

The Henryk Niewodniczański Institute of Nuclear Physics Polish Academy of Sciences

The in-kind experience gained by IFJ PAN and its implementation into the FAIR project during the two years collaboration

Dariusz Bocian
Jacek Świerblewski



The Division of Scientific Equipment and Infrastructure Construction (DAI)



- Personnel: **561**; Prof. **30**, Assoc. Prof. **61**, Ph.D. **101**, engineers **117**

- Scientific Divisions:

- Division of Particle and Astroparticle Physics
- Division of Nuclear Physics and Strong Interactions
- Division of Condensed Matter Physics
- Division of Theoretical Physics
- Division of Interdisciplinary Research
- Division of Applications of Physics

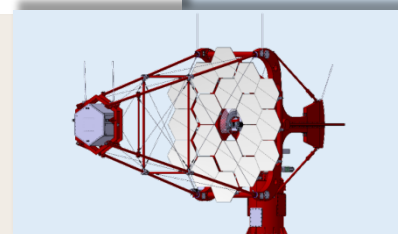
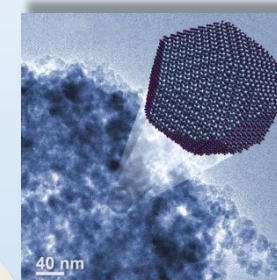
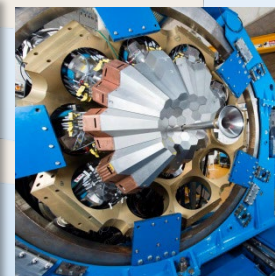
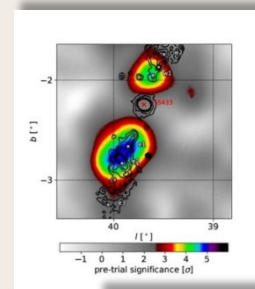
- Researcher Departments:

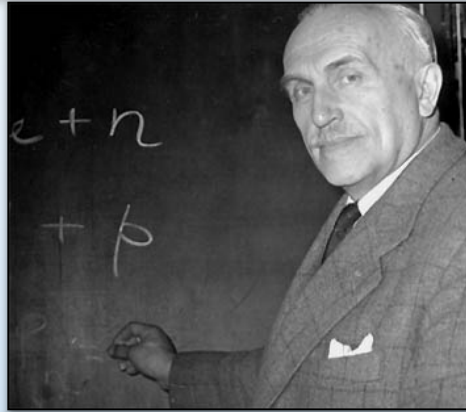
- Cyclotron Centre Bronowice
- Division of Scientific Equipment and Infrastructure Construction
- Four accredited laboratories

- Education:

- International Ph.D. Studies
- Interdisciplinary Doctoral Studies
- Kraków Interdisciplinary Doctoral School

- Scientific output: **> 650** publications annually





- **1955** – foundation of the IFJ – as a branch of the Institute of Nuclear Research – Prof. Henryk Niewodniczański (1900-1968)



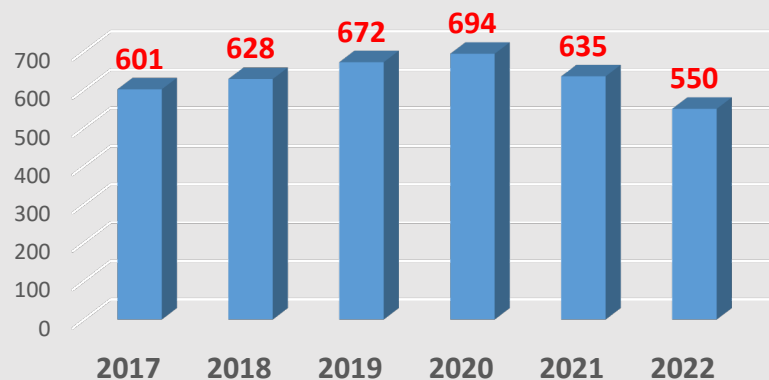
(Fot. Archiwum of the IFJ PAN)

- **1960** – IFJ as a standalone unit
- **1970** – Particle physics enters – Prof. Marian Mięśowicz (1907-1992)
- **1988** – IFJ gets the name of its patron – Henryk Niewodniczański
- **2003** – IFJ gets the status of a Research Institute of Polish Academy of Sciences

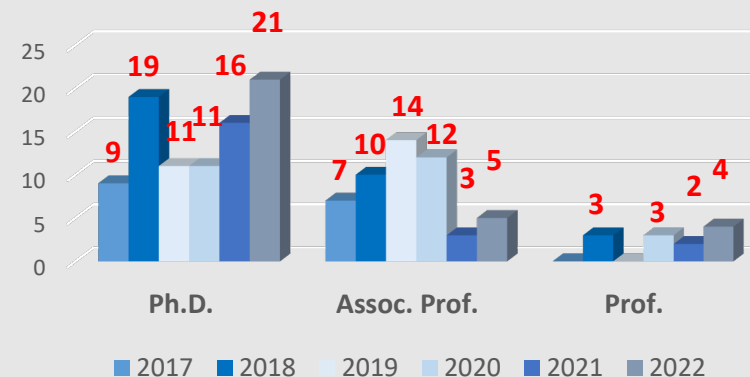




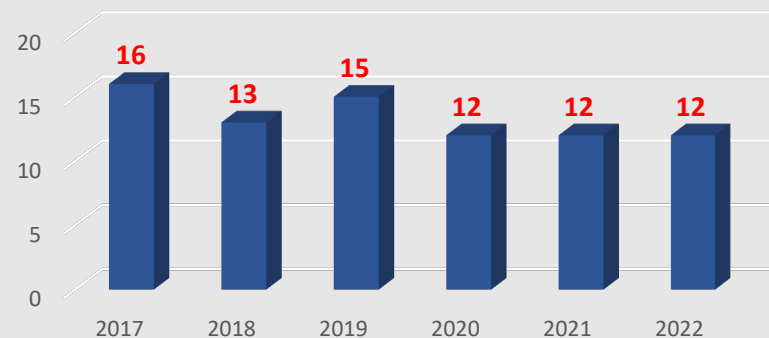
Publications



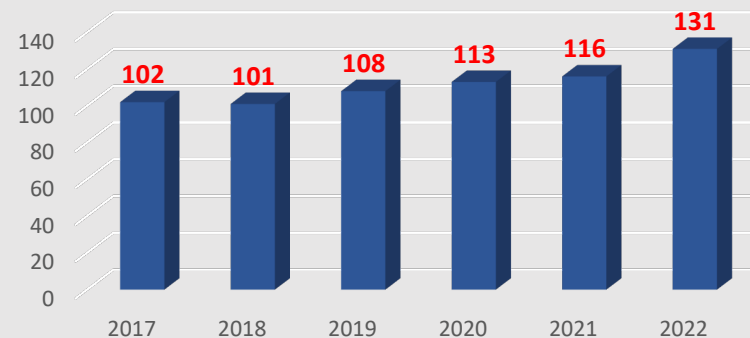
Scientific careers



International grants (EC, F4E, VF, SNF)



National grants (NCN, NCBiR, FNP, MEiN, NAWA)





Participation of IFJ PAN in projects aimed at the Development of Innovation and Cooperation of European Technological Infrastructures for Accelerators and Magnets



TIARA – Test Infrastructure and Accelerator Research Area (2 years, 2011-2013)

In Poland, the project was carried out by a consortium of 7 scientific institutions: the Henryk Niewodniczański Institute of Nuclear Physics of the Polish Academy of Sciences, the AGH University of Science and Technology, the Cracow University of Technology, the Andrzej Sołtan Institute of Nuclear Problems, the Warsaw University of Technology, the Lodz University of Technology, the Wrocław University of Technology.



AMICI – Accelerator and Magnet Infrastructure for Cooperation and Innovation (2017-2019)

In Poland, the project was carried out by the Henryk Niewodniczański Institute of Nuclear Physics of the Polish Academy of Sciences



i.FAST – Innovation Fostering in Accelerator Science and Technology (2021-2025)

WP13 activities are carried out by the Henryk Niewodniczański Institute of Nuclear Physics of the Polish Academy of Sciences



FuSuMaTech - Future Superconducting Magnet Technology (2017-2019, 2021-2025)

In Poland, the project is was carried out by the Henryk Niewodniczański Institute of Nuclear Physics of the Polish Academy of Sciences

Facility for Antiproton and Ion Research



Creating extreme conditions existing in the universe with heavy ion accelerators



Foto: NASA, ESA, G.Dubner (IAFE, CONICET-University of Buenos Aires) et al., A.Loi et al., T. Temim et al., F. Seward et al., VLA/NRAO/AUI/NSF, Chandra/CXC, Spitzer/JPL-Caltech, XMM-Newton/ESA, and Hubble/STScI (oben), Penn State University (unten)

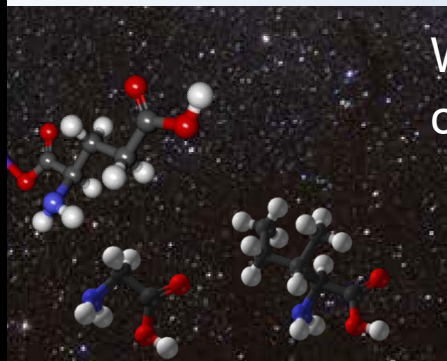
Source: FAIR the Universe in the Lab - prof. Paolo Giubellino

**To find answers to fundamental questions about the Universe:
The Universe in the lab ...**

Where are heavy elements created?



What is in the interior of neutron star?



What happens to human cells on the way to Mars?



How are complex molecules created?

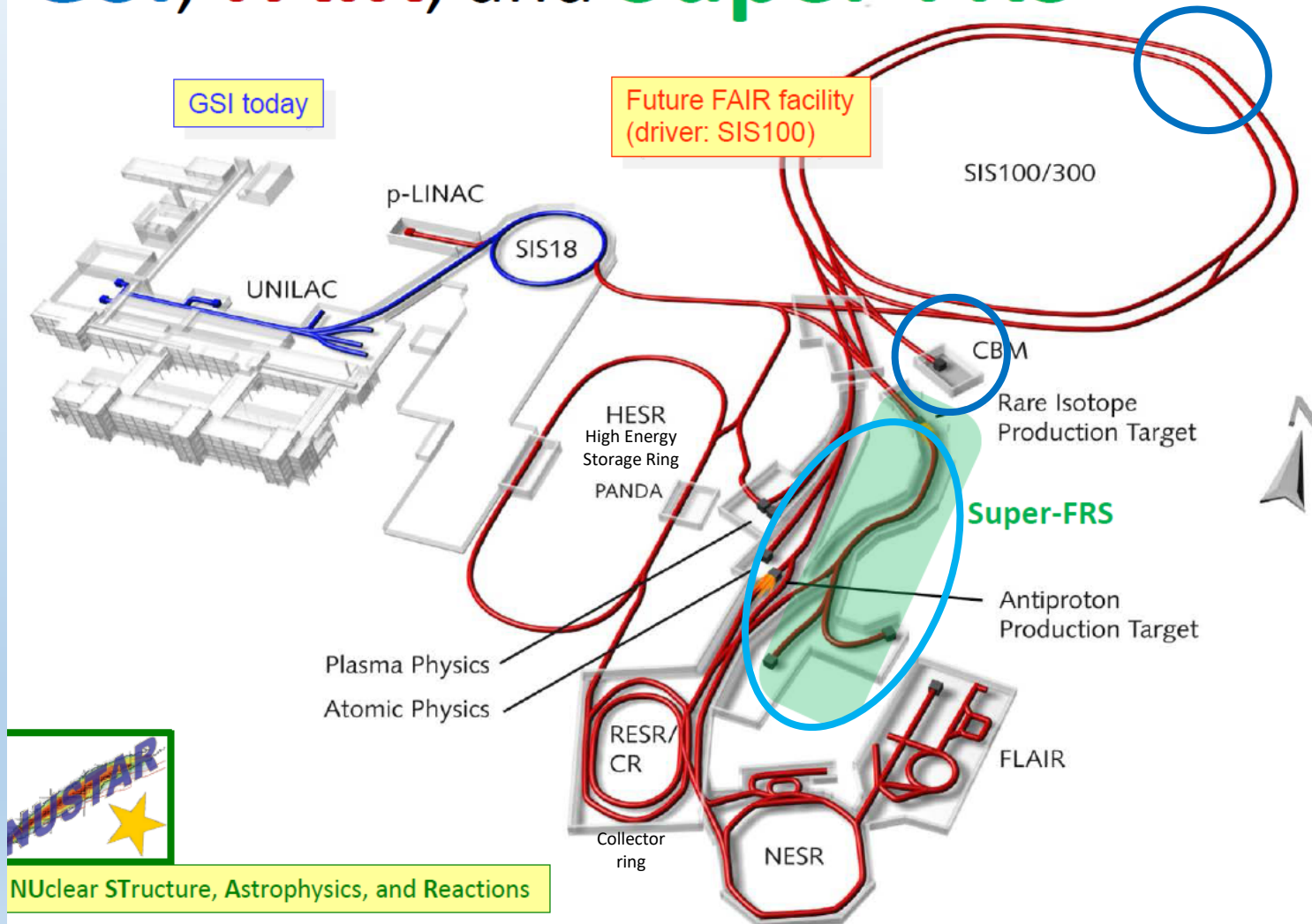


How do materials behave under high pressure?

Fotos: Uranus, Jupiter, Erde Quelle: <http://de.wikipedia.org>

courtesy GSI/FAIR Colleagues

GSI, FAIR, and Super-FRS



Primary Beams

- $3.5 \cdot 10^{11} \text{ } ^{238}\text{U}^{28+}/\text{s}$ (DC) @ 1.5 GeV/u
- $5 \cdot 10^{11} \text{ } ^{238}\text{U}^{28+}$ (pulsed) @ 1 GeV/u
- factor **100-1000** in intensity over present

Secondary Beams

- Broad range of short-lived (= "exotic") beams up to **1.5 GeV/u**
- up to **factor 10 000** in **intensity** over present (GSI+FRS)



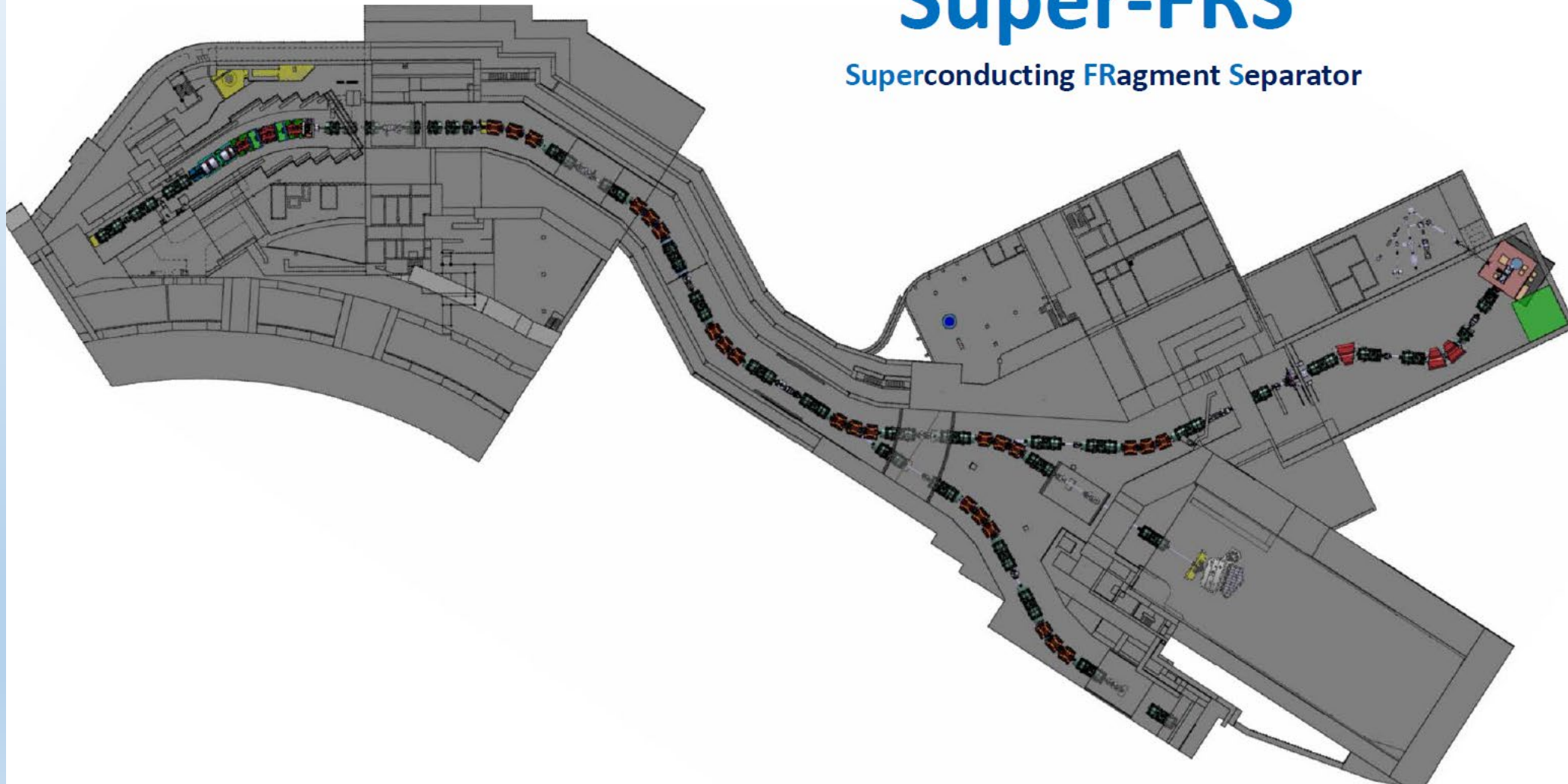
NUclear STructure, Astrophysics, and Reactions



courtesy GSI/FAIR Colleagues

Super-FRS

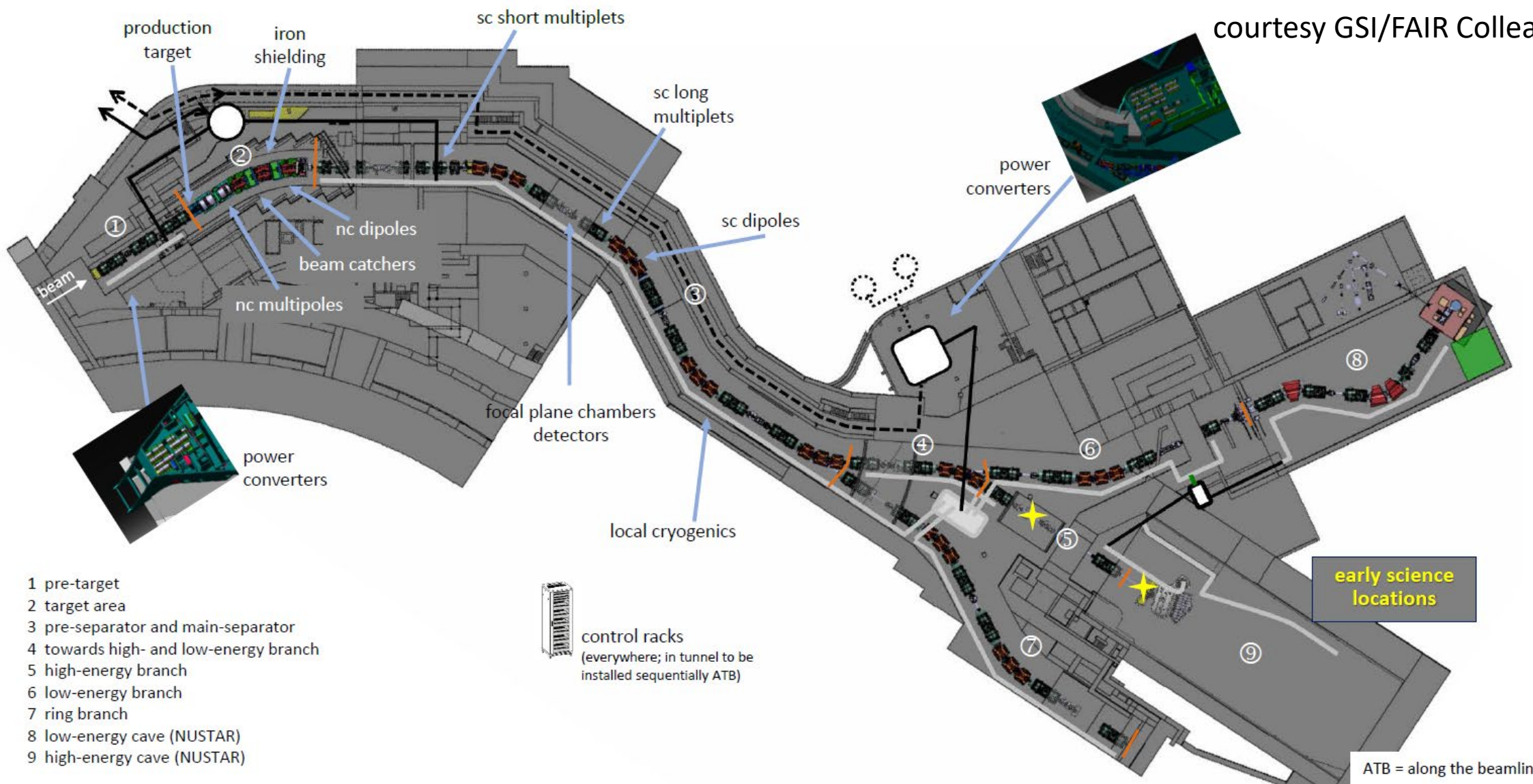
Superconducting FRagment Separator





Super-FRS main components and installation blocks

courtesy GSI/FAIR Colleagues

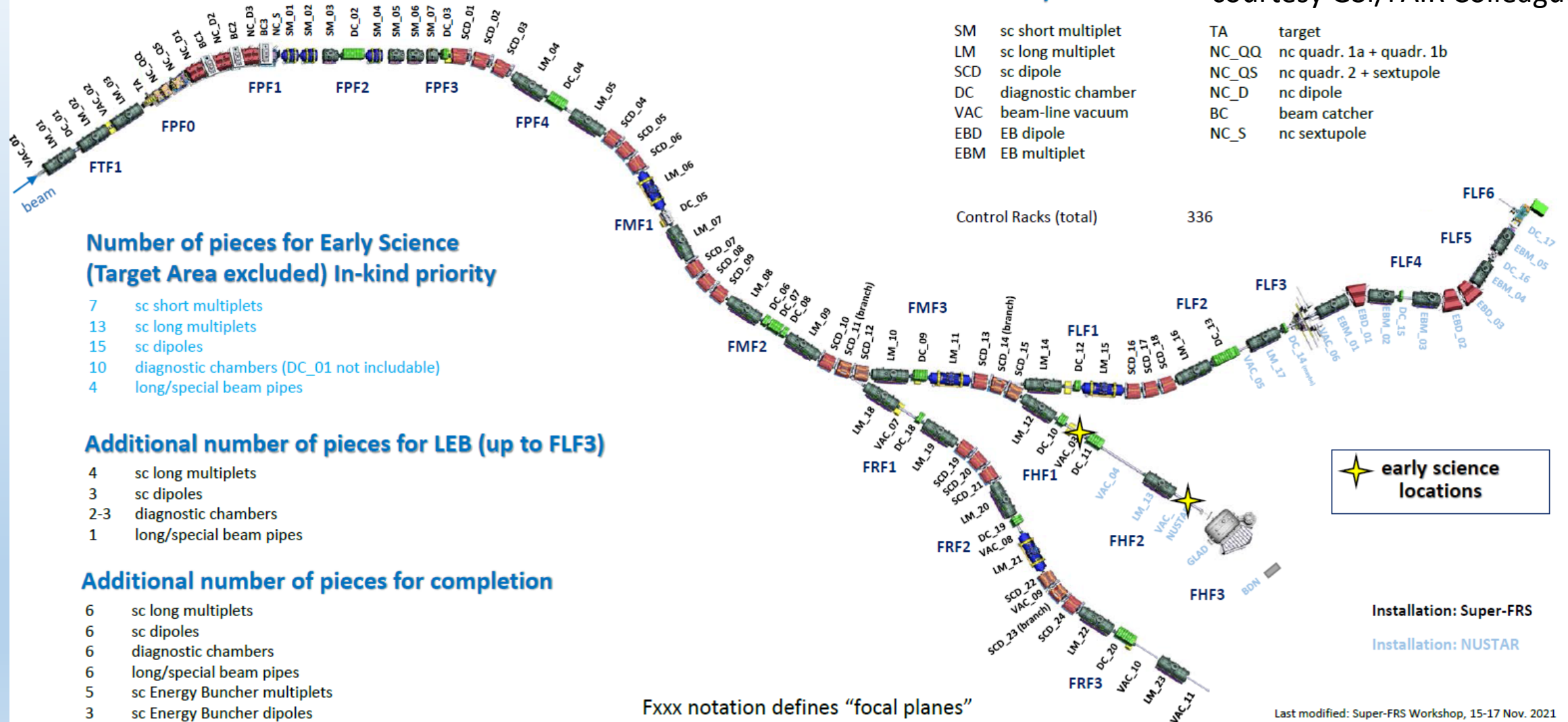




Assembly Units along the beam line

Assembly Units' names courtesy GSI/FAIR Colleagues

SM	sc short multiplet	TA	target
LM	sc long multiplet	NC_QQ	nc quadr. 1a + quadr. 1b
SCD	sc dipole	NC_QS	nc quadr. 2 + sextupole
DC	diagnostic chamber	NC_D	nc dipole
VAC	beam-line vacuum	BC	beam catcher
EBD	EB dipole	NC_S	nc sextupole
EBM	EB multiplet		





SFRS

LEB

HEB

The Super-FRS Multiplets example



Short Multiplet (30t each)

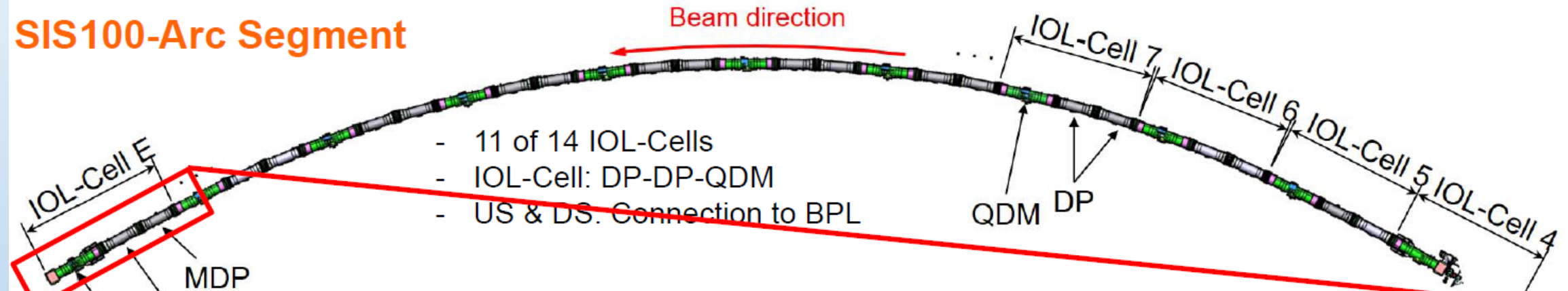


Long Multiplet (60t each)

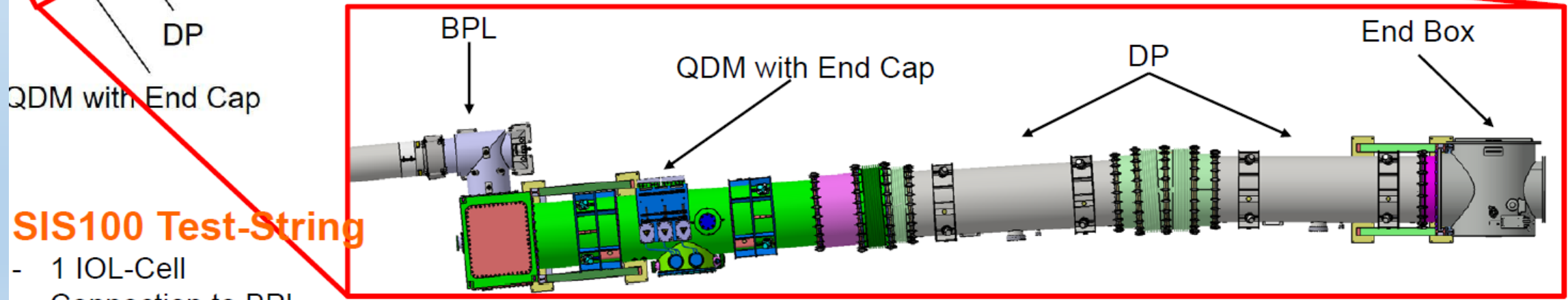
courtesy GSI/FAIR Colleagues

■ SIS100 Test-String as representation of one SIS100 IOL-Cell

SIS100-Arc Segment



- 11 of 14 IOL-Cells
- IOL-Cell: DP-DP-QDM
- US & DS. Connection to BPL



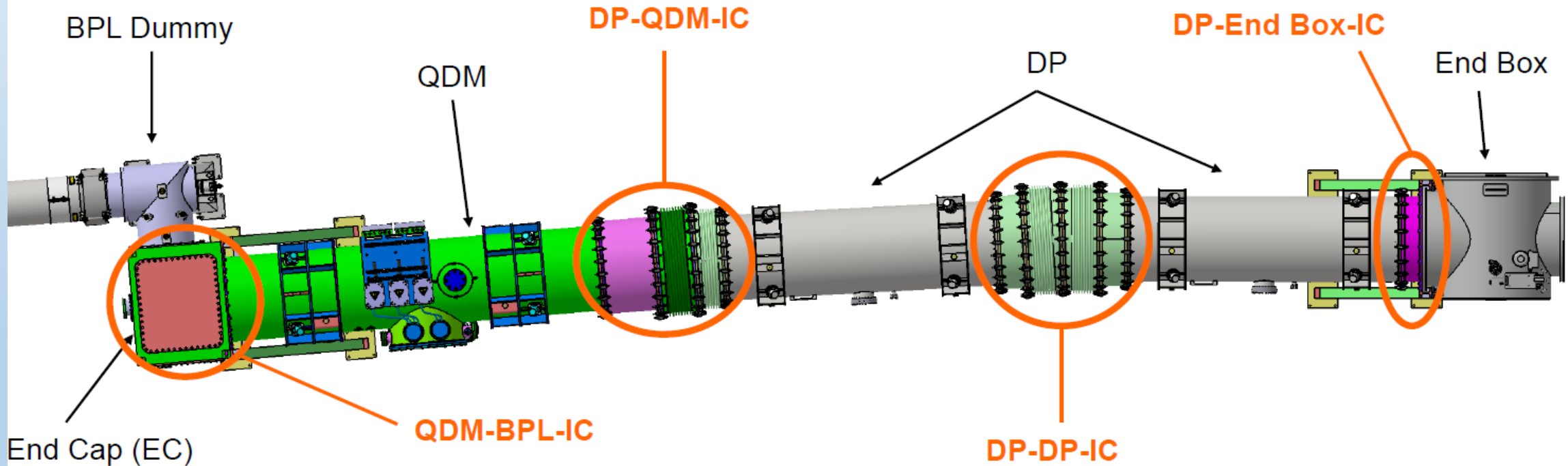
SIS100 Test-String

- 1 IOL-Cell
- Connection to BPL

■ SIS100 Test-String with multiple interconnections

SIS100 Test-String

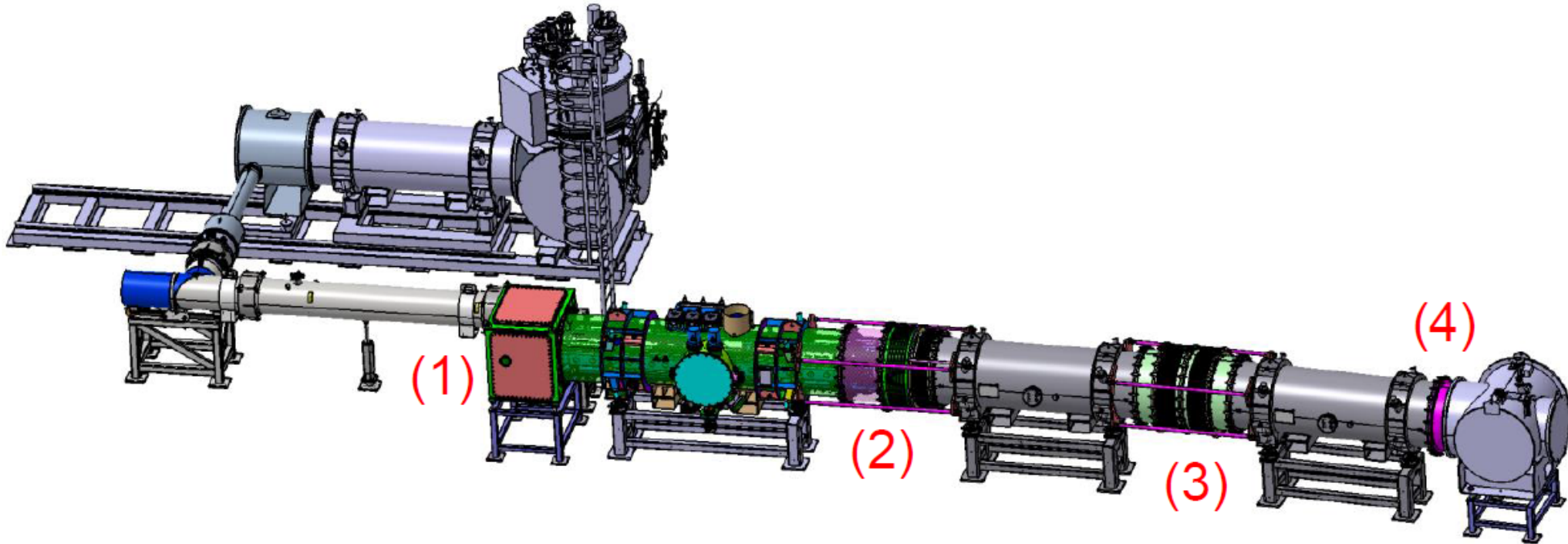
multiple sub-systems of SIS100 are interconnected within according IC-Cryostats:
Beam vacuum chambers, BBs, He-process lines, thermal shield with MLI, insulation vacuum system



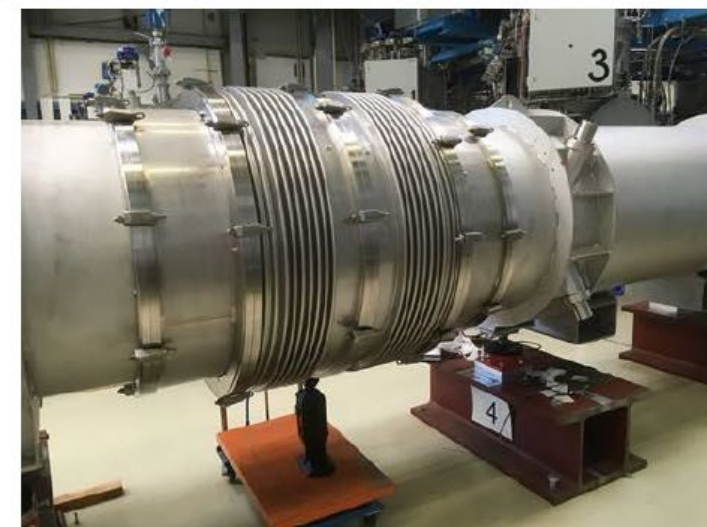
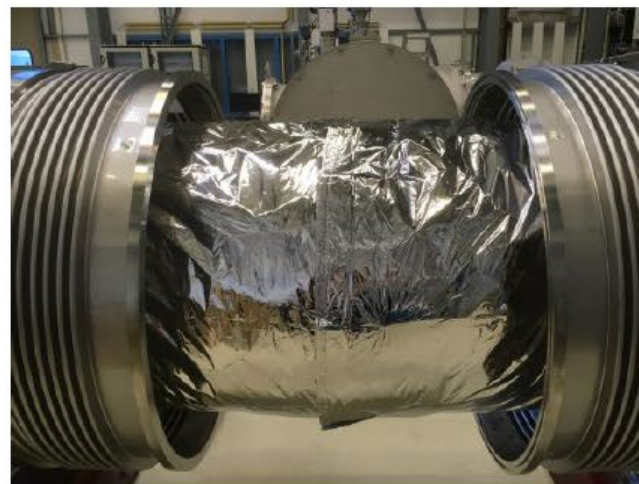
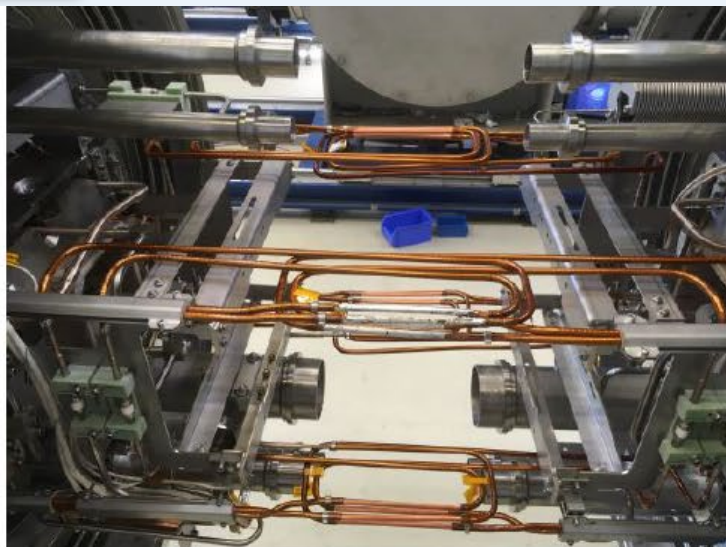
The SIS100 string test has the following interconnection areas:

courtesy GSI/FAIR Colleagues

- (1) Connection BPL – End Cap – FoS QDM 2.5
- (2) Connection FoSQDM 2.5 - Dipole Module
- (3) Connection Dipole Module – Dipole Module
- (4) Connection Dipole Module – End Box



String test interconnection areas

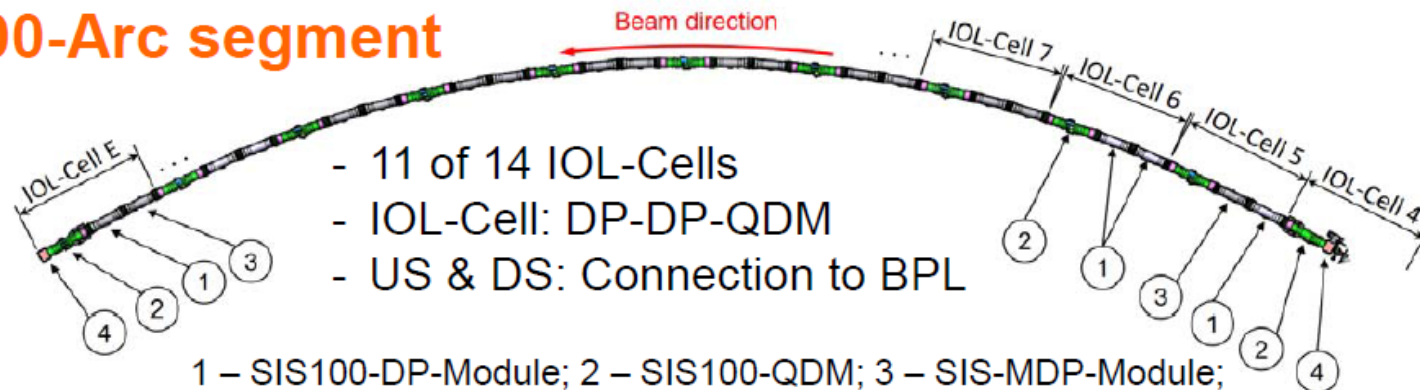
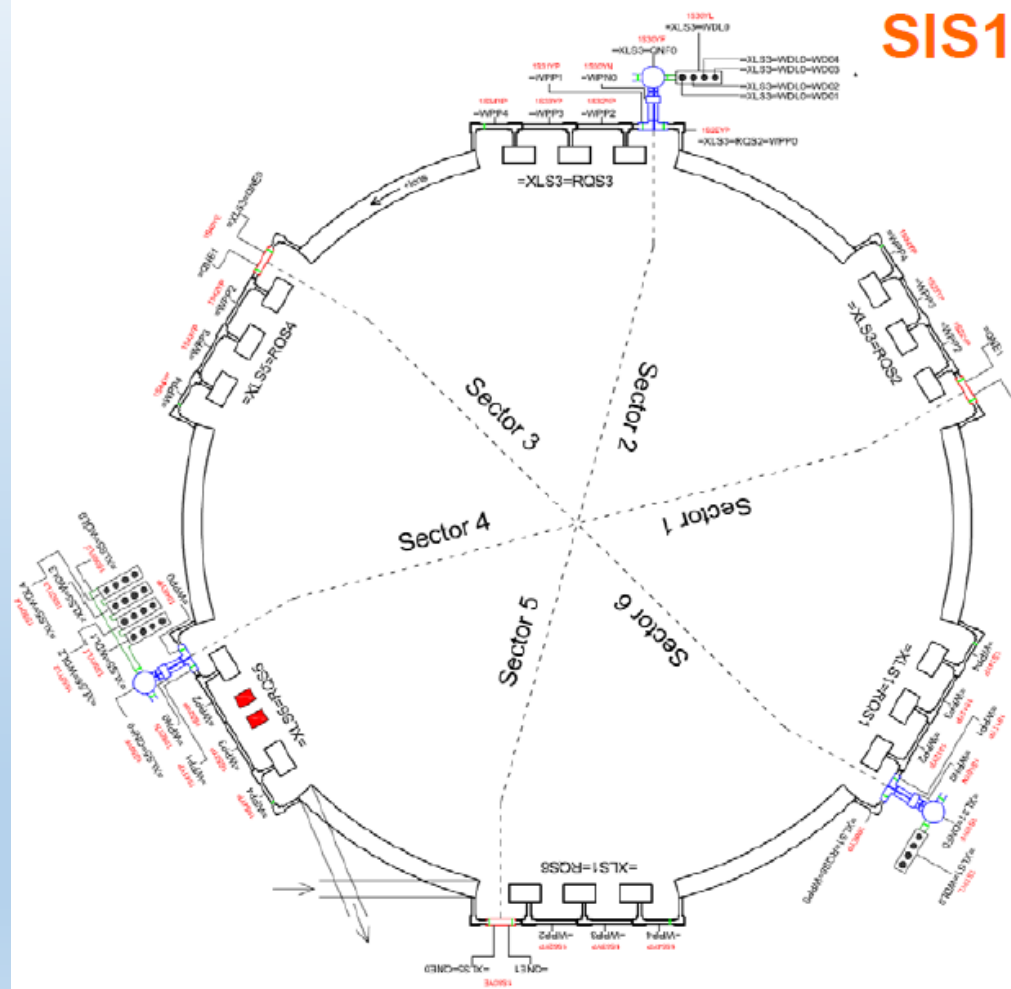


courtesy GSI/FAIR Colleagues

A brief overview on the SIS100 accelerator

courtesy GSI/FAIR Colleagues

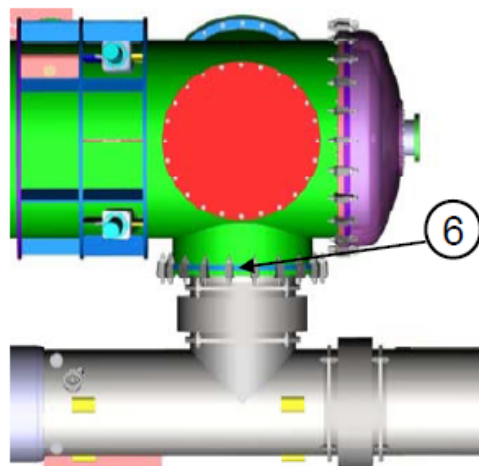
SIS100-Arc segment



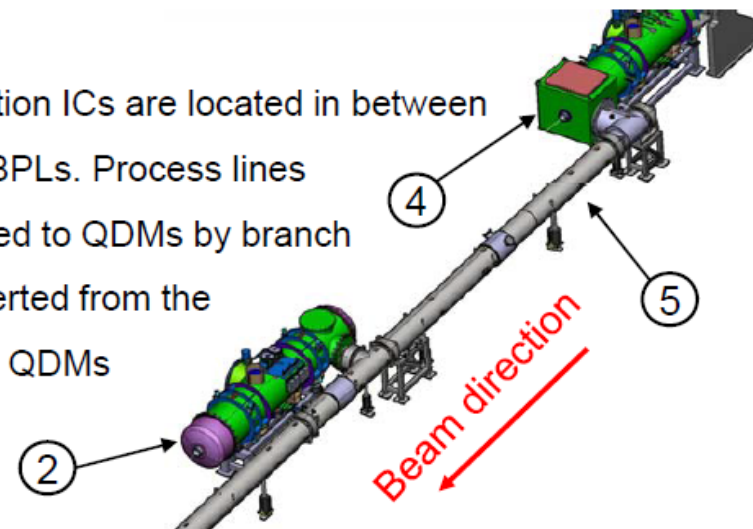
- 11 of 14 IOL-Cells
- IOL-Cell: DP-DP-QDM
- US & DS: Connection to BPL

1 – SIS100-DP-Module; 2 – SIS100-QDM; 3 – SIS-MDP-Module;
4 – End Cap with connection to BPL; 5 – SIS100-BPL; 6 – IC between BPL and QDM

ICs in straight sections



Straight section ICs are located in between QDMs and BPLs. Process lines are connected to QDMs by branch lines are diverted from the BPL into the QDMs



SCHEDULE AIK 10.1-Cryomodule test

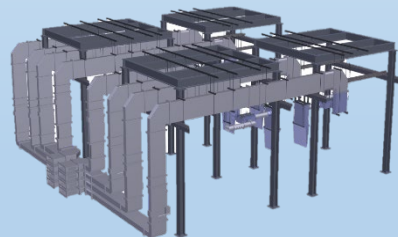
- Reception of Cryomodule units
- Preparation of Cryomodule units for the test bench
- Installation on the test bench
- Initial testing
- Cool down
- Heat load measurements
- Warm up
- Disconnection
- Preparation for the tunnel
- Participation in site activity coordination
- Final review



2017 - 2026

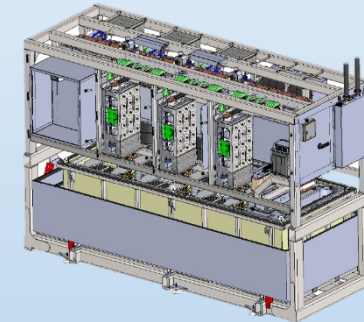
SCHEDULE AIK 8.6 -RF Installation

- Stub installation
- LLRF installation
- LPS installation
- Distribution system installation
- High Power Amplifier installation



SCHEDULE AIK 17.3 -PC Installation

- Klystrons Modulators for RFQ and DTL
- Klystron Modulators for Medium / High Beta
- Magnet Power Converters



SCHEDULE AIK 8.8

CONTRIBUTION TO THE LOW AND HIGH-POWER TESTS
OF RF EQUIPMENT AND TESTING AND INSTALLATION OF
RFPS'S IN TS3 AND IN G02.

2022 - 2023





- Cryogenic experts,
- Mechanical and electrical specialists,
- RF engineers,
- Vacuum specialists,
- Skilled technicians,

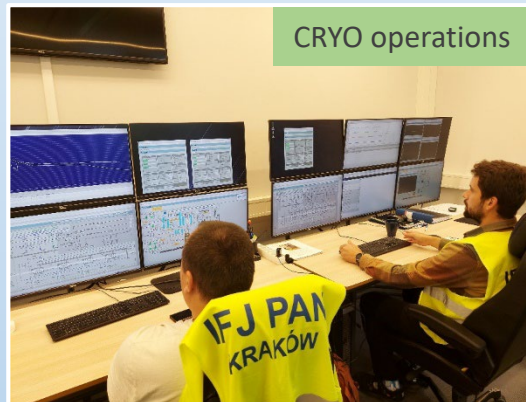
permanently at ESS site 14 persons in
total



MECH inspection



VAC activities



CRYO operations



ELE measurements

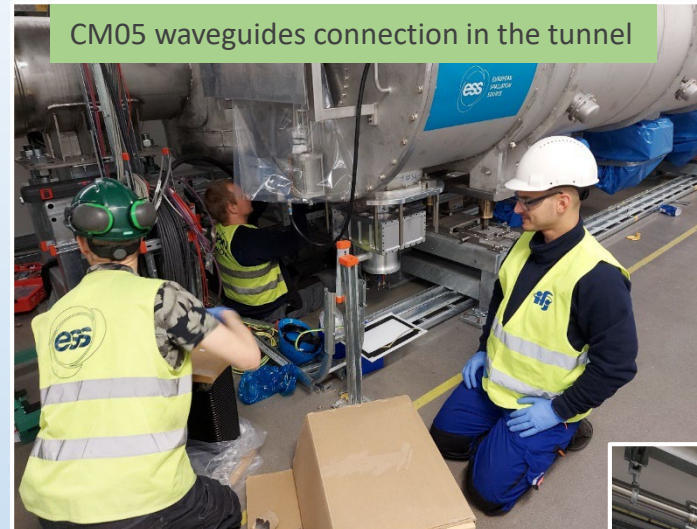


TECH work

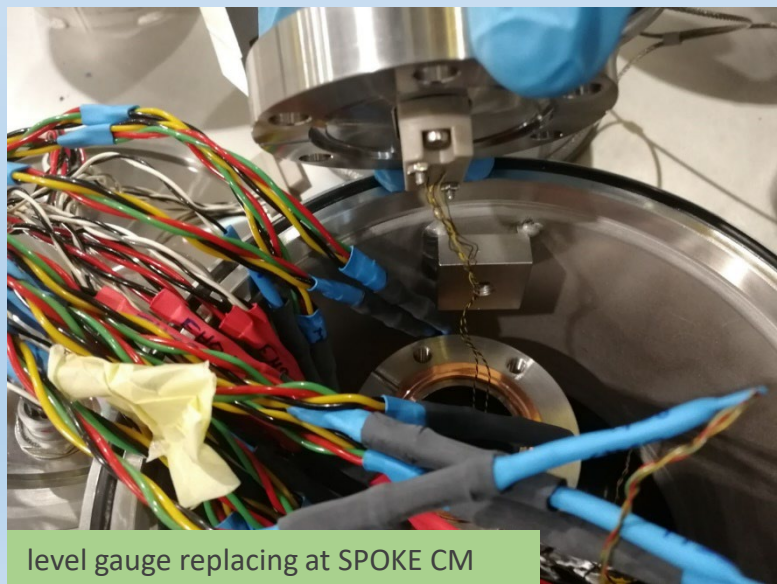


Supported activities at ESS side

- ▶ Support with installation trial of elliptical CM05 & spoke CM02 in the tunnel,
- ▶ Support with SPOKE CM10 CTS motor replacing,
- ▶ Replacing of the LG at all SPOKE CM's,
- ▶ Various leak tests for choosen SPOKE CM's,
- ▶ Support with MLI installation for ACCP-CTL interconnections,
- ▶ And ...



CM05 waveguides connection in the tunnel



level gauge replacing at SPOKE CM



CTS motor repairing at SPOKE CM

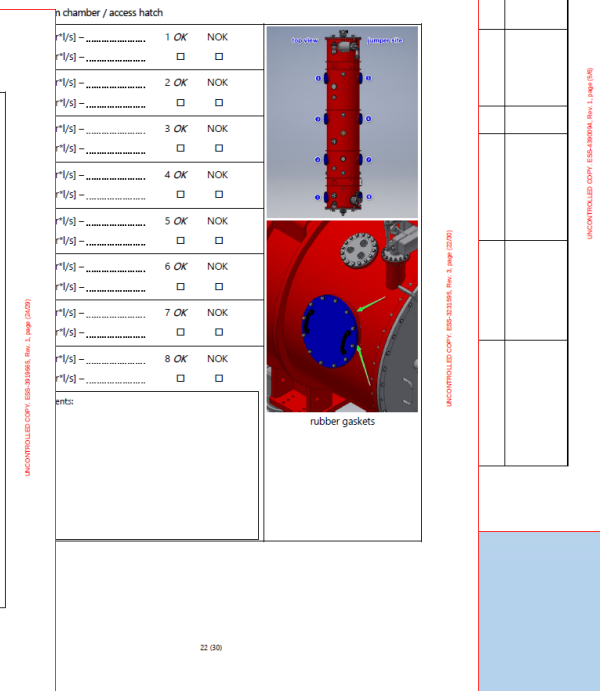
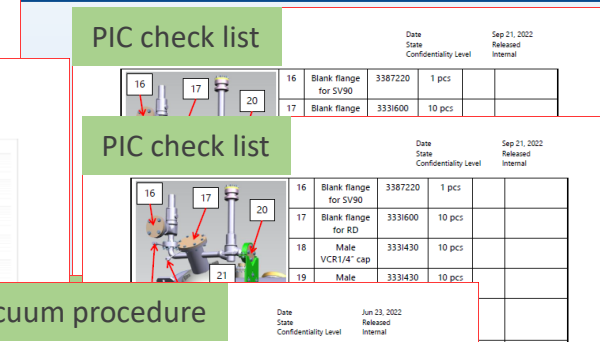
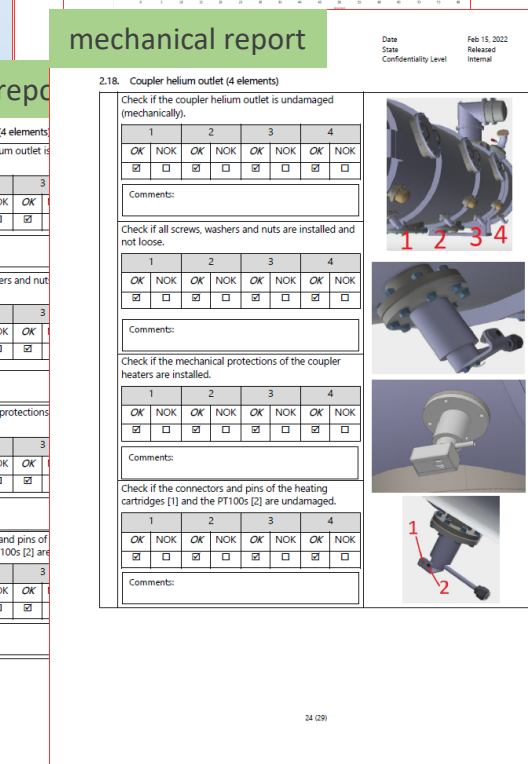
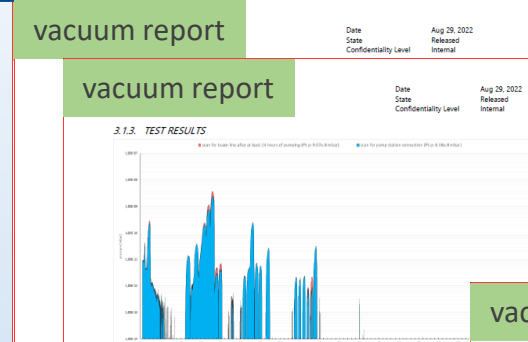
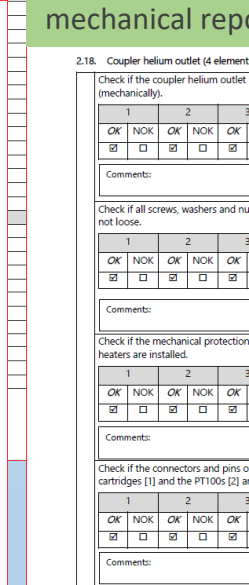
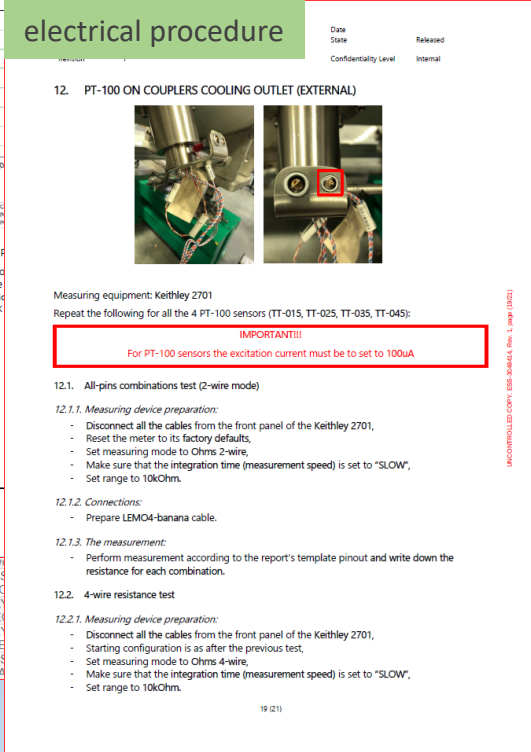
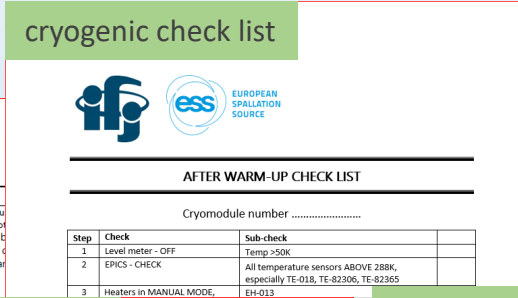
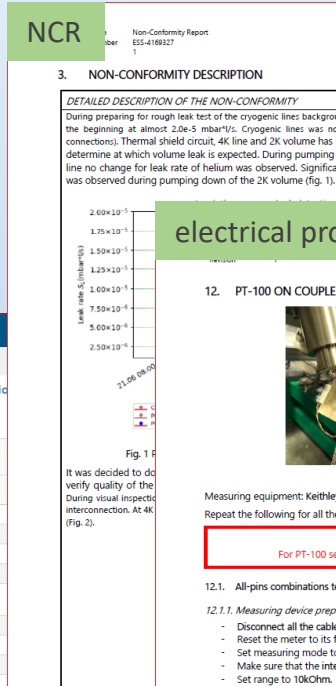
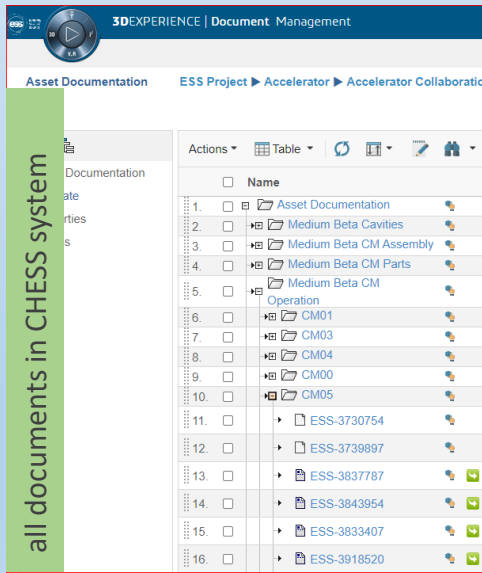


CM05 Jumper connection in the tunnel



Documents

- 10 procedures
- 47 reports
- 15 check lists
- 13 NCR's



UNCONTROLLED COPY - ESS-30484, Rev. 1, page 14/15

UNCONTROLLED COPY - ESS-30484, Rev. 1, page 15/15

UNCONTROLLED COPY - ESS-30484, Rev. 1, page 16/16

UNCONTROLLED COPY - ESS-30484, Rev. 1, page 17/17

UNCONTROLLED COPY - ESS-30484, Rev. 1, page 18/18

UNCONTROLLED COPY - ESS-30484, Rev. 1, page 19/19



High Power test procedure includes:

- DC conditioning;
- RF conditioning;
- RF test to check the functionality of the klystron.



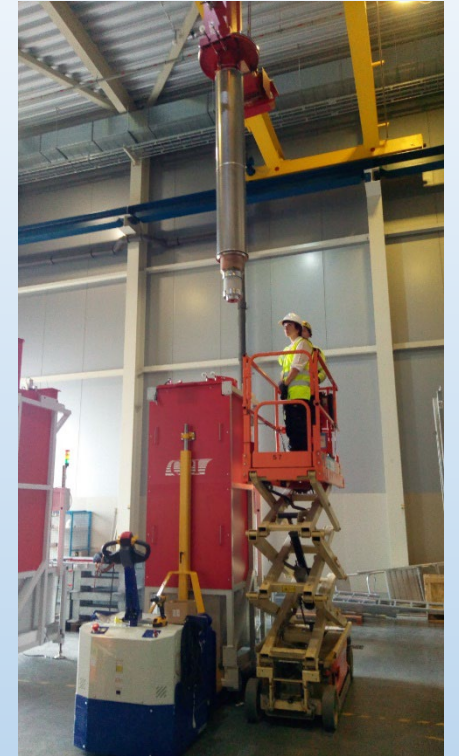
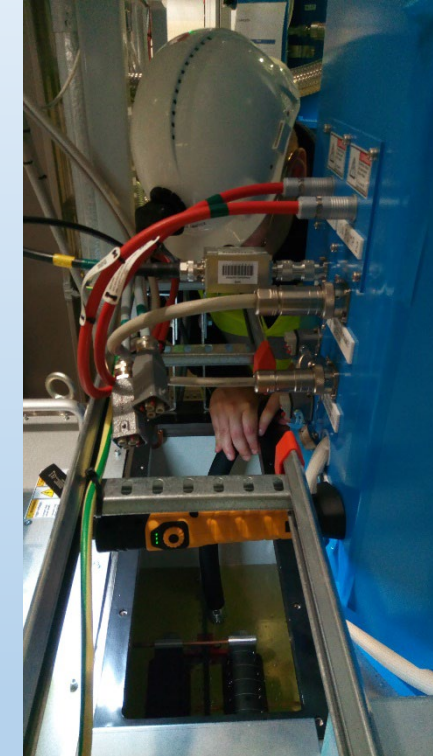
Low Power test includes:

- Checking the cables;
- Checking electronic devices installed in RACK's;
- Setting the interlocks thresholds;
- Checking the response in GUI.



Additional tasks done by IFJ PAN:

- Klystron preparation before LPT;
- Filling klystron with oil;
- Participation during cavity tuning in NCL klystron (together with Thales and ESS experts);
- Participation during swapping the vacuum tube for CPI klystron between two magnet



LHC – construction, commissioning, consolidation

Signing of the agreement in 2005-2010 between IFJ PAN

- ✓ Design and implementation of automatic measurement systems for testing superconducting LHC circuits
- ✓ Quality Control of superconducting electrical circuits
- ✓ Inspection of LHC superconducting magnet connections



Quality Control of
superconducting
electrical circuits
ELQA TEAM

LHC during Long Shutdown



New measurement systems



*Damage disclosed during QC-
ICIT TEAM*

- ✓ The work managing
of the
multinational team
"Alpha-Omega"



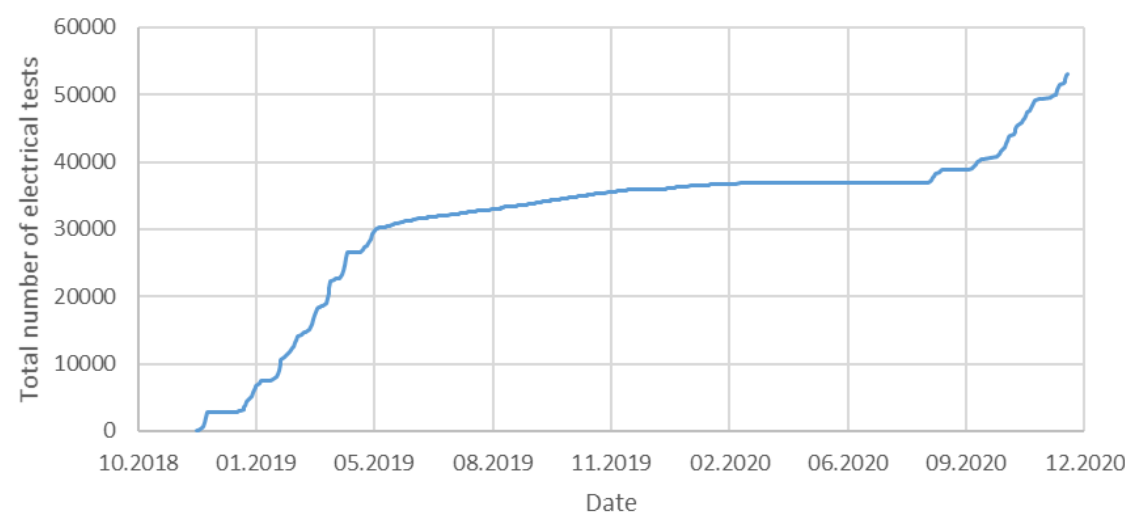


Standard ELQA measurements in the LHC during Long Shutdown 2.

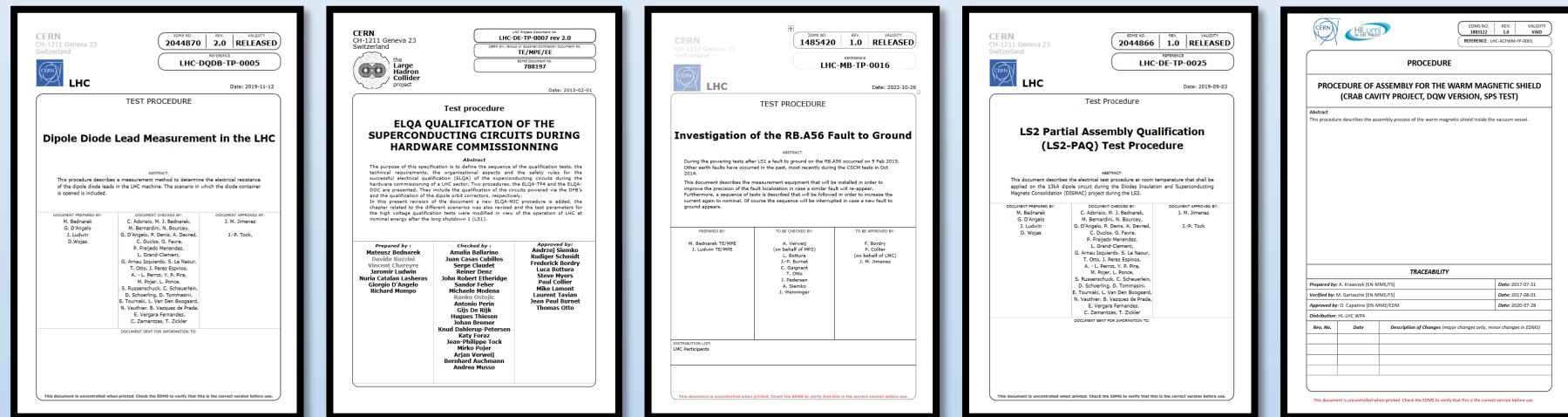


- Standard measurements on more than 1600 LHC superconducting circuits and their instrumentation before and after warm-up of the LHC.
- Software development, design and fabrication of four dedicated diode lead measurement systems.

Up to 25 engineers and technicians from IFJ PAN on CERN site



Number of ELQA measurements performed by IFJ PAN personnel during LS2 until the end of 2020.

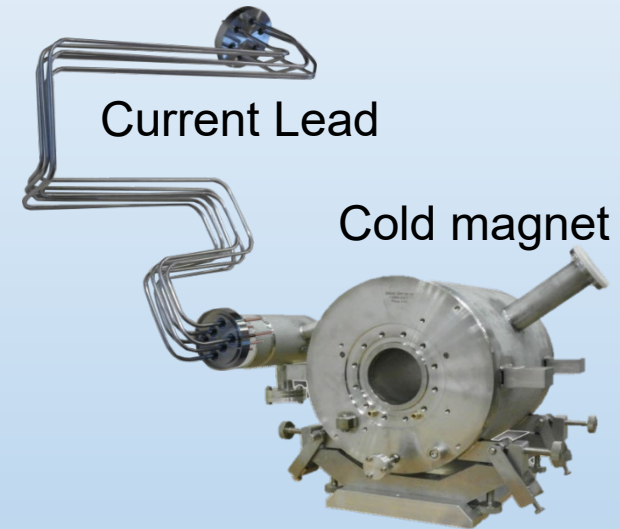


- Co-authorship of 10 procedures related to electrical quality assurance of LHC and HL-LHC superconducting circuits
- Prototype crab cavity assembly procedure



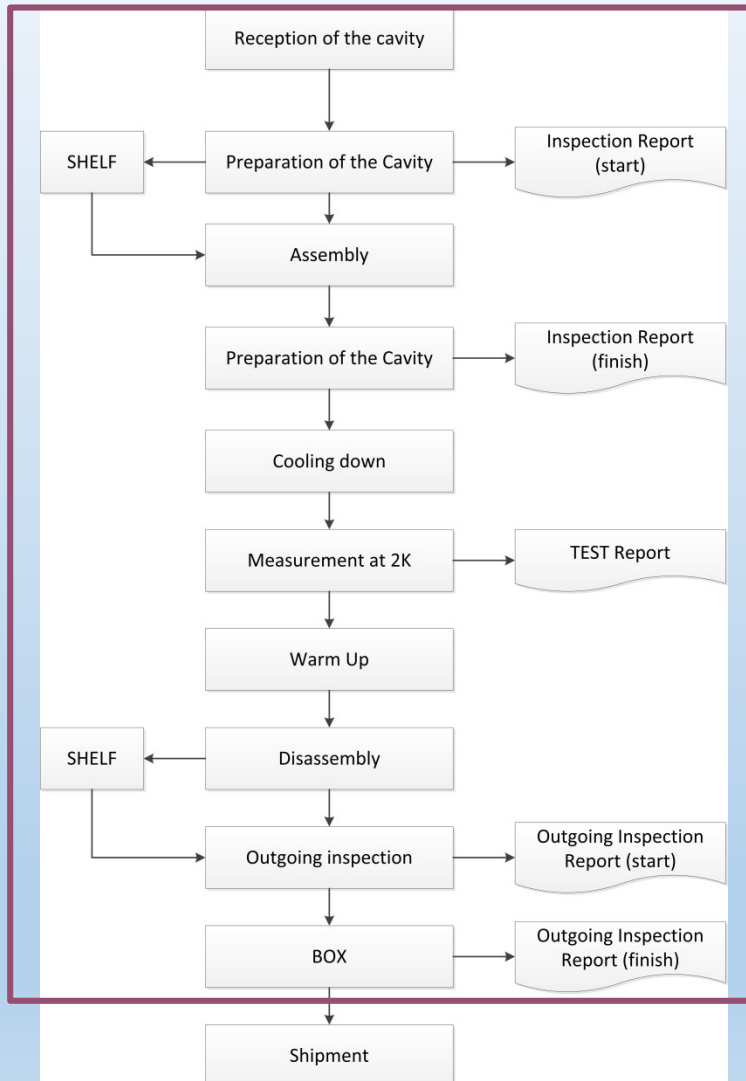
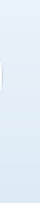
Acceptance tests of superconducting components of the XFEL accelerator

IFJ PAN in-kind contribution to the XFEL 2010 – 2016





TEST - What does it mean ?

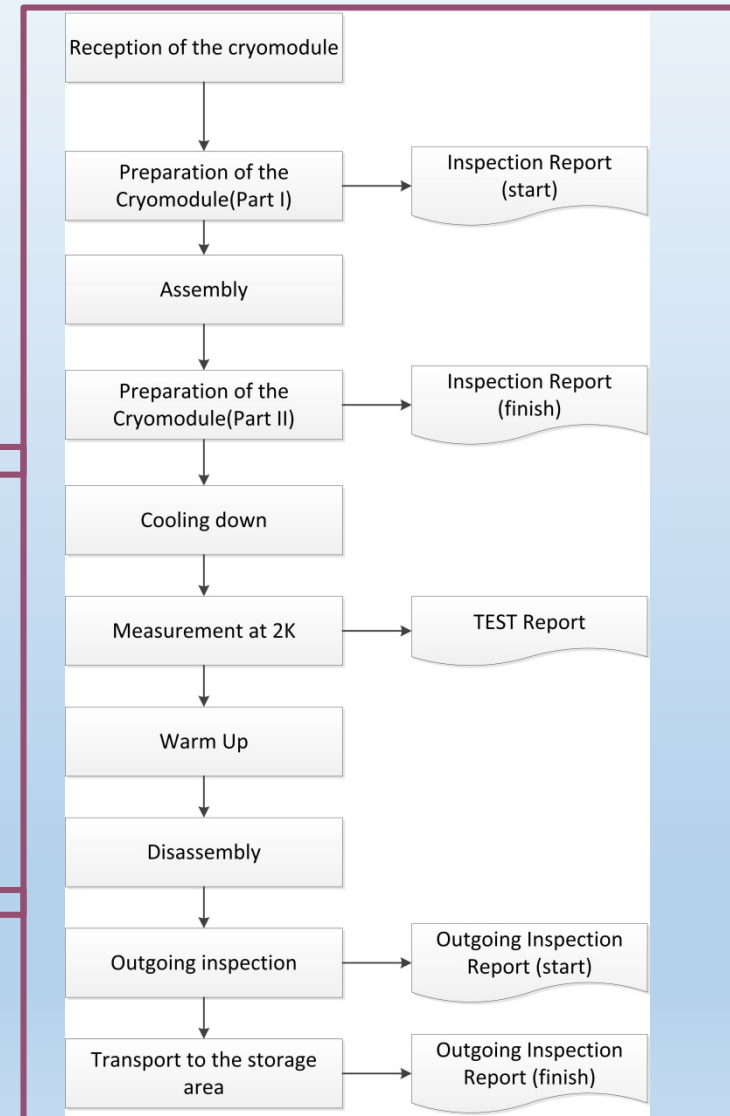


Cavity test main flow diagram

Cryomodule test main flow diagram

TEST

The test program is realized according to the written procedures





Very time consuming and laborious

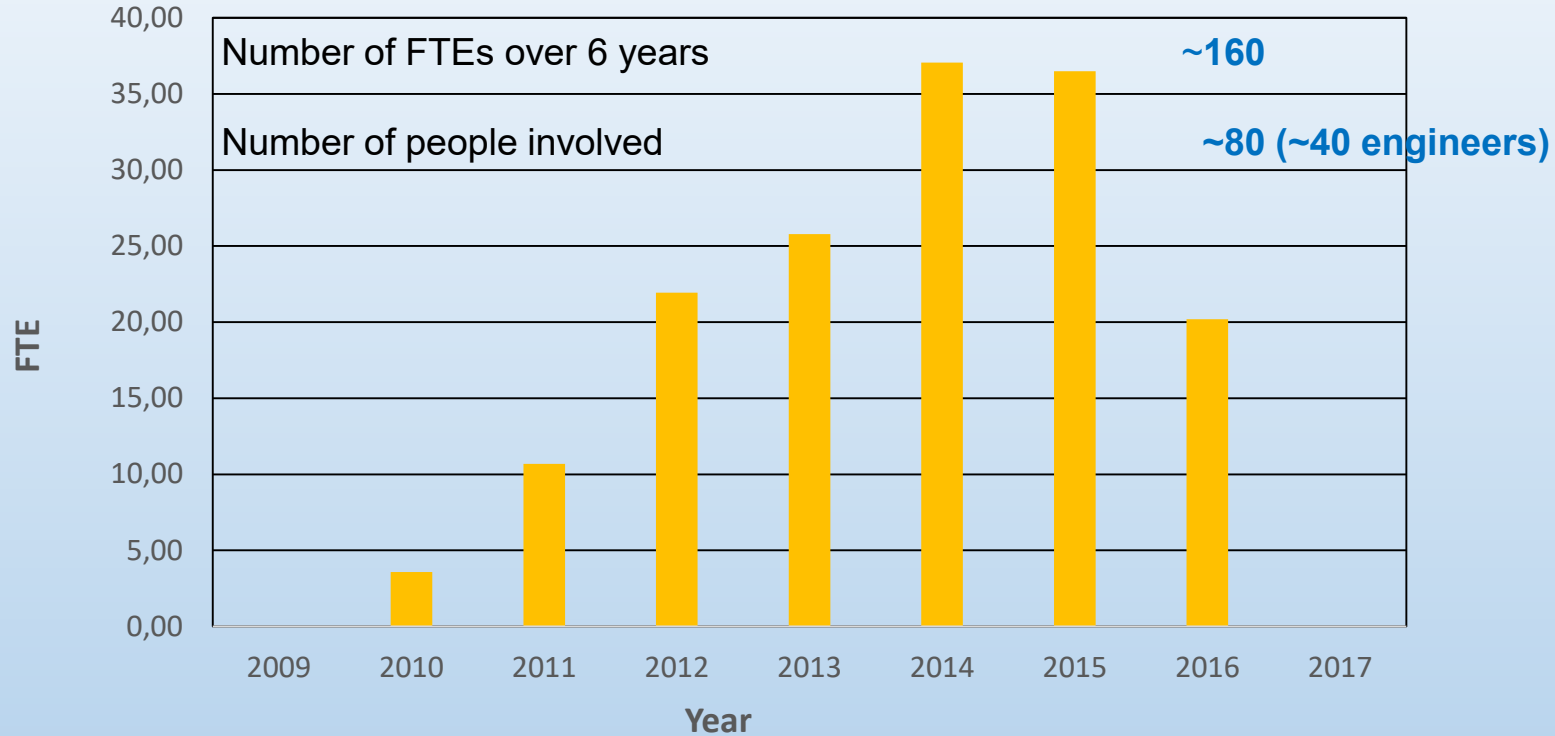


Location: DESY campus at Hamburg



IFJ PAN Team met the logistic challenge in facility operating (equipped with) :

- Two cryostats
- Preparation area for cavities (6 Inserts)
- Three test stands for cryomodules
- Preparation areas for cryomodules (3x special support for survey check + additional 5 place for further incoming check).
- Limited Storage areas for cavities and cryomodules
- 2 cryo operation (2 slots) available at the same time



In total were performed:

1214 tests for **813** series cavities performed

108 tests performed of **101** series cold magnets and current leads

107 tests for **100** series cryomodules



Unloading of the cryomodule after transport



Cryomodule preparation area



Cryomodule test stand

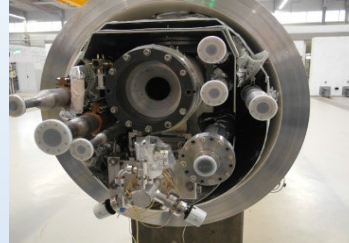


Cryomodule test stand – module inside



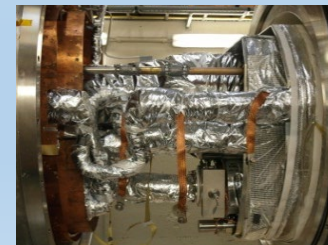
Cryomodule test stand – front view

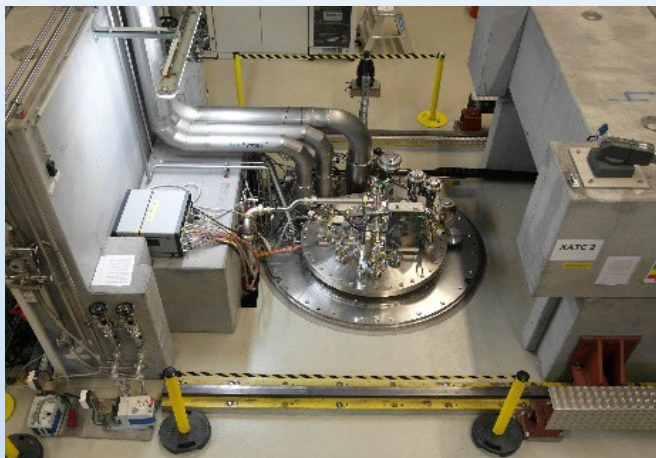




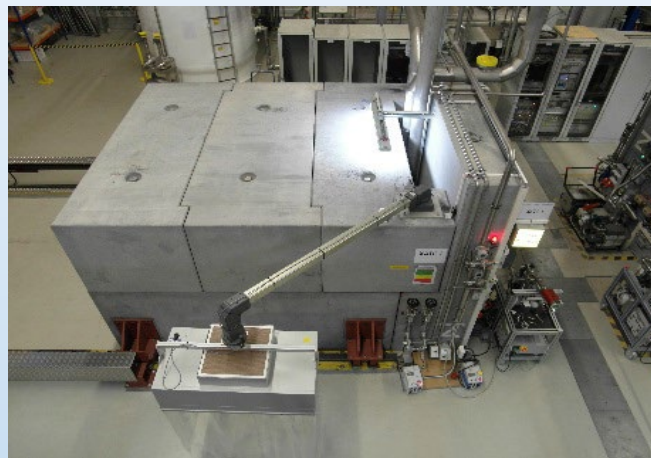
Main tasks:

- Unload the cryomodule from the truck
- Incoming checks
- Load the cryomodule to the movable support
- Assembling Cryomodule at the test stand
- Connecting Cryomodule beam line to the test stand under clean room conditions
- Leak check of beam line interconnections and mass spectroscopy of the beam line
- Connecting of the waveguides
- Connecting of all electrical cables
- Connect of all cryomodule process pipes to the test stands
- Leak check of cryomodule vessel (ISO-VAC)
- Leak check of cryomodule cryogenic lines
- Assembly and isolating thermal shields
- Pumping down of isolation vacuum





Vertical Cryostat



Radiation protection shielding



Cavity preparation area



Cavity storage area



Cavity incoming check area

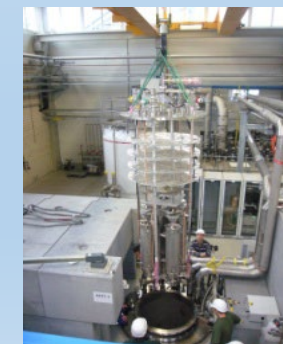


Clean room



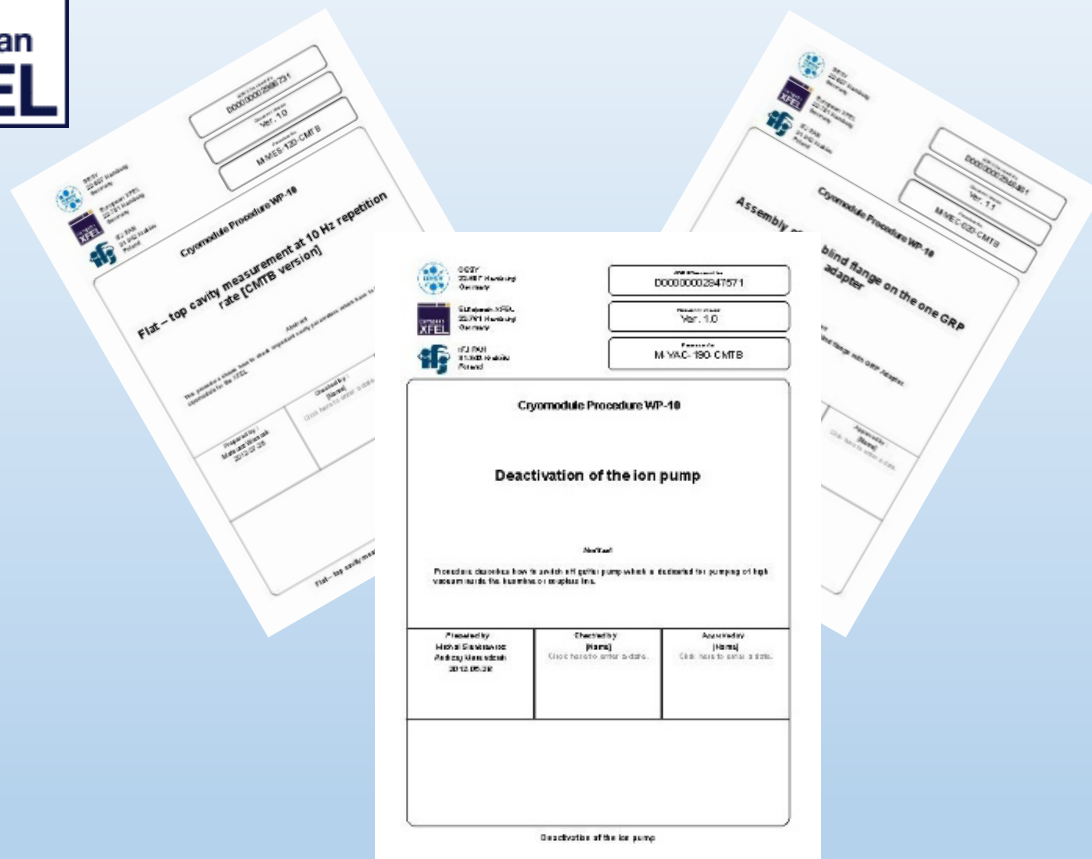
Main tasks:

- Incoming checks
- Assembling Cavity to the Insert
- Connecting Cavity to the vacuum line (in cleanroom conditions)
- Tuning of Fundamental Mode Rejection Filters of both HOM couplers + Cables connection
- Leak check of the Cavity
- Transport of the Insert to the cryostat + vacuum connection





XFEL Procedures



Number of created procedures:

~50 for Cryomodule (AMTF)
~19 for Cavity (AMTF)

~146 for Cryomodule (CMTB)
~21 for Cavity (HALL 3)

Activation and deactivation of Ion Pump	D00000006689411	09.02.2016
Activation of Titanium Sublimation Pump (TSP)	D00000006689491	09.02.2016
Alignment_of_the_cryomodule	D00000006678751	26.01.2016
Assembly final tightening and connection of GRP adapter	D00000006651881	26.01.2016
Cavities fine tuning and module calibration	D00000006630821	11.12.2015
Closing of the sliding muff	D00000006650681	20.01.2016
Connection of all process pipes	D00000006651941	26.01.2016
Connection of the beamline	D00000006790331	24.03.2016
Connection_of_the_waveguides	D00000006853821	25.04.2016
COOL DOWN_XATB	D00000006563271	08.01.2016
COOL DOWN_XATB_checklist	D00000006552401	09.01.2016
Coupler tuner bellow check at warm	D00000006637781	18.12.2015
Cryomodule Heat Loads measurements	D00000006710641	23.03.2016
Detune all cavities after cold test	D00000006632411	14.12.2015
Disconnection of all process pipes	D00000006652001	21.01.2016
Disconnection of the beamline	D00000006790571	24.03.2016
Disconnection_of_the_waveguides	D00000006853921	25.04.2016
Dismounting of GRP adapter	D00000006652061	26.01.2016
Flat - top measurement	D00000006638681	18.12.2015
Heat Loads Measurements at 2K RF	D00000006637201	18.12.2015
Installation of the 80K thermal shield at End-cap and Feed-cap sides	D00000006678511	26.01.2016
Installation of the 8K thermal shield at End-Cap and Feed-cap sides	D00000006678461	26.01.2016
Integral leak check of the cryomodule	D00000006633341	15.01.2016
Isolating of all process pipes	D00000006652431	20.01.2016
Isolation of the 80K thermal shield using MLI at End-cap and Feed-cap sides	D00000006678631	26.01.2016
Isolation of the 8K thermal shield using MLI at End-cap and Feed-cap sides	D00000006678571	26.01.2016
Leak check of the cryomodule	D00000006711021	15.02.2016
LLRF measurements at AMTF	D00000006637721	05.01.2016
Low power RF measurement at 2K	D00000006630761	11.12.2015
Magnet test at 2K	D00000006632351	21.12.2015
Opening and closing of the cold valve	D00000006710831	15.02.2016
Opening of the sliding muff	D00000006651091	20.01.2016
Post caps installation	D00000006651331	20.01.2016
Pumping down of the cryomodule insulation vacuum	D00000006789801	24.03.2016
Removal of Post caps	D00000006651391	20.01.2016
Removal of the transport-cap at downstream side	D00000006651451	21.01.2016
Removal of the transport-cap at upstream side	D00000006651501	21.01.2016
Unloading of the XFEL cryomodule from the trailer and transfer to the preparation area	D00000006678691	26.01.2016
Vacuum incoming inspection for cryomodule	D00000006632481	15.01.2016
Warm coupler conditioning	D00000006637261	18.12.2015

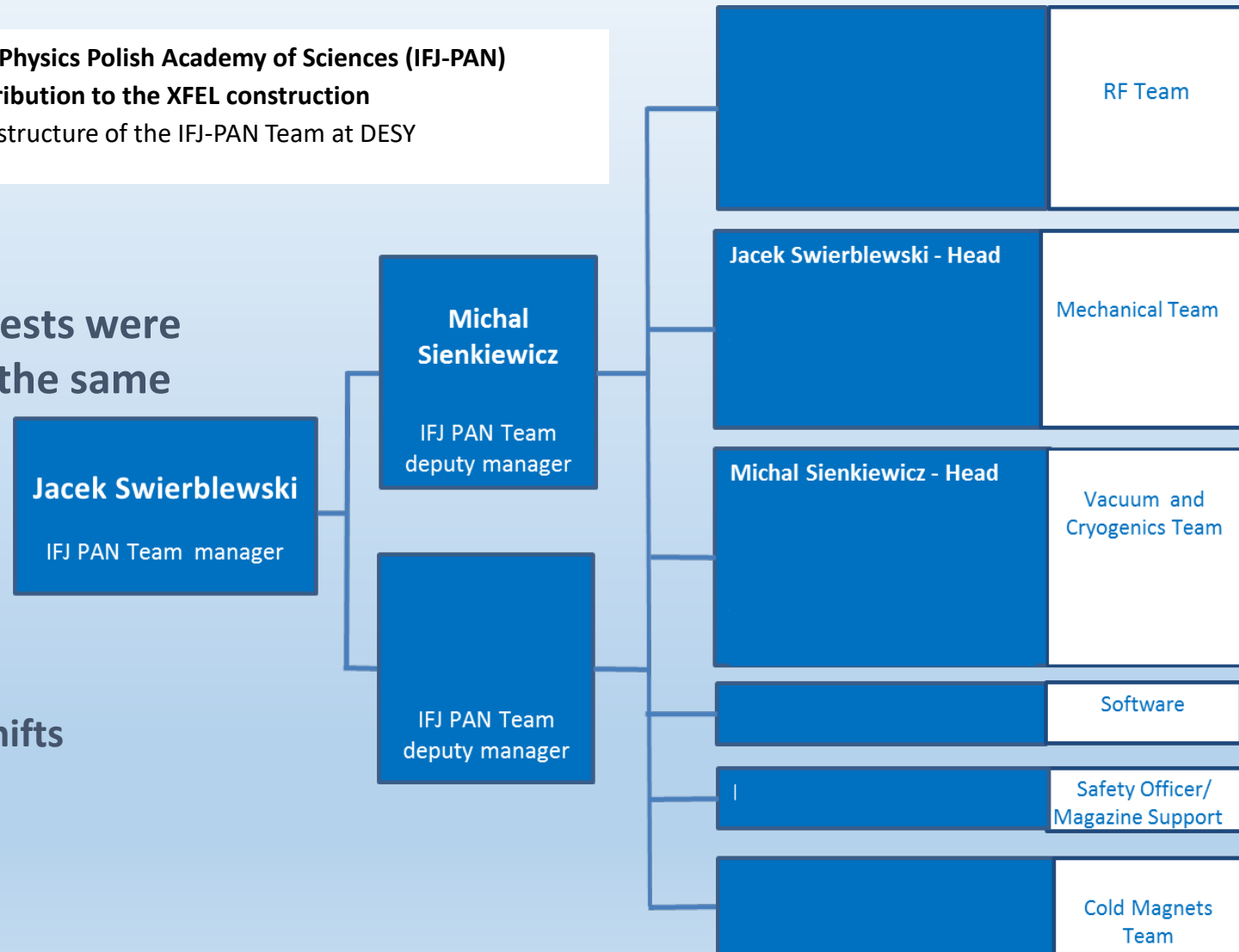


Institute of Nuclear Physics Polish Academy of Sciences (IFJ-PAN)
in-kind contribution to the XFEL construction
Organizational structure of the IFJ-PAN Team at DESY

For Cavities and Cryomodules tests were involved around 50 persons at the same time:

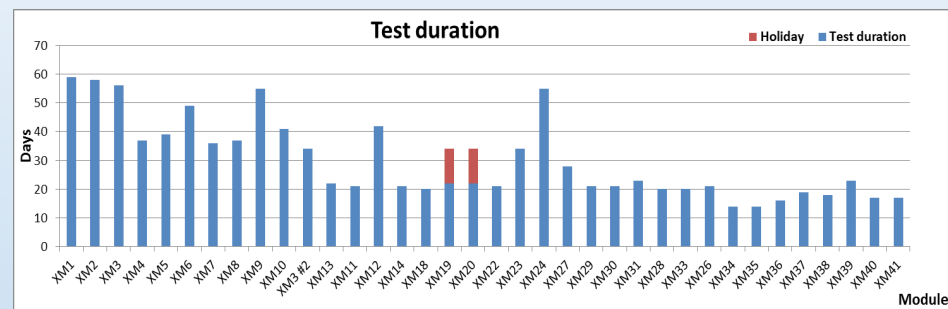
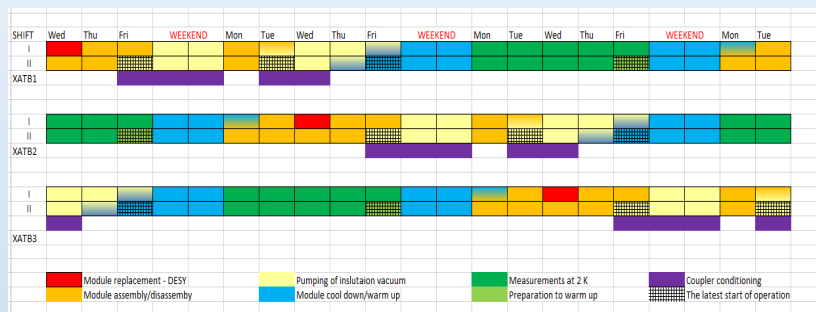
- AMTF Technical Coordinator
- 25 engineers
- 24 technicians

The work was organized on two shifts

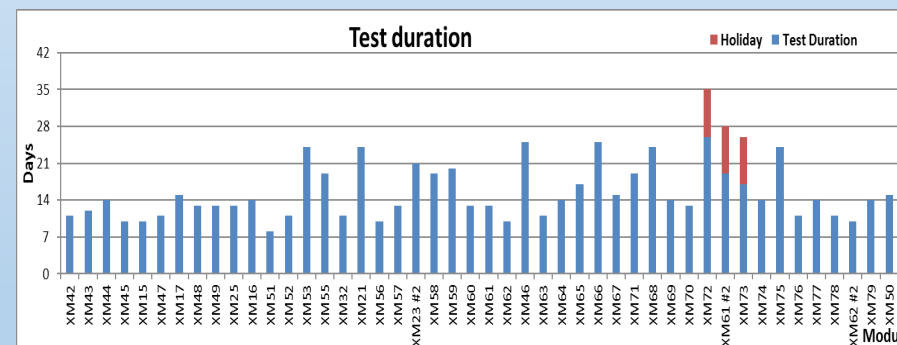
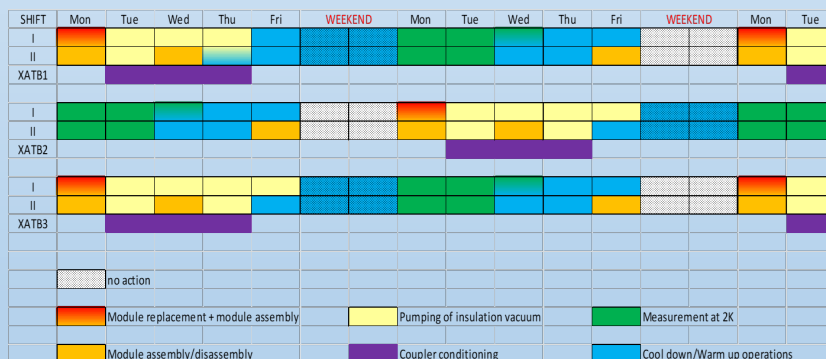




In November 2014 the major plan how to perform the test of the cryomodule with rate 1 per week (21 days test program) have been created



Test rate 1 module per week



Test rate 1.5 module per week

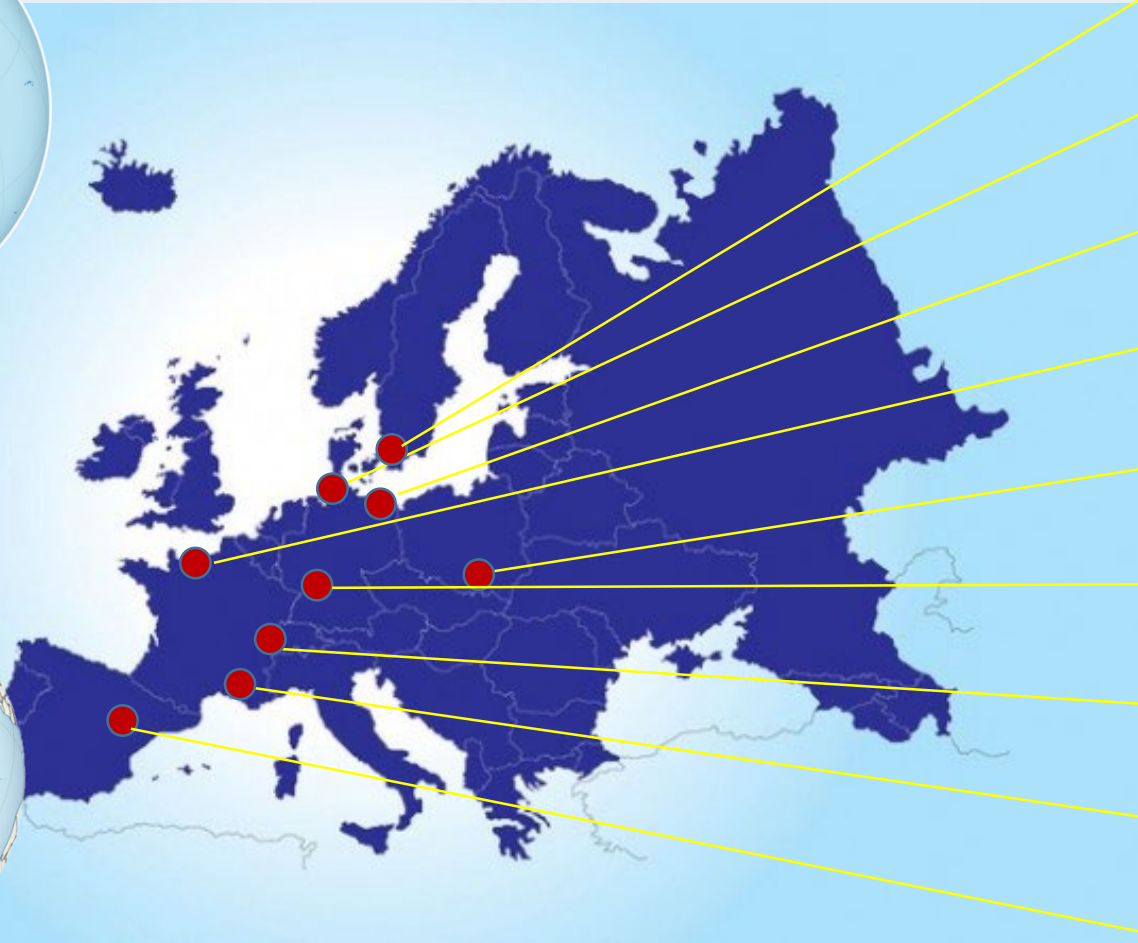
Concluding



T2K, J-PARC
BELLE 2, KEK



CTA
Pierre Auger



ESS
LUND

E-XFEL
DESY

W7X
IPP GREIFSWALD

SPIRAL 2
GANIL, CAEN

IFJ PAN
KRAKÓW

FAIR
GSI DARMSTADT

LHC, ATLAS
CERN

ITER
CADARACHE

F4E
BARCELONA

Quality Assurance

Quality assurance can be defined as "part of quality management focused on providing confidence that quality requirements will be fulfilled." The confidence provided by quality assurance is twofold—internally to management and externally to customers, government agencies, regulators, certifiers, and third parties.

Quality Control

Quality control can be defined as "part of quality management focused on fulfilling quality requirements." While quality assurance relates to how a process is performed or how a product is made, quality control is more the inspection aspect of quality management.



QC focuses on the results of the work performed, whereas QA is concerned with the adequacy of the underlying processes, methodology, and standards in place to create the output.



This standard describes the fundamental concepts and principles of quality management which are universally applicable to the following:

- organizations seeking sustained success through the implementation of a quality management system;
- customers seeking confidence in an organization's ability to consistently provide products and services conforming to their requirements;
- organizations seeking confidence in their supply chain that product and service requirements will be met;
- organizations and interested parties seeking to improve communication through a common understanding of the vocabulary used in quality management;
- organizations performing conformity assessments against the requirements of ISO 9001;
- providers of training, assessment or advice in quality management;
- developers of related standards.



E.W. Deming defines quality as the anticipated degree of homogeneity and reliability of a product at the lowest possible cost and adjusting it to the market requirements.

Quality means conformance to requirements. (Crosby, 1979)

Project Management Theory and Practice, Third Edition, 2019

7 Principals of Quality

- Customer focus
- Leadership
- Engagement of people
- Process approach
- Improvement
- Evidence-based decision making
- Relationship management

One American computer manufacturer was dissatisfied with one of its American suppliers. So he decided to try to cooperate with the Japanese. In the order, he wrote that he expected for every 10 000 no more than 4 defective products on average, which was in line with the US military standard 105D at that time. The Japanese took the order. Some time later the delivery of the equipment came, along with a letter that read: "We Japanese have a hard time for understanding the North American way of doing business. Four defective parts per 10 000 are delivered separately. We hope you are satisfied with this. "

Andrzej Blikle, Doktryna jakości (wydanie II turkusowe) — rzecz o turkusowej samoorganizacji (16 września 2016)



QUALITY – fundamental Sensei

W. Shewhart

J. Bank

E. Skrzypek

J. Oakland

Ph. Crosby

G. Taguchi

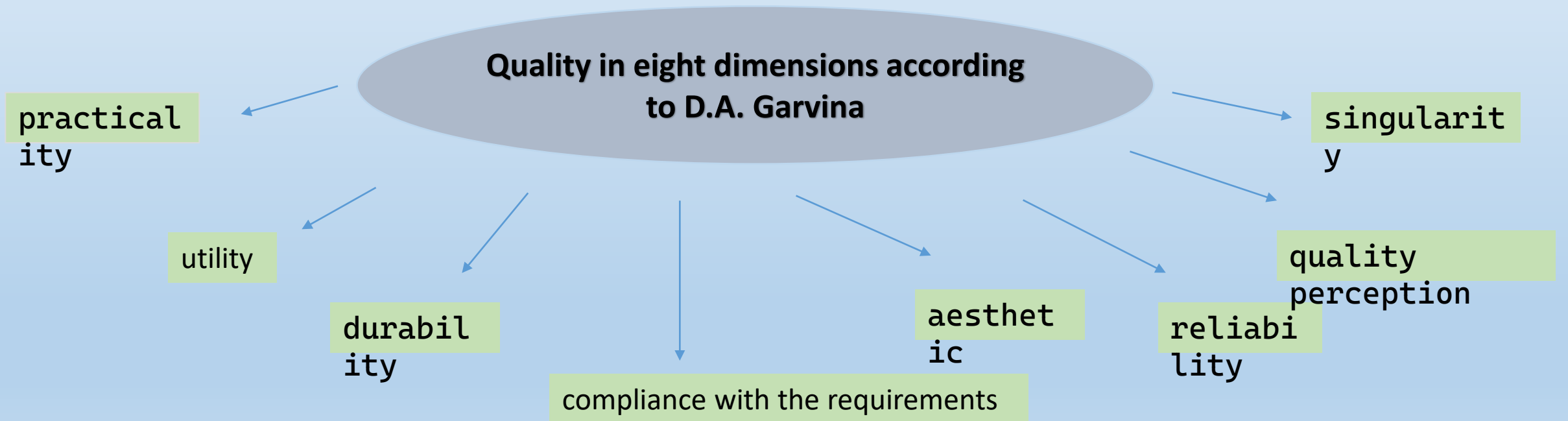
J.M. Juran

W.E. Deming

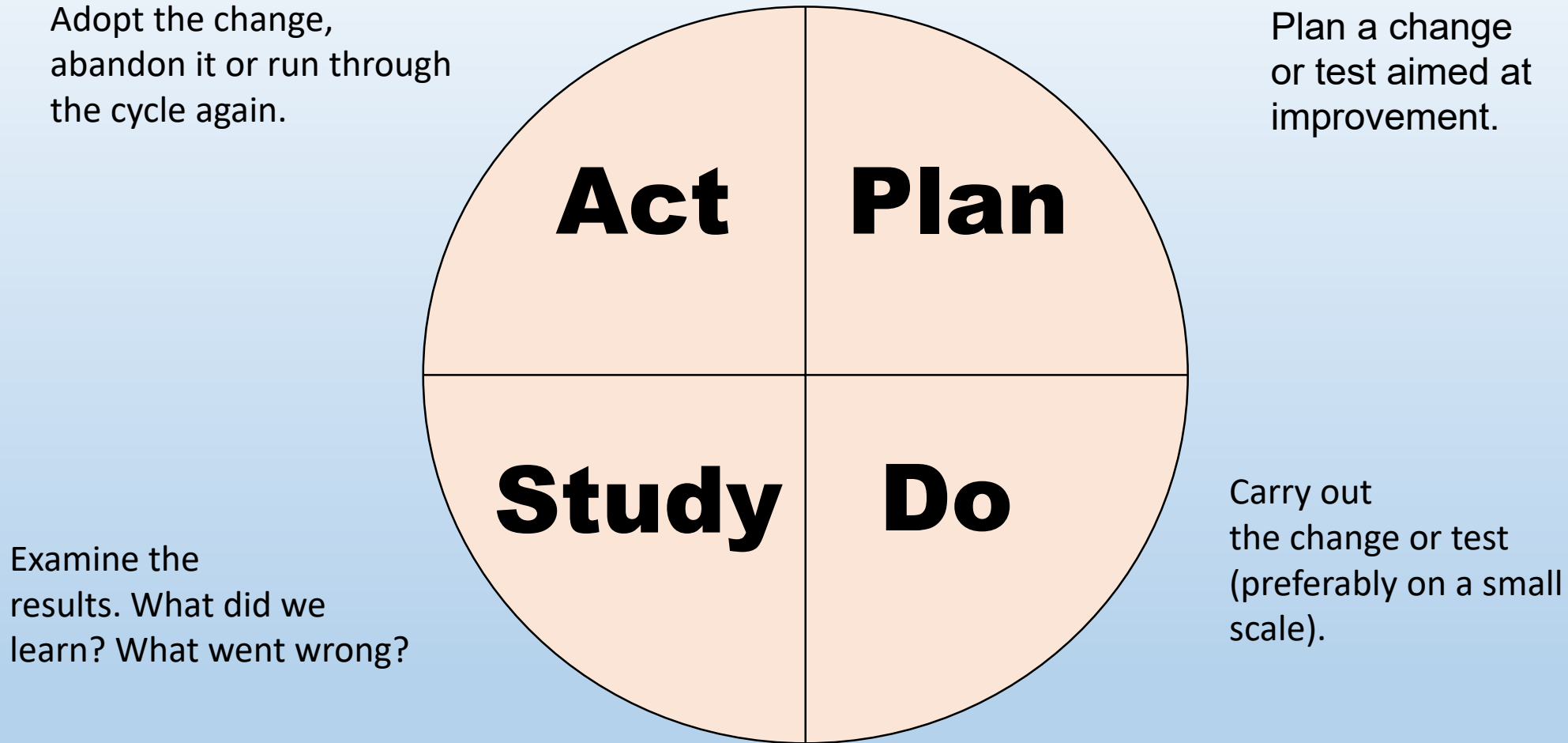
K. Ishikawa

A.V. Feigenbaum

A.V. Feigenbaum



PDSA – Deming's cycle



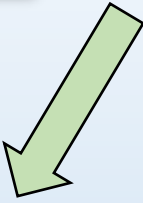
Deming modified Shewhart cycle and called new one → the Shewhart Cycle for Learning and Improvement

Deming described it as a flow diagram for learning and improvement of a **product** or a **process**.

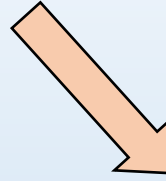


Classification of quality management methods

- Failure mode and effects Analysis (FMEA)
- Quality function deployment (QFD)
- Projektowanie eksperymentów
- Metoda Taguchiego
- Single minute exchange of die
- Poka yoke
- Total productive maintenance
- Just in time
- Kanban
- 5xS



ENGINEERING



STATISTICAL

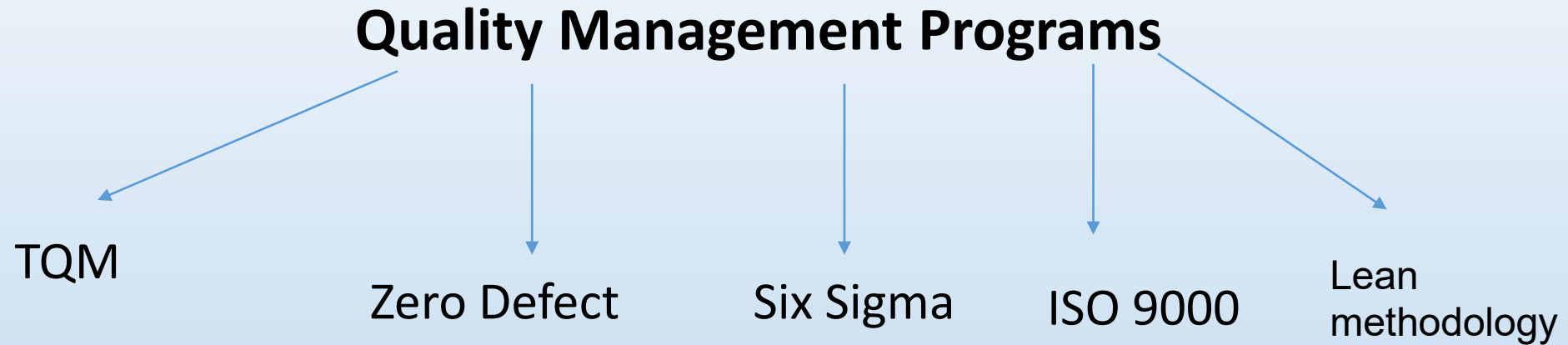
- Control card
- Pareto diagram
- Scatter correlation diagram
- Histogram
- Data analysis matrix
- Analytical sheet
- Statistical quality control
- Statistical controls process
- Process capability analysis



MANAGEMENT

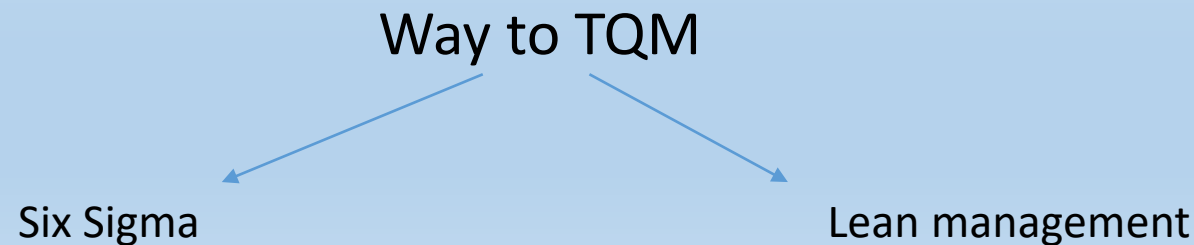
- Kaizen
- Continuous improvement cycle(PDCA)
- Quality cost analysis
- Ishikawa diagram
- Relationship diagram
- Matrix diagram
- Decision tree
- Programming chart the decision process
- Benchmarking
- Quality planning
- Graphical presentation processes
- Flag method

- Process improvement cycle (DMAIC)
- SERVQUAL
- Quality wheels
- Quality audit meeting
- Empowerment
- Hoshin kanri
- Catchball
- Criteria quality awards (incl. W. E. Deming, M. Baldrige)
- EFQM excellence
- ISO 9004
- Management review
- Internal audit



Total Quality Management — TQM

The heart of the TQM philosophy is the prevention of problems and an emphasis on quality in the design and development of products and processes. A formal quality planning process is integral to the TQM philosophy.





Deming's 14 Points for the Transformation of Management First presented in Dr. Deming's seminal book, *Out of the Crisis*

85% of quality problems are due to system errors and only 15% can be attributed to employees.

- ✓ *Create constancy of purpose for improving products and services*
- ✓ *Adopt the new philosophy*
- ✓ *Cease dependence on inspection to achieve quality*
- ✓ *End the practice of awarding business on price alone; instead, minimize total cost by working with a single supplier*
- ✓ *Improve constantly and forever every process for planning, production, and service*
- ✓ *Institute training on the job*
- ✓ *Adopt and institute leadership*
- ✓ *Drive out fear*
- ✓ *Break down barriers between staff areas*
- ✓ *Eliminate slogans, exhortations, and targets for the workforce*
- ✓ *Eliminate numerical quotas for the workforce and numerical goals for management*
- ✓ *Remove barriers that rob people of pride of workmanship, and eliminate the annual rating or merit system*
- ✓ *Institute a vigorous program of education and self-improvement for everyone*
- ✓ *Put everybody in the company to work accomplishing the transformation*

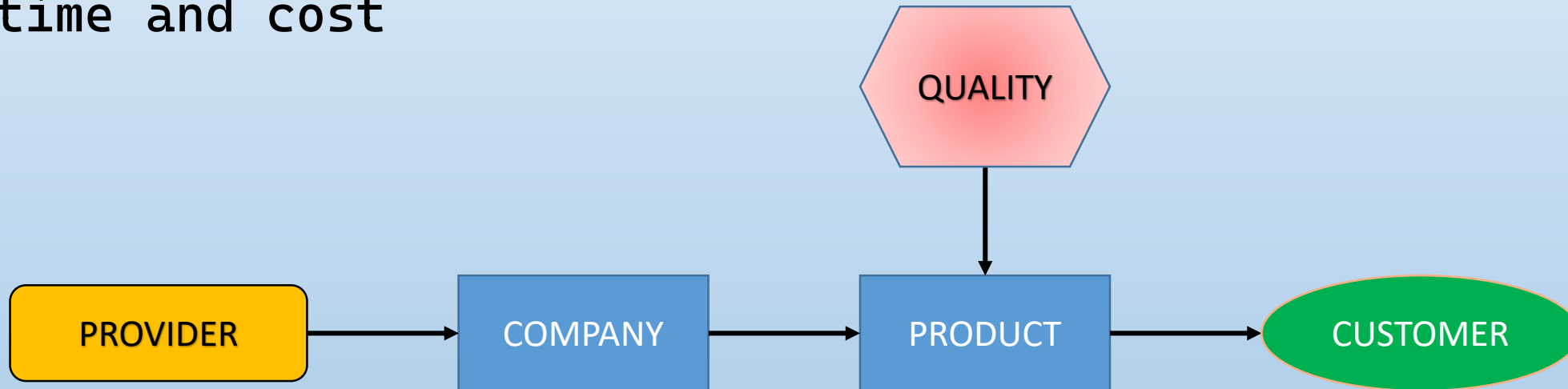
Traditional quality assurance model

QUALITY

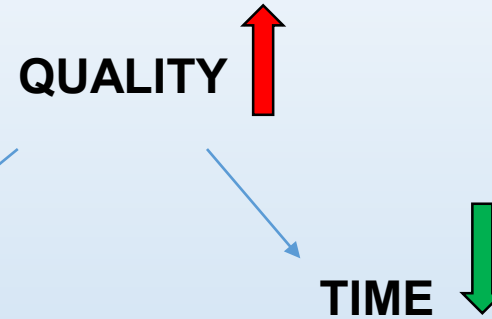
↑ COSTS

↑ TIME

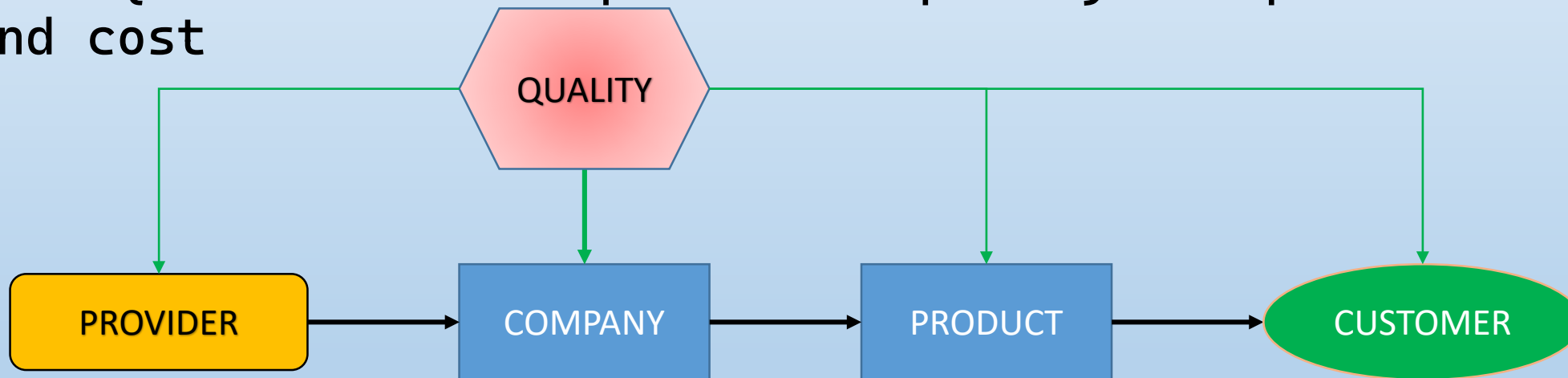
The traditional relationship between quality and production time and cost



TQM quality assurance model



The TQM's relationship between quality and production time and cost



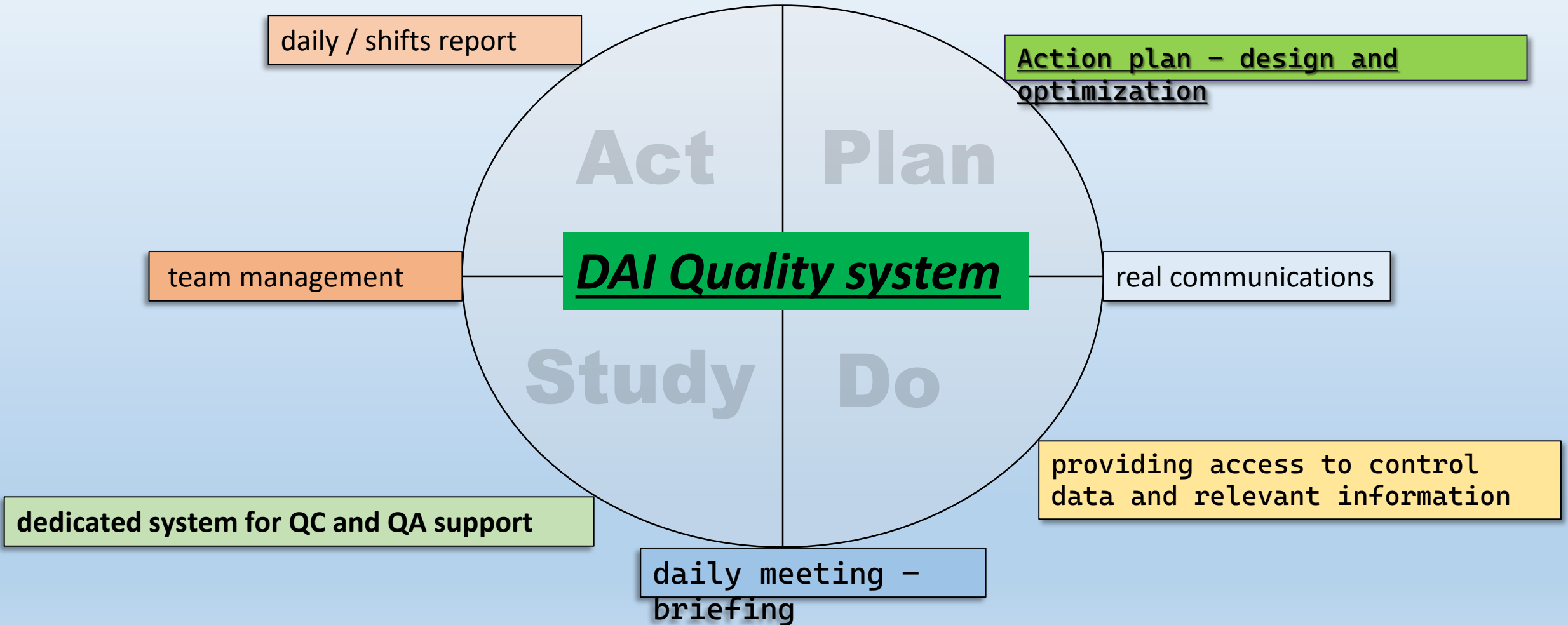


1. ***Lack of constancy of purpose*** to plan product and service that will have a market and keep the company in business and provide jobs. *Lack of a set course of action is not like a runny nose or the flu. It is not a mild disease. It is a fatal disease and leads to the collapse of the company*
2. ***Emphasis on short-term profits***: short-term thinking (just the opposite from constancy of purpose to stay in business), fed by fear of unfriendly takeover, and by push from bankers and owners for dividends.
3. ***Evaluation of performance, merit rating, or annual review.***
4. ***Mobility of management***; job hopping.
5. ***Management by use only of visible figures***, with little or no consideration of figures that are unknown or unknowable.
6. ***Excessive medical costs***. As reported by Dr. Deming in Out of the Crisis (pages 97-98), executives shared with him that the cost of medical care for their employees was amongst their largest overall expenses, not to mention the cost of medical care embedded in the purchase price of what they purchased from their suppliers.
7. ***Excessive costs of liability***, swelled by lawyers that work on contingency fees.



„The EFQM Model not only remains relevant but continues to set the management agenda for any organisation wanting a long term, sustainable future.” - [EFQM Model Change Management Framework | EFQM](https://www.efqm.org/efqm-model)

<https://www.efqm.org/efqm-model>





Action plan – design and optimization

STEP I

Required to perform ~10% tests of the all tested component

Conceptual design of the action plan for testing object

Creation of the procedures

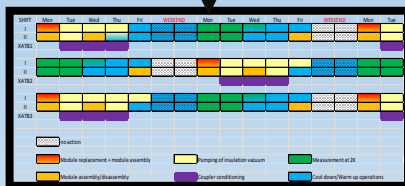
Preliminary design of the action plan for testing object

Improvement of the procedures

Final design of the action plan for testing object

Improvement and approval of the procedures

RESULT



STEP II

Required to perform ~10% tests of the rest tested component

Analysis of the achieved testing information vs. costs and time

Analysis of the modifying procedures possibility without losing quality, cost and time.

Analysis of the possibility of a potential damage, failure occurrence for the tested component during its operational phase and its effects.

NO

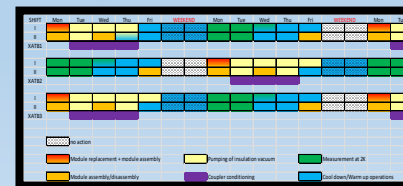
acceptance

YES

Optimal design of the action plan for testing object

Improvement and approval of the procedures

Optimal result





Data:	Zmiana:	Shift Leader:	Nieobecni:	1.	2.	3.	4.
/ / 2015	I						

	Prep 1	Prep 2	Prep 3	Prep 4	Prep 5	Prep 6
DONE						
In Progress						
TO DO						

	XATC1	XATC2	PREP SUP
DONE			
In Progress			
TO DO			

Transport		
Z:	Do:	Sztuk

SACLAY			
OUT-R	OUT-M	OUT-V	Papier

Inne akcje CAVITY			
X-rays	Spawanie	RI	ZANON

	XATB1	XM...	XATB2	XM...	XATB3	XM...
DONE						
In Progress						
TO DO						

XATB1 – XM...				XATB2 – XM...				XATB3 – XM...			
CCC	SPE	TUN	CAL	CCC	SPE	TUN	CAL	CCC	SPE	TUN	CAL
Flat – top first run				Flat – top first run				Flat – top first run			
1	2	3	4	5	6	7	8	1	2	3	4
5	6	7	8	1	2	3	4	5	6	7	8
Flat – top final run				Flat – top final run				Flat – top final run			
1	2	3	4	5	6	7	8	1	2	3	4
5	6	7	8	1	2	3	4	5	6	7	8
HL "0"	HL RF	HL "0"	HL "0"	HL RF	HL "0"	HL "0"	HL RF	HL "0"	HL RF	HL "0"	HL RF
LLRF	LLRF -C	MAG	LLRF	LLRF -C	MAG	LLRF	LLRF -C	MAG	LLRF	LLRF -C	MAG
PPOS	PiMod	RI MG	PPOS	PiMod	RI MG	PPOS	PiMod	RI MG	PPOS	PiMod	RI MG

MODULY – PRZED TESTEM													
MODUL	VM SR	RC	IM	IR 1	IR 2	SO	SD	KBL SZ	KBL CZ	KBL att.	VM SD	AVD	PC SM
XM..													
XM..													
XM..													
XM..													

OTHERS / PROBLEMS	
1.	
2.	
3.	
4.	
5.	
6.	

MODULY PO TESTIE				
MODUL	OUT-M	OUT-R	OUT - V	Papier OUT
XM..				
XM..				



team management

Study on incentive and supervision mechanisms of technological innovation in megaprojects based on the principal-agent theory

Study on
incentive and
supervision
mechanisms



Engineering, Construction and
Architectural Management
© Emerald Publishing Limited

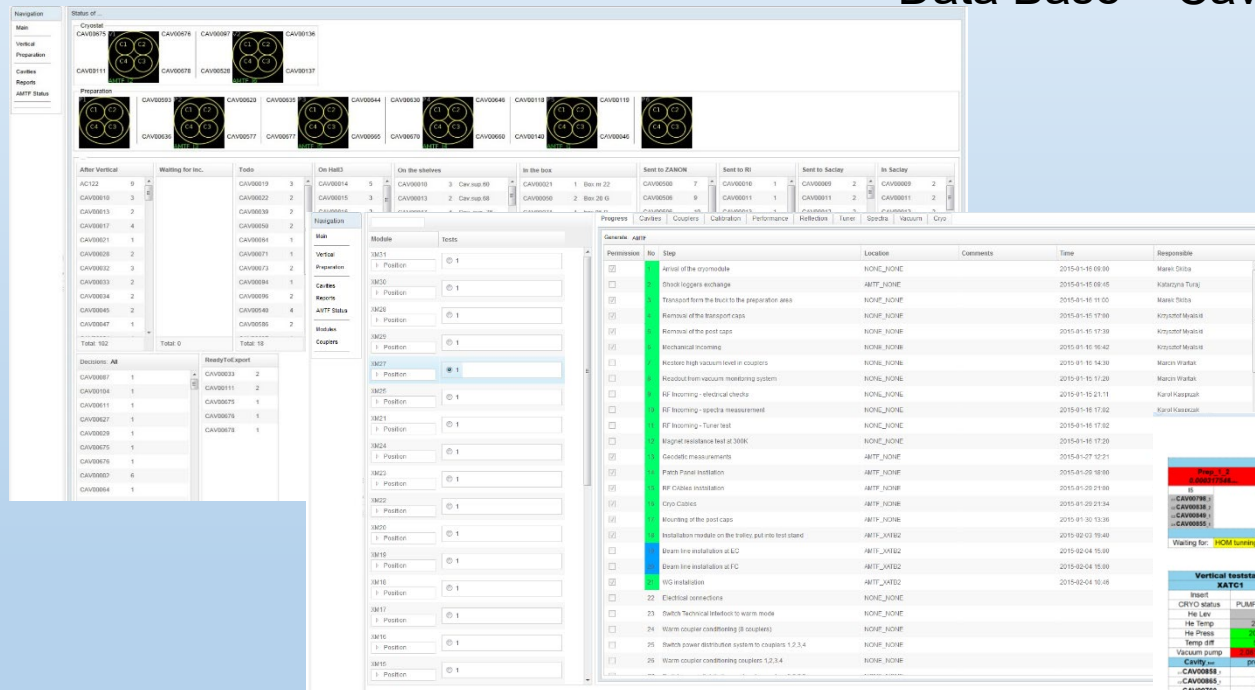
real communications



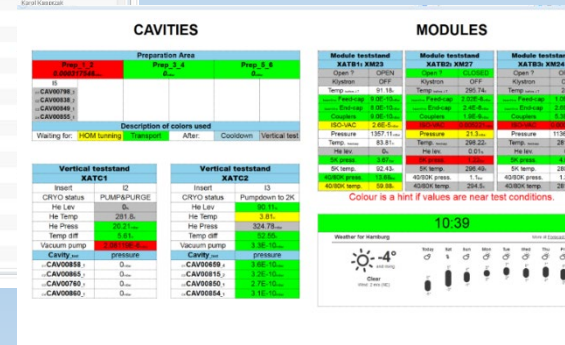
Data management - systems

- **quality control**
- **problem analysis**
- automatic report generation (in development)
- electronic logbook

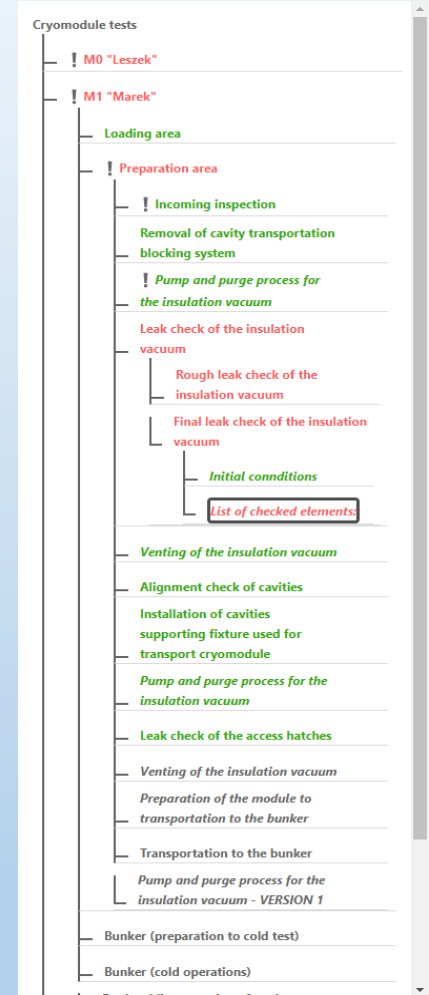
Data Base – Cavity status at AMTF



Screen at hall



Data Base – cryomodule tasks XFEL



Cryomodule tasks ESS



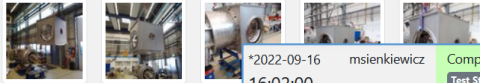
2022-09-05 13:27:46

msienkiewicz

Completed
Test String QM01
SIS100 / Workflow / String Test / Preinstallation / Attachment of the EC to the QM /

EC has been attached to the quadropole moodule

- 4 clamps were not installed (welds in the place where should be flat surface in the attach point)
- there was one problem with the thread -> solved with [help of screw tap](#)
- points/surface of contact of clamps are on the edge of EC inner flange
- operation performed with a help of the crane and the pallet truck

Attachments:

History (7) Edit

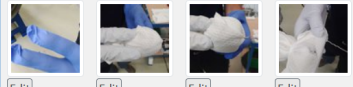
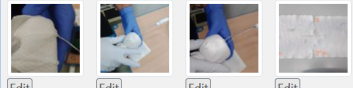
2022-09-29 13:46:58

wgaj

Completed
Test String

Cleaning of 2 DMs beamline chambers

- * done by pulling through the chamber an plastic element (cut to the shape of the chamber cross section) which is wrapped with tissues (wettened with IPA)
- * always it was the same dirrection: beam direction
- * repeated 5 times for each module (the 5th turn with dry tissue)
- * each time the tissue was changed
- * after the first cycle for both modules it was vissble black dirt at least on one side of the tool and on the bottom
- * after the second cycle there was much less of the dirt
- * after the third cycle the dirt was not vissilbe
- * the fourth cycle done just in case
- * the fifth cycle done with the dry tissue
- * the tool was rotated between cycles (up and down)
- * Flanges knives were checked with the help of magnifi glass and the light of the chamber souranding elements were cleaned

Attachments:

History (4) Edit

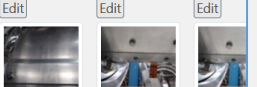
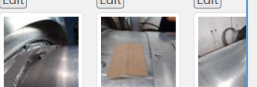
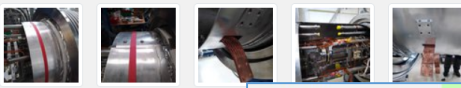
2022-09-16 16:02:00

msienkiewicz

Completed
Test String QM01
SIS100 / Workflow / String Test / Preinstallation / Installation of the thermal screen (DM and QM) /

Installation of thermal shields between QDM and DM - 4/4

- DM has been positioned in respect to QDM
- position was chckeed by survey people
- both shields were installed successfully
- it was only necessary to make 2 holes on the top bigger probably because of the diameter of the shield of Fos module is bigger than nominal (the same reason previously to make holes bigger at the side)
- it should be recommended to use something (for instance piece of polimer) when lashing straps are used to avoid scratching shields during releasing
- the gap on the botom between 2 halves of the shield is quite big so it should be checked with responsible person if it is acceptable

Attachments:

History (5) Edit

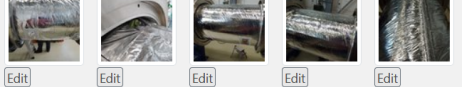
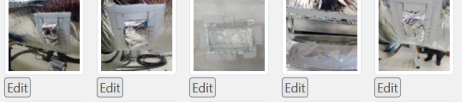
2022-09-22 16:53:38

msienkiewicz

Completed
Test String QM01

Wrapping of interconnection between QDM and DM

- there were two diffarant sizes of MLI (marked "upstream" 105 cm, marked "downstream" 113 cm)
- we have used MLI which was labeled "downstream" (teoretically it should be upstream side so it has to be clarify) because second one was to short
- used MLI fits
- should "white" areas (especially holes on around MLI covers of thermal bridges) will be covered for instance with aluminium tape?
- MLI is much weaker in the place where are seams so it is very easy to break the foil there
- touch fasteners are very strong
- the way of contacting individual layers between interconnection MLI and QDM MLI has to be checked (there are 3 layers on both sides)
- the way of contacting individual layers between interconnection MLI and DM MLI has to be checked (there are 3 layers on the interconection MLI and 4 layers on DM)

Attachments:

History (4) Edit

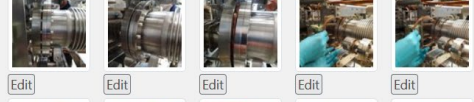
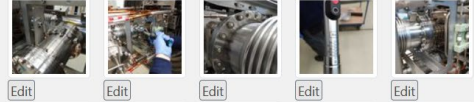
2022-10-14 14:12:38

msienkiewicz

Completed
Test String Vacuum

Beamline interconnection between DMs

- * 2 screws on the top have to by installed in oposite orientation
- * access to several screws with torque wrench imposible
- * applied torque: 25 Nm
- * CAP fixation element can't be released (CAP has to be pointed downwards)

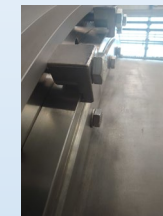
Attachments:

History (3) Edit

- EC temporary installed on the support in front of the QDM (18.08)



- EC has been attached to the QDM module (05.09)



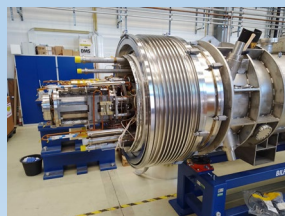
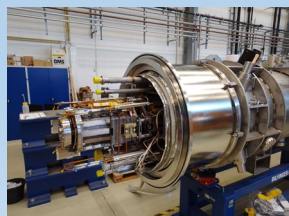
- Visual inspection of beamlines of two dipoles (25.08)



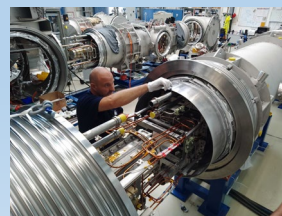
- QM & EC has been moved to the final position (06.09)



- Visual inspection of beamlines of two dipoles (02.09)



- Installation of thermal shields between QDM and DM (07.09 – 16.09)



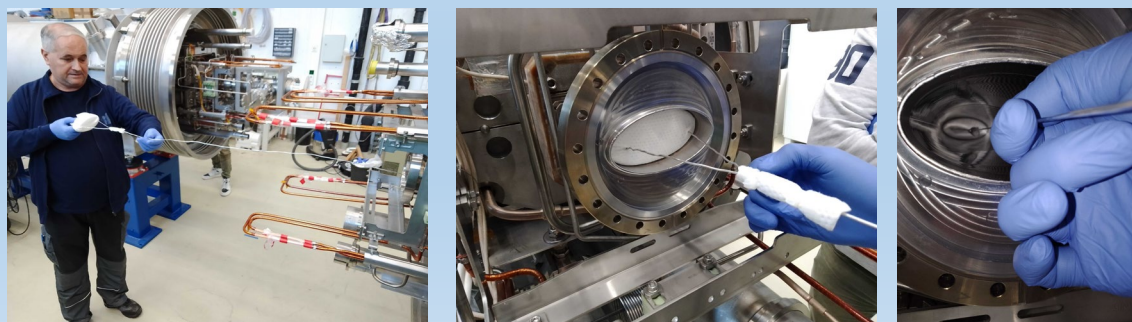
- MLI Wrapping of interconnection between QDM and DM (22.09)



- Connection of the EC to the BPL (06.10)



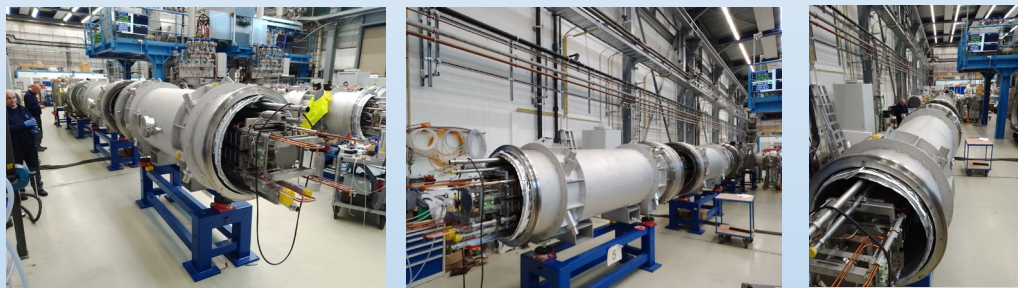
- Cleaning of 2 DMs beamline chambers (29.09)



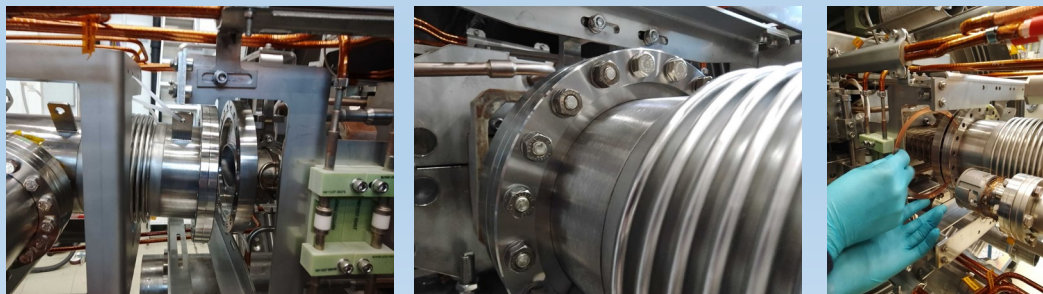
- Transportation of the FoS QDM on the blue line and connection to the EC (11.10)



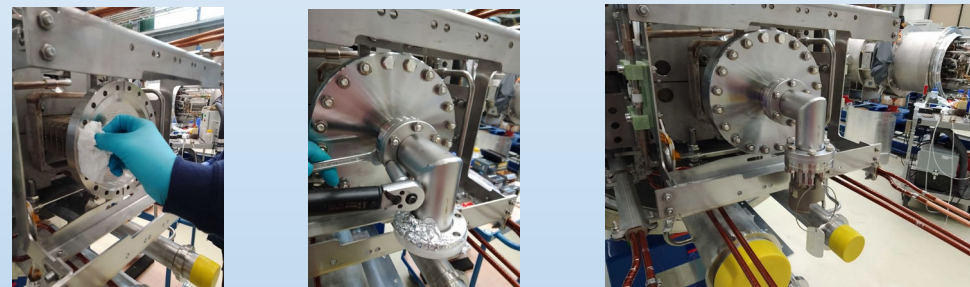
- Putting of 2 DM on the position (new blue line) (13.10)



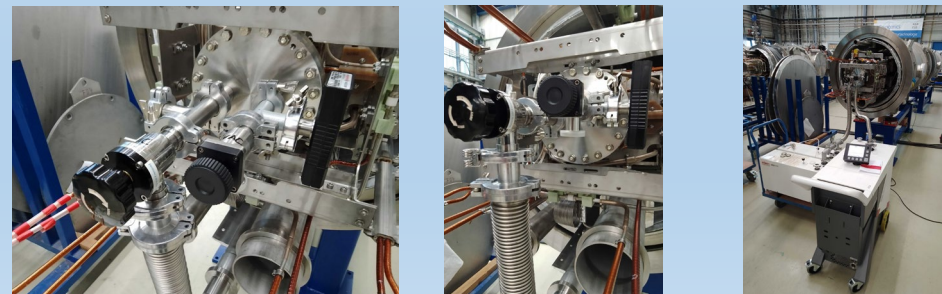
- Beamline interconnection between DMs (14.10)



- Installation of vacuum equipment on the beamline in EB (20.10)



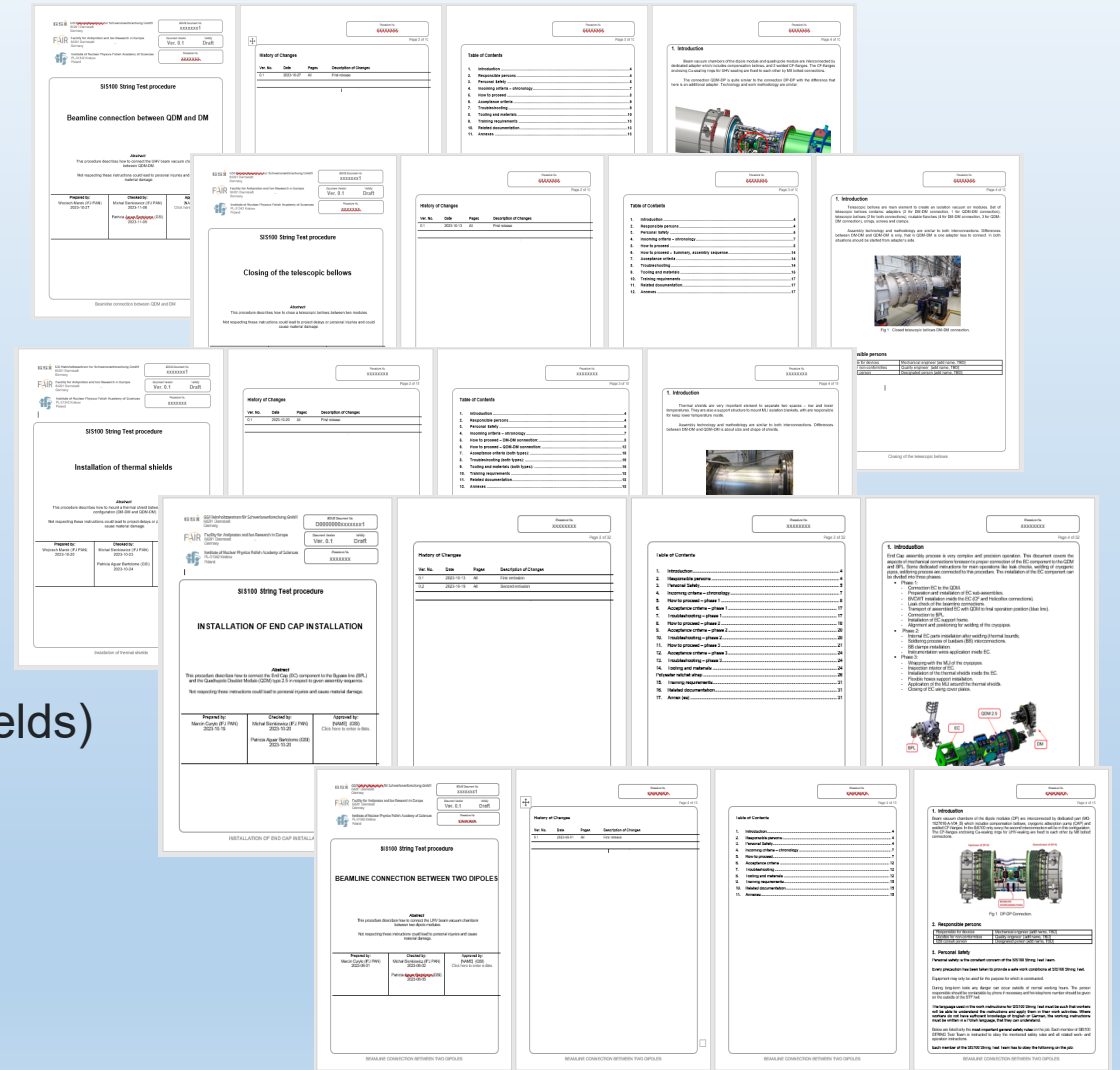
- Connection of the vacuum eq. to the beamline at the downstream side of the DM-DM string (21.10)





List of prepared procedures (under review):

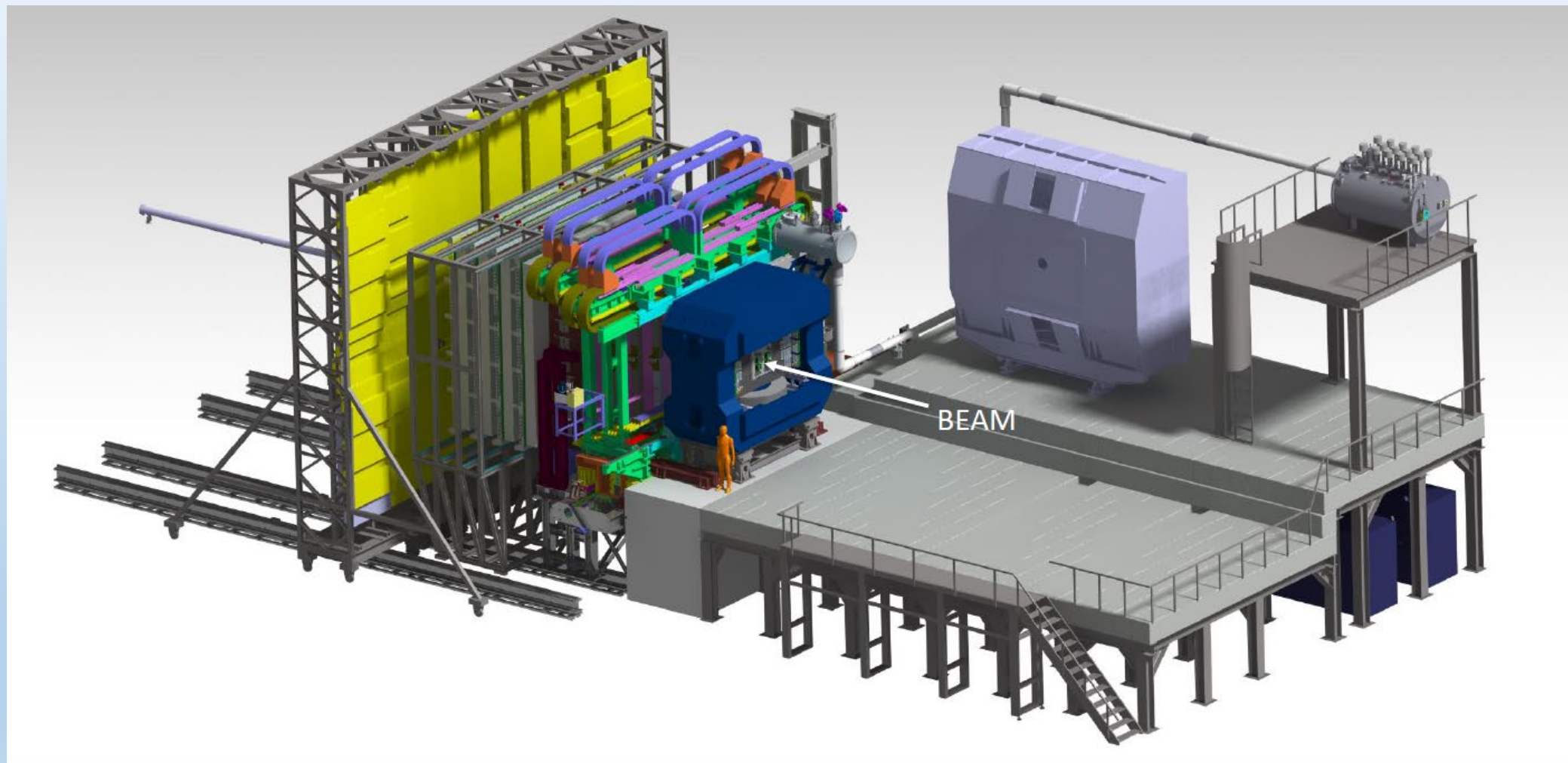
1. Beamline connection between two dipoles
2. Installation of the End Cap
3. Installation of thermal shields
4. Closing of the telescopic bellows
5. Beamline connection between QDM and DM
6. Installation of MLI (beamline, process pipes, thermal shields)
7. Assembly and installation of the pumping chamber



Document structure:

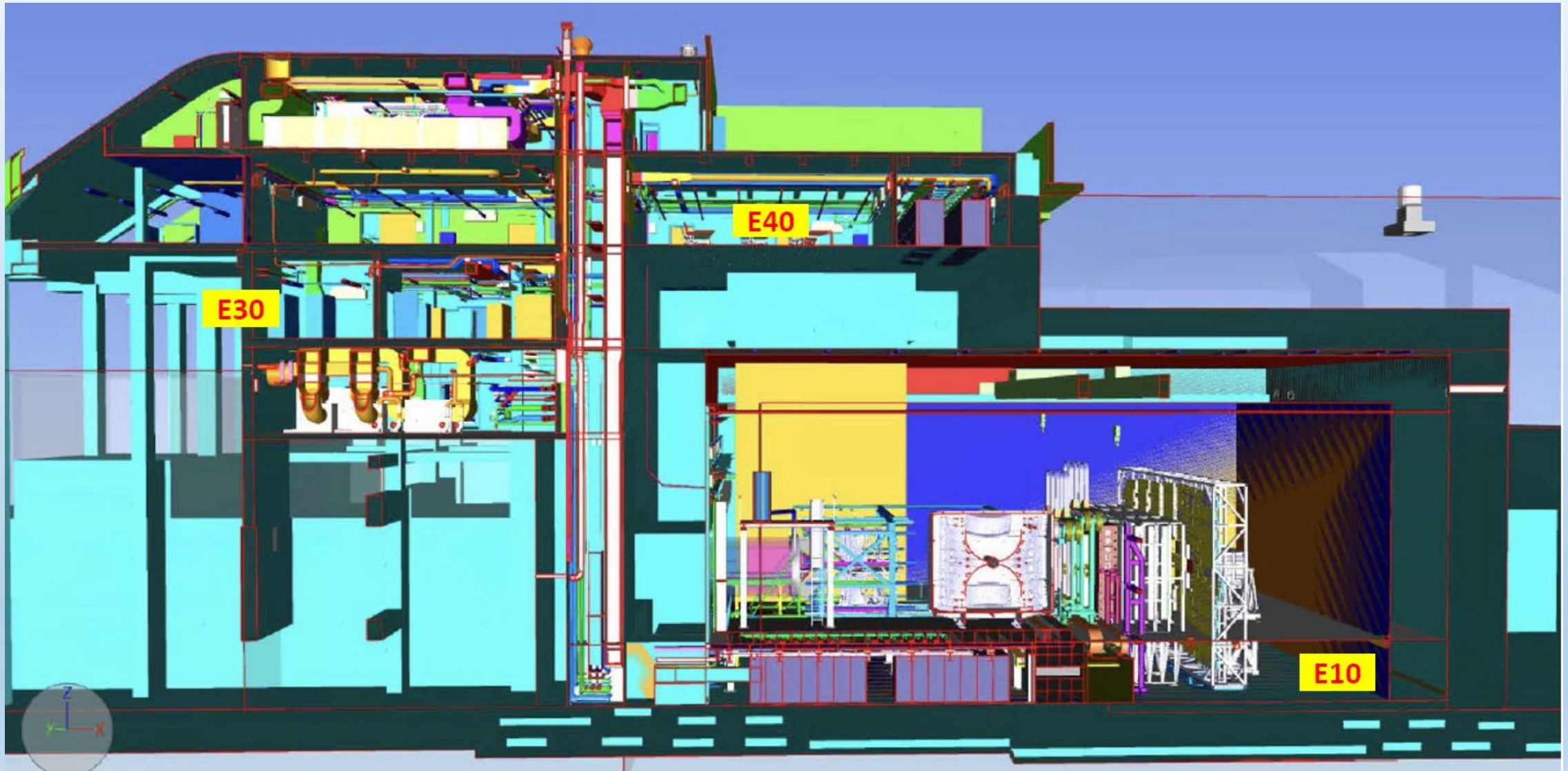
- General information
- Introduction
- Responsible persons „End Cap installation process”
- Personal safety
- Incoming criteria – chronology
- How to proceed
- Acceptance criteria
- Troubleshooting
- Tooling and materials
- Training requirements
- Related documentation
- Annexes

Procedure describing how to install End Cap





CBM – cabling and electrical connection





IFJ PAN potential contribution to FAIR

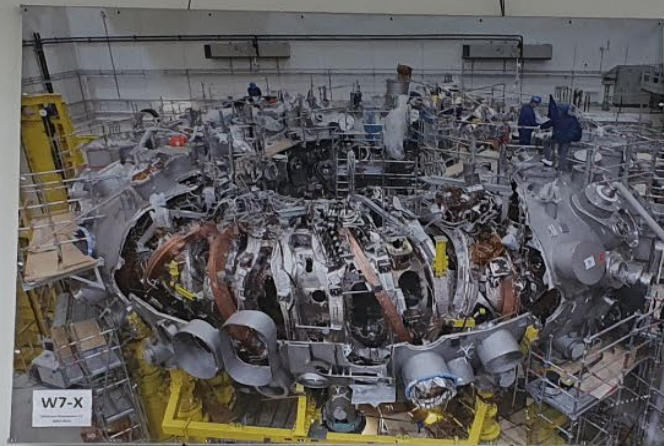
				Period
1.1	SiS100 Vacuum package	Cleaning of beamline for Dipole Magnet (DM)	120 DMs (108+6+6)	½ 2023 – ½ 2026
		Beamline connections	120 DMs, 33 QDM (Quadrupole Modules arc), 17 QDM (straight), 2 QDM (special), 12 ECs. Interconnections: 198	
		Leak checks		
		Connection of vacuum equipment		
1.2	SiS100 Assembly package	Thermal screens instalations	120 DMs, 33 QDM (arc), 17 QDM (straight), 2 QDM (special)	½ 2023 – ½ 2026
		MLI wrapping		
		Integrity tests of instrumentation	interconnections: 186 (6 sectors * 31 interconnections)	
		HV test against ground of integrated section		
		Installation of bus bar clampps and soldering of bus bar joints		
		Closing of telescopic belows		
3.1	S-FRS Preassembly of magnets	End Caps assembly and installations	24 interconnections: 12 Ecs with 2 ICs	2023 – 2025
		beam pipe cleaning and vacuum tests	32 Multiplets + 24 Dipols	
		assembly of power connection boxes		
		assembly of valve control boxes (proportional valves system)		
		pre-assembly quench detection for SC power units		
3.2	S-FRS Stepper Motor Drive Concept	Mounting/Dismounting of the transportation tie rods		2023
		DESIGN + PROTOTYPE	CAD, FEM, full documentation, prototype	
3.3	S-FRS Focal plane chambers	Vacuum leak checks of the empty chamber	11 chambers	½ 2023 – ½ 2025
		Assembly of some components and vacuum test	11 chambers - vac pumps, slides....	
		Preassembly of some components before tunnel installation	11 chambers - vac pumps, ...	
4.1	S-FRS Gas/Media supplay	Super-FRS gas supplay	cables and gas pipes to install, 21 patch panels (design, production, instal.)	
		Media supplay (patch panels)		
4.2	S-FRS Beamline and ISO-VAC installations	Safty valve installations	short multiplet: 7, long multiplet 13	¾ 2024 – 2026
		Mounting of vacuum pumps	dipoles: 15, diagnostic chambers: 19	
		Gate Valve installations	long special beam pipes: 11	
		Beamline interconnections	blocks: PT, PM, HL, H	
		Leak checks (beamline and ISO-VAC)		
4.3	S-FRS Other installations/conections	Dismounting of the transportation tie rods	short multiplet: 7, long multiplet 13	¾ 2024 – 2026
		Courent leads warm gas (Swagelock)	dipoles: 15, diagnostic chambers: 19	
		Power cables and earthing	long special beam pipes: 11	
		Signal cables connections and tests	blocks: PT, PM, HL, H	
		Installations of slids in vacuum chambers		
6.1	HEBT Pre-Assembly Vacuum Assembly Units and Tests	Installation on support frame, Integration of VAC Diagnostics and Pumping devices, Leaktest, Documentation	13 (early science) + 17 (first science) + 5 (first science+)	2024 – 2025
6.3	HEBT Pre-Assembly : NC Magnets Assembly Units	Magnet Installation on support frame, Integration of VAC chambers, Documentation	16 dipols (+23), 11 quadropols, 88 small quads, 55 steerer magnets; total: 170	2024 – 2025

IFJ PAN in-kind work-packages for FAIR Early Science and First Science covering ~ 100 FTEs



				Period
2.1	SiS100 LLRF installations	cables connection between devices cables installation on trays groundings cables tests	153 LLRD racks	¼ 2023 – 2024
2.2	SiS100 Vacuum equipment installation	bake-out terminal boxes (+cable connections and tests) solid state relay racks (+cable connections and tests) components of vacuum chambers	273 units (SIS100 + HEBT) + 91 units (SIS100 + HEBT) 282	¼ 2023 – ½ 2026
2.3	SiS100 Beam instrumentation installation	installation of BPM electronics (rack assembly + cabling) first turn diagnostics chambers assembly and UHV test installation of Beam Loss Monitors (IC)	84 Mini-Racks (27 config.) + 60 elect.rooms 6 – chamber, support frame, heating jackets 200 (2 at each QDMs + 32 other locations)	2024 - 2025
2.4	SiS100 Installation of: Terminal boxes Quench Detection	Cold and warm sections !!!	440 QCBs & 55 QuD	2024 – ½ 2026
5.1	CBM Electrical connections	(terminations of connectors, cables pulling, trays fabrication...)	HV, LV, signal cables, 7000 channels, 120 km, LEMO, Redel, etc	2026
5.2	CBM Optical connections	(prep., connection, pulling of optical fiber trunk cables, patch panels)	QC >2500, 130 trunk cables, 18720 opt. channels, 13 km	2026
6.2	HEBT Installation „Closing Vacuum System HEBT with deliveries	Installation on support frame, Integration of VAC Diagnostics and Pumping devices, Leaktest, Documentation	308 (early science) + 410 (first science) + 95 (first science+) total: 813	2024 – 2025

Furthermore, FAIR and IFJ PAN have negotiated an additional 8 optional work packages with 97 FTEs, which could be potentially useful depending on FAIR's future needs for First Science and First Science plus.



Division of Scientific Equipment and Infrastructure Construction (DAI)

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So that customers come back to you, not products! Quality is something that satisfies and even delights customers.

William Edwards Deming