A detailed wireframe model of the Super-Fragment Separator (Super-FRS) at FAIR. The model shows a large, oval-shaped ring structure with a central beam pipe. The ring is composed of many segments, each with a cylindrical shape. The beam pipe is a long, thin cylinder running through the center of the ring. The model is shown in a perspective view, highlighting the three-dimensional structure of the accelerator.

Remote handling in the Super-FRS (Super-Fragment Separator) at FAIR

Presenter: F. Amjad

Contributors: H. Weick, C. Karagiannis, C. Schloer, N. Nociforo

Big Science, Sweden, 04.02.2021

A vertical line on the left side of the slide connects a series of circles. The top circle is a solid blue circle, and the subsequent six circles are white with blue outlines. Each circle is connected to a horizontal blue bar containing text.

Introduction to GSI and FAIR

Status of the construction site

Remote handling scenarios in Super-FRS facility

Target area remote handling

Hot-Cell facility at Super-FRS

Mobile robot system

FAIR RH projects status



- Existing facility: GSI Darmstadt (Foundation: 1969)
- Shareholders: federal government (90%), Hesse (8%), Rhineland-Palatinate (1%), Thuringia (1%)
- Further locations in Mainz and Jena
- Future facility: FAIR (Foundation: 2010)
- Employees on campus: approx. 1,450
- Ground breaking: July 2017

Shareholders worldwide

Shareholders

- Finland
- France
- Germany
- India
- Poland
- Romania
- Russia
- Sweden
- Slovenia

Associated

- United Kingdom

Aspirant

- Czech Republic



A vertical line with circles at the end of each item, serving as a visual index for the agenda. The second circle is filled with blue, while the others are white.

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Status: Construction of the FAIR Southern Area (Started 2020)



SIS 100

pbar Target Building

Super-FRS Target Building



A vertical line with circles at the end of each segment, serving as a visual index for the agenda items. The circles are white with blue outlines, except for the third and fourth items which are solid blue.

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FAIR, Super-FRS and NUSTAR



GSI Helmholtz Centre for Heavy Ion Research

Ion sources
all elements

Linear accelerator

Ring accelerator
SIS18

FAIR — Facility for Antiproton and Ion Research

Ring accelerator
SIS100

100 m

HESR

Experimental and
storage rings

CR

Production and selection
of new nuclei

Production
of antiprotons

Existing facility

Planned facility

Experimental setups

- Intensity
- Precision
- Storage rings

Production Targets

NUSTAR experiments

Super-FRS Beamline

Super-FRS Beamline



Super Fragment Separator (Super-FRS) Facility



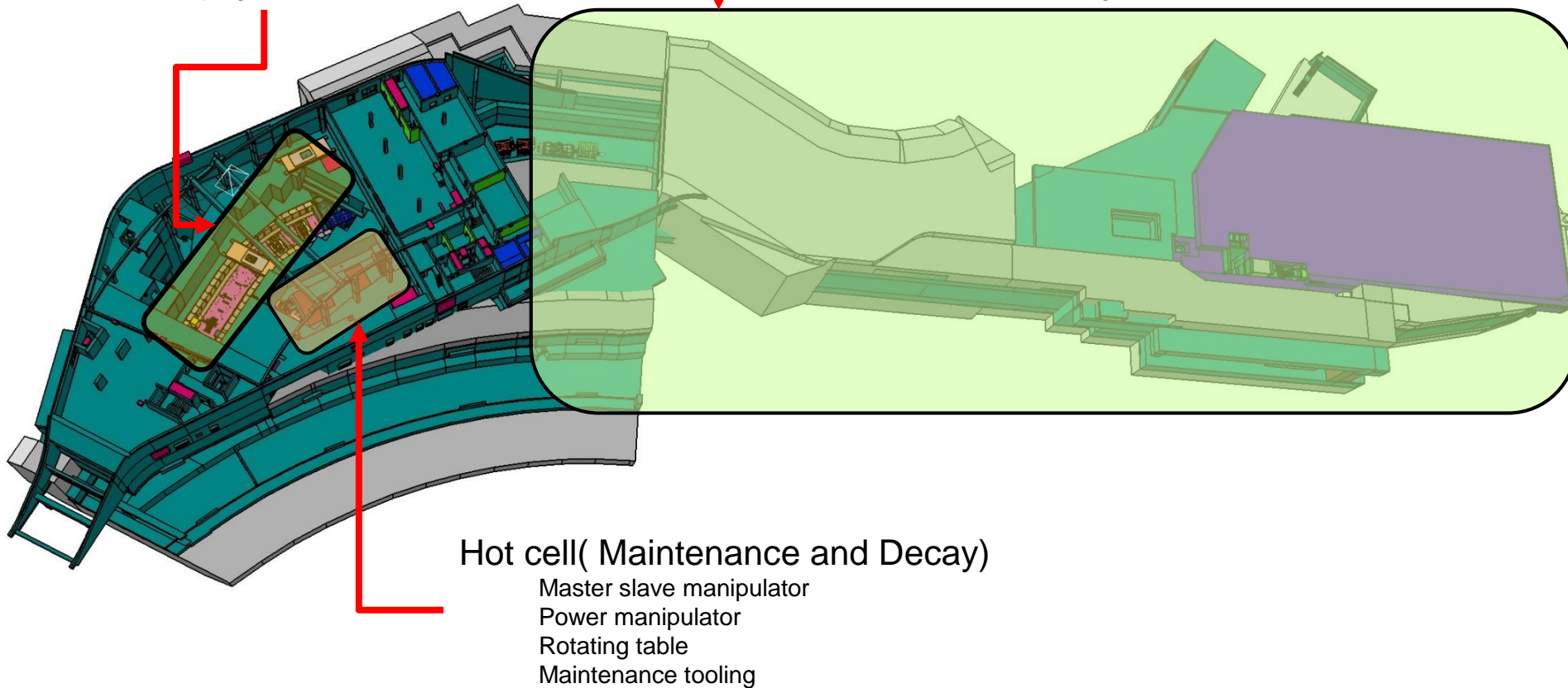
Super-FRS facility (320m long) Remote Handling (RH)

Target Area (40 m tunnel)

Closed tunnel (Heavily shielded)
Shielding flask to conduct RH
Heaviest plug 8 tons

Main separator (130m tunnel)

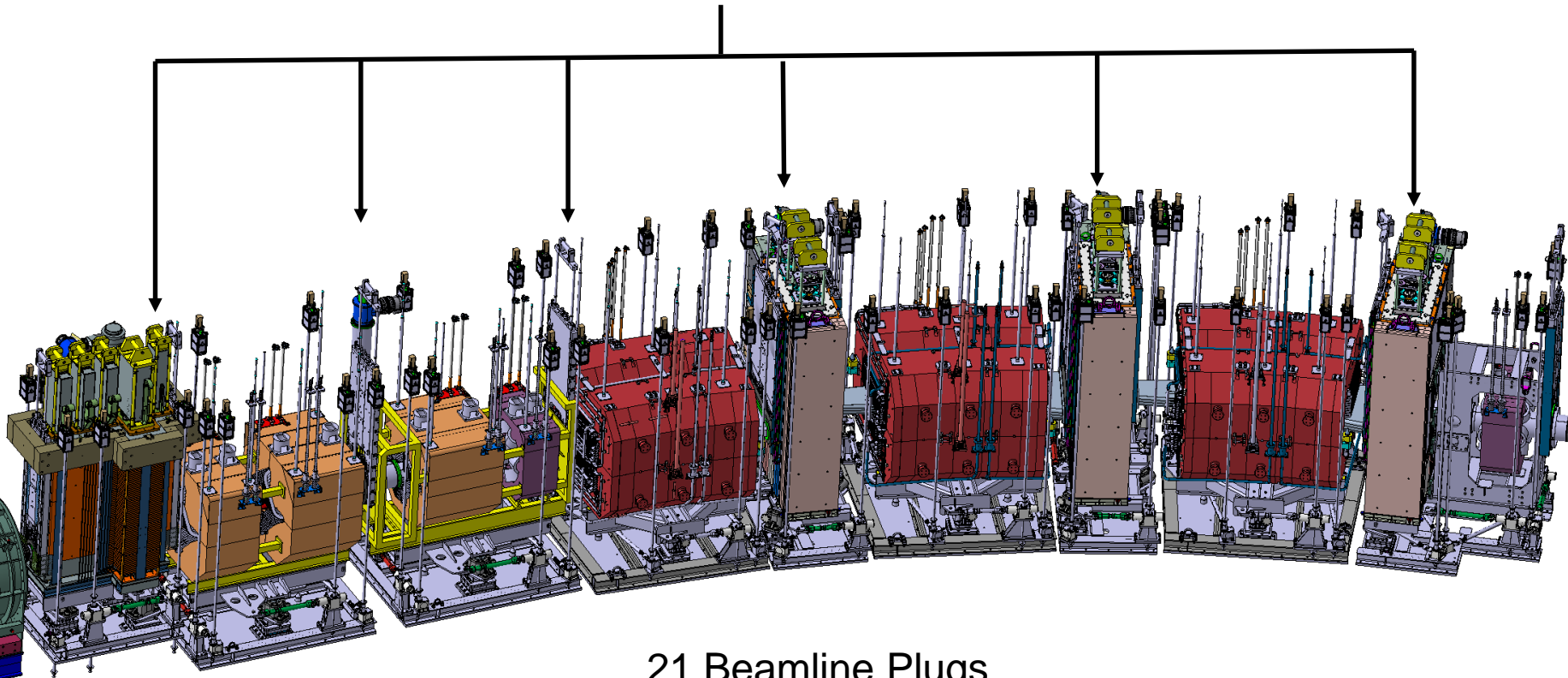
Open tunnel
Mobile robot to conduct RH
Heaviest element 580 kgs



Hot cell(Maintenance and Decay)

Master slave manipulator
Power manipulator
Rotating table
Maintenance tooling

Beamline Plugs Remote Handling



21 Beamline Plugs

Super-FRS Beamline plugs (21 plugs) Designed for Remote Handling

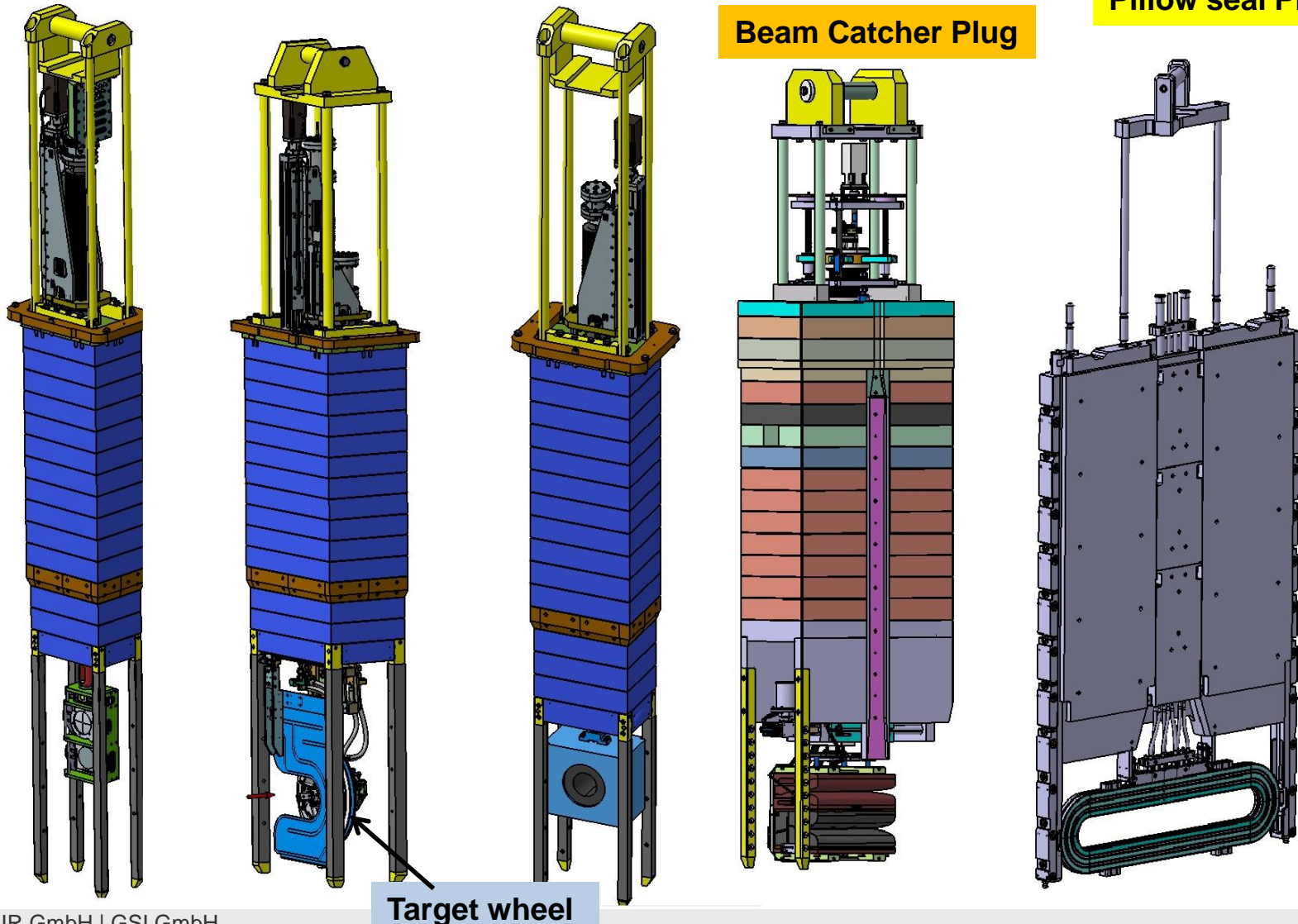
Detector Plug

Target Plug

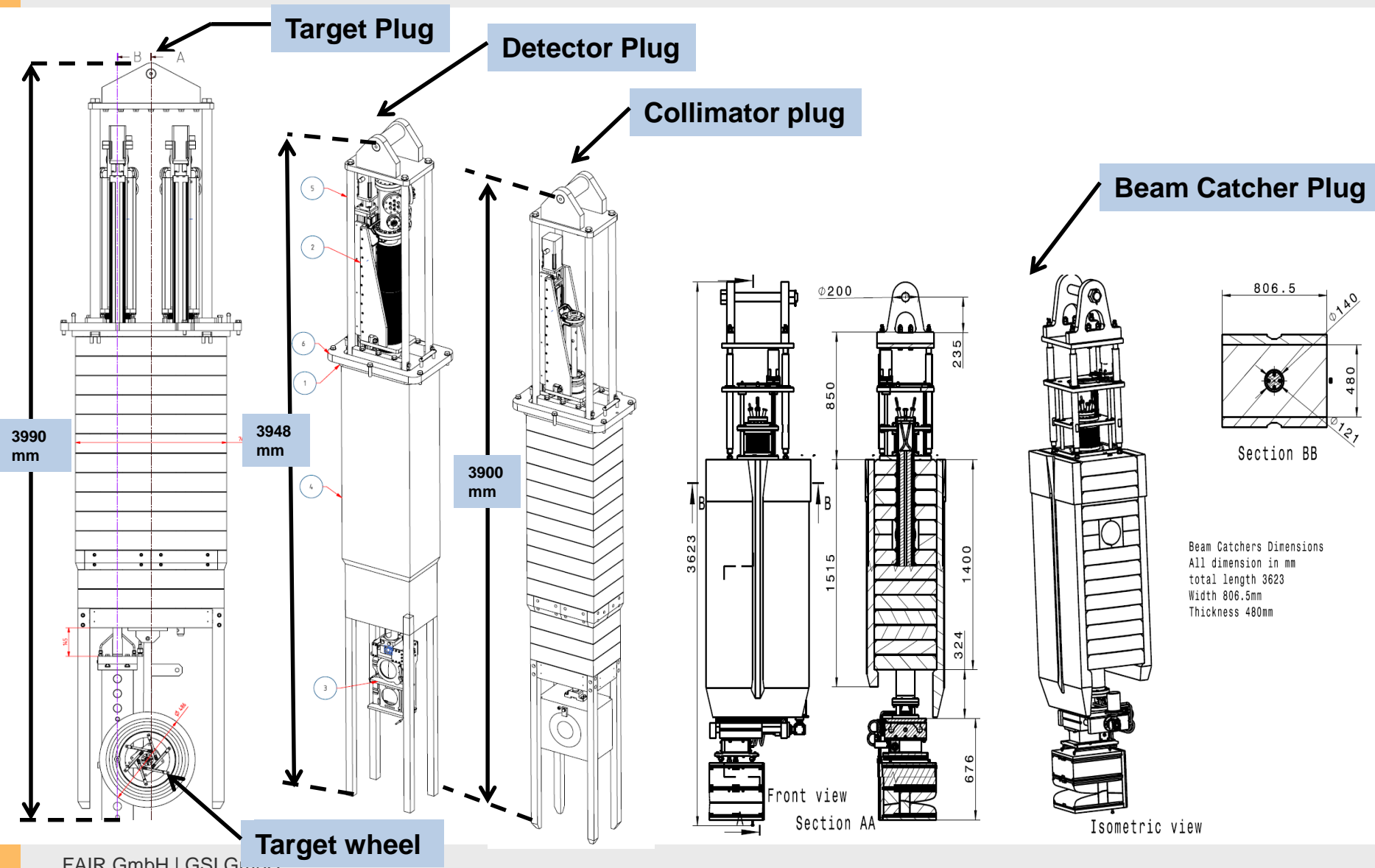
Collimator plug

Beam Catcher Plug

Pillow seal Plug



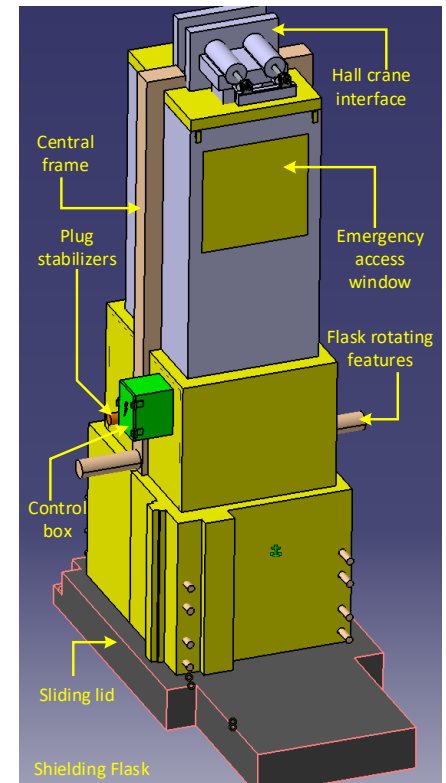
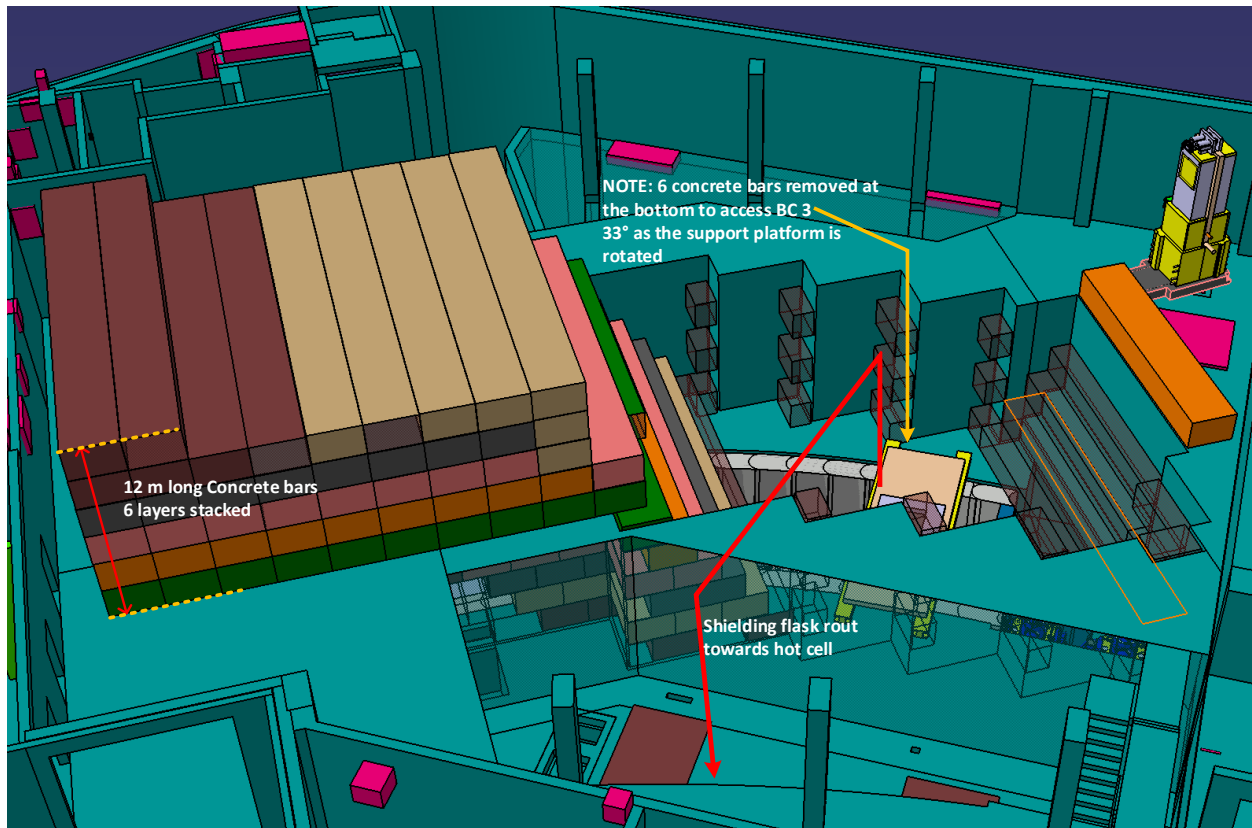
Super-FRS target area plug remote handling requirements



Target Area RH Setup

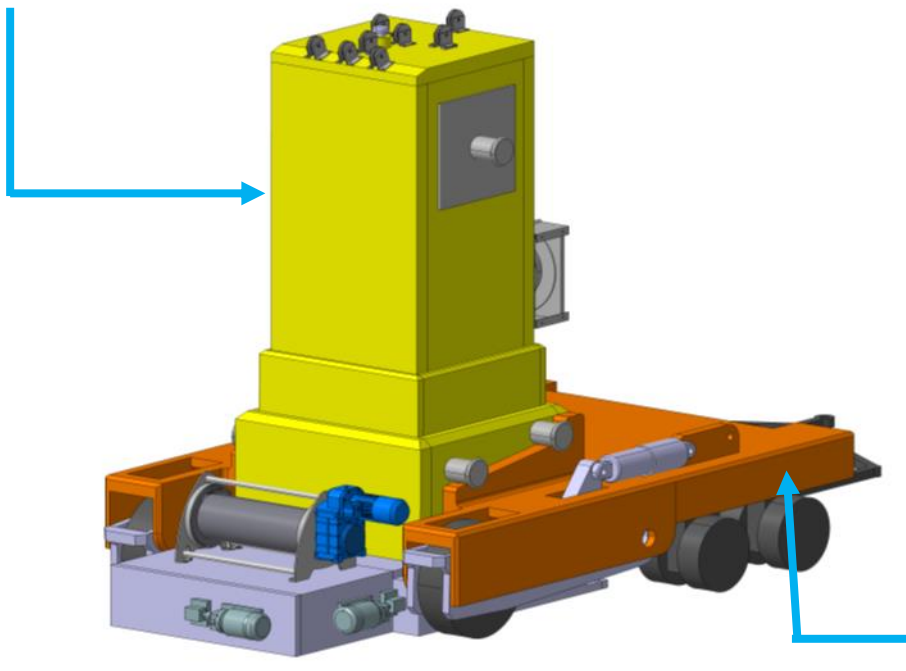
Target Area (40 m tunnel)

- 21 plugs positions that requires RH (8 tons heavy activated plugs)
- 60 Tons shielding flask
- 40 Tons of support platform for positioning (5 positioning configurations)



Shielding Flask

Shielding Flask



Flask Trailer

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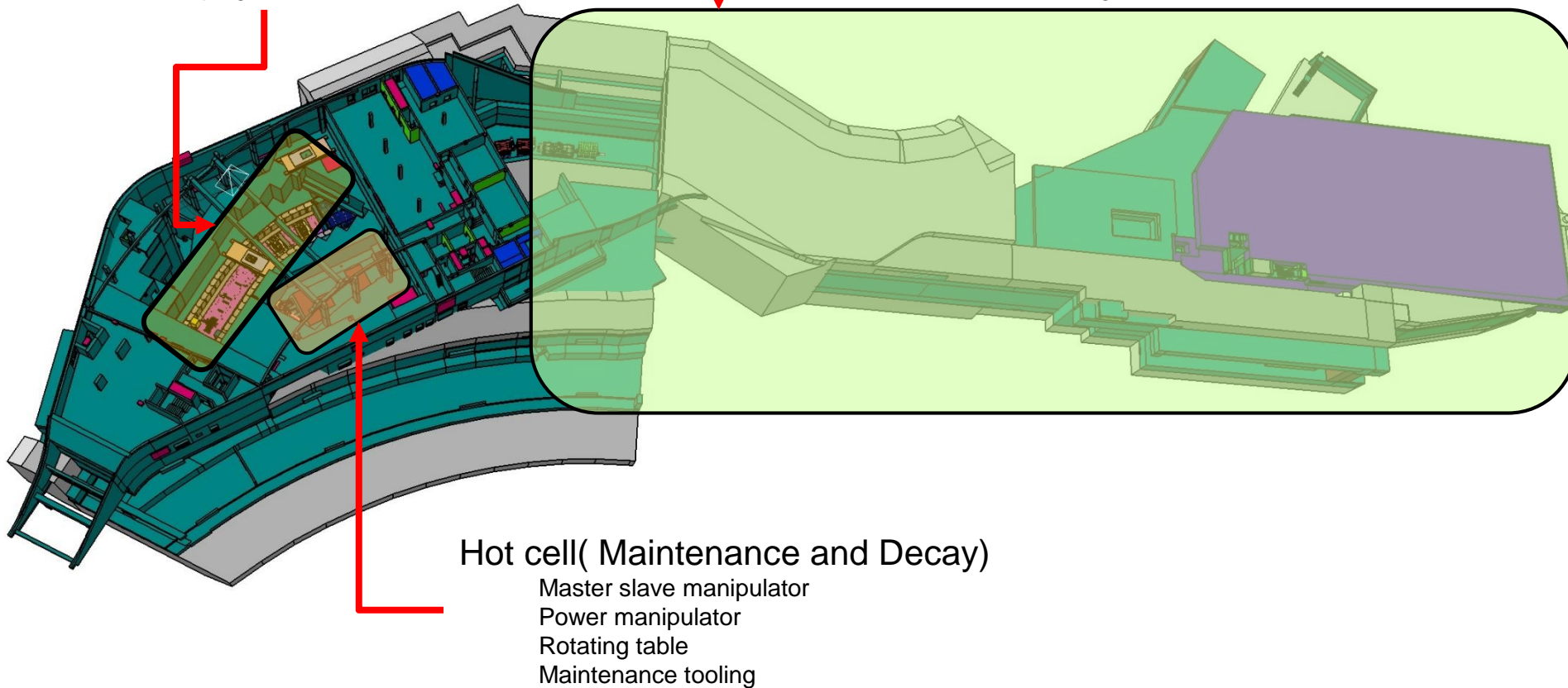
Super-FRS facility (320m long) Remote Handling (RH)

Target Area (40 m tunnel)

Closed tunnel (Heavily shielded)
Shielding flask to conduct RH
Heaviest plug 8 tons

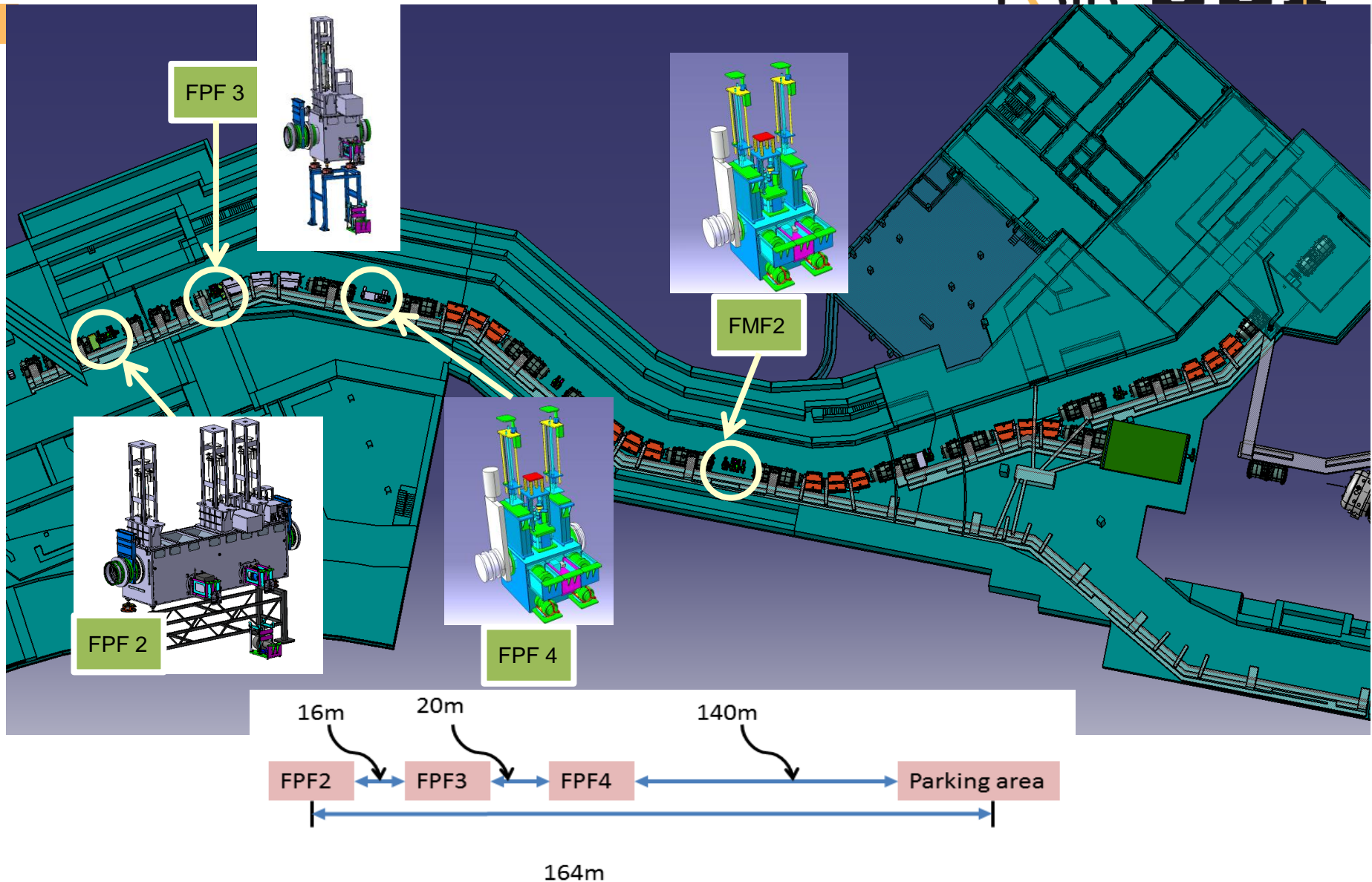
Main separator (130m tunnel)

Open tunnel
Mobile robot to conduct RH
Heaviest element 580 kgs

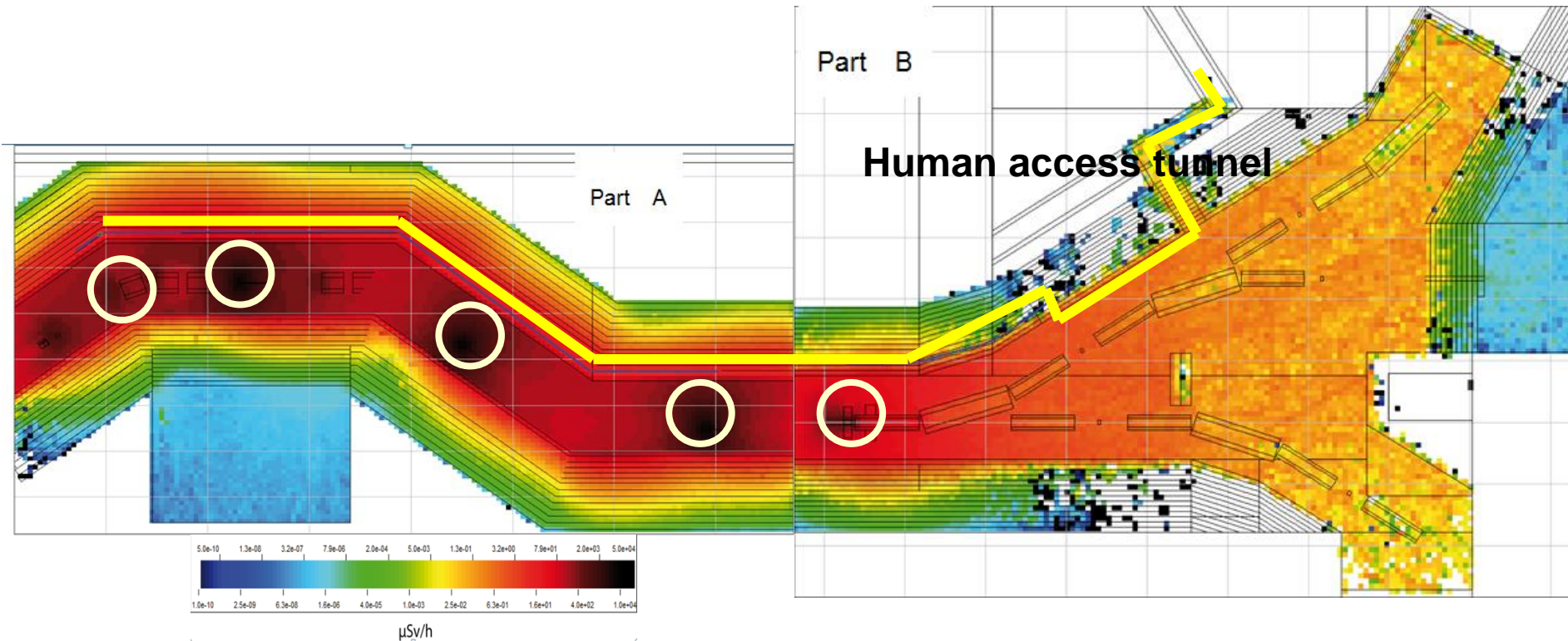


Super-FRS Remote handling scenario

Mobile Robot



Super-FRS Remote handling scenario (Radiation Environment)



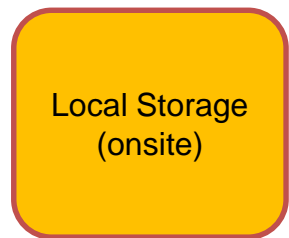
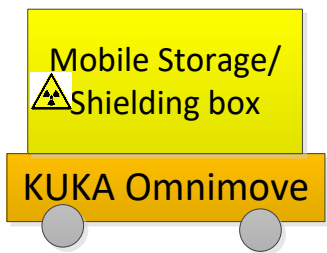
On average one person can get 1.5 mSv to 2.93 mSv dose per beamline insert replacement. Remote handling system is required here to replace, transport and store the beamline insert.

Super-FRS Remote handling scenario (open tunnel) Concept design

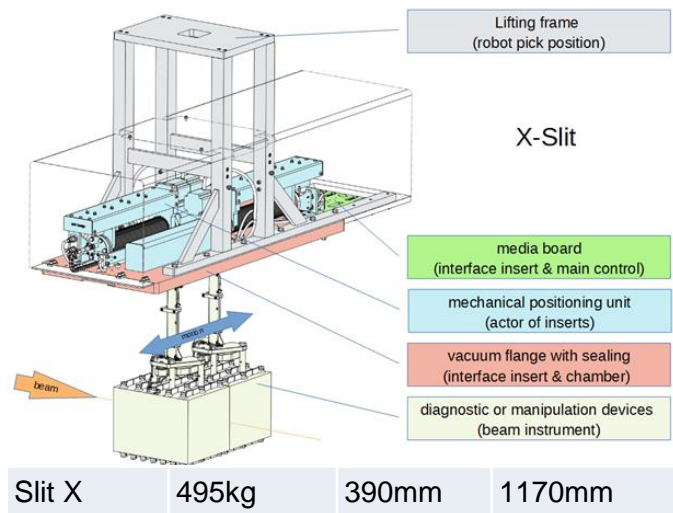
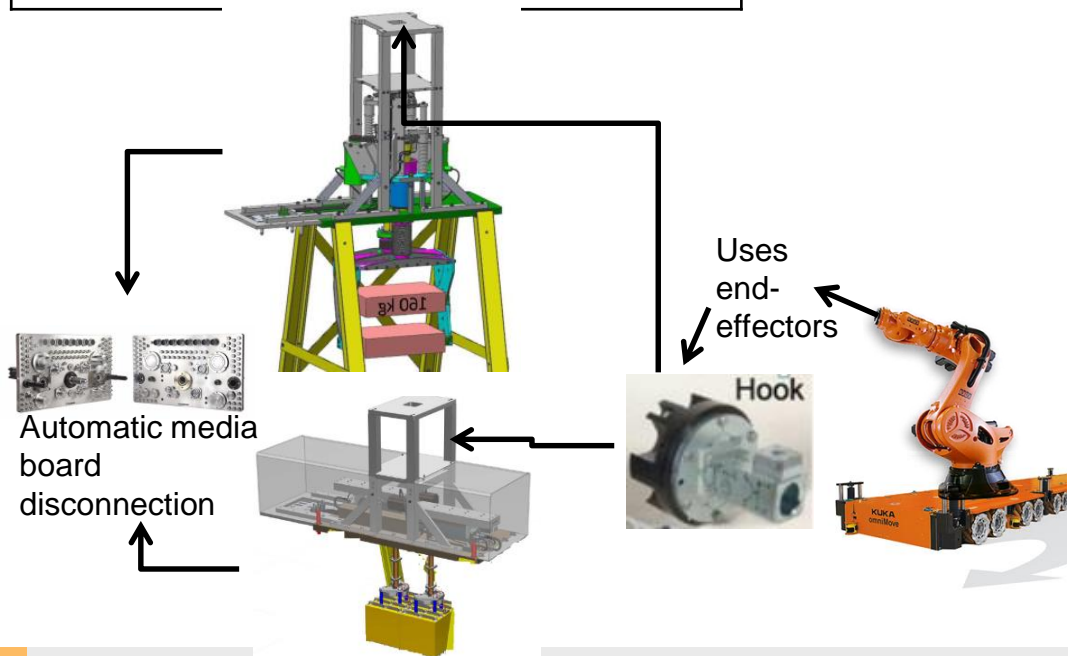


Mobile robot RH system

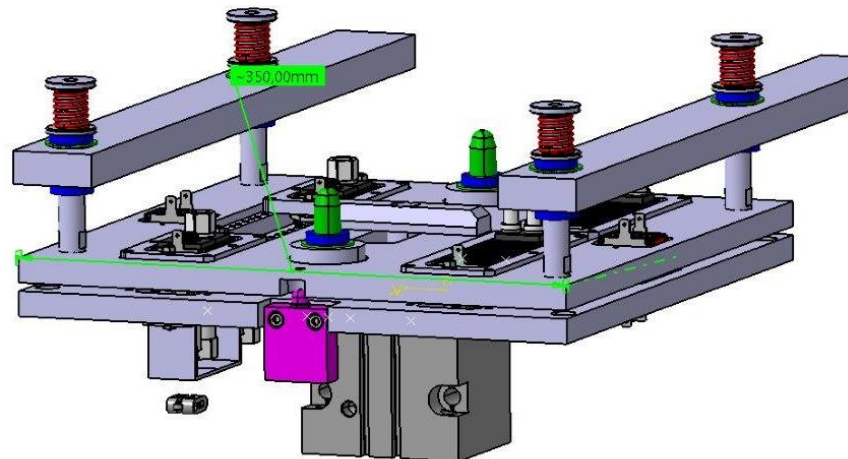
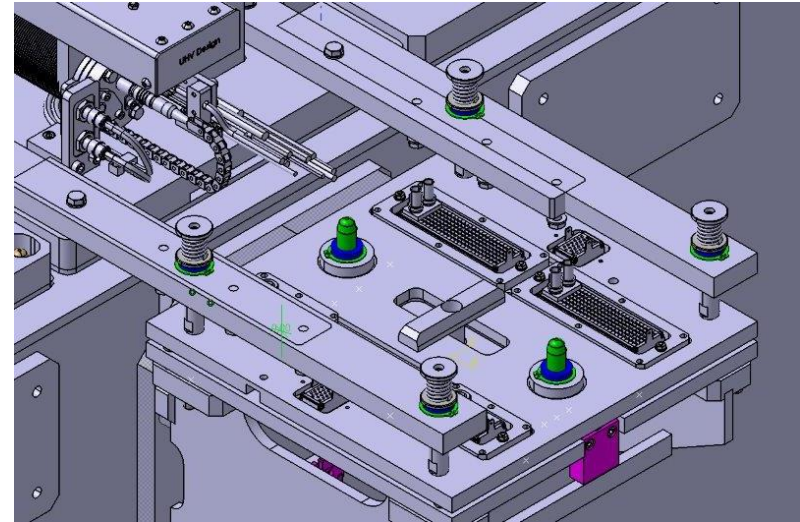
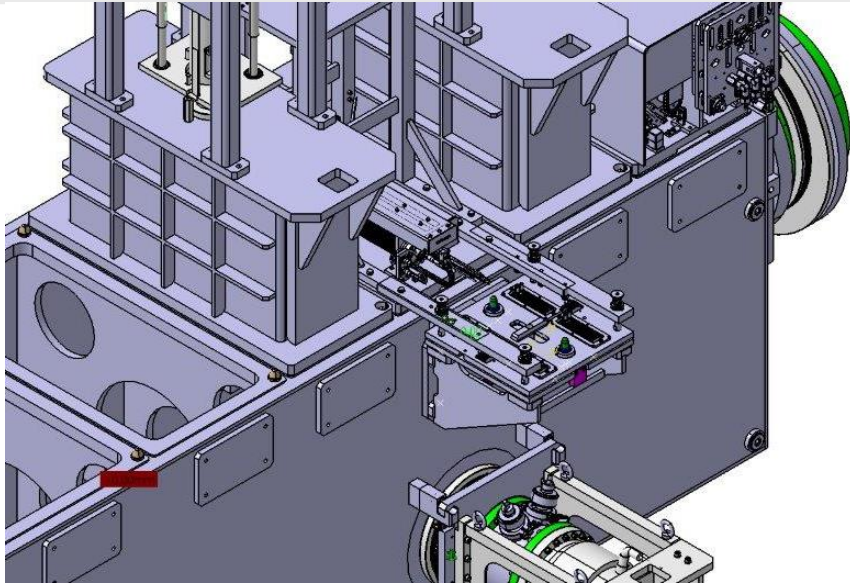
- Six axis (KUKA titan) robot to perform remote manipulation.
- Mobile platform (KUKA omnimove / AGV) that can transport robot in-between parking position to maintenance region.
- Mobile shielding container to transport activated beamline inserts.
- Power supply, navigation and parking system.
- Automatic media board connection



Remote Handling of beamline inserts (X and Y slits) example



Media board in house developed (Already being tested at GSI)



C. Schloer

FAIR GmbH | GSI GmbH

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- Super-FRS shielding flask
 - Awarded in late 2020
 - BILFINGER NOELL GMBH 
- Mobile robot system for remote handling (Future)
 - Mobile robot systems (6 axis robot and AGV omnimove)
 - Remote operation of the system
 - Positioning across the tunnel
 - Storage and transportation of active plugs
- Hot cell in requirements (Chris presentation)
- Collaboration with GSI experts.
- Testing at GSI facilities.
- Link to GSI website
- https://www.gsi.de/en/work/administration/einkauf_und_materialwirtschaft/ausschreibungen.htm



**Thank you for
your attention!**