$Z/W + jets$ production at the Large Hadron Collider (LHC): a comparison among different Monte Carlo generators

One of the goals of the first LHC physics will be to measure the $Z/W + jets$ production rates and the characterization of this kind of events. In the early phase of the detector operation these processes will be very useful for calibration purposes: in particular they will be very useful for the determination of the calorimeter system energy scale and for the calibration of the detectors in events in which undetectable particles need to be identified through missing transverse energy (missing E_t) signatures. Besides, these processes represent an extremely important background for many searches, such as Supersimmetry searches in the jets+lepton+missing E_t channel, and as such must be known very accurately.

In the last years the theoretical high energy physics community produced many programs, usually known as Monte Carlo generators or event generators, to simulate a variety of physics processes, producing simulated events according to the theoretically predicted distributions. The necessary starting point for a study of $Z/W + jets$ events is a comparison between the different Monte Carlo programs able to produce them. I'm currently working on such a comparison using the RIVET analysis tool. RIVET is a C++ library designed to produce distributions of many interesting observables, using different Monte Carlo generators; using RIVET it is possible to easily compare the outcome of different Monte Carlo tools as well as to compare the simulated distributions with data from experiments.

I'm currently working on the comparison of the SHERPA and ALPGEN event generators. For this purpose I setup an analysis in RIVET producing several plots of the most relevant observables. As an example Fig. 1 represents the p_t of the Z boson for different numbers of jets in the final state.
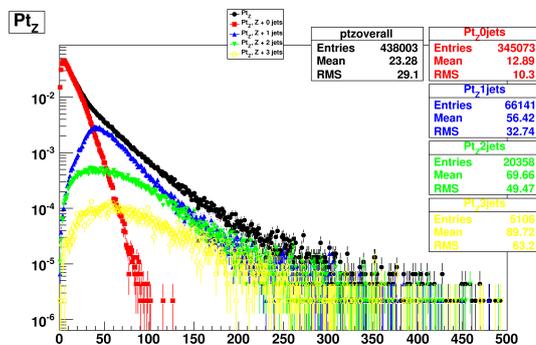

Figure 1: p_t of the Z boson in $Z+jets$ events. The black markers represent all jet multiplicity. The spectra for 0, 1, 2, 3 jets are also shown.

I'm also actively involved in the development of the package; I'm implementing new observables and I'm working on the interface of the package with the Monte Carlo generators.

This work is being very fruitful for my PhD research program, and it allows me to gain experience with the variety of Monte Carlo tools available for the production of LHC events, understanding the differences as well as the applicability limits of the different codes.