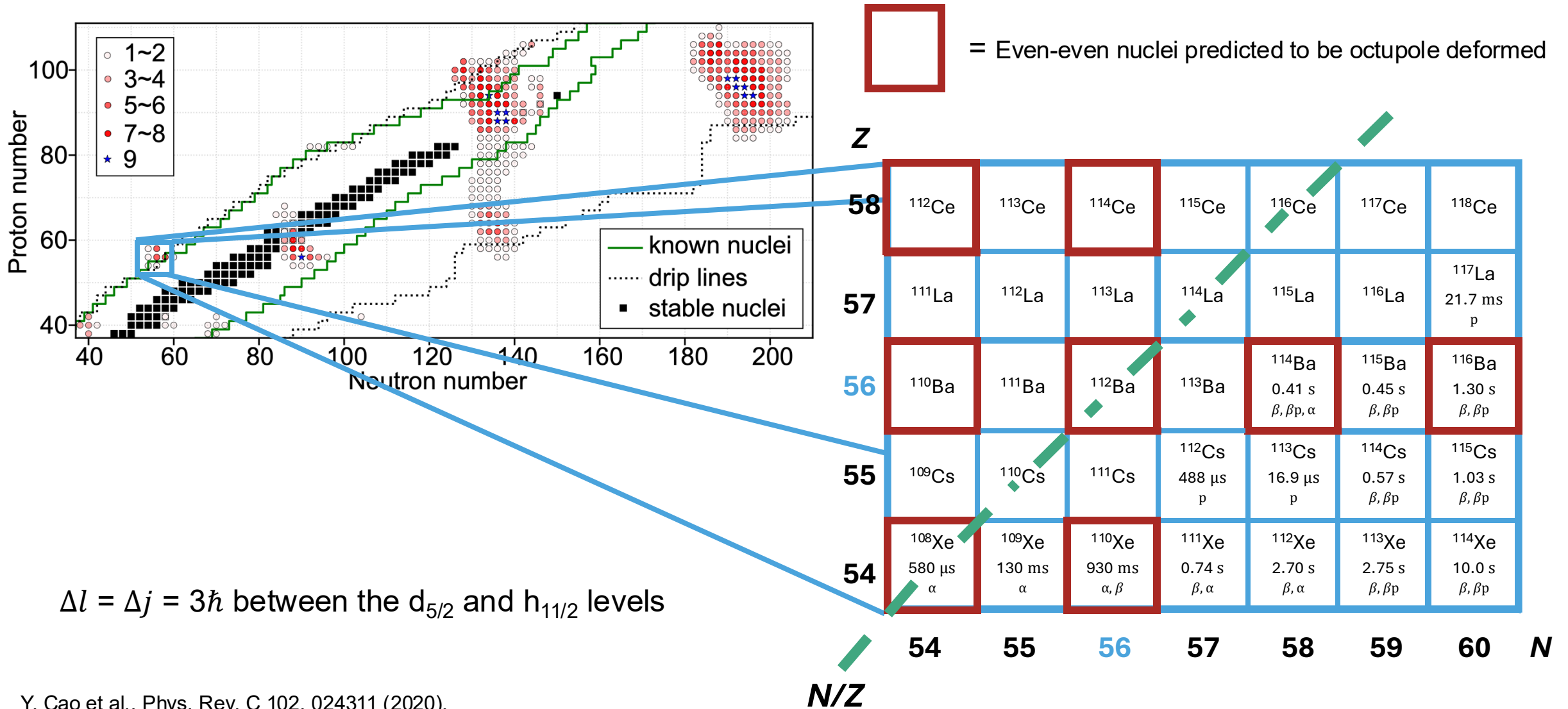
Characteristic properties:

- Interleaving opposite-parity energy levels in even-even nuclei
- Parity doublets in odd-mass nuclei
- Enhanced E1 transitions
- Large E3 transition probabilities

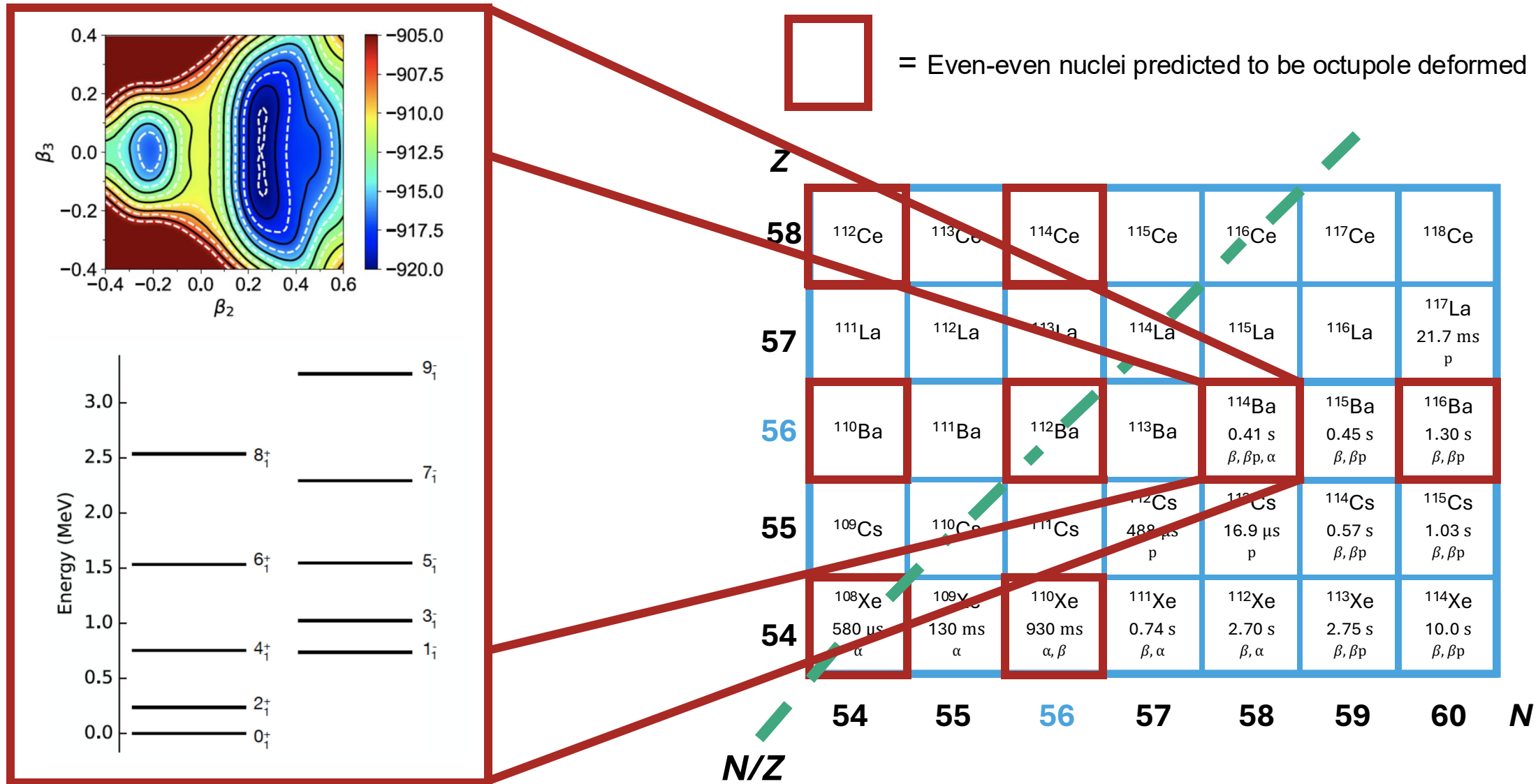


Vibrational octupole Transitional octupole Rigid octupole

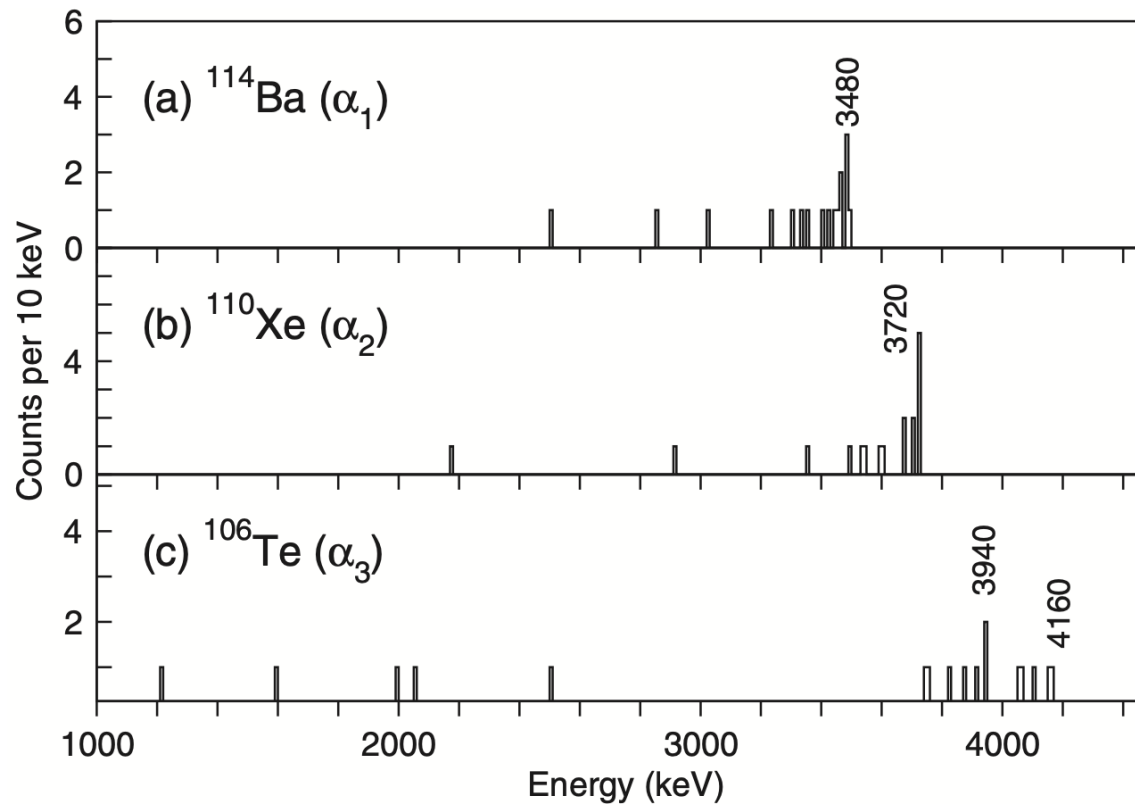
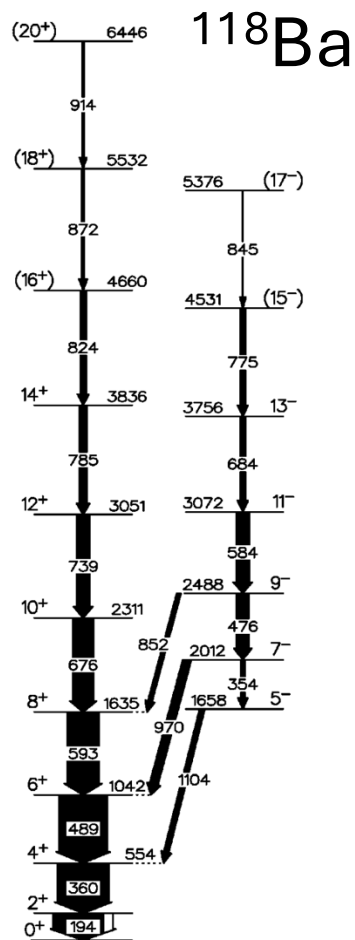
Regions of octupole deformation in even-even nuclei



Predicted octupole correlations in ^{114}Ba

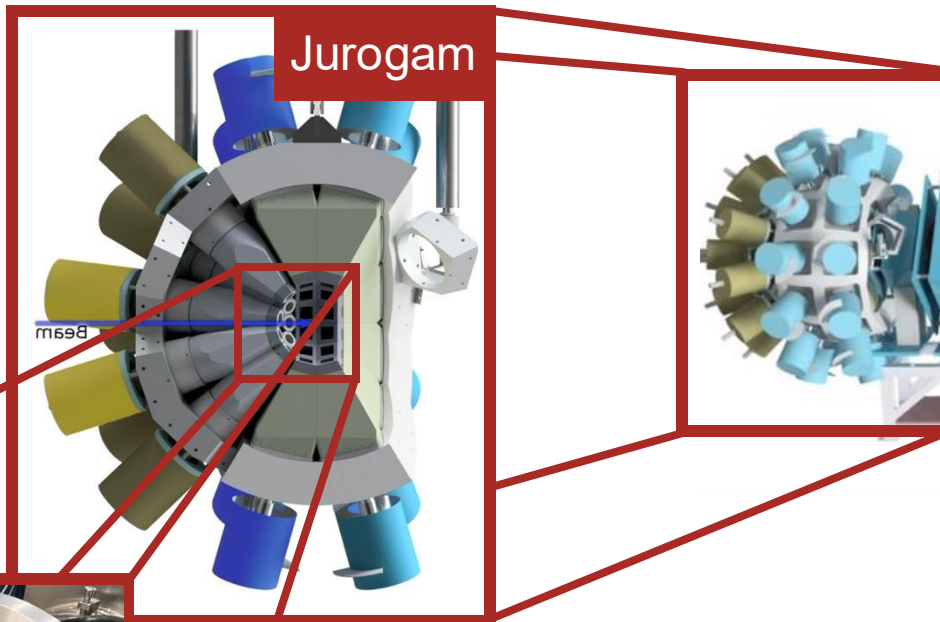


Studies of neutron-deficient isotopes near ^{114}Ba



Experimental details: MARA, Jurogam and JYTube

24 clover and
15 n-type Ge
detectors



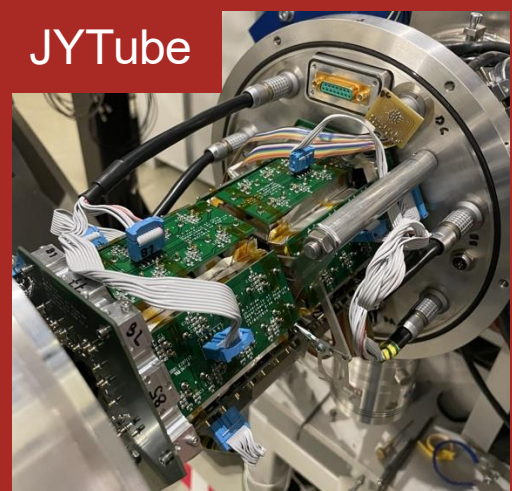
Jurogam

MARA separator

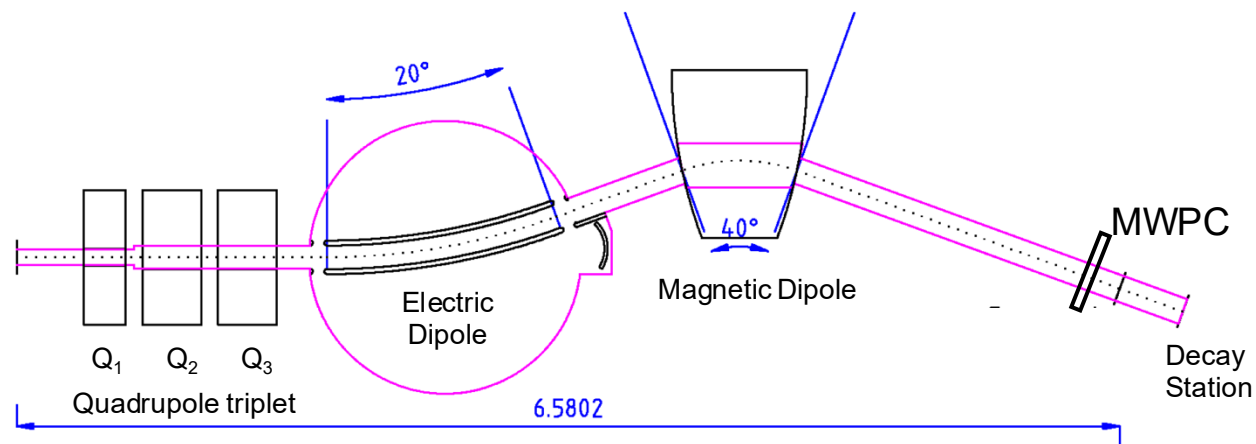
Decay station



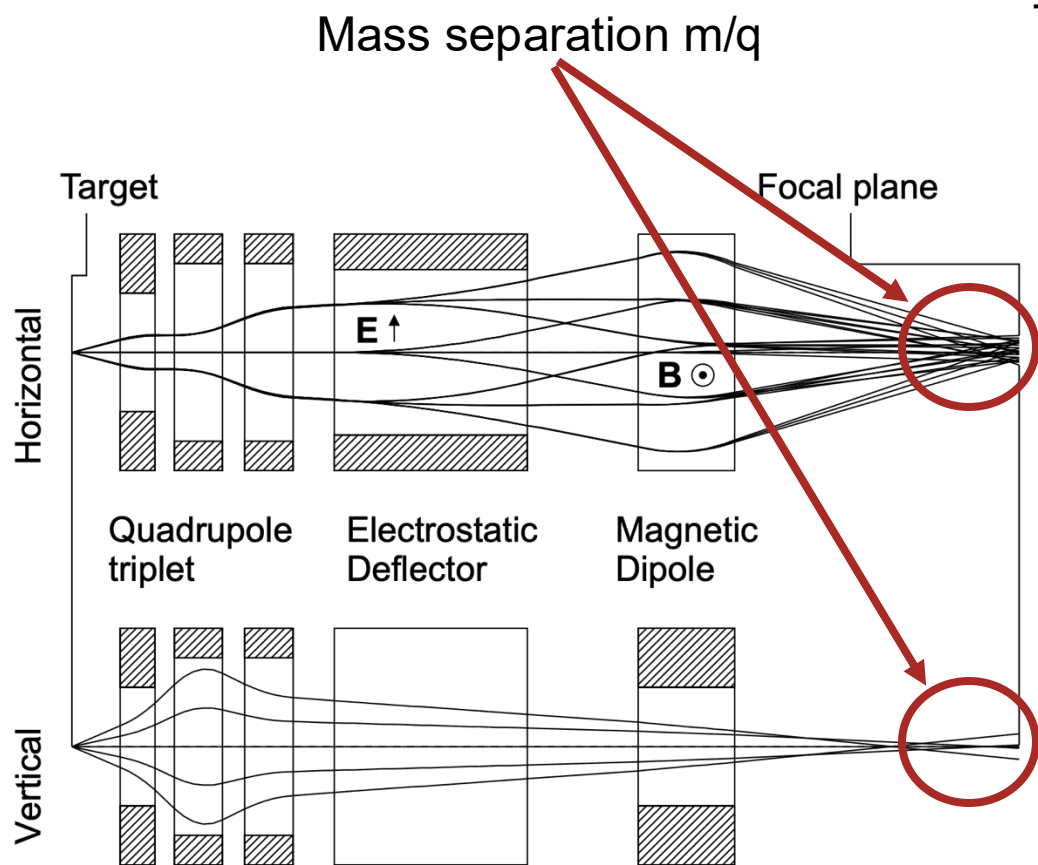
JYTube



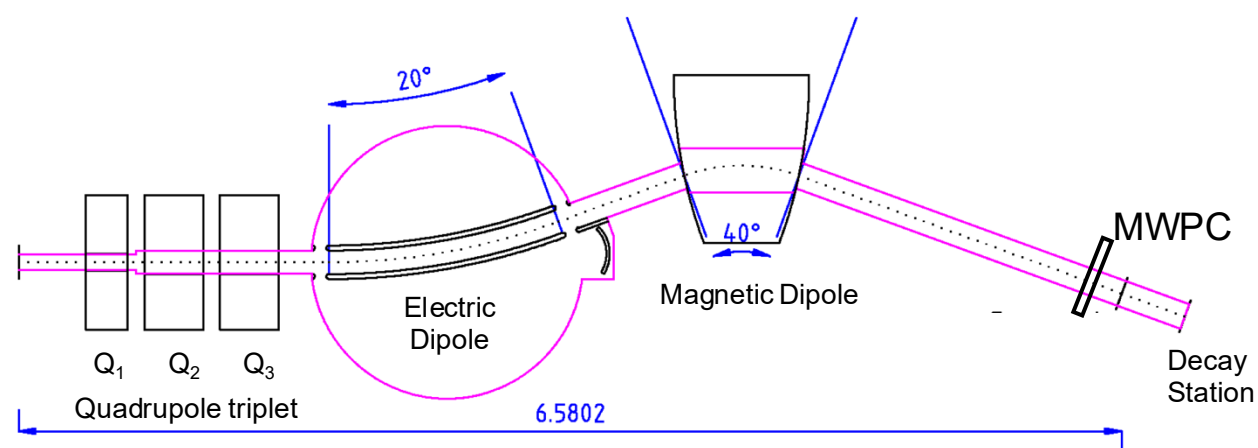
120 plastic scintillators



Experimental details: MARA mass separation

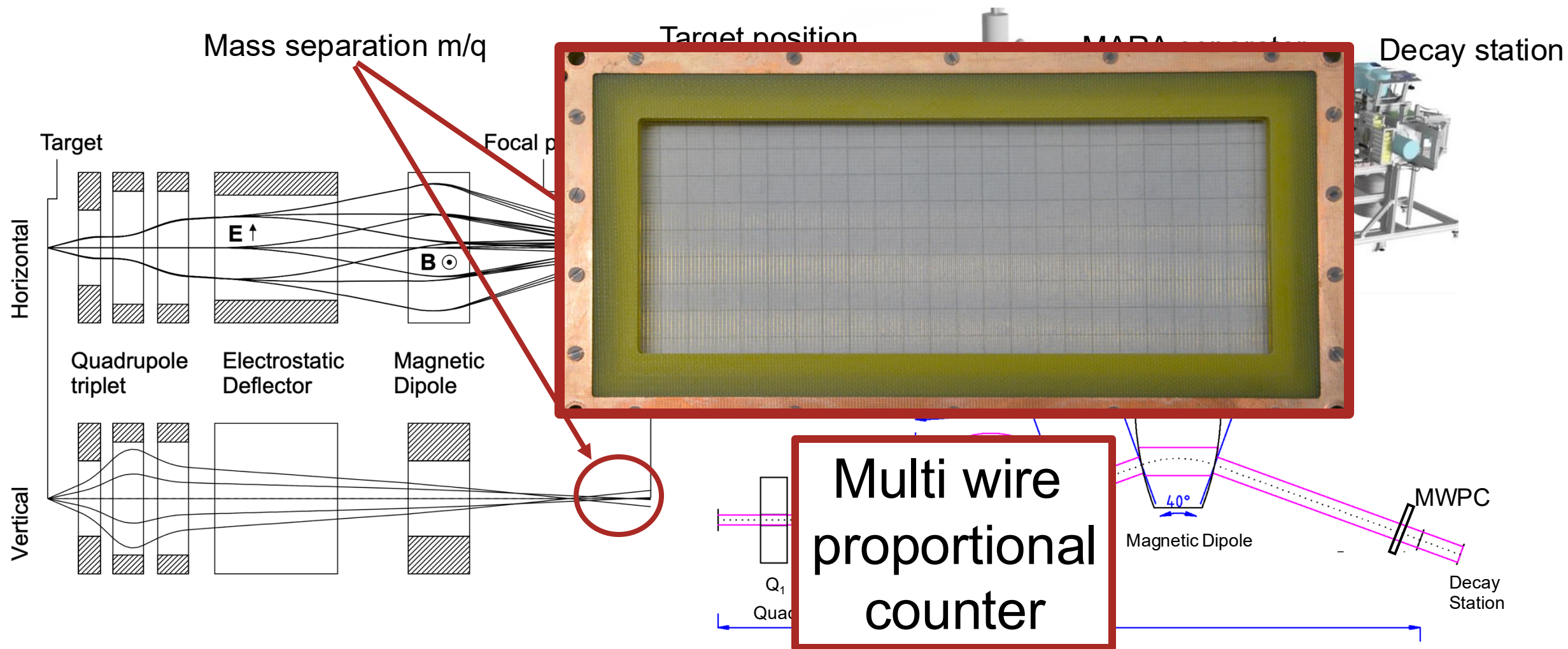


J. Saren et al., NIM-B 266, 4196 (2008)



P. Ruotsalainen, Gamma-ray spectroscopy employing JUROGAM 3 and MARA, NuSpin 2019. J. Uusitalo et al., Acta Phys. Pol. B 50, 319 (2019)

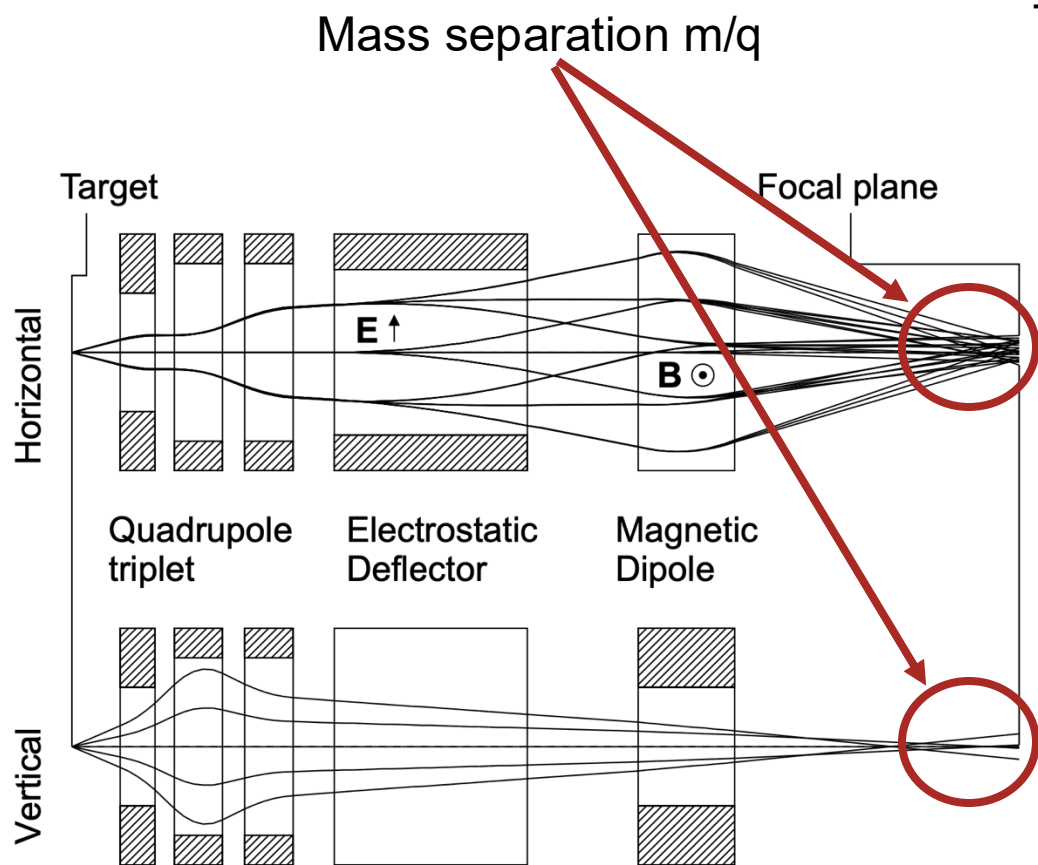
Experimental details: MARA mass separation



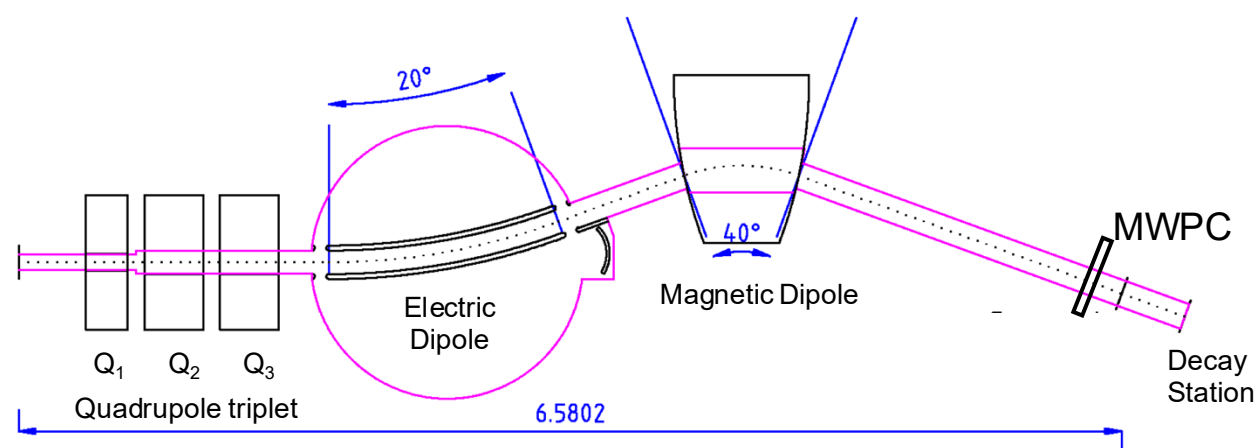
J. Saren et al., NIM-B 266, 4196 (2008)

P. Ruotsalainen, Gamma-ray spectroscopy employing JUROGAM 3 and MARA, NuSpin 2019. J. Uusitalo et al., Acta Phys. Pol. B 50, 319 (2019)

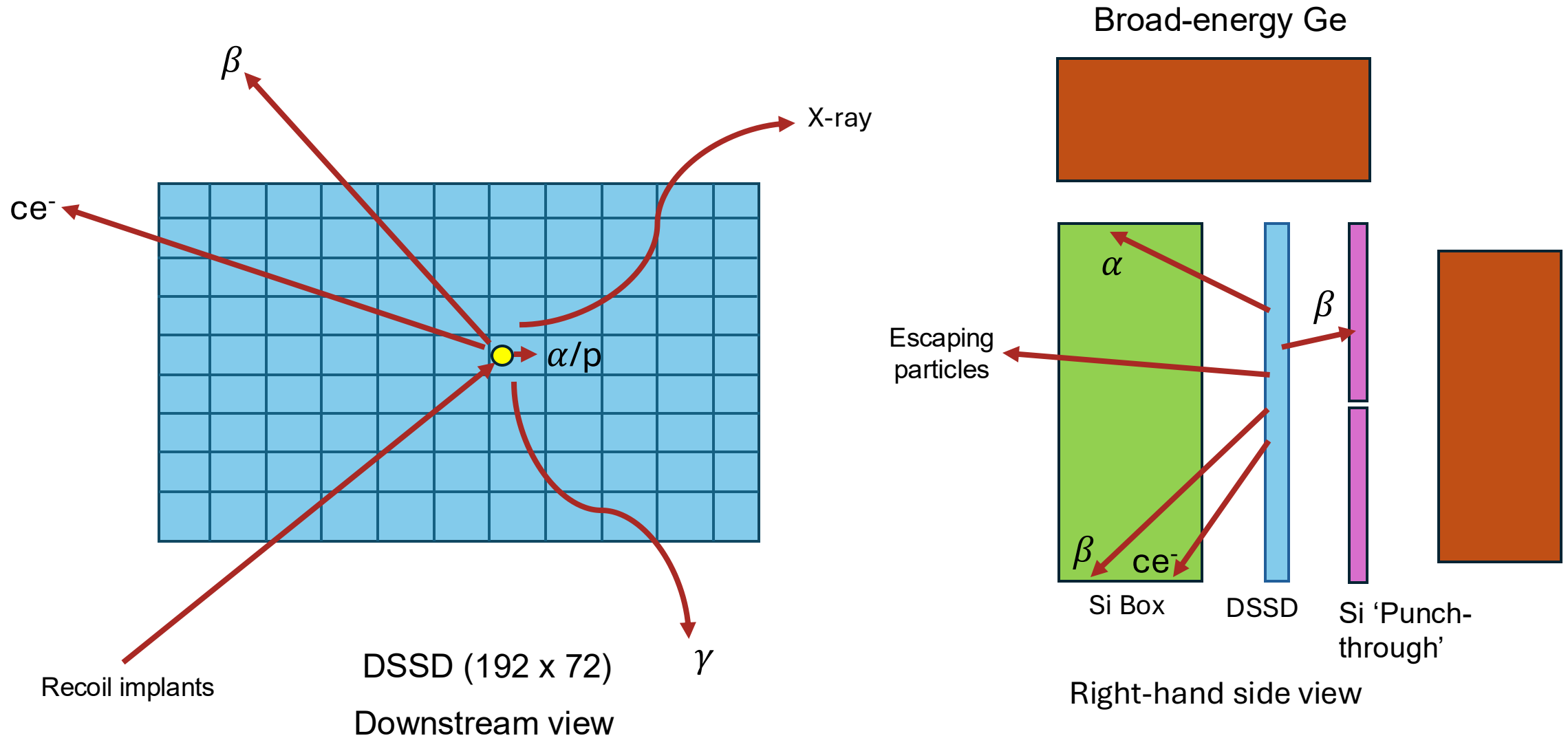
Experimental details: MARA mass separation



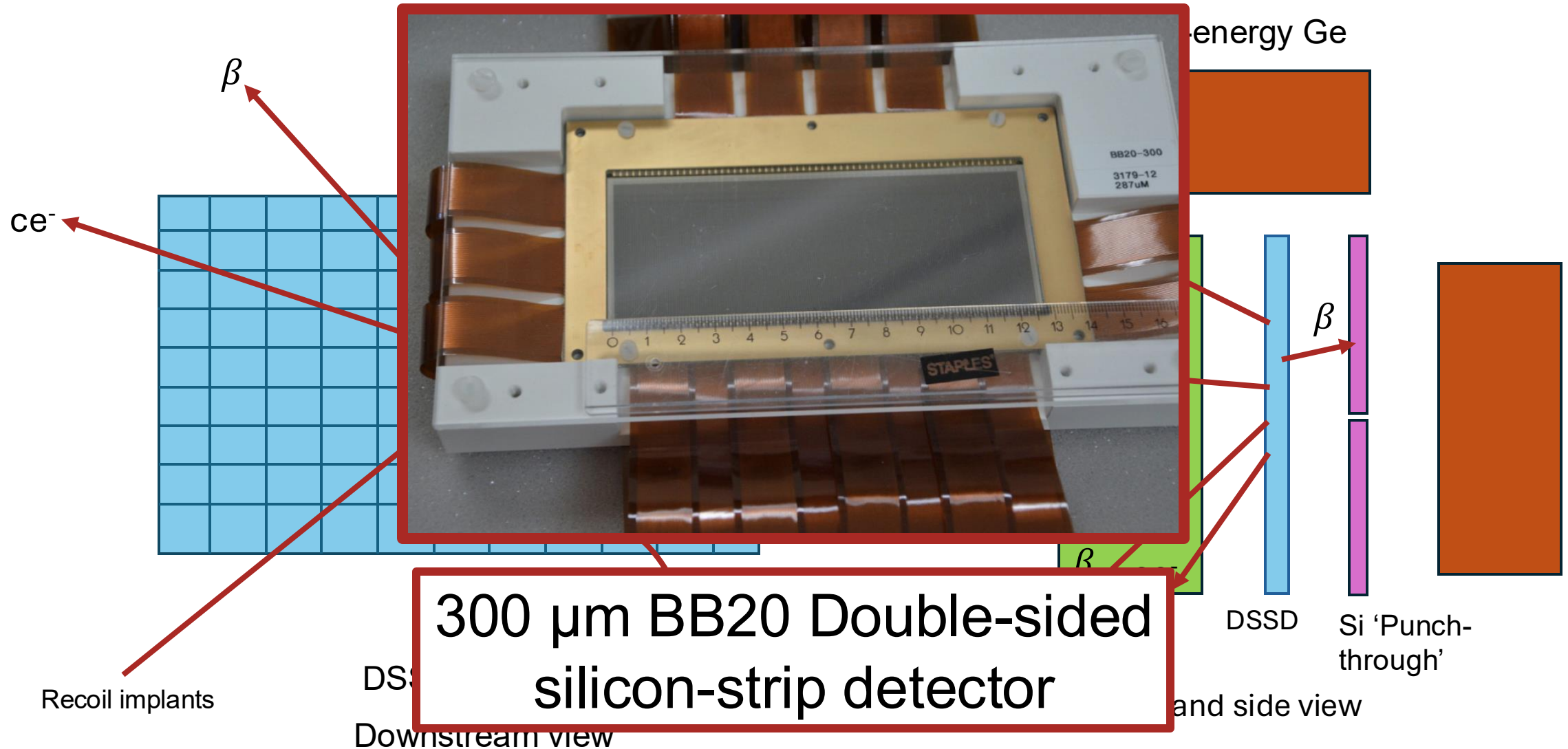
J. Saren et al., NIM-B 266, 4196 (2008)



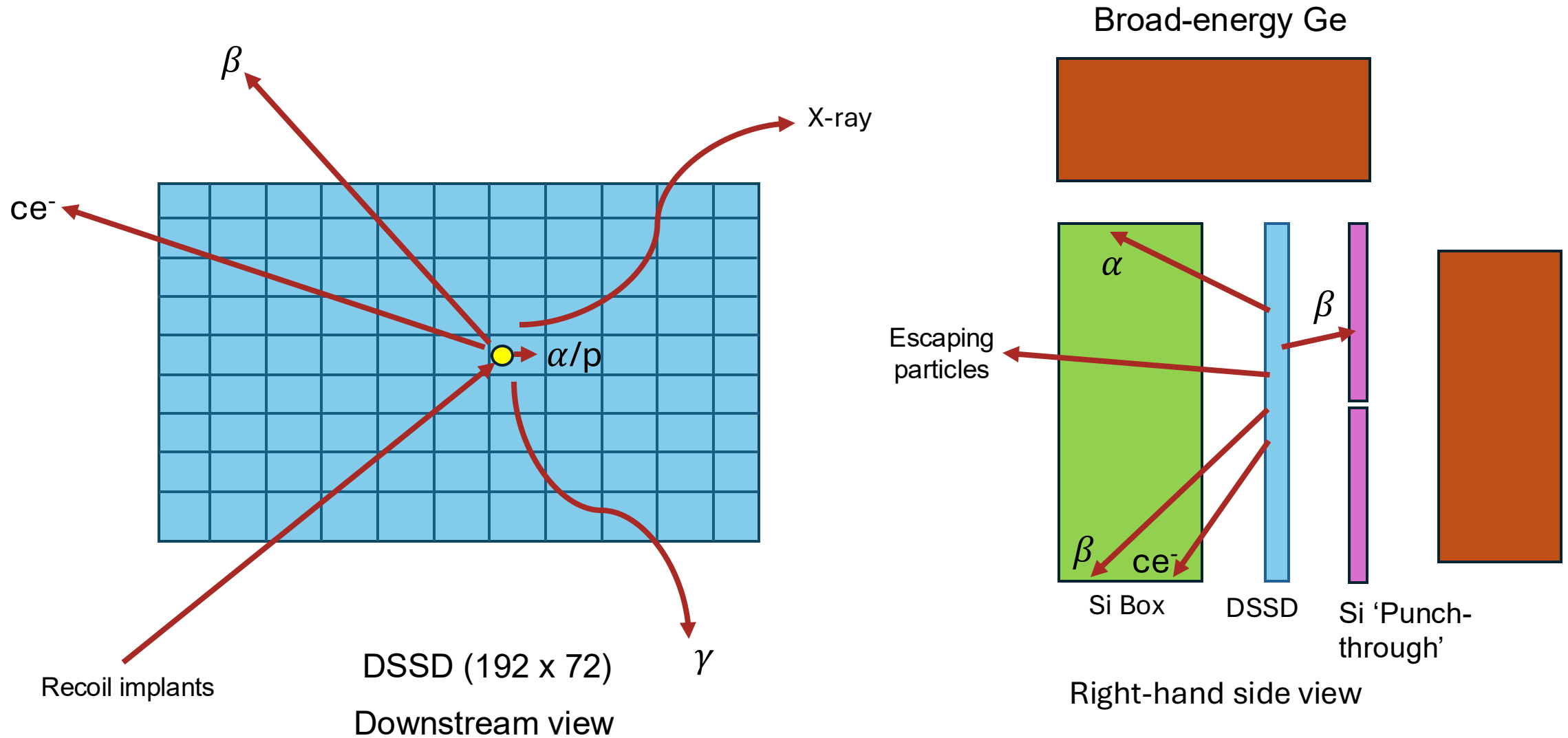
Experimental details: decay station



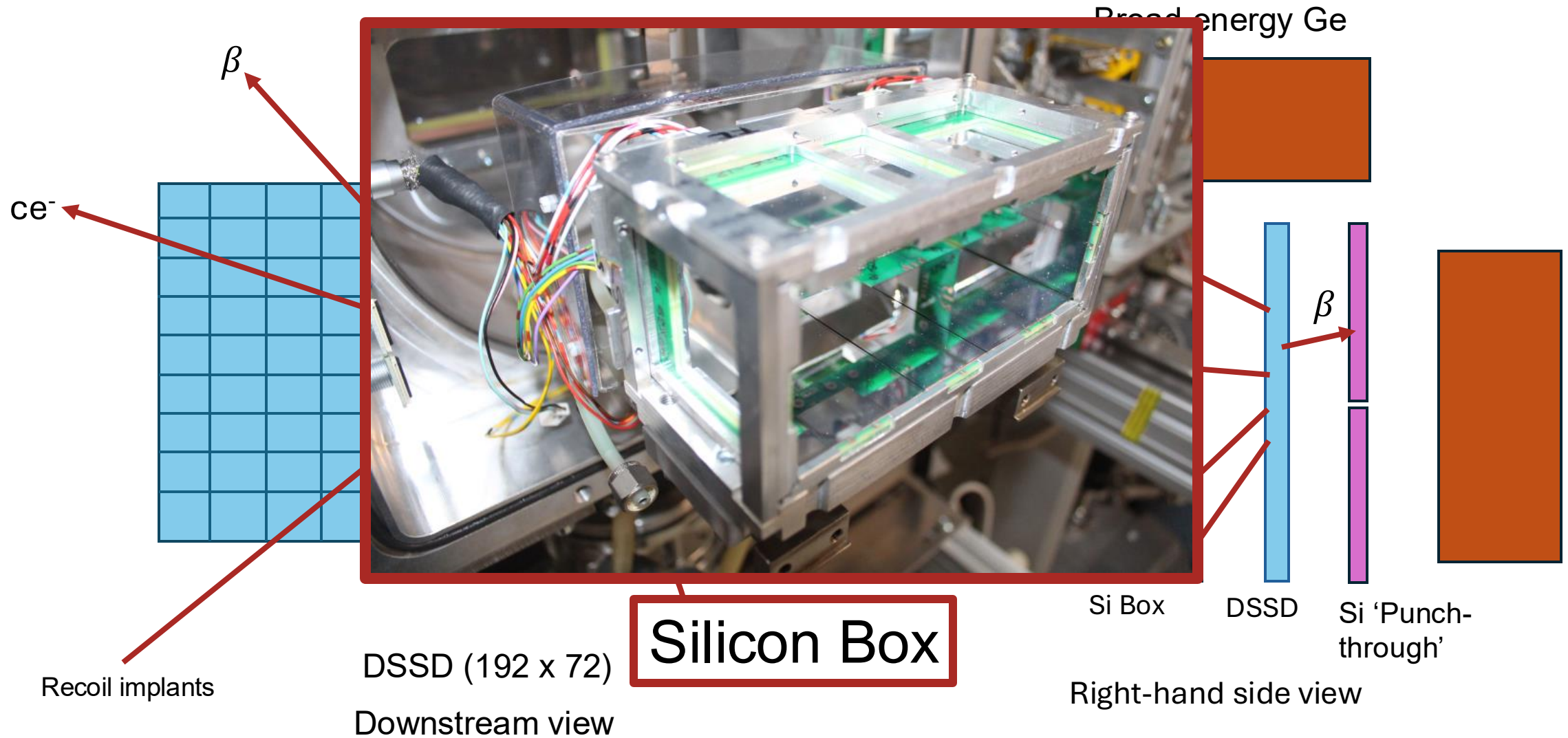
Experimental details: decay station



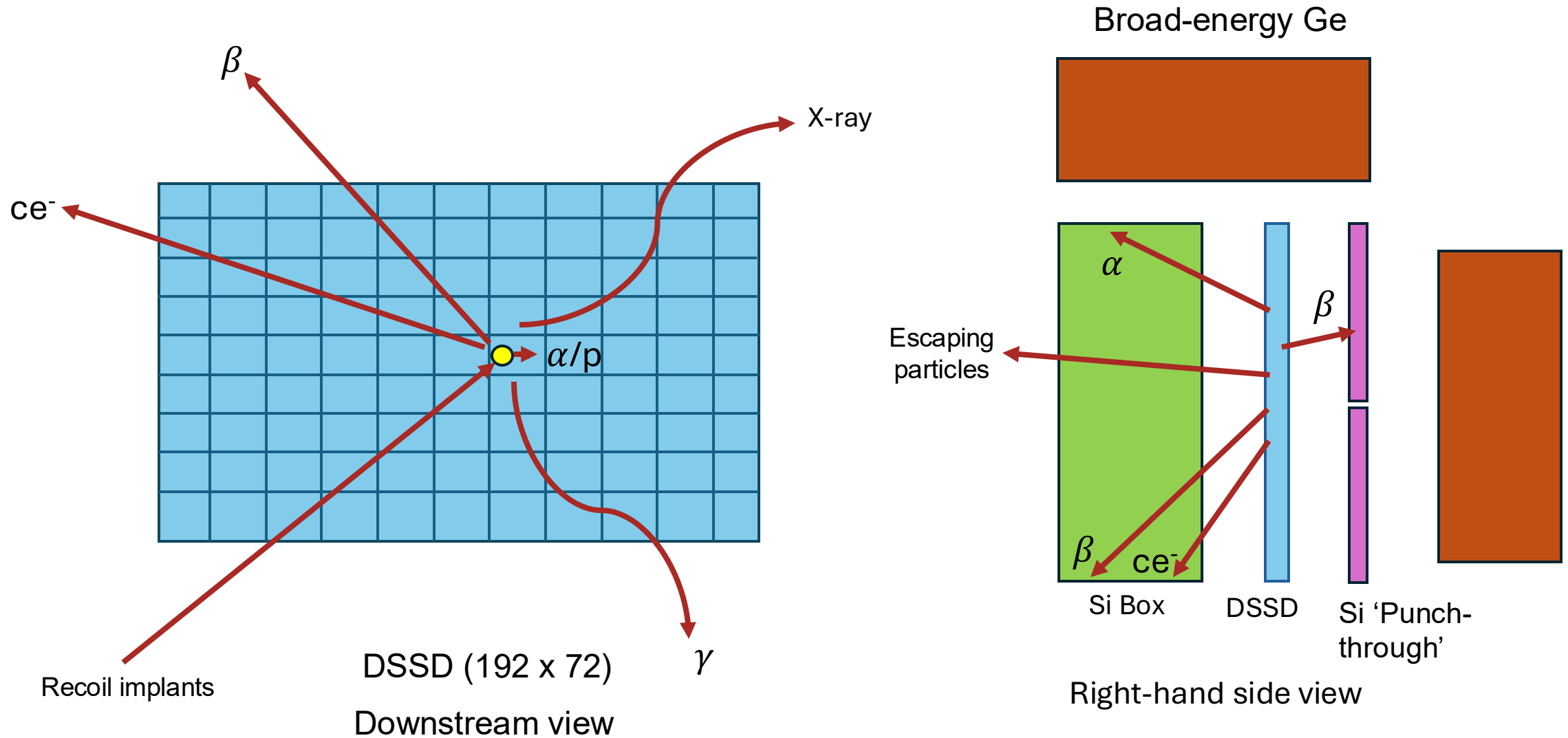
Experimental details: decay station



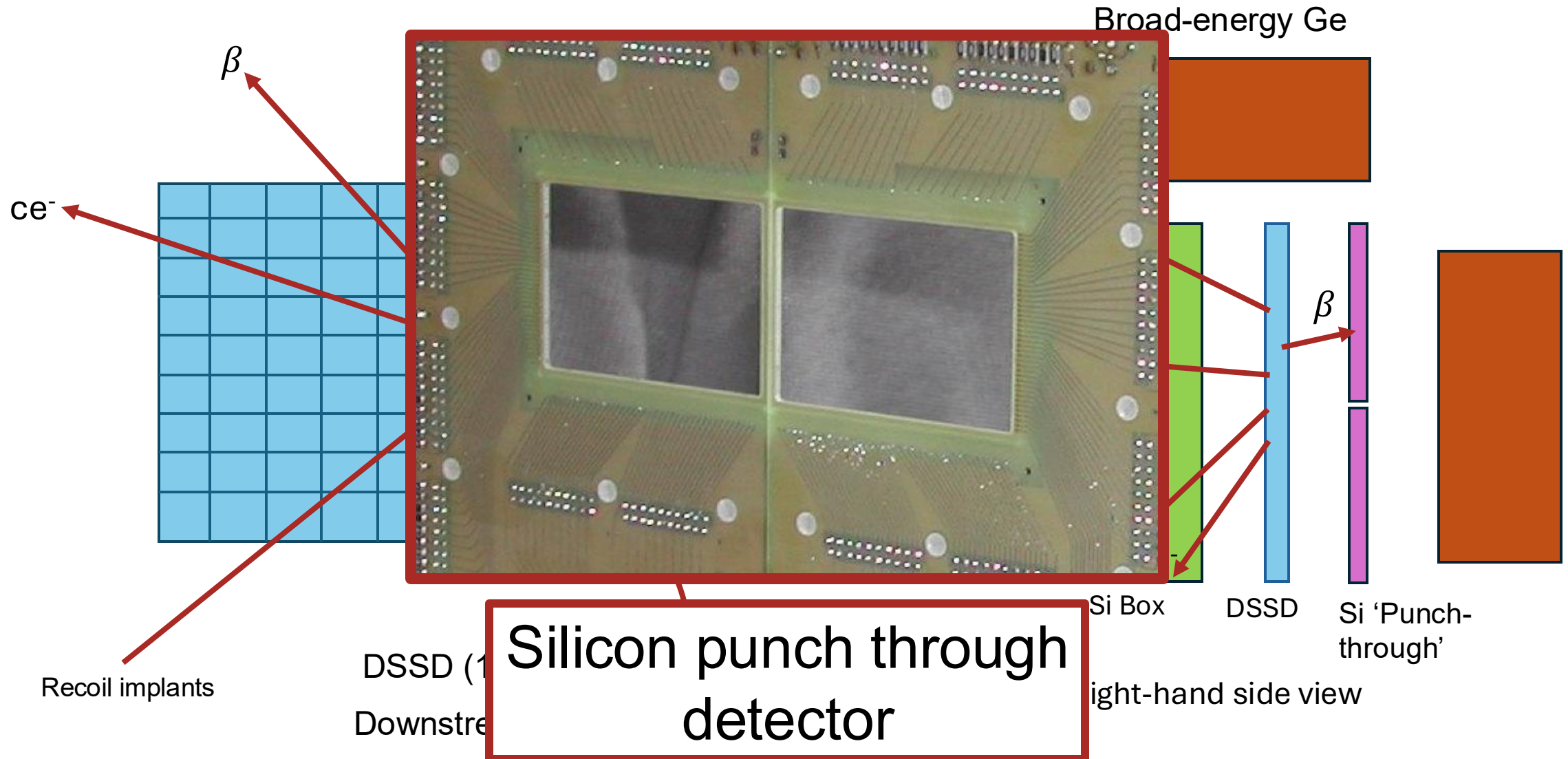
Experimental details: decay station



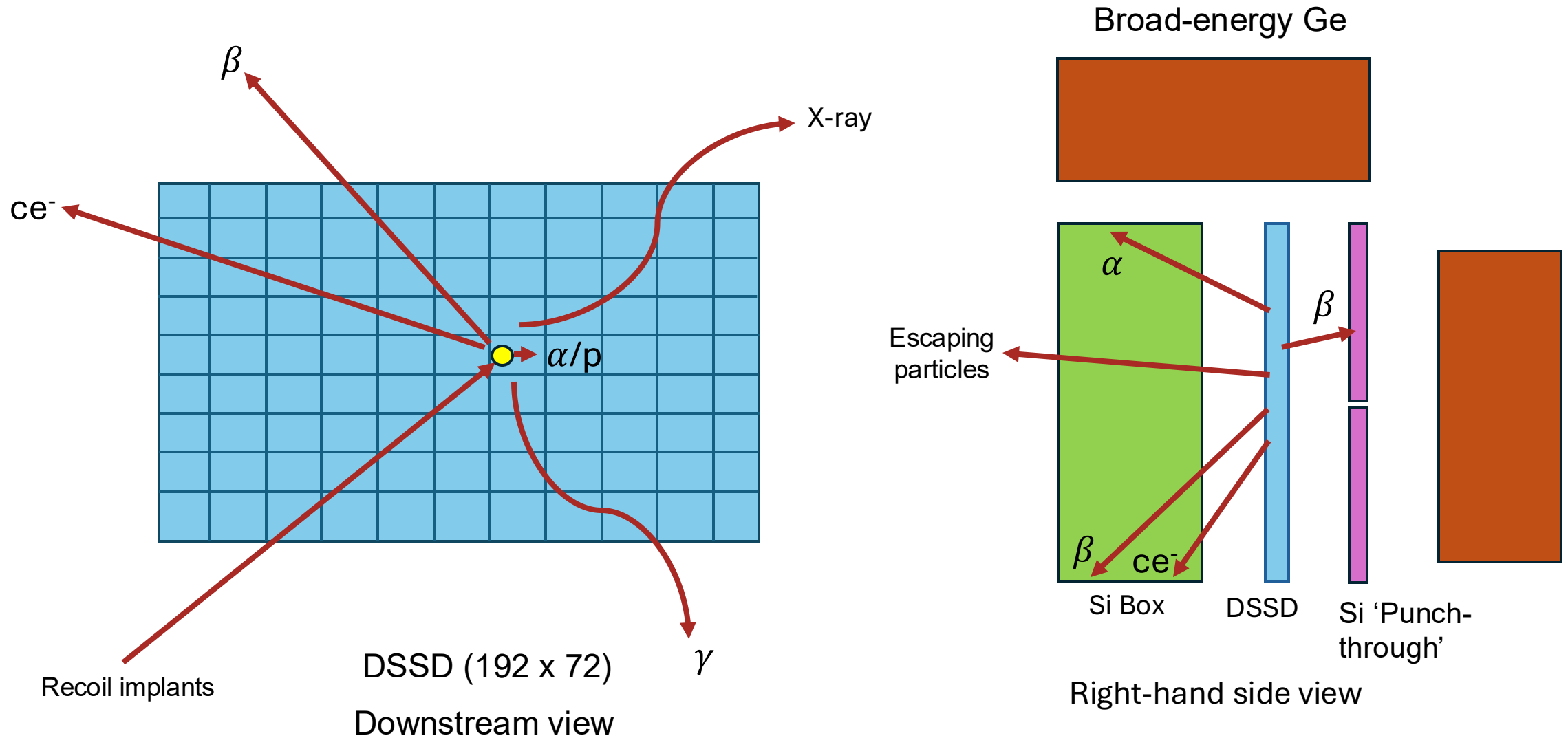
Experimental details: decay station



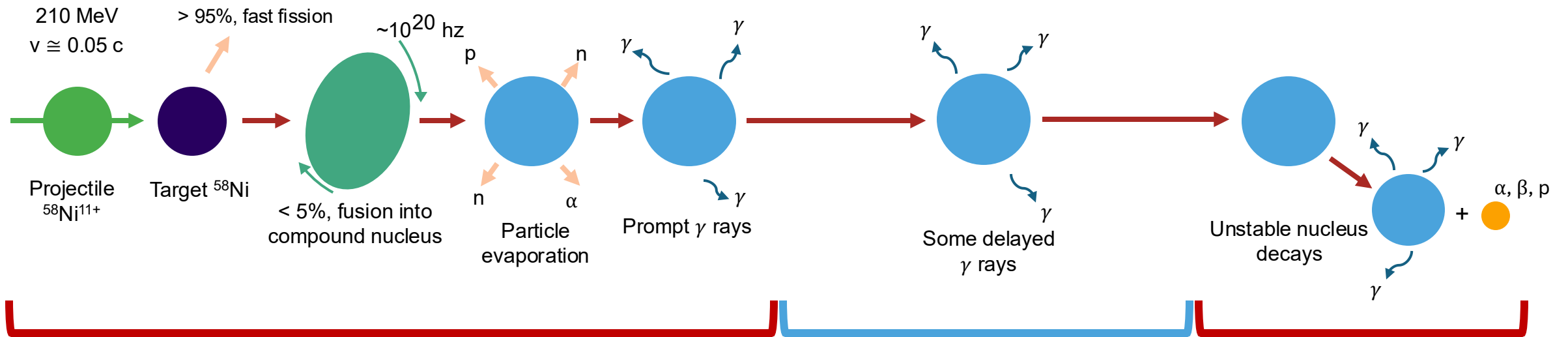
Experimental details: decay station



Experimental details: decay station



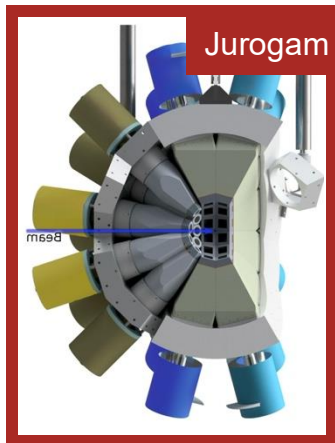
Recoil-decay tagging



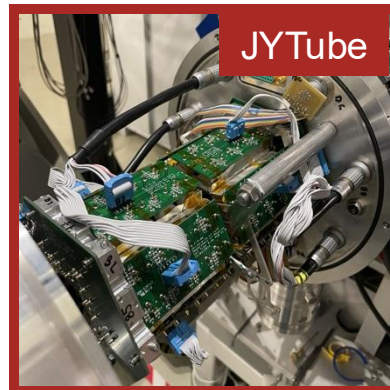
ToF ~ few ns

ToF ~ 1 μs

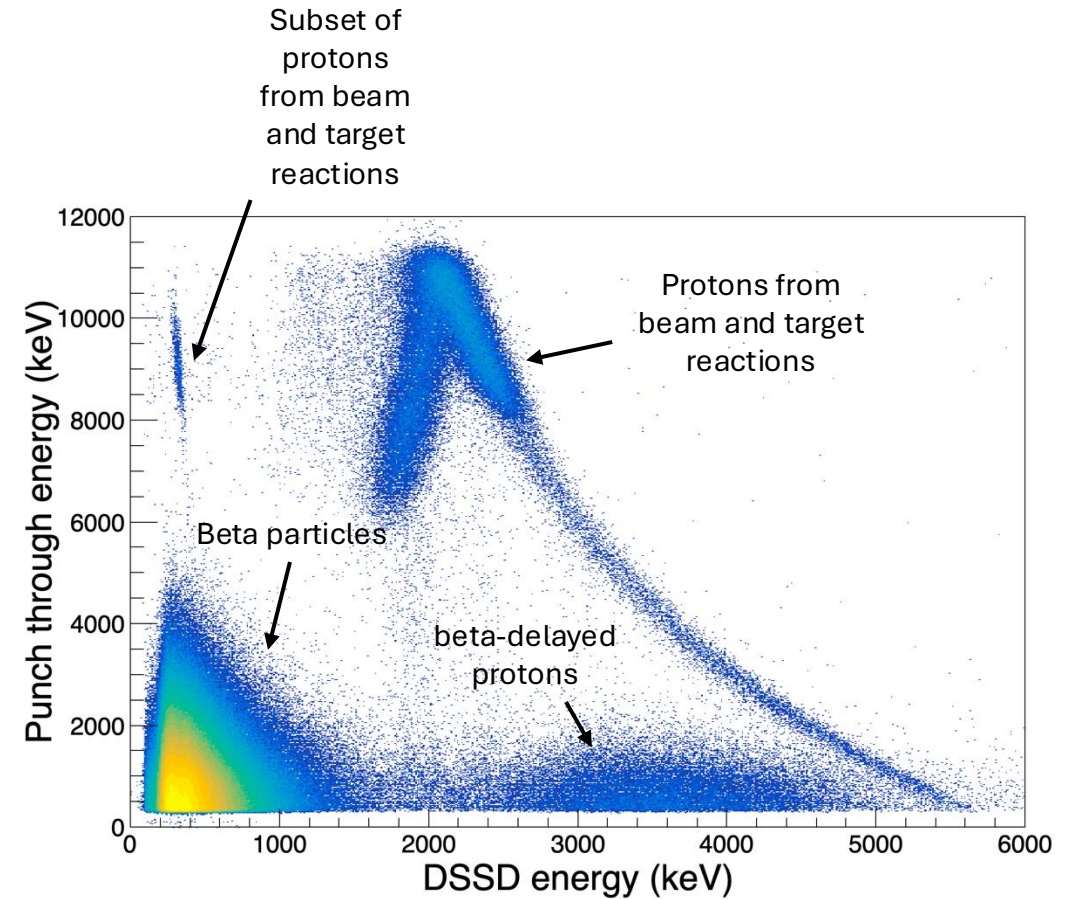
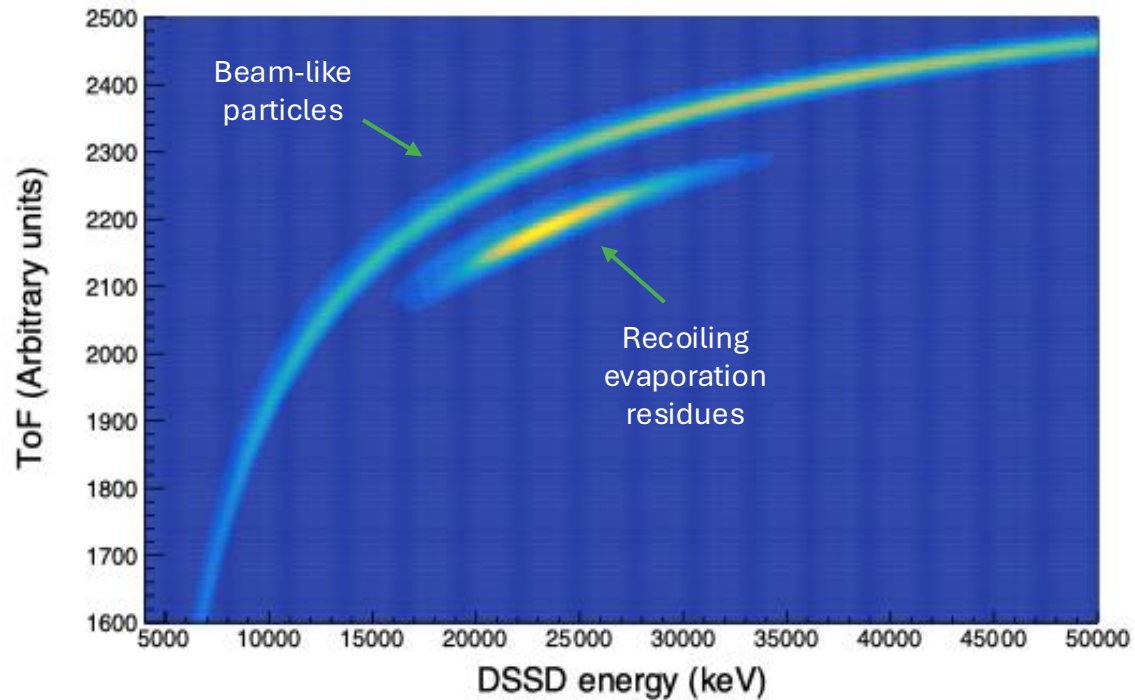
Decay time: μs - seconds



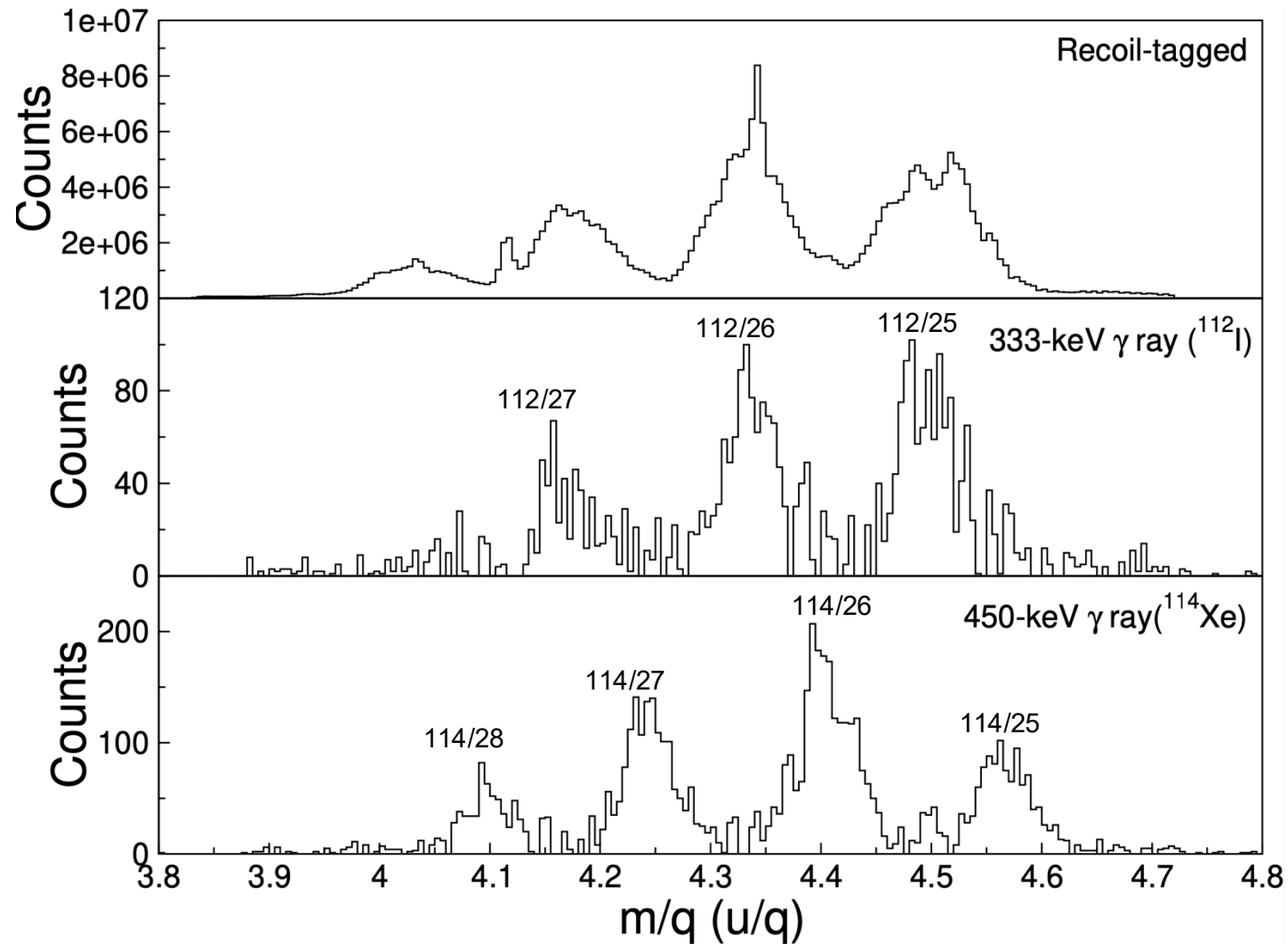
+



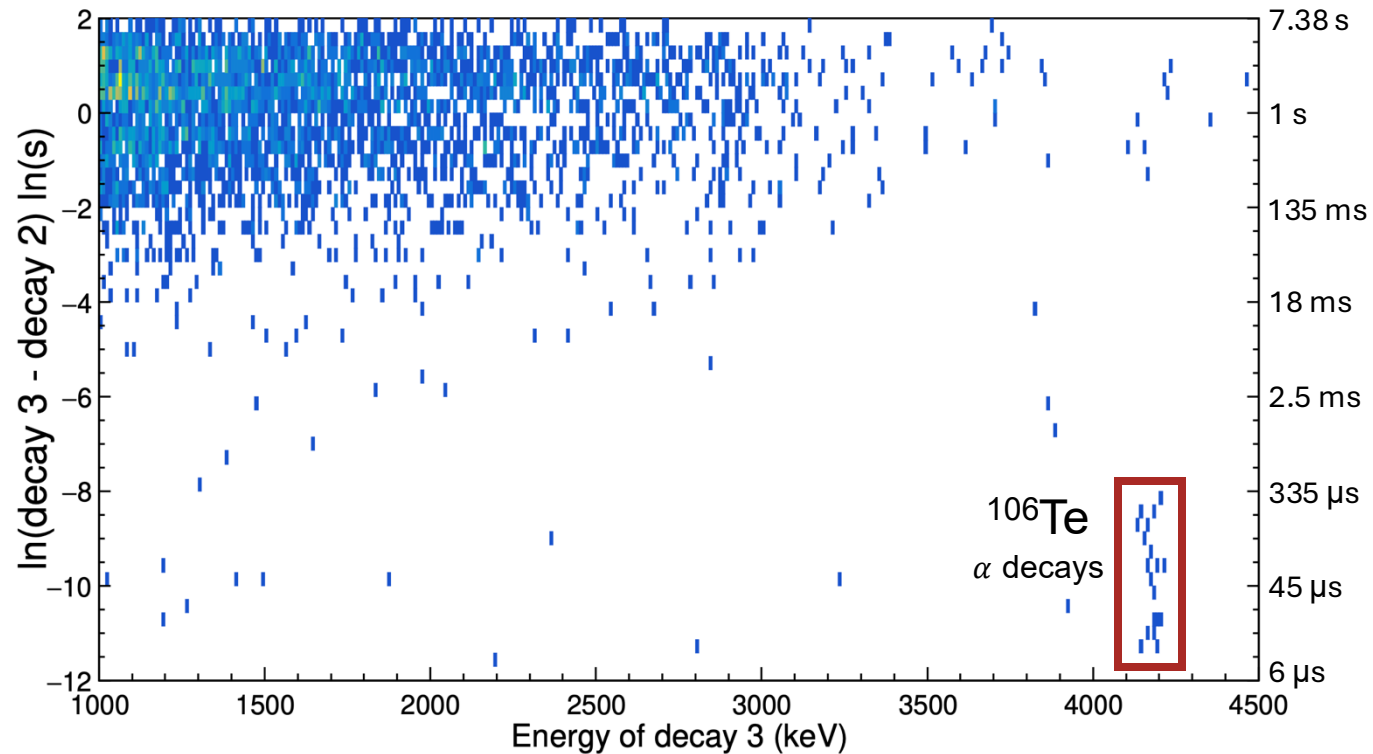
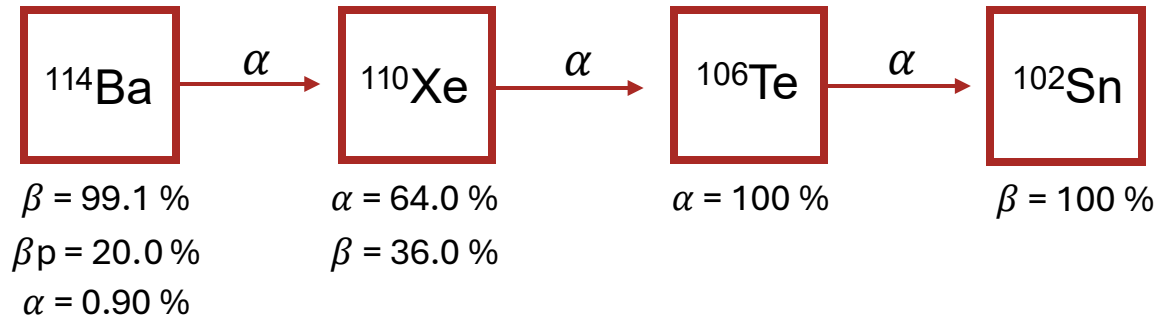
Preliminary analysis: reaction products



Preliminary analysis: mass-to-charge ratio



Preliminary analysis: presence of ^{114}Ba

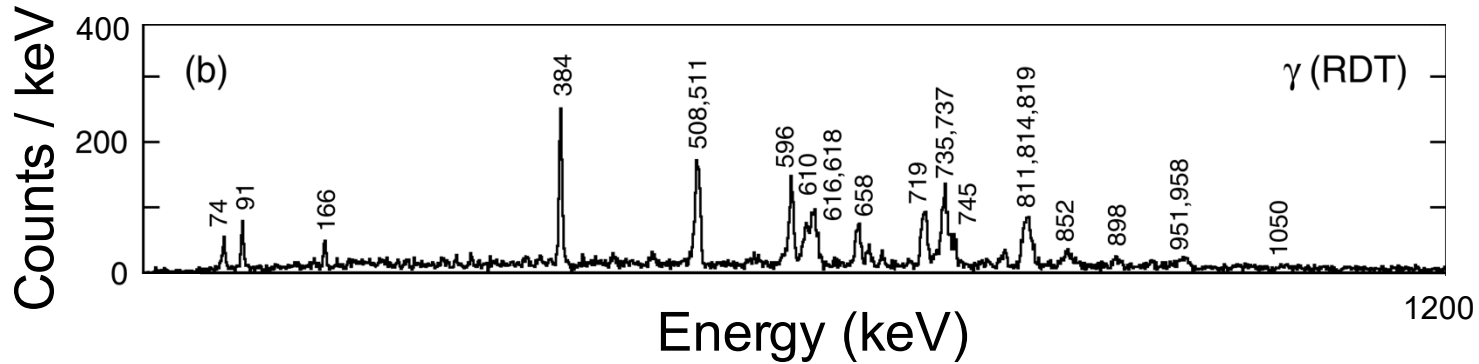


Acknowledgements and summary

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G. García², R. Nicolás⁵

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7. University of Liverpool | 8. Institute for Basic Science, Daejeon
9. University of Padua

Extra: ^{113}Cs , sample of RDT

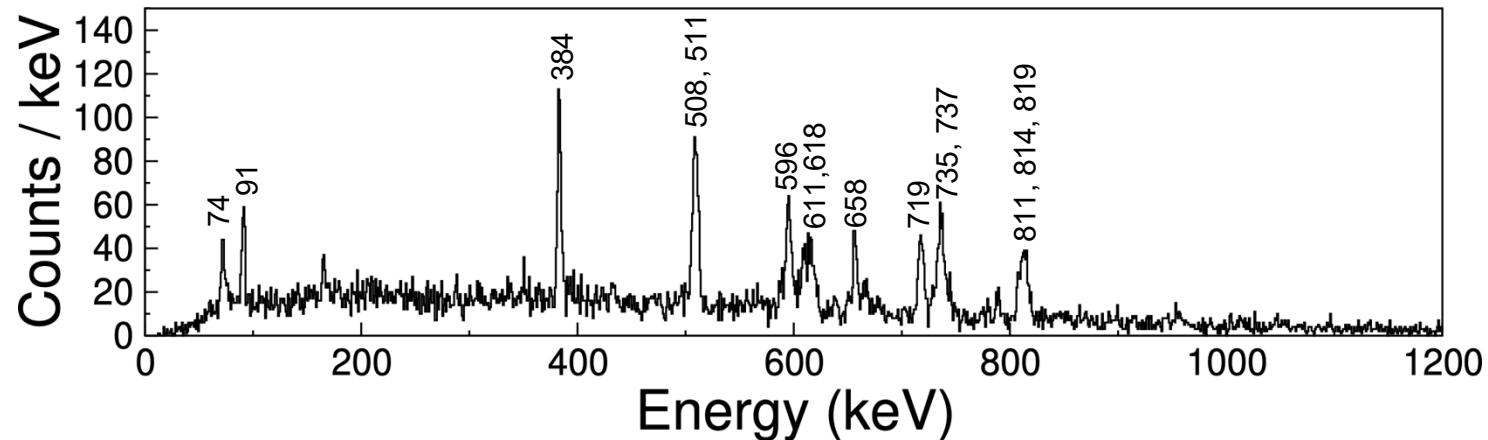


P. T. Wady et al. *Physics Letters B* 740 243-249 (2015)

$^{58}\text{Ni}(^{58}\text{Ni}, p2n)^{113}\text{Cs}$ $E_{\text{beam}} = 230 \text{ MeV}$
target thickness = 500 ug/cm^2 $I_{\text{beam}} \approx 1.5 \text{ pA}$

Total data: ~390 GB.

Recoil-proton tagged: 969(8)-keV proton, 100us.



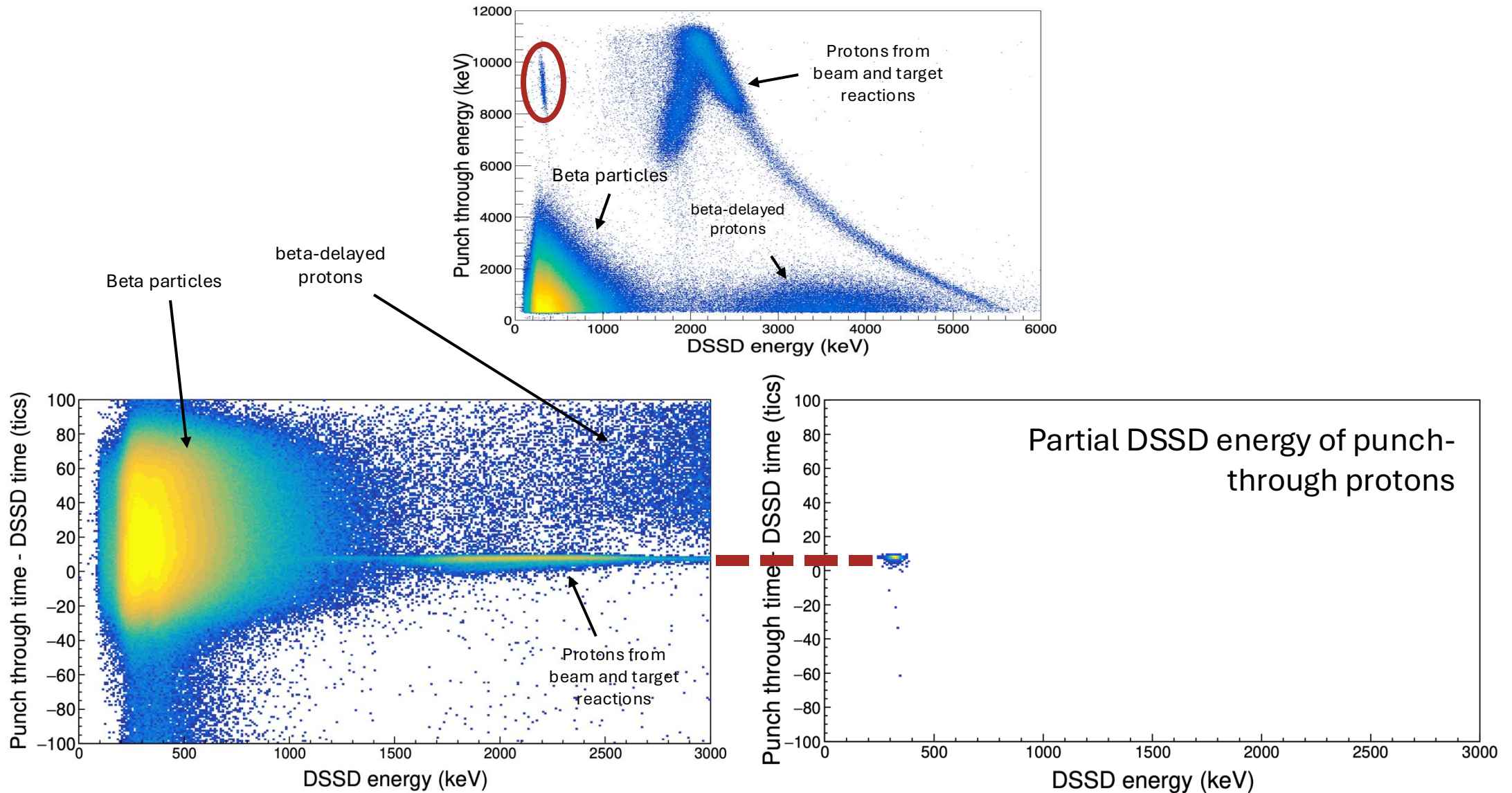
This experiment

$^{58}\text{Ni}(^{58}\text{Ni}, p2n)^{113}\text{Cs}$ $E_{\text{beam}} = 230 \text{ MeV}$
target thickness = 700 ug/cm^2 $I_{\text{beam}} \approx 3 \text{ pA}$

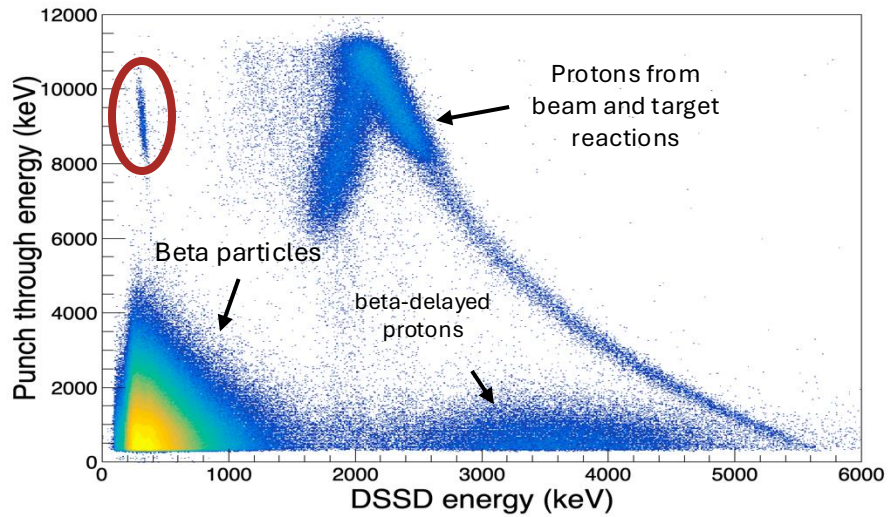
Total data
represented in figure :
~221 GB

Recoil-proton tagged: [930, 1100]-keV proton, 100us.

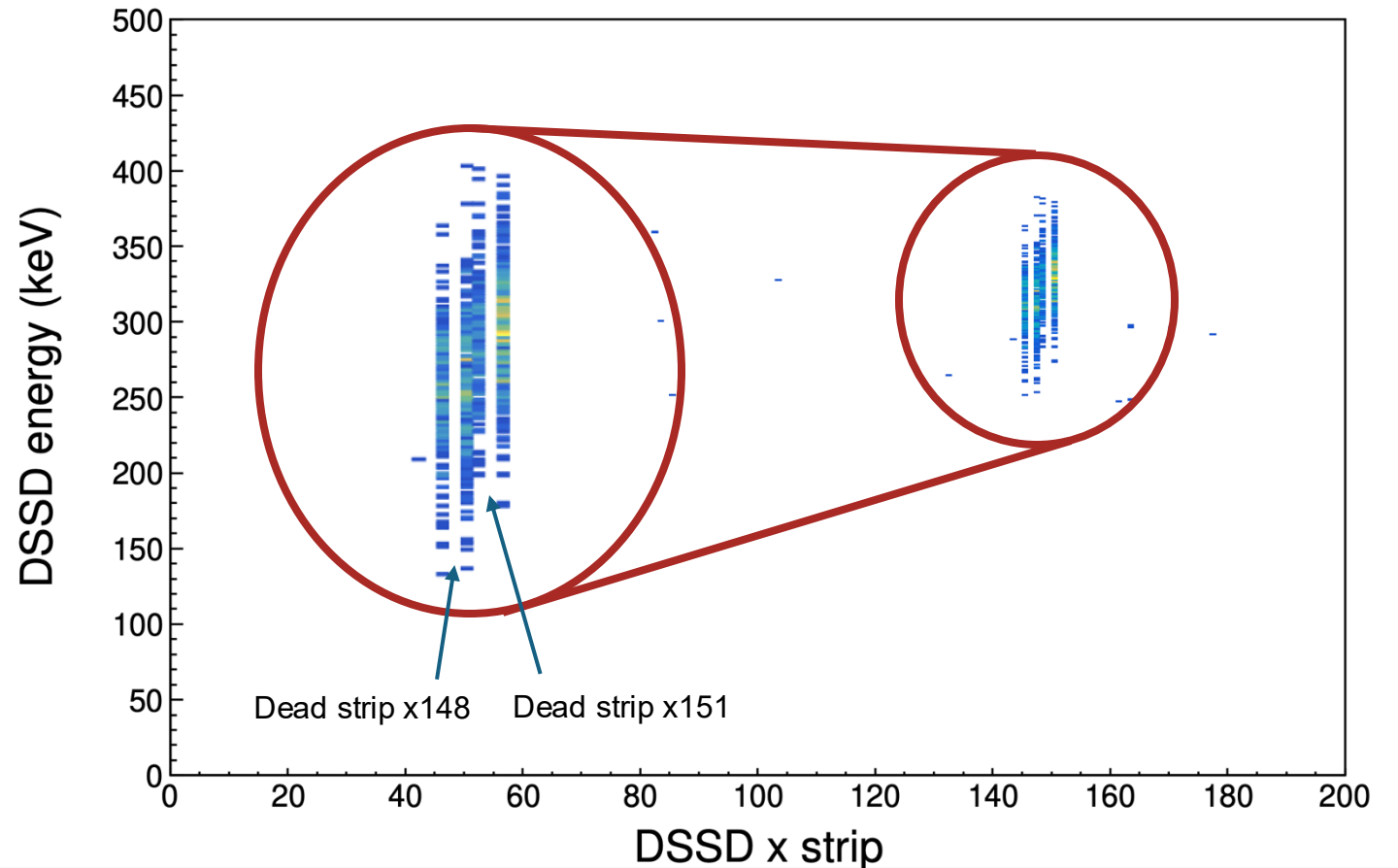
Extra: Δt between DSSD and Punch through



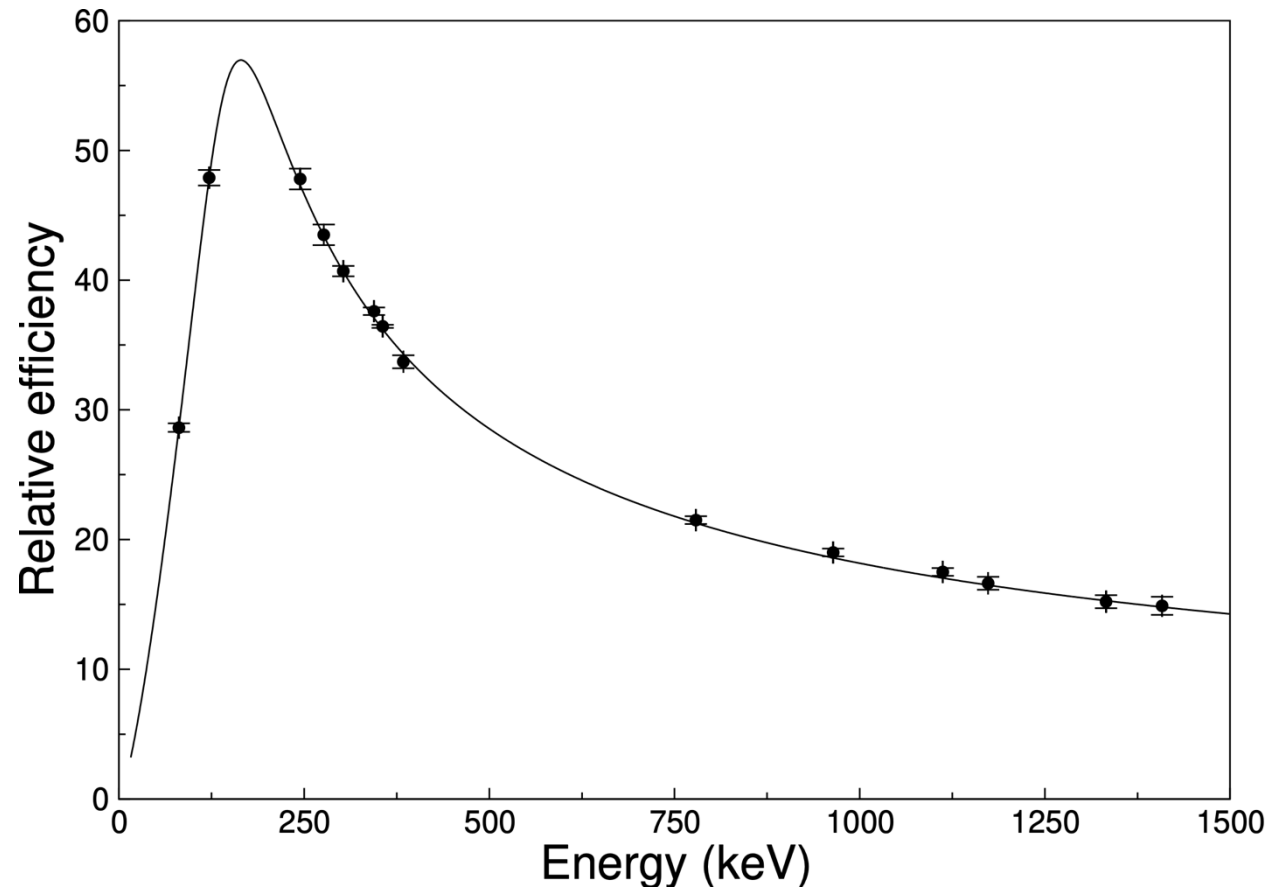
Extra: Protons hitting dead strips of the DSSD



- Dead strip hit on DSSD
- Induced charge partially collected in neighbouring strips



Extra: Relative efficiency of jurogam



Extra: MARA mass slits

