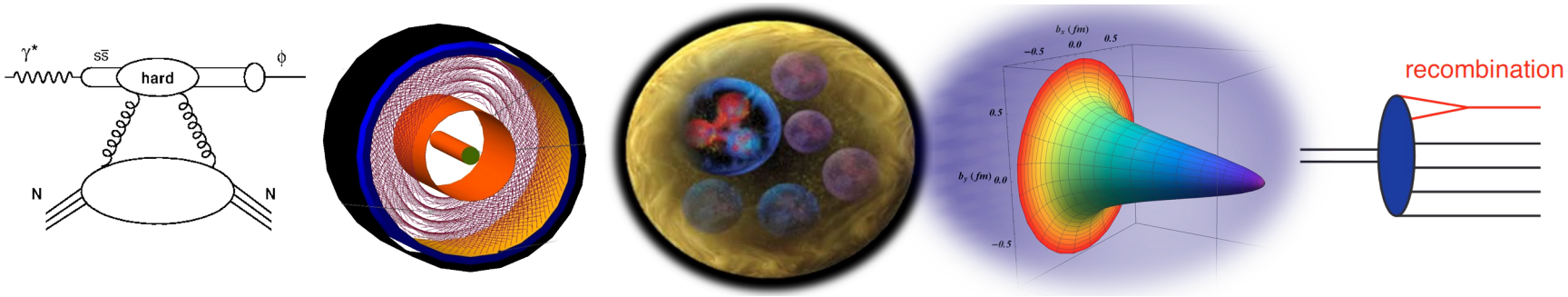
Update Exclusive Reaction Working Group



Barbara Pasquini, Daria Sokhan, Raphael Dupre, Salvatore Fazio, Tuomas Lappi

Raphaël Dupré

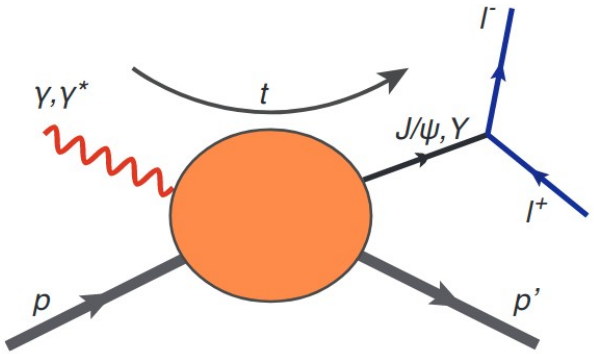
General

- **Thanks to the many contributions made in our weekly meeting**
  - We try to summarize here the needs in terms of detectors for the exclusive physics
- **We will focus here mostly on the aspects where we have specific requests**
  - Not all the physics is presented
  - Not all detectors are discussed
- **Few areas require further investigation**
  - Either because we need more input from the detector groups for more advanced study
  - Or we need further analysis on the physics side to assess the criticality of an issue

Tracker

An extension of the tracker acceptance to low η (backward)

- **Would significantly improve DVMP studies (J/Ψ and Y)**
- **Mostly important in highest energy configurations**
- **Any gain would help, going to -4.5 like Ecal would be ideal**

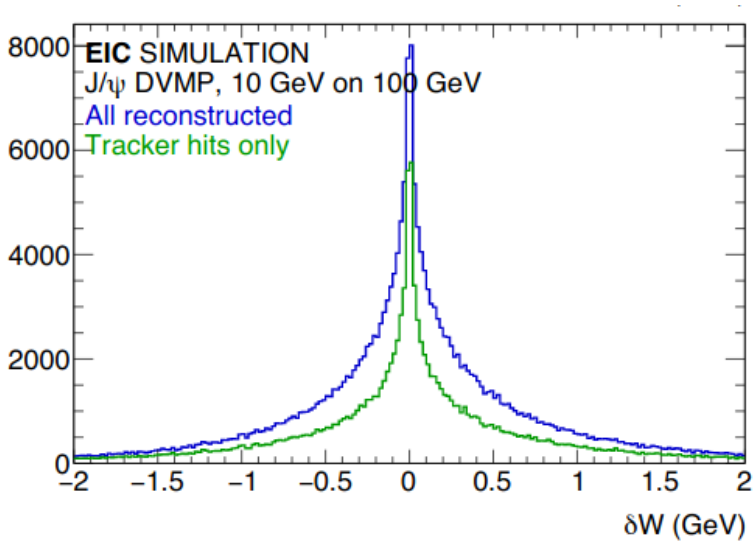


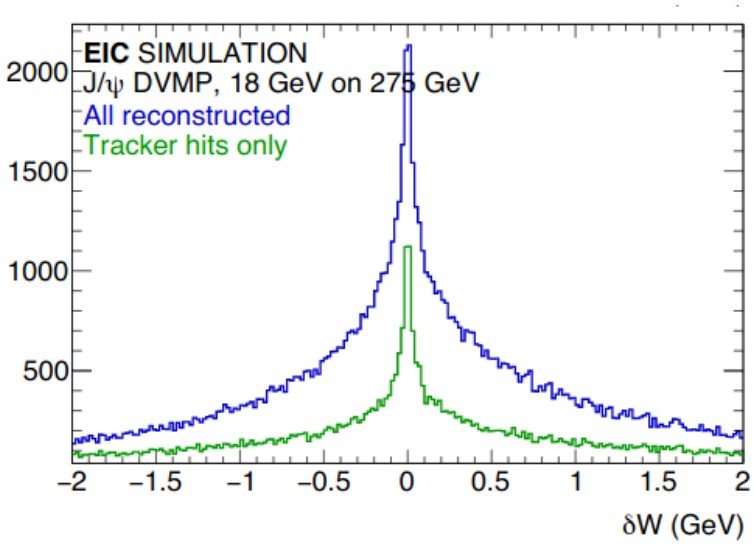
Simulation by S. Joosten (ANL)

What is the minimum transverse momentum detectable?

- **This value will impact DVMP measurements for lighter mesons**
- **We would like to access ϕ, ω and ρ down to $p_T \sim 0$**

Simulation by I. Strakovsky (GWU)





Electromagnetic Calorimeter

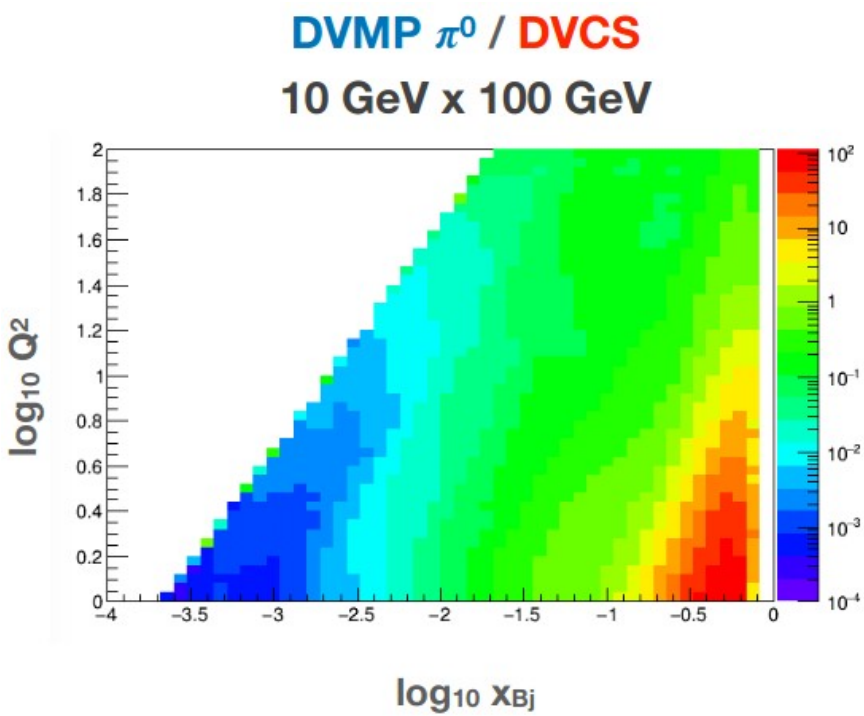
Separation between π^0 and γ needs to be clarified

- **The separation performance likely depends on angle and energy**
- **We need to precisely study the parts of the detector that are most critical in this regard**

Simulation S. Fazio (BNL) M. Defurne (CEA) W. Li (W&M) P. Sznajder (NCBJ) and PARTONS team

Resolution of ECal in the forward region appears low

- **Will this affect the π^0 / γ reconstruction or separation ?**

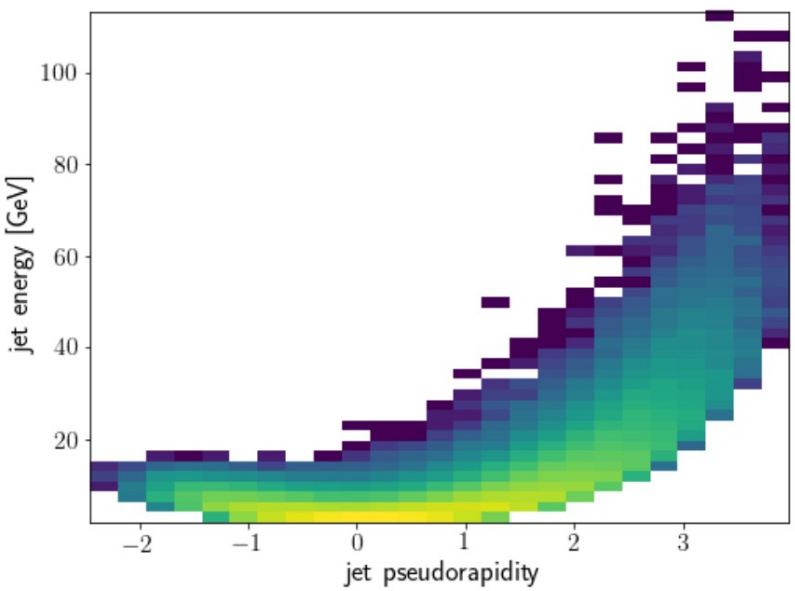


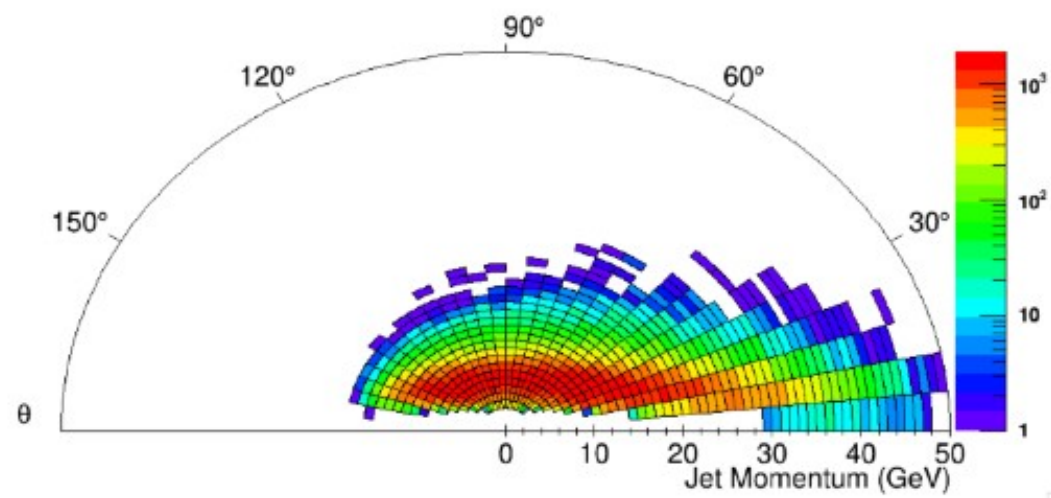
Hadron Calorimeter

We need large HCal coverage for jet studies

- **Exclusive di-jet production and diffractive jets are promising channels**
- **They necessitate a large coverage in pseudo-rapidity, from -4 to 4**
- **The resolution numbers should be refined in physics simulations when detector options are clarified**

Simulations for different channels from M. Arratia (UC Riverside) and Z. Zhang (BNL)



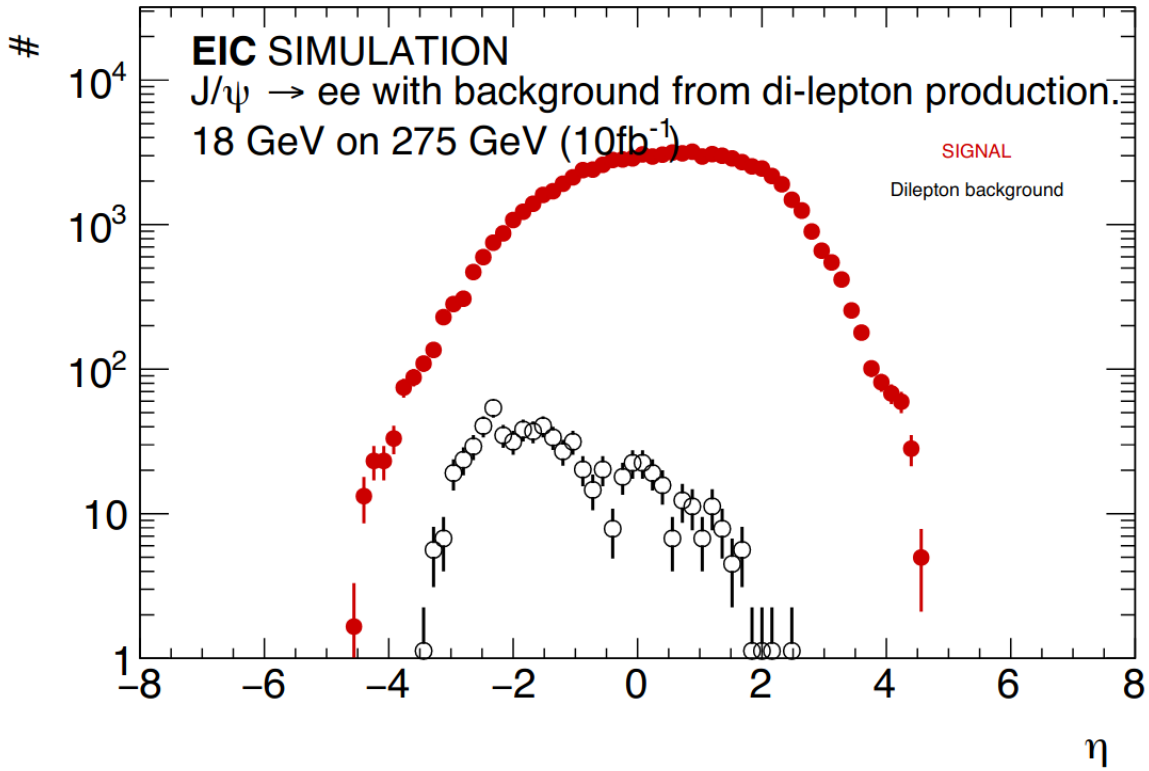


Muon detection

Muon PID would be very useful

- **In the barrel but also in the endcaps**
- **Important to improve resolution of DVMP measurements (J/Ψ and Y)**

Simulation by S. Joosten (ANL)

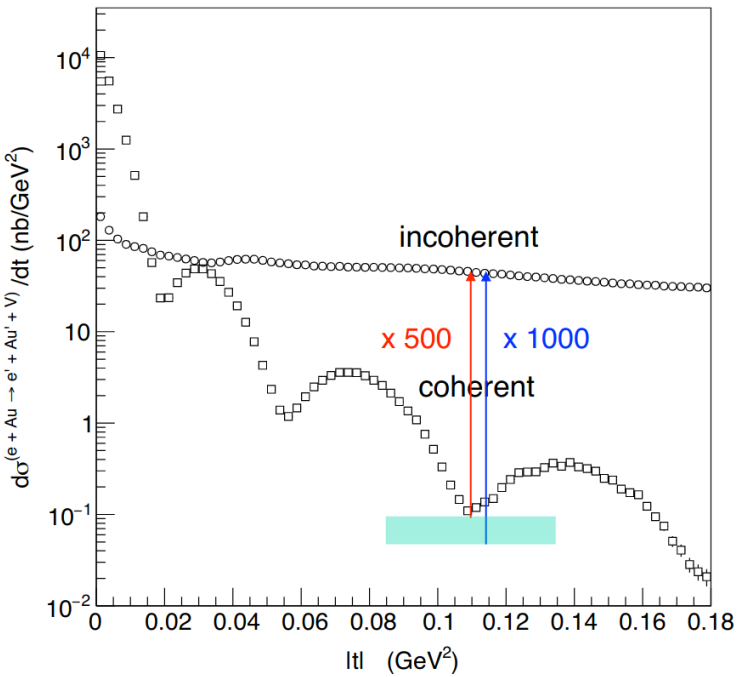


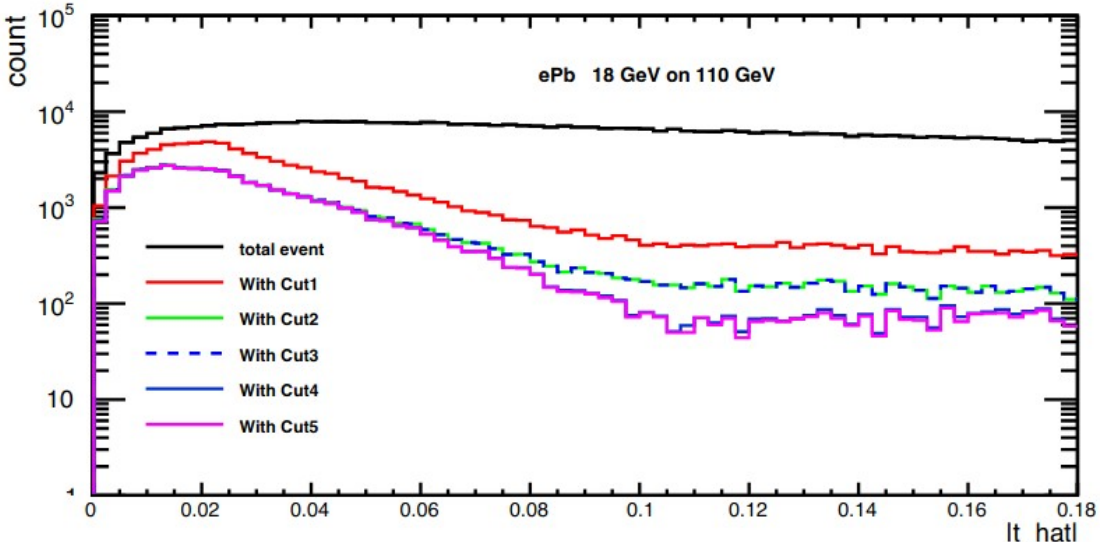
Forward Auxiliary Detectors (1)

We need neutral particle detection at 0 degree

- **This is necessary for coherent processes on heavy nuclei to suppress incoherent events**
- **This is covered pretty well for neutrons**
- **But we also need to detect photons (E>50 MeV)**

Simulations by W. Chang (CCNU) and T. Ullrich (BNL)





Cut1:
- no neutron in ZDC

Cut2 :
- Cut1 + no photon ***E>50MeV*** in ZDC

Cut3:
- Cut2 + no proton in Roman Pots

Cut4:
- Cut3 + no proton in off-energy detector

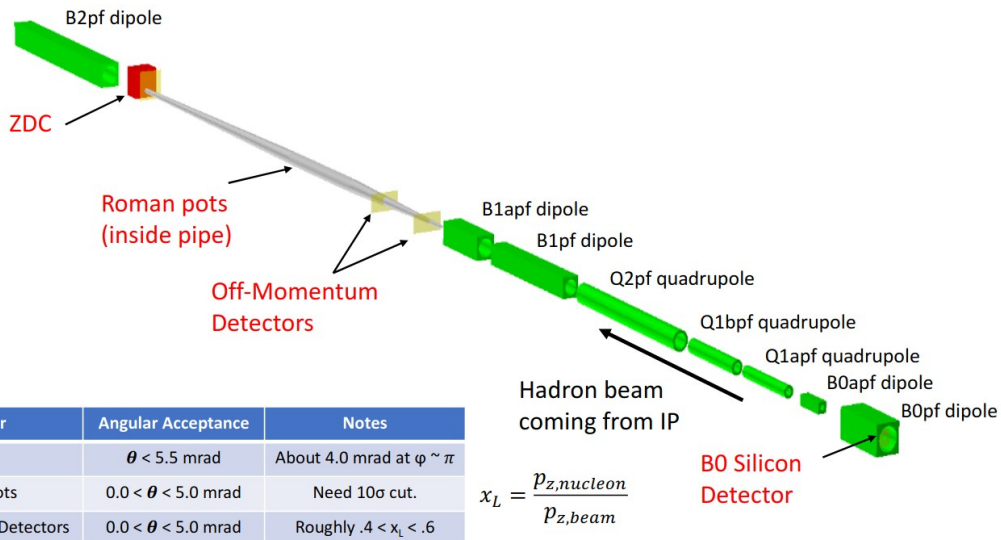
Cut5:
- Cut4 + no proton in B0

Forward Auxiliary Detectors (2)

Far forward spectrometer

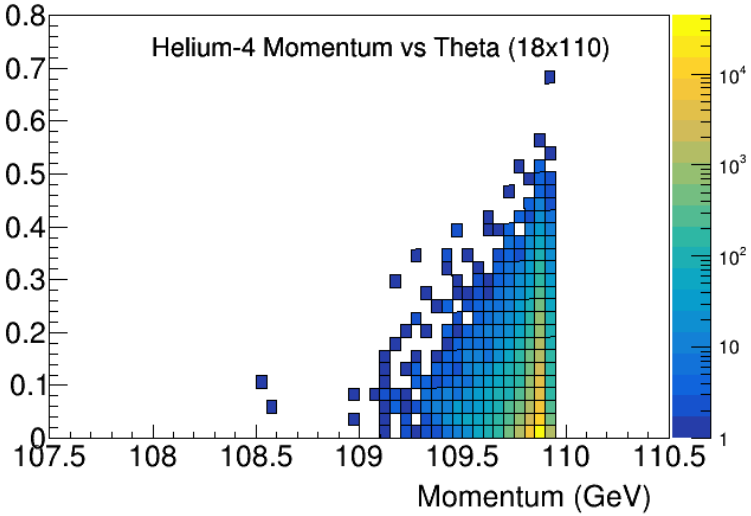
- **Appears to be good for proton DVCS**
- **We appreciate the progress in this area**
  - *Full simulations are in progress to validate estimates for light nuclei*
  - *We are looking into this with the far forward detector group*
- **We estimated values similar for protons and light nuclei**
  - *This cuts a significant amount of light nuclei DVCS*
  - *Light nuclei DVCS appears to be the most demanding here*

Simulations by S. Fucini, S. Scopetta (Perugia) R. Dupre (IJCLab) A. Jentsch (BNL)



$$x_L = \frac{p_{z,nucleon}}{p_{z,beam}}$$

Detector	Angular Acceptance	Notes
ZDC	$\theta < 5.5$ mrad	About 4.0 mrad at $\varphi \sim \pi$
Roman Pots	$0.0 < \theta < 5.0$ mrad	Need 10σ cut.
Off-Momentum Detectors	$0.0 < \theta < 5.0$ mrad	Roughly $.4 < x_L < .6$
B0 Sensors	$5.5 < \theta < 20.0$ mrad	Still need to optimize.



Summary

Several improvements would be boosting our physics reach

- Larger tracker acceptance
- Higher ECal resolution
- Muon identification

Several points are critical for some physics topics

- Large HCal coverage for Jets
- Good separation between π^0 and γ for DVCS
- Photons in the far forward detector to suppress incoherent processes
- Far forward detectors going to very low -t for light ions

Some work can still be improved

- Nonetheless we thank our many contributors for making such progress in only a few very complicated months