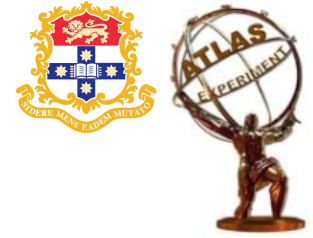


Tau Physics Validation Update

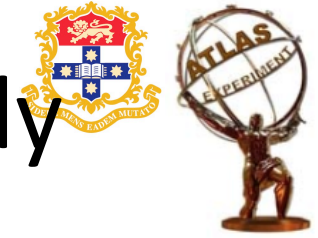
Aldo F. Saavedra
Sydney University
Tau Workshop 2009



Highlights:

- Different Pile up Scenarios with Athena 14.2.25.6
- Validating geometry GEO-06-00-00 - Good
- Reconstruction and digitisation version 15.0.0.2 – still under investigation.
- Next week
 - Simulation in 15.0.0.3
 - Atlafast II
 - New Truth strategy in Geant 4 that is default in v15.
- The studies will be soon on the web. Email announcement.

Highlights from the Pileup Study



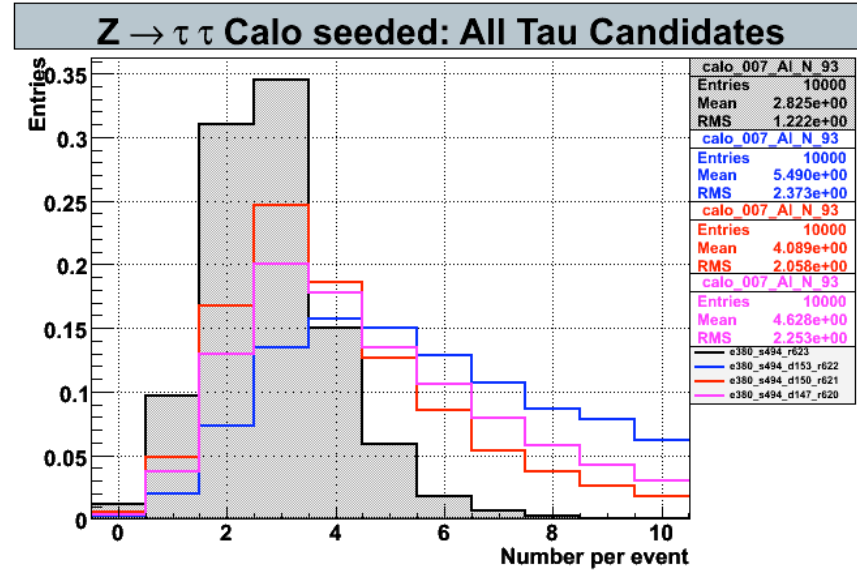
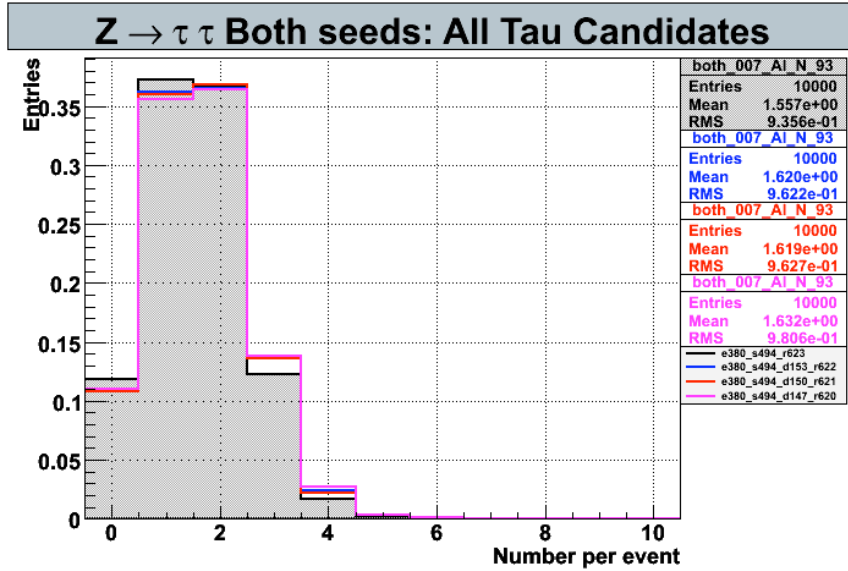
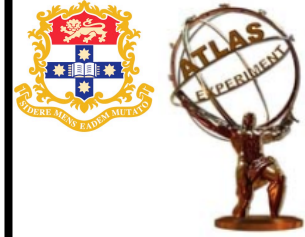
The different Scenarios for Pile Up studied for validation:
(results shown are from 105188 sample)

Sample Number	Sample Tag	Bunch Crossing (ns)	Luminosity ($\text{cm}^{-2}\text{s}^{-1}$)	Cavern Safety Factor
1	e380_s494_r623		10^{31}	N/A
2	e380_s494_d150_r621	450	10^{32}	2
3	e380_s494_d147_r620	75	10^{33}	5
4	e380_s494_d153_r622	25	2×10^{33}	5

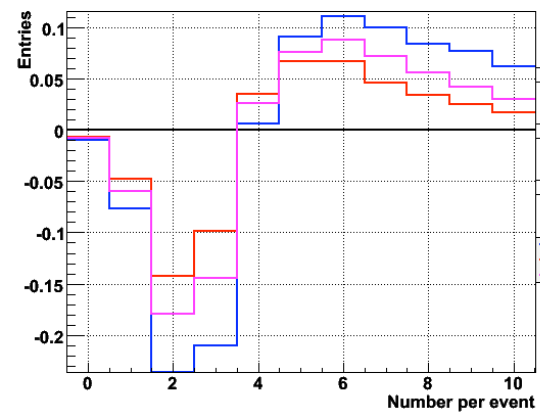
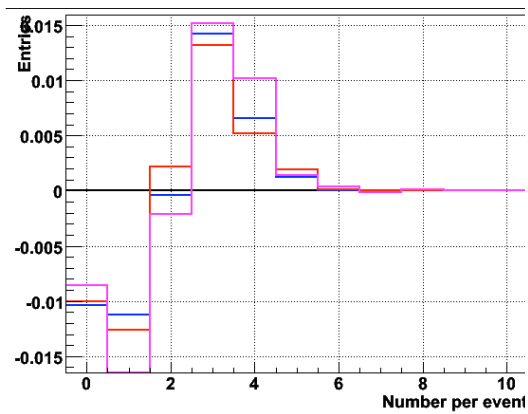
Sample Number	Cavern Events	PileUp Collisions	Initial Bunch	Final Bunch
2(Lumi001DigitConfig_450ns.py)	4	4.1	-2	2
3(Lumi010DigitConfig_75ns.py)	7	6.9	-12	11
4(Lumi020DigitConfig_25ns.py)	5	4.6	-36	32

Number of reconstructed tau objects:

- No PileUp
- 25ns, 2×10^{33}
- 450ns, 1×10^{32}
- 75ns, 1×10^{33}



Difference between the reference sample (no pileup) and pile up samples



Both Seeds Efficiency:



No PileUp **Average Efficiency Difference (%)**
Efficiency(%) 450ns, 1×10^{32} 75ns, 1×10^{33} 25ns, 2×10^{33}

Title	Mean(Ref)	Ref-Test Eff	Ref-Test Eff	Ref-Test Eff
1 Prong Matched ϕ Efficiency	61.97	3.58	5.79	4.57
1 Prong Matched + ID ϕ Efficiency	38.91	12.17	15.87	17.87
3 Prong Matched ϕ Efficiency	61.90	3.17	3.62	3.56
3 Prong Matched + ID ϕ Efficiency	47.93	11.60	15.76	19.86
All Matched ϕ Efficiency	71.66	0.24	0.58	1.02
All Matched + ID ϕ Efficiency	42.18	12.05	16.11	18.66
1 Prong Matched η Efficiency	61.97	3.58	5.79	4.57
1 Prong Matched + ID η Efficiency	38.91	12.17	15.87	17.87
3 Prong Matched η Efficiency	61.90	3.17	3.62	3.56
3 Prong Matched + ID η Efficiency	47.93	11.60	15.76	19.86
All Matched η Efficiency	71.66	0.24	0.58	1.02
All Matched + ID η Efficiency	42.18	12.05	16.11	18.66
1 Prong Matched P_T Efficiency	61.88	3.57	5.81	4.58
1 Prong Matched + ID P_T Efficiency	38.78	12.17	15.92	17.90
3 Prong Matched P_T Efficiency	61.89	3.19	3.67	3.58
3 Prong Matched + ID P_T Efficiency	47.86	11.66	15.84	19.92
All Matched P_T Efficiency	71.58	0.23	0.59	1.03
All Matched + ID P_T Efficiency	42.05	12.04	16.14	18.69

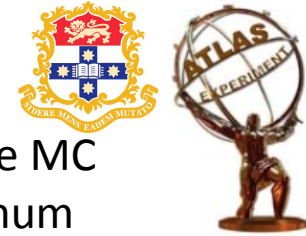
- The overall efficiency has not been affected by the scenarios

- There is a big drop in efficiency for matched 1prong and 3prong candidates.

- The pile-up is affecting the correct number of tracks in each candidate.

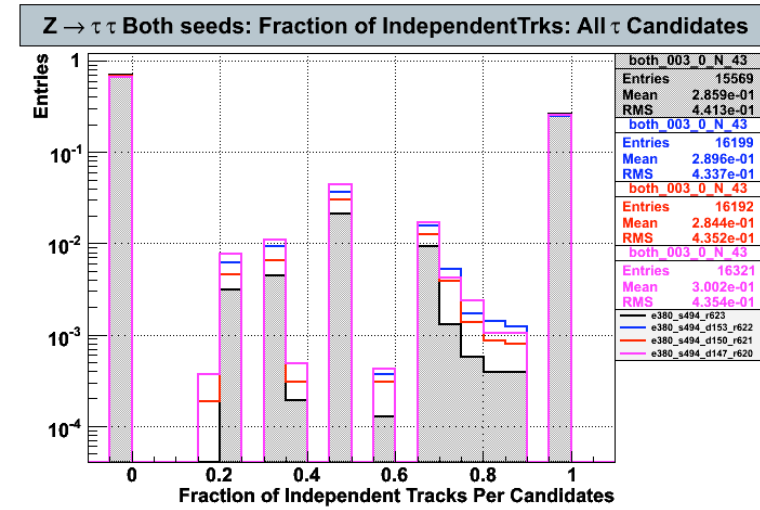
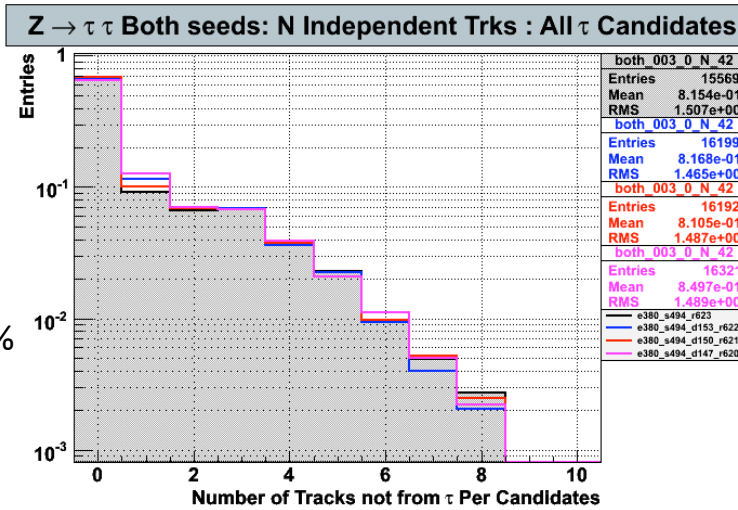
• Yellow is an average difference less than 5%. Red is an average difference greater than 5%.

Tracks from Tau Candidates: (Preliminary)

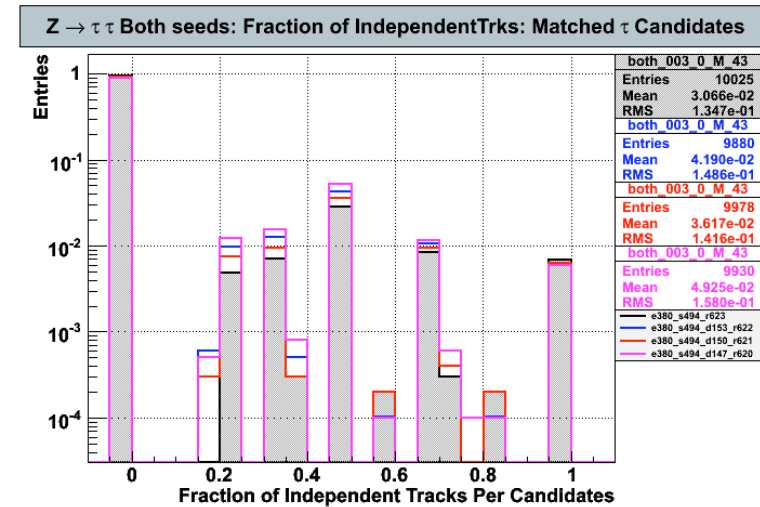
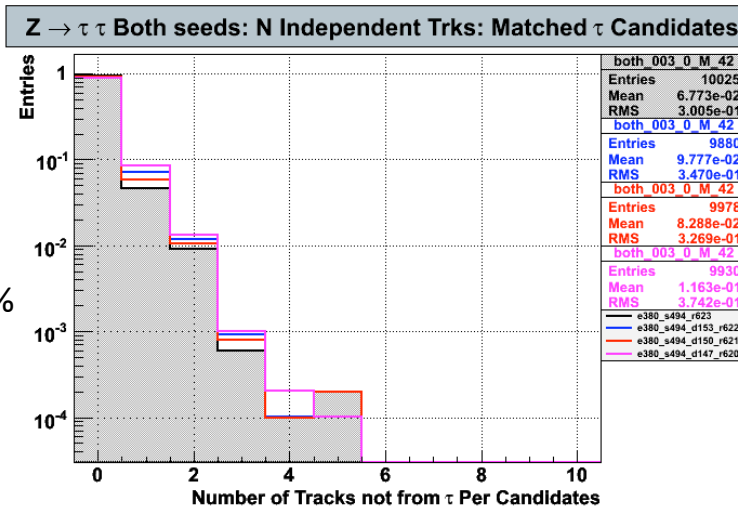


- Independent tracks are tracks which had a probability greater than 0.8 but the MC particle associated with it did not come from the tau. Most probably minimum bias.

The percentage with no independent tracks is:
No pileup: 70%
Pileup: 66-69%



The percentage with no independent tracks is:
No pileup: 95%
Pileup: 90-93%

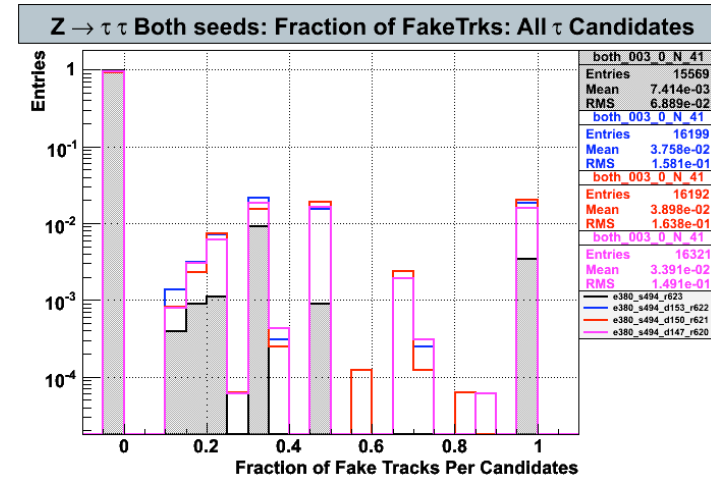
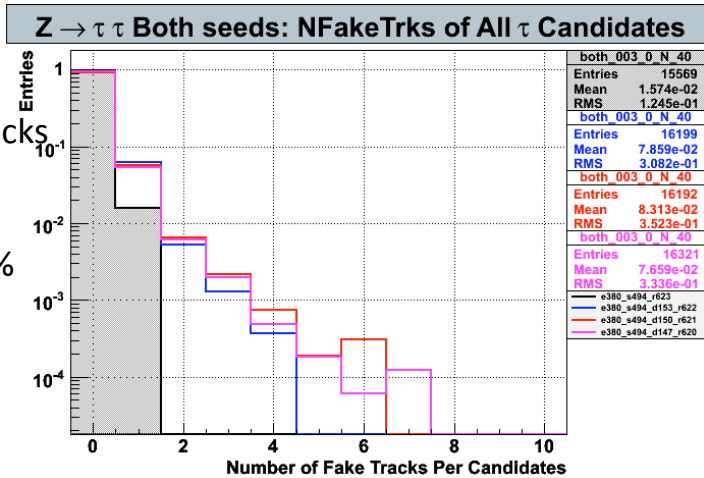


Tracks from Tau Candidates: (Preliminary)

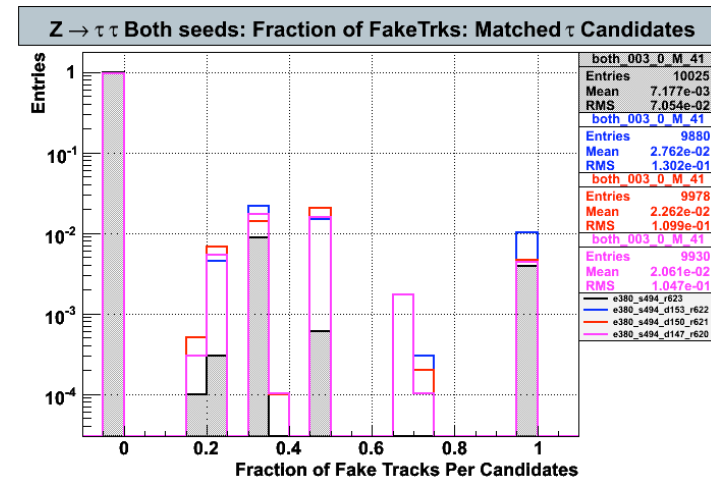
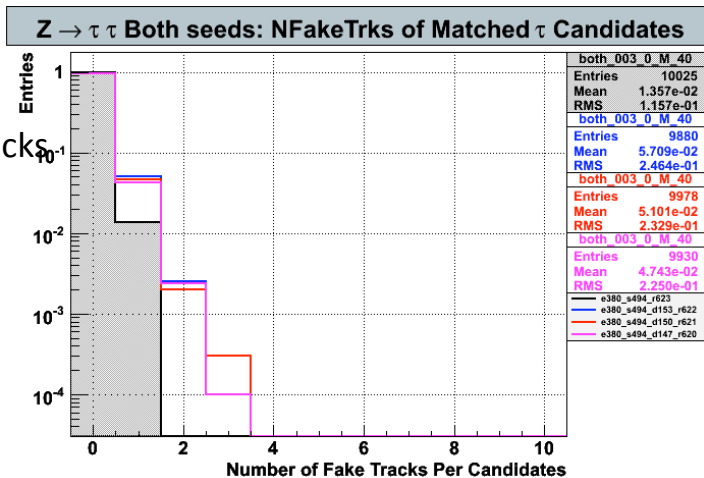


- Fake tau tracks are tracks whose probability was less than 0.8.

The percentage for zero fake tracks is:
No pileup: 98%
Pileup: 94-93%

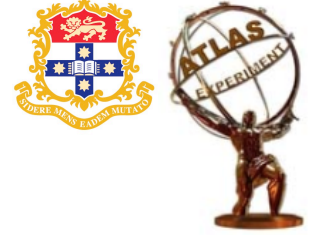


The percentage for zero fake tracks is:
No pileup: 99%
Pileup: 95%



The increase in fake tracks and independent tracks is affecting the 1prong and 3prong efficiency

Pile up Conclusion



- The tau reconstruction package managed to reconstruct candidates under early running pile-up conditions.
- It has been shown that number of fake tracks and tracks from particles associated with the hadronic tau decay affected the efficiency of 1prong and 3prongs. A good parameter to keep an eye on for subsequent validations.
- More work is needed to understand the changes in energy resolution and identification.