STRIPLINE DESIGN OF A FAST FARADAY CUP FOR THE BUNCH LENGTH MEASUREMENT AT ISOLDE-ISRS

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Plan de Recuperación, Transformación y Resiliencia
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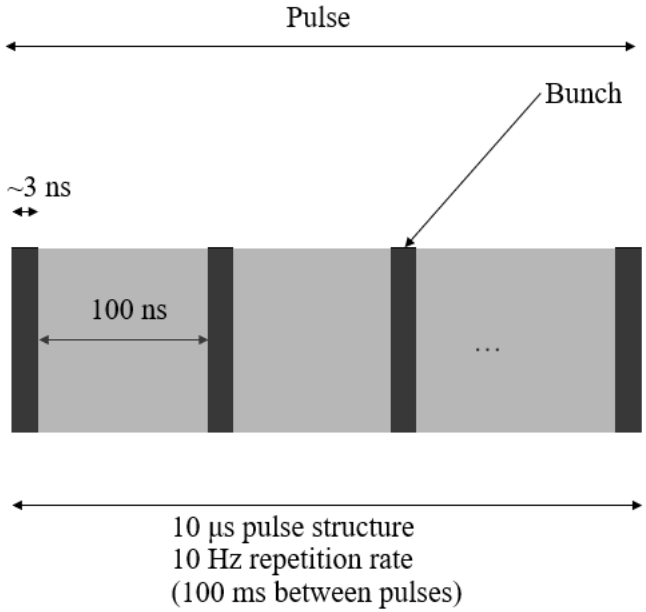
CERN
ISOLDE

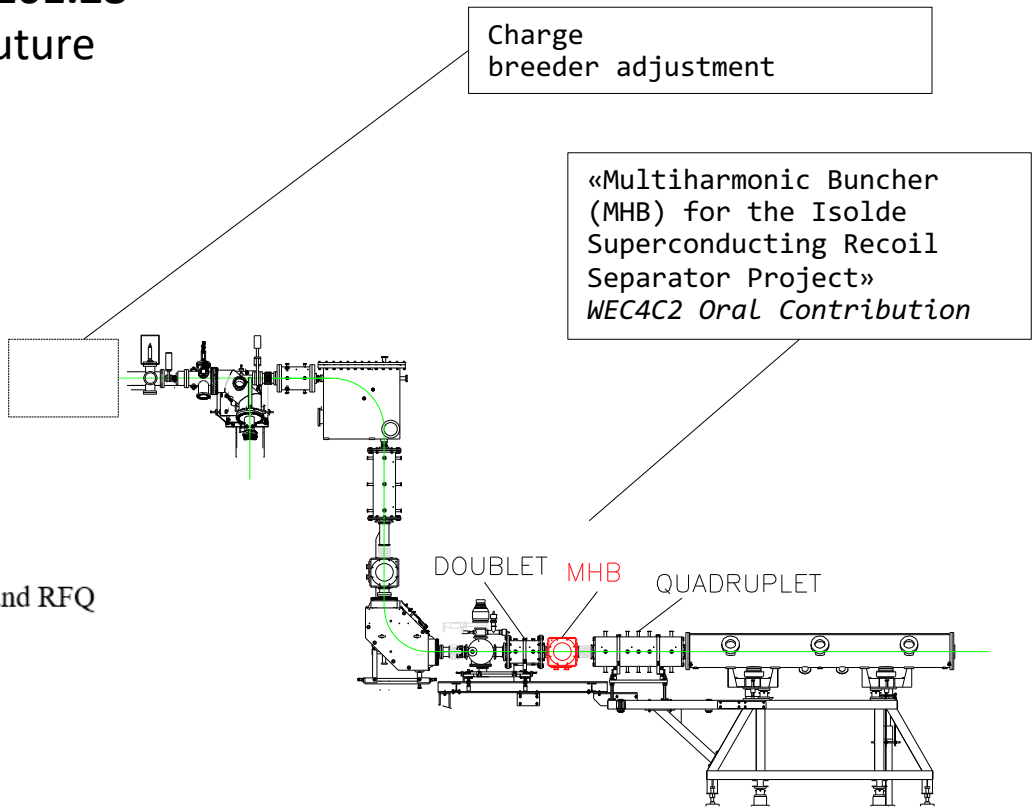
Objective

PROJECT OBJECTIVE

The objective is to reduce by a factor 10 the current frequency of the HIE-ISOLDE LINAC **101.28 MHz** for the optimum performance of the future ISRS spectrometer.

ISOLDE Superconducting Recoil Separator





After MHB and RFQ

HIE-ISOLDE-PROJECT-Note-0035

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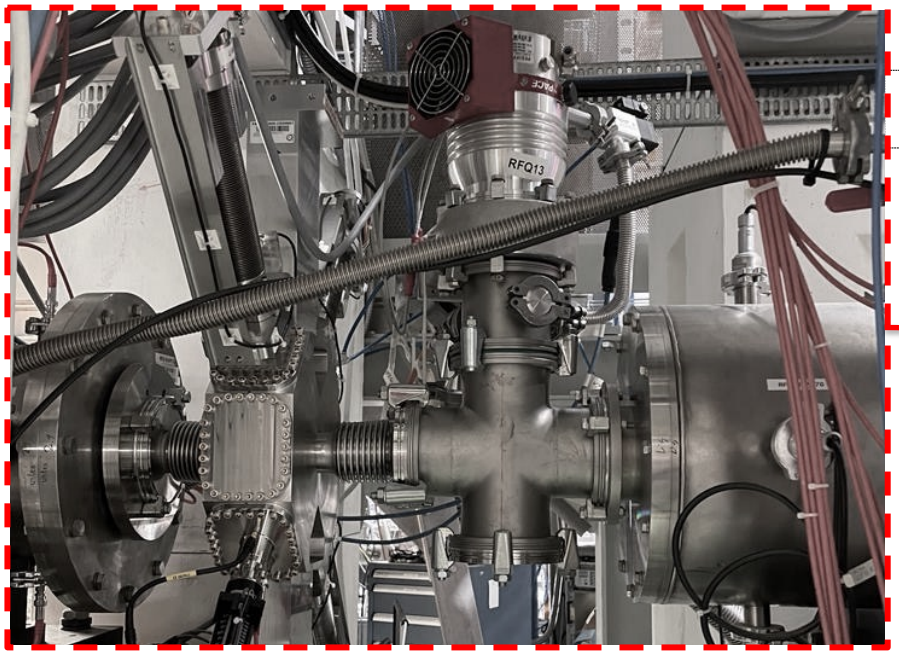
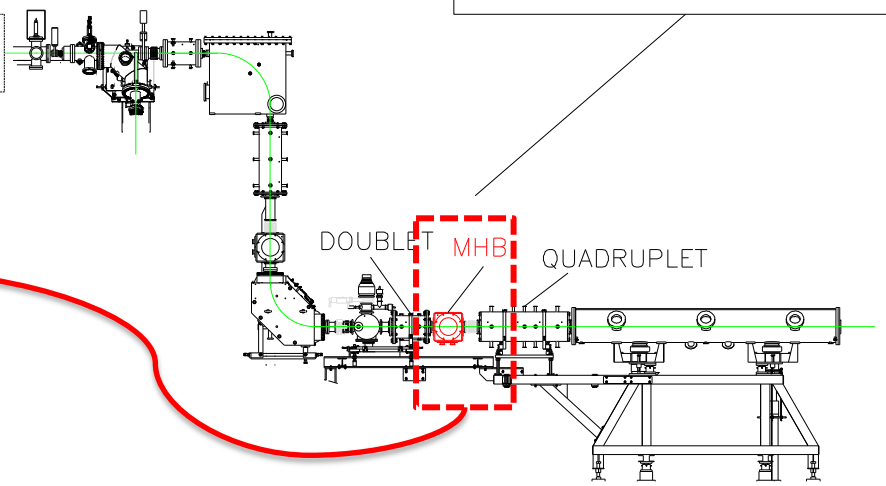


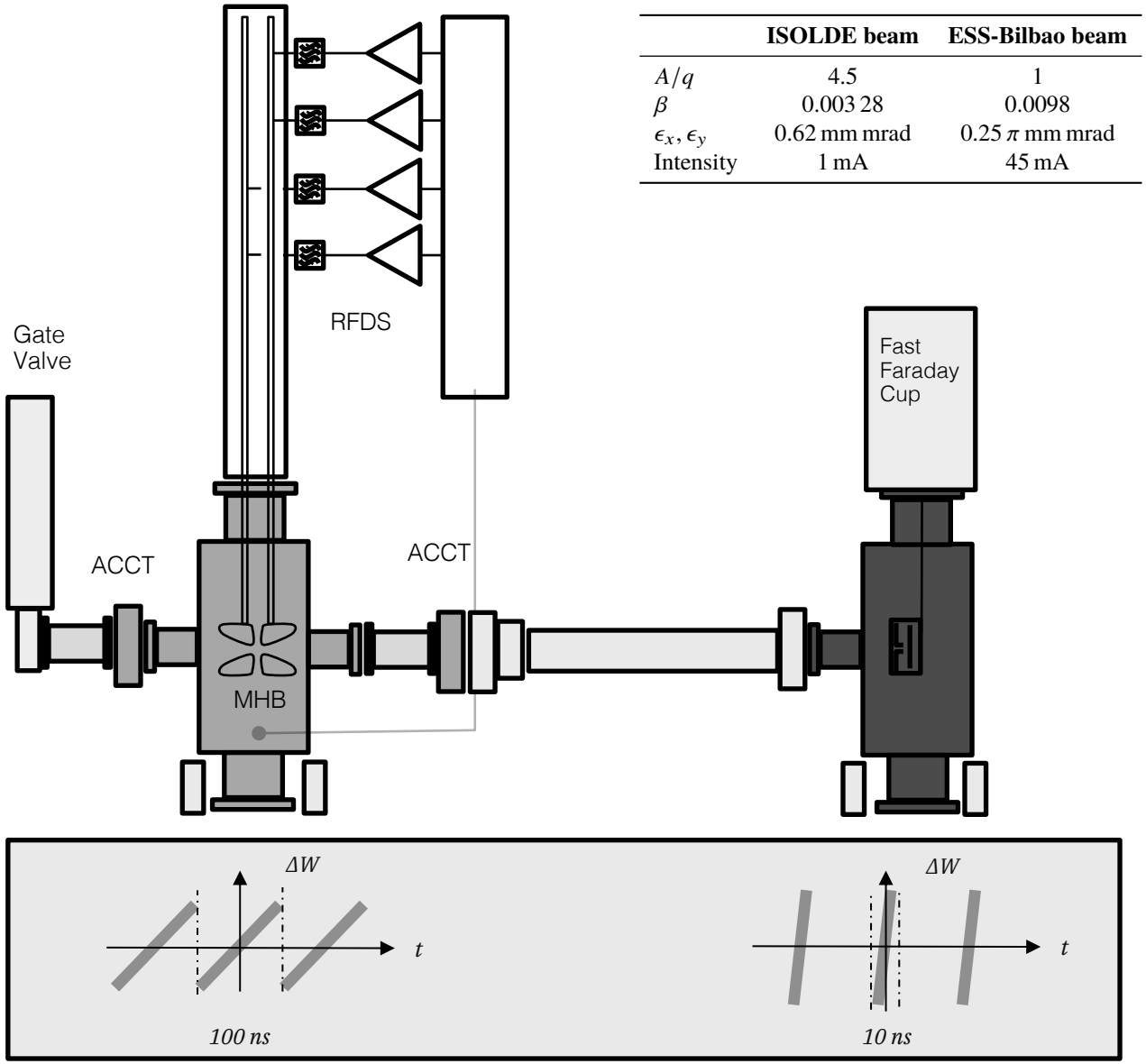
Charge breeder adjustment

«Multiharmonic Buncher (MHB) for the Isolde Superconducting Recoil Separator Project»
WEC4C2 Oral Contribution



HIE-ISOLDE-PROJECT-Note-0035

Test bench for MHB



	ISOLDE beam	ESS-Bilbao beam
A/q	4.5	1
β	0.003 28	0.0098
ϵ_x, ϵ_y	0.62 mm mrad	0.25 π mm mrad
Intensity	1 mA	45 mA

In order to validate the MHB, ESS-BILBAO ions source will be used to test and fine tune the MHB parameters.
This versatile Ion source provides H+, H2+, H3+, He+, N+. We can produced and measure from 50ns upto 3ms pulsed beams. Repetition rate (1-50Hz) can be adjusted. Extraction Energy is 45 keV/q, but we could go up to 75 keV/q with a new power supply, and adjusting the extraction system.

In order to confirm the transmission two beam current transformers (ACCT) are proposed before and after the MHB. After the bunching of the incoming beam, a (fast) faraday cup might be used to measure longitudinal bunch length for very low current beam. In case a focusing system is added.

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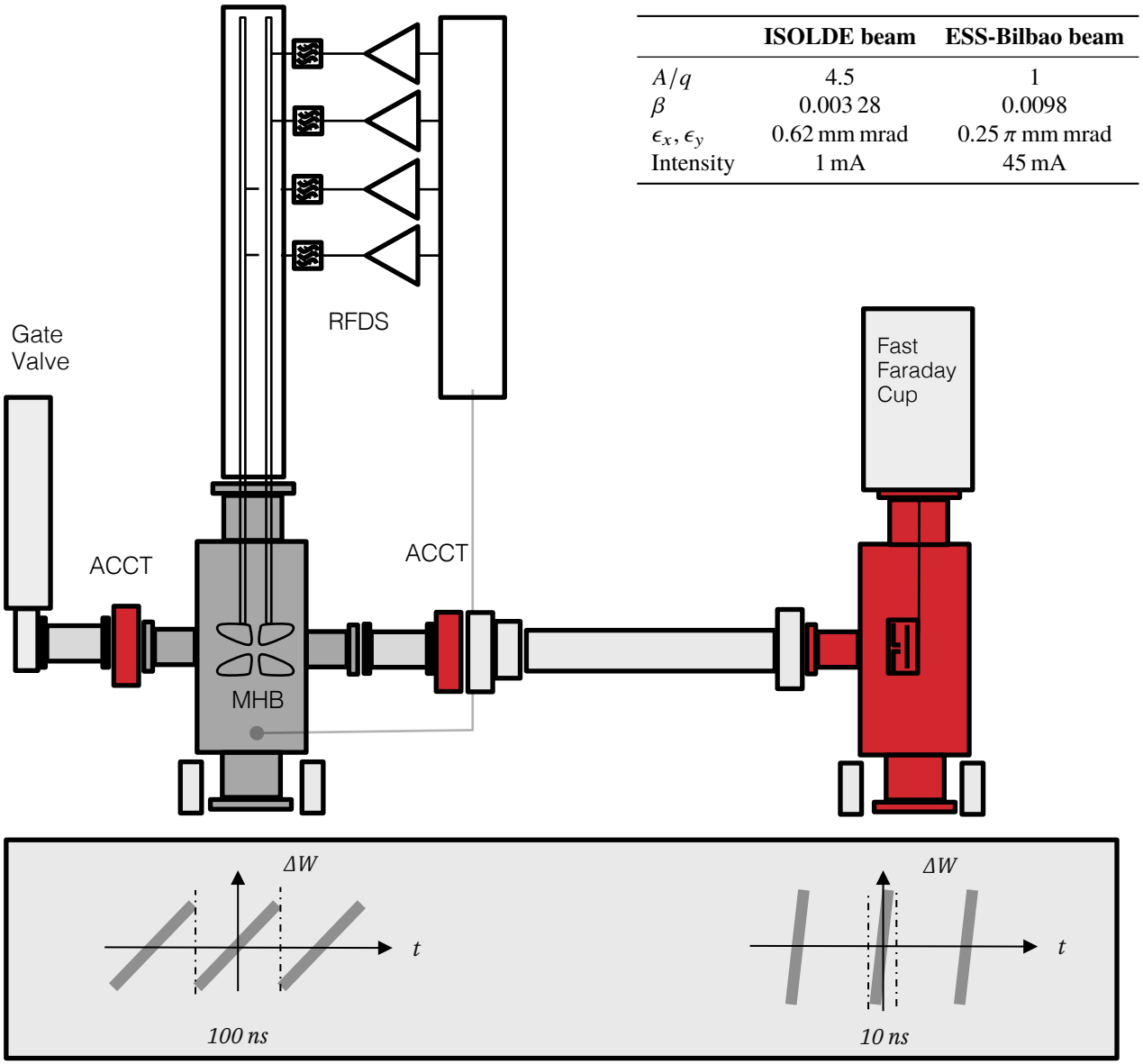

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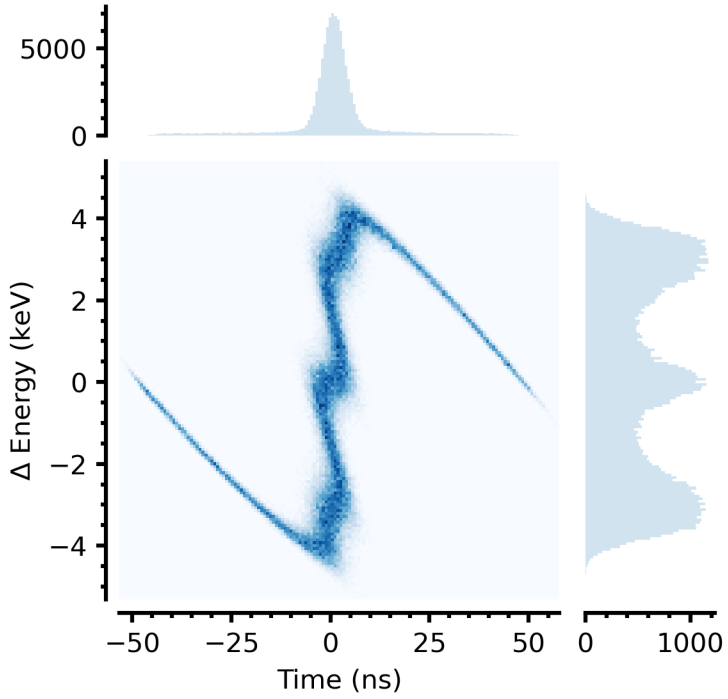
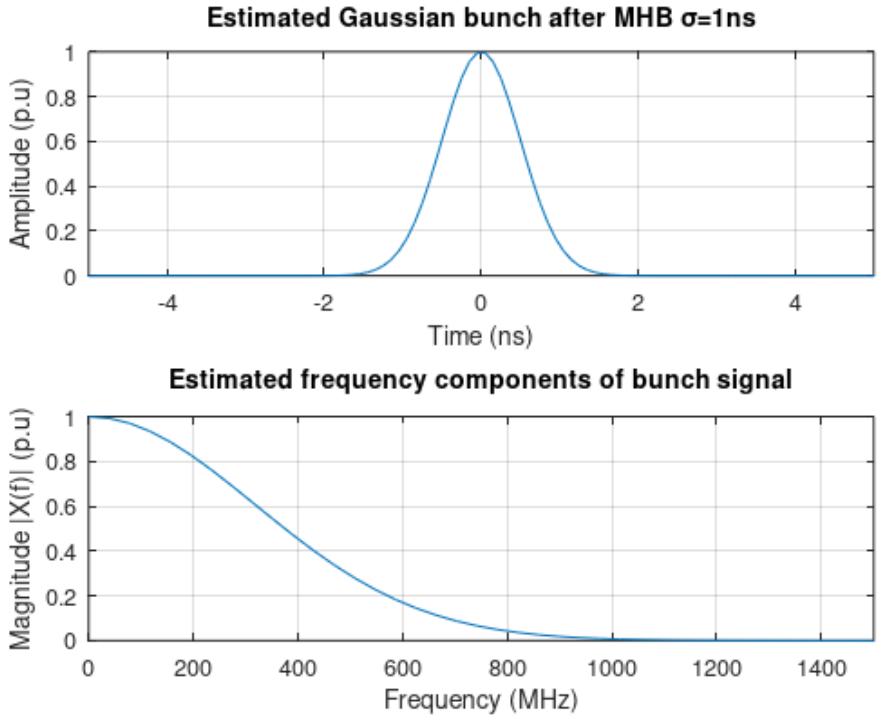
FFC design inputs

The bunching develops just after the MHB and progressing its length variation.

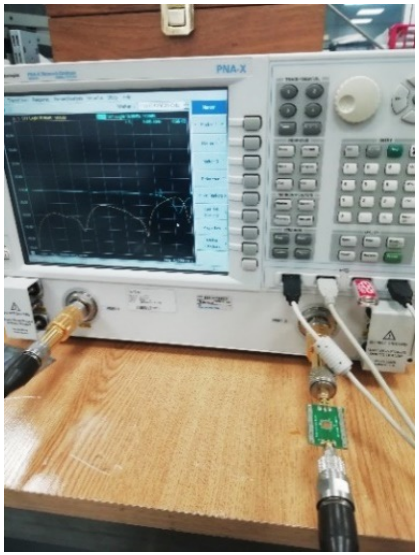


Bunch formation development at a distance of 1m from MHB. Horizontal axis corresponds to time (ns) and vertical axis to energy (keV). 8-12ns width

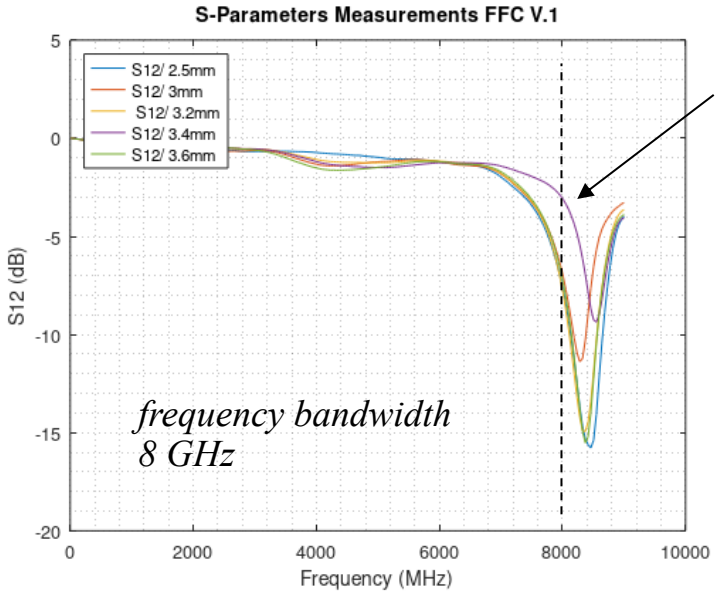


Expected shortest bunch temporal distribution and frequency spectrum after MHB in the FFC location. The frequency components goes up to 1 GHz.

FFC **frequency** and time

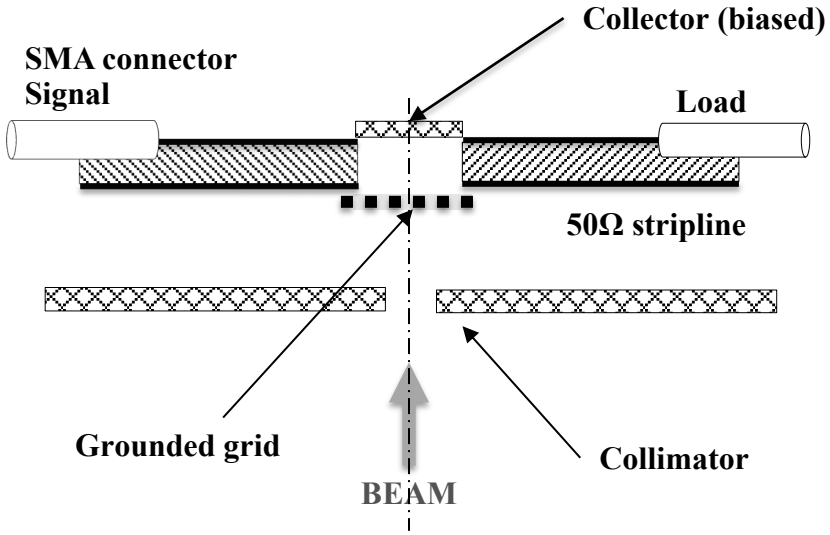


Frequency domain Measurements



Selected design
W = 3.4 mm

Measured S12 parameters
of various prototypes.
Standard FR-4 substrate thickness of 1.5 mm

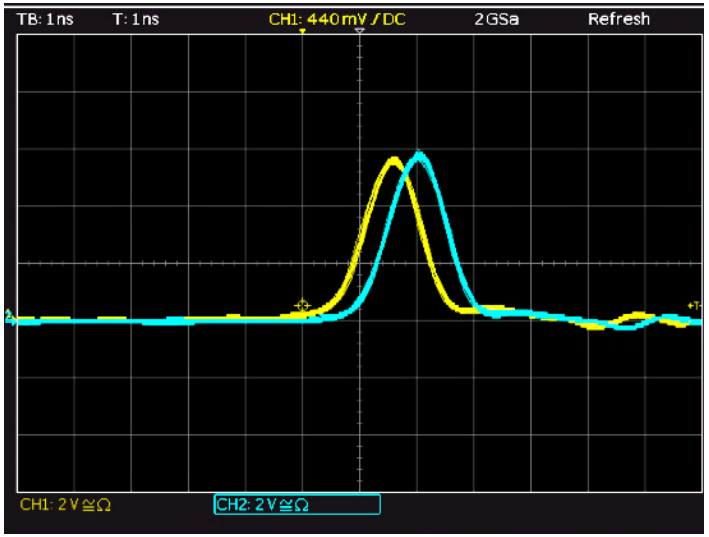


$$Z_0 = \frac{120\pi}{\sqrt{\varepsilon_{eff}\left[\frac{W}{H} + 1.39 + \frac{2}{3}\ln\left(\frac{W}{H} + 1.44\right)\right]}}$$

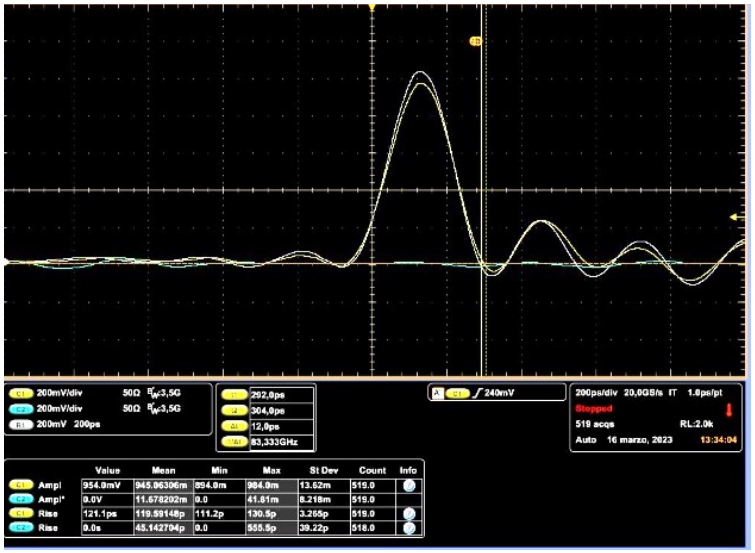
Analytic expression: characteristic impedance of a microstrip W: trace thickness of W, H: substrate height.

FFC frequency and **time**

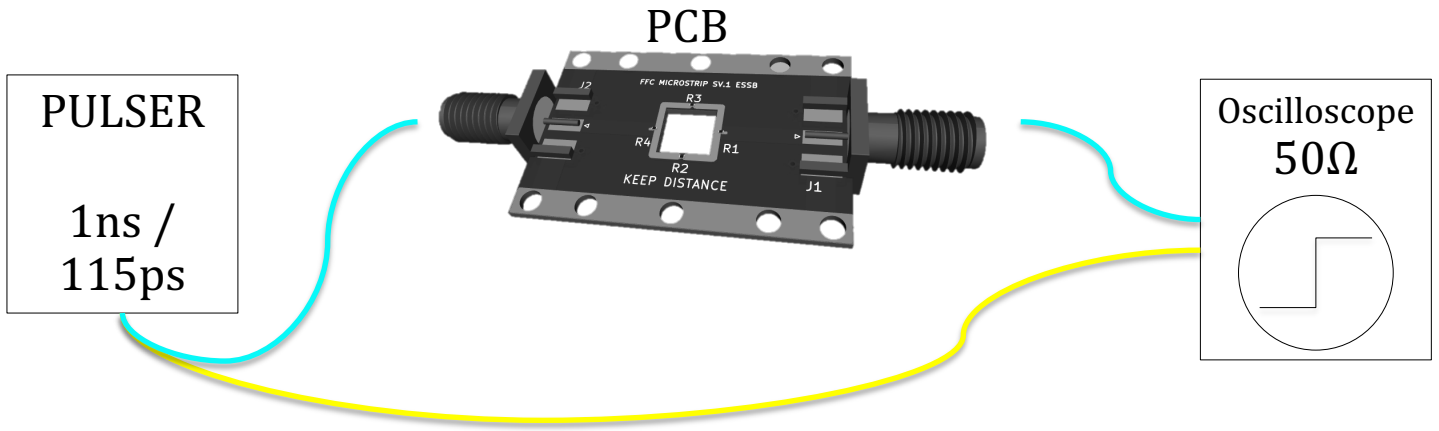
Check the possible deformation of the temporal distribution of the bunch signal.



Temporal measurements with **1ns** pulser.



Temporal measurements with **115ps** pulser.



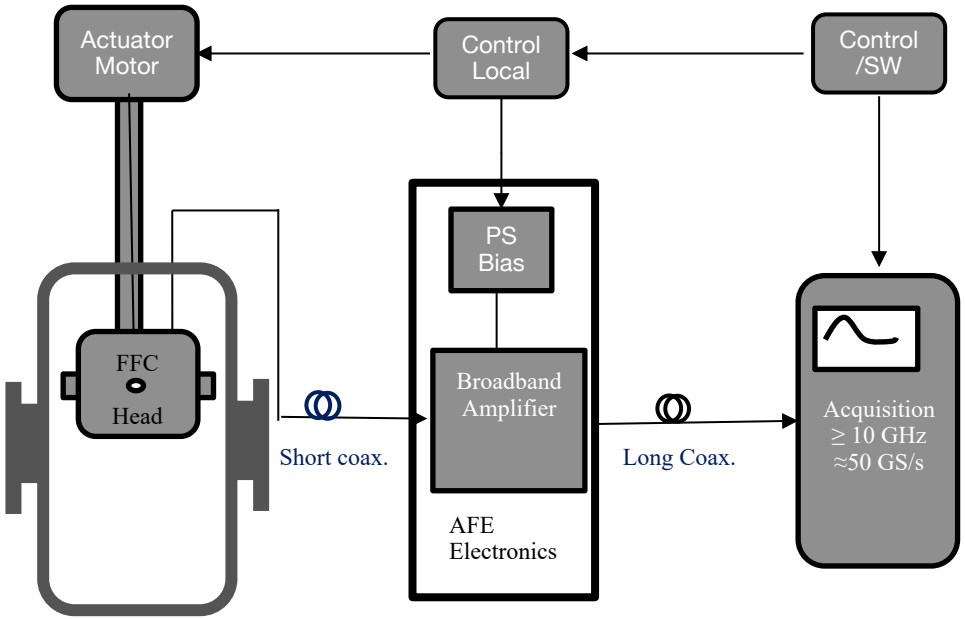
FFC close out

Summary:

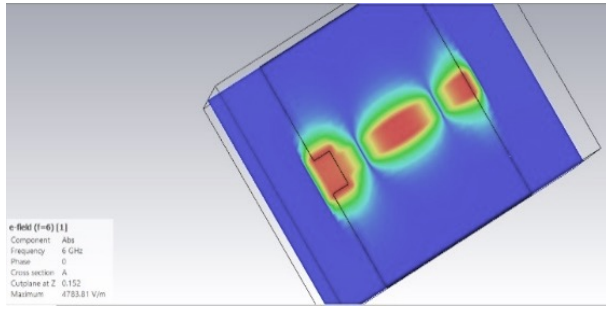
- Stripline type FFC
- Ready for even shorter bunch lengths.

Future steps:

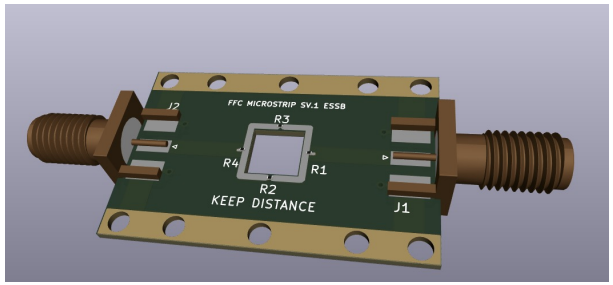
- Fine adjust some details on the PCB.
- Manufacture the rest of the FFC head components..



General Scheme of the Fast faraday Cup interconnections



Mid-plane signal propagation in the FFC PCB



3D image of the FFC head without collimator