Tower 2 problem

For about 30 BLS boards tower 0 is read out instead of tower 2

⇒ the information from tower 0 appears twice (once correctly)
⇒ the information from tower 2 is lost

⇒ problem occurred for most boards during January shutdown, but some broke also at a later date

Robert Zitoun: problem discovered from pulser run analysis
Nirmalya et al.: fixing hardware (June/July)
July 8 http://www-d0.fnal.gov/~parua/Cat_070803.ppt
Jan Stark: providing correction function:
August 5:http://www-clued0.fnal.gov/~stark/CATF5aug.ppt

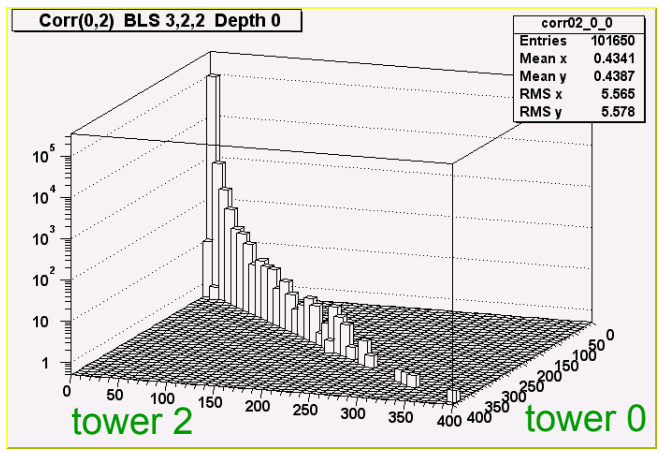
⇒ correction procedure in cal_corr_dst package
⇒ can be applied on tmb to correct cal_data_block
⇒ presented study done by Jan Stark

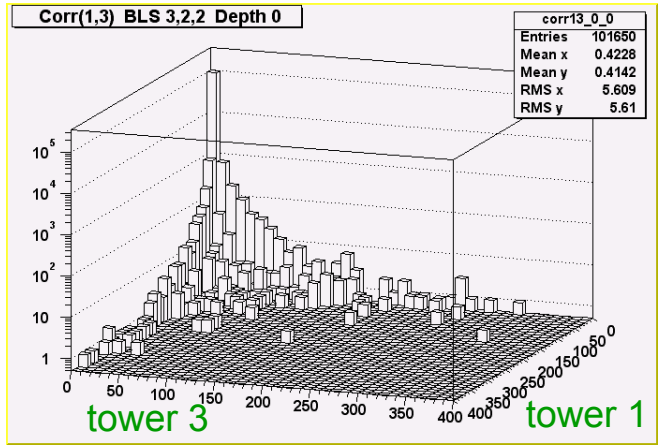
Signature of tower 2 problem

BLS board (3/2/2):

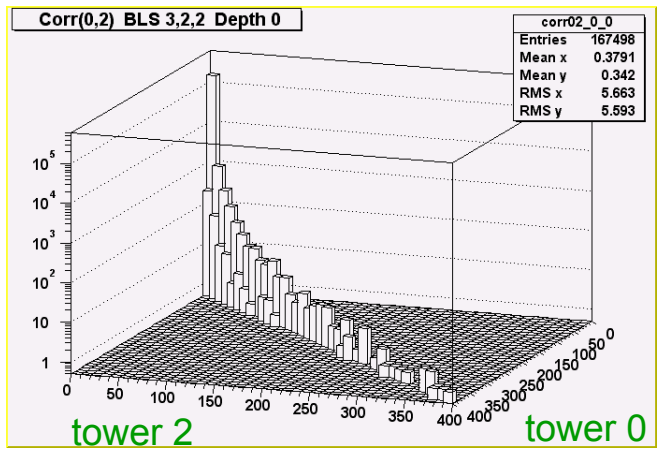
correlation of raw ADC counts in towers 0 and 2 (depth 0) and towers 1 and 3

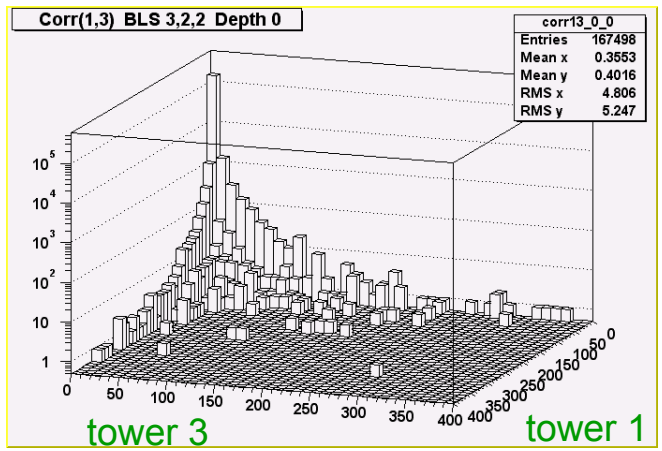
Run 172482





Run 177826

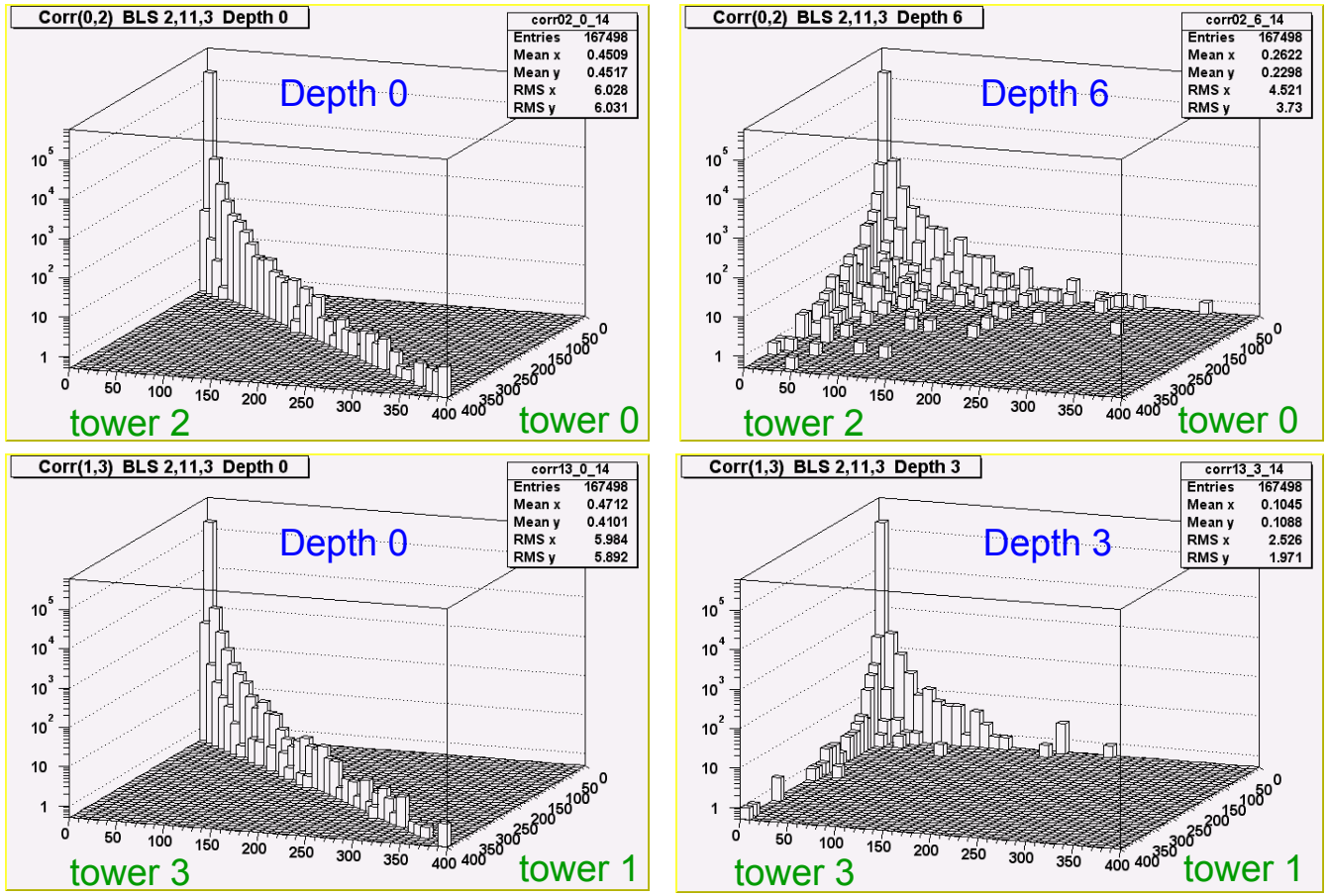




Plots for depths 1 to 11 show the same features.

Tower 3 can be also be affected

BLS board 2/11/3 in run 177826 and run 172482



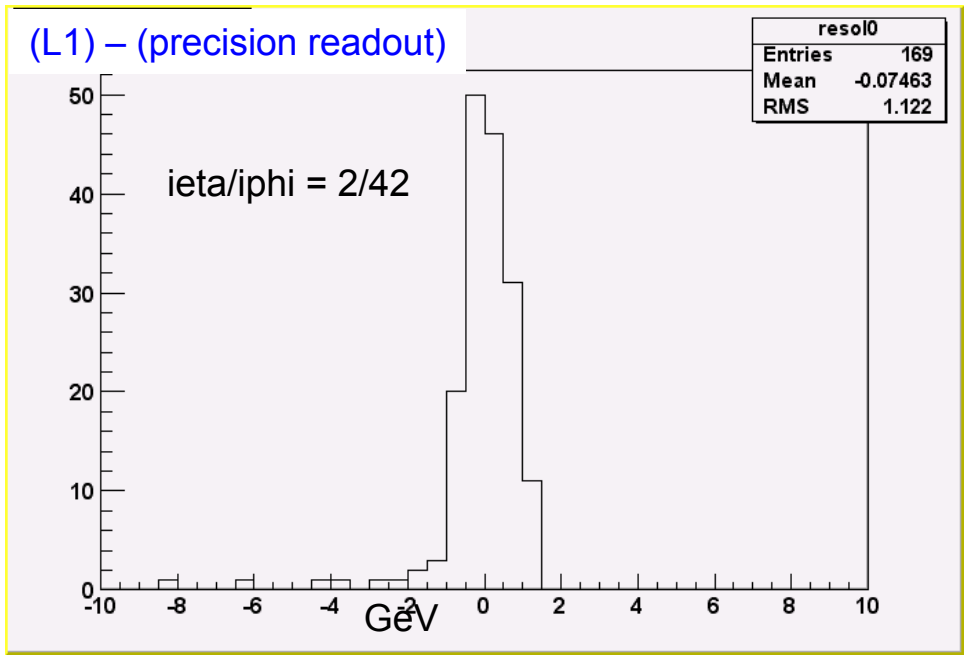
- **tower 3 also has the “tower 2 problem”.**
- **for tower 2 only depths 0 to 5 are affected, for tower 3 only depths 0 to 2.**

Correction from L1 information?

L1 readout is not affected by the tower 2 problem.
$\Rightarrow$ use L1 information to correct the problem, but less precise!

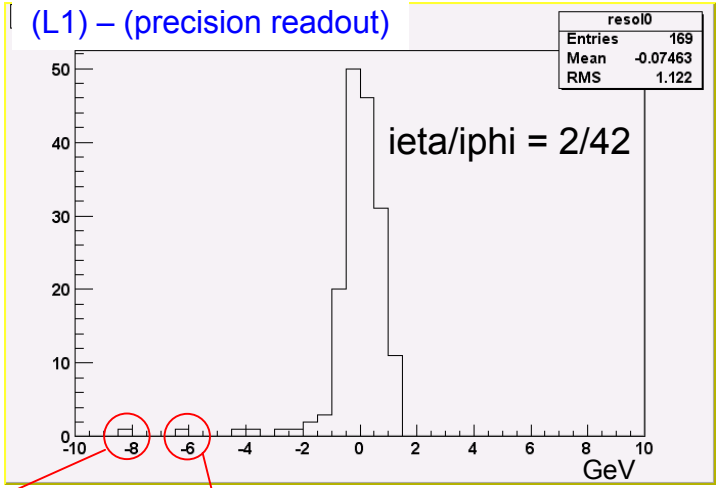
estimation of L1 precision:
- run prior to tower 2 problem
- compare the L1 energy in corresponding trigger tower with energy measured by the precision readout

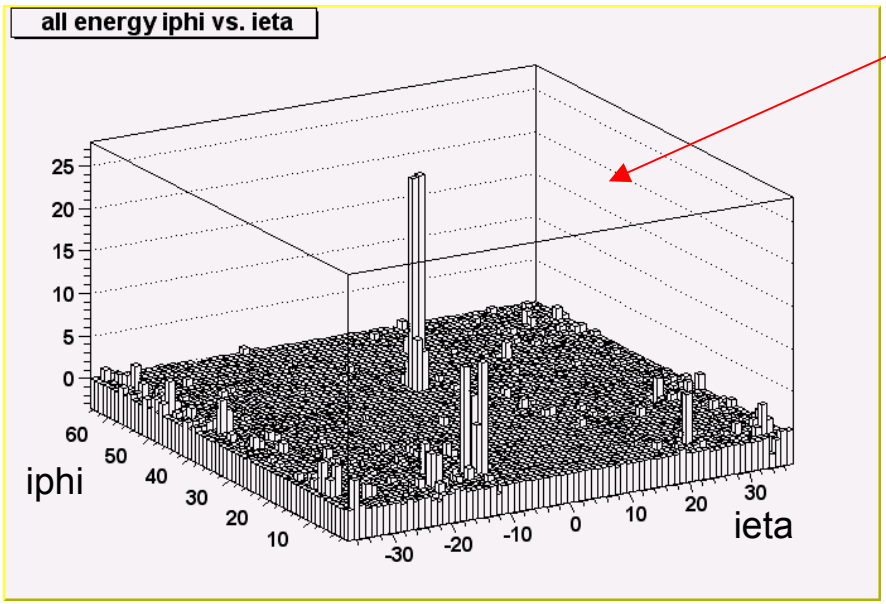
- E(L1) - E(RO):
  μ= – 0.07 GeV σ = 1.22 GeV
- some tails!



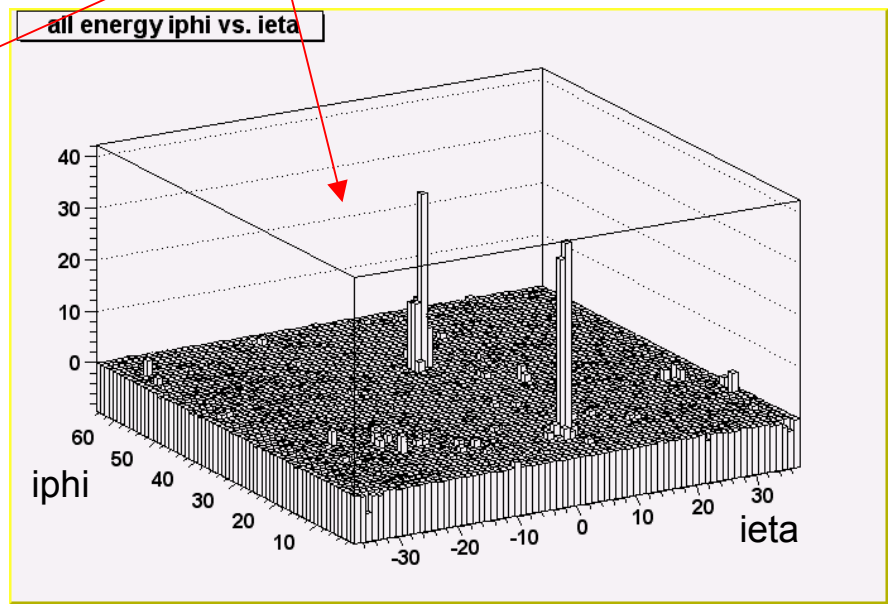
Tails in L1/RO correlation

- clean events
- probably RO is right and L1 is wrong
- L1 precision within 20 %





Trig. tower: 44.5 GeV, prec. readout: 52.8 GeV



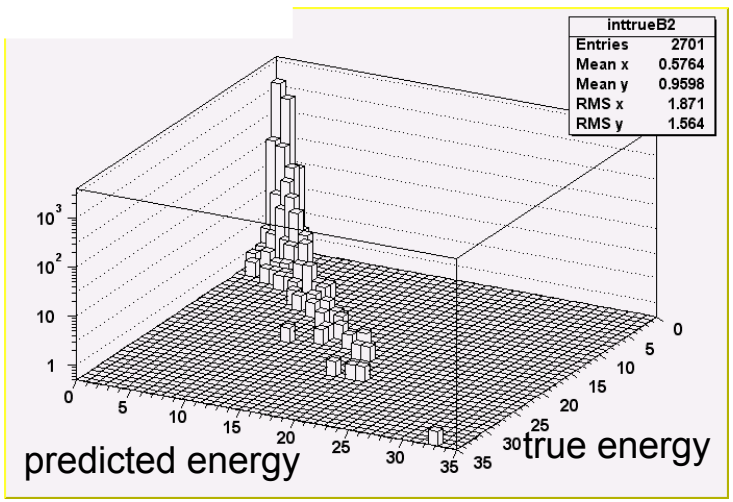
Trig. tower: 44.0 GeV, prec. readout: 50.0 GeV

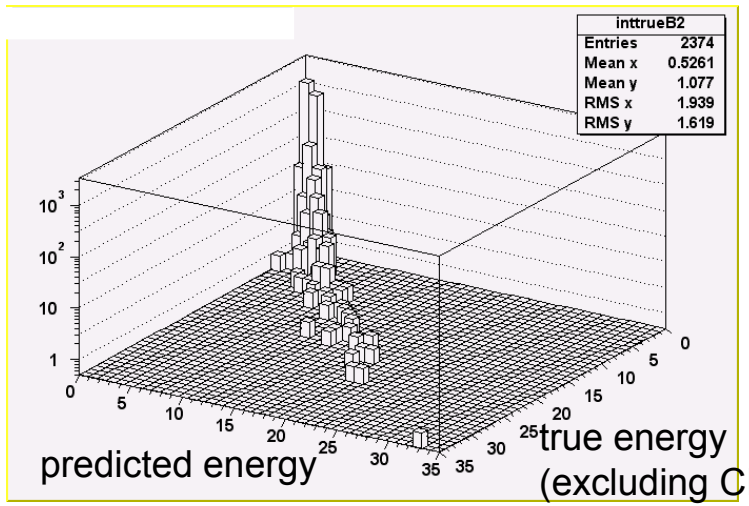
Algorithm for the correction

- **each L1 trigger tower comprises four RO-towers**
- **subtract energy of 3 RO-towers from L1-tower energy**
- **L1 only provides the sum of energy in EM layers and in FH layers**

⇒ distribute equally among the different EM (FH) layers, set CH to zero

simulate procedure: total energy in tower 2 vs energy predicted by correction





- good correlation, but slope ≠ 1, even without CH contribution

⇒ latest L1calibration factors not used yet.

Case if towers 2 and 3 are affected

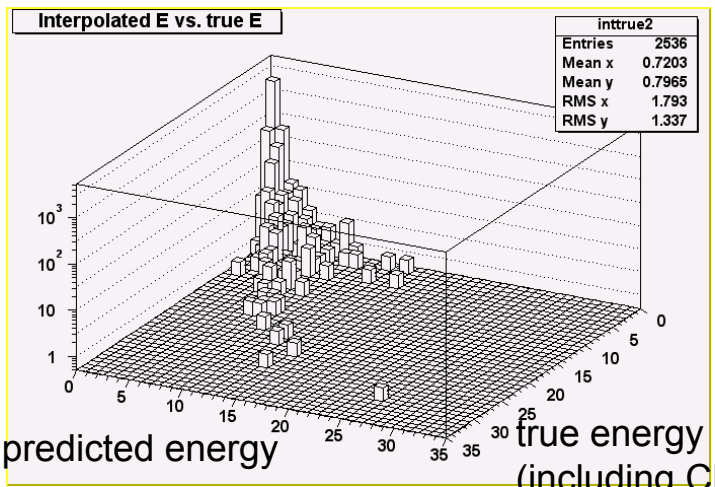
tower 2 and 3 of a BLS board are part of the same trigger tower

⇒ only the energy sum of the two tower is recovered with good precision

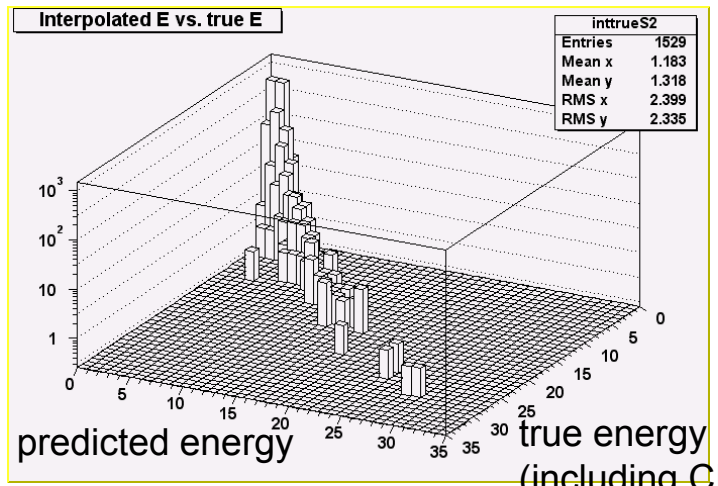
⇒ split energy more or less arbitrarily between the two towers.

⇒ should be good enough for missing E_T and typical cone jet.

Individual towers:



Sum of the two towers:



Limited L1 eta coverage

crate	adc	bls	ieta	iphi	
3	2	2	2	42	
3	6	2	6	32	
8	2	4	6	10	
8	5	6	10	2	
8	7	2	10	62	
8	8	2	2	58	
8	10	0	6	54	
9	0	6	-2	51	
9	6	0	-2	1	
9	8	0	-10	5	
0	3	0	-14	37	
0	8	4	-30	43	
0	9	0	-14	45	
1	6	4	-22	25	
2	11	3	-4	47	
6	10	4	14	50	
10	0	5	-24	1	
10	4	6	-18	7	
11	2	0	-22	51	
11	3	1	-16	53	
11	5	5	-32	55	
11	7	1	-32	57	
11	10	7	-20	63	
11	4	4	-14	55	
1	9	4	-22	29	
2	9	2	-6	41	
1	11	3	-28	31	(affects only runs with extended L1 eta coverage)
10	11	5	-32	15	(affects only runs with extended L1 eta coverage)

$\Leftarrow$ BLS boards known to be affected by the tower 2 problem during some period of time

- trigger list v10.x: $-24 \leq ieta \leq 24$
- TL v11.x and later: $-32 \leq ieta \leq 32$

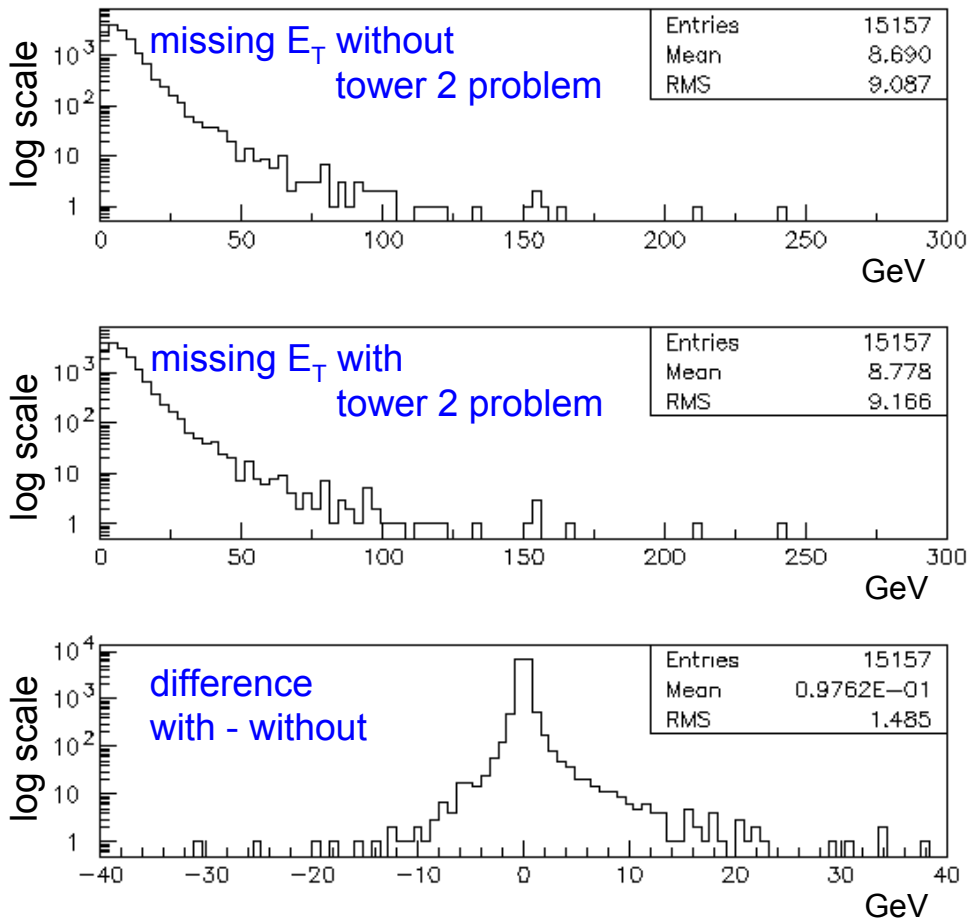
$\Rightarrow$ 3 boards outside L1 coverage in TL v10.x

$\Rightarrow$ no information available!

$\Rightarrow$ take these towers out in all runs during this period

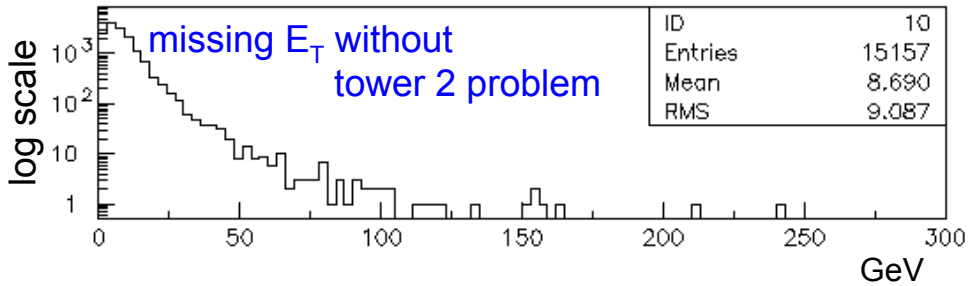
Impact on missing E_T

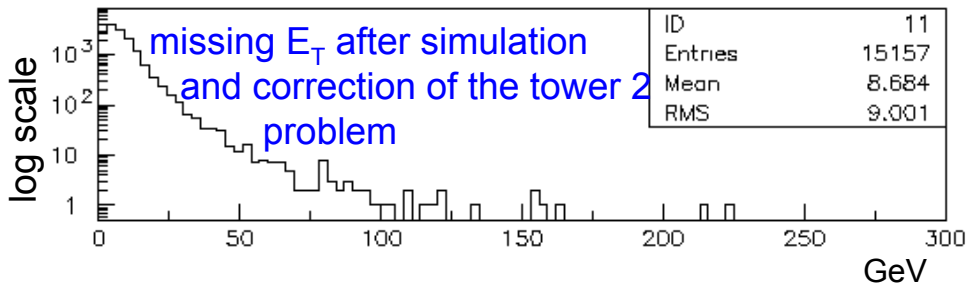
- simulate the tower 2 problem on 15k events from a run that precedes the problem
- compare missing E_T distribution with and without tower 2 problem
- μ= – 0.1 GeV σ = 1.5 GeV
- tails up to 40 GeV



Impact on missing E_T

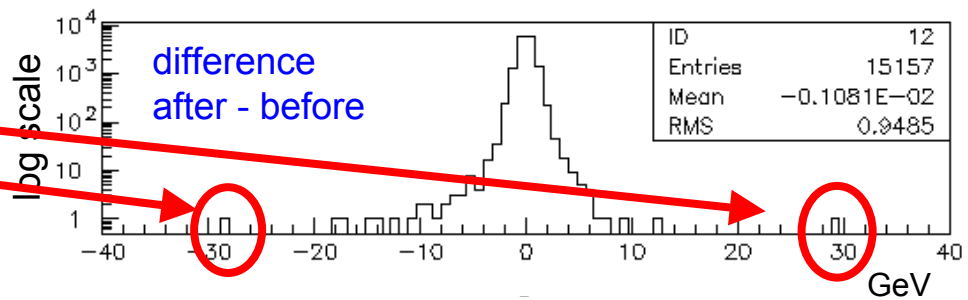
- same distributions after corrections
- μ= – 0.01 GeV σ = 0.9 GeV
- some outliers





CH not treated by corrrection

noise problem



Impact on jets: an example event

Comparison on all jets in an example event
(not a typical one, though)

Without tower two problem			With tower two problem			After correction (as it is implemented now)		
pT	eta	phi	pT	eta	phi	pT	eta	phi
92.9795	0.947578	6.01831	127.353	0.977964	6.02065	92.0136	0.94604	6.01678
91.5699	-0.776211	2.78362	91.5699	-0.776211	2.78362	91.9203	-0.776675	2.78526
11.4774	0.221958	4.92006	11.4774	0.221958	4.92006	11.4774	0.221958	4.92006
9.1915	-1.04239	4.34488	9.0071	-1.03703	4.34439	9.0071	-1.03703	4.34439
8.9408	0.643591	1.55351	8.9408	0.643591	1.55351	8.9408	0.643591	1.55351
-	-	-	-	-	-	8.2105	-1.66933	0.29836

The correction fixes the gross mistakes, but cannot get all the little details right!

Summary

$\Rightarrow$ tower 2 problem appeared since January on ~30 BLS boards

$\Rightarrow$ hardware has been fixed in June/July

$\Rightarrow$ effect on data and correction studied in detail

$\Rightarrow$ correction procedures provided in cal_dst_correct package (since August 3rd)

$\Rightarrow$ some fine tuning may still be done