Digi+Reco Validation

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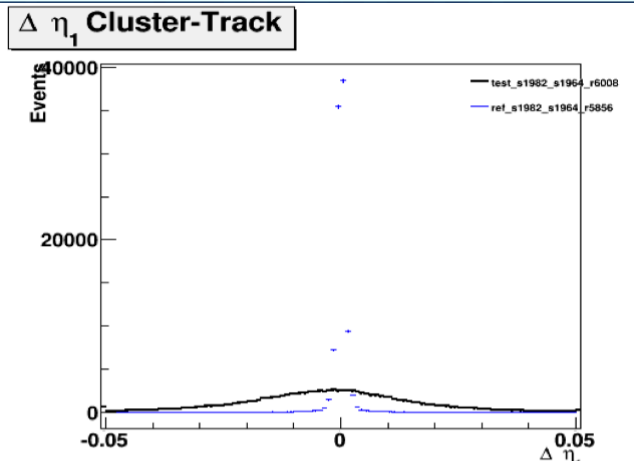
Physics Validation Meeting

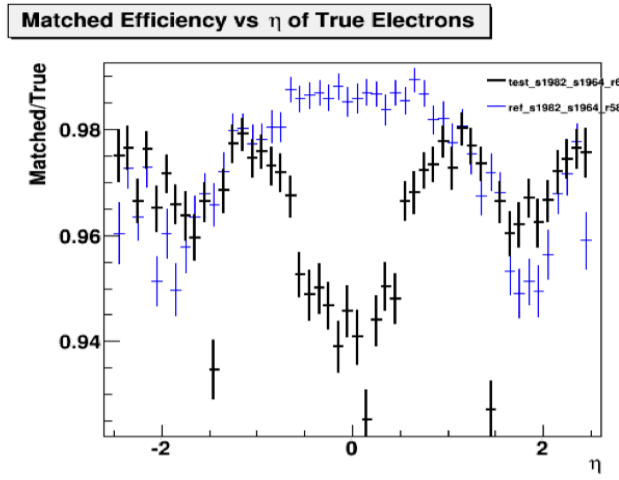
Introduction

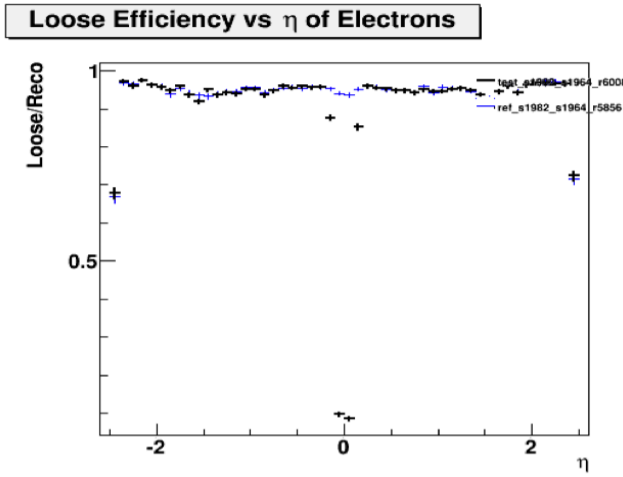
- Today:
  - Second round of validation for v20 digi+reco
  - Hopefully final validation of 50ns digi+reco in v19
- Many issues seen in first round of v20 validation
  - Will give a quick reminder of the issues and which are resolved or still outstanding
- Then, details of three tests for this week

Resolved Issues (1)

- Electrons
  - Track-cluster Δη very wide & Δϕ shifted
    - Understood as due to bug in track extrapolation to middle of calo layer
  - Elec reco effic few % lower at central η & strange second peak in ΔR(truth,γ)
    - Both believed to be due to above issue
  - (Loose) ID effic goes down to ~0 at η=0
    - Due to a bug in elec ID tool config; fixed
- Photons
  - Change in topo-seeded p_T spectrum
    - Reference was suffering from inefficiency to reconstruct high E_T photons with the standard algo
  - Pileup induced migration of “true unconverted"->"converted 1 track TRT" candidates much smaller than in v19.
    - Also caused by extrapolator bug

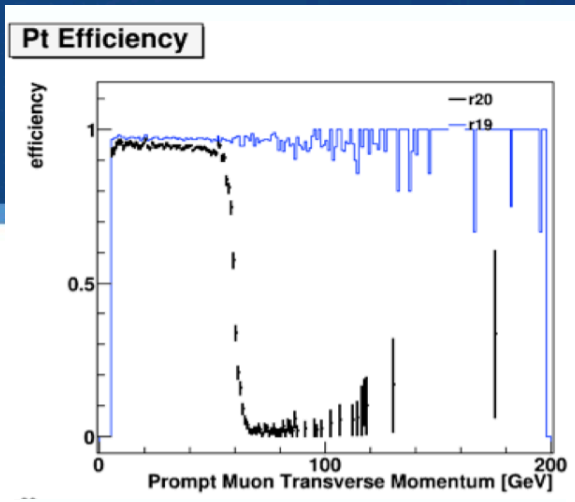


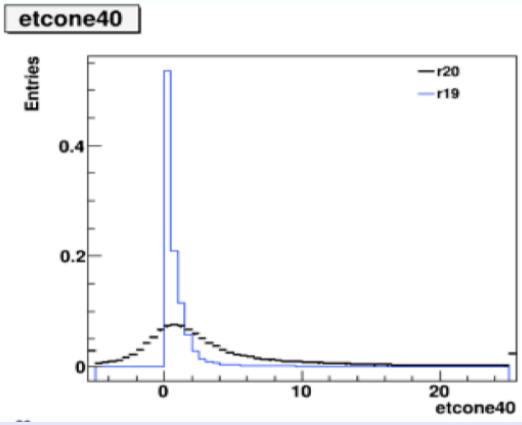


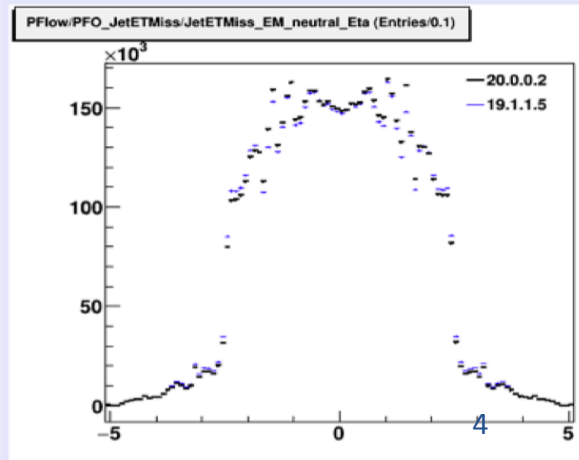


Resolved Issues (2)

- Muons
  - Large drop in MuGirl effic for p_T > 60 GeV
    - Issue understood and fixed in 20.1.0.Y
  - Changed in track and calo isolation
    - Bug found and fixed now
- Topoclusters
  - Moments have changed shape.
    - Due to new float compression for CaloCluster
- Neutral PFO show changes
  - Seems consistent with moving to new track extrapolation tool + updates to the algorithm
- MET
  - Change in muon term
    - Expected due to fix for rejecting bad muons

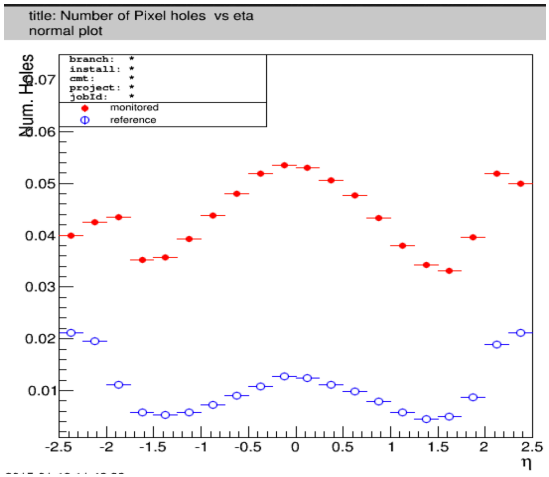


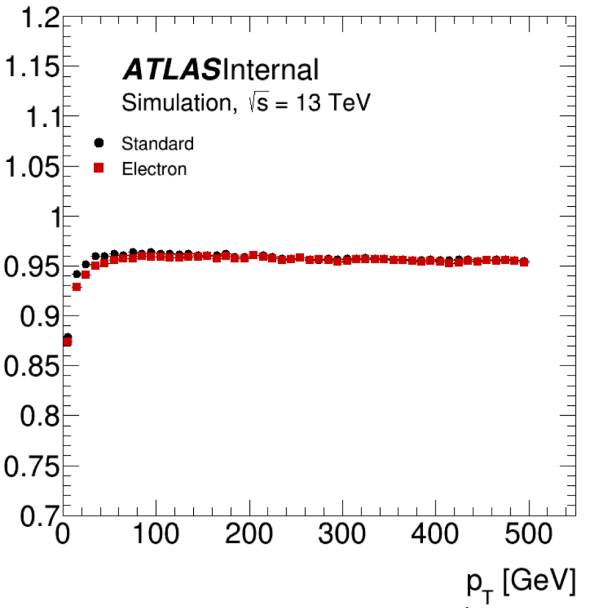




Outstanding Issues (1)

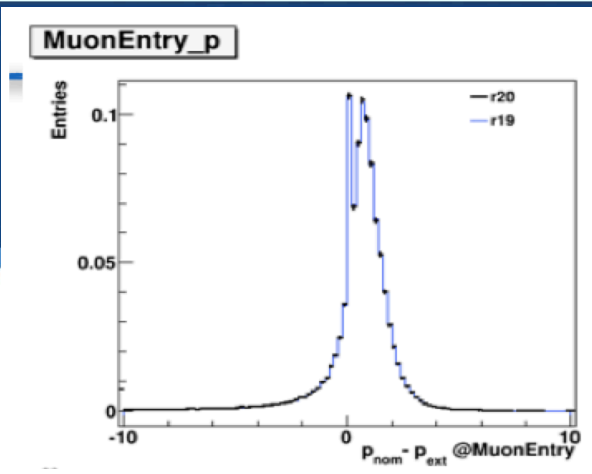
- Tracking
  - Pixel/SCT hit efficiency reduced. Also, see an increase in number of holes + number of outliers increases a little
    - Both traced back to increase number of material intersections. Being investigated
  - New pixel issues discovered (ATLASRECTS-1563)
    - HashID problem with 3D modules → fixed
    - Pixel charge not correct → being fixed now
      - Calibration not correctly applied



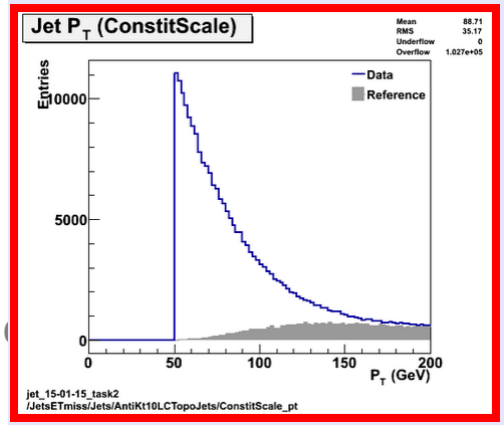


- New bug discovered in dedicated e tracking
  - Reduces efficiency at low E_T
  - Being followed in in ATLASRECTS-1562

Outstanding Issues (2)



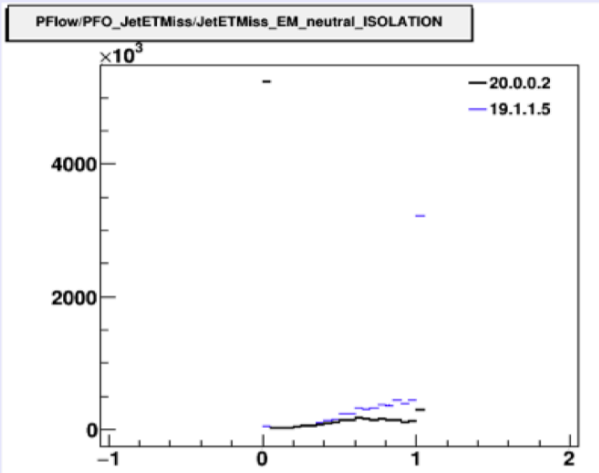
- Muons
  - Differences in truth association
    - Δp(nominal, extrapol) at calo entry & muon exit wider & muon entry shifted. Need to tweak Eloss param
    - Truth issues will be fixed on longer term.
- Jets
  - Change in E in various calo layers (EM and tile) and larger jet width
  - Huge increase in anti-k_t 1.0 jets
    - Due to change in config: No calib/subtraction in v20 as turned off at T0 for untrimmed jets
    - Produced a new test sample with it re-enabled
  - Also large difference in track jets
    - Likely related to change in tracking cuts. Qualitatively expected but would be good to get specific checks

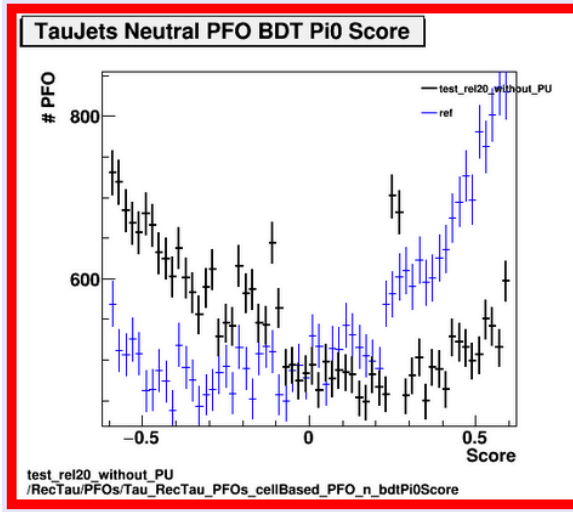


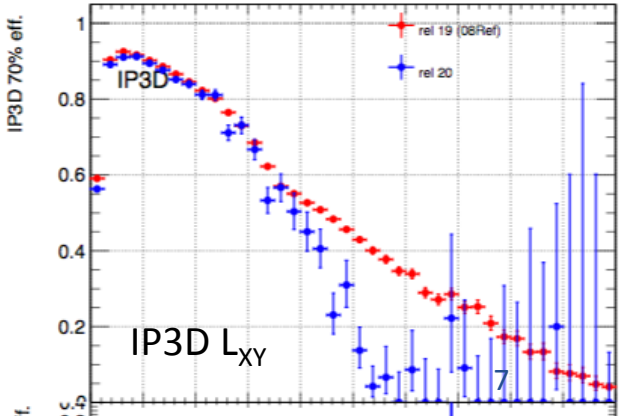
- MET
  - Larger PVSoftTrk and change in MET_SoftClus
    - No changes expected; could be due to changes in topoclus

Outstanding Issues (3)

- Pflow
  - Unexplained diffs seen in charged PFO
    - Unlikely pflow software as are just selected tracks
    - Not understood by the tracking group: cannot be explained by run 1 -> 2 cut change
  - Neutral PFO has many more low p_T neutral PFO with zero isolation moments. Not understood
- Tau
  - Large differences in sub-structure
    - Changes expected as changed algo for v20
    - But still need to check if quantitatively as expected
- B-tag: worse performance for many taggers
  - SV1: bug in SV1/VKalVrt
    - Can't deal with rotation of reference
  - IP3D: Efficiency falls off quicker vs L_{xy}
    - Due to relaxed b-layer requirement in r19







Task 1

- Test of digi+reco in 20.1.0.2 in **DC14-like** configuration **with** pileup.
  - This is the DC14 setup but with the trigger turned OFF and the references are the last validated 19.1.1.5 samples and the 20.0.0.2 samples from the previous round.
  - Any differences above statistical compared to reference 1 should be reported; for reference 2 you should check that the known issues reported in the previous validation round are now fixed.

  - Ref1: s1982_s1964_r5787 (17.7.3.9.6 MCProd, 17.6.51.4, 19.1.1.5)
    Ref2: s1982_s1964_r6006 (17.7.3.9.6 MCProd, 17.6.51.4, 20.0.0.2)
    Test: s1982_s1964_r6059(17.7.3.9.6 MCProd, 17.6.51.4, 20.1.0.2)

  - The histogramming for ref 1 (2) was run with p1783 (p1828) and for the test with p1832 (some will likely need rerunning with up-to-date code)
  - https://its.cern.ch/jira/browse/ATLPHYSVAL-279

Task 2

- Test of digi+reco in 20.1.0.2 in **MC15-like** configuration **without** pileup.
  - This is the MC15 setup (ATLAS-R2-2015-02-01-00 geometry and OFLCOND-RUN12-SDR-22 conditions) but with the trigger turned OFF and the reference is the sample from the MC15 simulation validation in 20.0.0.2.
  - The reference will, therefore, have the same issues as seen in the previous round of DC14-like validation and you should report other differences above those seen between the test and reference 2 in task 1 above.
  - Ref: s2081_r6012 (19.2.1.2, 20.0.0.2, 20.0.0.2)
    Test: s1982_r6064(17.7.3.9.6 MCProd, 20.1.0.2)
  - The histogramming for the ref was run with p1828 and for the test with p1832 (again some will likely need rerunning with up-to-date code)
  - https://its.cern.ch/jira/browse/ATLPHYSVAL-279

Task 3

- Validation of digi+reco with 50 ns bunch spacing vs 25 ns.
  - This is an update from the last validation, with the 50 ns options now correctly set for OFC optimization.
  - Any difference above statistical should be reported. As these samples contain pileup, please cross check the stat of your samples to make sure you are sampling the same mu distribution in test and ref.
  - Test: s1967_s1964_r6063_p1813 (17.7.3.9.2 MCProd, 17.6.51.4, 19.1.1.9, 19.1.1.9) - 50 ns
    - (AODs are valid 1, for histograms, take the latest of valid1 or valid2)
  - Reference: 1967_s1964_r5961_p1813 (17.7.3.9.2 MCProd, 17.6.51.4, 19.1.1.9, 19.1.1.9) - 25 ns
    - (take valid3 or mc14_valid if it exists)
  - https://its.cern.ch/jira/browse/ATLPHYSVAL-242