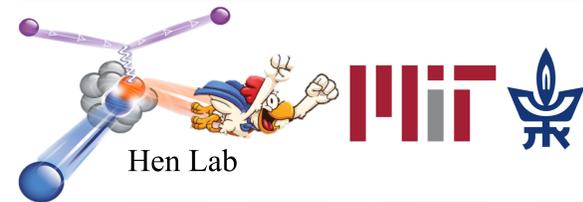


Detection of Residual Nucleus for Short Range Correlations (SRC) Studies at BM@N

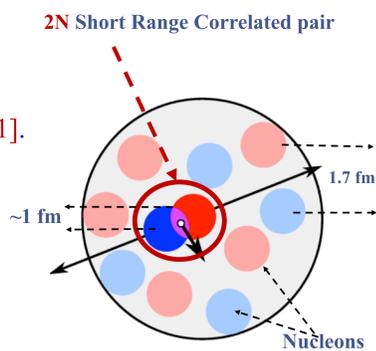


V. Lenivenko for SRC at BM@N collaboration
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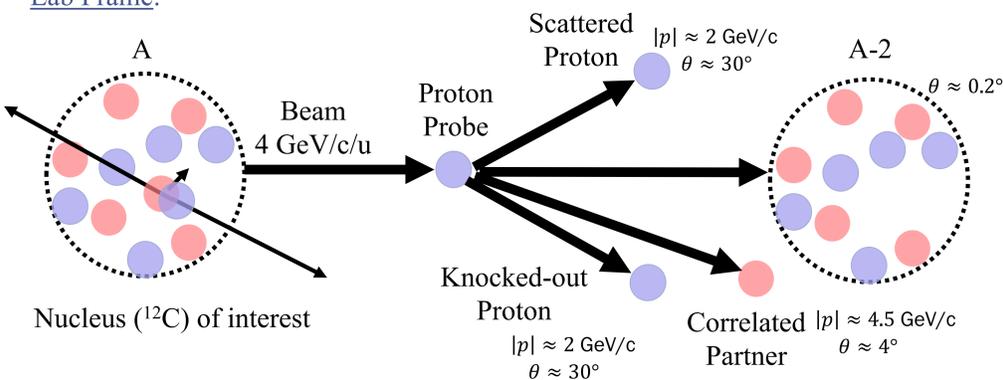


SRC in Inverse Kinematics

- Almost all high-momentum nucleons in a nucleus belong to SRC pairs
- Nucleons within SRC pairs have **high relative momentum and low center-of-mass momentum** [1].
- SRC pairs are the important part of the nuclear wave function and also **the densest objects available on Earth**
- They are relevant for understanding of **dense baryonic matter and neutron stars**
- They are also important for nuclear parton distribution functions and neutrino oscillations



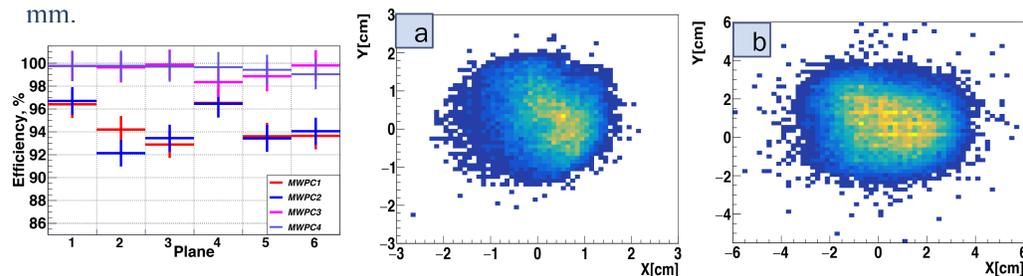
Lab Frame:



A-2 Identification

MWPC

Role of MWPCs: Beam monitor; Number of tracks; Beam track before the target; One MWPC has 6 planes[2]. Wire pitch $d = 2.5$ mm. Coordinate resolution $d/\sqrt{12} = 0.72$ mm.

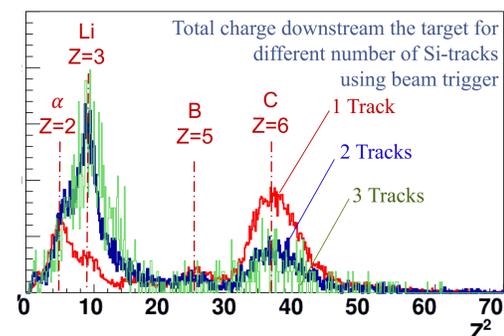


MWPCs efficiency per plane

Beam profile before(a) & after target(b)

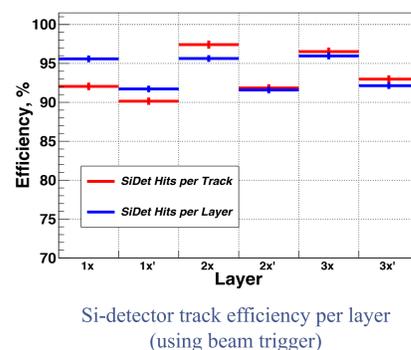
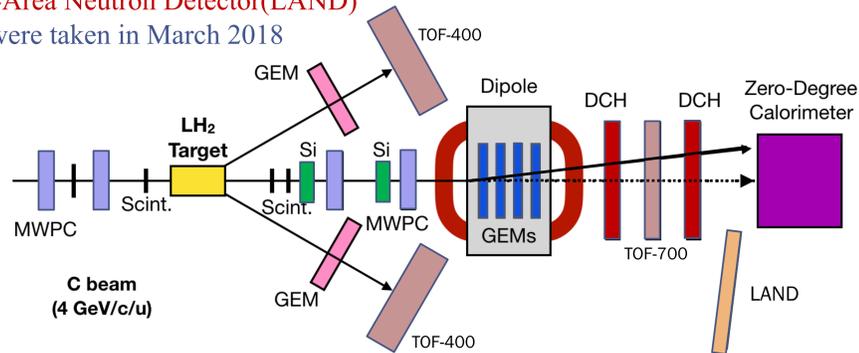
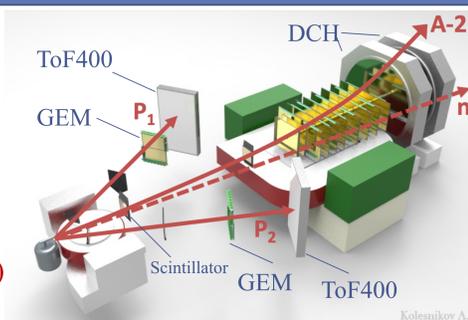
Silicon Detector

- High precision tracking
 - High loads
- Each detector has 640 straight strips with a pitch of 95 μm and 640 strips tilted by 2.5° with a pitch of 103 μm [3]. The detector thickness is 300 μm .

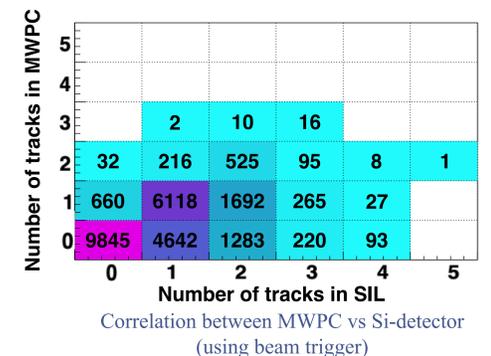


Experimental Setup

- We focus on:
- Gas Electron Multiplier (GEM) and Time of Flight (TOF-400) systems for the arms: measure momenta of the two protons and reconstruct the interaction point.
 - Scintillator detector - total Z^2 , 4 counters form the beam trigger
 - Multiwire Proportional Chambers(MWPC) Silicon detector(SIL) and Drift Chambers(DCH) : turning angle determination
 - TOF-700 + turning angle: define A and Z of the A-2
 - Large-Area Neutron Detector(LAND)
 - Data were taken in March 2018



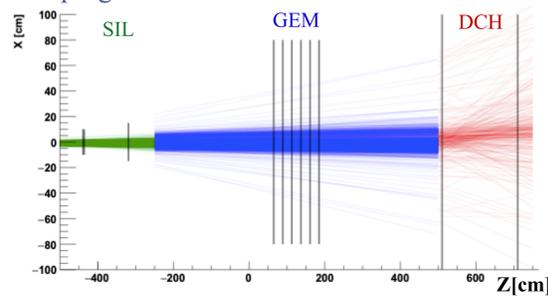
Si-detector track efficiency per layer (using beam trigger)



Correlation between MWPC vs Si-detector (using beam trigger)

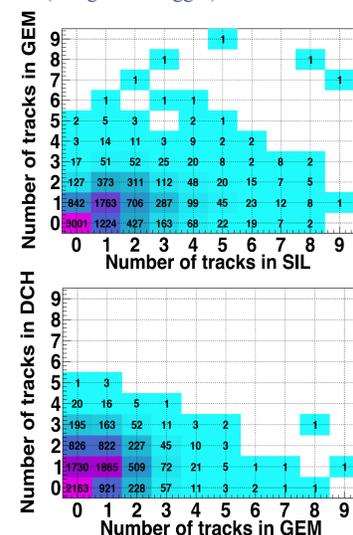
SIL+GEM+DCH Tracks

- Track matching between different subsystems is in progress

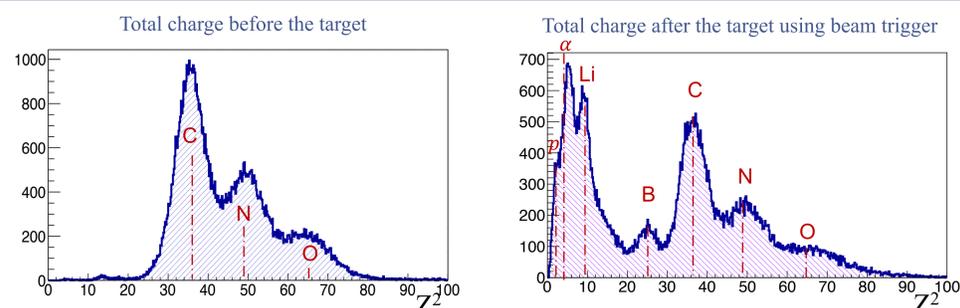


Tracks from Si-detector, GEM, DCH. B=0, empty target

Courtesy of S.Merts



Z² Before & After H2 Target



- Scintillator counters form the trigger: an incoming ion and a particle in each arm
- Signal amplitude ~ the total charge
- We see a rich spectrum of nuclei after target
- Together with the tracking information on the number of tracks \rightarrow what happens with the carbon nucleus after an SRC pair is knocked out?

Summary & Outlook

Last year, a new topic was added to the BM@N physics program – the first SRC measurement took data aiming at studying the properties of the residual nuclear system (A-2). The charge spectrum of the A-2 shows a wide range of different nuclei. The next step in the ongoing analysis is to set up the global tracking to check different combinations of the total charge using the number of tracks. The preliminary results from the tracking detectors show a realistic beam spot (MWPCs), reasonable number of tracks after the target (Si), correlation between different tracking systems. The tracking is going to be combined with the TOF information to provide identification (determination of A and Z) for the A-2.

References:

- [1] Hen, et al., Reviews of Modern Physics (2016)
- [2] Sauli F, 1976, CERN Yellow Reports 10.5170/CERN-1977-009
- [3] Kovalev Yu., et al., 2017, Journal of Instrumentation 12