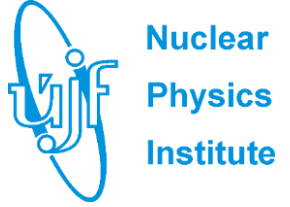




**FACULTY  
OF MECHANICAL  
ENGINEERING  
CTU IN PRAGUE**



# CBM beam pipe downstream area

***Jan Kollarczyk*<sup>1) 2)</sup>, Martin Janda<sup>1)</sup>, Martin Smetana<sup>1)</sup>, Petr Chudoba<sup>3)</sup>, et al.**

<sup>1)</sup> CTU in Prague, Faculty of Mechanical Engineering

<sup>2)</sup> Nuclear Physics Institute of the Czech Academy of Sciences

<sup>3)</sup> CTU in Prague, Faculty of Nuclear Sciences and Physical Engineering



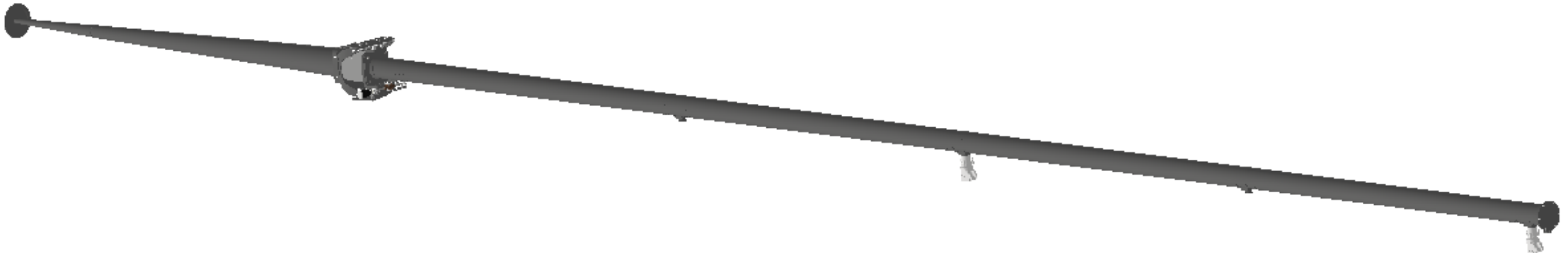
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871072



09. 02. 2023



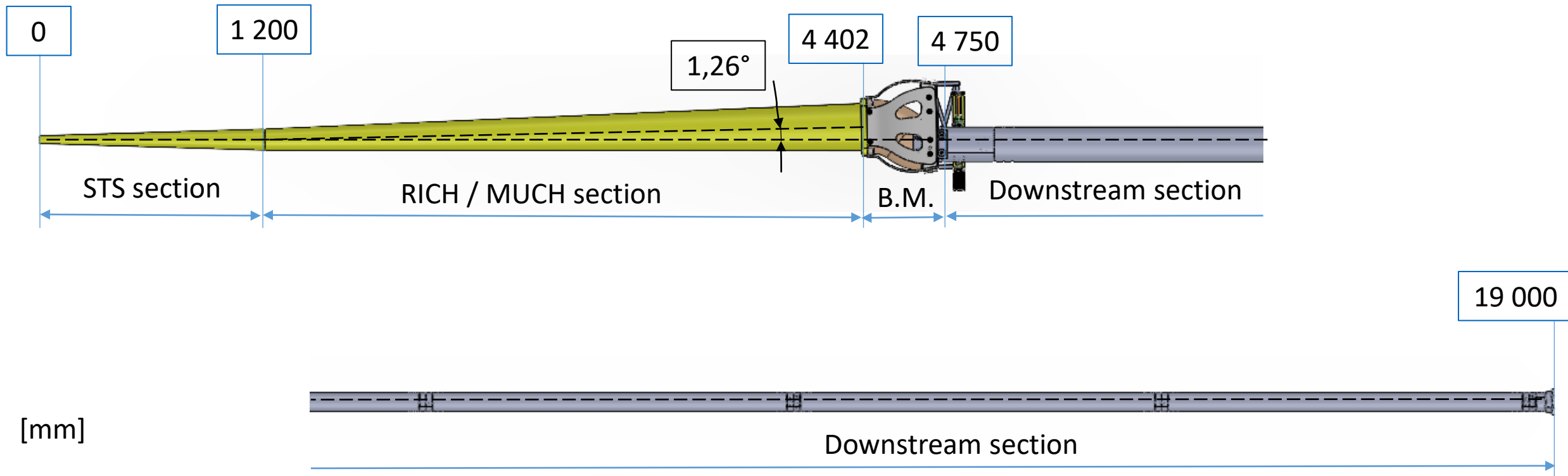
- **CBM beam pipe downstream the target** *[10 min]*
  - Overview of present design
  - Future outlook
  - Discussion *[2 min]*





# CBM beam pipe: Overview

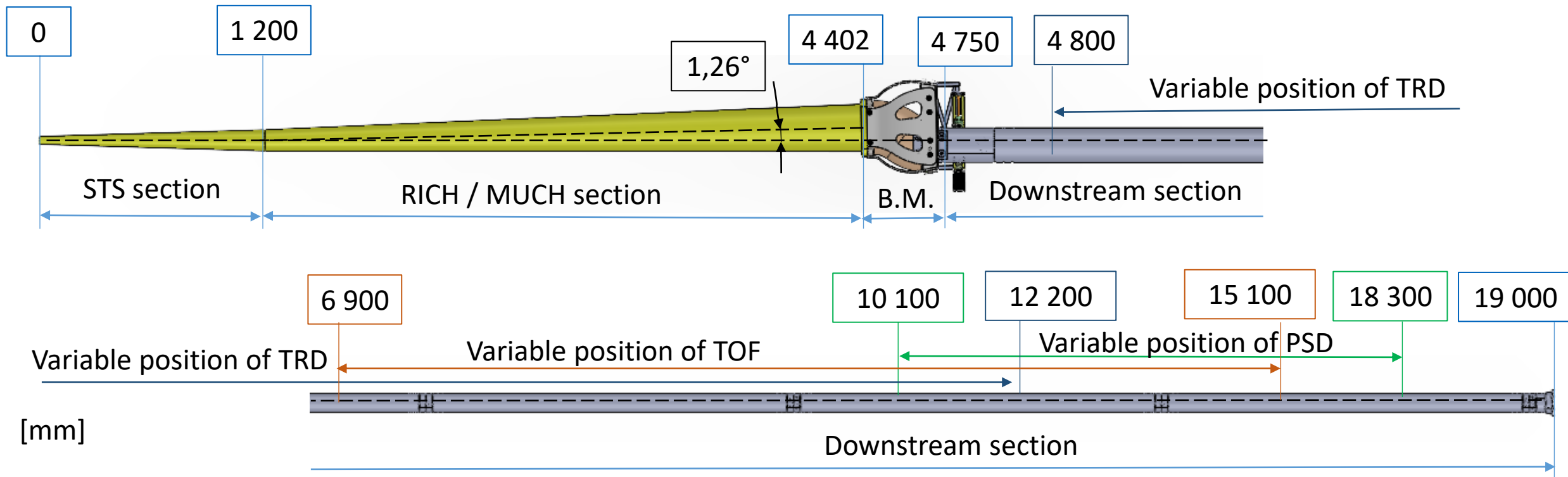
Carbon fibre beam pipe for CBM experiment:





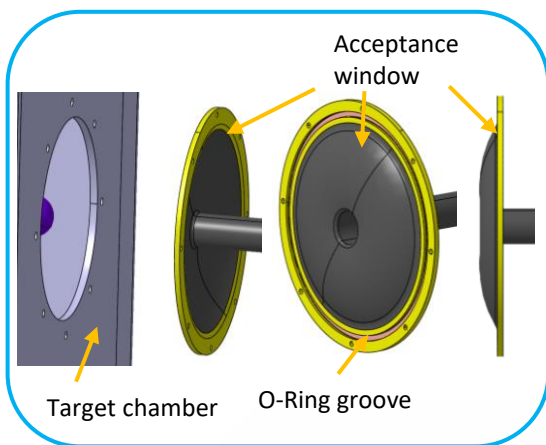
# CBM beam pipe: Overview

Carbon fibre beam pipe for CBM experiment:

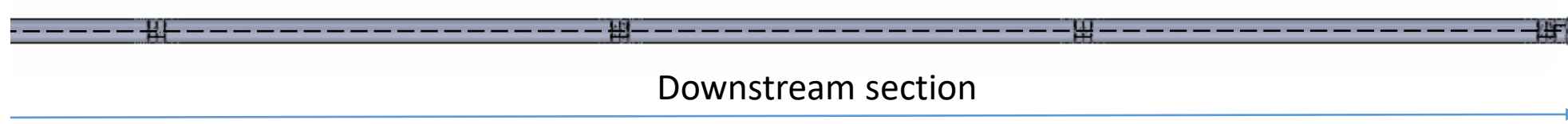
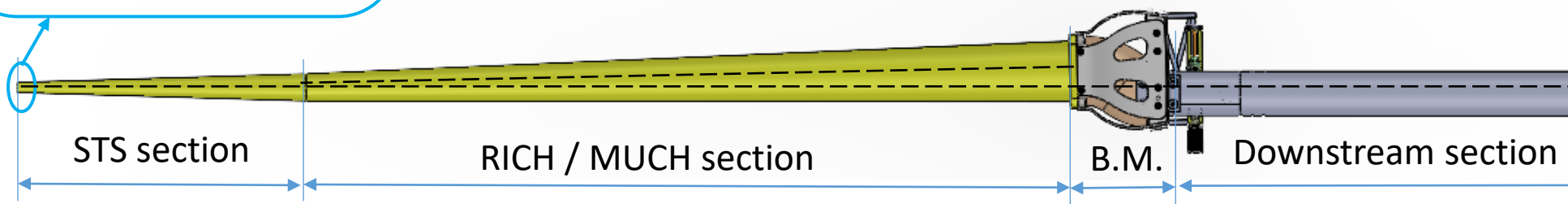




# CBM beam pipe: Mounting

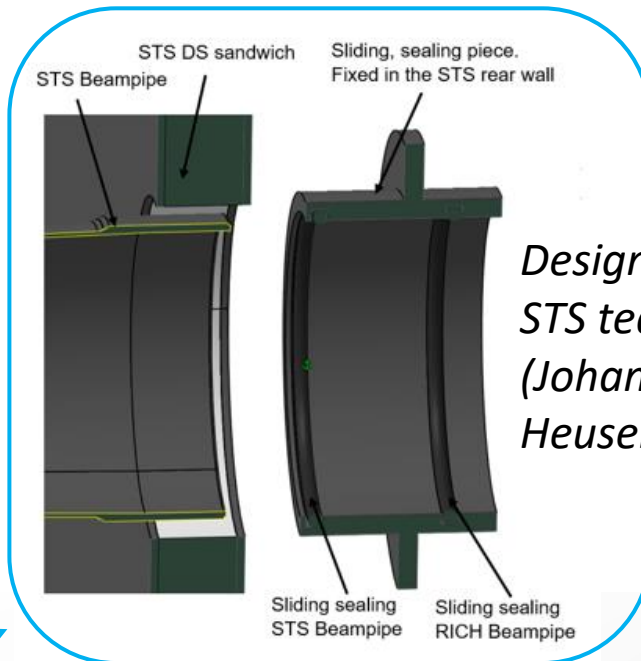
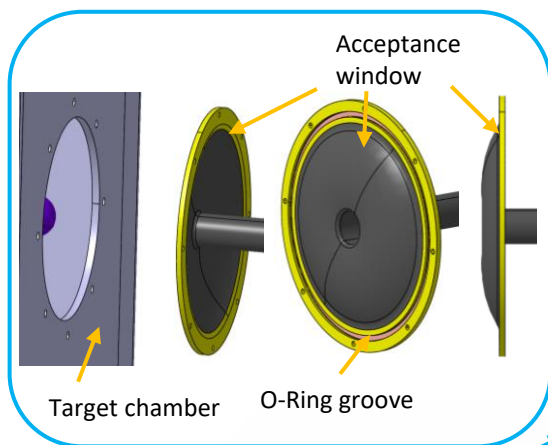


*Design of the  
STS team  
(Johann M.  
Heuser, et al.)*

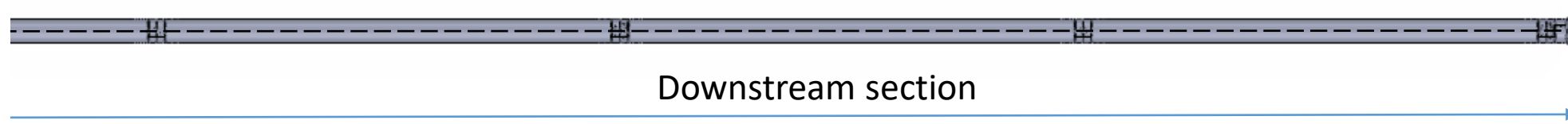
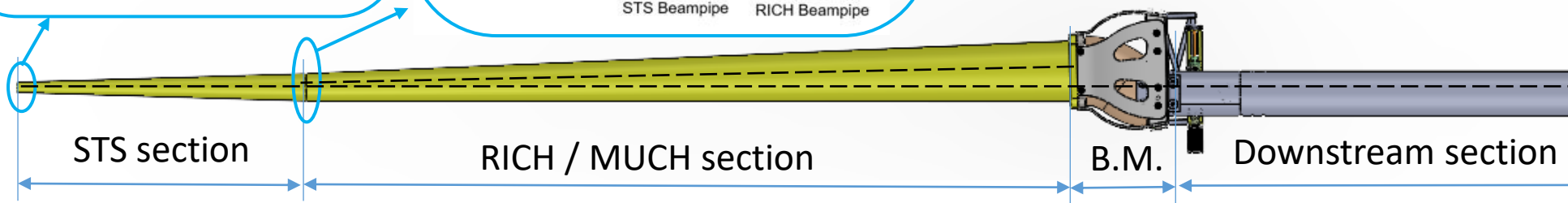




# CBM beam pipe: Mounting

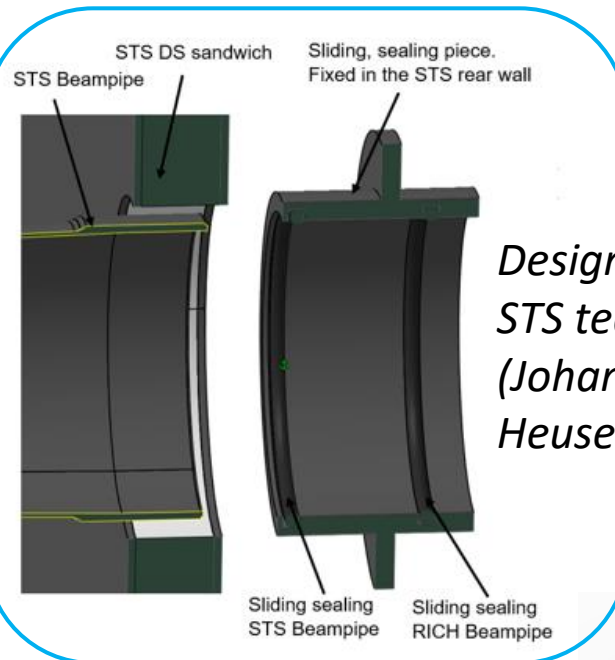
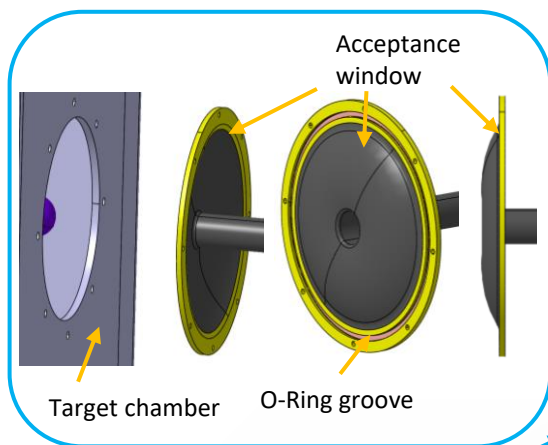


*Design of the  
STS team  
(Johann M.  
Heuser, et al.)*

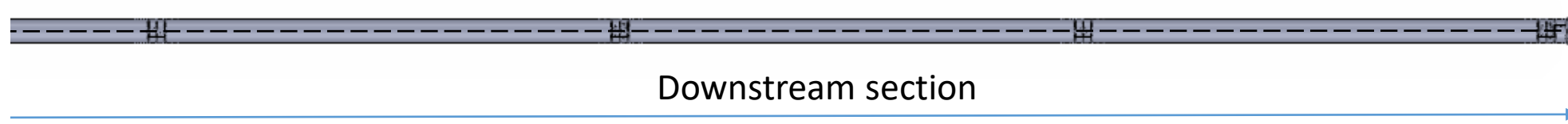
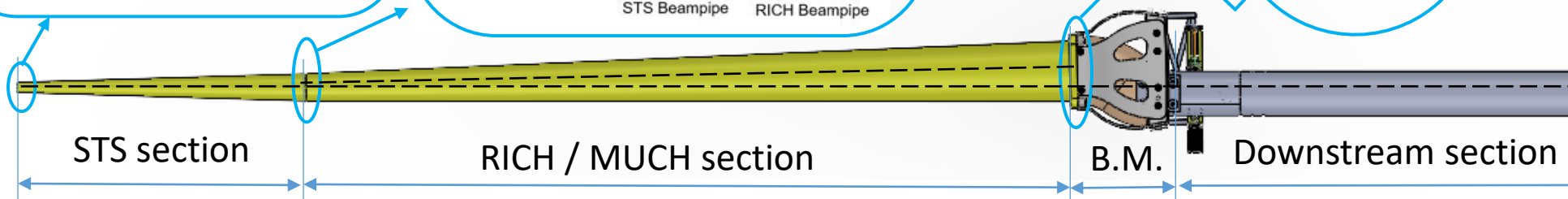
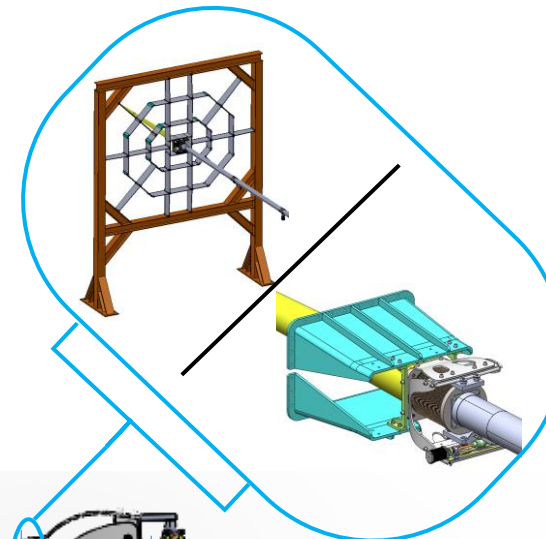




# CBM beam pipe: Mounting

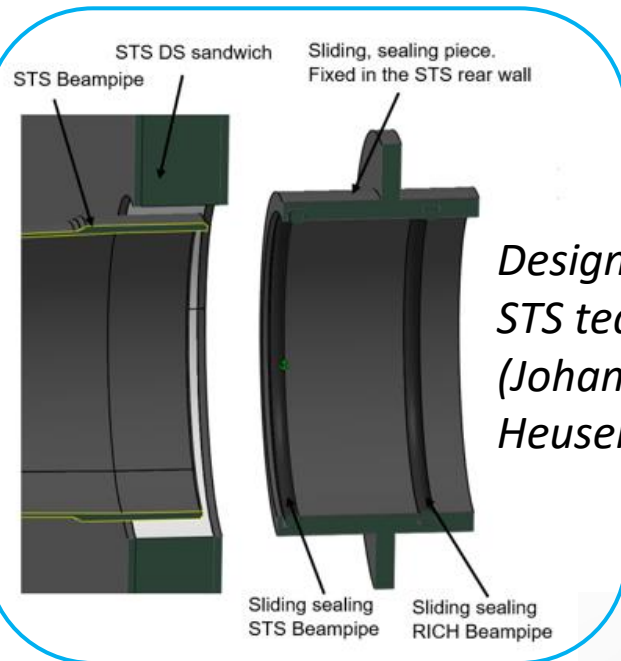
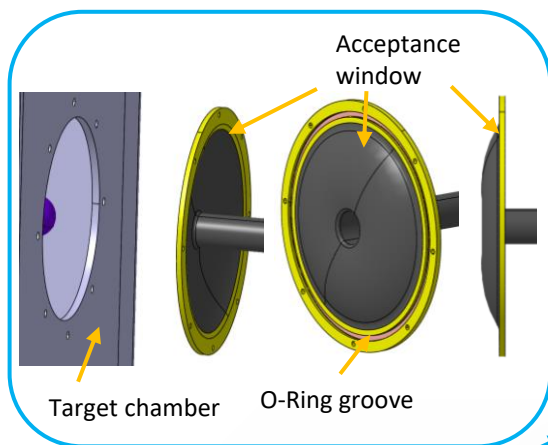


*Design of the  
STS team  
(Johann M.  
Heuser, et al.)*

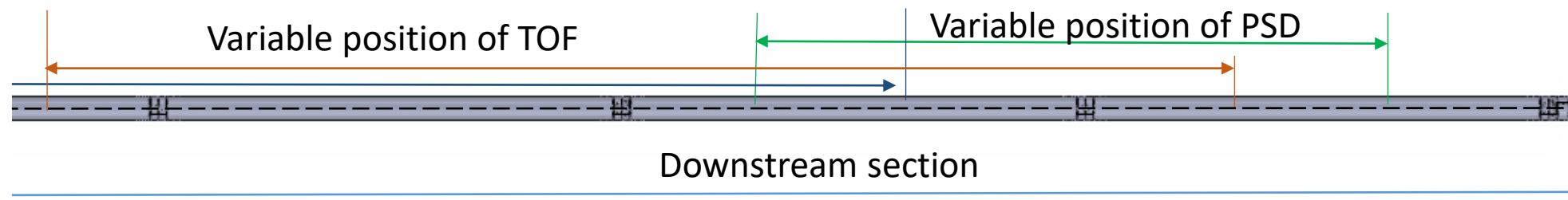
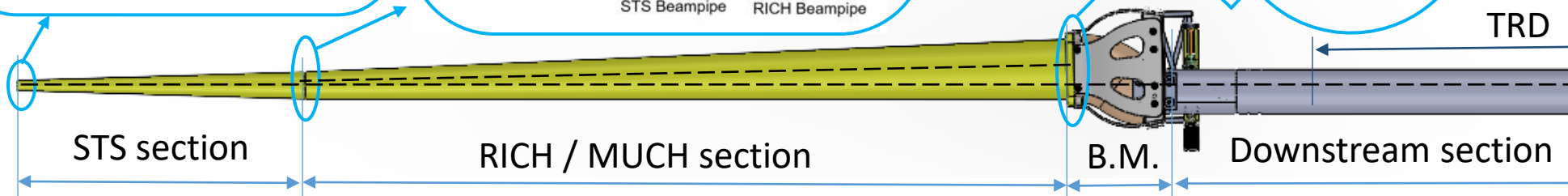
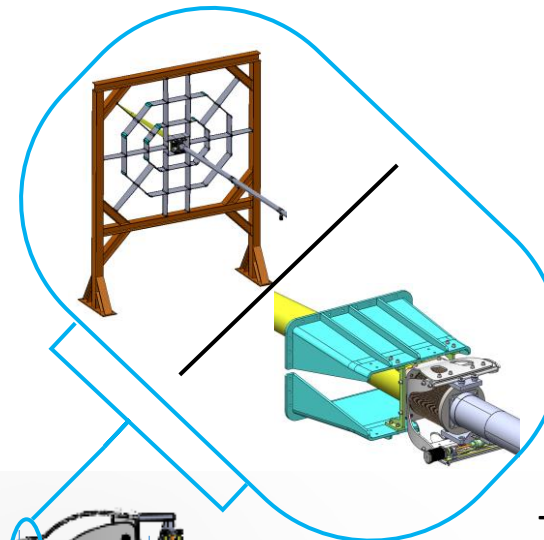




# CBM beam pipe: Mounting

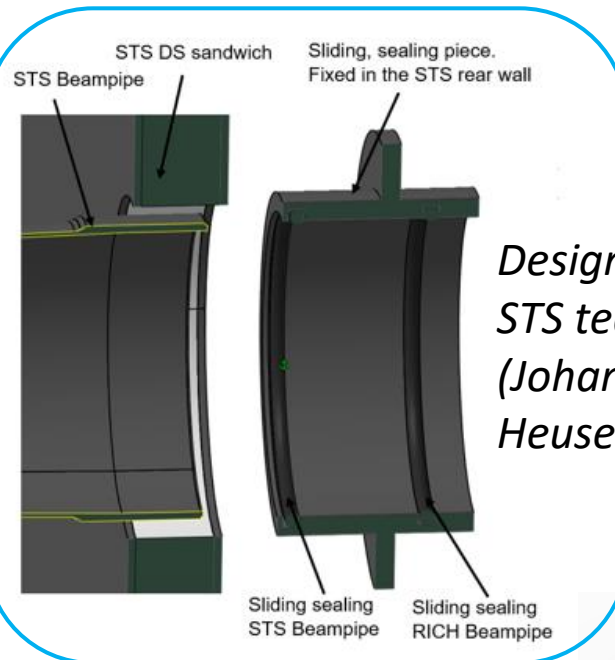
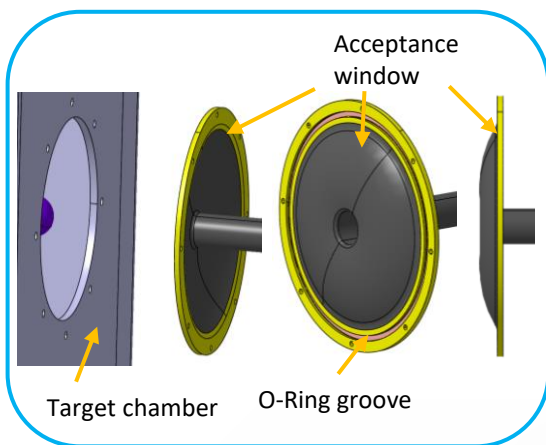


*Design of the  
STS team  
(Johann M.  
Heuser, et al.)*

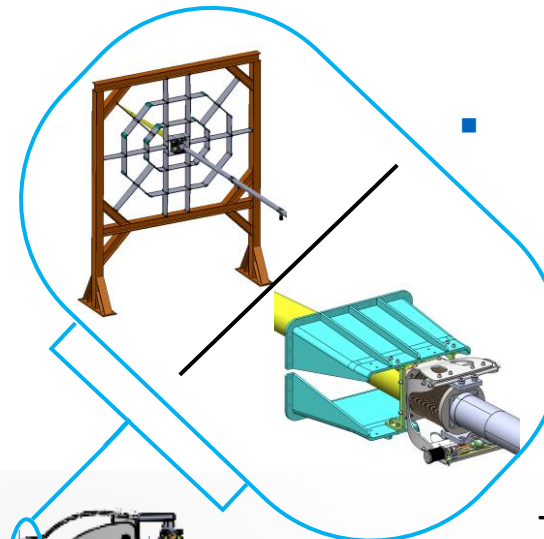




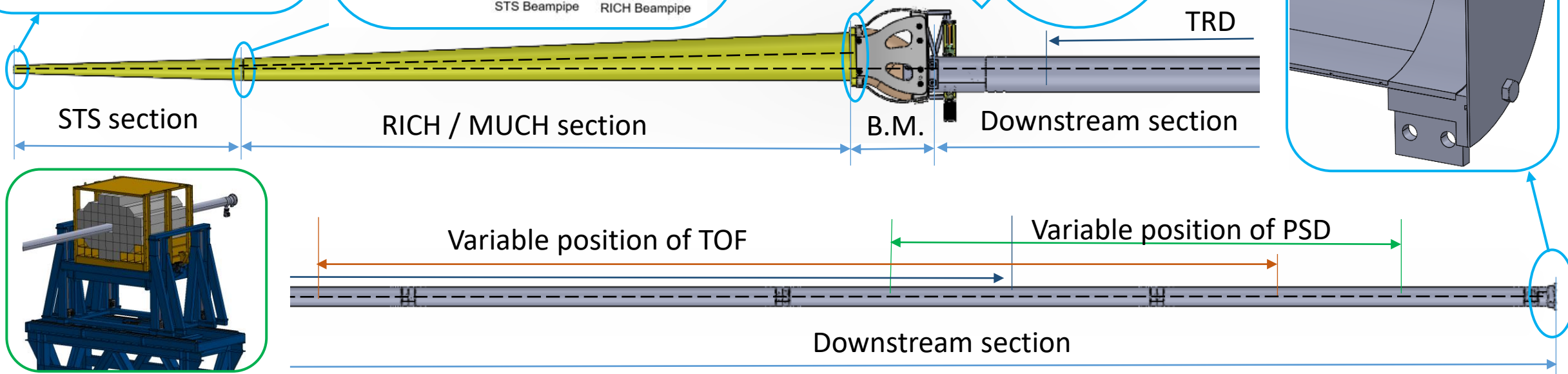
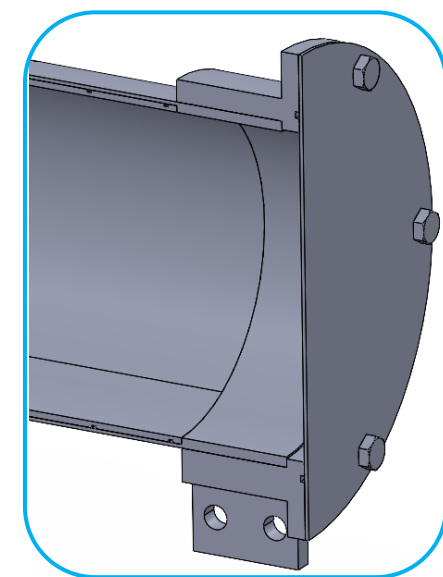
# CBM beam pipe: Mounting



*Design of the  
STS team  
(Johann M.  
Heuser, et al.)*



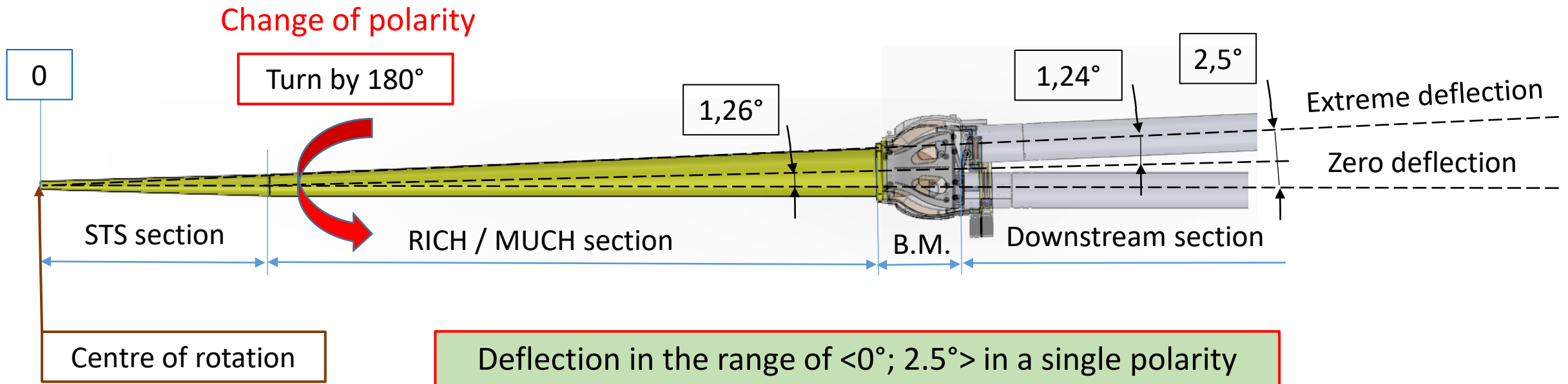
- Need of further research





# CBM beam pipe: Bending concept

Downstream beam pipe with deflection:

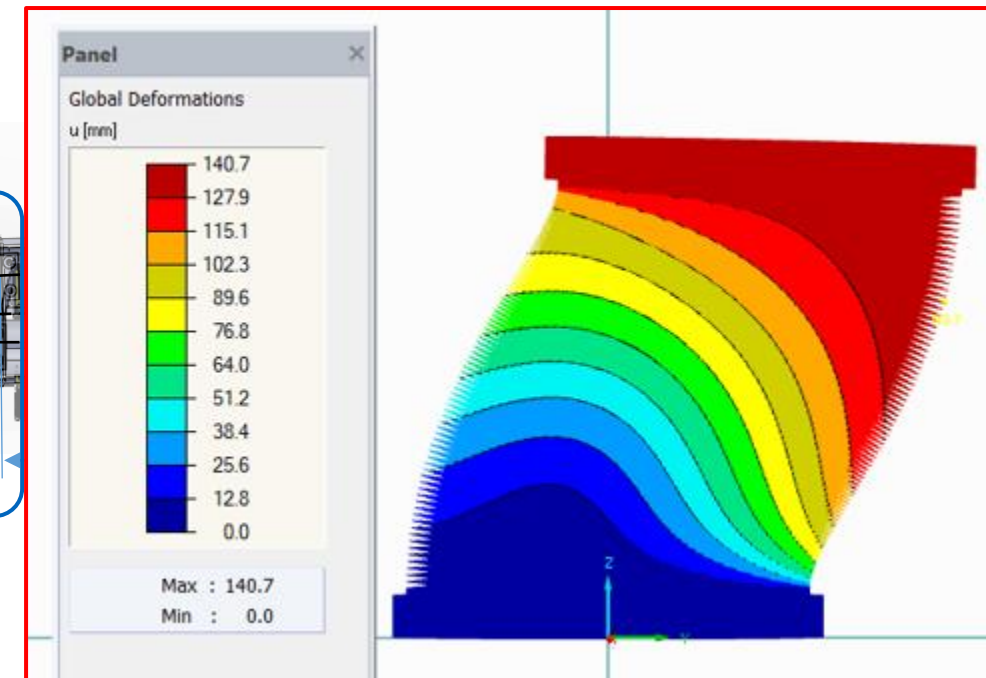
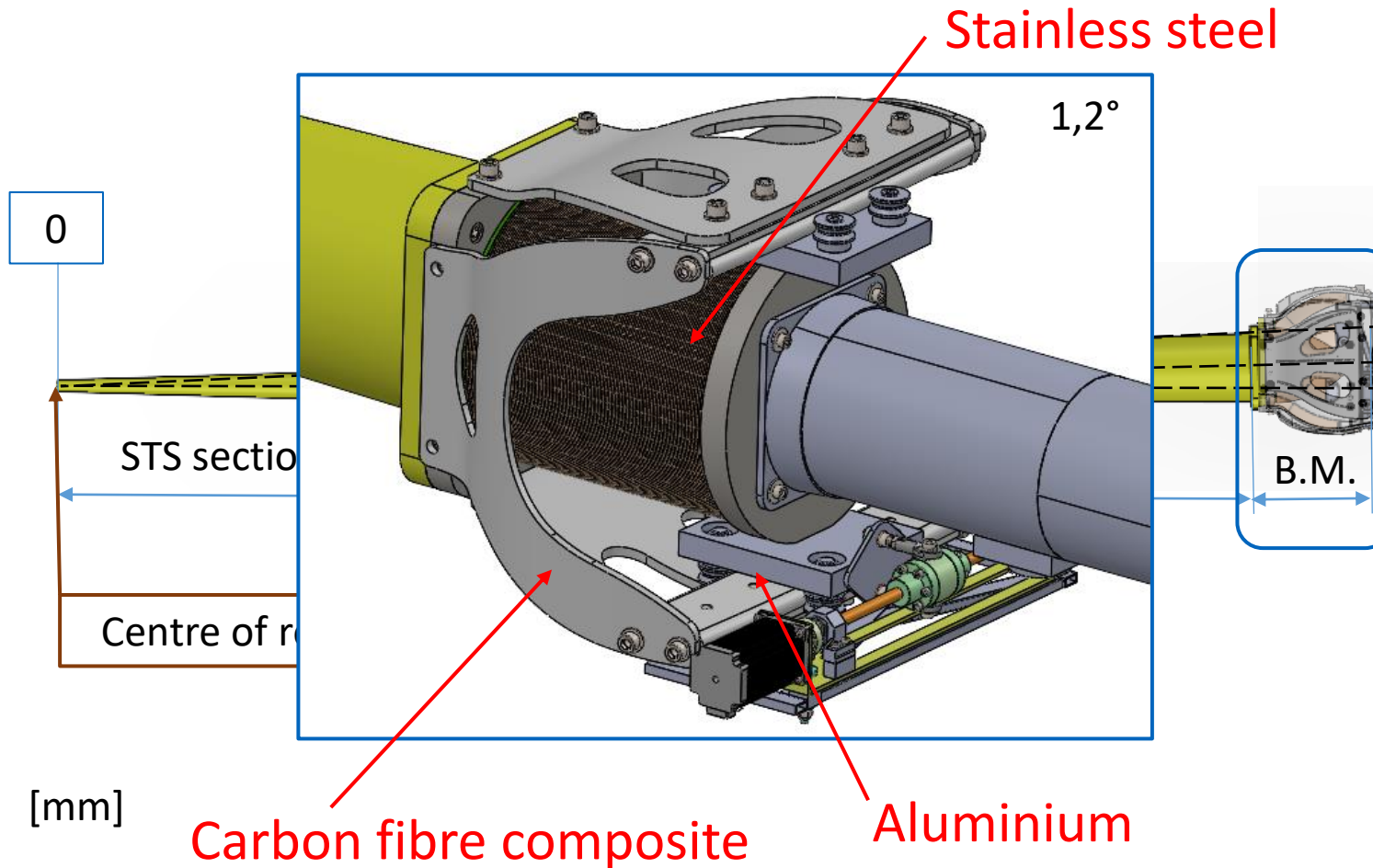


[mm]



# CBM beam pipe: Bending concept

Downstream beam pipe with bending mechanism:



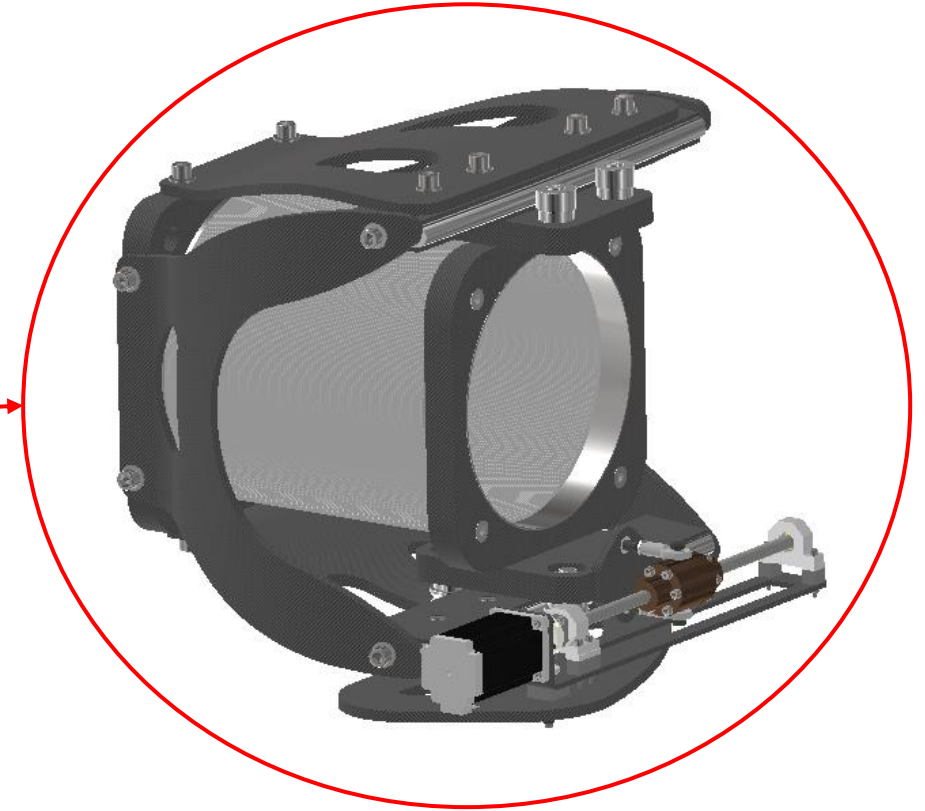
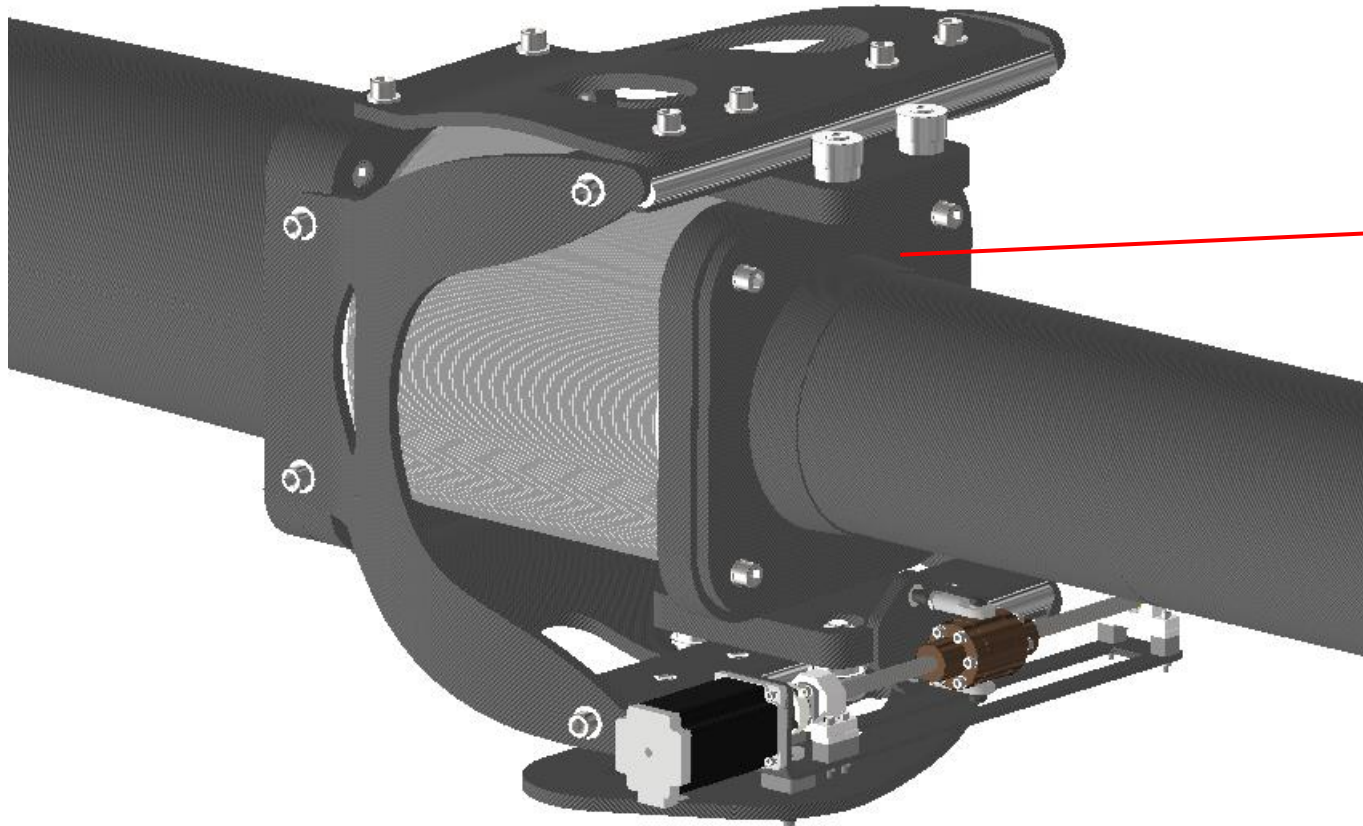
Older concept



# CBM beam pipe: Bending concept

Downstream beam pipe with bending mechanism:

- *Need of further research*

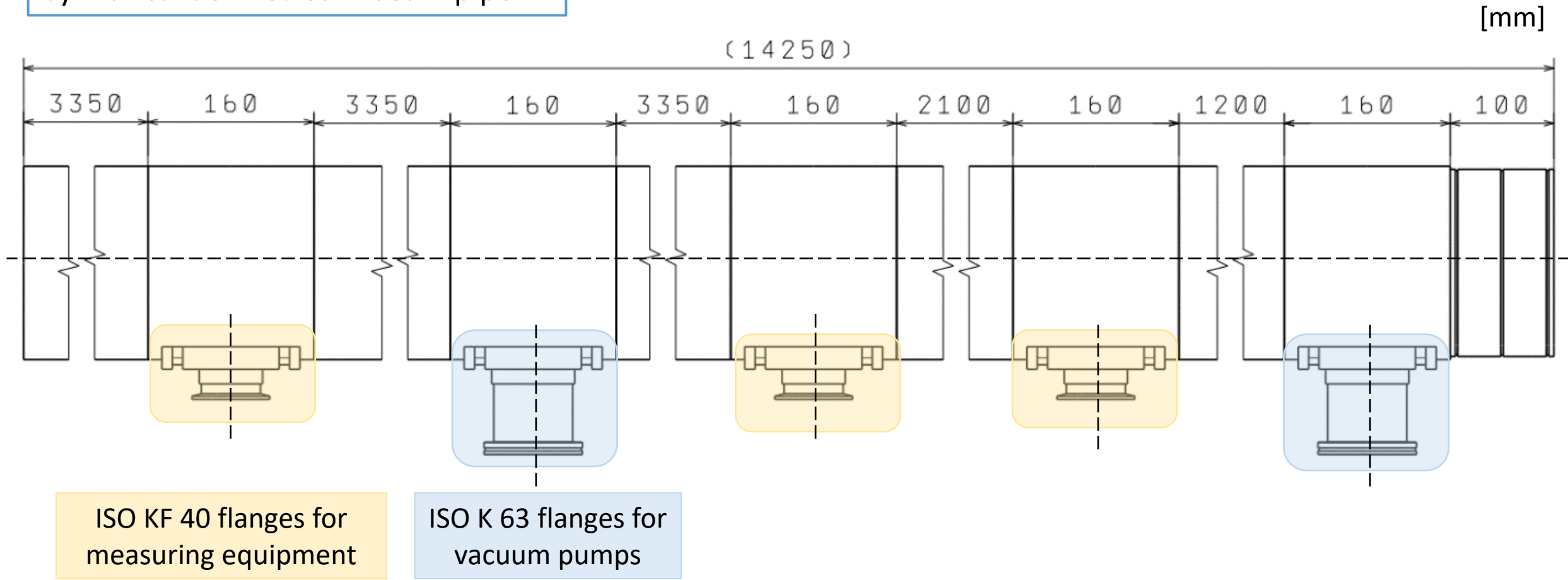


Latest approach



# CBM beam pipe: Downstream section

Cylindrical downstream beam pipe:



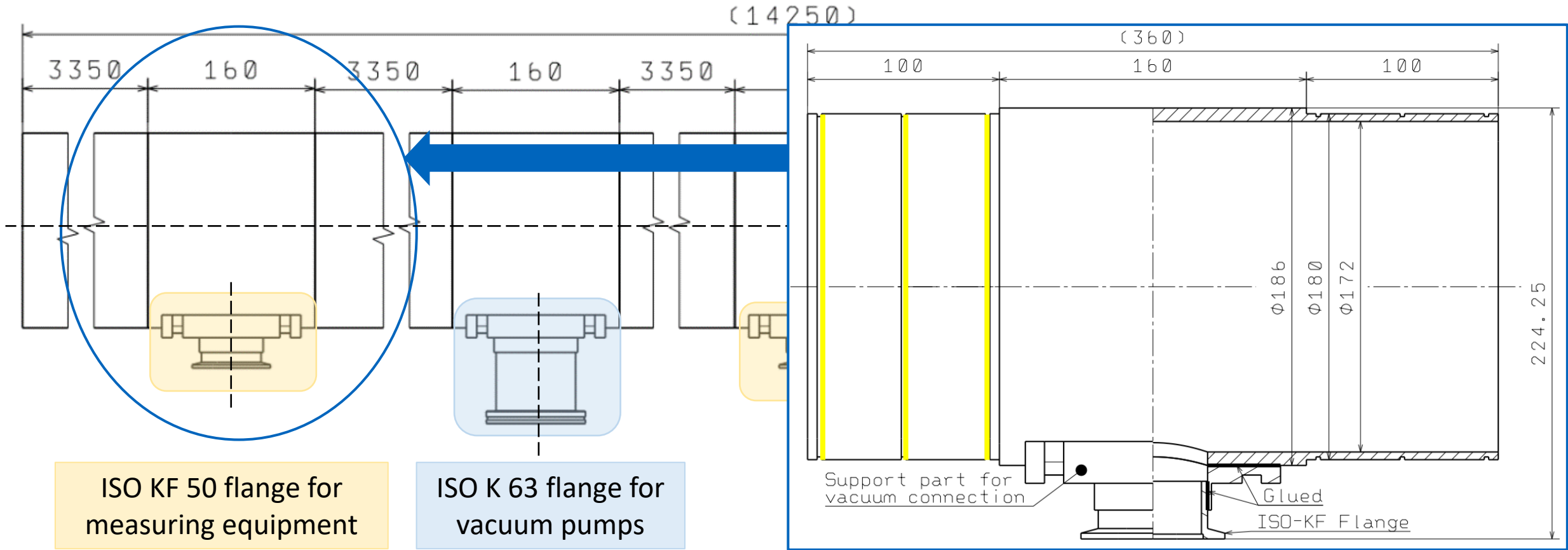


# CBM beam pipe: Downstream section

Cylindrical downstream beam pipe:

Interconnecting part with grooves for O-rings

[mm]

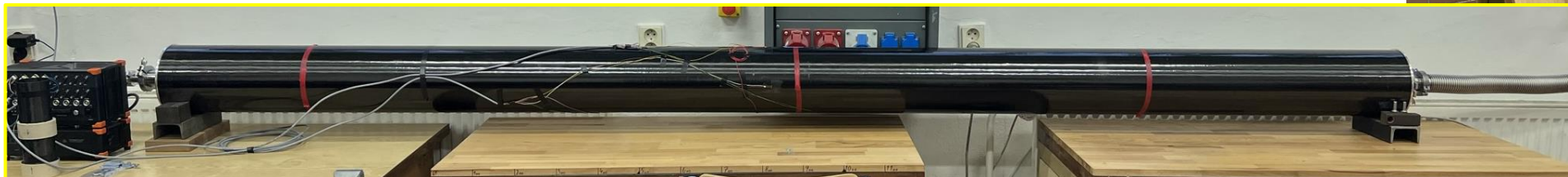
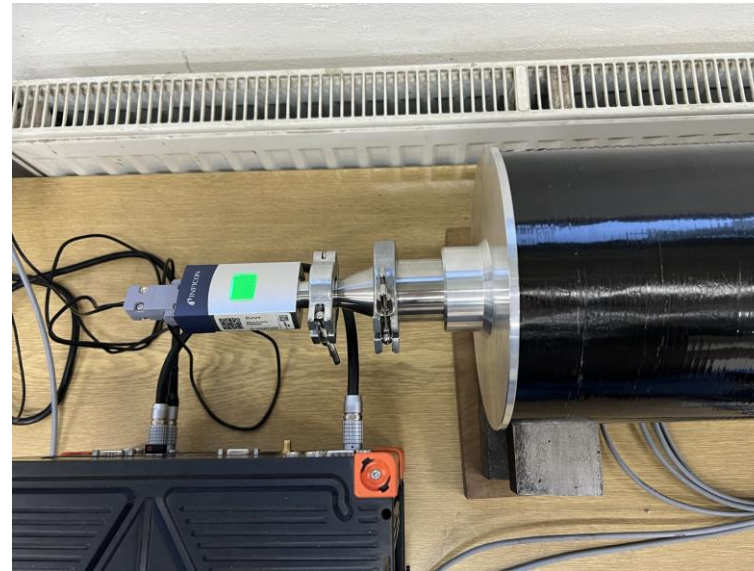




# CBM beam pipe: Testing specimen

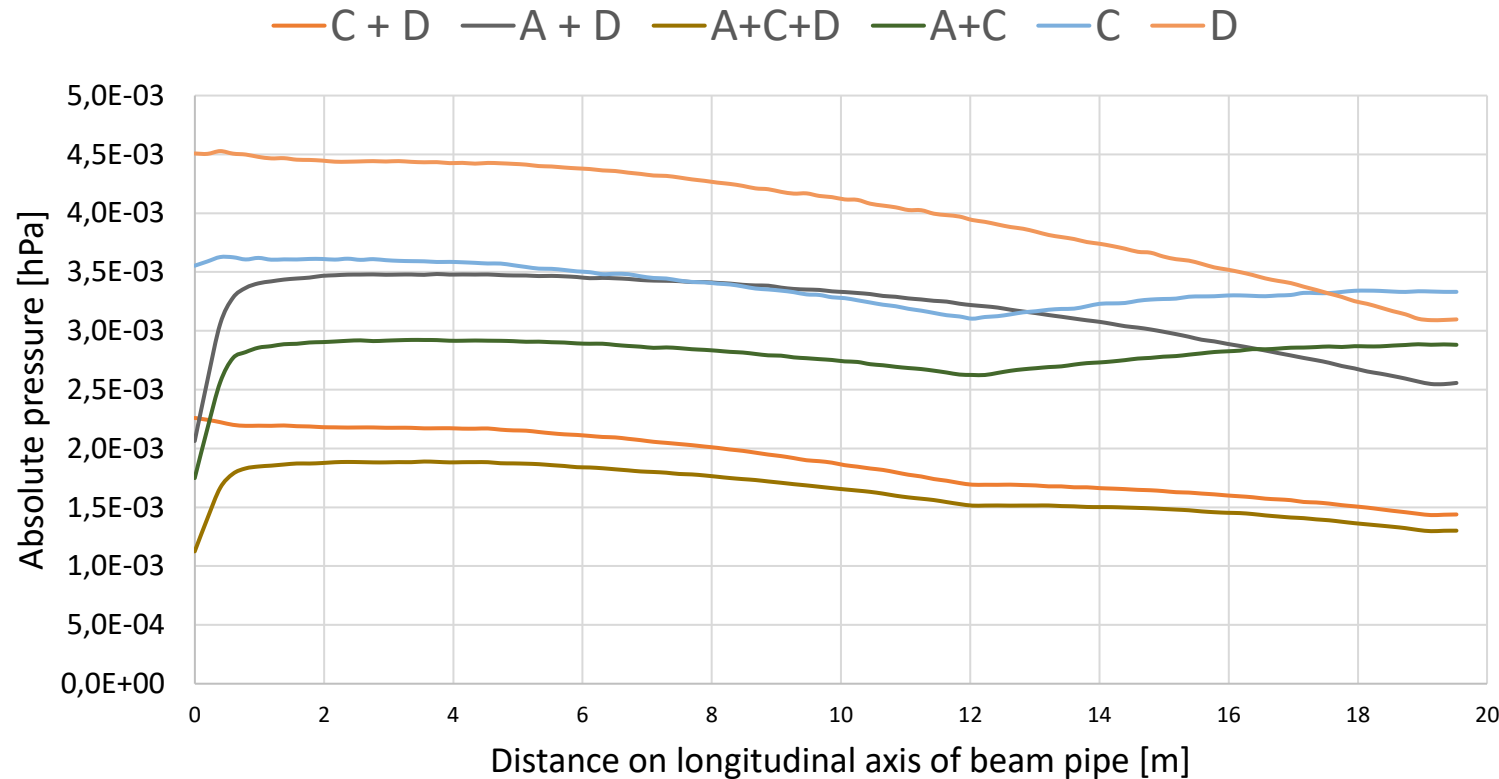
Cylindrical downstream beam pipe:

- *Stability demonstration*
- *Vacuum conditions*
- *Thickness = 3 mm*
- *Length = 3 350 mm*
- *Strain measurements*
- *Inner vacuum:  $10^{-5}$  mbar*



# CBM beam pipe: Vacuum system

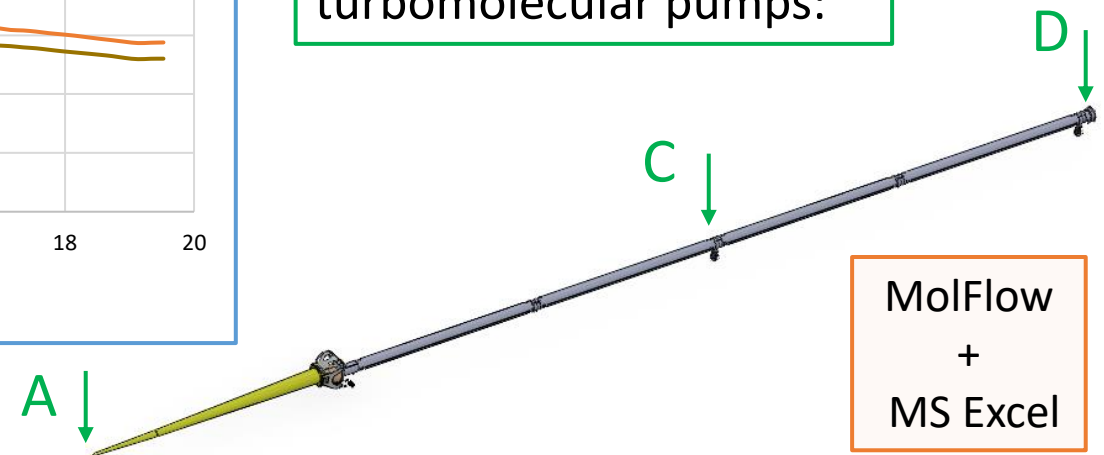
Pressure profiles



## Calculation parameters:

- Pumping speed  $S_{eff} = 35 \text{ [l/s]}$
- Outgassing rate  $q = 1e - 6 \left[ \frac{\text{mbar} \cdot \text{l}}{\text{s} \cdot \text{cm}^2} \right]$

## Options for placement of turbomolecular pumps:



MolFlow  
+  
MS Excel



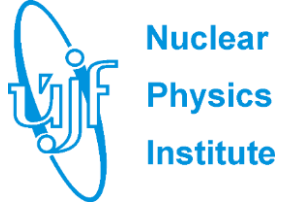
# CBM beam pipe: Conclusion

## OUTLINE OF NEXT STEPS:

- Production finalization of the Downstream section of the CBM beam pipe
- Interpretation of the test results, comparison to numerical simulations
- Further development of CBM beam pipe mounting with respect to the vacuum conditions
- Development of the bending connector, research of new concepts



**FACULTY  
OF MECHANICAL  
ENGINEERING  
CTU IN PRAGUE**



## THANK YOU FOR YOUR ATTENTION

Work supported by:

- European Union's Horizon 2020 research (EURIZON)
- Project infrastructure program under grant agreements FAIR-CZ LM2018112 and LM2023060
- Innovation program under grant agreement FAIR-CZ-OP II. CZ.02.1.01/0.0/0.0/18\_046/0016066



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871072



*E-mail: Jan.Kollarczyk@ujf.cas.cz*