ATLAS Trigger Simulations
Present & Future?

What tools exist?

What are they good for?

What are the limitations?

How do you use them

Where are they available?

What do you do?

Information resources?

Where are they going?

The Architecture Task Force report

PASO?

What is currently available?

ATRIG

- ✓ "Official" ATLAS package
- ✓ Full GEANT-based simulation
- ✓ Up-to-date & realistic model of e/γ, τ, jet algorithms
- ✓ $E_T$miss being updated
- ✗ Currently lacks pulse history or BCID simulation
- ✗ Sum E_T trigger absent
- ✗ Restricted to $|\eta|$<3.2 (FCAL being added)
- ✗ Slow to run, event slower to generate datasets

ATLFAST

- ✓ Fast, easy to generate datasets
- ✓ Models resolution, longitudinal shower development
- ✓ Models of all elements of LVL1 algorithms (e/γ needs updating)
- ✓ PPR simulation includes pileup, pulse-history & BCID as options
- ✓ Easy access to simplified model of offline reconstruction
- ✗ Trigger simulation "semi-private"
- ✗ No transverse shower profile, detailed material simulation

What is ATRIG?

Input data

Output of GEANT-based ATLAS detector simulation (DICE).

Typically 3 different jobs are run:

- Physics Monte Carlo produces 4vectors
- DICE reads 4vectors ("KINE") & produces "DIGI" output
- Atrig reads DIGI and simulates trigger output

First two are normally run centrally (i.e. not your problem)

What is it used for?

- Study performance of LVL1 and LVL2 trigger algorithms
- As "filter" for higher-level trigger or offline physics or detector performance studies

LVL1 Atrig Simulation

What is in the calo trigger simulation?

- Combine detector pseudo-digitisations into trigger towers
- Simulate summing-chain noise, digitisation, pedestals, thresholds
- Sum trigger towers to jet elements, truncate words
- Execute e/γ, τ, jet, ETmiss algorithms
- Compare against thresholds, count "hits" & pass to CTP simulation
- Produce list of RoIs for LVL2

It also summarises LVL1 results in a "column-wise ntuple"

- You will probably want to add your own, with the quantities *you* are interested in......

How to run Atrig

Where?

At CERN, on the Atlas Workgroup Server

- Can install code & copy datasets to home system if you want :-)

How?

This is, by ATLAS standards, unusually well-documented:

- To run the standard executable, follow instructions in:
    www-wisconsin.cern.ch/~atsaul/Docs/RunningAtrig.html

- If you want to add/change code, see "Atrig Developer's Guide"
    www.cern.ch/Atlas/GROUPS/DAQTRIG/ATRIG/atrig-dev-guide.html

- You can find a list of datasets at
    atlasinfo.cern.ch/Atlas/GROUPS/SOFTWARE/HELP/productions.html

How to change parameters

Where are they?

The procedure for running Atrig will create a directory "0.0.nn/job", where "0.0.nn" is the release number.

- The parameter files can be found in "0.0.nn/job/AtrigPar/"

There are two types:

DICE parameters (which "detectors" to use, debug printing, etc)

- job/AtrigPar/<run_condition>.dat

Trigger parameters (thresholds, noise levels, trigger requirements)

- job/AtrigPar/<run_condition>.tit

Copy the file to your "job" directory & edit it to change values

ATLFAST

What is it?

A "fast" simulation used to study possible physics reach of ATLAS

- Models detector resolution & reconstruction by smearing 4vectors
- Lacks detail of detector material

LVL1 Simulation:

Added by Mainz group (primarily Rolf Dubitzky)

- Use parameterised detector response to fill trigger towers
- Simulate pre-processor, e/γ, τ, jet, ETmiss, SumET
- Can add in pileup including pulse history

How to Run ATLFAST

Where?

Best to run this on your own system

- **ATLFAST code & documentation can be found at**
  http://atlasinfo.cern.ch/Atlas/GROUPS/PHYSICS/HIGGS/Atlfast.html
- **The LVL1 simulation package can be downloaded from**
  http://butler.physik.uni-mainz.de/~thomas/simtrig-v0.3.tar.gz
  http://butler.physik.uni-mainz.de/~thomas/l1t-v0.4ATLF.tgz

  These include source code, makefiles etc.

  I can probably give advice on installation etc (it wasn't too hard)
- **Instructions for running this at Birmingham can be found at:**
  www.ep.ph.bham.ac.uk/publications/atw/ftp_archive/documentation/
  atlfast_lvl1_guide.html

What comes next?

Object-Orientation

Want something better-designed & more maintainable

Some first attempts exist,such as

- ATLFAST++ - unofficial C++ version, no trigger simulation

Main effort should start this year

- Architecture Task Force report submitted last year
- Approval (or not?) April
- Real work should start after that

In the meanwhile?

- PASO?

Next Steps for LVL1?

Need to *plan* first:

Understand what trigger will do

Understand existing code (though OO version will be very different)

Study requirements for LVL1 calorimeter code

- A rough study for the trigger code generally exists at
  www.hep.ph.rhbnc.ac.uk/atlas/trigger_sw_req.txt
  We will have many specific requirements of our own

Discuss/study general structure of LVL1 code

Discuss with other trigger software people

Read ATF report

Try a testbed implementation in PASO framework?

Summary

Two distinct sets of tools exist

- ATLFAST is more suitable for quick studies, or studies of wide range of physics processes
- ATRIG required for detailed understanding of detector geometry

Documentation for these exists

- I'm trying to put together a set of links & LVL1-specific documents at

    www.ep.ph.bham.ac.uk/publications/atw/atlas.html

Move to OO/C++ architecture

- Must start this year
- Can we put together a group to start work in LVL1 calo?