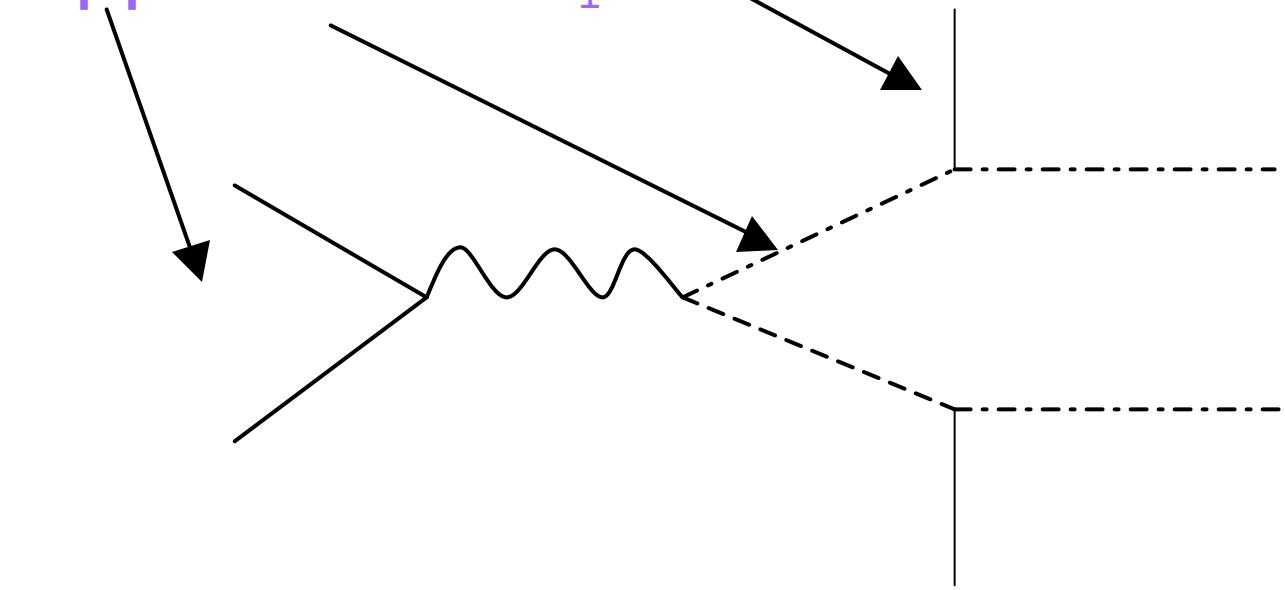
RunII Stop in ttbar & ICD

Ted Eltzroth

Stop direct production

$q\bar{q} \rightarrow \tilde{t}\bar{\tilde{t}} \rightarrow c\,\tilde{Z}_1^0$



RunI Results

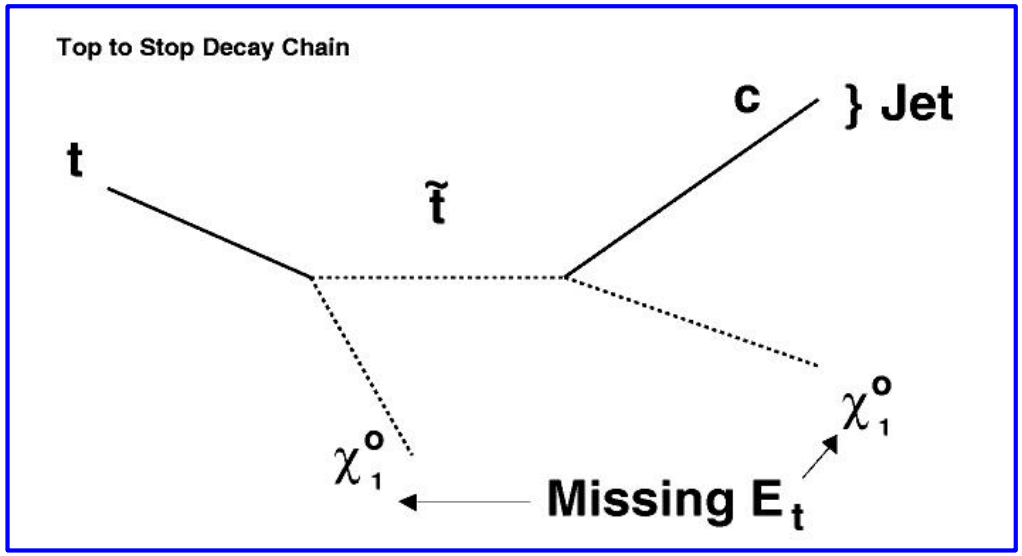
- MEt > 40 GeV
- $90<\Delta\phi(j1,j2)<165$ Acolinearity
- $10<\Delta\phi(MEt,j1)$; $\Delta\phi(MEt,j1)<125$
- No leptons ; Jets , MEt signal
- Σ Et(jets) > 175 for W/Z Background
- M(stop)>90 GeV@95% CL ΔM>35 GeV

RunII Changes

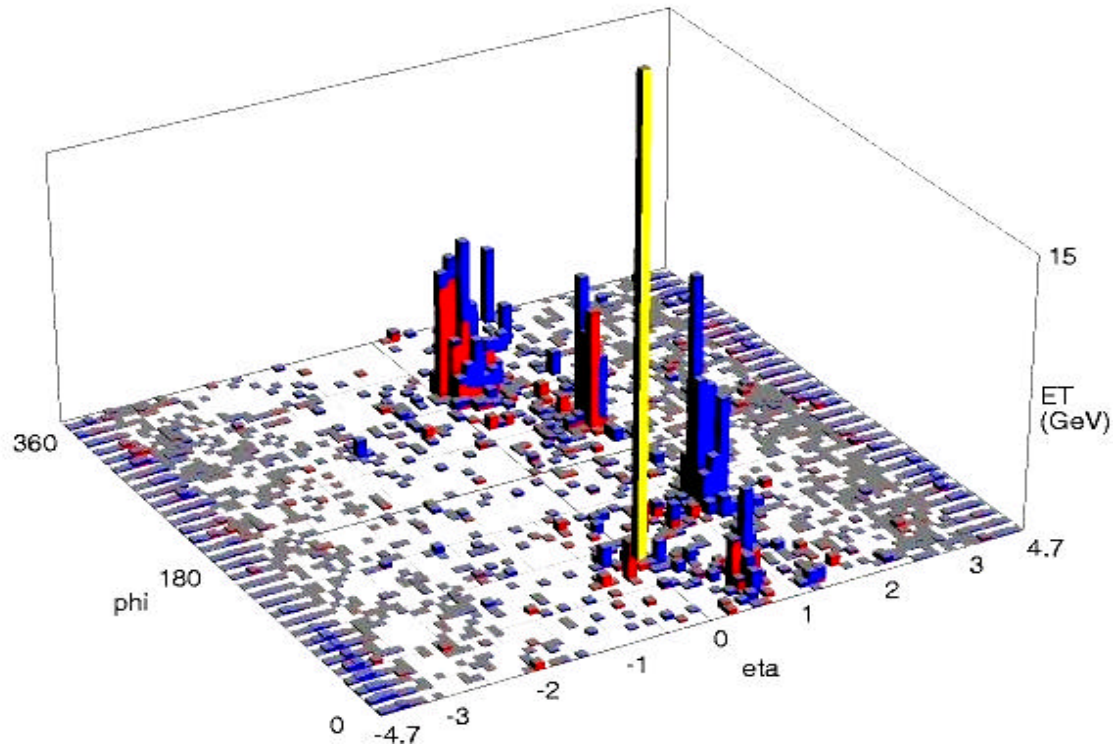
- Tevatron upgrade 1.8TeV-->1.96 TeV
- D0 detector upgrades Calorimetry with faster electronics, 2 Tesla solenoid, Silicon Fiber tracking 800k/ 77k channels respectively, revamped muon detector, and continually evolving DAQ system.
- All upgraded detector systems fully instrumented
- Expectation for winter holidays is 300 pb^{-1}
- More than **twice** RunI data sample

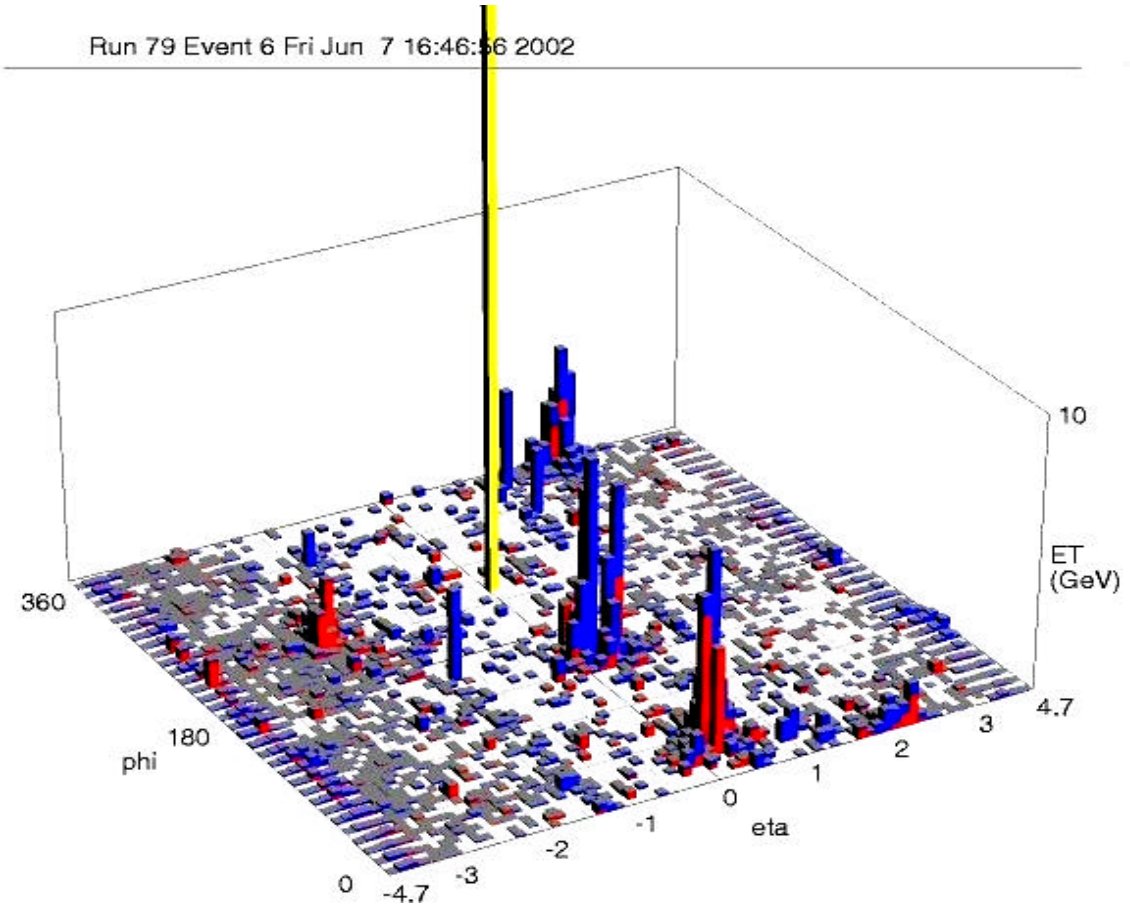
ttbar Decay Channel

- One Standard Model top decay into all jets
- One top to stop+neutralino and the stop then to charm+neutralino:



Signal Displays




Run 79 Event 6 Fri Jun 7 16:46:56 2002
10
ET
(GeV)
4.7
360
180
phi
0
-4.7
-3
-2
-1
0
1
2
3
eta

Assumptions / Cuts

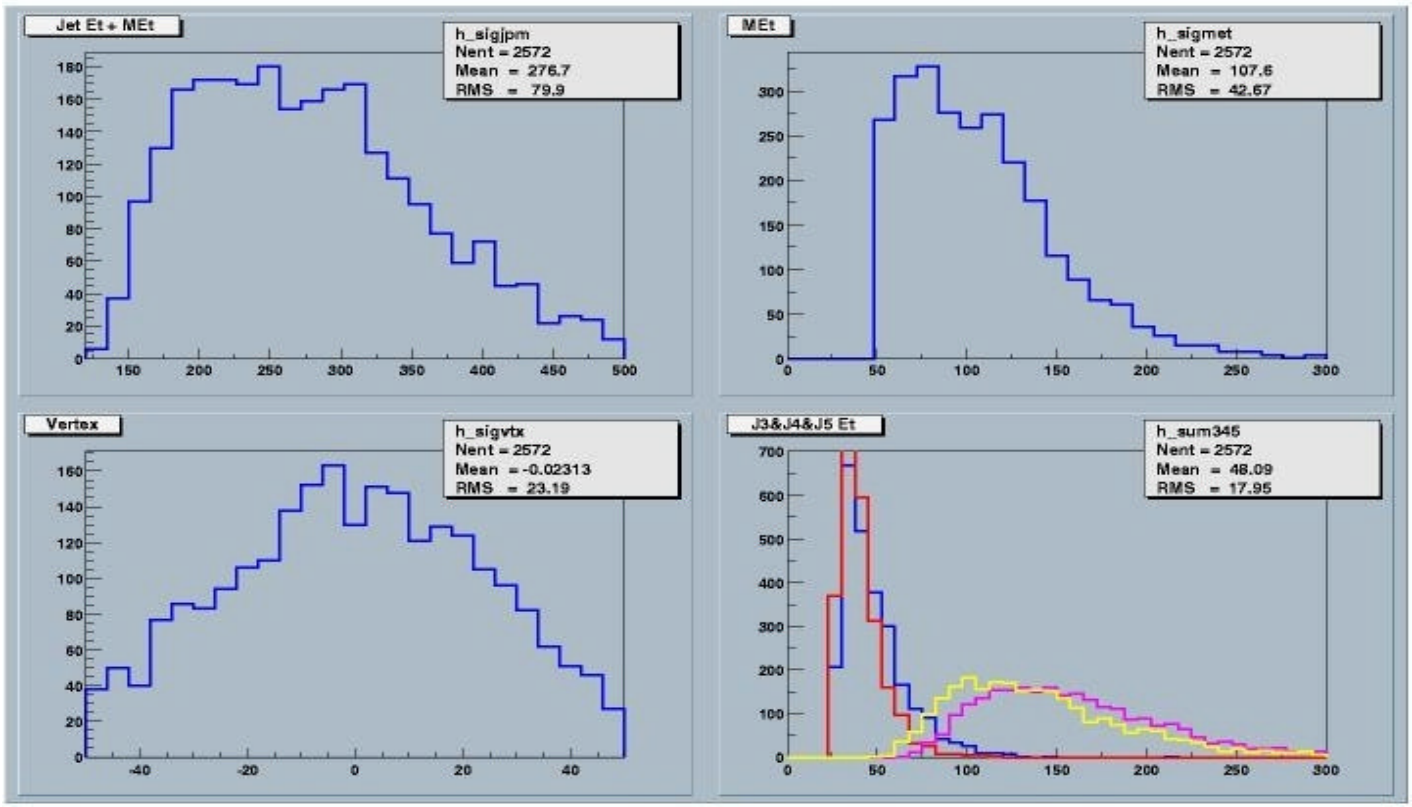
- BR($\tilde{t}$-->cχ) =100%
- χ is the LSP and R-Parity is conserved
- Jets / MEt signal
- Standard Jets quality cuts
- 0.05<EMF<0.95
- CHF<0.4
- HotF<10
- n90>1

More Cuts

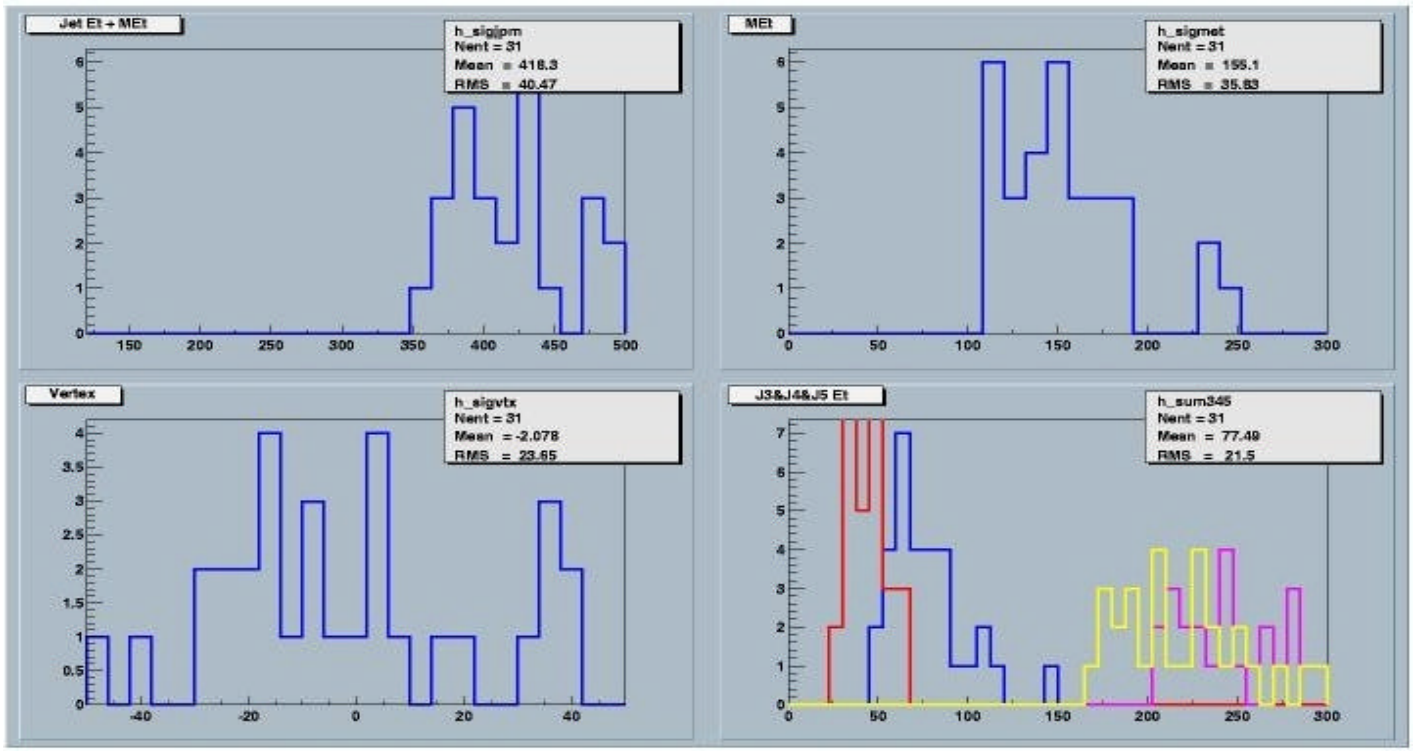
- Met
- Jet Et
- Topology / Acolinearity
- Total Jet + Met mass
- Lepton Veto

Msugra Plots

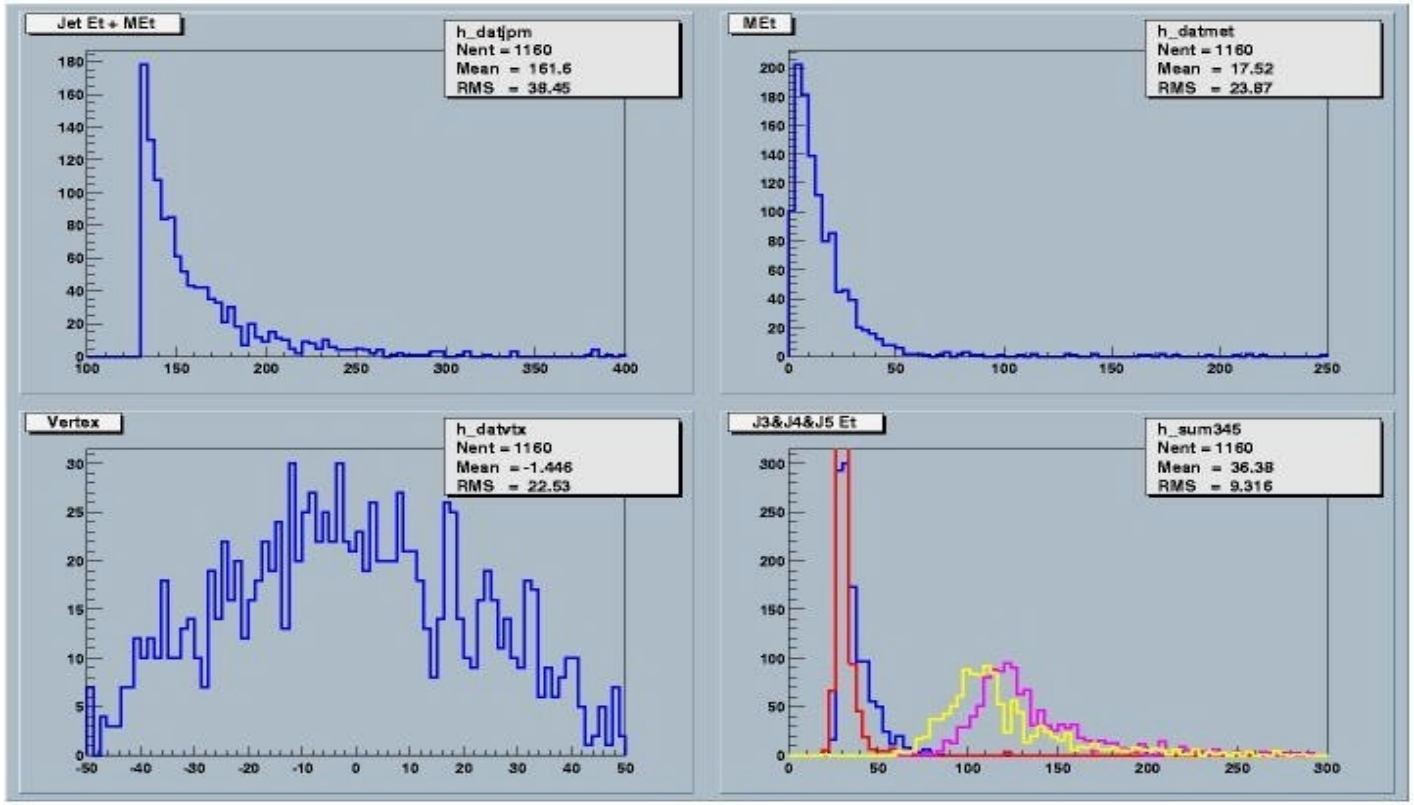
- P10.15.01 MCRunjob Msugra



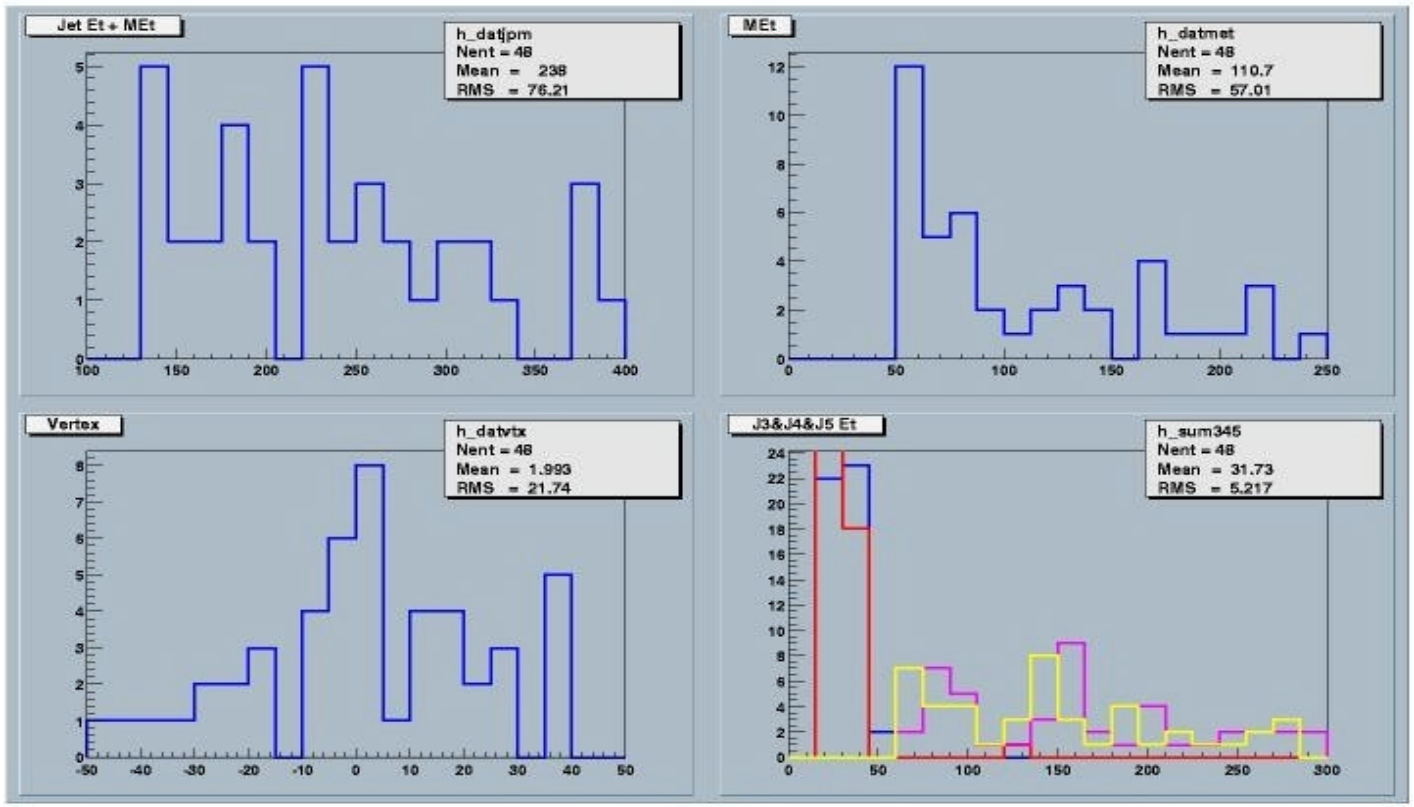
With MEt Cut


Jet Et + MEt
h_sigjpm
Nent = 31
Mean = 418.3
RMS = 40.47
MEt
h_sigmet
Nent = 31
Mean = 155.1
RMS = 35.83
Vertex
h_sigvtx
Nent = 31
Mean = -2.078
RMS = 23.65
J3&J4&J5 Et
h_sum345
Nent = 31
Mean = 77.49
RMS = 21.5

Data 0402 / 40k events



With MEt Cut


Jet Et + MEt
h_datjpm
Nent = 48
Mean = 238
RMS = 76.21
MEt
h_datmet
Nent = 48
Mean = 110.7
RMS = 57.01
Vertex
h_datvtx
Nent = 48
Mean = 1.993
RMS = 21.74
J3&J4&J5 Et
h_sum345
Nent = 48
Mean = 31.73
RMS = 5.217

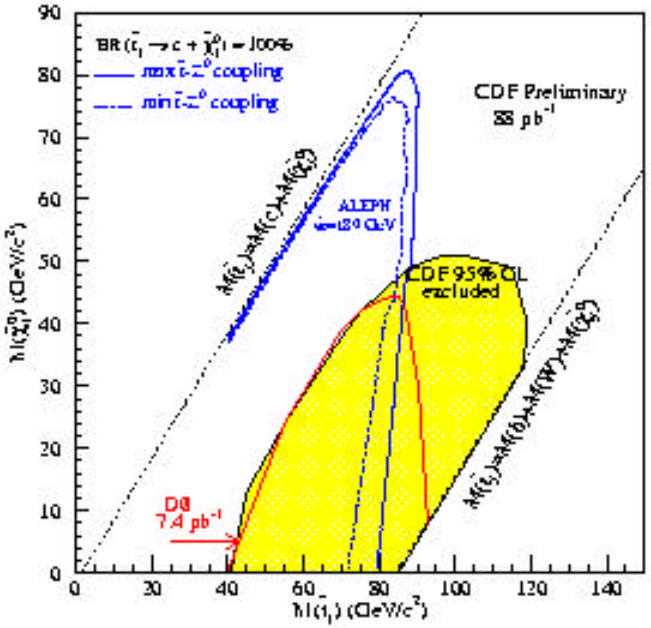
Signal and Backgrounds

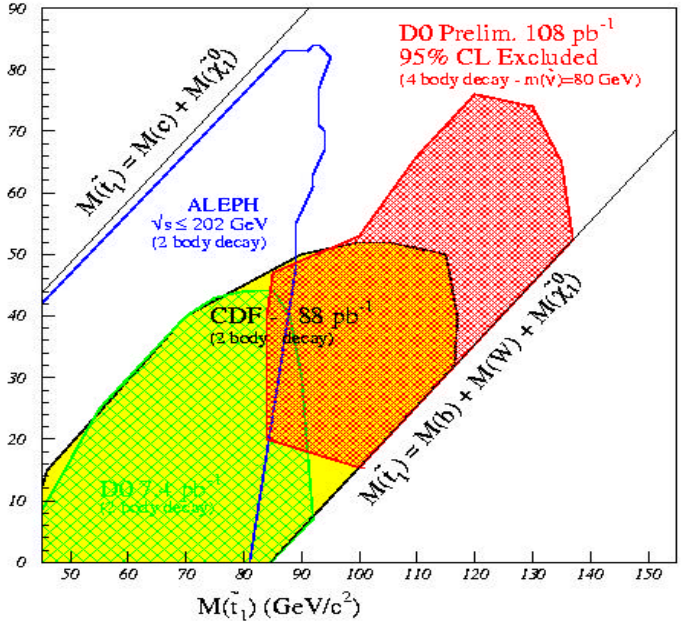
- Signal has:
- N Jets = 4 and Missing E_t
- 1 b tagged jet and 3 High E_t Jets
- No Leptons

- Principal backgrounds are:
- Ttbar (t 0bW 0jet + $\tau\nu$ & τ decays hadronically)
- QCD (multijet with mis-measured jets)
- Vector Boson (W/Z production + jets)

M_{stop} vs. M_{χ} exclusion

From 2-body & From 4 body





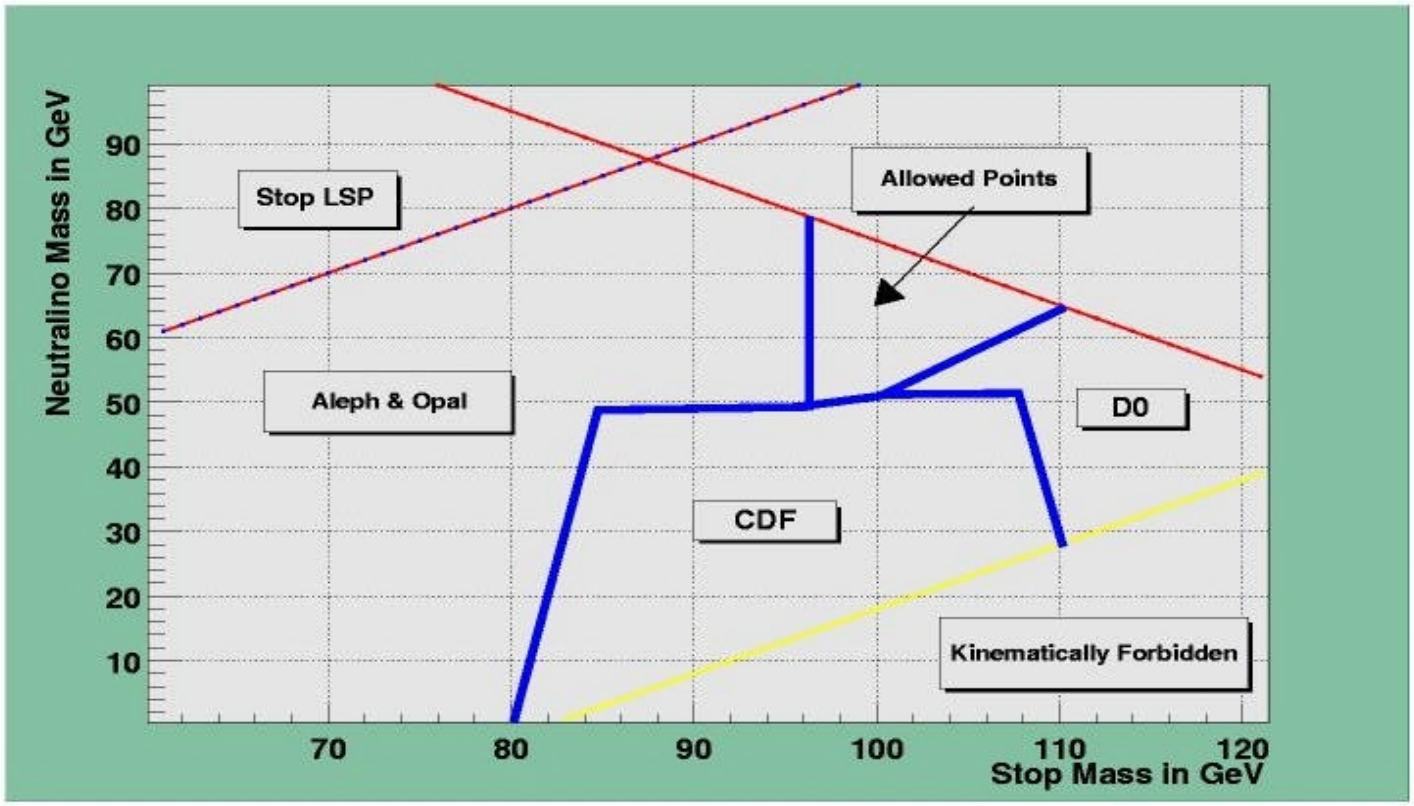
Triggers and Data

- L1 MEt trigger rate ⇧ exponentially with L
- Ideally, L1 has 2 Jet towers > 15 GeV , 3 jet towers > 7 GeV and 4 jet towers > 3 GeV
- At L1 with 3 jet events JT_65TT 0 3 cal seed jets > 5 GeV and L3 Jet Filter has 1 jet with Et > 65 GeV
- At L1 with 4 jet events JT_125TT 0 4 cal seed jets > 7 GeV and L3 Jet Filter has 1 jet with Et > 125 GeV
- Chancing Met, ? ME_3JET? 0 2 cal seed jets > 5Gev, MEt > 20 GeV at L1 & 3 jets with Et > 10 GeV and 20 GeV of significant Met at L2

Building on previous work

- Using top ten stop mass points from thesis work of Y. Song: Exclusion plot next slide.
- Generated cross section information from Isajet v7.58.00 which on average gives 3 pb !
- Pythia rootuples generated here are broke
- Signal MC (& Backgrounds ??) from UTA to be requested
- Decision on Isajet / Pythia to be made

Excluded Mass Points



Triggers & Conclusions

- QCD background studies use low Et jet triggers
- Current triggers of interest are in CalMuon-7.30: JT_65TT and JT_125TT multi-jet triggers
- **********
- For m_{stop} ~110 GeV, stop in ttbar is competitive with direct production searches in 2 jets + MEt.
- Backgrounds with 4 jets and MEt are easier to handle than di-jet backgrounds.
- Vector Boson backgrounds expected to be low.
- ttbar MC is or will be readily available.

To Do List

- Get MC Signal for 10 selected points of interest
- Sam / Isajet Backgrounds
- Optimization of analysis cuts / Combined effects
- Trigger studies for Signal:Background optimization ; {local experts Andy & Fajer}
- Find good QCD background trigger
- MEt trigger ???
- Clean data samples
- Write / defend thesis

ICD Status

- ICD coverage in Run II $1.1 < |\eta| < 1.4$
- $|\text{ieta}| = 12, 13, 14$
- All ICD components are fully tested & installed
- Timing of ICD relative to Calorimeter is understood
- 5/378 channels give low/dead response. These will be fixed during September shutdown

South EC

Ted Eltzroth

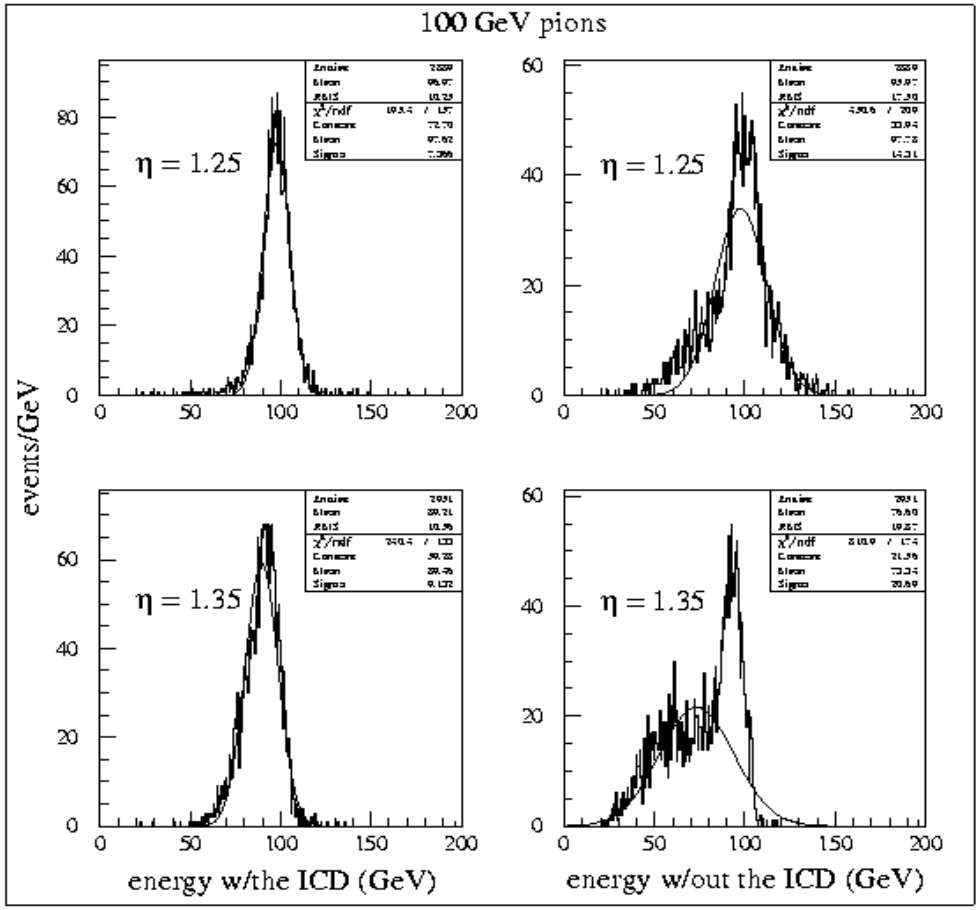


Figure 1.3: Test beam calorimeter response to 100 GeV pions, (left) with and (right) without the ICD.

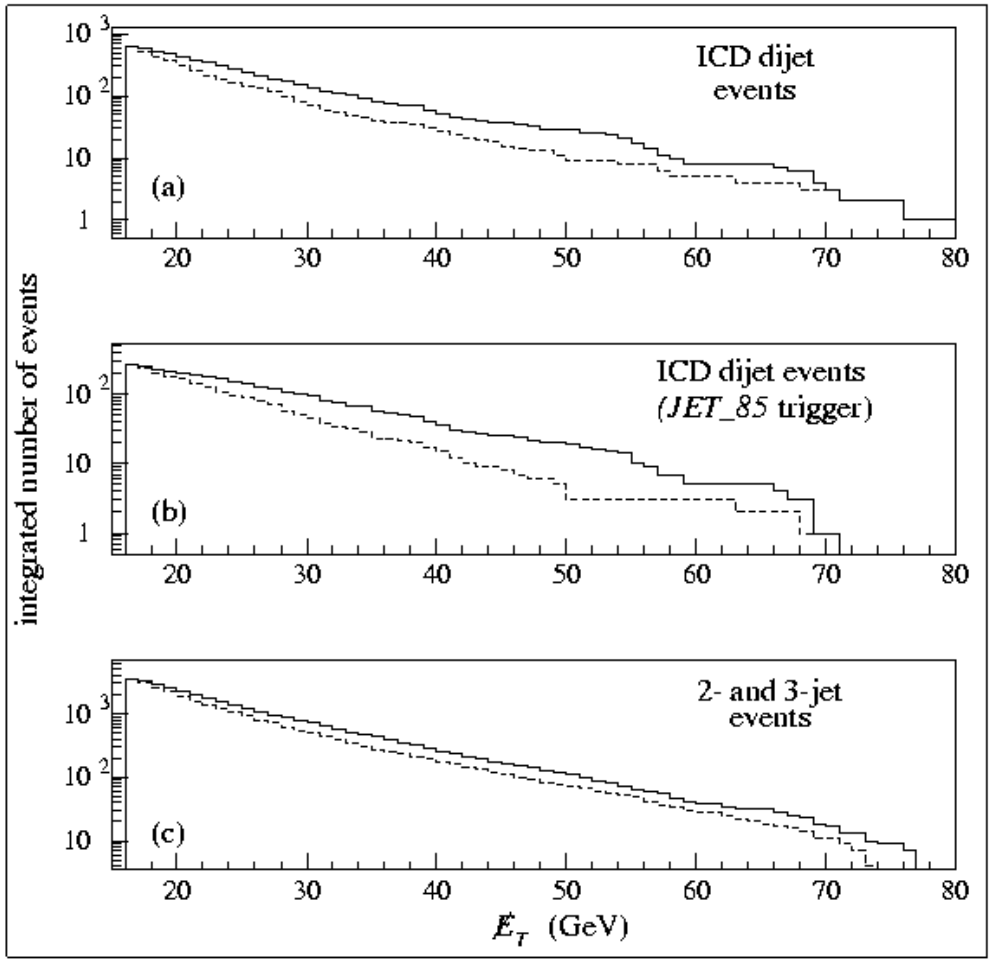


Figure 1.5: Integrated number of events as a function of $\not\!\!E_T$, with the ICD (dashed lines), and without the ICD (solid lines), for three data sets described in the text.

Energy Calibration

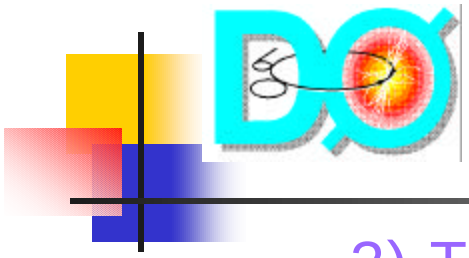
1. ADC to GeV Conversion factor
2. Sampling fractions
3. Tile to tile variation

ADC to GeV conversion

1) The specific energy loss (dE/dx) in the Bicron BC-400 scintillator.

   dE/dx (min) = 1.956 MeV/(g/cm**2) x 1.032 g/cm**3 = 2.02 MeV/cm

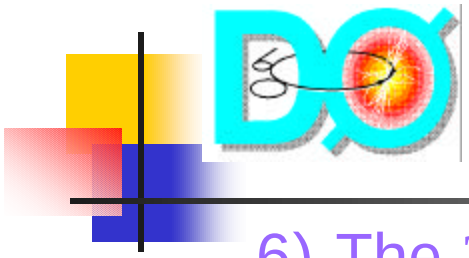
2) Mean MIP peak in teststand ADC counts. From Mark? s distribution of June 2001 the mean for 368 channels was 135.7. (Target was 140).



3) The relative gain factor between calorimeter preamps and the ICD preamps. This factor was measured at the teststand to be 3.8.

4) The extra amplification of x8.7 that we used to boost the signal on the teststand.

5) The factor of 10 between the least count of the teststand ADC? s and the calorimeter ADC? s. The least count for the teststand ADC is 1 mV and for the calorimeter is 0.1 mV.



6) The ? Cosine factor? for each eta bin covered by the ICD:

Eta	Cosine factor
12	0.592
13	0.633
14	0.671

7) The thickness of an ICD tile. All tiles are 0.5 inch thick = 1.27 cm.

The average MIP in calorimeter ADC counts is

(135.7 x 10) / (3.8 x 8.7) = 41.0 counts

Energy deposition in an ICD tile is then:
Cal. ADC count/41.0 x 2.02 MeV/cm x 1.27 cm
divided by the cosine factor

This gives the energy deposition as
cal adc x 0.14 MeV and a max recordable
signal of ~ 780 Mips.

Sampling fractions

Present values are from a Monte Carlo simulation

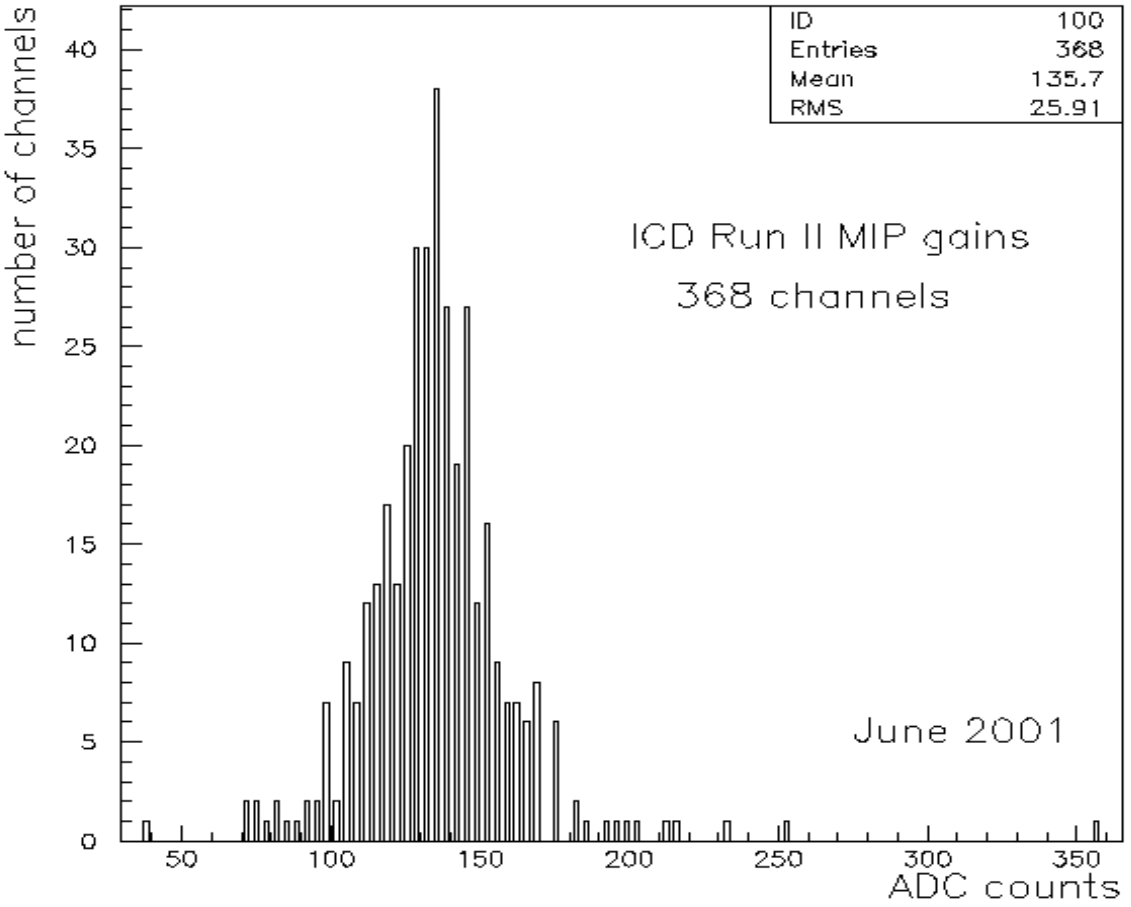
using 20 GeV/c single pions

From caltables:

```
float Weight_icd1    = 72.6591    //ilayer = 9,
|ieta|==12
float Weight_icd2    = 69.5046    //ilayer = 9,
|ieta|==13
float Weight_icd3    = 63.4282    //ilayer = 9,
|ieta|==14
```

Tile to tile variations

- Each tile + fiber cable + PMT combination was calibrated using cosmics on the ICD High Bay teststand
- These combinations stayed together on the detector (apart from changes due to component failures)
- The variation from the mean response is known and will be used as an additional calibration correction
- These data are in DB as run dependence is anticipated



ICD tiles - teststand results

ICD CONCLUSIONS

- All factors available for initial ICD calibrations
- Need to study effects of ICD contributions to energy correction scale
- Need high statistics di-jet and jet-γ samples
- -> float sampling fractions to optimize correction
- -> Consider phi dependencies