FCC-ee Beam Background

Katie Kudela

04/08/25

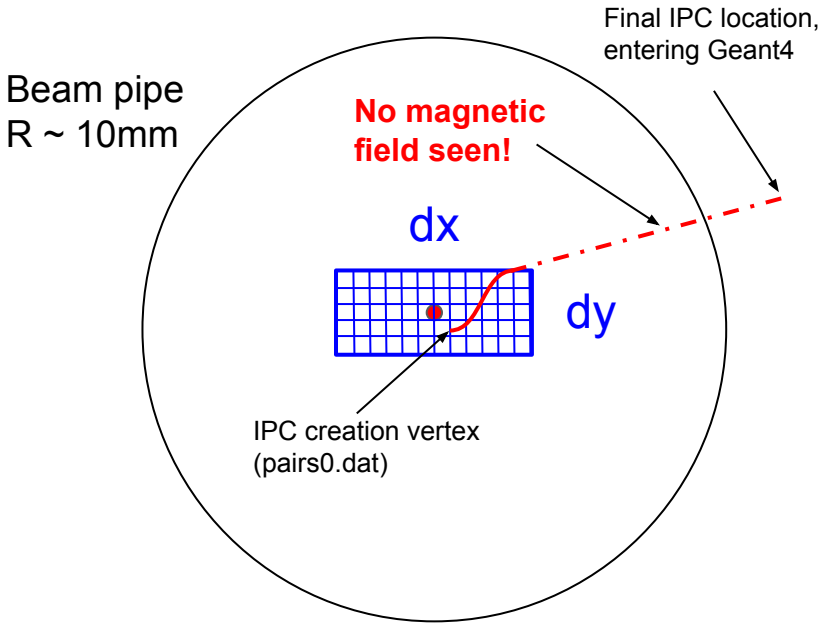
Guinea Pig studies

- The majority of the MC particles hitting VTX layer 1 are “created” outside of the beam pipe
- This means all of those particles propagate large distances without feeling the magnetic field of the detector
- This greatly affects occupancy

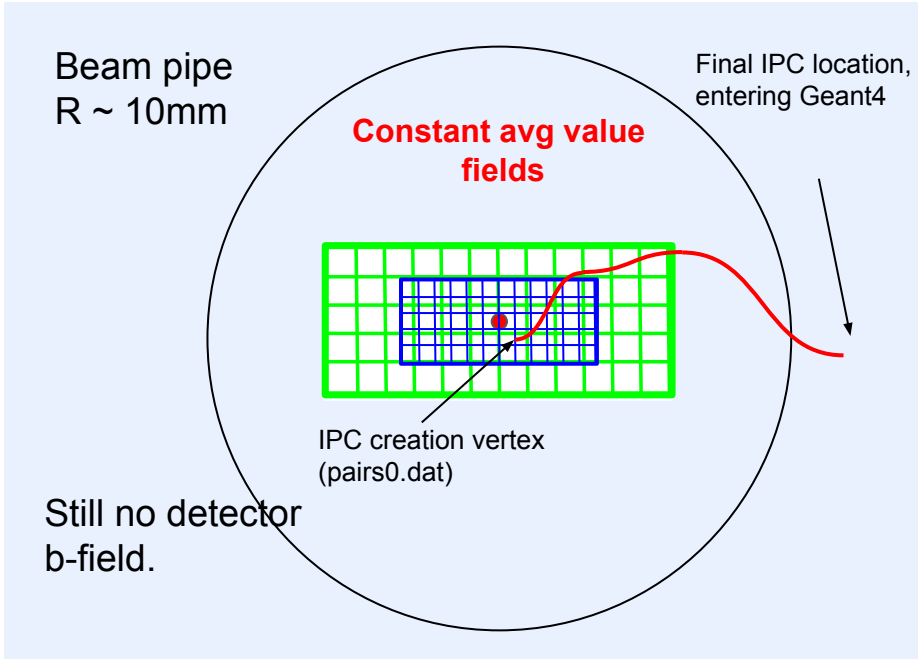
Need to configure Guinea Pig such that we are accurately including the fields of the beams as well as the detector’s magnetic field.

How does Guinea Pig work?

What we originally thought:



What we learned from experiment & Ciarma:



Guinea Pig studies

Issues:

- These grids extend past the beam pipe
- Detector magnetic field is not taken into account
- Beampipe fields not taken into account (difficult problem for later)

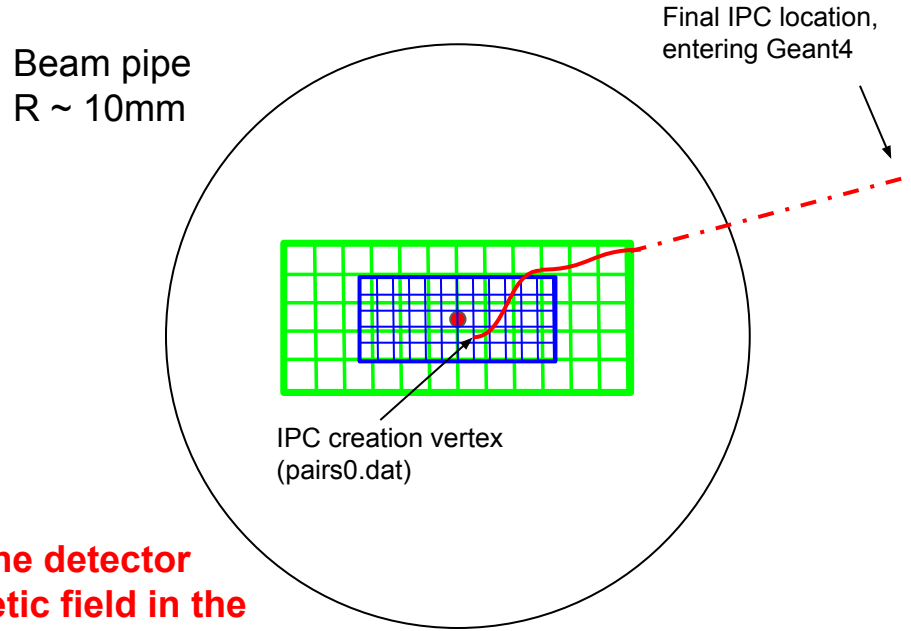
Two solutions that should be compatible with each other:

1. Take the MC particles that have propagated outside of the mesh grid and trace them back to the edge
2. Edit Guinea Pig such that these particles are not allowed to propagate outside of the grid in the first place

These two solutions should be compatible with each other.

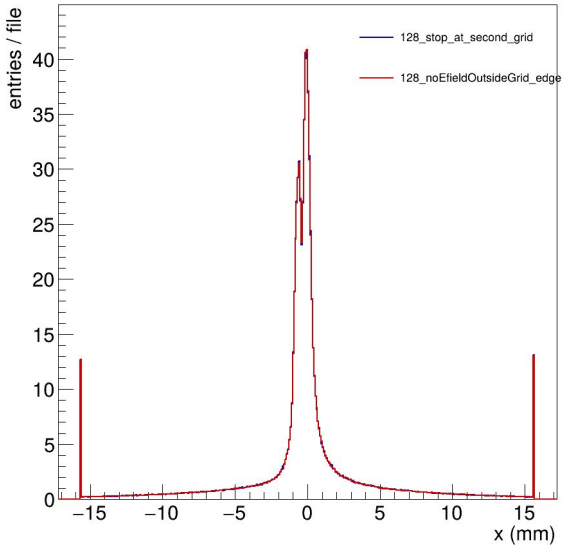
Current Guinea Pig configuration

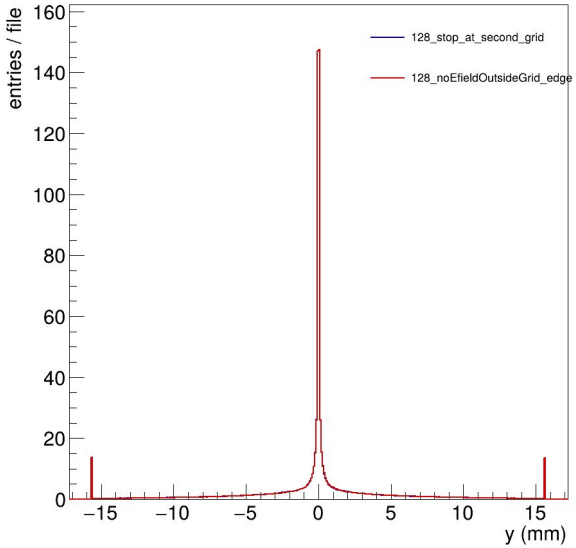
- We kill the average value field outside and can accurately trace the particles back
- We add the magnetic field of the detector

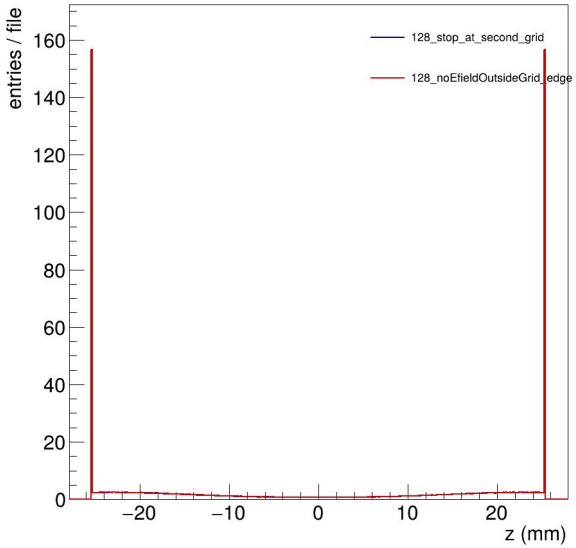


With the detector magnetic field in the grids.

Results







Mapping these particles back and stopping them within Guinea Pig finally result in the same physics → We understand how Guinea Pig works.

Conclusions + TODO

- We have a much better understanding of how Guinea Pig works
- Once we finalize the new configuration, it will be used by all other groups working on FCC beam background

TODO

- Ensure we aren’t losing significant information with this grid reduction
- (Maybe) implement the beampipe interactions
- See how this affects occupancy and distribution