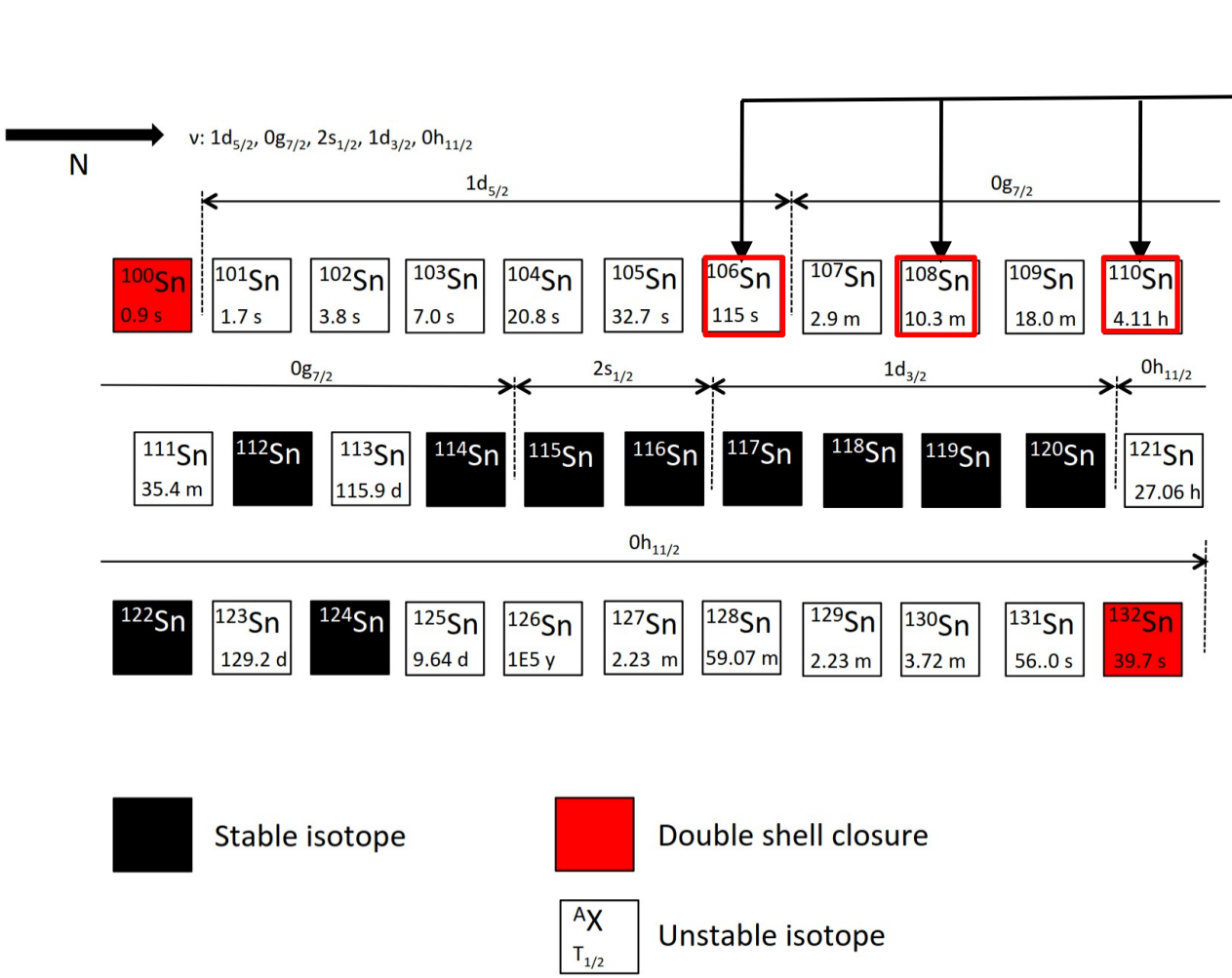
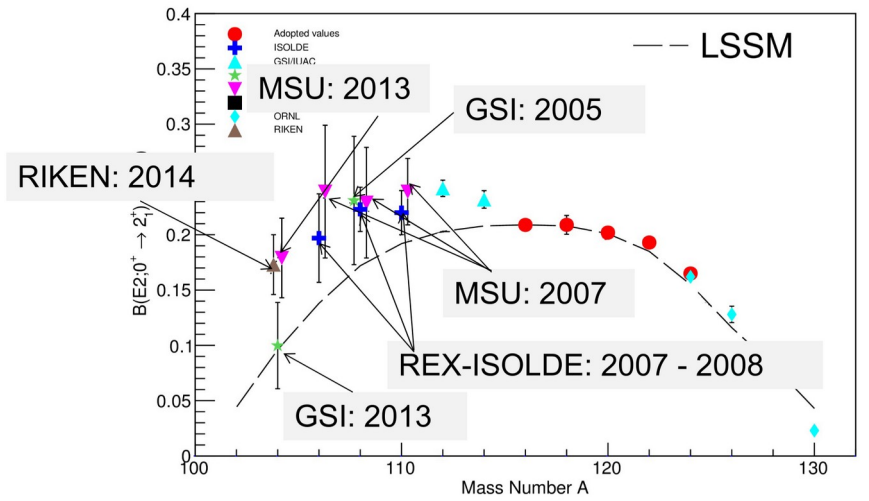
The quadrupole moments of the 2^{+}_{1} state in the even neutron deficient Sn isotopes

Presenter: Rafael Antonio Lopez

Physics case





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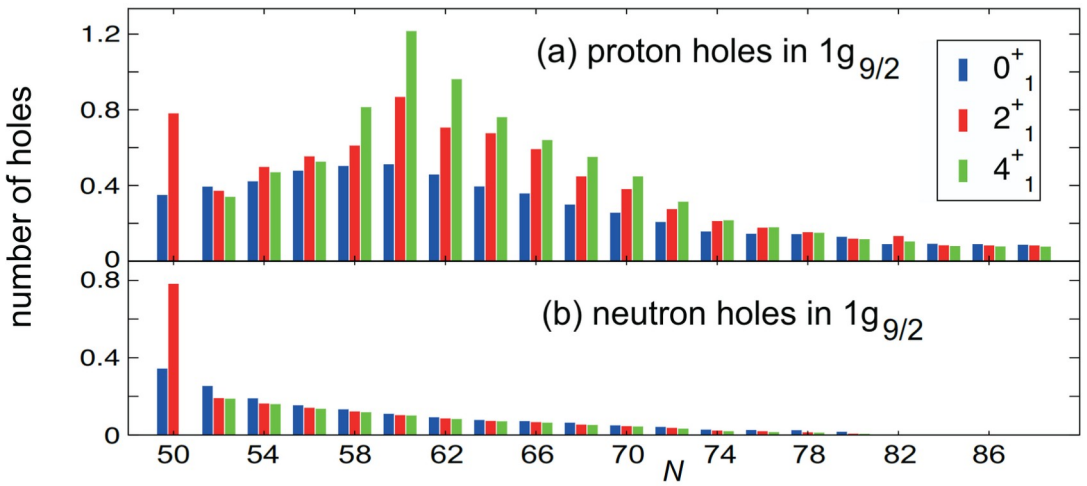
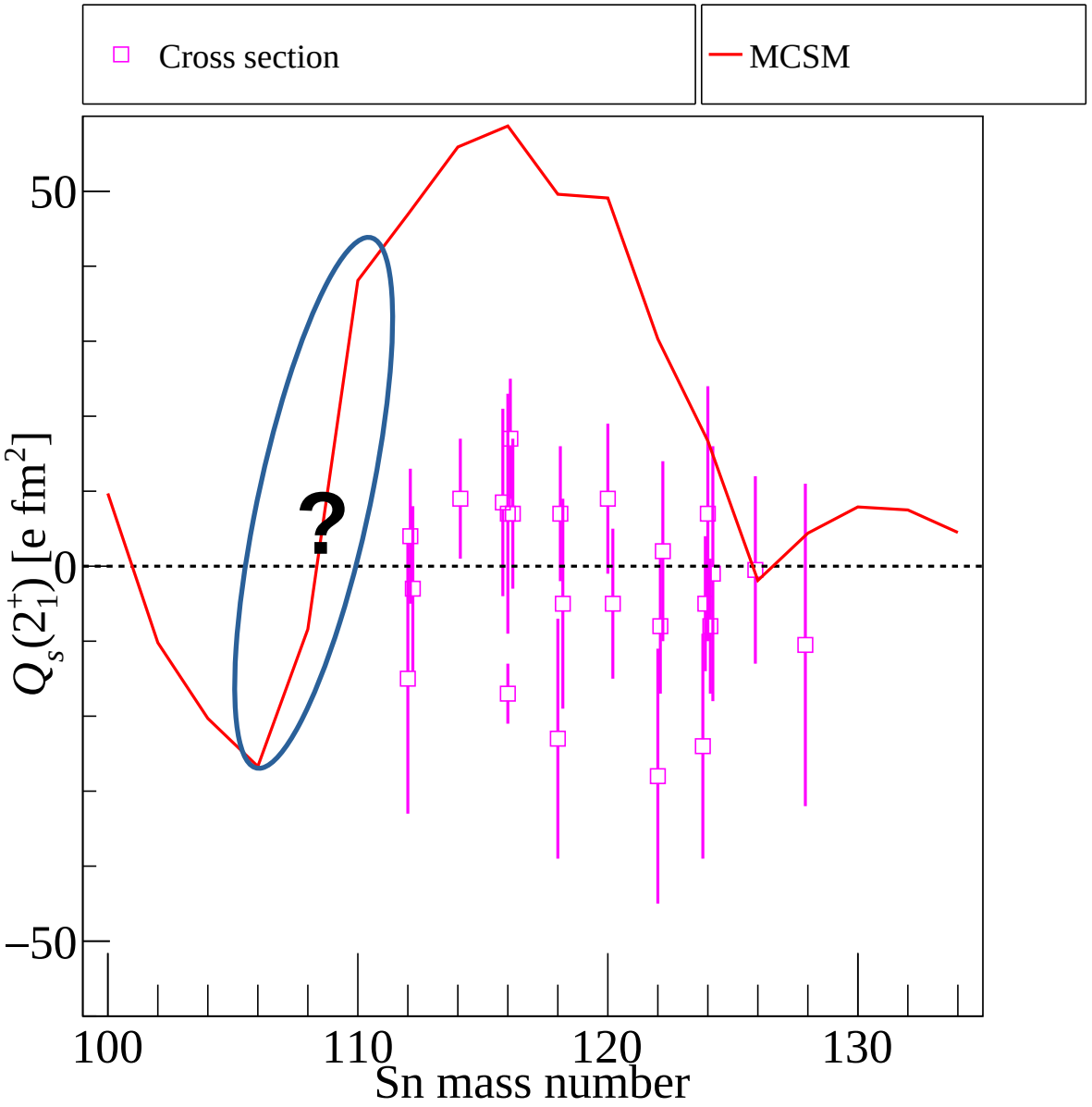
Physics case

- MCSM
  - 2^+ Shape change



T. Togashi et al., PRL 121, 062501 (2018)



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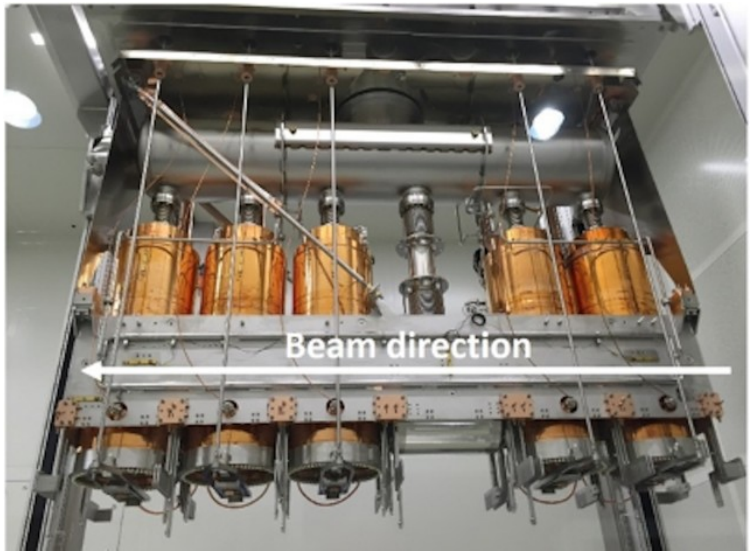
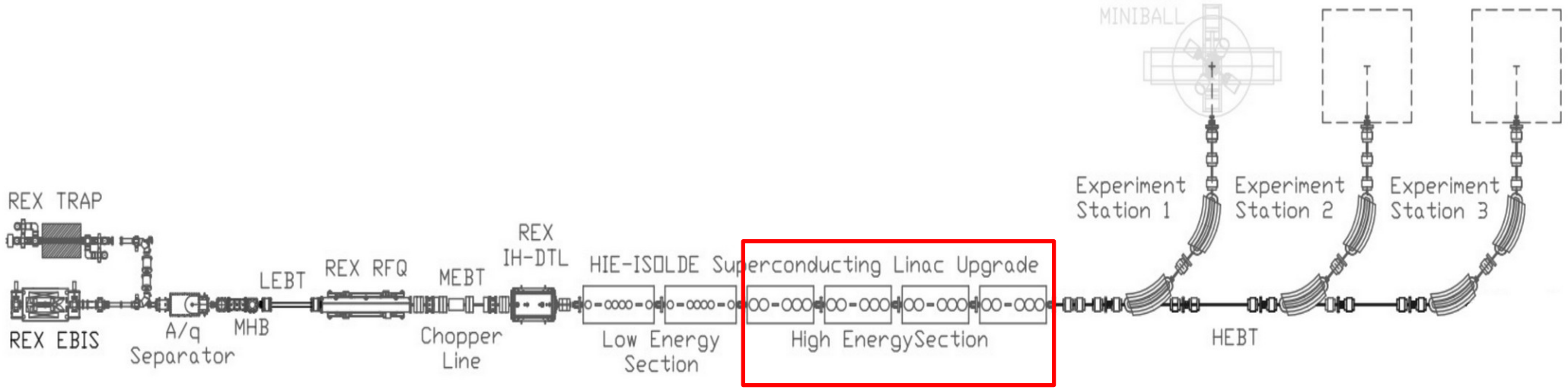
Experimental setup

- ISOLDE
- Upgrade (REX → HIE)
  - ~3 MeV/u → ~10 MeV/u
  - New Beam/Targ species





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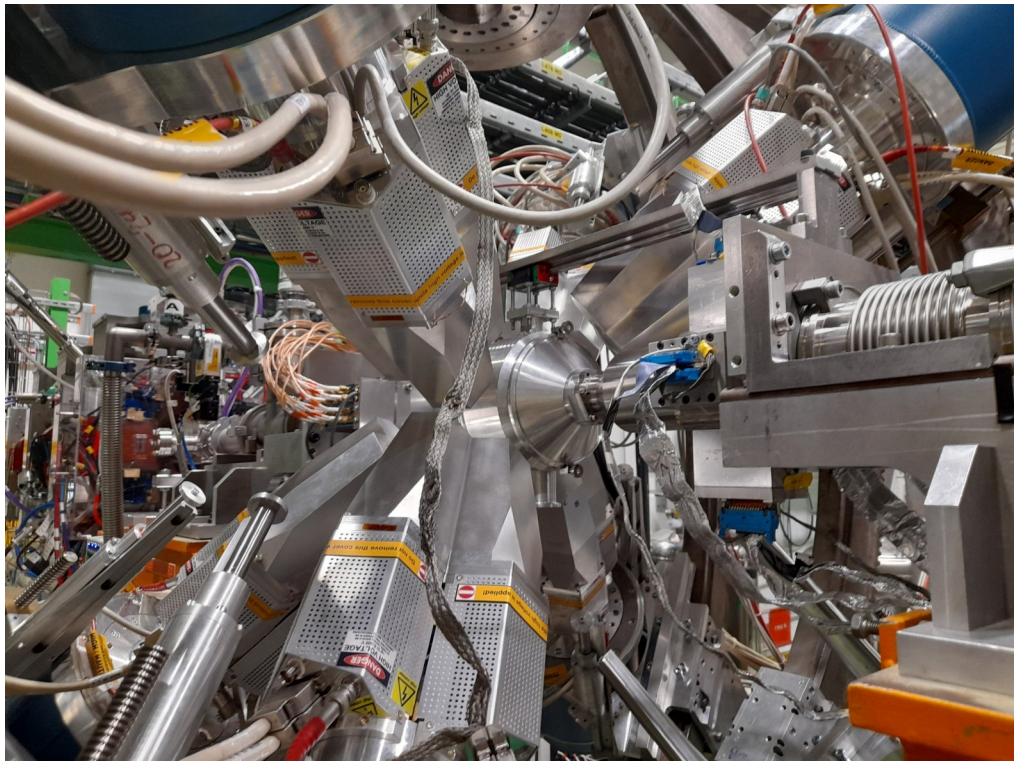
Experimental setup

- Miniball: HPGe + Si CD detectors



	^{110}Sn	^{108}Sn	^{106}Sn
D_{target} [mg/cm^2]	4.0	4.2	4.2
θ_{lab} [deg]	21.4 → 60.8	23.4 → 63.0	18.0 → 55.8
Purity [%]	~98	~80	~35
E_{beam} [MeV]	4.5 ±	4.4 ±	4.404 ±

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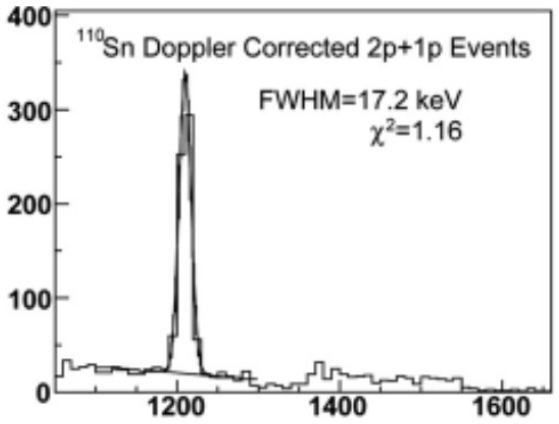
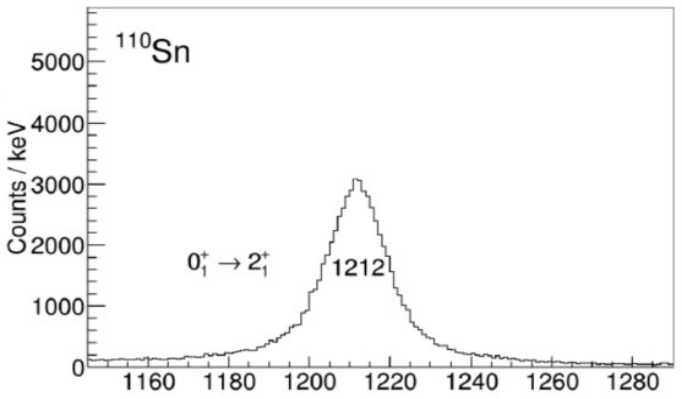
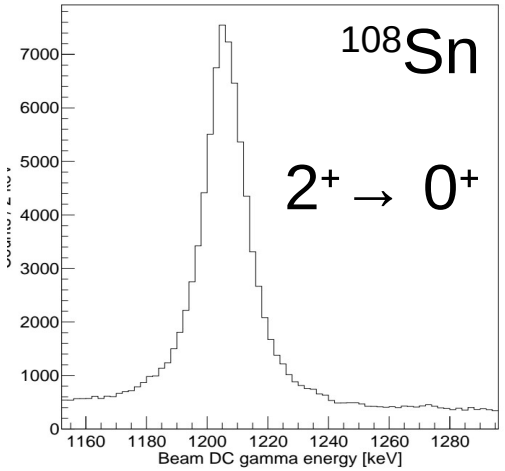
Statistics

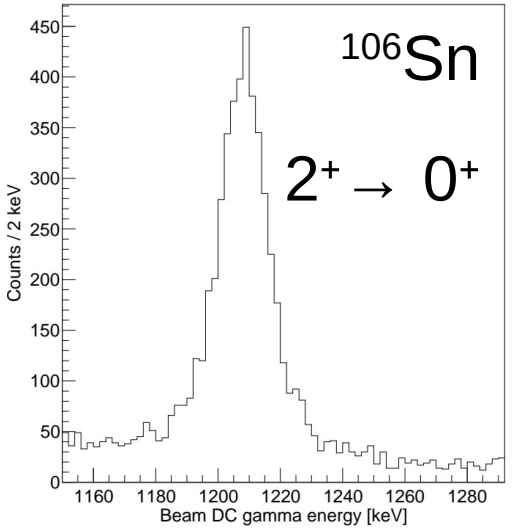
- Increase in statistics (post ISOLDE upgrades)
- ^{106}Sn: Low statistics







~64k Counts



~4k Counts

J. Cederkäll et al., PRL 98, 172501 (2007)

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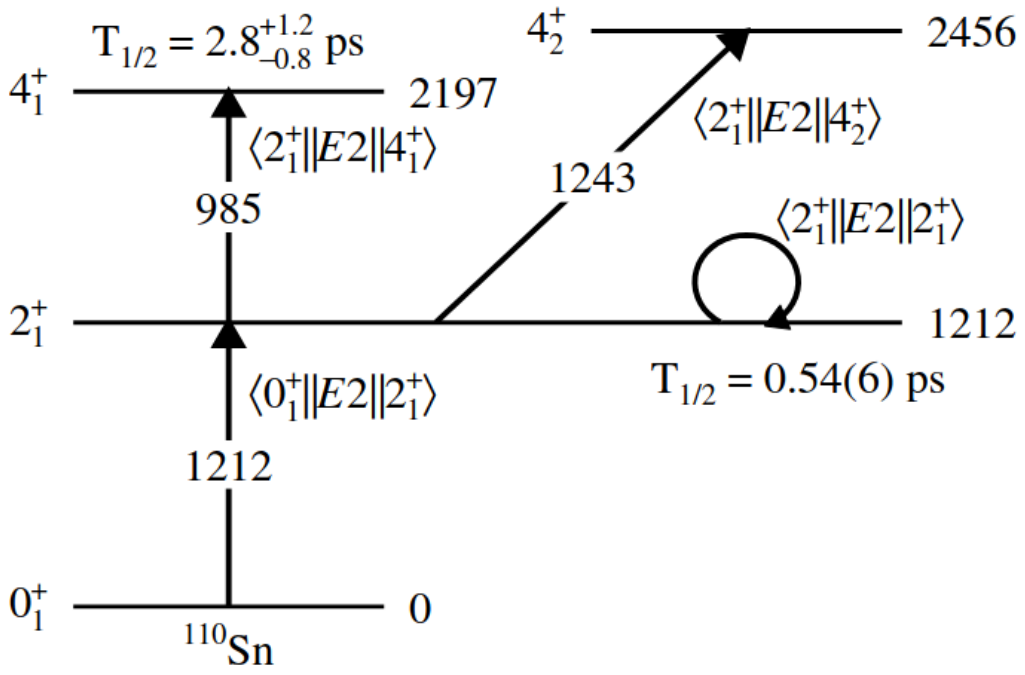
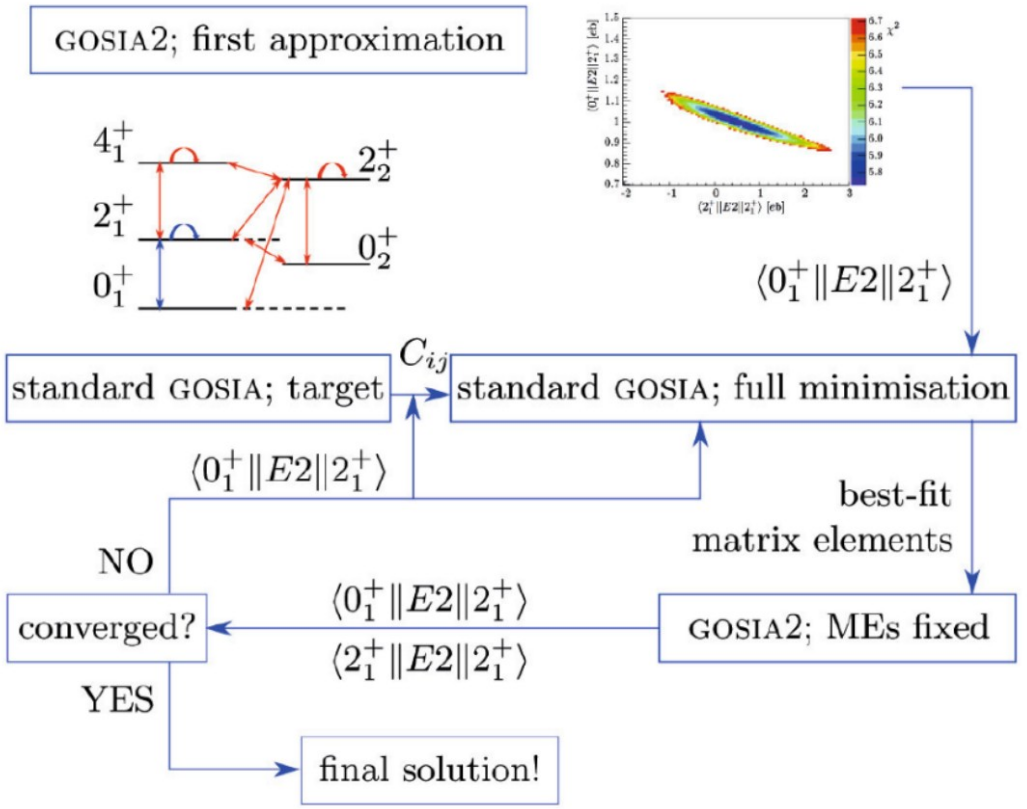
Data analysis with higher order effects

Example level scheme





M. Zielińska *et al.*, EPJA 52, 99 (2016)

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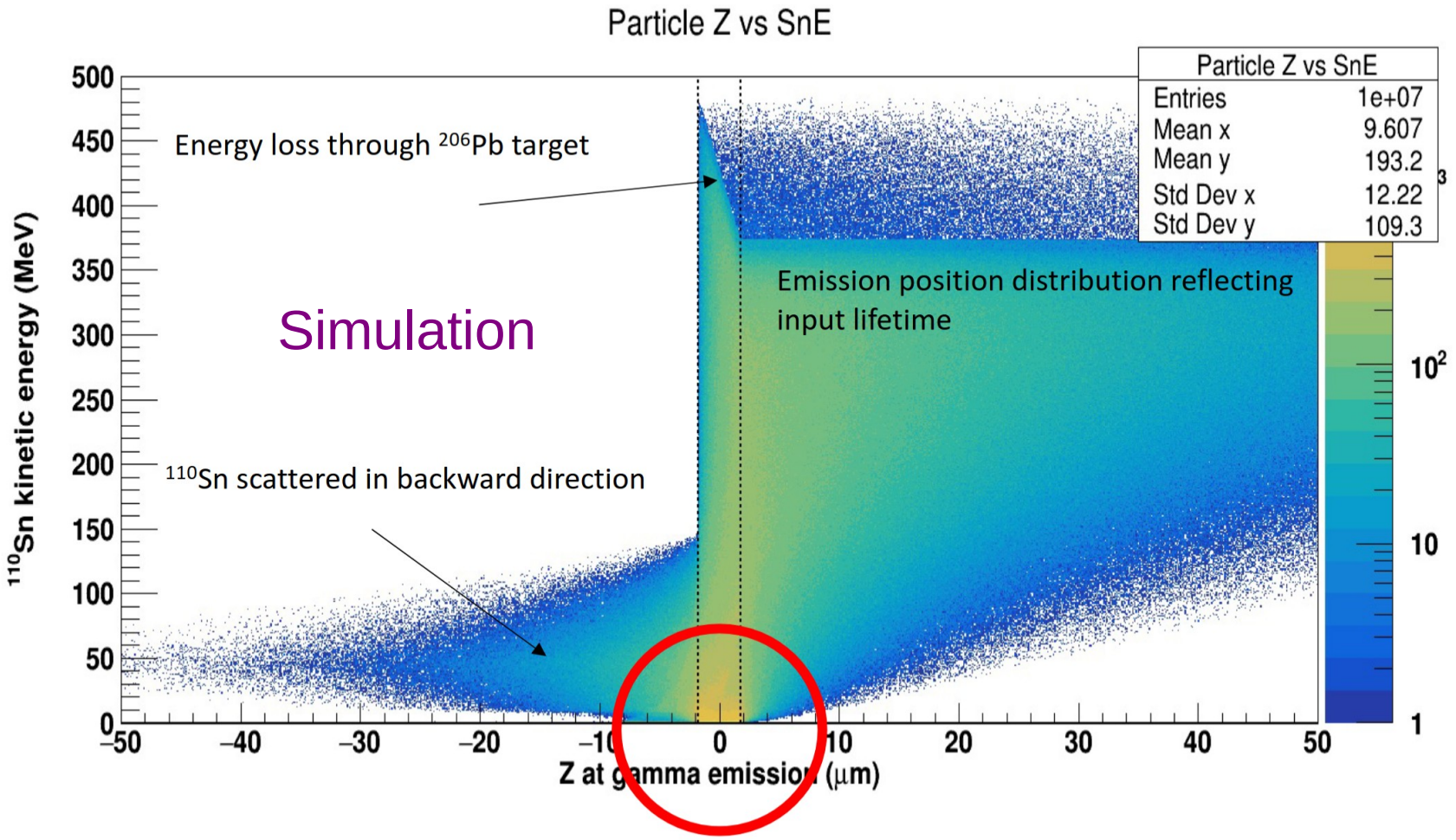
Lifetime study with DSAM



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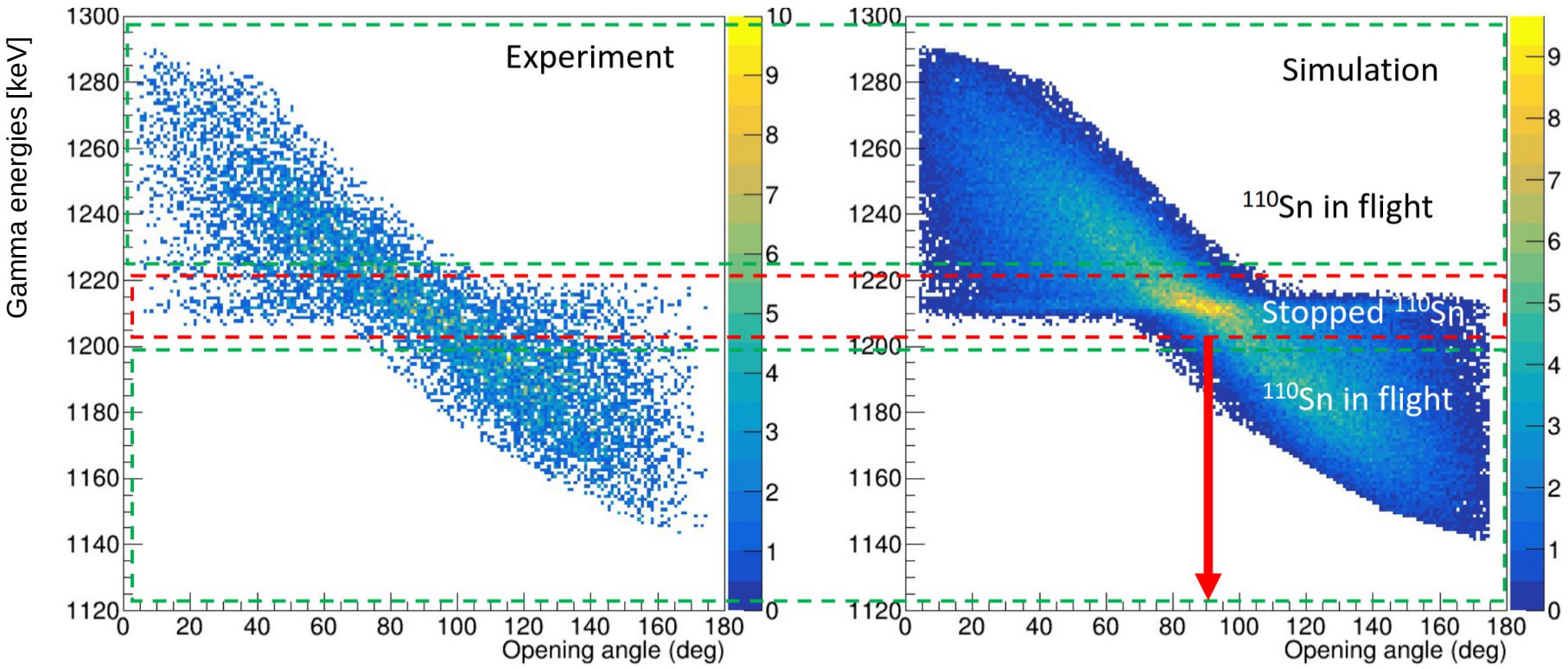
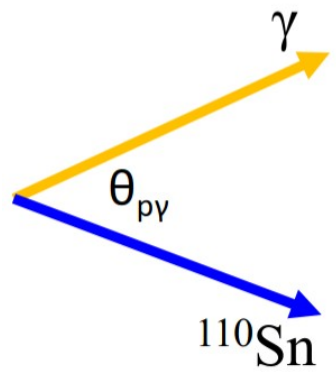
Lifetime study with DSAM





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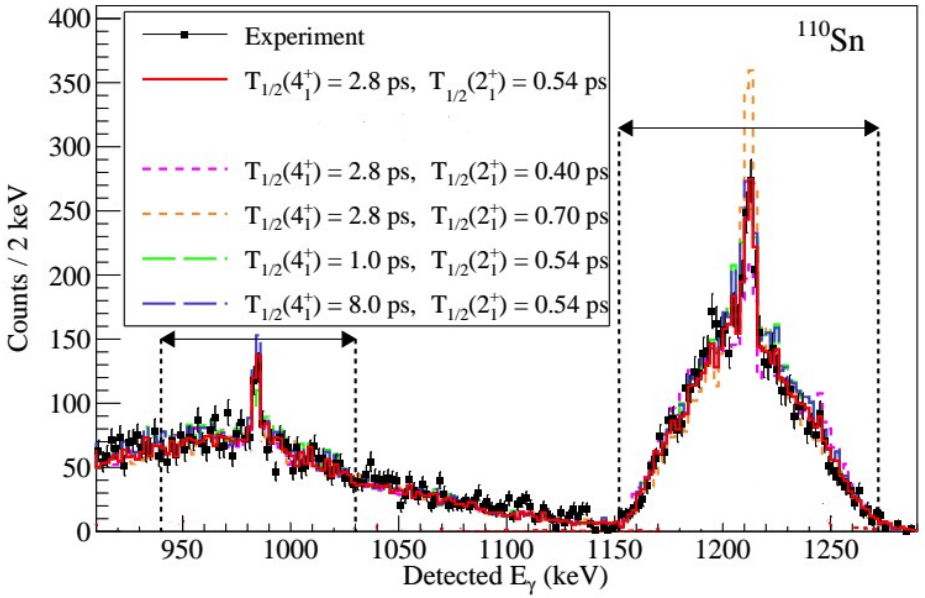
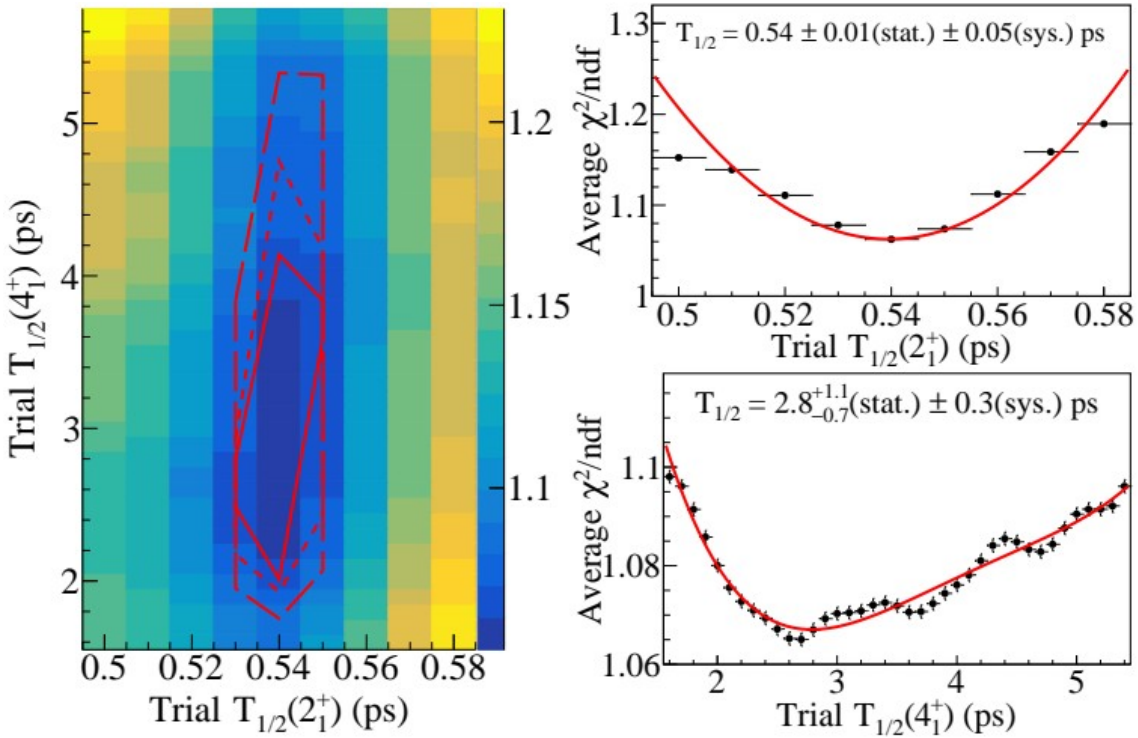
Lifetime study with DSAM

- DSAM lifetime study
  - Geant4 simulation
  - χ^2 scan





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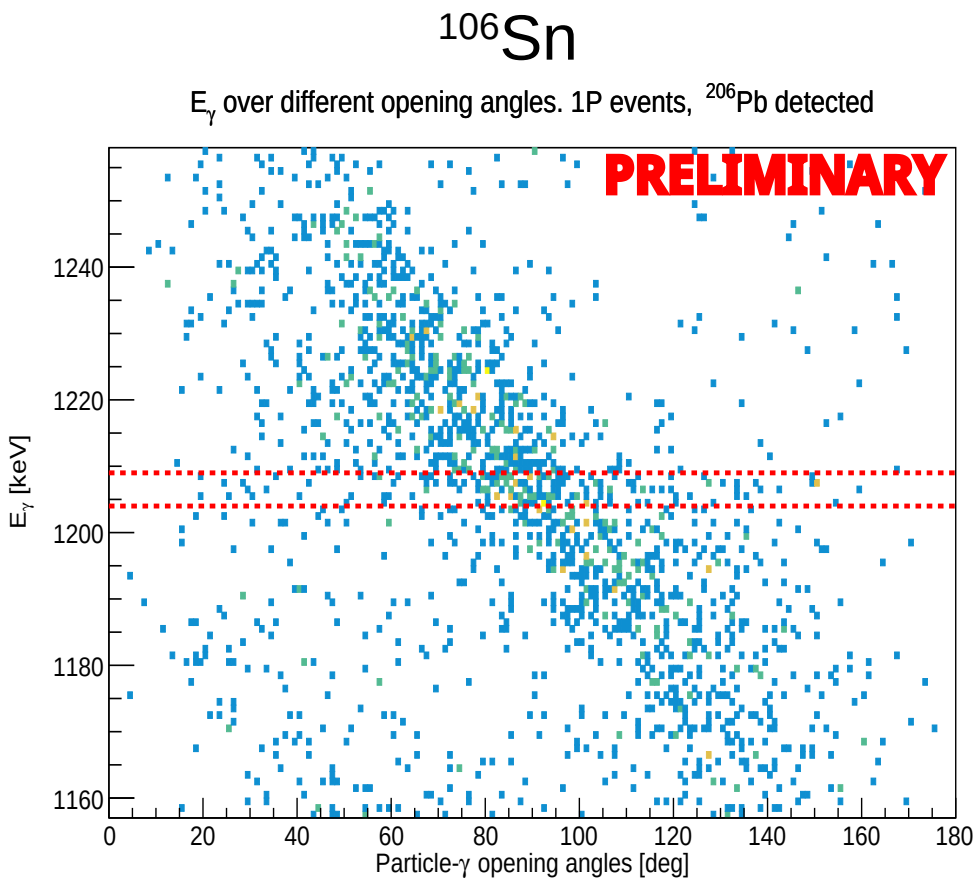
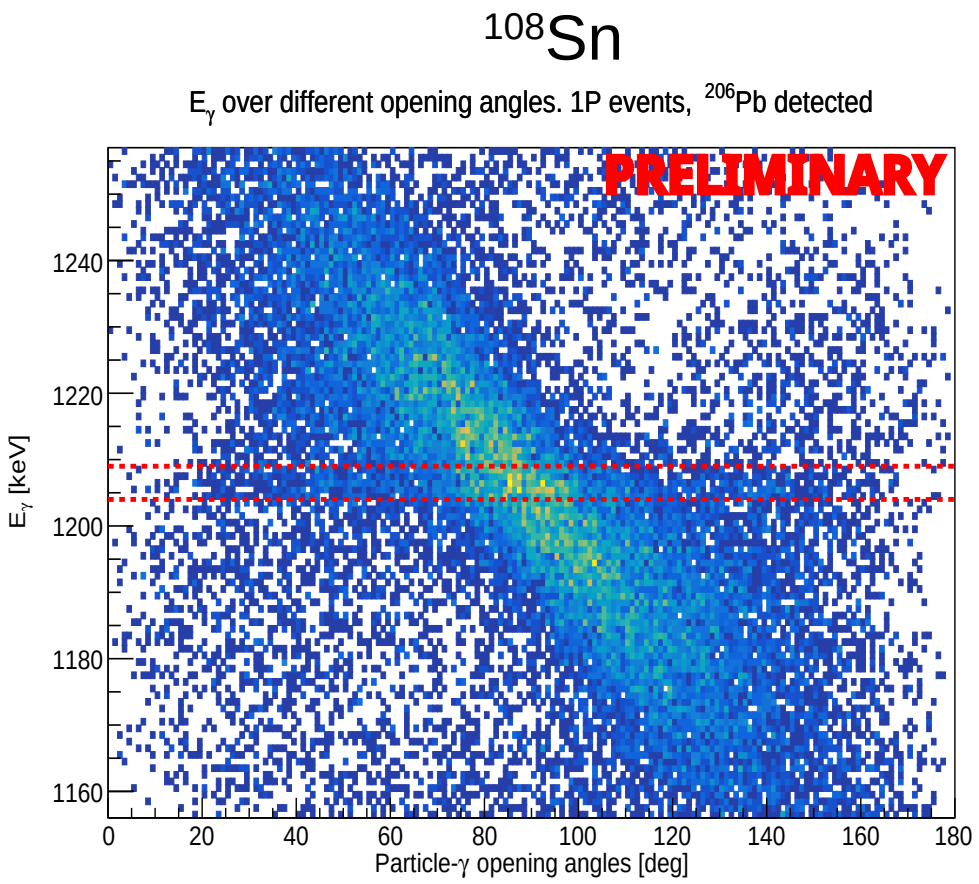
Lifetime study with DSAM





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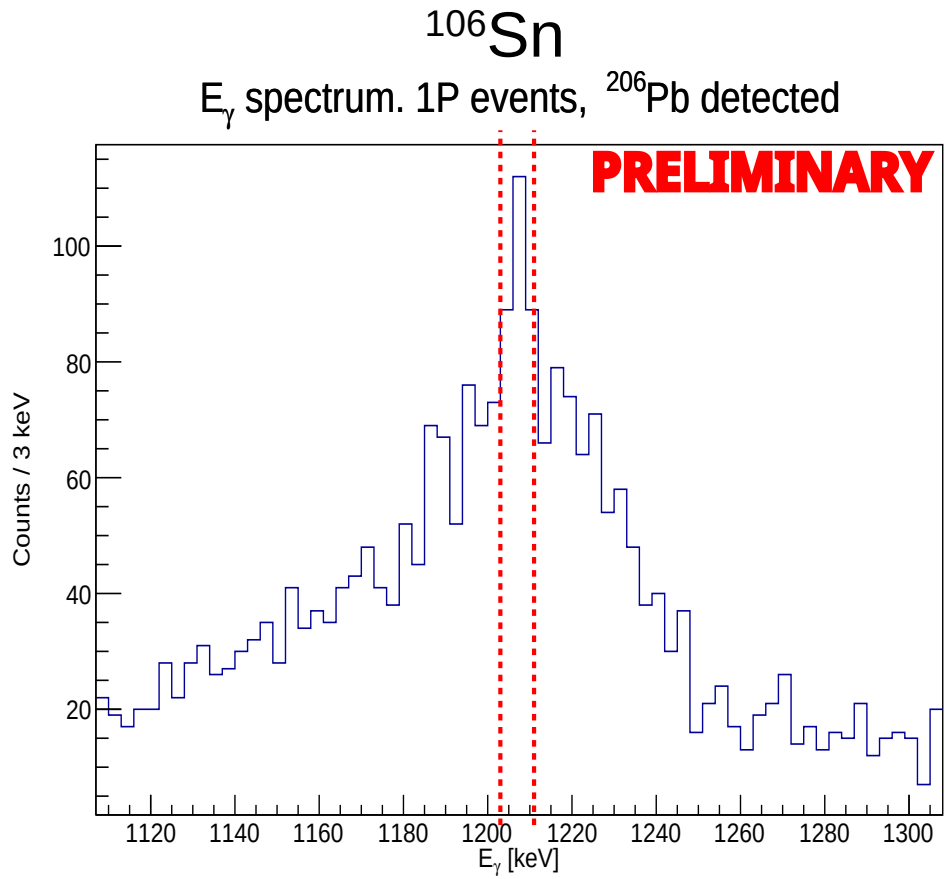
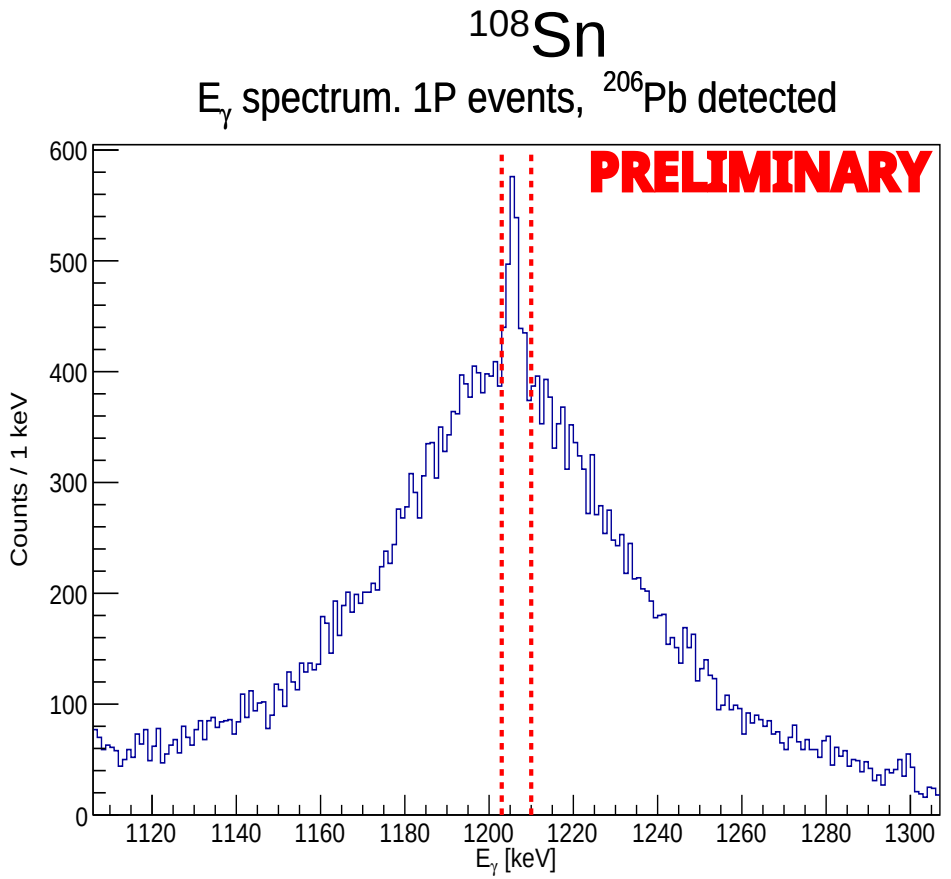
Lifetime study with DSAM





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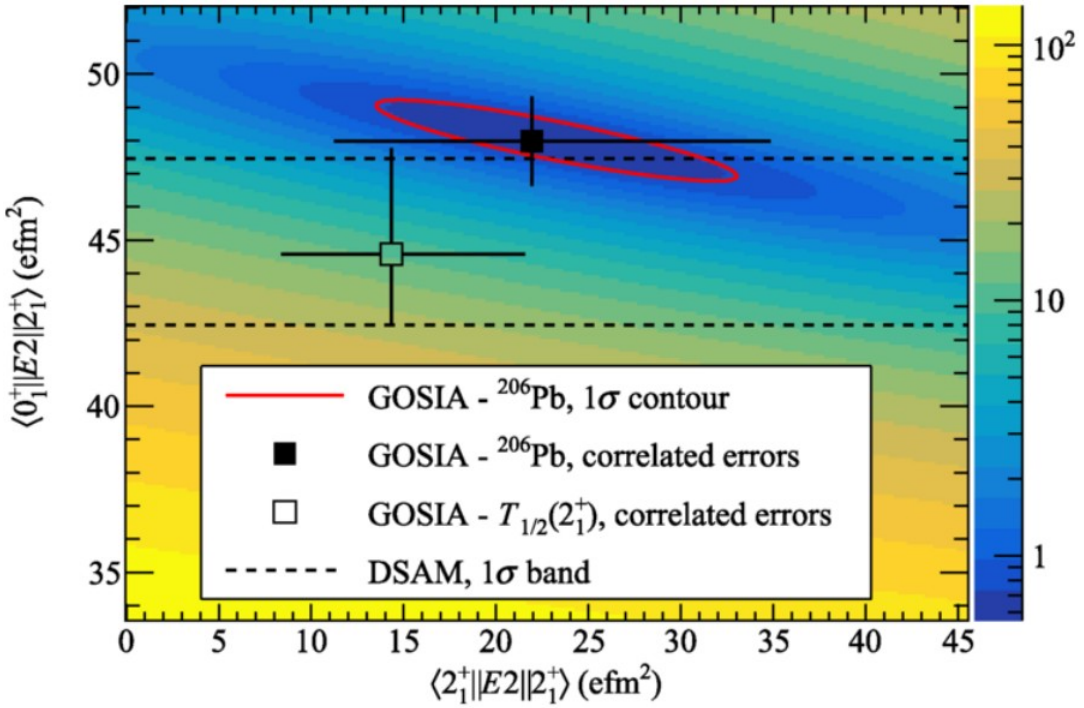
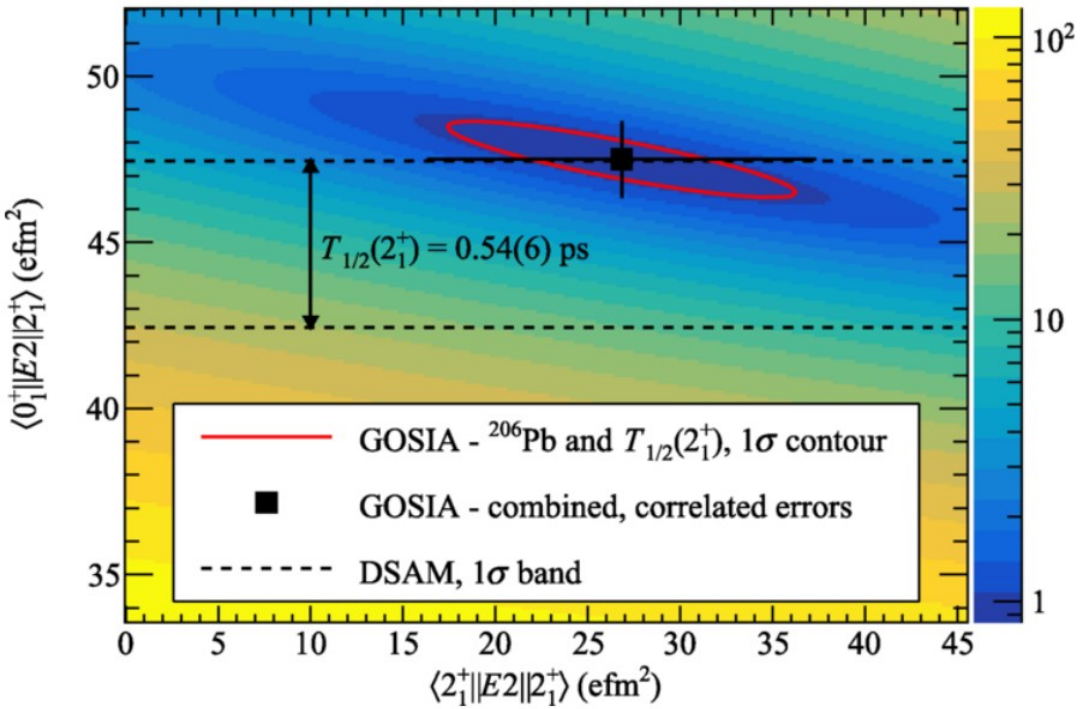
Results: ^{110}Sn

Contour w/o DSAM-lifetime



Contour with DSAM-lifetime



Published: J. Park, **R. A. Lopez**, J. Cederkäll et. al., Phys. Rev. Lett. 135, 222502 (2025)

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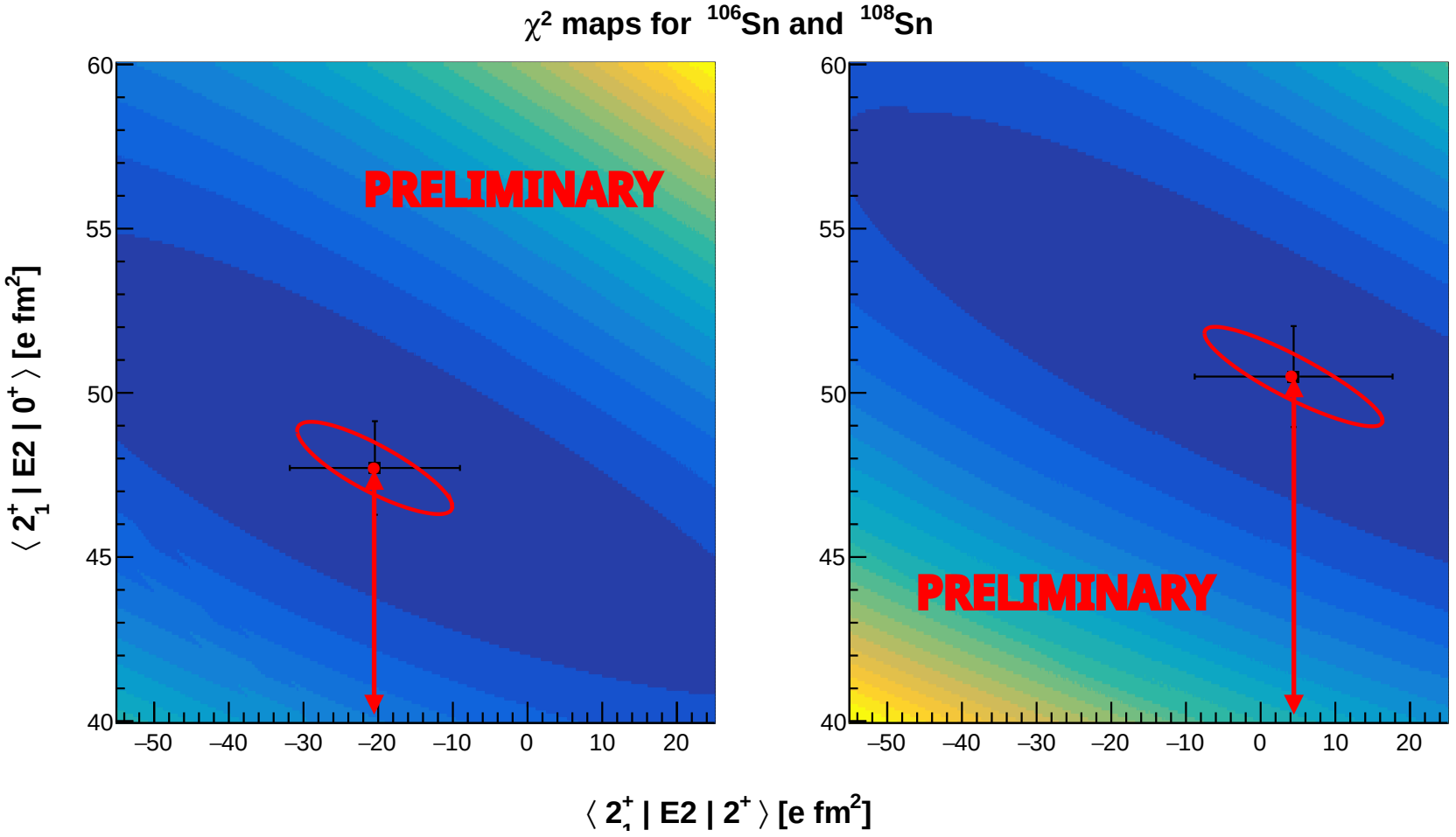
Results: ^{106}Sn and ^{108}Sn



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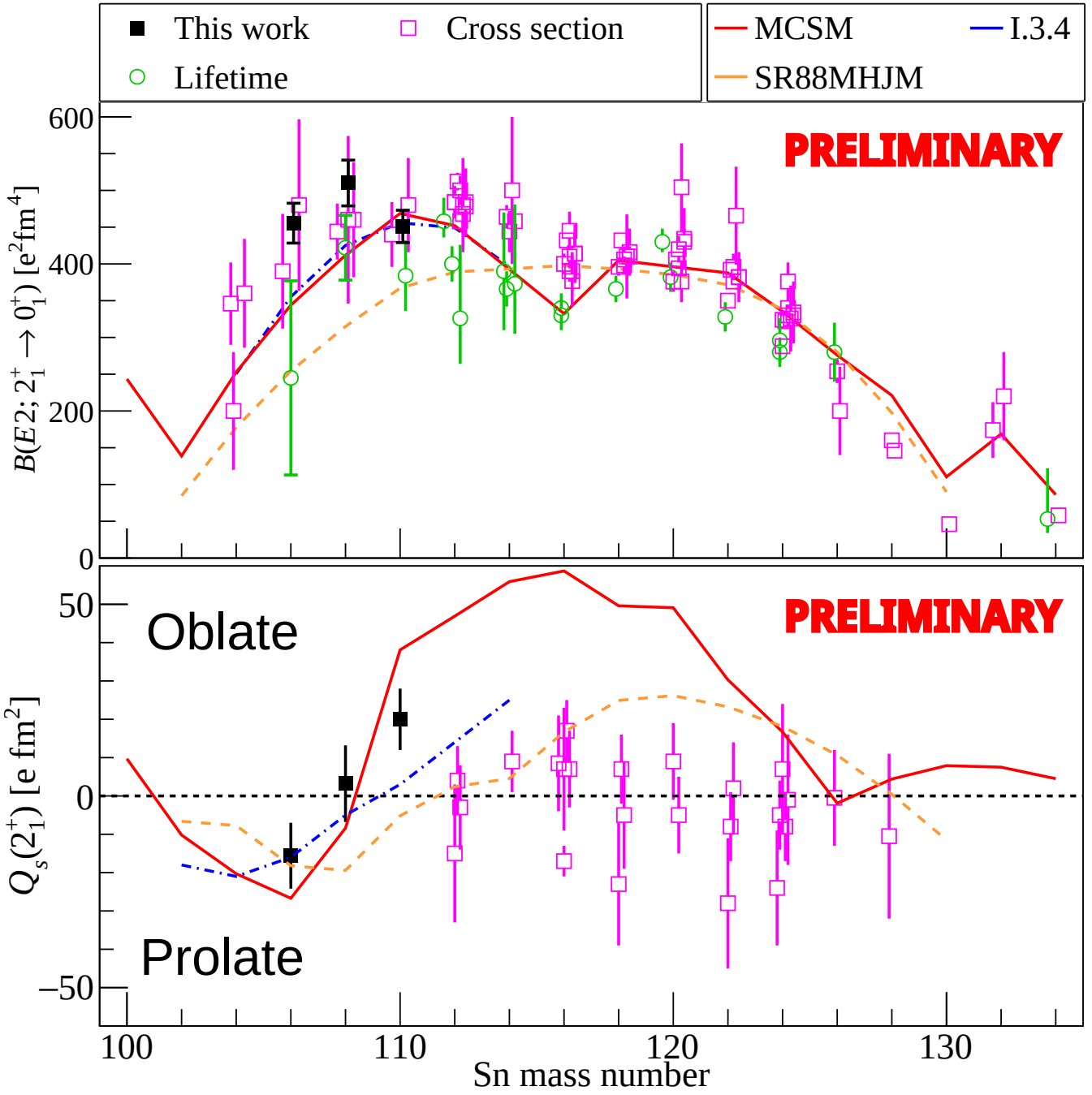
Results

- Higher precision B(E2)
- Clear trend in $Q_S(E2)$



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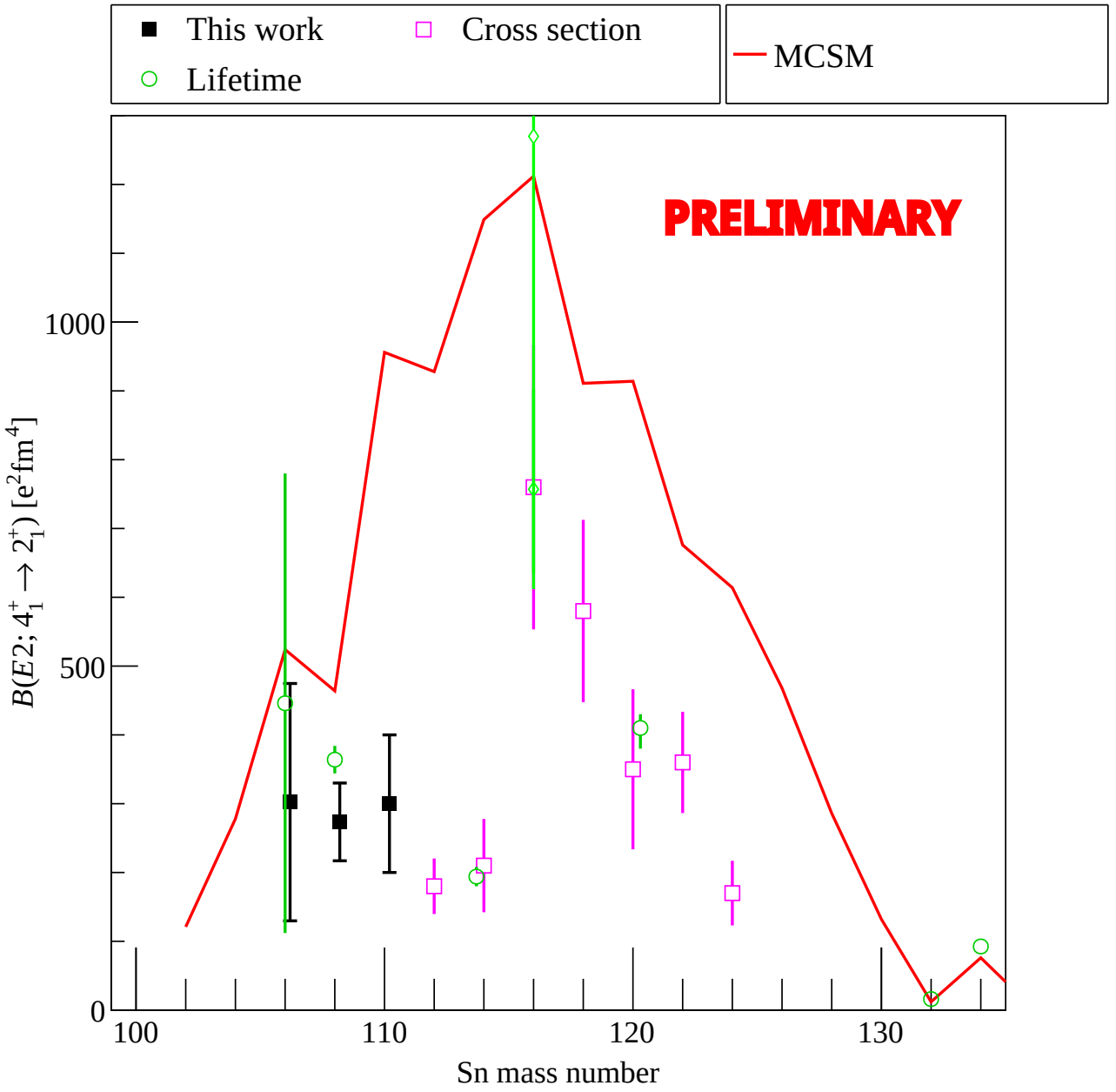
Results

- B(E2; $4^+ \rightarrow 2^+$)
  - Next step!



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Summary

IS562 Collaborators:

J. Park,
J. Cederkall,
C. Fahlander,
P. Golubev,
K. Wrzosek-Lipska,
J. Iwanicki,
Miniball collaboration,
et. al.

- Coulomb Excitation Reactions with $^{106, 108, 110}$Sn
- Measured $Q_s(E2; 2^+)$ for first time
- Extracted B(E2) with higher precision
- Provided independent $T_{1/2}$ estimation
  - $^{106, 108}$Sn remaining

Isotope	Observable	N[^{206}Pb]	DSAM $T_{1/2}$	Combined	MCSM
^{110}Sn	$B(E2; 2^+ \rightarrow 0^+)$ [e^{2}fm^4]	460(26)	400^{+50}_{-40}	451(22)	469
	$Q(2_1^+)$ [efm]	17^{+10}_{-8}	–	20(8)	38
^{108}Sn	$B(E2; 2^+ \rightarrow 0^+)$ [e^{2}fm^4]	510(31)	TBD	TBD	412
	$Q(2_1^+)$ [efm]	3 (10)	–	TBD	-8.4
^{106}Sn	$B(E2; 2^+ \rightarrow 0^+)$ [e^{2}fm^4]	302(14)	TBD	TBD	344
	$Q(2_1^+)$ [efm]	-16 (9)	–	TBD	-26.7

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