

DQW tuner weld calculations

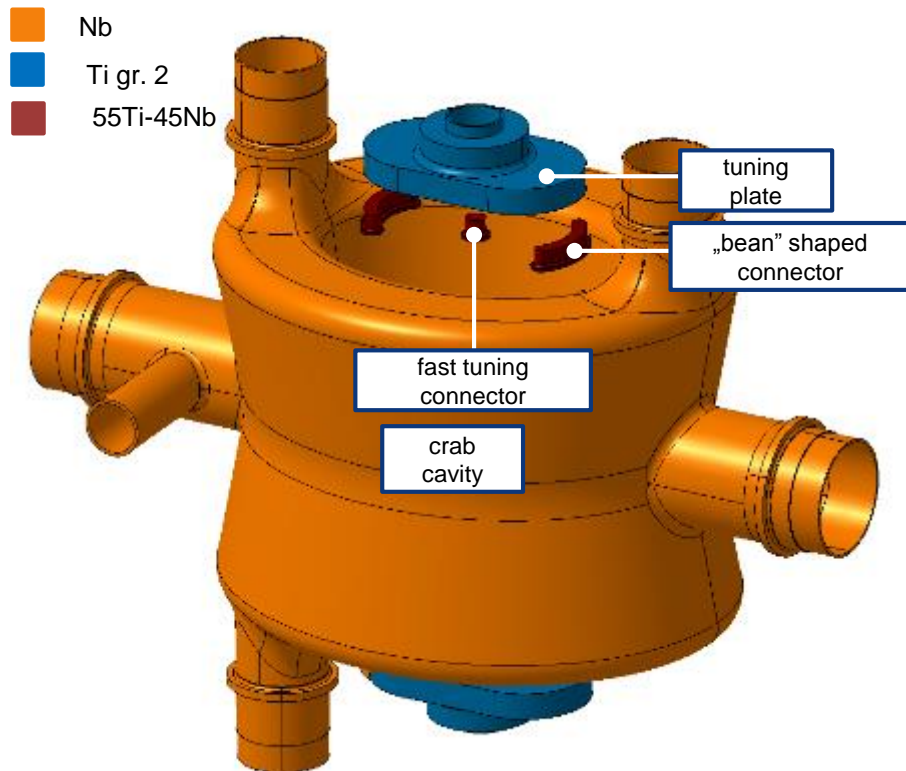
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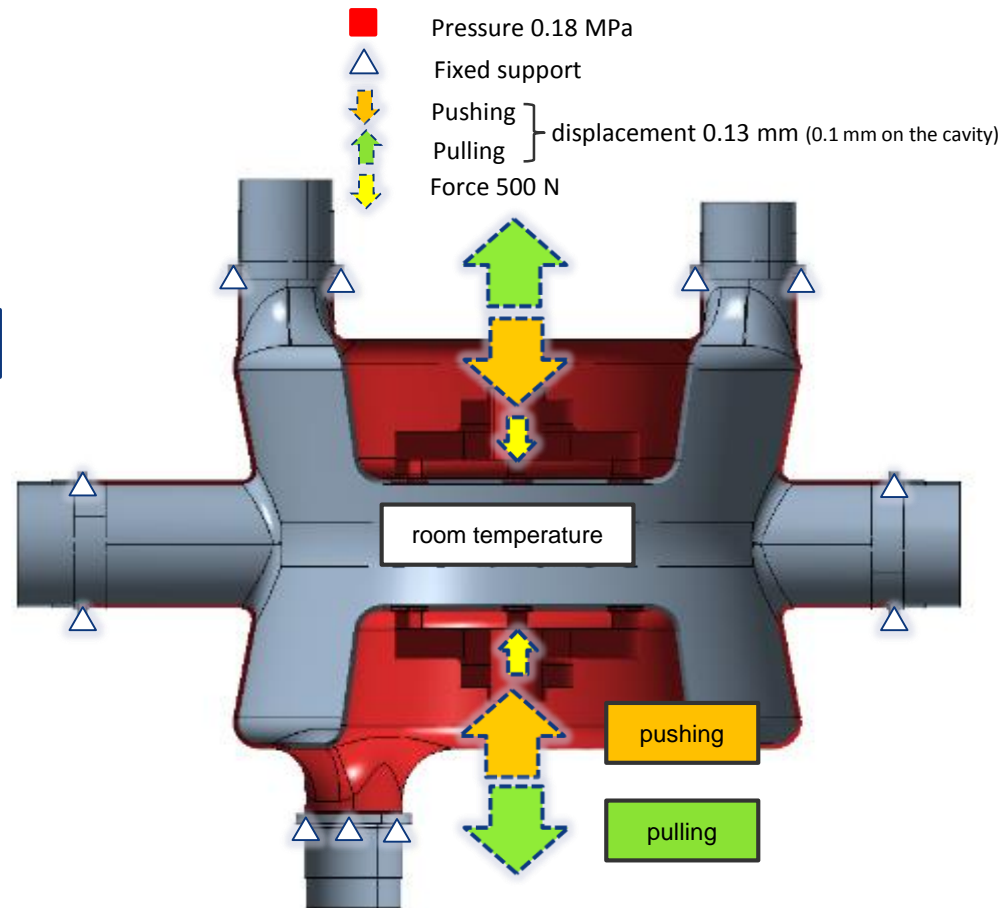


ENGINEERING
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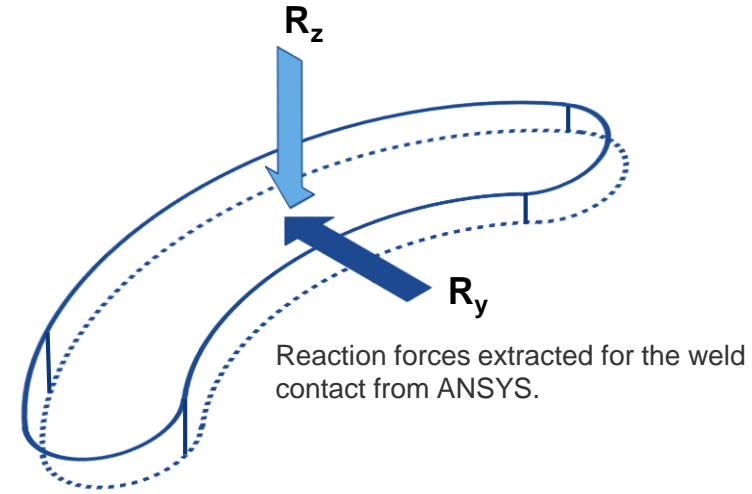
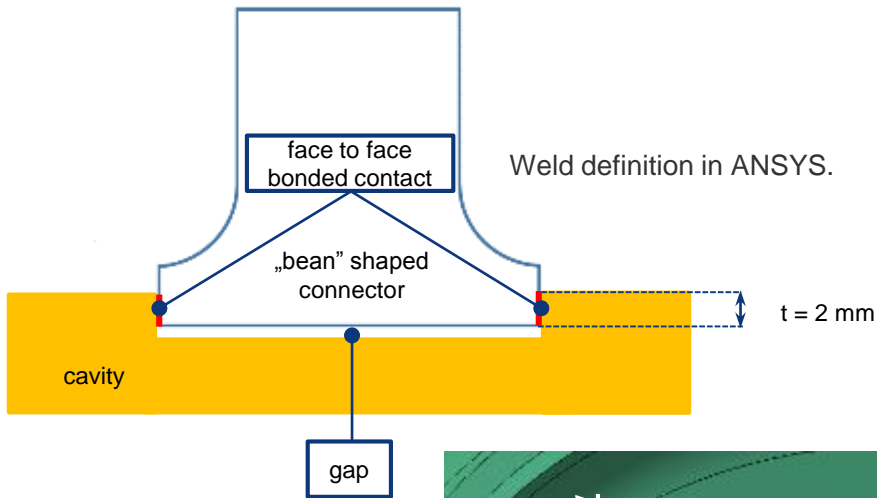
FE model



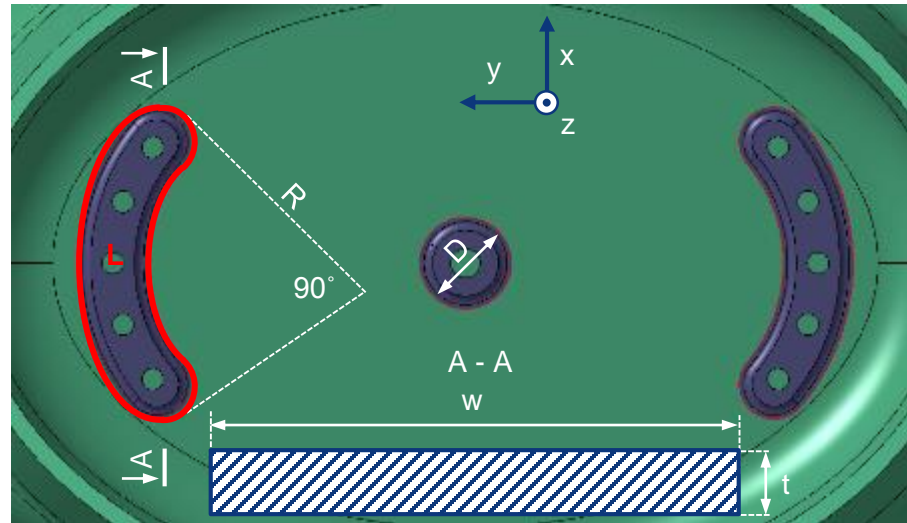
Materials for the model.



BCs and loads for the pre-tuning and fast tuning.



Weld properties.



Stress calculated for the weld as follows:



$$\sigma_y = \frac{R_y}{2A_y}$$

$$\tau_z = \frac{R_z}{A_z}$$

$$\sigma_{eq} = \sqrt{\sigma_y^2 + 3\tau_z^2}$$

Material	Shape	A_y [mm ²]	A_z [mm ²]	L [mm]	R [mm]	w [mm]	D [mm]	t [mm]	A_y [mm ²]	A_z [mm ²]
55Ti-45Nb Nb		wt	Lt	170.35	43	60	-	2	120	340.7
		Dt	πDt	-	-	-	21		42	131.95

Weld results

Case	Weld	t [mm]	Material	F _Y [N]	F _Z [N]	R _{p0.2} [MPa]	σ _y [MPa]	τ _z [MPa]	σ _{eq} [MPa]	0.7·R _{p0.2} /1.5 [MPa]	Safety factor
Pushing		2	Nb	1910	3780	75	7.96	11.09	20.80	35	1.68
Pulling				3150	5910		13.13	17.35	32.79		1.06
Fast tuning				-	500		-	3.79	3.79		9.24

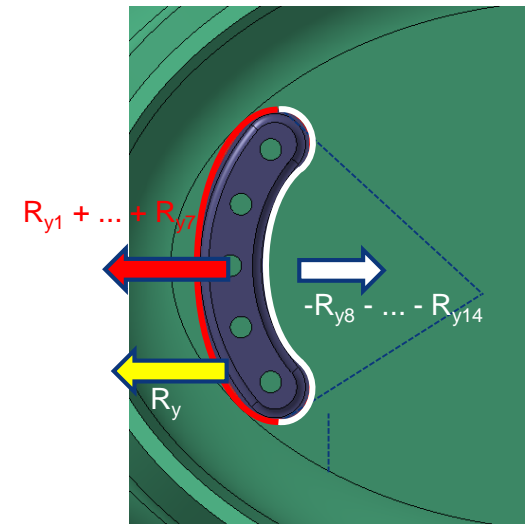
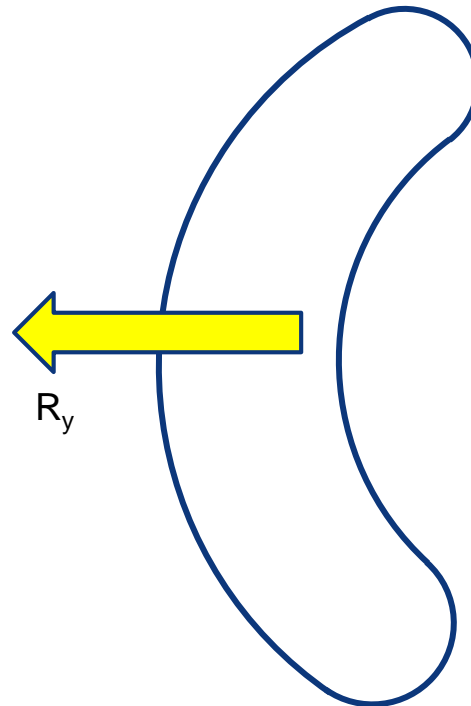
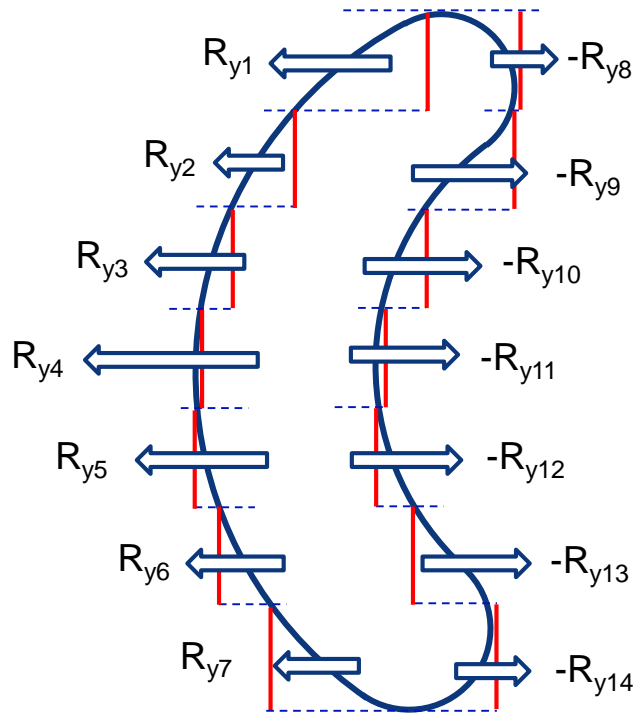
- The calculation for the welds using the reaction forces from ANSYS indicates that the stress on the welds is acceptable, however the pulling may be limited.
- The difference between weld performance for the pushing and pulling is due to the pressure force assisting the pushing and hindering the pulling.
- The allowable stress for the Nb was additionally decreased multiplying by a joint coefficient 0.7.
- The calculated stress is an **average value** and a local plasticization may occur anyway.

Why do we expect the elastic behaviour of the welds when plastically deforming the cavity?

How ANSYS calculates the reaction force?

identical area

$$R_y = \sum R_i$$



$$\sigma_{y1} = 50 \text{ MPa}$$

$$\sigma_{y2} = -12.5 \text{ MPa}$$

$$\sigma_y = 18.75 \text{ MPa}$$