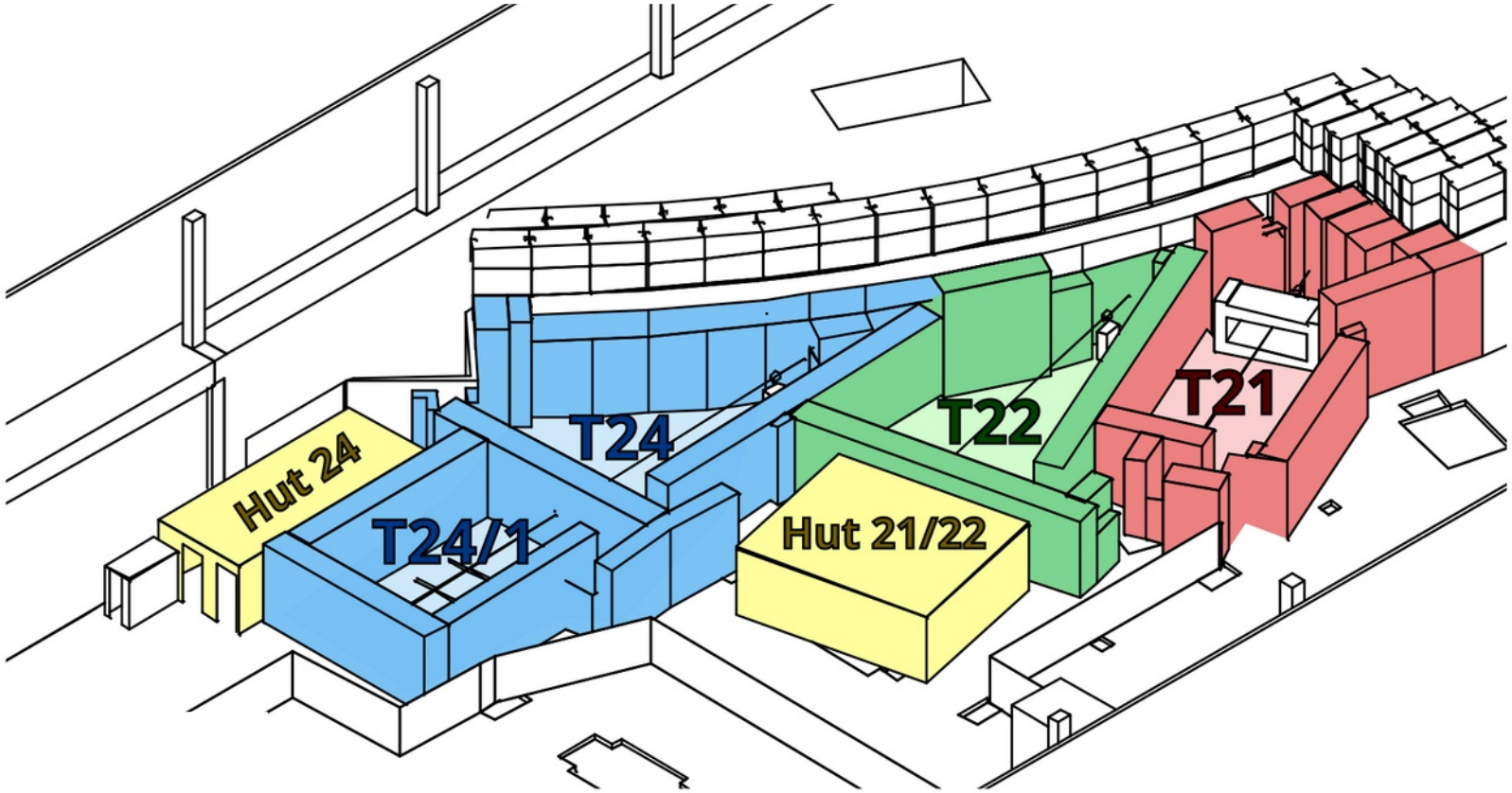
DESY II Test Beam Facility

Safety Briefing

Coordinators:

Sven Ackermann
Ralf Diener
Marcel Stanitzki



Status: Nov 18, 2025

HELMHOLTZ

DESY.

Introduction

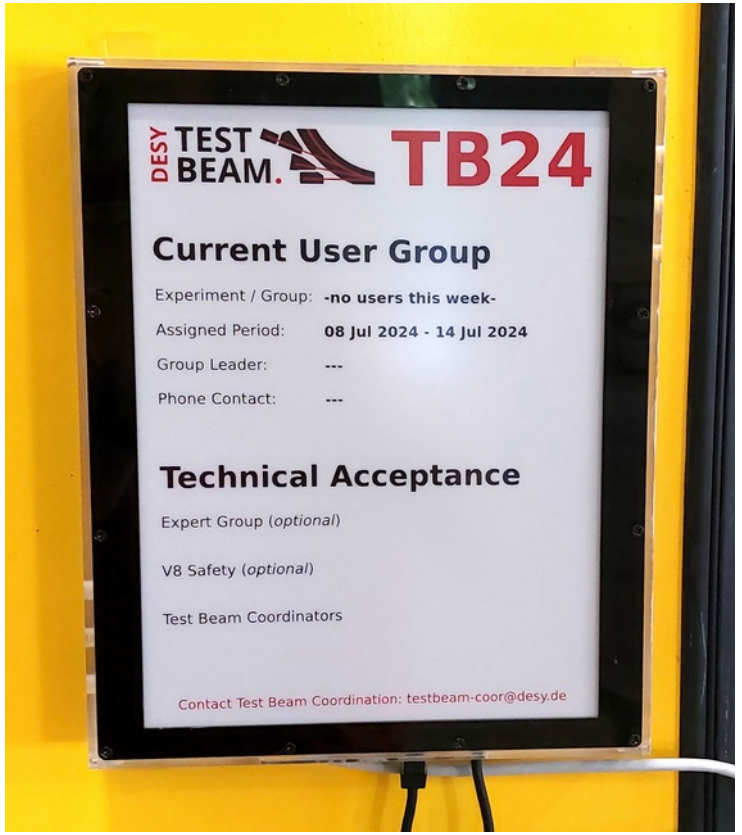
- In this lecture, your attention is not optional

→ No smartphones, laptops etc.

Introduction

- Each user has to attend this safety lecture once every twelve months
- 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 has to be present during the test beam!
  - This person is responsible for the actions of the whole group
  - **All** communication should include this person
  - All responsibilities listed on the e-paper door sheet
    (including a mobile phone number)
  - Communicate any changes of responsible person ASAP

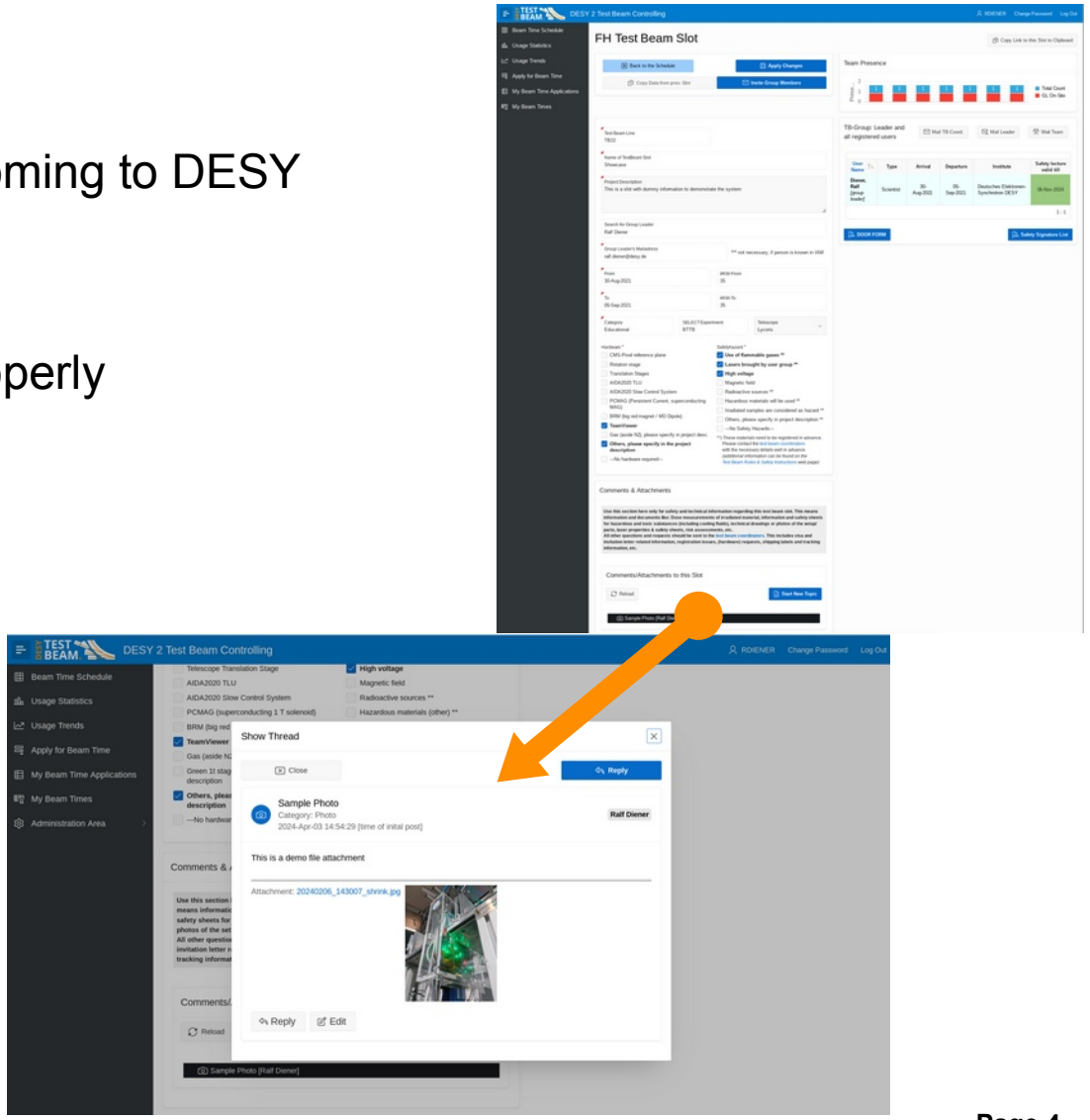


Introduction

- **Before** data taking: Safety check by test beam coordinators
  (special setups: involvement of DESY safety experts)
- All **hazardous material** has to be announced well before coming to DESY

  - Everything has to be handled/marked/stored/disposed properly
  - Do not just leave things behind after your beam time
  - Ask beforehand if unsure
- Safety relevant information like
  - Safety data sheets for chemicals, cooling liquids (**any** except pure water), etc.
  - Sample declarations and irradiation reports etc.

  has to be uploaded to the slot page **before use**
  → accessible to complete user group and test beam crew



DACHS

DESY Access Control Handling System

- Access and interlock controlled by DACHS system

  → DACHS card mandatory for DESY test beam

  - Entry in the DESY person information system via your beam time registration

  - Card can be obtained in Bld. 6 / Room 110

- Personalized ID: Must not be handed to others

- Three levels of permissions
  - Working permission: Access hall & huts
  - Beam permission: Interlock search
  - Coordinator

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

General Safety Rules

- **Obey all safety signs**
  - No people with pacemakers or active medical implants in the hall

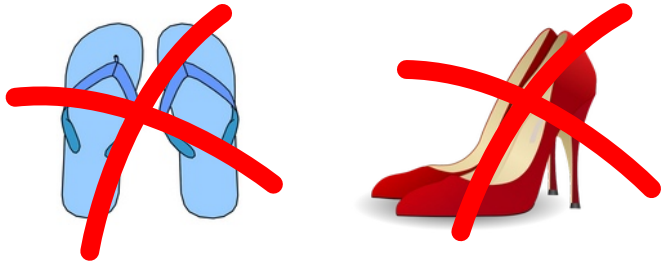
- **No headphones / earbuds** in the areas (acoustic warning)

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

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

- **Working alone is not permitted**, there always has to be a second person that can call for help
  - Underage persons (below 18 yrs.) have to be always under supervision

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



- User hut **occupancy limit** (5 or 7, see signs) → don't put additional chairs inside!
  - Do not set up working places in the hall area outside the huts and beam areas

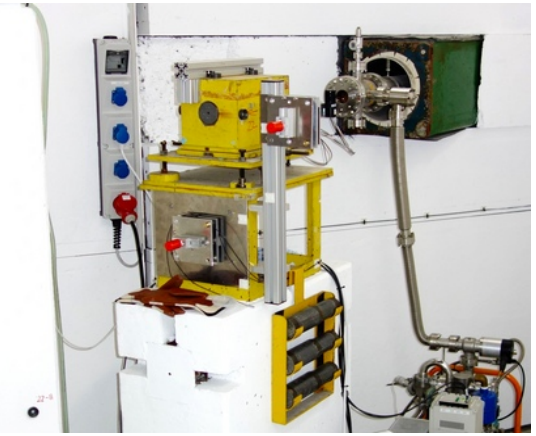
Ladders, Bricks and Lead

- **Ladders**: working in heights 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 shielding wall 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 → danger of hurting feet etc.



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

General Tidiness

- Keep all ways in the areas tidy and escape routes clear **at all times including the setup phase**

- Use trash bins or for large amounts containers outside
- 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
  - Clean up area and hut

- Leave the clean blue and red chairs in the huts, use only the grey, old ones in the areas

Phone Numbers and Emergency Call

- 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 come and help as fast as possible
- Remember your first aid training and help

- First aid supplies (band-aids)
  - Next to hut H22
  - South-west corner of the hall
  - In front of the restrooms

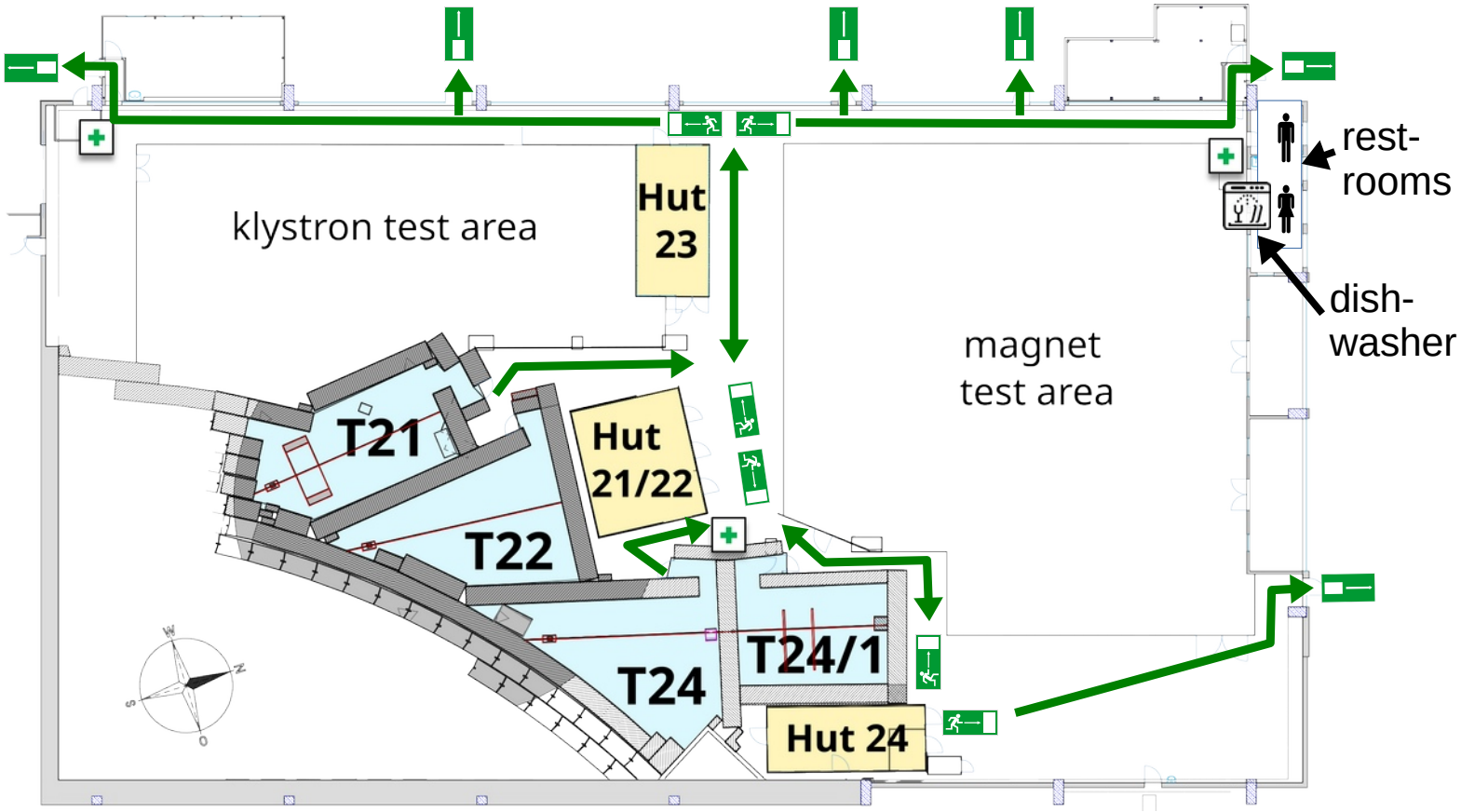
Emergency (Notruf)	**2500**
DESY Mobile	**66-2500**
External Mobile	**+49-40-8998-2500**
Technical Emergency Service	5555
Accelerator Control Room (BKR)	3500
Coordinators	
Sven Ackermann	(9)6239
Ralf Diener	(9)3426
Marcel Stanitzki	(9)4930
Telescope Support	telescope-support@desy.de
Porter's Lodge Notkestrasse	3333

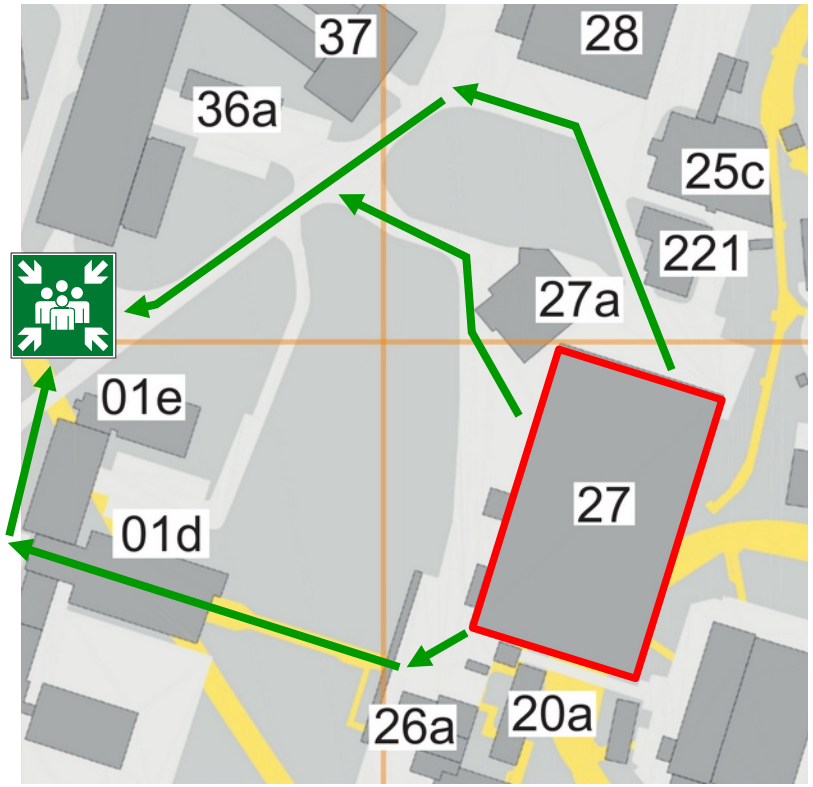
Technical Emergency Service (☎ 5555):
If you hear anomalous noise or notice other strange things (water floods...)
→ *(take into account to leave the hall)*

- Inform the test beam coordinators about any safety relevant incident

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
    → confirms alarm from smoke detectors

  - 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

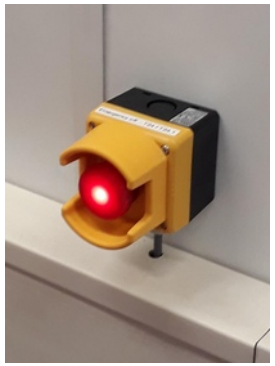
  - For HV systems: Must use CO_2 fire extinguisher
  - Inform test beam coordinators and Technical Emergency Service (☎ 5555)

Emergency Off and Lights

- Emergency-off buttons in huts and areas
  - Kill both: beam and electrical power
- Electrical circuits
  - ① Areas TB21 + TB22 + hut H21/22
  - ② Areas TB24 + TB24/1 + hut H24
    → take power only from inside specific area or hut, respectively

- Areas/huts equipped with mobile emergency lights
  - In case of a larger power cut:
    emergency power should be available after 60 s

- **Keep** emergency-off and lights **always accessible**:
  no material, tables, boxes, cables etc. in front



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…

- 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, ...)

Translation Stages

- In all areas
- Be careful: danger of squeezing
- The big green stages can carry up to 1 t

- Remote controlled
  - Stay in contact via phone during remote operation if people are inside the area

- Make sure that the stages do not hit persons or equipment and don’t rip of cables

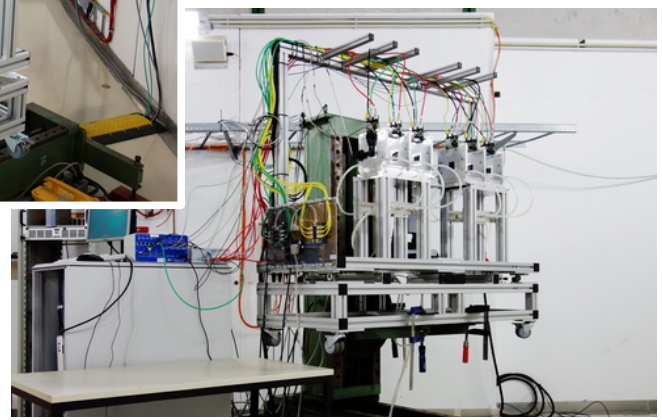
Beam Telescopes

- Two areas equipped with EUDET-type telescopes one with an Alpide based telescope

- Contact & Support telescope-support@desy.de

- Safety & Rules
  - The telescopes are flexible but sensitive
    - Upper frame can be rotated *(not fixed!)*
    - Behind the thin foil are 50 µm silicon sensors
  - Watch out the travel range of the PI-µm-stages

  - Telescope low voltage provided by uninterruptible power supply (8 V Mimosa26, 15 V PMTs)



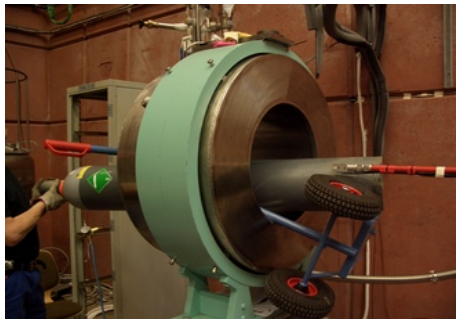
- Usage:
  - Data flow should be over the local network 192.168.<2x>.<x> ranges
  - Copy your data saved from the local raids after your test beam to free the disk space

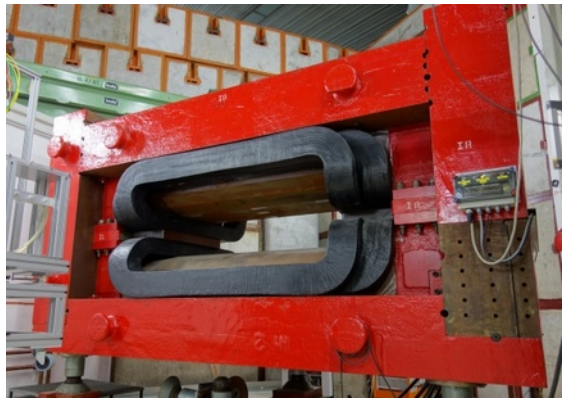
Test Magnets

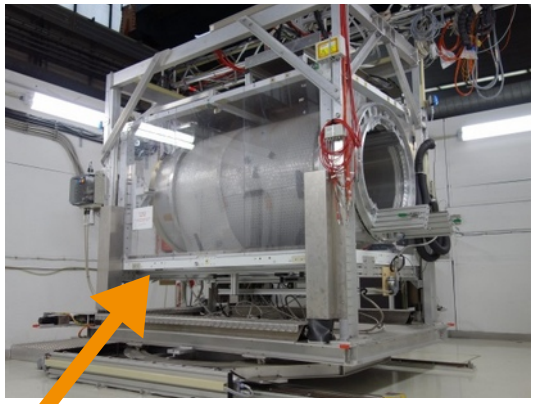
Operation only by trained users (extra training)

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

  → Secured by door interlock







- BRM Dipole in T21: no access

- PCMAG in T24/1:
  - Access possible by bridging interlock
  - For small adjustments only
  - Do not open blue door when magnet current sign on
    Careful: takes up to 12 h to cool down after emergency-off

- 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 → less than 20% have this reflex

- **Rules**
  - Announce use before switching on
  - Never look directly into any laser:
    turn away / close eyes if accidentally doing so
  - 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 operated at DESY have to be announced » 4 weeks in advance, including a description / sketch + risk assessment

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 cable and 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)

  that is not shielded → 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.

Gas Safety

- Announce well in advance
- Pre-mixed gases can be supplied
- Measures adjusted to specific gas (mixture)
  - Flammable gases possible: mobile gas safety system
- Always use exhaust and ventilation system
- **No** mechanical work on system under pressure: depressurize before breaking lines
- **Always** protect gas cylinders from falling

  → store cylinders in the cabinets or in the stand outside (north gate)

Cryogenic Gases and Dry Ice

- 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 / oxygen sensor may be required

- Refer to CERN Cryogenics Course

Radiation Safety

General Rules

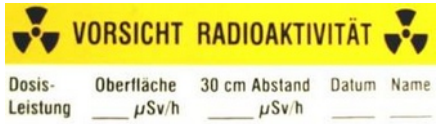
- Always practice **ALARA**:
  As **L**ow **A**s **R**easonably **A**chievable
- Key ingredients
  - Proper shielding
  - Minimize exposure time
  - Maximize distance ($1/r^2$ is your friend)
- Dose limits from the German regulations (Strahlenschutzverordung)
  - Rad Worker:
    Maximum annual dose for category B / A:
    6 / 20 mSv/a *(Lifetime dose of 400 mSv)*
  - Everyone else
    Less than 1 mSv/a allowed due to occupation

- For reference: 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

Radioactive Material - Shipping and Handling

- Radioactive material and irradiated samples
  - Contact us well in advance
  - RSO/D3 will determine, if a dosimeter is needed
- Needs to be clearly marked and properly stored (thief-proof)
  - Label: details, date, name, group



  - Radiation safes in every hut
  - Lockable Freezer (-24 ºC) in hut 22
  - Remove from the safe/freezer (and ship) at the end of your beam time

- **Shipping** irradiated samples and material 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

Radiation Safety

DESY II Test Beam Facility

- A dosimeter not required when beam is off
- No activation of material in the areas

- **Interlock** (see following slides) needs to be set before beam shutter can be opened
  - When interlock is set, area becomes a *Prohibited Area / Sperrbereich*

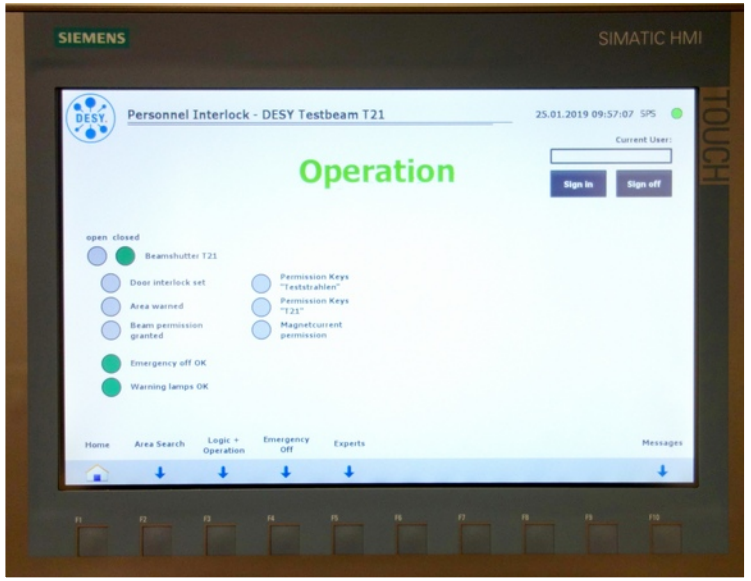
- **Yellow doors** and the rest of the interlock system are part of the radiation safety
  - Any manipulation or work around radiation protection leads to consequences, up to the cancellation of your current and future test beam(s)
  - If you leave the area, yellow doors should be closed, but **never** be locked/blocked (escape routes)

Beam Interlock

Introduction

- Keys always stay in the cabinet (only needed for maintenance)

- Operation of interlock system:
  - User panel in hut and buttons in area



- Area search by **single person only (no exceptions)**

Setting the Area Interlock

Starting the Procedure

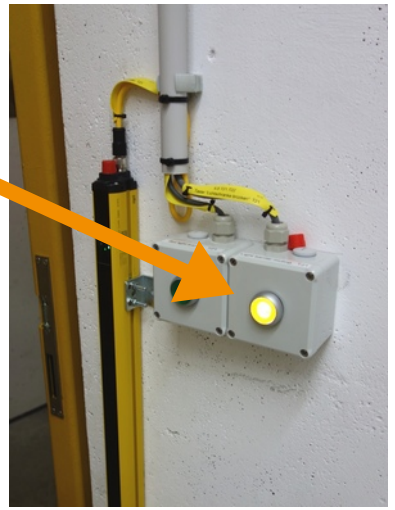
- Do
  - Swipe DACHS card across reader at entrance
  - Go in past the light barrier and press green “Set light barrier” button right after entrance
- Effect
  - Yellow interlock light at entrance and green search buttons inside area will light up
  - Announcement that the interlock search is taking 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 (yet)
  - **Don't enter** an area **when yellow** door **light is on**!

Setting the Area Interlock

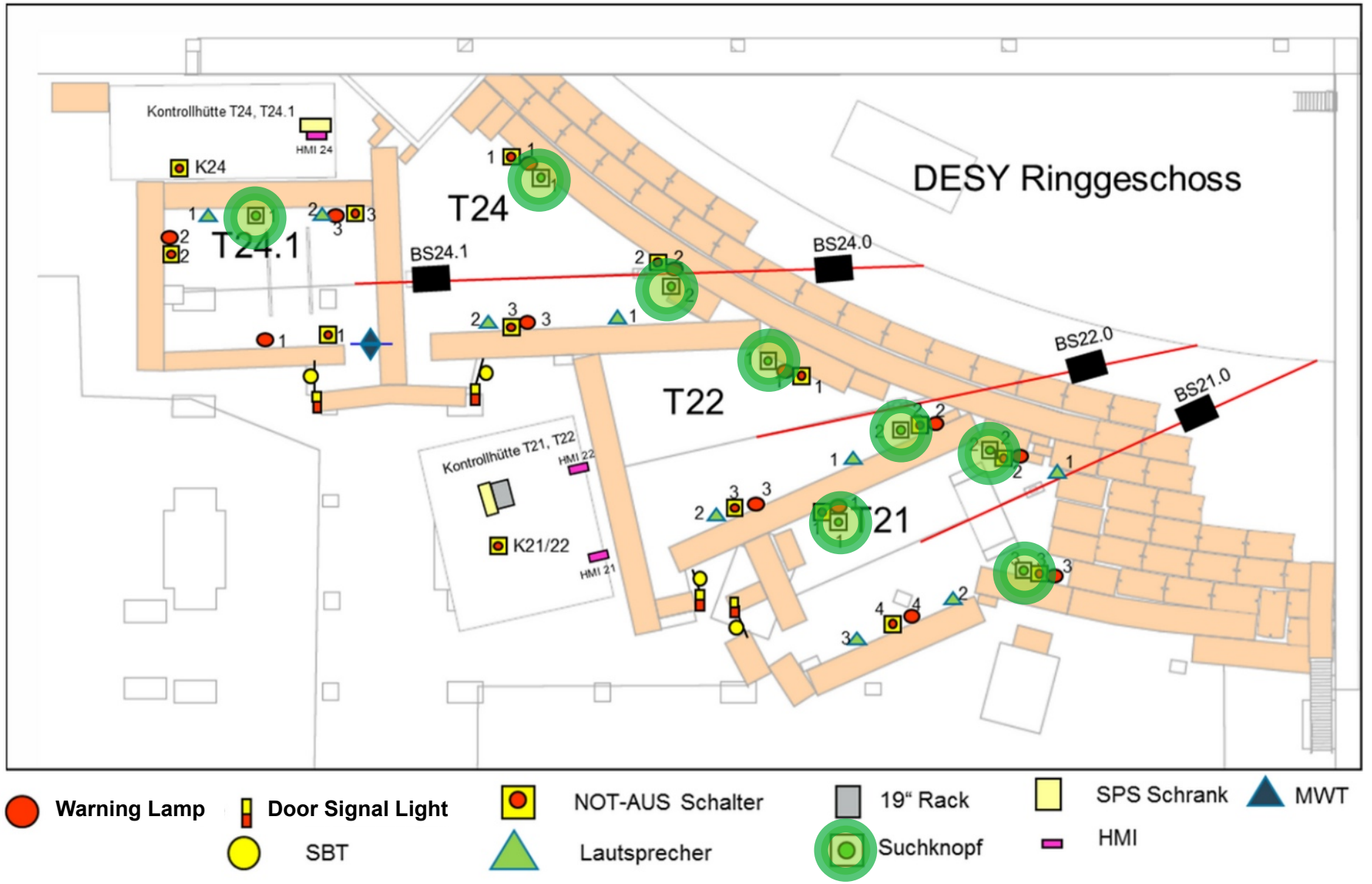
Search and Leaving the Area

- 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

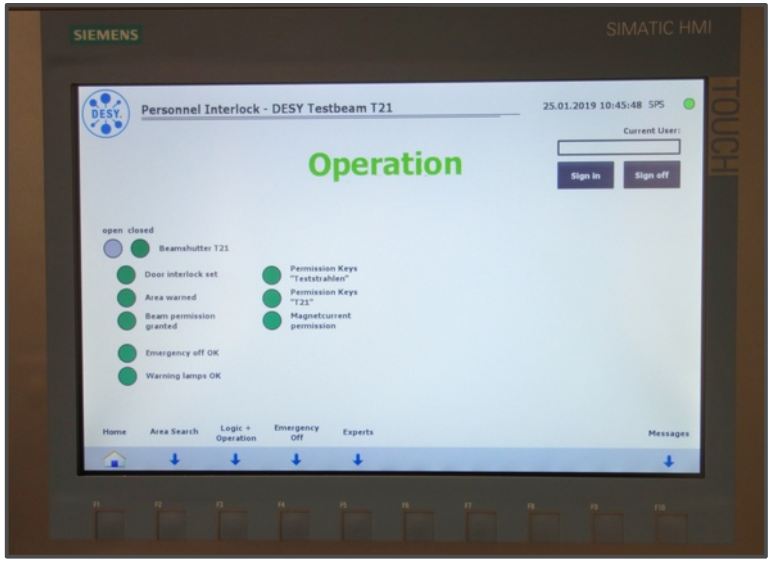


Skizze Interlockkomponenten in den Teststrahlgebieten (A. Liedtke)

Setting the Area Interlock

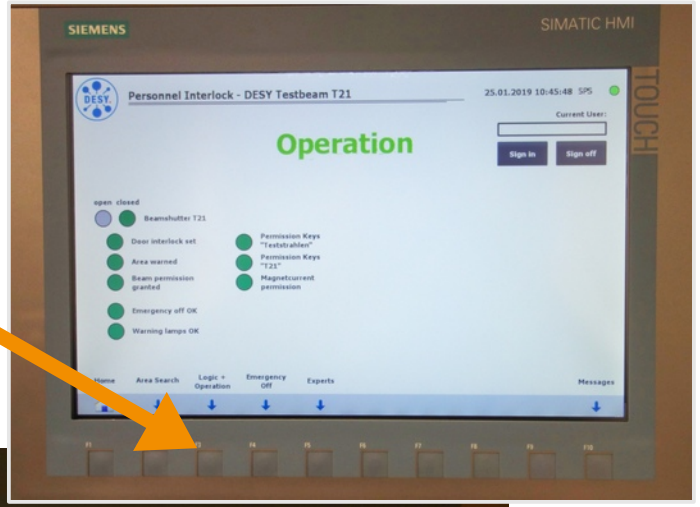
Finishing

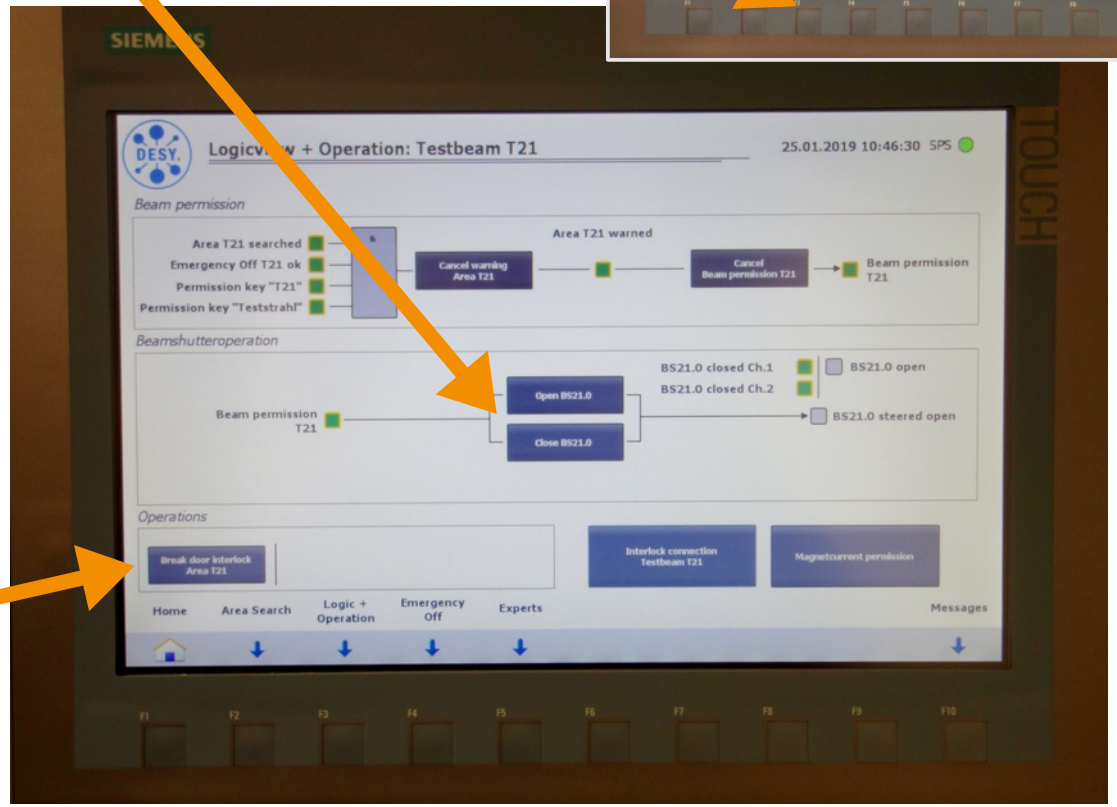
- Do
  - Close door
  - Press “Set button main door”
  - Swipe DACHS card across reader *(same card as at start!)*
- Effect
  - Door secured, red door light switches on
  - Announcement in area for about 30 s that beam is going to be switched on (German + English)
  - After this:
    - Area ready to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

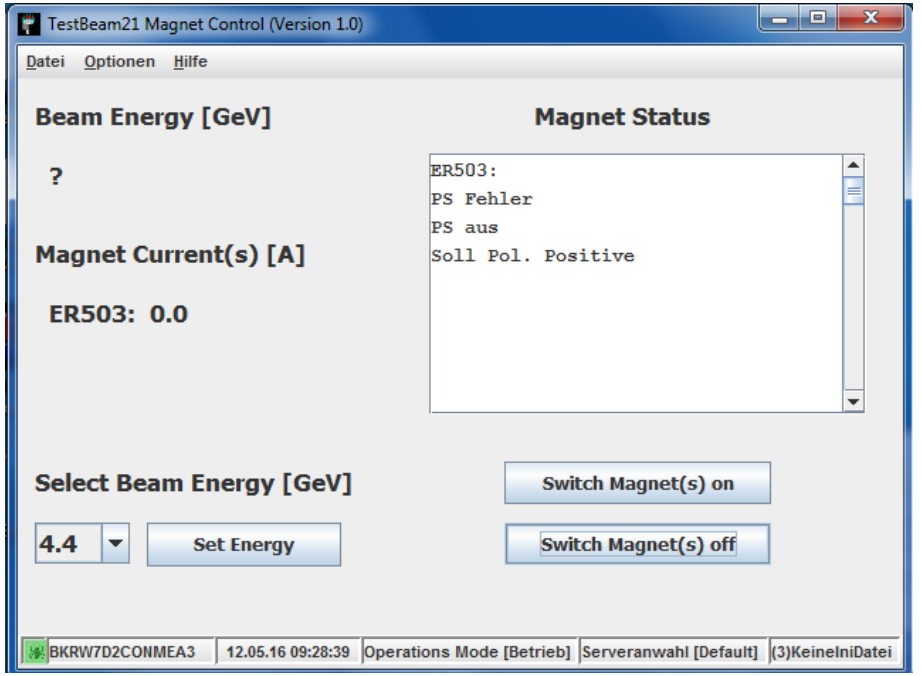
  Press Emergency-off
  and / or
  Leave area though door / light barrier

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

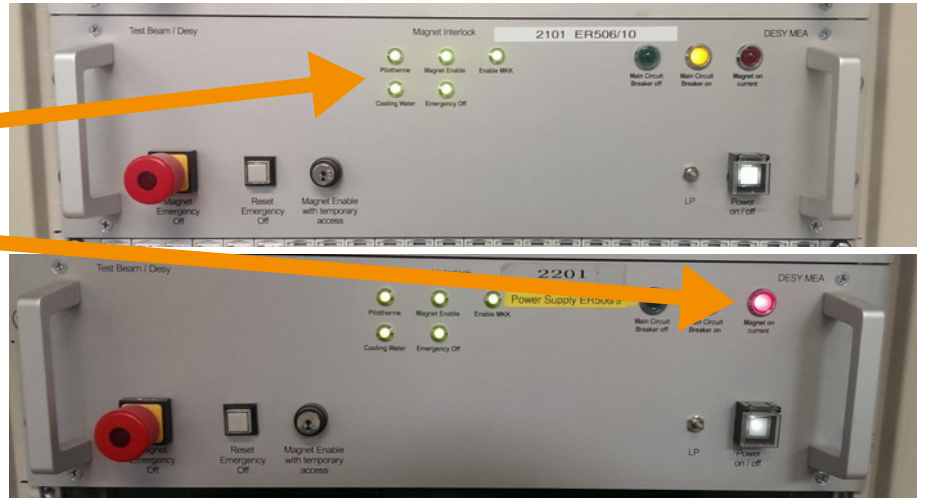
  → **Leave area immediately** ***(avoid crossing beam path)***
  - Keep others from entering
  - Call control room (BKR ☎ 3500) to immediately shut off machine and inform test beam coordinators

Beam Operations

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



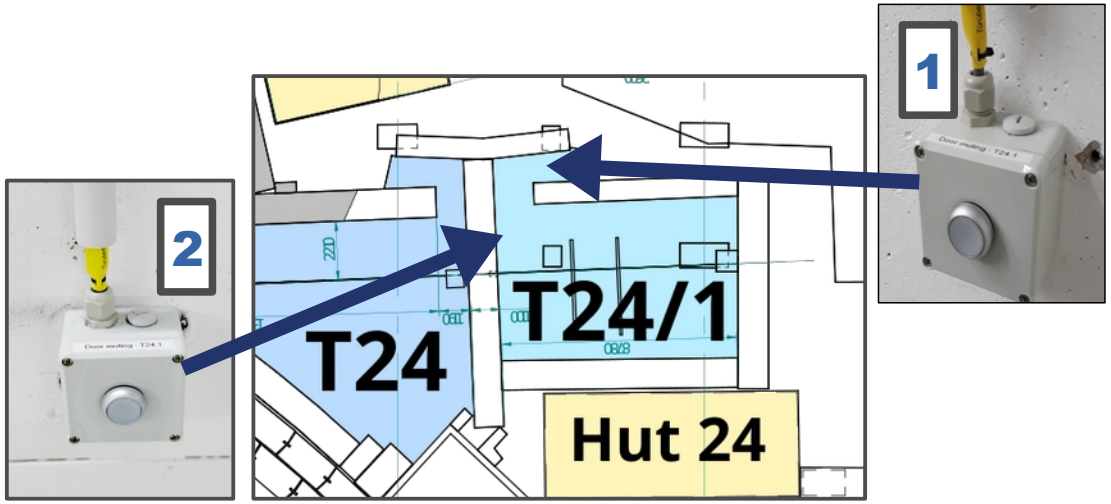
- Checking status of magnet power supplies
  - All 5 green LEDS need to be on to power up
  - Big red light indicates, if magnet is powered



PCMAG Magnet Interlock in T24/1

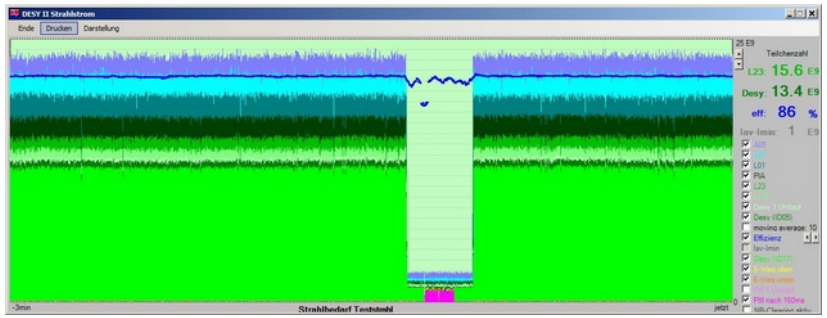
Setting and Bridging

- 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, watches, jewelry etc.
    - 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
    → **Extra careful!**



DESY II Test Beam

- **DESY II** synchrotron: 6.1 GeV, typically 6-15 x 10^9 e^- / bunch
  - Injector for PETRA III:
    Depending on mode, top-up every few minutes



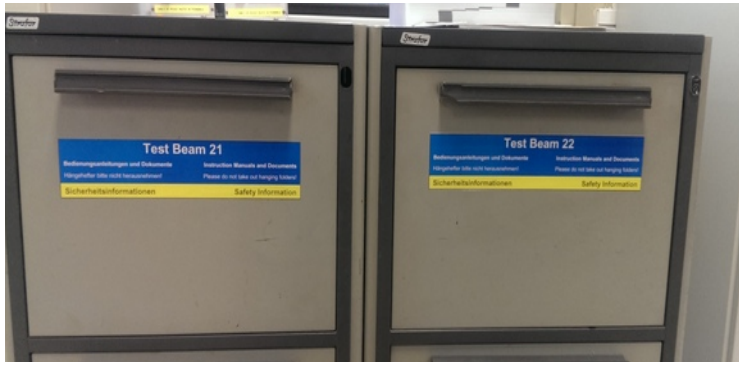
- **Wednesdays**
  - Machine studies possible 7-15h → beam might not be stable
  - Every second Wednesday: no beam from 07:00 till *noonish* possible
- **Operating** costs: ~ 500 € /hour (84000 € /week) → Use your beam time well and save power (cost)
  - Close shutter when beam not used (saves RF power)
  - Switch off beam magnets for longer breaks (automatic switch-off when shutter closed > 60 min)

Closing Remarks I

- Most important: **think** before doing

- For more information see our **web page**: http://testbeam.desy.de
  - Link to current version of this lecture:

- Refer also to safety information and reference provided in cabinets



- Web page of our favorite synchrotron: https://min.desy.de/beschleuniger/desy_ii/

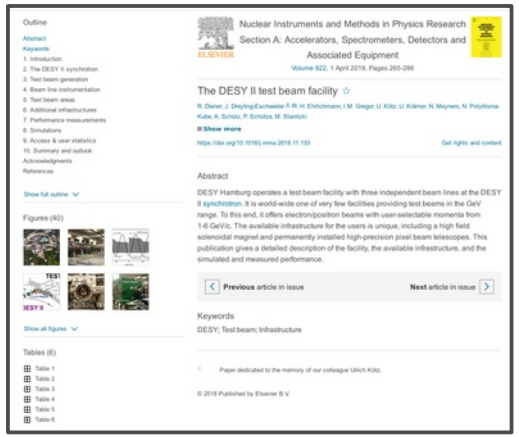
- In doubt: ask us!

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 **acknowledgment** 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.