DESY II Test Beam Facility

Safety Briefing

Coordinators:
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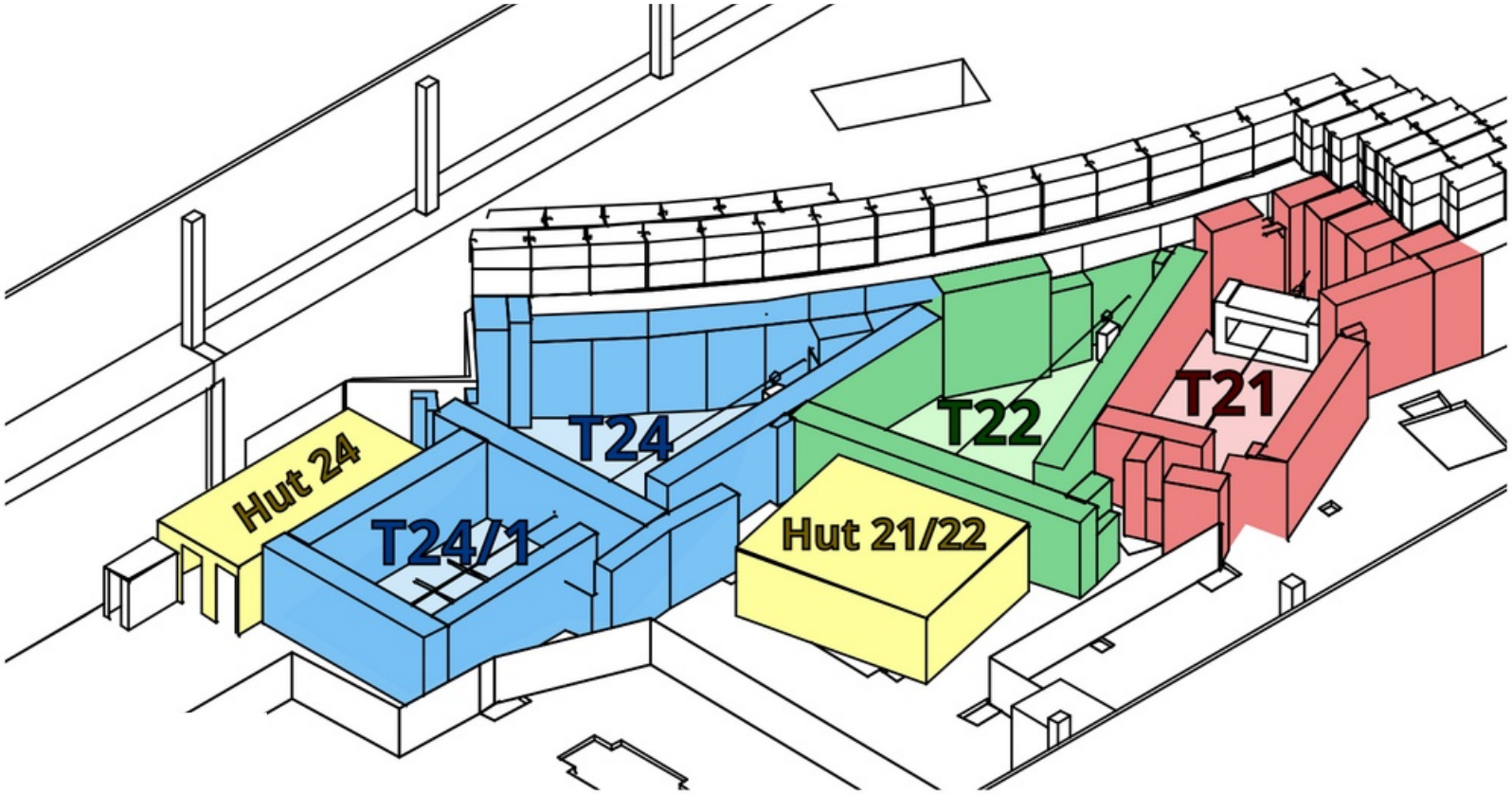
Status: May 14, 2024



For more detailed information,
see general DESY safety instructions

HELMHOLTZ

DESY.

Introduction

- In this lecture, your attention is not optional

→ No smartphones, laptops etc.

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

Experiment at the
DESY II Test Beam Facility

Beam Line: 23

Experiment / Group: Generic Experiment
Assigned Test Period: 2023-02-06 - 2023-02-12

Responsible Person(s): Jane Doe

Contact phone number: _____

Technical Acceptance (Technische Abnahme)

Optional technical acceptance by DESY expert group _____

(Signature) _____

Optional safety acceptance by D5 (DESY Safety Group)

(Signature) _____

Acceptance by DESY Test Beam Coordinators _____

A copy of this form must be posted in front of the entrance door of the beam hut.
---- Mark your equipment and remove it at the end of the test period ---

- **Before** data taking: Safety check by test beam coordinators *(special setups: involvement of DESY safety)*

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

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

- **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

Currently working alone is not permitted

General Safety Rules

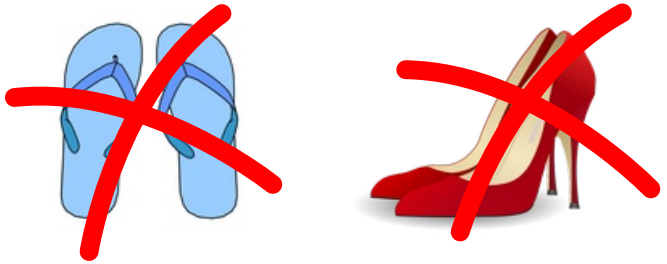
- All user huts have an occupancy limit which is based on general work and safety regulations
  - 5 persons in hut 21, 22 and 24
  - 7 persons in hut 23

  → don't put additional chairs inside!

  - Hall area outside the huts and beam areas is not a working place:
    Do not set up tables, chairs, etc. there

- Do not wander into other areas of the hall (magnet / klystron test areas ...)

- Wear proper footwear
  (e.g. no flip-flops or very high heeled shoes)



- No earphones in the areas

- Test beam hall access controlled by DACHS system

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

blue	DACHS ready
green	Access granted
green / **red**	*Hold card longer in front of terminal*
red	Access denied

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

- 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…

- Unattended data taking is **not allowed** when hazardous material is in use (i.e. flammable gas or radioactive material, ...)

Phone Numbers and Emergency Call

Emergency (Notruf)	**2500**
DESY Mobile	**66-2500**
External Mobile	**+49-40-8998-2500**
Technical Emergency Service	5555
Accelerator Control Room (BKR)	3500
Coordinators	
Ralf Diener	(9)3426
Norbert Meyners	(9)3321
Marcel Stanitzki	(9)4930
Telescope Support	telescope-support@desy.de
Porter's Lodge Notkestrasse	3333

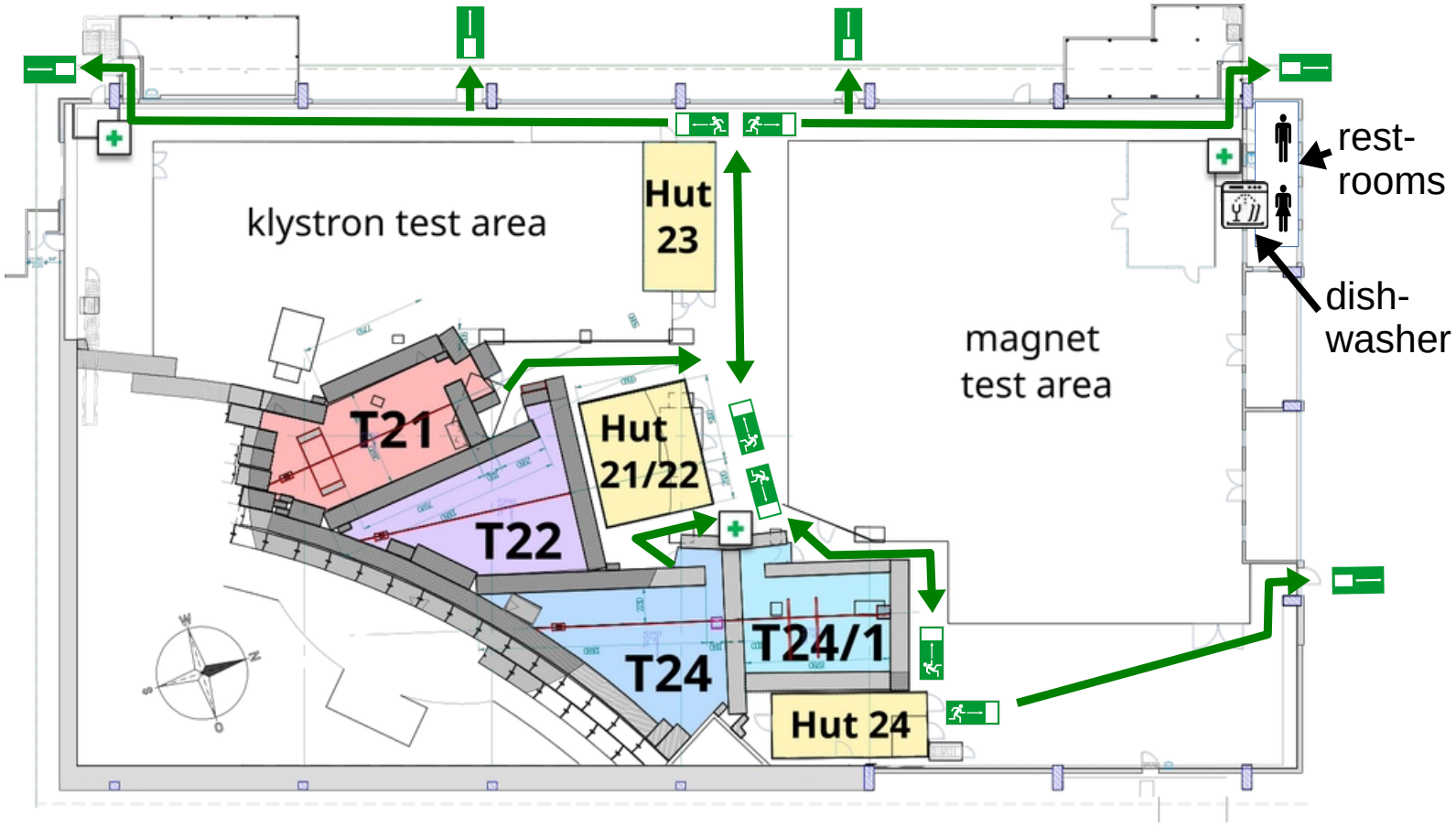
- If you hear anomalous noise or notice other strange things (water floods...) → Technical Emergency Service (☎ 5555) *(take into account to leave the hall)*

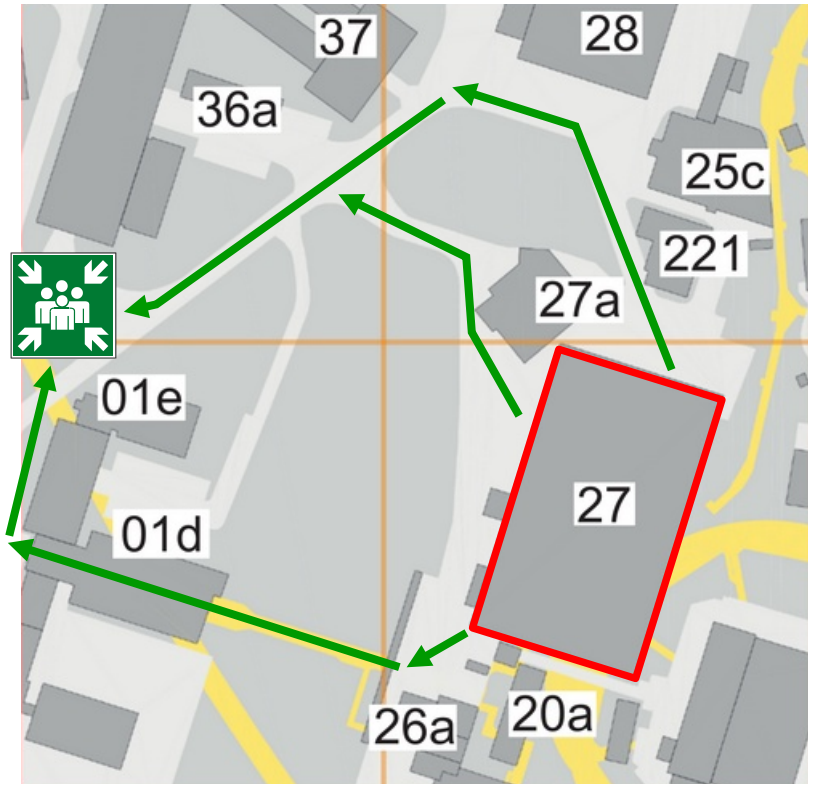
- In case of an **emergency: Call 2500**
  - **Never** call external emergency number
  - Answer the usual questions:
    Who? Where? What? How many?
    Most importantly: **Wait!** for questions
  - DESY SAVE will help as fast as possible
  - Remember your first aid training and help!
  - First aid supplies (band-aid etc.) close hut 22, in south-west corner of the hall and in front of the restrooms

- Inform the test beam coordinators about any safety relevant incident that occurred

Escape Routes & 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 CO_2 fire extinguisher
  - Inform test beam coordinators and Technical Emergency Service (☎ 5555)

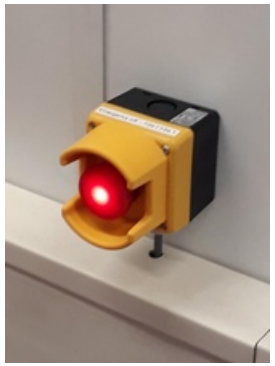
Emergency Off

- 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)
  - In case of a power cut:
    emergency power should be available after 60 s



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 including the setup phase**
  - No trash or boxes in areas where people walk
- Use trash bins or containers outside for your garbage
  - Small trash bins can be emptied into large bins
  - Remove returnable bottles yourself
  - Remove smelly trash from the control huts
- Before you leave (the incoming group will appreciate it):
  - Put all your cups & dishes into the dishwasher (in front of the ladies' restroom)
  - Clean up area and hut
- Leave the clean blue and red 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

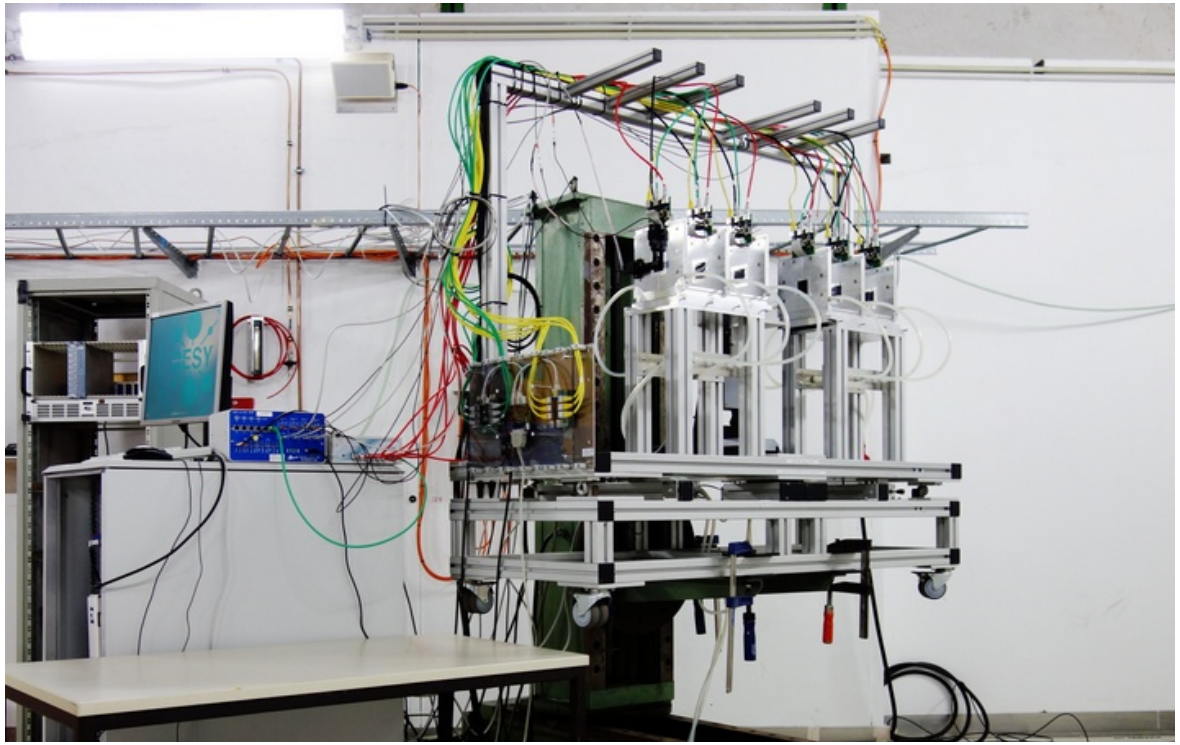
  - Do **not** take broken ones
  - Use properly: correct angle, solid ground, both feet on the ladder
  - Remove large ladders from area when finished
  - You are not allowed to climb on the walls or huts
  - When any beam line is ON, do not climb higher than the wall height with any body part
  - **Always** use a ladder, step-stool, elephant foot **Never** use tables, (swivel) chairs, infrastructure
- **Lead/Iron bricks and collimators** … are heavy

  - Lead is poisonous: Avoid hand-mouth contact → wear gloves
  - Don't work on or scrape of the lead

Beam Telescopes

- Two areas equipped with EUDET-type telescopes one with Alpide based telescope
  - User manual: https://confluence.desy.de/display/BTDITB/
  - 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
  - Telescope low voltage provided by an uninter-ruptible power supply (8 V Mimosa26, 15 V PMTs)



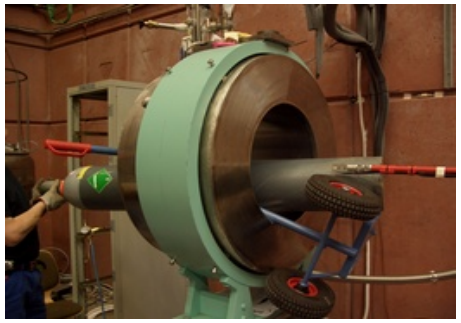
- Usage remarks
  - Data flow should be over the local network: 192.168.<2x>.<x>
  - Copy your data saved from the local raids after your test beam to free the disk space

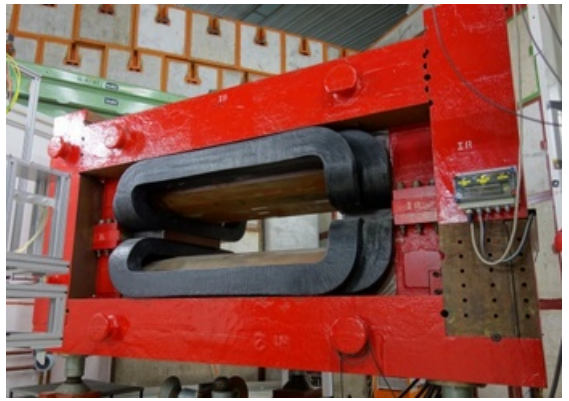
Test Magnets

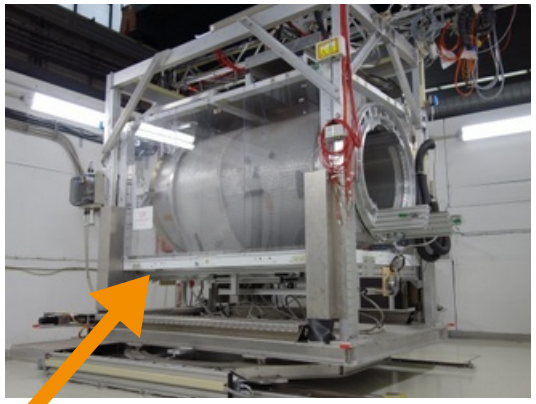
Operation only by trained users (extra training)

- **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
  - For small adjustments only!

- PCMAG lifting stage
  - Watch all cables carefully
  - Do not climb on stage
  - Do not manipulate mechanical setup (includes mounting rails and **all** screws)

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
    1**M**: 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 well in advance
- Pre-mixed gases can be supplied
- Adjust measures to specific gas (mixture)
- Flammable gases possible
  - Mobile gas safety system
  - Put a warning sign on your setup
- Use exhaust and ventilation 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

- The use of liquid gases (nitrogen, helium) or dry ice needs to be announced beforehand

- Danger of cryogenics burns
  - Use the appropriate personal protection equipment:
    - Cryogenic gloves and safety goggles must be worn (available from the coordinators)
    - Wear closed shoes, long trousers, long sleeves

- Additionally asphyxiation hazard:
  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 **L**ow **A**s **R**easonably **A**chievable
- Key ingredients
  - Proper shielding
  - Minimize exposure time
  - Maximize distance ($1/r^2$ is your friend)
- Dose limits from the German regulations (Strahlenschutzverordung)
  - 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 at DESY
  - **Supervised Area**
    Effective dose < 1 mSv/a
    but activation possible
  - **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
  - Additional sign when
    Activation Possible

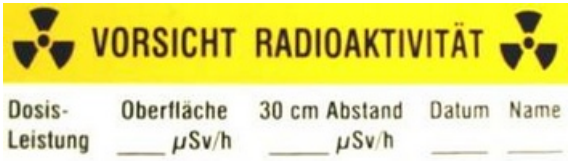
Radiation Safety

DESY II Test Beam Facility

- A dosimeter not required when beam is off and no activation of material in the areas
- **Interlock** (see following slides) needs to be set before beam shutter can be opened
  - When beam is present, areas become *Prohibited Area / Sperrbereich*
- **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/blocked, since they are part of the escape routes

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



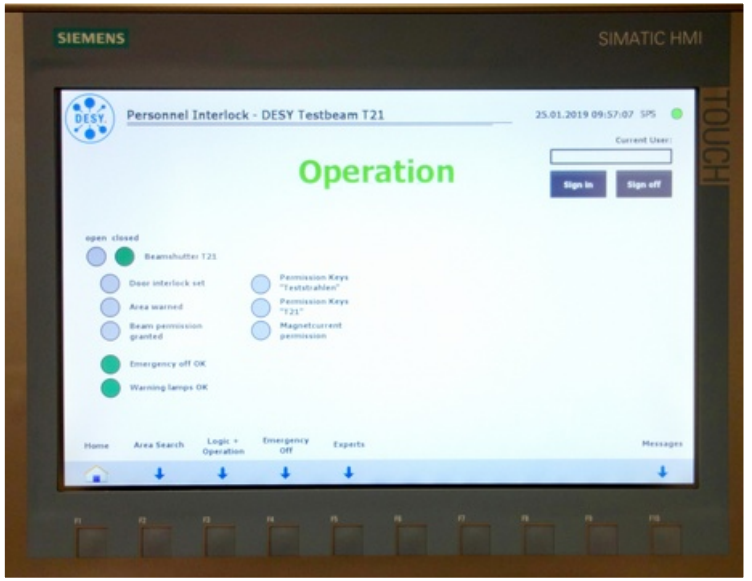
- Additional training required (see here)
  → Contact us well in advance

Beam Interlock

Introduction

- 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

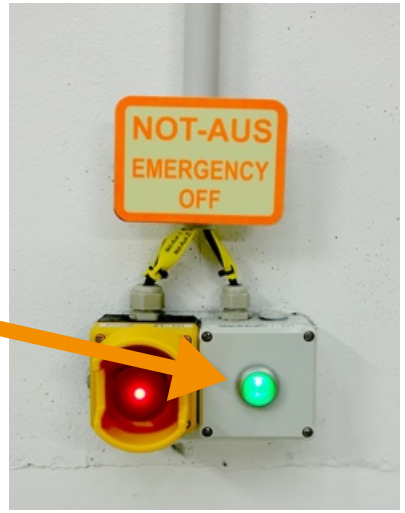
Starting the Procedure

- 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**!

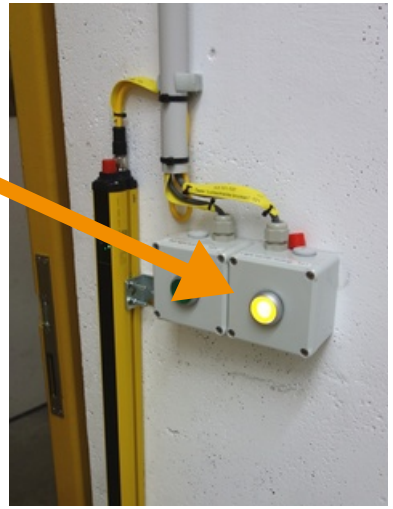
Setting the Area Interlock

Search and Leaving the Area

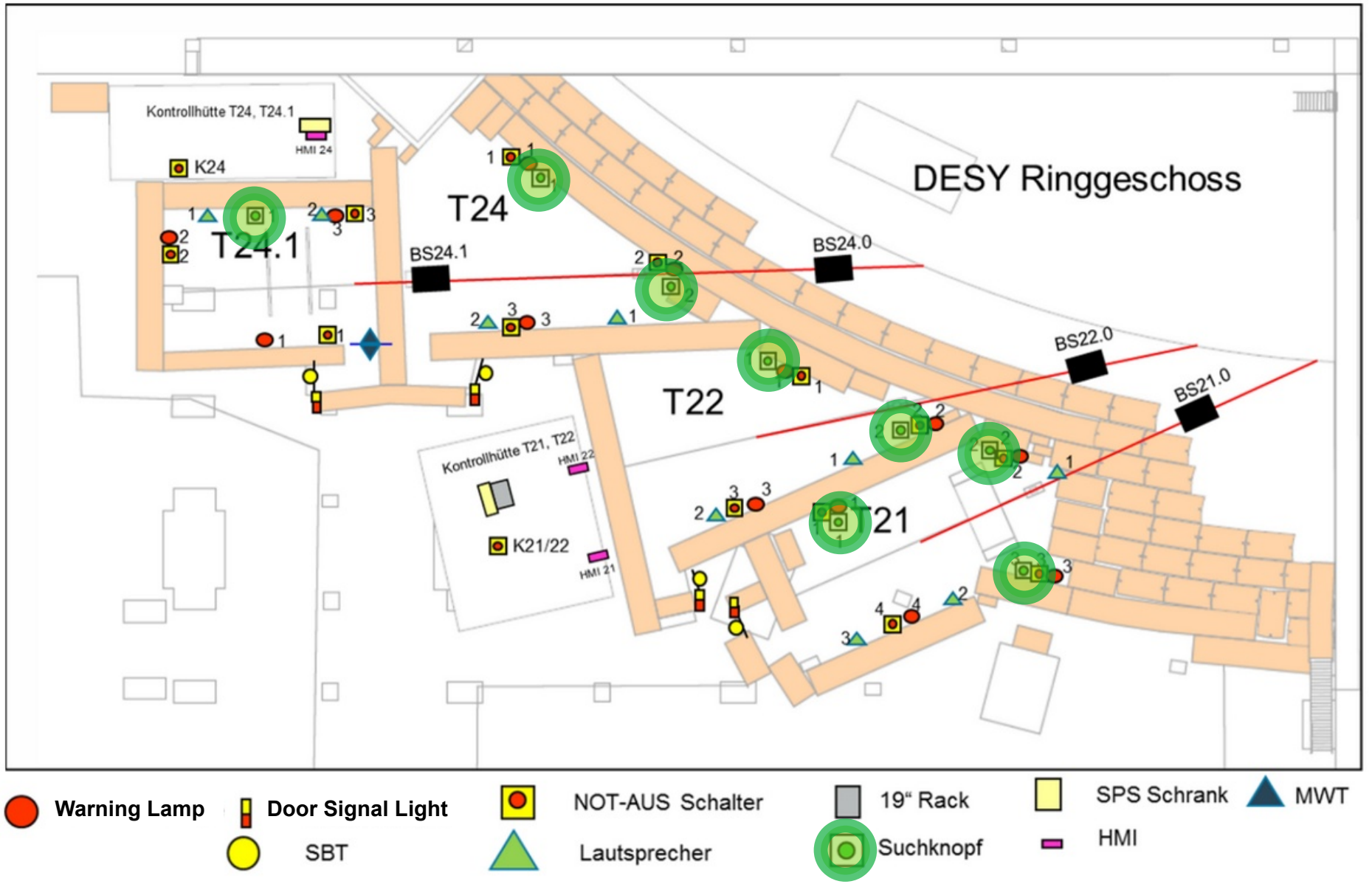
- Do
  - Search area, confirm at every green search button
- Effect
  - Button turns off, presence confirmed
  - “Light barrier muting” button will light up



- 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



Locations of Search / Emergency-Off Buttons

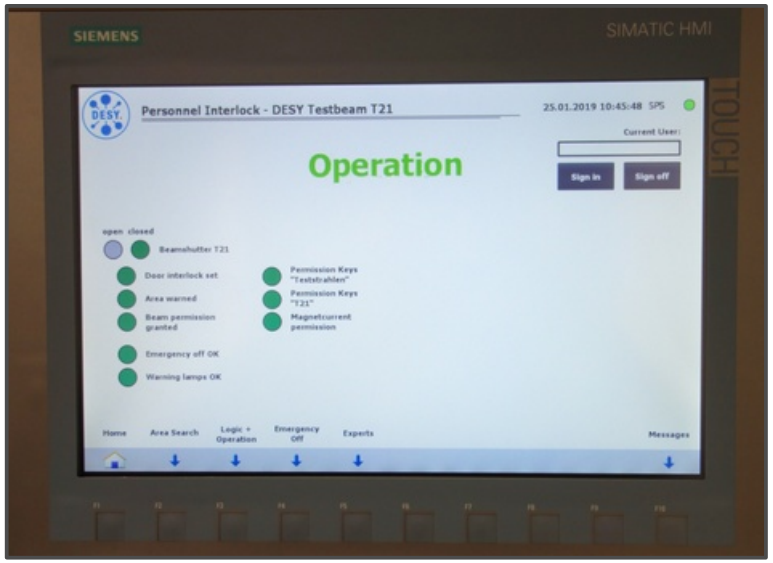


Skizze Interlockkomponenten in den Teststrahlgebieten (A. Liedtke)

Setting the Area Interlock

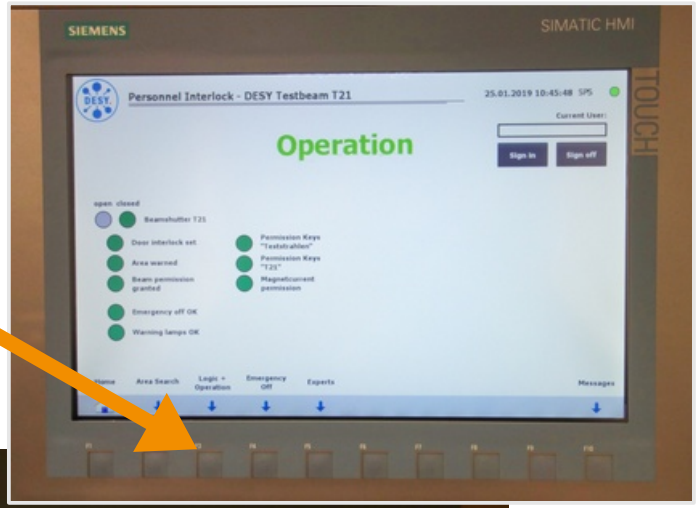
Finishing

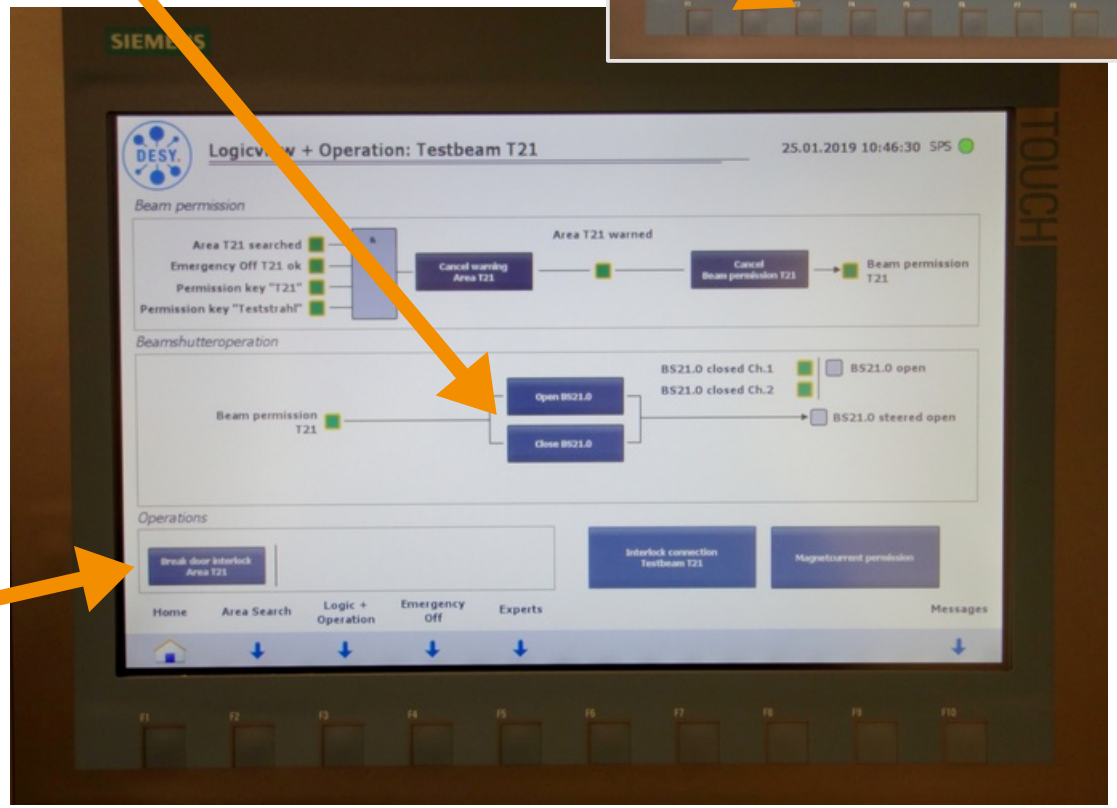
- Do
  - Close door
  - Press “Set button main door”
  - Swipe DACHS card across reader *(same card as at start!)*
- Effect
  - Door secured, red door light switches on
  - Announcement in area for about 30 s that beam is going to be switched on (German + English)
  - After this:
    - Area ready to 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 T*XY*”

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

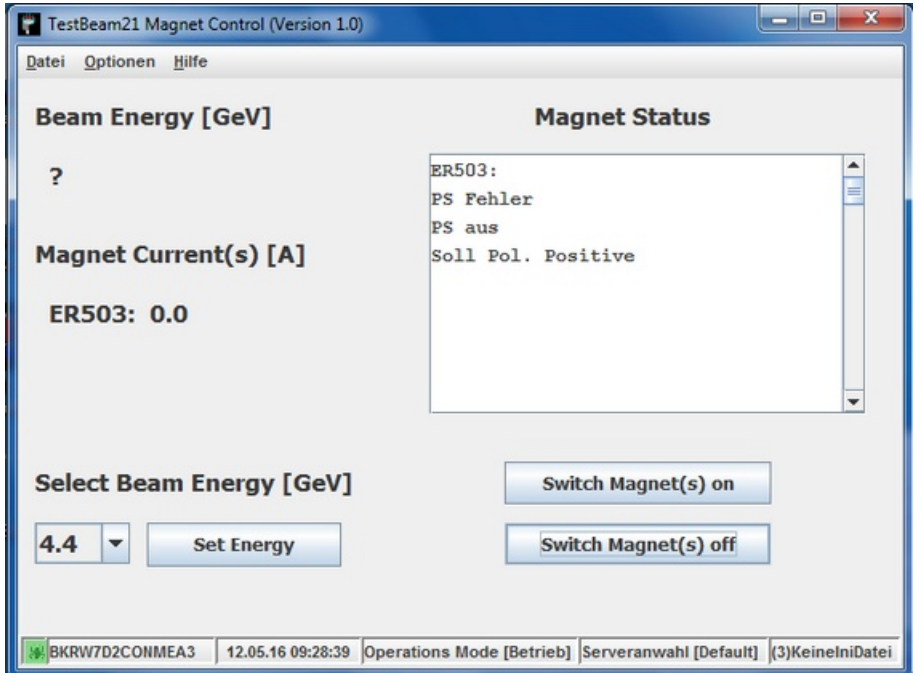
- **Area open, not interlocked**
  - Loud warning signal
  - Radiation alarm sign switches on

→ **Leave area immediately** ***(avoid crossing beam path)***

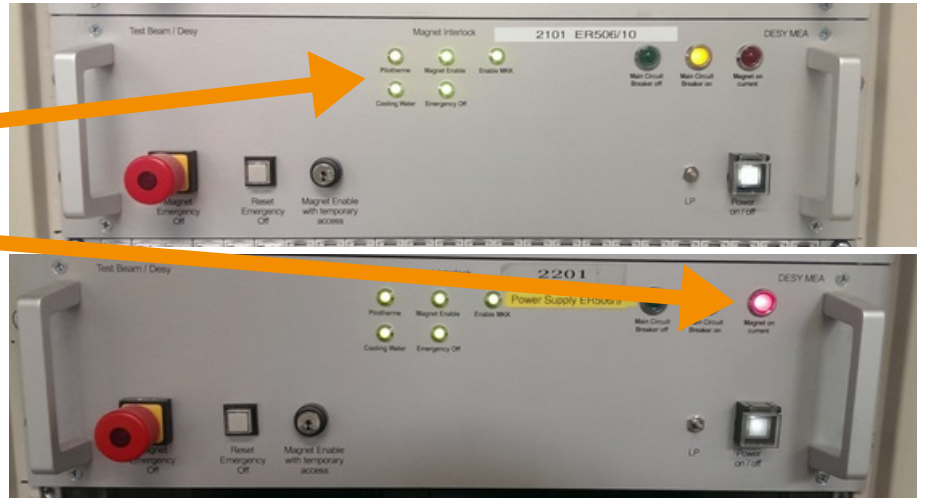
- Keep others from entering
- Call control room (BKR ☎ 3500) to immediately shut off machine and inform test beam coordinators

Beam Operations

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



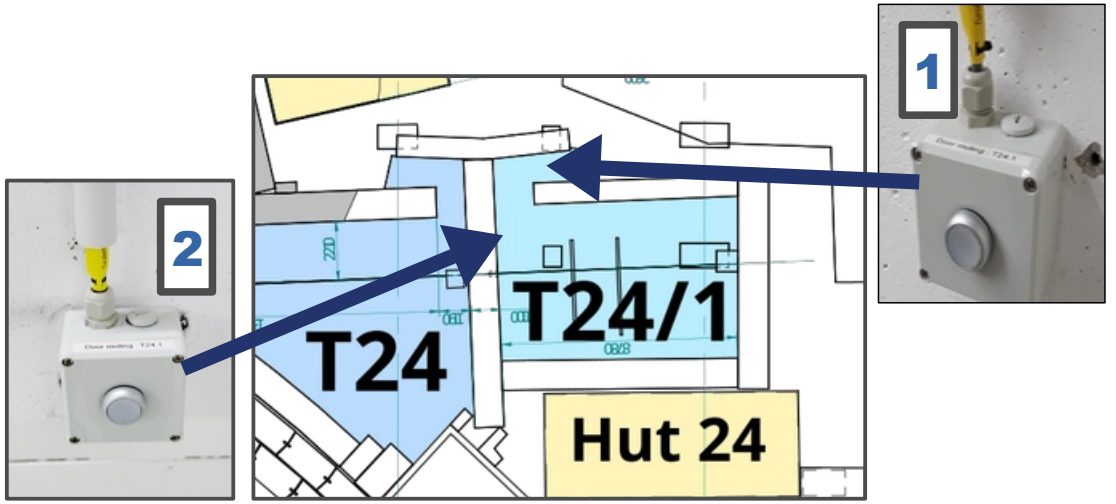
- Checking status of magnet power supplies
  - All 5 green LEDS need to be on to power up
  - Big red light indicates, if magnet is powered



PCMAG Magnet Interlock in T24/1

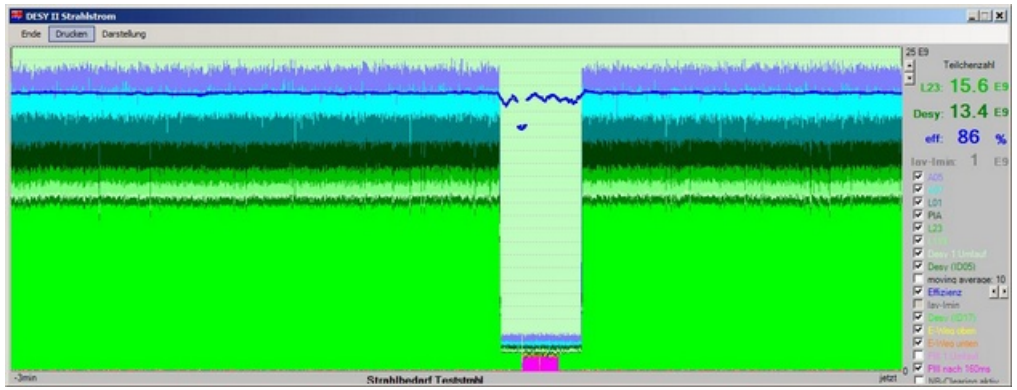
Setting and Bridging

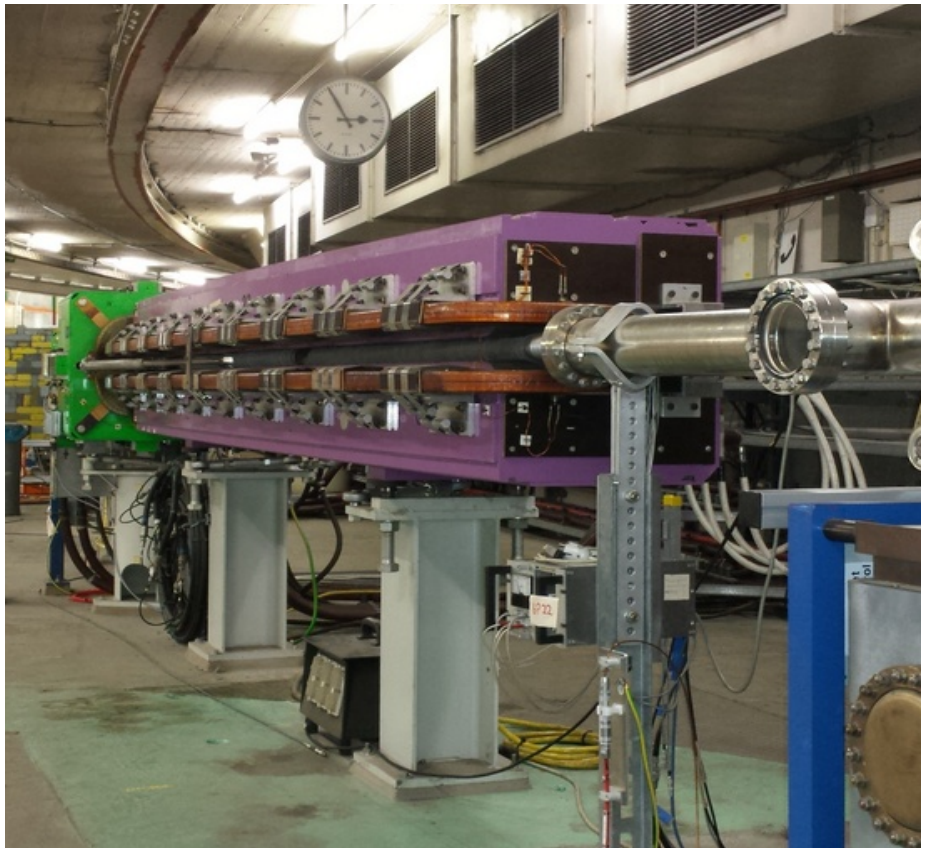
- PCMAG interlock set by closing blue door during normal beam interlock procedure
- Temporary access **for small adjustments only!**
  - Release beam interlock door in touch panel
    → Magnet current warning sign active
  - Bridging *(2 person procedure)*:
    - Check carefully for magnetic tools, jewelry etc. you wear
    - 1st person keeps pressed “door mute” button ”1” at area entry
    - 2nd person enters 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 x 10^9 e^- / bunch
- Injector for PETRA III:
  Depending on operating mode, top-up every few minutes

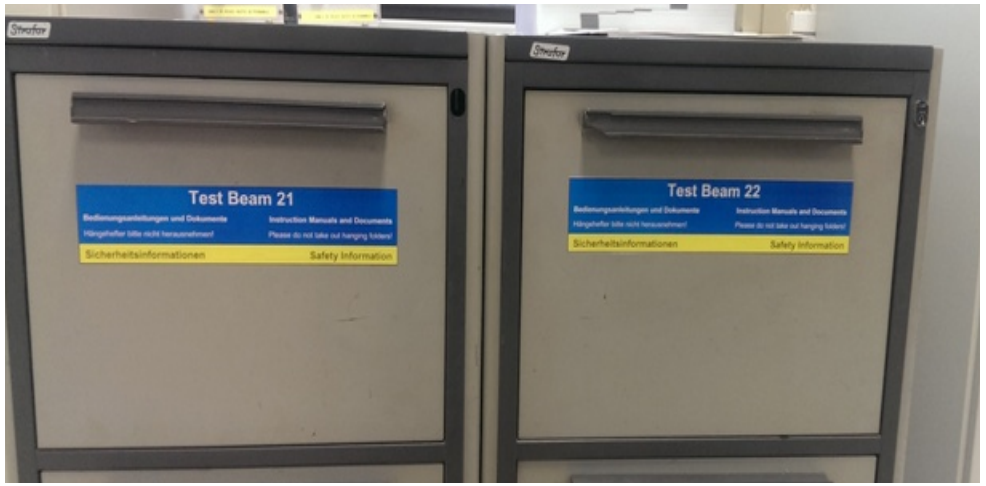




- Machine mornings:
  no beam every second Wednesday from 07:00 till *noonish*
- Operating costs (estimate): 500 € /hour → 84000 € /week
- Make good use of your beam time and save power (=cost)
  - Close shutter when beam not used (saves HF power)
  - Switch off beam magnets for longer breaks (automatic switch-off when shutter closed > 60 min)

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://min.desy.de/beschleuniger/desy_ii/ (status, calendar... only DESY internal)
- In doubt: ask us!

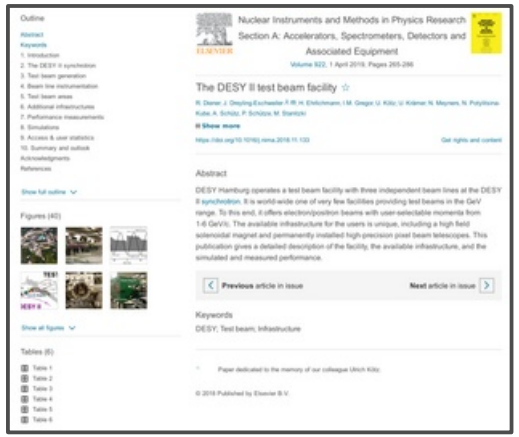


Closing Remarks II

- 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)."

- In accordance with the *Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities*, signed by all German research organizations, the Helmholtz Association among them, the Deutsches Elektronen-Synchrotron supports the open access movement.
  Therefore, we encourage our users to publish their scientific results, that are based in total or in part on data taken at the DESY II Test Beam Facility, in open access journals.