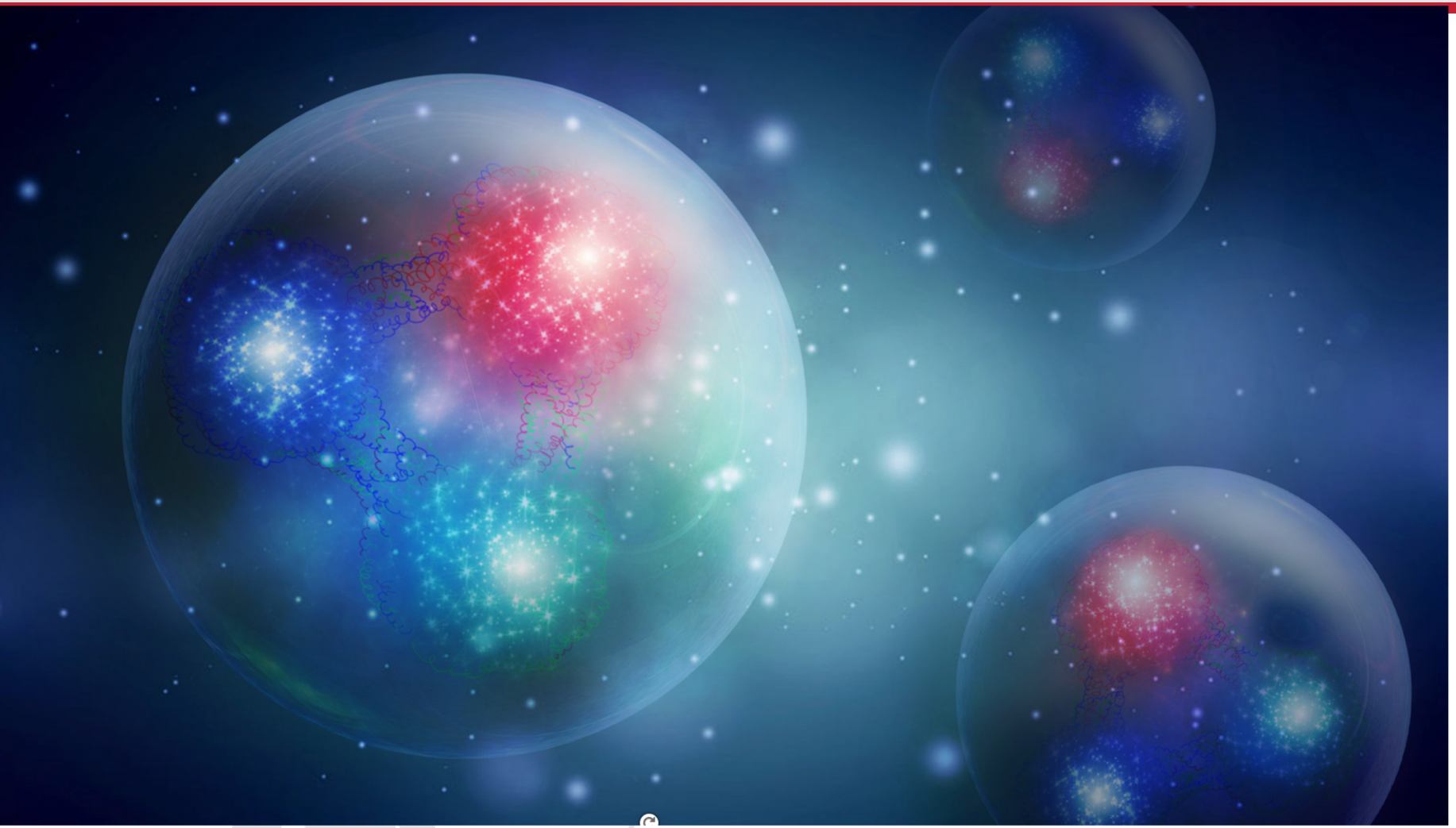
Requirements for a forward detection



Yulia Furletova

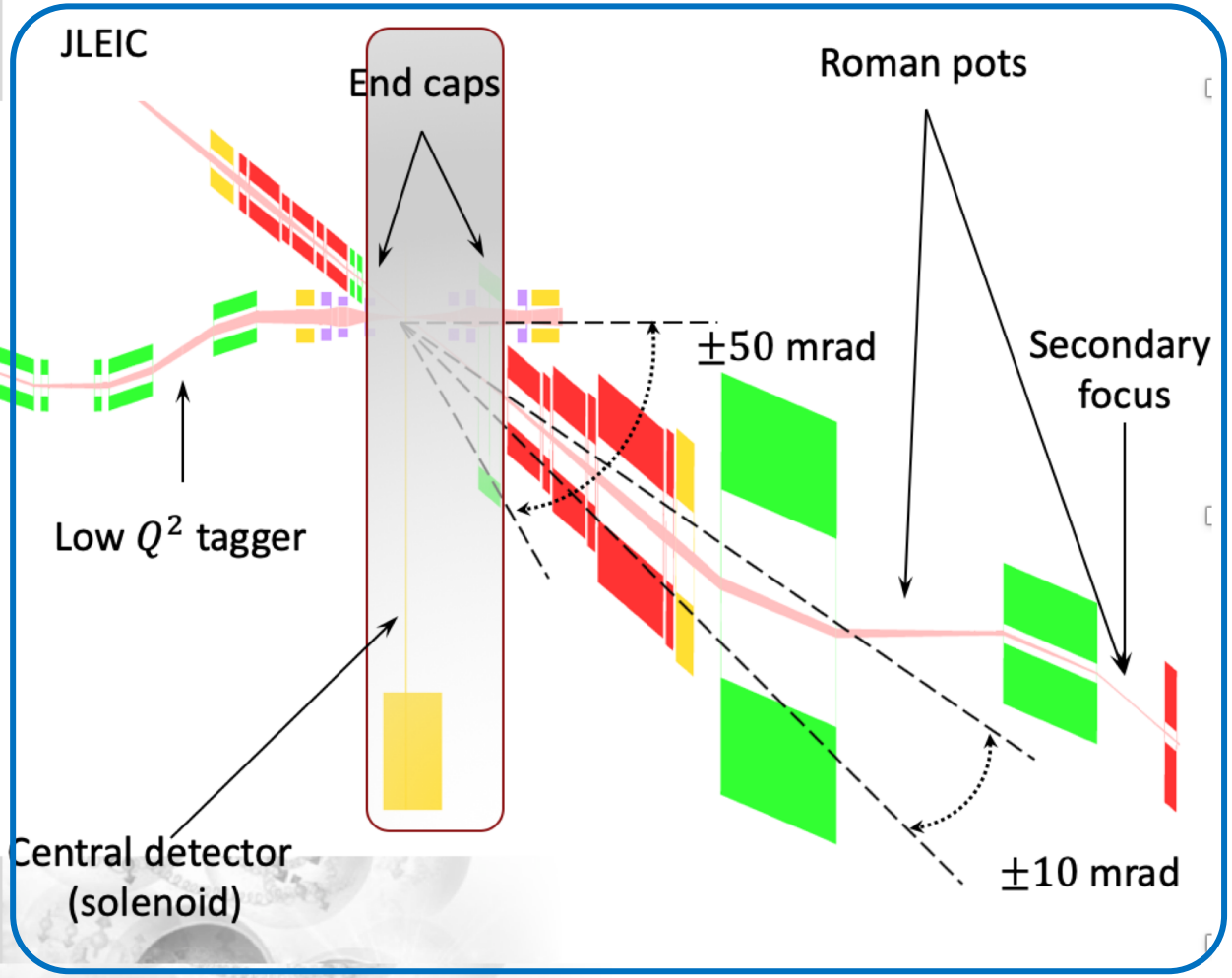
Jefferson Lab

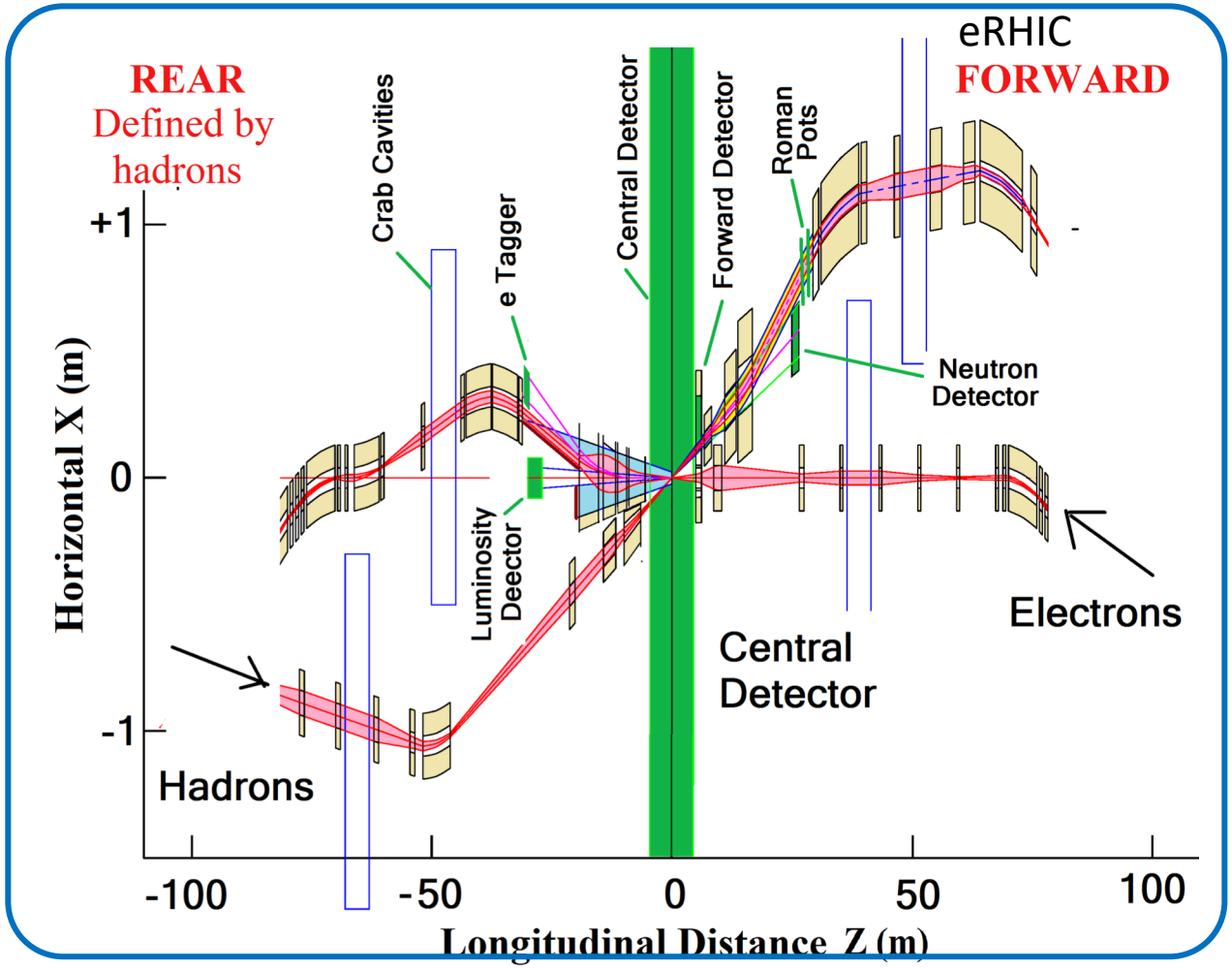
Thanks to many colleagues for help with materials for this talk!!!

MC samples: BEAGLE (M.Backer)

Most slides for JLEIC case, some deviations applied for eRHIC case.

Forward detection system



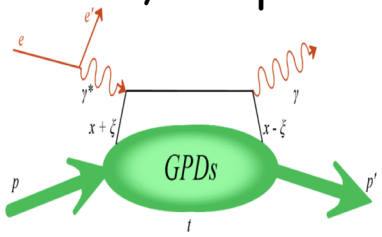


- Why do we need a crossing angle? why it is 50mrad for JLEIC and 25mrad for eRHIC?
- Why do we need a large-bore requirements? why 10mrad for JLEIC and 5mrad for eRHIC ?

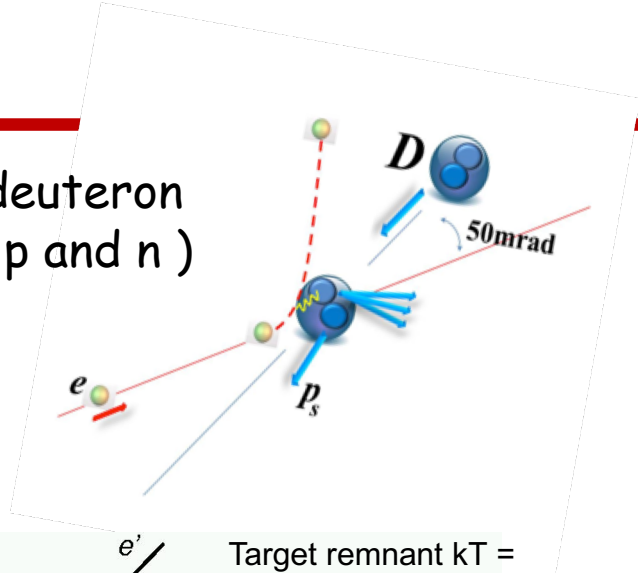
Forward physics

- DVCS, VM production (p -> p′) , (p->n′), (D->D′)

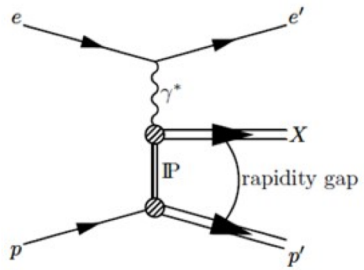
(exclusive reaction)

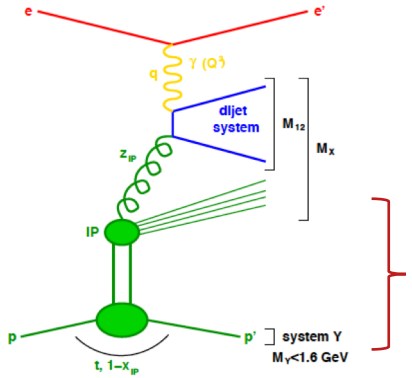


- Double tagging with deuteron (where D is breaking to p and n)

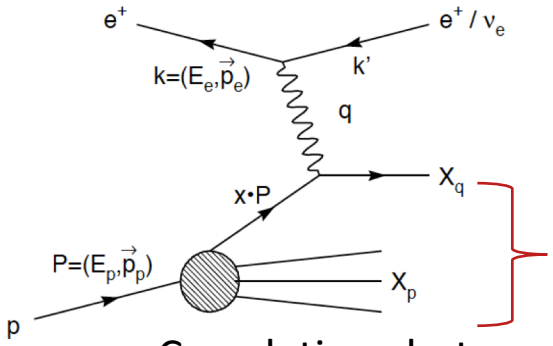


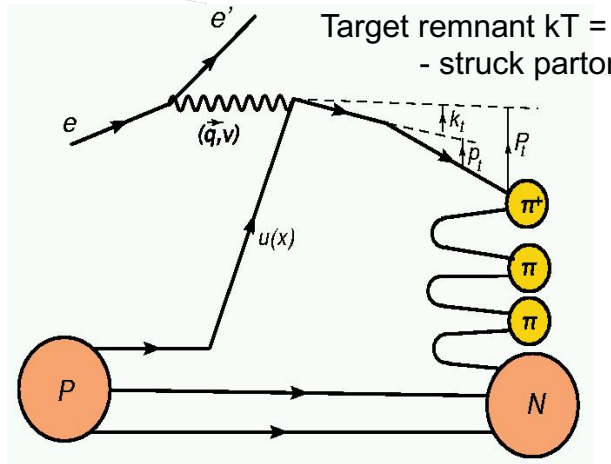
- Diffraction





- Remnant



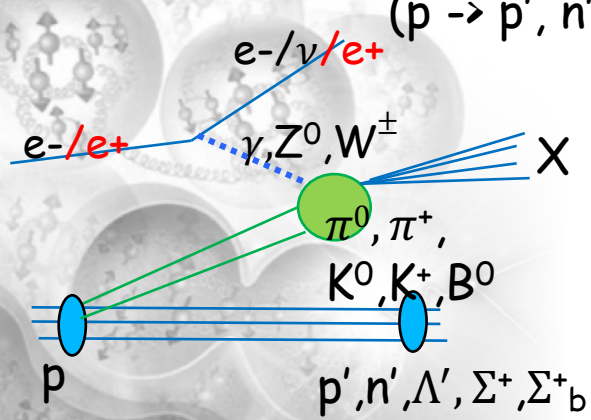


Correlations between current-jet and remnant-jet

- Pion/Kaon structure

(p -> p′, n′, Λ′, Σ+,Σ+b)

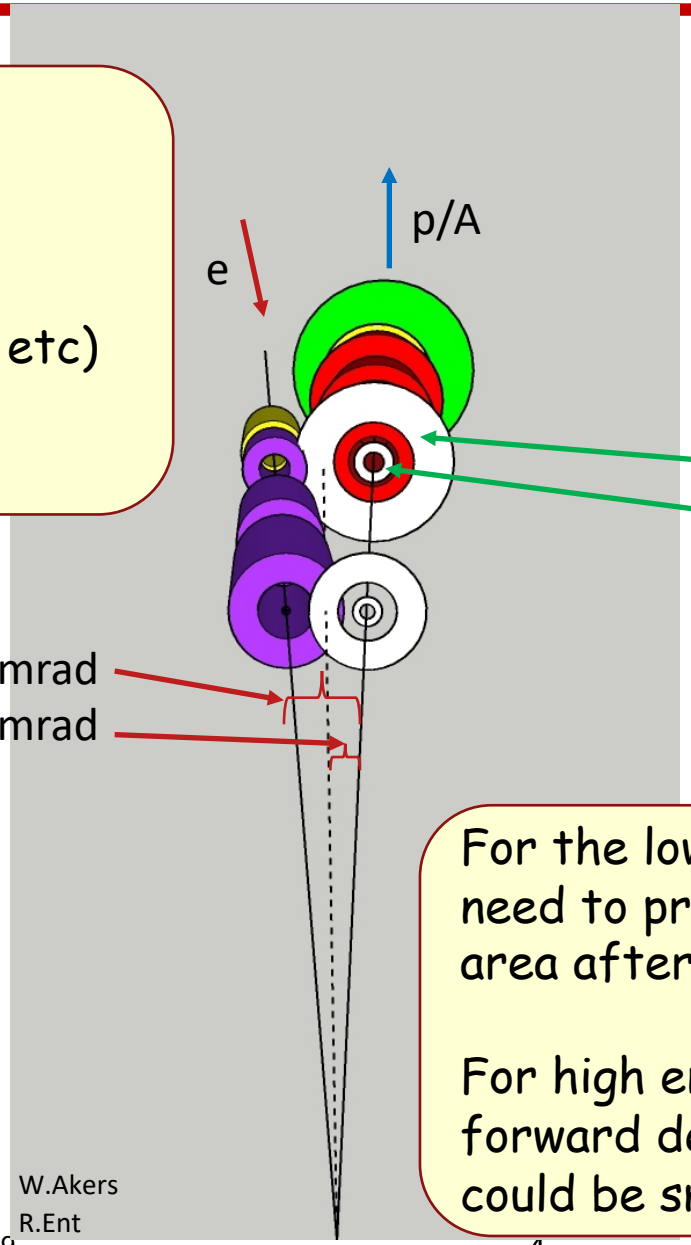
Decay to p,n , K, π



Typical scale:
0< -t < 1 (2) GeV and 0 < P_T < 2 … GeV
Exclusive reaction acceptance for charged (p,D) and neutral (n)
Detection for decay products(Λ′, Σ, etc)
Remnant jet

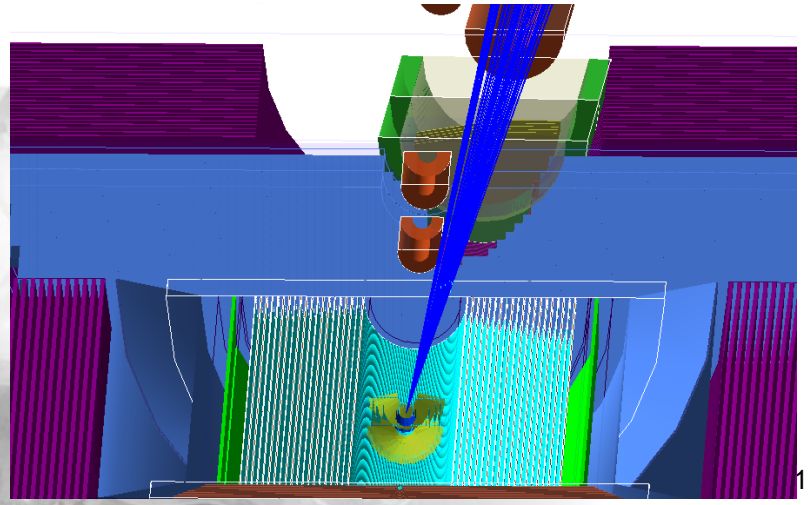
Crossing angle, bore-radius for FFQs

Multi-dimensional problem:
- beam energy operation
- physics processes
- crossing angle
- Geometry (size, infrastructure, etc)
- bore-radius for FFQs
- space for detectors



White circles:
inner radius corresponds to P_T =1GeV
outer radius corresponds to P_T = 2GeV

Outer cone: 50 GeV beam
Inner cone: 200 GeV beam

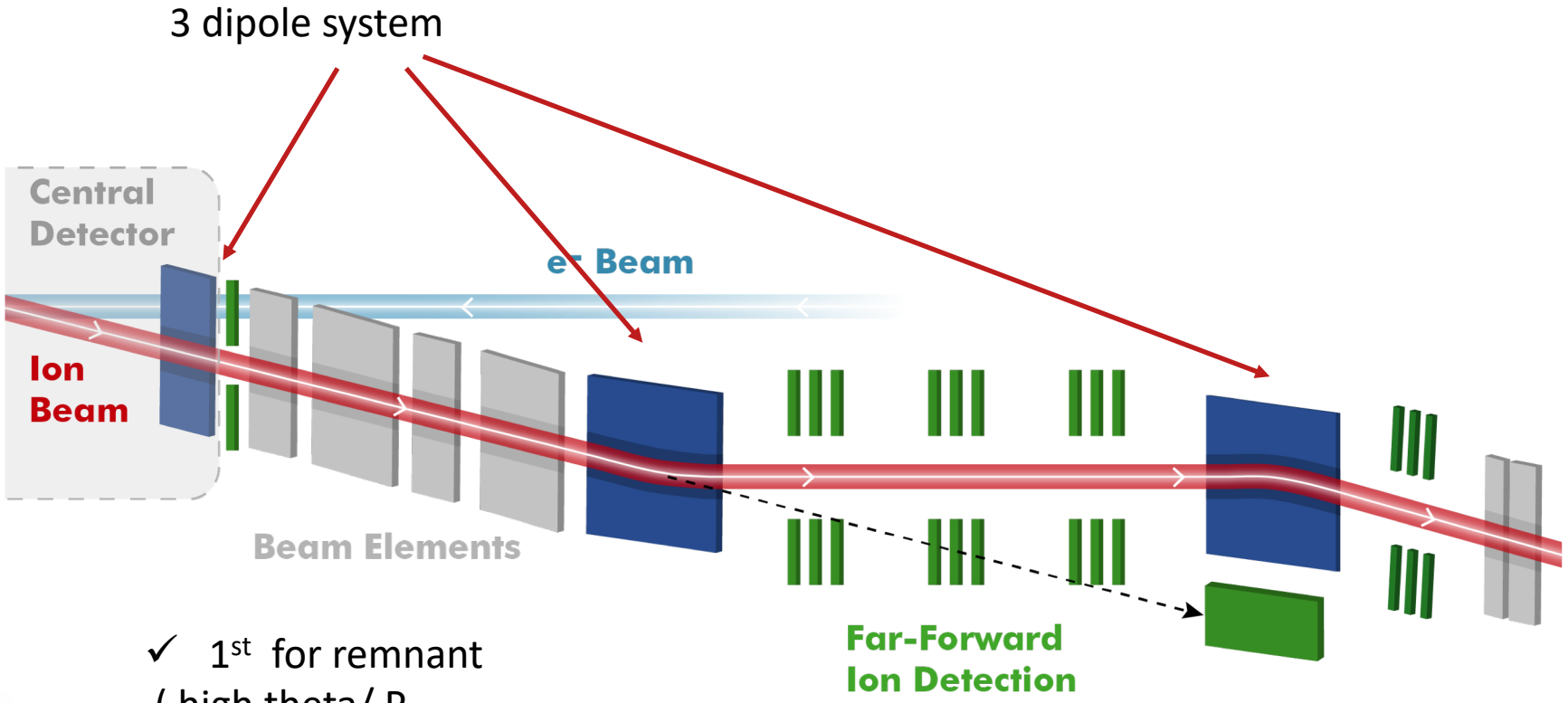


W.Akers
R.Ent

For the low energy operation (ca 20-100 GeV) we need to provide good acceptance for far-forward area after the ion-FFQs for particles pT<1GeV

For high energy beam operation (>200GeV) far-forward detection far-forward cone aperture could be smaller, as well as a crossing angle.

Forward detection system

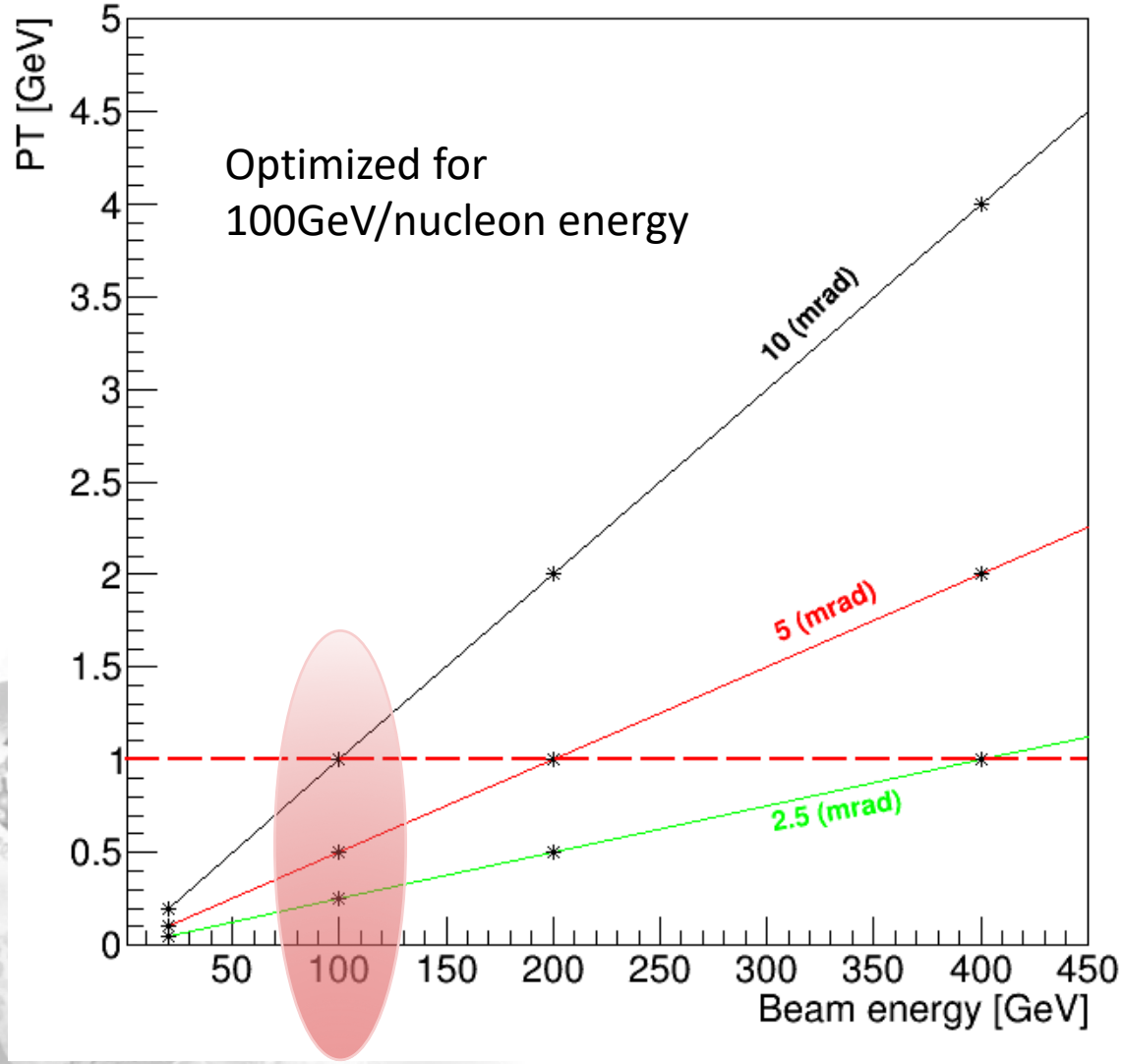


✓ 1st for remnant (high theta/ P_T spread particles, before FFQs)

✓ 2nd mostly for Decay products of Λ, Σ, etc. (long decay time)
High t exclusive p', D'
All neutrons

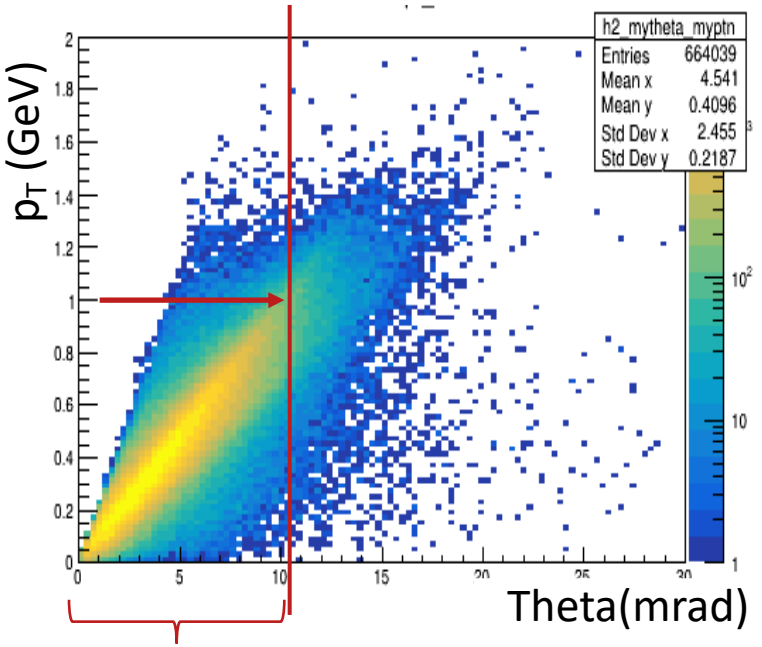
✓ 3nd mostly for low-t exclusive p',D' (roman pots)

Forward detection system



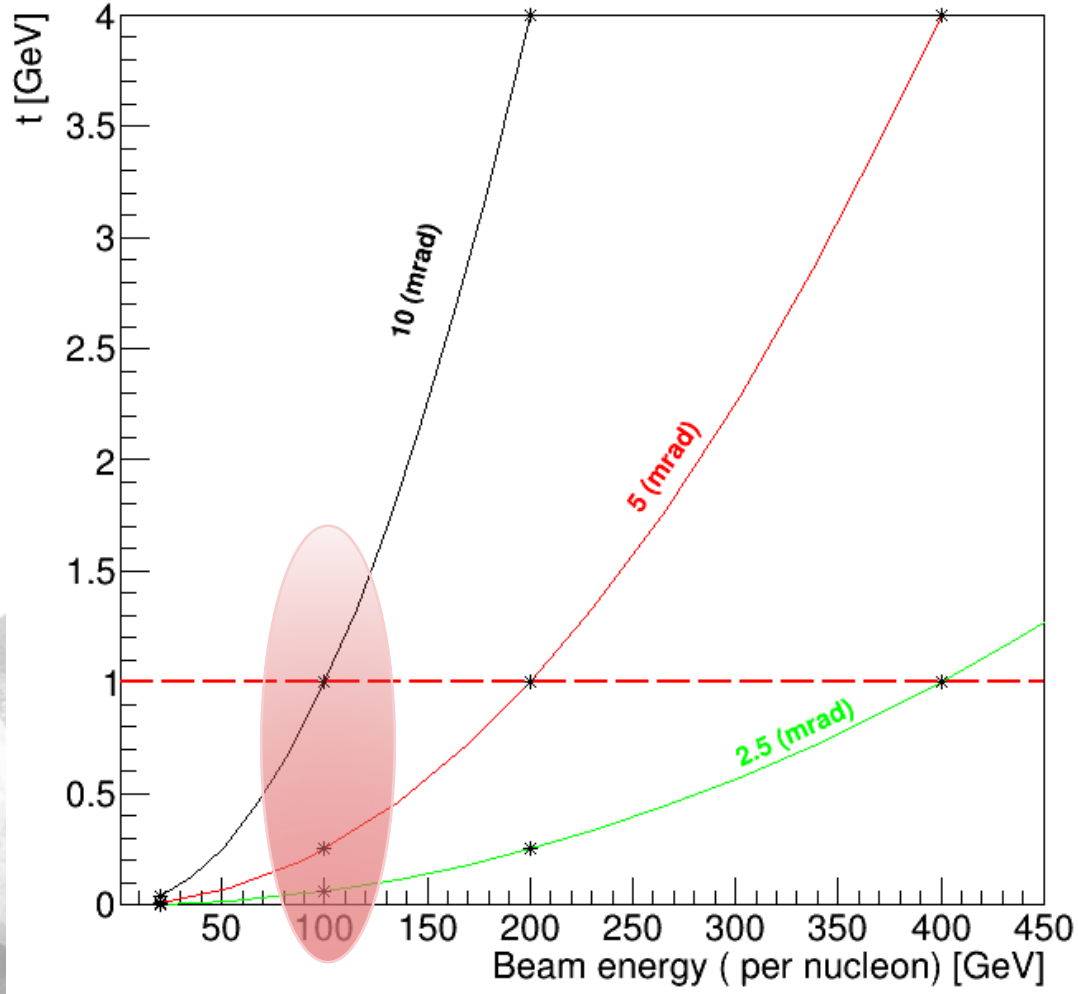
EIC is designed to operate with **various beam energy**. That means we have to design our detector/IR to be able to provide enough acceptance for **all beam configurations**.

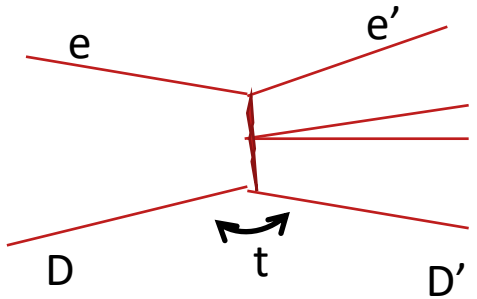
Exclusive J/PSI : (5x100/nucleon) eD-> e' J/Psi (n'p')



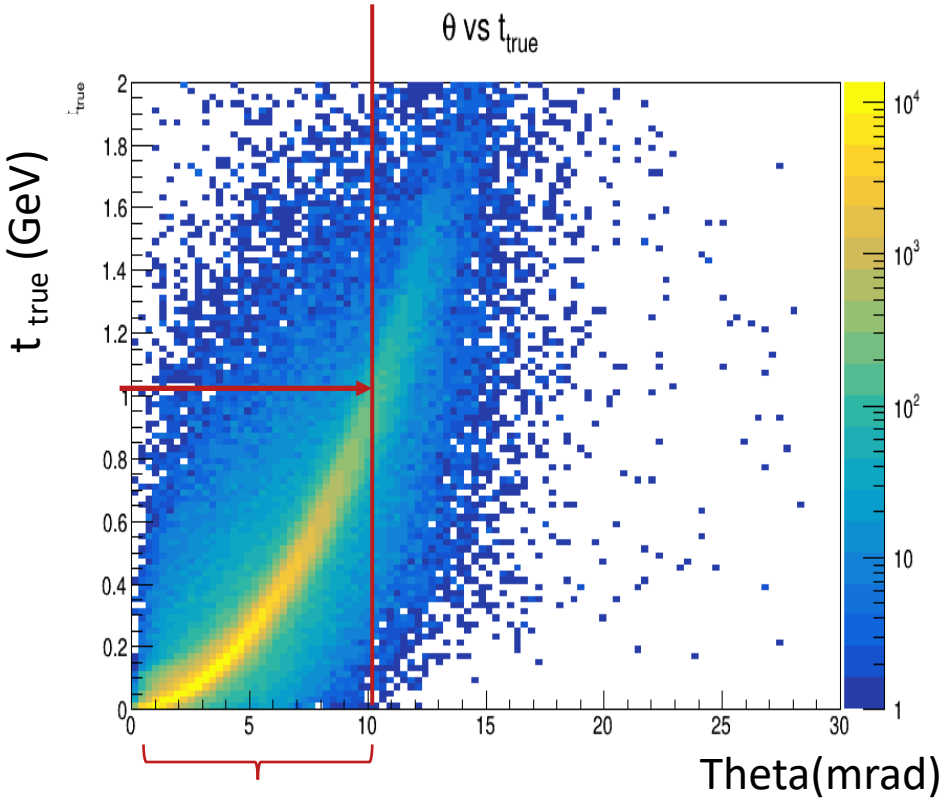
Forward detection system

Exclusive J/PSI : (5x100/nucleon) eD-> e' J/Psi (n'p')





$t = (D-D')^2 \approx A \frac{P_T^2}{xL} - t_0$



Conclusions

- EIC will be a unique facility: Highly tunable electron-ion CoM energy range, a factor of 5-7 in tunability – **never done before!!!**
- Requirements for crossing angle and bore-radius depend on requirements for beam energy and physics needs.