

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

10<sup>th</sup> TTB

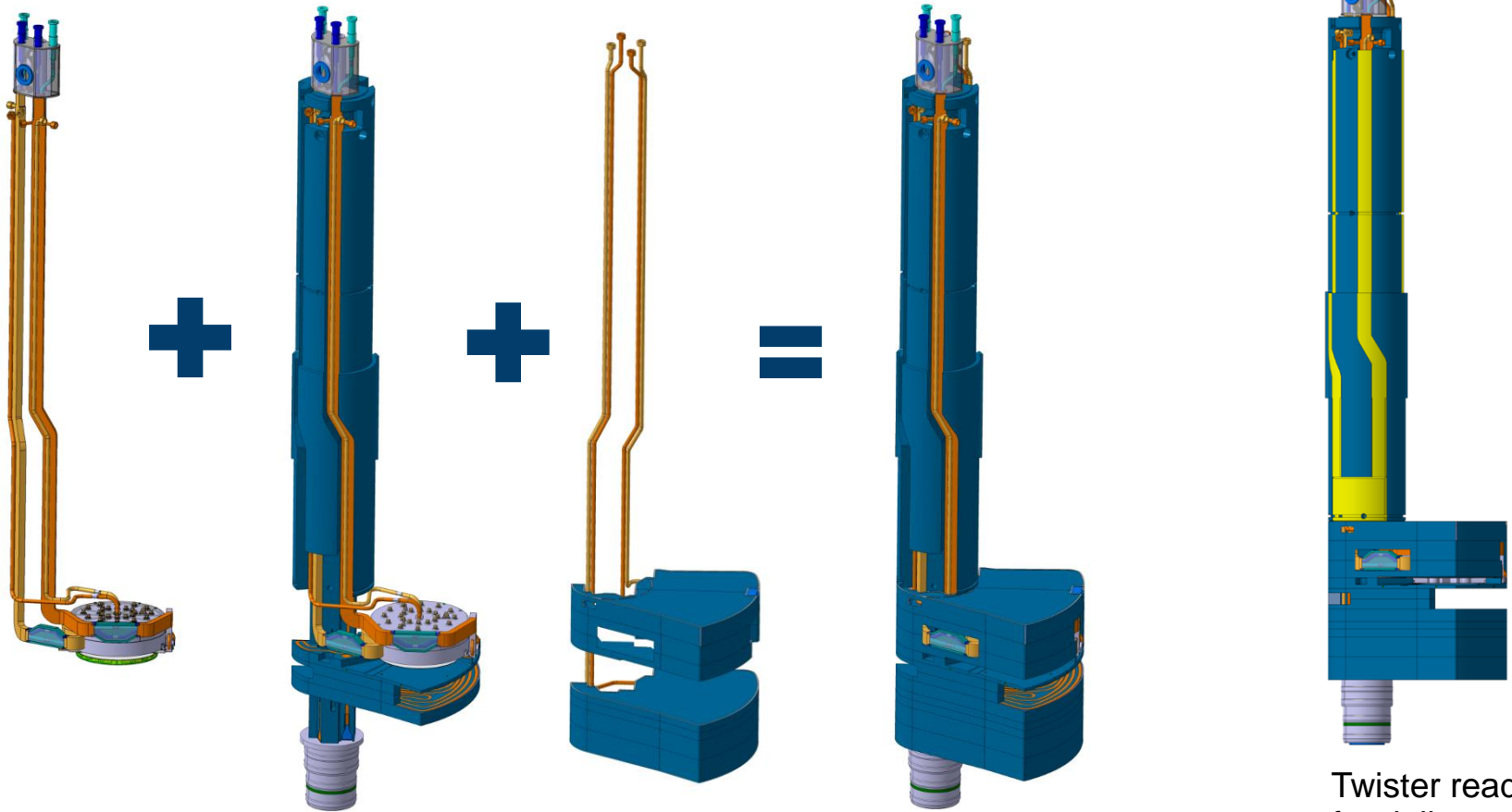
2018.08.29 | Y. BEßLER

# OUTLINE

- Moderator & Reflector Plug -TIK3.1 status
- Cryogenic Moderator System -TIK3.2 status
- Additional small ESS projects
- Target Monitoring Plug -TIK4.1 new project
- Neutron beam extraction system -planned project

# MRP TIK3.1

## Design solution



Moderator &  
Reflector Plug

FAT setup 1

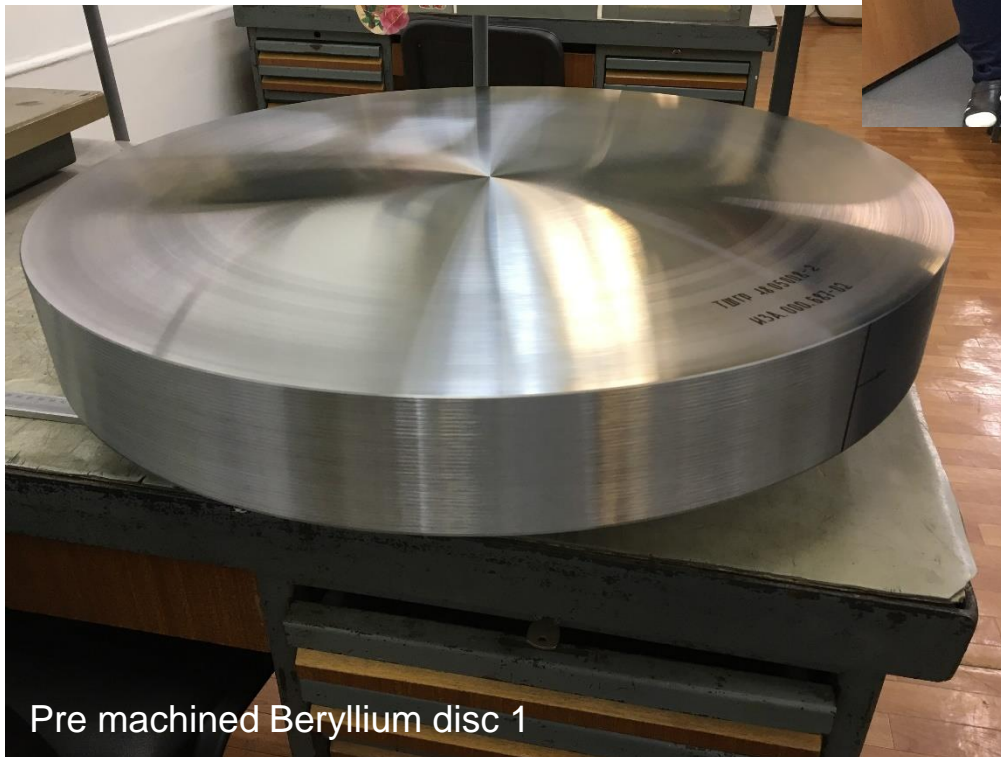
FAT setup 2

Twister ready  
for delivery

# MRS TIK3.1

## Reflector (Beryllium)

- ✓ Beryllium raw material production
  - Beryllium milling (Moscow) is running
  - Acceptance test and delivery Oct. 18
  - Welding Reflector Nov. 18 (ZEA-1)
  - FAT Nov. / Dec. 18





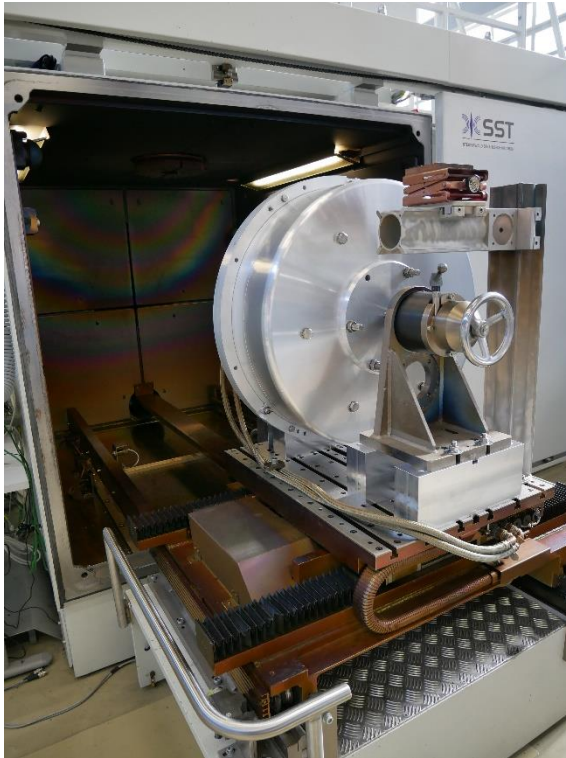
# MRS TIK3.1

## Reflector vessel (Al6061-T6)

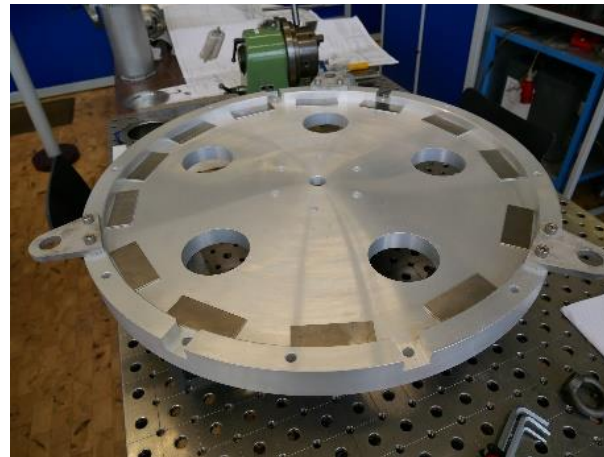
- ✓ Production completed
  - Welding Reflector Nov. 18
  - FAT Nov. / Dec. 18



Upper part



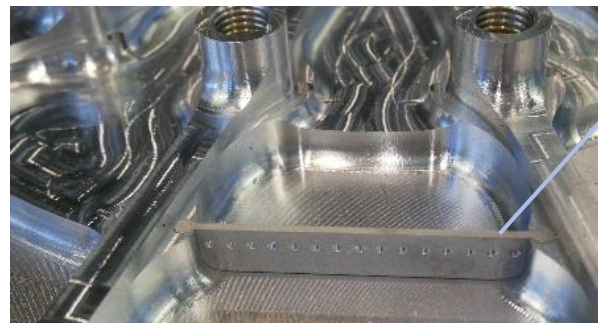
Test vessel (ebeam welding)



Welding devices



Lower part



"Swirl destroyer"

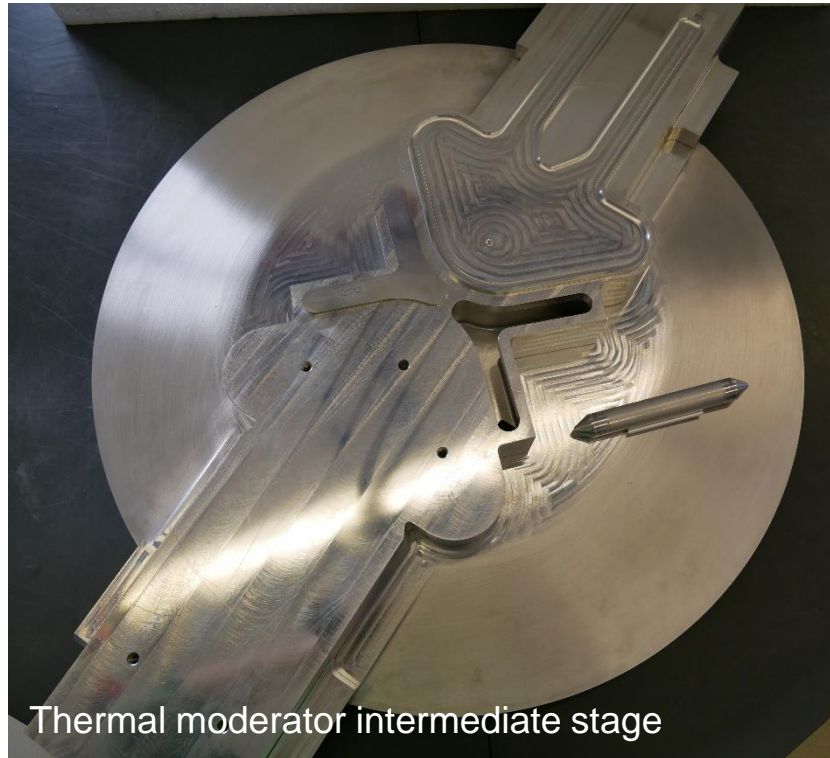
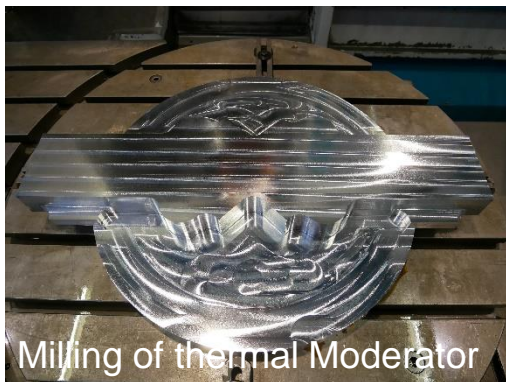


Lower part backside

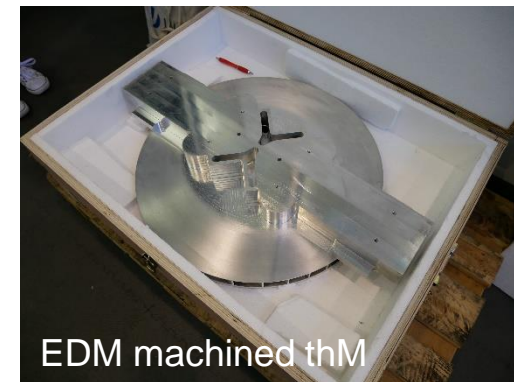
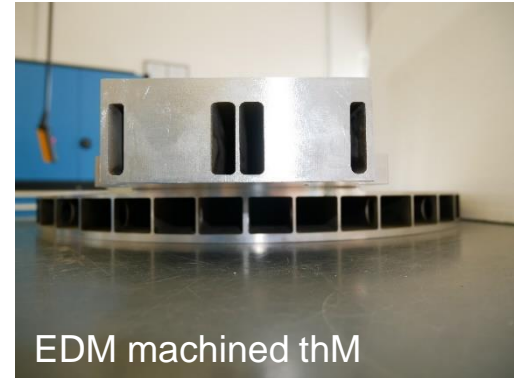


# MRS TIK3.1

## Thermal Moderator



- Production is running until Nov. / Dec. 18
- FAT Dec. 18
- Ready for integration (Twister) Jan. 19

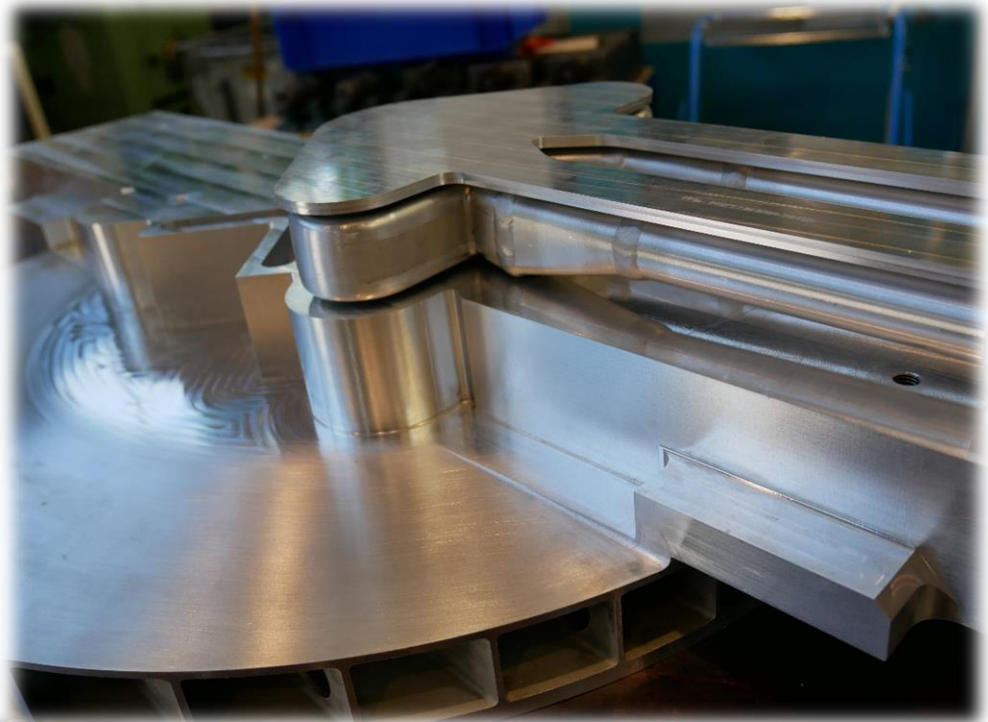


# MRS TIK3.1

## Cold Moderators



Final cold Moderators



Cold Moderators with thermal Moderator (intermediate stage)



- ✓ Production completed
  - FAT 10-11 Sep. 18
  - Integration (thM) Sep. 18



# MRS TIK3.1

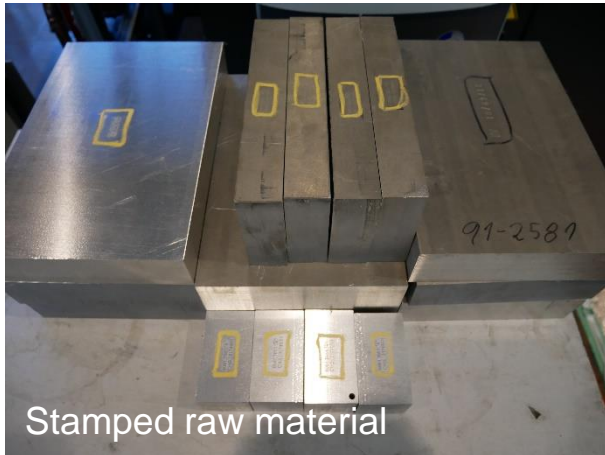
Cold Moderators  
Milling / EDM



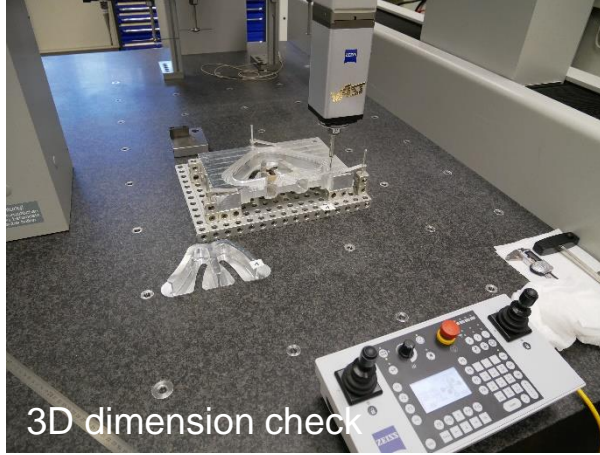
Upper part



Transition pipe



Stamped raw material



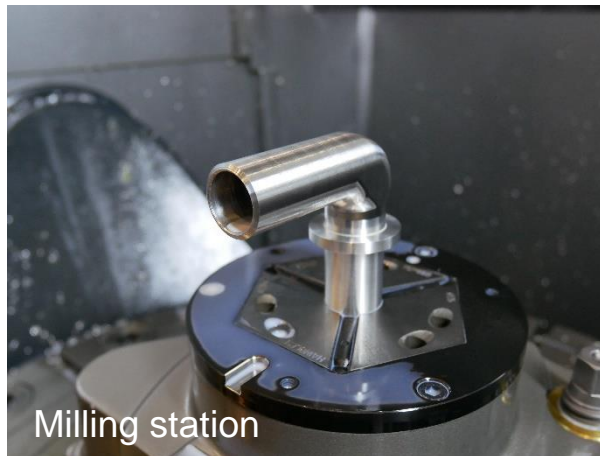
3D dimension check



Laser cutted filler metals



Milling station



Milling station

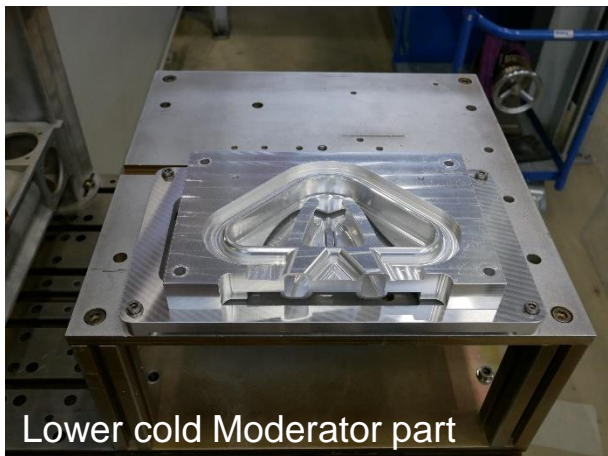
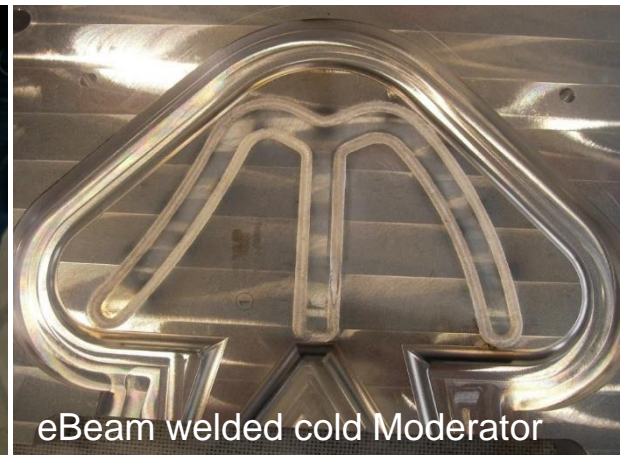
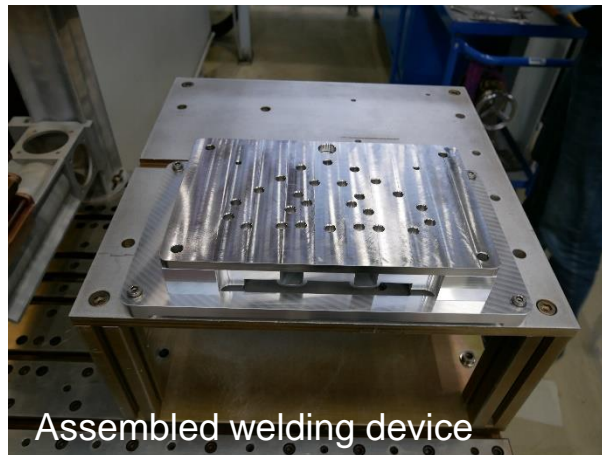
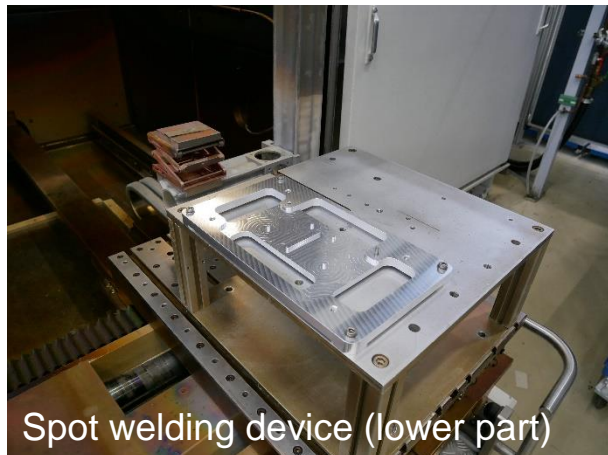
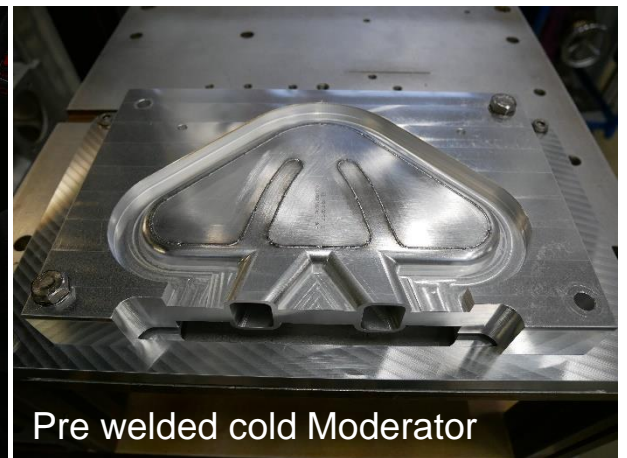


Cold Moderator spacers (EDM)



# MRS TIK3.1

## Cold Moderators eBeam welding





# MRS TIK3.1

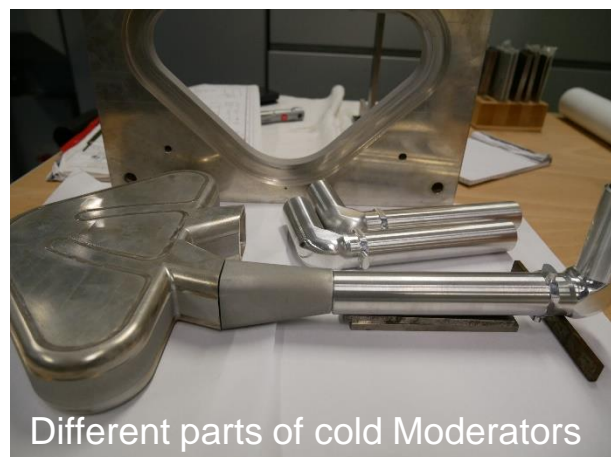
## Cold Moderators TIG Welding



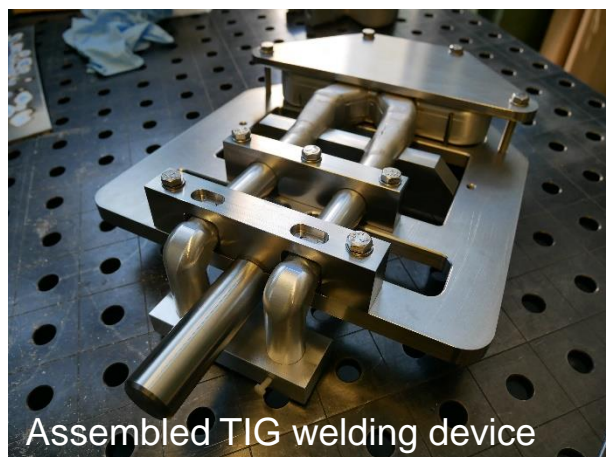
Assembled TIG welding device



TIG welding of transition pipes



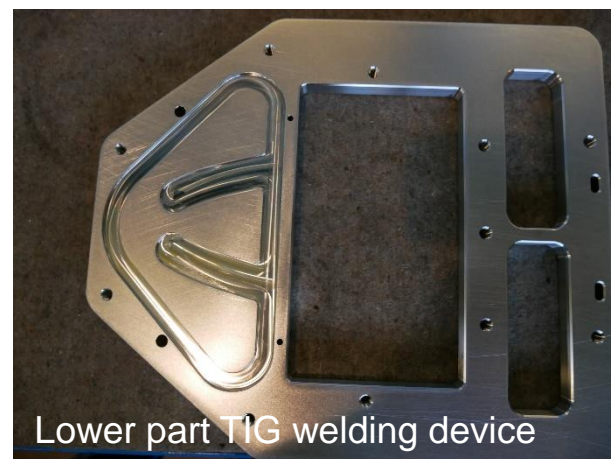
Different parts of cold Moderators



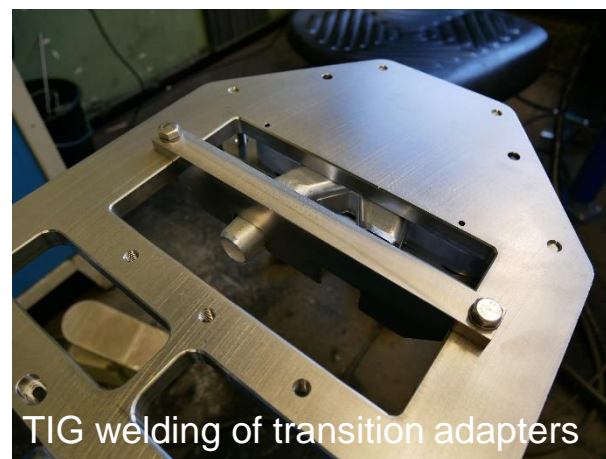
Assembled TIG welding device



TIG welding of transition pipes



Lower part TIG welding device



TIG welding of transition adapters



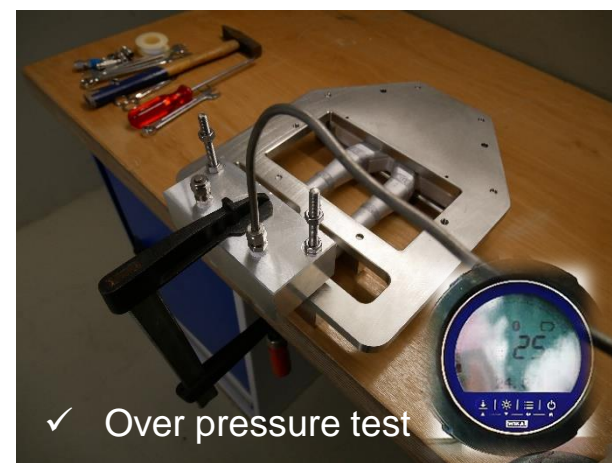
Final Moderator



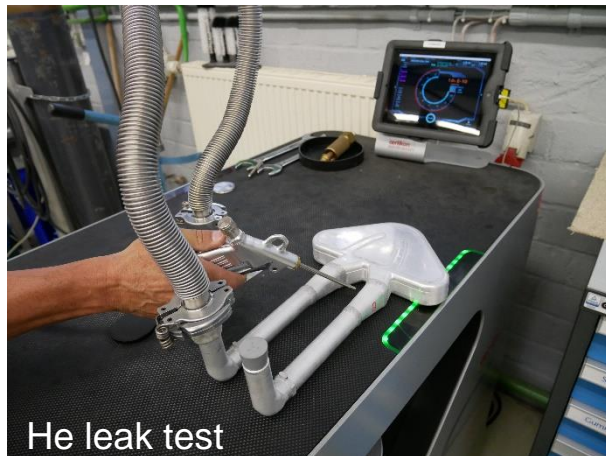
# MRS TIK3.1

## Cold Moderators non destructive testing

- ✓ Visual inspection
- ✓ He leak test  $10^{-10}$  mbar\*l/s
- ✓ Dry penetration test
- ✓ X-ray test
- ✓ Over pressure test 25 bar



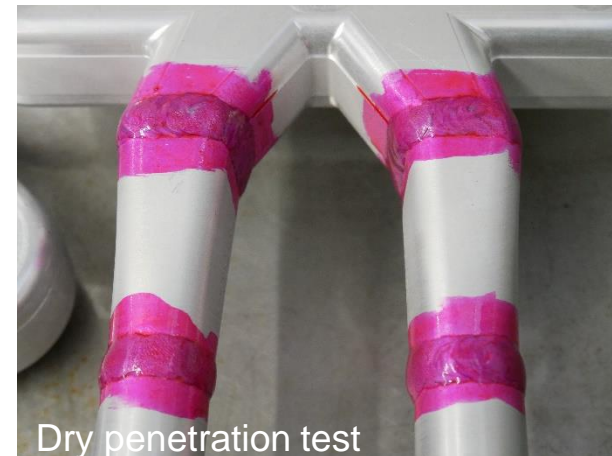
✓ Over pressure test



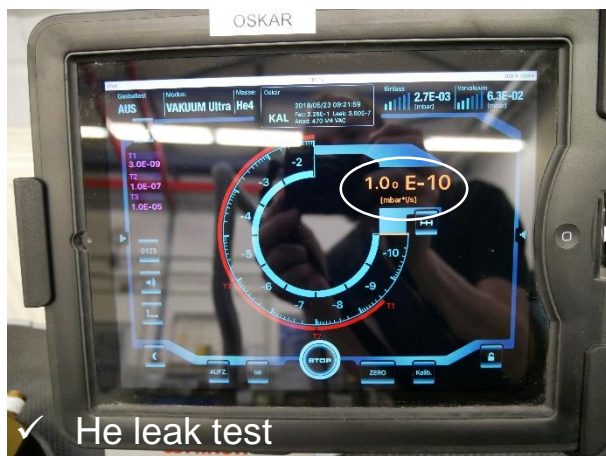
He leak test



X-Ray inspection



Dry penetration test



✓ He leak test



✓ x-ray image



✓ Dry penetration test

# MRS TIK3.4

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



Inner holder with  
96 samples...

Welded inner  
holder



Final Irradiation Module



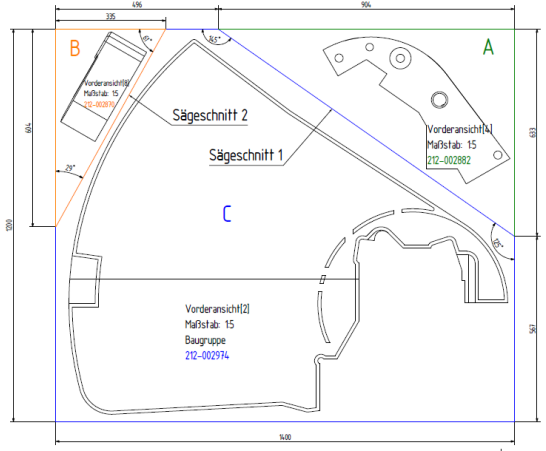
Assembly of Irradiation Module

- ✓ Production completed
- ✓ FAT completed
- Integration (thM) Sep. 18

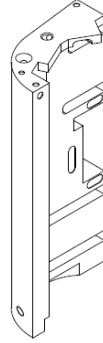


# MRS TIK3.1

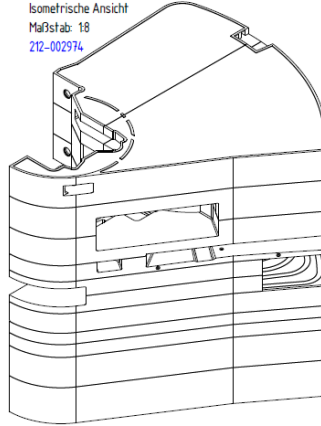
## Twister



Isometrische Ansicht(Z)  
Maßstab: 18  
212-002882



Isometrische Ansicht  
Maßstab: 18  
212-002974



Twister Frames and Food raw material (1.4306 Co≤0,05%)



16t block



Yannick and Marc

forge the of Twister shaft



# MRS TIK3.1

## Rotation Unit



- ✓ Production completed
- ✓ FAT (functional)
  - FAT el. Cabinet Sep. 18

Final assembly of Rotation Unit at ZEA-1





# MRS

## Bucket (extra project) and Crown (TIK3.1)



Raw material of Bucket and Crown



Milling of crown



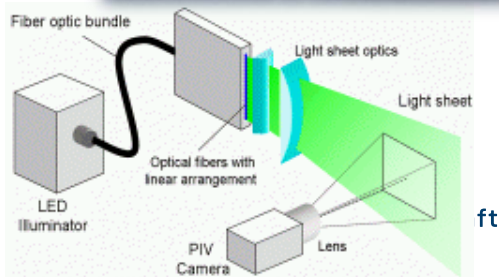
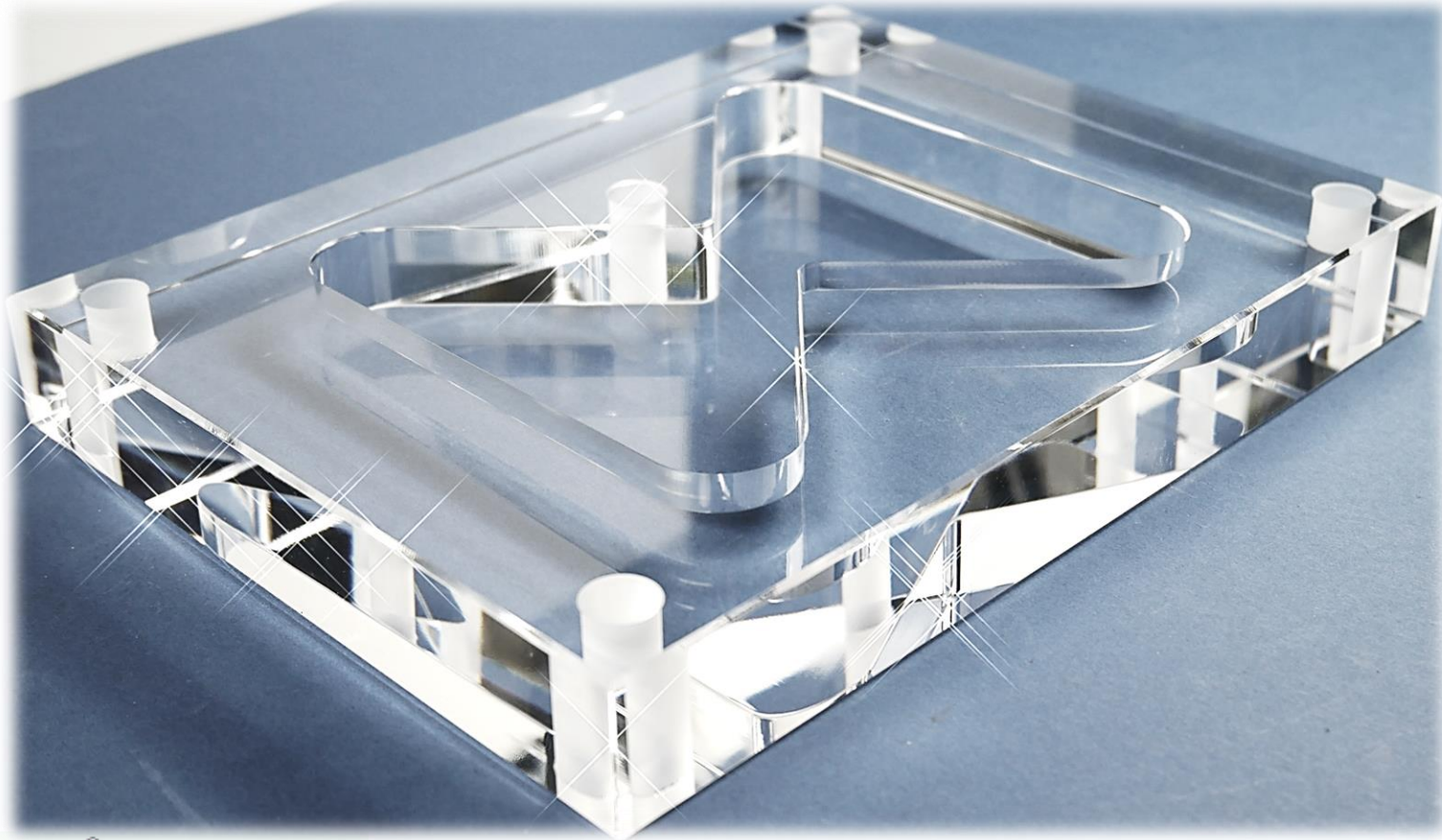
3D dimension check of Crown



Final Crown and Bucket

- ✓ Production completed
- Ready for FAT

# PARTICLE IMAGE VELOCIMETRY (PIV) EXPERIMENT OF BF1 MODERATOR

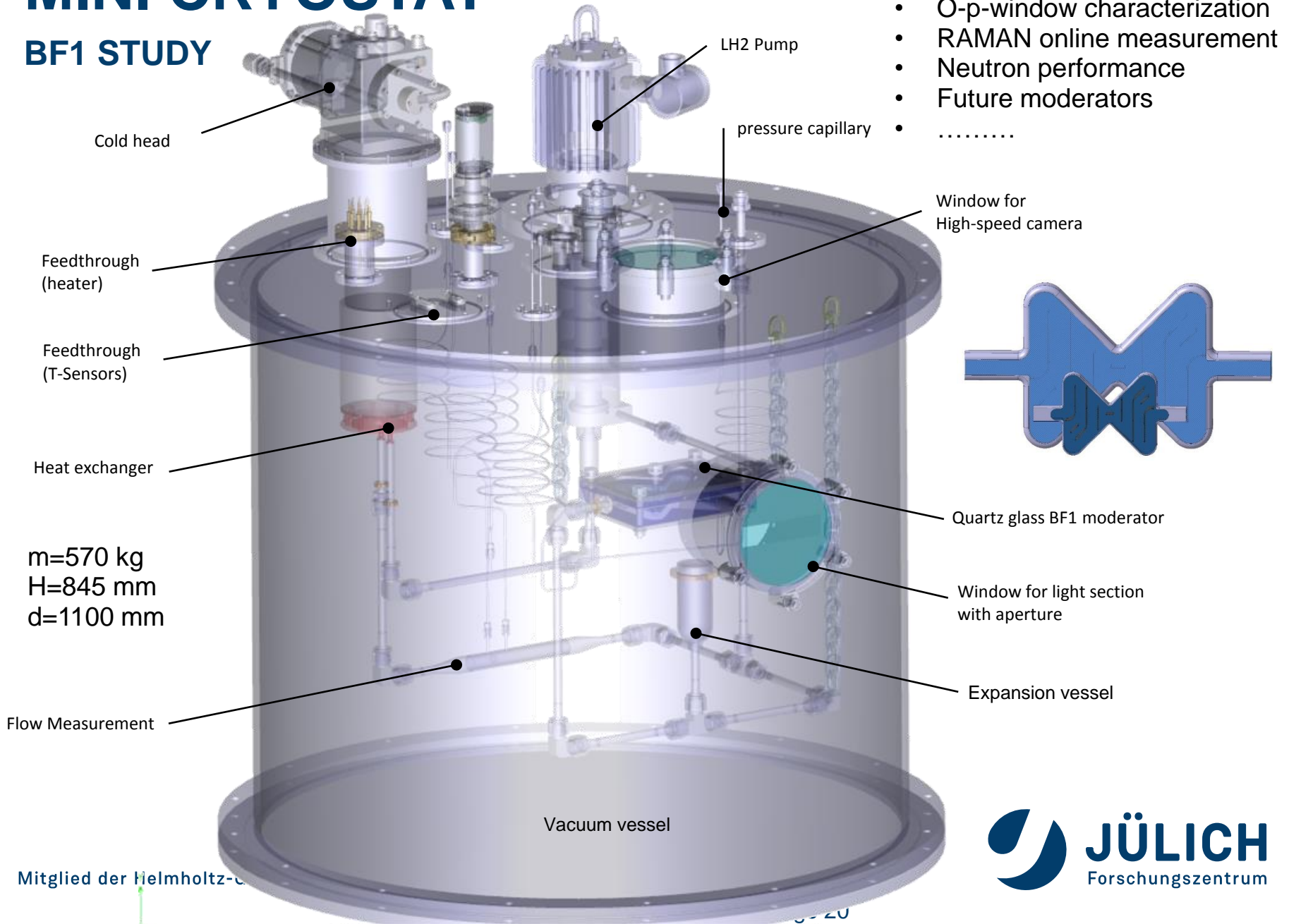


- ✓ CFX simulation
- Experiment Nov. 18
- Documentation 03.19



# MINI CRYOSTAT

## BF1 STUDY



- CFX validation
- O-p-window characterization
- RAMAN online measurement
- Neutron performance
- Future moderators
- .....

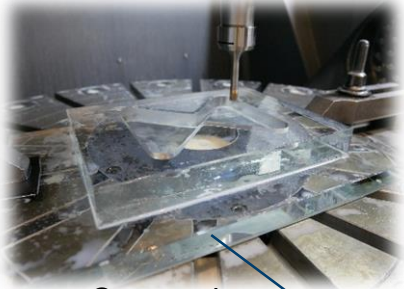


# PIV EXPERIMENT

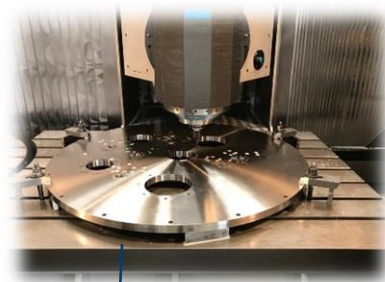
## BF1 STUDY



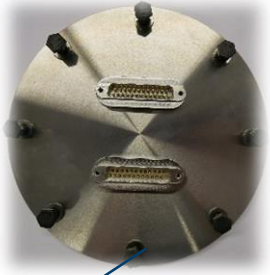
Cover plate and fluid guides



Quartz glass body



Top plate



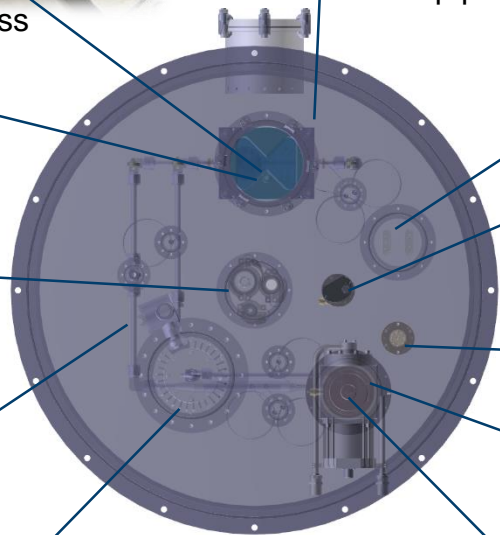
T-Sensor feedthrough



vacuum measurement



Feedthrough safety valve vent valve vacuum pump



Heating wire Vacuum feedthrough



T-Sensor holder



H2 feedthrough



LH2-Pump



PCB



Cold Head

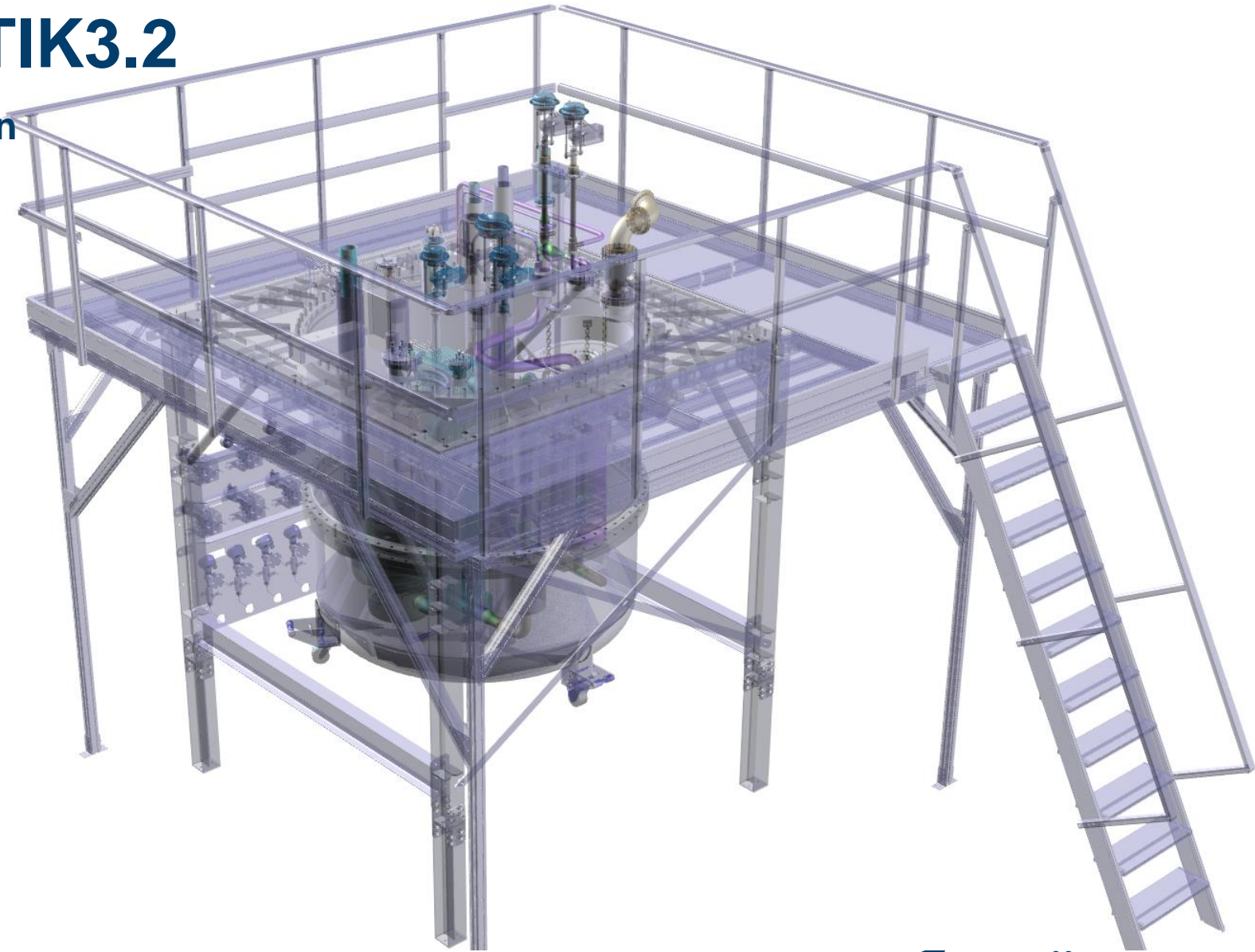


HX



# CMS TIK3.2

CMS design  
solution



# CMS TIK3.2

## Manufacturing and testing o-p-converter



o-p-Con. mesh quench test



Machining o-p-converter



Mesh holder



Inspection of inner welds



Pre machined vessel



Welding o-p-converter



Pre welded formed head



Welding of formed head



Final o-p-converter



# CMS TIK3.2

## Manufacturing and testing of HX2



Finned Cu tube (LH2)



Inner assembly



Outer vessel milling



Outer vessel welding



PCB, HX 2 and Converter



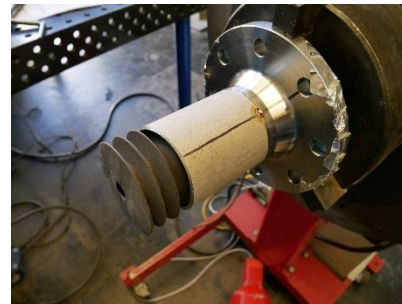
formed head



Friction welding adapter



Outer vessel welding



Flange for pressure test



PCB test (TUD)

# ADDITIONAL “SMALL” PROJECTS

- **LH2 Pump cooling**

→ procurement in ongoing; delivery of the unit is expected around December 2018

- **CMS Cabinet**

→ is already ordered, delivery will be November 2018

- **Retro Reflector Project**

→ **funding still missing**

- **RAMAN view port characterization**

→ Master thesis is ongoing, results and report are expected around January 2019

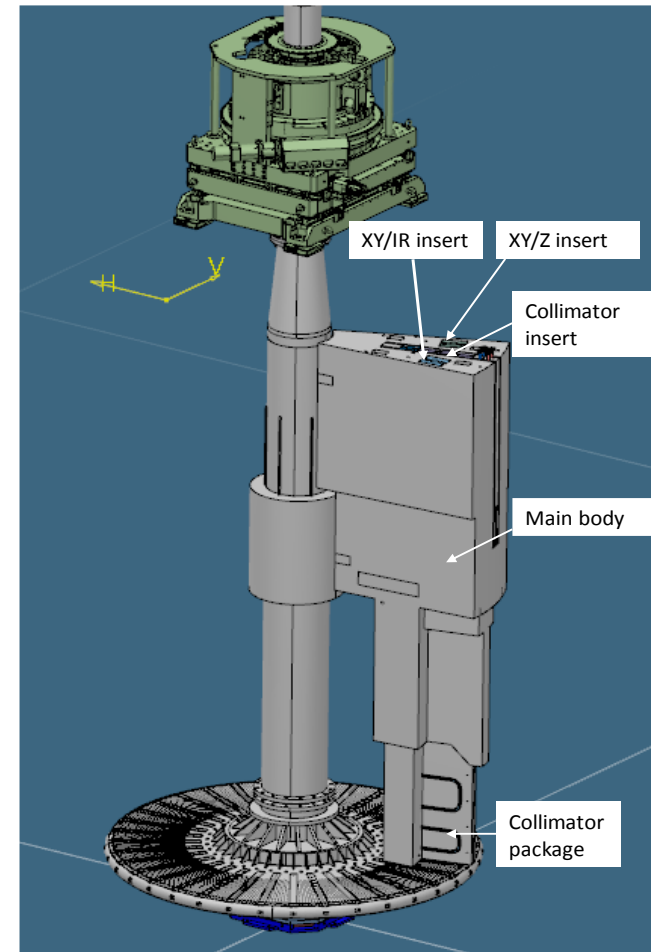


# TMP TIK4.1

## New project

### Task of Target Monitoring Plug (TMP)

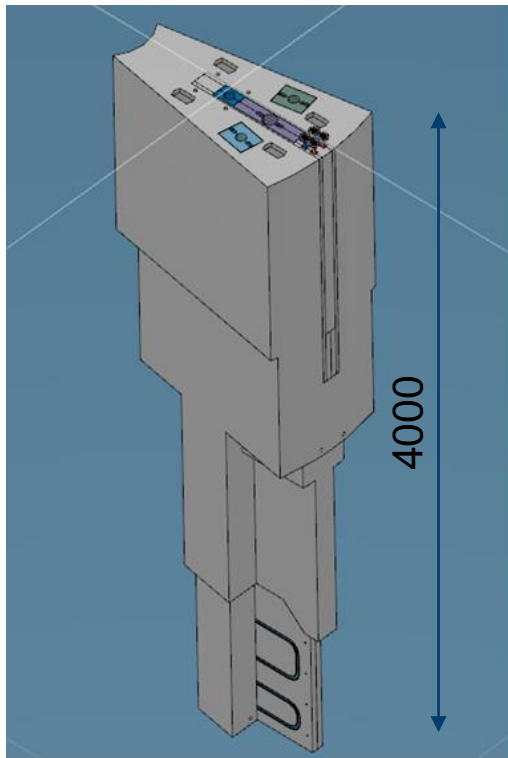
- Measure the x/y position of the wheel
- Measure the z position of the wheel
- Measure the helium coolant outlet temperature from each cassette during operation
- Measure shaft vibration during operation
- Measure helium borne sound in the helium coolant for acoustic diagnostics of the target cooling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



Source: ESS

# TMP TIK4.1

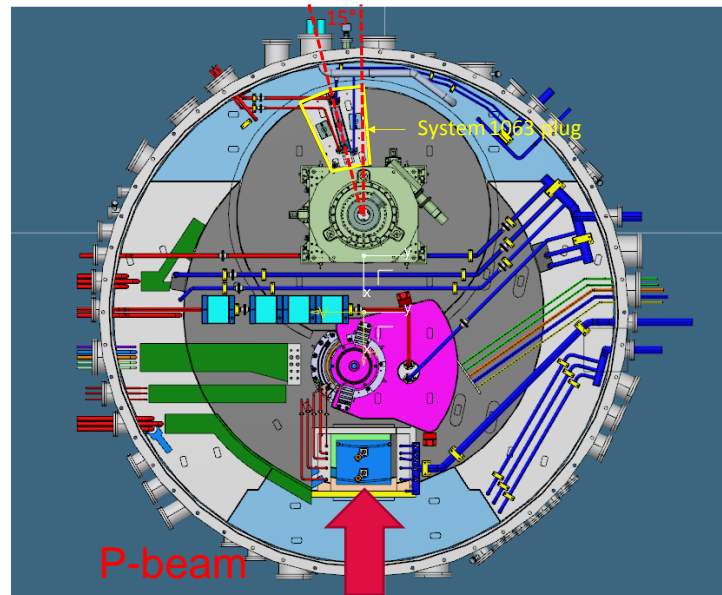
## Primary design solution



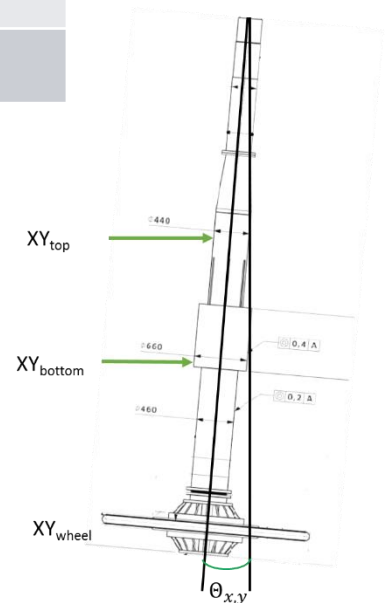
Source: ESS

Part	Main Material	Weight
Complete plug	316L	11200 kg
Main Body	316L	8800 kg
XY/Z insert	316L	260 kg
XY/IR insert	316L	260 kg
Collimator assembly	316L	1570 kg
Scintillator insert (replaceable)	316L	230 kg
Scintillator insert (permanent)	316L	80 kg

Source: ESS



Source: ESS

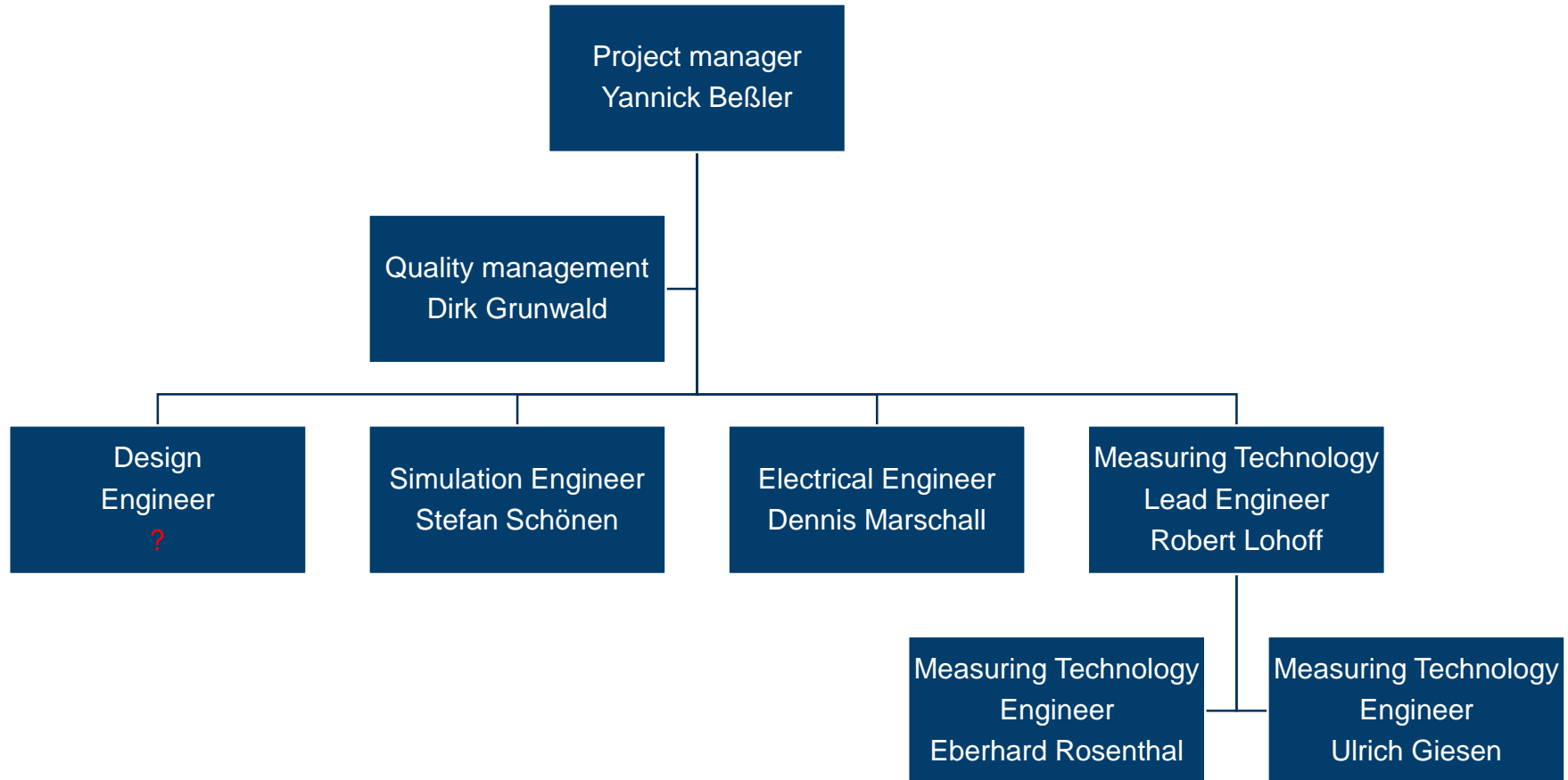


Source: ESS



# TMP TIK4.1

## Project team (final design phase)



# TMP TIK4.1 SCHEDULE

name	duration	start	complete
<b>target monitoring plug (TMP)</b>	<b>528 d</b>	<b>Fr 01.06.18</b>	<b>Di 09.06.20</b>
<b>pre phase</b>	<b>72 d</b>	<b>Fr 01.06.18</b>	<b>Mo 10.09.18</b>
<b>final design phase</b>	<b>177 d</b>	<b><u>Mi 12.09.18</u></b>	<b>Do 16.05.19</b>
verification of concept design	20 d	Mi 12.09.18	Di 09.10.18
detail design (CAD)	3 m	Do 11.10.18	Mi 02.01.19
mechanical design	2 m	Do 08.11.18	Mi 02.01.19
fluid dynamic design	2 m	Do 08.11.18	Mi 02.01.19
evaluation of ESS measurement technology	2 m	Do 08.11.18	Mi 02.01.19
pre tests	3 m	Do 11.10.18	Mi 02.01.19
<b>preparation of CDR documents</b>	<b>72 d</b>	<b>Fr 04.01.19</b>	<b>Mo 15.04.19</b>
<b>Milestone CDR</b>	<b>2 d</b>	<b><u>Di 30.04.19</u></b>	<b><u>Mi 01.05.19</u></b>
approval of CDR by ESS	1 d	Do 16.05.19	Do 16.05.19
<b>making phase</b>	<b>185 d</b>	<b>Mo 20.05.19</b>	<b>Fr 31.01.20</b>
<b>procurement raw material and parts</b>	<b>60 d</b>	<b>Mo 20.05.19</b>	<b>Fr 09.08.19</b>
<b>manufacturing</b>	<b>132 d</b>	<b>Mo 20.05.19</b>	<b>Di 19.11.19</b>
<b>assembly of TMP</b>	<b>52 d</b>	<b>Do 21.11.19</b>	<b>Fr 31.01.20</b>
<b>test phase</b>	<b>91 d</b>	<b>Di 04.02.20</b>	<b>Di 09.06.20</b>
functional tests	3 m	Di 04.02.20	Mo 27.04.20
<b>Milestone FAT</b>	<b>1 d</b>	<b><u>Mi 29.04.20</u></b>	<b><u>Mi 29.04.20</u></b>
approval of FAT by ESS	10 d	Fr 01.05.20	Do 14.05.20
preparation of final documentation	60 d	Di 04.02.20	Mo 27.04.20
<b>Milestone FD</b>	<b>1 d</b>	<b><u>Mi 29.04.20</u></b>	<b><u>Mi 29.04.20</u></b>
approval of final documentation by ESS	1 w	Fr 01.05.20	Do 07.05.20
cleaning, packing and shipping preparations	10 d	Mo 18.05.20	Fr 29.05.20
TMP ready for delivery	1 d	Di 02.06.20	Di 02.06.20
<b>Milestone Delivery</b>	<b>4 d</b>	<b><u>Do 04.06.20</u></b>	<b><u>Di 09.06.20</u></b>



# NBEX WBS 12.4.2.4

## Planned new project

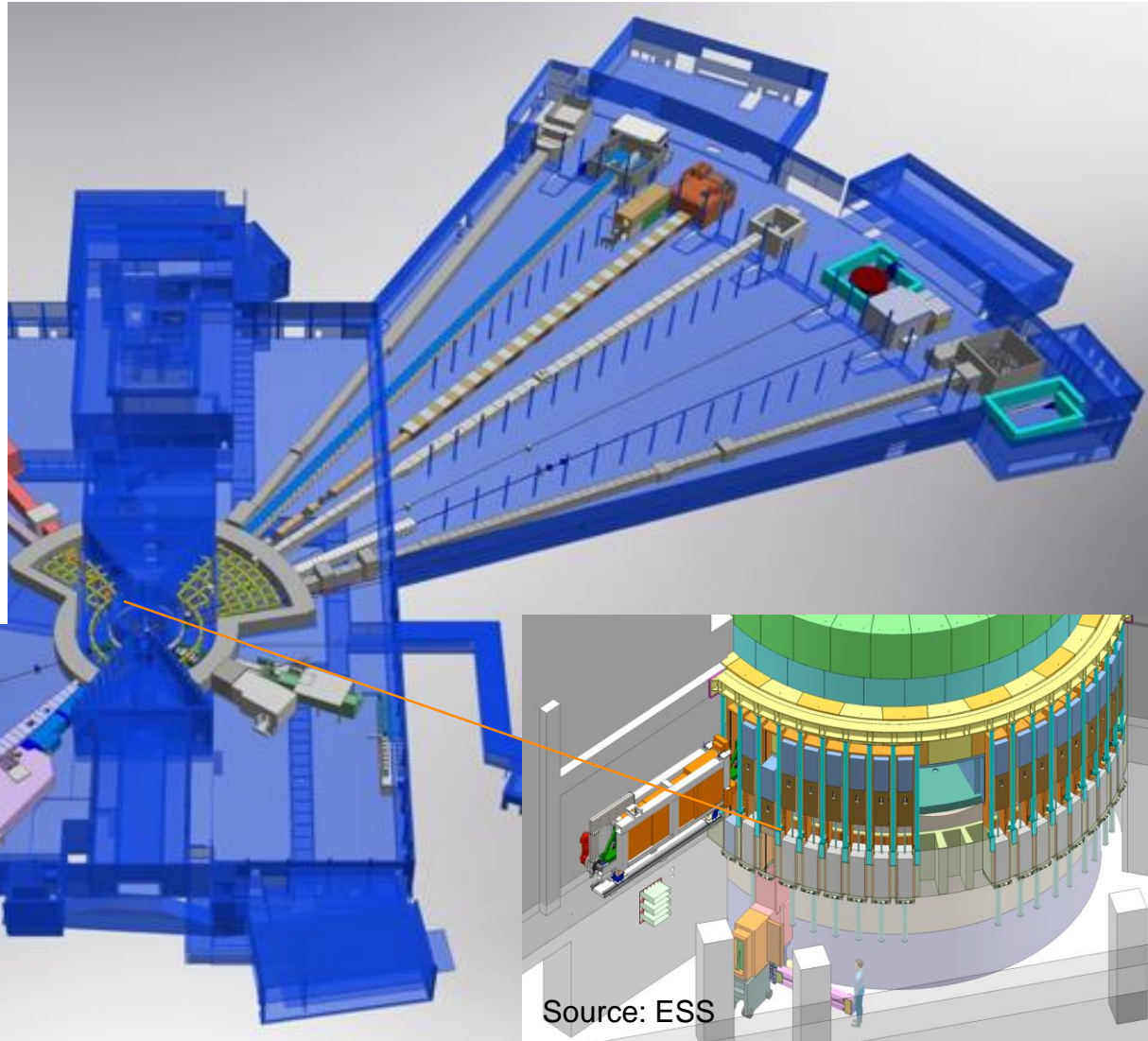
### Phase 1:

- Test Stands
- Prototype (NBPI)

### Phase 2:

- Neutron Beam Port Insert
- Neutron Beam Port Plug
- Neutron Beam Window
- Light Shutter System

42 inserts / plugs are needed

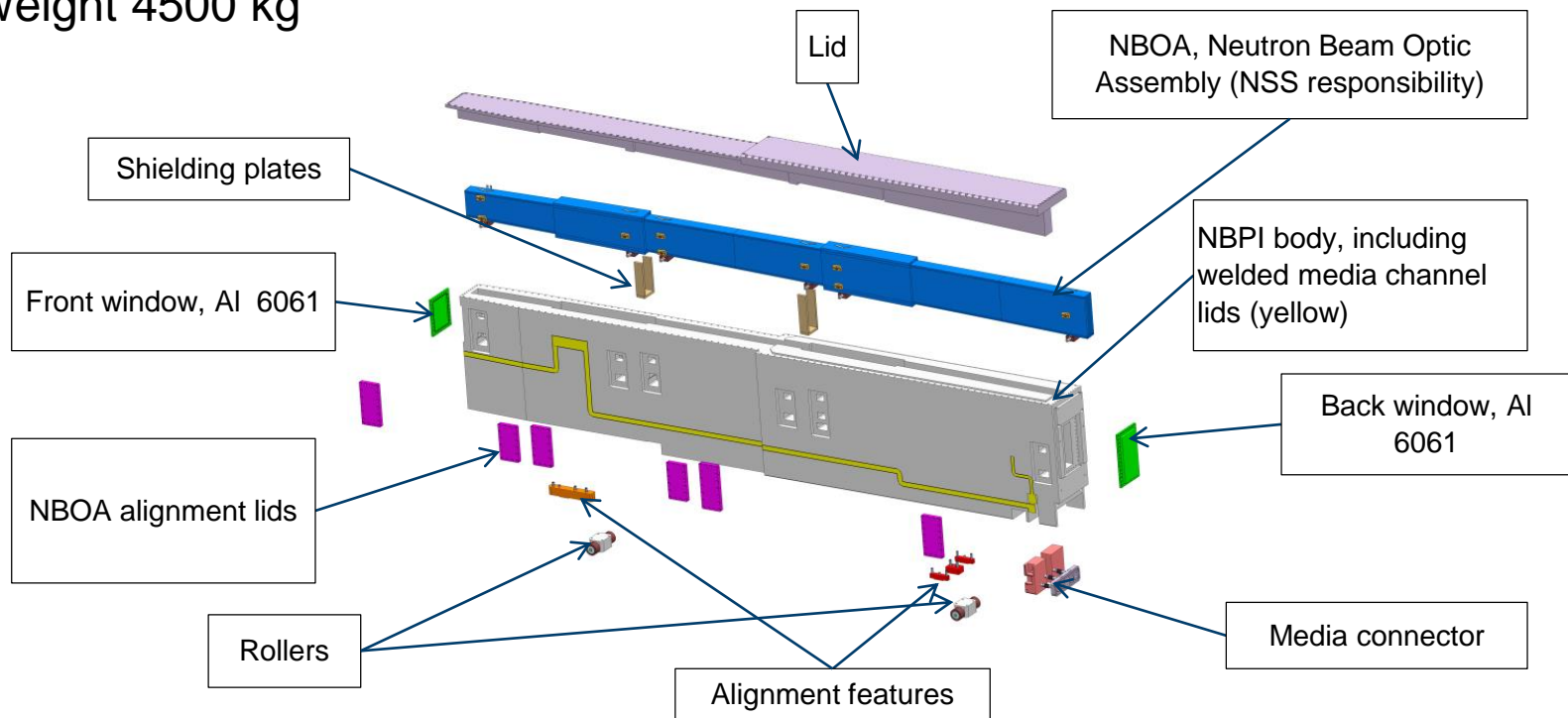


# NBEX - NBPI PROTOTYPE

## Scope of phase 1

Outer dimensions 3480 x 722 x 270 mm

Weight 4500 kg

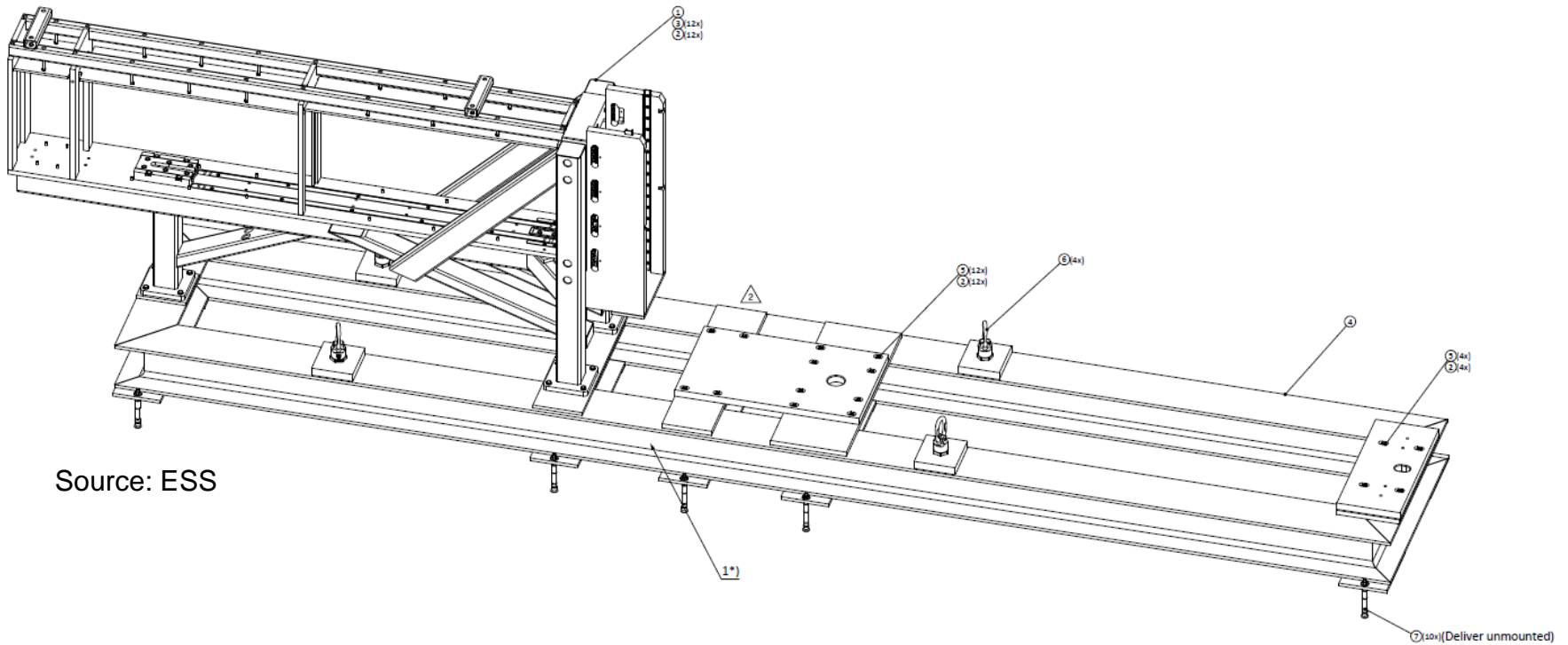


Source: ESS



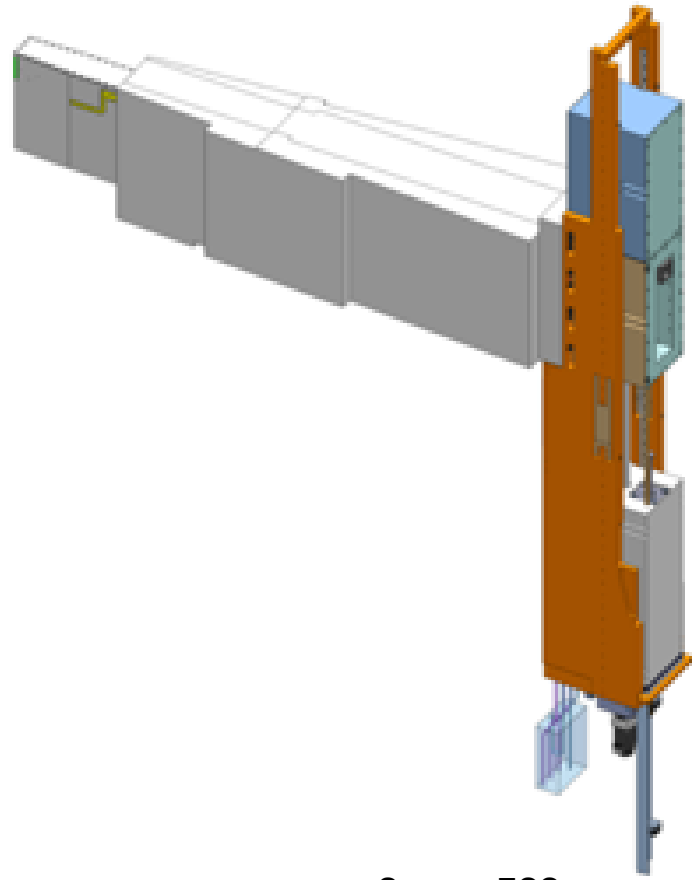
# NBEX – HORIZONTAL TEST STAND

## Scope of phase 1



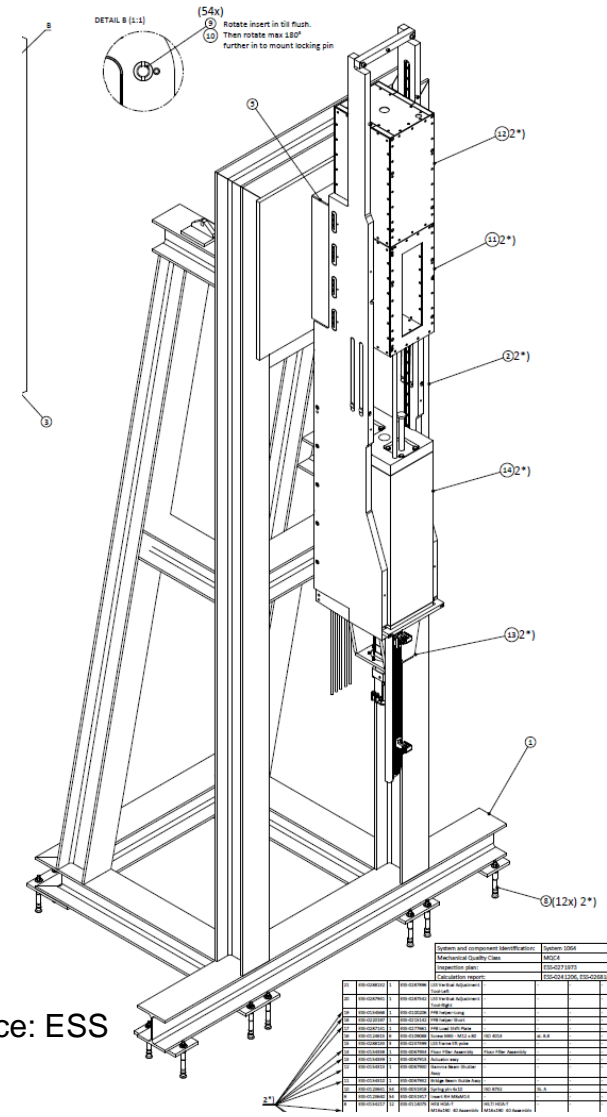
# NBEX – LIGHT SHUTTER TEST STAND

## Scope of phase 1



Source: ESS

Mitglied der Helmholtz-Gemeinschaft



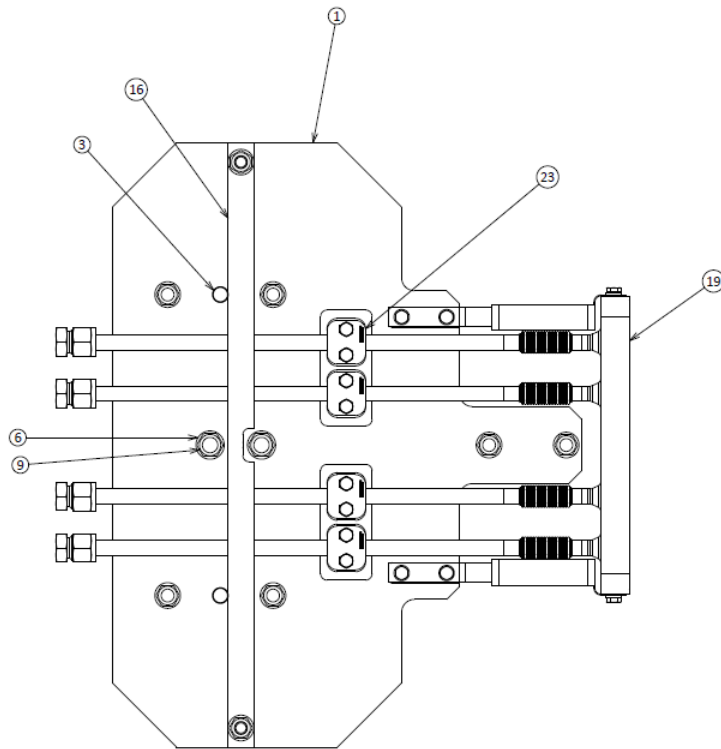
Source: ESS

**JÜLICH**  
Forschungszentrum

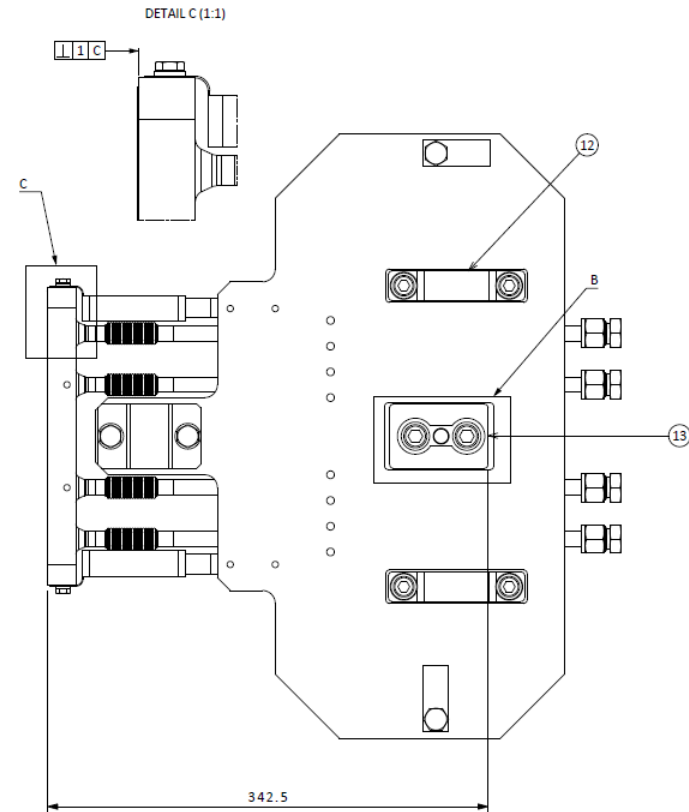


# NBEX TIK MEDIA CONNECTOR TEST

## Scope of phase 1

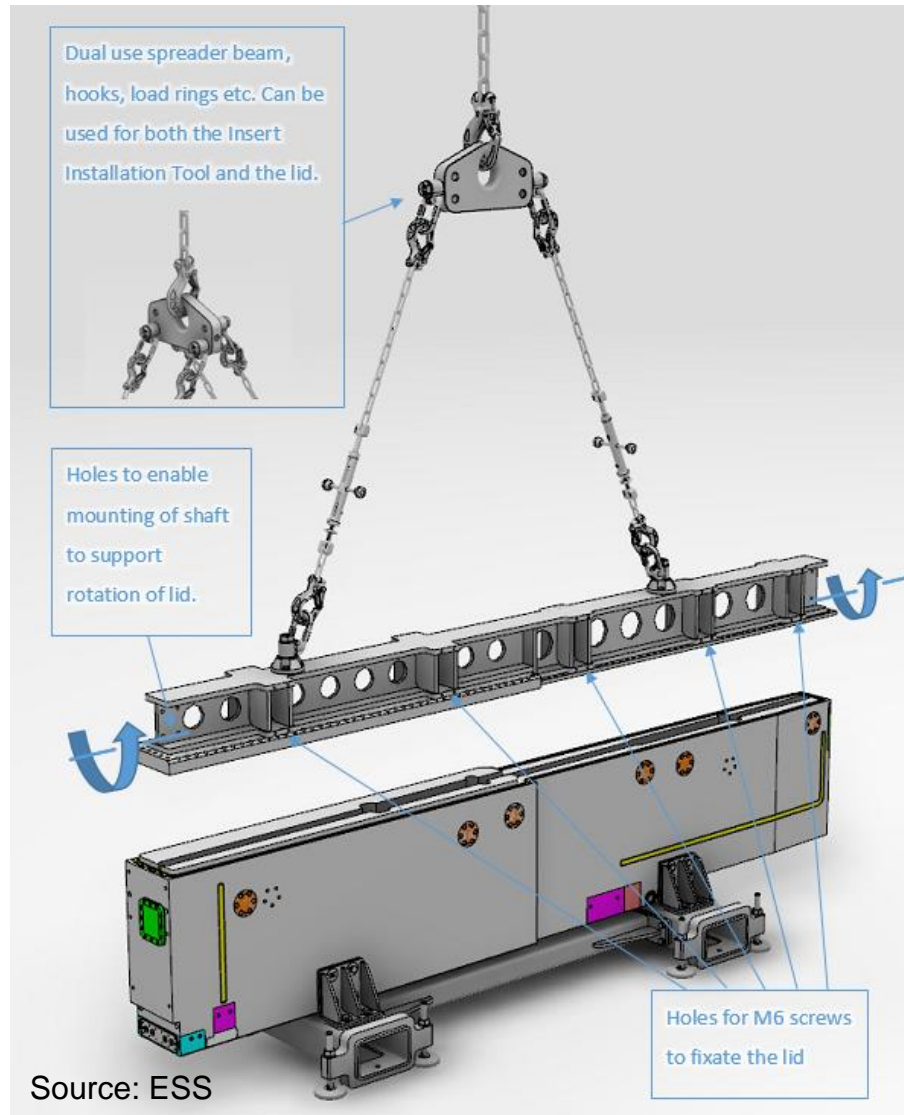


Source: ESS



# NBEX LID HANDLING TOOL

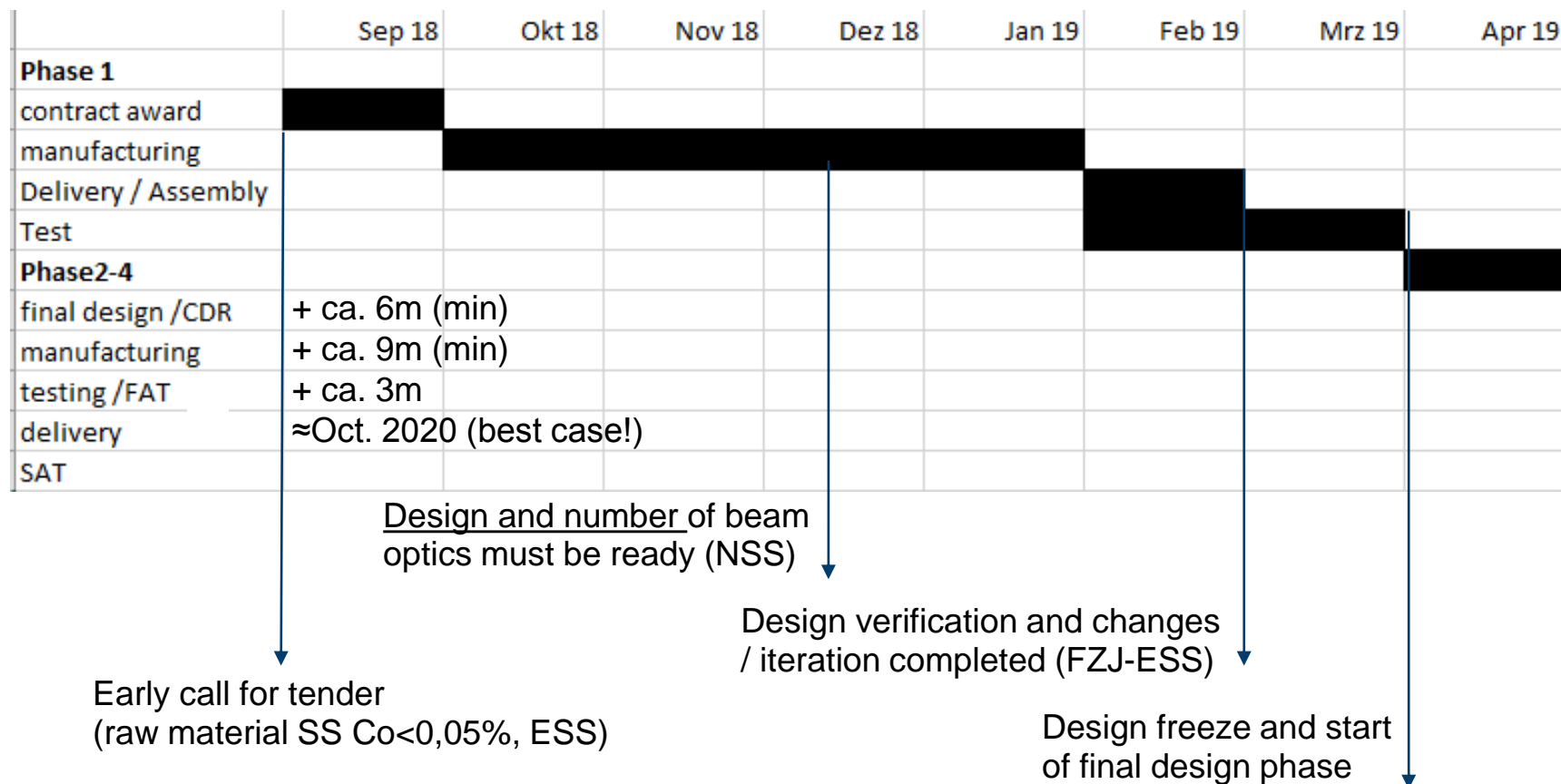
## Scope of phase 1





# NBEX

## Schedule of phase 1 and 2



# SUMMARY

- TIK3.1 & TIK3.2 will be complete around early summer 2019
- Small projects will be complete around February 2019
- TIK4.1 will be complete around early summer 2020
  
- NBEX phase 1 will be complete around April 2019
- NBEX phase 2 (dependent on design adjustment effort!) around end of 2020?
  - ESS schedule delivery Q2 2020, FZJ schedule delivery Q3-4 2020 in the best case!

