τ Reconstruction validation

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(The τ validation group)

16^{th} April 2009
Tau Workshop @ Copenhagen

Overview: validation of τ reconstruction

Offline Validation

- Express stream validation/monitoring at Tier0 (tau monitoring).
- Validation/commissioning after Cosmic/collider data taking.

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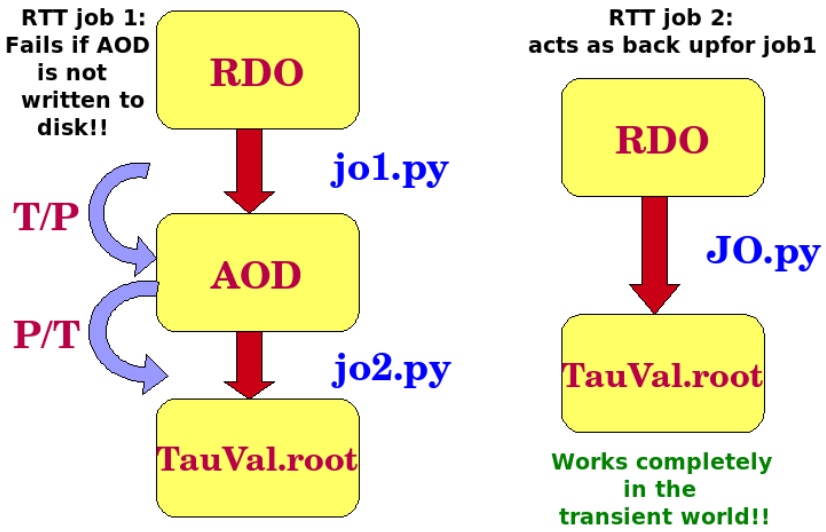
Offline Validation: TauTools/TauValidation packages

- Nightly tests inside **R**un **T**ime **T**ester framework (Till).
- Weekly/Bi-weekly Physics Validation (Aldo)
  $\Longrightarrow$ backbone for central MC production.
  - Tests *EvGen* $\rightarrow$ *Simulation* $\rightarrow$ *Digitization* $\rightarrow$ *Reconstruction* chain.
- Tau Event Data Model (EDM) validation
  (merging tauRec & tau1p3p and CommonDetails).
- Validation of centrally produced MC samples.

TauValidation takes POOL formats, i.e, $ESD/AOD/D^1PD$ as inputs and runs in Athena or AthenaROOTAccess(ARA).

RTT tests: Daily Feedback

RTT setup

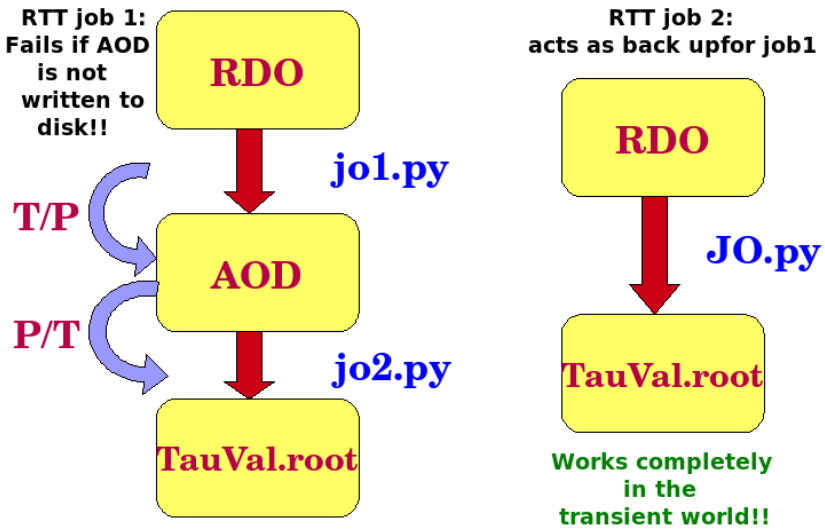


MC data Sample

- $Z \rightarrow \tau\tau$, csc11 (14TeV)
- $W \rightarrow \tau\nu$, csc11 (14TeV)
- mc08 $Z \rightarrow \tau\tau$, displaced vertex (10TeV)
- mc08 $W \rightarrow \tau\nu$, displaced vertex (10TeV)

RTT tests: Daily Feedback

RTT setup



MC data Sample

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- mc08 $Z \rightarrow \tau\tau$, displaced vertex (10TeV)
- mc08 $W \rightarrow \tau\nu$, displaced vertex (10TeV)

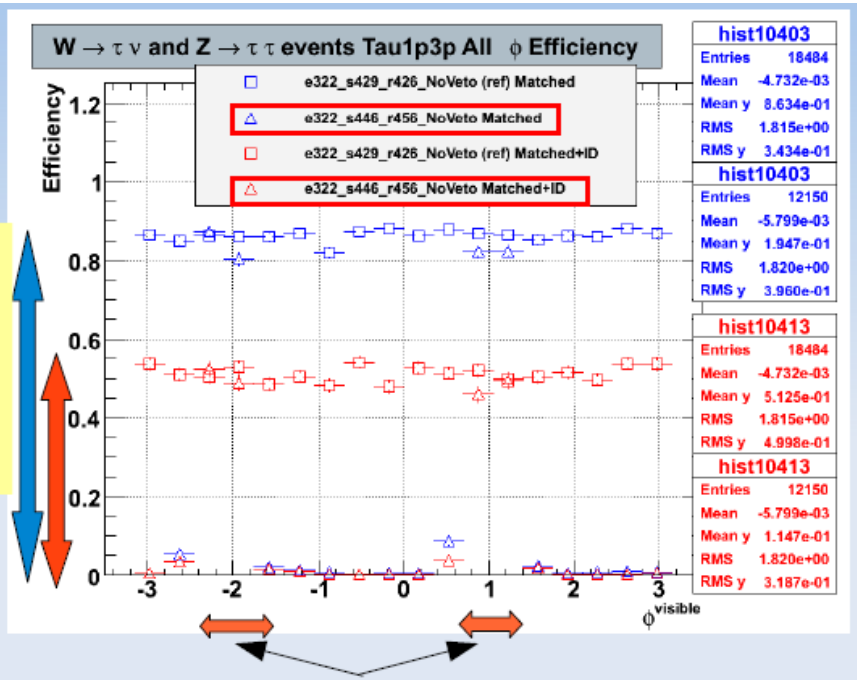
Updates:

- **RTT TWiki page** updated. Documenting the "tauRec" and "tauEvent" tags used for making "Reference" TauVal.root files.
- Latest reference: dev rel_0, Sunday 5^{th} April 2009
- No problems noticed since then.

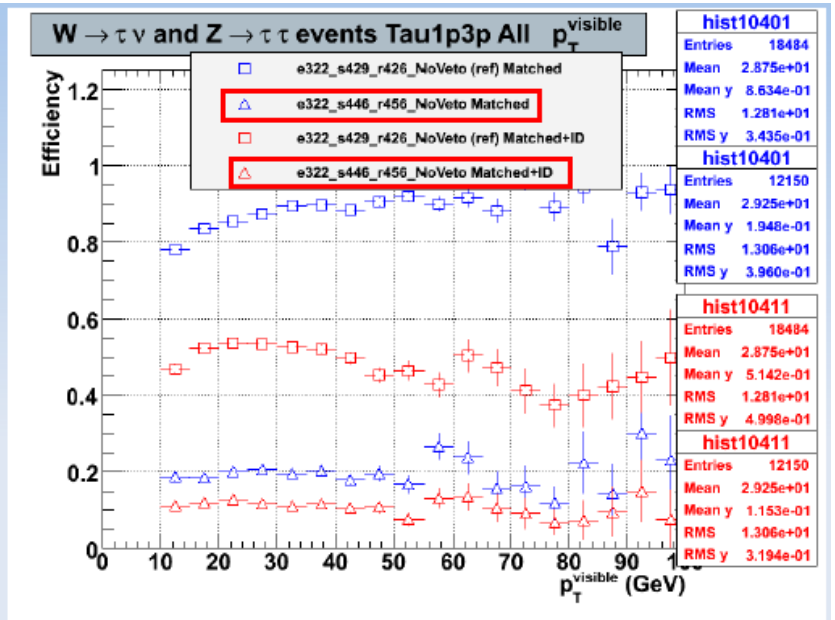
Physics Validation: Weekly Feedback

When "Displaced vertex" was first used in sampleA production

Drop in efficiency of 66% and ID of 40%



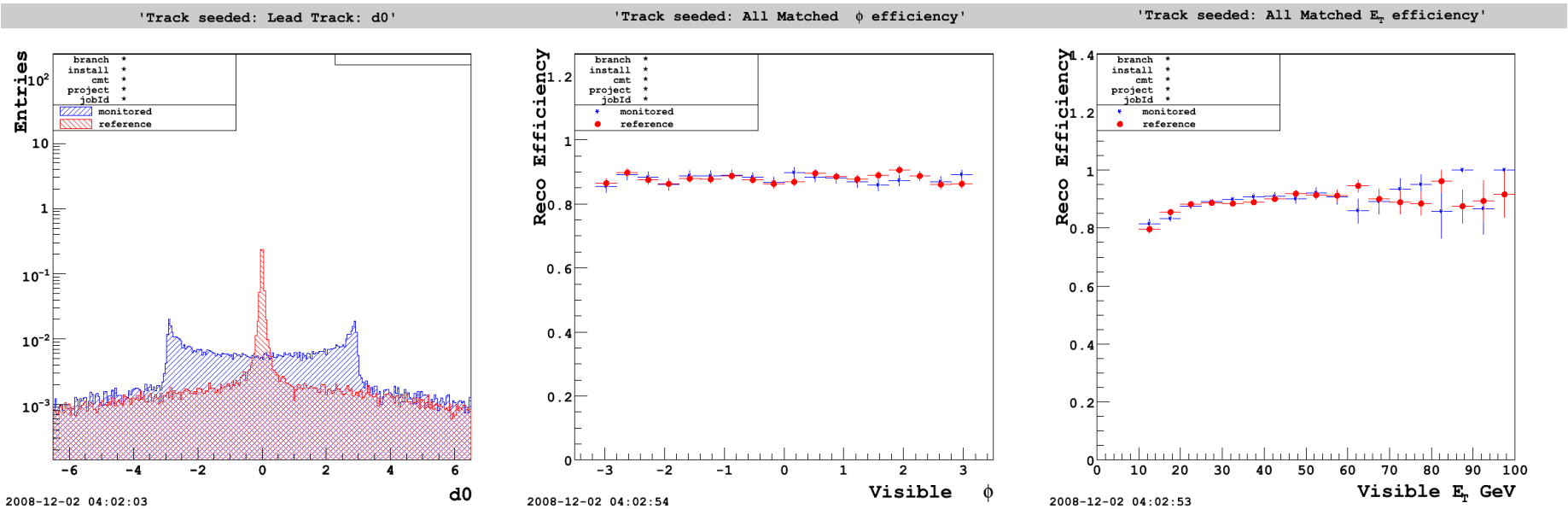
Also features the region where the Efficiency and ID are restored to original values



The transverse momentum distribution shows the same trend

Physics Validation: Weekly Feedback

After using external track selector tool in "tauRec" to take "Displaced vertex" into account.



"Displaced vertex" is used in MC08 samples.

Physics Validation: Updates

News

- MC09 sample production will start around 20^{th} *May* (for full schedule look at the backup slide).
- Validation of release 15 started.

Updates

- Reconstruction and digitization version 15.0.0.2 - still under investigation.
- More details on validation of pileup sample scenarios can be found in the additional slides from Aldo attached on the agenda server.

TauValidation: New roles

New role 1:

- TauValidation does the performance validation nightly & weekly/bi-weekly.
- New role is to extend this package even for producing the plots & tables for the regular updates of "tauRec performance notes".

Motivation:

- Centralized way of providing "True Hadronic taus and prongs". Also the truth matching and efficiency/rejection definitions.
- Provide test bed to compare the performance of various tau ID discriminants.
- CBNTs in Release15 with newEDM (uses dumper from TauTools) are completely different from Release14 CBNTs (and do need validation!).

TauValidation: New roles

New role 2: Primary DPD validation:

- DPD is a Skimmed, Slimmed and Thinned version of ESD/AODs
- Made from Region of Interest ESDs, ie, store tracks around the tau candidates for doing tau re-reconstruction.
- Antonio Limosani will be talking more on this.

Performance of the tau reconstruction and identification algorithm with release 14.2.20 and mc08 data

A. Christov [1], Z. Czyczula[2], M. Janus[1], L. Janyst[3,4], A. Kaczmarska[5], A. Kalinowski[6], J.R. Komaragiri[7], S. Lai[1], N. Meyer[1], E. Richter-Was[4,5], Ch. Ruwiedel[8], M. Wolter[5]

[1] *Fakultät fur Physik, Albert-Ludwigs-Universität, Freiburg, Germany*
[2] *Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark*
[3] *European Organization for Nuclear Research (CERN)*
[4] *Physics Department, Jagellonian University, Cracow, Poland*
[5] *Institute of Nuclear Physics (IFJ PAN), Polish Academy of Sciences, Cracow, Poland*
[6] *University of Regina, Regina, Canada*
[7] *Simon Fraser University, Burnaby, BC, Canada*
[8] *Physikalisches Institut, Universität Bonn, Bonn, Germany*

- No. of ways to define true hadronic tau, no. of prongs in its decay, no. of reco tracks, truth matching is directly proportional to the no. of authors!
- tauRec developers use CBNTs and tauID developers use CBNTs/AODs!

Details on the cross checks

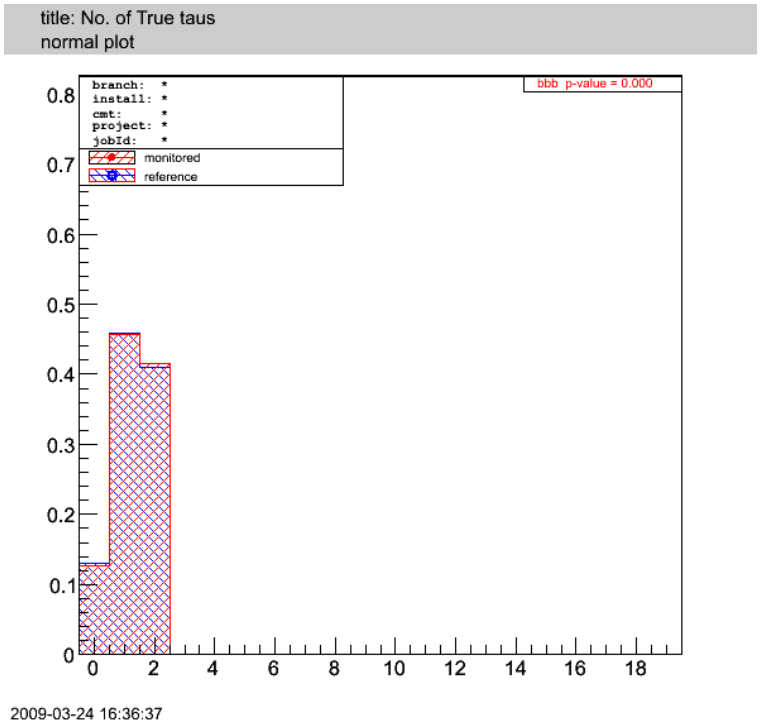
Validating tau validation software:

- For cross checking with CBNT code: CBNTs were produced from AODs (signal/background) and CBNT code is run on them. TauValidation is run on the same AODs which went in making the CBNTs.
- Same AOD datasets are used for cross checking with Artur's TauTrackTools + ARA code for "Rejection vs Efficiency".
- Same selection cuts are applied.

List of basic variables to check first

True Hadronic Tau counting

Exclude Geant4 particles including taus.

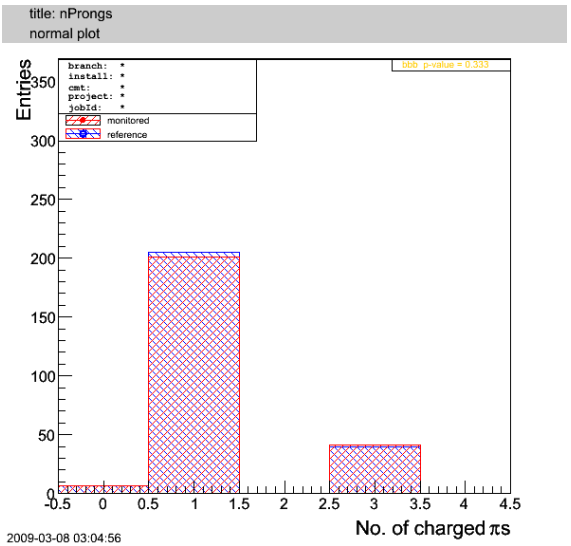


REFERENCE: TauTools MONITORED: CBNT code

List of basic variables to check first

Counting no. of prongs in hadronic tau decay

- Exclude Geant4 particles in the decay chain.
- Do not include $K^{\pm}(pdgID = 321)$ in prong counting.
- Exclude $\pi^{\pm}$ in K^0_S decays

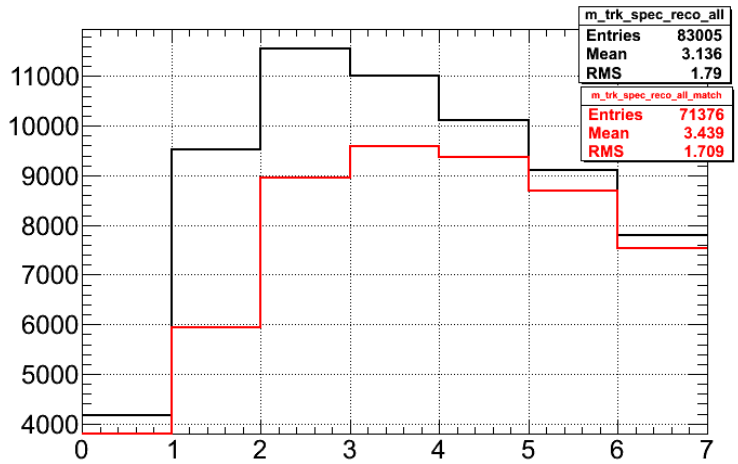


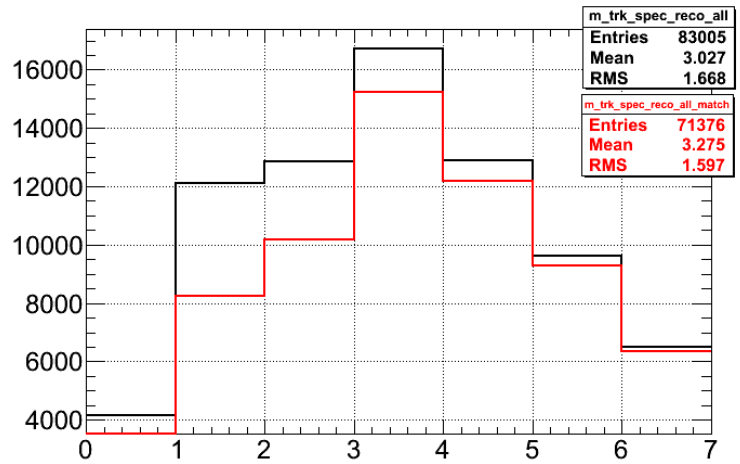
REFERENCE: TauTools MONITORED: TauTrackTools

List of basic variables to check first

Track Multiplicty of Reco Tau candidates

Use *tauJet* → *numTrack*() for all the three types of reco tau candidates
Left: nLooseTrk() Right: numTrack() for all calo candidates.





tauJet → *numTrack*() provided default tracks for both & track ONLY seeded and loose tracks for calo ONLY seeded reco taus.

Performance cross checks on Signal samples

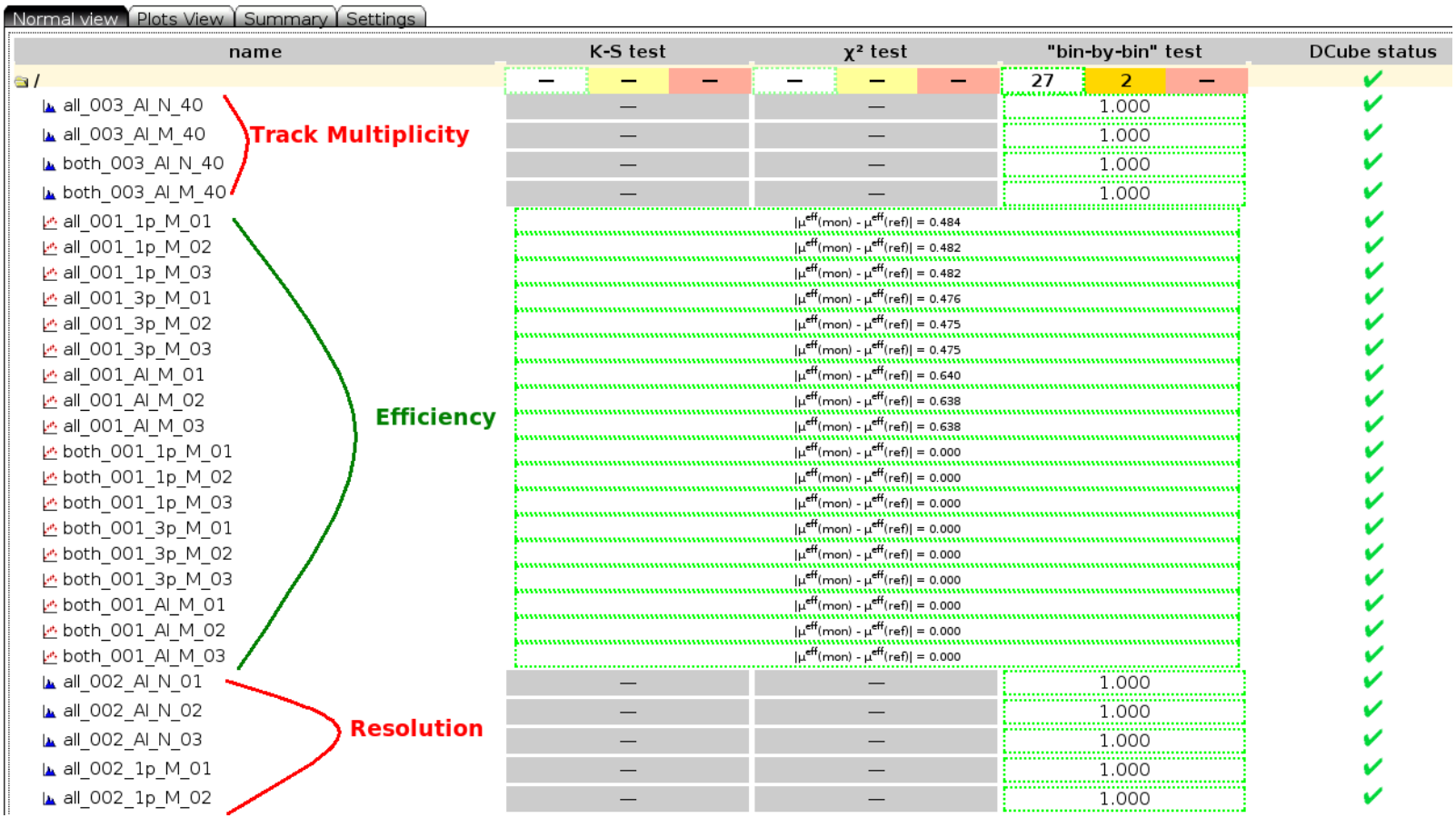
Before any bug fixes:

name	K-S test			χ^2 test			"bin-by-bin" test			DCube status
/	–	–	–	–	–	–	8	14	2	!
all_003_Al_N_40	–			–			1.000			✔
all_003_Al_M_40	–			–			0.143			?
both_003_Al_N_40	–			–			1.000			✔
both_003_Al_M_40	–			–			0.333			?
all_001_1p_M_01	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.473$									✔
all_001_1p_M_02	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.472$									✔
all_001_1p_M_03	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.472$									✔
all_001_3p_M_01	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.492$									✔
all_001_3p_M_02	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.491$									✔
all_001_3p_M_03	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.491$									✔
all_001_Al_M_01	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.574$									✔
all_001_Al_M_02	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.572$									✔
all_001_Al_M_03	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.572$									✔
both_001_1p_M_01	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.003$									✔
both_001_1p_M_02	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.004$									✔
both_001_1p_M_03	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.004$									✔
both_001_3p_M_01	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.029$									✔
both_001_3p_M_02	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.029$									✔
both_001_3p_M_03	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.029$									✔
both_001_Al_M_01	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.236$									✔
both_001_Al_M_02	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.244$									✔
both_001_Al_M_03	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.244$									✔
all_016_Al_M_01	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.123$									✔
all_016_Al_M_02	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.122$									✔
all_016_Al_M_03	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.122$									✔
both_016_Al_M_01	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.076$									✔
both_016_Al_M_02	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.076$									✔
both_016_Al_M_03	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.076$									✔
both_016_Al_M_01_tprof	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.087$									✔
both_016_Al_M_02_tprof	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.091$									✔
both_016_Al_M_03_tprof	$\lvert\mu^{rm}(mon) - \mu^{rm}(ref)\rvert = 0.091$									✔
all_002_1p_M_01	–			–			0.244			?
all_002_1p_M_02	–			–			0.757			?
all_002_1p_M_03	–			–			0.854			?
all_002_3p_M_01	–			–			0.226			?
all_002_3p_M_02	–			–			0.889			?
all_002_3p_M_03	–			–			0.911			?
both_002_1p_M_01	–			–			0.744			?
both_002_1p_M_02	–			–			0.986			?
both_002_1p_M_03	–			–			0.986			?
both_002_3p_M_01	–			–			0.581			?
both_002_3p_M_02	–			–			1.000			✔
both_002_3p_M_03	–			–			1.000			✔
trak_012_Al_N_00	–			–			1.000			✔
calo_012_Al_N_01	–			–			1.000			✔
both_012_Al_N_01	–			–			1.000			✔
both_012_Al_N_01	–			–			1.000			✔
trak_012_Al_M_00	–			–			0.542			?
calo_012_Al_M_01	–			–			0.061			!

REFERENCE: CBNT result MONITORED: TauValidation result

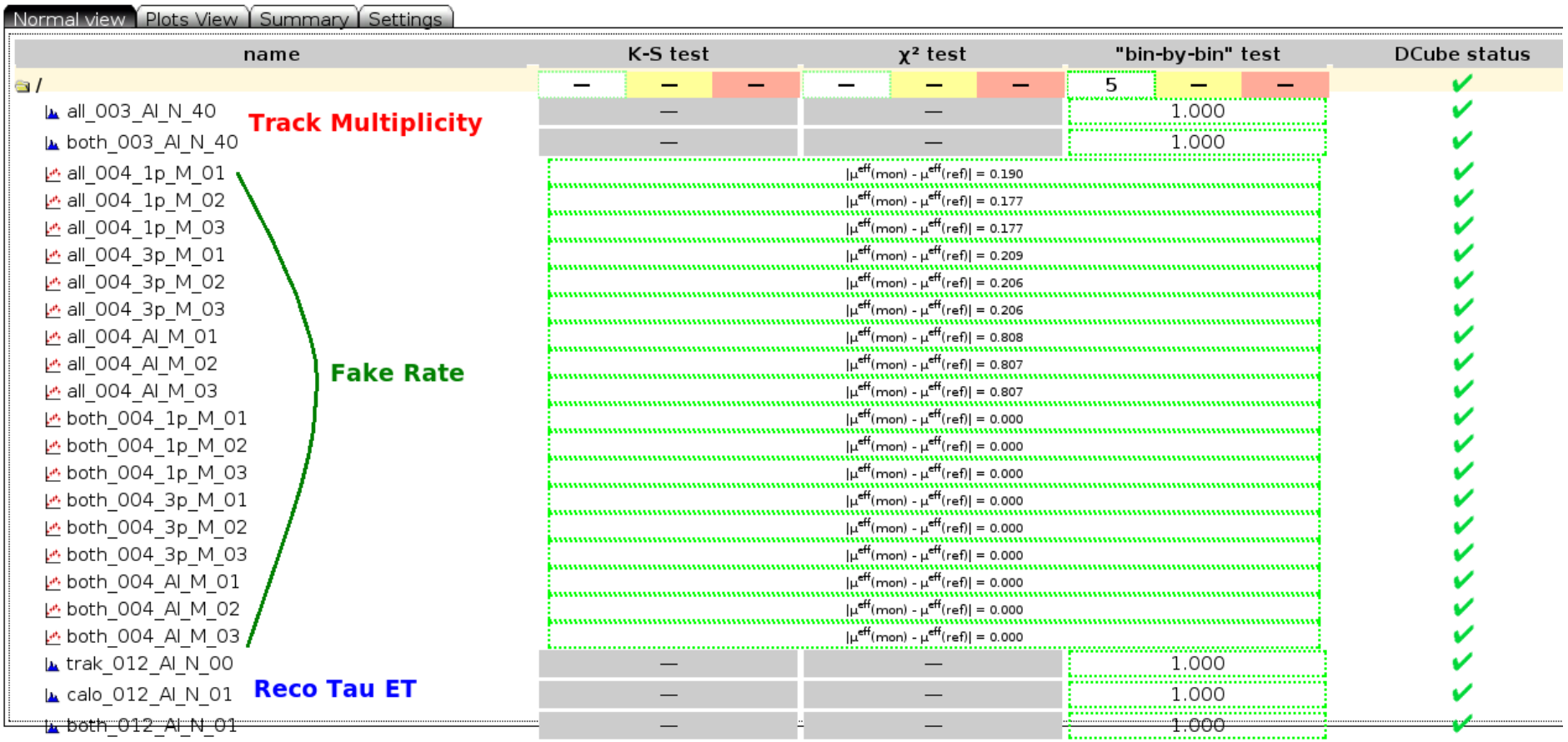
Performance cross checks on Signal samples

After fixing the no. of true had taus, prong counting and tracks associated with reco tau candidates in CBNT code
and using visiblep_T instead of visibleE_T in TauValidation code.



REFERENCE: CBNT result MONITORED: TauValidation result

Performance cross checks on Background samples

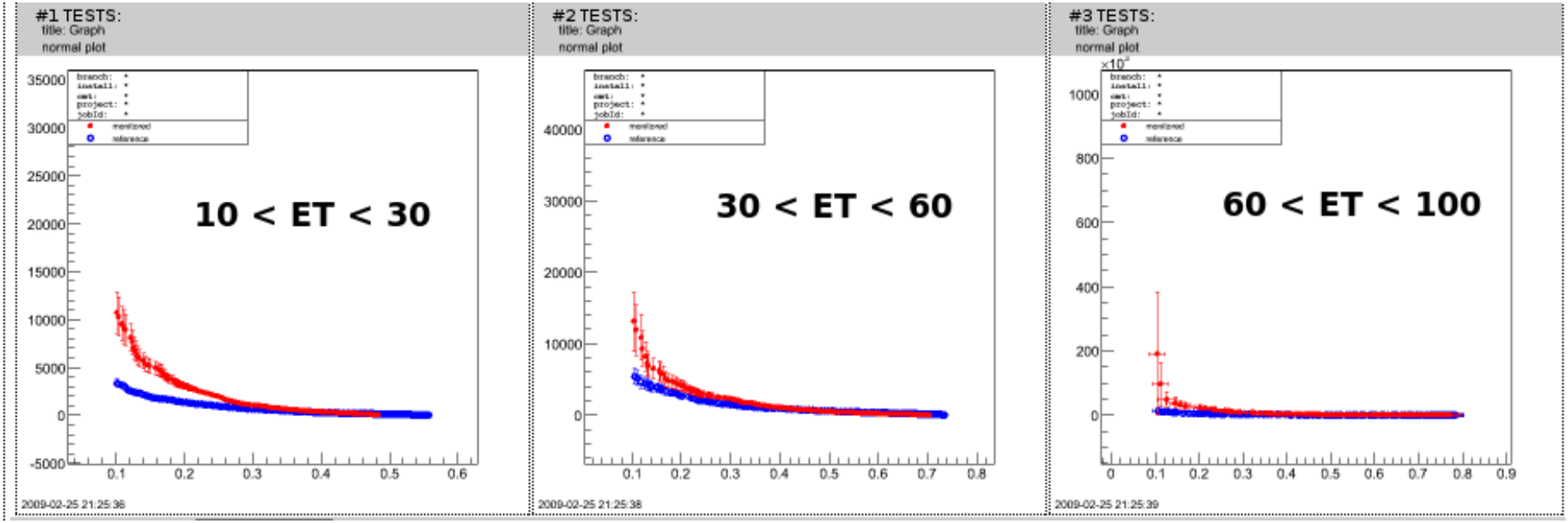


REFERENCE: CBNT result MONITORED: TauValidation result

Rejection vs Efficiency comparisons

TauTools vs TauTrackTools for truth had tau and prong counting

3 prong both seeds in three visET bins



Legend:

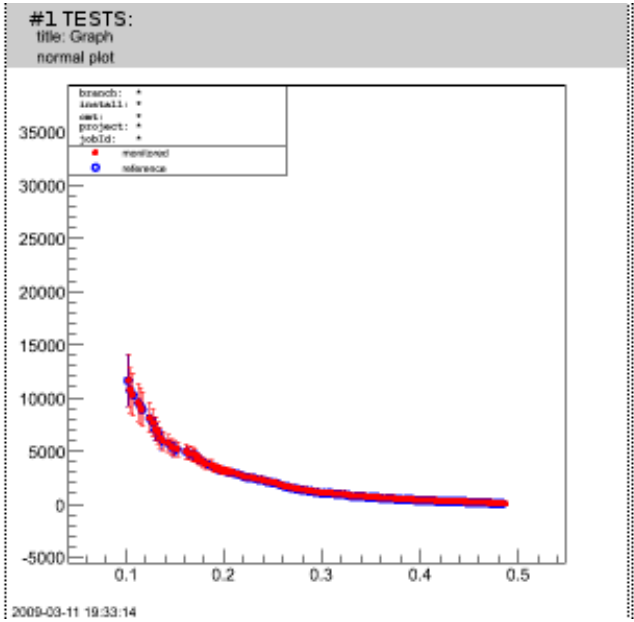
BLUE: Artur's result

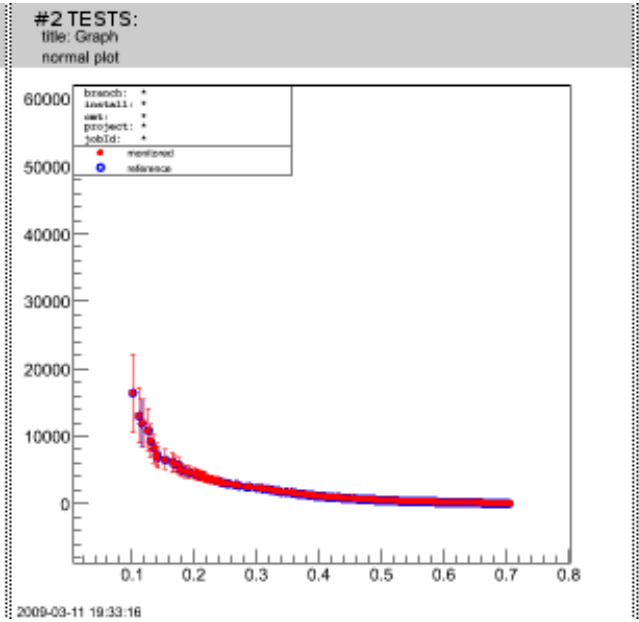
RED: TauValidation result

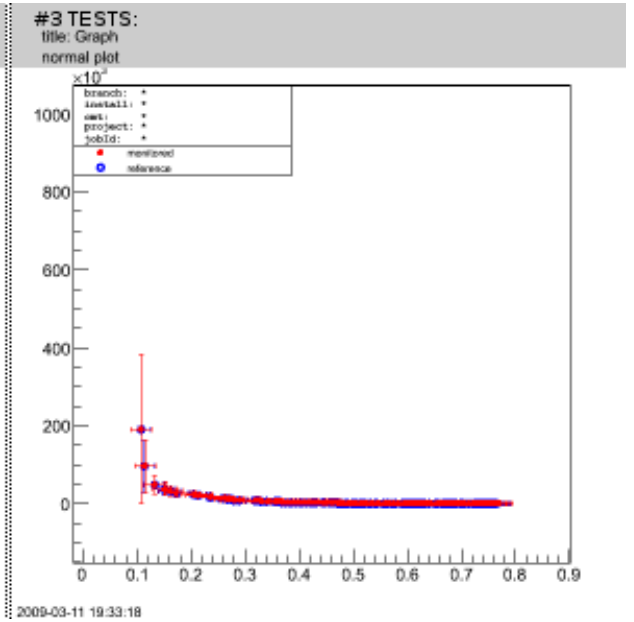
Rejection vs Efficiency comparisons

After using bug-fixed TauTrackTools

3 prong both seeds in three visET bins







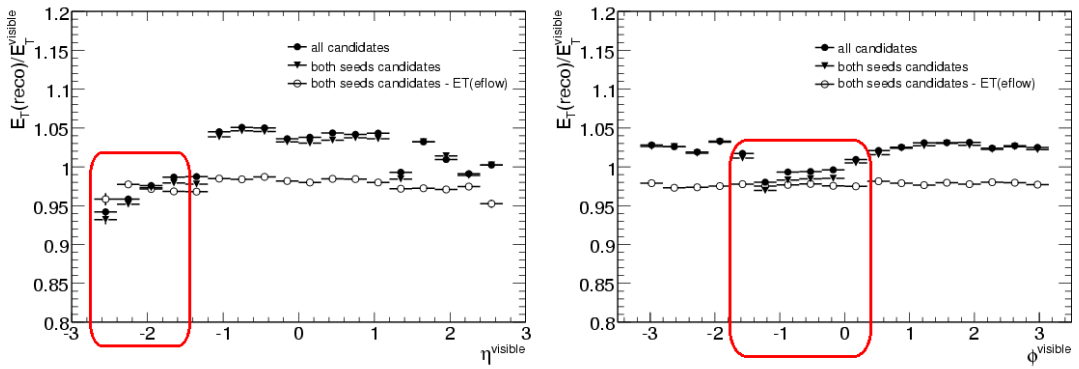
Legend:

BLUE: Artur's result

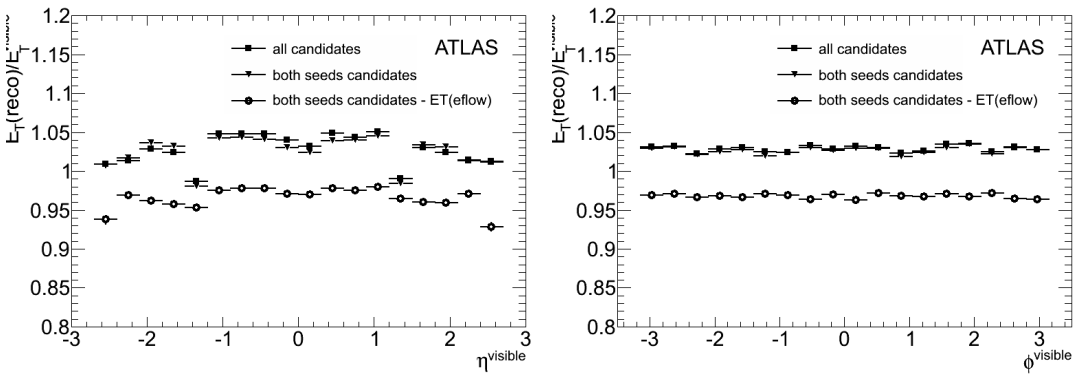
RED: TauValidation result

tauRec note Plots with r604 samples

- In r541 samples one forward HEC sector is OFF.



- In r604 samples the above HEC sector is put back in.



tauRec note plots using r604 samples....almost final.

Summary and Plans

Summary

- Analysis framework independent tools for doing Tau performance studies are written from scratch and are available in CVS.
- These tools are being used nightly/weekly/bi-weekly and also to validate new EDM.
- Also for the ATLAS note providing regular performance updates of tauRec algorithm and Primary DPD validation.
- While making the plots for tauRec note extensive cross checks of TauTools/Validation packages are done.
- Finished making the plots for tauRec note with r604 samples.

Summary and Plans

Plans

- Put the plots and tables for r604 samples in the "tauRec note" once the conveners are happy.
- Document running TauValidation to make tauRec note performance plots on TWiki.
- Add needed methods for validating skimming/slimming and thinning for Primary DPD validation.
- Help out tauWG in the transition to move to new/improved definitions for truth tau, nProngs, truth matching, efficiency and rejection.

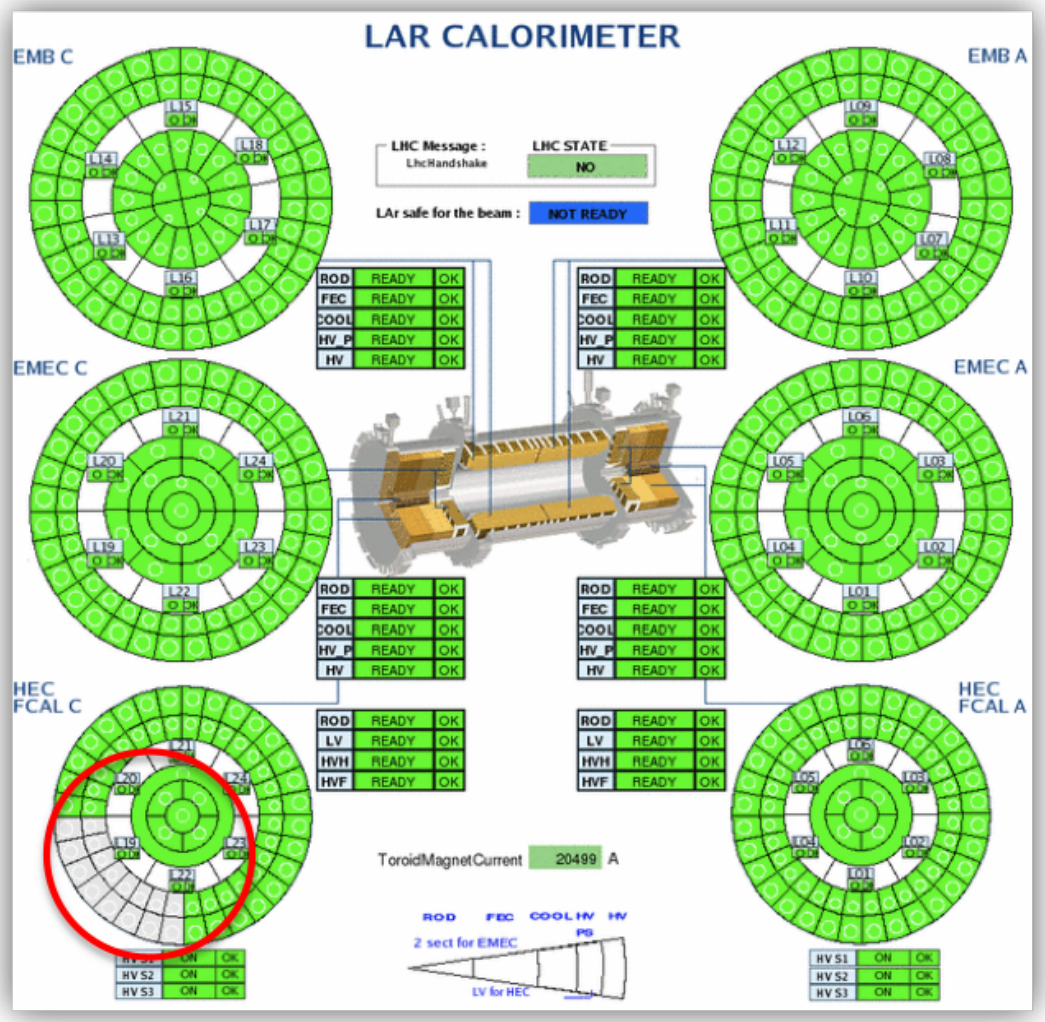
BACKUP SLIDES

BACKUP SLIDES

MC09 validation plans and sample production

Date	Release	Release comments	sample A production	Validation meeting topics	Production
April					
15th	15.0.0.3 released	simulation fixes	full sample A sim - sample A reco (g491 and g492)		
15th	15.1.0 released	final mc09 geometry			
21th				g492 validation (after fixes) against g491 (ATLAS-GEO-06-00-00)	
22th	15.1.0.1 released				
23-27 th			full sample A sim (final geometry - non displaced vertex) - reco of ATLAS-GEO-06-00-00 and of the new geometry		
28- may 3rd			full sample A sim with displaced vertex - sim of ATLAS-GEO-02-01-00 - reco of both		
30th				Comparison of the new geometry against ATLAS-GEO-06-00-00	
May					
5th				Comparison of the new geometry (displaced) against g492/ ATLAS-GEO-02-01-00. Comparison of g492/ATLAS-GEO--02-01-00 against g491/ ATLAS-02-01-00	
+ 2 weeks contingency (late software releases, production issues , bugs found) --> May 20th					MC09 can start

HEC sector


LAR CALORIMETER
EMB C
EMB A
EMEC C
EMEC A
HEC FCAL C
HEC FCAL A
LHC Message :
LhcHandshake
LHC STATE
NO
LAr safe for the beam :
NOT READY
ROD READY OK
FEC READY OK
COOL READY OK
HV_P READY OK
HV READY OK
LV READY OK
HVH READY OK
HVF READY OK
HV S1 ON OK
HV S2 ON OK
HV S3 ON OK
ToroidMagnetCurrent 20499 A
ROD FEC COOL HV PS
2 sect for EMEC
LV for HEC

DQMF

Data Quality Monitoring Framework

Overview

The DQHistogramAnalyzer is a utility to check histograms in an automated way and report results and summaries; it is also referred to as "offline DQMF", as the primary 'han.exe' application uses the DataQualityMonitoringFramework (DQMF). The primary utilities are

- han.exe
- han-config-gen.exe
- han-config-print.exe
- han-results-print.exe
- handi.py

For displaying results one can use DCube as well.

Displaying results

As above, running the han display utilities without any arguments prints usage information. The command-line utility 'han-results-print.exe' provides a convenient and quick way to dump the results from the output han file to the screen. For a complete display, use the 'handi.py' ("han display") script to produce web pages with the results. An example of this display is shown here.

Alternatively, the DCube display, written by Krzysztof Daniel Ciba, provides a way of viewing the han results, as shown here. There is a documentation link at the bottom of the DCube pages describing how to configure and run this application.