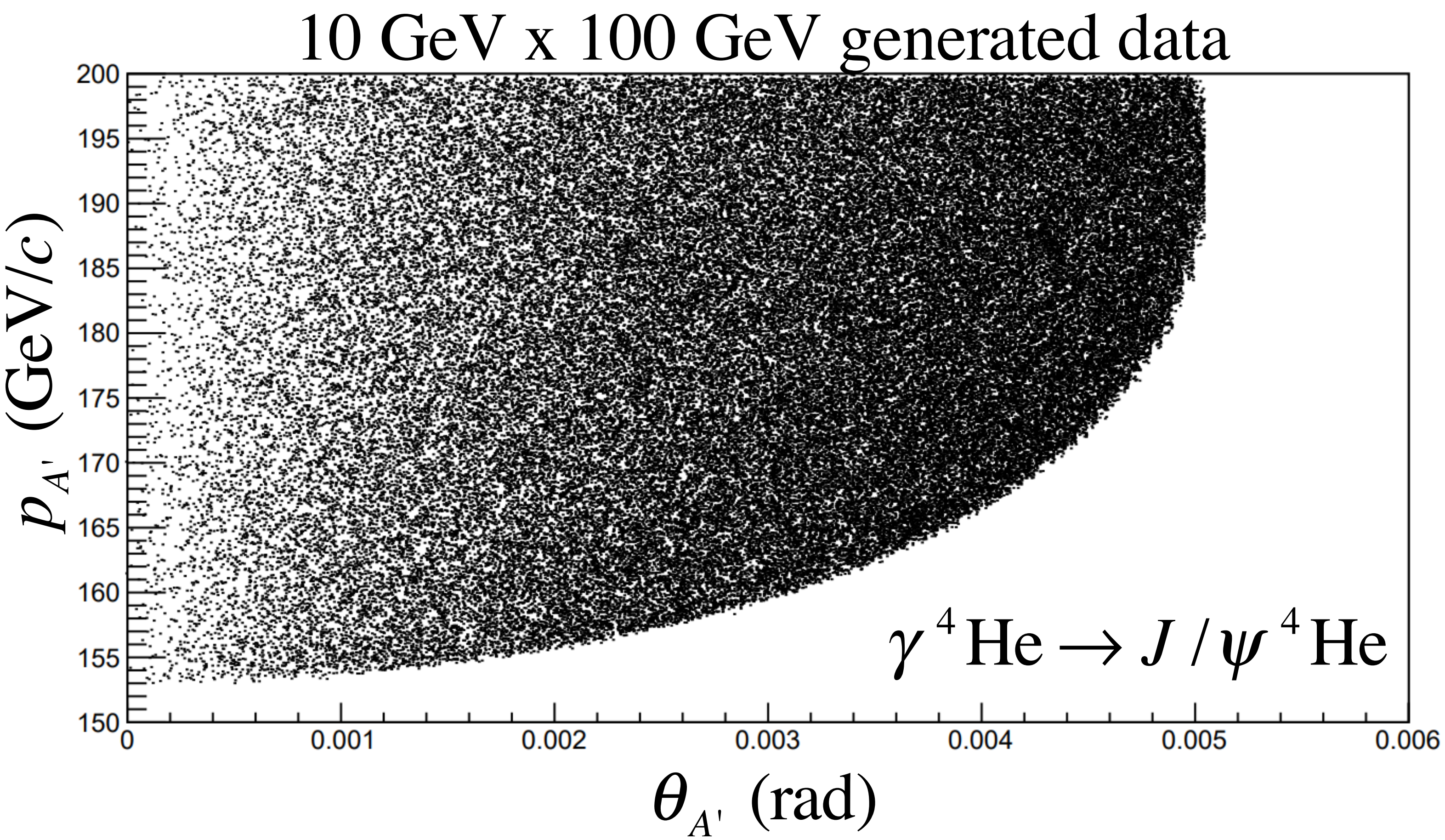
Particle ID in FF at 2nd IR for Fast Nuclei

R&D Consideration

The DIRC Group

The Problem



$p_A = 200$ GeV/c, so $p_{A'} = (0.78-1)p_A$

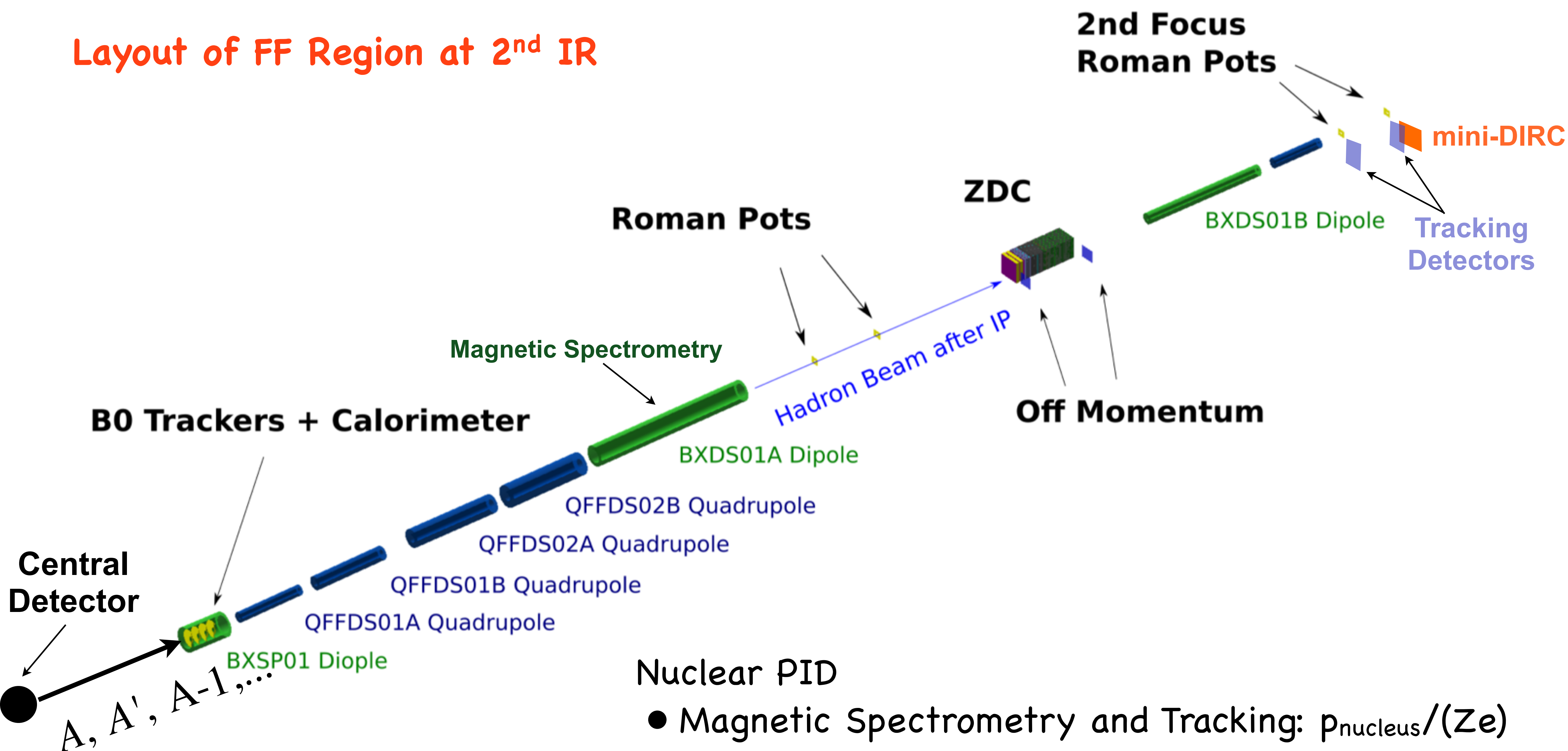
phase-space distributed events

Several EIC physics programs require detection of very forward-scattered fast nuclei (diffractive J/ψ, rare isotopes - Brynna Moran's talk)

- small scattering angles (outside the central detector acceptance)
- momentum near the ion-beam momentum

The 2nd IR is very-well suited to carry out such measurements

A mini-DIRC PID Detector at 2^{nd} IR



Nuclear PID

- Magnetic Spectrometry and Tracking: $p_{nucleus}/(Ze)$
- $p_{nucleus}/A_{nucleus} \sim p_A/A$
- mini-DIRC (single bar with a PMT): Z
- Then, $A_{nucleus}$ can be solved for

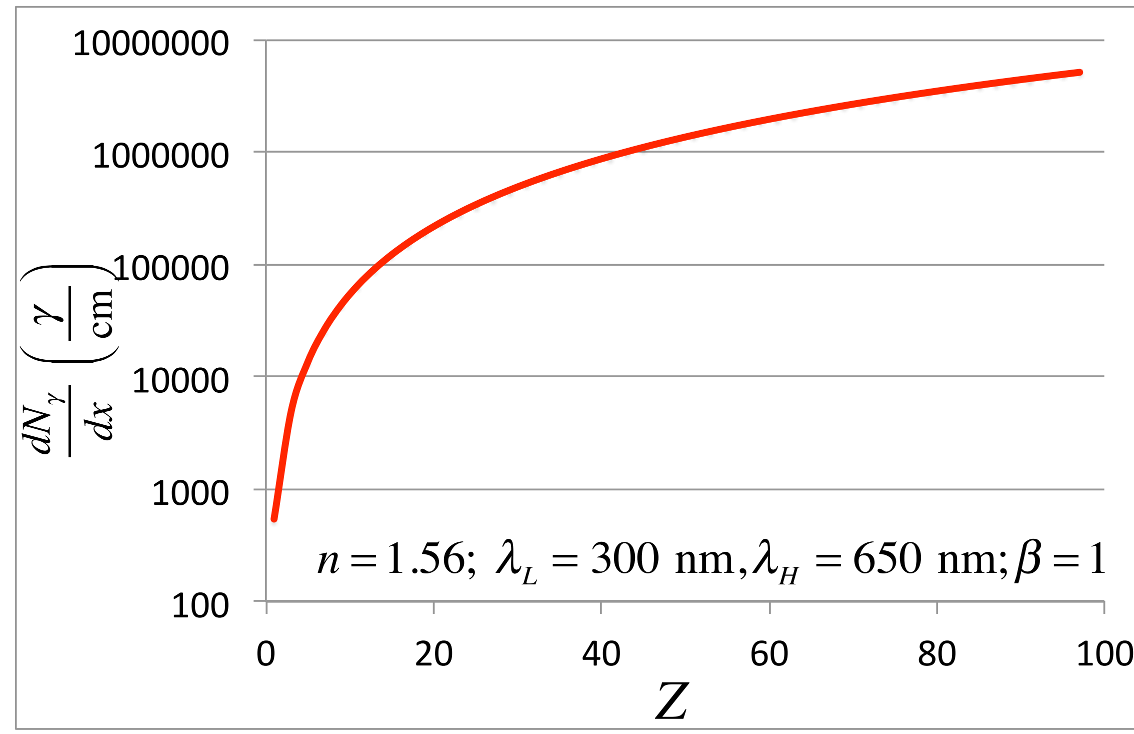
A mini-DIRC for the 2nd IR

Cherenkov Radiation Emission

- intense source of EM radiation
- continuous distribution of wavelengths

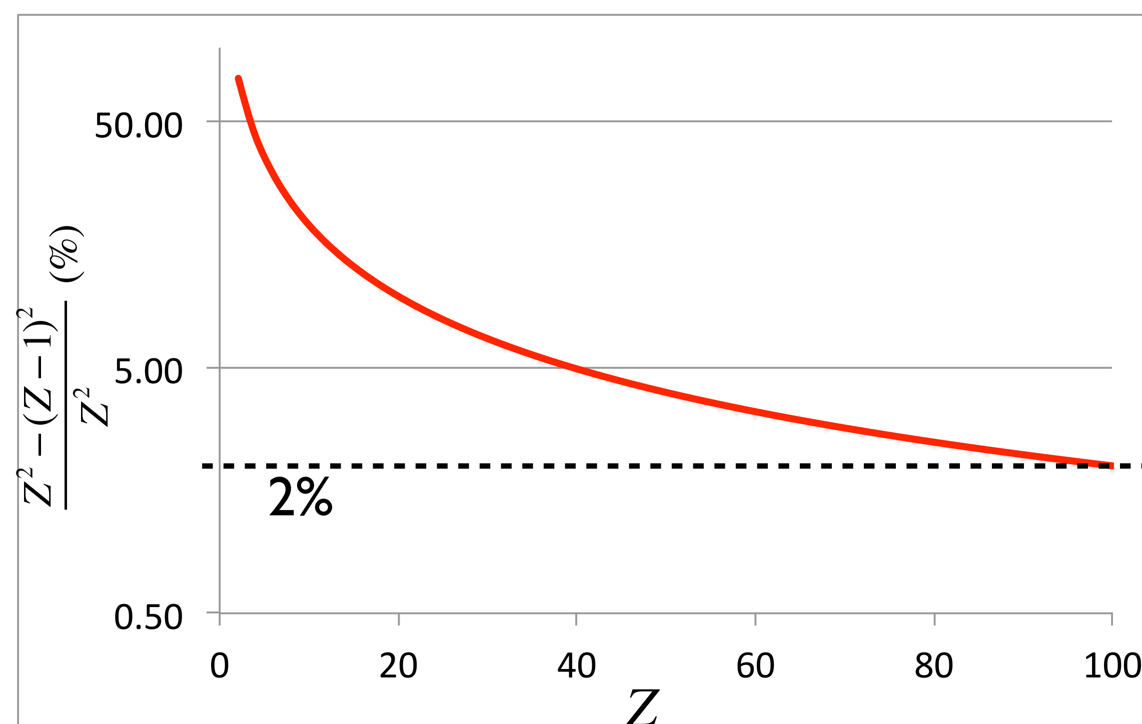
$$\frac{d^2N_\gamma}{dx d\lambda} = \frac{2\pi Z^2}{\lambda^2}\alpha \sin^2\theta_c$$

$$\frac{dN_\gamma}{dx} = 2\pi Z^2 \alpha \sin^2\theta_c \left(\frac{1}{\lambda_L} - \frac{1}{\lambda_H}\right)\ \frac{\gamma}{\text{cm}}$$



mini-DIRC

- single quartz bar at second focus
- measures photon energy flow (N_γ)
- 2% resolution needed to distinguish Z=100 from Z=99
- the needed high resolution at high Z is supported by the high photon yield at high Z



R&D

- best solution for a PMT
- detector simulation: photon transmission efficiency, determination of Z from PMT response