Trigger & Physics week

- Trigger & physics week May 29-June 1
- Format: plenary opening and conclusions, parallel trigger & physics group meetings
- Special emphasis on early running with low luminosity
- Physics talk largely “trigger aware”
- Agenda and talks available at http://agenda.cern.ch/fullAgenda.php?ida=a062332

Conditions for early running

- Initial luminosity: about $L=10^{31}cm^{-2}s^{-1}$;
- Bunch spacing: 75 ns;
  - Whe know which “25 ns” bunch is filled-in;
  - Excellent opportunity to relax the timing of the several systems
  - No real problem to identify the Bunch Crossing
- Background in the muon system: is expected to be not a concern even in the more pessimistic scenarios
  - Trigger: time calibration not critical→relax the pulse width of the trigger detector signals
  - Low occupancy of the muon chambers
- Data Acqusition rate: 200 events/s, for 1.5 MB average event size; it can go up to 400 MB/s (see D. Francis talk)

(A. Nisati)

LVL1-only Menu @ 10^{31}

Object (GeV)	rate(Hz)	prescaling
Muon 6(5)	40	6
Muon 20	14	1
Dimuons 2x6 (2x5)	3	1
e/γ/τ 25	20	10
e/γ/τ 15	20	70
2e/2γ/2τ 2x15	20??	1
Jets: 25,50,90,200	22	10^4,10^3,25,1
Dijets,Trijets,...	10	?
ETMiss 25,100	30	?
Minimum Bias	20	$5x10^4$
and/or random trigger		
Monitoring/Diagnostics	20	1
TOTAL RATE	**219**	

LVL1*HLT Menu @ 10^{31}

Object (GeV)	LVL1(Hz)	HLT	prescaling
Muon 6(5)	240	40	1
Muon 20	14	1	1
Dimuons 2x6 (2x5)	3	3	1
e/(γ)/τ 25	200	1?	1
❖ γ 40		?	1
e/(γ)/τ 15	1000	10?	1
2**e**/(2γ)/2τ 2x15	20??	<1	1
❖ 2γ 20		<1	1
Tau*ETMiss			
Jets: 25,50,90,200	2200?	?	10^2,10,1,1
Dijets,Trijets,...	10	?	1
ETMiss 25,100	30?	?	?
B-Physics	uses muon low-pt selection		
Minimum Bias	20	?	$5x10^4$
Monitoring/Diagnostics	10	30	

Release 11.0.x

- Current production release
  - Clients are physics validation, detector commissioning, CTB, HLT
- 11.0.0 built on 21 Oct 2005
  - 11.0.1 (11 Nov), 11.0.2 (25 Nov), 11.0.3 (15 Dec), 11.0.4 (21 Jan 2006)
  - 11.0.41 (10 Feb), 11.0.42 (30 Mar)
  - 11.0.5 (1 Apr)
  - 11.0.6 open for HLT
- Long, slow convergence to production quality
  - Late discovery of problems
  - Stress the importance of early and repeated validation
  - Users cannot just wait until production quality achieved - they need to be actively involved in validation

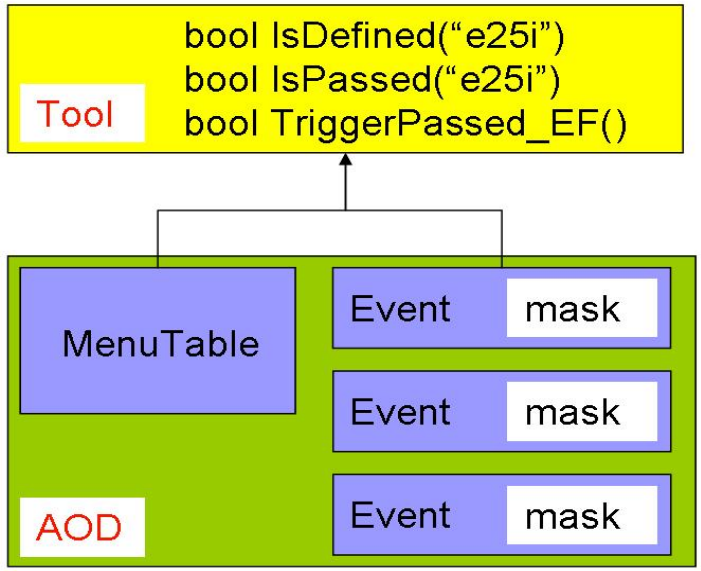
D. Quarrie

Release 12

- Release 11.5.0 built 7-9 May
  - Pre-release for release 12
- Release 12 build started on 23 May (distribution being validated now)
  - Delayed primarily because of persistency problems due to ROOT5 migration
    - See later slide
- Primary goals
  - Complete implementation of as-built geometry for all detectors
  - Conditions DB infrastructure in place and significant usage of COOL
    - Includes new COOL functionality (requires ROOT5)
  - Trigger AOD EDM in place
  - Implementation of MC Truth Task Force Recommendations
  - Implementation of Event Tag Working Group Recommendations
  - New Tracking validated and performance equal or better than alternatives
  - Backwards compatibility support in place for simulated data

TriggerDecision for physics analysis

- Typical application for 'physicists'
  - Find out if event was trigger/not triggered
  - Find out if signature was in trigger menu
  - Note: trigger decision is event decision, not object decision



- Signatures passed/failed/prescaled encoded in a **bit pattern** for each reconstructed event: must be **interpreted** through a MenuTable

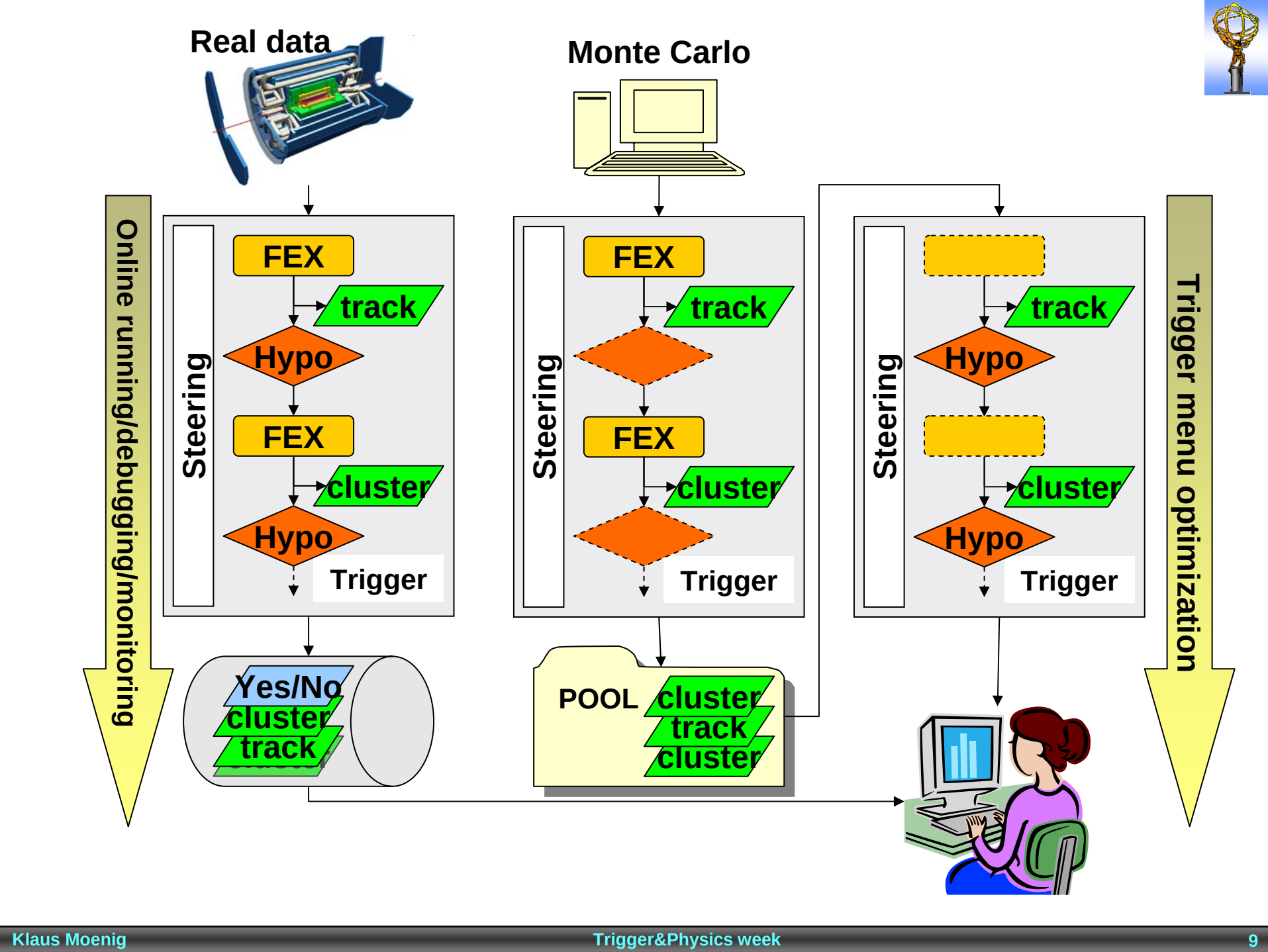
- This is the purpose of the TriggerDecision object

R. Goncalo

Advanced analysis for experts

- Using additional trigger information:
  - Compare with offline object and figure out e.g. why electron didn't trigger e25i whereas offline electron is 'good' electron
  - Needs some navigation from signature to particles, e.g. TrigElectron

- Re-run the hypothesis algorithms e.g. to do
    - Optimisation of given trigger item
    - Test new optimisations on physics channels
    - Develop new triggers
    - Debug trigger menu
  - Need to re-run trigger steering in AOD/ESD analysis


Real data
Monte Carlo
Online running/debugging/monitoring
Trigger menu optimization
Steering
FEX
track
Hypo
FEX
cluster
Hypo
Trigger
Steering
FEX
track
FEX
cluster
Trigger
Steering
track
Hypo
cluster
Hypo
Trigger
Yes/No
cluster
track
POOL
cluster
track
cluster

E-gamma trigger

- Trigger Software issues
  - All algorithms for e/gamma available, though EF egammaRec, EF cluster reconstruction still needs validating
  - e/g trigger objects added to AOD/ESD
  - 11.0.5 recommended release for combined trigger+offline studies
  - Some ‘official’ production samples should become available soon
  - First functionality for trigger-aware analysis available
  - Tutorial available
    - https://twiki.cern.ch/twiki/bin/view/Atlas/TriggerPATTutorial

D. Froidevaux

Trigger-aware analysis in GMSB channel (OJinnouchi)

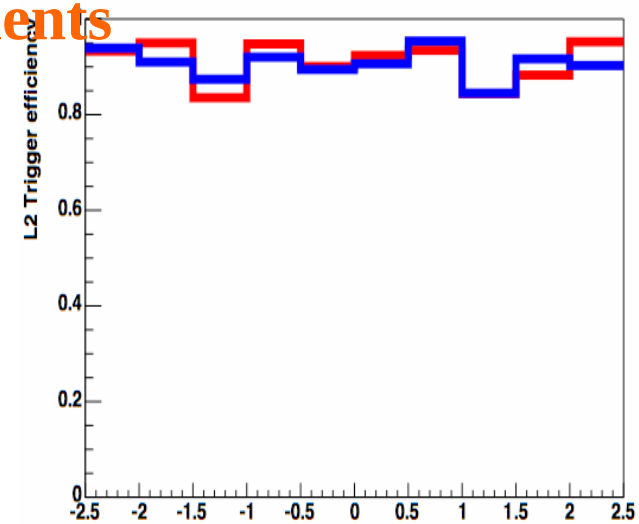
- **Peculiar event signature (*m*γ's + *n*Leptons + Jets + EtMiss)**
- ***G* is the LSP – all SUSY decays lead to G productions (R-parity assumed)**
- **Here, focus is on one of the typical parameter points (G1a: mGMSB LHC points, short x10 lifetime → photons look like primary γ)**
- **Check of photon trigger on this channel (to be seen: does one need it?)**
  - **Use Rome optimisations**

	1γ60	2γ20(i)	OR
After L1	0.99	0.99	1.00
After L2	0.89		0.99
After EF	0.80	0.63	0.87

  - **Efficiency normalised to p_T (γ1), p_T(γ2) > 20GeV, |η| < 2.5 (also removing cracks) on particle level**
- **First impression:**
  - **With 11.0.5, TAA is not so straightforward to use (on the other hand, good to know what is happening inside for the trigger decisions) → hope for improvements in 12.0.x**

$e^{\pm}$ trigger efficiency measured from Z→ee data

- Control sample: "Good" Z from 2 offline e^+e^- with loose selection cuts) + 1 $e^{\pm}$ trigger signature satisfied (take bgd into account)
- Trigger efficiency determined from counting in how many cases the second $e^{\pm}$ satisfies the trigger requirements



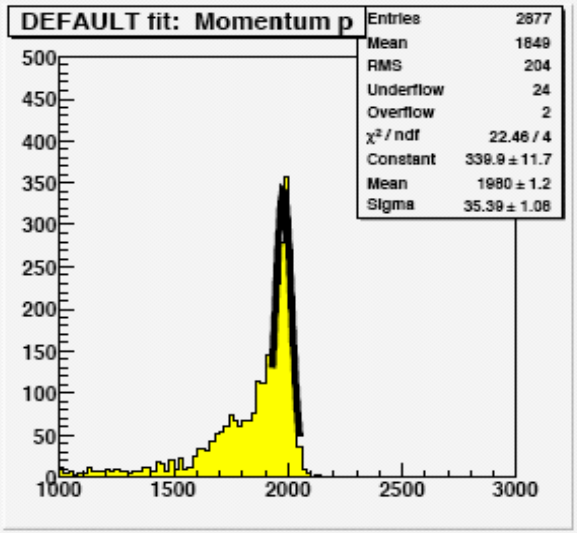
- Analysis done for L2 on ESD's
  - Run L2 hypothesis on ESD's using Release 11.0.5
  - Extract $\varepsilon_{L2/L1}$ = [93.3 ± 0.7 (stat)] %
- Further studies are needed to determine the trigger efficiency as a function of η, ϕ, E_T and also charge sign
- Systematics need to be studied (e.g. from electrons lost by trigger/reco and appearing in background, from correlations between two electrons)

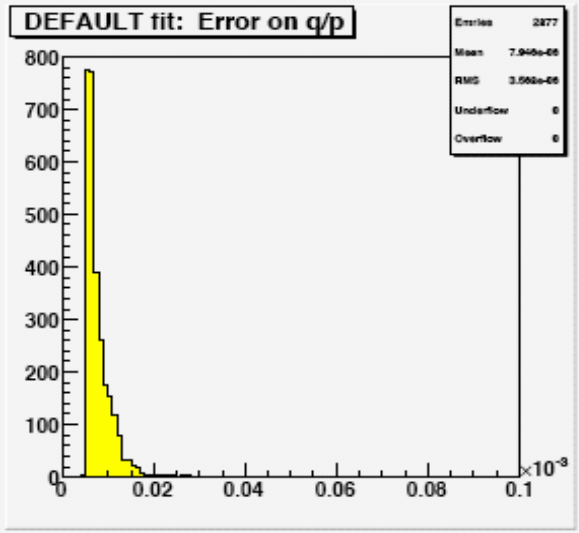
T. Fonseca

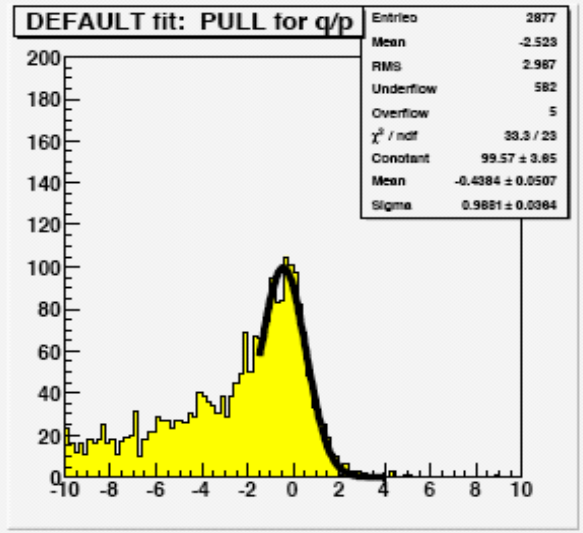
Brem recovery

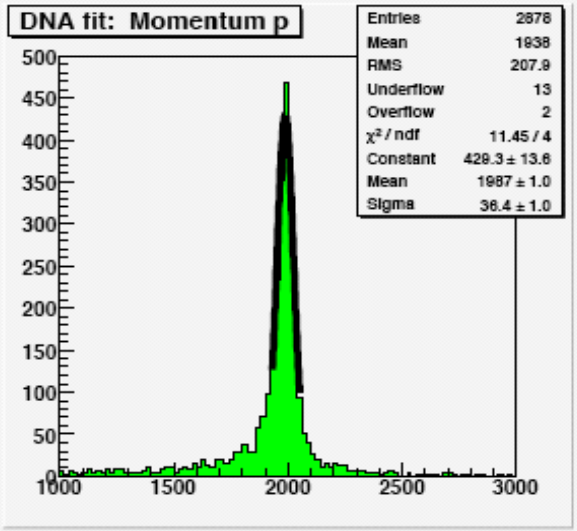
V. Kartvelishvili

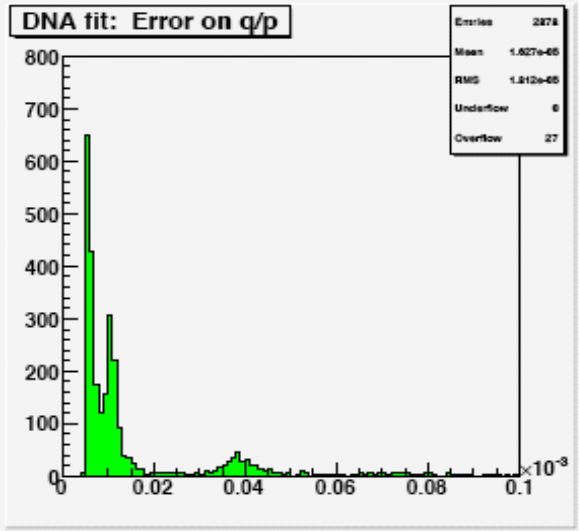
2 GeV single electrons, barrel only

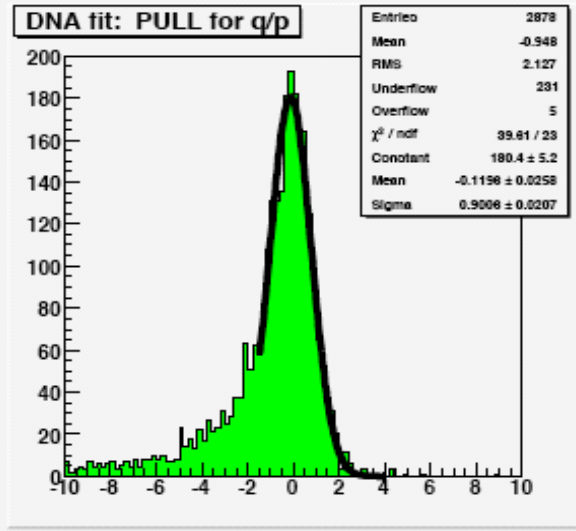




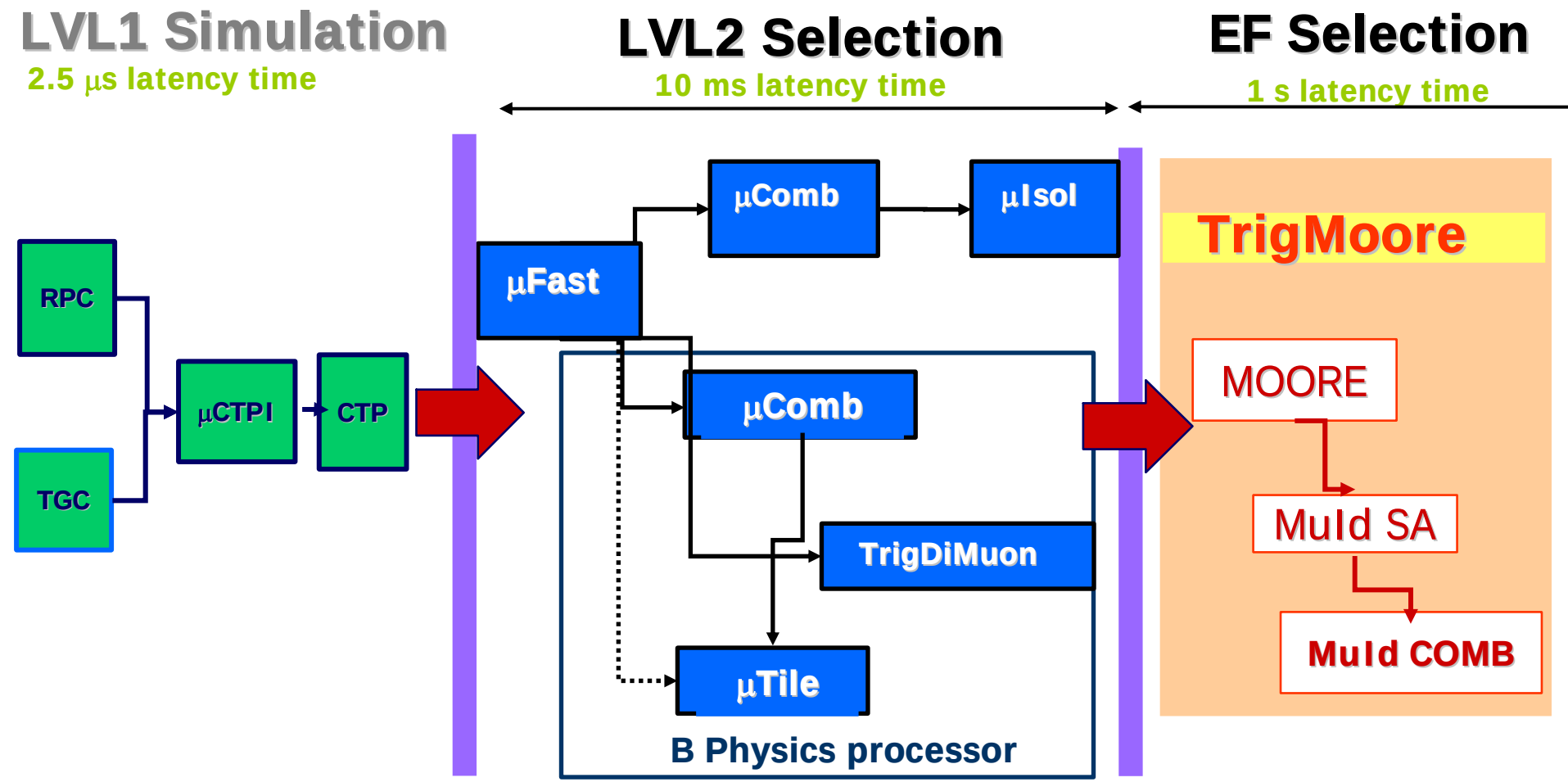




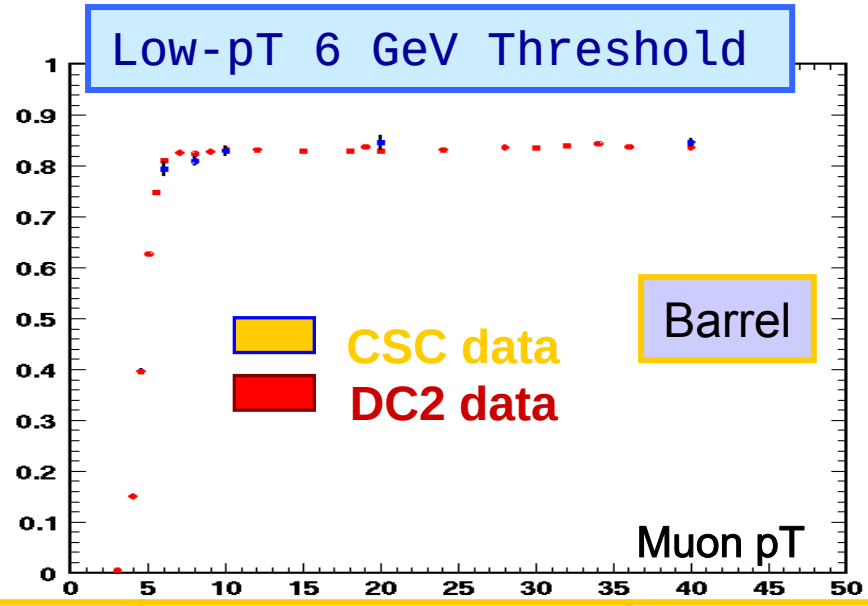


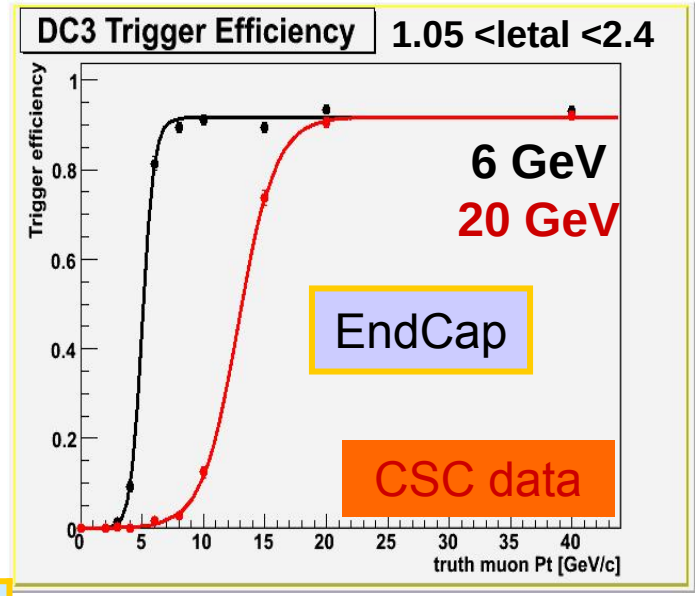


Muon Trigger Slice



LVL 1 Muon Trigger : Barrel and EndCap

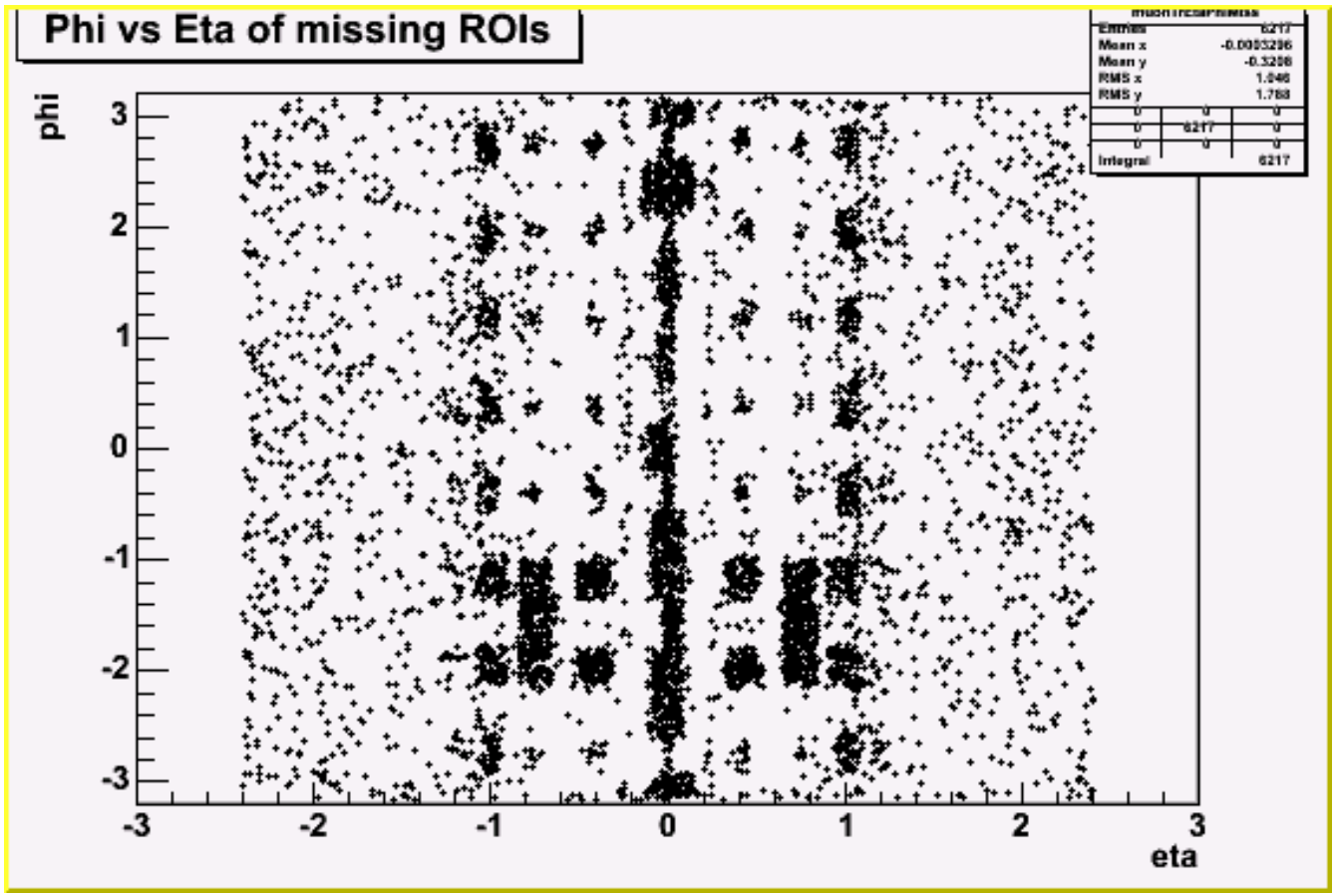




	Barrel Rates (kHz)		End Cap Rates (kHz)	
Muon sources	6 GeV threshold Lumi=10^{33}	20 GeV threshold Lumi=10^{34}	6 GeV threshold Lumi=10^{33}	20 GeV threshold Lumi=10^{34}
π/K	9.3	1.1	*5.9*	*6.4*
b	1.6	0.7	*1.8*	*1.2*
c	0.9	0.3	*1.0*	*0.6*
W	0.003	0.03	*negligible*	*negligible*

- Efficiencies and rates are under control
- EndCap rates could be further reduced by masking specific module
- Ongoing analysis on cosmic simulation
- Overlap handling reduces dimuon LVL1 fake rates

Muon LVL1 Trigger Efficiency

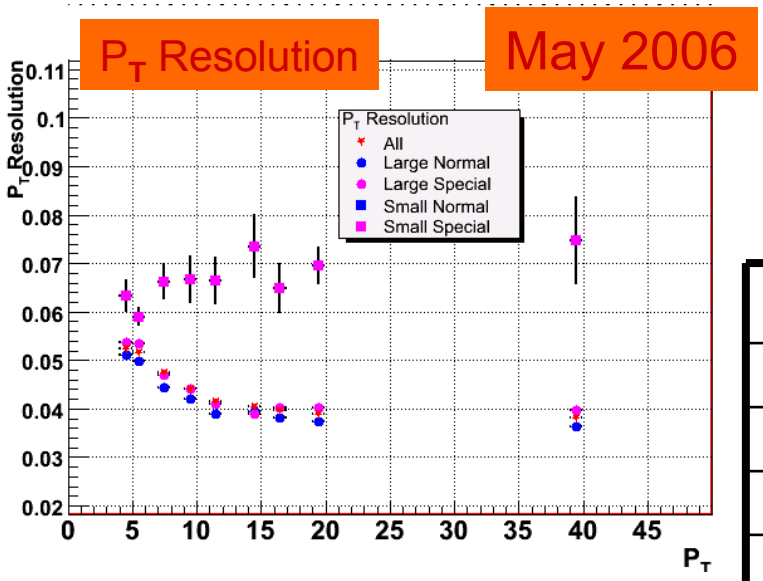


- η-ϕ of the true muons not matching any ROI
- Feet, ribs, lift and cracks are clearly visible

- Well matching the results obtained by the muon-LVL1 trigger group, directly using LVL1 simulation – check of AOD content (see talk by F. Conventi at the Muon Trigger session)

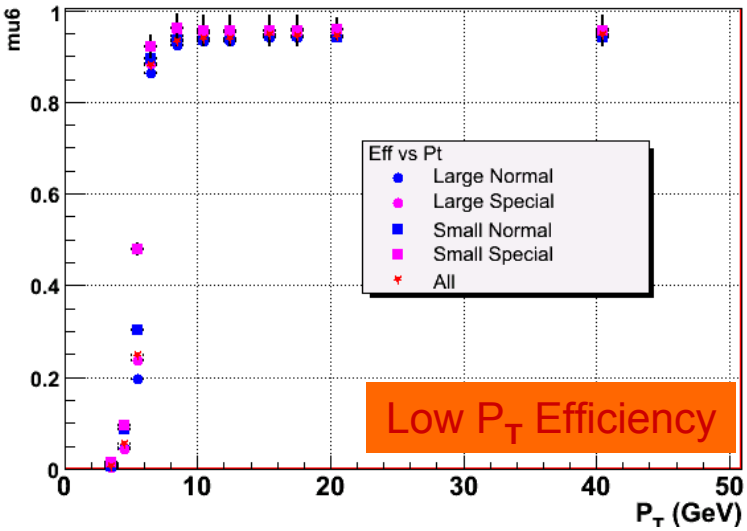
S. Rosati

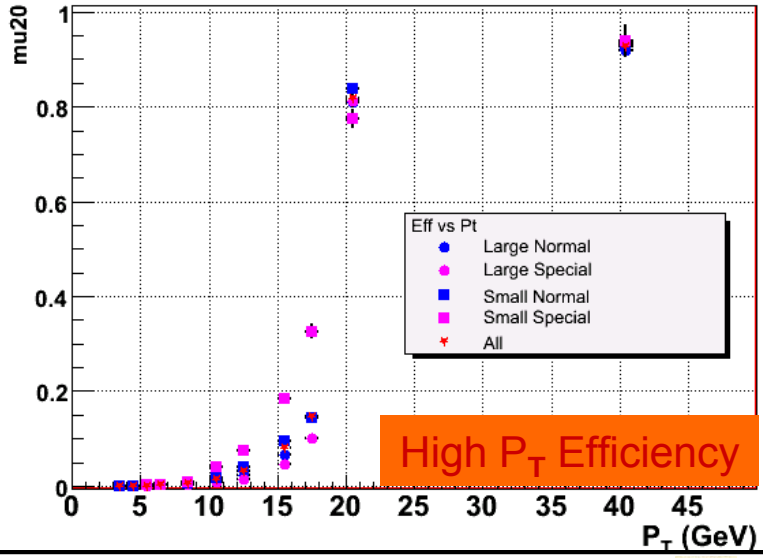
LVL 2 Muon Trigger : MuFast Barrel



- muFast performance (P_T resolution, efficiency, rates) in Barrel are now under control. (**new** CSC production,rel 11.0.5)
- rates will be further reduced after MuComb.

L2 Rates	Low P_T (6 GeV)(KHz)		High P_T (20 GeV)(KHz)	
	Layout Q	CSC 11.0.5	Layout Q	CSC 11.0.5
K/π	3.18	3.33	0.07	0.09
b	0.91	0.93	0.10	0.11
c	0.41	0.49	0.04	0.04
Total	4.5	4.75	0.24	0.26

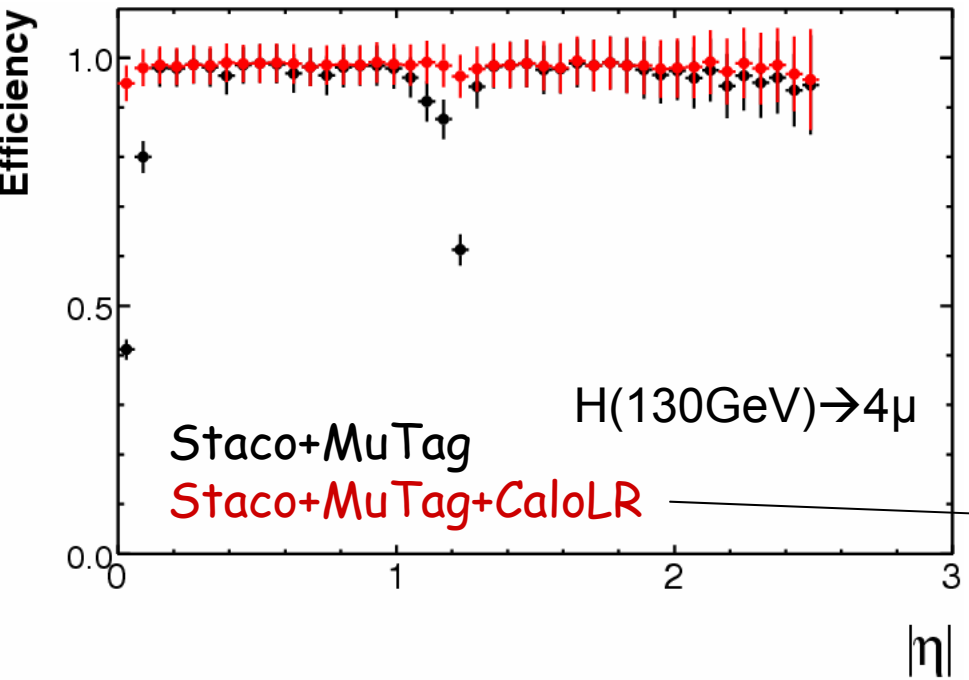




Calorimeter Based Muon Identification

Mainly two on-going efforts for **calorimeter based muon identification**.

- Calorimeter → Identification (using longitudinal and lateral profile)
- Inner Detector → Track Parameters



Main gain at difficult MS regions

-|η|≈0

-|η|≈1.2

CaloLR – uses TopoClusters → μ/π separation based on calorimeter energy deposition profile

Needs to be optimized with noise, pileup, backgrounds and cavern hits

- Using **Muon Spectrometer hits/segments** for further fake rejection is possible.

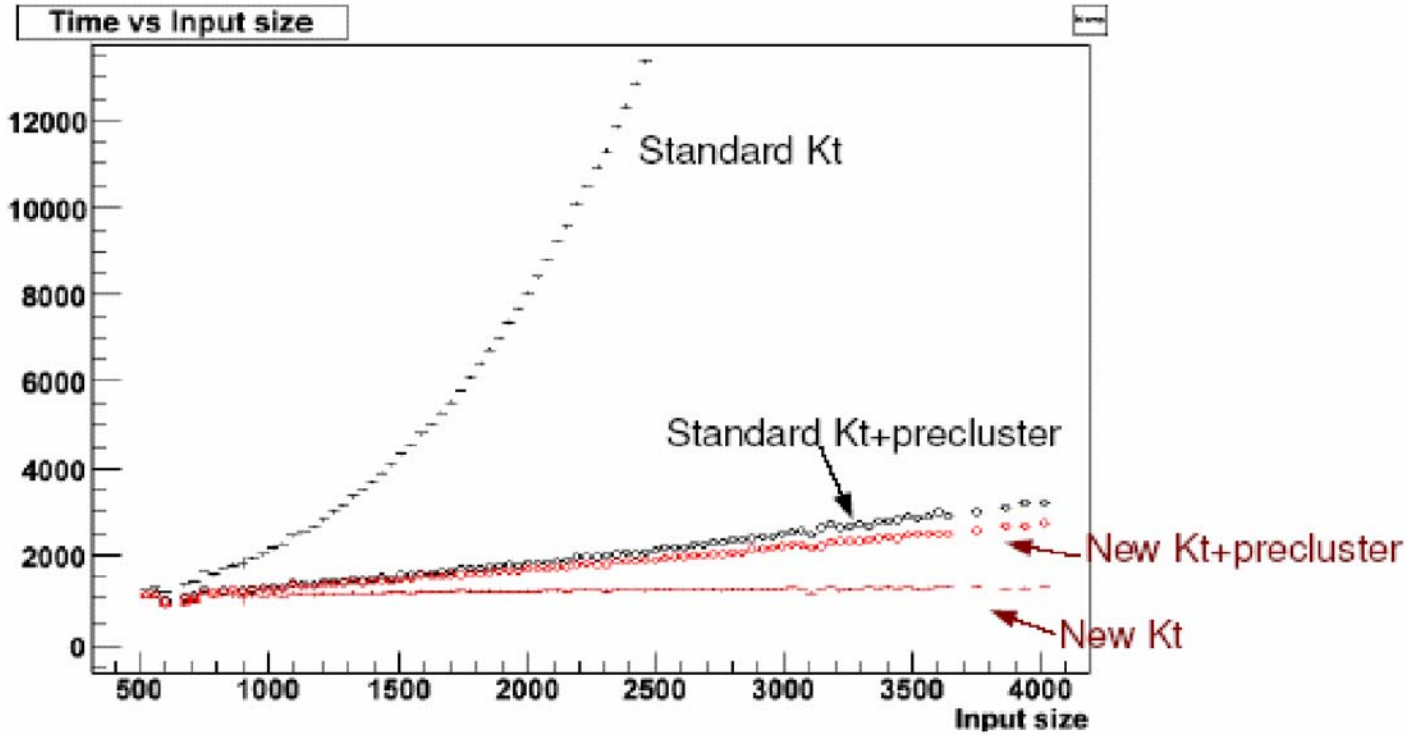
Tau/jet/etmiss triggers

- Lots of work going on in this area
- However no clearly defined algorithms as for e/μ
- Will show some scattered results from the summary of K. Cranmer

Optimisation of jet algorithm

Fast Kt

Pierre-Antoine has implemented a new version of the Kt algorithm that gives enormous speed improvements

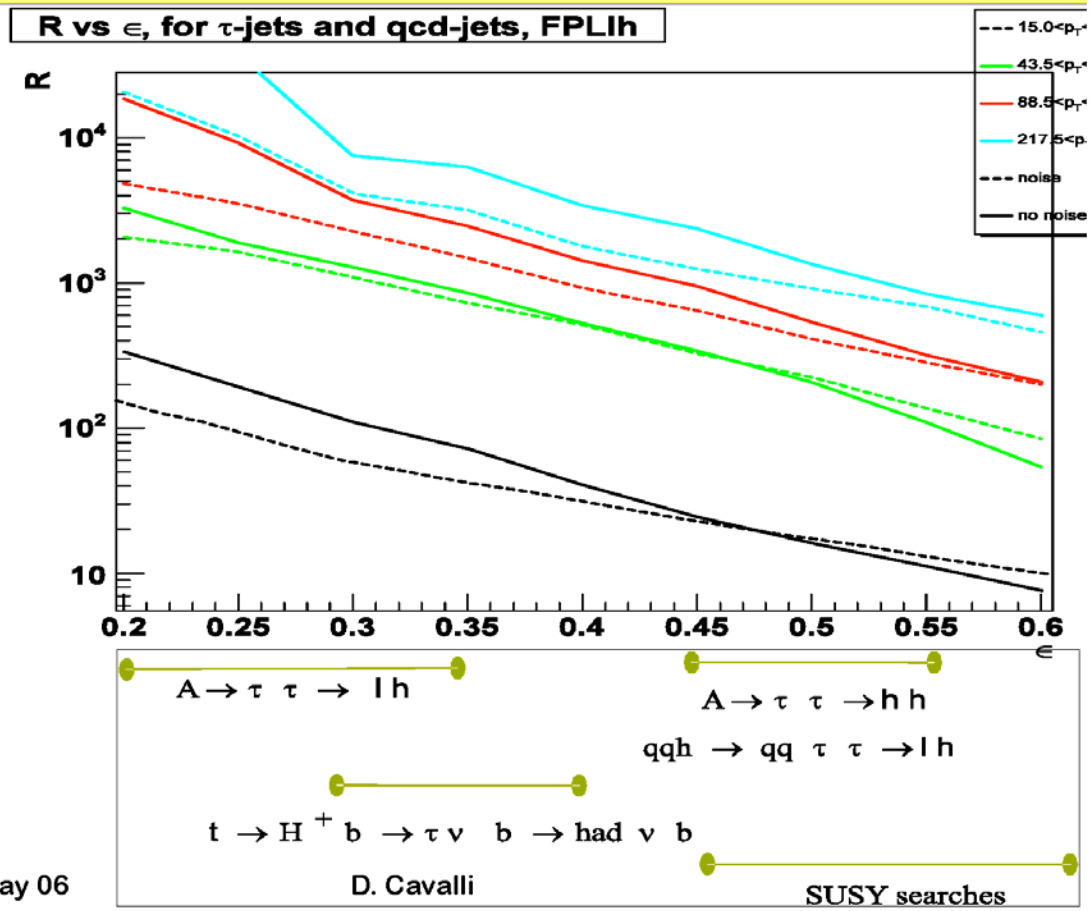


Tau trigger rejection

Tau Rejection vs efficiency curves from Taurec and typical Tau-eff range for different analyses

DC1 data

Using Likelihood (p_T -dependent) built from Tau_Id variables REM, FISO, Ntrack, Strip Width, Nstrip, Charge, Impact param, ET/pT(1sttrack)



M. Heldmann, D.Cavalli ATL-PHYS-PUB-2006-008;

Trigger & Phyisics week - May 06

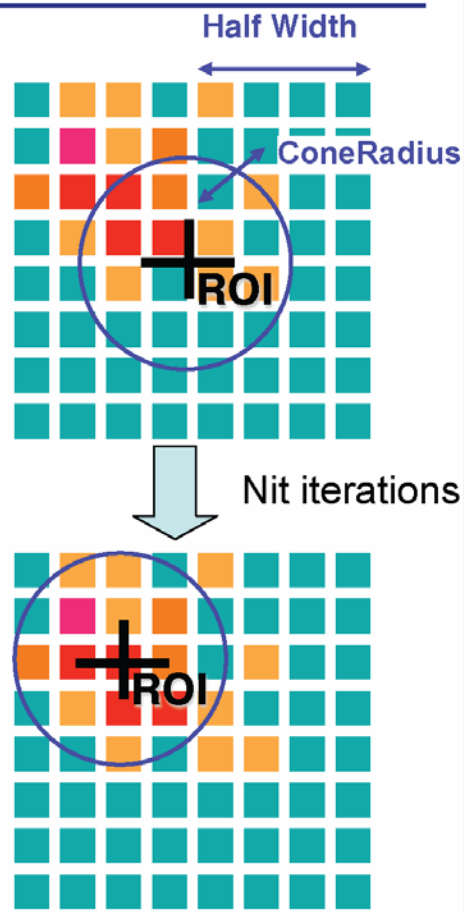
Speed up of data-decoding

LAr FEB Headers

Ignacio Aracena has done great work to access Ex/Ey/Ez partial sums performed in the LAr RODs.

These sums can be used by L2 Jets or EF MissingET

	Cells	FEBs	Cells	FEBs
Half Width Cone Radius	1.0 0.7	1.0 0.7	0.8 0.7	0.8 0.7
RegionSelector	2.92	2.16	2.12	1.48
LAr BSCnv	9.38	0.44	6.52	0.34
Tile BSCnv	3.15	2.95	2.27	2.22
Prepare Grid	12.79	11.34	9.42	9.47
Cone algo (Nit = 1)	16.63	1.08	11.21	0.80
Total	45.54	12.85	32.19	10.69



using LArFEB header method has clear impact on timing!

May 30th 2006

I. Aracena
ATLAS TP Week

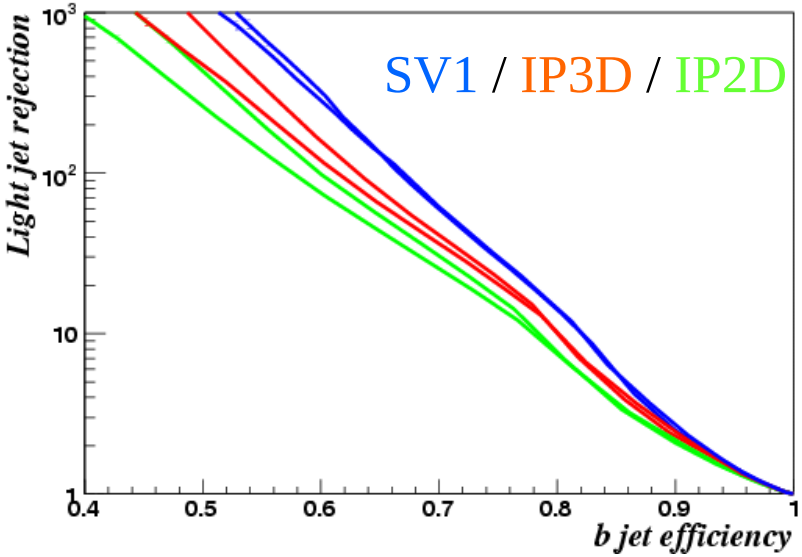
➢ B-tagging (J.B. de Vivie)

- ✓ Since last TP week, the b-tagging group has focused on two main points :
  - validation of the new ParticleJet EDM
  - performances with CSC data, for a three pixel layer layout
- ✓ NewTracking is now the default tracking algorithm and is also being validated in the group, for single tracks and tracks in jet
- ✓ One of the *very weak points*, the measure of tagging efficiency and mistag rate in the data, is being addressed now

b-tagging performances

- General remarks

→ From Rome to CSC (WH120, old PYTHIA shower)

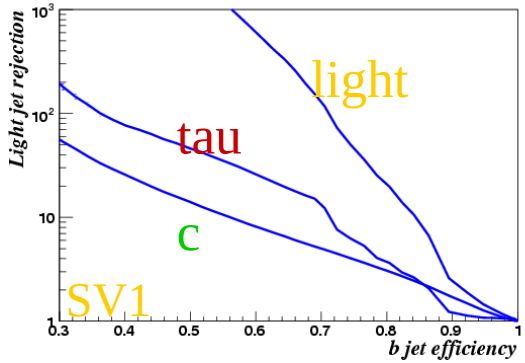


⇒ Clear improvement with the 3 layers,
e.g. light jet rejection @ ε_b = 60 (50) % (iPatRec)

raw	IP2D	SV1
Rome	76 (270)	285 (1265)
mc11	99 (450)	324 (1550)

→ BUT performances on CSC samples can be surprising !

- New PYTHIA shower seems to bring a very large degradation
  (*i.e.* back to Rome perf. with a 3 pixel layer geometry)
  → *more work is needed…*
- Be careful with tau jets (see for example T1 5200 sample →)



→ New pdfs with consistent CSC data should be built (current ones correspond to Rome)
This is important for the most powerful algo. (SV1,2) and essential for NewTracking
(which was bad for releases < 11.3.0 giving correspondingly bad calibration)

➢Thoughts on calibration with data

- Measurement of ε_b (ε_c, $\sigma(tt)$) in tt events (H. Bachacou)

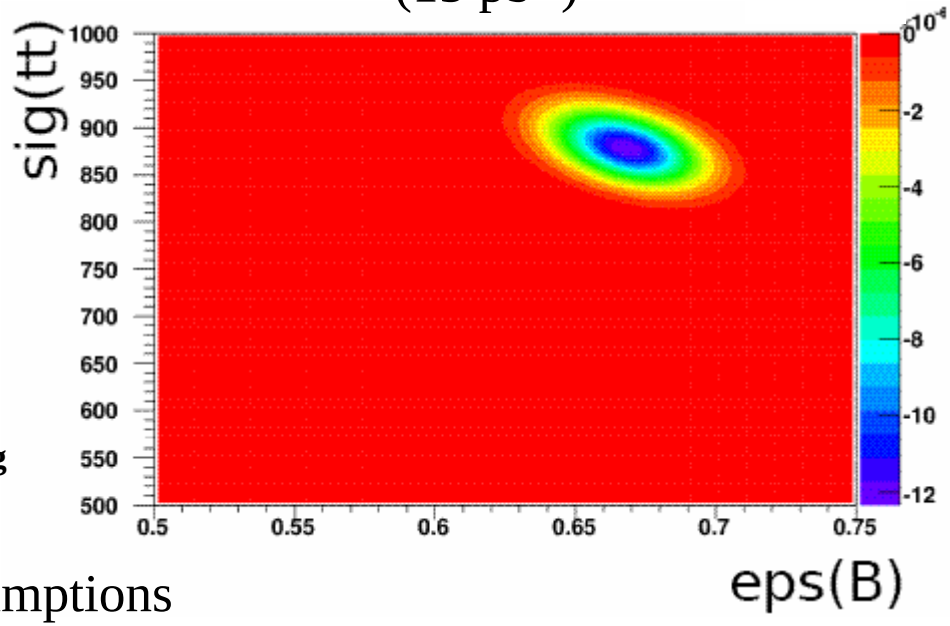
$\Rightarrow$ profit from the large tt statistics

$\Rightarrow$ just count the number of events with 1, 2 or 3 tags and extract ε_b (ε_c, $\sigma(tt)$) from a likelihood fit

parameters	"True"	"Measure"
ε_b (%)	67.9	66.8±2.3
ε_c (%)	20.3	28.5±5.3
ε_{udsg} (%)	0.93	input
$\sigma(tt)$ (pb)	857	878±28

In addition, ε_b is not very sensitive to ε_{udsg}

Likelihood for one experiment (15 pb^{-1})



$\Rightarrow$ promising result BUT many strong assumptions
(especially MC dependence, heavy flavour content, estimation of background, …)

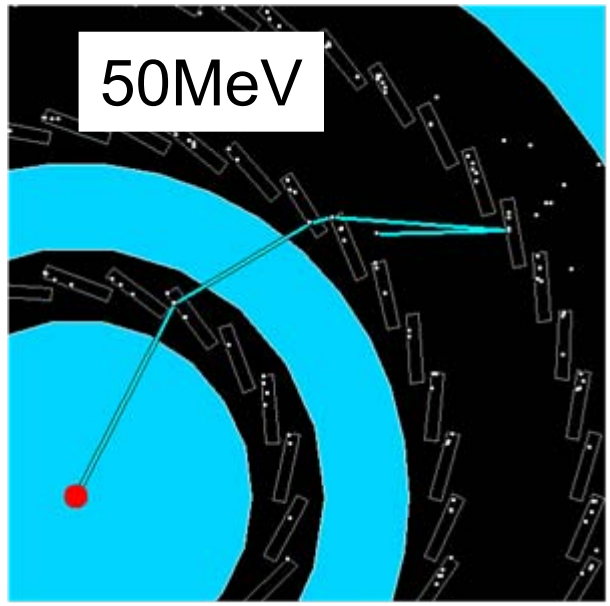
Many systematic studies to be done…

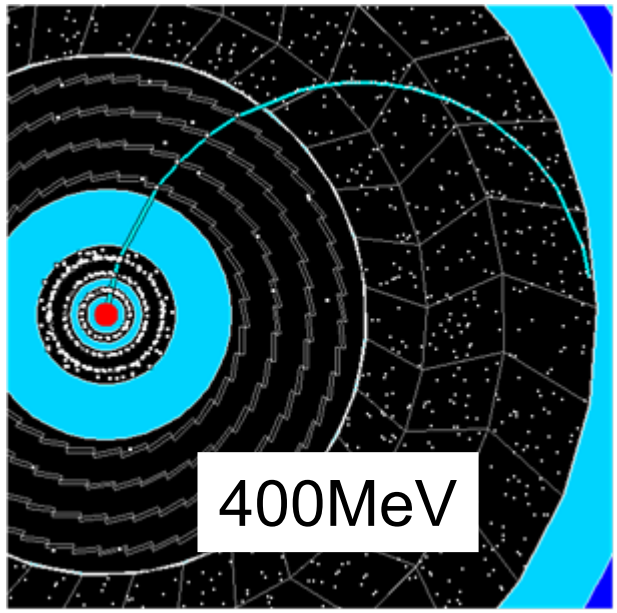
Physics studies (D. Tovey)

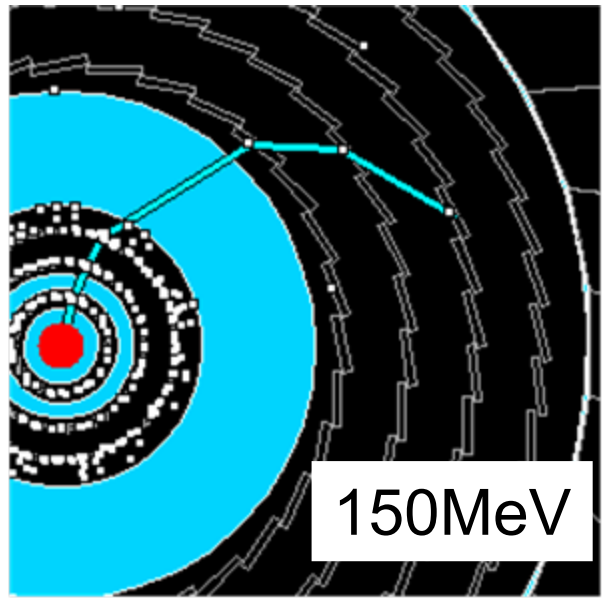
- Full exploitation of AOD trigger info top priority for physics groups.
- Groups keen to fully implement trigger aware analyses
  - Renewed emphasis on trigger issues in all sessions
  - Lots of preparation for full trigger AOD studies
- So far mainly 'expert-level' studies (11.0.5)
  - Valuable user feedback
- 'Physicist-level' analyses ready to ramp rapidly ➔ eagerly awaiting trigger-aware AODs (11.0.5 / 12.0.x)
- Crucial requirement ➔ trigger aware analysis studies must become default
- Majority of talks in groups focusing on early data now
- Emphasis on key topics: In situ calibration / bkg estimation from data
- More work needed especially in use of prescale triggers for in situ calibration ➔ feedback use cases to define strategy

Low pT Min Bias Track Recon

- Tracker is in principle sensitive to soft tracks
  - Pt = 400 MeV - tracks reach end of TRT
  - Pt = 150 MeV - tracks reach last SCT layer
  - Pt = 50 MeV - tracks reach all Pixel layers
- Strategy 1: Primary track reconstruction
- Strategy 2: Secondary track reconstruction
- New Strategy: Soft particle reconstruction after primary vertexing







A.Salzburger

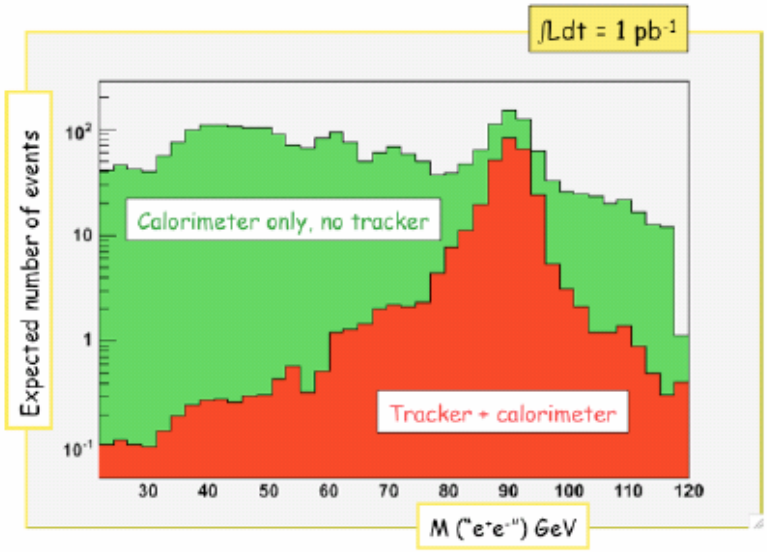
Elsing

Z→ee with early data

Z→ee without tracks ?

ongoing by Fabiola G. : http://agenda.cern.ch/fullAgenda.php?ida=a062332

Goal : get a useful sample in the early days for unbiased studies
in the trigger and offline



Calorimeter only, no tracker :

2 e/γ E_T>15 GeV
in mass bin 80-100 GeV

isEM =0 in PhotonContainer
isEM(calo only)=0 and
author()=1 in ElectronContainer

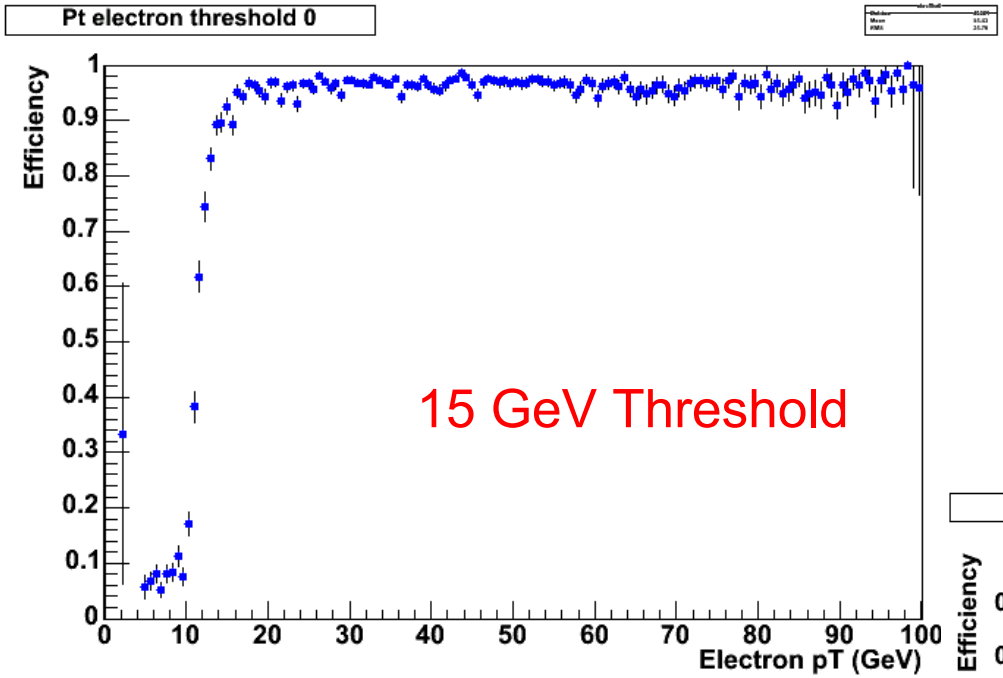
S/√B ~32 (S : 450, B: 200 evts)
(S/√B > 300 with full isEM=0)

Gianotti (egamma)

Le Bihan

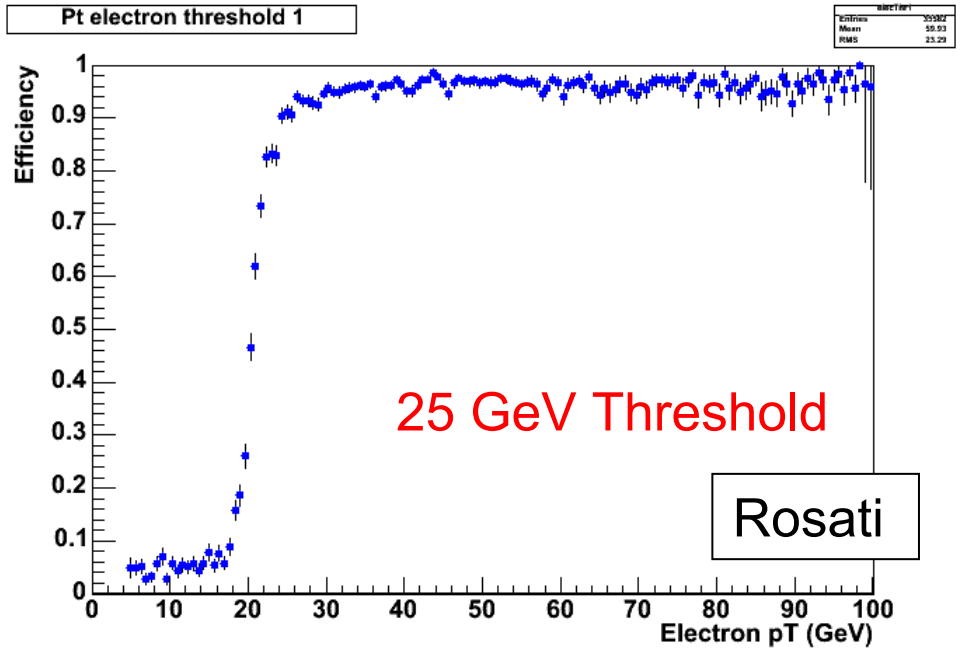
Trigger & Physics week *SM meeting* *31/05/2006*

Electron LVL1 Trigger Efficiencies: H→4l



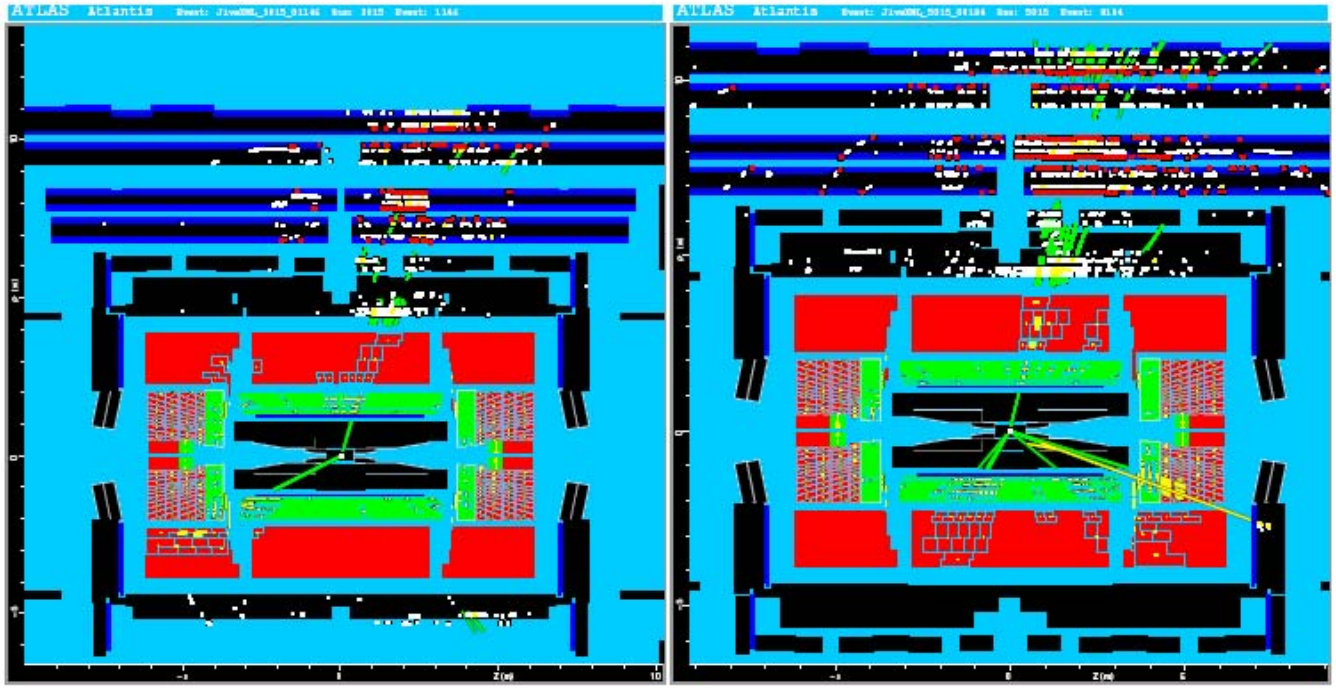
- Single electron efficiencies vs p_T
- Using CSC samples ($ZZ^*/\gamma^* \rightarrow 4l$ or $H \rightarrow ZZ^* \rightarrow 4l$)
- True electron from the AOD truth container, select only e within $|\eta|<2.5$

- Look for match of true electrons with LVL1 electron ROIs (criterium $\Delta R<0.2$)
- Efficiency plateau at ~97%



Fake ETmiss from Shower Leakage

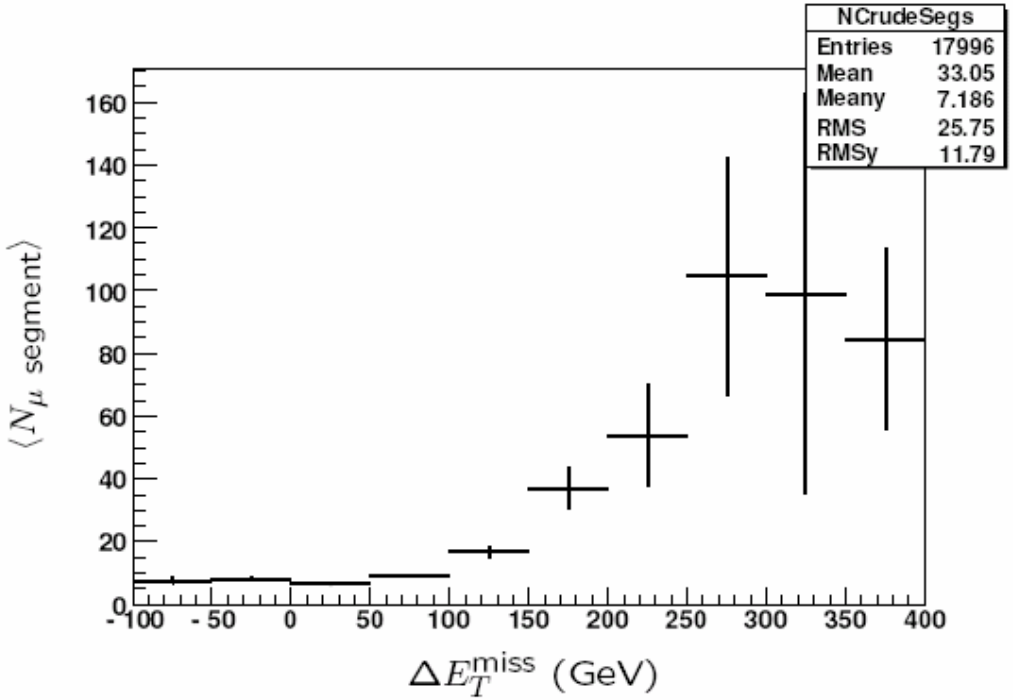
Three punchthrough events (1146, 9184, 30743) giving leakage and large muon showers:



Paige

E_T Tails with 11.0.4

Fake ETmiss from Shower Leakage



Not much increase for hits or segments until $\Delta \not\!\!E_T > 100\,\text{GeV}$.

Examine first 20 events with $\Delta \not\!\!E_T > 100\,\text{GeV}$. Observe much less leakage in muon system — just 2/20 events. Still no clear association with jets in cracks.

Paige