Plan for Joint JetMET/EWK Physics Analysis Summary

Performance of Missing Transverse Energy Reconstruction in events from pp collision data with $\sqrt{s} = 7\ TeV$ containing electroweak bosons.

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JetMet meeting
CERN, 19-Apr-2010

The task

Performance of Missing Transverse Energy Reconstruction in events from pp collision data with $\sqrt{s} = 7$ *TeV* containing EWK bosons.

- MET Commissioning in events where true MET is present.
- Similar work in multijets/Susy/... events by MET group (see previous talks)

- Select W and Z in electron and muon channel, following recipes from VBTF.
- Study MET(s) (Calo - raw and Type-I, Type-II corrected -, Tc, PF, ...) for W events;
- Study MET(s) in Z events with and w/out one lepton removed;
- If possible, study also W+N-jets events;
- Also high-pt isolated photons.
- Following plots taken from past presentation, linked from TWiki page: https://twiki.cern.ch/twiki/bin/view/Main/MSEWKMETCommissioningThoughts

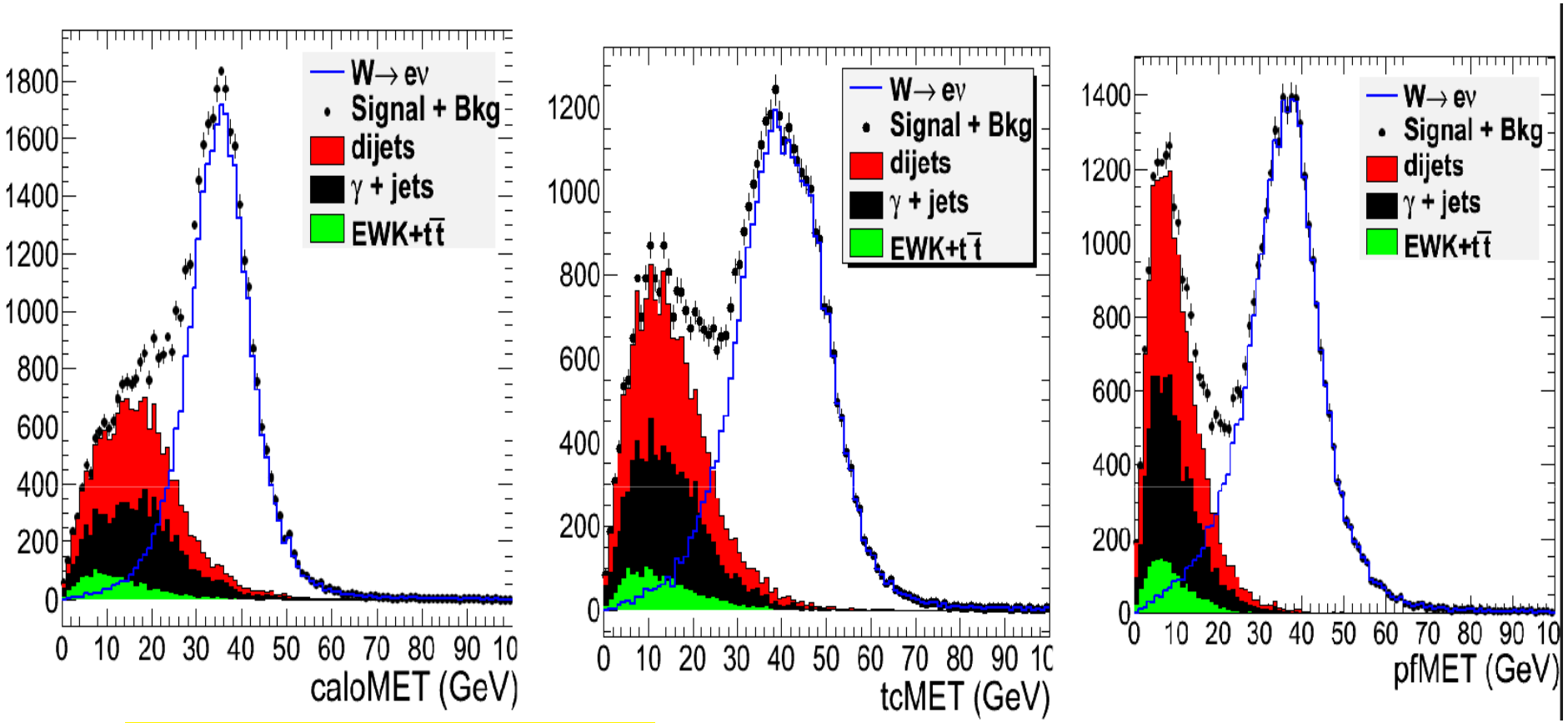
Event selection

- Standard dataset selection;
- the object of the PAS is not to study VB events as such but to look at MET in those events;
- Follow recipes from relevant DPG/POG/PAG;
- Need a uniform definition of basic object (lepton, jets, MET types, MET corrections, . . .)
- event cleaning (ECAL spikes, HCAL noise, monster events, . . .) should be uniform across analysis as well;
- will collect technicalities about VB baseline selections, MET definitions and such in the TWiki page;

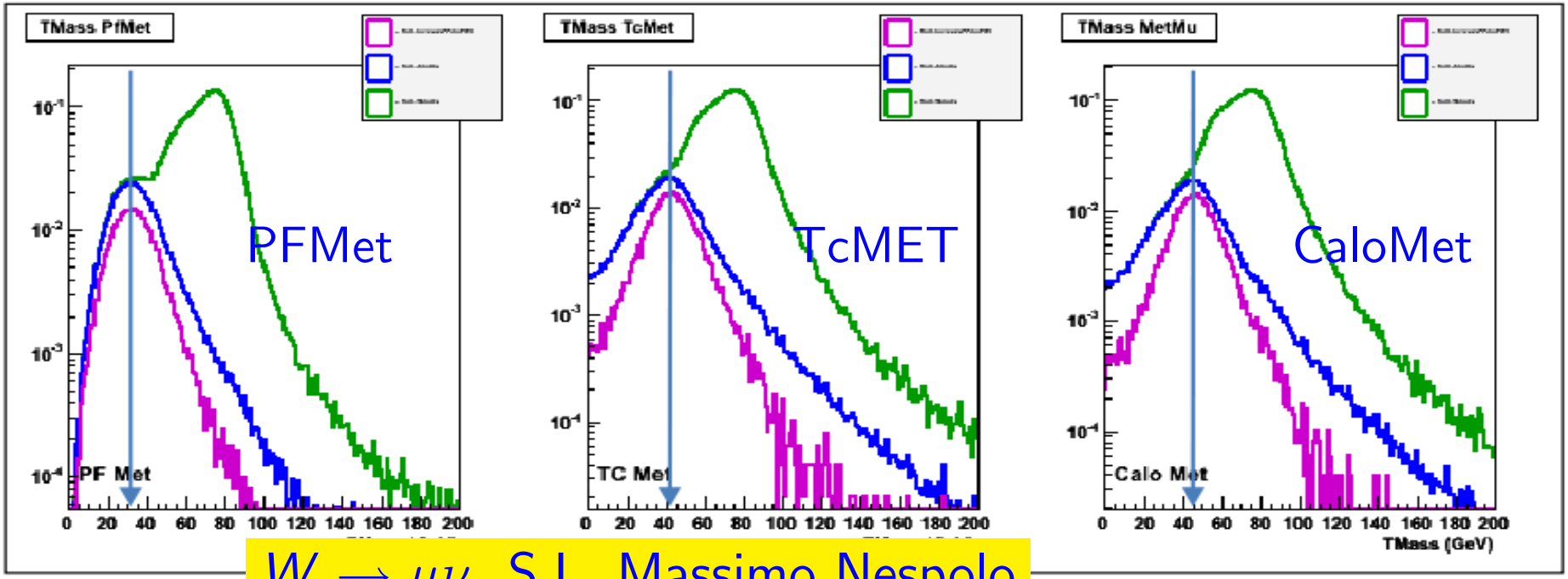
W Events - after a tight selection but loose cut on MET

- both electron and muon channel
- how well does the shape of the MET distribution in the MC match real data?
  - demands control of the background as well
  - critical: position and shape of the peak (maybe better to look at MT)
  - check the tail to the high end
  - check events with a jet veto - probes the lepton contribution
  - check events with an energetic jet - probes the jet contribution
- what is the composition (thinking of PF) ?
- Compare CaloMET, tcMET and PFMET on an event-by-event basis
  - examine events in which differences are large - is there any sign of an error?
  - are there events in which one method gives an unusually high value?
  - if so, what is the reason?

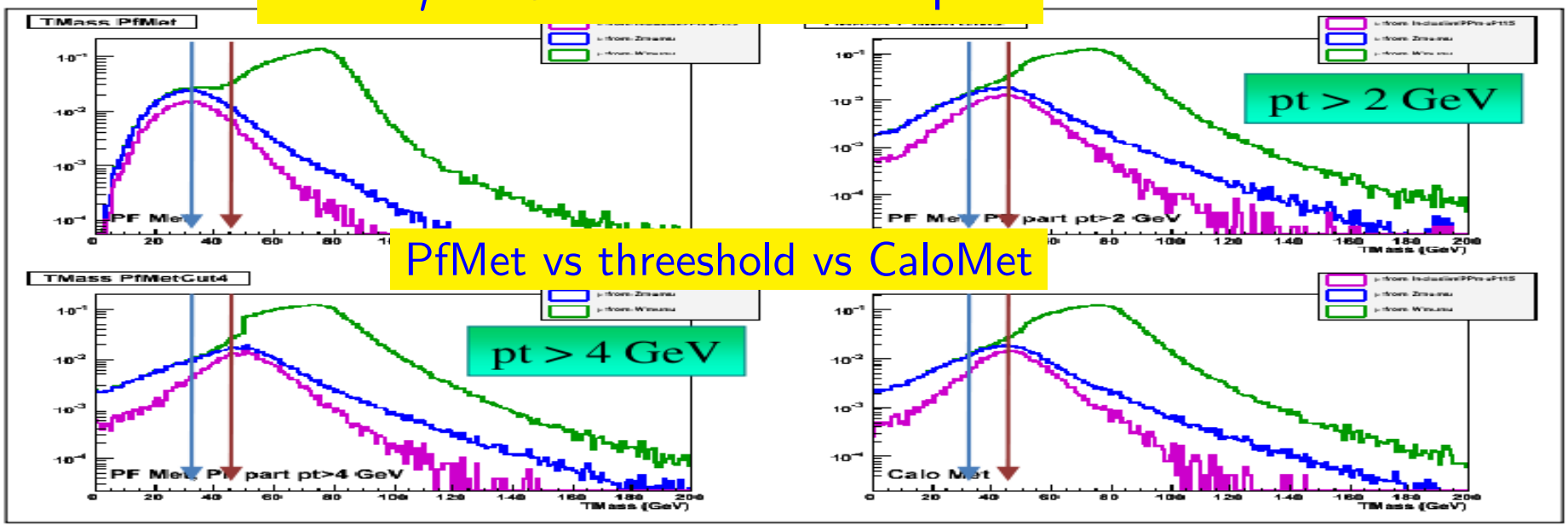
$W \rightarrow e\nu$



Nikolaos Rompotis

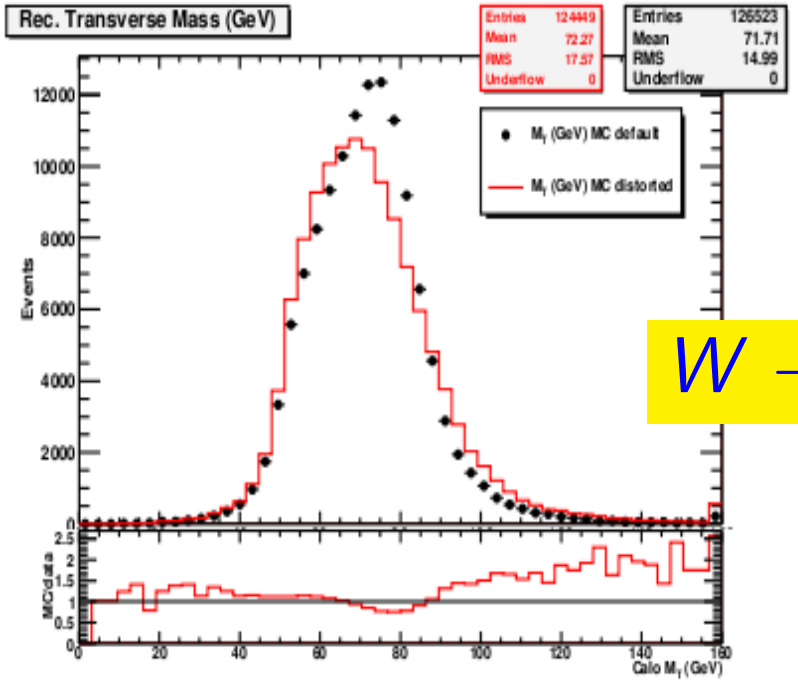


$W \rightarrow \mu\nu$ S.L. Massimo Nespolo

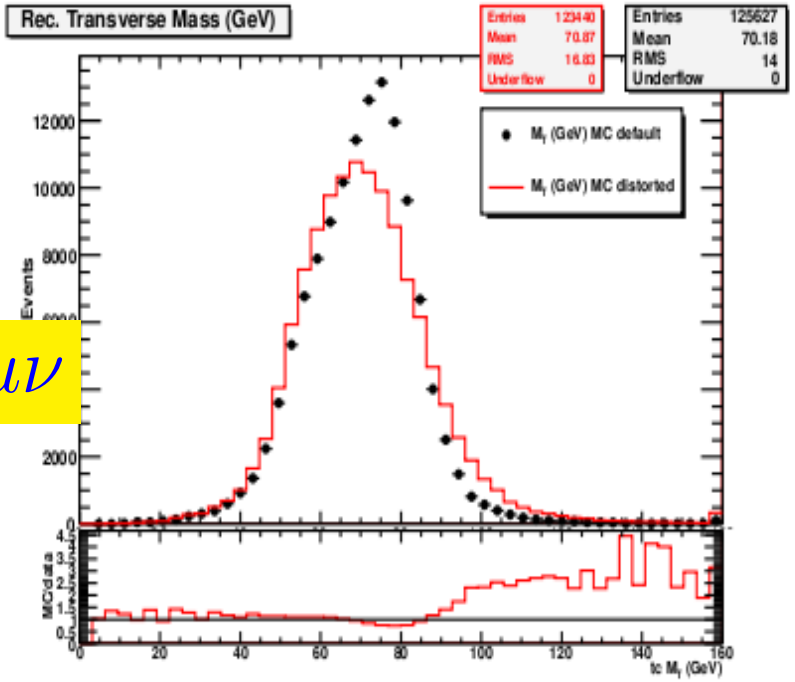


PfMet vs threeshold vs CaloMet

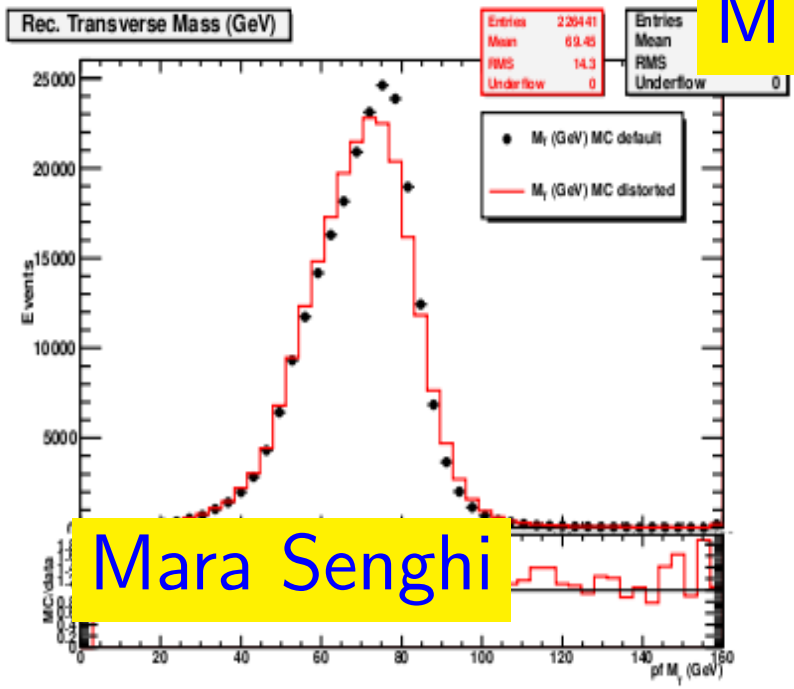
The higher the threshold → The higher the PF Met



$W \rightarrow \mu\nu$



MT distortion due to *realistic* μ



Mara Senghi

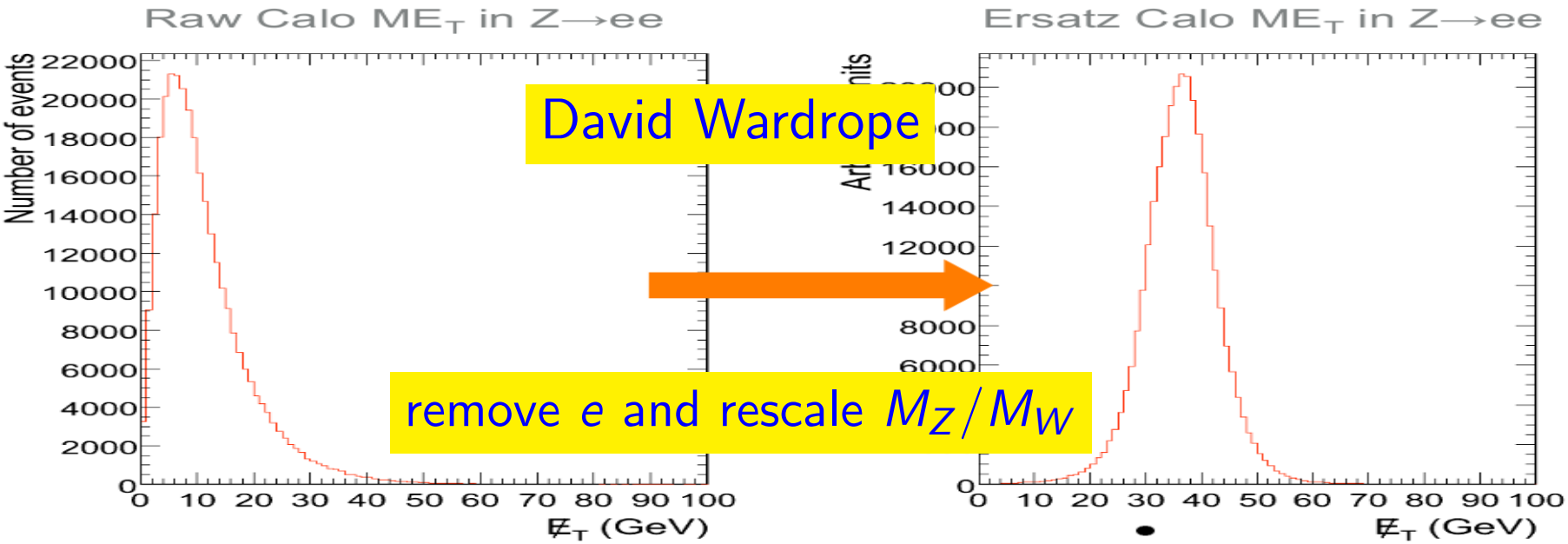
M_T from Calo and TC
(above) PF MET (below)

** Large effects **

data will tell if μ-distortion is needed and its magnitude

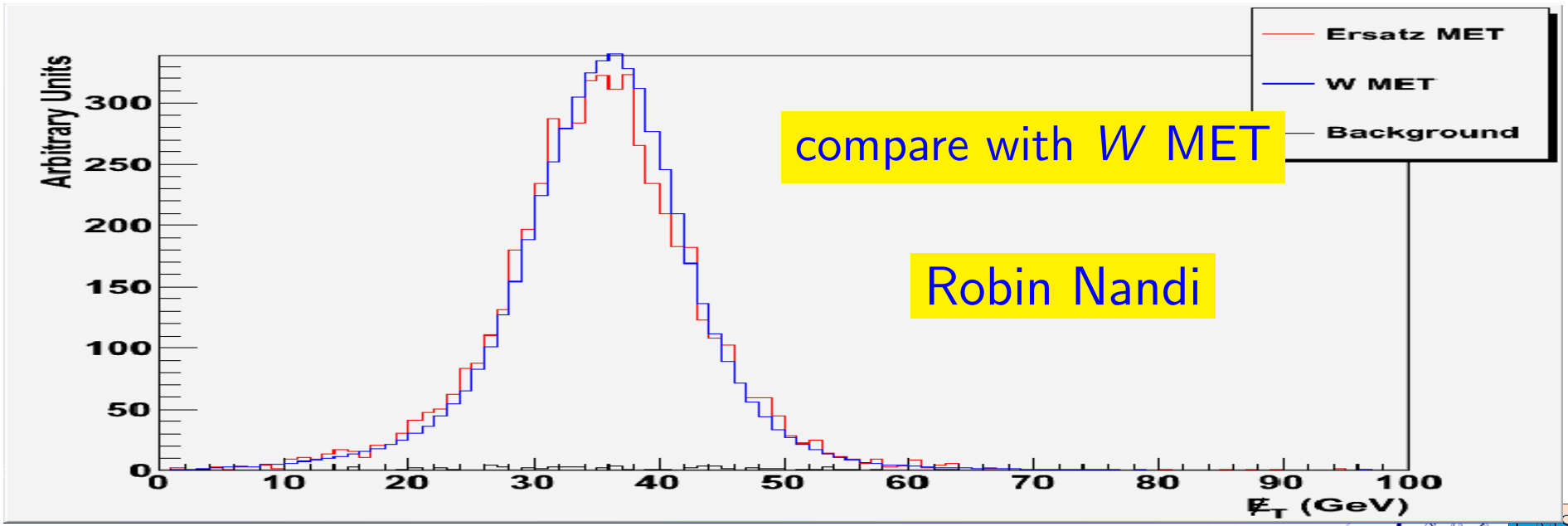
Z Events - should already be very clean

- both electron and muon channel
- compare the MET distribution data/MC
  - check events with a jet veto - probes the lepton contribution
  - check events with an energetic jet - probes the jet contribution
  - what is the composition (thinking of PF) ?
  - are the parallel and perpendicular (response vs noise) components of the hadronic part well simulated?
  - which MET is best (has the best resolution)?
- Since there is no intrinsic MET component for Z events, we can use them to make a data-driven comparison.
  - Drop one of the leptons and recalculate the MET. Compare to the value before dropping the lepton.
  - Rescale for M_Z/M_W and compare with $W \to l\nu$ MET;
  - Which MET has the narrowest distribution of the difference?
  - Is the distribution of the difference well simulated?
- Derive MET corrections for MET in $W \to l\nu$ from $Z \to ll$ by dropping one lepton using Data. AN2009_092
- Try to use also J/ψ candidates?



David Wardrope

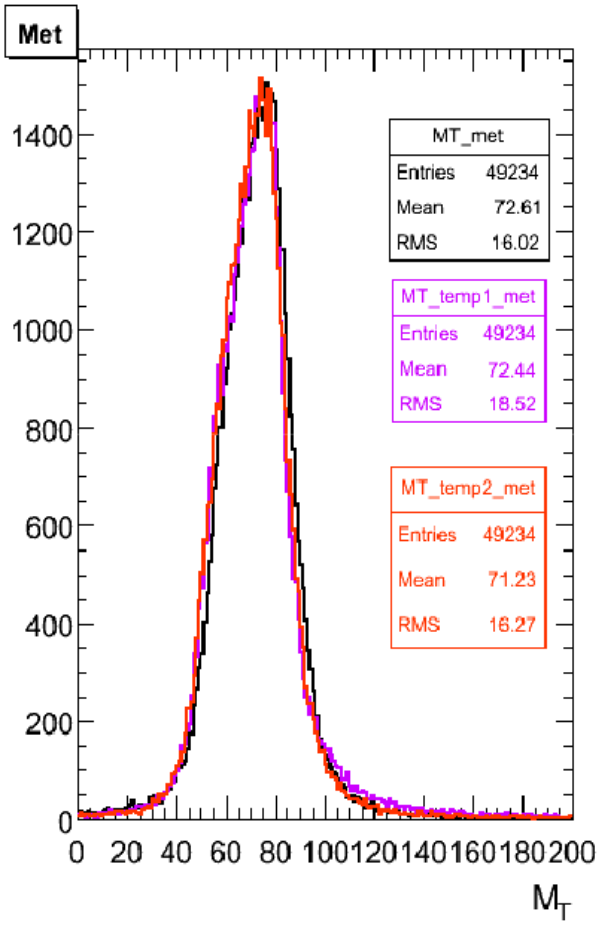
remove e and rescale M_Z/M_W

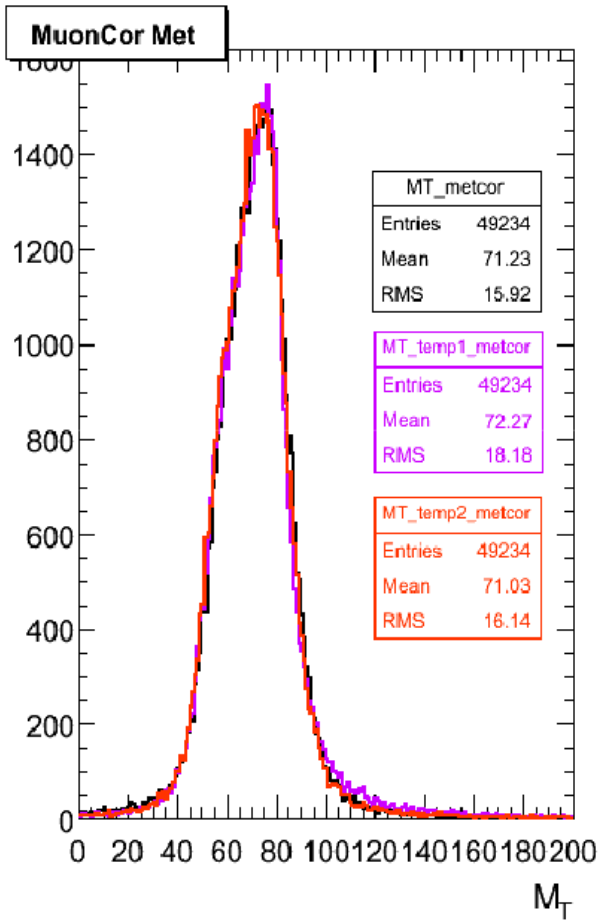


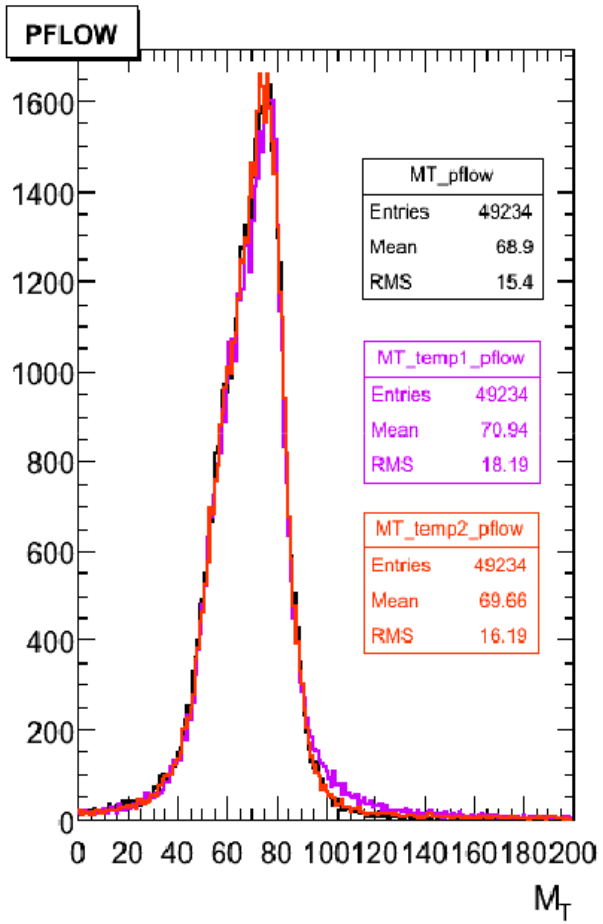
compare with W MET

Robin Nandi

$W \rightarrow \mu\nu$

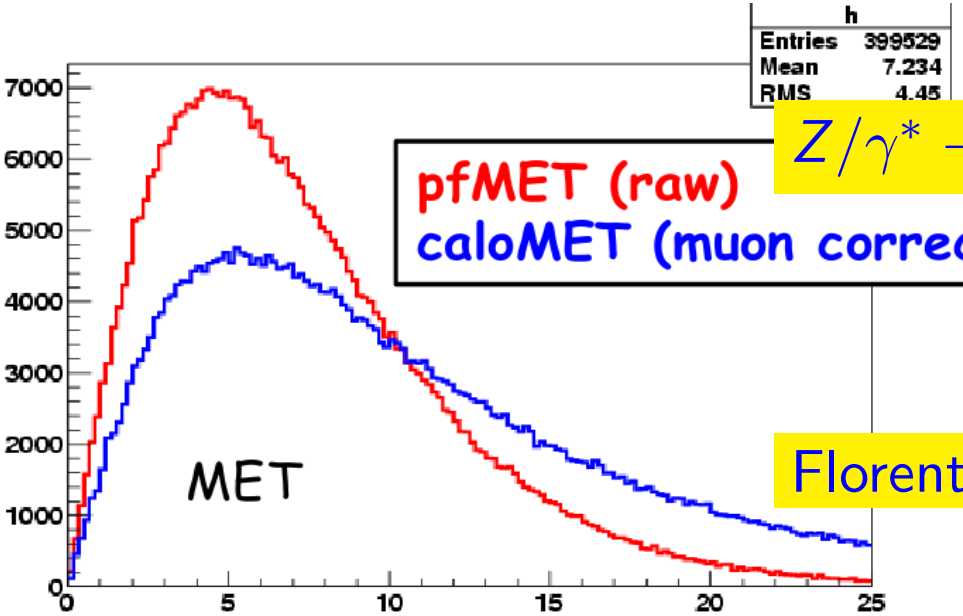






M_T template for $W \rightarrow \mu\nu$ using $Z \rightarrow \mu\mu$, μ removed and M_Z/M_W rescale

Maria Cepeda et al

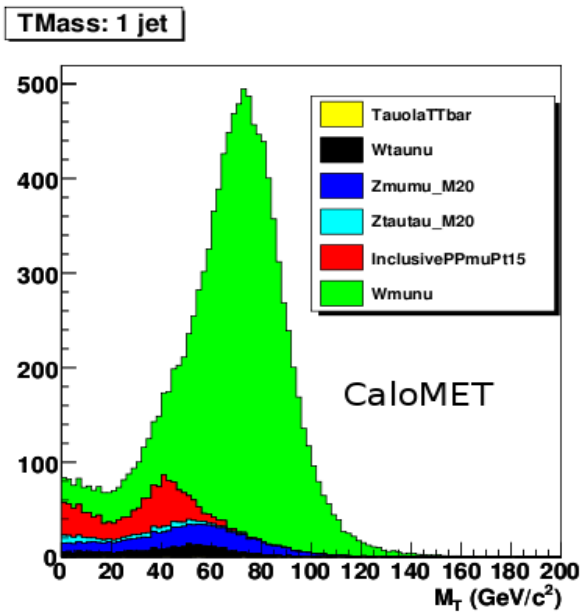


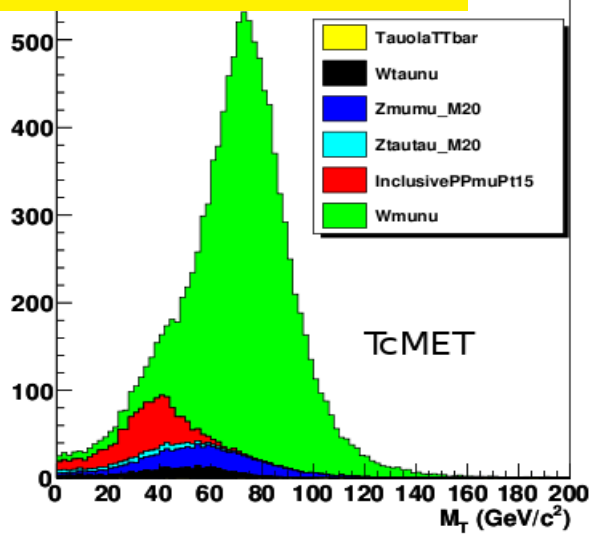
pfMET (raw)
caloMET (muon corrected)

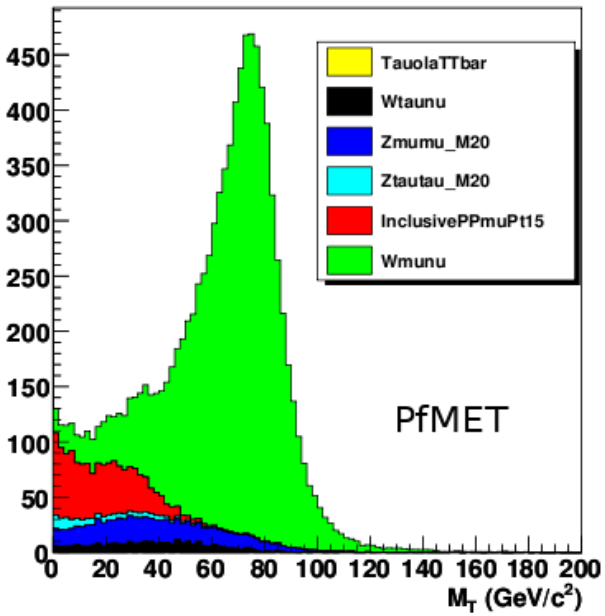
$Z/\gamma^* \rightarrow \mu\mu + 1\ jets$

Florent Lacroix

$W \rightarrow \mu\nu + 1\ jets$







Massimo Nespolo

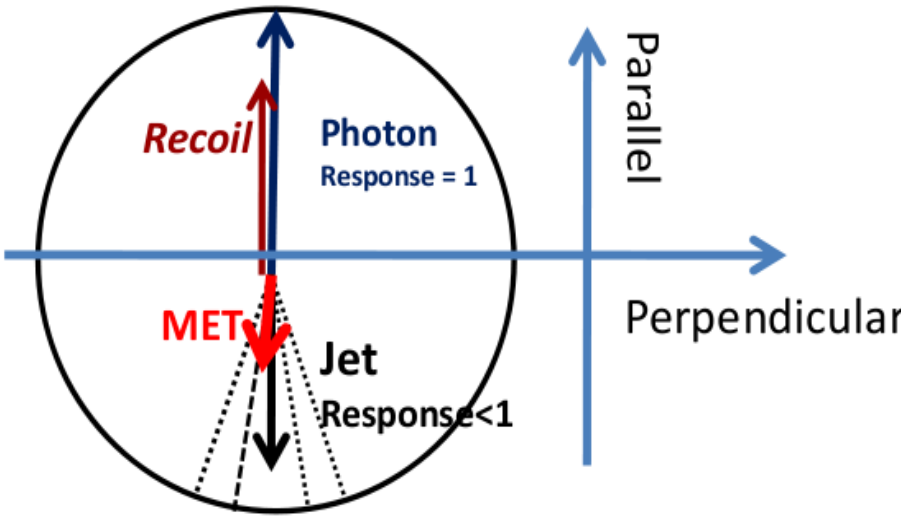
High pt isoltaed photons + jet

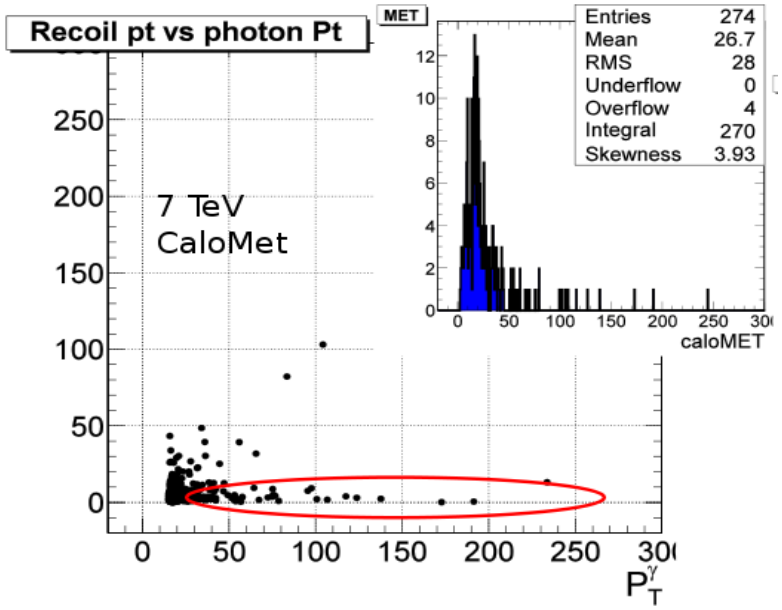
- γ measured by ECAL, no physical MET in the event
  - study MET scale;
  - compare MET(s);
  - compare recoil with photon;
  - magnitude and direction;
- how well does the shape of the MET distribution in the MC match real data?
- what is the composition (thinking of PF) ?
- are the parallel and perpendicular components of the hadronic part (Uperp and Uparallel) well simulated?
- which MET is best (has the best resolution)?

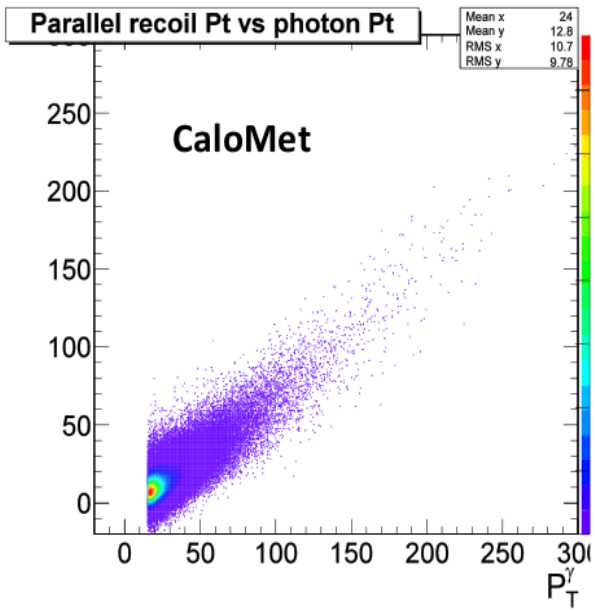
$\vec{\text{Recoil [GeV]}} = \vec{\text{MET}} + \vec{P^{\gamma}_{t}}$

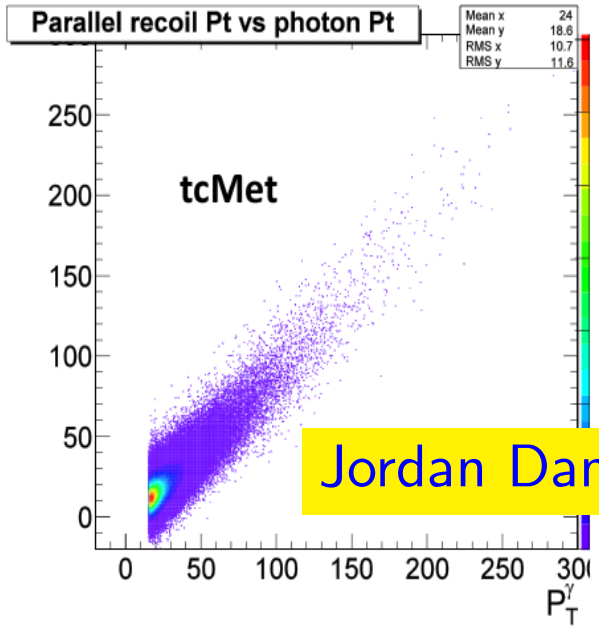
$\gamma + jet$

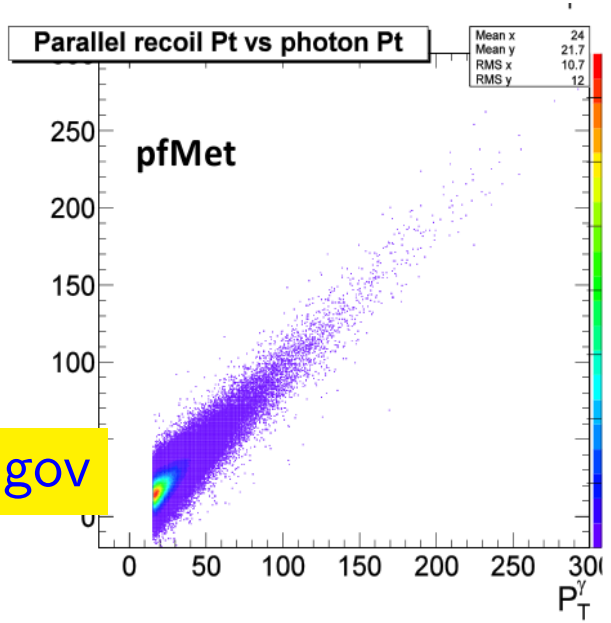
Parallel Recoil Pt vs Photon Pt











Jordan Damgov

Timescale

Goal is to have PAS ready for ICHEP (22-27 Jully)

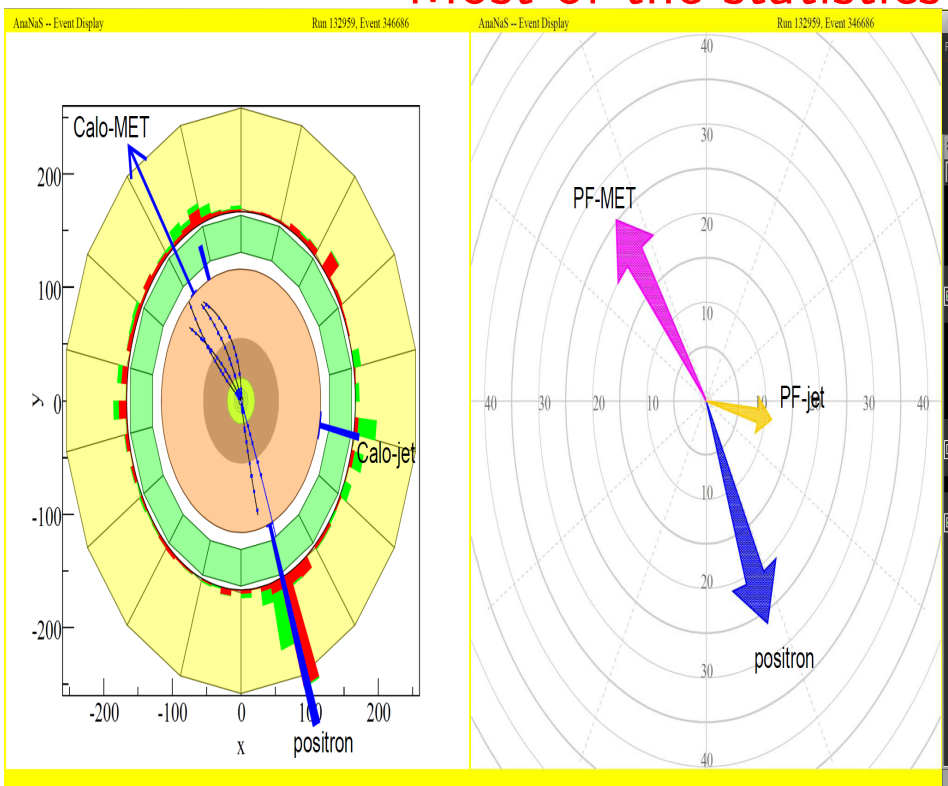
WEEK	Monday	Meeting	Event		
4	19-APR	JetMET	Todays meeting		
5	26-APR				
6	03-MAY	JetMET	TrackJet Commissioning JME-10-006 Pre-Approval in JetMET May-03		
7	10-MAY				
8	17-MAY	Phys Week	Freeze Data 17-MAY	Summaries of all PAS analyses	
9	24-MAY		AN and PAS 24-MAY		
10	31-MAY	JetMET	Pre-approval 31-MAY	Freeze Data 31-MAY	
11	07-JUN		ARC gives OK 9-JUN	AN and PAS 07-JUN	
12	14-JUN	CMS Week	Approval 16-JUN	Pre-approval 15-JUN	Freeze Data 14-JUN
13	21-JUN		Jet PAS: JME-10-003	ARC gives OK 23-JUN	AN and PAS 21-JUN
14	28-JUN	JetMET		Approval 30-JUN	pre-approval 28-JUN
15	05-JUL			SUSY MET PAS: JME-10-004	ARC gives OK 7-JUL
16	12-JUL	JetMET			Approval 14-JUL
17	19-JUL		ICHEP 21-JUL		EWK MET PAS: JME-10-005

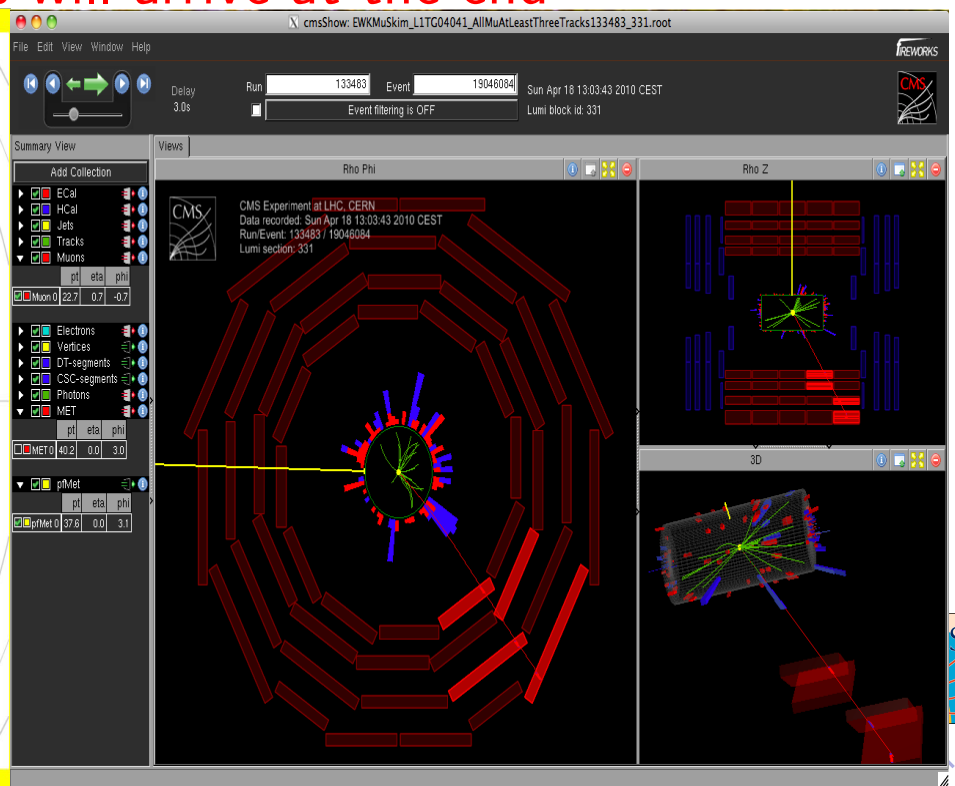
Activy must start NOW and will last up to begin of summer

Luminosity and statitics

date	$\int \mathcal{L} dt$	$W \to l\nu$	$+1jet$ $(> 25\ GeV)$	$Z \to ll$	$+1jet$ $(> 25\ GeV)$
today	$0.26\ nb^{-1}$	$\mathcal{O}(1)$	$\mathcal{O}(0)$	$\mathcal{O}(0)$	$\mathcal{O}(0)$
end april	$\sim 0.5\ pb^{-1}$	$\mathcal{O}(1500)$	$\mathcal{O}(500)$	$\mathcal{O}(150)$	$\mathcal{O}(50)$
end may	$\sim 1.5\ pb^{-1}$	$\mathcal{O}(4500)$	$\mathcal{O}(1500)$	$\mathcal{O}(400)$	$\mathcal{O}(100)$
mid june	$\sim 3.0\ pb^{-1}$	$\mathcal{O}(10000)$	$\mathcal{O}(3000)$	$\mathcal{O}(1000)$	$\mathcal{O}(300)$

Most of the statistics will arrive at the end





People

Contributors

Work division VERY preliminary

$W \to \mu\nu$, $Z \to \mu\mu$	Mara Senghi Soares, Carmen Diez, Massimo Nespolo, Stefano Lacaprara, Sara Vanini, Antonio Branca,
$W \to e\nu$, $Z \to ee$	Michail Bachtis, Kira Grogg, Chiara Rovelli, Emanuele Di Marco, Matthieu Marionneau, David Wardrope, Robin Nandi, Phil Dudero (?)
$W's$	Meenakshi Narain, Gena Kukartsev, Michael Segala, Lawrence Gibbons, Aleko Khukhunaishvili, Jim P Alexander, Freya Blekman
$Z's$	Florent Lacroix, Ulla Gebbert
γ	Jordan Damgov, Sungwon Lee
MET decomposition with W's	Chris Rogan, Artur Apresyan, Maria Spiropulu, Yi Chen
PfMET in W's	Gennai Simone, Alexander Savin, Michalis Bachtis

If you are not in the list but wish to contribute, please get in contact with us

Plan

Plan

- Interested in work that can be completed by the PAS deadline
- Likely will have most of EWK candidate rather at the end, close to the PAS deadline;
- Start with MC studies, prepare PAS plots ready to be filled with increasing statistics for data;
- Start asap at looking at MET in real EWK candidates event-by-event;
- Fill distribution with available statistics as candidates are collected;
- by May 17th we need to show preliminary results on the work

Documentation

`TWiki` available at

`https://twiki.cern.ch/twiki/bin/view/Main/MSEWKMETCommissioningThoughts`

will be kept up-to-date