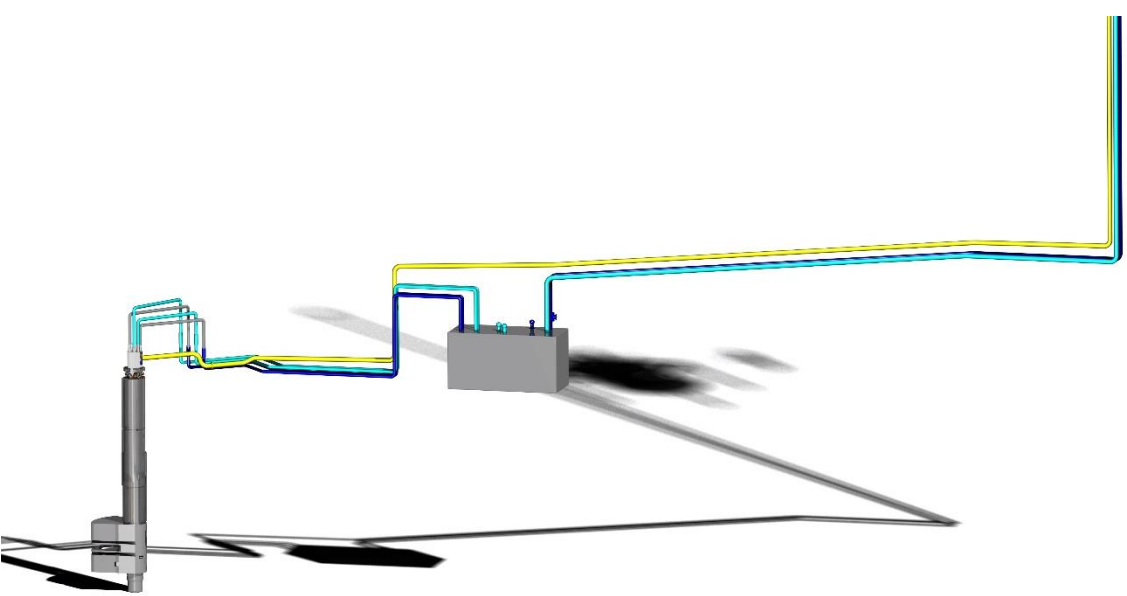

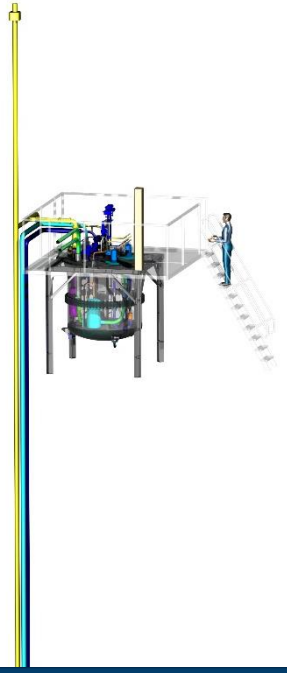

TIK3.1, TIK3.2, TIK4.1 AND NBEX

TTB

2019.03.14 I Y. BEßLER

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ZEA-1 | Engineering & Technologie
Technologie für Spitzenforschung

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Mitglied der Helmholtz-Gemeinschaft

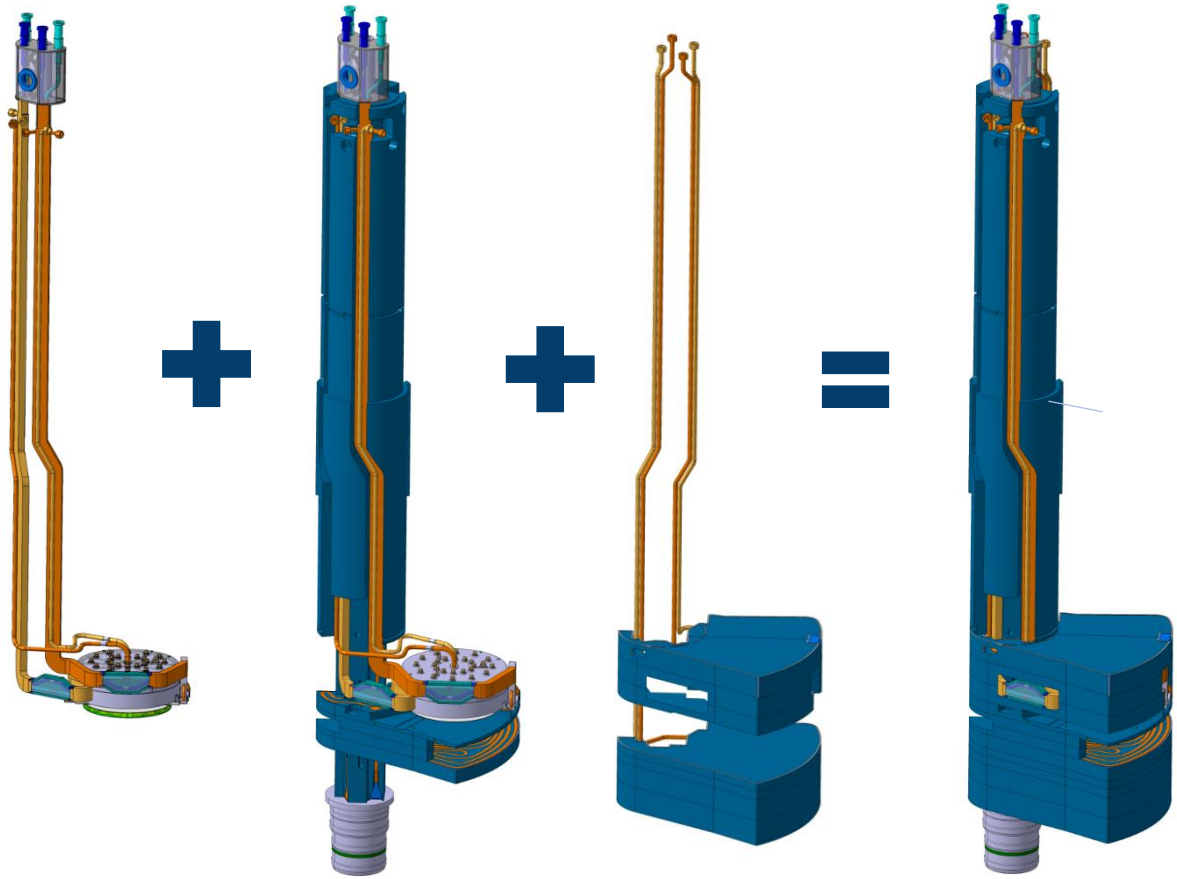
OUTLINE

- Moderator & Reflector Plug -TIK3.1
- Cryogenic Moderator System -TIK3.2
- BF1 study
- RAMAN in situ measurement
- Additional small ESS projects
- Target Monitoring Plug -TIK4.1
- Neutron beam extraction system

MRP TIK3.1

- Manufacturing complete
- Manufacturing in progress

Twister overview

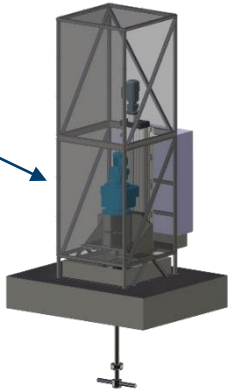


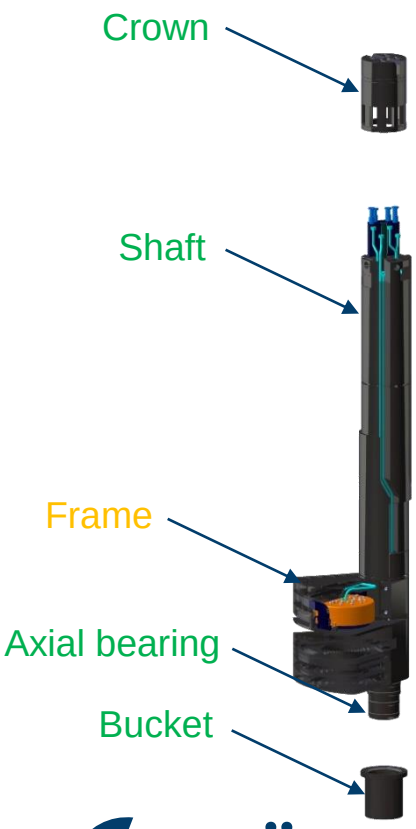
Moderator & Reflector Unit

FAT setup 1

FAT setup 2

Twister ready for delivery





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MRS TIK3.1

Twister components (shaft)


Twister shaft ready milled


Twister shaft forged

about 6.4 t of 15 t of low Co stainless steal left ....

MRS

Twister components (axial bearing / crown / bucket / frames)


Twister axial bearing holder


Twister axial bearing holder


Twister bucket and crown


Twister frames pre cut

Twister axial bearing
before tungsten coating

MRS TIK3.1

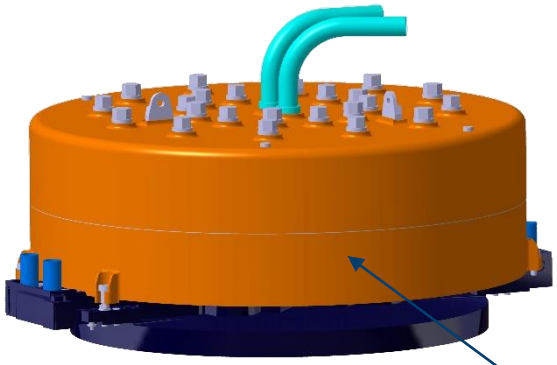
Twister handling tool -Rotation Unit

Detail view of rotation mechanism

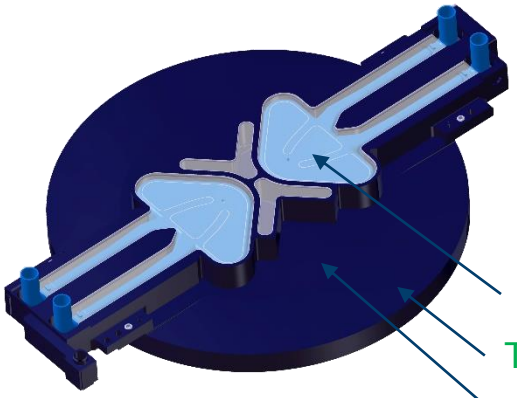
Final assembly of Rotation Unit at ZEA-1

MRP TIK3.1

Moderator & Reflector Unit overview



Beryllium Reflector



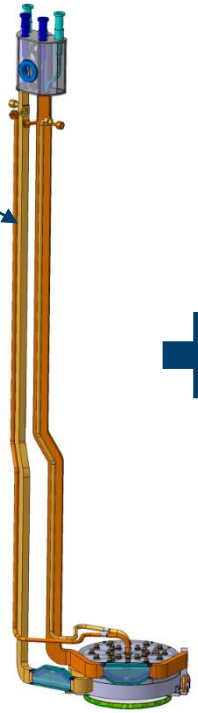
Cold Moderators

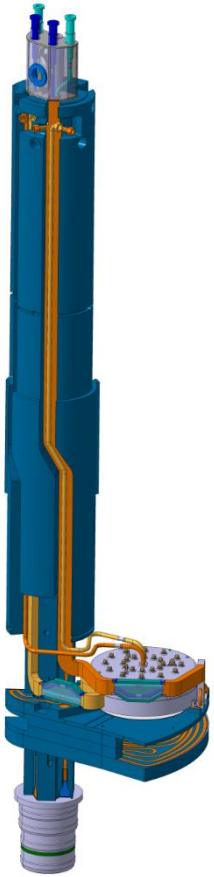
Thermal Moderator

Irradiation Module

- Manufacturing complete
- Manufacturing in progress

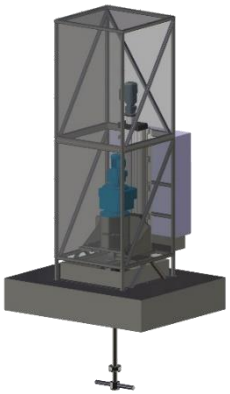
Vacuum jacket





Moderator &
Reflector Unit

FAT setup 1



MRS TIK3.1

Reflector (Beryllium)


Acceptance test (Moscow)

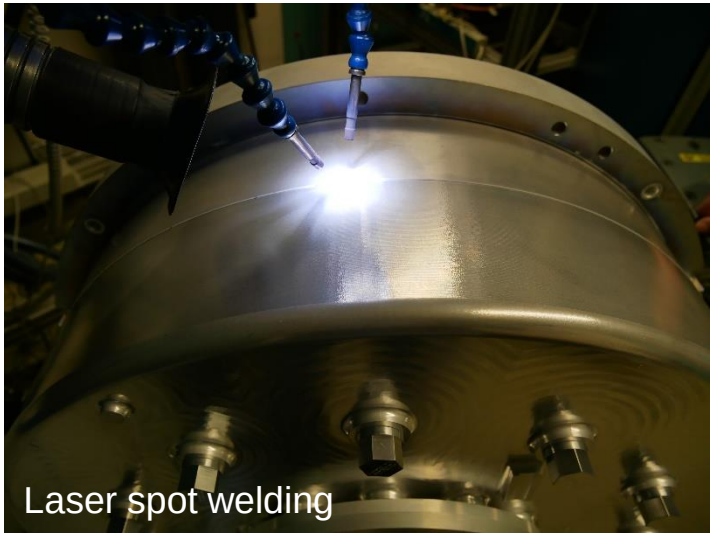

Acceptance test (Moscow)

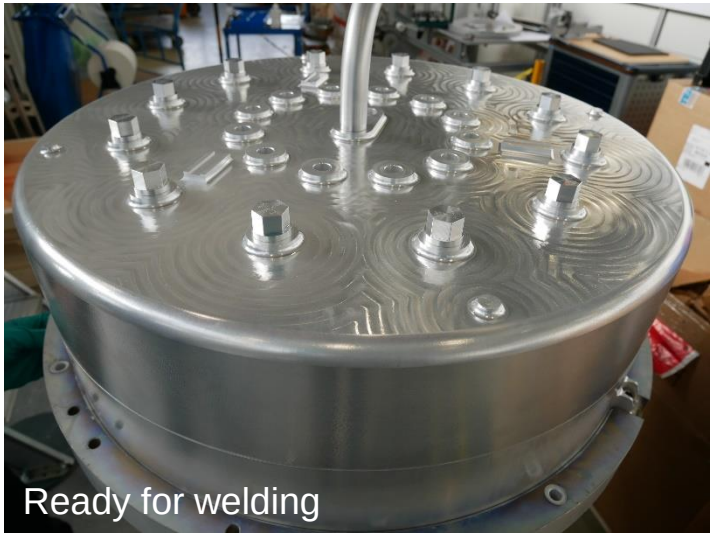

Beryllium arrived in Jülich ;-)

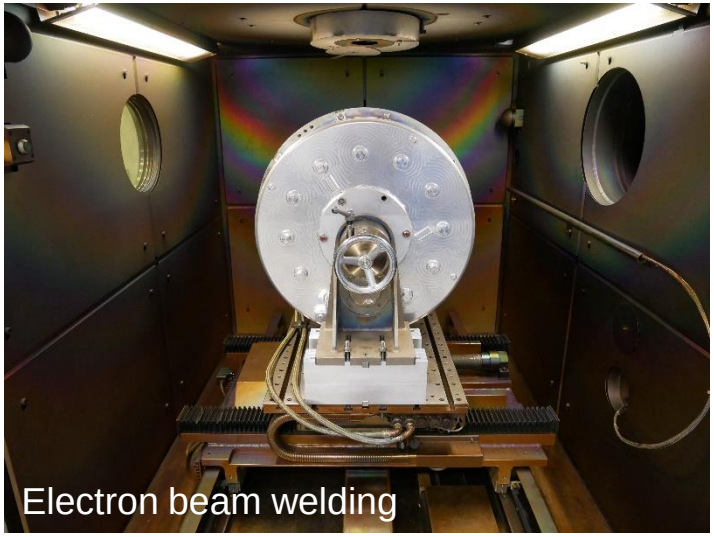
MRS TIK3.1

Full reflector assembly


Assembly of Be and vessel


Laser spot welding


Ready for welding


Electron beam welding

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MRS TIK3.1

Cold Moderators

Cold Moderators with thermal Moderator (intermediate stage)

Final cold Moderators

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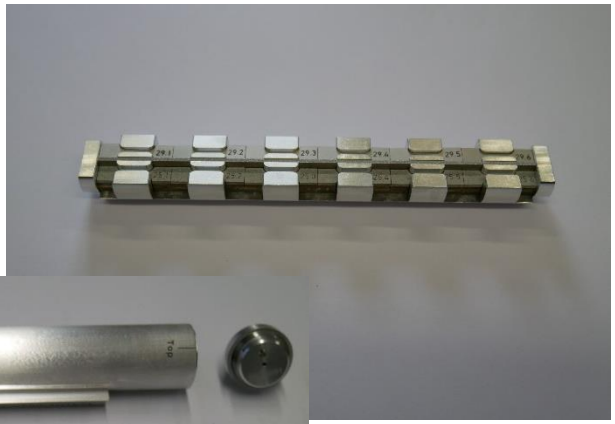
MRS TIK3.4

Irradiation Module (extra project Cooperation with Uni Roma / R. Senesi)



Inner holder with 96 samples…

Welded inner holder

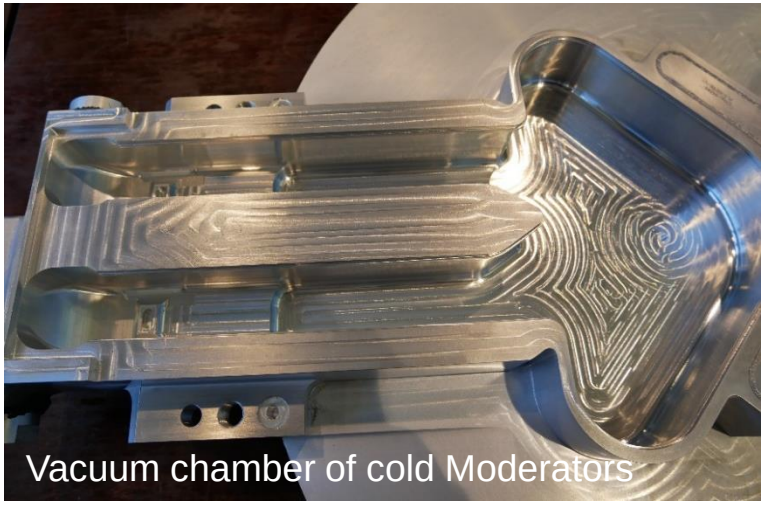
Final Irradiation Module

Assembly of Irradiation Module

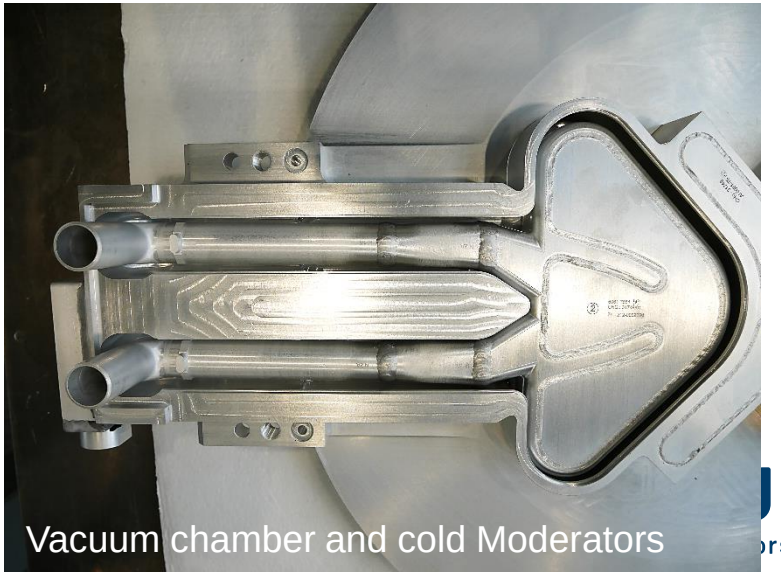
MRS TIK3.1

Thermal Moderator

TIG welding adapters


Vacuum chamber of cold Moderators


He leak test


Vacuum chamber and cold Moderators

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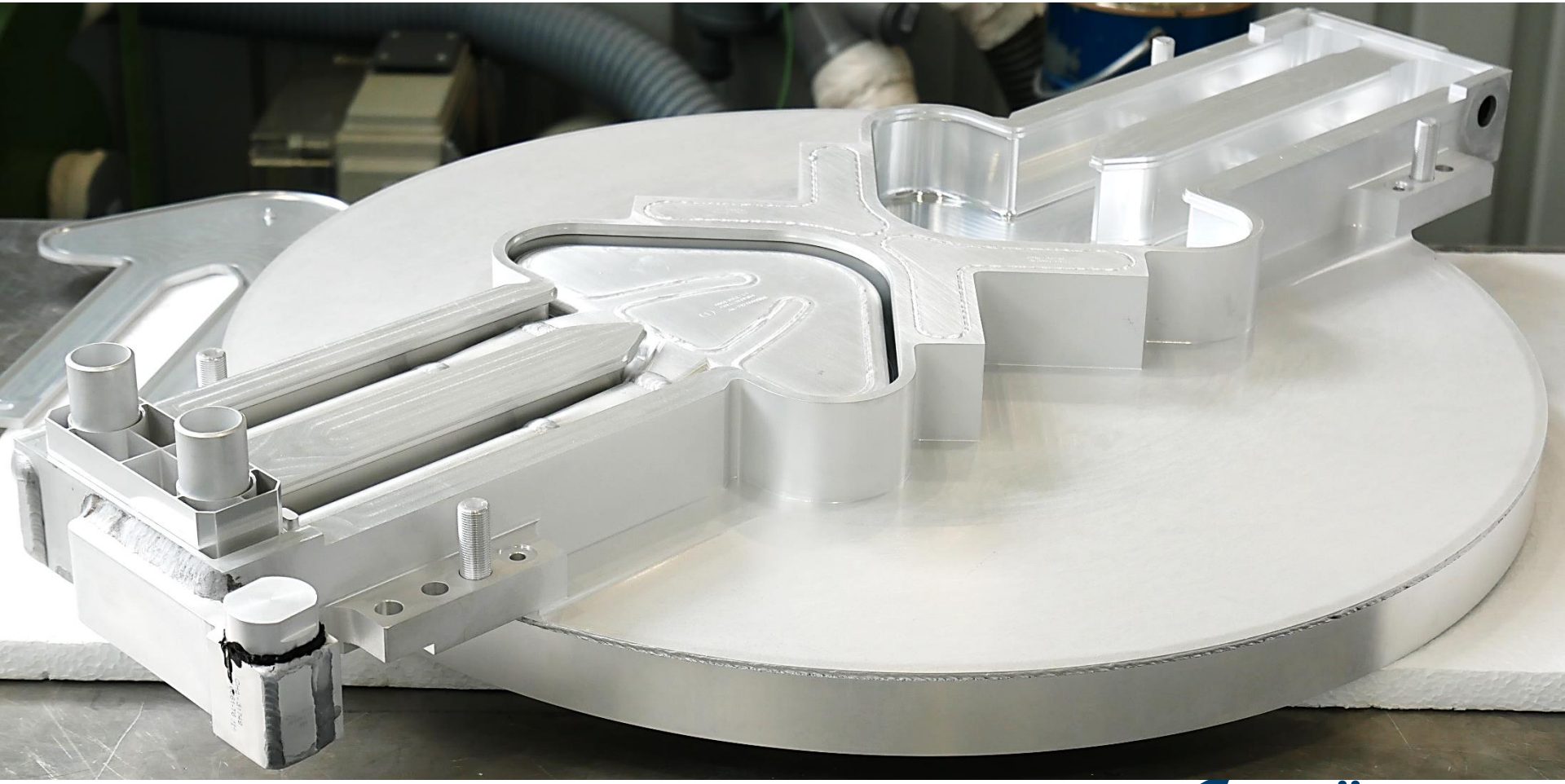
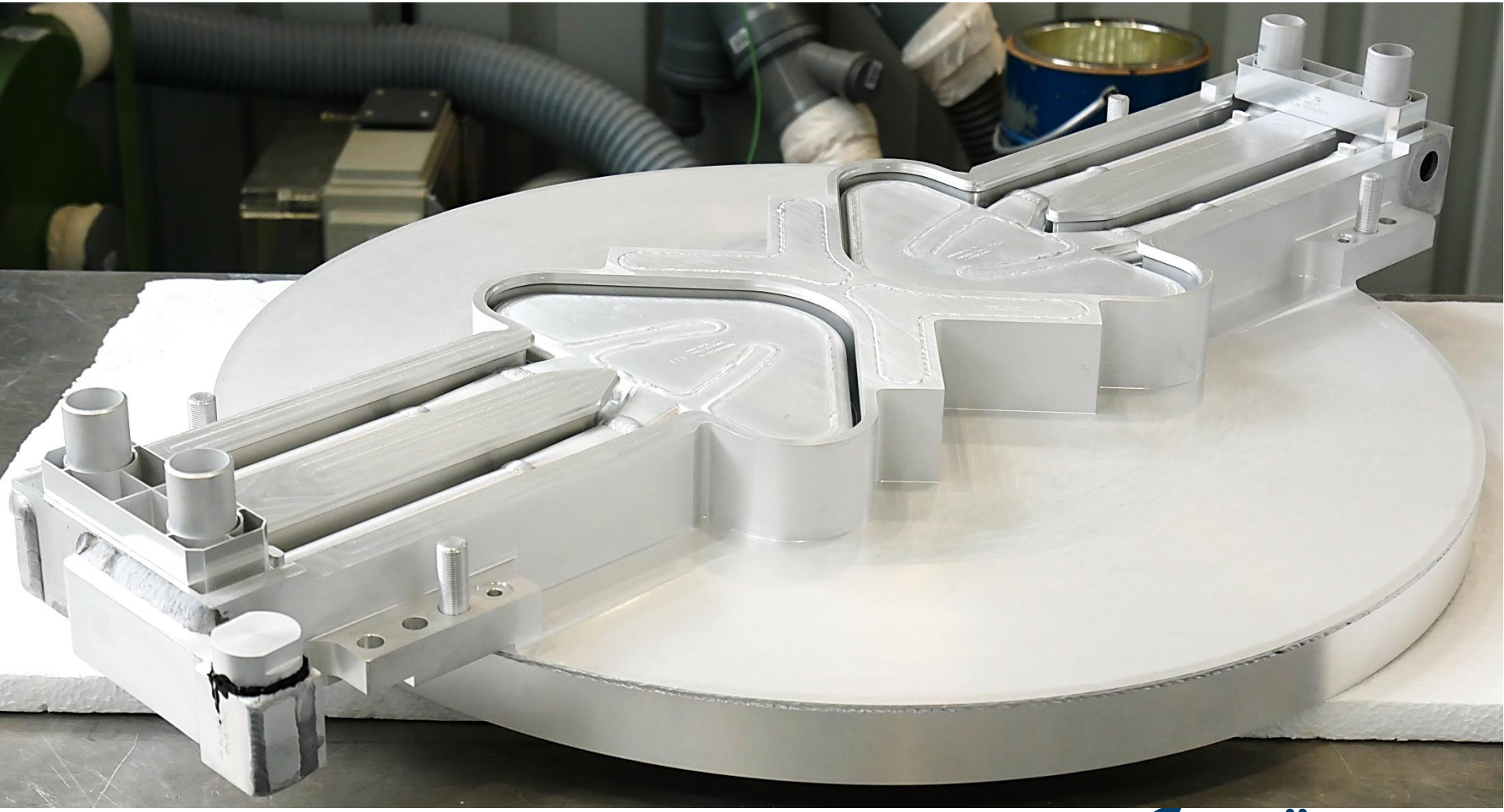
MRS TIK3.1

Thermal Moderator



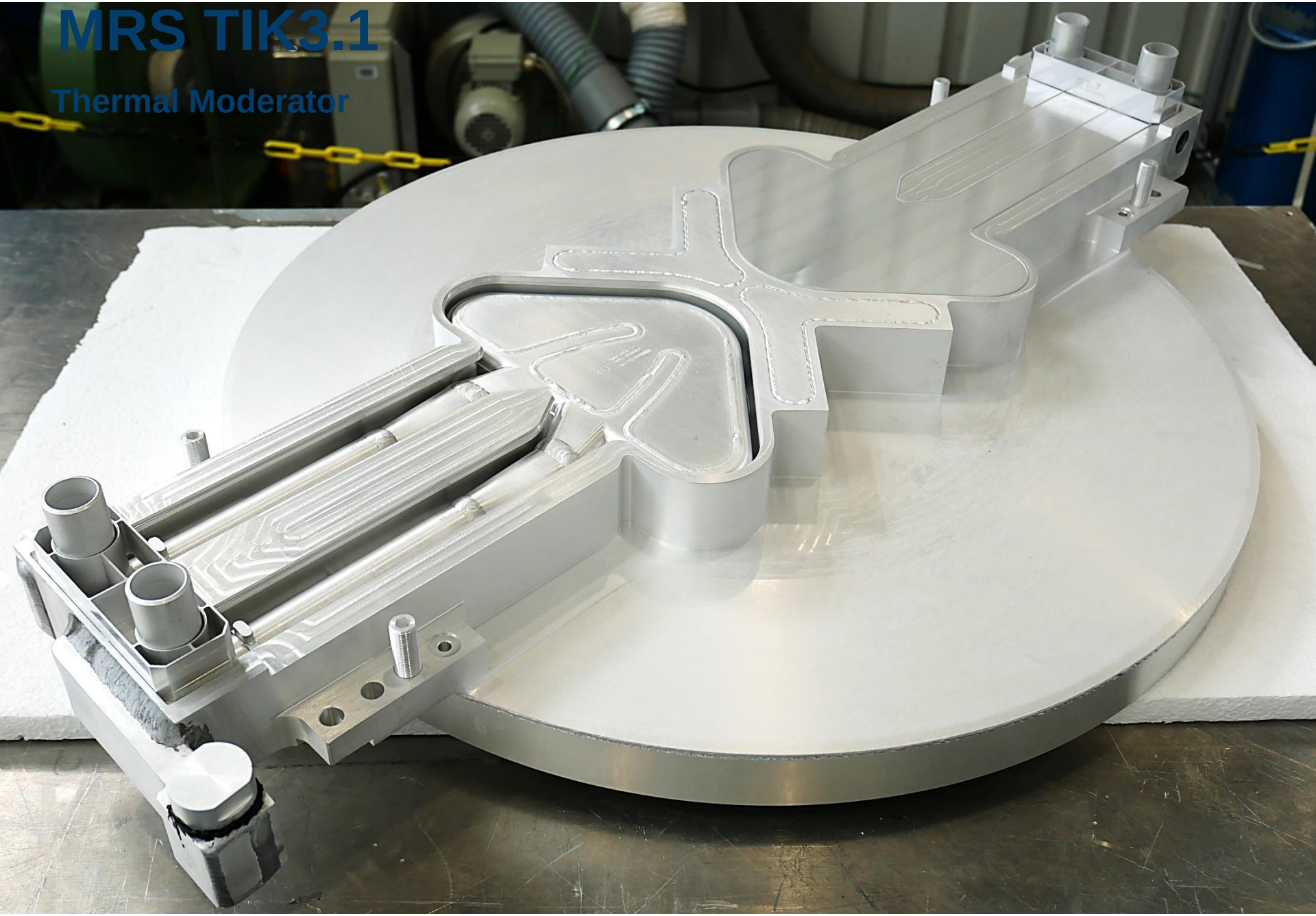
MRS TIK3.1

Thermal Moderator



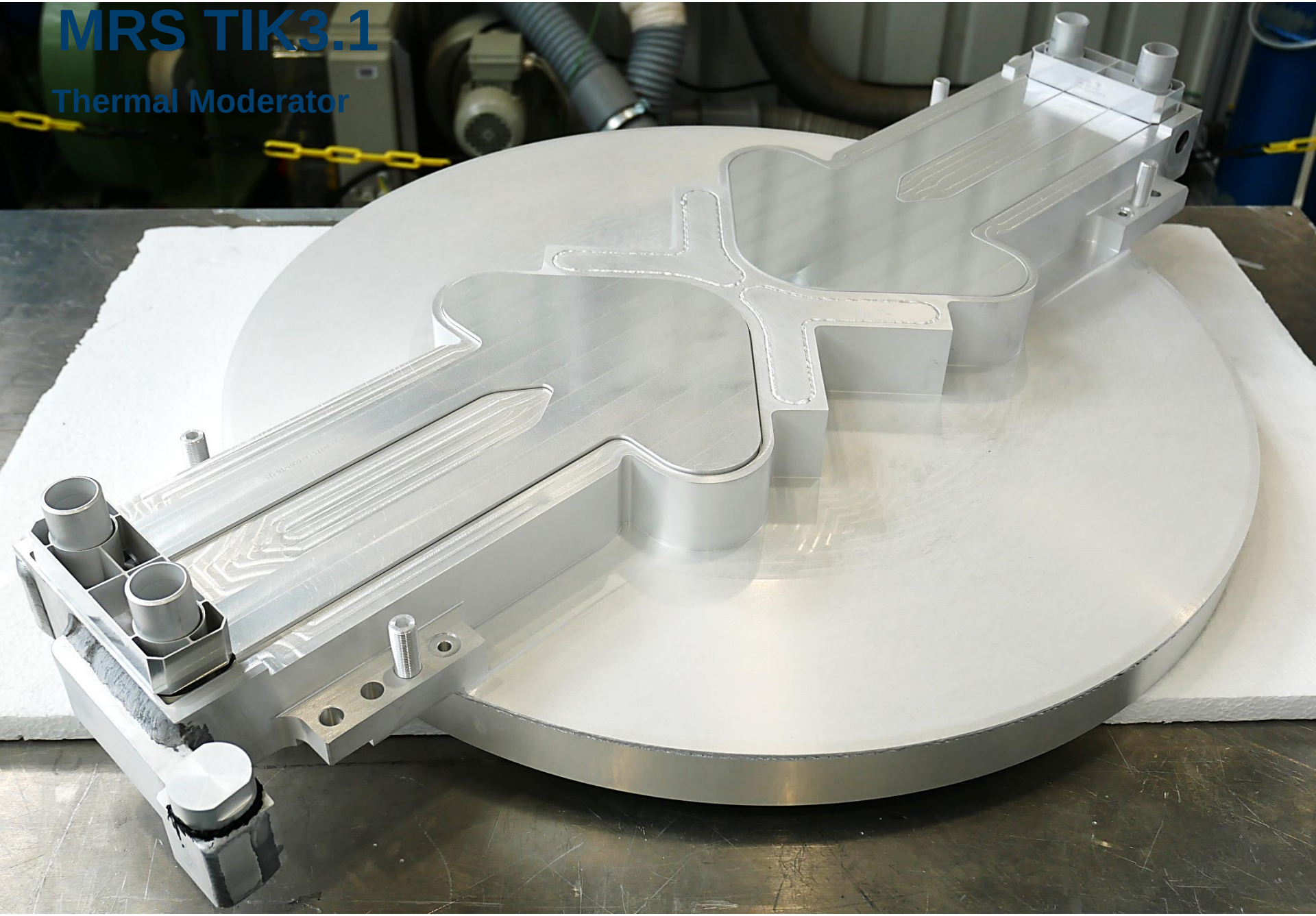
MRS TIK3.1

Thermal Moderator



MRS TIK3.1

Thermal Moderator



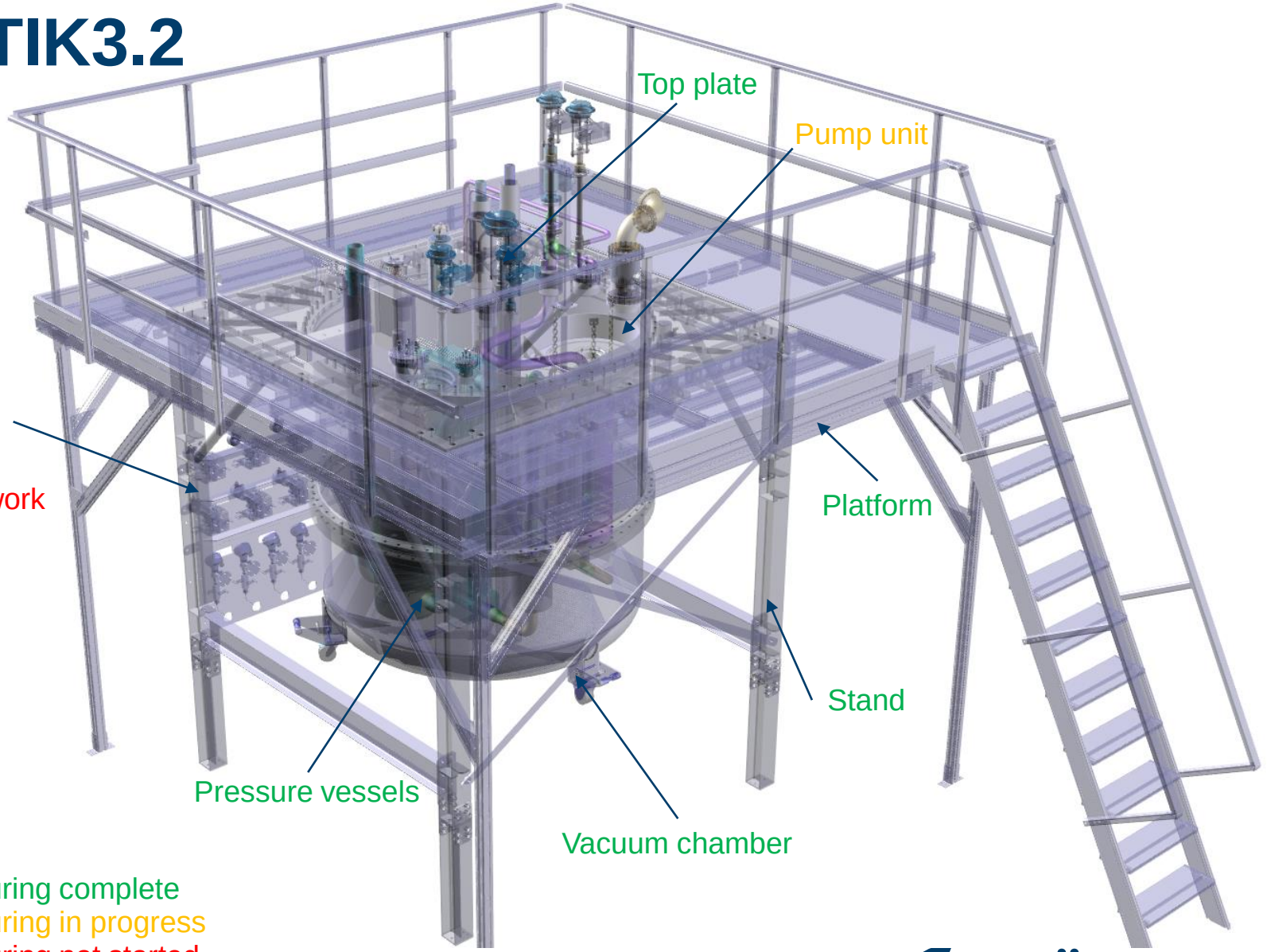
MRS TIK3.1

Schedule status and outlook

Sub unit	Final design	CDR	Manufacturing	FAT	delivery	SAT
Cold Moderator	✓ .	✓ .	✓ .	✓ .	2020	X
Thermal Moderator	✓ .	✓ .	✓ .	04-19	2020	X
Beryllium Reflector	✓ .	✓ .	✓ .	04-19	2020	X
Vacuum Jacket	✓ .	✓ .	08-19	09-19	2020	X
Crown	✓ .	✓ .	✓ .	✓ .	2020	X
Bucket	✓ .	✓ .	✓ .	✓ .	2020	X
Rotation Unit	✓ .	✓ .	✓ .	✓ .	2020	X
Shaft assembly	✓ .	✓ .	07-19	08-19	2020	X
Radial bearing	✓ .	✓ .	04-19	05-19	2020	X
Axial bearing	✓ .	✓ .	04-19	05-19	2020	X
Frames assembly	✓ .	✓ .	07-19	08-19	2020	X
M&R Plug	✓ .	✓ .	**09-19**	**10-19**	**2020**	**X**

CMS TIK3.2

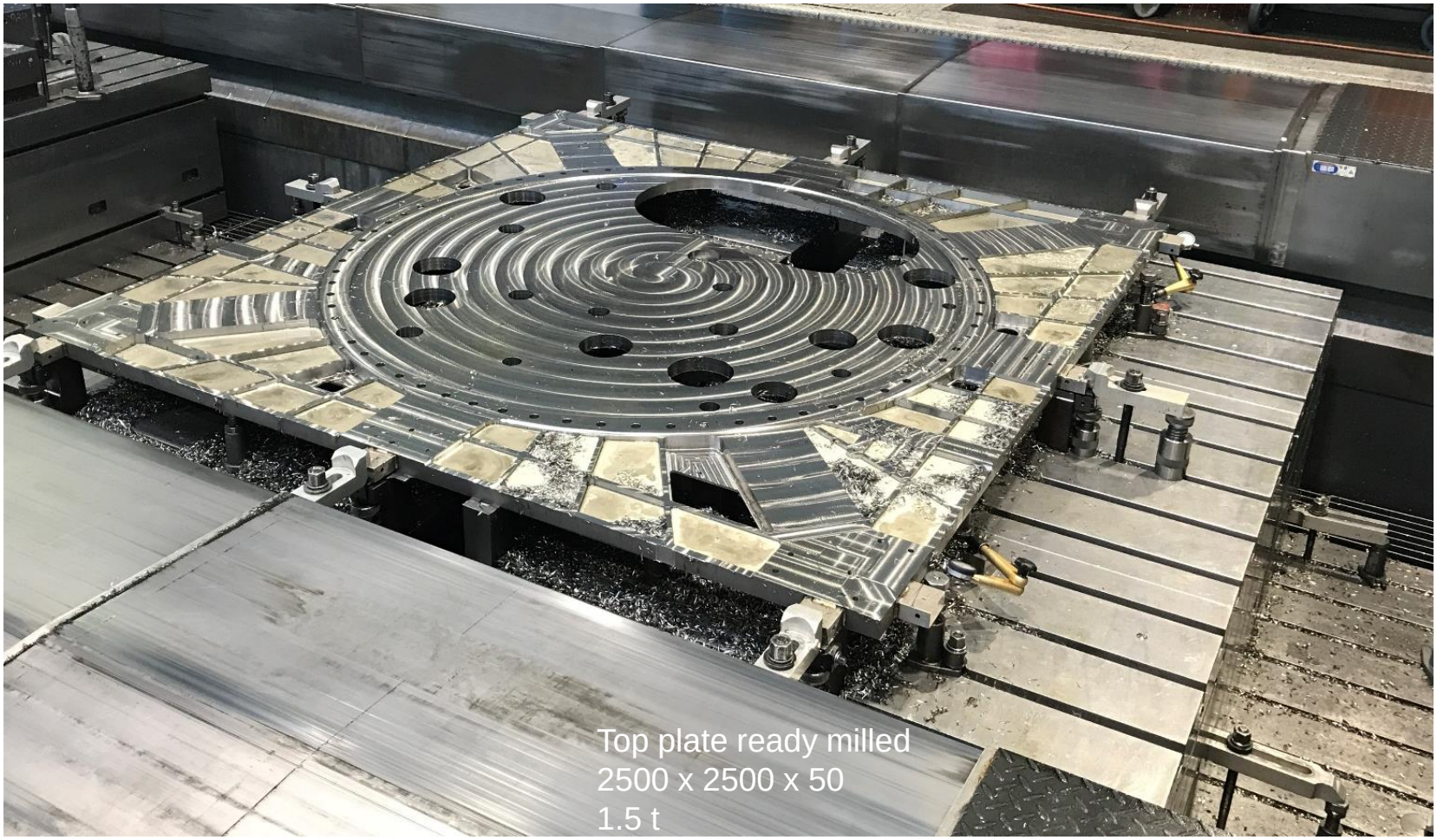
Cryostat overview



- Manufacturing complete
- Manufacturing in progress
- Manufacturing not started

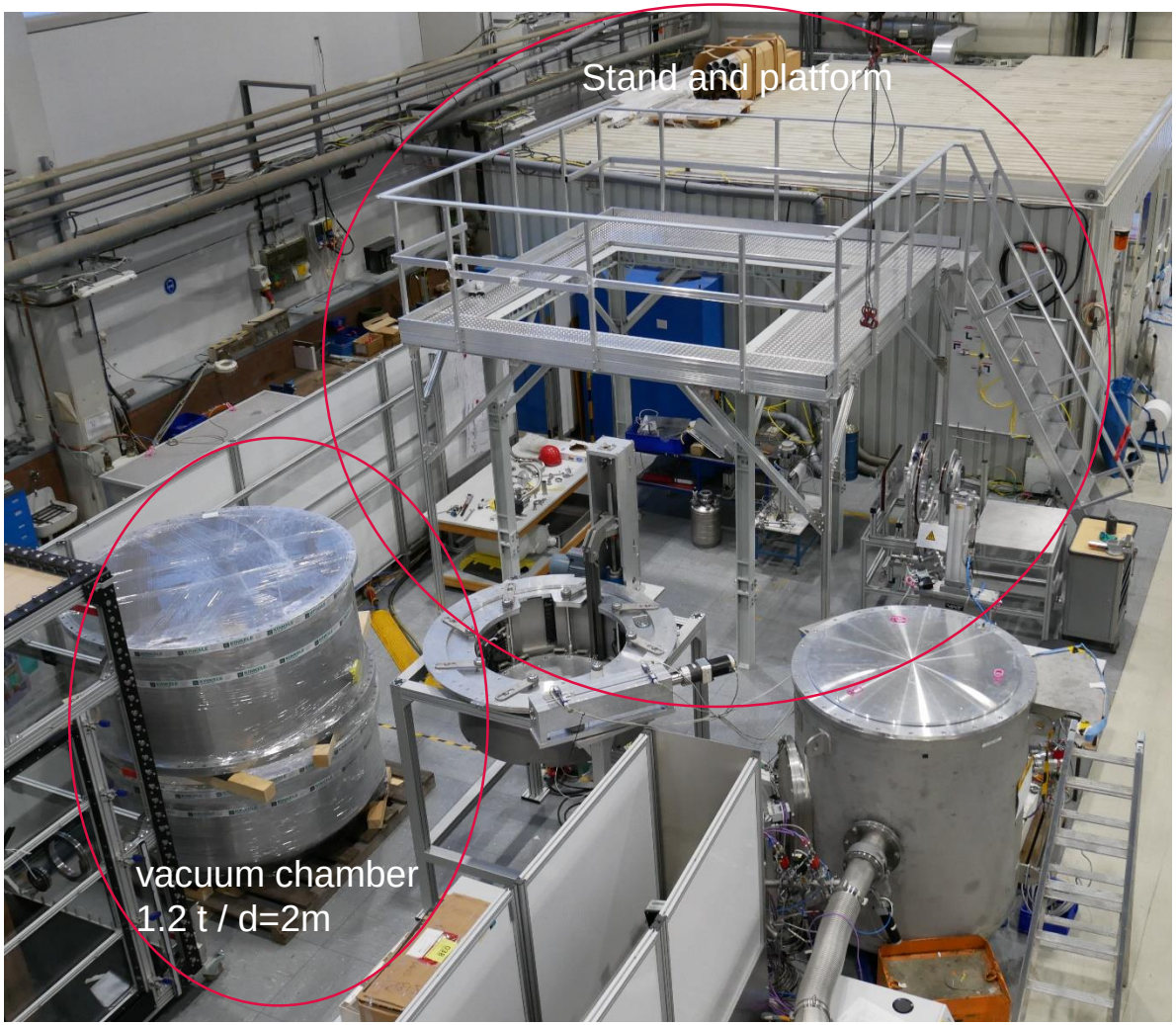
CMS TIK3.2

Top plate



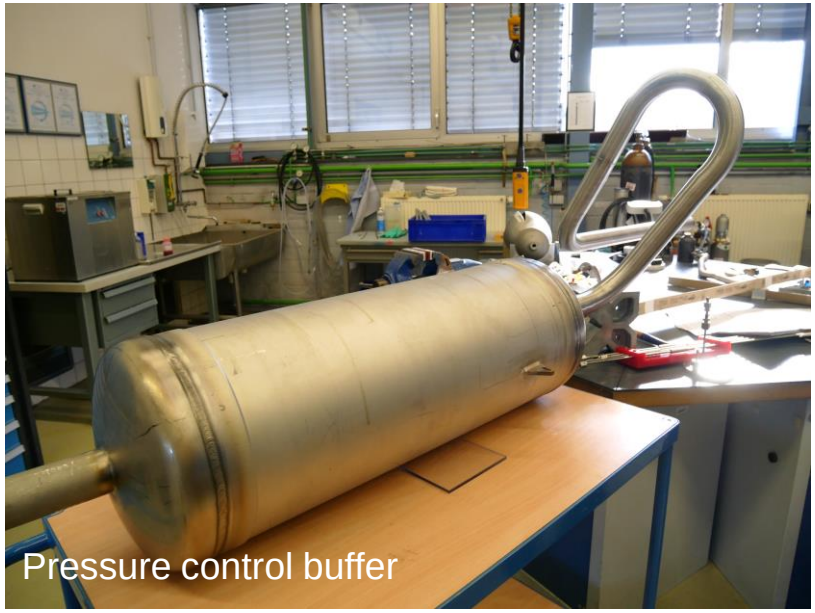
CMS TIK3.2

Stand, platform and vacuum chamber



CMS TIK3.2

Pressure vessels



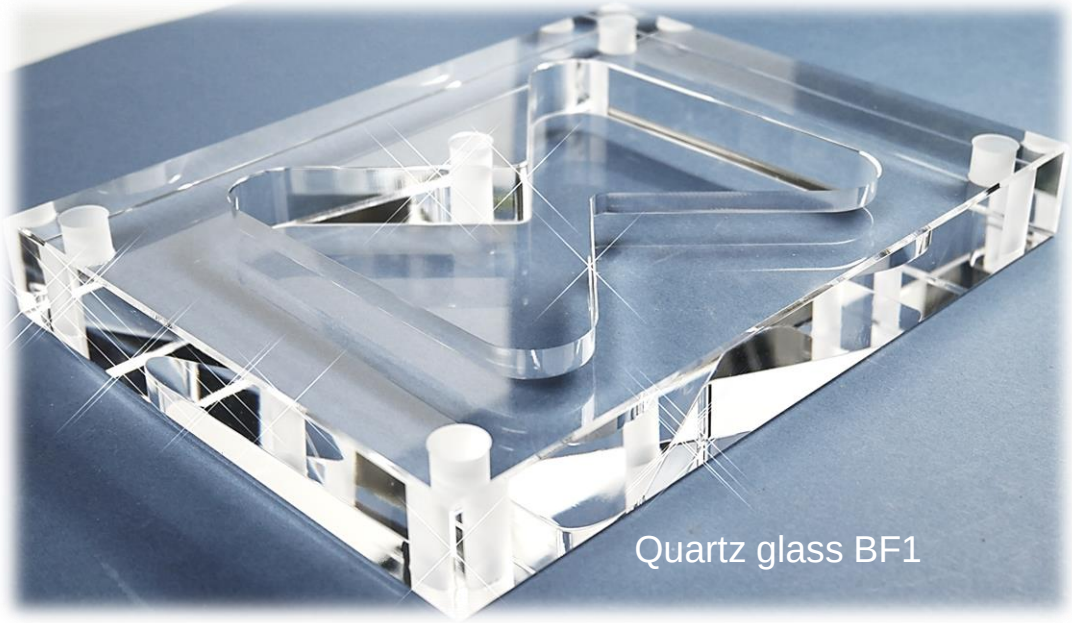
MRS TIK3.2

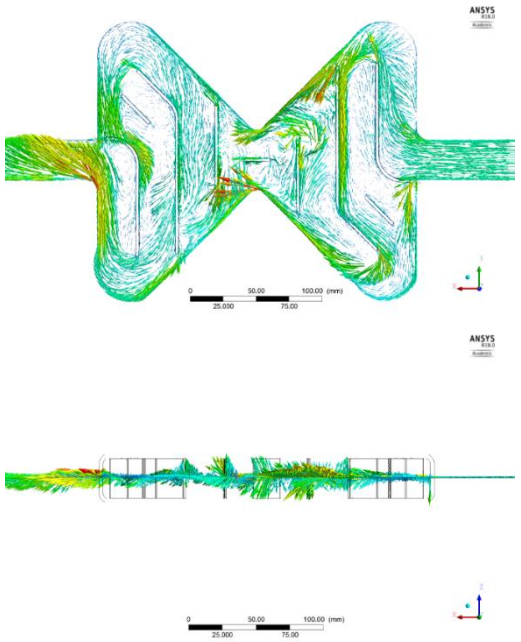
Schedule status and outlook

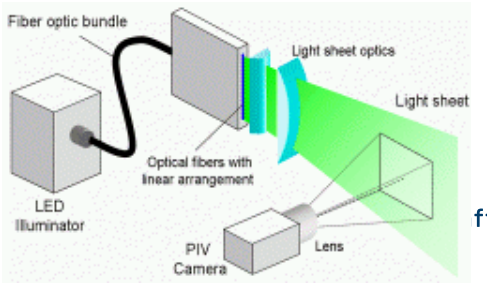
Sub unit	Final design	CDR	Manufacturing	FAT	delivery	SAT
Vacuum chamber	✓ .	✓ .	✓ .	X	2020	X
Stand	✓ .	✓ .	✓ .	X	2020	X
Platform	✓ .	✓ .	✓ .	X	2020	X
Top plate	✓ .	✓ .	✓ .	X	2020	X
Pressure control buffer	✓ .	✓ .	✓ .	✓ .	2020	X
Ortho para converter	✓ .	✓ .	✓ .	✓ .	2020	X
Heat exchanger	✓ .	✓ .	✓ .	✓ .	2020	X
LH2 pumps	✓ .	✓ .	✓ .	✓ .	2020	X
Cold pipework	✓ .	✓ .	08-19	X	2020	X
Gas management panel	✓ .	✓ .	08-19	X	2020	X
Control cabinet	03-19	04-19	06-19	07-19	2020	X
CMS Cryostat	✓ .	✓ .	**10-19**	**11-19**	**2020**	**?**

BF1 STUDY

PARTICLE IMAGE VELOCIMETRY (PIV)







ft

- ✓ CFX simulation
- ▪ Experiment
- ▪ Documentation

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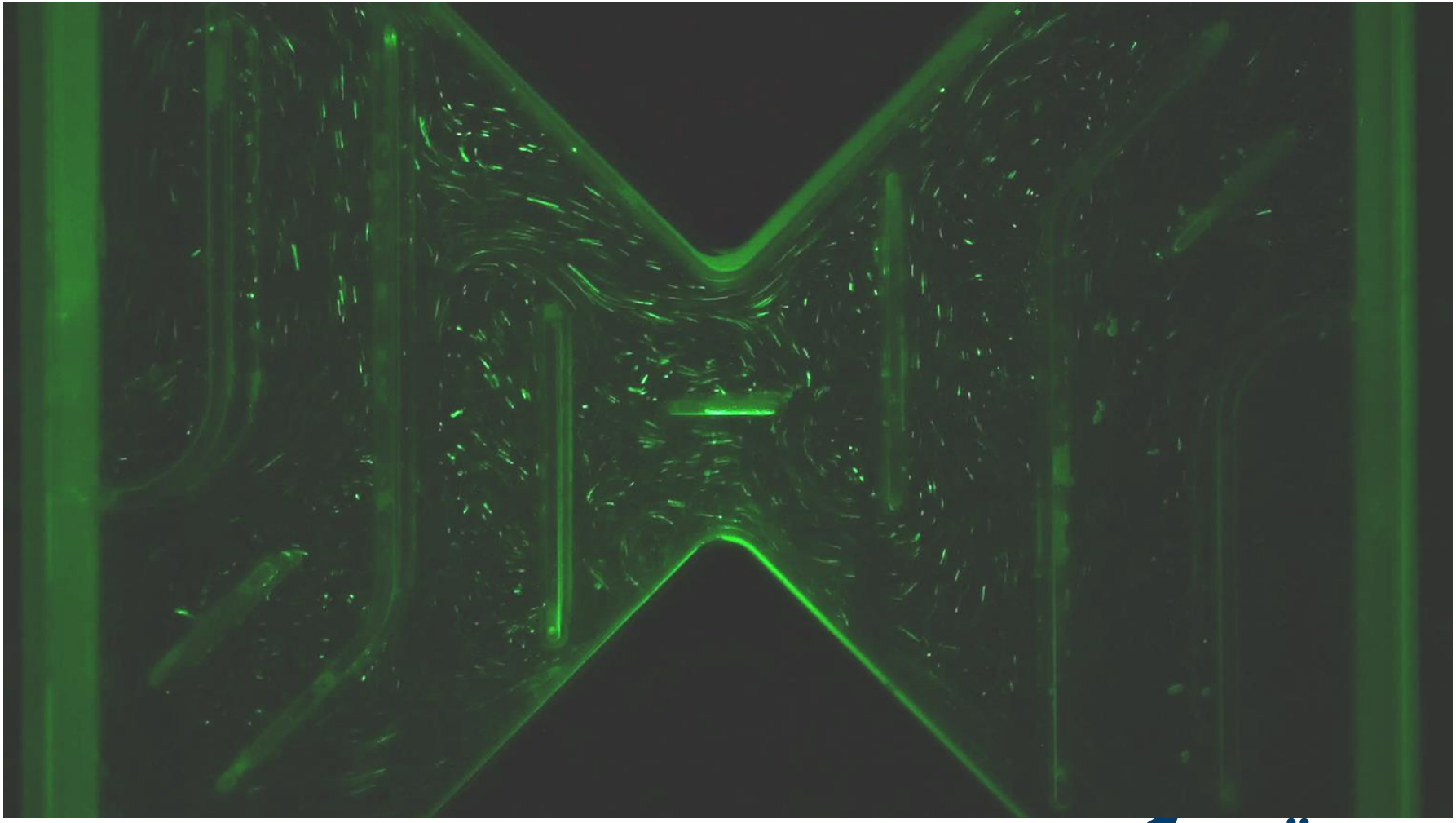
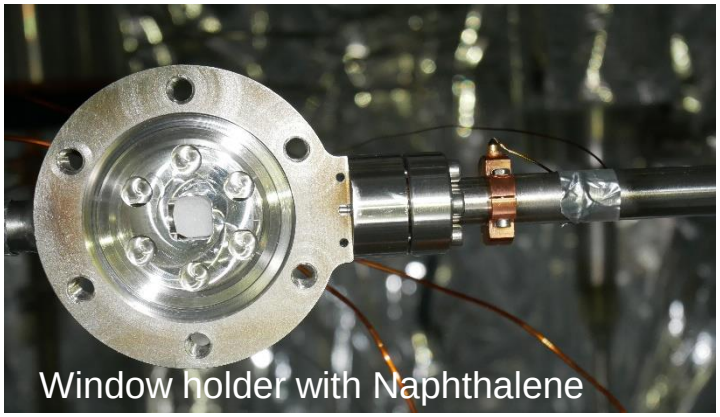
BF1 STUDY

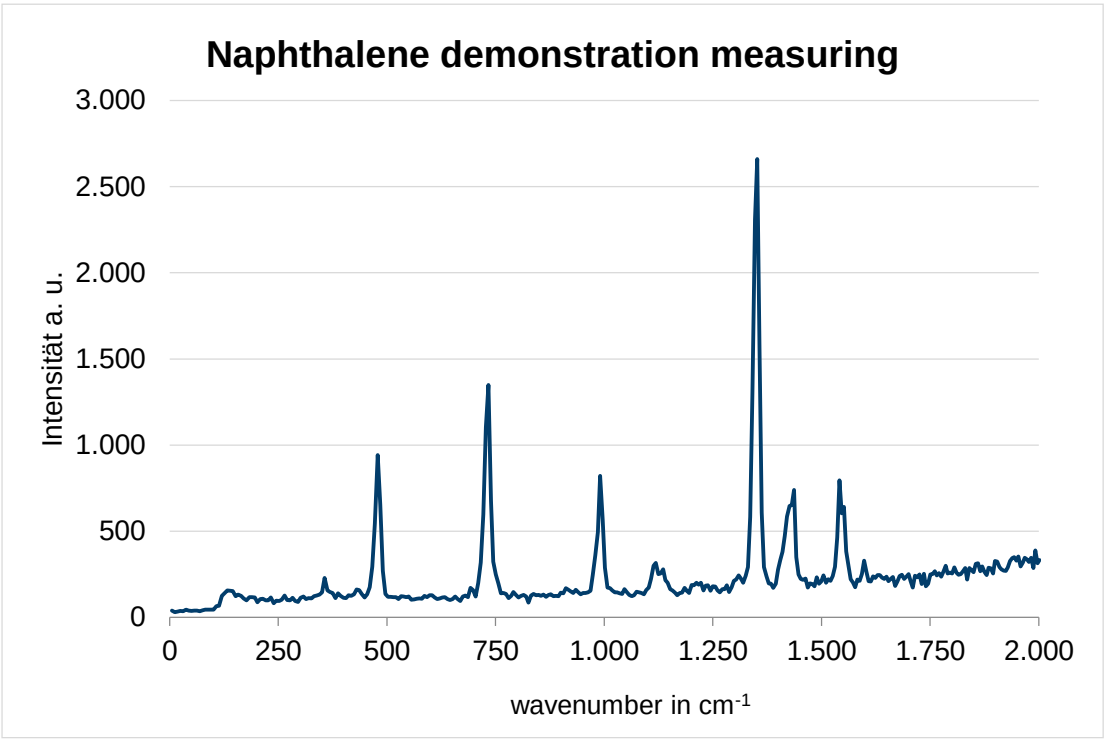
First PIV test (water)



BF1 STUDY

RAMAN MEASUREMENT / CODL WINDOW TEST





Measurement system provided by Monika (ESS)
→Thanks!

ADDITIONAL “SMALL” PROJECTS

- **LH2 Pump water cooling**

→procurement stopped; Financing only covers 30% of costs….

- **CMS Cabinet**

→delivery will be July 19

- **Retro Reflector Project**

→funding not in place

- **RAMAN view port characterization**

→Master thesis is complete

TMP TIK4.1

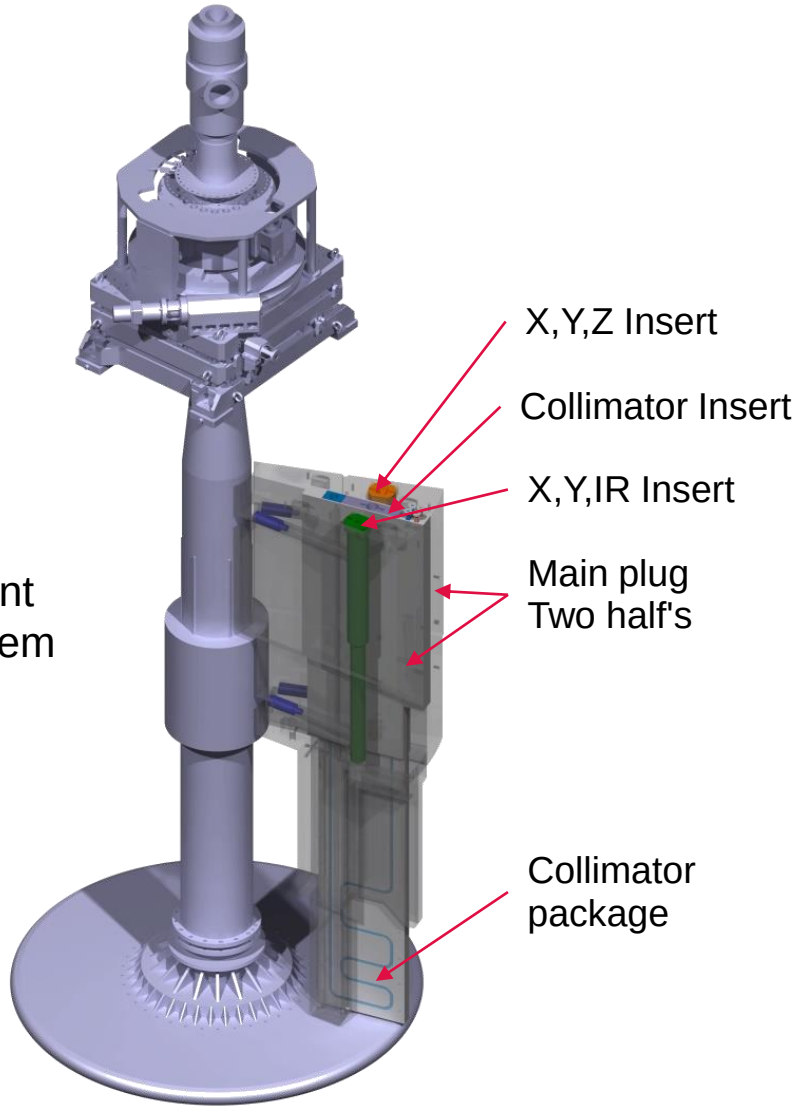
Overview and status

Task of Target Monitoring Plug (TMP)

- Measure the x/y position of the wheel
- Measure the z position of the wheel
- Measure the helium coolant outlet temperature from each cassette during operation
- Measure shaft vibration during operation
- Measure helium borne sound in the helium coolant for acoustic diagnostics of the target cooling system and for acoustic diagnostics
- Measure the internal cooling system inlet and outlet temperature

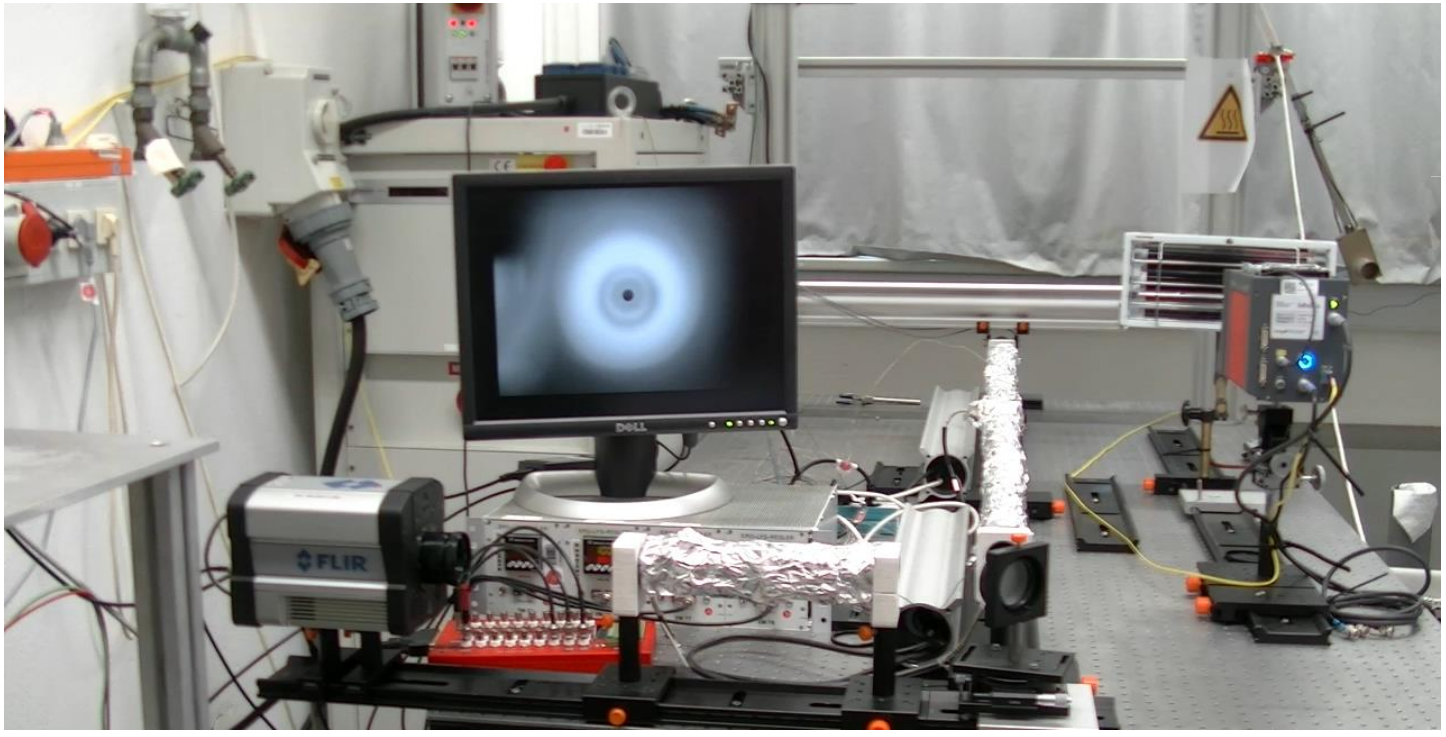
Status

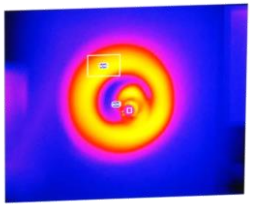
- CDR will be in May 2019 (1 month delay)
- FAT will be in April 2020
- Delivery will be in June 2020

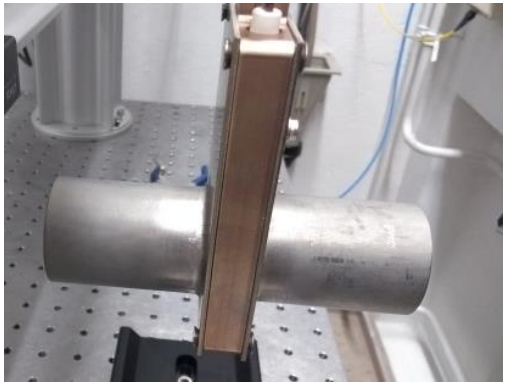


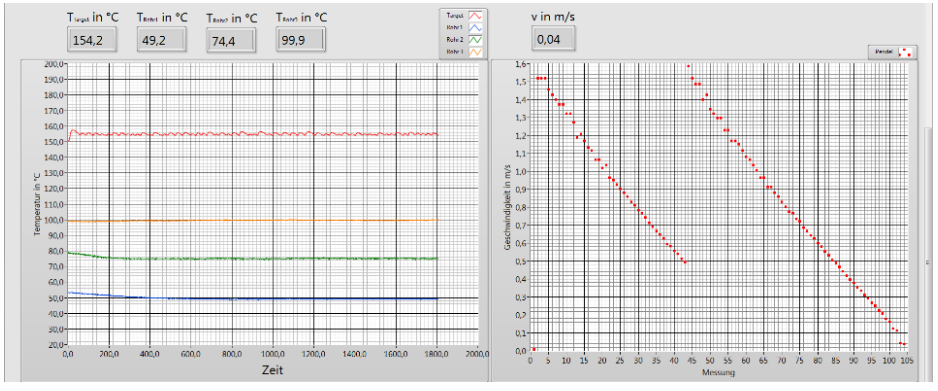
TMP TIK4.1

IR measurement









Mitg

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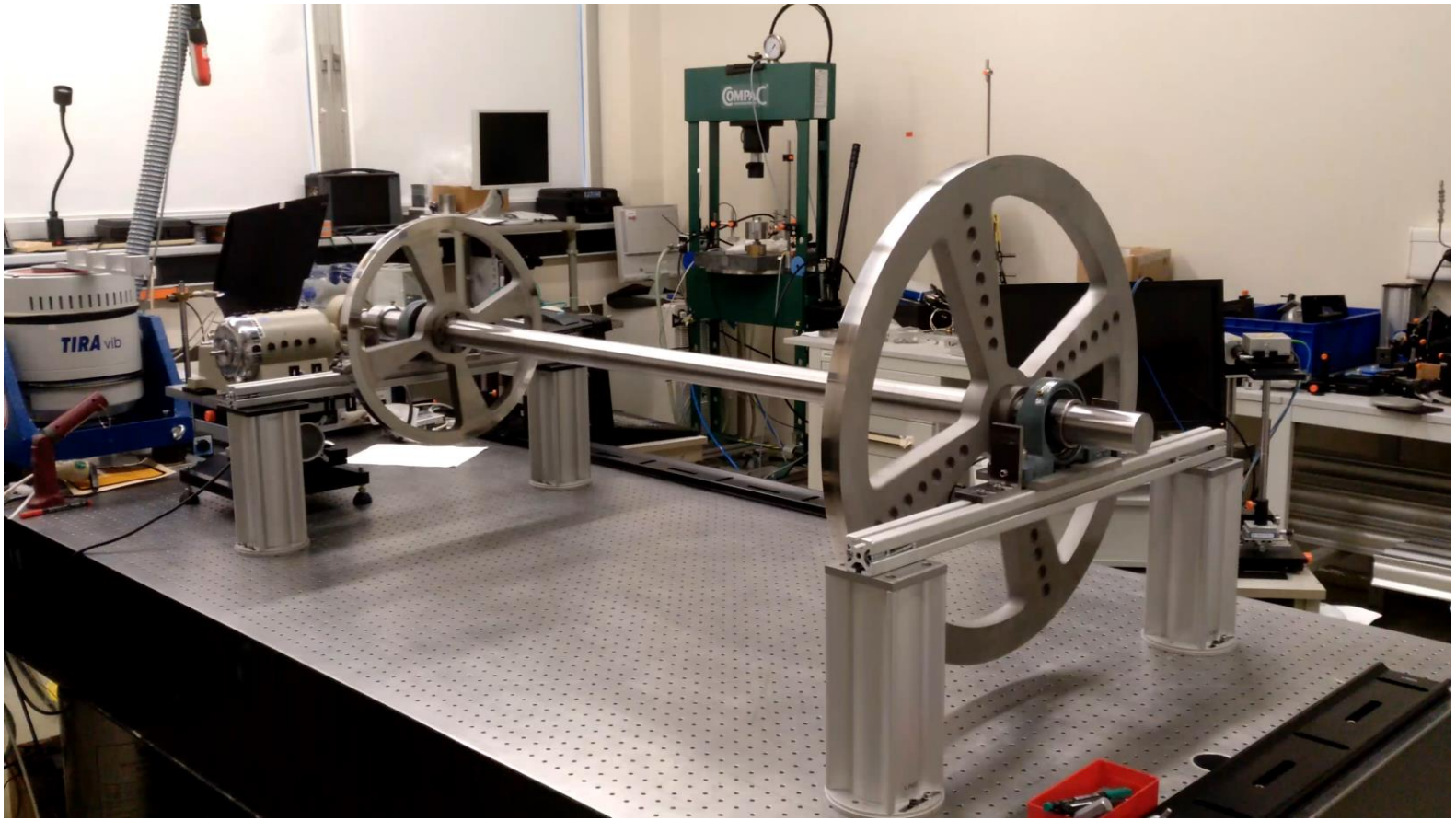
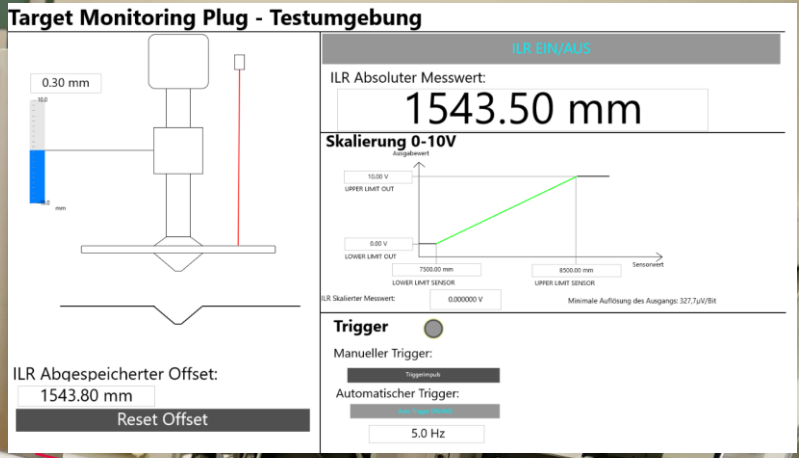
TMP TIK4.1

X,Y,Z- measurement



TMP TIK4.1

X,Y,Z- measurement



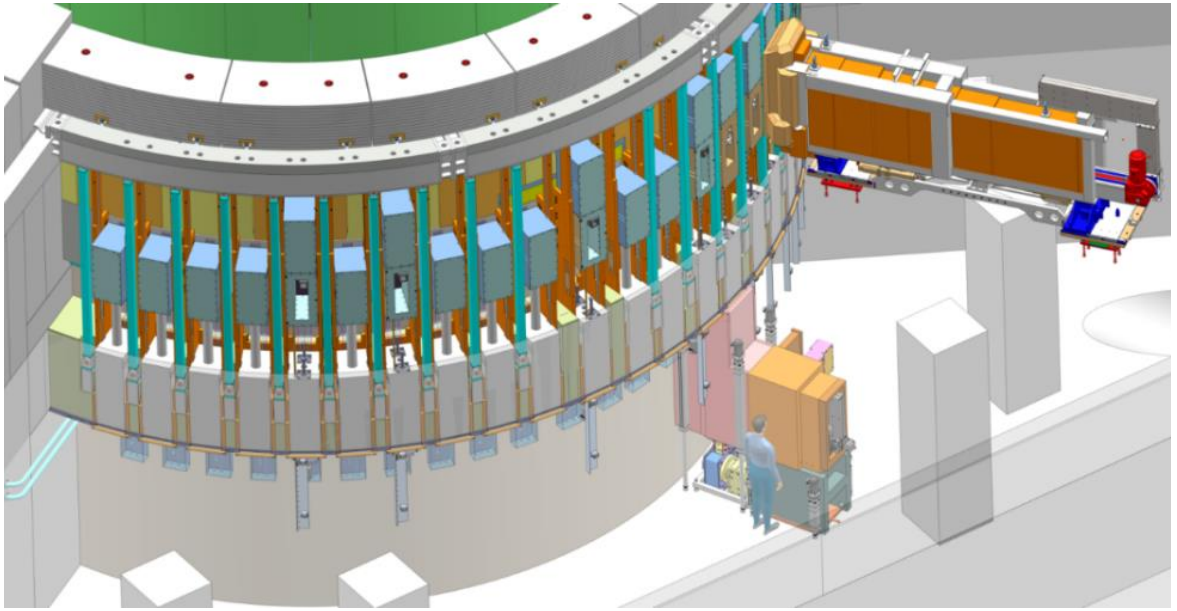
TMP

SUMMERY

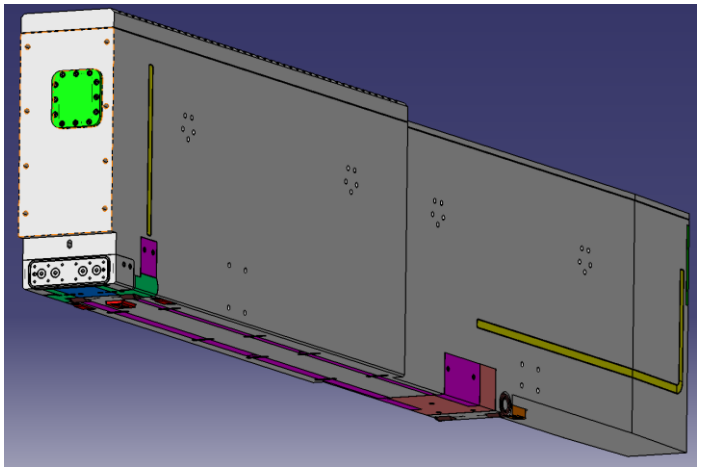
- Raw material specification already approved by ESS
  - Early call for tender will start end of March (low Co stainless steel, 16 w delivery time)
- Meeting with Target group needed to define measurement surface quality's
- New radiation damage calculation of the final design are needed in front of the CDR
- The radiation resistance of the components used must be verified during operation….
- Verification of pre selected measurement system will be compete in April 19
- Final design will be complete in April 19
- CDR will be at the 27th of May 19

NEUTRON BEAM EXTRACTION SYSTEM (NBEX)

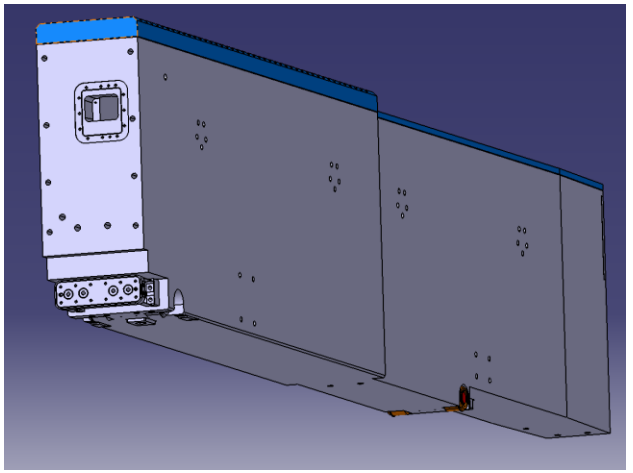
- NBEX Assemblies phase 1
  - Neutron Beam Port Insert (NBPI) prototype for LoKI instrument
  - Vertical Handling Teststand (VTS) & Light Shutter System (LSS)
  - Horizontal Test Stand (HTS)
  - Insert Installation Tool (IIT)
  - Media Connector prototype



NEUTRON BEAM PORT INSERT (NBPI) PROTOTYPE FOR LOKI INSTRUMENT



- Original design by ESS
  - Milled cooling channels
  - 3D bended pipework with a lot of complicated back fillers and tied tolerances
  - Welded cooling tubes
  - 7 m flat seal between body and lid made of soft Aluminum



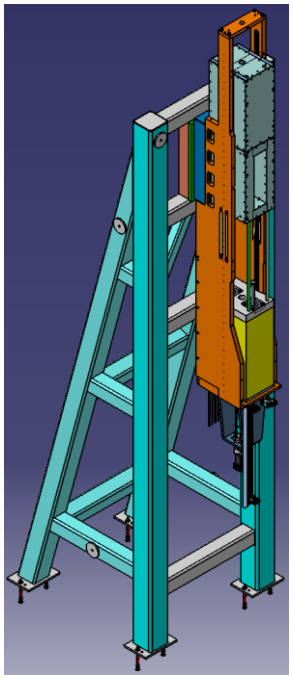
- Updated design
  - Cooling channels via deep hole drilling
  - Wire seal between body and lid made of copper

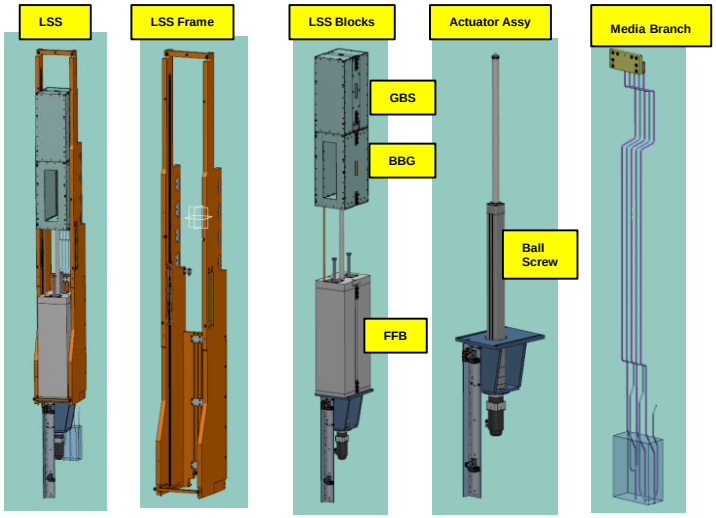
NEUTRON BEAM PORT INSERT (NBPI) PROTOTYPE FOR LOKI INSTRUMENT

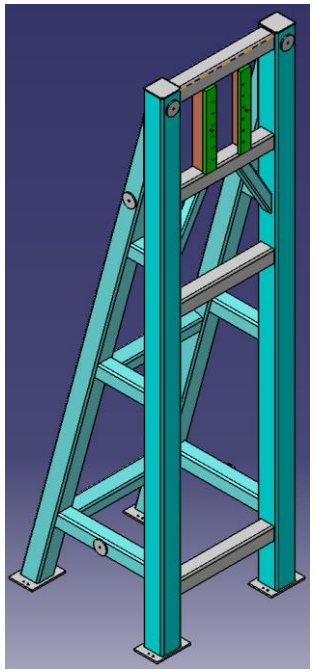
STATUS

- ✓ Finished redesigning NBPI body and lid by FZJ designer
- ✓ Drawing package of redesign sent to ESS for approval
- ✓ External feasibility study for both, the ESS design and the FZJ design, is ongoing
  - ➢ processing time for feasibility study is about three weeks
  - ➢ Result will be manufacturability of individual parts / detail cost and time estimation
- Complete redesign of NBPI prototype assembly will be completed by the end of March
- Various components of NBPI assembly are currently being manufactured, e.g. upstream and downstream windows and flat seal made of soft aluminum
- Expected completion of NBPI prototype assembly in July / August 2019

VERTICAL HANDLING TESTSTAND (VTS) & LIGHT SHUTTER SYSTEM (LSS)

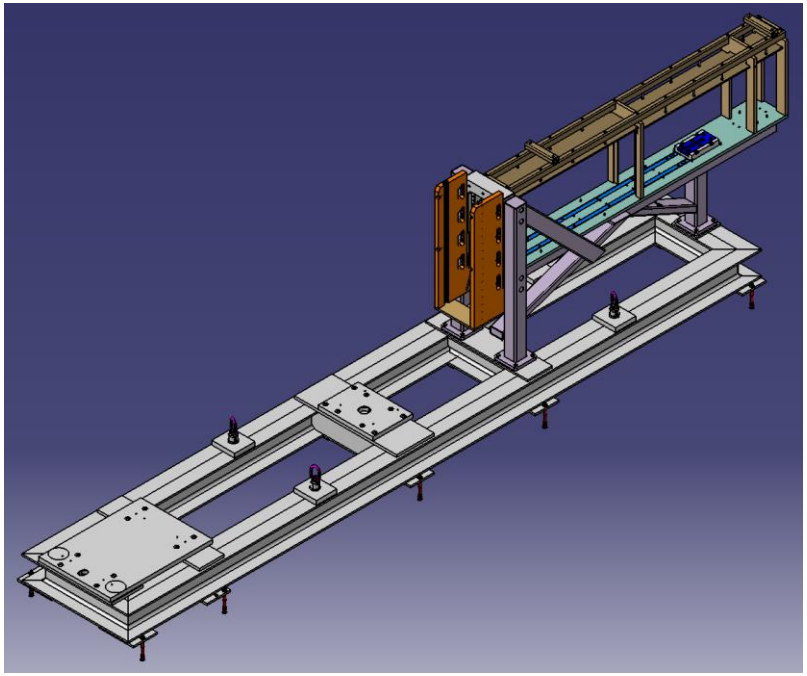






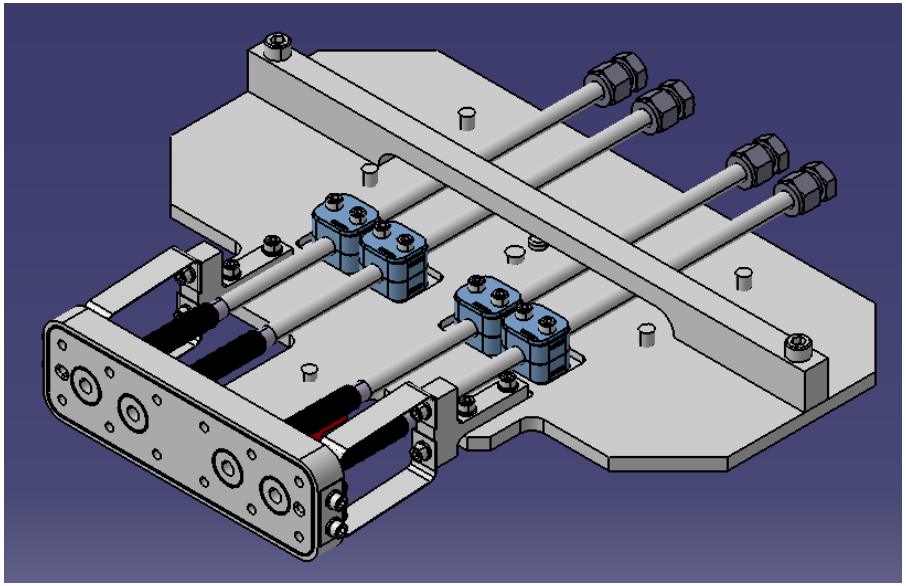
- Updated drawing package (February 19) is currently being reviewed by FZJ
- ≈ +14 weeks manufacturing time

HORIZONTAL TEST STAND (HTS)



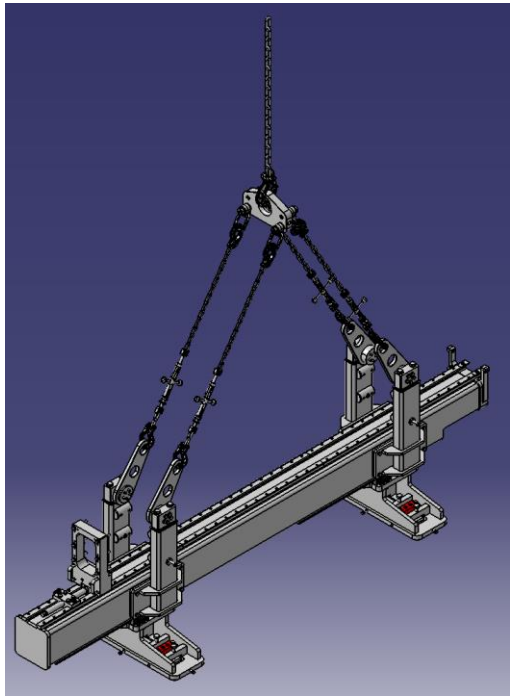
- Handed out drawings from ESS (December 18) need to be modified for external manufacturer
- Modifications are expected to be completed in April and will then handed over to the workshop
- ≈+12 weeks manufacturing time

MEDIA CONNECTOR PROTOTYPE



- Media connector prototype assembly is currently in FZJ workshop
- Delivery time of the metal bellows from Witzenmann is 16 weeks
- Anticipated completion in July 2019

INSERT INSTALLATION TOOL (IIT)

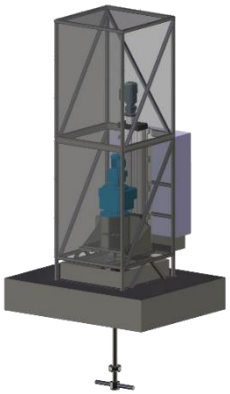


- The final drawing package has been received (February 19) and need to be reviewed by FZJ
- ≈+10 weeks manufacturing time

CONCLUSION AND OUTLOOK (NBEX)

- Requirement / specifications for the NBEX phase 2 are still not available…
- Drawings of phase 1 are not in producible state and need to be modified by FZJ
- Weekly Video meetings with ESS to discuss and answer design questions
- Both, the ESS and the FZJ, do not have enough resources to handle and to redesign all the assemblies in parallel….
  - ➢ However, another designer will support FZJ's NBEX team for redesigning VTS and LSS assemblies, beginning in march
- Designer Bengt Jönsson from ESS will visit FZJ every two weeks to improve the collaboration and speed up the processes

SUMMERY



- TIK3.1 & TIK3.2 will be complete around late summer 2019.
- Full FAT will be in autumn 2019
- Delivery will (can) be in early 2020

- BF1 study will be complete around summer 2019

- TIK4.1 will be complete around summer 2020

- NBEX phase 1 will be complete (include tests) around September / October 2019