Sblocco di 20 keuro

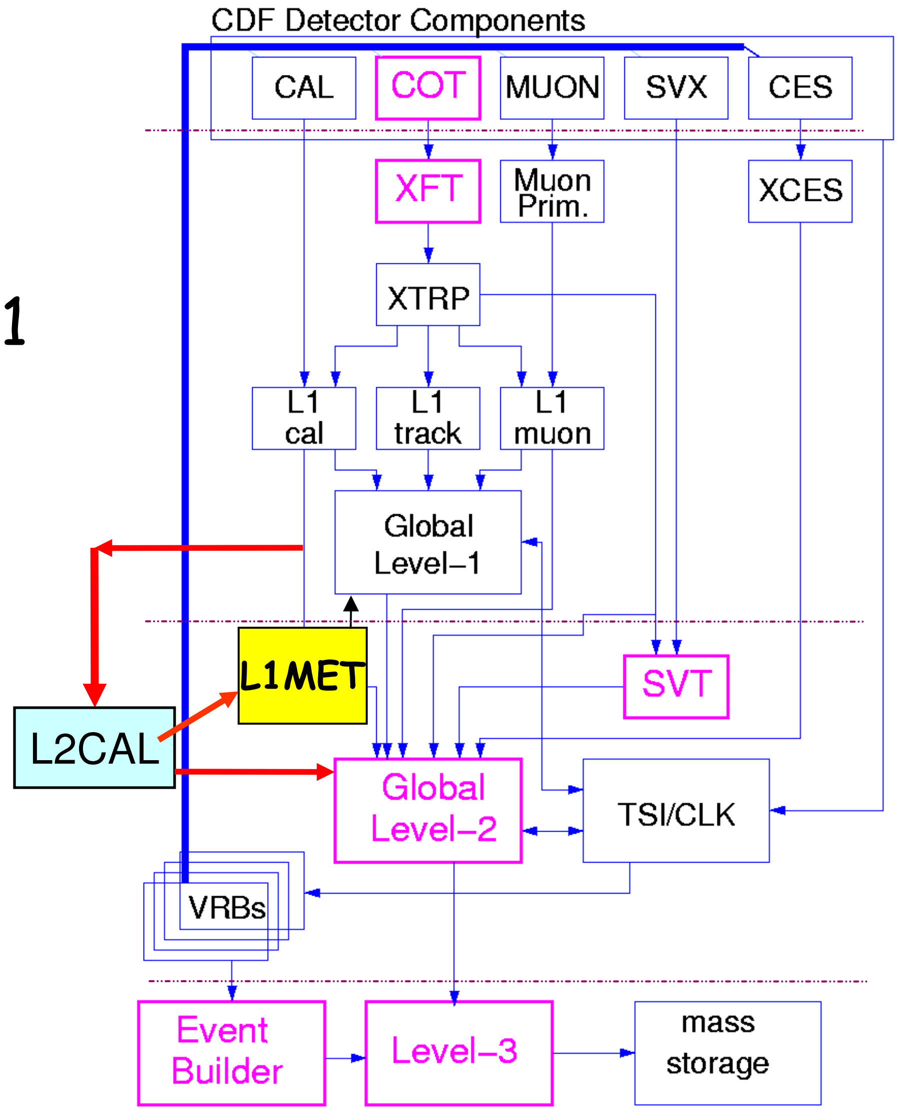
- 15 keuro a Pisa e 5 keuro a Padova.
- GigaFitter - produzione/montaggio 4 mezzanine ~9 keuro Pisa per chips e 5 keuro Pd per PCB
- Piccole spese upgrade di livello 1 ~ 2 keuro
- Piccole spese Laboratorio ~ 4 keuro

Upgrade del trigger calorimetrico

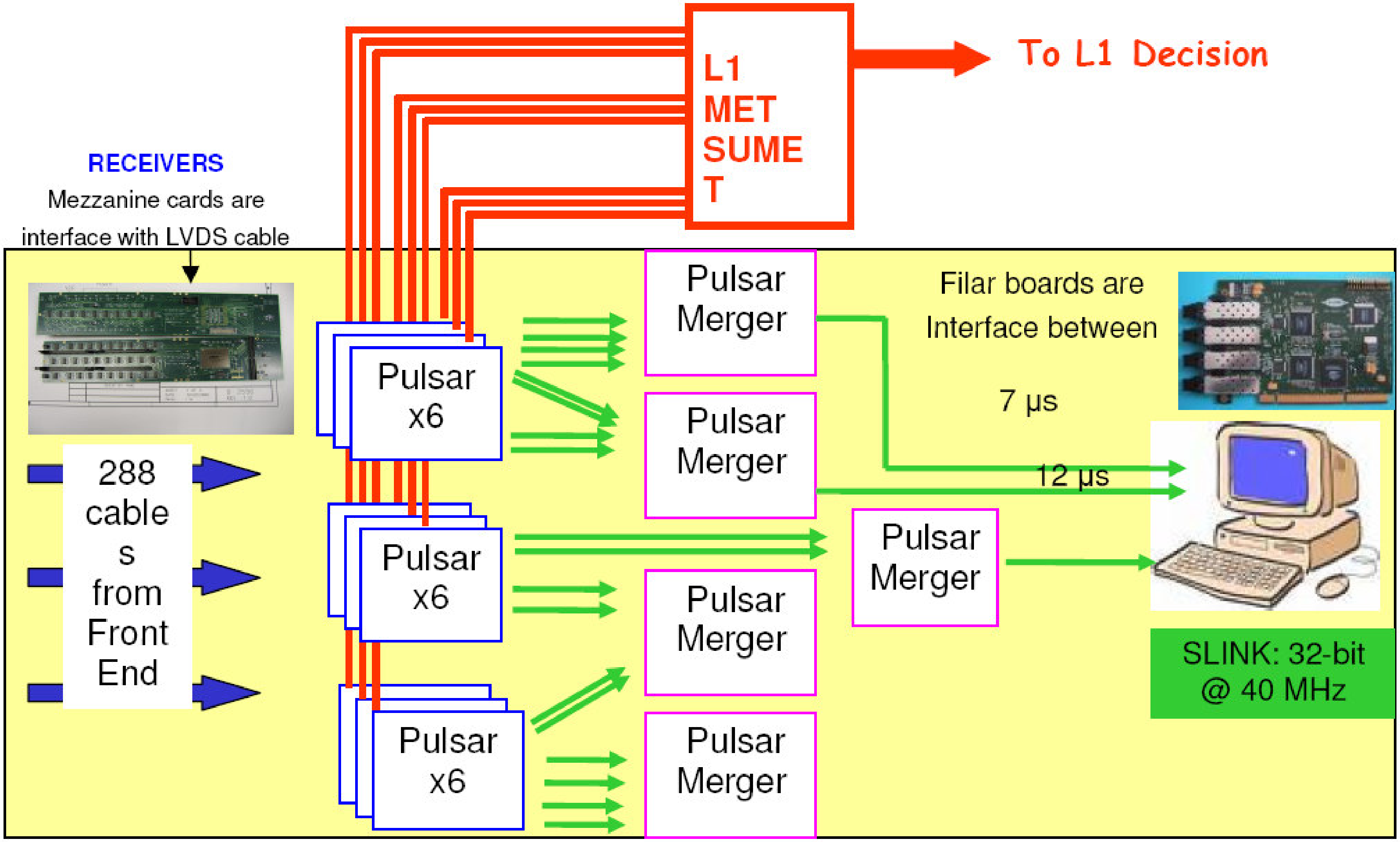
- 2007 installato il nuovo L2
- 2008 installazione del nuovo L1

Attivita' in corso:

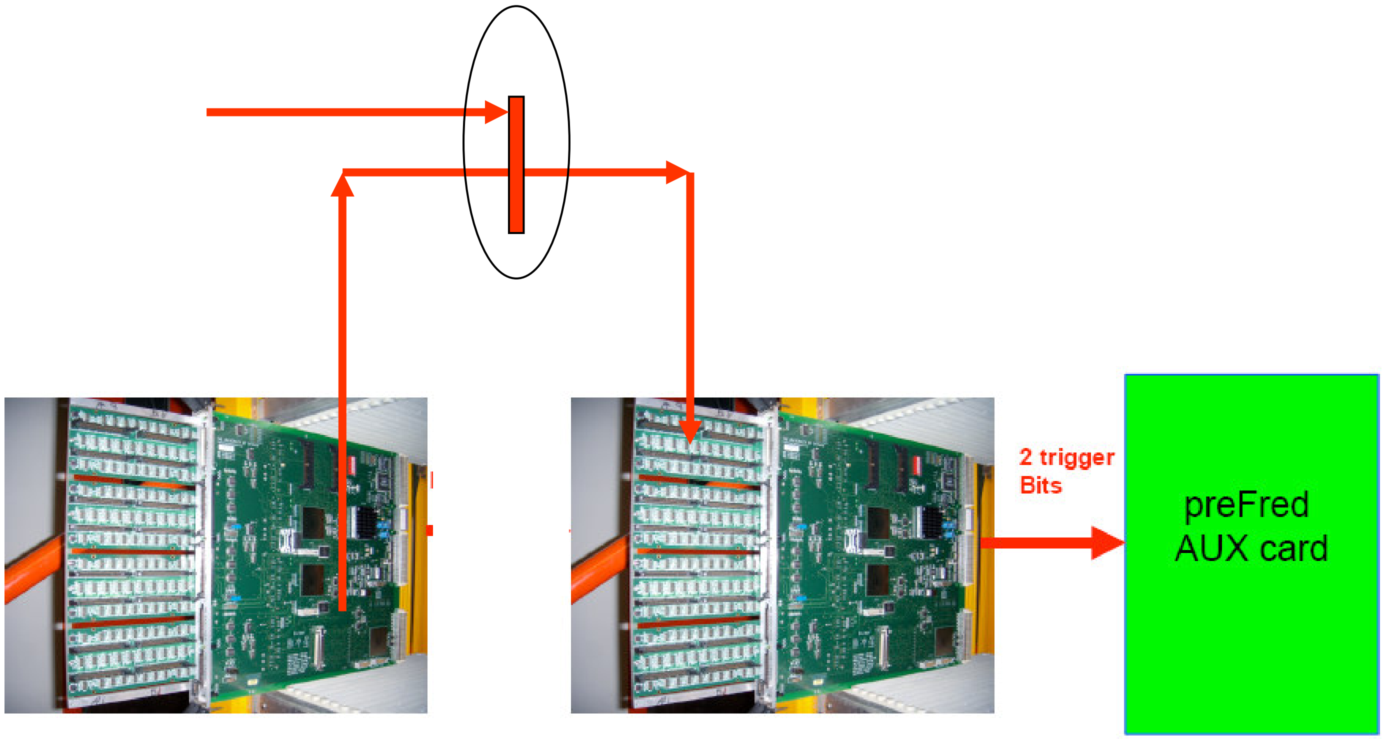
- **L2**: analisi del campione nuovo
- **L1**:
  a) completamento hw
  b) studio per pianificare uso nuovo L1



NUOVO L1= 1 nuova Pulsar



Dove stanno nascosti I piccoli costi



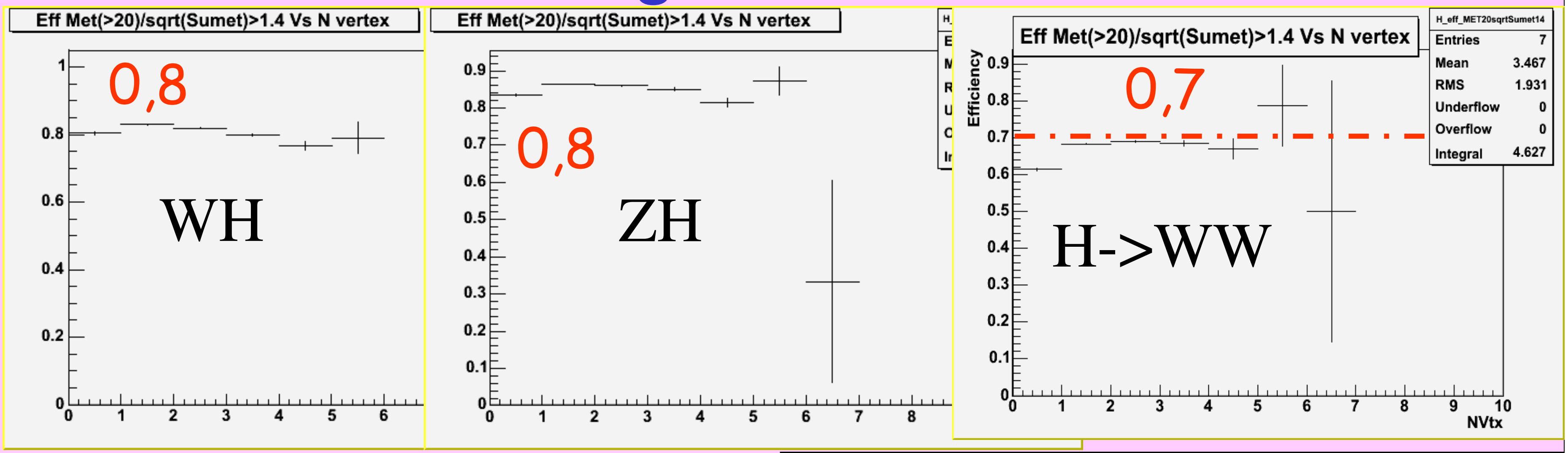
18 L2CAL Pulsar Board
Each Pulsar receives trigger towers from 2 adjacent wedges.

L1MET board
Test-crate b0l2pu07

L1 Decision
Crate

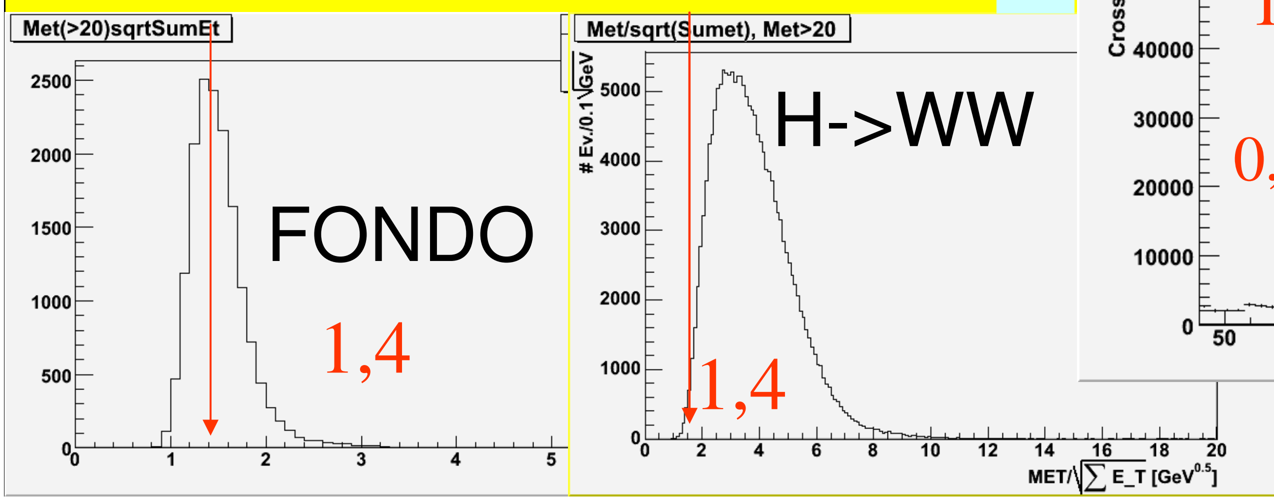
Dove sta la fatica del lavoro che **resta da fare**

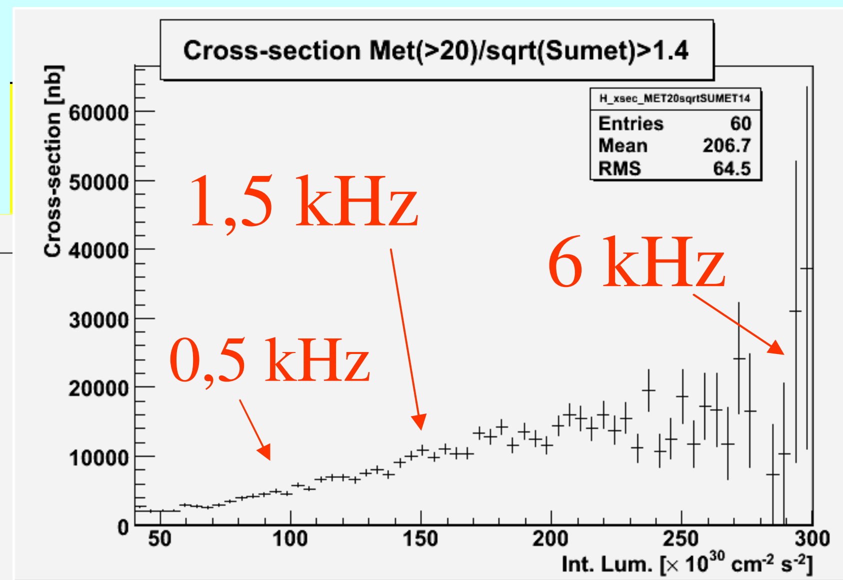
Come usarlo? MET(>20)/ √SUMET:
METS =la significativita' di MET



Efficienze vs #eventi di pile-up

La selezione proposta a L1: METS>1,4



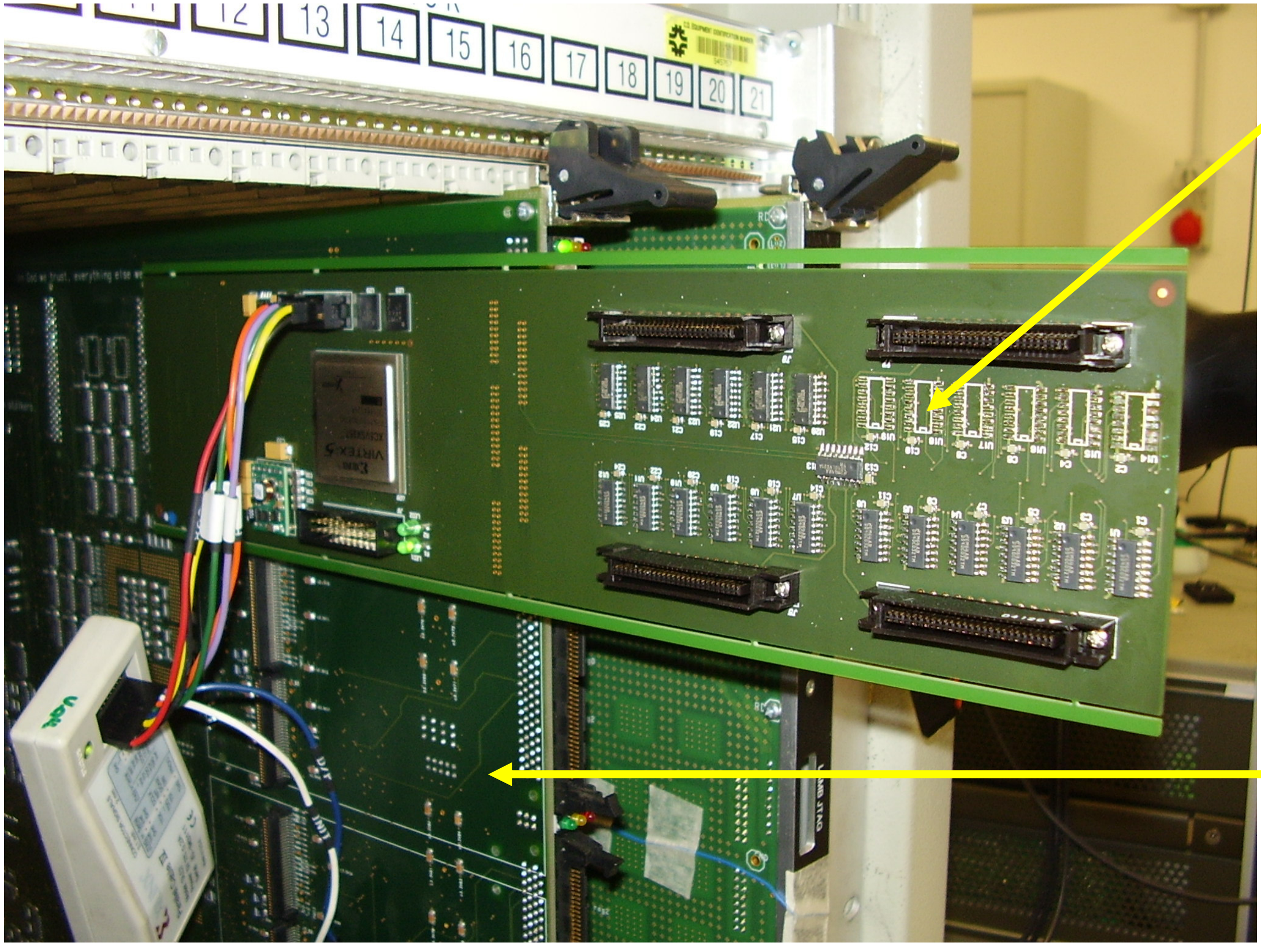


RATE @L1

Il GigaFitter: perche’

- 16 schede (12 TF + 4 Mergers+ Ghost Buster) saranno compattate in 1→ minore latenza, meno cavi, connettori…..
- Alto rate, grande parallelismo: piu’ di un fit/nanosec → minor tempo di processamento
- Maggiore efficienza ad alta Luminosita’
- Permette di allargare la memoria associativa → maggiore accettanza

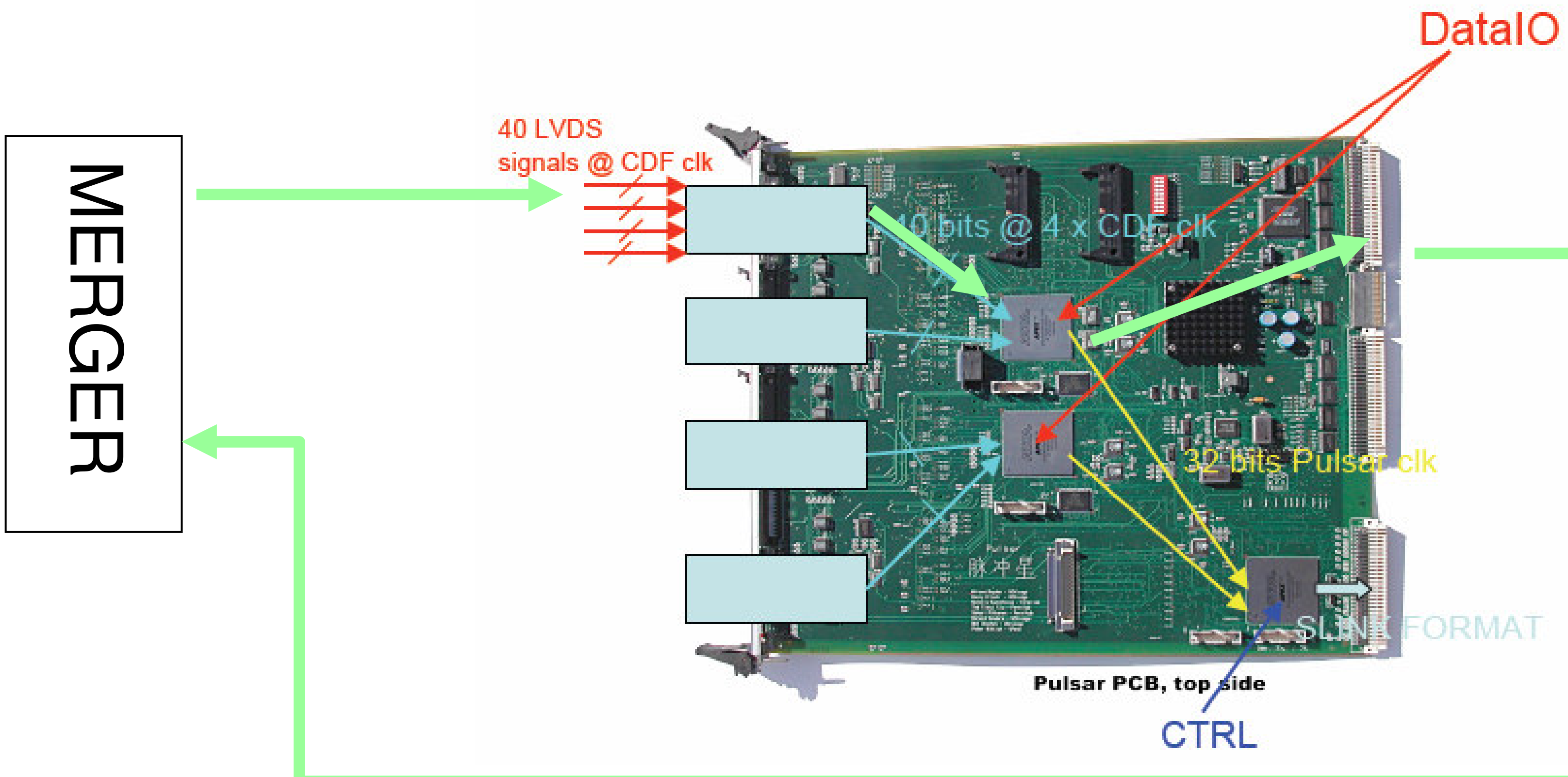
Come e’ fatto



Mezzanina

Pulsar

A che punto sono I tests



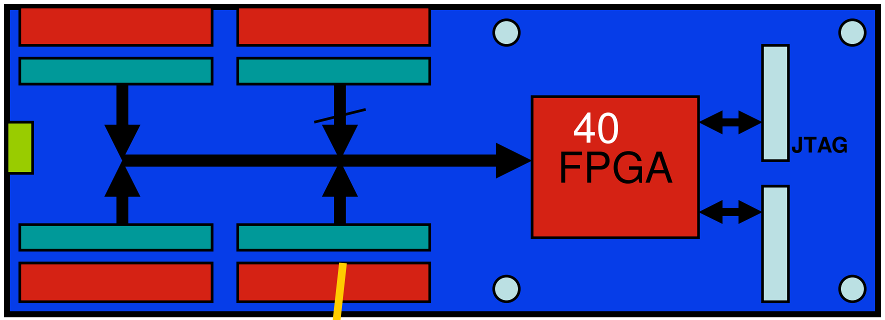
I dati sono scritti da VME tramite Merger, attraversano mezzanina e Pulsar e tornano al Merger.

Next: scrivere da VME su mezzanina le costanti poi fittare realmenente gli hits

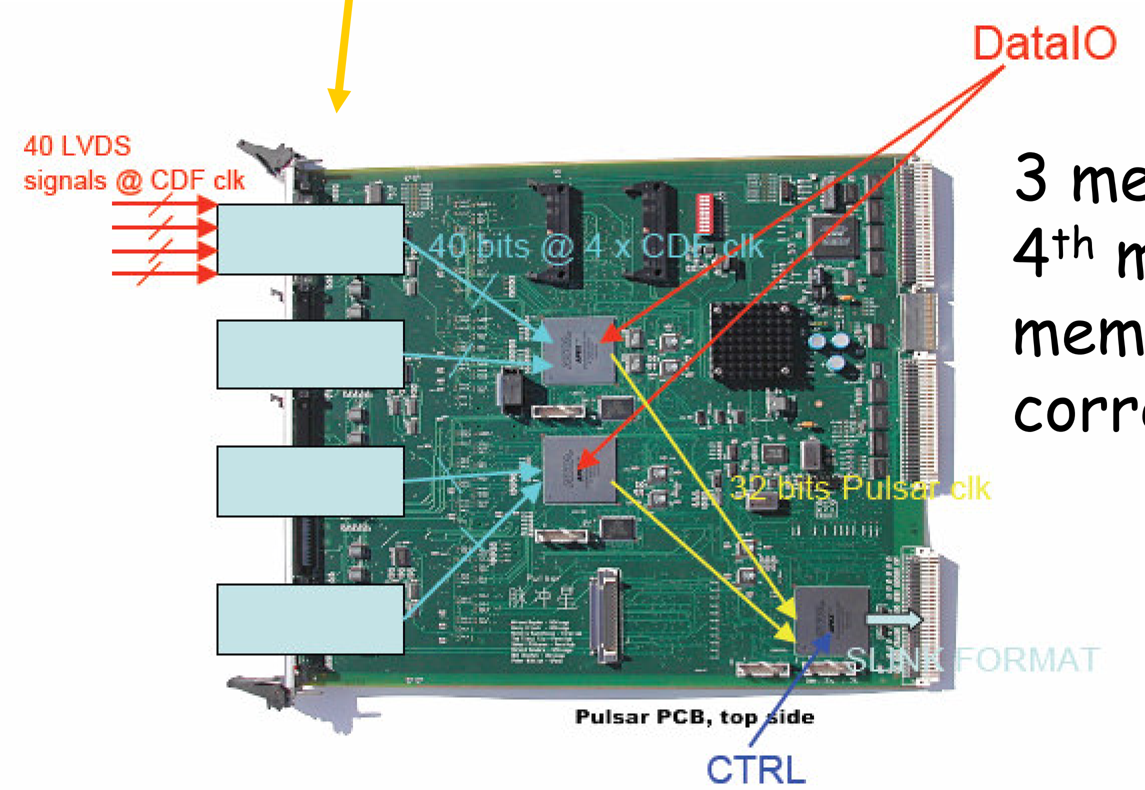
Conclusioni

- Abbiamo un impatto importante sul trigger di L1
- Gigafitter in CDF a cavallo 2008-2209: aiuterebbe sicuramente ad alta ILUM
- Le prime analisi cominciano ad usare i nuovi campioni acquisiti. Alcuni esempi:

1. Eventi adronici come Hbb
2. ZH con soglie ottimizzate per MET e ET1
3. WH con W che decade in muone neutrino



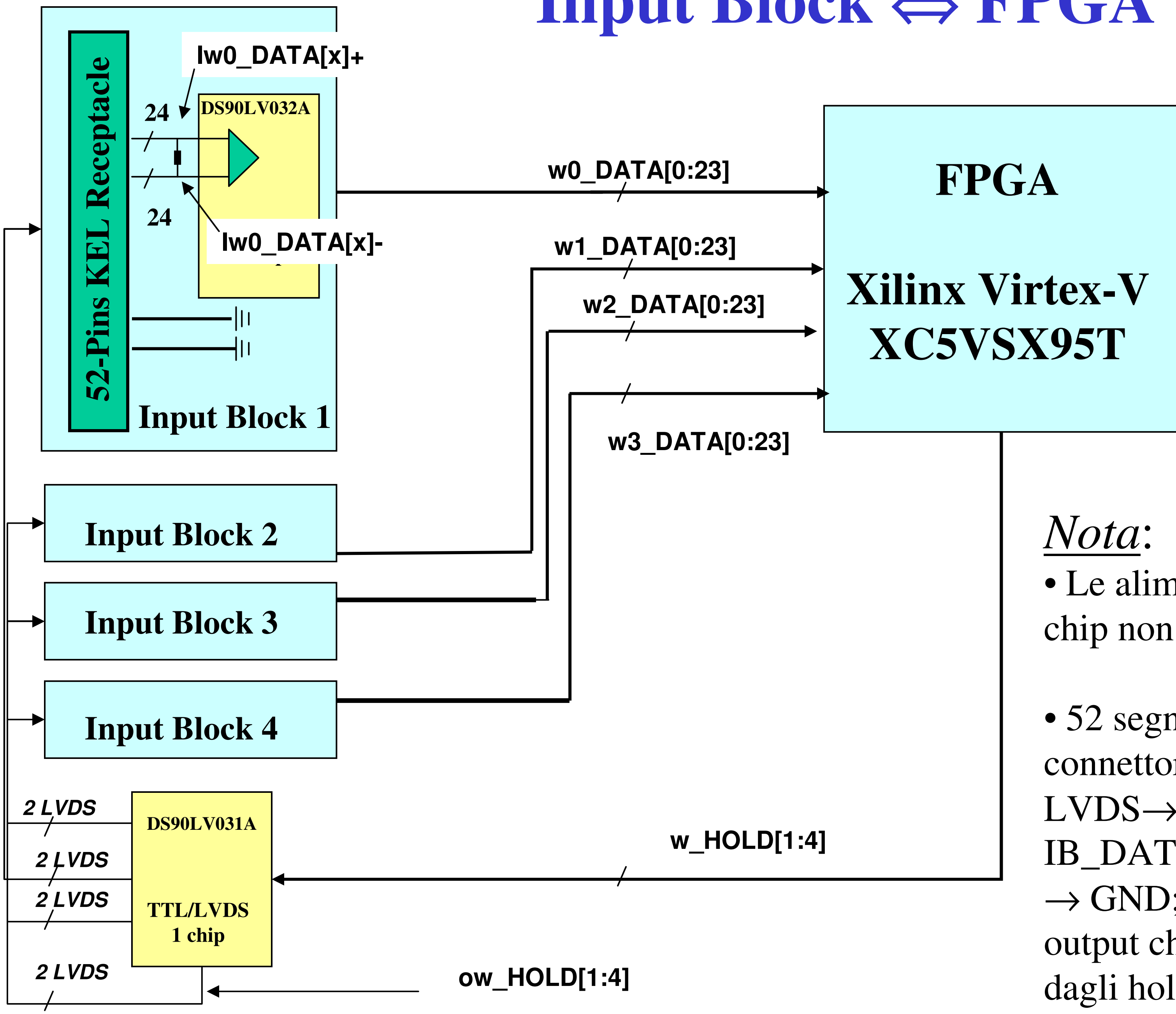
4 wedge connectors on each mezzanine → possible up to 6x4=24 fits in parallel



3 mezzanines = 12 wedges

4^{th} mezzanine → large memory for non-linearity corrections

Input Block ⇔ FPGA

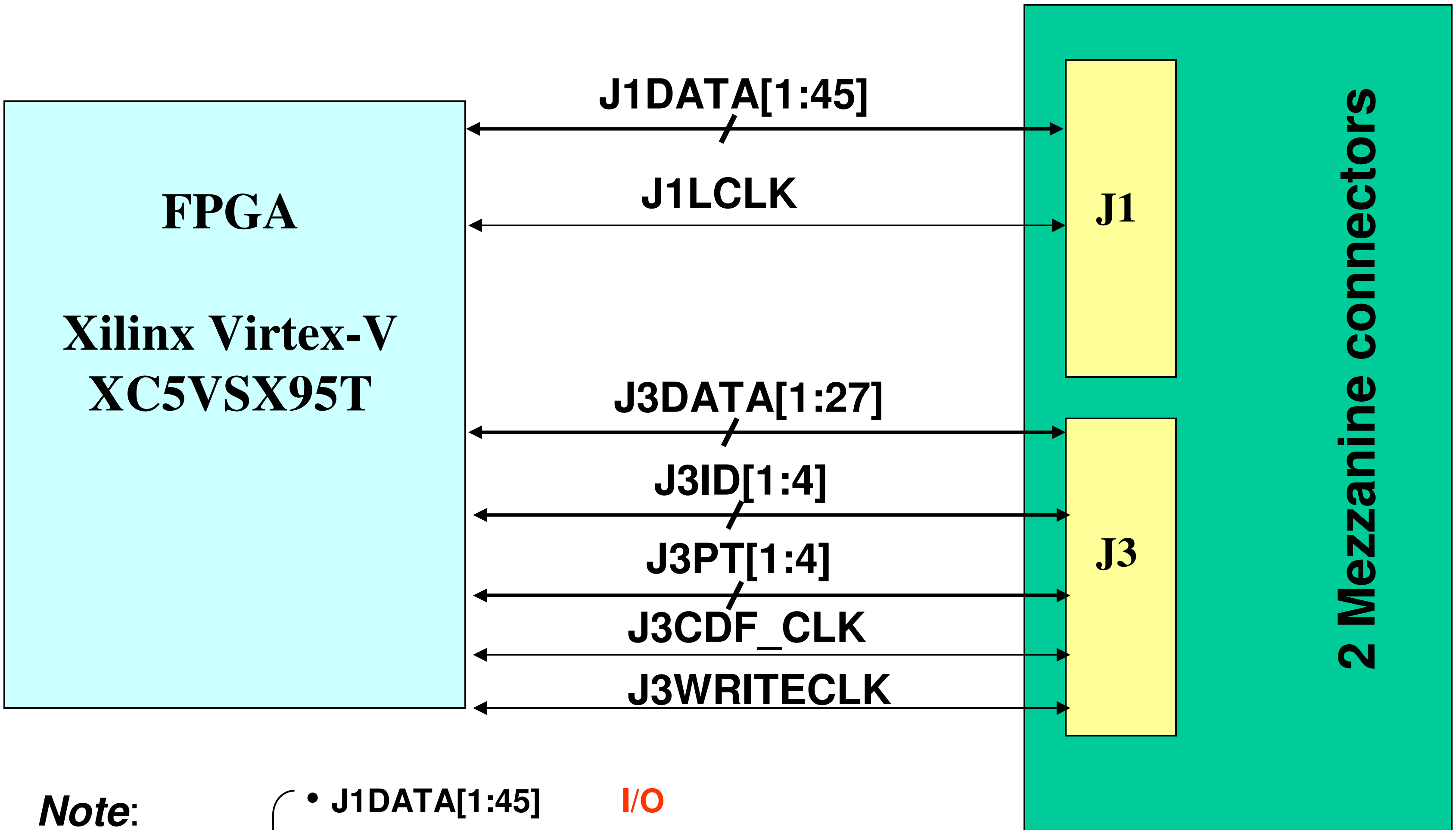


Nota:

- Le alimentazioni dei chip non sono indicate.

- 52 segnali per connettore di cui: 48 LVDS→ 24 TTL per IB_DATAX; 2 LVDS → GND; 2 LVDS in output che vengono dagli hold.

J1/J3⇔ FPGA



Note:

Tipi di pin FPGA a cui connettere I segnali

- J1DATA[1:45] I/O
- J1LCK I/O
- J3DATA[1:27] I/O
- J3ID[1:4] I/O
- J3PT[1:4] I/O
- J3CDF_CLK I/O
- J3WRITECLK CLK

VIRTEX 5: 65 nm- 550 MHz devices
XC5VSX95T: 160 x 46 CLB Array (Row x Col)

244 39kbits BlockRams or *Fifos* + *640 DSP Slices* (organized in columns)

~1200 euro

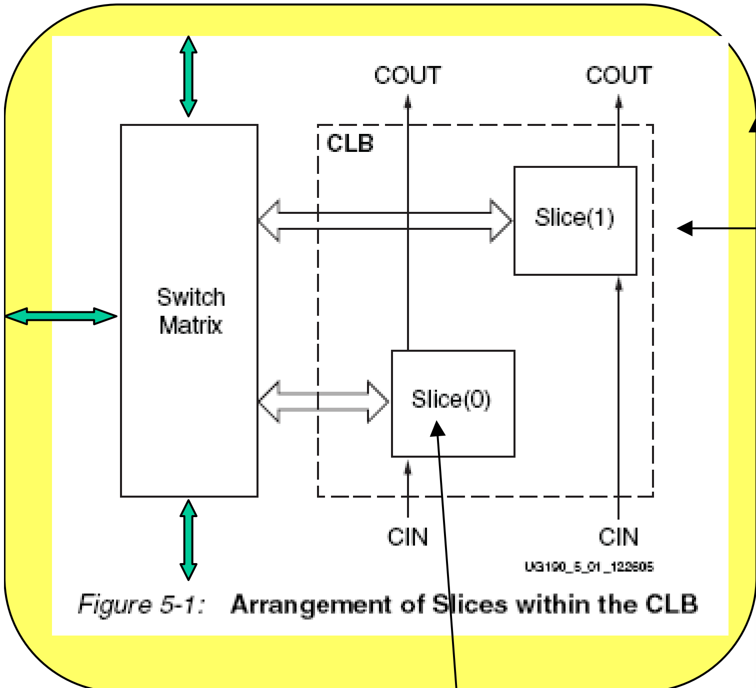
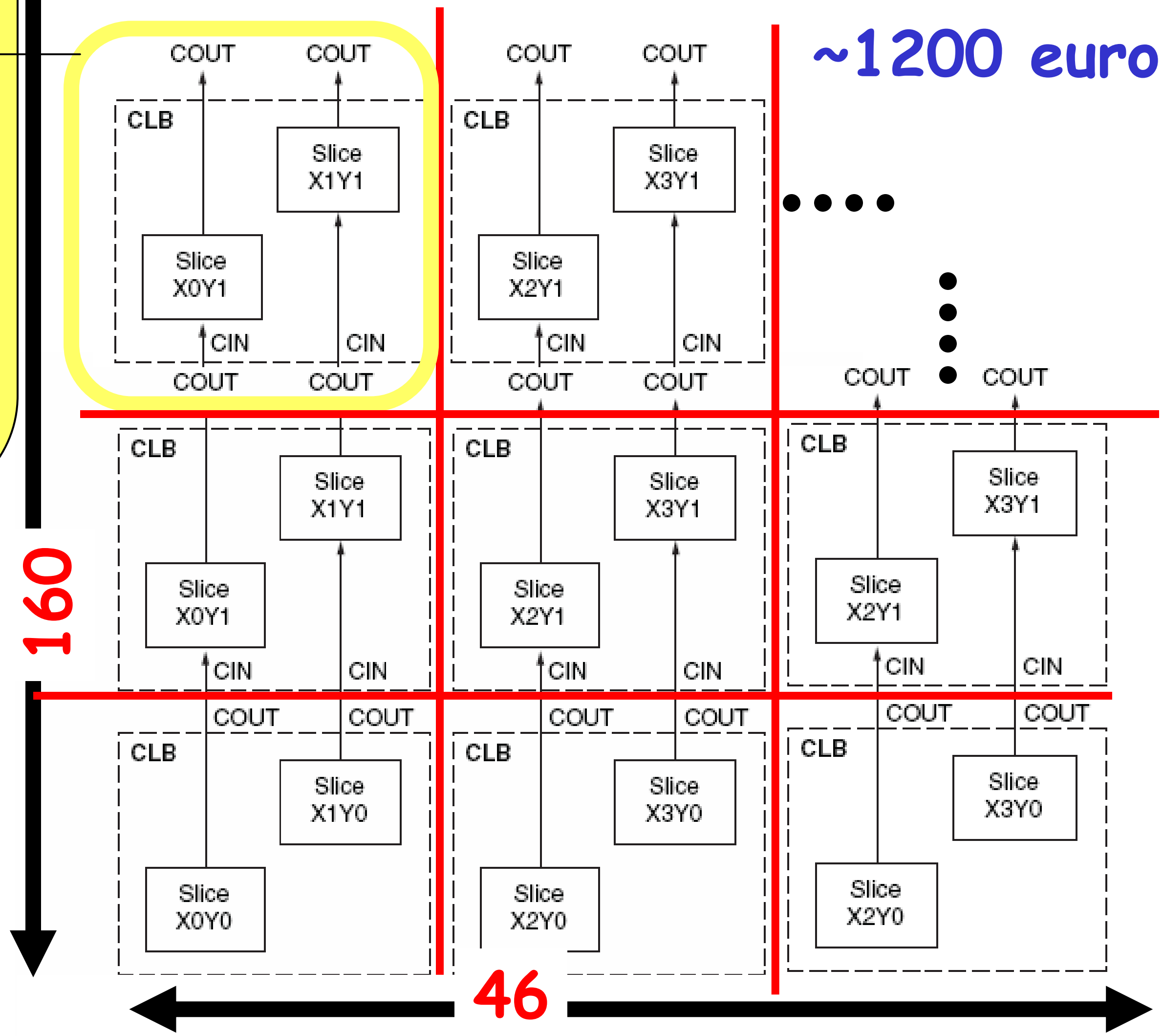
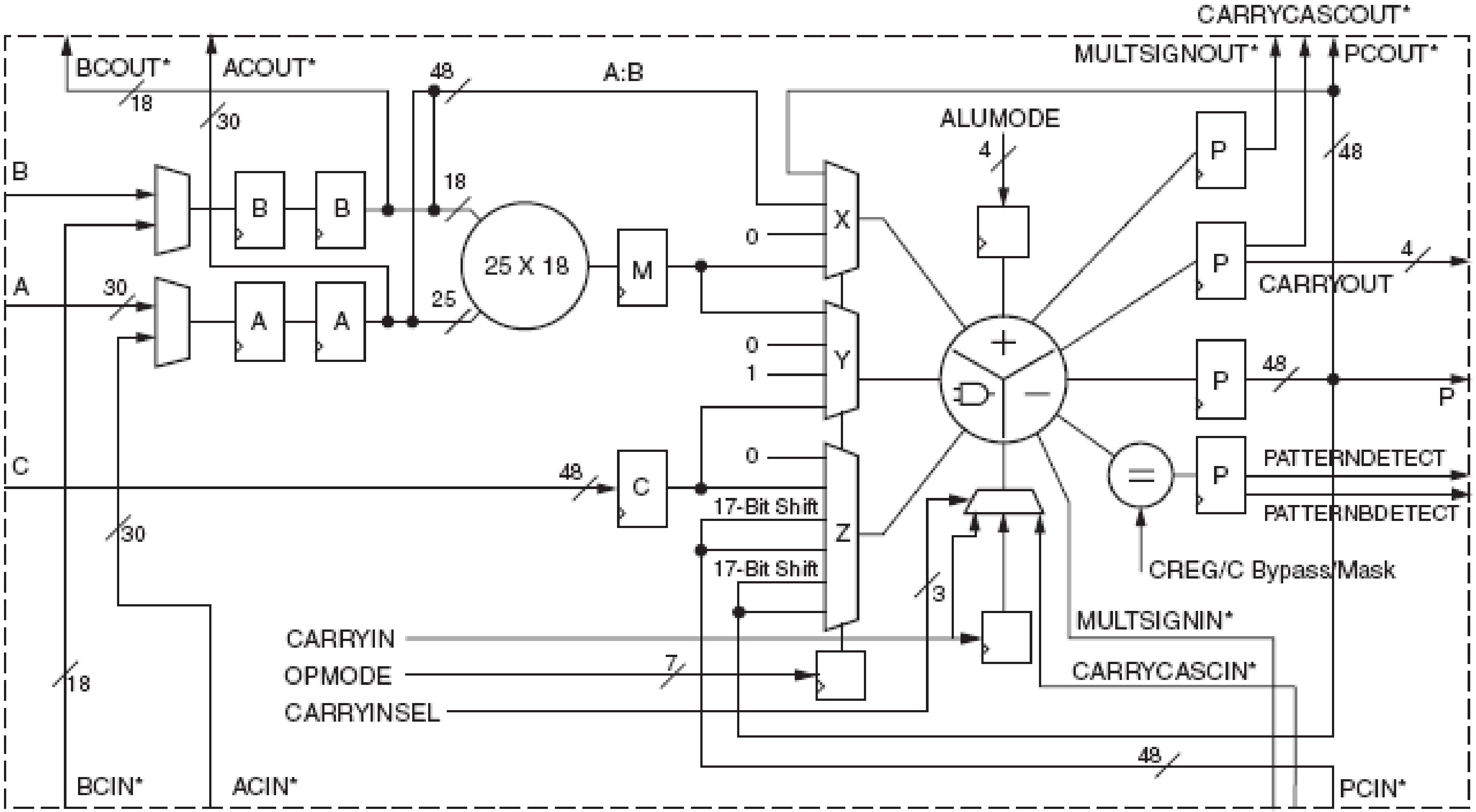


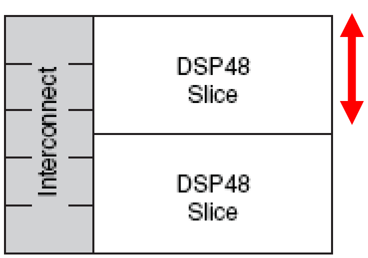
Figure 5-1: **Arrangement of Slices within the CLB**



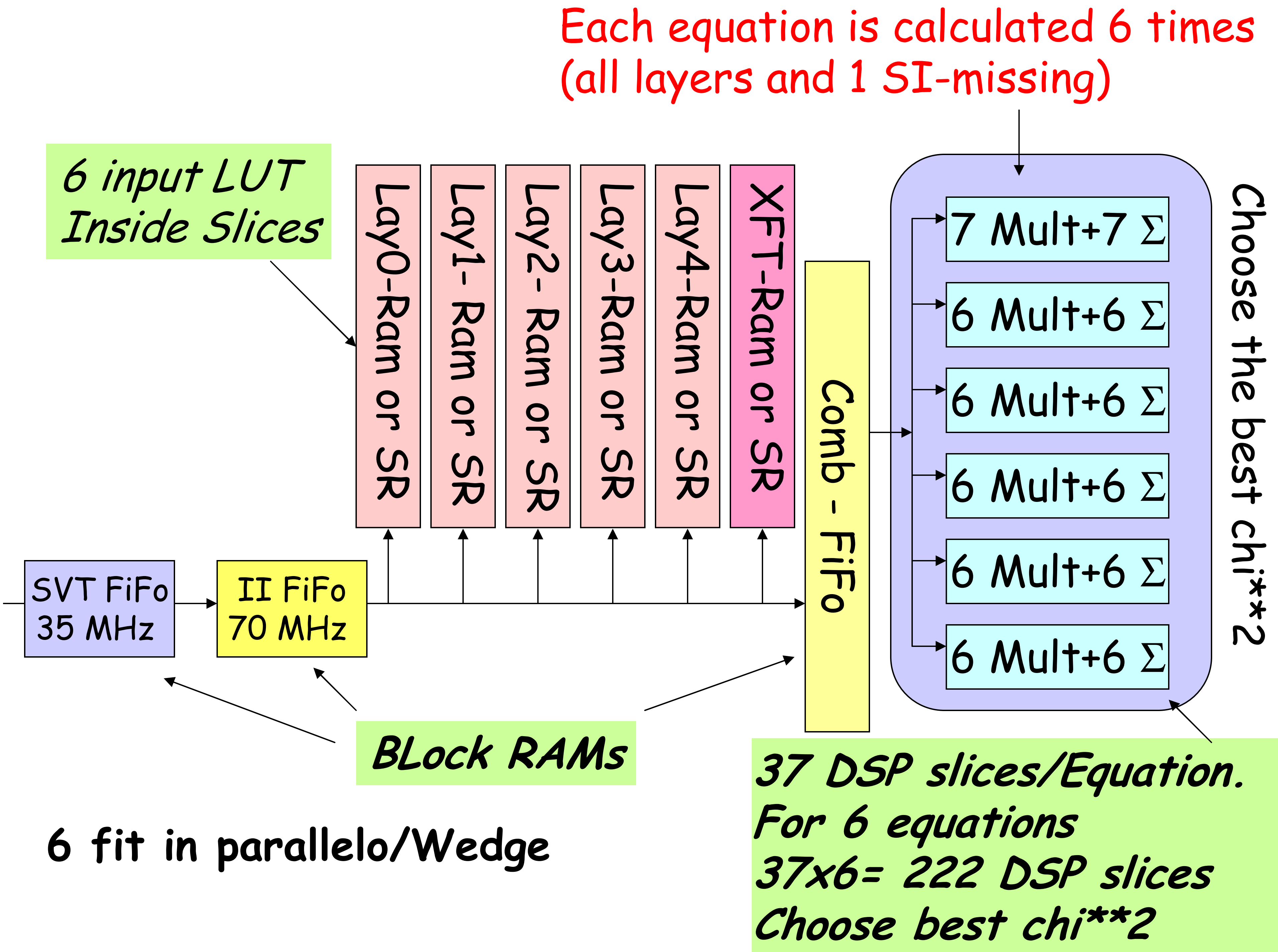
***Each Slice*:**
1. 4 6-input Luts or RAM or SR
2. 4 FFs
3. Wide MUXs
4. Carry logic

DSP SliCEs





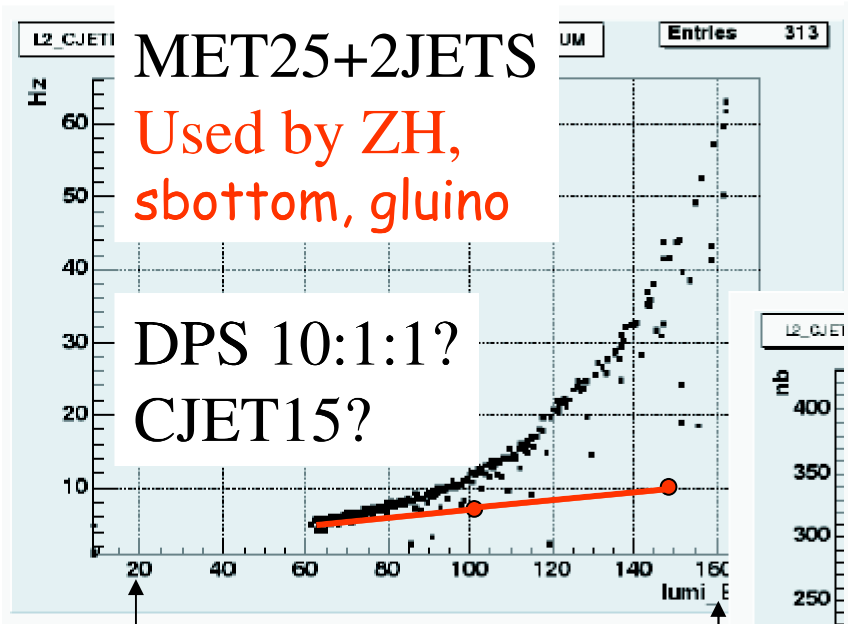
5 CLB (come Block RAM): 32 into each column x 20 colonne

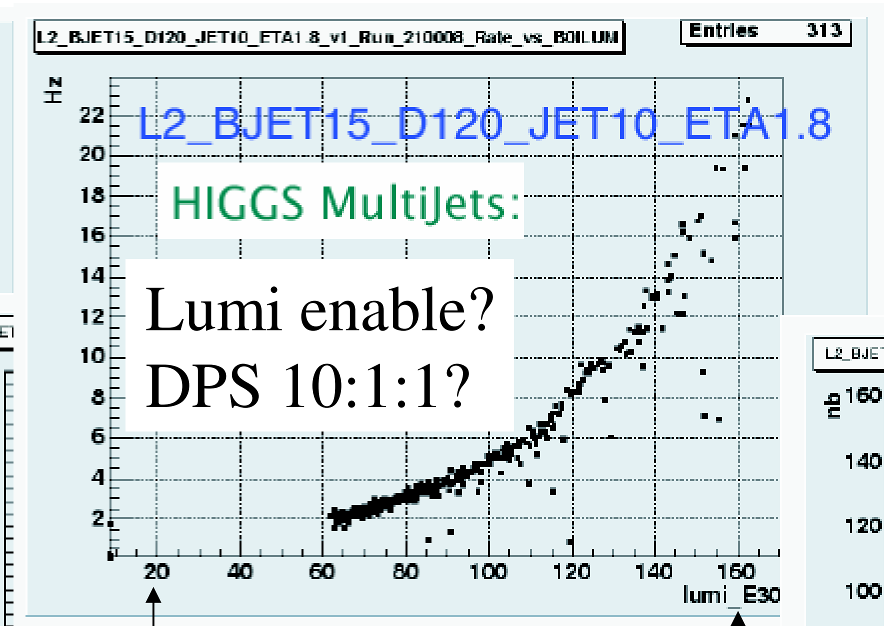


Each equation is calculated 6 times
(all layers and 1 SI-missing)
6 input LUT
Inside Slices
Lay0-Ram or SR
Lay1- Ram or SR
Lay2- Ram or SR
Lay3-Ram or SR
Lay4-Ram or SR
XFT-Ram or SR
Comb - FiFo
7 Mult+7 Σ
6 Mult+6 Σ
6 Mult+6 Σ
6 Mult+6 Σ
6 Mult+6 Σ
6 Mult+6 Σ
Choose the best chi**2
SVT FiFo
35 MHz
II FiFo
70 MHz
BLock RAMs
37 DSP slices/Equation.
For 6 equations
37x6= 222 DSP slices
Choose best chi**2
6 fit in parallelo/Wedge

Too HOT Jet/MET rates @L2

Factor 10 in [60-160] ×E30

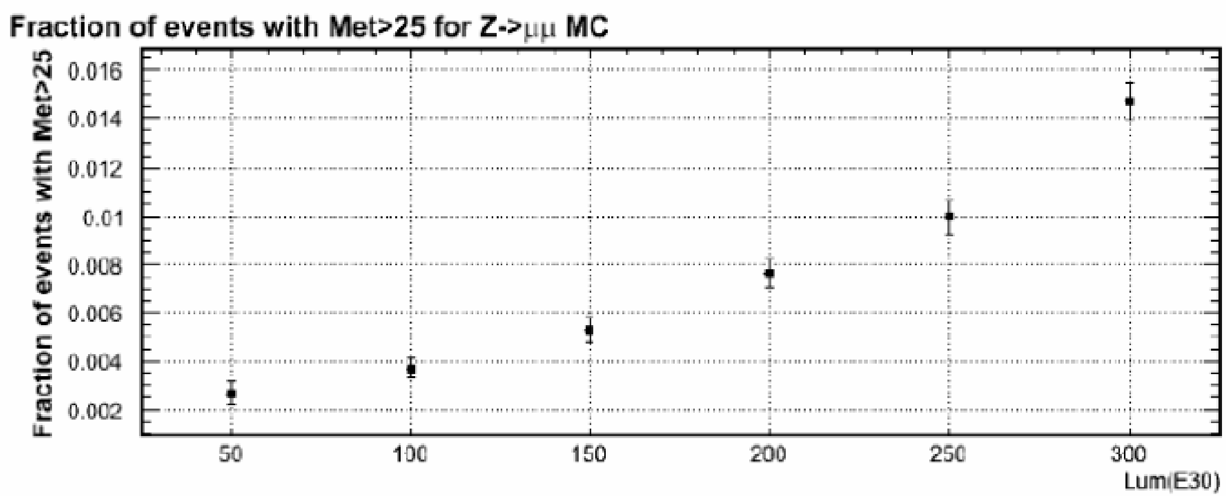




20 160 20 160

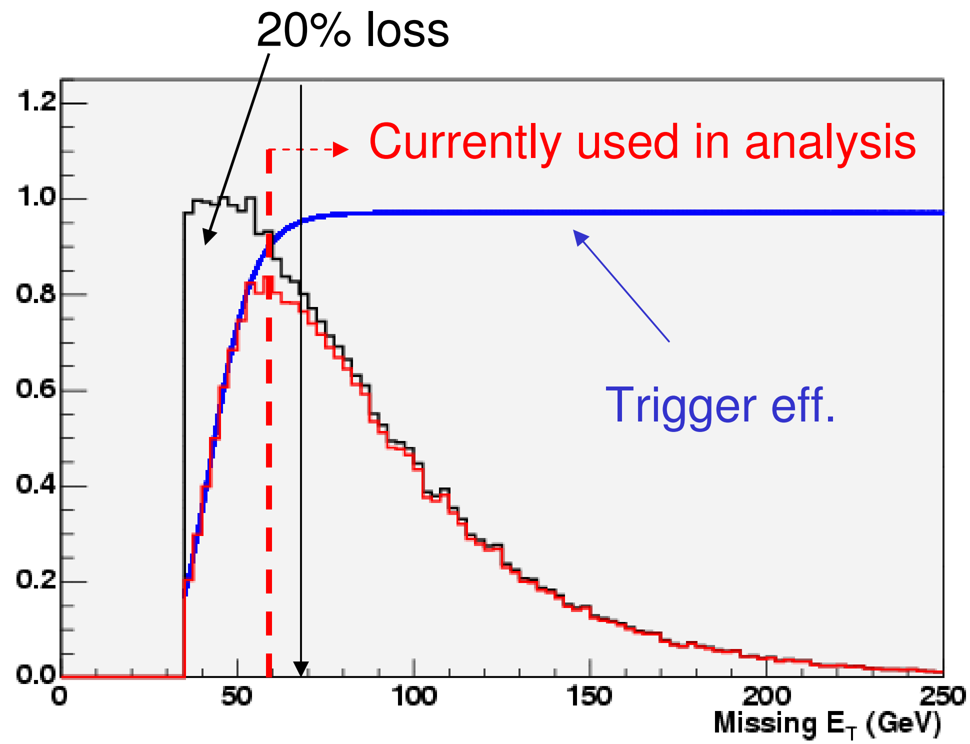
Ted idea: ~offline jet/Met reconstruction using Pulsars/CPUs

Factor 5 in [50 × 300] E30



MET35 + 2 Jets trigger efficiency

- At analysis level the trigger efficiency is parametrized with the corrected Missing E_T
- Red curve shows the signal after applying the trigger efficiency
- The trigger is not yet fully efficient in the bulk of the Higgs signal
- Raising the MET threshold is not an option



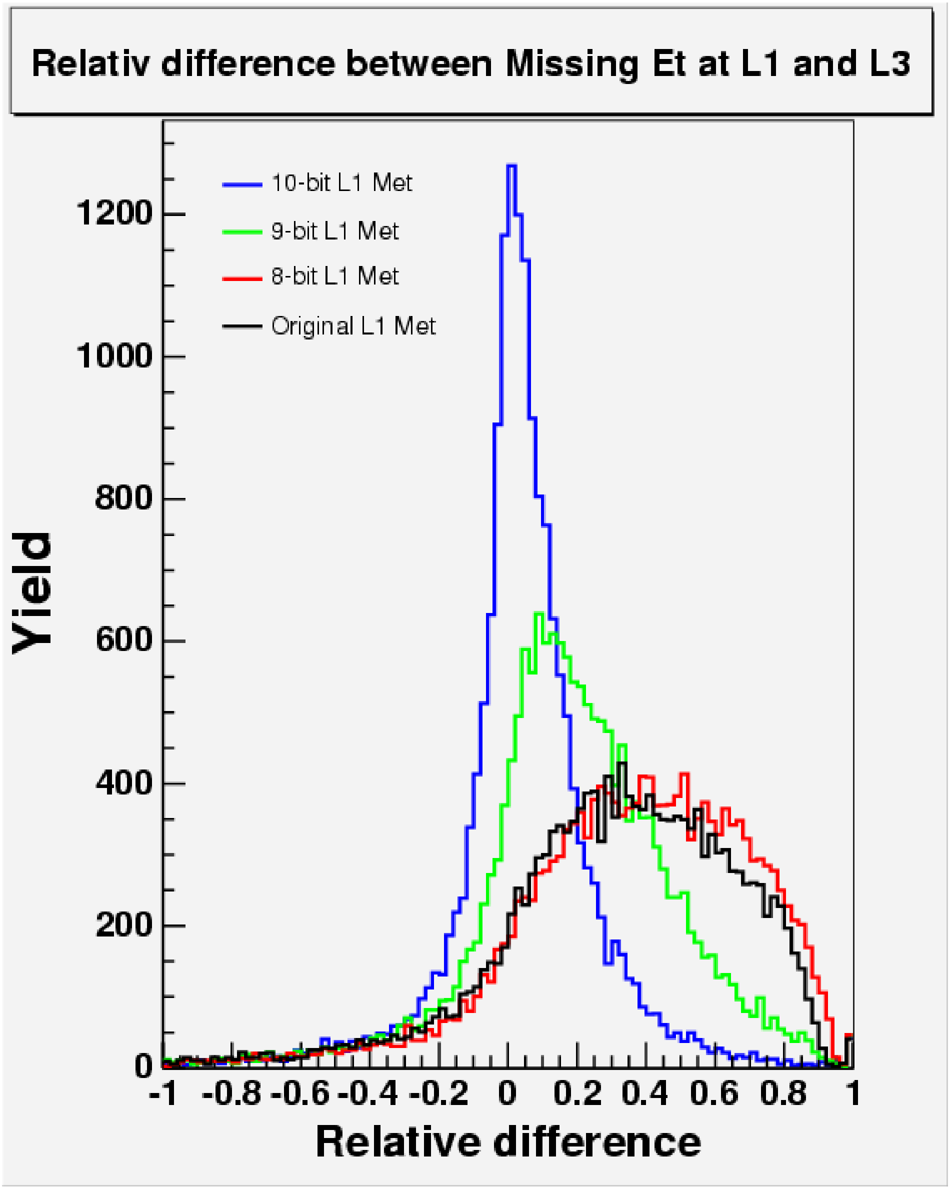
Corrected Missing E_T of the SM Higgs ZH->vvbb, M_H=120 GeV (arbitrary normalization)

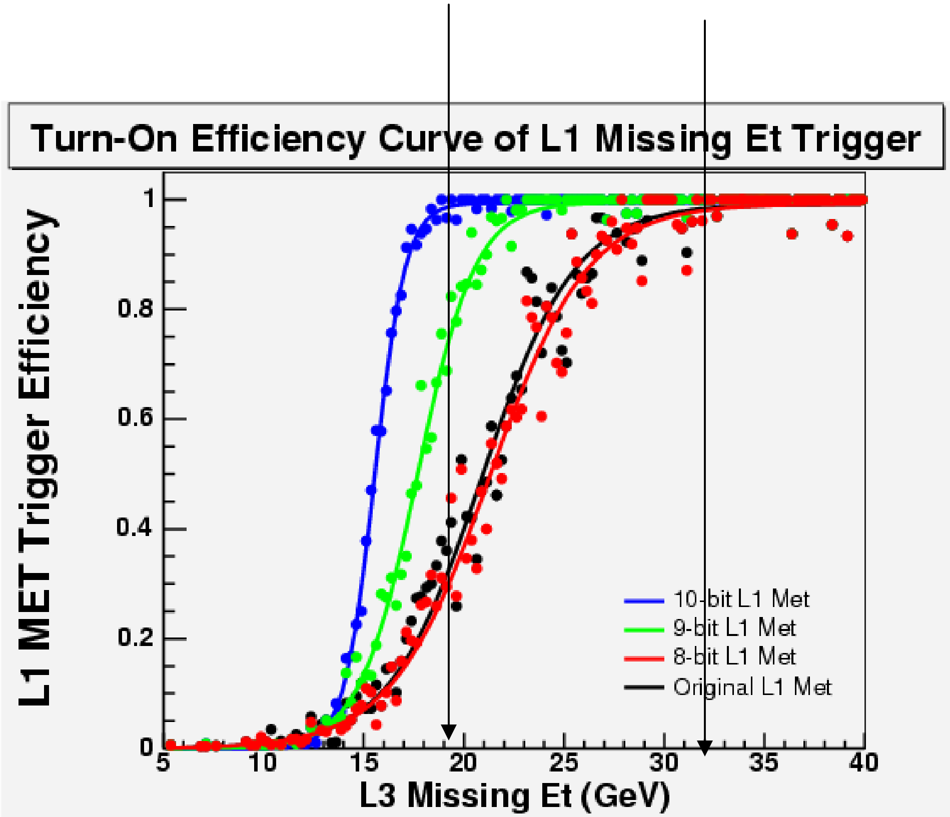
- A High-pt muon sample was used to study the efficiency of the L1 Met cut

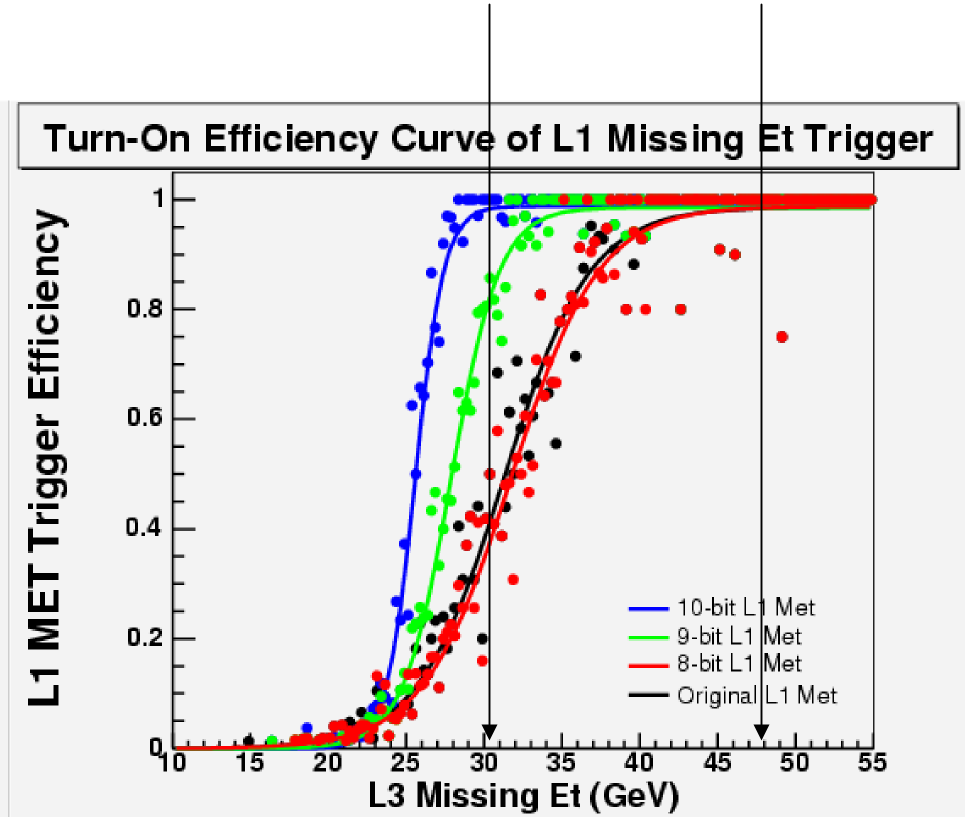
- Met was calculated using
  - 125 MeV (blue),
  - 250 MeV (green),
  - 500 MeV (red)

  granularities.

- Black graph, the actual L1 Met, agrees to the red one which was reconstructed with the same precision
  - Main differences are in the projection along x and y (the real L1 Met uses a look-up table)







Efficiency of a Met = 15 GeV cut calculated with various precisions

Used in

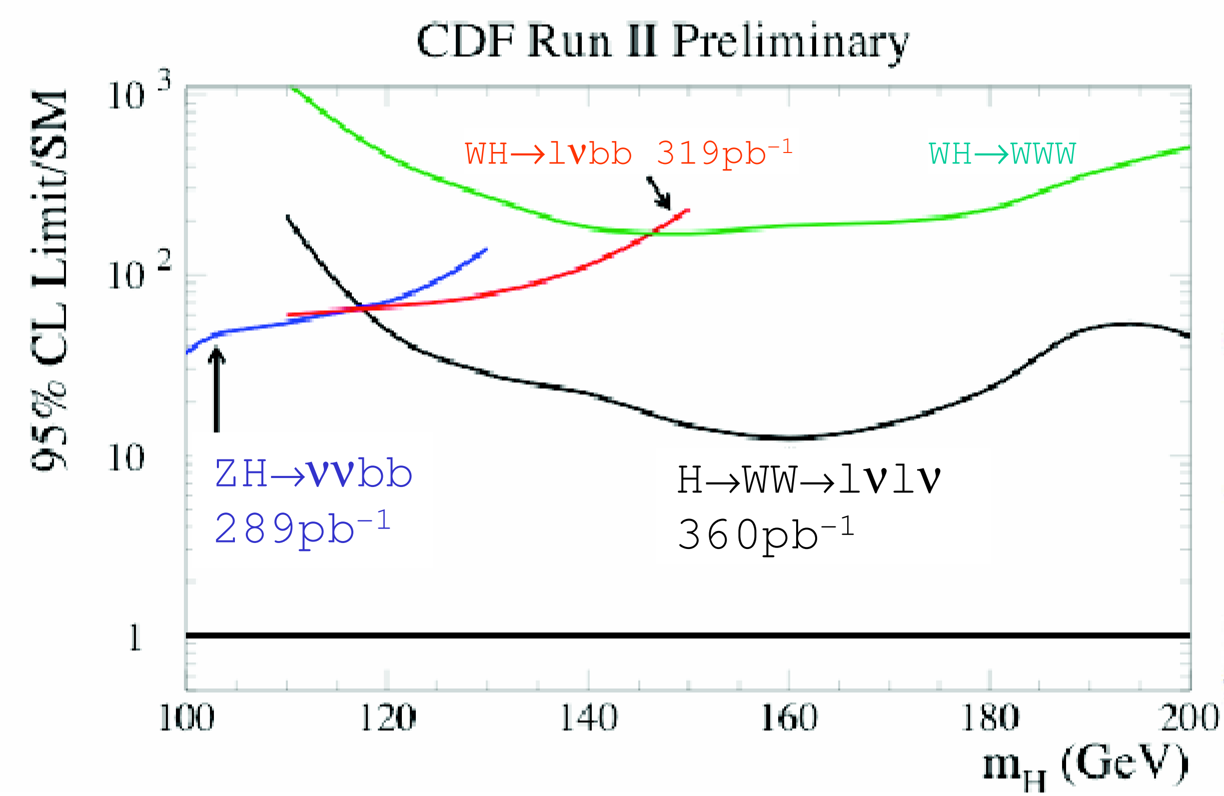
MET_BJET trigger

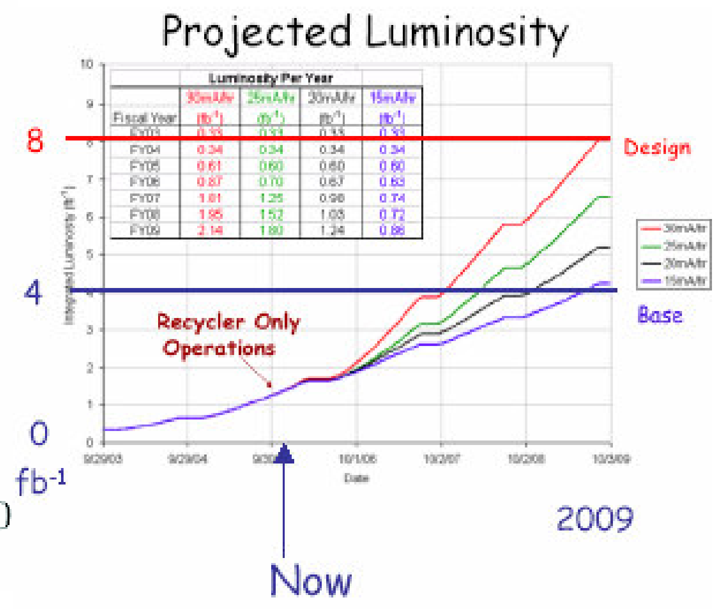
Efficiency of a Met = 25 GeV cut

Used in :

MET35_&_TWO_JETS

MET45





2005 Status

- CDF preliminary results with 200 - 400 pb⁻¹ data
  - channels not combined, some missing
  - need factor of 30-40
    - factor of ~20 from data up to 2009
    - factor of 2 from CDF/D0 combination
- Working on ways to improve sensitivity
  - Neural Nets for everyone ! (factor of ~1.7)
  - Improved jet resolution (1.1 for each 1%)
  - Improved lepton acceptance (> 1.5)

2003 Sensitivity Projections

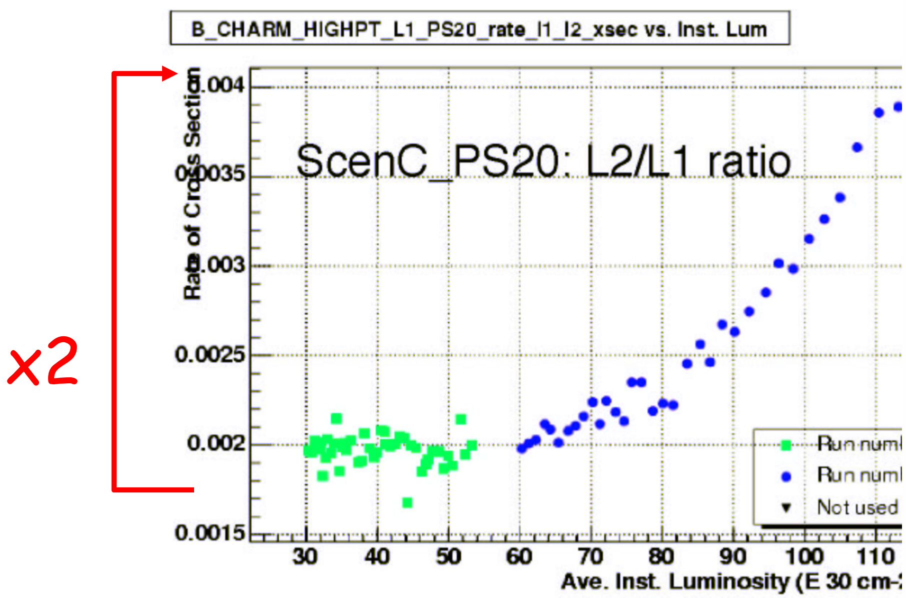
- m_H = 115 GeV
  - ~ 2 fb⁻¹ for exclusion (if not there)
  - **~ 4 fb⁻¹** for m_H = 115 3σ evidence
- Assumes :
  - all Higgs channels combined at both CDF and D0
  - realistic data, no systematics
- 8 fb⁻¹ by 2009 is design

L2 Triggers selecting track IPs too HOT @high lum

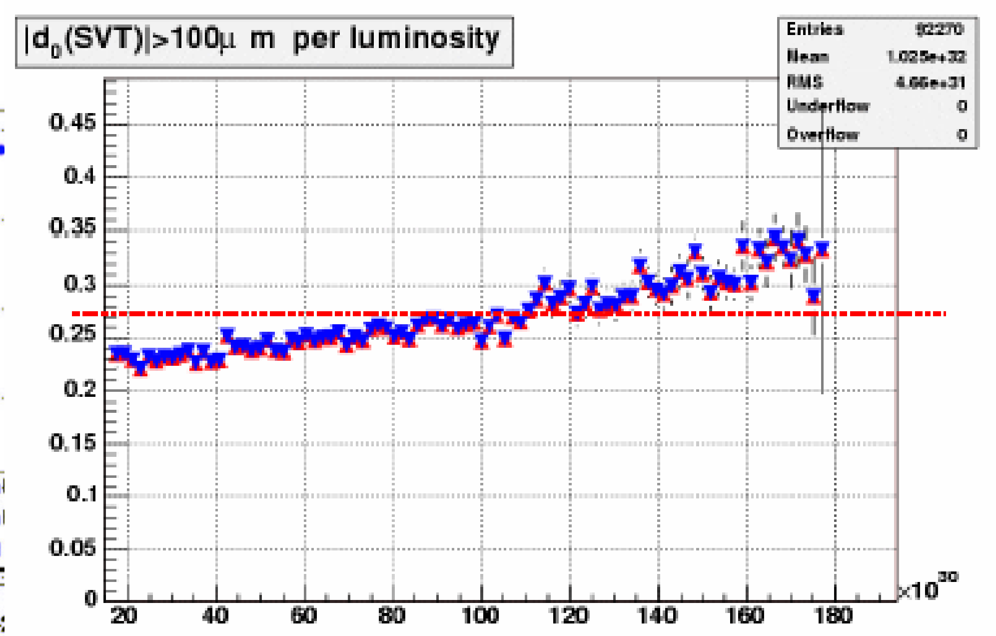
THE MET+bjet trigger is already prescaled
IP> 100 um selection has increasing fakes @ high LUM

Scenario A & C show exactly the same problem

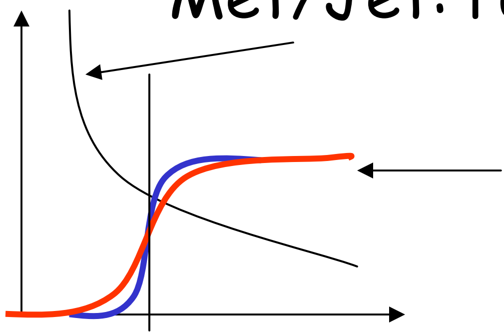
ScenC:
Two_TRK2.5_Oppq_Dphi135_Sumpt6.5
ScenA:
Two_TRK2_Oppq_Dphi135_Sumpt5.



Tails vs luminosity



Met/Jet: rapidly falling Spectrum



A sharp turn on trigger efficiency is important to reduce background from the energy region below threshold & increase efficiency above threshold

How much an ~offline jet/Met measurement reduces the L2 trigger rates for MET/Jet selections?

Can ZH $\rightarrow \nu\nu$ bbar be improved ?

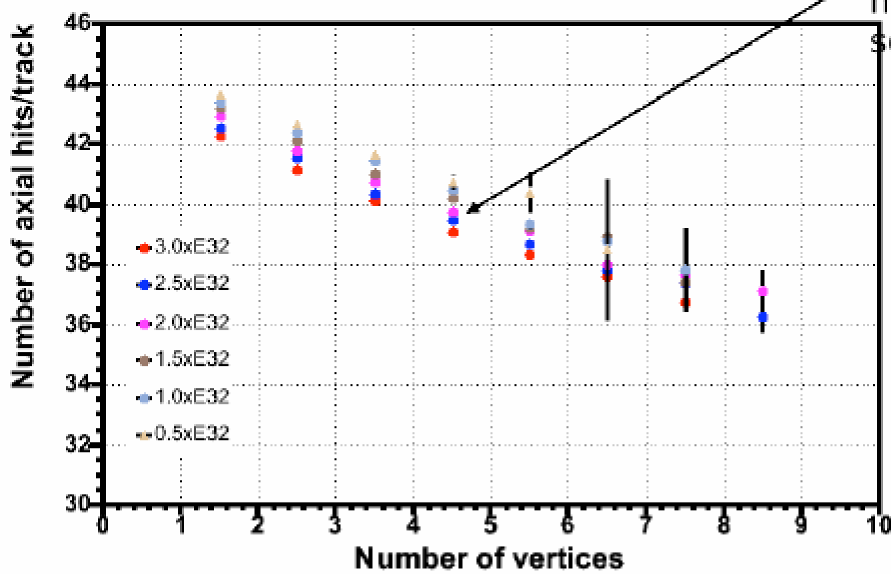
Can we have a trigger selection for this channel that will not need a DPS at 300xE30, without loosing signal efficiency?

Tracking

Number of Axial Hits/Track vs Nvtx

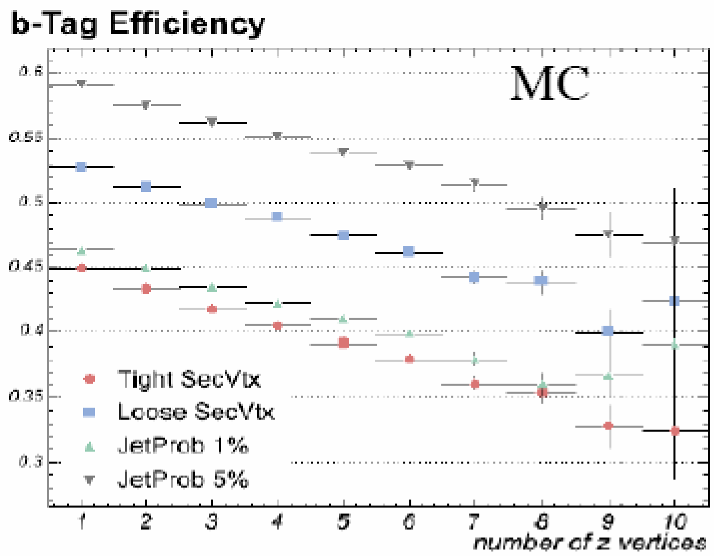
Used high-p_T muons from $Z \rightarrow \mu\mu$ events

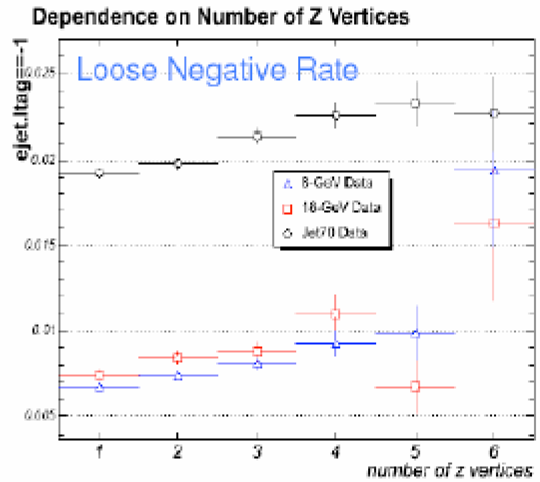
2xE32 ~3 extra min bias + 1 hard scattering



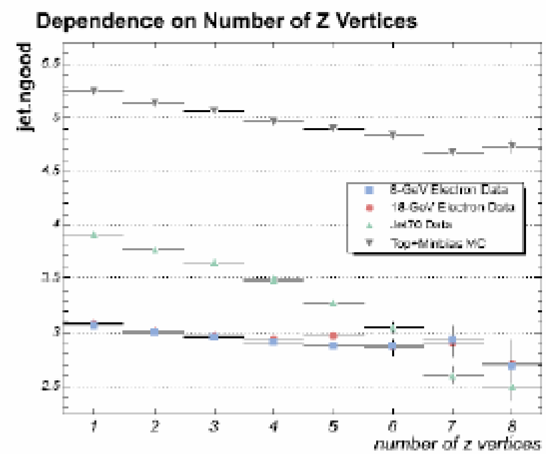
Number of vertices >=1 (hard scattering).
10% drop in # hits for 2E32.

B-tagging



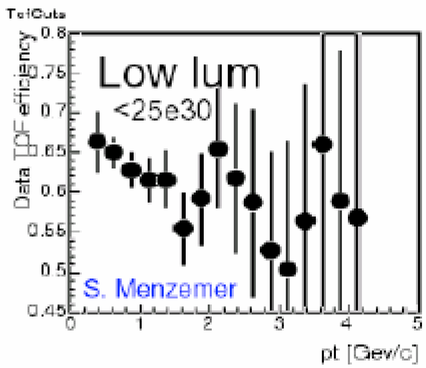


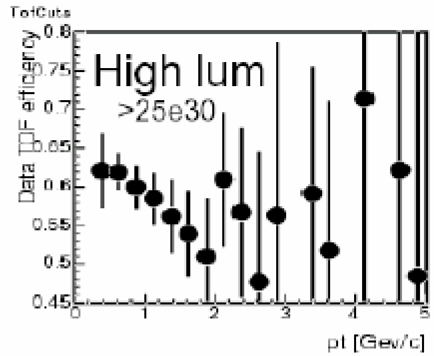
- Decrease in efficiency
  - Most likely due to loss of COT tracks
  - Trend seen in MC and data
- Increase in fake rate



Time Of Flight efficiency

- TOF efficiency decreases with occupancy
- About 8 % variation seen for 2004 data
- To be done for higher $\mathcal{L}$





Effect on Same side Kaon tagging.
Assume:

- drop in ε of 25%
- 3 different resolutions

resolution not too important, drop in efficiency will hurt.

	εD^2
default (ε_0^{tof}, σ_0)	4.0%
$\varepsilon_0 = 0.75\ \varepsilon_0$, $\sigma = 1.14\sigma_0$	3.6%
$\varepsilon_0 = 0.75\ \varepsilon_0$, $\sigma = 1.23\sigma_0$	3.5%
$\varepsilon_0 = 0.75\ \varepsilon_0$, $\sigma = 1.36\sigma_0$	3.4%
no PID at all	2.8%

Later we learned: εD^2 30% lower in 0h than 0d data