Instrumentation Schools

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ICFA Panel for Detector organizes, since 1987, Instrumentation Schools in countries technologically unprivileged

• to stimulate particle physics instrumentation in <u>all</u> parts of the world

• to promote future collaborations between young physicists from countries of different level of technical experience

ICFA School formula: 2 weeks of lectures in the mornings and hands-on laboratories courses on the cutting edge of detectors technologies in the afternoons

After 2010 ICFA School in Patagonia, we launched a survey in the whole HEP Community in order to understand the needs for a similar school on detectors hold *for young physicists working in major HEP laboratories*



A survey on the needs of Instrum. School

The results of the survey were, to me, flabbergasting!

population	Undergraduate	5 %
	Graduate	40 %
	Post-doc	20 %
	Senior physicists	35 %

75% of the population is involved in data analysis 60% of the population works on development of algorithms and raw data processing



Survey: question & answer

Do you consider that your knowledge and understanding of the detector aspects of YOUR EXPERIMENT is:

Exceeding the real needs, I can help colleagues	16%
Just adequate	42 %
Marginal, usually manage, but I need help	38 %
Feel totally lost and need a lot of help	4%



Survey: question & answer

How useful would be a school dedicated to the various aspects of detectors and instrumentation?

1 (not at all) to 5 (very badly needed)



The large majority suggested a school conceived as follows:

- 2 weeks
- 50% theoretical lessons 50% practical courses



The results of the survey were presented at the ICFA Directors meeting Everybody was convinced that a lack of practical experience in our young scientists may have a negative impact on our field, namely

- in the context of interpreting the response of the actual detectors in complex data analysis
- when designing the upgrades of today experiments
- in the conceptual design phase and in the planning for the future incoming experiments

→ICFA Panel for Detector was encouraged to hold EDIT2011 School, at CERN, with a scientific program that was conceived on the basis of the results of the survey (was this really optimized?????)

http://edit2011.web.cern.ch/edit2011/



the students

EDIT2011 was devoted to young researchers, in the last year of their PhD or to Post-docs.

EDIT2011 was promoted to some 200 Universities, to major HEP Experiments, via SPIRES and via FNAL and CERN user pages

We received:

- more than 250 valid applications within the deadline
- more than 50 applications after
- we accepted 89 students

Activity	%
Purely analysis	40
Hardware oriented	60

Involvement	%
Present colliders	60
Future colliders	10
Other	30



Interesting applications

We received applications and mails of interest from Industry:

- electron microscopy
- equipment for the scientific community; main product line are neutron detectors
- beam diagnostic
- constructors of beam pipes
- surfaces treatment
- R&D on advanced material and composites

We did not accepted applicants from Industry, *but it is a point that shall be followed up by the Community for the next EDITions (hopefully in a coherent way)* – ICFA Directors expect input on this point



EDIT2011 scientific program

2 weeks of lectures interleaved with laboratories. The school covered 8 different disciplines (detailed program is posted on INDICO):

- 1. Basic Electronics and Microelectronics
- 2. Advanced electronics and FPGA programming
- 3. Gaseous detectors for LHC and for Linear Colliders
- 4. Scintillation and Cherenkov light from crystals and fibers
- 5. Principles, performance and limitations of photo-detectors
- 6. Electromagnetic & Hadronic Calorimetry
- 7. Silicon strips technologies
- 8. Pixels detectors for LHC and for Linear Colliders

The students were subdivided into 8 small groups (~10 people) according to their background (expert in Silicon detectors, data analysis, Calorimetry....

Every day, each group was attending one of the 8 topical courses quoted above

DPF – Instr. Taskforce meeting 2/5/11

EDIT2011: the "Silicon Pixel day"

9:00 - 10:00 Lecture 1 "Introduction to Silicon Detectors"" Lecturers : Manfred Krammer (HEPHY, Wien), Frank Hartmann (Karlsruhe IT) 10:15 - 10:45 Lecture 2 "Hybrid Silicon Pixel Detectors" Lecturer: Markus Keil 10:45 - 11:30 Laboratory 1 "Handling of silicon wafers, chips....." Tutors: Markus Keil, Simon Kwan 11:30 - 12:00 Lecture 3: Monolithic Pixel Detectors Lecturers: Marc Winter; Jerome Baudot 12:00 - 13:00 Laboratory 2 "The MIMOSA detector" Tutors: Marc Winter; Jerome Baudot; Constanza Caviccholi

13:00-14:00 Lunch break

14:00 - 14:30 Lecture 4 "System aspects of Pixel Detectors in HEP and HI Experiments"
Lecturers : Vito Manzari
14:30 - 16:00 Laboratory 3 "Operate a mini HEP experiment"
Tutors: Vito Manzari, Annalisa Mastroserio, Marian Krivda, Constanza Caviccholi, Romualdo Santoro
16:30 - 18:00 Laboratory 4 "Pixel Systems at the LHC"
Tutors: Heinz Pernegger, Daniel Dobos
18:00 - 18:30 Lecture 5 "Future of Pixels"
Lecturers: Heinz Graafsma, Michael Campbell, Simon Kwan

Overall the students attended: 27 lectures and 36 laboratories



EDIT2011: the silicon classes

Every day there were 36 spots were activities were going on almost in parallel → maximization of the number of Professors, tutors 106 of teachers for 89 students....



the experimental set-ups

We exploited, mainly, existing set-ups from LHC, LHC upgrades, LC and RD facilities \rightarrow this school was done at CERN and was, due to the equipment that we have, "colliders oriented"

Some educational equipment was built on purpose, it can be transported and re-used in other schools

Laboratories	N. of set-ups
test systems from LHC	5
R&D for LHC upgrades	1
R&D for Linear Colliders	3
educational transportable	16
educational in situ	8

Outlook -1-

ICFA Panel for Detectors organized a school on Detectors and Instrumentation in HEP that offered, as well, hands-on laboratory courses. Students were young researchers from major laboratories and Universities

The survey launched at the end of the school shows an extraordinary positive impact of the school! 100% of the students gave a positive feedback to EDIT2011 indicating a clear wish and <u>need</u> to continue this project \rightarrow FNAL will host next EDITion in 2012

We gathered many suggestions from the students to improve next EDITions:

• Today school had students of different backgrounds; new schools can target homogenous populations of students: only LHC experts in data analysis – engineers dedicated to new experiments – physicists working for incoming colliders - only gas experts



Outlook -2-

• Next schools can concentrate on learning in details the Detectors installed in LHC and not accessible anymore in the incoming years

• We can organize an edition for undergraduate students (we had a large number of applications from undergraduates....)

• We shall investigate, among Universities, if it is possible to grant credits to the PhD or undergraduate students who participate to the school – This year we had two Universities that equalized EDIT school to an examination in experimental physics

- We may consider three kind of schools:
 - Electronics, Data Acquisition and trigger
 - Detectors and Instrumentations
 - Test beam

..... and many more.....