

# Debugging FastSim Tracking Discrepancies

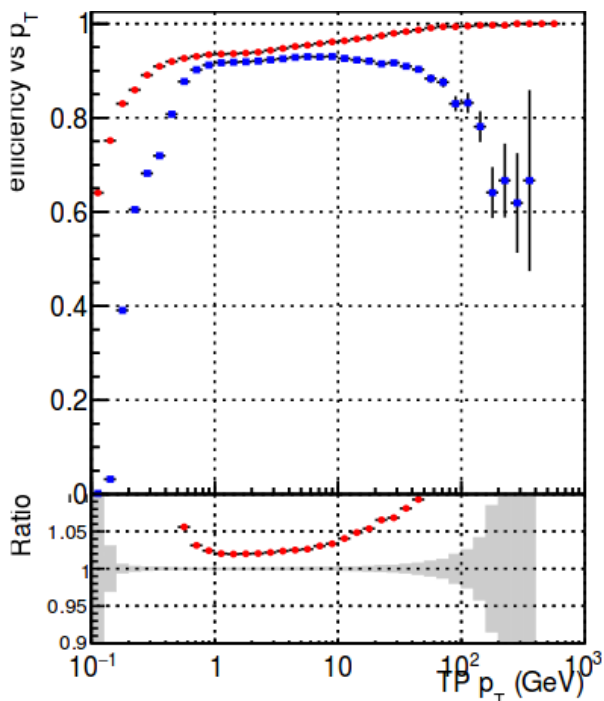
[Anshul Kapoor](#)  
Lukas Vanelderren  
Sourabh Dube

18/01/16

# History of Discrepancies

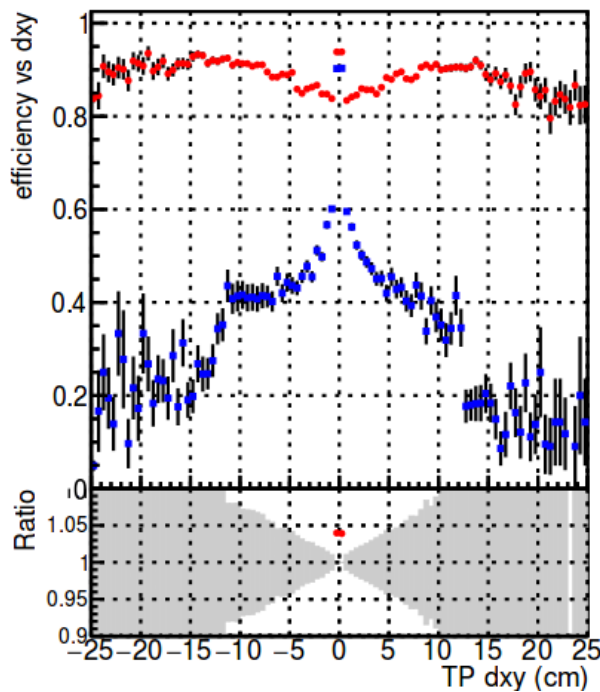
FastSim vs FullSim  
Ttbar sample with no pileup  
OutOfTheBox Tracks

1



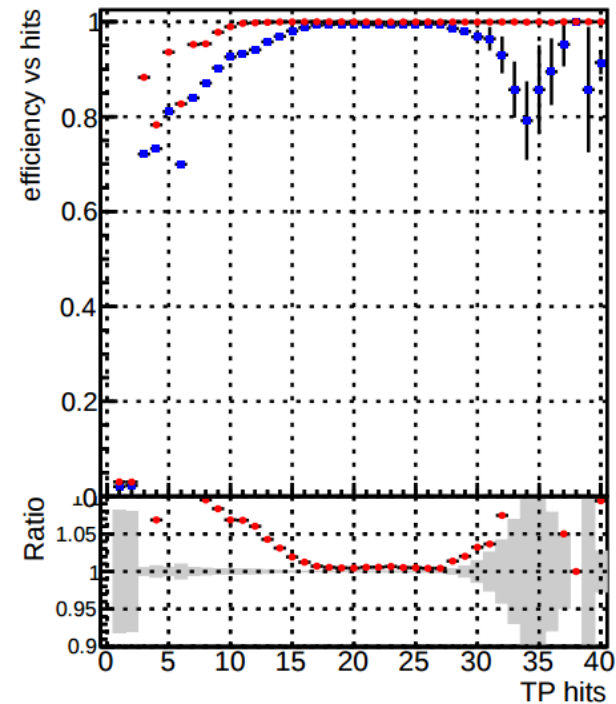
Efficiency Vs Pt

2



Efficiency Vs dxy

3



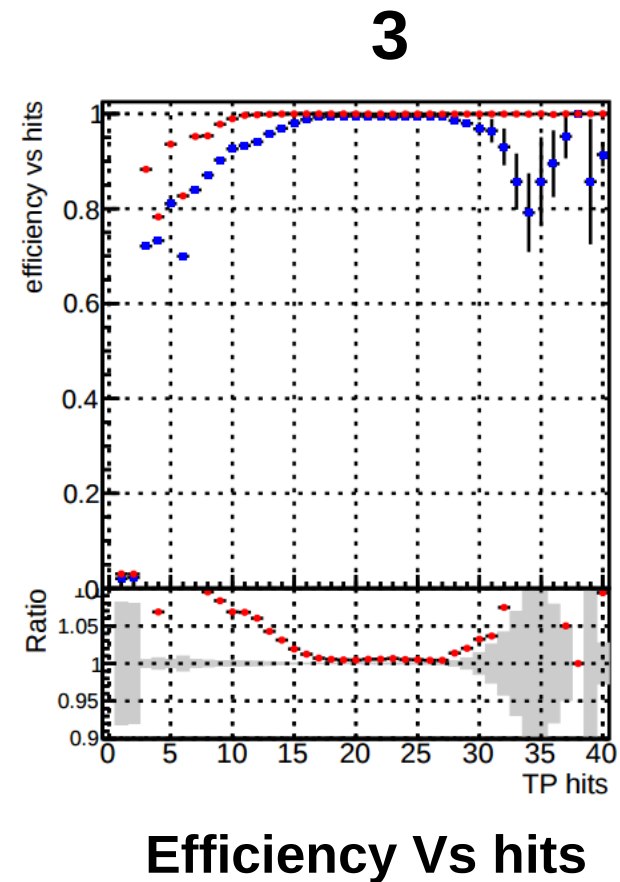
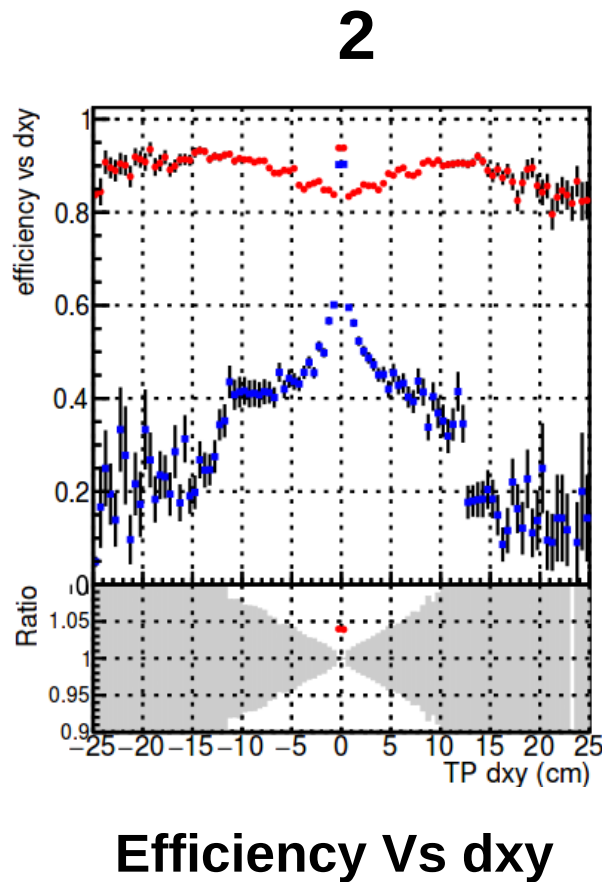
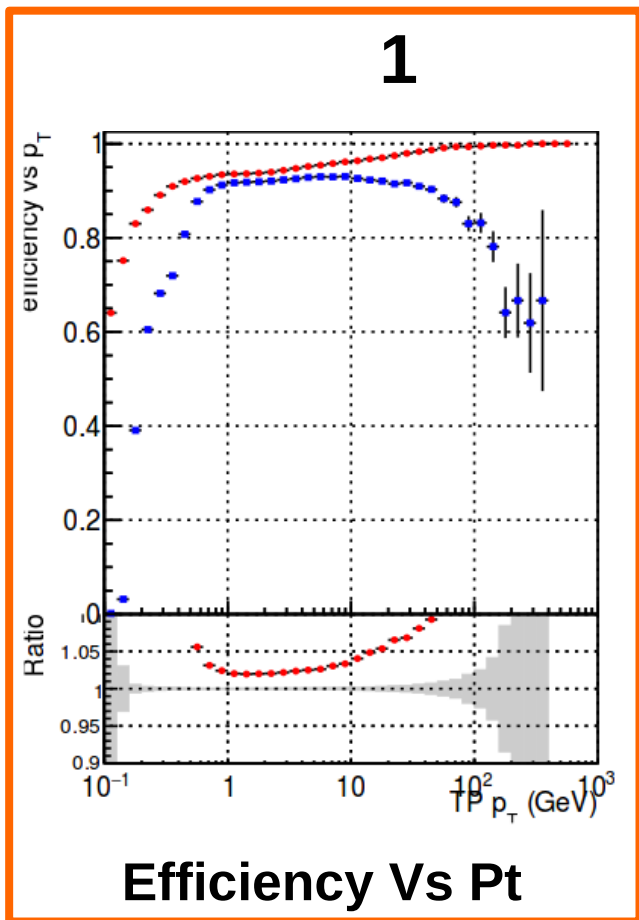
Efficiency Vs hits

Previous Report:  
<https://indico.cern.ch/event/470257/>  
14 Dec 15 - Tracking POG Meeting

FastSim 8\_0\_0 pre1 —●—  
FullSim 8\_0\_0 pre1 —●—

# History of Discrepancies

FastSim vs FullSim  
Ttbar sample with no pileup  
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Previous Report:  
<https://indico.cern.ch/event/470257/>  
14 Dec 15 - Tracking POG Meeting

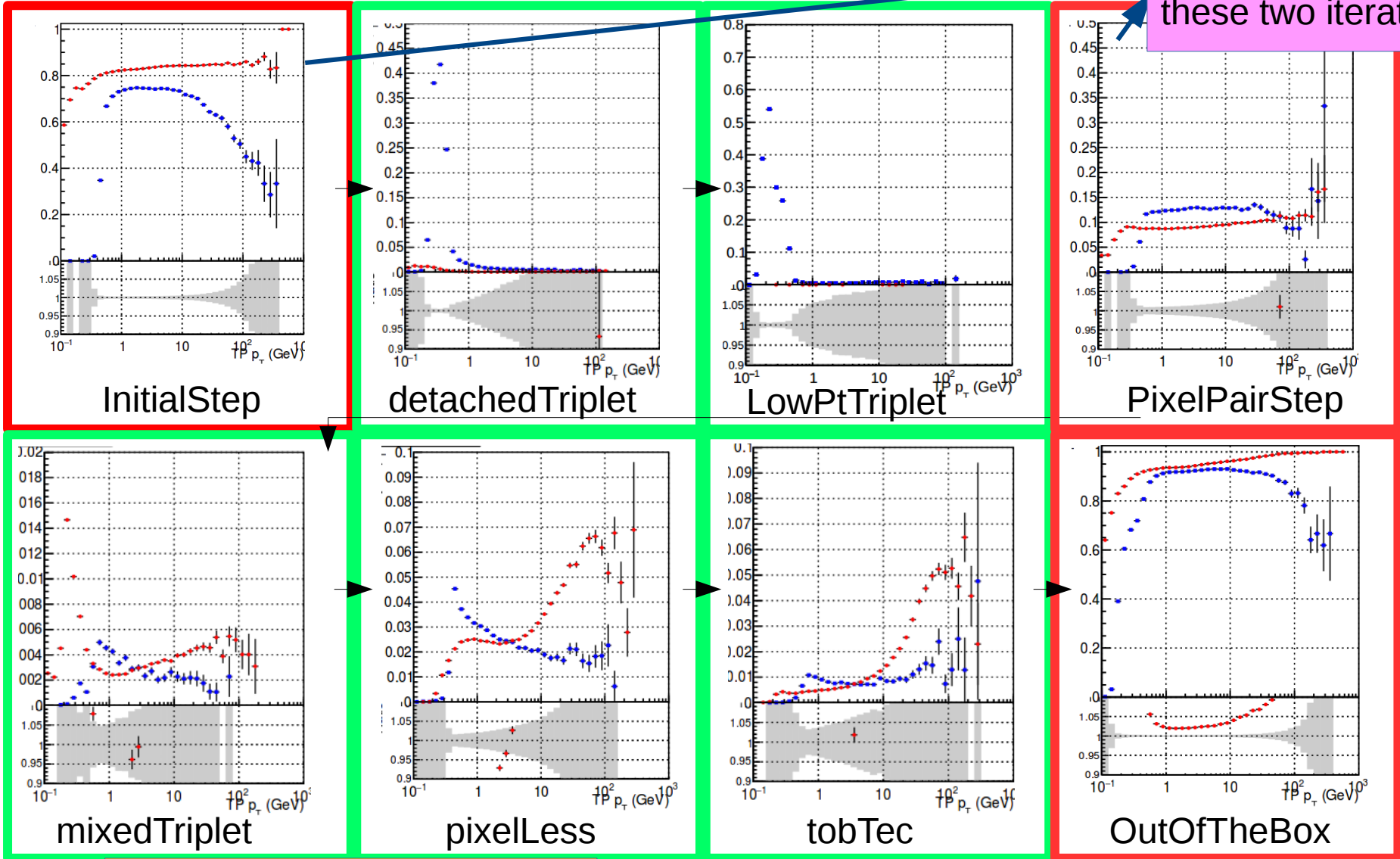
FastSim 8\_0\_0 pre1 —●—  
FullSim 8\_0\_0 pre1 —●—

# FastSim vs FullSim

## Ttbar sample with no pileup

### Efficiency Vs Pt

(Major discrepancies in these two iterations.

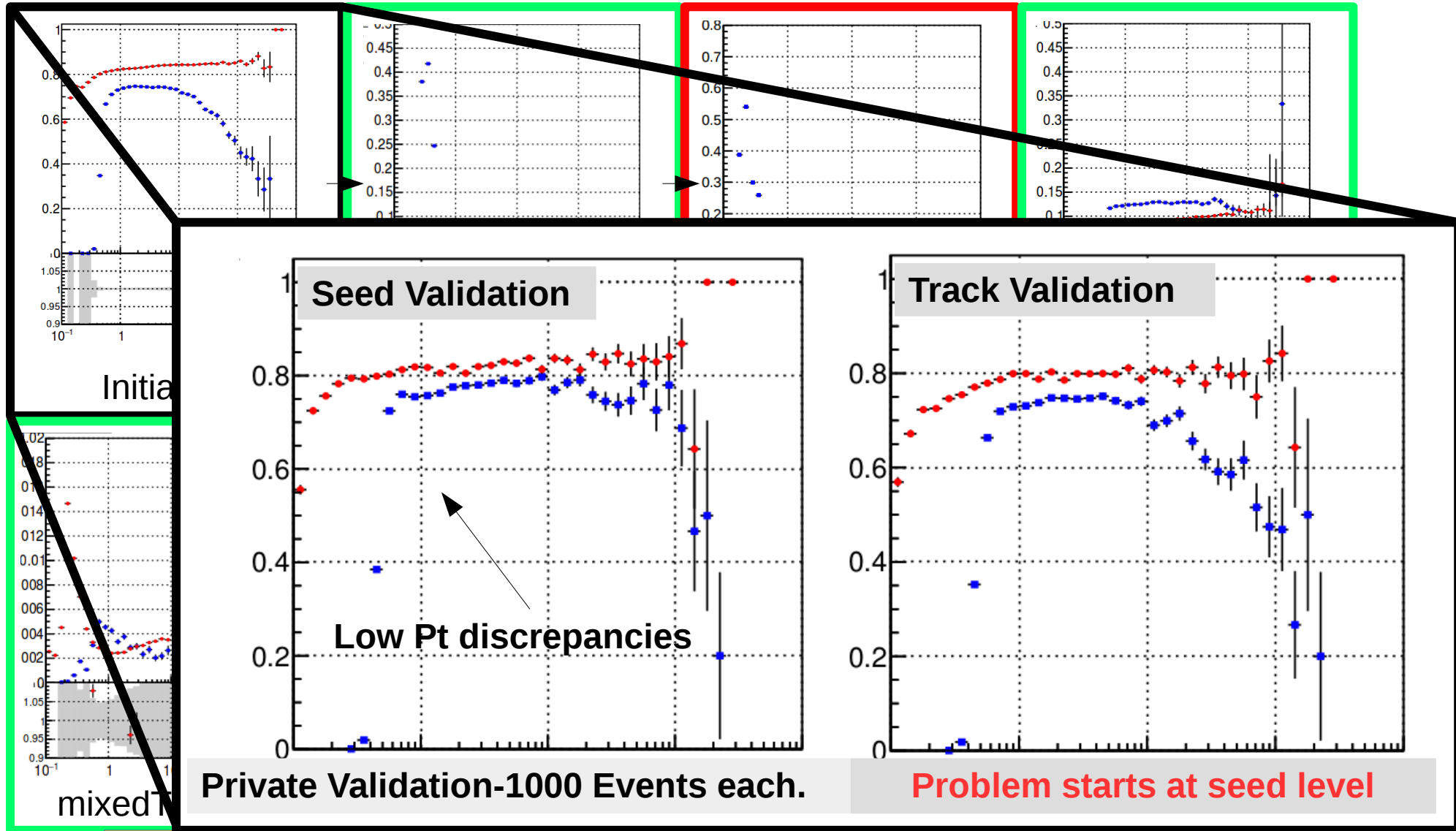


FastSim 8\_0\_0 pre1 —●—  
FullSim 8\_0\_0 pre1 —●—

# FastSim vs FullSim

Efficiency Vs Pt

## Ttbar sample with no pileup



FastSim 8\_0\_0 pre1 —●—  
FullSim 8\_0\_0 pre1 —●—

# Standard Seeding (Until 14 Dec 15)

(the way we understand it)

- a pair / triplet of hits becomes a seed if
  - **compatible with seed layer of layer definition**
  - **inner pair compatible with tracking region constraints (HitPairGeneratorFromLayerPair::doublets)**
  - **triplet compatible with tracking region constraints (PixelTripletHLTGenerator::hitTriplets)**
  - **(compatible with seed comparitor)**
  - **seedCreator succeeds to create a TrajectorySeed**

**proper fastsim implementation  
(as far as we understand)**

**incomplete fastsim implementation**

**no fastsim implementation**

# Standard Seeding

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  - **(compatible with seed comparator)**
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Complete

**proper fastsim implementation  
(as far as we understand)**

~~**incomplete fastsim implementation**~~  
**no fastsim implementation**

Changes in the full-sim code !

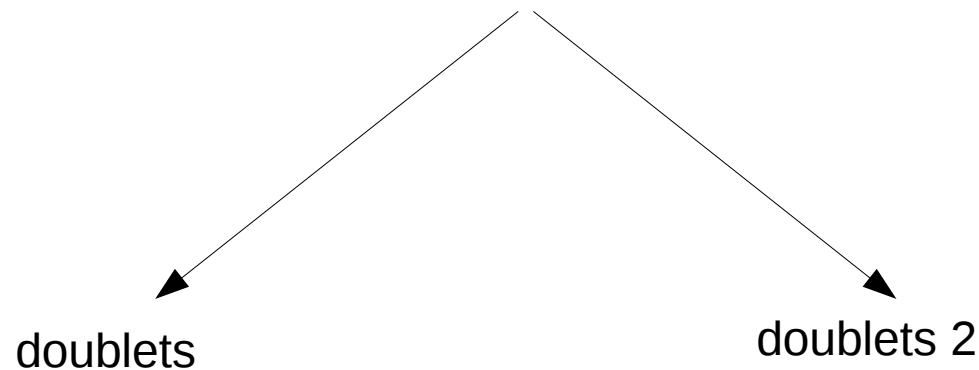
Attacked:

[RecoTracker/TkHitPairs/src/HitPairGeneratorFromLayerPair.cc](#)

## Re-arrangement

### HitPairGeneratorFromLayerPair::doublets

( const TrackingRegion& region, const edm::Event & iEvent, const edm::EventSetup& iSetup, Layers layers)



Link to github



[https://github.com/cms-sw/cmssw/compare/CMSSW\\_8\\_0\\_X...ANSH0712:hitPairImplementation](https://github.com/cms-sw/cmssw/compare/CMSSW_8_0_X...ANSH0712:hitPairImplementation)



Used in FastSim

Attacked:

[FastSimulation/Tracking/plugins/TrajectorySeedProducer.cc](#)

**TrajectorySeedProducer::pass2HitsCuts**

**(const TrajectorySeedHitCandidate & innerHit, const  
TrajectorySeedHitCandidate & outerHit){**

.....

HitPairGeneratorFromLayerPair::doublets2(\*\*ir,\*innerLayer,\*o  
uterLayer,\*ihm,\*ohm,\*es\_,0,result);

if(result.size() != 0)

HitPair Check Passed and we initialize seed creation

.....

**}**

[https://github.com/cms-sw/cmssw/compare/CMSSW\\_8\\_0\\_X...ANSH0712:hitPairImplementation](https://github.com/cms-sw/cmssw/compare/CMSSW_8_0_X...ANSH0712:hitPairImplementation)

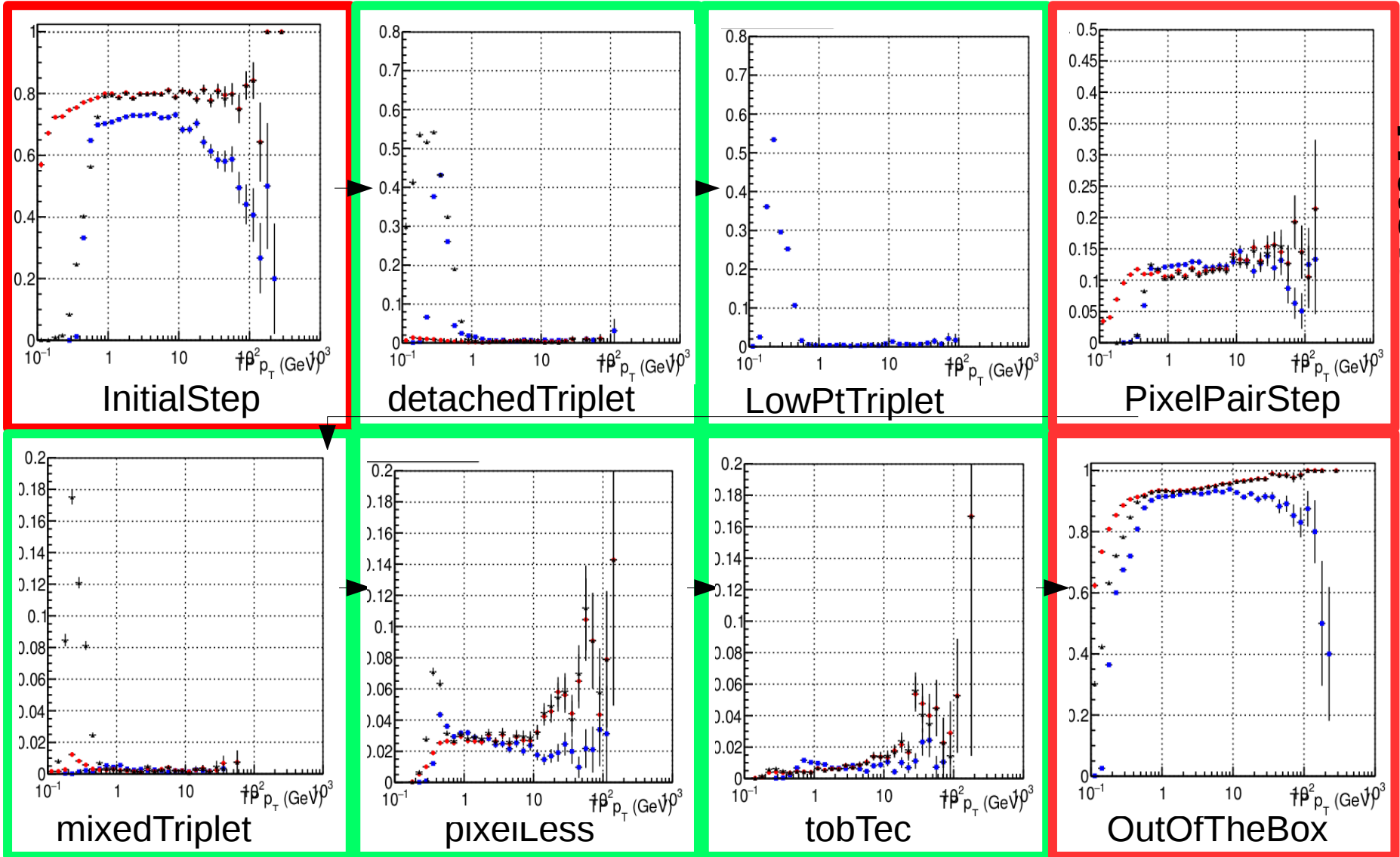
# FastSim vs FullSim

## Ttbar sample with no pileup

Efficiency Vs Pt

CMSSW  
8\_0\_X\_2016-01-15-2300

Track Validation



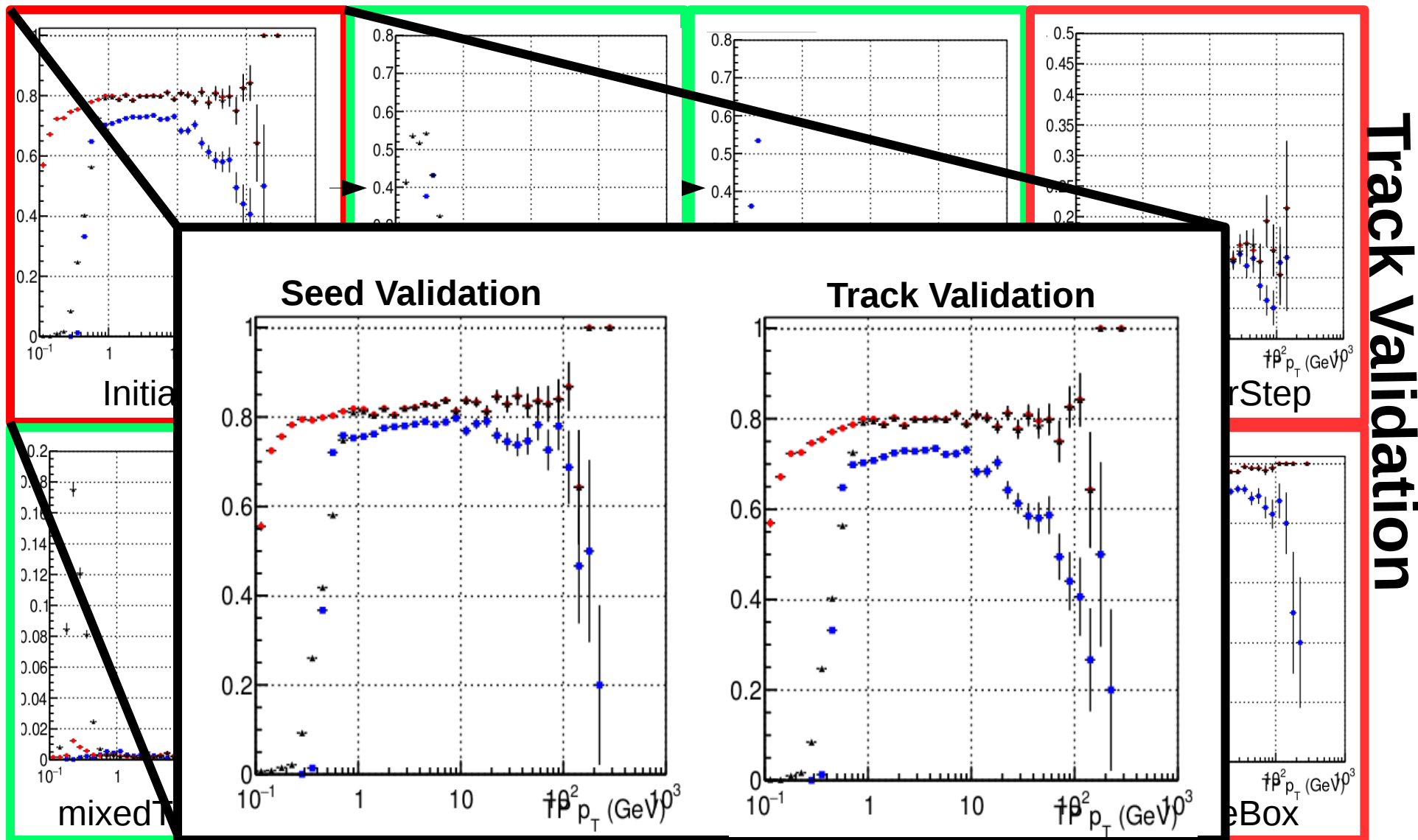
# FastSim vs FullSim

## Ttbar sample with no pileup

Efficiency Vs Pt

CMSSW

8\_0\_X\_2016-01-15-2300



FastSim Standard —●—  
FullSim Standard —●—

ChangedFastSim —●—

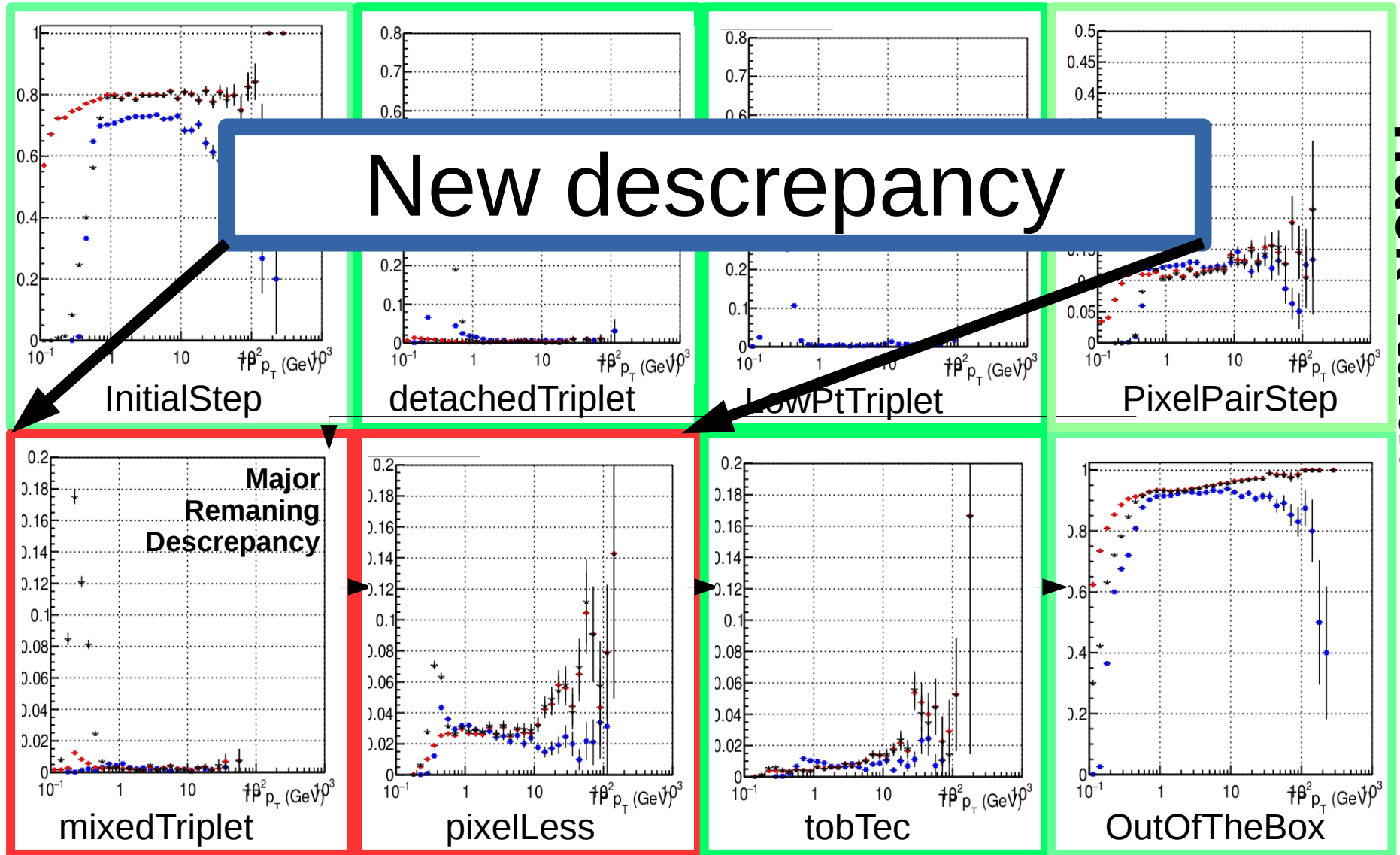
# FastSim vs FullSim

## Ttbar sample with no pileup

Efficiency Vs Pt

CMSSW

8\_0\_X\_2016-01-15-2300



Track Validation

FastSim Standard —●—  
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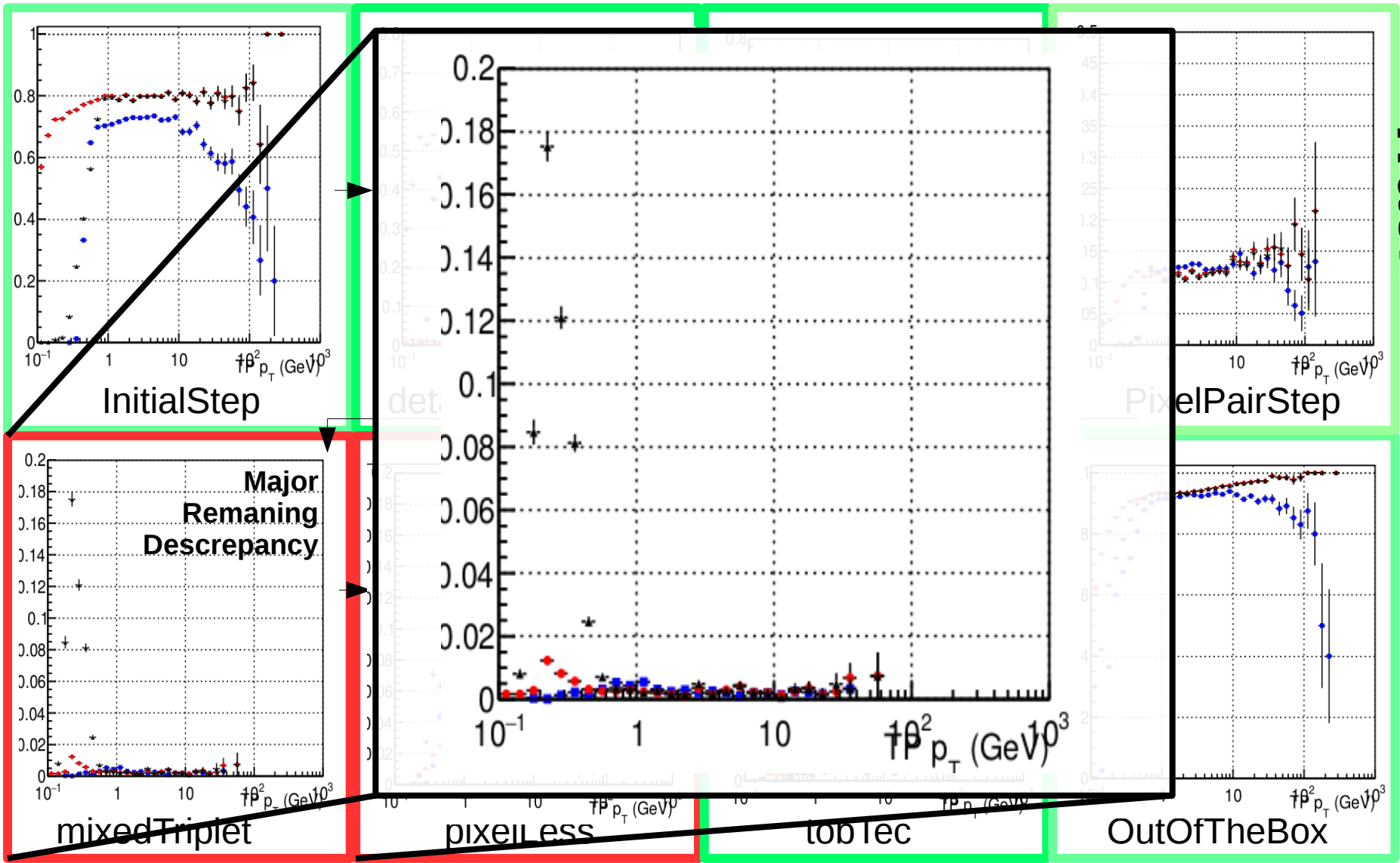
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## Ttbar sample with no pileup

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CMSSW  
8\_0\_X\_2016-01-15-2300

Track Validation



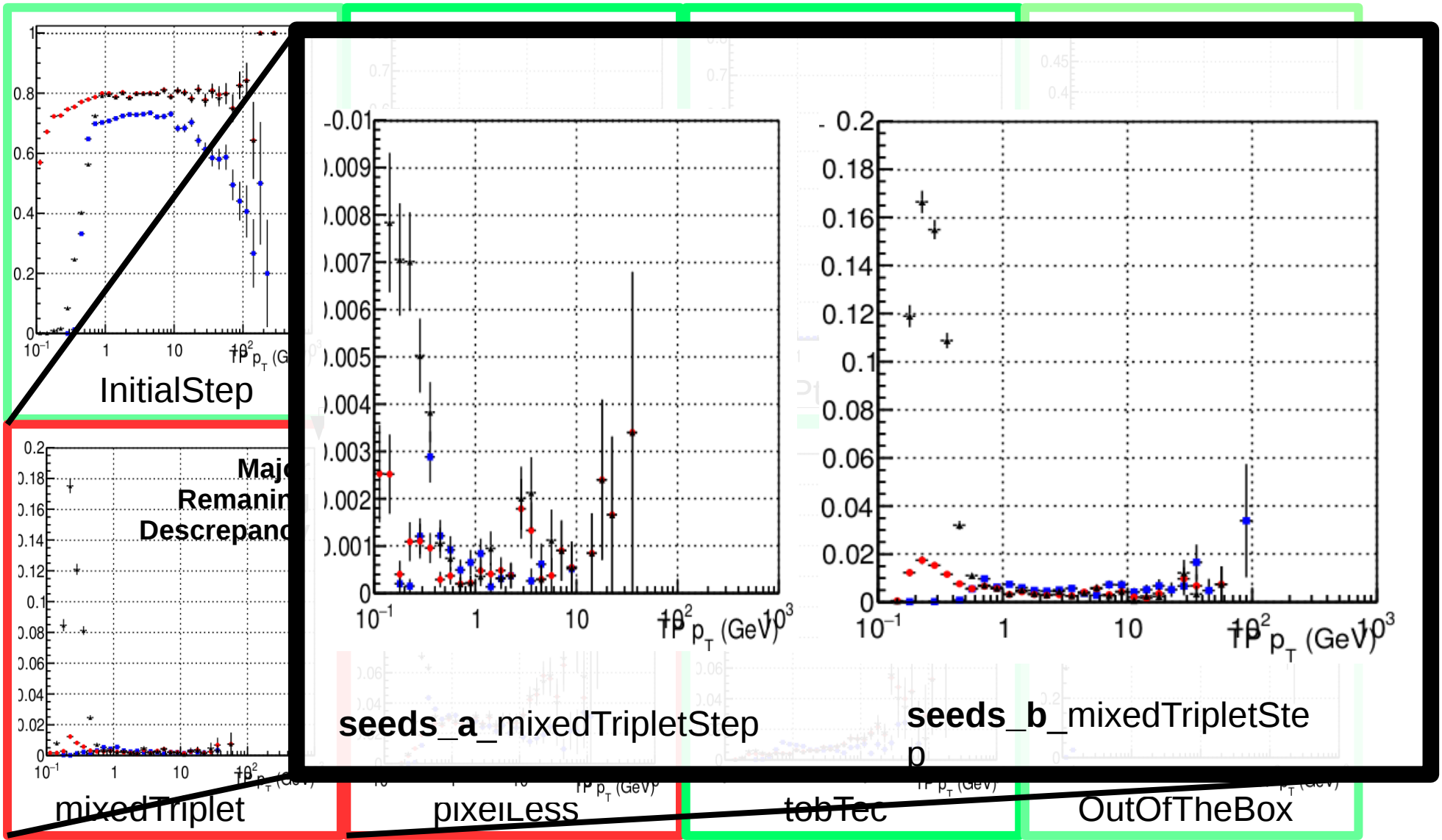
FastSim Standard —●—  
FullSim Standard —●—  
ChangedFastSim —●—

# FastSim vs FullSim

## Ttbar sample with no pileup

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8\_0\_X\_2016-01-15-2300



FastSim Standard —●—  
FullSim Standard —●—  
ChangedFastSim —●—



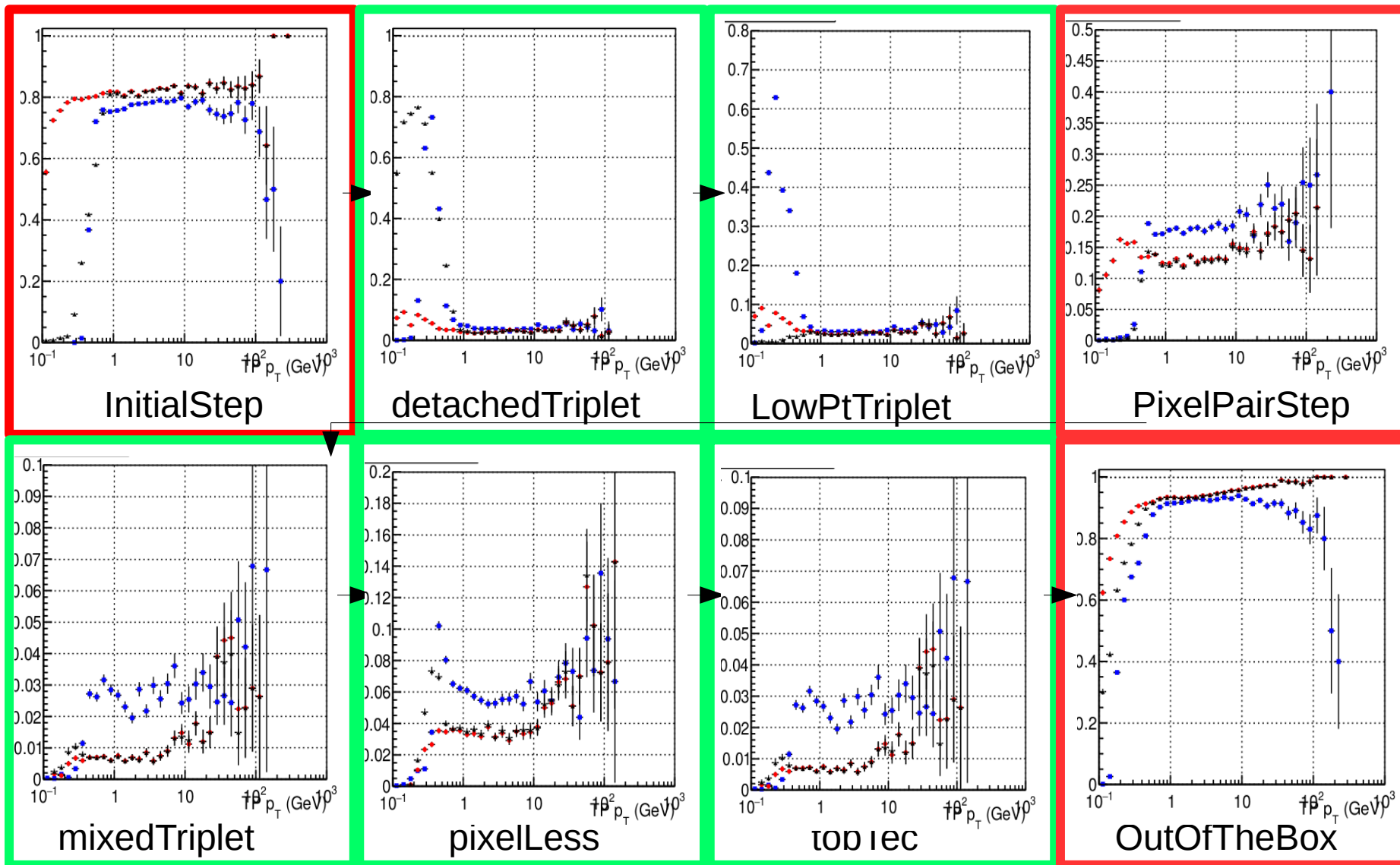
# FastSim vs FullSim

## Ttbar sample with no pileup

Efficiency Vs Pt

CMSSW

8\_0\_X\_2016-01-15-2300



Seed Validation

FastSim Standard —●—  
FullSim Standard —●—

ChangedFastSim —●—

# Partially Solved

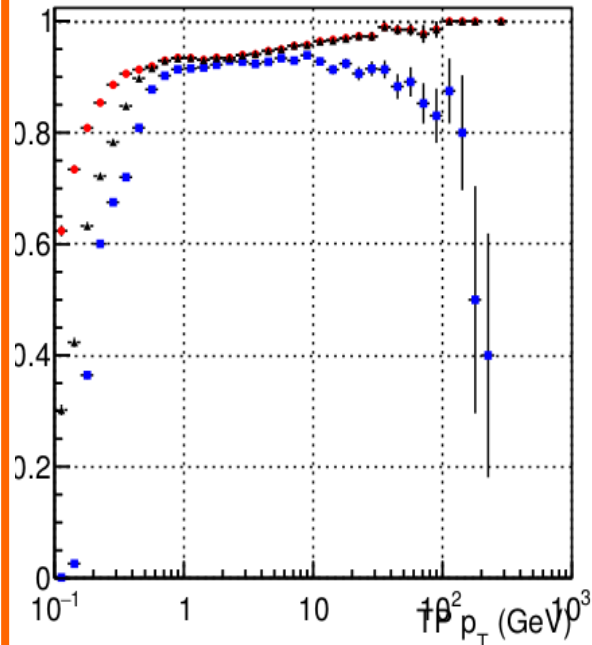


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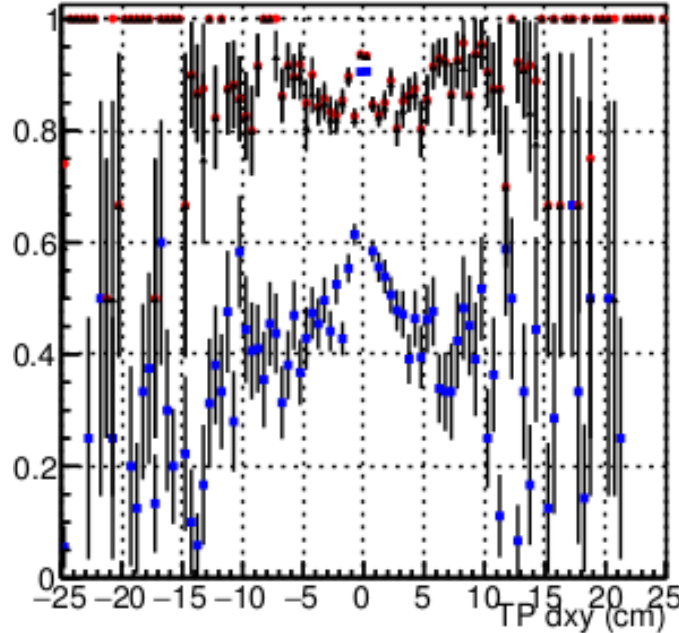
1

2

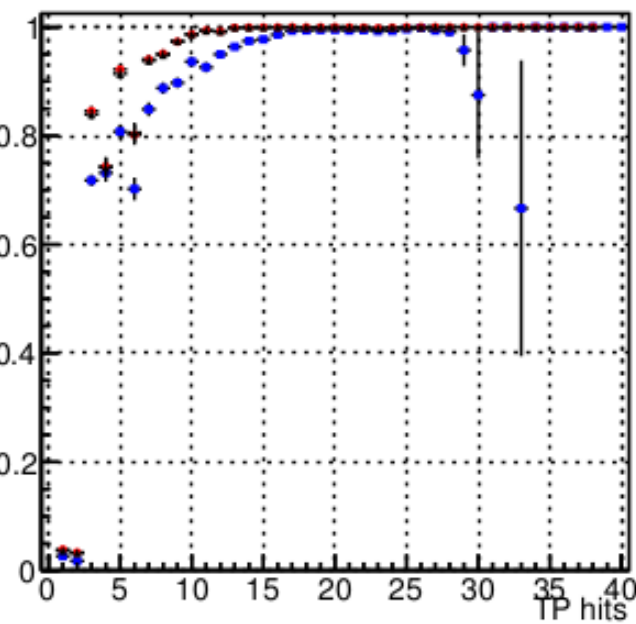
3



Efficiency Vs Pt



Efficiency Vs dxy



Efficiency Vs hits

FastSim Standard —●—  
FullSim Standard —●—

ChangedFastSim —●—



# Concluding Remarks

- **Eff vs Pt**

Proper Implementation of doublets check had a big impact.

Can triplet check also have a major effect ? FastSim as of now does not have a triplet check. Would it make sense to interface the fullsim triplet code also ?

- **Eff vs hits**

FastSim does not use standard track fitters. Is there a reason ? Using fullsim fitter in tobtec step had some minor impact. Should we use the Standard fitters ?

Also fastsim track fit takes into account all the particle hits. Fastsim should skip hits ignored by the seeding. **(work in progress)**

# Backup



# Precautionary Measure

- Time Report – FastSim – Local Sample – 1000 Events

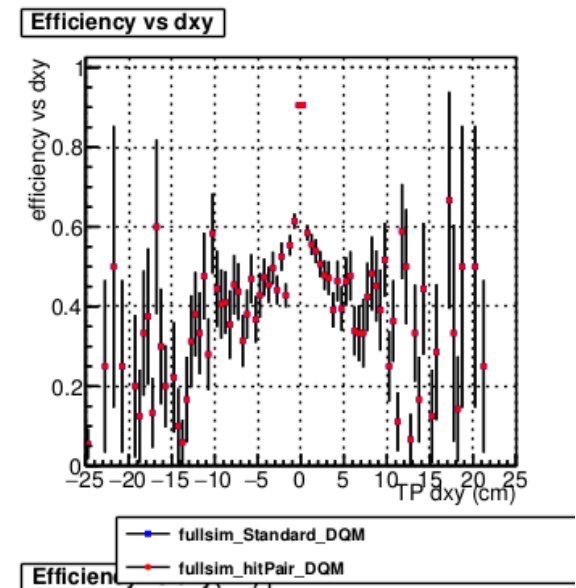
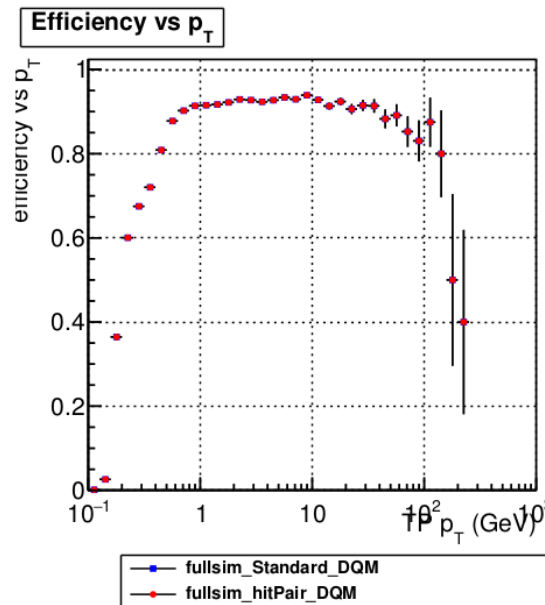
CMSSW\_8\_0\_X\_2016-01-04-2300 + new (hit pair implementation) changes:

real 35m 58.354s    user 33m 9.256s    sys 1m 25.656s

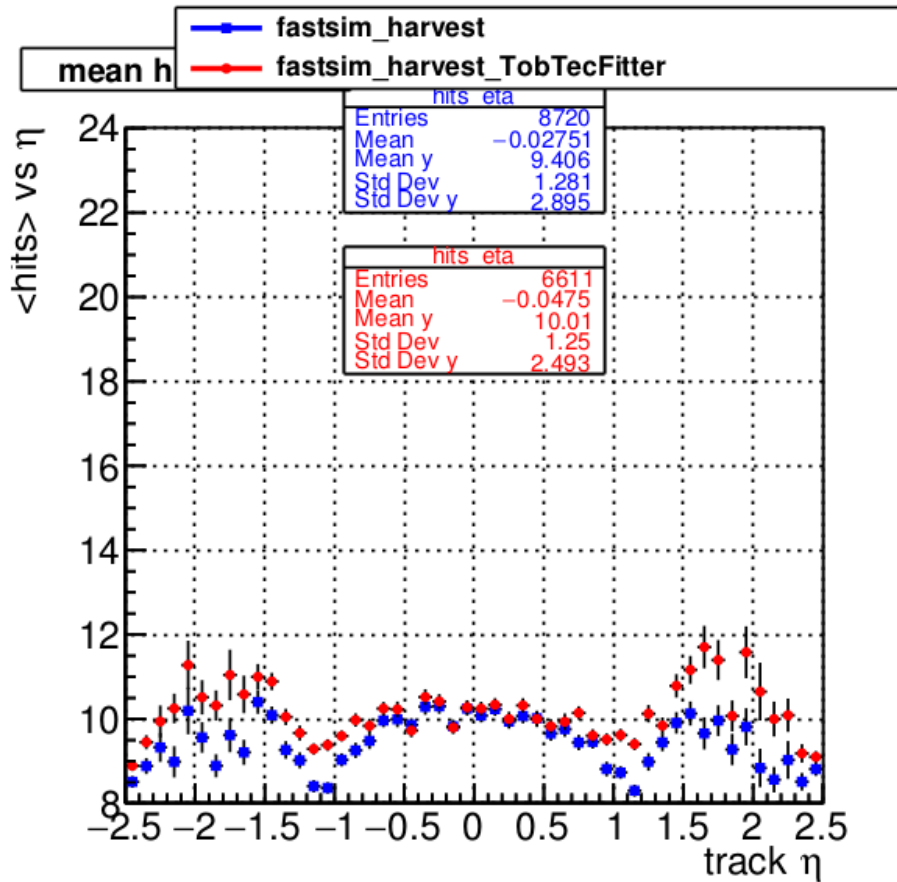
CMSSW\_8\_0\_X\_2016-01-04-2300 (Standard)

real 35m 58.201s    user 33m 4.156s    sys 1m 50.575s

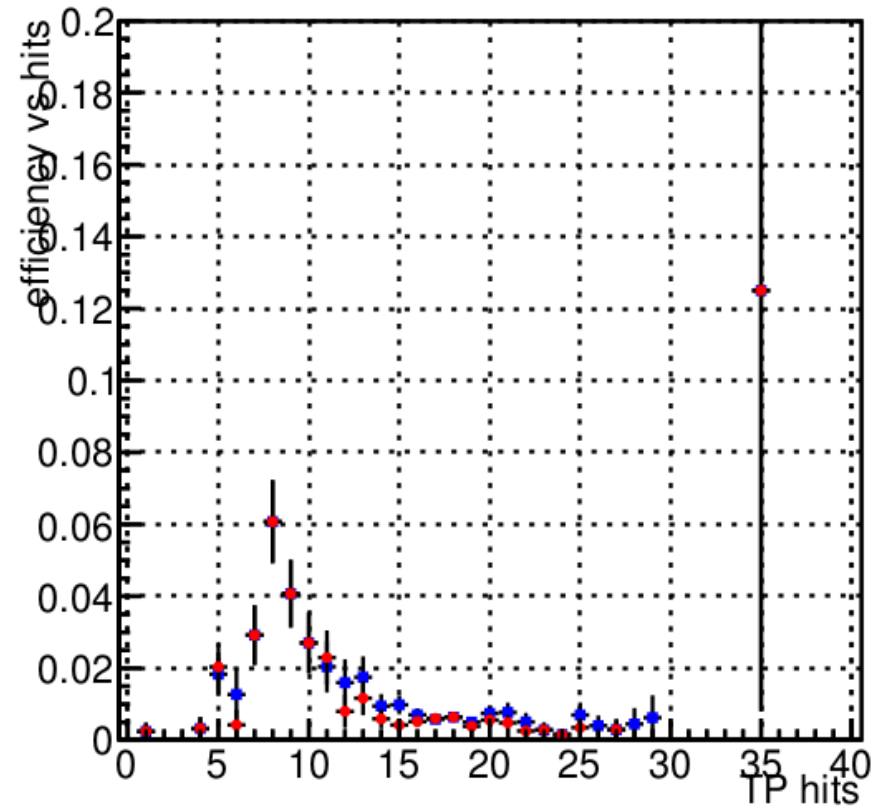
- Full Sim Validation



# Standard Fitter



Efficiency vs hit

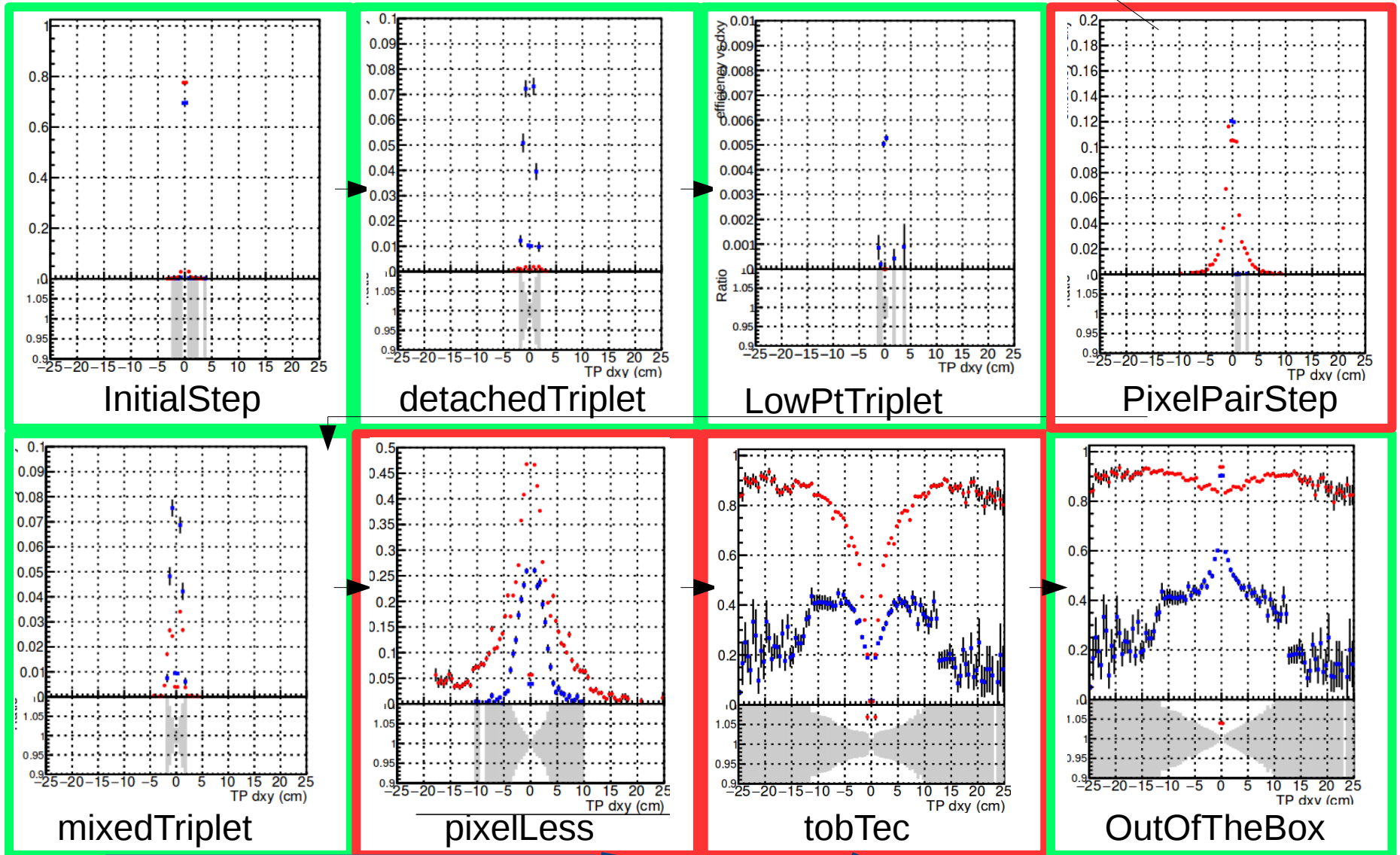


# FastSim vs FullSim

## Ttbar sample with no pileup

### Efficiency Vs dxy

Is there some cut in FullSim



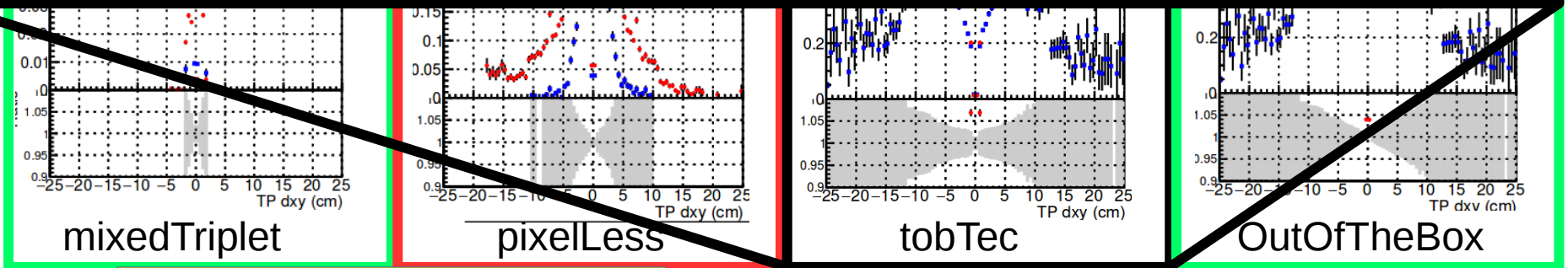
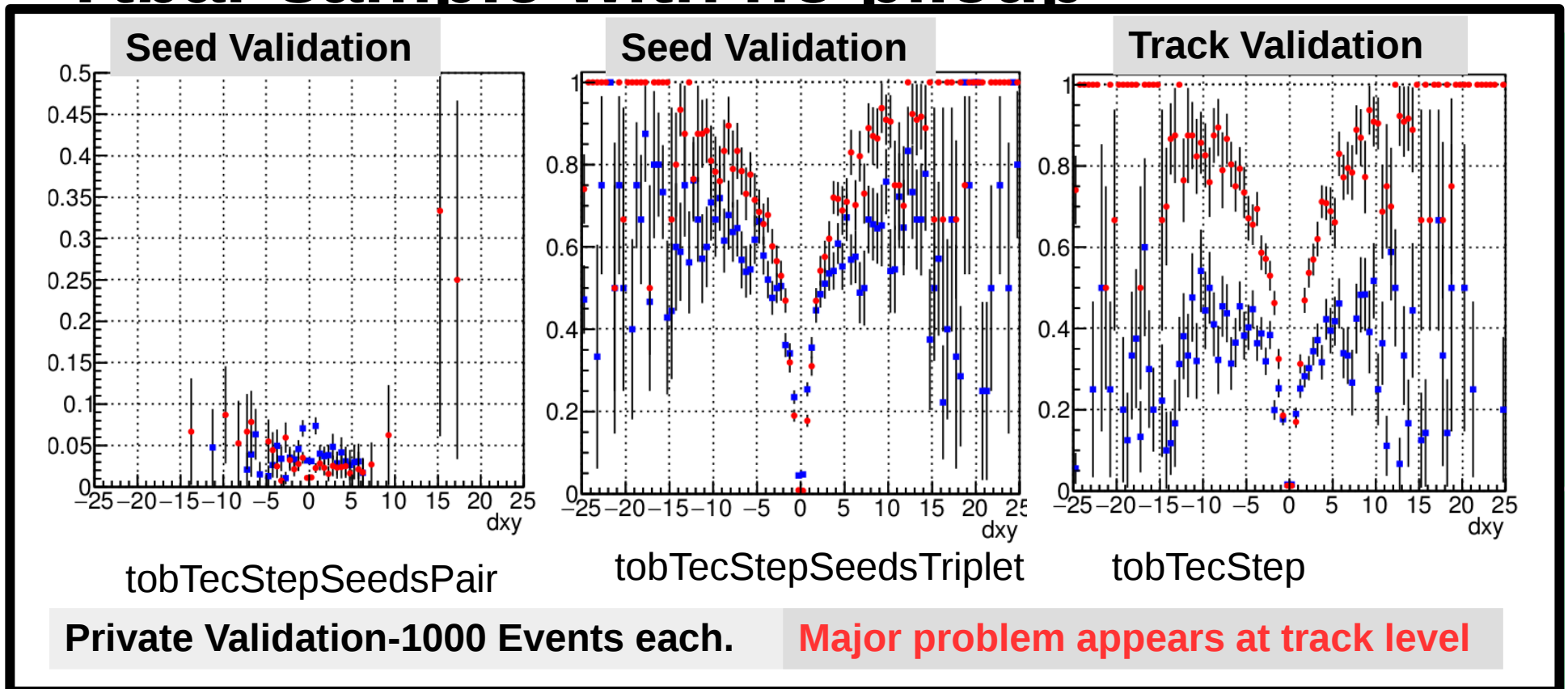
FastSim 8\_0\_0 pre1 —●—  
FullSim 8\_0\_0 pre1 —●—

(Major discrepancies)

# FastSim vs FullSim

Efficiency Vs dxy

## Ttbar sample with no pileup



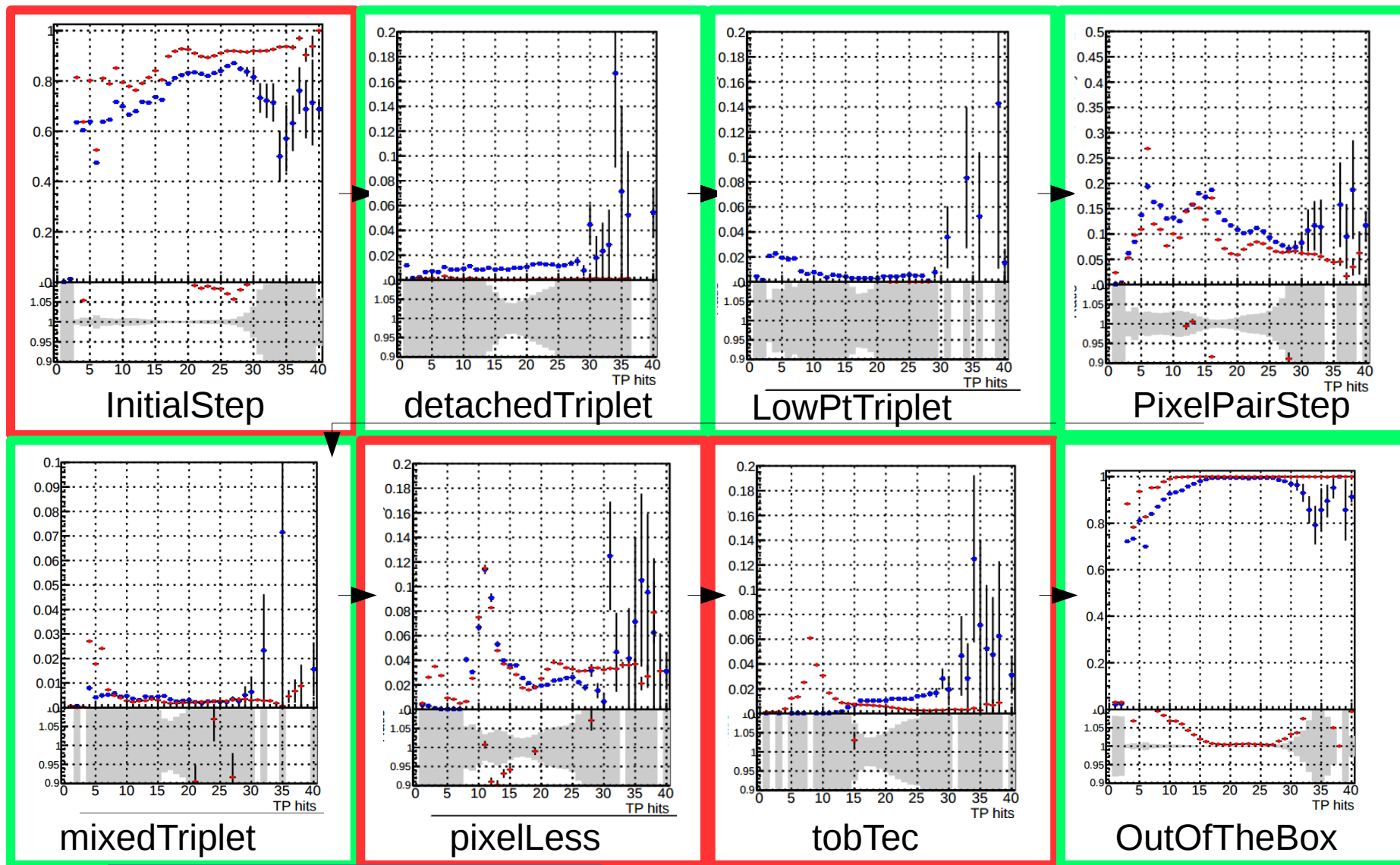
FastSim 8\_0\_0 pre1 ●  
FullSim 8\_0\_0 pre1 ●



# FastSim vs FullSim

## Efficiency Vs hits

### Ttbar sample with no pileup

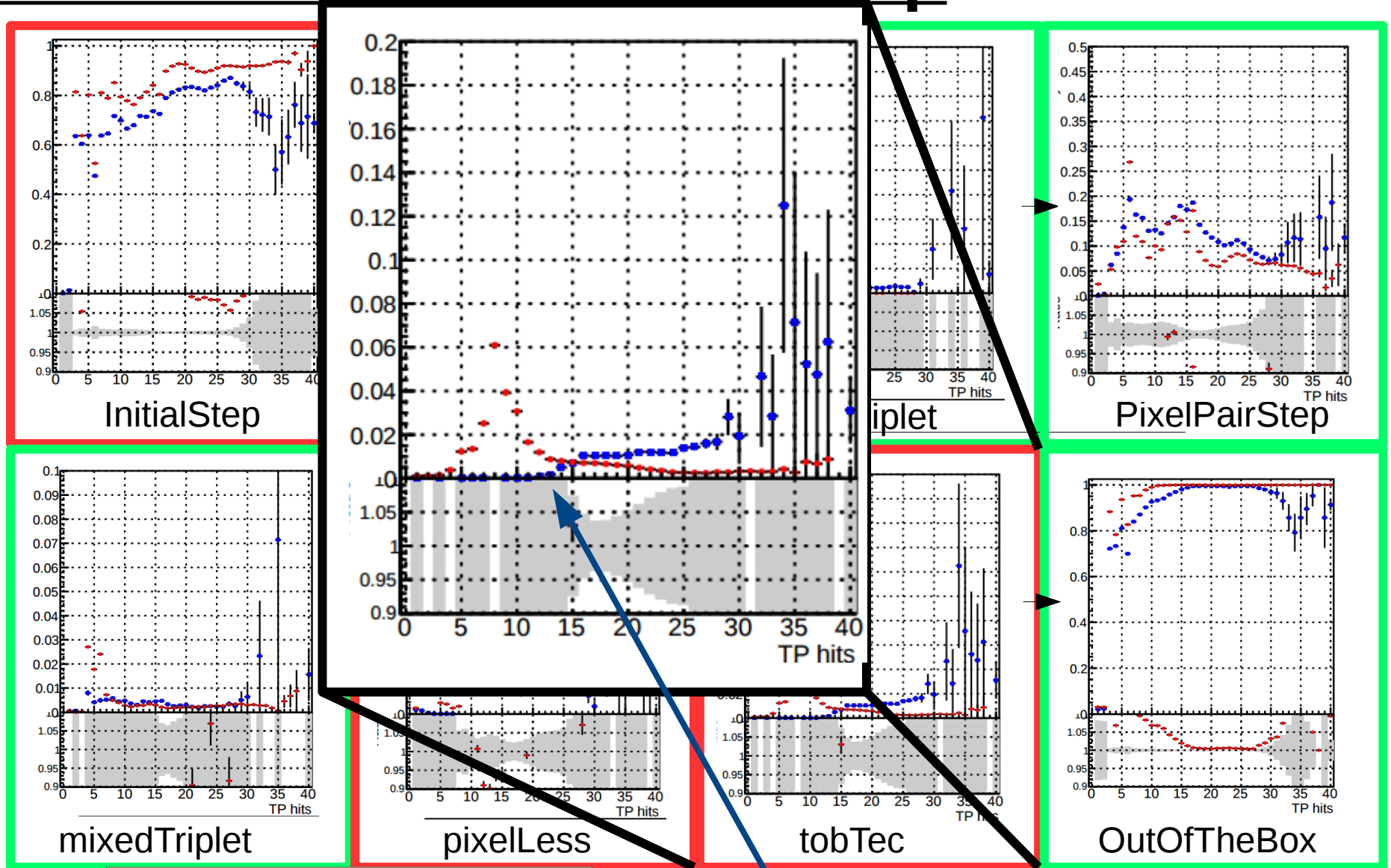


FastSim 8\_0\_0 pre1 —●—  
FullSim 8\_0\_0 pre1 —●—

# FastSim vs FullSim

Efficiency Vs hits

## Ttbar sample with no pileup



FastSim 8\_0\_0 pre1 —●—  
FullSim 8\_0\_0 pre1 —●—

Some min hits criteria