RFD cavity stress assessment

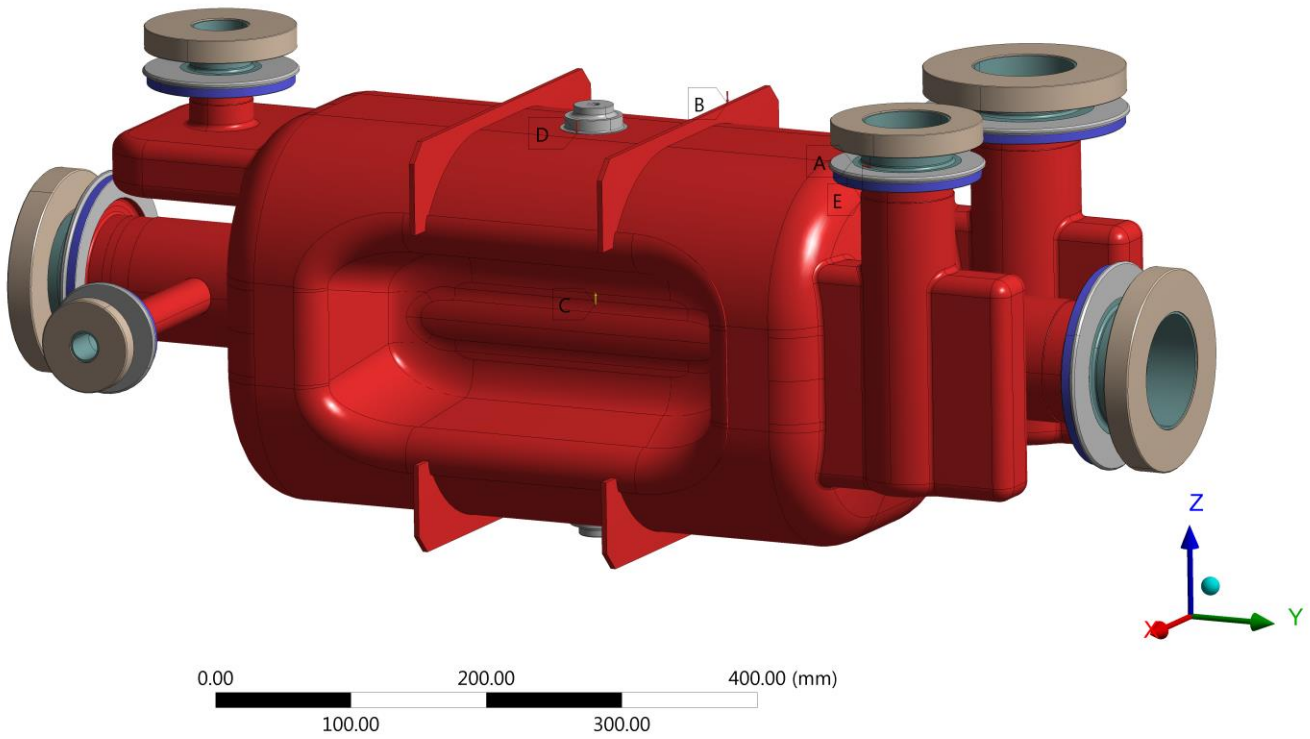
Influence of the presence of the stiffeners and design proposals

Eduardo Cano Pleite

13/10/2017

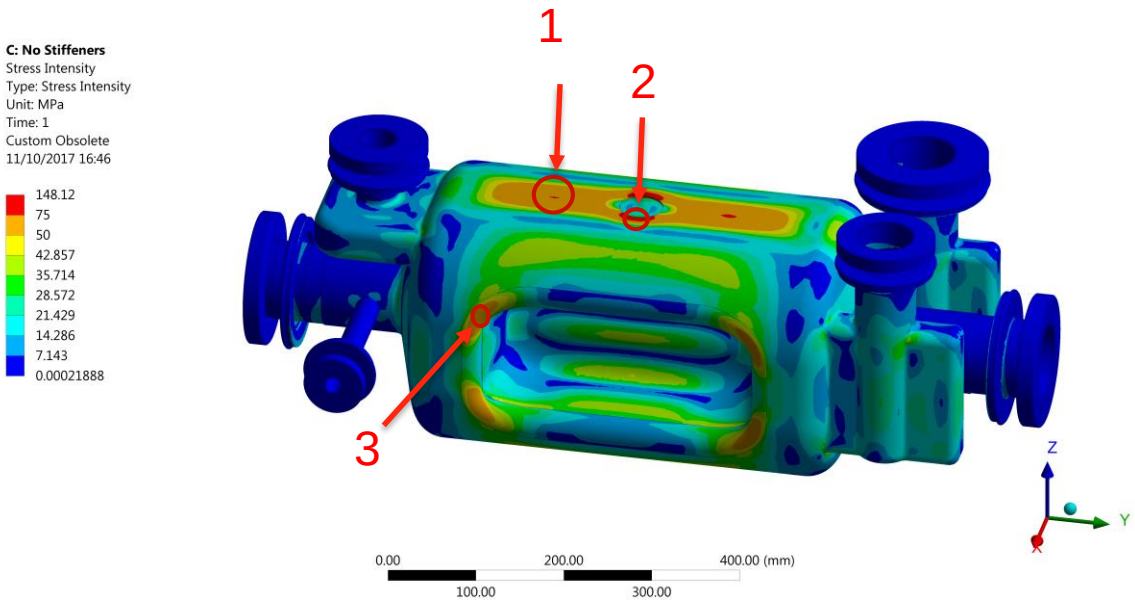
RFD stress intensity with and without stiffeners

Boundary conditions for all the cases



No stiffeners

- Tresca equivalent stress - High stress intensity regions

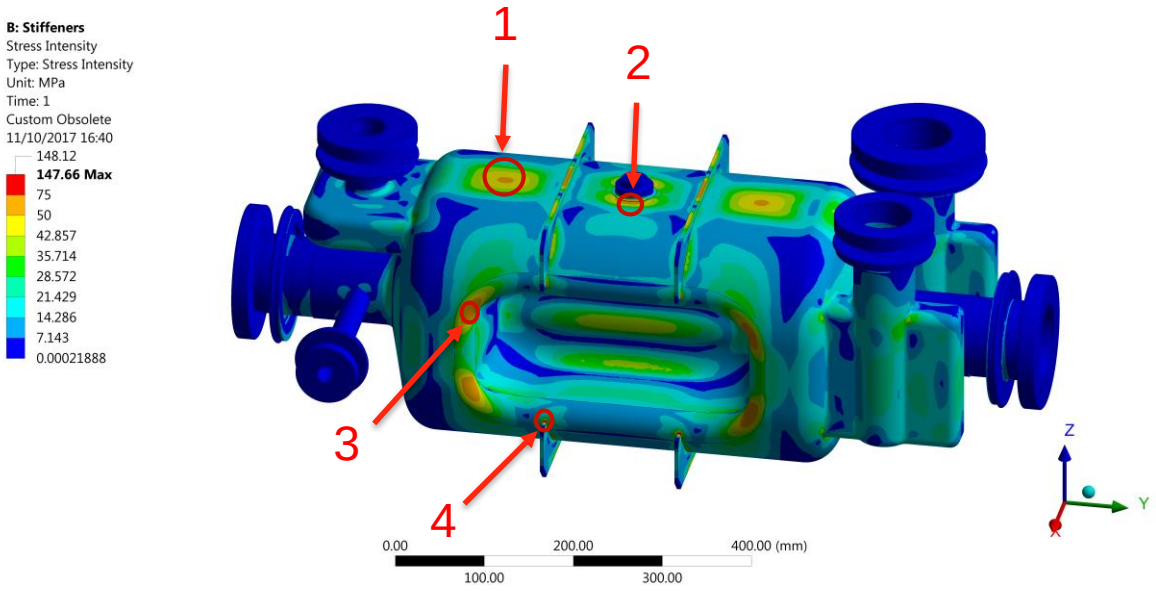


	Linearized stress	
	Pm (MPa)	Pm+Pb (MPa)
1	12.5	75.5
2	22.7	125.9
3	36	66.8
Limit	50	75

Without the stiffeners the beyond de linearized stress limits in the top and bottom regions of the cavity

With stiffeners

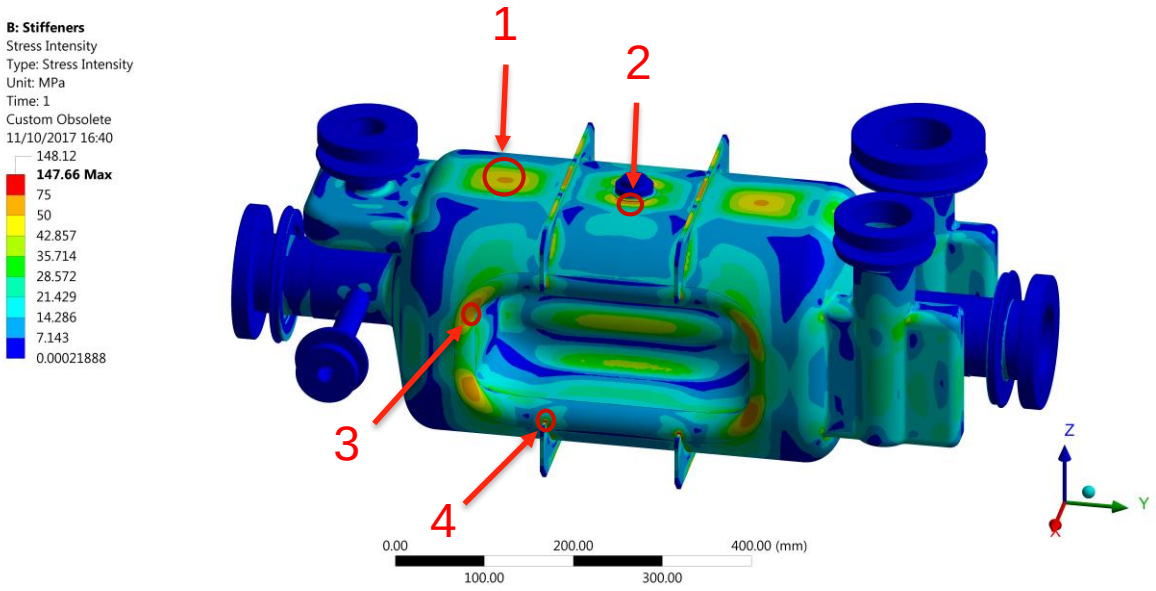
- Tresca equivalent stress - High stress intensity regions



	Linearized stress	
	Pm (MPa)	Pm+Pb (MPa)
1	11.5	50.9
2	17.9	63.9
3	37.6	68
4	32.8	86.6
Limit	50	75

With stiffeners

- Tresca equivalent stress - High stress intensity regions



	Linearized stress	
	Pm (MPa)	Pm+Pb (MPa)
1	11.5	50.9
2	17.9	63.9
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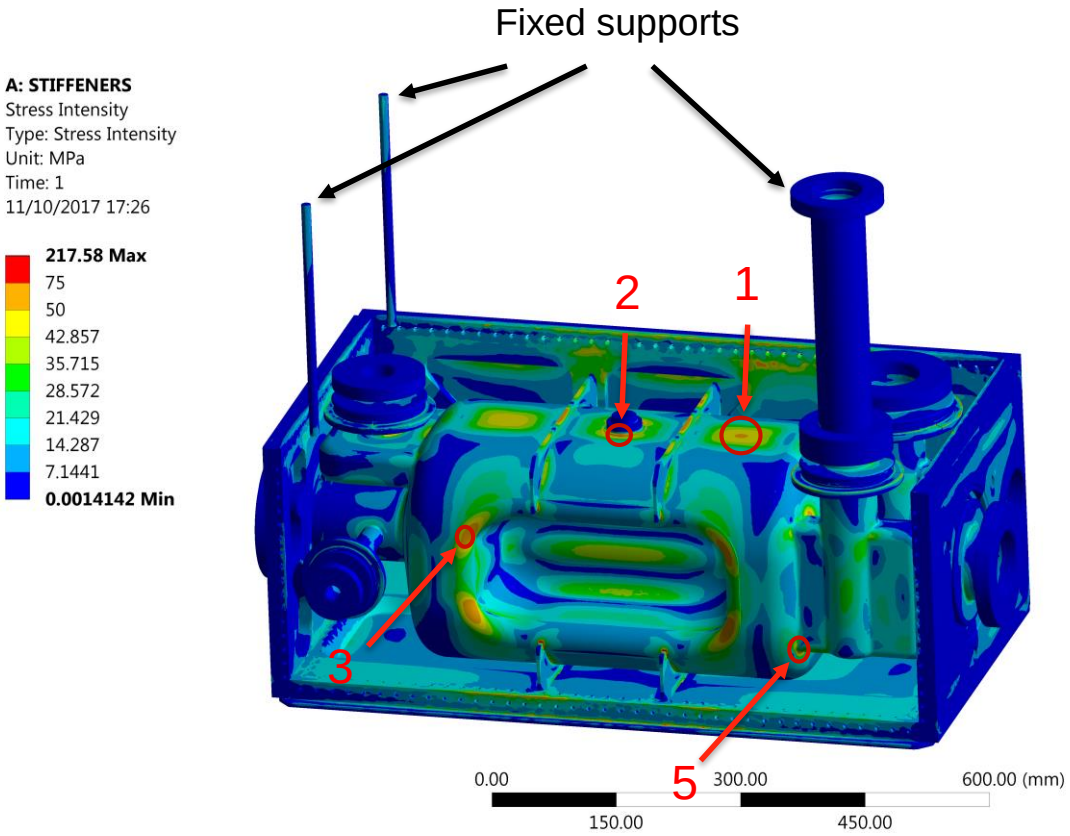
4	32.8	86.6
Limit	50	75

Contact regions to be further analyzed

With stiffeners + Helium tank

- Tresca equivalent stress - High stress intensity regions



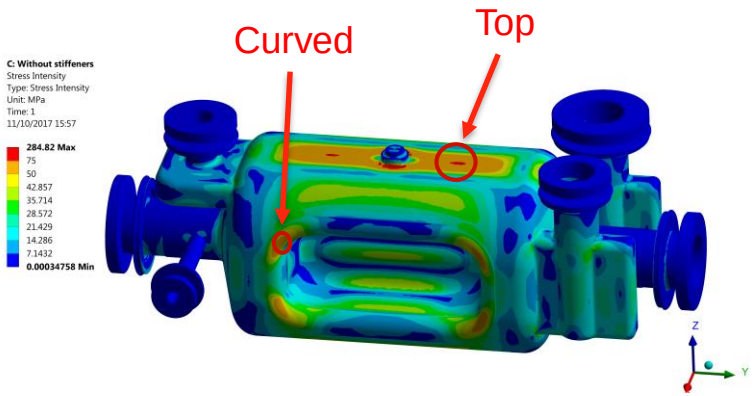
	Linearized stress	
	Pm (MPa)	Pm+Pb (MPa)
1	9.5	51
2	13.7	58.7
3	36.7	67.4
5	37.9	58.9
Limit	50	75

CERN RFD design proposals

- Extension of the curved thicker region
  - Simpler manufacturing
  - Tests: 6.2 mm and 5.85 mm in thickness

CERN RFD design proposals

- Extension of the curved thicker region



5.85 mm

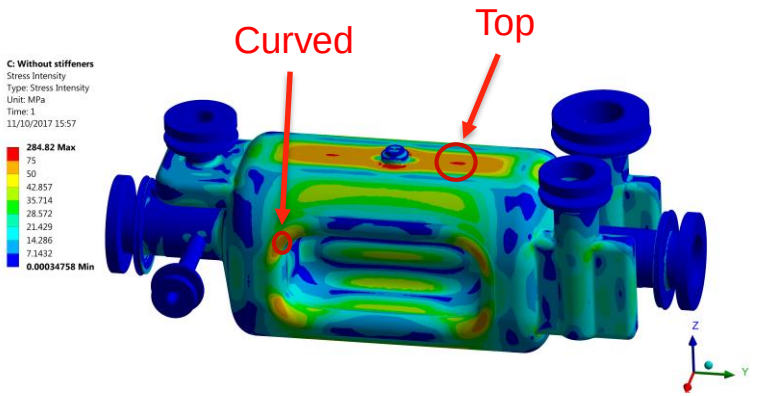
	Linearized stress	
	Pm (MPa)	Pm+Pb (MPa)
Top	11.2	76
Curved	35.5	64.5

6.2 mm

	Linearized stress	
	Pm (MPa)	Pm+Pb (MPa)
Top	10.9	75.7
Curved	31.5	60.6

CERN RFD design proposals

- Extension of the curved thicker region



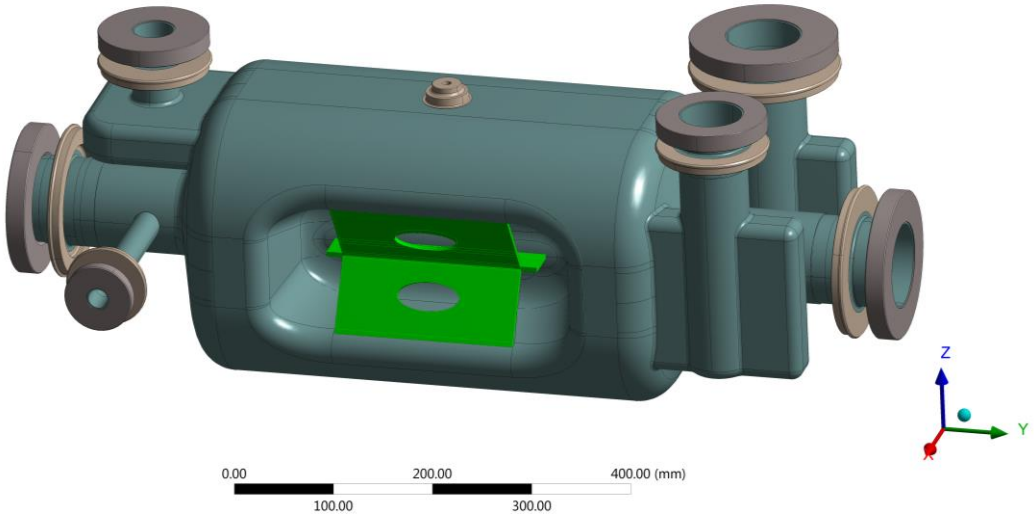
5.85 mm

	Linearized stress	
	Pm (MPa)	Pm+Pb (MPa)
Top	11.2	76
Curved	35.5	64.5

6.2 mm

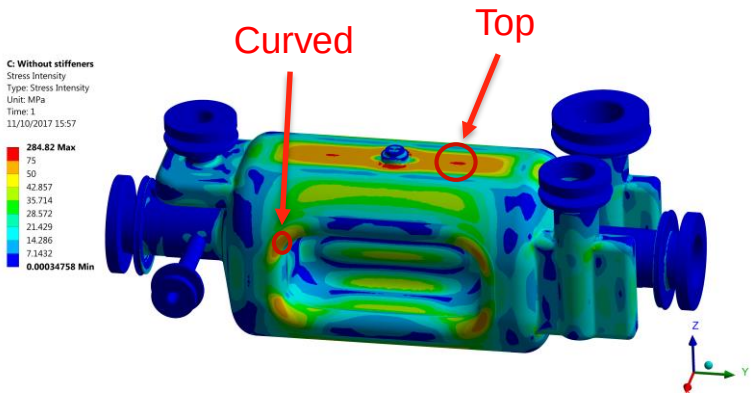
	Linearized stress	
	Pm (MPa)	Pm+Pb (MPa)
Top	10.9	75.7
Curved	31.5	60.6

- Y stiffeners



CERN RFD design proposals

- Extension of the curved thicker region



5.85 mm

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Top	11.2	76
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6.2 mm

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Top	10.9	75.7
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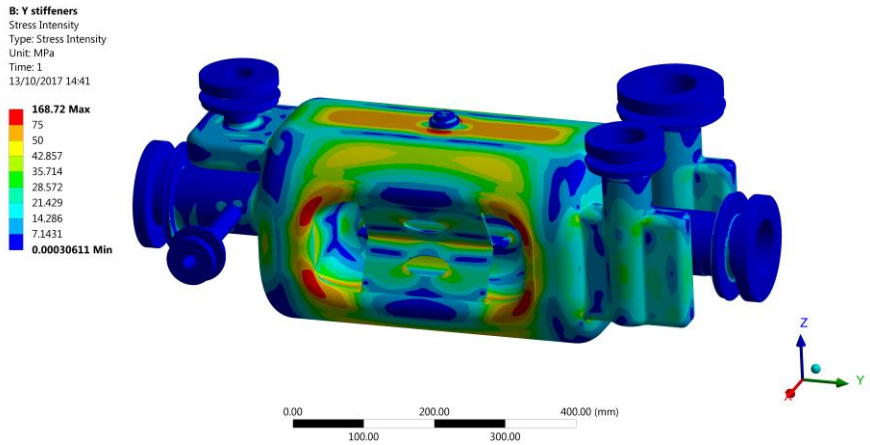
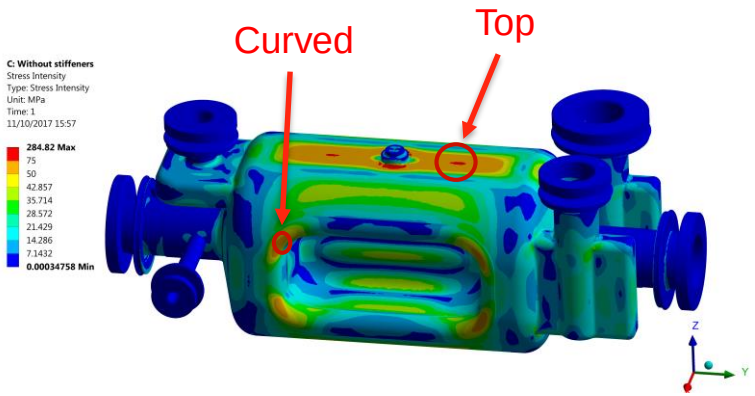
- Y stiffeners



	Linearized stress	
	Pm (MPa)	Pm+Pb (MPa)
Top	8	72.3
Curved	51.3	97.7

CERN RFD design proposals

- Extension of the curved thicker region



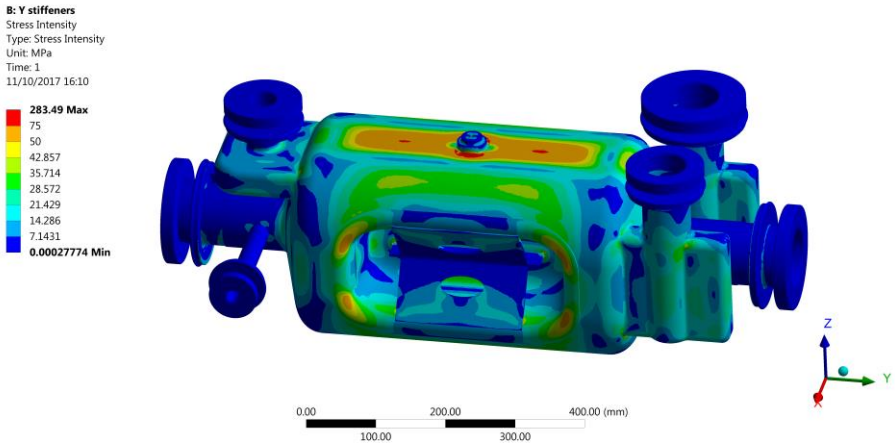
5.85 mm

	Linearized stress	
	Pm (MPa)	Pm+Pb (MPa)
Top	11.2	76
Curved	35.5	64.5

6.2 mm

	Linearized stress	
	Pm (MPa)	Pm+Pb (MPa)
Top	10.9	75.7
Curved	31.5	60.6

- Extension of the curved thicker region + Y stiffeners



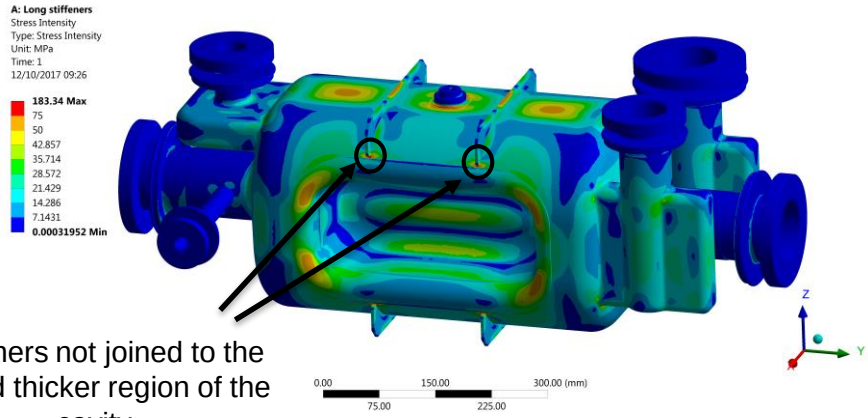
6.2 mm

	Linearized stress	
	Pm (MPa)	Pm+Pb (MPa)
Top	12	75.5
Curved	32.5	60

High stress intensity on the top and bottom of the cavity → Need of stiffeners in those regions

CERN RFD design proposals

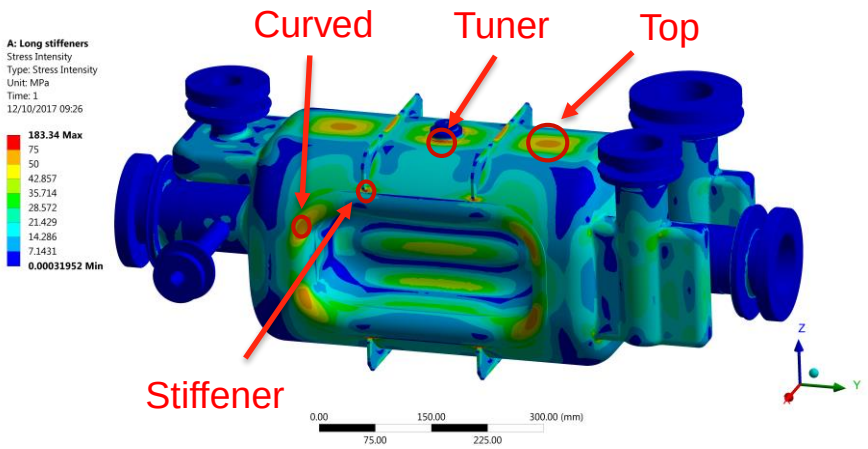
- 5.85 mm thickness extension + shorter stiffeners



Stiffeners not joined to the curved thicker region of the cavity

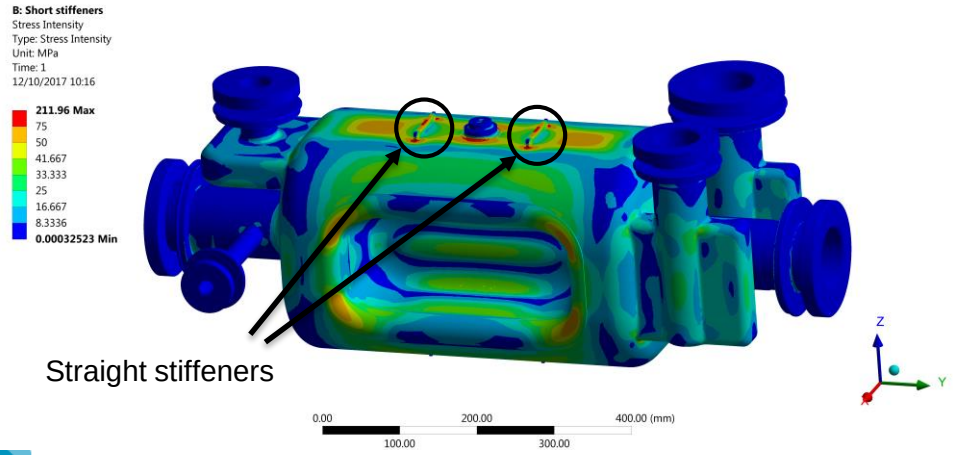
CERN RFD design proposals

- 5.85 mm thickness extension + shorter stiffeners



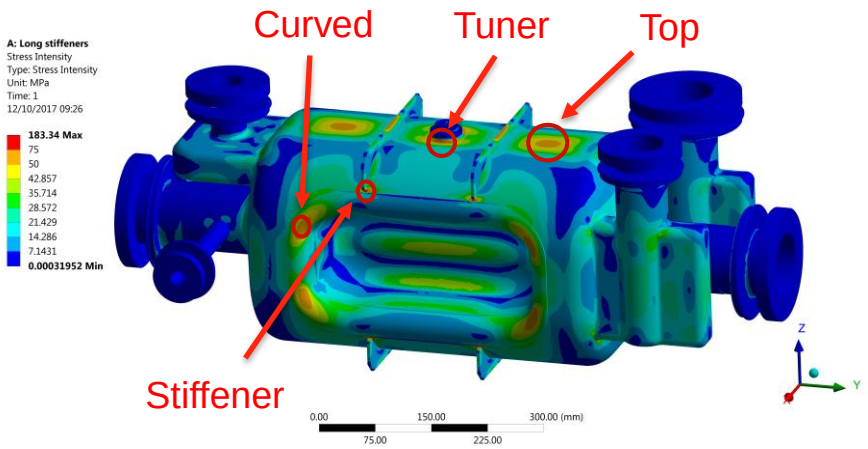
	Linearized stress	
	Pm (MPa)	Pm+Pb (MPa)
Top	9.2	53.7
Curved	34.6	63.4
Tuner	15	70

- 5.85 mm thickness extension + straight stiffeners



CERN RFD design proposals

- 5.85 mm thickness extension + shorter stiffeners



	Linearized stress	
	Pm (MPa)	Pm+Pb (MPa)
Top	9.2	53.7
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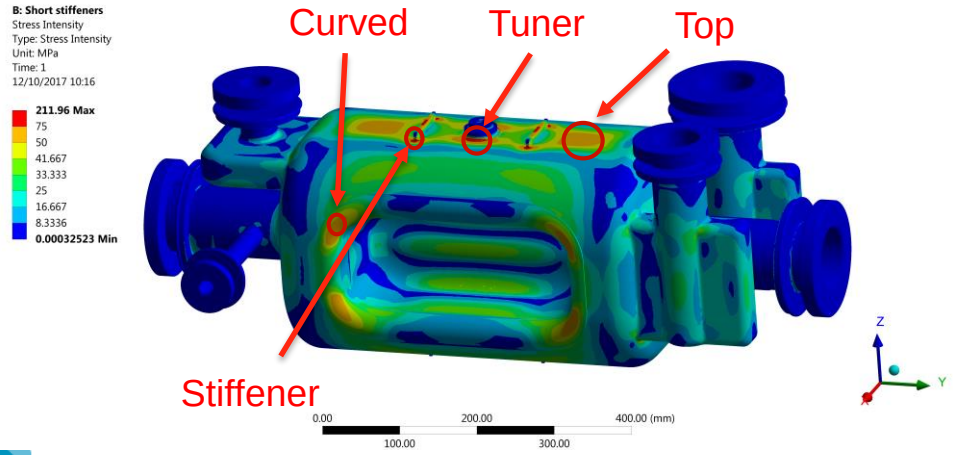
- 5.85 mm thickness extension + straight stiffeners



	Linearized stress	
	Pm (MPa)	Pm+Pb (MPa)
Top	8.4	60.1
Curved	36.7	65.6
Tuner	15.2	90

Design conclusions

- The top stiffeners have a structural function.
- Without the top stiffeners the stress intensity is above the limits in the top and bottom regions of the cavity → Stiffeners are necessary.
- Tuner and stiffeners contact regions can be further optimized.

RFD cavity stress assessment

Influence of the presence of the stiffeners and design proposals