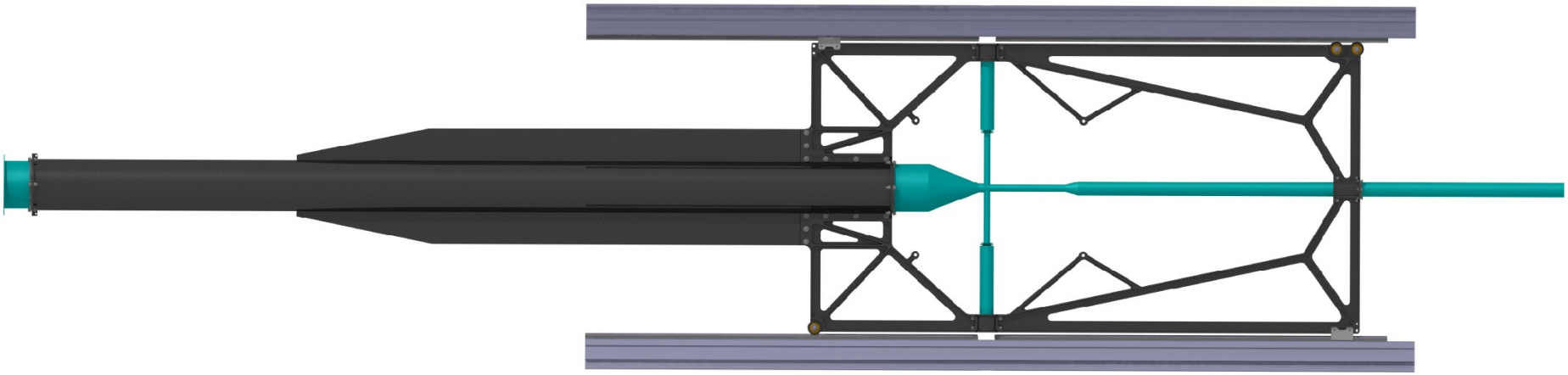
Extended design of the new concept for the Central Space Frame(CSF)



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Requirements:

- CSF has to carry the STT, the MVD and possibly the DCDC and the GBT electronics

  Electronic: ~180kg in its center of gravity 1506 mm upstream from the interaction point

  STT: ~80kg

  MVD: ~30kg

- CSF has to fix the target pipe and the target cross

- The volume of material has to be preferably low

- The material of the frame should have a low density and a low nuclear charge number

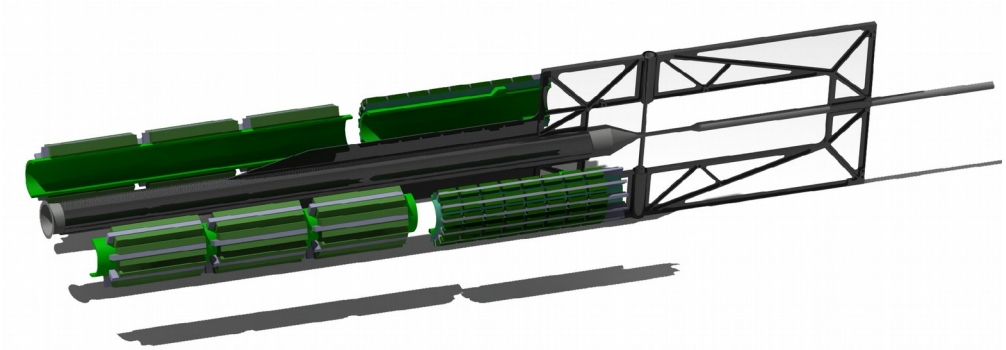
2. Material comparision

Regarding to the requirement described, carbon composite seems to be the best choice for the central space frame.

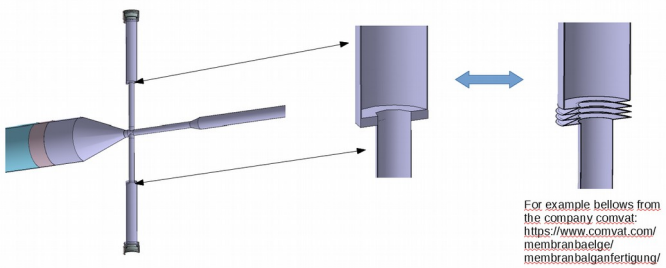
material	Titan	Aluminum	CFRP (carbon composite)
density	4,5 g/cm³	2,7 g/cm³	~1,6 g/cm³
nuclear charge number	22	13	6*
young‘s modulus	105 GPa	80 GPa	≥ 125 GPa

Suggestions:

1. An CSF design in combination with an additional support structure for the electronics. It could release the beam pipe of the critical torque without any further needs for suspensions during transport or mounting.

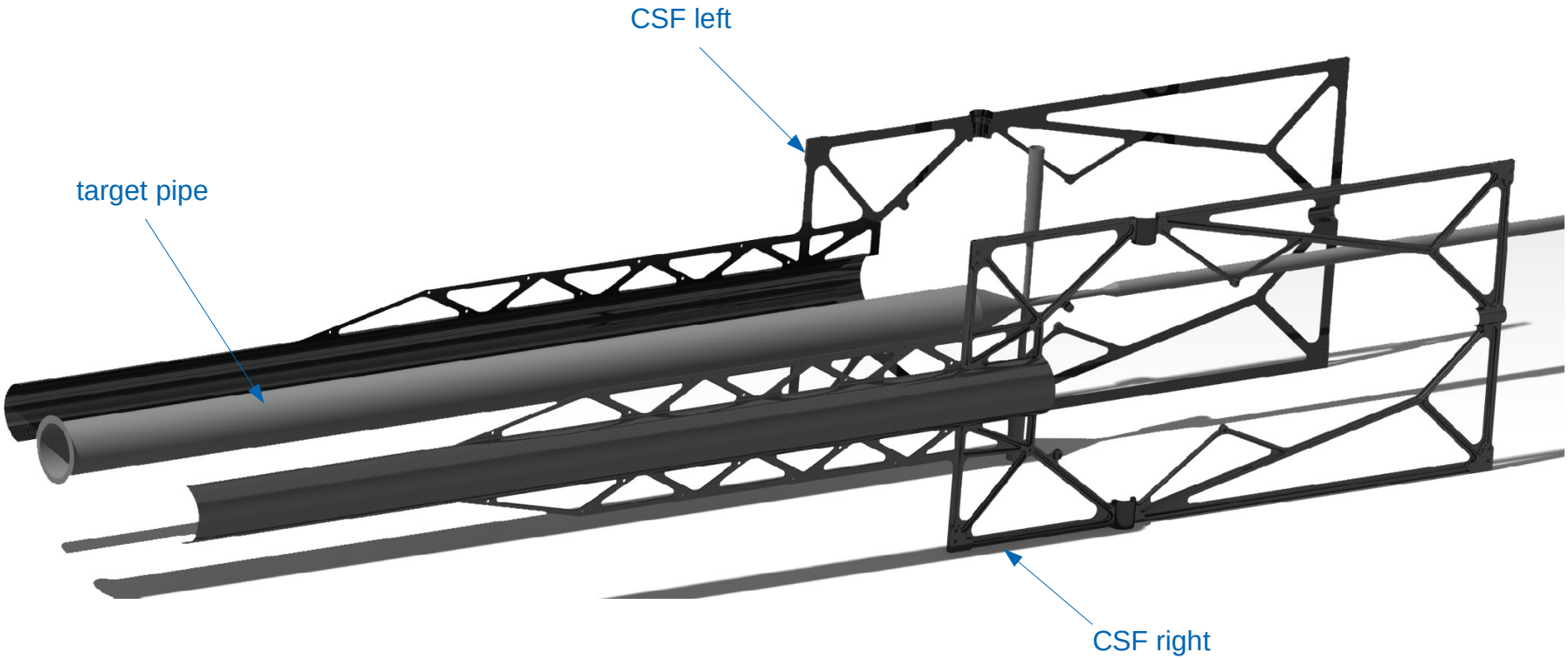


2. With two bellows perpendicular to the target pipe, instead of the current welded flange, critical stresses in the target cross could be avoided.



3. Overview of the first concept

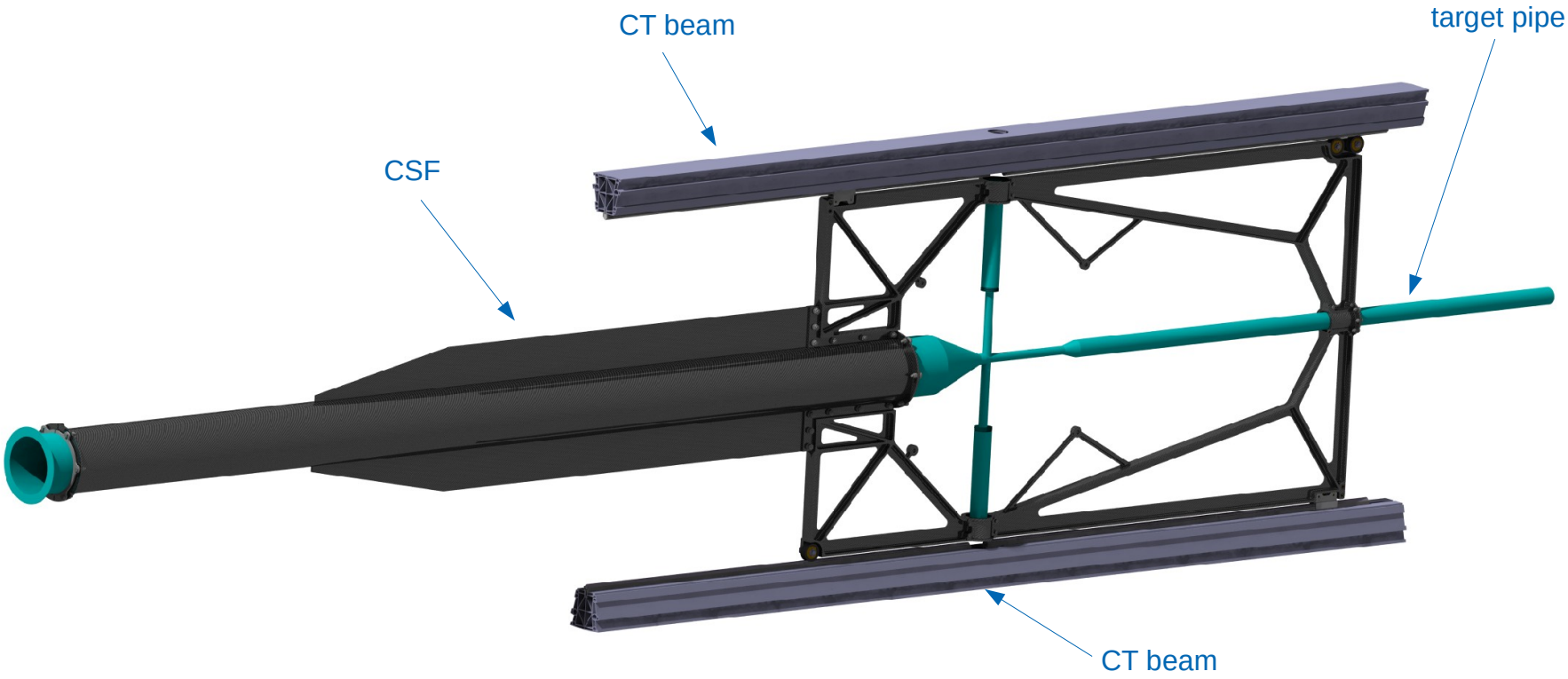
In the first design the CSF and the support structure was made of two separate symmetric halves, to be connected in the Y,Z-plane of the target cross. The two halves should be attached together with screws at the roller skates of the rails of the Barrel DIRC.



The picture below shows the extended design of the CSF with the CT beams of the Barrel DIRC.

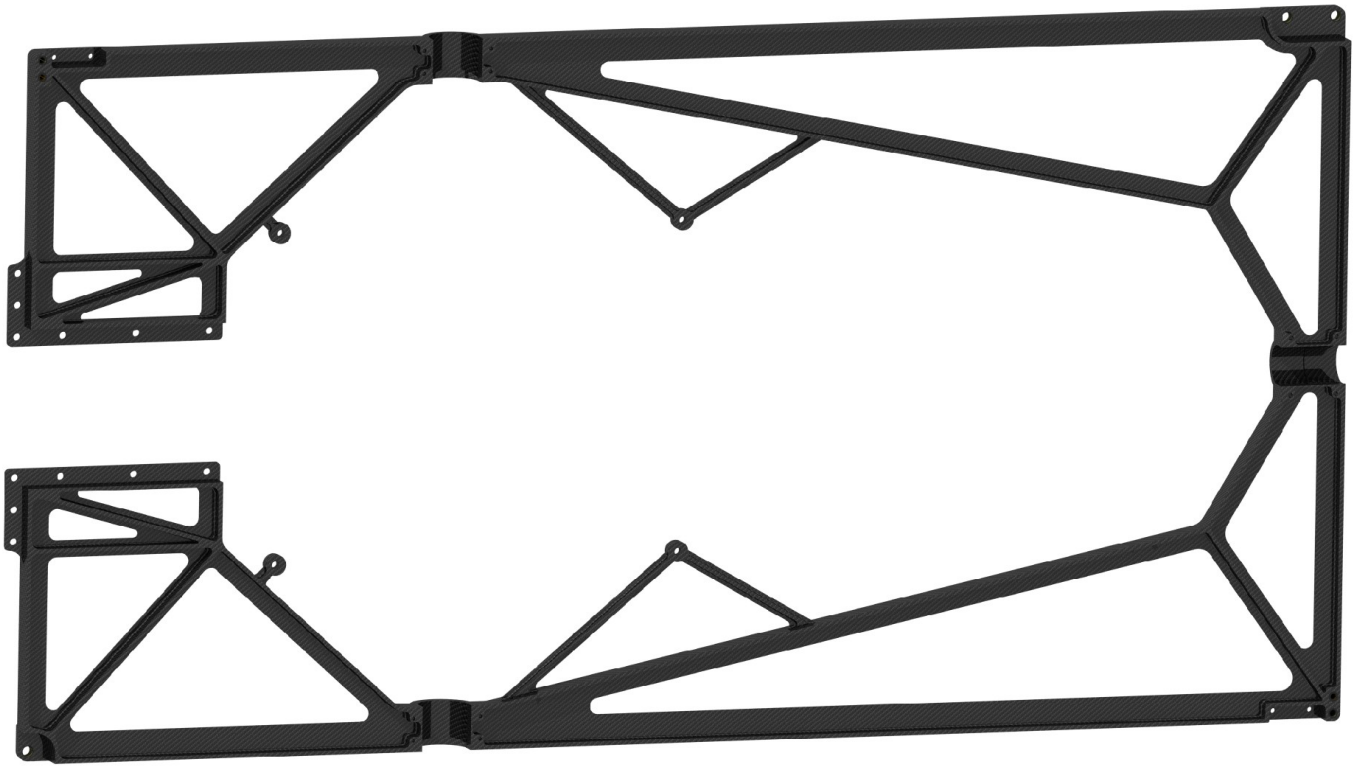
The CT beams carries the guiding system for the CSF and the inner detectors.

The following slides shows a short overview of the seperatet components of the assembly.

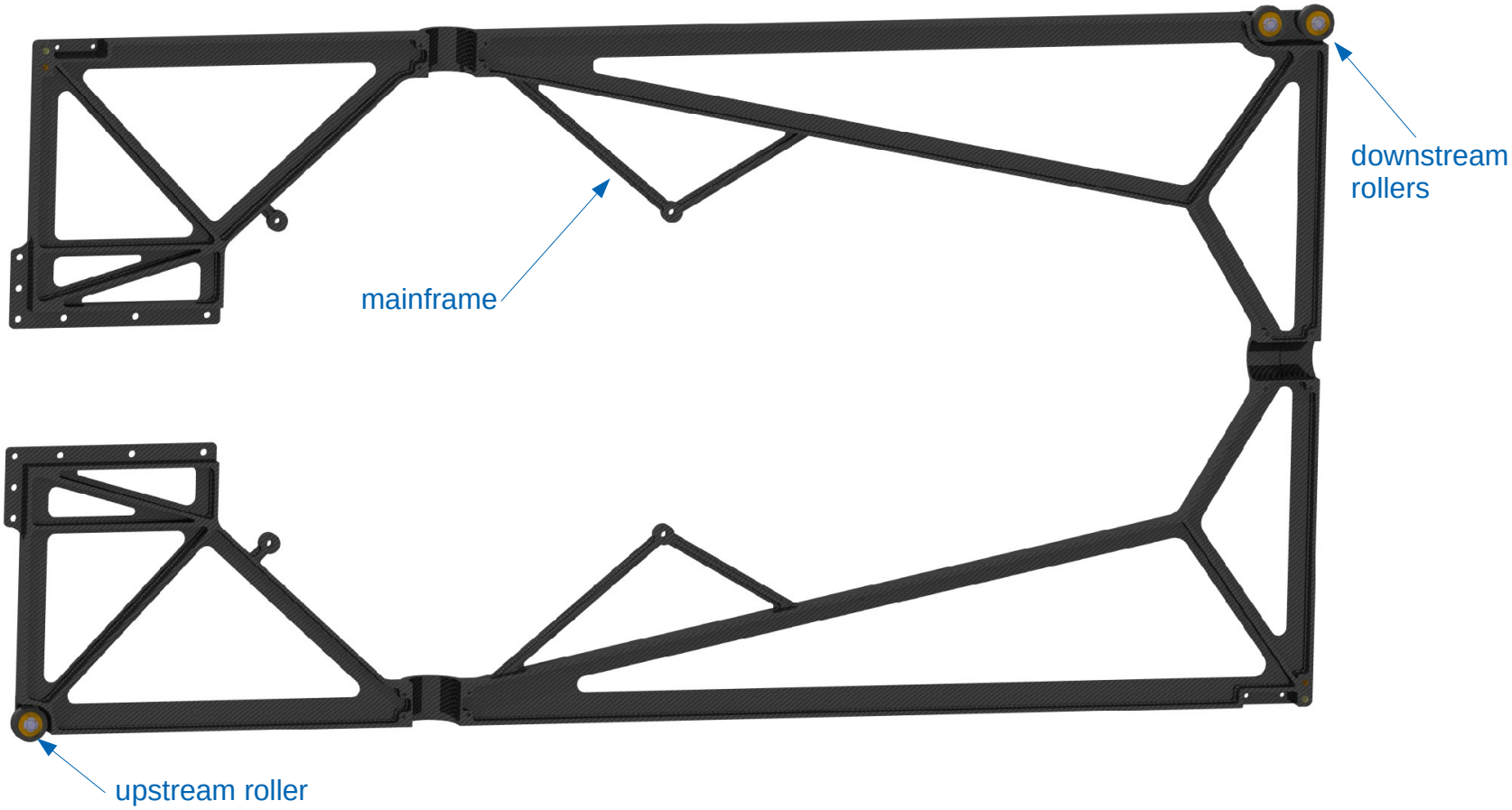


The first component of the CSF is the mainframe. It is splitted no longer in two parts, which makes production and mounting more easily.

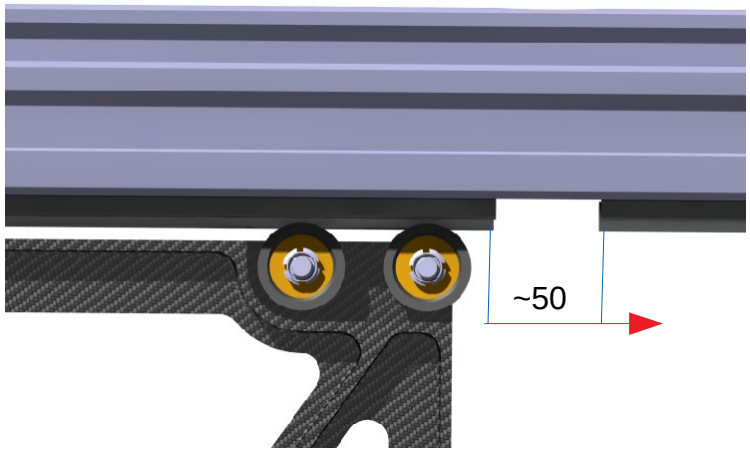
Integrated in the mainframe are several inserts for anchor points of the detectors and the roller and guiding system.



For the movement rollers with ball-bearings are in charge. Because of the magnetic field and the radiation the rollers and the bearings are made out of technical ceramic.



Because of the hole for the target pipe the CSF has to cross, two rollers are needed on the downstream side.

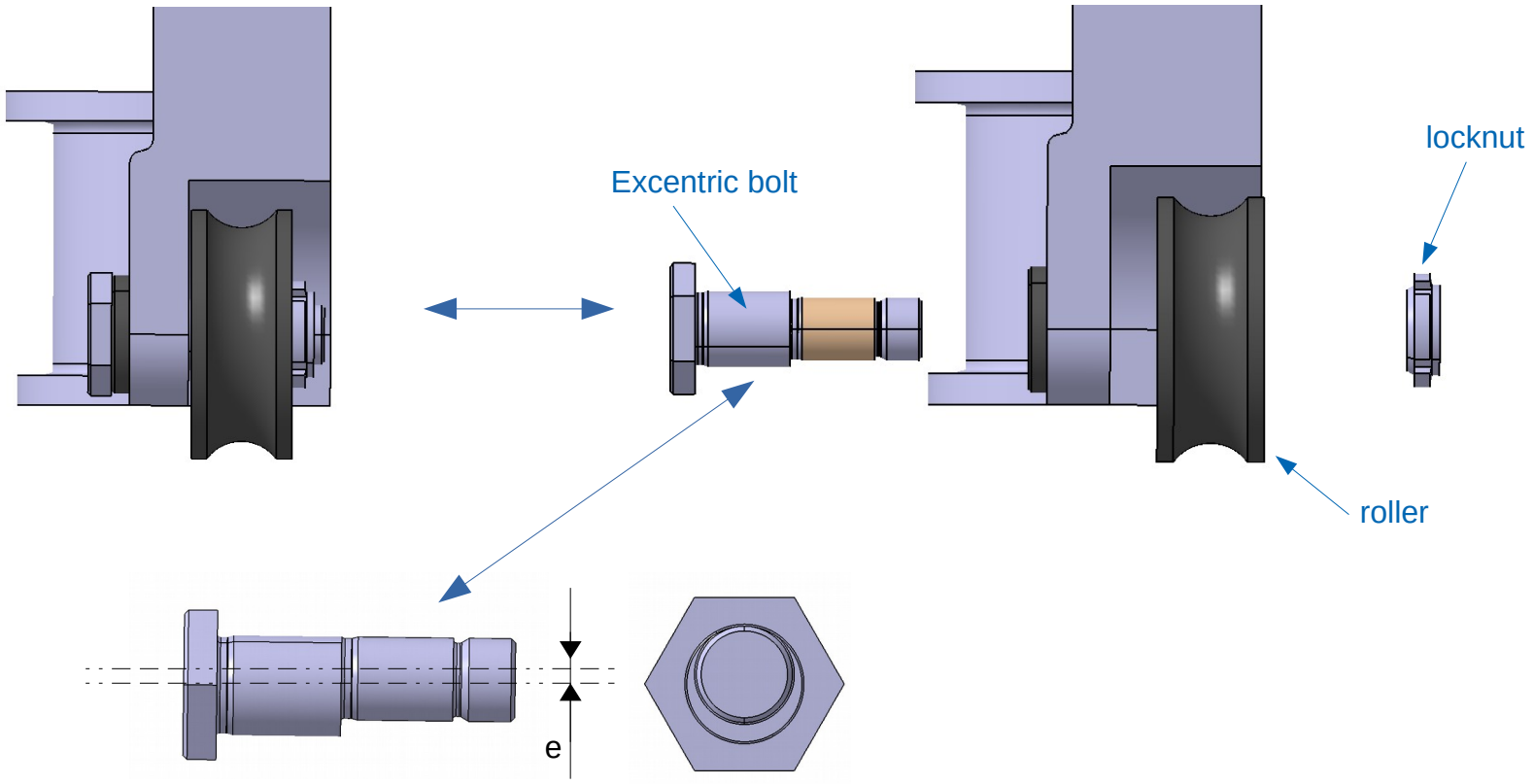


upstream roller

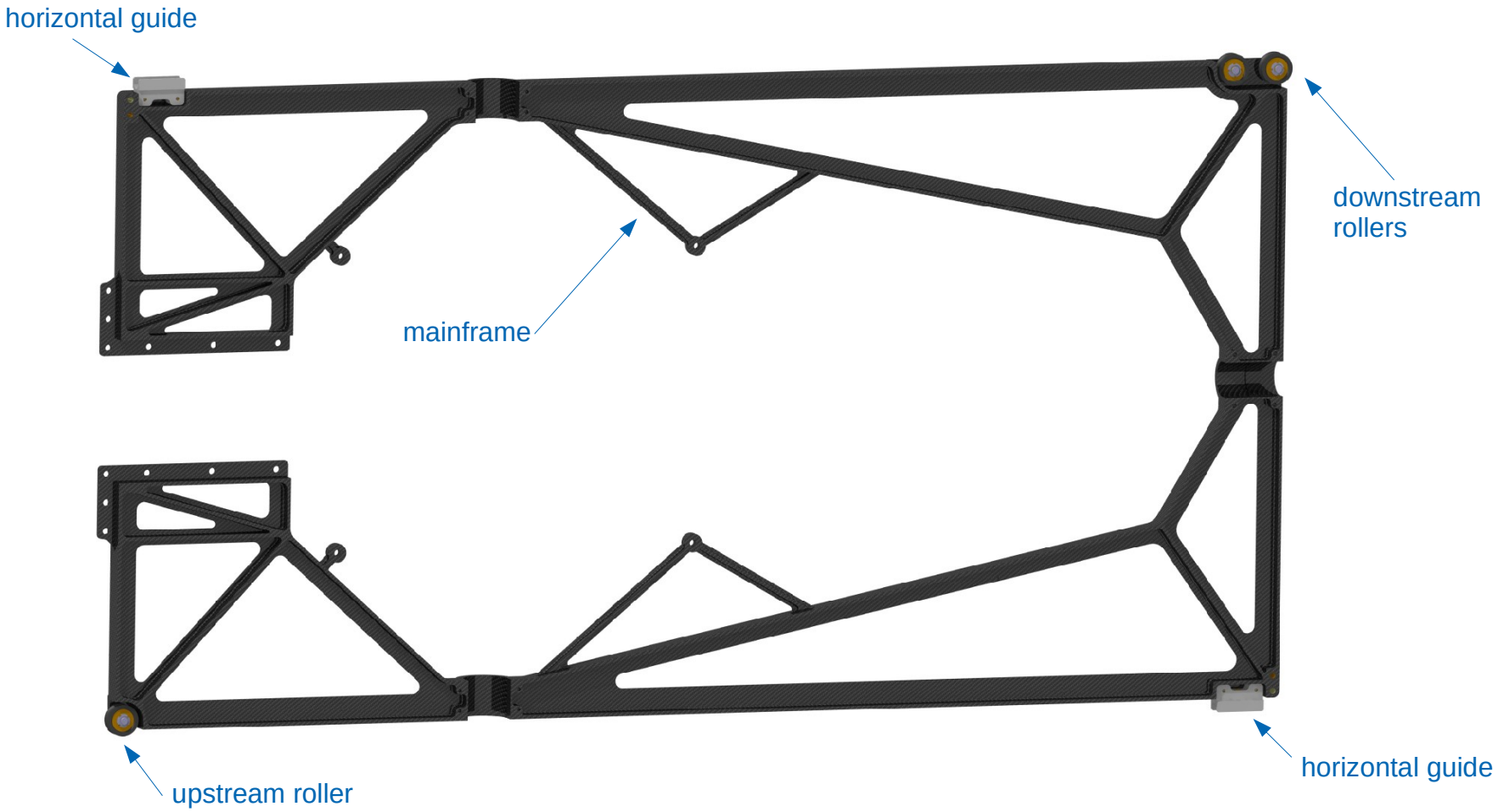
downstream rollers

The single roller on the upstream side has an eccentric bolt for adjusting the CSF in vertical axis.

By loosen the lock nut and turning the Bolt, the roller move the CSF up or down.

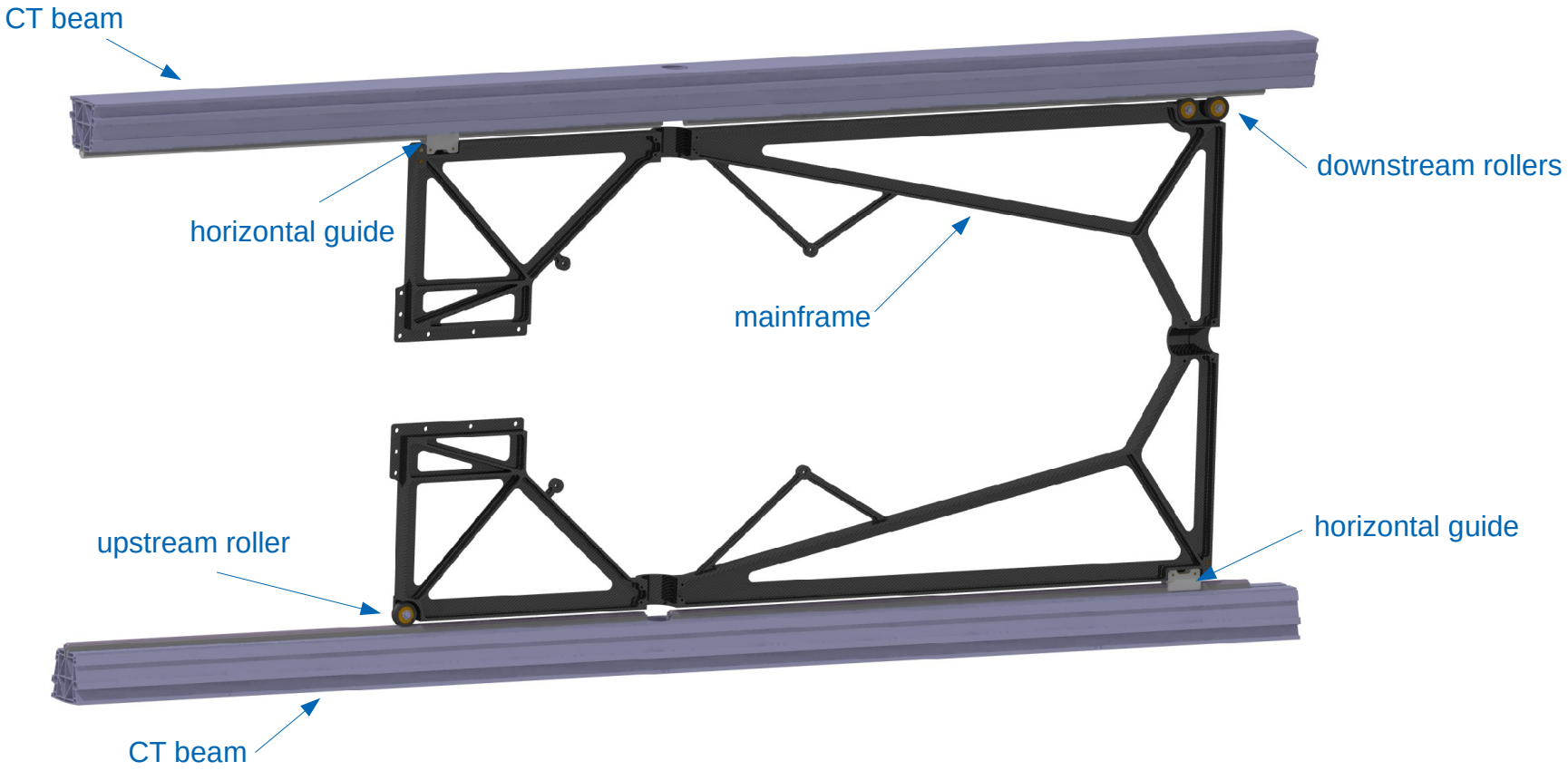


For an additional guiding only perpendicular of the beam, two components made of PEEK are foreseen.



With the rollers and the guides, the main frame can be attached to a mounting beam.

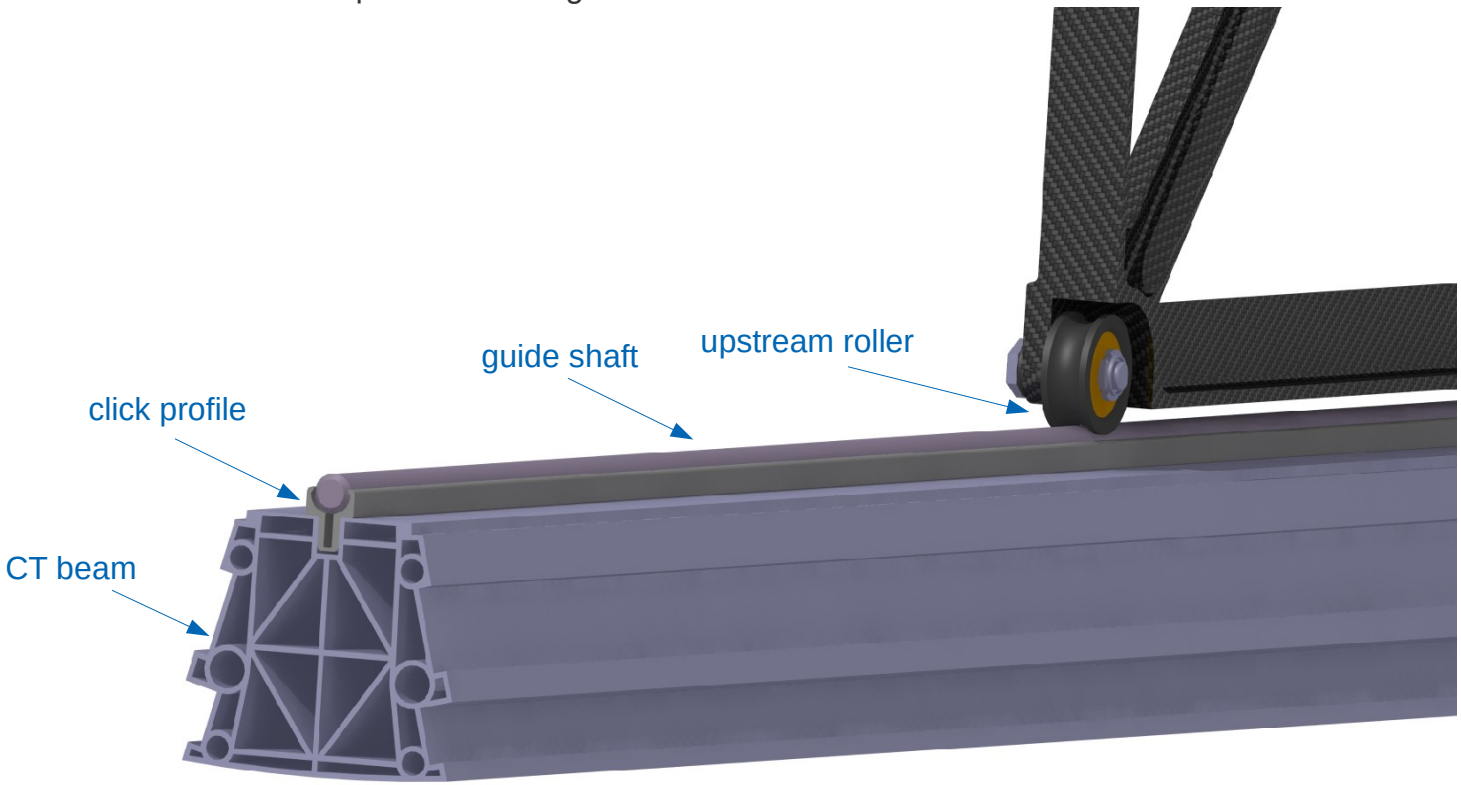
The following pictures shows the CT beams of the Barell Dirc instead of a possible mounting beam.



Attached to the CT beam is a guide shaft made of hard anodized aluminum.

The guide shaft is clicked into a aluminum profile from the company ITEM.

This Profile is pressed into a groove of the CT beam.



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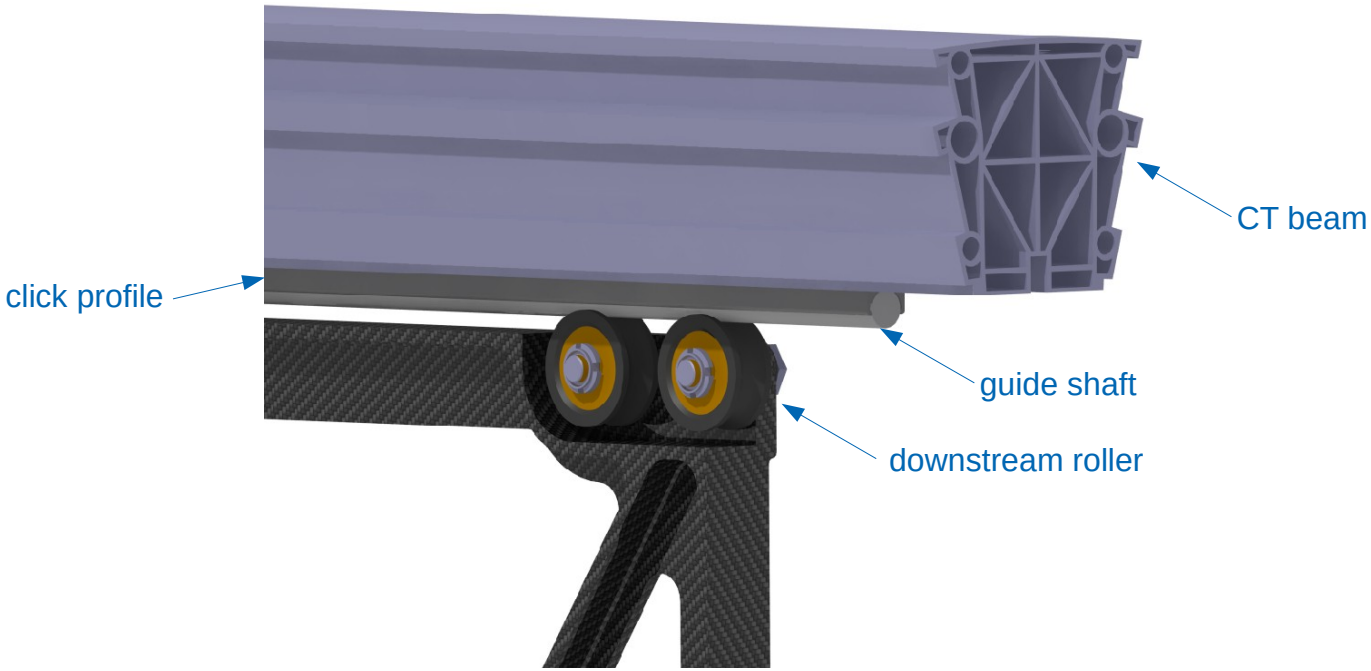
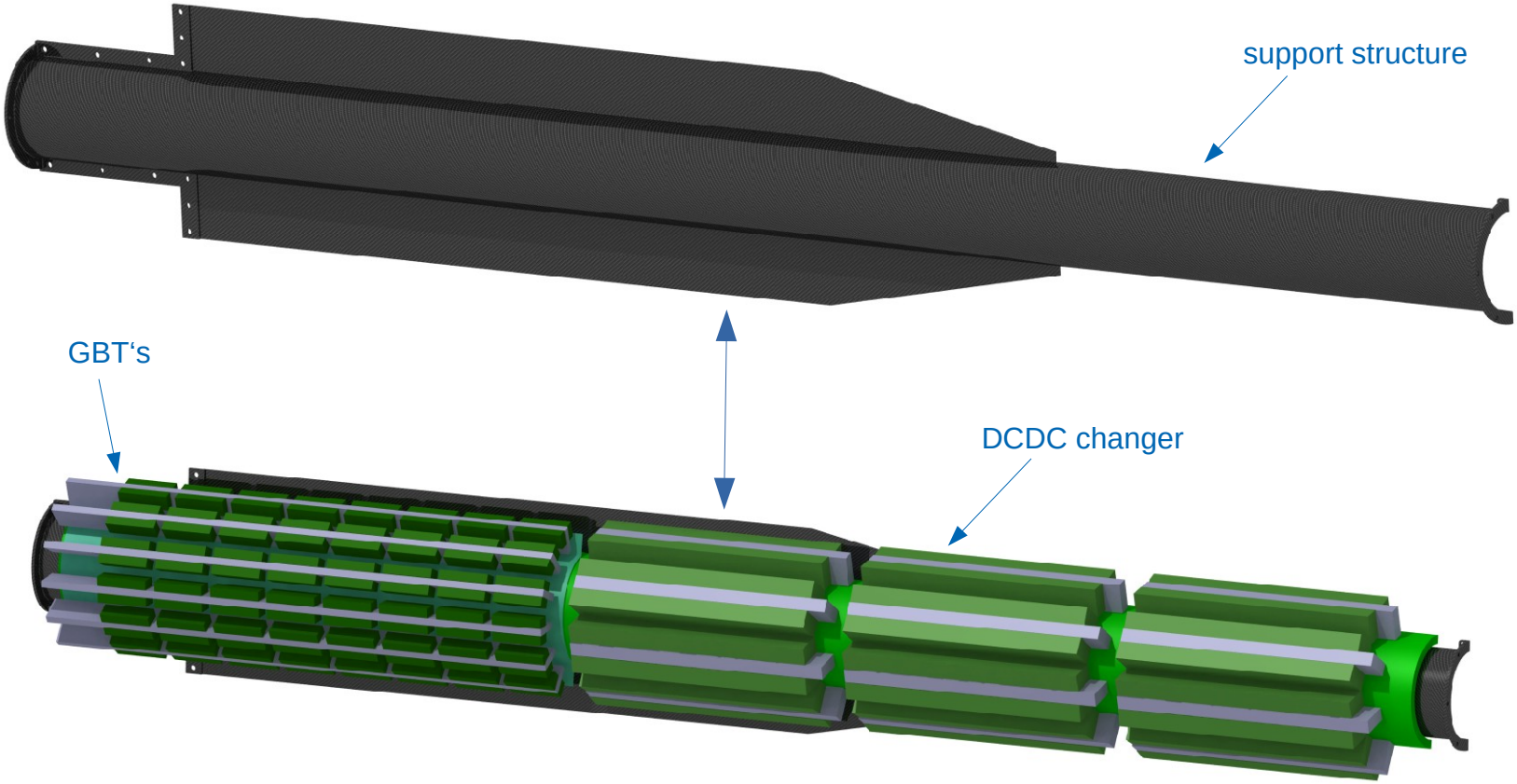


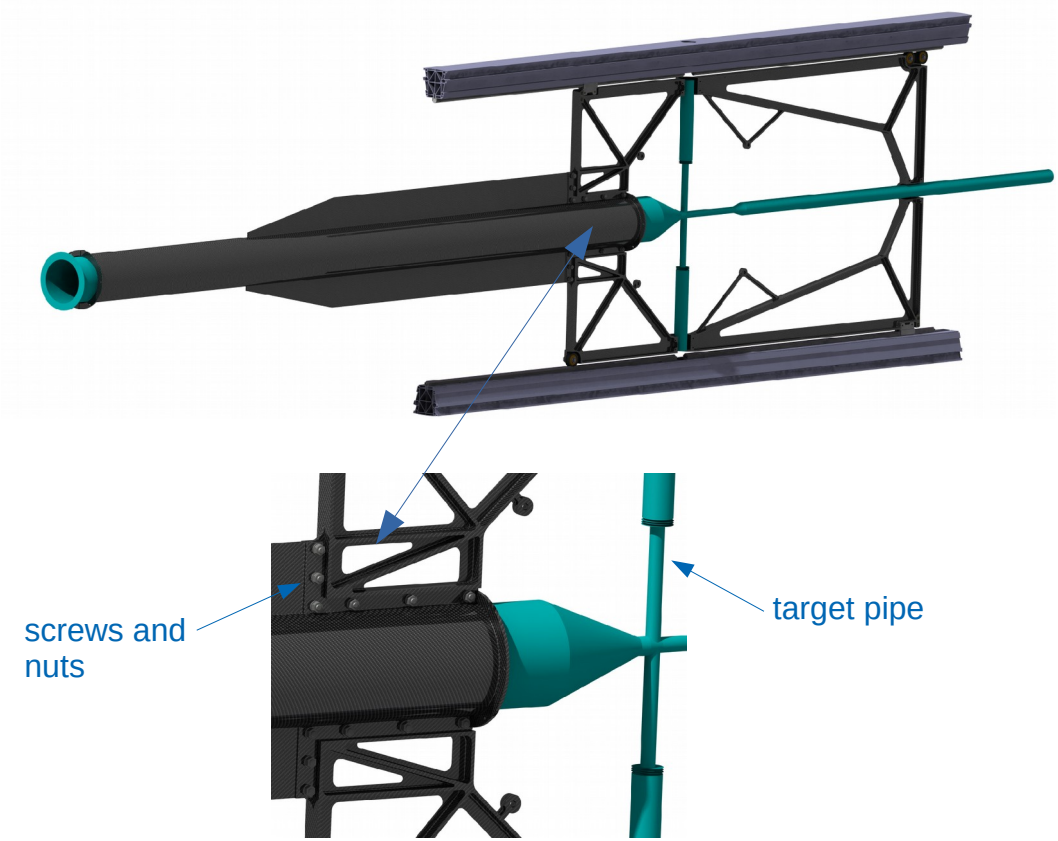
The second component of the CSF is the support structure for the electronic.

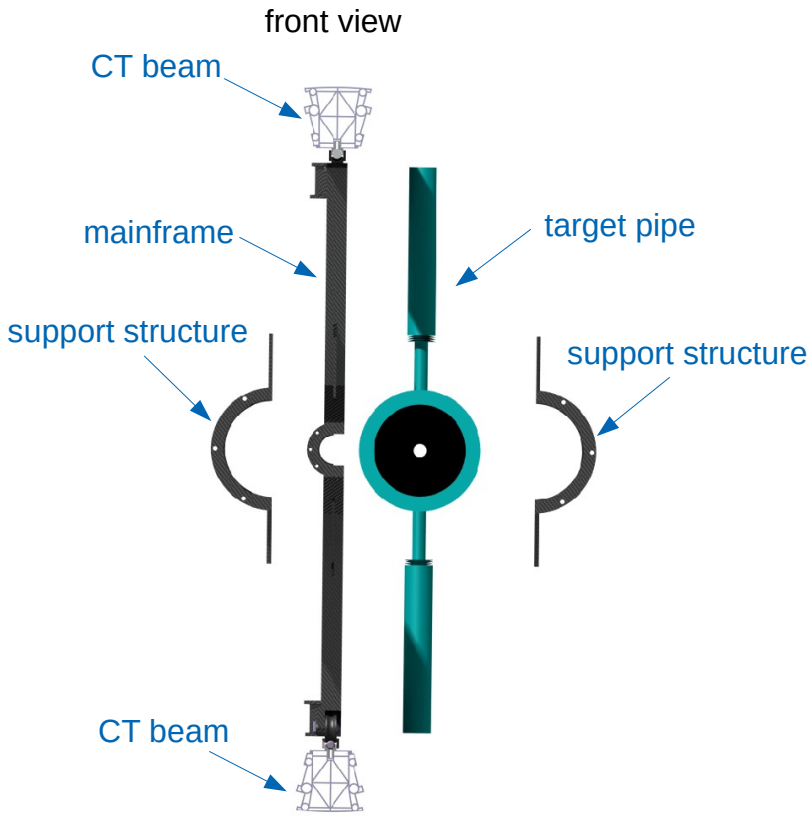
The support structure is splitted in two identical parts on the west and the east side.



Together with the target pipe, both support structures will be connected to the mainframe via screws.

With the mainframe, the four components build a very stiff assembly.





The next two components are the two adapter for the bayonet lock at the cross and the adapter for the target pipe at the downstream side.

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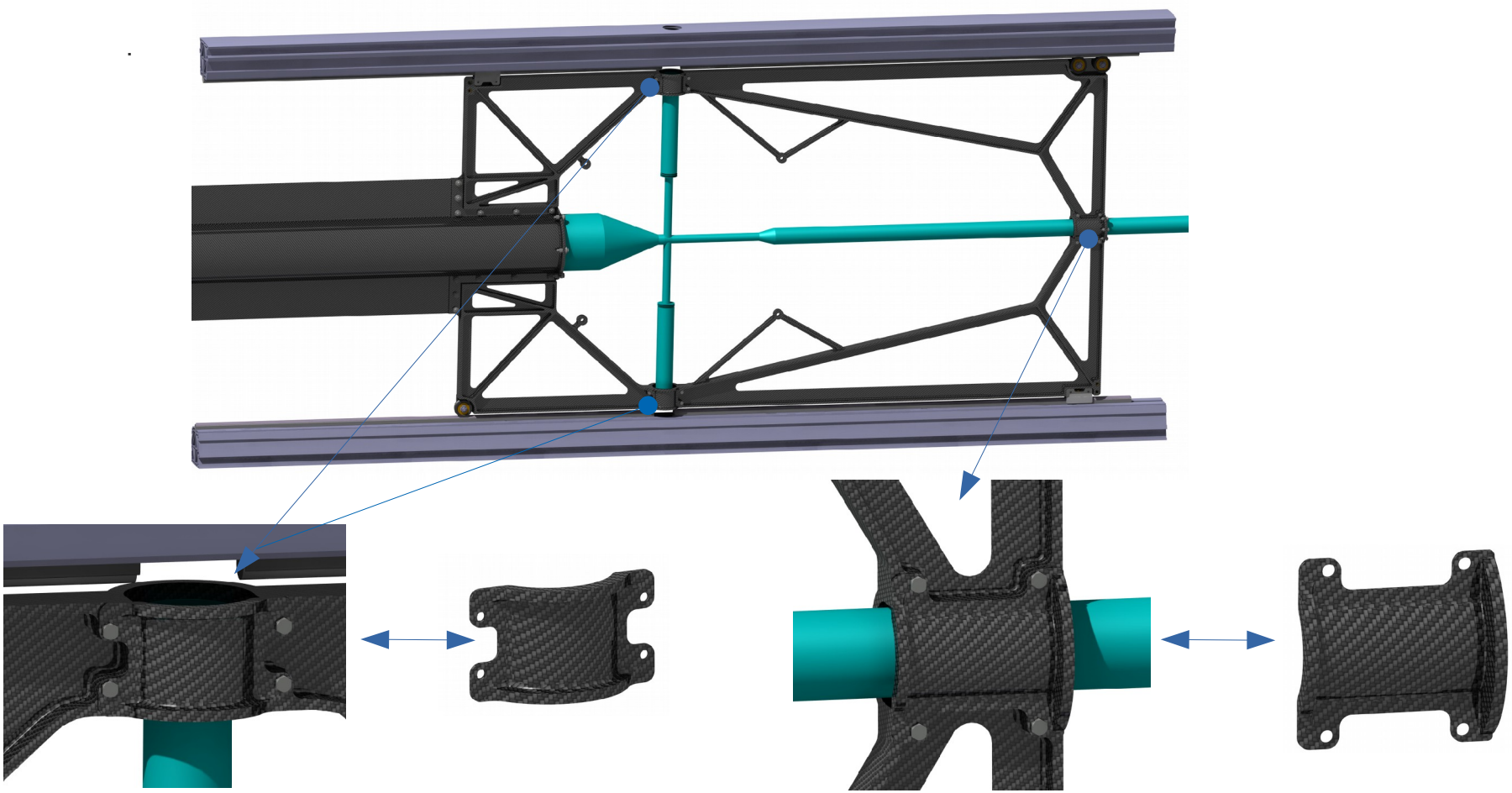
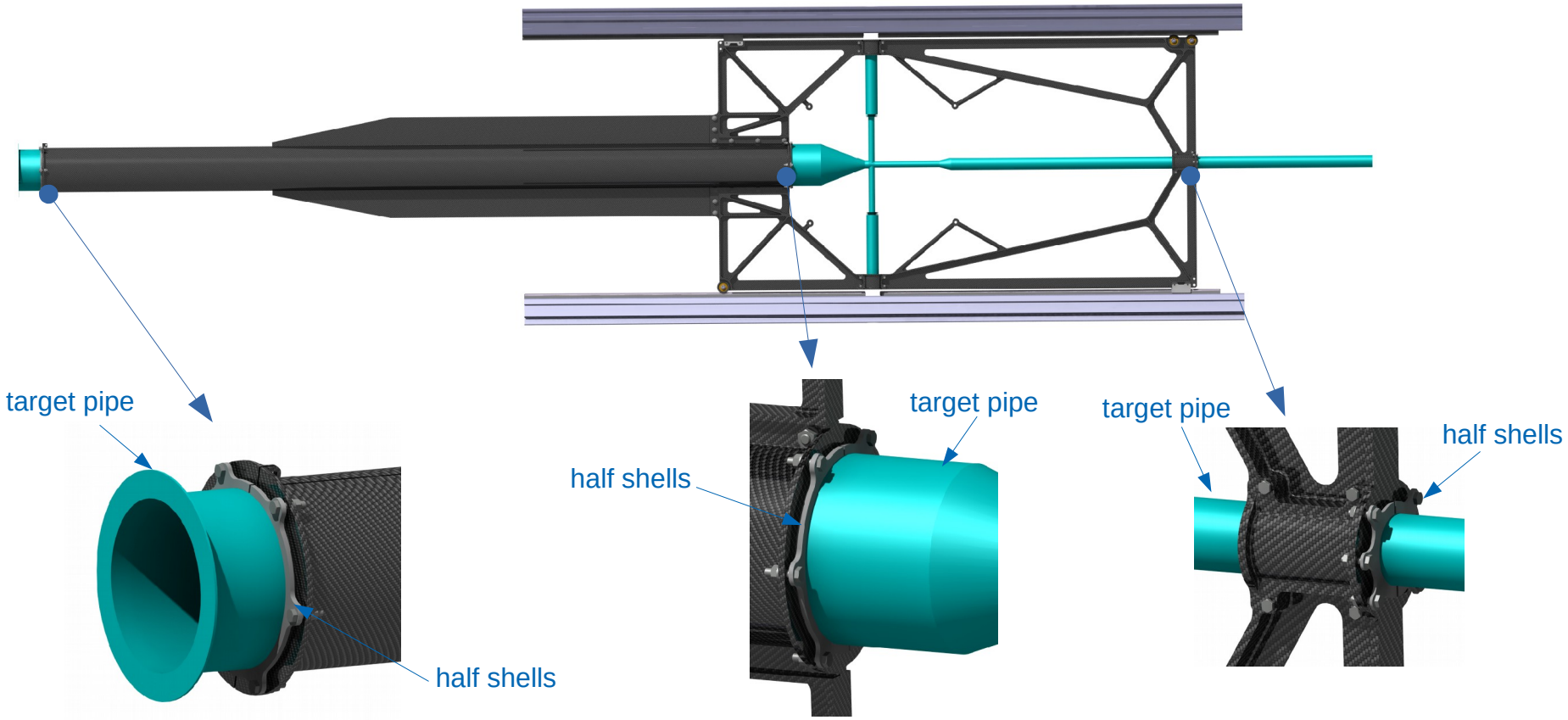


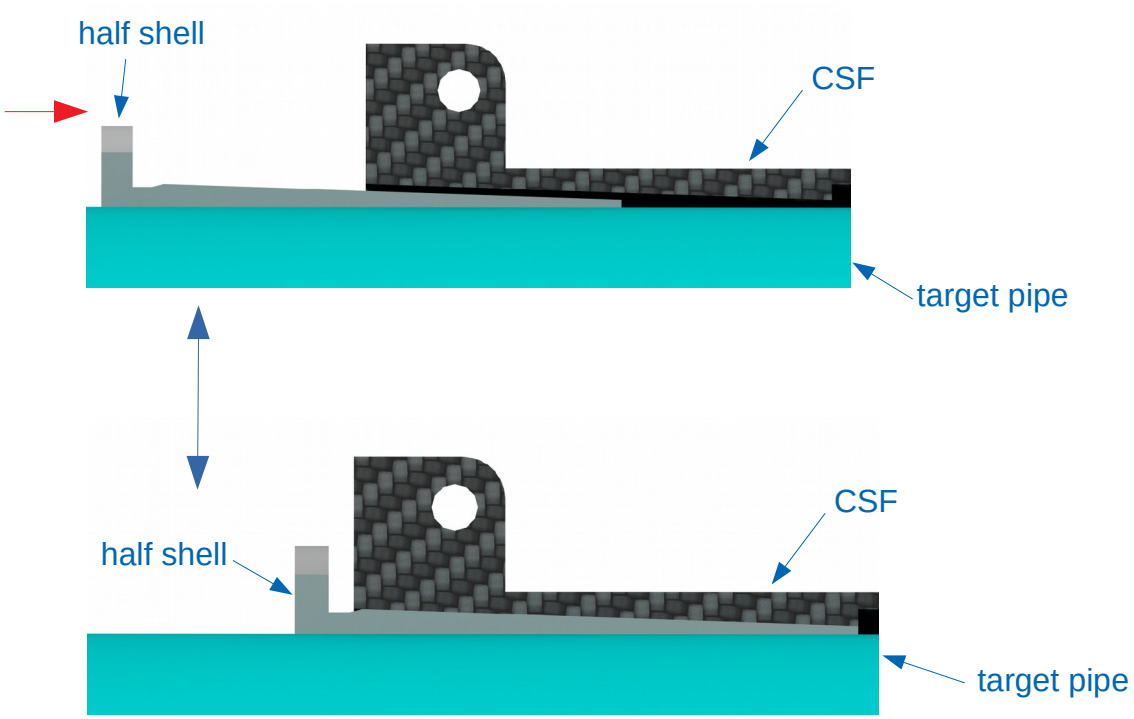
The connection between the target pipe and the CSF is made via wedge shaped half shells.

This half shells are made out of PEEK and are located at three points of the CSF.



The principal working of the half shells based on clamping the target pipe against the CSF via a wedge geometry.

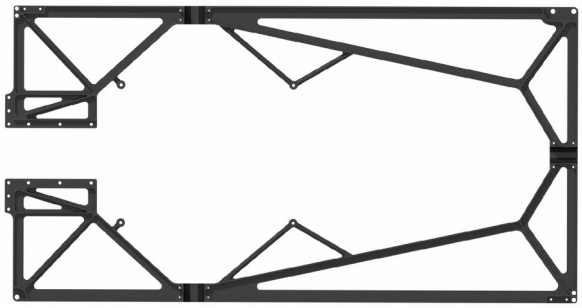
For realizing that, wedge shaped geometries are integrated in the CSF as well.



wedge shaped geometry in the CSF (here by way for example at he upstream side)

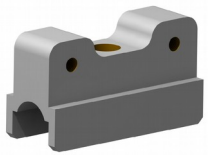
Here again the summary of the individual components of the CSF.

1x mainframe



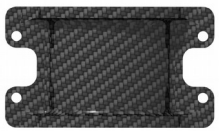
3x roller

2x horizontal guides



2x support structure

2x adapter for bayonet

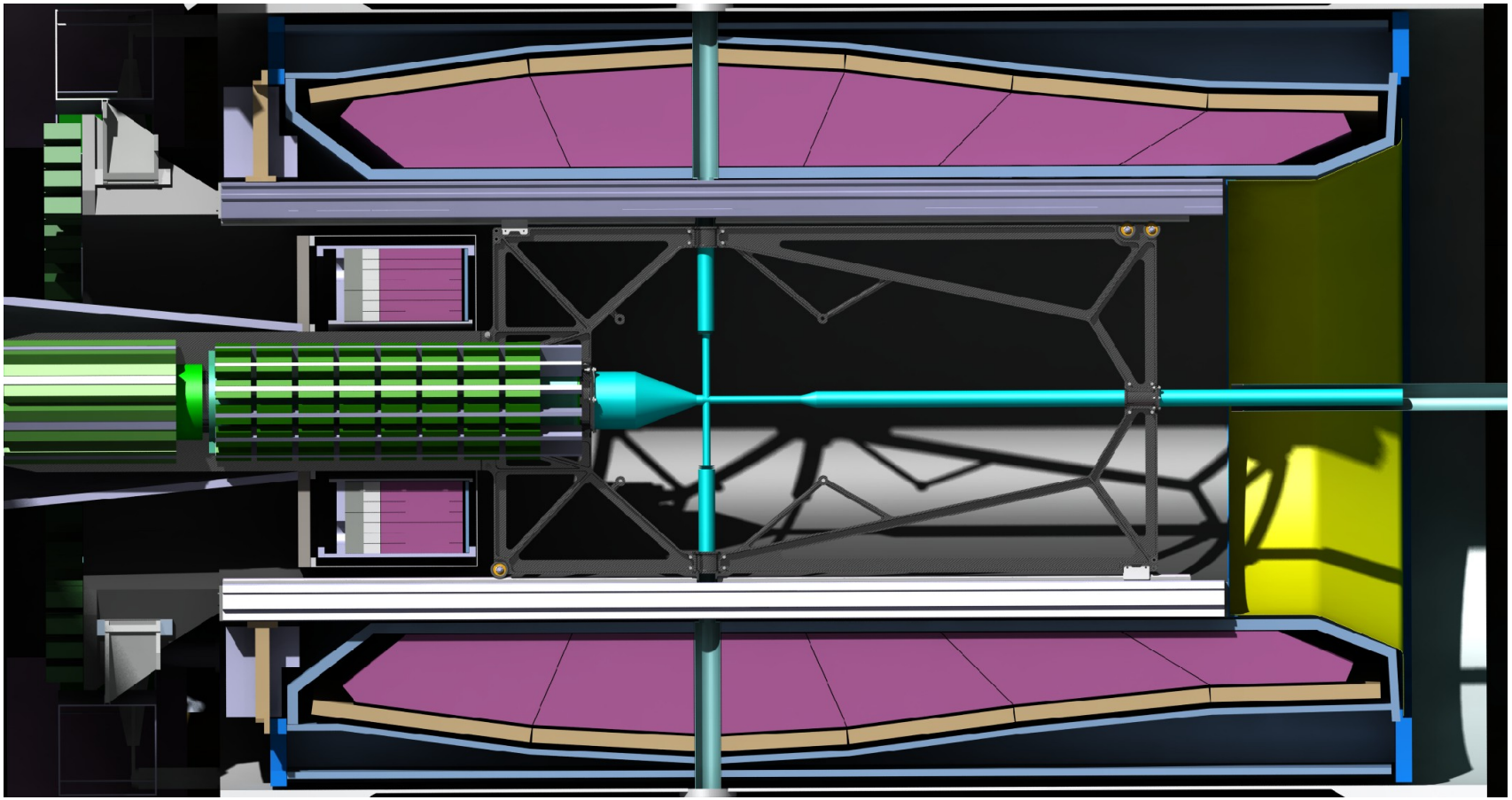


1x adapter downstream

4x half shell upstream

2x half shell downstream

The last two slides shows the CSF at its later position in the target spectrometer with and without the electronic, which will be attached to the support structure.



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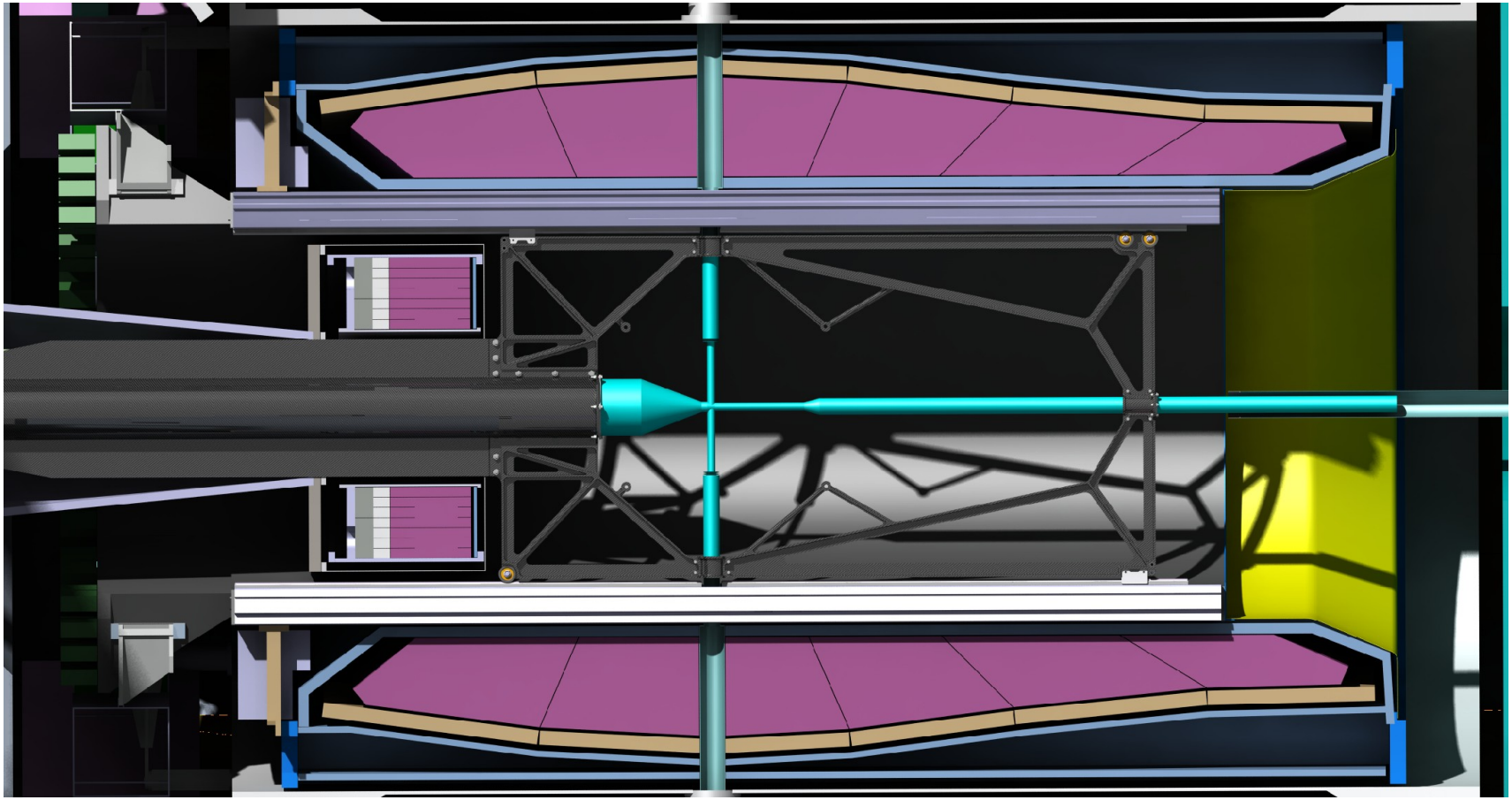

5. Conclusion

pros	cons
Target pipe will not be loaded by the electronic	The diameter of the target pipe has to be reduced from 150 mm to 140 mm(in the area of the support structure)
There is no need for suspensions during the mounting of the detectors	The CSF would be more complex regarding to the additional structure
No temporary suspension rods are necessary while installation the BW EMC in the spectrometer	
There is a lower risk to cause damage to the target pipe, while exchange the suspensions for example	
We need no welded anchor points on the target pipe for suspensions for the electronics	
By the seperated support structures, assembly of the electronic should be more flexible	
The mounting of the hole assembly can be done on the final rails system	