BGU group physics plans

Zvi Citron (PI), Eden Mautner (Student), Michael Pitt (Postdoc)

Detector involvement:

- Development of the B0 detector: Simulation / hardware, therefore our physics goals match physics targeted with the Far-Forward detectors

Interests in exclusive physics

- Photoproduction of VM:
  - In collaboration with Kong/Mark we study vetoing incoherent VM production with full ePIC simulation.
  - Looking to collaborate on coherent VM studies
- Exclusive photon-photon physics: low mass resonances, di-lepton, di-jet
- Photon – pomeron interaction with tagged ions / protons, ππ interference, low mass resonances

More info in the next slides…

אוניברסיטת בן-גוריון בנגב
جامعة بن غوريون في النقب
Ben-Gurion University of the Negev

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Photoproduction of VM:

- Background vetoing studies – motivated by [2108.01694]

Investigation of the background in coherent J/ψ production at the EIC

Wan Chang,[1,2,*] Elke-Caroline Aschenauer,[2,†] Mark D. Baker,[3,‡] Alexander Jentsch,[2,§] Jeong-Hun Lee,[2] Zhoudunming Tu,[2,4,¶] Zhongbao Yin,[1] and Liang Zheng[5]

- Veto.1: no activity other than e^- and J/ψ in the main detector ($|\eta| < 4.0$ and $p_T > 100$ MeV/c) ;
- Veto.2: Veto.1 and no neutron in ZDC;
- Veto.3: Veto.2 and no proton in RP;
- Veto.4: Veto.3 and no proton in OMDs;
- Veto.5: Veto.4 and no proton in B0;
- Veto.6: Veto.5 and no photon in B0;
- Veto.7: Veto.6 and no photon with $E > 50$ MeV in ZDC.

ePIC SIM

- Veto.1: no activity other than e- and J/ψ in the main detector
- Veto.2: Veto.1 and veto signal in ZDC
- Veto.3: Veto.2 and veto signal in RP
- Veto.4: Veto.3 and veto signal in OMD
- Veto.5: Veto.4 and veto signal in B0 tracker
- Veto.6: Veto.5 and veto signal in B0 ECAL

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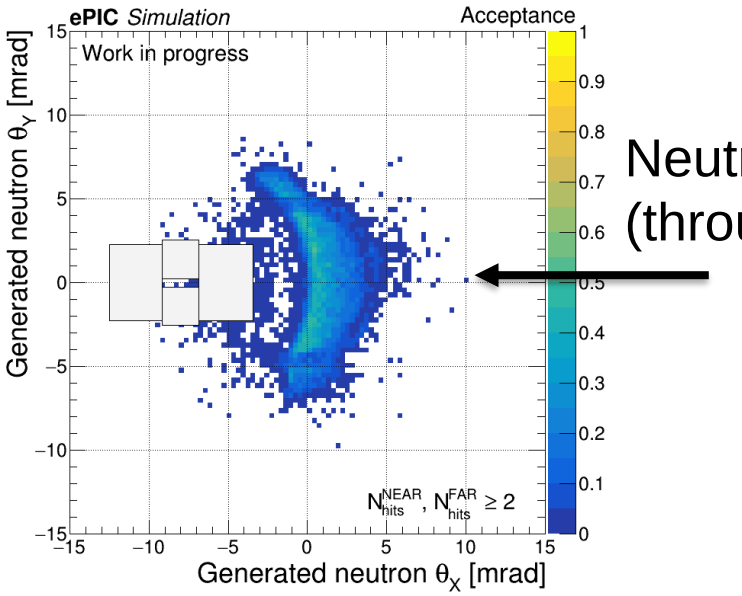
Photoproduction of VM:

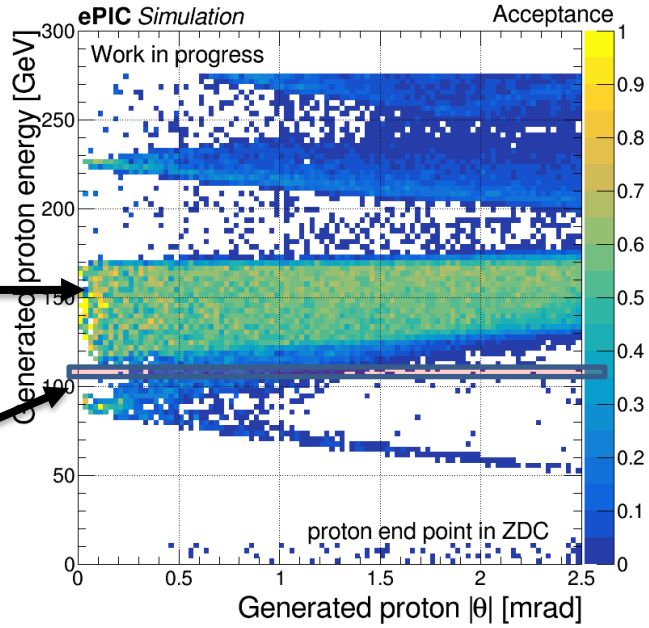
- Background vetoing studies – signal veto in detectors.
- Based on acceptance studies presented at the FF meeting (Feb 7): https://indico.bnl.gov/event/18322/



Neutrons in RP
(through secondaries)

Protons in ZDC

Protons from Pb



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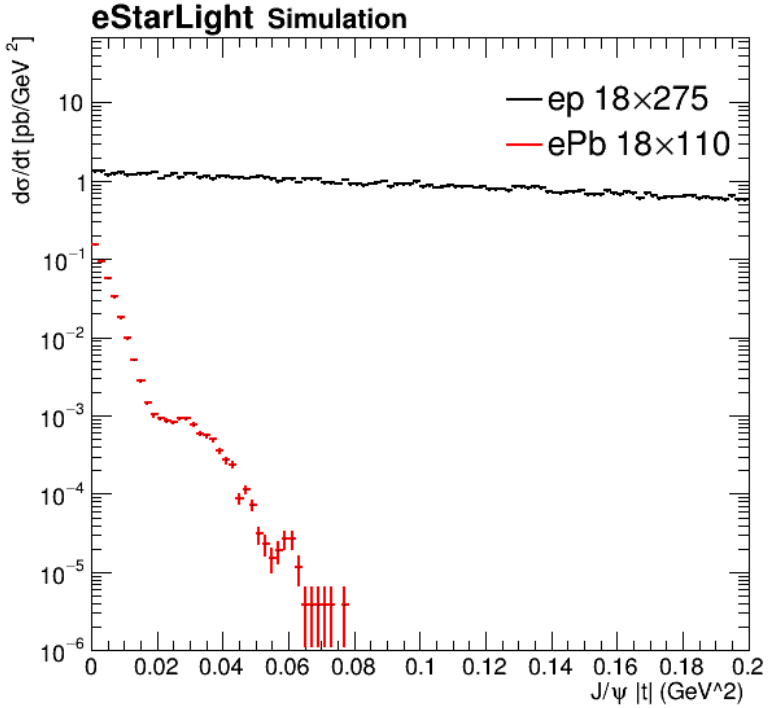
Photoproduction of VM:

- Looking to collaborate on coherent VM studies
- Working with eStarlight MC simulation (production of hepmc output)
- Study the effect of resolution (The plan to use the AfterBurner output)
- Further studies – improving resolution effects to identify maxima and minima



- Simulation results using truth VM p_T
- Electron smearing effects are under study

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Exclusive photon-photon physics:

- Recent developments in Madgraph5 (MG5) MC allow eA collisions, and obtaining photon fluxes from electrons and ions
- MG5 – MC event generator based on matrix element – probing SM + BSM scenarios
  - Exclusive di-lepton / di-jet production
  - Low mass resonances

TABLE I: Gold-plated SM and BSM processes accessible via photon-photon collisions in UPCs at hadron colliders.

Process	Physics motivation
$\gamma\gamma \to e^+e^-, \mu^+\mu^-$	"Standard candles" for proton/nucleus γ fluxes, EPA calculations, and higher-order QED corrections
$\gamma\gamma \to \tau^+\tau^-$	Anomalous τ lepton e.m. moments [29–32]
$\gamma\gamma \to \gamma\gamma$	aQGC [25], ALPs [27], BI QED [28], noncommut. interactions [36], extra dims. [37],...
$\gamma\gamma \to \mathcal{T}_0$	Ditauonium properties (heaviest QED bound state) [38, 39]
$\gamma\gamma \to (c\bar{c})_{0,2}, (b\bar{b})_{0,2}$	Properties of scalar and tensor charmonia and bottomonia [40, 41]
$\gamma\gamma \to$ XYZ	Properties of spin-even XYZ heavy-quark exotic states [42]
$\gamma\gamma \to$ VM VM	(with VM = ρ, ω, ϕ, J/ψ, Υ): BFKL-Pomeron dynamics [43–46]
$\gamma\gamma \to a, \phi, \mathcal{M}\mathcal{M}, G$	ALPs [27, 56], radions [57], monopoles [58–61], gravitons [62–64],...

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Photon – pomeron interactions

- Ion tagging (EIC as a mass spectrometer)
- Low mass states: interference in di-pion, …