



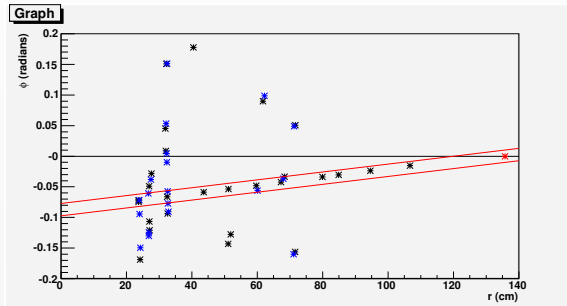
Tracks Seeded by Electron SuperClusters

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Hits passed to TrackProducer



- ▶ Linear band in $\phi(r)$ ($\Delta\phi = 10$ mrad) from SuperCluster (red)
- ▶ All rphi (black) and stereo (blue) SiStrip hits within band are copied to TrackCandidate
- ▶ Also has a trajectory state, valid at position of innermost hit



C++ snippet

```
edm::OwnVector<TrackingRecHit> outputHits;

...
outputHits.push_back(((TrackingRecHit*)(*hit))>clone());
...

// Initial uncertainty for tracking
AlgebraicSymMatrix errors(5,1); // makes identity 5x5 matrix, indexed from (1,1) to (5,5)
errors(1,1) = 3.;               // uncertainty**2 in 1/momentum
errors(2,2) = 0.01;             // uncertainty**2 in lambda (lambda == pi/2 - polar angle theta)
errors(3,3) = 0.0001;           // uncertainty**2 in phi
errors(4,4) = 0.01;             // uncertainty**2 in x_transverse (where x is in cm)
errors(5,5) = 0.01;             // uncertainty**2 in y_transverse (where y is in cm)

outputHits.sort(TrackingRecHitLessFromGlobalPosition(((TrackingGeometry*)(tracker)), alongMomentum));

TrajectoryStateOnSurface state(
    GlobalTrajectoryParameters(position, momentum, -1, magneticField),
    CurvilinearTrajectoryError(errors),
    tracker->idToDet(innerhit->geographicalId())>surface());

TrajectoryStateTransform transformer;
PTrajectoryStateOnDet* PTraj = transformer.persistentState(state, innerhit->geographicalId().rawId());
TrajectorySeed trajectorySeed(*PTraj, outputHits, alongMomentum);
trackCandidateOut.push_back(TrackCandidate(outputHits, trajectorySeed, *PTraj));
```



.cfg snippet

```
# KFUpdaterESProducer
include "TrackingTools/KalmanUpdaters/data/KFUpdaterESProducer.cfi"

# Chi2MeasurementEstimatorESProducer
include "TrackingTools/KalmanUpdaters/data/Chi2MeasurementEstimatorESProducer.cfi"

# KFTrajectoryFitterESProducer
include "TrackingTools/TrackFitters/data/KFTrajectoryFitterESProducer.cfi"

# KFTrajectorySmootherESProducer
include "TrackingTools/TrackFitters/data/KFTrajectorySmootherESProducer.cfi"

# KFFittingSmootherESProducer
include "TrackingTools/TrackFitters/data/KFFittingSmootherESProducer.cfi"

# PropagatorWithMaterialESProducer
include "TrackingTools/MaterialEffects/data/MaterialPropagator.cfi"

# PropagatorWithMaterialESProducer
include "TrackingTools/MaterialEffects/data/OppositeMaterialPropagator.cfi"

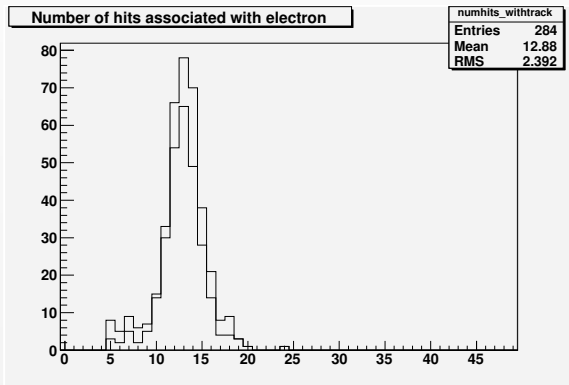
# TransientTrackingBuilder
include "RecoTracker/TransientTrackingRecHit/data/TransientTrackingRecHitBuilder.cfi"

# TrackProducer
include "RecoTracker/TrackProducer/data/CTFFinalFitWithMaterial.cfi"
replace CTFWMaterial.src = "findElectronsInSiStrips"
```



75% efficiency!

- ▶ 284 fitted tracks from 378 track candidates
- ▶ 50 GeV electron-gun with $\eta = 0$

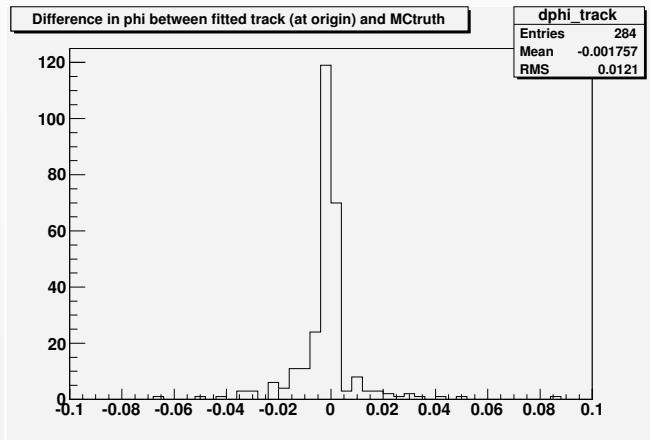


overlay successful events on all candidate events (# hits)



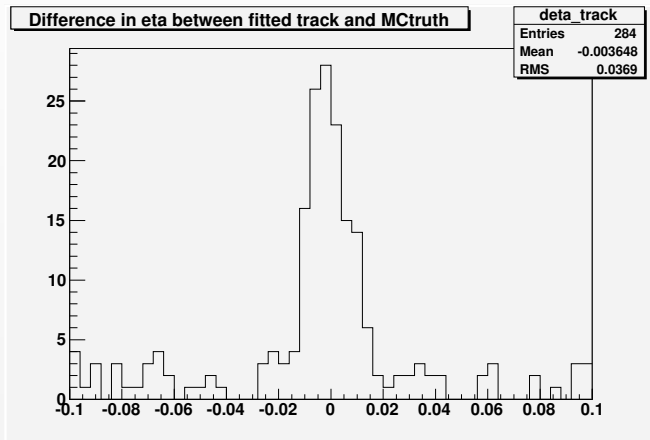
Tracks from Electrons — Jim Pivarski (5/17)

ϕ resolution is 12 mrad





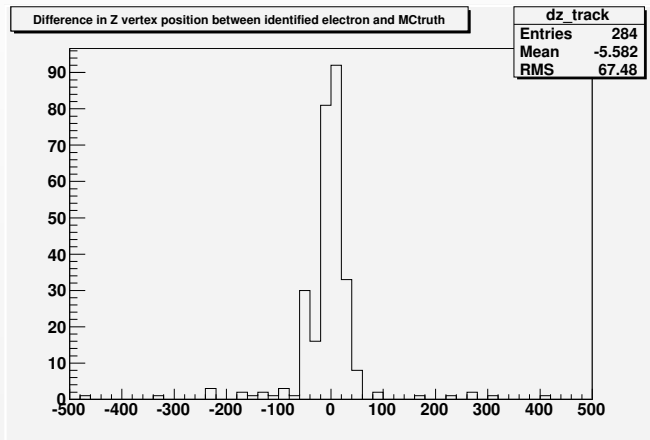
η resolution is 0.03





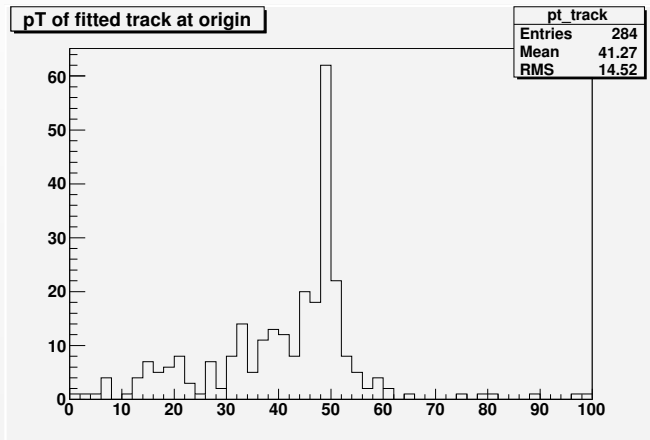
Tracks from Electrons — Jim Pivarski (7/17)

z resolution is 40 mm





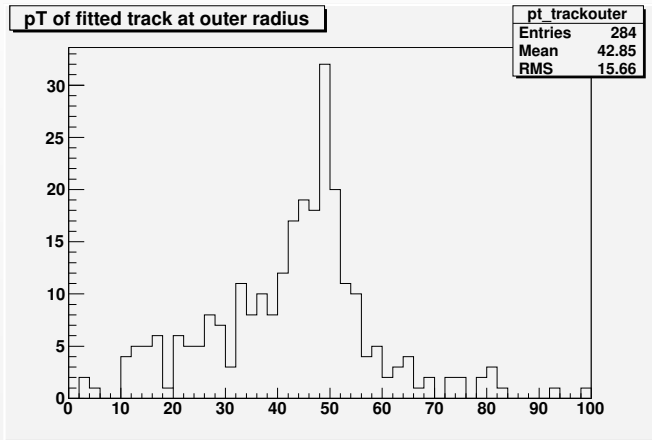
p_T has a low-energy tail





Tracks from Electrons — Jim Pivarski (9/17)

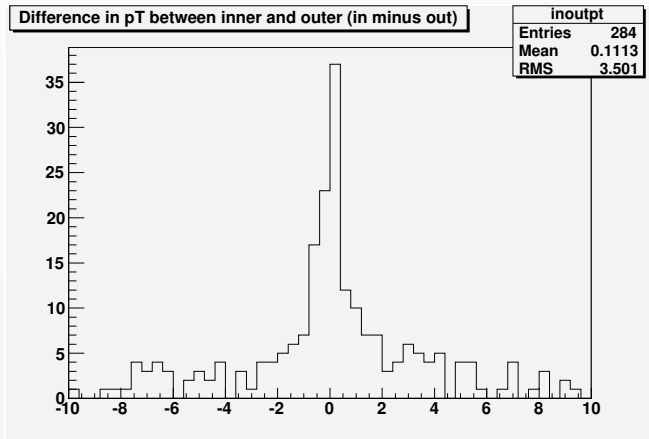
$p_T|_{\text{outer}}$ has a bigger low-energy tail (good)





Tracks from Electrons — Jim Pivarski (10/17)

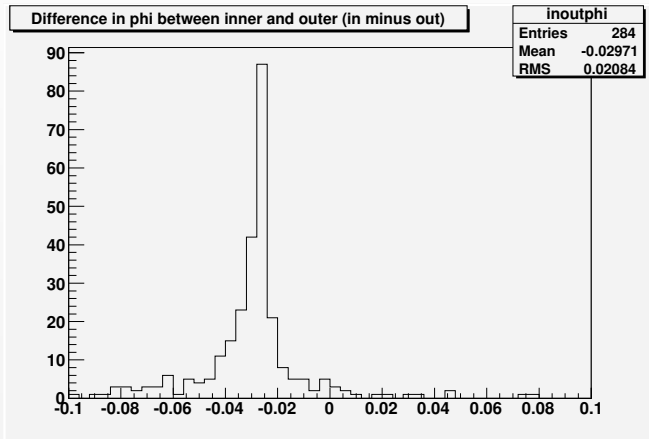
$p_T|_{\text{inner}} - p_T|_{\text{outer}}$ is symmetric (huh?)





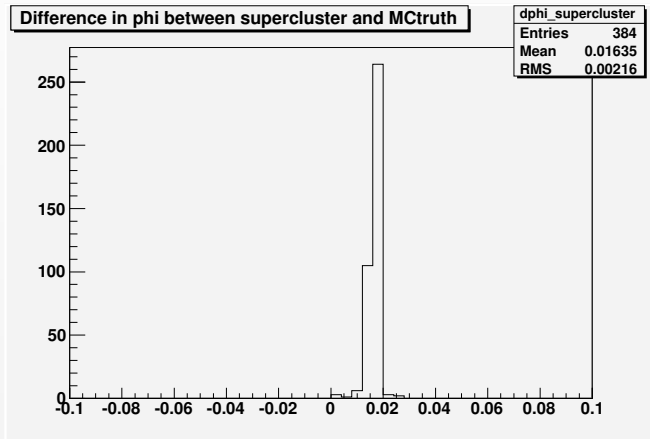
Tracks from Electrons — Jim Pivarski (11/17)

$\phi|_{\text{inner}} - \phi|_{\text{outer}}$ is too big by a factor of two





Why do I say that?





I also have a factor of two error in $\phi|_{\text{inner}} - \phi|_{\text{outer}}$

```
// This comes from Jackson p. 581-2, a little geometry, and a FUDGE  
// FACTOR of two in the denominator. Why is that factor of two correct?  
// (It's not confusion about radius vs. diameter in the definition of  
// curvature.)
```

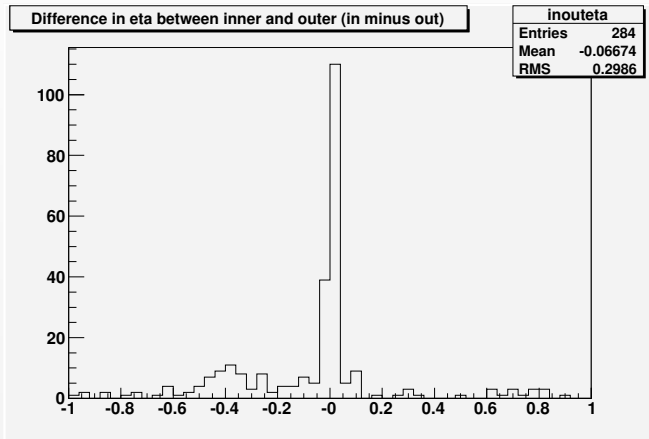
```
double phiVsRSlope = -3.00e-3 * chargeHypothesis * magneticField->inTesla().z() / pT / 2.;
```

The $\phi|_{\text{inner}} - \phi|_{\text{outer}}$ I calculate is $2\times$ larger than the simulated track. Could it be that

- a) electron-gun p_T is half of the value requested, and
- b) reco::Track reports p_T as twice the value fitted?

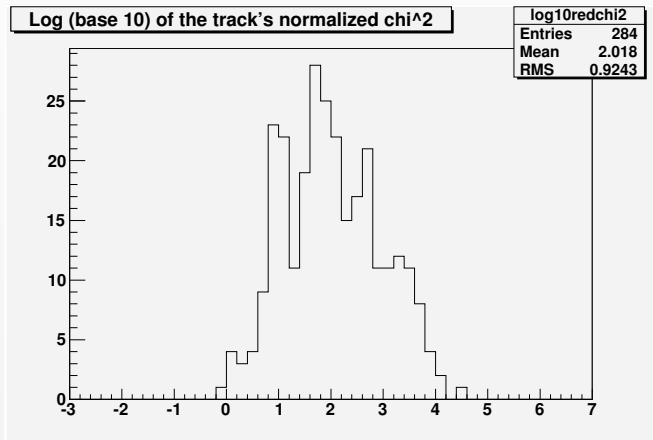


$\eta|_{\text{inner}} - \eta|_{\text{outer}}$ has an asymmetric satellite



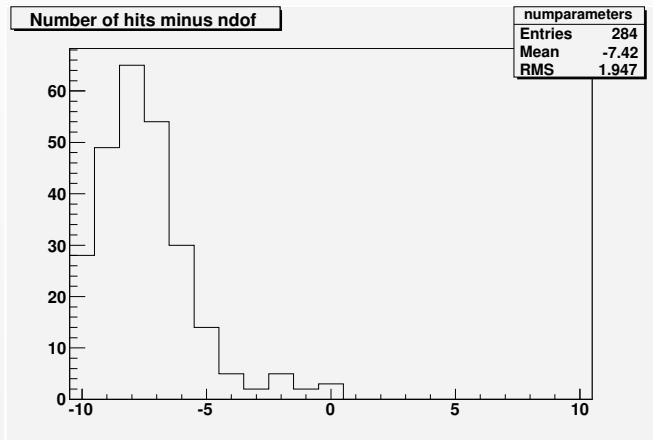


χ^2/N_{dof} is still too large (I'm passing too many hits)





Why is $\#hits - N_{dof}$ not constant (why not 5)?





First Impressions

- ▶ 75% efficiency and χ^2 may be due to extraneous hits
- ▶ Strange features in inner – outer track parameters
- ▶ I also have a factor of two error converting between p_T and $\phi|_{\text{inner}} - \phi|_{\text{outer}}$
- ▶ `track.found() == #input hits != track.ndof()+5`