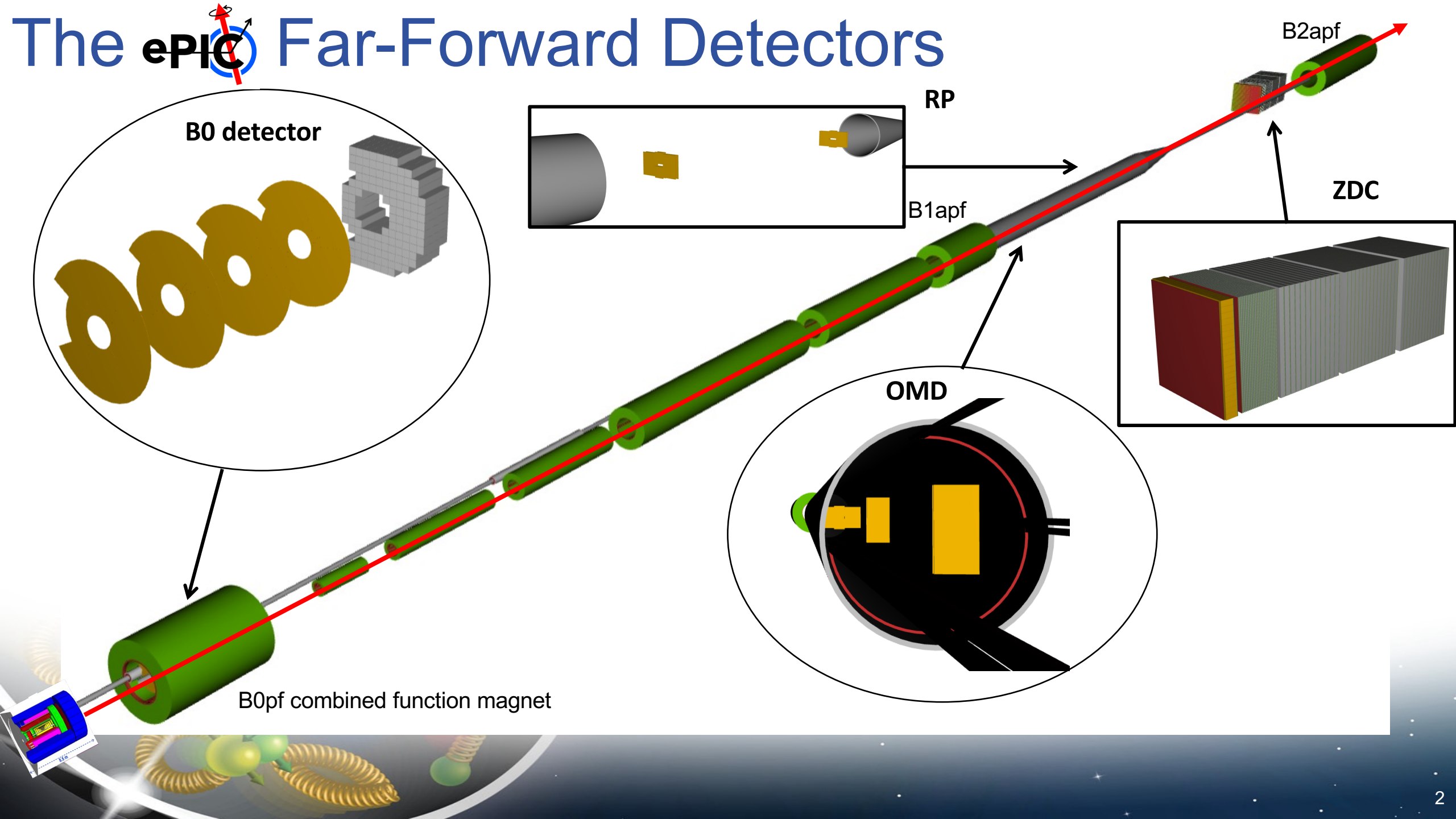




ePIC Far-Forward Detectors: Introduction

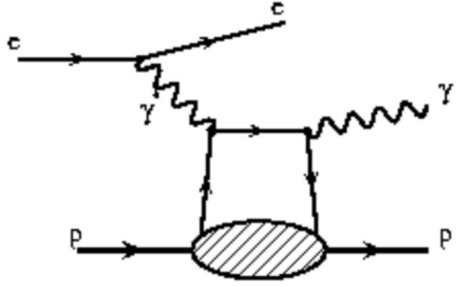
Alex Jentsch (BNL)
ePIC Collaboration Meeting
FF/FB/Exclusive Parallel Session
January 10th, 2023

The **ePIC** Far-Forward Detectors

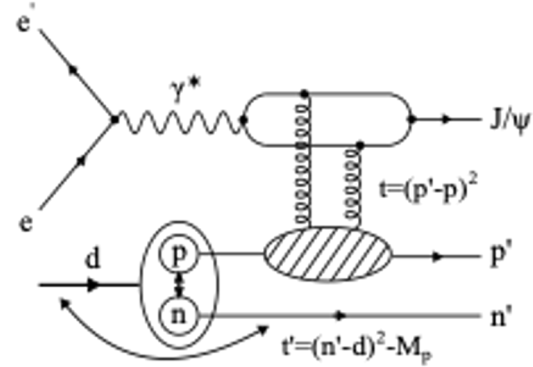


(some) Far-Forward Processes at the EIC

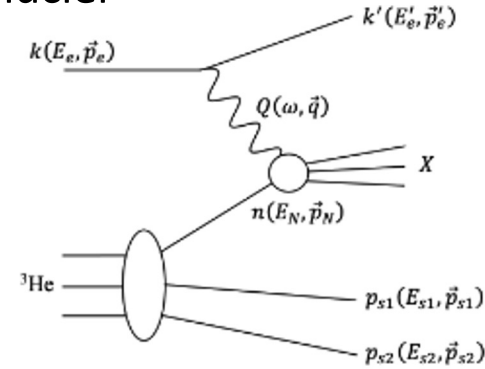
e+p DVCS



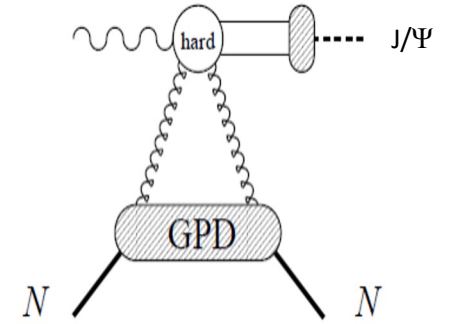
e+d exclusive J/Psi with p/n tagging



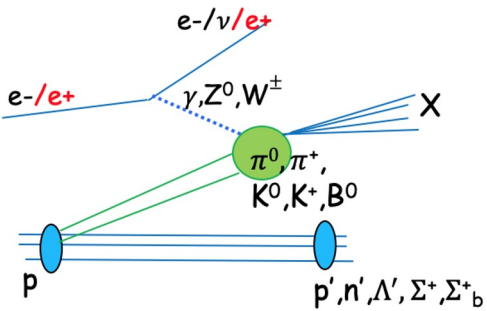
spectator tagging in light nuclei



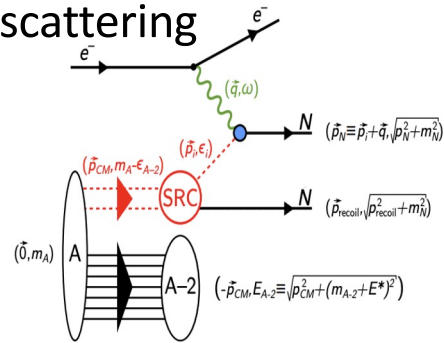
coherent/incoherent J/ψ production in e+A



Sullivan process

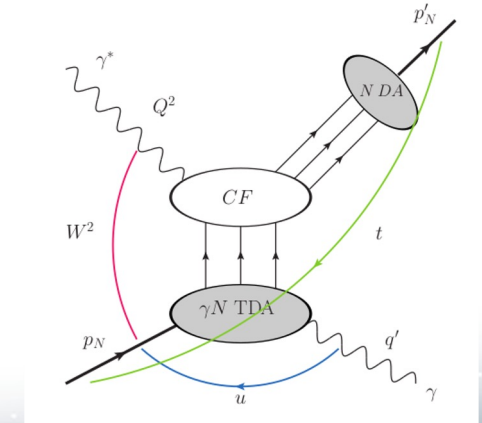


Quasi-elastic electron scattering



- Roman pots
- Off-momentum detectors
- ZDC EMCAL/HCAL
- B0 tracking
- B0 EMCAL

u-channel backward exclusive electroproduction

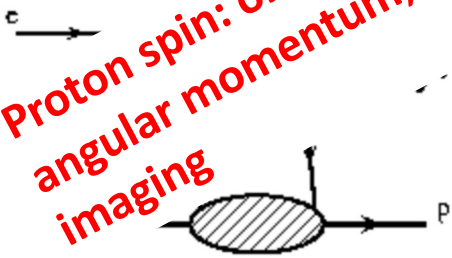


...and MANY more!

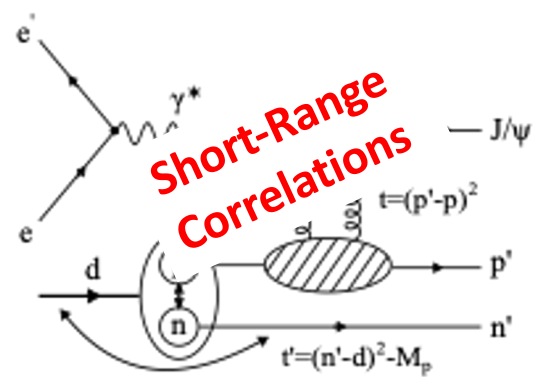
(some) Far-Forward **Physics** at the EIC

e+p DVCS

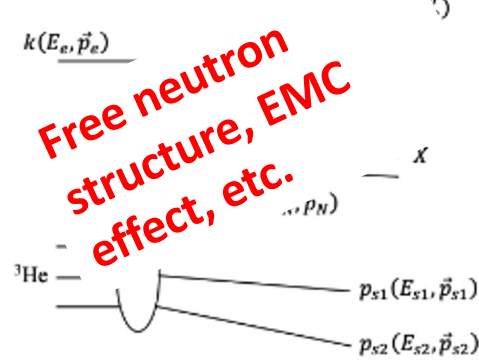
Proton spin: orbital angular momentum; imaging



e+d exclusive J/Psi with p/n tagging

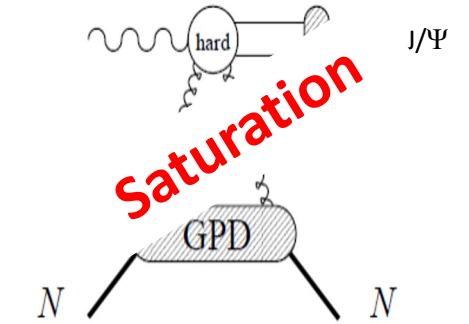


spectator tagging in light nuclei



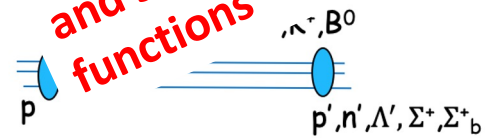
Free neutron structure, EMC effect, etc.

coherent/incoherent J/psi production in e+A

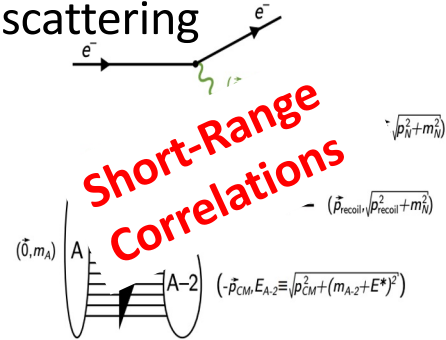


Sullivan process

pi/K form factors and structure functions



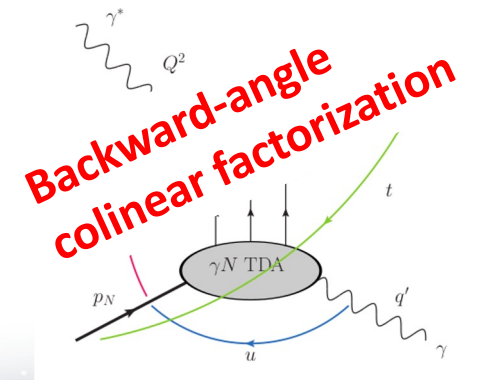
Quasi-elastic electron scattering



Short-Range Correlations

- Roman pots
- Off-momentum detectors
- ZDC EMCAL/HCAL
- B0 tracking
- B0 EMCAL

u-channel backward exclusive electroproduction

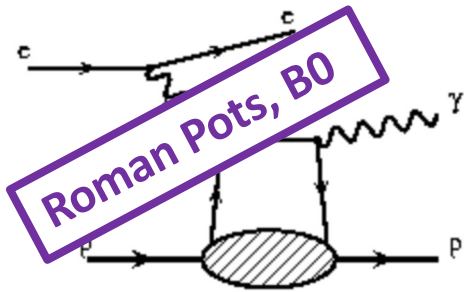


Backward-angle colinear factorization

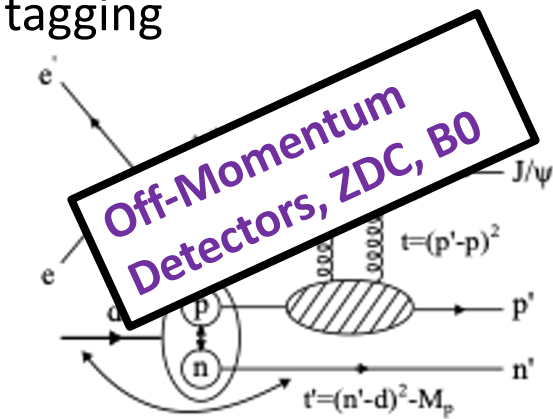
...and **MANY** more!

(some) Far-Forward **Detectors** at the EIC

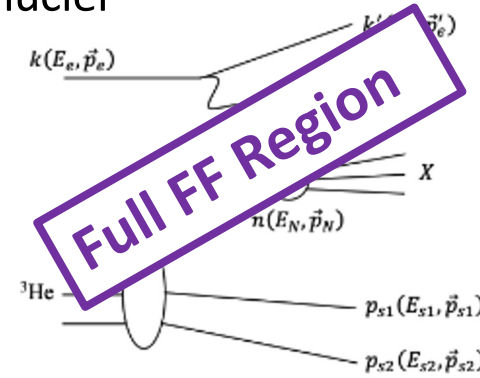
e+p DVCS



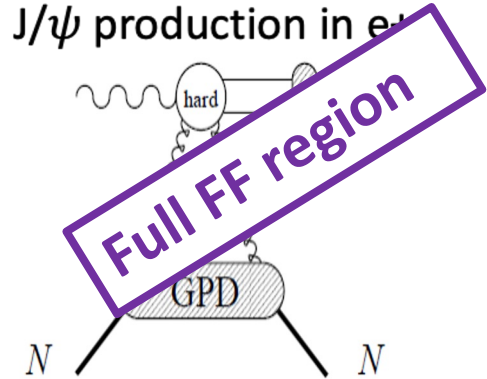
e+d exclusive J/Psi with p/n tagging



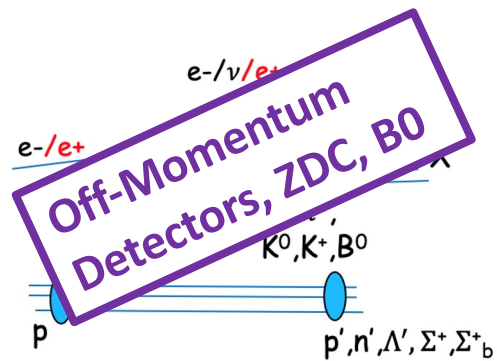
spectator tagging in light nuclei



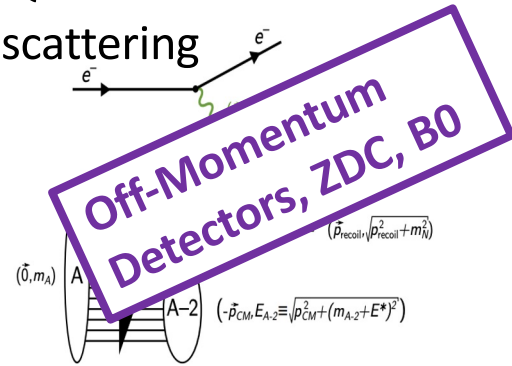
coherent/incoherent J/psi production in e+e-



Sullivan process

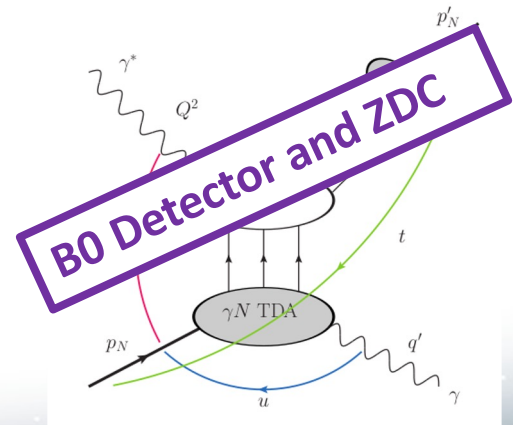


Quasi-elastic electron scattering



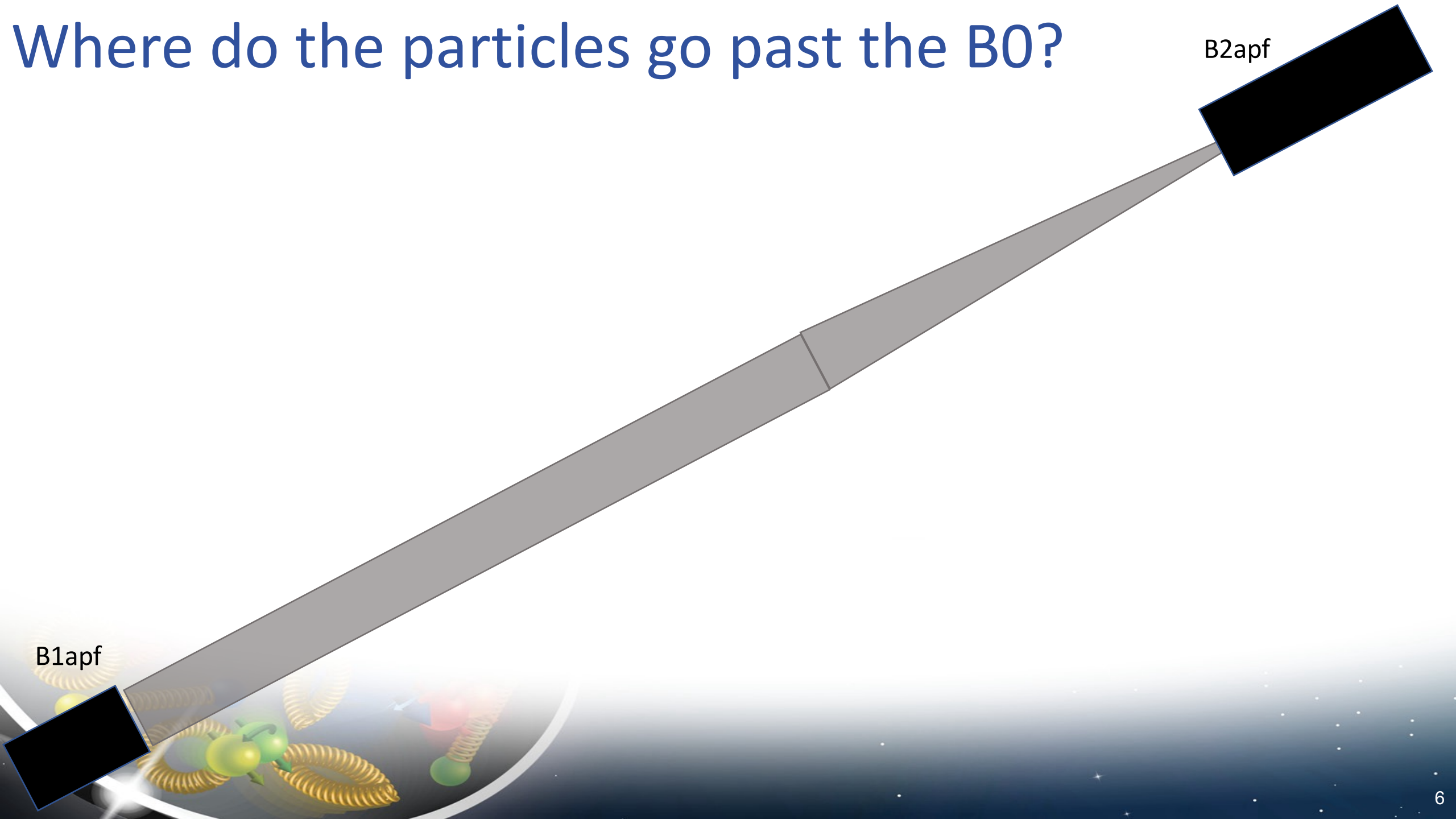
- Roman pots
- Off-momentum detectors
- ZDC EMCAL/HCAL
- B0 tracking
- B0 EMCAL

u-channel backward exclusive electroproduction



...and MANY more!

Where do the particles go past the B0?

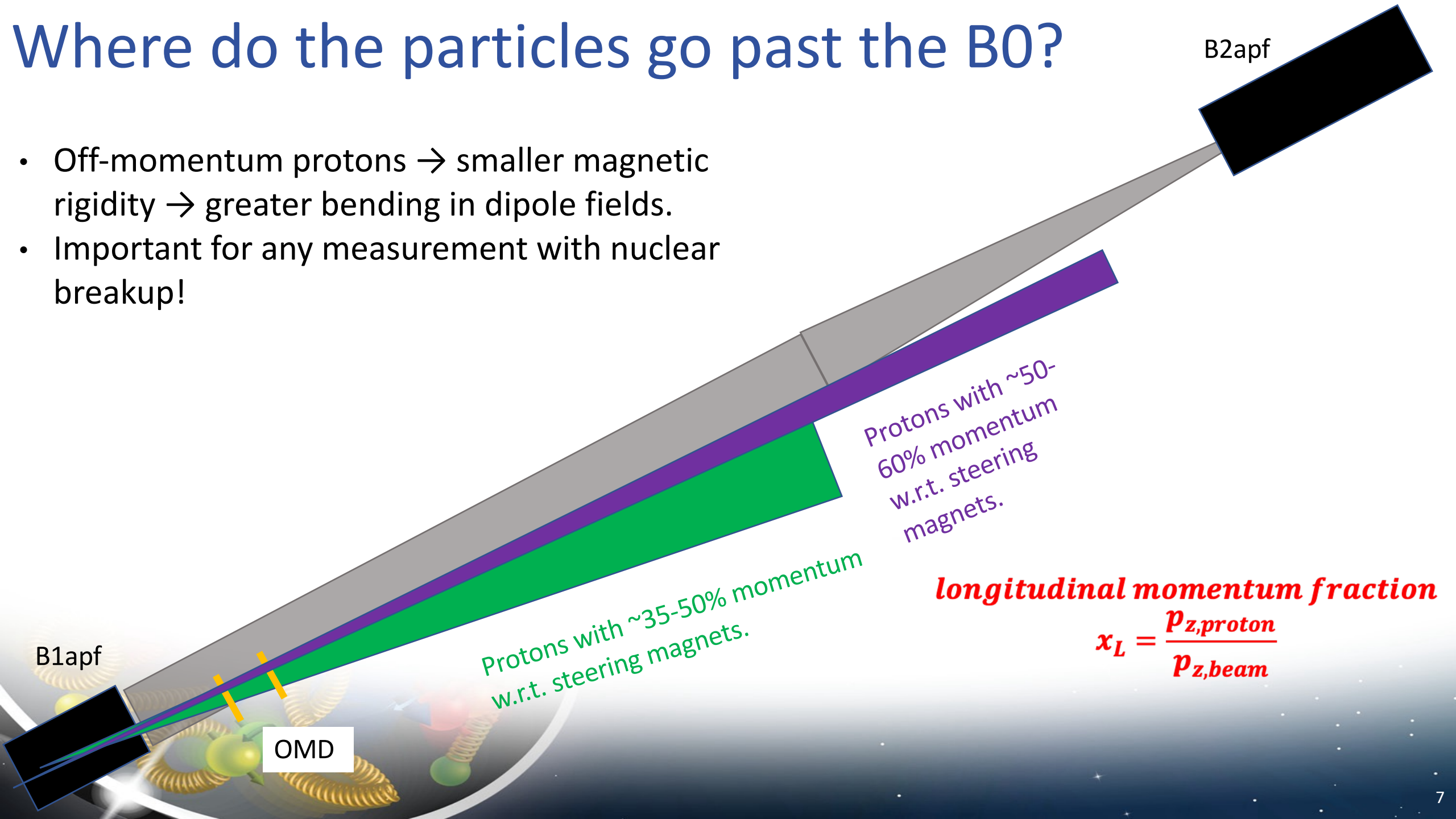


B1apf

B2apf

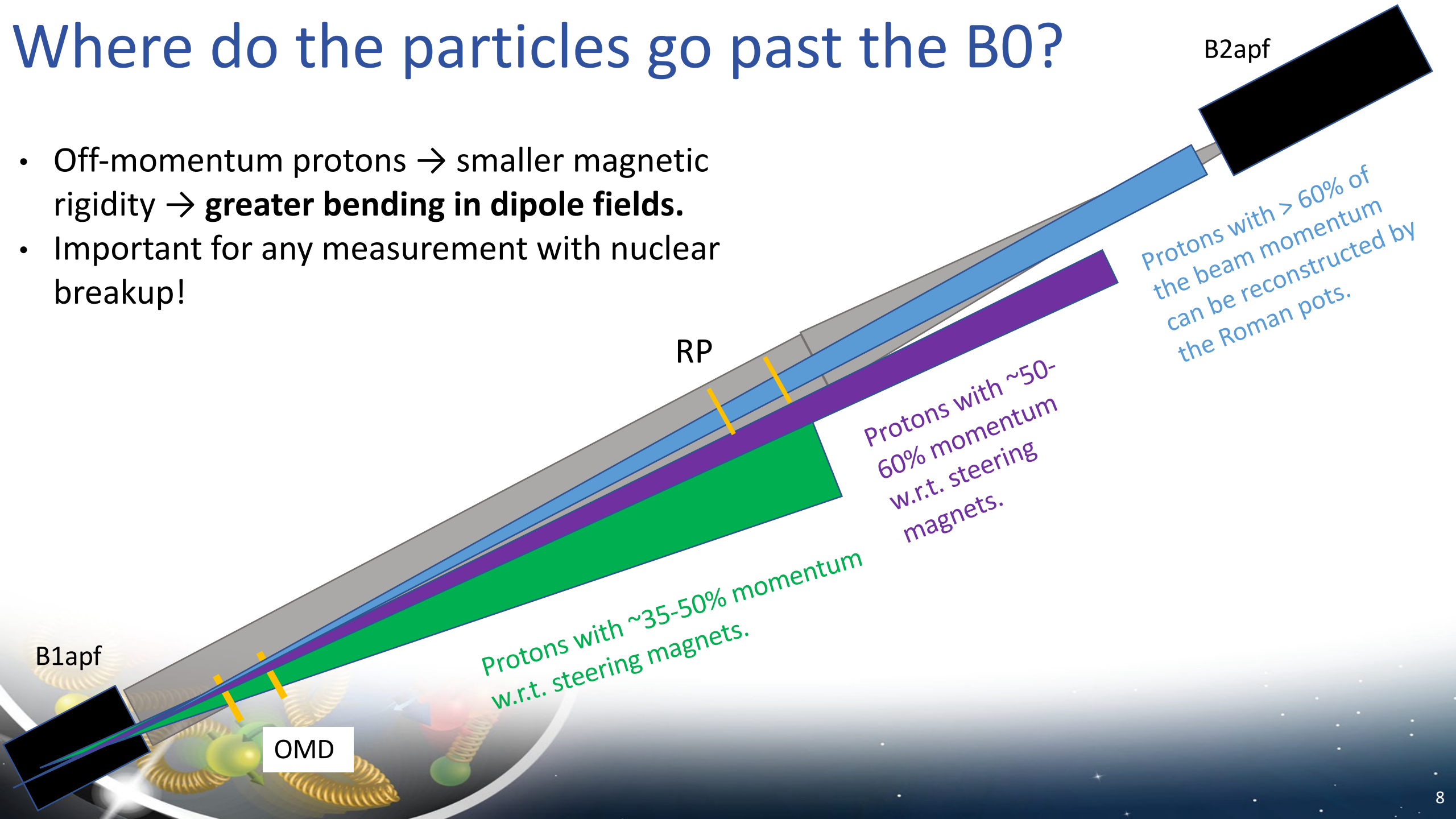
Where do the particles go past the B0?

- Off-momentum protons \rightarrow smaller magnetic rigidity \rightarrow greater bending in dipole fields.
- Important for any measurement with nuclear breakup!



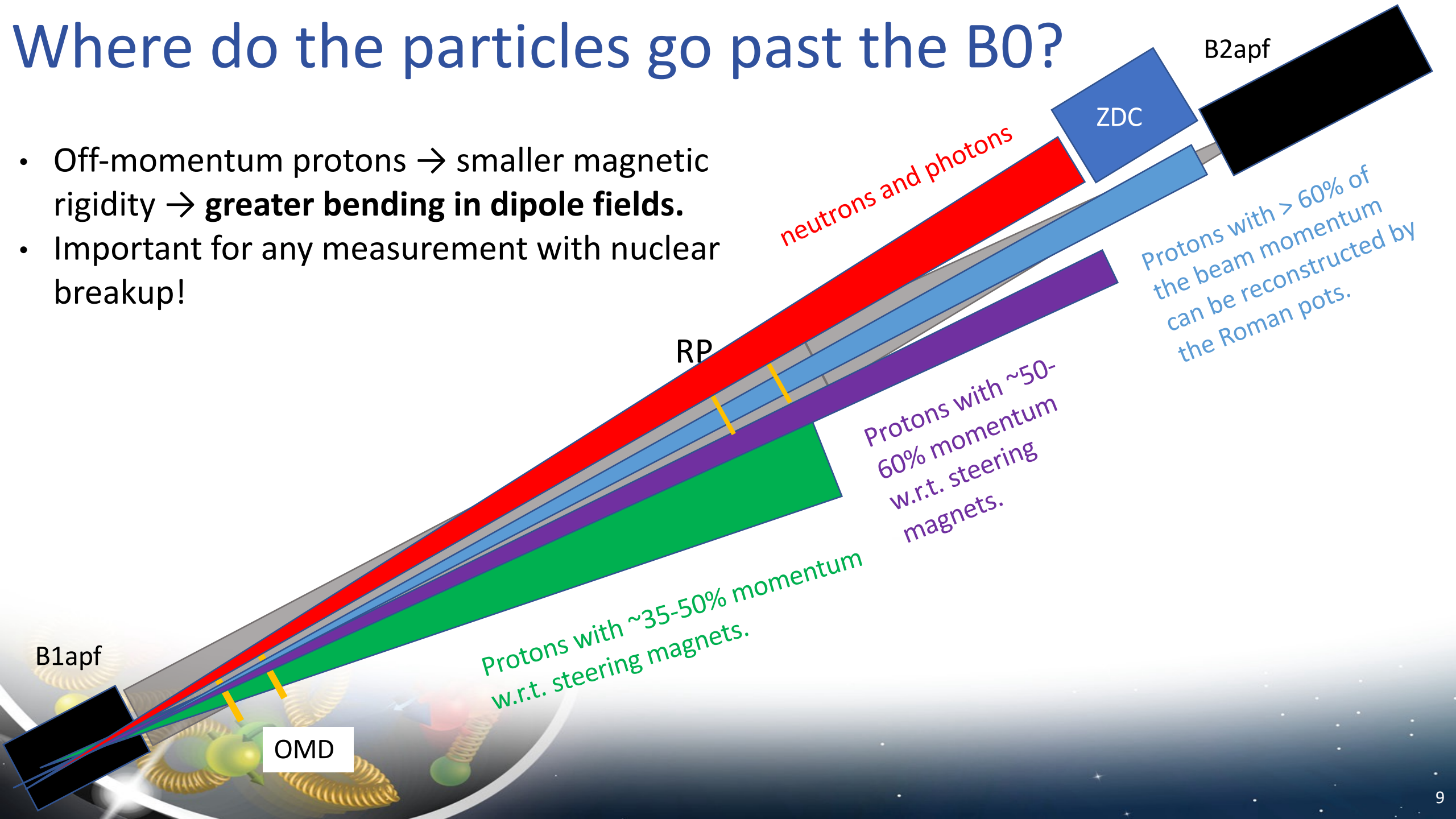
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Where do the particles go past the B0?

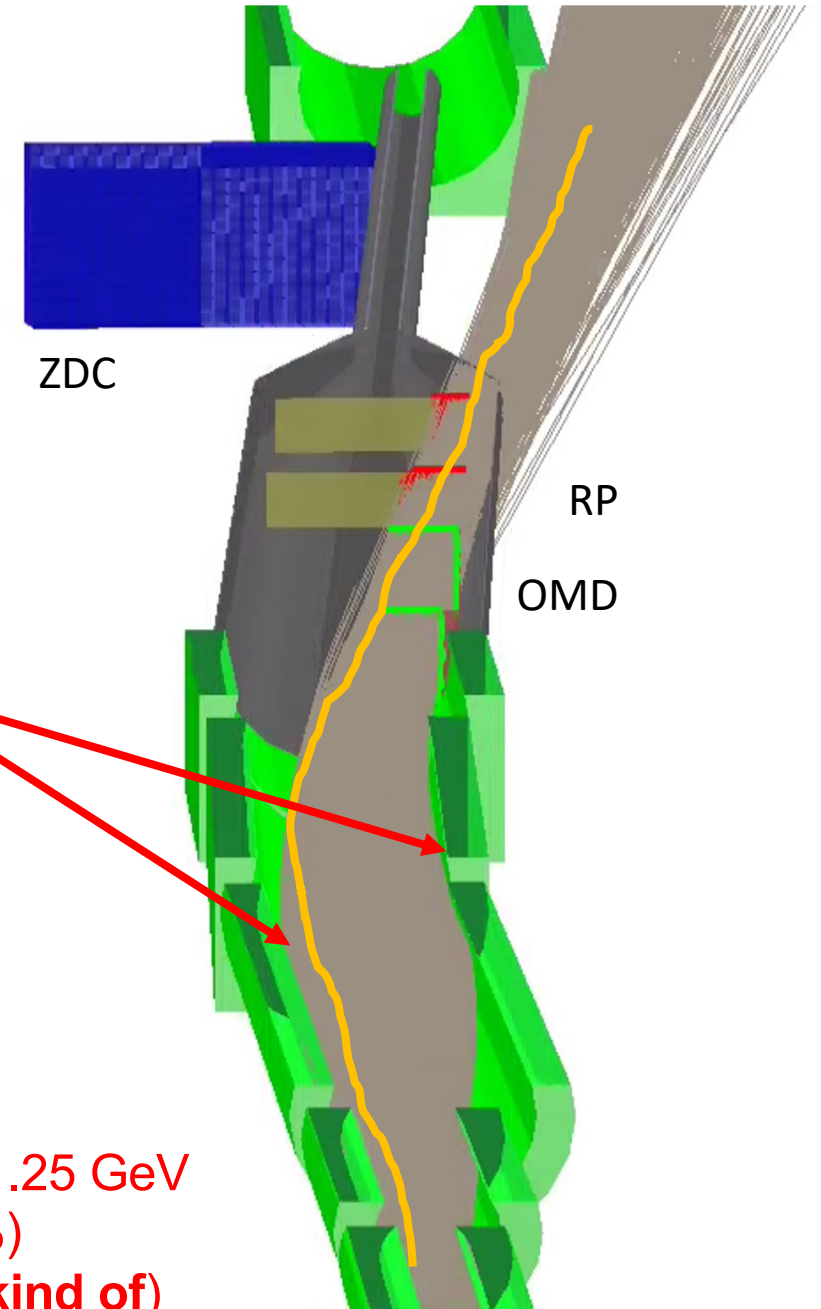
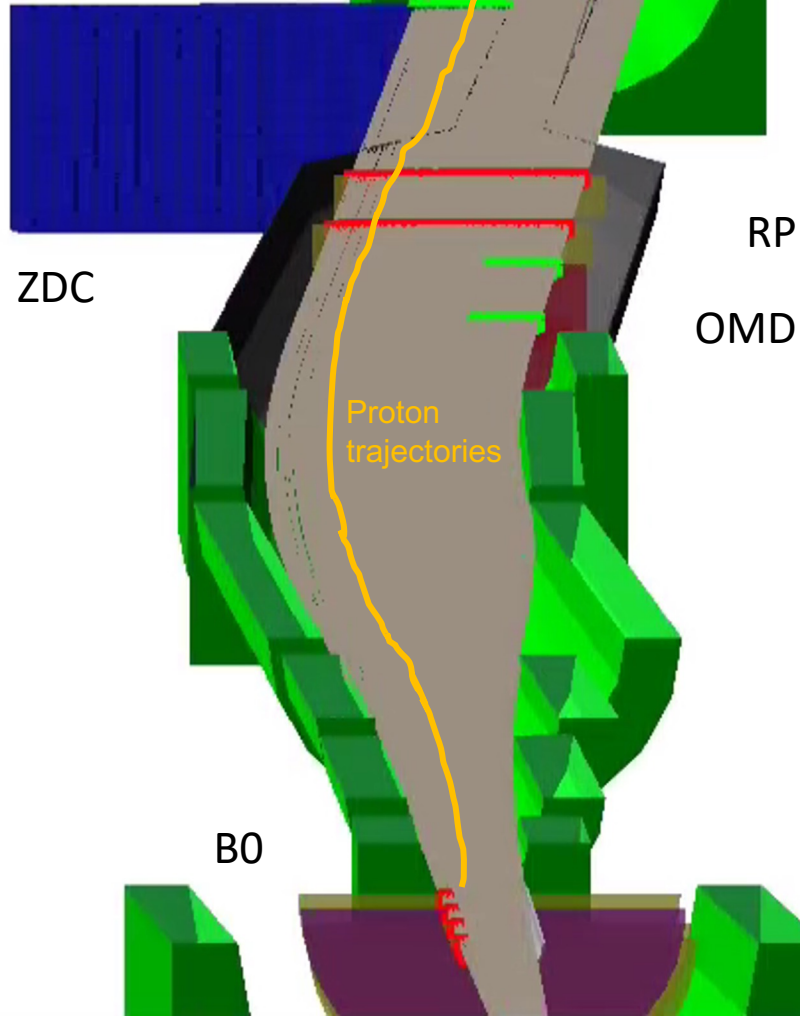
- Off-momentum protons \rightarrow smaller magnetic rigidity \rightarrow **greater bending in dipole fields.**
- Important for any measurement with nuclear breakup!



Roman Pots and OMD

Protons
 $E = 275 \text{ GeV}$
 $0 < \theta < 5 \text{ mrad}$

Full GEANT4 simulation.

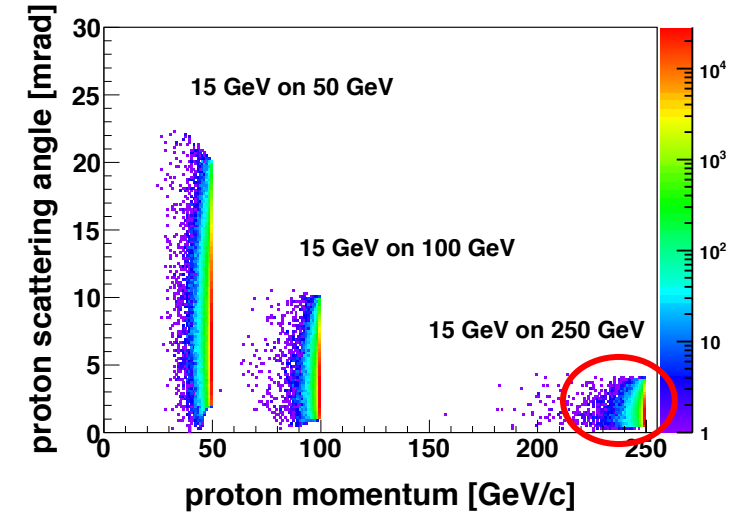
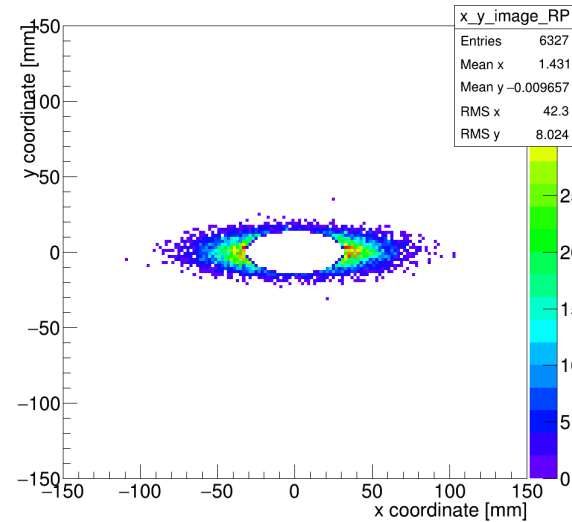
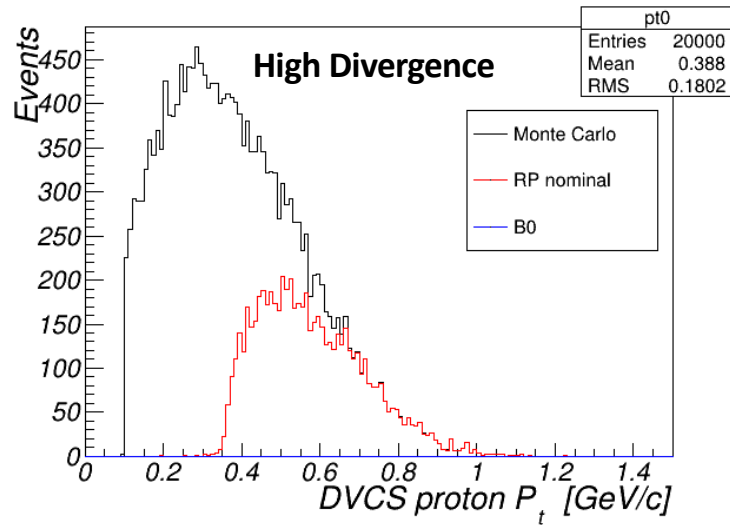


High-angle ($\theta > 2 \text{ mrad}$)
particles lost in aperture.

Protons
 $123.75 < E < 151.25 \text{ GeV}$
($45\% < x_L < 55\%$)
 $0 < \theta < 5 \text{ mrad}$ (kind of)

Digression: Machine Optics

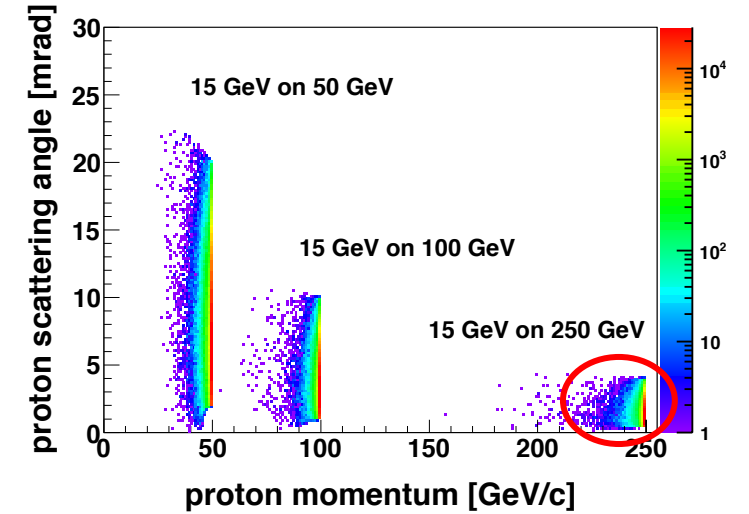
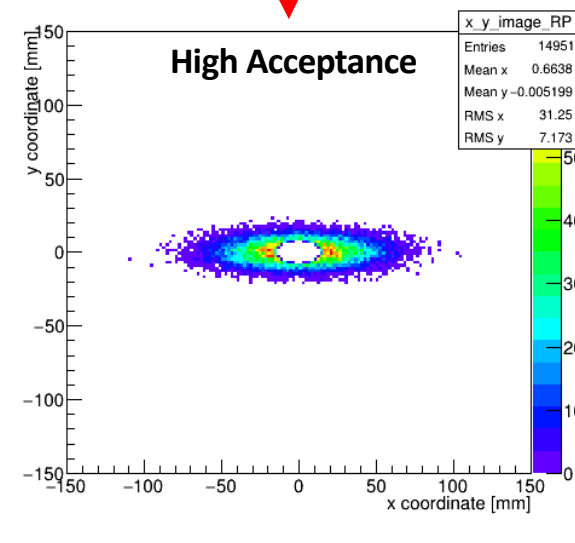
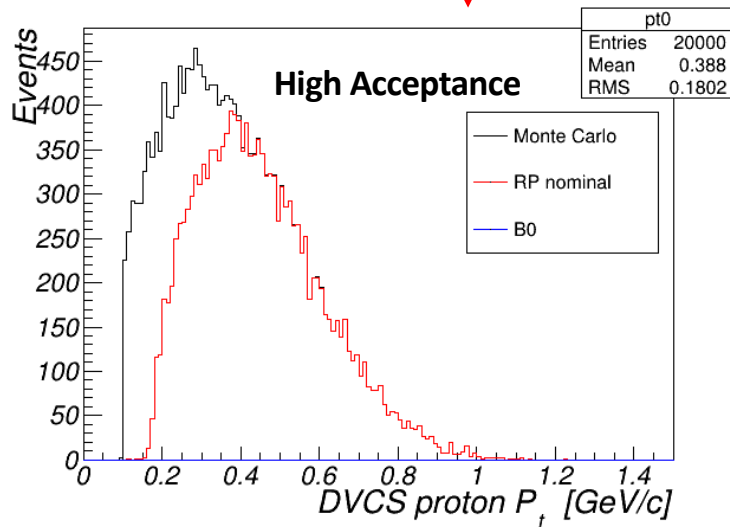
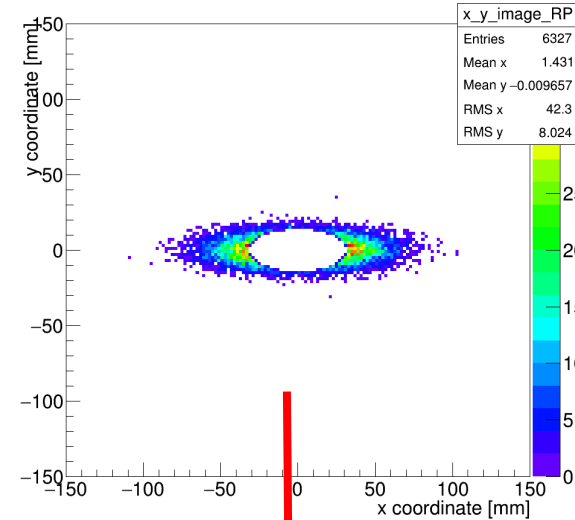
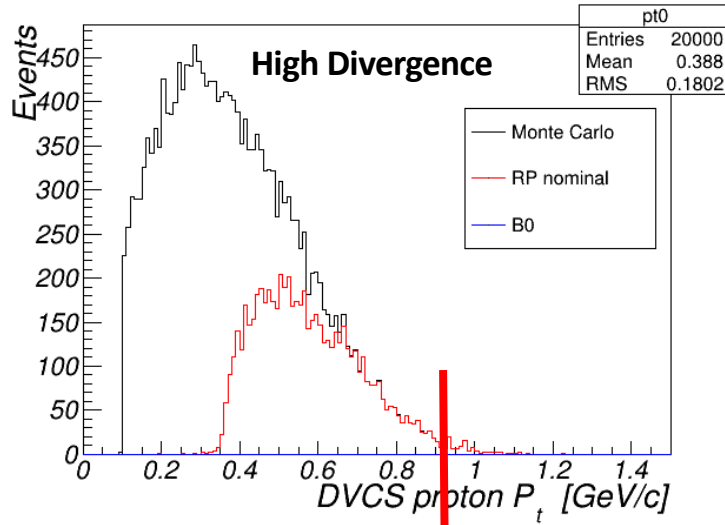
275 GeV DVCS Proton Acceptance



High Divergence: smaller β^* at IP, but bigger $\beta(z = 30m)$ -> higher lumi., larger beam at RP

Digression: Machine Optics

275 GeV DVCS Proton Acceptance

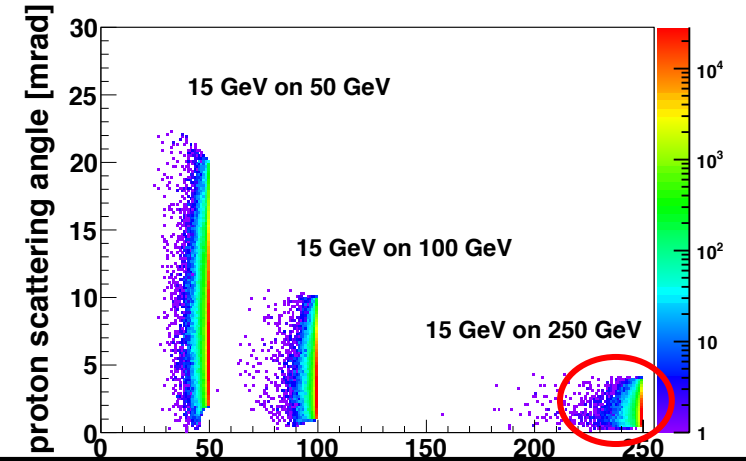
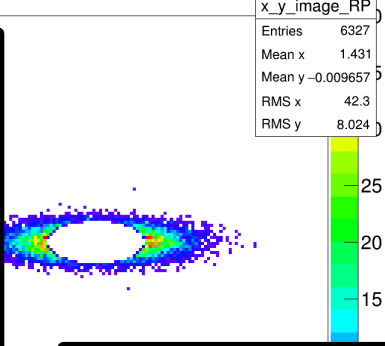
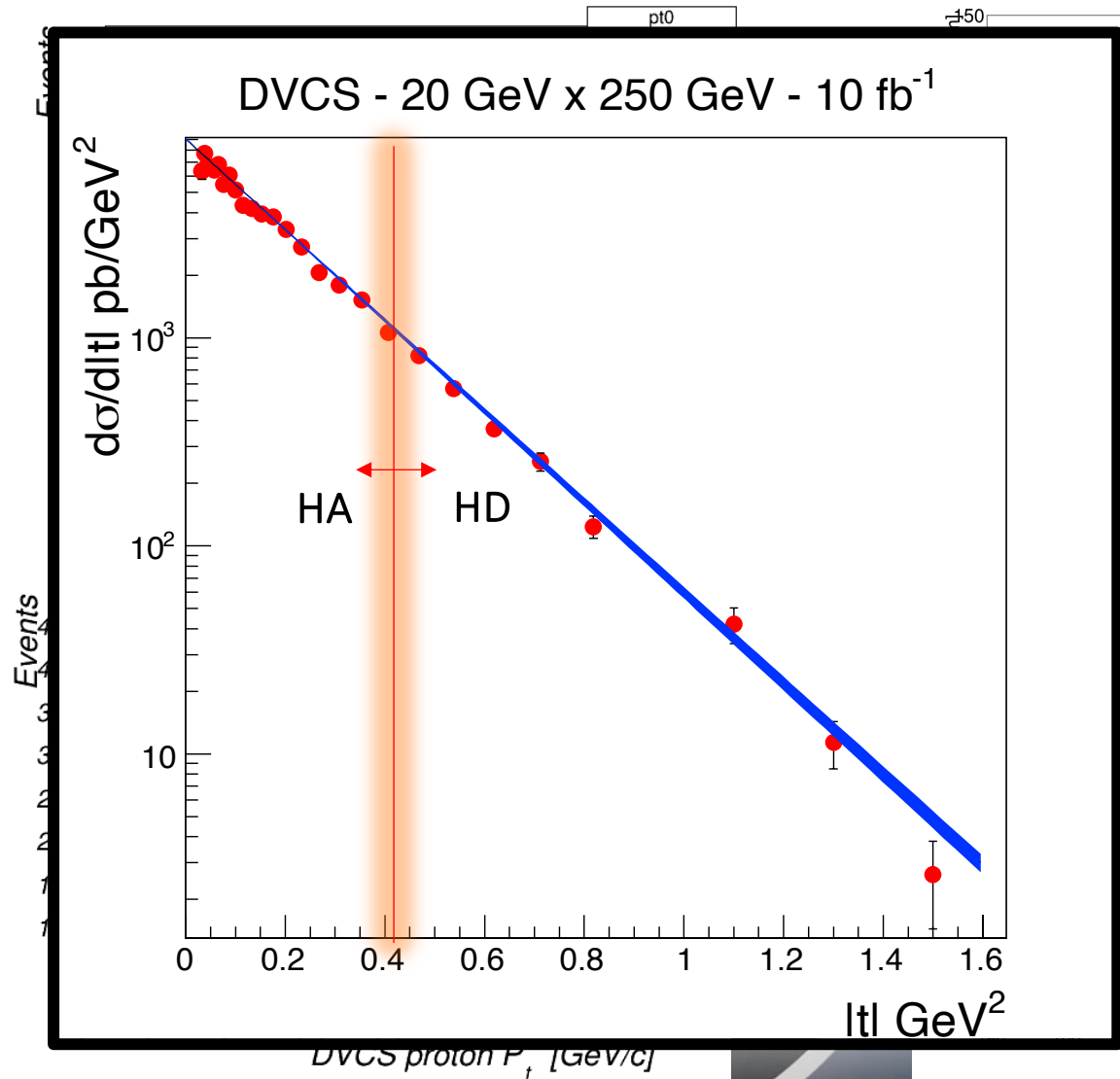


High Divergence: smaller β^* at IP, but bigger $\beta(z = 30m)$ -> higher lumi., larger beam at RP

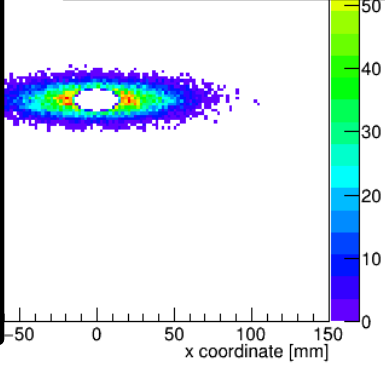
High Acceptance: larger β^* at IP, smaller $\beta(z = 30m)$ -> lower lumi., smaller beam at RP

Digression: Machine Optics

275 GeV DVCS Proton Acceptance



Using the two configurations, we are able to measure the low- t region (with better acceptance) and high- t tail (with higher luminosity).



High Acceptance: larger β^* at IP, smaller $\beta(z = 30m)$ -> lower lumi., smaller beam at RP

Summary

- All beamline detectors required for important aspects of Exclusive physics program.
- Simulation usage and details will be discussed in the afternoon session.

