RESEARCH INTERESTS

Professional Goal:

- To be an experimental high energy physicist in a challenging post-doc position implied in data analysis and software development.

Physics Profile:

My research interests are in experimental particle physics: experimental investigation of the fundamental constituents of matter and their interactions using high-energy accelerators and powerful and large detectors based on advanced technology. Particle physics seems to be the most elegant and tangible description of how physics operates at the smallest scales. Our current understanding is expressed in the Standard Model (SM) of particle physics a theory of the strong, electromagnetic and weak interactions. This theory has been tested to very high accuracy with great success and explains almost all observed experimental facts. However, the SM is not expected to be a complete theory. For example, it doesn't explain the number of fermion families or their mass hierarchy. It also doesn't provide a unified description of all gauge symmetries. Compositeness models postulate constituents of the SM fermions and new strong dynamics that bind these constituents.

We search for quark compositeness by measuring dijet mass differential cross section in a few regions of rapidity magnitude ($|y|$) using about 3 fb^{-1} of data collected by the CDF experiment. The signal is expected in the region with small $|y|$. We also studied CMS sensitivity to quark contact interactions in the dijet final state using the CMS software framework for simulation and reconstruction (CMSSW). We found that for an integrated luminosity of 10 pb^{-1}, 100 pb^{-1}, 1 fb^{-1}, and 10 fb^{-1} CMS can expect to exclude at 95% CL a Λ value of $3.67, 6.461, 11.51$, and 14.31 TeV or discover at 5σ significance a Λ value of $2.69, 4.703, 8.694$, and 12.81 TeV, respectively. **Published in J.Phys.G36:015004,2009**.

Study of direct photon production in high energy hadronic collisions provides a clean tool for testing the essential validity of perturbative QCD predictions as well as for constraining the gluon distributions of the hadrons. This motivated me to study in detail the characteristics of single direct photon production in the kinematical regions accessible at the LHC regime. I also studied parton kT smearing effects in direct photon production at Tevatron centre of mass energy using CDF and D Run1 data. **Published in Phys. Rev. D., 67, 014016, Jan. 2003 and Phys. Rev. D., 68, 014017, July 2003**.

Physics at the Large Hadron Collider (LHC) requires extremely high performance detectors. The Compact Muon Solenoid (CMS) electromagnetic calorimeter (ECAL) has been designed to facilitate the discovery of the Higgs Boson. The most stringent requirements imposed on the electromagnetic calorimeter (ECAL) are from two photons decays of the intermediate mass Higgs Boson. But there are significant amount of background from the decay of pions into two photons. The Preshower in the CMS detector is incorporated to reject neutral pions in the endcap. The basic structure of the Preshower devices used in CMS are two layers of a dense absorber material (lead) followed by a Silicon microstrip detector plane. The precise shaping of the lead absorber in the transverse direction was still to be resolved. It was the requirements that all lead must be covered by Silicon sensors but it was unclear as to whether the lead should be shaped to follow the outline of the sensors or indeed to follow the outline of the crystals that are behind the Preshower.

The CMS Object-oriented (CMSOO) software was used for detailed simulation and analysis for transverse shaping of lead absorbers in the CMS Preshower. It had been concluded from the above studies that shape of Lead will follow according to dimensions of crystals in the ECAL endcap at lower eta ($\eta = 1.653$) and circular at higher eta ($\eta = 2.6$). This design of Lead absorbers in CMS preshower will improve the low p_T physics potential of CMS experiment at LHC. **Results has been cited in CMS Detector Physics TDR, Vol. - I (Page No. 150)**

Computing Profile:

I always have a fond interest in computing. I was the **system administrator** for University of Delhi, High Energy Physics group from 2000 - 2006. I **conducted the Simulation Workshop** for CMS, $16^{th} - 24^{th}$ Feb., 2004, held at the Center for Detector & Related Software Technology, University of Delhi, India.

The CDF experiment has generated more than 4 fb^{-1} of raw data. We need monte carlo (MC) data for detector understanding and physics analysis. The present framework for MC data production is non-scalable and don't utilises any grid tool for its data management. A framework has been proposed for transportation of MC data from remote sites to Fermilab. This framework relies on integration of SAM with Storage Resource Manager (SRM). We used SAM because it is the default data handling framework of the CDF. The reasons for using SRM are to avoid unnecessary complications which may arise from different Storage Elements (SE) at different remote sites. The proposed framework will soon be integrated in the CDF central analysis framework(CAF). **Abstract submitted to CHEP 2009**.