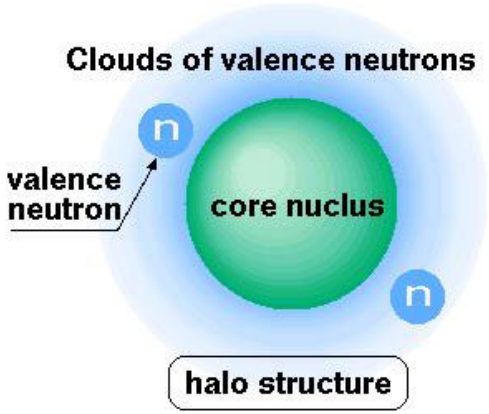
Reaction mechanisms in collisions induced by a ^{8}B beam close to the barrier

Roberta Spartà
Catania - Italy

Motivation: effects of halo structure on reaction dynamics



Halo nuclei:
small binding energy, low break-up thresholds

coupling to break-up states (continuum) important → CDCC

The n-halo case: e.g. ^{11}Li, ^{11}Be, ^{6}He

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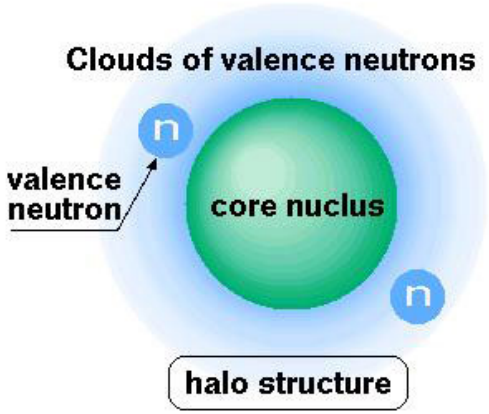

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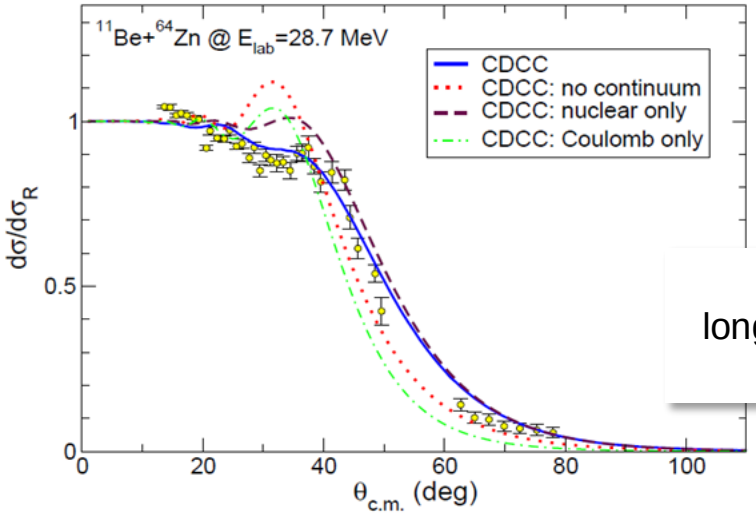
Elastic scattering

^{11}Be+^{64}Zn ISOLDE experiment



At low bombarding energy coupling between relative motion and intrinsic excitations important.

Coulomb and nuclear
long range absorption effects
because of the halo.

A. Di Pietro et al., PRL 105,022701(2010) & PRC 85, 054607 (2012)

The p-halo case: ^{8}B

Weakly bound Sp=0.137 MeV (easy to break-up)

Scarce data in the literature.
Only in-flight beams used so far

(ISOLDE has the only ISOL ^{8}B beam)

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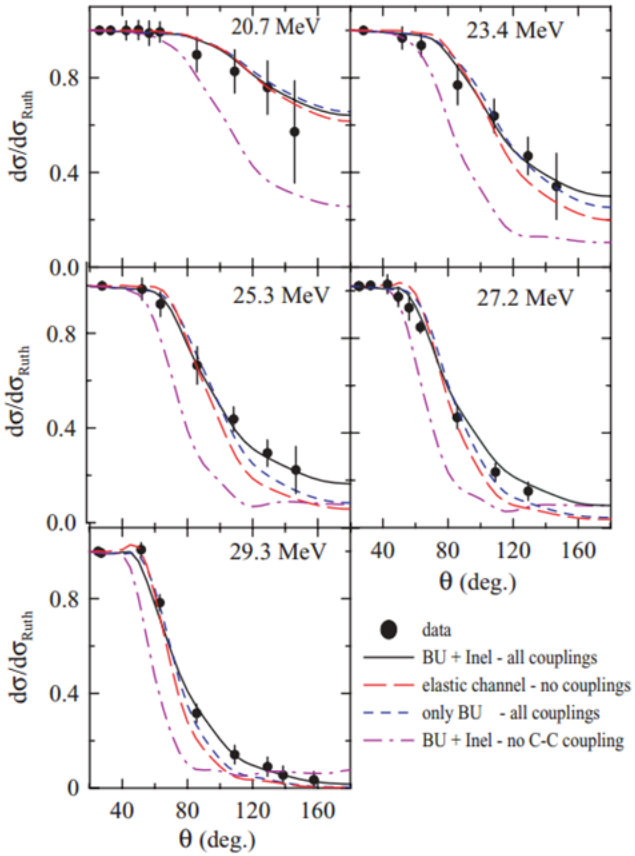
$^{8}B+^{58}Ni$ elastic scattering



J. Lubian et al PRCC 79, 064605 (2009)
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Some details of this experiment:

- In-flight produced ^{8}B beam
- Beam divergence = **6°**
- Large angular detector opening **Δθ=12°**
- No particle discrimination

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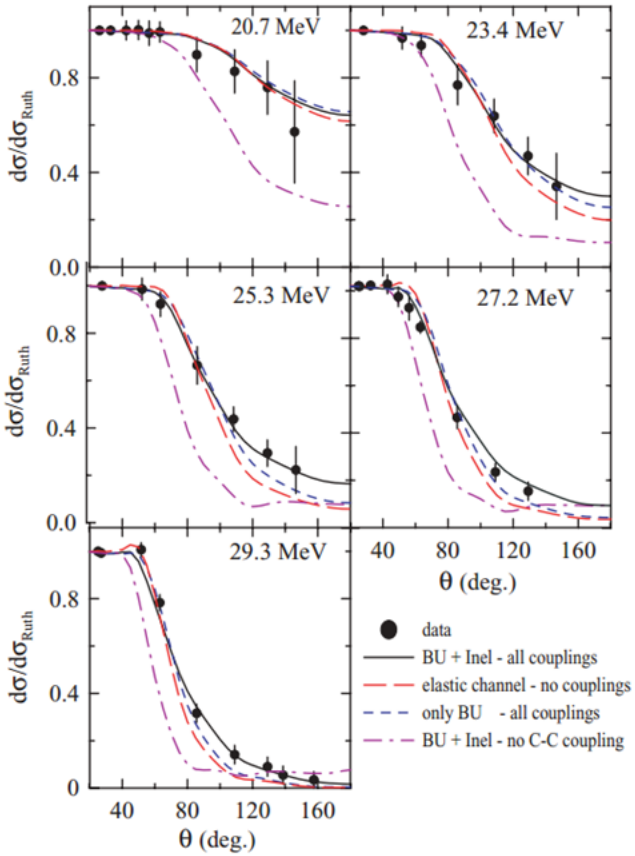

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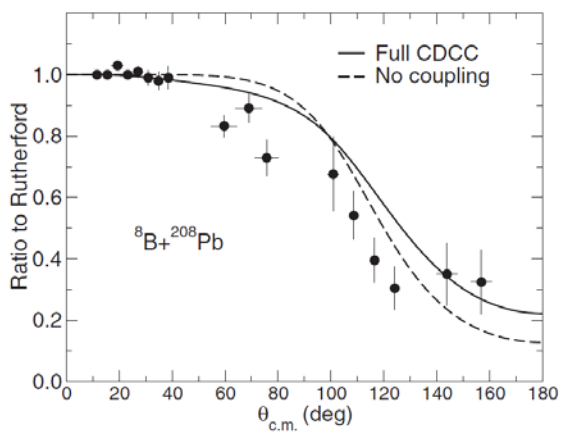
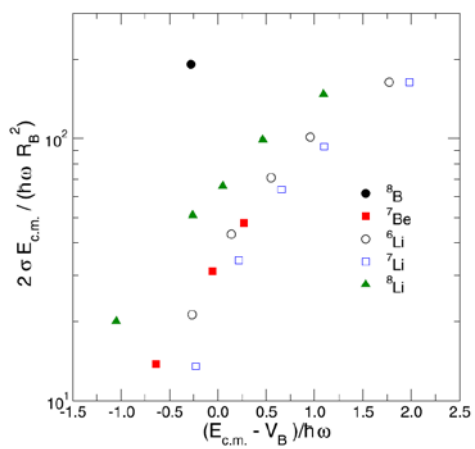
M. Mazzocco et al. PRC 100 024602 (2019)
Large σ_R with respect to other weakly bound nuclei





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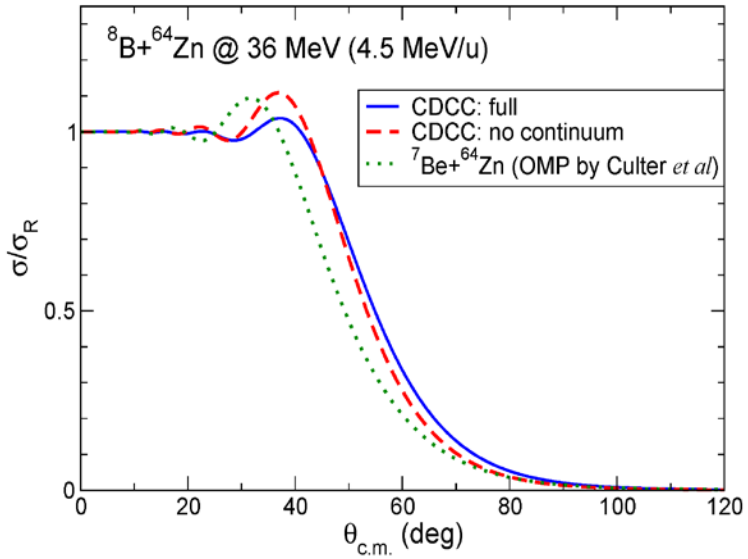
CDCC calculations foresee small effects on the elastic cross-section.



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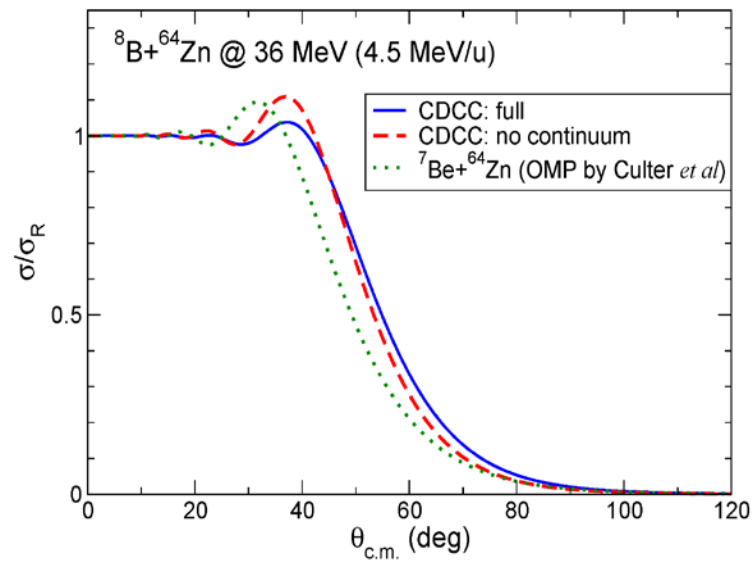

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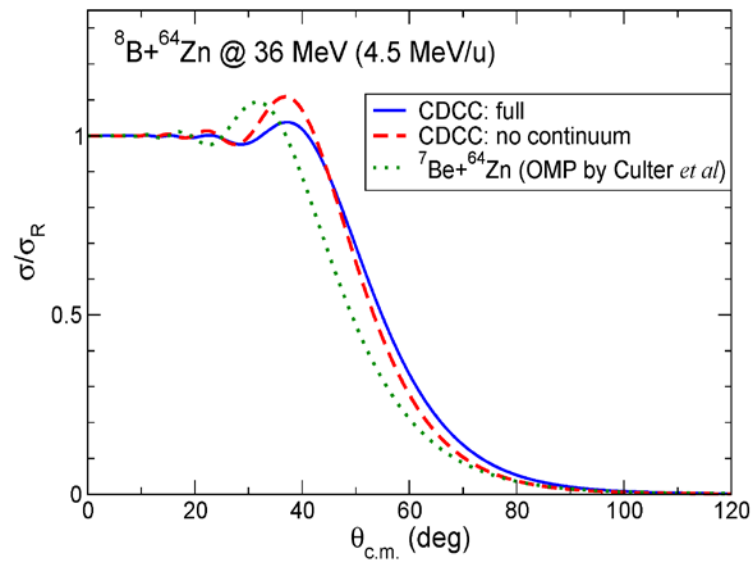

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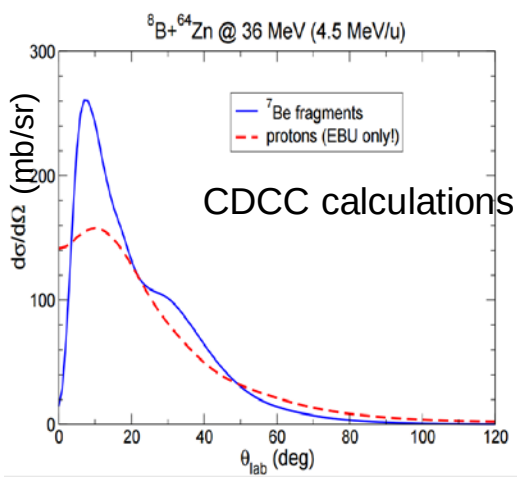

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→ disentangle elastic - non elastic break-up (transfer, incomplete fusion….)

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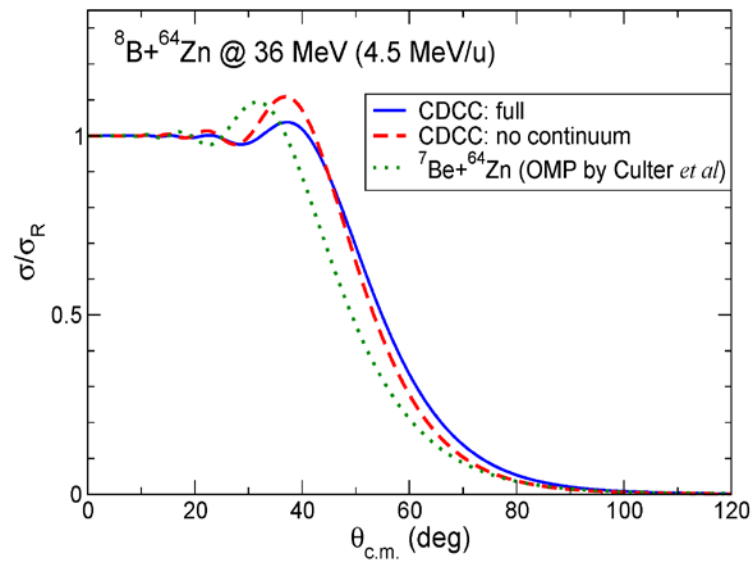

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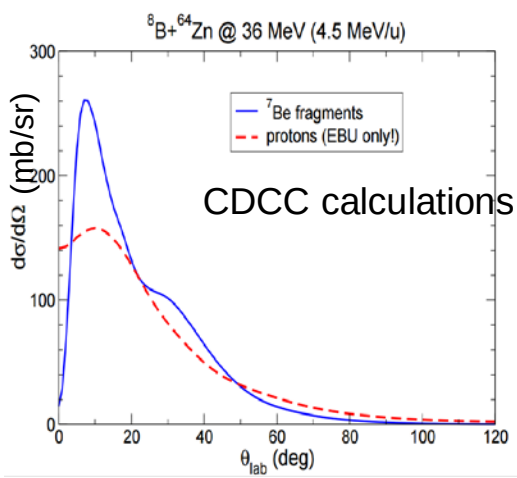

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Improvements:

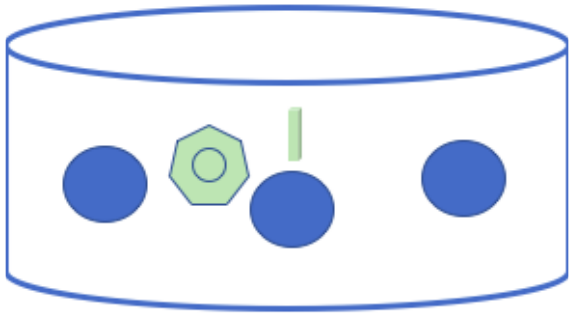
- ^{8}B post-accelerated ISOL beam
- Large solid angle + high granularity → good angular resolution
- Coincidence measurement

Beam diagnostics

SEC

(inside)

F-cup @ target position



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  - Current measure
  - 2 pepper-pots
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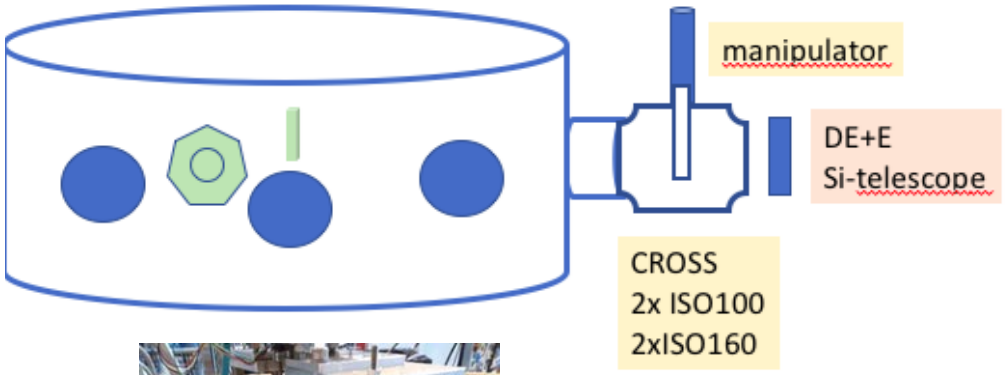

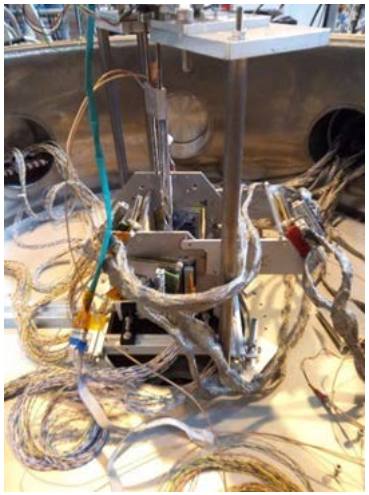

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  - Different collimators 12, 10, 8 mm

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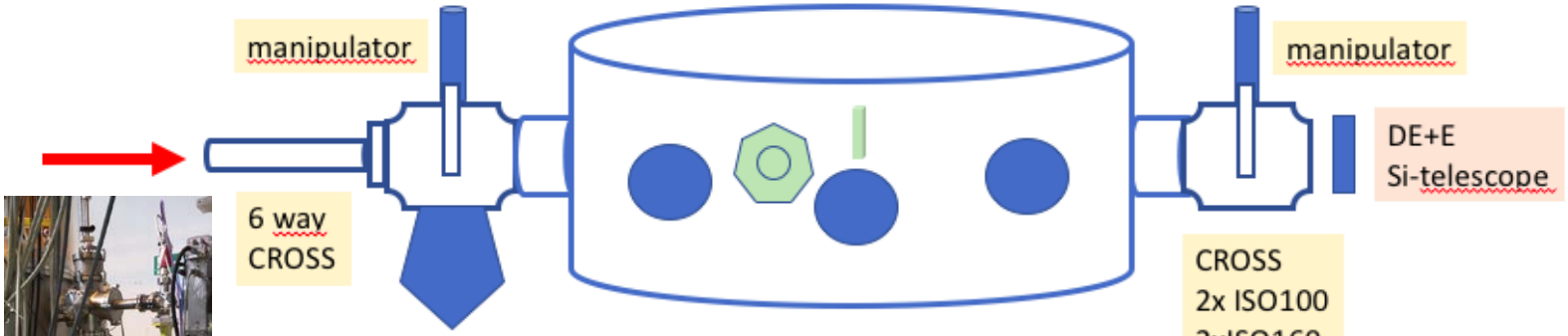

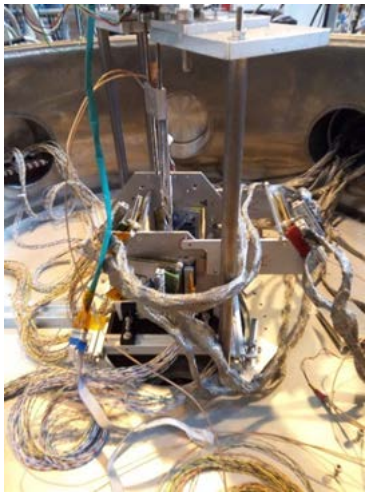

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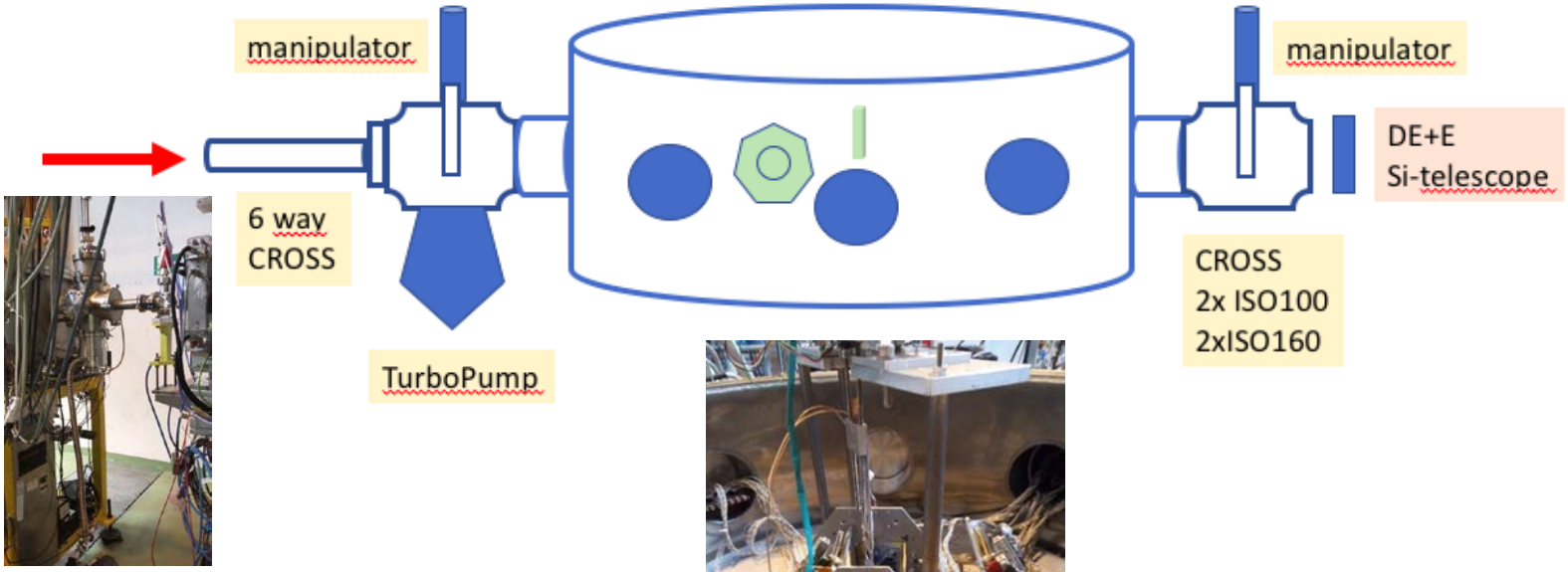

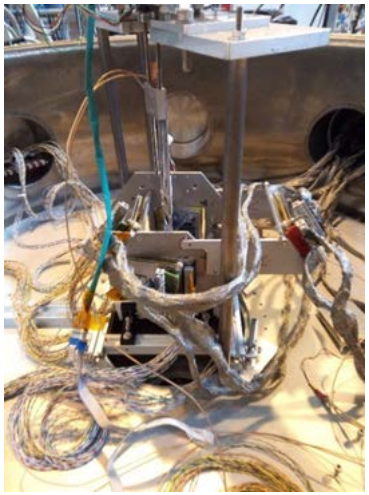

^{12}C beam

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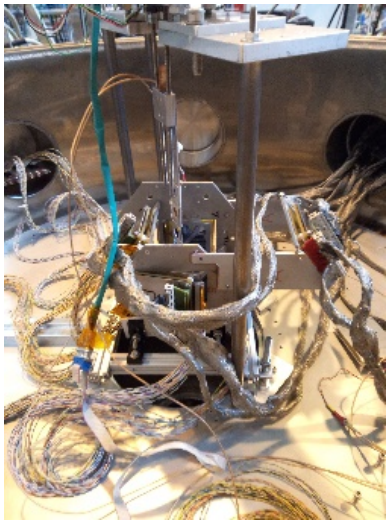
Gloria

Telescope A moved at smaller angles (5.5°<θ<23°) using an extension



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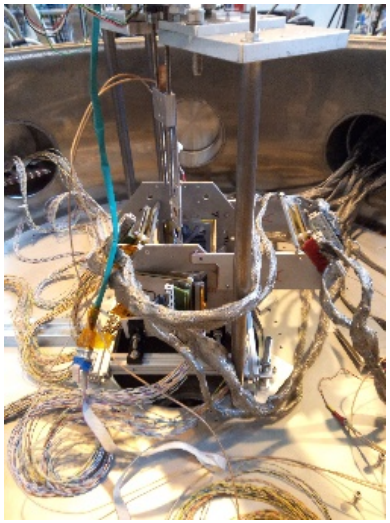

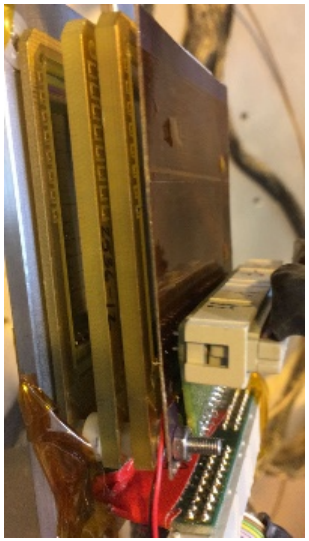

Detection system:

- 2 ΔE1-ΔE2-Epad telescope θ<60°
- 4 ΔE1-E Si telescopes at θ>60°

with:

ΔE1: 40 μm DSSSD detector (16+16 strips)

ΔE2: 1000 μm DSSSD (16+16 strips)

E_{pad}: Si PAD detector 1000 μm

E: 1000 μm DSSSD (16+16 strips)

Geometry determination

detectors geometry definition = main part of the data analysis (precise angle and solid angle evaluation)

long time dedicated to ^{12}C @ 4.9 MeV A on Au (300 µg/cm^2 thick)

geometry optimization has been done with a Montecarlo code considering:

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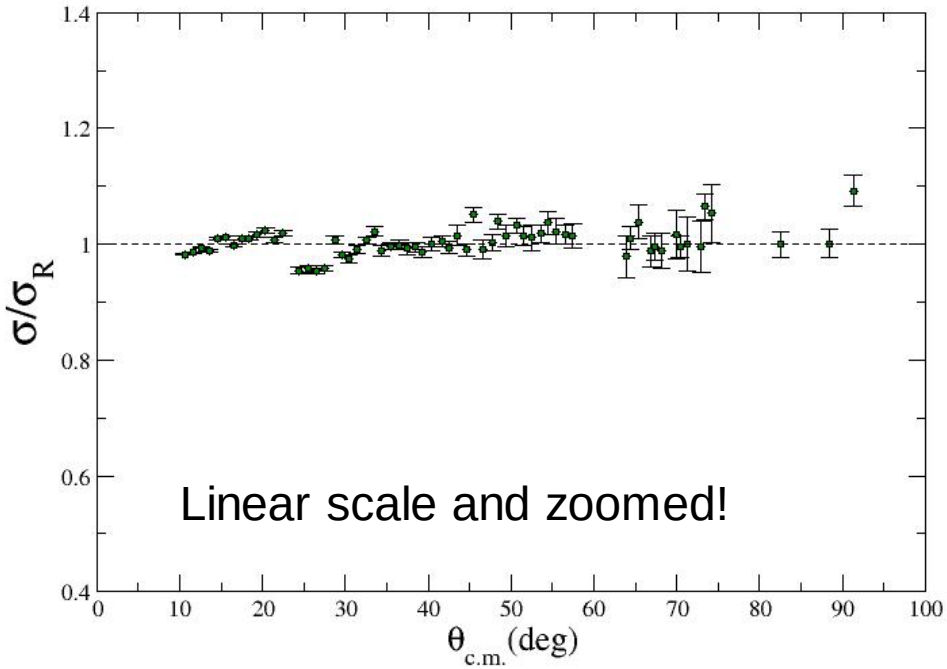

Low statistics for θ > 90° because we had half of the BTU approved

^{8}B very preliminary results

Angular distribution steps:
for $\theta \leq 25°$ at steps of $\theta \leq 1°$
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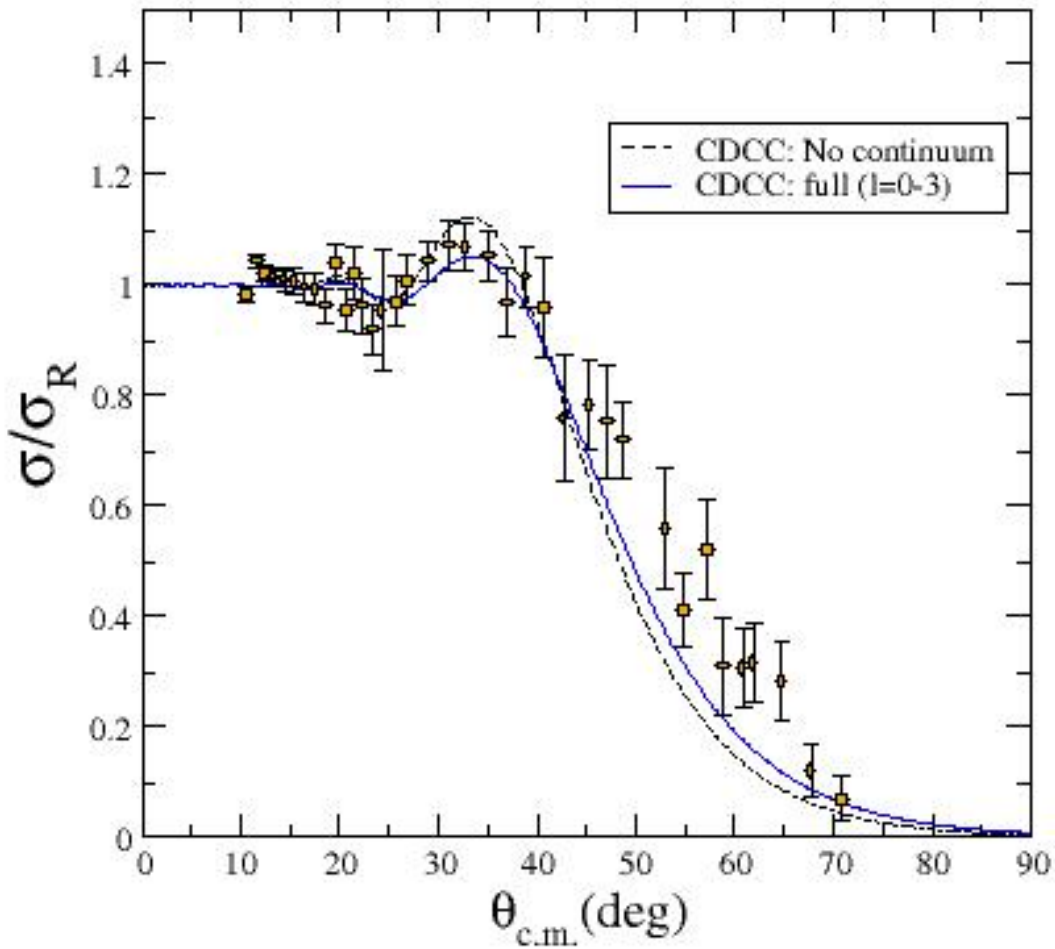
Anyway better than foreseen

Test calculations (^{7}Be no spin), now under definition

For ^{8}B 1/10 of the expected intensity (300 pps)!!



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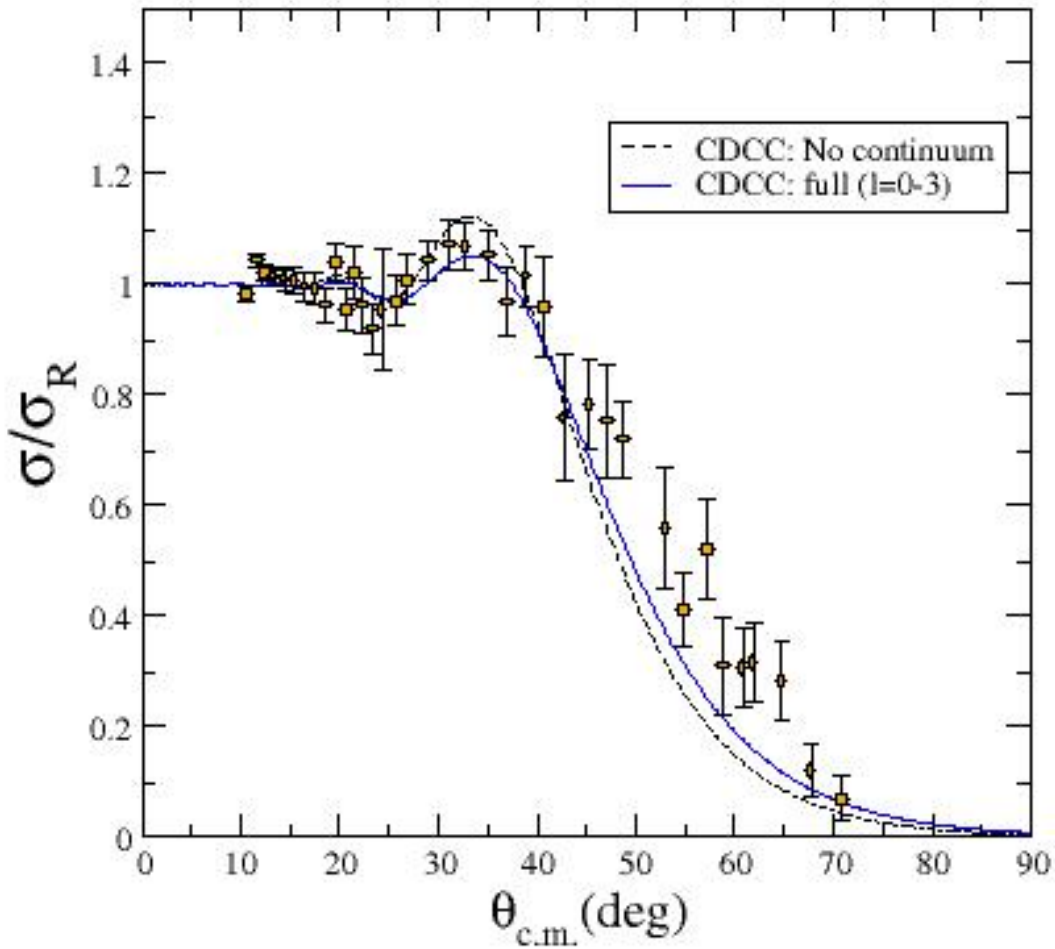

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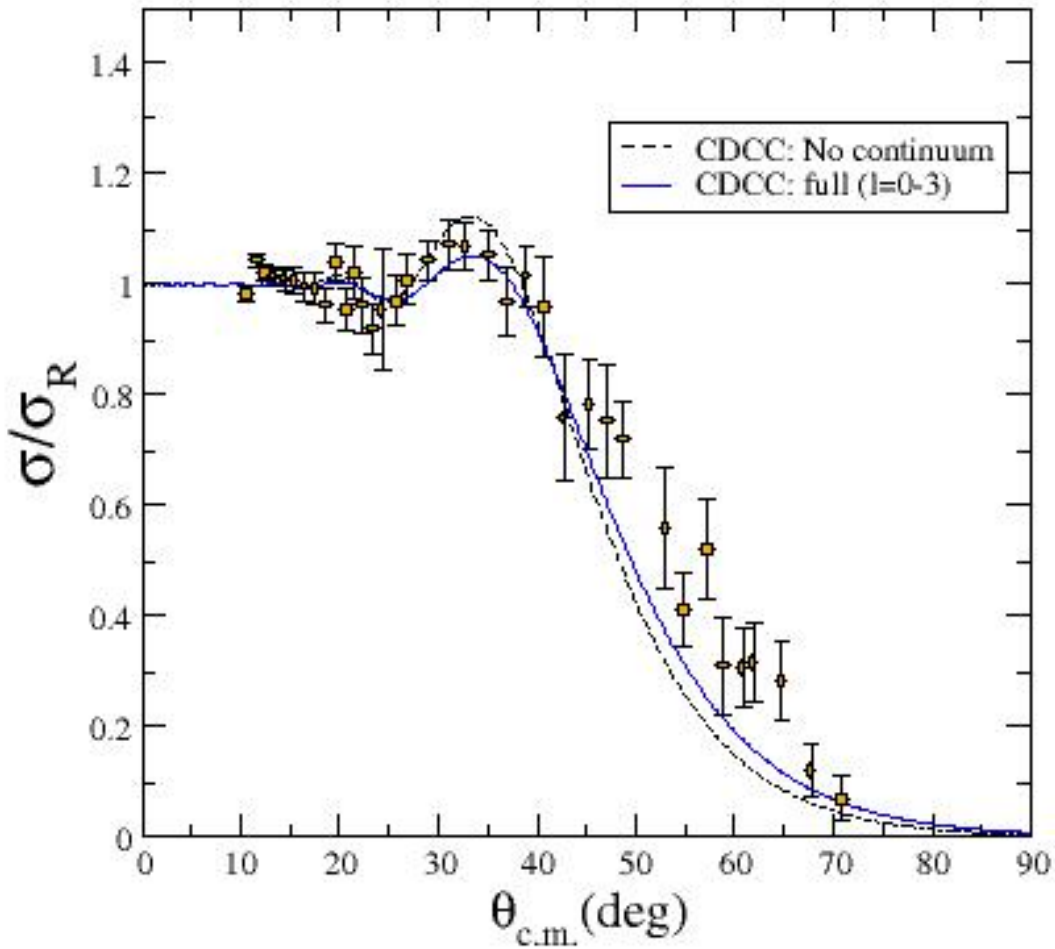

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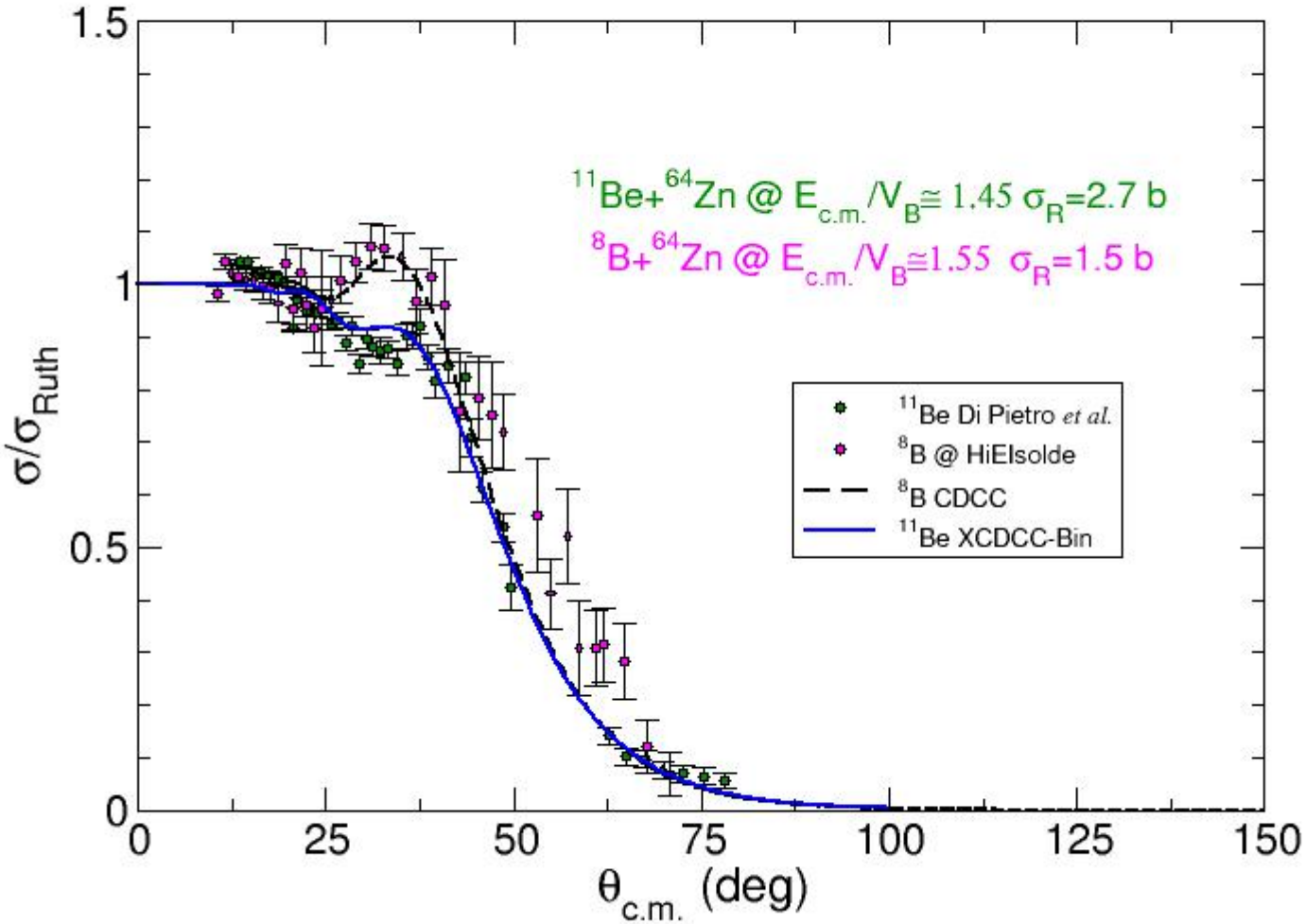
No suppression of the elastic cross section opposite to ^{11}Be
→ as foreseen, the halo effect on the rainbow peak is SMALL

Is it a candidate p-halo?



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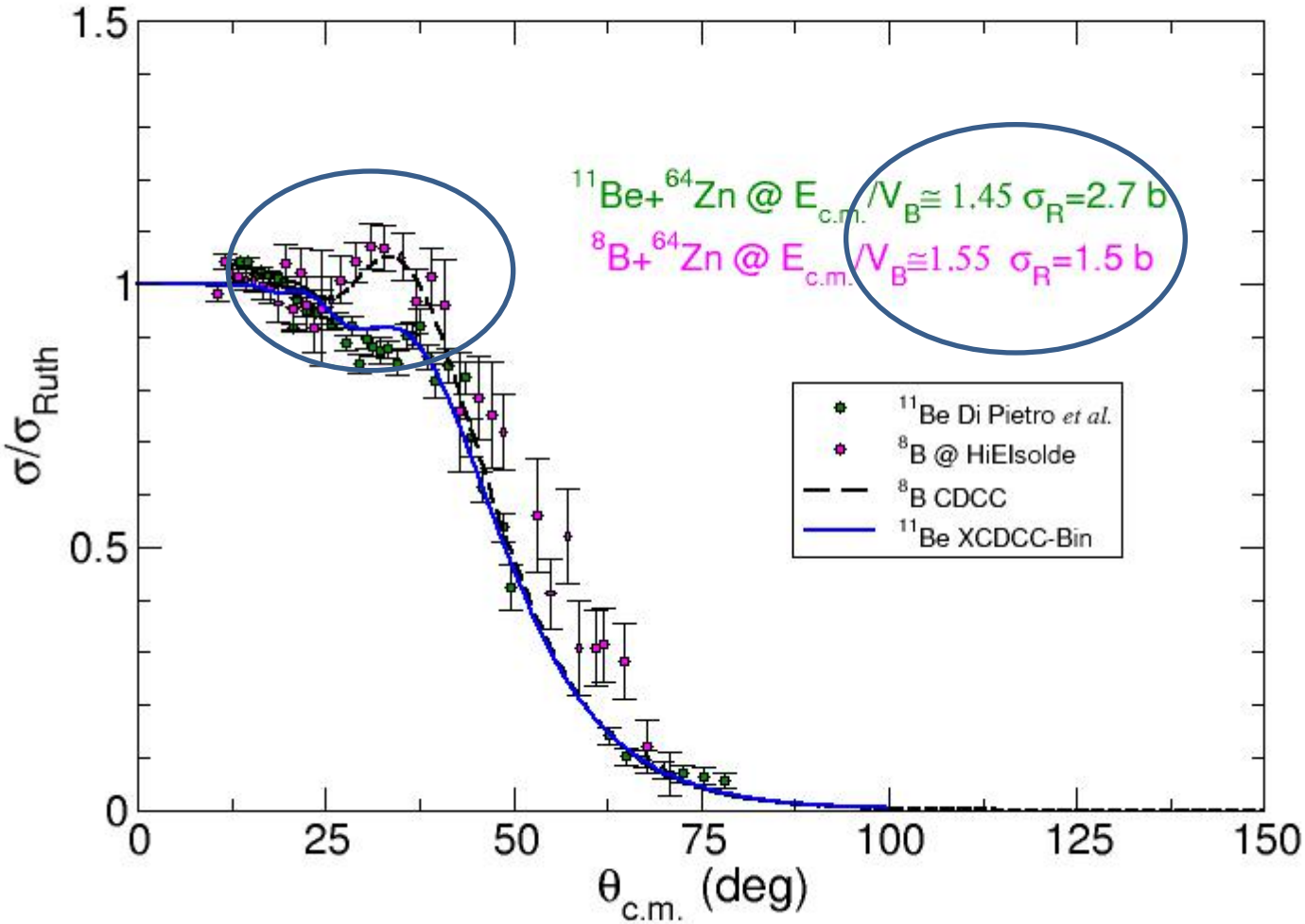
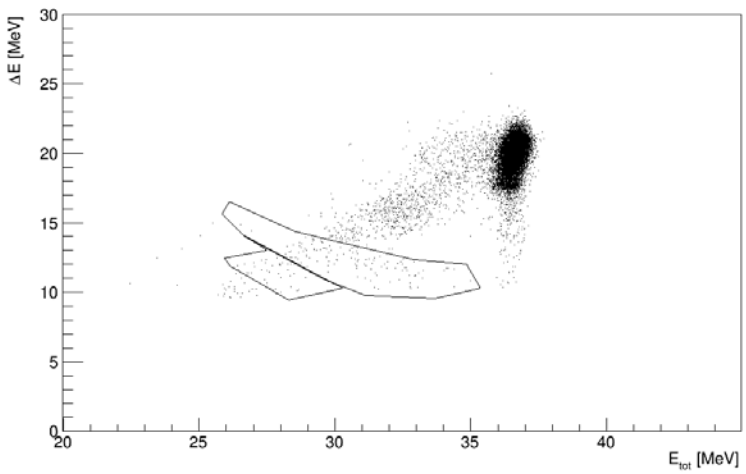
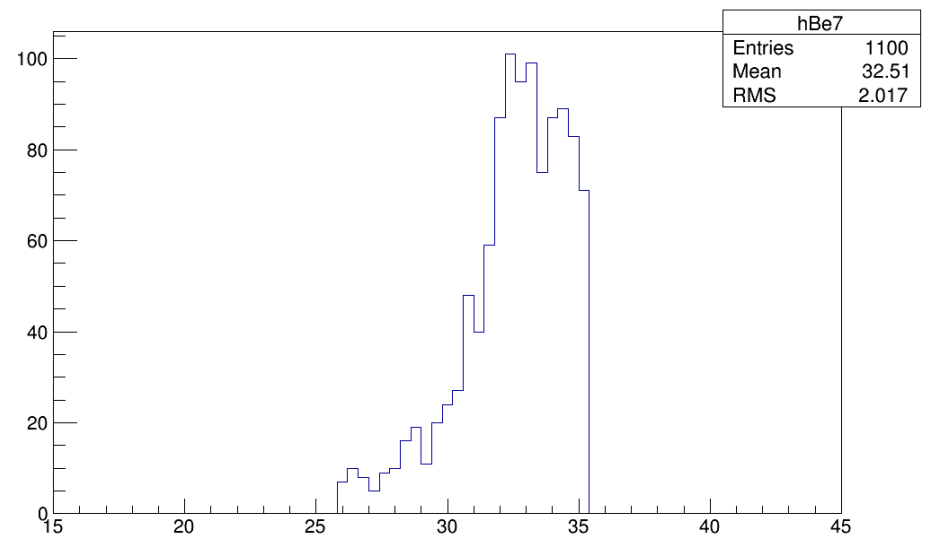


^{7}Be events

Break up evaluation now under analysis





Conclusions

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Negative

- We could not measure coincidences (^{7}Be – p) because of the <u>very low beam intensity</u> → we will not distinguish break up different components

…anyway we expect to end up with very interesting results …

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