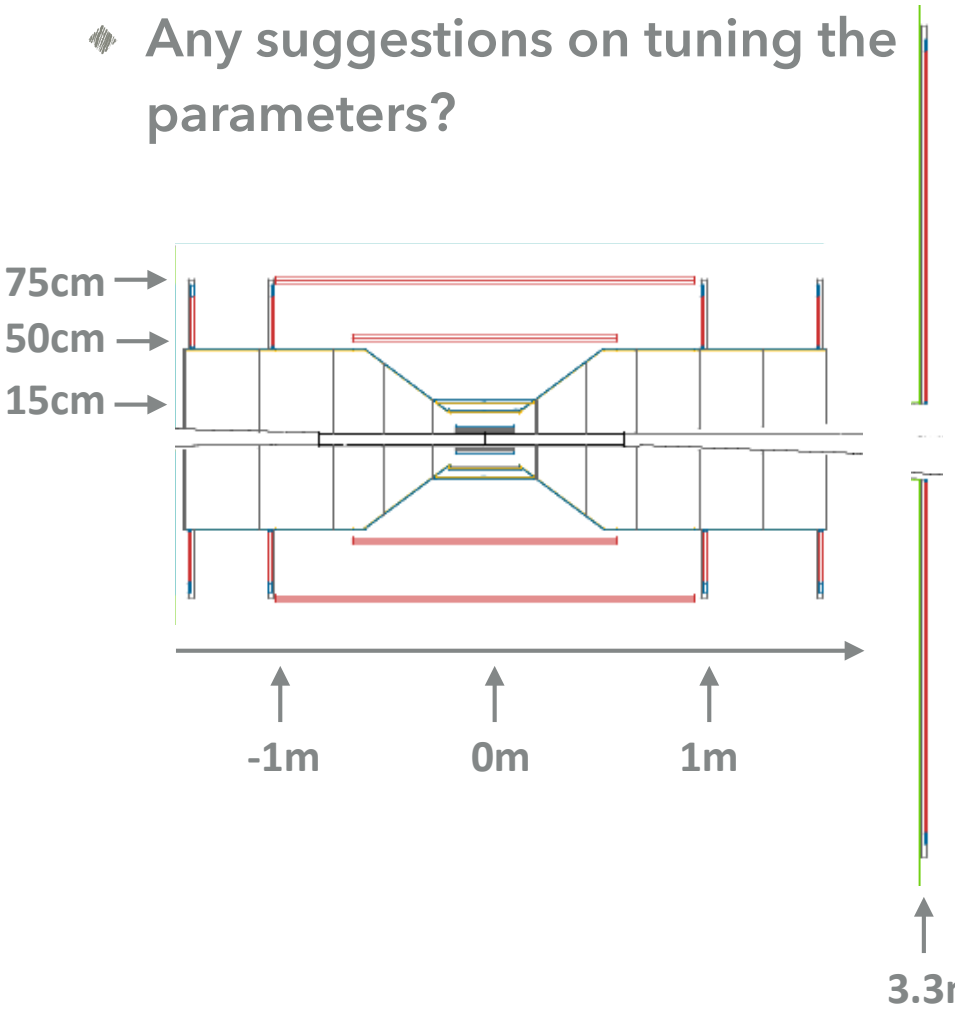
Seeding

- Configuration
  - We cannot adjust deltaRMmax to much higher value
  - Tighter beam spot contraints
  - Any suggestions on tuning the parameters?




```
std::vector<std::string> inputSpacePoints;
/// Output track seed collection.
std::string outputSeeds;
/// Output proto track collection.
std::string outputProtoTracks;
float bFieldInZ = 3 * Acts::UnitConstants::T;
float minPt = 150 * Acts::UnitConstants::MeV;
float rMax = 320 * Acts::UnitConstants::mm;
float zMin = -4000 * Acts::UnitConstants::mm;
float zMax = 4000 * Acts::UnitConstants::mm;
float deltaRMin = 1 * Acts::UnitConstants::mm;
float deltaRMax = 320 * Acts::UnitConstants::mm;
float cotThetaMax = 45.003; // 27.2899; // About eta = 4
// 7.40627;  // 2.7 eta
//
float collisionRegionMin = -250 * Acts::UnitConstants::mm;
float collisionRegionMax = 250 * Acts::UnitConstants::mm;
float maxSeedsPerSpM = 10;
float sigmaScattering = 50;
float radLengthPerSeed = 0.1;
float beamPosX = 0 * Acts::UnitConstants::mm;
float beamPosY = 0 * Acts::UnitConstants::mm;
float impactMax = 3 * Acts::UnitConstants::mm;

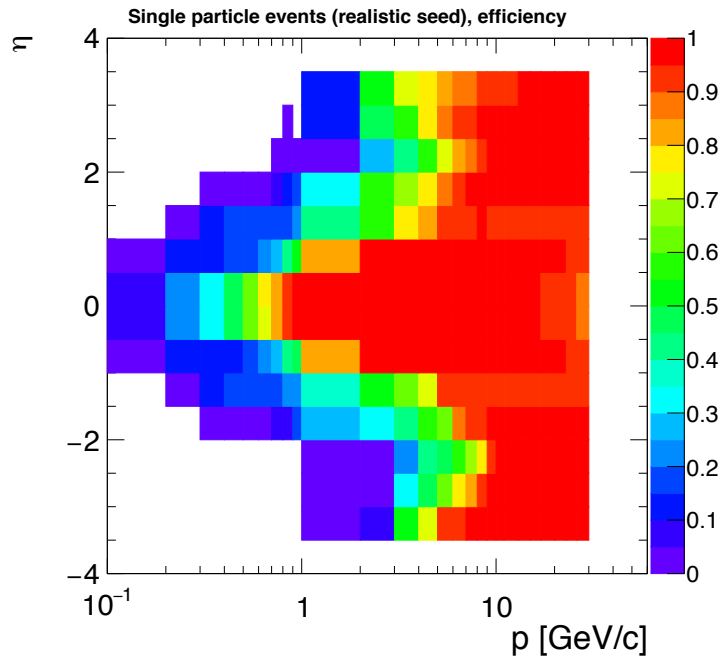
/// The minimum magnetic field to trigger the track
/// parameters estimation
double bFieldMin = 0.1 * Acts::UnitConstants::T;

/// Constant term of the loc0 resolution.
double sigmaLoc0 = 25 * Acts::UnitConstants::um;
/// Constant term of the loc1 resolution.
double sigmaLoc1 = 100 * Acts::UnitConstants::um;
/// Phi angular resolution.
double sigmaPhi = 0.02 * Acts::UnitConstants::degree;
/// Theta angular resolution.
double sigmaTheta = 0.02 * Acts::UnitConstants::degree;
/// q/p resolution.
double sigmaQOverP = 0.1 / Acts::UnitConstants::GeV;
/// Time resolution.
double sigmaT0 = 1400 * Acts::UnitConstants::s;
```

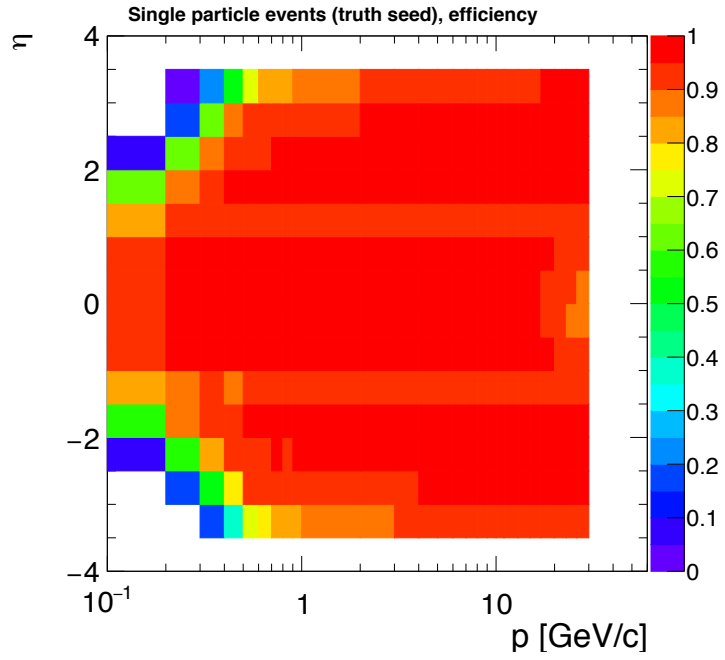
Current problem — seeding at low p and forward

- In high p and mid-rapidty
  - Realistic seeding consistent with truth-seeding results (p resolution, efficiency)
- In low p or forward(backward)-rapidty
  - Much lower efficiency with realistic seeding, a lot of fake tracks with wrongly reconstruct momentum direction (even polar angle θ)
- Comments from last time
  - Two close points in the triplet can cause issues in seed finding
  - Tried increasing the minimum distance bewteen the points used in the triplet (by changing deltaRMin from 1mm to 10mm)

Realistic seeding



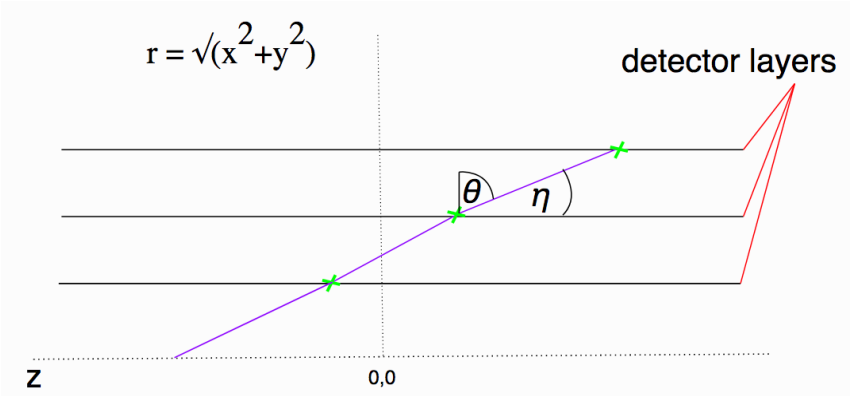
Truth seeding

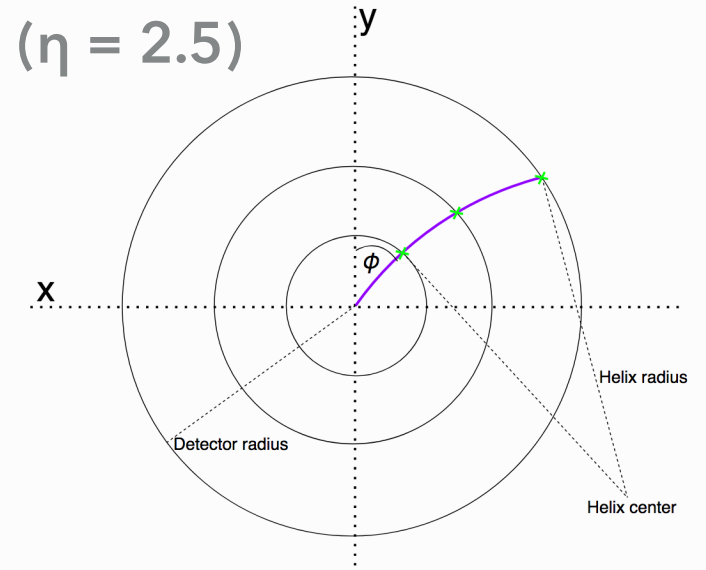


Looking into the event with no good seed

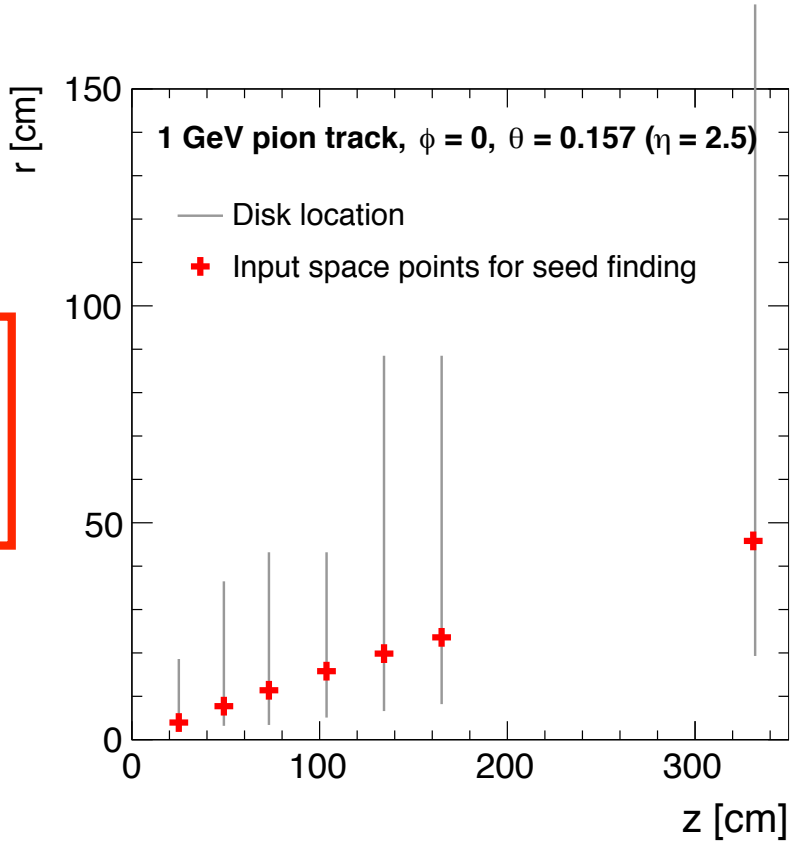
- Single pion p = 1GeV, ϕ = 0 rad, θ = 0.157 rad (η = 2.5)

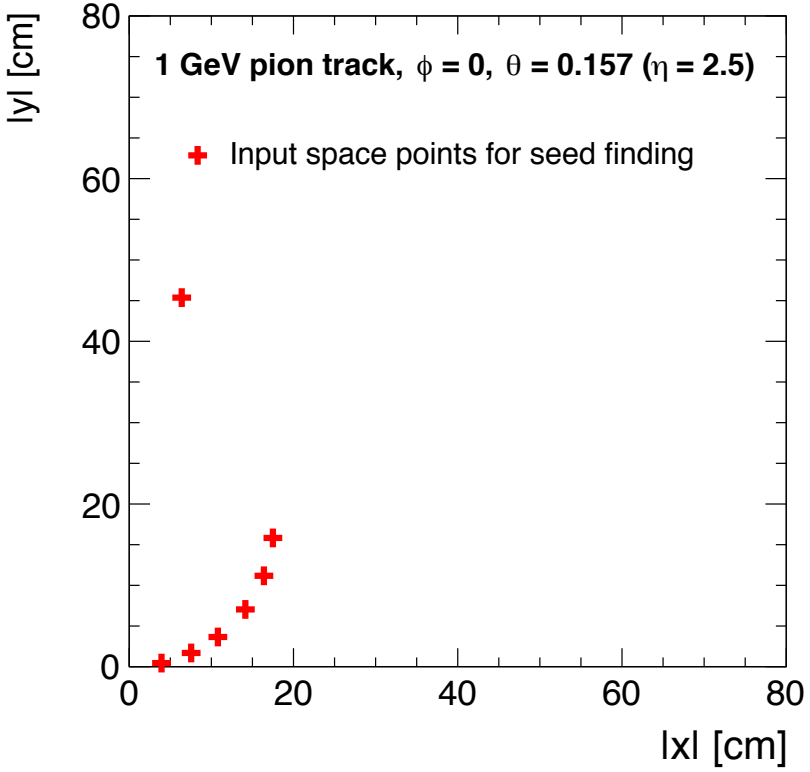
Sinple model to reconstruct θ





Input points looks reasonable





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```
acts_seeding_init   DEBUG /global/project/projectdirs/m3763/wenqing/eic/juggler/JugTrack
/src/components/TrackParamACTSSeeding.cpp:435: iseed = 0, 4, 107.021, -18.8706, 249.865
acts_seeding_init   DEBUG Seed components (sp index) for seed 0 is 1432689727, 3, 5
acts_seeding_init   DEBUG Estimation of track parameters for seed 0 is with q/p 2.10718
phi -0.221514 theta 0.337566 and charge 1
```

```
const auto& params = optParams.value();
const double charge =
    std::copysign(1, params[Acts::eBoundQOverP]);
debug() << "Seed components (sp index) for seed " << iseed << " is " << seed.sp()[0]-
    >measurementIndex() << ", " << seed.sp()[1]->measurementIndex() << ", " << seed.
    sp()[2]->measurementIndex() << endmsg;
debug() << "Estimation of track parameters for seed " << iseed << " is with q/p " <<
    params[Acts::eBoundQOverP] << " phi " << params[Acts::eBoundPhi] << " theta " <<
    params[Acts::eBoundTheta] << " and charge " << charge << endmsg;

initTrackParameters->emplace_back(
    surface->getSharedPtr(), params, charge,
    m_covariance);
spTaken[seed.sp()[0]->measurementIndex()] = true;
spTaken[seed.sp()[1]->measurementIndex()] = true;
spTaken[seed.sp()[2]->measurementIndex()] = true;
```

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```

Invalid index of input space points!!!

Comments and suggestions

- Configuration
  - rMax, zMin, zMax: detector bounds seen by the seeding algorithm (it's better to have the track exiting the volumn hence for low p tracks a smaller volumn might work better)
  - radLengthPerSeed: radiation length for multiple scattering (M.S.) calculation
  - sigmaScattering: scattering allowed in unit of standard M.S.
- Forward seeding
  - Try 2GeV pions also (1GeV might hit some edges)
  - ACTS seeding algorithm has a stronger assumption for initial track paramter reconstruction (seed reconstruction): a homogenous magnetic field → s trainght line in r-z plane and circle in x-y plane, so we want to use the hits in the region where magnetic field is homogenous