

Coherent VM production Status and plans

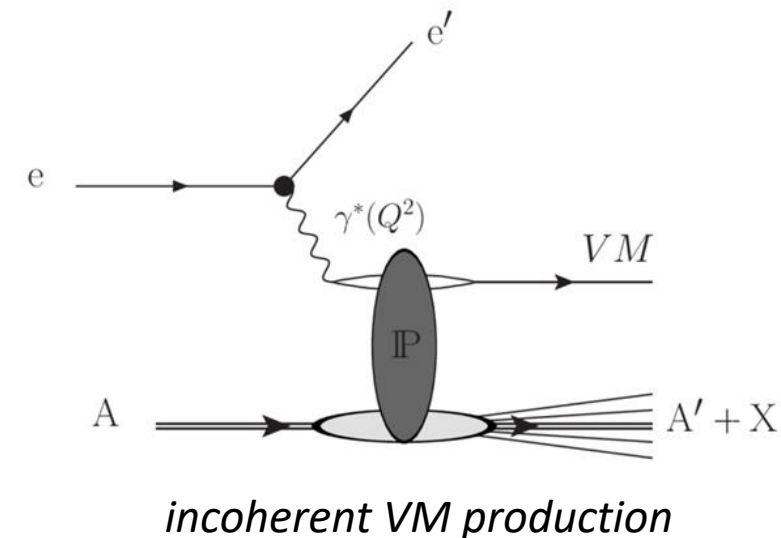
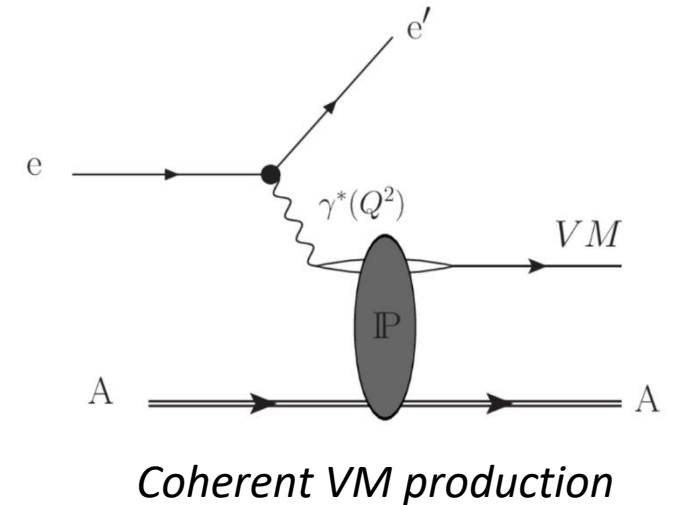
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Coherent VM production at EIC

Simulation

- Coherent VM production is modeled with eStarlight (signal)
- Incoherent VM production with BeAGLE (background)
- An Issue with ion propagation seems to be solved (see next slide)
 - Validation is in process
- EICRecon includes
 - Backward: low-Q taggers
 - Forward: B0 tracker, B0 ECAL, RP, OMD, ~~ZDC~~



Coherent VM production at EIC

Kinematics

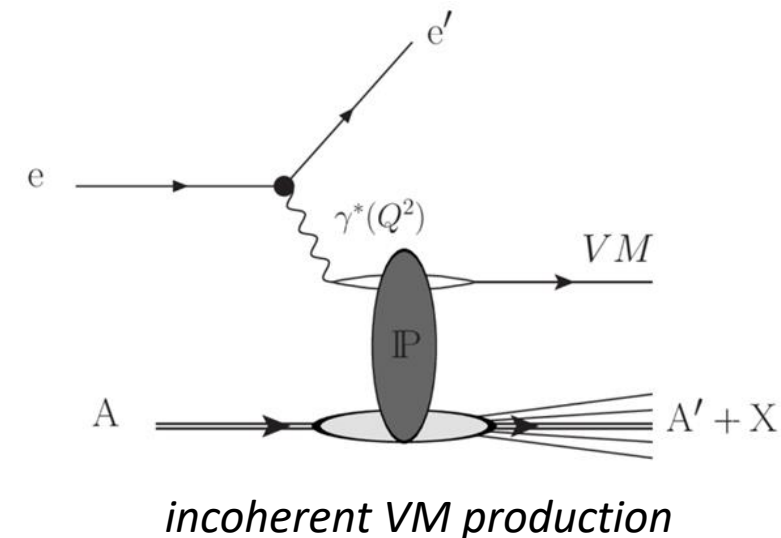
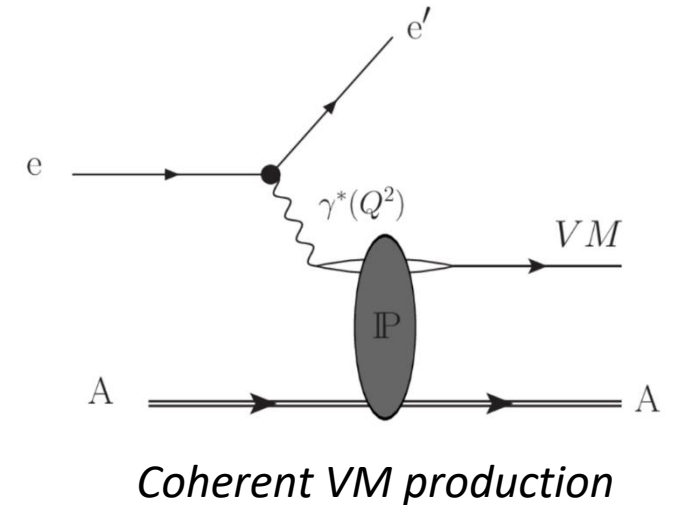
Reconstruction of parameters of interest:

e – incoming electron (**determined by beam parameters**)

e' – outgoing electron (**measured**)

VM – vector meson (**measured**)

- Energy scale $Q^2 = -(e - e')^2$
- Momentum transfer $-t = (VM - (e - e'))^2$
- Meson transverse momentum $VM_{PT} = VM.P_t()$



Coherent VM production at EIC

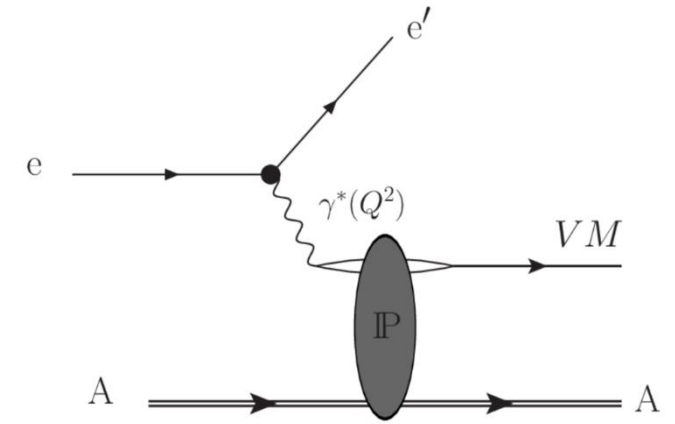
Signal

- Simulation with eStarlight¹: $e + A \rightarrow VM + e' + A'$
- Ions: ^{16}O , ^{63}Cu , ^{90}Zr and ^{208}Pb
- Vector mesons: rho, omega, J/psi, Phi, Upsilon
- Consider different energies: $5 \times 100 \text{ GeV}^2$ and $18 \times 275 \text{ GeV}^2$
(energies of the accelerated electron and proton beam respectively)

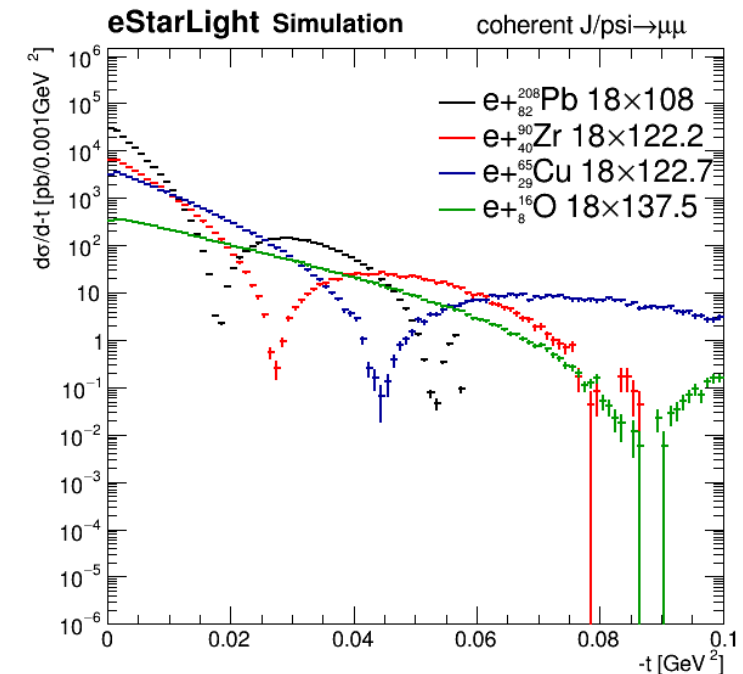
Comments:

- Saturation not included in eStarlight
- Can probe different VM and ion beams

Focus on J/psi in ePb collisions at $18 \times 108 \text{ GeV}$



Coherent VM production

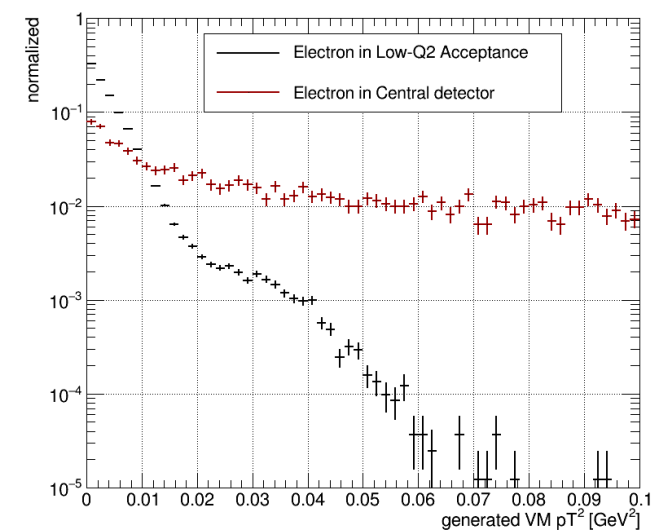
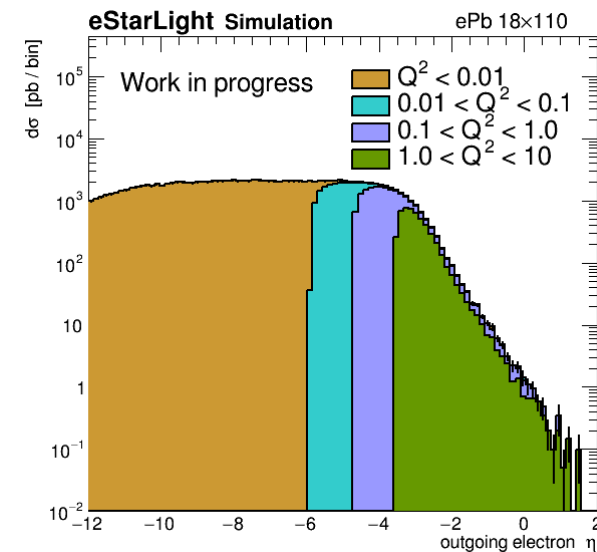
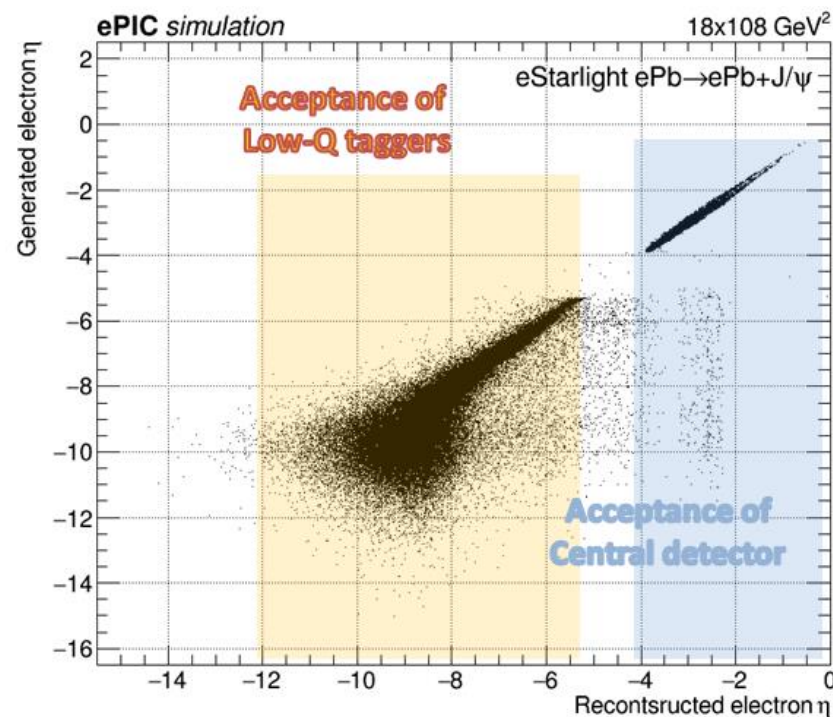


Coherent VM production at EIC

Analysis strategy

- Rely on Q^2 dependence (in low- Q^2 region t can be approximated as PT)
 - Central detector acceptance: $\sim 10\%$
 - Low- Q^2 taggers acceptance: $\sim 40\%$

Adding low- Q^2 category increases the signal acceptance by x5



Coherent VM production at EIC

Ion propagation

- One of the reasons for slow simulation time was the World's material – Air (10% of protons with nominal energy decayed in the beampipe) → set Vacuum
- Signal simulation:
 - No ions in air 1.91 sec / event
 - Ion in air 330.3 sec / event
 - Ion in vacuum 16.74 sec / event (99% ions passed 100m)
 - Ion in vacuum 4.92 sec / event (100% ions passed 100m)
- Background simulation:
 - No ions in air 31.35 sec / event
 - Ion in air 315.8 sec / event
 - Ion in vacuum 10.79 sec / event

Coherent VM production at EIC

Work in progress

- The issue with the ion/proton stability in simulation seems to be solved
 - More dedicated study on ion propagation is on the way (2 options)
 - A. Assuming $E_{ion} = E_0 \times A$ with $E_0 = 275 \times \frac{Z_{BEAM}}{A_{BEAM}}$ energy / nucleon we can translate all periodic table in terms of acceptance of FF detectors
 - B. We can focus only on BeAGLE output for incoherent production and map discuss ion acceptance (FFD dedicated study)
- Large production was submitted and we expect acceptance studies soon
- Final goals is to produce t and PT distributions in high/low Q^2 regions using ePIC reconstruction