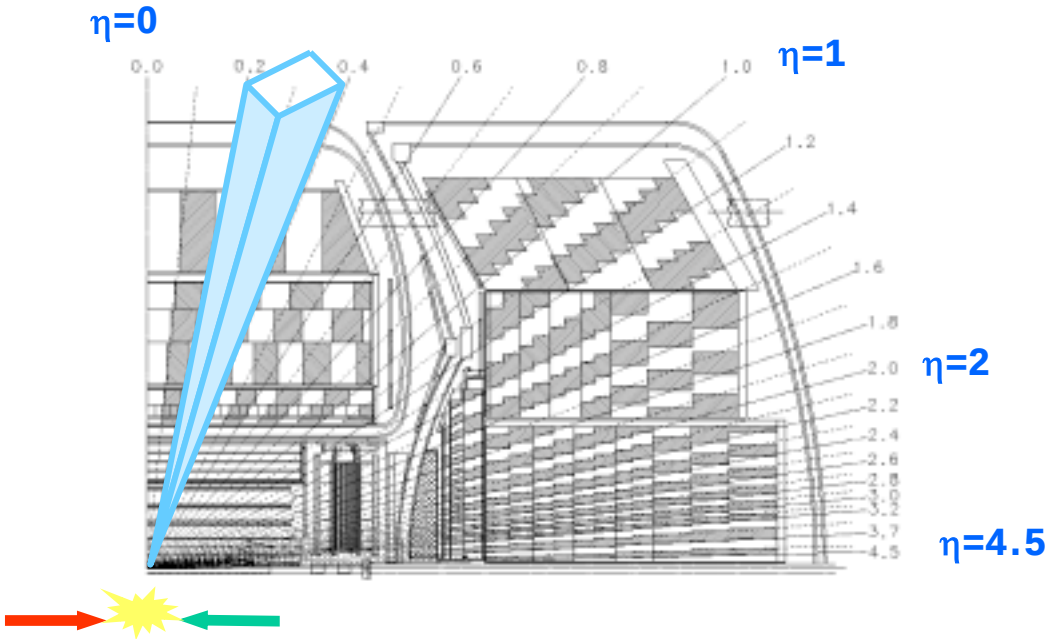
Simulation of the performances of the upgraded L1Cal

- Short reminder
- Performances (jets)
  (see Jovan's talk for electron studies)
- Studies under way

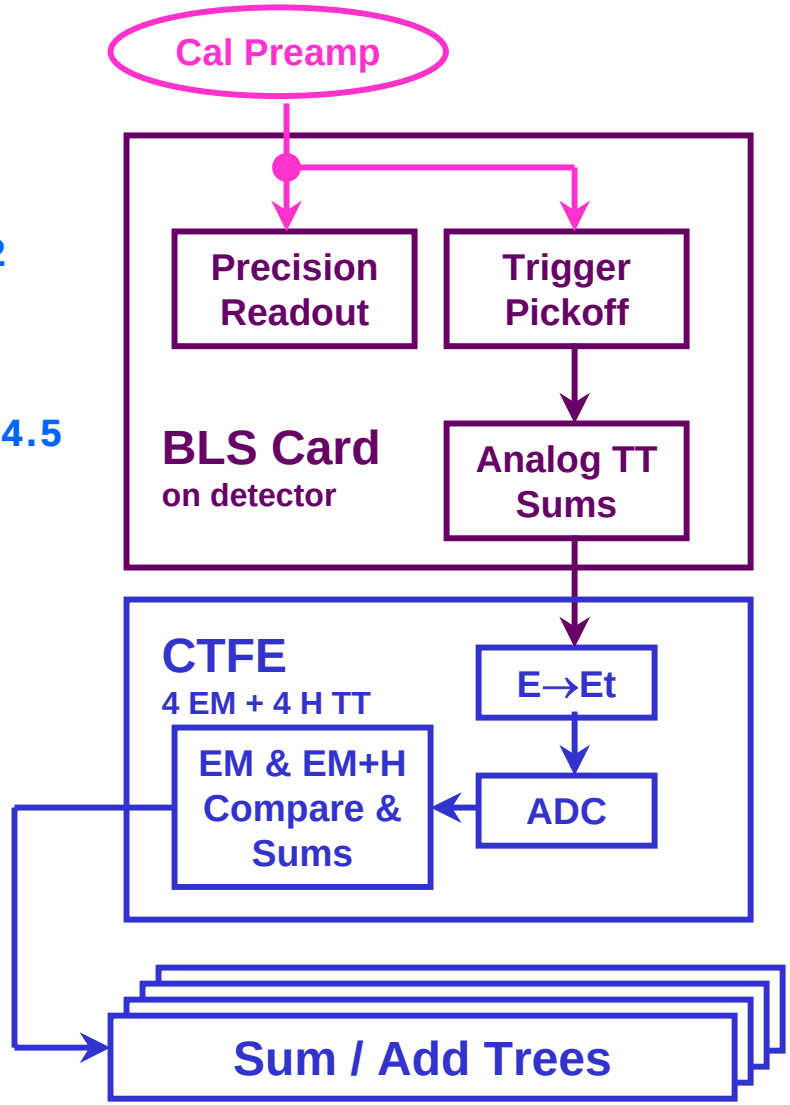
RunIIa L1 Cal



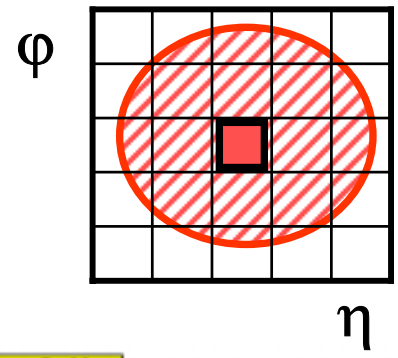
- **Level-1 calorimeter Trigger :**
  - **Run I System (1990)**
  - **Unit = Trigger Tower (TT)**

    $\Delta\eta \times \Delta\phi = 0.2 \times 0.2 \Rightarrow 40 \times 32$

    $\Rightarrow$ **1280 EM + 1280 Had**
- **Outputs :**
  - **# EM & EM+H TTs > 4 thresholds**
  - **Global Sums (E_T tot & missing E_T)**

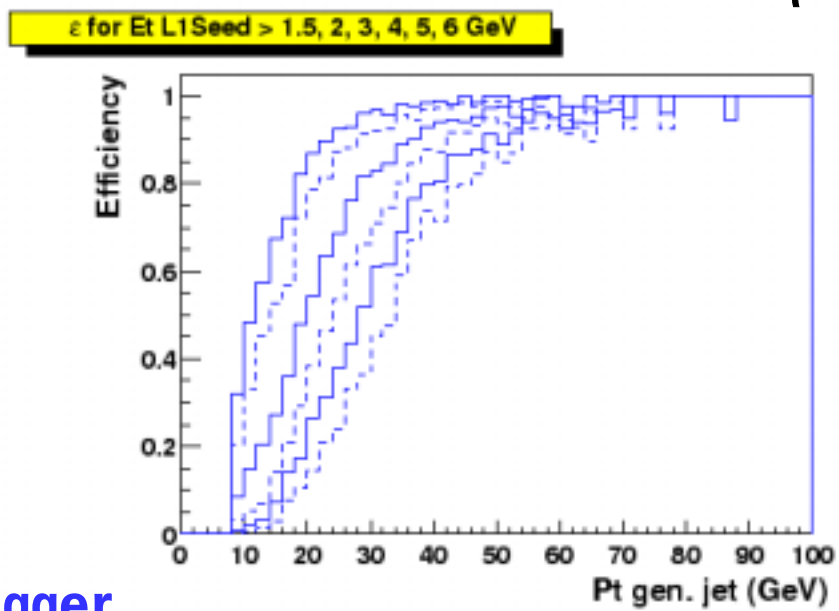


Expected problems with high Lumi



- Size of a jet >> size of one TT (0.2 x 0.2)
  - Low thresholds, even to trigger on hard evts
  - Bad energy resolution
  - Slow rise of the trigger efficiency

⇒ bad background reduction

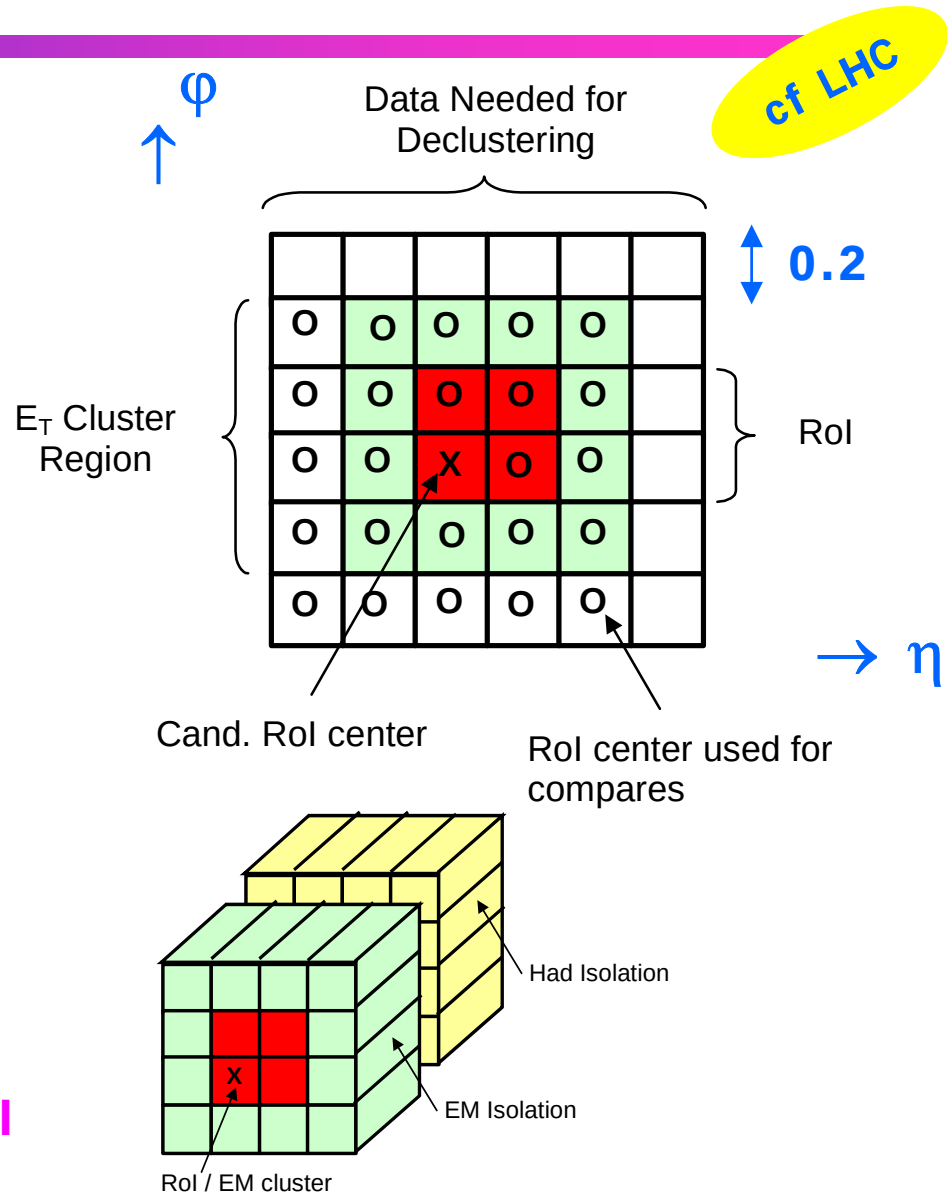


- At L = 10^{32} cm^{-2} s^{-1} : expected trigger rate with current menu > 5 kHz. Solution :

→ More selective L1Cal

“Sliding windows” algorithm

- **“jets” finder :**
  - **Sliding sums of 2x2 Tower Triggers (RoI)**
  - **Search for local maxima : comparison with neighboring RoI’s in an array 5x5**
  - **jet Energy = E in the 4x4 region (0.8 x 0.8 in η x φ) around the RoI**
- **Also allows :**
  - **Better ident. of electrons at L1 (isolation, transverse shape)**
  - **Triggering on τ (narrow jets)**
  - **Including ICR at the trigger level**

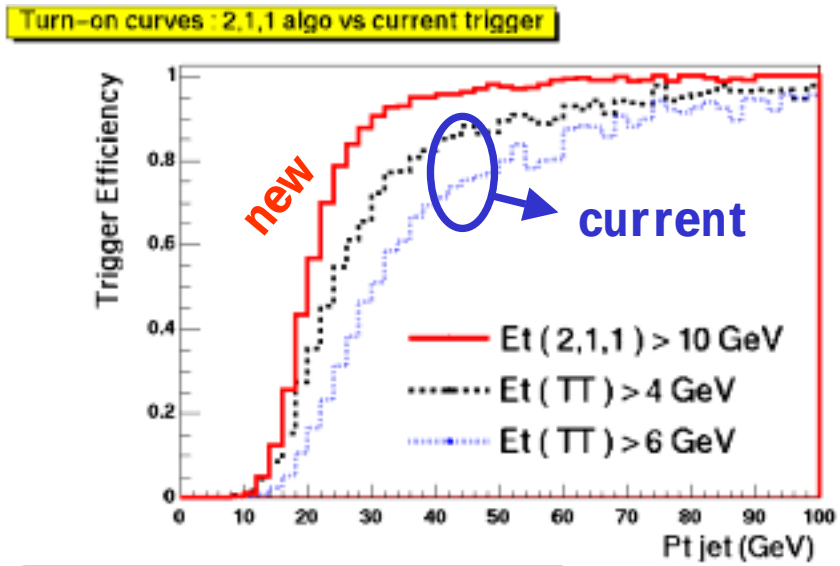


Simulation code

- Sliding window algorithms implemented in a D0 package (tsim_l1cal2b)
- Simulates jet, electron and global algos
- Parameters : RoI size, declustering, size of the “jet” or “elec” region, isolation …
- Used in Saclay & Nevis for simulation studies
- Should be stable now … (bug in the noise treatment introduced at some point.. Corrected in september)
- Jets : various algos studied & compared

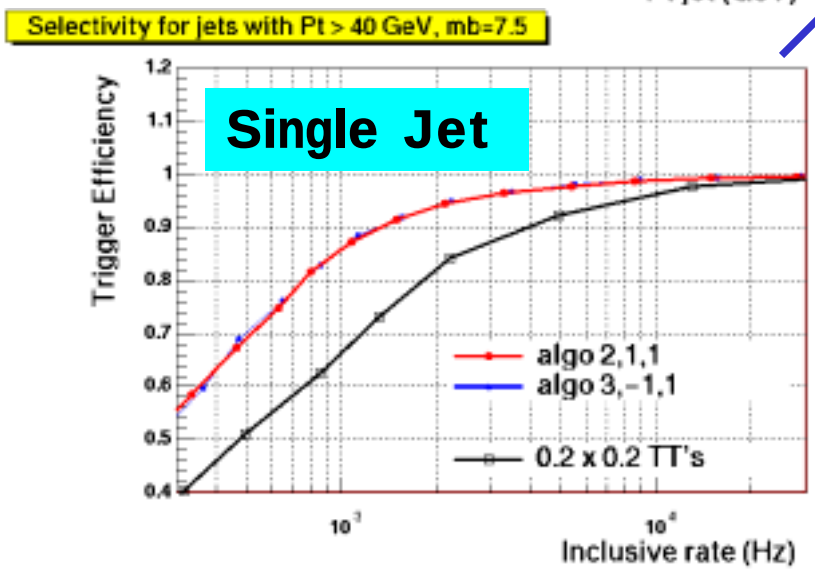
  Similar performances $\rightarrow$ use “2,1,1”
- Next : adapt to run the same code on data and MC

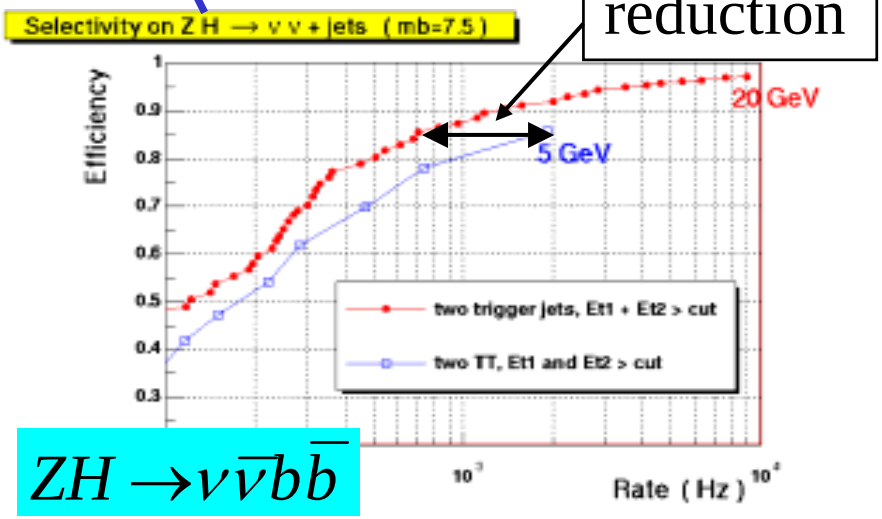
Few simulation results



Sharper turn-on curves

Reduction of trigger rates



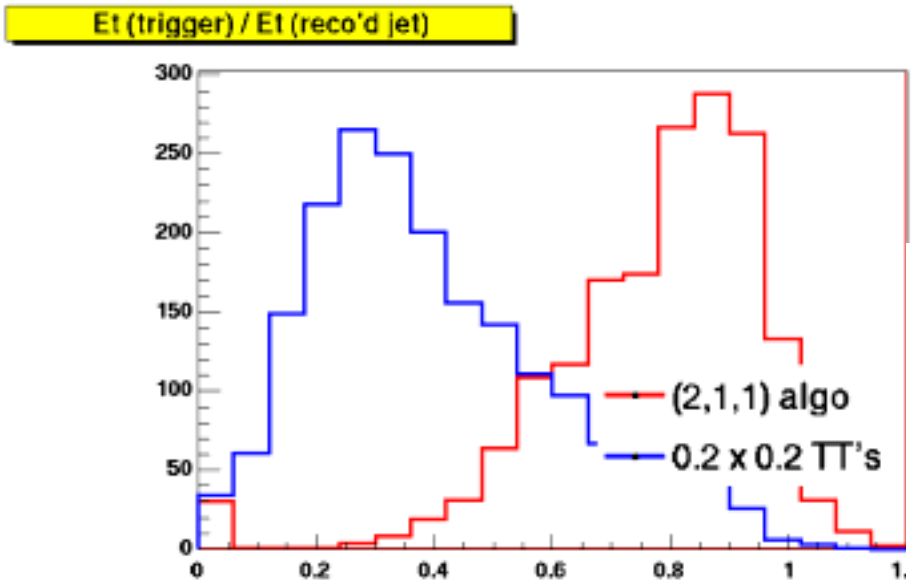


×3 rate reduction

$ZH \rightarrow \nu\bar{\nu}b\bar{b}$

Performance on real data

Using the "Moriond" J/ψ sample :



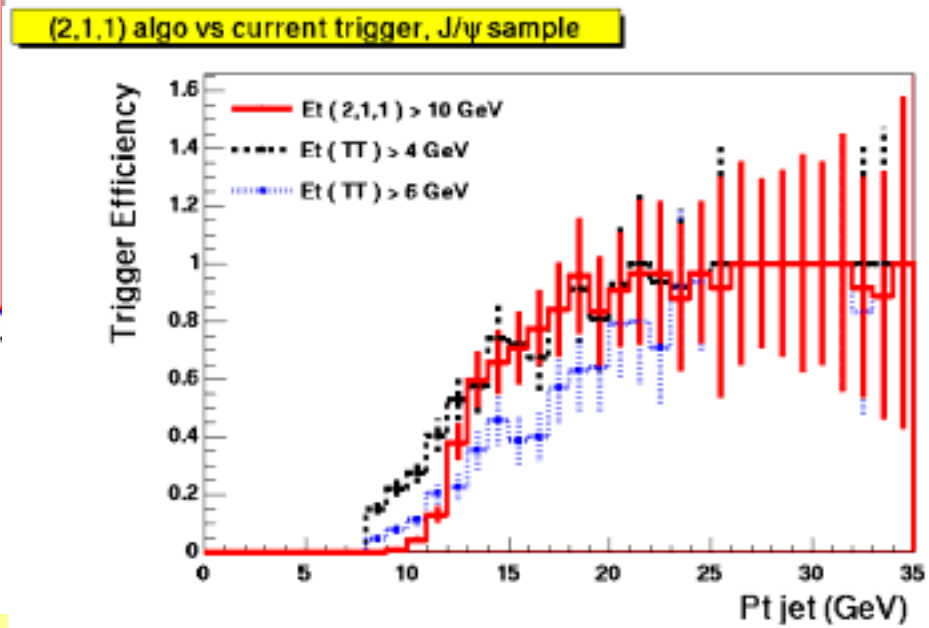
RMS / Mean :

23.8 % for (2,1,1) algo

53 % for current algo

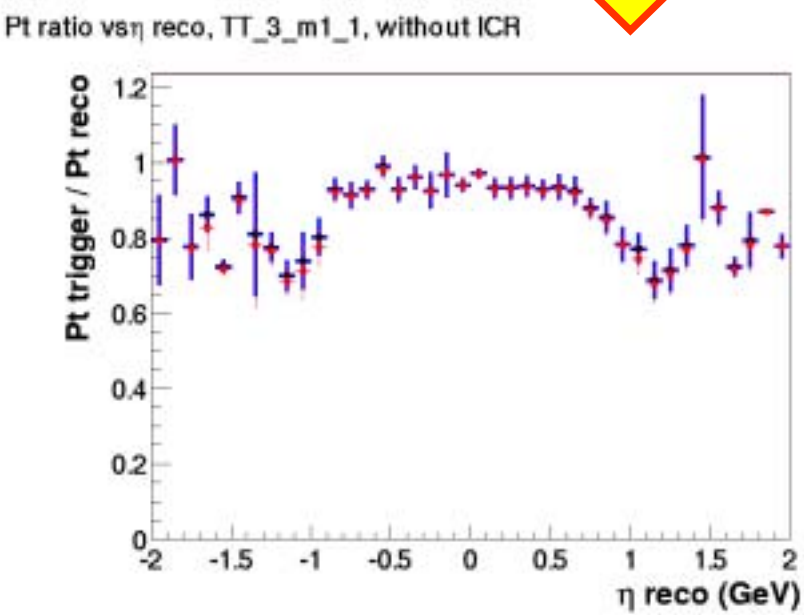
Agreement with simulation

Sharper turn-on curves

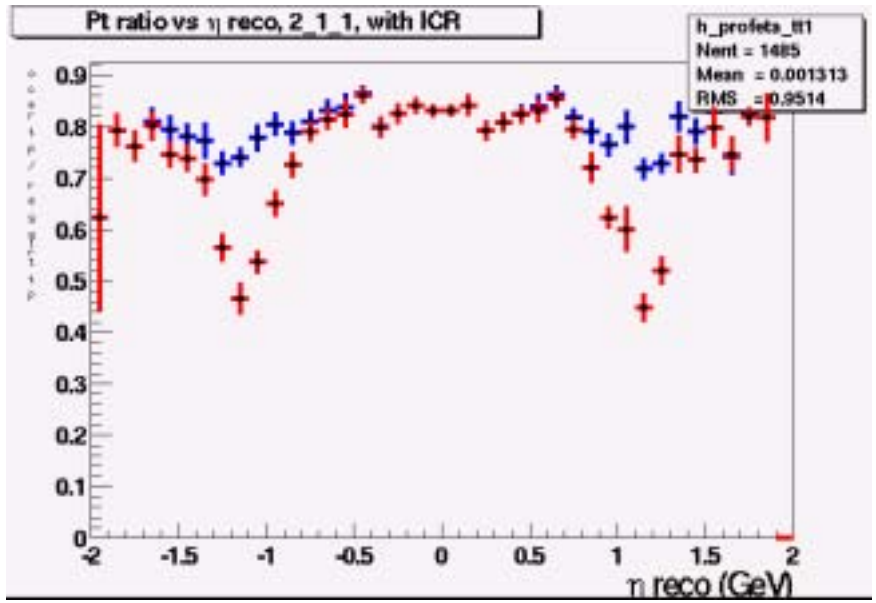


Including ICR in trigger jets

- Our "standard" files (7.5 mb) :
  old version of d0sim
  wrong energies for TT's in the ICR region



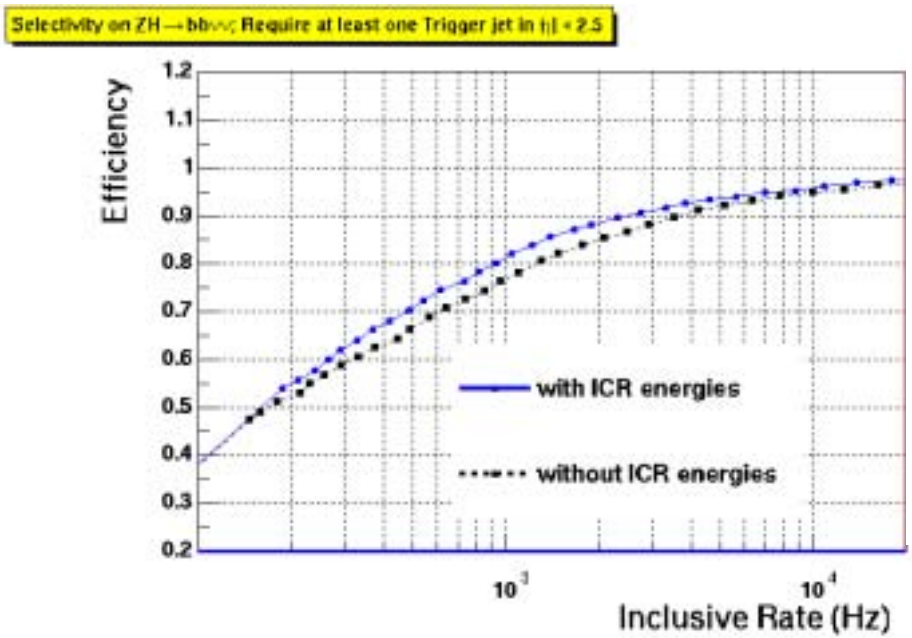
- On more recent files : see the expected difference between with / without ICR

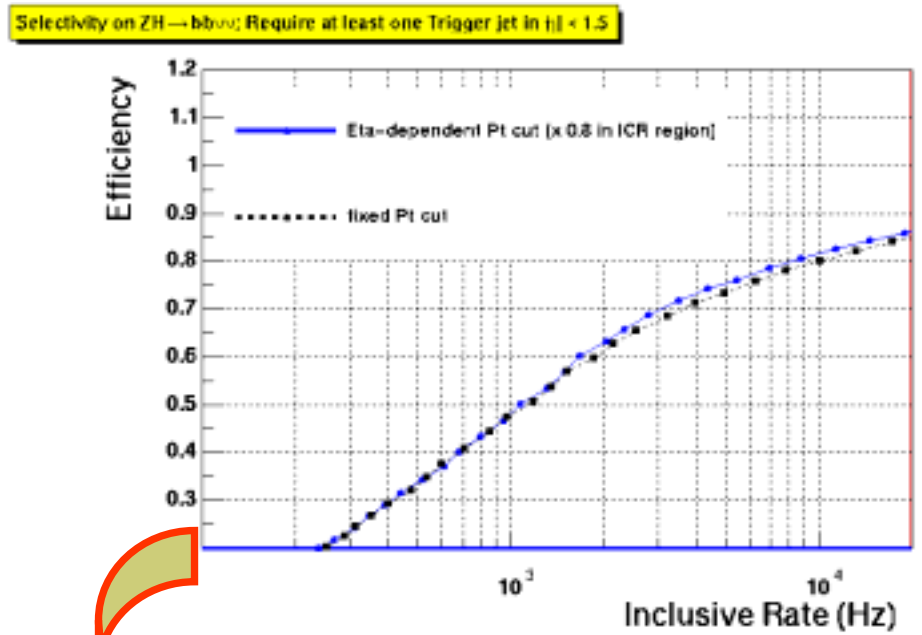


The 7.5 mb files will be re-processed (p13)
Meanwhile : can get a feeling of the effect
Using the precision readout

Including ICR in trigger jets

Using the precision readout :





Without ICR, using a η dependent Pt cut

→ Seems worthwhile to include ICR in the trigger jets

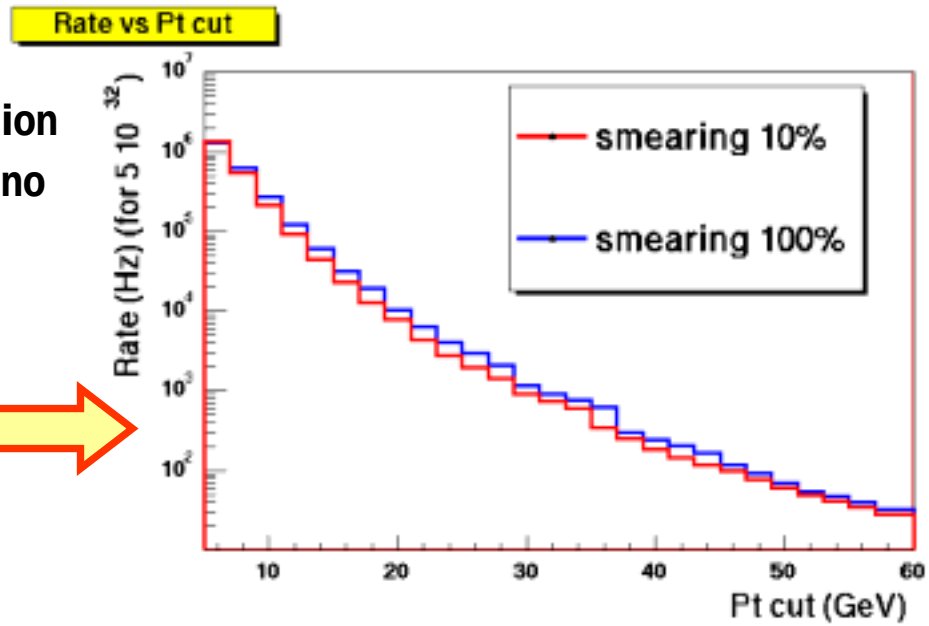
Study to be finalized with p13 files

Studies under way

- **Effect of the TT's energy resolution on the trigger performances**

Currently : use 10% resol in the simulation
Due to the digitisation step (0.25 GeV) no further improvement is expected when resolution becomes < xxx %

→ **First look by Mathieu Agelou**



- **TT's energy resolution on the data**

Compare energies seen by the trigger with precision readout
Discussions (Jiri) with J. Kalk → know how to do