

work on IP8 acceptance for ions

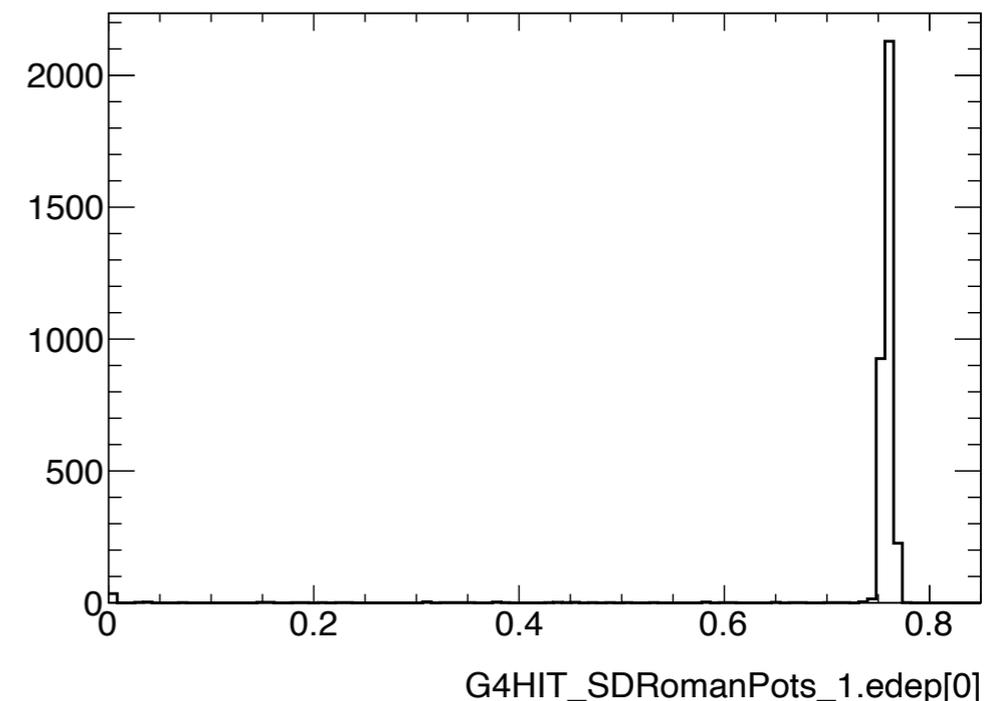
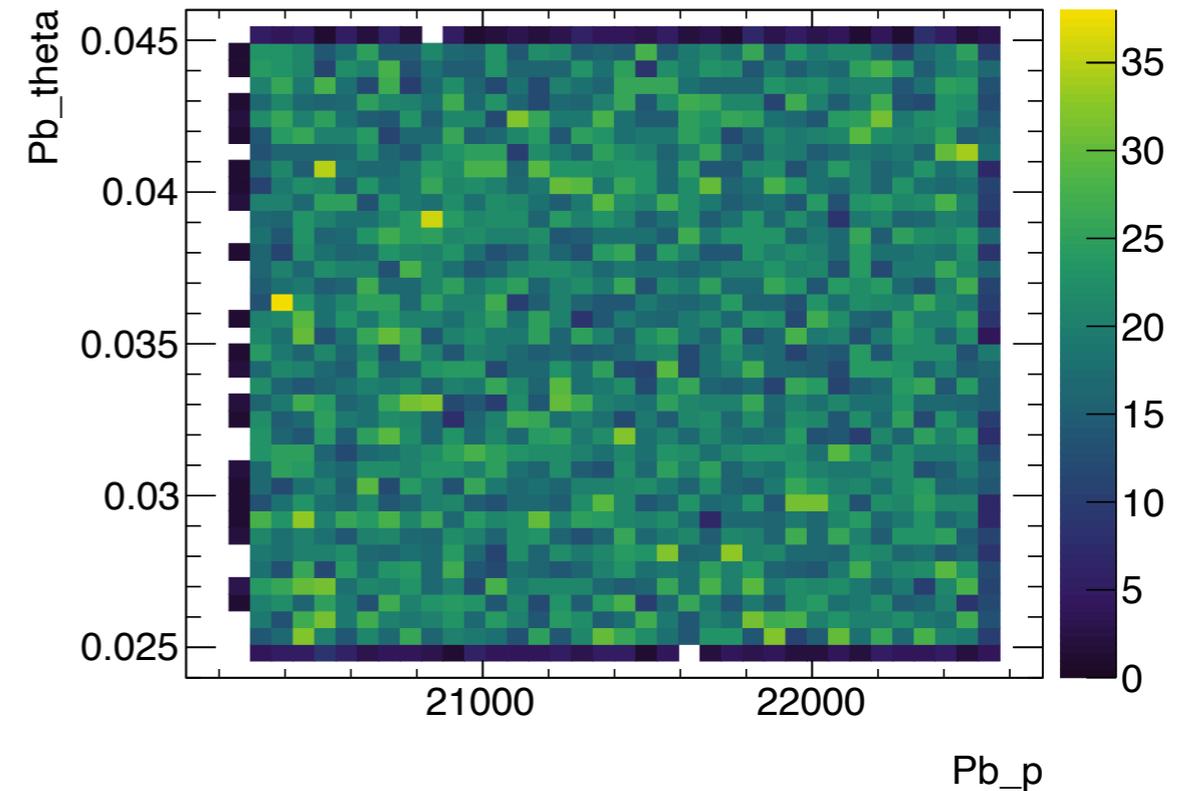
Peter Steinberg, BNL/ ECCE diffraction & tagging meeting / 28 July 2021

Work in last week

- **We still need to do an extensive particle gun study to understand acceptance of FF detector systems (IP6 & IP8)**
- **Decided to focus on IP8 since that remains unique to ECCE (& there are more detectors)**
- **Explored using 2 mechanisms for analysis**
 - Bill's module is a great start, but I wanted a bit more information (& the truth tree wasn't being filled)
 - I am currently using the DSTReader mechanism
 - *Not the most space efficient but it gives low-level info on the entire detector*
- **Encountered a lot of difficulties with the existing IP8 setup, which just seemed unfinished**
 - Lots of detectors defined outside enclosure - just pushed through and fixed this
 - Names of IP8 detectors not matching expected nodes in DSTReader (designed for IP6)
 - Something not quite right w/ SuperDetector groupings
 - *When I add two detectors to one super detector, e.g. RP, RP2, OMD - I am not seeing them both in the DSTReader node tree*
- **More difficulties found in trying to push ions through the FF system**
 - ion gun would work but I didn't see how to make it create a distribution (to illuminate a region)
 - PHG4SimpleEventGenerator seemed obvious to use, but I could not get it accept Pb208, due to information loss in name/PDG code translation
 - *Adapted it to *only* use PDG code, and now works*
 - `INPUTGENERATOR::SimpleEventGenerator[0]->add_particles(1000822080, 1);`
 - `INPUTGENERATOR::SimpleEventGenerator[0]->set_p_range(0.9*208*108.4,208*108.4);`
 - `INPUTGENERATOR::SimpleEventGenerator[0]->set_theta_range(0.025,0.045)`
 - `INPUTGENERATOR::SimpleEventGenerator[0]->set_phi_range(-.5,.5);`
 - Now trying to get a generator that only produces the ions in the generator frame using HEPMC, so I can feed it to G4_Input and get crossing angle, divergence, etc.
 - *Kolja developed the gun for me...but it uses TDatabasePDG to get the mass so crashes on ions!*
- **Final difficulties w/ IP8 setup**
 - You can use it, but you have to put the experiment in deep space, or else showering in air within ECCE
 - `G4WORLD::WorldMaterial = "G4_Galactic";`
- **....Finally ran 25k events (but forgot to include $p > 208 * 108.4!$)**

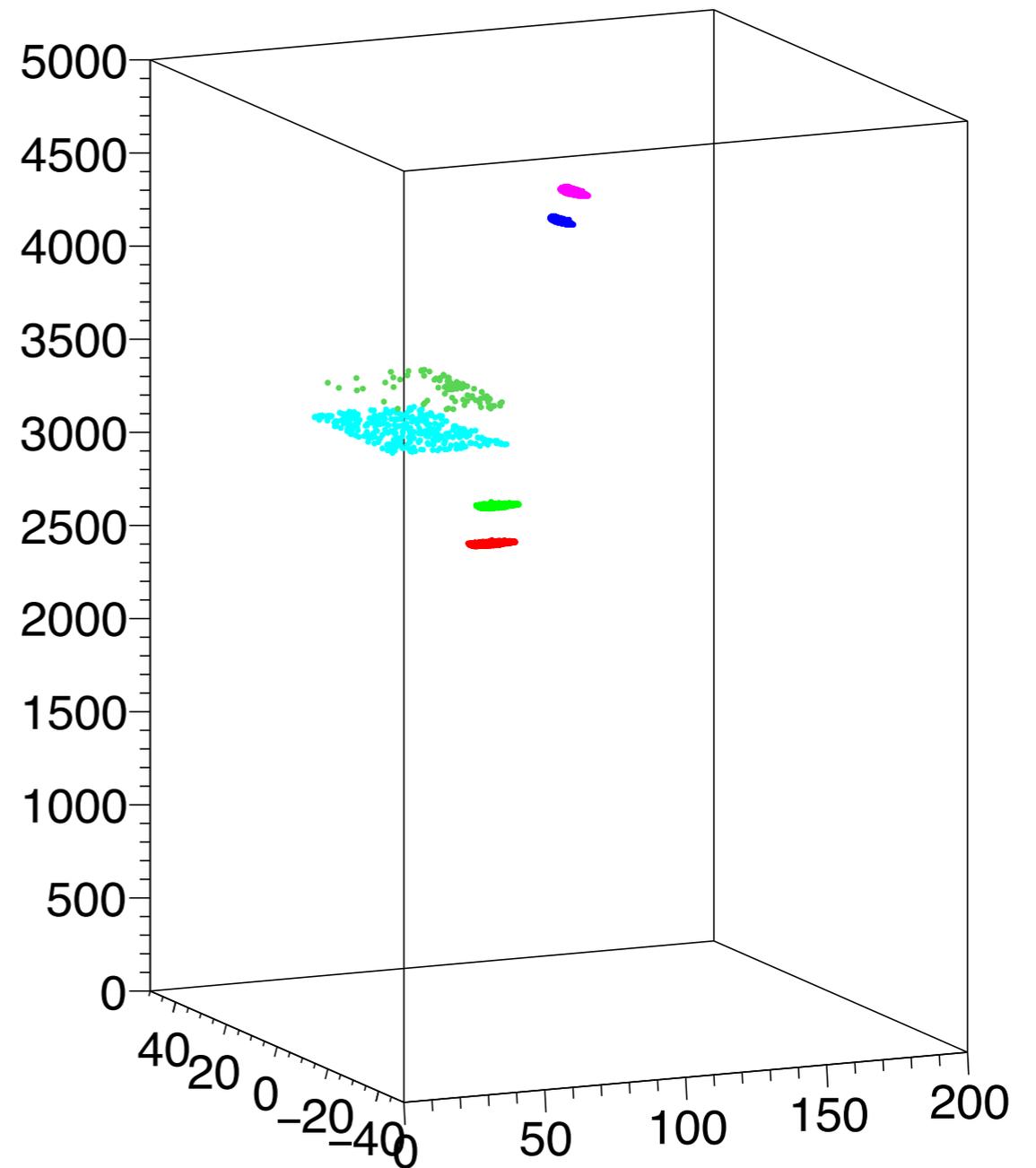
Initial distributions

- **Pb208 thrown by simple generator**
 - Flat in momentum ($x_A=0.9-1$) ($x_A=1$ is $p=208 \cdot 108.4$ GeV)
 - Flat in theta = 25-45 mrad
 - Phi = -0.5 to 0.5 radian
- **Hits defined by simple cuts in edep[0] (incoming)**
 - Roman pots: 0.5 MeV(?)
 - offMom: $3e-5$
 - Nothing here in OMD from ions
 - *Just from delta electrons (I think)*



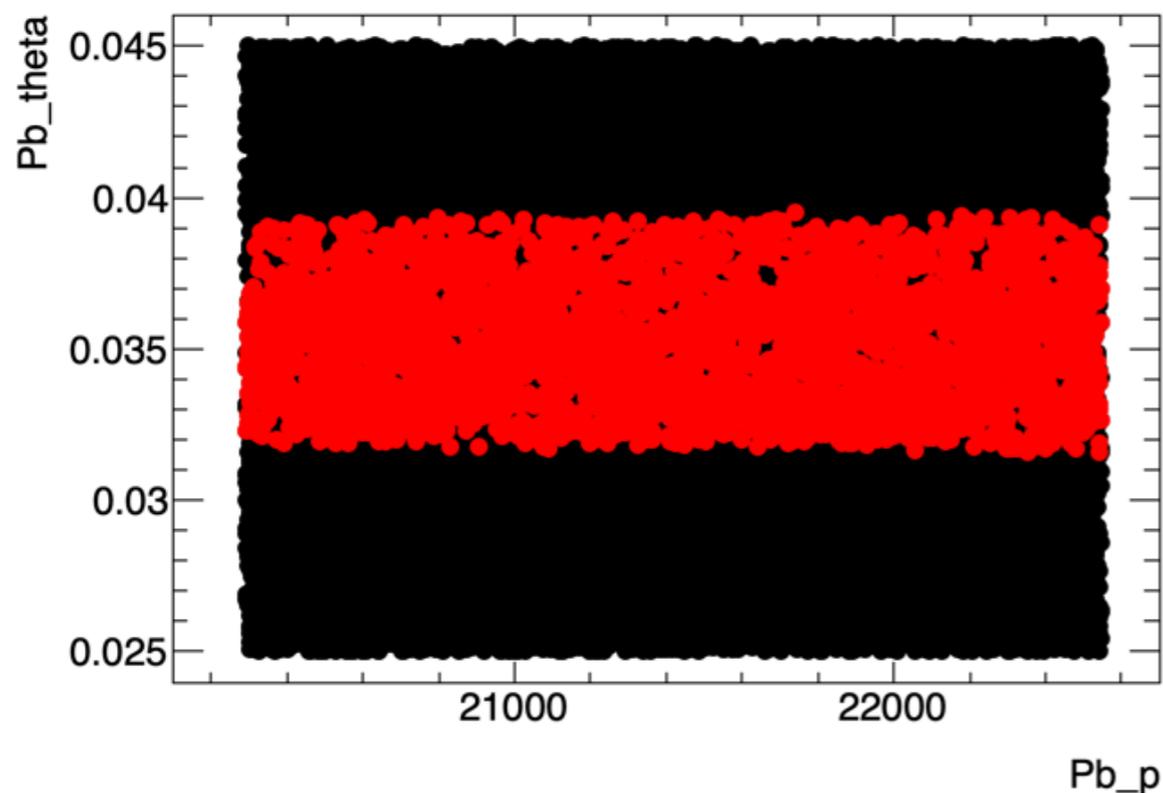
Hits in detectors

- **Interaction vertex is**
 - $x=0, y=0, z= -5$ to 5 cm
- **Hits seen in**
 - RomanPots_0 and _1
 - offMomTruth_0 and _1
 - RomanPots_2nd_0 and _1
- **Shapes seem to reflect choices of theta, phi, p**

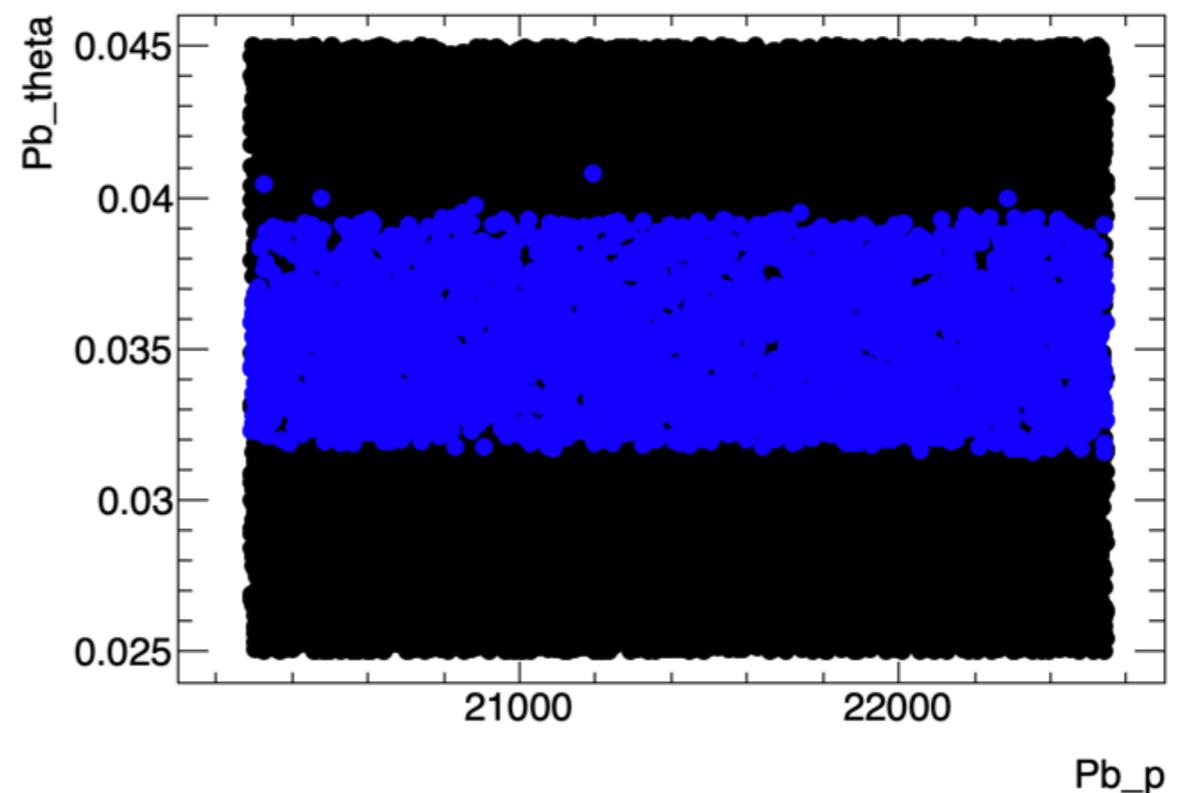


Something not quite right

- I would expect to see the Pb with the highest momentum and near the x-ing angle (35 mrad) get cut off, but i don't see that in either RP or RP_2nd
 - These days, it's always "it's not you, it's me"
 - *This is very fresh work - I could use input and advice!*
 - Will be easier if I parametrize in terms of deviations from hadron beam direction (so $\theta=0$ at the x-ing angle) so then could use full phi range vs. a first guess



All (black), 2 hits in RP (red)



All (black), 2 hits in RP_2nd (red)

Next steps

- **Review changes to IP8 G4 setup with Bill, Axel, Jin, etc.**
 - Double check it corresponds to Alex's June 2021 spreadsheet
- **Debugging**
 - Compare with protons of same rigidity ($p = 275$ GeV)
 - Compare w/ HEPMC input simple generator
 - Needed cross check for simple generator
- **Cross check against project plots**
 - Check acceptance of project proposed detectors against Alex J's plots
 - Does Alex have ion vs. proton comparisons?
- **Campaign of checking Mark's original requests**
 - e.g. acceptance for Pb207 and Tl207, again compared to project plots where possible

Discussion point: integration with analyses

- **Carlos made a reasonable request, to include forward detector information in event_evaluator**
 - Would be very nice to look at integrated analyses, e.g. reconstructing J/psi and forward activity in BeAGLE
 - Separate trees can work, but it's a lot more work
- **Should we use bill's algorithm as the main development tool but also add a section of reduced info to the event_evaluator?**
 - x,y,z,edep for hits RPs, RP2s (for IP8) and OMDs (after edep cut) - might need to be vectorized for realistic events
 - Similar for ZDC (but perhaps clustered?)