



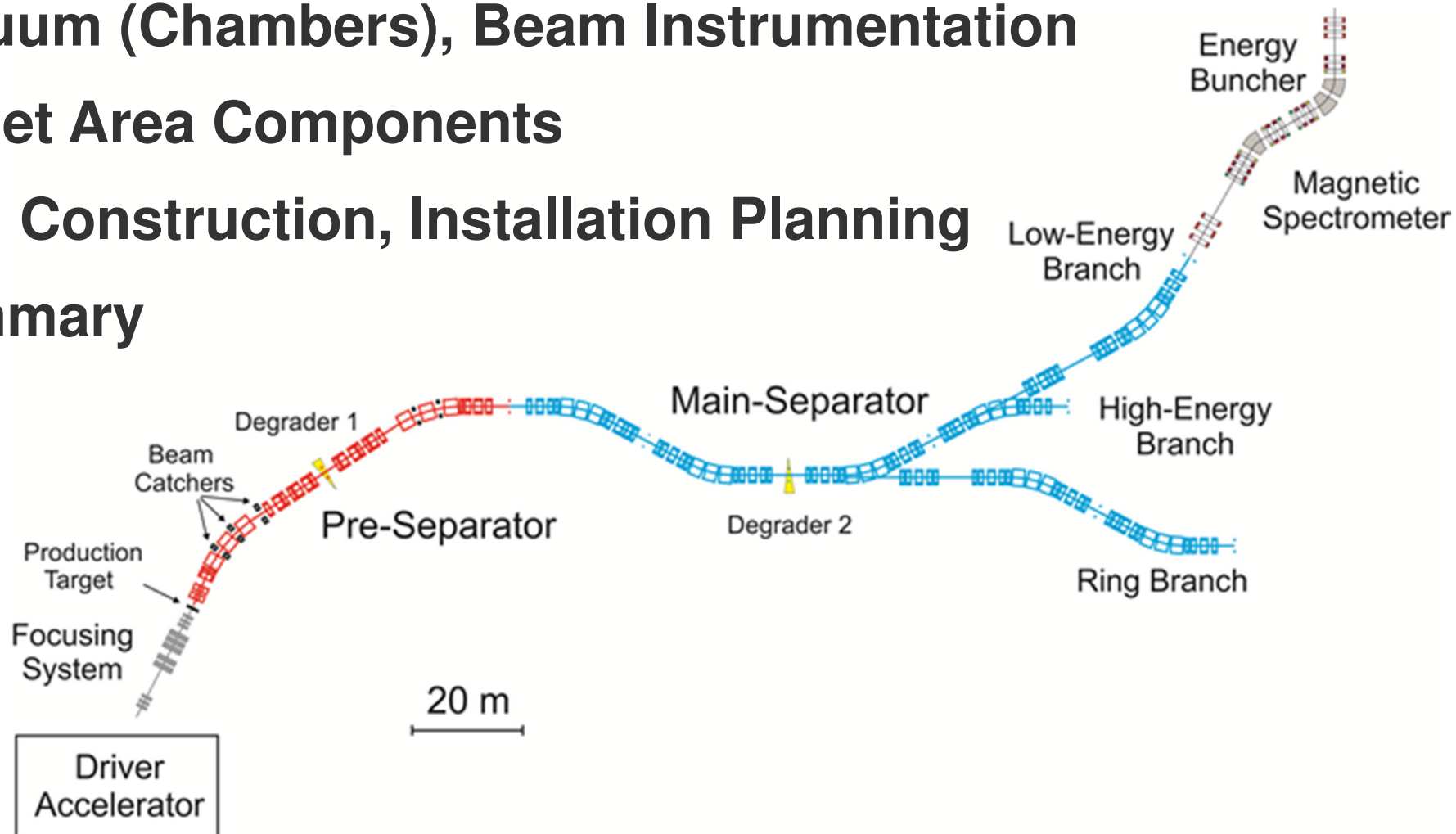
Super-FRS Status

M. Winkler

NUSTAR Annual Meeting, GSI, March 1 - 2, 2017

Outline

- 1) Magnets, Testing and Local Cryogenics
- 2) Vacuum (Chambers), Beam Instrumentation
- 3) Target Area Components
- 4) Civil Construction, Installation Planning
- 5) Summary



Magnets I

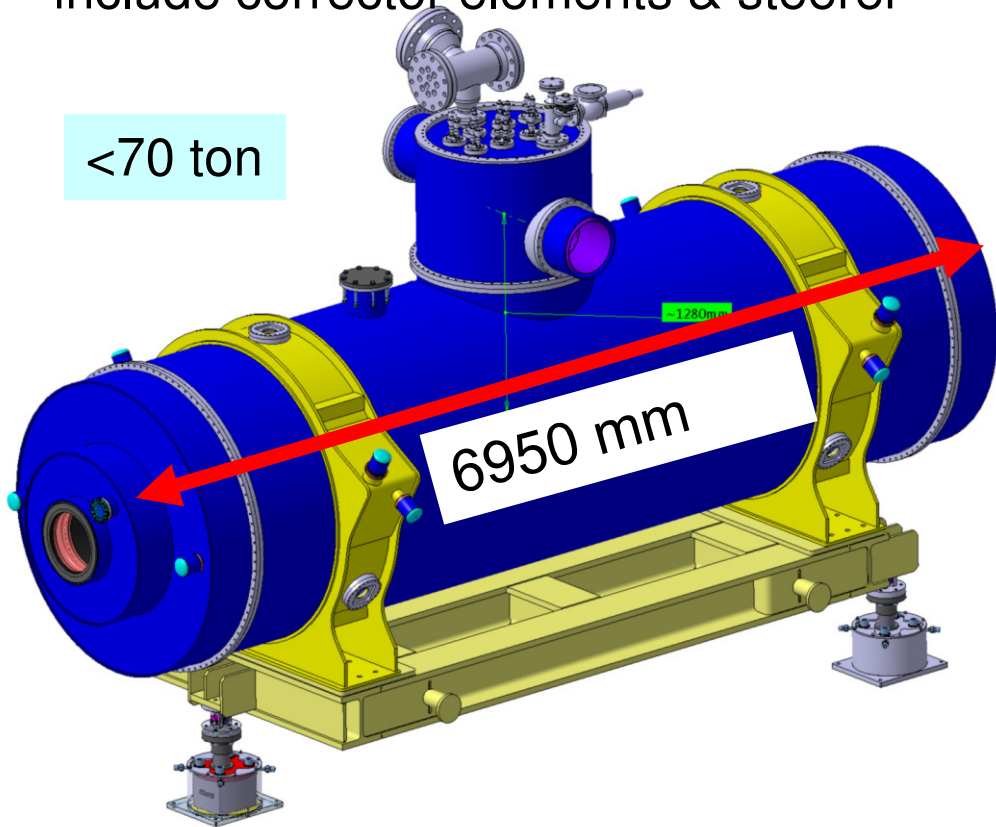
(SC Multiplets, Overview)

H. Müller,
E.J. Cho et al.



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

<70 ton



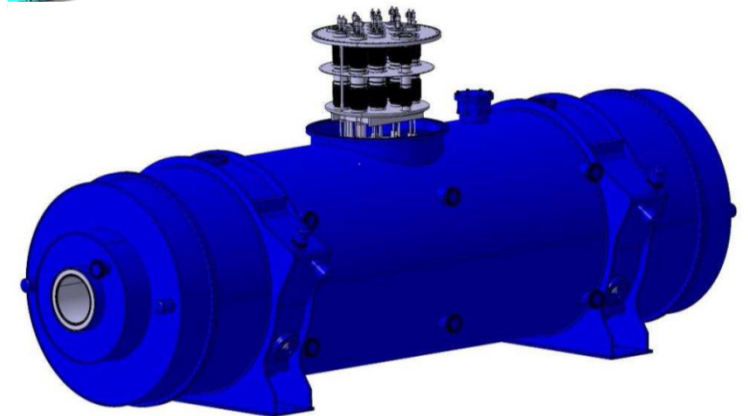
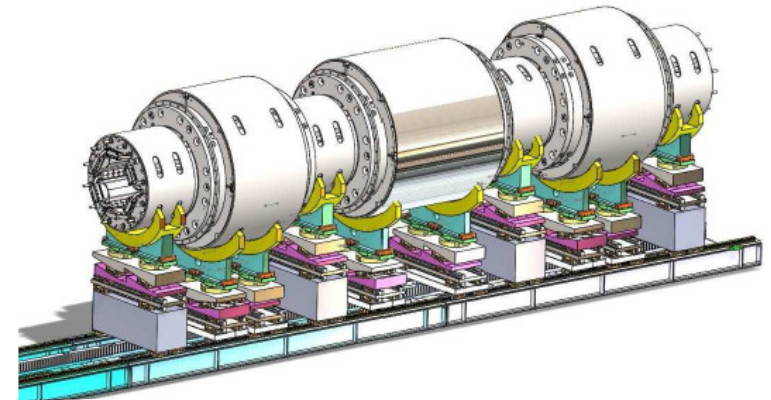
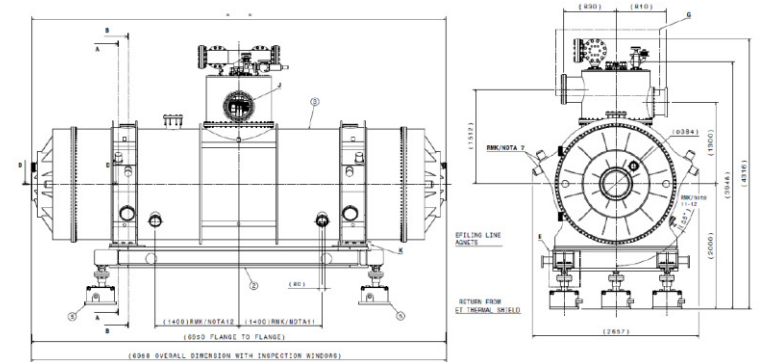
Overall schedule SC multiplets

- ✓ Contract closed 07/2015
 - (ASG, Genova)
- ✓ Design phase running
 - ✓ PDR 07/2016
 - ✓ FDR scheduled Nov 30th / Dec 1st
 - PRR 05/2017 (short multiplet)
- FAT of FOS short multiplet 12/2017
 - SAT @ CERN, FOS SM 06/2018
 - SAT ok → start series production
- FAT of FOS long multiplet 07/2018
 - SAT @ CERN, FOS LM 01/2019
- Series testing @ CERN:
 - Q2/2019 – Q4/2022

Magnets II

(SC Multiplets, PDR & FDR)

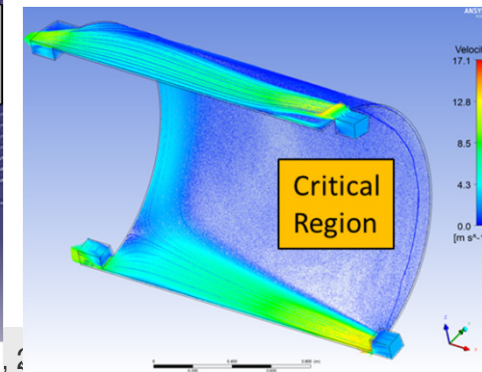
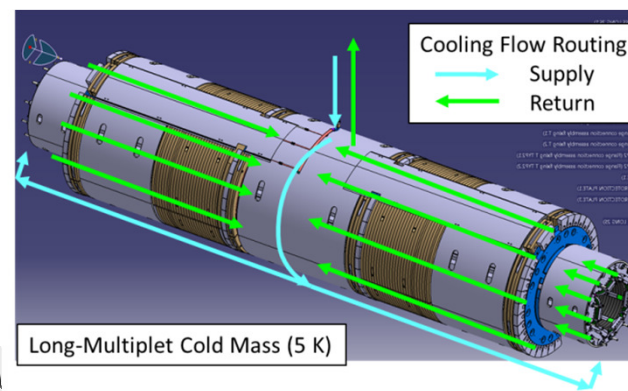
- PDR Jul 26th , 34 documents
 - Magnetic design of all individual magnets
 - Sensitivity analysis / field quality
 - Mechanical design
 - Assembly concept
- FDR Nov 30th / Dec 1st , 74 documents
 - Detailed calculation reports (including beam pipe analysis, tie rod sizing, quench calculation, ...)
 - Reports on mock-up
 - QCP / QA documents
 - Set of drawings (≈320) / 3D Model
 - Lifting / sliding tool
 - Support foot



Magnets III

(SC Multiplets, Production Preparation)

- Wire procurement running
- Steel procurement running
- ✓ Existing press refurbished
- ✓ Specimen: quarter yoke (500 mm) produced
- ✓ Specimen: beam tube produced,
 - μ r measurement done → field quality
 - vacuum tests done → cleaning process
- ✓ Optimization of cool down routing running
- ✓ Coil impregnation
 - HV tests, mechanical strength
- ✓ Sextupole coil produced
- Steerer support tube (with grooves)
 - Specimen procured
 - steerer mock-up running
- Current Lead procurement running
 - qualification at GSI (CW 12/2017)
 - test cryostat in preparation



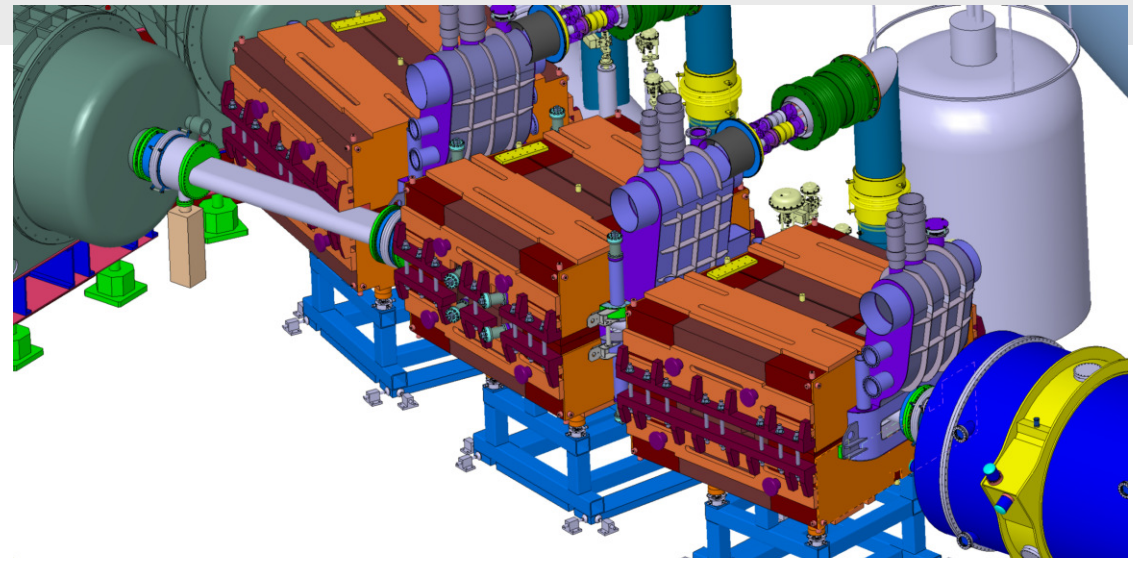
Magnets IV

(SC Dipole Magnets, Status)



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



Design Status (standard dipole units):

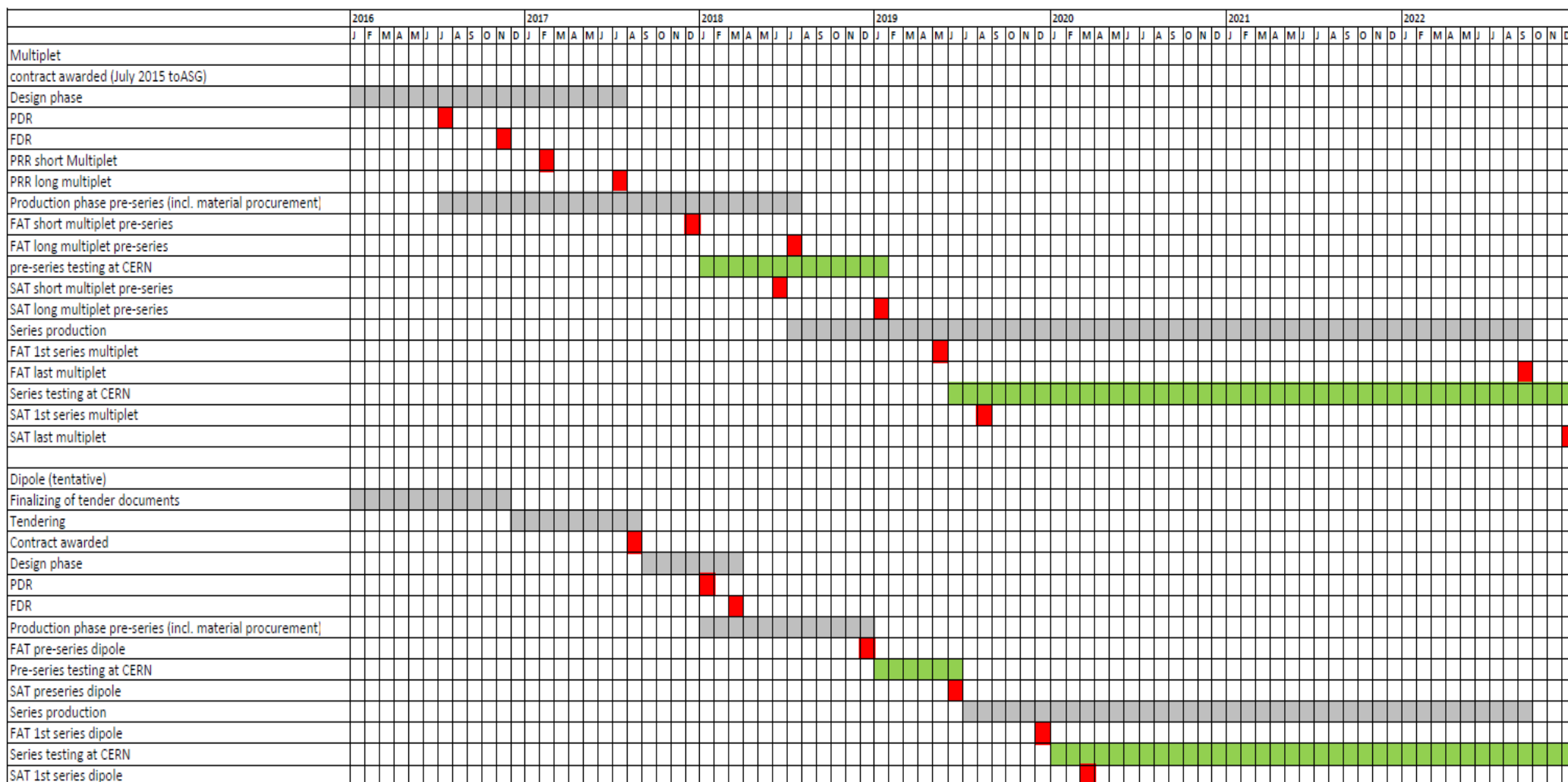
- ✓ Collaboration agreement with CEA/Saclay:
 - Detailed design, Technical follow-up
- ✓ 3D Model & 2D definition drawings are finalized
- ✓ Detailed Specification approved
- ✓ Conceptual Design Report approved
- ✓ Tender documentation ready

➤ **Tender to be launched CW 10/2017**

Branching Magnets:

- needs special design for yoke & cryostat
- ✓ R&D contract with CEA/Saclay:

Magnets V (Schedule)

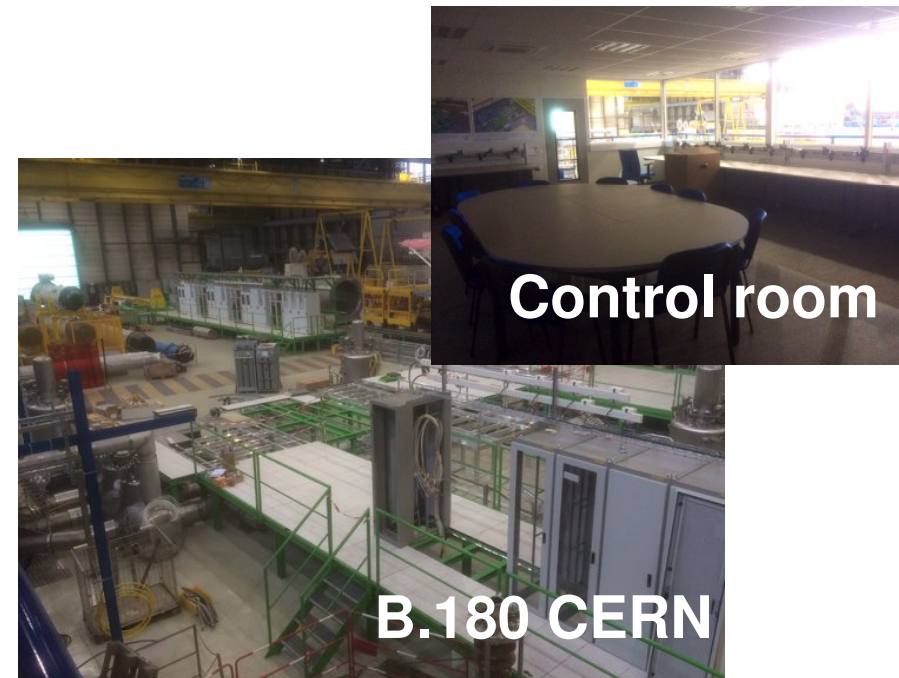
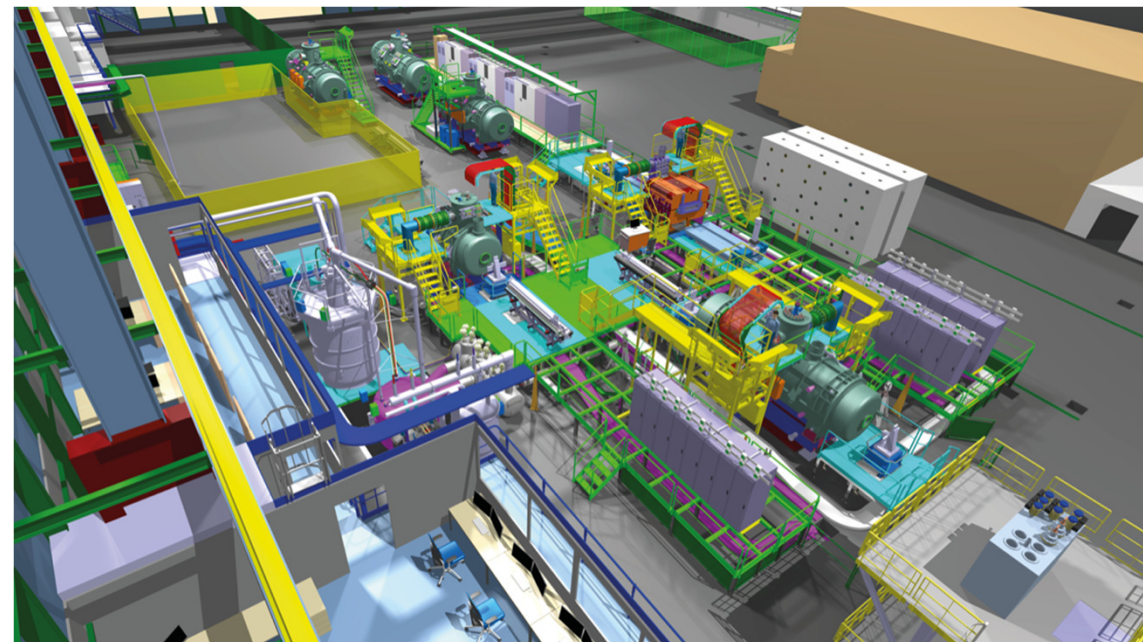


Magets VI (SC Magnet Testing @ CERN)

P. Schnizer,
K. Sugita et al.



- Collaboration between CERN and GSI
 - CERN Building 180: Infrastructures, renovation
- Cold (4K) testing of the superconducting dipoles and multiplets
 - 3 test benches, incl. magnetic field measurements
- Completion of the facility soon
- Commissioning will be started in 2017
- Pre-series short multiplet testing is planned in 2018
- Schedule, resource plan for the operation have to be finalized



Magets VII (Local Cryogenics Interface)

F. Wamers,
Y. Xiang et al.

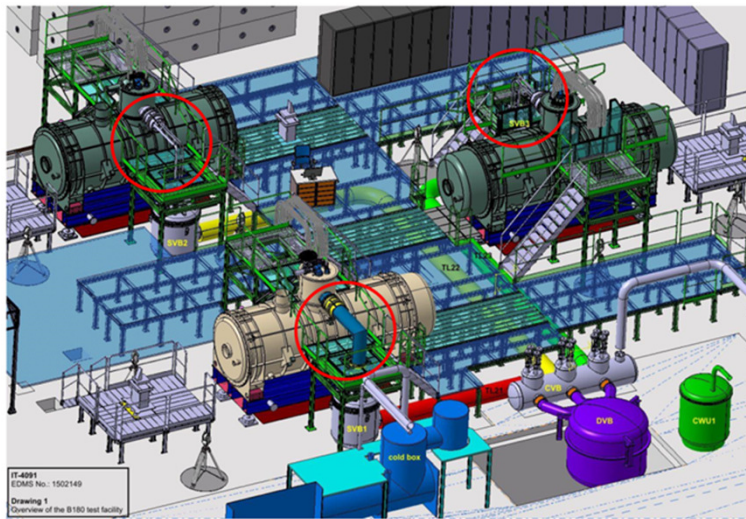
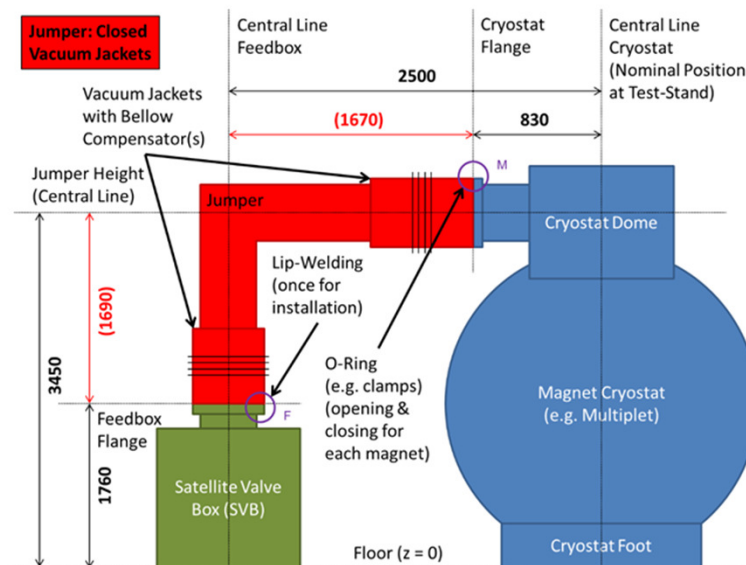
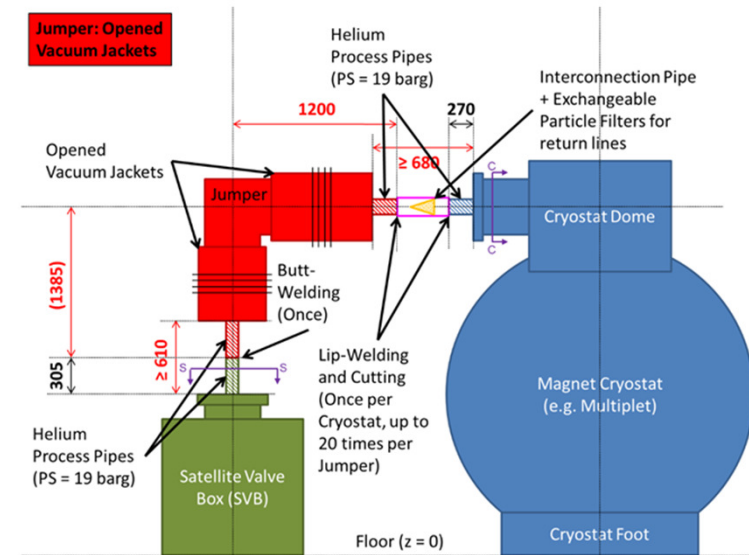
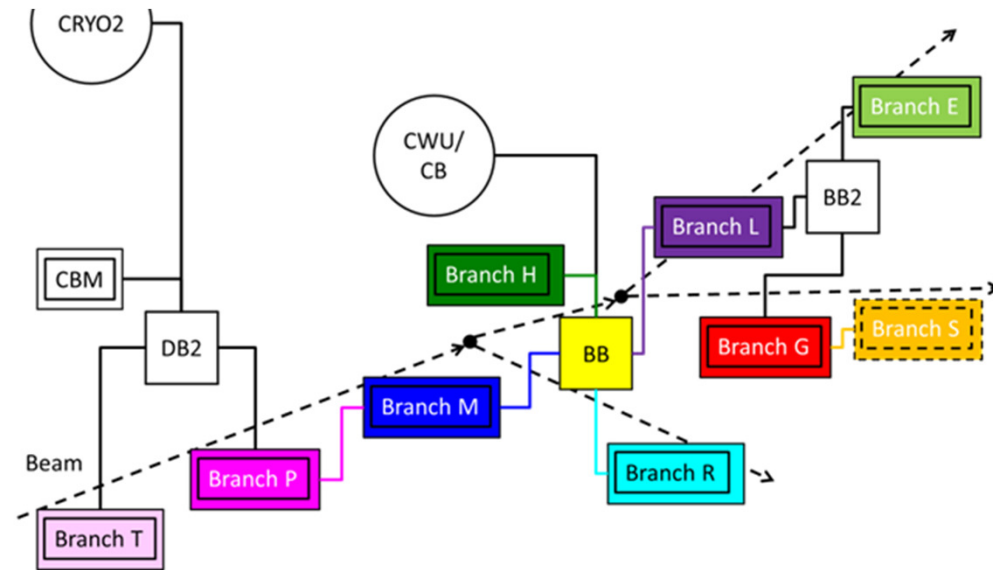
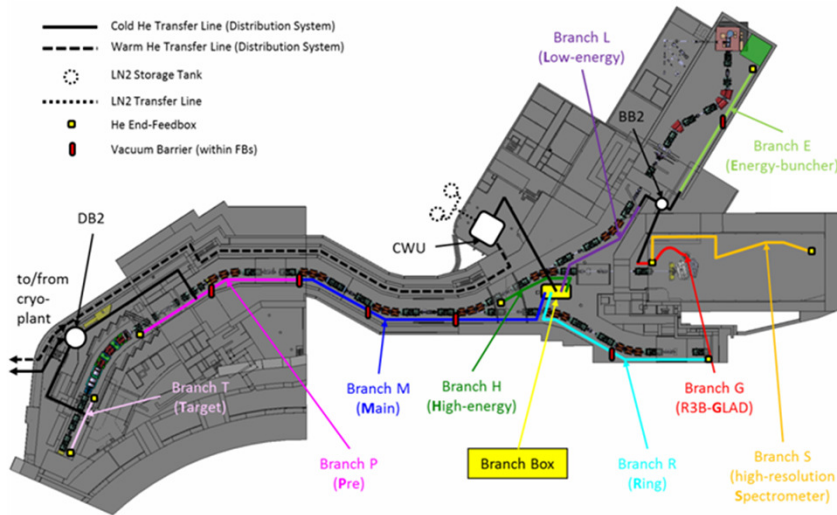


Figure 1: Schematic view of the cryogenic test facility in B180 at CERN. L-shaped jumpers (locations highlighted by red circles) are required to connect the cryogenic SVBs to the large magnet cryostats. Figure courtesy by CERN (EDMS No.: 1502149).

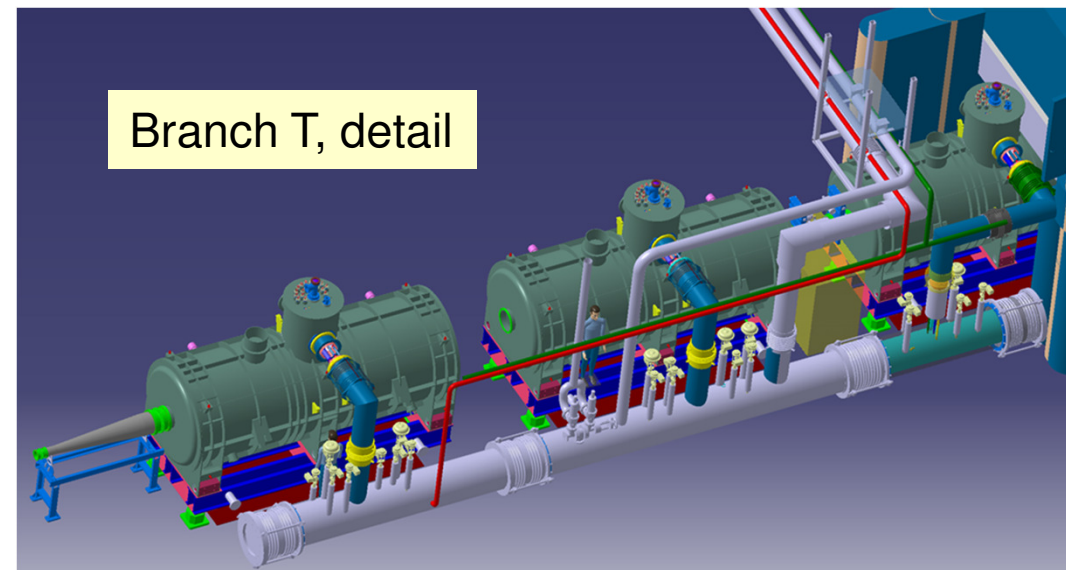


- Jumper cryo-interface procured by GSI
- ✓ Detailed Specification **Approved**
(<https://edms.cern.ch/document/1709654/2>)
- Upcoming Schedule:
 - Tendering Started: **21st Feb. 2017**
 - Contract Award: **04/2017**
 - Delivery to CERN: **end 2017**
 - Installation & SAT: **beginning 2018**
 - Commissioning: **with magnets**

Local Cryogenics



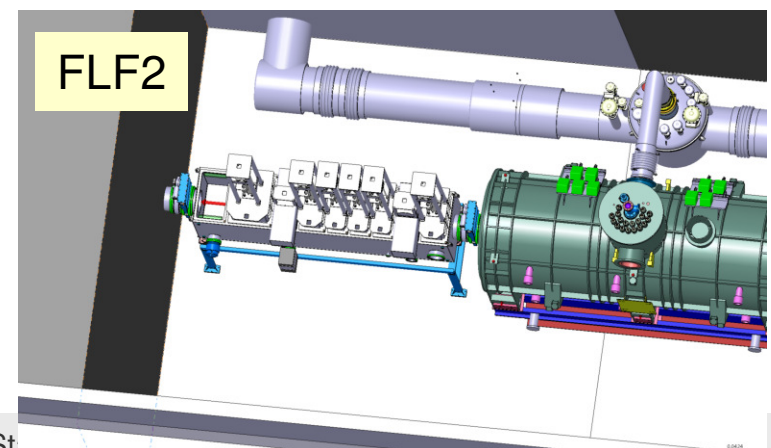
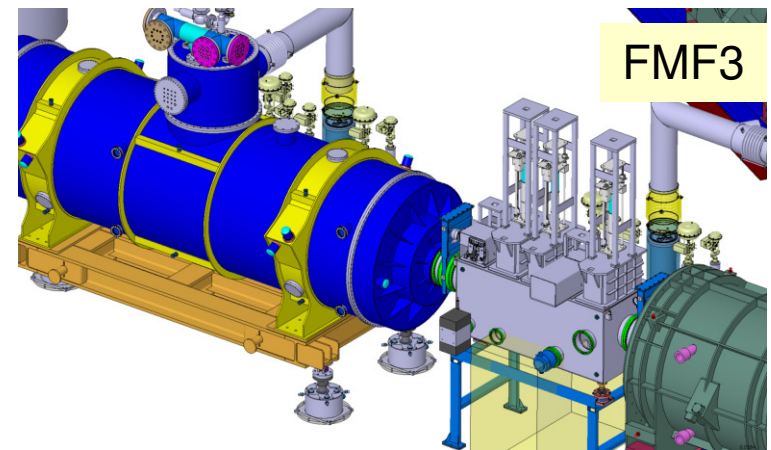
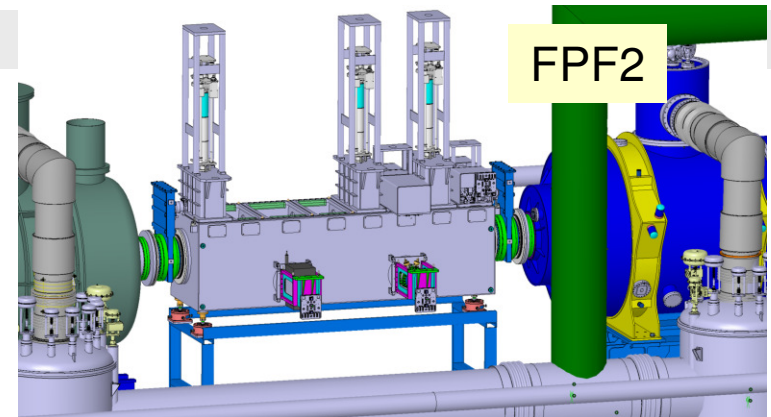
- Updated Local Cryogenic Structure
 - Additional “Branch Box 2”
 - supplying LEB & R3B
- Updated Procurement Strategy
 - One entire framework contract
 - Production along branches
- Specification of Branch T components in preparation
- Cold-Testing of Pre-Series FB at STF



Vacuum System

- ✓ Vacuum system closed
- Overall 21 focal plane chambers (Ru in-kind)
 - length between ≈ 800 mm to ≈ 4.400 mm
 - cross section $\approx 1 \times 1$ m²
 - specification under approval
- Overall 24 dipole vacuum chambers (Ru in-kind)
 - 21 chambers for standard dipoles, including pumping ports between dipole units
 - specifications under approval
 - 3 chambers for branching dipoles
 - ✓ design specification approved
 - chamber/cryostat integration tbd by CEA
- Multiplet vacuum chambers are integral part
- Number of bellows and additional beam pipes defined, exact dimensions to be determined
- Numbers of bellow valves, pumps station, etc. defined

→ IKC with Ru to be done in 2017

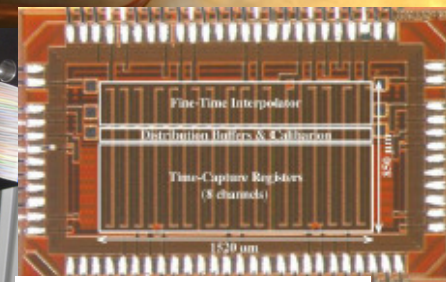
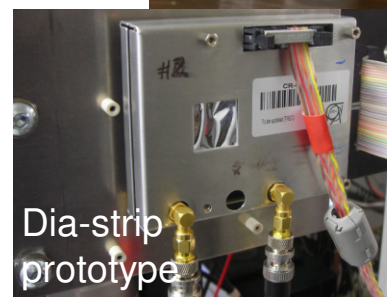
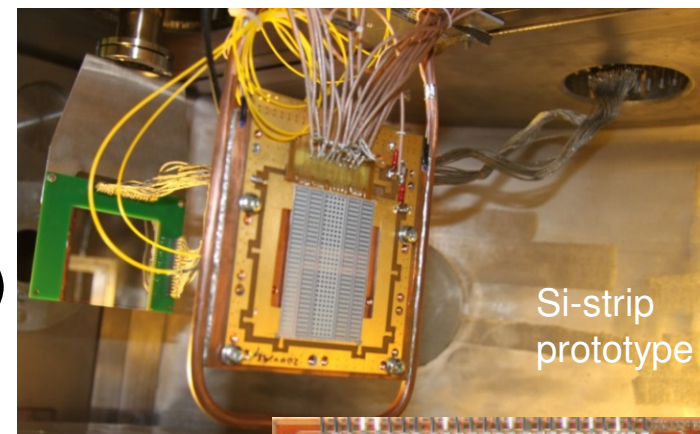
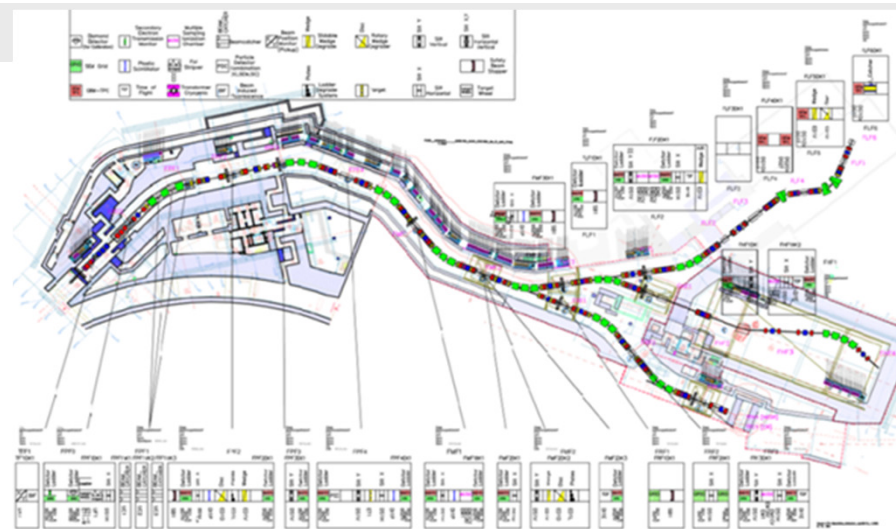


Beam Instrumentation I (Beam Diagnostics)

C. Nociforo
O. Kiselev et al.



- Beam instrumentation, defined for each FP
- Full isotope identification ($x, y, x', y', \Delta E, \text{TOF}$)
- Modes: fast- and slow-extracted beams
- Time-of-Flight (Russian in-kind)
 - ✓ Specification approved Q3/2016
 - ✓ Contract documentation provided Q3/2016
 - ✓ IKC running (FAIR, kick-off done)
 - drafted contract version in Ru
 - R&D on diamond and silicon ongoing
(use of CERN/EP-ESE picoTDC under investigation)
 - LNS beam time last week
- Plastics (Swedish in-kind)
 - ✓ Specification approved Q4/2016
 - ✓ Contract documentation provided Q4/2016
 - IKC running (FAIR, kick-off done)



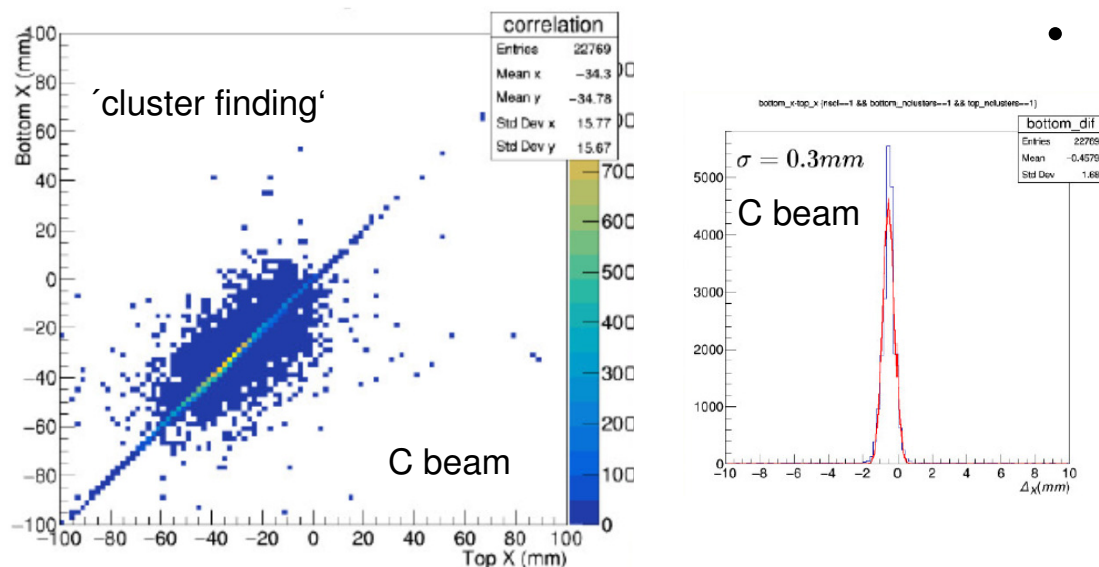
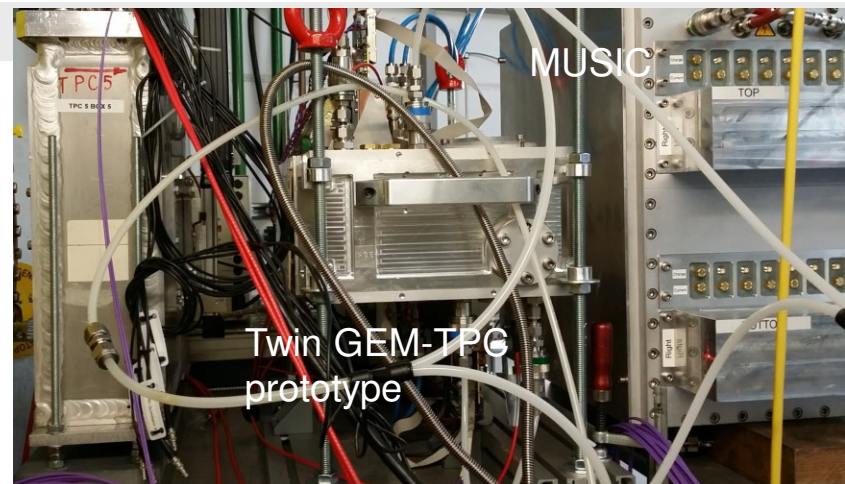
TDC in 130 nm

Beam Instrumentation II (Beam Profile Detectors)

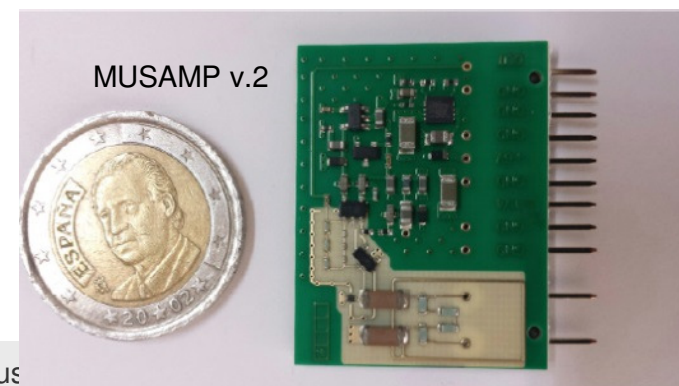
A. Prochazka,
C. Nociforo et al.



- Position detectors (tracking, Finnish in-kind)
 - combined with SEM-Grid on a common drive
- ✓ Twin prototype tested in-beam at JYFL and GSI
- ✓ New GMX_2NX board based on XYTER v. 2 designed and tested at GSI
 - Data analysis ongoing



- MUSIC (energy-loss, Finnish in-kind)
 - ✓ Specification approved Q1/2017
 - ✓ Contract documentation provided
 - ✓ IKC running (FAIR, kick-off done)
 - contract PreAmps by CEA Bruyeres under preparation



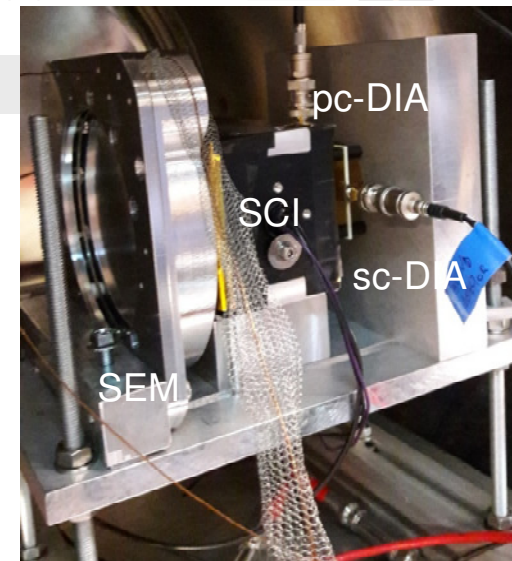
- Specification in preparation
- Beam time 2017 requested in JYFL

Beam Instrumentation III (Beam Monitors)

F. Schirru,
S. Schlemme et al.

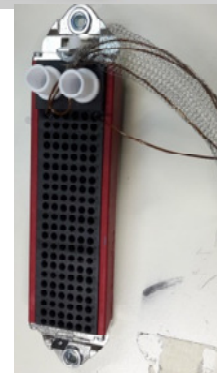
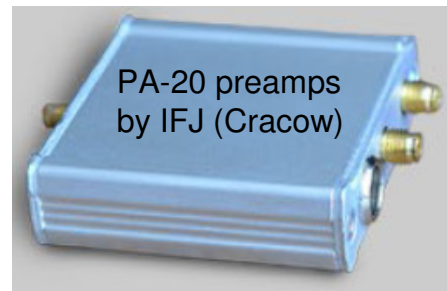
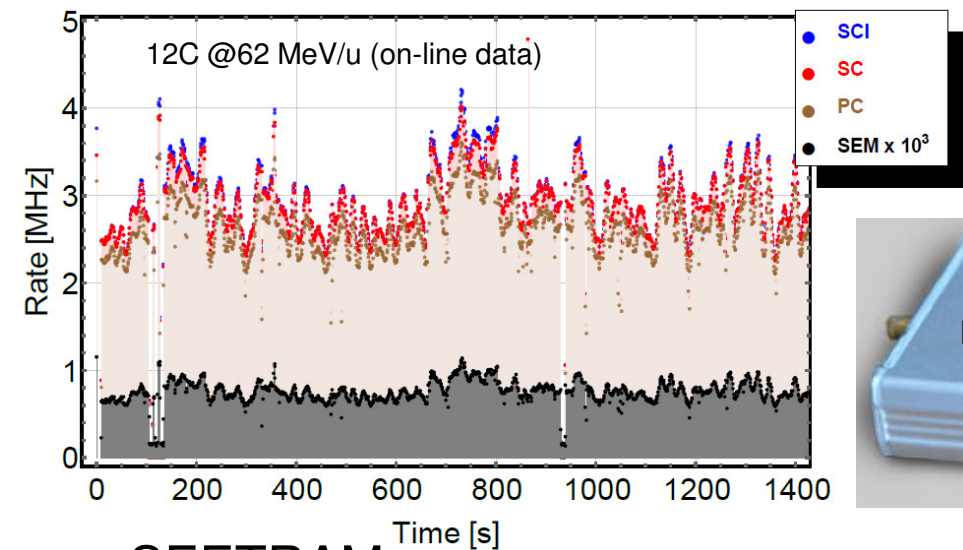


- Beam intensity detectors
 - combined particle rate detectors (diamond) and beam current monitors (IC, SEETRAM) designed at GSI
- ✓ Prototypes tested in-beam at GSI and INFN-LNS (Catania)
- Specification in preparation



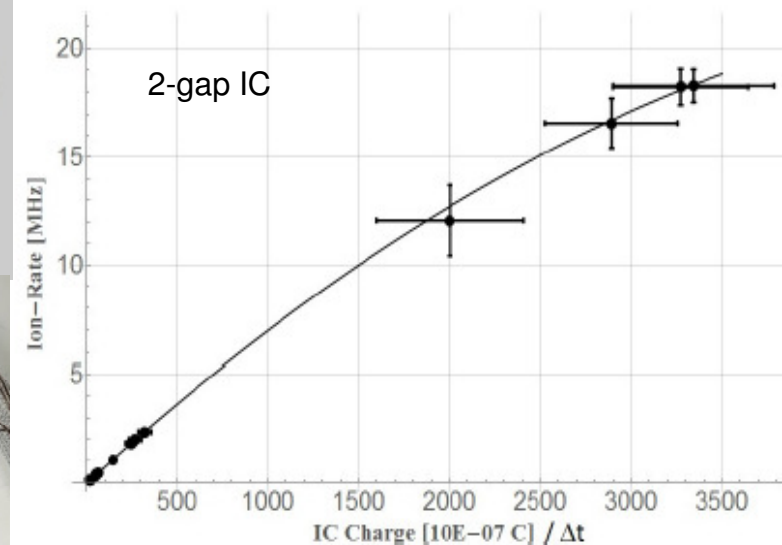
• Diamond

- ✓ pcCVD/scCVD sensors by GSI-DL
- ✓ PA-20 preamps 20dB (1.5 GHz) tested



• SEETRAM

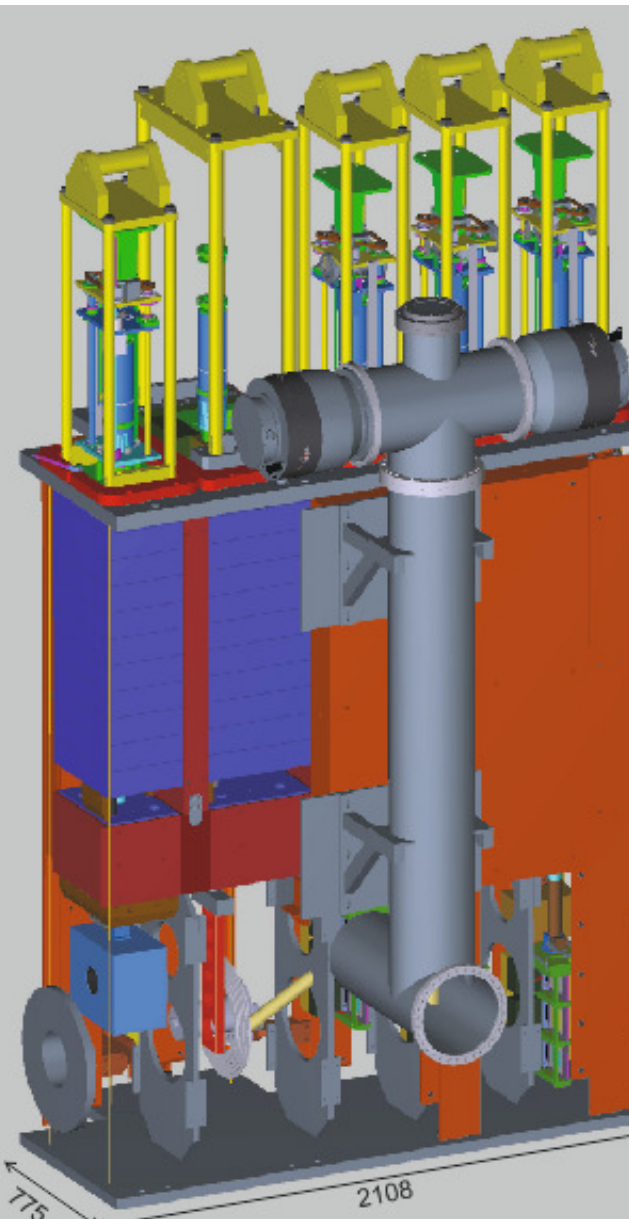
- ✓ 3-Al foils (24 μm) produced by GSI tested and calibrated with DIA
- ✓ radiation-hard multi-pin self-aligned connectors tested



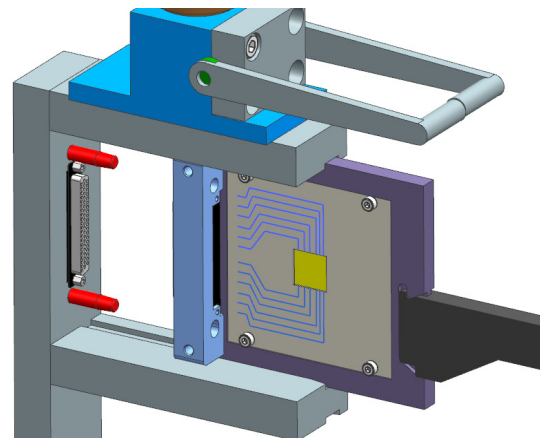
S. Schlemme et al. GSI report (2015)

Target Area I (Target Chamber & Plug Systems)

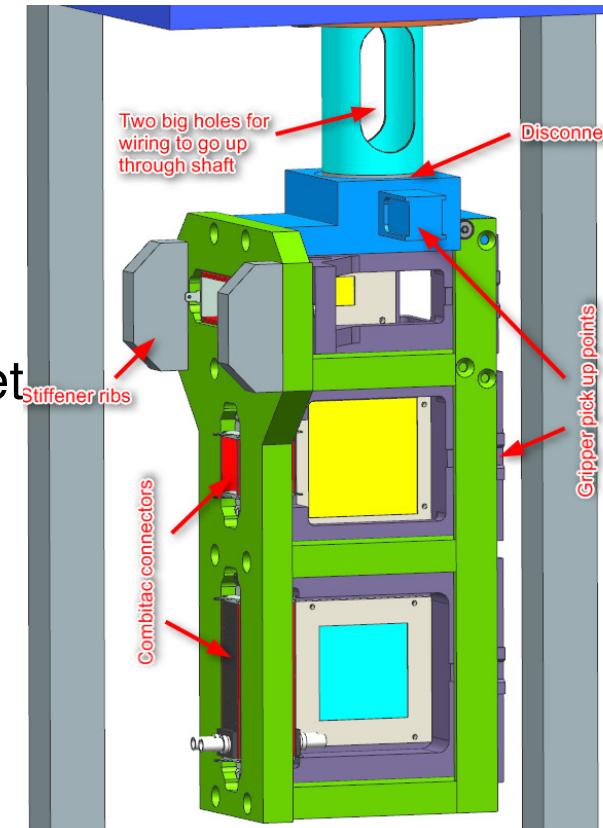
H. Weick,
C. Karagiannis



- ✓ Collab. Contract with KVI-CART
- ✓ Specification released
- Design phase running, includes:
 - chamber and plug design
 - 5 plugs (2nd target ladder)
 - beam spot diagnostic on target
 - plug adjustment/guidance (interface to transport flask)
- PDR planned for Q1/2017
- FDR expected for Q1/2018

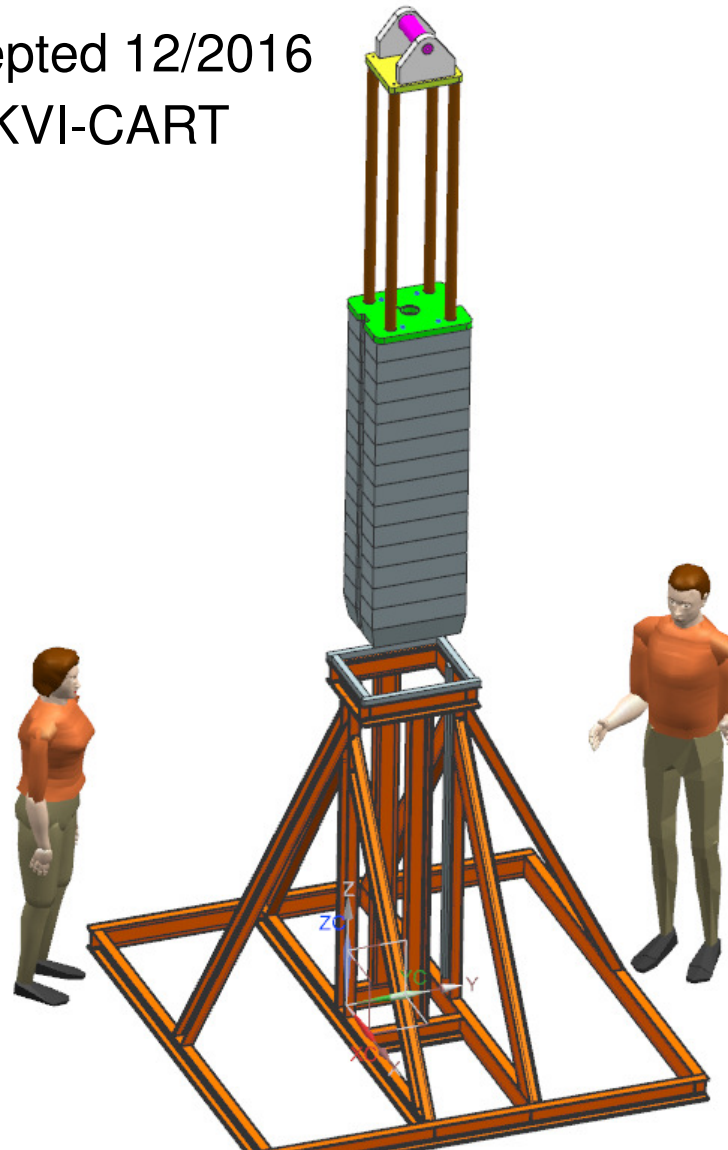
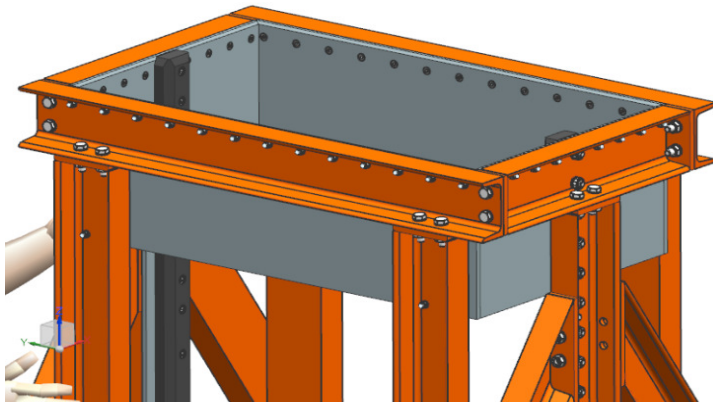
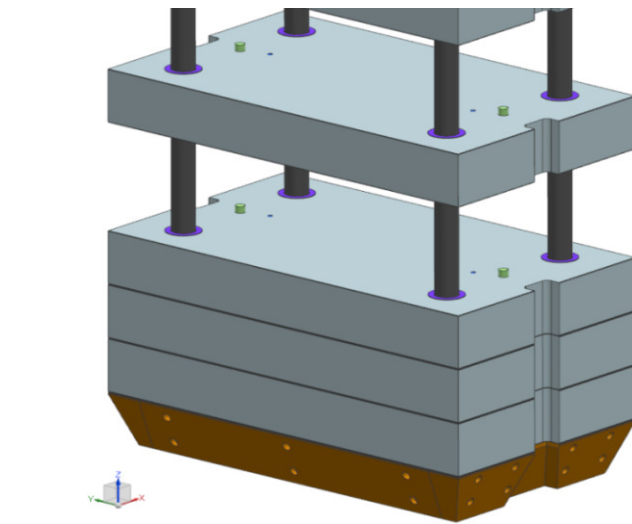


Detector ladder with
slots for single detectors



Target Area II (Plug Guidance)

- CDR/FDR plug guidance accepted 12/2016
- full scale mock-up running at KVI-CART



required: $\pm 20\text{mm}$ shift, 2 mrad tilt

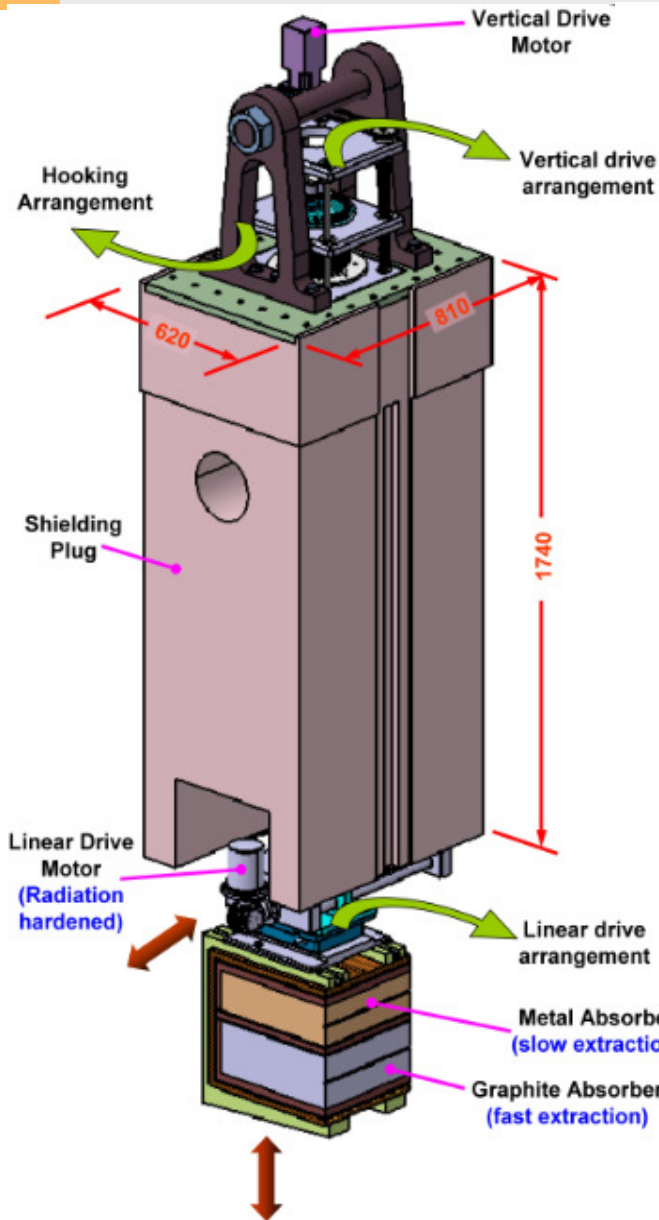
Michel Lindemulder,
Henk Smit, KVI-CART

Target Area III (Beam Catcher Plugs)

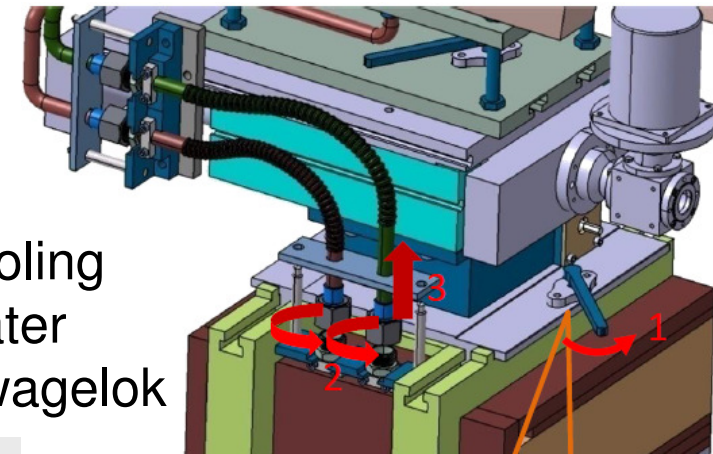
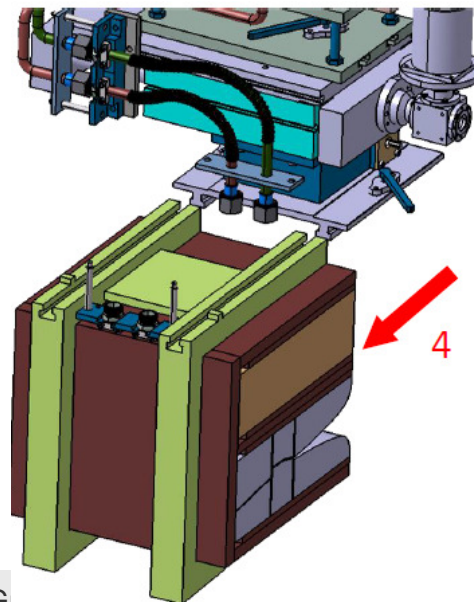
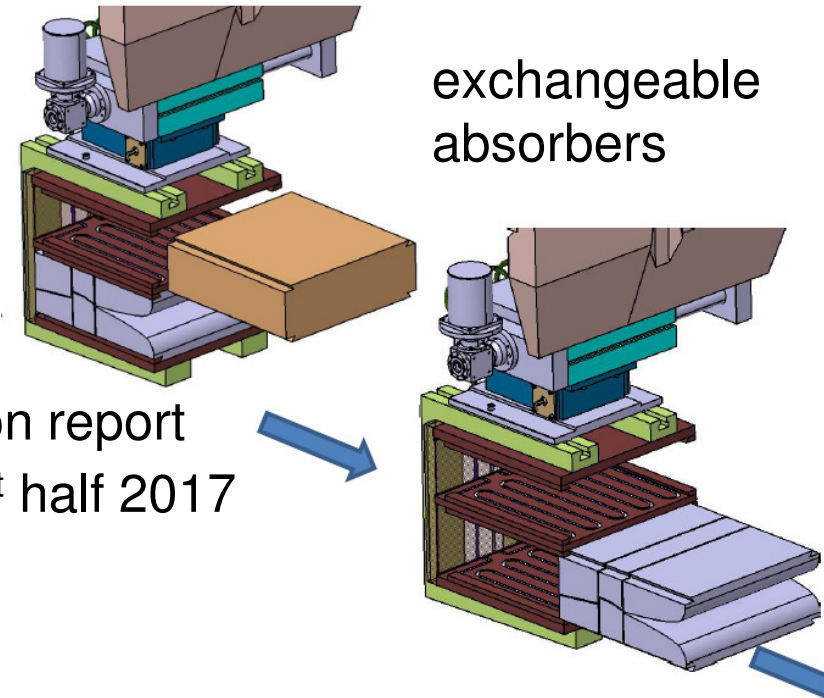


CSIR - CMERI

सी एस आई आर - केन्द्रीय यांत्रिक अभियांत्रिकी अनुसंधान संस्थान
CSIR - Central Mechanical Engineering Research Institute



- Indian in-kind
- Collaborator:
CMERI Durgapur
- Design running
 - based on definition report
 - CDR expected 1st half 2017

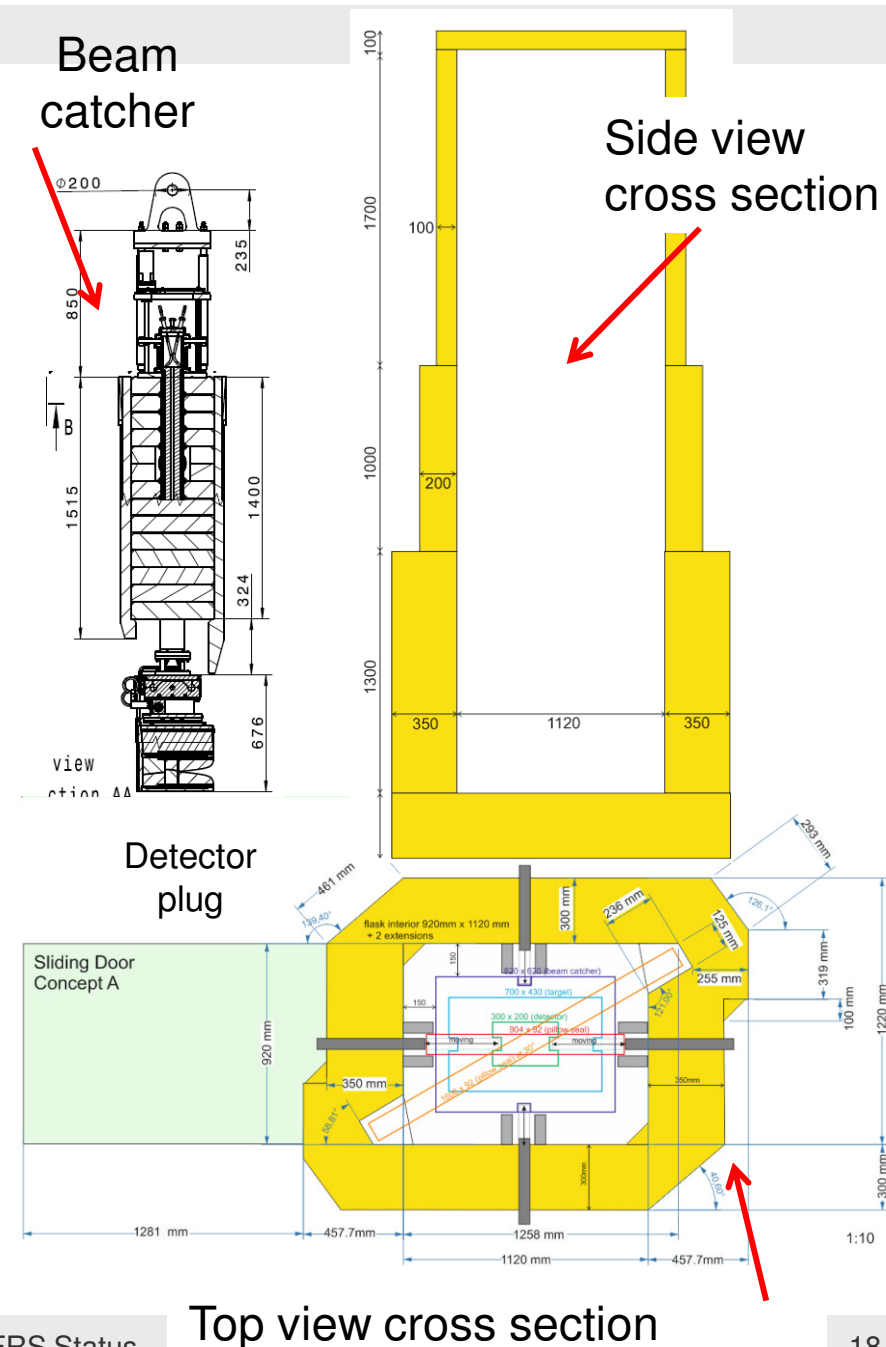
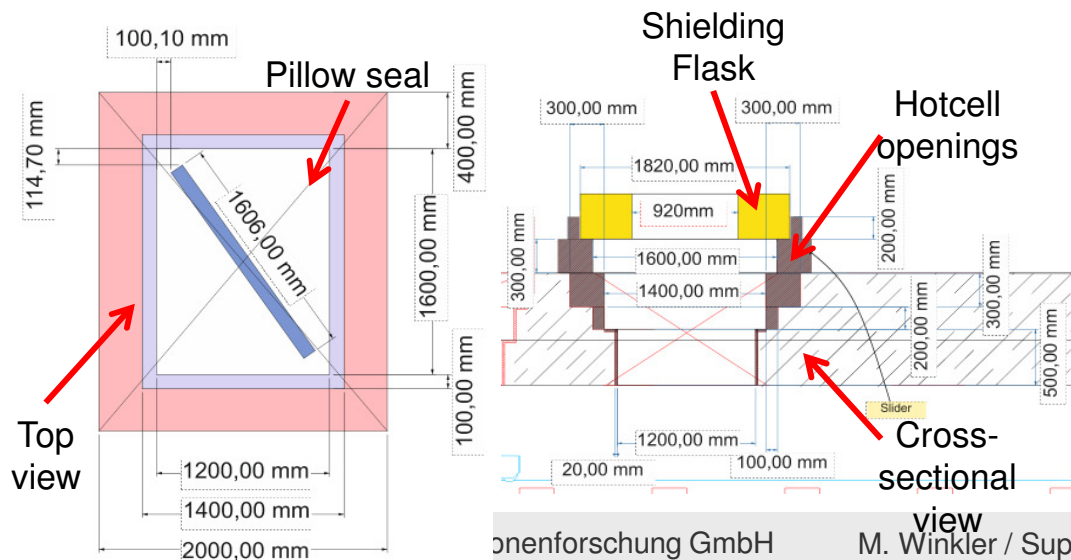


Target Area III (Shielding Flask)

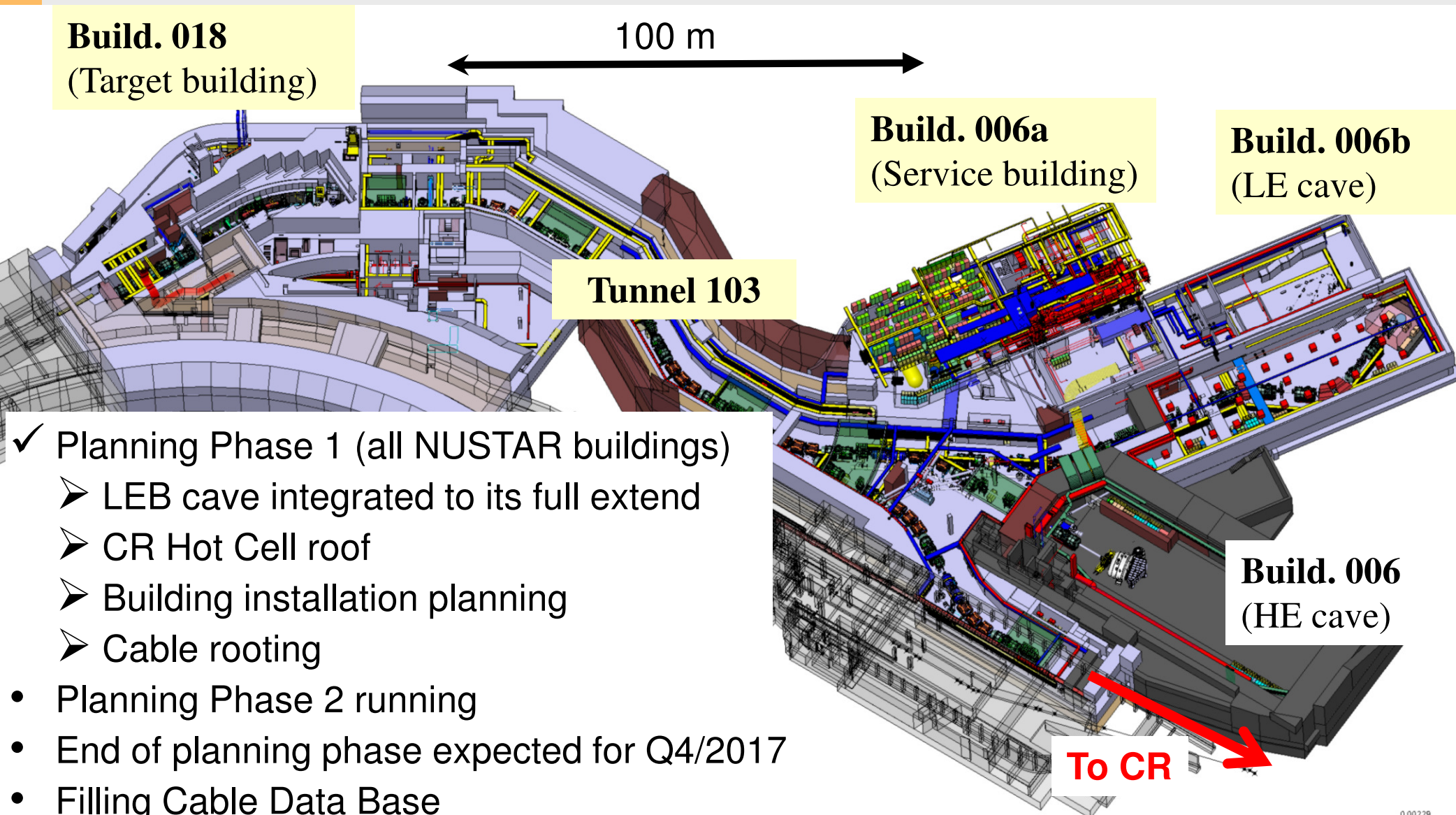
F. Amjad,
H. Weick et al.



- ✓ Finland in-kind contribution
 - contract discussions initiated
- Cross section accommodates pillow seal
 - Hot Cell roof opening modified
- Finalizing specification
- R&D activities of flask subsystems running:
 - ✓ 9t internal crane with automatic gripper
 - ✓ Support platform and interface plate
 - ✓ Additional shielding / airgap cover
 - ✓ Double door sliding mechanism



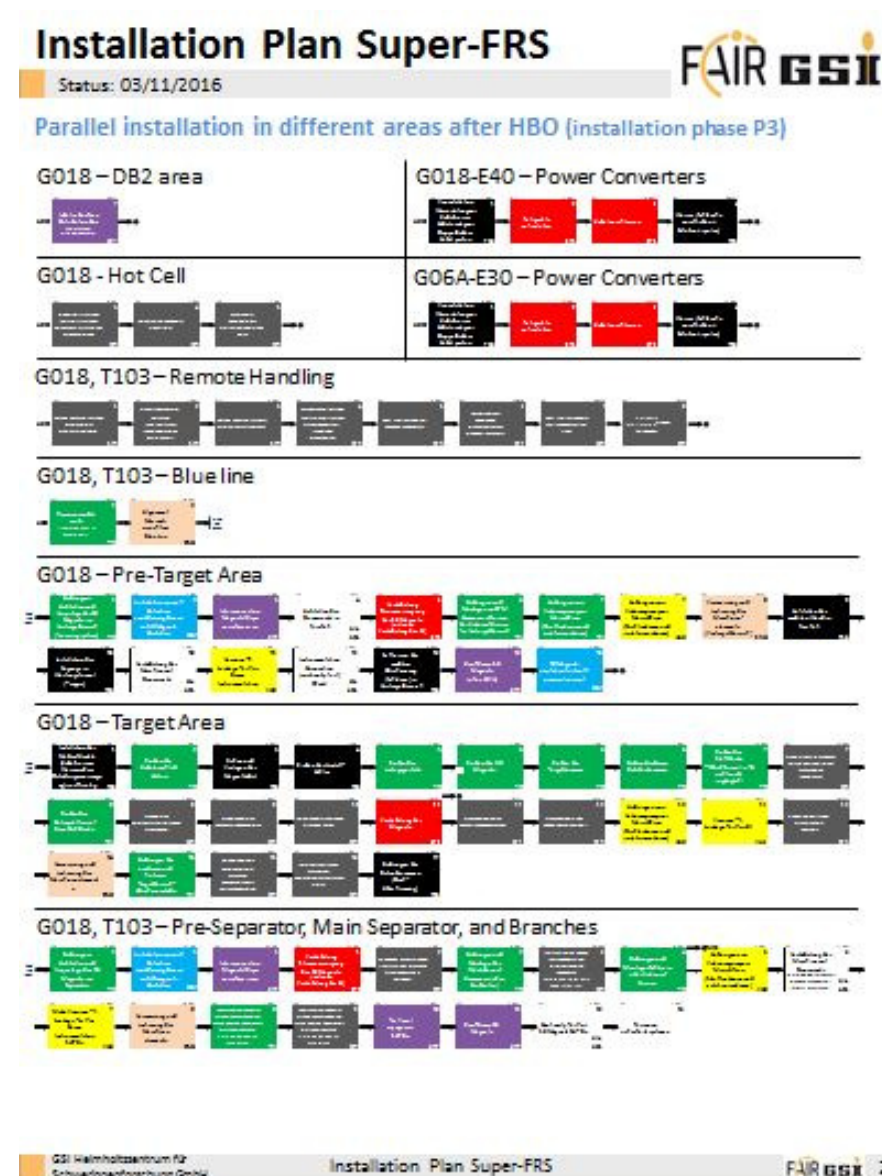
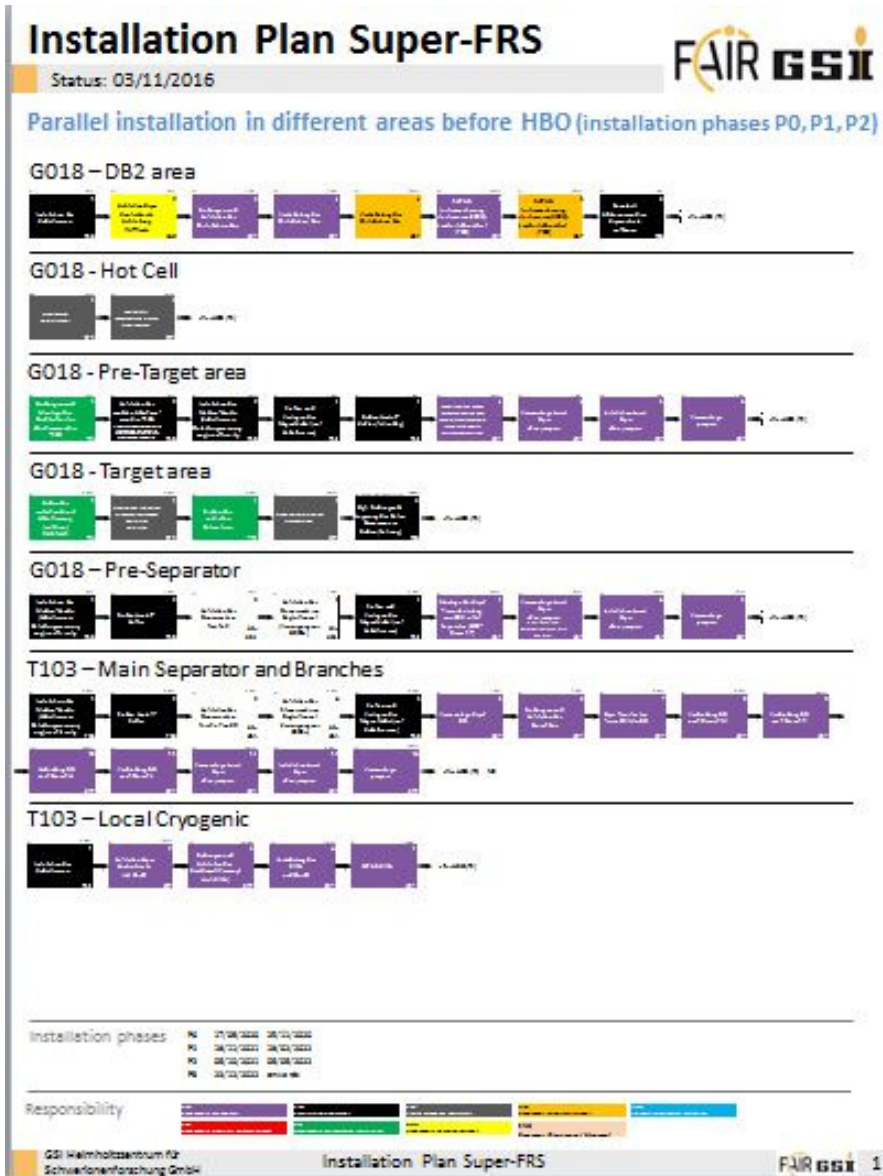
Civil Construction (Overview)



- ✓ Planning Phase 1 (all NUSTAR buildings)
 - LEB cave integrated to its full extend
 - CR Hot Cell roof
 - Building installation planning
 - Cable routing
- Planning Phase 2 running
- End of planning phase expected for Q4/2017
- Filling Cable Data Base
- Planning of detector gas supply
- ✓ Detail planning of Hot Cell running (industrial study)

0.00229

Installation Planning



- SC Magnets & Testing (most time critical items):
 - multiplets: design running; PDR and FDR done 2016; preparation of FoS
 - standard dipoles: all tender documents approved, tendering ready to start
 - branching dipoles: R&D contract signed, design ready to start
 - Testing facility at CERN under construction; commissioning in 2017, 1st magnet expected for early 2018
- Development and procurement of various other components under way
 - specification of focal plane chambers and dipole chambers in approval process
 - specification of various beam instrumentation components approved and corresponding IKC running
 - target chamber and plug inserts, beam catcher systems
- Civil Construction planning running; expected to be finalized in 2017

Thank you for you attention !