CTF3 kicker activities at CIEMAT

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CTF3 Kicker Status

- Brief summary of last collaboration meeting
- Last modifications
- Kicker tests at Frascati (June 07)
- Wakefields simulation
- New project: The Tail Clippers
- Conclusions

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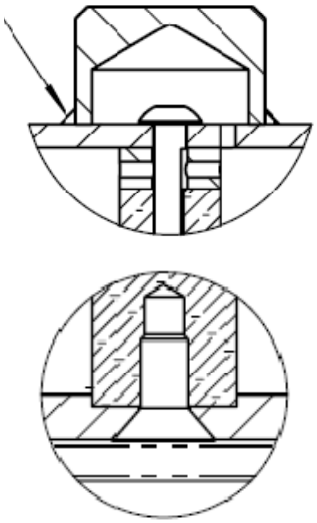
CTF3 Kicker Status

- Conclusions of last year's collaboration meeting:
  - Kicker already built and waiting for EM tests in Frascati: They were done on June 2007.
  - Some minor modifications to the design could be made to improve stand-off bindings: They were implemented in the new design.
  - About power supply, the engineering and development will continue as scheduled: See Mike Barnes presentation.

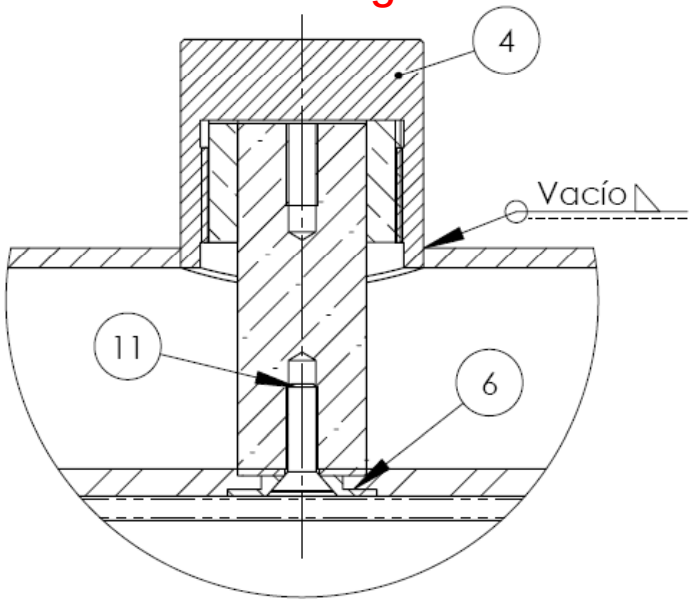
CTF3 Kicker Status

- Last modifications: Stand-offs (I)
  - Stand-off supports modified to improve stiffness and steatite reliability.
  - Steatite now supported by an interference fit case screwed to a cap which is welded to the kicker tube.

Old design



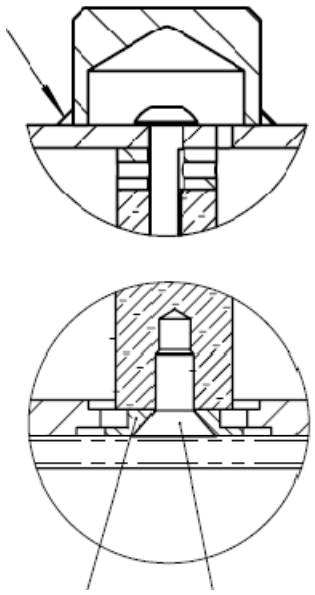
New design



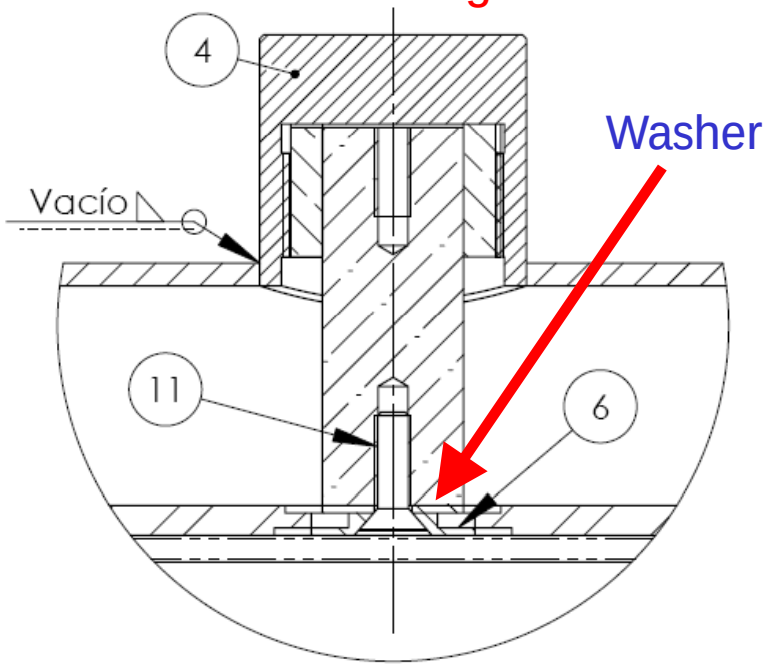
CTF3 Kicker Status

- Last modifications: Stand-offs (II)
  - Sliding supports also modified with the same method. 5 supports per strip
  - Copper washer inserted between steatite and steel to reduce friction.

Old design



New design



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CTF3 Kicker Status

- Last modifications: Stand-offs (III)

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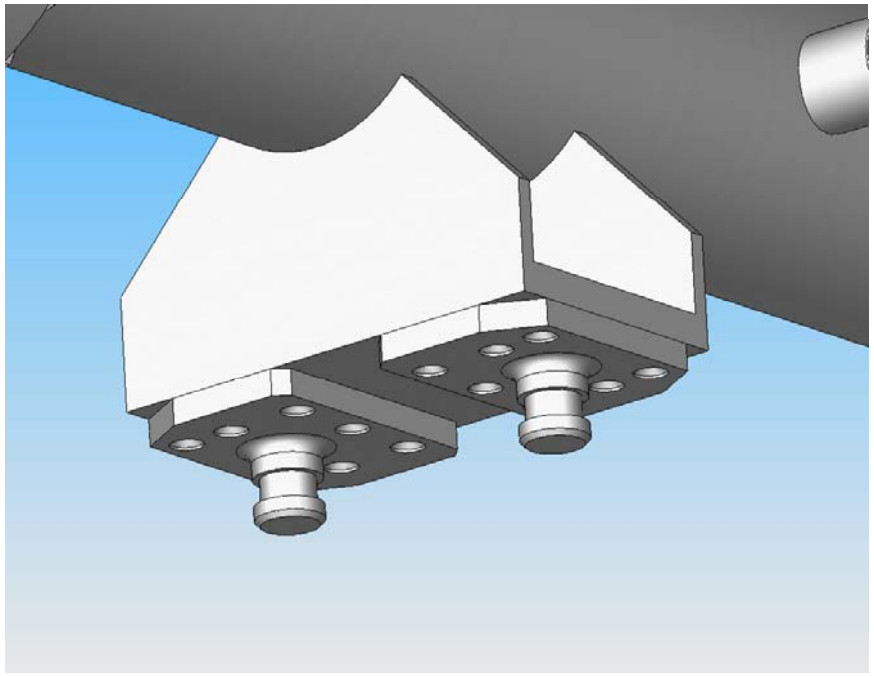
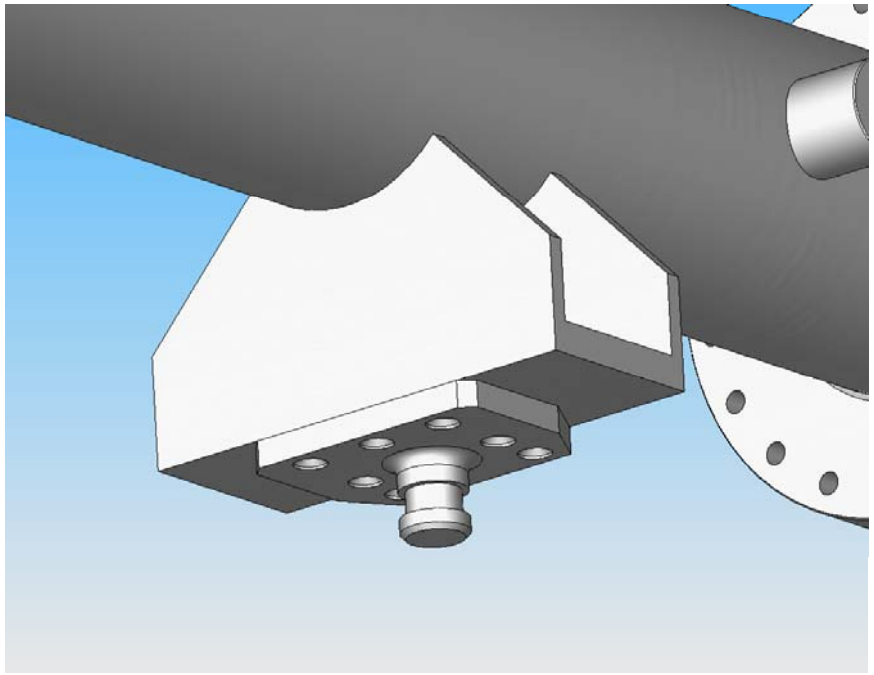
CTF3 Kicker Status

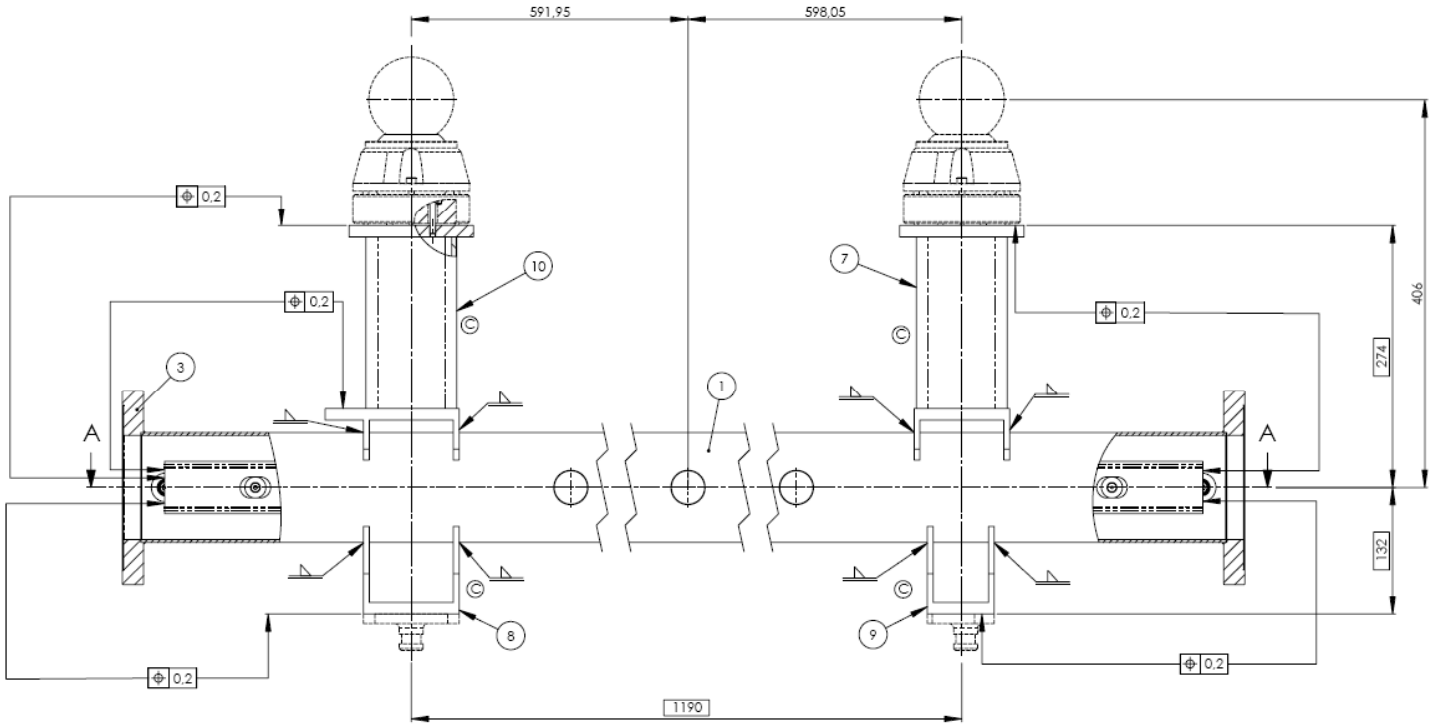
- Last modifications: Structural supports
  - Two flat supports added to fix three male centering pieces.
  - Precision machining. Distance to beam axis: 132±0.1 mm





CTF3 Kicker Status

- Last modifications: Alignment targets
  - Two flat surfaces added to place targets and a level, raised 274±0.1 mm over beam axis.

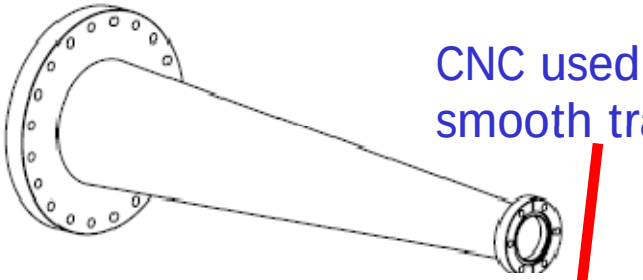


CTF3 Kicker Status

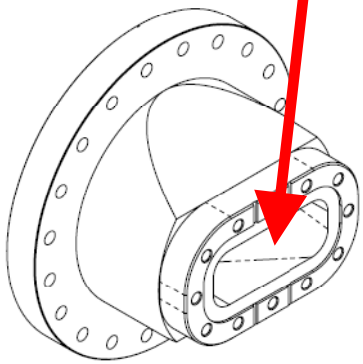
- Last modifications: New transitions
  - New design needed for the transitions due to space requirements. One conical 561 mm long, other racetrack 106 mm long.

Old design

New designs

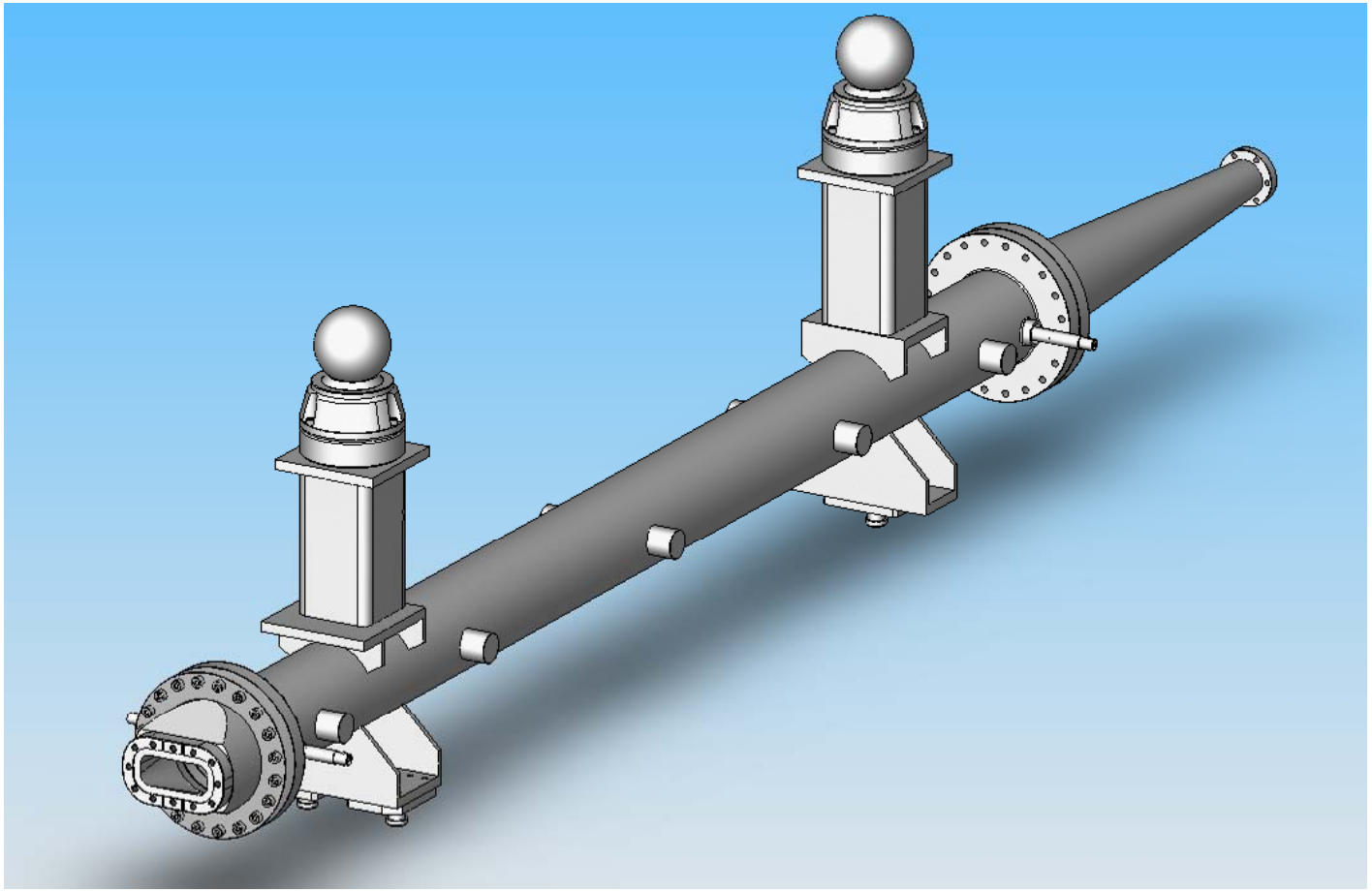


CNC used for the smooth transition



CTF3 Kicker Status

- Last modifications: Final assembly



CTF3 Kicker Status

- Kicker tests at Frascati: Vacuum test
  - Simple turbo pump and no bake-out.
  - Pumping from one of the old conical transitions. New transitions design was not yet implemented.
  - $2x10^{-7}$ mbar achieved in the third day.
  - Leak rate about $1.2x10^{-10}$ mbar.l/s (test done in manufacturer's lab)

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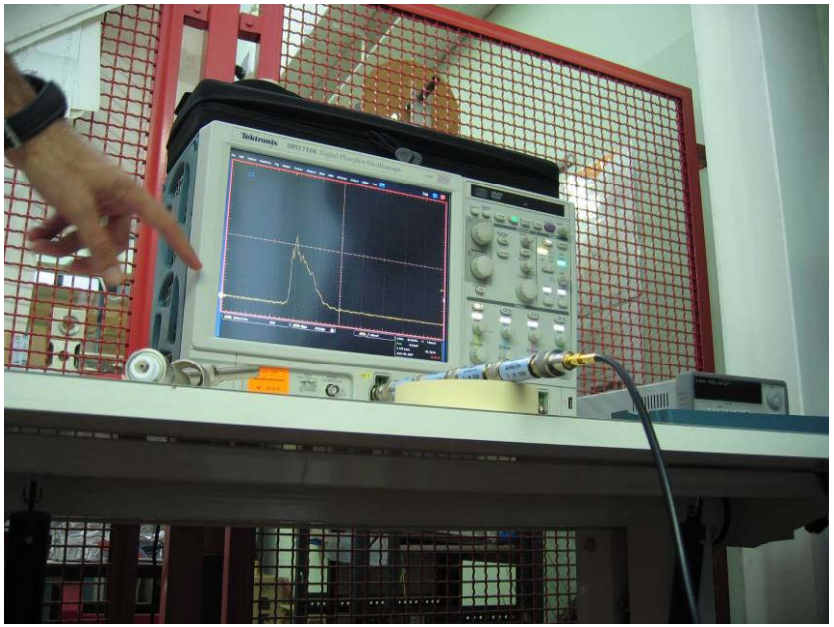
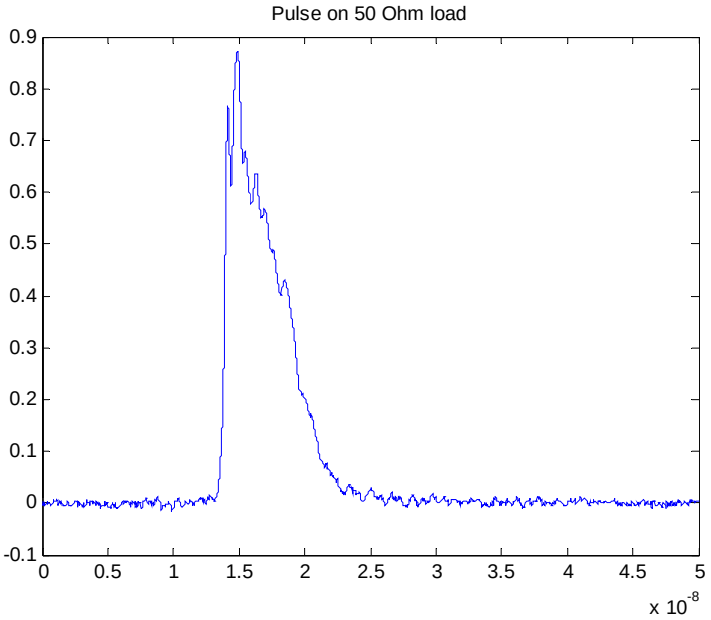
CTF3 Kicker Status

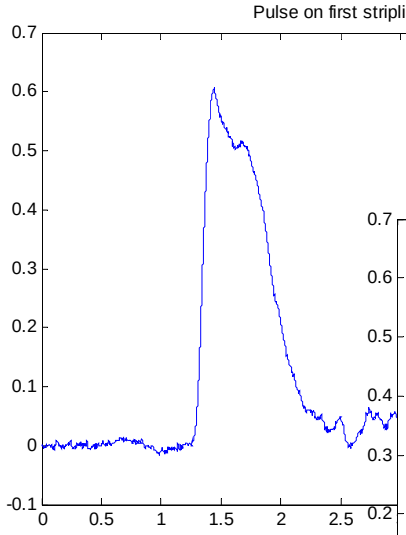
- Kicker tests at Frascati: Pulser test (I)
  - 16 kV, 5 ns pulser used for tests, kicker loaded with 50 Ohm load.

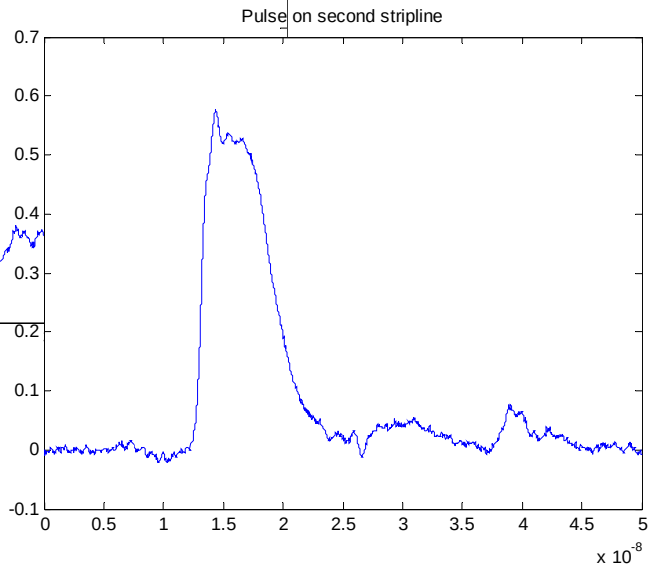


CTF3 Kicker Status

- Kicker tests at Frascati: Pulser test (II)
  - Good transmission of the signal, even when kicker is designed for 40 times slower pulses (200 ns). Only very high frequencies are filtered (above 1GHz)







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CTF3 Kicker Status

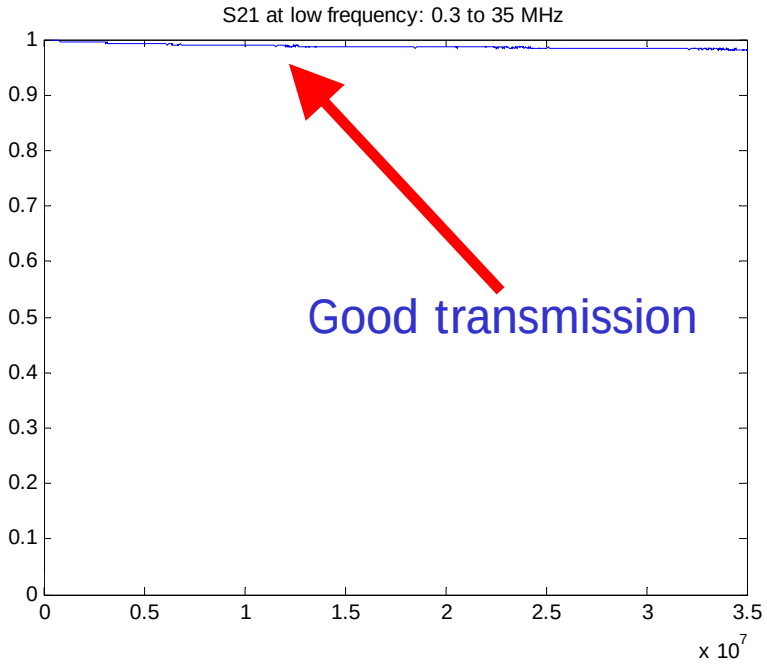
- Kicker tests at Frascati: DC voltage test
  - Each kicker plate tested up to 18 kV DC voltage (no current). No major problems were found in both striplines, only few sparks at the beginning of the test.

CTF3 Kicker Status

- Kicker tests at Frascati: RF test (I)
  - Hybrids used to split and de-phase the network analyzer signal.
  - 0.2 to 35 MHz for low frequency tests, 2 to 2000 MHz for high freq. test.

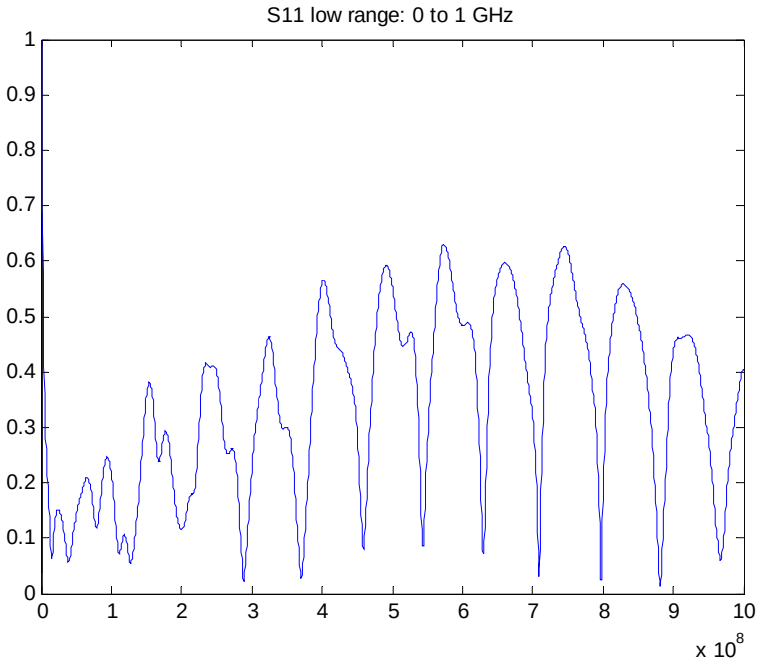
CTF3 Kicker Status

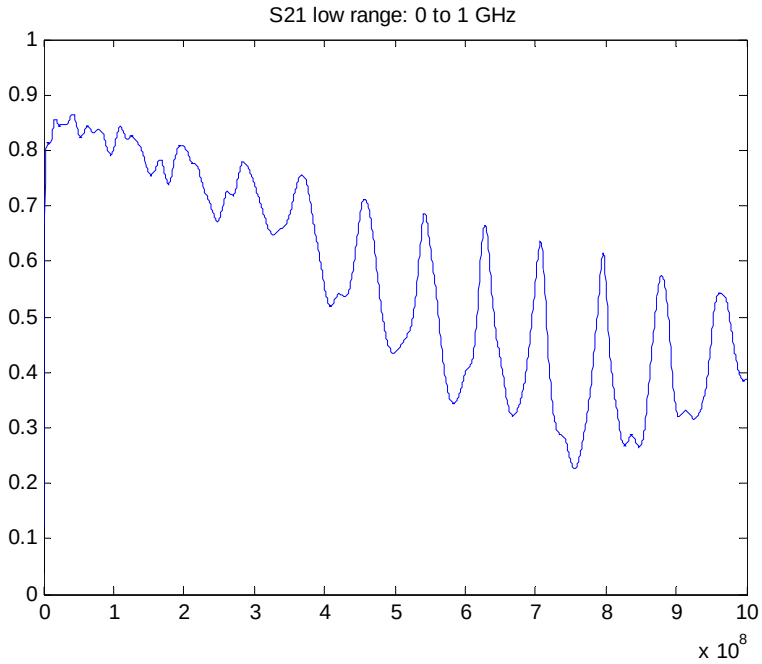
- Kicker tests at Frascati: RF test (II)
  - Low frequency testing (200 ns pulse frequencies content up to 35 MHz).



CTF3 Kicker Status

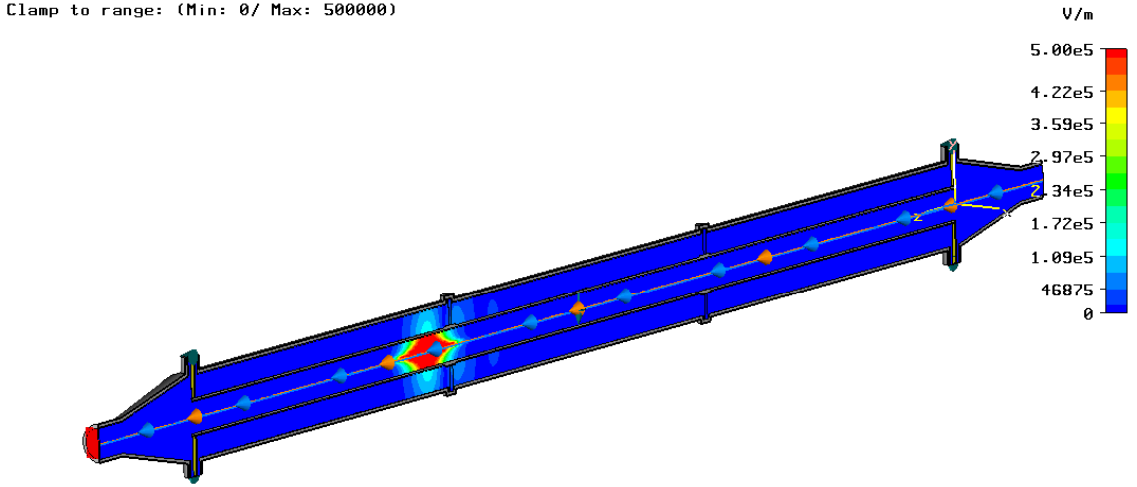
- Kicker tests at Frascati: RF test (III)
  - High frequency testing (up to 1 GHz). Results agree HFSS ones presented in last year's meeting.





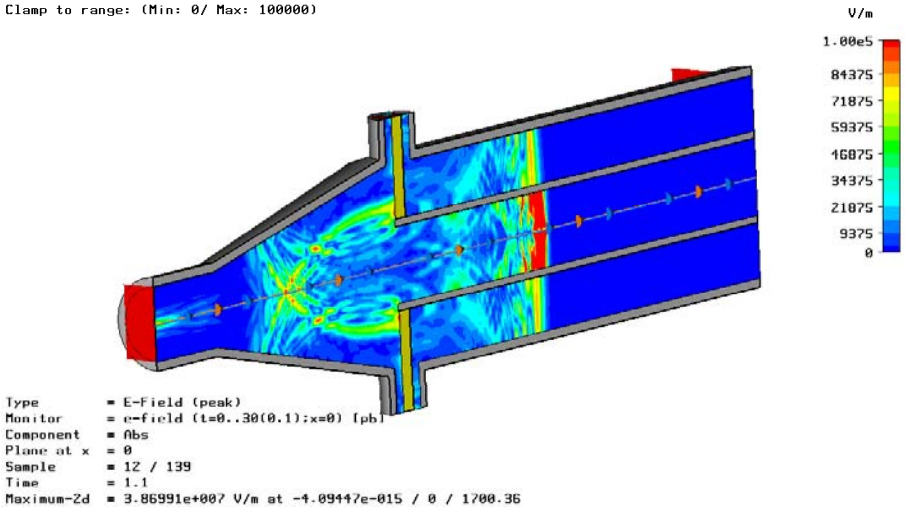
CTF3 Kicker Status

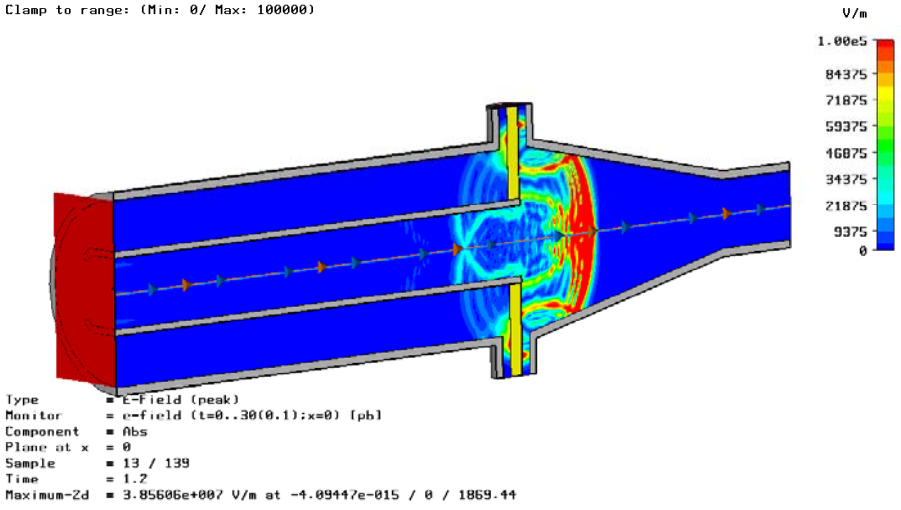
- Wakefields simulation (I)
  - In Combiner Ring: 4 turns before kick. Wakefield effects expected not to be dangerous. Low Q stainless steel structure: fast decay of induced fields.
  - Simulations done in ABCI, GDFidl and CST Particle Studio with old conical transitions. Coaxial ports absorb the wakefields for the coupled frequencies (simulated first coaxial modes up to 100th).



CTF3 Kicker Status

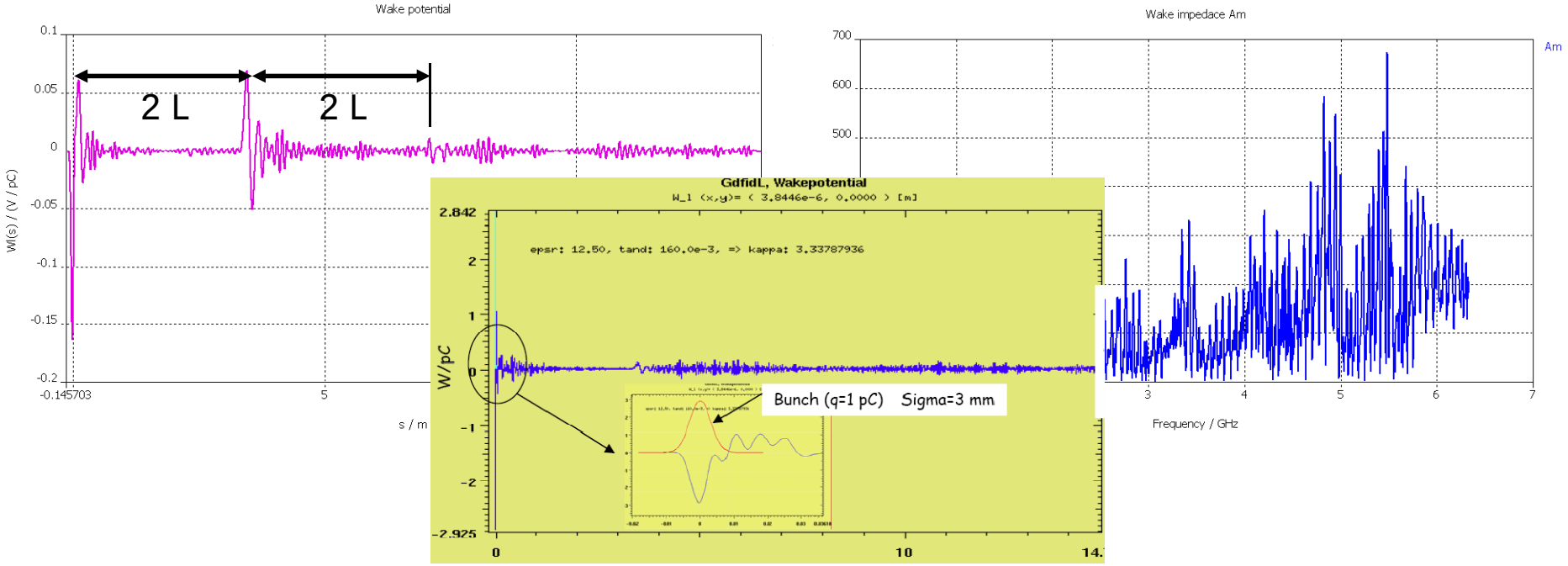
- Wakefields simulation (II)
  - Difficult simulation due to long structure vs short bunch (sigma = 3mm). Enormous memory requirements.
  - Several models developed, to simulate input, output and full kicker.





CTF3 Kicker Status

- Wakefields simulation (III)
  - Wakepotential plot (up to 13 m) shows that first reflected wave is almost totally absorbed by the coaxials (ideally connected).



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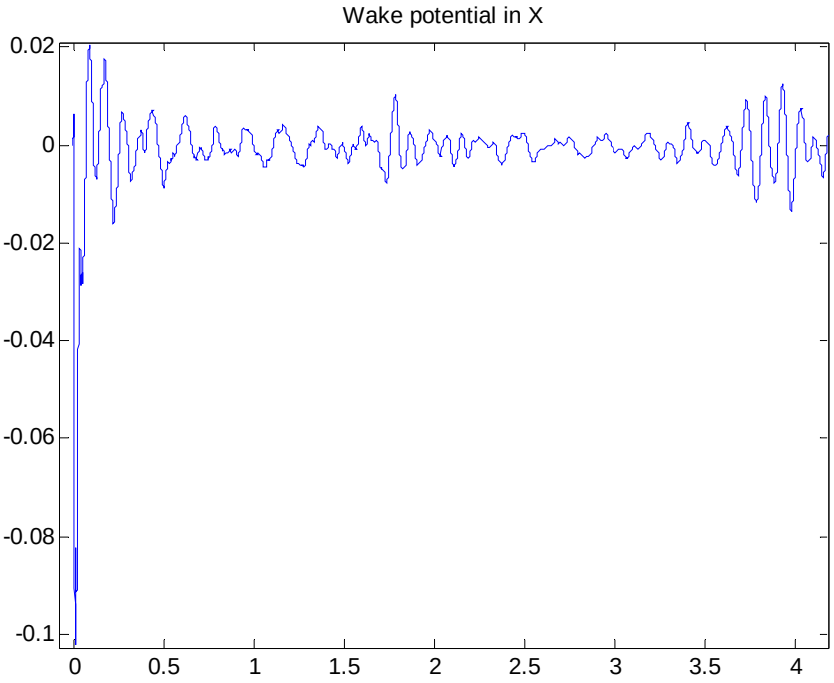
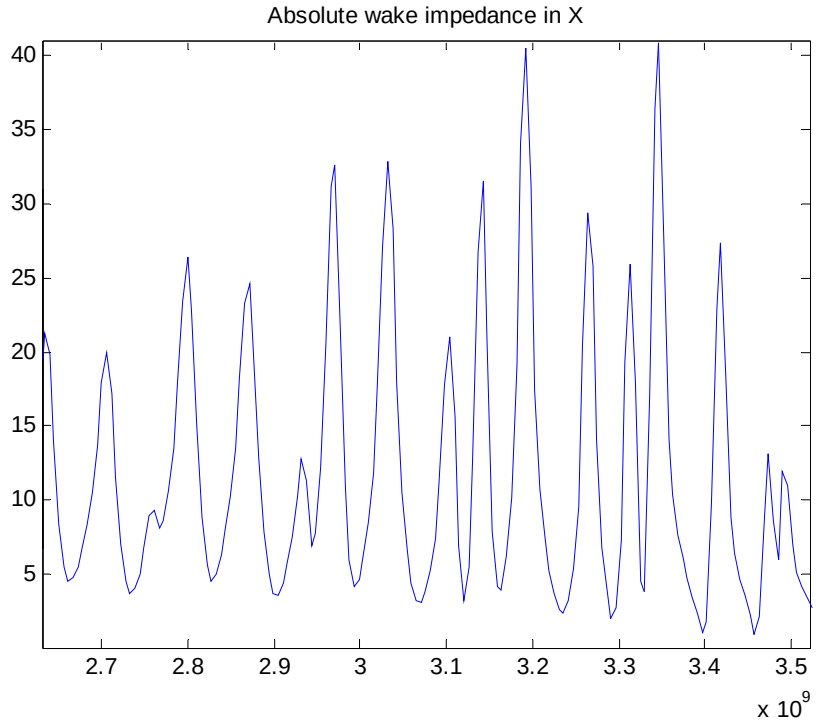
CTF3 Kicker Status

- Wakefields simulation (IV)
  - New last simulation with final transitions in GDFidl at CERN (thanks to Igor Syratchev).
  - Simulation problems even harder than the old design ones:
    - New structure much longer
    - Different input and output transitions: Slower integration method for transverse wake calculation.
  - Transverse wakes calculated in a plane normal to the kicking one.

CTF3 Kicker Status

- Wakefields simulation (V)
  - Results also discussed with R. Corsini. No major problems expected at beam frequency (3 GHz)





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CTF3 Kicker Status

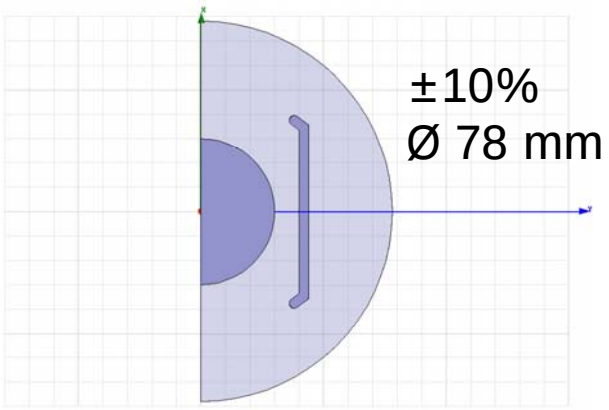
- New Project: The Tail Clippers (I)

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)	200	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 (between centre's of feedthroughs)	(333)	mm
Total available straight section length	1625	mm
Vacuum tank material	Stainless steel or Antico	
Electrode material	Stainless steel or Antico	
Flange material	Stainless steel or Antico	
Pumping ports	none	
Supports and Alignment system	as per CR kicker	

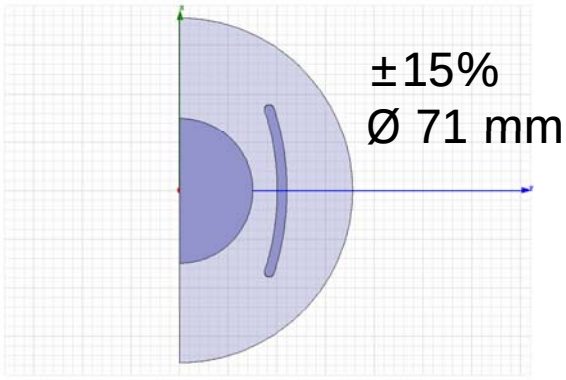
CTF3 Kicker Status

- New Project: The Tail Clippers (II)
  - Several straight sections analyzed, trying to decrease chamber diameter but not disturbing the homogeneity too much.
  - Wakefields behaviour improvement using reduced chamber.
  - Higher center field using curved electrodes for a given aperture

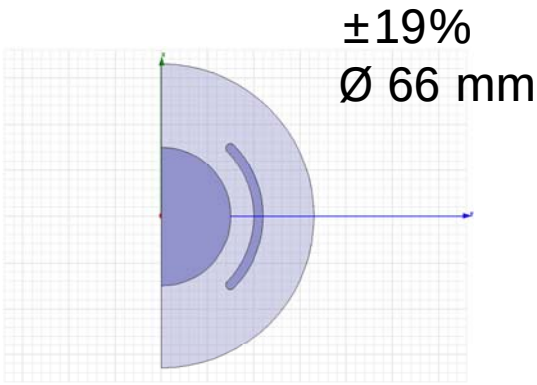
Flat electrodes



Elliptical electrodes



Circular electrodes



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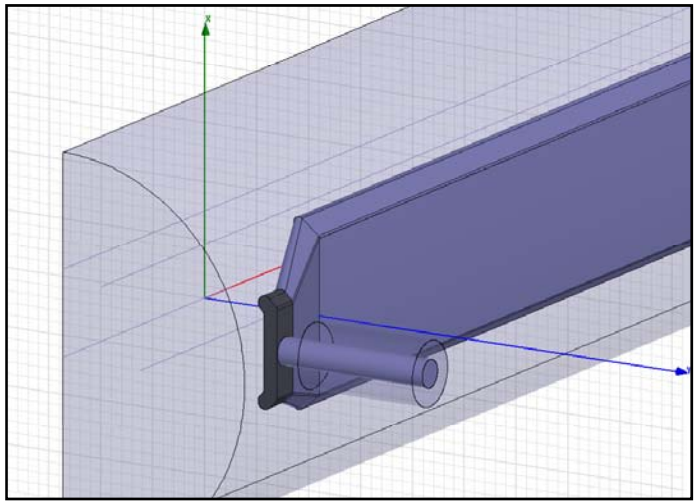
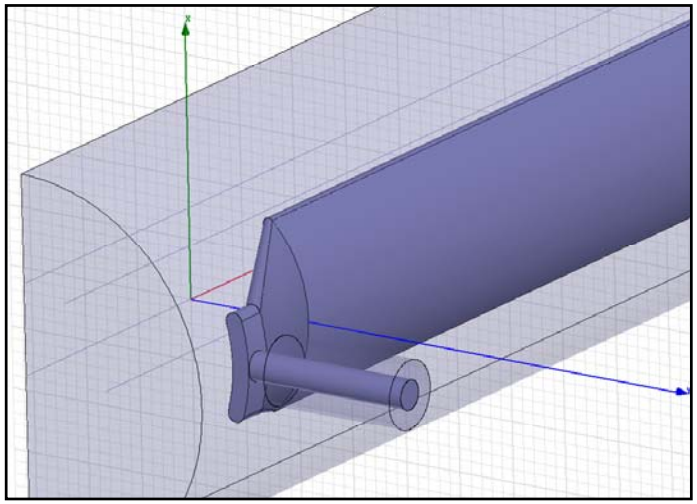
CTF3 Kicker Status

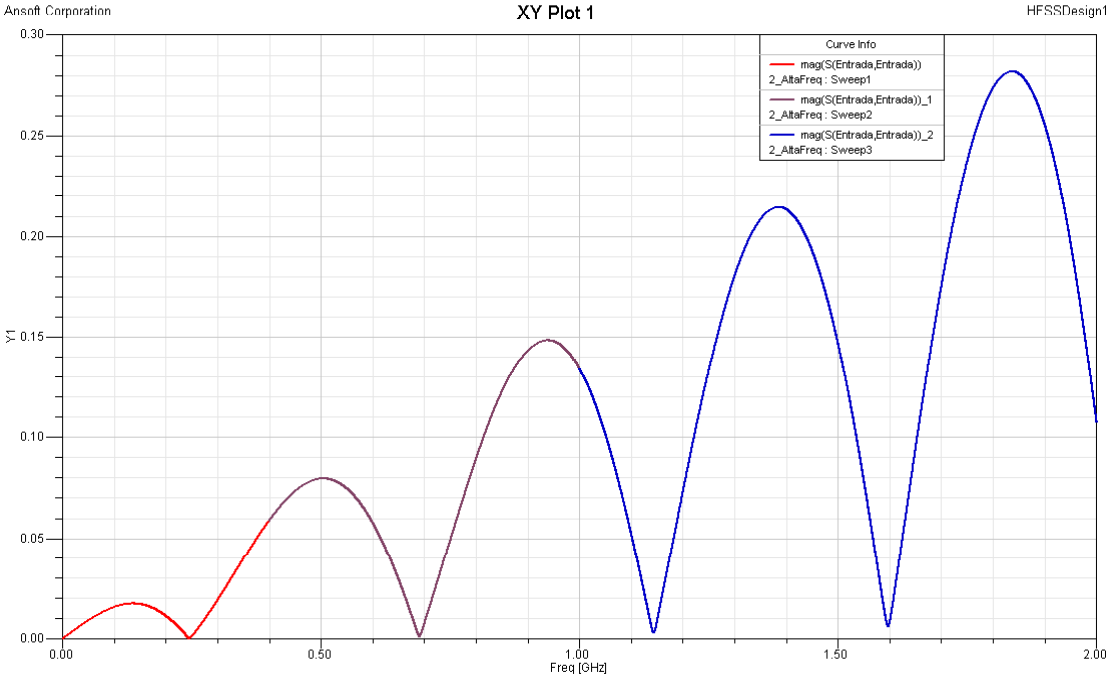
- New Project: The Tail Clippers (III)
  - Smooth transitions from coaxial to strip-line.
  - Tapered electrodes preserving 50 Ohm characteristic impedance.





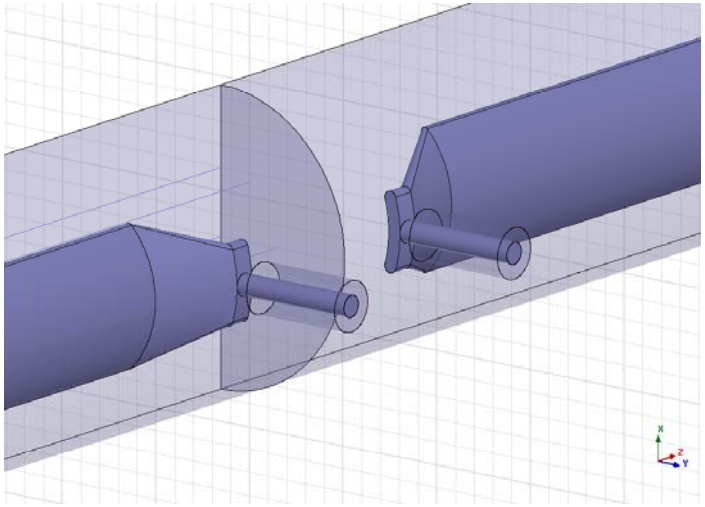
CTF3 Kicker Status

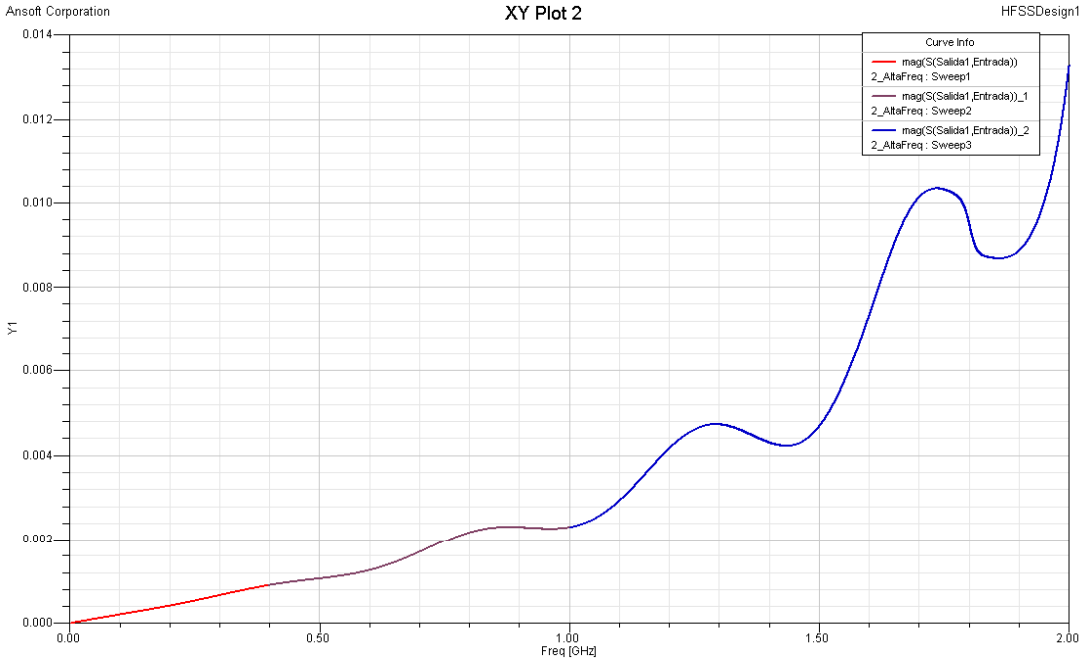
- New Project: The Tail Clippers (IV)
  - Good transmission of power even at higher frequencies (needed for 5ns rise time pulse). S_{11}<0.02 from 0 to 200 MHz



CTF3 Kicker Status

- New Project: The Tail Clippers (V)
  - Cross-talk between adjacent strip-lines studied. Very small power coupling at small distance (55 mm) in the full frequency range.





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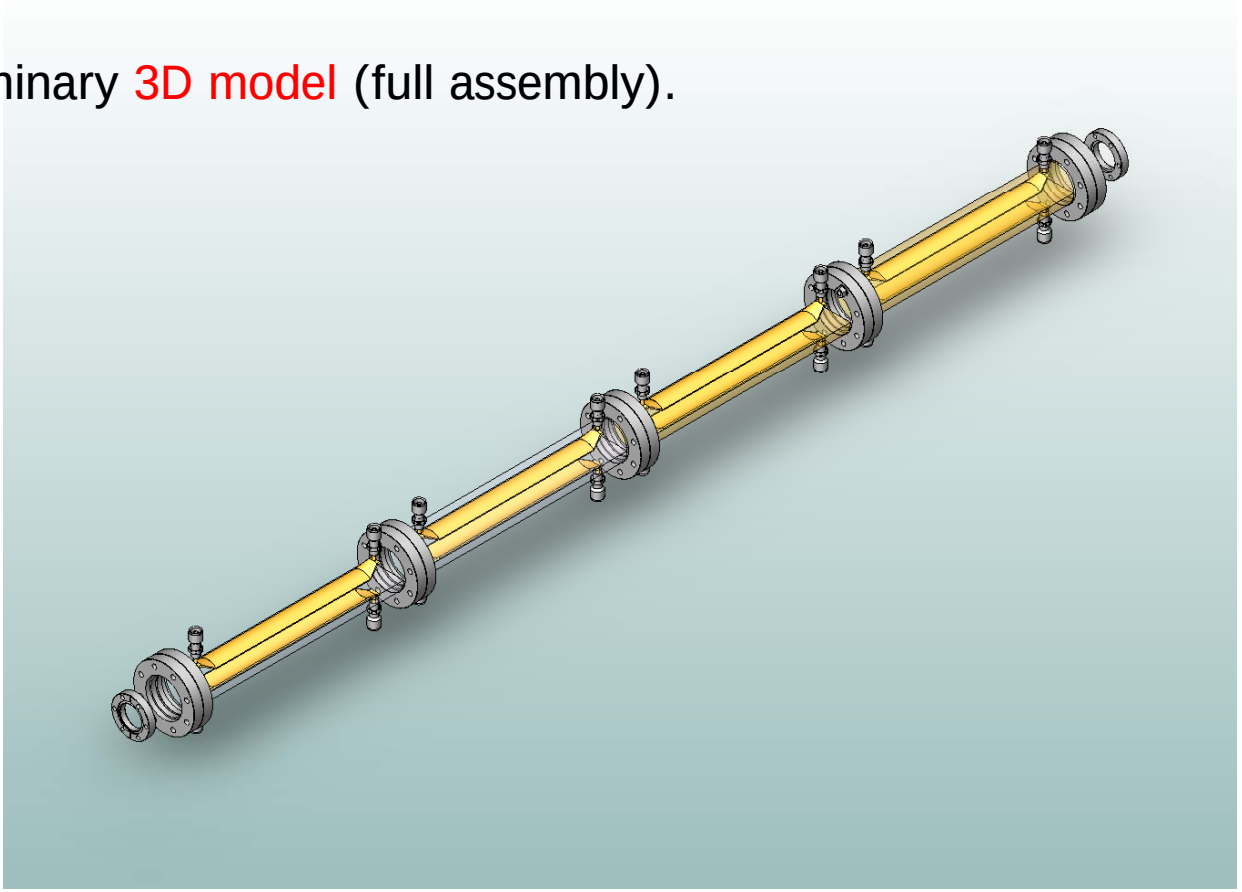
CTF3 Kicker Status

- New Project: The Tail Clippers (VI)
  - Preliminary 3D model (full assembly).



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CTF3 Kicker Status

- Conclusions
  - The kicker is now finished and fully analyzed. It has arrived at CERN and it will be installed soon.
  - No major problems are expected after the wakefield analysis.
  - All the know-how acquired with the strip-line kicker is being applied to the tail clipper project.
  - The tail clipper main parameters are already defined and final design could soon be available. Fabrication could be finished for end of 2008.