



# MINERVA

[cern.ch/atlas-minerva](http://cern.ch/atlas-minerva)

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# Contents

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- Minerva on the web
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(Asked to focus on Minerva but other ATLAS event displays  
Amelia, Hypatia also available)



# Overview

- Aims

From collisions in detectors to physics discoveries  
- event visualisation

Recognising particles in ATLAS

Detecting  $W$  and  $Z$  bosons (and the Higgs)

Simulated data now – collision data in time!



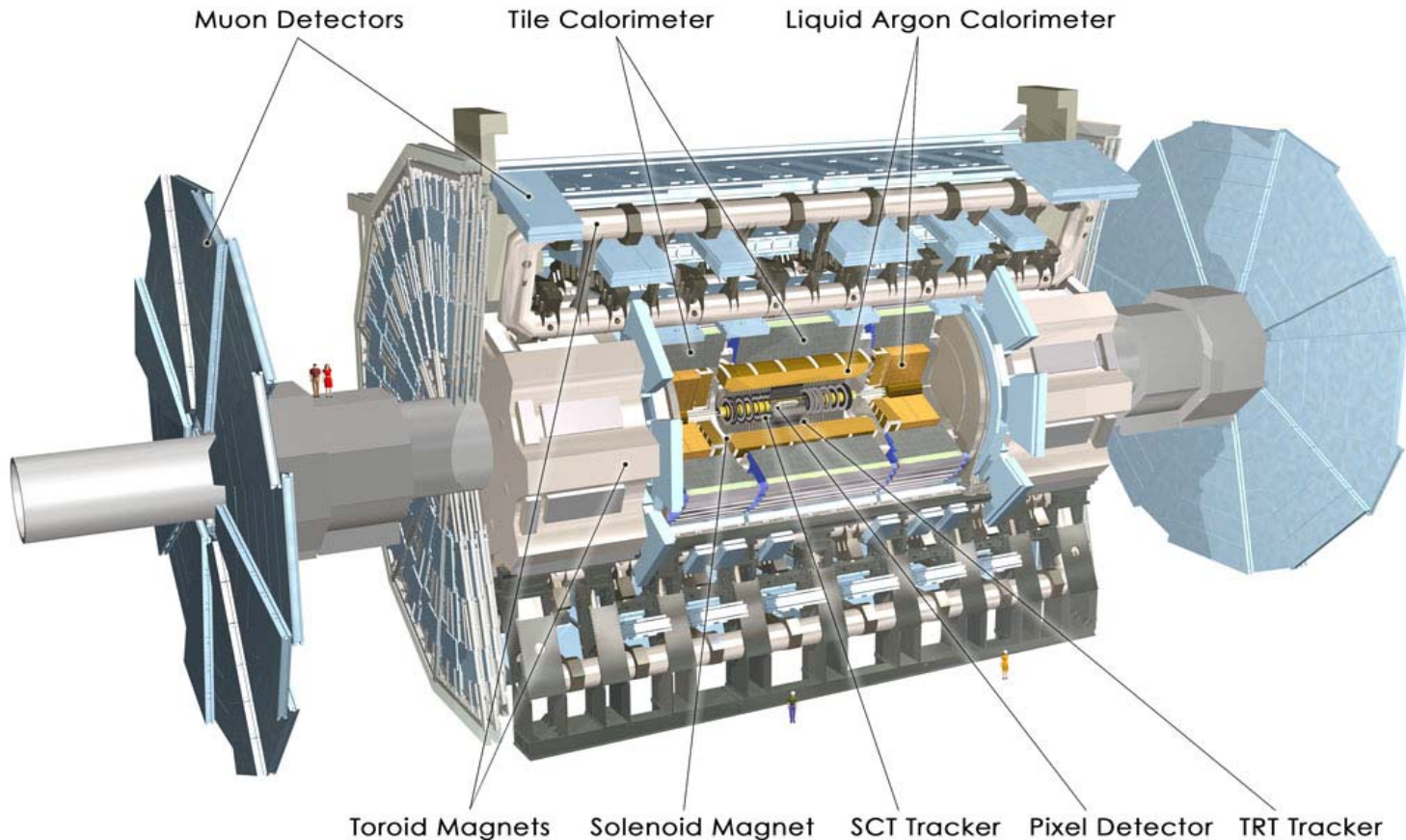
# MINERVA MASTERCLASS

- Students learn about the ATLAS experiment at the LHC
- ATLAS visualisation package Atlantis - xml format files
- Software very easy to load
- **Used at many Masterclasses around the world since 2008**
  - UK - Birmingham, Daresbury, Oxford, RAL, RHUL ...
  - US - Cincinnati, Notre Dame, Richmond
  - Canada – Carleton, Triumf
- Measure ratio of number of W and Z bosons in sample
- Search for the Higgs

<https://twiki.cern.ch/twiki/bin/view/Atlas/MinervaMasterclass>



# ATLAS DETECTOR

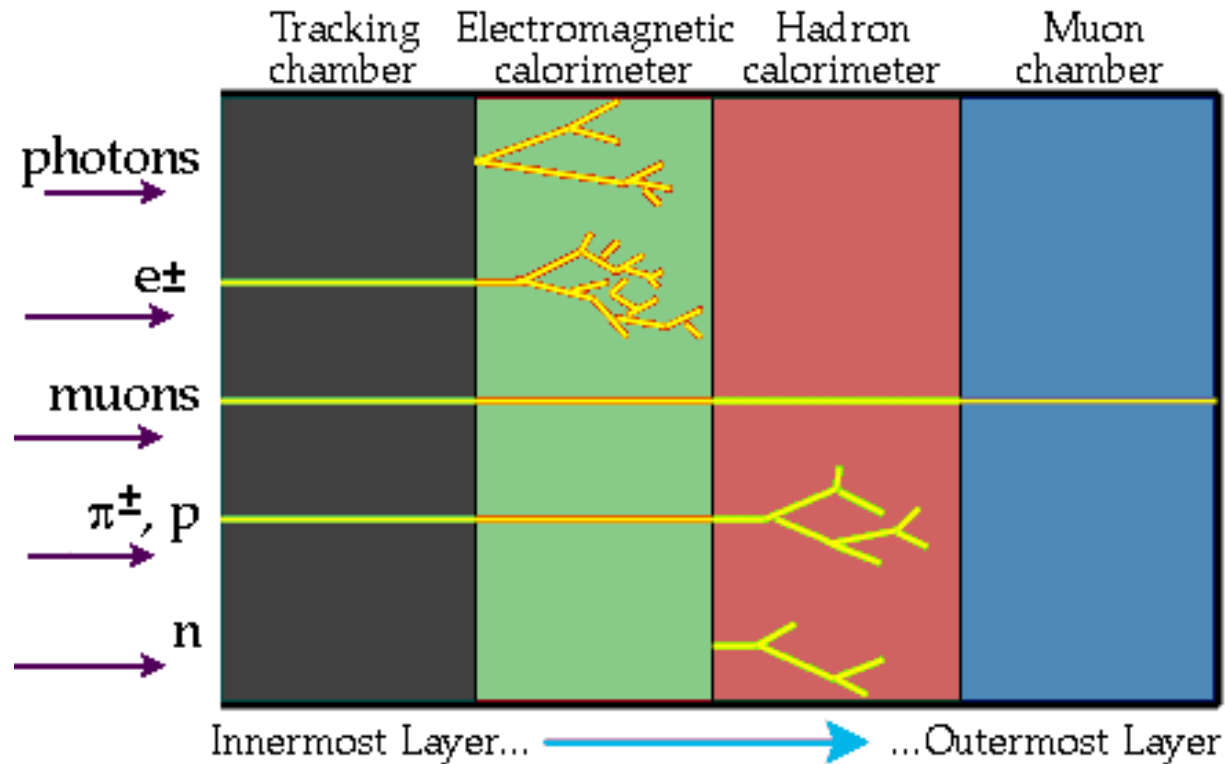


The ATLAS experiment is a collaboration of over 2000 scientists from 167 institutions in 37 different countries.



# Identifying Particles

Particles identified by their detector signatures

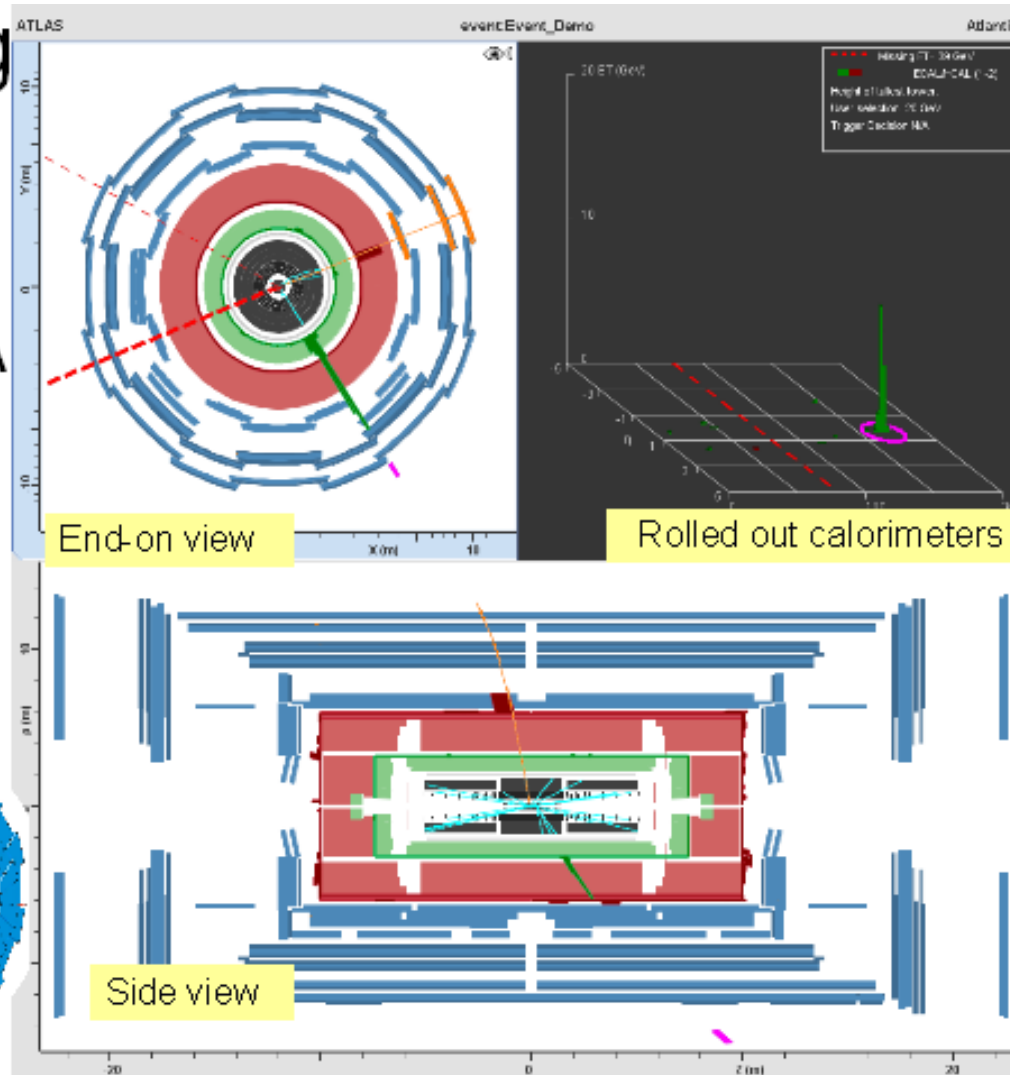
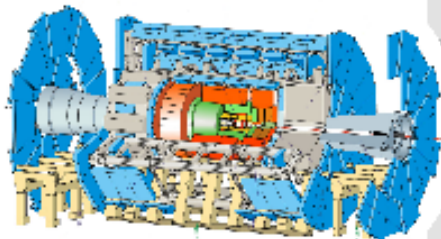




# MINERVA

## Visualising ATLAS with MINERVA

The event display shows the same event from 3 different views





# MINERVA MASTERCLASS

- Interactive event display  
zoom or pick on track for momentum ....
- Success in Masterclass requires support of many volunteers
- Feedback vital for development
- Comprehensive Twiki
- Recent feedback very positive
- Atlantis is used by physicists too

Outreach - "Higgs Hunters for the Day!!"

13 May 2008



School students get a taste of particle physics at the RAL MasterClass, scanning simulated ATLAS events and hunting for the Higgs boson.





# MINERVA on the Web

- Version for use by students, teachers and others on the web
- Cater for wide range of users eg individuals or school groups
- Provide quick entry to the material and early feedback to the user on progress
- Still working on the best way to structure it
- Some challenges remain with school firewalls



# Minerva on the Web



## MINERVA

[Home](#)[About](#)[Support](#)[Contact](#)

*Masterclass INvolving Event Recognition Visualised with Atlantis.*



**Start  
MINERVA**

**Masterclass  
resources**



MINERVA is a masterclass tool for students to learn more about the ATLAS experiment at CERN. It is based on a simplified setup of the ATLAS event display, Atlantis, which allows users to visualise what is happening in the detector. The aim is to look at ATLAS events and try to recognise what particles are seen in the detector. There are tutorial events, then a selection of events to categorise and finally a search for the Higgs! The project is a joint venture between the Rutherford Appleton Laboratory (RAL) and the University of Birmingham.

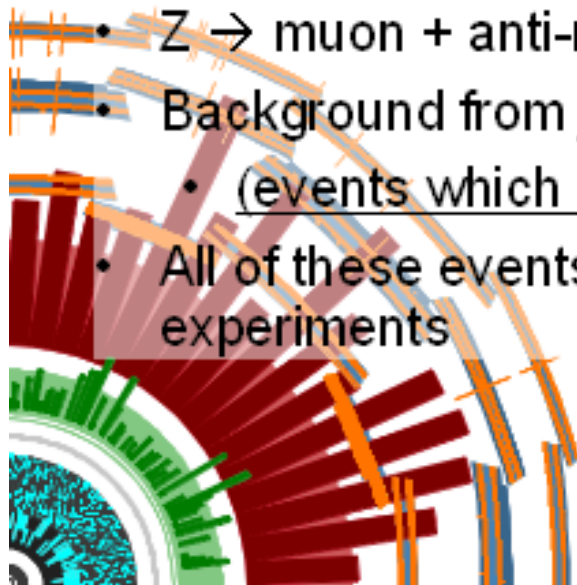




# Aims of the exercise

- Identify electrons, muons, neutrinos in the ATLAS detector using the Atlantis event display
- Types of Events (particles produced in one collision):
  - $W \rightarrow$  electron + neutrino (missing energy)
  - $W \rightarrow$  muon + neutrino (missing energy)
  - $Z \rightarrow$  electron + positron
  - $Z \rightarrow$  muon + anti-muon
- Background from jet production
  - (events which might look like W or Z event)
- All of these events are "well-known" processes from previous experiments

*\*The massive W and Z created in the proton-proton collision decay very quickly*



## MINERVA

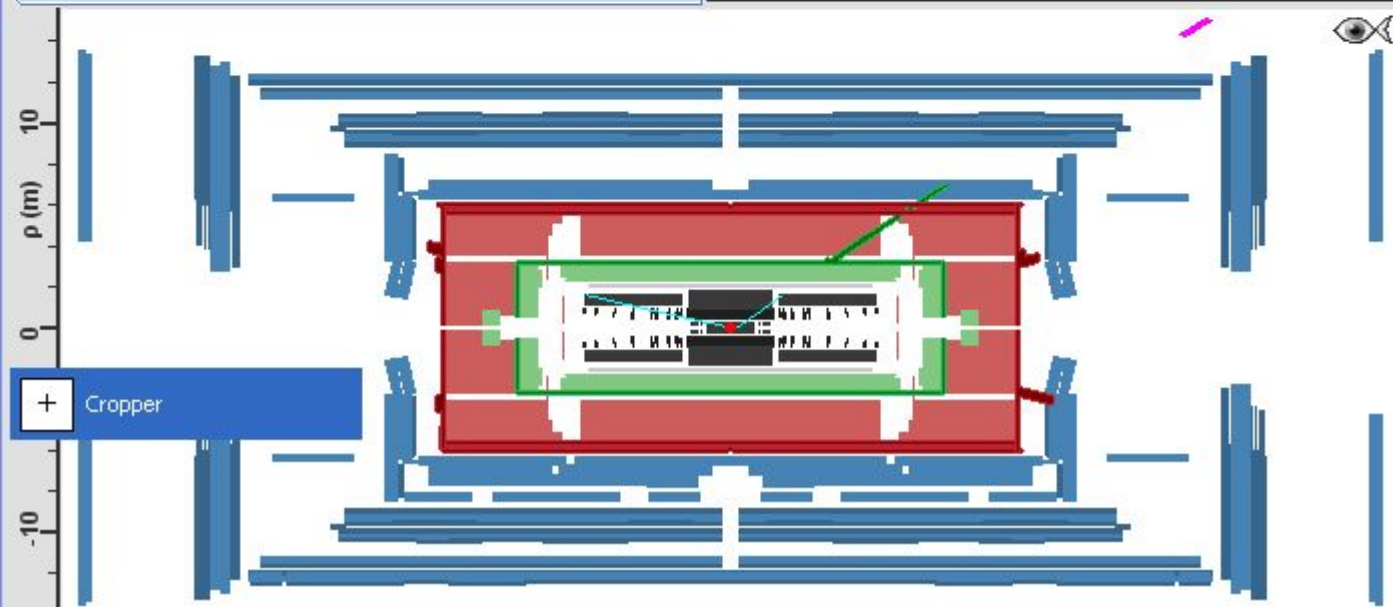
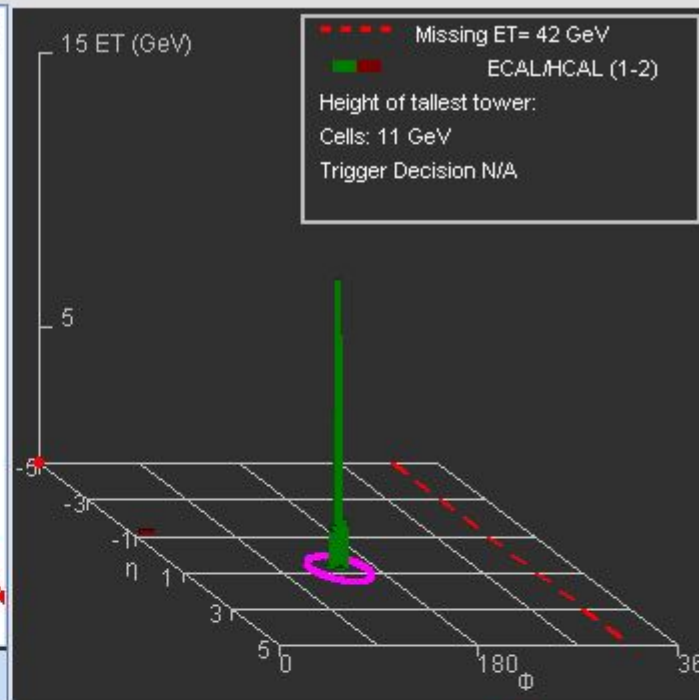
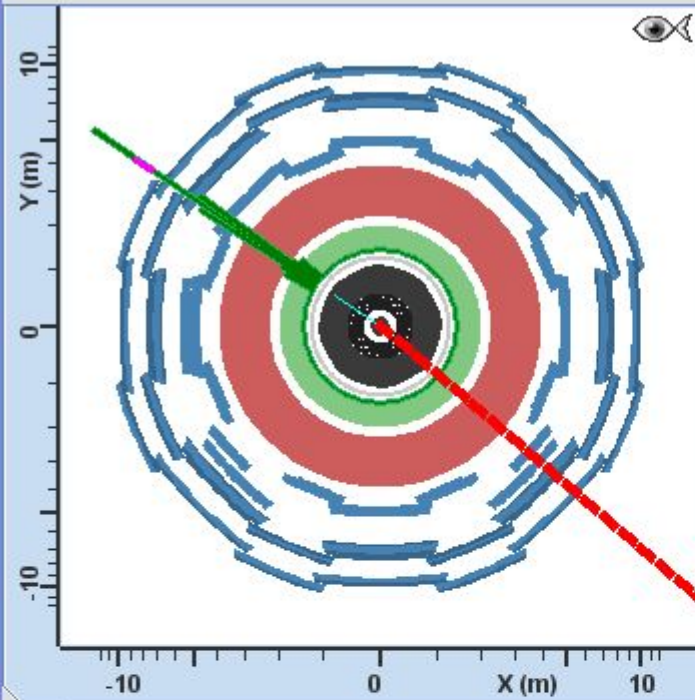
[cern.ch/atlas-minerva](http://cern.ch/atlas-minerva)



ATLAS

event:Tutorial\_Event\_1

Atlantis

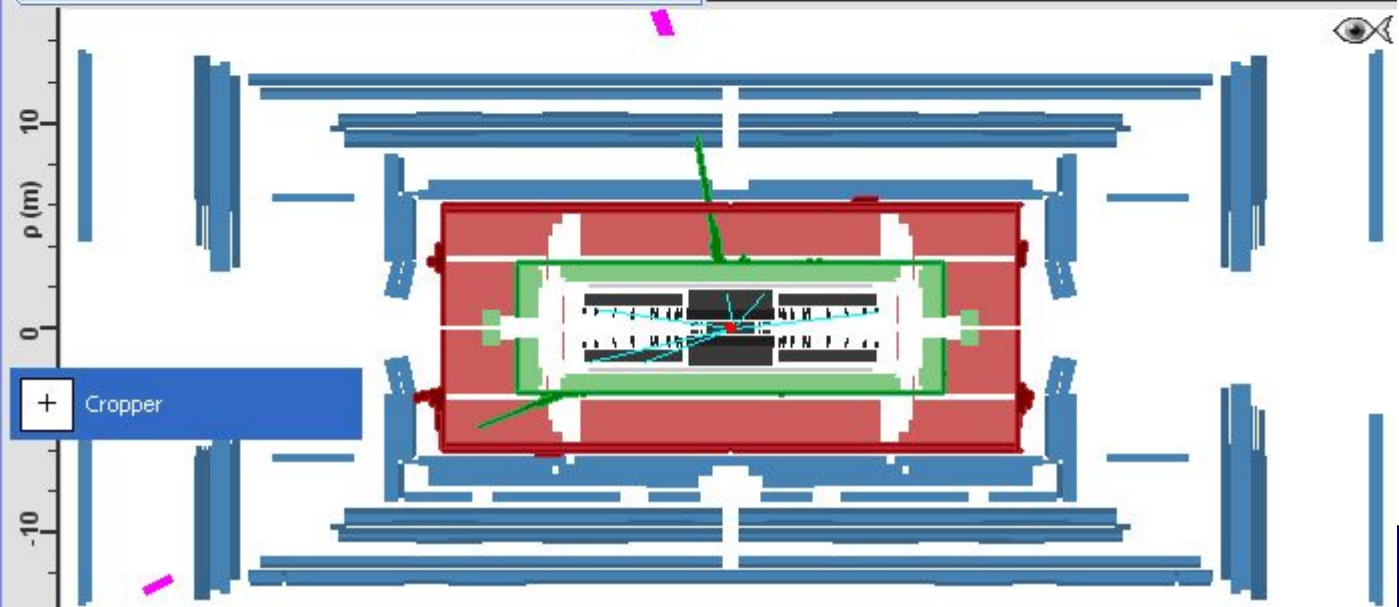
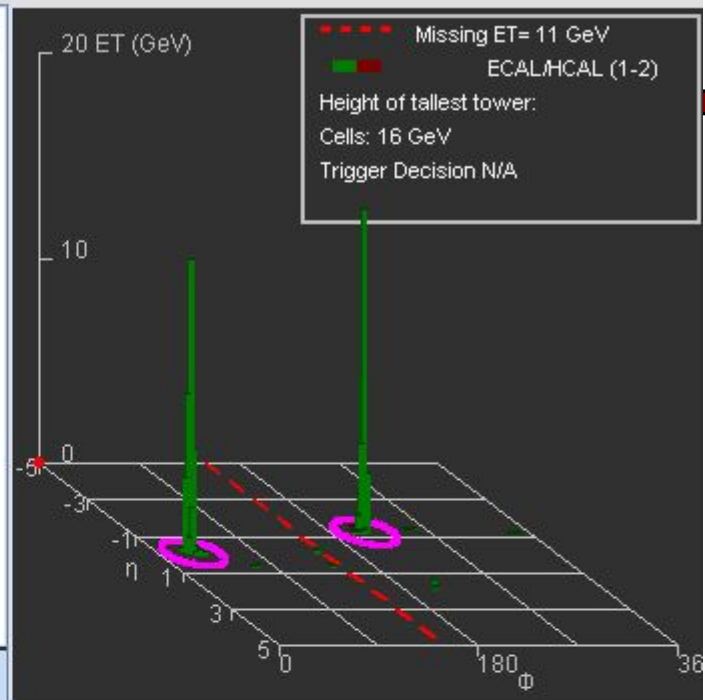
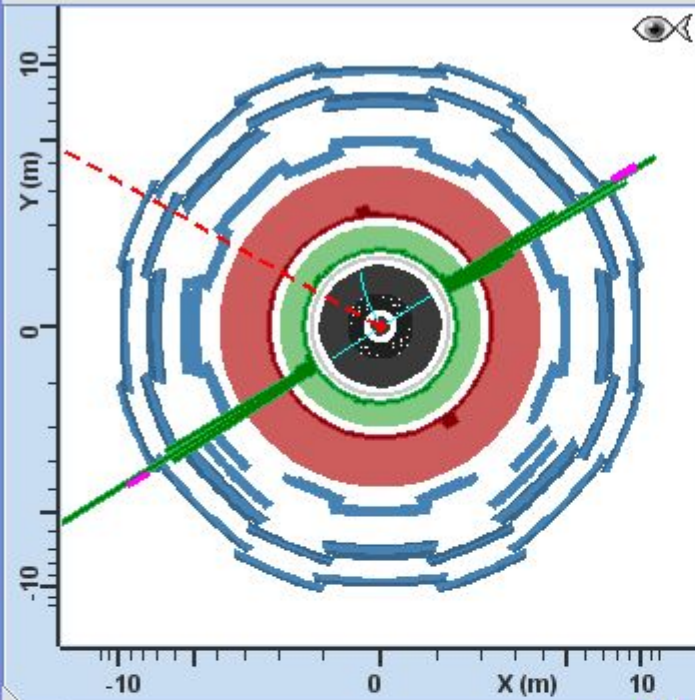




ATLAS

event:Event\_008

Atlantis







# Current work and plans

- Optimising and trialling the Minerva web version
- Studied by CERN High School Teachers group
- Developing scenarios for its use in schools
- Advanced sessions include invariant mass
- Considering other event samples
- Producing background material with ATLAS colleagues
- Please join us tomorrow morning if you can

