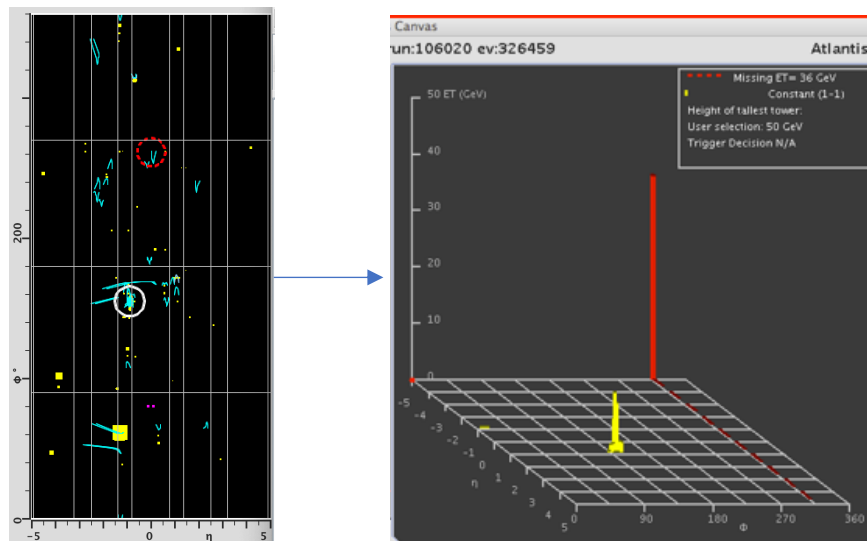


## Features List

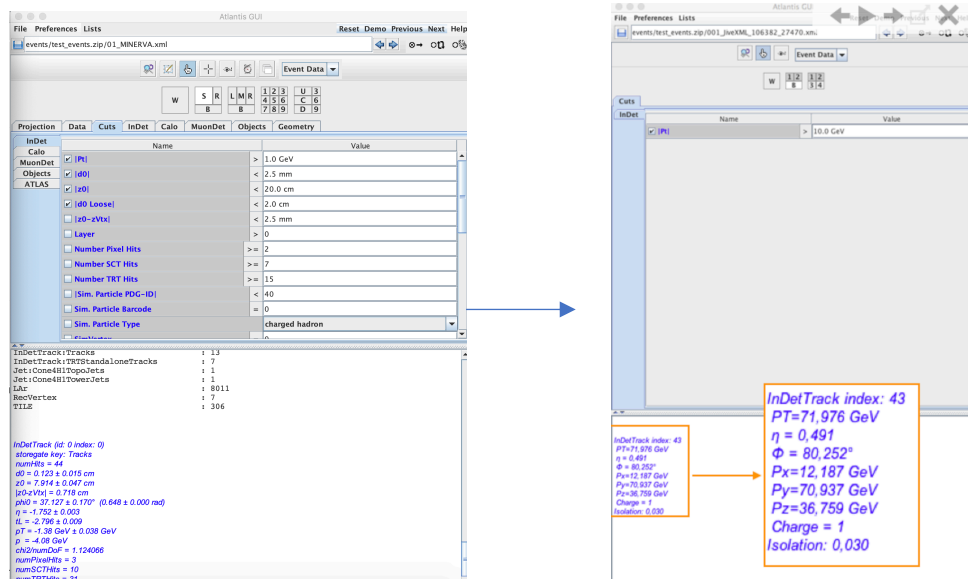
If arrow is pointing from a picture, that picture is what the program **actually shows**.  
If arrow is pointing to a picture, that picture is what the website  
(<https://atlas.physicsmasterclasses.org/en/index.htm>) says the program **should show**.

MINERVA:

- Lego Plot only in 2-D
- Lego Plot doesn't show Missing ET box

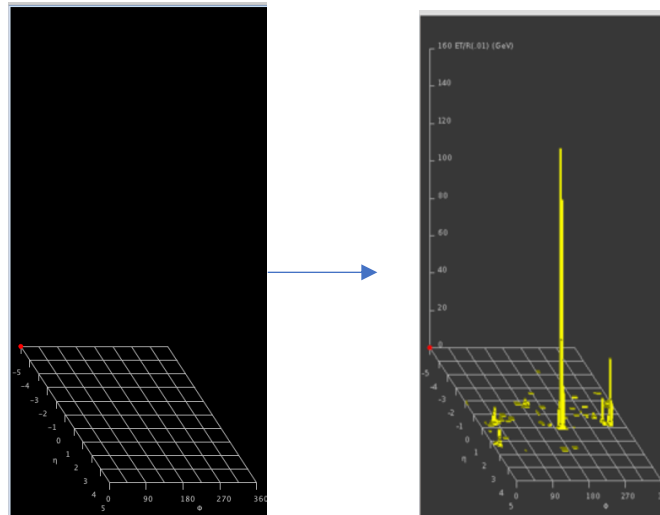


- Charge and Isolation numbers not shown in the information box.

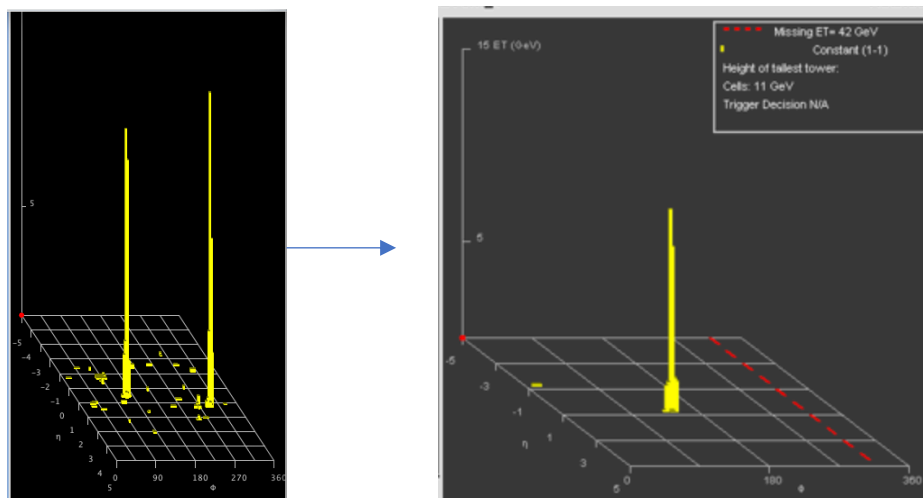


## HYPATIA:

- Lego Plot Inactive after initial launch of the program. Need to load an exercise file first to activate the plot.



- Lego plot doesn't show missing ET box



## Comparison and Contrast of MINERVA and HYPATIA Event Displays

### Comparison:

- Both Hypatia and Minerva have essentially the same side view and cross-sectional view of the detector.
- Both Show vertices of collisions.
- Both have the same Control Window.
- Both have generally the same colour scheme.
- Both can load the same format of files (data).

### Contrast:

- Only Minerva can show angles between two tracks.
- Only Minerva has a 2-D Lego Plot.
- Only Minerva can show Charge and Isolation numbers after selecting a track.  
(Bugged: doesn't show)
- Only Minerva shows jets as white cones in the Canvas Window.
- While in Minerva the Missing ET is shown with a red arrow, in Hypatia it is shown with a red dashed line.
- While in Minerva one has to click on the missing ET's red track to see the missing ET, in Hypatia one can see it automatically in a separate window (underneath the previous event button). (Bugged: both should show missing ET box in lego plot)
- Only Hypatia has a Track Window where one can see some physical information on the selected track, as well as identify the track and move it to the invariant mass table for further analysis.
- Only Hypatia has an Objects Table which shows tracks of strong signal objects from the event.
- Only Hypatia has an Invariant Mass Table Window.
- Only Hypatia has a built in histogram function for the tracks in the invariant mass table.

## **Why is Hypatia Better?**

Generally it can be said that Hypatia event display is more useful in identification of particles than Minerva due to its mathematical nature. Here are a couple reasons why Hypatia is better.

First reason is that Hypatia comes with the Track Window and Invariant Mass Window, as well as a built-in Histogram Function. Being able to view the selected tracks and compare them in the Track Window makes identification process easier. In addition the histogram function can map the invariant mass tracks for further analysis, hence providing a broader understanding of the events taking place.

Second reason that Hypatia is better is the existence of the Objects Window. This is very useful as it automatically shows strong signal objects once you have clicked on the selected tracks, making them easier to analyse and identify.

## **Why is Minerva Better?**

Even though Hypatia is more mathematical in its nature and allows to work with more physical quantities, Minerva has some very important tools that can only be accessed through it. Hence Minerva is the better event display when it comes to the tools provided.

These are the Isolation and Charge numbers, as well as the 2-D version of the Lego plot. Some events require the isolation numbers to confirm the type of decay happening, while it is also sometimes more convenient to look at the 2-D version of the Lego plot rather than 3-D.

In addition to this, one very important tool of Minerva that cannot be utilised in Hypatia is the opening angle calculation between two tracks. This can easily be done in Minerva and is very useful when identifying particles and events.

## **Conclusion:**

In my opinion Hypatia is more experimentally tuned for work with identification of particles and events. Hypatia can be used for work with the Track Tables and Invariant Mass Tables, as well Histograms. On the other hand when it comes to identification, and more parameters are needed to be known, it would be more convenient to switch to Minerva for the same event and note down the Isolation, Charge, and Opening Angle. Then go back to Hypatia and continue with the analysis.