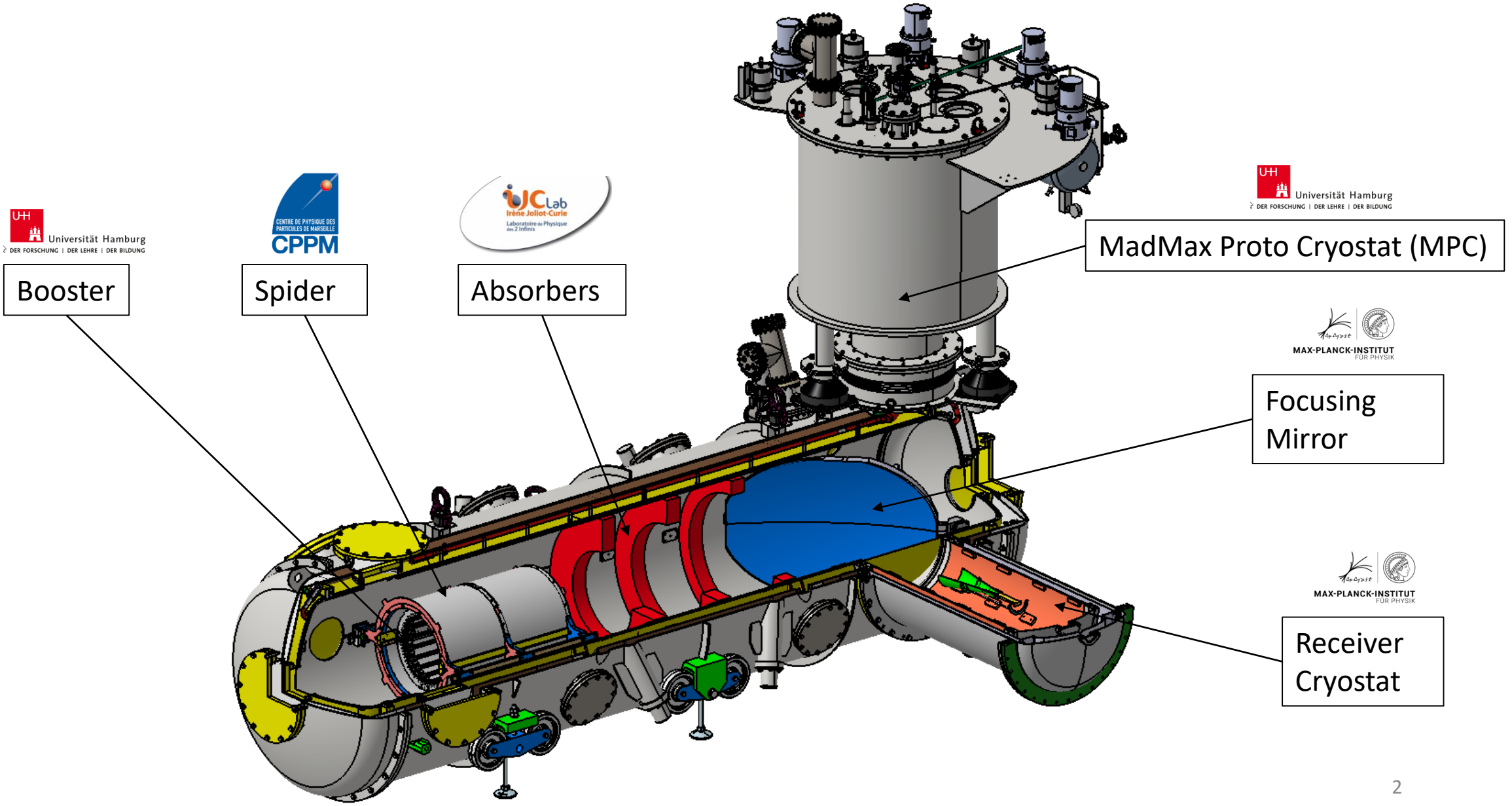
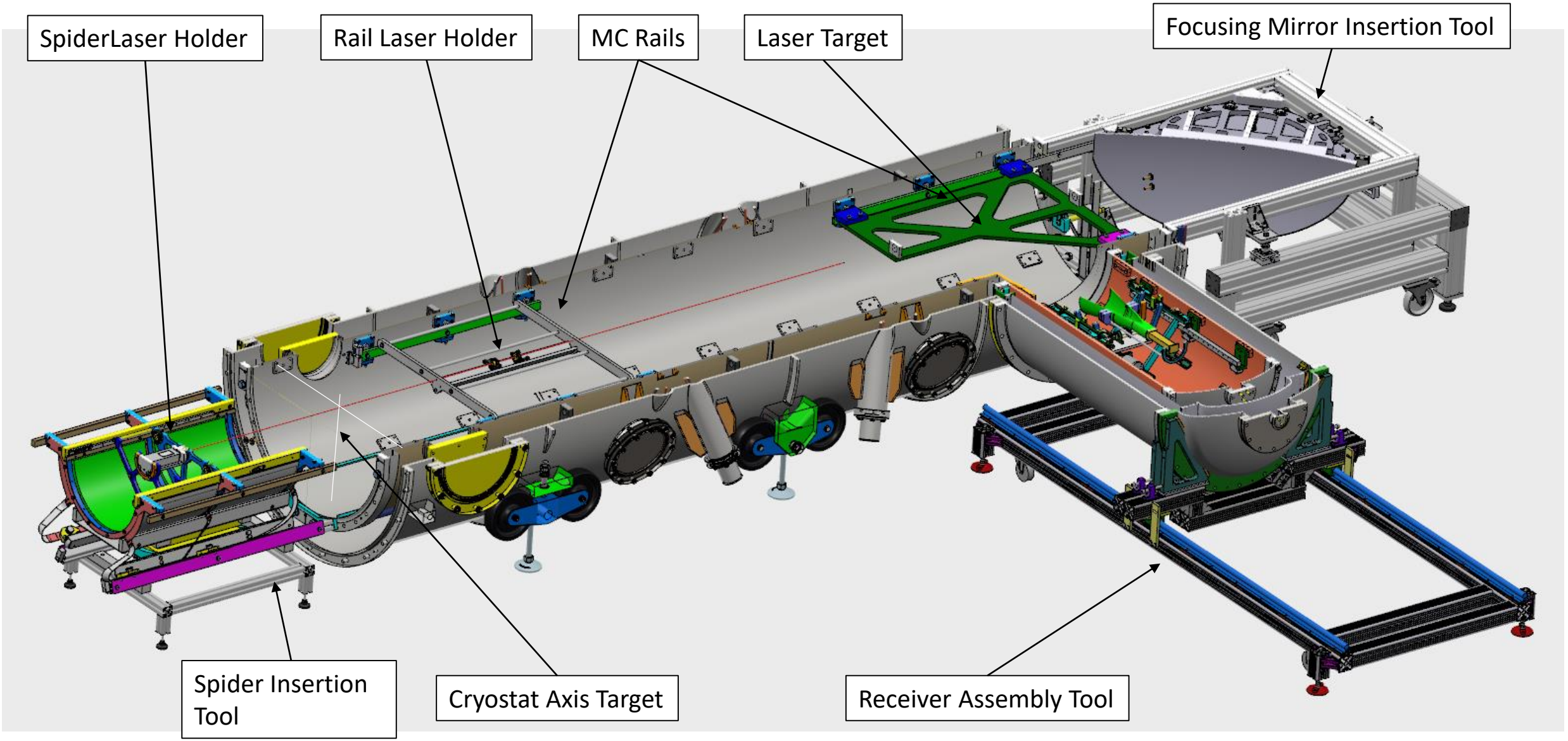
Project OB300
Integration and Alignment Procedure

Project OB300 : Overview



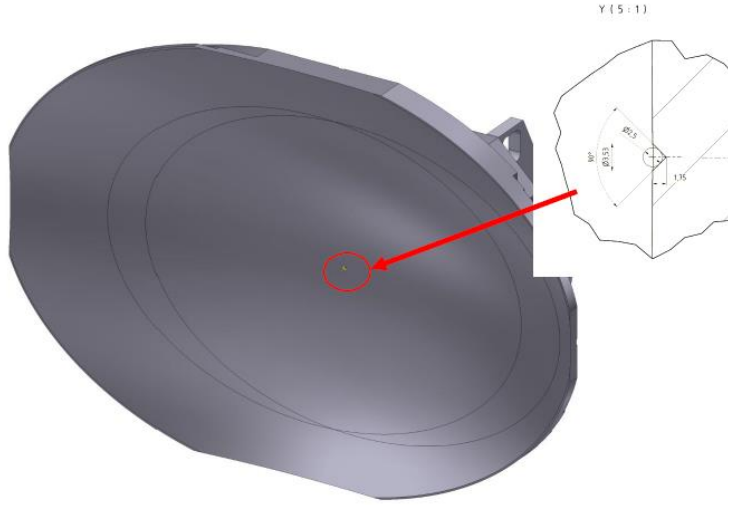
Project OB300 : Integration and Alignment Tools



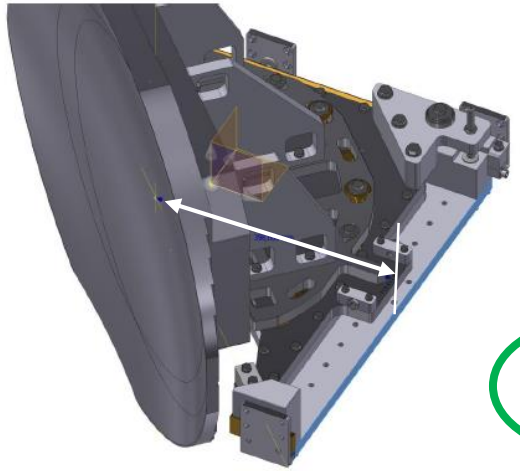
Focussing Mirror measurements

- Measurement 01: Checking the position of the Focusing Point after moving the mirror in the horizontal/vertical axis: 0,00mm

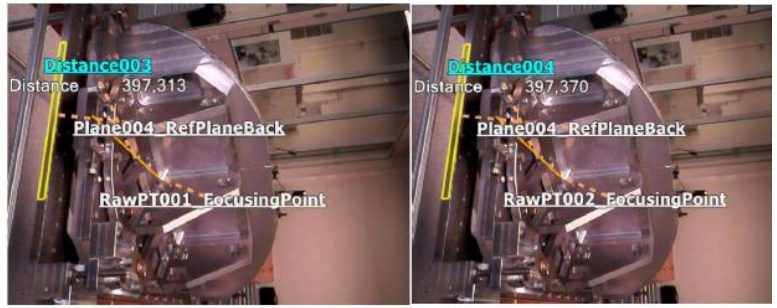
No.	Element Name/Output Item	Mes. Value	Unit	Design Value
1	Distance_Center--Center_ 01/Distance	0,121	mm	0,000
2	Distance_Center--Center_ 02/Distance	0,089	mm	0,000
3	Distance_Center--Center_ 03/Distance	0,122	mm	0,000
4	Distance_Center--Center_ 04/Distance	0,092	mm	0,000
5	Distance_Center--Center_ 05/Distance	0,101	mm	0,000
6	Distance_Center--Center_ 06/Distance	0,127	mm	0,000

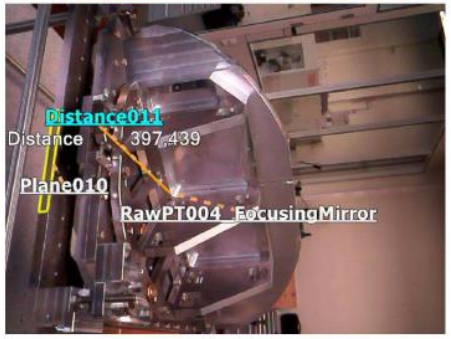


- Measurement 07: FocusingPoint to EndingSurfaceBackside: 398,00mm

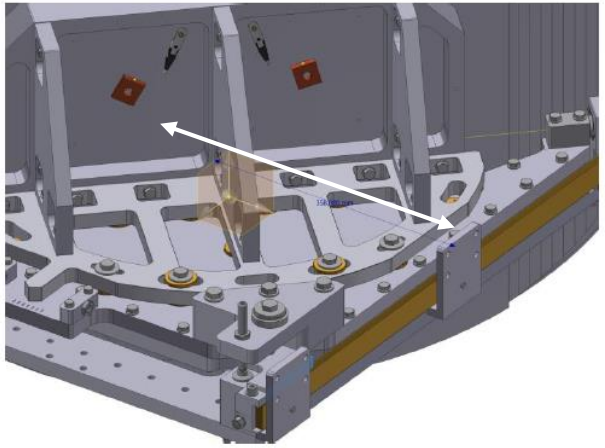


397,370

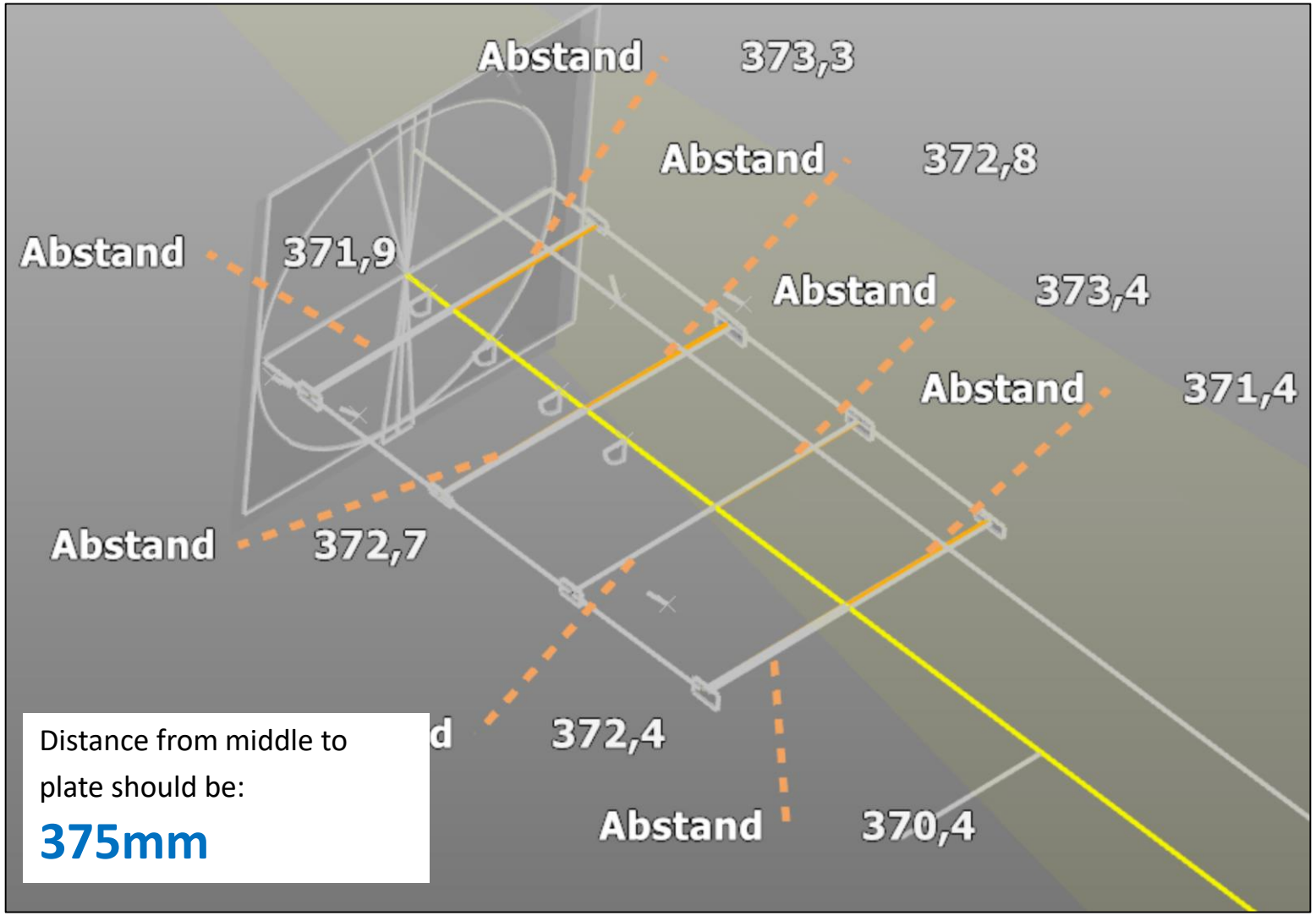




- Measurement 08: FocusingPoint to EndingSurfacePrism: 358mm

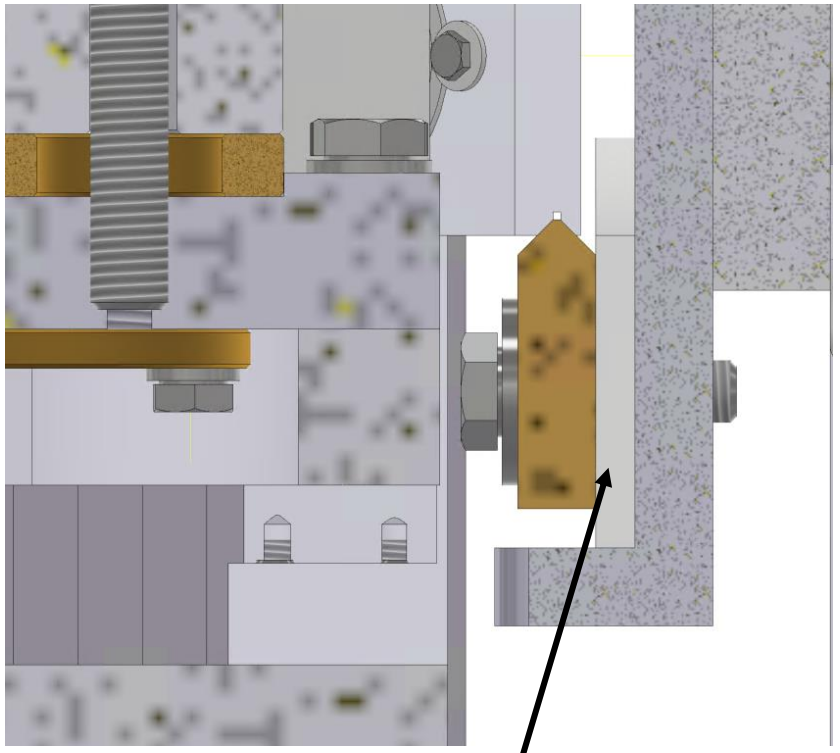


MC measurements – Spider side



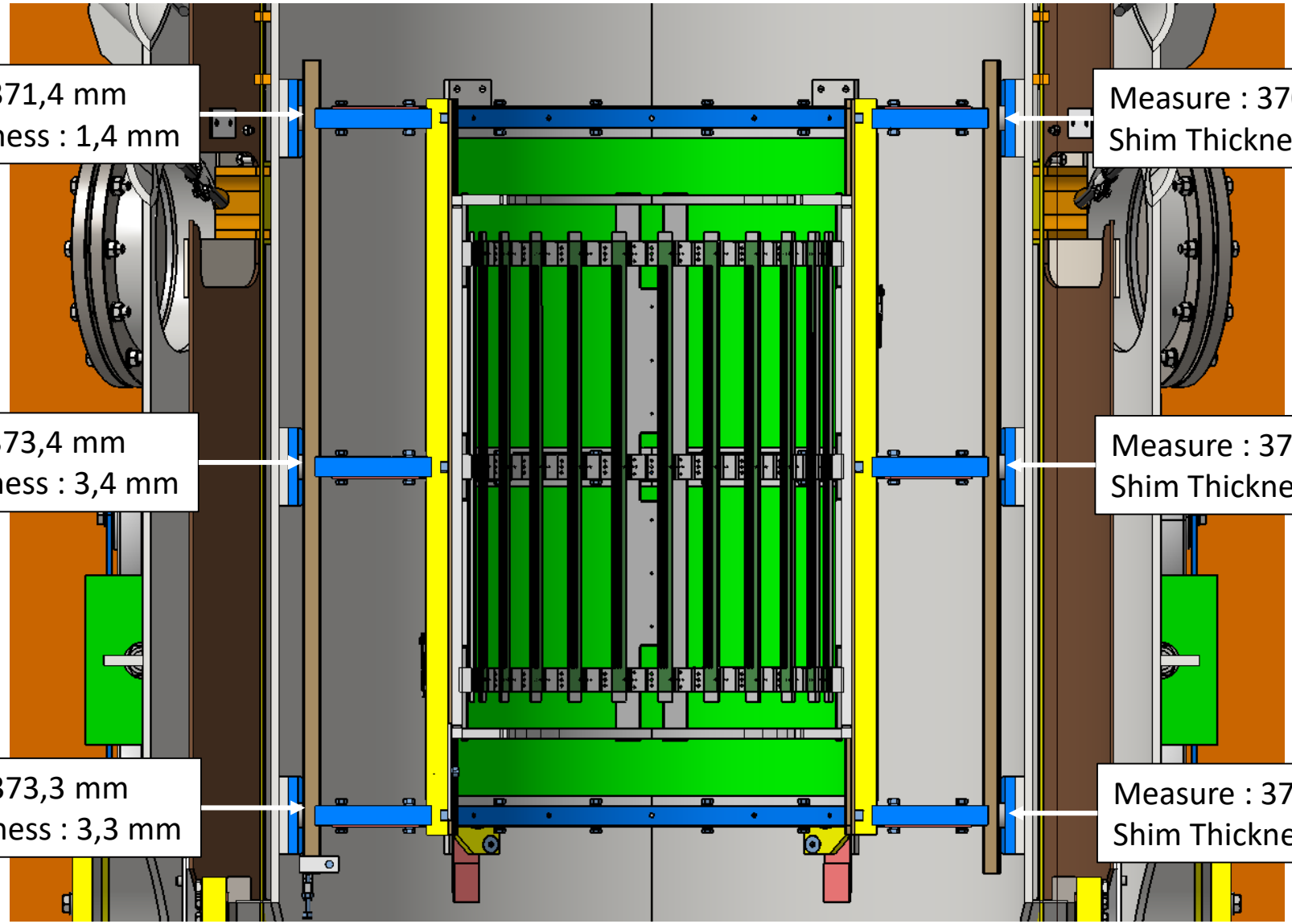
Distance from middle to plate should be:

375mm

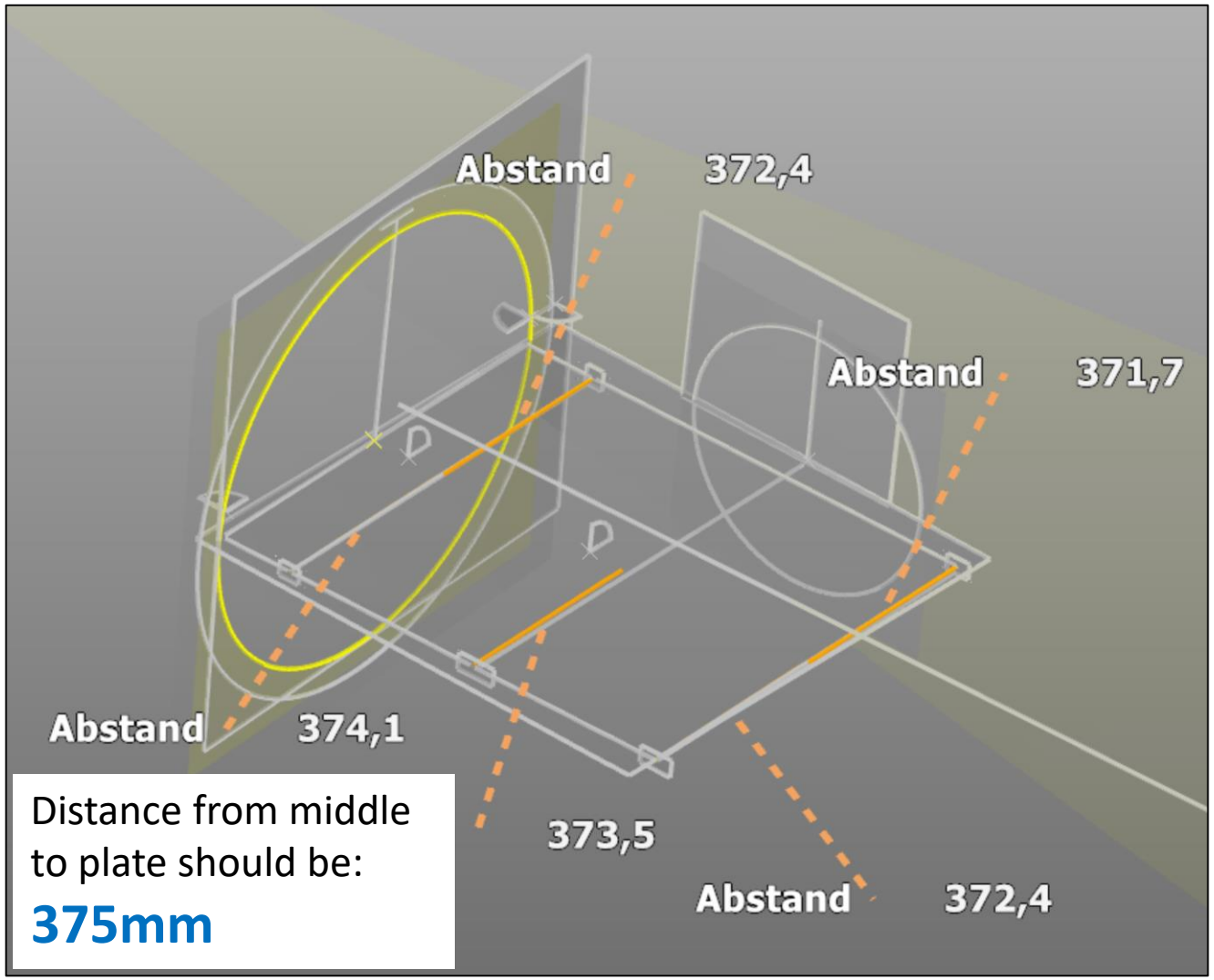


5mm shimming on each side

Booster Side – Distances from the Longitudinal axle

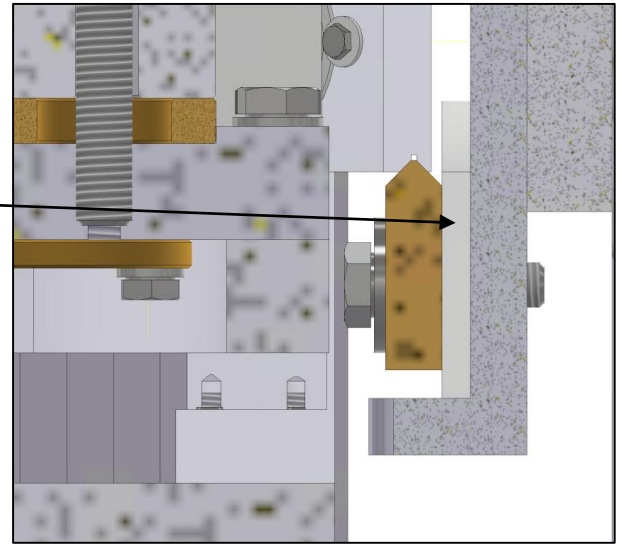

#1
Measure : 371,4 mm
Shim Thickness : 1,4 mm
#2
Measure : 373,4 mm
Shim Thickness : 3,4 mm
#3
Measure : 373,3 mm
Shim Thickness : 3,3 mm
#6
Measure : 370,4 mm
Shim Thickness : 0,4 mm
#5
Measure : 372,4 mm
Shim Thickness : 2,4 mm
#4
Measure : 372,7 mm
Shim Thickness : 2,7 mm

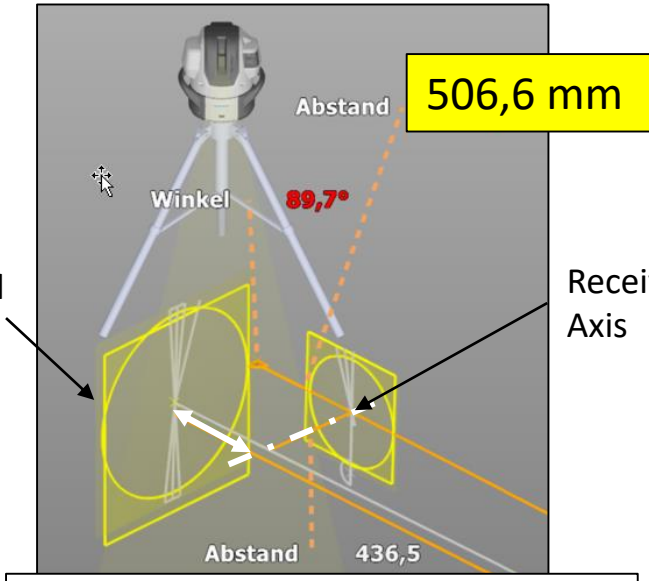
MC measurements – FM side



Focusing Side – Distances from the Longitudinal axle

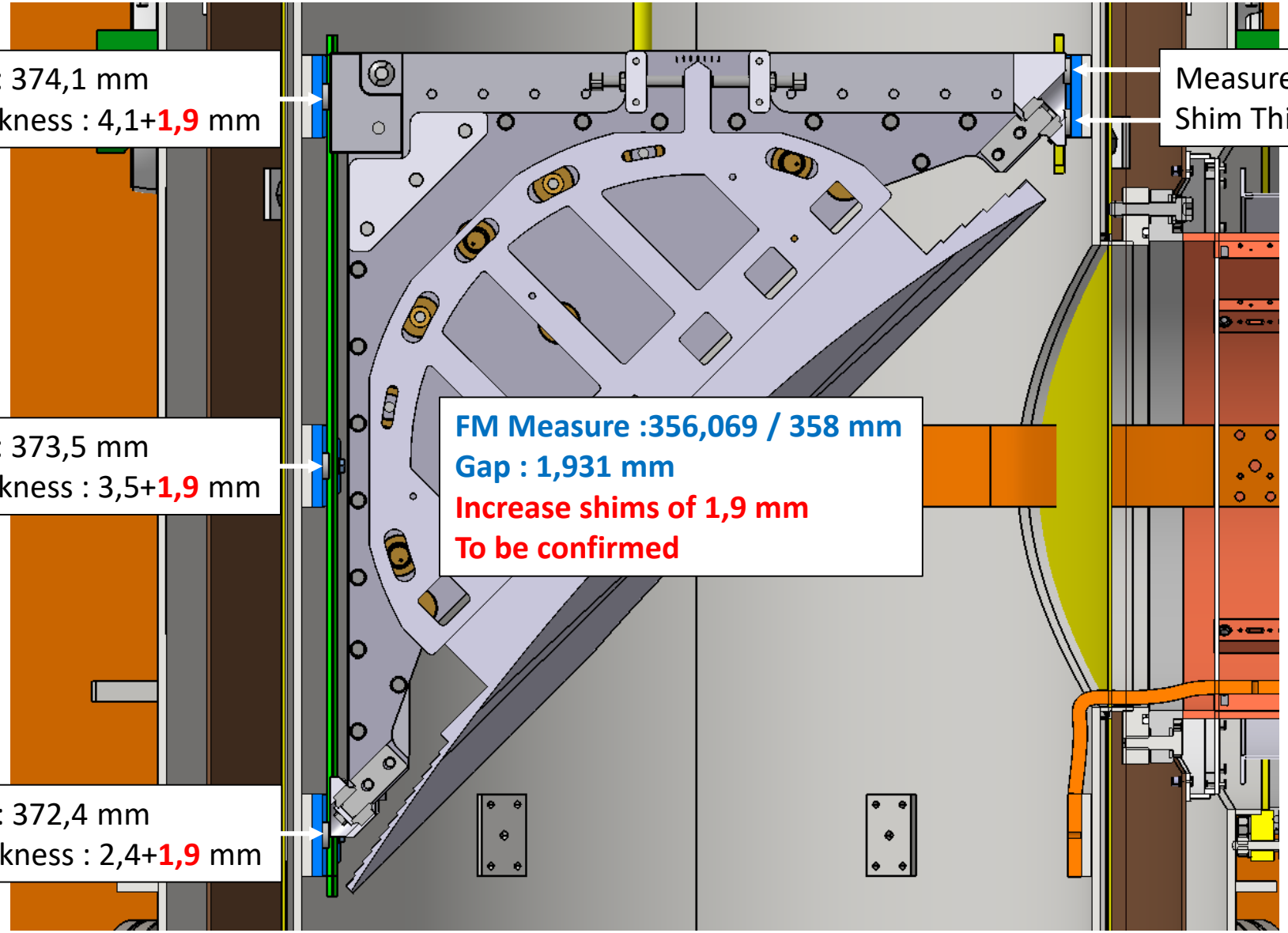
5mm shimming on each side





Distances Receiver axis from the flange

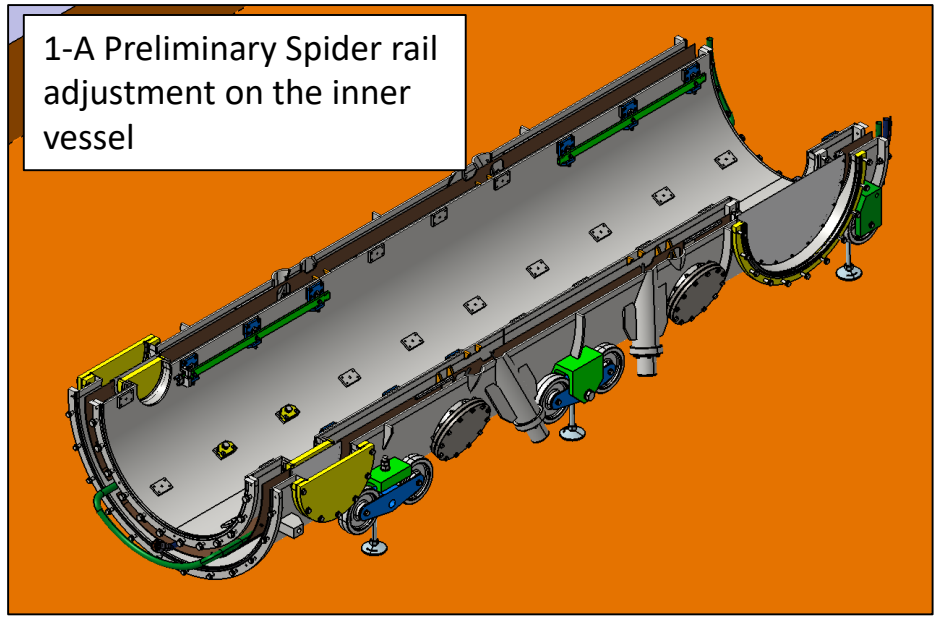
Rail installation preparation

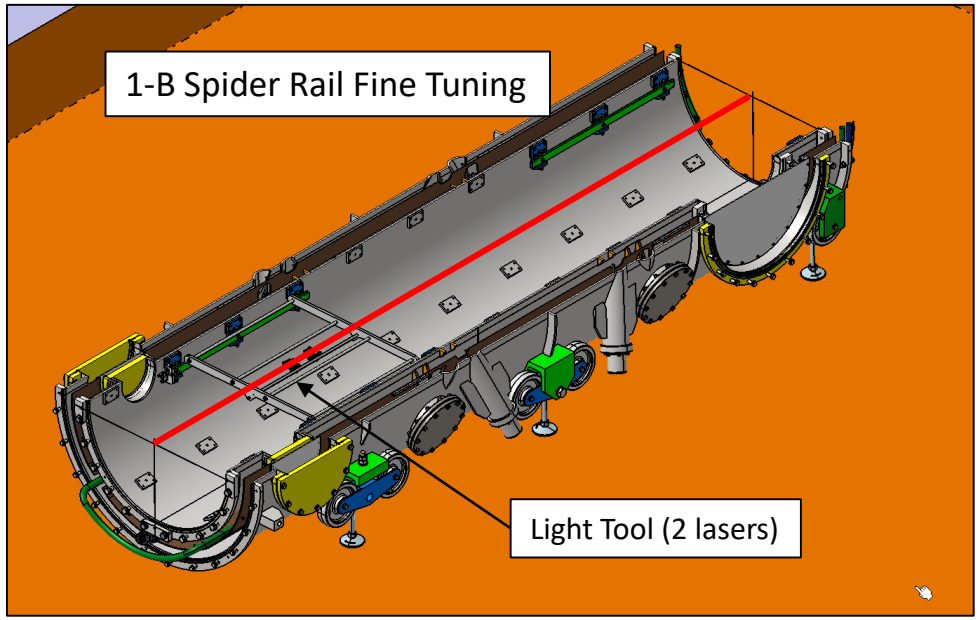


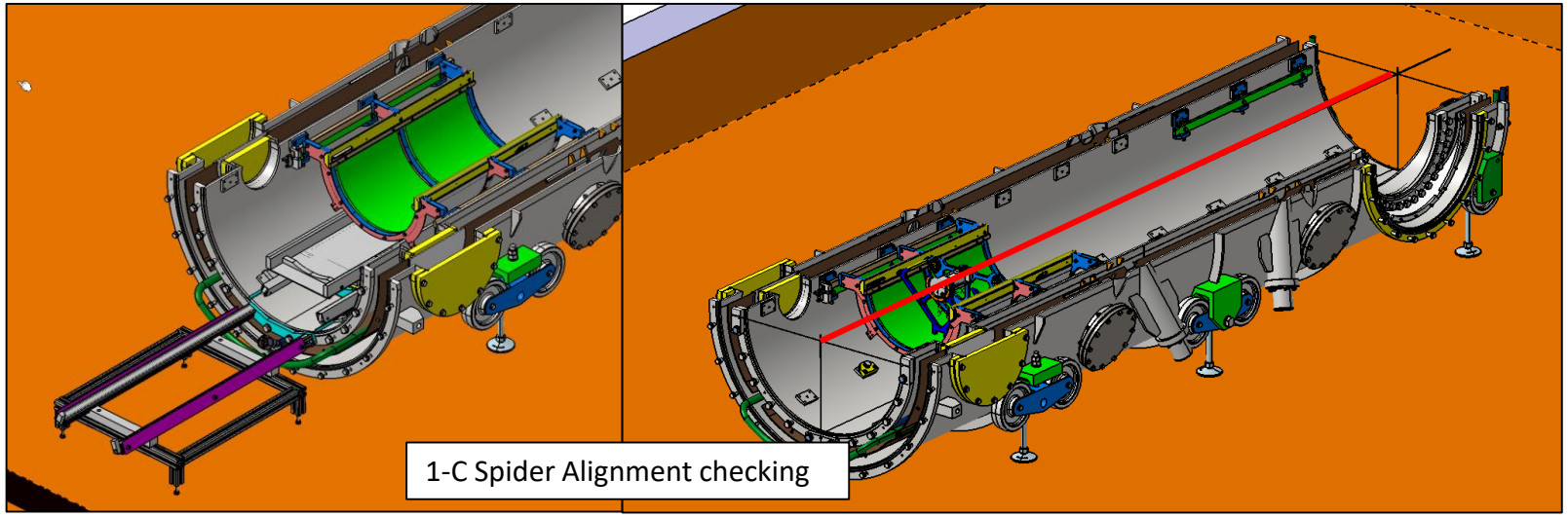
Project OB300 – Alignment : 1 - Spider/Booster positioning

Operations	Values	Tolerances	Duration Estimation	Equipement
1 - Spider Alignment			**2 days**	+ margin of 1/2 day
<u>1-A Preliminary Spider rail adjustment on the inner vessel</u> • Optional : Measuring Arm, measure position rails / vessel axis • First position adjustment of the rail with screw and shims with the expected thickness			½ day	Measuring arm Set of shims Spider Rails
<u>1-B Spider Rail Fine Tuning</u> • Mount Light tool with Laser (Define if the existing is usable or we need a new one, with a smaller beam.) • Mount and adjust the Targets at both sides • Fine tuning of the rails with the laser and targets (wires) Adjust the vertical direction with the screws • Modify the shims thickness • Check the horizontal with the spirit level • Remove the light tool			½ day	Light Tool Targets on the Flanges at both sides Set of shims Spirit Level
<u>1-C Spider Alignment checking</u> • Remove the Target at Booster side • Installation of the Spider Insertion tool • Mount Spider and Laser Holder at the expected position for the distance d2 = 2300 mm • Check the adjustment with the laser on the target **Keep the Spider and laser holder in place**			½ day	Spider Spider Insertion Tool Spider Laser Holder Target at FM side

Project OB300 – Alignment : 1 - Spider/Booster positioning



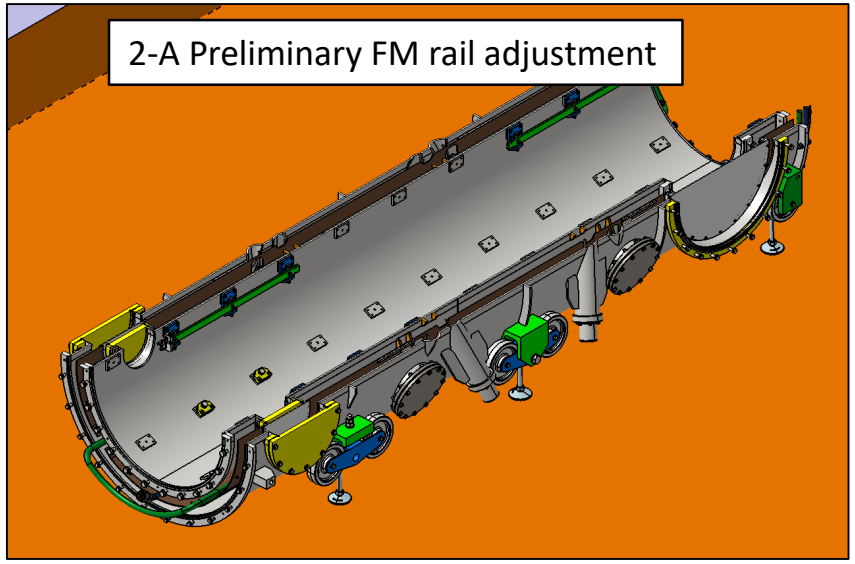


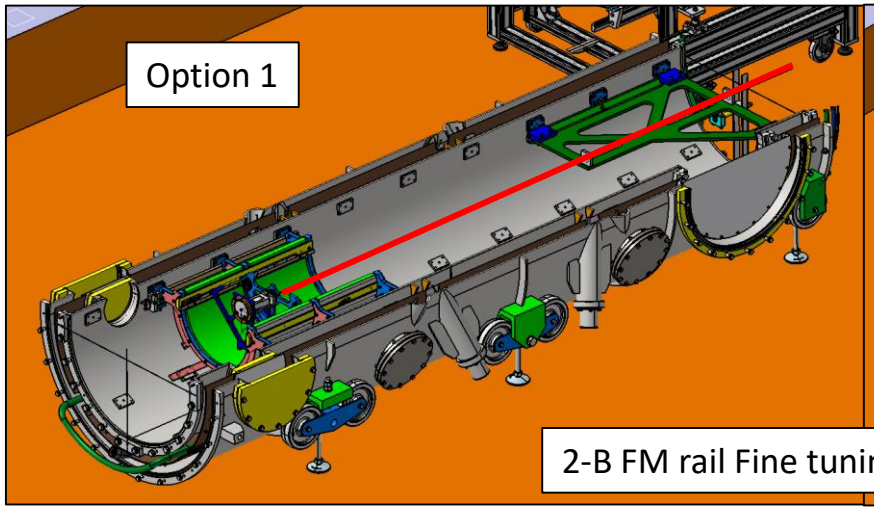


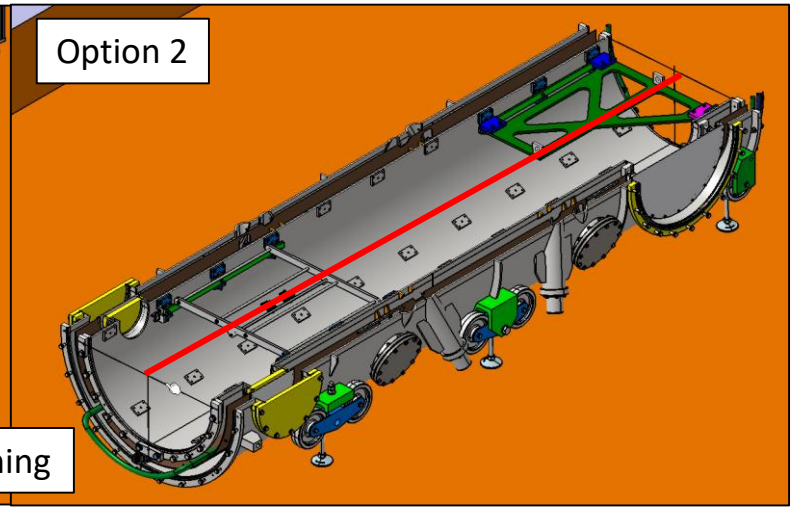
Project OB300 – Alignment : 2- Focusing Mirror Installation and adjustment

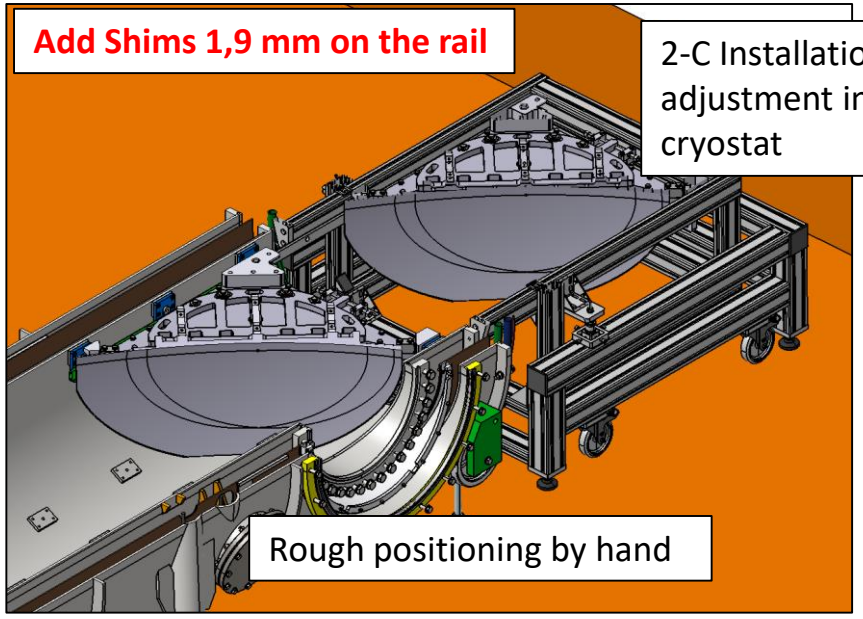
Operations	Values	Tolerances	Duration Estimation	Equipement
2- Focusing Mirror and Receiver Rails Alignment			**3 days**	+ margin of 1 day
Keep the Spider and laser holder in place **Remove the Bilfinger tapes at the receiver interfaces**				
<u>2-A Preliminary FM rail adjustment</u> • Optional :Measuring Arm, measure position rails / vessel axis • First position adjustment of the rail with screw and shims • Adjust the vertical direction with the screw • Estimate the horizontal adjustment • Modify the shims thickness			½ day	Measuring arm Set of shims FM Rails
<u>2-B FM rail Fine tuning</u> • Mount the FM Laser target holder / light Tool • Check the adjustment with the laser • Check the horizontal with the spirit level • Adjust the vertical direction with the screw • Modify the shims thickness • Remove the Laser target holder			½ day	FM Laser Target holder Light Tool / Laser holder Set of shims Spirit level
<u>2-C Installation of the FM and adjustment in front of the receiver cryostat</u> • Installation of the mirror foils • Mount and fix the FM at the distance in respect with the flange **d=506,6 mm** (align the center of the FM with the Receiver flange) • **Dimension FM = 397,37 => distance flange/edge = 109,23 mm**			½ day	Focusing Mirror - MPP FM insertion tool - CPPM Measuring Arm – CPPM FM Fine position Tool
<u>2-D Alignment and FM angular adjustment</u> • Mount a target on the MC flange of the outer flange of the receiver • Refine the position of the laser holder on the Spider **d2 = 2300 mm** with telemeter– Measure the position in respect with the edge of Spider (used for the Booster installation) • Adjust the angle of the FM for the alignment of the spots on the target			½ day	Spider Laser holder Focusing Mirror – MPP Receiver Target

Project OB300 – Alignment : 2- Focusing Mirror Installation and adjustment

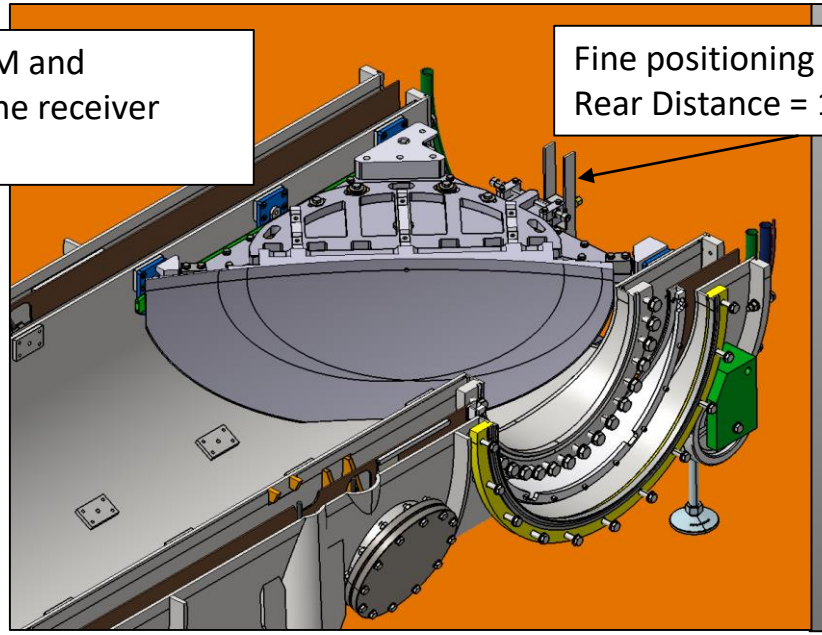


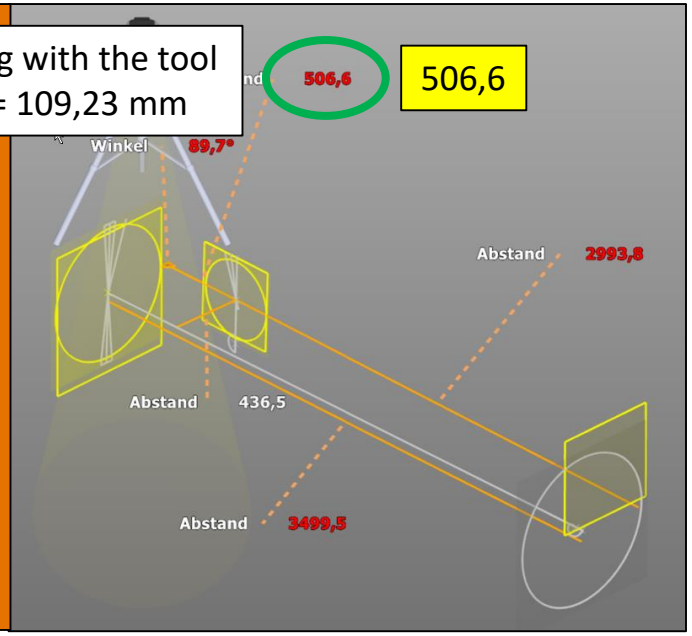




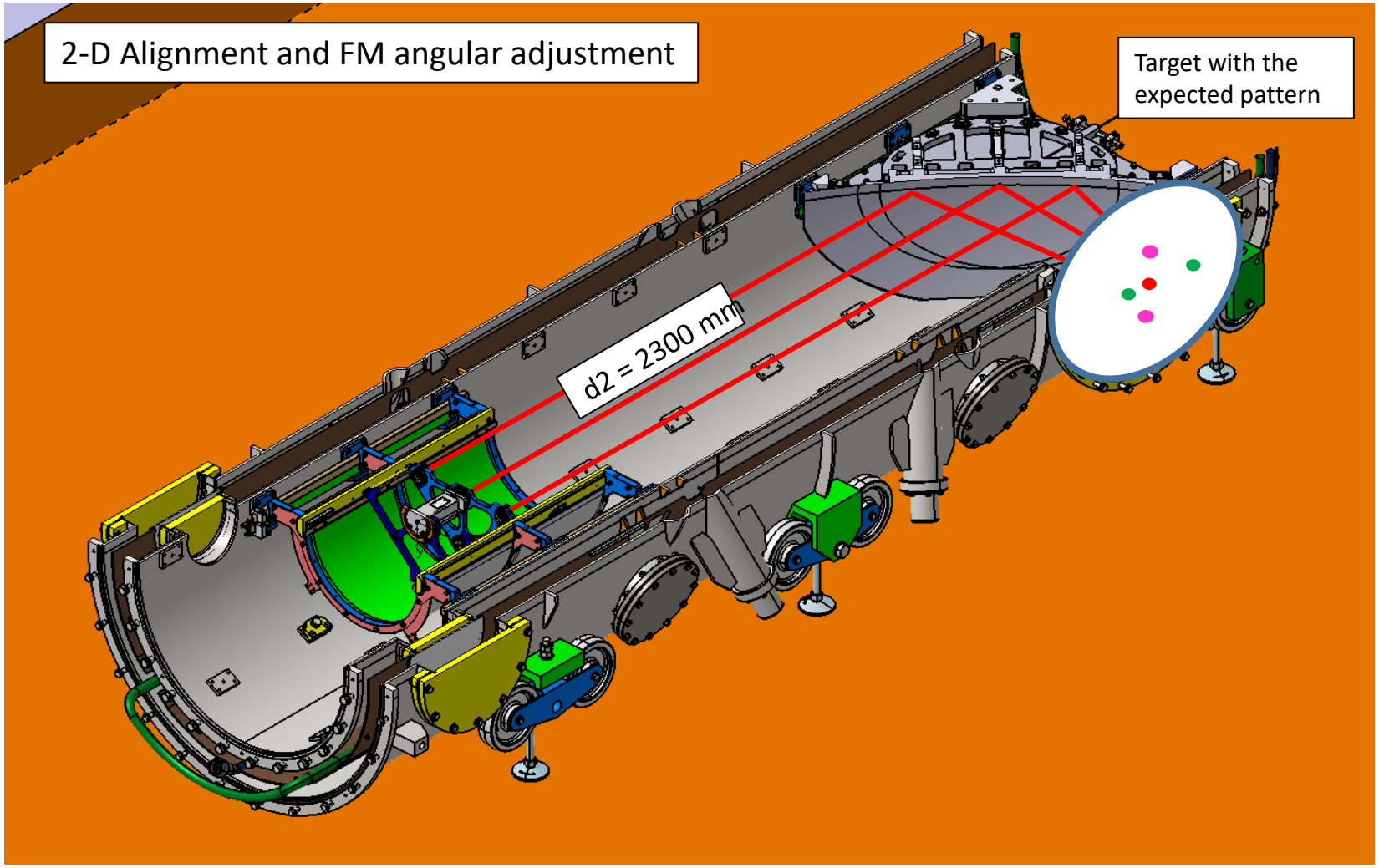


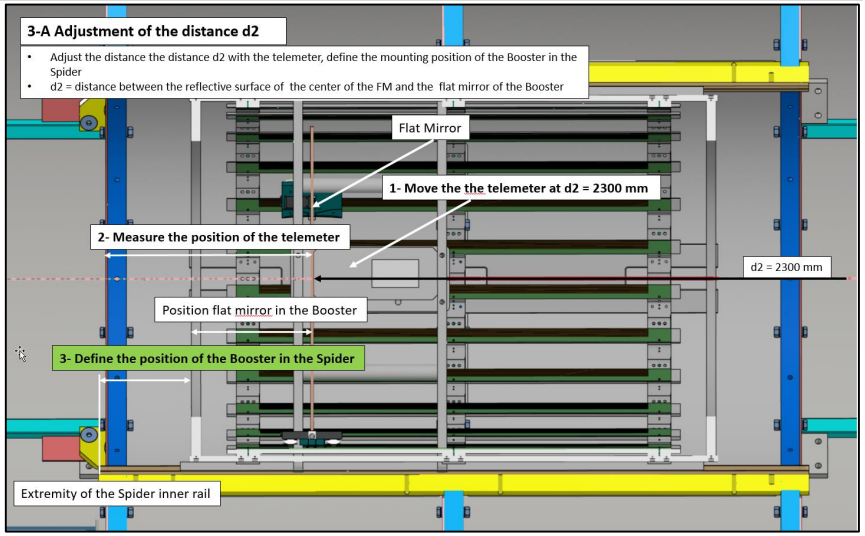
2-C Installation of the FM and adjustment in front of the receiver cryostat



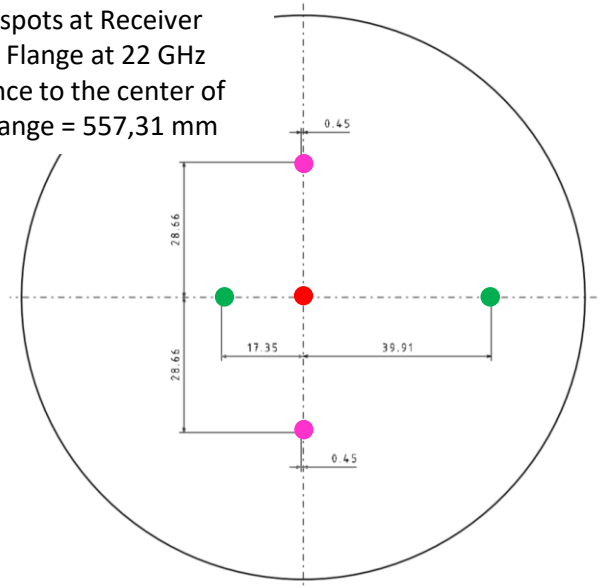


Project OB300 – Alignment : 2- Focusing Mirror Installation and adjustment





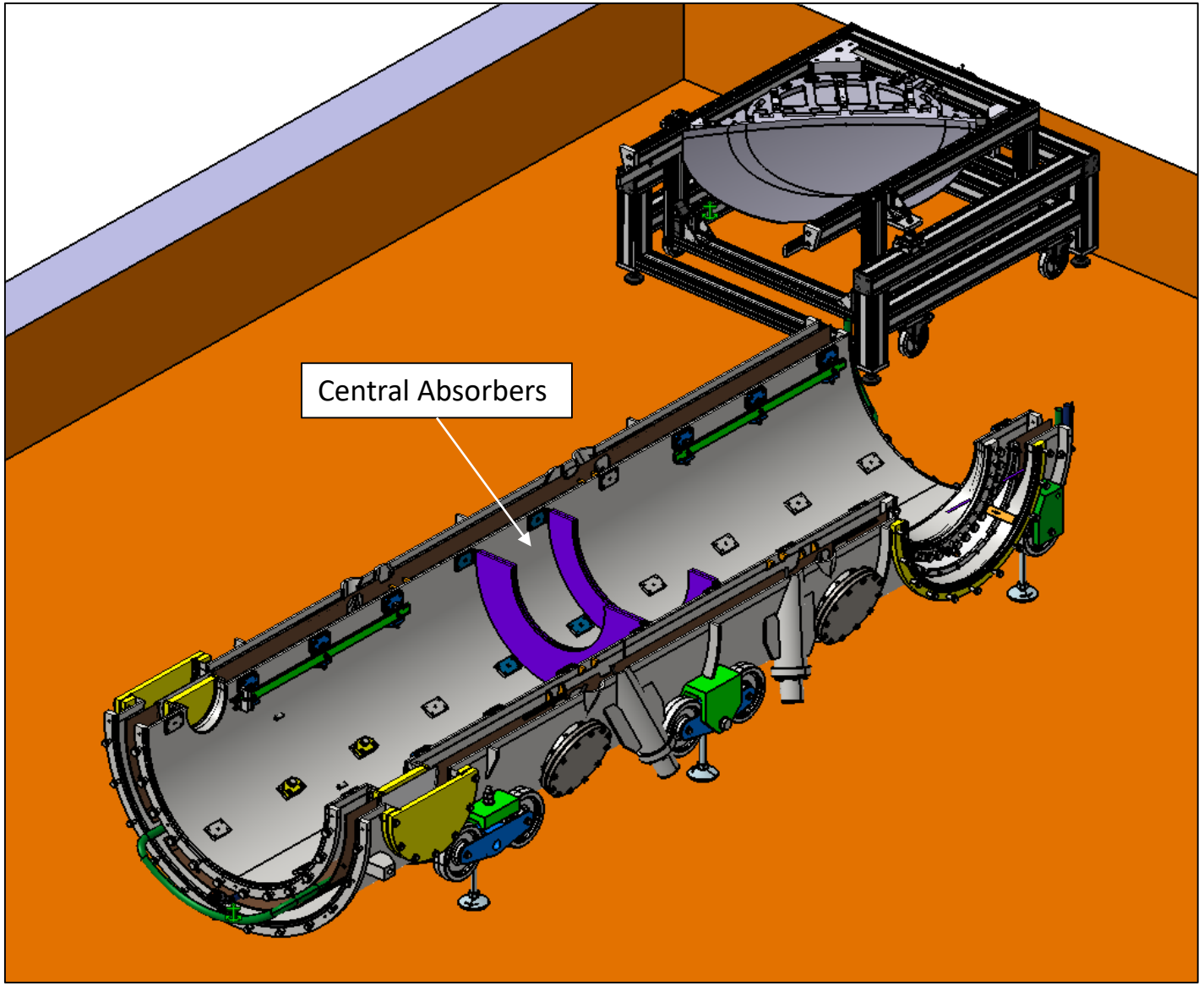
Laser spots at Receiver Outer Flange at 22 GHz
Distance to the center of the Flange = 557,31 mm



Project OB300 - Alignment : 3- Absorber Installation in the inner vessel

OPERATION	Values	Tolerances	Duration estimation	Equipment
3 – Absorber Installation			**2 days**	+ margin of 1/2 day
<u>3-A Removing of the Focussing Mirror</u> • Measure with precision the FM position in the Z direction • Remove the Focusing Mirror • Remove the FM Insertion Tool • Free the Cryostat access			½ day	Spider Laser Holder Telemeter Laser
<u>3-B Removing of the Spider</u> • Measure with precision the Laser Holder position in the Spider • Remove the Spider • Remove the Spider Insertion Tool • Free the Cryostat access			½ day	Spider Spider Support Booster Support Booster
<u>3-C Installation of the Absorber in the inner vessel</u> • Mount the absorber by the Booster side			½ day	Spider Spider Support Spider Cart Insertion External Support

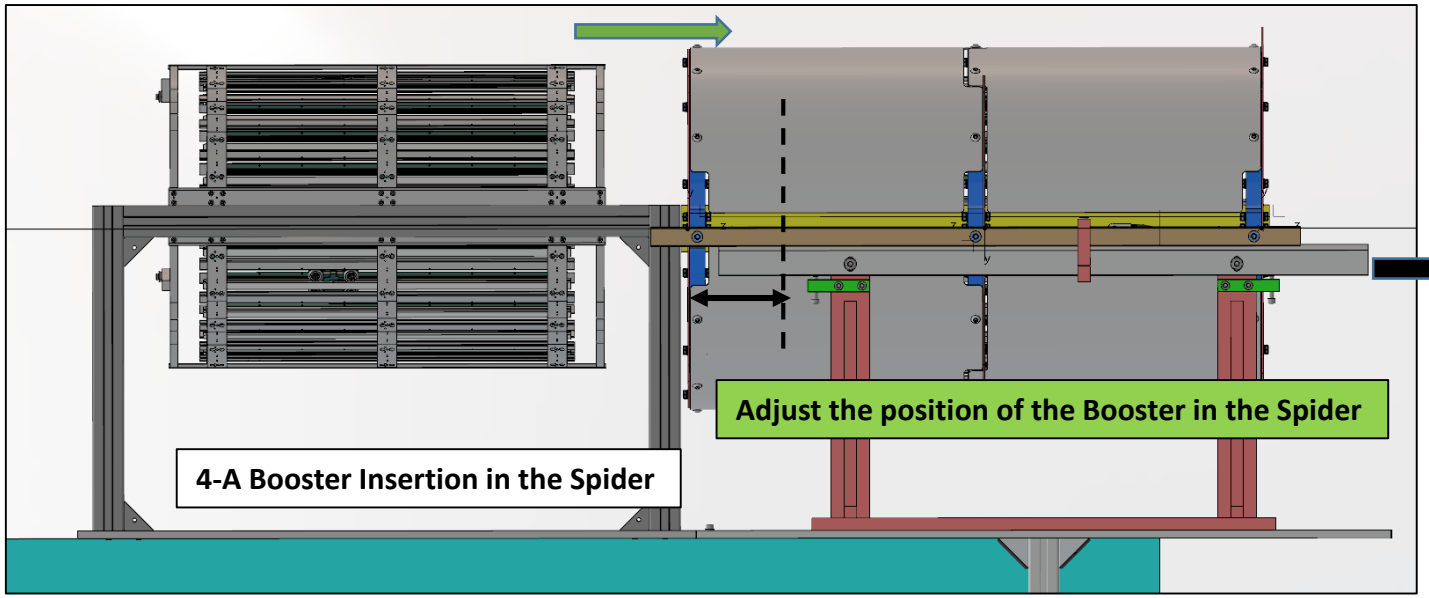
Project OB300 - Alignment : 3- Absorber Installation in the inner vessel

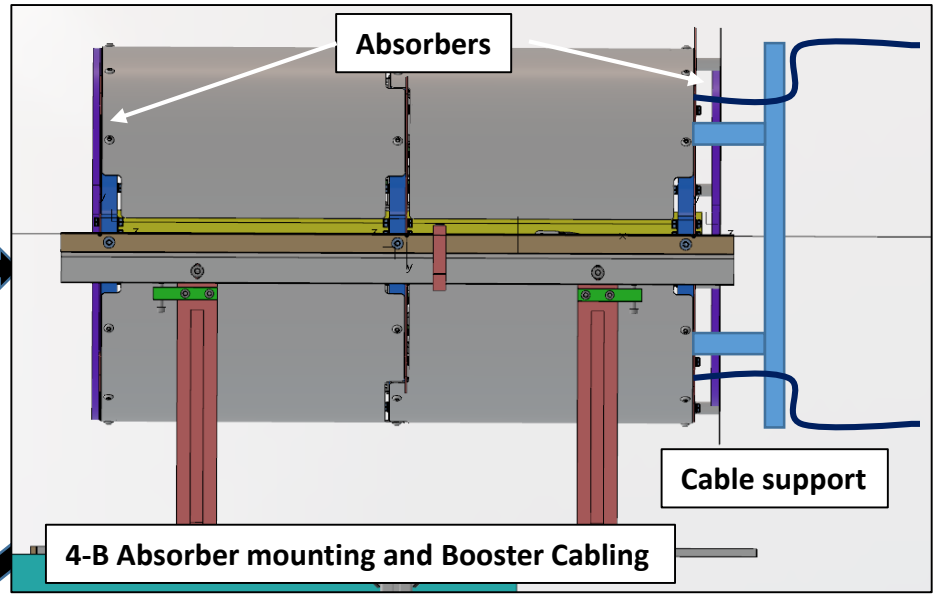


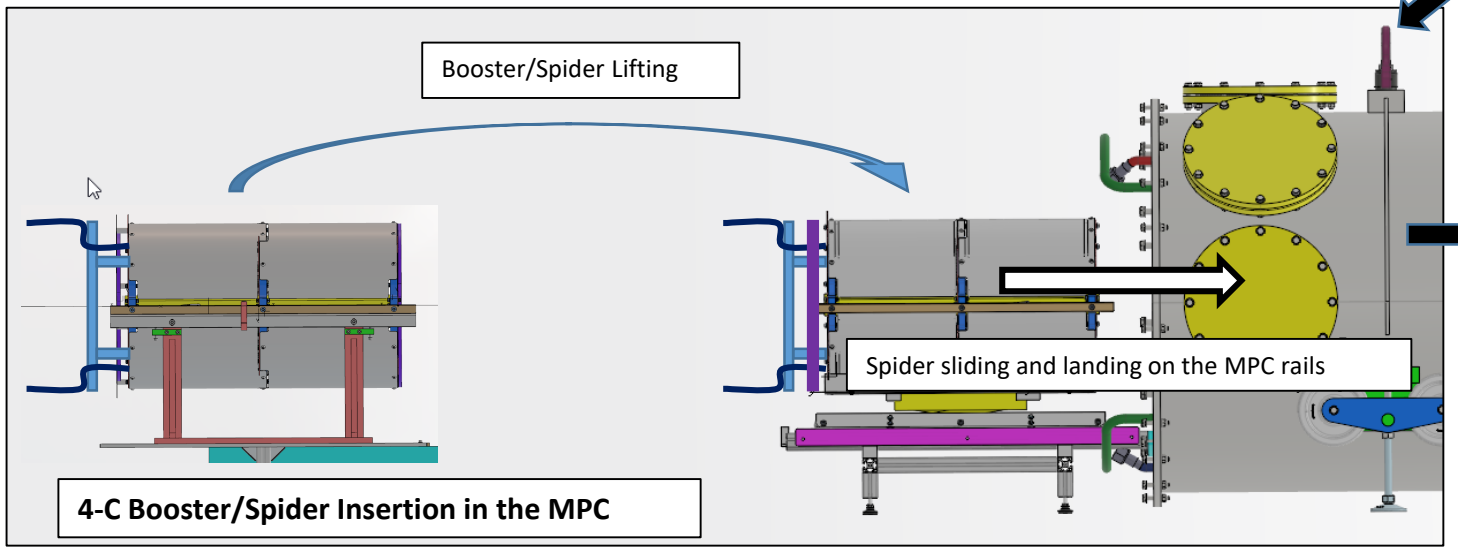
Project OB300 - Alignment : 4- Booster Insertion

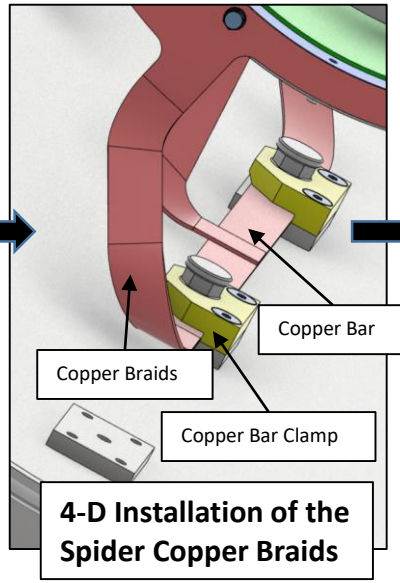
OPERATION	Values	Tolerances	Duration estimation	Equipment
3 - Booster insertion			**3 days**	+ margin of ½ day
<u>4-A Booster Insertion in the Spider</u> • The rails of the Supports are aligned • The Booster is inserted in the Spider and it moves until the position measured at the previous step (2D) • Fixe the Booster with the stopper			½ day	Optical Table Spider Support + Spider Booster + Support
<u>4-B Absorber mounting and Booster Cabling</u> • Absorber Installation on both side and installation of the Booster cables and fibers • Mount the Cables and the fiber support • Installation of the Cables and fibers on the support			½ day	Spider + Spider Support Booster Support +Booster Spider Absorbers Cable Support
<u>4-C Booster/Spider Insertion in the MPC</u> • Mont the insertion tool with the MC • Lifting of the Booster/Spider on the Cart • Mount the Spider copper braids • Sliding of the Cart at the Spider position • Landing of the spider on the MPC rails • The spider is fixed against the Spider Stopper with the clamp			½ day	Spider + Booster Spider Insertion Tool Spider Copper Braids
<u>4-D Installation of the Spider Copper Braids</u> • Mount the 4 Copper bars into the clamps • Tightening of the special screws with a dedicated tool (to be designed)			½ day	Spider Copper Braids Spider copper Braids Tightening Tools
<u>4-E Routing of the Booster Cables and fibers</u> • Define the length and routing of the Cables and fibers from the Booster to the Feedthroughs. • Define the thermalization on the Spider front copper surface			½ day	

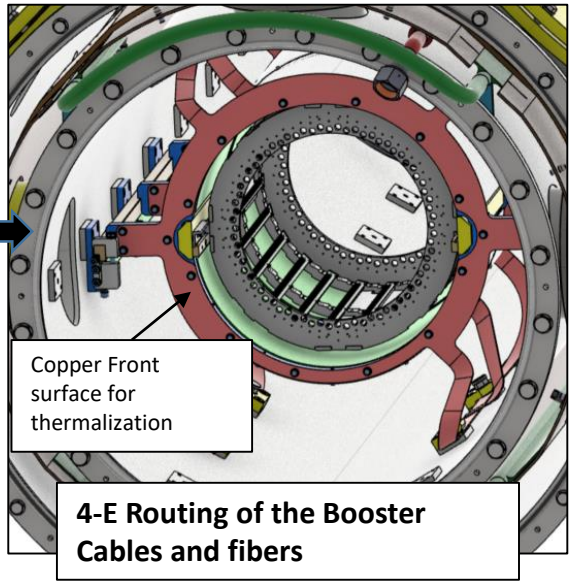
Project OB300 - Alignment : 4- Booster Insertion



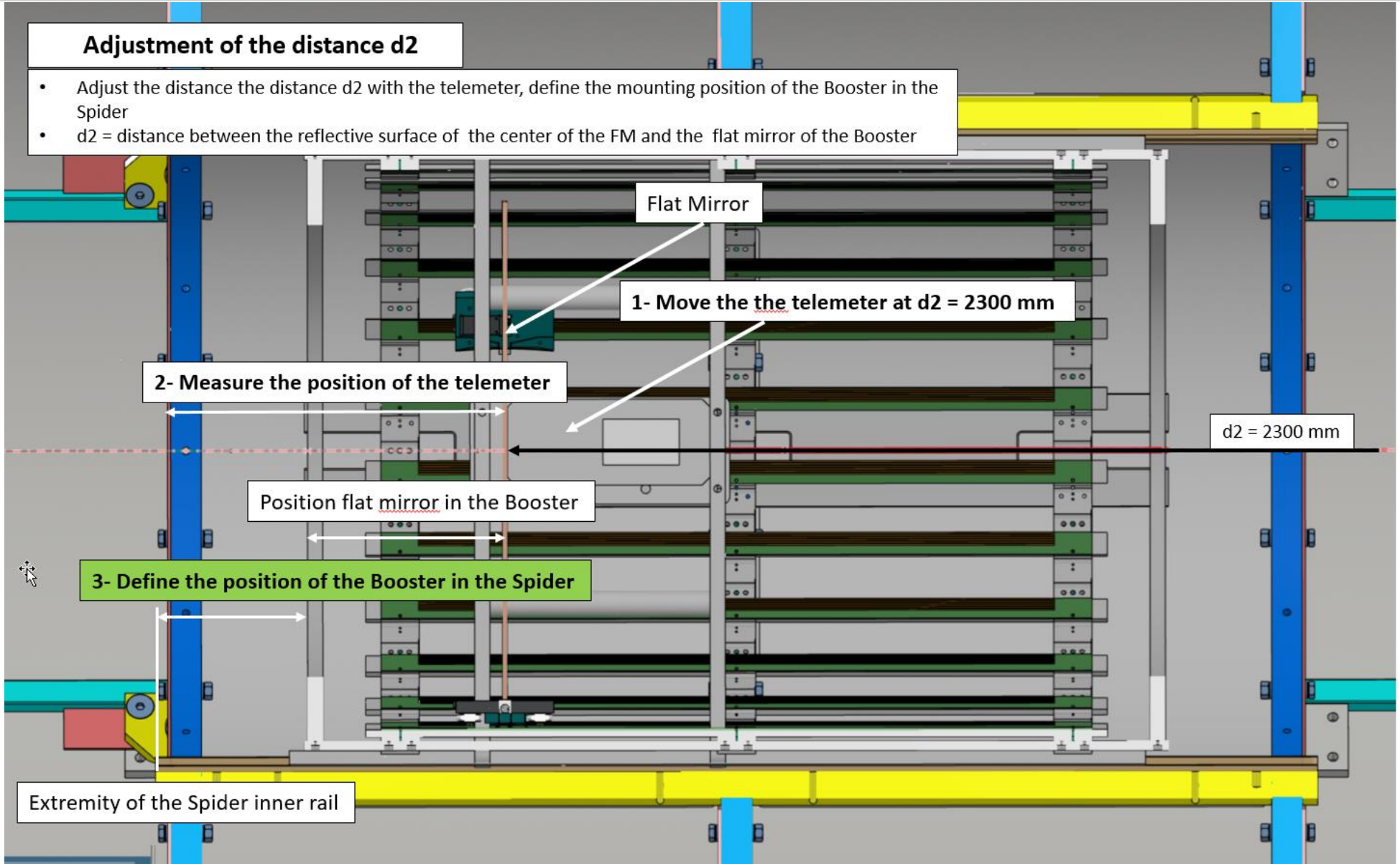








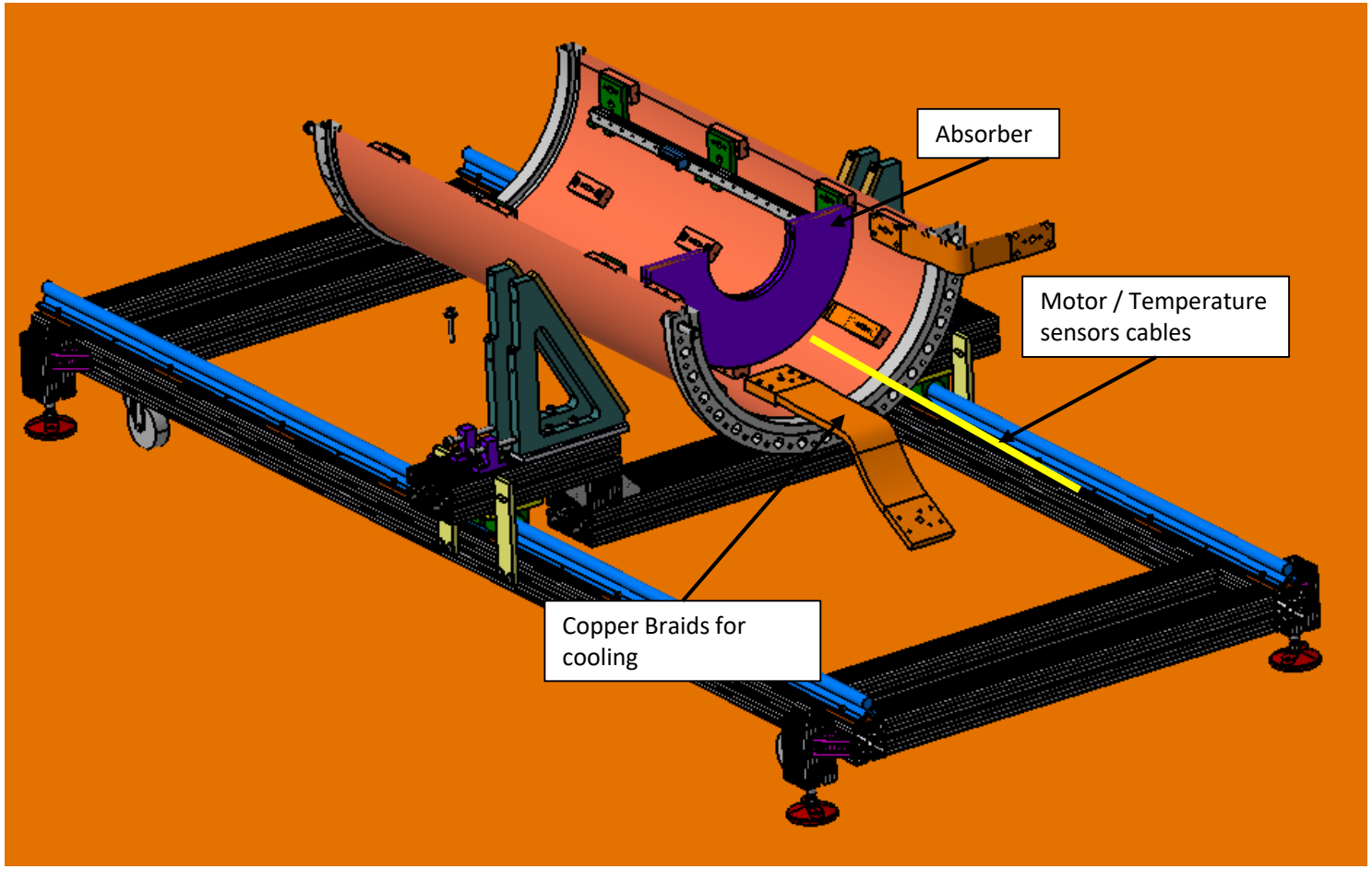
Project OB300 - Alignment : Booster Position in the Spider



Project OB300 – Alignment : 5 – Receiver Installation

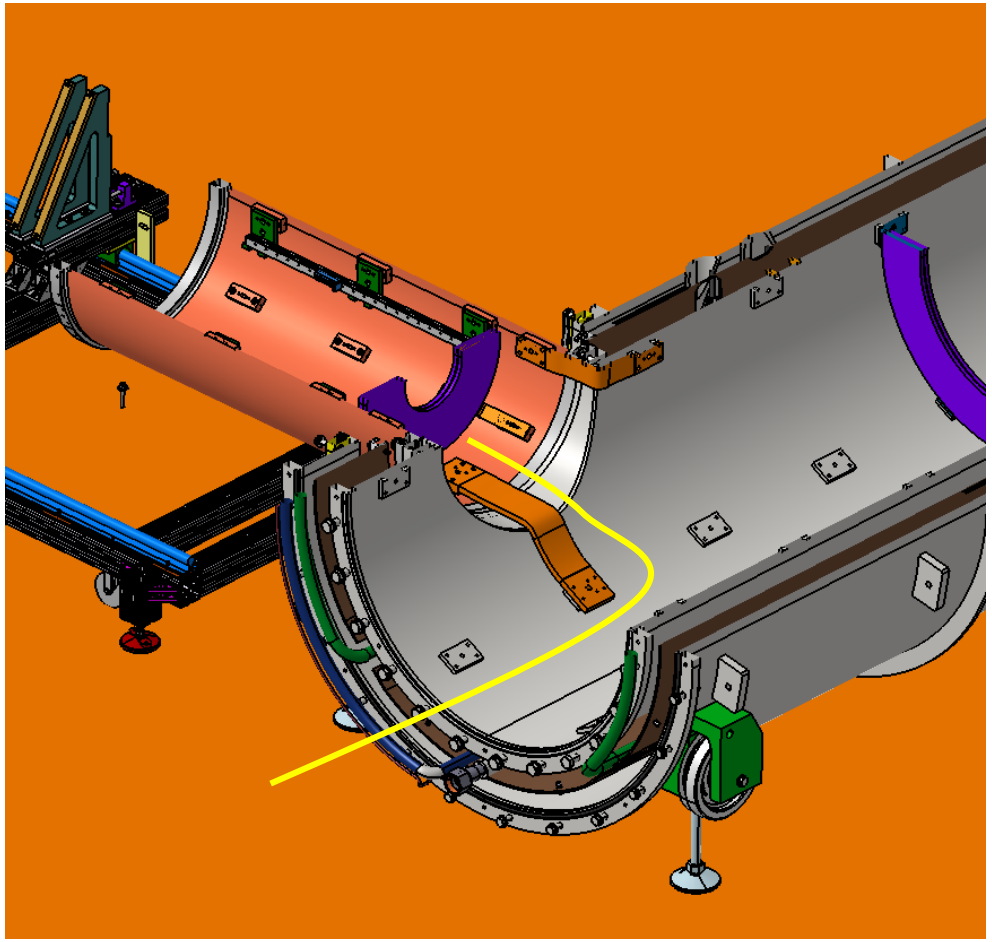
Operations	Values	Tolerances	Duration Estimation	Equipement
2- Focusing Mirror and Receiver Rails Alignment			**4 days**	+ margin of 1 day
5-A Equipment of the Receiver Inner Vessel ***Could be done in advance*** • Inner rails • Copper braids and electrical cables • Absorbers			½ day	
5-B Mounting of the Inner Vessel on the MC • Screwing the Inner Vessel on the Flange • Routing the electrical cables • Screwing of the Copper Braids			½ day	
5-C Installation of the Focusing Mirror ***(could be later after 5E)***			½ day	
5-D Adjust the receiver rails (Option) • Install the Receiver Laser • Adjust the Receiver Rails			½ day	
5-E Receiver Installation • Mount the Multi Layer Insulation on the Inner Vessel • Mount the thermal shield • Mount the Multi Layer Insulation on the thermal shield • Mount the Outer Vessel • Mounting of the Receiver setup in the cryostat ▪ Insertion of the Antenna and the mechanism ▪ Fix the mechanism on the rails ▪ Electrical cabling + Tests ▪ Connection of the Antenna with the RF cable			1 day	
5-F RF Alignment of the Horn Antenna			TBD	

Project OB300 – Alignment : 5 – Receiver Installation



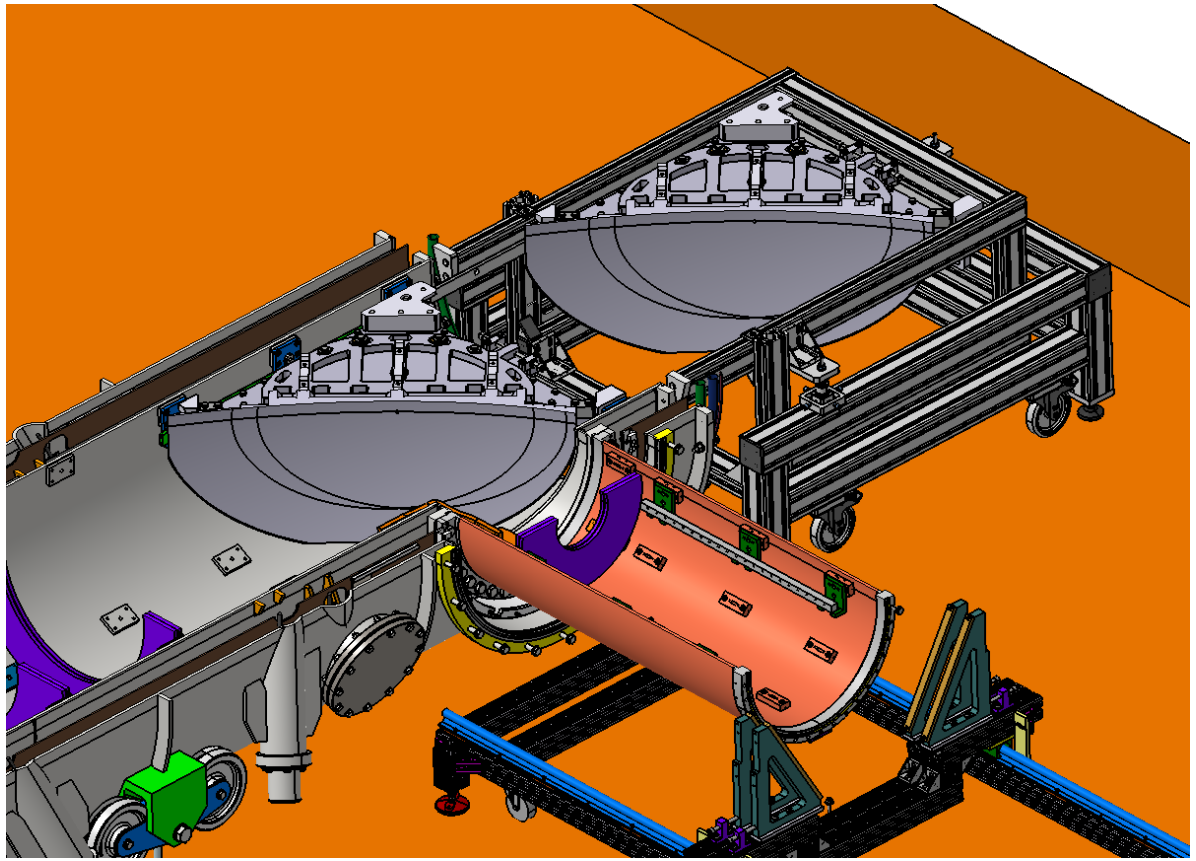
5-A Equipment of the Receiver Inner Vessel

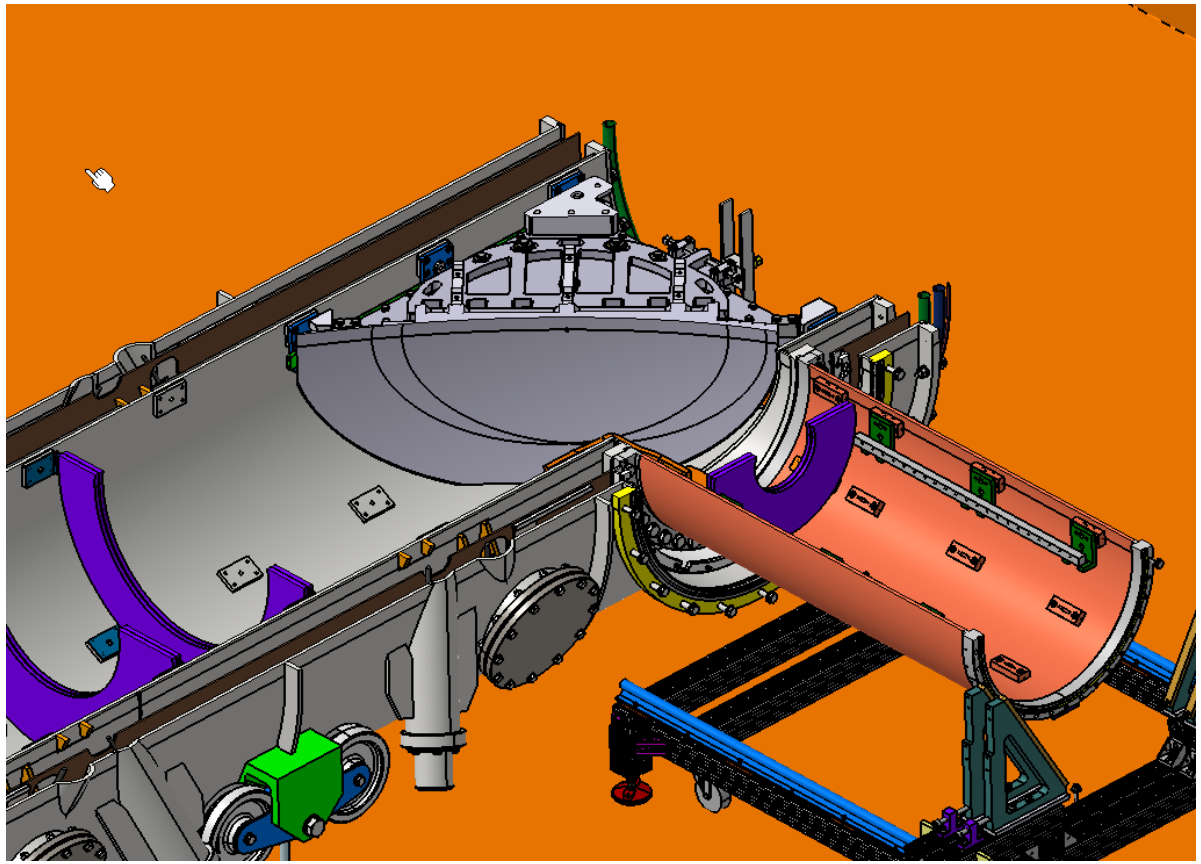
Temperature sensors cabling above the FM



5-B Mounting of the Inner Vessel on the MC

Project OB300 – Alignment : 5 – Receiver Installation





Temperature sensors cabling above the FM

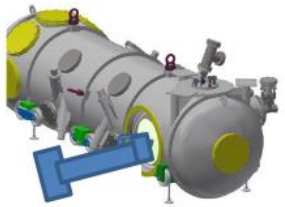
5-C Installation of the Focusing Mirror

Project OB300 - Alignment : Receiver Installation

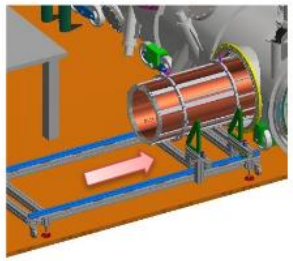
Receiver Cryostat

Mounting sequence

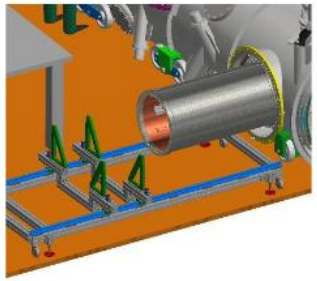
Step 1: Remove blind flanges of main cryostat with Bilfinger-tool



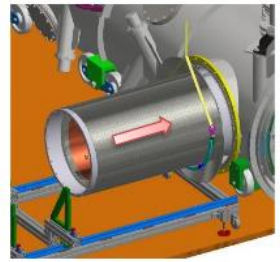
Step 2: Insert the inner vessel with frame and prisms;

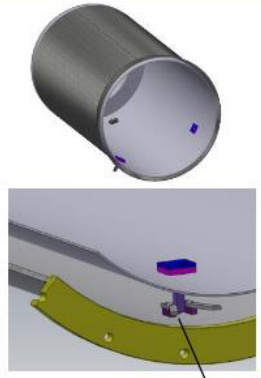


Step 3: install multi layer insulation



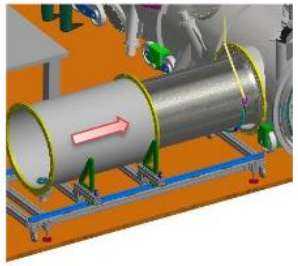
Step 4: insert thermal shield, install multi layer insulation



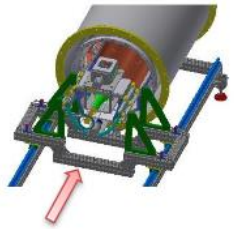


Shield now supported by rods via outer vessel

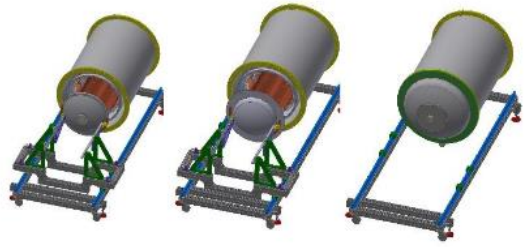
Step 5: install outer vessel



Step 6: slide in receiver setup



Step 7: close all 3 lids



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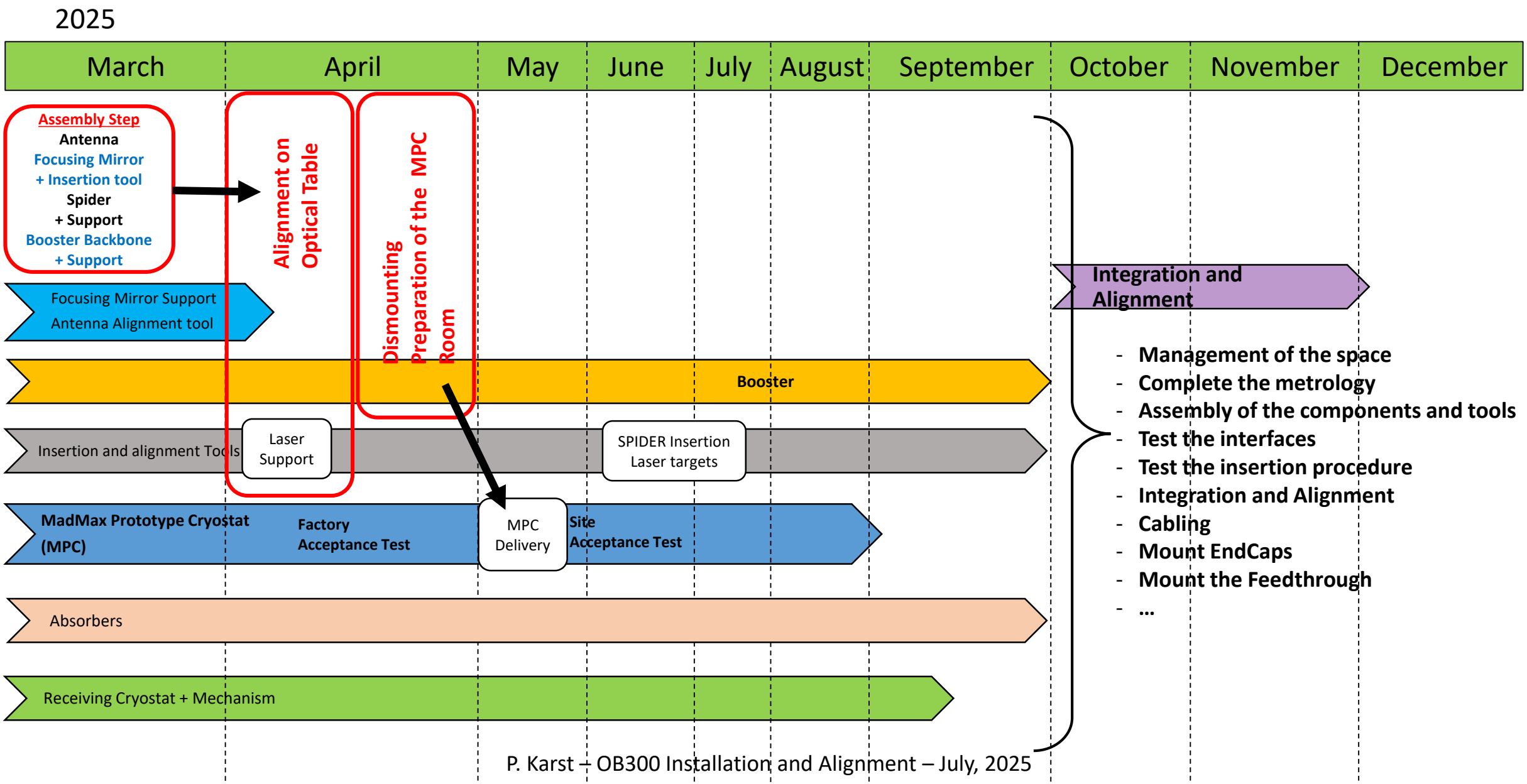
Project OB300 – Alignment : Rough Time estimation

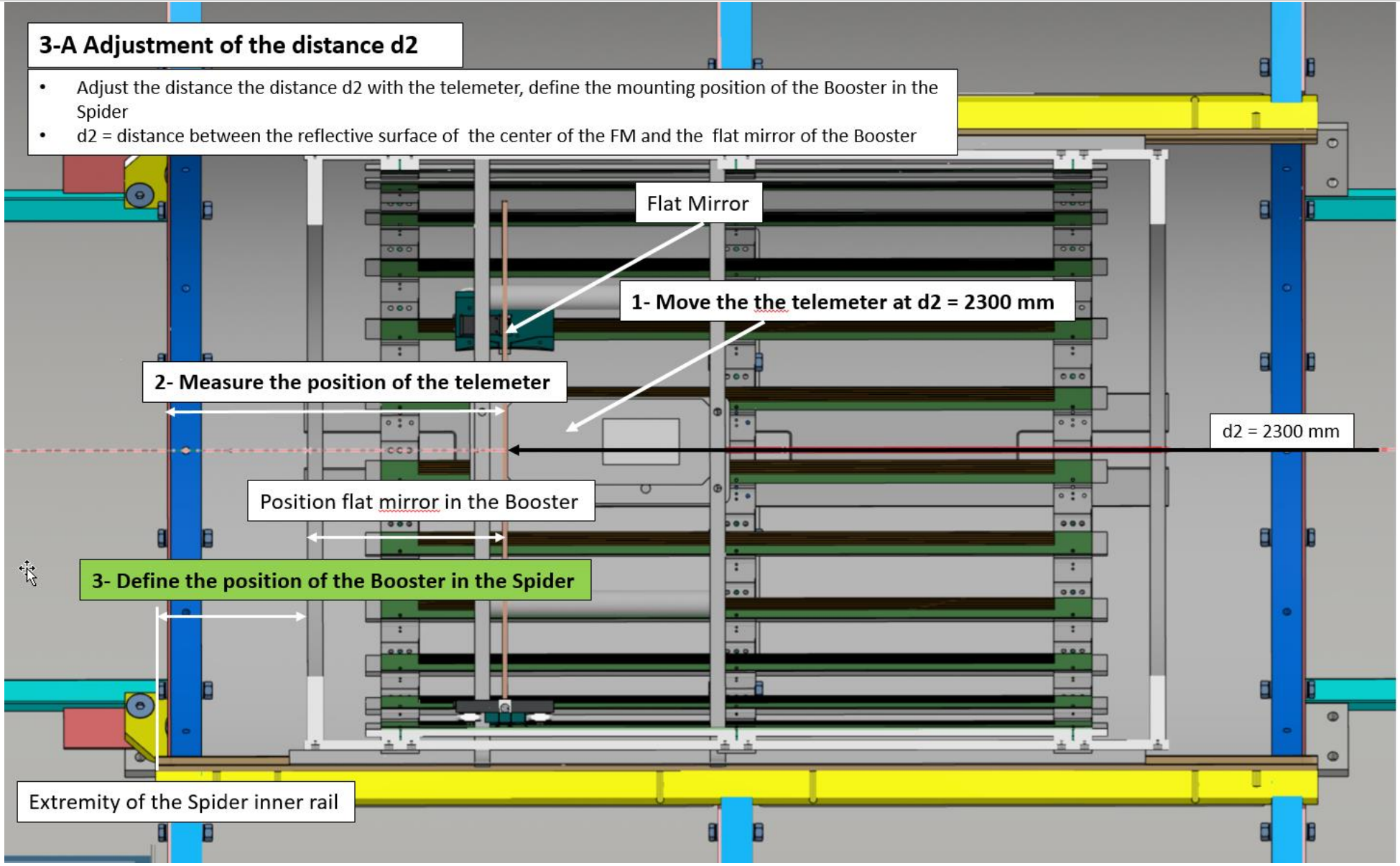
OPERATION	Duration estimation	Comments
1 - Spider Alignment	**2 days**	
2- Focusing Mirror Installation and adjustment	**3 days**	
3- Absorber Installation in the inner vessel	**2 days**	3 weeks • Improvement of the tools • Training • Refine the procedure Could be reduced to 2 weeks to the next installation (alignment already done)
4 - Booster insertion	**3 days**	
5 - Receiver Installation	**4 days**	
RF Alignment of the Horn Antenna	**TBD**	
Total duration for the Installation and Alignment	**14 days**	

Project OB300 : Alignment – Integration - Schedule

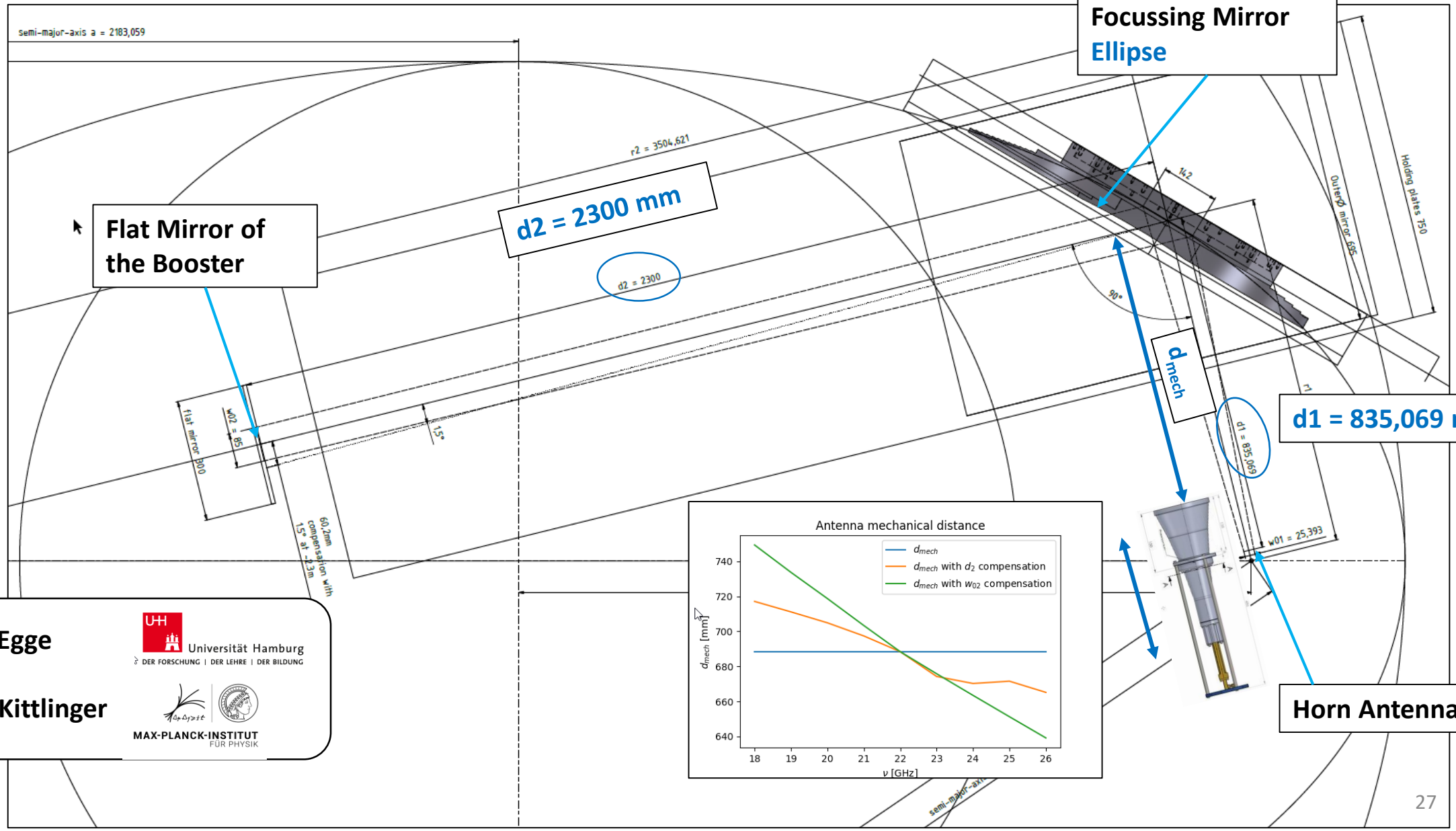


Back-up

Project OB300 - Alignment : 3- Booster Insertion



Project OB300 : Specification – Dimensions



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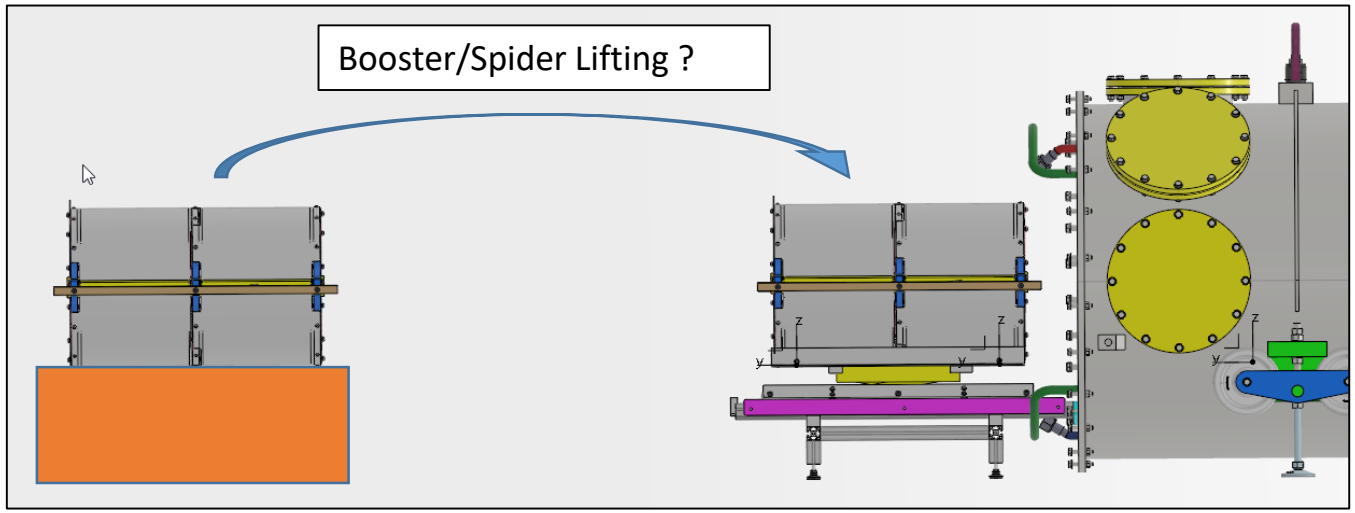
Project OB300 : Expected values and Tolerance

General tolerances :
Angle of the axis := ± 1 mrad
Distance d2 = ± 5 mm

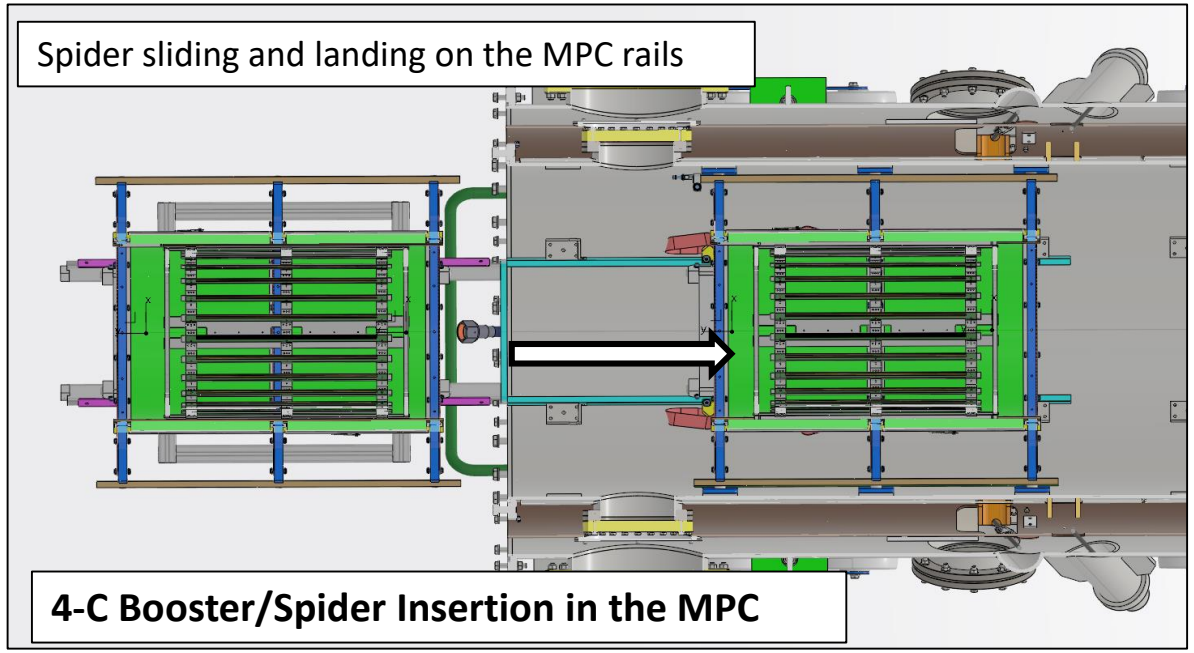
Position specification	Nominal Value	tolerance
1 - Alignmment Spider Rail/ MPC axis (laser target)	0 mm	**± 0,8 mm**
2B - Alignment FM rails / Laser Target	0 mm	**± 1 mrad = ± 2,3 mm**
2D - Focusing Mirror Position into the Cryostat In respect with the receiver cryostat axis Position of the center / Spider axis - Laser	 500 mm (to be measured) 0 mm	 **± 2 mm** **± 1 mrad = ± 2,3 mm**
Focusing Mirror Orientation Horizontal axis ± 3 degree Vertical axis ± 1,5 degree	Adjustable +5°/-3° +2°/-3°	 **± 1 mrad** **± 1 mrad**
3- Distance booster/ Focusing Mirror “d2” Distance telemeter – FM Distance telemeter – Spider Distance Booster - Spider	 2300 mm TDB TBD	 **± 5 mm** **± 2 mm** **± 2 mm**
4 - Receiver Angular Orientation – rail adjustment Laser alignment at the center Laser alignment at R 150 mm - Position	 0 degree 0 mm See simul	 **± 1 mrad** **± 1 mrad = ± 3 mm** **± 1 mrad = ± 3 mm**

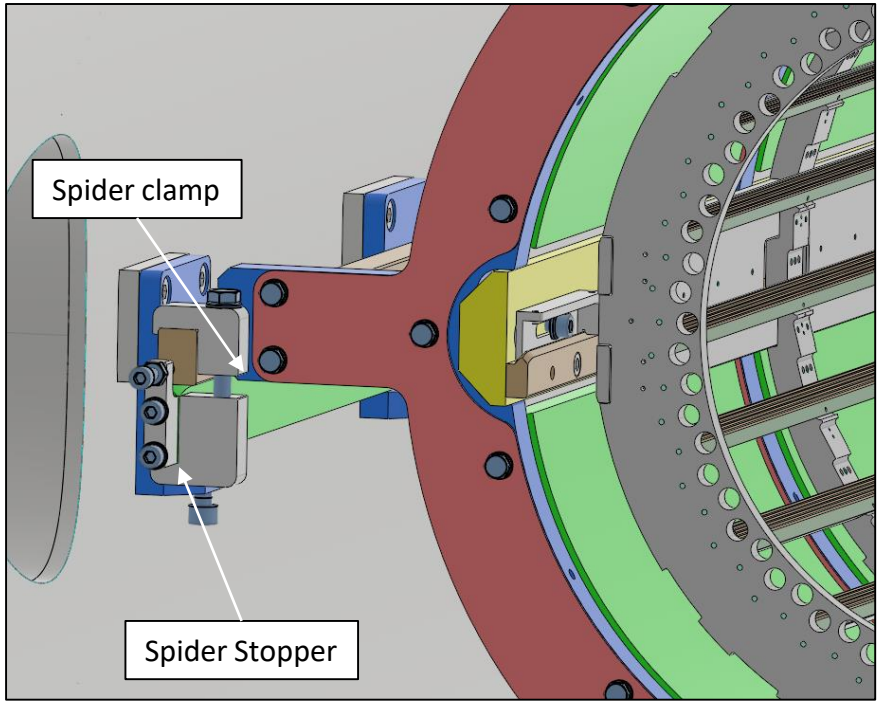
Project OB300 - Alignment : 4- Booster Insertion



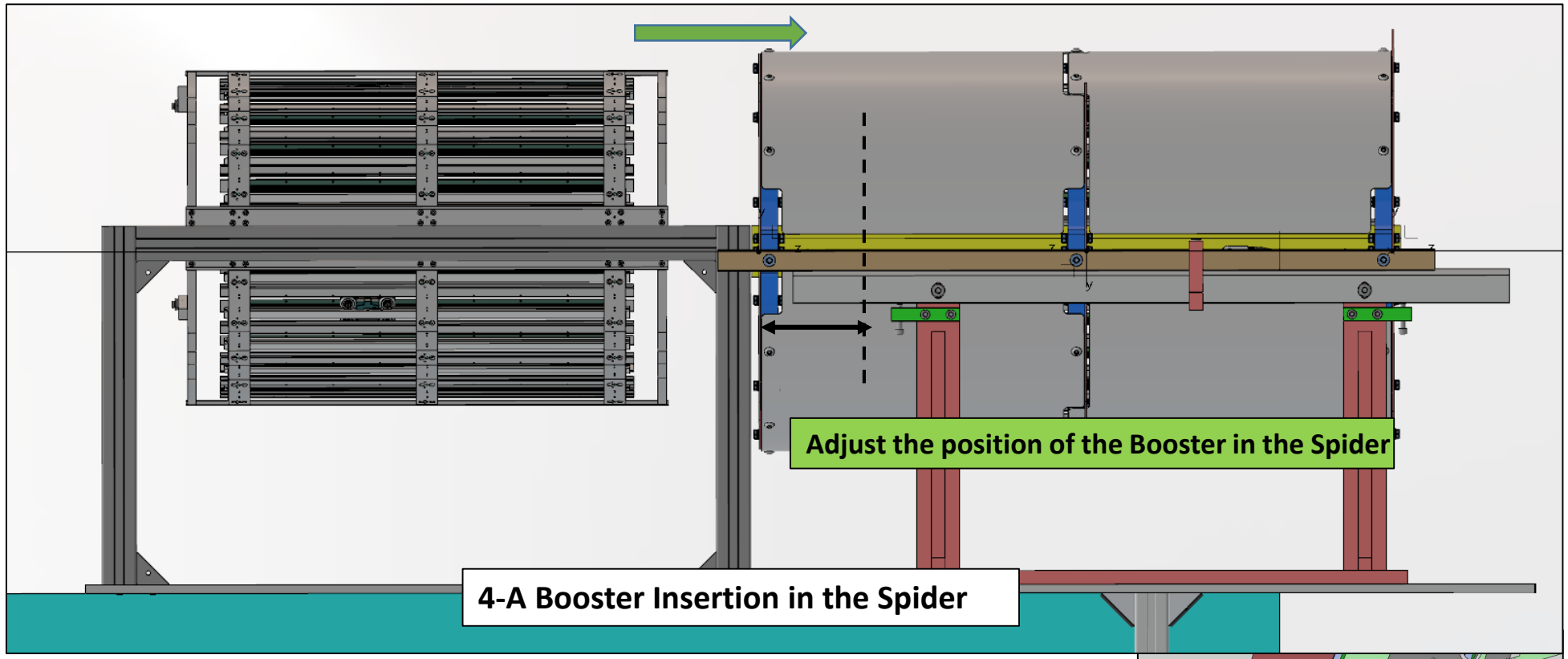
Weights :
Spider = 30 kg maxi
Booster = 20 kg ? TBD

- Lifting of the Booster/Spider on the Cart
- Sliding of the Cart at the Spider position
- Landing of the spider on the MPC rails
- The spider is fixed against the Spider Stopper with the clamp

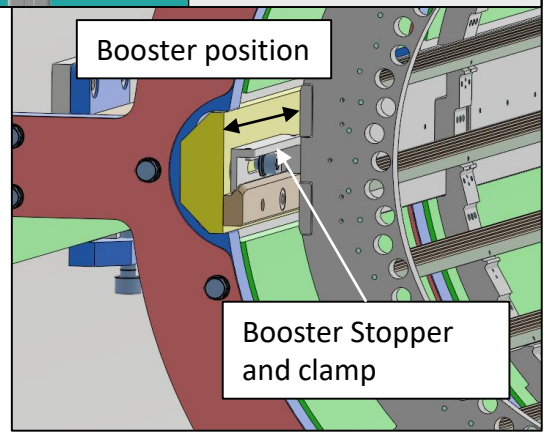




Project OB300 - Alignment : 4- Booster Insertion



- The rails of the Supports are aligned
- The Booster is inserted in the Spider and it moves until the position measured at the previous step (Adjustment of the distance d2)
- Fixe the Booster with the stopper and the clamp
- Preparation of the Cables and the Fibers routing and thermalization



Project OB300 – Alignment : 2- Focusing Mirror and Receiver Rails Alignment

Deviation 1 mrad => 2,3 mm on the Focusing Mirror

- 5 lasers, 1 at the center and 4 the radius 150 mm
- Checking of the incident spot on the Receiver target