Update in the design of the FTD mockup

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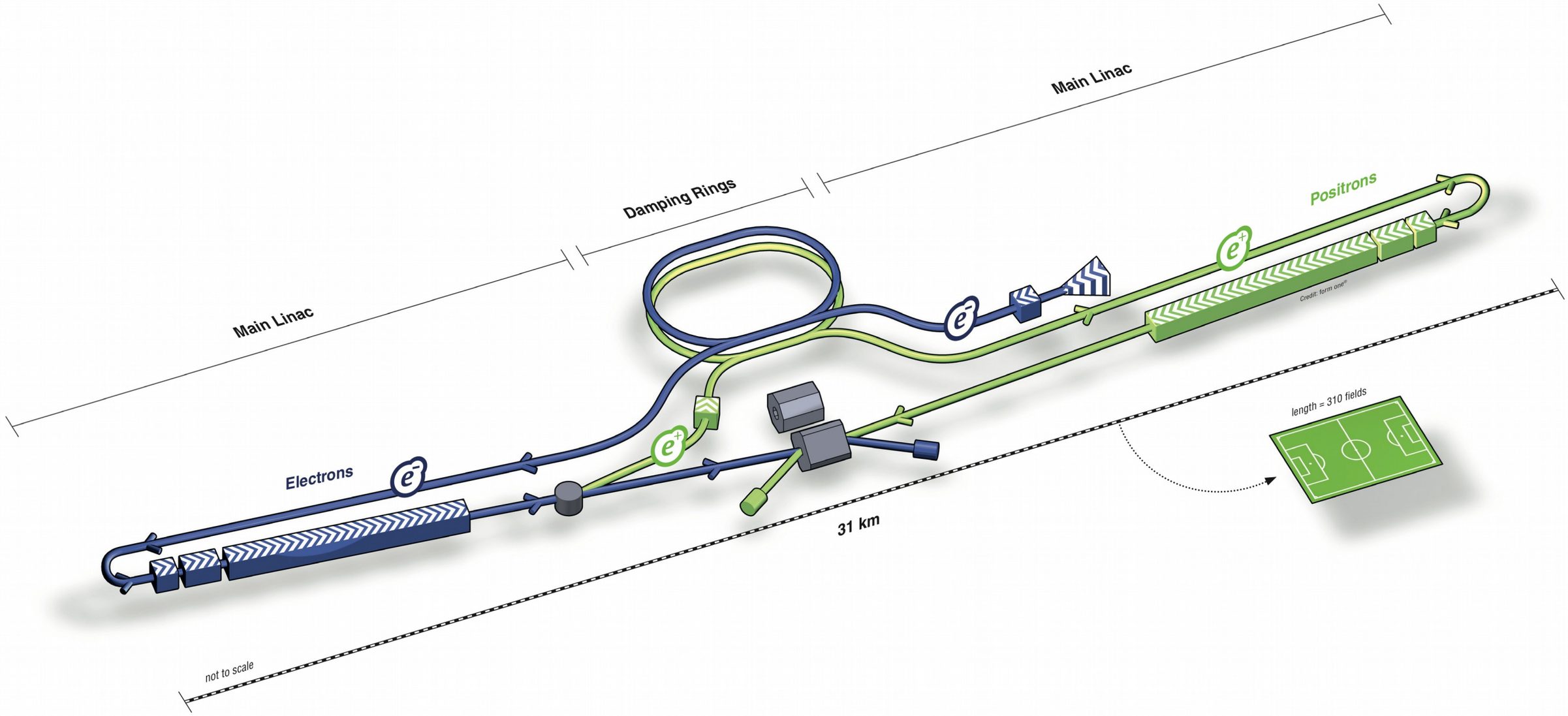
Outline

- 1 - Introduction
- 2 - Mock-up
- 3 - Summary

1.1 ILC

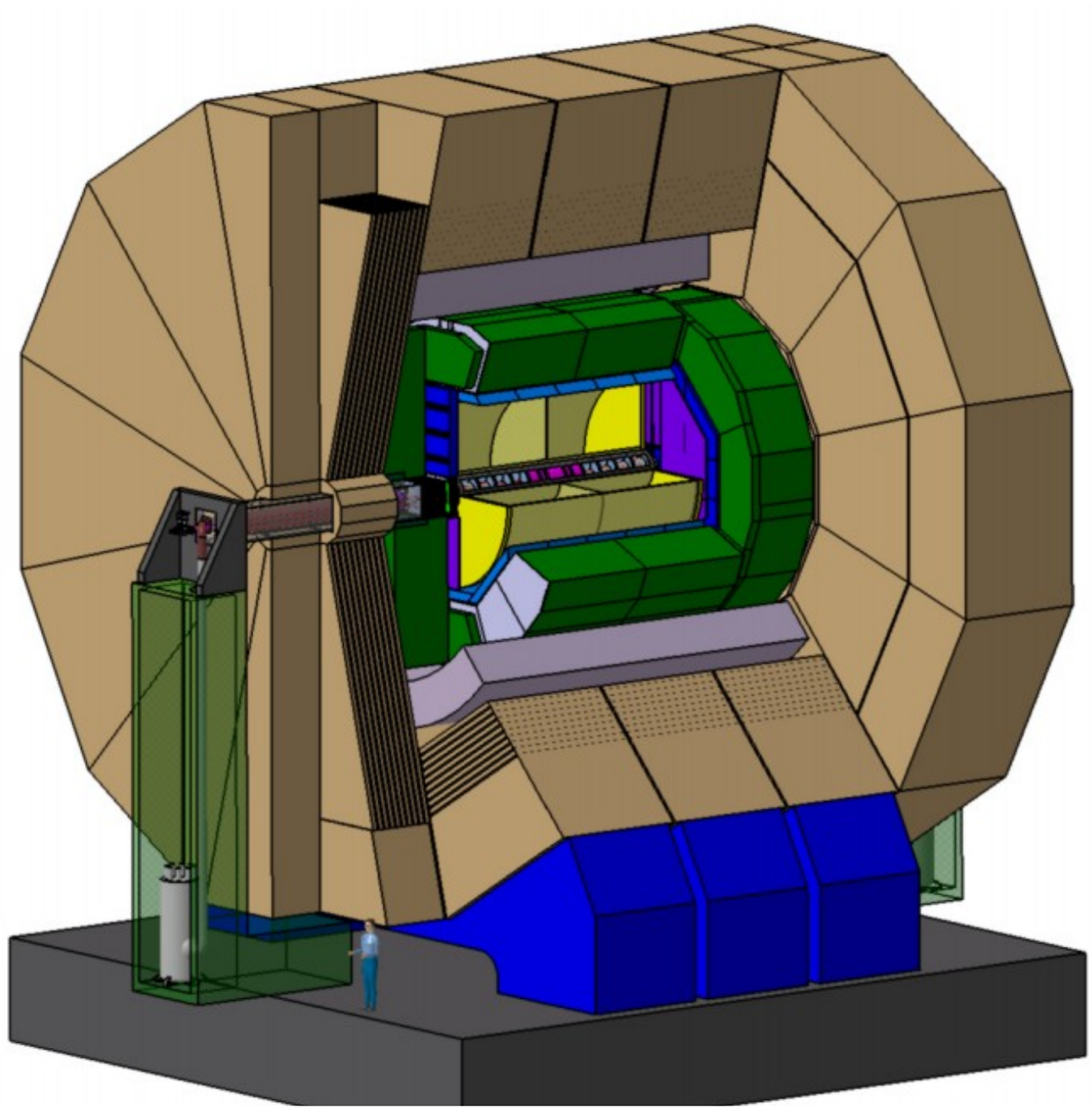


Linear e- e+ accelerator

Complement of the LHC at CERN

It will contribute to explore the physics beyond the Standard Model

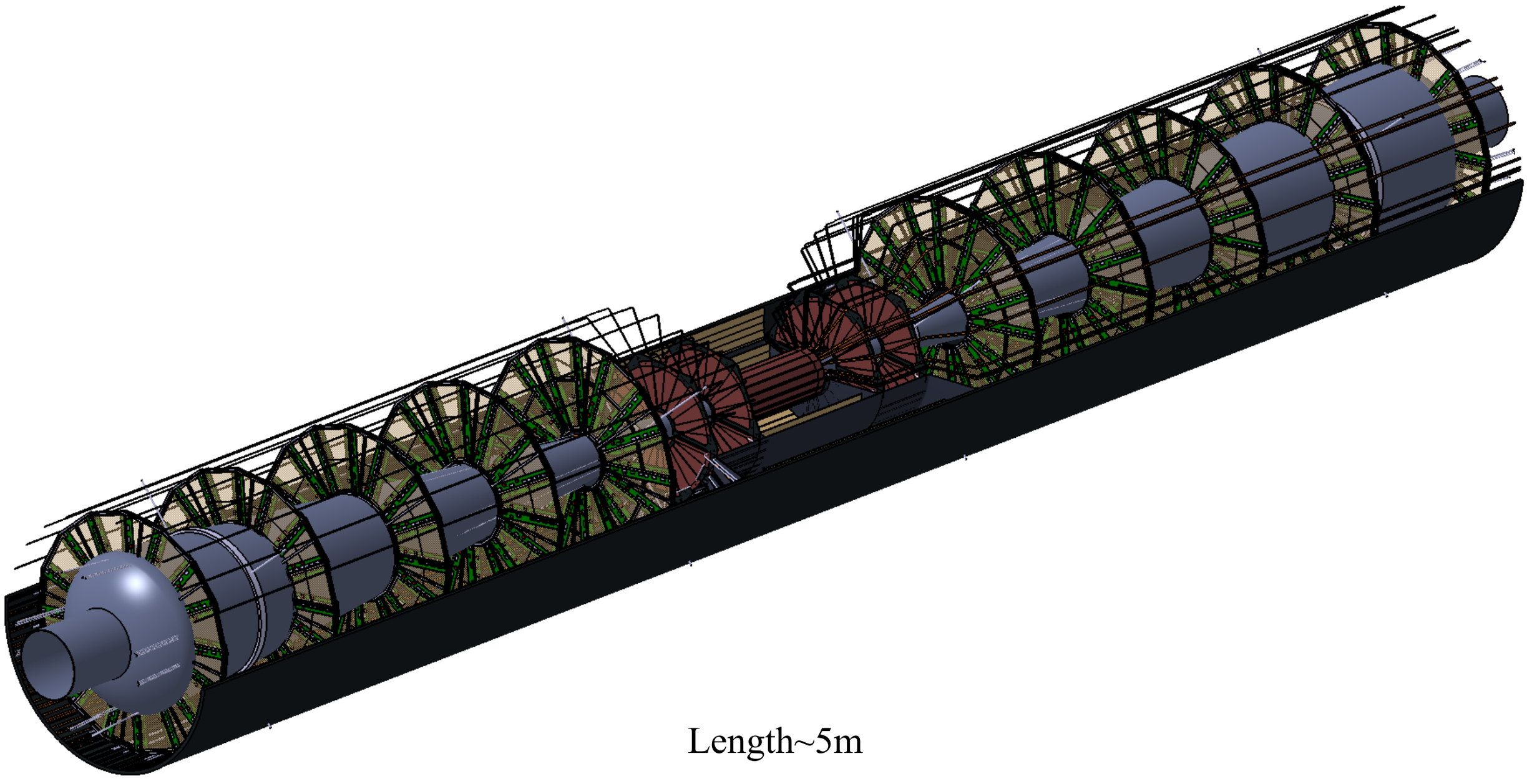
1.2 ILD



The ILD detector systems have many layers surrounding the point where the beams collide

We will focus in the inner most region (the first layer)

1.3 Innermost region

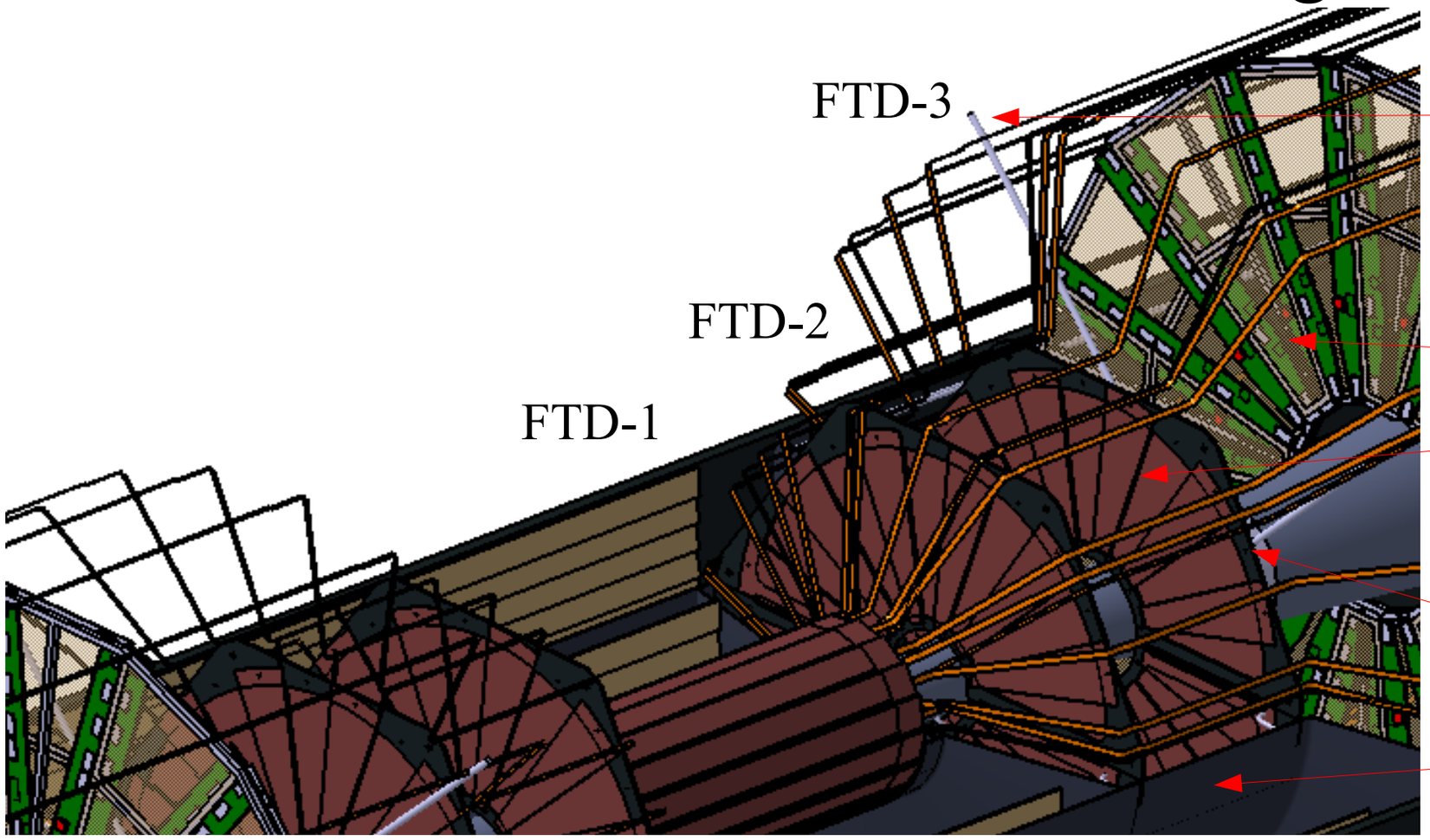


Length~5m

Diameter~0,64m

As light and rigid as possible

1.3 Innermost region



Integration ⟷ **Materials**

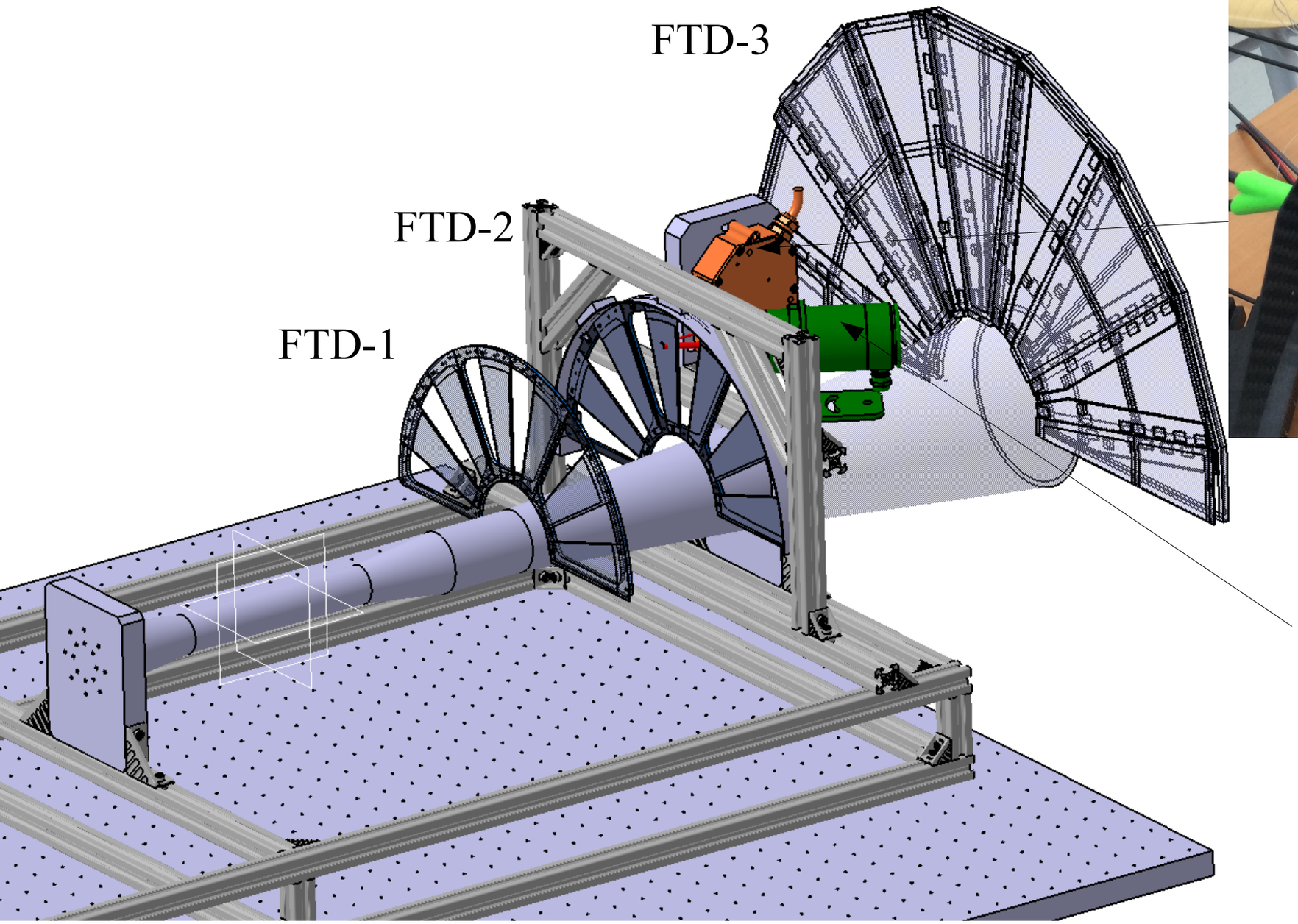
- Radiation length
- Mechanical properties
- Joints
- New materials
- ...

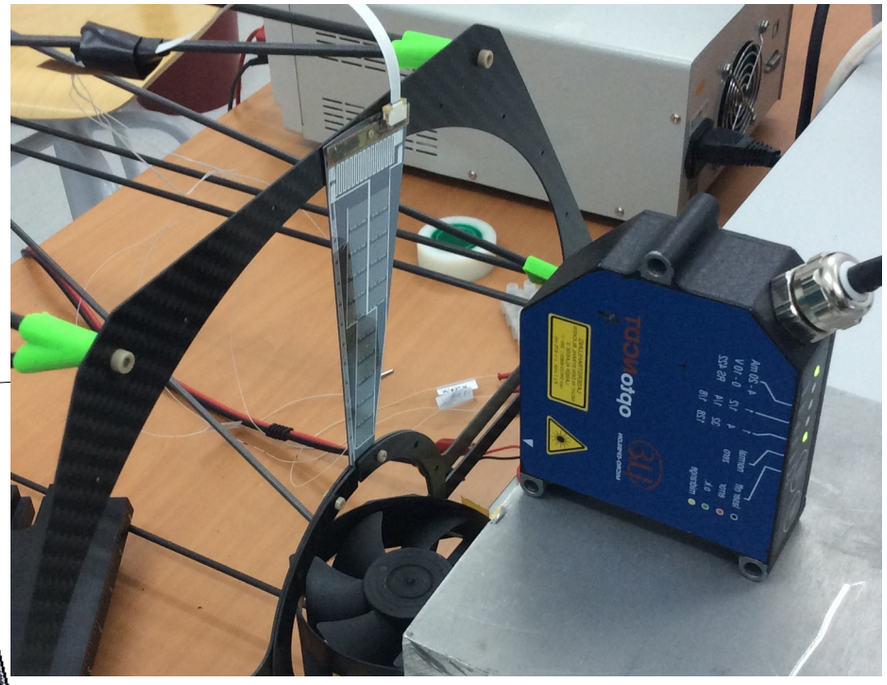
Services

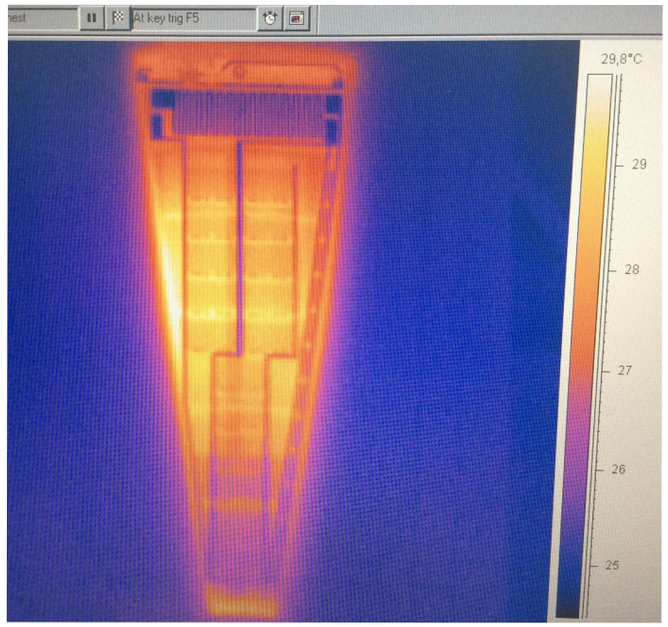
- Power to deliver
- Cooling strategy
- Layout
- ...

- High mechanical stability
- Low material quantity is a must
- Innermost region
- High power applied
- Air cooling is the only option

2.1 Mockup concept

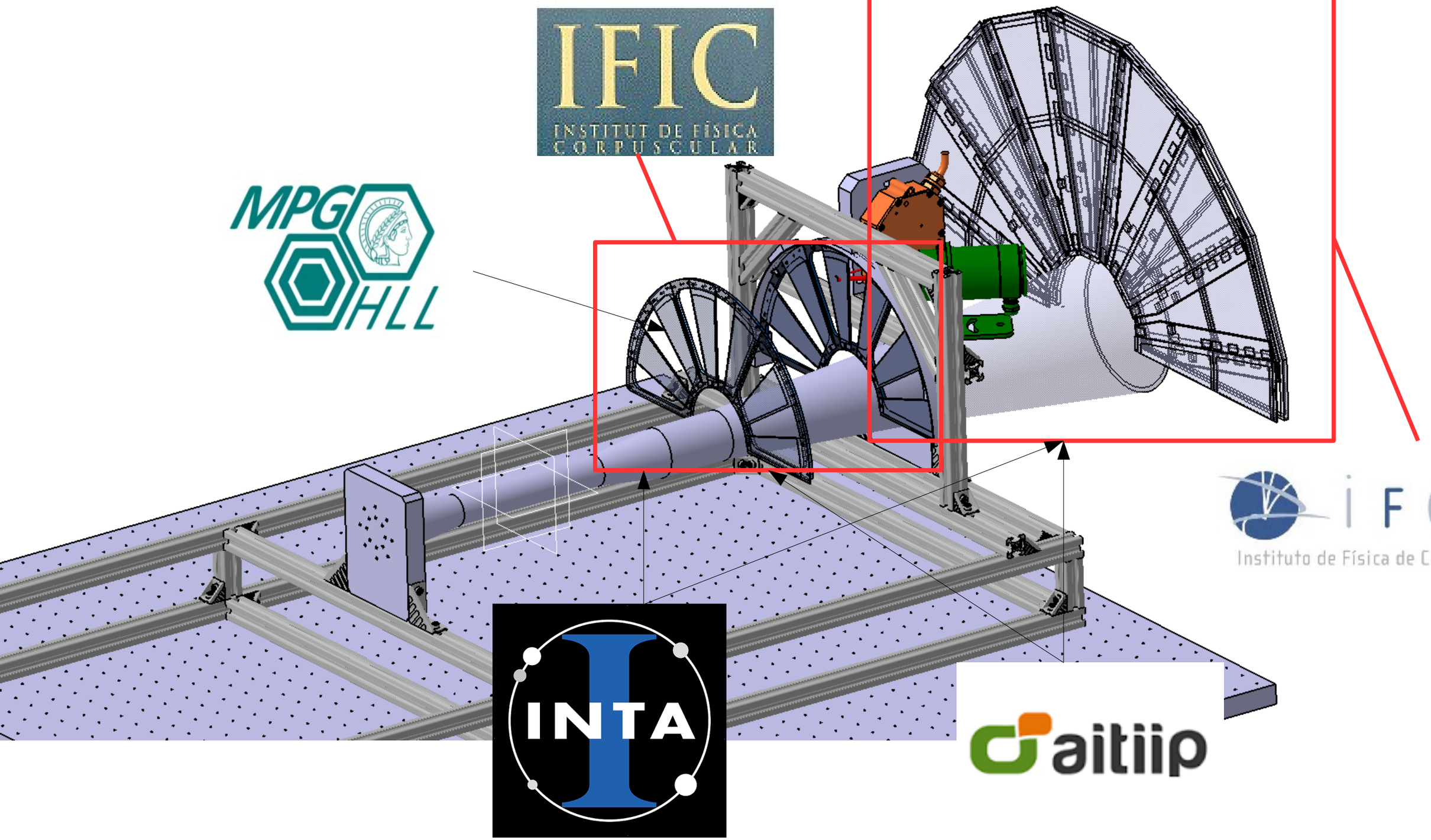






2.2 Mockup build up strategy

Objective: mechanical setup understanding



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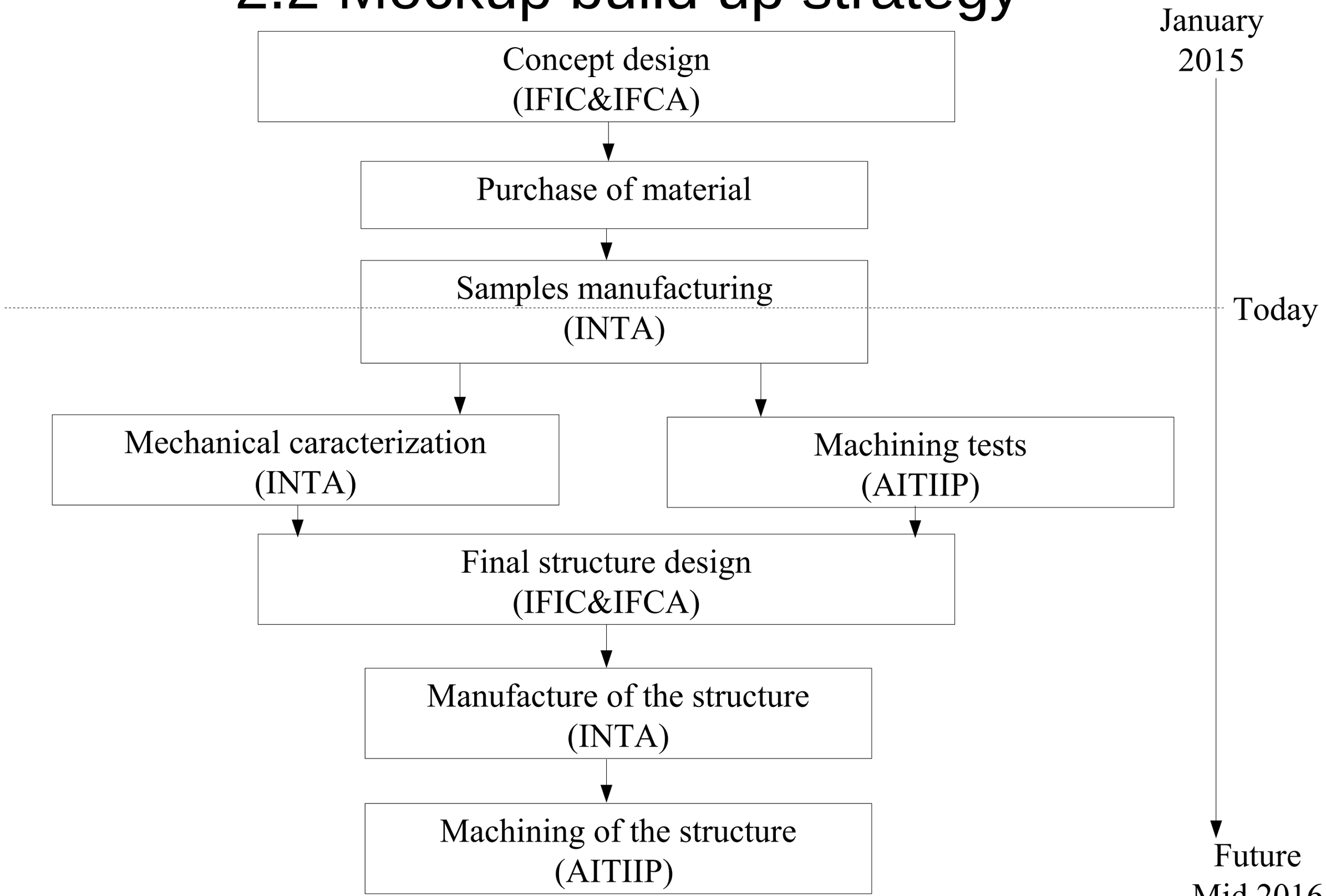
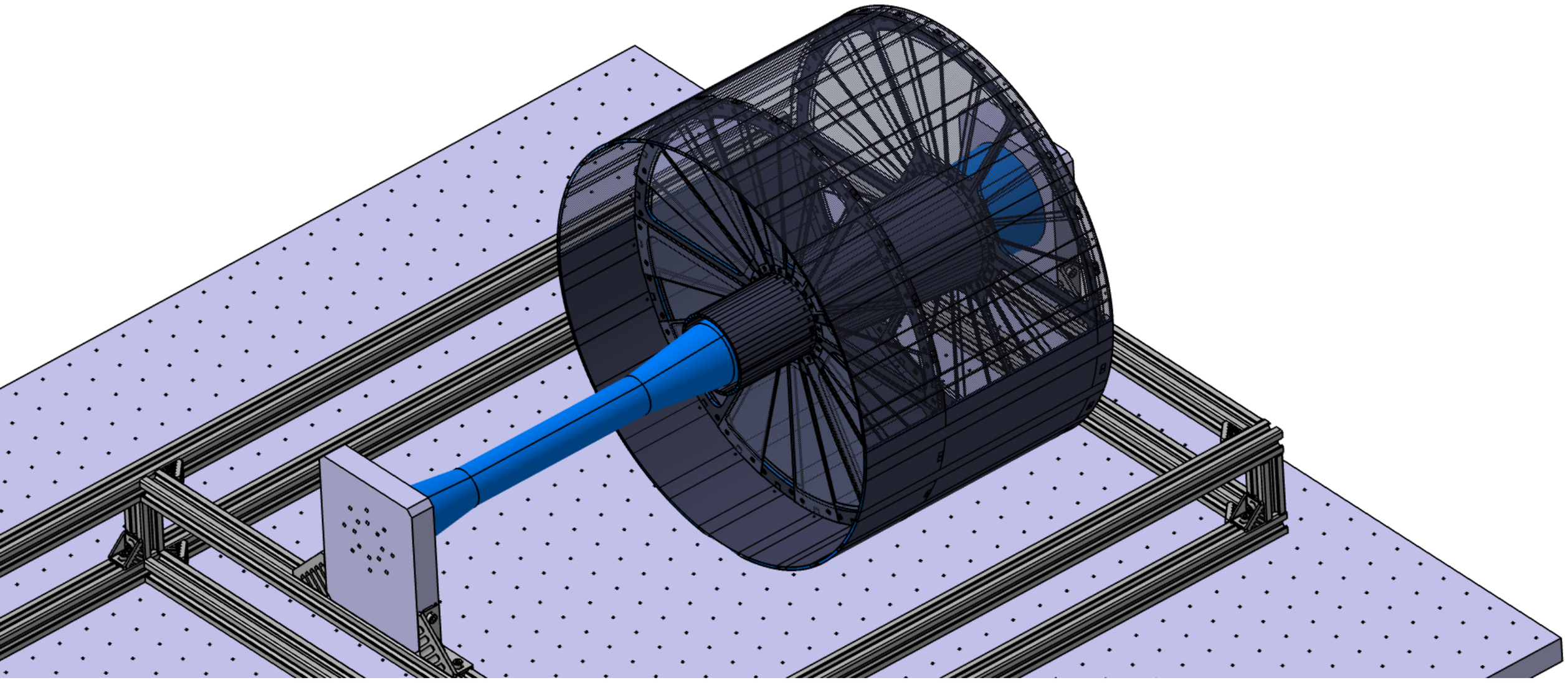


2.3 Mockup design



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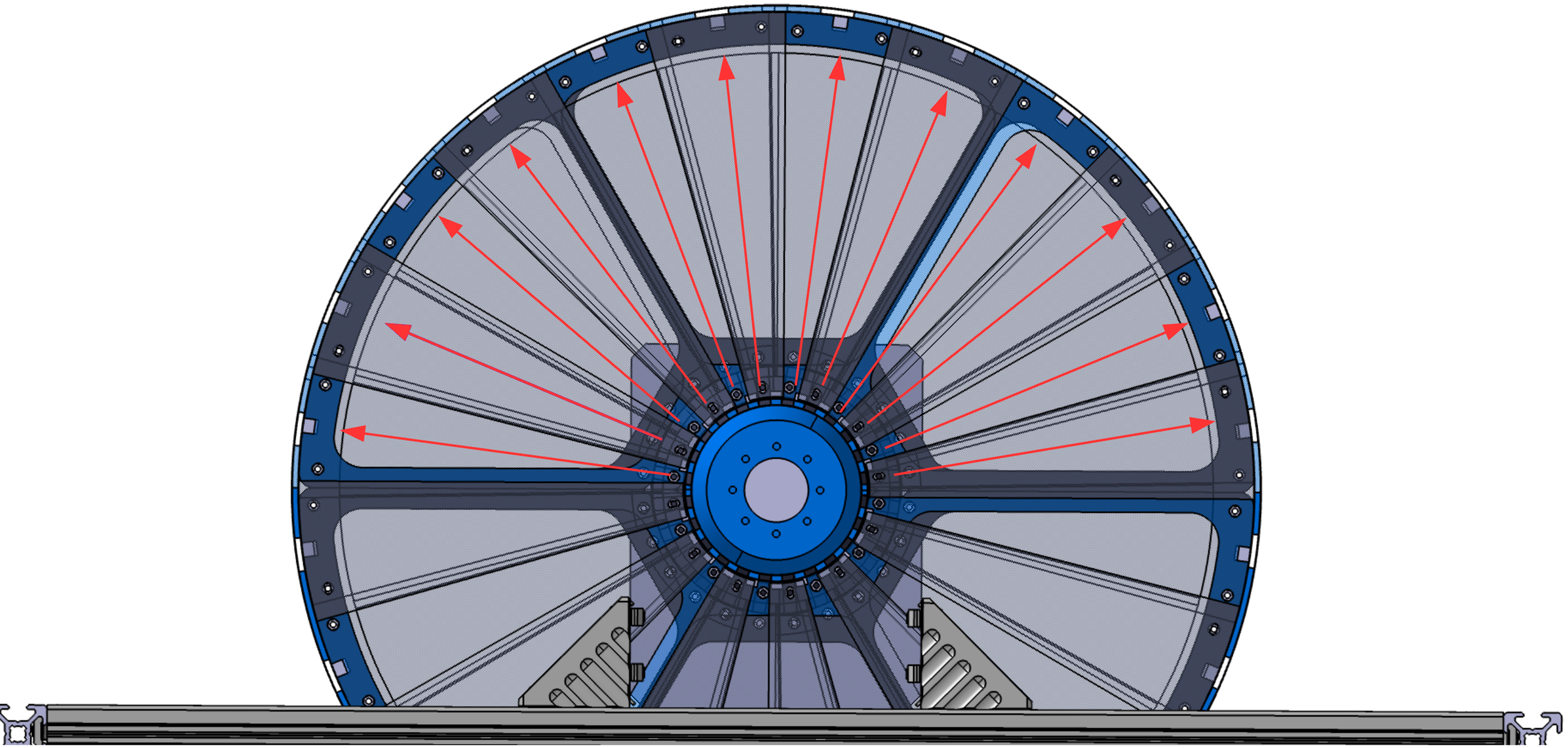

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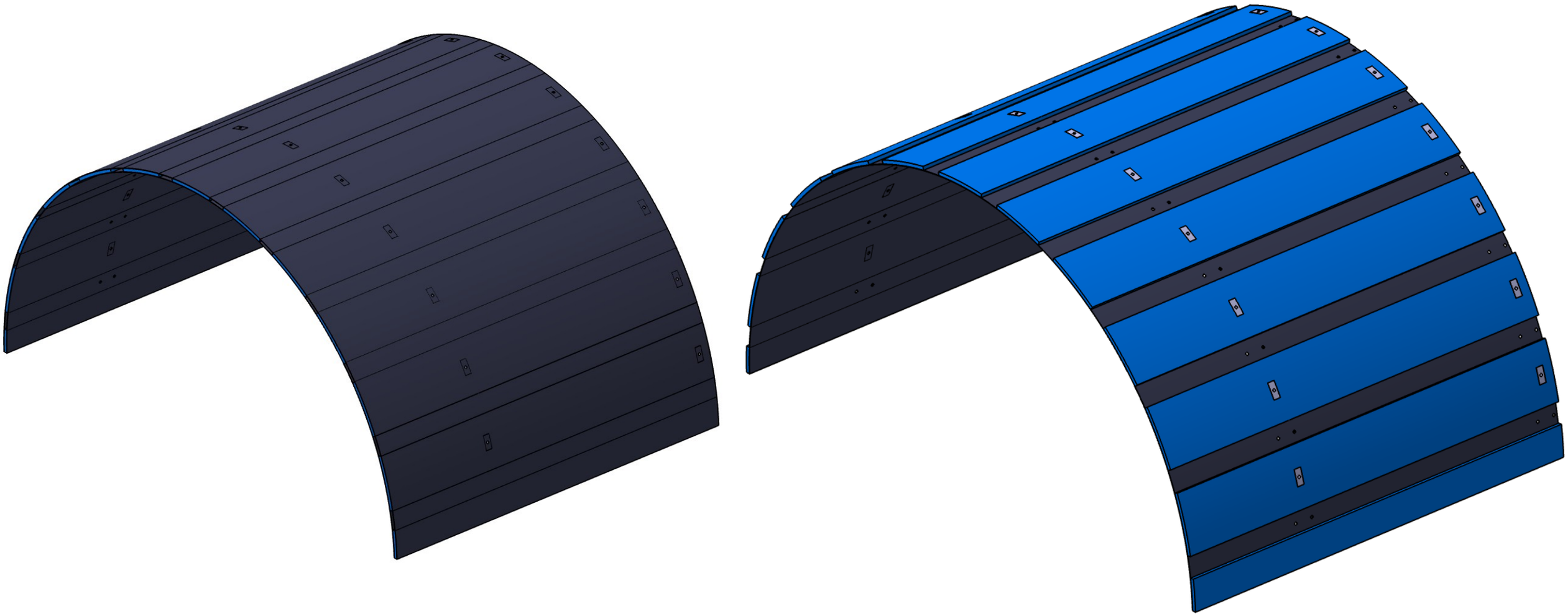

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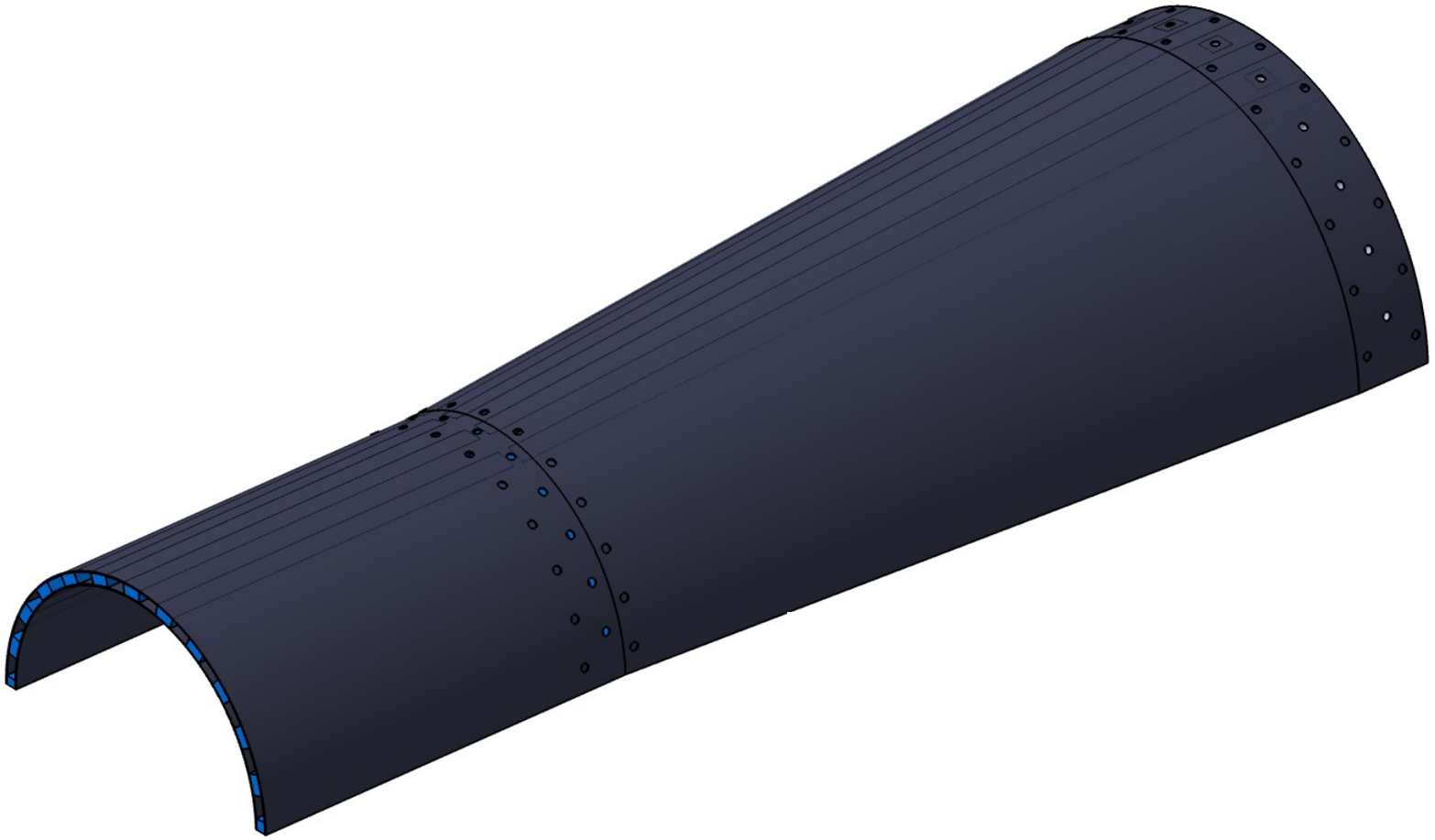

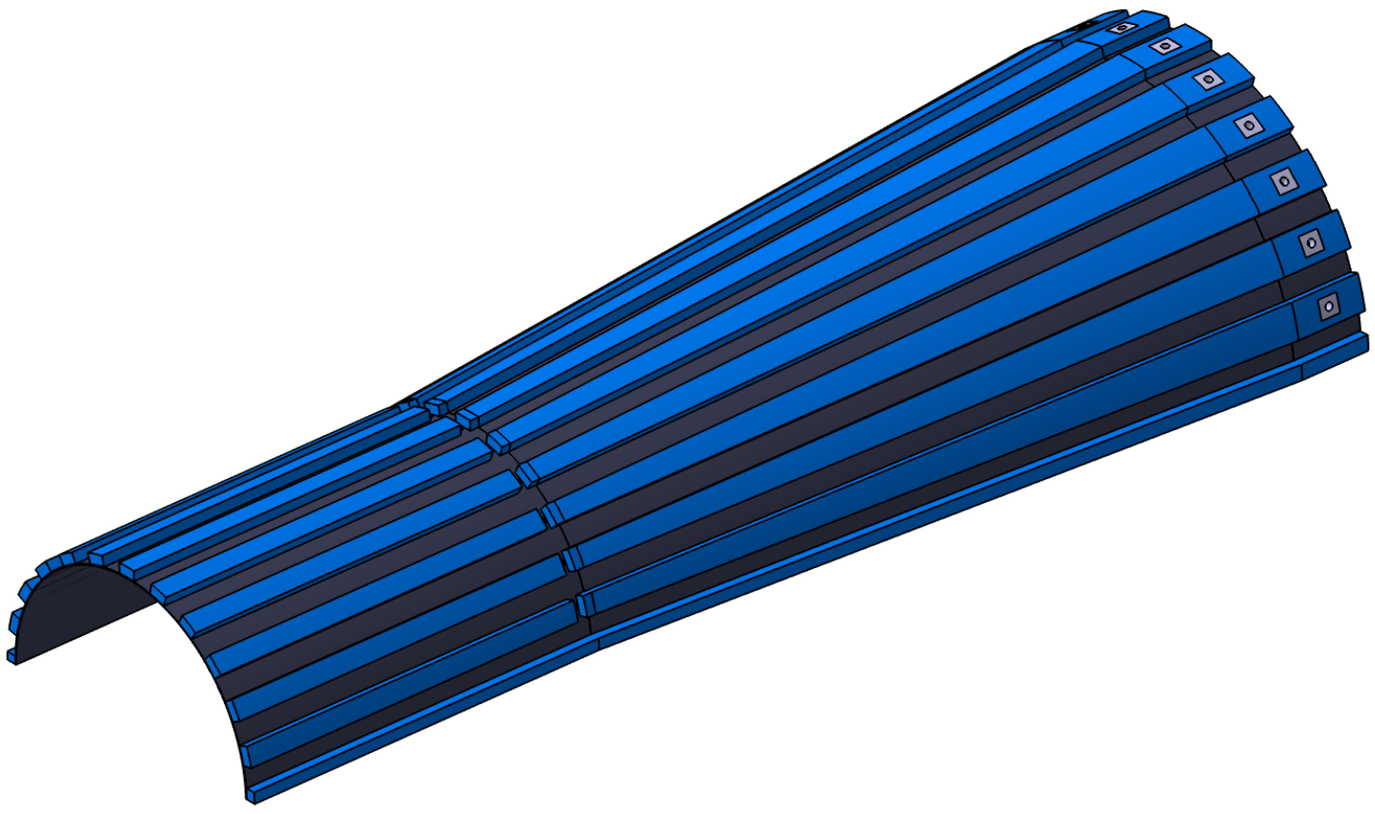

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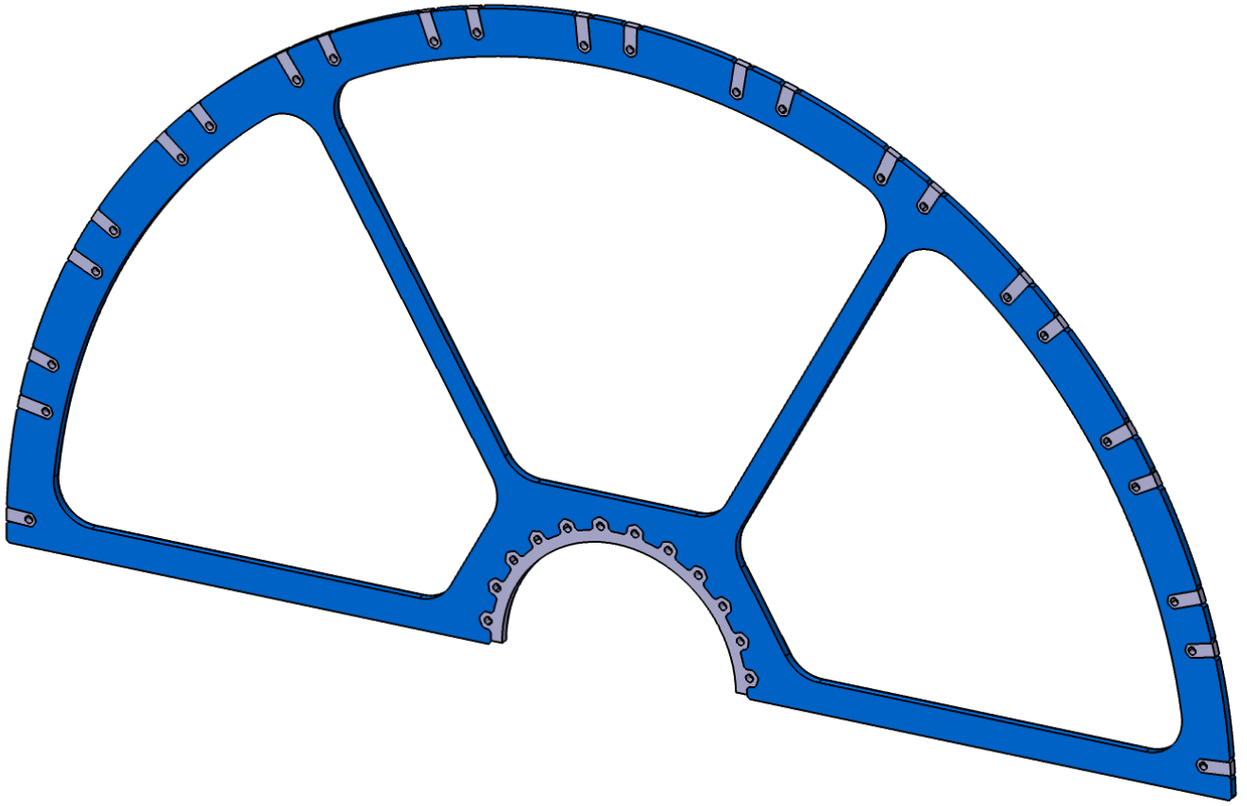

2.3 Mockup design

Carbon fiber

- Low moisture absorption: high mechanical and dimensional stability
- Resistant to gamma radiation
- Corrosion resistance
- Very good mechanical properties
- High thermal stability in longitudinal direction
- Electrically and thermally conductive
- Small, negative longitudinal CTE coefficients of thermal expansion but positive coefficients in the transverse direction

Carbon HM Fibres						
M40J	(Toray)	4410	377	1.2	1770	5
M46J	(Toray)	4210	436	1	1840	5
YSH-50A	(NGF) [2]	3900	520	0.7	2100	7
M55J	(Toray)	4020	540	0.8	1910	5
M60J	(Toray)	3820	588	0.7	1930	5
K135 2U	(Mitsubishi) [1]	3600	620	0.6	2120	10
K63712	(Mitsubishi) [1]	2626	636	0.4	2120	11
YSH-70A	(NGF) [2]	3630	720	0.5	2140	7
P100S	(Cytec)	2410	759	0.3	2150	10
YS-80A	(NGF) [2]	3630	785	0.5	2170	7
P-120S	(Cytec)	2410	827	0.3	2170	10
K13C2U	(Mitsubishi) [1]	3800	898	0.42	2200	10
YS-95A	(NGF) [2]	3530	900	0.3	2190	7
K1100	(Cytec)	3100	931	-	2200	10
K13D 2U	(Mitsubishi) [1]	3700	935	0.4	2200	11

Resin

- Low moisture absorption: high mechanical and dimension stability
- Resistant to gamma radiation
- Corrosion resistance
- Good mechanical properties
- High thermal stability
- Low dielectric constant

Product Designation	Manufacturer	Processing Characteristics	Comments/Applications
954-2A	Fiberite, Germany/USA	177°C cure with optional 232°C postcure	Low flow, toughened system for complex structures. Usually with high strength and intermediate modulus carbon fibres.
954-3		177°C cure with optional 232°C postcure	High flow cyanate system. Principally for space structures with UHM carbon fibres.
954-6		135°C cure	Low temperature curing system, with 155°C T_g., for dimensionally stable structures.
996		177°C cure	Cyanate siloxane with extremely low moisture absorption (low CME) for dimensionally stable structures. Low resin density.
M22	Hexcel, France/UK*	180°C cure	Low moisture absorption. Intended for space applications and use with UHM carbon fibres.
RS-3	YLA, Inc. USA	177°C cure	Good balance of toughness and hot/wet performance. Suitable for satellite structures, airframe/missile structures and radomes.
RS-9		193°C cure plus 315°C post-cure.	High temperature resin for use to 287°C. RTM processible.
RS-12		121°C cure	Low temperature curing system for space applications.
EX-1515	Bryte Technologies, Inc. USA	107 to 120°C cure	Ultra-high conversion, extremely low moisture absorption, self-adhesive and high resistance to microcracking. Specifically for space programmes.
EX-1505		177°C cure	T_g of 316°C, high char yield, low moisture absorption. Aircraft radome and rocket nozzles.
BTCy-1		177°C cure	177°C to 204°C hot/wet service.
BTCy-1A		177°C cure	Toughened version of BTCy-1.
BTCy-2		177°C cure	Very good electrical properties for ultra low dielectric/low loss radomes.
BTCy-3		121°C cure	Excellent electrical and structural properties.
BTCy-3A		121°C cure	Toughened version of BTCy-3.
LTM 110	Advanced Composites Group, UK	70°C initial autoclave cure.	Tooling prepreg for high temperature applications with T_g of 375°C when postcured.

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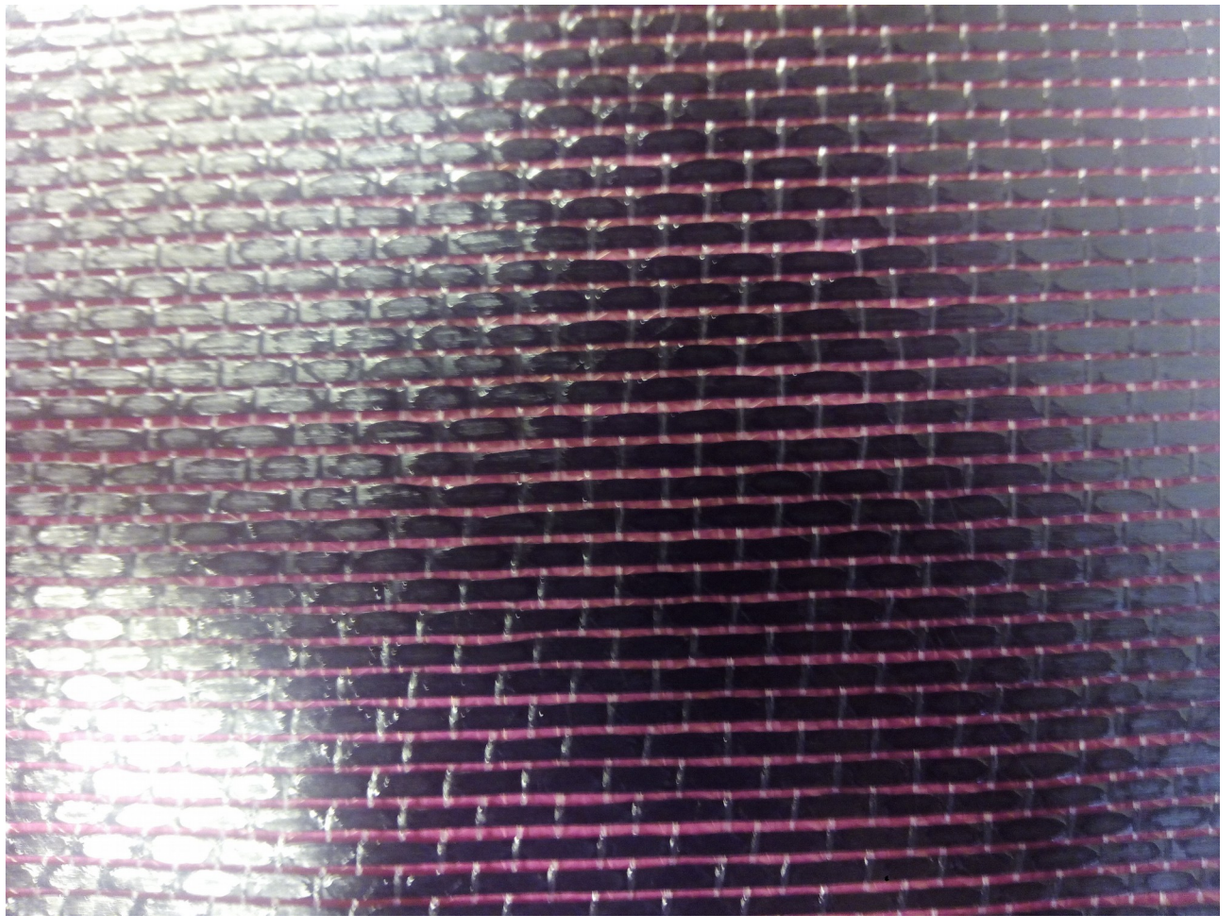

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Summary

- Compromise with the FTD region in the ILC
- Deeper understanding of the mechanical possibilities (design, material, performance, manufacture process, machining,...)
- Stronger links between the collaboration members
- From concept to more detailed design
- No data yet