LNF-CS Test Laboratories 2016

Monday, 17 October 2016 - Friday, 21 October 2016

LNF-INFN

Scientific Programme

LTL2016 School for Doctorate

(L**NF-Cs **T**est **L**aboratories**)

Brief history

The first edition (LTL2014) was held in Frascati at the INFN National Laboratories, alternating classroom presentations with guided visits of some of the most important laboratories of the LNF. The detailed program of LTL2014 can be found at the INFN web site

(https://agenda.infn.it/conferenceDisplay.py?confId=8141).

The topics treated during the school concentrated on the main activities of LNF: elementary particle, nuclear, accelerator and space physics and the linked technologies.

The second edition of the school (LTL2015) was held in Cosenza in the Calabria University. The major innovation compared to the previous edition has been the introduction of laboratory activities. Students were divided into groups of 5-6 students, and assigned to a research group with a well-defined laboratory program. Students worked together to tutors, spending all their time in the assigned group. The work consisted in acquiring, analyzing and interpreting experimental data on a specific topic. Their work ended with a presentation to all participants of the school.

The detailed program can be found on the LTL2014 INFN website

(https://agenda.infn.it/conferenceDisplay.py?ovw=True&confId=9702).

The success of this last edition, and the fruitful experience of the EDIT-2015 international school held at LNF in October 2015, pushed us to repeat the school with laboratory activities also for the LTL2016 edition. The laboratory activities will be mainly focussed on the INFN activities and the participants will be mostly PhD students of XXIX, XXX and XXXI cycles.

School organization

The first day will be entirely dedicated to illustrate the INFN research activities at LNF and the laboratory activities prepared for the LTL2016 students. During the second, third and forth day, it will alternate classroom presentations with related laboratory activities. The last day will be devoted to the presentation of the results reached during the laboratory activities. Each student can follow only ONE laboratory activity. The students will form groups of 4, at maximum. Each group will have at least one tutor. At the end of the first day the students will be asked to follow an online safety course that is mandatory for access to the laboratories.

Laboratory activities

The following laboratories will be activated:

Accelerator laboratory (M. Ferrario, S. Gallo)

Space characterization of satellite laser ranging payloads at the SCF Lab (S. Dell'Agnello)

Trigger and data acquisition laboratory (D. De Pedis, M. Del Gaudio, G. Mazzitelli, M. Schioppa)

Instruments for data analysis (G. Mazzitelli, Paolo Ciuffetti e Francesco Galletti)

1. Accelerator laboratory (M. Ferrario, S. Gallo)

The Accelerator Laboratory aims to give to the students a practical background on the main subsystems forming a particle accelerator, i.e. Radio-Frequency accelerating structures, vacuum and magnets technology, electron beam diagnostics.

The laboratory consists of three classes in which students will be introduced to basic concepts and will acquire experimental skills through "hands on" activities on:

· Measurements on RF cavities

· Characterization of a quadrupole magnet

· Characterization of instrumentation for transverse and longitudinal beam diagnostics

· Measurements on vacuum systems and visit to the SPARC_LAB test facility

2. Space characterization of satellite laser ranging payloads at the SCF Lab (S. Dell'Agnello)

Students will take part in the characterization of basic thermal and optical properties of some retro-reflectors used for satellite laser ranging payloads for Earth observation satellites, radio navigation satellites, space, Geodesy and Moon gravitational physics. Satellite Laser Ranging is one of the most precise and cost effective positioning techniques for Earth orbiting satellites. Its absolute positioning, with respect to the geocenter, is used for calibration of other positioning techniques, geodesy measurements and gravitational physics. A complete description of the research activity of the group can be found at <u>http://www.lnf.infn.it/esperimenti/etrusco/ </u>

The activity will be organized as follows:

· Day 1: introduction to satellite laser ranging and retro-reflectors.

· Day 2: set up of all the subsystems, especially for thermal and optical acquisition, to begin the test.

· Day 3: participation to the test and analysis of thermal and optical data.

3. Trigger and data acquisition laboratory (M. Del Gaudio, D. De Pedis, G. Mazzitelli, M. Schioppa)

Purpose of the DAQ_Lab is to learn how to build a simple trigger and DAQ system with some scalability feature from scratch by applying it to a simple experiment to measure the speed of cosmic muons.

· Introduction to trigger and acquisition system simulation program (TASS. The manual can be found at link <u>www.top1.it/tass</u>. Students interested to start practice can ask the author, D. De Pedis, for downloading the simulation program). Practices with TASS. Set-up preparation: positioning the scintillators, connecting them to the NIM modules. Counting experiments (day 1)

· Introduction to DAQ. VME modules. Write the DAQ program using TASS. Connect the discriminated signals to the TDC. Debug the system (day 2)

· Start measurements and comparison between simulation and data (day 3)

4. Instruments for data analysis (G. Mazzitelli, Paolo Ciuffetti e Francesco Galletti)

The laboratory activity is an introduction to the basic instruments of the Data Mining. The main aim of this activity is to give to the students the basic instruments for data analysis and interpretation. The detailed program of the class is:

· Introduction and context

· Build a full environment for data handling

· Data access and linked open data

· Data elaboration, analysis and interpretation

· Conclusions

The students will learn to install and configure a virtual machine on which it is present the development environment for the laboratory activity. The development and analysis environment will be realized by mean of the virtualization of a XX machine on a YY operative system, on which the student will find pre-installed packages like a, b and c for the data elaboration. Through Pyton queries the students will learn to access to data and develop a simple application for data analysis and graphic presentation of the results.