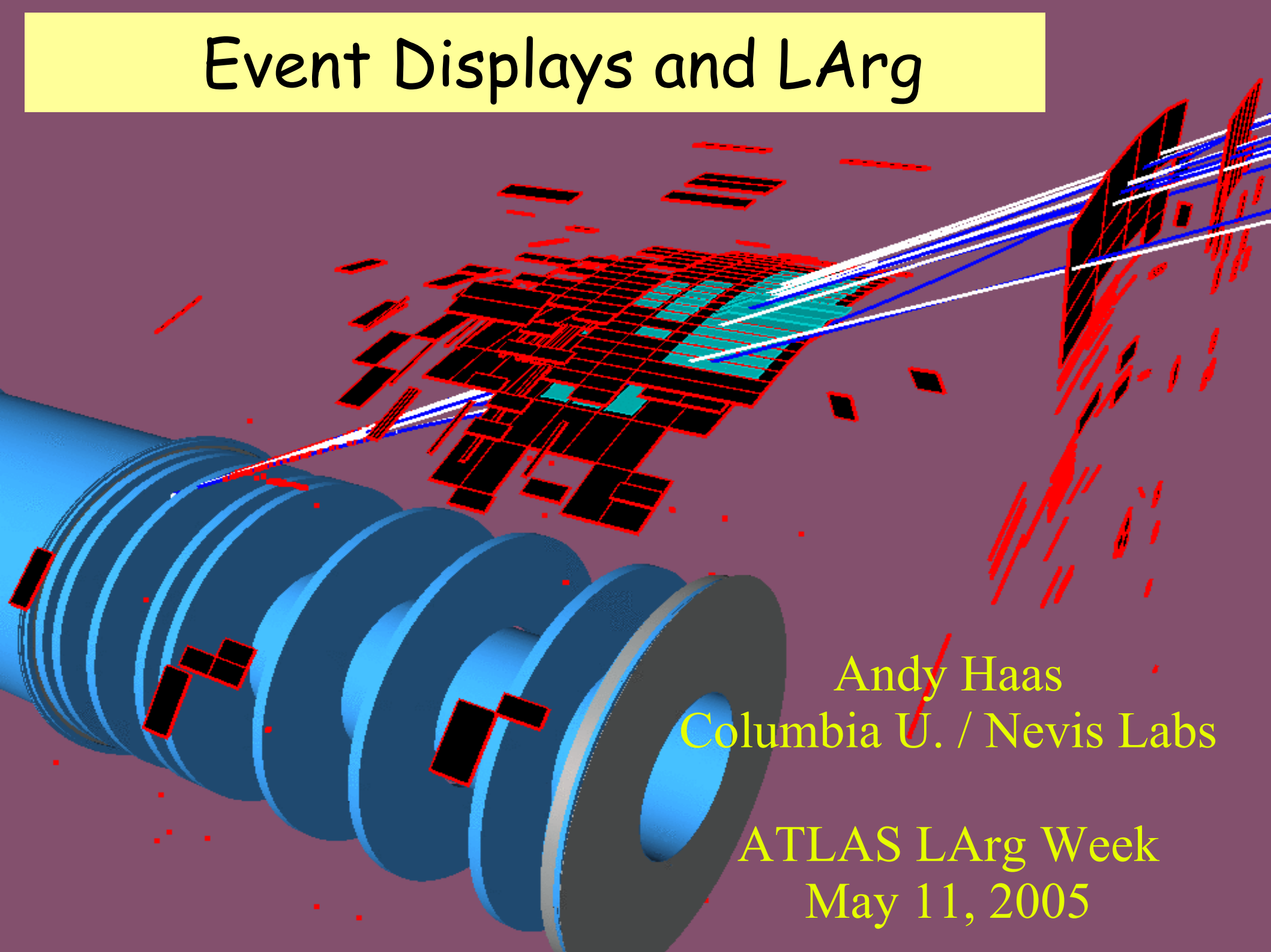
Event Displays and LArg



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ATLAS LArg Week
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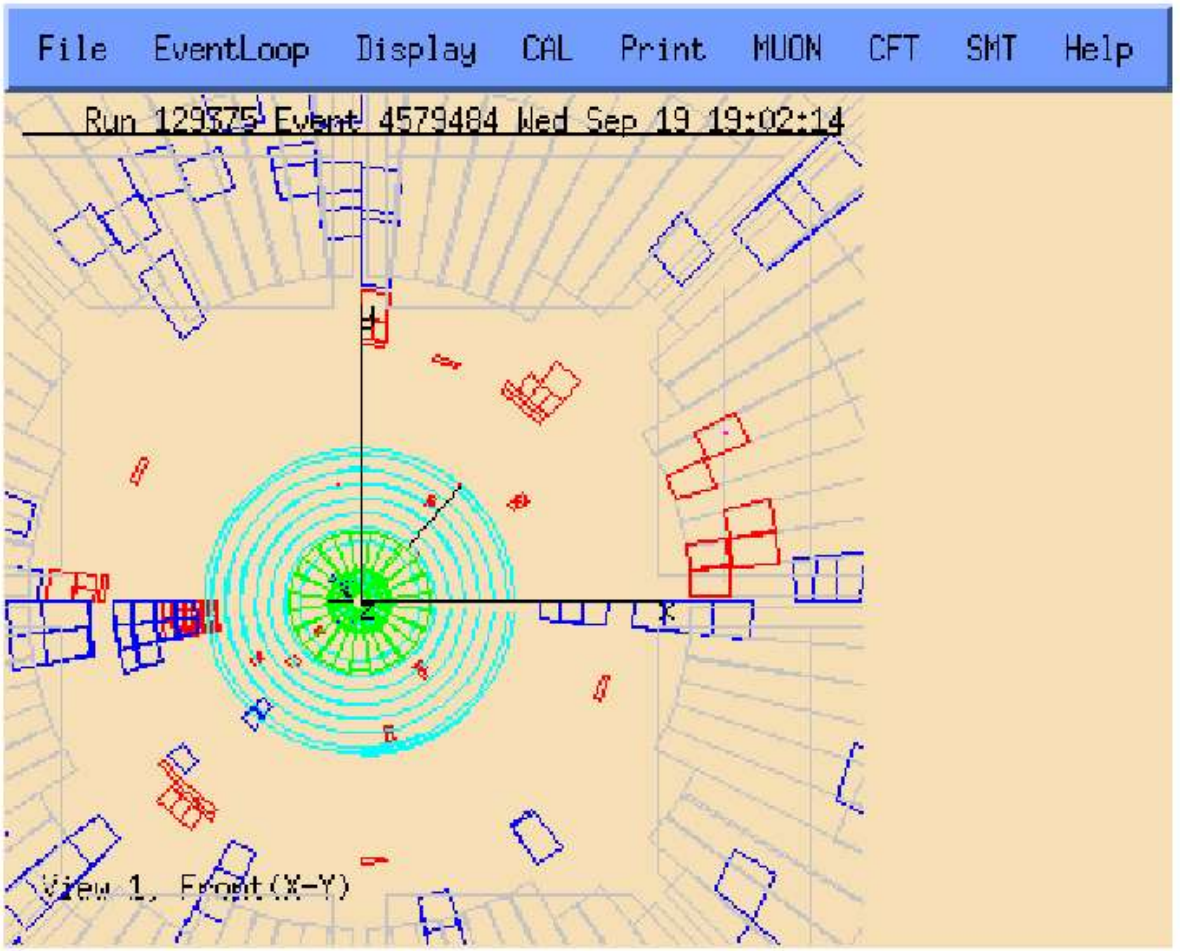
Introduction

- Displays are needed in various ways at different stages of the experiment:
  - Software development: understanding offline & trigger algorithms
  - During commissioning
    - Cosmics, first events, weird features of the first pb^{-1}
    - "Debugging" the geometry, readout, timing, calibration, dead spots, hot spots, warm spots, noise, etc…
  - Data taking: online monitoring, offline monitoring, weird problems
  - Physics: understanding event topologies, backgrounds processes
  - Outreach: picture of SUSY for the front page of the New York Times
- Thus displays must be flexible, and in fact multiple types of displays are desirable which are better suited for certain tasks
- LArg places certain specific needs on displays
  - Showing its detailed geometry, in barrel, EC, FCAL
  - Energy deposits & clusters in various ways by eta/phi/layer, em/had, time
  - Correlations with other detector subsystems for electrons, photons, jets, muons, etc.
  - Understanding of dead material for calibration, Brem., conversions, etc.

First electron at DO Run II

- A good example of event display use during commissioning
  - Tracking in only one phi-sector (pi/4), in fiber-tracker only
  - Manual scan of 81 Z->ee candidates from first 1 pb^{-1}
  - Saw a few EM clusters with high-pt, isolated, track matches, with good E/pT !

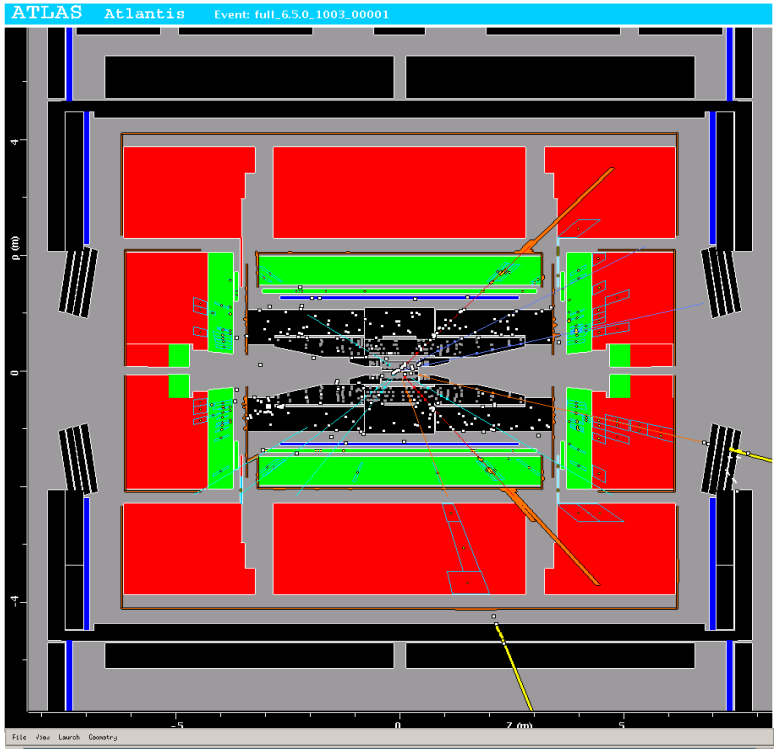


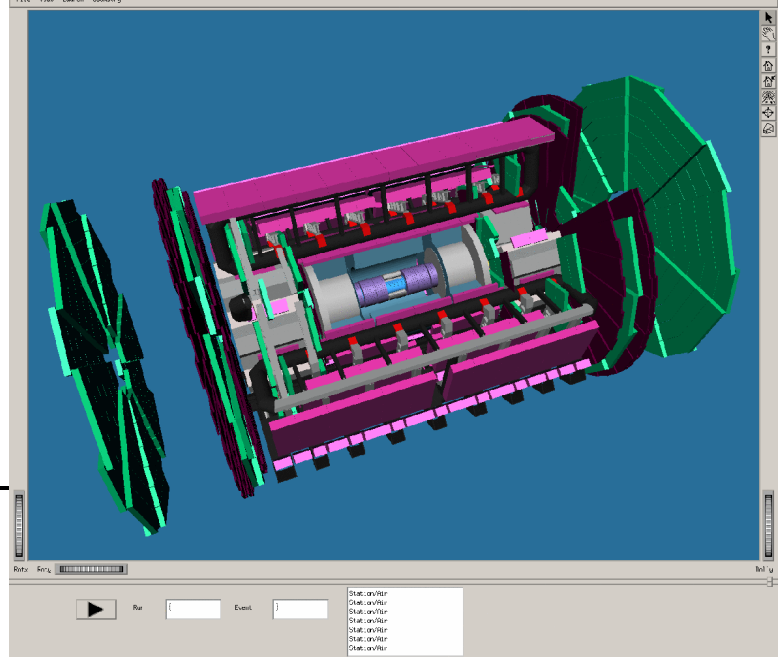
this the first electron ? $E_t/p_t = 0.95$

(We want the bottle of wine ....)

Where we stand (at ATLAS)

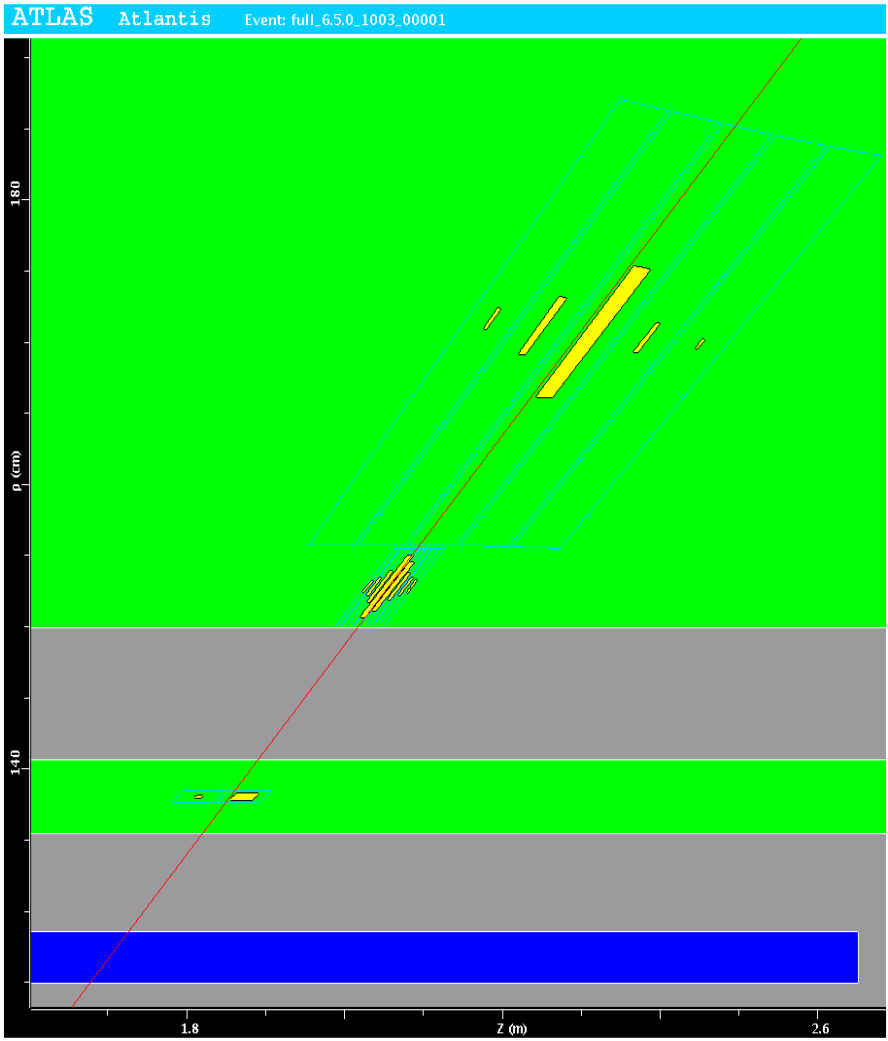
- **Atlantis**
  - 2D, multiple “data-oriented projections” : XY, eta-phi, RZ, Lego, etc.
  - Loosely coupled to Athena
    - Athena ->JiveXML (C++) -> XML files
    - XML files -> Atlantis (Java)
  - Strong support team (~5 FTE), very flexible configuration options, but harder to customize the software yourself
- **v-atlas**
  - 3D, like “virtual reality”
  - Tightly coupled to Athena
    - Can directly access any storegate info, change geometry, re-run algorithms, etc.
  - Supports a “plugin”-model. Easy to customize, but you may have to do work
- *The two approaches happen to complement each other perfectly!*



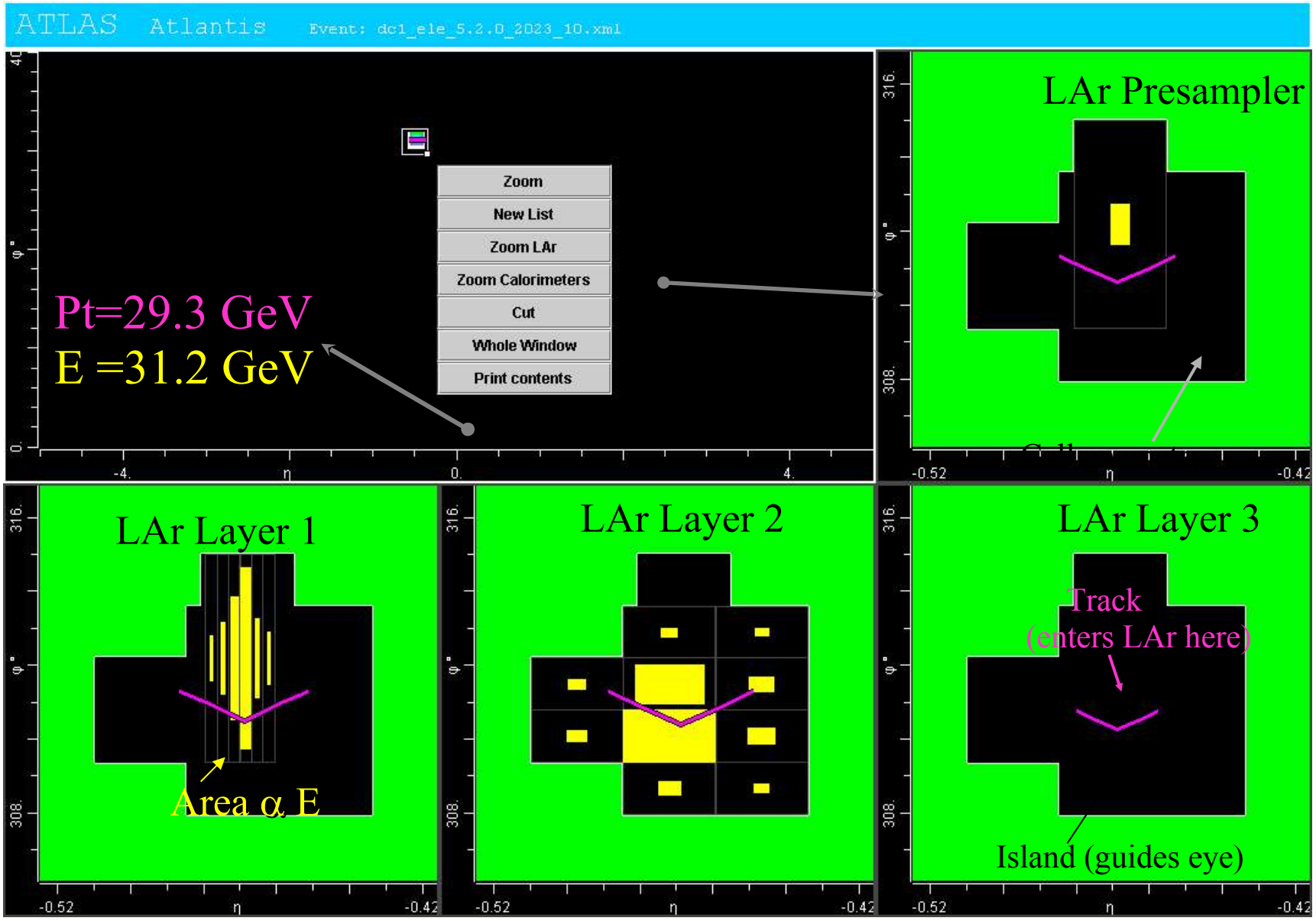


Understanding algorithms

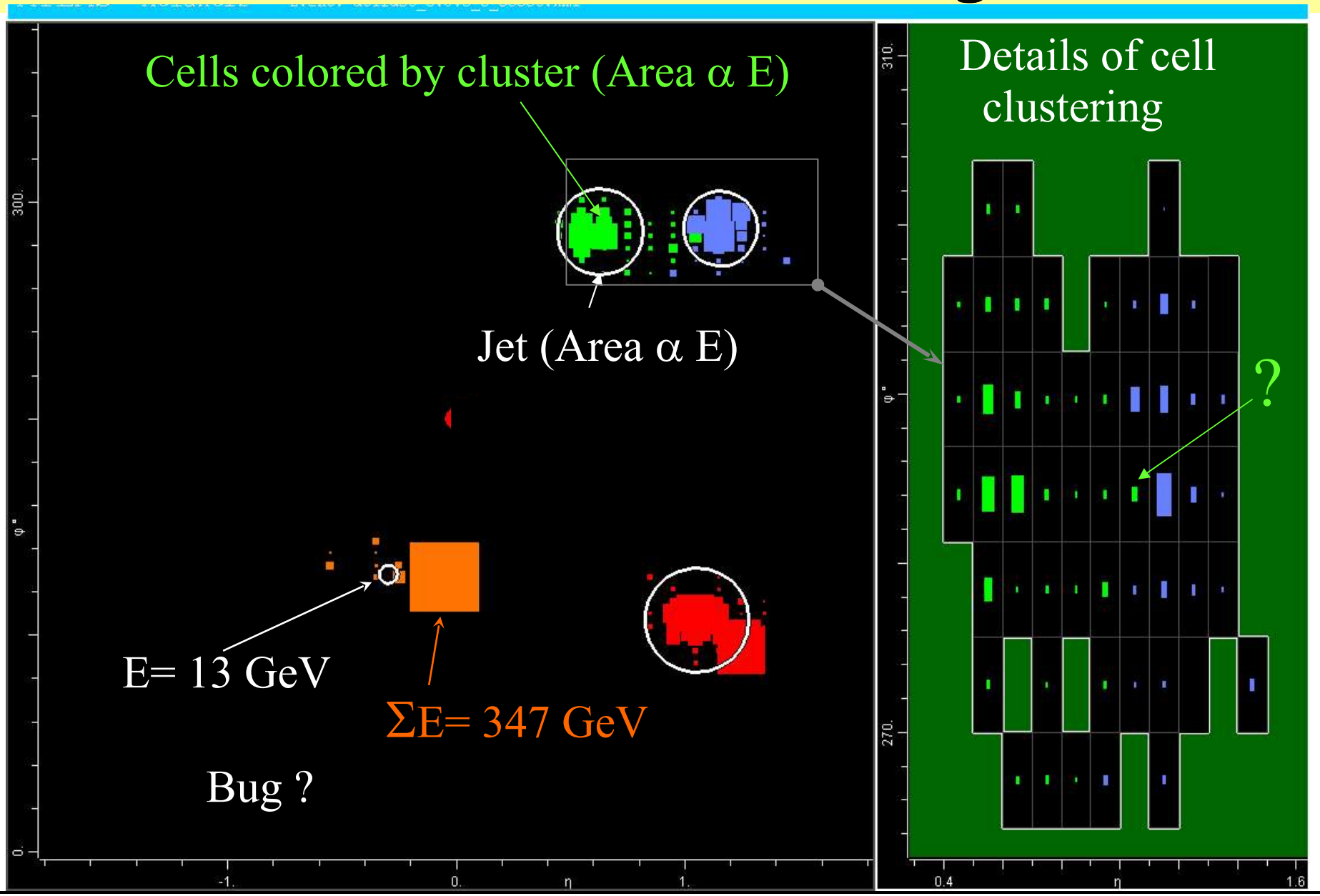
- Atlantis does pretty well here
  - Can show reconstructed objects (electrons, photons, jets, MET, etc.) and associations to cells in very clever ways
  - elec / photon reco. & trig.
    - match electrons / photons to EM cells in each layer
  - jet reco. & trig.
    - clustering of cells matched to jets
    - lego plot, with reco objects (jets...)
  - jet and em object ROI - trigger
- v-atlas is useful in a different way
  - Can display all information, especially very detailed MC truth
    - Everything that's in StoreGate!
  - Can interact with Athena and re-run algorithms more directly



Atlantis v-plot for LArg

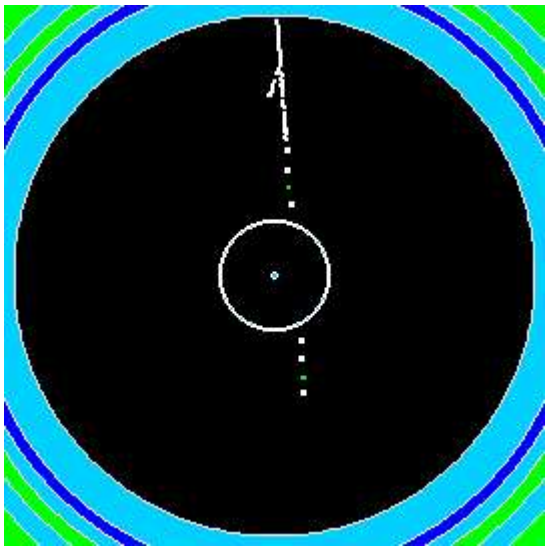


Cell clustering in Atlantis

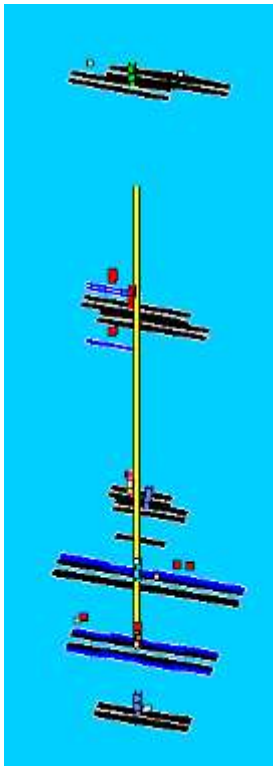


LArg commissioning

- Test beam:
  - Fully supported by Atlantis
  - Geometry also could be shown with v-atlas
- Cosmic runs:
  - Can see muon, tile, and LArg hits in either display
  - Timing information could be particularly interesting: currently not supported!
- First beam:
  - Good *flexibility* will be needed here
    - some parts of the detector may not be performing like current MC...
  - Displays should be well-documented and easy to use, since *everyone* will want to examine the first few 14 TeV events!

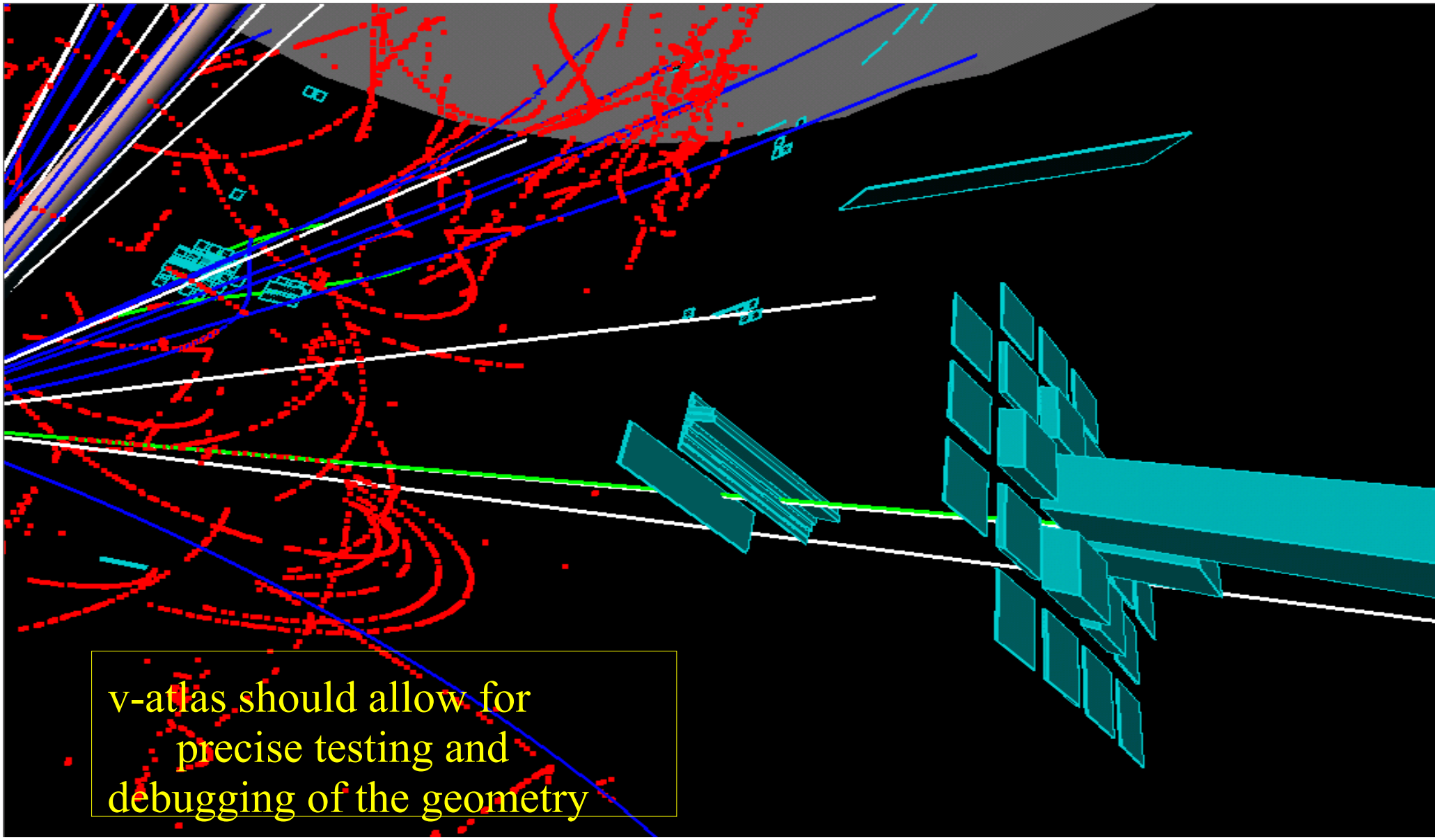


Simulated cosmic



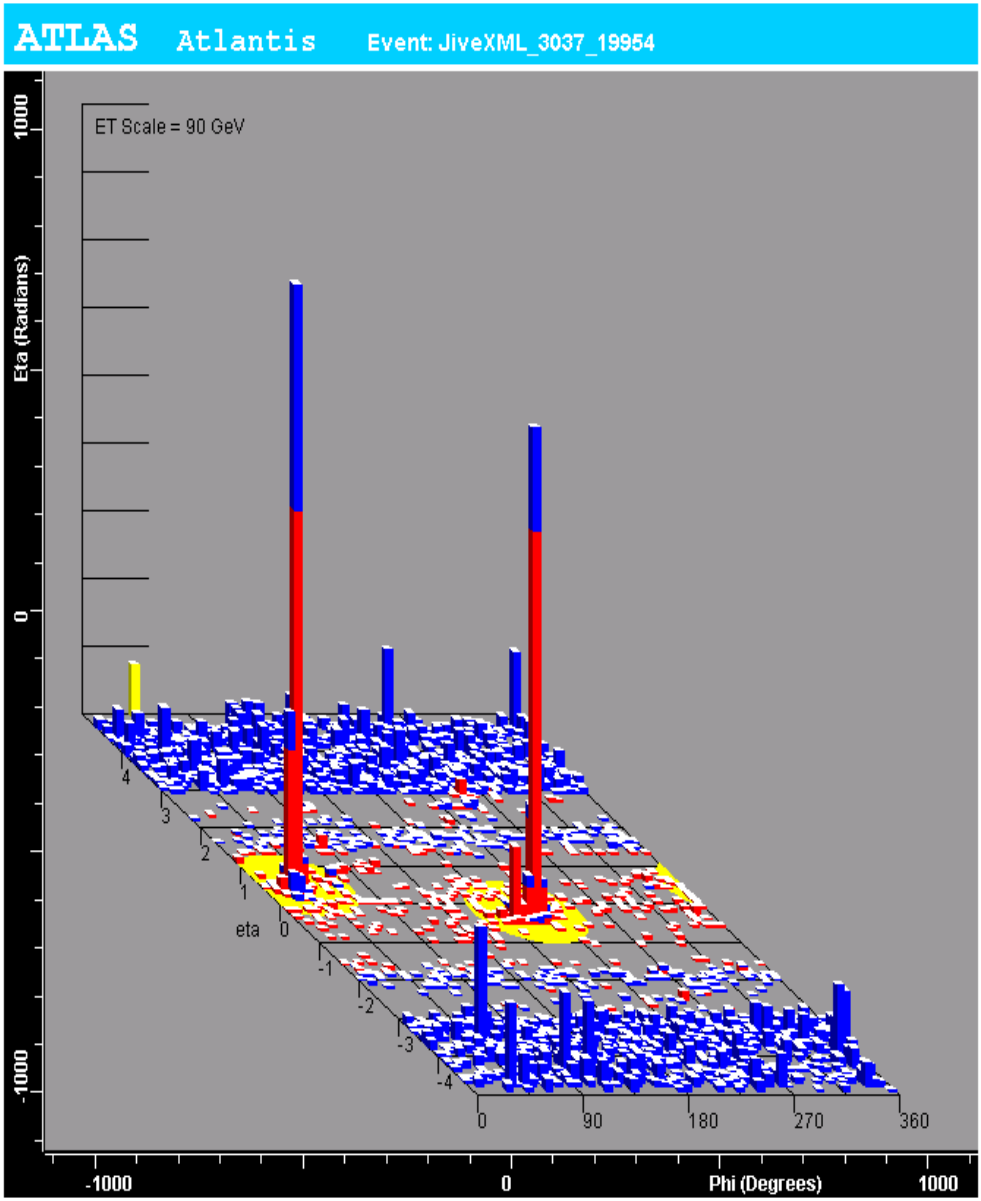
Testbeam

v-atlas : Commissioning of e/gamma



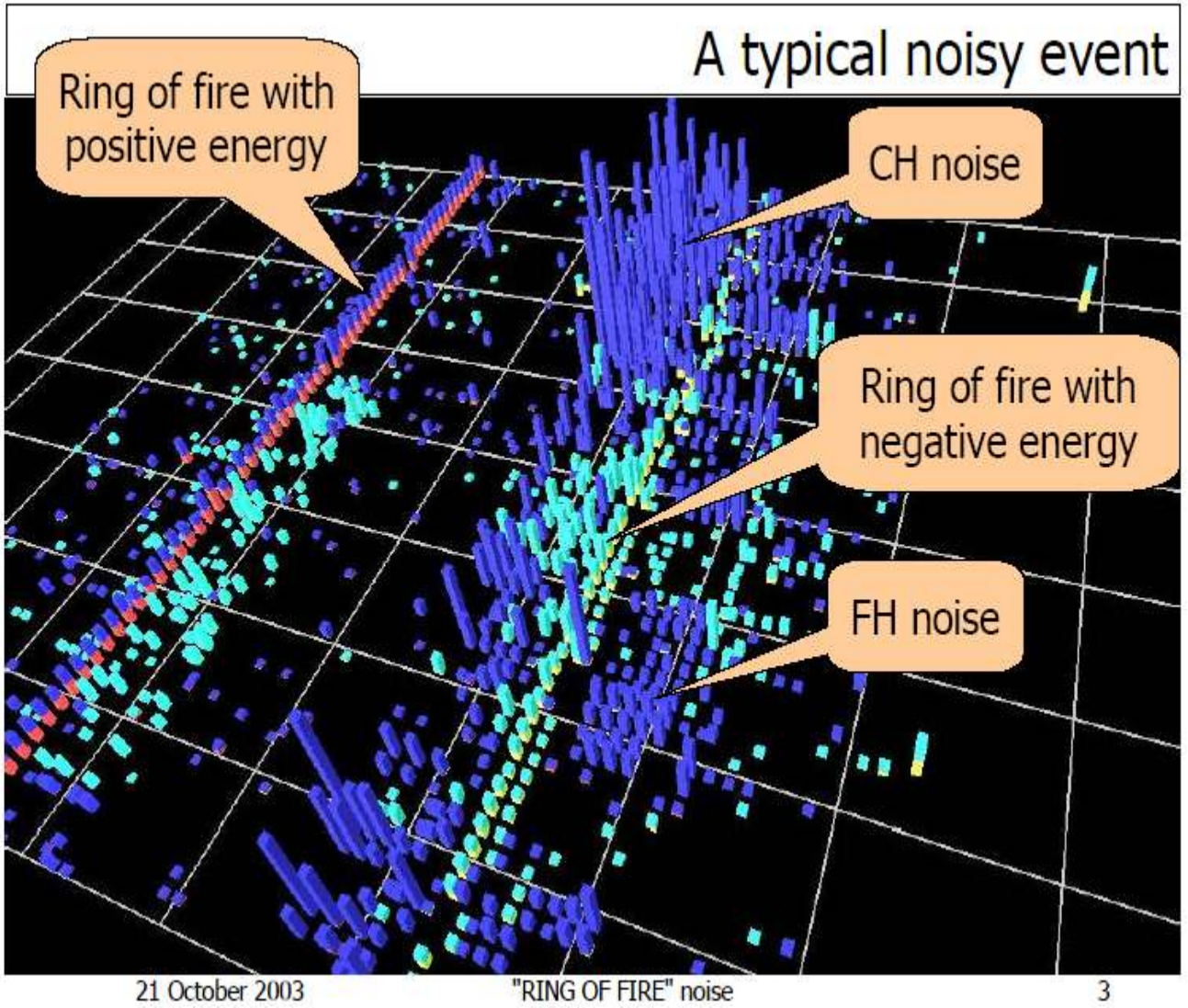
Online monitoring displays

- Trigger information should be watched closely
- Larger views allowing shifters to spot anomalies -> lego plot
  - Can see from “across the room”
- Select the right events to show in each display
  - A general monitoring issue
- Athena-based displays (v-atlas & Atlantis) can run as modules on a monitor data stream
- Atlantis has a special client/server mode, connect to the Athena server from your laptop, and browse online events
- A webpage of “today's cool events” could also be set up



"Ring of Fire" at D0

- A good example of why you want an event display for online monitoring
  - These noisy events with similar noise patterns seen in the control room at D0
  - Shifters would log when the problem occurred
  - Grounding problem? Eventually went away, and could be corrected for offline.



Event display plans

- Upcoming v-atlas workshop
  - Goal is to write a lot of code, support more 'physics' objects
  - Useful for LArg
    - more physics quantities from reconstruction / trigger
      MET / Jets / e / gamma ?
    - timing info?
    - polishing of calibration hits
  - We need someone from LArg !!! Volunteer, please!
- Atlantis worklist
  - More trigger info, timing info
  - Lego: clusters, separate by layer
  - Better EC display in XY projection, layer by layer, etc.
  - New eta-phi drawing types, cells by color / intensity, etc.
  - New color scales in general, normalizing different calorimeters
  - Better display of jets, reco e/gamma, etc.

Summary

- Basic functionality is already excellent
  - Two displays are under heavy development and are well supported: Atlantis & v-atlas
- Working to make sure the online event displays will fulfill our needs
- Web page on event displays for LArg will be available
  - LArg-specific information, instructions, advice, configurations
  - Links to and information about more general event displays, for online -> physics
- Some LArg-specific functionality can and will be improved
  - Send me your requests, questions, comments!
    - Andrew.Haas@cern.ch
  - The evolution of the LArg part of these displays will largely be driven by *your* input