

$eA \phi$ - Latest Progress

Exclusive, Diffraction, Tagging Physics Working Group

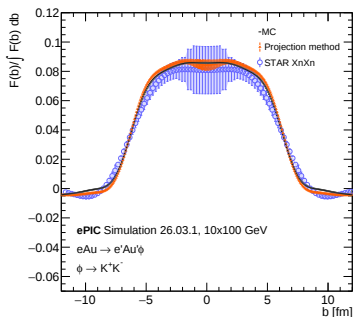
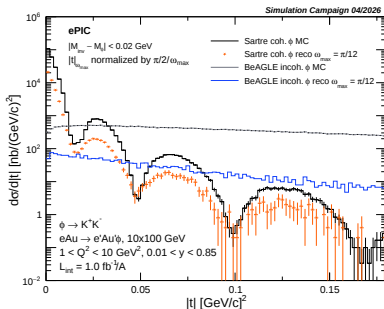
Maci Kesler

Joint ePIC/EICUG Meeting
University of Glasgow, Scotland, UK

July 11 - 17, 2026



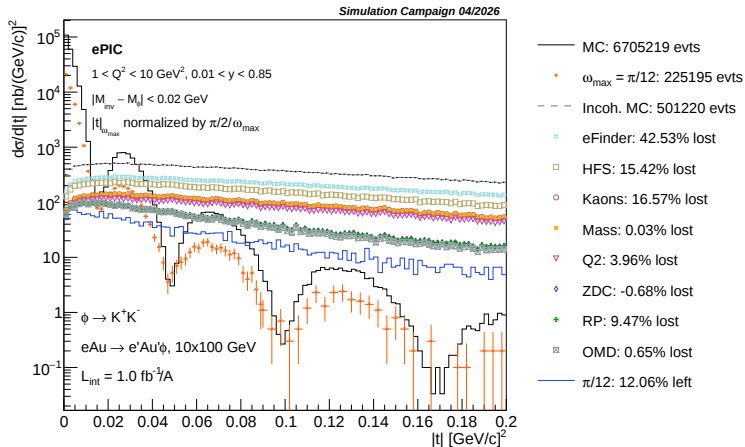
Results for NIM A paper



- These plots are in ESR and finalized
- "Imaging program of heavy nuclei and saturation physics" portion of paper **updated and completed**

Now working on incoherent separation

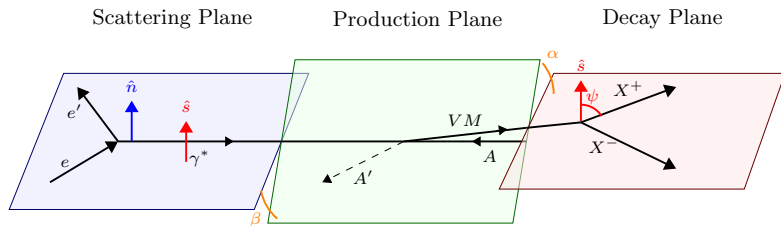
Motivation



Detector cannot suppress all incoherent background

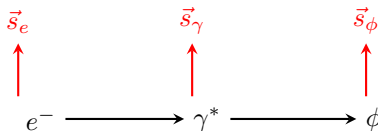
Spin Projection

Measure decay angle of VM wrt electron beam polarization



- **Difference in spin transfer** between coherent & incoherent
- VM **azimuthal decay patterns** should also **differ**
- ψ measured relative to spin axis → **longitudinal or transverse polarization**

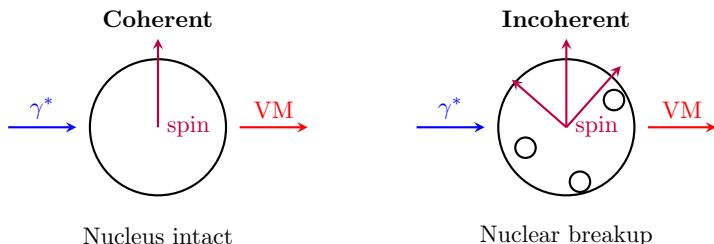
Coherent Processes



Spin transfer through spin-0 Pomeron

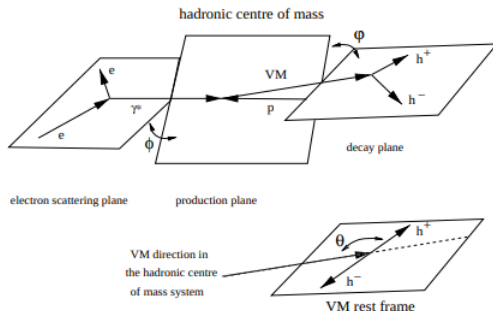
- In $ep \rightarrow$ **photon polarization** almost fully **transferred to VM**
HERMES Collab.: [10.1140/epjc/s10052-011-1609-2](https://arxiv.org/abs/10.1140/epjc/s10052-011-1609-2)
- In UPCs $\rightarrow$ **VM spin aligned with photons polarization**
STAR Collab., <https://doi.org/10.1103/w977-dnxq>
- Alignment results in **azimuthal modulation in daughter emission** wrt VM momentum

Incoherent Processes



- **Little azimuthal modulation has been observed**
- **Correlation** between polarized photon and VM spin **not fully preserved**
- **Can be experimentally tested:**
 - In UPCs: measure spin alignment of incoherently produced VMs wrt reaction plane
 - In eA: measure polarization of an incoherent process at a given $|t|$

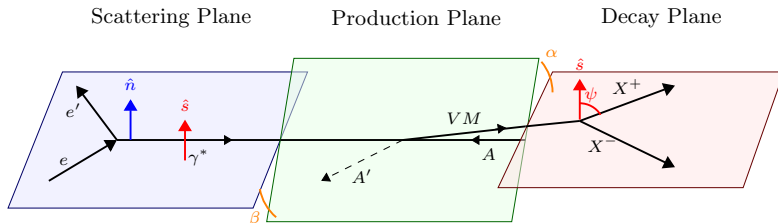
Traditional Spin Density Matrix Element (SDME) Method



H1 Collab: [https://doi.org/10.1007/JHEP05\(2010\)032](https://doi.org/10.1007/JHEP05(2010)032)

- **Quantization axis: -target momentum ($-P_A$)**
- $\cos 2\phi$ modulation wrt this axis
- Traditional formalism by Schilling and Wolf: Nuclear Physics B61 (1973) 381-413

Spin-axis Projection Method



M. Kesler, A. I. Sheikh, et. al.: 10.1016/j.physletb.2026.140585

- **Quantization axis: $\hat{n}$**
- $\cos 2\psi$ modulation wrt this axis
- Coherent $\rightarrow$ strong spin transfer
- Incoherent $\rightarrow$ little to no alignment

Separating Coherent From Incoherent Production

Goal:

Take advantage of **differences in** degree of **spin alignment**

Implementation Plan:

- 1 Define quantization axis
- 2 Rotate and add spin weights
- 3 Reconstruct ψ
- 4 Compare coherent and incoherent distributions

Summary

Latest Progress

- ESR plots finalized
- Diffractive ϕ analysis finished for NIM A paper
- Spin-based method for **coherent/incoherent separation in progress**

Next Update

- Present first ψ distributions

Thank you :)

