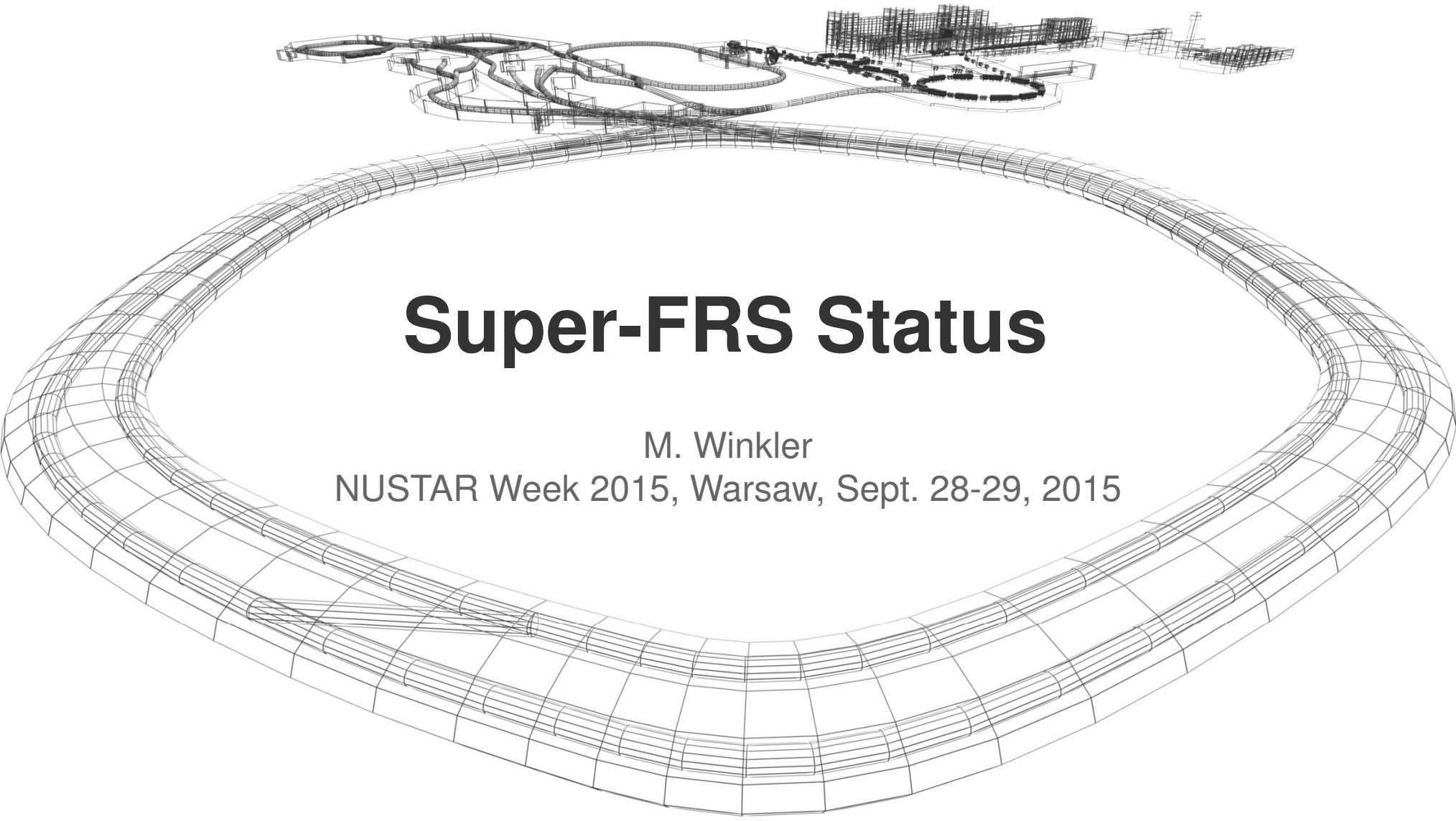


A detailed 3D wireframe model of the Super-FRS (Super-Fragment Separator) accelerator. The model shows a large, oval-shaped ring structure composed of many segments, with a complex network of smaller components and pipes extending from it. The entire structure is rendered in a black wireframe style, highlighting its geometric complexity.

Super-FRS Status

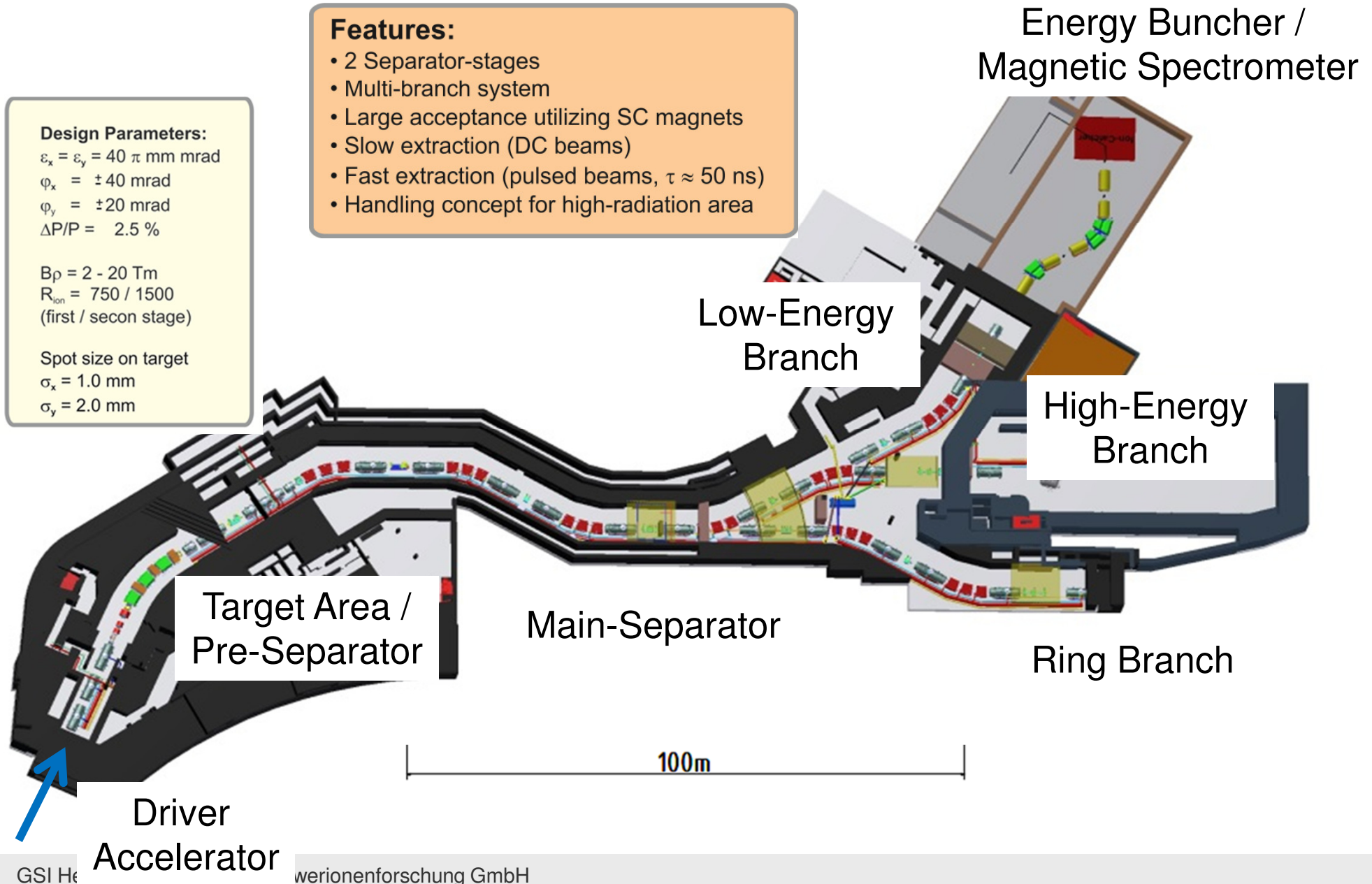
M. Winkler

NUSTAR Week 2015, Warsaw, Sept. 28-29, 2015

Outline

- **Super-FRS Layout and Design Principles**
- **Civil Construction**
- **Super-FRS Components**
- **Project Control**
- **Summary**

Super-FRS Layout and Design Principles



03_Major_Milestones (Buildings)		
CC Phase B		
SCC	Transfer SFRS - Experimente (K0410A) (T103)	
SCC.MB10-LV	Building ready for installation + Low voltage distribution boards active	14.01.2020
SCC.MB11	Building ready for accelerator commissioning	30.06.2020
SCC	SFRS (L0516A) (G018)	
	Kontrolle und Überprüfung von Ausführungsplanung	01.08.2016
	Start of construction	03.07.2017
	Shell building ready for iron shielding (ESTIMATION!!!)	11.01.2019
SCC.MB09	Building shell completed	03.07.2017
SCC.MB10-LV	Building ready for installation + Low voltage distribution boards active	14.01.2020
SCC.MB11	Building ready for accelerator commissioning	30.06.2020
SCC	SFRS HE-Cave (K0308A) (G006)	
SCC.MB09	Building shell completed	03.07.2017
SCC.MB10-LV	Building ready for installation + Low voltage distribution boards active	14.01.2020
SCC.MB11	(K0308A) (G006) Building ready for accelerator commissioning	30.06.2020
SCC	SFRS LE-Branch (G006B)	
SCC.MB10-LV	Building ready for installation + Low voltage distribution boards active	14.01.2020
SCC.MB11	Building ready for accelerator commissioning	30.06.2020
SCC	SFRS Supply (L0321A) (G006A)	
SCC.MB10-LV	Building ready for installation + Low voltage distribution boards active	14.01.2020
SCC.MB11	Building ready for accelerator commissioning	30.06.2020

NUSTAR Buildings



- Execution planning: on hold
- Route planning: on hold
- Review 02/2015: consider LEB cave
- **CR target area shielding**
- Gas supply, gas mixing station
- Establishing cable base

Build. 018,
(Target building)

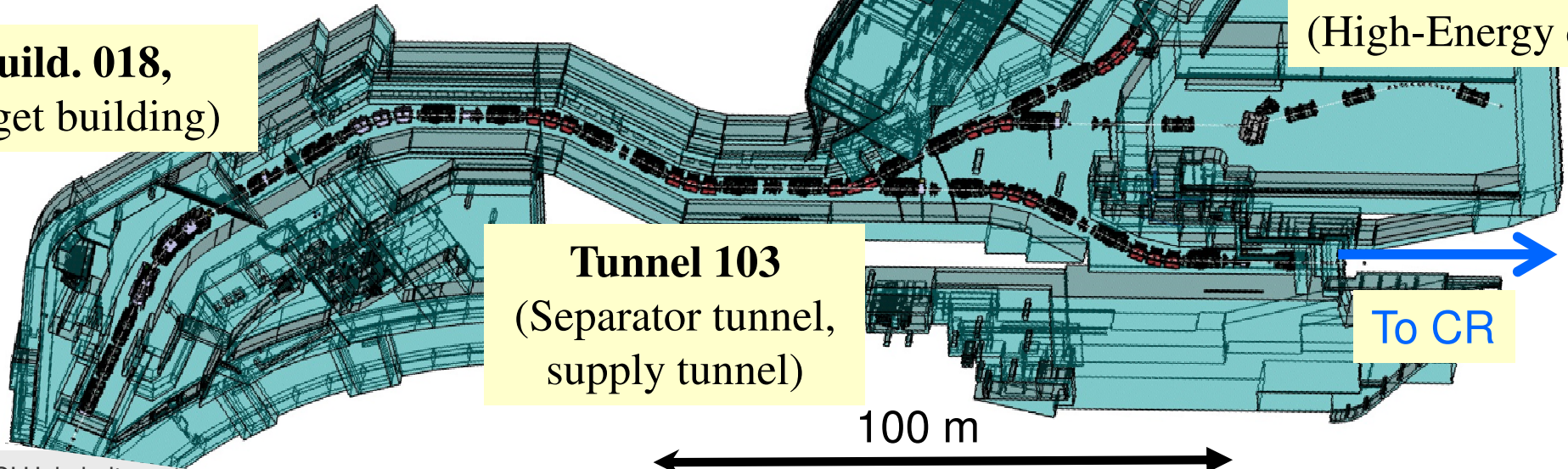
Build. 006a,
Service building

Build. 006
(High-Energy cave)

Tunnel 103
(Separator tunnel,
supply tunnel)

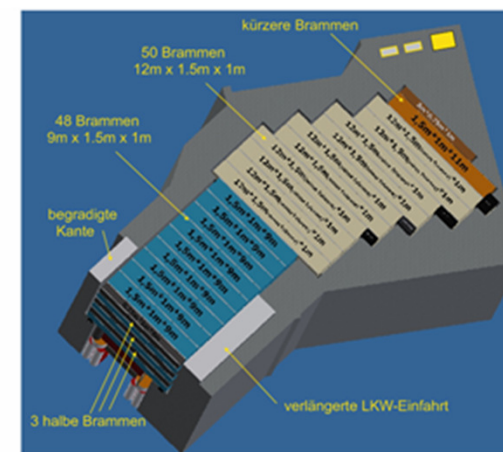
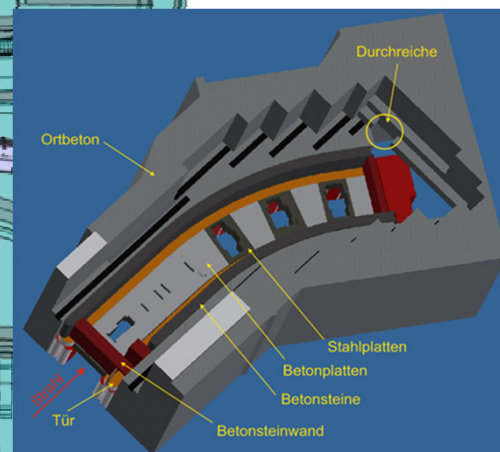
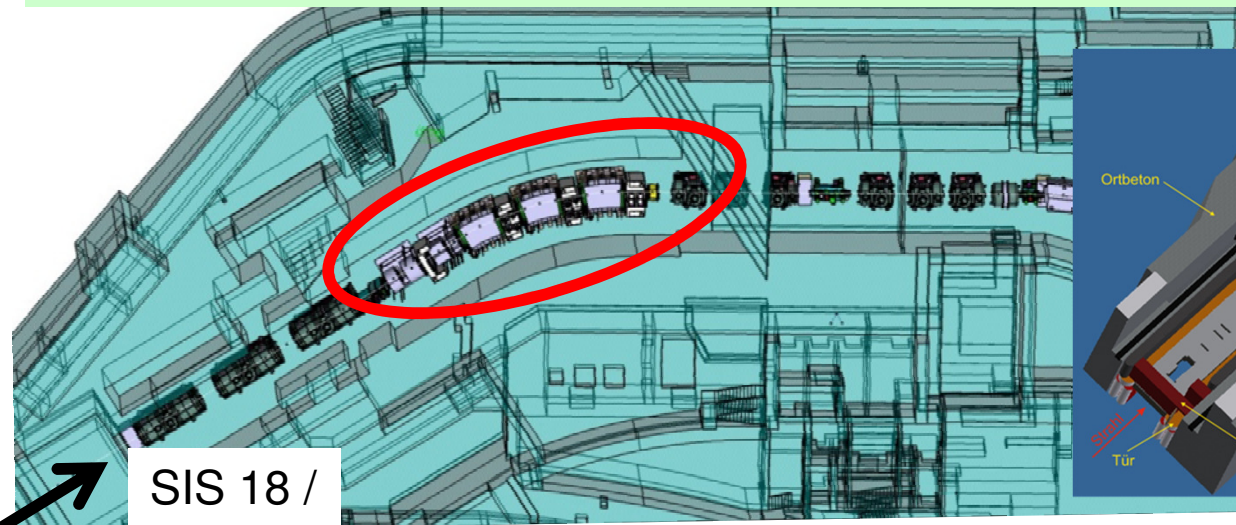
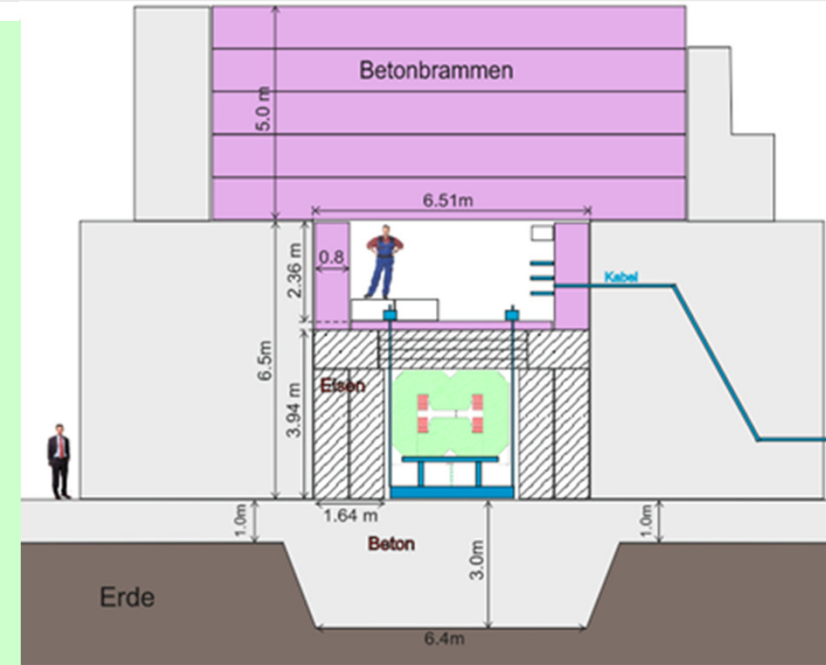
To CR

100 m

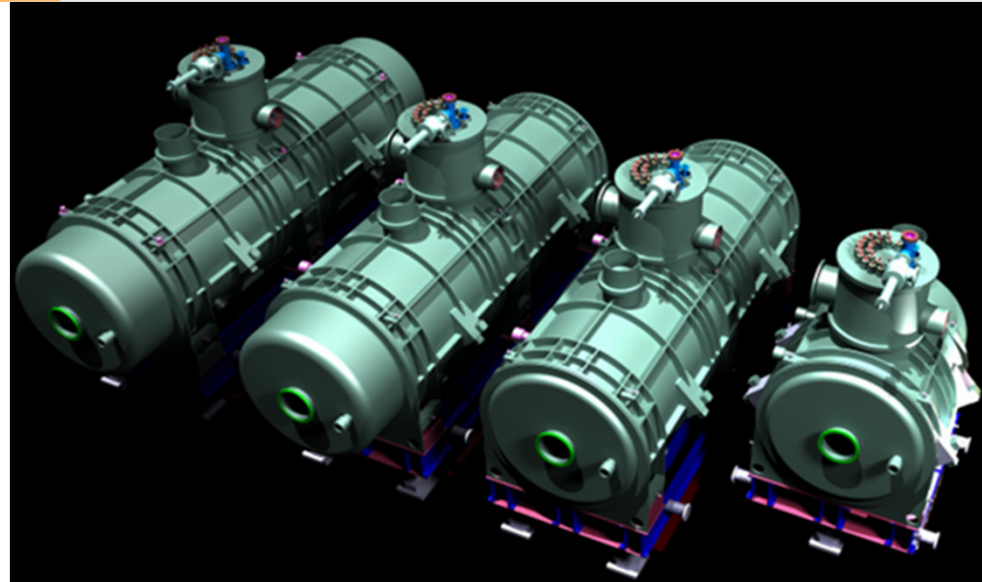


Target Shielding, Build. 018 (CR under approval)

- Detailing of target area shielding planning
 - advanced overhead crane design
 - advanced planning of maintenance-tunnel
- Main measures of proposed changes
 - adapt shielding of beam-tunnel
 - height and shielding of maintenance-tunnel
 - slab shielding of maintenance-tunnel
 - various: front-end access to maintenance-tunnel, storage for plug-insertion, ...



SC Multiplets



Tender History:

- Tender opened in Q3/2013
 - ✓ qualifying and two negotiation rounds
- Interruption in Q2/2014 (formal aspects)
- Re-opening in Q3/2014,
 - ✓ supervised by lawyer's office
 - ✓ no qualifying, two negotiation rounds
- **Contract award July 1st, 2015** 😊 😊 😊
- Winning company: ASG Genoa
- **Contract volume: ≈ 50 M€**

- 25 long multiplets (mainly MS)
- 8 short multiplets (PS)
- Quadrupol triplet / QS configuration
- include corrector elements & steerer



- iron dominated, cold iron (≈40 tons)
- common helium bath, LHe ≈ 1.300 l
- warm beam pipe (38 cm inner diameter)
- per magnet 1 pair of current leads
- max. current <300A for all magnets

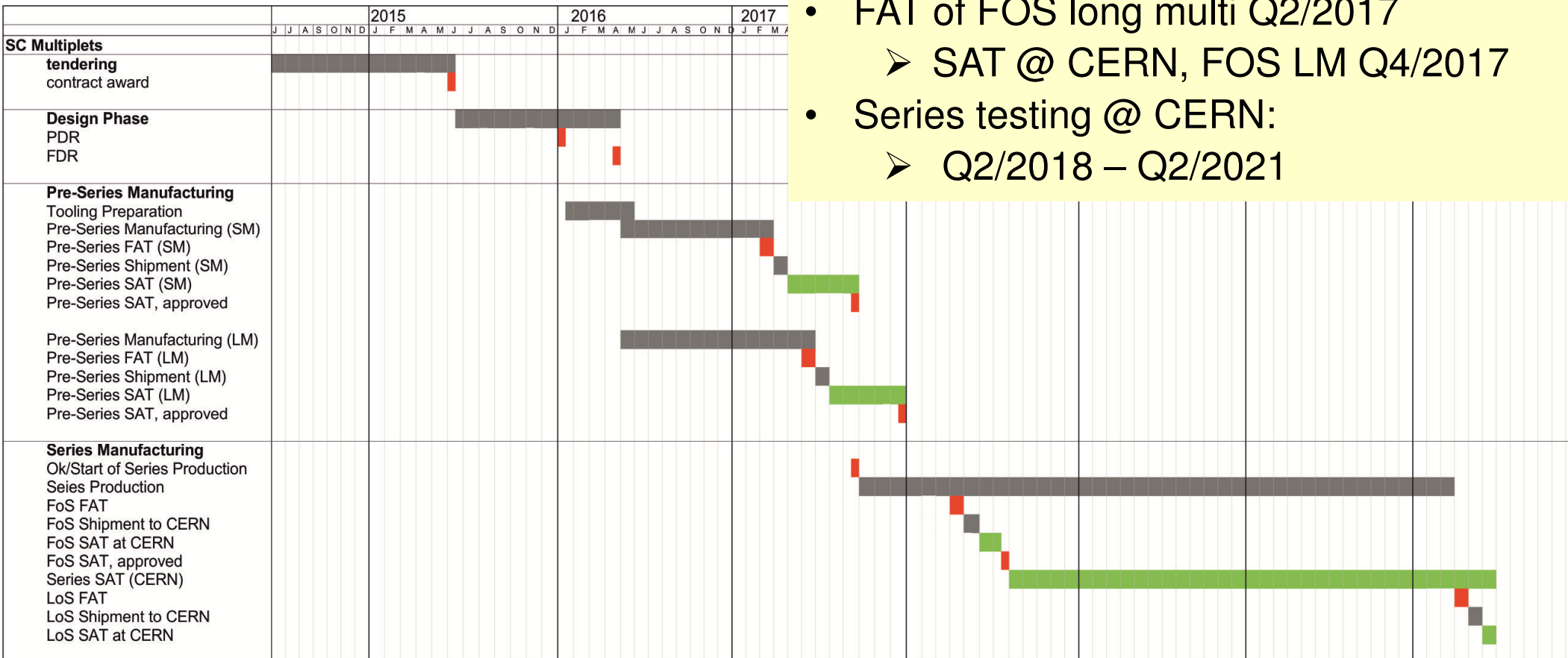
Kick-off, ASG Genoa, July 14, 2015

Overall Manufacturing and Testing Schedule for SC Multiplets



Overall schedule SC multiplets

- design phase until Q2/2015
- FAT of FOS short multiplet Q1/2017
 - SAT @ CERN, FOS SM Q3/2017
 - SAT ok → start of series production
- FAT of FOS long multi Q2/2017
 - SAT @ CERN, FOS LM Q4/2017
- Series testing @ CERN:
 - Q2/2018 – Q2/2021

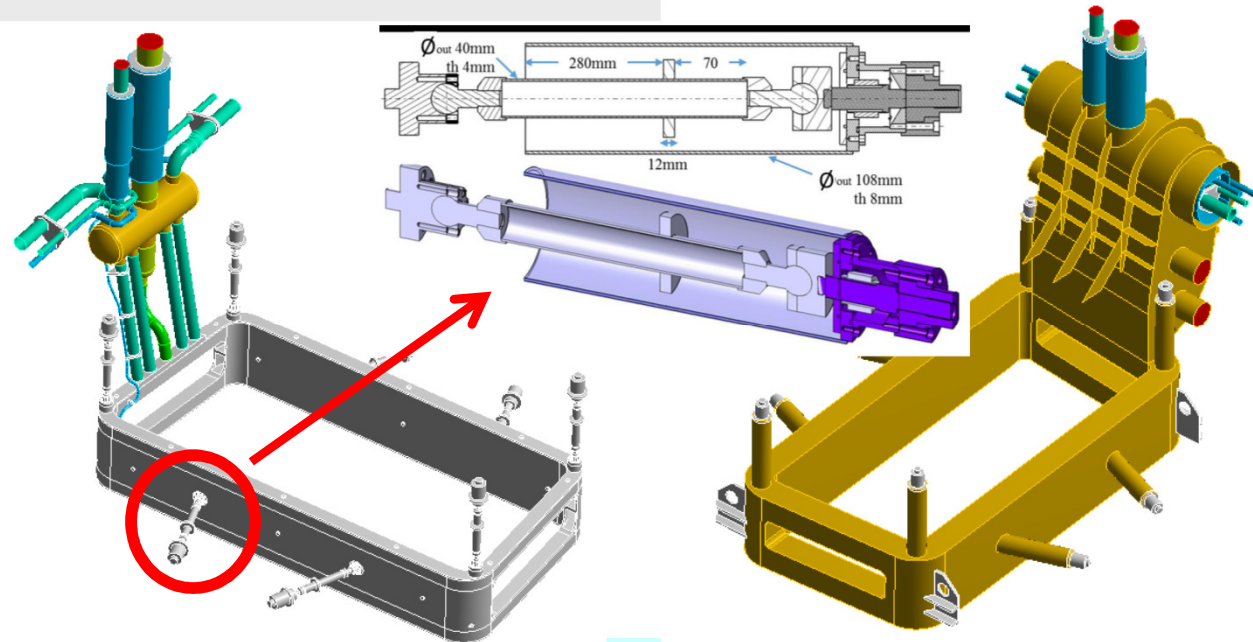
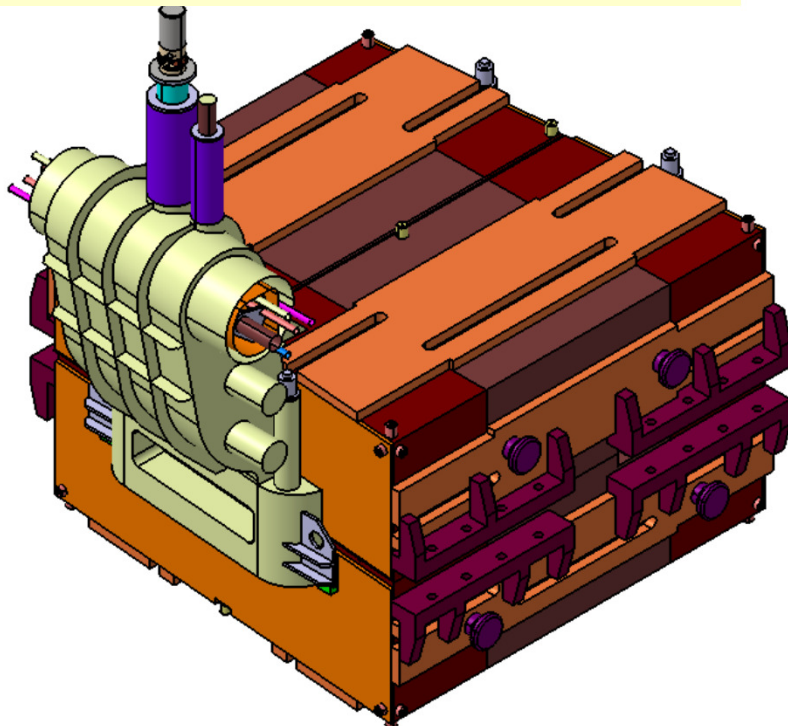


SC Dipole Magnets I



Scope

- 3 dipole units 11°
- 21 dipole units 9.75°
 - 3 times modified cryostat
- Warm iron, SC coil
- Aperture $\pm 190\text{mm} \times \pm 70\text{mm}$
- Weight: 50 to 60 ton



Overall Status (branching dipoles not included):

- ✓ Collaboration agreement with CEA/Saclay:
 - IKC under preparation, includes
 - Detailed design, Technical follow-up
- ✓ Technical Kick-off 01/2014
- ✓ IMP Visit 04/2014 (CEA & GSI)
- ✓ PDR & FDR (includes external advisor)
- ✓ CDR established, DS draft under assessment
 - Design includes all safety aspects (20 bar design)
 - Documents in release process (EDMS, 10/2015)

SC Dipole Magnets II

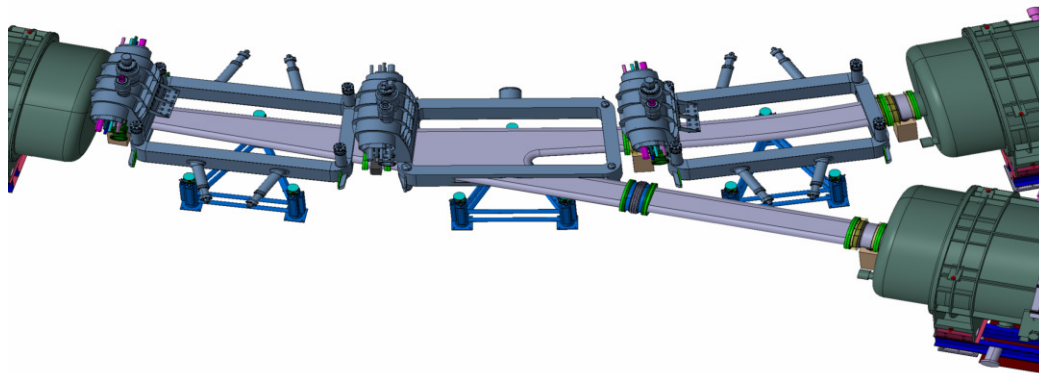


Branching Magnets:

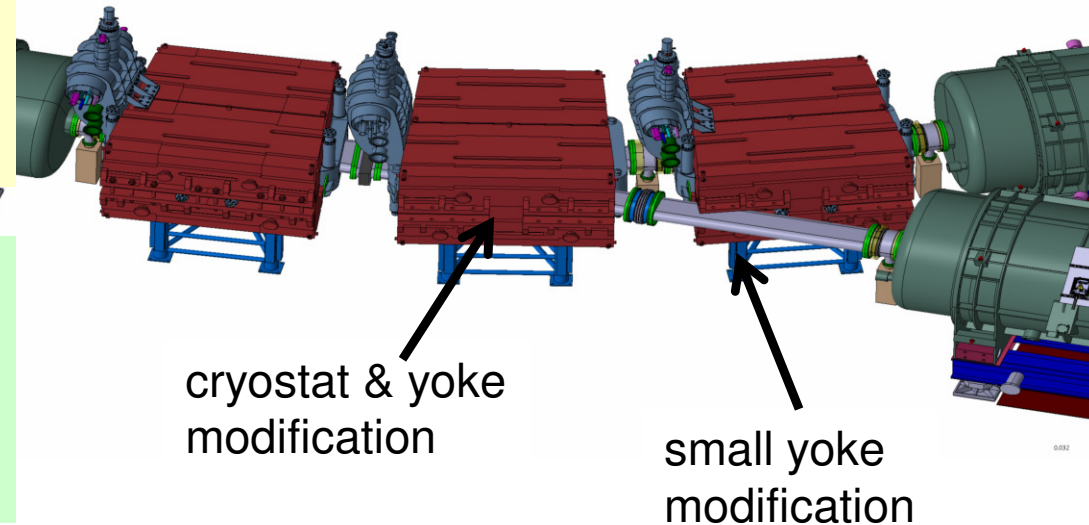
- needs special design for yoke & cryostat
- integration of y-shape vacuum chamber to reinforce cryostat

SC Wire Tendering (closed):

- Contract award 05/2015
- Winning Company: Luvata, Fi
- Delivery 1st batch 05/2016 (-> FOS dipole)



Branching Point



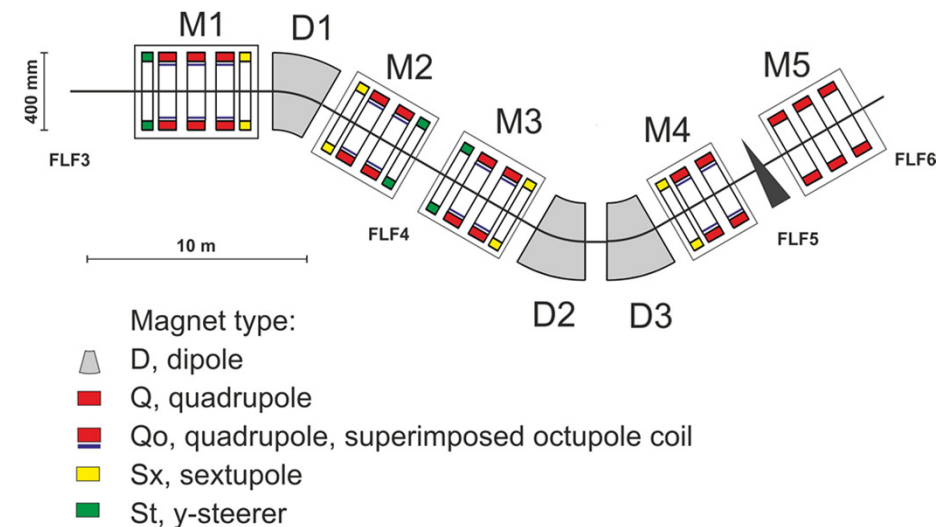
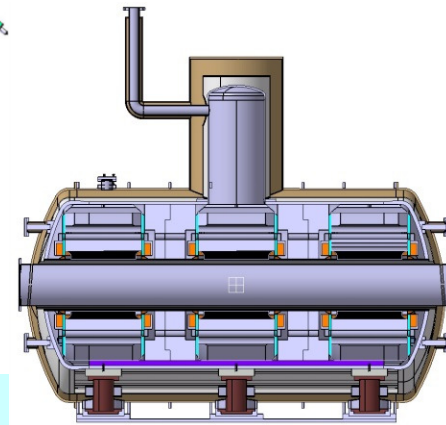
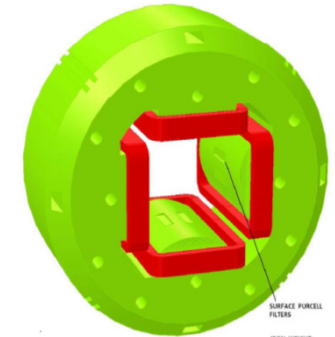
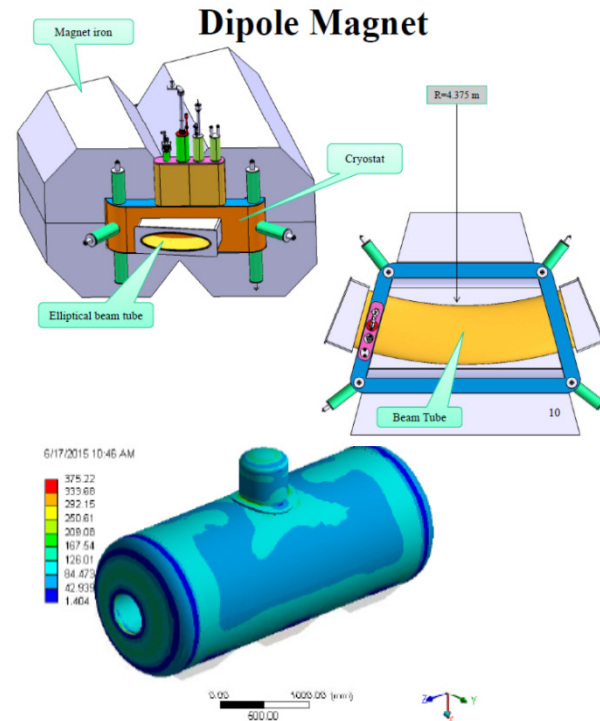
Procurement Dipoles:

- ✓ Pre-bidder information meetings Q4/2014
- Tender opening (by FAIR): Q4/2015
- Contract award expected Q2/2016
- FDR expected Q4/2016
- FAT FOS: Q3/2017
- SAT (CERN): Q1/2018 -> release of series
- Production and Testing of series:
 - Q2/2018 – Q2/2021

Magnets for Energy Buncher

Overall status:

- Collaboration partner VECC (in-kind)
- Regularly meetings established
- Parameters of individual magnets fixed
- Preliminary magnetic designs available
- Preliminary cryostat designs available
 - Collision within available space
 - 20 bar design to be verified

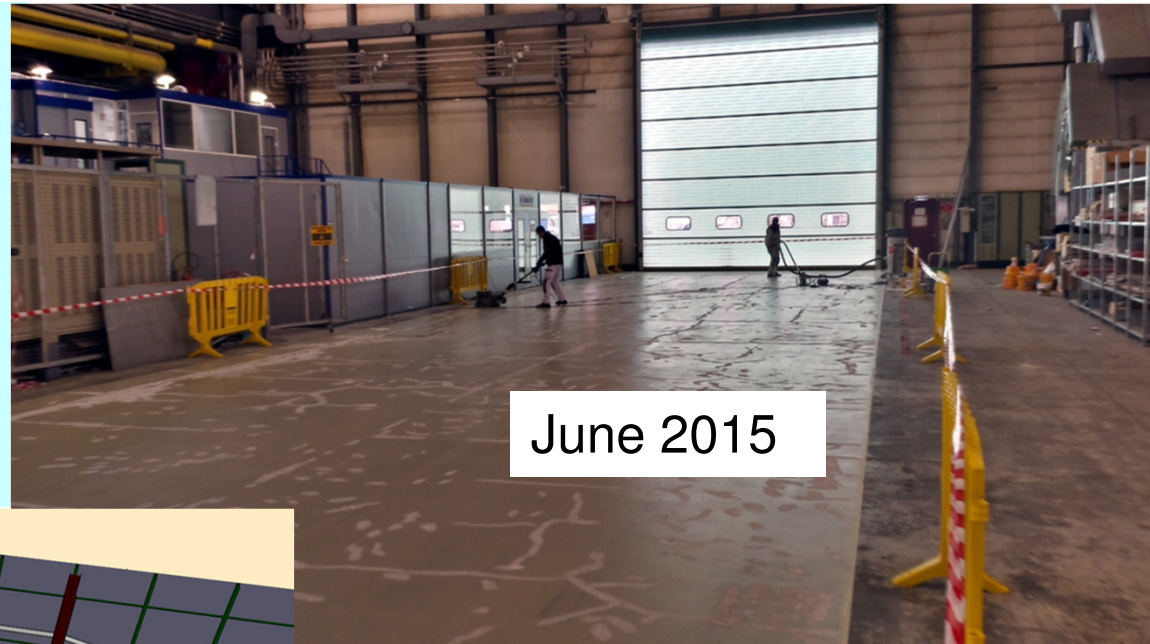


Scope:

- 3 dipole units with 30° deflection angle
 - superferric, warm iron, SC coils
 - challenging: required field quality
- 5 multiplets, QD or QT configuration
 - superferric, cold iron
 - parameters of magnets like in separator

Magnet Testing @ CERN

- Scope (separator magnets):
 - ✓ 24 Dipoles (PS & MS),
 - ✓ 31 Multiplets (+ 2 spare)
 - does not include EB magnets
- Place: CERN building 180; includes:
 - testing area, storage area
 - control room, offices



- Facility ready in Q4/2016
- 3 universal test benches, basically:
- 1 setting-up & cool-down
 - 1 measuring
 - 1 warm-up & disassemble
- each activity ≈ 15 days
- Series measurement time
- 3 to 3.5 years

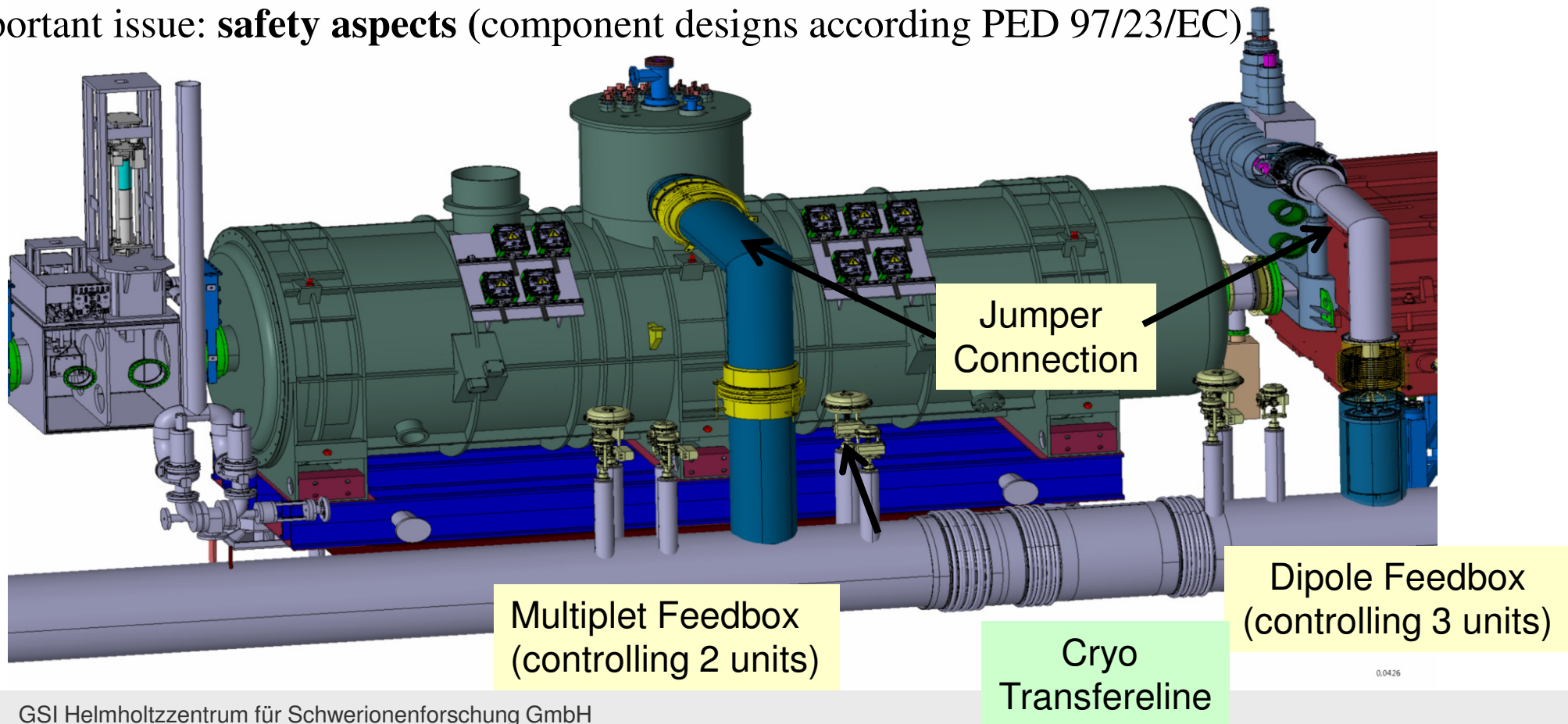
Super-FRS Local Cryogenics

Tasks:

- Design and development of Super-FRS local cryogenic system
- Specifying/developing of main LC components (**Polish IKC**)
- Support of Super-FRS SC magnet development
- Support to the design of the testing facility @ CERN

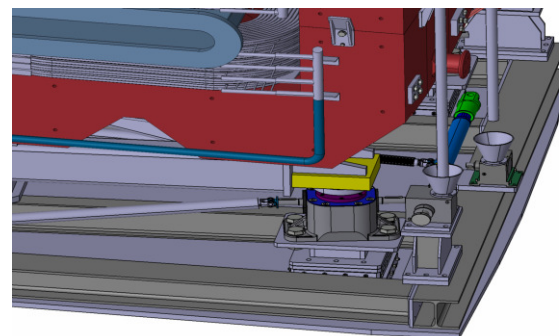
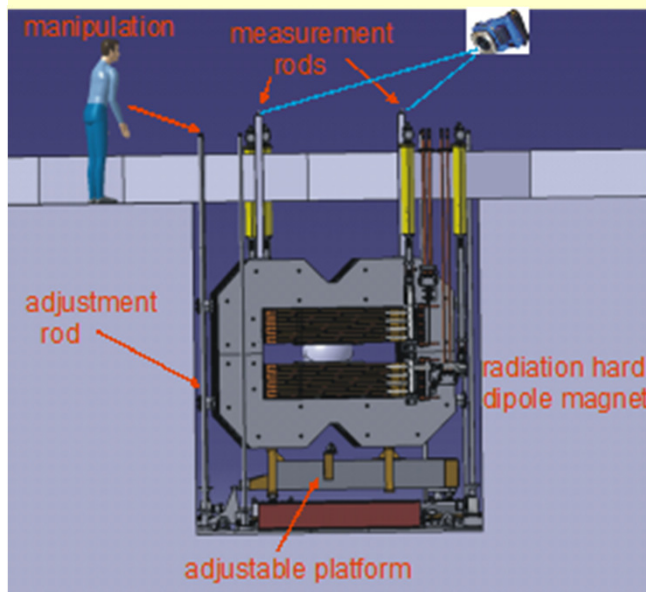
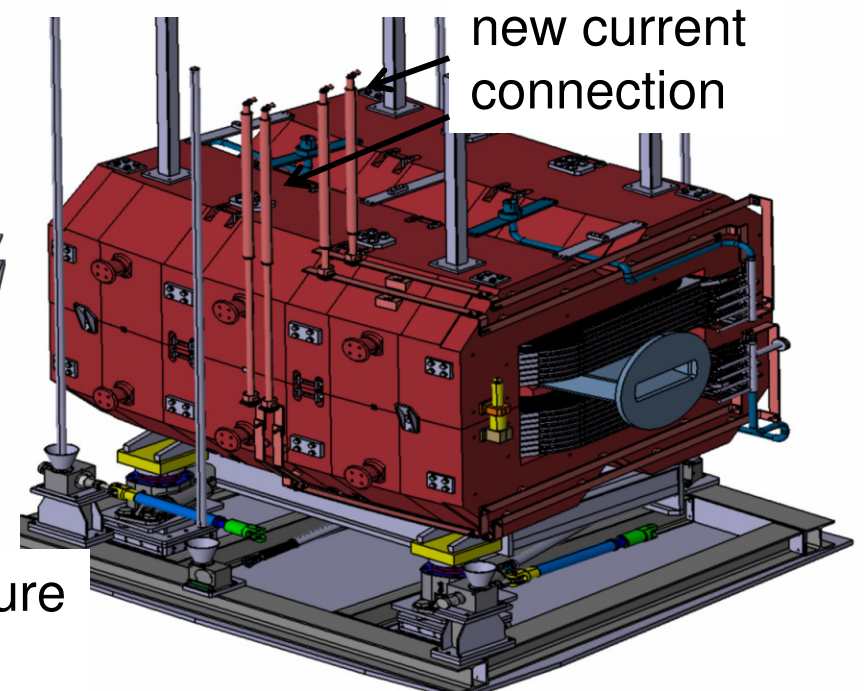
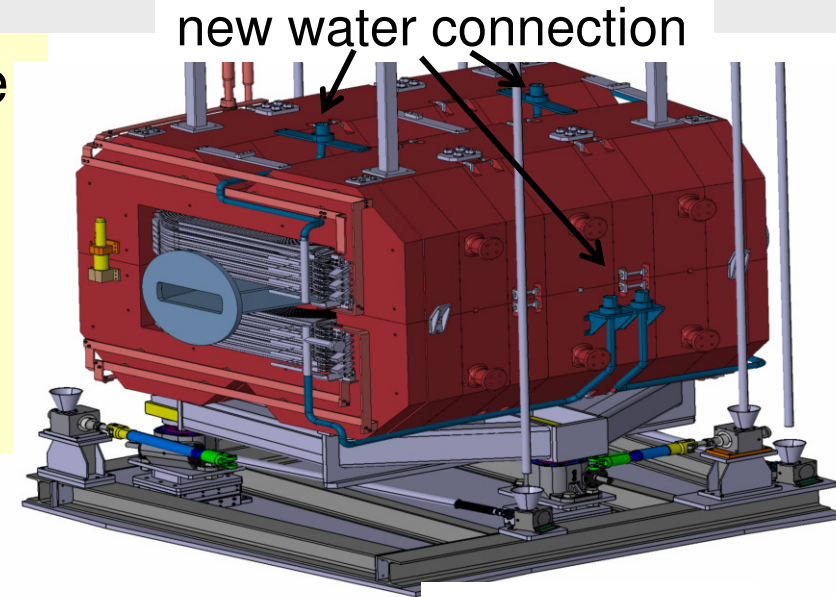
→ see also presentations:
F. Wamers (Super-FRS LC)
M. Chorowski (Polish IKC)

Important issue: **safety aspects** (component designs according PED 97/23/EC).



Radiation Resistant Magnets (at the Target Area of Super-FRS)

- ✓ Normal conducting magnets using MIC cable
- ✓ 3 dipole units, 3 quadrupoles, 2 sextupoles
- ✓ Prototype dipole (95 ton) built and tested
- Modification of remote alignment
 - ✓ Design ready
 - ✓ Tender (construction) in preparation
- Remote connectors under revision
- Tendering of magnets via FAIR (Q3/2016)



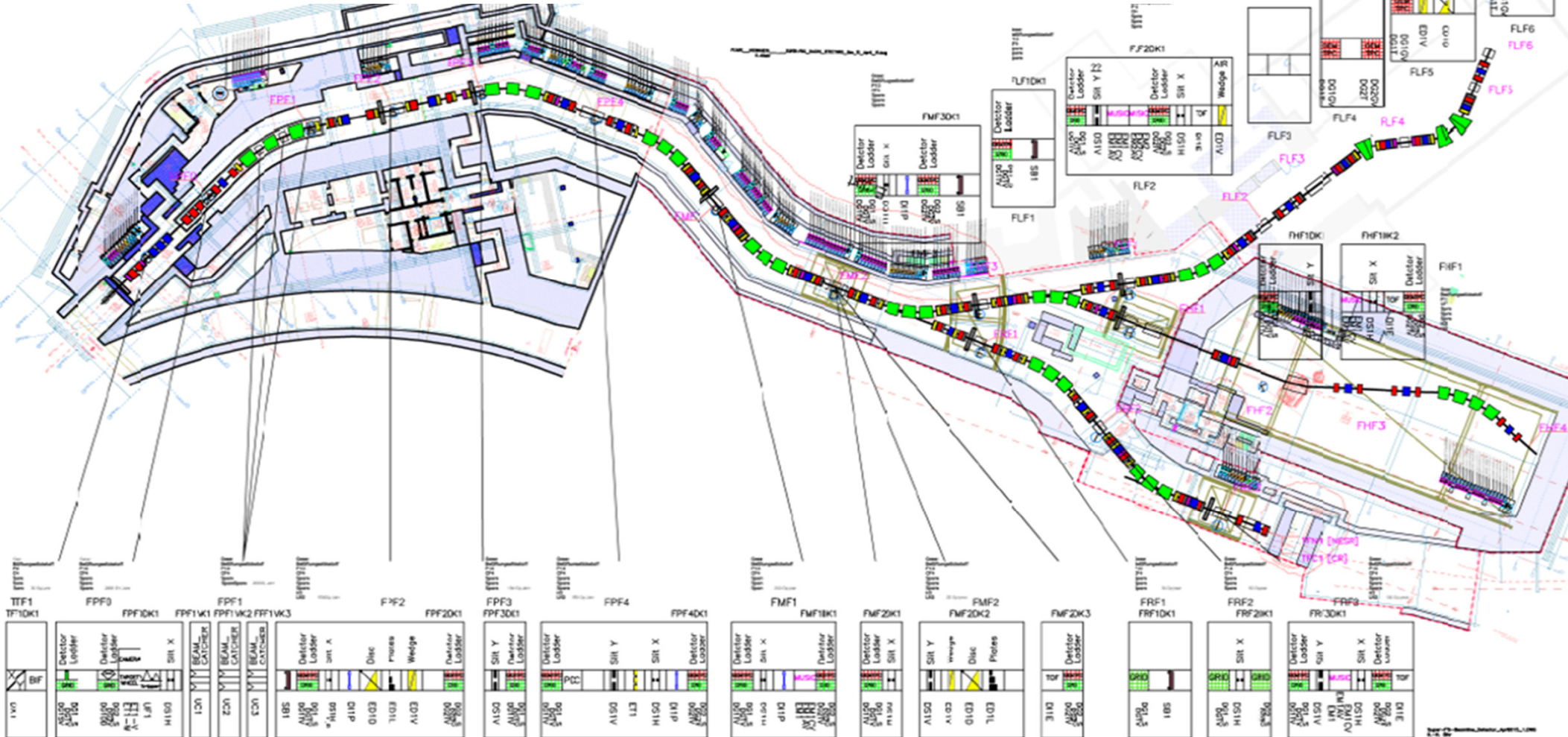
new support structure
(lubricants free)

Focal Plane Equipment (Overview)

→ see also presentation
C. Nociforo on recent detector tests

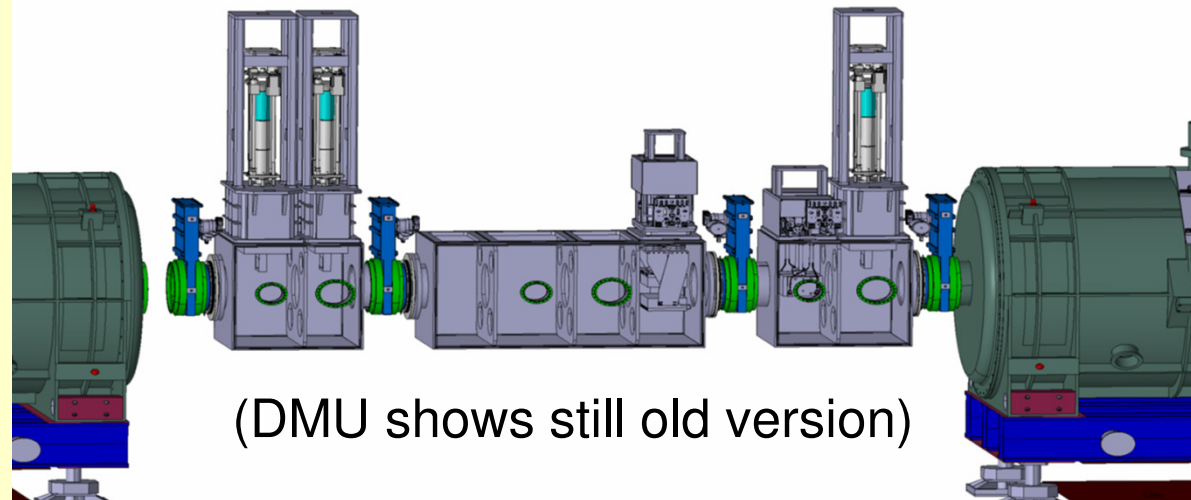
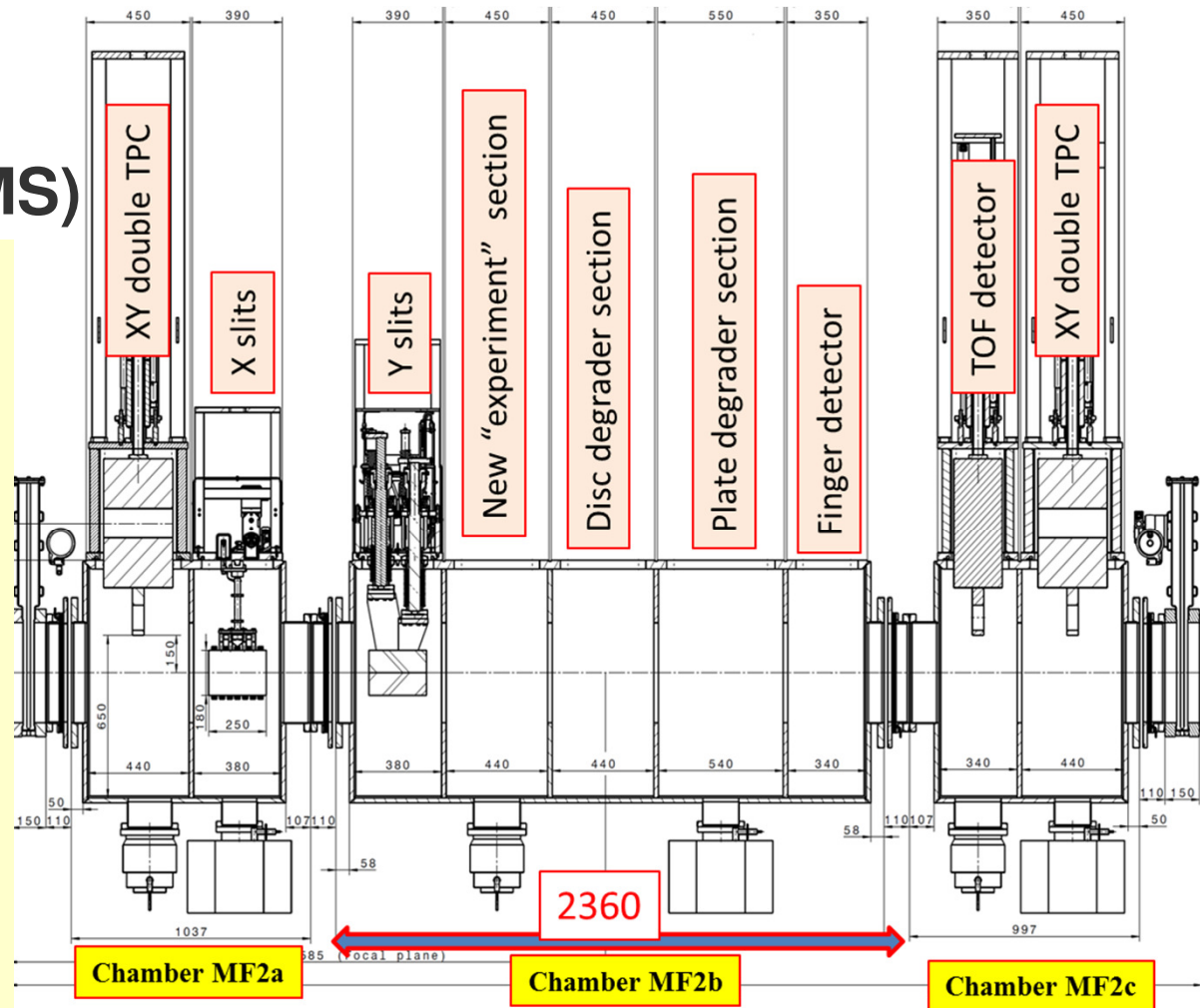


- Beam instrumentation defined for each focal plane (separator mode)
- Beam Diagnostic & particle identification (x , y , x' , y' , ΔE and TOF)
- Major challenges: radiation hardness, particle rates (1/day... 10^9 /s), dynamic range (p...U, 100...1.500 MeV/u)



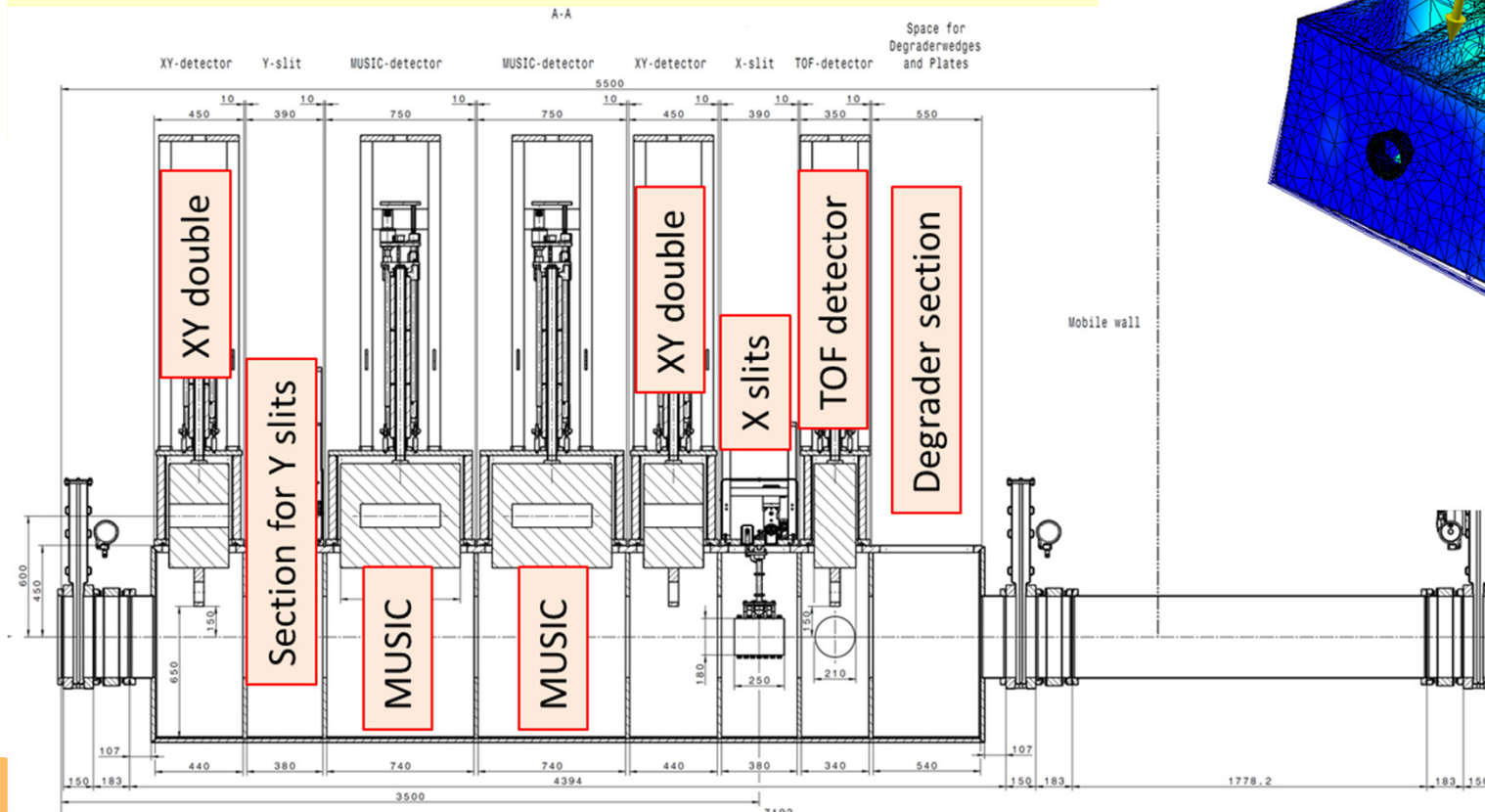
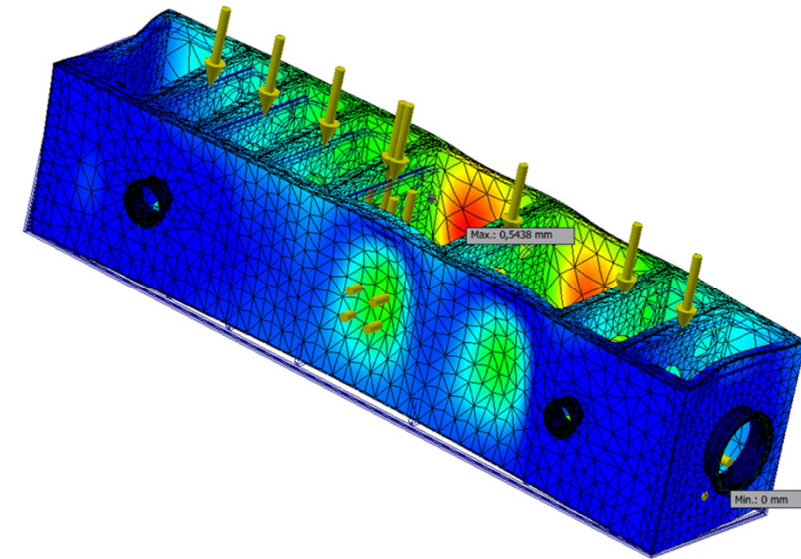
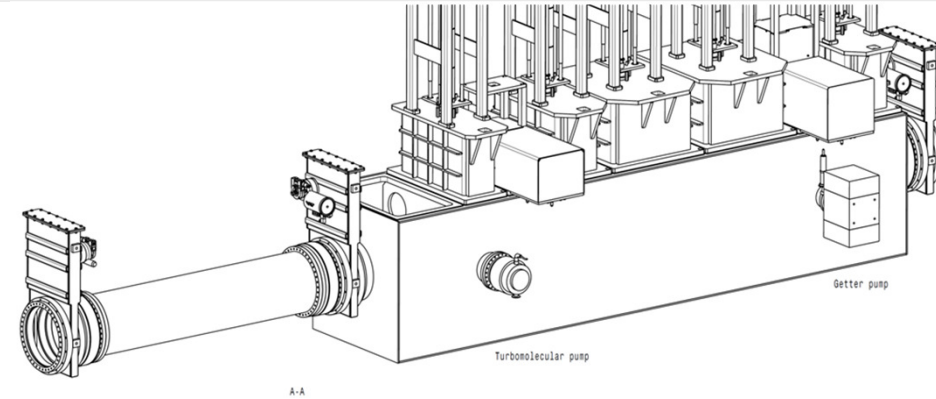
Focal Plane Chambers (example: FMF2, midplane MS)

- Overall 19 chambers
- Chambers cross section
 - 720 x 1130 mm²
 - 970 x 1130 mm² (slits)
 - 970 x 1280 mm² (degrader)
- Chambers length
 - from ≈ 800 mm to ≈ 4.400 mm
- ✓ 'Standardize' flanges for inserts
- ✓ Pumping ports and vacuum instrumentation considered
- ✓ FEM simulation on chamber stability including insert load
- ✓ DMU collision checks
- ✓ Remote handling capability (robotic @ Pre-Separator)
- ✓ Modularized chambers arrangement at FMF2 and FHF1



Focal Plane Chambers (example: FLF2, exit slit LEB)

- FLF2 area prolonged by 2m
- 8 inserts, length ≈ 4.400 mm
- includes now:
 - two large flanges for MUSIC
 - additional flange for degrader (final layout still under discussion)



Beam Instrumentation

(slits, degrader, secondary targets, ...)



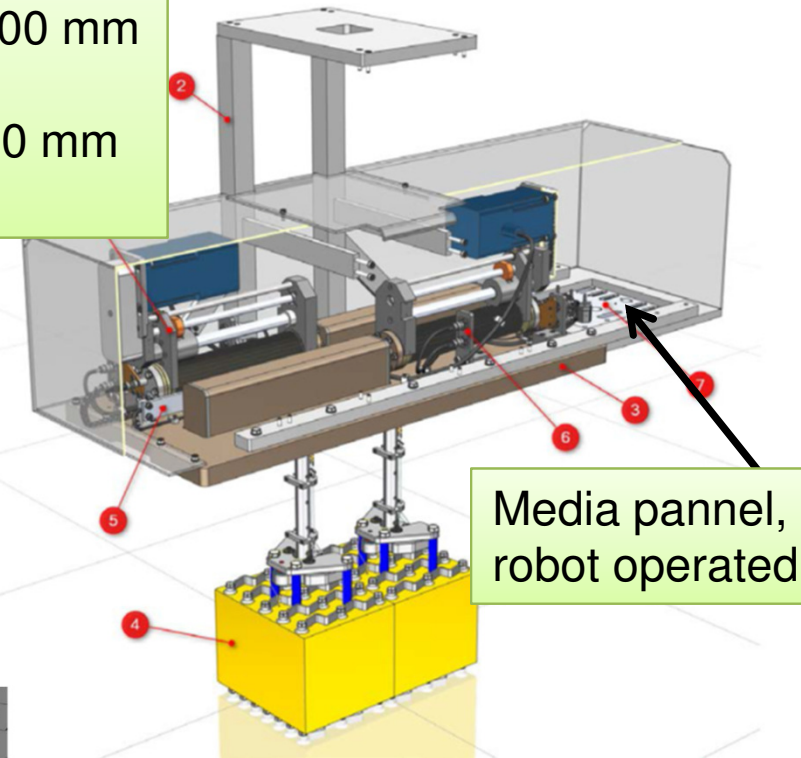
university of
groningen



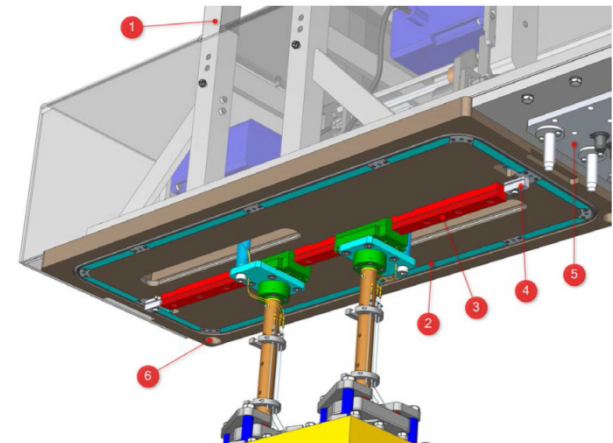
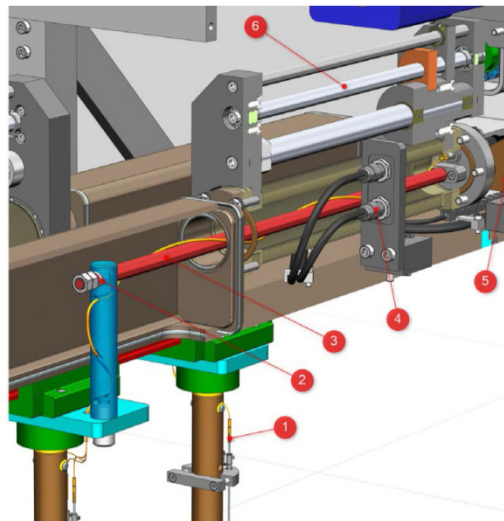
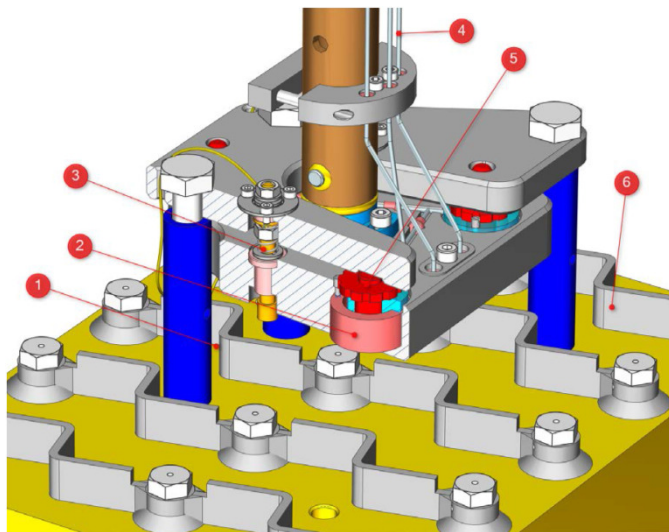
x/y Slit-systems

- Overall 18 slit pairs required
- Remote handling foreseen
- ✓ Specification established
- ✓ Collaboration contract with KVI-CART
- ✓ PDR done 08/2014,
 - Pre-design existing
 - thermal simulation / cooling issues considered
- Pre-Series slit-system expected Q3/2015

x-slit system:
block size: 200mm x 200 mm
y-slit system:
Block size: 400mm x 90 mm
Material: Densimet



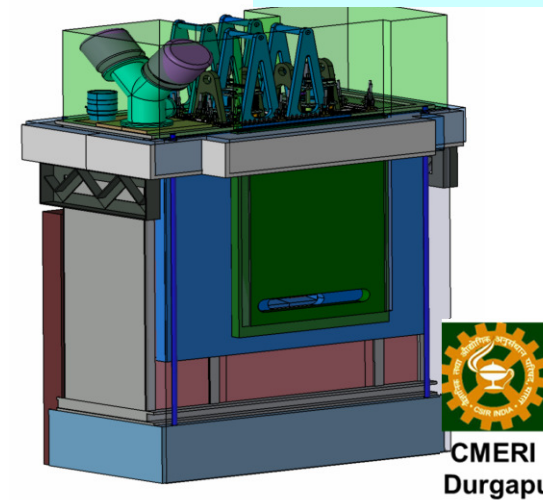
Media panel,
robot operated



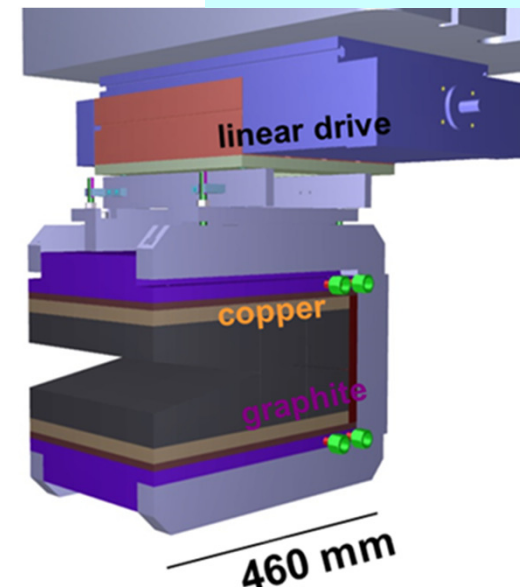
Target Area Installation

- Target chamber & plug inserts (German in-kind)
 - ✓ draft specification existing
 - collaboration contract with KVI-CART in preparation
- Target wheel & plug inserts (German in-kind)
 - ✓ Prototype wheel existing, long term R&D running
 - collaboration contract with KVI-CART in preparation
- Beam catcher (Indian in-kind, chamber & plug inserts)
 - ✓ visit of CMERI colleagues in Q4/2014 →
 - ✓ definition report agreed → preparation of specification
- Pillow seals (German in-kind)
 - ✓ Prototype set-up (large size) existing

BC chamber



BC plug insert



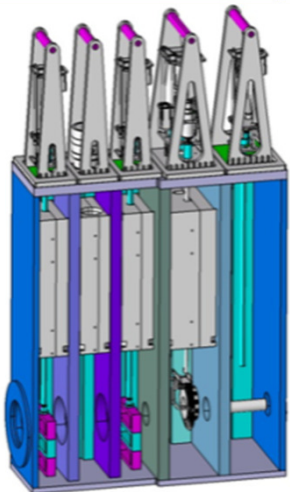
Pillow seal set-up



Prototype target wheel



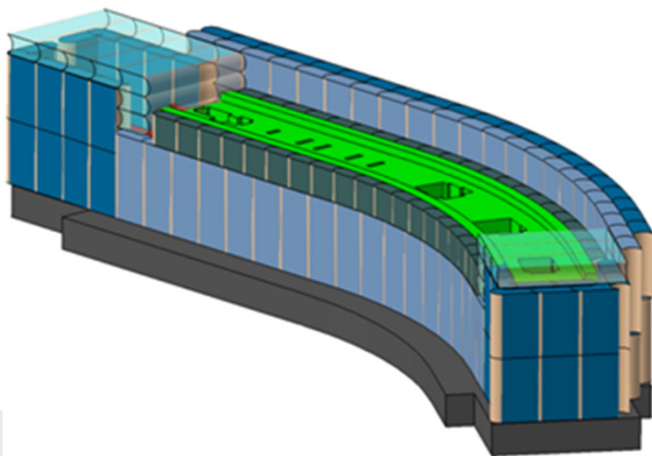
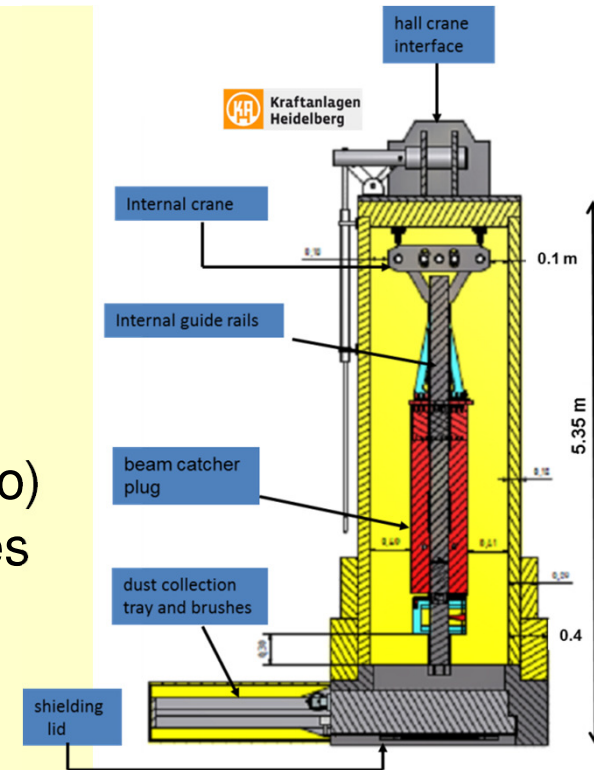
Target chamber



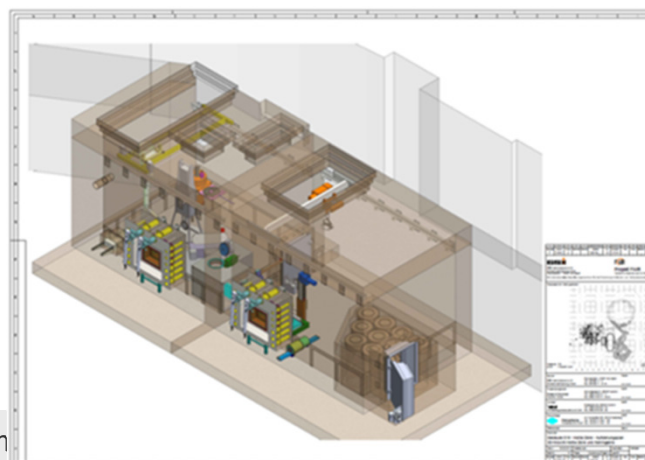
für Schwerion

Target Area Infrastructure

- Hot Cell Complex (German in-kind)
 - Two-cell concept (maintenance and storage)
 - ✓ Prelim. & approval planning by nuclear eng. company
 - ✓ Mock-up installed on ESR roof
- Shielding flask (Finnish in-kind, 50 ton)
 - ✓ Draft specification available
 - ✓ Finnish partner identified (Hollming Works LTD, U Aalto)
 - GSI/FAIR will have responsibility on permissions issues preplanning → approval process → order production.
- Iron shielding (previous 'missing item', not yet assigned)
 - ✓ Draft specification available



ing Gm



- ## Last Project Plan update

The screenshot displays a Microsoft Excel spreadsheet with a complex financial model. The spreadsheet is organized into columns and rows, with alternating light blue and white background colors for rows. The columns are labeled with various financial metrics, and the rows contain numerical data points. The data is presented in a structured, tabular format, typical of financial modeling software. The spreadsheet appears to be a detailed financial model, possibly for a company's performance over time, with multiple columns for different financial metrics and rows for different time periods or scenarios. The data is presented in a clear, organized manner, with numerical values and some text labels visible in the cells.

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	

Case No.	Test Name	Test Date	Test Result	PC/Code	Signature/Date	Reviewer
22_04_08_02	Mitochondrial DNA 2018	01.12.2018 08:00	2018	12.36	MMC/AC2018	
22_04_08_02	ACU1 encoded	18.12.2018 17:00	2018	12.2.6.8.1.2.2	2000	
22_04_08_02	DCT1 encoded	18.12.2018 08:00	2018	12.2.6.8.1.3.8	2000	
22_04_08_02	ACU1 encoded	18.12.2018 08:00	2018	12.2.6.8.1.2.2	2000	
22_04_08_02	DCT1 encoded	18.12.2018 08:00	2018	12.2.6.8.1.3.8	2000	
22_04_08_02	ACU1 encoded	21.12.2018 08:00	2018	12.2.6.8.1.2.2	2000	
22_04_08_02	DCT1 encoded	21.12.2018 08:00	2018	12.2.6.8.1.3.8	2000	
22_04_08_02	ACU1 encoded	21.12.2018 08:00	2018	12.2.6.8.1.2.2	2000	
22_04_08_02	DCT1 encoded	18.12.2018 08:00	2018	12.2.6.8.1.3.8	2000	
22_04_11_02	design contract signed	04.11.2018 08:00	2018	11.2.1.1.1.3		

- Civil Construction
 - review on target shielding design -> CR
 - execution planning ready to be continued
- SC Magnets and Testing (most time critical items):
 - multiplets: contract awarded
 - dipoles: CDR established, tendering in preparation; design of branching units still tbd
 - Test facility at CERN under preparation
- Development and procurement of various components under way (according project plan)
- Project control and steering using MS Project