Questions and answers - Maria Elena Monzani Lecture

The following questions were submitted through Google Form. Some may have been answered in the Q&A session already. Nevertheless, we request our lecturers to provide written answers here for the benefit of those who could not attend that session. Thank you!

Slide “LZ screams”. What are the ~horizontal black stripes? For example around y ~ 3.25. If I understand correctly, this is the dataset before the selections on the next page, so they are not artifacts of selection cuts.

Those events (below the NR band) are above-the-anode gas events. They are removed by two types of cuts: a) Top-bottom asymmetry (see slide 38 - “cluster 4”); and b) setting the max time for the S2 NOT at the very beginning of the event (shown in slide 39).

As for your actual question, I don’t believe we ever figured out why these events have bands in S2 like that. More on the above-the-anode gas events is at this presentation. Given that production mechanism, I wouldn’t be surprised if there was some “counting” effect for the electrons produced above the anode. But we would need to investigate.

Slide “WHAT KIND OF S2 ANOMALIES SHOW UP?”. I don't understand how we actually figure out that the right-side signal is actually background from unresolved multiple scatters rather than signal. Is the role of AE here to focus the physicist's attention and then it is up to the physicist to decide - however they decide - whether it is S or B?

We do a combination of things, actually. When a new type of anomaly shows up, we inspect the events with the LZ event viewer (see for example a presentation here and a demo here). The visual inspection will give us an insight on what the anomaly is.

Then, if we notice that the anomaly is produced by a reconstruction issue, we go back and fix the underlying code. If the anomaly is a detector effect, we can develop new cuts that target this class of events specifically (again, see the presentation above).

Finally, in the case of multiple scatters, we can compare the resolution found with the AE to the resolution of the “standard” position reconstruction algorithm (which is an updated version of the tool described in this paper).

Slide 41. What's the energy cut off for unresolved multiple scatters by the autoencoder?

The autoencoder project is very much proof-of-concept at this stage. We don’t really have a good sense for the energy cutoff (if any). The more interesting factor will be the TIMING resolution for the different methods which we can use to separate multiple scatters. But those are important questions and we should explore this method further.