RF Test of Standing Wave Deflecting Cavity with Minimized Level of Aberrations.

Poster THPO079

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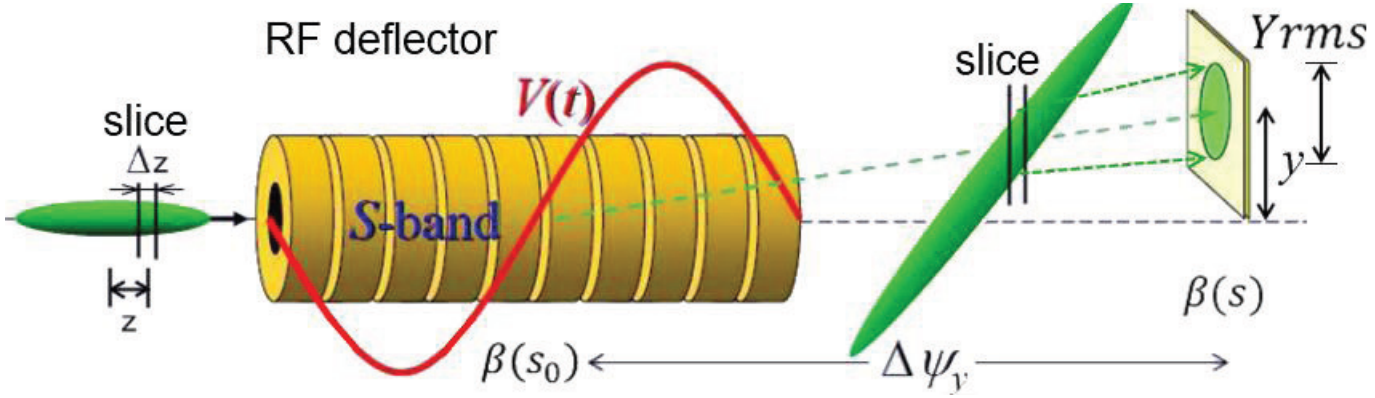
Deflecting structures find applications for the bunch rotation with the purposes of diagnostic for the longitudinal distribution, the emittance exchange and the luminosity improvements in colliders. For these applications it should provide the minimal, as possible, own distortions in the original transverse emittance.



LEADING PHYSICAL IDEA

The concept was introduced at Linac 2012 Conference (TUPB002)

1 – keep the bunch closer to the cavity axis;
2 – minimize the level of nonlinear additives in deflecting field;
3 – improve RF efficiency.

$$E_d = E_x - \beta Z_0 H_y, \quad Z_0 = \sqrt{\frac{\mu_0}{\epsilon_0}},$$

$$\delta\psi_d(z) = \psi_d(z) + \frac{\Theta_0 z}{d}, \quad \Psi_d = max(|\delta\psi_d(z)|),$$

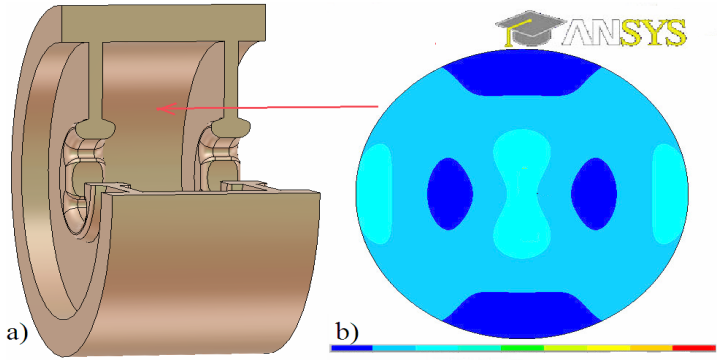
$$E_{def}(z) = E_{d0} cos(\psi_d(z)) \sim E_{d0}(1 - \frac{\Psi_d^2}{2}),$$

$$E_{rot}(z) = E_{d0} sin(\psi_d(z)) \sim E_{d0}\Psi_d,$$

DESIGN PARAMETERS

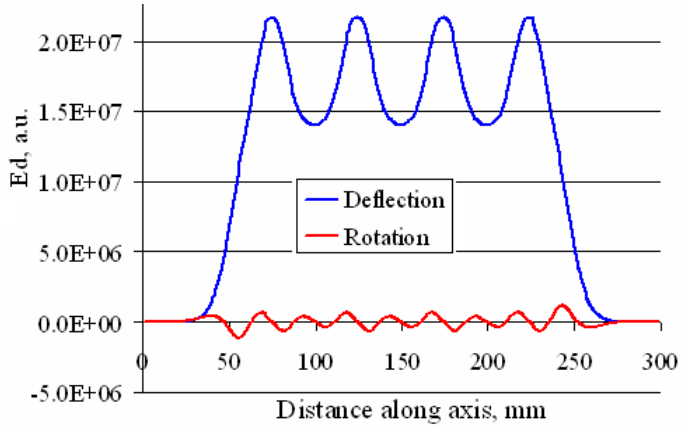
Table 1: Cavity design parameters

Parameter	Unit	Value
Operating frequency	MHz	2997.925
Energy of electrons	MeV	5
Operaring phase advance	radian	π
Active cavity length	mm	≈ 210
Total cavity length	mm	270
Calculated quality factor		12550
Maximal phase deviation	radian	0.033
Separation with nearesr mode	MHz	13.68
Effective shunt impedance, DS	$\frac{MOm}{m}$	43.2
Effective shunt impedance, cavity	MOm	7.58
Input RF power	kW	5
Expected deflecting voltage	kV	190

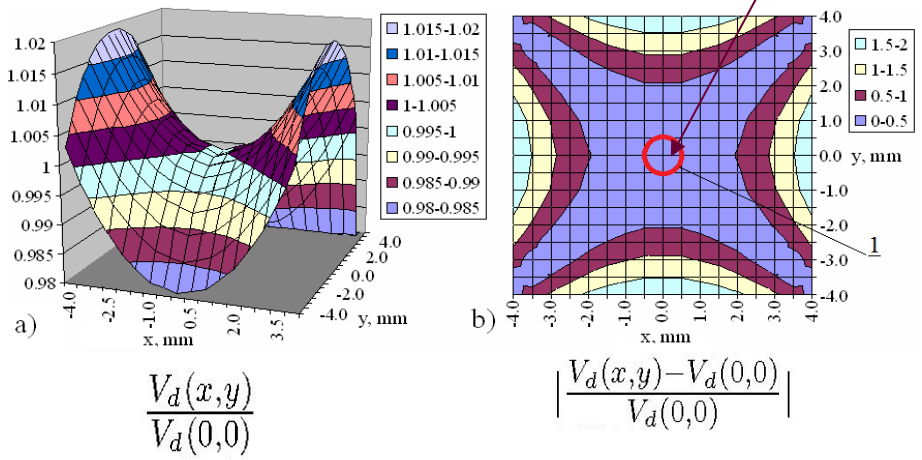


Accepted deflecting structure

rms beam size, (0.06% Vd(0.0)



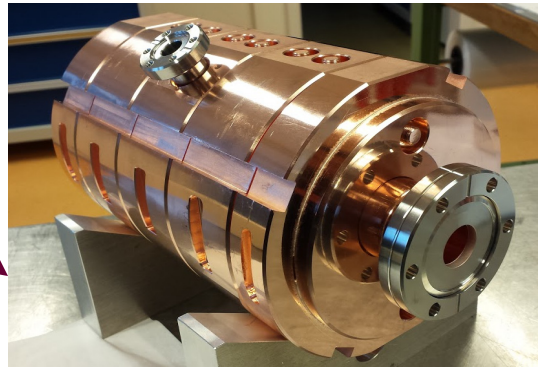
Deflecting field along cavity axis



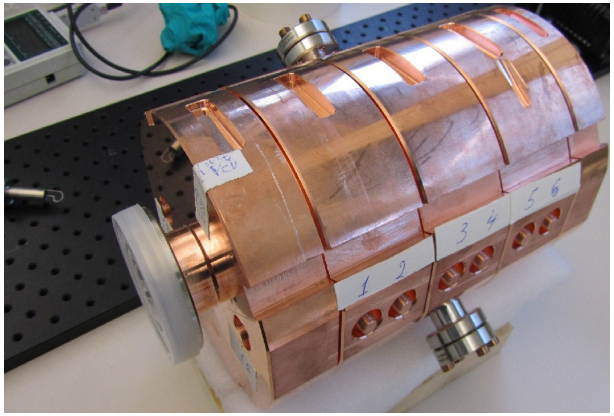
Uniformity of deflection voltage

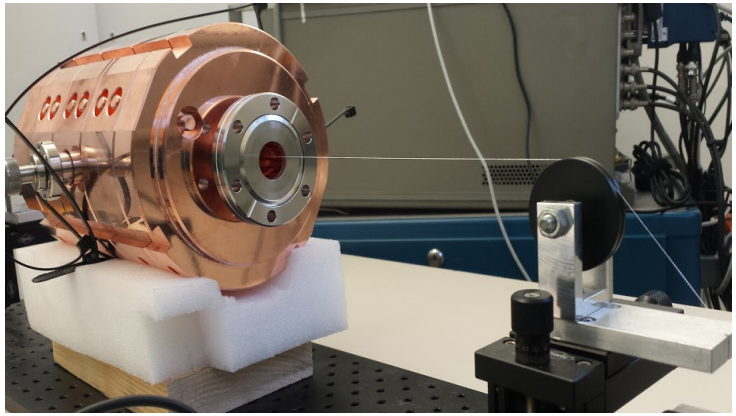
CONSTRUCTION AND RF TUNING

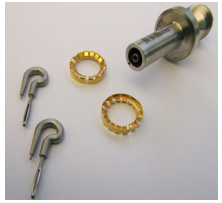
CANDLE SRI



Before brazing, manufactured CANDLE SRI, Yerevan







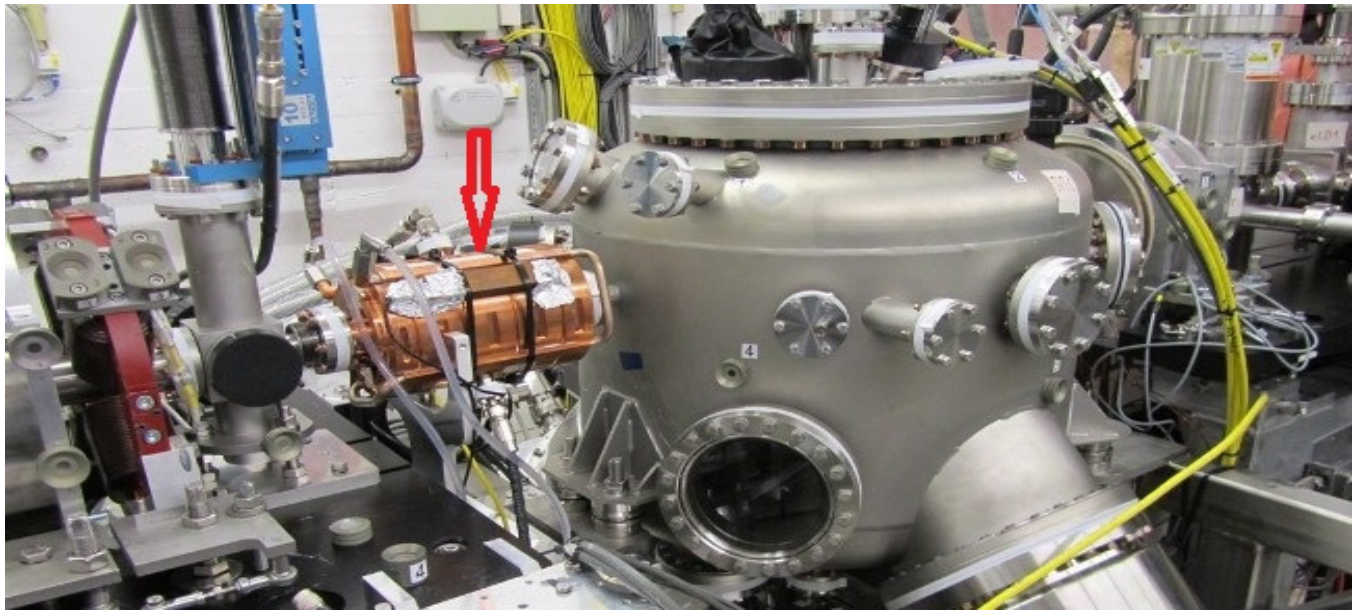
RF tuning, field distribution *1 2 3 4*

100:100,08:100,04:99,86

driving loops

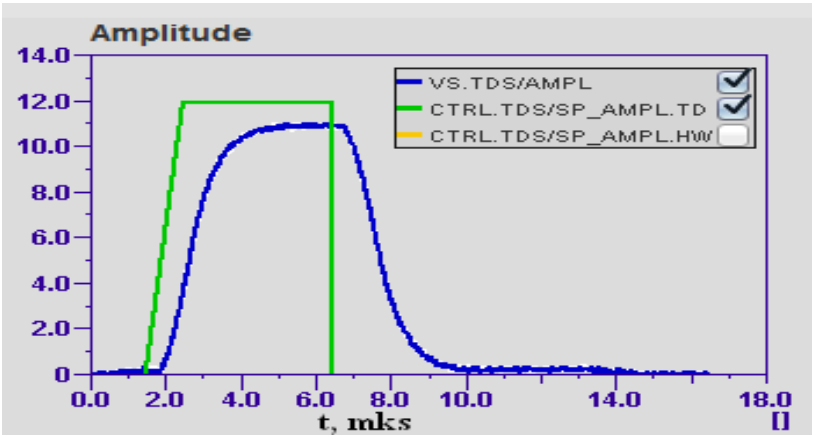
3D printing

RF TEST



Cavity at the REGAE beam-line

RF amplifier



Control signal and signal from cavity

SUMMARY

For the first time was realized and RF tested the deflecting cavity specially optimized for minimal transverse emittance perturbation during rotation of bunch.

These performances are requested in the facilities with unique bunch parameters.

The successful test of the cavity at the nominal RF power was carried out.

The cavity is ready for operation by purpose.

Thank You for attention!

For more details -

welcome to poster

THPO079 !