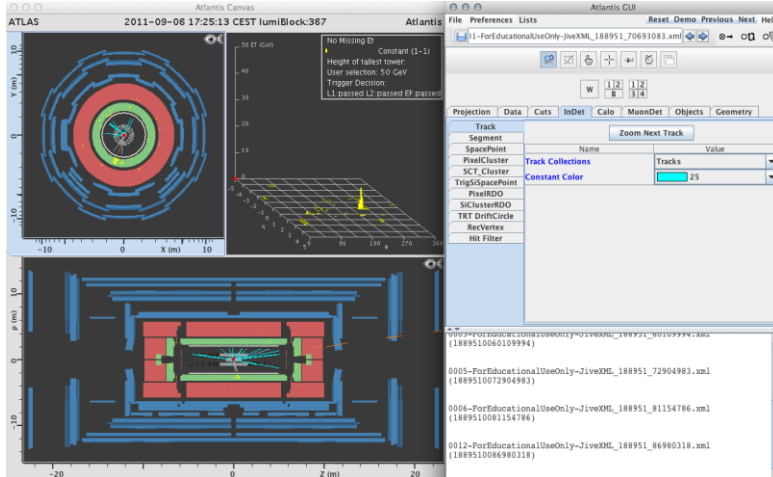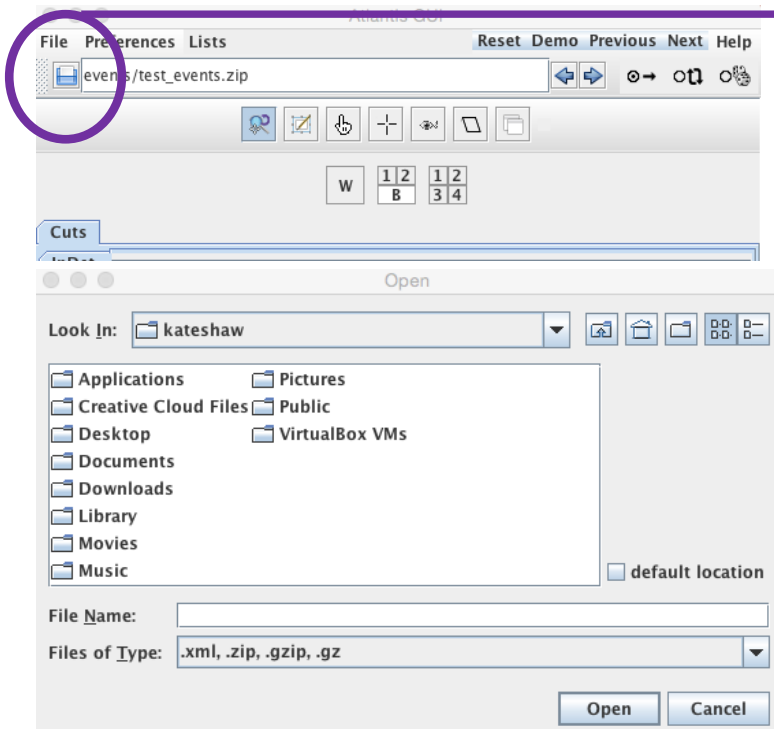# Introduction to MINERVA

## Exercise 2:



**Exercise2:**
Look through 10 events Look for our signal W boson

Your task is to distinguish between signal and background events. Here, signal events are events, which produce exactly one W particle. After identifying a signal event, you can determine whether the W particle has decayed into an electron or positron and an (anti-)electron neutrino or into a muon or anti-muon, and a (anti-)muon neutrino. Events with jets, Z particles, and top-quark pairs are background events.
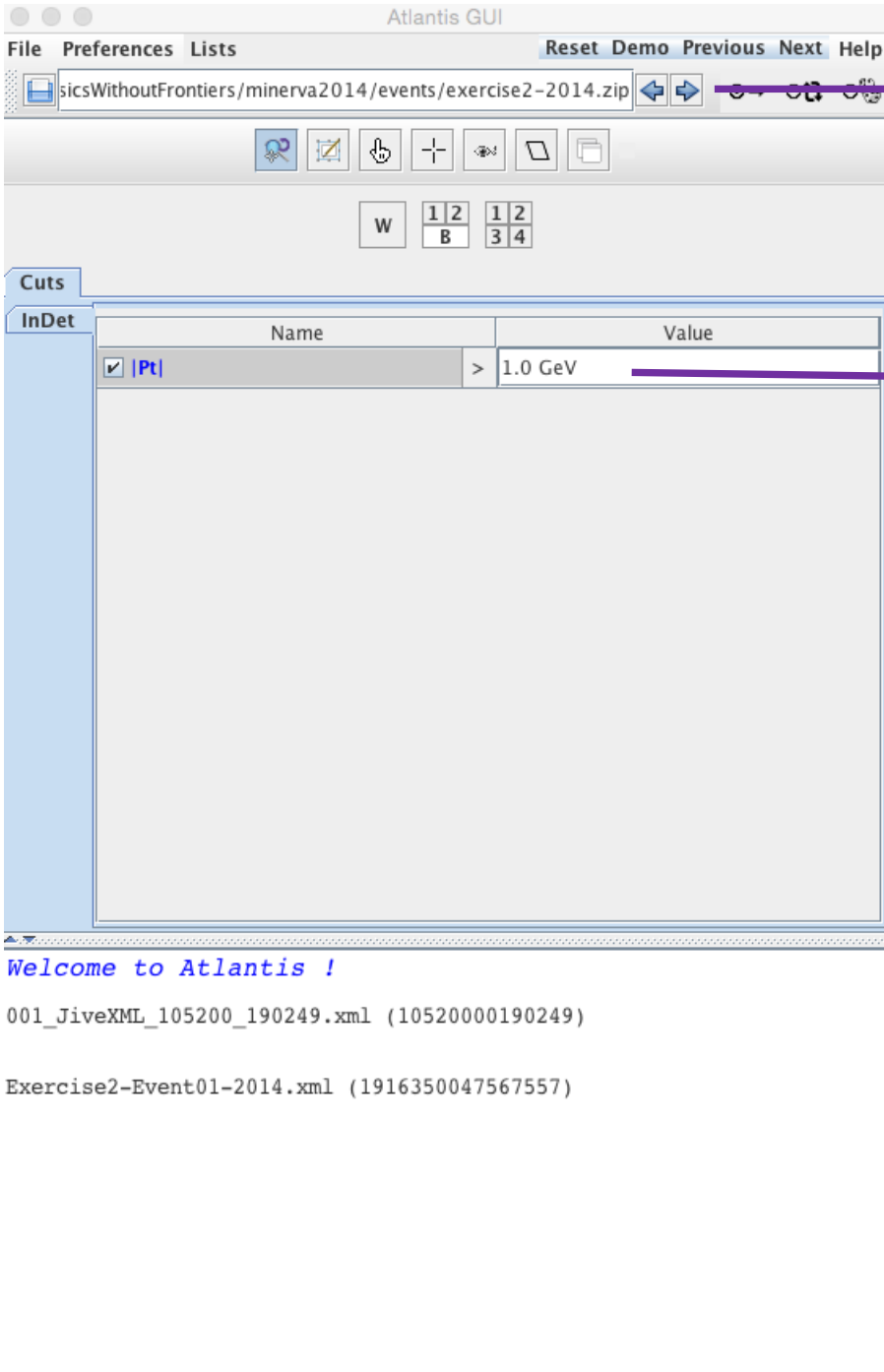
### To open exercise 2
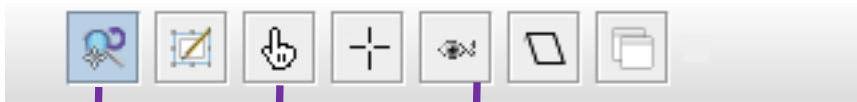


Click here



Go to Desktop/ MINERVA/ exercise2.zip

# Introduction to MINERVA



Right arrow to click to next event

Cut on the transverse momentum (Pt) of tracks
-> Change to 10 GeV
**-> Press enter**
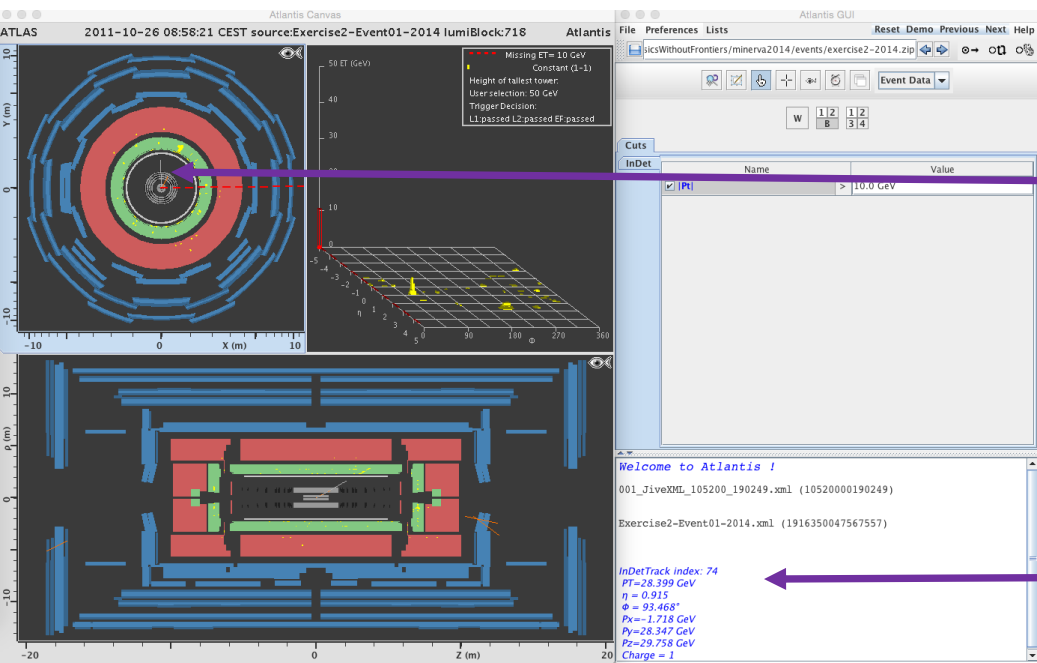See the number of tracks decrease



**ZOOM**:
1. Select
2. Use on the event display to Zoom in and out

**Finger**:
1. Select
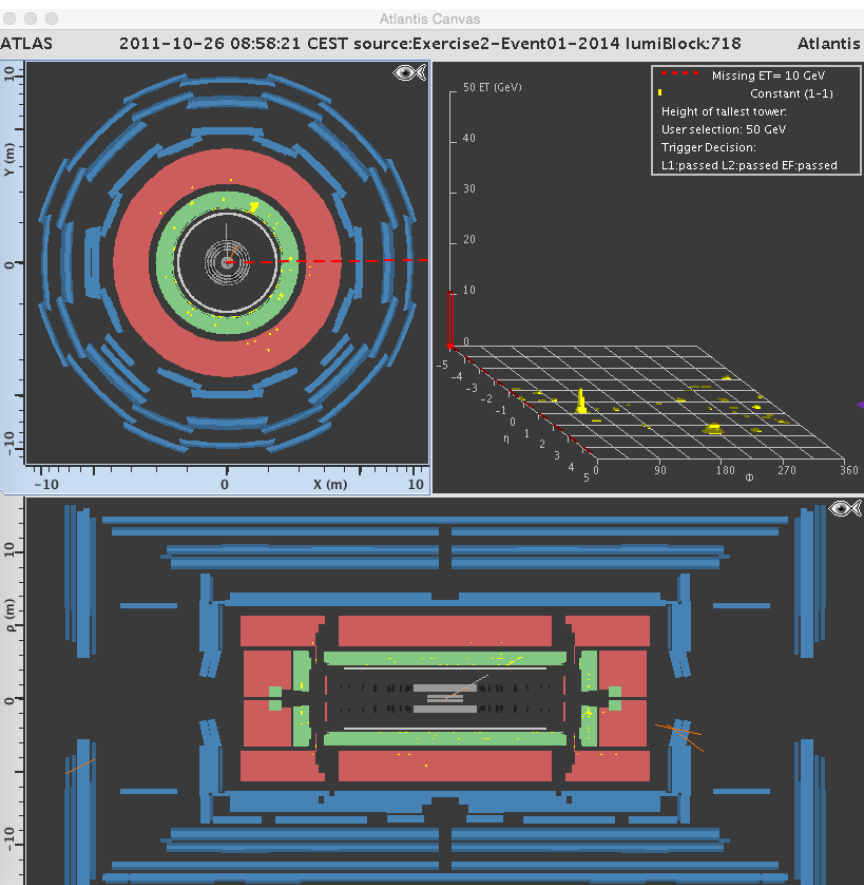2. Use to click on TRACKS to see information

**Fisheye**:
1. Select
2. To change the view to fish eye – nice but probably don't need much
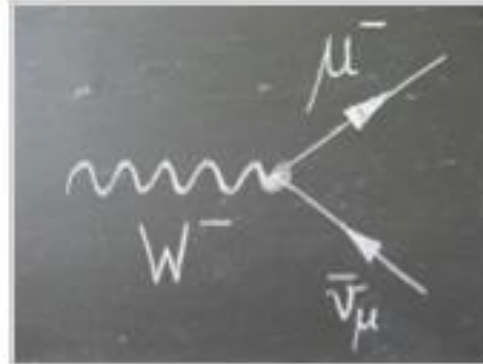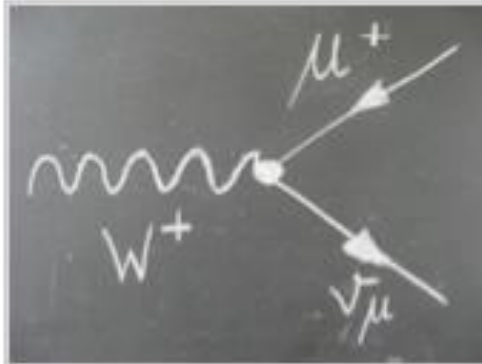
# Introduction to MINERVA
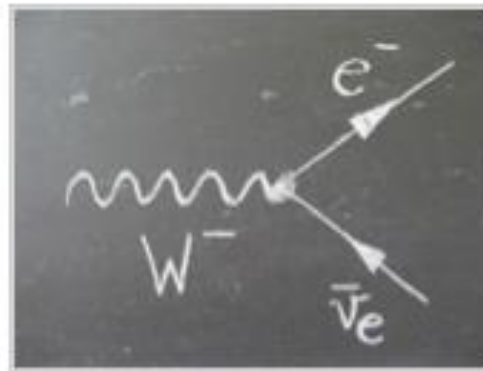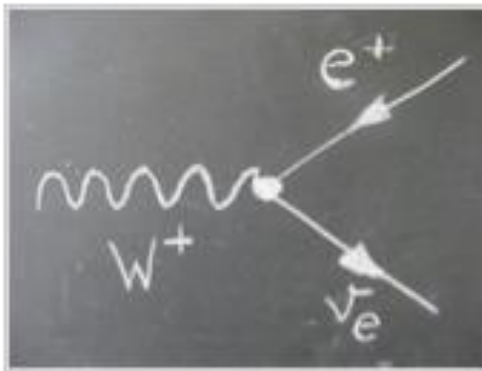


Click on track

Tells you charge and pt

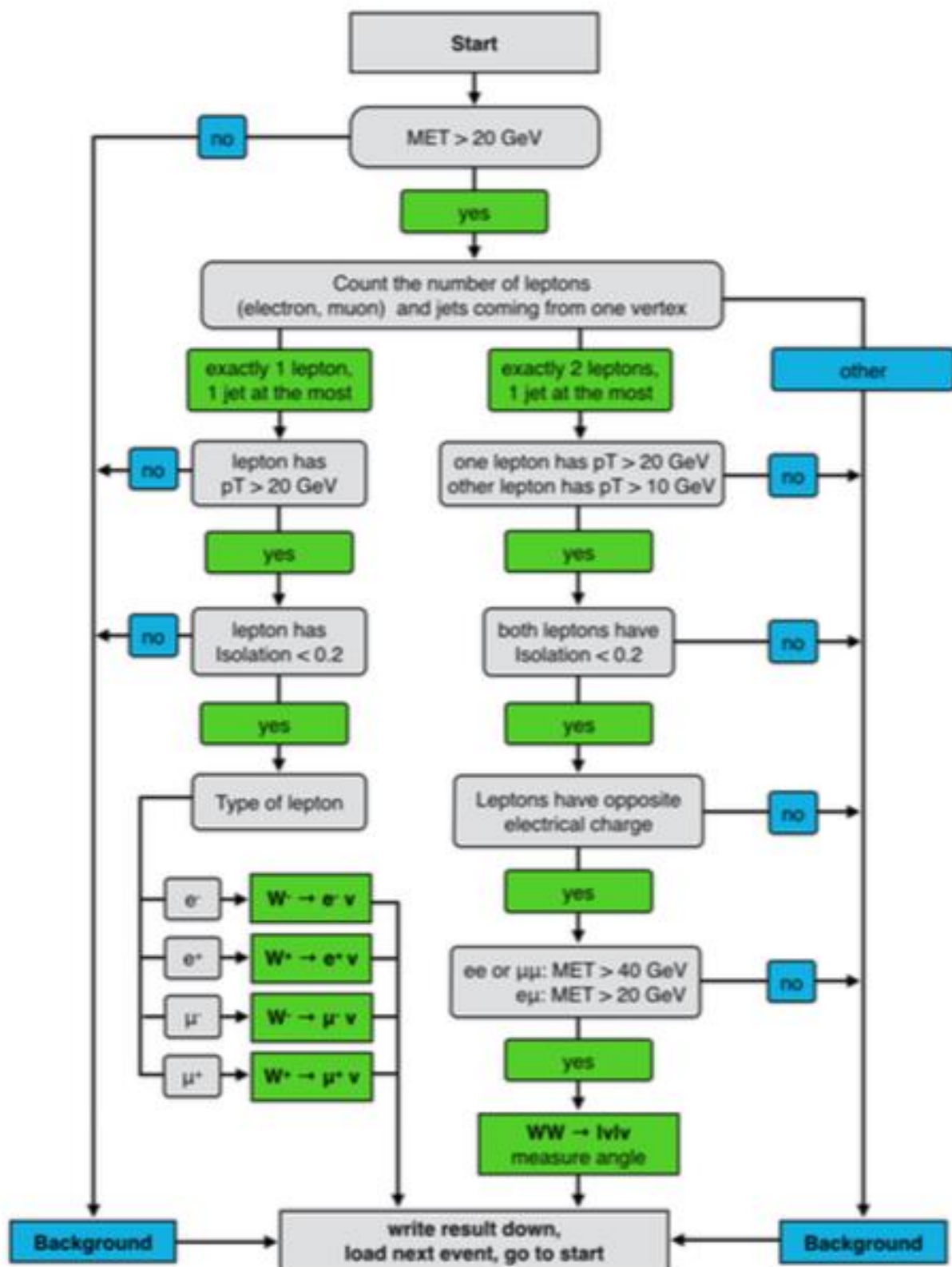

Tells you the missing energy (MissET)

Shows the amount of energy

# Signal



■There are 10 events to look at – each of a different type
- $W^+ \rightarrow e^+ + \nu_e$
- $W^- \rightarrow e^- + \nu_e$
- $W^+ \rightarrow \mu^+ + \nu_\mu$
- $W^- \rightarrow \mu^- + \nu_\mu$
- $WW^- \rightarrow l^- + \nu_l + l^+ + \nu_l$
- Background from jets, $Z \rightarrow e^+ e^-$, $Z \rightarrow \mu^+ + \mu^-$

# Cut Flow

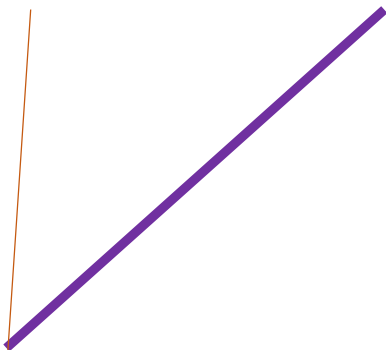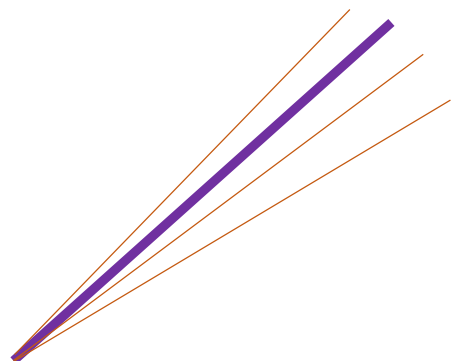# Exercise 2 Answers

| Event | $W^+ \to e^+ + v_e$ | $W^- \to e^- + \bar{v}_e$ | $W^+ \to \mu^+ + v_\mu$ | $W^- \to \mu^- + \bar{v}_\mu$ | $WW^- \to l^- + \bar{v}_l + l^+ + v_l$ | Background | |
|-------|------|------|------|------|------|------|------|
| 01 | ○ | ○ | ○ | ○ | ○ | ○ | Check |
| 02 | ○ | ○ | ○ | ○ | ○ | ○ | Check |
| 03 | ○ | ○ | ○ | ○ | ○ | ○ | Check |
| 04 | ○ | ○ | ○ | ○ | ○ | ○ | Check |
| 05 | ○ | ○ | ○ | ○ | ○ | ○ | Check |
| 06 | ○ | ○ | ○ | ○ | ○ | ○ | Check |
| 07 | ○ | ○ | ○ | ○ | ○ | ○ | Check |
| 08 | ○ | ○ | ○ | ○ | ○ | ○ | Check |
| 09 | ○ | ○ | ○ | ○ | ○ | ○ | Check |
| 10 | ○ | ○ | ○ | ○ | ○ | ○ | Check |

## Isolation

- Sometimes a track that looks like an electron might actually be on track out of many tracks of a jet.

- We know it is an electron if it is isolated, that means if it is not near other tracks

- To do the isolation cut, reduce the pT cut to 2 GeV, see if the track is isolated (if it is not among many other tracks). If it is then great its is isolated, if not it may be a fake electron and thus is not isolated.



isolated                                        Not isolated