GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN
Ciemat Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas

Design, manufacturing and testing of CTF3 Tail Clipper kickers

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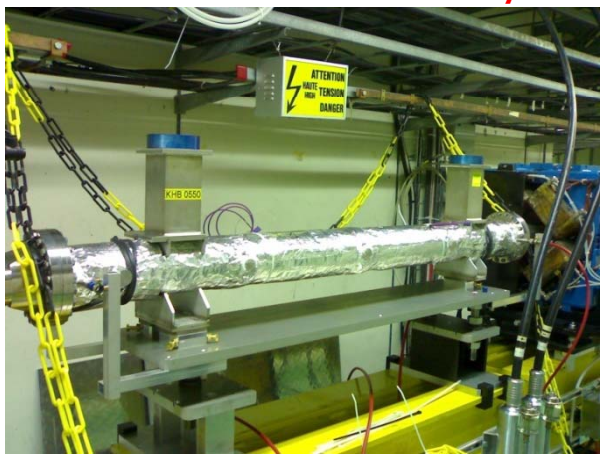
Contents

- 2008 commitments fulfilled!
- Specification updates
- Design and calculations
- Manufacturing
- Tests
- Conclusions

2008 commitments fulfilled !

- The kicker is now finished and fully analyzed. It has arrived CERN and it will be installed soon: The kicker is already installed and working.



- The Tail Clipper main parameters are already defined and a final design could soon be available. Fabrication could be finished for end of 2008: The Tail Clippers were finished and delivered to CERN on December 2008.

Specification updates

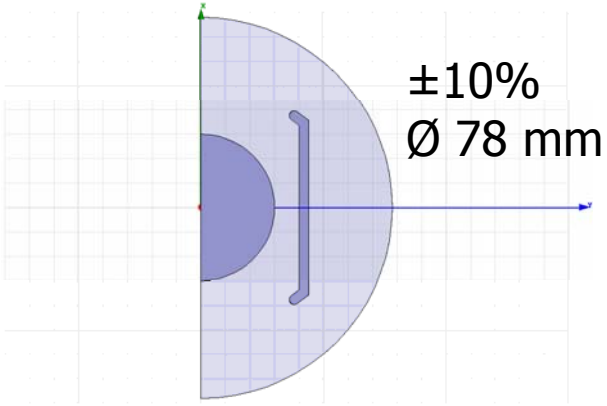
- Available overall length shortened stripline length to 300 mm. 2 kV required.

Beam energy	200	MeV
Total kick deflection angle	1.2	mrad
Deflection plane	vertical	
Stripline plate separation	40	mm
Field homogeneity	±20	%
Characteristic impedance	50 ±1	Ohms
Pulse duration (maximum)	140	ns
Maximum field rise-time (0.25 to 99.75%)	5	ns
Maximum timing jitter	1	ns
Pulse repetition rate – nominal/maximum	5 / 50	Hz
Number of stripline sections	4	
Stripline section length (electrode length)	300	mm
Total available straight section length	1625	mm
Vacuum tank material	1.4307	
Electrode material	AL6082	
Flange material	1.4429	
Pumping ports	none	
Supports and Alignment system	as per CR kicker	

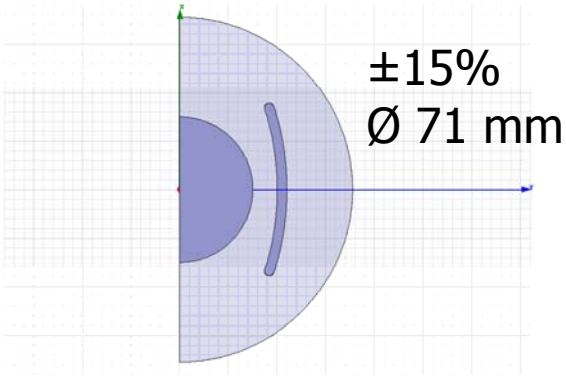
Design and calculations (I)

- Several straight sections analyzed, trying to decrease chamber diameter but not disturbing the homogeneity too much.
- Beam impedance improvement using a reduced chamber.

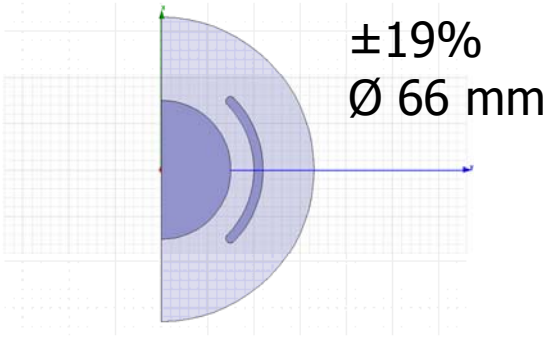
Flat electrodes



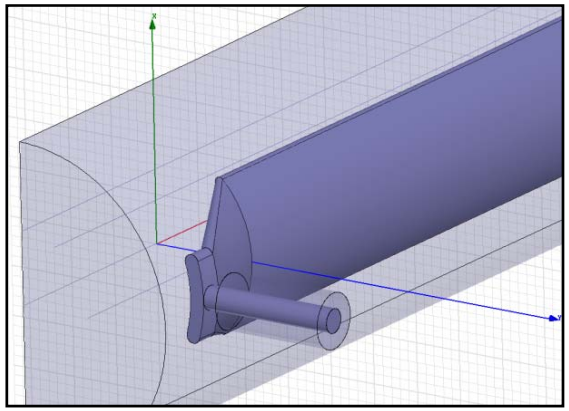
Elliptical electrodes



Circular electrodes

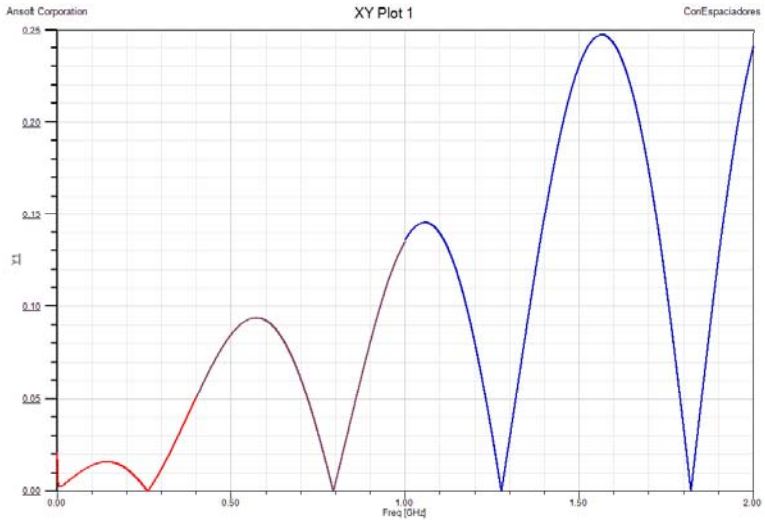


- Smooth tapered electrodes preserving 50 Ohm characteristic impedance to improve high frequency transmission.



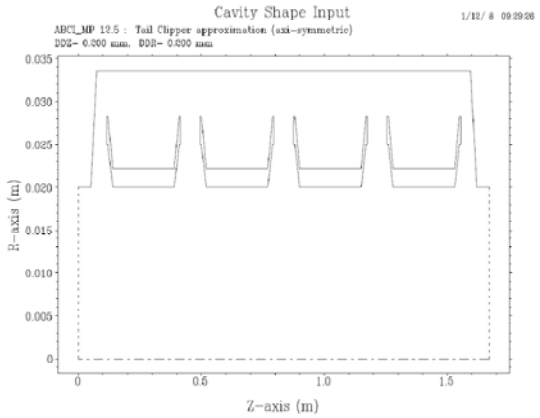
Design and calculations (II)

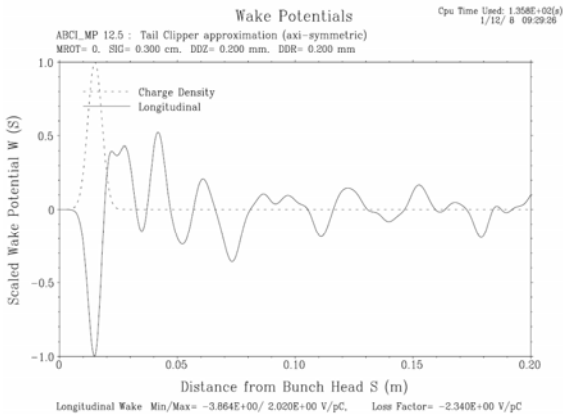
- Excellent transmission of power at high frequencies. Reflected power is lower than 0.25 % up to 400 MHz (the top frequency content of the pulse).
- Negligible cross talk between adjacent strips

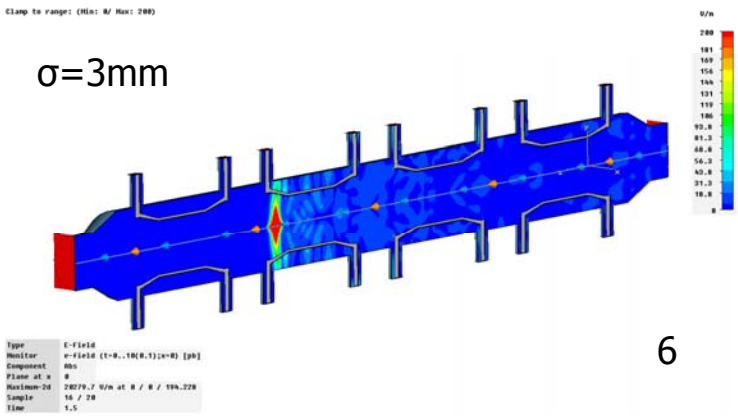


- The beam passes once. Stainless steel structure with low Q factor. HOM damping not foreseen.

- Wake impedance not calculated due to problems with CERN's distributed calculations in GDFidl. However, ABCI (axi-symmetric) and CST Particle Studio (short 3D model) show the wake loss factor: 2.34 and 2.22 V/pC, respectively.

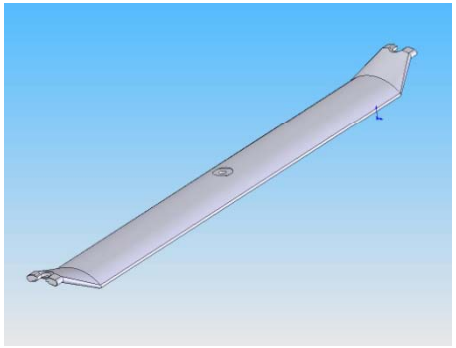




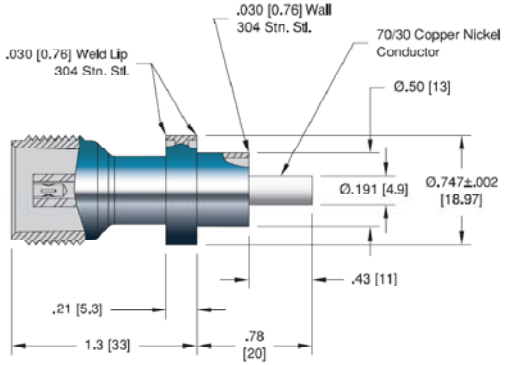


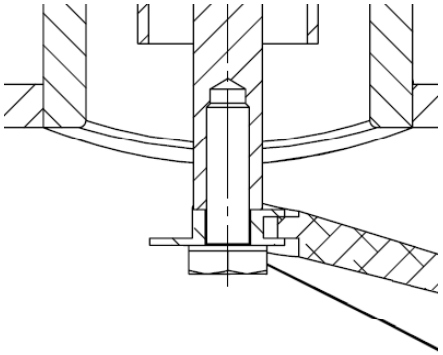
Manufacturing (I)

- Electrodes machined using CNC and cleaned by ultrasonic bath.



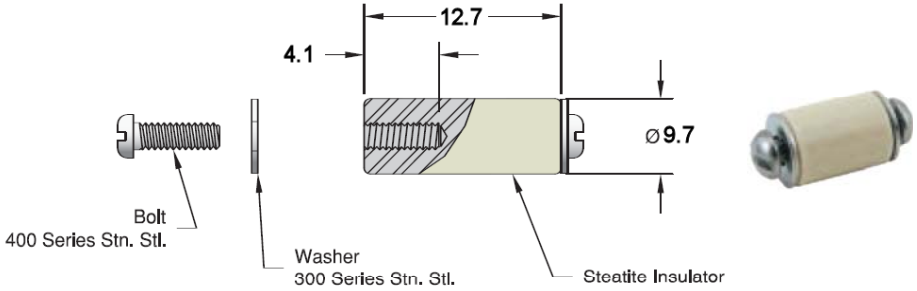
- Weldable Ceramaseal 50 Ohm feedthroughs, which are extremely delicate. Challenging sliding electrical connections. Several damaged feedthroughs.

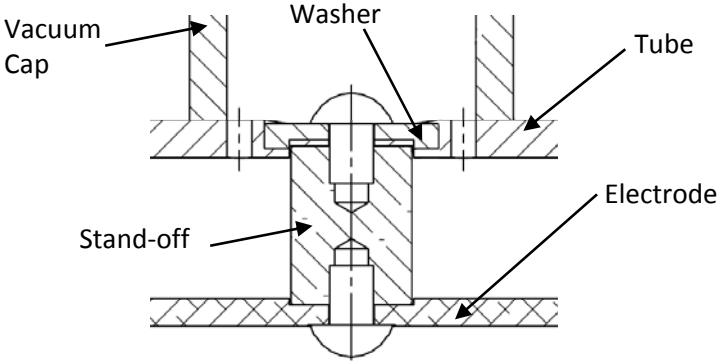




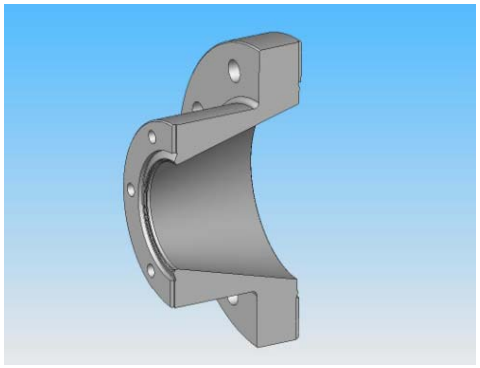
Manufacturing (II)

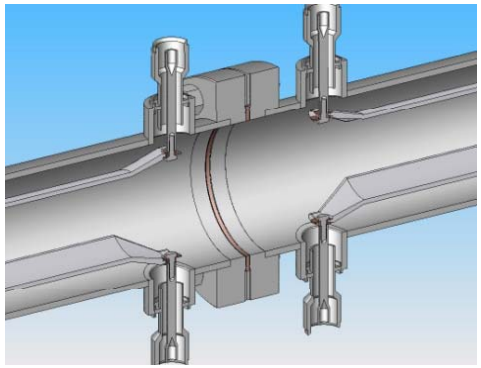
- One central steatite stand-off per electrode. Fixation using bolts.

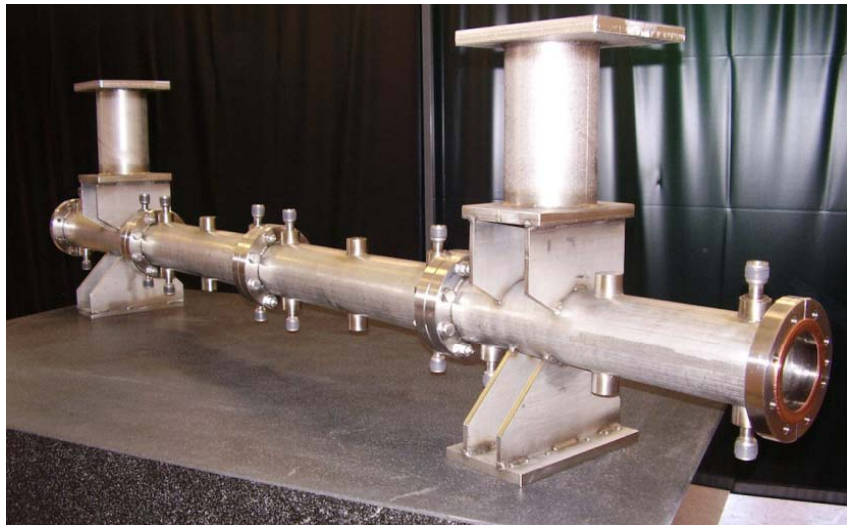




- CF63 to CF40 adapters designed for smooth transition. Silver plated copper gaskets machined to the adequate inner diameter.



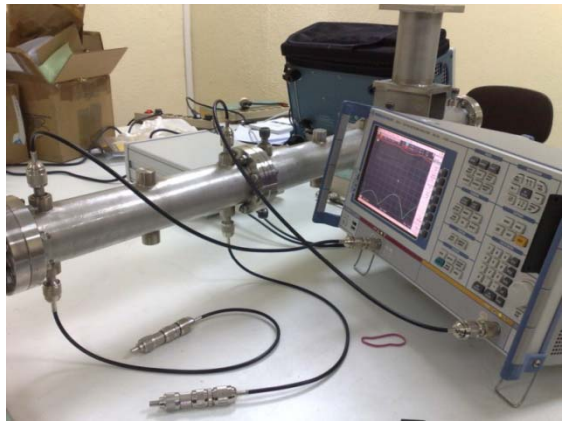


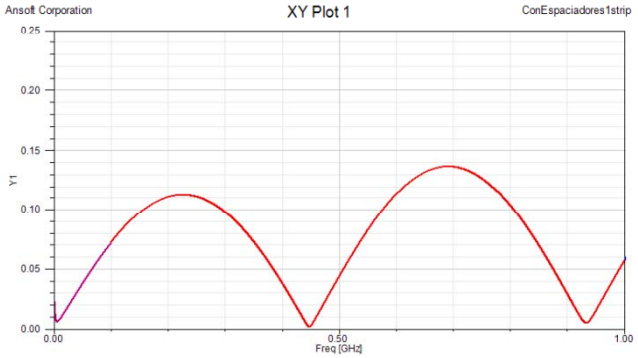


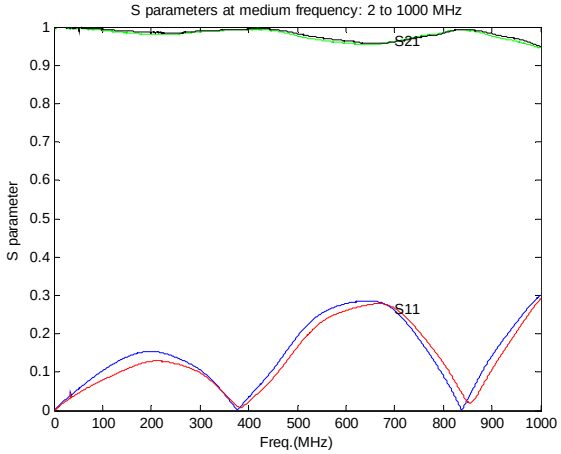
Tests (I)

- Leak rate < 10^{-10} mbar.l/s. Vacuum level: $7x10^{-9}$ mbar achieved after 24 h, 120 ºC mild bake-out.

- Successful RF tests, comparable with HFSS simulations. Good transmission of high frequencies up to 1 GHz. All strip-lines independently tested.



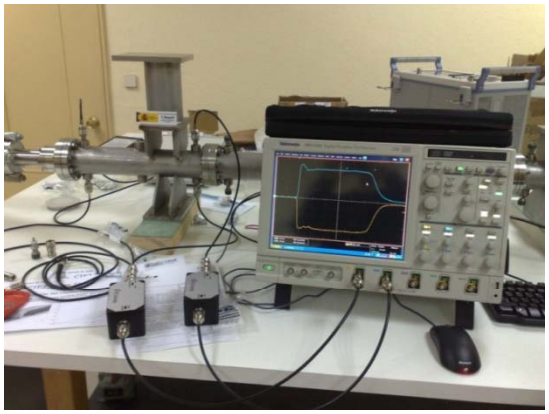


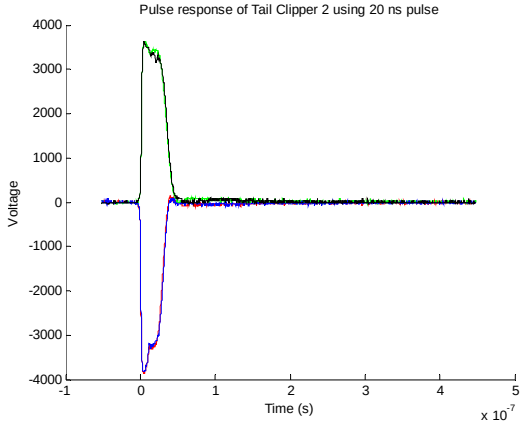


- DC high voltage test up to 3 kV in 10^{-6} mbar vacuum level. No problems detected.

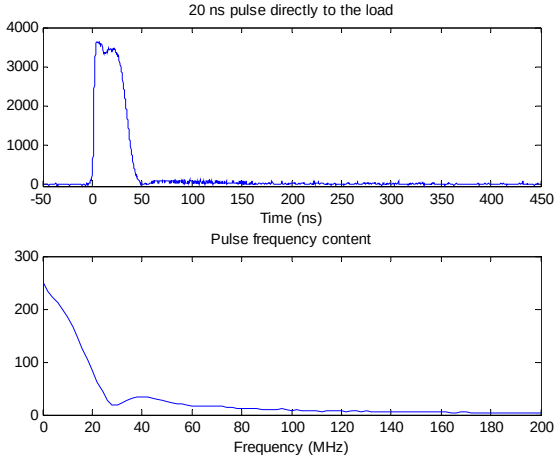
Tests (II)

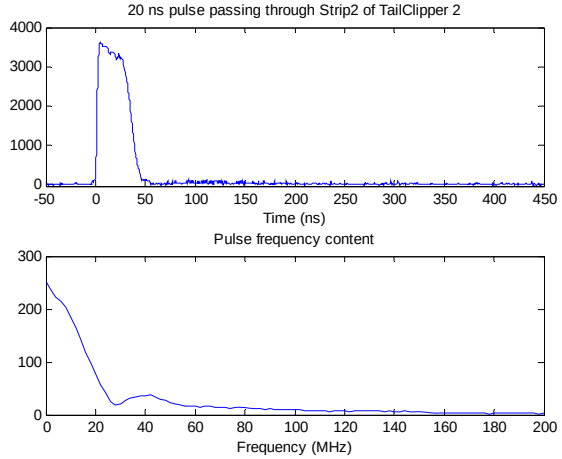
- Pulser test. FID ±3.5 kV, 20 to 200 ns regulation, mirrored pulser.





- Excellent transmission through the 4 Tail Clippers.





Conclusions

- Tail Clippers design and calculations were successfully developed according to the experience gained from the CTF3 kicker.
- Manufacturing was a challenging process, especially for the electrical connection between feedthrough and electrodes.
- Leak rate was successful. Final vacuum successfully achieved at CERN using mild bake-out.
- RF, high voltage and pulsed test were successfully developed at CIEMAT.
- The Tail Clippers were delivered to CERN on time and are being currently installed and tested.