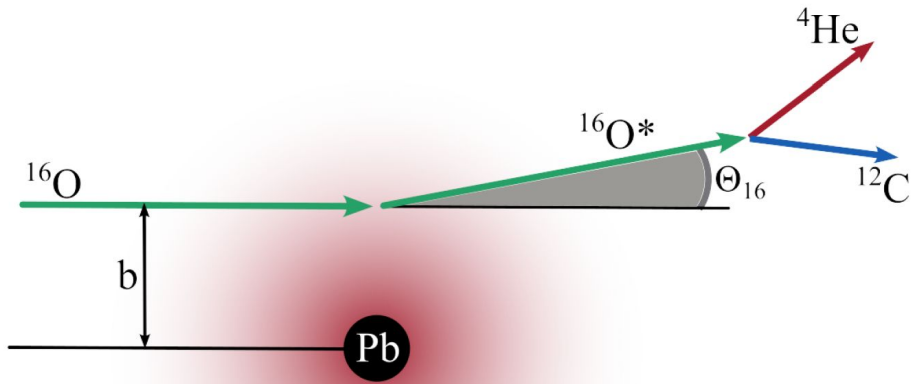# Coulomb Dissociation of ^{16}O into ^{12}C and ^{4}He Status of Analysis s494

L. Bott, M. Heil, A. Kelić-Heil

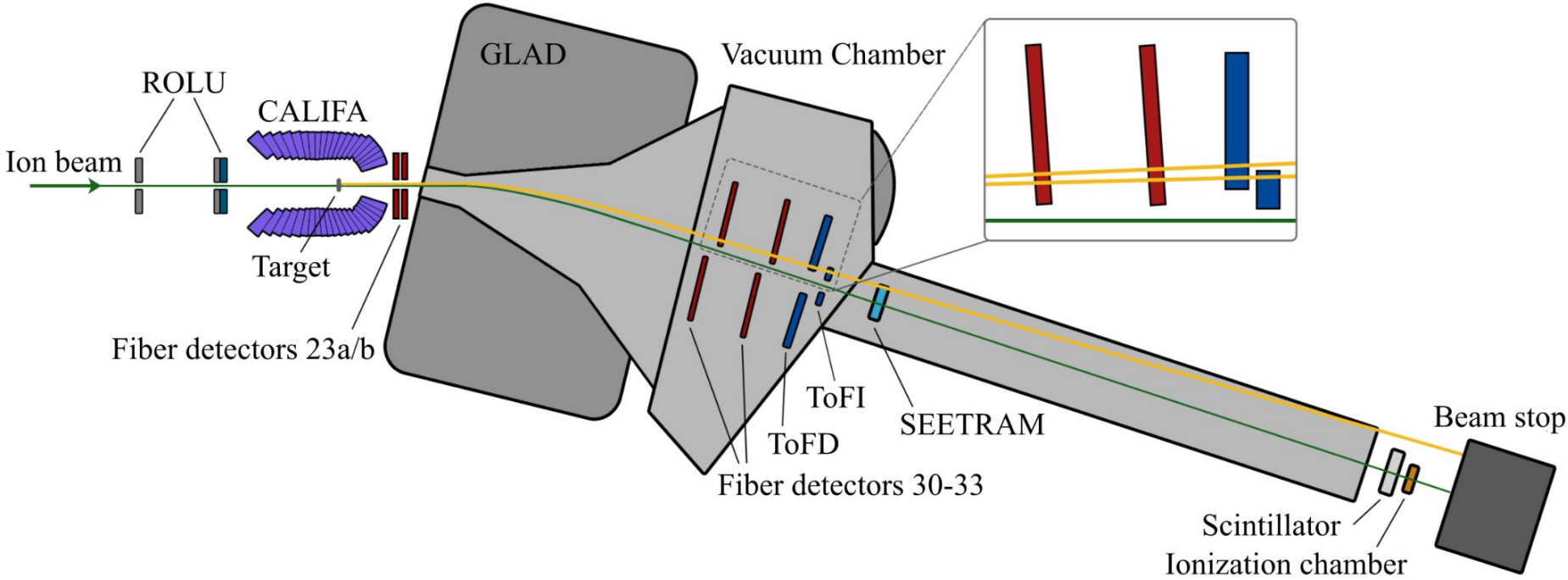R^{3}B collaboration meeting Darmstadt, July 2024

Coulomb dissociation of ^{16}O

- detect ^{12}C and ^4He

- larger (γ,α) cross section than direct measurement

- high intensity ($\sim 10^9$ s^{-1}) ^{16}O beam

Reminder - Setup s494

# Status at the meeting last year:

- All detectors included in the analysis

- Started analysis on GSI HPC cluster

- Started comparing tracking results with theoretical model from Stefan Typel (cdxsp)

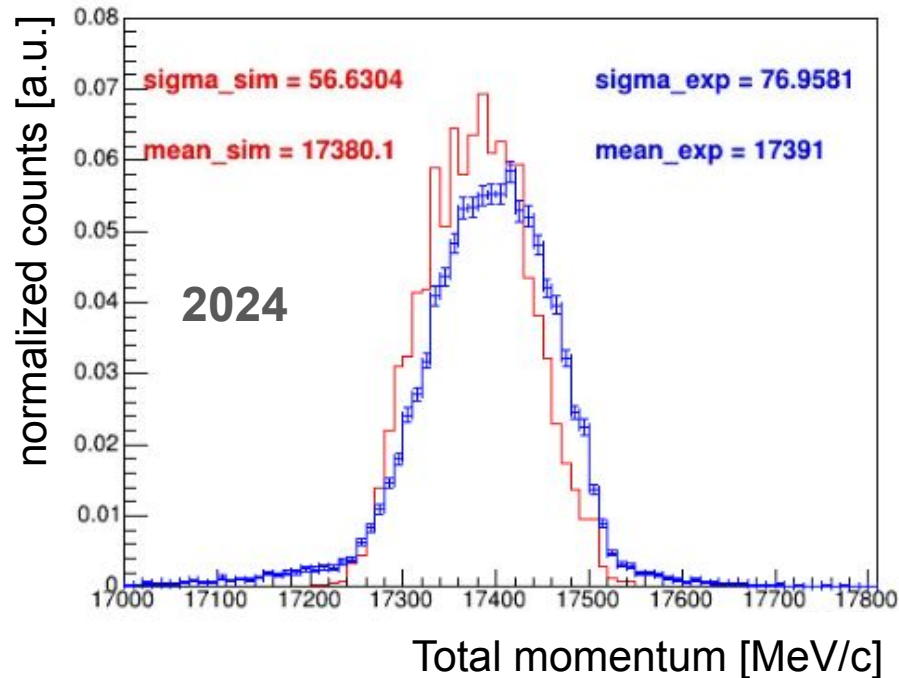# What has been done since the last meeting:

- Improved tracking and analysis

- New cdxsp model

- Improved simulations

- Analysis and optimization of magnetic field

- Comparison with the cdxsp theoretical model
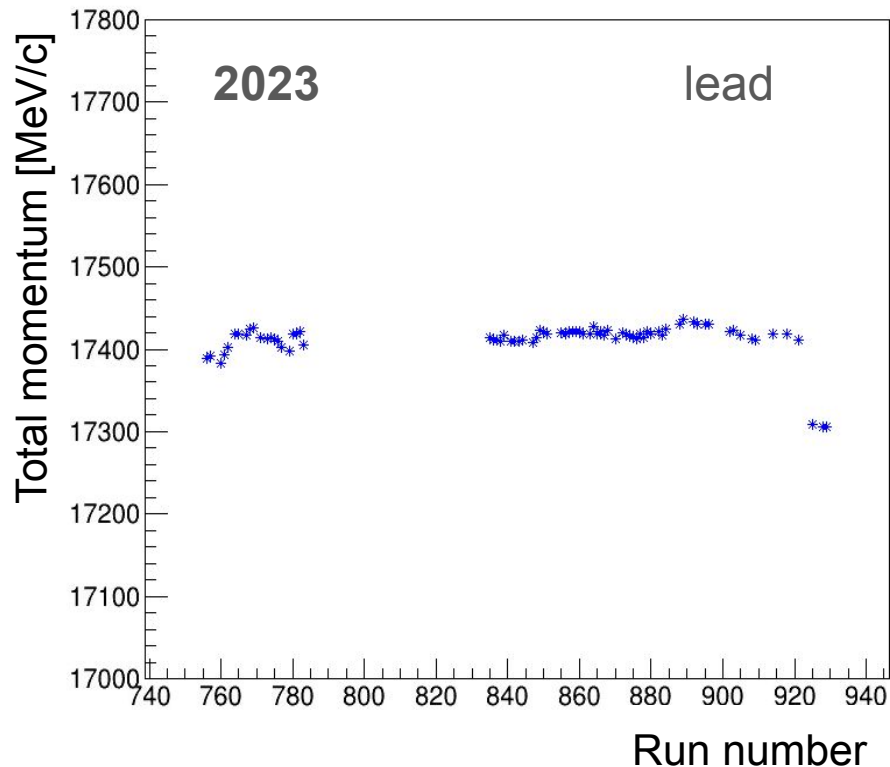
Improved tracking & GLAD field map
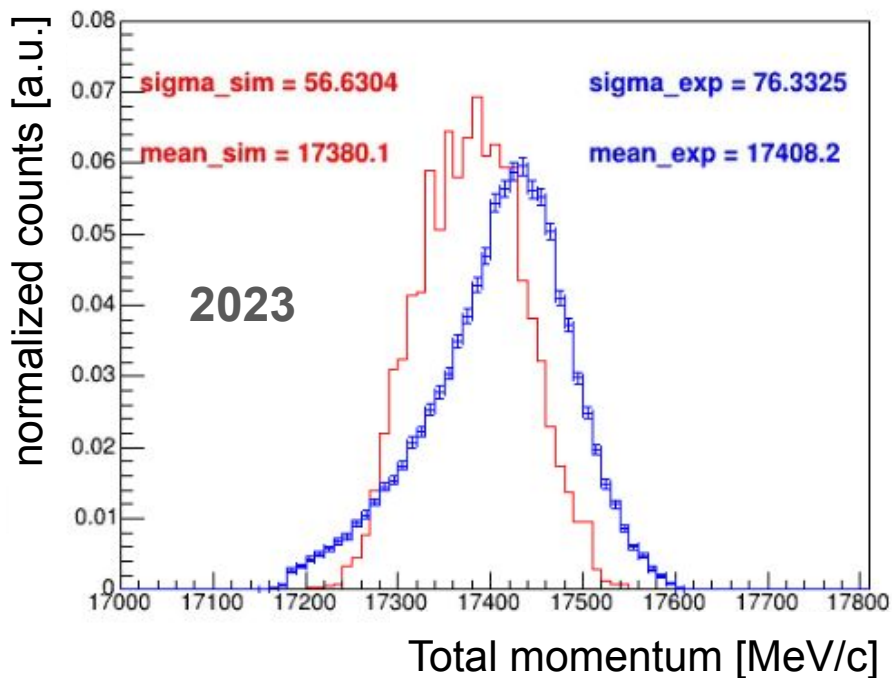
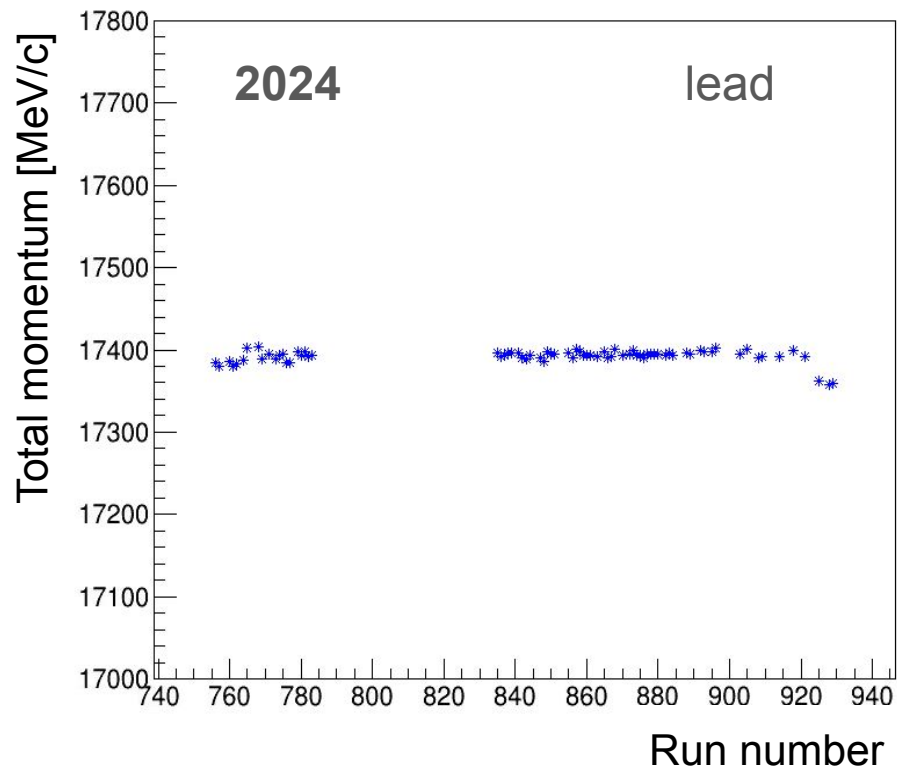results using the **calculated** field map

results using the **optimized** field map && tracking

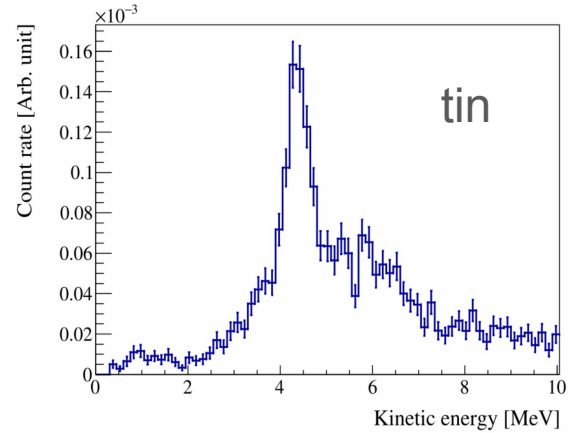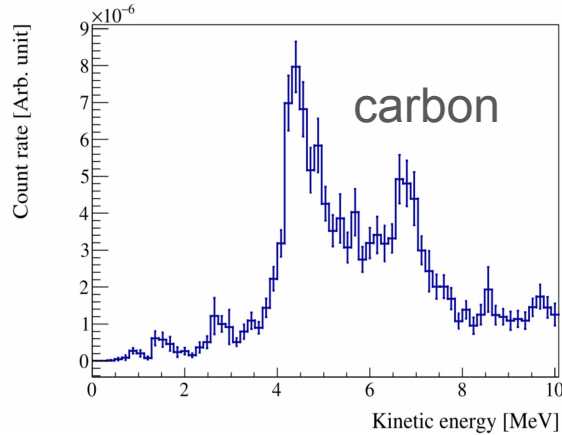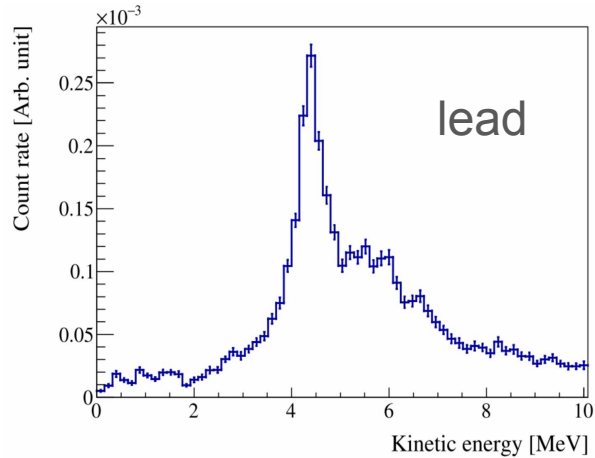# Improved tracking & GLAD field map

results using the **calculated** field map

results using the **optimized**
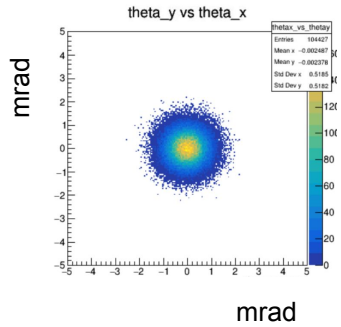field map && tracking

Energy spectra for different targets

- Coulomb dissociation events for all targets

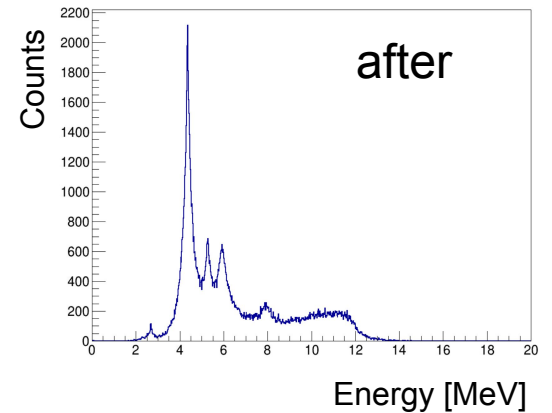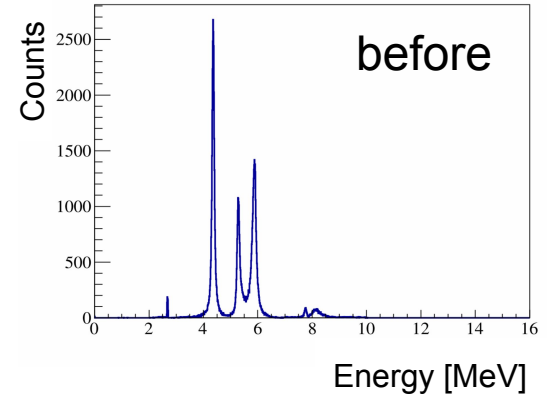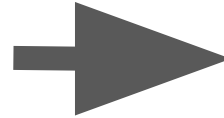- Contribution from excited state of $^{12}C^*$ is subtracted in the next step

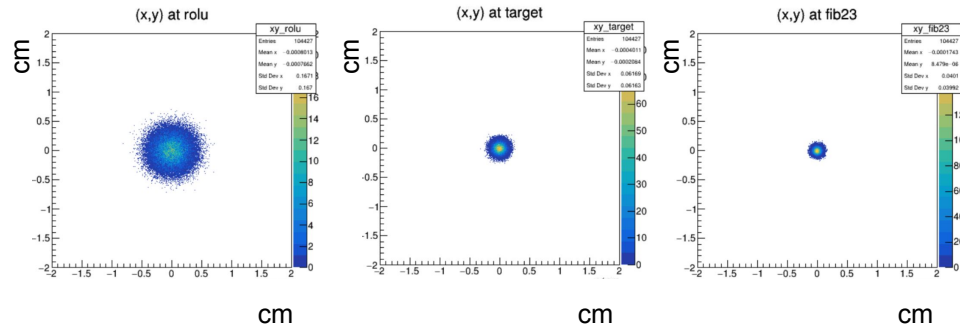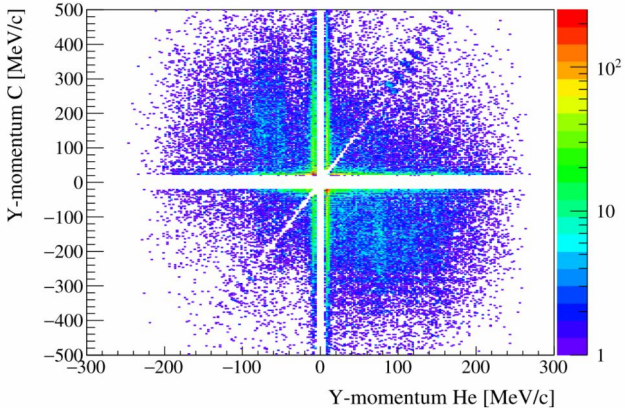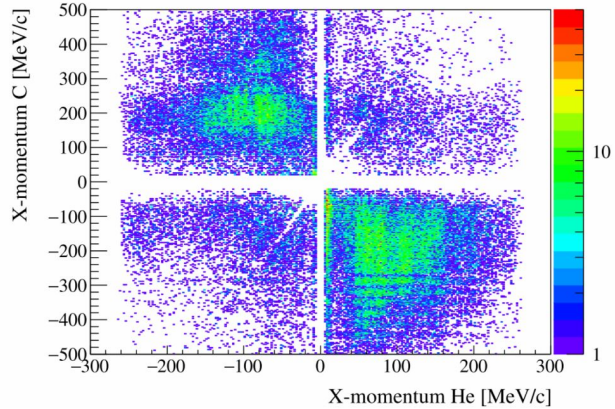# Improve simulation
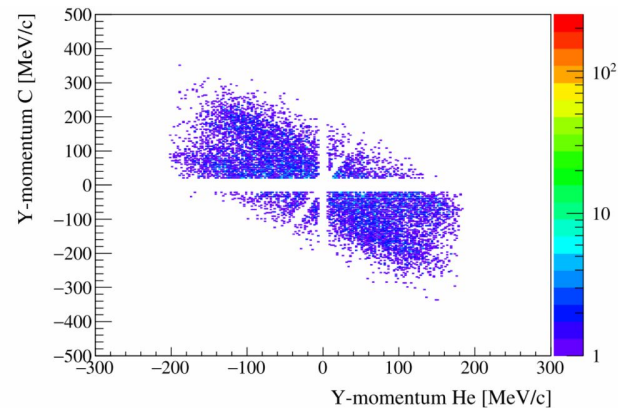
- consider incoming angles

- realistic beam spot size

Comparison with simulation

data

simulation
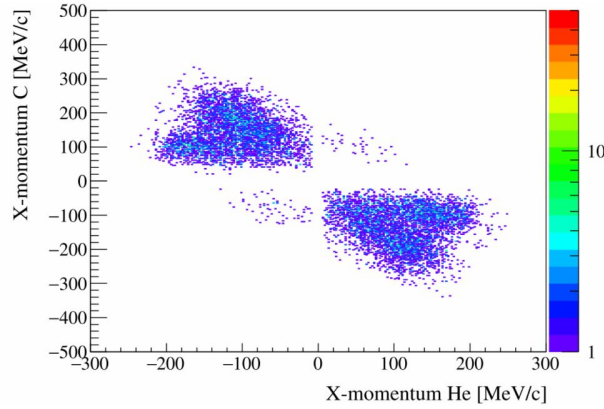
Comparison with theory - cdxsp model from Stefan Typel

standard parameter as starting point
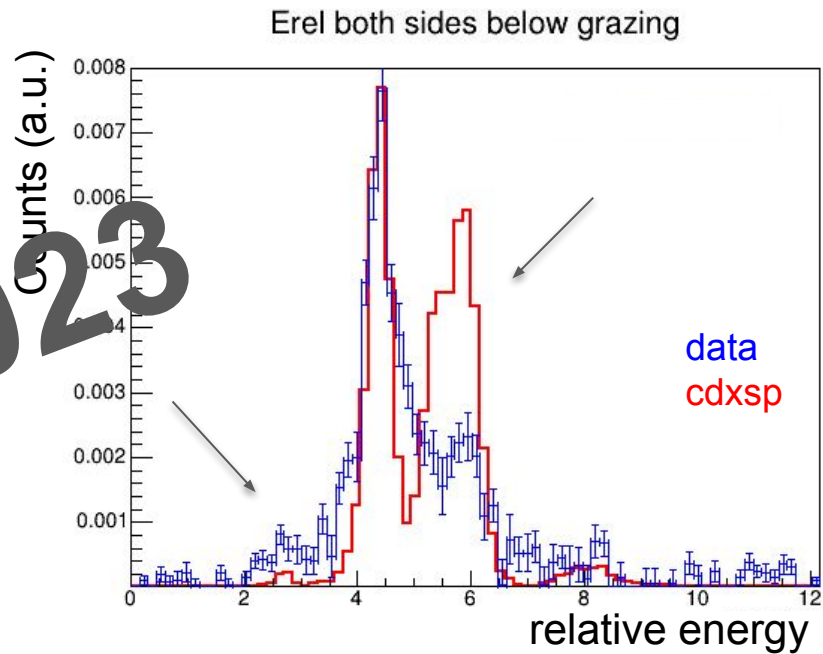
preliminary results after starting to adjust parameters
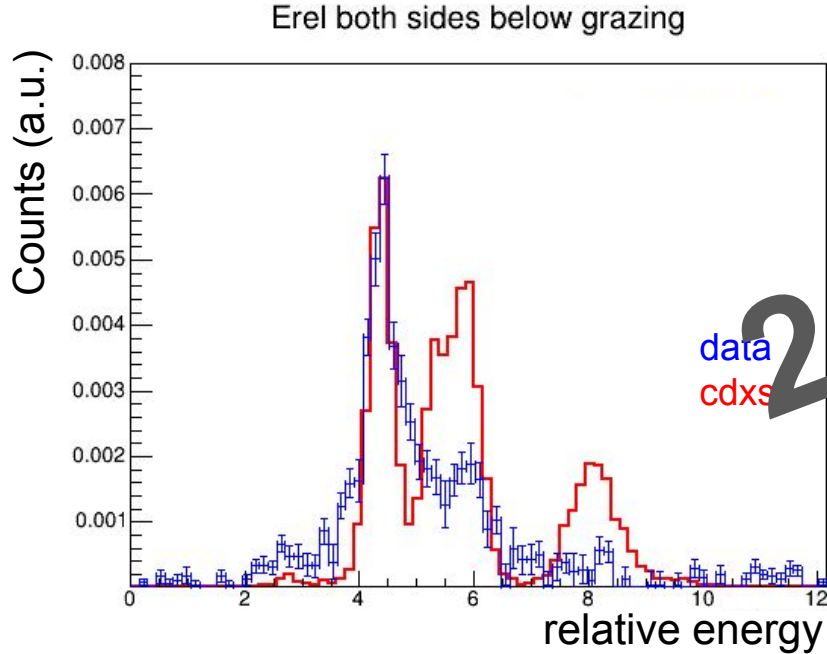
Comparison with theory - cdxsp model from Stefan Typel
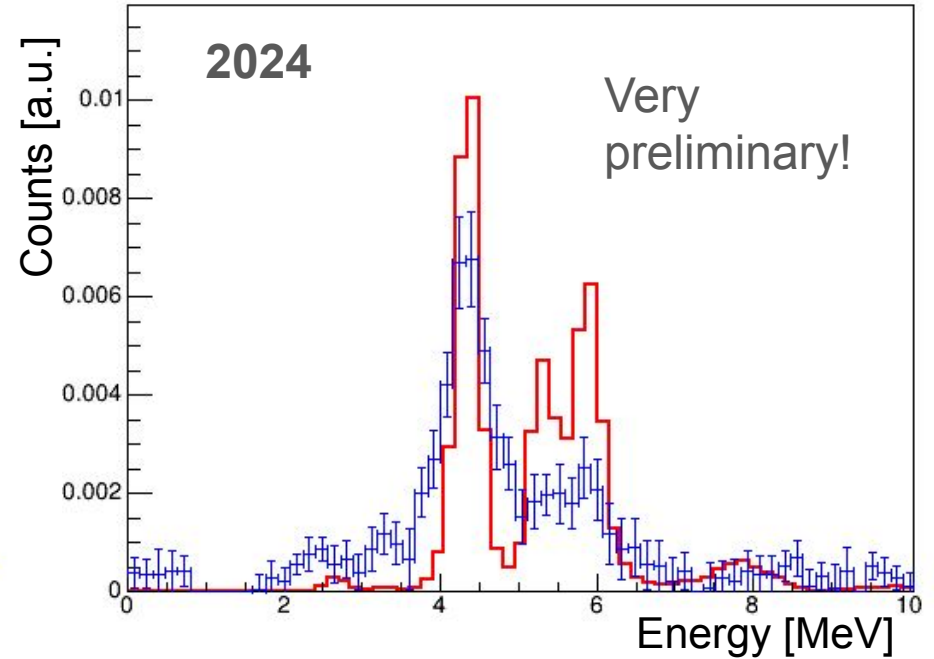
- below grazing angle
- contribution from excited states sutracted

Comparison of S-factor with previous data
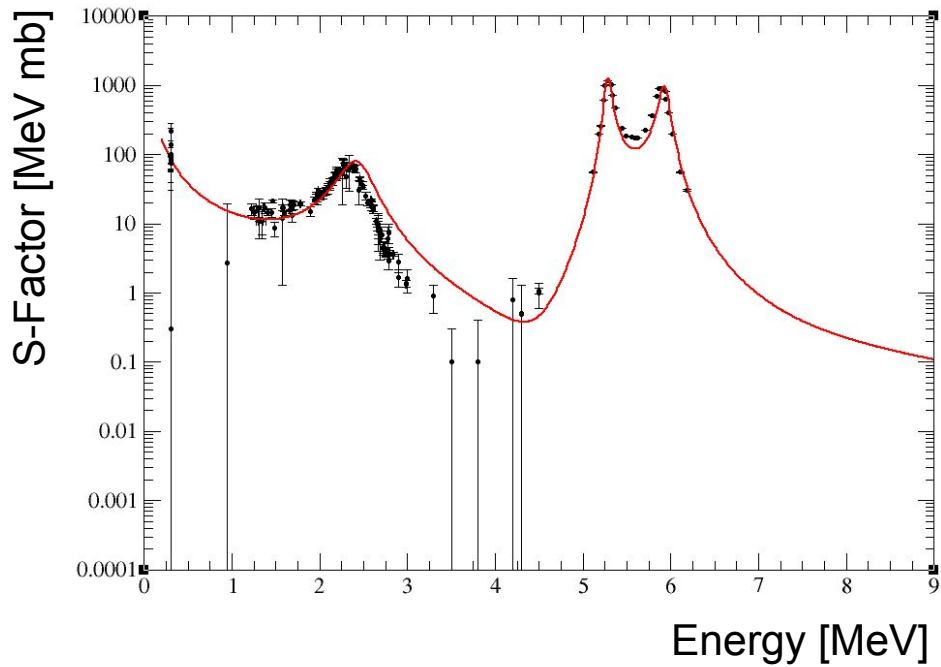
S-Factor E1
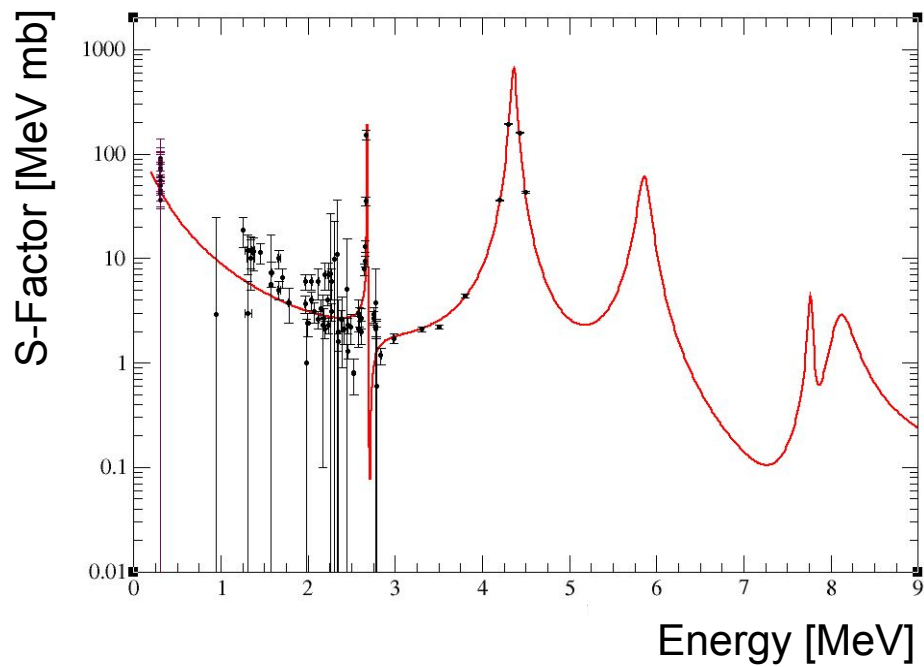
S-Factor E2

results using the **old** cdxsp code

Comparison of S-factor with previous data
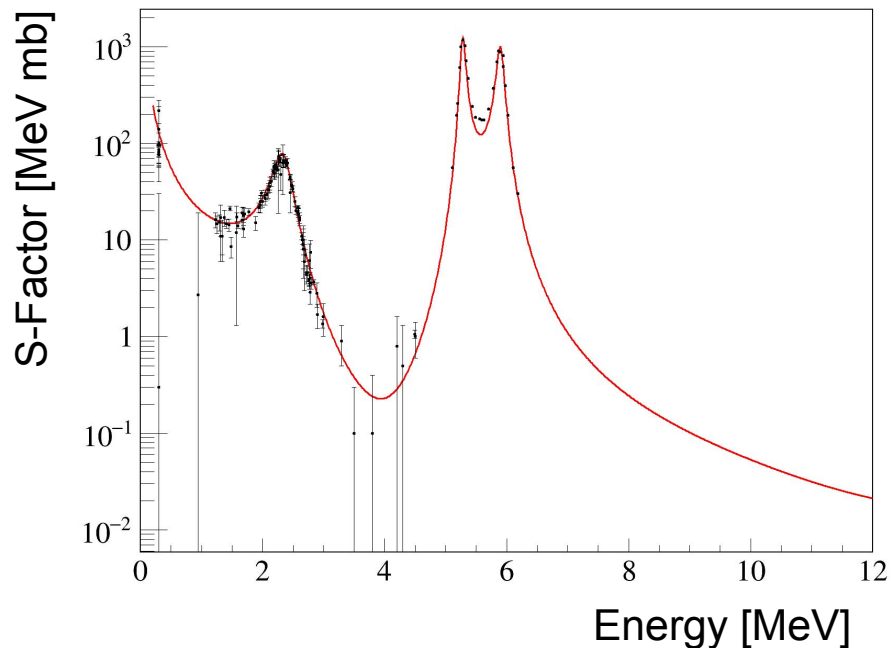
S-Factor E1

S-Factor E2
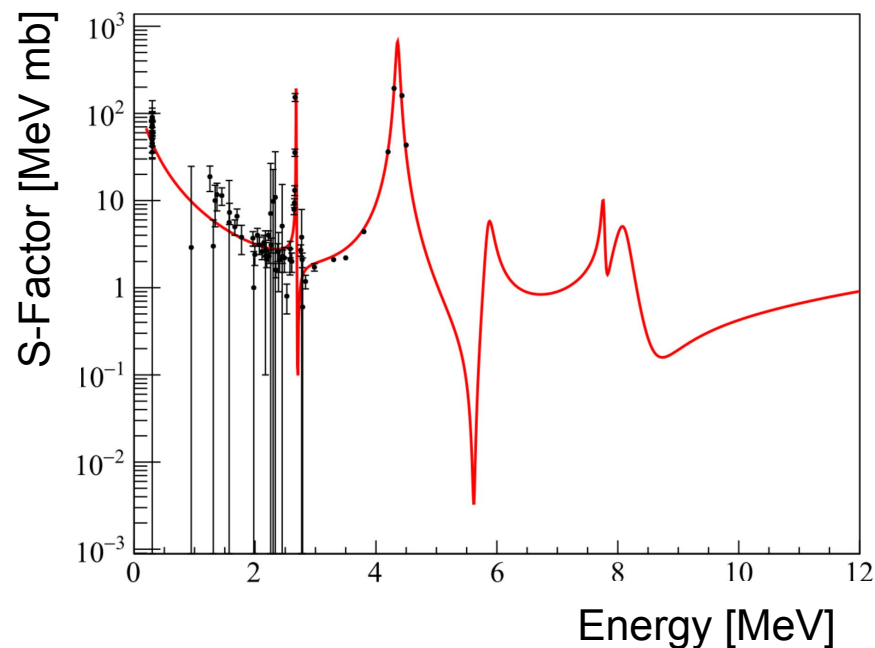
results using the **new** cdxsp code

Influence of the energy resolution
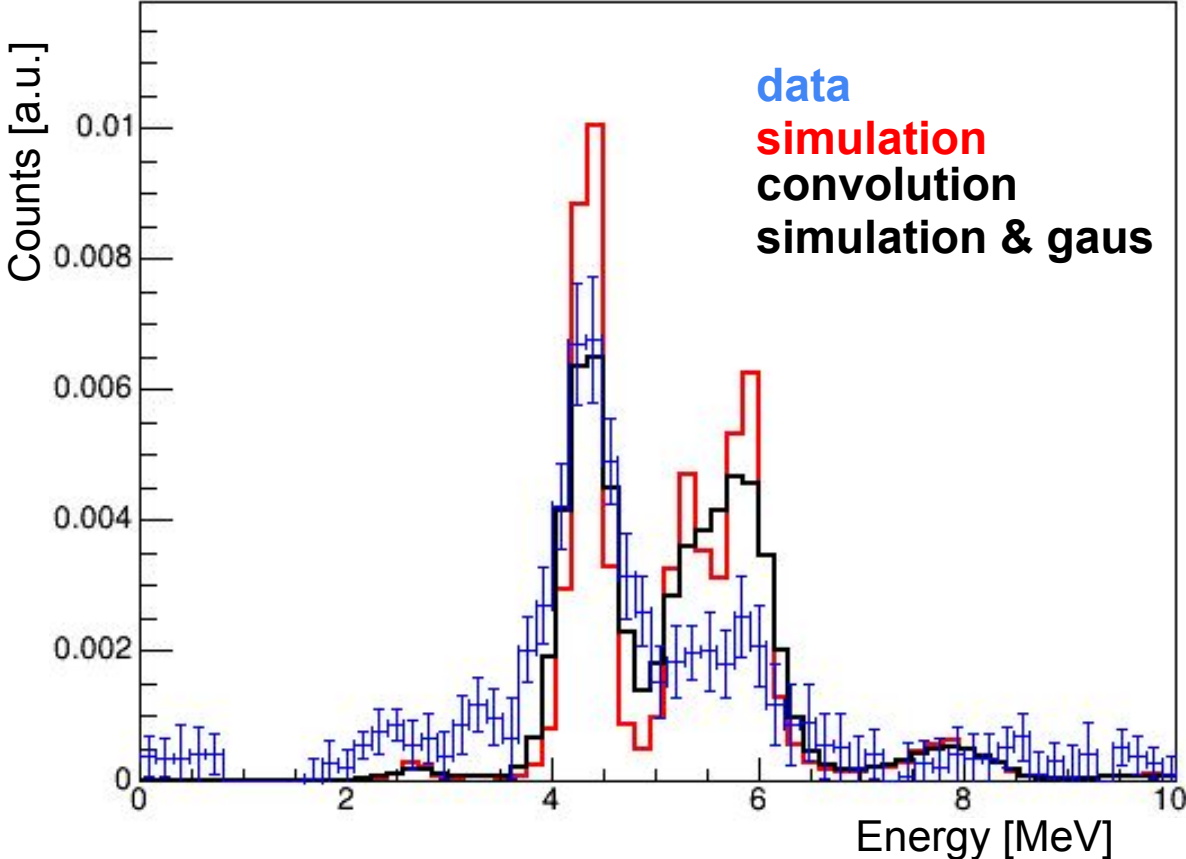
Outlook

- Redo calibrations of tracker (detector positions)
- Check excited-state subtraction
- Check relative energy resolution
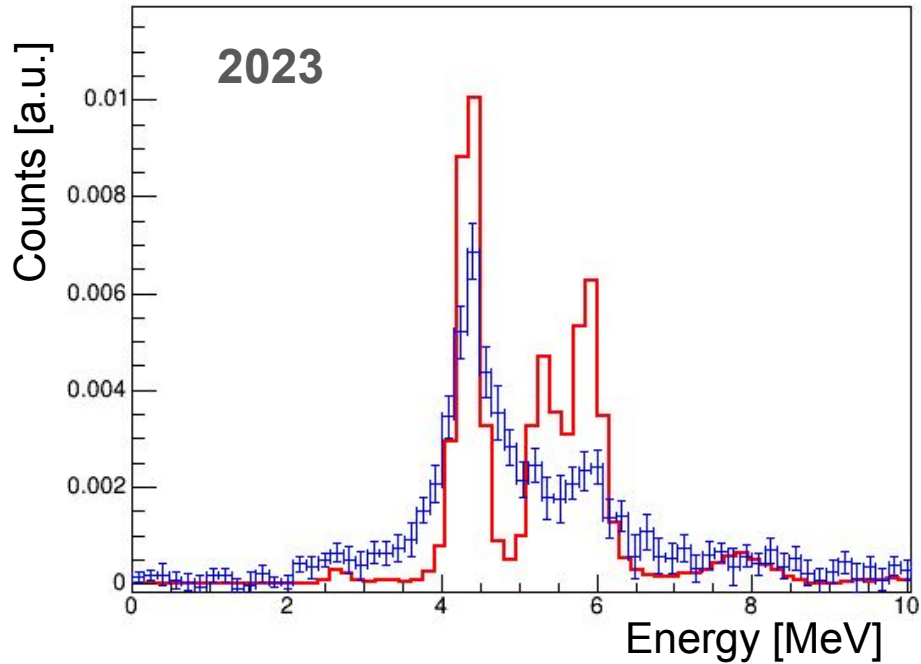- Separation of E1 and E2 contributions
- Detailed comparison with theory, including not only relative energy but also other observables

High count rate on Fiber detectors…

He efficiency of Fiber detectors:
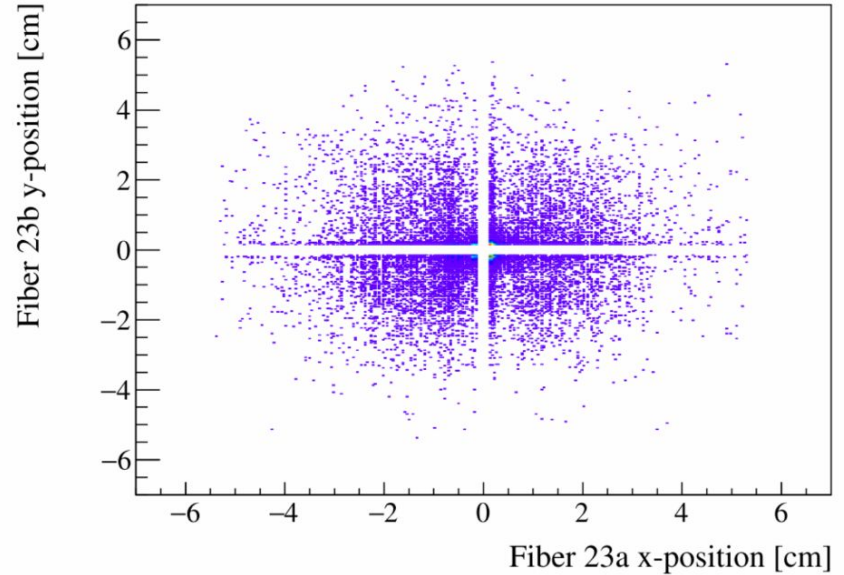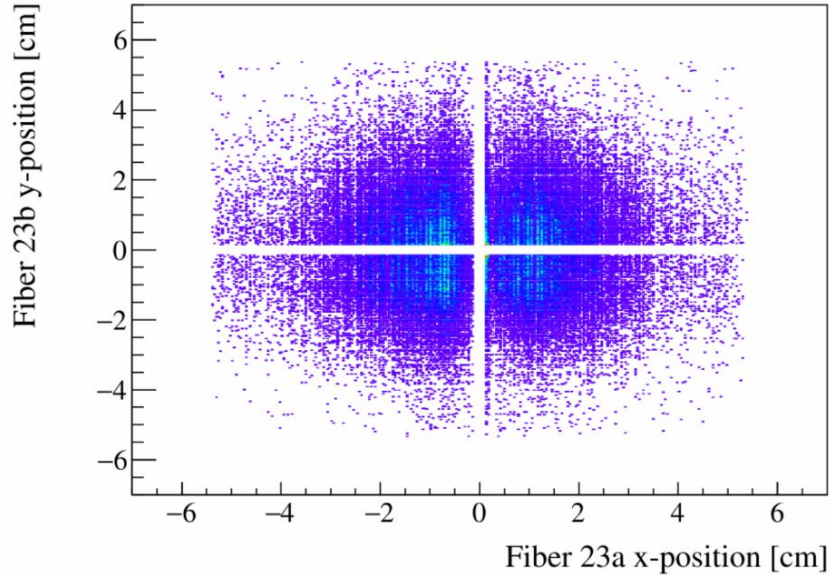
High count rate on Fiber detectors…

all events
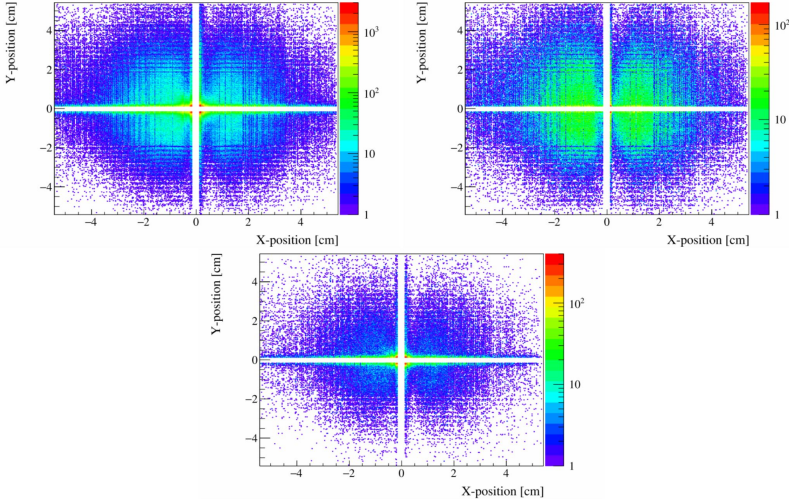
events $\chi^2 < 10$
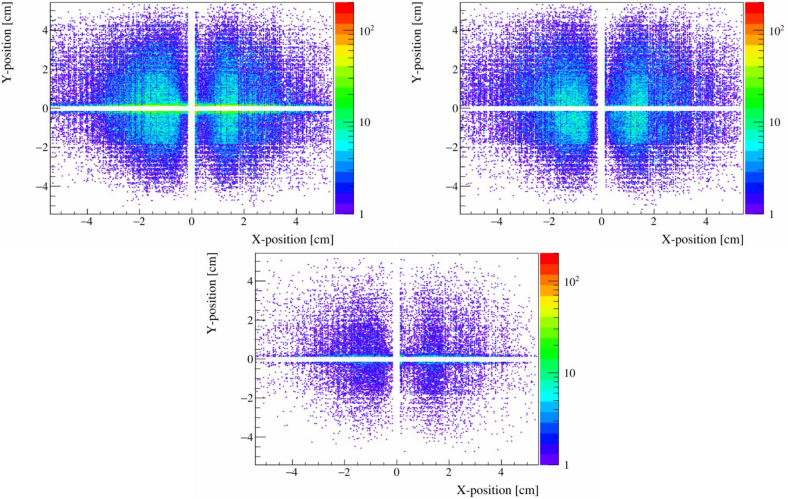
Geometrical acceptance
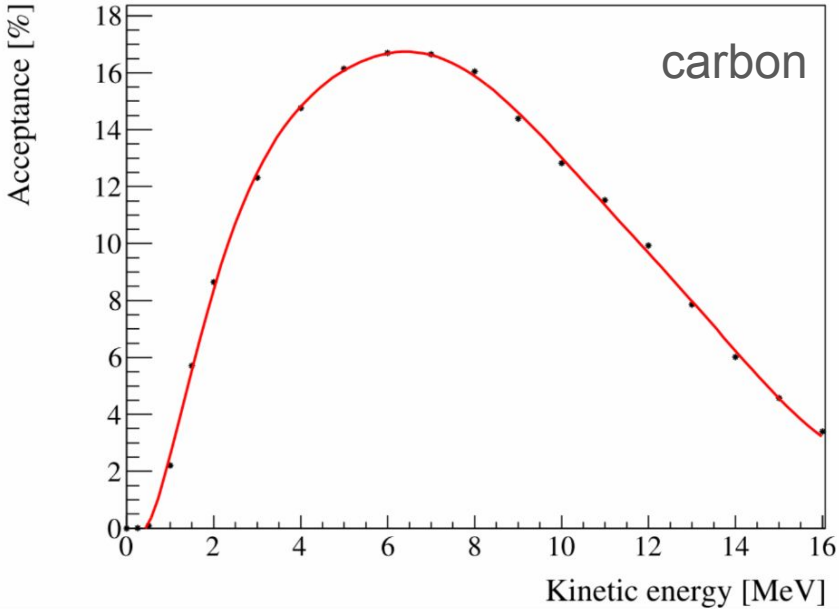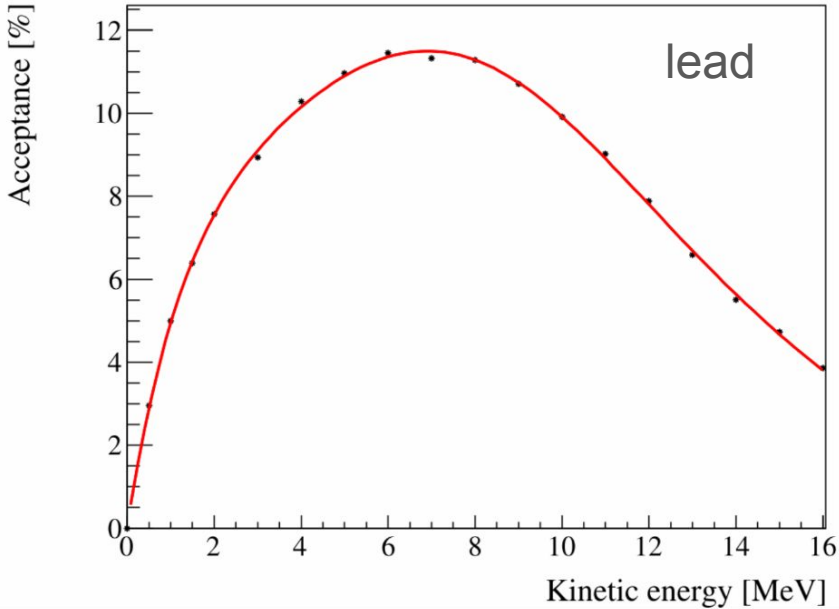
Energy spectra for different targets

Target	Thickness [μm]	Energy loss [MeV]	Angular straggling σ [mrad]
Pb	38(8)	4.011	0.703
C	252(5)	7.849	0.294
Sn	104(2)	8.1	0.794
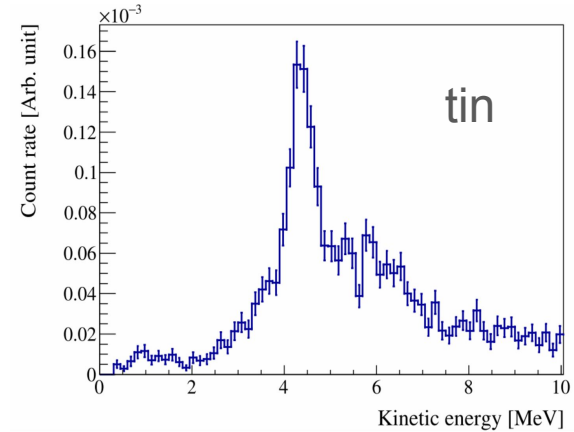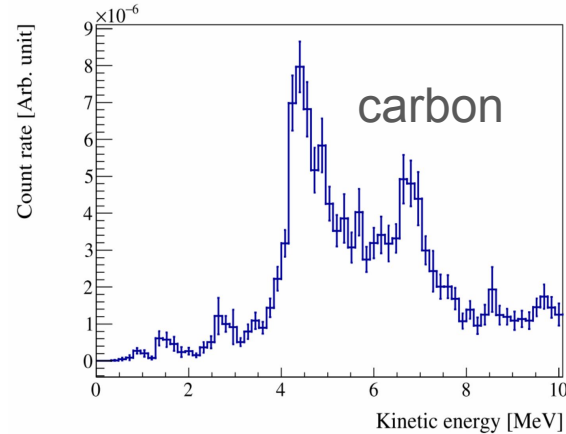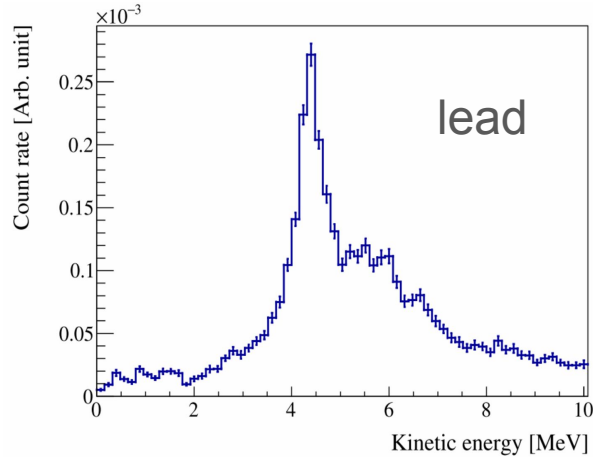
lead

carbon

tin

- Coulomb dissociation events for all targets

- Contribution from excited state of $^{12}C^*$ is subtracted in the next step

Erel 2023

?

C252 target

$E_{cm}=0.3$MeV

^{12}C+α,7.162

^{12}C+^{6}Li-d, 5.687

^{12}C+^{7}Li-t, 4.694

^{15}N+P,12.128

^{12}C*+α,11.601

^{16}N
$T_{1/2}$=7.13s

7×10^{-9}

1×10^{-5}

0.01

0.05

0.66

1×10^{-4}

0.28

^{16}O

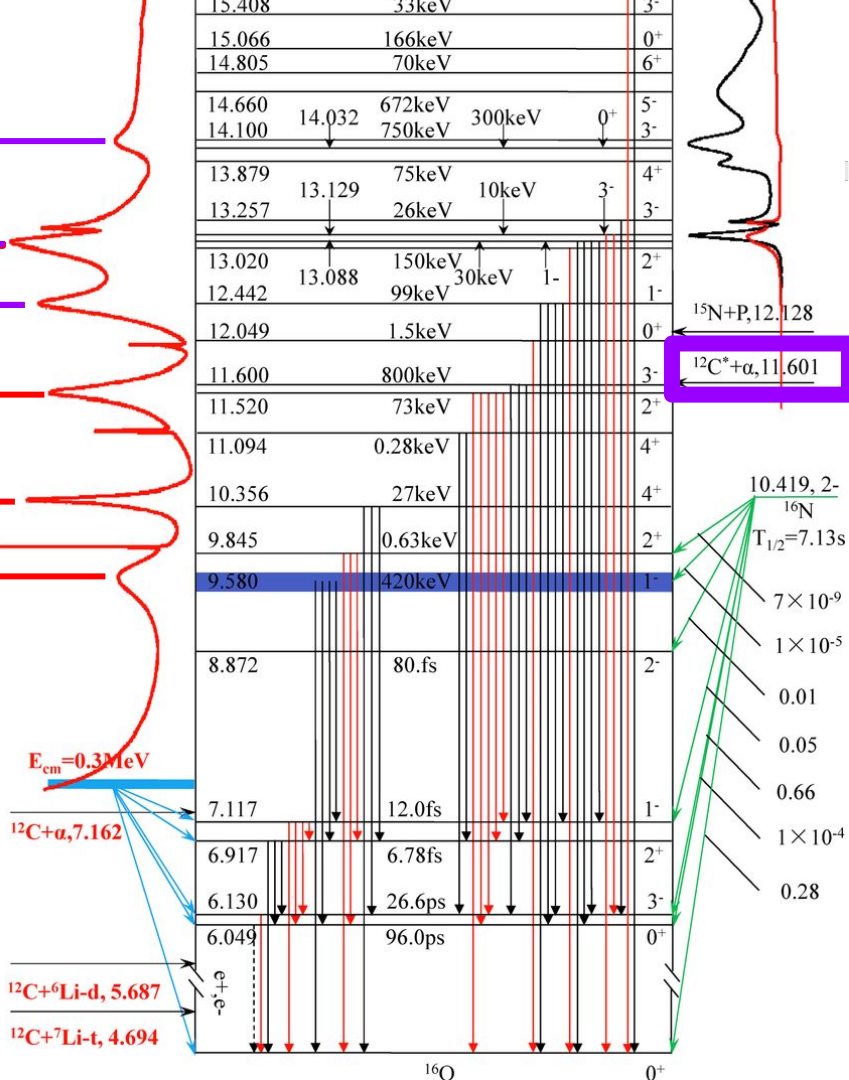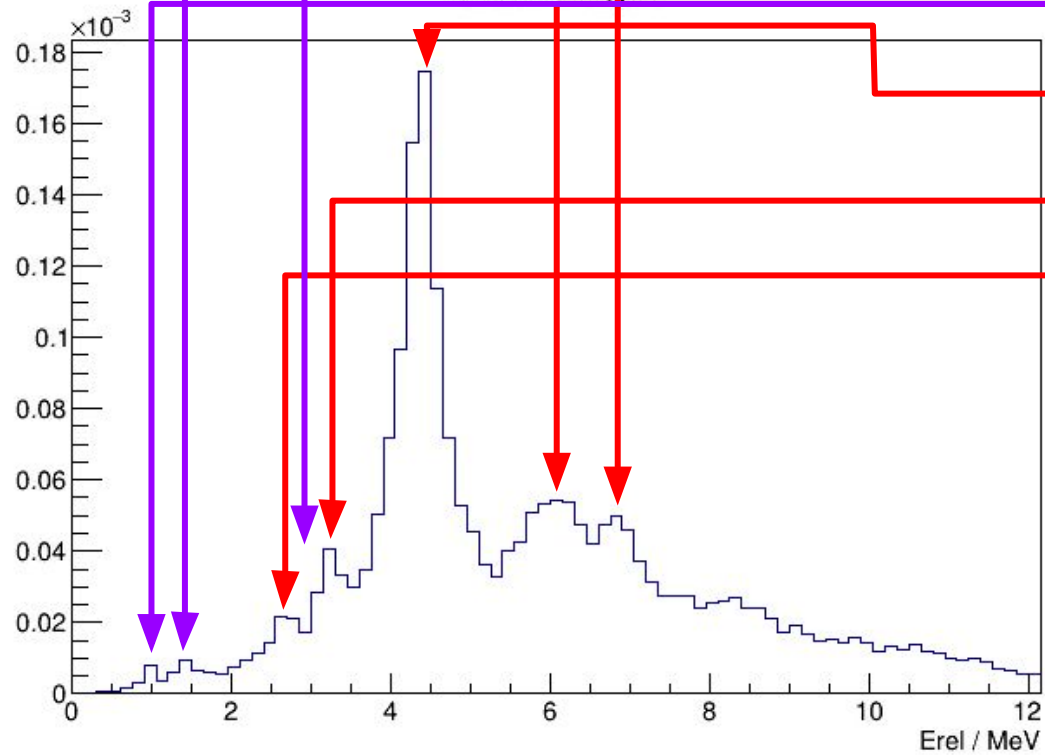| 15.408 | 33keV | | | 3$^-$ |
15.066	166keV			0$^+$
14.805	70keV			6$^+$
14.660	14.032	672keV	300keV	0$^+$	5$^-$
14.100		750keV			3$^-$
13.879	13.129	75keV	10keV		4$^+$
13.257		26keV		3$^-$	3$^-$
13.020	13.088	150keV	30keV		2$^+$
12.442		99keV		1$^-$	1$^-$
12.049	1.5keV			0$^+$
11.600	800keV			3$^-$
11.520	73keV			2$^+$
11.094	0.28keV			4$^+$
10.356	27keV			4$^+$
9.845	0.63keV			2$^+$
9.580	420keV			1$^-$
8.872	80.fs			2$^-$
7.117	12.0fs			1$^-$
6.917	6.78fs			2$^+$
6.130	26.6ps			3$^-$
6.049	96.0ps			0$^+$

10.419, 2$^-$

e^+e^-
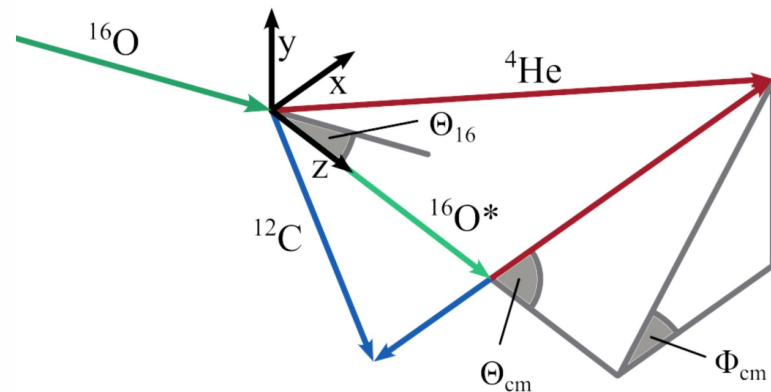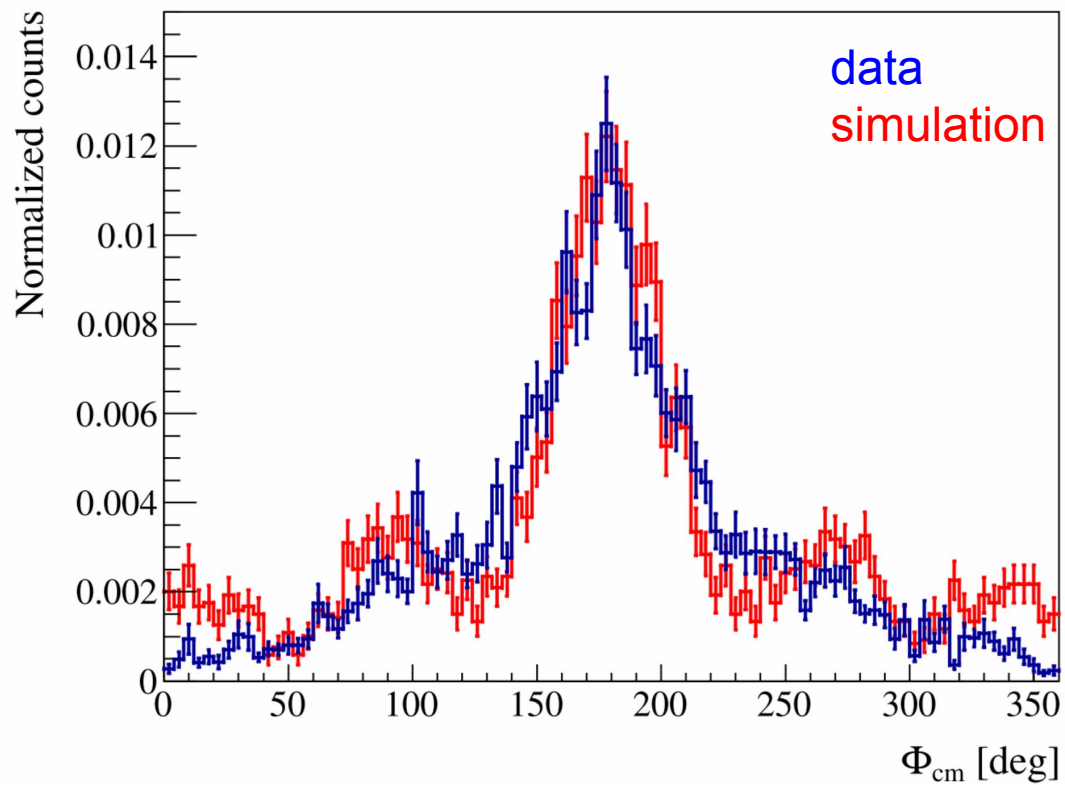
E1 && E2 separation

Magnetic field parameters

- **New parameters of the Glad field:**

    {x/cm, y/cm, z/cm, angleX/deg, angleY/deg, angleZ/deg, scale}:

    {0.4942526, -1.022616, 174.5851, 0.0419, -14.18602, -0.1464, 1.000450};

    angleX and angleZ fixed to values measured by M. Heil.