

Examination – your mission



Write a software version of a level on trigger using ROOT > 5.17

A screenshot of a web browser window. The address bar shows 'http://www.physto.se/~sten/Detector/'. The page title is 'Index of /~sten/Detector'. The page content shows a directory listing with columns for Name, Last modified, Size, and Description. The listing includes a 'Parent Directory' link, four files with question mark icons, and a 'cross-section.txt' file. At the bottom, there is a footer with server information: 'Apache/2.2.8 (Unix) mod_ssl/2.2.8 OpenSSL/0.9.8g mod_python/3.3.1 Python/2.4.5 DAV/2 PHP/5.2.5 Server at www.physto.se Port 80'. A status bar at the bottom right shows '0 errors / 0 warnings'.

Name	Last modified	Size	Description
Parent Directory	-	-	-
5010 tt.root	10-Sep-2008 13:00	126M	
5144 tt.root	10-Sep-2008 13:08	324M	
5200 tt.root	10-Sep-2008 13:15	309M	
Start.C	11-Sep-2008 13:14	1.9K	
cross-section.txt	11-Sep-2008 13:14	149	

1: Fetch data on <http://www.physto.se/~sten/Detector>

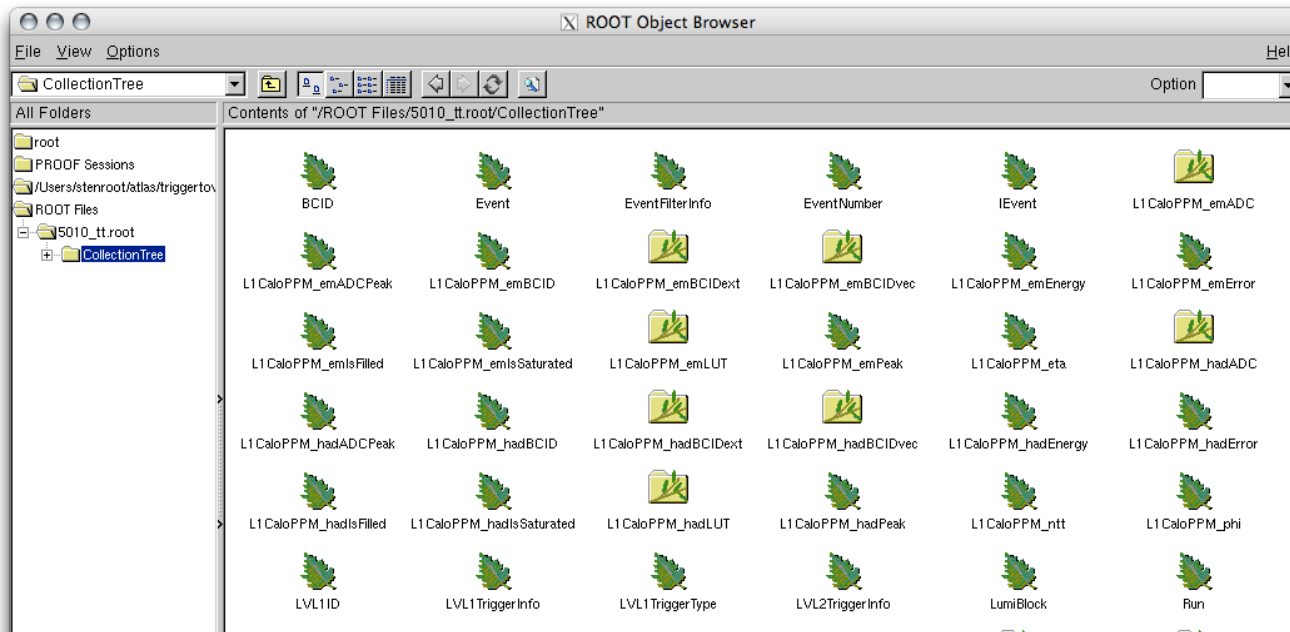
cross-section.txt will tell you:



5144 = $Z \rightarrow ee$ = 1733 pb

5010 = dijet parton pt 17-35 GeV = 380000000 pb

5200 = $t\bar{t}$ I+X NLO (positive/negative weights!!) = 450 pb (after weighting)



2. Check data.

The interesting variables are:

- L1CaloPPM_ntt, number of trigger towers with energy above 0 in each event.
- L1CaloPPM_eta and L1CaloPPM_phi is eta and phi of trigger towers (units of 0.1 and $\pi/64$).
- L1CaloPPM_hadEnergy is hadronic energy (unit is 1 GeV) of trigger towers
- L1CaloPPM_emEnergy is electromagnetic energy (unit is 1 GeV) of trigger towers

3. Use "Makeclass" in ROOT to create an analysis class in the standard way.

You will need to cheat ROOT to compile the vector type objects with

```
#include <vector>

#ifdef _MAKECINT_
#pragma link C++ class vector<string>;
#pragma link C++ class vector<long>;
#pragma link C++ class vector<vector<int> >;
#endif
```

in the header file.

4. Unpack data.

For each event you fill two eta-phi maps of the calorimeters, one for hadronic and one for electromagnetic energy.

Granularity $\eta \times \phi = 0.1 \times 0.1$

Ignore all data with $|\eta| > 3.5$

5. Create trigger algorithms that use these calorimeter maps.

For ideas on how, you might consult the ATLAS documentation:

The ATLAS Level-1 Calorimeter Trigger
Journal of Instrumentation 3 (2008) P03001, 6 March 2008.
R. Achenbach et al.

but feel free to invent your own algorithms

You should produce and send to Sten Hellman, sten@physto.se :



C++ files (and header files) which can be loaded into root

.L Answer.C++

for which the Loop method runs a jet-trigger and an electron trigger algorithm.

These should implement phi-wrap-around and local max. for both algorithms, em and had isolation for the electron algorithm.

Plots showing rates at luminosity of $10^{33} \text{ cm}^{-2}\text{s}^{-1}$ for "your" jet trigger as a function of p_T threshold when applied to the data in the dijet sample.

Plots showing rates at luminosity of $10^{33} \text{ cm}^{-2}\text{s}^{-1}$ for "your" electron trigger when applied to the Z- \rightarrow ee sample as a function of p_T threshold for at least two different combinations of isolation thresholds.

For one of these combinations you should also provide rate-plots for the jet and ttbar samples