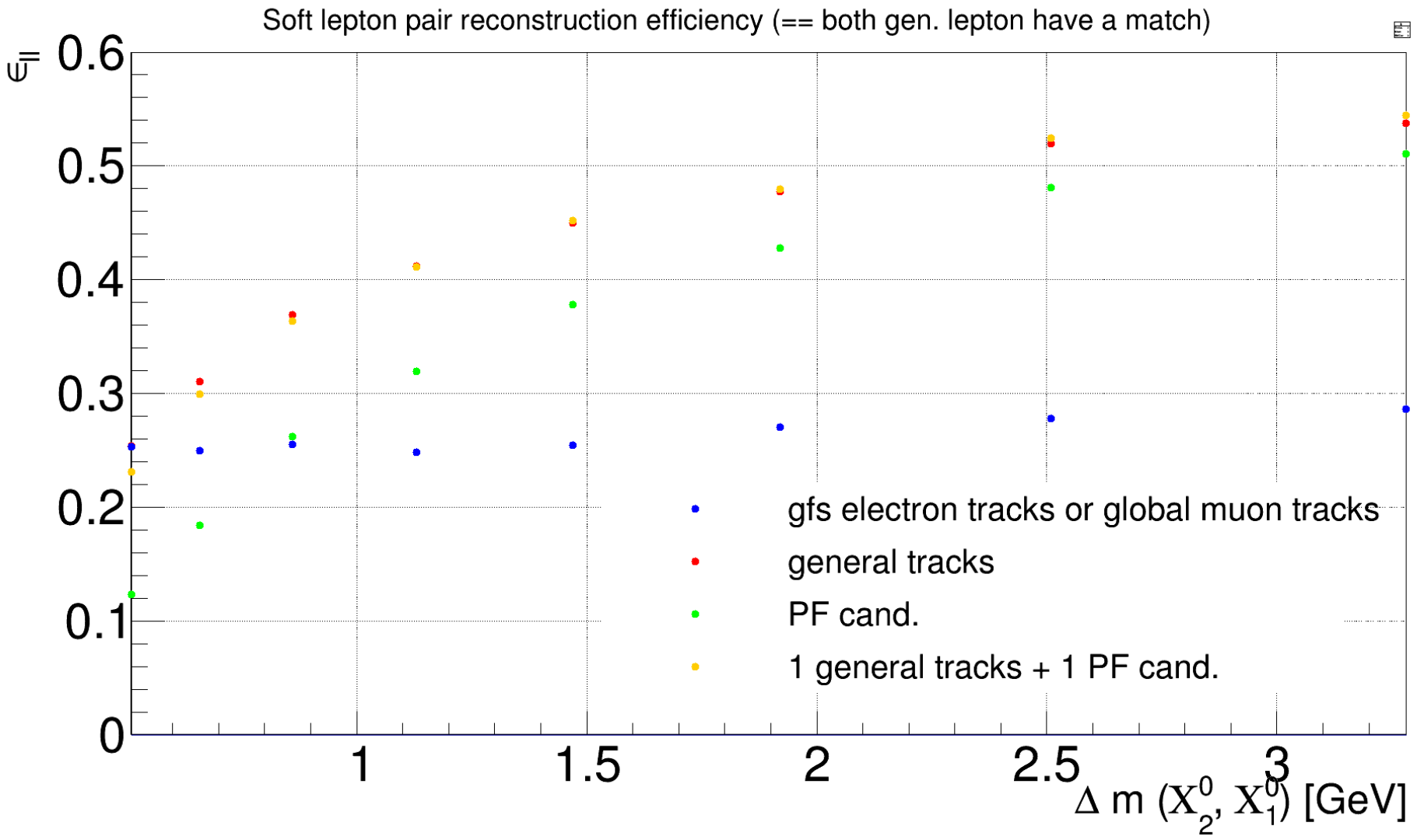
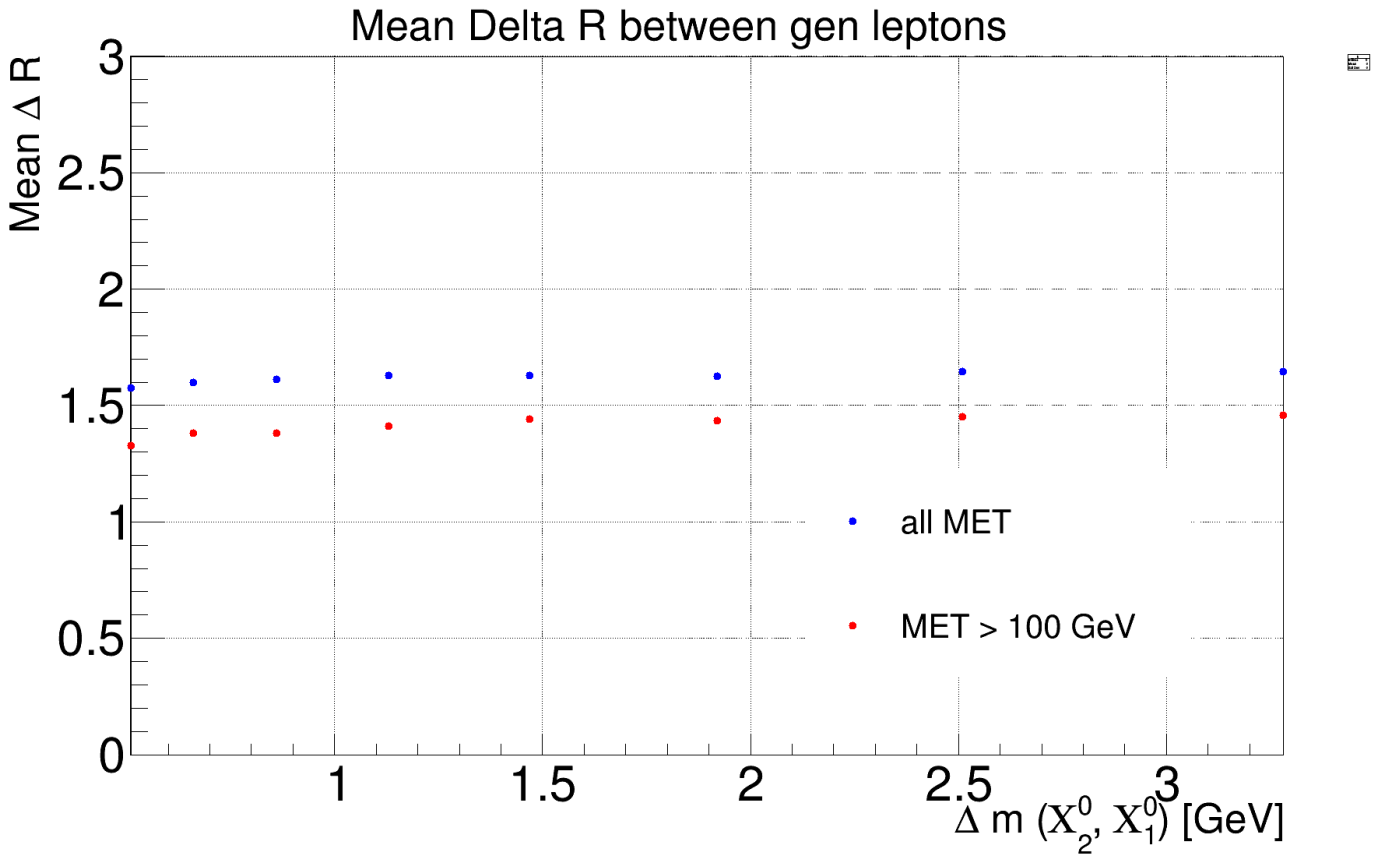
Compressed Higgsinos study

Update: Lepton recopnstrcution efficiencies



Mean Distance between the gen. leptons



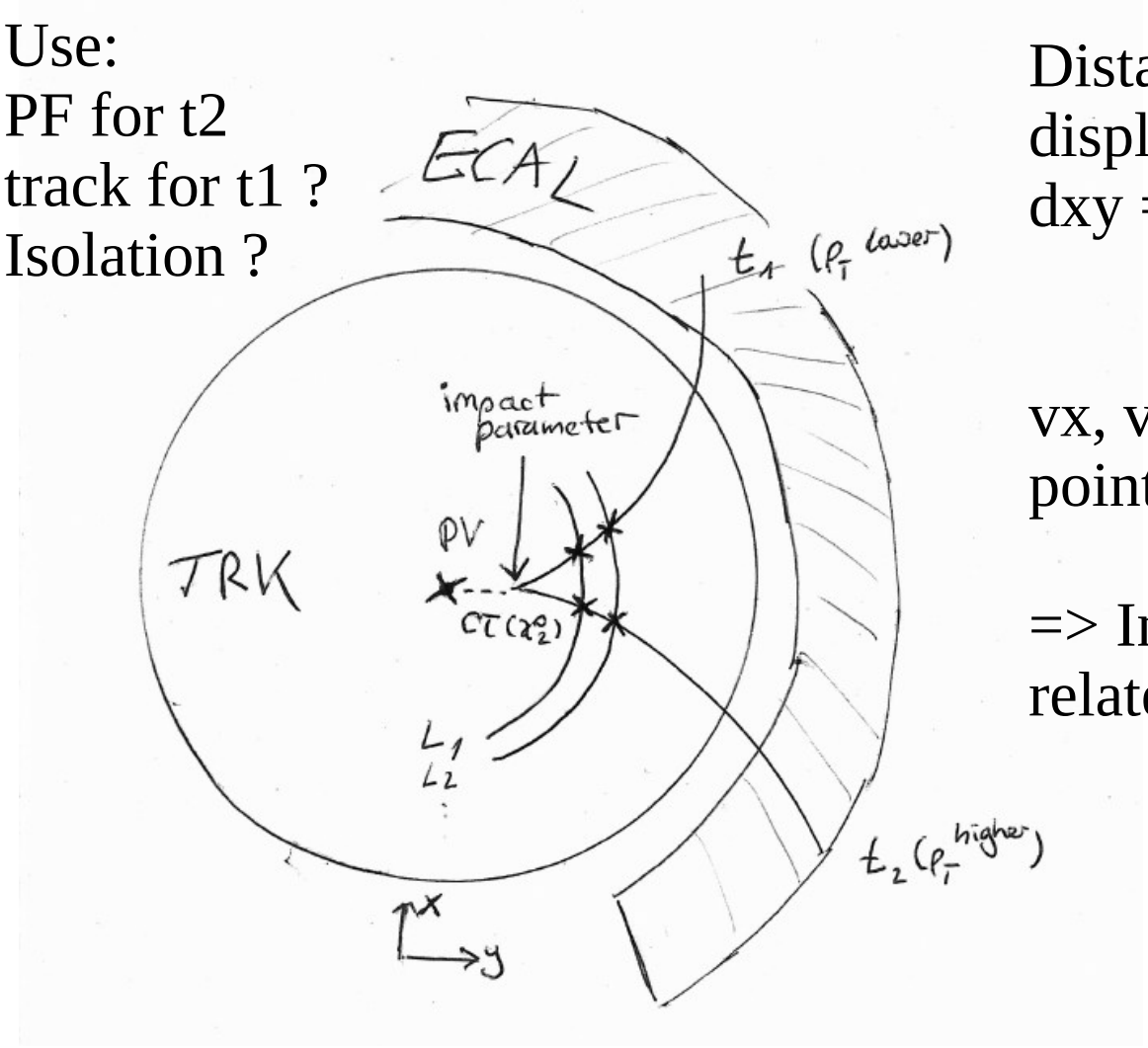
dR = pi/2 across all mass splittings

pT(chi20) peaks at 0 GeV in lab frame

→ decay products come out back to back

How can we extrapolate the leptons to their common vertex?

Use:
PF for t2
track for t1 ?
Isolation ?

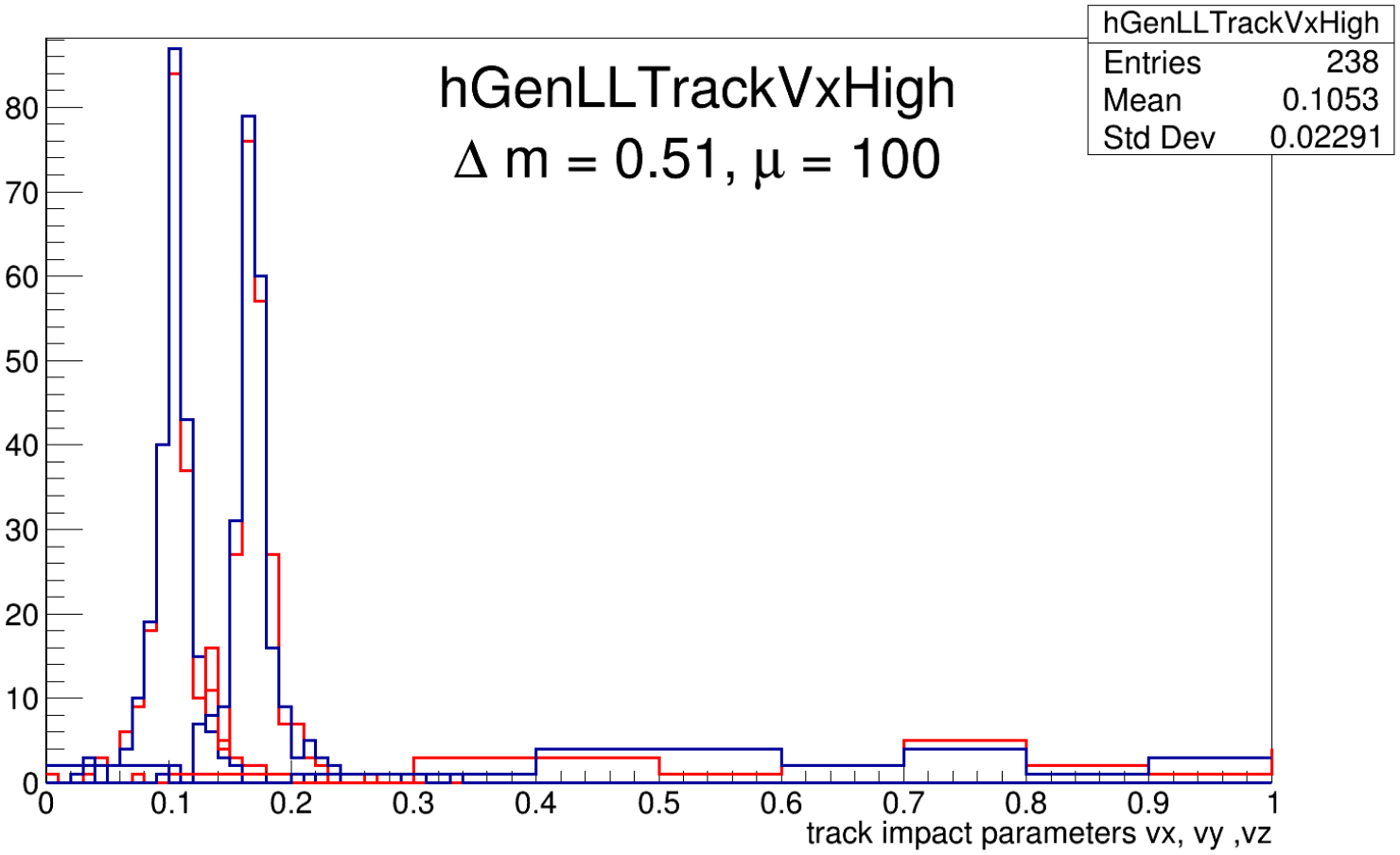


Distance PV to impact parameter == displacement of track : dxy (=-d0), dz
dxy = (-vx*py + vy*px)/ pt

vx, vy, vz = x, y, z, coordinate of ref. point on track

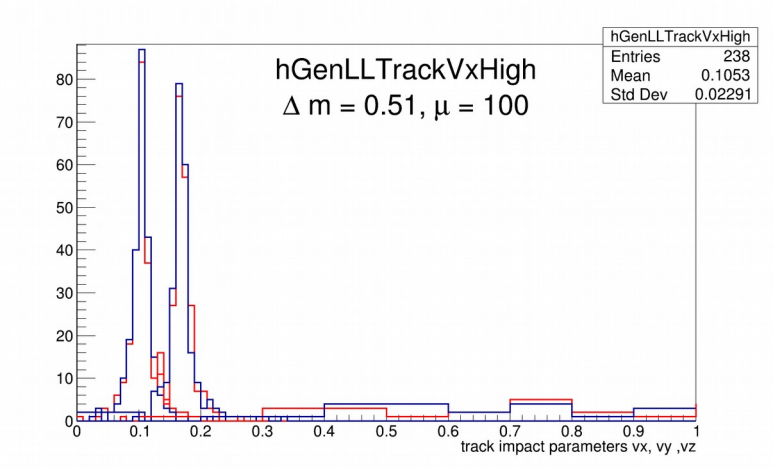
=> In case of two tracks:
relate vx(t1) to vx(t2)

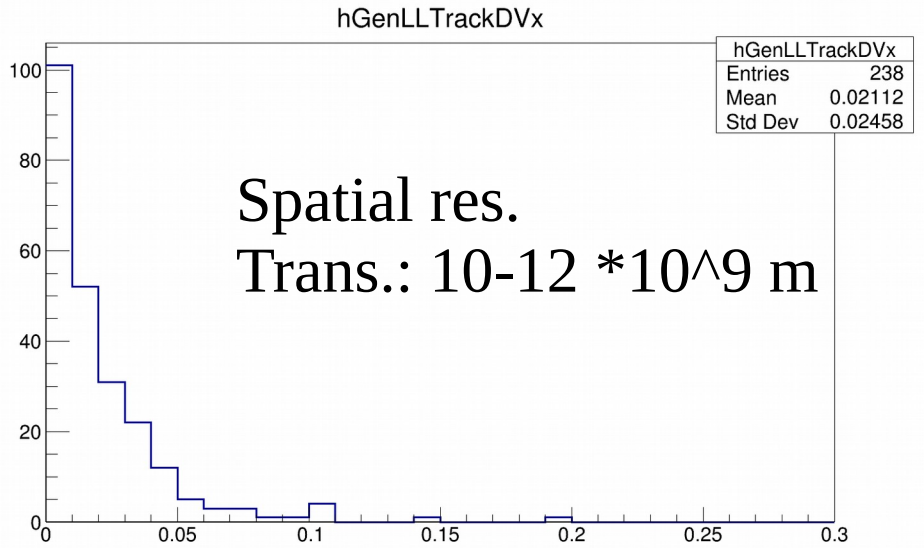
Track impact parameter for lepton tracks

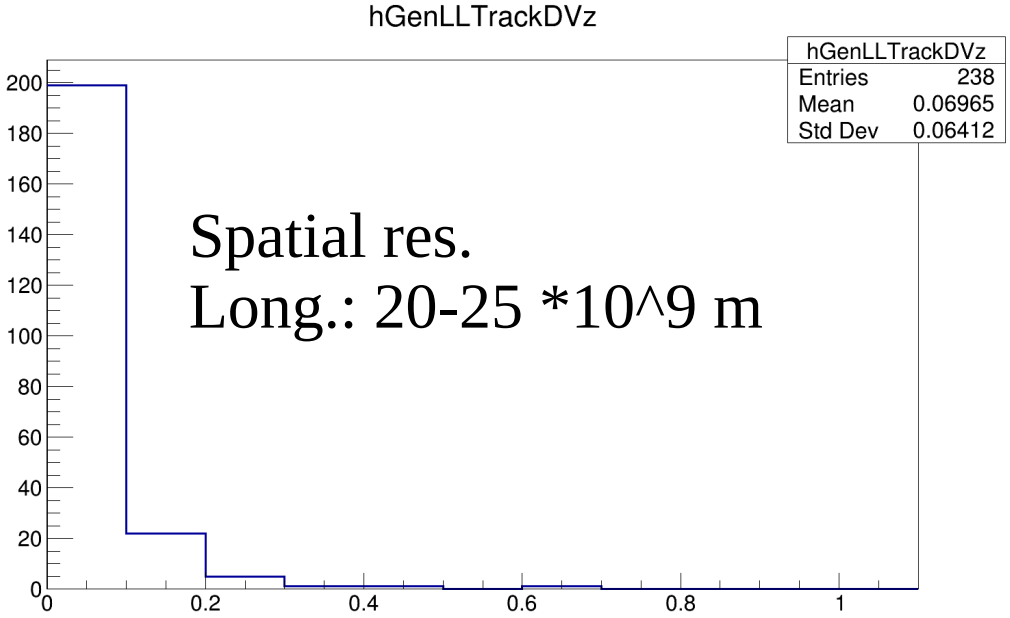


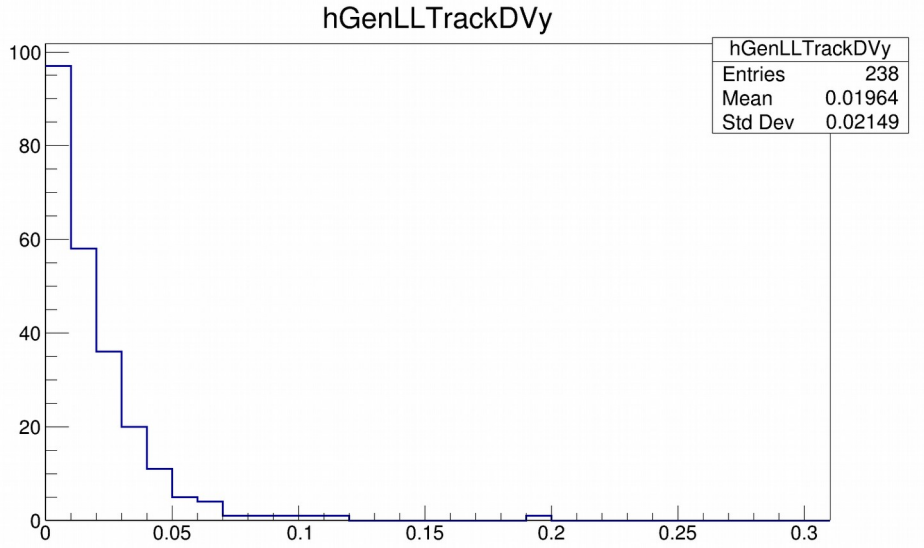
Shows:
tracks that match the gen. Leptons
e.g.
vx(t1) blue
vx(t2) red

Δvx, Δvy, Δvz for lepton tracks

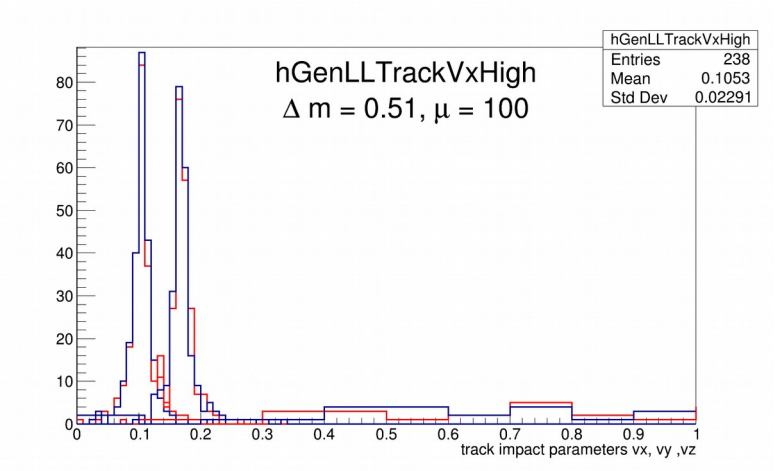




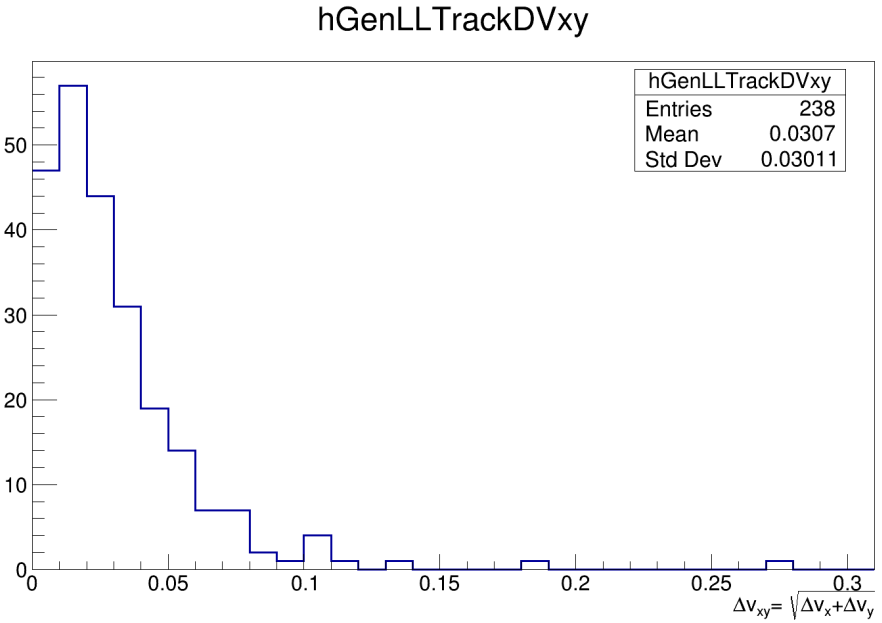


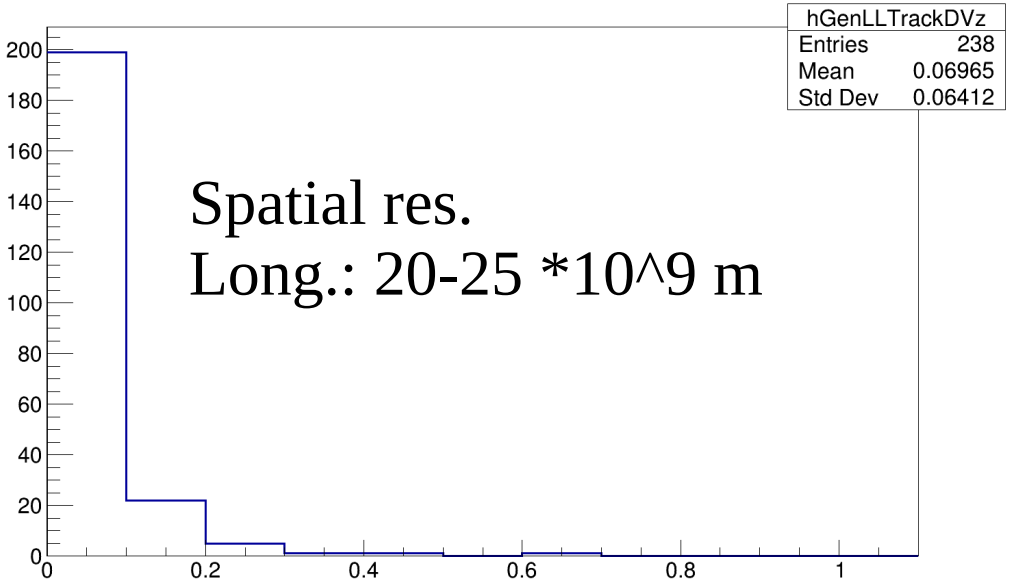


Δvx, Δvy, Δvz, for lepton tracks



Spatial res.
Trans.: 10-12 *10^9 m

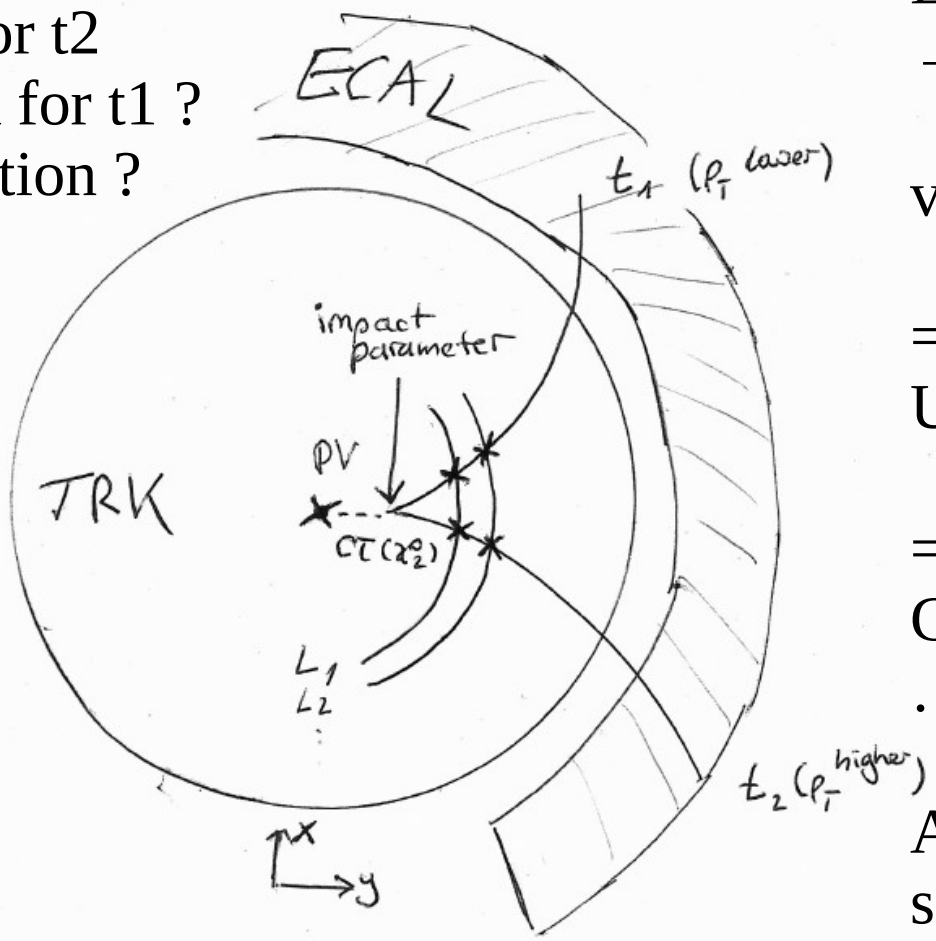




Spatial res.
Long.: 20-25 *10^9 m

How can we extrapolate the leptons to their common vertex?

Use:
PF for t2
track for t1 ?
Isolation ?



Each PF has a .bestTrack()
→ dyx → vx, vy

vx, vy, vz = x, y, z, coordinate of vertex

=> In case of two PF Candidates:
Use the vertex?

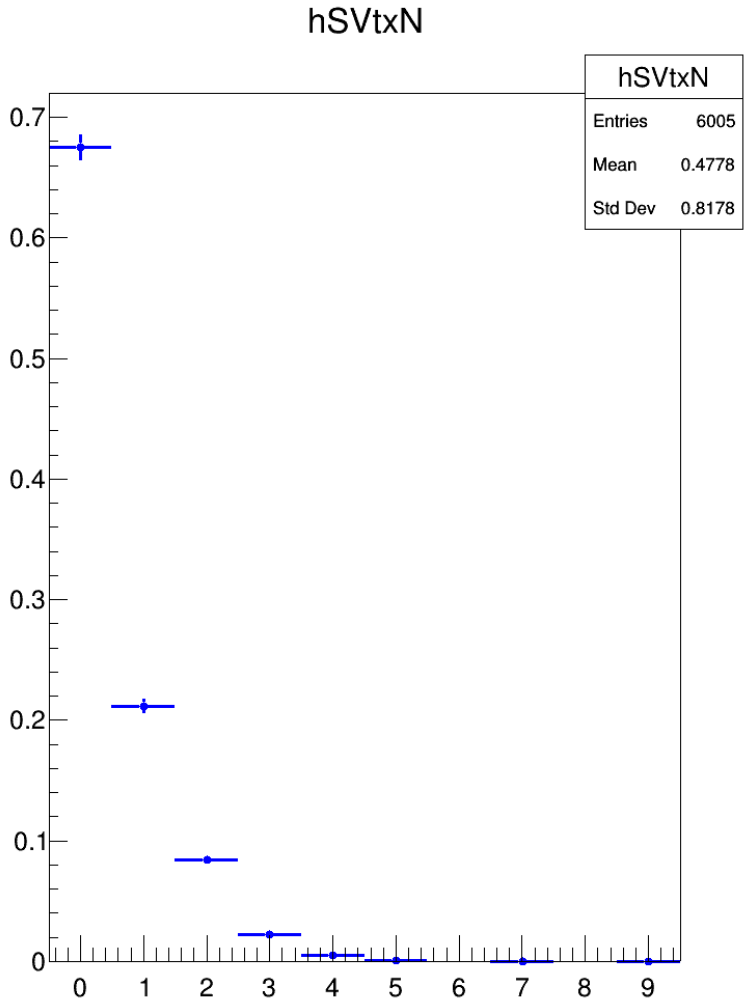
=> In case of one track and one PF Candidate:
….?

Are the two leptons associated to a secondary vertex?

A look in the inclusiveSecondaryVertex Collection @ DeltaM 510 MeV

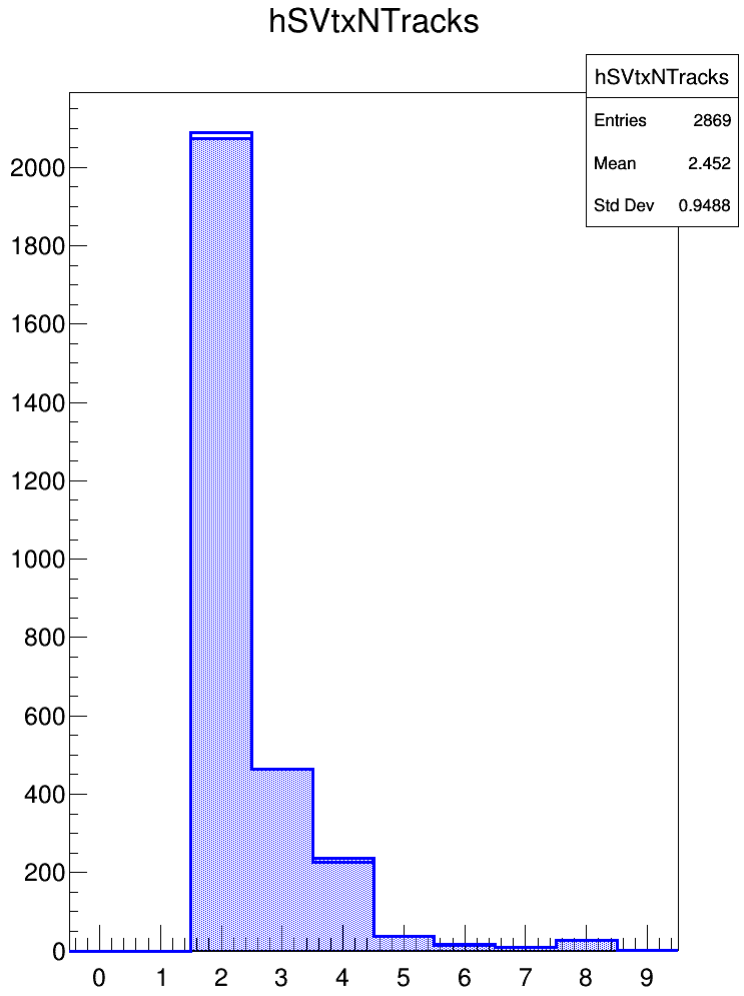
Also here only “HLT” Tier saved (should be RECO level info)

No. of SV per event:

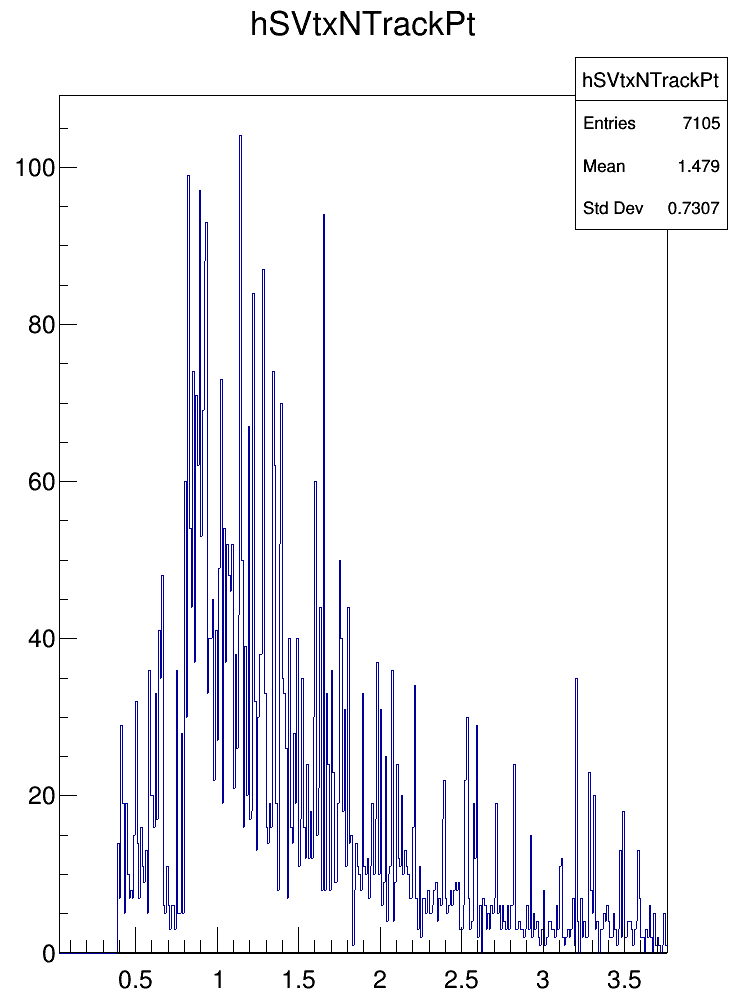


A look in the inclusiveSecondaryVertex Collection @ DeltaM 510 MeV

No. of tracks in the SV (before and after refit):



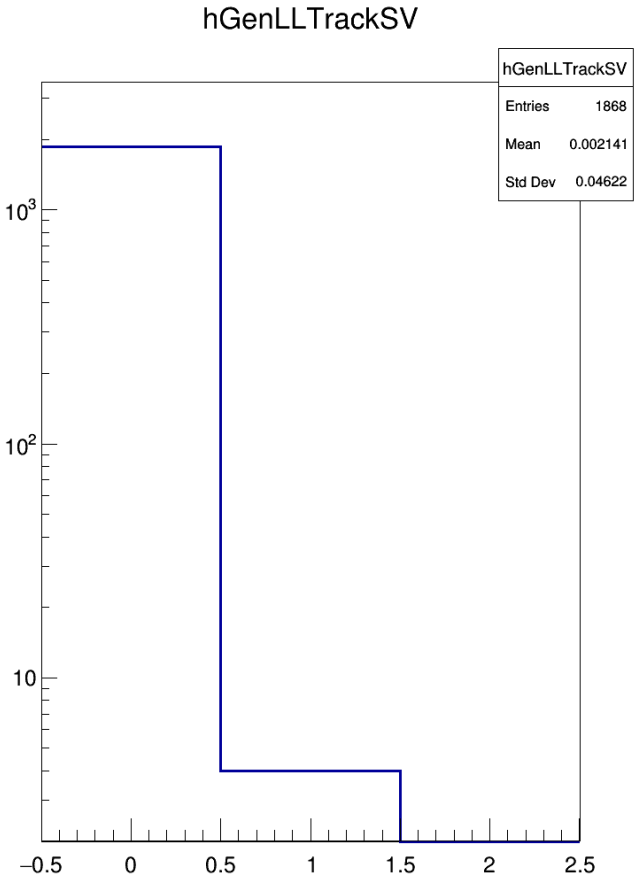
Pt spectrum of the tracks in the SV:

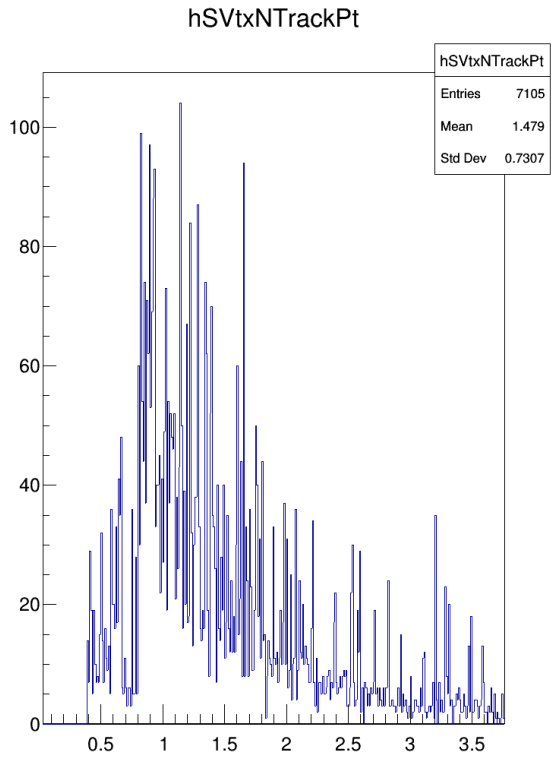


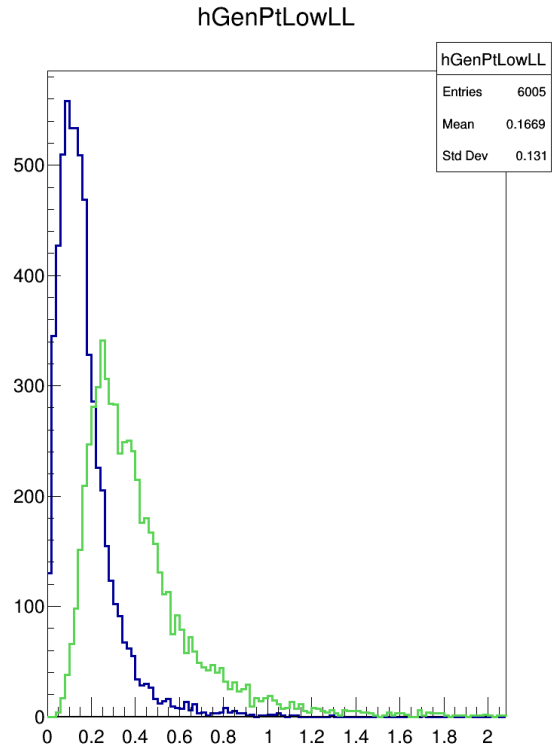
A look in the inclusiveSecondaryVertex Collection @ DeltaM 510 MeV

In case of two matched tracks and SV present, how many of the tracks are assigned to the SV?

One reason: pt requirement for tracks in vertex





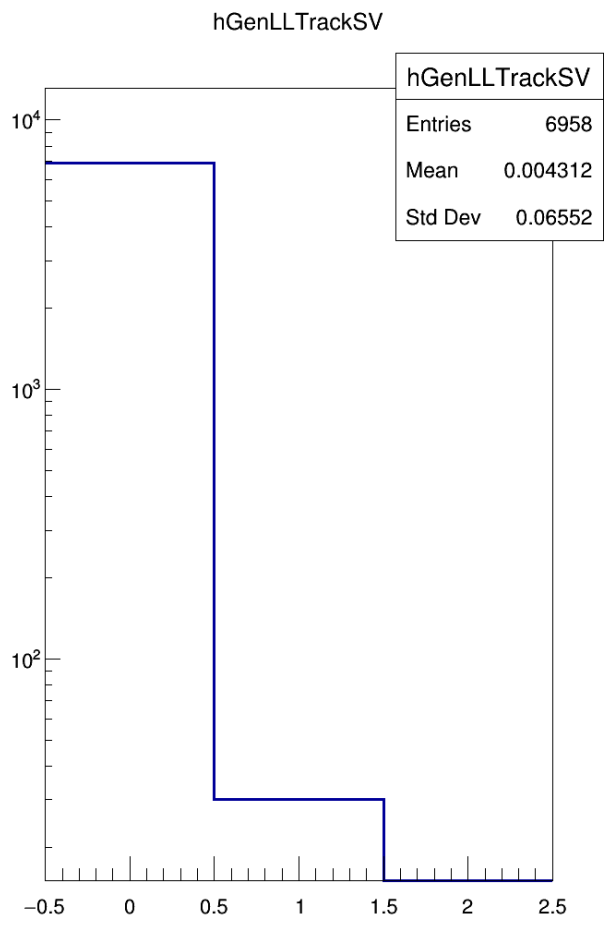


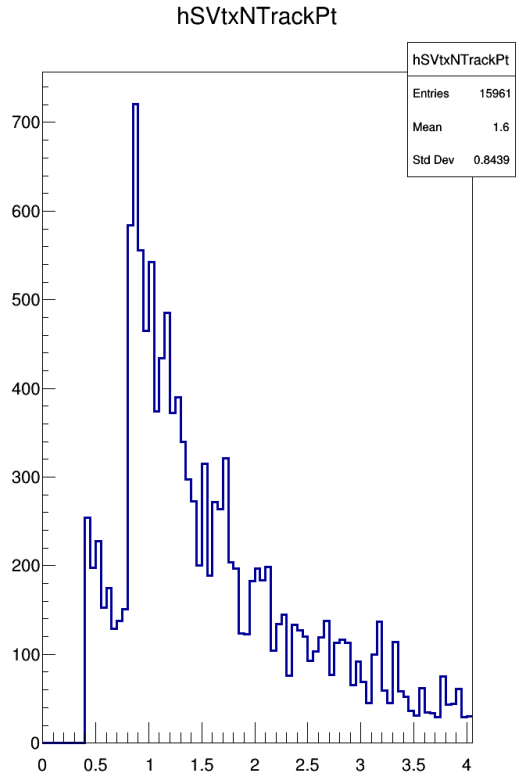
Pt spectrum of all tracks in all SVs

Pt spectrum of gen. leptons

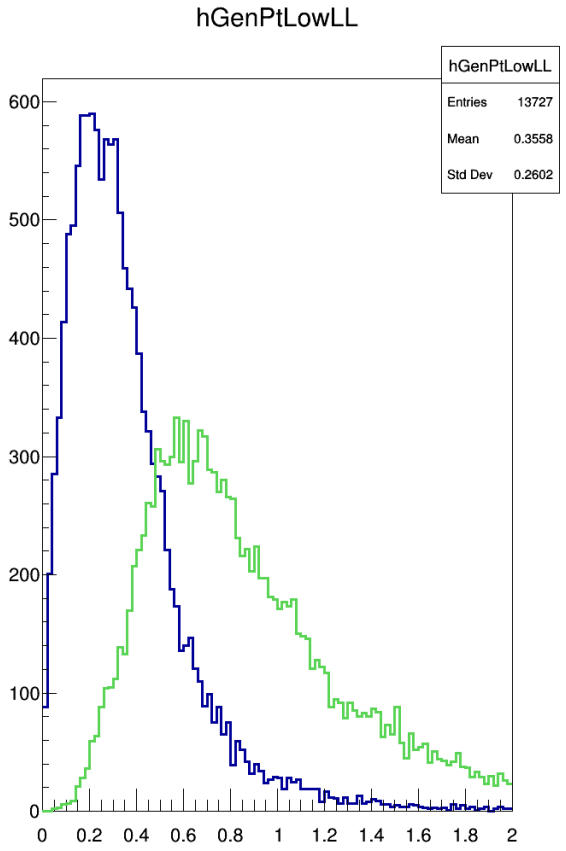
A look in the inclusiveSecondaryVertex Collection @ DeltaM 1.13 GeV

How does the picture change for larger mass differences?





Similar pt spectrum of all tracks the SVs



Pt spectrum of gen. Leptons @ 1.13 Ge

Outlook and open tasks

Rerun the SVBuilder with looser pt cut – how to do that?

Build categories and different tags for each category

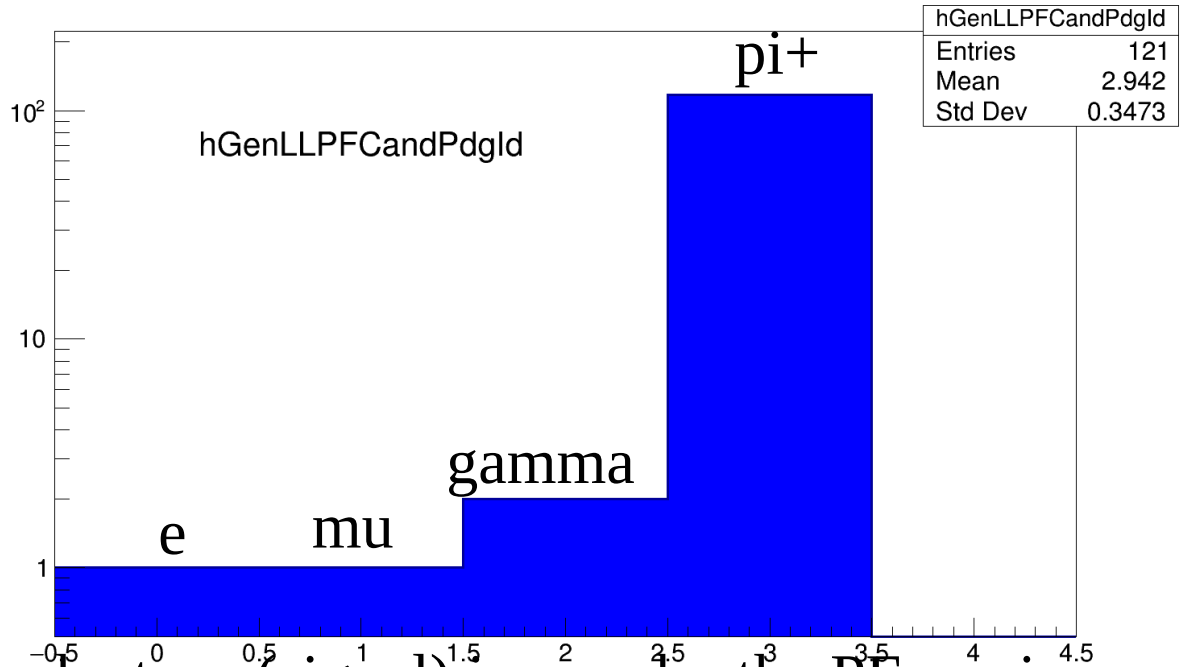
- 1PF 1 Track
- 1PF, 1Track, HighMET
- 1PF, 1Track, 1 Disappearing Track
- 1PF, 1Track, 1 Disappearing Track, HighMET
- no / one lepton from VBF ? (paper?)

How the vertex is build depends on the ParticleType Classification of the PF

```
const math::XYZPoint & PFCandidate::vertex() const {
  switch (vertexType_) {
  case kCandVertex:
    return LeafCandidate::vertex();
    break;
  case kTrkVertex:
    return trackRef()->vertex();
    break;
  case kComMuonVertex:
    return muonRef()->combinedMuon()->vertex();
    break;
  case kSAMuonVertex:
    return muonRef()->standAloneMuon()->vertex();
    break;
  case kTrkMuonVertex:
    return muonRef()->track()->vertex();
    break;
  case kTPFMSMuonVertex:
    return muonRef()->tpfmsTrack()->vertex();
    break;
  case kPickyMuonVertex:
    return muonRef()->pickyTrack()->vertex();
    break;
  case kDYTMuonVertex:
    return muonRef()->dytTrack()->vertex();
    break;

  case kGSFVertex:
    return gsfTrackRef()->vertex();
    break;
  }
  return LeafCandidate::vertex();
}
```

Mu 100, dM 0.51 Gev (PF is not yet so efficient)



Most of our leptons (signal) is seen by the PF as pions

PF pdgID assignment highly un-tuned for ultra-low pT lep.

Special ID algo?

Training a BDT using signal candidates and sample of gen-matched pion PF candidates as background

What can we ask a track?

const math::XYZPoint& reco::Track::innerPosition () = position of the innermost hit

XYZPointD/F = point in space with cartesian internal representation

double dxy (const Point &myBeamSpot) = dxy parameter with respect to a user-given beamSpot (WARNING: this quantity can only be interpreted as a minimum transverse distance if beamSpot, if the beam spot is reasonably close to the refPoint, since linear approximations are involved). This is a good approximation for Tracker tracks.

double dxy (const BeamSpot &theBeamSpot) = dxy parameter with respect to the beamSpot taking into account the beamspot slopes (WARNING: …

RecHitsBegin () = iterator to first hit on a track

What can we ask the TrackingRecHit?

virtual GlobalPoint globalPosition ()

virtual LocalPoint localPosition () const =0

virtual LocalError localPositionError () const =0

virtual AlgebraicVector parameters () const =0

virtual bool sharesInput (const TrackingRecHit *other, SharedInputType what) const

What can we ask a track?

const math::XYZPoint& reco::Track::innerPosition () = position of the innermost hit

Needs track extra collection!

double dxy (const Point &myBeamSpot) = dxy parameter with respect to a user-given beamSpot (WARNING: this quantity can only be interpreted as a minimum transverse distance if beamSpot, if the beam spot is reasonably close to the refPoint, since linear approximations are involved). This is a good approximation for Tracker tracks.

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