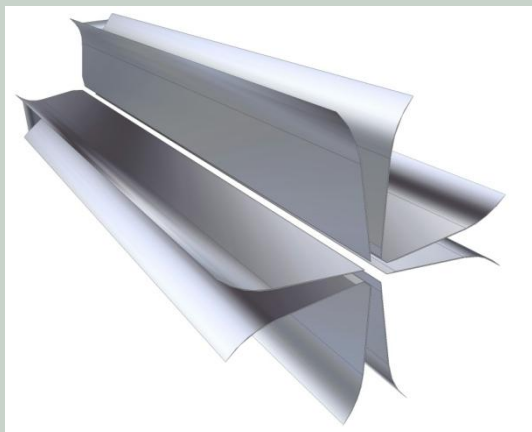# FETS RFQ Modelling

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22nd September 2010

Many different CAD models have been created to be imported into CST and COMSOL to make electrostatic simulations.

The models vary in internal size, length, number of ports, vacuum port design, end flange design etc. The idea is to understand the effect of these features on the resonant frequency.

In addition, two types of model were being used:
- Type 1 – uses the RFQ cold model internal geometry
- Type 2 – uses the latest CAD design internal geometry

When both model types were stripped of all features and matched for internal radius they should have returned the same resonant frequency. They did not. We needed to find the discrepancy.

Type 1 (Cold model type) – blue

Type 2 – identical to Type 1 *except* flats have been added to vane sides near the tip to aid machining of vane tip modulations. This is the only internal geometry difference.
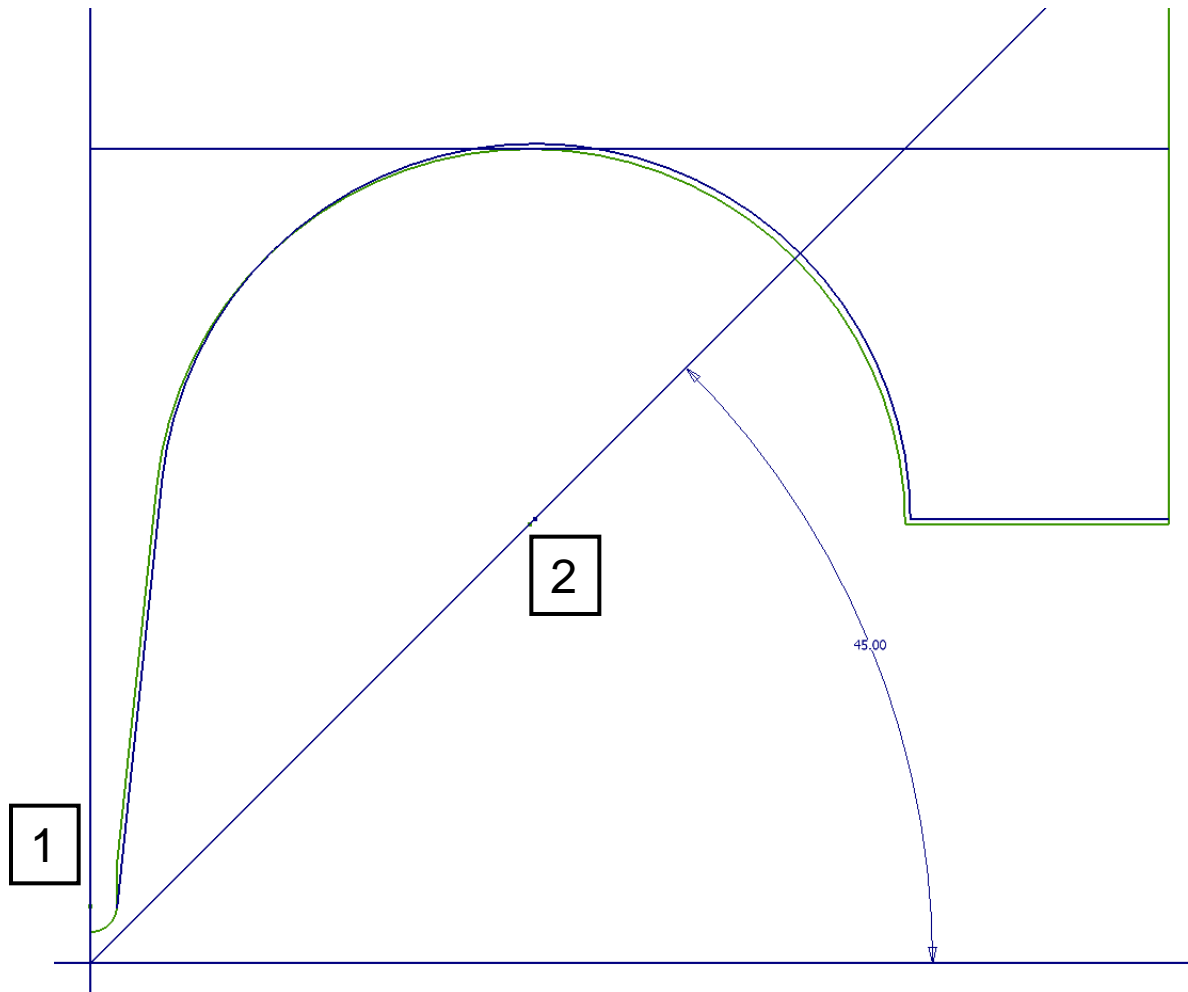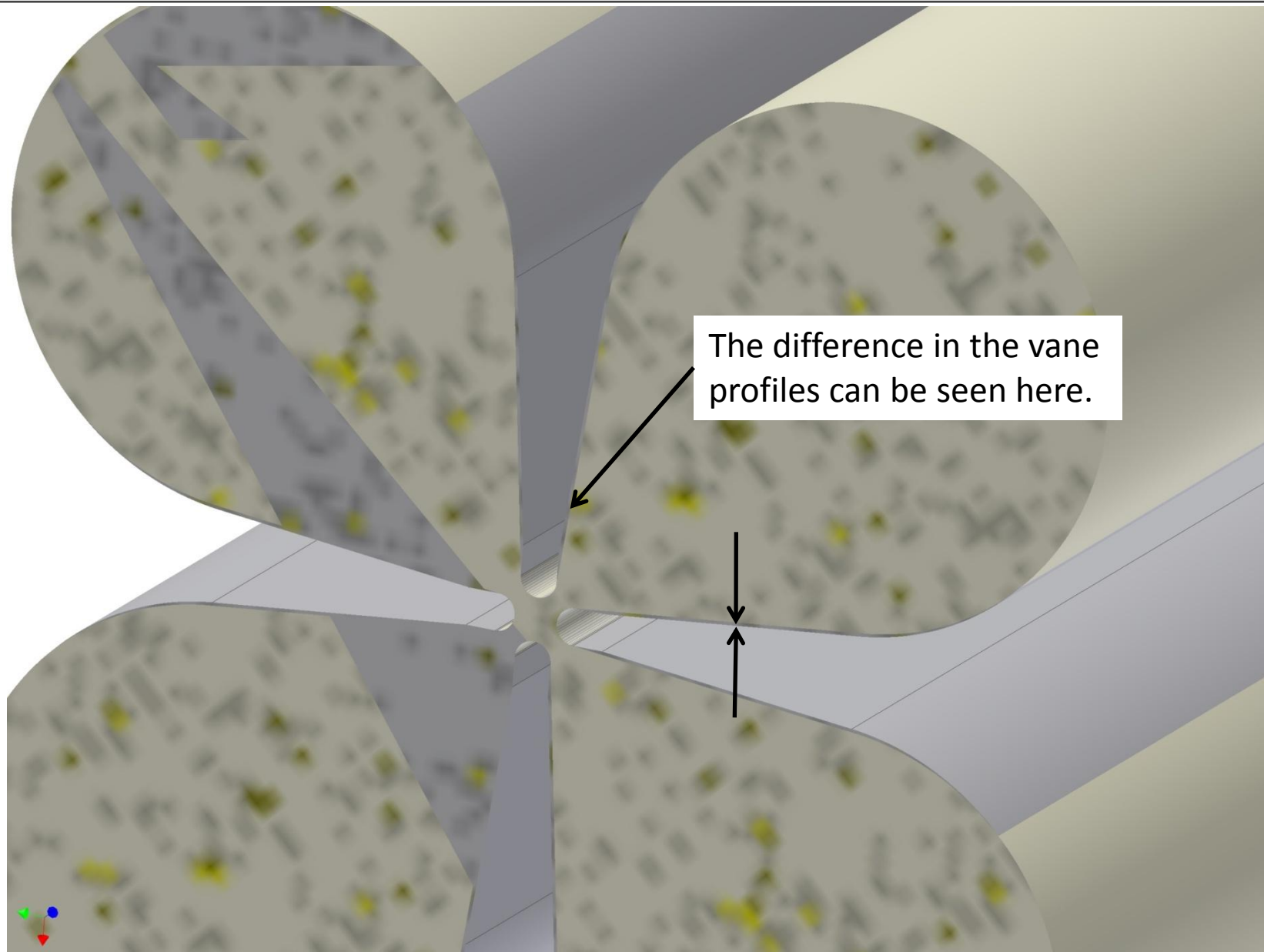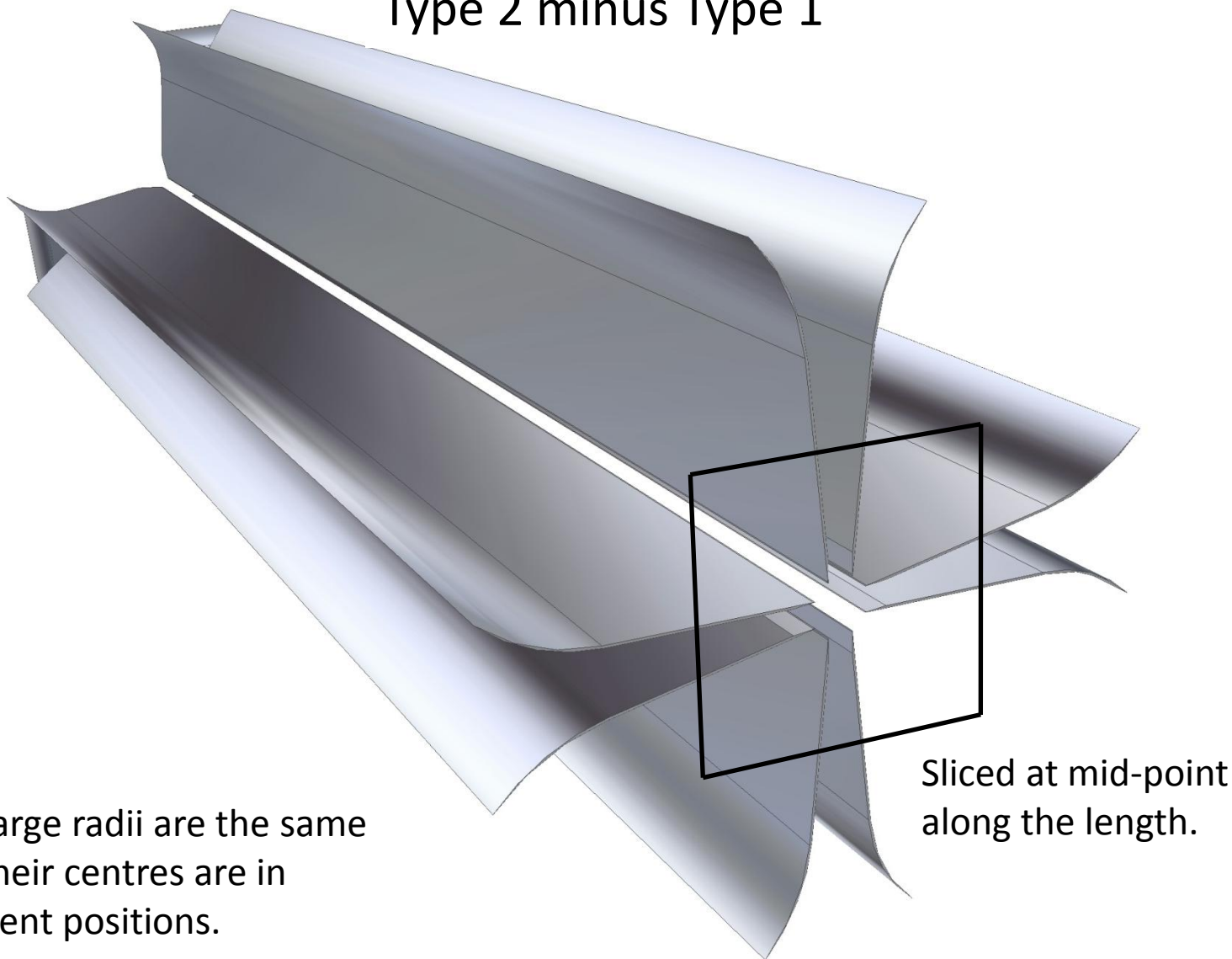
But...
If a flat is added near the vane tip (1) and the vane angle and large inner radius remain the same then the large radius centre moves along the 45^0 line (2).
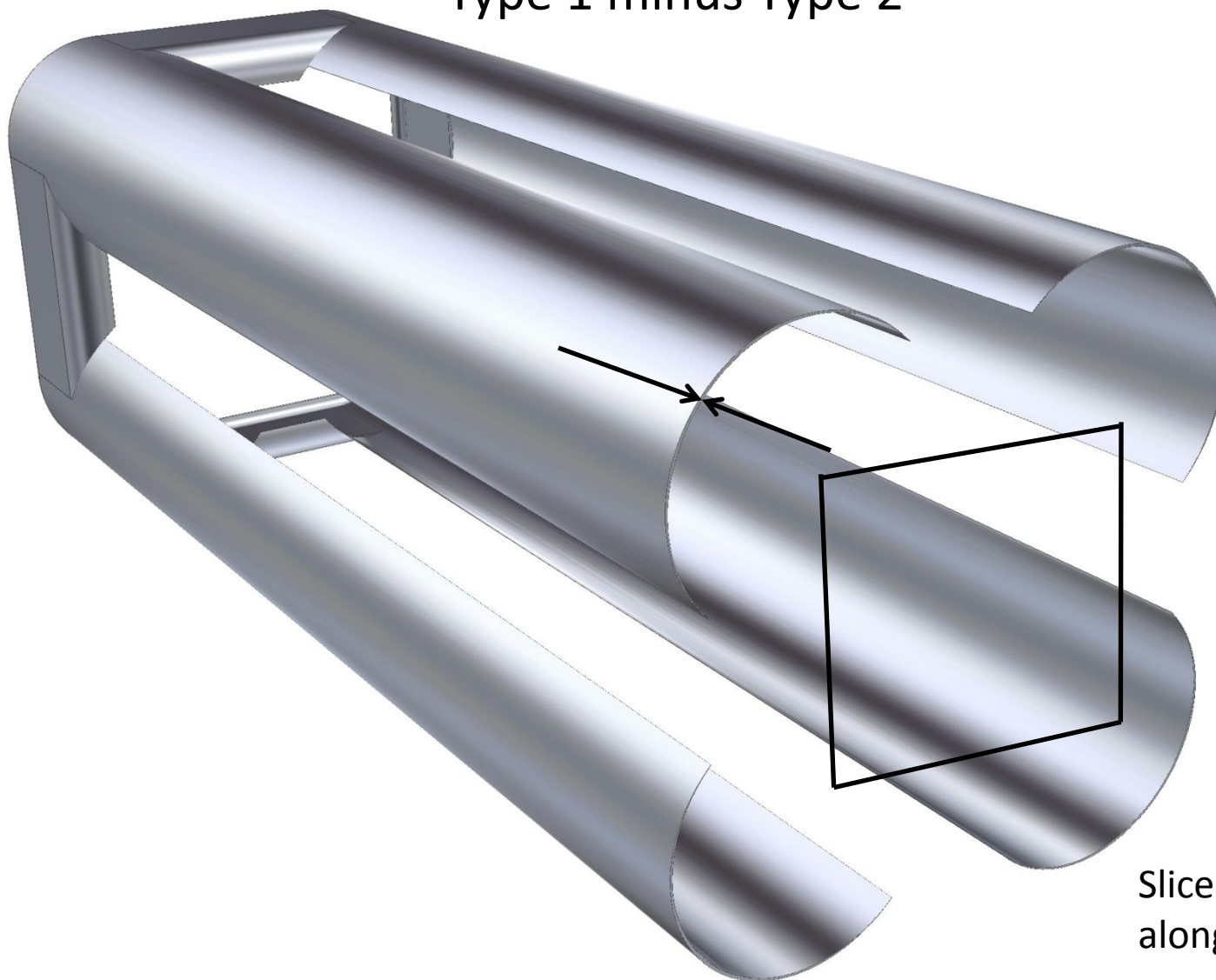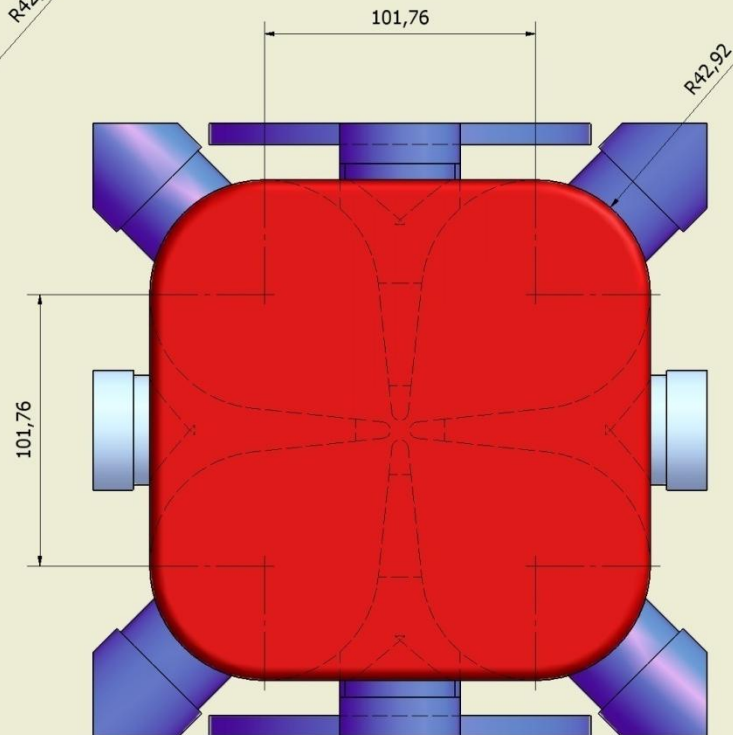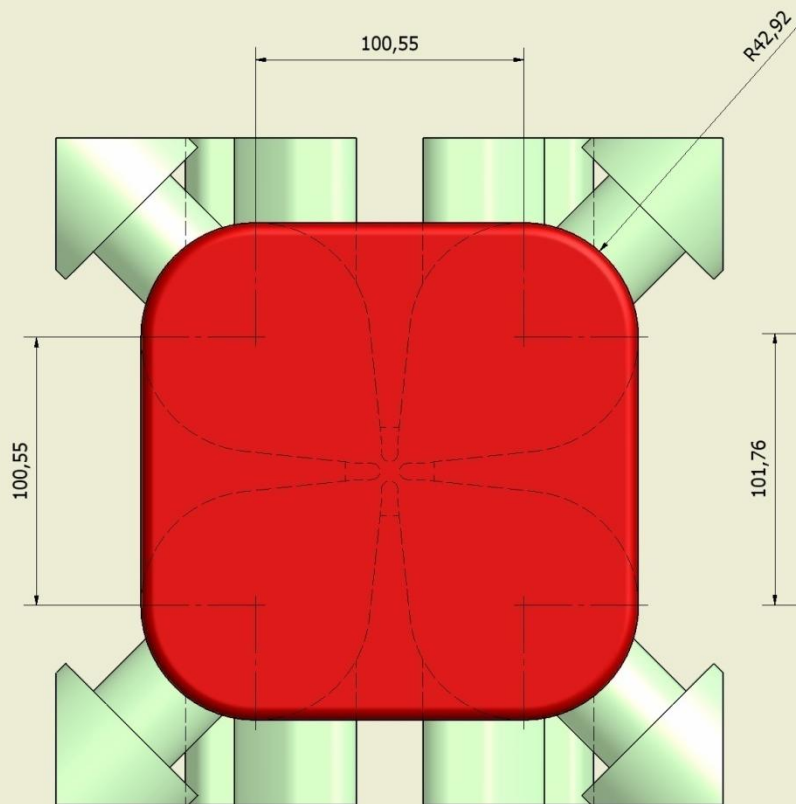
The difference in the vane profiles can be seen here.

Type 2 minus Type 1
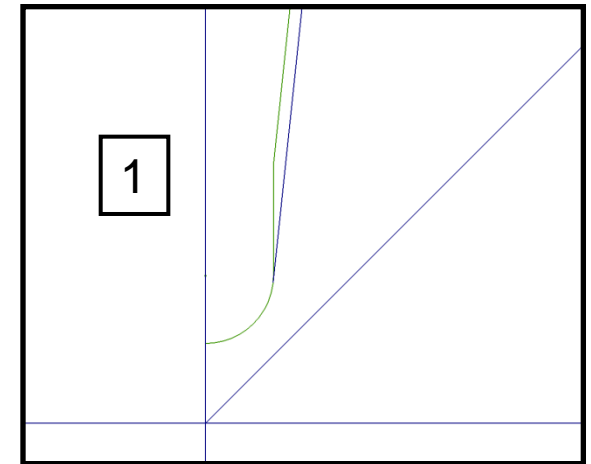
Sliced at mid-point along the length.

The large radii are the same but their centres are in different positions.

Sliced at mid-point along the length.

	CST result	Rad centre offset
Type 1 (Blue)	324.1MHz	101.76mm
Type 2 (Green)	331.1MHz (+2.1%)	100.55mm (-1.2%)

Conclusion

Adding a small flat below the vane tip causes
additional geometry changes that could account
for the 2.1% discrepancy in frequencies between
the Type 1 and Type 2 models.

Thank you.