Summary Radiation Protection MAC Subgroup December 2009 and (preliminary) answers to 5 items formulated by the Subgroup

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Summary (1/2) Topics MAC Subgroup workshop

- Legal Aspects and Design Strategies
- Operation and Failure Conditions
- Examples for Radiation Protection Studies:
    1. SIS100/300
    2. Super-FRS
    3. CBM Cave
    4. Anti Proton Production Target Area
- Implementation in Civil Construction

Summary (2/2) Mandate for MAC Subgroup

1. Are the inputs (e.g. operation and failure scenarios) to the radioprotection calculations reasonable?

2. Are the requirements for operation and the access concepts reasonable?

3. Does the committee see possibilities for optimized civil construction without undue impact on the radiation safety?

4. Does the committee see possibilities for optimized civil construction without undue impact on the physics program (e.g. simplification of experimental halls)?

5 items of the MAC Subgroup

Content

1. Cost comparison for different variations of service tunnel and accelerator tunnel of SIS 100/300 (Problem of He leak is discussed by P. Spiller)
2. Access conditions / radiation protection areas
3. Roofs / fencing (further potential of cost reduction)
4. Sandwich shielding (Steel/concrete combinations)
5. Activated material (Handling/Storage)

1.) Cost Comparison (by ion 42)

Costs that can be cut as a result of eliminating the pocket of soil between the radiation-, and service tunnel T110:

By merging the tunnels 110 (SIS 100/300) and service tunnel 110a to create a gapless wall to wall situation instead of the current planning decision of both tunnels maintaining 8m distance to each other, the following reduction of costs for the KG 300 can be determined:

KG 310 Building excavation approx.	1.281.000,00 €
KG 320 Foundations approx.	3.555.000,00 €
KG 360 Roofing approx.	3.852.000,00 €
Sum	8.688.000.00 €

A detailed cost comparison for the tunnel variations could be produced once the user requirements have been determined during the course of further planning.

1.) SIS 100/300 MC-calculations

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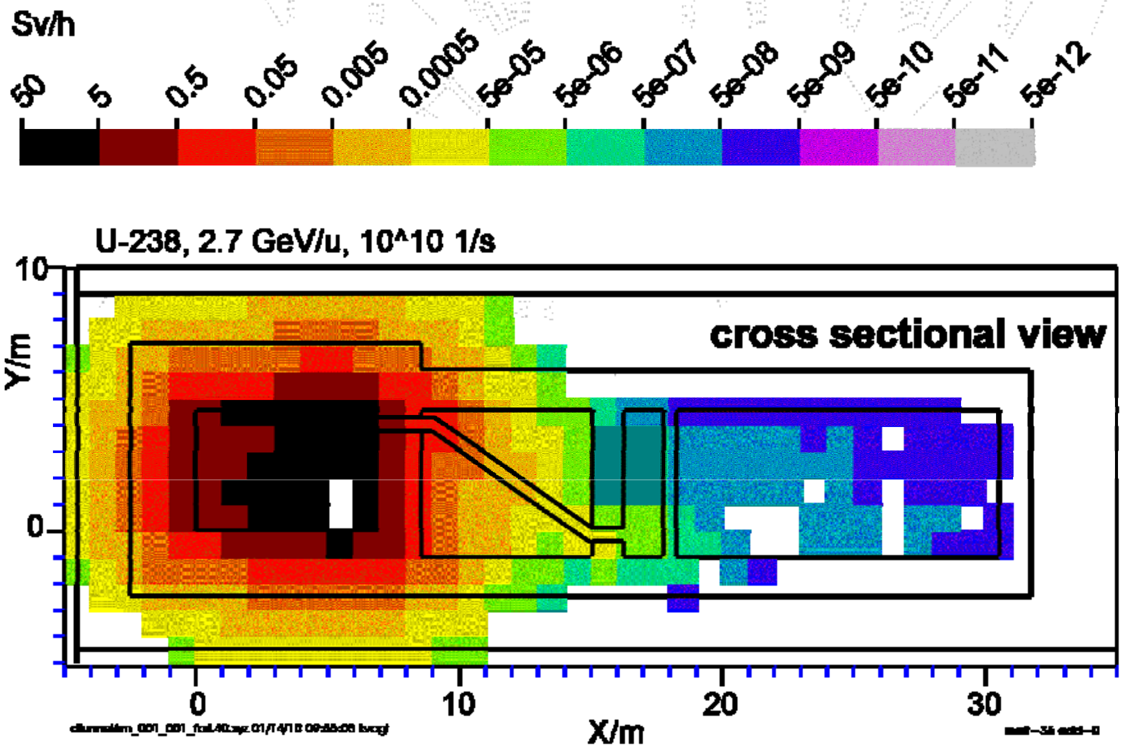
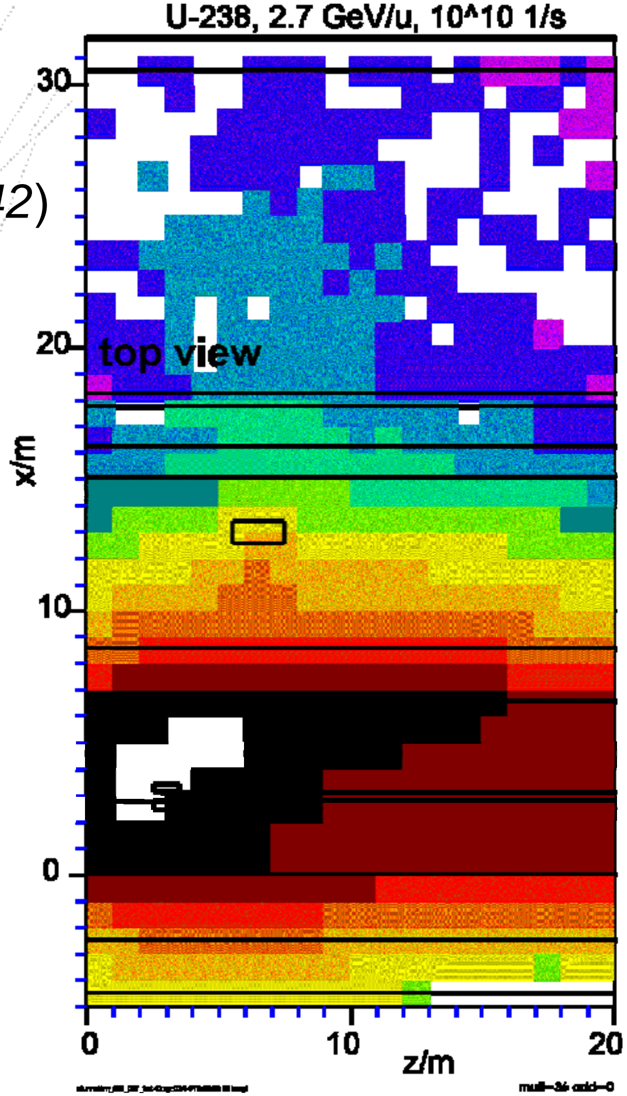
- Latest layout and calculations (Jan. 2010)
- 6m soil between tunnels
- Difference in cost reduction for removal of gap (6m instead of 8m) not known (to be calculated by *ion42*)





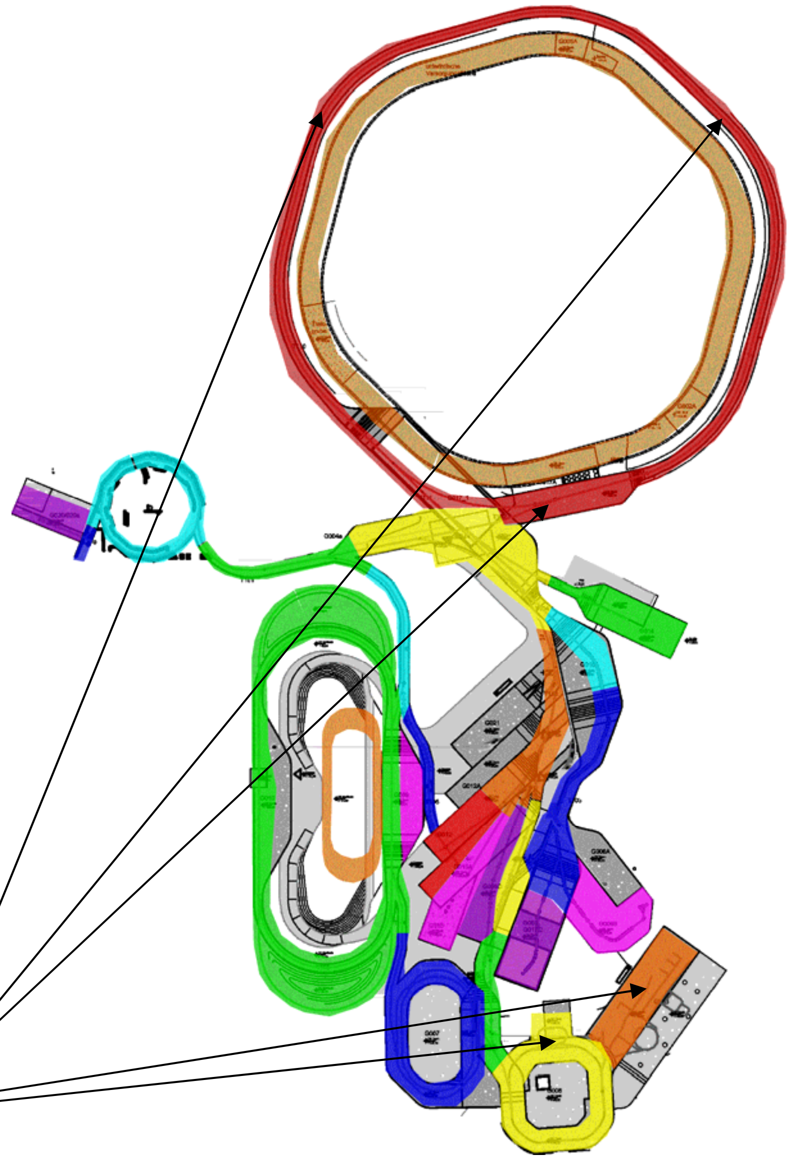
2.) Acces conditions / radiation protection areas

- Conventional system of radiation protection areas @ FAIR
  - prohibited area
    - accelerators / beam lines / exp. caves with beam operation
  - controlled area
    - accelerators / exp. caves with considerable amount of activation
    - caves / beam lines with insufficient shielding to neighbouring areas with beam operation
  - surveyed area
    - complete area around accelerators and experimental caves

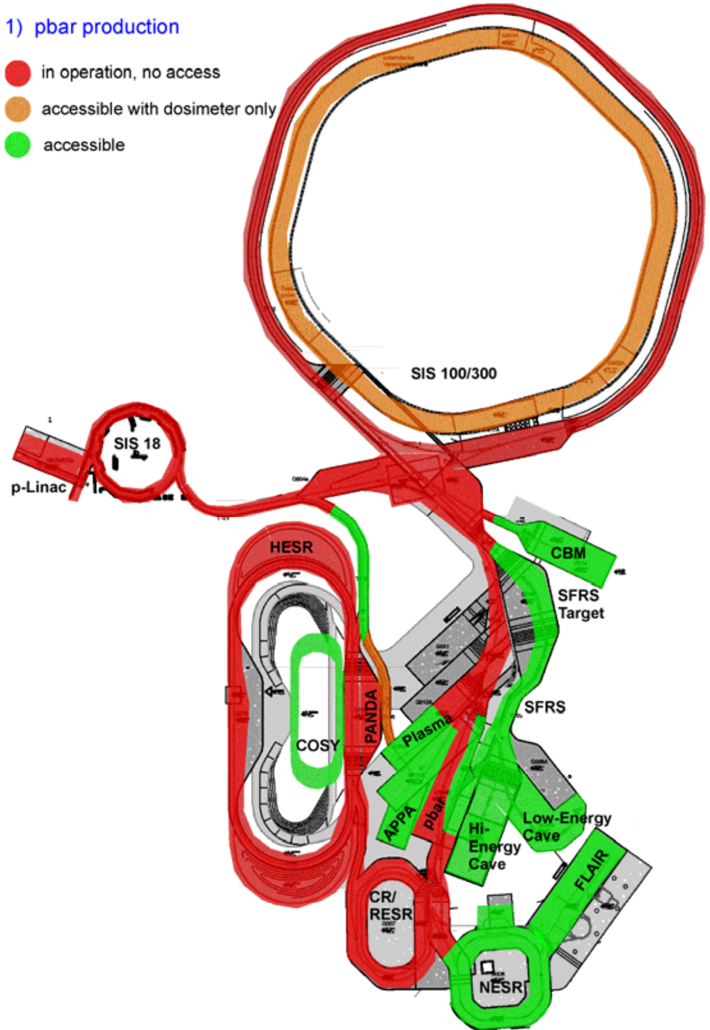
2.) Radiation protection areas

FAIR will have at least
25 radiological areas
for the accelerators,
beam lines and
experimental caves
(laboratories, hot cells, hot
workshops etc. not included).

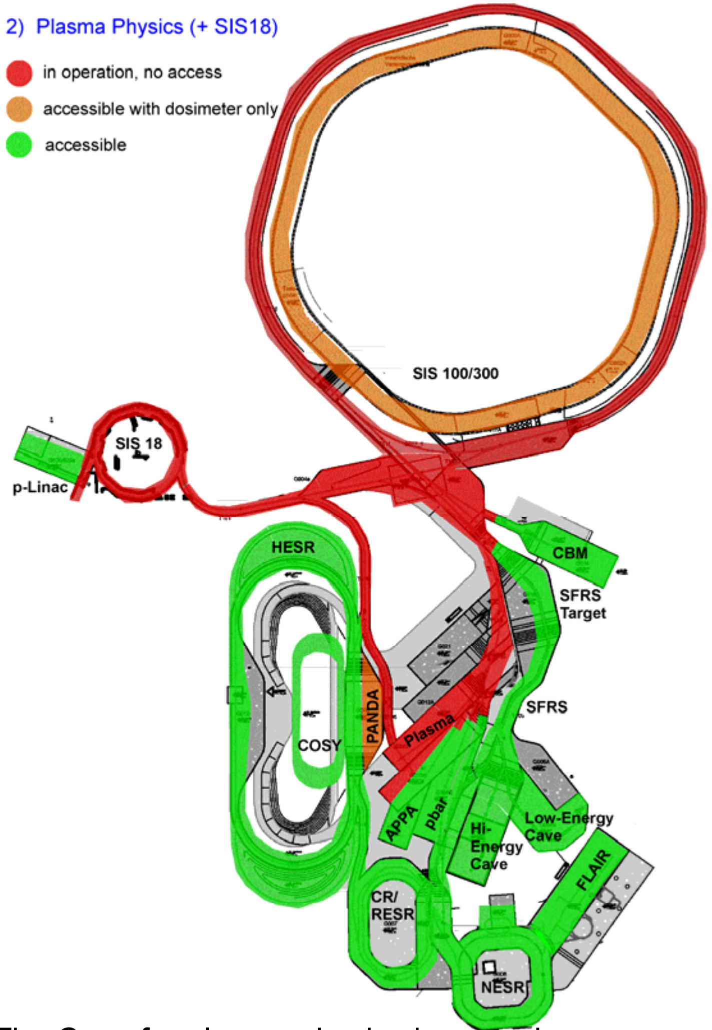
Further subdivisions of radiation
protection areas possible/desired
in few cases.



2.) Examples of operation 1/4

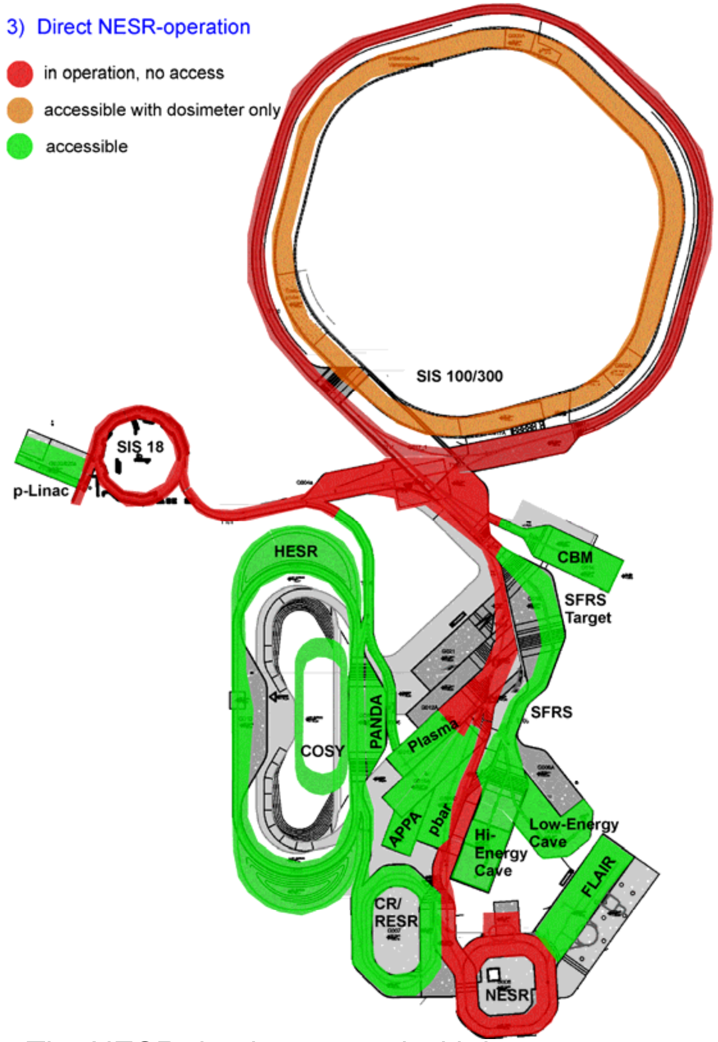


Protons from the p-Linac are injected into the SIS18 transported to the SIS 100 guided to the pbar-production target, accumulate and pre-cooled in the RESR/CR and finally injected into the HESR where for example experiments with the PANDA detector are performed.

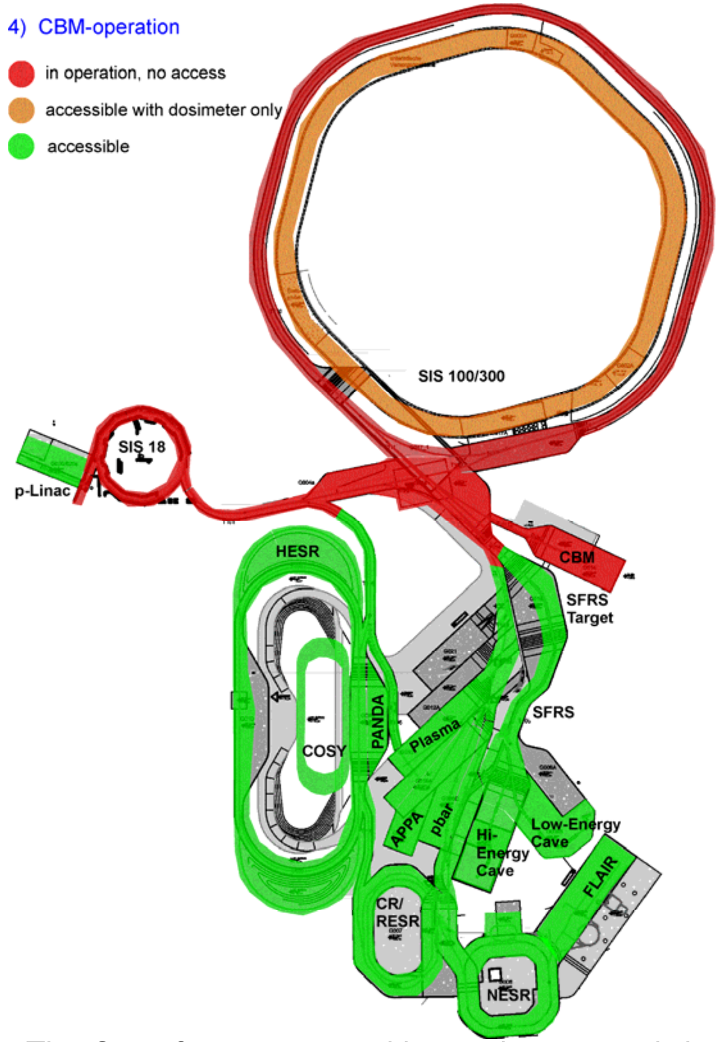


The Cave for plasma physics is served simultaneously by a SIS100 and a SIS 18 beam. As the wall to the Panda area is not sufficiently thick the Panda cave needs to be set to controlled area.

2.) Examples of operation 2/4

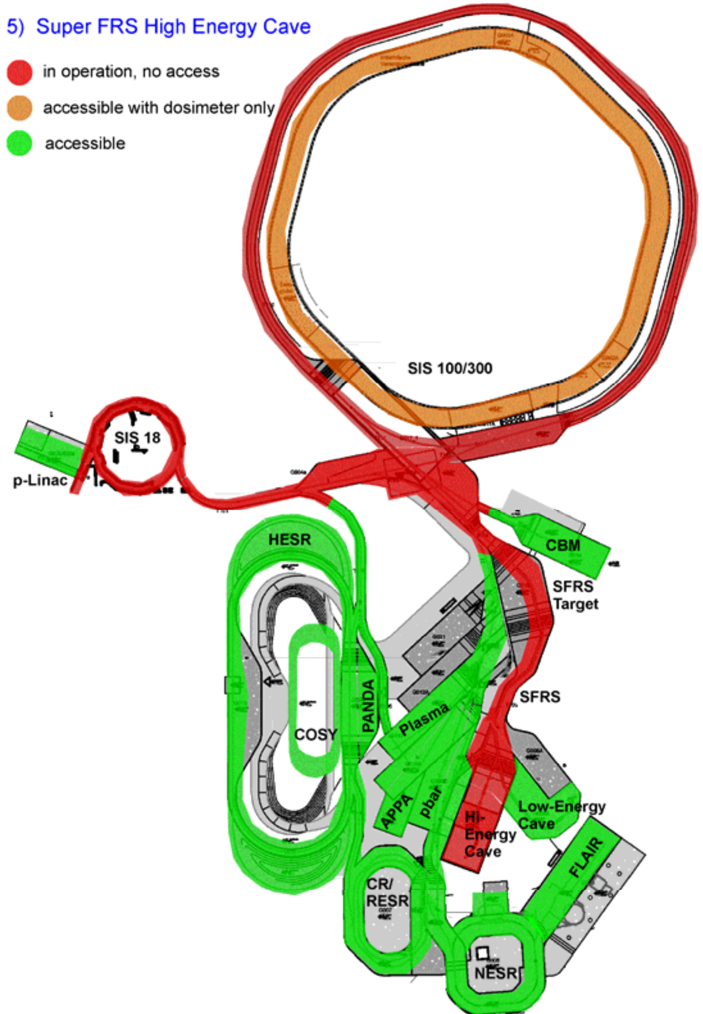


The NESR ring is operated with beams coming directly from SIS 100 or SIS 18

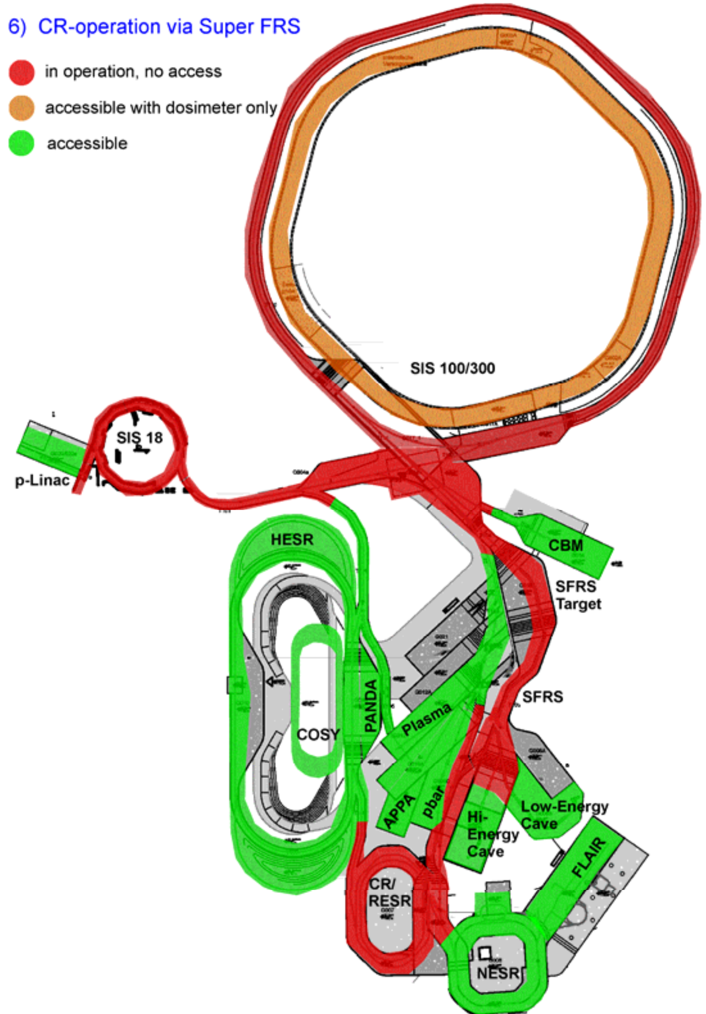


The Cave for compressed baryonic matter will be delivered by beams from the SIS 100/300

2.) Examples of operation 3/4

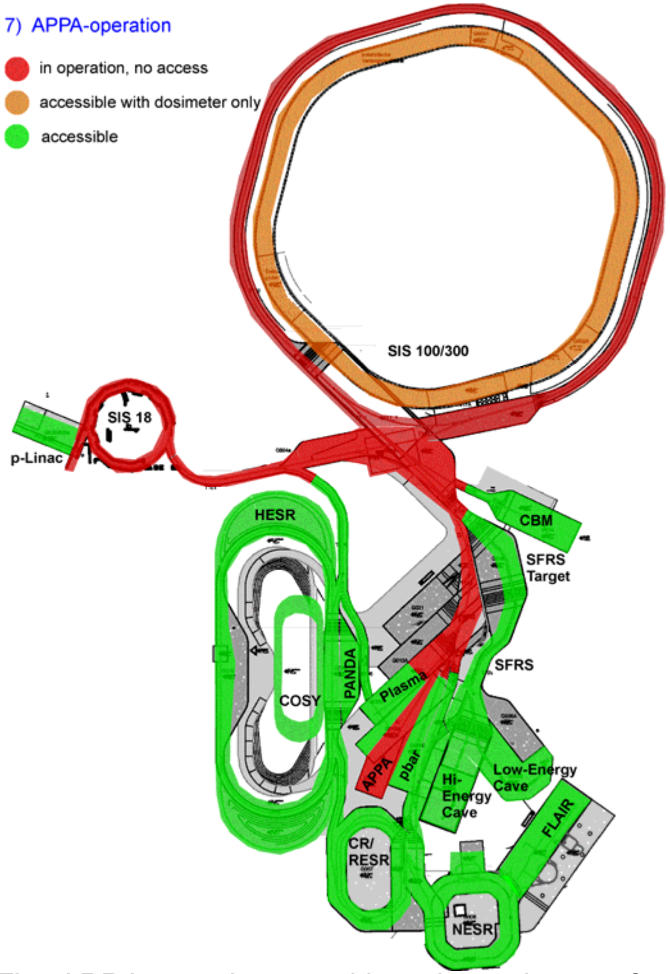


Primary beams are guided from the SIS 100 onto the target of the Super Fragment Separator. The cave for High Energy Nuclear Physics gets secondary beams from the Super Fragment Separator target area



Primary beams from the SIS 100 are directed onto the target of the Super Fragment Separator. The primary beam is fragmented and separated secondary beams are guided through the Super Fragment Separator and injected into the CR.

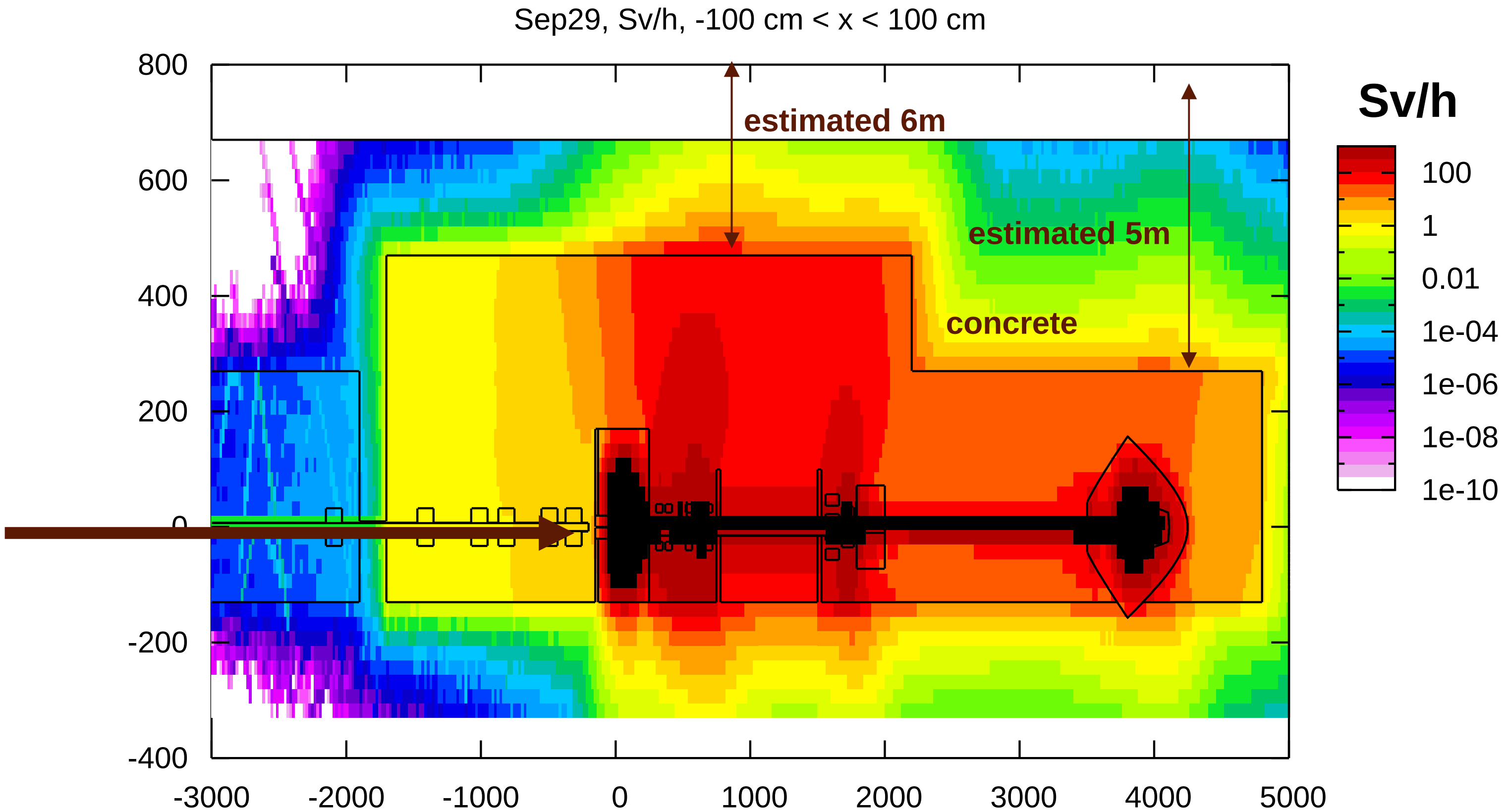
2.) Examples of operation 3/4



The APPA cave is served by primary beams from the SIS100/300 synchrotron

3.) Roofs and Fencing 1/2

ion 42: The architects are aware of the substantial dimensions of the shielding for the buildings G006c and G014. They are the result of the shield dimensioning during the initial planning process.
Due to many factors of dependency within the buildings, the architects would suggest an optimization of the concrete shielding, i.e. a review for simplification of construction through use of soil or fencing in the course of the next planning steps.



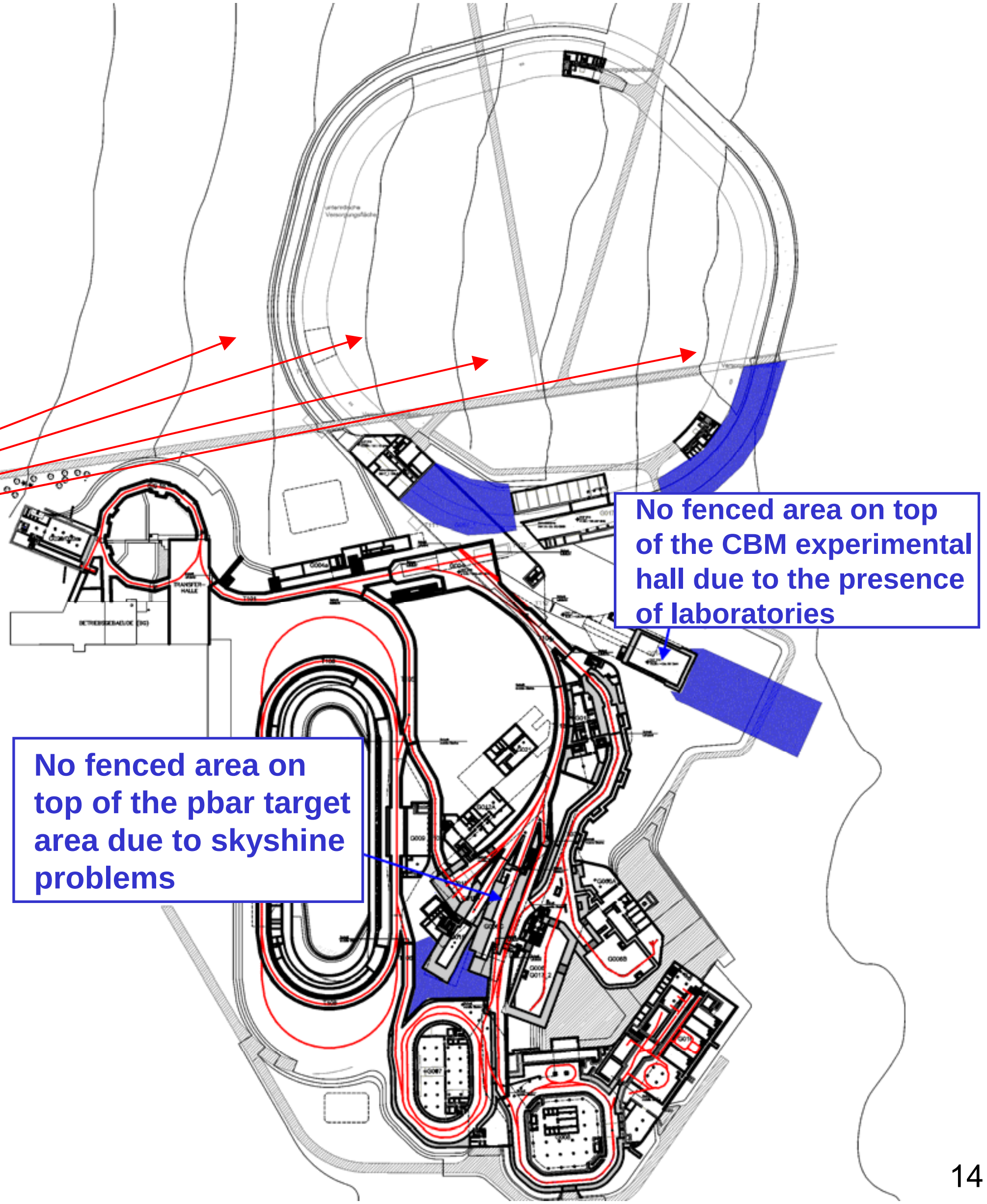
K. Knie

Side view of pbar target area
(was not shown on the Radiation Protection MAC meeeting)

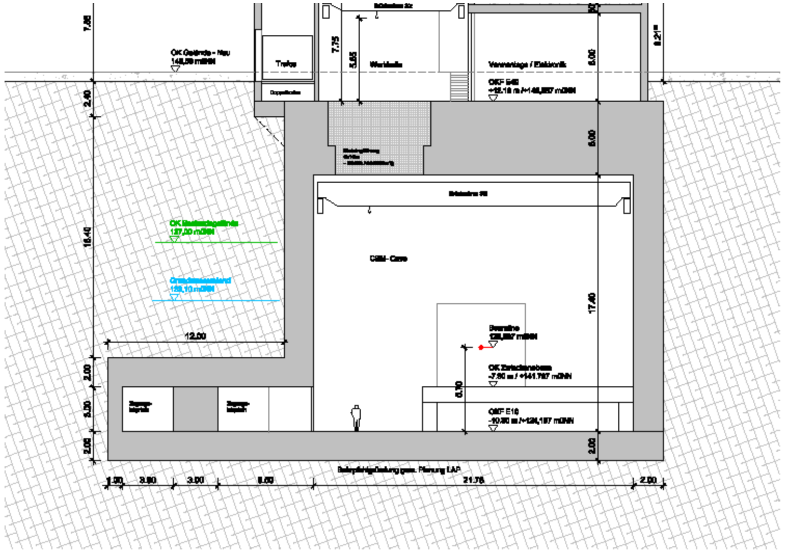
3.) Roofs and Fencing 2/2

Proposals for fenced areas
(in blue)

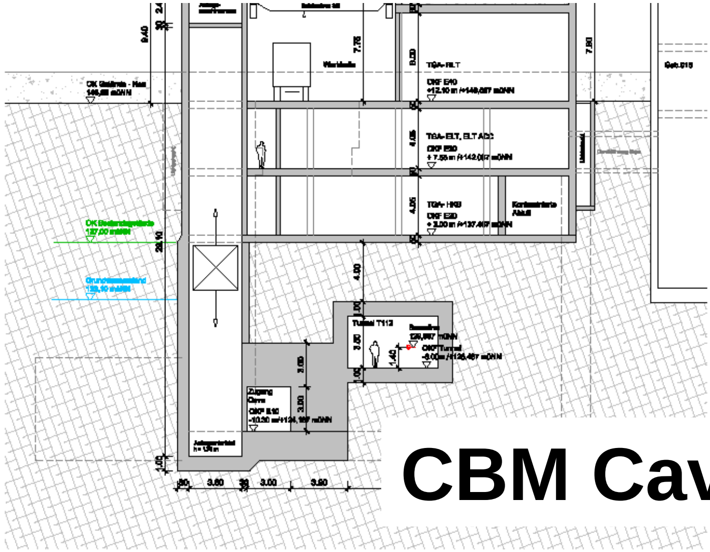
•Paths for transportation on the premises should not be blocked by fenced areas
(possible in case of the CBM beam dump area)
•No fencing on public ground
•Authorities have stated according to §43 StrlSchV (German radiation protection ordinance) that the radiation safety of the personnel has to be assured prior-ranking by proper enclosing solutions, i.e. the use of shielding has to be considered for most cases. Fencing can only be used in exceptional circumstances.



CBM Cave



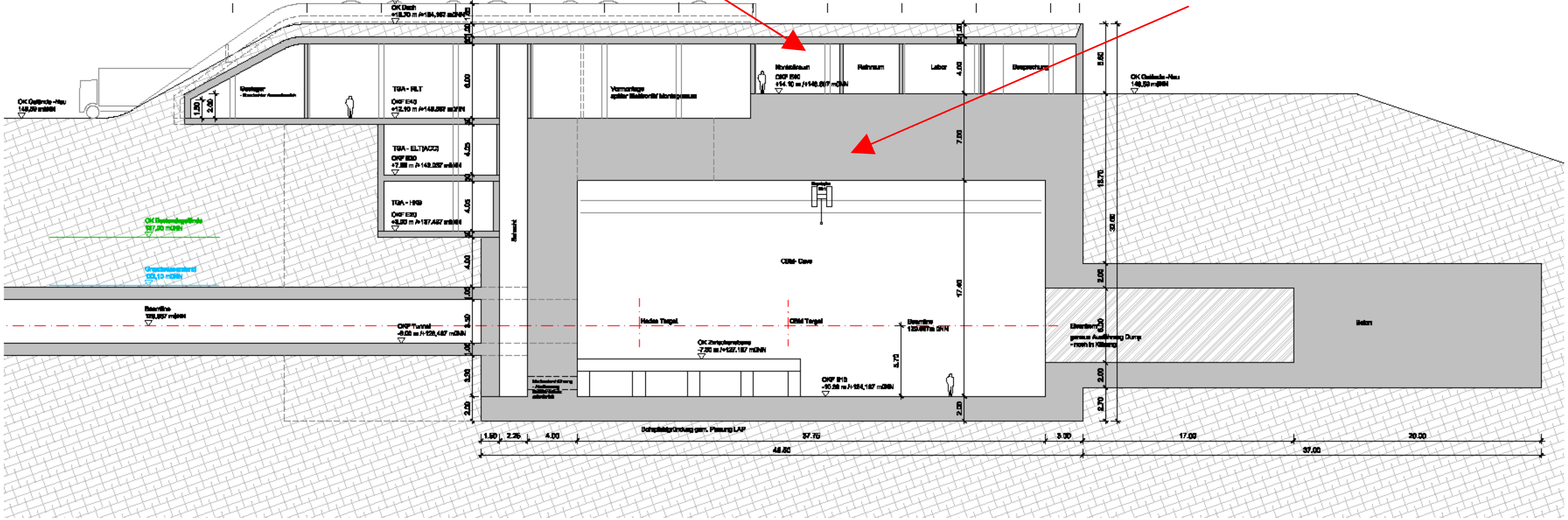
Schnitt C-C



Schnitt B-B

Technical Areas will be removed

Partial Replacement of Concrete by Soil

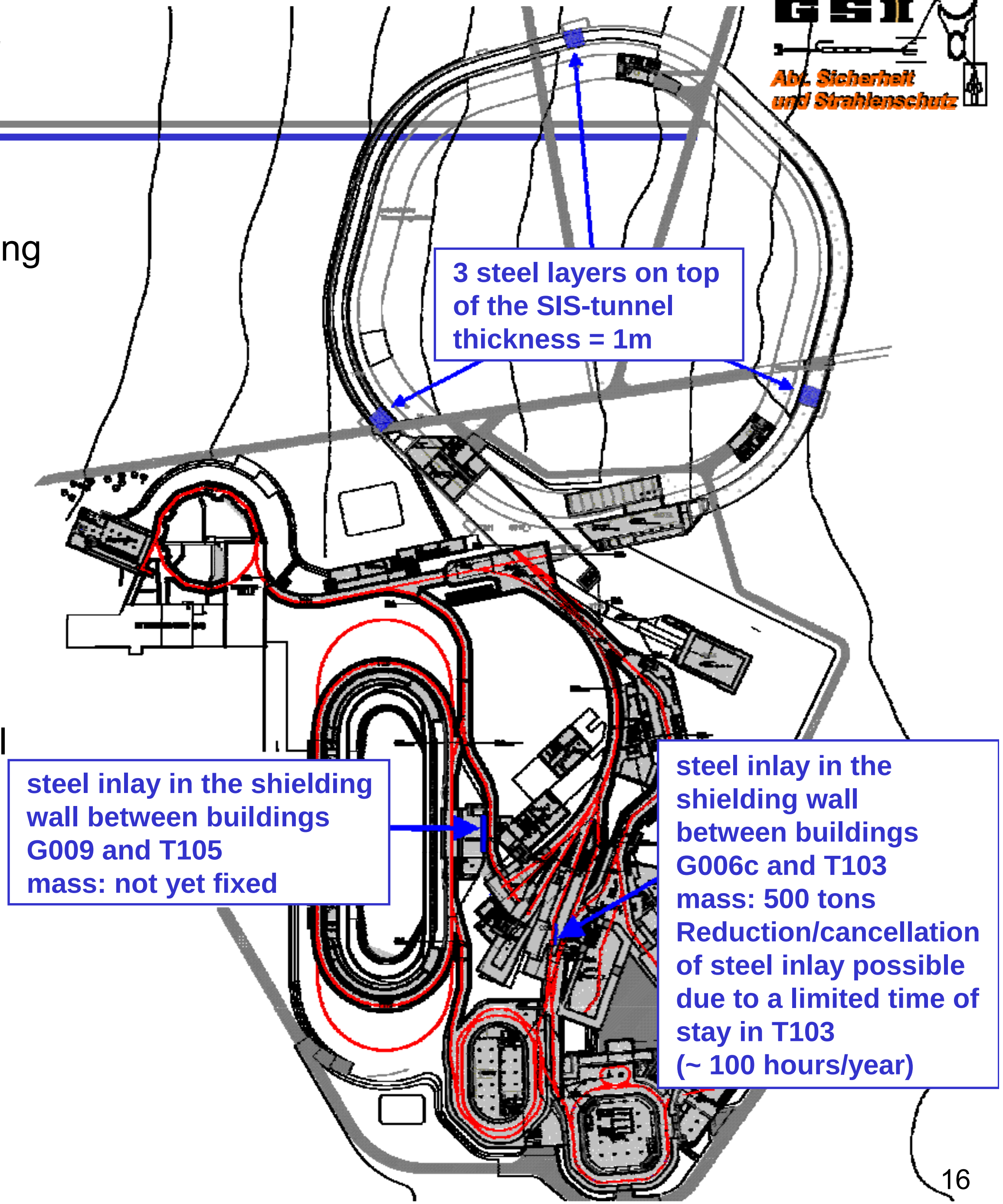


Schnitt A-A

4.) Sandwich Shielding

Sandwich Shielding =
Combination of Steel/Concrete Shielding

1. Sandwich shielding has only been foreseen in places where a severe problem of space prevents the use of ordinary concrete shielding. → Revision of access concepts (duration of stay, cut/change of beam lines) will lead to a cancellation of sandwich shielding
2. The possible chemical contamination of cheap steel is well known at GSI.
3. Calculations for the activation of steel as a function of its composition have already been performed.



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5.) Building No. 21 (Area for storage, radioactive decay and clearance of activated components)

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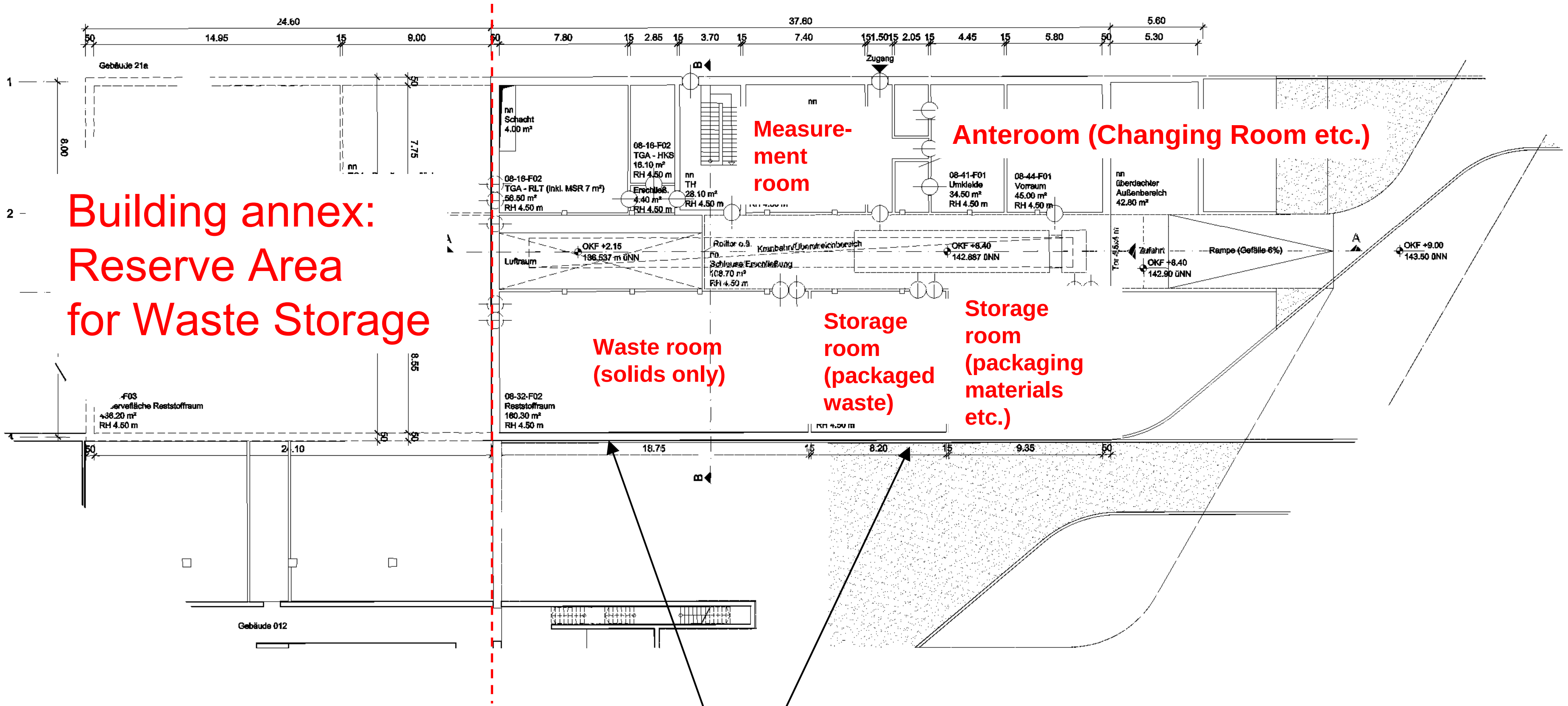
Start with a comparatively small building,
extension of the building parallel to the development of FAIR



hot workshop can/should be implemented in starting/extended version of building 21

5.) Activated material

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Area	Space (m^2)	Building vol. (m^3)	Storage capac. ~ (m^3)
Delivery / Conditioning			
Lock / delivery area	108.7	489.2	
Measuring room	57.2	257.4	
Hot workshop	160	720.0	
Sum	325.9	1466.6	
Warehousing / Transport			
Waste room (solids only)	160.3	721.4	367
Storage room (packaged waste)	70.1	315.5	144
Sum Anteroom	230.4	1036.8	511
Decay area			
Decay-in-storage (solids)	211.8	953.1	513
Decay-in-storage (liquids)	107.7	484.7	
Sum	319.5	1437.8	513
Infrastructure			
Storage room (packaging materials etc.)	80	360.0	165
Anteroom	45	202.5	
Locker room	47.3	212.9	
Sum	172.3	775.4	165
Reserve			
Reserve area (solid waste)	436.2	1962.9	
Reserve area (decay-in-storage)	453.6	2041.2	
Sum	889.8	4004.1	2736
Sum w/o reserve	1048.1	4716.45	1189

Areas for storing and handling of activated or contaminated parts.