

Study of ECAL noise in jet analysis

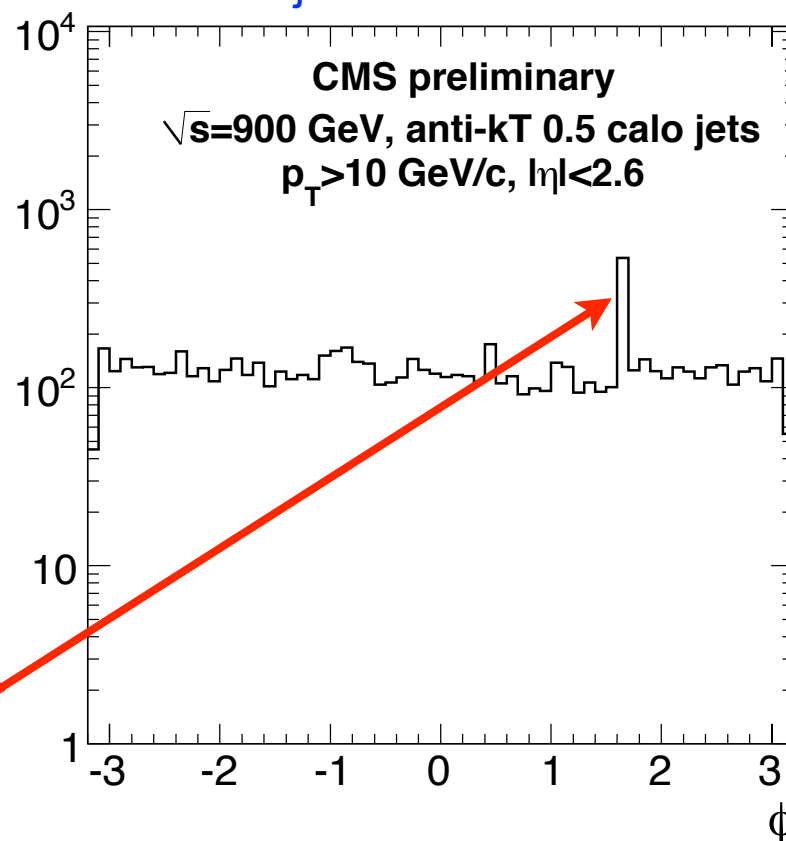
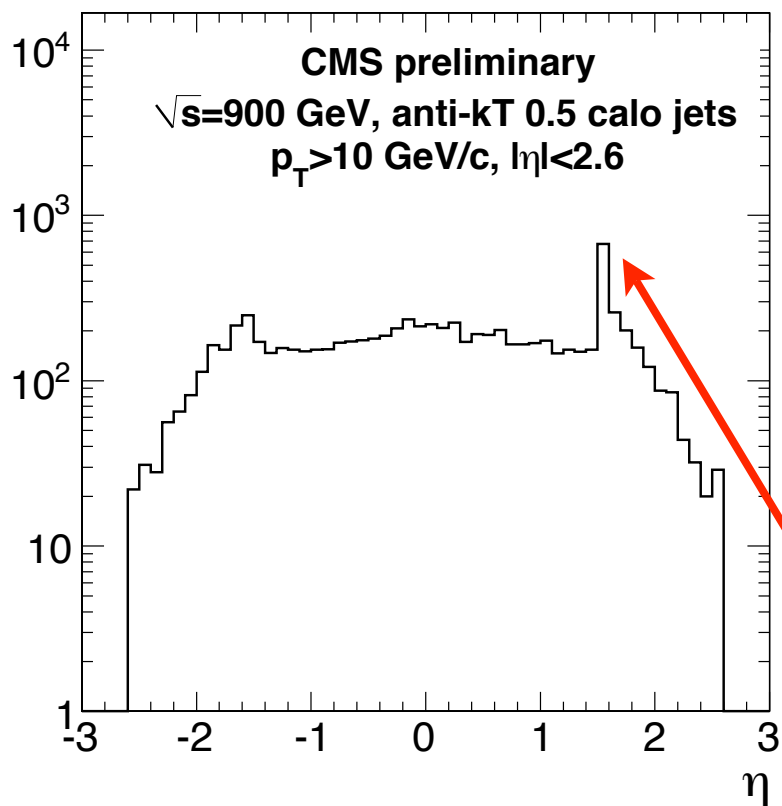
Kalanand Mishra
Fermilab

for JetMET group



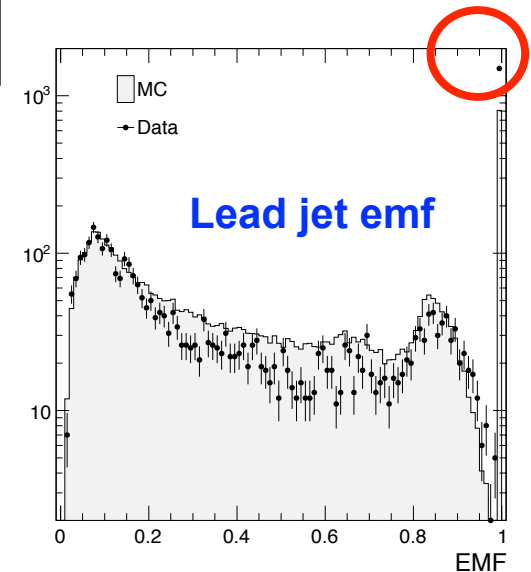
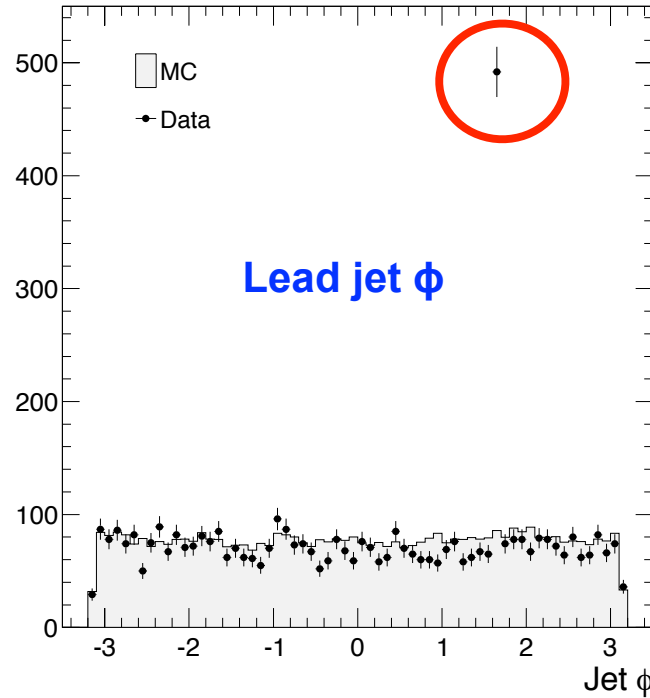
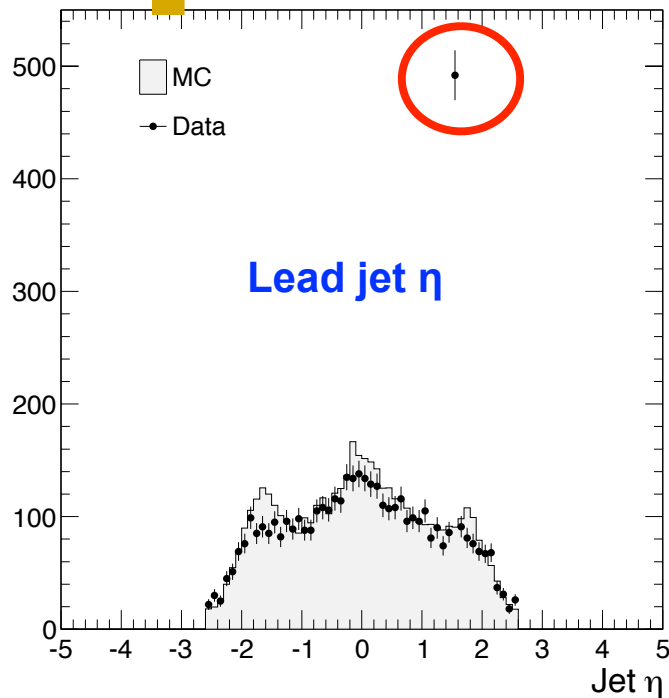
Leading jet η , ϕ after minimal cleanup

Use all 900 GeV prompt-reco data. Require BX, BSC, Phys-declared, PV.
Reject beam halo. Plot distributions for inclusive jet events.



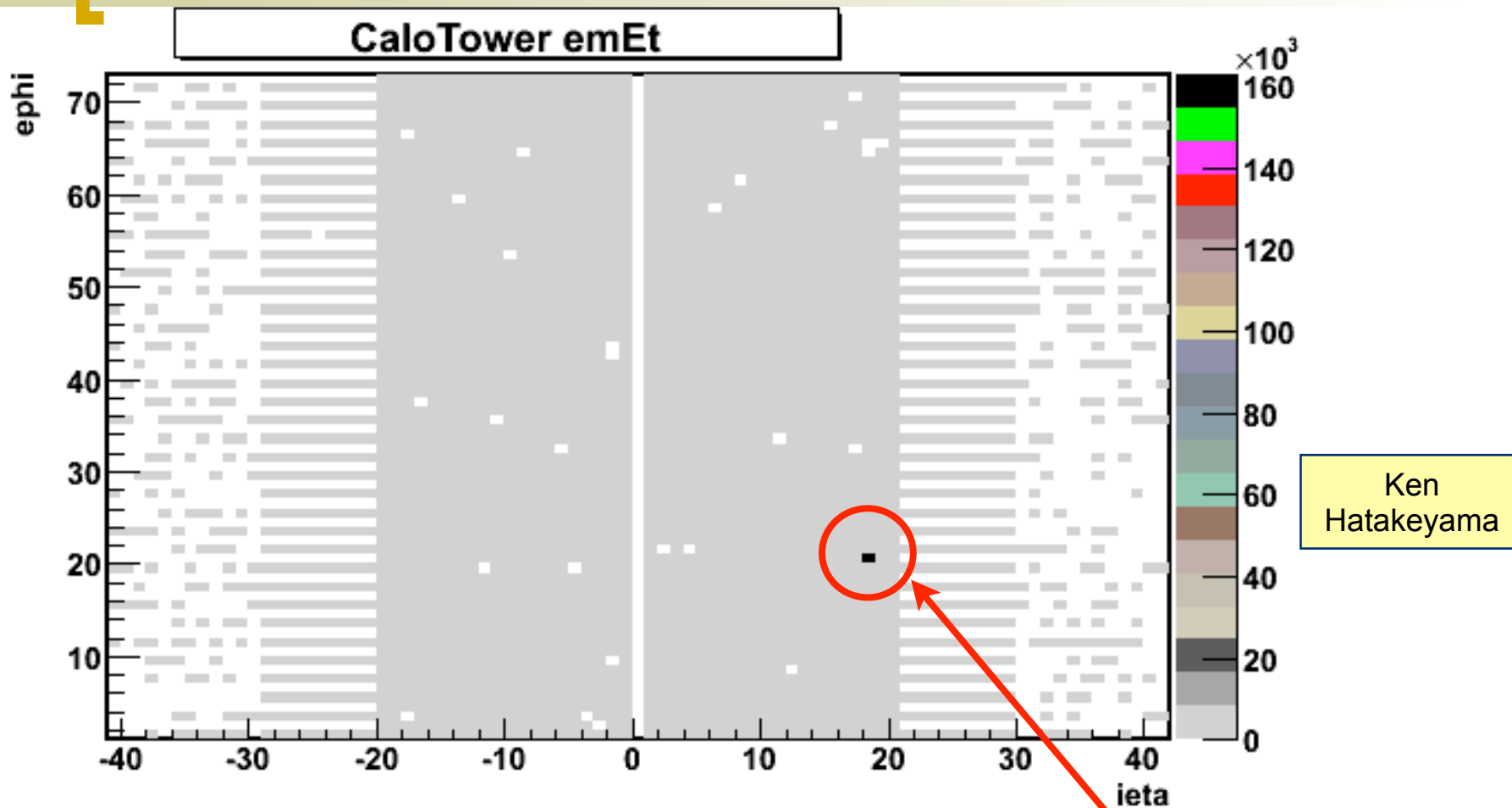
- ◆ The spike is in the bin: $1.5 < \eta < 1.6$, $1.6 < \phi < 1.7$
- ◆ Spread across several runs (I found events in 123-970,77,78,87 & 124009)
- ◆ Quickly diagnosed to be due to ECAL noise → see next 2 slides

Spike is not present in MinBias Monte Carlo



- ◆ The spike was also quickly detected by JetMET DQM
 - See next slide for the DQM plot with spike
 - Appears as a noisy crystal in EE
 - Also causes asymmetry in, e.g., MET ϕ distribution

ECAL spike in JetMET DQM plot

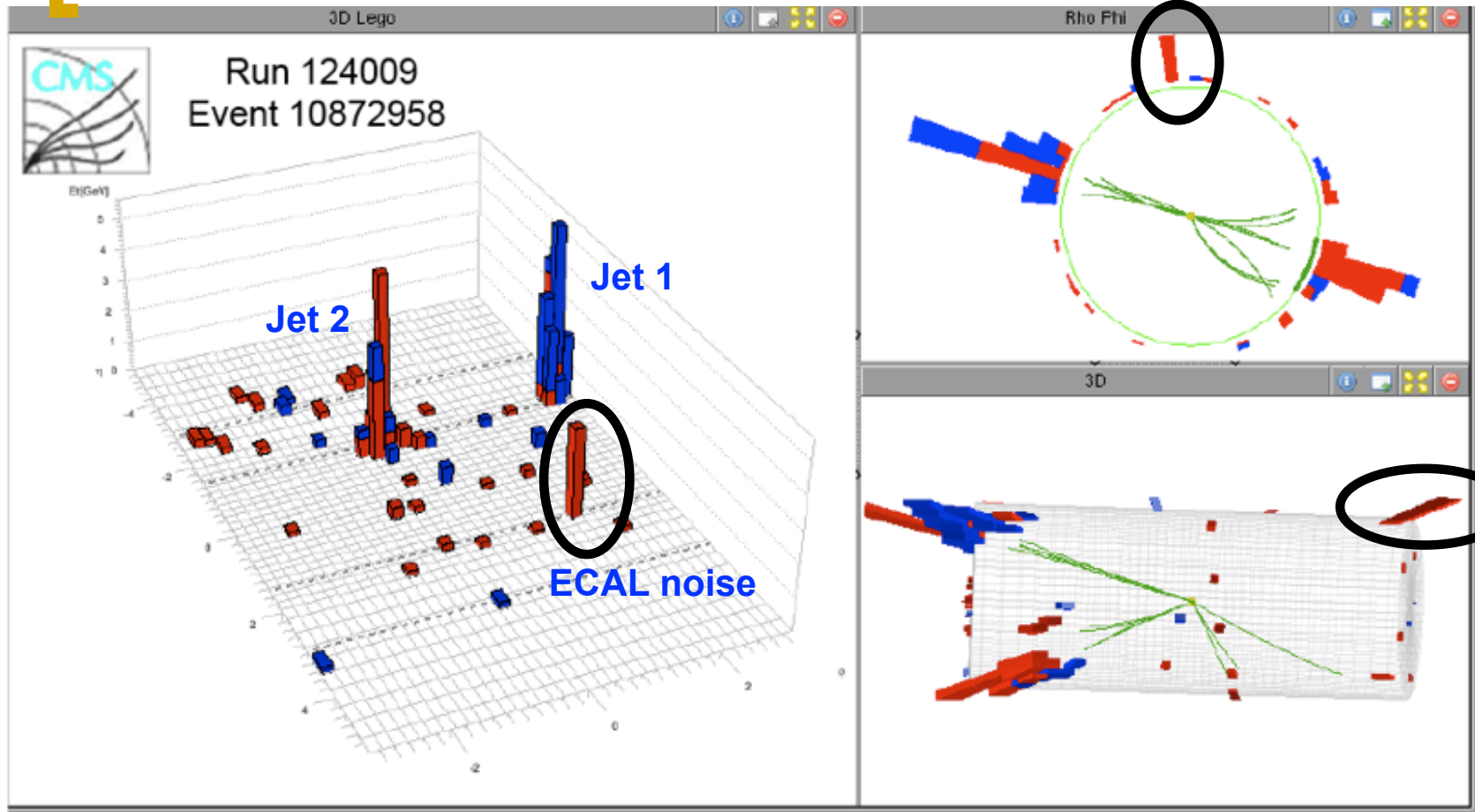


◆ See more details in the following hypernews thread

<https://hypernews.cern.ch/HyperNews/CMS/get/jetmet-dqm/10.html>

Is this cell masked in Dec 14 Re-reco data sample? In other two Re-reco samples?

Spiky event can contain a good dijet ☹️



AK5 CaloJets	Corr. P_T (GeV)	η	ϕ	EM Fraction
Jet 1	45	-1.7	2.8	0.4
Jet 2	38	-1.2	-0.3	0.8

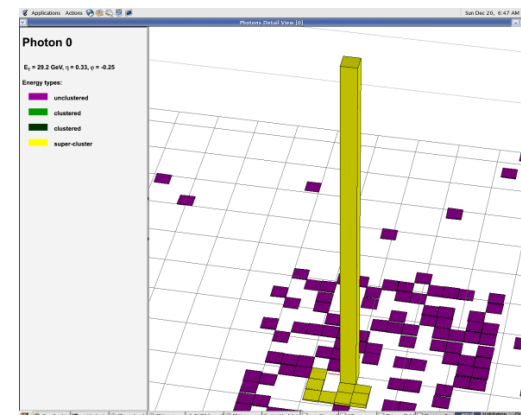
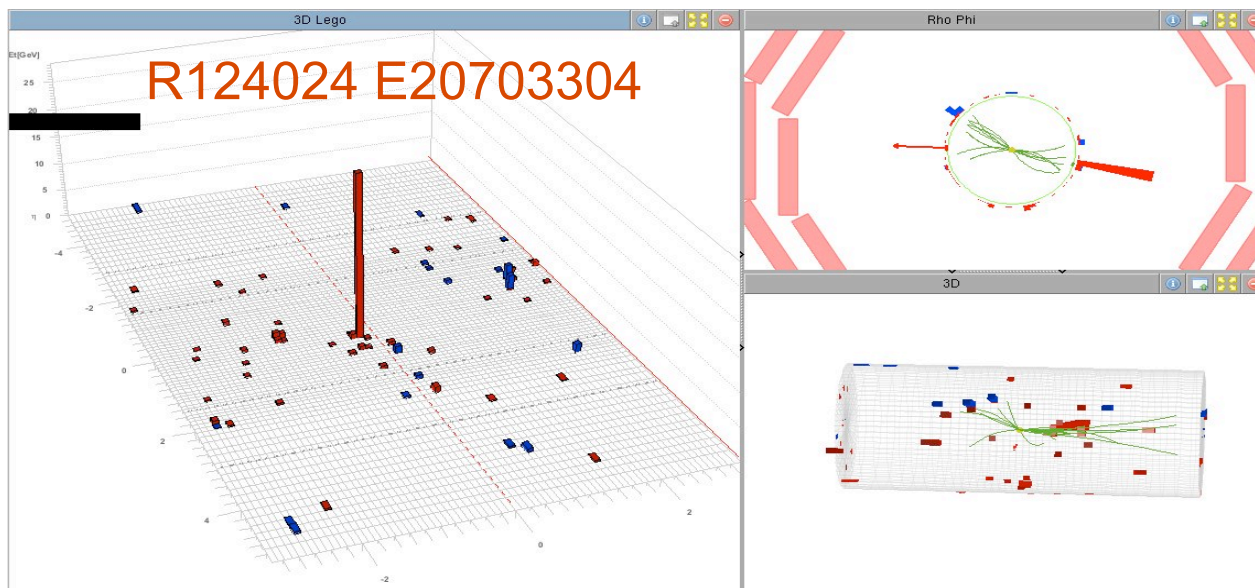


Rejection of ECAL spikes

◆ A cut on $N_{90hits} > 1$ effectively removes these events

- N_{90} Hits is number of Rechits with $> 90\%$ of jet energy

Chiyong Jeong



AK5CaloJets	Corr. P_T (GeV)	η	Φ	EM Fraction	n90Hits	n90	Sigma_eta	Sigma_phi
Jet 1	50	0.4	-0.3	1	1	1	0.076	0.032
Jet 2	19	-0.5	2.5	0.3	7	4	0.061	0.076

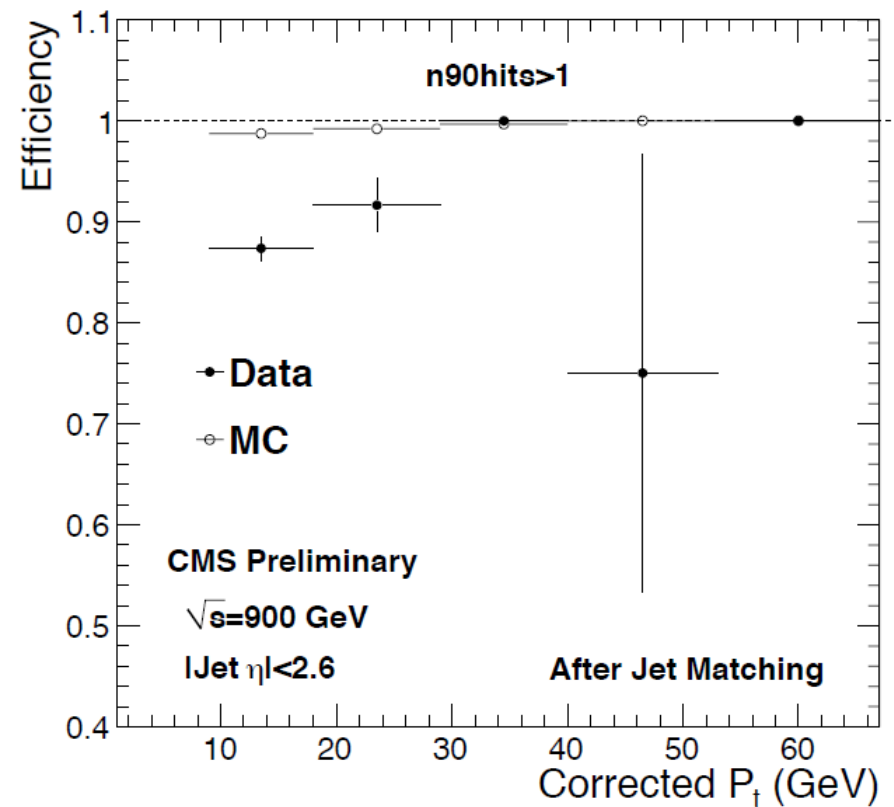
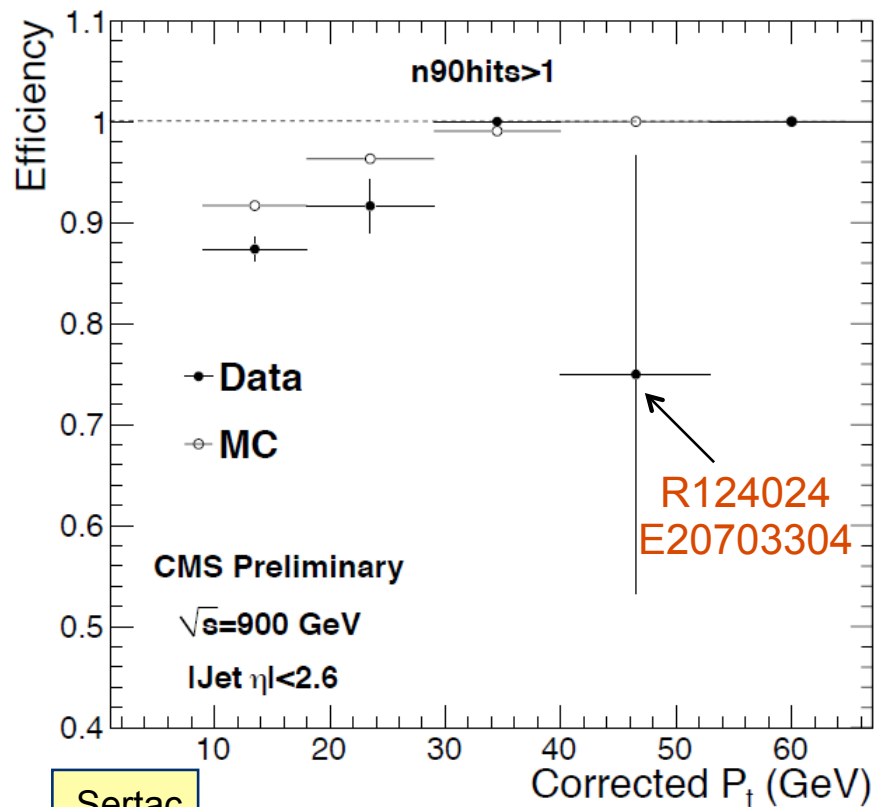
N90hits efficiency in dijet sample



◆ **N90hits > 1 cut rejects Ecal spikes in data and has high MC efficiency**

✓ Inefficiency may be due to removal of jets made from single HCAL RecHit.

✓ Very close to 1 after requiring CaloJet matches a GenJet within $\Delta R=0.5$



Sertac
Ozturk

Summary



- A preliminary study of jets in collision data indicates significant ECAL noise

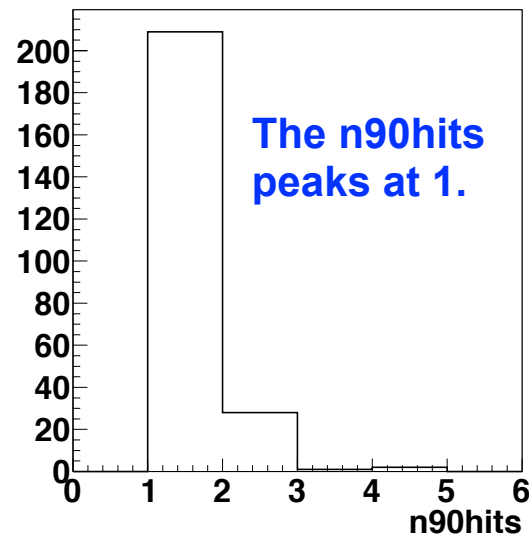
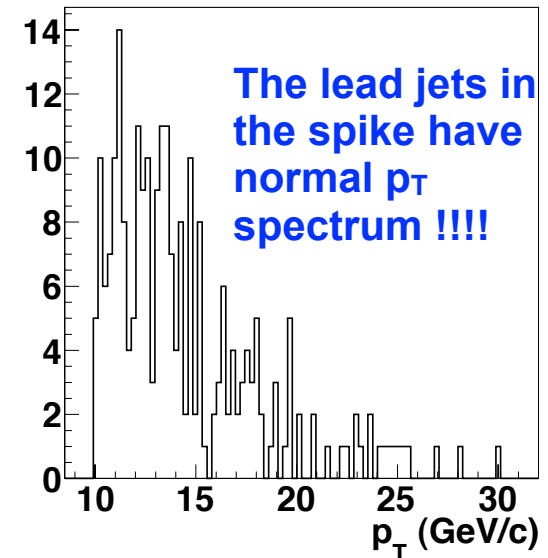
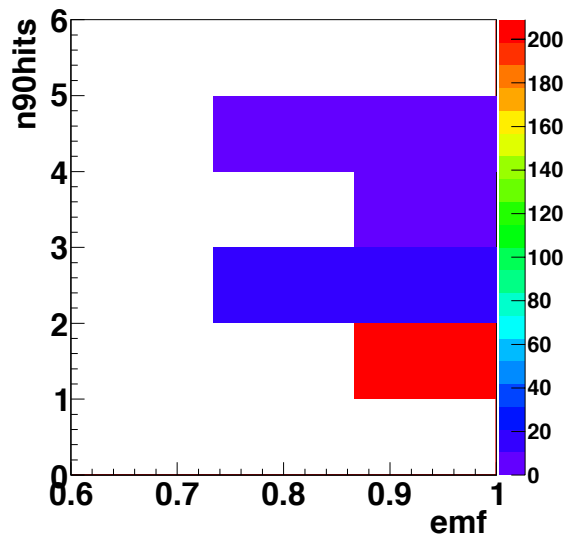
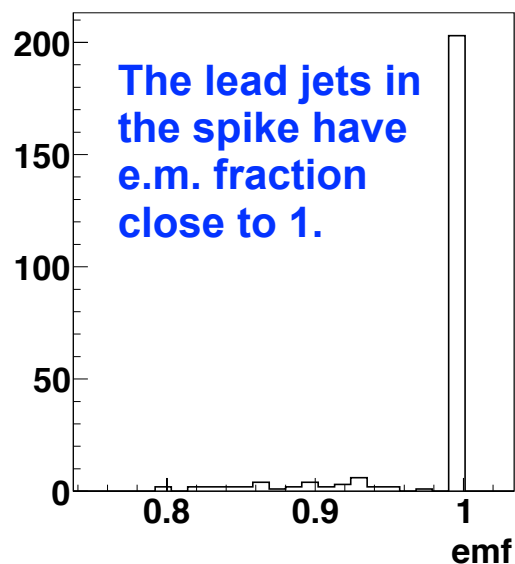
- We find N90hits (>1) to be quite effective in reducing the noise
 - verified in dijet sample in data and MC
 - also efficiently removes *mono jet* events in inclusive jet sample
 - upper cut on EMF is not as effective, and has larger inefficiency

- Requiring two back-to-back jets (i.e., a dijet) removes many unphysical and noisy events. Therefore, inclusive jet sample has significantly more jets from noise than in dijet sample.

Thank You !

Backup slides

Further investigation of the spike (inclusive jet)

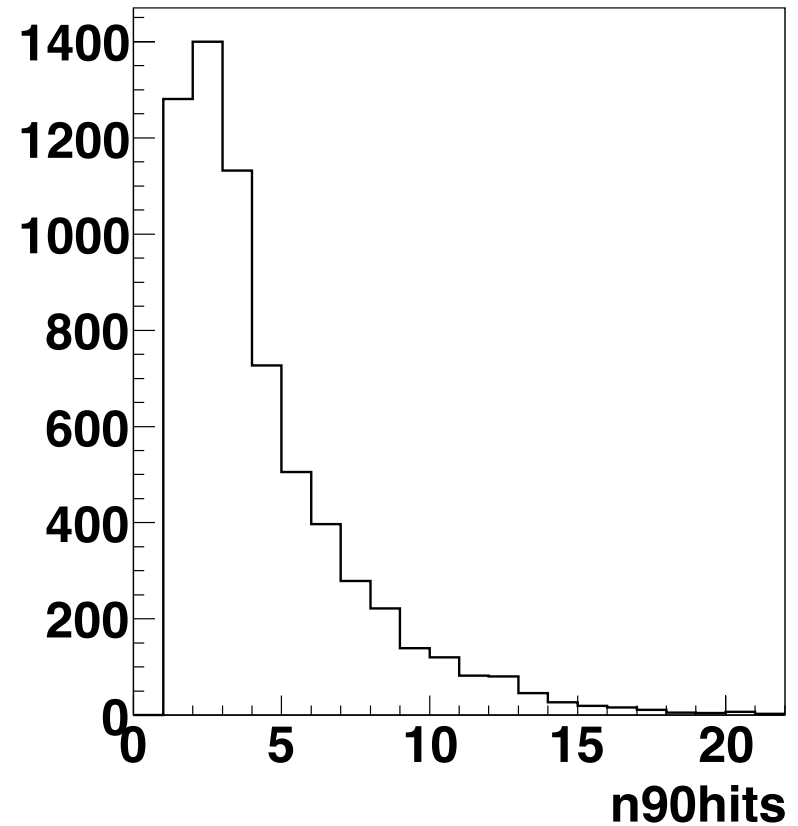
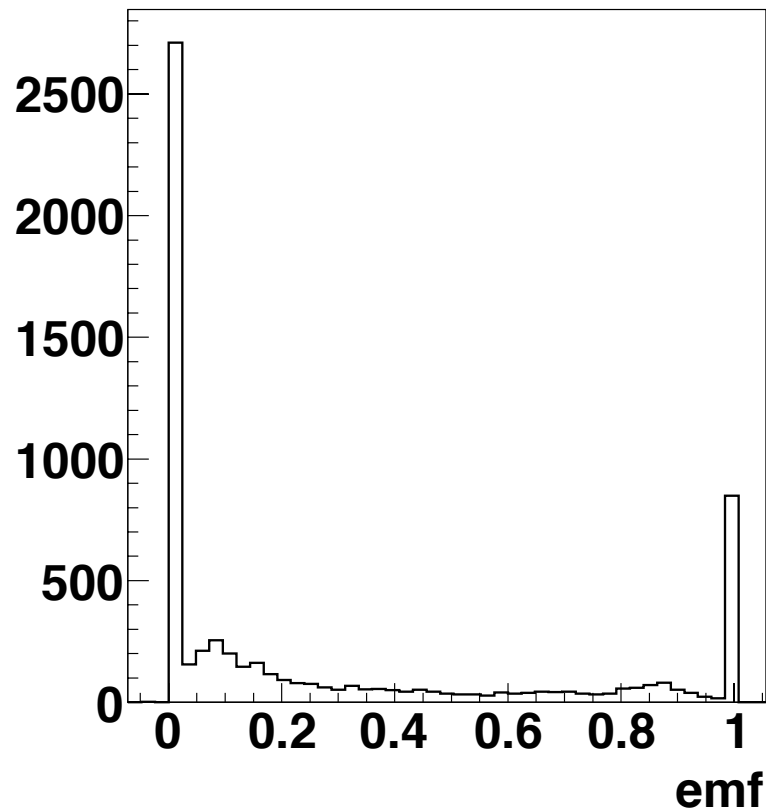


- ◆ Noise often has associated track at calo face !!!
- ◆ Can be removed by requiring $n_{90hits} > 1$ or by cutting on emf

- $n_{90hits} \equiv$ minimum number of rechits which contribute at least 90% of the jet energy

- ◆ The n_{90hits} cut has a better overall efficiency, so we currently use it in dijet analysis

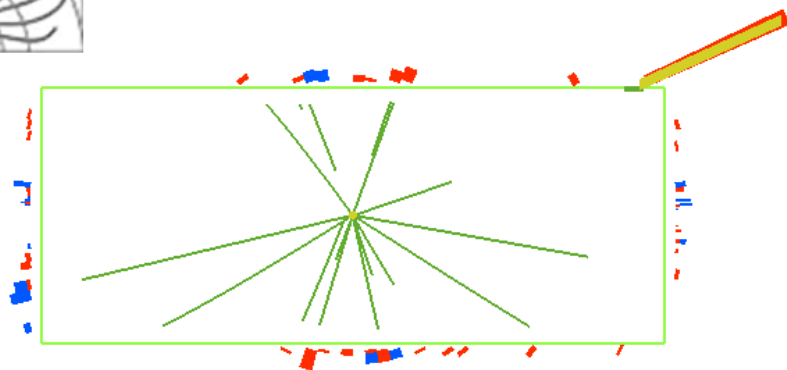
EMF, n90hits distributions excluding spiky cell



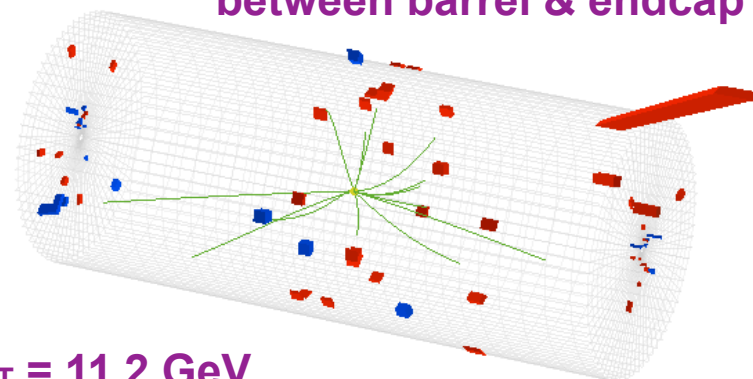
An event from the spiky bin



Run:124009
Event:20663888



In the transition region
between barrel & endcap



$p_T = 11.2 \text{ GeV}$
 $\eta = 1.527$
 $\phi = 1.663$
EMF = 1

Most of these events have EMF = 1 and n90 sharply peaking at 1.

