TRACK SEEDING CUTS

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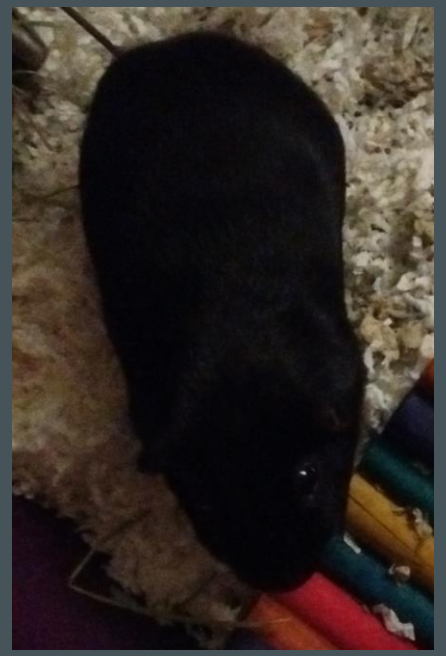
AUGUST 28 2017

github issue 126

(formerly "Three Point Helix Check error")

(my new helper for getting out of rabbit-holes)



MAKING SEEDING CUTS GREAT AGAIN

- org.lcsim.recon.tracking.seedtracker.FastCheck ▶ThreePointHelixCheck
  triplet-finding for track seeds
  - For each of the 3 hits, calculates contribution to *z error*

```
dztot += _nsig * Math.sqrt(hit.getCovMatrix()[5]);
```

lcsim z
(hps y)

  - Then

```
//  Add multiple scattering error here - for now, just set it to 1 mm
dztot += 1.;  dztot += _nsig * MSerror;
```

  - Compares *total z error* to *(predicted – actual) z position* of middle hit

```
if (Math.abs(zpred - z[1]) > dztot) return false;
```

- Need to fix:
  - Hit contribution to z error (value from un-corrected covariance matrix is too big)
  - MSerror function
  - Value of _nsig (default was 10)
  - Add hit contributions and MSerror in quadrature (not linearly) to obtain dztot

HIT CONTRIBUTION TO Z ERROR

```
public Hep3Vector getDirection(CircleFit circle, double slope, double phi0, double s) {

    double phi = phi0 - s / circle.radius();
    double sth = 1. / Math.sqrt(1 + Math.pow(slope, 2));
    //  direction unit vector
    double uy = Math.cos(phi) * sth * -1.0;
    double ux = Math.sin(phi) * sth;
    double uz = slope / Math.sqrt(1 + Math.pow(slope, 2));

    return new BasicHep3Vector(ux, uy, uz);
}
```

```
TrackDirection dir1 = new TrackDirection(getDirection(circle, slope, phi0, s[0]), null);
Hep3Vector poscor1 = HitUtils.PositionOnHelix(dir1, ((HelicalTrackCross) hit1).getStrips().get(0),
                     ((HelicalTrackCross) hit1).getStrips().get(1));
zCorr[0] = poscor1.z();
double dz1 = zCorr[0] - z[0];
```

… similarly for dz2 and dz3

```
// dAB = difference between actual x coordinates of hits A and B
dztot = dz2 * dz2 + (dz1 * d23 / d13) * (dz1 * d23 / d13) + (dz3 * d12 / d13) * (dz3 * d12 / d13);
```

ADDING MS ERROR

$\Theta_{MS} \approx (0.0136 / p) \cdot \sqrt{L} \cdot (1 + 0.038 \ln L)$

L ≡ sensor thickness, in radiation lengths

$p_{est} = b \cdot |R| \cdot \sqrt{(1 + m^2)}$

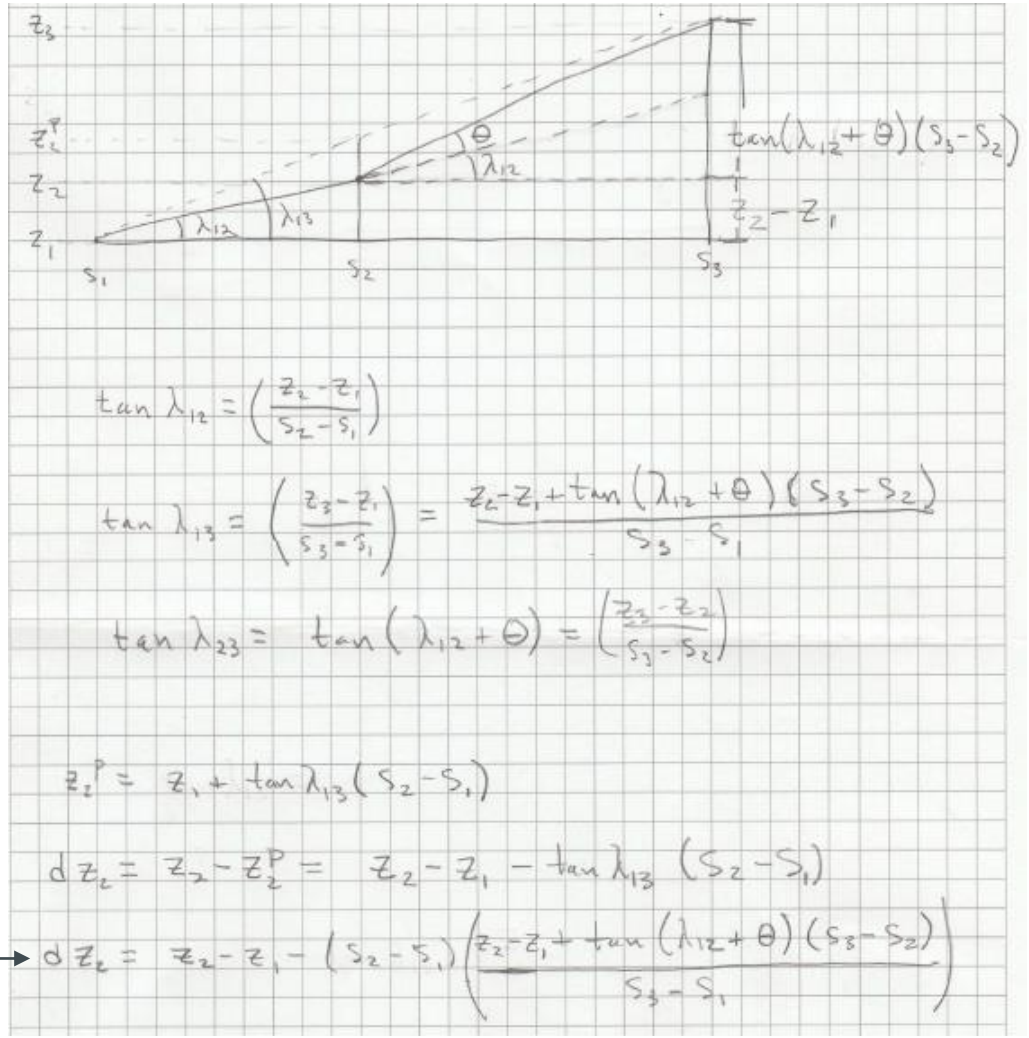
m ≡ helix slope (already calculated)

b ≡ magnetic field (already an input parameter)

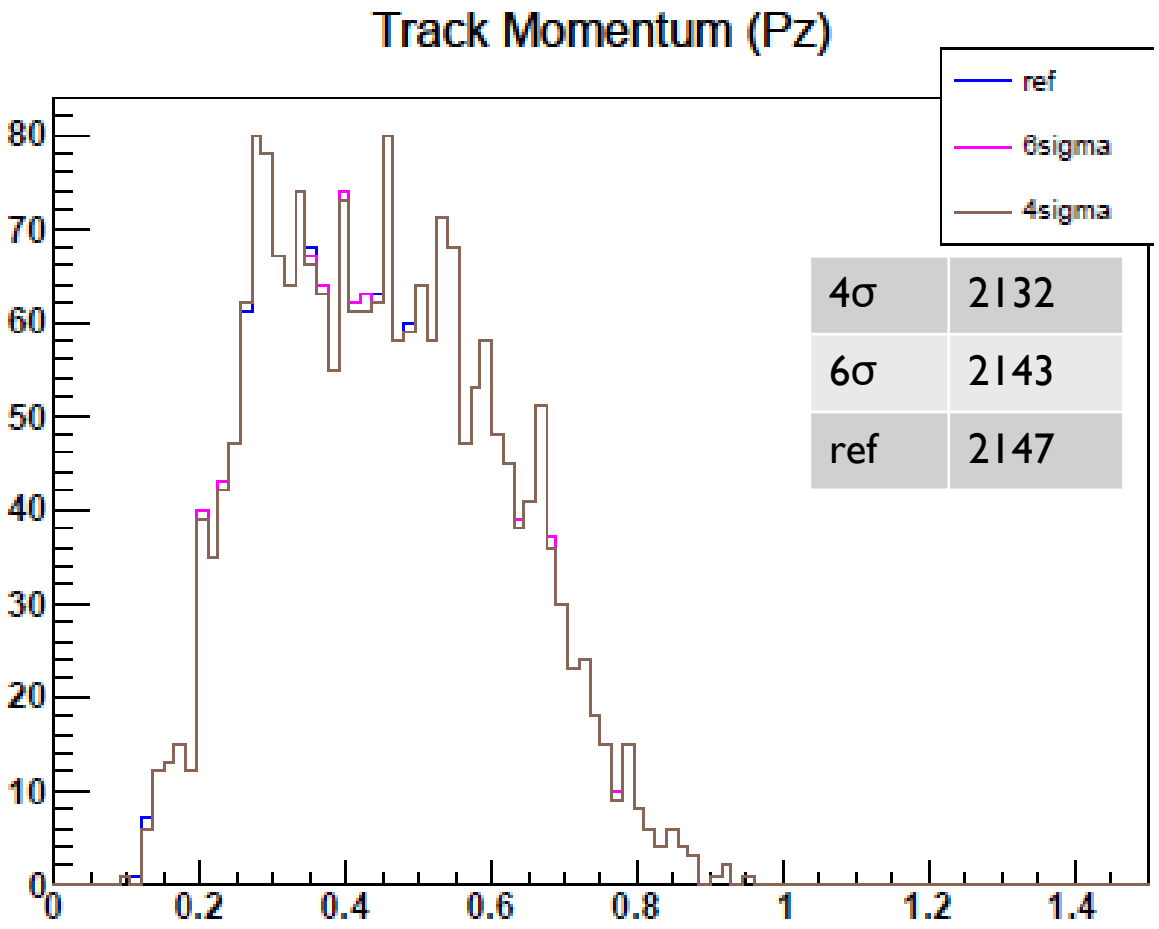
R ≡ helix radius of curvature (already calculated)

Take p = min(p_{est}, beam_energy)

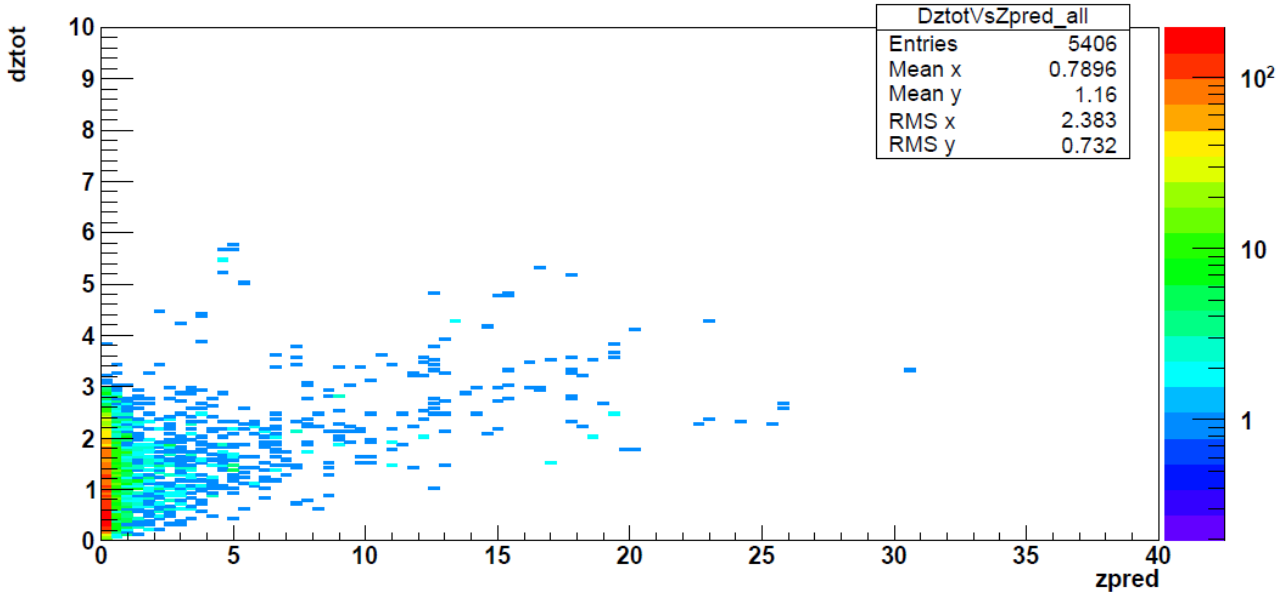
- Calculate MSerror using Θ_{MS}
- Add in quadrature to dztot
- Multiply dztot by _nsig

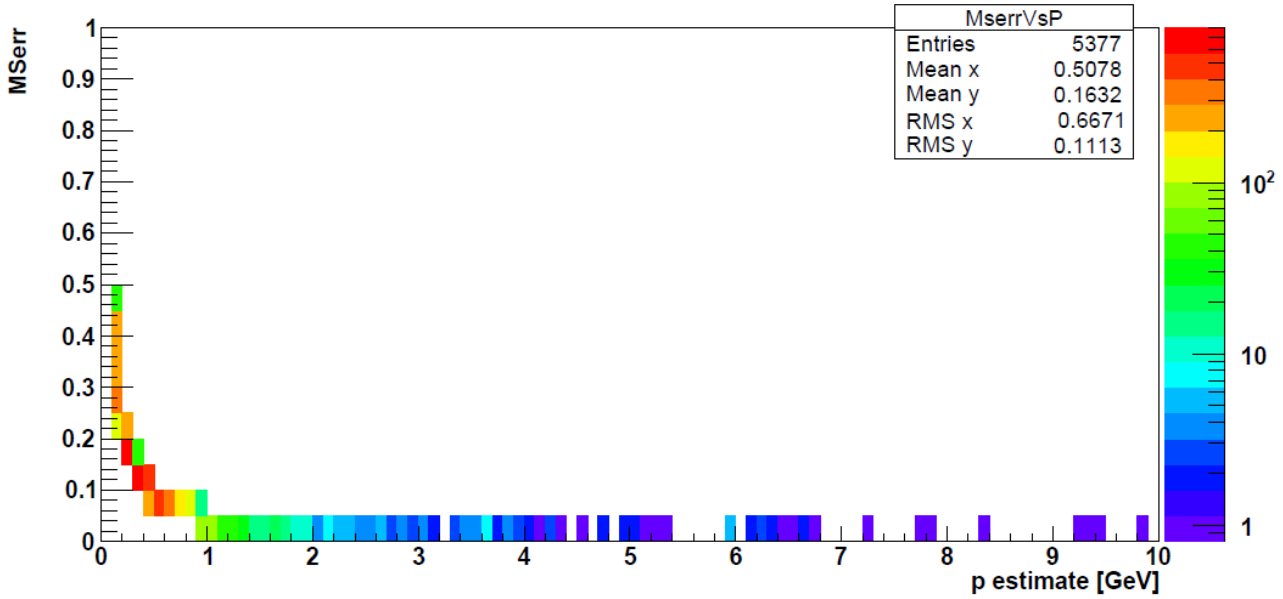


PROMPT A' MC



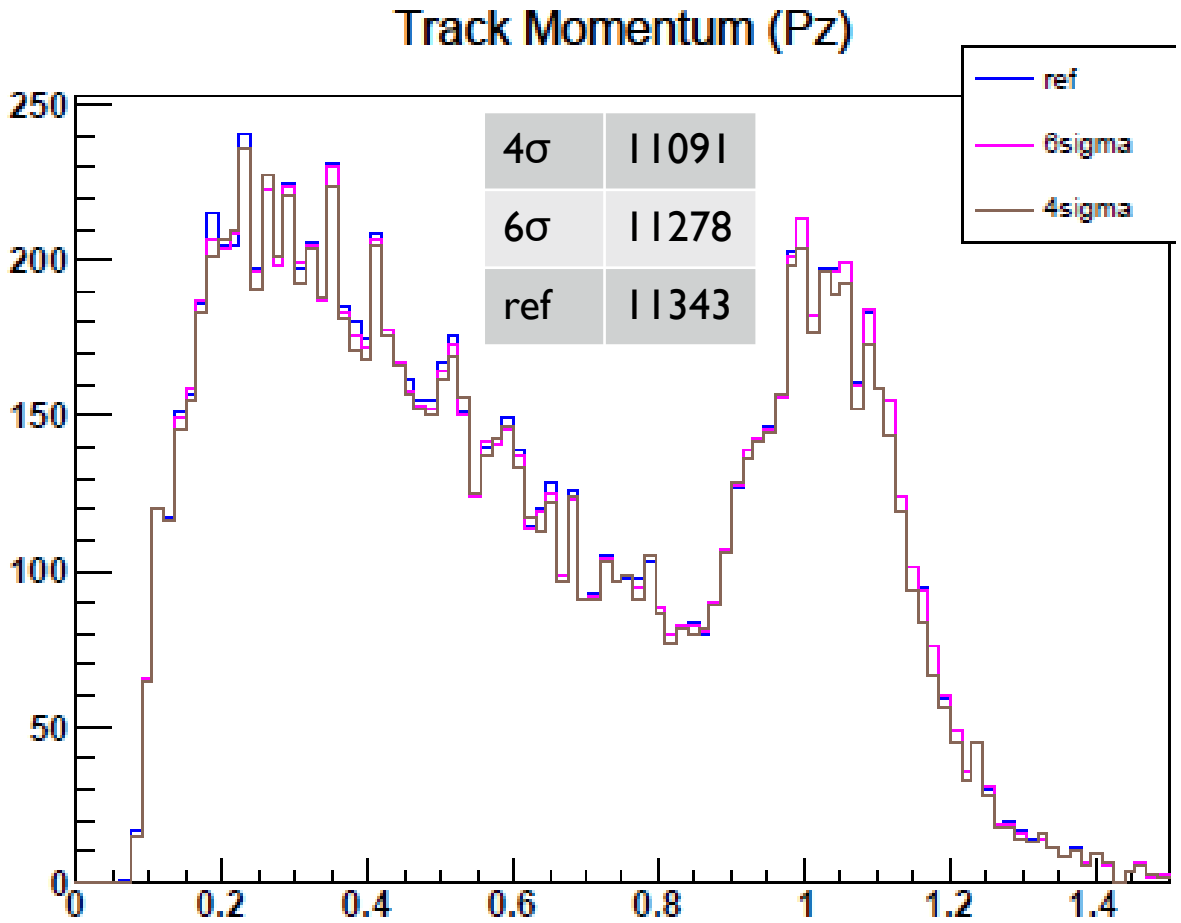
4σ	2132
6σ	2143
ref	2147

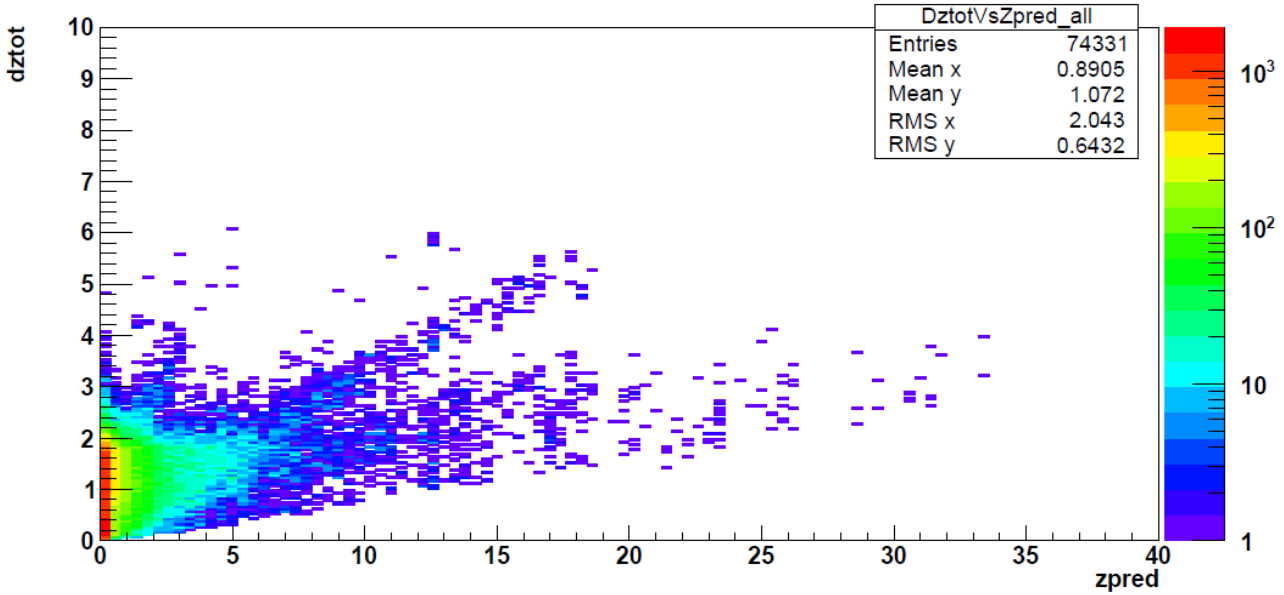


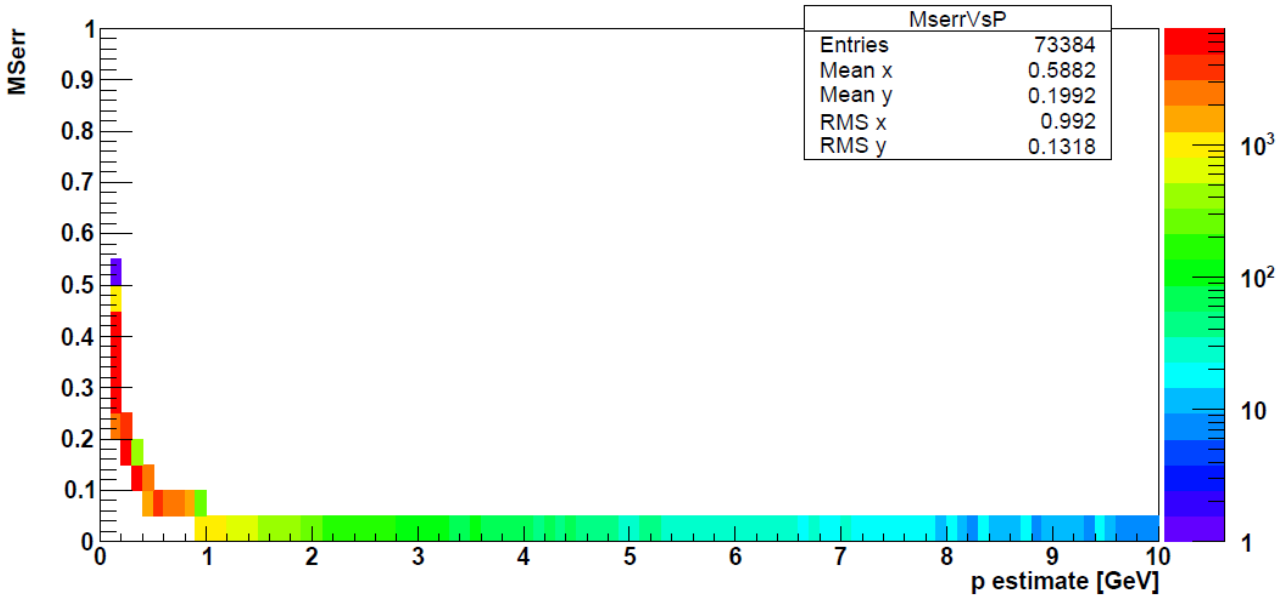


741 / 5406 seeds eliminated at 4σ

RUN 5772 DATA







16165 / 74331 seeds eliminated at 4σ

NEXT STEPS

- Further studies to find optimal value of _nsig?
- What validation plots, checks, profiles, etc do people need to see for final approval?