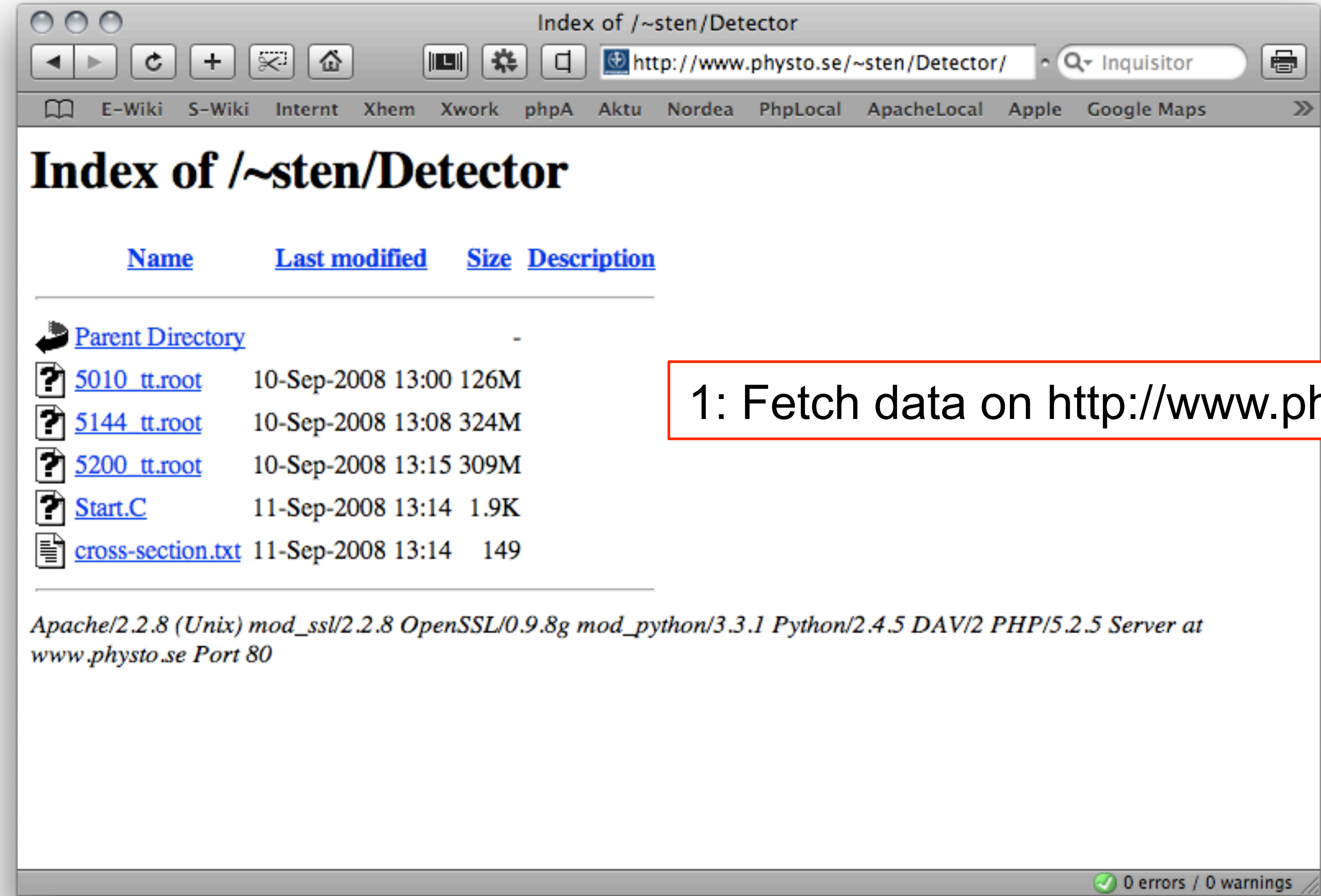
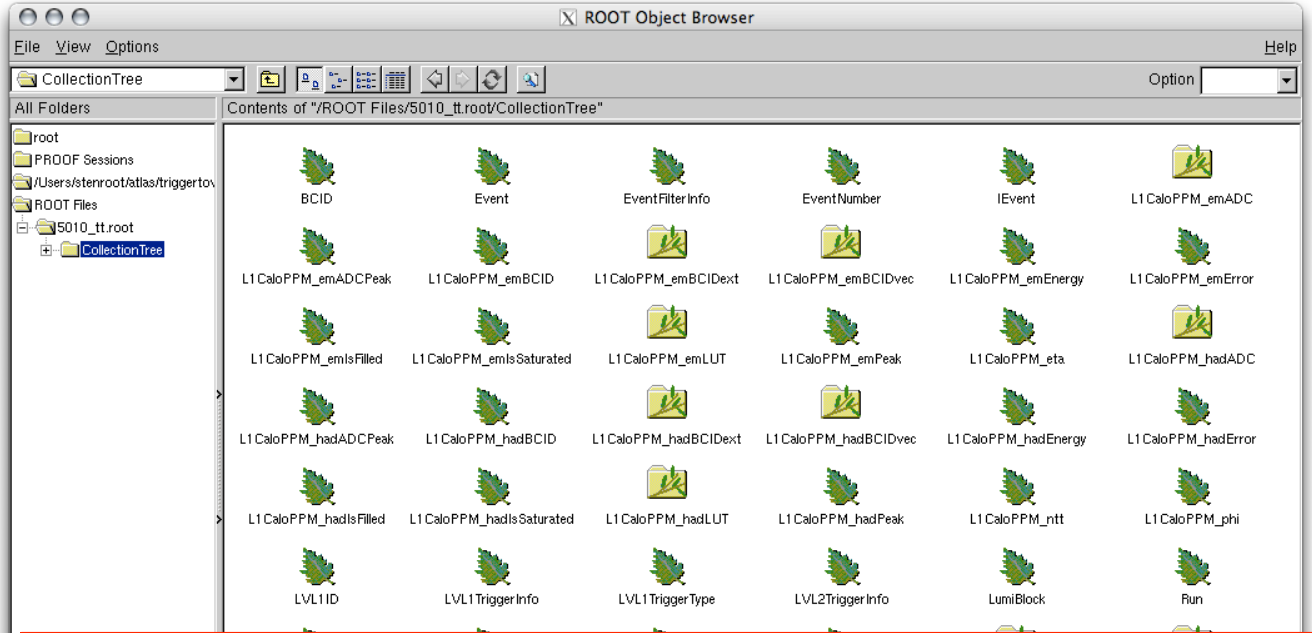
Examination – your mission

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



1: Fetch data on http://www.physto.se/~sten/Detector cross-section.txt will tell you:

5144 = Z->ee = 1733 pb
5010 = dijet parton pt 17-35 GeV = 380000000 pb
5200 = ttbar l+X NLO (positive/negative weights!!) = 450 pb (after weighting)



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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 x 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 :

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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} $cm^{-2}s^{-1}$ 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} $cm^{-2}s^{-1}$ for ”your” electron trigger when applied to the Z->ee sample as a function of p_T threshold for least two different combinations of isolation thresholds.

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