India-CMS meeting, Sept 27-28, 2007
University of Delhi - Delhi

An effort for

Joining International India-CMS Collaboration

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Guru Nanak Dev University at a Glance

One of the fastly growing youngest University in India (Established in the year 1969)

One of the largest University in Norhern India
(Nearly 160 Colleges, two regional centers at Jallandhar & Gurdaspur)

NAAC accrediated 5 star status, Advanced center in Genetic disorders, UGC Center of Excellence in Sports Sciences

Major earthquake research center (approved by Ministry of Earth Sciences, Indian Metereological Deptt.)

40+ full fledged departments, 110+ academic and technical courses, fully computerised, 500 acres lush green campus.

20 times (highest by any University) winner of Maulana Abdul Kalam Azad Trophy

(*www.gnduonline.org, www.gndu.ernet.in*)

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Department of Physics, GNDU

16 Faculty members with different physics backgrounds
(Professors – 4, Readers – 8, Lecturers - 4)

Research Fields

Geophysics (Earthquake prediction studies), Meterial Science (Thin films and Nanomaterials), Nuclear Physics, Energy Science, Bioactive Glasses, Radiation Physics, Plasma Physics and High Energy Physics.

Research Projects

DST, UGC, CSIR, IUAC sponsored projects of worth Rs. 1.5 crores

Courses offered by the deptt

BSc (Hons. Sch.), MSc (Hons. Sch.), MSc (Hons.), MPhil, PhD

Nuclear and particle physics

Theory:- Once in BSc and Thrice in MSc
Practical:- Once in BSc and Twice in MSc
(Particle interactions, Scintillation counters, GM counters, Fast electronics, Statistics)

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Chance for EHEP Exploration at GNDU

Faculty

Myself, PhD work partially done at PU, TIFR, CERN
titled ``Study of Higgs at LHC Energy using CMS Detector''

Another Lecturer, Experimental Nuclear physics background
Research work in collaboration with PU,TIFR, IUAC

Research Fellows

2 Students (with good academic bkd.) interested in doing MPhil + PhD
Plan to have 2 PhD students with PU group

8 MSc students already doing their 1 year dessertation projects
(MC simulations using CMKIN, Detector simulations with CMSSW, Testbeam analysis, Statistics using ROOT, Fabrication of Fiber Scanner, Fast Electronics Studies using NIM/CAMAC etc)

Scientists/Technical staff

Techinical and administrative staff, whenever needed, assured by Head of the Department

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EHEP Interests

Physics Analysis

Standard Model Higgs --> mu mu (qqH channel)
(CMS Analysis Note 2006/105)
MSSM Charged Higgs --> Tau + Nu (ongoing study)
Collaborator: Prof. R. Kinnunen, HIP Helsinki
NMSSM, Higgs Physics, Top Physics at CMS
Collaborator: Prof. Suman Beri, PU Chandigarh

Testbeam Analysis

Participated in CMS HCAL testbeam 2003 (HE) & 2004 (VLE)
(CMS Note 2006/044, CMS Note 2006/138, CMS Note 2006/139, CMS Note 2006/143)
Interested in ongoing CMS HCAL testbeam activity, Combined test

Detector Hardware

Has worked for CMS HO complete fabrication, testing and installation
(CMS Note 2006/127)
Expertise help can be used in ongoing HO hardware jobs at CERN and RPC work with PU, DU, BARC

Definite interest in future detector upgrades !!!

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Experience in CMS collaboration

More than 6 Years in India-CMS Collaboration

Physics Analysis

Standard Model Higgs --> mu mu (qqH channel)

(CMS Analysis Note 2006/105)

The observability of the Standard Model Higgs boson decay into two muons in the VBF Higgs boson production qq --> qqH was studied with the full detector simulation for m_H = 120 GeV at low luminosity. The events were selected by single or double isolated muon trigger. Off-line selections include upper cut 50GeV on the missing E_T against tt background, lower cut 60 GeV on di-muon p_T against Z+jets background, di-muon mass window 4 GeV and a set of WBF cuts for tagging jets. The WBF cuts include rapidity separation 4.5 between two highest E_T jets, lower cut 1 TeV on di-jet invariant mass and central jet veto. The dominant backgrounds considered were QCD and electroweak Z+2jets and tt. The background from WW+jets and bb+jets was found to be negligible. The QCD Z+jets background was generated using PYTHIA Z+j process. Comparison with ALPGEN Z+jets generation shows that PYTHIA does not underestimate Z+2jets background after event selections. The electroweak Z+2jets background was generated with MadGraph and tt was generated by PYTHIA. After all selections 1.7 event of signal and 3.7 events of the total background are expected in the di-muon mass window 118-122 GeV for 60 fb-1. Assuming the background uncertainty of 100% the upper limit 6.6 fb can be set up at 95% confidence level on the cross section times branching ratio qq-->H, H --> mu mu, mode for m_H = 120 GeV at 60 fb-1 luminosity.

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Testbeam Analysis

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(CMS Note 2006/044, CMS Note 2006/138, CMS Note 2006/139, CMS Note 2006/143)

CMS outer hadron calorimeter (HO) trays were mounted on the test beam table of H2 beamline along with other hadron calorimeter (HCAL) detectors and electromagnetic calorimeter (ECAL) for studying the real effects of particles of different energies. ECAL was exposed to 100 GeV electrons for its calibration purpose. The muon beam of 150 GeV energy was used to calibrate hadron barrel (HB) and HO. The wire source runs were also used to calibrate HB and HO trays. The data was analyzed to see the response of CMS calorimeters i.e. ECAL and HCAL at different energy electrons and pions respectively. The HCAL test beam study helps to understand the performance of the CMS hadronic calorimeter in measuring energies of single electrons, pions and muons. It helps in calculating preliminary calibration constants which can be used in simulation and reconstruction softwares and directs trigger related algorithms for physics analysis. The test beam data allows us to evaluate and study the physics potential of the CMS detectors.

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Detector Hardware

Fabrication, testing and installation of Outer Hadron Calorimter (HO)

(CMS Note 2006/127)

The whole responsibility of fabrication, testing and installation of HO in CMS detector was successfully completed by TIFR and Panjab University. HO is divided in to 5 rings ±2, ±1, 0 (with inner and outer layers). Panjab University took responsibility for the fabrication of HO ±1 ring. The Bicron BC408 plastic scintillator sheets were procured and cut in to required dimensions. Sigma-type grooving and side polishing was done using sophisticated controlled CNC machine. CMS HO scintillator submodules `scintillator tiles' were assembled in to single `tray' units. The performance of these HO trays is checked for its sensitivity to produce a usable signal for a given radiation and relation between the amount of scintillation light and the charge contained in the output signal. Testing and quality control of the HO detector module is done mainly by three tests namely cosmic-muon test, radioactive wire source test and radioactive X-Y scanning. HO trays are being tested at CERN for any damage during transportation. Tested trays were installed in to the CMS Detector. HPD testing (quality control and burn-in) and laying of the HO readout cables was done at SX5@CERN.

In all the India-CMS activities mentioned above we participated and contributed significantly.

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Outlook

EHEP Group

Two Permanent Faculty Members
(Expertise in Experimental High Energy and Nuclear Physics)

+ Full time PhD students (4-5 years), Full time MPhil students (2 years), Full time MSc students (1 year dessertations)
+ Scientific/Technical staff

For CMS Collaboration

Research may enhance collaboration among different CMS Institutions on various CMS aspects (Physics analysis, Testbeam studies, Hardware etc.)

Local Support

Institutional support (space, deputation leave, project management etc) assured by Head, Director Research and worthy Vice-Chancellor

In Summary

Definite chance for an opening in EHEP at GNDU !!!

Invitation

Next India-CMS meeting at GNDU Amristar (Dec-Jan)

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