SCENARIO 1 (SUSY discovery)

The ATLAS and CMS experiments at the CERN LHC have just discovered evidence for "SUSY". This is the theory of Supersymmetry that has been postulated to resolve various [mathematical] problems in the Standard Model of particle physics and could also explain "Dark Matter" that makes up about 25% of the universe. These are early results, so the scientists are being cautious about making definitive claims, but there is a very high likelihood that the discovery is real.

(For reference, only about 5% of the universe is in the form of normal matter, i.e. stars, planets, etc.; about 25% is Dark Matter that could be explained by SUSY; and the remaining 70% is so-called "Dark Energy".)

More information

In this scenario, you are working on one of the two experiments and being interviewed about the SUSY discovery.

Both experiments have seen events with many jets and large missing transverse energy at a rate significantly above what is expected in the Standard Model. A rough estimate of the combined significance is 5.2 sigma, although each individual experiment only sees an effect of less than 5 sigma. More data will be needed before definitive claims can be made, but there is a lot of discussion in the physics community that has been picked up by the press.

In more detail, the results in your experiment are based on two zero-lepton analyses, i.e. analyses that veto isolated leptons. One analysis considers events with 2–6 jets, while the other one requires 7–10 jets; in both cases large missing transverse energy is required. Each of these two analyses has a significance of about 4 sigma.

You don't have much detail about the analysis of the other experiment, but you are aware that a signal excess of about 4.5 standard deviations is observed. You know that this is from a zero-lepton search requiring high jet multiplicity and large missing transverse energy.

You know details that you are not allowed to discuss in public from your own experiment. A search looking for events with two same-sign leptons plus missing transverse energy has a significant excess of more than 5 sigma by itself. However, there are some issues with the background determination method that are still being sorted out.

SCENARIO 2 (LHC magnet problem)

The LHC is restarting after the current long shutdown and the first high-energy collisions have just taken place, but there is a technical problem…

One of the superconducting magnets that steer the particle beams around the LHC tunnel has failed and cannot be powered any more. It is not yet understood exactly what went wrong, but the magnet will have to be removed from the LHC tunnel and replaced with a spare one. This is a long and complicated procedure.

More information

In this scenario you are doing an interview that was planned some time ago, before the problem with the magnet occurred. You had been expecting to discuss the success of the LHC restart and the prospects for new physics discoveries in Run 2. However, as a result of recent events, the emphasis of the interview has changed.

One of the superconducting dipole magnets in the LHC accelerator quenched unexpectedly and, for reasons that are not understood yet, it has developed a short circuit. The damage is localized to a single magnet, so this is not an incident on the same scale as in September 2008 when many magnets were affected by the explosive release of helium that propagated down pipes linking different magnets in a chain. Nevertheless, it is very unfortunate that the restart of the LHC did not go according to plan, and there is concern that there could be latent faults in other magnets that will show up when operations resume. One should remember that extensive repairs had to be made to magnet splices following the 2008 incident, even in parts of the machine that were completely unaffected by the incident.

In more detail, the replacement of a dipole magnet with a spare one is a major operation. The tunnel is 100 m under ground, the dipoles are about 16 m long and weight about 35 tons. To remove a magnet it is necessary to break the vacuum in the beam pipe, and it will take time to restore the vacuum once the replacement magnet has been put into place. Furthermore, it takes a long time to cool the part of the machine that will need to be warmed up during the operation of replacing the magnet.

Realistically, it will take months before the LHC will be back in operation, even if everything goes smoothly with the repairs. In the meantime, there will be no beam in the LHC, and the experiments will be unable to collect data.