



NanoESCA Beamline Safety Instructions

Parent process: PRSI - Procedere in sicurezza

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1 Purpose

This document contains information on the main scientific and technical activities carried out at the "NanoESCA" beamline (abbreviated name "NAES") at Elettra - Sincrotrone Trieste S.C.p.A. (hereinafter "Elettra Sincrotrone Trieste" or "Company") and a series of *Operating Instructions* necessary to perform these activities in safe conditions.

This document can be downloaded directly from the beamline website:

<https://www.elettra.eu/lightsources/elettra/elettra-beamlines/nanoesca/safety.html>

For anything not expressly considered below, reference is made to the laws and regulations in force, and in particular to the [LEGISLATIVE DECREE 9 April 2008, no. 81](#).

2 Persons in charge of safety

The responsibility for the safety of workers operating at the beamline lies with the following subjects:

- The *beamline safety supervisors*. They are the *beamline coordinator*, i.e., the person in charge of the activity, the *beamline scientists* and, in some cases, the *postdocs* and internal PhD students. The *safety supervisors* oversee the various activities carried out at the beamline, ensuring the implementation of the employer's directives and giving instructions for their correct execution.
- The list of the beamline safety supervisors can be downloaded from the following link:
<https://www.elettra.eu/lightsources/elettra/elettra-beamlines/nanoesca/safety.html>
- the *Safety Managers*, in the persons of the *Group Coordinators* of the SPEED and IDEAS beamline groups, who organize the work activity of each Group and supervise its proper implementation, with particular attention to prevention and protection measures. Their names can be found on the web page:

<https://www.elettra.eu/it/about/contatti-dei-coordinatori-di-gruppo.html>

2.1 Duties of the safety supervisors of the beamline

The beamline or laboratory safety supervisors must ensure that workers (including users, external collaborators, students, trainees, etc.) use the prescribed protective equipment and follow all prescribed safety instructions.

In the absence of the safety supervisor, this responsibility is fulfilled by her/him through the prior information and training of workers and the provision of safety procedures and instructions.

3 Beamline personnel

The names and contact information of the designated personnel can be found on the following web page:

<https://www.elettra.eu/lightsources/elettra/elettra-beamlines/nanoesca/contacts.html>



3.1 Categories of workers

Subject to appropriate training, the following categories of workers are authorized to work at the experimental stations and other parts of the beamline:

- Internal research personnel, i.e., personnel that is affiliated to the partner institute managing the beamline, namely the *beamline coordinator* (or *beamline responsible*), the *beamline scientists*, *postdocs* and PhD students (called *internal students* hereafter);
- external research staff, and in particular academic or industrial users (*users*), collaborators, fellows from other institutions, graduate students and trainees (external students hereafter);
- technical staff of the beamline (i.e., the beamline technicians).
- maintainers: electrical-electronic technical staff, information-technology staff, mechanical-fluid technical staff; technical staff of the Mechanical, Vacuum and Optical Engineering group.
- movers.

Each worker is responsible for taking care of his or her own health and safety and that of other persons in the workplace, on whom the effects of his or her actions or omissions fall, in accordance with his or her training, instructions and means provided by the employer.

3.2 General safety prescriptions and training

Each job category is required to complete the prescribed training courses for the specific activities of the job assignment, made available through the *Virtual Unified Office* (VUO) system.

All are encouraged to consult Elettra's **Risk Assessment Document** (document code: **PVAR-MAN-01**). In addition, electrical maintenance workers should take notice of the recommendations in the **PVAR-SCH-07** document, electrical-electronic technicians of those in the **PVAR-SCH-16** document. fluid-mechanic technicians of those in the **PVAR-SCH-09** e the **PVAR-SCH-19** documents. Administrative-informatics-project staff should take notice of the information provided in the **PVAR-SCH-03** document.

Important note: *it is beyond the scope of this document to report in detail on the safety requirements of electrical maintenance workers called upon to carry out routine and extraordinary maintenance operations on distribution electrical panels, or repair interventions on electrical sockets or similar devices, as there are risk assessment documents and specific safety instructions related to their activities. It is strictly prohibited for beamline scientific and technical personnel, as well as external researchers, to engage in any work activities involving electrical installations.*

4 The "NanoESCA" beamline

4.1 Description of the work area

The "NanoESCA" beamline (see **Figure 1**) is located inside the "S" building in the area between the wall surrounding the storage ring and the outer corridor near columns 14 and 16. The area occupied by the "NanoESCA" and "Nanospectroscopy" beamlines is separated from the adjacent beamlines by the escape routes (3) and (5).

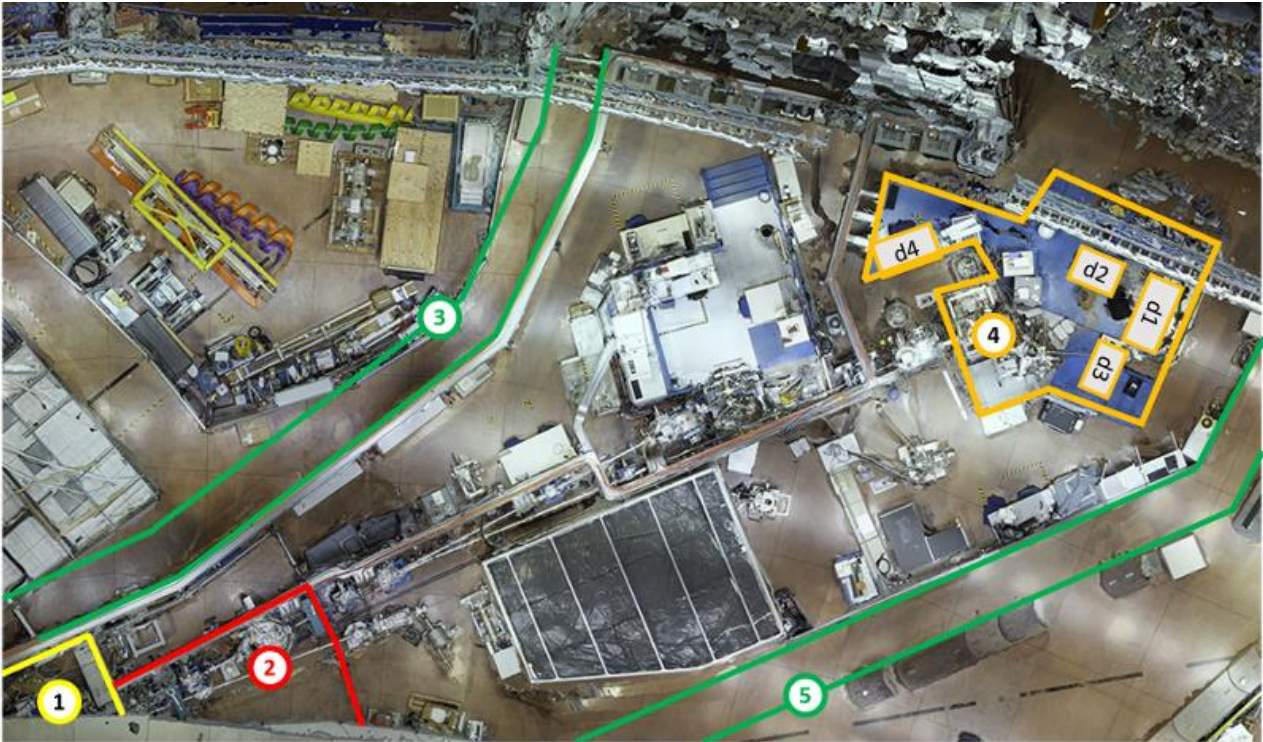


Figure 1: Plan of the "NanoESCA" beamline.

Referring to **Figure 1**, the areas marked in **yellow** (1) and **red** (2) correspond to the radiation protection *hutch* of the *front-end* and the safety fence located immediately downstream of the hutch, which contains the monochromator. They can be accessed only by authorized personnel, i.e., by those who have taken the "radiation protection course for personnel authorized to withdraw keys of the Elettra hutches" (document code: **GREL-PRO-22**) and are in possession of the code necessary to withdraw the *front-end* key from the *key-safe box* located at the exhibition area.

The areas marked by the **green** lines (highlighted by labels 3 and 5 in **Figure 1**) are escape routes. In particular, escape route (3) connects the *front-end* radiation protection *hutch* to the corridor outside the experimental room. Escape routes should be kept clear of obstructions at all times.

The orange contour in **Figure 1** highlights the elevated platform that houses the "NanoESCA" beamline experimental station (4), at which experiments approved by the Elettra *Proposal Review Panels* are performed.

The "NanoESCA" and its preparation experimental stations have an adequate number of workstations (indicated "d1-d4" in **Figure 1**), at which data acquisition and analysis activities can be carried out during the experiments. Each workstation is equipped with a desk and one or more ergonomic chairs.

Instead, sample preparation and assembly takes place in the ESP4 PT 008 laboratory, where a suitable work table is set up for this purpose.



4.2 Scientific activity of the beamline

The "NanoESCA" beamline operates in the 25-1000 eV spectral range. It is used by a large and heterogeneous academic community to study the electronic structure and spin properties of materials, with applications in the fields of surface science and materials science, nanoscience and solid state physics.

The experimental station of the "NanoESCA" beamline houses a full-field *spectroscopic* electron microscope called "NanoESCA", designed and built by FOCUS GmbH. The "NanoESCA" spectromicroscope exploits the photoemission phenomenon to visualize surfaces, interfaces and thin films of metallic and organic molecules, oxide and semiconductor materials.

The experimental-station of the "NanoESCA" beamline enables a wide range of experimental analytical investigation methods to be performed with structural, chemical and magnetic sensitivity, and in particular:

- *Microspot Angle Resolved Photoelectron Spectroscopy* (μ -ARPES)
- *Spin resolved Angle Resolved Photoelectron Spectroscopy* (Spin-ARPES)
- *X-ray PhotoEmission Electron Microscopy* (X-PEEM)
- *X-ray Absorption Spectroscopy PhotoEmission Electron Microscopy* (XAS-PEEM)
- *X-ray Magnetic Circular Dichroism PhotoEmission Electron Microscopy* (XMCD-PEEM)
- *X-ray Magnetic Linear Dichroism PhotoEmission Electron Microscopy* (XMLD-PEEM)
- *Microspot X-ray Photoelectron Spectroscopy* (μ -XPS)

4.3 Instrumentation available

A list of the main equipment used at the beamline is provided in this Section (the **CE** symbol indicates the special marking required for marketing the products within the European Community).

4.3.1 User and instruction manuals

The manuals of the instrumentation available at the beamline are stored in the drawer file cabinet located in the rack. PDF versions of the manuals of the instruments placed in the beamline racks can be downloaded from:

<https://drive.elettra.eu/d/d0ede4a21238445e9970/>

4.3.2 Beamline vacuum chambers

The beamline vacuum chambers house the synchrotron beam transport optics from the source to the experimental stations of the "Nanospectroscopy" and "NanoESCA" *branchlines*, the related manipulators, pressure sensors, ion pumps and beam diagnostic instruments.

A list of the vacuum chambers installed on the beamline is reported in the following, in the order from the source to the experimental station:

- Vacuum tube connecting the beamline to the *front-end*
- Vacuum chamber of the Elettra ring FEL mirrors (to be removed at the end of 2024)
- Vacuum chamber of prefocusing mirror (will be replaced during 2025)
- Vacuum chamber of the horizontal slit of the monochromator
- Vacuum chamber of the monochromator entrance slit
- Vacuum chamber with auxiliary horizontal slit (will be installed in 2025)



- Vacuum chamber of the Monochromator
- Vacuum chamber of monochromator exit slit
- Vacuum chamber of the beam deflection mirror to the *branchline* "NanoESCA"
- Auxiliary vacuum chamber for sample and specimen holder preparation
- Intermediate pumping stage of the "*Nanospectroscopy*" *branchline*
- Intermediate pumping stage of the "NanoESCA" *branchline*
- Vacuum chamber of refocusing mirrors of the "*Nanospectroscopy*" *branchline*
- Vacuum chamber of refocusing mirrors of the "NanoESCA" *branchline*

4.3.3 Beamline control instrumentation

All instrumentation listed in this section belongs to Elettra-Sincrotrone Trieste, and is maintained by Elettra's employees.

- *Rack 1* (radiation protection *hutch* access control), containing the following controllers:
 - 1x Eaton EATS16 Rack Mount Power Supply **(CE)**
 - 1x Custom-made instrumentation enabling access control to the radiation protection *hutch*.
- *Rack 2* (*front-end* instrumentation control), containing the following controllers:
 - 2x *Heidenhein* Display Unit [obsolete, not in use].
 - 1x VAT *fast closing system*
 - 1x Elettra *custom made PLC* (master unit)
 - 1x Eaton EATS16 Rack Mount Power Supply **(CE)**
- *Rack 3* (*front-end* instrumentation control), containing the following controllers:
 - 2x *Balzers* TPG 300 **(CE)**
 - 1x *Agilent* 4UHV ion pump controller **(CE)**
 - 2x Elettra *custom made* YAMS *power supply* 24VDC @ 14.6 A
 - 1x Eaton EATS16 *Rack Mount Power Supply* **(CE)**
 - 1x MOXA N-port 5650-8 **(CE)**
- *Rack "01 ALIM DA QD1N/QD1P"* (*beamline* instrumentation control), containing the following controllers:
 - 2x MOXA N-port 5650-8 **(CE)**
 - 5x *Balzers* TPG 300 **(CE)**
 - 4x *Agilent* 4UHV ion pump controller **(CE)**
 - 1x *Varian Multivac* Power Supply **(CE)**
 - 2x Elettra *custom made bunch-marker and beam synchronization unit*
 - 2x Eaton EATS16 *Rack Power Supply* **(CE)**
- *Rack "02 ALIM DA QD1N/QD1P"* (*beamline* instrumentation control), containing the following controllers:
 - 1x *Heidenhein* ND780 Display Unit **(CE)**



- 2x Elettra *custom made* YAMS power supply 24VDC @ 14.6 A
- 1x Elettra *custom made* PLC unit (*slave*)
- 1x Eaton EATS16 Rack Mount Power Supply **(CE)**
- Rack "04 ALIM DA QD1N/QD1P" (monochromator instrumentation control, *bendable* mirrors, and auxiliary sample preparation chamber and sample holder), containing the following instruments:
 - 1x Elettra YAMS power supply 24VDC @ 14.6 A
 - 1x Eaton EATS16 Rack Mount Power Supply **(CE)**
 - 1x FUG 140-1250 Power Supply **(CE)**
 - 1x Elmitec Evaporation Source U200
 - 1x Pfeiffer DualGauge **(CE)**
 - 1x Varian TV70 Turbo V70 Controller **(CE)**
 - 1x Pfeiffer DCU 110 Turbo Controller **(CE)**

All instrumentation listed in Sections 4.3.4, 4.3.5 and 4.3.6 belongs to and is maintained by personnel affiliated with Forschungszentrum Juelich.

4.3.4 "NanoESCA" Microscope

- The "NanoESCA" microscope includes of the parts listed in the following:
 - Main experimental chamber and its pumping system, namely:
 - 1x Ion Gamma Vacuum pump
 - 2x Sublimation pump SUBLI-CON
 - 2x Turbo pumps Pfeiffer 300
 - 1x Pumping station Pfeiffer HiCube Eco
 - Gas-line
 - Various *bake-out* equipment
 - *Custom-made* bake-out controller (Forschungszentrum Juelich, FZJ)
 - *Hemiheating* heating tapes **(CE)**
 - Dewars
 - 1x Cryotherm APOLLO 150, 150 L **(CE)**
 - Cryostat Janis

4.3.5 "NanoESCA" microscope control instrumentation

- Data acquisition *workstation* named pc-nanoesca1
- Data analysis *workstation* named pc-nanoesca2
- "NanoESCA" microscope control *rack*, containing:
 - DC power supply boards of "NanoESCA" microscope lenses and alignment devices.
- " NanoESCA" instrumentation rack, containing the following controllers.
 - 2x ion gauge controllers, IONIVAC IM 540/ Granville-Phillips350 **(CE)**
 - 2x Sublimation pump controllers, SUBLI-CON **(CE)**
 - 2x Turbo pump controllers, DCU pPfeiffer **(CE)**



- 2x Power suppliers of CCD camera, PCO.POWER **(CE)**
- 1x Temperature controller, LAKESHORE **(CE)**
- 1x Power supply of “spin filter” set-up, FOCUS **(CE)**
- 1x Motor power suppliers of the sample manipulator, SmarAct **(CE)**
- 1x D-link web smart switch **(CE)**
- 1x Focus UHV Evaporator Power Supply **(CE)**
- 1x Gamma Vacuum pump controller **(CE)**
- 1x bake-out controller unit, custom-made (FZJ)

4.3.6 Instrumentation of the experimental preparation station

- Vacuum chamber, equipped with:
 - VG manipulator
 - LEED system, Specs
 - E-beam evaporators, FOCUS
 - Sputter gun, Specs
 - E-beam sample heater
 - Auger analyser
 - Pumping system consisting of:
 - 1x Turbo pump, Pfeiffer300
 - 1x Gamma Vacuum ion pump**(CE)**
 - 1x Sublimation pump **(CE)**
 - 1x Pumping station, Pfeiffer HiCube Eco **(CE)**
 - Fast entry lock:
 - 1x Turbo pump, Pfeiffer HiPace80 **(CE)**
 - 1x Pumping station, Pfeiffer HiCube Eco **(CE)**
- Computer for LEED and Auger data acquisition
- Instrument control rack of the preparation chamber, housing the following controllers:
 - 2x Turbo pump controllers, DCU pfeiffer**(CE)**
 - 1x Ion gauge controller, Granville-Phillips 350 **(CE)**
 - 1x Penning gauge controller, Pfeiffer Dual Gauge **(CE)**
 - 1x Sublimation pump controllers, SUBLI-CON **(CE)**
 - 1x FOCUS e-beam evaporation controller
 - 3x Auger power suppliers, STAIB instruments **(CE)**
 - 1x LEED power supplier, ErLEED 1000-A **(CE)**
 - 1x Two phase lock-in analyzer **(CE)**
 - 1x Gamma Vacuum pump controller **(CE)**



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- Other instrumentation at the side of the end-station:
 - Hemiheating heating tapes (**CE**)



4.4 Access to the beamline

External research personnel wishing to perform experiments at the "NanoESCA" beamline must fill out an appropriate request for access to the Elettra Sincrotrone Trieste site on the VUO portal and pass the required safety tests. Access to the beamline takes place in a very specific manner, which depends on the category and professional status of the applicant, see **Figure 2**:

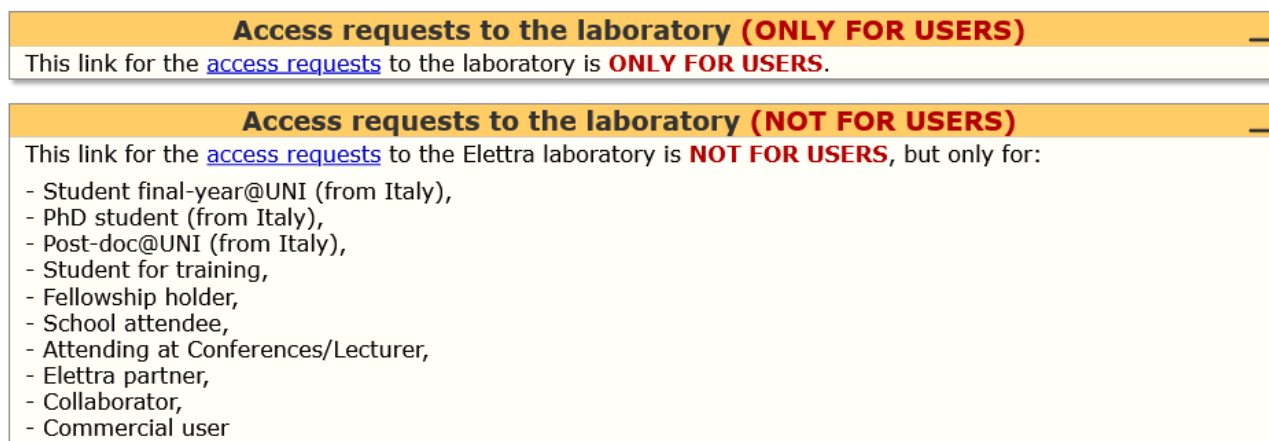


Figure 2: Types of access requests and categories of applicants

The main types of access requests are described below:

- **Academic users (following the approval of a proposal by the Elettra Review Panel):** submission on the VUO portal of an access request to Elettra's "NanoESCA" beamline following the approval of a scientific proposal for beamtime by the Elettra Proposal Review Panel. The access request is taken up and approved by the Users Office of the facility to which it is addressed.
- **Academic users (following the approval of an *in-house* research proposal):** submission on the VUO portal of a request for access to Elettra "NanoESCA" beamline as a participant in an internal research proposal, i.e., an "in-house" proposal. The access request is taken up and approved by the Users Office of Elettra Sincrotrone Trieste.
- **Industrial users:** submission on the VUO portal of an access request to the "NanoESCA" beamline as a participant in an industrial research proposal managed through the Industrial Liaison Office (ILO). The access request is handled by the ILO.
- **Collaborators and partners:** submission on the VUO portal of an access request to the Elettra Sincrotrone Trieste "NanoESCA" beamline as a collaborator or partner. This request is approved by an internal "tutor", namely a staff member of the beamline and then by the Users Office of Elettra Sincrotrone Trieste.
- **Students and trainees, external fellows, PhD students:** submission on the VUO portal of an access request to Elettra Sincrotrone Trieste's "NanoESCA" beamline as a student, trainee, external fellow, or PhD student. An agreement (such as a *Memorandum of Understanding/Convention*) between Elettra Sincrotrone Trieste and the institution with which the student/fellow is affiliated must be in place at the time of the request. The request for access is approved by the Human Resources Activity and an internal "tutor", in this specific case a member of the beamline staff.
- **Outside firms:** sending a request to the Prevention and Protection Service (PPS), for example by e-mail, to perform installations or provide services at the "NanoESCA" beamline following a procurement request and corresponding order. The contractor is required to provide and update the list of names of personnel who will be going to the Elettra Sincrotrone Trieste site. Entry will



be authorized by the SPP Activity, after sending the names of the personnel involved and the license plate of the vehicle with which access to the site will take place. According to current occupational safety regulations (Legislative Decree 81/08 as amended), any activity entrusted to the contractor must be preceded by a mutual exchange of safety documents, see:

<https://www.elettra.eu/activities/spp/information-for-external-firms.html>

5 Safety operating instructions

This section reports the safety operating instructions related to the main scientific and technical activities performed at the "NanoESCA" beamline and related experimental stations. These instructions were prepared on the basis of the risk assessment documents (DVRs) produced by Elettra Sincrotrone Trieste and Forschungszentrum Juelich with respect to their instrumentation and activities.

- “NanoESCA” beamline risk assessment summary document
- “NanoESCA” beamline worker risk assessment sheet (part of Elettra competence)
- “NanoESCA” end-station worker risk assessment sheet (part of Forschungszentrum Juelich competence)

All members of the beamline staff are responsible for ensuring that the activities specified herein are carried out in accordance with applicable regulations and in accordance with directives issued by the Responsible for the Activity, i.e., the *beamline coordinator*, and the *group coordinator*. Of particular relevance are the provisions concerning the use of the prescribed Personal Protective Equipment (PPE) detailed in the following.

Regarding the Protection and Safety Standards governing the activities in the Elettra Experimental Hall, we invite the reader to take notice of the document "Radiological Risk in the Elettra Experimental Hall" (document code: **RPFO-SCH-05**). Access to the hutch and the fenced area around the monochromator is allowed only to authorized personnel, see "Key management of Elettra hutches - General rules for beamline personnel" (document code: **GREL-PRO-22**). In order to allow safe access for maintenance personnel working under emergency conditions or on call, any interference hazards should be clearly marked on access doors to these areas. **Non-emergency access by unauthorized internal or external personnel, on the other hand, must be agreed upon with the beamline coordinator and always take place in the presence of authorized personnel.**

5.1 Special health conditions of the worker.

The performance of certain work activities described below may be incompatible with special physical or medical conditions. Workers are urged to promptly notify the beamline coordinator or the safety supervisor of any resulting limitations.

In the special case of pregnancy conditions, it is recommended that only those activities that can be assimilated to office work (described in Section 5.2), i.e., video terminal activities and in particular data acquisition or data analysis operations, should be performed. Particular attention should be paid to the observance of breaks.

Pregnant or post-partum workers must absolutely refrain from activities that expose them to electrical, chemical or radiological hazards or involve the risk of injury, or the performance of physical exertion. Please refer to the procedure "Pregnant and Postpartum Workers. Protection from health risks in the workplace" (document code: PVAR-IOP-01).



5.2 Video terminal activities (data acquisition and analysis, etc.)

Task Description: all work activities that require the use of personal computers or workstations, and in particular:

- data acquisition;
- data analysis;
- software development;
- CAD drawing;
- document preparation, e.g. scientific articles, email correspondence, etc.

Associated risks:

- demand for high visual attention in carrying out the operation;
 - no PPE is provided; current regulations require a break of 15 minutes for every 120 minutes of continuous activity;
 - appropriate training must be provided;
- repetitive movements, fixed postures, uncomfortable positions. Skeletal-muscular damage is possible. It is required to:
 - Maintain an ergonomically correct posture;
- slips, falls at level. Possible tripping on access ladder. It is required to:
 - Take special care when climbing up or down the staircase to access the elevated platform of the experimental station.

Video display screen activity may be conducted by the following categories of workers:

- research staff of the beamline and internal PhD students;
- external research staff;
- technical staff of the beamline.

Please note:

- *users, collaborators, fellows, external students and trainees may conduct data acquisition activities only after appropriate training by beamline staff. Damage to the instrumentation and thus a negative impact on the outcome of the ongoing experiment is possible. Elettra and Forschungszentrum Juelich reserve the right to seek compensation for damages incurred in case of negligent or irresponsible conduct.*
- *the activity of data acquisition should not be confused with that of manual operation of the experimental apparatus, which requires more training and experience and may pose risks to the operator.*
- *users cannot change the monochromator gratings, because the area in question is subject to radiation protection with access limited only to authorized personnel.*

5.3 Installation, use and removal of high-voltage instrumentation

Task Description: work activities involving the installation and use of scientific instrumentation whose internal parts can reach voltages from more than 500 volts up to several thousand volts, for example:

- electron beam sample heaters;



- electron beam evaporators;
- ion guns;
- Penning- or Bayard-Alpert-type pressure sensors;
- mass spectrometers (or QMS);
- ion pumps or titanium sublimation pumps;

Associated risks: electrocution. The following requirements should be followed:

- consult the manuals and strictly follow the installation instructions;
- check the integrity of the controller-instrument cabling before installation;
- Make sure not to exceed the maximum permissible curvature of the cables of ion and ion-gauges;
- connect and disconnect the instrument only when the power supply is off;
- follow the instructions for proper grounding of the instrument and its controller.

The activities described above can be carried out by the following categories of workers:

- research staff of the beamline and internal PhD students;
- external research staff;
- technical staff of the beamline;
- maintainers (electrical, electronic, IT and vacuum technicians).

Please note:

- *users, co-workers, fellows, external students and trainees may conduct this type of activity only after receiving appropriate training and authorization from the beamline safety supervisors. Instructions received must be followed strictly.*

5.4 Installation, use and removal of low voltage instrumentation

Task description: installation, use and removal of scientific instrumentation operating at low voltage (< 50 V). High currents (*), up to 10 A, may be present in some cases. Examples follow:

- capacitive pressure sensors;
- Pirani-type pressure sensors;
- filaments for heating samples or evaporation baskets (*);
- alkaline dispensers (*);
- Knudsen cell type evaporators (*).

Associated risks: burns. Possible explosion due to the electric arc following the accidental interruption of electric circuit continuity. The following requirements should be followed:

- consult the manuals and strictly follow the installation instructions;
- check the integrity of controller-instrument cabling before installation;
- connect and disconnect the instrument only when the power supply is off, being sure that no current is flowing through the cable connecting the controller to the instrument;
- pay special attention to connections between laboratory cables equipped with banana plugs.



The activities described above can be carried out by the following categories of workers:

- research staff of the beamline and internal PhD students;
- technical staff of the beamline;
- maintainers (electrical, electronic, IT and vacuum technicians).

Please note:

- *users, employees, fellows, external students and trainees may conduct this type of activity only after receiving appropriate training and authorization from the beamline safety supervisors. Instructions received must be followed strictly.*

5.5 Small repairs of electronic instrumentation

Task Description: replacement of damaged electronic components, such as fuses or capacitors, or replacement of entire electronic boards:

Associated risks: electrocution. The following requirements should be followed:

- before carrying out the repair, consult the manuals and strictly follow the instructions therein. Contact the manufacturer if in doubt;
- always disconnect the equipment from the power source before operating on it;
- always pay attention to the residual charge of the capacitors, since it persists even after the instrument is turned off. Wait sufficient time for the capacitors to discharge completely;
- in case of using the soldering iron, choose a suitable workstation. There is a fire hazard from using the soldering iron. Remove flammable objects from the work table. Turn off the soldering iron immediately after completing the repair;
- after completing the repair, inform the beamline coordinator and agree with him/her on the tests to be performed.

Electronic instrumentation repair activities can be performed by the following categories of workers:

- research staff of the beamline and internal PhD students;
- technical staff of the beamline;
- maintainers (electrical, electronic, IT and vacuum technicians).

Please note:

- *users, collaborators, fellows, external students and trainees ARE NOT AUTHORIZED to carry out this type of activity.*

5.6 Routine or extraordinary maintenance operations in the racks.

Task description: these are repair/replacement of instruments (e.g., controllers and power supplies) installed in the control racks of the beamline or experiment station, or repair/replacement of signal or serial/Ethernet communication cables.

Associated risks: electrocution. The following requirements should be followed:

- strictly observe electrical safety regulations;
- take into account what is stated in Sections 5.3, 5.4 and 5.5.
- before carrying out the installation or repair of any equipment, consult the manuals and scrupulously follow the instructions given therein. Contact the manufacturer if in doubt;
- always disconnect the equipment from the power supply before working on it; if necessary,



disconnect the power supply to the rack;

- always pay attention to the residual charge of the capacitors, since it persists even after the instrument is turned off. Wait sufficient time for the capacitors to discharge completely;
- be careful not to damage the cables of other instruments, especially those carrying high voltage (ion gauges, ion pumps); if necessary, turn off these instruments and move or remove their cables;
- after completing the repair, inform the beamline coordinator and agree on the tests to be performed.

Electronic instrumentation repair activities can be performed by the following labor categories:

- research staff of the beamline and internal PhD students;
- beamline technical personnel;
- maintenance personnel (electrical, electronic, IT and vacuum technicians).

Please note:

- **users, collaborators, fellows, external students, and trainees ARE NOT AUTHORIZED to perform this type of activity.**

5.7 Routine and extraordinary electrical maintenance work

Task description: routine maintenance operations of electric appliances, such as:

- electrical repairs in racks or on the electrical distribution boards;
- installation/repair of electrical sockets or socket panels;
- maintenance of electrical panels; testing of proper functioning of circuit breakers.

Associated risk: electrocution. The following requirements should be followed:

- strictly comply with electrical safety regulations;
- take note of the recommendations given in document **PVAR-SCH-07**.

Maintenance activities may only be performed by the following labor categories:

- maintenance workers (electrical-electronic technicians in the Infrastructure Group).

Please note:

- **all other work categories ARE NOT AUTHORIZED to perform this type of activity.**

5.8 Installation/removal of heavy or bulky instrumentation

Description: these are activities that must be performed with the support of the removals personnel. Typically, these are the transport, installation or removal of encumbered or heavy parts of the beamlines instrumentation or experimental stations, for example:

- vacuum chambers;
- manipulators;
- scientific instruments of relevant weight and size;
- ion or turbo-molecular pumps of significant weight and size;

Associated risks: manual handling of loads; shocks, hits, impacts. The following requirements should be followed:



- agree with the beamline coordinator on a plan for safe assembly/disassembly;
- request the intervention of removals personnel;
- always make use of the overhead crane for lifting vacuum chambers and heavy objects. Where it is not possible to intervene with the overhead crane, use a "goat" type lift;
- work in pairs to reduce the load and corresponding strain;
- always wear the prescribed PPE:
 - protective gloves, for example, leather gloves or cut-resistant gloves;
 - safety shoes;
 - protective helmet (only in case of overhead crane use).

The work activities described in this section can be conducted by the following categories of workers:

- research staff of the beamline and internal PhD students;
- technical staff of the beamline;
- movers

Please note:

users, collaborators, fellows, external students and trainees ARE NOT AUTHORIZED to carry out this type of activity.

5.9 Installation/removal of vacuum equipment and instrumentation

Task Description: installing or removing parts of the instrumentation of the beamlines or corresponding experimental stations, without use of the overhead crane and without support from removals personnel. By way of example, this involves performing the following tasks:

- installation or removal of scientific instruments (weighing up to 20 kg), ion or turbo-molecular pumps, membrane or diaphragm pumps;
- installation or removal of small to medium-sized vacuum instrumentation (weighing up to 20 kg);
- assembly or disassembly of various instrumentation, e.g., manipulators (weighing up to 20 kg);
- installation or removal of instrumentation in *racks* (weighing up to 20 kg);

Associated *risk*:

- manual handling of loads. The following requirements should be followed:
 - work in pairs to reduce the load and corresponding strain;
- shocks, hits, impacts. We recommend:
 - wear the following PPE: protective gloves, for example, leather gloves or cut-resistant gloves.
- slips, falls at level, tripping. It is recommended to:
 - keep the floor free of sharp objects, highlight any obstacle.

These work activities can be carried out by the following categories of workers:

- research staff of the beamline and internal PhD students;
- external research staff;
- technical staff of the beamline;



- maintenance personnel (electrical, electronic, IT and vacuum technicians).

Please note:

- *users, co-workers, fellows, external students and trainees may conduct this type of activity only after receiving proper training and authorization from the beamline safety supervisors. Instructions received must be followed strictly.*

5.10 Minor maintenance work on vacuum chambers

Task Description: routine maintenance operations of vacuum chambers and/or their vacuum components, for example:

- installation/removal or assembly/disassembly of instrumentation or parts and components of vacuum systems, e.g., *gate-valves, leak valves*, linear manipulators (*z-translators*), pressure sensors, ion cannons;
- opening/closing flanges to allow repairs and routine maintenance operations inside in the vacuum systems of the beamline or experimental stations;

Associated risk: shocks, hits, impacts;

- there are no prescriptions or use of PPE

Maintenance activities can be performed by the following categories of workers:

- research staff of the beamline and internal PhD students;
- external research staff;
- technical staff of the beamline.

Please note:

- *users, co-workers, fellows, external students and trainees may conduct this type of activity only after receiving proper training and authorization from the beamline personnel in charge of safety. Instructions received must be followed strictly.*

5.11 Small fluid-mechanical maintenance operations

Task description: minor fluid-mechanical maintenance, such as:

- water leak repairs;
- installation or replacement of faucets, rigid pipes, hoses, and flow switches.

Associated risk: shocks, hits, impacts;

- take notice of the recommendations in the **PVAR-SCH-09** and **PVAR-SCH-19** documents.

Associated risk: electrocution;

- take notice of the recommendations in the **PVAR-SCH-07** document and in **Section 6.3**.

Maintenance activities can be performed by the following labor categories:

- maintenance workers (fluid-mechanical technicians of the Infrastructure Group).

Please note:

- ***all other work categories ARE NOT AUTHORIZED to perform this type of activity.***



5.12 Elevation work on cable trays or vacuum chambers

Task description: operations performed in elevation on ladders or scaffolds, such as:

- laying or removing cables from cable trays;
- maintenance operations of the internal or external parts (e.g., manipulators) of the vacuum chambers of the beamline.

Associated risk: slip or fall from elevated positions. The following requirements should be followed:

- whenever possible, use a harness and secure to solid supports;
- work in pairs; one of the two must hold the ladder firmly.

The following **PROHIBITIONS** must also be observed:

- *work in elevation in positions that allow viewing inside the beamline shielding walls when the beam-stopper is open.*
- *working at elevation above 3 meters at a distance of less than 5 meters from the ring screens during machine physics shifts.*

Activities related to elevation work can be conducted by the following categories of workers:

- technical staff of the beamline.

Please note:

- **beamline researchers, users, collaborators, fellows, external students and trainees ARE NOT AUTHORIZED to carry out this type of activity.** The beamline research personnel may assist the technical staff

5.13 Cleaning of ultra-high vacuum components and tools

Task description: these are operations carried out in the course of routine or extraordinary maintenance of vacuum chambers and/or their parts and components:

- cleaning of small metal parts, such as parts of specimen holders, manipulators, and sensors. Cleaning is done by immersion in ethyl alcohol or acetone;
- cleaning of the tools used for assembly/disassembly of parts in ultra-high vacuum;
- material removal using filings or sandpaper, resulting in the formation of metal dust.

Associated risks:

- inhalation of gases or vapors. The following requirements should be followed:
 - avoid prolonged exposure to acetone vapors; if so, work under a fume cupboard;
 - wear latex gloves;
- inhalation of dust or fibers. The following requirements should be followed:
 - working under a fume cupboard;
 - wear latex gloves and lab coat;
 - wear FFP2 or FFP3 mask during all material removal operations.



Activities related to the cleaning of components and parts for use in ultra-high vacuum can be conducted by the following categories of workers:

- research staff of the beamline and internal PhD students;
- external research staff;
- technical staff of the beamline.

Please note:

- *users, co-workers, fellows, external students and trainees may conduct this type of activity only after receiving proper training and authorization from the beamline safety supervisors. Instructions received must be followed strictly.*

5.14 Maintenance of primary pumps

Task description: this is a routine maintenance operation, typically to be carried out once every one to two years, necessary to restore the pristine pumping speed of *scroll*, diaphragm, or diaphragm pumps. Seals/membranes are changed and mechanical cleaning is carried out using brushes, vacuum cleaners, and wet rags.

Associated risks: inhalation of dust. The following requirements should be followed:

- refer to the manual provided with the pump maintenance kit. Follow the manufacturer's recommended instructions;
- work under a fume cupboard or outside;
- wear latex gloves;
- wear FFP2 or FFP3 mask during the entire duration of cleaning operations.

The work activity related to the cleaning of primary pumps can be performed by the following categories of workers:

- technical staff of the beamline.

Please note:

- *The beamline research personnel may assist the technical staff. Users, collaborators, fellows, external students and trainees ARE NOT AUTHORIZED to carry out this type of activity.*

5.15 Leak check operations

Task description: search for leaks in vacuum chambers. A quadrupole mass spectrometer and a helium cylinder with a capacity of 16 liters is used.

Associated risks: shocks, hits, impacts. Prescriptions:

- the use of PPE is not expected;
- always use the appropriate trolley for handling the cylinder;
- always secure the cylinder to a fixed structure using the chain with which it is tied to the trolley, in order to prevent it from accidentally tipping over

Leak check operations can be carried out by the following categories of workers:

- research staff of the beamline and internal PhD students;
- external research staff;
- technical staff of the beamline.



Please note:

- *users, co-workers, fellows, students and trainees may conduct this type of activity only after receiving proper training and authorization from the beamline safety supervisors. Instructions received must be followed strictly.*

5.16 Bake-out of vacuum chambers

Task description: to achieve the usual ultra-high vacuum conditions, vacuum chambers are baked out at temperatures typically between 100°C and 150°C. Bake-out preparation consists of the following operations, each of which presents specific risks:

- Use of resistive heaters and tapes.

Associated risks:

- exposure to heat, burns during disassembly due to residual heat. The following requirements should be followed:
 - wear heat protective gloves during disassembly operations
- electrocution. The following requirements should be followed:
 - always use only **CE**-marked equipment;
 - multimeter verification of the heating tapes electrical integrity before use.
- inhalation of dust/fibers:
 - it is prohibited to use fiber-glass coated heating tapes, or fiber-glass sheets.
- **interference risk: signal with appropriate signs the danger from hot parts in order to prevent burns to personnel assigned to other tasks.**

Work activities related to *bake-out* operations can be conducted by the following categories of workers:

- research staff of the beamline and internal PhD students;
- external research staff;
- technical staff of the beamline.

Please note:

- *users, co-workers, fellows, external students and trainees may conduct this type of activity only after receiving proper training and authorization from the beamline safety supervisors. Instructions received must be followed strictly.*



5.17 Powder sample preparation

Task description: powders or nanoparticles are deposited on metallic or semiconductor samples for example by *spin coating* technique, or by fixing them under pressure.

Associated risks: inhalation of dust and/or fibers. The following requirements should be followed:

- consult the Safety Procedure of the User Support Laboratory;
- consult the safety datasheet of the substance and take necessary precautions;
- carry out the preparations in the Support Laboratory, always working under the fume cupboard;
- wear prescribed PPE: chemistry lab coat, latex gloves, goggles, FFP2 or FFP3 mask during the entire duration of preparation operations.

The work activity related to the powder sample preparation can be carried out by the following categories of workers:

- beamline research staff and internal PhD students;

Please note:

- *users, co-workers, fellows, external students and trainees may conduct this type of activity only after receiving appropriate training and authorization from the beamline personnel in charge of safety. Instructions received should be followed scrupulously.*

5.18 Mounting and insertion of samples into the experimental chambers

Task description: mounting samples on the “NanoESCA” Omicron type sample holders and introducing them into the *fast-entry lock* of the experimental station for pumping and subsequent transfer under high vacuum conditions to the preparation and main experimental chambers of the “NanoESCA” end-station.

Associated risks:

- inhalation of dust, fibers. The following requirements should be followed:
 - consult the safety datasheet of the substance and take necessary precautions;
 - use latex gloves; if necessary, wear an FFP2 or FFP3 mask;
- repetitive movements, uncomfortable postures. Temporary incongruous postures may cause musculoskeletal disorders. There are no special prescriptions.

Sample assembly activity can be conducted by the following categories of workers:

- research staff of the beamline and internal PhD students;
- external research staff.

Please note:

- *external research personnel, i.e., users, collaborators, fellows, external students and trainees may assemble and insert samples into the experimental chambers only after receiving appropriate training and clearance from the beamline safety supervisors. Instructions received must be followed strictly. Substantial damage to the instrumentation caused by unintentional venting of the experimental apparatus is possible. Elettra and Forschungszentrum Juelich reserve the right to claim compensation for damages incurred in case of negligent or irresponsible conduct.*



5.19 Use of liquid nitrogen

Task description: scientific experiments with the “NanoESCA” microscope or the sample preparation sometimes require cooling the sample by the use of liquid **nitrogen** and liquid **helium** cryostats. Operation of a cryostat requires certain preparatory activities to be carried out, each of which is characterized by a specific risk:

- “Filling of the “APOLLO 150” dewar with liquid nitrogen at the distribution station.

Associated risks:

- exposure to cold due to accidental contact with low-temperature liquid or gaseous nitrogen. Injuries from frostbite or burns are possible. The following requirements should be followed:
 - wear cryogenic gloves and protective goggles;
 - it is advisable to have taken the "Azoto Elettra" course or equivalent course on the use of cryogenic gases and liquids;
 - training and information: refer to **PRSI-PRO-03** Safety Procedure;
 - do not to exceed the maximum dewar fill level of 120 l (measured with the level gauge meter).

- Transportation of the dewar to the experimental station.

Associated risks:

- shocks, hits, impacts; crushing due to the possible tipping over of the dewar at the access ramp to the Elettra experimental room. The following requirements should be followed:
 - training and information: refer to **PRSI-PRO-03** Safety Procedure.

- Connection, use and disconnection of the “APOLLO 150” dewar to the experimental station cryostat by liquid nitrogen transfer line.

Associated risks:

- shocks, hits, impacts. The following requirements should be followed:
 - Work in pairs during the assembly/disassembly operations of the liquid nitrogen transfer line;
- exposure to cold from accidental contact with low-temperature liquid or gaseous nitrogen. Injuries from frostbite or burns are possible. The following requirements should be followed:
 - wear cryogenic gloves and protective goggles;
 - strictly follow the instructions in the user's manual of the "APOLLO 150" dewar;
 - prevent overpressure from building up in the “APOLLO 150” dewar; in particular, after lowering the pump into the dewar, connect the outlet to the power and check that the standby mode is on.

Work activities related to the operations *of filling, transporting, and connecting dewars to the cryostat* can be conducted by the following categories of workers:

- research staff of the beamline and internal PhD students;
- technical staff of the beamline.



Please note:

- *users, co-workers, external students and trainees will be allowed to cooperate in such operations only after receiving appropriate training and authorization from the beamline safety supervisors. Instructions received must be followed scrupulously.*

5.20 Use of liquid helium

Task description: scientific experiments performed with the “NanoESCA” microscope sometimes require cooling the sample through the use of liquid helium cryostats. Operation of the cryostat requires connecting a dewar containing liquid helium to the experimental chamber via a transfer line. Liquid helium dewars are delivered by the external supplier contracted by Elettra at the sampling point located in the “S” Building. The beamline personnel are responsible for transporting dewars to the nearby “NanoESCA” experimental station. Once the experiments are completed, dewars must be brought back to the pickup point.

- Transportation of the dewar to the experimental station or the dewar’s pick up point.

Associated risks:

- None. There is no risk of tripping, bumping, hitting, impacting, or even crushing, since there are no ramps to cross.:
- Connection, use and disconnection of dewar to the experimental station cryostat through liquid helium transfer line.

Associated risks:

- shocks, hits, impacts. The following requirements should be followed:
 - Work in pairs during the assembly/disassembly operations of the liquid helium transfer line;
- exposure to cold due to accidental contact with liquid or gaseous helium at low temperature. Injuries from frostbite or burns are possible. The following requirements should be followed:
 - use protective gloves and goggles both when connecting/assembling the transfer line and when disassembling/disconnecting it
 - aery slowly lower the pump / transfer line into the dewar;
 - after lowering the pump into the Dewar, connect the outlet to the power and check that the standby mode is on, as this will prevent overpressure from building up;

Work activities related to the operations of filling, transporting, and connecting dewars to the cryostat can be conducted by the following categories of workers:

- research staff of the beamline and internal PhD students;
- technical staff of the beamline.

Please note:

- *users, co-workers, external students and trainees will be allowed to cooperate in such operations only after receiving appropriate training and authorization from the beamline safety supervisors. Instructions received must be followed scrupulously.*

5.21 Experiments with non-toxic gases

Task description: gas-line preparation, evacuation, and filling using mini-bottles (1-liter capacity at 12-bar pressure) of the following gases: O₂ , H₂, CO₂, Ar, Ne, He, CH₄, C₂H₄.



Associated risks: not significant. The gases are nontoxic and are used in minute quantities, on the order of a few tens of thousands of L (Langmuir).

Gas-line preparation instructions:

- connect the mini-bottle to the *gas-line*;
- ensure that the drains of all primary pumps are connected to the suction system;
- test the vacuum tightness of the *gas-line* section on which the cylinder is connected;
- fill the gas-line with gas and perform the necessary flushing operations;
- finished the experiment, evacuate *the gas-line* before removing the mini-bottle.

Work activities related to *gas-line* preparation can be carried out by the following categories of workers, subject to appropriate training (damage to the experimental apparatus is possible):

- research staff of the beamline and internal PhD students;
- external research staff;
- technical staff of the beamline.

Please note:

- *users, co-workers, fellows, external students and trainees may conduct this type of activity only after receiving proper training and authorization from the beamline safety supervisors. Instructions received must be followed strictly.*

5.22 Experiments with toxic or corrosive gases

Task description: installation of pressure regulator on cylinders; connection of cylinder to gas-line; preparation, evacuation and filling of gas-line; gases used: NO, NO₂, NH₃ (contained in 2- or 5-liter volume cylinders) and CO (1-liter mini-bottle).

Associated risks: inhalation of vapors or gases. The experiments are performed under vacuum conditions at pressures below 2·10⁻⁶ mbar, dosing very low quantities, on the order of a few tens of thousands of L (Langmuir). The following requirements should be followed in order.

Interference risk: any gas leaks could affect the nearest laboratories and beamlines. Act with utmost care, strictly observing all the steps listed below:

- make sure the central gas extraction system is working properly;
- consult the safety data sheet of the gas and take necessary precautions, e.g., use of gas mask;
- in the case of NO, NO₂, NH₃ one must have a pressure regulator suitable for the gas in use. CO, on the other hand, is available in mini-bottles. The amount of CO contained in the mini-bottles is such that there is no cause for concern, given the volume of Elettra's experimental room;
- mount the pressure regulator on the cylinder by working under a hood or outdoors; work in pairs.
- secure/anchor the cylinder to a solid support located near the gas-line of the experimental station;
- connect the cylinder to the gas-line using steel pipes dia. 6 mm and Swagelok connections®;
- ensure that the exhausts of all primary pumps are connected to the suction system;
- test the vacuum tightness of the gas-line section on which the gas cylinder is connected;
- fill the line with gas by opening the tap and pressure regulator of the cylinder;
- perform the necessary gas-line flushing operations;
- once the experiment is finished, close the cylinder and evacuate the gas-line. Pump for a long



time before venting and detach the cylinder from the gas-line;

- store the cylinder in a safe place, that is, in the outdoor cages dedicated to hazardous gas storage.

In case of accidental gas leakage in large amount, inform the control room (8922) to request evacuation of the experimental room by loudspeaker. If possible, intercept the leak and stop it without endangering your own safety. Open the gates of the experimental room to favor air exchange.

All work activities related to gas-line preparation **MUST BE** performed by the following categories of workers, after adequate training and authorization from the beamline coordinator:

- senior research staff of the beamline;
- technical staff of the beamline.

Please note:

- *users, co-workers, fellows, postdocs, internal and external students, trainees, and especially pregnant or post-partum women ARE NOT AUTHORIZED to carry out this type of activity.*

5.23 Maintenance operations on the “NanoESCA” microscope control rack.

Task description: the microscope control rack is opened at the rear and/or front in order to perform maintenance operations, such as installation or removal or repair of a power supply or a specific scientific instrument used in selected experiments.

Associated risks: shocks, hits, impacts. In the stages of opening and disassembly of the racks, accidental falling of the closure panels may occur. Tools used in disassembly may fall during work. There is no risk of electrocution, since opening the rack panels causes the rack power supply to be cut off. The following requirements should be followed:

- carefully consult the “NanoESCA” (FOCUS GmbH) microscope manuals, available at the end-station
- those assisting the person performing the procedure should not stand in the area adjacent to the rear platform, as they would be exposed to the accidental falling of tools or panels;
- do not tamper with the rack or its internal or external parts.

The experimental activities performed herein described can be carried out by the following categories of workers, following appropriate training:

- research staff of the beamline and internal PhD students;
- technical staff of the beamline.

Please note:

- *users, collaborators, fellows, external students and trainees ARE NOT AUTHORIZED to conduct this type of activity.*



6 Electrical Safety Standards

Electrical and electronic equipment in operation at the beamline experimental stations expose operators to electrical hazards. This risk is reduced by complying with current regulations and following the guidelines and prohibitions below:

6.1 Recommended electrical safety guidelines

- Comply with safety signs and related regulations.
- Ensure that the electrical system or equipment has the necessary approvals and certifications, if necessary contacting the competent personnel.
- Be sure of the location of the electrical panel supplying power to the area in which you are working so that you can promptly de-energize the system if necessary.
- Use electrical systems in accordance with their intended use and respective operating manuals.
- Ensure that the power cords of electrical appliances are adequately protected from mechanical (passing people, sharp objects, etc.), thermal (heat sources) or chemical (corrosive substances) actions.
- Make sure the power has been turned off before performing any simple operation on the facilities (including changing a bulb) or equipment.
- Always make sure the electrical system is disconnected (after operating the appropriate switch) before unplugging.
- Disconnect the equipment from the power source before starting periodic cleaning.
- Plug the equipment into the nearest outlet, avoiding the use of extension cords as much as possible.
- Do not overload outlets with too many electrical consumers, always checking that the total current load intensity does not exceed the limits of the outlet itself.
- The multiple adapters allowed by the standards are those with only two side sockets. The other type, with a third socket parallel to the plugs, is considered dangerous because it allows multiple sockets to be chained together.
- German-type (Schuko) plugs can be inserted into Italian-type sockets only by means of an adapter that transfers the ground connection made via the side plates to a central plug. It is absolutely forbidden to forcibly insert Schuko plugs into Italian sockets.
- Avoid subjecting all parts of electrical systems to mechanical or impact actions (passing trolleys, etc.).
- When using roller extensions, they must be fully unwound to avoid overheating. In fact, the capacity of the coiled cable is reduced. The capacity of the cable, which must be indicated, must always be respected.
- Do not pull the power cord to disconnect an electrical appliance from the outlet, but use the plug.
- Do not tamper with electrical equipment (qualified personnel must be requested for any need in accordance with company procedures).

6.2 Prohibitions

- Prohibition of tampering with electrical appliances.
- Prohibition to install or use private electrical equipment or materials.



- Prohibition to intervene in case of failure on switchboards or electrical panels.
- Prohibition of covering or concealing the controls and electrical panels with cabinets or other furnishings (allow inspection and timely intervention in case of anomalies).
- Prohibition of removing the protective channels of electric cables.
- Prohibition of overloading outlets with too many electrical consumers, using adapters or multiple outlets.
- Prohibition of depositing flammable substances in the vicinity of equipment.
- Prohibition of depositing containers filled with liquids on the devices.
- Prohibition of exposing equipment to excessive radiation or heat sources.
- Prohibition of preventing proper ventilation of equipment by covering ventilation openings.
- Prohibition of touching facilities and/or equipment if you have wet hands or shoes.
- Prohibition on the use of water for extinguishing fires of electrical origin.

6.3 Behavior to be followed in case of water leakage

The electron beam evaporators and turbo-molecular pump in use at the “NanoESCA” microscope experimental station and at the preparation chamber require cooling water. Some of the beamline chambers also need water, which is used to cool the monochromator optics, the entrance slits and the pre-focusing mirror. Such water is demineralized, and therefore non-conductive.

Given the presence of high voltage in many pieces of equipment, the risk of electrocution cannot be ruled out. For this reason, it is important to avoid putting yourself or others in a dangerous condition. The following recommendations must be followed:

1. Consult the beamline safety supervisor, if she/he is on site.
2. Don't get caught up in rush or panic.
3. Avoid stepping on wet areas.
4. Avoid touching wet areas with your hands.
5. Prevent flooding by closing the cooling circuit subject to leakage.
6. DO NOT dry wet areas with paper or rags, unless you have turned off power to all *racks* and utilities. Cordon off the area so as to prevent third parties from accessing it.
7. If the presence of water is limited to the concrete platform on which the microscope rests, use dry nitrogen gas to promote its evaporation.



7 Emergency management

Various and of different severity are the emergencies that can happen on the power line. They must be handled according to the company's Emergency Plan (see procedure GEEM-PRO-02-rev03IT).

