

## WP.6 – Access to CERN test beams and irradiation facilities

still incomplete....., LL 29/1/2007

### 1. Introduction

Throughout the development of particle detectors from initial conceptual models up to final detector modules, testing and qualification under realistic conditions is of prime importance. In particular, detector responses to high-energy particles of different types and energies need to be assessed. In case particle detectors are developed for experiments where high irradiation levels prevail, extensive testing of detector components and detector system elements under high irradiation doses is required. In this context, CERN as the largest particle accelerator laboratory in the world offers unique infrastructures for particle detector developers.

This work package describes access to two types of CERN infrastructures:

- Test beams of high energy particles
- Irradiation facilities based on particle beams or a combination of strong radioactive sources and particle beams

In both cases support for unit costs as well as subsistence and travel expenses for the Users is requested from the European Commission.

<b>Work package number</b>	6	<b>Start date or starting event:</b>	M1
<b>Work package title</b>	Access to CERN test beams and irradiation facilities		
<b>Activity Type<sup>1</sup></b>	SUPP		
<b>Participant number</b>			
<b>Participant short name</b>	CERN		
<b>Person-months per participant<sup>2</sup>:</b>			

<b>Description of the infrastructure</b>
<u>Name of the infrastructure:</u> CERN PS and SPS test beams; PS east hall irradiation facilities; GIF++ irradiation facility
<u>Location (town, country):</u> Geneva, Switzerland
<u>Web site address:</u> <a href="http://public.web.cern.ch/Public/Welcome.html">http://public.web.cern.ch/Public/Welcome.html</a> And in particular: <a href="http://ab-div-atb-ea.web.cern.ch">http://ab-div-atb-ea.web.cern.ch</a> and <a href="https://ph-dt2.web.cern.ch/PH-DT2/default.htm">https://ph-dt2.web.cern.ch/PH-DT2/default.htm</a> and <a href="http://ess.web.cern.ch/ESS/GIFProject/index.html">http://ess.web.cern.ch/ESS/GIFProject/index.html</a>
<u>Legal name of organisation operating the infrastructure:</u> CERN, European Organization for Nuclear Research
<u>Location of organisation (town, country):</u> Geneva, Switzerland
<u>Annual operating costs (excl. investment costs) of the infrastructure (€):</u>

<sup>1</sup> Please indicate one activity per work package:

RTD = Joint Research Activity;; MGT = Management of the consortium; COORD: Coordination activity; SUPP: transnational access activity or service activity; .

<sup>2</sup> except human effort already included in the calculation of the access costs.

## Description of the infrastructure:

### **CERN PS and SPS test beams**

The CERN PS (proton synchrotron) and SPS (super proton synchrotron) test beams provide particle beams in the energy range from 1 GeV to 250 GeV. Following extraction from the PS and SPS proton accelerators the test beams emerge from selectable primary targets. Upstream of the physicist's test set-up sophisticated beam line equipment allows selecting the particle type (e.g. electron, muon, hadron), its polarity and energy as well as the beam intensity (typically up to  $10^4$  particles per 1-2 sec beam spill). In total at least 7 general purpose test beam lines and their large well-equipped experimental areas are available for transnational access.

This activity will start from the beginning of the DevDet project. Unique high-energy test beams with their supporting infrastructure are already available now. As described in WP10 and WP11 substantial infrastructure additions will be constructed within the framework of DevDet. These additions will allow for an ever more optimised and specialized use of the CERN test beams, adapting them to the challenges imposed by the future particle physics experiments. They will progressively become available (see WP10 and WP11 deliverables), without major interruption of the test beam schedules. Therefore they will gradually become integral parts of the WP6 transnational access provision.

The CERN test beams are unique facilities in Europe, with beam energies and diversity going largely beyond what is available elsewhere. They have extensively been used for the majority of the particle physics experiments in Europe and even world-wide. Complemented with the additional infrastructures constructed within DevDet the beam lines can provide much improved quality to the Users in the form of: better information on particle identification, allowing combined detector performance assessments, providing plug-in DAQ systems, state-of-the-art detector cooling.....

### **CERN PS East Hall irradiation facilities**

The irradiation facilities in the PS East Hall have been operational since 1992 and have been upgraded several times since then. The facilities use two secondary beams, extracted from the PS proton accelerator. Several kinds of irradiations are provided:

- Direct exposure to 24 GeV/c protons
- Low intensity radiation field of backscattered particles
- Mixed field irradiations (mainly 1 MeV neutrons)

At the proton irradiation zone, samples with an area of up to  $2 \times 2 \text{ cm}^2$  can be exposed to fluences of up to  $5 \times 10^{13}$  particles/cm<sup>2</sup> per hour. At the mixed field zone samples of up to  $30 \times 30 \times 30 \text{ cm}^3$  and 5 kg weight can be exposed to fluences of up to  $10^{12}$  neutrons/cm<sup>2</sup> per hour (1 MeV energy equivalent). Automatic shuttle systems are available for remotely positioning the samples into the beam, thereby the exposure to radiation of Users and personnel. Occasionally proton irradiations can be carried out over larger surfaces, using scanning tables, but without availability of the shuttle system.

The facilities have been used extensively in the past years to test materials, sensors and electronics components. The majority of the Users originate from the particle physics community. Since 2000 there have been 130 registered users working for 32 different physics experiments. In the year 2007 alone, 1500 objects have been irradiated and 500 dosimeters measured during 135 days of beam time

The PS East Hall irradiation facilities will be available as of the start of the DevDet project. As described in WP9, task 2, an upgrade of the facility is part of the DevDet project.

## **CERN GIF++ irradiation facility**

To be written....

Services currently offered by the infrastructure:

### **CERN PS and SPS test beams**

Test beam Users will profit from the professional advice technical support of experts, who are specialised in the optimisation of test beams according to the User's requirements. On request, selected elements of the test beam infrastructure are adapted to the needs of the User. Standard infrastructures like electricity, water cooling, counting rooms, computer networks and electronics racks are generally available. Specialised additions can be provided with the professional help of CERN services (payable).

### **CERN PS East Hall irradiation facilities**

A number of technical services are provided with the proton/neutron irradiation facilities. Based on over 15 years of experience with irradiations, individual professional advice on irradiation issues is given to the Users. Dosimetry measurements accompany the irradiations, using techniques adapted to each case. Dosimeters are analysed and calibrated in-house. Low volumes of passive irradiations are carried out by the operators themselves. A bench for the electrical characterization of irradiated materials is available to the Users. All material are handled, packaged and shipped following strict Safety Regulations. This includes tracing of all irradiated material. Where needed, shipping is performed in containers that keep the samples cold for several days

## **CERN GIF++ irradiation facility**

To be written....

### **In general**

Users of the facilities will fully profit from CERN's general User support. User accounts to the central CERN computing facilities will be provided including internet access and access to many specialised professional software tools. Users will attend adequate safety training related to their work at the test beam. They can fully profit from the scientific life at the laboratory and are invited to the many seminars (typically daily) and scientific events. They have access to the scientific library and a wealth of web-based scientific information. They can be hosted in one of the three on-site guest houses providing accommodation at cost price.

CERN test beams and irradiation facilities are unique world-wide. They are not only used by physicists preparing experiments on the CERN site, but also for testing particle detectors for many experiments outside CERN, including experiments outside Europe. CERN presently has 8000 registered Users who are using its infrastructures. A major fraction of these Users are profiting directly and indirectly from its test beams and irradiation facilities.

## **Description of work**

Modality of access under this proposal:

Access to the CERN test beams and irradiation facilities will be provided free of charge. The irradiations will take place on the CERN site, and the users are given access to the experimental areas, where they can install and test their equipment. Professional crews operate the beam lines, while the Users themselves can carry out standard setting-changes. Depending on the complexity of the equipment under test, the minimum duration of test beam access is 12 hours, though in general periods span from several days to several weeks. Irradiations at the PS East Hall typically last from 1 hour to 1 day. GIF irradiations span normally from several days to several weeks. Scheduling of the facilities take place on a yearly basis for client requiring long exposure times. For shorter exposures, the schedules allow for more short-term flexibility. Transnational access Users will be treated on an equal footing with normal users both for the access and for the scheduling. In addition transnational access Users will have the advantage of being eligible for receiving travel and subsistence payments.

The ultimate result the Users will obtain from the test beam and irradiation campaigns will be a thorough understanding of the performance of his/her particle detectors under realistic conditions.

**Support offered under this proposal:**

See above

**Outreach of new users:** *State what measures will be taken, or have been taken, to attract potential new users (e.g. web-page, call for proposals, etc.), including users from new areas of research, if appropriate. Indicate why and to which extent the Community funding of this Transnational access and/or service activity will provide European research teams with new opportunities of access to the infrastructure. Indicate if the number of international users is expected to increase as a result of this proposal. If the infrastructure is being opened to international users for the first time, what evidence is there that there will be sufficient demand to use the access being offered in this proposal?*

**Review procedure under this proposal:** *For transnational access activities, describe the peer review procedure that will be used to select users under this proposal. Outline the composition of the User Selection Panel. Demonstrate that the selection of users will follow the principles of transparency, fairness and impartiality. For services activities, describe ourhow the periodical assessment of the services offered to the scientific community will be carried out (i.e, international review panel).*

*Give a multi annual implementation plan for the full duration of the proposed project using the table below (implementation plan). The implementation plan quantifies the minimum quantity of access to be provided (e.g. in terms of beam-hours, experimental days) by the infrastructure if the proposal were to be accepted for funding, including the estimated number of users, number of person-days they will spend at the infrastructure and corresponding number of user projects. This table should include as many lines as necessary when the infrastructure is made up of several installations.*

**Implementation plan**

Short name of installation	Unit of access	Unit cost	Min. quantity of access to be provided	Estimated number of users	Estimated number of days spent at the infrastructure	Estimated number of projects
CERN PS and SPS test beams	8-hour shift		200	120	70	20
CERN East Hall irradiation facilities	??					
CERN GIF++ irradiation facility	8-hour shift		200	50	70	8

Unit of Access:

For the PS and SPS test beams as well as for the GIF++ facility the unit of access is an 8-hour shift. This time covers full access to the experimental area and availability of the beam. The time therefore includes the setting-up and dismantling time of the User's equipment in the beam area, as the beam cannot be made available to another User during that time. Obligatory safety courses are taken outside the units of access. The average up-time of the CERN PS and SPS beam facilities amounts typically to 90%???. In case of important beam failures, every effort is normally undertaken to provide additional beam time to the disadvantaged User.