Proposal for dijet analysis

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Proposal

We would like to express our interest and plans for the measurement of the QCD inclusive dijet mass spectrum and angular distribution.

Time scale: We envision to provide a note by the end of summer, wherein we will use Monte Carlo to explore the main aspects of the measurement and its expected uncertainties. These include issues relating to generator and PDF choice, jet energy scale and resolution, $\eta - \phi$ variation of detector response and jet reconstruction efficiency, etc.

Physics motivation

This analysis will be a fundamental test of QCD. Even at $\sqrt{s} = 10$ TeV, we will be probing a distance scale of $\sim 10^{-19}$ m, about 5 times smaller than that of the Tevatron. This measurement will span a range of at least 2 TeV in jet p_T, extending considerably the direct measurement of the running of α_{s}. Testing perturbative QCD predictions in a new kinematic region will provide a powerful constraint to proton PDF's, which are a systematic uncertainty in all analyses at the LHC.

This measurement is also a prerequisite to search for new physics that have QCD as their main source of background. Numerous scenarios of exotic new physics – including excited quarks, Kaluza Klein towers predicted by extra dimensions, Technicolor-inspired states, heavy gauge bosons (W', Z'), and even String Theory – could possibly appear while examining these QCD observables.

Resources

Martina Hurwitz from Chicago has been a major contributor in developing the measurement of the dijet mass spectrum and angular distribution. She has reported on resolution effects, PDF effects, and calibration issues. As for the authors of this proposal, GC and EF have developed a technique to reconstruct jets in event of significant damage in the Calorimeter. GC has worked in validating QCD Monte Carlo. EF has contributed to studying PDF uncertainties and different jet reconstruction algorithms.

The authors of this proposal will be the main contributors to this analysis from the University of Chicago. Between now and the summer, GC (post-doc) will devote 50%, EF (Ph.D. student) 100%, and Professor JP 30% of his time.

We expect collaborators from other institutions to share interest in this analysis, and would plan to work closely with groups from Pisa and Upsala as well as any others expressing an interest. With the facilitation of the Standard Model group conveners, we wish to foster cooperation.