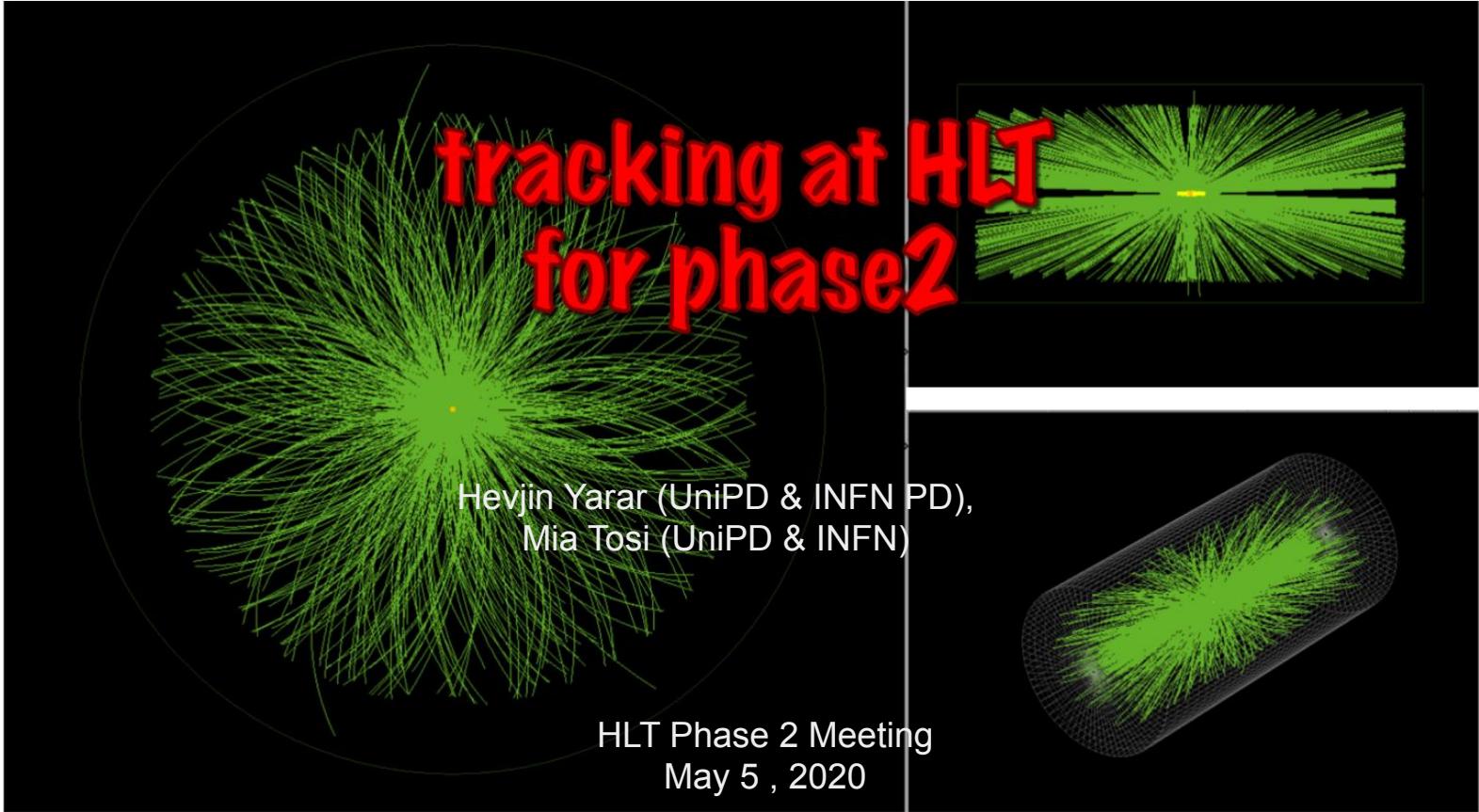


tracking at HLT for phase2

Hevjin Yarar (UniPD & INFN PD),
Mia Tosi (UniPD & INFN)

HLT Phase 2 Meeting
May 5 , 2020



MC_Tracking current versions

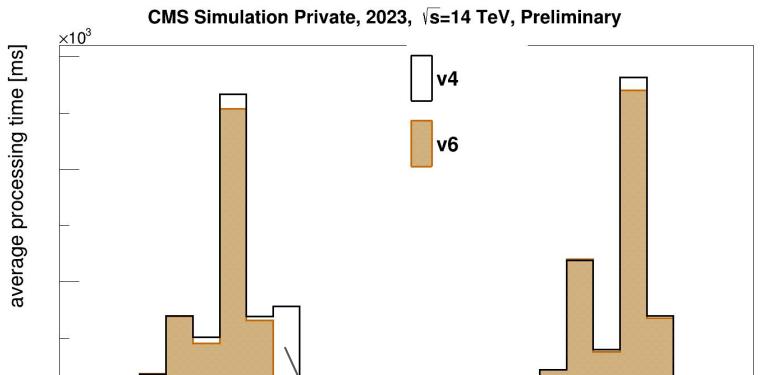
cff file name	Description	Tracking Timing [s]
MC_Tracking_v0	all iterations	25
MC_Tracking_v2	2 iterations	11.4
MC_Tracking_v3	v2 + (pt > 0.9)	6.4
MC_Tracking_v4	v3 + track building optimized	5.5
MC_Tracking_v6	v4 + pixelVertices	4.9
MC_Tracking_v6_1	v6 + initialstepseeding using pixeltracks	4.6 → 3.8 (so far)
MC_Tracking_v7_1	v6_1 + trackingregions_globalBS_globalPV	3.2 → 2 (so far)
MC_Tracking_v7_2	v6 + optimal trackingregions_globalPV_globalPV	2.1 (so far)



v6 - Baseline Timing

- $\text{Pt} > 0.9$
- Track building optimized
- pixelVertices used for track selection in initialstep

pixeltracks/vertices take 940 ms

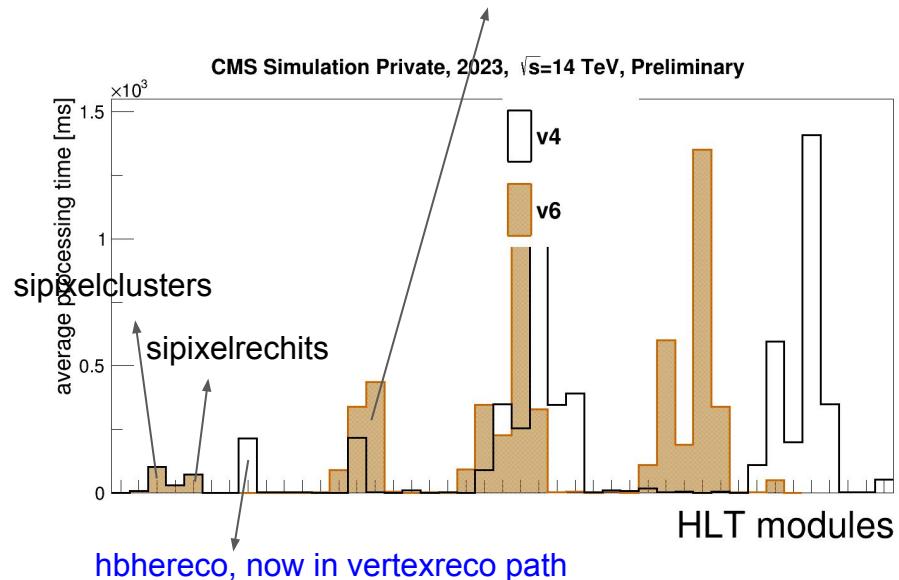


Track selection with pixel vertices

v4 --> 5.50 s [89.3 %]

v6 --> 4.87 s [81.8 %]

timing of 2 iterations



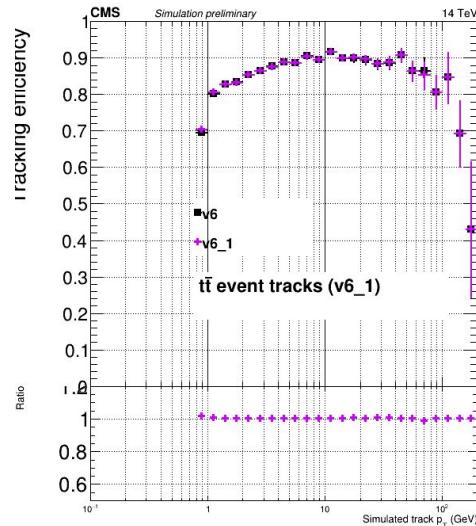
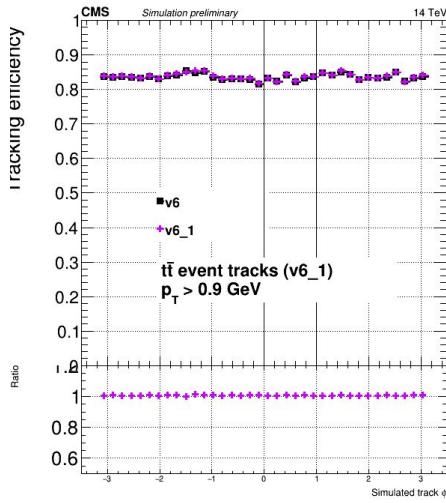
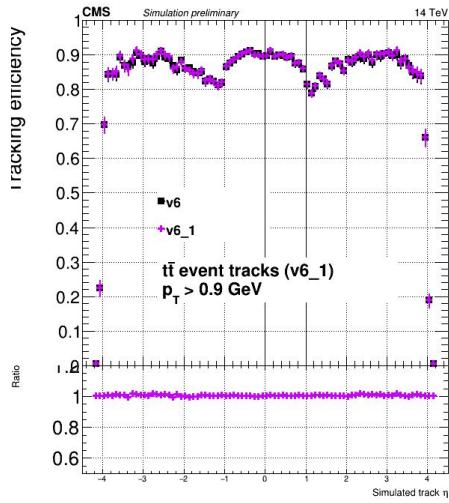
v4 --> 6.1 s

v6 --> 6.0 s

full tracking timing up to general tracks

v6_1 - Performance (I)

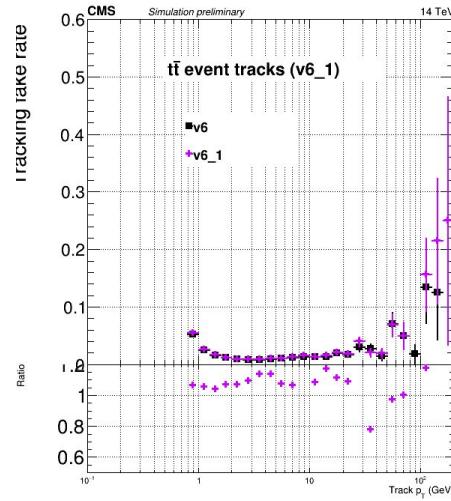
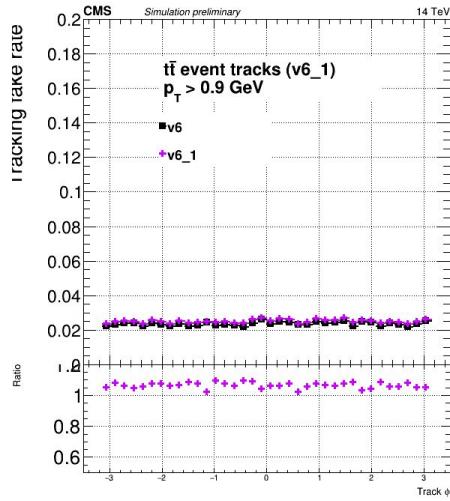
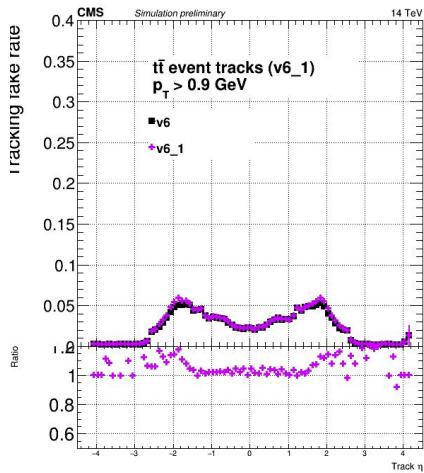
- $P_T > 0.9$
- Track building optimized
- pixelVertices used for track selection in initialstep
- initialstepseeding using pixeltracks



- Efficiency looks unaffected

v6_1 - Performance (II)

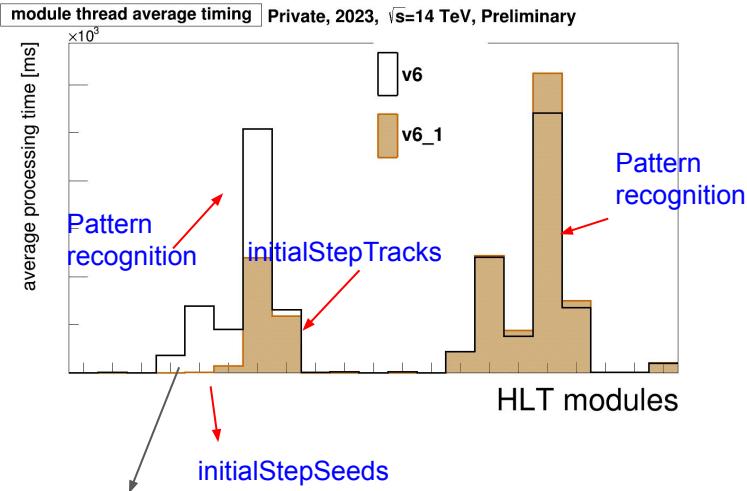
- $Pt > 0.9$
- Track building optimized
- pixelVertices used for track selection in initialstep
- initialstepseeding using pixeltracks



- Fakes increase slightly (at transition region).

v6_1 - Timing

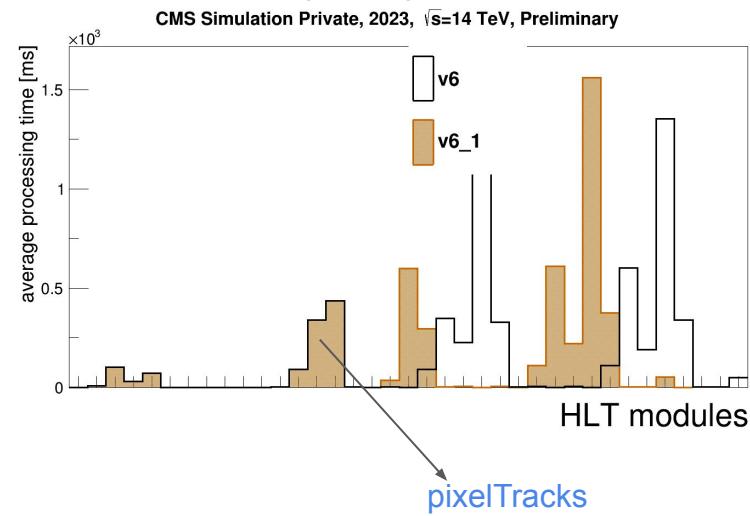
- $\text{Pt} > 0.9$
- Track building optimized
- pixelVertices used for track selection in initialstep
- initialstepseeding using pixeltracks



Seeding now done
with pixeltracks

v4 $\rightarrow 5.49 \text{ s}$
v6 $\rightarrow 4.67 \text{ s}$

timing of 2 iterations

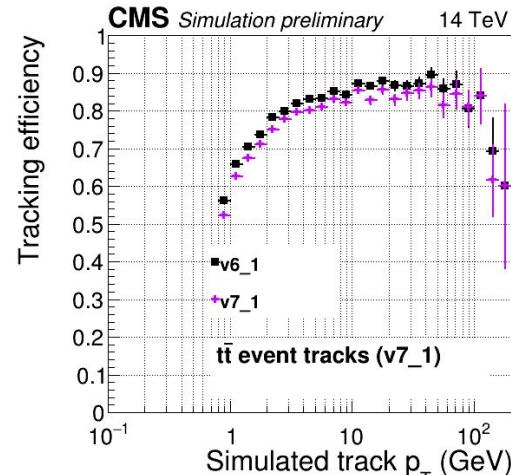
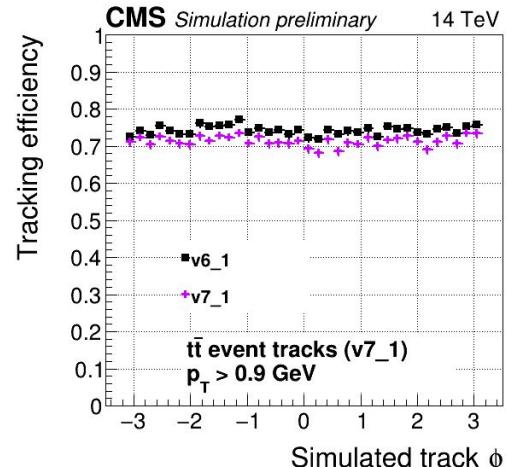
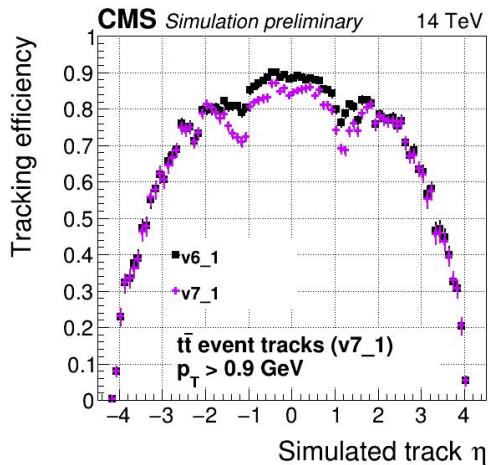


v4 $\rightarrow 6.10 \text{ s}$
v6 $\rightarrow 5.87 \text{ s}$

full tracking timing up to general tracks

v7_1 - Performance (I)

- $P_T > 0.9$
- Track building optimized
- pixelVertices used for track selection in initialstep
- TrackingRegions - globalBS_globalPV



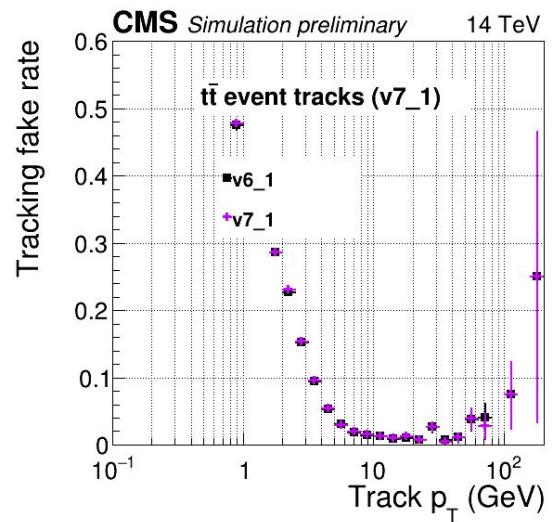
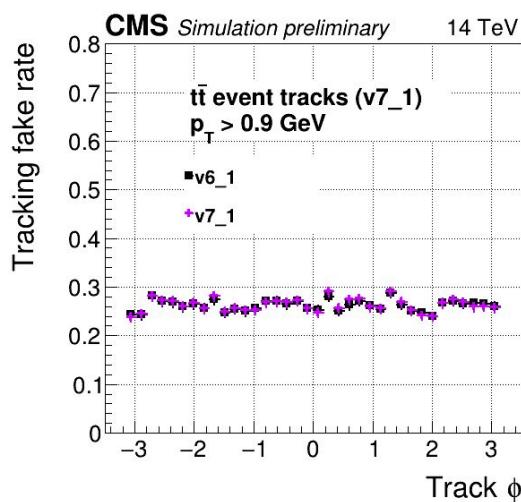
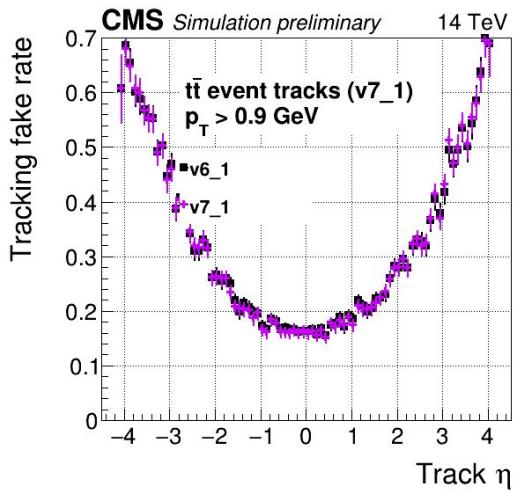
folder_eff = "TrackFromPV/hltPhase2CutsRecoFromPV~~Hp_hltPhase2ingParticleRecoTrackAsssoiation~~"



tracking particles from signal PV

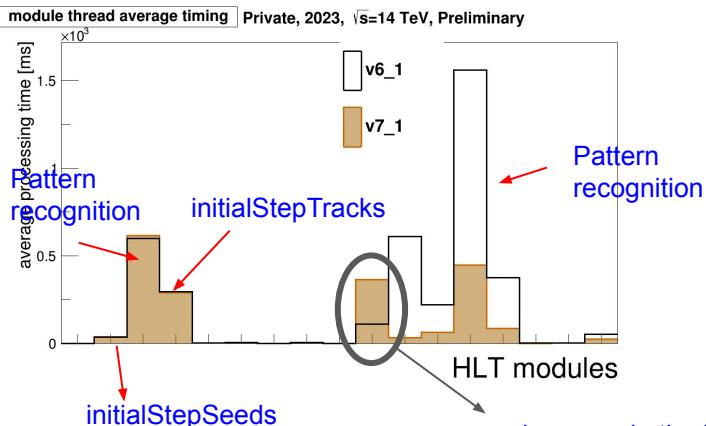
v7_1 - Performance (II)

- $P_T > 0.9$
- Track building optimized
- pixelVertices used for track selection in initialstep
- TrackingRegions - globalBS_globalPV



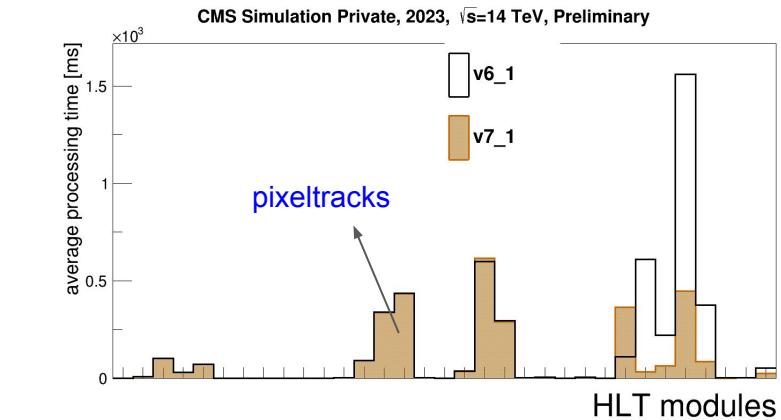
v7_1 - Timing

- $Pt > 0.9$
- Track building optimized
- pixelVertices used for track selection in initialstep
- TrackingRegions - globalBS_globalPV



$v6_1 \rightarrow 3.82$ s [77.9 %]
 $v7_1 \rightarrow 1.95$ s [64.4 %]

timing of 2 iterations



$v6_1 \rightarrow 4.90$ s
 $v7_1 \rightarrow 3.02$ s

full tracking timing up to general tracks

Summary

- v6 is the new baseline.
- v6_1 (initialstep seeding with pixeltracks) seems to be performing well.
- v7_1 is still the best v7 version. Timing is reduced with initialstep seeding using pixeltracks without much performance loss.
- Next:
 - Check if we can recover the full efficiency for v7_1
 - Check if we can improve v7_2 performance
 - Try candidate based tracking region

BACKUP

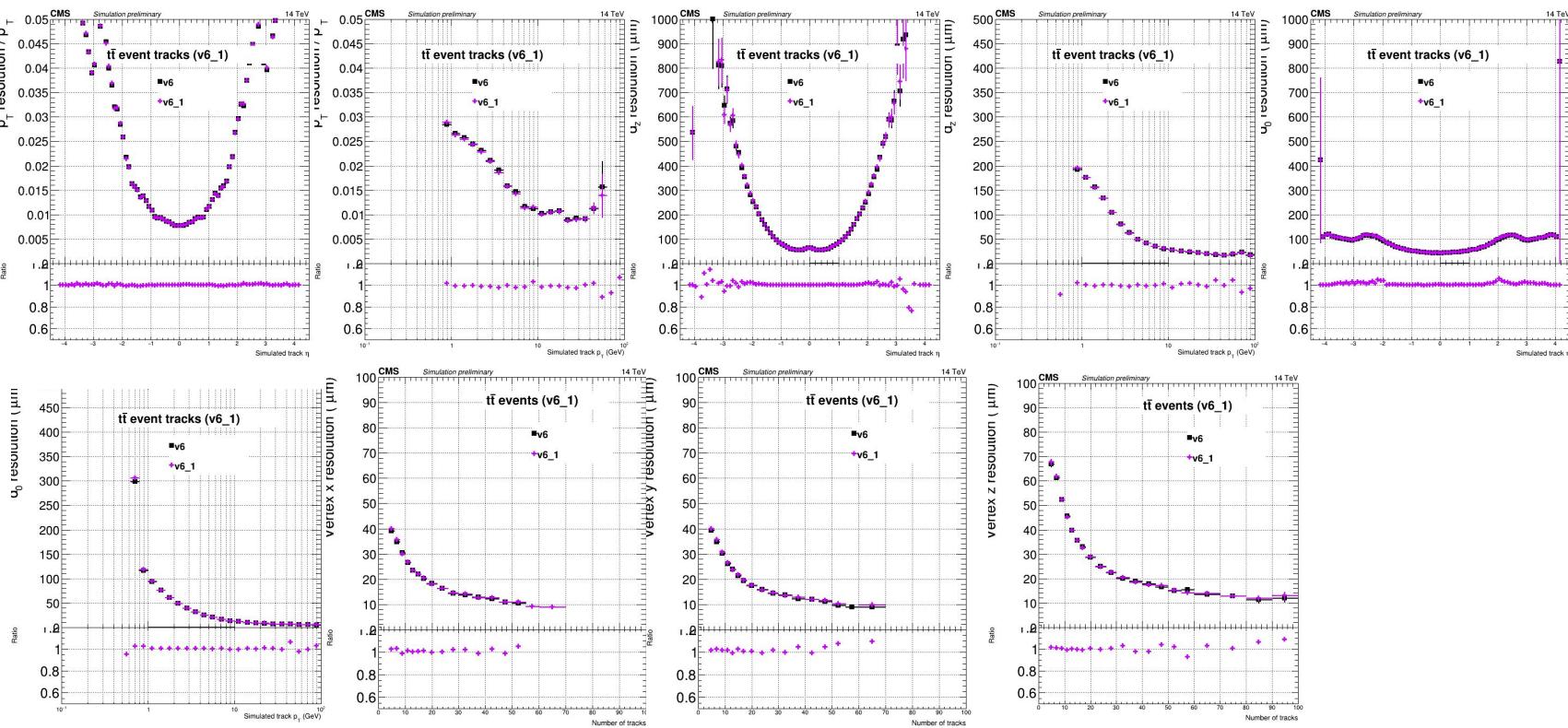
To Do

- reduce the number of iterations from 6(8) to 2 iterations ✓
- tuning the **pattern recognition** in order to minimize the timing (while keeping the physics performance) ✓
 - i.e. limit the number of candidates in the pattern recognition ✓
- update: using the **beamspot** instead of the PV in the track selection (~✓)
- Increase the thresholds ($pT > 0.9 \text{ GeV}$) ✓
- Limit pseudorapidity ($|\eta| < 3$) ✓
- Check usage of pixel PV, pixelTracks (ongoing)
- Try seed cleaning
- Check effect of PV constraint
- MC_Tracking_v0 : it represents the minimum set of modules for the track reconstruction as it is done in the offline reconstruction ✓
- MC_Tracking_v2 : path with 2 iterations ✓
 - Performance and Timing Plots with this version ✓
 - Working with CMSSW_11_0_0_pre6 + Run on new samples (106X, thanks !) ✓
 - Working with CMSSW_11_1_0_pre3 + Run on new samples ✓

v6_1 - Performance (III)

Resolution Plots

- $Pt > 0.9$
- Track building optimized
- pixelVertices used for track selection in initialstep
- initialstepseeding using pixeltracks

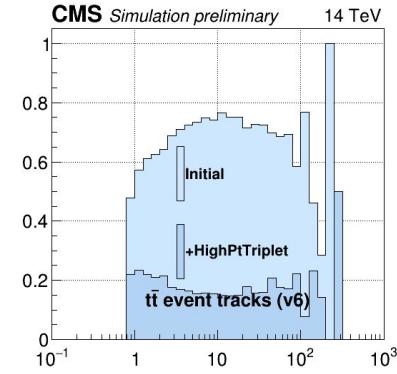
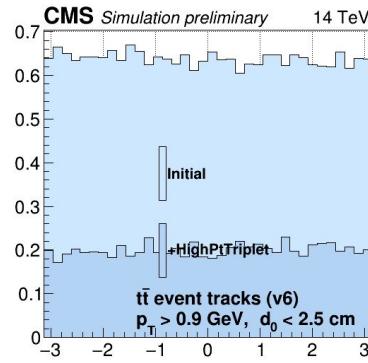
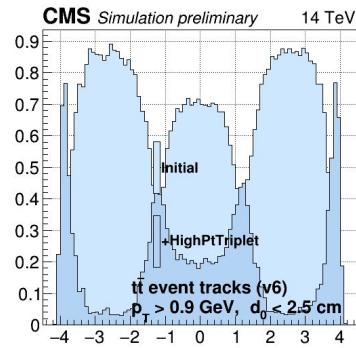


v6_1 - Performance (IV)

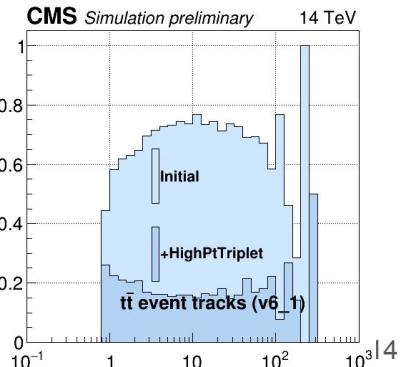
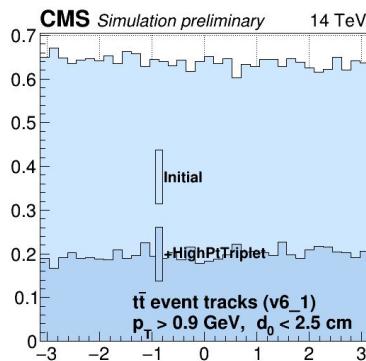
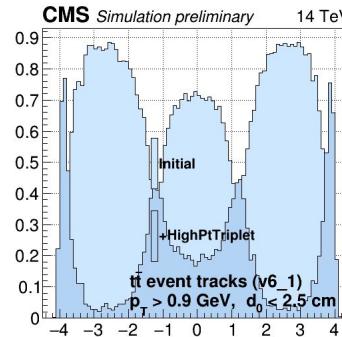
Iterations Efficiency

- $\text{Pt} > 0.9$
- Track building optimized
- pixelVertices used for track selection in initialstep
- initialstepseeding using pixeltracks

v6 plots



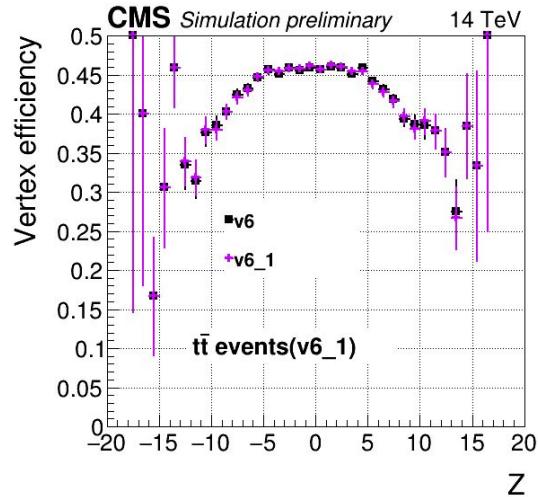
v6_1 plots



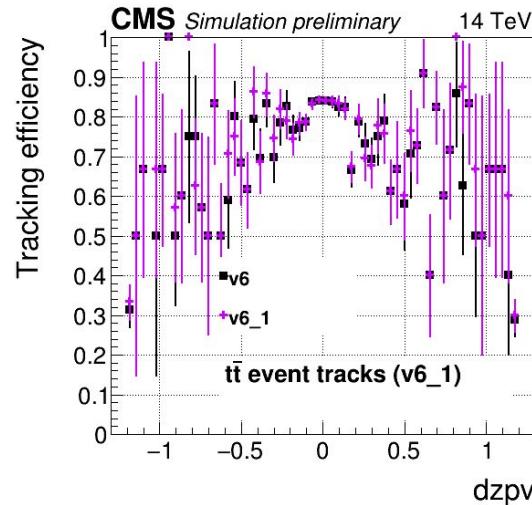
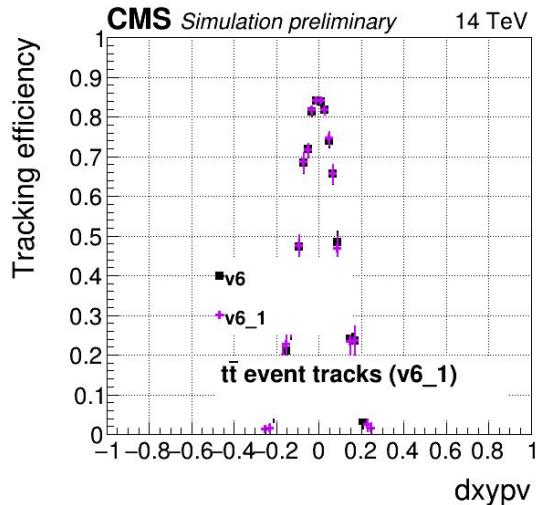
v6_1 - Performance (V)

Vertex Efficiency vs Z

TrackingEfficiency vs IP

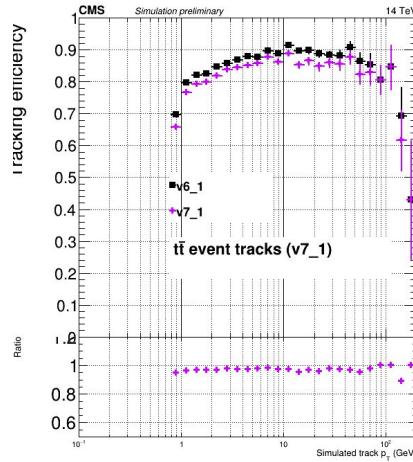
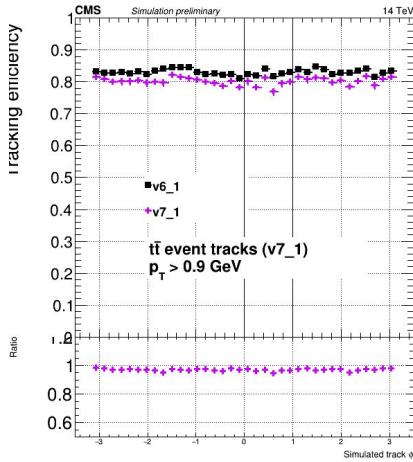
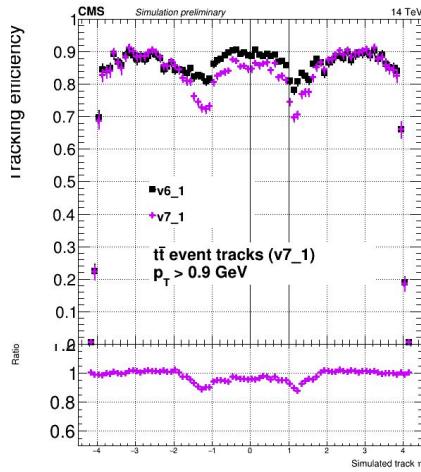


- $Pt > 0.9$
- Track building optimized
- pixelVertices used for track selection in initialstep
- initialstepseeding using pixeltracks



v7_1 - Performance (I)

- $P_T > 0.9$
- Track building optimized
- pixelVertices used for track selection in initialstep
- TrackingRegions - globalBS_globalPV

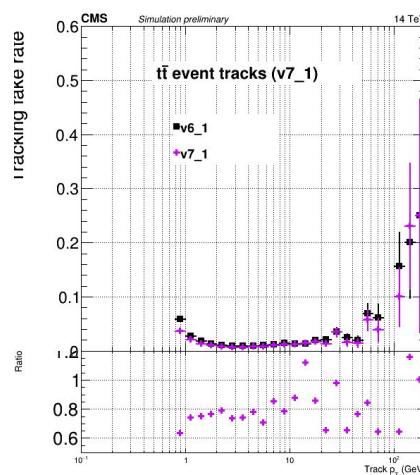
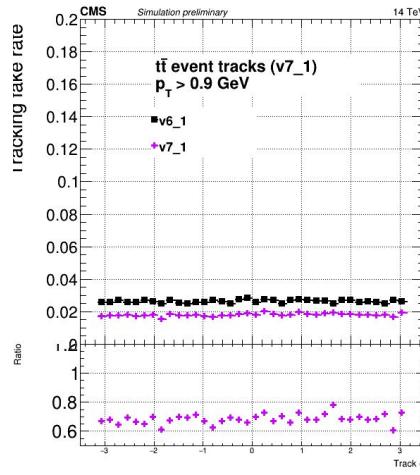
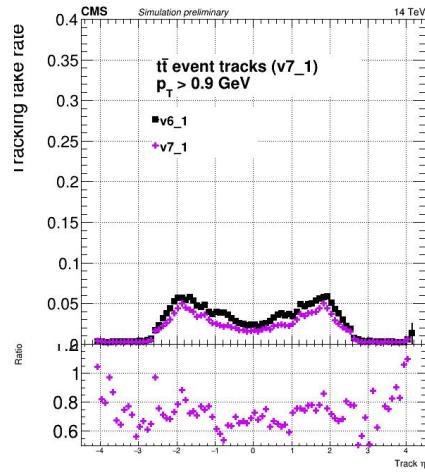


folder_eff =
"hltPhase2CutsRecoHp_hltPhase2ingParticleRecoTrackAsssoiation/""

- Slight decrease of efficiency

v7_1 - Performance (II)

- $\text{Pt} > 0.9$
- Track building optimized
- pixelVertices used for track selection in initialstep
- TrackingRegions - globalBS_globalPV

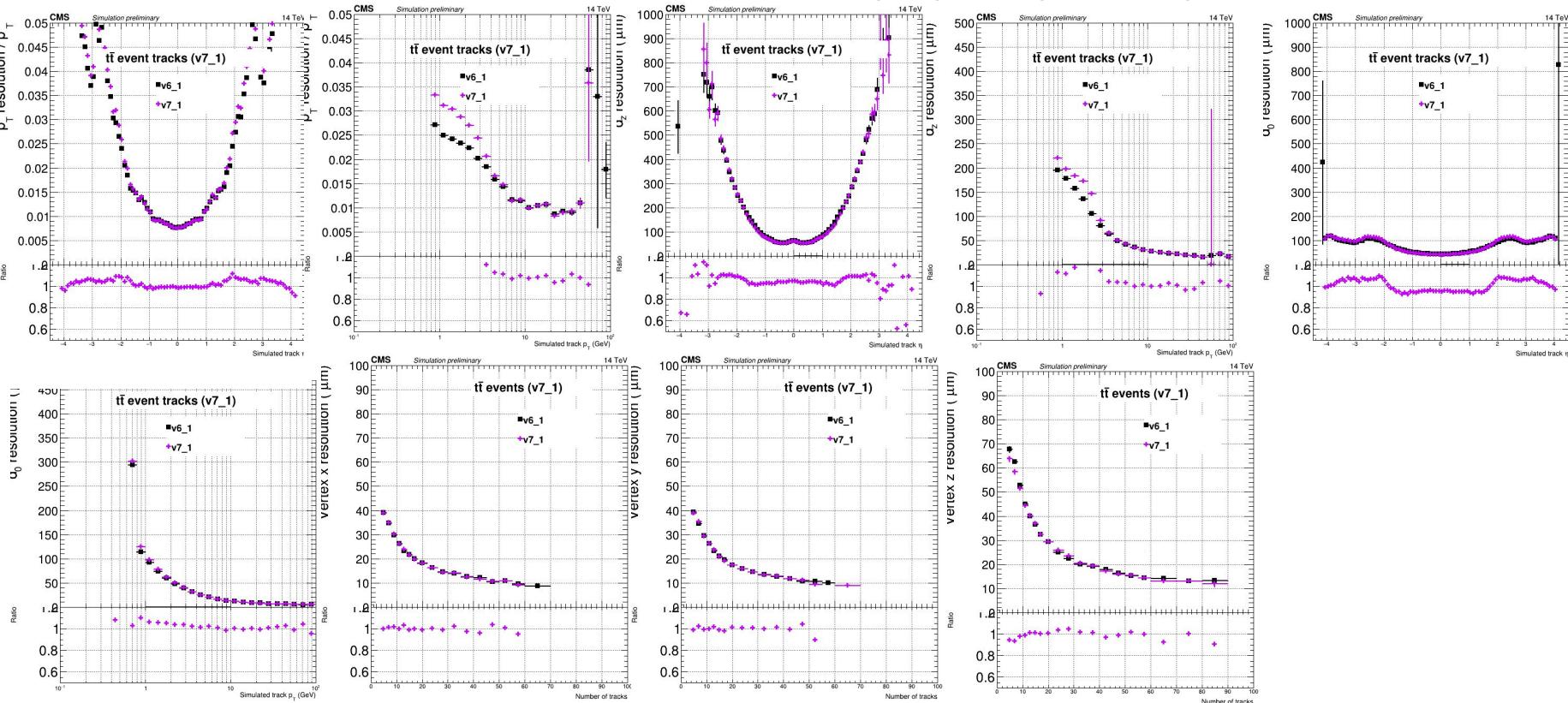


- Fake rate is decreased.

v7_1 - Performance (III)

Resolution Plots

- $Pt > 0.9$
- Track building optimized
- pixelVertices used for track selection in initialstep
- TrackingRegions - globalBS_globalPV

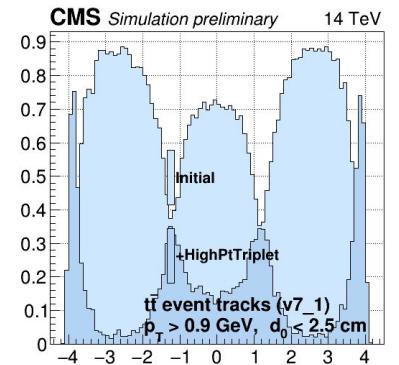
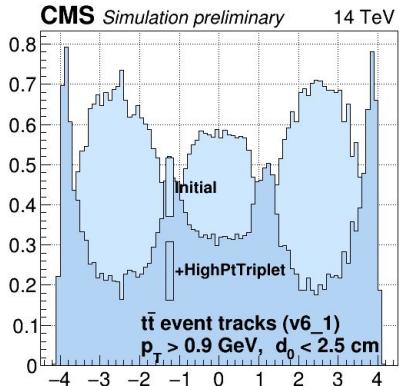


v7_1 - Performance (IV)

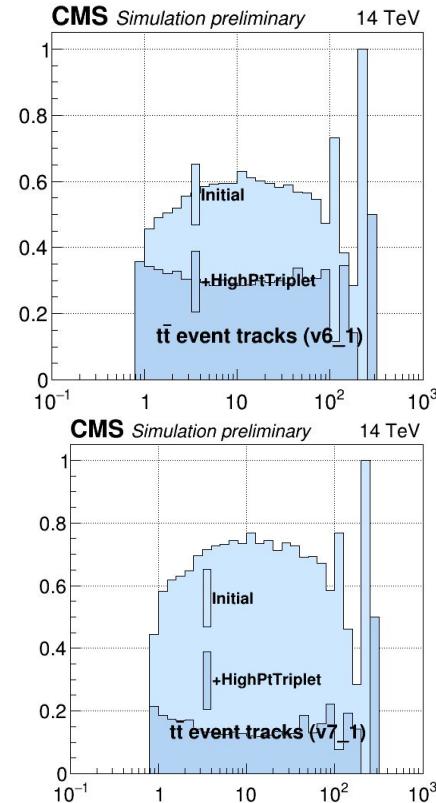
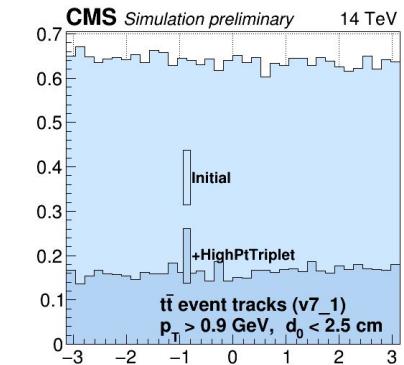
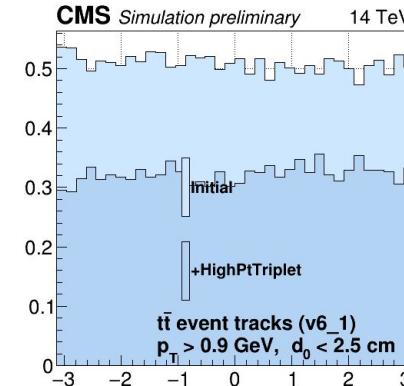
Iterations Efficiency

- $\text{Pt} > 0.9$
- Track building optimized
- pixelVertices used for track selection in initialstep
- TrackingRegions - globalBS_globalPV

v6_1 plots



v7_1 plots



v7_1 - Performance (V)

Vertex Efficiency vs Z

TrackingEfficiency vs IP

- $Pt > 0.9$
- Track building optimized
- pixelVertices used for track selection in initialstep
- TrackingRegions - globalBS_globalPV

