

Status report on Near Detector Slicing (using a different method than SR & MST)

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Outline

- Initial Motivation for this new attempt of ND slicing improvement
- Brief description of the method
- Results & Comparison with SR for a low intensity file
- Summary & On-going work

Motivation

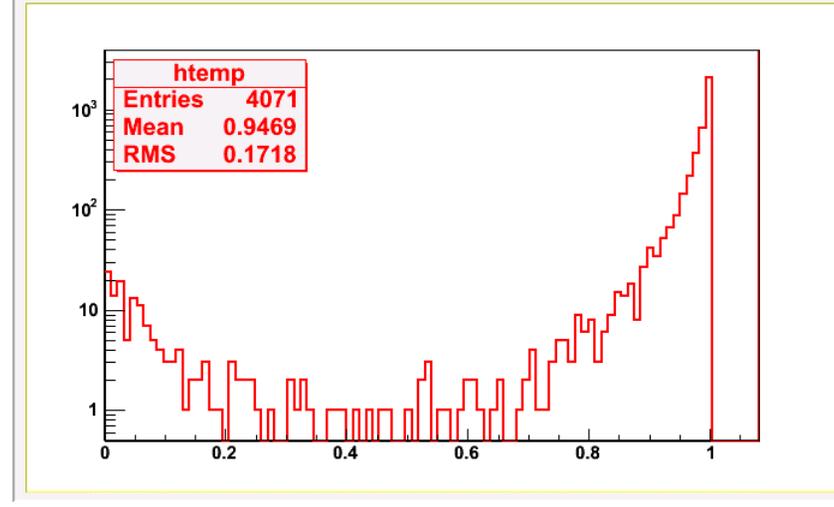
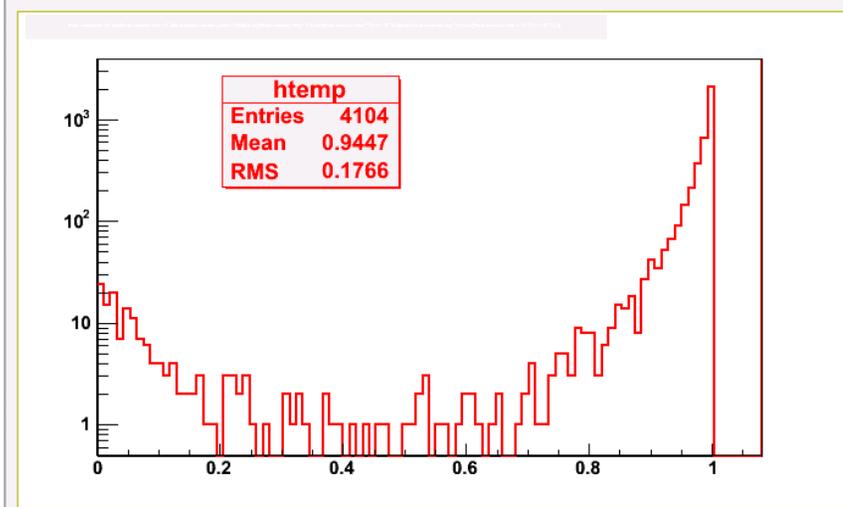
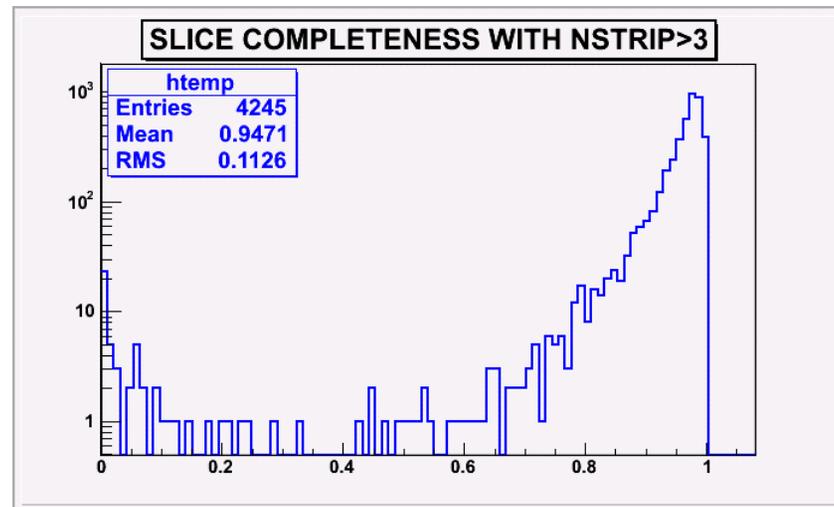
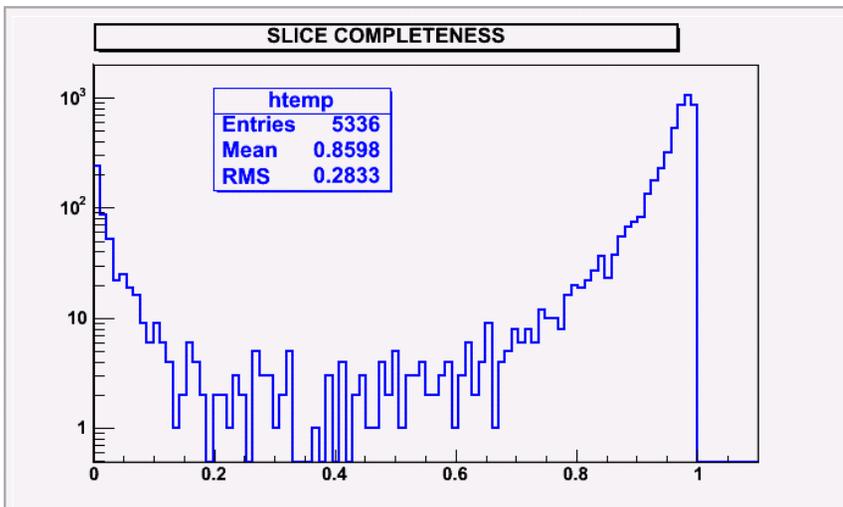
- In the previous NC meeting I showed some initial results on NC/CC separation at the ND. Two “issues” came up after the discussion:
 - CC Events with no tracks are essentially classified as NC which results in a really low NC selection purity.
 - NC event slicing and reco efficiency is low.
- In the process of trying to understand and if possible fix these problems I developed an additional new & simple method of doing the slicing that produced some interesting results...

ASAP Slicing Method (ASAP= As Simple As Possible)

- Playing with the MST and SR method that give ~ comparable results I was looking more carefully at strip and digit times and topologies.
- Doing that I decided to use the actual digit times (NOT the corrected) and just define ONE time difference (=1 bucket) to separate different events...
- The results are surprisingly (to me at least) good..

ASAP results & comparison with SR 1

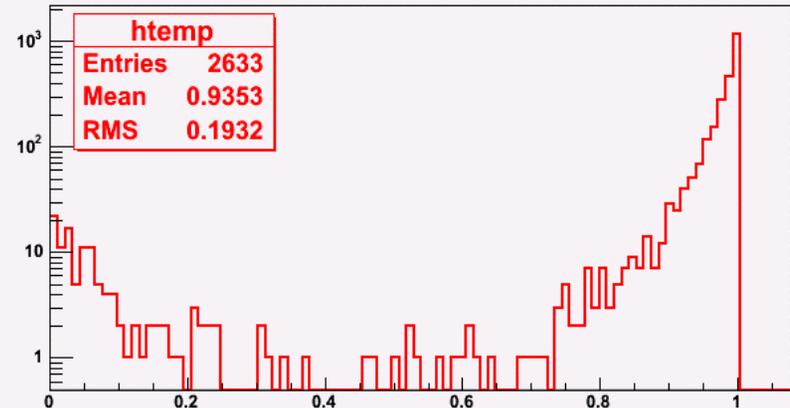
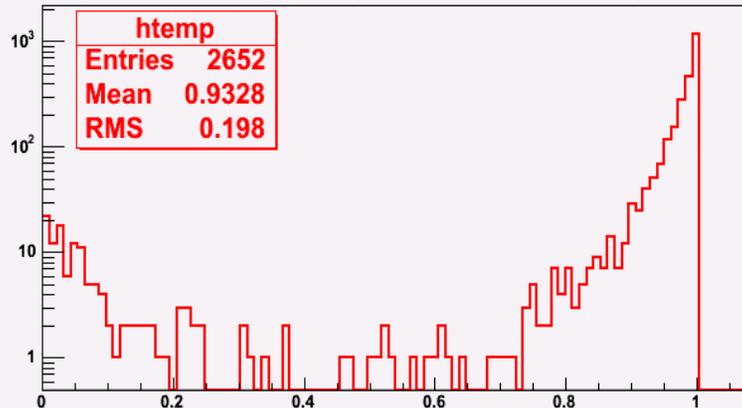
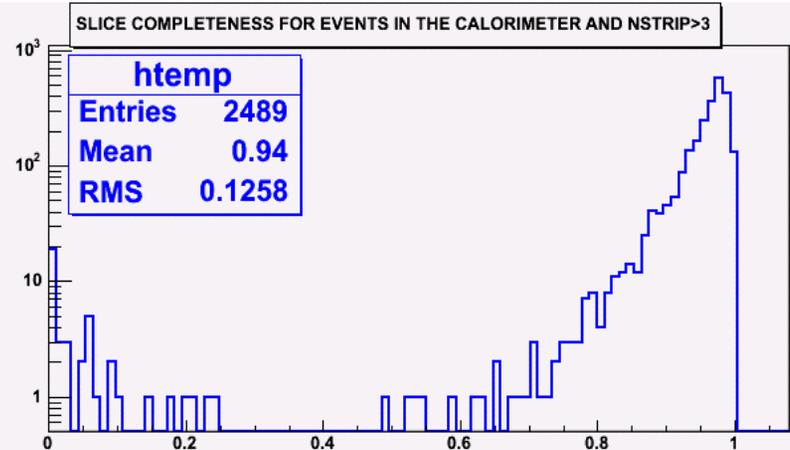
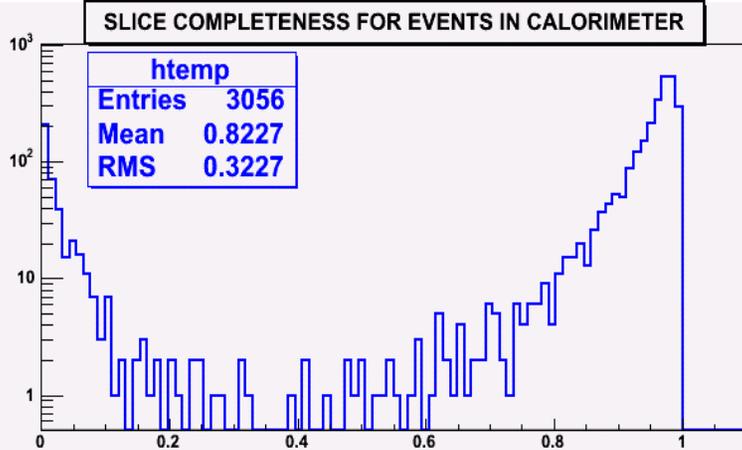
Slice Completeness (All EVENTS) ASAP (BLUE) SR (RED)



- ASAP is as good as the SR with a completeness of 95% if we neglect slices with ≤ 3 strips. The SR Slicing results in a very small number of slices with ≤ 3 strips.

ASAP results & comparison with SR 2

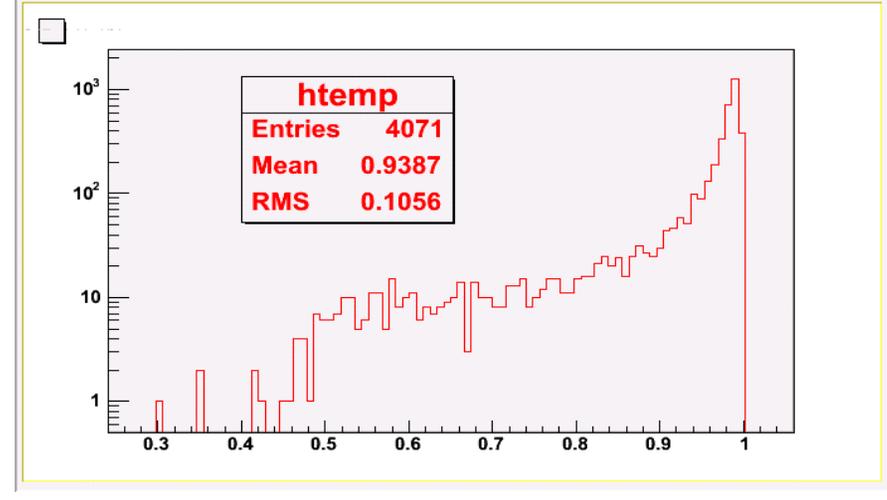
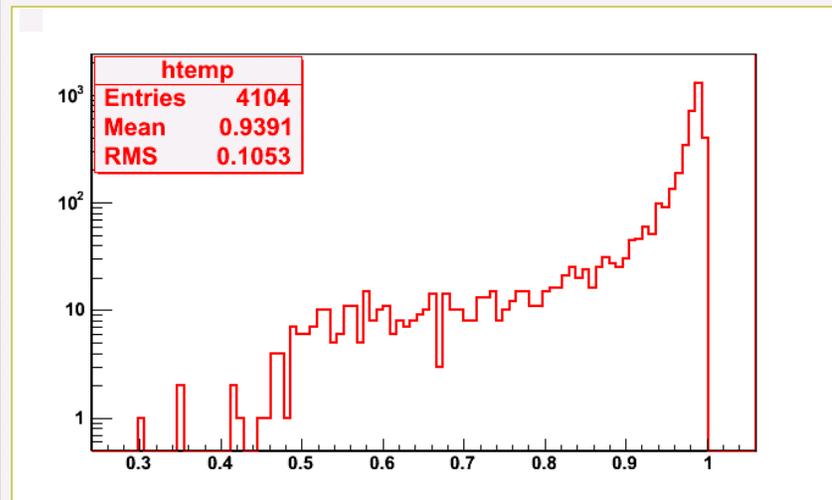
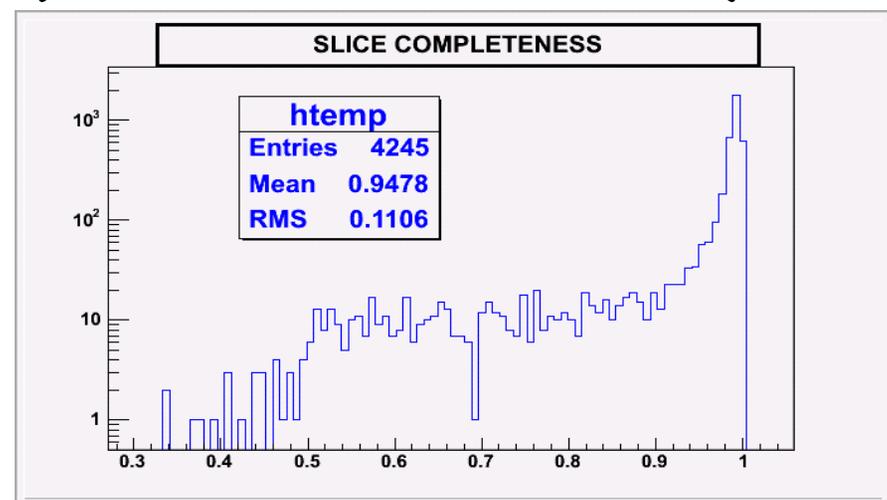
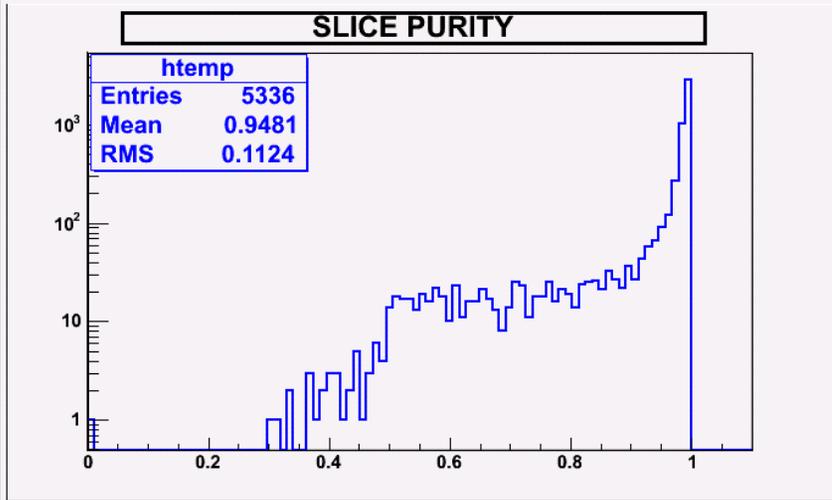
Slice Completeness (EVENTS IN THE DETECTOR)



- ASAP is slightly better than the SR with a completeness of 94% if we neglect slices with ≤ 3 strips. The SR Slicing results in a very small number of slices with ≤ 3 strips.

ASAP results & comparison with SR 3

Slice PURITY All events (LEFT) Events in the Detector (RIGHT)

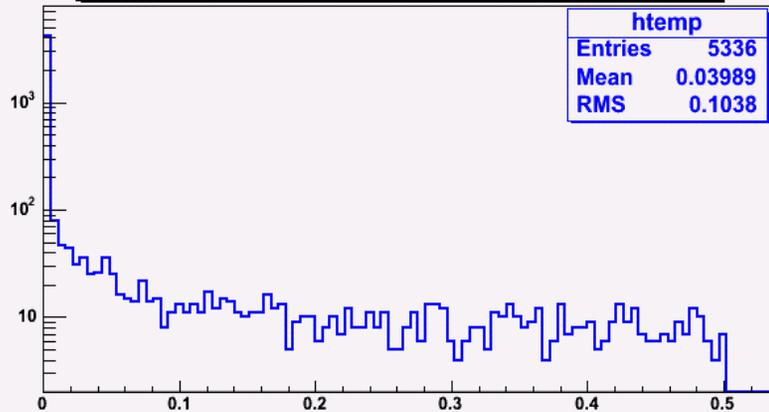


- ASAP has a higher purity than the SR ...

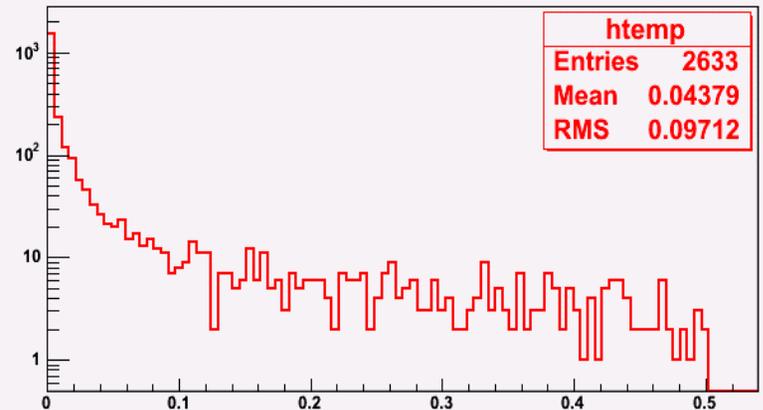
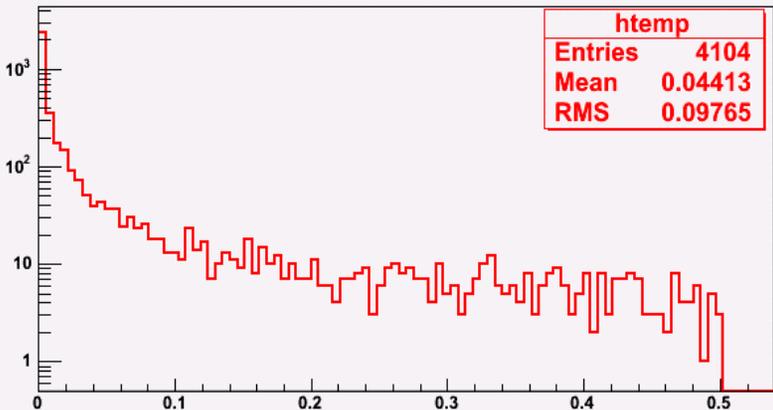
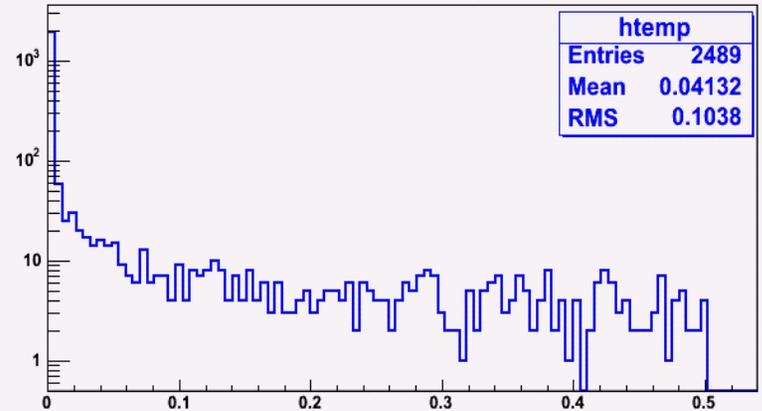
ASAP results & comparison with SR 4

Slice Second PURITY All events (left) Events in the Detector (right)

SLICE SECOND PURITY



SLICE SECOND PURITY FOR EVENTS IN THE CALORIMETER AND NSTRIP>3

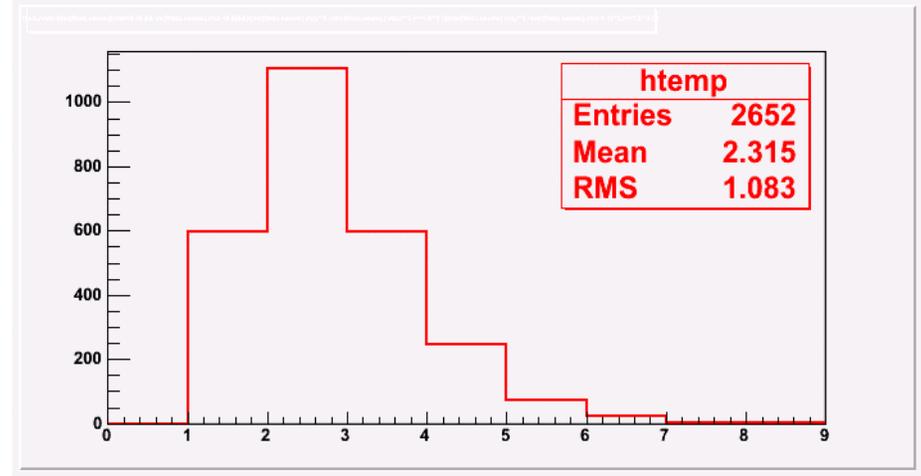
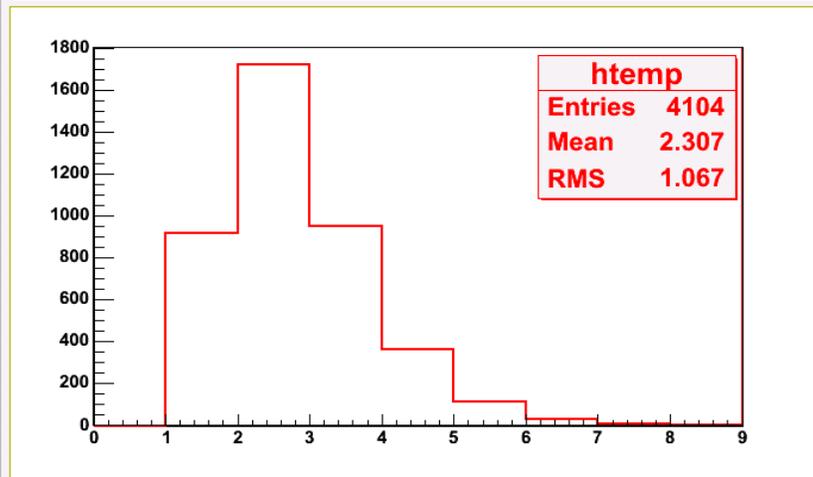
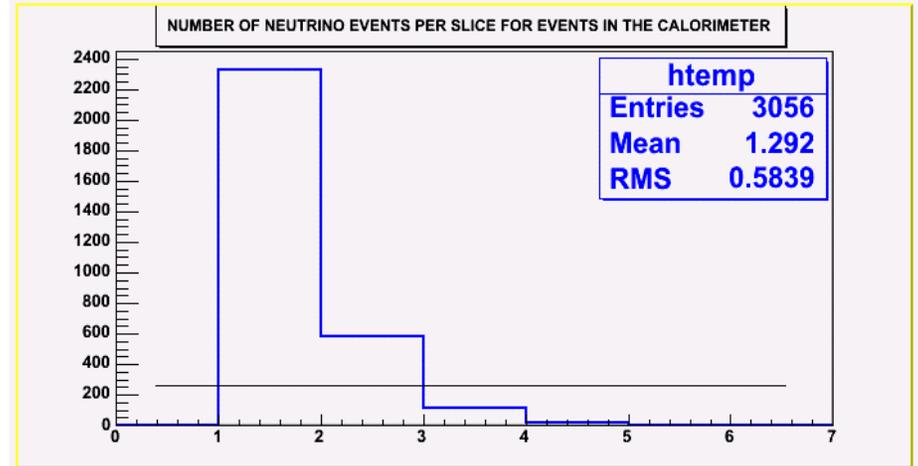
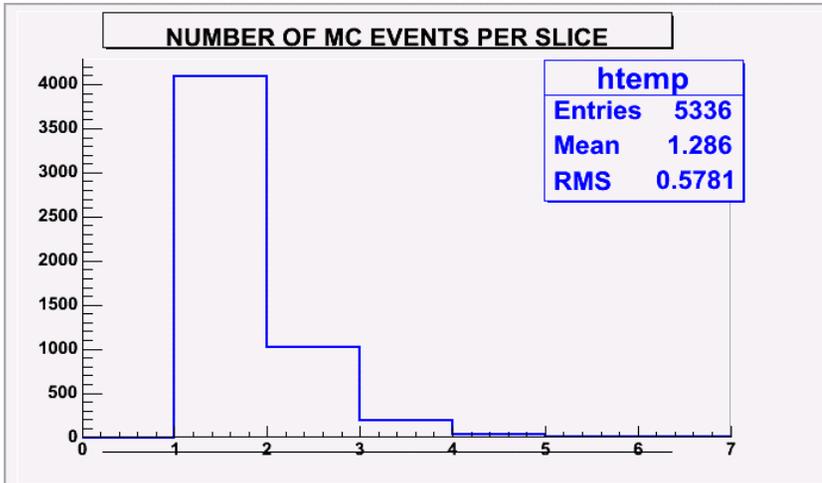


- ASAP has a lower(which is better) secondpurity than the SR

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ASAP results & comparison with SR 5

Number of Neutrino events per Slice: All events (left) Events in the Detector (right)

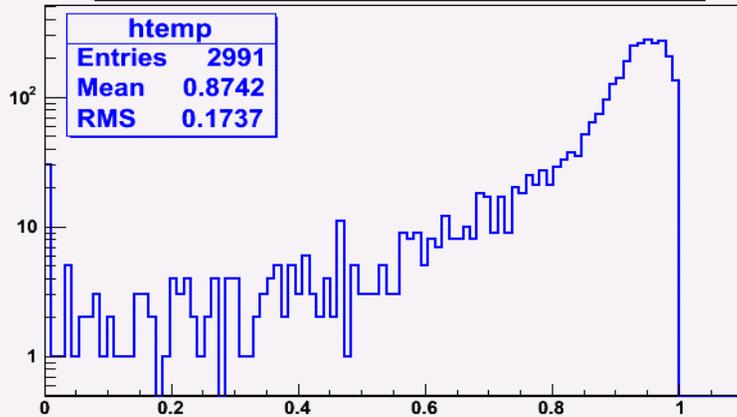


- ASAP is significantly better than the SR. Ideally we expect to have 1 neutrino event per Slice. ASAP is much closer to that than the SR. Having clean Slices should also help in better event reconstruction.

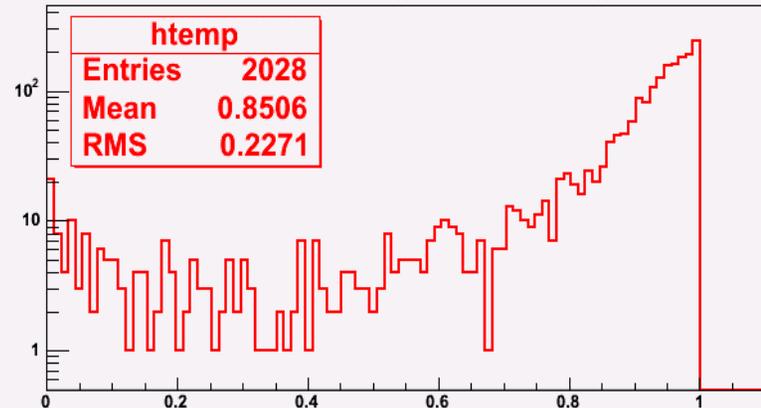
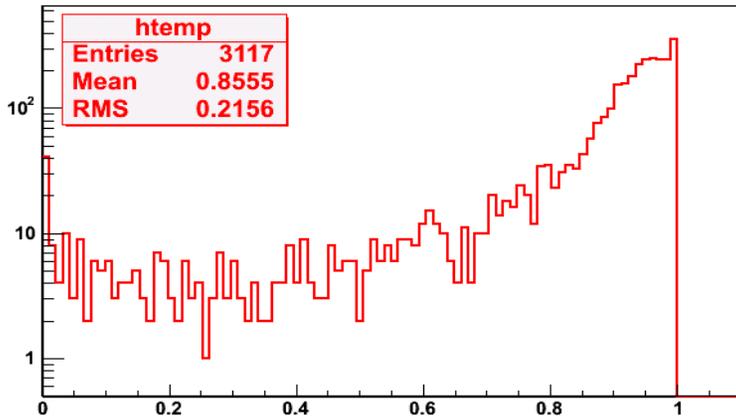
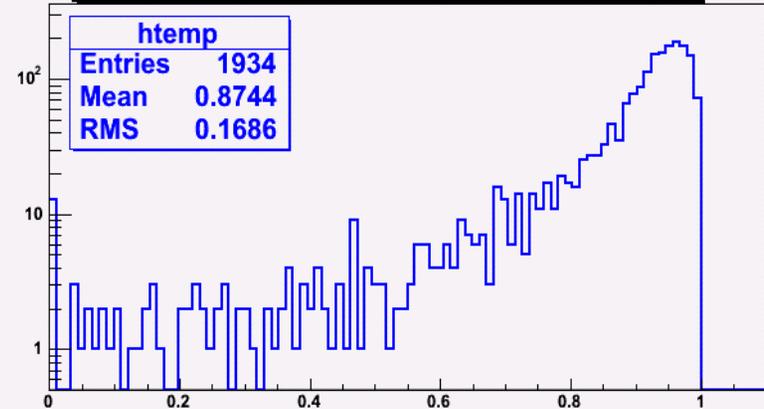
ASAP results & comparison with SR 6

Event Completeness: All events (left) Events in the Detector (right)

EVENT COMPLETENES



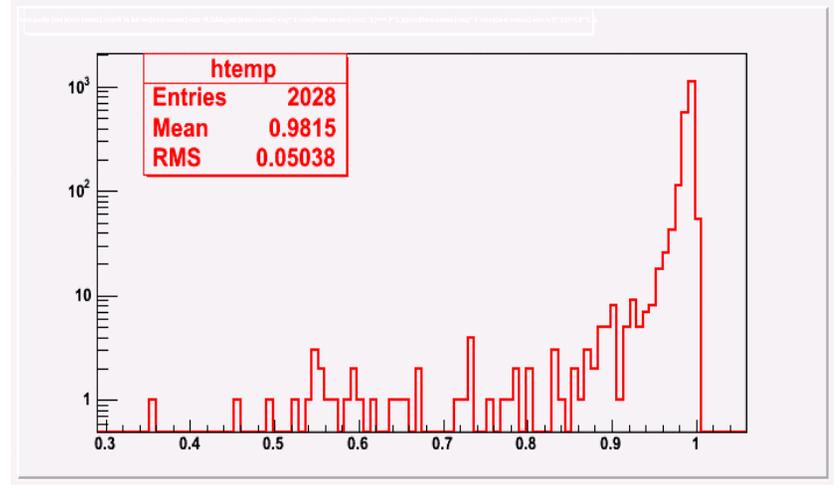
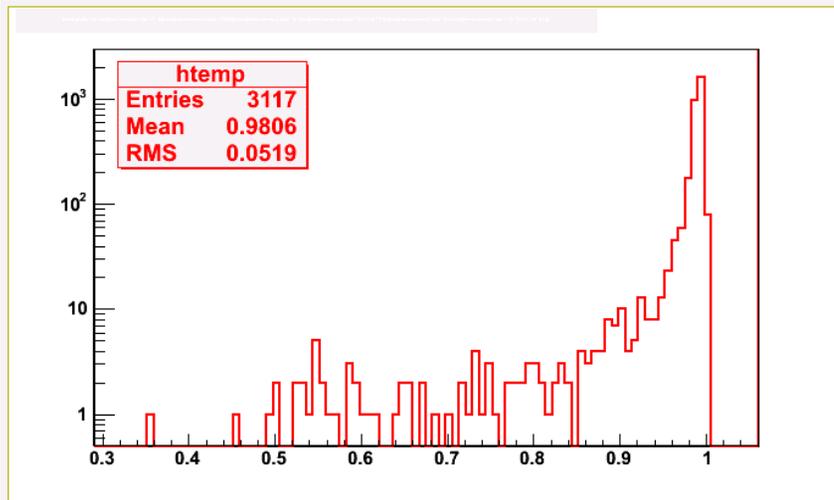
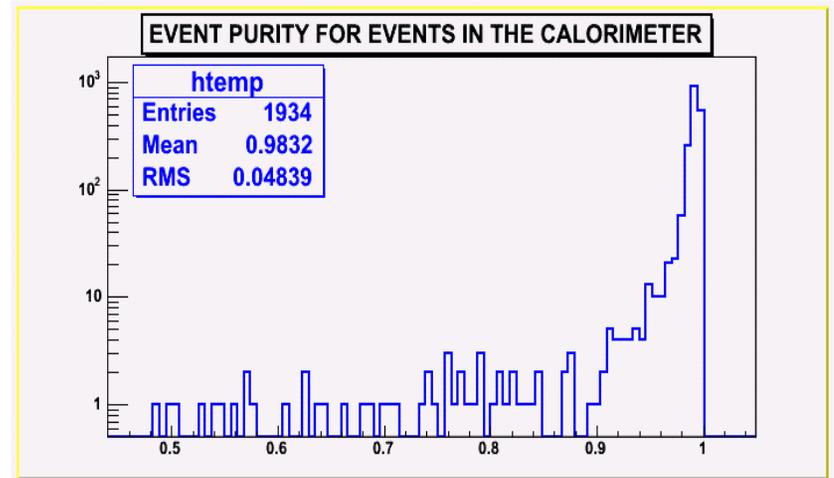
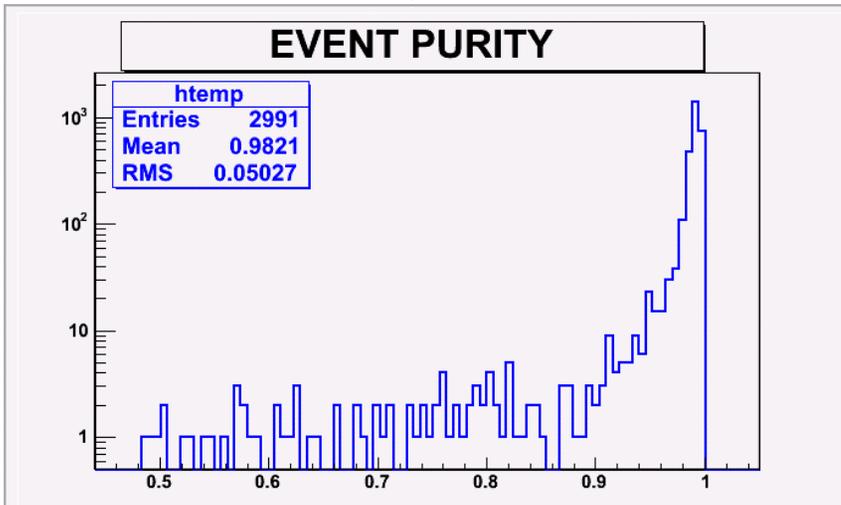
EVENT COMPLETENESS
EVENT COMPLETENESS FOR EVENTS IN THE CALORIMETER



- ASAP having a completeness of 87.5% for the reconstructed events is better than the SR (85.1%).

ASAP results & comparison with SR 7

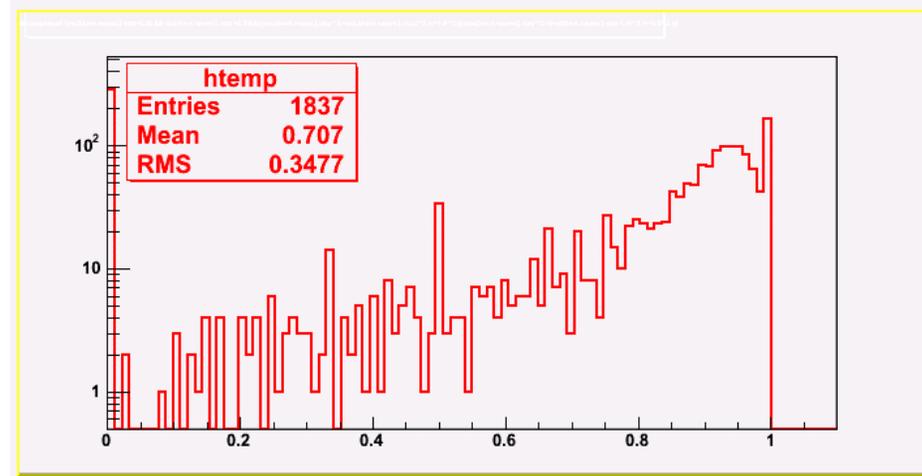
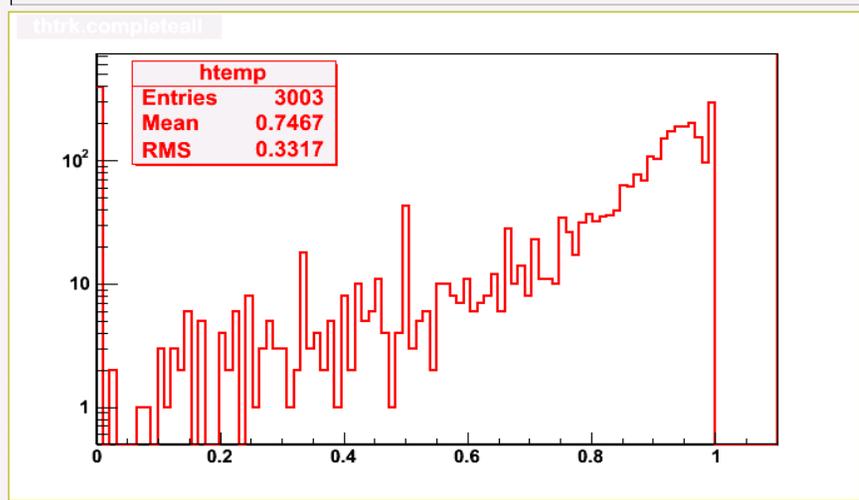
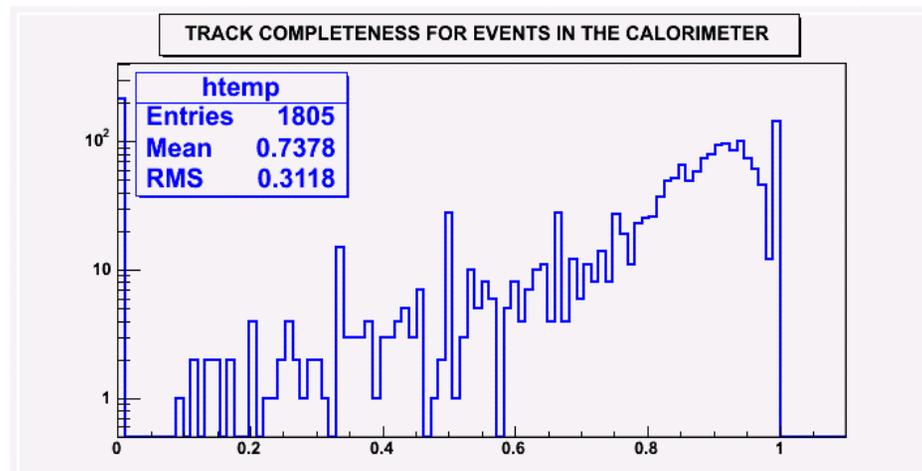
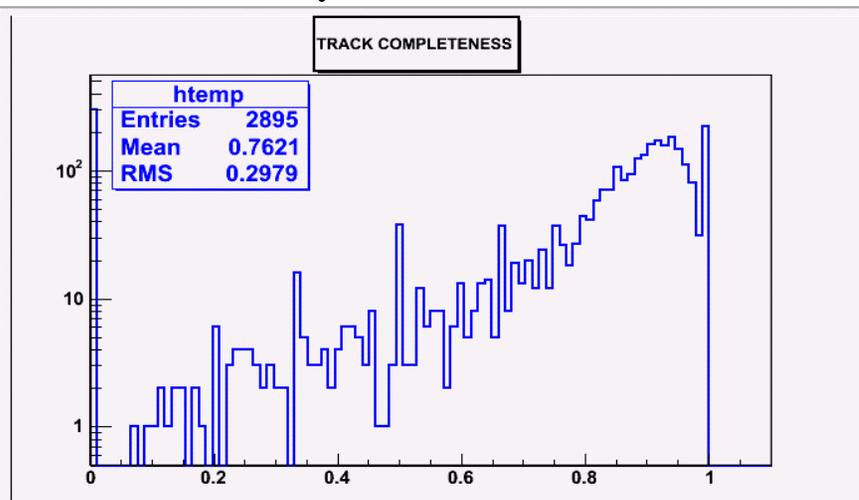
Event Purity: All events (left) Events in the Detector (right)



- ASAP and SR event reconstruction purity is the same (98%)

ASAP results & comparison with SR 8

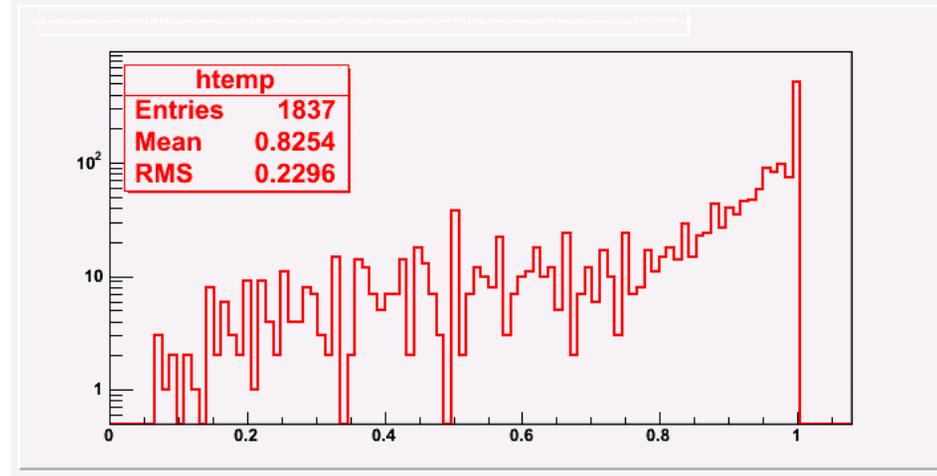
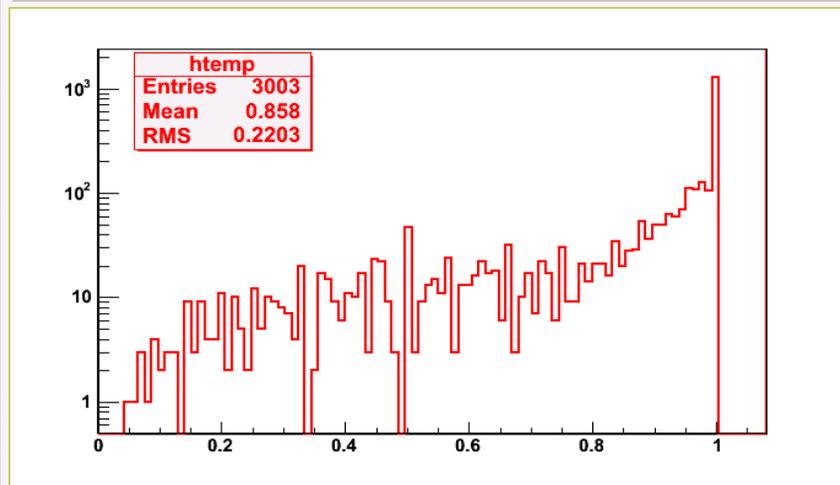
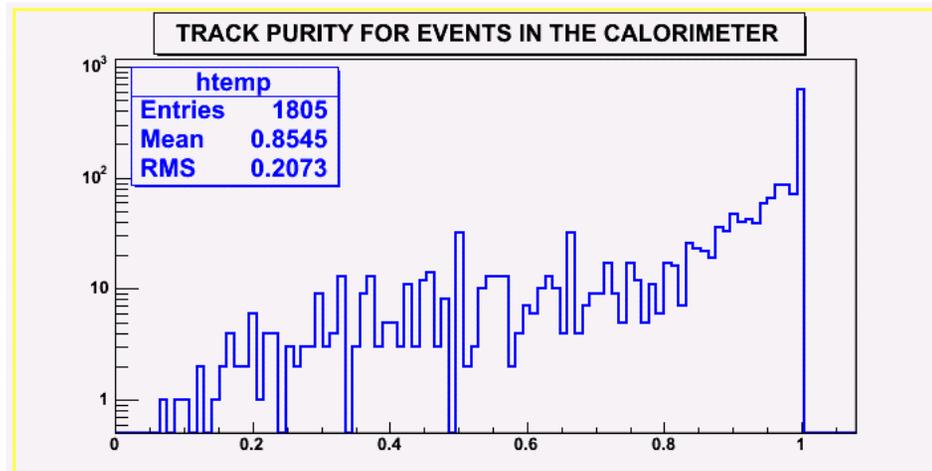
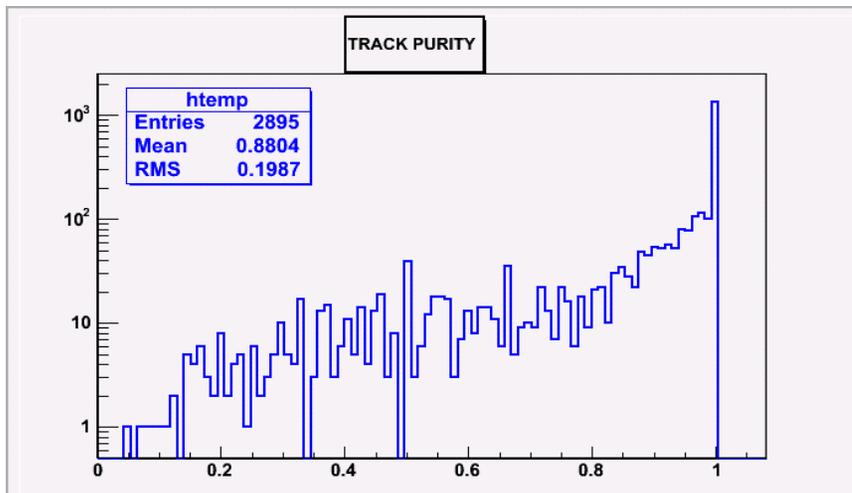
Track completeness: All events (left) Events in the Detector (right)



- ASAP has a higher track completeness (76%) than the SR (75%) especially for beam events (ASAP 74% SR 71%).

ASAP results & comparison with SR 9

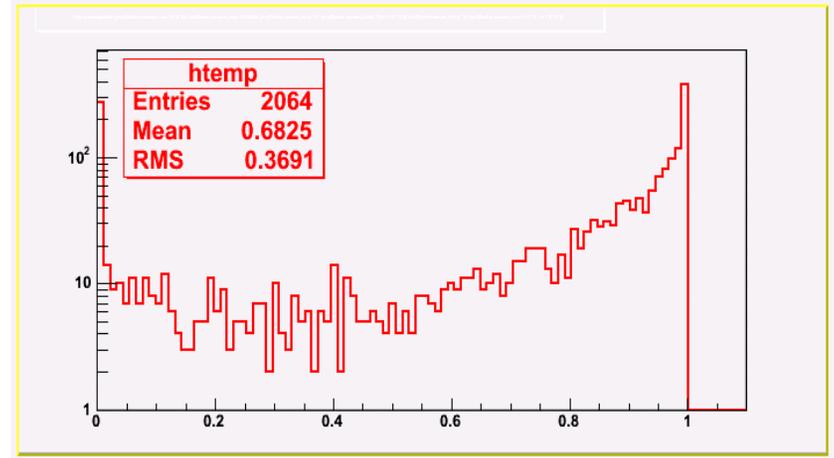
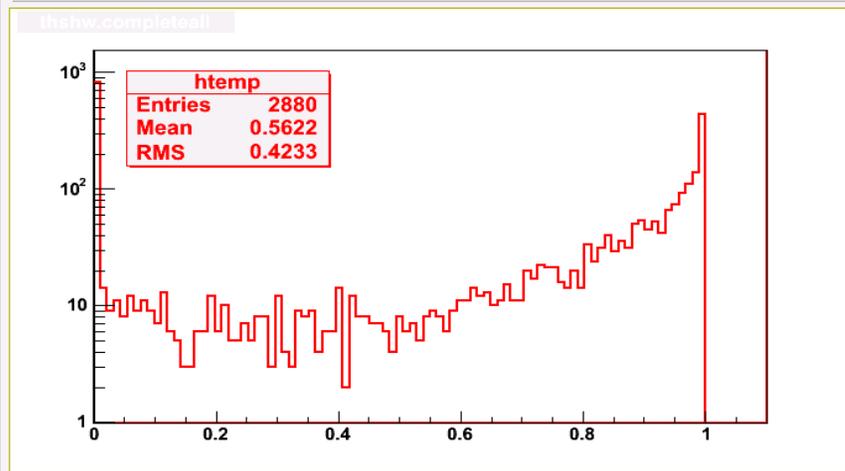
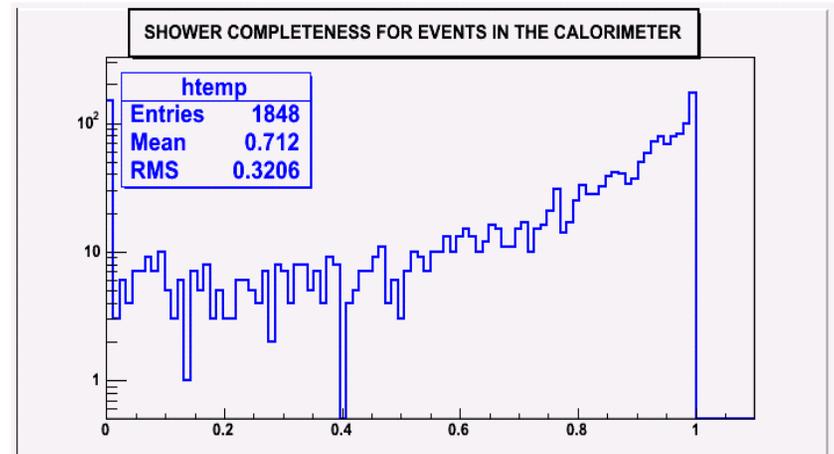
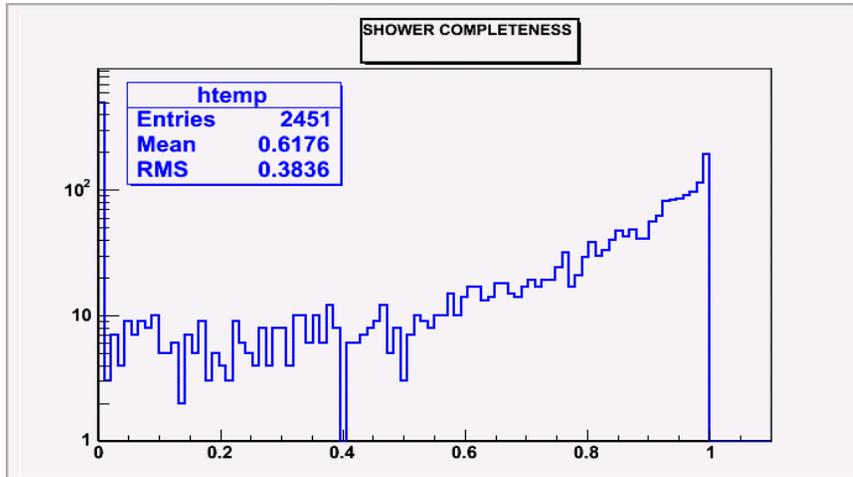
Track Purity : All events (left) Events in the Detector (right)



- ASAP has a higher track purity (88%) than the SR (86%) especially for beam events (ASAP 85% SR 82%).

ASAP results & comparison with SR 10

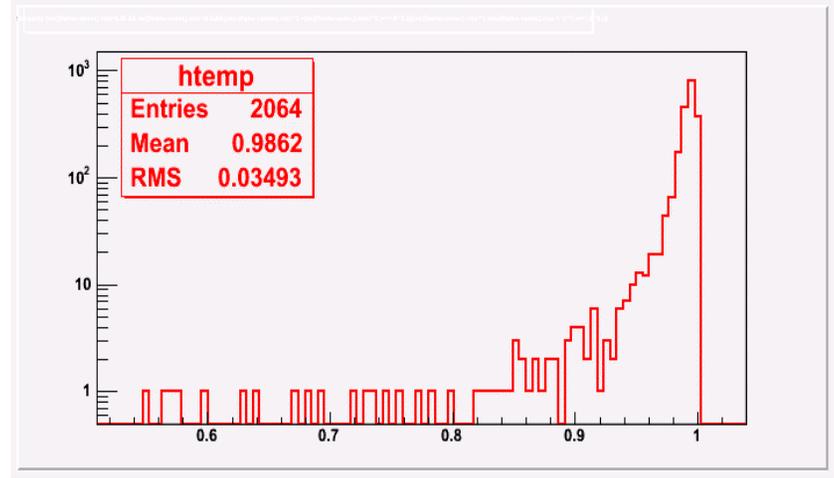
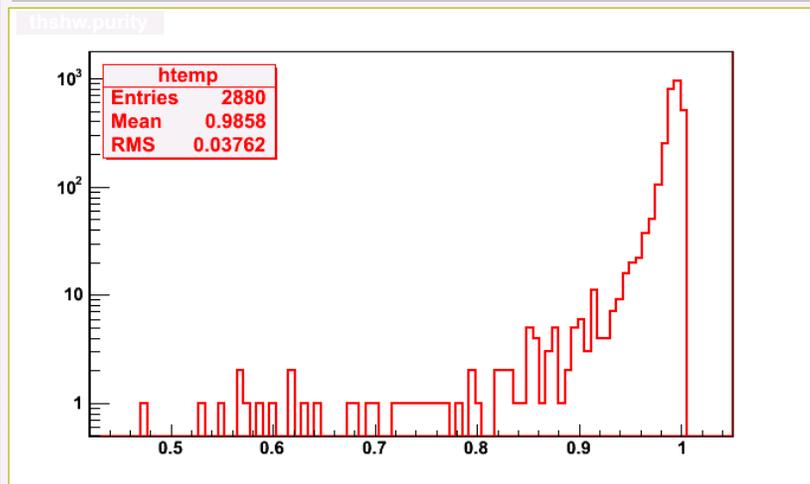
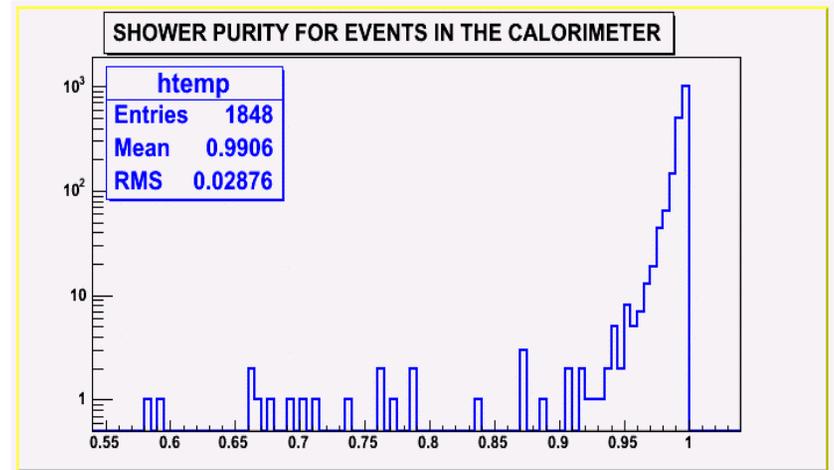
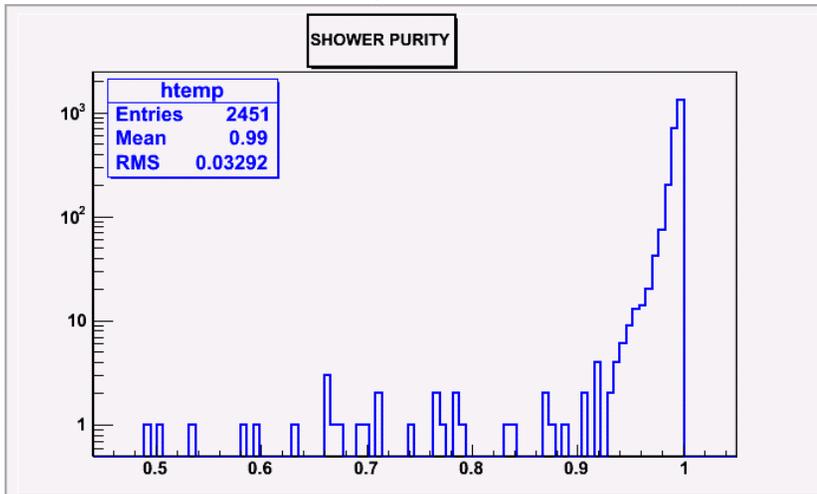
Shower Completeness: All events (left) Events in the Detector (right)



- ASAP has a higher shower completeness (62%) than the SR (56%) (for beam events (ASAP 71% SR 68%).)

ASAP results & comparison with SR 11

Shower Purity : All events (left) Events in the Detector (right)



- ASAP and SR have a high shower completeness $\sim 98\%-99\%$

NC and CC slicing efficiencies

- **ASAP :**
 - Number of MC NC events in the detector : 770
 - Number of NC Slices : 549
 - Percentage of NC sliced events : 71 %
- **SR :**
 - Number of MC NC events in the detector : 770
 - Number of NC Slices : 461
 - Percentage of NC sliced events : 60 %
- **ASAP :**
 - Number of MC CC events in the detector : 2542
 - Number of CC Slices : 2507
 - Percentage of CC sliced events : 99 %
- **SR :**
 - Number of MC CC events in the detector : 2542
 - Number of CC Slices : 2191
 - Percentage of CC sliced events : 86 %

**BUT I NEED TO MAKE SURE I AM NOT DOUBLE COUNTING
(SLICES THAT POINT TO THE SAME MC EVENT)**

NC and CC event reconstruction efficiencies

- **ASAP :**
 - Number of MC NC events in the detector : 770
 - Number of NC events : 258
 - Percentage of NC events : 33 %
- **SR :**
 - Number of MC NC events in the detector : 770
 - Number of NC events : 283
 - Percentage of NC events : 37 %
- **ASAP :**
 - Number of MC CC events in the detector : 2542
 - Number of CC events : 1676
 - Percentage of CC events : 66 %
- **SR :**
 - Number of MC CC events in the detector : 2542
 - Number of CC events : 1745
 - Percentage of CC events : 69 %

**BUT I NEED TO MAKE SURE I AM NOT DOUBLE COUNTING
(RECO EVENTS THAT POINT TO THE SAME MC EVENT)**

NC and CC number of reconstructed tracks

- **ASAP :**
 - Percentage of **CC** events with 0 tracks : 6.9 %
- **SR :**
 - Percentage of **CC** events with 0 tracks : 8.1 %
- **ASAP :**
 - Ratio of **CC** events with 0 tracks to total **NC** events : 39 %
- **SR :**
 - Ratio of **CC** events with 0 tracks to total **NC** events : 50 %

In the previous NC meeting I showed initial results on **CC/NC** separation in the ND. The main reason for the very low NC selection purity was the number of **CC** events with 0 reconstructed tracks in combination with the low ratio of **NC** events to **CC** events.

Either the new slicing method or a better reco in the 2-3 days between the processing of the **MC** file with the new method (I need to check that) resulted in a better ratio of **CC** events with 0 tracks/ Total **NC** events that will improve the separation.

Summary & Ongoing work

- This very simple slicing method gives better results than the SR in slicing and event reconstruction completeness and purities and also in the number of neutrino events per Slice.
- I need to check the possible double counting of both events and slices in order to have more representative and reliable results as far as NC and CC efficiencies are concerned.
- I want to visually scan more systematically slices and events to look in more detail on failure modes.
- I will try to have both methods (MST & ASAP) ready to be used by the offline software along with the SR (giving the user the option to select either of the three) by Monday.
- Next time I will also have results and comparisons on a high intensity file.