

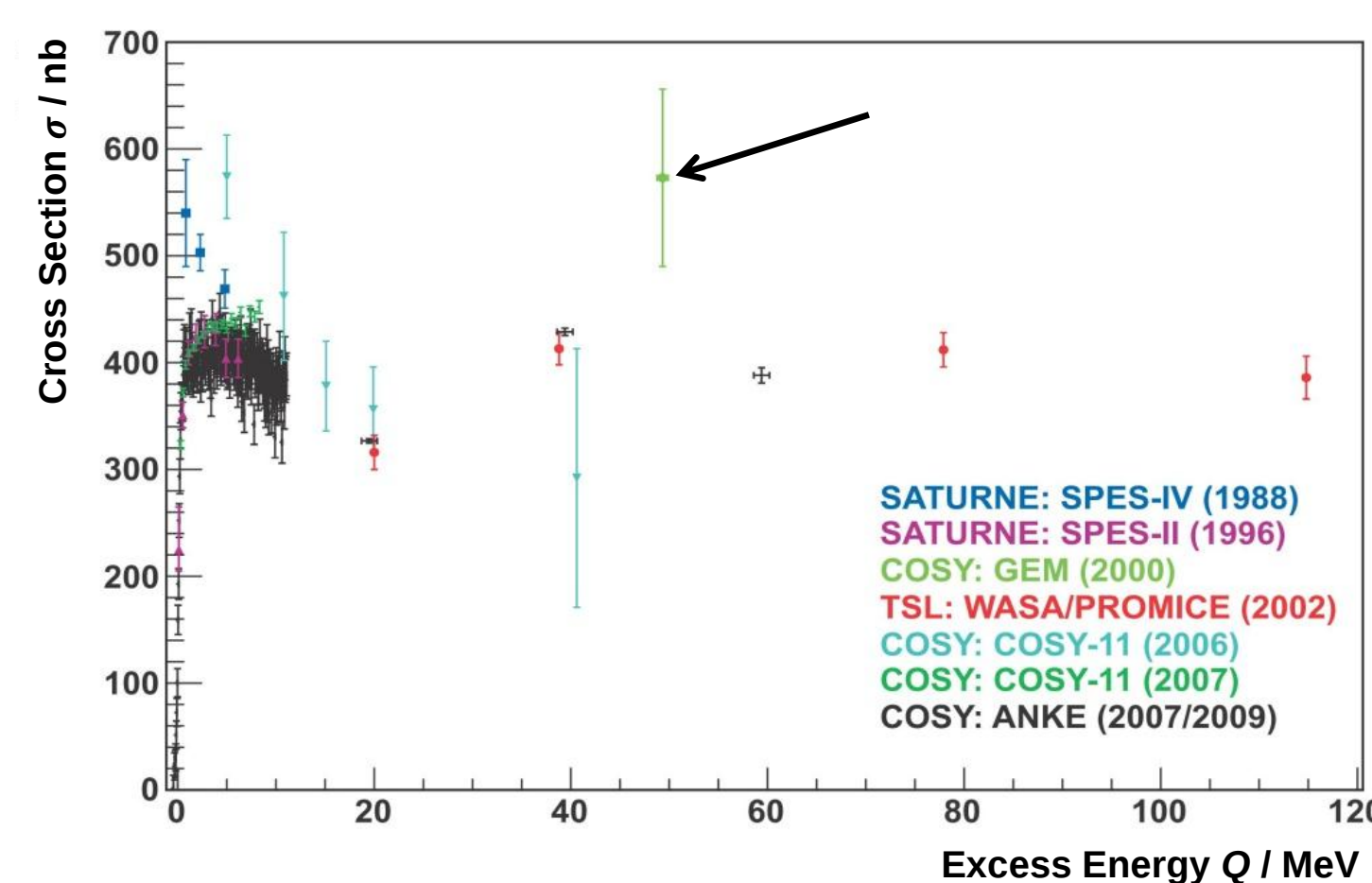
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Total and Differential Cross Sections of $pd \rightarrow {}^3\text{He} + \eta$ at 49 and 60 MeV Excess Energy

Motivation

- Strong energy dependence within the first MeV excess energy caused by an unexpected large final state interaction
- Evidence for an η - ${}^3\text{He}$ bound state

- Limited data set at higher excess energies
- Data from WASA/PROMICE and ANKE show a cross section plateau between 40 and 120 MeV



- 49 MeV GEM data point might indicate a cross section increase above this plateau But: Large normalization uncertainties
- A peak-like structure would be of high interest:
 - Reaction process?
 - Final state interaction?
 - Resonance?

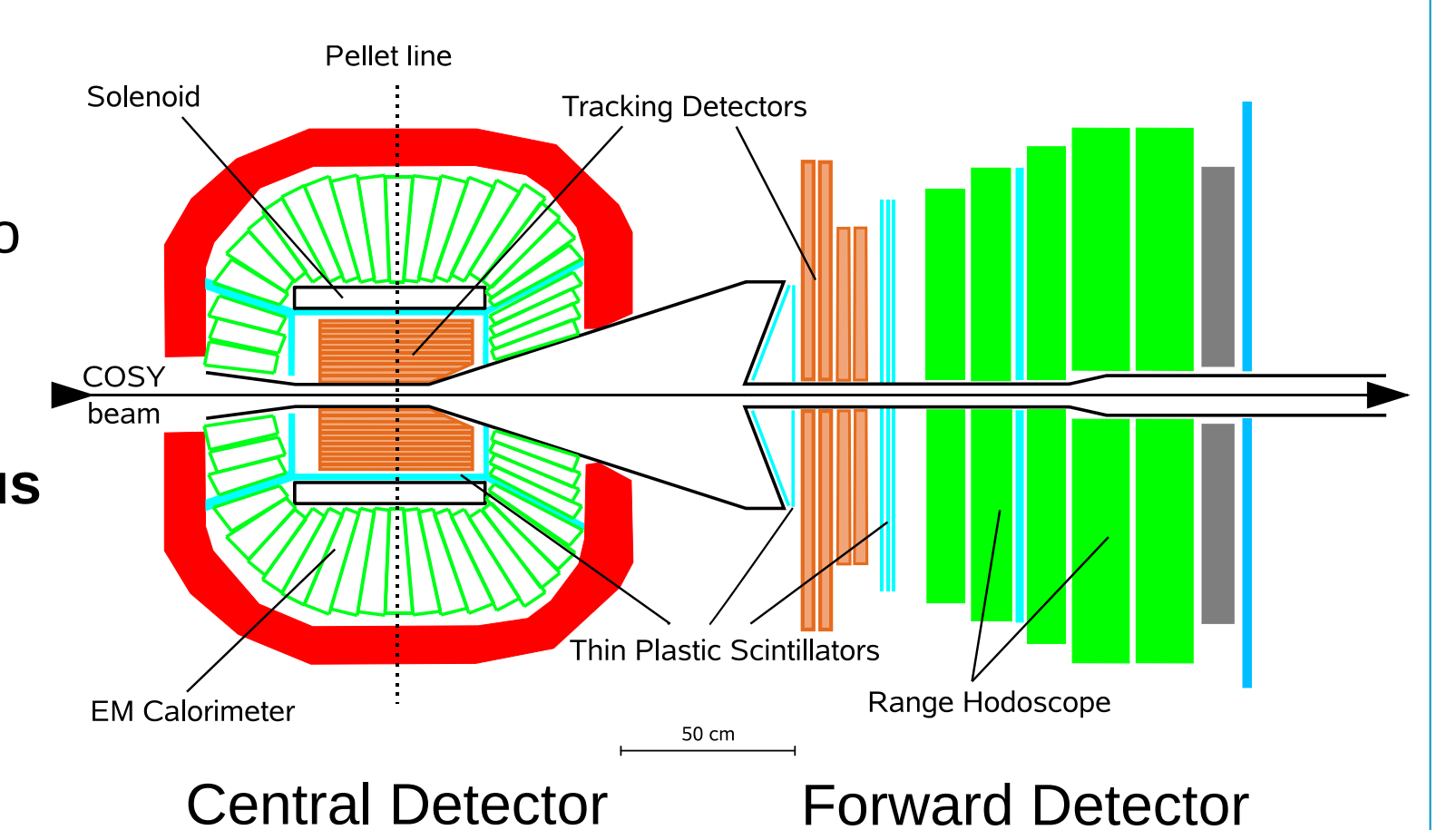
Experiment

COSY – Cooler Synchrotron

Provides an (un)polarized proton or deuterium beam with momentum of up to 3.7 GeV/c [1]

WASA – Wide Angle Shower Apparatus

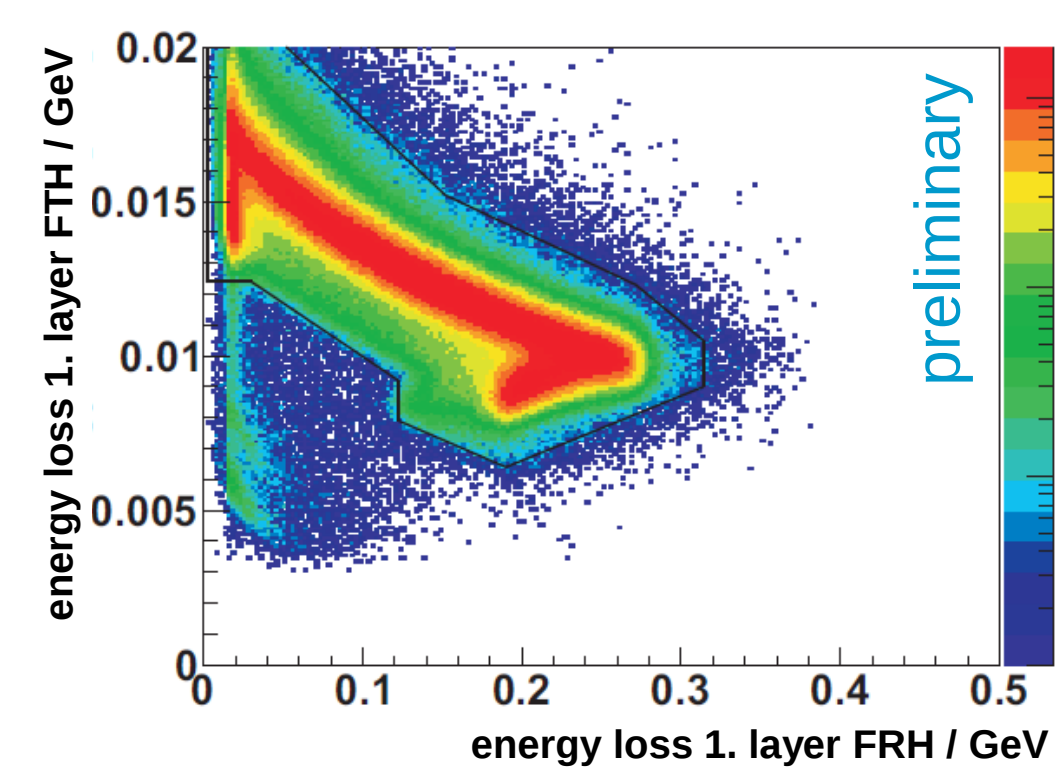
- Frozen hydrogen or deuterium pellets as an internal target
- The central part can detect neutral as well as charged particles with a near 4π -acceptance
- The forward detector is used for detecting charged particles like protons, deuterons and He nuclei [2]



[1] R. Maier, Nucl. Instrum. Meth., doi:10.1016/S0168-9002(97)00324-0
[2] H.-H. Adam et al. (WASA-at-COSY Collaboration), arXiv:nucl-ex/0411038

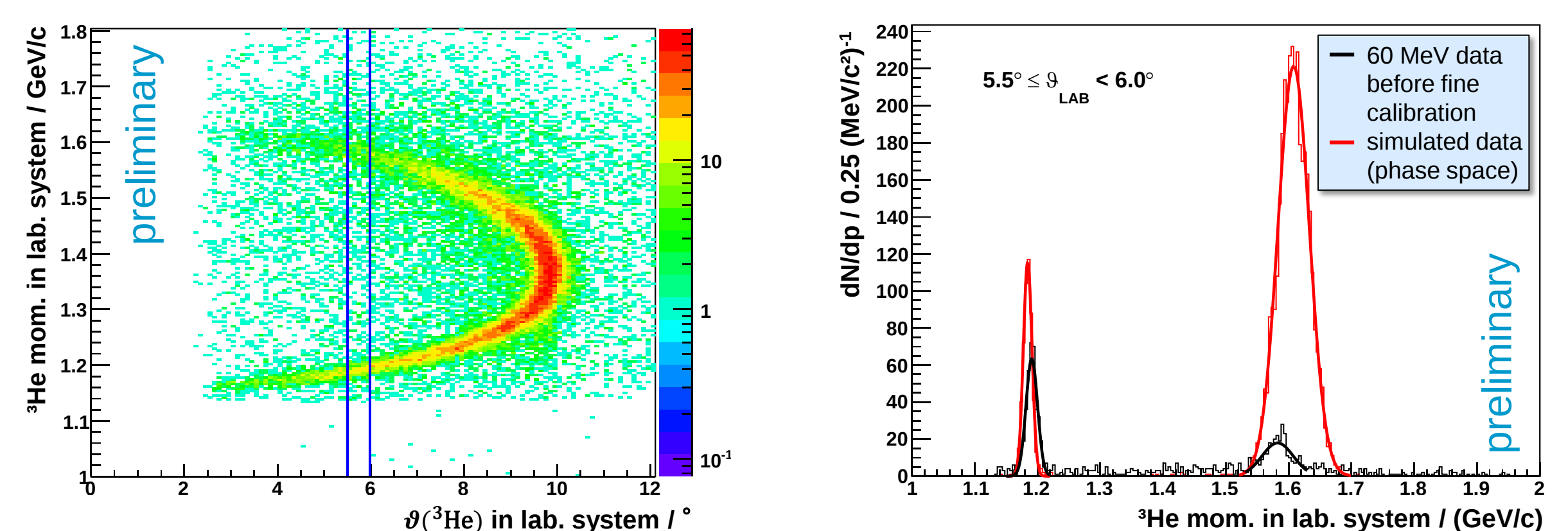
Data Sample

- Data for the reaction $p + d \rightarrow {}^3\text{He} + \eta$ at 49 MeV and 60 MeV excess energy were taken with WASA-at-COSY
- Relative normalization of both data sets possible
- Preselection on $p + d \rightarrow {}^3\text{He} + X$ events via ${}^3\text{He}$ identification in ΔE - E plot (energy loss in Forward Trigger Hodoscope versus energy loss in Forward Range Hodoscope)



Systematics

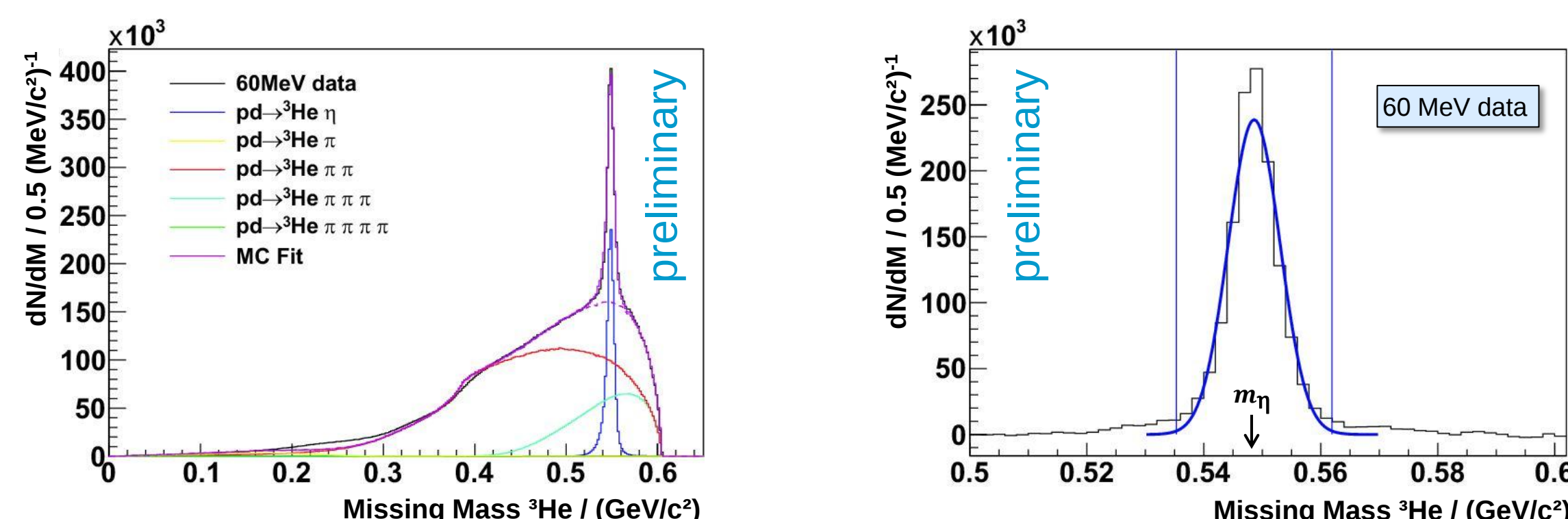
- Fine calibration of ${}^3\text{He}$ momenta by precisely measured scattering angles (two-body reaction)
- Measured data are compared to the momenta expected by Monte Carlo simulations



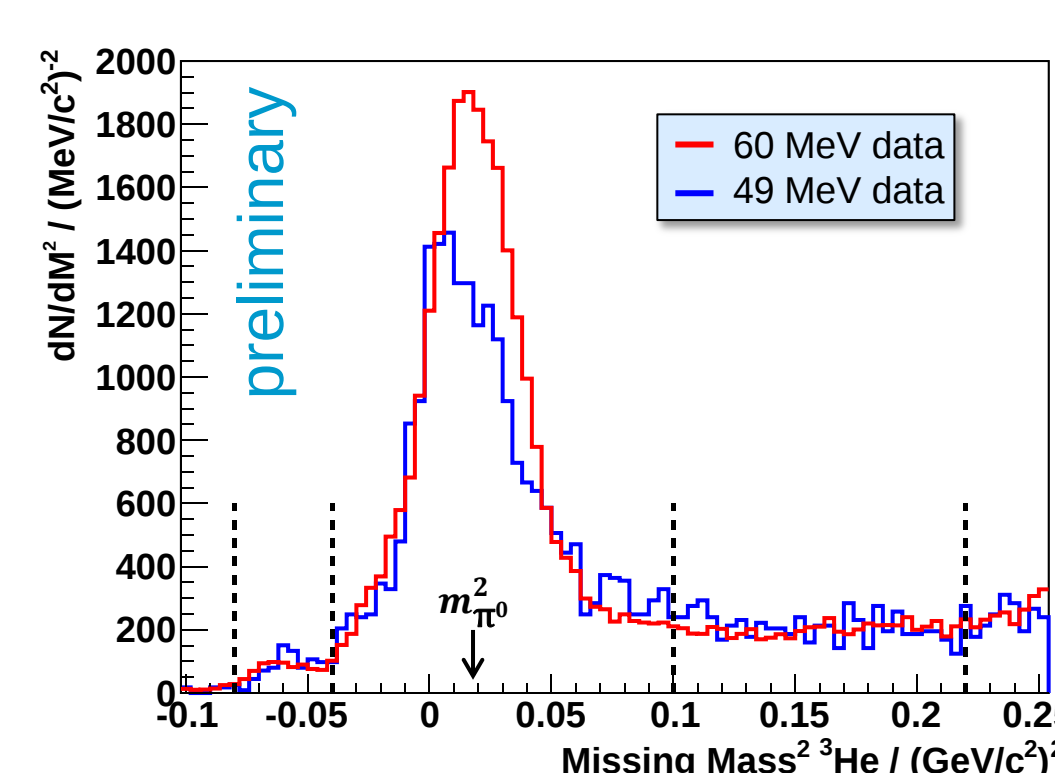
- Further systematic checks and optimization of the analysis to minimize the systematic uncertainties in progress

Analysis

- The numbers of η events are extracted from the ${}^3\text{He}$ missing mass spectra of different angular ranges
- The background for each $\cos \vartheta_{\text{CMS}}$ bin is fitted with MC simulations and subtracted



- Clear η -meson signal is visible in all $\cos \vartheta_{\text{CMS}}$ bins
- Relative normalization $\left(\frac{\sigma(49 \text{ MeV})}{\sigma(60 \text{ MeV})}\right)$ is done via the single pion production $p + d \rightarrow {}^3\text{He} + \pi^0$
- Absolute normalization to the 60 MeV ANKE cross section



First analysis and determination of cross sections by A. Passfeld (diploma thesis)

Preliminary Results

- New data point proves the plateau even at 49 MeV excess energy
→ A peak at 49 MeV can be excluded
- Precise angular distribution at 49 MeV and 60 MeV excess energy
- The angular distributions of the 49 MeV GEM data and WASA data are in agreement

