

Questions and answers - Josh Bendavid Lecture 2

The following questions were submitted through Google Form. Some / all 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!

Page 2. Why don't we use hadronic decays to measure W mass? It does not suffer from missing neutrino.

The dijet cross section at the LHC is so large compared to W production that the background would be overwhelming. In addition a calibration of the jet energy scale at the required level of accuracy would be extremely difficult/impossible. (n.b. It is possible to reconstruct a hadronic W peak in $t\bar{t}$ events or at very high transverse momentum in the "boosted" topology, but these are still not relevant for a W mass measurement due to statistical and calibration accuracy limitations.)

Page 11. What are weak modes?

"Weak modes" are variations of the geometry, usually with a particular coherent pattern across the detector such as increasing the radial spacing of all layers, or rotating one ring of tracker modules with respect to the rest, in which the variation is weakly constrained by the global alignment procedure. Typically this occurs because a particular variation of the geometry is difficult to distinguish from a related variation of the track parameters. (ie a radial expansion of the tracker may be difficult to distinguish from a uniform change in the transverse momentum of all tracks entering the alignment procedure.)

Page 44. The first blue point appears to be higher than the first red point. Is this really the case or some kind of fluctuation?

This is really the case. The reason is that the "PUPPI" pileup subtraction algorithm shown here has been optimized for high pileup conditions and actually "over-subtracts" in the low pileup case, leading to a degradation in performance. If pileup subtraction techniques are going to be used for real measurements in the low pileup data, they will require dedicated optimization for these conditions (and there may still be challenges related to controlling the corresponding systematic uncertainties)

Page 50. Can you explain how to read the upper right plot? I am confused. .

This plot is showing the relative fraction, as a function of transverse momentum, of different particle types at reconstruction level (in this case as reconstructed and classified by the CMS particle flow reconstruction). This can be compared to the plot on the left which shows a similar breakdown, but using generator truth information in Monte Carlo. Note that the breakdown into individual hadrons at reconstruction level is not possible, since the detector has limited particle identification capabilities (ie not possible to distinguish the type of hadron beyond determining its charge in most cases).