In-Medium Neutron Structure Functions with TDIS mTPC

Arun Tadepalli – Jefferson Lab

Thank you for the conversations!

Thia Keppel

Steve Wood

Rachel Montgomery

Carlos Ayerbe Gayoso
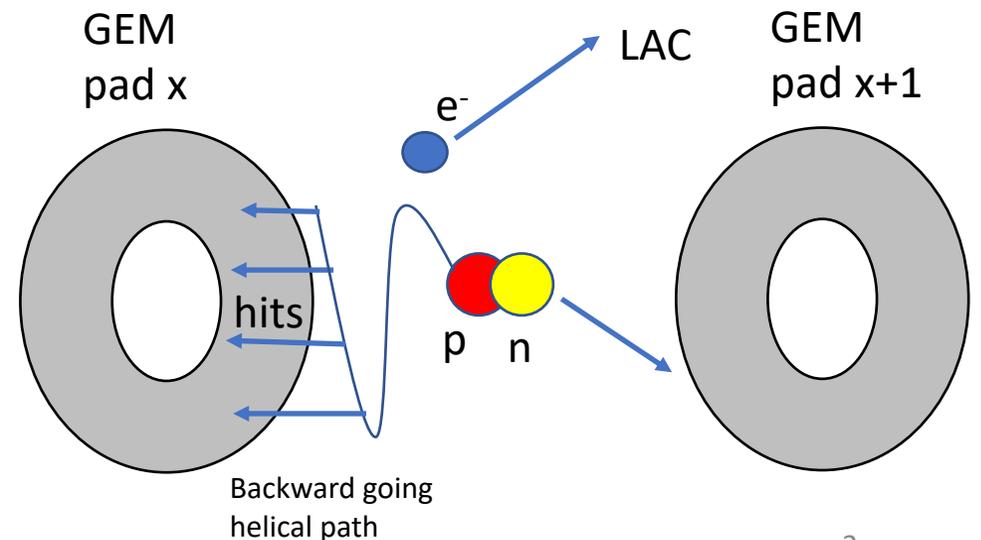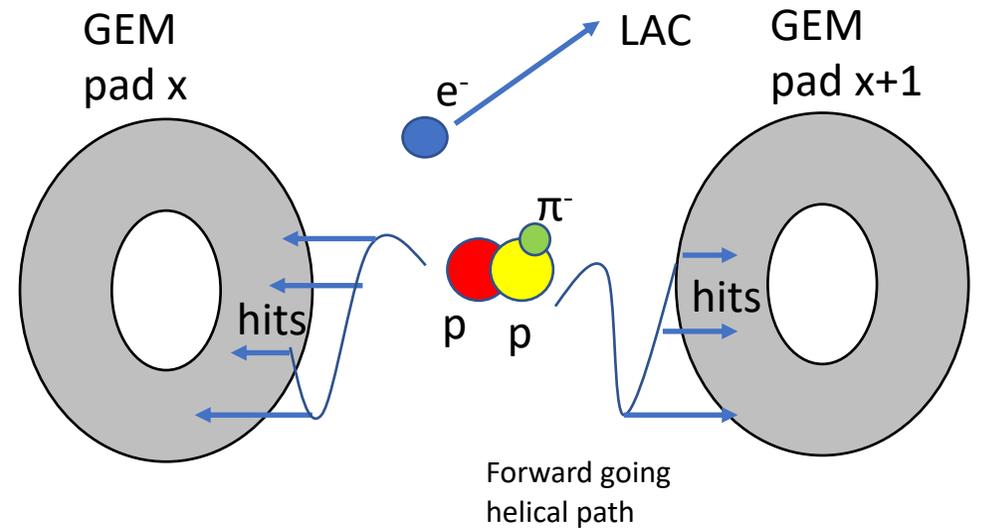
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A range of phenomena in the deuteron can be studied with our mTPC depending on the momentum of the recoil proton

- Cynthia Keppel

Introduction

- Our goal for TDIS is to study meson structure functions

- Electron beam impinges on a deuterium target and we reconstruct protons (forward going helix) and another proton (another helix) with our mTPC

- Under some special circumstances, the proton could recoil with relatively high momentum

GEM pad x

LAC

GEM pad x+1

e⁻

π⁻

hits

hits

p   p

Forward going helical path

GEM pad x

LAC

GEM pad x+1

e⁻

hits

p   n

Backward going helical path

What (else*) can we get out of this?

- One can compare the in-medium modified neutron structure function compared to "free" neutron structure function

- Studying the nuclear modification as a function of the recoil momentum and scattering angle of the proton would tell us how the correlations between proton and neutron affect the bound neutron structure function

- Anyway we have to be able to do track reconstruction for TDIS like events and these would be the background (or is it??)

else* = added by Thia

Questions…

- What are the:
  - Rates?
  - Momentum distributions of the recoil protons?
  - Resolutions of our detector in context to what we want to look at?

- How does this affect our experiment? i.e. if this is a background for TDIS, then we would have to implement it at the generator level

Other experiments and studies…

- DEEPS (E94-102) looked into modified structure function by tagging spectator protons

- BONuS (E03-102) looked into this as well?

- ALERT (Hall B) does something similar for recoil protons off a variety of nuclei (deuterium, ^{3}H, ^{3}He and ^{4}He) with a luminosity of 3x 10^{34} cm^{-2}s^{-1}

- Carlos had a chat with Rey Cruz Torres. Summary below:
  - Interesting idea!
  - Similar to what BAND (LAD) did (plan to do) in Hall B (C) to measure but with a recoil neutron (https://pdfs.semanticscholar.org/3bd0/f520a352872f3fac21917846b0fca5544f19.pdf)
  - Strongly recommended using AV18 potential for rate estimates
  - Theory center at JLab has also developed some code. Might be interested in that?

Summary

- Although the rates will be dominated by QE, insight into this topic (and many other interesting topics) would be a natural consequence of track reconstruction (once it is demonstrated)

- We would have to incorporate this process at the generator level since it would be a "background" and understand the rates if so