

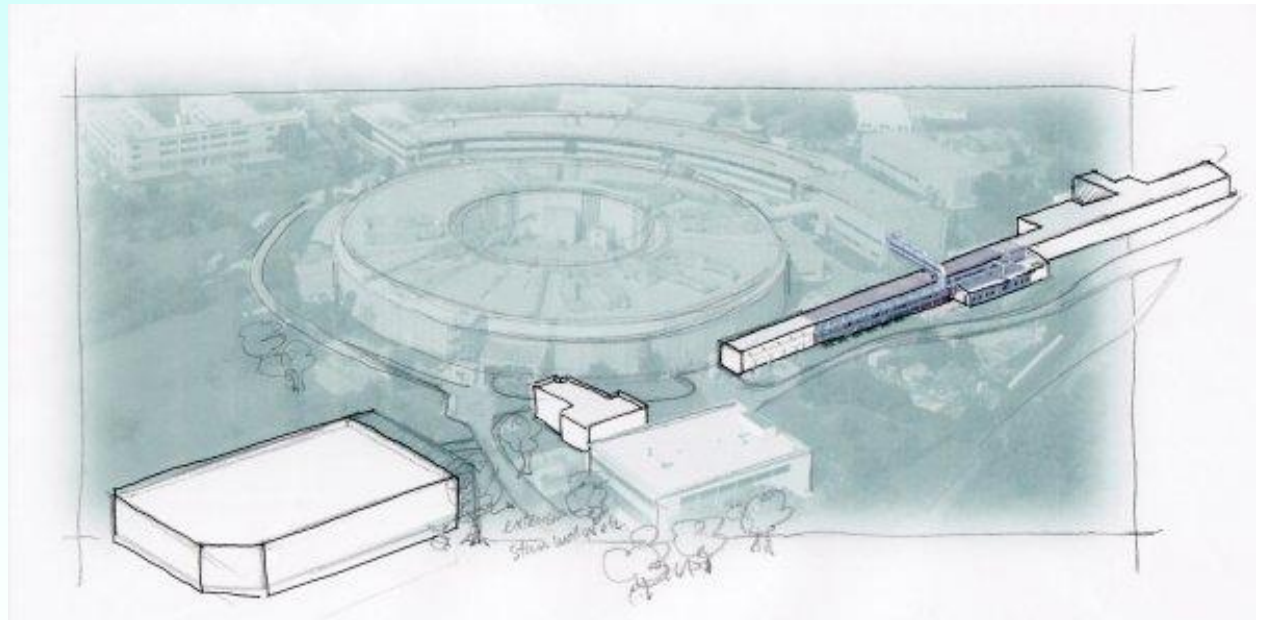
RF Deflectors for the FERMI@Elettra Project

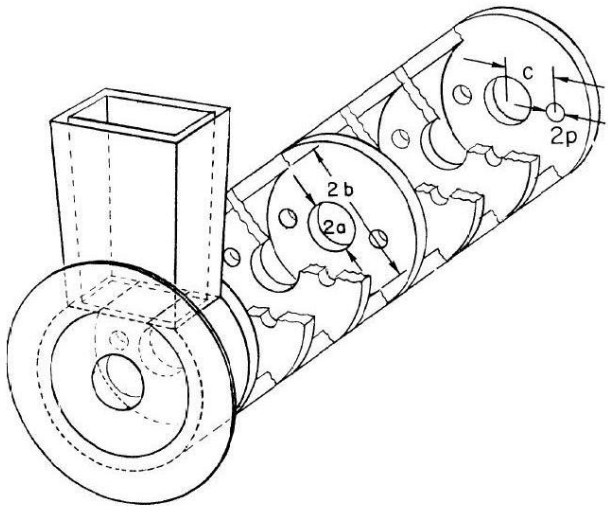
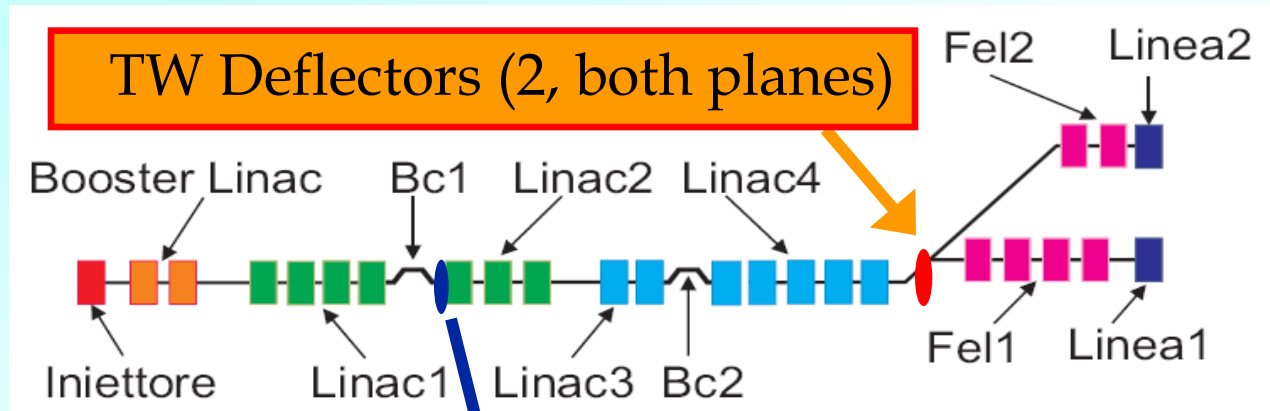
M. Petronio (Università degli Studi di Trieste)
P. Craievich (Elettra, Trieste)
R. Vescovo (Università degli Studi di Trieste)



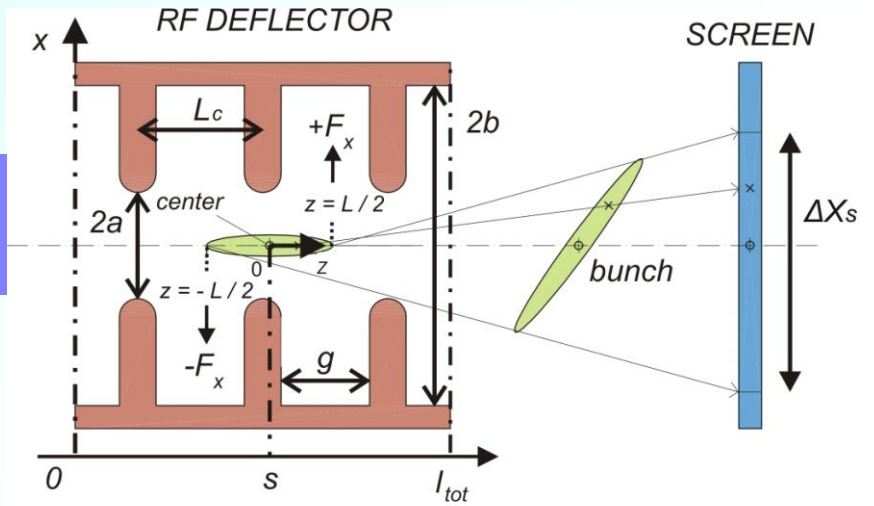
Agenda:

- RF Deflectors in the FERMI@Elettra Project
- Low Energy Deflector
- High Energy Deflectors



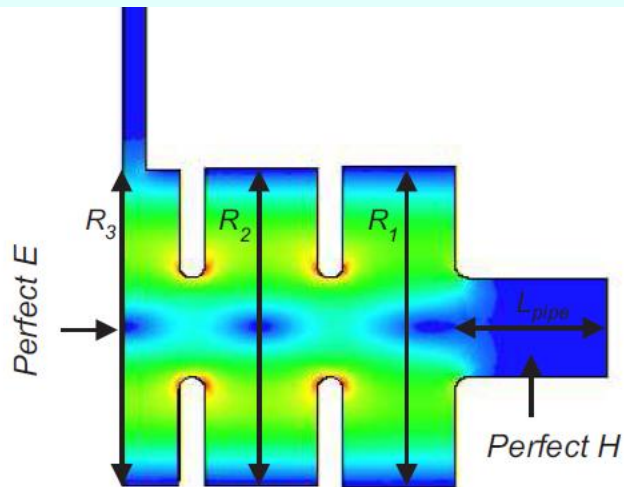
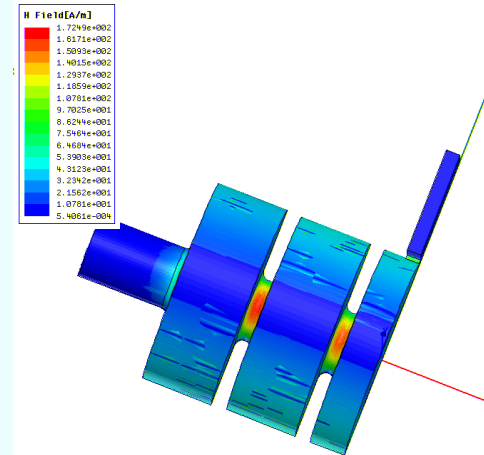
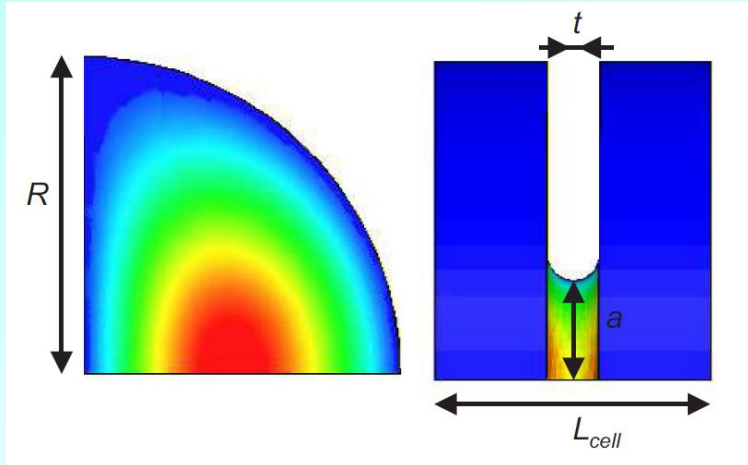


**SW Deflector
(Vertical plane)**



- The cavity has been designed in collaboration with INFN-LNF and Università La Sapienza, Rome.
- It has been installed in February 2010 and is now under commissioning.
- It is a five cells structure fed by a central coupler which works at 2.998 GHz.
- It operates at 350 MeV.

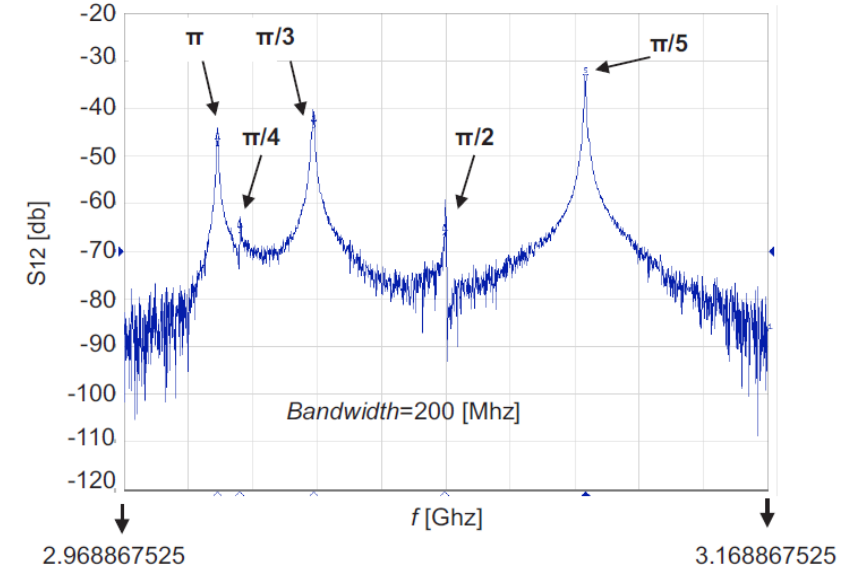
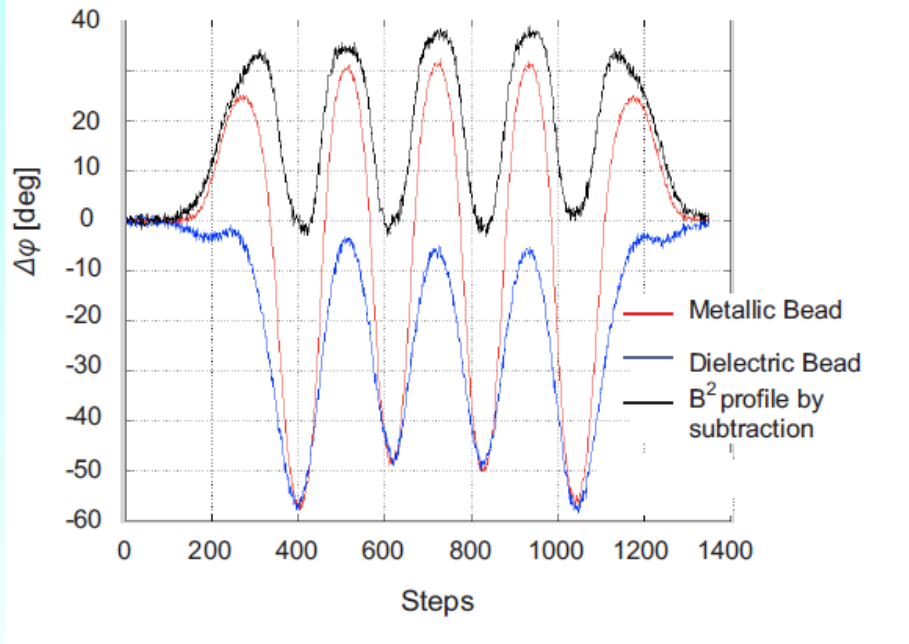




L_{cell}	50.00 mm
R_1	58.25 mm
R_2	57.60 mm
R_3	57.45 mm
a	18 mm
y_w	8 mm
x_w	19.5 mm
t	9.5 mm

f	2.998 GHz
Q_0	15600
R_t	2.4 M Ω
R_t/Q_0	156 Ω
t_F	2.4 μ s
$V_t@5$ MW	4.9 MV
s_{11}	-27.8 dB
β	1.08

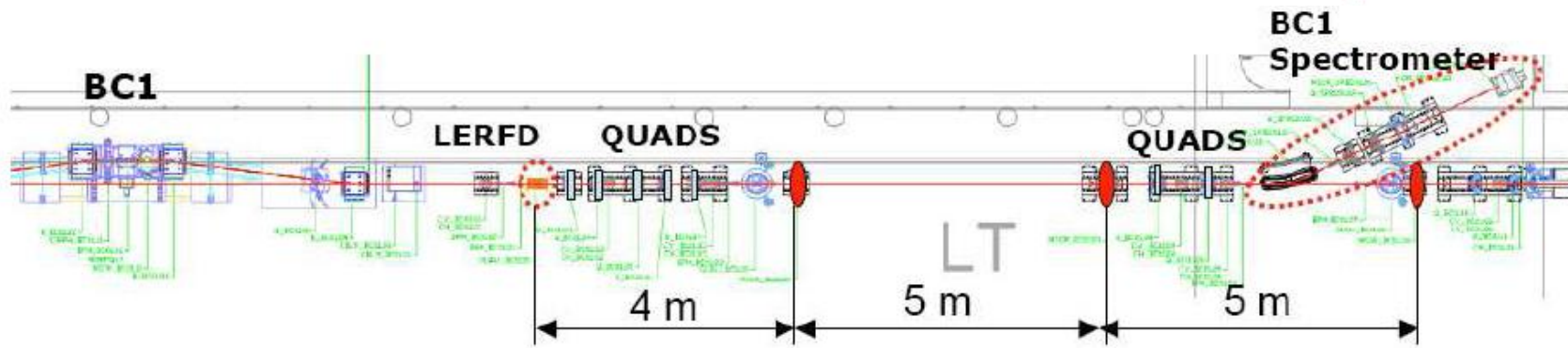
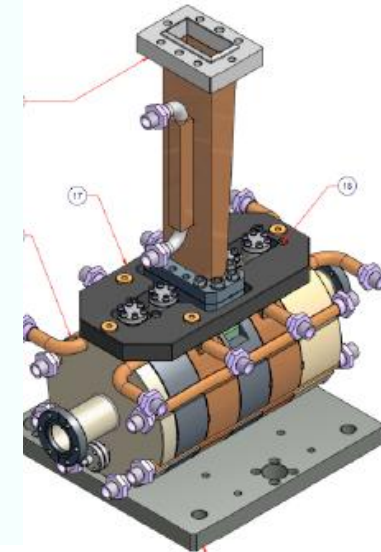
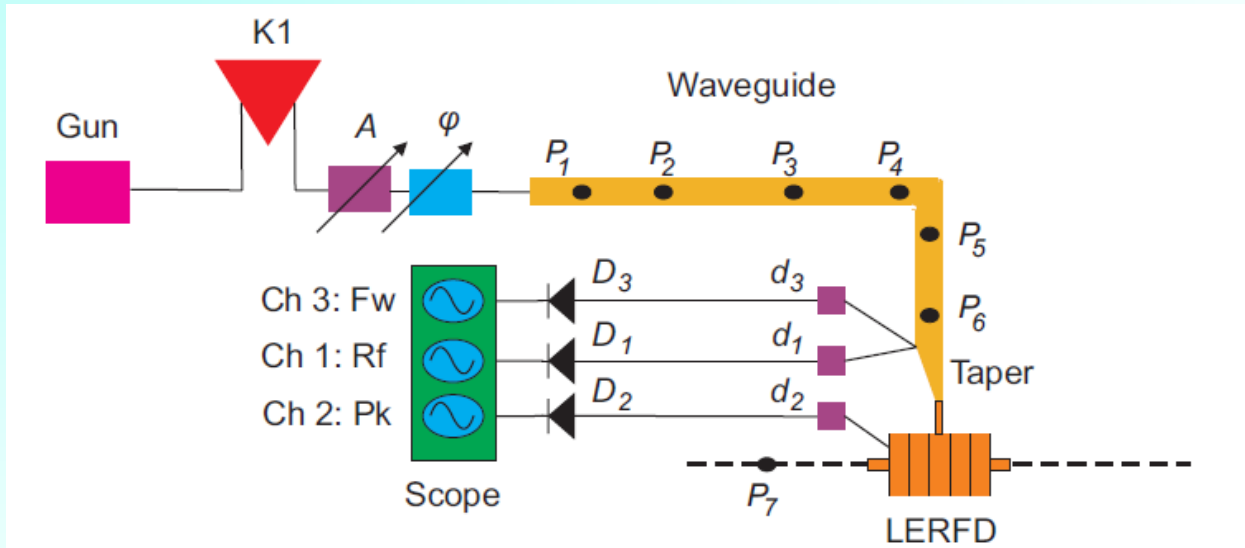


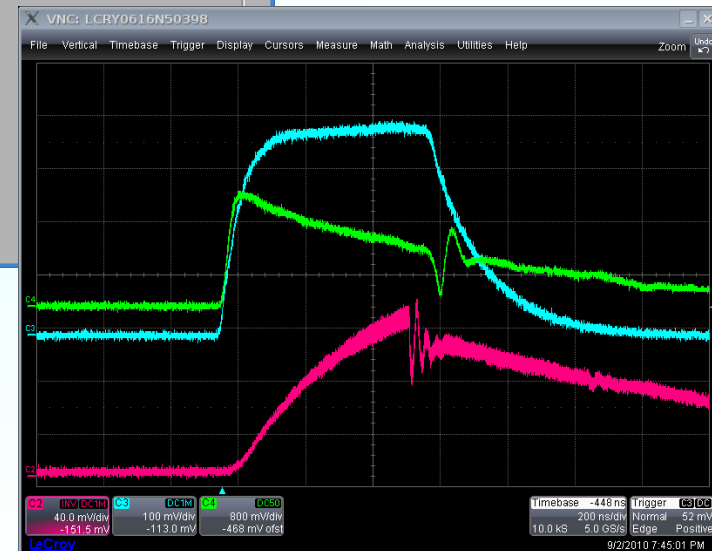
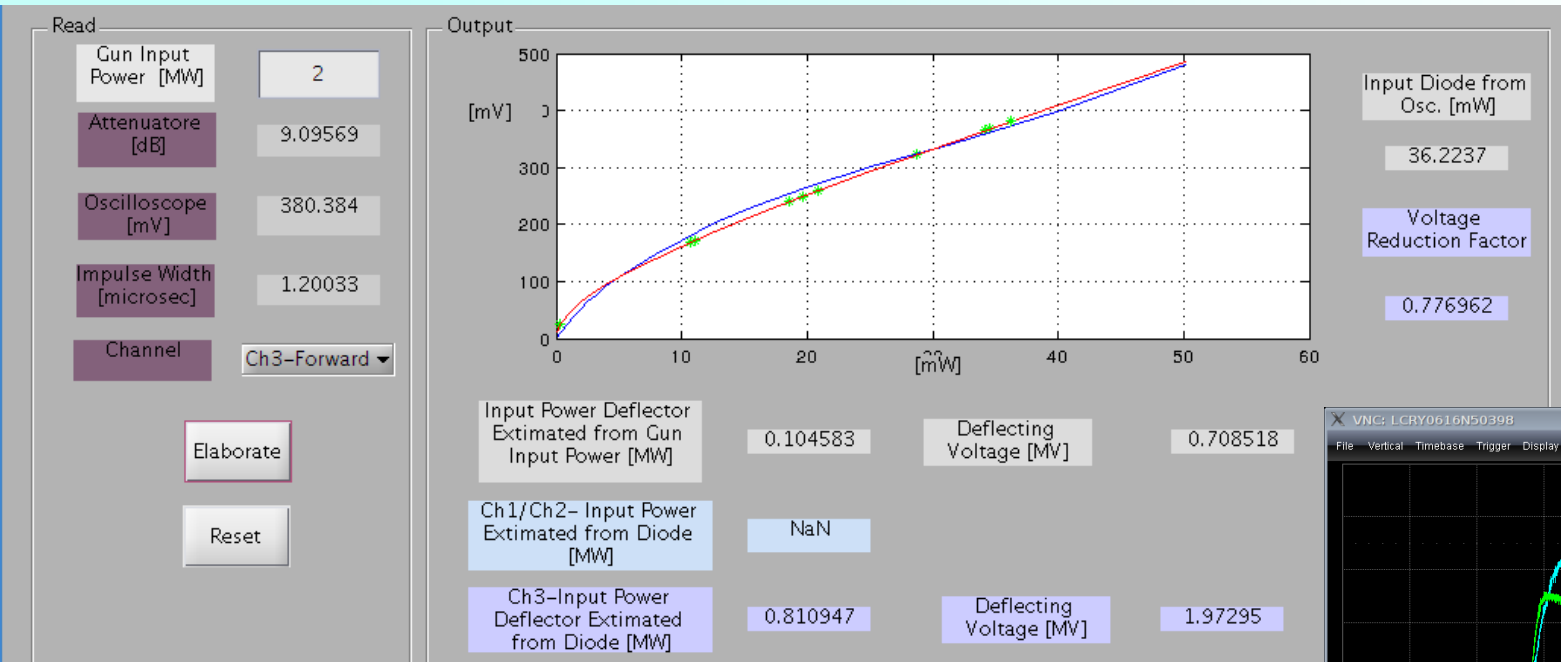


- Measurements performed with the network analyzer confirm the predicted value (courtesy of P. Craievich).

	HFSS	Measured
β	1.08	1.1
Q_0	15600	14600
Q_l	7090	6900
Q_{ext}	14300	13200
$\tau [\mu s]$	0.8	0.74
s_{11}	-27.8	-26.3







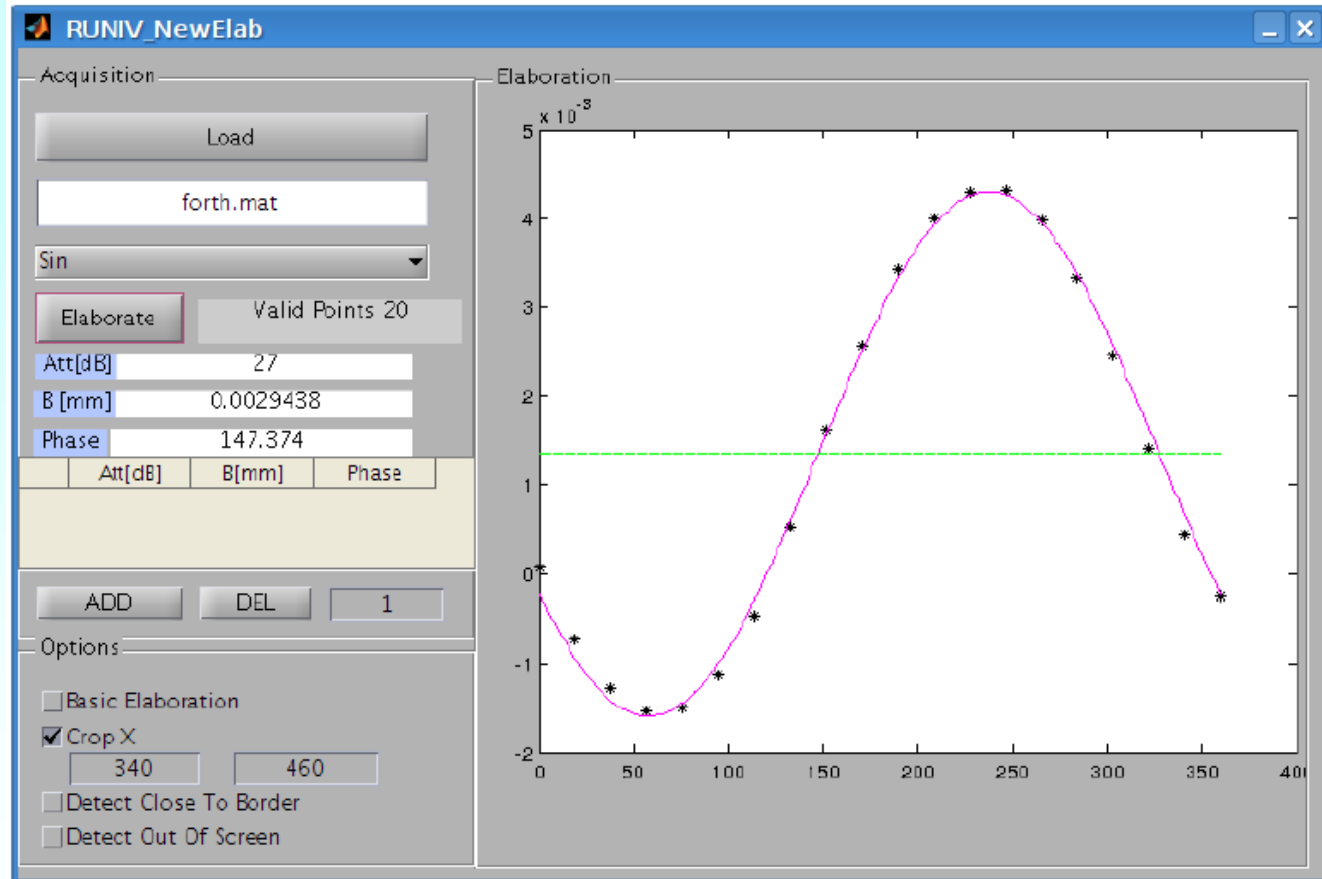
▪ The results presented in the next slides have been obtained working in control room with A. Lutman and G. Penco (Sincrotrone Trieste S.C.p.A.).

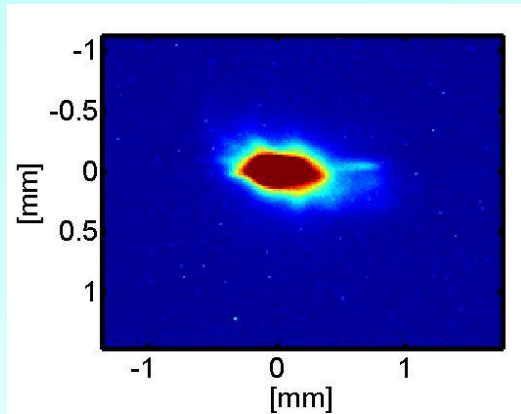


- Calibration GUI with a sin fitting at $V_t=0.16\text{MV}$,
- Zero crossing= 147 deg,
B=2.9mm

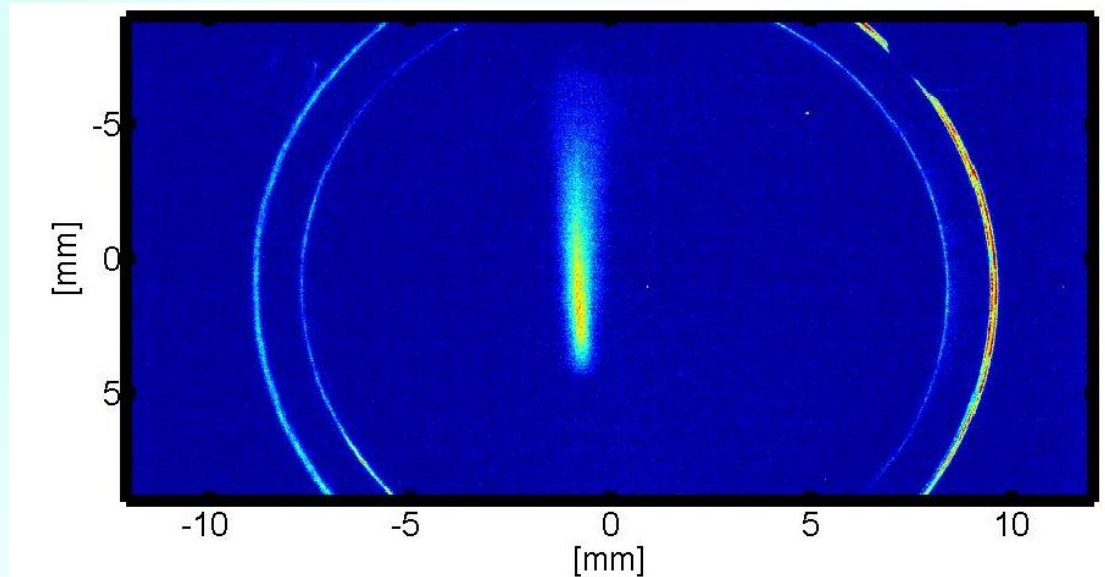
$$y = B \sin(\varphi - \varphi_z) + C$$

$$B = \frac{V_t \sqrt{\beta_S \beta_D} \sin \psi_{DS}}{E_{tot}}$$





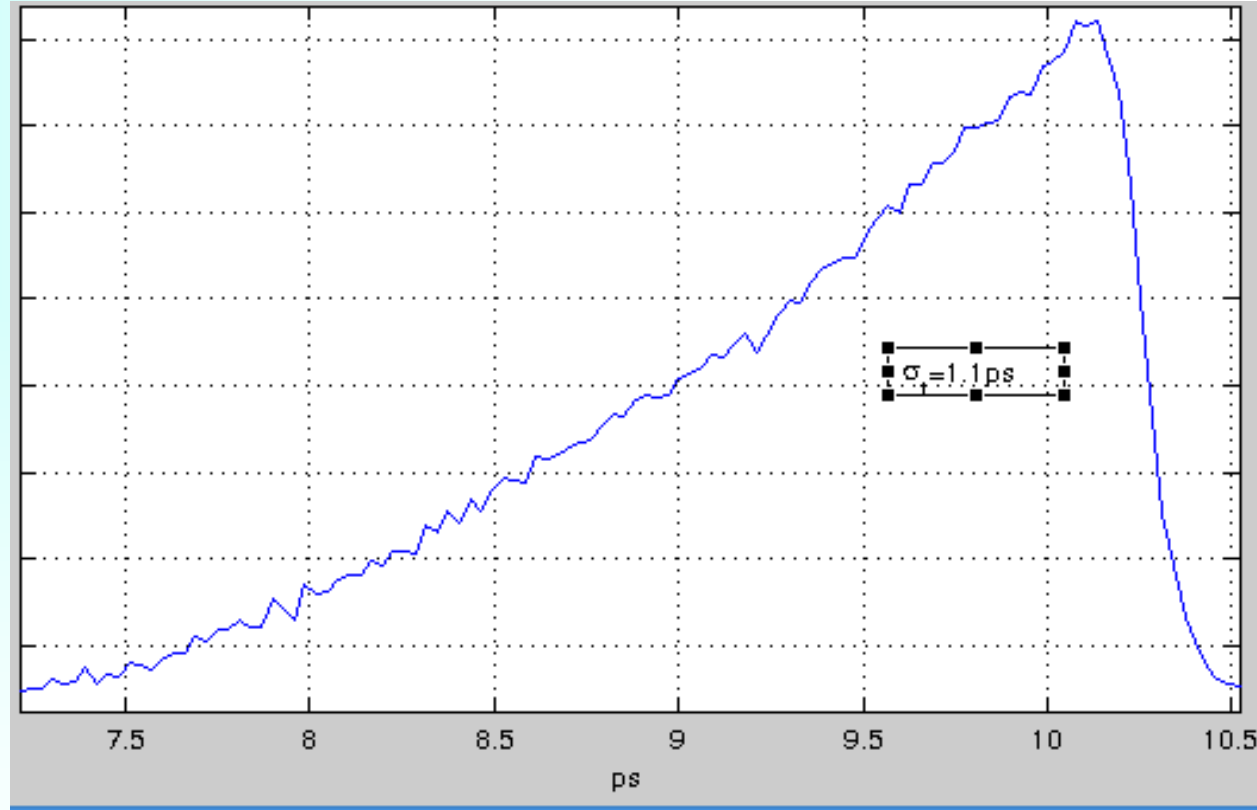
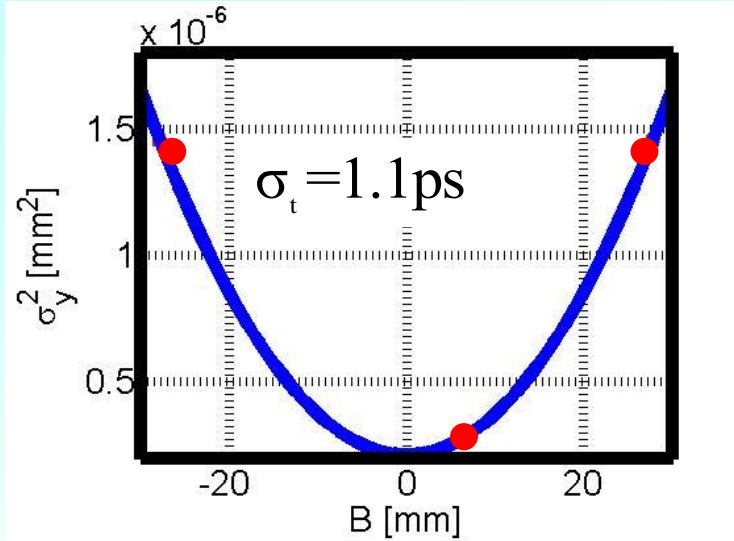
$V_t=0.27\text{MV}$



$V_t=1.5\text{MV}$

- Vertical enlargement of the trace, which can be exploited for bunch length and emittance slice measurements.

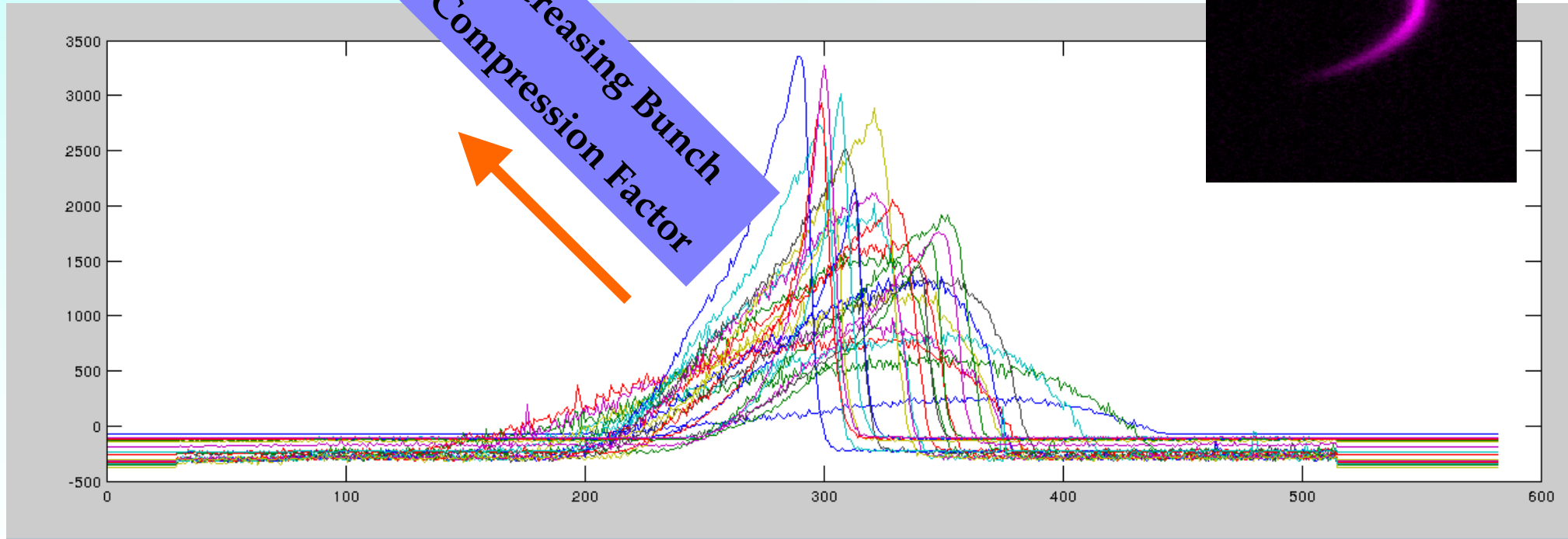
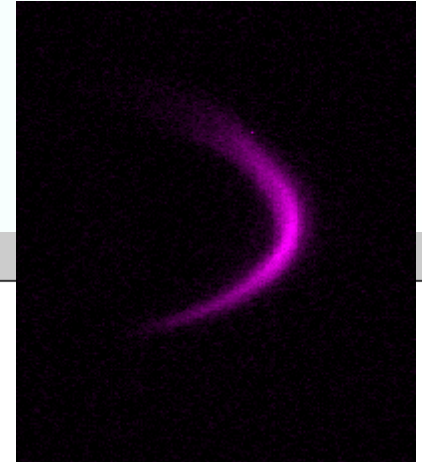




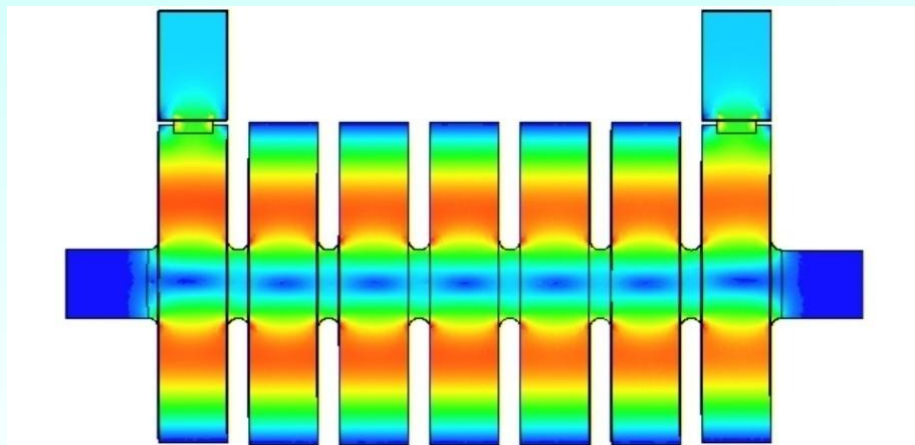
- Bunch Length Measurement=1.1ps (uncompressed bunch)



- Bunch Compressor Estimation and energy profile at BC1 spectrometer.



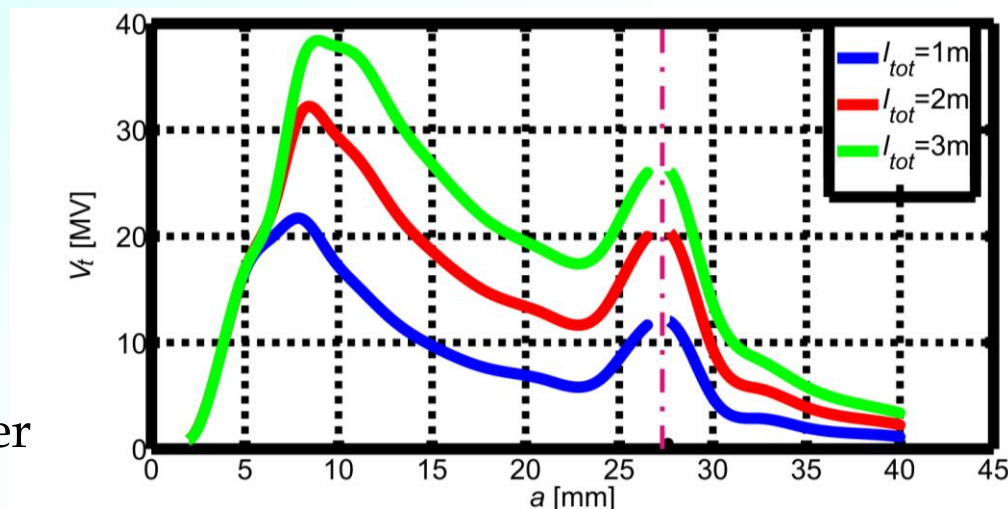
- The high energy deflectors will be 2.5 meters long, working in 2/3 pi mode.
- Deflection in vertical/horizontal planes.



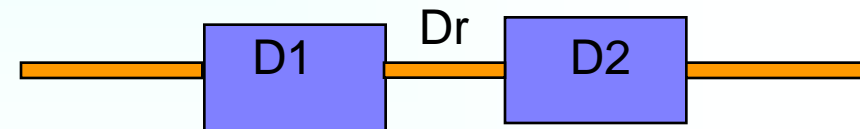
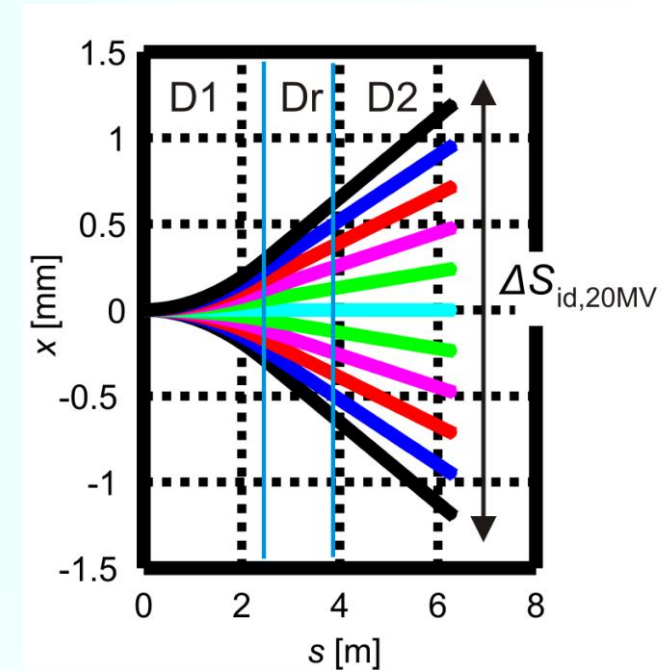
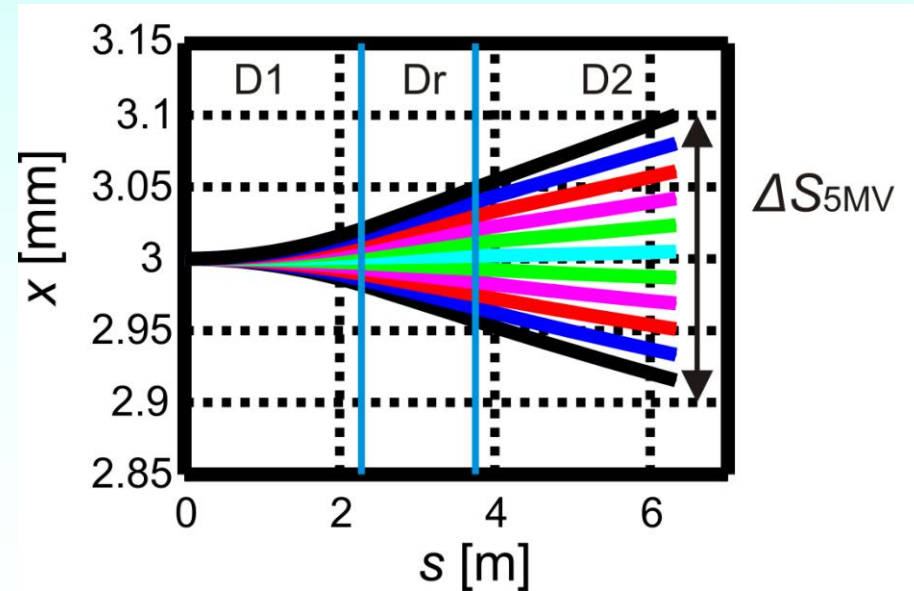
72 cells+ 2 couplers (HFSS design now under realization at PMB-France)

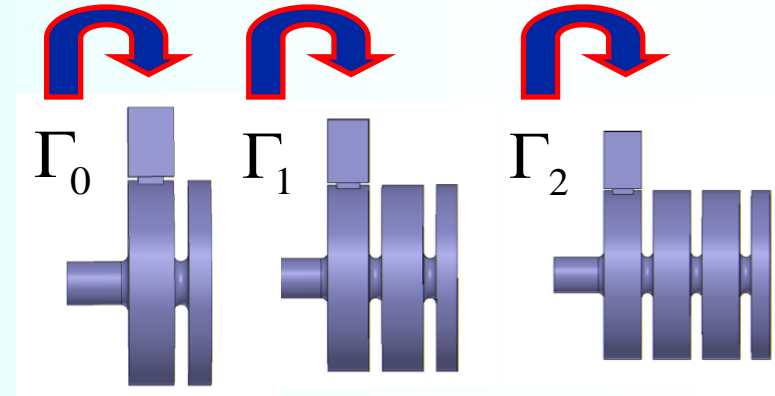
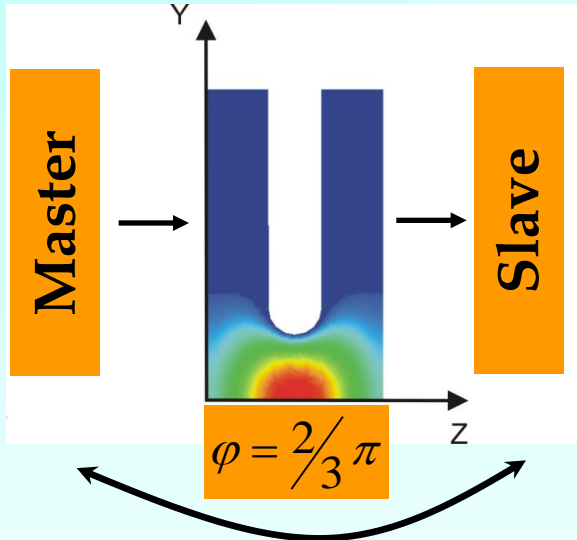
L_{tot}	2.5 m
a	12.5 mm
b	59.33 mm
L_{cell}	33.33 mm

f	2.998 GHz
V_t	20 MV
t_f	3 μ s
E	1.2 GeV

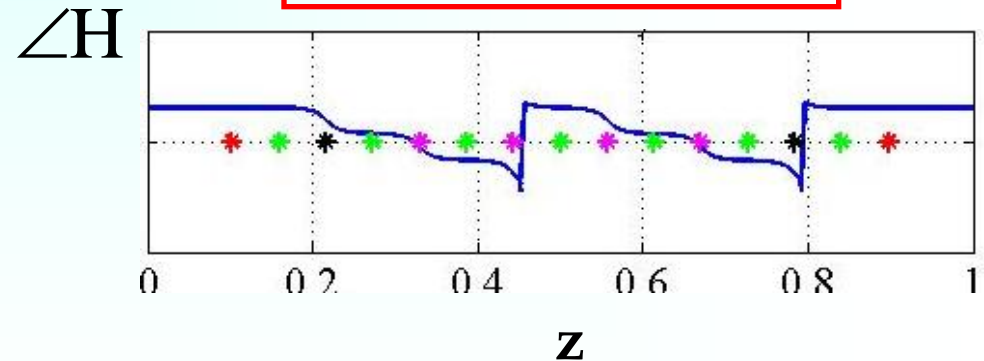
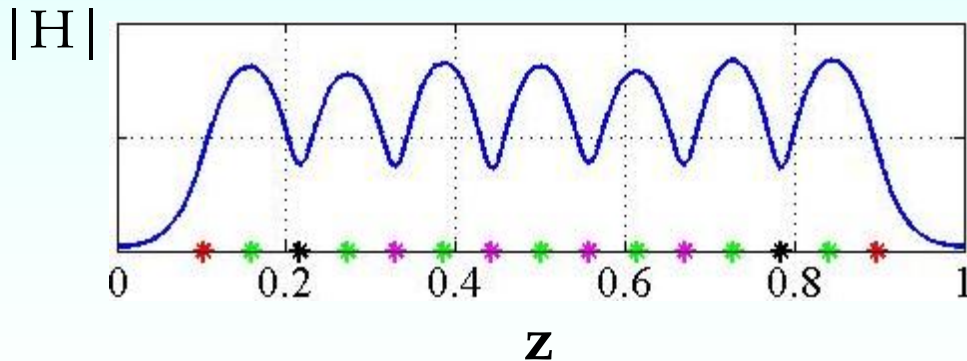


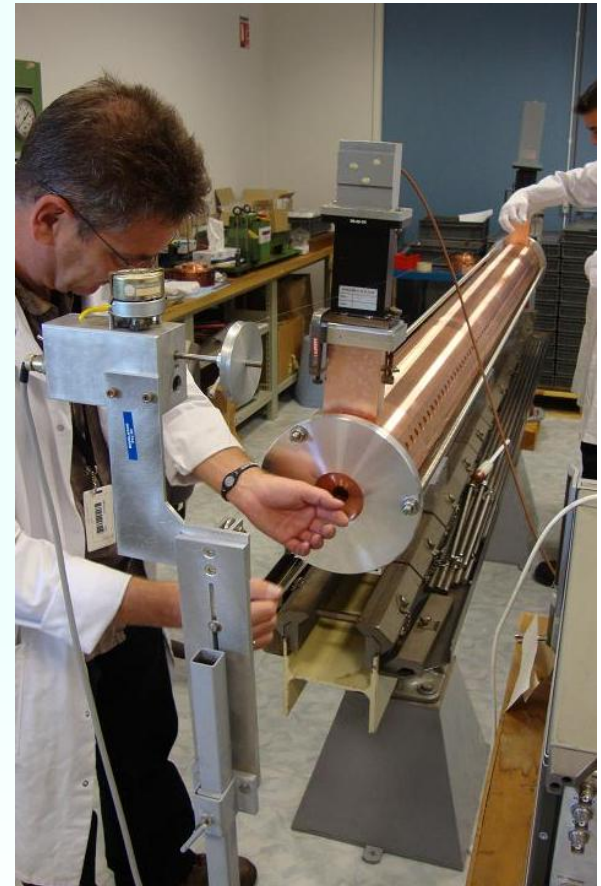
- An analytical model which takes in account the wakefield effect have been implemented (Riunione Nazionale Elettromagnetismo 2010).





$$\alpha = \angle \frac{\Gamma_1}{\Gamma_0} = -2\varphi \quad \beta = \angle \frac{\Gamma_2}{\Gamma_2} = -2\varphi$$





.. work in progress.



- The RF deflectors are a very useful beam diagnostic tool.
- The Low Energy Deflector has performed the first diagnostic measurements.
- The High Energy Deflectors will arrive within few months and will be used to observe the beam properties just before the FEL.

- The work presented here have been done during my PhD under the supervision of prof. Vescovo and P. Craievich.
- A big thank also to: A. Lutman, G. Penco, M. Dalforno, S. Di Mitri, E. Allaria, M. Trovò, S. Spampinati, S. Biedron, D. Lacivita and all the other people of the FERMI@Elettra team involved

