

WP8: transfer of knowledge

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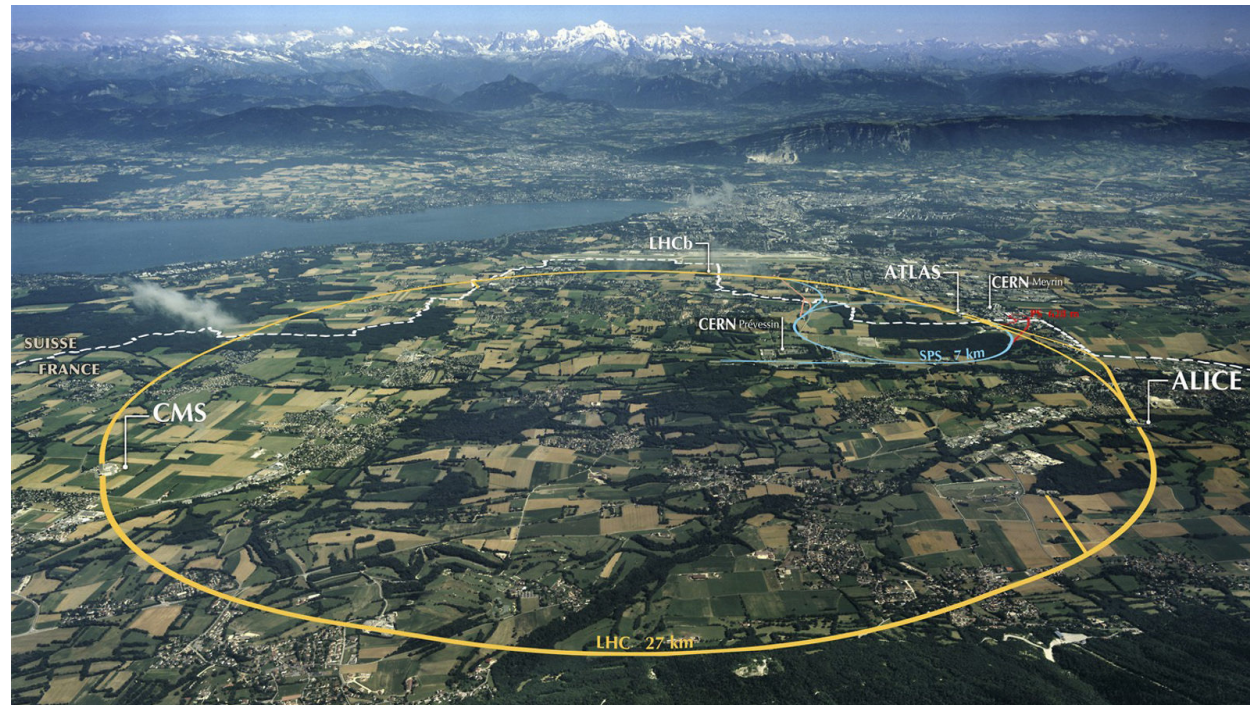
PROBES MIDTERM REVIEW – 27/02/2024

INTRODUCTION

- The current PROBES program involves secondments at the largest and most advanced particle physics laboratories in the world
- They share a similar mission and similar experimental technologies, with the consequent safety risks involved
- They are all committed to a constant scientific and technological training of both employees and visitors from other institutions
- Most secondments don't have transfer of knowledge as their main focus, but a continuous and intense exchange of knowledge between laboratory staff and visitors is at the core of their mission and approach
- On the more scientific side, this involves a large variety of seminars, workshops and schools
- On the more technical side, each laboratory provides a very complete training program to make sure external scientists/technicians contribute to the lab mission in an efficient and safe way

CERN (EUROPEAN LABORATORY FOR PARTICLE PHYSICS)

- European laboratory managed collectively by 23 member states (+ 48 states with co-operation agreements)
- Founded in 1954
- Performs world-leading research in the fields of particle physics and accelerator science
- ~2500 staff members, and ~12000 scientific visitors



GENERAL TRAINING FOR ACCESS TO CERN

- Any CERN user, even off-site, can in principle access CERN computing resources remotely. Basic computer security courses – with corresponding on-line exams (typically multiple-choice quizzes) – on computer security and data privacy are required
- On-site access is conditioned by additional security on-line courses, such as:
 - Safety at CERN
 - Covid-19
 - Electrical safety (awareness)
 - Cryogenic safety (awareness)
 - Radiation protection (awareness)
 - Road traffic
- All this training is managed automatically for each user

The screenshot displays the CERN Learning Hub interface with the following sections:

- MY LEARNING**: Features an icon of a computer monitor with an open book.
- BROWSE CATALOGUE**: Features an icon of binoculars.
- TRAINING ATTESTATION**: Shows a progress indicator for a course, with 'Before 10 Sep 2018' and 'After 10 Sep 2018*'. A note below states: '*Only within CERN IT Network, Internet Explorer not supported'.
- PERSONALISED LEARNING**: Features an icon of a green arrow pointing up and to the right.
- SEARCH COURSE**: Features an icon of a magnifying glass over a document.
- MANDATORY COURSES**: Features a red circular stamp with the word 'MANDATORY' in the center.
- COURSE VALIDITY**: Features an icon of a bar chart with three stars above it.
- SUPPORT**: Includes a 'Contact us' button with a speech bubble icon and a 'Help' button with a question mark icon. Below this is a section for 'Getting Started: Video Tutorials' with links:
 - How to enrol for a classroom course (1'24")
 - How to enrol for a programme (1'40")
 - How to withdraw from a classroom course (0'34")
 An 'FAQ' section follows with links:
 - How do I change the language of the Learning Hub?
 - How do I enrol for a classroom course?
 - Where can I find the courses for which I have enrolled?
 A 'Show more' link is provided.
- PRIVACY NOTICES**: Includes a link to 'Internal Training and Safety Training'.

**CERN “Learning hub”
page
Summarizes each user’s
training courses**

SPECIFIC TRAINING FOR ACCESS TO CERN PROTECTED AREAS

- Some CERN areas, including many detector buildings, are declared as «protected» because of additional risk factors, such as higher radioactivity, high voltage or potential oxygen deficiency hazards (ODH)
- They therefore require further training, in addition to the generic CERN User one. This includes
 - Higher level training courses for electrical safety, radiation, cryogenics...
 - Access and emergency exits
 - Possible underground operations
 - ...

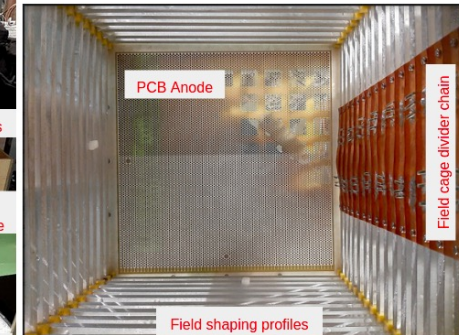
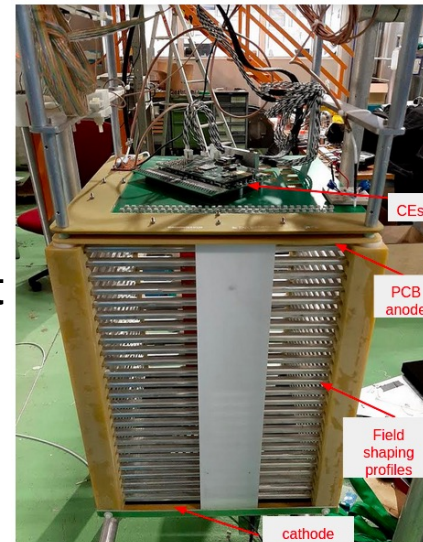
Safety training courses include both a theoretical part and a practical one, to be held in the dedicated Safety Training Centre on the Preveessin site

More information can be found at <https://hse.cern/services-support/safety-training>

- Of course anyone coming to CERN to perform specific measurements or learn experimental techniques can count on informal but dedicated training from local experts

PROBES ACTIVITIES AT CERN

- R&D activities for liquid Argon TPCs can be performed on two test facilities (~ 50 l and ~ 1000 l). Recent activities include:
 - Development/testing of PCB-based anodic read-out structures, of interest for the DUNE vertical drift module
 - Testing of light detection with PMT, SiPM, ARAPUCA detectors. In particular, wavelength shifting with Xenon doping
 - Low-energy calibration with radioactive sources (Bismuth-207)
- The ProtoDUNE detectors will test and validate the design for DUNE modules
- The second phase, currently in preparation, will consist in two detectors of similar mass (~ 400 t instrumented), both in CERN hadron beamlines:
 - Horizontal drift*: classical wire-based LAr-TPC, with new ARAPUCA photon detectors and new calibration methods;
 - Vertical drift*: new PCB-based read-out with vertical orientation. New solutions for HV (300 kV) distribution



CERN ACADEMIC TRAINING

- CERN provides a program of academic training on science and technology subjects
- This is optional and has the goal to advance knowledge for all CERN users
- It is provided through series of lectures (~1 hour)
- Subjects can be very diverse: particle and accelerator physics, computer science, other science topics, social/ethical aspects of the CERN community (see <https://indico.cern.ch/category/72/> for details)
- A very thorough cycle of lectures (master degree level) are provided every summer in the context of the Summer Student program, but are open to everyone. Topics are particle physics, accelerator physics, data analysis techniques....
- Higher level training is provided through the Theory Workshops (<https://theory.cern/workshops-schools>) and Theory Institutes (<https://th-dep.web.cern.ch/th-institutes>), that can include the participation of experimentalists

FERMI NATIONAL ACCELERATOR LABORATORY (FERMILAB)

- The largest US laboratory in particle physics, managed by the US Department of Energy (Office of Science)
- Founded in 1967
- Performs world-leading research in the fields of particle physics, accelerator science and quantum computing
- 2160 employees, and scientific visitors from more than 50 countries



GENERAL TRAINING FOR ACCESS TO FERMILAB

- Any person with a Fermilab account (including remote access to computing resources) is required to complete basic training courses
- They include computer security, interactions with the media, data sharing/publication policies, export control...
- All required training is managed by Environmental, Safety, Health and Quality (ESH&Q: eshq.fnal.gov)

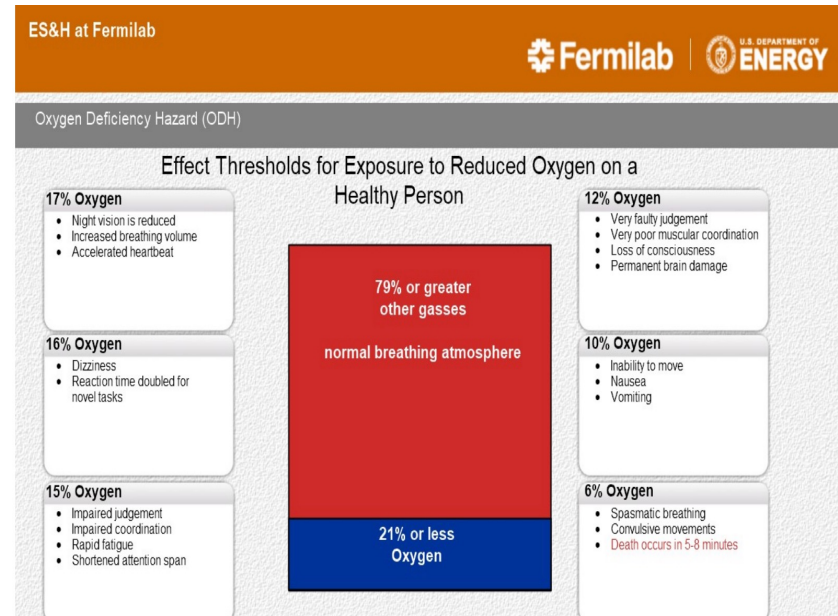
FN000412 / CR	Protecting Personal Information	C
FN000763 / CB	General Records Management Refresher	
FN000741 / CB	Fermilab Emergency Preparedness Awareness Training	C
FN000519 / CB	Safeguards and Security Counterintelligence	C
FN000374 / CB	Basic Computer Security	1
FN000235 / CR	Basic Electrical Safety	C
FN000755 / CB	Changes to Wilson Hall Access	1
FN000387 / CR	Electrical Safety Orientation	C
FN000377 / CR	Environmental Management System (EMS)	C
FN000692 / CB	Escort Responsibilities	1
FN000733 / CB	Event Review and Analysis Overview for Employees, Users, and Affiliates	C
FN000540 / CB	Export Control Awareness	1
FN000466 / CB	General Records Management	C
FN000156 / CR	Hazard Communication	C
FN000034 / CR	New Employee ES&H Orientation	C
FN000029 / CR	O.D.H. Training	C
FN000199 / CR	PPE (Personal Protective Equipment) Availability And Use	C
FN000719 / CB	Science and Technology (S&T) Risk Matrix Lab-wide Training	C
FN000742 / CB	Site Access and Badging	C
FN000749 / CB	Site Access and Badging (Addendum)	C
FN000682 / CR	Work Planning & Controls	1
FN000684 / CB	Working Safely in the Era of COVID-19 and the Return to On-site Work	C
FN000508 / CR	Workplace Violence and Active Shooter/Active Threat Awareness Training	C

TRAINING FOR FERMILAB ONSITE ACCESS

- Some additional courses are required for access to one of the FNAL sites: Batavia, Illinois (main site) or Lead, South Dakota (DUNE far detector site)
 - **ESH&Q new user/employee orientation** including basic safety rules and procedures:
 1. Environmental Management System (EMS) FN000377
 2. PPE (Personal Protective Equipment) Availability And Use FN000199
 3. Hazard Communication FN000156
 4. GHS Hazard Communication Update FN000496
 5. Electrical Safety Orientation FN000387
 6. Job Hazard Analysis FN000432
 7. General Employee Radiation Training FN000241
 - **Sexual harassment training and prevention**
 - **Workplace violence and active shooter/active threat awareness**
- Each employee or visitor has an Individual Training Plan (ITP) compiled by their supervisor, that lists the required training based on their job tasks. The TRAIN system manages each user's ITP (listing courses and their due date)
- Visitors without required training must be escorted on site at any time. They can have a limited access onsite (excluding controlled areas) for maximum 1 week

BUILDING-SPECIFIC TRAINING AT FERMILAB

- In order to access to buildings or sites with additional risk factors (radiation, electrical, chemical...), specific training courses and exams must be passed
- Similarly, additional training may be required for performing specific tasks. This must be stated in the corresponding Work Plan
- As an example, lower levels of the ICARUS building (mezzanine and pit) have large quantities of cryogenic liquids -> high risk of oxygen deficiency (ODH)
- Access to these level requires ODH training, medical examination and an oxygen monitor. At least 2 people must access together



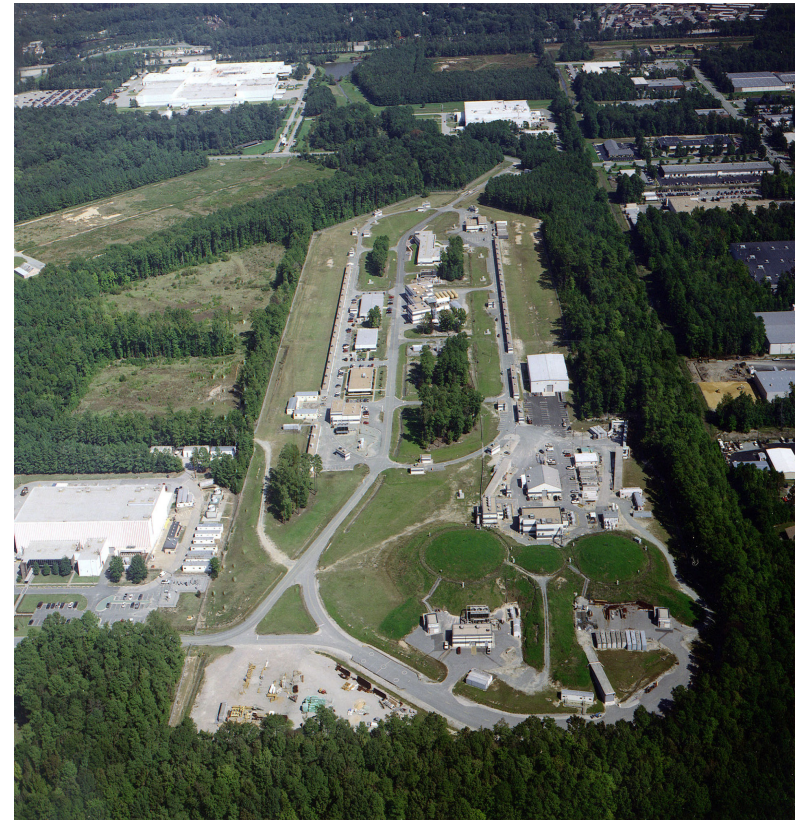
FERMILAB ACADEMIC TRAINING

- Academic (non-compulsory) training at FNAL is provided through a rich program of seminar cycles on all research topics at the lab:
 - Accelerator Physics and technology
 - Computing Techniques
 - LHC Physics
 - Neutrino Physics
 - Particle Astrophysics
 - Research Techniques
 - Theoretical Physics
- Lectures targeted to undergraduate/graduate level (e.g. Neutrino University: <https://npc.fnal.gov/neutrino-university/>) happen in summer in coincidence with the FNAL/INFN Summer Student program
- FSPA (student/postdoc association) has a cycle of dedicated lectures for orientation of early-career scientists in science and society
- Public colloquia (open to everyone) explore a wide range of science-related topics

events.fnal.gov

THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY (JLAB)

- The largest US laboratory in particle physics, managed by the US Department of Energy (Office of Science)
- Founded in 1984, located in Newport News (Virginia)
- Broad research program centered on studies of nuclear structure using the CEBAF (Continuous Electron Beam) accelerator
- Employs ~750 people, with ~2000 international scientific visitors



JLAB TRAINING

- Training required to visit the lab and take shifts in the experimental halls

CST001: **Cyber Security** Awareness

GEN034: **Security Awareness** Training

Required for all visitors

SAF100: **Environment, Safety and Health** Orientation

SAF103: **Oxygen Deficiency** Hazard

SAF111: **Hall B Safety** Awareness

SAF116kd: Physics Division **Work Governance**

SAF801C: **Radiation** Worker 1 Class

Required, on top of the other trainings, to take shifts

SAF801P: **Radiation** Worker 1 Practical

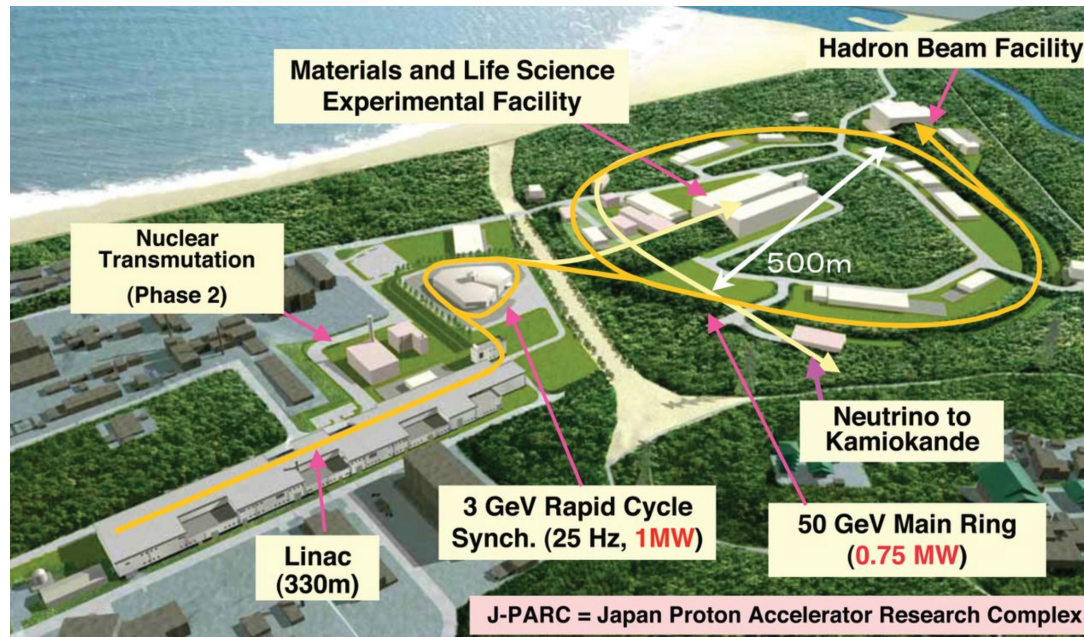
SAF801T: **Radiation** Worker 1 Test

SAF801kd: General Access **Radiation** Work Permit

The trainings have variable duration, and different « formats »:

- CST001 expires annually and is a video that has to be watched entirely, plus questions at the end
- SAF801T expires every 2 years, and is a web-based quiz that has to be taken on site from a specific PC in the presence of a User Liason representative
- SAF801kd expires annually and is a pdf that has to be read and signed at the end
- ...

JAPAN PROTON ACCELERATOR RESEARCH COMPLEX (J-PARC)



- Located in Tokai. Managed jointly between KEK (High-Energy Accelerator Research organization) and JAEA (Japanese Atomic Energy Agency)
- 3 main accelerators (400 MeV linac, 3 GeV Rapid Cycling Synchrotron, 30 GeV main ring)
- Provides neutrino beam to Kamiokande lab (T2K experiment)

J-PARC Users Training Courses

• General Safety Training Course:

This course covers fundamental safety protocols and guidelines applicable to working in a laboratory or research facility. This includes basic safety procedures, emergency protocols, laboratory hygiene, equipment handling, and the proper use of personal protective equipment (PPE). This training is essential to ensure that individuals are aware of potential hazards and equipped to work safely in the facility environment.

The training is available online to allow users to complete it prior to their visit to J-PARC, thereby familiarizing themselves with safety protocols in advance.

• Radiation Safety Training Course:

Given the nature of research conducted at J-PARC, which involves particle accelerators and may involve the use of radioactive sources, radiation safety training is of utmost importance. This training covers topics such as the principles of radiation safety, the hazards associated with exposure to radiation, proper handling and storage of radioactive materials, radiation monitoring and detection, and emergency response procedures in case of radiation incidents.

The radiation safety training course is conducted on-site after users arrive at J-PARC. This allows for more specific instruction tailored to the facility's radiation safety protocols and ensures that users are adequately prepared to work safely with radiation sources during their experimental activities.

1

To Experiments and Work Safety
~Safety education for J-PARC users~

J-PARC

Labels in the aerial view: Materials and Life Science Experimental Facility, Hadron Experimental Facility, Main Control Building, Nuclear Transportation Experimental Facility, Neutrino Facility, 50 GeV Proton Synchrotron, 3 GeV Proton Synchrotron, Linac.

Educational contents

- <General matters>
 - In case of a fire or an explosion
 - In case of an earthquake
 - In case of injury or sudden illness
 - Caution and procedures for experiments
 - The duty of a work supervisor
- <Technical matters>
 - Chemicals
 - High pressure gases and liquefied gases
 - Electrical systems
 - Cranes
 - Work at heights
 - Lasers
 - Other work
- <Accident cases>

Safety education for J-PARC users(NOV, 2009) v1.6.1

Complete on-line safety instruction

3

Reporting Procedure

J-PARC

Flowchart steps: 1. A detector triggers an alarm. 2. The person in charge of the accident area or the substitute contacts the fire department of Tokai village (0119) and JAEA emergency (6222). 3. The person in charge of the accident area or the substitute reports to the Central Security Office (029-282-5555).

Example of Fire and Emergency report flow chart

Each reporting chart is posted on the wall in each laboratory

Ⓜ1) If no extensions : 119
Ⓜ2) If no extensions : 029-282-5555 (Central Security Office)

(Caution)
- 0119 and 6222 cannot speak English
- Ask nearby personnel or your host researcher by telephone

Safety education for J-PARC users

IRMA

Innovative Radiation Monitor for contAiners at port customs gates

Progetto IRMA – Revisione Finale
18/01/2023



UNIONE EUROPEA

IRMA

Innovative Radiation Monitor for
contAiners at port custom gates

Progetto cofinanziato dal
POR FESR Toscana 2014-2020

AZIONE 1.1.5 sub A1

*Project managed by INFN-University of Pisa in collaboration with the
Tuscany Region and local private companies*

*Just an example of how technologies developed in the particle physics
community can be applied for very different use cases*

Applying technologies developed for particle physics research to homeland security

We developed a portal to detect radioactive/nuclear materials accidentally dispersed or intentionally hidden in commercial containers in transit in the harbour areas.

Main portal characteristics:

- High sensitivity (to possibly detect small amounts of radioactive material)
- Low rate of false positives (minimise false alarms)
- Discriminate photons (most radioactive materials) from neutrons (Plutonium)
- Extremely robust, can be installed directly on the spreader (hostile operational environment, temperature/humidity variations, mechanical stress, vibrations)
- Easy to connect to the harbour communication and surveillance infrastructure
- Cheap (we used plastic scintillator, wavelength shifters, silicon photomultipliers)

Detector tests on the spreader

