

Phase 1 L1Calo Upgrade Simulation Status

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For MSU group (J. Kraus, J. Koll, JTL)

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L1Calo Meeting, Cambridge

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Cross Checks: is MC correct now?

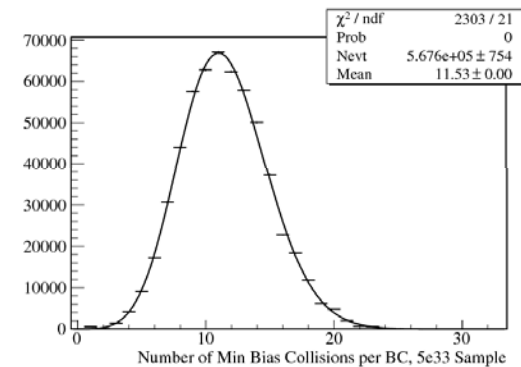
Production MC vs. MSU samples – look the same

Yet another bug: FCAL (Buttinger: Feb)

Mean and Variance Linearity? Mostly reasonable (updated thru 2E34)

Understand MET ϕ distribution – displaced vertex (+ old bugs)

Distribution of # pileup events: new samples:
really looks Poisson for 0.5 to 2.0 E34



Rate calculations: Cambridge vs. MSU x2 differences

Predict single bunch pileup? Not too bad

Compare single bunch pileup vs bunch train pileup

MC vs 1999, 2002 MC -- in progress

2 E32 data vs. MC (correct bunch train: Buttinger talk)

New trigger list: appropriate thresholds needed

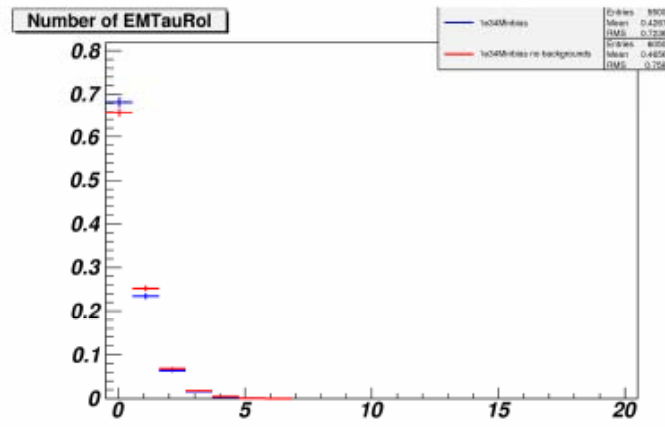
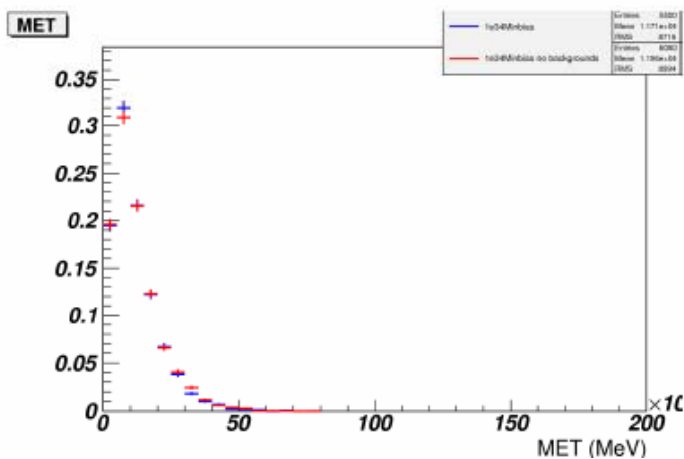
*Jet, MET comparison w/
2002 TDR MC:
need better statistics*

Rates for $2j > 50$, $MET > 20$:

Old MC (TDR) .5 kHz

~Current MC: 1-3 kHz (w/o Fcal fix)

- Testing the effects of removing cavern background, beam halo, and beam gas from pileup simulation.
 - Multiplicities and MET are higher without backgrounds?
 - Otherwise little difference.



Std: no cavern bkg's etc; compare to MSU samples with all bkg's

MET Phi: Understood now

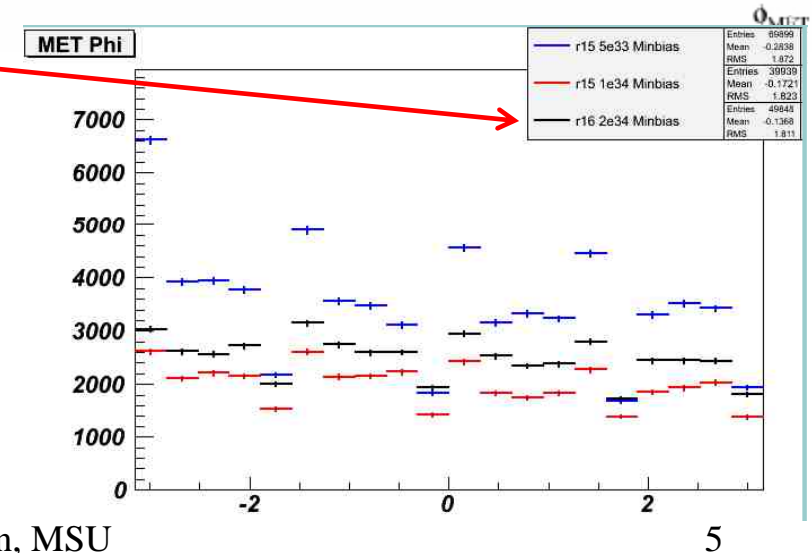
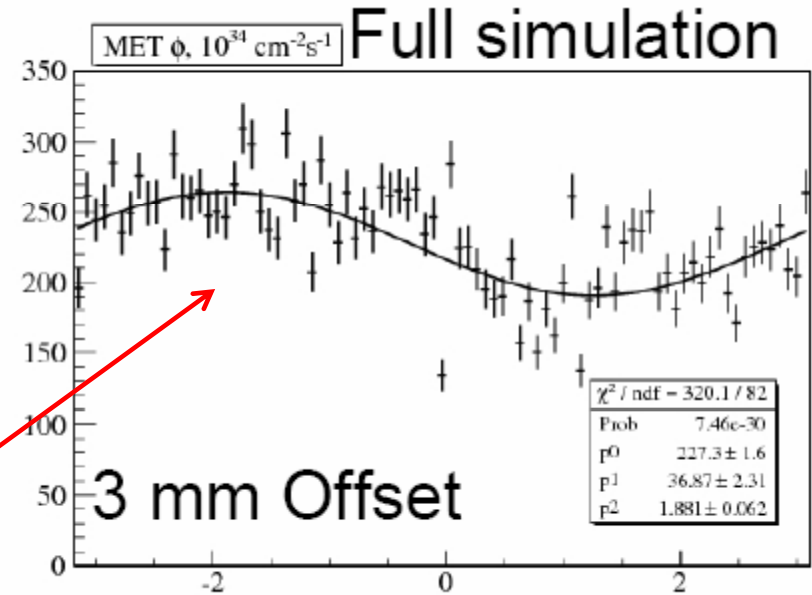
Sensitive test of MC
Significant eta dependence
thanks MET group!

MC: due to offset vertex
was 3mm: now ~ 0mm

No crossing angle in MC

Spikiness at low MET:

1 GeV quantization in MET_x, y
~ gone for MET > 10



Long list of tests at MSU

http://hep.pa.msu.edu/people/kraus/task_list.html



status - running with full pileup

- Finish investigating beam crossing angle. -Kraus



have confirmed no crossing angle at generation



checking for Lorentz boost to create crossing angle during detector simulation. Conditions tag indicate no crossing angle

- run a sample with W. Buttingers FCal bug fix, check its effect on distributions Kraus/Koll



status - samples made

- Make plots of our trigger rates vs rates predicted in previous documentation



status - J. Kraus has old plots, need to spend time estimating positions of points and adding to more recent plots

*4 pages
worth!*

Other Parameterization Techniques

- Toy MC with Long's η function included - Kraus



status - Finished, shown in February.

- Do pileup study using single event bunch train -Kraus



status - Events have been generated and ntuplized - single events still need to be combined.

Bug fix cross cross checks

Tests 1-4 need to be done with both corrected and old buggy MC in order to understand whether they are sensitive enough to have detected our problems.

1. Compare single bunch crossing (no bunch train) single event with pileup under same conditions. This should be simple addition (see below). Ideally, wou electronics noise probably significant, since tuned so as to equal pileup "noise" at 1E34. -Kraus



Done and shown on Oct 6, 2010

2. Algebraic test: to the extent that pileup is a simple addition, Linnemann did [calculations](#) that found that both mean and variance of Et in a trigger object sh Kraus



Done and shown on Dec 17, 2010

3. Compare this "no bunch train" pileup MC with full bunch train simulation and see whether differences appear to be plausible. Kraus



Done and shown on Oct 6, 2010

3

4. Data test: necessary but not sufficient that MC describe low luminosity data. This is tricky as bunch structure of data is the more dense structure expected



Done and shown

In-time only pileup?

Attractive: higher lumi possible

But: rates change by x2

must compensate for baseline

currently attempting to parameterize

Insufficient info in standard .esd

know how to make custom .esd

Rate Comparison Studies

Discrepancies (x2) in rate evaluation from

.rdo Cambridge

.esd MSU

Idea: re-use of minbias drove .rdo vs .esd rate differences?

Readdown Scale Factor:

re-use of minbias events in pileup simulation

p (drop event after use) = $1/\text{RDSF}$ (150 default)

RDSF=1 : run out of statistics at hi Pt

Not clear the readdown scale factor dominates

Either at .5 or 2 E34

see following plots...

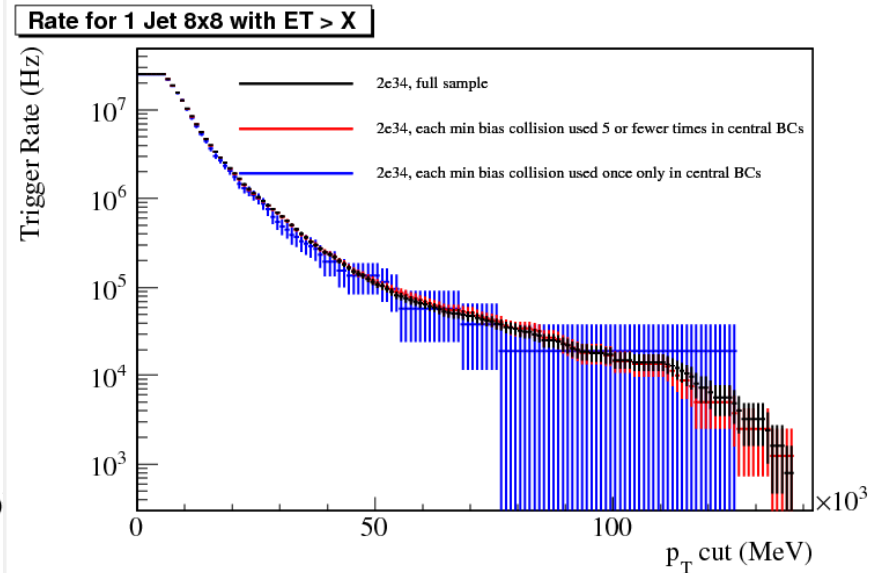
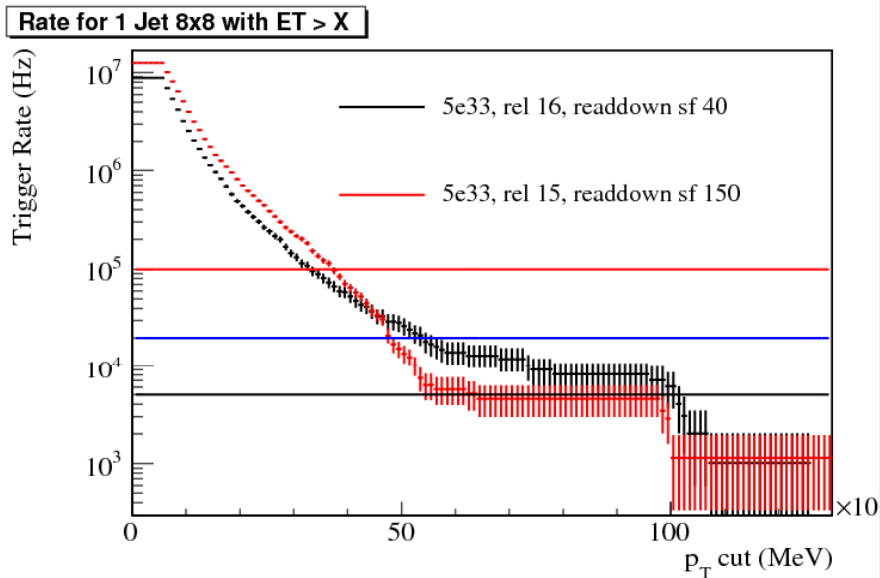
Rate Calculation checks (cf. last week)

.rdo and .esd gives x2 difference?

little discrepancy in **minbias re-use** choice for 2E34

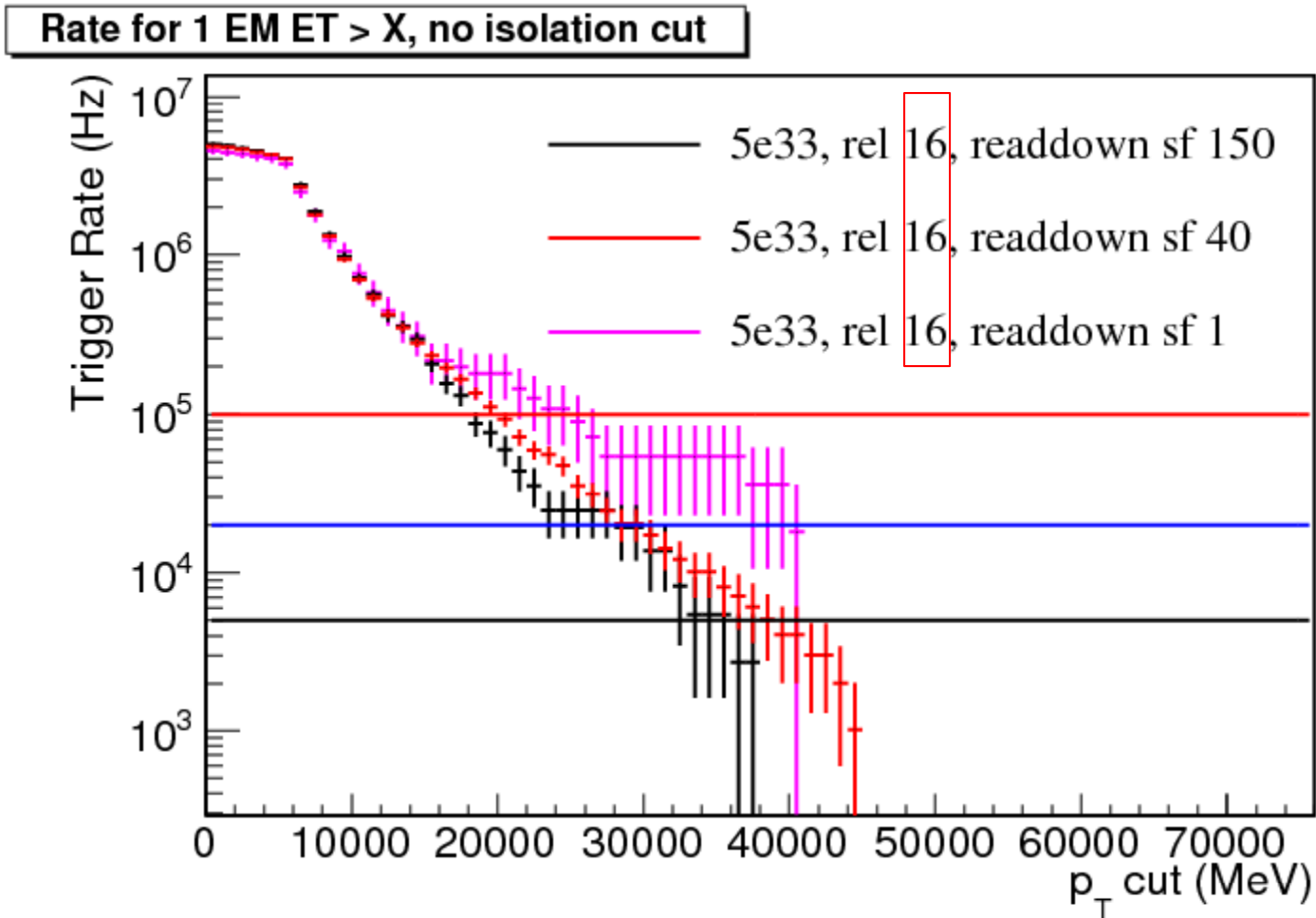
but more at .5E34 ? (geom/conditions tags : release 15 vs. 16?)

maybe more for em than jets also?

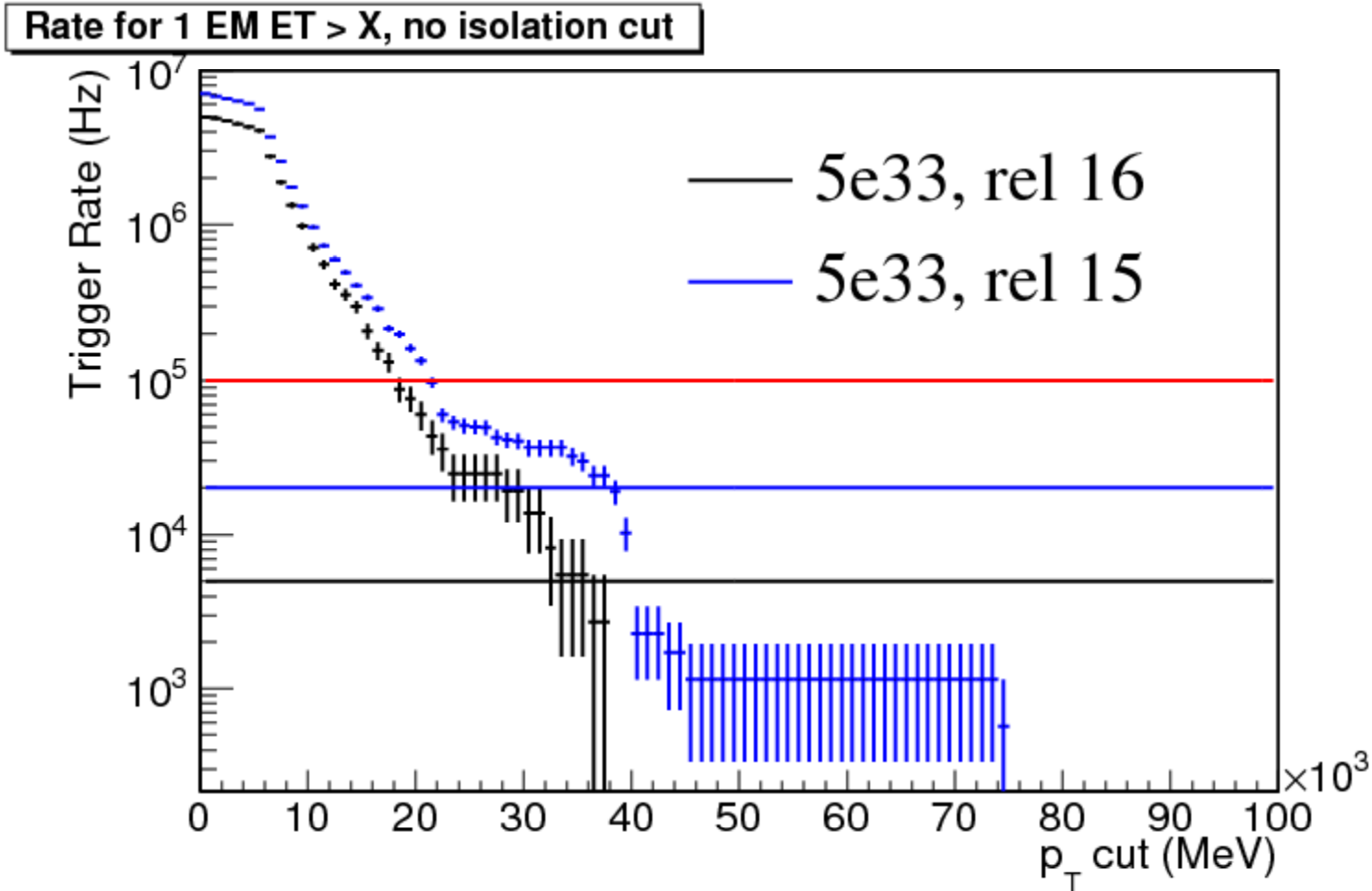


Readdown factor Comparison: EM

same until to 16 GeV

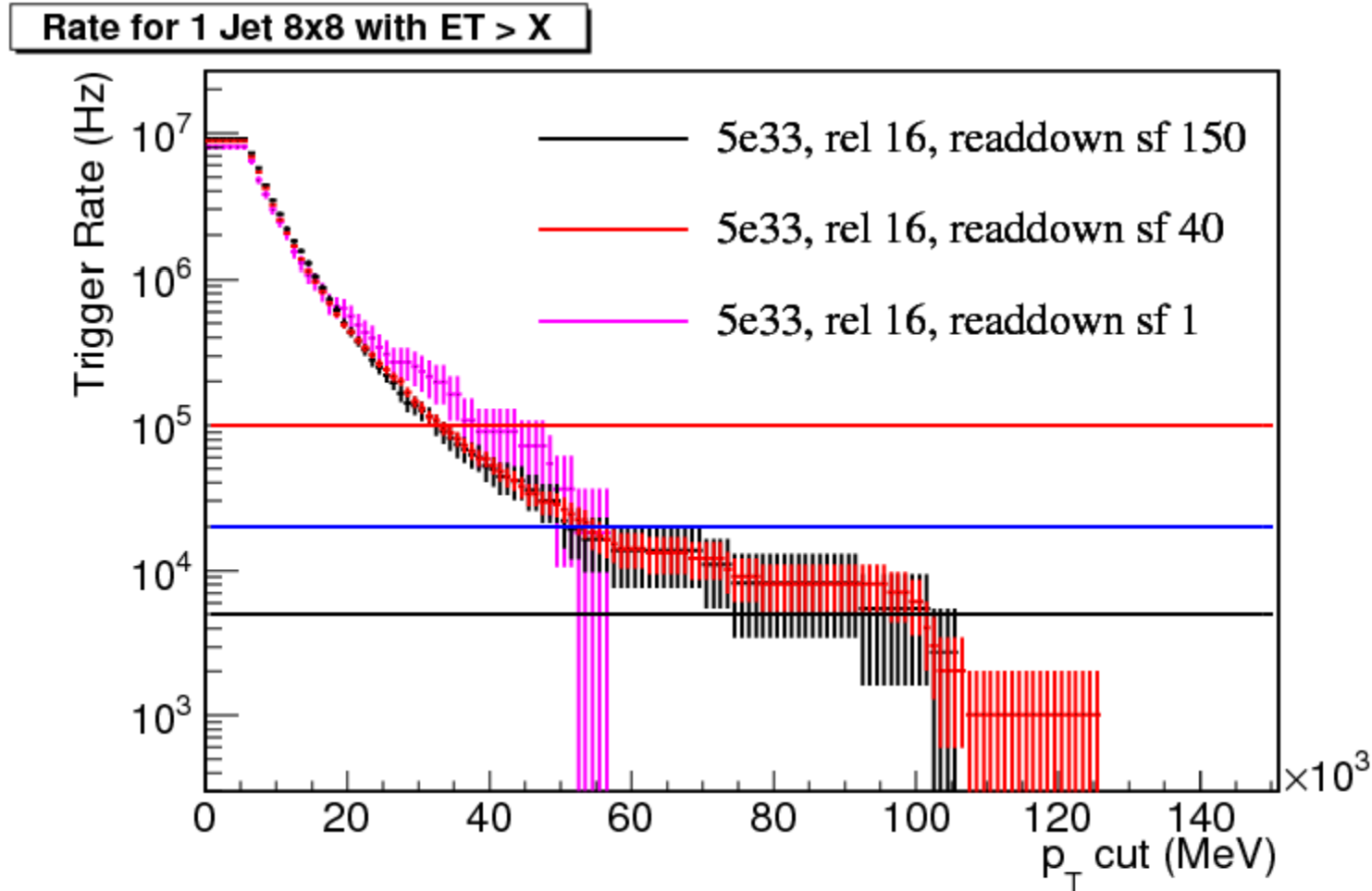


EM Rates: 15 vs. 16

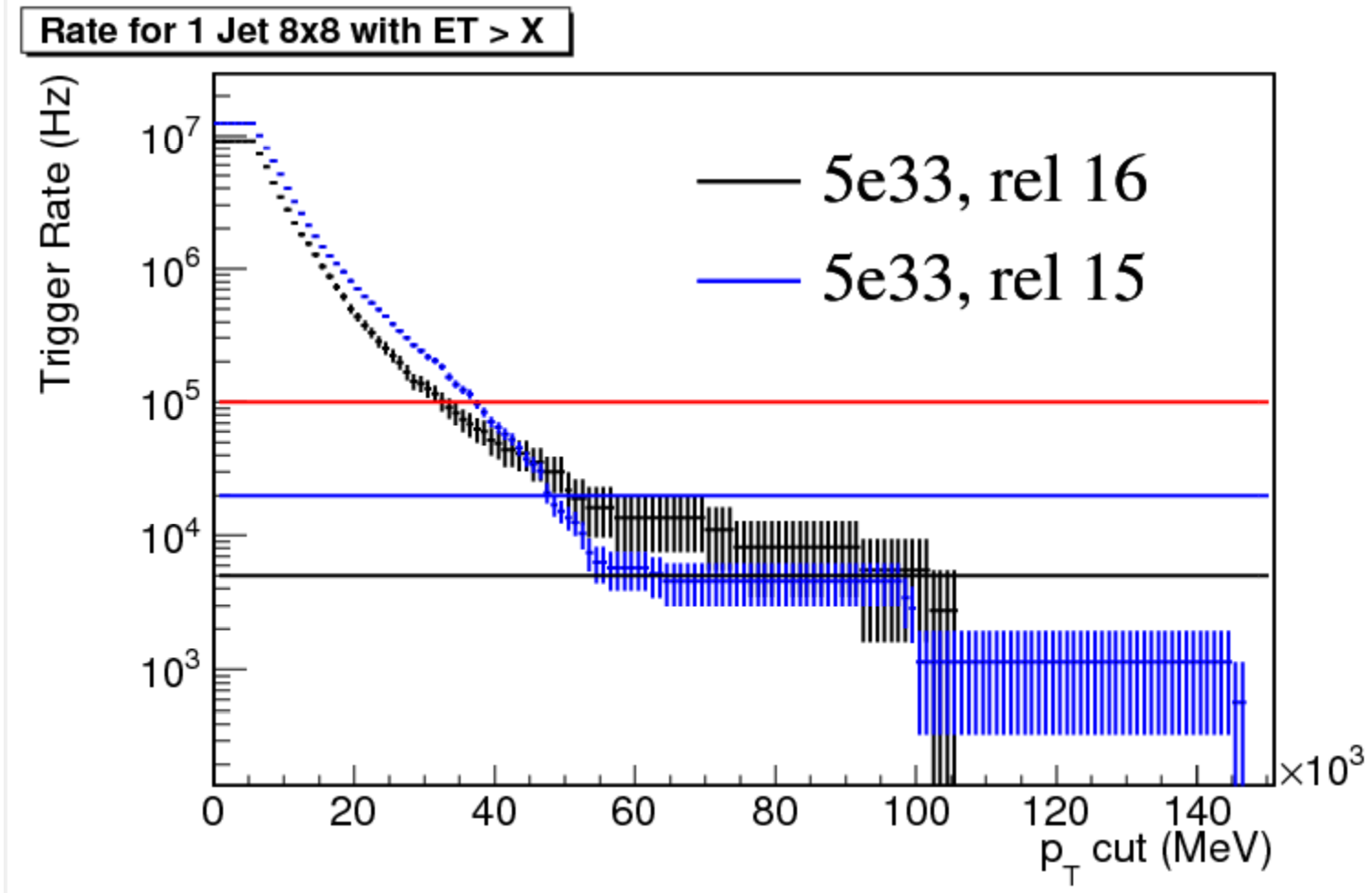


Readdown factor Comparison: Jets

same out to 20 GeV



Jet Rates: 15 vs. 16 (Jets)



Update on ROI multiplicities

Minbias only so far

need Jxx and physics samples
and verify against data

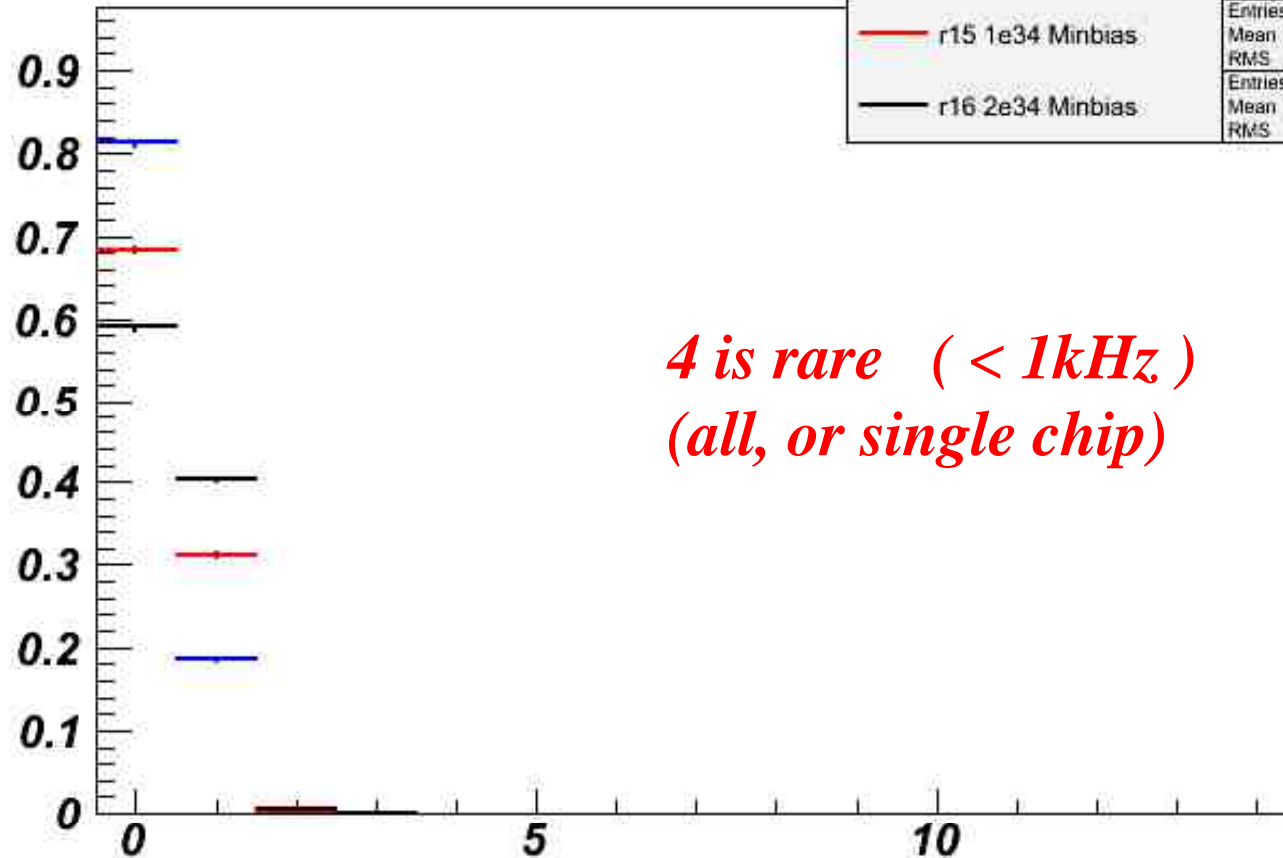
with *appropriate* thresholds

Lower than old bugged MC by a lot

4 is max seen in minbias: EM or J

ROI Multiplicity: CPM (minbias)

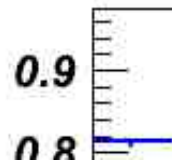
Highest CPM multiplicity



r15 5e33 Minbias	Entries: 69899
	Mean: 0.1891
	RMS: 0.3966
r15 1e34 Minbias	Entries: 39939
	Mean: 0.3186
	RMS: 0.472
r16 2e34 Minbias	Entries: 49848
	Mean: 0.4157
	RMS: 0.5056

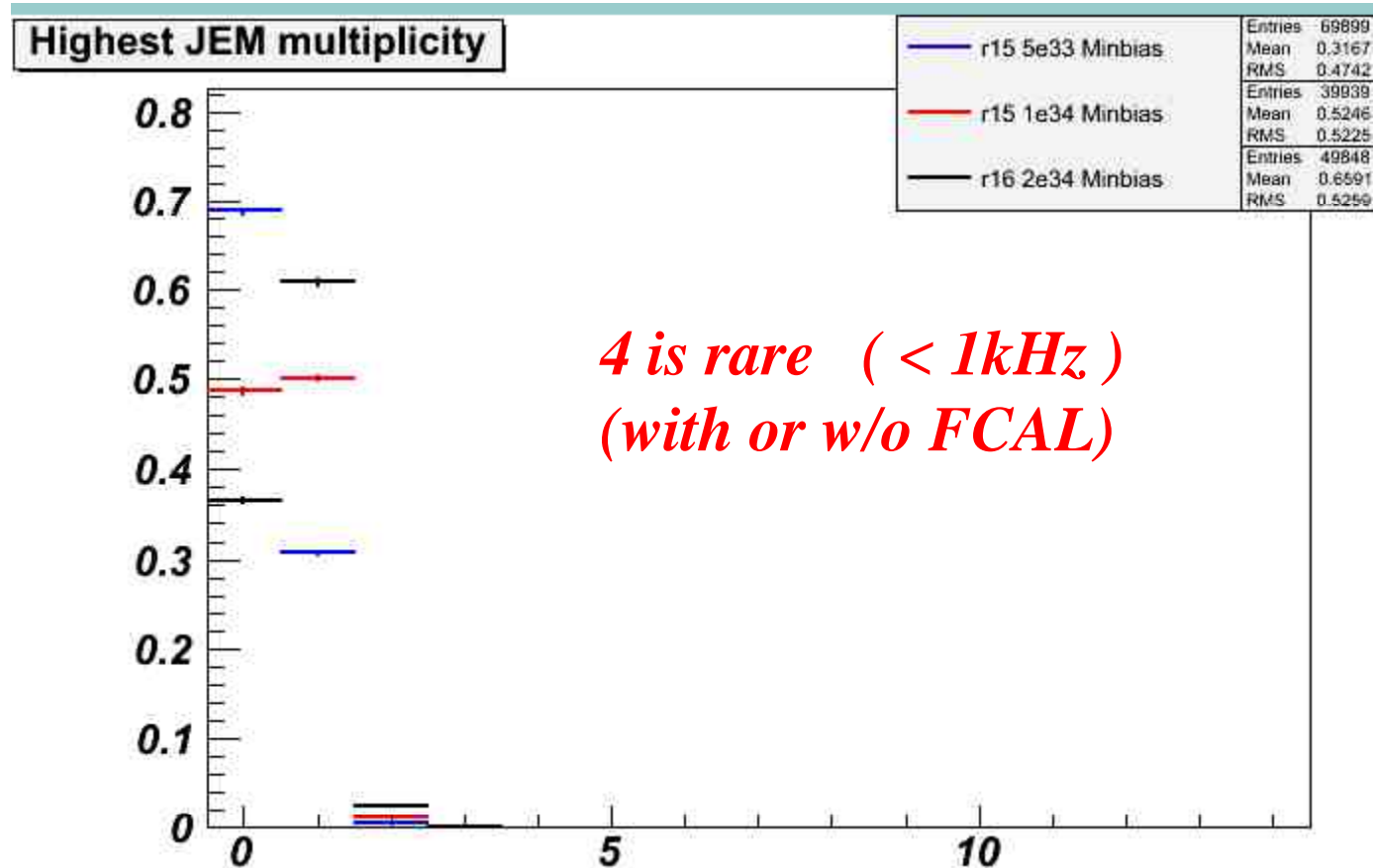
*4 is rare (< 1kHz)
(all, or single chip)*

Highest CPM chip multiplicity



r15 5e33 Minbias	Entries: 69899
	Mean: 0.1877
	RMS: 0.3921
r15 1e34 Minbias	Entries: 39939
	Mean: 0.3159
	RMS: 0.4653
r16 2e34 Minbias	Entries: 49848
	Mean: 0.4097
	RMS: 0.4924

JEM ROI Multiplicity (minbias)



Rates Update: Version 16

Rates from **Minbias pileup**

no cavern, beam halo, beam-gas,

Samples:

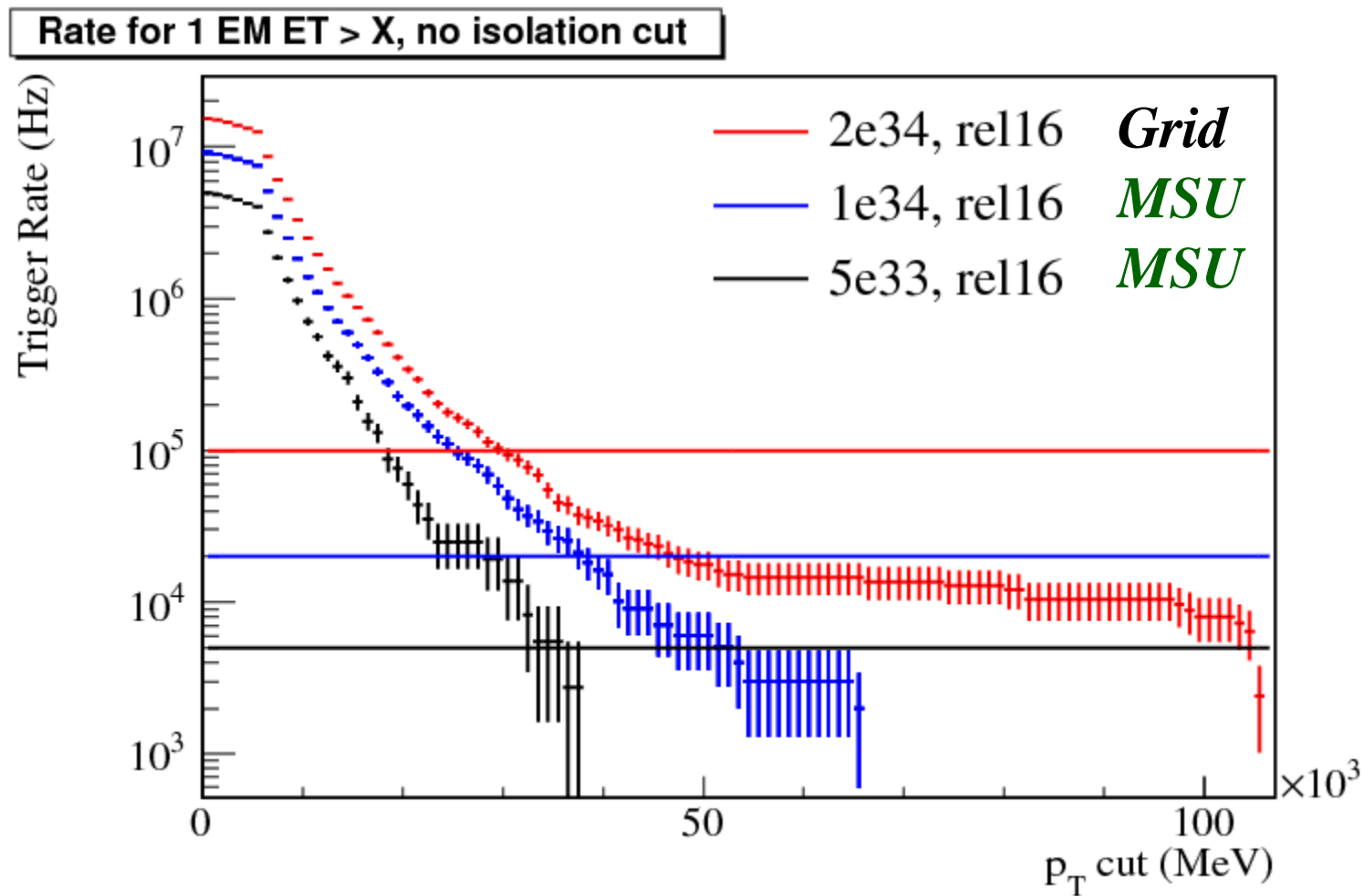
2E34 from standard production

All bugfixes except FCAL

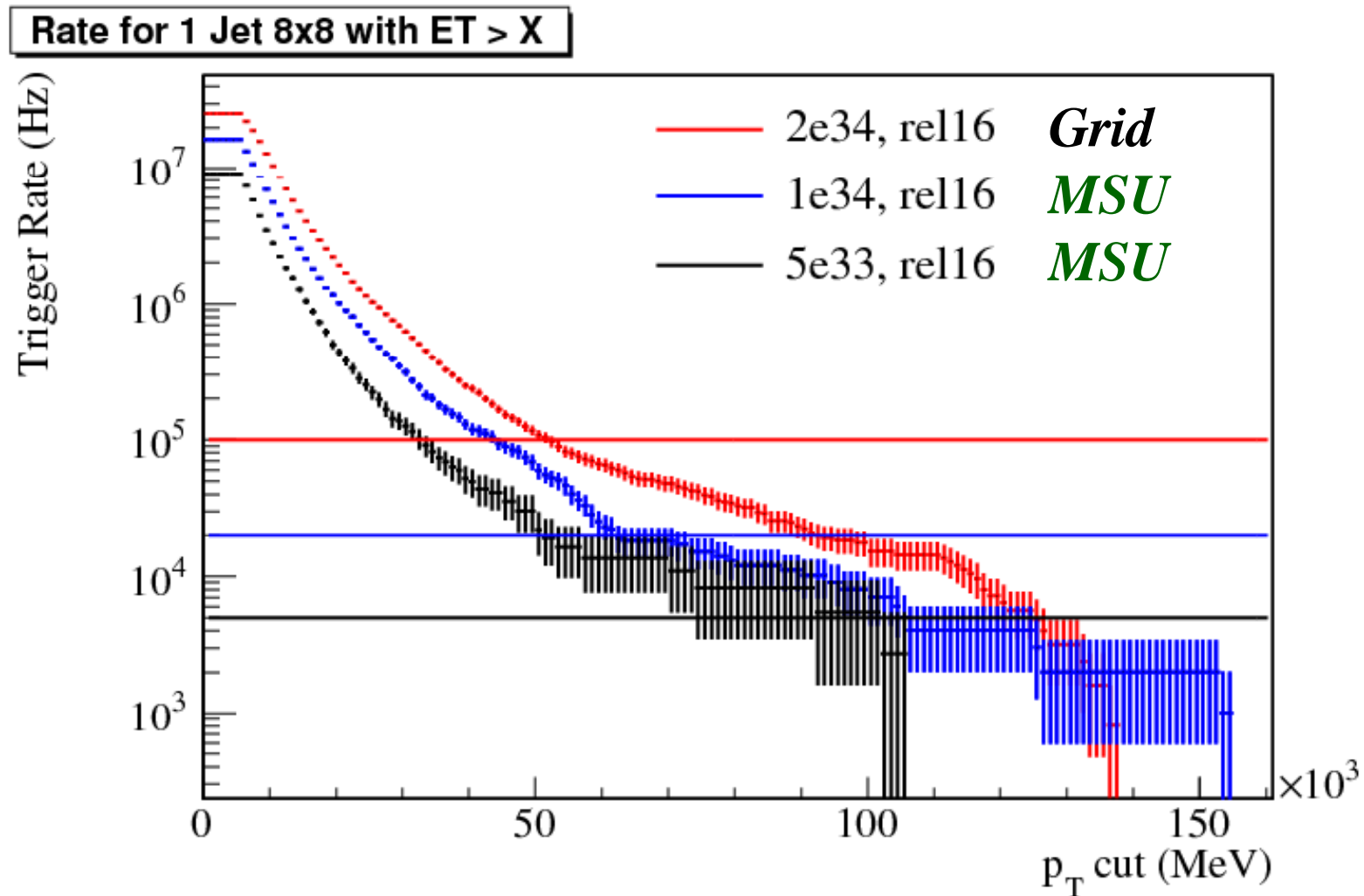
Lower lumi samples made at MSU

All current bugfixes

EM Rate vs. Lumi v16



Jet Rate vs. Lumi v16



For more detail...

Linearity vs Lumi: buggy, fixed, in-time only MC

24 vars (Et, Nroi) x {mean, sd} x 3 MC versions

compare good and bad MC: what caught by nonlinearity?

http://hep.pa.msu.edu/people/kraus/meanvarlineplots_withnew2e34/index.html

Lumi dependence (minbias only) .5, 1, 2 E34

~75 plots: Nroi, Pt dists, MET, etc; (v15 bugfix and v16)

http://hep.pa.msu.edu/people/koll/Atlas/Luminosity_Comparison_1.0/

Compare minbias reuse: RDSF @ .5E34

same 75 plots: (v15 bugfix, RDSF=150) vs. (v16, RDSF =40)

http://hep.pa.msu.edu/people/koll/Atlas/Readdown_Comparison_1.0/

Algorithms to trigger menu...

In progress: Patrick True & Jim Kraus

First candidates:

Em/j overlap removal

Jet delta phi

Jet delta eta

Always in Progress

Ttbar sample not studied yet

5E34: can privately make .rdo

but not .esd

rates x2 different (see above)

would need **certified 64b .exe**

can't address enough VM in 32b

Summary

Much verification and improved understanding

Still some things in progress...

Waiting for more production samples

Good enough for TP?

Backup

Recent Meetings L1Calo Sim

Dec 17, 2010

<http://indico.cern.ch/conferenceDisplay.py?confId=116858>

Feb 16, 2011

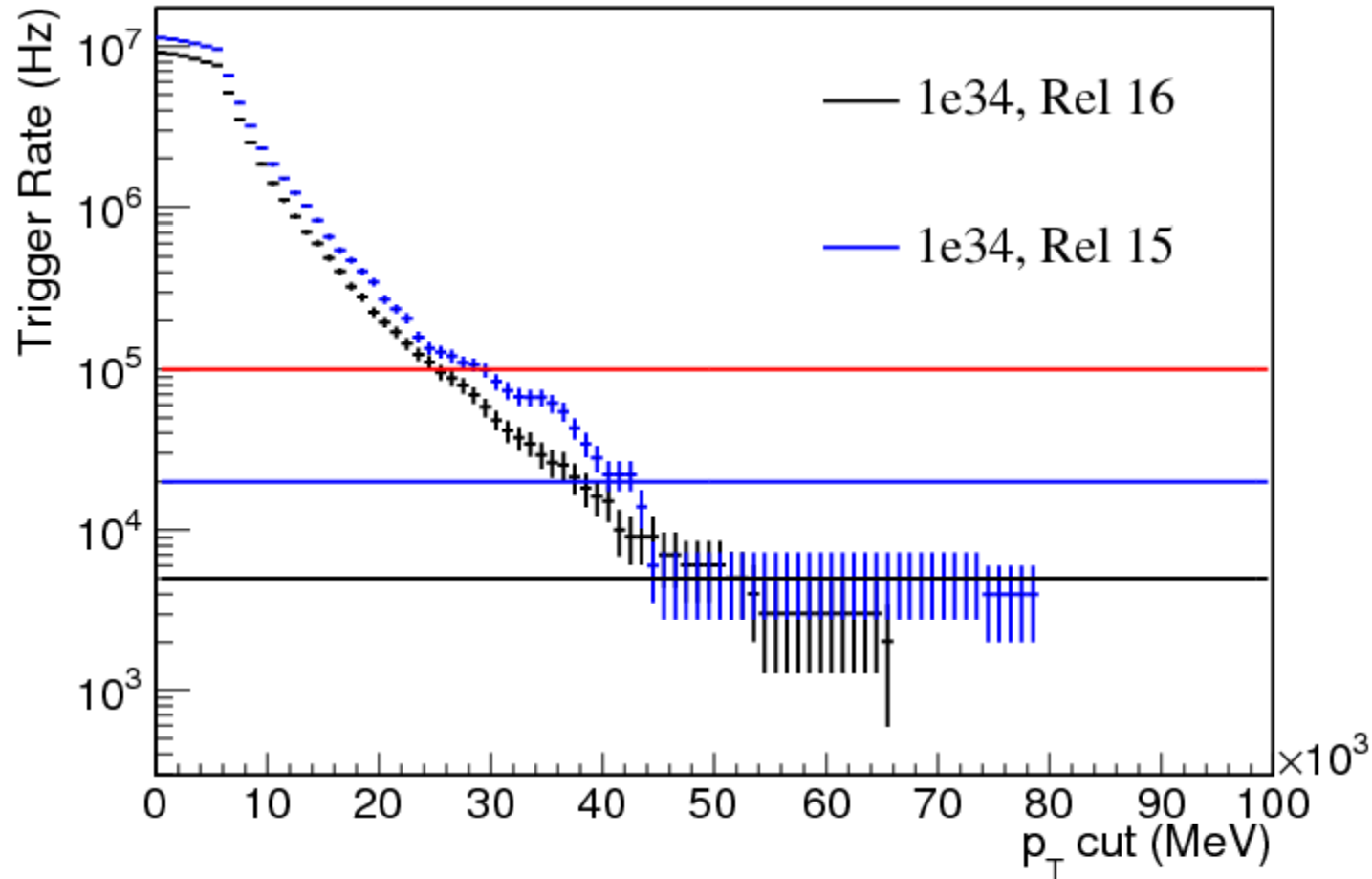
<http://indico.cern.ch/conferenceDisplay.py?confId=126214>

March 16, 2011 last week

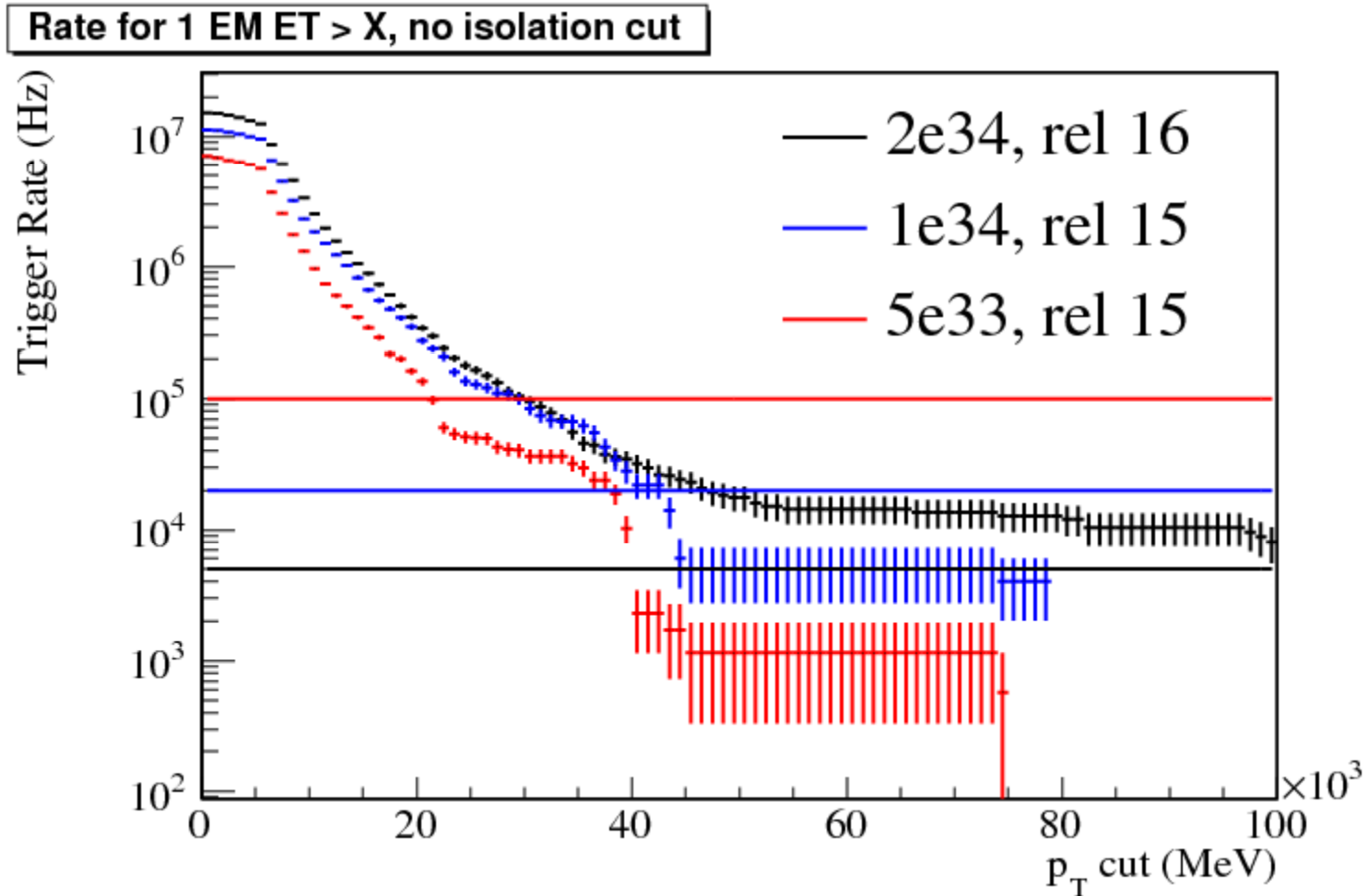
<https://indico.cern.ch/conferenceDisplay.py?confId=131565>

Rates EM, 15 vs 16, 1E34

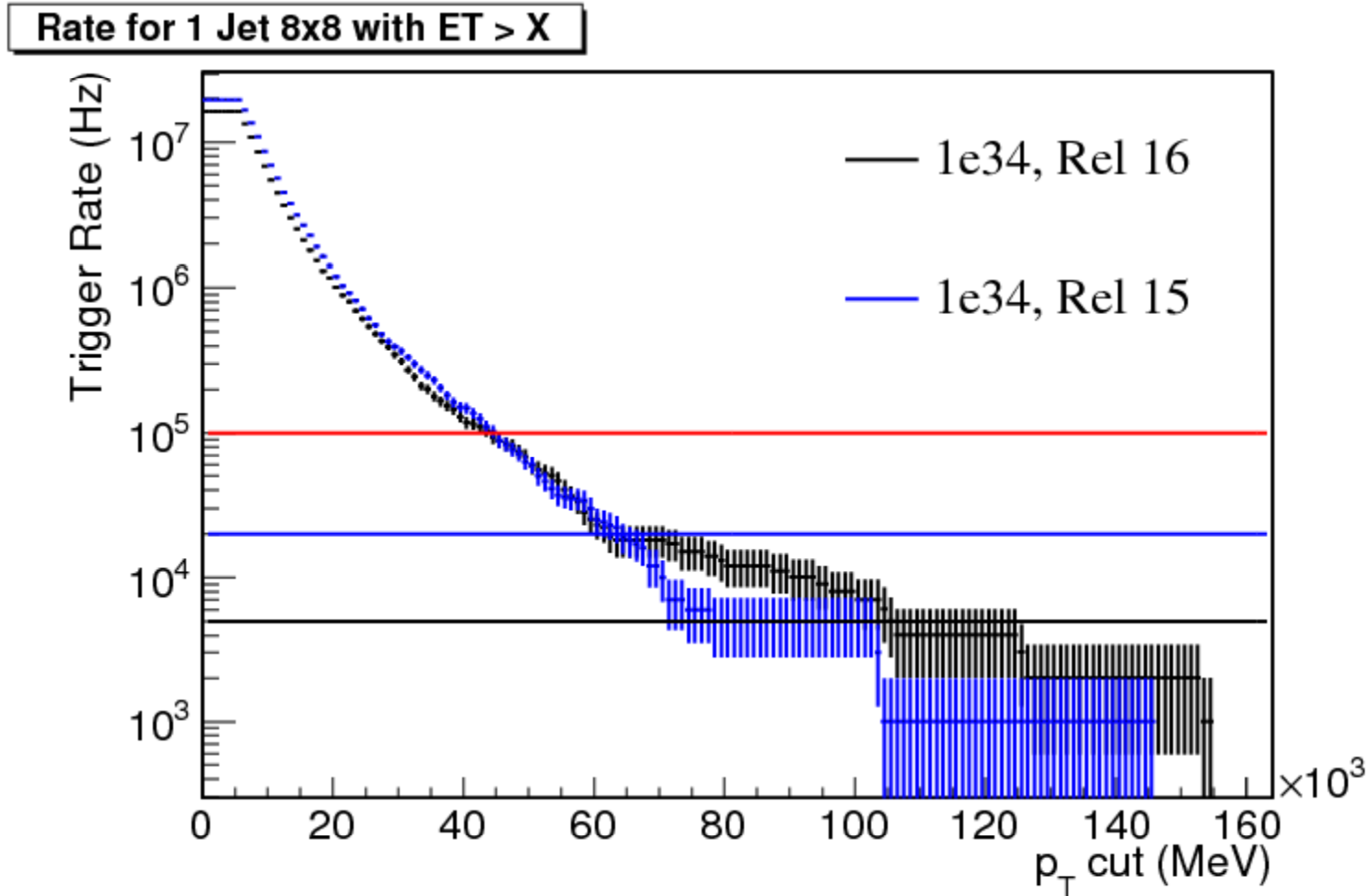
Rate for 1 EM ET > X, no isolation cut



EM Rate for Various Lumi (15 vs. 16)

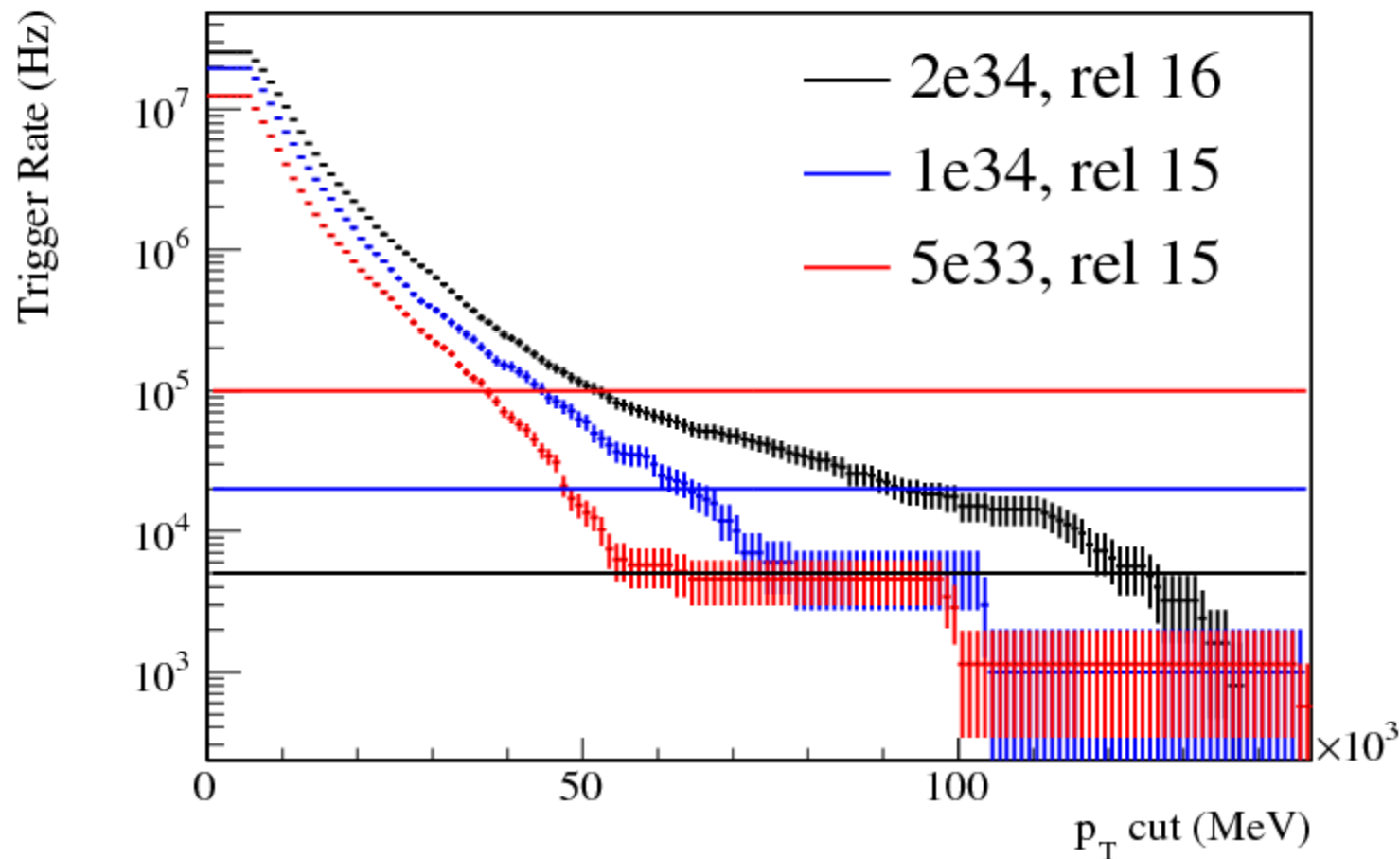


Jet Rates: 15 vs 16, 1E34



Jet Rate for various Lumi (15 vs. 16)

Rate for 1 Jet 8x8 with ET > X



Readdown and 15 vs. 16

