12C(p,2p)11B Quasi Free Scattering in Inverse Kinematics at R3B

Tobias Jenegger

R3B Collaboration Meeting 2022

Setup Experiment S444

12C(p,2p)11B reaction

Analysis

Summary & Outlook

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BMBF 05P19WOFN1, 05P21WOFN1
and the FAIR Phase-0 program

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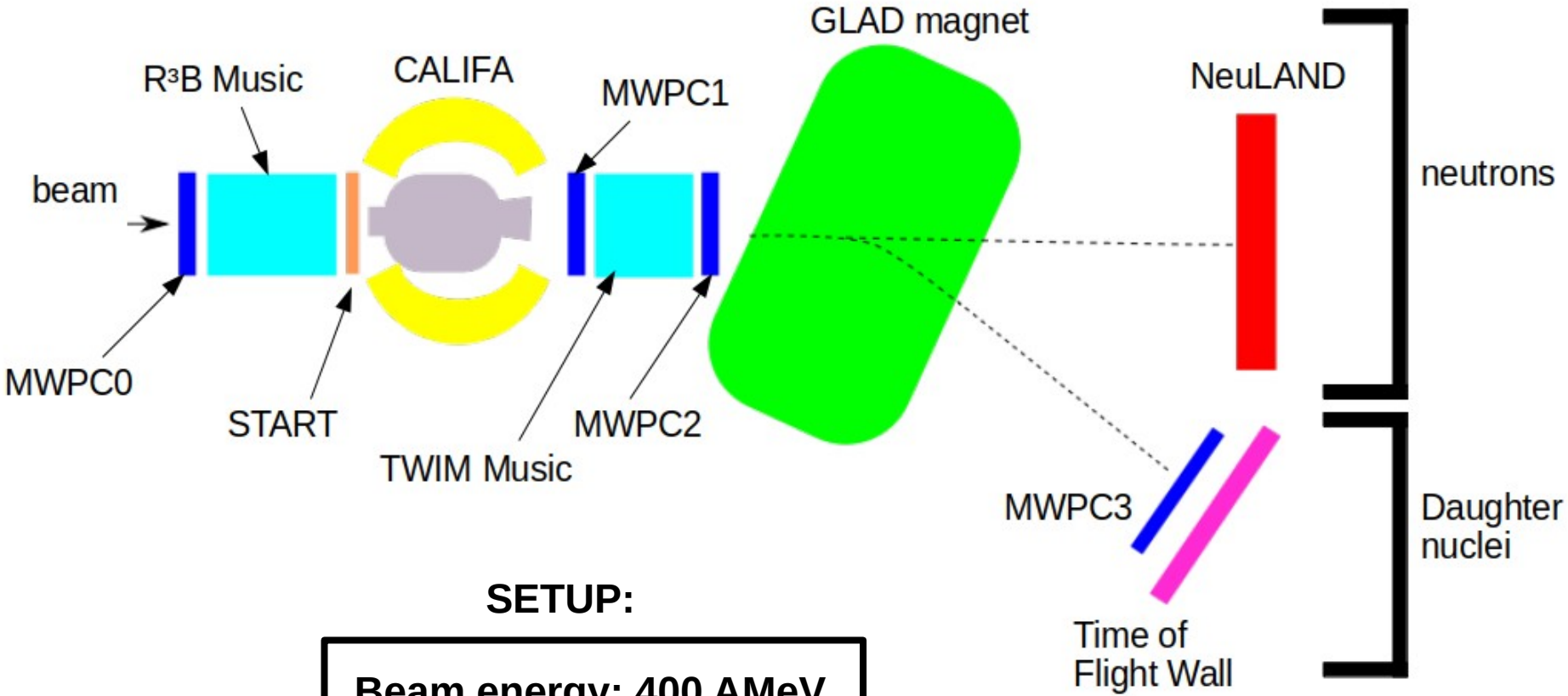
Quasi Free Scattering Analysis with Experiment S444/467 (2020)



SETUP:

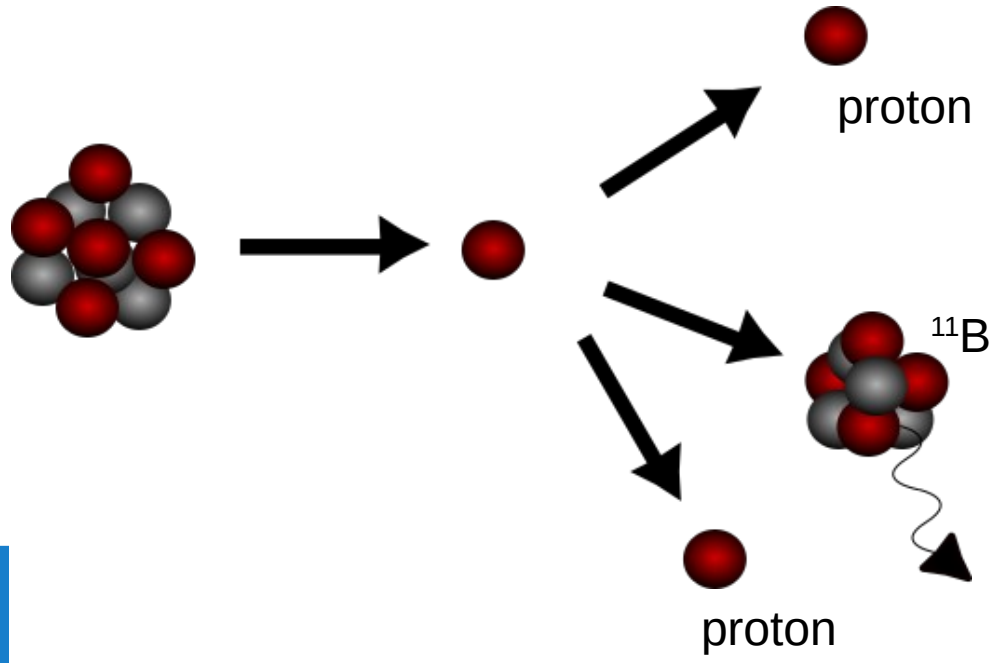
Beam energy: 400 AMeV
Beamtype: ^{12}C
Target: CH_2

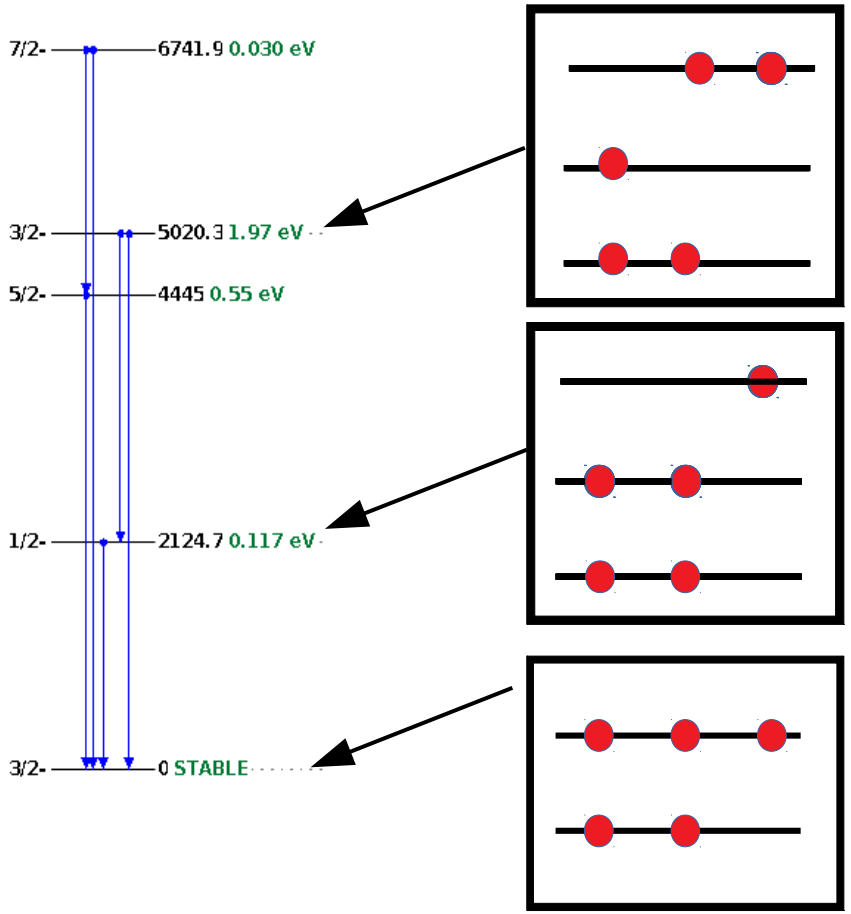
12C(p,2p)11B reaction

- ^{12}C beam
- proton like target

→

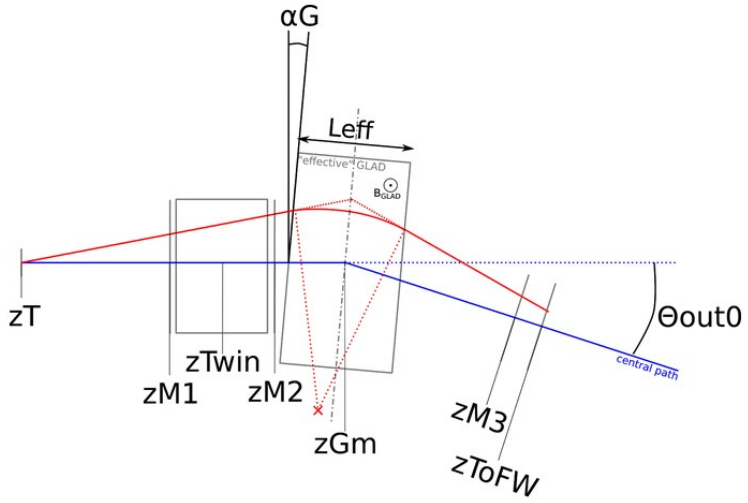
- 2 protons
- ^{11}B fragment (spectator)



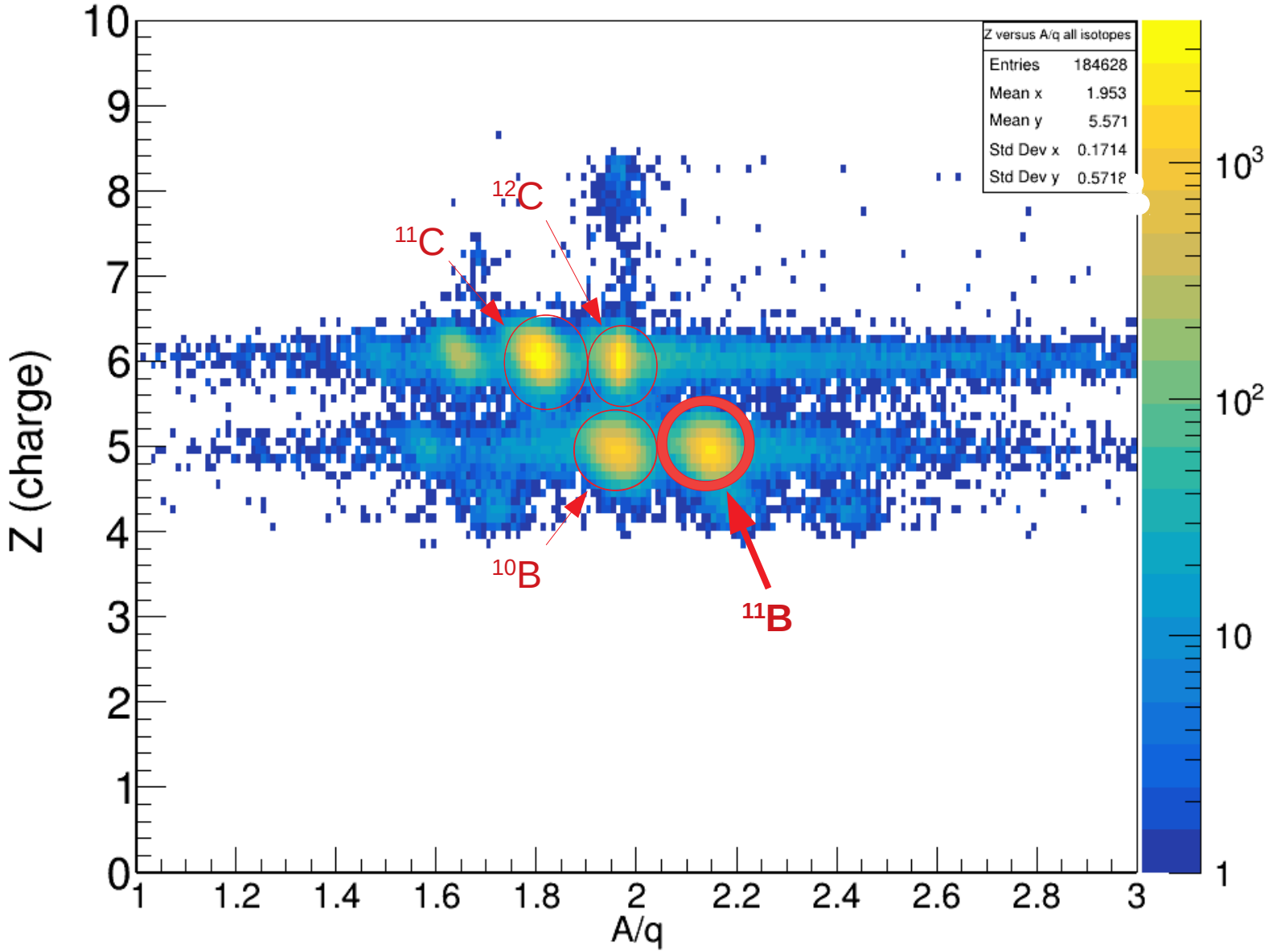


Fragment Particle Identification

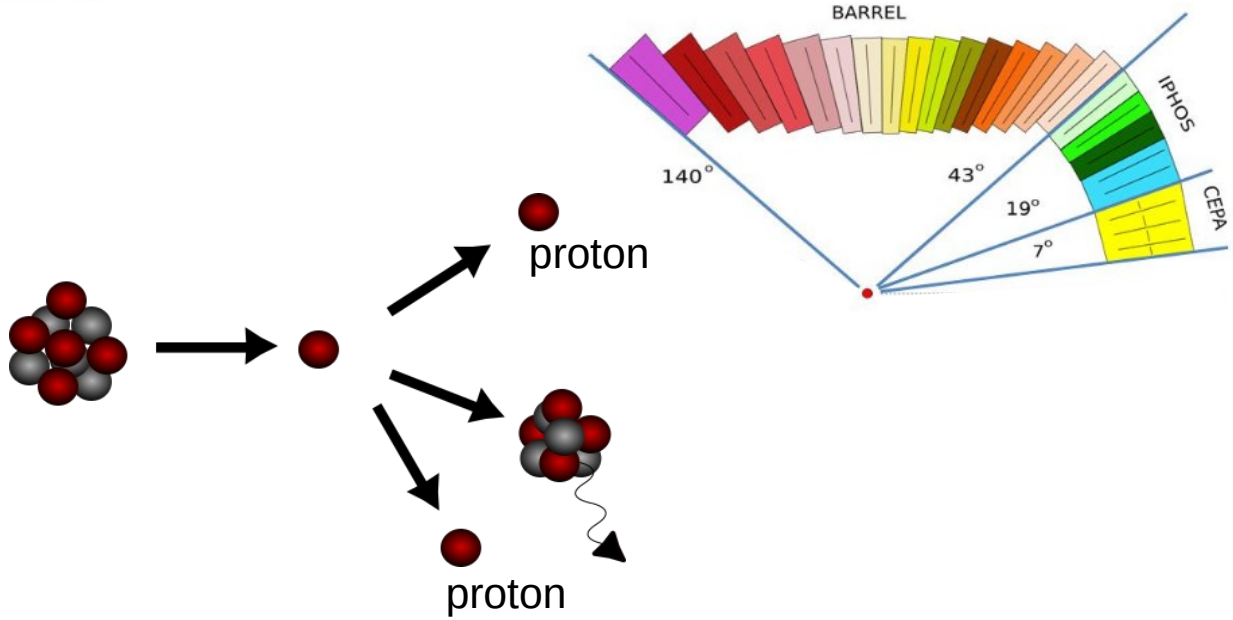
- Time Measurement (START & TOFW)
- Charge Measurement (TWIM Music)
- Flightpath Reconstruction:

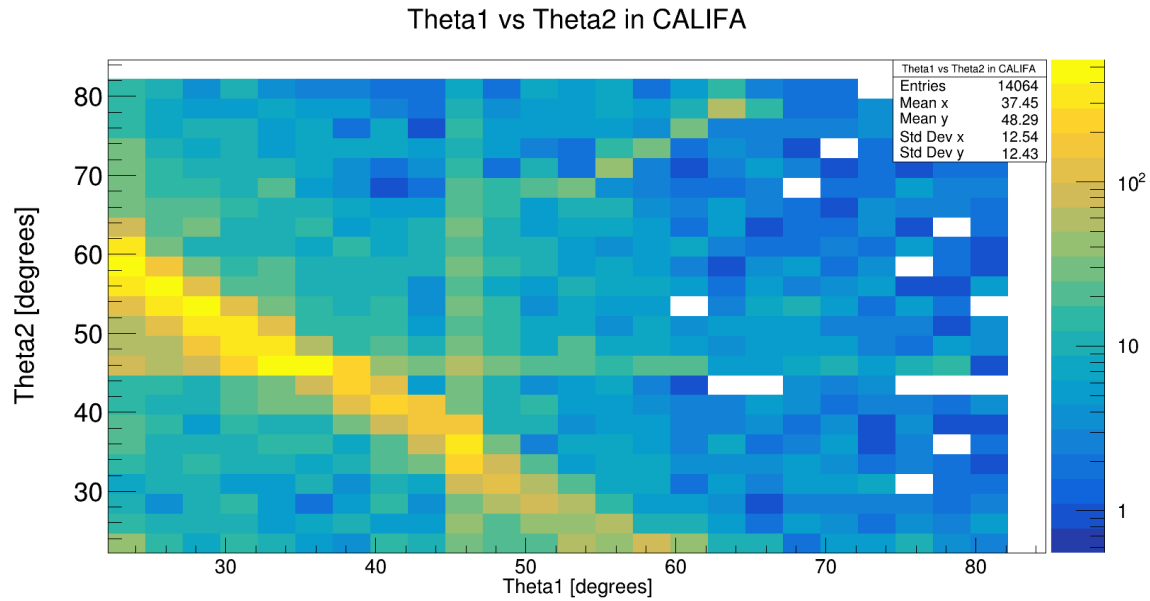


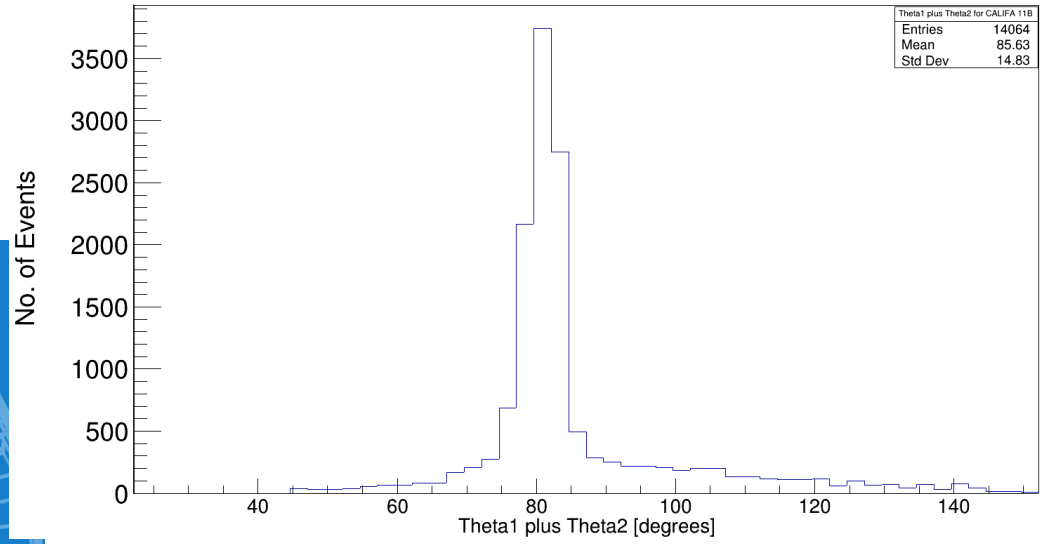
$$B*\rho = \frac{\beta*\gamma*M}{q}$$

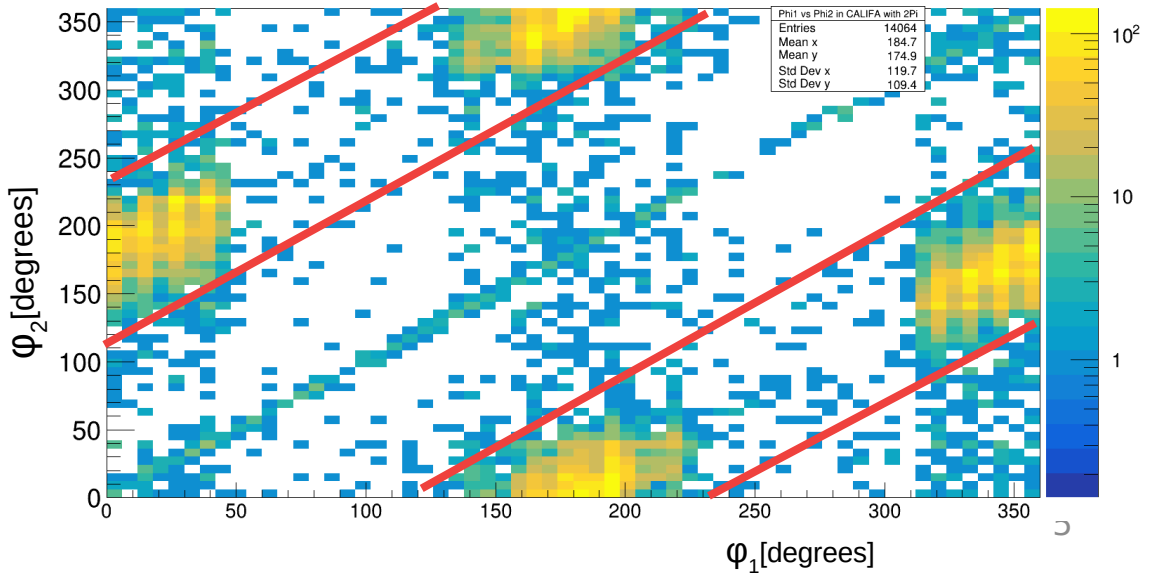


Identification of the two correlated Protons

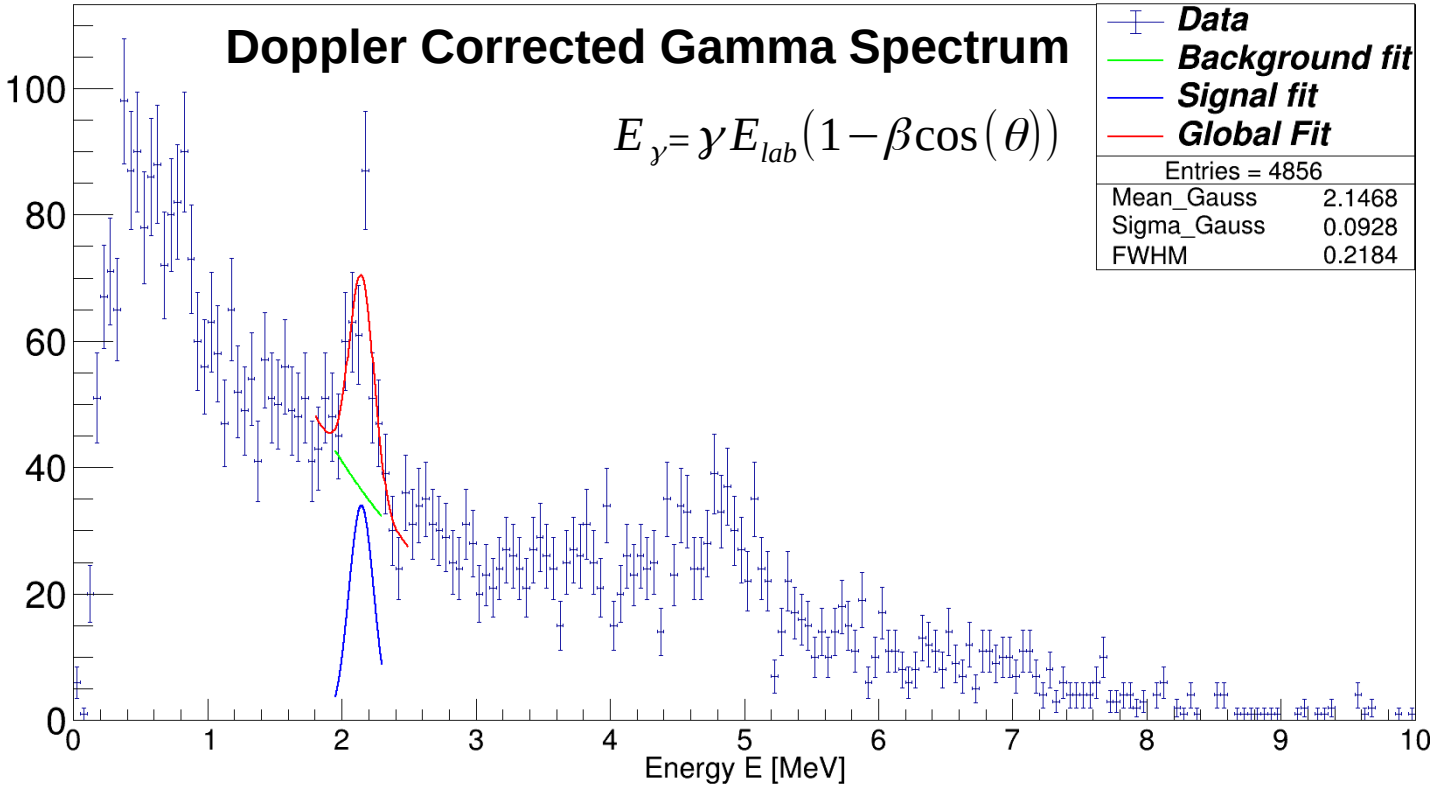


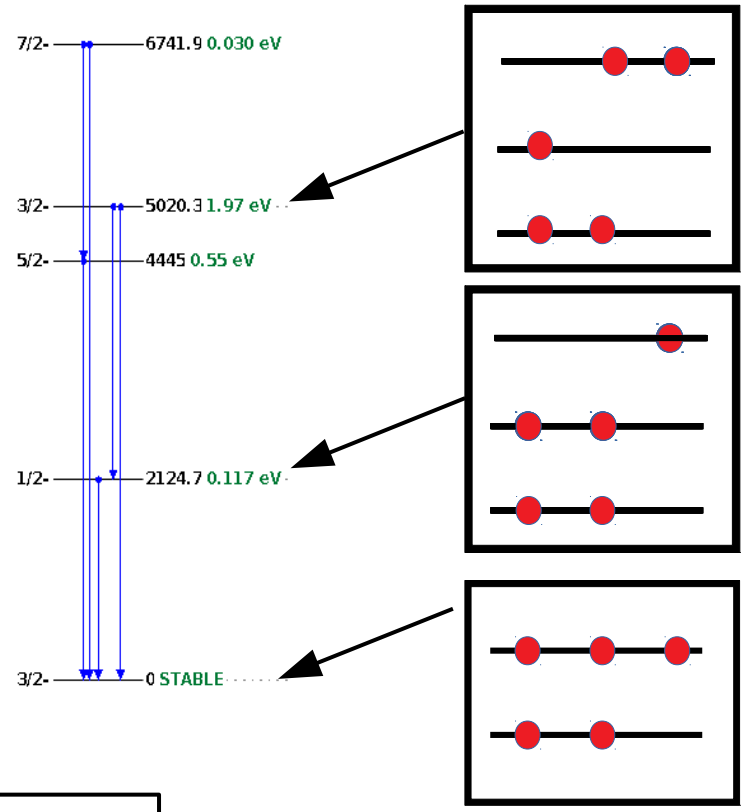






Gamma Spectrum of 11B



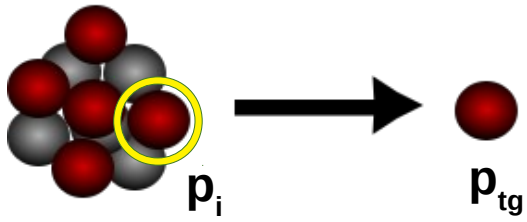


Event Selection Criteria:

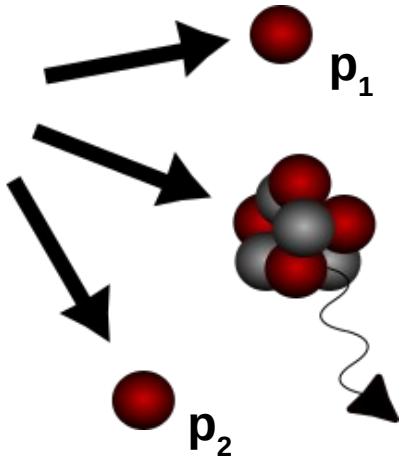
- ^{11}B fragment identification
- Two hits (protons) with E_{hit} > 30 MeV
- θ1 + θ2 < 90°
- Δφ = 180° +- 40°

Reconstruction of Inner Momenta

Before Scattering:



After Scattering:



(Four-)Momentum conservation relation:

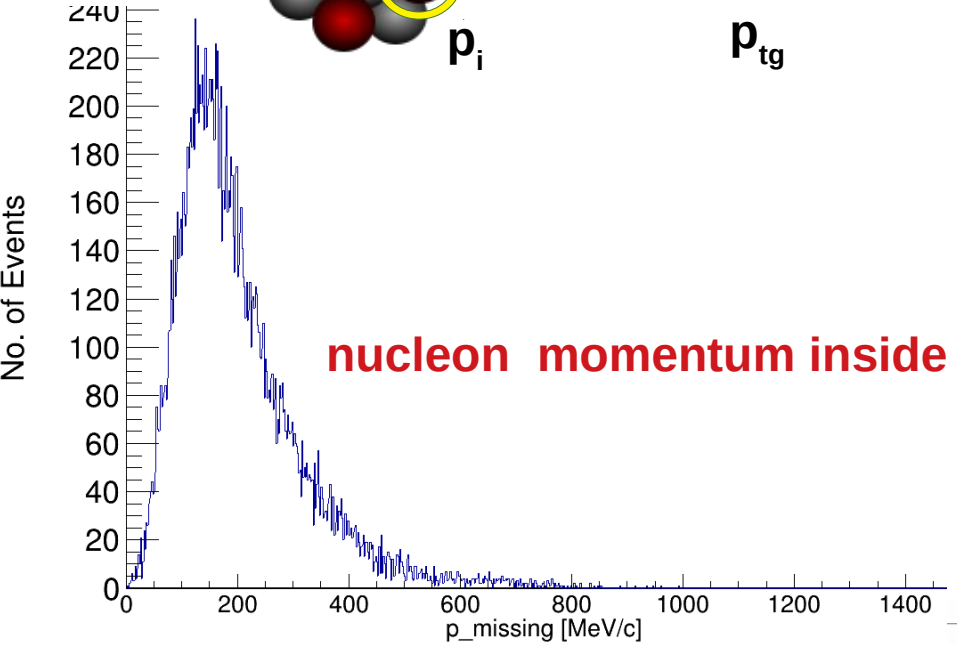
$$p_{12C} + p_{tg} = p_1 + p_2 + p_{11B}$$

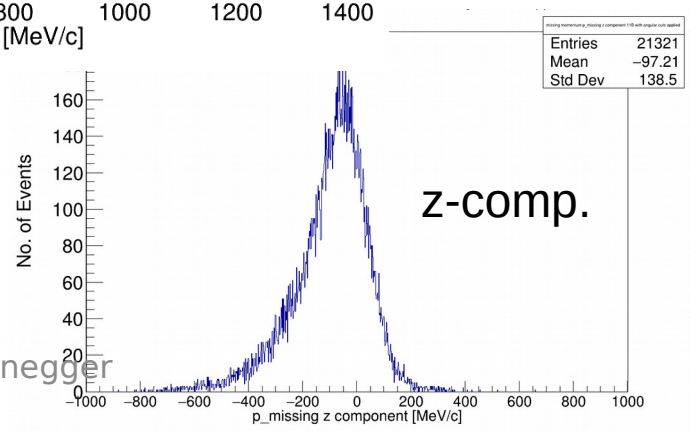
assuming QE scattering in mean field potential:

$$p_{12C} = p_i + p_{11B}$$

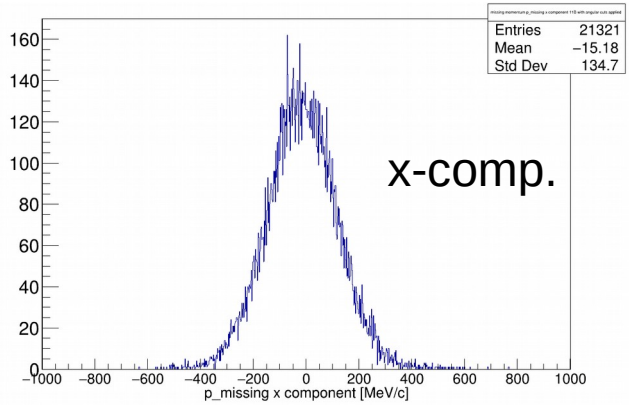
$$p_i \approx p_{missing} = p_1 + p_2 - p_{tg} \, (no\ ISI / FSI)$$

nucleon momentum inside 12C

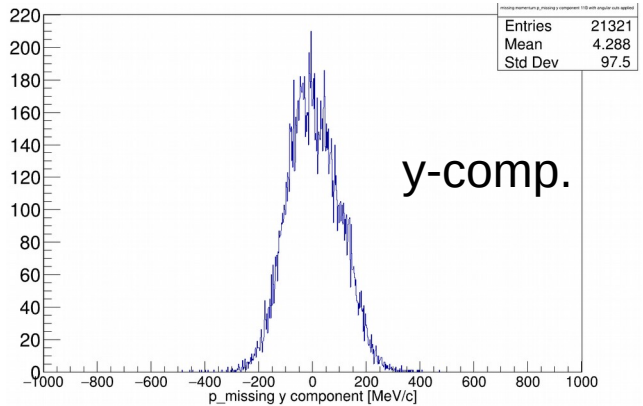




z-comp.



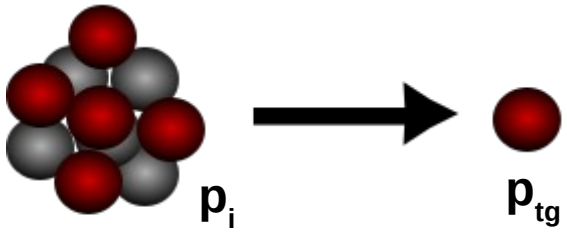
x-comp.



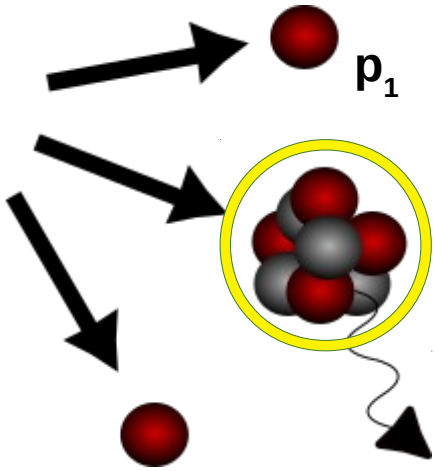
y-comp.

Momentum reconstruction of 11B

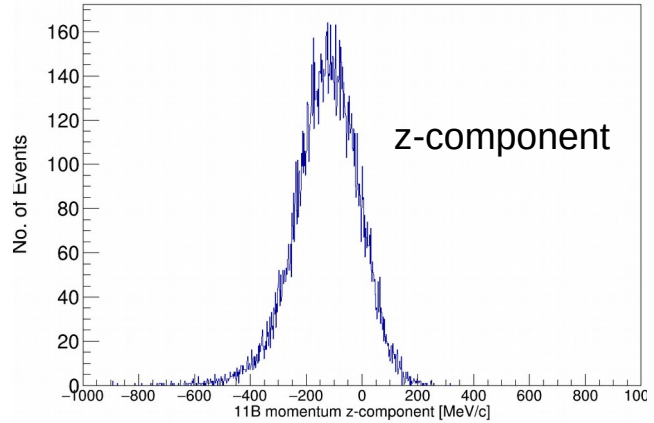
Before Scattering:

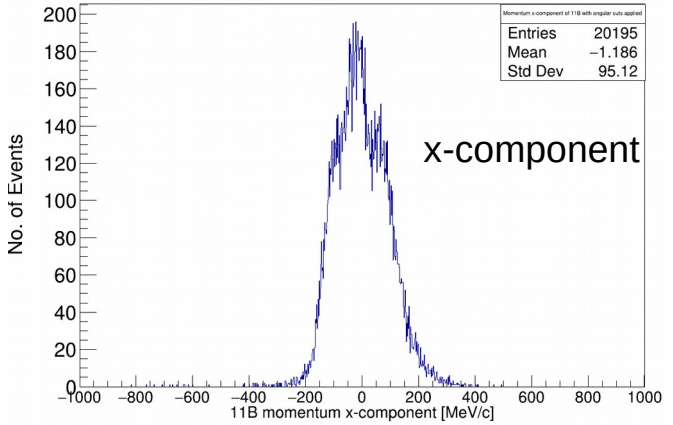


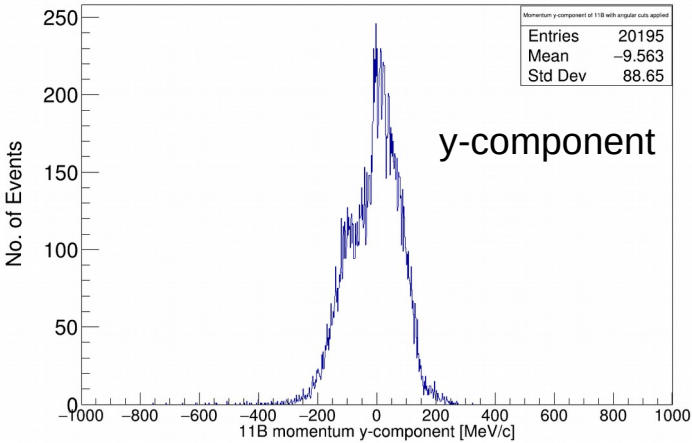
After Scattering:



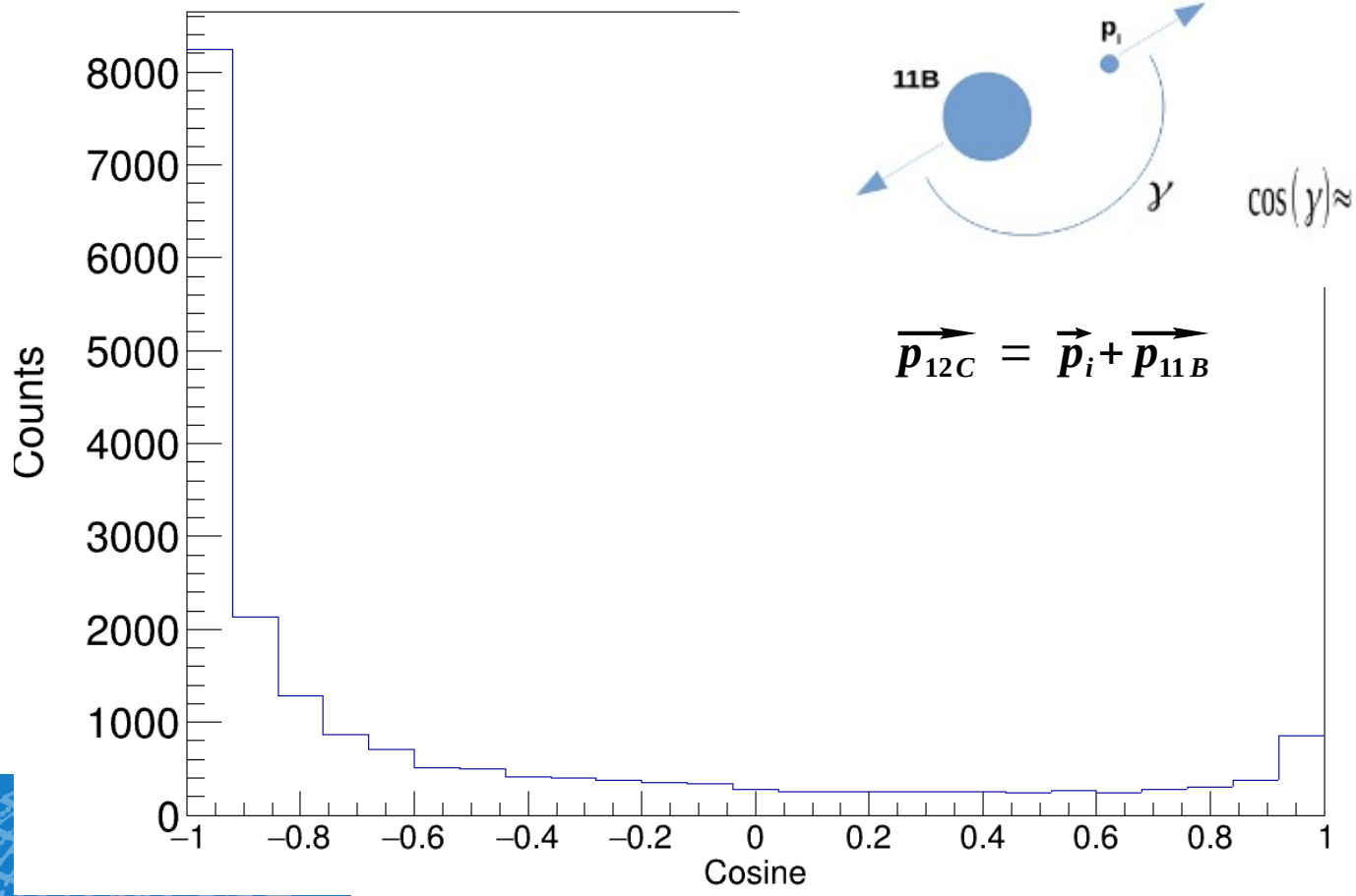
Spectator!





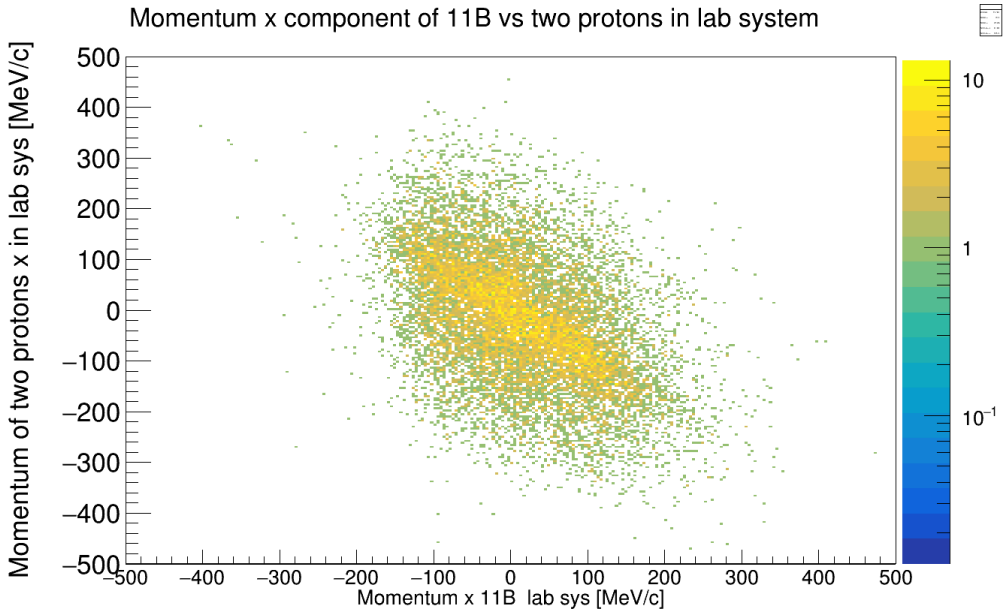


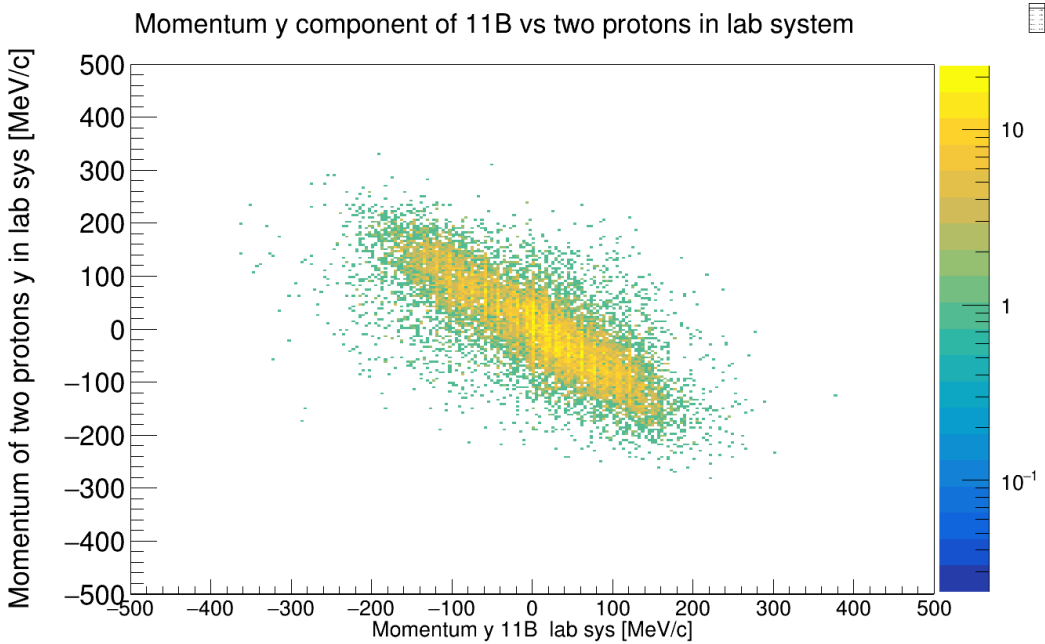
Correlations between Fragment and Proton Pair



$\cos(\gamma) \approx -1$

$$\overrightarrow{p_{12C}} = \vec{p}_i + \overrightarrow{p_{11B}}$$





Summary

Outlook

Thank you!

Special Thanks to:

GENP-USC Group (J. Benlliure, G. Garcia, A. Gonzalez, J. L. Rodriguez Sanchez, et. al.)

SOFIA Group (A. Chatillon, J. Taieb, et. al.)