DESY II Test Beam Facility

Safety Briefing

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Status: 1/24/20

For more detailed information, see general DESY safety instructions
Introduction

- Each user has to attend this safety lecture once per year
- 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)
General Safety Rules

- **Obey the safety signs!**
  - No people with pacemakers or other 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

- 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 system

- Watch out for crane work
  - Stay clear of hanging loads
  - Wear protective clothes *(hard hat, safety shoes)* when assisting

- Spring 2020 installation of new windows
  - Walkways / corridors close to the wall may get temporary blocked / fenced for safety
  - Respect the barriers and choose a different way!
**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 / red</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

- 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, ...)

- 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…
Phone Numbers and Emergency Call

<table>
<thead>
<tr>
<th>Emergency (Notruf)</th>
<th>2500</th>
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</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="https://tblogs.desy.de">https://tblogs.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 in white lockers: close hut 22 and in south west corner of hall
- Inform the test beam coordinators about any safety relevant incident that occurred

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

Both light switches are labeled: “Hallen-Licht”
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 \textit{(basically all ways in any area)} clear \textbf{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 smelly trash from the control huts
- Cleaning staff does not come 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**
  - The bricks are heavy
  - Lead is poisonous
    - Avoid hand-mouth contact → wear gloves
    - Applies also to lead collimators in areas
    - Don’t scrape the lead of the collimators
Beam Telescopes

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

• Contact & Support
  • Use the e-log: https://tblogs.desy.de
    → (automatic) mail to 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 blue door
    - 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
  • No more warning lamp at entrance
  • Movable 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
  - The yellow doors and the rest of the interlock system are part of the radiation safety
  - Any manipulation of or attempt to work around radiation protection leads to consequences up to the immediate cancellation of your current and future test beam(s)
  - If you leave the area, the doors should always be closed
- **Additional radioactive material** (sources or irradiated samples)
  - Dosimeter will be mandatory if dose is > 5 µS/h in 30 cm distance
  - Needs to be clearly marked and properly stored
  - 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

Warning Lamp  Door Signal Light  Emergency-Off Button  Speaker  Search Button  19" Rack  SPS Schrank  MWT  HMI

Skizze Interlockkomponenten in den Teststrahlgebieten (A. Liedke)

DESY Test Beam Coordinators - Safety Briefing
Setting the Area Interlock

Finishing

- Do
  - Close door
  - Press “Set button main door”
  - Swipe DACHS card across reader \textit{(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 lights up
- Bridging (2 person procedure):
  - 1st person presses and keeps pressed “door mute” button “1” at area entry
  - 2nd person enters though 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 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, calendar, maintenance schedule)

• 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

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• Include the following acknowledgment sentence in 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)".