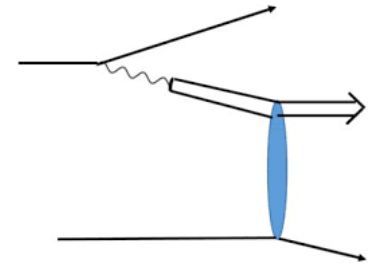


Exclusive and Tagging Group: Golden Channels and other news

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ATHENA Monthly PM meeting
July 1st, 2021

- Discussions: Lessons from HERA
- Golden Channels
- Monte Carlo Comparisons



Golden channels – goals & questions

- A mixture of reactions to challenge different parts of the detector
- Many of our channels factorize into ‘central’ & far-forward parts
 - ◆ The latter are mostly from nuclear breakup
 - ◆ Backward/u-channel production is the exception
- Spectroscopy (e. g. XYZ states) is included in our charge
- Far-forward detector design and resolution at low t will be largely similar between the detector proposals, so we should focus on channels which challenge the central detector.
 - ◆ Coherent light ions are mostly limited by far-forward detectors.
Should this be a key (partial) channel for the ATHENA proposal?
- We need channels for which MC generators exist
 - ◆ For many channels, we have multiple MC generator, but we do not know how well they agree with each other?
- Should all golden channels be at the top beam energy?
 - ◆ Backward production is probably better at lower energies

Golden Channel List

- Incoherent DVCS on deuteron + π^0 + BH (central γ or $\gamma\gamma$ + p + n)
- TCS (central e^+e^-)
 - ◆ more challenging than J/ψ photoproduction channel
- Φ in eA (central K^+K^- + intact/dissociated ion)
- Y in ep (e^+e^- or $\mu^+\mu^-$)
 - ◆ Show that we can see first (or 2nd or 3rd) minimum
 - ✦ 2nd or 3rd minimum is needed to avoid windowing artifacts in the Fourier transform to $F(b)$
 - ✦ Could do this with other mesons instead (or also)
 - ◆ Need decent mass resolution to separate 3 Y states
- Other possible channels
 - ◆ Backward/u-channel production of $\omega \rightarrow \pi^0\gamma$
 - ✦ A challenge for forward calorimetry
 - ◆ $Z_c^+ \rightarrow J/\psi \pi^+$
 - ✦ σ largest at threshold \rightarrow forward focused. Or look at $X \rightarrow J/\psi \pi^+\pi^-$

Generators

- 4 vector meson generators with partially/mostly overlapping final states
 - ◆ SARTRE, BEAGLE and eSTARlight, lager
- Do they agree with each other? Do they agree with HERA data?
 - ◆ Proposal: pick a set of channels. Have each MC proponent (or ??) generate a set of events (in HEPMC format or ?),
 - ◆ An independent party will compare the cross-sections, & distributions of rapidity, Q^2 , M , t and decay product angles
 - ✦ In multiple Q^2 ranges since the cross-section drops so quickly with Q^2 ?
 - ✦ Other variables to compare (outgoing electron or proton/ion?)
 - ◆ Looking for an independent volunteer to lead this
- Possible channels for comparison:
 - ◆ $ep \rightarrow epp + \text{direct } \pi^+\pi^- \rightarrow ep\pi^+\pi^-$ at HERA energies
 - ◆ $ep \rightarrow ep Y(1S) \rightarrow eAuee$ at HERA energies
 - ◆ $eAu \rightarrow eAu Y(1S) \rightarrow eAuee$ 18 GeV e^- on 110 GeV/n Au
 - ◆ $eAu \rightarrow eX \phi \rightarrow eXK^+K^-$ 18 GeV e^- on 110 GeV/n Au