Update on Level 1 selection for the multijet trigger for $H + W/Z$

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for

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In this talk:

1. Examining various Level 1 options
2. ... and their impact on Level 2 and Level 3 rates

Next time:

1. Use of tracking information: XFT and SVT
2. b-tagging at Level 3? (SECVTX, JPB, 1 or 2 tags...)

Old multijet trigger

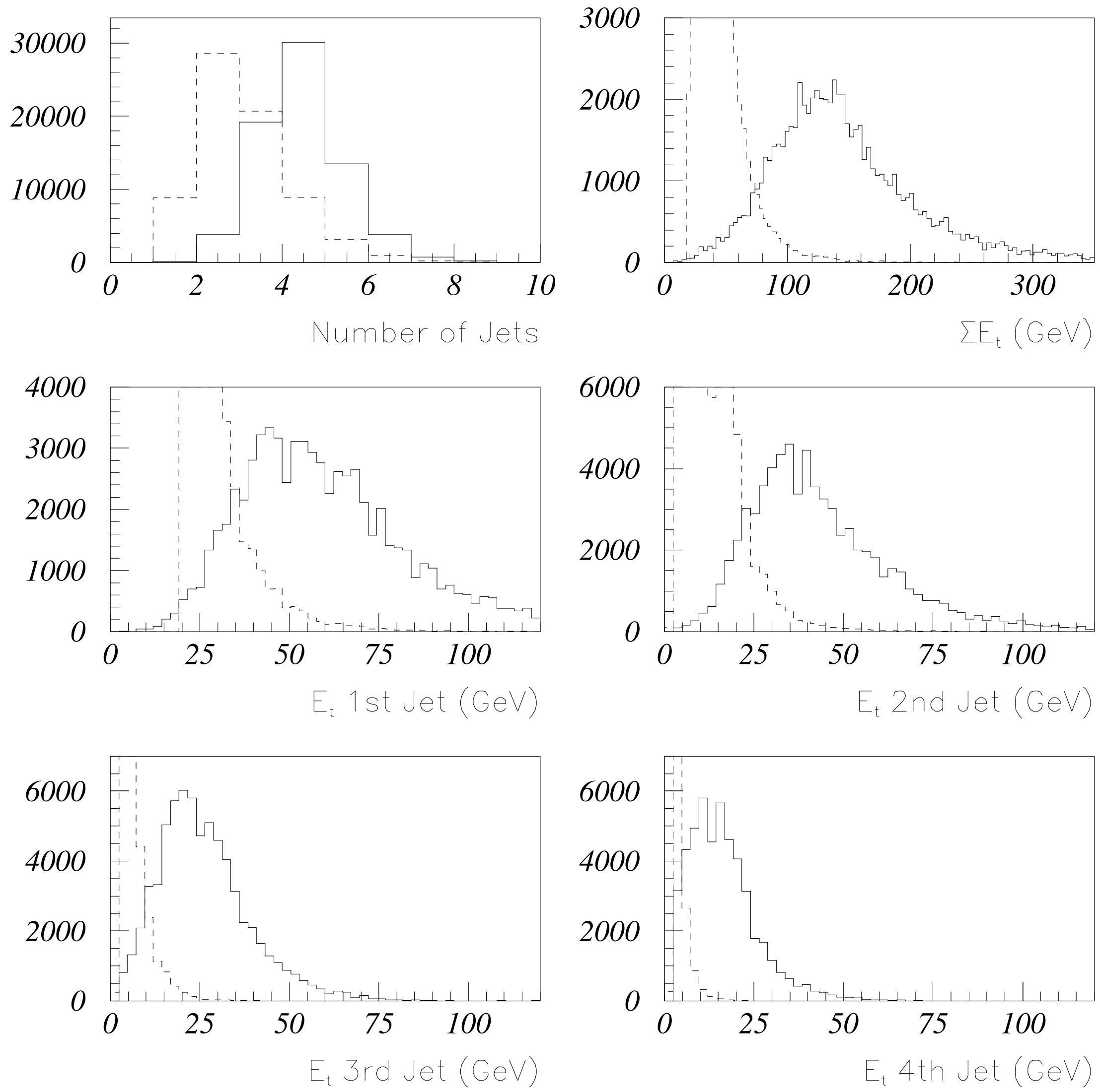
Run I multijet trigger:

- **Designed for $t\bar{t} \rightarrow 6$ jets**
- **4 jets, $E_T > 15$ GeV (10 GeV in Run Ia)**
- **$\sum E_T > 125$ GeV ($\sum E_T > 100$ in Run Ia)**

Problems for Higgs: low efficiency

- **$\sum E_T > 125$ is too high**
- **$N \geq 4$ jets too restrictive (in trigger)**

Improving efficiency for H + W/Z



New multijet trigger – basics

1. **relax number of jets to 3**
2. **relax $\sum E_T$ cut down to 80 GeV**

New multijet trigger

New cuts:

1. **SVT: some number of displaced tracks at Level 2**

   (currently favor 3 tracks with $|d_0| > 150\mu$m)

   but not the topic of today's talk

2. **two b-tags (SECVTX) tags at Level 3**

   (we will consider only one, or two unequal, but this is a measure of offline-useful events*)*

Our plan

- **we have to suffer the loss due to two b-tags**

$\Rightarrow$ **don't worry about the events that will be lost anyway**

$\Rightarrow$ **try to keep calorimeter L1 and L2 efficiency as high as possible, rates as low as possible, while keeping an eye on the total Level 3 efficiency**

Datasets used in the study

- **signal efficiency:**
  use $H+W/Z$ Pythia Monte Carlo
  ($m_H = 120$ GeV)

- **Level 1: use minimum bias**
  'effective' $\sigma(\mathrm{minb}) \approx 32mb$
  (after correcting for multiple interactions)

- **Level 2, Level 3 rates**
  use Jet 20 data
  (since $E_T > 20$ GeV for leading jet)

- $\sigma(\mathrm{Jet20}) = 6.5\mu$ **b**
  $\mathcal{L} = 10^{32} cm^{-2} s^{-1}$

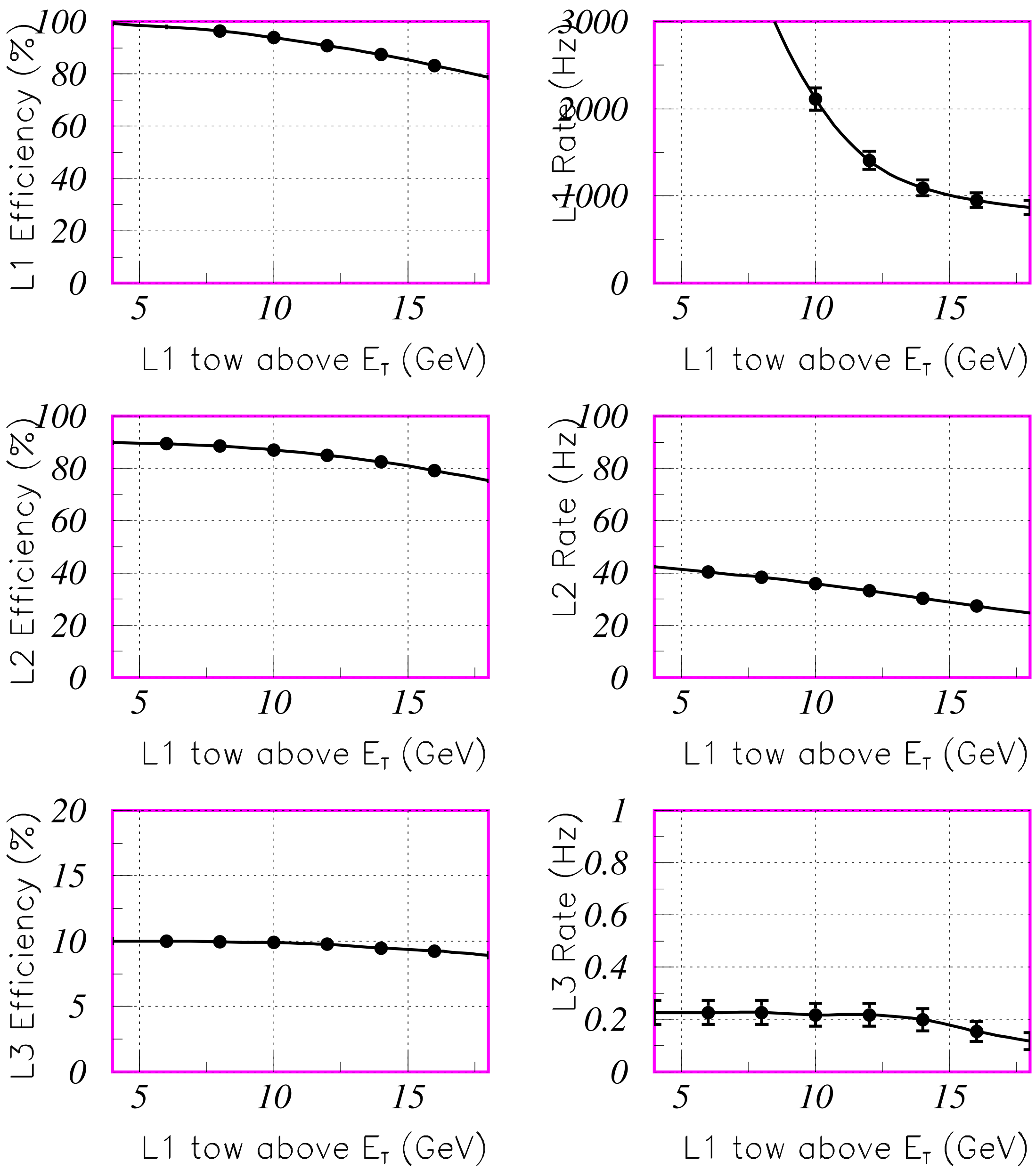
Studying Level 1 requirements

Our selection:

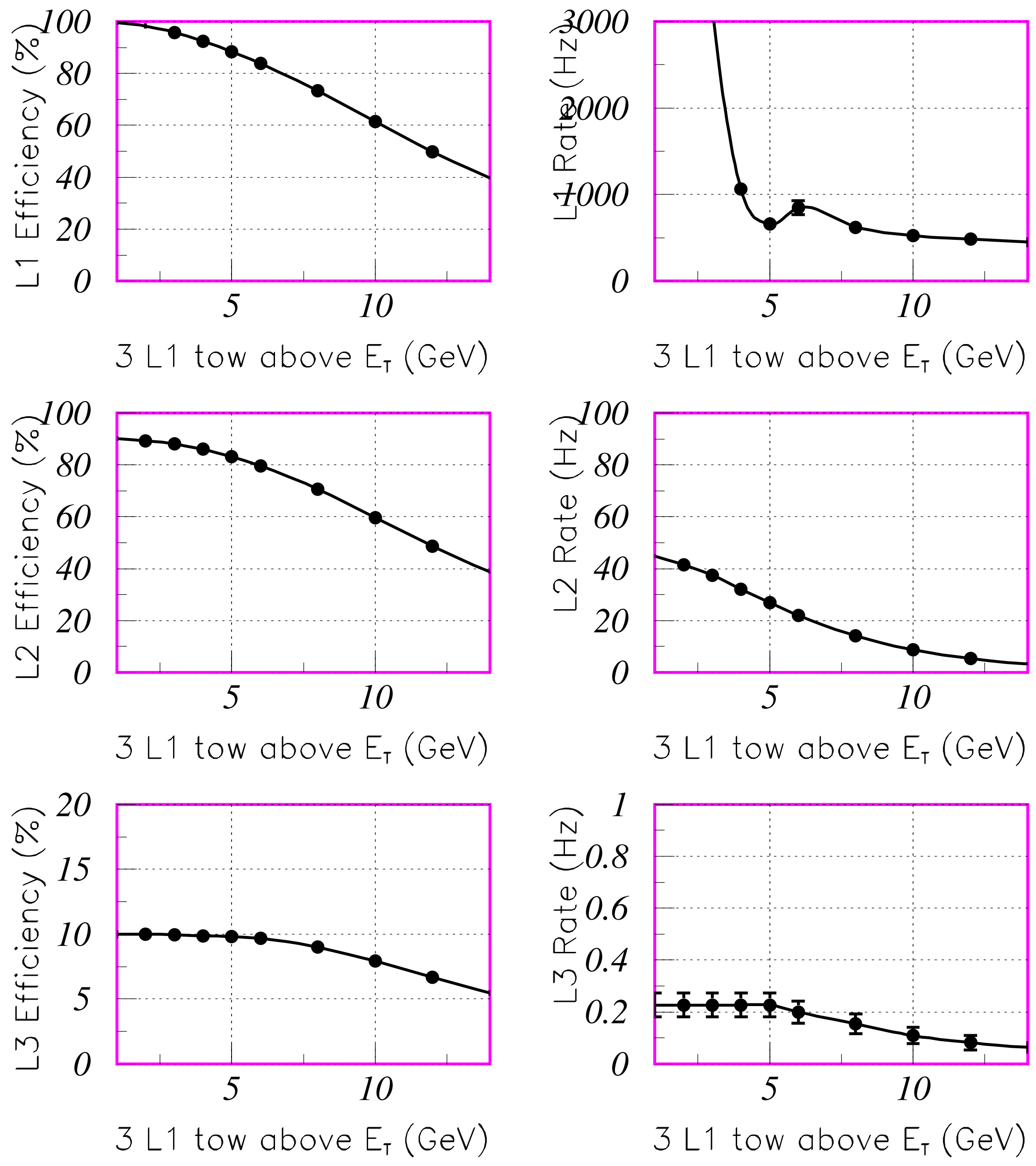
- **removed bad runs**
- **Level 2:**
  - **at least three clusters**
  - $E_T^1, E_T^2 > 20$ **GeV,** $E_T^3 > 5$ **GeV**
  - **sum of clusters above** $3GeV$
    $\sum_{E_T>3} E_T > 80$ **GeV**
  - **currently, no tracking cuts**
- **Level 3:**
  - **at least two** b**-tags (SECVTX)**

(Level 1 selection as indicated on each figure)

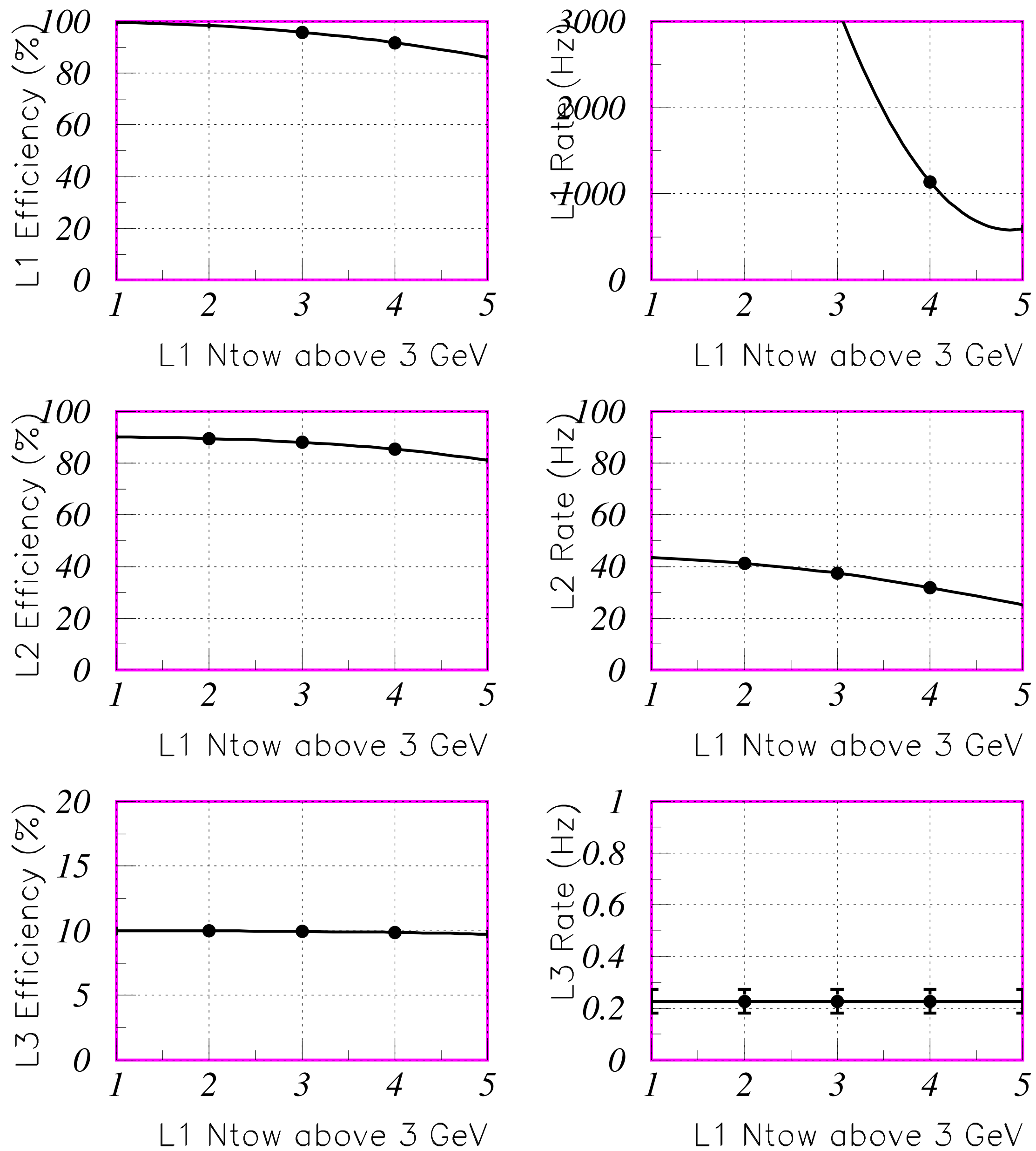
Level 1 tower above certain E_T



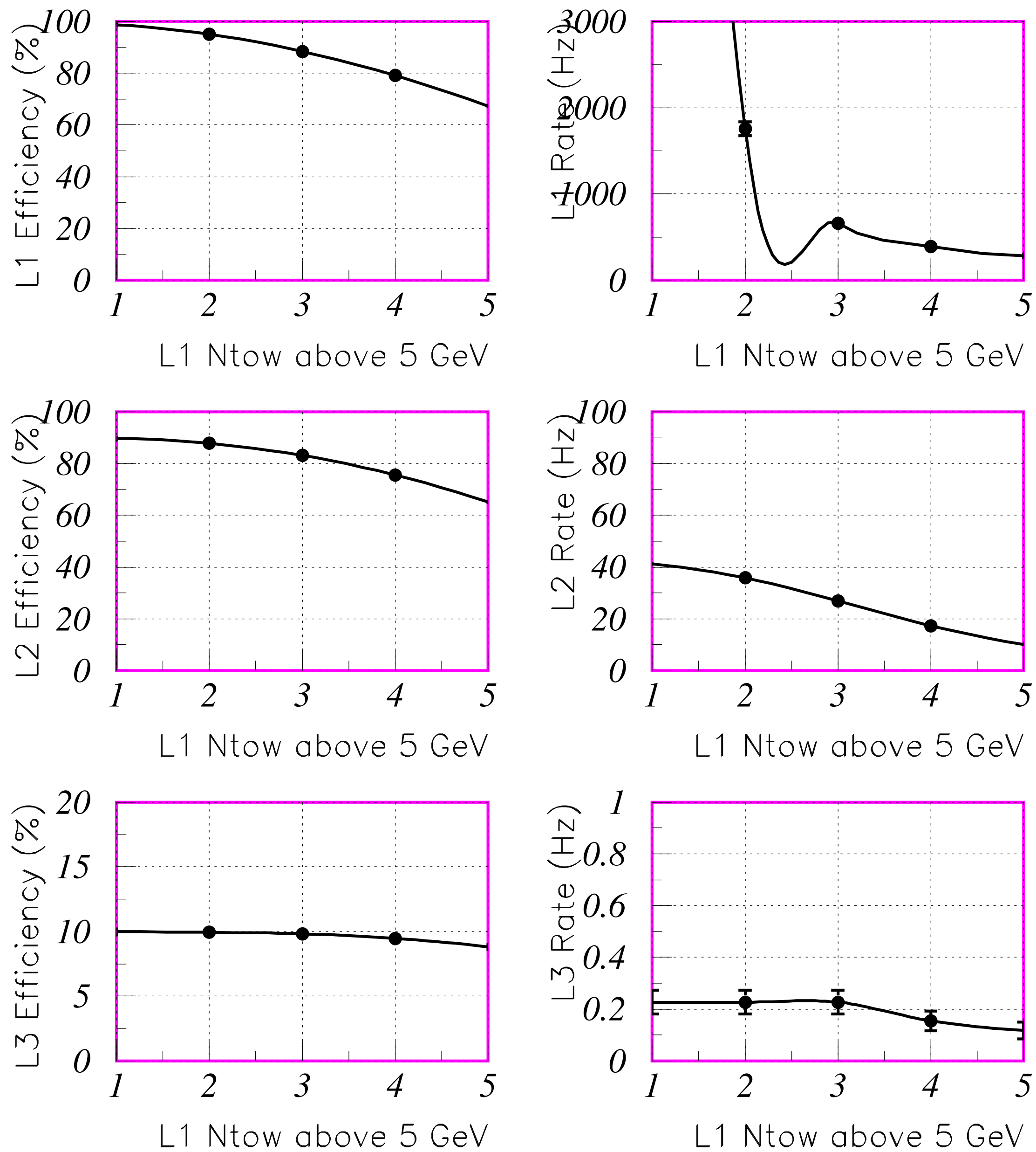
Three Level 1 towers above certain E_T



N Level 1 towers above $E_T > 3$ GeV

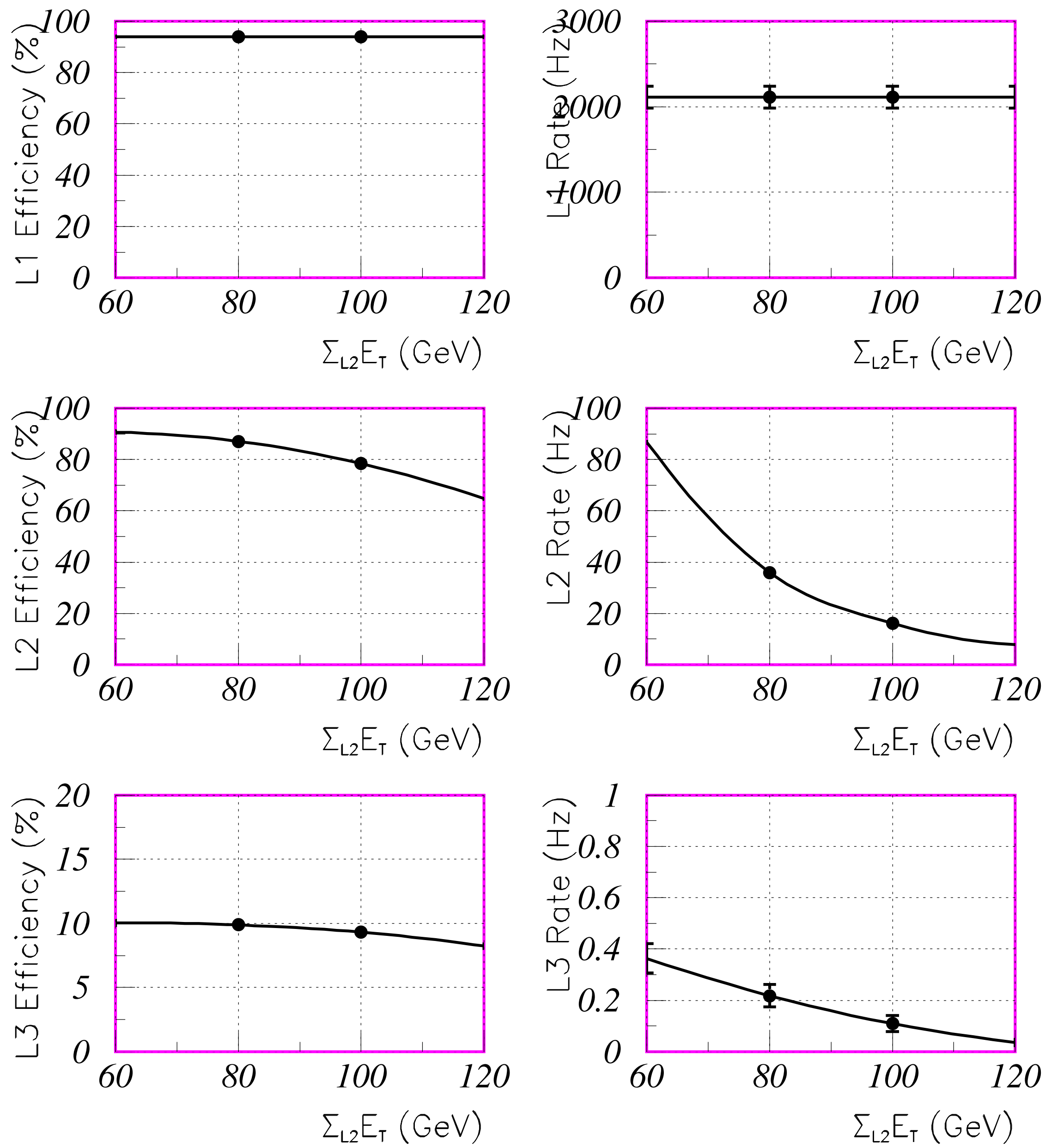


N Level 1 towers above $E_T > 5$ GeV

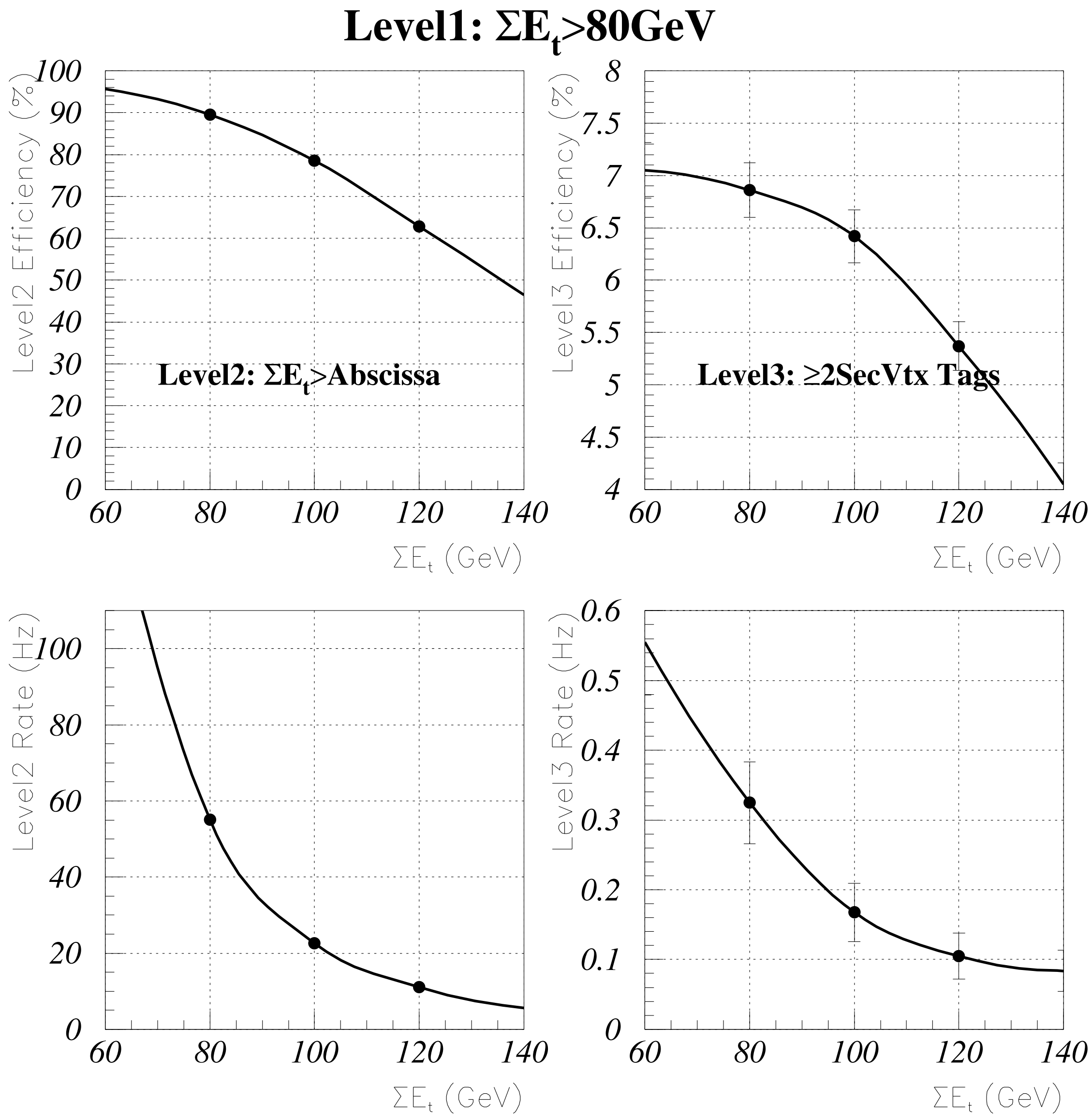


Level 2 $\sum_{E_T>3} E_T$

Now for Level 1: at least one tower with $E_T > 10$ GeV, we re-do our standard Level 2 $\sum_{E_T>3} E_T$ scan

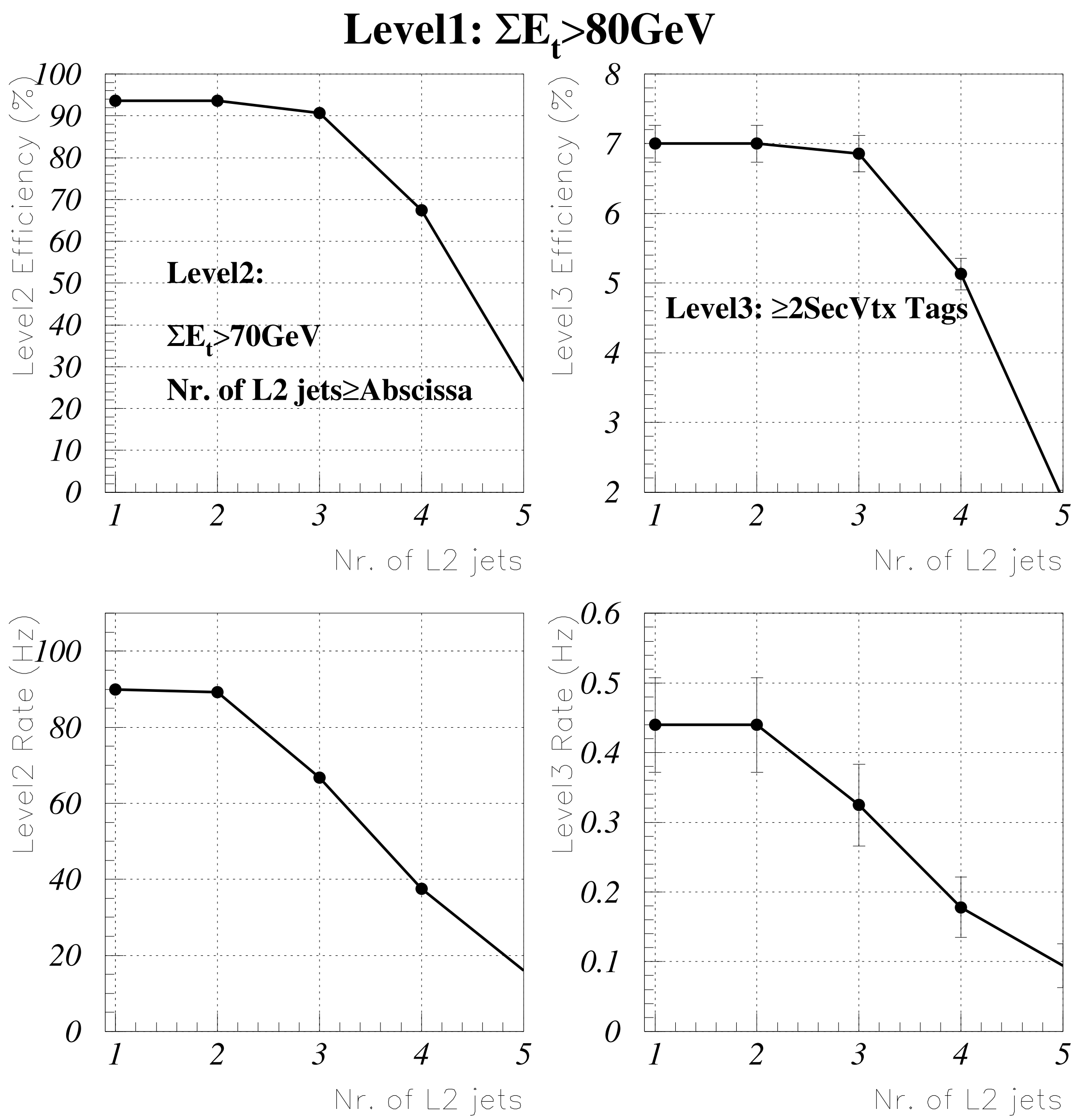


Efficiencies and rates vs. $\sum E_T$ cut



Efficiencies and rates vs. cut on $N_{L2clust}$

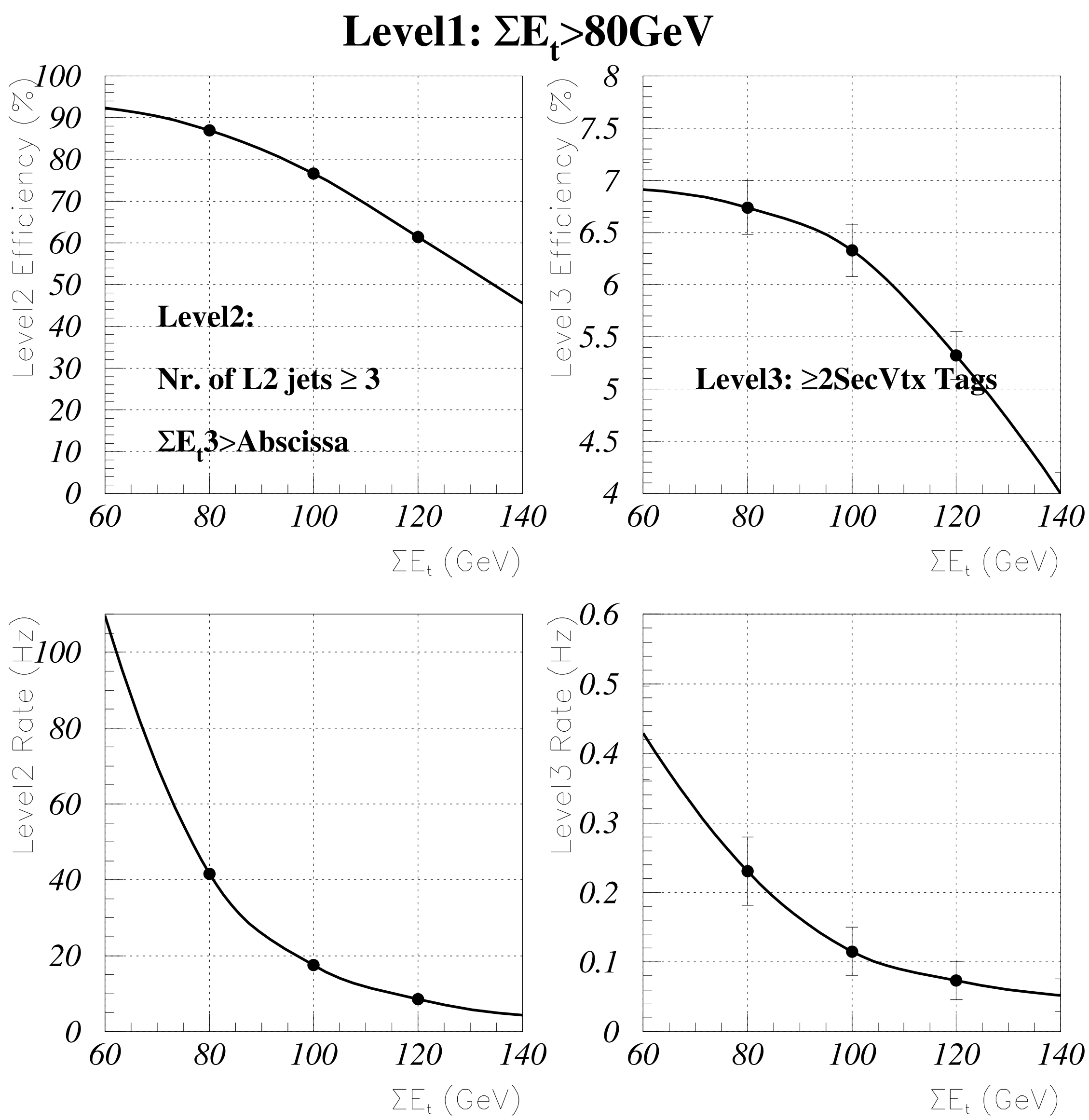
We cut on the number of Level 2 clusters:



We can't afford the drop in efficiency for $N_{L2clus} \geq 4$!

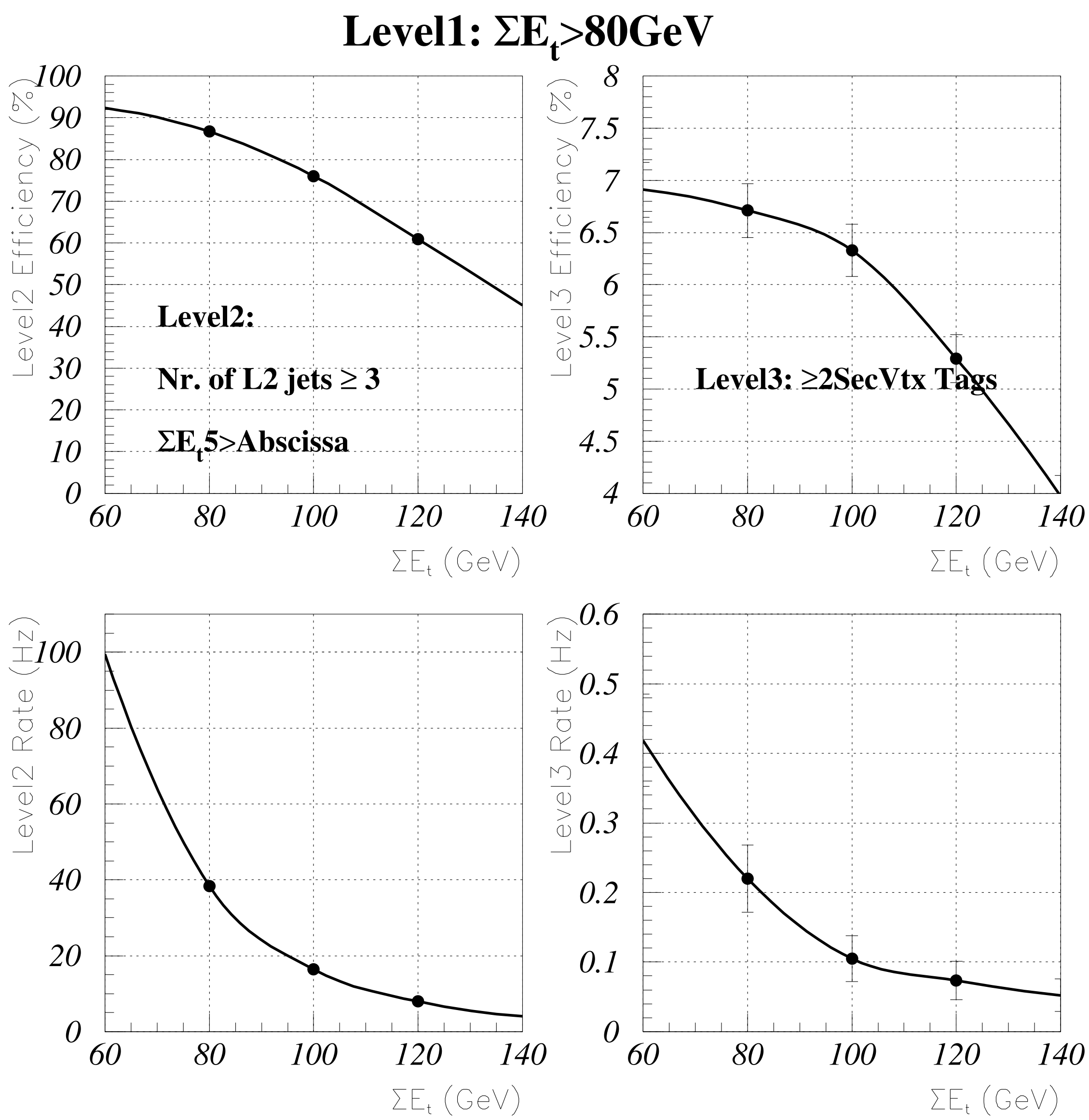
Efficiencies and rates vs. $\sum_{>3GeV} E_T$ cut

$\sum_{>3GeV} E_T$ = a sum over clusters with $E_T > 3$ GeV



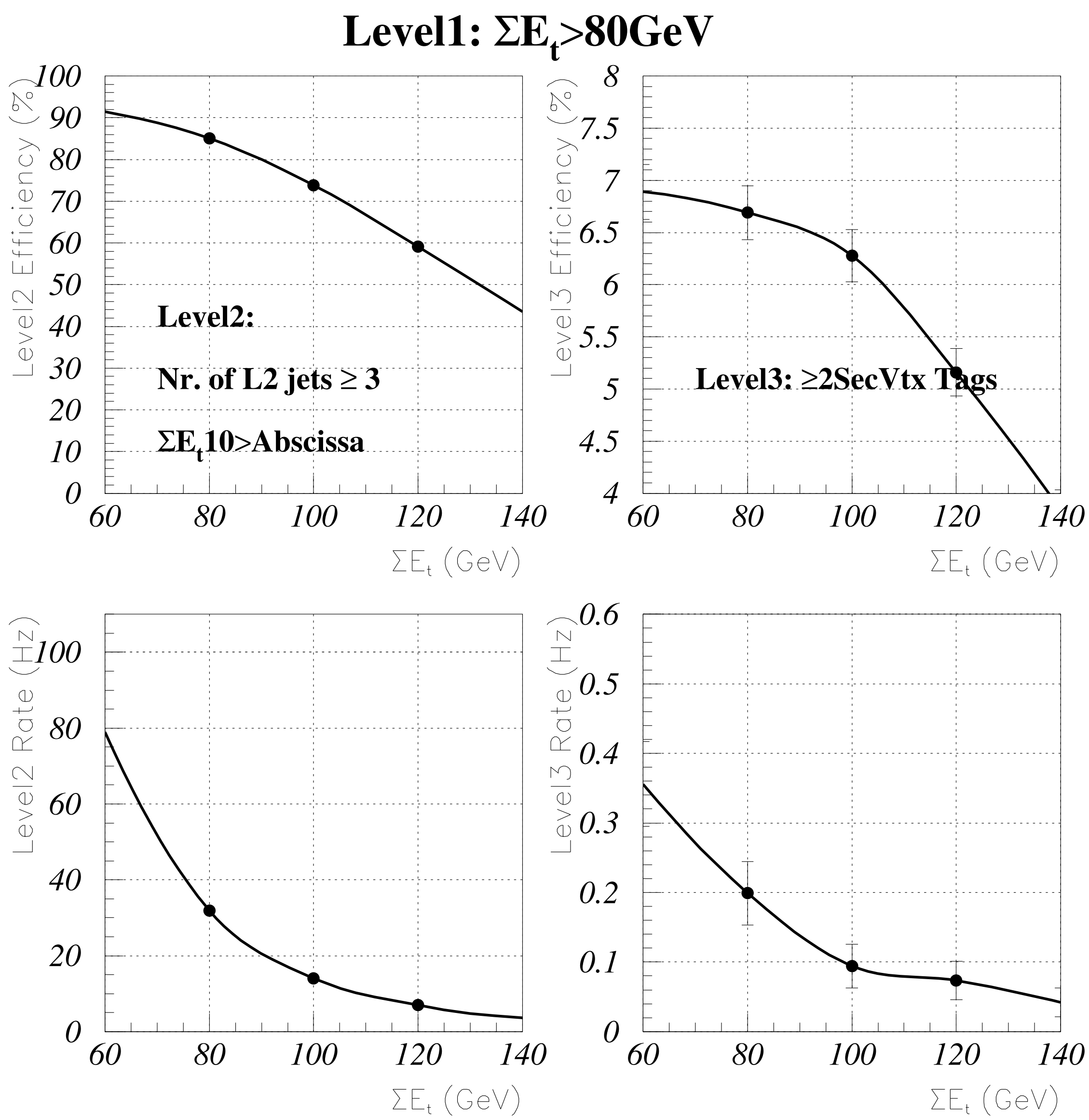
Efficiencies and rates vs. $\sum_{>5GeV} E_T$ cut

$\sum_{>5GeV} E_T$ = a sum over clusters with $E_T > 5$ GeV



Efficiencies and rates vs. $\sum_{>10GeV} E_T$ cut

$\sum_{>5GeV} E_T$ = a sum over clusters with $E_T > 10$ GeV



Status of calorimeter requirements

- Level 2: $\sum E_T > 80$ GeV at Level 2 efficient for Higgs

- Level 1: most cuts contemplated by the QCD group are OK.

  For example, we are happy with $E_T^(1) > 10$ GeV.

What remains

- revisit tracking requirements (SVT and XFT at Level 2)

- close Level 1 and Level 2, and devote time to b-tagging at Level 3...

- check the efficiencies for other interesting signals:

  - single top
  - Technicolor
  - MSSM Higgs ($Ab\bar{b}$), etc.