PETRA IV.
NEW DIMENSIONS

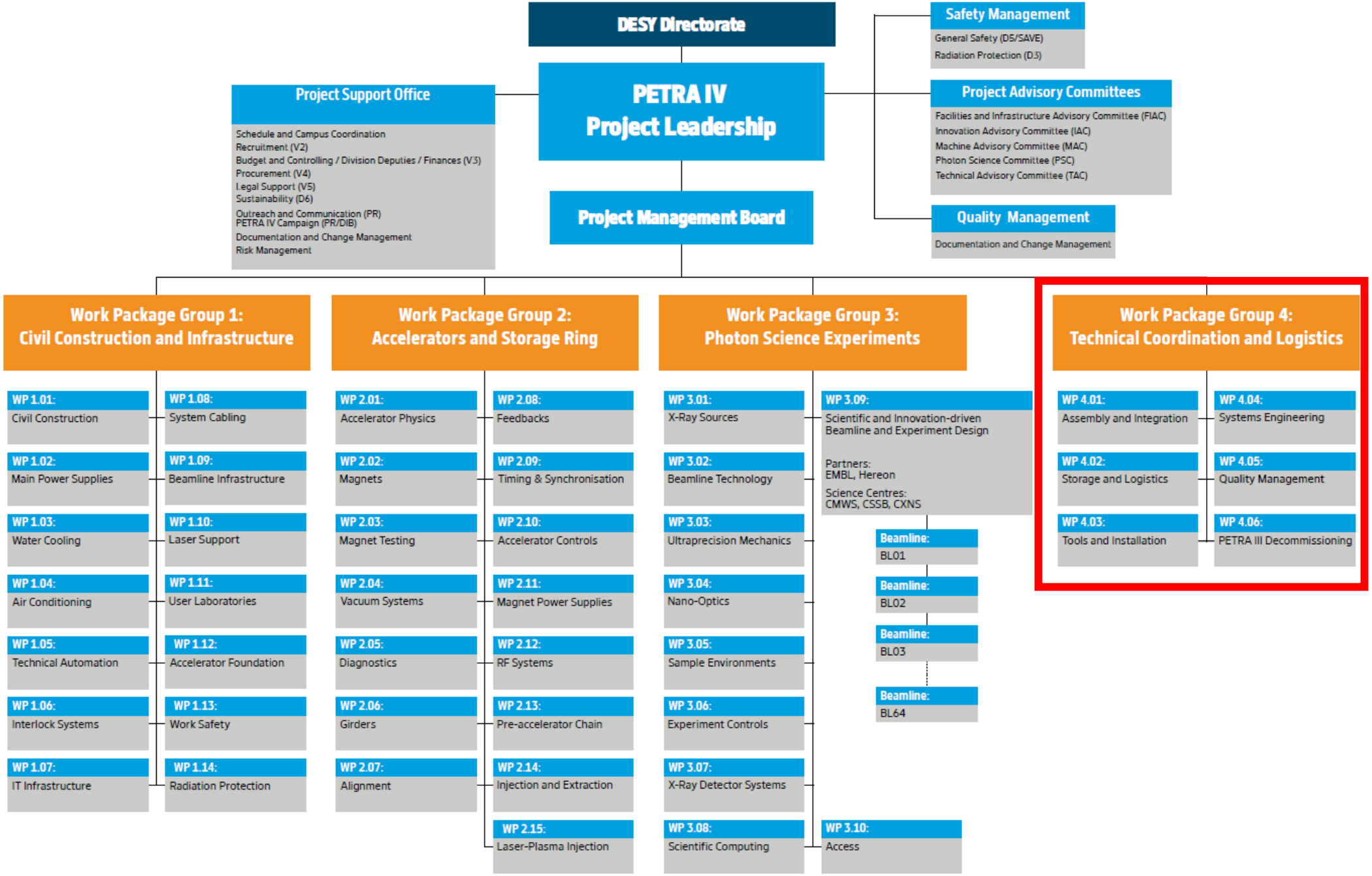
Technical Coordination & Logistics

Markus Hüning

Hamburg, 27.11.2023

HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

DESY.


DESY Directorate
PETRA IV Project Leadership
Project Support Office
Schedule and Campus Coordination
Recruitment (V2)
Budget and Controlling / Division Deputies / Finances (V3)
Procurement (V4)
Legal Support (V5)
Sustainability (D6)
Outreach and Communication (PR)
PETRA IV Campaign (PR/DIB)
Documentation and Change Management
Risk Management
Project Management Board
Safety Management
General Safety (DS/SAVE)
Radiation Protection (D3)
Project Advisory Committees
Facilities and Infrastructure Advisory Committee (FIAC)
Innovation Advisory Committee (IAC)
Machine Advisory Committee (MAC)
Photon Science Committee (PSC)
Technical Advisory Committee (TAC)
Quality Management
Documentation and Change Management
Work Package Group 1: Civil Construction and Infrastructure
WP 1.01: Civil Construction
WP 1.02: Main Power Supplies
WP 1.03: Water Cooling
WP 1.04: Air Conditioning
WP 1.05: Technical Automation
WP 1.06: Interlock Systems
WP 1.07: IT Infrastructure
WP 1.08: System Cabling
WP 1.09: Beamline Infrastructure
WP 1.10: Laser Support
WP 1.11: User Laboratories
WP 1.12: Accelerator Foundation
WP 1.13: Work Safety
WP 1.14: Radiation Protection
Work Package Group 2: Accelerators and Storage Ring
WP 2.01: Accelerator Physics
WP 2.02: Magnets
WP 2.03: Magnet Testing
WP 2.04: Vacuum Systems
WP 2.05: Diagnostics
WP 2.06: Girders
WP 2.07: Alignment
WP 2.08: Feedbacks
WP 2.09: Timing & Synchronisation
WP 2.10: Accelerator Controls
WP 2.11: Magnet Power Supplies
WP 2.12: RF Systems
WP 2.13: Pre-accelerator Chain
WP 2.14: Injection and Extraction
WP 2.15: Laser-Plasma Injection
Work Package Group 3: Photon Science Experiments
WP 3.01: X-Ray Sources
WP 3.02: Beamline Technology
WP 3.03: Ultraprecision Mechanics
WP 3.04: Nano-Optics
WP 3.05: Sample Environments
WP 3.06: Experiment Controls
WP 3.07: X-Ray Detector Systems
WP 3.08: Scientific Computing
WP 3.09: Scientific and Innovation-driven Beamline and Experiment Design
Partners: EMBL, Hereon
Science Centres: CMWS, CSSB, CXNS
Beamline: BL01
Beamline: BL02
Beamline: BL03
Beamline: BL64
WP 3.10: Access
Work Package Group 4: Technical Coordination and Logistics
WP 4.01: Assembly and Integration
WP 4.02: Storage and Logistics
WP 4.03: Tools and Installation
WP 4.04: Systems Engineering
WP 4.05: Quality Management
WP 4.06: PETRA III Decommissioning

Outline

- Roombooks
  - Structured Documents
  - Freeze/Release
- Layout of Supply Buildings
- Rack Planning
- Tunnel Layout
- Review of DESY4 Options
- Reemtsma-Halls
- GAB

Table Definition

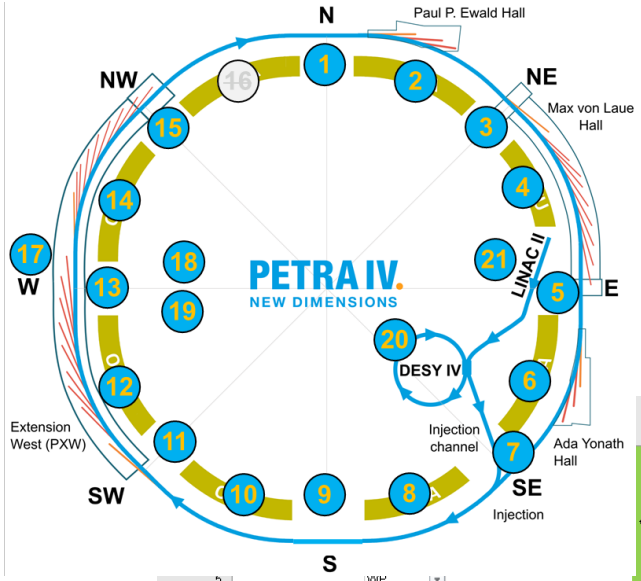
Concentrate

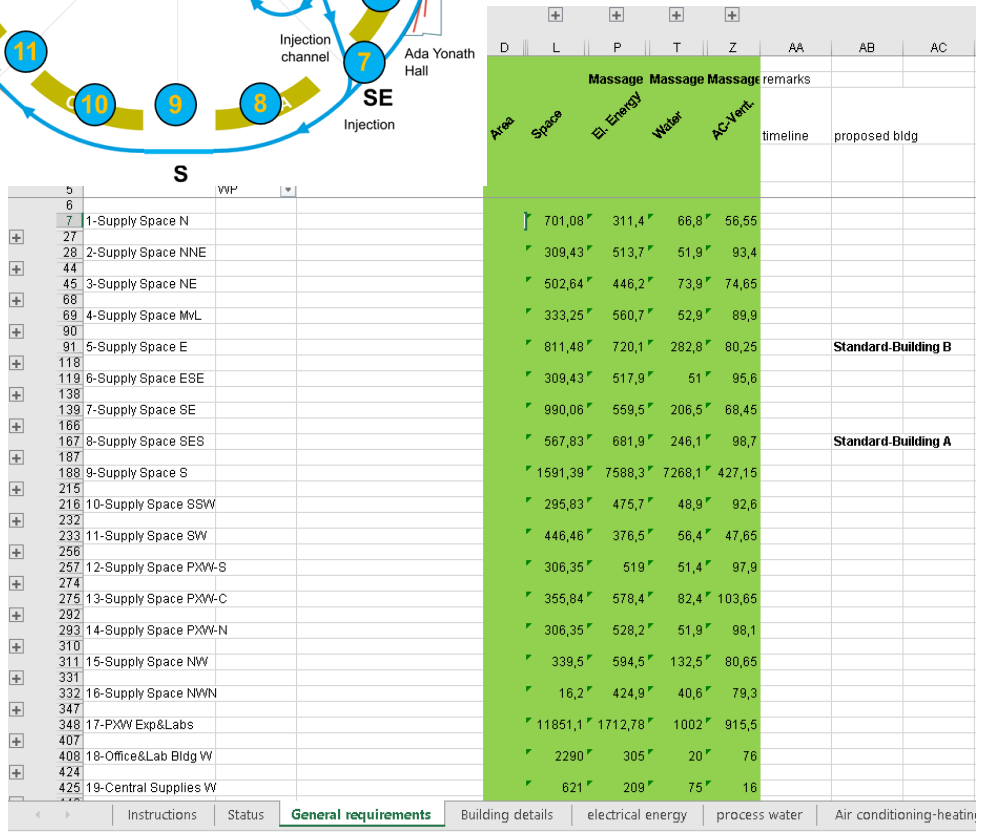
Start from a template already used for the European XFEL

- One sheet per topic
(floor space, electrical power, cooling water, air conditioning)
- One cover page with the summary values
- Level of details adjusted to the stage of the project

Initially one person collected the input from each work package and copied the input into the correct position of the tables

The users had to check the whole table if their input was collected correctly





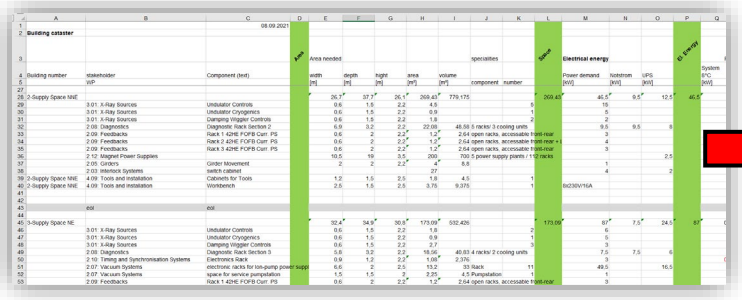
	Area	Space	Massage El. Energy	Massage Water	Massage AC-Vent	remarks timeline	proposed bldg
7	1-Supply Space N		701,08	311,4	66,8	56,55	
28	2-Supply Space NNE		309,43	513,7	51,9	93,4	
45	3-Supply Space NE		502,64	446,2	73,9	74,65	
69	4-Supply Space MvL		333,25	560,7	52,9	89,9	
91	5-Supply Space E		811,48	720,1	282,8	80,25	Standard-Building B
119	6-Supply Space ESE		309,43	517,9	51	95,6	
139	7-Supply Space SE		990,06	559,5	206,5	68,45	
167	8-Supply Space SES		567,83	681,9	246,1	98,7	Standard-Building A
188	9-Supply Space S		1591,39	7588,3	7268,1	427,15	
216	10-Supply Space SSW		295,83	475,7	48,9	92,6	
233	11-Supply Space SW		446,46	376,5	56,4	47,65	
257	12-Supply Space PXW-S		306,35	519	51,4	97,9	
275	13-Supply Space PXW-C		355,84	578,4	82,4	103,65	
293	14-Supply Space PXW-N		306,35	528,2	51,9	98,1	
311	15-Supply Space NW		339,5	594,5	132,5	80,65	
332	16-Supply Space NWN		16,2	424,9	40,6	79,3	
348	17-PXW Exp&Labs		11851,1	1712,78	1002	915,5	
408	18-Office&Lab Bldg W		2290	305	20	76	
425	19-Central Supplies W		621	209	75	16	

Instructions | Status | General requirements | Building details | electrical energy | process water | Air conditioning-heatin

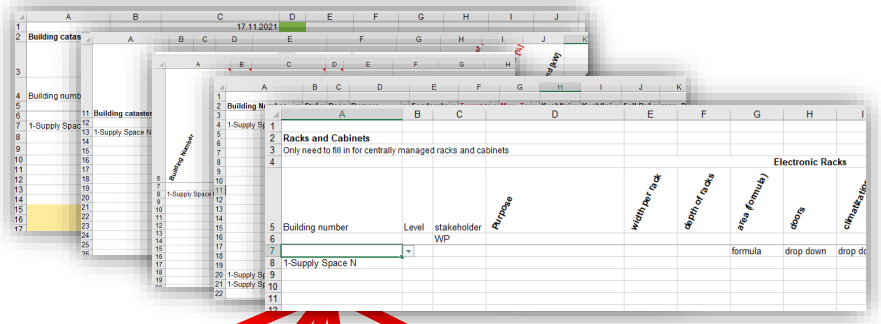
Splitting the Roombooks

Separate by Topic

1 file / 1 tab



1 file / 5 tabs



5 files

Electrical racks

Area	Sub-Area	stakeholder	Component (text)	Qty	width per rack [m]	depth of racks [m]
1-Supply Space N				232		
1-Supply Space N		1.05 Technical Automation	Cabinets for cooling water	16	0,8	0,8
1-Supply Space N		1.06 Interlock Systems	switch cabinet	2	0,6	0,6
1-Supply Space N		1.07 IT Infrastructure	Network Office & MCS	2	0,8	0,8
1-Supply Space N		2.04 Vacuum Systems		12	0,6	1
1-Supply Space N		2.05: Diagnostics	BPM, BLM, MPS, Temperatur	8	0,8	1
1-Supply Space N		2.05: Diagnostics	climatization	3	0,3	1
1-Supply Space N		2.08 Feedbacks	Rack - 42HE FOFB - LOCal node	1	0,6	0,6
1-Supply Space N		2.08 Feedbacks	Rack - 42HE FOFB - GLObal node	1	0,6	0,6
1-Supply Space N		2.09 Timing and Synchronisation	Maybe HF -Cables !!! Room for big cables to be anticiapted	8	0,8	1

Footprint / surface

Building catester

Building number	stakeholder	Component (text)	Area needed width [m]	depth [m]	height [m]	area [m²]	volume [m³]
01-Supply Space N	1.02 Main Power Supplies	central supply ("Technikraum")				40	
01-Supply Space N	1.02 Main Power Supplies	local supply, close to user appliance				2	
01-Supply Space N	1.02 Main Power Supplies	UPS				5	
01-Supply Space N	1.02 Main Power Supplies	UPS-Battery				5	
01-Supply Space N	1.02 Main Power Supplies	central station safety-lighting				5	
01-Supply Space N	1.02 Main Power Supplies	storage (Serviceparts, Tools, Docs, Desk etc)				10	
01-Supply Space N	1.02 Main Power Supplies	transformer and highvoltage switchboard				33	
01-Supply Space N	1.03 Water Cooling	Cooling water supply	60	5	3,5	300	1050
01-Supply Space N	1.03 Water Cooling	Cooling tower	30	11		330	
01-Supply Space N	1.04 Air Conditioning	climatization/ heat suplly	60	6,5	4	390	1560
01-Supply Space N	1.05 Technical Automation	Cabinets for cooling water	12,8	2,6	3,5	33	116
01-Supply Space N	1.06 Interlock Systems	switch cabinet	2	2,5	3	5	15
01-Supply Space N	1.06 Interlock Systems	switch cabinet	1	2,5	3	3	8
01-Supply Space N	1.07 IT Infrastructure		4,4	2,8	3	12,3	37
01-Supply Space N	1.14 Radiation Safety	Pandoras	1	1	2,5	1	3

Electrical power

Building number	stakeholder	Component (text)	Qty	Connection type	Nominal voltage	Special voltage	Power demand per unit [kW]	peak power [kW]
1-Supply Space N							6031	
1-Supply Space N	1.04 Air Conditioning	climatization/ heat supply						
1-Supply Space N	1.05 Technical Automation	Group of cabinets for cooling water.	1	Fix connection	3-phase 400 V	non	810	810
1-Supply Space N	1.05 Technical Automation	Cooling water SPS	1	Fix connection	AC 230 V	non	1	1
1-Supply Space N	1.05 Technical Automation	Group of cabinets for cooling water.	1	Fix connection	3-phase 400 V	non	810	810
1-Supply Space N	1.06 Interlock Systems	switch cabinet	2	Fix connection	AC 230 V	no	1	-
1-Supply Space N	1.07 IT Infrastructure	Network equipment	4	Special connection	3-phase 400 V	no	5	-
1-Supply Space N	1.07 IT Infrastructure	Network equipment (cooling and ligl	2	Schuko 230 V, 16 A	AC 230 V	no	1	-
1-Supply Space N	1.14 Radiation Safety	Pandoras	1	Fix connection	AC 230 V	no	0,03	-
1-Supply Space N	2.04 Vacuum Systems	electronic racks for Ion-pump power	12	Fix connection	AC 230 V	no	4	4
1-Supply Space N	2.04 Vacuum Systems	Connection for service pumpstation	1	Schuko 230 V, 16 A	230 V	no	0,5	1,0

Air conditioning

Building catester

Building number	stakeholder	Component (text)	Heat to air [kW]	Temp. [°C]	Air cond Stabilit y [K]
1-Supply Space N			369		
1-Supply Space N	1.02 Main Power Supplies	central supply ("Technikraum")		22	+/-3
1-Supply Space N	1.02 Main Power Supplies	local supply, close to user appliance		22	+/-3
1-Supply Space N	1.02 Main Power Supplies	UPS	2	22	+/-3
1-Supply Space N	1.02 Main Power Supplies	UPS-Battery	2	22	+/-3
1-Supply Space N	1.02 Main Power Supplies	central station safety-lighting	1	22	+/-3
1-Supply Space N	1.02 Main Power Supplies	storage (Serviceparts, Tools, Docs, Desk etc)		22	+/-3
1-Supply Space N	1.02 Main Power Supplies	transformer and highvoltage switchboard		22	+/-3

Cooling water

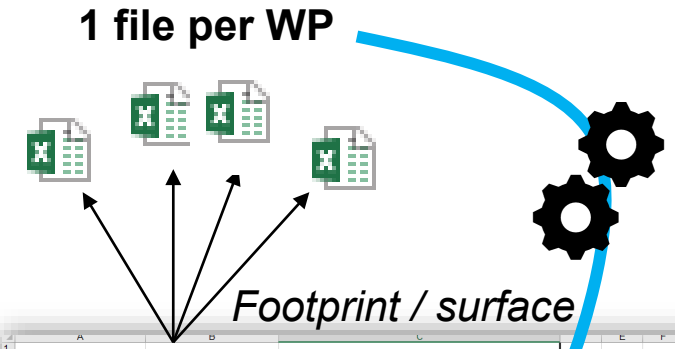
Building Number	Stakeholder	Purpose	Qty	Water type	Cooling performance nominal case [kW]	Cooling performance extreme case [kW]
01-Supply Space N	2.12 RF Systems	Cavity area 4 1.5Ghz	4	30 °C VE	3	7
01-Supply Space N	2.12 RF Systems	Cavity area 5 500 MHz	4	30 °C VE	16	41
01-Supply Space N	2.12 RF Systems	Cavity area 5 1.5Ghz	4	30 °C VE	3	7
01-Supply Space N	2.12 RF Systems	Cavity area 6 500 MHz	4	30 °C VE	16	41
01-Supply Space N	2.12 RF Systems	Cavity area 6 1.5Ghz	4	30 °C VE	3	7
01-Supply Space N	3.01 X-Ray Sources	Cryo cooler	2	KW 18°C	12	
02-Supply Space NNE	1.04 Air Conditioning	Kühlleistung	1	KW 8°C for AC only	148	
02-Supply Space NNE	1.04 Air Conditioning	PXN	1	KW 8°C for AC only	437	
02-Supply Space NNE	2.05 Diagnostics	Diagnostic Rack Section 2a - LPC S	2	KW 18°C	6,0	10
02-Supply Space NNE	2.05 Diagnostics	Diagnostic Rack Section 2b - LPC S	2	KW 18°C	6,0	10

Splitting the Roombooks

Separate by Workpackage

! More than 100 files in total !

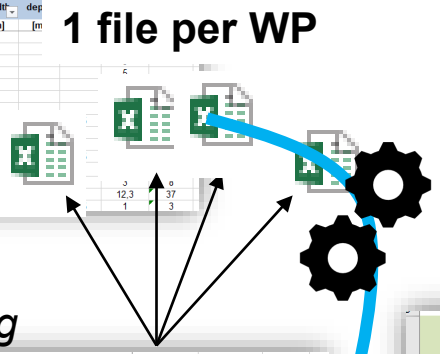
1 file per WP



Footprint / surface

Building number	stakeholder	Component (text)	width [m]	dep [m]
01-Supply Space N	1.02 Main Power Supplies	central supply ("Technikraum")		
01-Supply Space N	1.02 Main Power Supplies	local supply, close to user appliance		
01-Supply Space N	1.02 Main Power Supplies	UPS		
01-Supply Space N	1.02 Main Power Supplies	UPS-Battery		
01-Supply Space N	1.02 Main Power Supplies	central station safety-lighting		
01-Supply Space N	1.02 Main Power Supplies	storage (Serviceparts, Tools, Docs, Desk etc)		
01-Supply Space N	1.02 Main Power Supplies	transformer and highvoltage switchboard		
01-Supply Space N	1.03 Water Cooling	Cooling water supply		
01-Supply Space N	1.03 Water Cooling	Cooling tower		
01-Supply Space N	1.04 Air Conditioning	climatization/ heat suplly		
01-Supply Space N	1.05 Technical Automation	Cabinets for cooling water		
01-Supply Space N	1.06 Interlock Systems	switch cabinet		
01-Supply Space N	1.06 Interlock Systems	switch cabinet		
01-Supply Space N	1.07 IT Infrastructure		12,3	3
01-Supply Space N	1.14 Radiation Safety	Pandoras	1	3

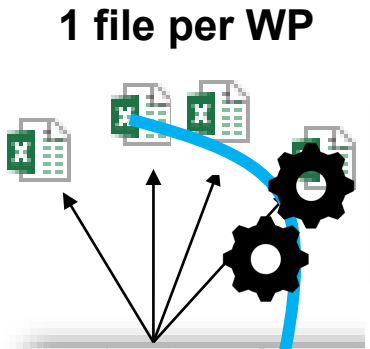
1 file per WP



Air conditioning

Building number	stakeholder	Component (text)	Heat to air [kW]	Temp. [°C]	Air cond Stability [K]
1-Supply Space N			369		
1-Supply Space N	1.02 Main Power Supplies	central supply ("Technikraum")		22	+/-
1-Supply Space N	1.02 Main Power Supplies	local supply, close to user appliance		22	+/-
1-Supply Space N	1.02 Main Power Supplies	UPS	2	22	+/-3
1-Supply Space N	1.02 Main Power Supplies	UPS-Battery	2	22	+/-3
1-Supply Space N	1.02 Main Power Supplies	central station safety-lighting	1	22	+/-3
1-Supply Space N	1.02 Main Power Supplies	storage (Serviceparts, Tools, Docs, Desk etc)		22	+/-3
1-Supply Space N	1.02 Main Power Supplies	transformer and highvoltage switchboard		22	+/-3

1 file per WP



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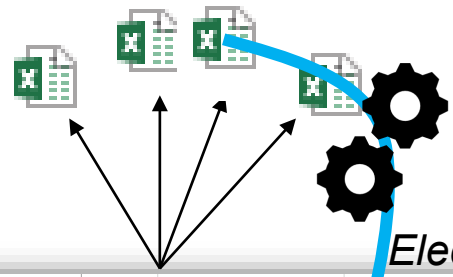
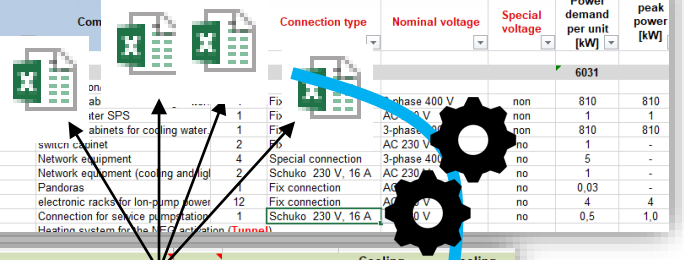


Electrical racks

Area	Sub-Area	stakeholder	Component (text)	Qty	width per rack [m]	depth of racks [m]
1-Supply Space N				232		
1-Supply Space N		1.05 Technical Automation	abinets for cooling water	16	0,8	0,8
1-Supply Space N		1.06 Interlock Systems	switch cabinet	2	0,6	0,6
1-Supply Space N		1.07 IT Infrastructure	Network Office & MCS	2	0,8	0,8
1-Supply Space N		2.04 Vacuum Systems		12	0,6	1
1-Supply Space N		2.05: Diagnostics	BPM, BLM, MPS, Temperatur	8	0,8	1
1-Supply Space N		2.05: Diagnostics	climatization	3	0,3	1
		2.08 Feedbacks	Rack - 42HE FOFB - LOCal node	1	0,6	0,6
		2.08 Feedbacks	Rack - 42HE FOFB - GLObal node	1	0,6	0,6
		2.09 Timing and Synchronisation	Maybe HF -Cables !!! Room for big cables to be anticiapted	8	0,8	1
		2.10 Machine Controls	Girder Movement	3		

1 file per WP



Electrical power

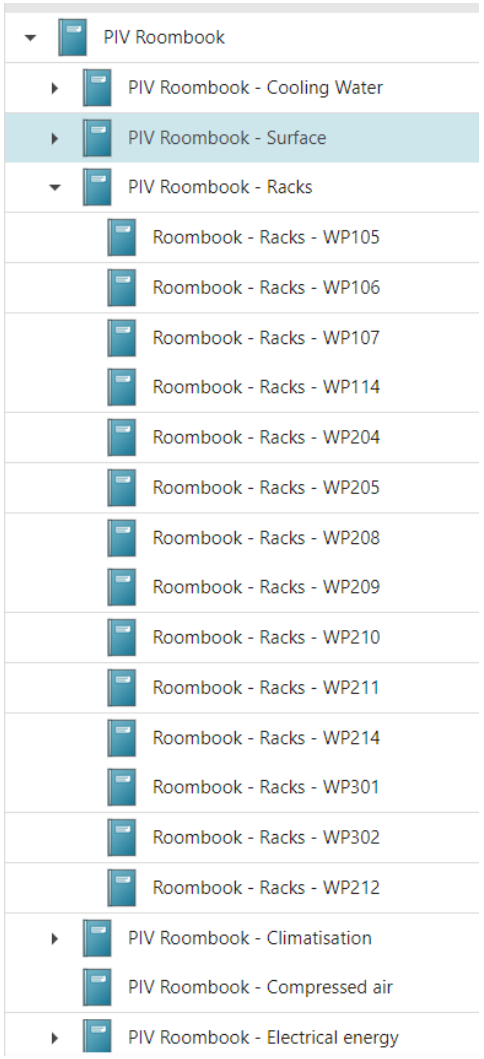
Building number	stakeholder	Component (text)	Connection type	Nominal voltage	Special voltage	Power demand per unit [kW]	peak power [kW]
1-Supply Space N						6031	
1-Supply Space N	1.04 Air Conditioning				non	810	810
1-Supply Space N	1.05 Technical Automation				non	1	1
1-Supply Space N	1.05 Technical Automation	abinets for cooling water	Fix	3-phase	non	810	810
1-Supply Space N	1.06 Interlock Systems	switch cabinet	Fix	AC 230 V	no	1	-
1-Supply Space N	1.07 IT Infrastructure	Network equipment	Special connection	3-phase 400	no	5	-
1-Supply Space N	1.07 IT Infrastructure	Network equipment (cooling and ligl	Schuko 230 V, 16 A	AC 230 V	no	1	-
1-Supply Space N	1.14 Radiation Safety	Pandoras	Fix connection	AC	no	0,03	-
1-Supply Space N	2.04 Vacuum Systems	electronic racks for Ion-pump power	Fix connection	AC	no	4	4
1-Supply Space N	2.04 Vacuum Systems	Connection for service pumpstation	Schuko 230 V, 16 A	V	no	0,5	1,0
1-Supply Space N	2.04 Vacuum Systems	Heating system for the LSS station (Tunnel)					

Cooling water

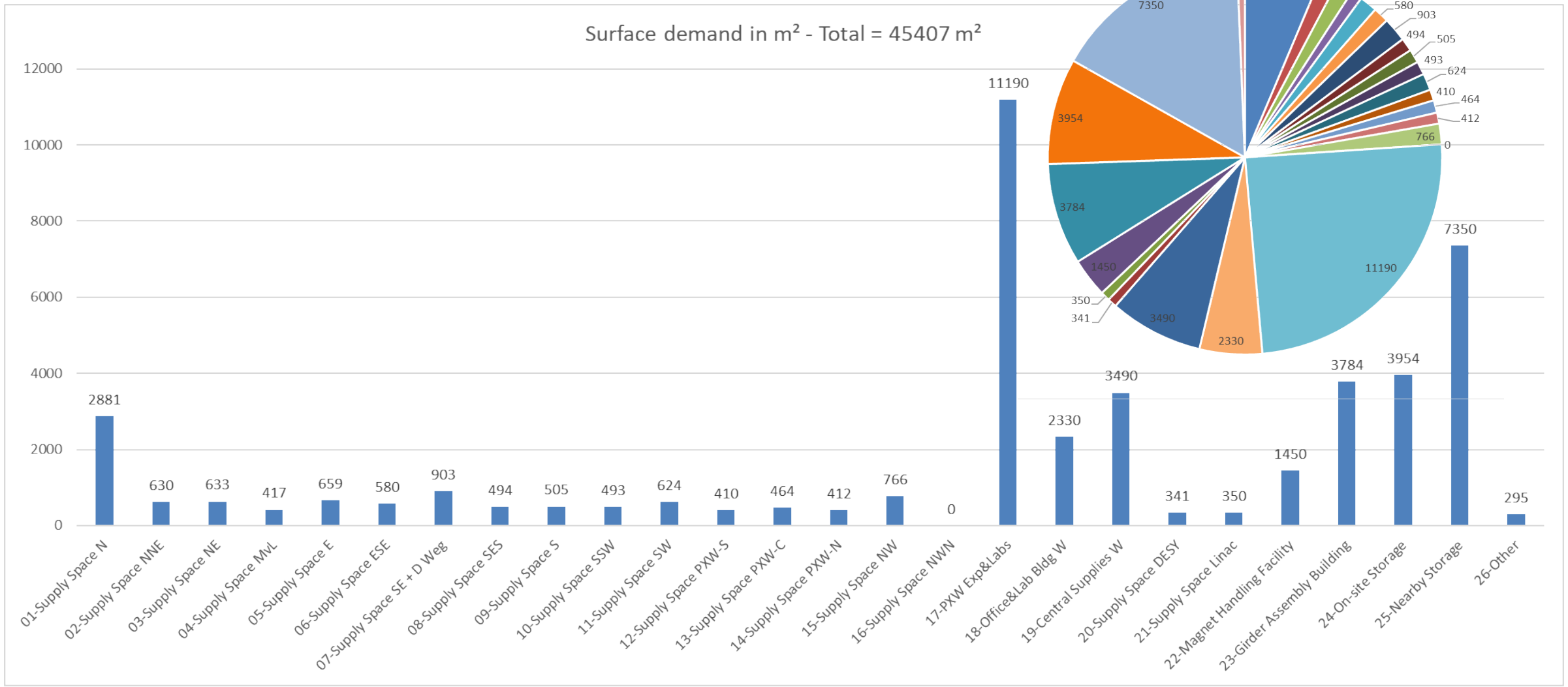
Building Number	Stakeholder	Purpose	Qty	Water type	Cooling performance nominal case [kW]	Cooling performance extreme case [kW]
01-Supply Space N	2.12 RF Systems	Cavity area 4 1.5Ghz	4	30 °C VE	3	7
01-Supply Space N	2.12 RF Systems	Cavity area 5 500 MHz	4	30 °C VE	16	41
01-Supply Space N	2.12 RF Systems	Cavity area 5 1.5Ghz	4	30 °C VE	3	7
01-Supply Space N	2.12 RF Systems	Cavity area 6 500 MHz	4	30 °C VE	16	41
01-Supply Space N	2.12 RF Systems	Cavity area 6 1.5Ghz	4	30 °C VE	3	7
01-Supply Space N	3.01 X-Ray Sources	Cryo cooler	2	KW 18°C		
02-Supply Space NNE	1.04 Air Conditioning	Kühlleistung	1	KW 8°C for AC only		
02-Supply Space NNE	1.04 Air Conditioning	PXN	1	KW 8°C for AC only	437	
02-Supply Space NNE	2.05 Diagnostics	Diagnostic Rack Section 2a - LPC S	2	KW 18°C	6,0	10
02-Supply Space NNE	2.05 Diagnostics	Diagnostic Rack Section 2b - LPC S	2	KW 18°C	6,0	10

Structured Document Storage

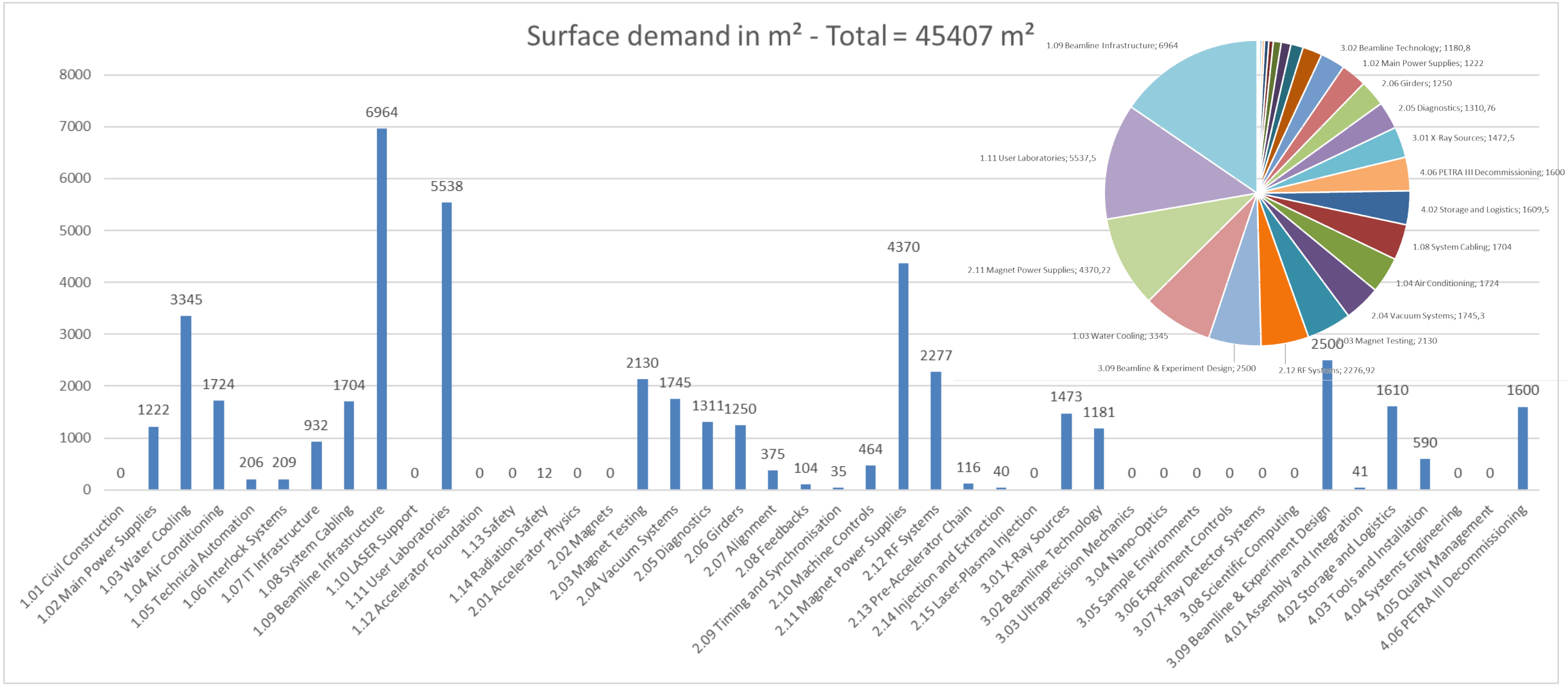
- Each (sub-)roombook is stored as individual database item in the Teamcenter
  - The items are managed individually (freeze, sign, release, revise)
  - They are combined into a single master document item (structured document)
- The entries of the individual roombooks are collated into summary tables with an automatted procedure
- The collated data is then available for analysis



Requested Floor Space by Location



Requested Floor Space by Trade



Document Release

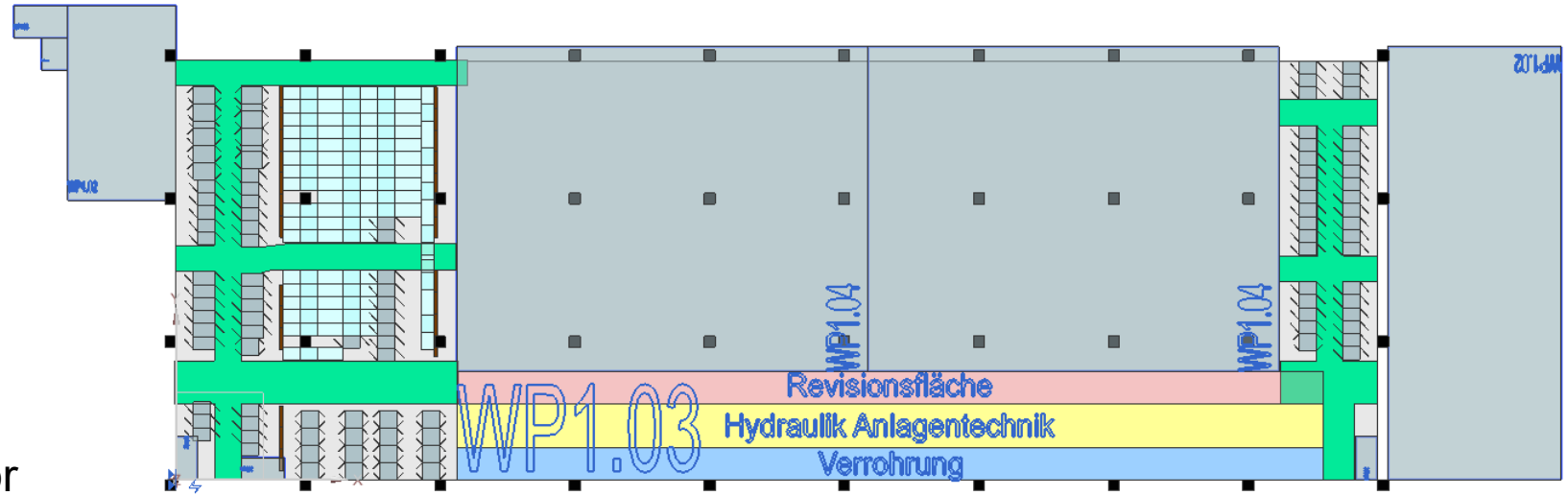
Need to freeze the Roombook for the Infrastrucutre Planning to proceed

- Need a stable set of roombook data for a reasonable infrastructure planning
- Therefore WP4.01 contacted WPs again to obtain missing signatures
  - Supply areas 1-16 (PETRA4) first
    → need closure this week
  - Supply area 17/19 (PXW and central supply) next, beginning of February
  - Supply area 18 (offices) postponed
  - Supply area 20 (DESY) depends on decision / update of booster design
- Once the roombooks are released, we will employ more strict change management

Layout of Supply Buildings

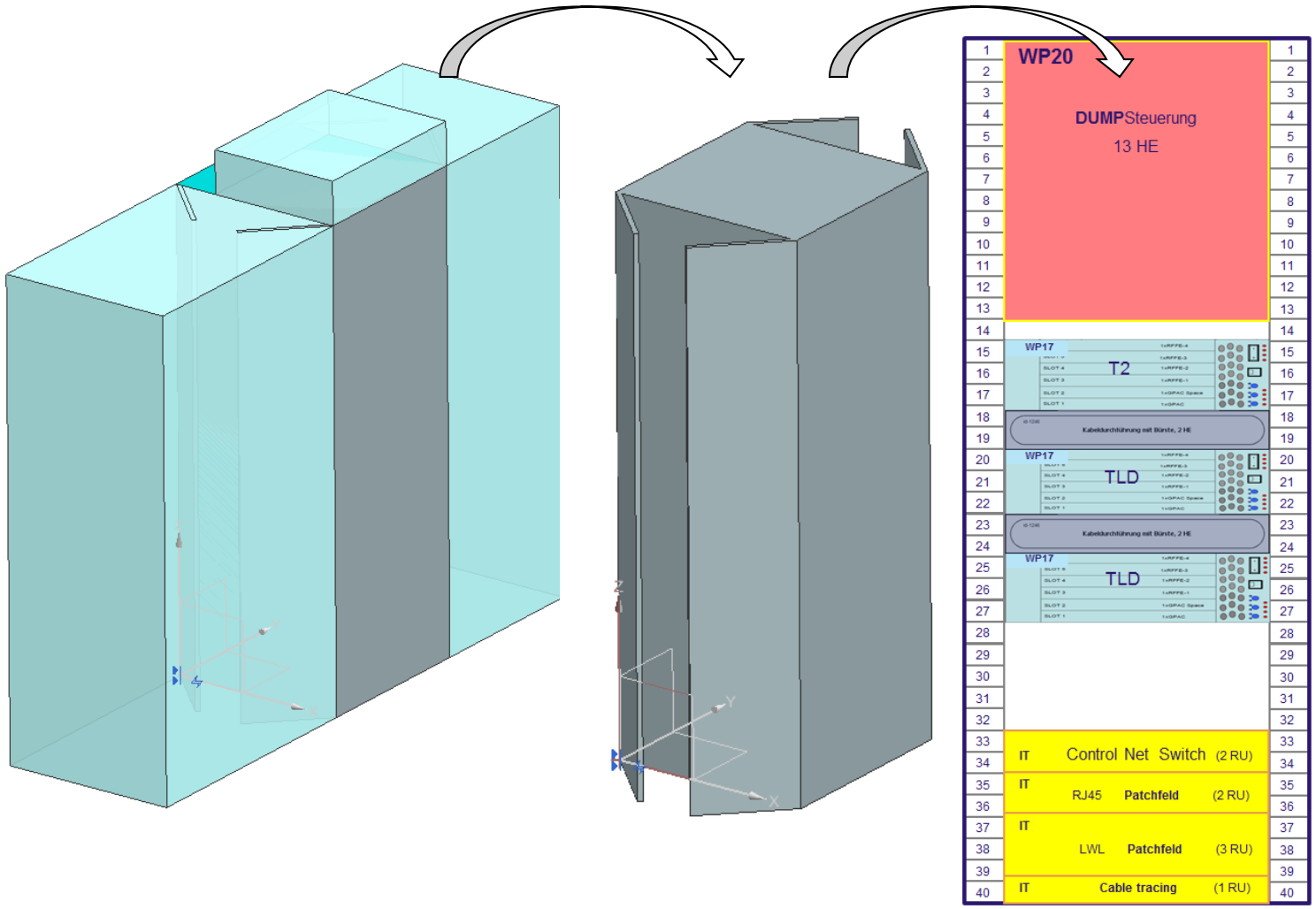
E.G. RF Hall

- Use the input from Roombook to populate supply buildings
- Started off with boxes sized according to roombook
- For the rack spaces a more detailed modelling proved necessary
- For this we created models for each rack type
  - Place them in the integration model and play with the arrangement



Models for Electronic Racks

Proper spacing contained in the DG2 models, great opportunities for integrated planning



- In the first step include maintenance rooms in each rack, to ensure proper spacing
- Each rack is placed as an individual entity in the integration model

⇒

- This also means that it shows up as an entity in the Teamcenter database
- This calls for closer linking of Teamcenter and KDS (already in contact with MDI)
- Already thinking of extending this to patch panels and outlets

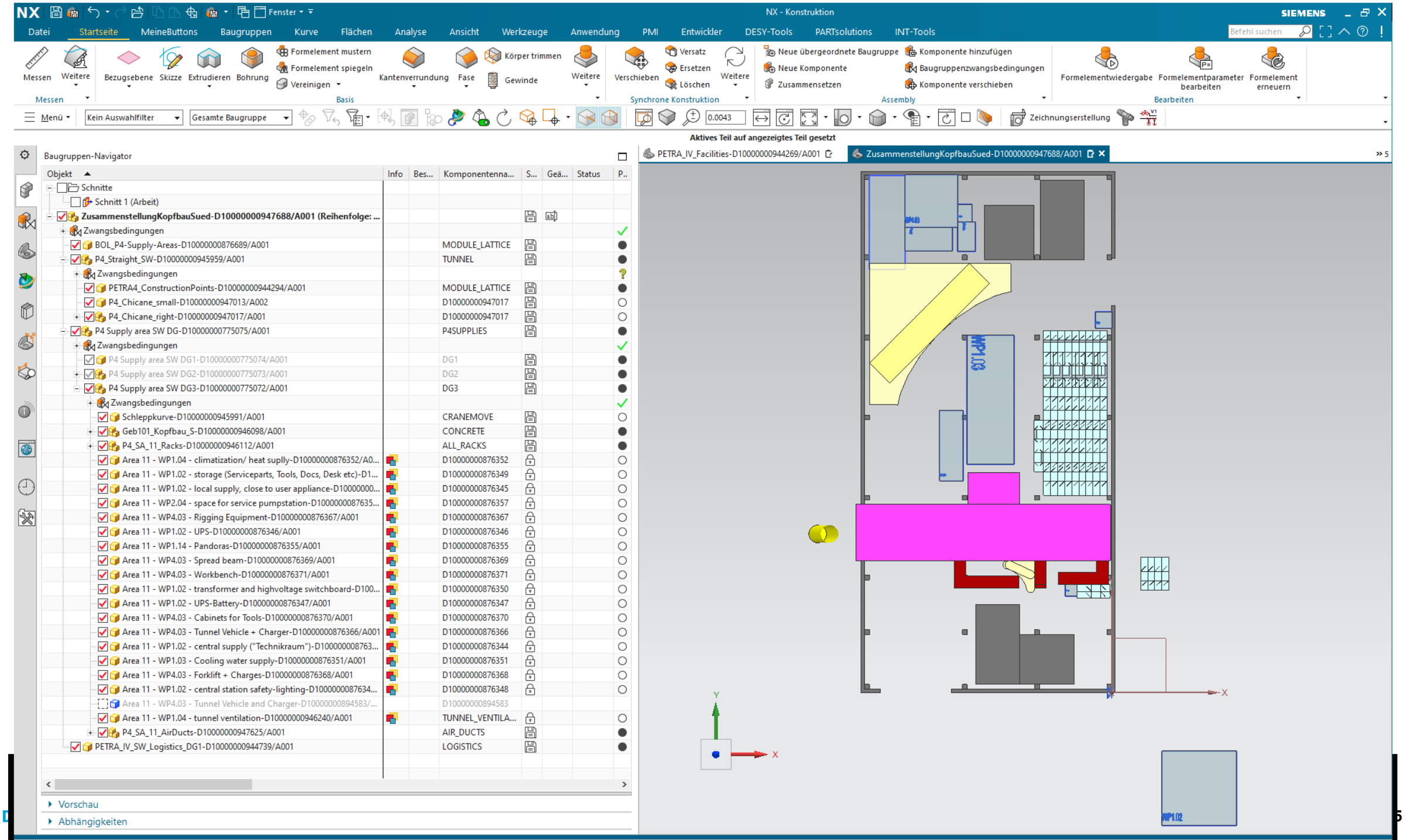
Critical Planning

Area West and North most critical for timely Shutdown

- Calculating backwards it is clear that civil construction and infrastructure planning for the PXW/endcaps and RF Hall have to urgently proceed
- That means that the layouting of those buildings has to proceed
- That also means that the requirements (roombooks) need to be

Southern End Cap

- Similar treatment as RF Hall
- Picture on the right shows high level separation between machine, beamlines and logistics
  (infrastructure of PXW suppressed here, the focus was the end-cap)


NX
NX - Konstruktion
SIEMENS
Datei
Startseite
MeineButtons
Baugruppen
Kurve
Flächen
Analyse
Ansicht
Werkzeuge
Anwendung
PMI
Entwickler
DESY-Tools
PARTsolutions
INT-Tools
Befehl suchen
Messen
Weitere
Bezugsebene
Skizze
Extrudieren
Bohrung
Formelement mustern
Formelement spiegeln
Vereinigen
Kantenverrundung
Fase
Körper trimmen
Gewinde
Weitere
Basis
Verschieben
Versatz
Ersetzen
Löschen
Weitere
Synchrone Konstruktion
Neue übergeordnete Baugruppe
Neue Komponente
Zusammensetzen
Komponente hinzufügen
Baugruppenzwangsbedingungen
Komponente verschieben
Assembly
Formelementwiedergabe
Formelementparameter bearbeiten
Formelement erneuern
Bearbeiten
Menü
Kein Auswahlfilter
Gesamte Baugruppe
0.0043
Zeichnungserstellung
Aktives Teil auf angezeigtes Teil gesetzt
Baugruppen-Navigator
Objekt
Info
Bes...
Komponentenna...
S...
Geä...
Status
P...
Schnitte
Schnitt 1 (Arbeit)
ZusammenstellungKopfbauSued-D10000000947688/A001 (Reihenfolge: ...
Zwangsbedingungen
BOL_P4-Supply-Areas-D10000000876689/A001
MODULE_LATTICE
P4_Straight_SW-D10000000945959/A001
TUNNEL
Zwangsbedingungen
PETRA4_ConstructionPoints-D10000000944294/A001
MODULE_LATTICE
P4_Chicane_small-D10000000947013/A002
D10000000947017
P4_Chicane_right-D10000000947017/A001
D10000000947017
P4 Supply area SW DG-D10000000775075/A001
P4SUPPLIES
Zwangsbedingungen
P4 Supply area SW DG1-D10000000775074/A001
DG1
P4 Supply area SW DG2-D10000000775073/A001
DG2
P4 Supply area SW DG3-D10000000775072/A001
DG3
Zwangsbedingungen
Schleppkurve-D10000000945991/A001
CRANEMOVE
Geb101_Kopfbau_S-D10000000946098/A001
CONCRETE
P4_SA_11_Racks-D10000000946112/A001
ALL_RACKS
Area 11 - WP1.04 - climatization/ heat suplly-D10000000876352/A0...
D10000000876352
Area 11 - WP1.02 - storage (Serviceparts, Tools, Docs, Desk etc)-D1...
D10000000876349
Area 11 - WP1.02 - local supply, close to user appliance-D10000000...
D10000000876345
Area 11 - WP2.04 - space for service pumpstation-D1000000087635...
D10000000876357
Area 11 - WP4.03 - Rigging Equipment-D10000000876367/A001
D10000000876367
Area 11 - WP1.02 - UPS-D10000000876346/A001
D10000000876346
Area 11 - WP1.14 - Pandoras-D10000000876355/A001
D10000000876355
Area 11 - WP4.03 - Spread beam-D10000000876369/A001
D10000000876369
Area 11 - WP4.03 - Workbench-D10000000876371/A001
D10000000876371
Area 11 - WP1.02 - transformer and highvoltage switchboard-D100...
D10000000876350
Area 11 - WP1.02 - UPS-Battery-D10000000876347/A001
D10000000876347
Area 11 - WP4.03 - Cabinets for Tools-D10000000876370/A001
D10000000876370
Area 11 - WP4.03 - Tunnel Vehicle + Charger-D10000000876366/A001
D10000000876366
Area 11 - WP1.02 - central supply ("Technikraum")-D100000008763...
D10000000876344
Area 11 - WP1.03 - Cooling water supply-D10000000876351/A001
D10000000876351
Area 11 - WP4.03 - Forklift + Charges-D10000000876368/A001
D10000000876368
Area 11 - WP1.02 - central station safety-lighting-D1000000087634...
D10000000876348
Area 11 - WP4.03 - Tunnel Vehicle and Charger-D10000000894583/...
D10000000894583
Area 11 - WP1.04 - tunnel ventilation-D10000000946240/A001
TUNNEL_VENTILA...
P4_SA_11_AirDucts-D10000000947625/A001
AIR_DUCTS
PETRA_IV_SW_Logistics_DG1-D10000000944739/A001
LOGISTICS
Vorschau
Abhängigkeiten
PETRA_IV_Facilities-D10000000944269/A001
ZusammenstellungKopfbauSued-D10000000947688/A001
WP1.03
WP1.02
Y
X
X

Draft Installation Plan

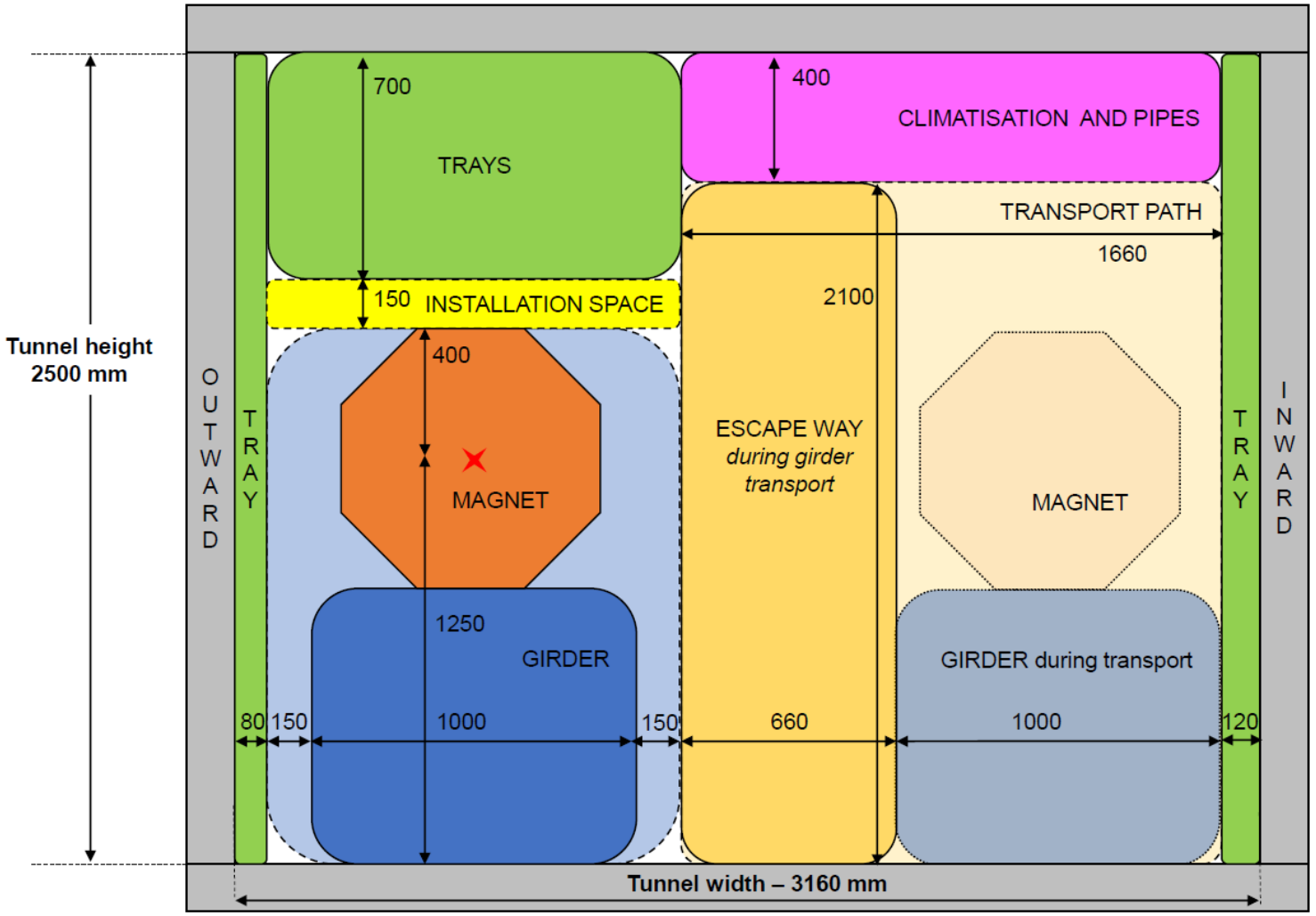
The Schedule is dominated by Civil Construction (and the assumptions are still optimistic)

Task Name	Dauer	Anfang	Ende
P4_Installation	450 d	Mon 28.12.26	Fre 15.09.28
Incoming	396 d	Mon 28.12.26	Die 04.07.28
Outgoing	126 d	Fre 01.01.27	Fre 25.06.27
PETRA4 Installation	445 d	Mon 04.01.27	Fre 15.09.28
1 Straight North	337 d	Mon 04.01.27	Die 18.04.28
2 Arc1	317 d	Fre 05.03.27	Mon 22.05.28
3 Straight NE	157 d	Mit 03.03.27	Don 07.10.27
4 Arc2	162 d	Mit 03.02.27	Don 16.09.27
5 Straight E	263 d	Mit 17.02.27	Fre 18.02.28
6 Arc3	226 d	Fre 19.03.27	Fre 28.01.28
7 Straight SE	273 d	Mit 24.02.27	Fre 10.03.28
8 Arc4	220 d	Mon 04.01.27	Fre 05.11.27
9 Straight South	150 d	Mon 03.05.27	Fre 26.11.27
10 Arc5	256 d	Mon 04.01.27	Mon 27.12.27
11 Straight SW	392 d	Mon 04.01.27	Die 04.07.28
12 Arc6	407 d	Mon 04.01.27	Die 25.07.28
13 Straight W	417 d	Mon 11.01.27	Die 15.08.28
14 Arc7	429 d	Don 14.01.27	Die 05.09.28
15 Straight NW	435 d	Mon 18.01.27	Fre 15.09.28
16 Arc8	363 d	Mon 25.01.27	Mit 14.06.28
20 DESY	125 d	Mon 04.01.27	Fre 25.06.27
26 MvL	379 d	Mon 04.01.27	Don 15.06.28
27 D-Weg	345 d	Mon 04.01.27	Fre 28.04.28

Machine Layout Review

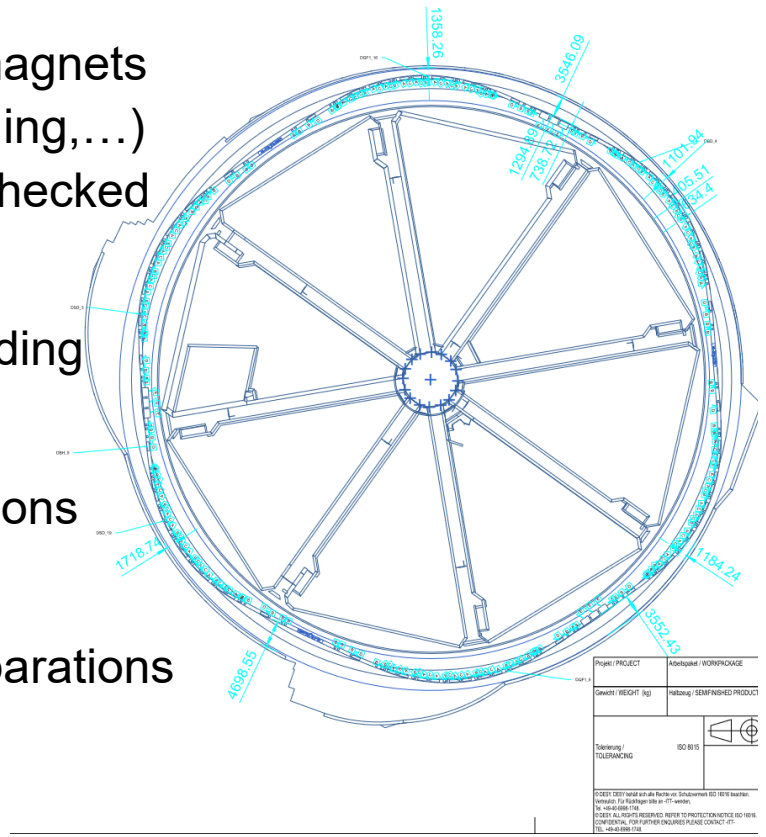
Review Questions from the Summer, signoff procedure pending

- Do all permanent installations have a space allocation (3D Model, Listing)?
- Have all media (cables) been considered (Cable List, Stromkreisliste)?
- Is there enough reserve (risk assessment)?
- Does the tunnel support all required installations (statics)?
- Will the installation procedures work (incl. safety requiremens)?
- Is the accessibility the best we can do?



DESY 4: Statics Limits, Anchors

- Based on estimated weights of the magnets (incl. suspension frames, piping, cabling,…) the load capacity of the ceiling was checked
- The result is very tight (98-105% of capacity used) not including dynamic load
- Furthermore, anchoring the suspensions in the ceiling proves to be difficult
- Last but not least the necessary preparations became more and more involved

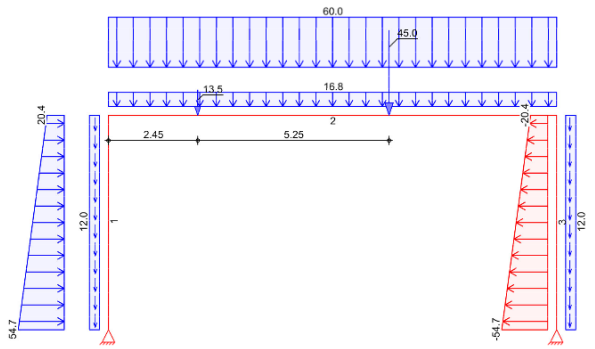


Referenz	Masse	Länge	Breite
A	3000kg	1500mm	400mm
B	600kg	400mm	400mm
C	400kg	300mm	300mm
D	1800kg	1500mm	400mm
E	1200kg	1550mm	1100mm

Belastungen — Belastungen auf das System

Grafik — Belastungsgrafiken (einwirkungsbezogen)

Einwirkung — Gk



Eigengewicht in z-Richtung — Eigengewicht am Stab

Stab	Kommentar	qz [kN/m]
1	Eigengew	12.00
2	Eigengew	16.80
3	Eigengew	12.00

Einw. Gk

Streckenlasten in x-Richtung — Streckenlasten am Stab

	Stab	Kommentar	a [m]	s [m]	qx,li [kN/m]	qx,re [kN/m]
(a,b)	1		0.00	5.90	54.70	20.40
	3		0.00	5.90	-20.40	-54.70

(a) aus Erddrck 51.8+2.9 = 54.70 kN/m

(b) aus Erddruck 17.5+2.9 = 20.40 kN/m

Streckenlasten in z-Richtung — Streckenlasten am Stab (auf Stablänge)

	Stab	Kommentar	a [m]	s [m]	qz,li [kN/m]	qz,re [kN/m]
(a)	2		0.00	12.30		60.00

Einw. Gk

(a) aus Erdauflast und Verkeheslast 60 = 60.00 kN/m

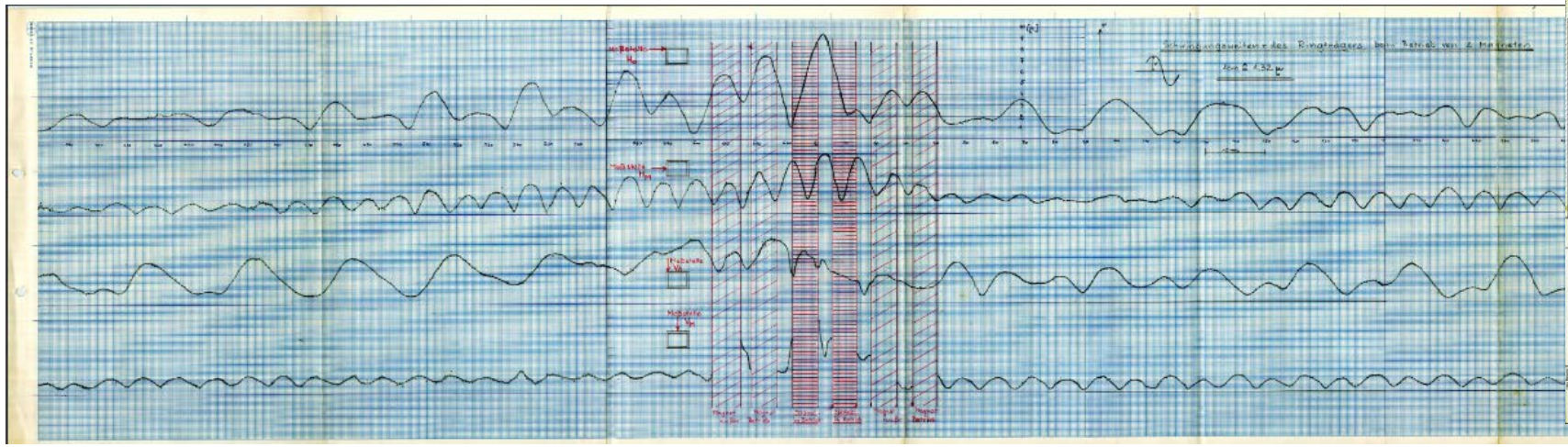
Punktlasten — Einzellasten am Stab

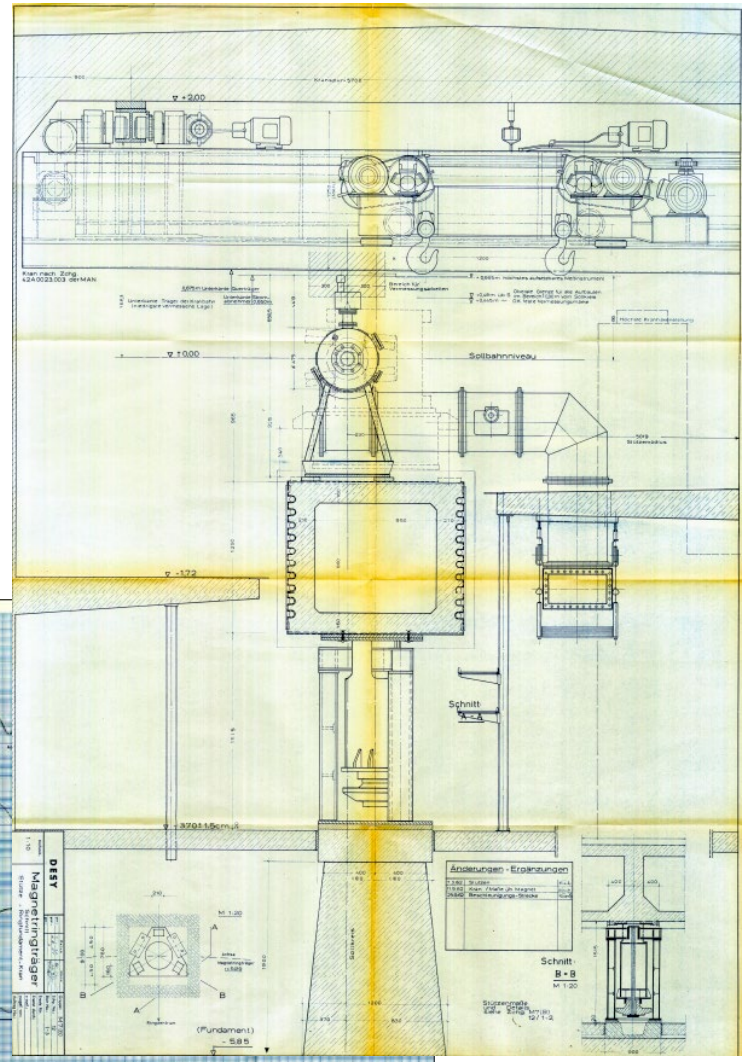
DESY Ringträger

- Looked into lowering the ring and placing it on the Ringträger
  (with extensions to the side)

- From the mechanical (statics) point of view
  acceptable

- But are confronted with problem that already haunted our predecessors in the 60ies





Assessment of Solutions

- Currently are collecting possible solution together with an assessment of their viability

  (statics, mounting, logistics, maintenance, civil construction, movements, vibrations, lattice, transport lines, schedule…)

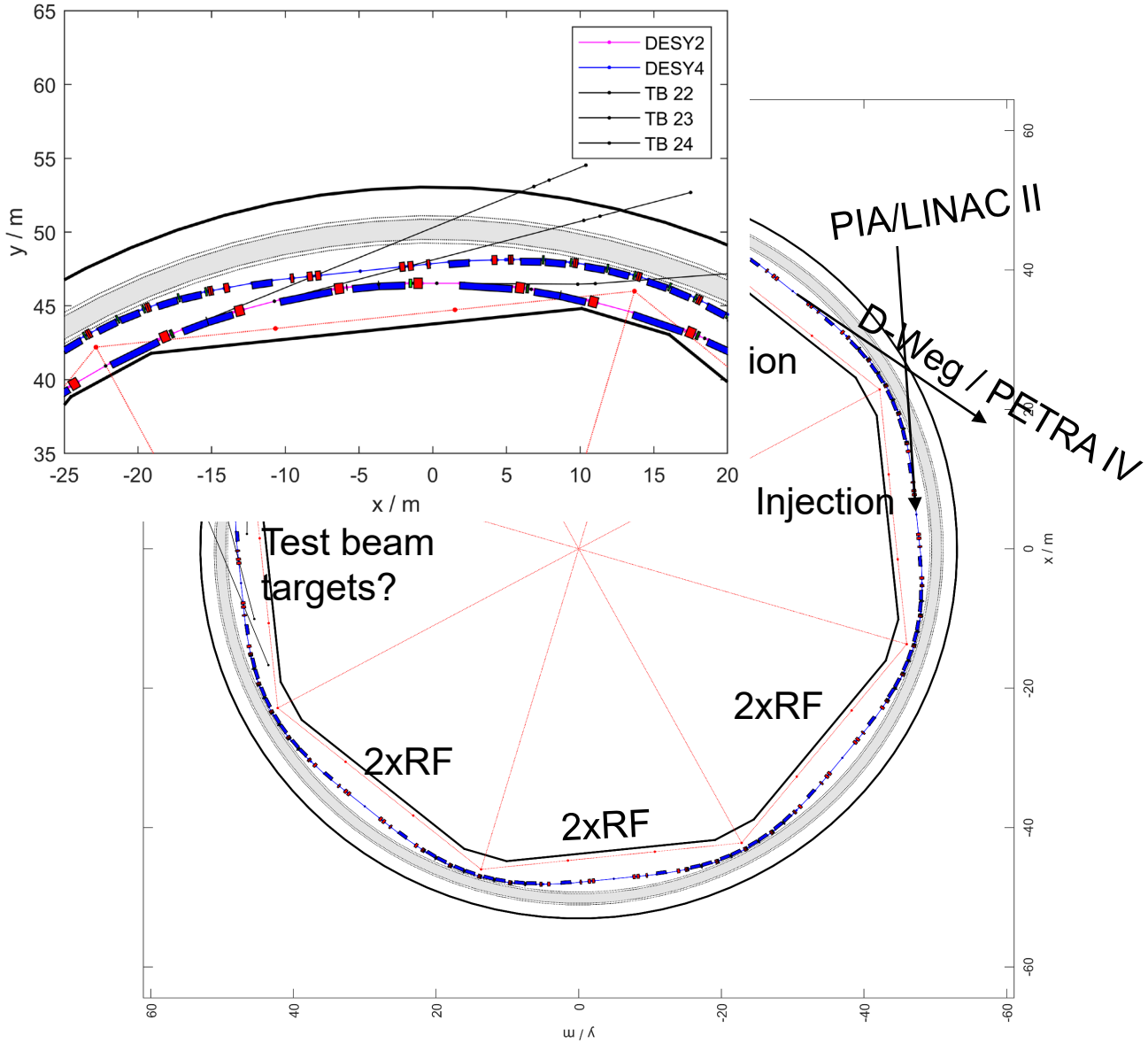
- Started off with installation options for the hexagonal lattice ring

- Meanwhile also looking into new lattice (octagonal) and even a solution based on keeping DESY II

Checklist Mounting Options		Ceiling direct	Ceiling via crane	Ring girder	Inner ring floor	Outer ring floor
		Deckenmontage	Decke Kranhalterung		innere Kragdecke	
Position		*Ceiling directly*	*Ceiling on the cranessupports*	*Ringträger*	*Inner floor*	*Outer floor*
Load capacity	assessment	problematic	to be checked	ok	to be checked	problematic
	description	the structural analysis shows a utilization of the maximum ceiling load of up to 105%.	A.P.Die Verankerung einer möglich Lastverteilkonstruktion / Stahlrahmen an den vorhandenen Kranauflagerpunkten müsste auf Machbarkeit geprüft werden. Gem. ersten Abschätzungen (Statiker Kapp) ist eine Durchankerung der Decke notwendig.	the structural analysis shows that the Ringträger is stable enough to support the booster. Torque and vibrations should be checked seperately.	DESY II is mounted on the inner floor. The load capacity should be high enough to support DESY IV, at least after disassembly of DESY II. Siehe Statik Kapp	The load capacity of the outer floor is 3 t/m². With a perliminary estimated magnet weight of 1.5 t and the same weight for the support structure, this is close to the limit. Siehe Statik Kapp
Mounting option	assessment	problematic	to be checked	ok	ok	ok
	description	For the mounting of the booster at least 4 cm long ancher bolts are needed. The ceiling is heavily reinforced, with reinforcement bars just 2 cm beneath the surface.	A.P.: Eine Möglichkeit der Befesteigung eines Stahlrahmens an den Kranfestpunkten/Schienen ist denkbar. Statische Betrachtung ist ausstehend	The booster could be mounted on a steelframes positioned on the Ringträger and if necesarry laterally supported.	The booster would be mounted on standard concrete stands and alignment frames.	The booster would be mounted on standard concrete stands and alignment frames.
		A.P.: Zwecks Vervollständigung der Statik sind Angaben zur Eigenschwingung und zur horizontalen Aussteifung in Längs- und Querrichtung erforderlich		A.P.: Nachweis für Bolzenanker FBZ 16/25, Verankerungstiefe 85mm nebst Ankerplatte t = 15mm wurde erbracht (Statik ab Seite 109)		
Logistic concept	assessment	problematic	problematic	ok	ok	ok
	description	A floor based transport and lifting system is needed. At the moment the outer floor is not sufficiently stable and smooth. Access to the hall must be created for the delivery of the components	A floor based transport and lifting system is needed. At the moment the outer floor is not sufficiently stable and smooth. Access to the hall must be created for the delivery of the components	The positioning of the components is done by crane. Components could be deliverd via the cailing hatches.	The positioning of the components is done by crane. Delivery of components via ceiling hatches. Alternatively access to the hall must be created.	The positioning of the components is done by crane. Components could be deliverd via the cailing hatches.
Maintenance concept	assessment	problematic	problematic	to be checked	ok	problematic
	description	work scaffoldings are needed.	work scaffoldings are needed.	Depending on the height of the booster above the Ringträger level, the machine would be accassable just standing on the Ringträger. A guardrail on the outer side of the Ringträger might be beneficial.	The booster would be installed in the height of DESY II and so be easily accassible standing next to the machine.	The booster would be installed in the height of DESY II. Near the Ringträger the machine could be accessible, when standing on the Ringträger. For the other parts of the machine work scaffoldings are needed.
Civil construction	assessment	problematic	problematic	ok	ok	to be checked
	description	Outer floor must be reinforced. Ringträger must be lowered or dismantled. A smooth and stable surface for transport and lifting vehicles must be prepared. Remedation of Ringträger	Outer floor must be reinforced. Ringträger must be lowered or dismantled. A smooth and stable surface for transport and lifting vehicles must be prepared. Remedation of Ringträger	Crane must be replaced. Remedation of Ringträger - Umfang unbekannt	Crane must be replaced. Keine großen Baumaßnahmen notwendig	Crane must be replaced. Additional support pillars might be needed to absorb vibrations.
movements	assessment	to be checked	to be checked	to be checked	to be checked	to be checked
	description	movements sensors are installed at the walls and should give a first indication also on the ceiling movement along an expansion joint.	movements sensors are installed at the walls and should give a first indication also on the ceiling movement along an expansion joint.			
vibrations	assessment	to be checked	to be checked	problematic	to be checked	to be checked
	description			The Ringträger has high mechanical eigenfrequencies in the range of 10 to 20 Hz. Magnets ramped at 5 Hz would excite these vibratons. The overall vibration amplitude must not		at least higher than on the inner floor, as the pedestals of the magnets have to be higher to have the same beam line height.
impact on DESY IV lattice	assessment	ok	ok	ok	problematic	problematic
	description	no redesign needed	no redesign needed	no redesign needed	redesign needed	redesign needed
impact on transfer lines desig	assessment	ok	ok	problematic	problematic	problematic
	description	no redesign needed	no redesign needed	redesign needed	redesign needed	redesign needed
impact on technical design	assessment	ok	ok	ok	problematic	problematic
	description	technical design can proceed	technical design can proceed	technical design can proceed	magnet design has to restart	magnet design has to restart
schedule	assessment	critical	critical	critical	to be checked	to be checked
	description	Dark period: Q1/Q2 civil construction work in DESY tunnel Q3 Installation of booster	Dark period: Q1/Q2 civil construction work in DESY tunnel Q3 Installation of booster	Dark period: Q1/Q2 civil construction work in DESY tunnel Q3 Installation of booster	Maybe some steps can be done during the operation period of PETRA III	Maybe some steps can be done during the operation period of PETRA III
risks	assessment					
	description					

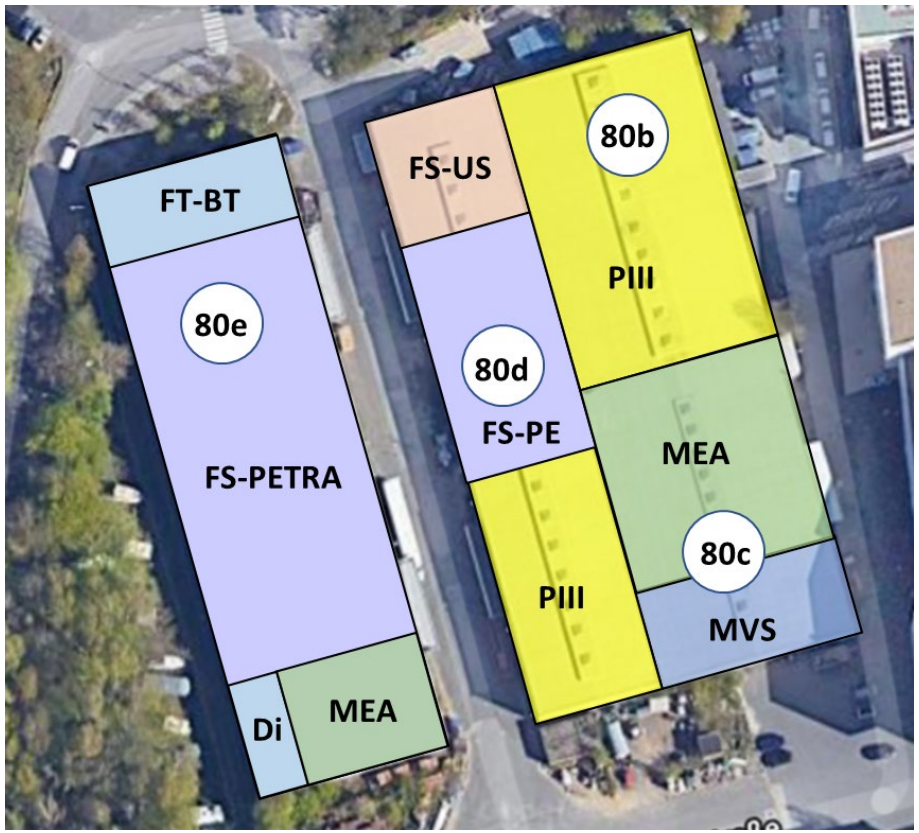
DESY 4 Octagon

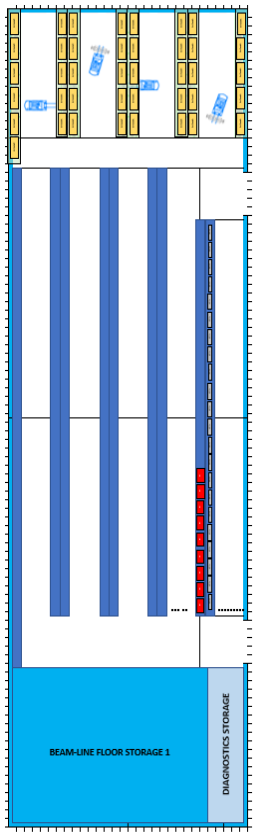
- The most promising candidate is a ring placed on the inner ring floor
- Investigating stability of the floor but expect good results because there are stiffening pillars close to the devised position of the ring

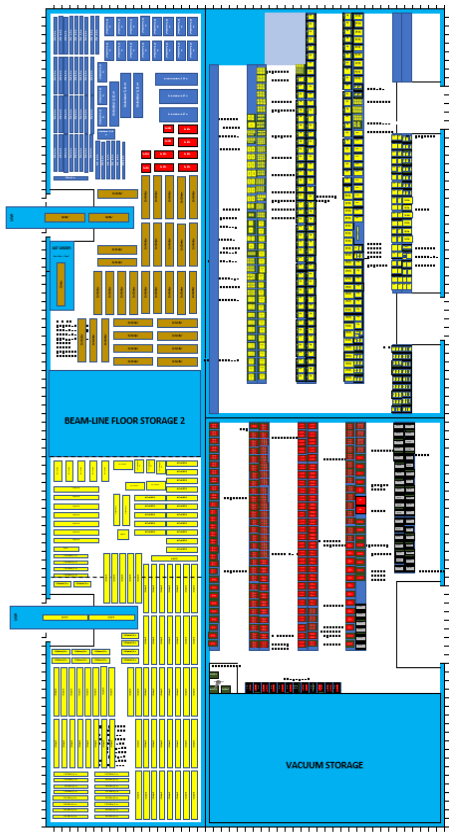


Reemtsma-Halls

Detailing of Planning revealed Room for Optimisation







External storage

No on-site Solution for Storage of Cables and Concrete blocks

Cable drum

- More then 100 km cables.
- Storage space: 1000 m^2.
- In/near Hamburg.

Shielding stone

- 768 pc. (max. two pc. stackable).
- Numbering necessary.
- W: 1m, L: 6-8m
- Storage space: 6000 m^2.
- In/near Hamburg (XFEL or HERA).

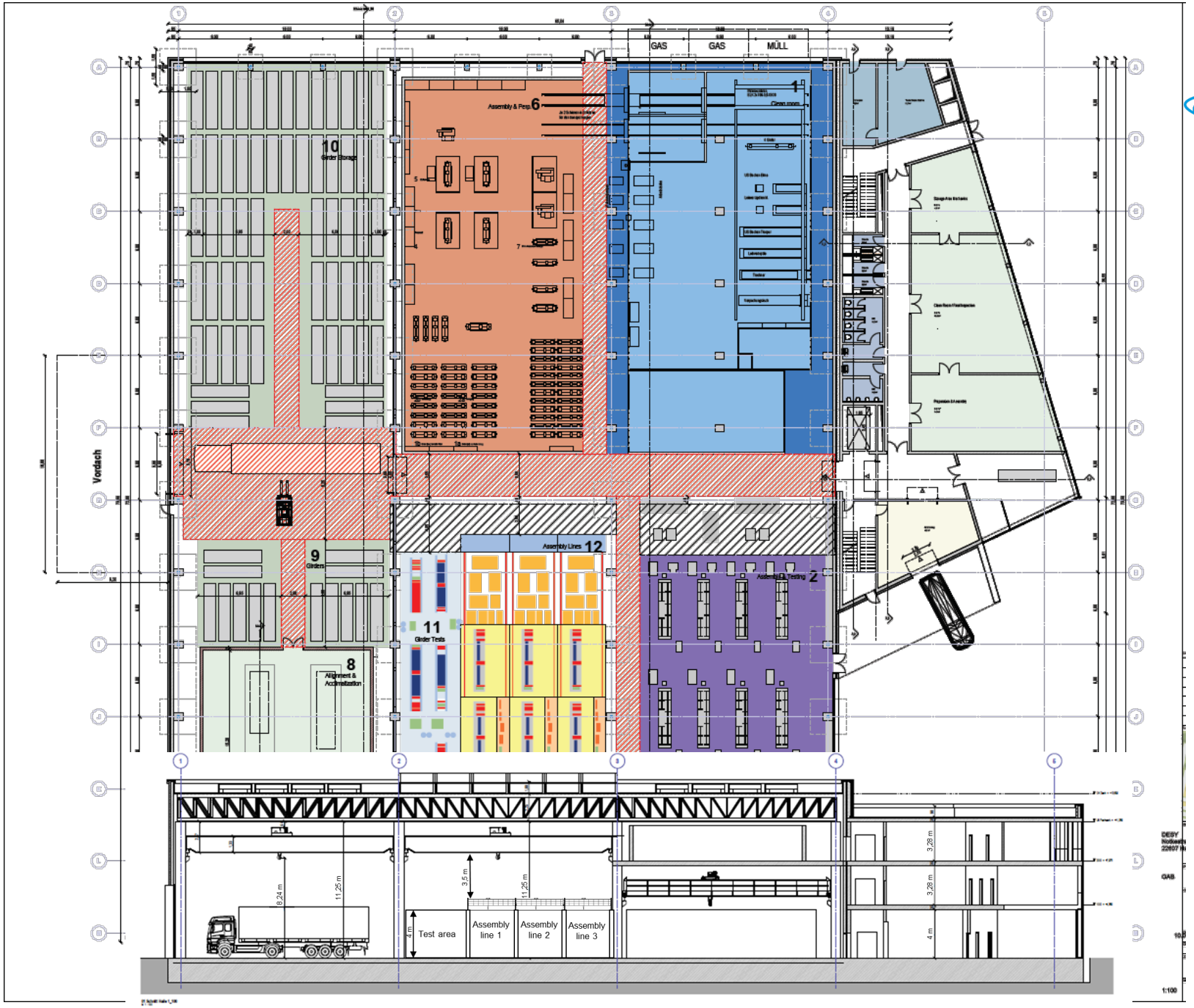
Clearing Out

- We need to continue clearing out the Reemtsma halls
- When the big contracts start delivering they have to be ready ⇒ empty beforehand (Basically at T0)
- Sakshi Pahalwan will revive the clearing efford
  - Update and refine the Inventory
  - Collect a schedule for clearing out
  - Track progress
- As important as clearing out the halls is preventing uncontrolled filling up
  - Anybody who brings new stuff inside needs to declare when it will leave again
  - Storage only through Sakshi

Remark: PETRA IV does not have the capability to search for replacement storage areas

GAB

Ground Floor
&
Cross Section



Construction Timeline

GAB Schedule underway but critical, Need support from higher up

- Schedule critical
- Identified approval process with authorities as most promising handle to expedite progress
  (need support by DIR and City)
- The date for handing in the building permit could not be held, shift from 28.11.23 to end of January 2024
- When we shift the shutdown from 2027 to 2028, the GAB changes from „too late“ to „tight but OK“
- Installations like assembly lines or cleanroom are not included in this schedule, they come after