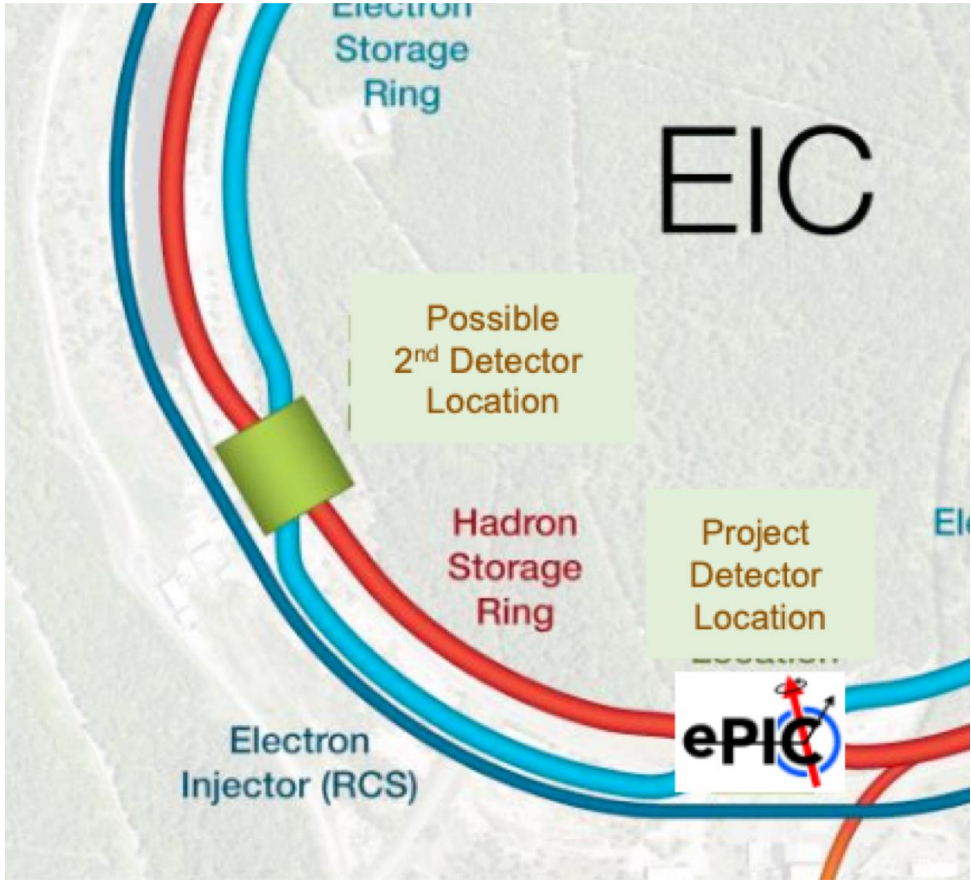
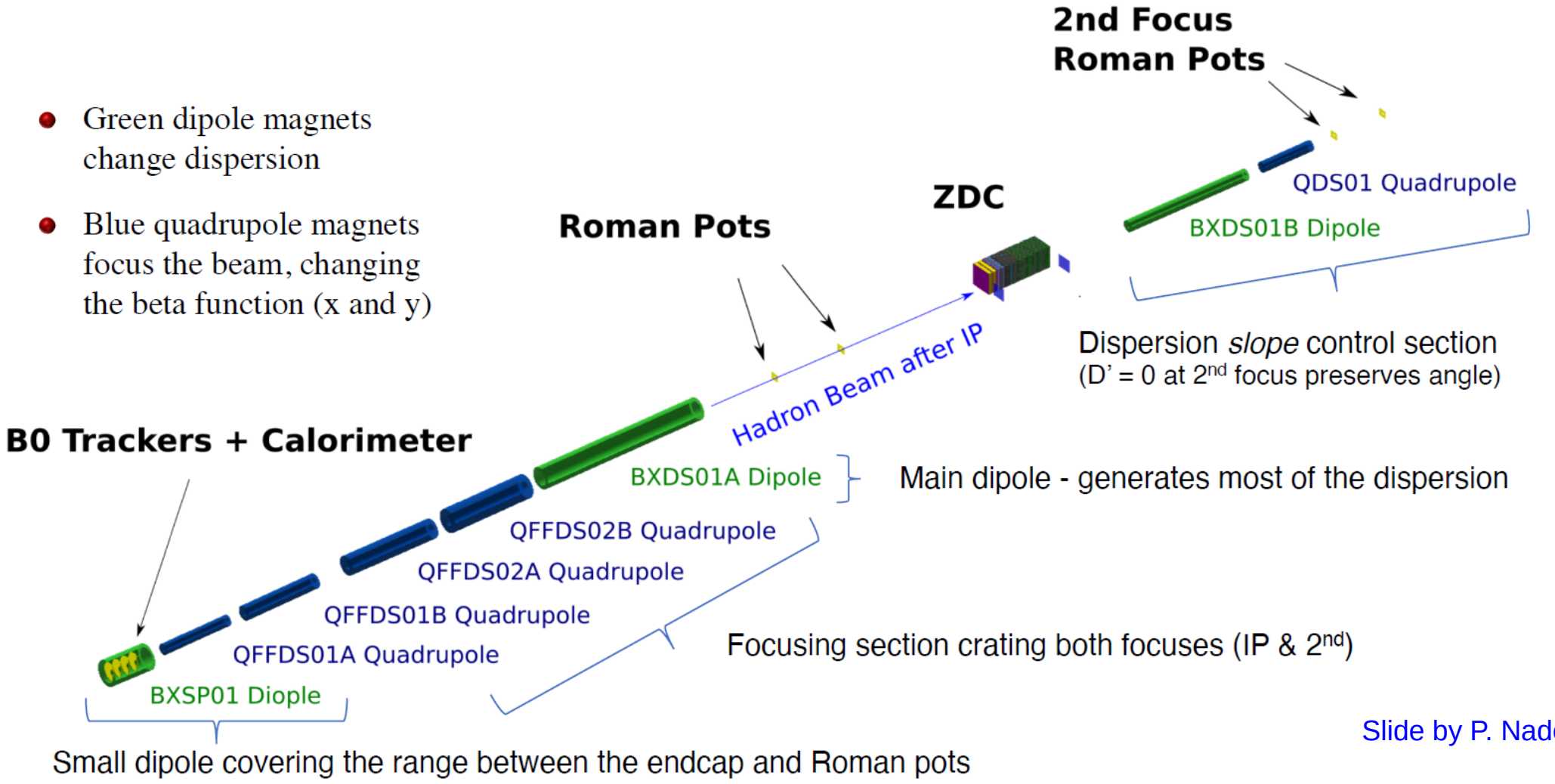
Using the 2nd EIC Interaction region to detect nuclear fragments

Barak Schmookler



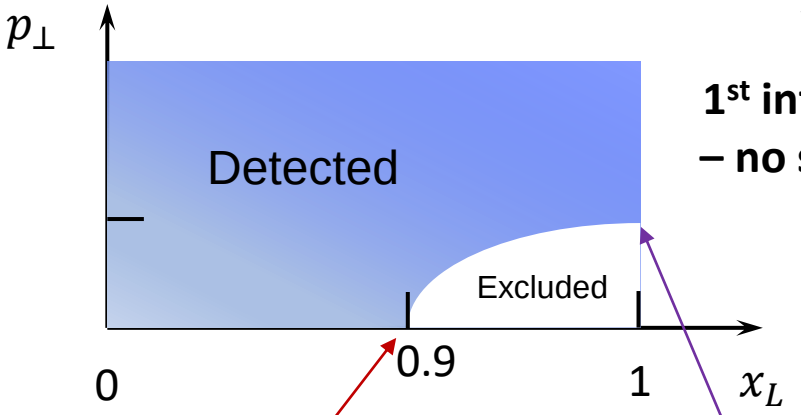
Conceptual design for 2nd EIC Interaction region contains a secondary focus in the forward spectrometer

- Green dipole magnets change dispersion
- Blue quadrupole magnets focus the beam, changing the beta function (x and y)



Slide by P. Nadel-Turonski

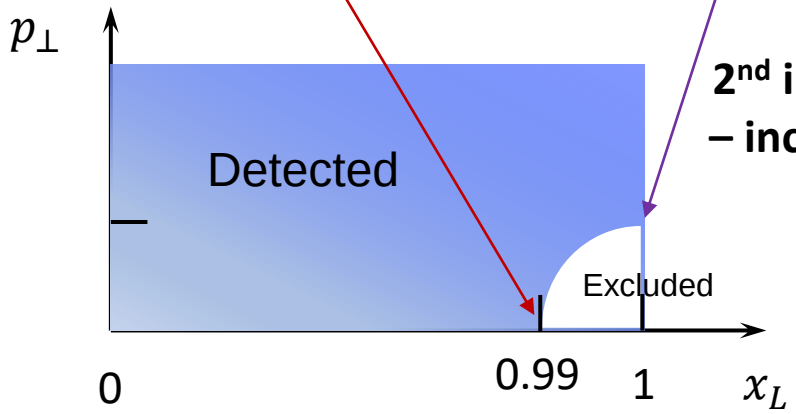
Conceptual design for 2nd EIC Interaction region contains a secondary focus in the forward spectrometer



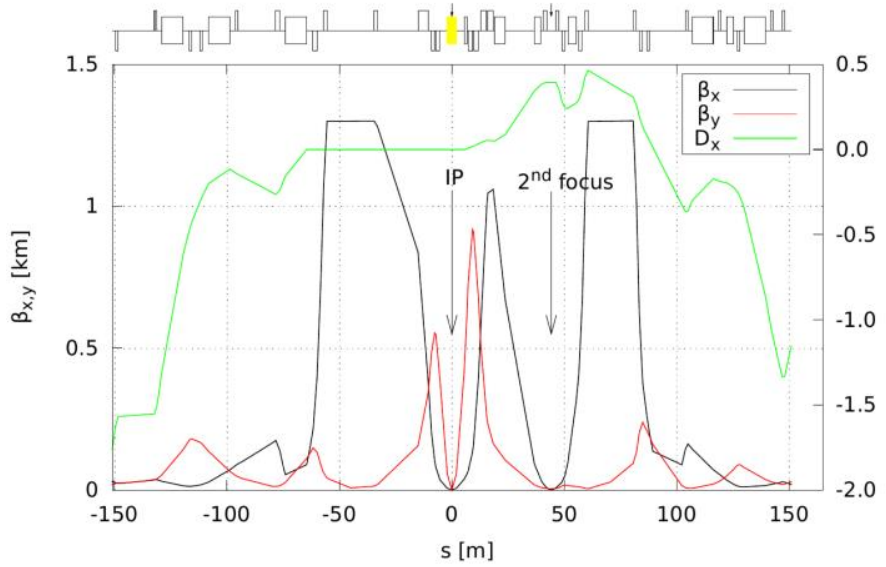
1st interaction region – no secondary focus

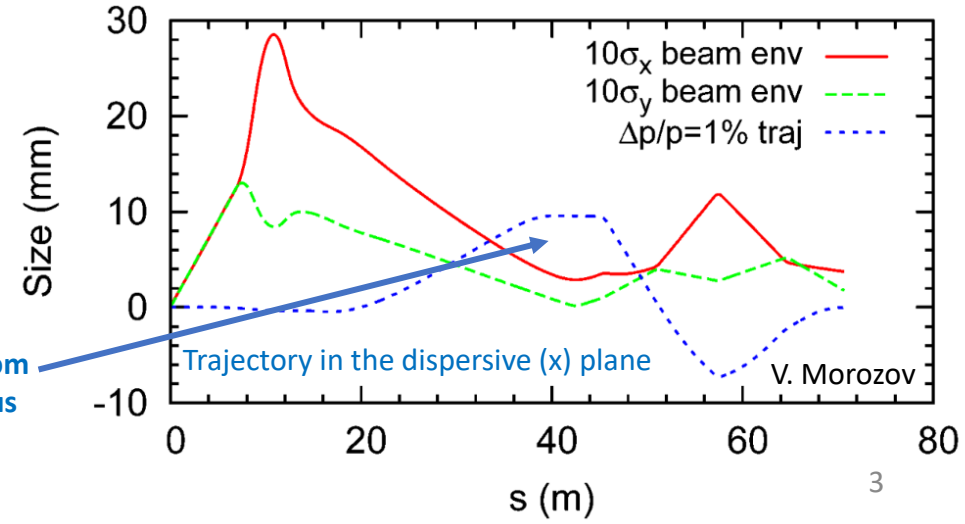
Limited by D_x and β_x

Limited by angular acceptance ($\beta^*=\beta_{IP}$)



2nd interaction region – including secondary focus

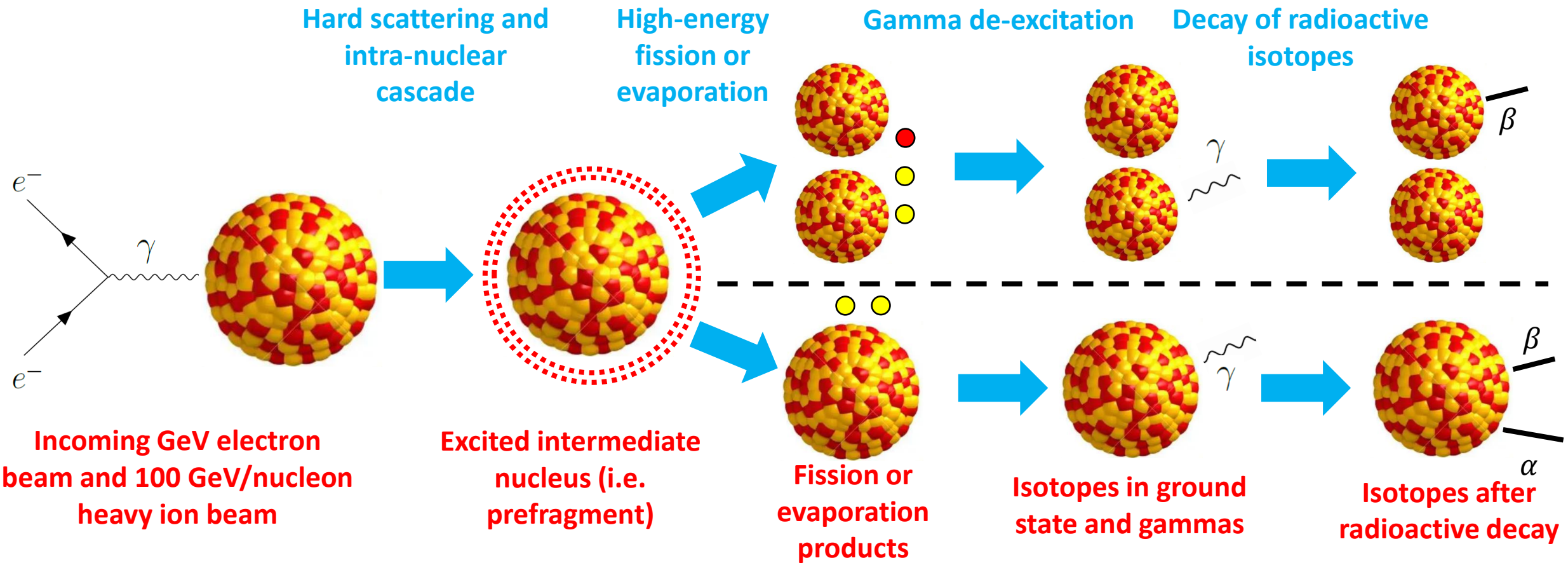




Particles emerge from beam near 2nd focus

https://arxiv.org/abs/2105.13564

One way this 2nd focus can be used – Nuclear fragments



t = 0

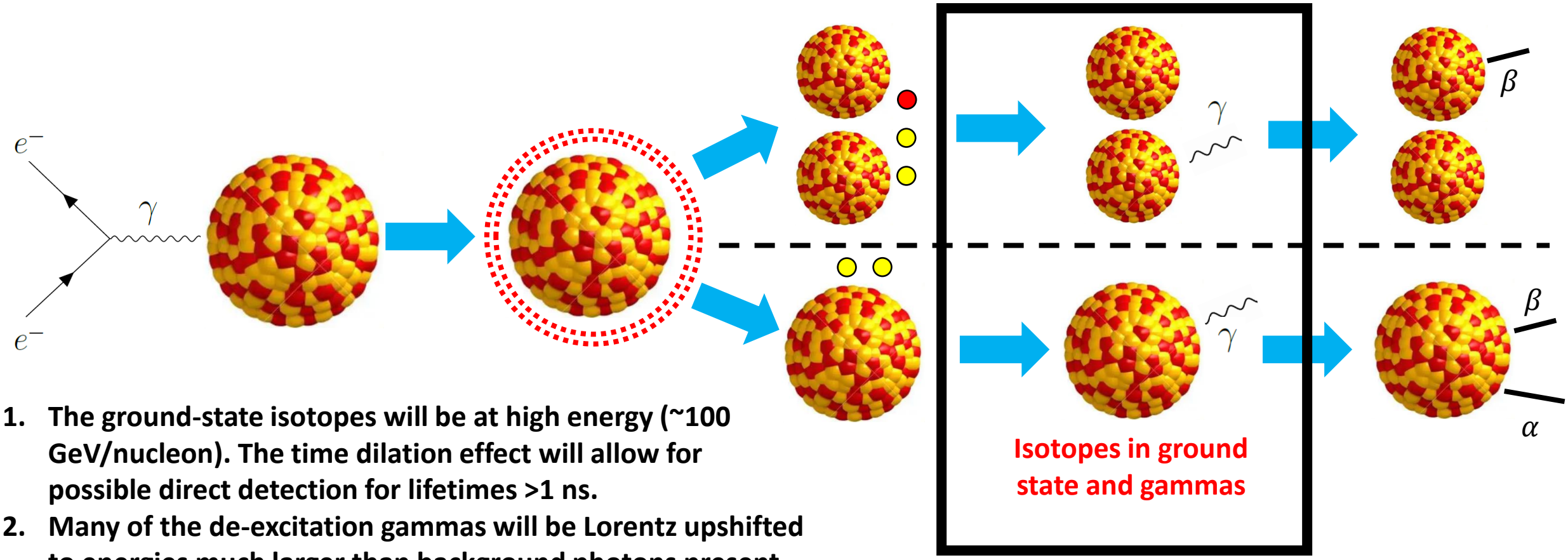
t = 10^{-22} s

t = 10^{-20} - 10^{-17} s

t = 10^{-14} s

t = ? – never (stable)

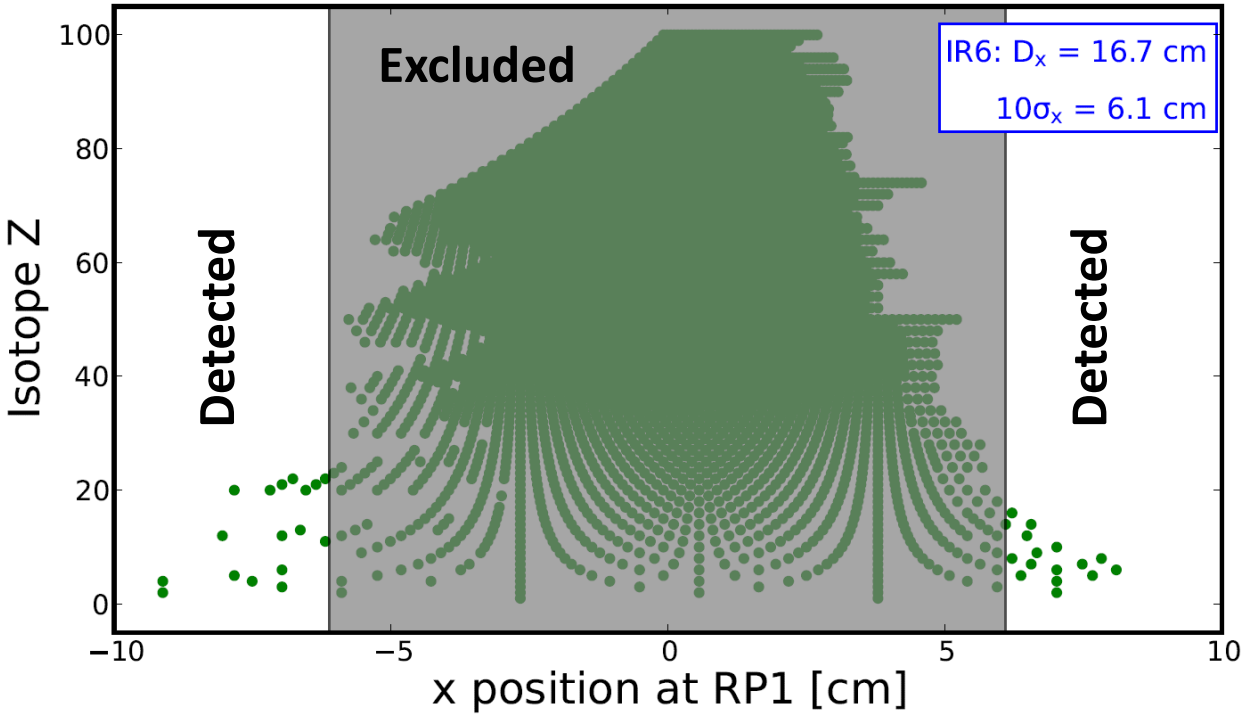
Where the EIC can potentially contribute



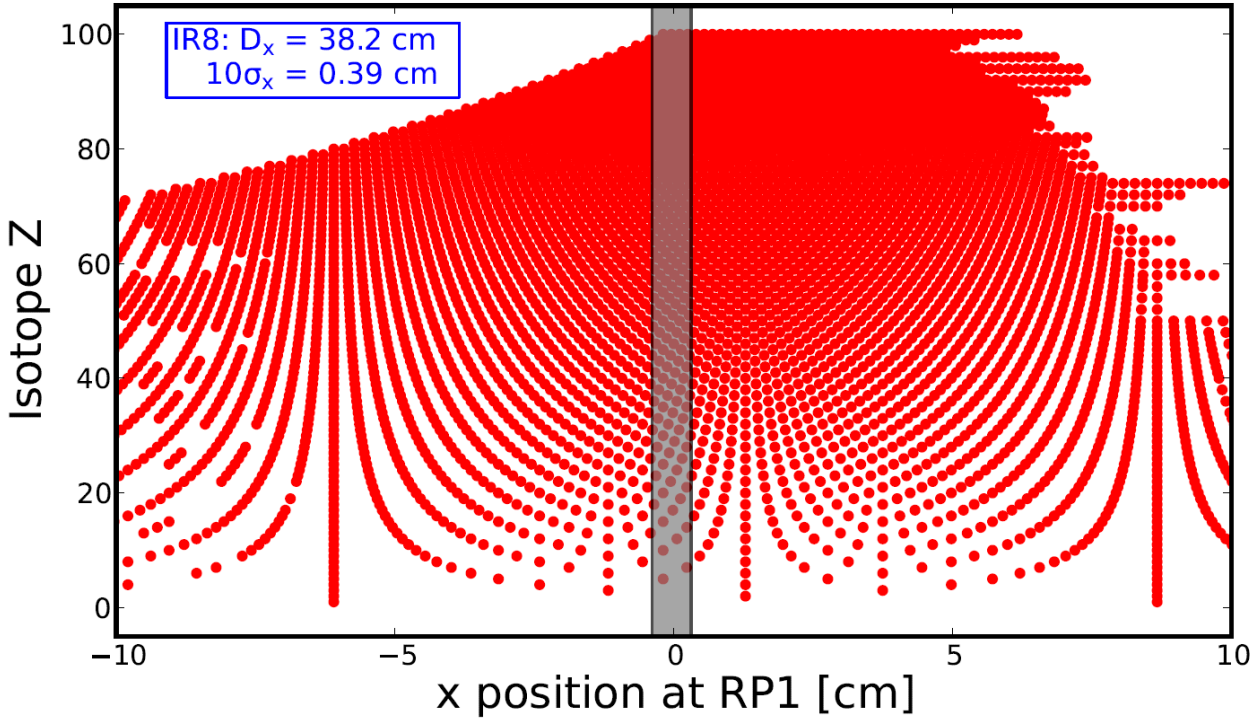
1. **The ground-state isotopes will be at high energy (~100 GeV/nucleon). The time dilation effect will allow for possible direct detection for lifetimes >1 ns.**
2. **Many of the de-excitation gammas will be Lorentz upshifted to energies much larger than background photons present in the detector area. This will allow for clean detection/identification of these gamma rays, which can be used to study the level-structure of the isotopes.**

Acceptance for fragments in IP6 and IP8

1st interaction region



2nd interaction region



x position gives $\sim A/Z$

Each point is an individual isotope. All known and potential isotopes which come from a combined *NNDC* and *LISE++* database are included.

Assuming a RP position resolution of 10-100 microns, isotopes with the same Z are well separated.

Thanks!

JiaJun will give details on the simulations!