Statement on the EUDET development in 2007

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Abstract

The External Scientific Advisory Board is in charge of writing an annual statement about the Project's development and status including its role with respect to developments in the Americas and in Asia

1 Introduction

The EUDET advisory board met once in 2007 during the Annual Meeting of the EUDET project. The present statement on the development of the project is 2007 is based on our observations on the presentations that we attended at the Annual Meeting and on the content of the Annual Report.

EUDET represents an important European organizational instrument in preparations for the design and development of technologies for the ILC particle detectors. EUDET provides vital infrastructures for hardware development and communications, as well as a forum for discussions, sharing of results and propagation of information. It represents a central pillar of the European participation in the global ILC detector development activity, and a complement to the ELAN and EUROTEV activities on the ILC accelerator.

EUDET sponsored infrastructure is also enhancing global collaboration for ILC detector research. This is a very important role for EUDET, since the ILC project has been proposed as a truly international project from the beginning involving physicists from Europe, Asia, and the Americas.

2 JRA1 Test Beam Infrastructure

The goal is to provide a test beam with a large-bore, high-field magnet, and a high-precision, fast beam telescope. The facility is crucial for determining detector component characteristics in a realistic environment. In general progress and accomplishment are excellent. All milestones and deliverables foreseen in 2007 have been accomplished. Specifically:

Magnet: The KEK magnet was commissioned in DESY already in 2006. In July 2007 the field was measured and the field map was created. The field map can be provided either as a real time computation or as a fixed map of points that then has to be interpolated. The magnetic measurements and the data analysis were significantly more complex than anticipated. For this reason the field map became available only at the end of the reporting period.

Pixel telescope: The first sensors of the demo pixel telescope were produced in large-area versions already in 2006. In 2007 the design and the production of the mechanics and cooling for the detector were completed. The first version of the mechanical setup already features most of the mechanical requirements also necessary for the final telescope: only the mechanism to ease the alignment to the beam was not included. The demonstrator telescope became available for TA2 in September 2007. The design and production of the telescope reference plane

sensors for the final telescope is ongoing, they will feature zero suppression and digital readout,

Data acquisition and evaluation software: In 2007 six readout boards were tested and used in test beams at DESY and CERN. Additionally eight boards were produced and are being prepared for future use in the final telescope. The DAQ software framework is lightweight, platform independent based on a minimum of external open source libraries. The evaluation software has been successfully used to analyze the data taken at the last test beams at DESY and CERN and to evaluate the telescope performance.

Validation of infrastructure: The full prototype telescope has been evaluated during three test beam periods at DESY and CERN. Experiences with the DAQ, the mechanics and the periphery were directly fed back to the designers of the final telescope.

3 JRA2 Infrastructures for Tracking Detectors

The scope of JRA2 is to provide infrastructures for developing and testing new readout structures for a Time Projection Chamber (TPC) and for silicon based tracking detectors. Some milestones are shifted from month 24 to month 27, but the delay will not seriously impact the upcoming research activities.

General purpose TPC development facility: the design of the field cage is finished including the users requirement on the interface between the cage and the readout structures. Some problems have been encountered in the fabrication of the field strip foil, causing a delay in the completion of the construction of the cage, now foreseen for March 2008. A first prototype of the slow control system for the monitoring of the gas and other parameters is now available. The first – still prototype - production of the front-end preamplifier has provided 1000 chips for the users of the EUDET community. This facility will be used by an international collaboration, known as LCTPC, involving physicists from Europe, Asia, and the Americas. The goal of this effort is to demonstrate, for the first time on a large scale prototype, the viability of a MPGD TPC to perform the high precision tracking necessary for the ILC. The groups are finalizing the design of the endplate and readout modules.

Silicon TPC based monitoring facility: the first step toward the ambitious goal of providing a pixelised readout of a TPC was already in 2006 with the use of the TimePix readout chip with gas detectors. During 2007 several single-chip systems have been tested and preparations have started to build small multi-chip systems. The completion date of this deliverable is moved to month 27.

Si-tracking facility: The first test beam large area silicon tracking structures prototypes with new ASICs was done in November 2006. In 2007 the 3D motorized table was delivered and a convection cooling system with dry air cooling was built and tested on beam. The completion of this deliverable (JRA2-D4) was shifted by four months because of problems with the supply of carbon fiber material. Progress was also done in the design of the alignment system.

4 JRA3 Infrastructures for Calorimeters

Scope of JRA3 is to provide infrastructures for research and development of full-sized, scalable, electromagnetic, hadronic and very-forward calorimeter systems including their DAQ. The activity has started well; the progress in the past year is satisfactory. During the reporting period 2007 all milestones have been achieved.

ECAL:

In 2007 the engineering drawings have been completed both for the structure and for the slabs. The active silicon sensors have been specified, a first order has been submitted. Special printed circuit boards with ASICs bonded directly in cavities inside have been designed; the first prototypes to study their feasibility have been submitted. The assembly procedure for the slab has also been defined.

HCAL:

For 2007, emphasis was put on the electromechanical design of the detector structure, on the validation of component designs with small prototypes and on the development of a single channel calibration system prototype. The delayed start of the mechanical design of the absorber structure, already reported last year, could not be recovered completely and will propagate into a modest delay in the start of construction. An LED-based calibration system has been developed and shows promising results.

VFCAL:

The effort within VFCAL was focused in 2007 on the design of the front-end electronics. Tests on the functionality of the ASICs are promising. The equipment for tests of the radiation hardness of sensors in a beam has been completed. Progress has been also made in the design and construction of a high precision laser position monitor system. Development of ultra-thin sensor planes using thin copper traces on flexible PCBs has been started.

DAQ:

In 2007, work has moved to detailed design of individual components as well as purchasing, building and programming the necessary components for the system. The basic concept, unlike before, is to use commercial solutions. Significant progress has been made on the off-detector receiver, which will collect and store all data sent from the Calorimeters as well as sending control data up to the detectors.

Front-end Electronics:
The final prototype readout ASICs have been fabricated: for the Digital Hadronic Calorimeter and for the electromagnetic calorimeter (ECAL). In 2007, these two ASICs have been very thoroughly characterized and were shown functional. A third Silicon Photomultiplier Integrated readout Chip has been fabricated during the summer of 2007. These ASICs will be carefully checked before mass production in a dedicated run mid 2008 can commence.

NA2 Detector R&D Network DETNET

Scope of NA2 is to provide the framework for exchange of information and facilities common to the JRAs. The activity is progressing well. The computer cluster is almost completed and regularly used; the common analysis framework was released in summer. The Web site was refurbished and is regularly used. During the reporting period all milestones have been achieved.

EXCHG: The Organization of the Annual meeting was correctly done with well-structured agendas posted on the INDICO system and with material promptly available to the participants.

WEBINFO: After a slow setting up during the first year, the web information system – based on ZMS – is now performing well and is regularly used by all participants.

COMP: Almost all EUDET dedicated resources, already acquired in 2006, where successfully set up during last year. These resources are regularly used for analysis of test beam data, for simulation of detector performance and for detector conception studies.

ANALYS: The development of a common test-beam data analysis and simulation infrastructure is tightly integrated with the overall common ILC/LCD software effort. The functionality has been extended for specific to EUDET tasks like test beam analysis. The focus for 2007 has been on improving the usability and the integration of the
JRA's software packages into the framework.

MICELEC: The contract on the 130 nm CMOS technology through CERN is active and ASICs designs have been submitted inside the EUDET project. One training sessions for engineers has been organized.

VALSIM: this more specialized task of simulation of the hadronic interactions has investigated the cause of discrepancies between test beam data and simulated shower profiles, including benchmarking of neutrons using old experimental data. A new cross-section parameterization was created for total and inelastic nucleon- nucleus interactions. These improvements are now included in GEANT4.

5 Transnational access activities

Following a discussion at the end of 2006, the Transnational Access activities are now regularly advertised on the EUDET web site and at several conferences to communities working on detector R&D.

The six out of the seven proposals submitted to the Transnational Access activity for the use of the DESY test beam were all of excellent scientific quality and were approved with rank A. One was approved with rank B. Given the small number of proposals there was no competition for the use of the facility.

With the completion of the beam telescope the first three requests for use of this facility were received and all three approved with rank A.

It is fair to say that after a slow start in the first year of the project the Transnational Access is now running at a correct level. The scientific results obtained using these EUDET facilities have been presented at numerous conferences and described in a number of scientific publications.

6 Conclusions

Now in the second year of life the project has reached maturity, has advanced well and is in a healthy situation. We congratulate the IC and the steering committee for the management of the project.

The annual report covers the status of the project at the end of the year that coincides also with an accumulation of milestones. We understand that a number of these milestones are just passed because of some “stretching” in their interpretation, hiding some real delays of a few months. This is fine, if the delay can be recuperated with parallel work in the next months. If however this delay is serial with the future steps of the project, this would be a concern, and the managers of the JRs should make soon a careful rescheduling to be discussed at the Steering Committee.

We have seen with pleasure that some of the weaknesses pointed out last year have been improved: the transnational access has now a number of requests and the rate of publication has increased compared to last year. On the latter, it would be nice to see a further increase, including reports of the annual meeting, both plenary and parallel sessions.

On the transnational access we notice that the number of requests has increased, however these requests are almost all from the EUDET community. This brings us back to the comment we made in our report of 2006: the community of the

potential users of the EUDET infrastructures is larger than the EUDET community itself and we should address in a practical way the question on who will use the infrastructures that we are building and when.

We reinforce now this statement and we believe that EUDET should invest some resources to solve this problem in a proactive way. Potential users in the particle physics and nuclear physics communities and industry should be identified and contacted to make them aware of the possibilities of using EUDET infrastructures.

Another important and correlated topic is the future of EUDET beyond the present phase. The big success of the present EUDET is that it has created a focused community. This result is even more relevant of the infrastructures that have been built. It would be beneficial for the projects to continue in the future with a similar structure. However the world around EUDET is changing: EUDET success has paved the way to a much larger European collaborative effort which is in the design and proposal phase for the next call FP7. What is the role of EUDET in this new scenario? This is a question to be debated in the near future starting from the definition of the scientific content of the next project.

On the administrative side we notice that the feedback from few participating institutes is not as fast as it needs to be. This is a serious problem: for the second year the Annual Report has been sent to Brussels incomplete because two institutes have not delivered the information in time. This will imply again a late transfer of the next instalment to all institutes, affecting the correct continuation of the project. We ask the steering committee to take measures to ensure that all partners take these administrative commitments very seriously.