



First results from CMS

Piotr Zalewski

IPJ Warsaw



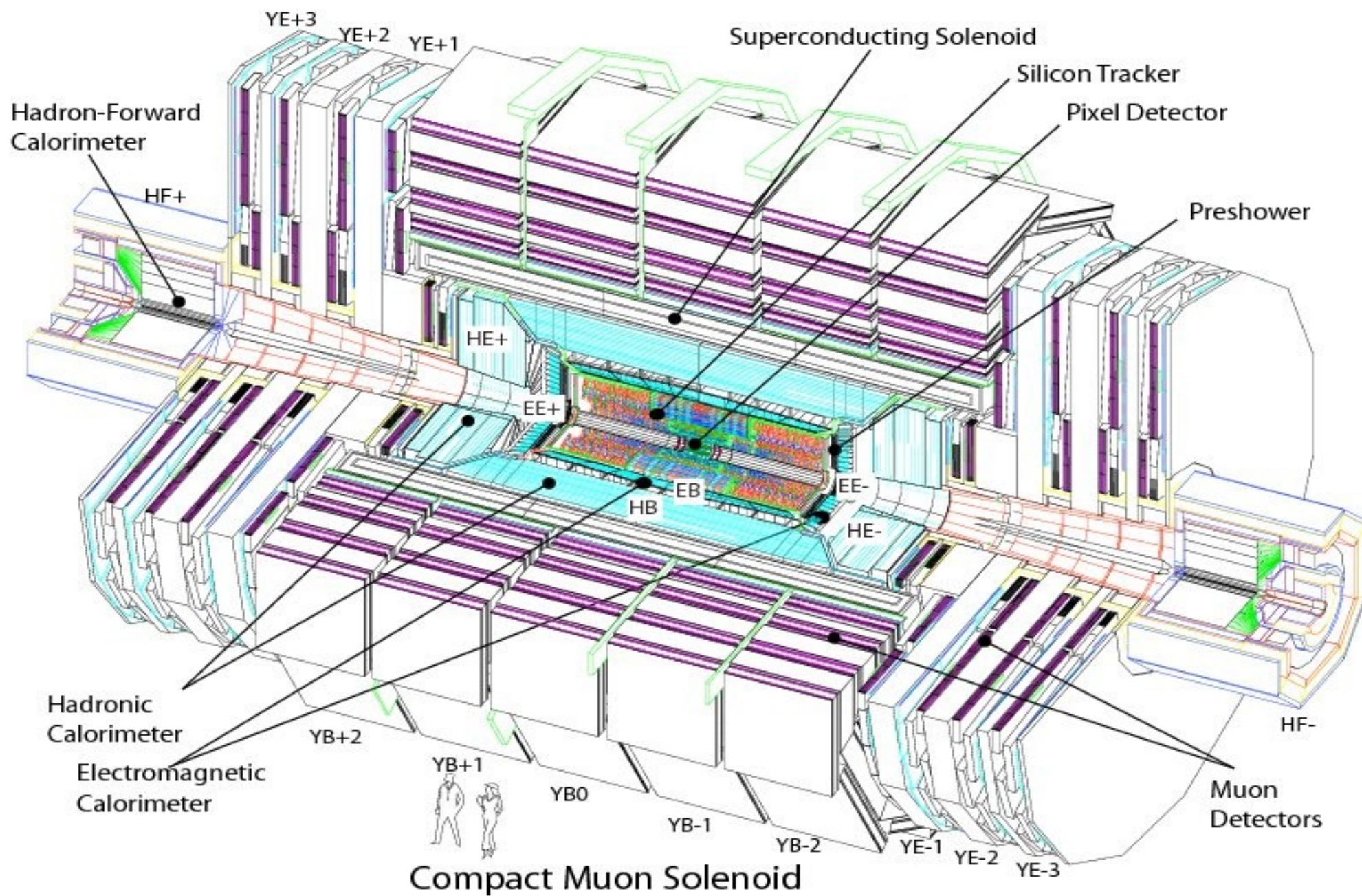
First results from CMS



outline

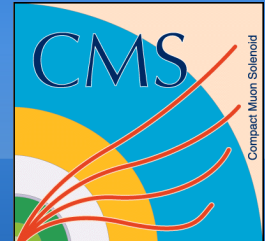
- CMS detector is fully operational
- CMS 2008/2009: millions of cosmics data
- CMS fall 2009: LHC is back
- What we have seen in the first collisions?
- Data – MC agreement
- What we expect for 2010?
- Conclusions

CMS detector



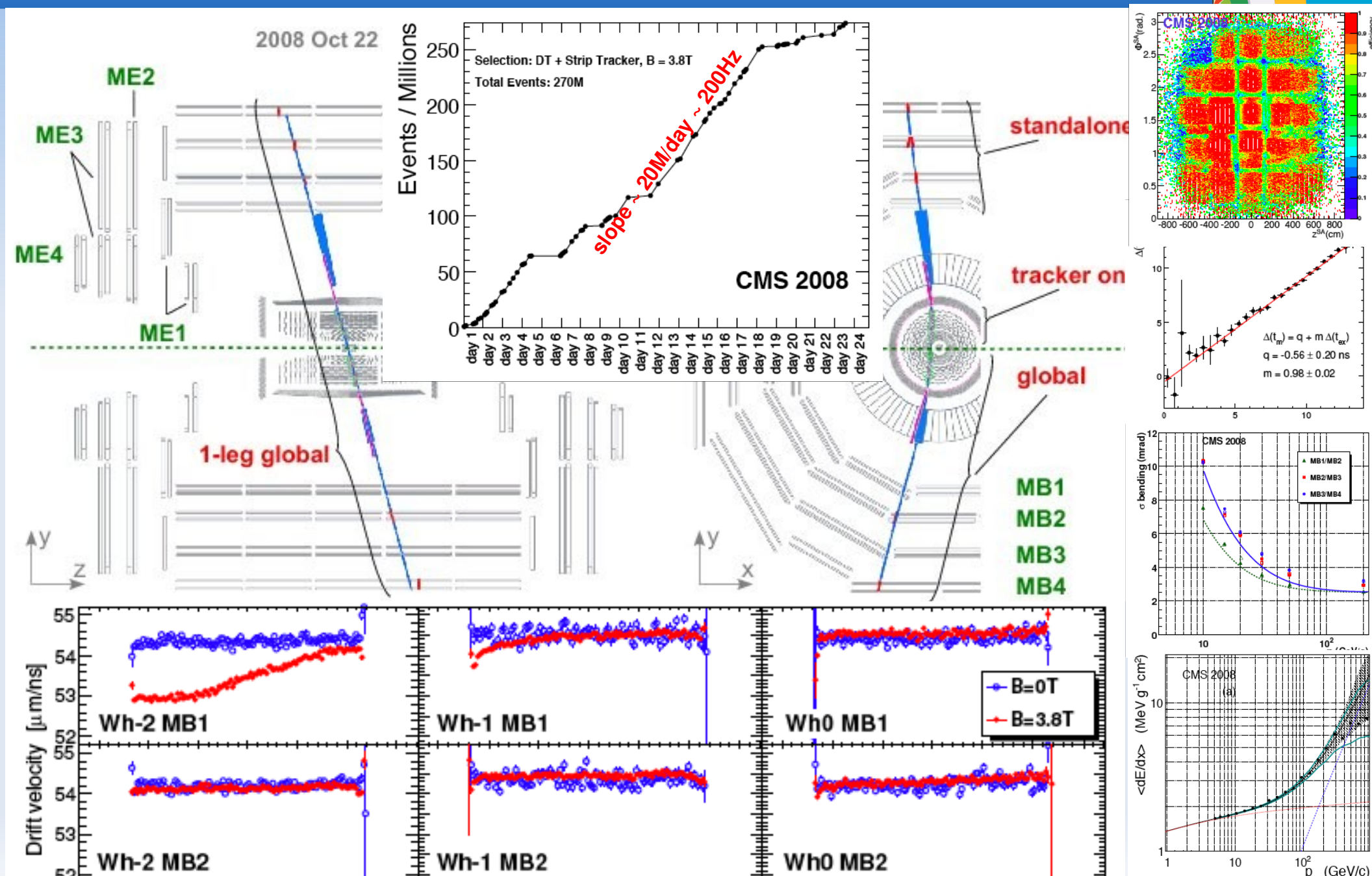


Cosmics data: Oct'08, Sep'09 with 3.8T



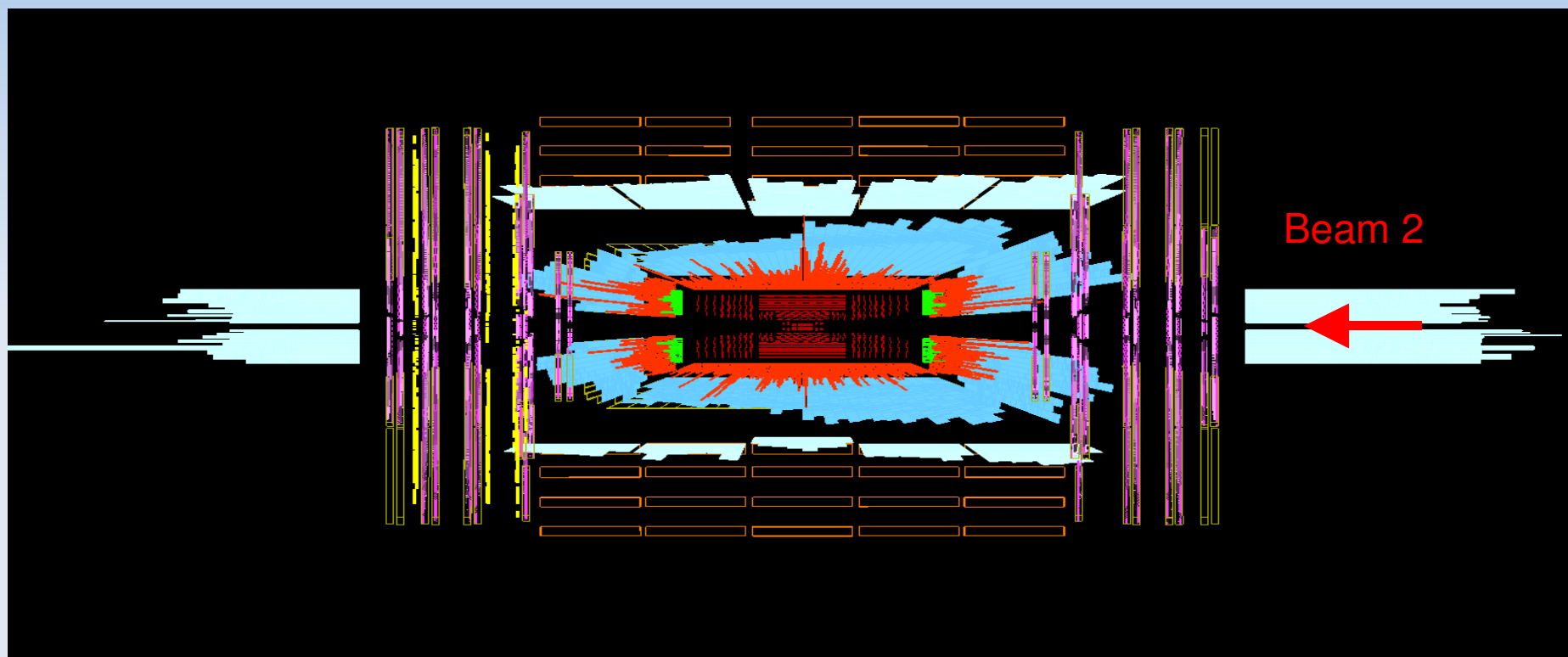
Piotr Zalewski
IPJ Warsaw

23 papers submitted to JINST



Beam splashes

Saturday 7 November 2009

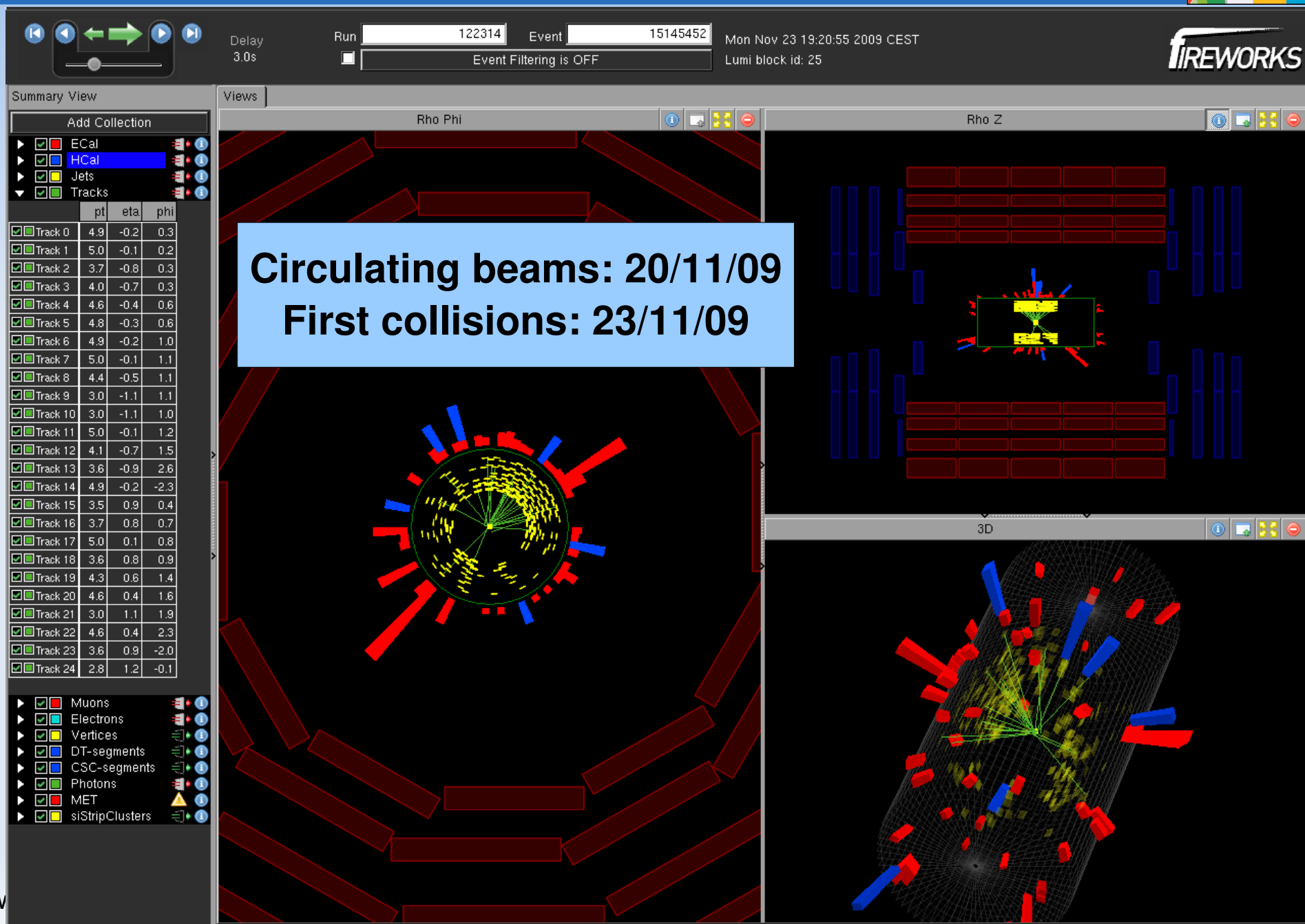
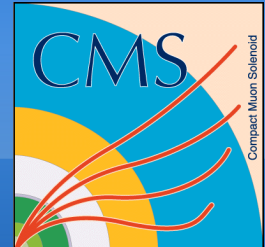


**ECAL energy deposits in red, Preshower in green,
HCAL energy deposits in blue (and light blue), RPC muon
hits are in yellow, and CSC muon hits are in magenta.**



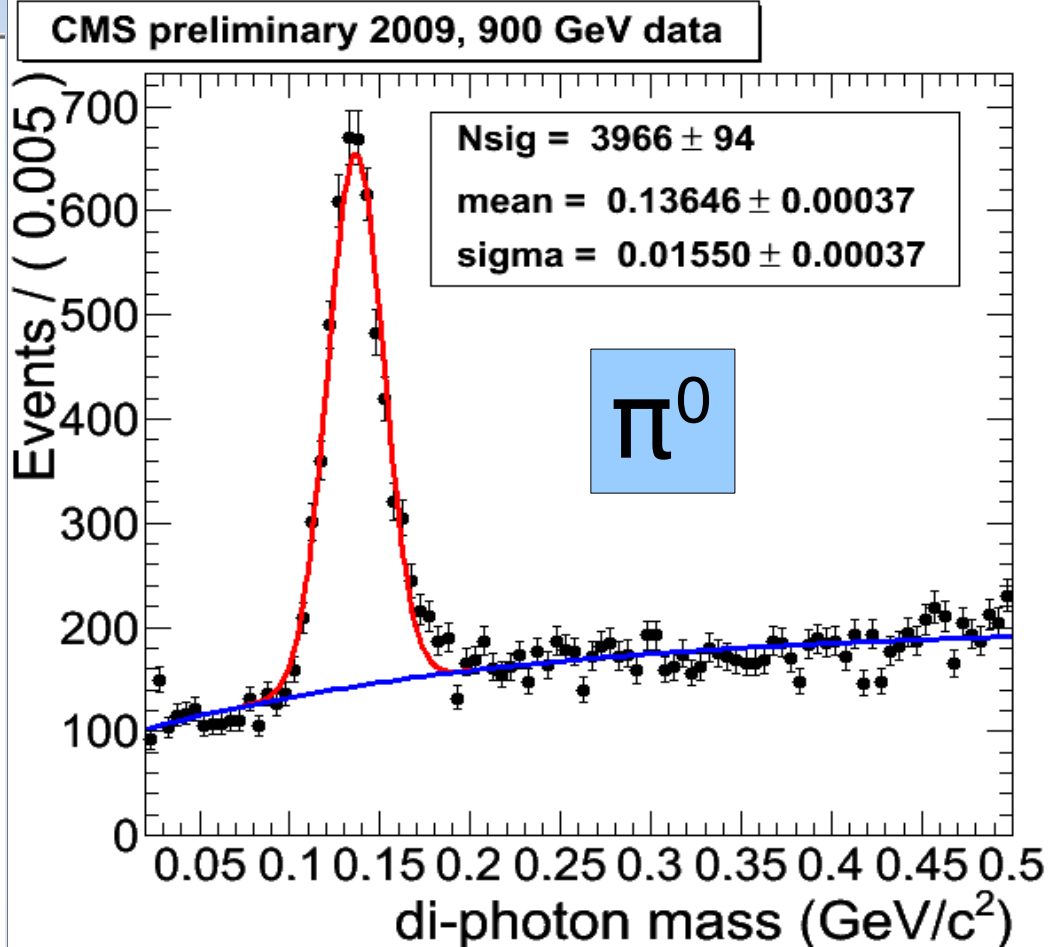
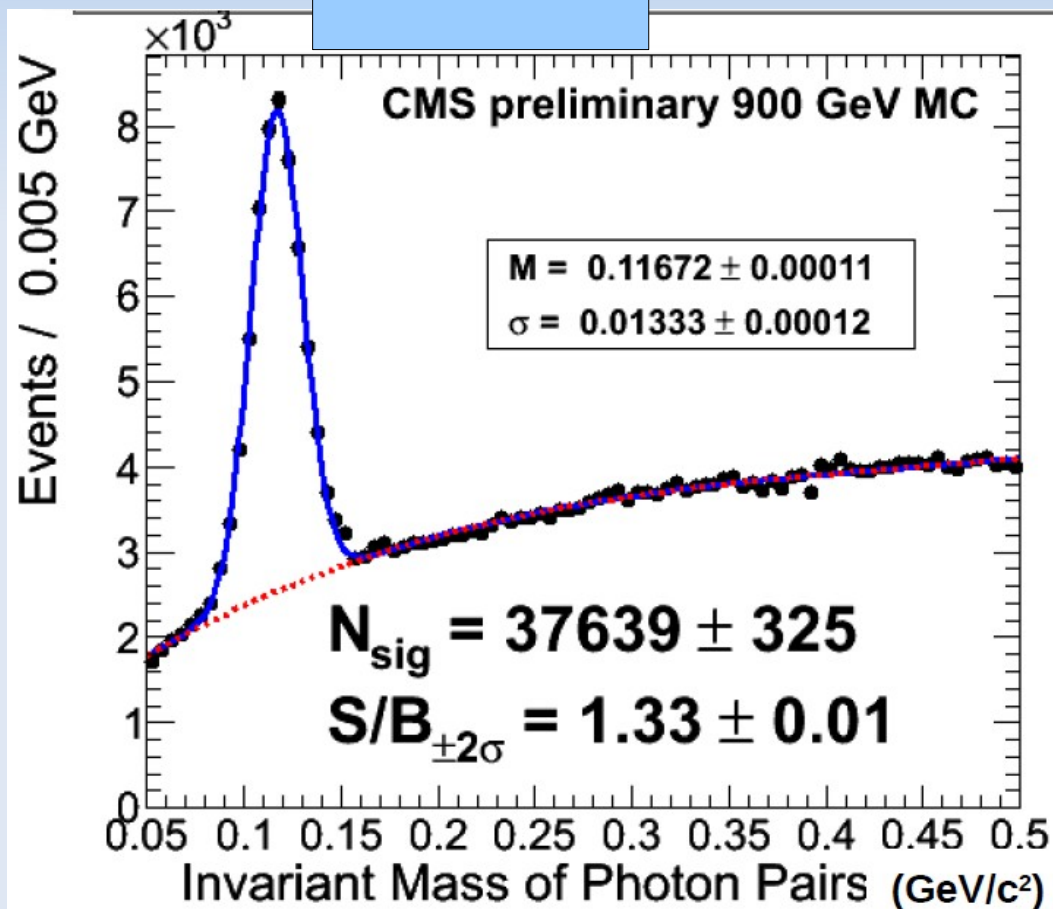
Piotr Zalewski
IPJ Warsaw

First collisions!

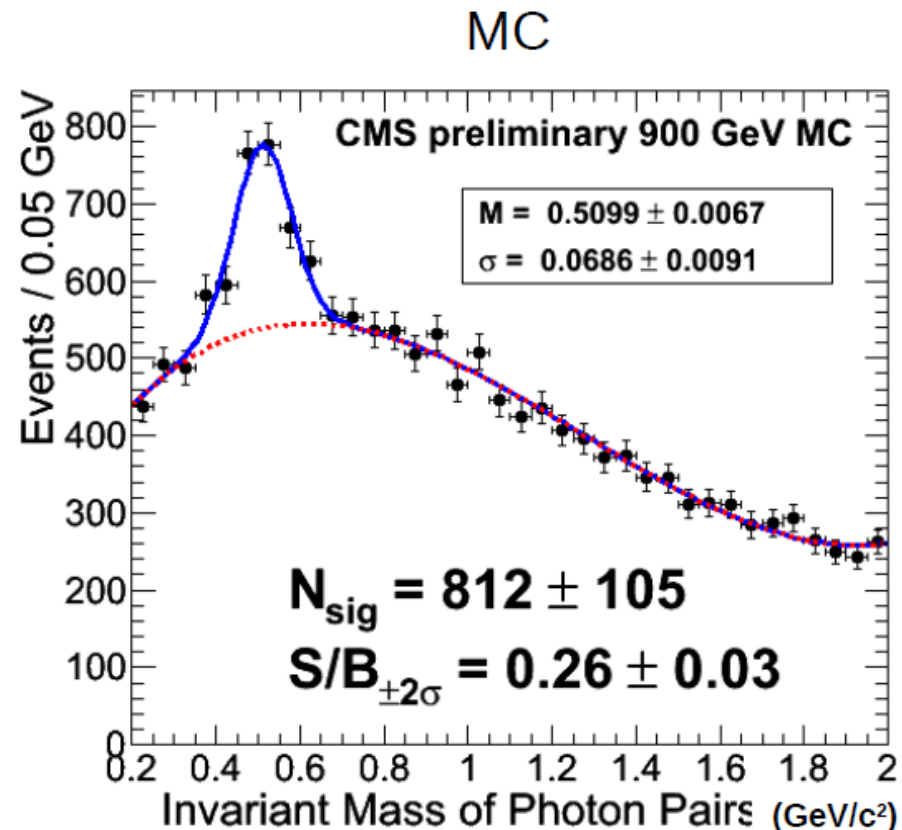
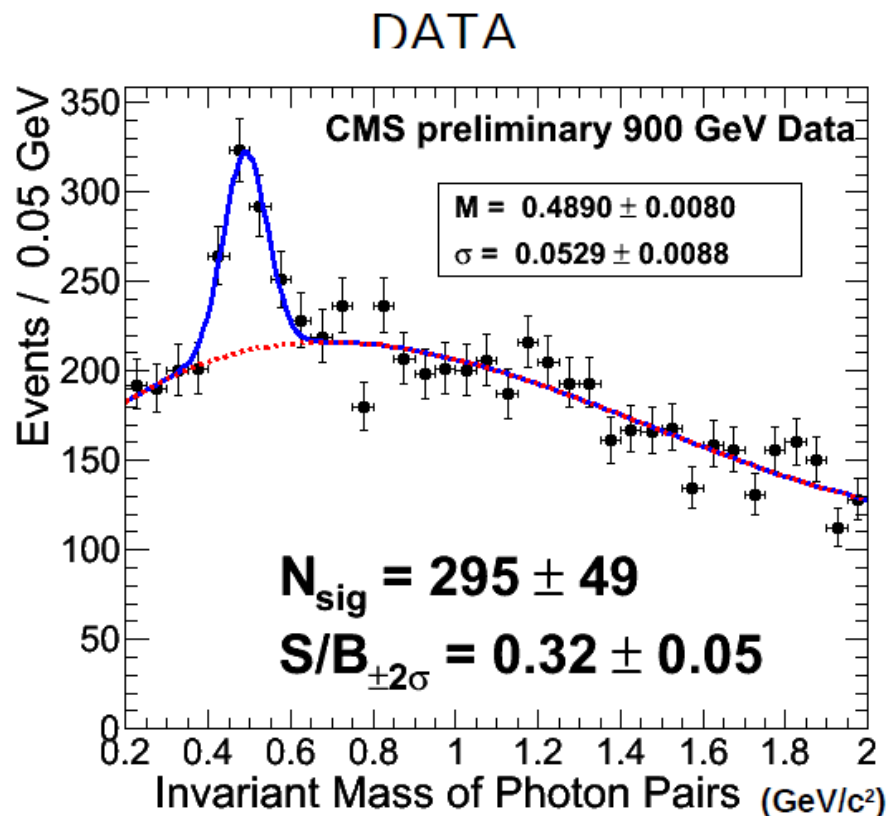


First di-photon distributions

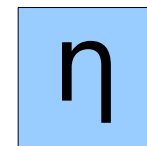
27/11/2009



First di-photon distributions

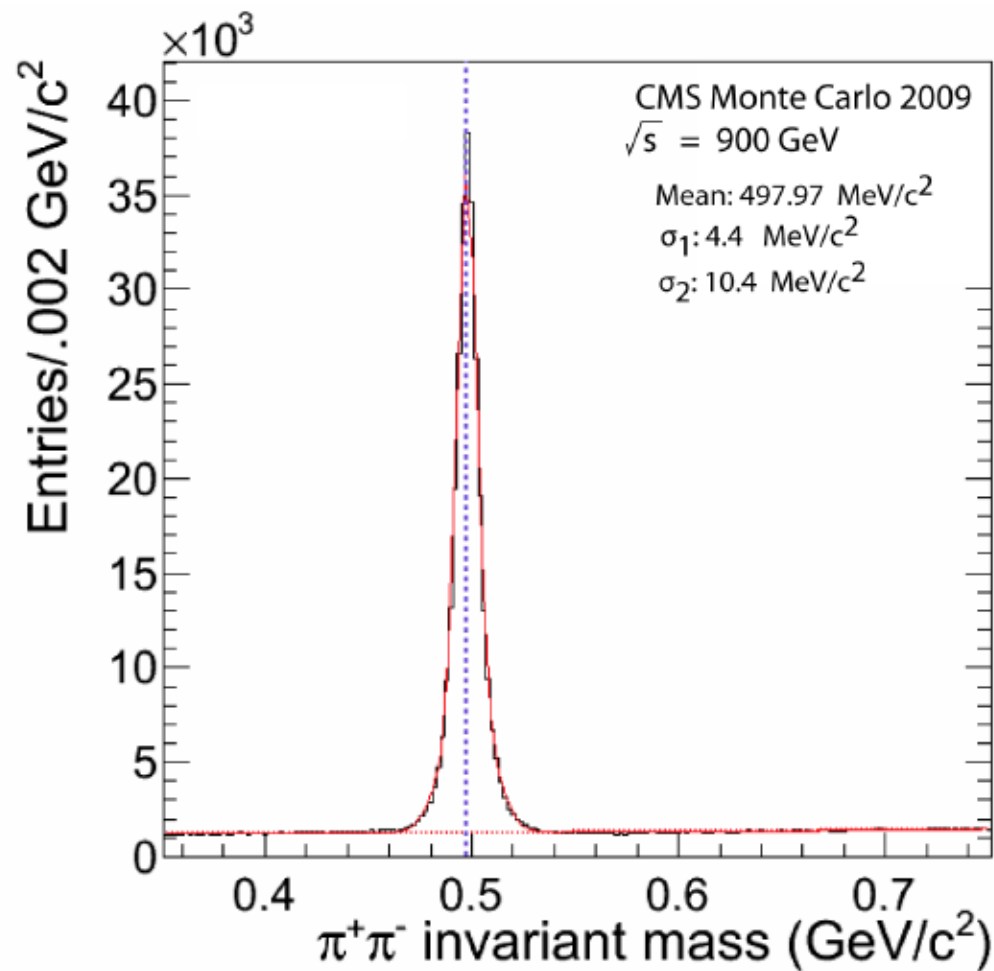
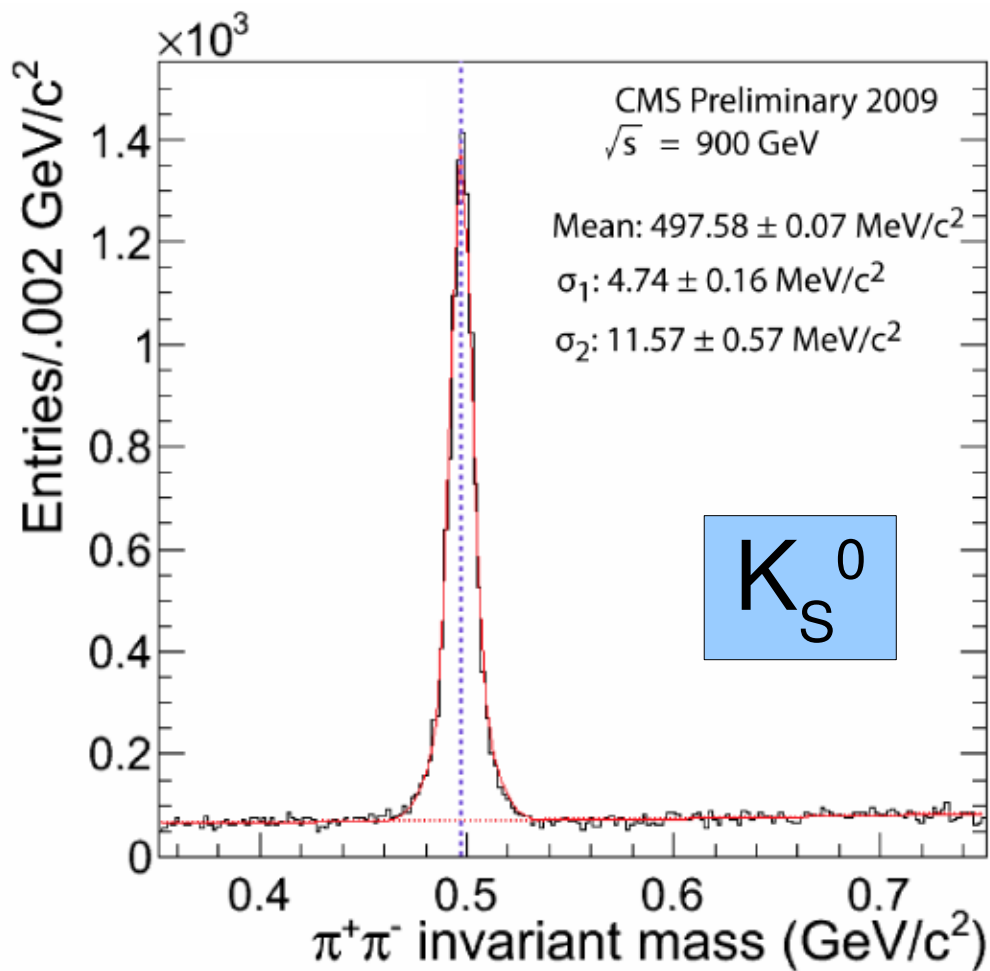


- Mass and width compatible with MC
- η yield scale as expected (π^0 candle)
 - ◆ $N(\eta) / N(\pi^0) = 0.020 \pm 0.003$ DATA
 - ◆ $N(\eta) / N(\pi^0) = 0.021 \pm 0.003$ MC



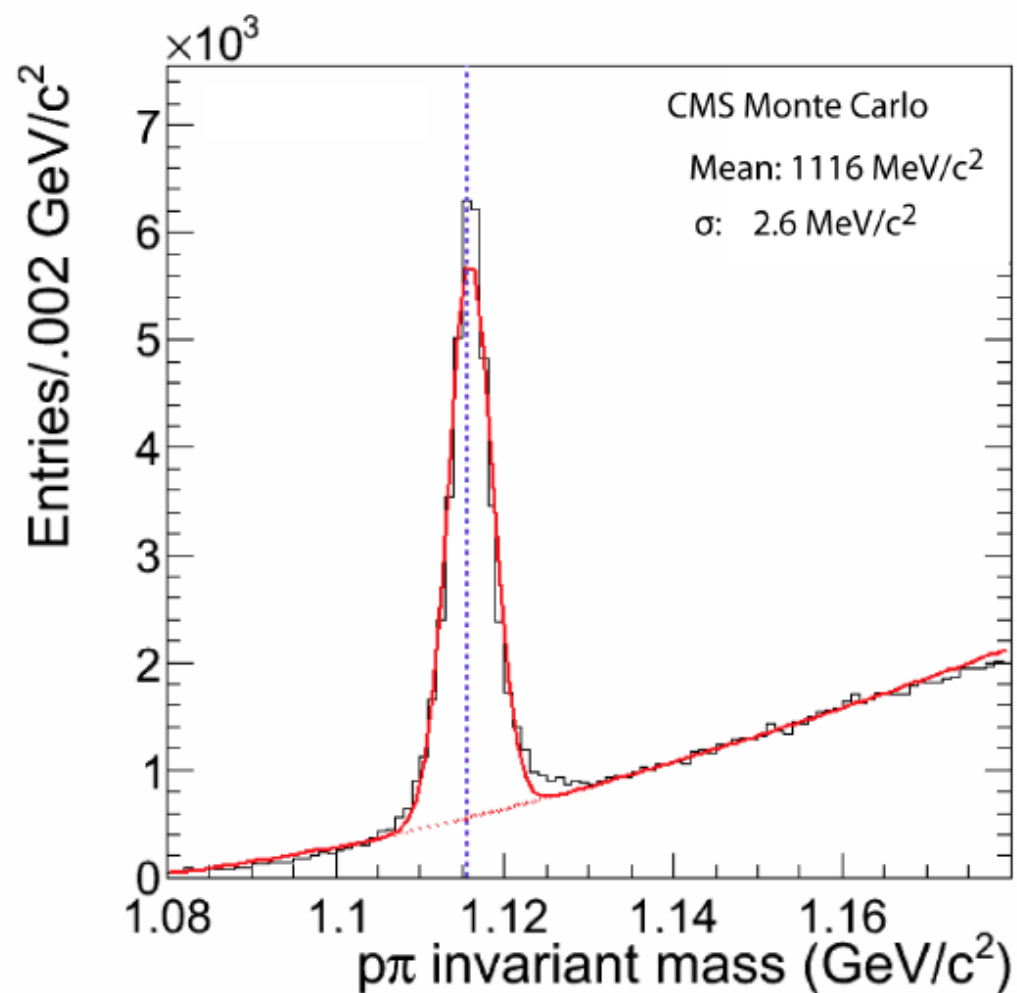
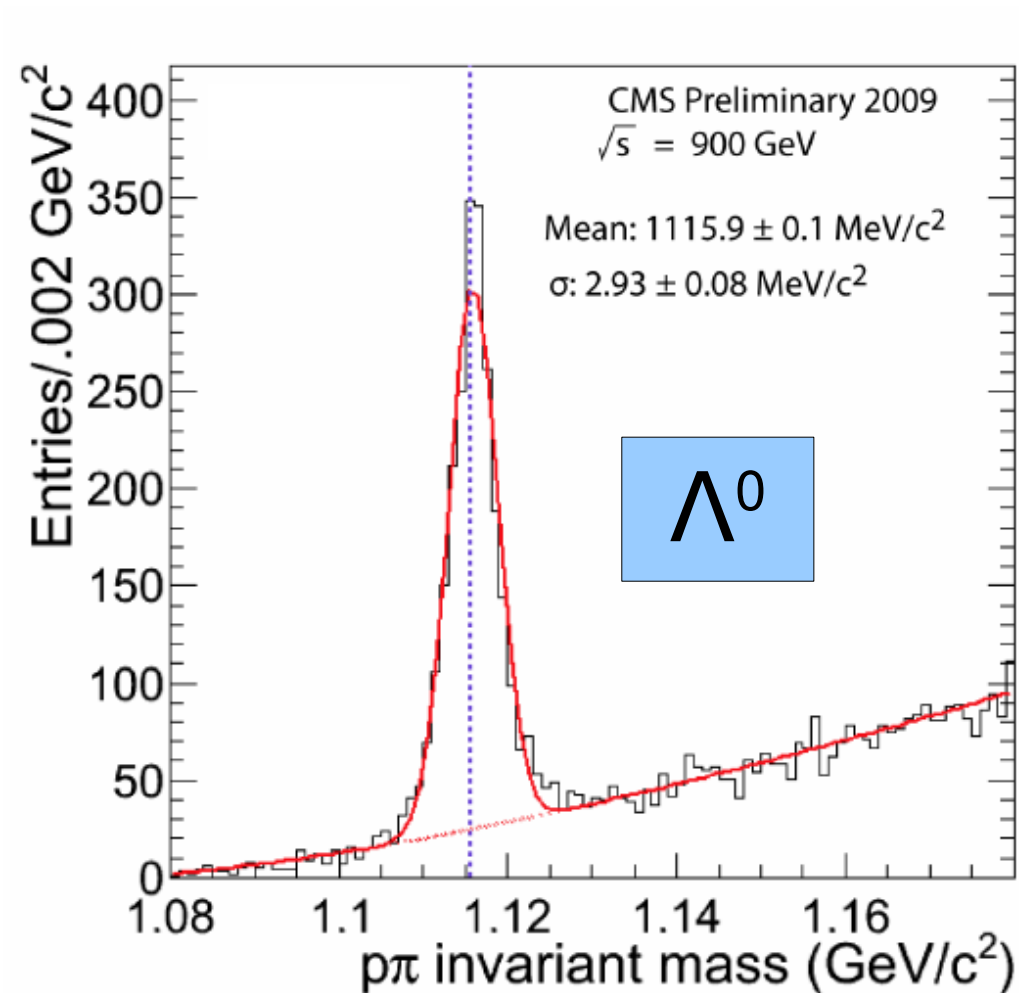
6/12/09: stable beams

First results were shown next day!



6/12/09: stable beams

First results were shown next day!

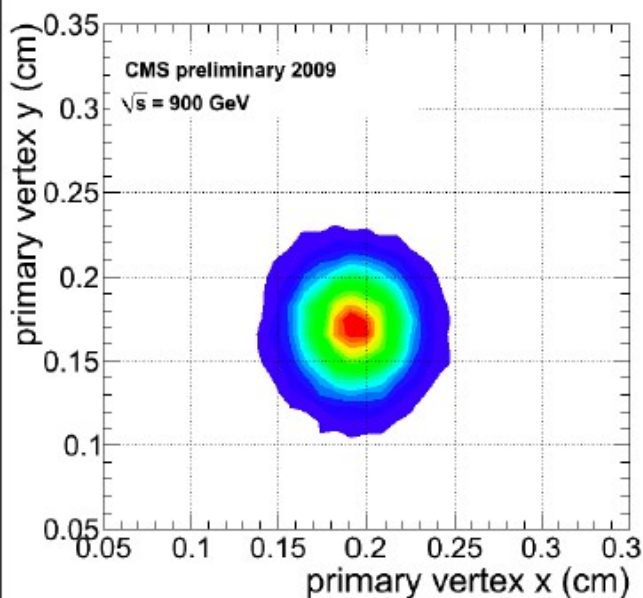
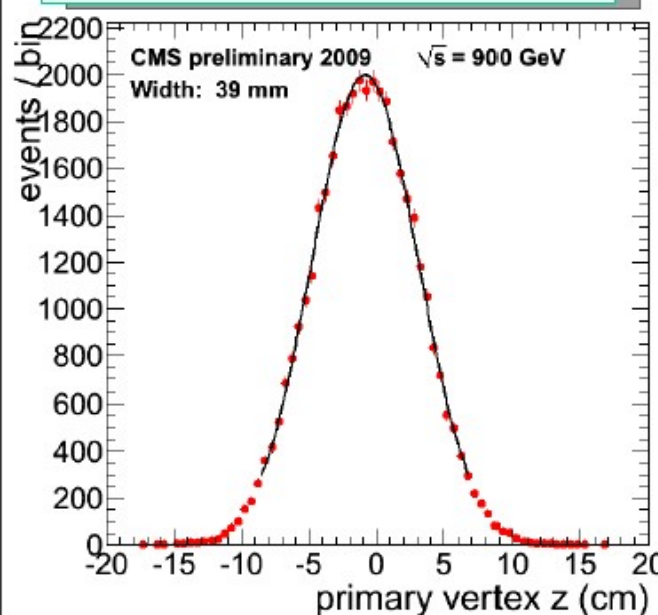




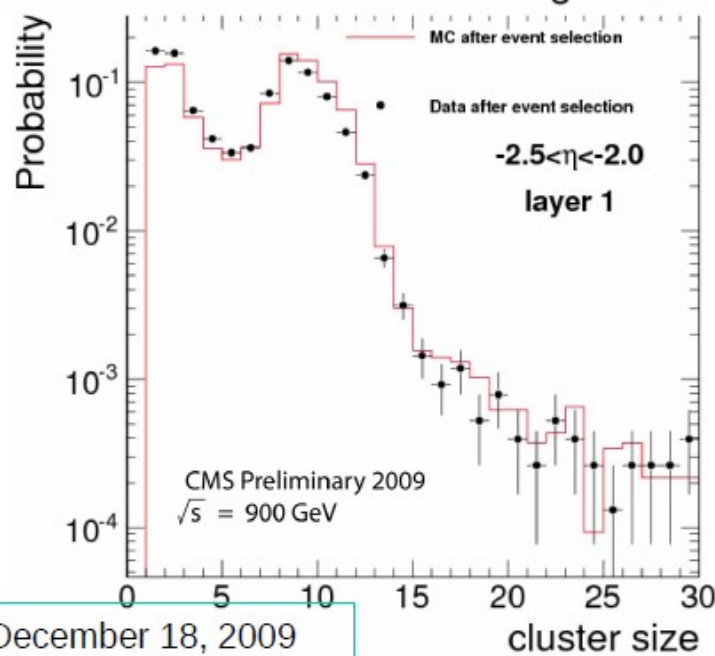
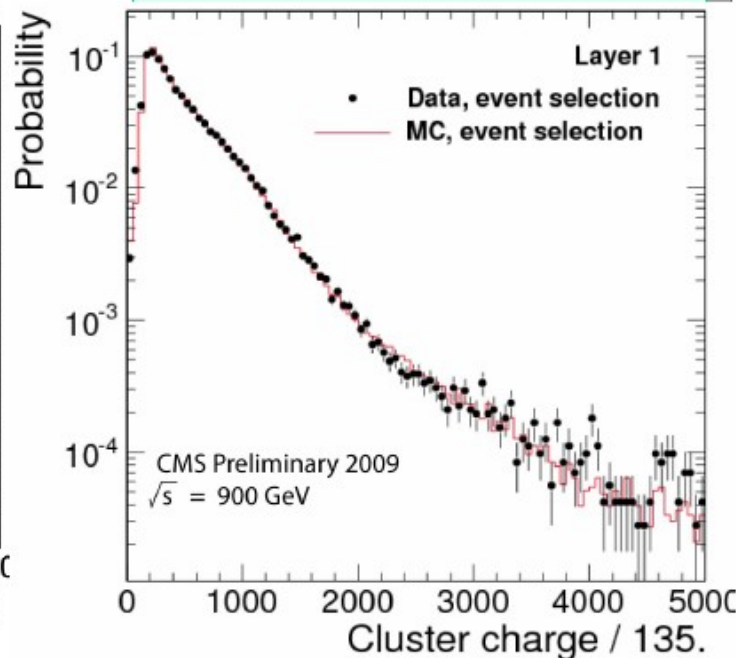
Detector performance tracking*



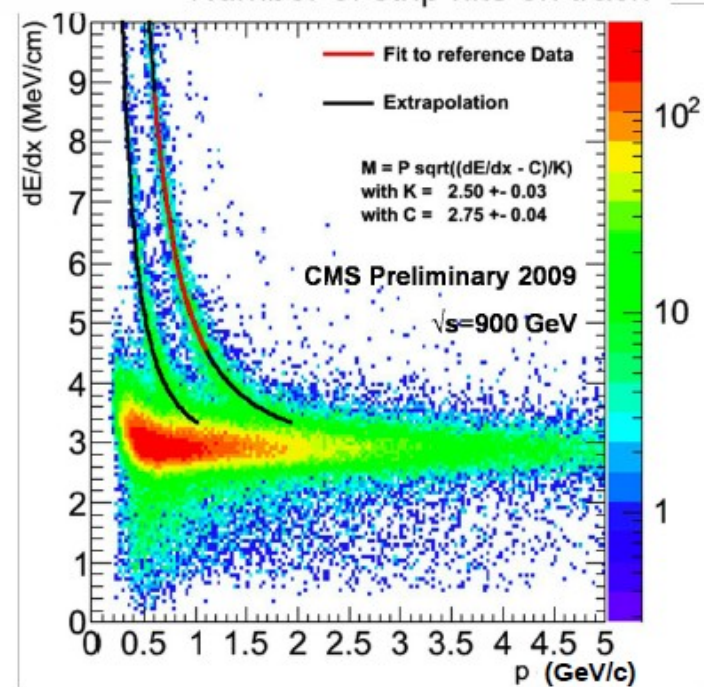
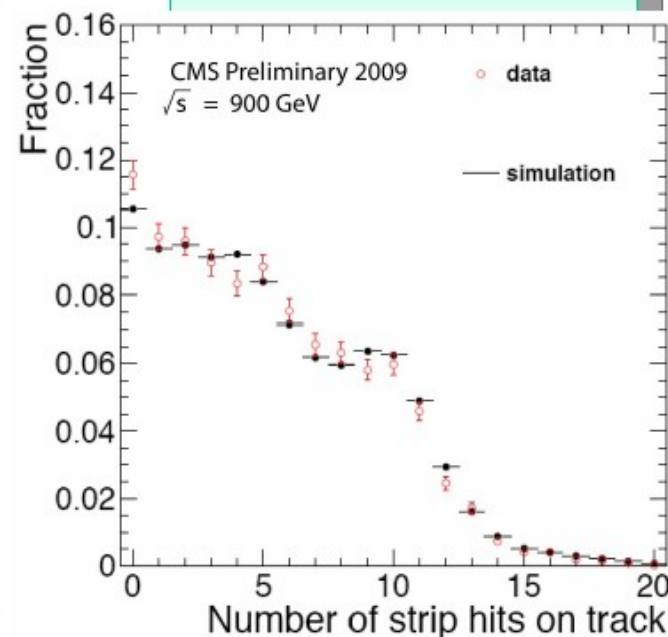
Primary Vertex



Pixels Clusters



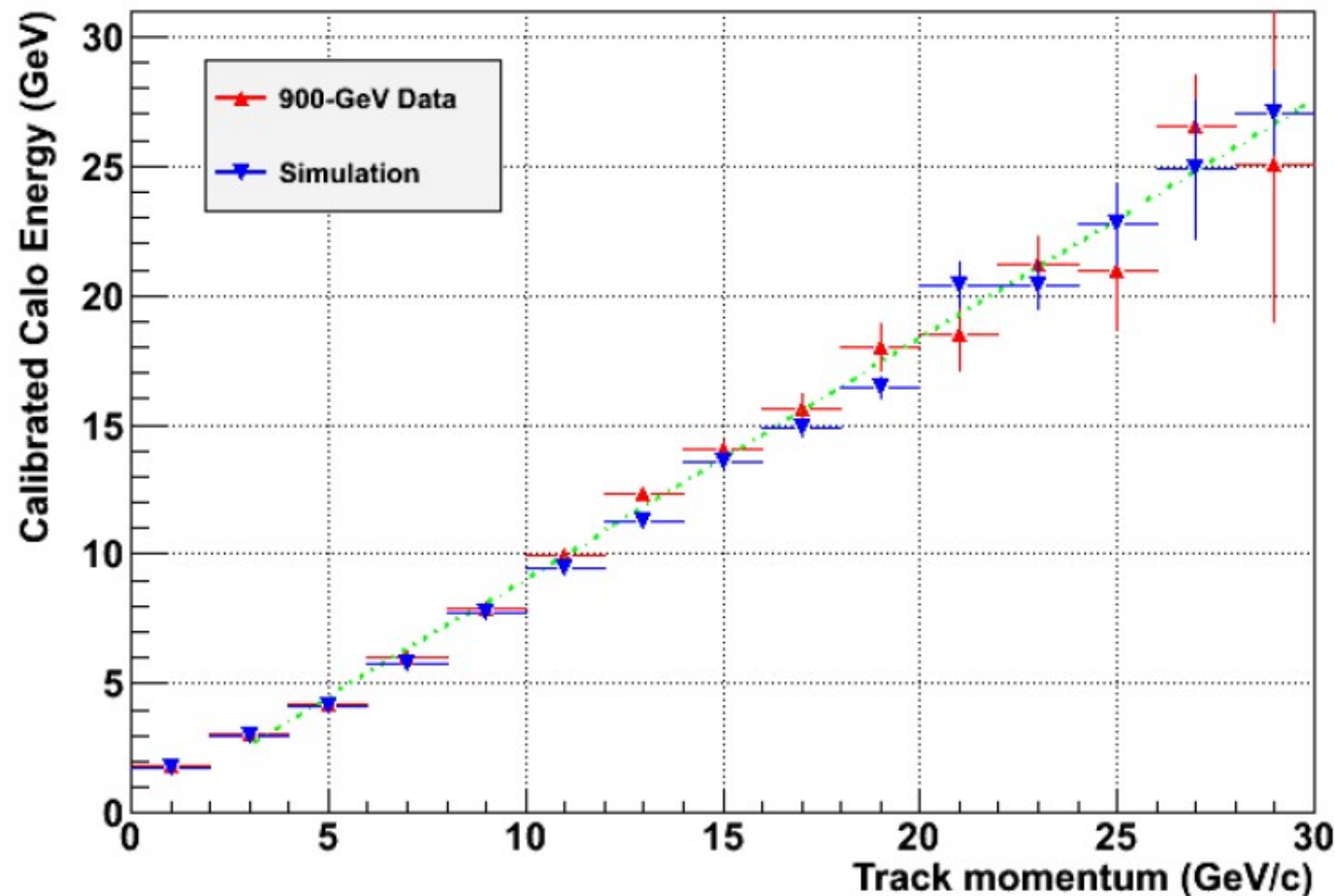
Strip Tracker



* From Jim Virdee's Council talk Friday December 18, 2009

Charged hadron response

CMS Preliminary 2009

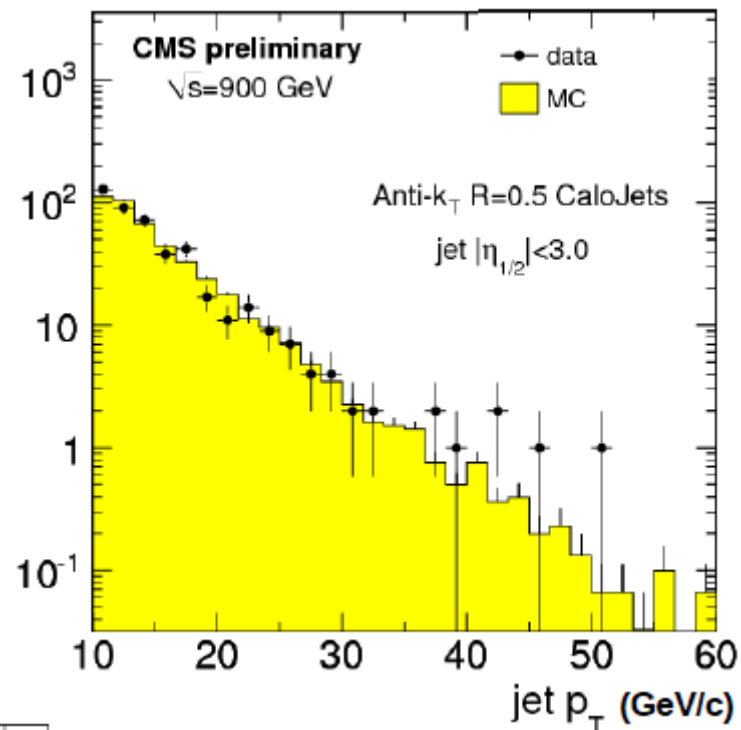
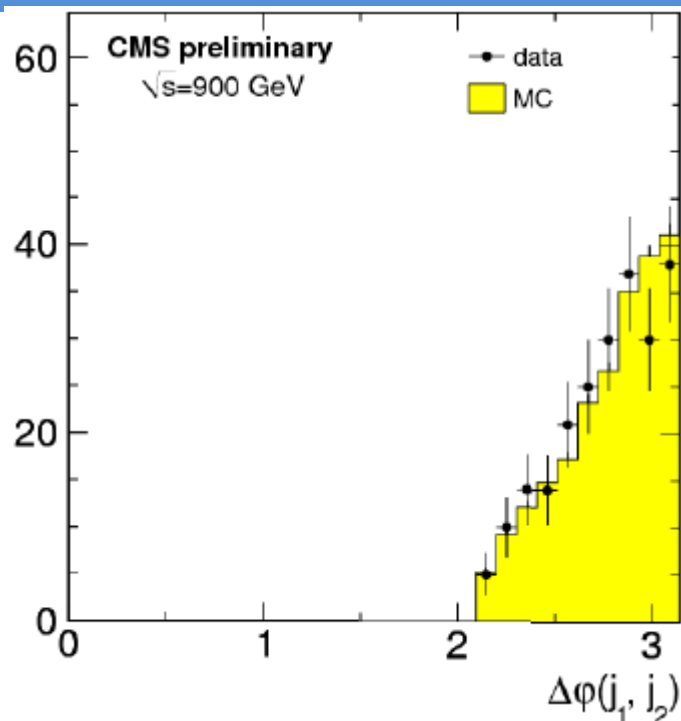
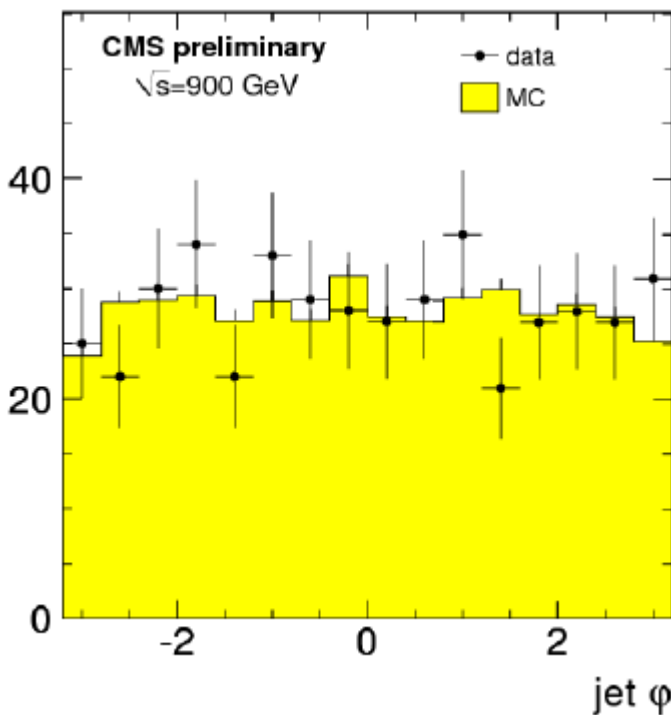


Selections:

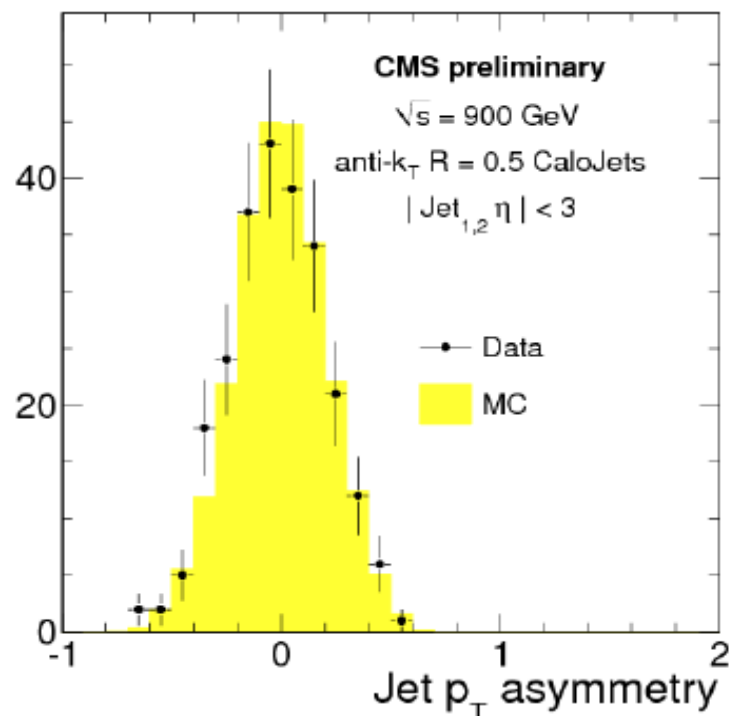
- track $p_T > 1$ GeV/c and $|\eta| < 2.4$
- $n_{\text{Hits}} > 14$ and $n_{\text{PixelHits}} > 1$
- only one track in the corresponding "PFBlock"
- Something in the HCAL linked to the track

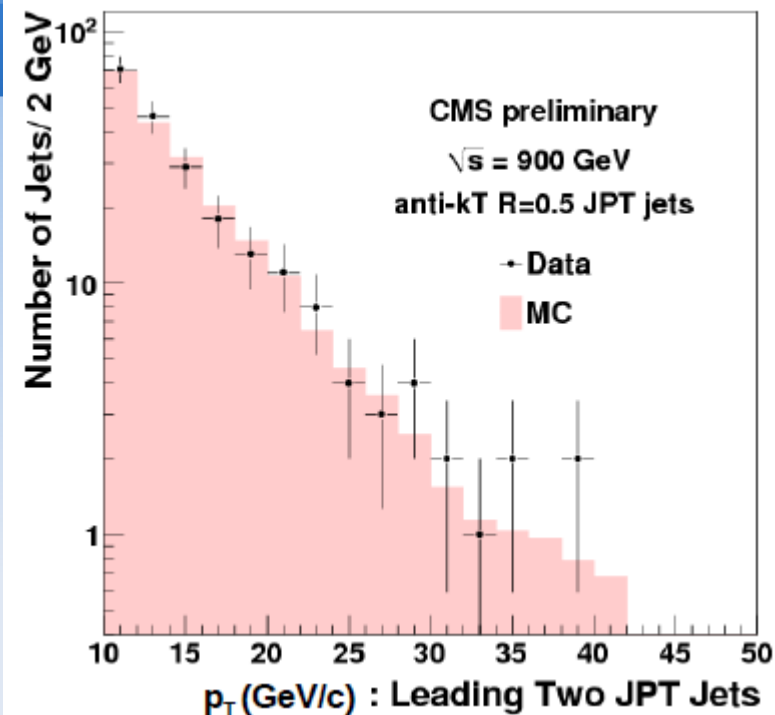
Linear fit to the data above 3 GeV.

MC based calibration is validated

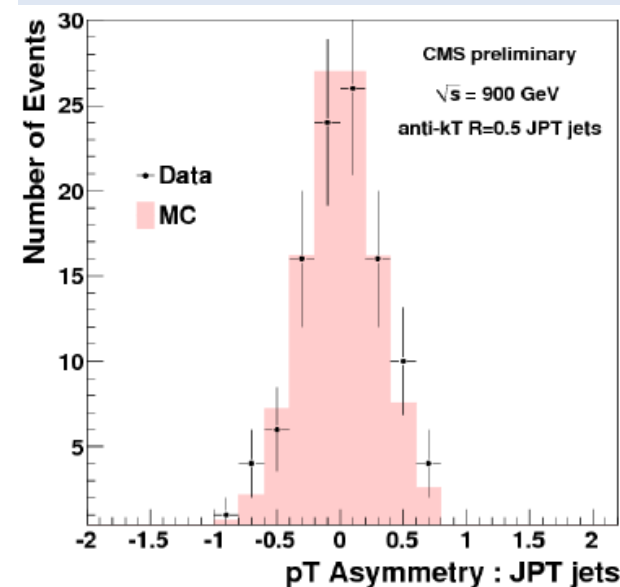
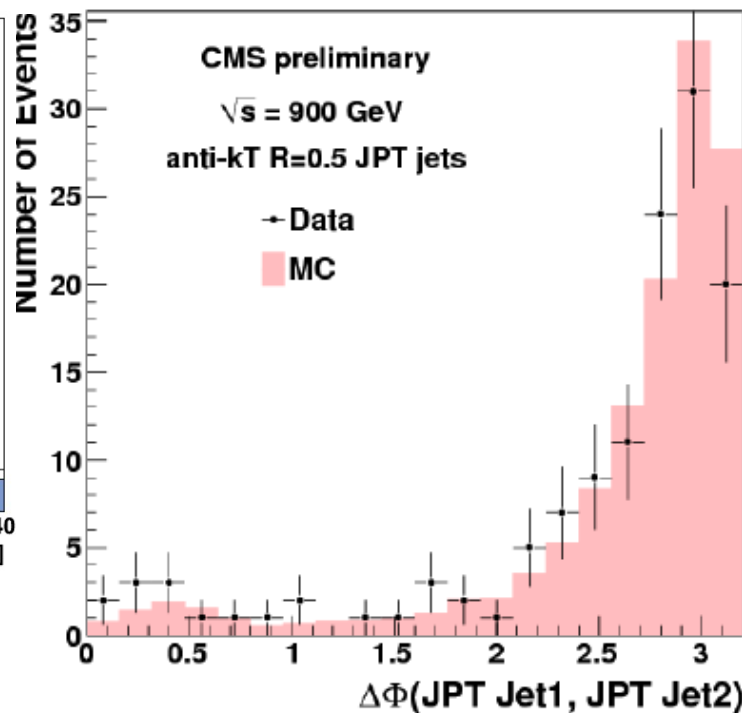
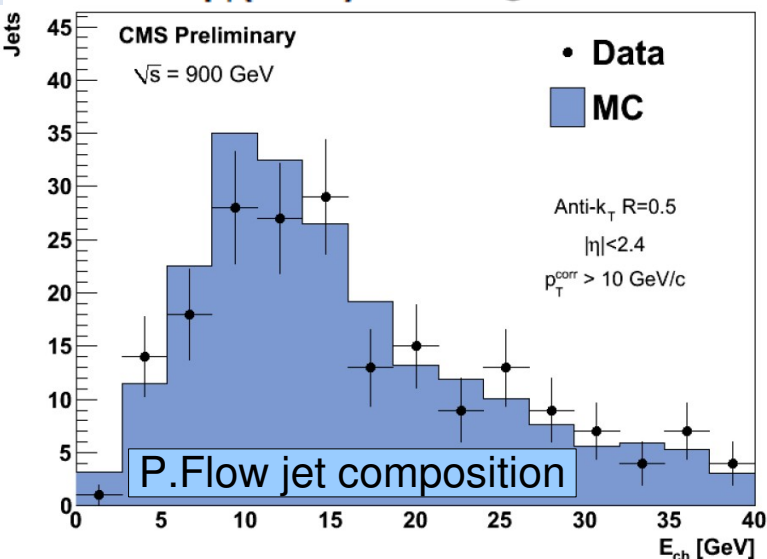
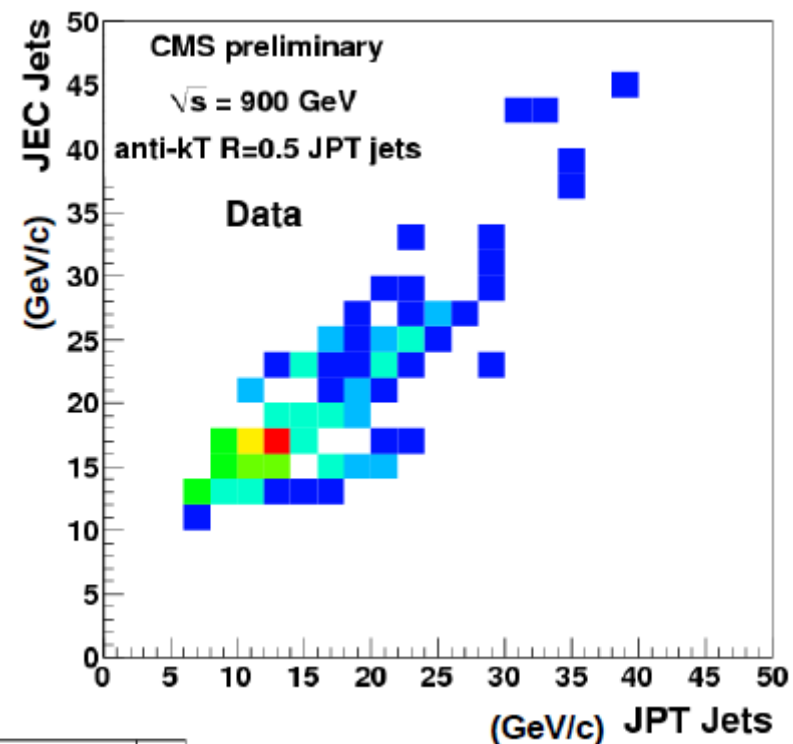


Data – MC
agreement

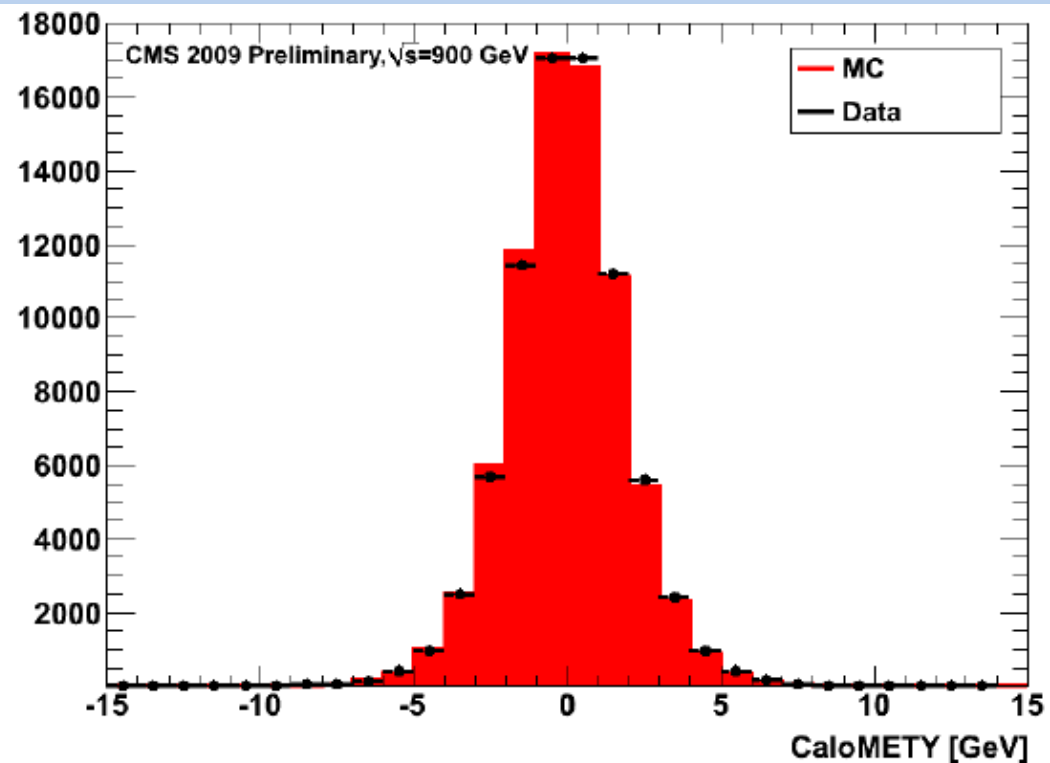
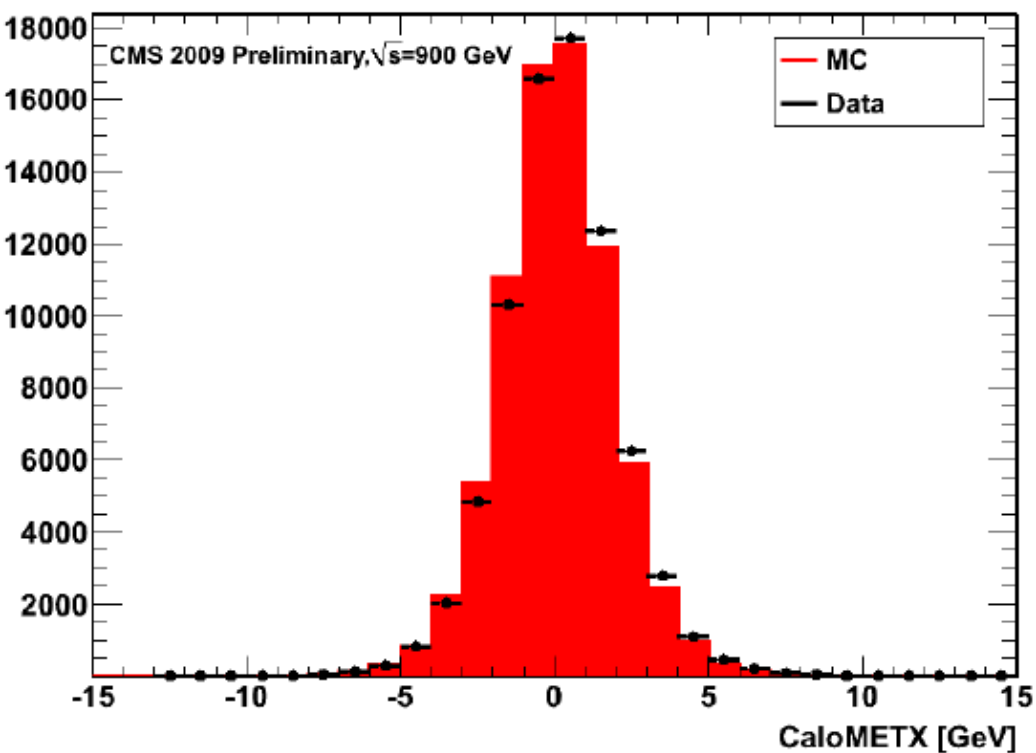




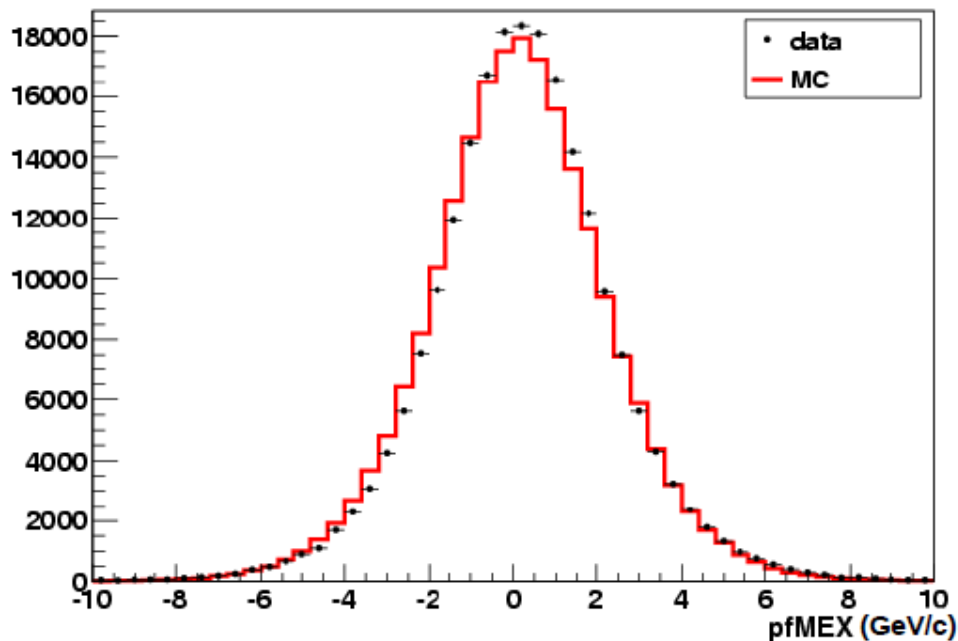
Data – MC
 agreement



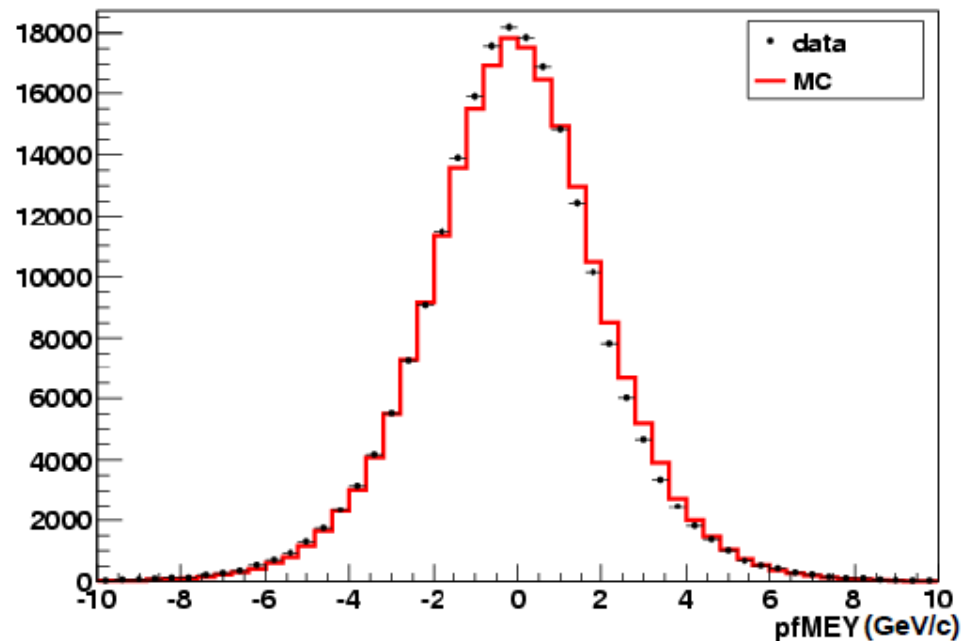
Colorimeter Missing ET



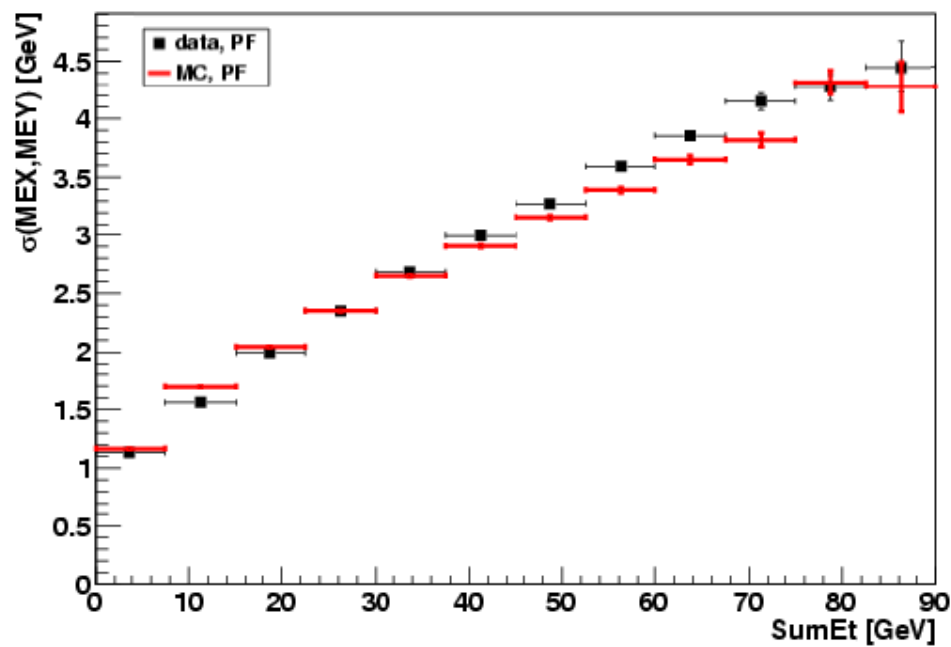
CMS Preliminary 2009, 900 GeV data



CMS Preliminary 2009, 900 GeV data



CMS Preliminary 2009, 900 GeV data



Note: In plot at left $\sigma(\text{MEX}, \text{MEY})$ corresponds to a Gaussian fit to a histogram containing MEX and MEY. Thus one has 2 entries per event and σ corresponds to the resolution on one coordinate of MET only.

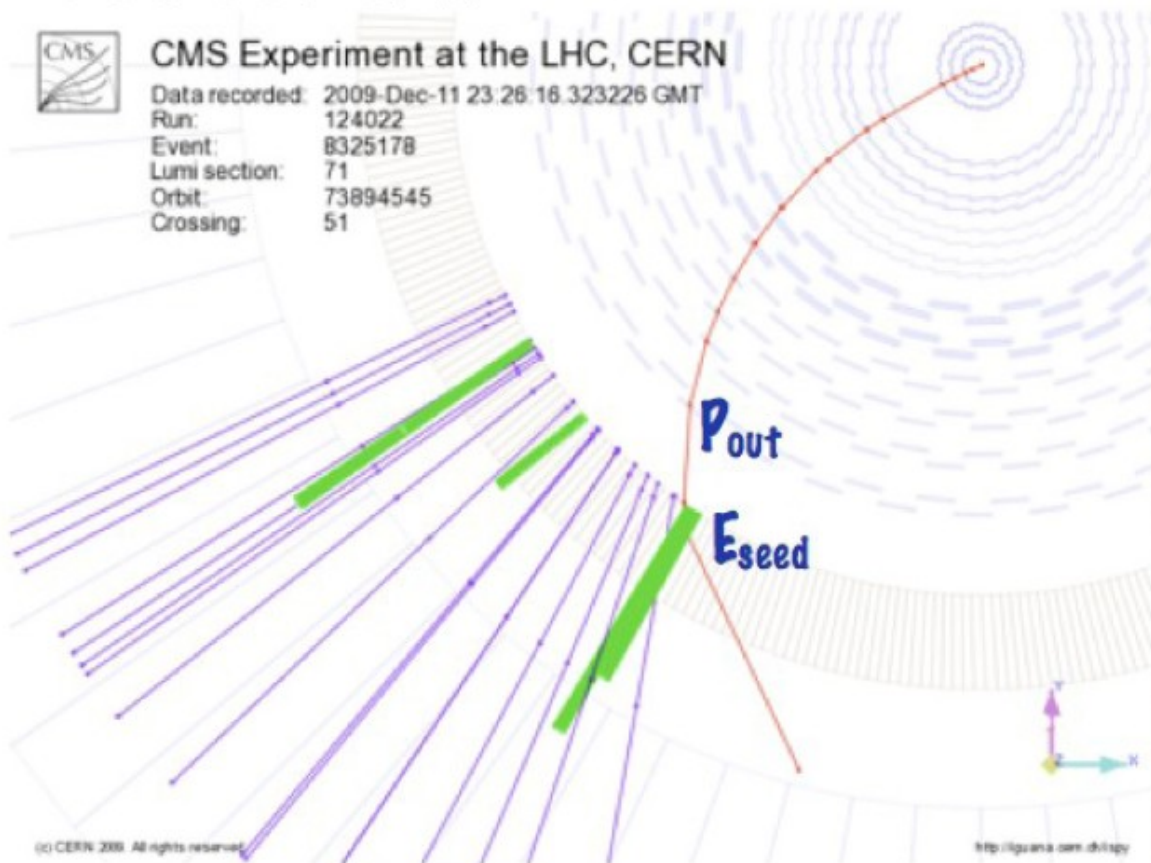
Electron candidate in the particle flow

900 GeV data



CMS Experiment at the LHC, CERN

Data recorded: 2009-Dec-11 23:26:16.323226 GMT
Run: 124022
Event: 8325178
Lumi section: 71
Orbit: 73894545
Crossing: 51



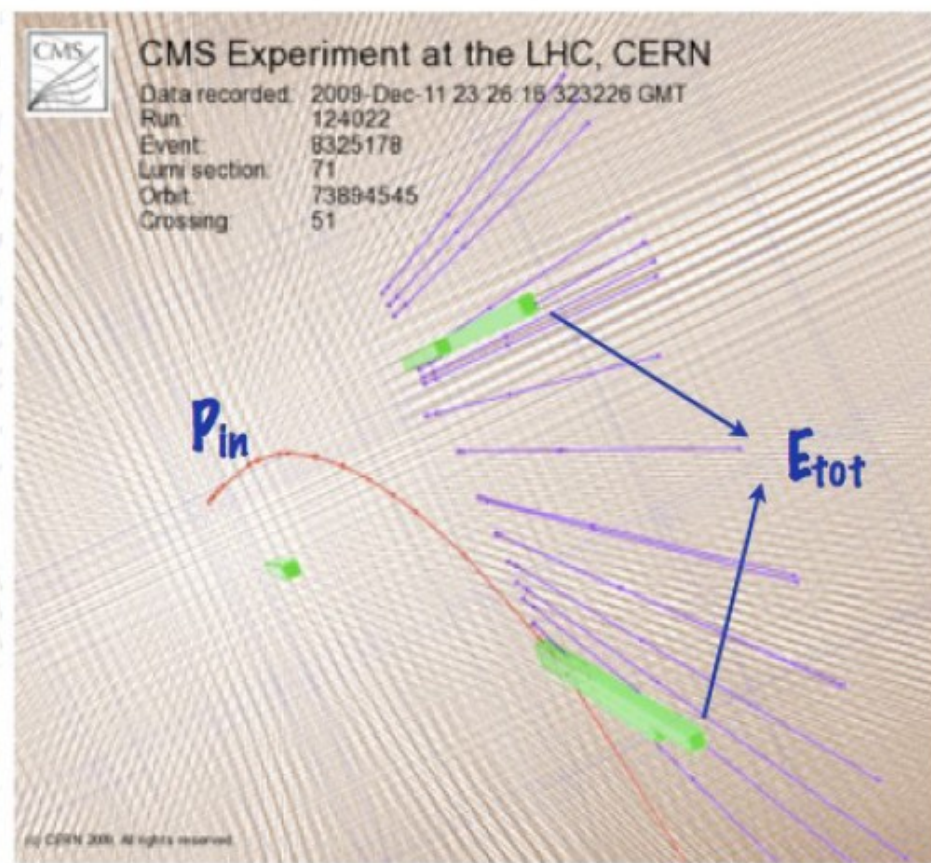
(c) CERN 2009. All rights reserved.

<http://lqguana.cern.ch/ipy>



CMS Experiment at the LHC, CERN

Data recorded: 2009-Dec-11 23:26:16.323226 GMT
Run: 124022
Event: 8325178
Lumi section: 71
Orbit: 73894545
Crossing: 51



(c) CERN 2009. All rights reserved.

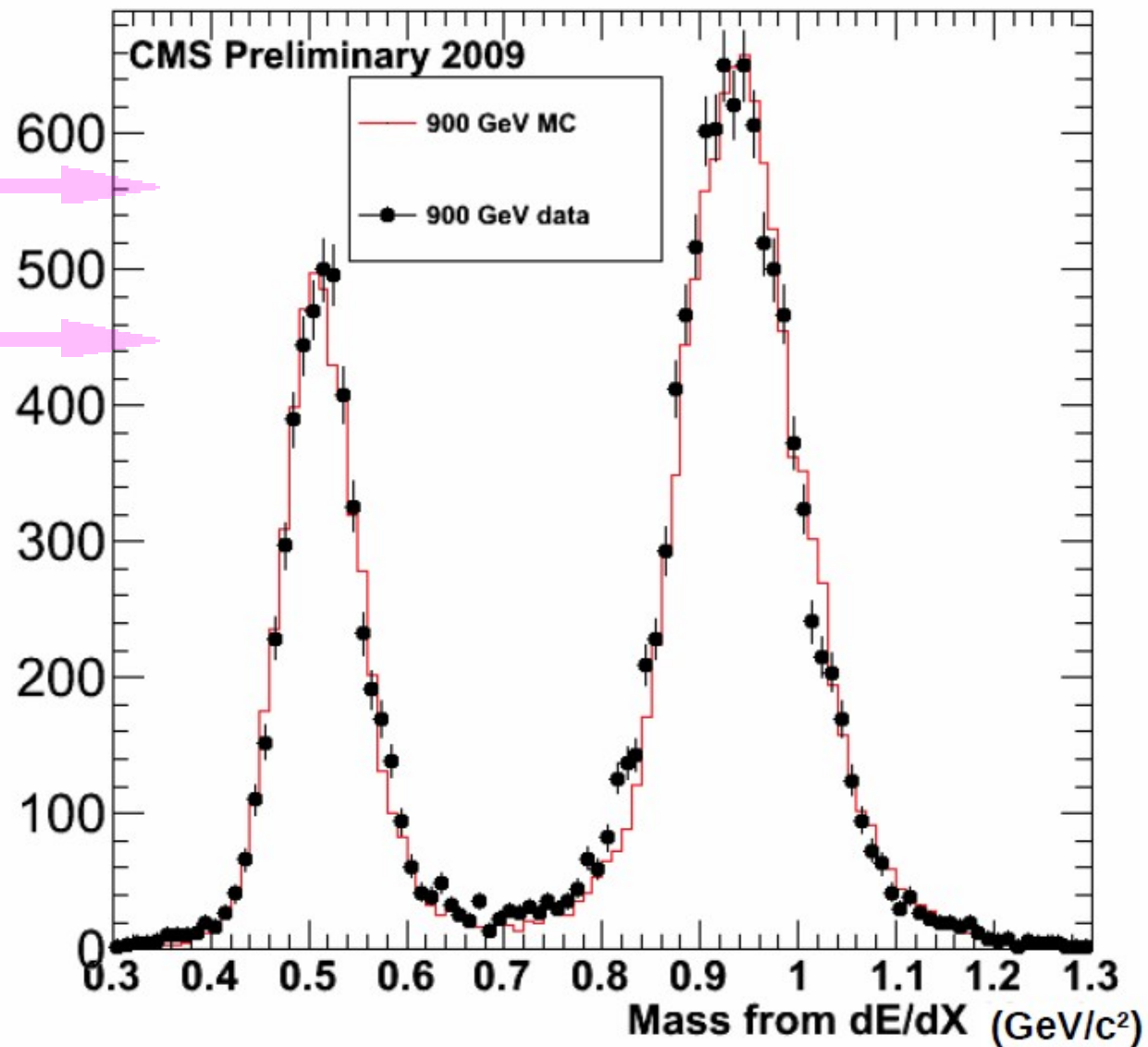
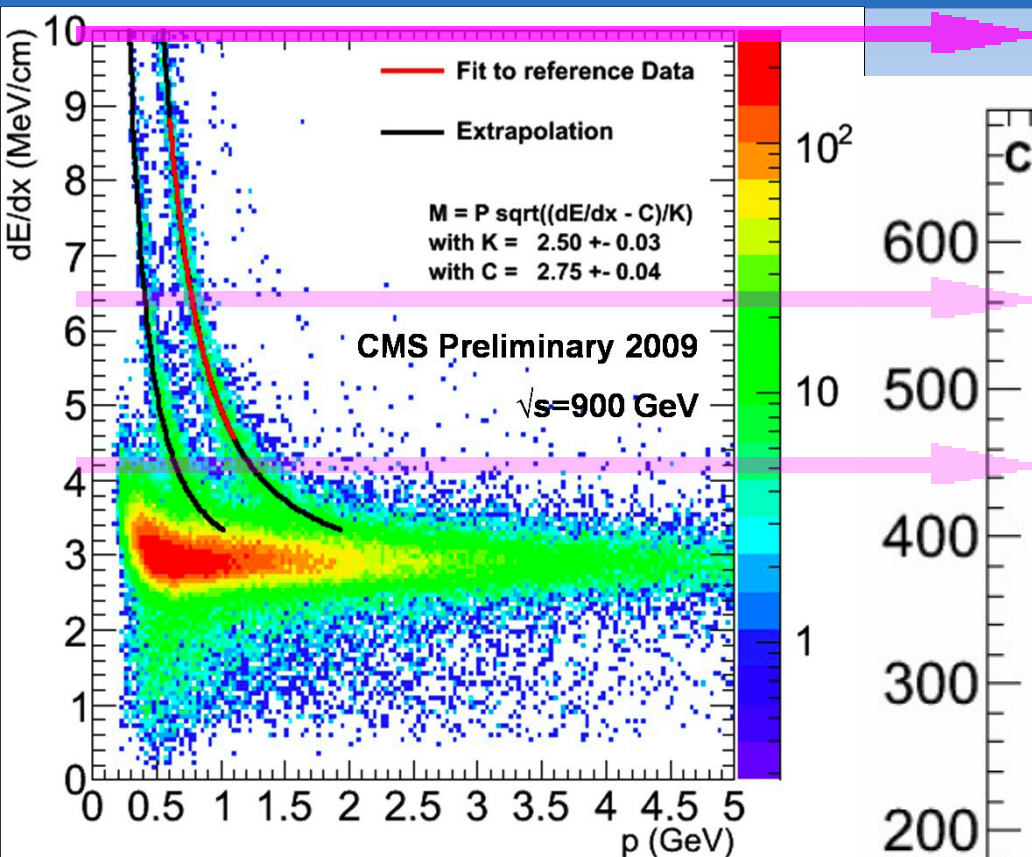
$E_{\text{seed}} = 1.26 \text{ GeV}$
 $P_{\text{out}} = 1.18 \text{ GeV/c}$
 $E_{\text{seed}}/P_{\text{out}} = 1.07$

$E_{\text{tot}} = 2.32$
 $P_{\text{in}} = 2.56 \text{ GeV/c}$
 $E_{\text{tot}}/P_{\text{in}} = 0.91$

$E_{\text{brem}} = 1.06 \text{ GeV}$
 $P_{\text{in}} - P_{\text{out}} = 1.38 \text{ GeV/c}$

dE/dx in silicon tracker particle identification

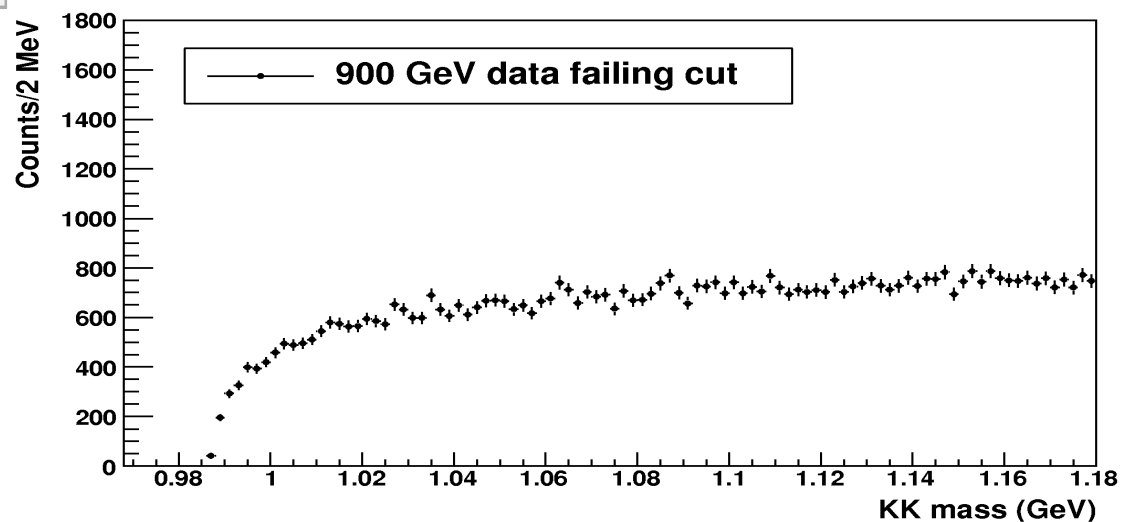
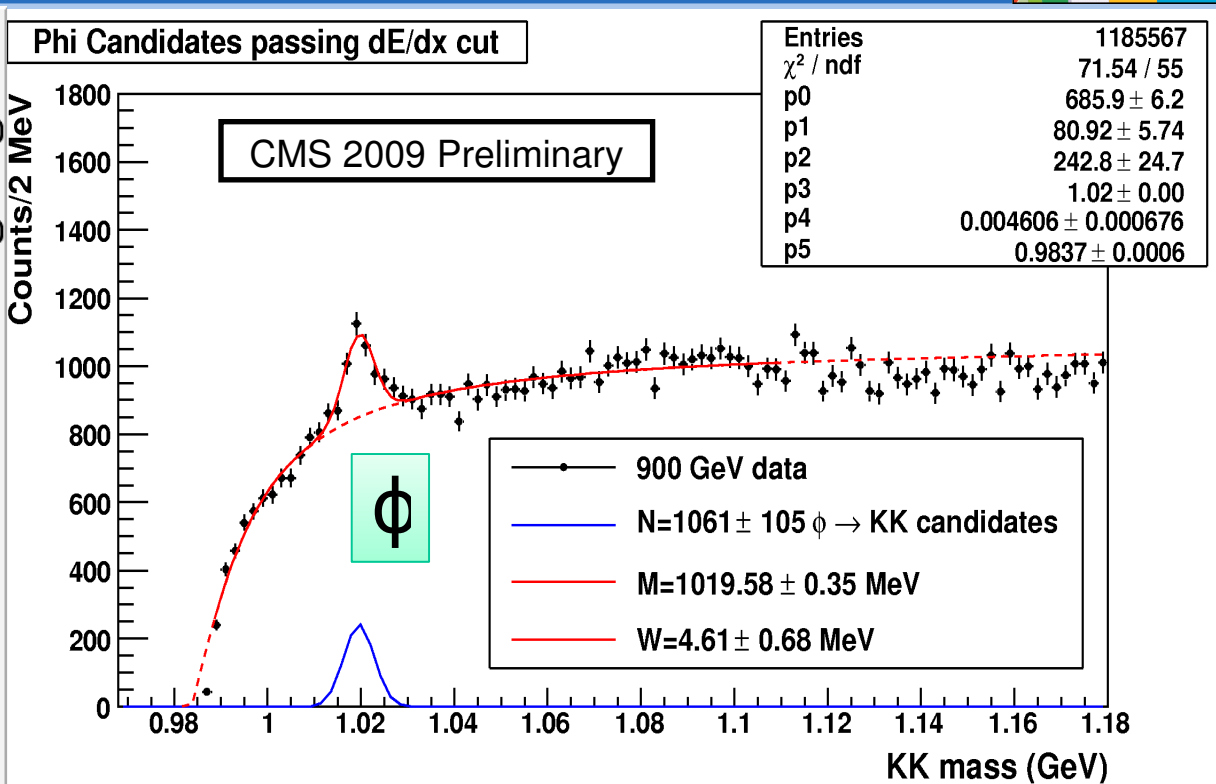
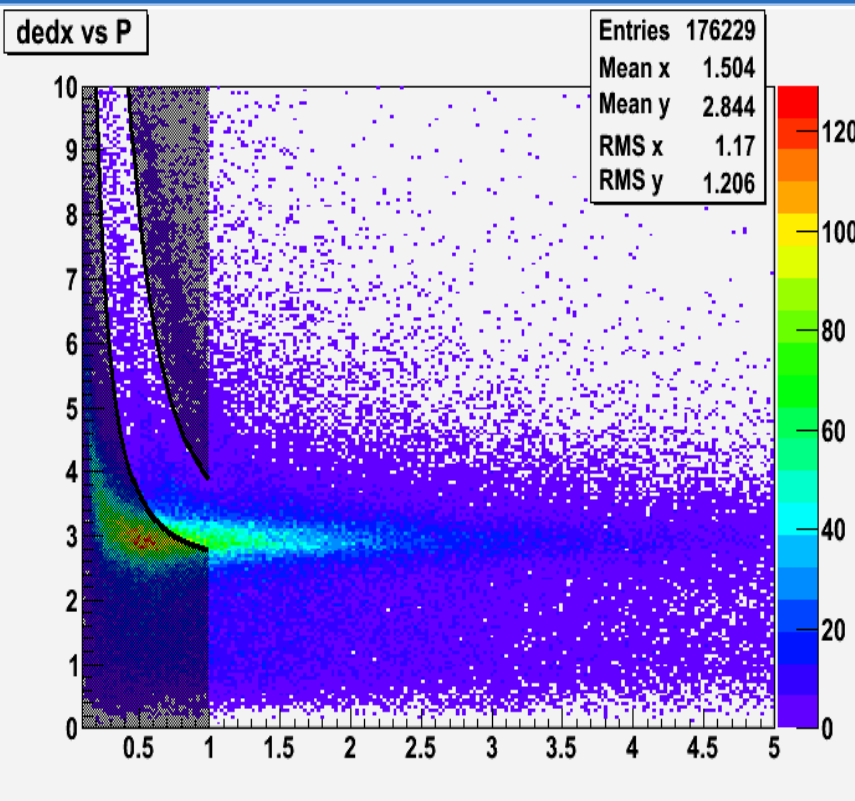
Piotr Zalewski
IPJ Warsaw





Piotr Zalewski
IPJ Warsaw

dE/dx in silicon tracker particle identification





14 December 2009: 2.36 TeV

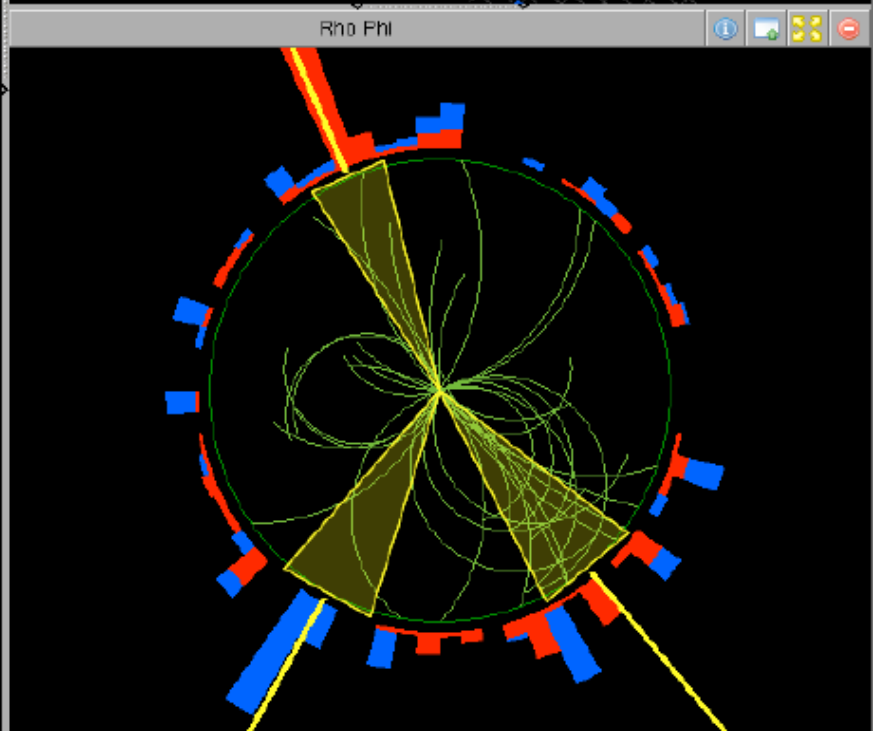
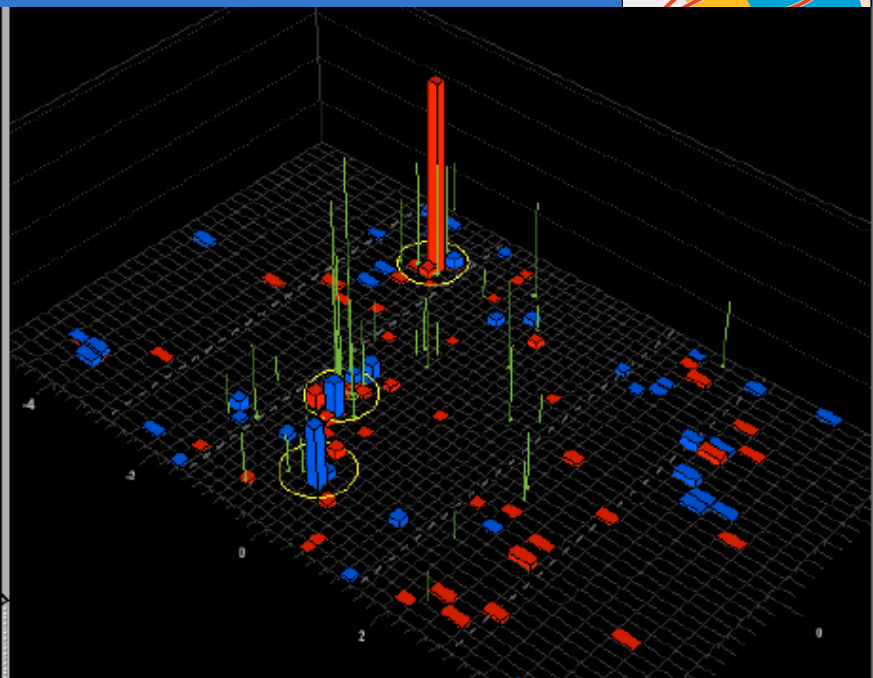
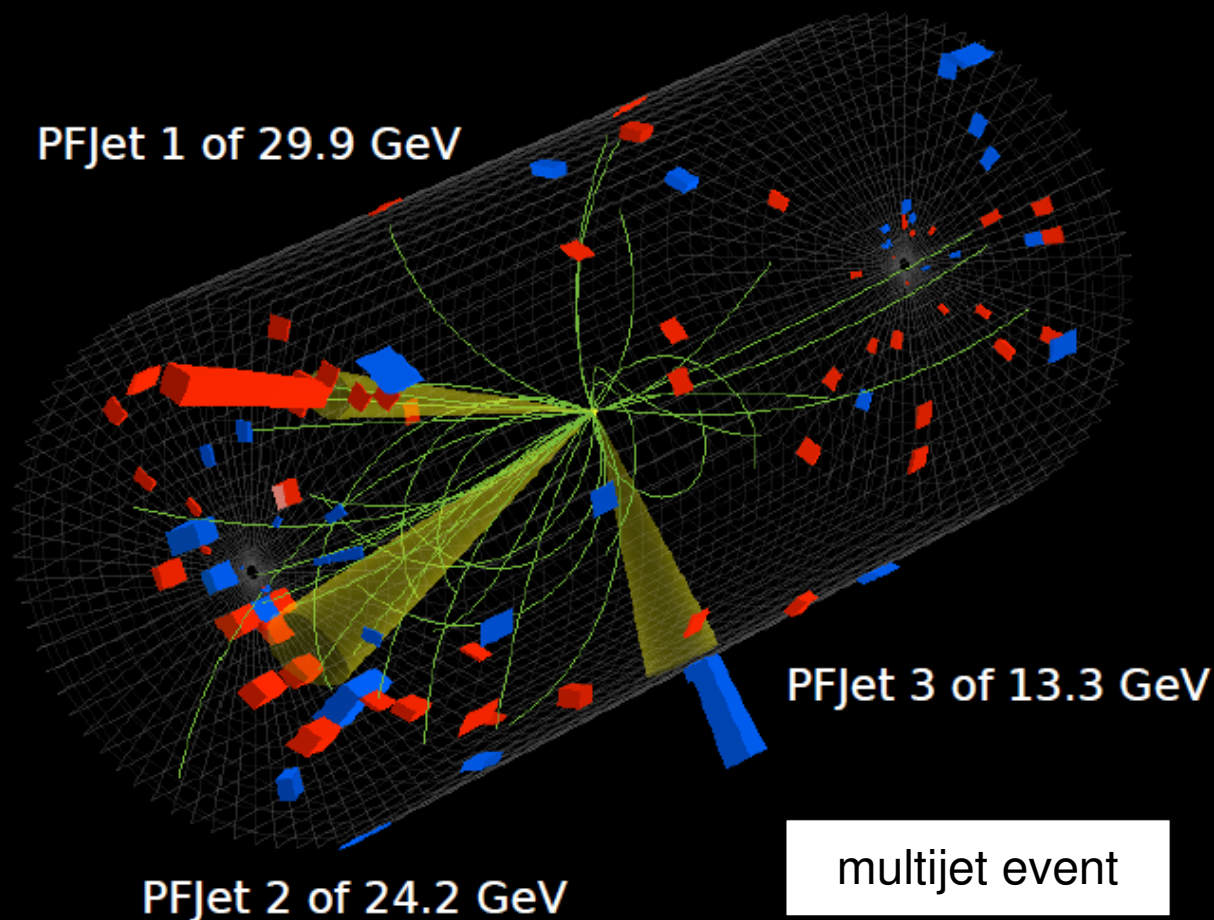


Piotr Zalewski



CMS Experiment at the LHC, CERN
Date Recorded: 2009-12-14 04:21:03 CEST
Run/Event: 124120/542515
Candidate multijet event at 2.36 TeV

PFJet 1 of 29.9 GeV





14 December 2009: 2.36 TeV

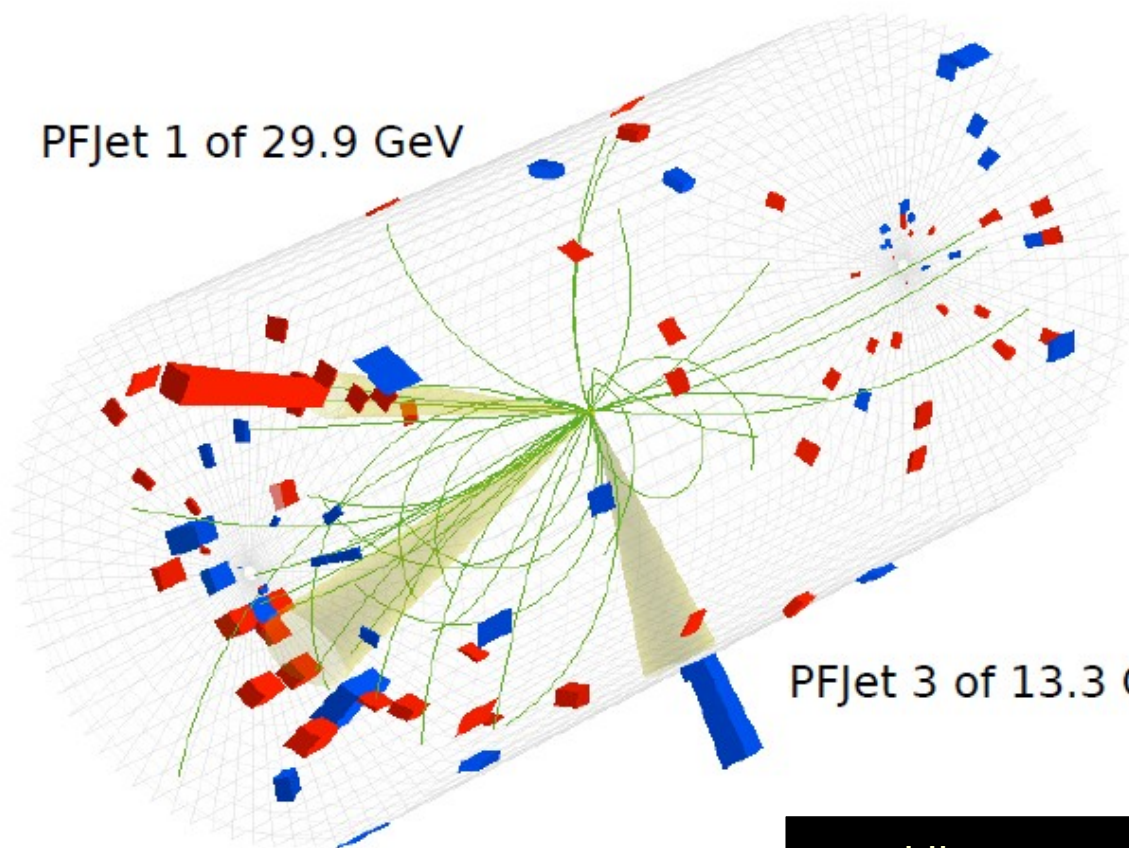


Piotr Zalewski



CMS Experiment at the LHC, CERN
Date Recorded: 2009-12-14 04:21:03 CEST
Run/Event: 124120/542515
Candidate multijet event at 2.36 TeV

PFJet 1 of 29.9 GeV

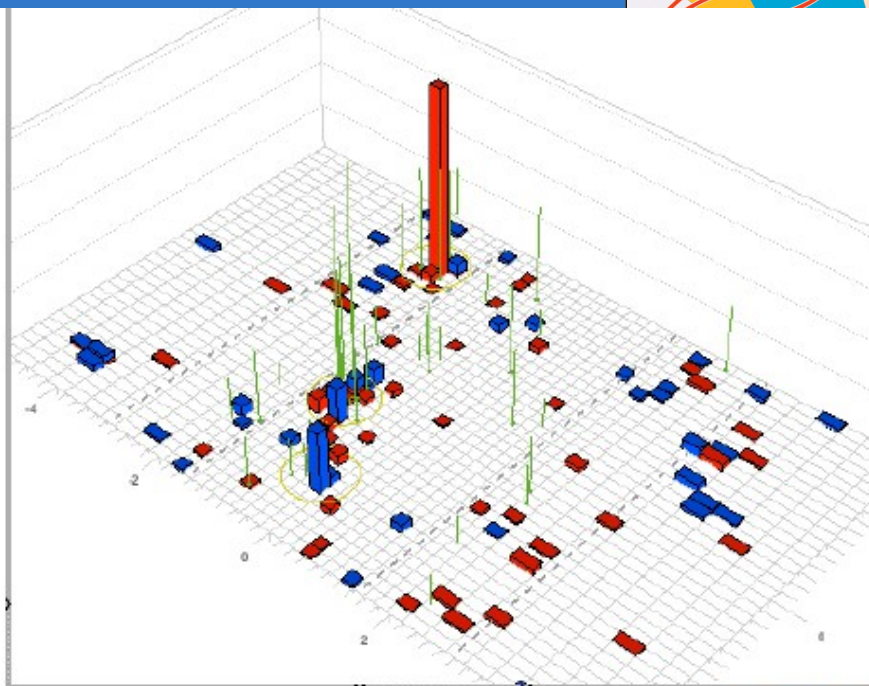


PFJet 2 of 24.2 GeV

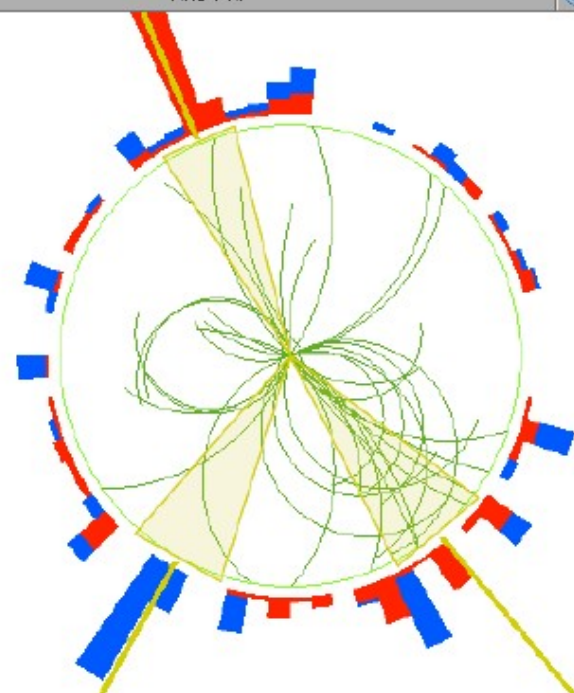
PFJet 3 of 13.3 GeV

multijet event

3 PFlow jets $p_T > 10$ GeV
 p_T cut on tracks displayed > 0.4 GeV



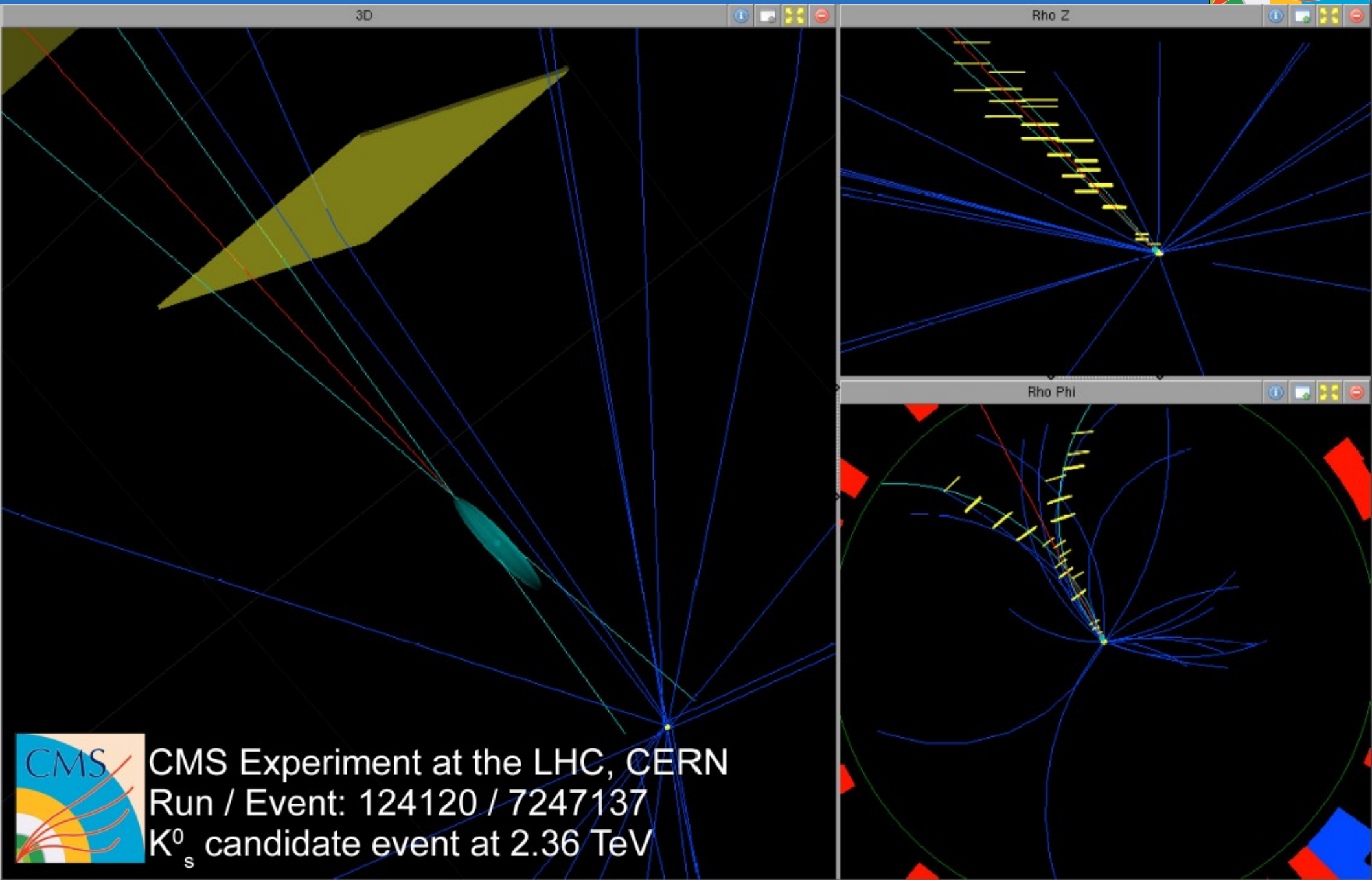
Rho Phi





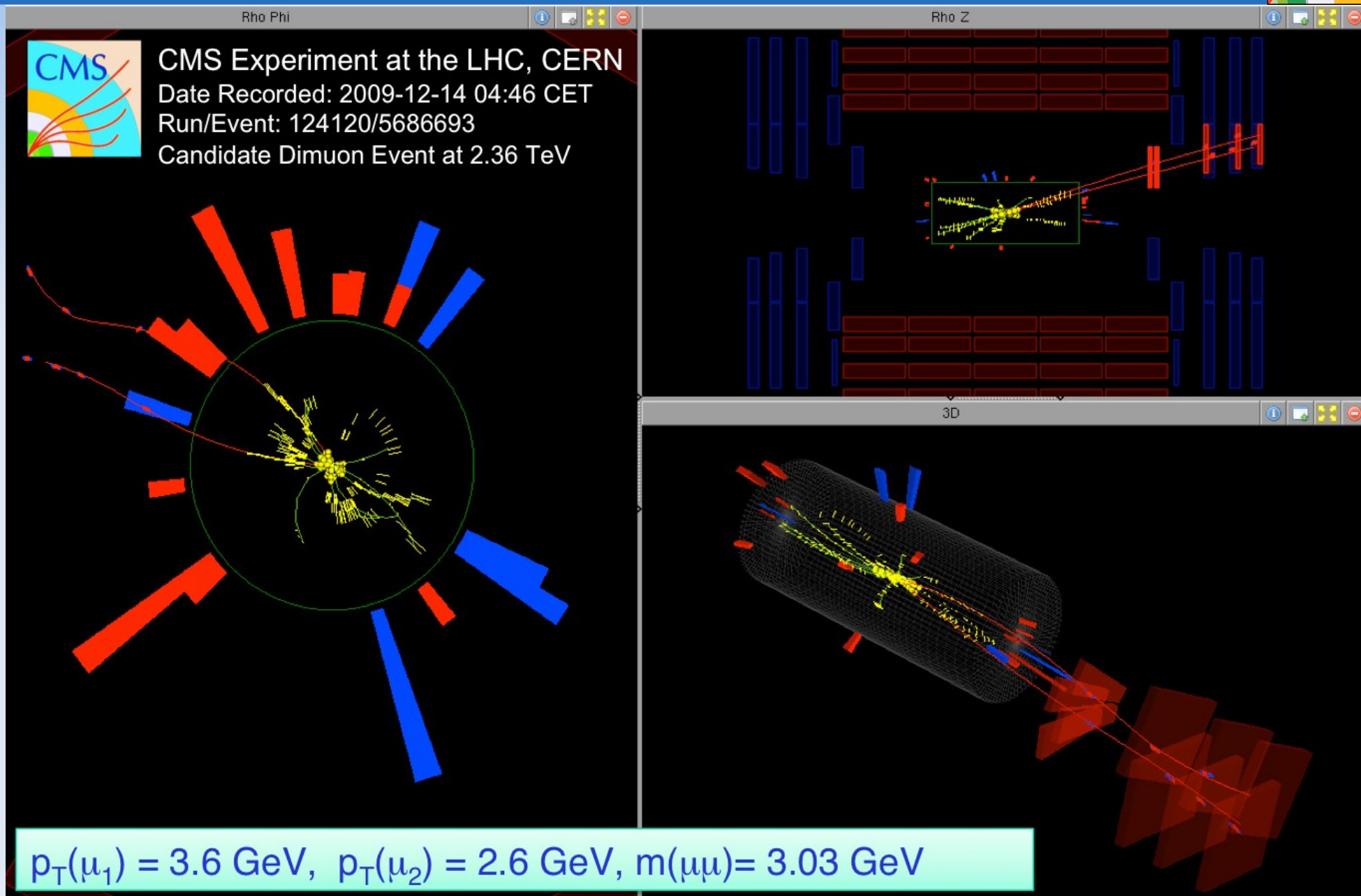
Piotr Zalewski
IPJ Warsaw

K_s^0 candidate @ 2.36 TeV



CMS Experiment at the LHC, CERN
Run / Event: 124120 / 7247137
 K_s^0 candidate event at 2.36 TeV

Interesting dimuon candidate





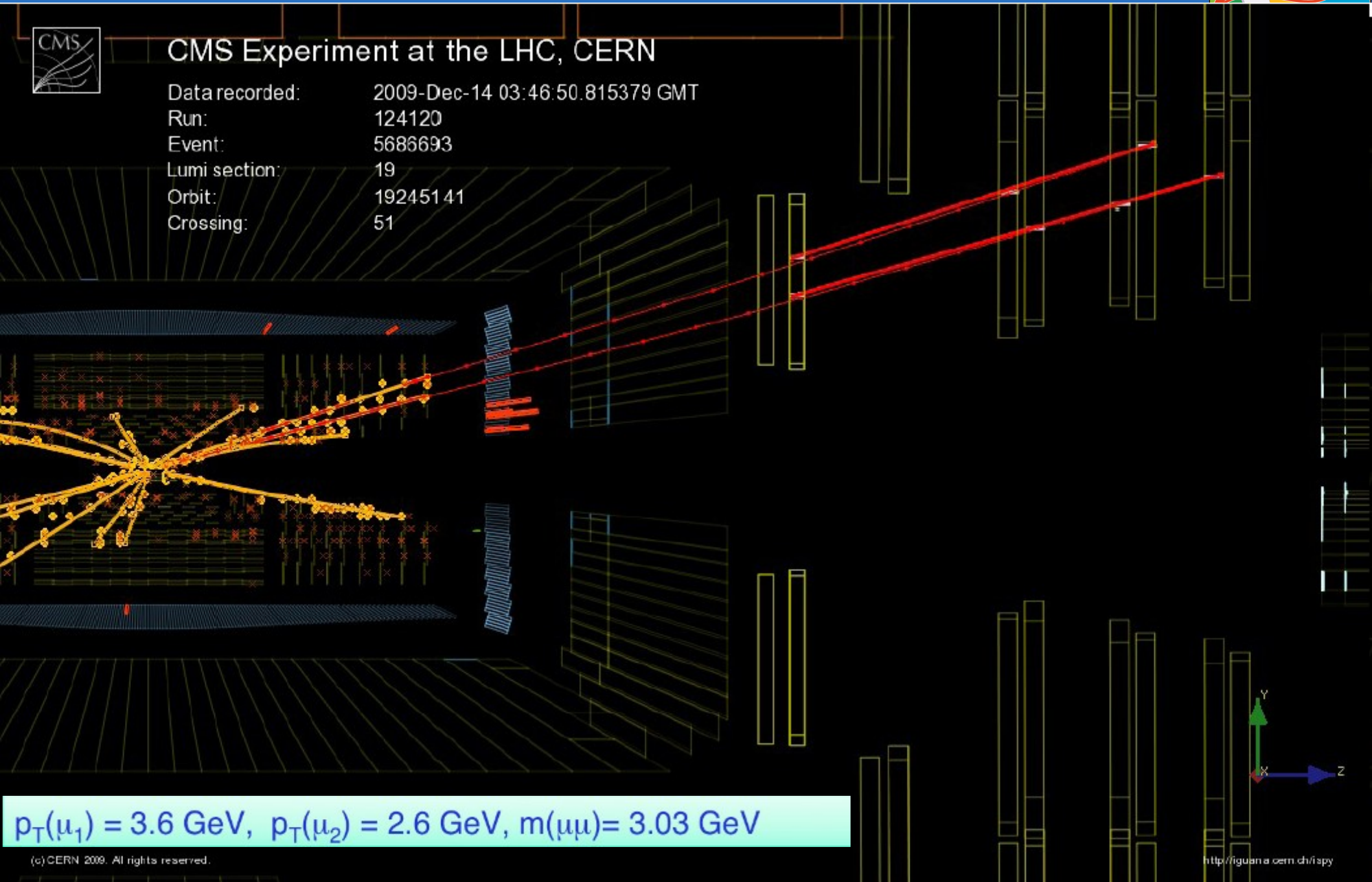
Piotr Zalewski
IPJ Warsaw

Interesting dimuon candidate



CMS Experiment at the LHC, CERN

Data recorded: 2009-Dec-14 03:46:50.815379 GMT
Run: 124120
Event: 5686693
Lumi section: 19
Orbit: 19245141
Crossing: 51



$p_T(\mu_1) = 3.6 \text{ GeV}$, $p_T(\mu_2) = 2.6 \text{ GeV}$, $m(\mu\mu) = 3.03 \text{ GeV}$

LHC 2009/2010

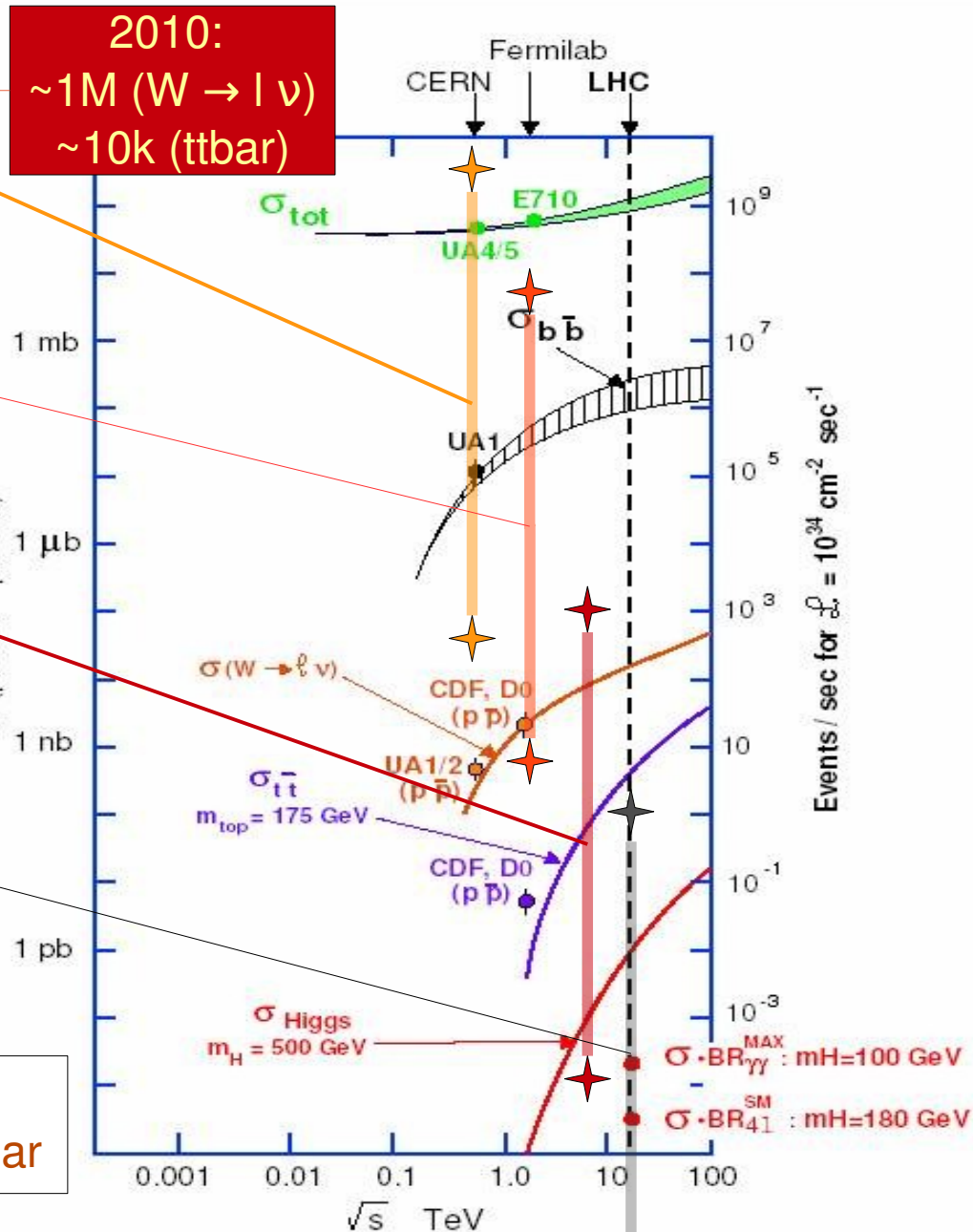
23/11/09: rate $\sim 0.1\text{Hz}$
luminosity: few $10^{24}\text{cm}^{-2}\text{s}^{-1}$
after 10^7s : $\sim 100/\text{ub}$

December 09: rate $\sim 10\text{Hz}$
luminosity: few $10^{26}\text{cm}^{-2}\text{s}^{-1}$
after 10^7s : $\sim 1/\text{nb}$

2010: rate $\sim 10\text{kHz}$ (?)
luminosity: $\sim 10^{31}\text{cm}^{-2}\text{s}^{-1}$ (?)
after 10^7s : $\sim 100/\text{pb}$ (?)

201?: rate $\sim 40\text{MHz}$
luminosity: $\sim 10^{34}\text{cm}^{-2}\text{s}^{-1}$
after 10^7s : $\sim 100/\text{fb}$

Upper star: $\star$ x-sec: rate= event/s
Lower star: $\star$ x-sec: rate= event/year



Conclusions

CMS is waiting for 2010 collisions.

More than 99% of subdetector electronic channels are operational.
Data can be analyzed rapidly, all analysis chains are working well.
Detector is initially aligned and time calibrated.
This situation will further improve with data.

In 2010 we will rediscover Standard Model
(1M leptonic W decays, 10k ttbar events).

With only few tens of inverse picobarns of data at 3.5 TeV,
CMS will start to be sensitive to new phenomena.