

ZPATH – Note

Although the first master classes have worked rather well, we have noticed a few things that can be (i) improved and/or (ii) explained if they happen again:

- The students seem to find too many 4-leptons. There are only 1-3 events per 50 events and 34 in total!
- The students seem to misidentify electrons as photons. This leads to a peak on the di-photon invariant mass. This is a good indicator in itself and does not influence too much the rest of the di-photon distribution. However there is room for improvement.

1. Important remarks for tutors

Students should not rush to finish all their 50 events: quality better than quantity

The students must follow strictly the following points:

1. Only enter pairs of oppositely charged tracks
 - a. Only l+l- or l-l+. No l+l+ or l-l-.
 - b. Don't enter l+l+l+l- or l-l-l-l+, ... as 4-leptons
2. Do not forget to remove the e+e- tracks entered into the "Invariant Mass Window" in order to test photon conversions.
 - a. To remove a track, click on it and click on "Delete Track" in the "Track momentum Window".
3. Do not enter further tracks as electrons (non-pointing or conversions) when physics objects are already entered as photons.
4. For electron track candidates, only enter the track information, not the physics objects in addition.
5. Tell the students that they only expect (1 to 3 max) 4-lepton events in their files.

The following cuts may help the students to make good choices

6. In general use Pt cut of 5 GeV for tracks (to be efficient to 4-lepton events), and 10 GeV otherwise.
7. To improve the quality of tracks, enable the cuts on "Number of SCT hits" and "Number of Pixel hits".
 - a. These cuts should be used as explained in the "instructions" sheet. However, we encourage the students to use them rather than entering blindly tracks, as they limit the number of wrong 4-leptons as well as reduce some of the conversions.
 - b. The drawback is that one loses the control over such rejected tracks, leading to some electrons misidentified as photons. This is where a peak (or clustering of entries) around the Z-mass in the di-photon invariant mass is a good indicator!

2. Additional remarks for the moderators

We kindly ask the moderators to read the section above.

If the observations made persist, we ask them to briefly explain why the students might

- see a peak ~ 90 GeV in the di-photon invariant mass
- have too many 4-lepton events than expected
- have entries outside the resonance regions in the di-lepton invariant mass