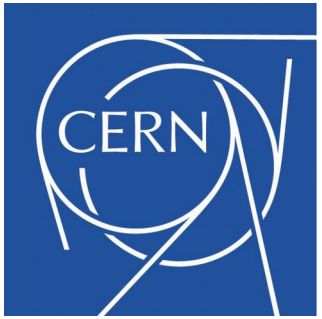


Duplicate tracks

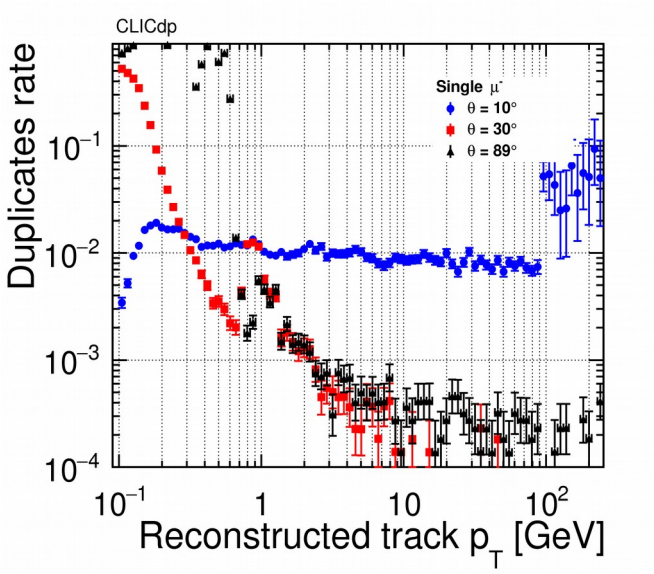
Status and on-going developments

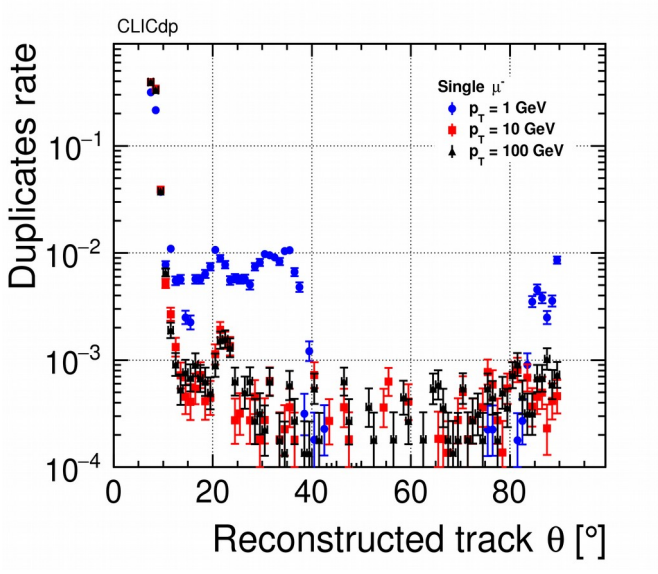
Erica Brondolin

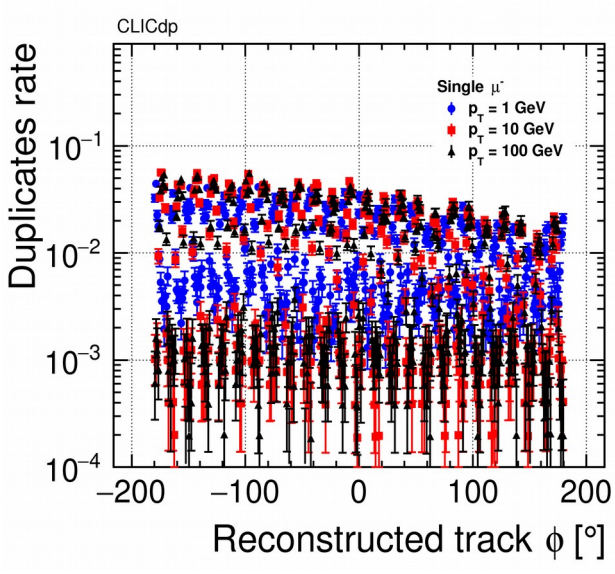
CLICdp New-Software Project-Meeting
8th October 2019

Current status

- **ILCSoft version used:** Release 2019_09_04
- Single particles: muons



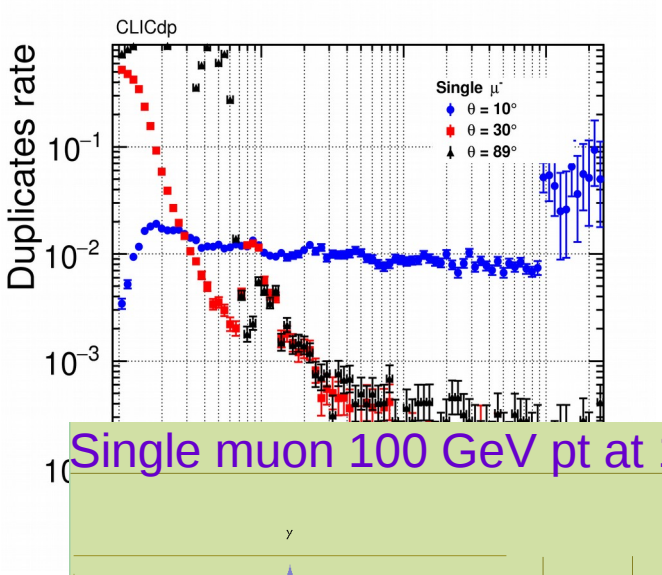


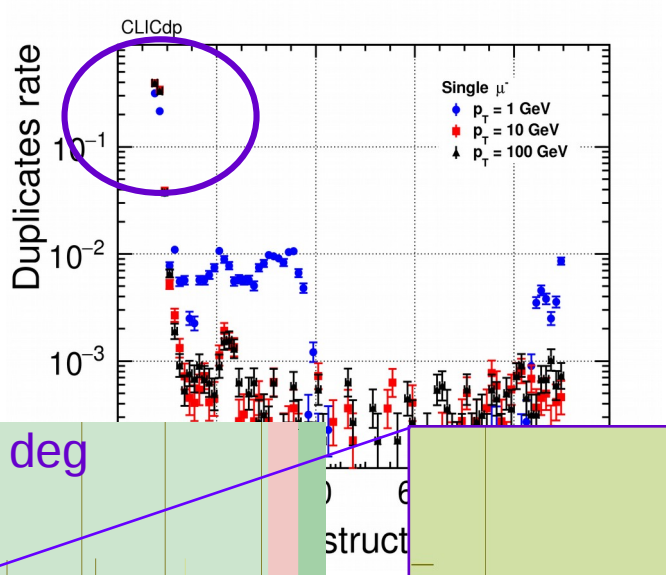


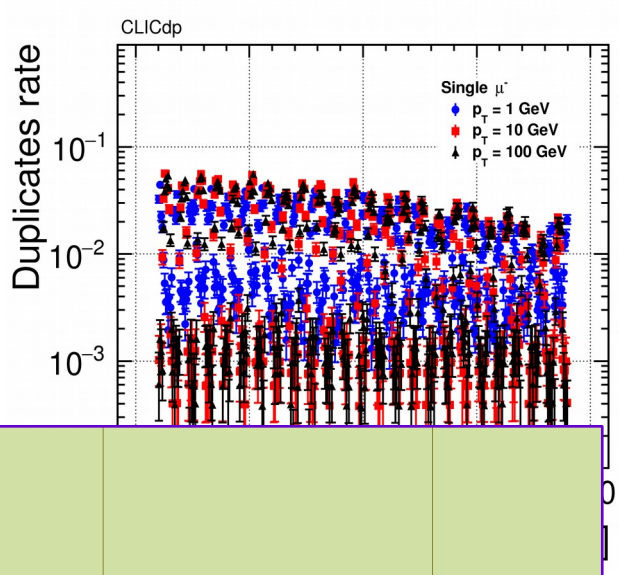
- **Clear pattern in phi**
- **High in very forward region (θ<40deg), peak at 10deg for all pT**
- **High for low pT**

Current status

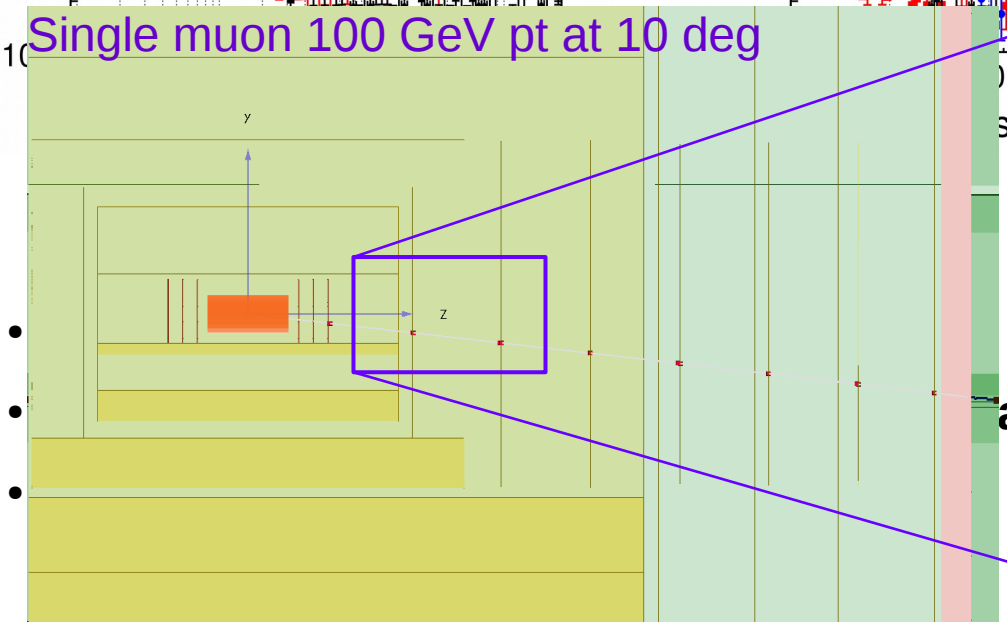
- **ILCSoft version used:** Release 2019_09_04
- Single particles: muons

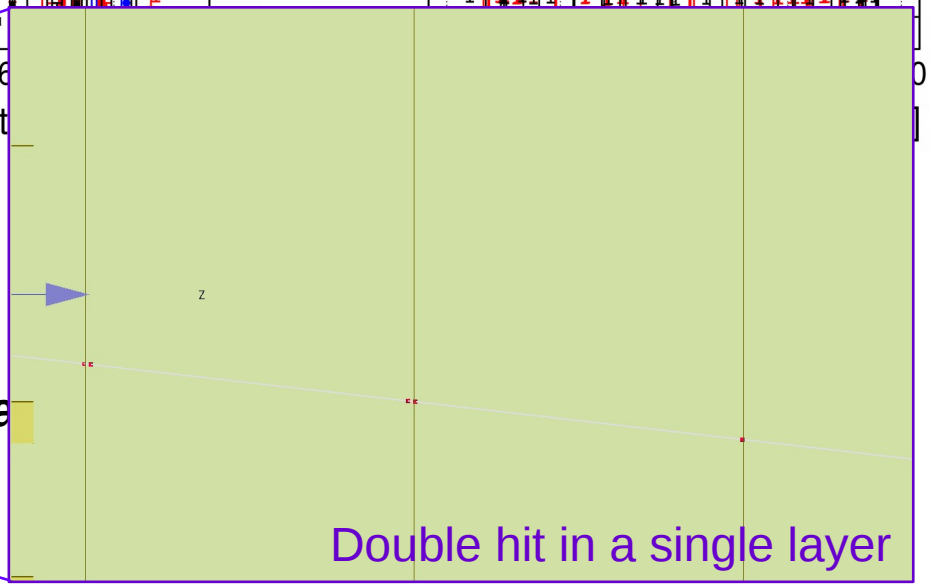






Single muon 100 GeV pt at 10 deg





Double hit in a single layer

Recovering double hits

- Current code: picking up 1 neighbour hit per Layer **only**
- Problem (single muon pt=100GeV in 10deg):

```
[   id   ] |cellId0 |cellId1 |  position (x,y,z)                |   EDep   |   time   |PDG of MCParticle|   (px,  py, pz)   | pathLength  | Quality
-----------|--------|--------|----------------------------------|----------|----------|-----------------|-------------------|-------------|---------
[00000328] |150994980|00000000|(+4.87e+01, -6.38e+01, +5.25e+02)| 2.16e-04 | 1.76e+00 | 00000000000013  | (9.25e+00, -1.20e+01, 9.89e+01) | 000001.01e-01|[   0   ]
      id-fields: (system:4,side:1,layer:0,module:0,sensor:9)

[00000329] |134217764|00000000|(+4.93e+01, -6.46e+01, +5.29e+02)| 1.72e-05 | 1.78e+00 | 00000000000013  | (9.25e+00, -1.20e+01, 9.89e+01) | 000001.01e-01|[   0   ]
      id-fields: (system:4,side:1,layer:0,module:0,sensor:8)

[00000330] |150995108|00000000|(+7.50e+01, -9.79e+01, +8.03e+02)| 2.98e-05 | 2.71e+00 | 00000000000013  | (9.30e+00, -1.20e+01, 9.89e+01) | 000001.01e-01|[   0   ]
      id-fields: (system:4,side:1,layer:1,module:0,sensor:9)

[00000331] |134217892|00000000|(+7.55e+01, -9.87e+01, +8.09e+02)| 3.08e-05 | 2.73e+00 | 00000000000013  | (9.30e+00, -1.20e+01, 9.89e+01) | 000001.01e-01|[   0   ]
      id-fields: (system:4,side:1,layer:1,module:0,sensor:8)
```

- Suggestion:

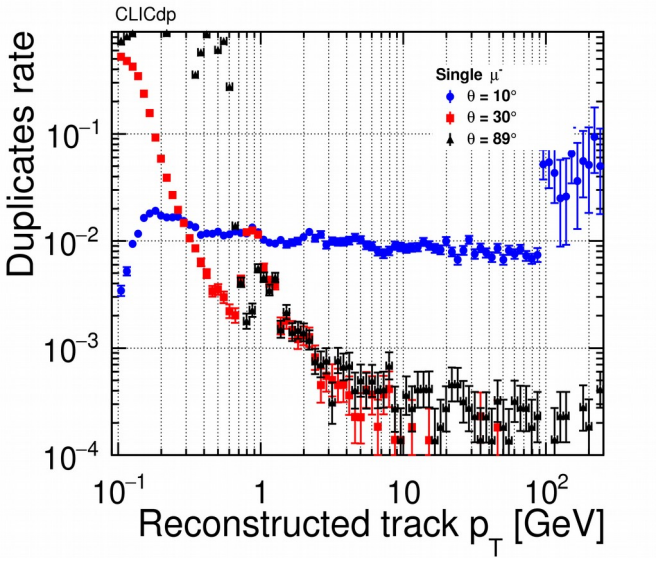
```
@@ -1592,8 +1598,9 @@ void ConformalTracking::extendSeedCells(SharedCells& cells, UKDTree& nearestNeig
          fakeHit, 0.625 * searchDistance, results, [&hit, vertexToTracker](SKDCluster const& nhit) {
            if (nhit->used())
              return true;
-           if (hit->sameLayer(nhit))
-             return true;
+           if (nhit->sameModule(hit))
+             if (fabs(nhit->getSensor() - hit->getSensor()) != 1)
+               return true;
            if (nhit->endcap() && hit->endcap() && (nhit->forward() != hit->forward()))
              return true;
            if ((vertexToTracker && nhit->getR() >= hit->getR()) || (!vertexToTracker && nhit->getR() <= hit->getR()))
```

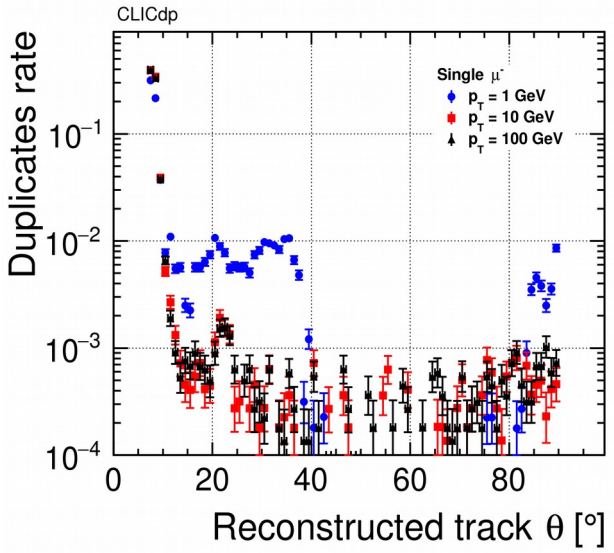
In case the current hit and the neighbour they are in the same Module, keep the neighbour if it is +/- sensor distance

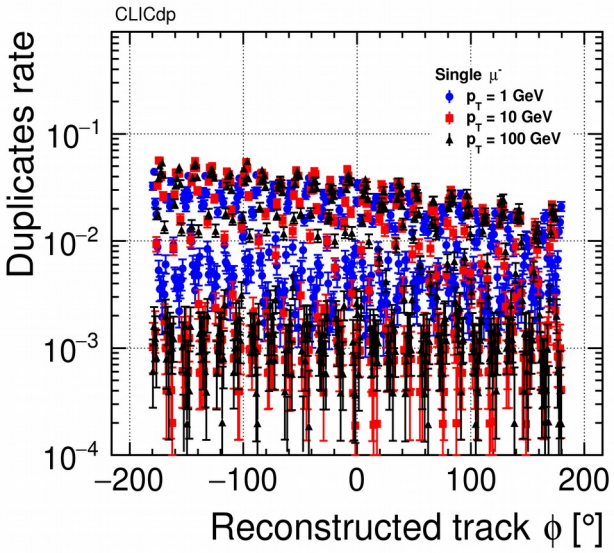
Results - Duplicates

- Single particles: muons

Vanilla

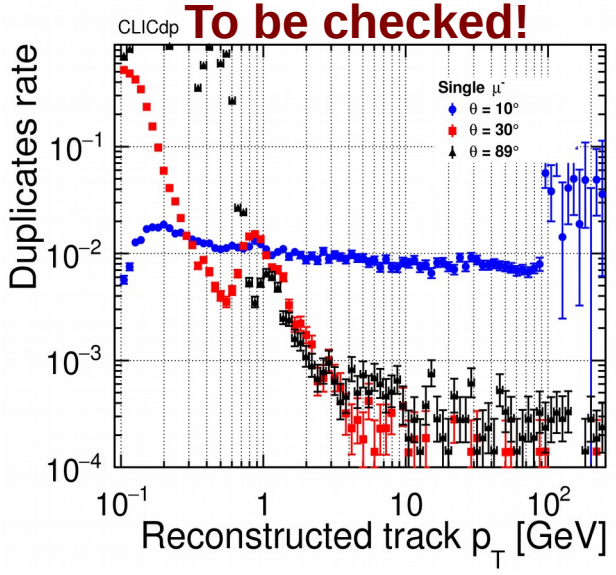


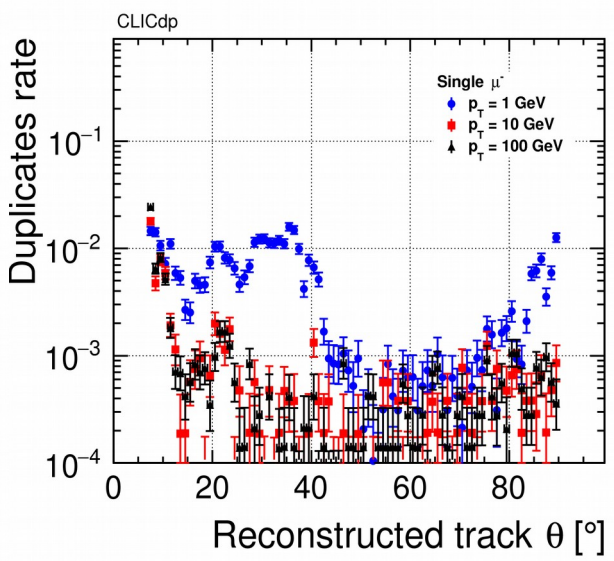


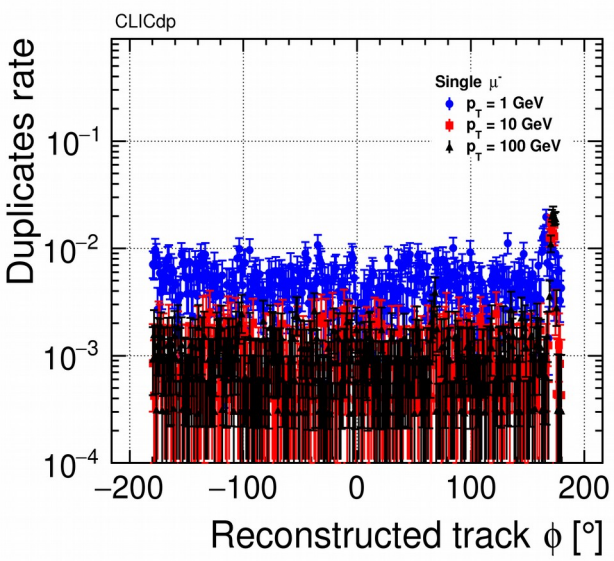


+- 1 sensor

To be checked!



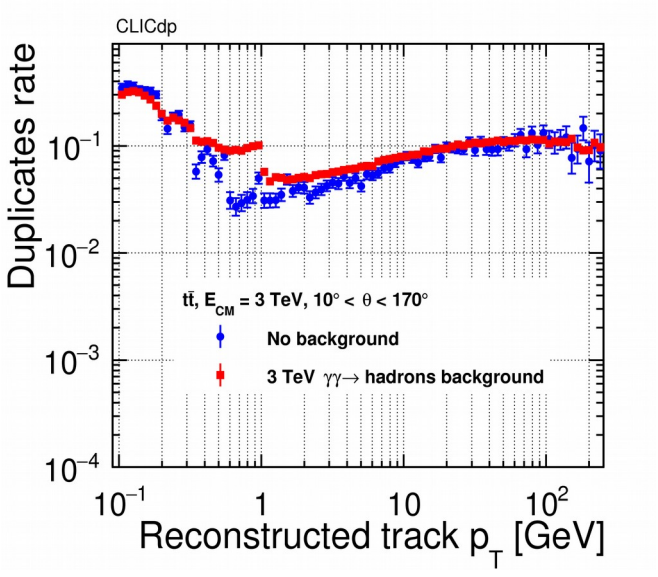


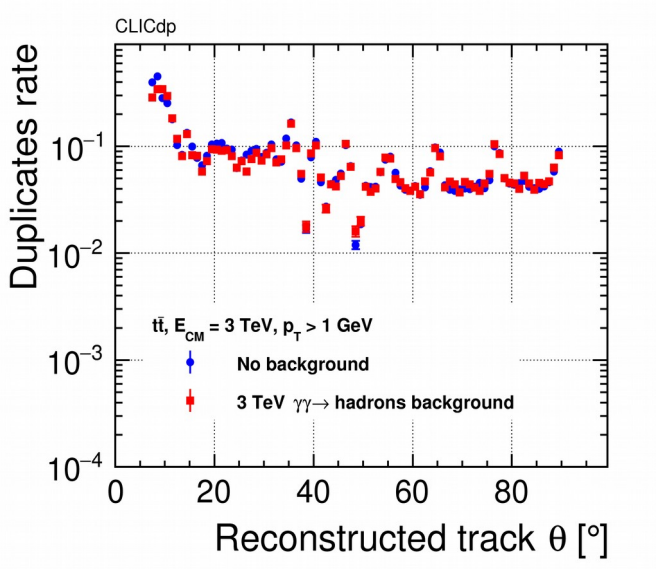


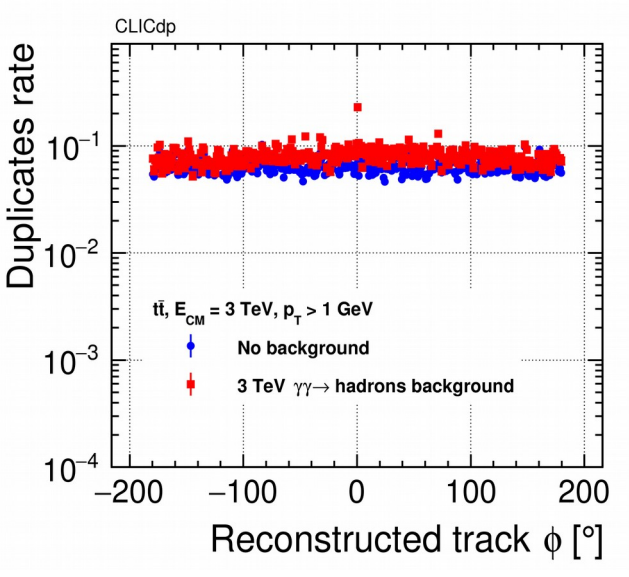
+ efficiency (in backup) and fakes basically unchanged!

Current status

- **ILCSoft version used:** Release 2019_09_04
- Complex events: ttbar



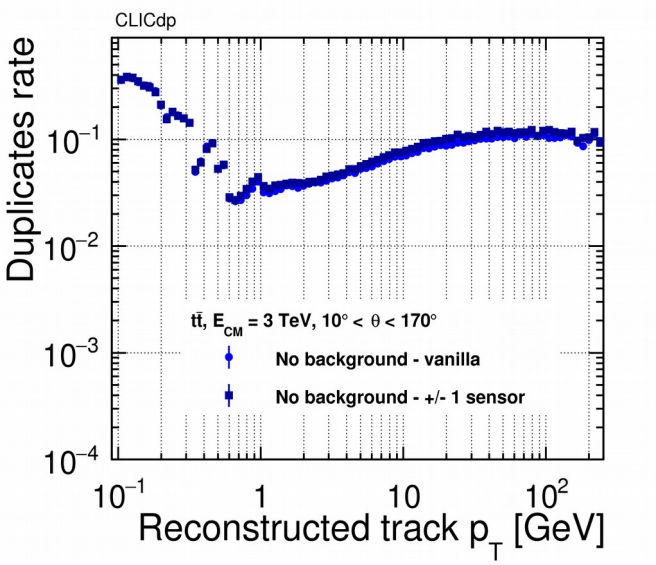


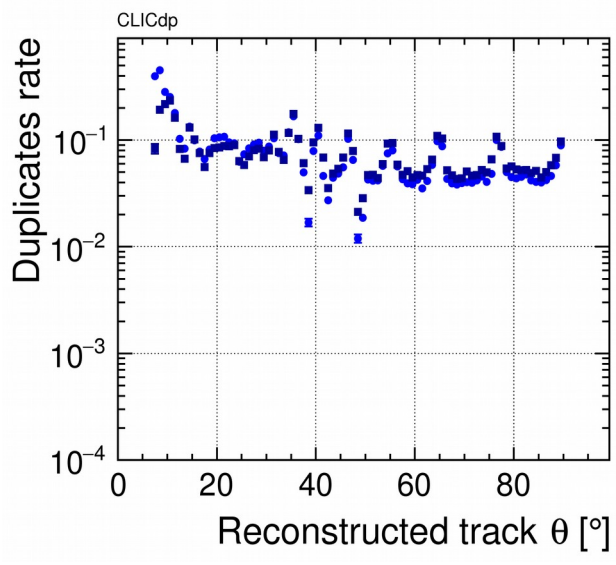


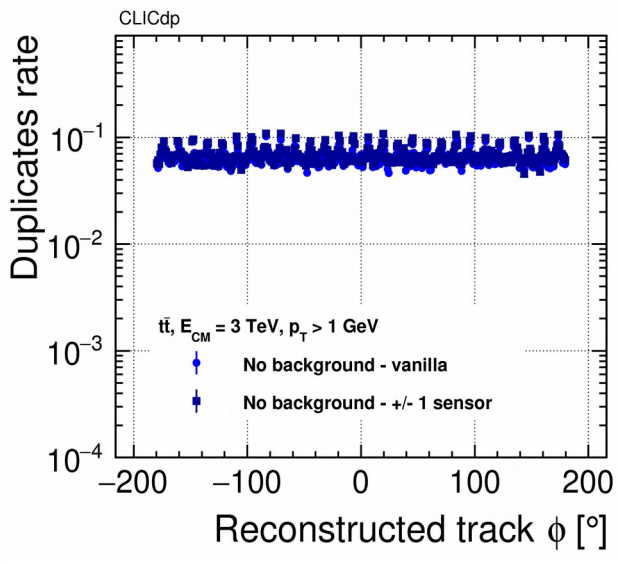
- **Similar w/o and w/ overlay**
- **Clear pattern in phi – peak at 0deg**
- **Higher in very forward region (θ<10deg)**
- **Higher for low pT**

Results - Duplicates

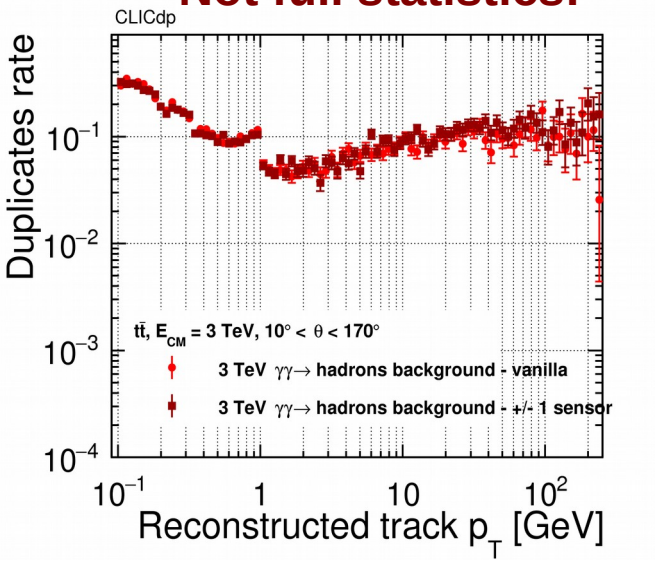
- Complex events: ttbar



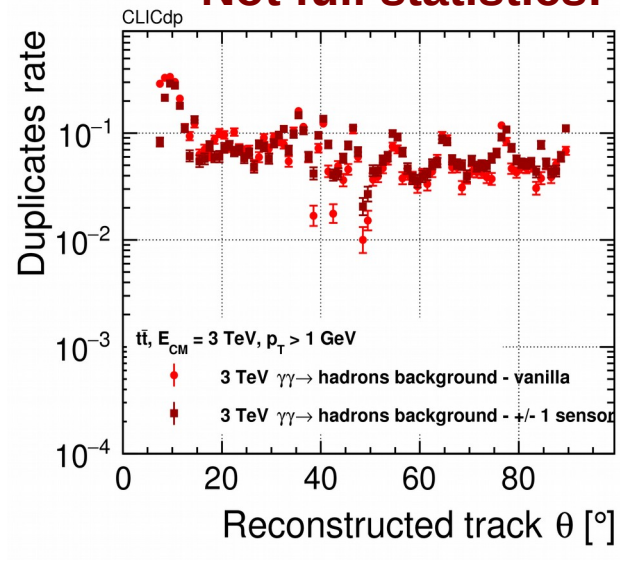




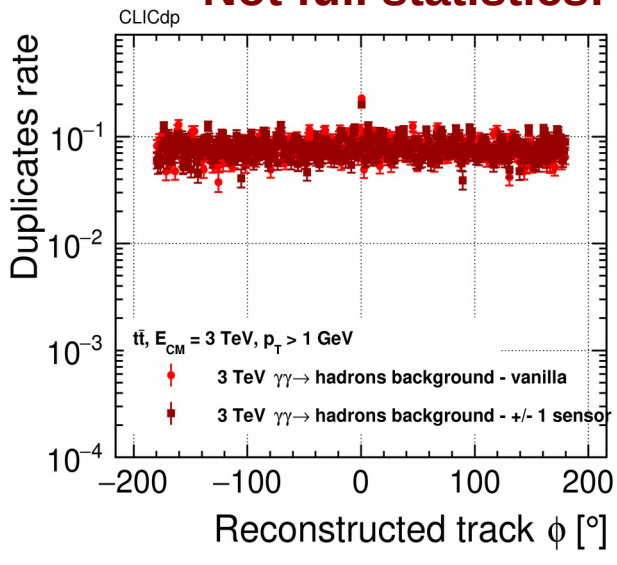
Not full statistics!



Not full statistics!



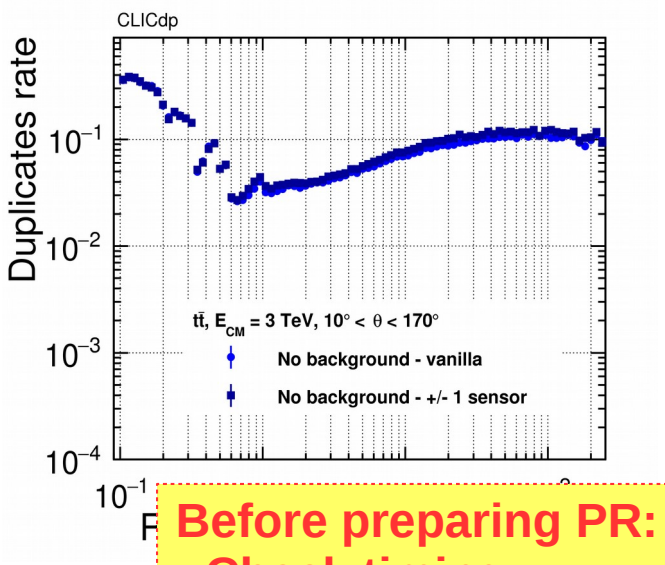
Not full statistics!

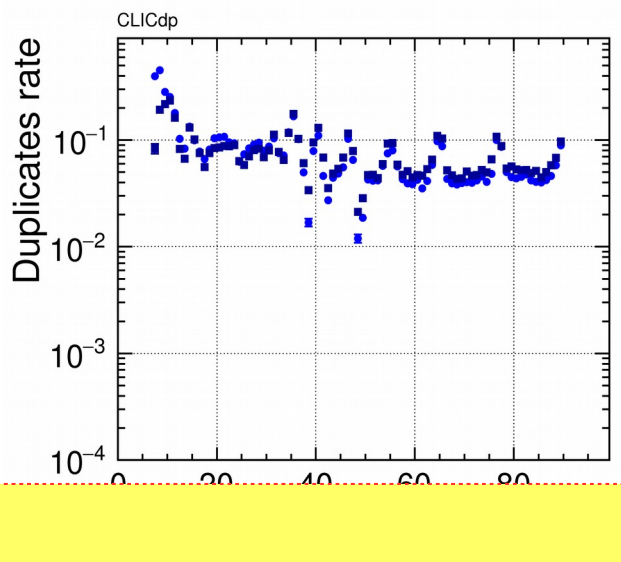


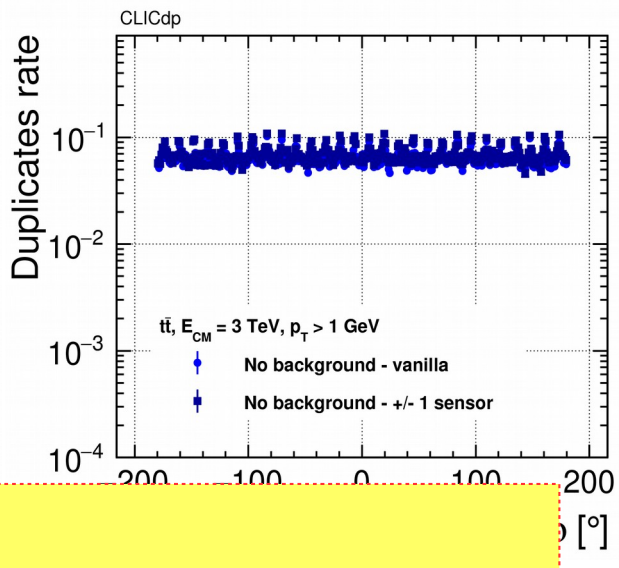
+ efficiency and fakes in backup

Results - Duplicates

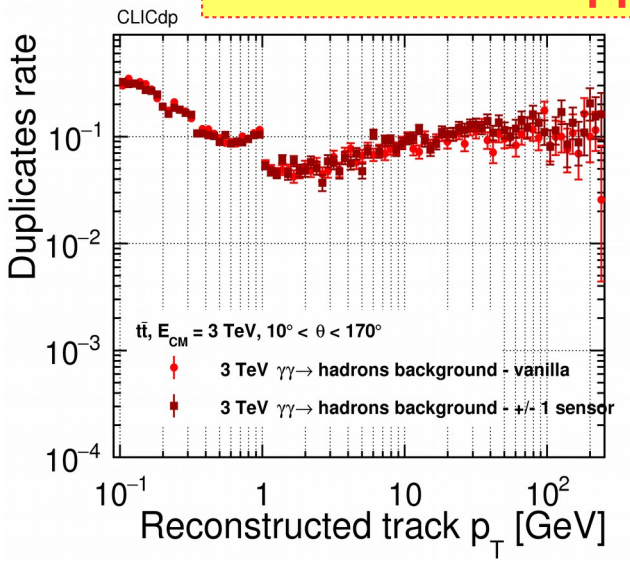
- Complex events: ttbar

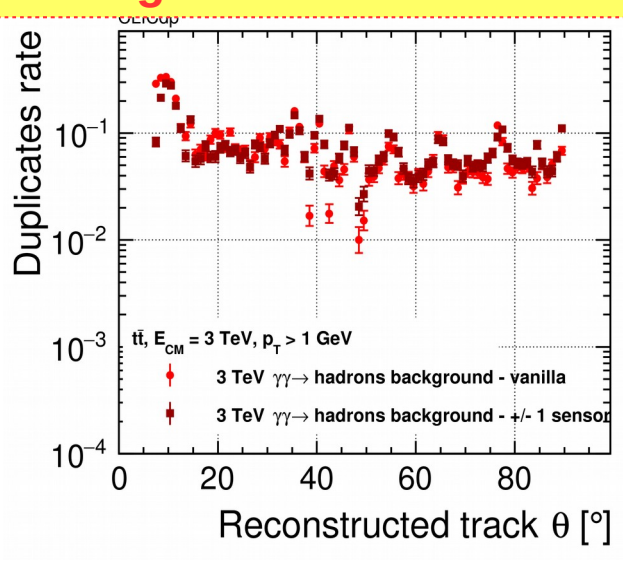


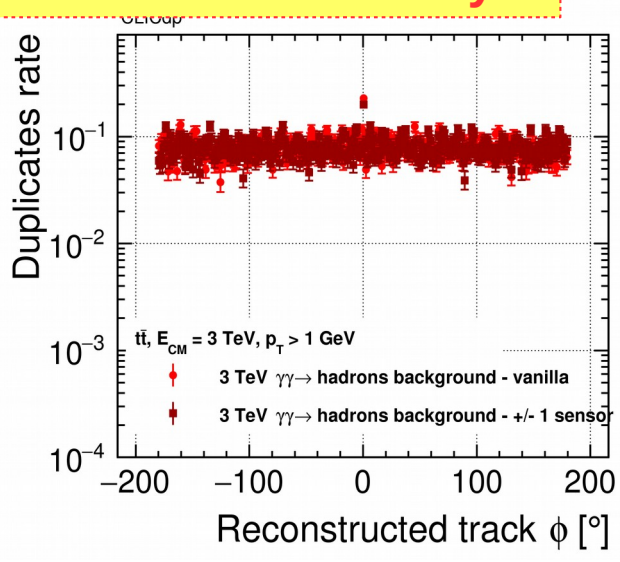




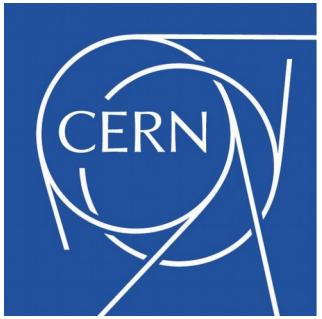
Before preparing PR:
- Check timing
- Check what happens if neighbour is in a different module but same layer







+ efficiency and fakes in backup

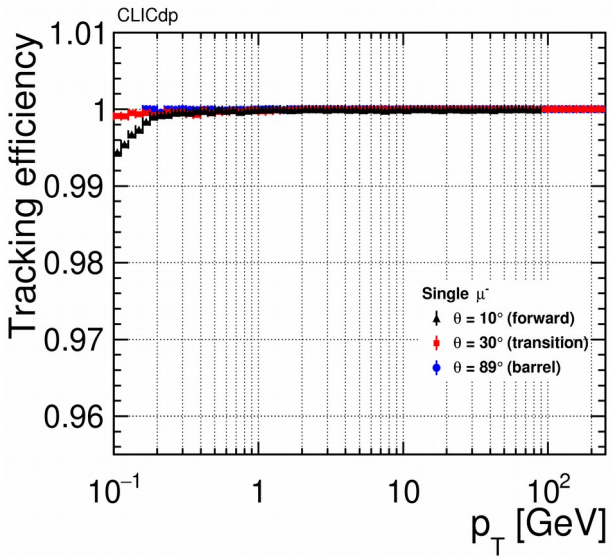


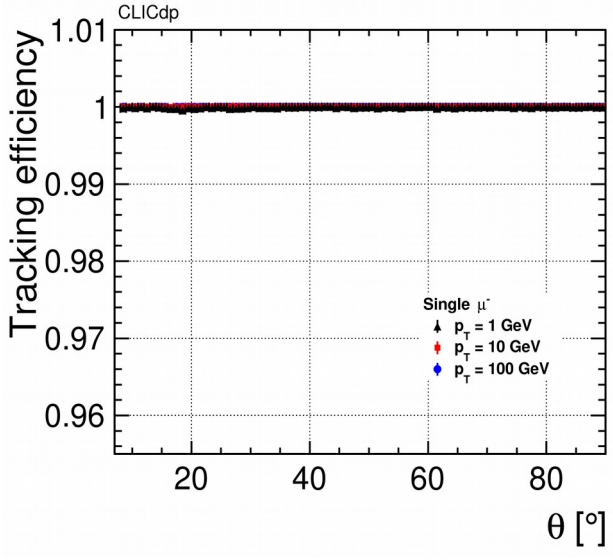
Thank you for the attention!

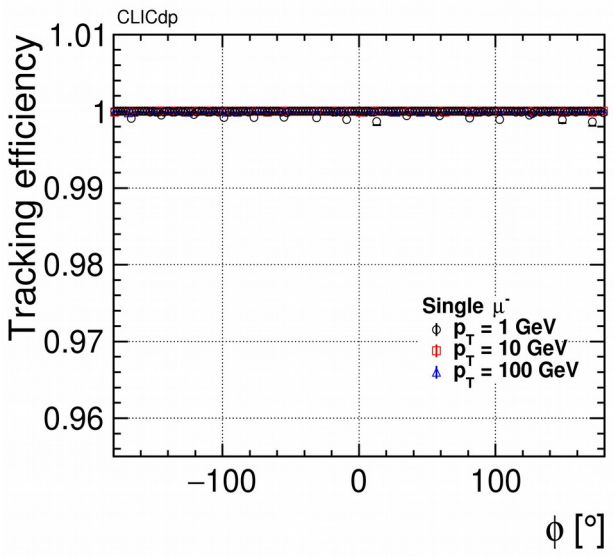
Results - Efficiency

- Single particles: muons

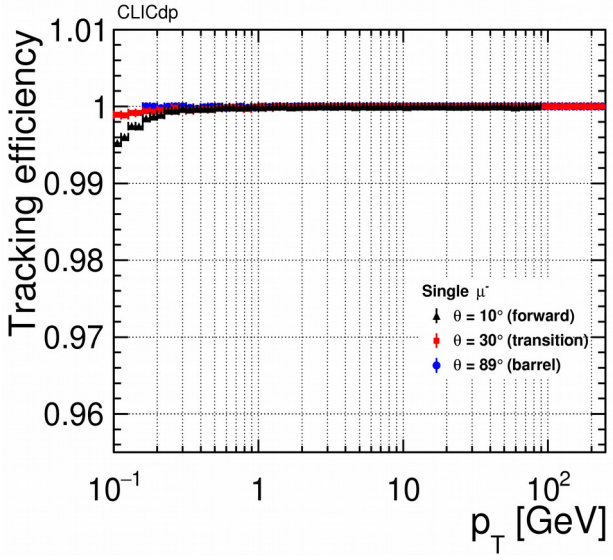
Vanilla

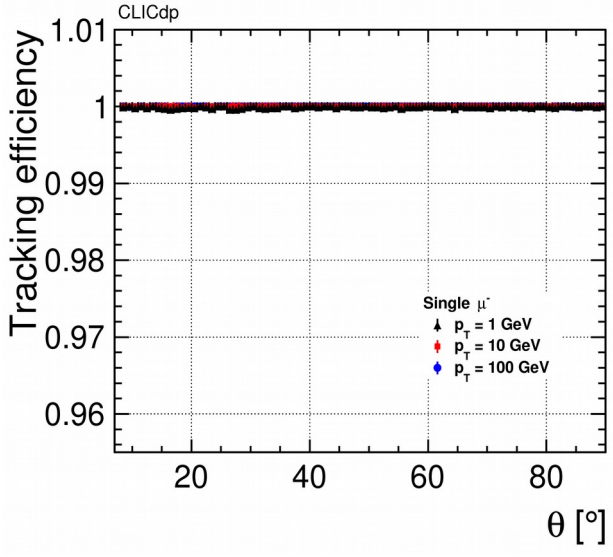


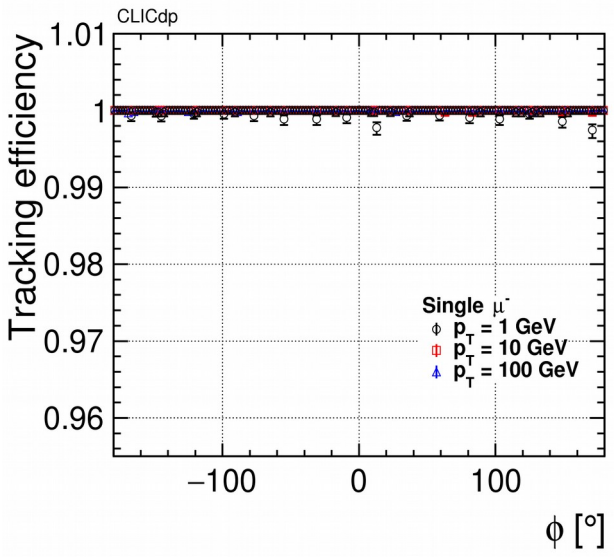




+- 1 sensor



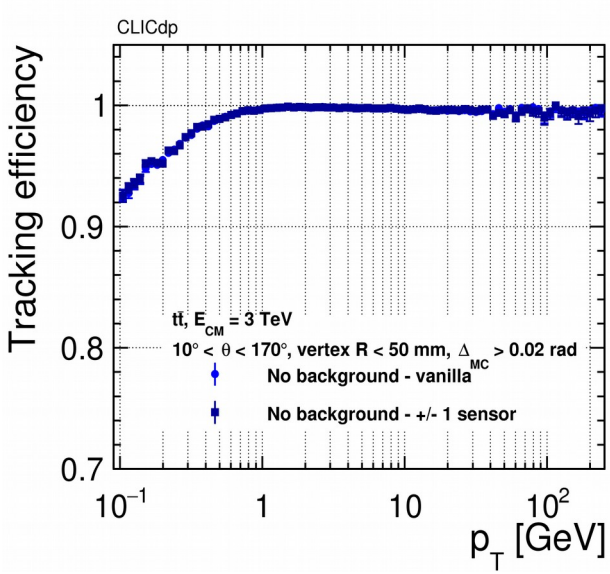


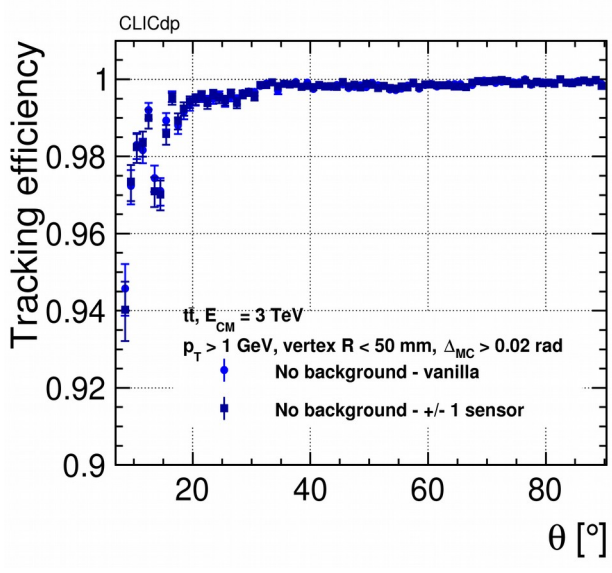


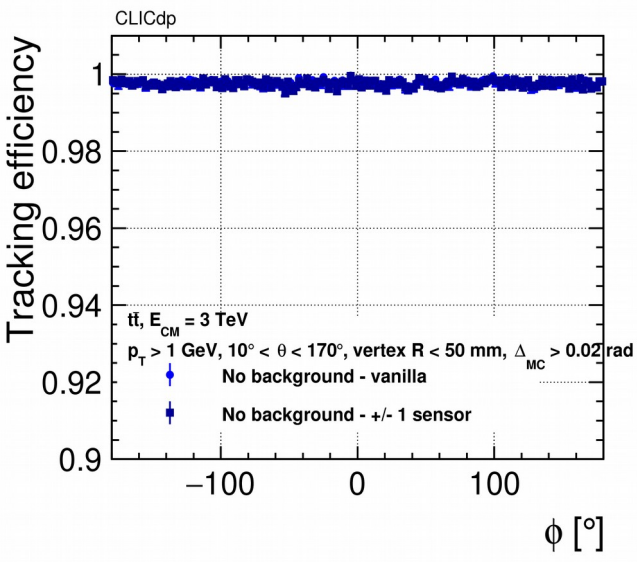
+ efficiency and fakes basically unchanged!

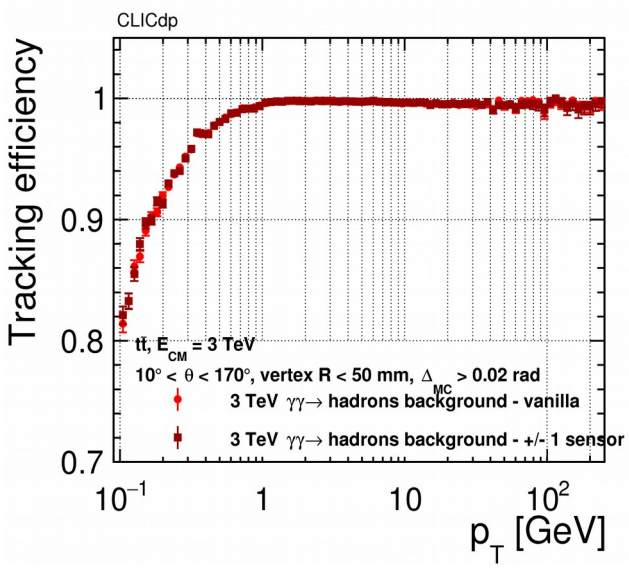
Results - Efficiency

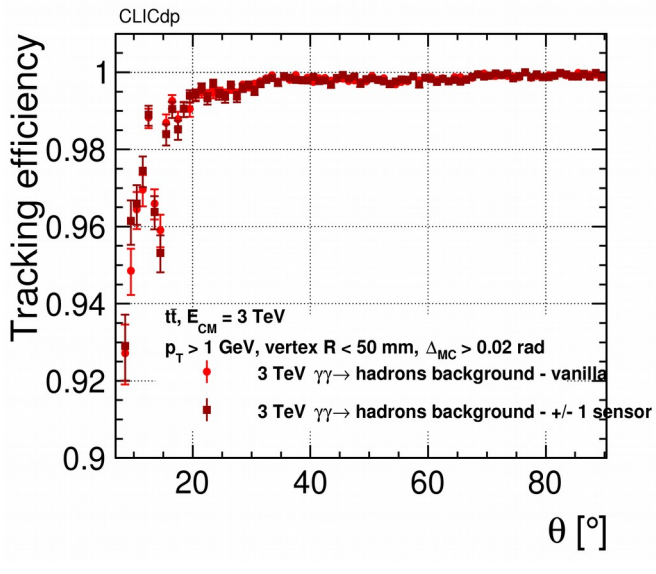
- **Complex events: ttbar,** nHits >= 4

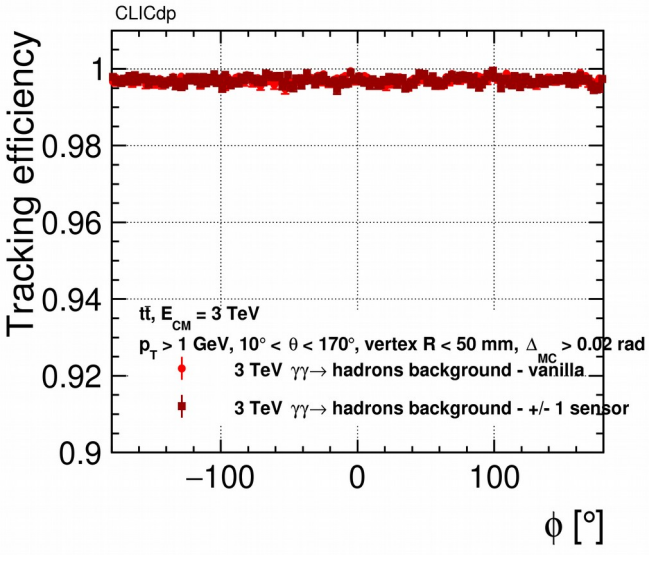












Results - Fake rate

- **Complex events: ttbar,** nHits >= 4