

Nordic Research Training Course in Detector Technology for Particle Physics

Hands-on exercises in Helsinki 2-6.11.2015

Course Plan as of 20.8.2015

VENUE: Helsinki Institute of Physics / Detector Laboratory,
Physicum, University of Helsinki, Gustaf Hällströmin katu 2a, 00560 Helsinki

WEBPAGE: <https://indico.nbi.ku.dk/conferenceDisplay.py?ovw=True&confId=758>

CONTENTS:

Laboratory exercises will provide the students with hands-on & minds-on training in detector technologies, used in particle physics experiments. The work will include semiconductor detectors, gas detectors, and detector read-out systems.

LEARNING TARGETS:

After the laboratory course the student will be able to:

- 1) work in a scientific laboratory environment taking into account strict safety rules such as appropriate caution for high-voltages, gases, chemicals, delicate instruments, and radiation safety procedures.
- 2) construct gas-filled radiation detector starting from simple everyday materials such as lemonade can and knots and bolts,
- 3) operate radiation detectors and data acquisition systems using typical laboratory equipment, such as source-meter-unit, radiation sources, gas piping, preamplifier, linear amplifier, multi-channel analyzer, and oscilloscope,
- 4) understand the differences and similarities between gas-filled and semiconductor radiation detectors.

ASSESSMENT:

After having contributions recognized, each student will be assigned 5 ECTS.

- 1) On-line assessment: Students' achievement and progress will be observed during the laboratory work. Teachers will observe the students' procedural and problem solving skills, ability to use hands, engagement in the given exercise, cooperation within the group, and communication skills.
- 2) Off-line assessment: Each group will write report about the tasks, explaining theory, methodology, analysis and results. The reports must be sent to Timo.Hilden@helsinki.fi and Jens.Brucken@helsinki.fi (TASK A) and Richard.Brenner@cern.ch (TASK B). Report deadline will be announced later.

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TASKS:

The students (20) will be divided in five groups of four persons (5X4). Experimental and theoretical physicists will be mixed in the groups. Each group will do two tasks:

A) Construction and measurement of gas-filled wire-chamber detector, 3-4 days

Students will construct their own particle detector using the traditional gas-filled wire chamber technology. Everyday materials such as copper tube and Cu/Be wire are used in the work. In addition, the detector and appropriate data acquisition equipment are used to measure the energy spectrum of a radiation source. All the groups will work simultaneously in the laboratory, each group with their own wire-chamber detectors. Instructors are available for questions all the time.

Instructors: Dr. Camille Belanger-Champagne, Dr. Erik Brücken, Dr. Francisco Garcia, Dr. Timo Hildén, Dr. Pauli Peura, Lab.Eng. Jouni Heino, Lab.Eng. Rauno Lauhakangas, Lab.Tech. Raimo Turpeinen, Aneliya Karadzhinova, Tiina Naaranoja, Alexander Winkler.

Venue: Laboratory B307.

B) Silicon detector response to irradiation, ½-1 day

Students measure the radiation response of a silicon detector connected to a read-out chip. The chain of data acquisition contains preamplifier, linear amplifier, multi-channel analyzer and oscilloscope. Two groups will work simultaneously with the instructor.

Instructor: Prof. Richard Brenner, University of Uppsala, Sweden,

Venue: Laboratory B304.

IN ADDITION: The students will be given an introduction to clean room environment. The students will use probe station to measure electrical properties of irradiated and non-irradiated silicon detectors.

Instructors: Jouni Heino (clean rooms), Dr. Panja Luukka (samples), Doc. Ivan Kassamakov, Tatyana Arsenovich and Aneliya Karadzhinova (measurements).

Venue: Clean Rooms AK108.

For fast groups:

C) Visit to Okmetic Oyj @ Friday November 6th afternoon

Okmetic is a Finnish company working in the field of semiconductor wafer manufacture. The students will familiarize themselves with the basics of resistivity and oxygen concentration in semiconductor ingots. In addition, the students will visit the factory.

Instructor: Dr. Jaakko Härkönen

Host: Vesa-Pekka Lempinen, Senior Manager, Customer Support, Okmetic Oyj

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TIMETABLE:

The course will take place in November from Monday 2nd to Friday 6th, each day 9:00-17:00.

The students will be picked up from hotel on Monday at 8:30. Transport information will be given later. The course starts with introduction.

During the week, office space A315 is available for group work.

HELSINKI PERSONNEL:

Prof. Paula Eerola, course supervisor
Doc. Eija Tuominen, course coordinator
Dr. Francisco Garcia, radiation safety
Lab.Eng. Jouni Heino, laboratory safety
Lab.Eng. Rauno Lauhakangas
Lab.Tech. Raimo Turpeinen
Doc. Ivan Kassamakov
Dr. Camille Belanger-Champagne
Dr. Panja Luukka
Dr. Erik Brücken
Dr. Timo Hildén
Dr. Jaakko Härkönen
Dr. Pauli Peura
M.Sc. Tatyana Arsenovich
M.Sc. Aneliya Karadzhinova
M.Sc. Tiina Naaranoja
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