

Diffraction physics working subgroup

Photo/electro-production at an EIC

Samuel Heppelmann
UC Davis & LBNL

Overview of eSTARlight

Coherent photonuclear cross-sections are parameterizations of $\sigma(\gamma p)$ from HERA/fixed target data or theory

Convolution of photon flux from electron with $\sigma(\gamma p \rightarrow \nu p)$

- Both depend on Q^2

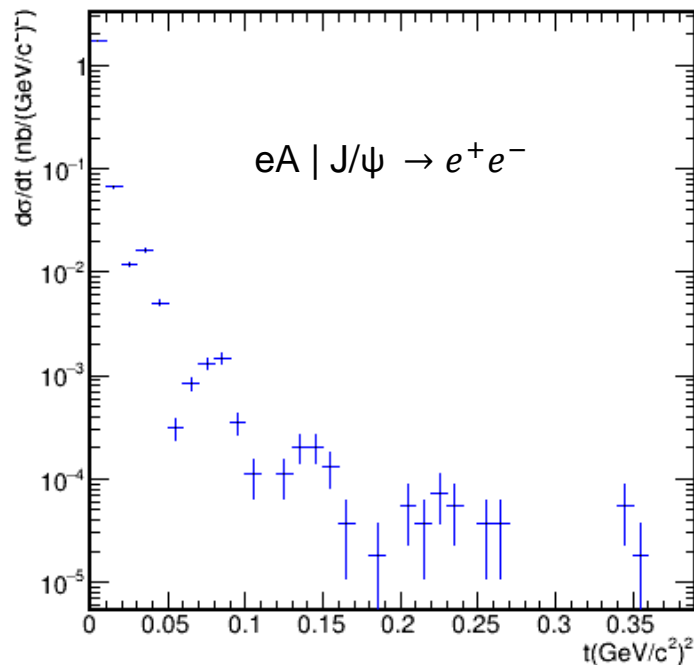
Weizsacker-Williams photon flux (with non-zero Q^2)

Nuclear targets included with a Glauber calculation

Vector mesons retain the photon spin

- For $Q^2 \sim 0$, transversely polarized
- As Q^2 rises, longitudinal polarization enters
- Spin-matrix elements quantified with HERA data

Embodied in eSTARlight code, available at:
<http://estarlight.hepforge.org>



Summary of studied channels: kinematics

Please list channels where kinematic distributions have been studied and required coverages are available

Measurement/ process	Main detector requirement (if known/anticipated)	Expected plot for the YR	Physics goal/topic	Contact person	Comments
Electro/Photo- production J/ ψ Upsilon 1S, 2S, 3S	Central Detector Scattered Electron Forward Detector for nuclear fragments to separate coherent/incoherent	Gluon distributions as a function of x and b_{\perp}	Gluon Dist. 3D Gluon imaging	S. Klein S. Heppelmann	Systems studied: e+p e (18 GeV) p (100 & 250 GeV) e+A e (18 GeV) A (100 GeV)

Summary of studied channels: fast simulations

Measurement/ process	Main detector requirement (if known/anticipated)	Expected plot for the YR	Physics goal/topic	Contact person	Comments
Electro/Photo- production J/ ψ Upsilon 1S, 2S, 3S	Central Detector Scattered Electron Requires less than 1% momentum resolution	Gluon distributions as a function of x and b_{\perp}	Gluon Dist. 3D Gluon imaging	S. Klein S. Heppelmann	EICRoot Framework Detector Setups: <ul style="list-style-type: none">• LBNL All-Si• BeAST

Channel 1:

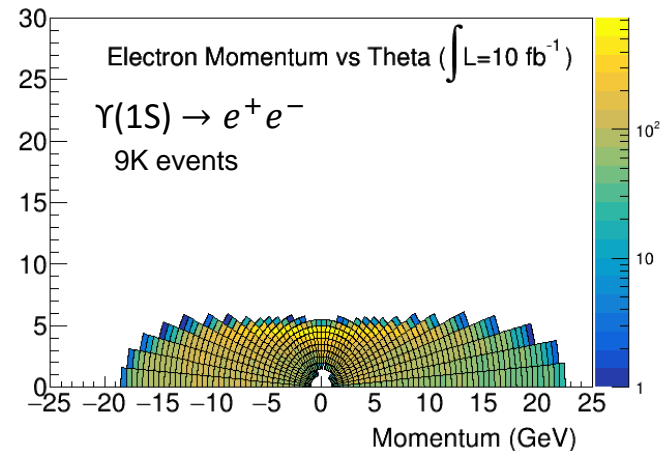
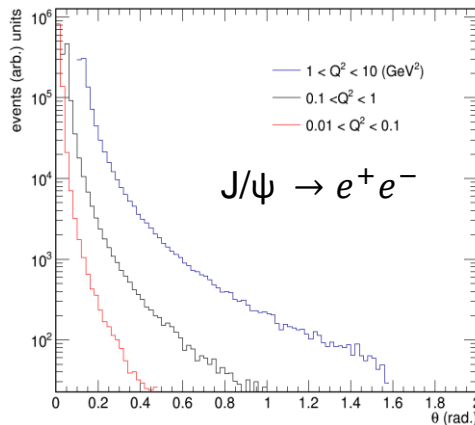
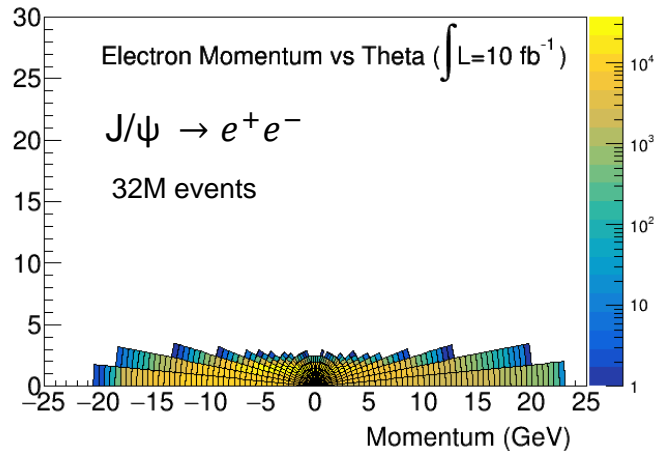
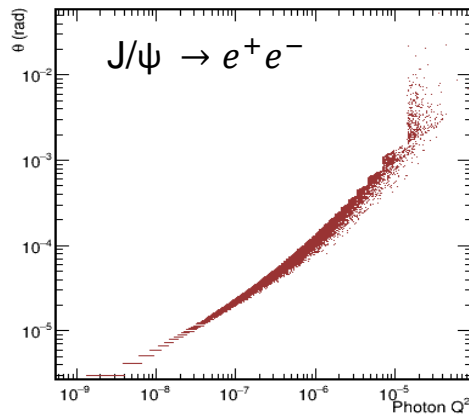
Electro/Photo-production

Photo/Electro-production: kinematics

$e + p$

Outgoing electron
deflection angle:

For photoproduction
($Q^2 < 1 \text{ GeV}^2$)



Upsilon Events in EICRoot All-Silicon Detector

LBNL All-Silicon Detector

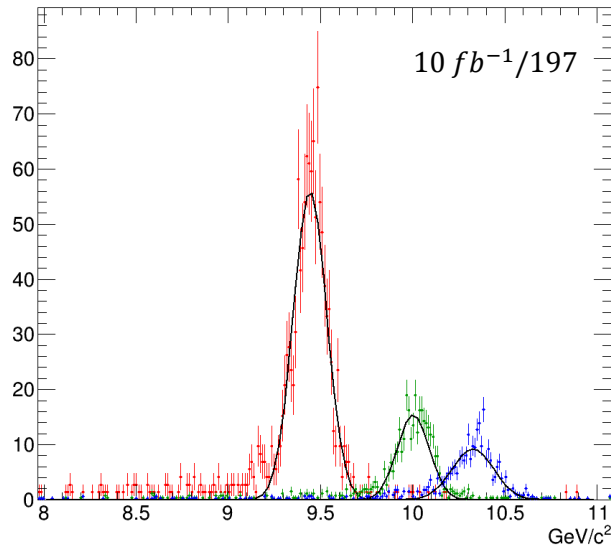
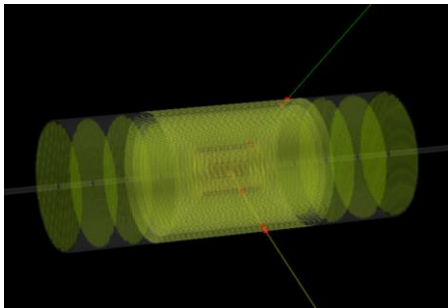
(Developed by LBNL's eRD16
generic EIC detector project)

- Silicon Tracker

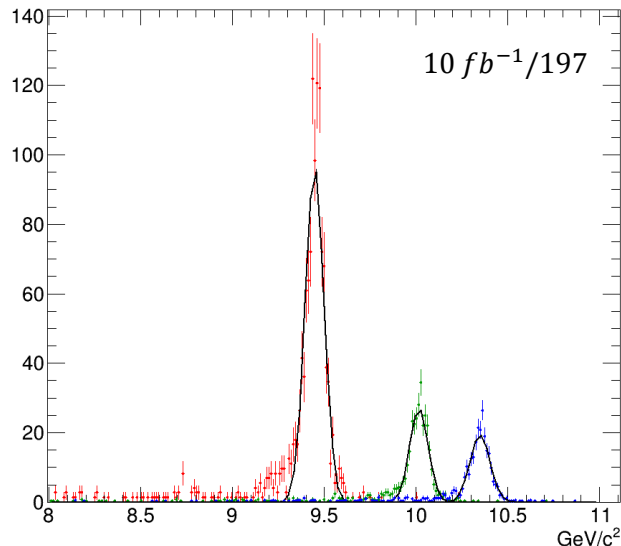
6 layers

- Silicon Endcap Disks

6 disks



1.5 Tesla



3.0 Tesla

Upsilon peaks are still distinguishable with a lower B-Field

Conclusion

eSTARlight simulations for photoproduction & electroproduction at an EIC

Vector Mesons:

- $J/\psi \rightarrow e^+e^-$
- $\Upsilon(1S), \Upsilon(2S), \Upsilon(3S) \rightarrow e^+e^-$
- Acceptance of the J/ψ and $\Upsilon(1S)$.

Preliminary studies with eSTARlight in EICROOT (BeAST & LBNL All-Silicon Detectors)

- Reconstruction efficiency
- Detector resolution for different field strengths and acceptance cuts