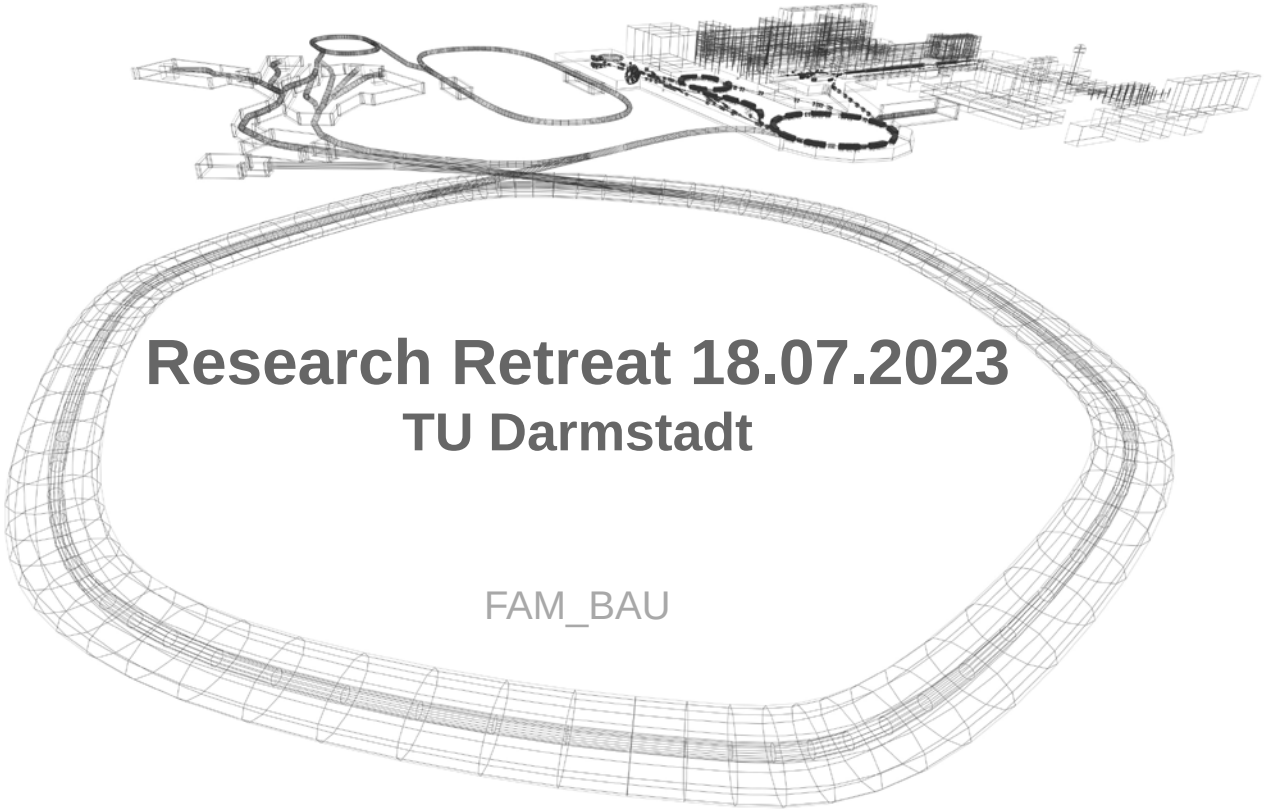


Research Retreat 18.07.2023

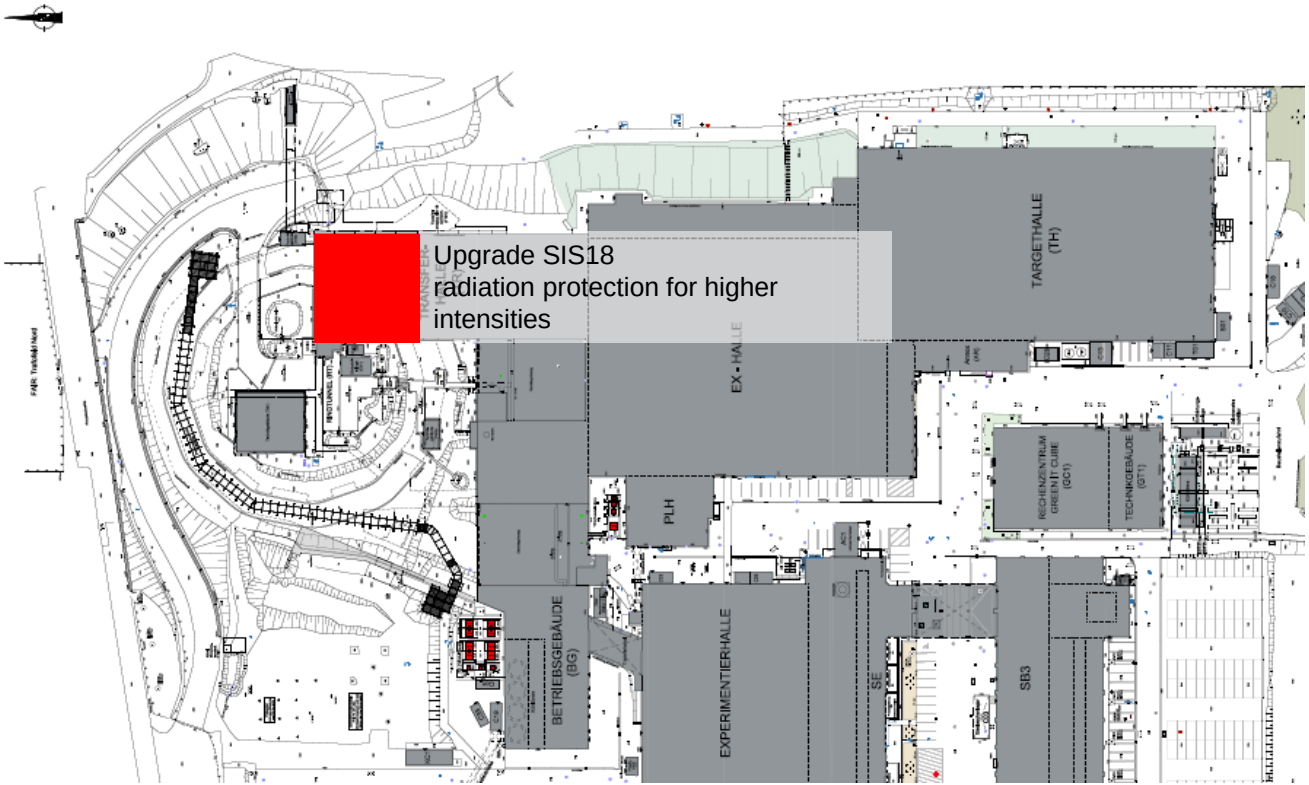
TU Darmstadt

FAM_BAU

Necessary construction measures to achieve building permission/ conformity

- Presentation of the construction projects that have an impact on the scientific operations (clashes of dates, spatial limitations, etc.)
  - GaF-Measure Nr.11 Upgrade SIS18
  - Building permission and fire protection measures:
    - Linear accelerator BH-VR/TU/SH1-4 + (EH)
    - Building BG
    - Experimental halls TR/EX/TH
  - Refurbishment of EH and replacement of LA24

Upgrade SIS18 inside the transfer hall



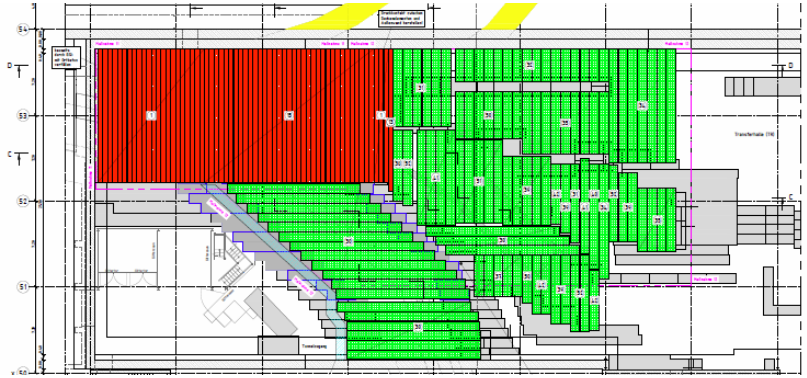
GaF-Measure Nr.11 Upgrade SIS18

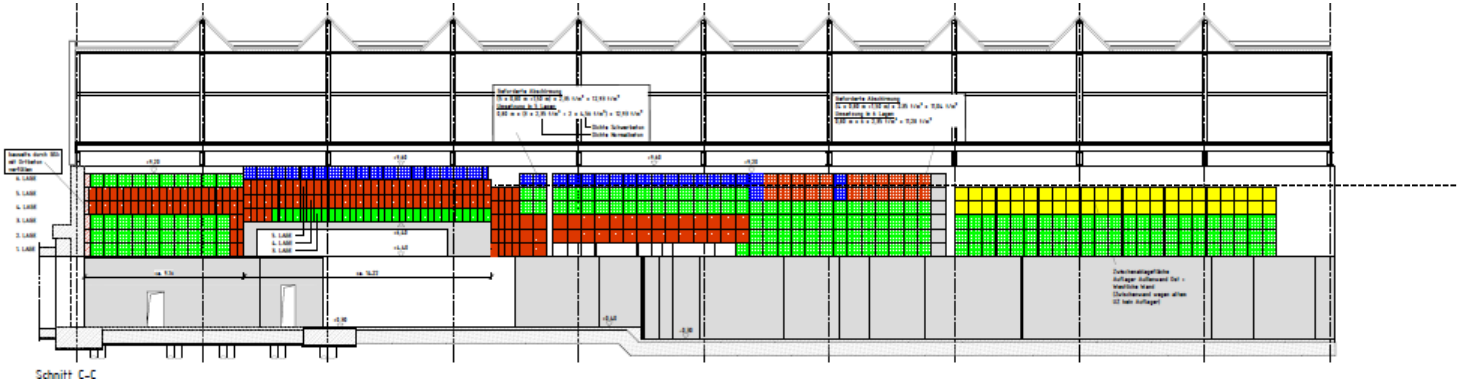
Reinforced ceiling shielding SIS18 /TR Nord

A total of 643 shielding beams must be moved within the hall/s

321 to the outside
279 new manufactures beams
and 43 intermediately stored beams have to be brought inside the TR

Transport time per beam 2 hours.





Variant 1: Removal and installation via facade opening (east and north) - rejected -

- due to the concrete wall located in front of the outside wall (opening of the facade only possible with a height h = approx. 3. 50 m).
- none of the possible facade panels has the required height or width – concrete beam width 12m –
- The mobile crane cannot lift the the ceiling beams, with approx. 20t, horizontally into the hall
- The resulting lever forces at 20to load are not manageable under the local conditions.

Variant 2: Mounting window in the roof north side (approx. 14,00m x 5,00m)

This variant has to be checked for feasibility by the planner and structural engineer

Disadvantages

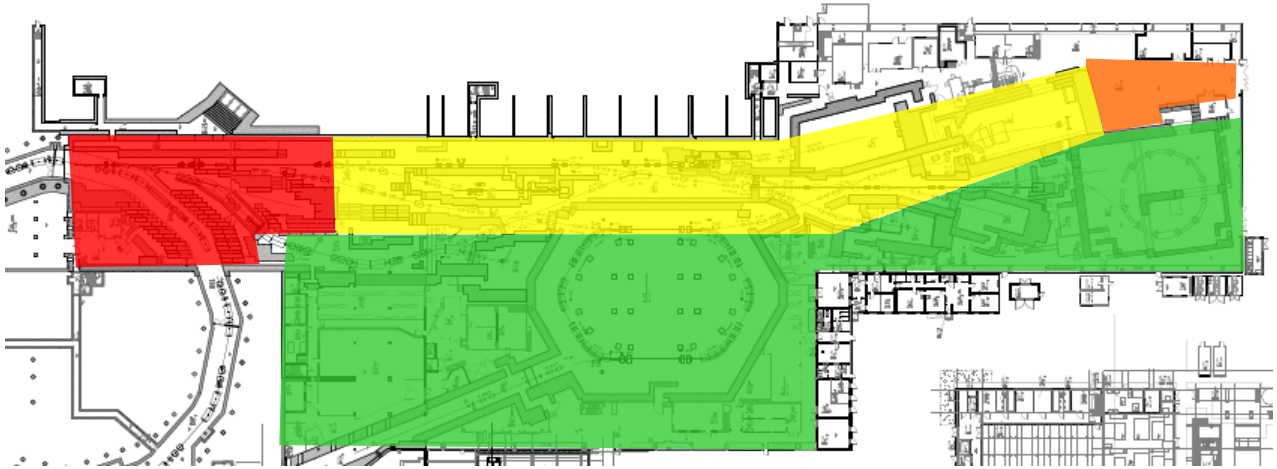
- Necessary weather protection roof (openable) during execution.
- Statics and planning for opening and closing the existing roof is required
- Structural engineering and planning for protective roofs
- Roof opening over approx. 4 months

Benefits

- Disassembly and lifting of the „last five rows“ without special construction
- faster handling in the northern area of the hall (TR)
- Installation directly from the „P-Linac“ parking storage area by crane
- most of the deliveries can be made via Prinzenschneise-> less stress on the campus of GSI
- Scientific activities are possible in the rest of the halls

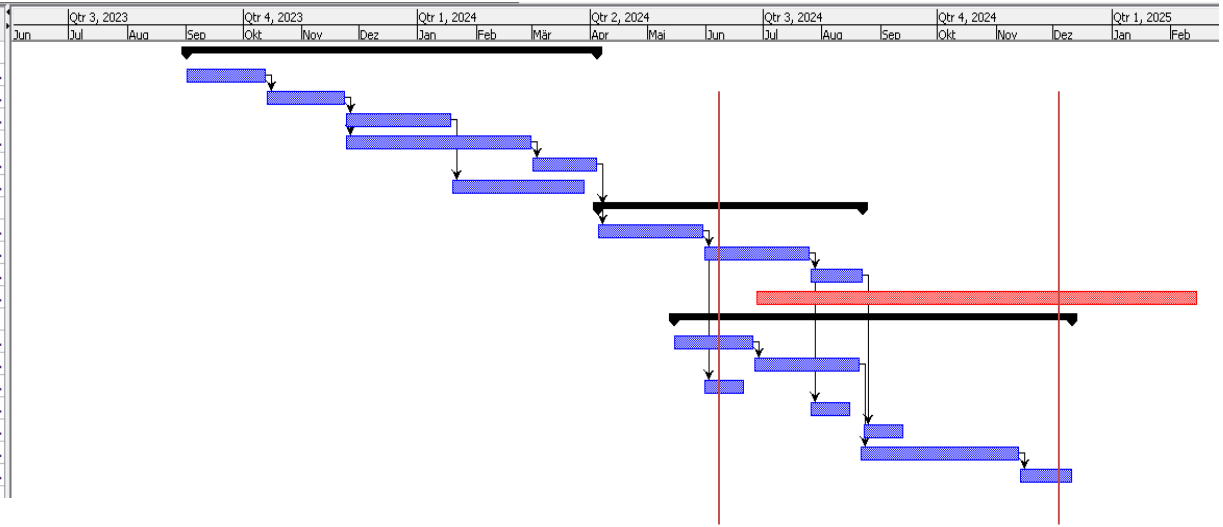
Variant 3 Complete transport through all three halls TR-EX-TH

- Levels 1 and 2 are locked during assembly time
- Level 2 is locked during transports for assembly
- Level 1 is locked during delivery and transport
- Level 1 and 2 ist fully usable



Schedule for upgrade SIS 18 (both variants)

	Name	Dauer	Start	Ende
1	**Planung**	155 tage	**01.09.23...**	**04.04.2...**
2	Ausschreibung Planer	30 tage	01.09.23 ...	12.10.23...
3	Planung Balken	30 tage	13.10.23 ...	23.11.23...
4	Planung Logistik	40 tage	24.11.23 ...	18.01.24...
5	Ausschreibung	70 tage	24.11.23 ...	29.02.24...
6	Vergabe, techn Bearbeitung, Detailklärung	25 tage	01.03.24 ...	04.04.24...
7	Ausschreibung Nebengewerke (Gerüst, Kran, Transportlogistik)	50 tage	19.01.24 ...	28.03.24...
8	**Produktion**	100 tage	**05.04.24...**	**22.08.2...**
9	Schwerbeton Rohdichte 4,42-4,56 kg/m³	40 tage	05.04.24 ...	30.05.24...
10	Schwerbeton Rohdichte 3,50 - 3,82 kg/m³	40 tage	31.05.24 ...	25.07.24...
11	Normalbeton	20 tage	26.07.24 ...	22.08.24...
12	Shutdown 2024/25	167 tage?	27.06.24 ...	14.02.25...
13	**Montage**	150 tage	**15.05.24...**	**10.12.2...**
14	Vorbereitenden Maßnahmen (Gerüst, Dachöffnung)	30 tage	15.05.24 ...	25.06.24...
15	Ausbau Bestand	40 tage	26.06.24 ...	20.08.24...
16	Lieferung Schwerbeton RD 4,42-4,56 kg/m³	15 tage	31.05.24 ...	20.06.24...
17	Lieferung Schwerbeton RD 3,50 - 3,82 kg/m³	15 tage	26.07.24 ...	15.08.24...
18	Lieferung Normalbeton	15 tage	23.08.24 ...	12.09.24...
19	Einbau	60 tage	21.08.24 ...	12.11.24...
20	Nachbereitende Maßnahmen	20 tage	13.11.24 ...	10.12.24...



- Removal and installation time is calculated on the assumption that three crane teams will be installed, one team each hall
- optimizable by opening the roof, if feasible
- schedule without any time buffer
- without taking account other planned activities

construction phase 6 months

Next steps Upgrade SIS 18

BAU_Björn Benz

requirements:

- Construction time of approx. 6 months
- Full-Shutdown required for both variants
- Variant Transport through hall only possible with complete construction freedom in the halls
- secured financing by FAIR approx. 5,2 million EUR

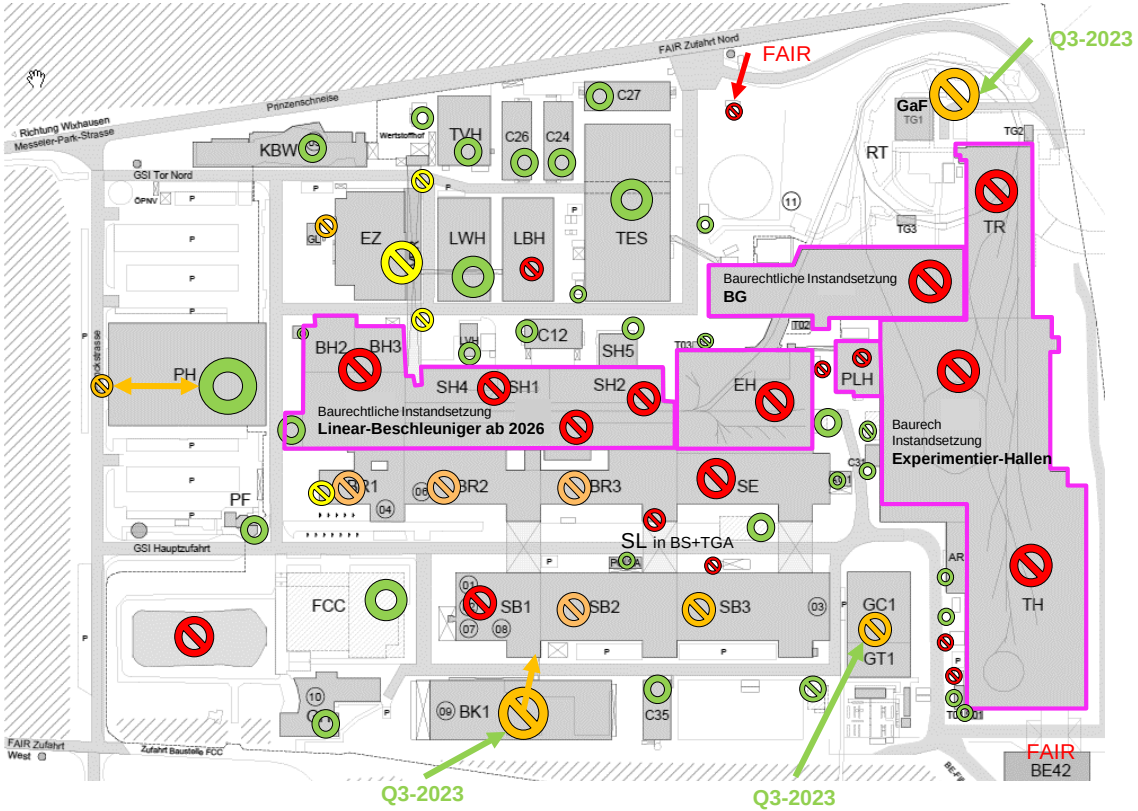
recommendation BAU:

- Implementation of the variant transport via roof opening, if possible
- Definition of the time window for “Full Shutdown” in 2024/2025

next steps:

- Shopping cart and procurement planning Q3 2023
- Decision on the variant after verification of static feasibility and cost-effectiveness comparison

Overview of building permit status Campus GSI



Legend

RED

Permit situation deviates from construction status

Fire protection qualification in building construction and TGA in buildings around the linear accelerator (BH1-3, TU, VR, SH1, 2, 4), experimental halls (TR, EX, TH), BG, PHL and SB1 to achieve compliance with building regulations

ORANGE

Building permit with small deviations

Buildings in final processing to achieve building permit conformity BK1, SB-2-3, BR1-3, GaF, GL, PH-E charging stations

GREEN

Permit situation in accordance with construction status

Not complaint from the building authority

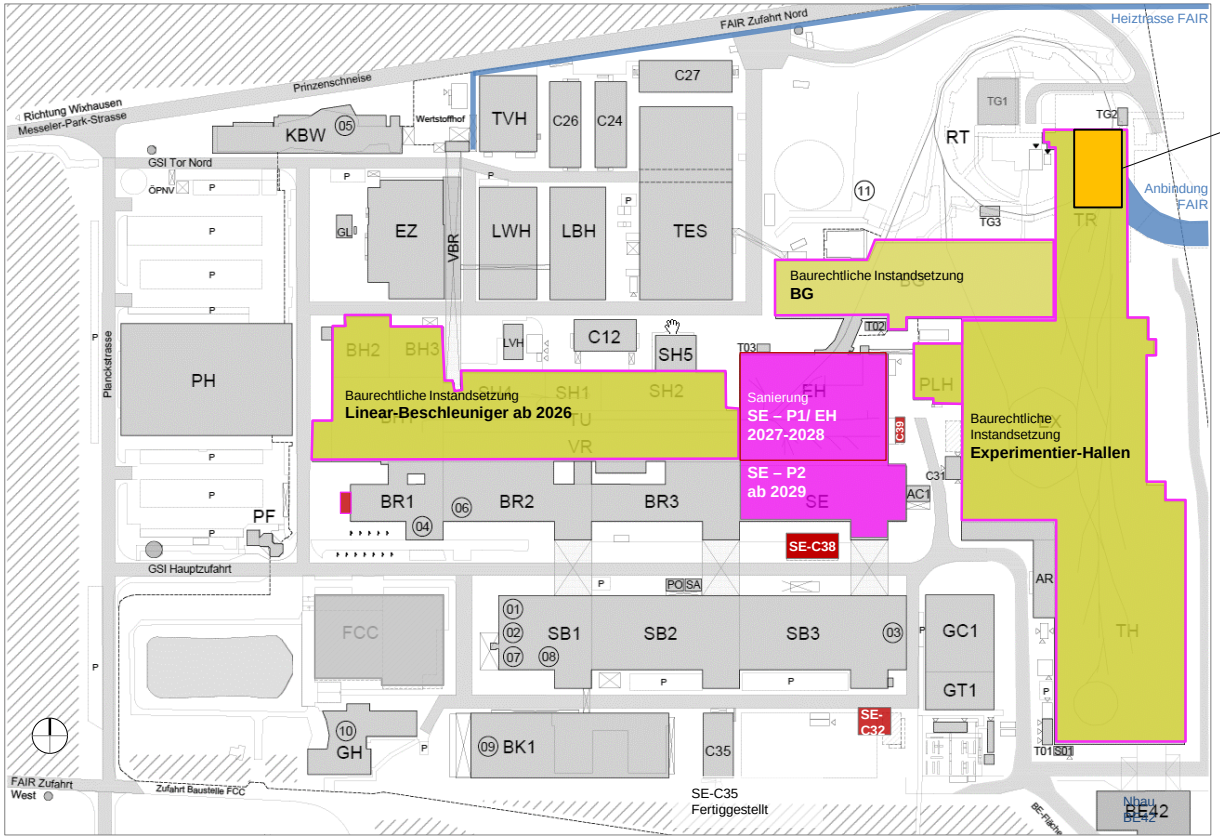
YELLOW

Building permit in progress

Approval will take place with implementation of the planned measures in SE+EH, EZ

AR 110 Baumaßnahmen > 2,5 Mio. €

- Neubauten
- Sanierungen
- Projektiert
- FAIR

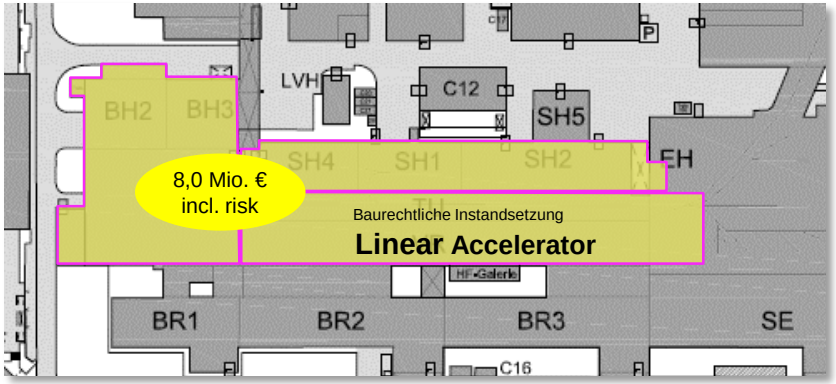


Building law refurbishment_linear accelerator

BAU_Maria Martin Pelaéz / N. N.

Refurbishment of Buildings around the accelerator:
Halls (BH1-3), tunnel (TU), utility rooms (VR) und stripper halls (SH1, 2 und 4)

Measures:	Fire safety measures: construction of locks, enclosure of stairs, fire doors, fire dumpers, fire bulkheads, fire walls, replacement of transformers, low-voltage main distributions and sub-distributions, electrifications of new locks, fire alarm systems (BMA), safety lighting (SiBel), BOS-radio, measurement control technology (MSR), renewal of drinking water supply, repair of basic lines, renewal of ventilation systems
User:	Linear accelerator and Power supply
Costs:	8 Mio. € inkl. risk (1,0 Mio. €) construction: 2,2 Mio. EUR TBE: 2,9 Mio. EUR (2,1 Mio. EUR ETS und ETE!)
Construction time:	2026 – 2028 (commissioning FAIR)
Status:	AR 111 proposal for a decision

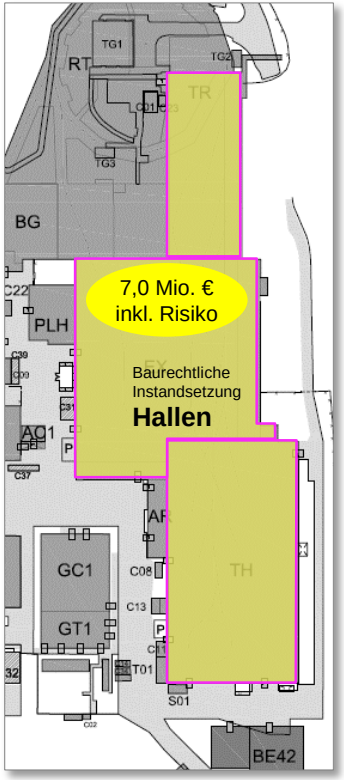


Building law refurbishment_experimental halls

BAU_Maria Martin Pelaéz / N. N.

Refurbishment of the experimental halls:
Transfer hall (TR), New experimental hall (EX), Target hall (TH)

Measures:	Fire protection and safety measures renewal and refurbishment of tecnical building equipment
User:	Scientific experiments
Costs:	7 Mio. € incl. risk (0,75 Mio. €) construction: 2,7 Mio. EUR TBE-tecnical building equipment: 2,0 Mio. EUR (1,65 Mio. EUR ETS_fire alarm systems (BMA), safety lighting (SiBel), BOS-radio,)
Planning/ Permit:	?– 2028 min. building permission untill commissioning FAIR
Construction time:	from 2028
Status:	AR 111 proposal for a decision

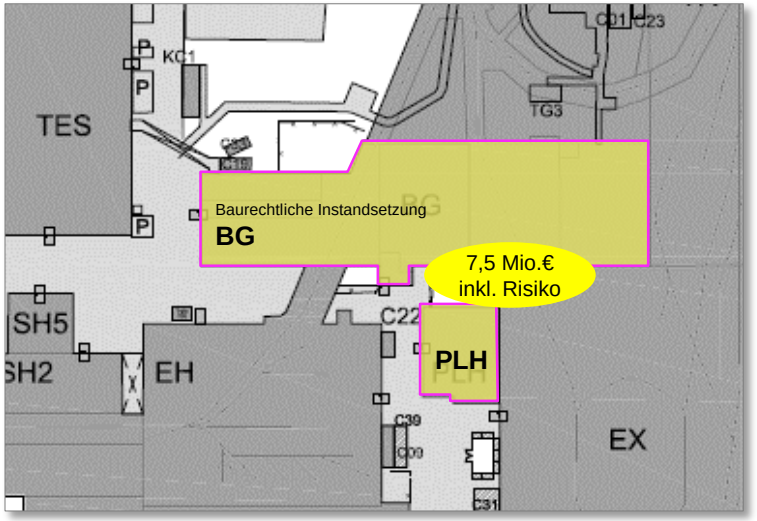


Building law refurbishment_building BG

Bau_Maria Martin Pelaéz / N. N.

Refurbishment Building BG and safety measures Phelix Gebäude (PH)

Measures:	Fire protection measures Renewal and refurbishment of tecnical equipment
User:	Operation GSI and science
Costs:	7,5 Mio. € incl. risk (0,9Mio. €) determined with cost characteristics on m² BGF
Planning:	?– 2028 min. concept of fire protection untill commissioning FAIR
Construction:	from 2030
Status:	AR 111 proposal for a decision



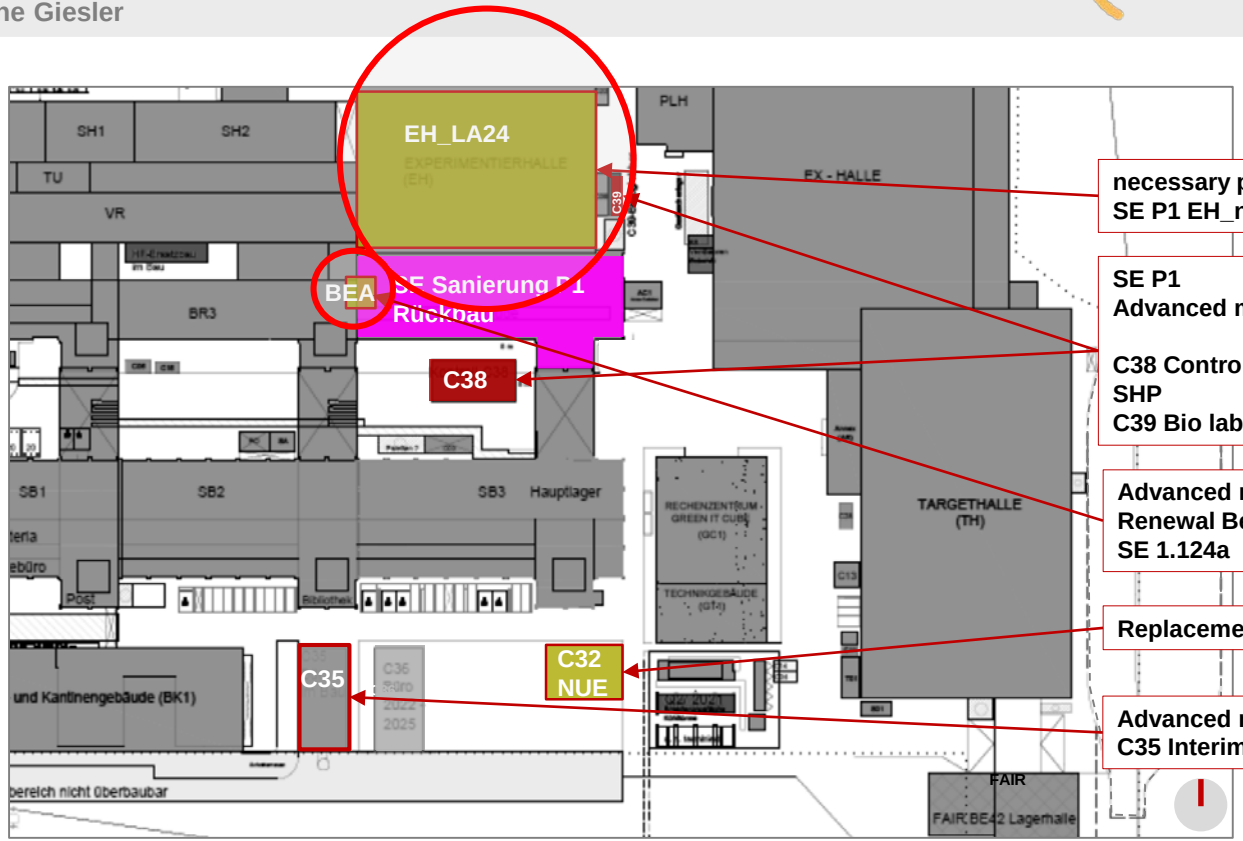
Refurbishment SE – P1_
Advance measures to maintain scientific excellence

BAU_Uwe Fabig / Anne Giesler

New construction

Refurbishment

Projected



necessary preliminery projekt for SE P1 EH_new LA 24

SE P1
Advanced measure II

C38 Control-container SIST + SHP
C39 Bio laboratory BMD

Advanced measure III
Renewal Beam diagnostics
SE 1.124a

Replacement area for NUSTAR

Advanced measure I
C35 Interim office building

Refurbishment SE – P1 Dismantling – EH_new LA24

BAU_Uwe Fabig / Anne Giesler

Measures: Separation of LA24 (old system) and construction of a replacement ventilation system for the EH (new LA24), Fire protection measures, building permit with new fire protection concept

User: The LA24 – refurbishment EH is necessary for the approval of accelerator operation under radiation protection law

Costs: ca. 4,0 Mio. €
Construction: Q1/2026 – Q3/2027
Commissioning: 2027

Status: Determination of user needs Q4/2022 to Q2/2023
Call for tenders for planners Q3/2023
Planning up to request building permit Q4/2024
Building permit Q3/2025 (3er Set 14 months!)
Start of construction 2026,

construction time approx. 18 Months!
Collision with current planning science and accelerator

Thank you very much for your attention!