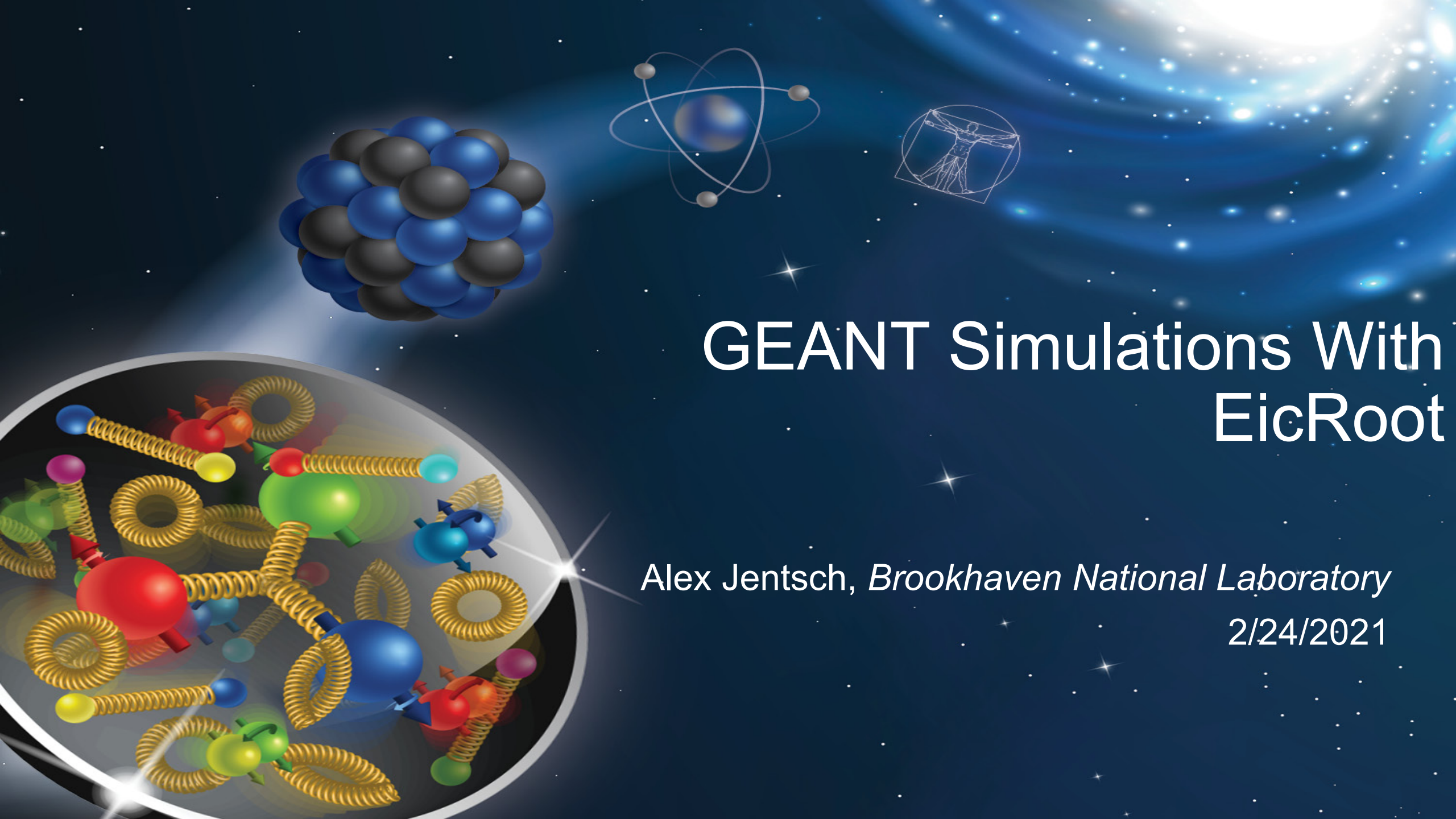

GEANT Simulations With EicRoot

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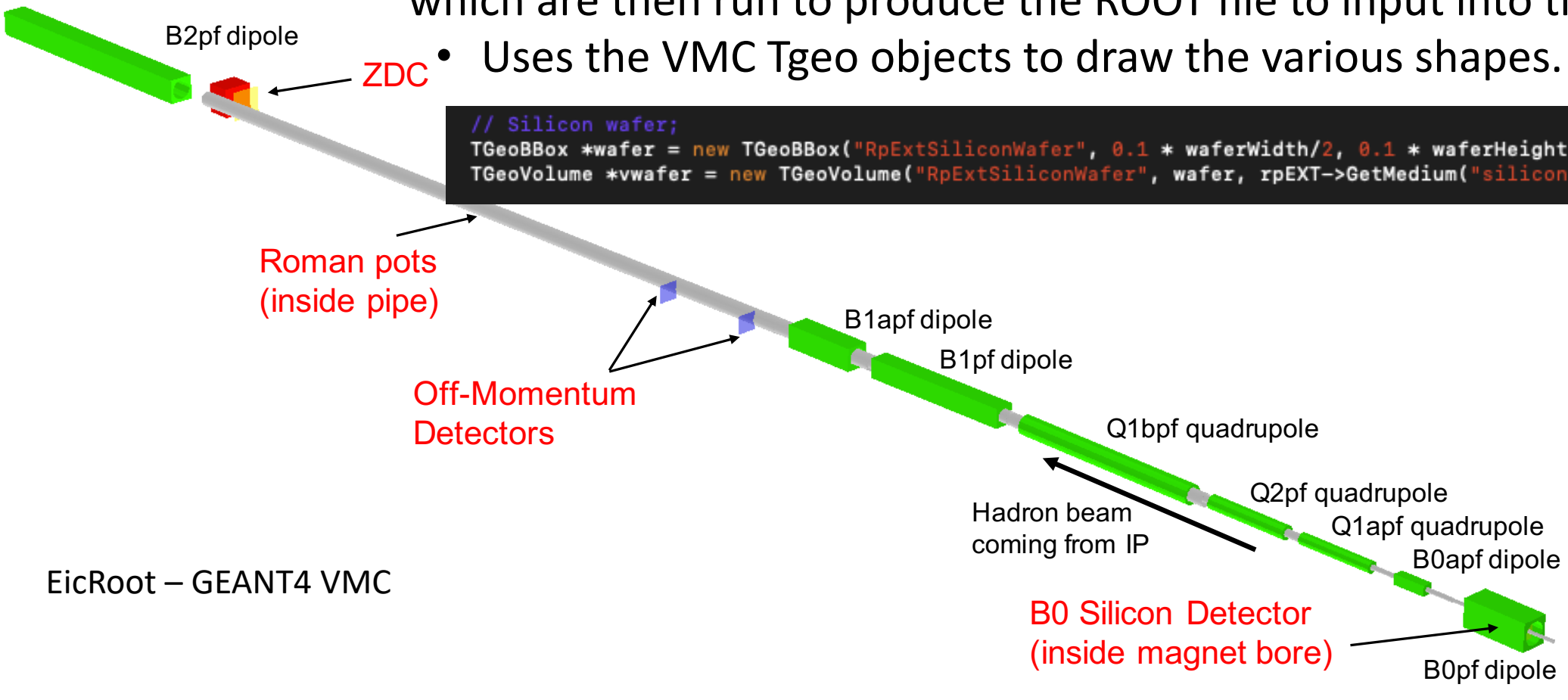
Preliminaries

- EicRoot is based on FairRoot which utilizes the ROOT VMC interface for Geant3 and Geant4.
  - In principle can switch between the two, each has different input configuration format for defining processes, cuts, etx. in the GEANT simulation, however.
- Includes classes for digitization of hits on active materials, and classes for tracking and reconstruction.
- Links to eic-smear for use of common EicTree class to allow for input from EicTree ROOT files, as well as LUND-style (PYTHIA6) txt input event files.

Element Placement and Definitions

- Magnets defined using native EicMagneticField class, which allows for setting the relevant components (bore size, length, rotation, dipole field, quad gradient, etc.).
- Detectors and beam line elements each defined via simple ROOT macros, which are then run to produce the ROOT file to input into the simulation.
  - Uses the VMC Tgeo objects to draw the various shapes.

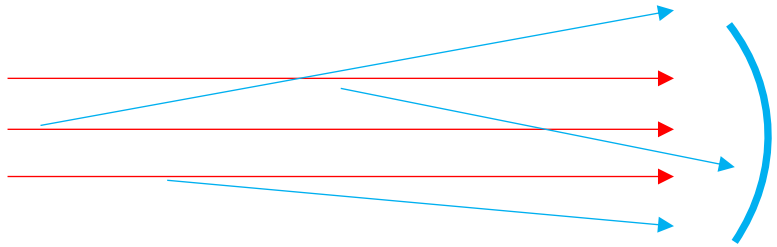
```
// Silicon wafer;
TGeoBBox *wafer = new TGeoBBox("RpExtSiliconWafer", 0.1 * waferWidth/2, 0.1 * waferHeight/2, 0.1 * waferThickness/2);
TGeoVolume *vwafer = new TGeoVolume("RpExtSiliconWafer", wafer, rpEXT->GetMedium("silicon"));
```



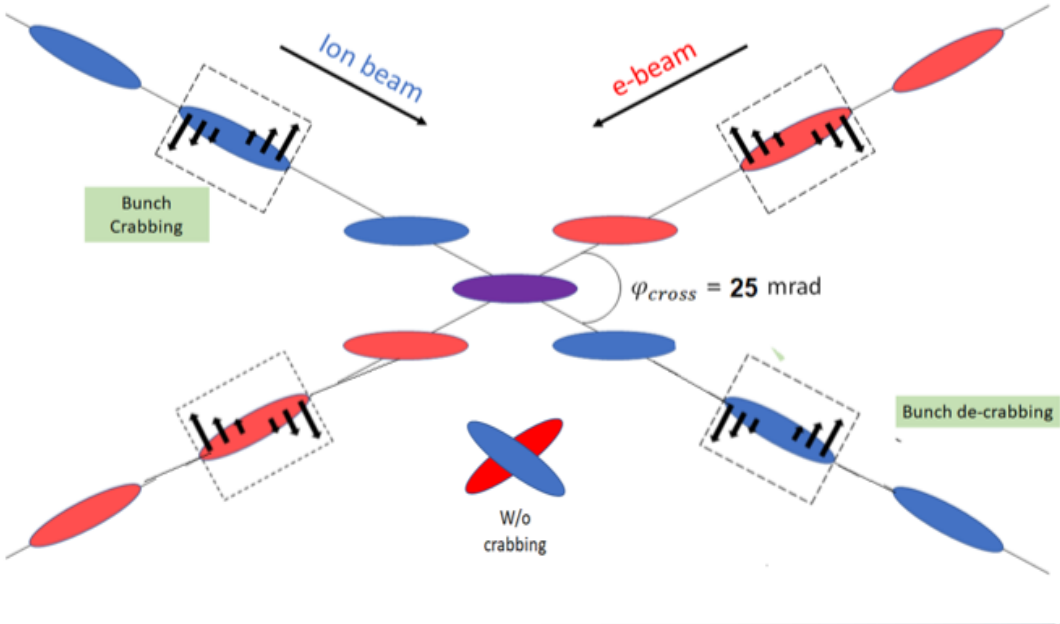
EicRoot – GEANT4 VMC

Included Effects (description)

- Angular divergence
  - Angular “spread” of the beam away from the central trajectory.
  - Gives some small initial transverse momentum to the beam particles.



- Crab cavity rotation
  - Can perform rotations of the beam bunches in 2D.
  - Used to account for the luminosity drop due to the crossing angle – allows for head-on collisions to still take place.



- Detector Choices
  - Pixel size, RP transfer matrix, etc.

These effects introduce smearing in our momentum reconstruction.

Included Effects (implementation)

- Angular divergence (final state)
  - Calculate boost of assumed initial beam hadron (px = 0, py = 0, pz = 275 GeV, for example).
  - Use angular divergence values in x,y from CDR tables as σ for random Gaussian smear of p_x and p_y of assumed initial beam. Get the “smeared boost”.
  - Boost final state particle vectors to rest frame of initial beam with unsmeared boost.
  - Boost back to lab frame with the “smeared boost”.
- Crab cavity rotation
  - Applied as vertex smearing on generator level before propagation through Geant.
- Detector Choices
  - Pixel size (Use Gaussian smearing at digitization stage).
  - RP transfer matrix (assume linear optics – done at analysis stage, not dependent on EicRoot).
  - Kalman Filter reconstruction for the B0 (uses internal classes, can choose to use vertex constraint, include efficiency, etc.)