1p*x*n removal cross sections of light exotic nuclei and the role of final state interactions in projectile fragmentation

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(R^3B collaboration)

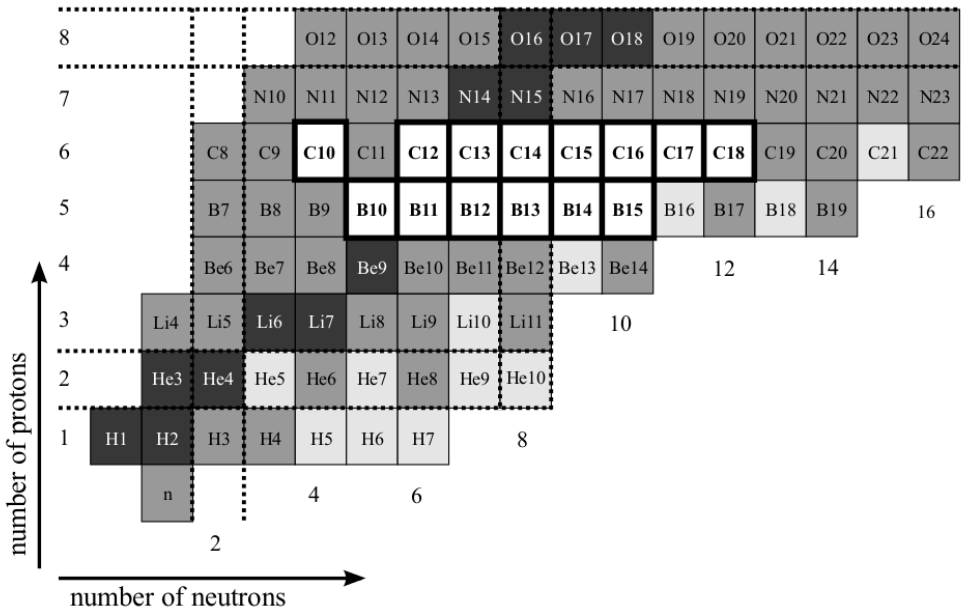
Chalmers University of Technology

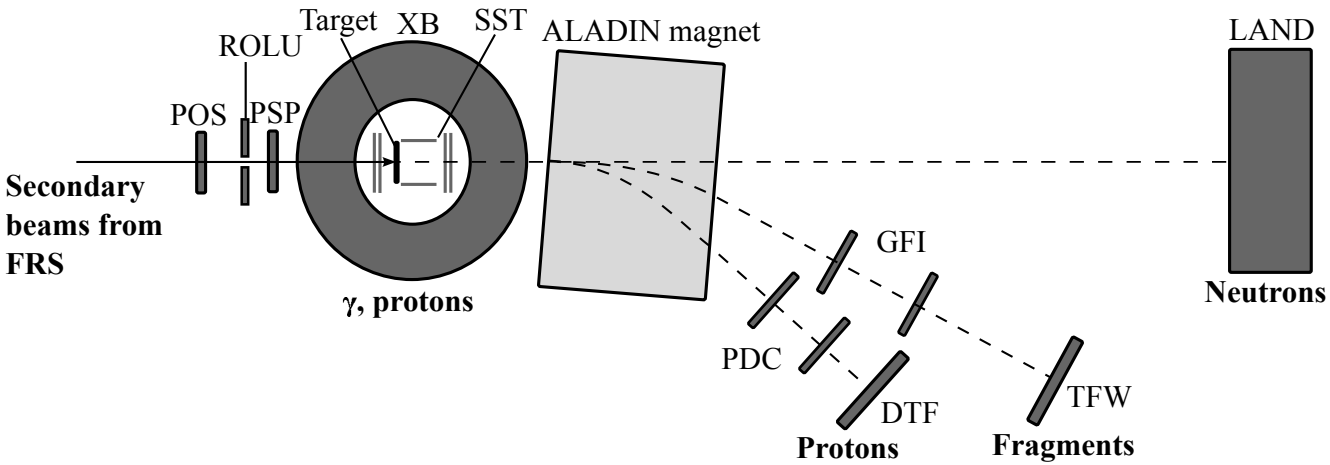
Direct Reactions with Exotic Beams
July 14th 2016

CHALMERS

Experiment

- 490 MeV/nucleon primary beam
- several centered A/Z: 1.66 – 3
- use B and C isotopes
- reaction target: C
- event-by-event data





Other talks:
O. Tengblad
L. Atar
J. Kahlbow

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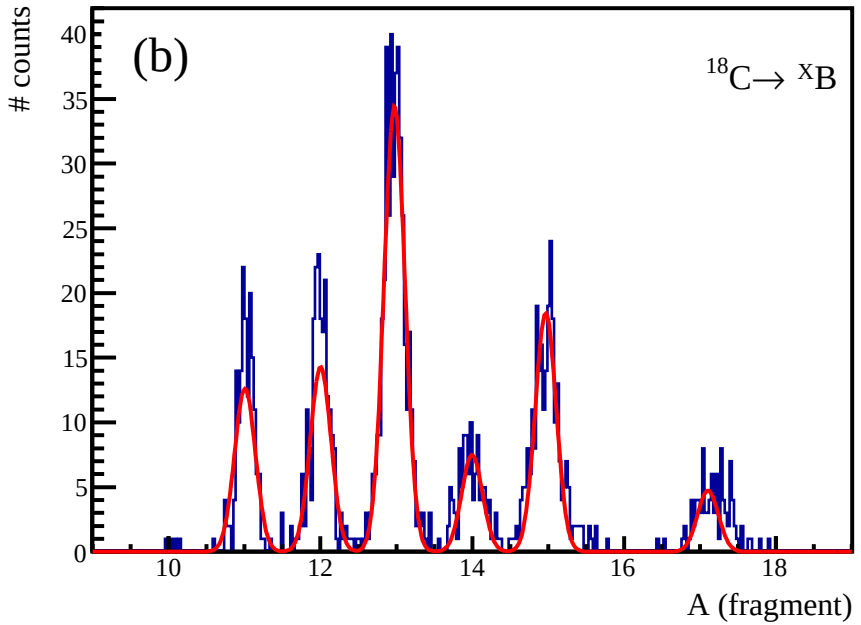

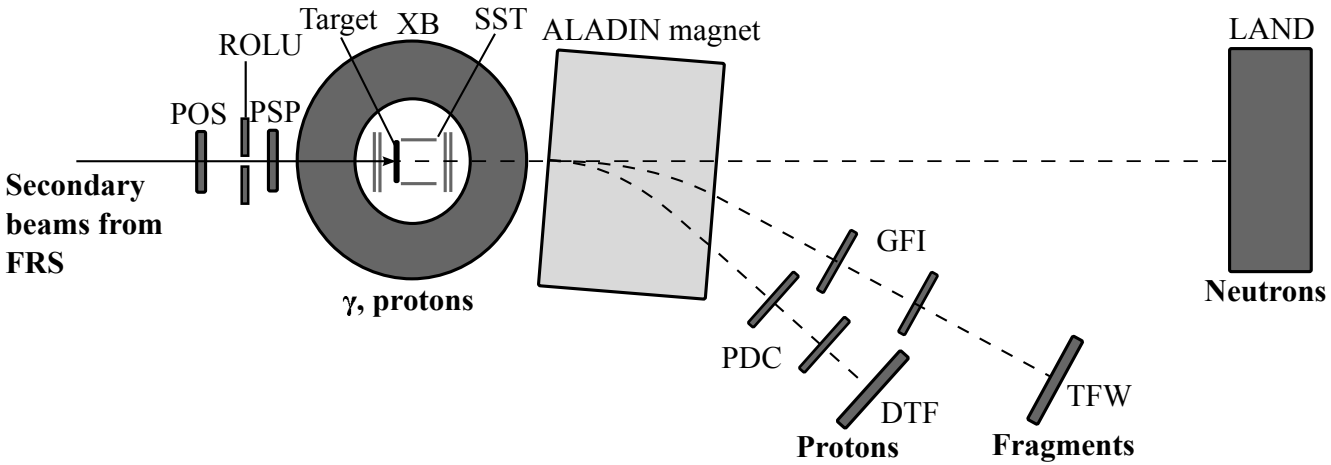

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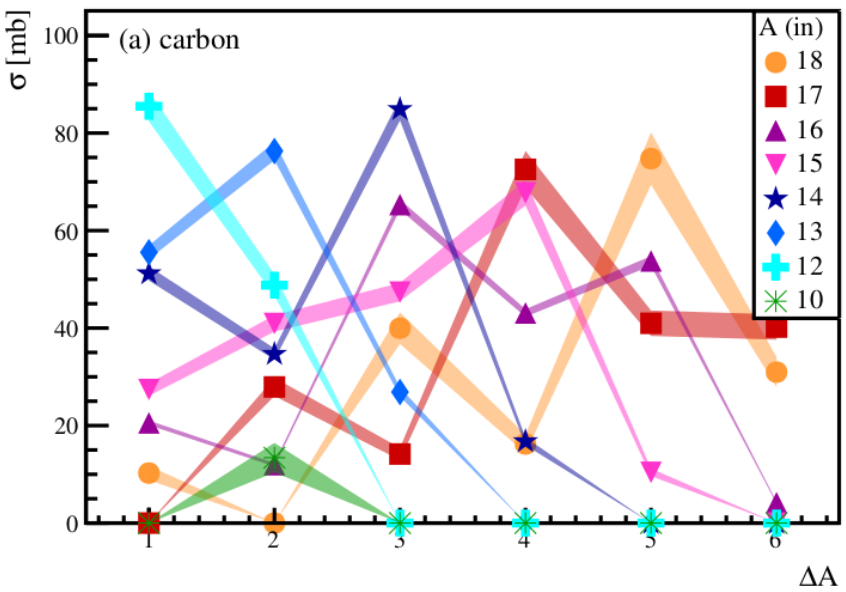
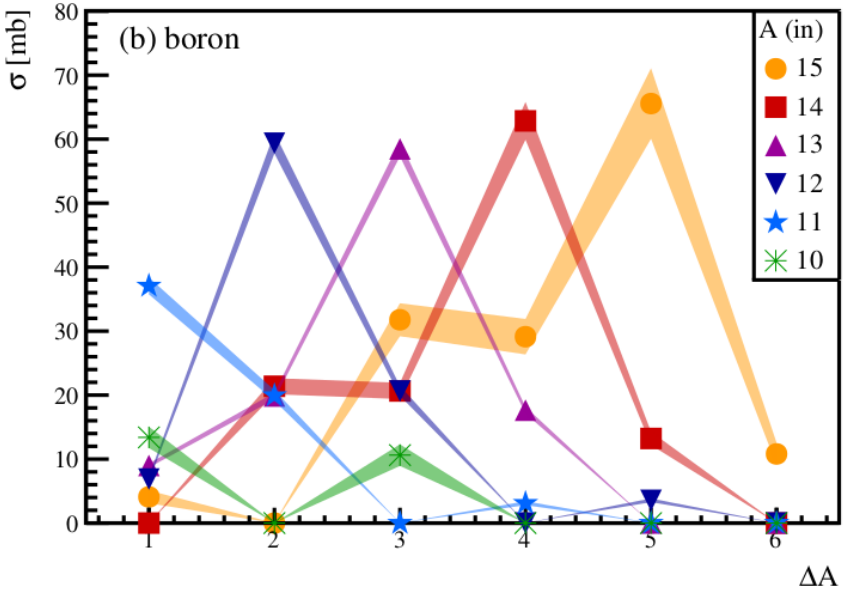
Cross Sections





- boron: highest cross section to ^{10}Be
- carbon: heavier than 15 goes to ^{13}B
- carbon: lighter than 16 goes to ^{11}B

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Model Calculations

EPAX3: parametrization, used for rate prediction at RIB facilities
ABRABLA07: abrasion-ablation model, designed for heavier nuclei

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Abrasion part of ABRABLA07:

- total interaction cross section
- amount of removed nucleons
- how many n/p removed
- induced excitation energy calculated
  - average excitation energy per abraded nucleon multiplied by number of abraded nuclei
  - multiply by a factor (f_{EE}) of 2
    Motivated by final state interactions.

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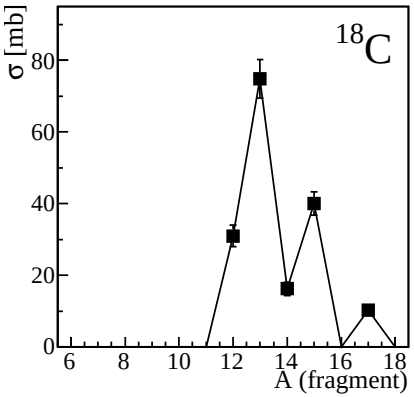
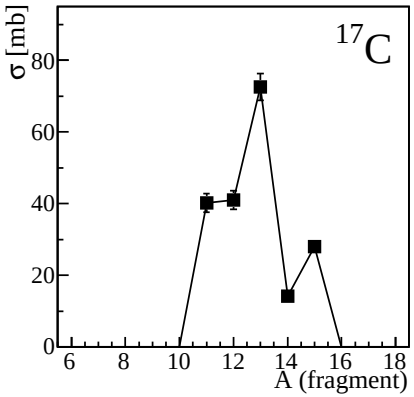
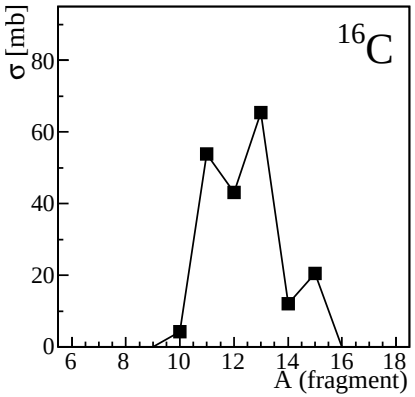
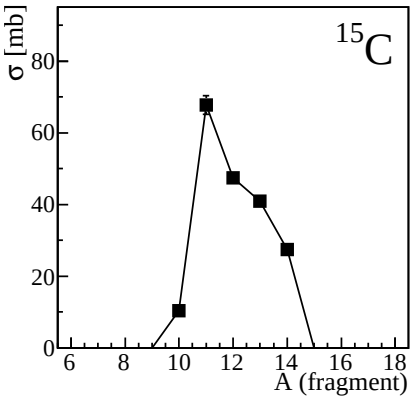
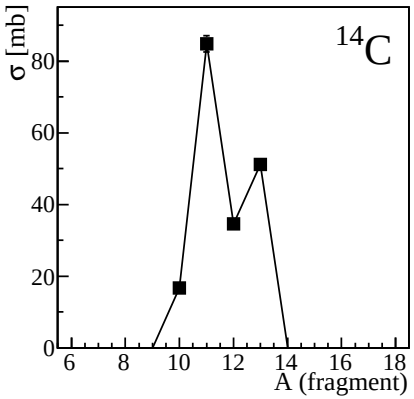
Benchmarking

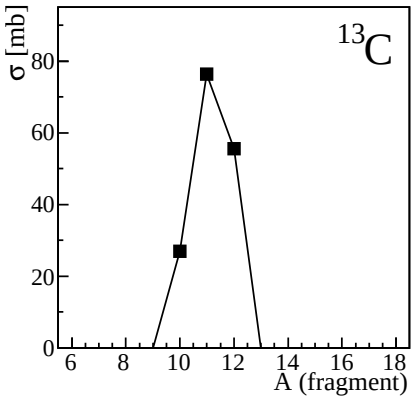


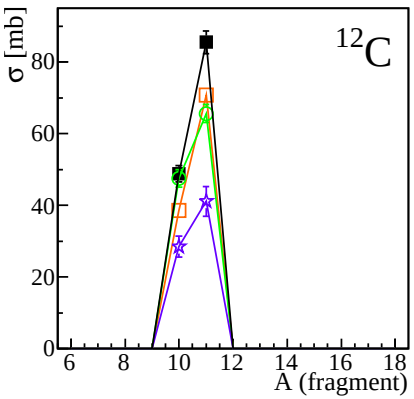


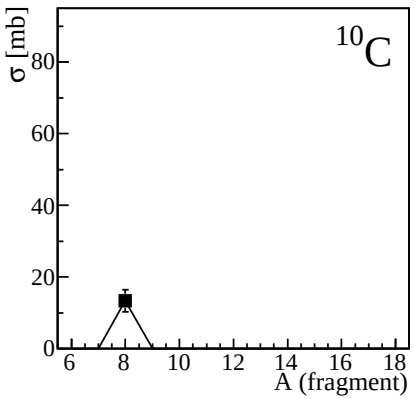












Data

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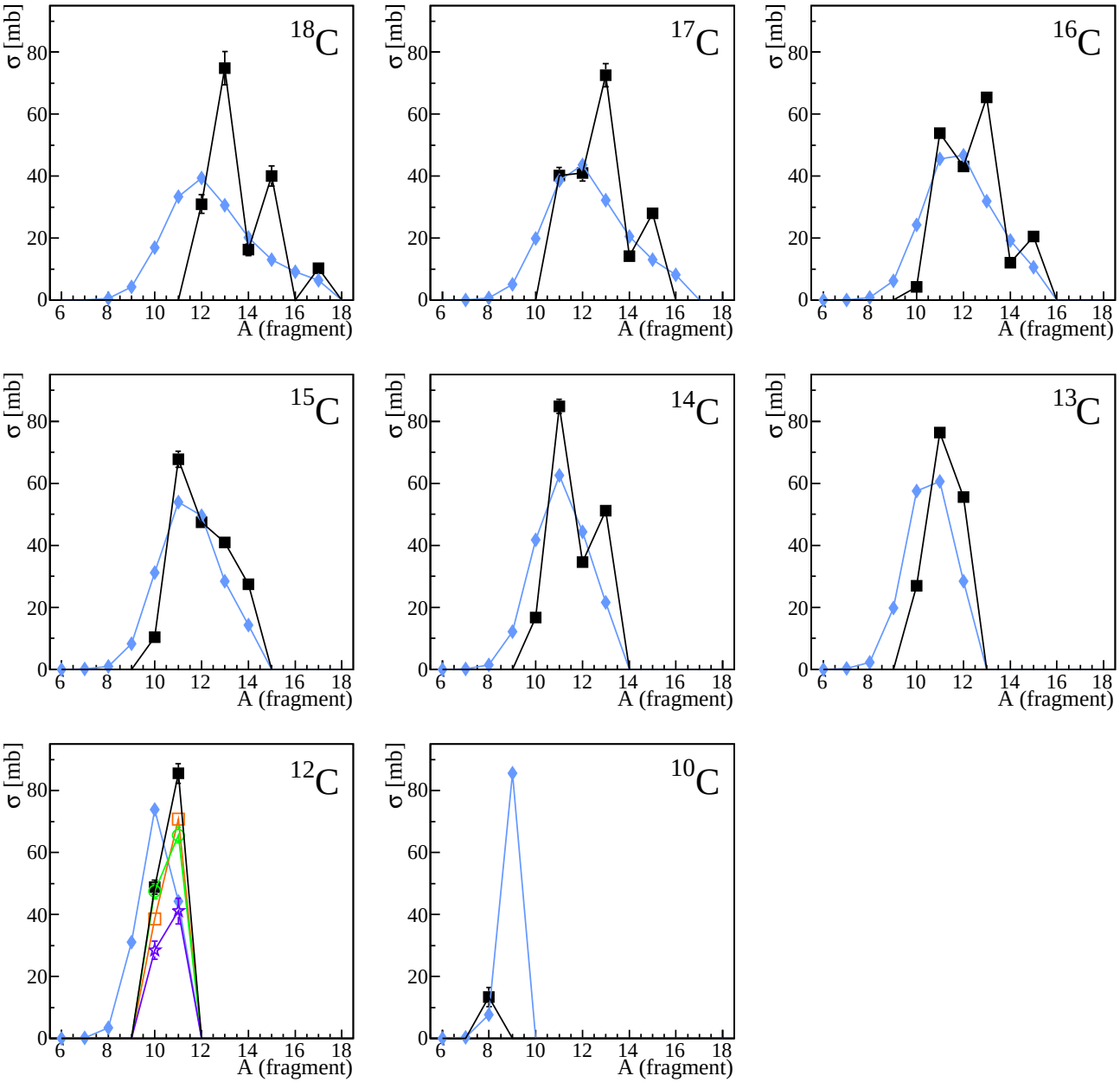
Benchmarking



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EPAX3

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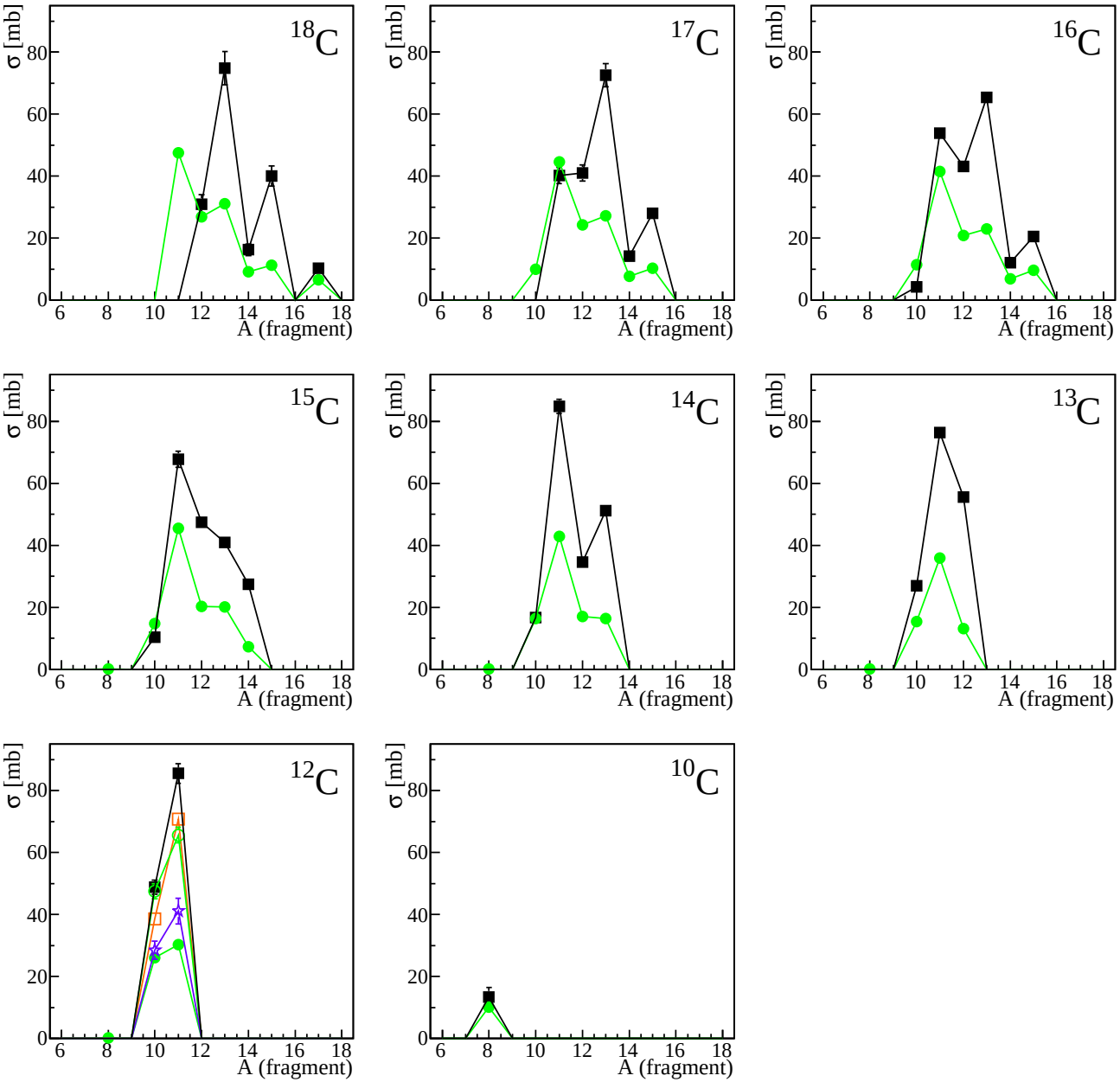

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ABRABLA07 original

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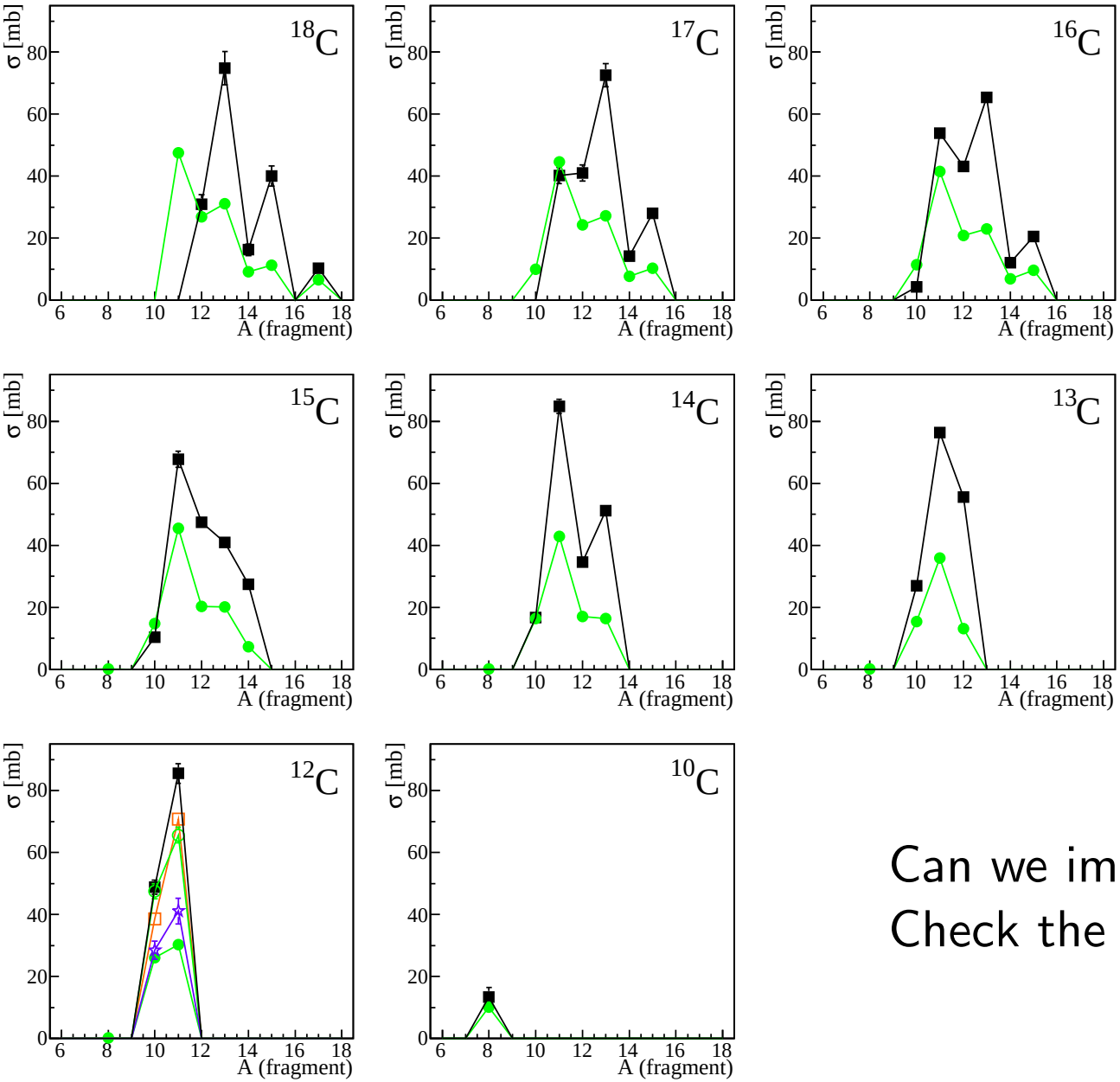

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ABRABLA07 original

Can we improve ABRABLA07?
Check the f_{EE}!

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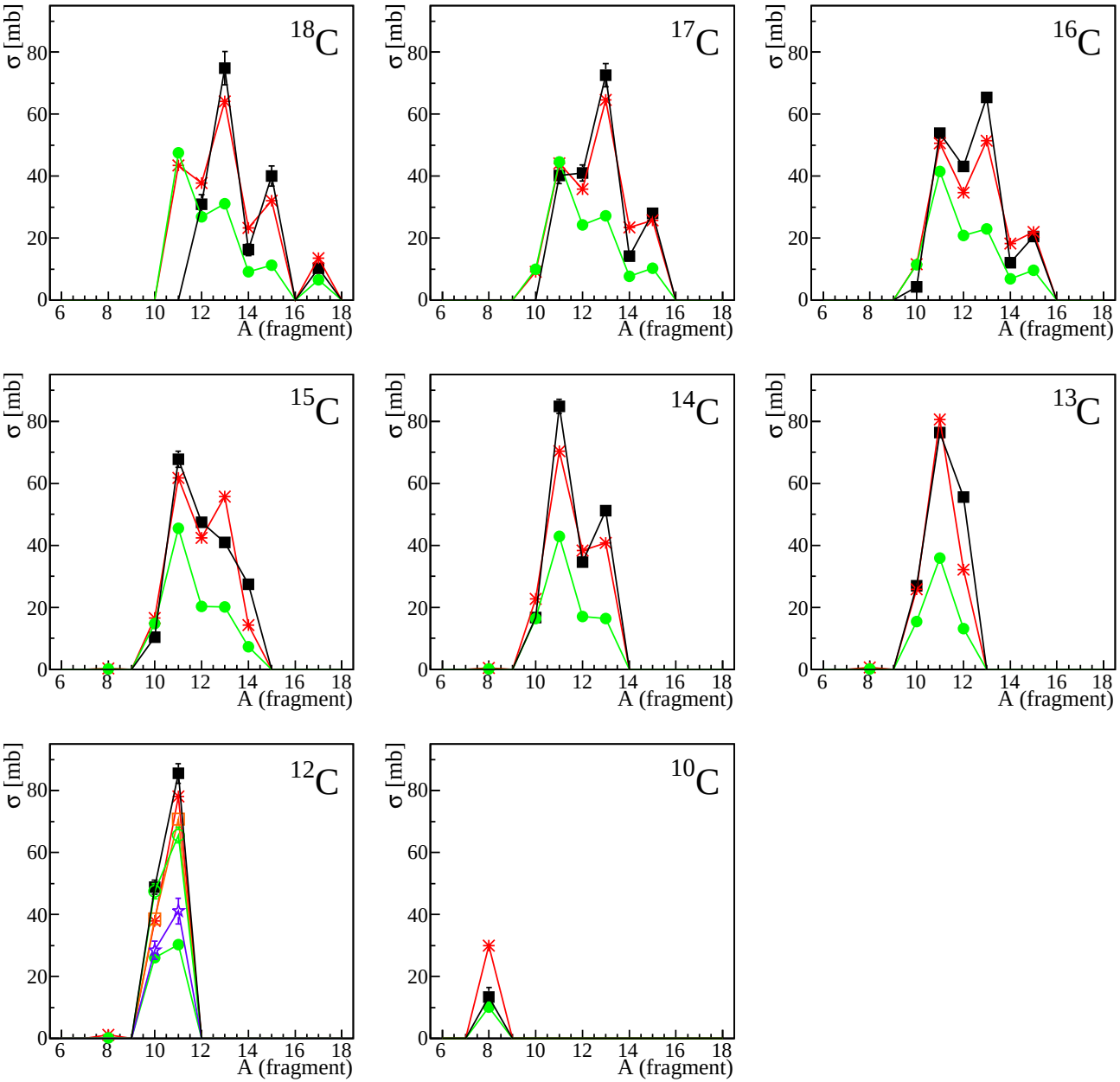

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ABRABLA07 original

ABRABLA07 with $f_{EE} = 0.6$ (best fit)

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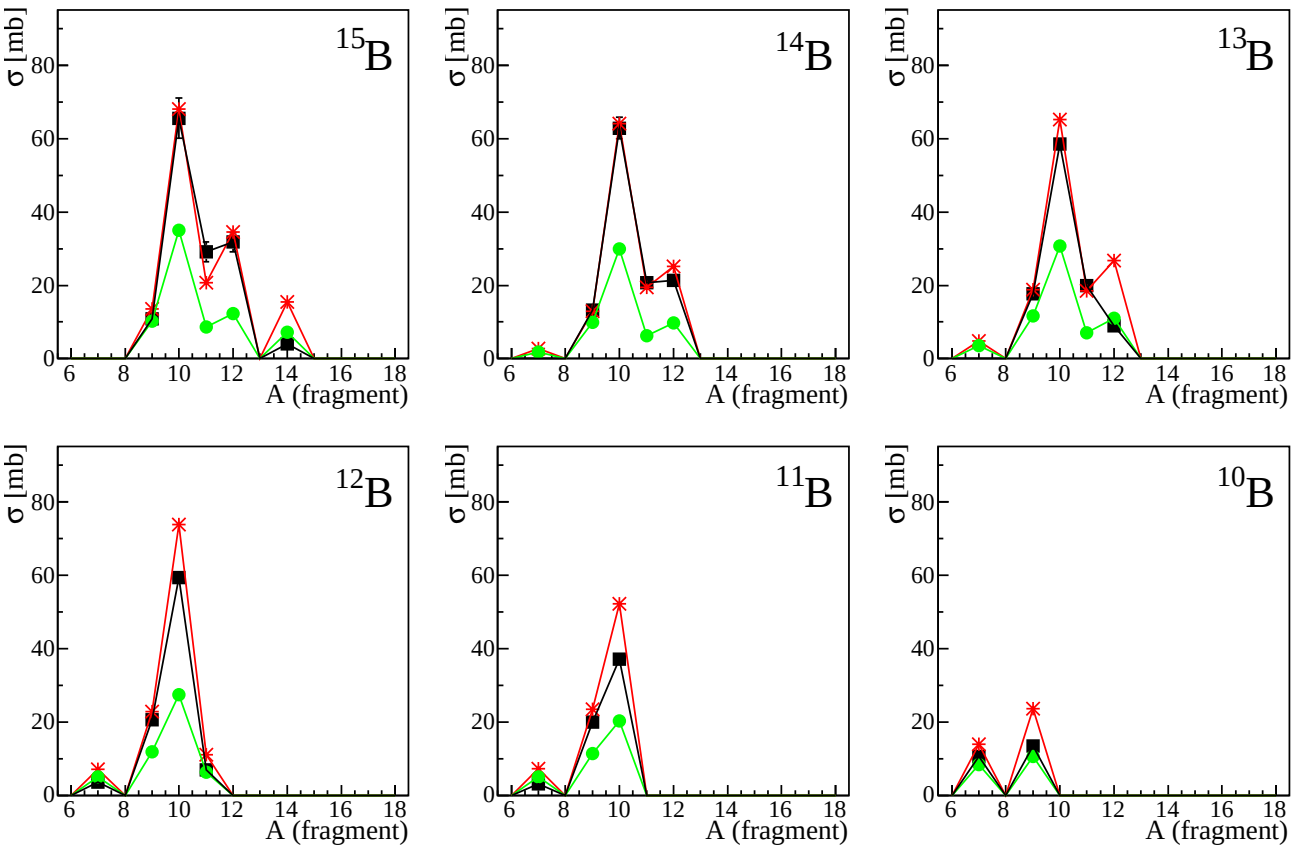

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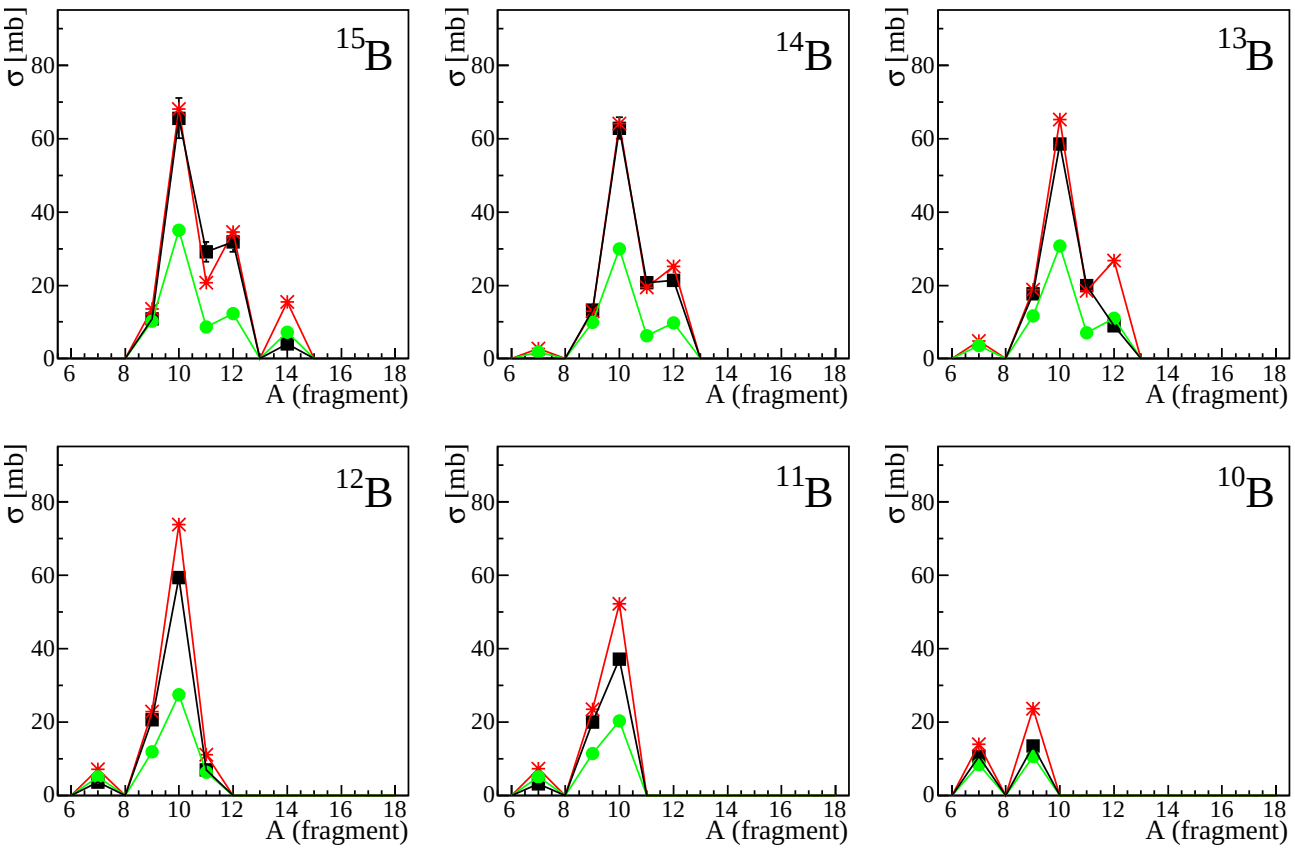

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Why is the best f_{EE} so low (original $f_{EE} = 2$)? On what does it depend?

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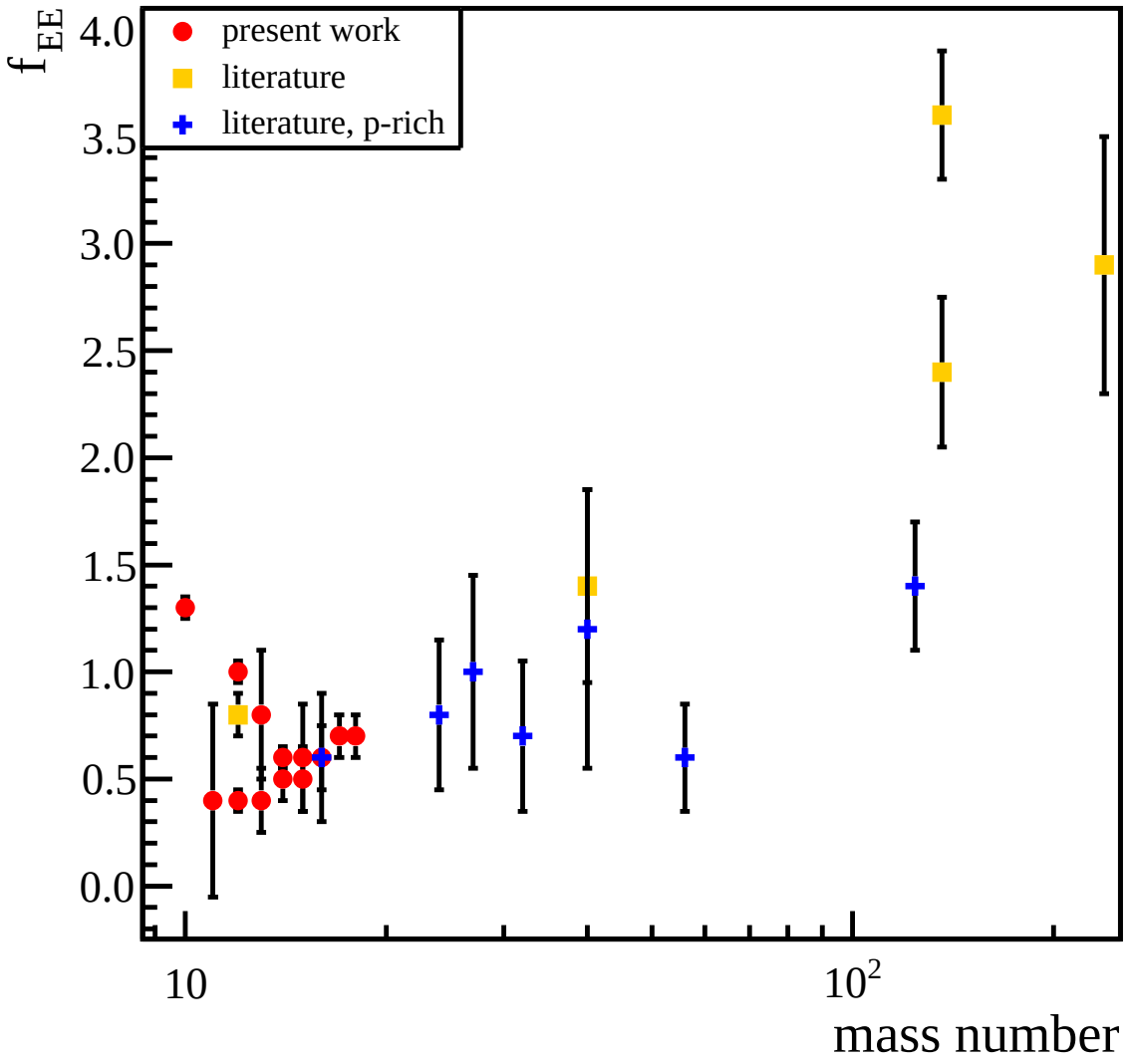
Systematics



Literature:

- D. Pérez-Loureiro *et al.*, Phys. Lett. B703, 552 (2011)
- W. R. Webber *et al.*, Phys. Rev. C 40, 547 (1990)
- T. Kurtukian-Nieto *et al.*, Phys. Rev. C 89, 024616 (2014)
- A. R. Junghans *et al.*, Nucl. Phys. A629, 635 (1998)
- D. Henzlova *et al.*, Phys. Rev. C 78, 044616 (2008)
- J. Benlliure *et al.*, Phys. Rev. C 78, 054605 (2008)
- B. Fernández-Domínguez *et al.*, Eur. Phys. J. A25, 193 (2005)

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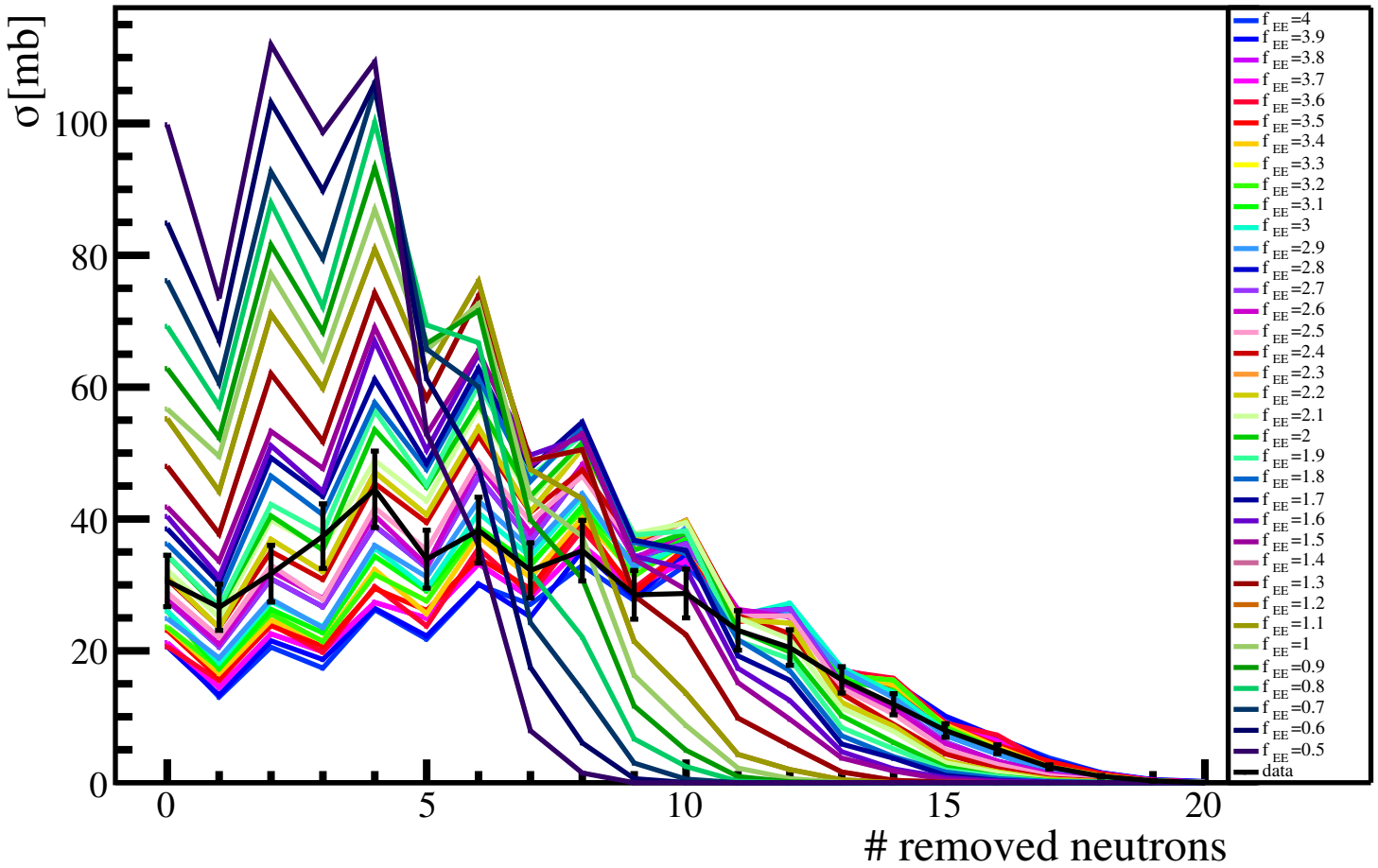
Other dependencies?



^{136}Xe, data from D. Henzlova *et al.*, Phys. Rev. C 78, 044616 (2008)

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Summary

- Measured 1pxn removal cross section for B on C isotopes in one experiment
- Comparison to model calculations
  - EPAX3 not successful (expected)
  - ABRABLA07 original: not satisfactory
  - Excitation energy modifications successful
- Induced excitation energy in ABRABLA07 needs better description.
- Dependencies: mass, impact parameter, isospin[1]

[1] J. Benlliure, EPJ Web of Conferences 88, 00028 (2015)

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Thank You!

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