DESY II Test Beam Facility

Safety Briefing

Coordinators:
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Norbert Meyners
Marcel Stanitzki

Status: 5/20/21

For more detailed information, see general DESY safety instructions
Introduction

- Each user has to attend this safety lecture once every twelve month
- The rules are specific for the DESY II Test Beam Facility
  - Might differ from other places at DESY
- Each group has to assign one responsible person, which should be present during the test beam!
  - This person is responsible for the actions of the whole group
  - All communication should include this person
  - If more than one group in an area: assign one coordinator
  - All responsibilities have to be filled in the door sheet (including a mobile phone number) which has to be placed at the entry of the hut
  - Communicate any changes of responsible person ASAP
- Before data taking: Safety check by the test beam coordinators (in case of special setups: involvement of DESY safety group)
Coronavirus/COVID-19

Special rules apply currently due to Coronavirus/COVID-19

- General DESY page (check regularly for updates!), read+respect the general DESY rules listed there
- Read+respect the additional rules for the test beam facility, confirm via signature sheet before arrival: https://particle-physics.desy.de/test_beams_at_desy/coronavirus_covid_19/index_ger.html
- Follow basic hygiene rules:
  - Don’t come if feeling sick or showing symptoms: Inform colleagues, coordinators and DESY health service!
  - Keep distance to other persons: absolute minimum 1.5 m, better 2 m (this includes looking at the same screen: only with distance!)
  - Don’t share tools (includes keyboard/mouse)
  - Wash hands regularly, especially before eating, use hand disinfectant
  - Keep number of people to minimum: max 8 per team, at least 2 on-site +
    - Huts: max 2 per side in hut 21/22, max 2 in hut 24 (hard limit)
    - Areas: more allowed keeping distance of > 1.5 m whenever possible and mandatory FFP2 masks used
  - Self- + Quick-tests: on voluntary basis
    - Strongly encouraged one or more times per week, as available (in addition to / not instead of other measures)
      But they are not mandatory and results are not checked
**Coronavirus/COVID-19**

Special rules apply currently due to Coronavirus/COVID-19

- “As the highest rule, a distance of at least 1.5 m, preferably 2 m, must always be maintained between two employees on campus.”

  *DESY Guidelines Corona Virus/COVID-19*

- Mask rules at the DESY II test beam
  - Wear medical mouth/nose protection masks in the huts **at all times**
  - Wear FFP2 (KN95) masks when
    - Minimum distance of 1.5 m to other persons cannot be kept
    - Working in the hall or areas
  - Keep in mind: FFP masks have limited wearing time due to the increased breathing resistance
  - In accordance with DGUV10 rule 112-190, uninterrupted maximum wearing time for a FFP mask without a valve is 75 minutes followed by a recovery time of 30 minutes

<table>
<thead>
<tr>
<th>Wearing time (min)</th>
<th>Recovery time (min)</th>
<th>Operations per shift</th>
<th>Working shifts per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>30</td>
<td>5</td>
<td>4 (2d – 1d break – 2d)</td>
</tr>
</tbody>
</table>

Comply with: *DESY Guidelines Corona Virus/COVID-19 - Appendix I: “Protective Masks”*
General Safety Rules

- Obey the safety signs!
  - No people with pacemakers or other active medical implants in the hall
  - Do not touch or enter areas signed as electrical area
  - Do not wander into other areas of the hall

- No open fires, smoking, eating or drinking in hall
  - Food and drinks (non-alcoholic) only inside huts

**Currently working alone is not permitted**
- Working alone only for data taking (in the hut) and during normal working hours (i.e. 8-17h, Mo-Fr)
  - Outside these times or inside areas: ≥ 2 people
  - Underage persons (below 18 yrs.) have to be always under supervision

- Test beam hall access controlled by DACHS
- Watch out for crane work
  - Stay clear of hanging loads
  - Wear protective clothes (hard hat, safety shoes) when assisting

- March-June ‘21
  New hut (between klystron & magnet test areas)
  - Stay clear of construction site + hut until finished
  - Still respect borders in case of temporarily missing fences/barriers

Currently working alone is not permitted
DACHS

DESY Access Control Handling System

- DACHS card mandatory for the DESY test beam
  - Entry in the DESY person information system by Indico registration for your beam period
  - Card can be obtained in Bld. 6 / Room 110
  - Personalized ID: Must not be handed to others

- Three levels of permissions
  - Access hall & huts
  - Interlock permission
  - Coordinator

<table>
<thead>
<tr>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>blue</td>
<td>DACHS ready</td>
</tr>
<tr>
<td>green</td>
<td>Access granted</td>
</tr>
<tr>
<td>green</td>
<td>Hold card longer in front of terminal</td>
</tr>
<tr>
<td>red</td>
<td>Access denied</td>
</tr>
</tbody>
</table>
Unattended Data Taking

- Possible solution to take the best out of the beam time even with small team
- Running automatically without people in the hall
- In principle allowed...

- Some requirements for running in auto pilot mode:
  - Call the BKR (3500) and tell them from when to when you will have the control room unattended and give them a contact phone number
  - Prepare a note with the same information and put it next to the interlock/shutter control
  - On return inform the BKR that the room is attended again

- Unattended data taking is not allowed when hazardous material is in use (i.e. flammable gas or radioactive material, ...
Phone Numbers and Emergency Call

<table>
<thead>
<tr>
<th>Emergency (Notruf)</th>
<th>2500</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESY Mobile</td>
<td>66-2500</td>
</tr>
<tr>
<td>External Mobile</td>
<td>+49-40-8998-2500</td>
</tr>
<tr>
<td>Technical Emergency Service</td>
<td>5555</td>
</tr>
<tr>
<td>Accelerator Control Room (BKR)</td>
<td>3500</td>
</tr>
<tr>
<td>Coordinators</td>
<td></td>
</tr>
<tr>
<td>Ralf Diener</td>
<td>(9)3426</td>
</tr>
<tr>
<td>Norbert Meyners</td>
<td>(9)3321</td>
</tr>
<tr>
<td>Marcel Stanitzki</td>
<td>(9)4930</td>
</tr>
<tr>
<td>Telescope Support</td>
<td><a href="mailto:telescope-support@desy.de">telescope-support@desy.de</a></td>
</tr>
<tr>
<td>Porter’s Lodge Notkestrasse</td>
<td>3333</td>
</tr>
</tbody>
</table>

- In case of an **emergency**: Call 2500
  - **Never** call external emergency number
  - DESY SAVE will help as fast as possible
  - Remember your first aid training and help!
  - First aid supplies (band-aid etc.) close hut 22 and in south west corner of the hall

- If you hear anomalous noise or notice other strange things (water floods...) → Technical Emergency Service (☎ 5555) (take into account to leave the hall)

- Inform the test beam coordinators about any safety relevant incident that occurred
Escape Routes and Assembly Point

Building 27
Behavior in Case of Fire

**Large fires**
- Leave hall as fast as possible via escape routes
- Make sure your colleagues are leaving with you
- Consider to press fire alarm when leaving → loud alarm from smoke detectors and sirens
- Call: 2500
- Go to the dedicated assembly point:
  - Wait for fire brigade
  - Answer questions and report missing people

**Small fires**
- May be attacked using fire extinguisher
- Only if you think it is safe for you!
- Press first emergency-off
- Keep a distance of 1 m minimum from electrical and HV systems
- For HV systems: Must use CO₂ fire extinguisher
- Inform test beam coordinators and Technical Emergency Service (☎ 5555)
Emergency Off

• Emergency-off buttons in huts and areas
  • Keep them always accessible (no boxes, tables etc. placed in front)

• Emergency-off kills both the beam and electrical power

• Electrical circuits:
  T21 + T22 together and T24 + T24/1 together
  →
  Take power only from inside specific area or hut, respectively

• Areas/hut equipped with mobile emergency lights (keep them accessible, no material, tables etc. in front)
Hall Lights

Switches at south and north gate, as well as all other entrances
Electrical Safety and Cabling

Rule #1: NO work on HV or electrical systems when the power is switched on!

- Only proper equipment is allowed!
  - Annual checks for equipment required
- Home made devices have to be proper too
  - E.g. obey the voltage limits of your connectors: NO HV on standard Lemo connectors etc.
- No Daisy-chaining of power strips
- Be extra careful when using remote-controlled power supplies

- High voltage:
  > 60 V (DC)
  > 25 V (AC)
  → Use a warning sign!

- Keep every path always free and easily passable
  - Use cable bridges

- In the rare cases, cable bridges don’t work: put cables at least(!) 2 m high
- Attach cables to stage platforms e.g with Velcro tape and screw terminals, etc.
General Tidiness

• Keep the areas tidy and escape routes *(basically all ways in any area)* clear **at all times**
  • This includes setup phase, too!
• No trash or boxes in areas where people walk
• Use larger trash bins in hall or containers outside of the hall for your garbage
  • Small trash bins can be emptied into large bins
  • Remove returnable bottles yourself
  • Remove smelly trash from the control huts
• Cleaning staff does not comes regularly
• Clean up before leaving the area: The incoming group will appreciate it
• Leave the blue, nice&clean chairs in the huts and only use the grey, old ones in the areas
Translation Stages / Ladders / Bricks

- **Stages**
  - Be careful! Danger of squeezing
  - The big green stages can carry up to 1 t
  - Stay in contact via phone during remote operation if people are inside the area
  - Make sure that the stages do not touch other equipment when they move remotely
    
    (Stages with adjustable end switches are available)
  - Make sure that you don’t rip your cables

- **Ladders**: working on ladders is dangerous
  - Do **not** take broken ones
  - Use properly: correct angle, solid ground, both feet on the ladder
    - Best if a second person is holding it
  - You are not allowed to climb on the walls or huts!
  - **Always** use a ladder, step-stool, elephant foot
  - **Never** use tables, (swivel) chairs, infrastructure

- **Lead/Iron bricks and lead collimators**
  - … are heavy
  - Lead is poisonous
    - Avoid hand-mouth contact → wear gloves
    - Don’t work on or scrape of the lead → contact us if necessary
Beam Telescopes

• Several areas equipped with EUDET-type telescopes
  • User manual: https://telescopes.desy.de
  • Usage needs to be requested in advance

• Contact & Support telescope-support@desy.de

• Safety & Rules
  • The telescopes are flexible but sensitive devices
    • The upper frame can be rotated (not fixed!)
    • Behind the black Kapton foil are 50 μm Silicon
  • Watch out the travel range of the PI-um-stages
  • The telescope power is provided by an uninterruptible power supply, but only low voltage devices (8 V Mimosa26, 15 V PMTs)

• Usage remarks
  • Data flow should be over the local network: 192.168.<2x>.<x>
  • Take your data saved on the local raids after your test beam
Test Magnets

Operation only by trained users (extra training)

- **1 T is a strong field**
  - forces very high
    - lifts *e.g.* gas bottle easily

- Magnets connected to door interlock

- BRM Dipole in T21: no access

- PCMAG in T24/1:
  - Access allowed by bridging interlock
    - *Careful: takes up to 12 h to cool down after emergency-off by broken interlock*
  - For small adjustments only!
  - Check carefully for magnetic tools, jewelry...

- PCMAG lifting stage
  - Watch all cables carefully
  - Do not climb on stage
  - Do not manipulate mechanical setup
    - includes mounting rails and all screws
  - Always keep control area at back of hut accessible
    - *no laptops, food, bags etc.*
Laser Safety

- Laser alignment system in all beam lines
  - Height: ~1.70 m → ~ eye level for 1.80 m person
  - Class 1M laser system:
    - **1M**: accessible laser radiation not hazardous in sensibly foreseeable conditions
    - **1M**: as long as no optical instruments used!
  - Operation restricted by key switch, warning sign at entrance

- Portable cross laser
  - Class 2: with intact protection reflexes no risk to eyes → not everyone has this reflex!

- Rules
  - Limit access (number of people)
  - Never look directly into the laser: turn away / close eyes if accidentally doing so
  - Only use one laser direction at a time
  - Never use optical instruments or reflecting tools
  - Use laser only during alignment, switch off immediately after

- User setups:
  All laser of class 3R, 3B or 4 brought to DESY have to be announced > 4 weeks in advance, including a description / sketch + risk assessment

- See also: DESY laser regulations
Gas Safety

- Announce use well in advance
- Pre-mixed gases can be supplied
- Adjust measures to specific gas (mixture)
- Flammable gases possible
  - Put a warning sign on / close to your setup
  - Mobile gas safety system
- Use exhaust and ventilation system
- **No** manipulation of the gas safety system
- **No** mechanical work on a running gas system: depressurize before breaking lines
- **Always** attach gas cylinders
  → Store gas cylinders outside or in cabinets
Cryogenic Gases

- **General:**
  - The use of liquid gases as Nitrogen, Helium or dry ice needs to be announced beforehand
  - Special safety precautions will be required
  - Use the appropriate personal protection equipment
    - Cryo gloves and safety goggles must be worn
    - Available on request from the coordinators
    - Also: closed sturdy shoes, long trousers and long sleeves
  - Danger of cryogenics burns
  - Additionally asphyxiation hazards
    - Proper ventilation may be required
  - Refer to CERN Cryogenics Course
Hazardous Materials - Shipping and Handling

- **Have to be announced** well before coming to DESY
- Have to be handled/marked/stored properly
- Ask beforehand if unsure

- **Shipping** irradiated samples to and from DESY
  - Needs to be announced well before (4-6 weeks)
  - **All** radioactive material coming to DESY has to be reported to the radiation safety group (D3)
  - Shipping will be done in consultation with D3
  - Shipping is your responsibility!
  - Transporting samples might be tricky
  - For details see this step-by-step description

- **Handling** irradiated samples
  - RSO/D3 will determine, if a dosimeter is needed
  - Need to be labeled accordingly
  - Needs to be stored properly (thief-proof)
    → Lockable Freezer (-24 ºC) available for storage:
    - Label: name, group, date, details
    - Need to be removed from the freezer (and shipped) at the end of beam time
Radiation Safety

General Rules

• Always practice **ALARA**: As Low As Reasonably Achievable

• Key ingredients
  • Proper shielding
  • Minimize exposure time
  • Maximize distance ($1/r^2$ is your friend)

• Dose limits from the German regulations (Strahlenschutzverordnung)
  • Rad Worker: Maximum annual dose for category B / A: 6 / 20 mSv/a (*Lifetime dose of 400 mSv*)
  • Everyone else Less than 1 mSv/a allowed

• Signposted areas
  • **Controlled area**
    Effective dose > 1 mSv/a
    • Training & Dosimeter required
    • No eating, drinking, smoking
    • No access under 18 and during pregnancy

  • **Prohibited area**
    Effective dose > 3 mSv/h
    • Entry strictly forbidden
Radiation Safety

DESY II Test Beam Facility

- A dosimeter not required when beam is off
- **Interlock** (see following slides) needs to be set before beam shutter can be opened
  - Area becomes *Prohibited Area / Sperrbereich* when beam is present
- **Yellow doors** and interlock system
  - Yellow doors and the rest of the interlock system are part of the radiation safety
  - Any manipulation or work around radiation protection leads to consequences up to the cancellation of your current and future test beam(s)
  - If you leave the area, yellow doors should be closed
  - The yellow doors must **never** be locked, since they are part of the escape routes

- **Additional radioactive material** (sources or irradiated samples)
  - Dosimeter will be mandatory if dose is $> 5 \mu S/h$ in 30 cm distance
  - Needs to be clearly marked and properly stored

  ![Vorsicht Radioaktivität](image)

  - Additional training required (see [here](#))

  → Contact us well in advance
Beam Interlock

**New System**

- **Keys**
  - Safety keys for test beam general + single areas *only* for safety during repairs/maintenance
  - Do not remove them from cabinet!

- **User panels in the hut**
  - Touch screen + buttons on the bottom

- **Area search by *single person only!***
Setting the Area Interlock

Starting the Procedure

- **Do**
  - Swipe DACHS card across reader at entrance
  - Go in past the light barrier and press green “Set light barrier” button right after entrance

- **Effect**
  - Yellow interlock light at entrance and green search buttons inside area will light up
  - Announcement that the interlock search is taking place will run in German and English

- **Beware**
  - Passing light barrier will break search procedure
  - Second swiping of DACHS card breaks search
  - You do not have to close the door

- **Don’t enter** an area **when yellow door light is on!**
Setting the Area Interlock

Search and Leaving the Area

- **Do**
  - Search area, confirm at every green search button
- **Effect**
  - Button turns off, presence confirmed
  - “Light barrier muting” button will light up
- **Do**
  - Press yellow “Light barrier muting” button *(can be done only once)* and exit area
- **Effect *(for ~ 6 seconds)***
  - Yellow door light goes off
  - Light barrier switched off to pass it
NEW Locations of Search / Emergency-Off Buttons
Setting the Area Interlock

Finishing

• Do
  • Close door
  • Press “Set button main door”
  • Swipe DACHS card across reader (same card as at start!)

• Effect
  • Door secured, red door light switches on
  • Announcement in area for about 30 s that beam is going to be switched on (German + English)
  • After this:
    • Area ready to switch on beam
    • Door locked when 30 s warning finished
    • Door emergency-open: Use key in red box
Shutter Operation and Breaking Interlock

- Display in hut: Go via button on bottom to ”Logic + Operation”
- Shutter operation *(BS = Beam Shutter)*
  - Open / close via respective touch screen buttons
- Interlock breaking
  - Press on touch screen “Break door interlock Area TXY”
Radiation Warnings inside Areas

Danger to Life: Immediate Action Required

- Interlock set, ready for beam
  - Orange warning lamps will flash
  - Voice announcing in German and English that beam is to be turned on

  → If inside area: ~ 30 sec to save your life!

Press Emergency-off and/or
Leave area though door/light barrier

- Area open, not interlocked
  - Loud warning signal
  - Radiation alarm sign switches on

  → Leave area immediately (avoid crossing beam path)

  • Keep others from entering
  • Call control room (BKR ☎ 3500) to immediately shut off machine and inform test beam coordinators
Beam Operations

- Operation via Software
  - MEA PC in corner of hut
  - Powering on and selecting desired energy

- Checking status of magnet power supplies
  - All 5 green LEDs need to be on to power up
  - Big red light indicates, if magnet is powered
PCMAG Magnet Interlock in T24/1

Setting and Bridging

- PCMAG interlock set by closing blue door when leaving area during normal beam interlock procedure
- Temporary access for small adjustments
  - Release beam interlock door in touch panel
    → Magnet current warning sign active
- Bridging (2 person procedure):
  - 1ˢᵗ person presses and keeps pressed “door mute” button “1” at area entry
  - 2ⁿᵈ person enters through blue door and presses and keeps pressed door mute button “2”
  - 1ˢᵗ person releases button “1” and enters area
  - Close blue door and release button “2”
  - Exiting likewise in reverse order
- Here only exception for beam interlock: 2 persons allowed during area search
DESY II Test Beam

- DESY II synchrotron: 6.3 GeV, typically $6-15 \times 10^9$ $e^-$ / bunch
- Injector for PETRA III:
  Depending on operating mode, top-up every few minutes

- Machine mornings:
  no beam every second Wednesday from 07:00 till *noonish*
- Operating costs (estimate): 500 € /hour → 84000 € /week
- Make good use of your beam time and save power (=cost)
  - Close shutter when beam not used
  - Switch off beam magnets for longer breaks
Closing Remarks I

- These rules are for your safety!

- For more information see our web page: http://testbeam.desy.de

- Refer also to safety information and reference provided in cabinets

- Web page of our favorite synchrotron: https://desy2.desy.de/ (logbook, status; calender offline)

- In doubt: ask us!
Closing Remarks II

• More information about the working and parameters of the DESY II test beam and the installed infrastructure can be found in the recent reference publication:

"The DESY II test beam facility"
https://doi.org/10.1016/j.nima.2018.11.133
NIMA, Volume 922, 1 April 2019, Pages 265-286

• The following note is expected to appear in the acknowledgements of all publications, presentations and posters based on data taken at the DESY II test beam:

"The measurements leading to these results have been performed at the Test Beam Facility at DESY Hamburg (Germany), a member of the Helmholtz Association (HGF)".