

**DEPARTMENT OF PHYSICS
PANJAB UNIVERSITY
CHANDIGARH
SIX-MONTHLY PROGRESS REPORT
PROFORMA FOR Ph.D. CANDIDATES**

01.01.2017 to 30.06.2017

(To be submitted bi-annually by June, 30th and December, 31st)

1. Name of the candidate: Anterpreet Kaur
2. Faculty : Science
3. Department : Physics
4. Enrollment No. and Date : 13/1033 , 10-04-2013
5. Registration No. and Date : 4962, 4 February, 2016
6. Tentative/Approved Title : MEASUREMENT OF MULTIJET CROSS-SECTION RATIOS IN PROTON-PROTON COLLISIONS WITH THE CMS DETECTOR AT THE LHC (Approved)
7. A summary of the work done during the last six months (Depending upon the stage of Ph.D. work) providing details of (i) Review of Literature (ii) Experimentation/Data Collection, Field work (iii) Data Processing (iv) Data Analysis and Interpretation and (v) Stage of thesis writing with specific reference to the goals set for the previous 6 months. (Separate sheet attached)
8. Did you complete the tasks and achieve the goals you had set for the period under report ?
Yes/No : Yes
If No : Difficulties, Constraints faced in achieving the objectives that had been formulated for the period under report.
9. Publications if any : N.A.

Certificate :

It is certified that the information provided above is correct to the best of my knowledge. I shall try my best to achieve the above targets during the next six months.

Name of the Candidate : Anterpreet Kaur

Signature :

Certificate:

Progress report of the candidate : Satisfactory/Unsatisfactory/Need to be improved

Supervisor Name : Prof. Manjit Kaur

Signature :

Counter –Signature of the Chairperson

PROGRESS REPORT

The inclusive 2-jet and 3-jet event cross sections are measured as a function of average transverse momentum (p_T) of two leading jets ($HT,2/2$), for two and more number of jets. Data from the LHC (Large Hadron Collider) proton-proton collisions at center of mass energy of 8 TeV, corresponding to an integrated luminosity of 19.71 fb^{-1} , have been collected with the CMS (Compact Muon Solenoid) detector. Jets are reconstructed with the anti- k_T clustering algorithm for a jet size parameter $R = 0.7$ in a phase space region ranging up to jet transverse momenta p_T of 2.0 TeV and an absolute rapidity of $|\eta| \leq 2.5$. The data are well described by predictions at next-to-leading order (NLO) in perturbative quantum chromodynamics, complemented with NP corrections that are important at low $HT,2/2$. Additionally the results are also compared to several Monte Carlo event generators. The strong coupling constant is determined in a fit to the ratio of 3-jet over 2-jet event cross section (R_{32}) measurement to $\alpha_S(M_Z) = 0.1150 \pm 0.0010$ (exp) ± 0.0013 (PDF) ± 0.0015 (NP) $+0.0050-0.0000$ (scale) using the MSTW2008 PDF set (Parton Distribution Function). Employing the MMHT2014 PDF set instead leads to very similar results. Equally compatible determinations of $\alpha_S(M_Z)$ are achieved with separate fits to the inclusive 2-jet and 3-jet event cross sections employing various PDF sets. The result for $\alpha_S(M_Z)$ is in agreement with previous determinations obtained by the ATLAS and CMS collaborations and with the world average value of $\alpha_S(M_Z) = 0.1181 \pm 0.0011$.

The analysis results got public in the form of CMS Physics Analysis Summary (PAS) : CMS Collaboration, “Determination of the strong coupling constant from the measurement of inclusive multijet event cross sections in pp collisions at $\sqrt{s} = 8 \text{ TeV}$ ”, **CMS-PAS-SMP-16-008 (2017)**

I got selected in LPC Guest and Visitor programme of Fermi National Accelerator Laboratory (Fermilab), Batavia, Chicago, USA. I am deputed to Fermilab for a period of six months (March 20, 2017 to September 14, 2017). Here an analysis related to jets is being carried out. A search for light, narrow scalar resonances decaying to b quarks in the mass range from 50-500 GeV produced in association with a high transverse momentum jet using 36.4 fb^{-1} of 2016 at 13 TeV proton-proton collision data collected by CMS, is being performed. Novel jet substructure and b-tagging methods and background estimation techniques are employed to search for a resonance in the jet mass distribution originating from a new particle in whose decay the b-quarks are merged into a single jet.

Other Activities :

- I am also working in Physics Performance and Dataset (PPD) with Data Quality Monitoring (DQM) group, CMS for software development of a tool called Historic DQM (HDQM) which is beneficial to study and check stability of various sub-detectors with time.

Goals for the next six months :

- To write the thesis.
- To participate in workshops, seminars and to attend academic lectures.

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