

# DAFNE STRIPLINE KICKERS

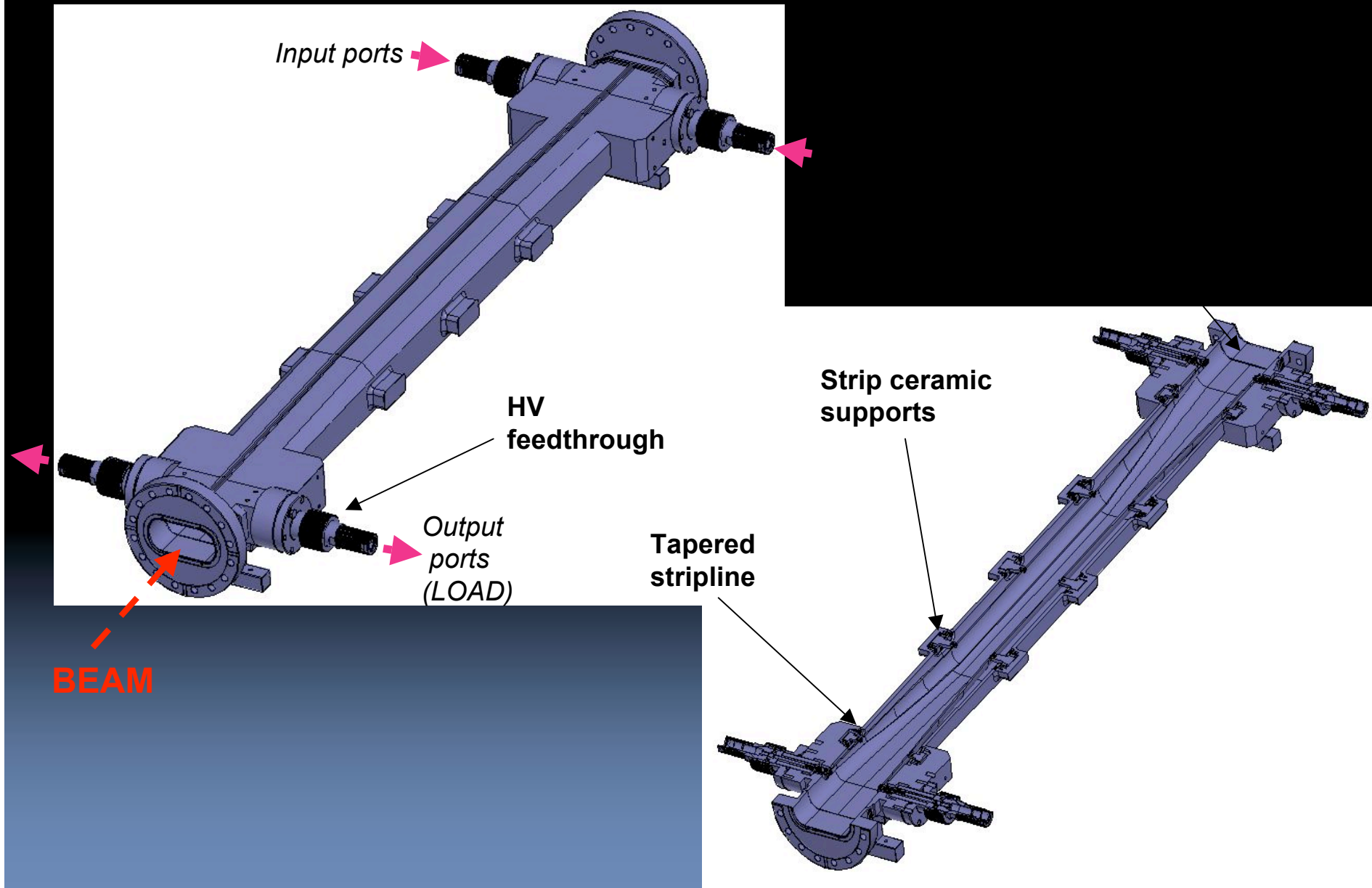
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Perugia 17 June 2009

## PRESENTATION OUTLINE

1. Design of a stripline kicker for beam injection in DAFNE storage rings.
2. HV tests and RF measurements of the kicker.
3. DAFNE operation with the new kickers.
4. Realization of a stripline kicker for ILC damping ring.

# 1. DESIGN OF THE NEW DAFNE INJECTION KICKER

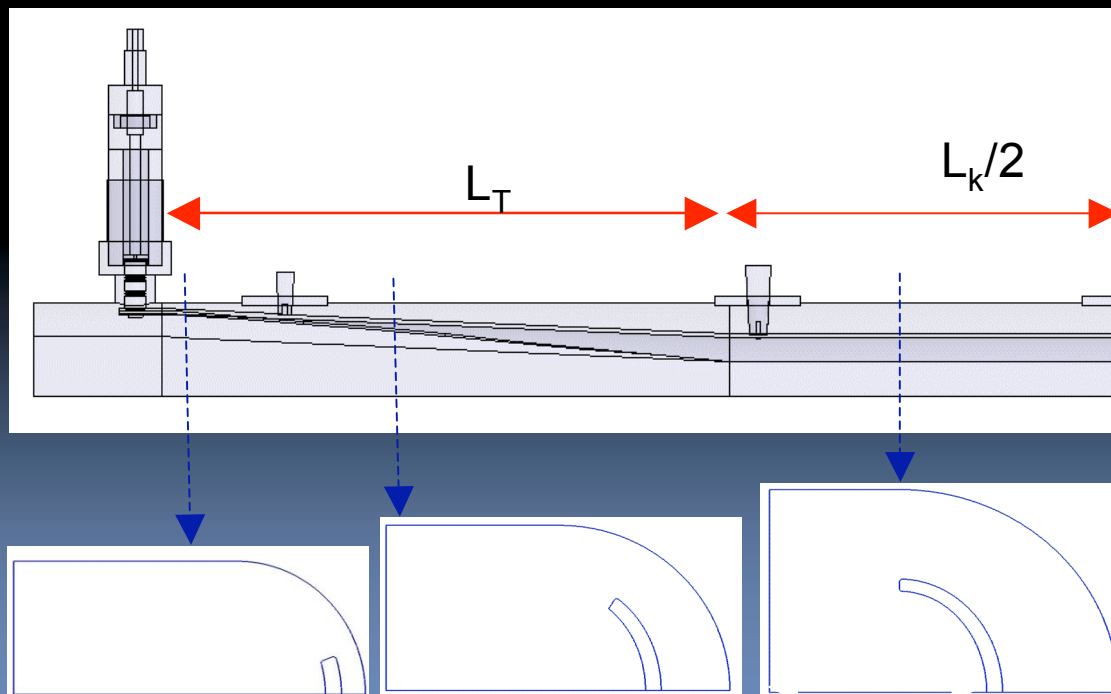


## The elliptical cross section:

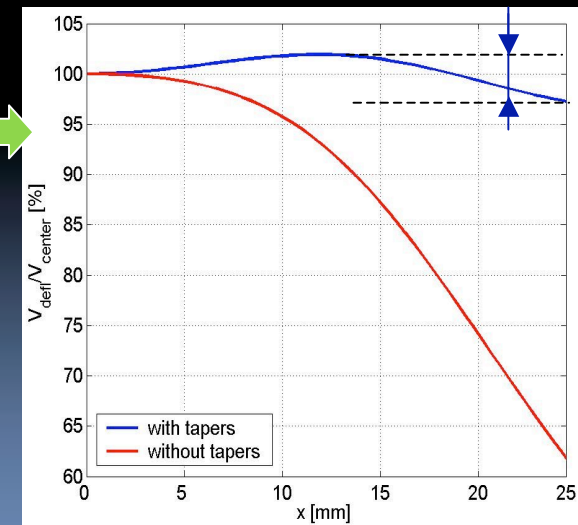
- Minimizes the discontinuity of the beam pipe cross section between the injection region and the adjacent dipole regions
- **Increases the deflection efficiency.**

## The tapered stripline:

- Improves the **uniformity** of transverse deflection as a function of the transverse position
- Reduces the contribution of the kicker to the machine **impedance**
- improves the **reflection coefficient** at high frequency (short pulses) because of smoother transition between feedthrough coax line and stripline.

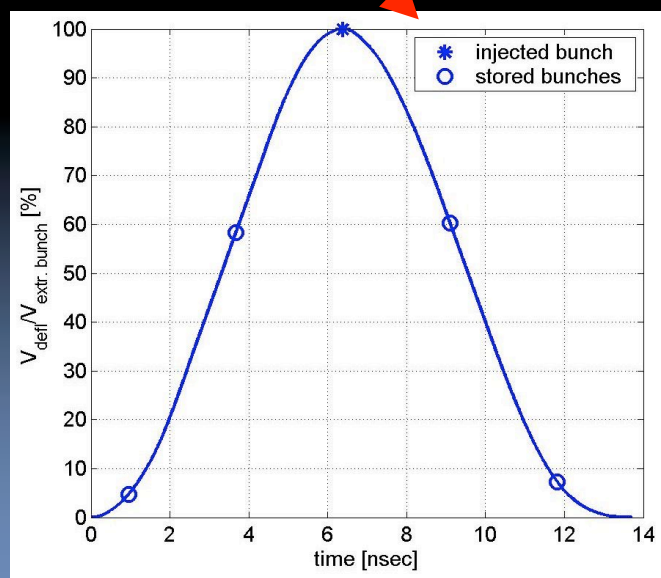
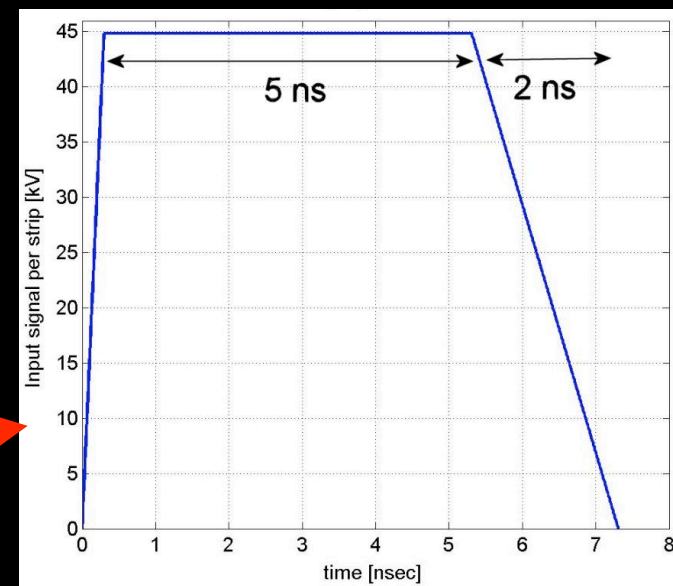


Field flatness by integration



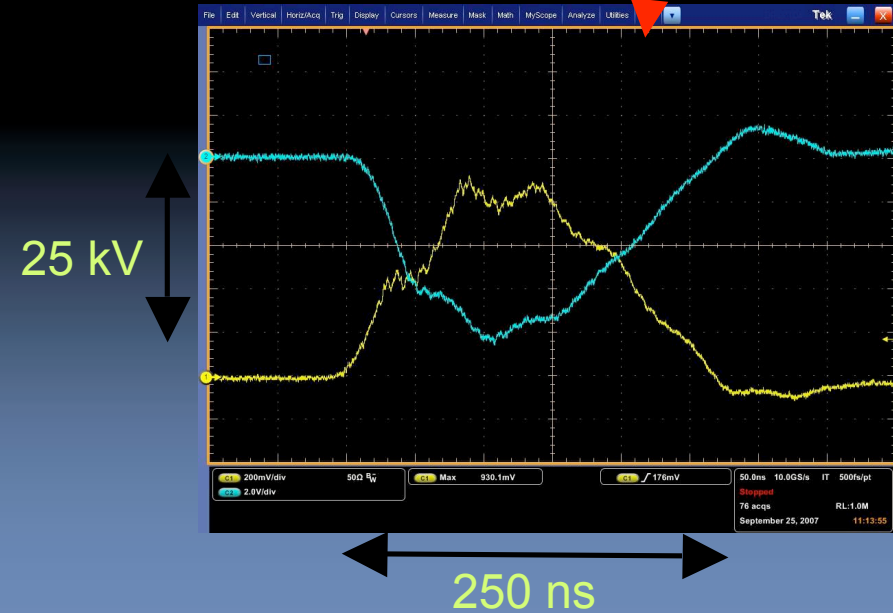
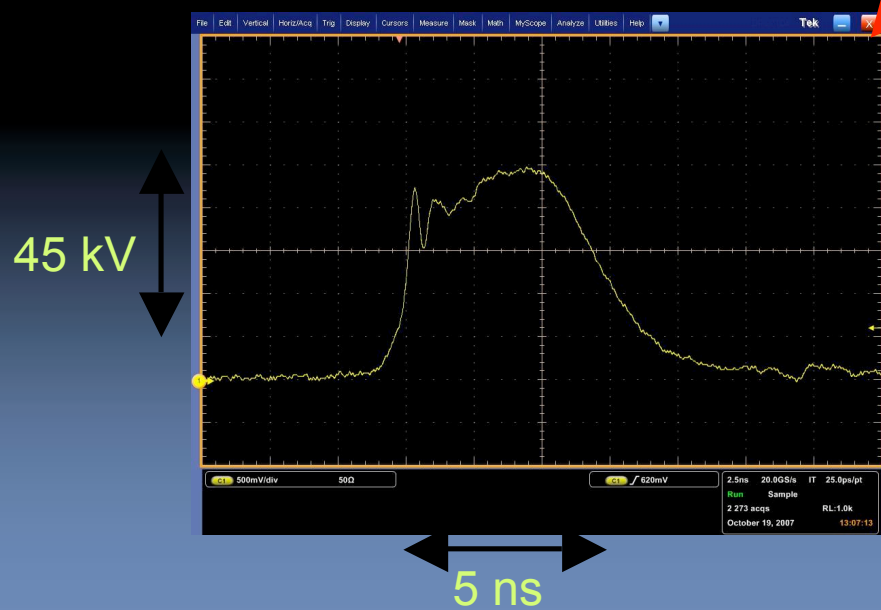
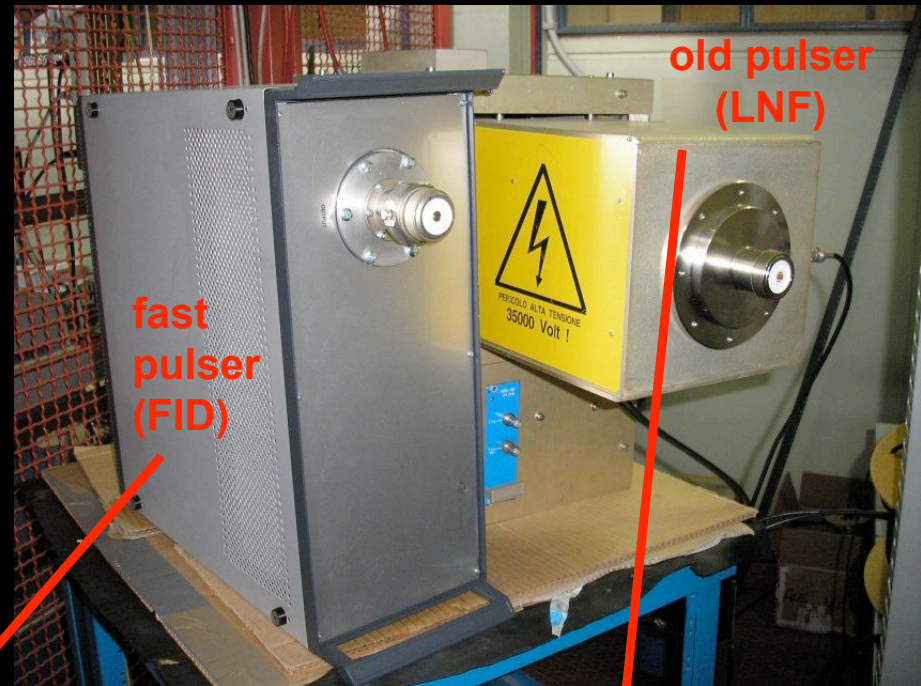
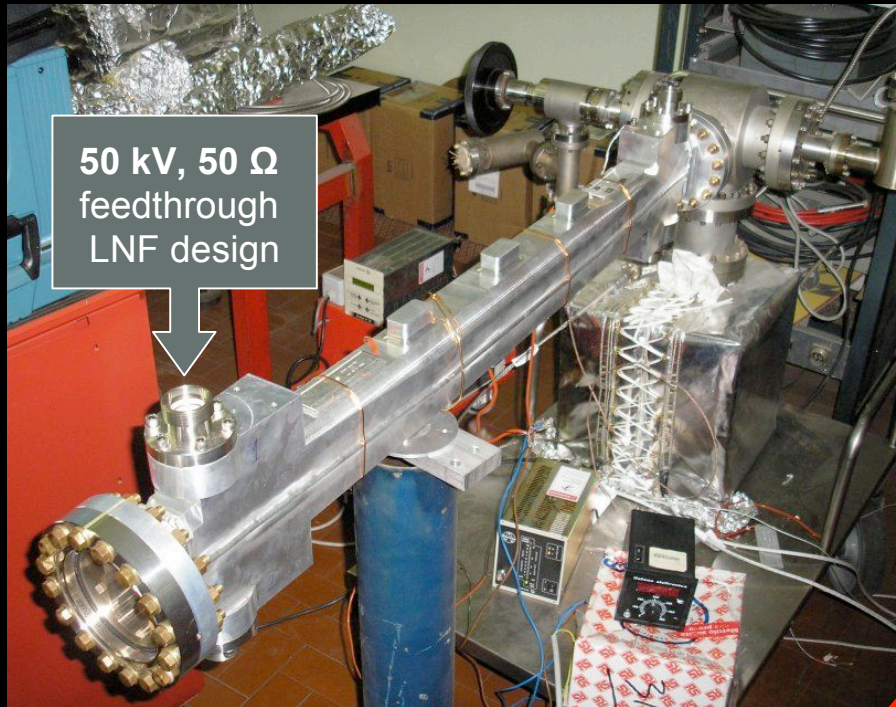
# injection kicker design parameters

PARAMETERS	
Beam Energy E [MeV]	510
Time spacing between bunches [ns]	2.7
Deflection [mrad]	<b>5</b>
Total deflecting voltage VT [MV]	2.5
Total kicker length L [cm]	~90
Voltage per strip [kV]	<b>45</b>
Input pulse length [ns]	~ 5
Pulse length "seen" by bunches [ns]	~10
Max rep rate [Hz]	10





## 2. HV TESTS

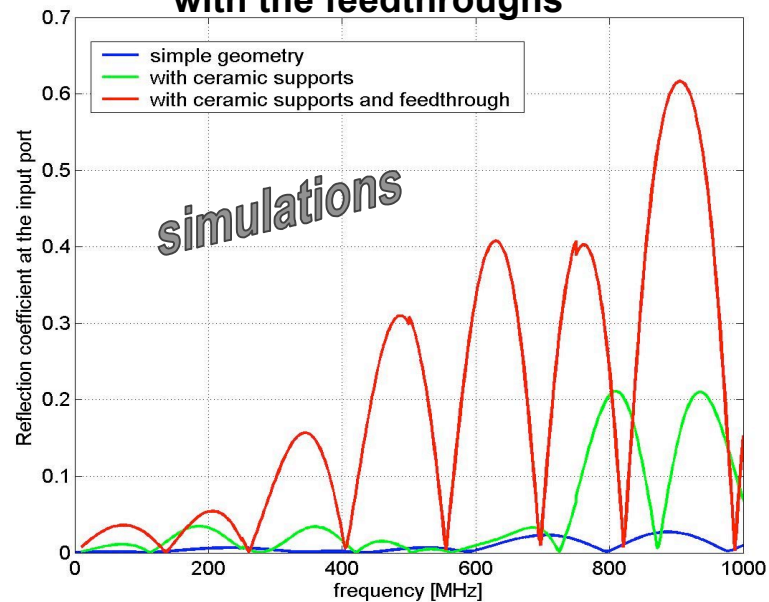


## 2. RF measurements: frequency response

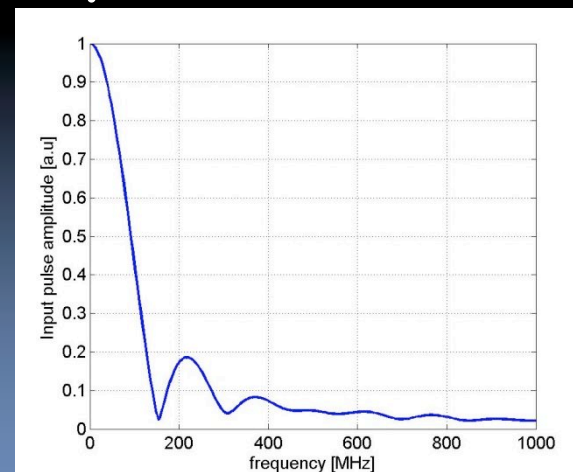
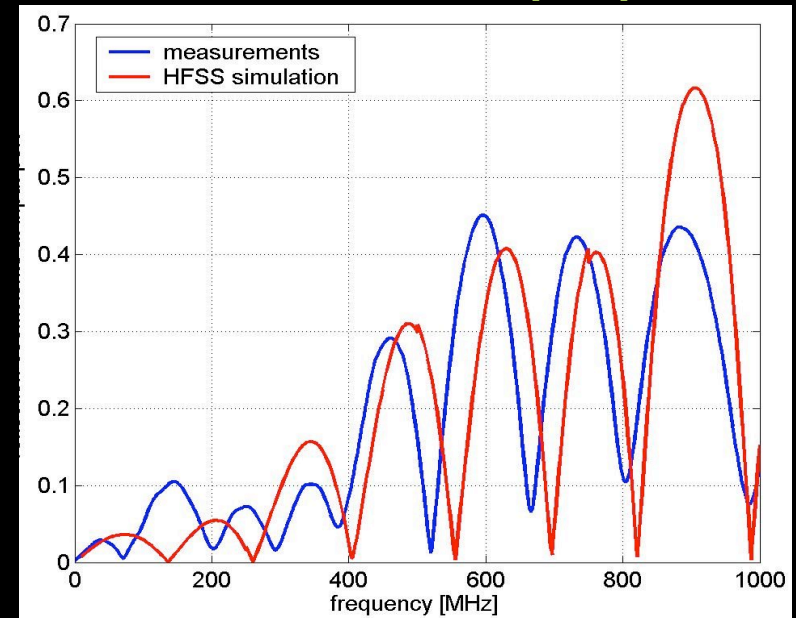
Special connectors needed to adapt HV connector to RF standards



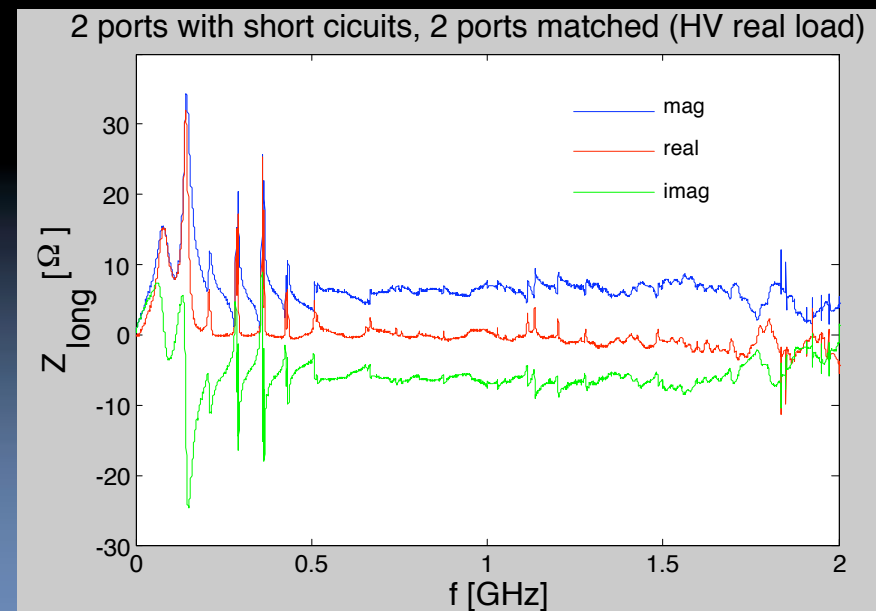
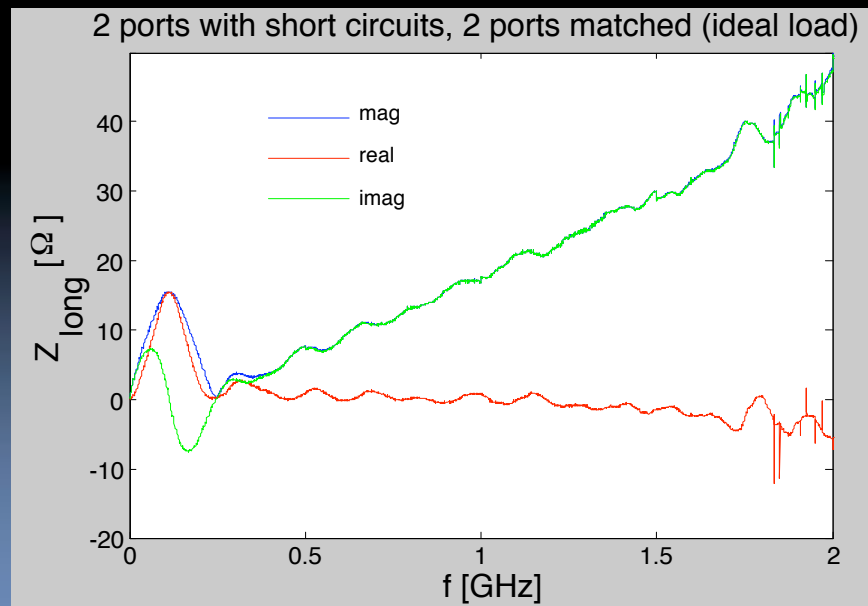
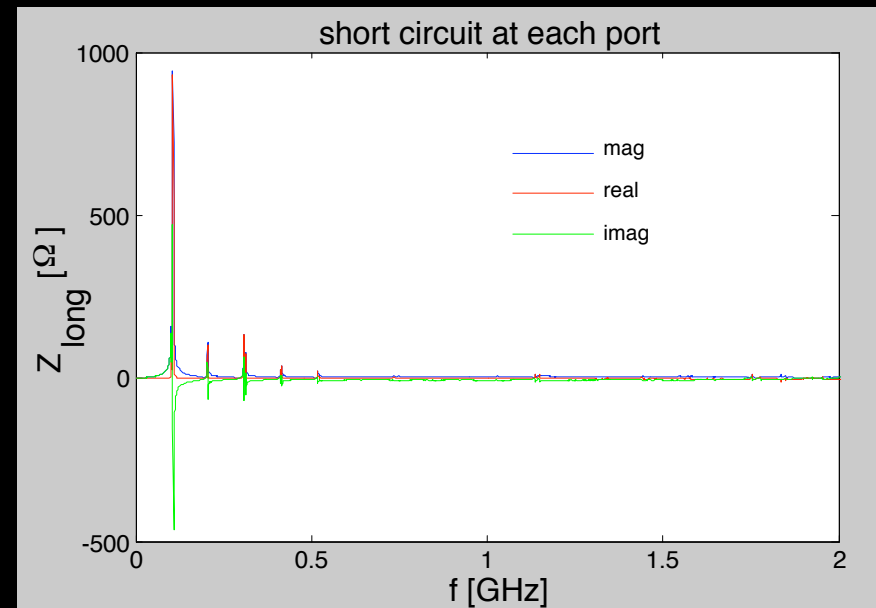
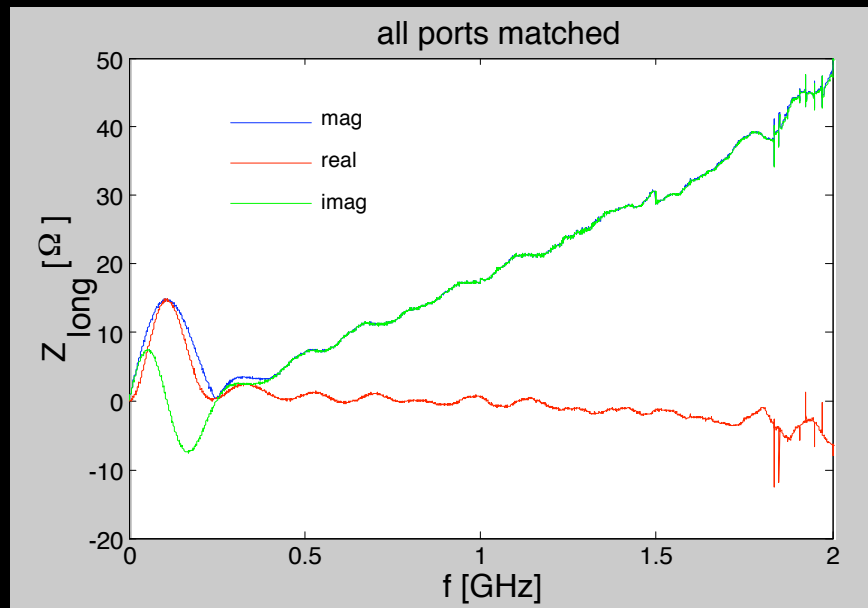
Reflections increase sensibly with the feedthroughs



Reflection at the input port



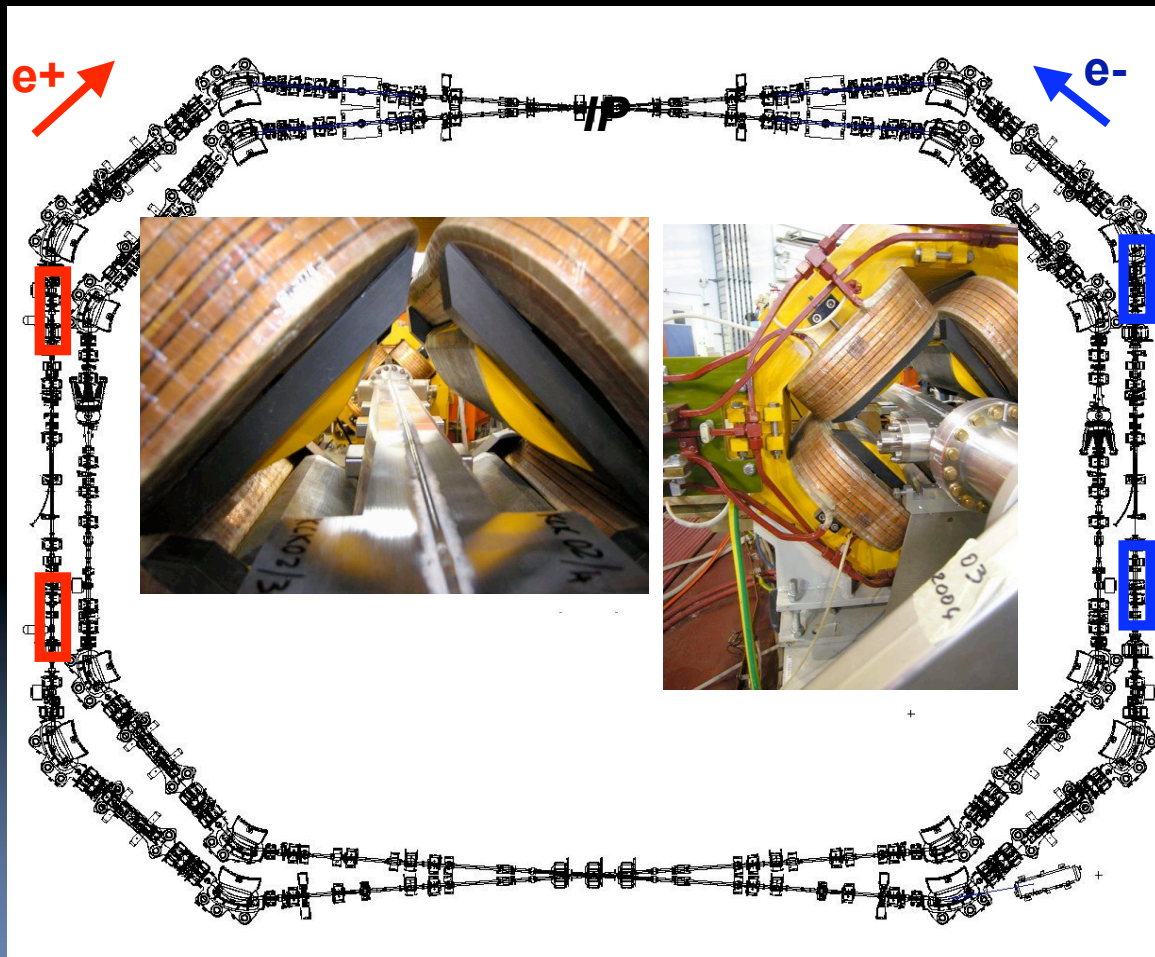
## 2. RF measurements: longitudinal impedance





### 3. DAFNE operation with the new kickers

New kickers installed in the DAΦNE rings (Nov. 07)



Final version of the 45 kV FID pulser has shown poor reliability.

FID GmbH repaired and updated several times the broken components but a reliable solution has not yet been found.

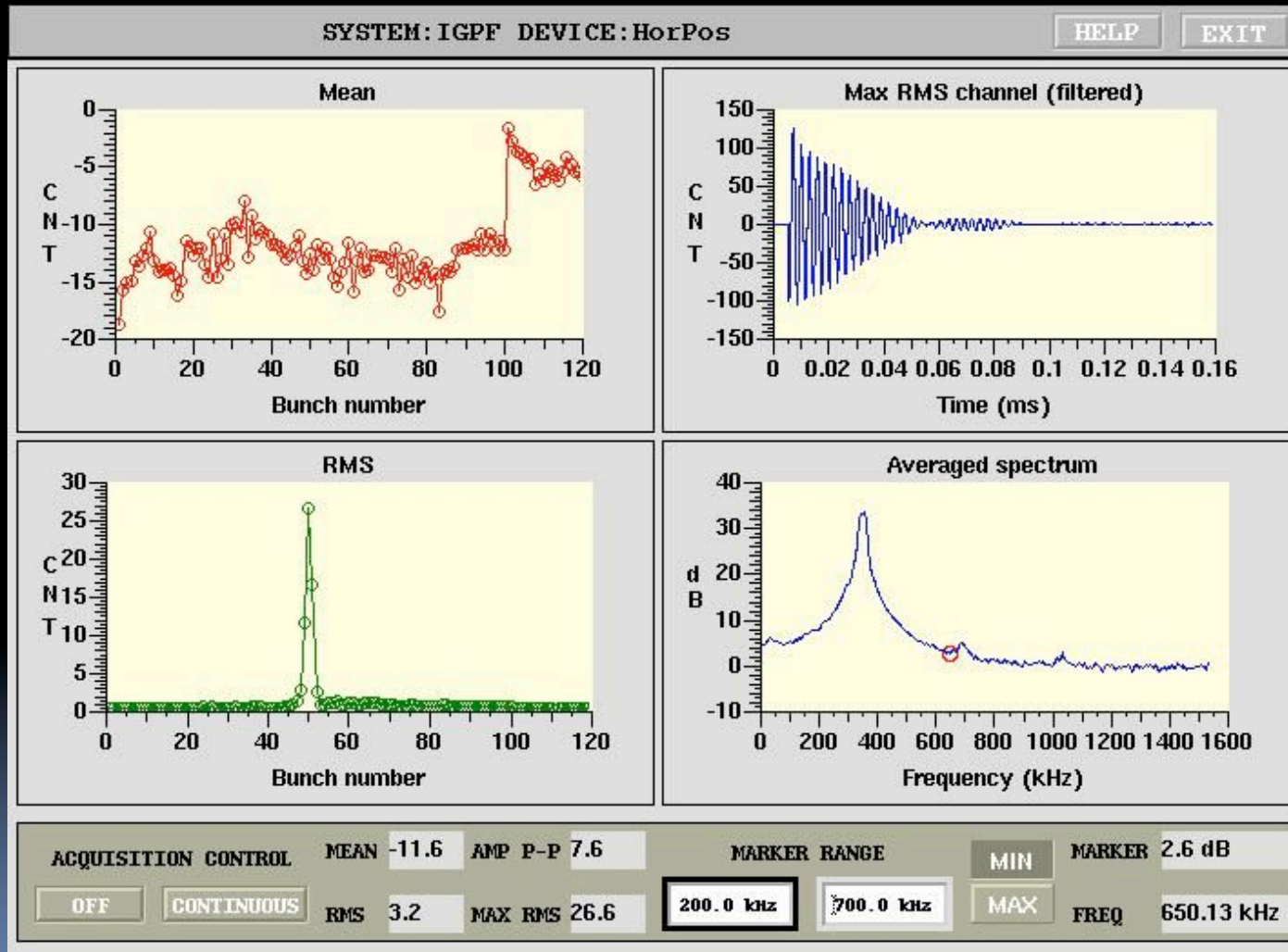
We never had the possibility to operate with the 4 pulsers working together at the same time.

We are now running with the old, long pulse system in both the rings.

In e+ ring we have successfully tested injection with a hybrid system connecting both the old pulser and the 45kV fast pulser to each kicker.

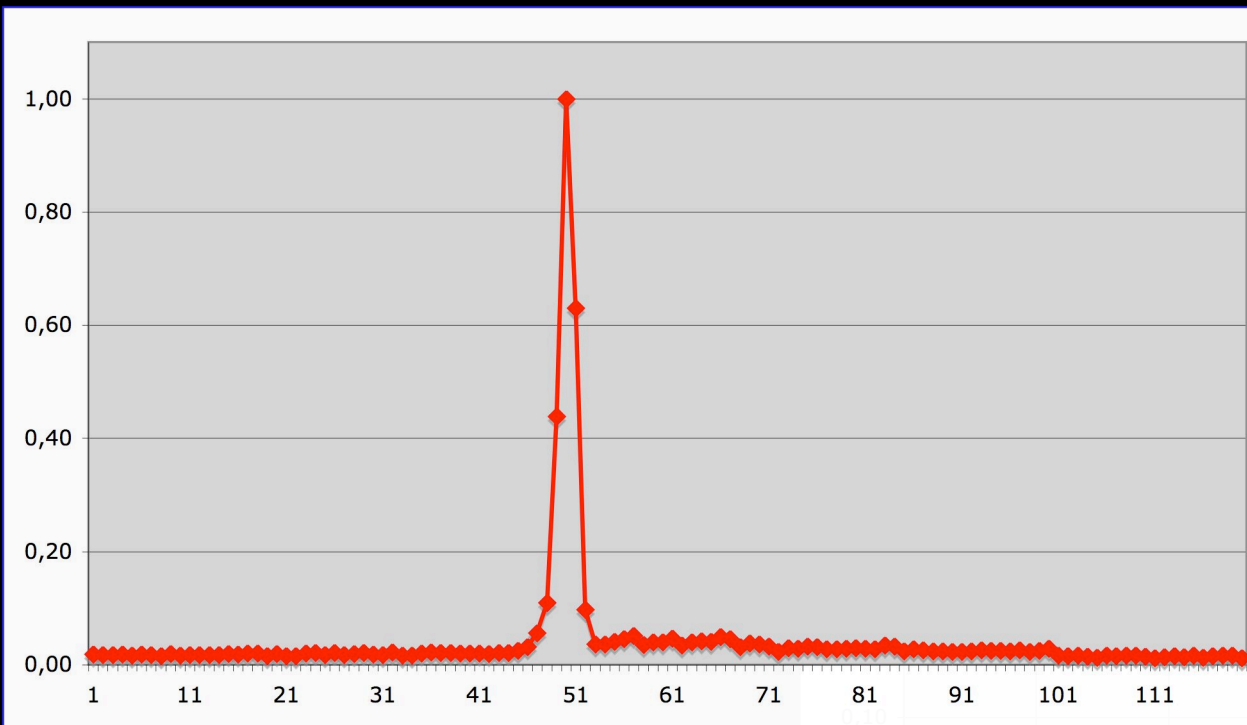
# DAFNE beam oscillations with fast kick

Measured by the horizontal digital feedback system.



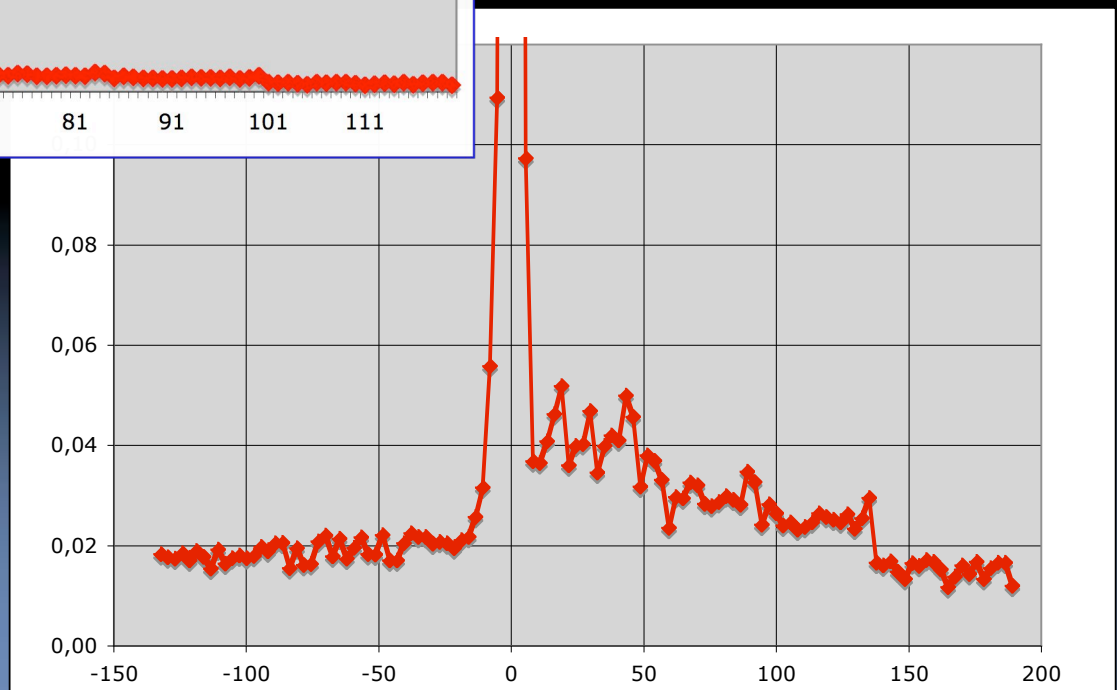
100, of 120, stored bunches with kicker pulse centered on bunch 50.  
bunch distance 2.7 ns.

# DAFNE beam oscillations with fast kick



rms oscillation  
amplitude of 100  
stored bunches with  
kicker pulse centered  
on bunch 50

Same plot with a scale in ns  
and amplified vertical scale  
Shows a tail of ~2% above  
noise level



## Experience with FID pulsers

First results of operation with FID fast pulsers have been very **promising**.

**Routine operation** with 45kV FIDs **not allowed** because of their very **poor reliability**.

After increasing  $\beta$  function in the kicker region and changing the beam orbit in the septa, we tried successfully **injection with a 24kV, 5ns FID**.

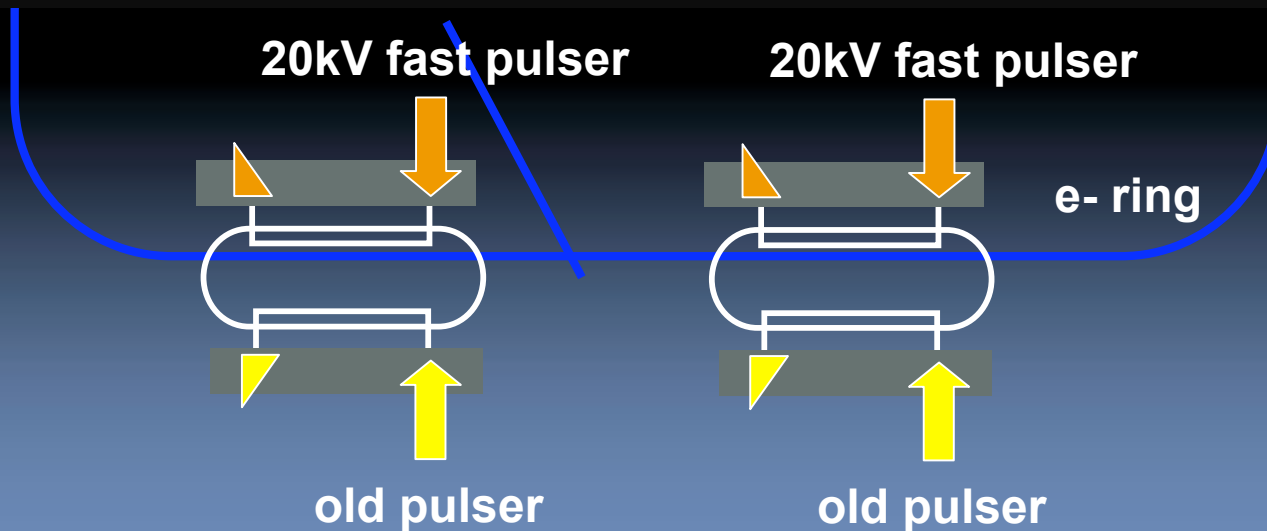
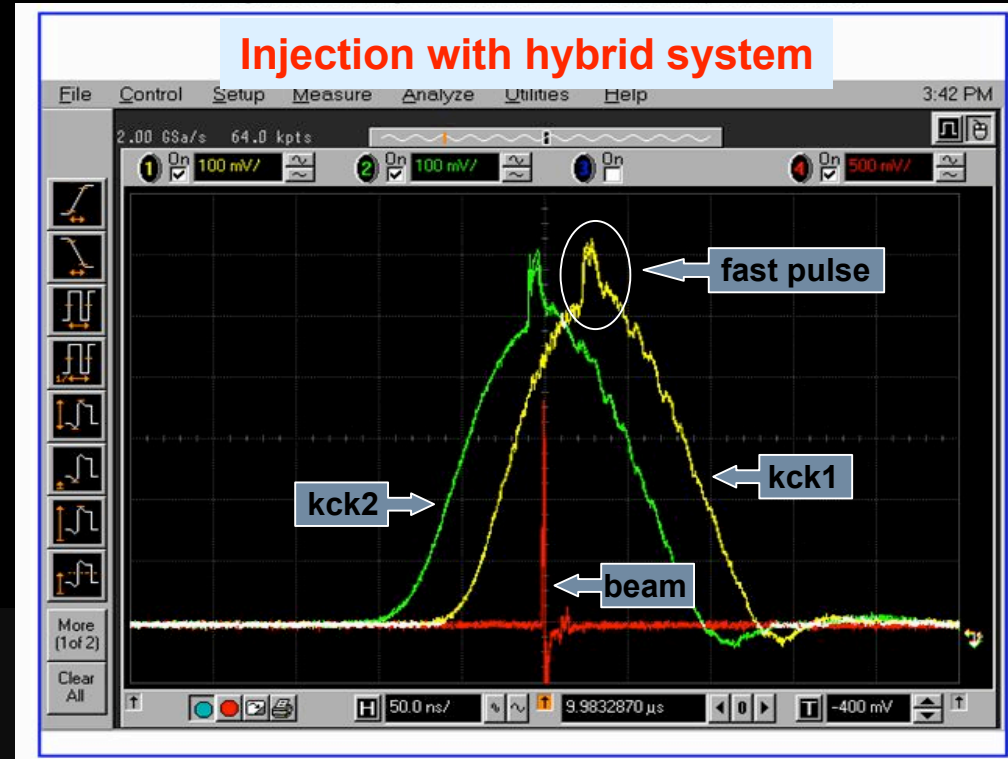
Pulse shape is the same of the 45kV FID, just lower voltage amplitude.



The 24kV FID used for lab HV tests

24kV FIDs have been tested in the electron ring kickers (“hybrid” configuration).

They worked well for about one month, then one FID failed followed by the other one after one more week of test in the lab.

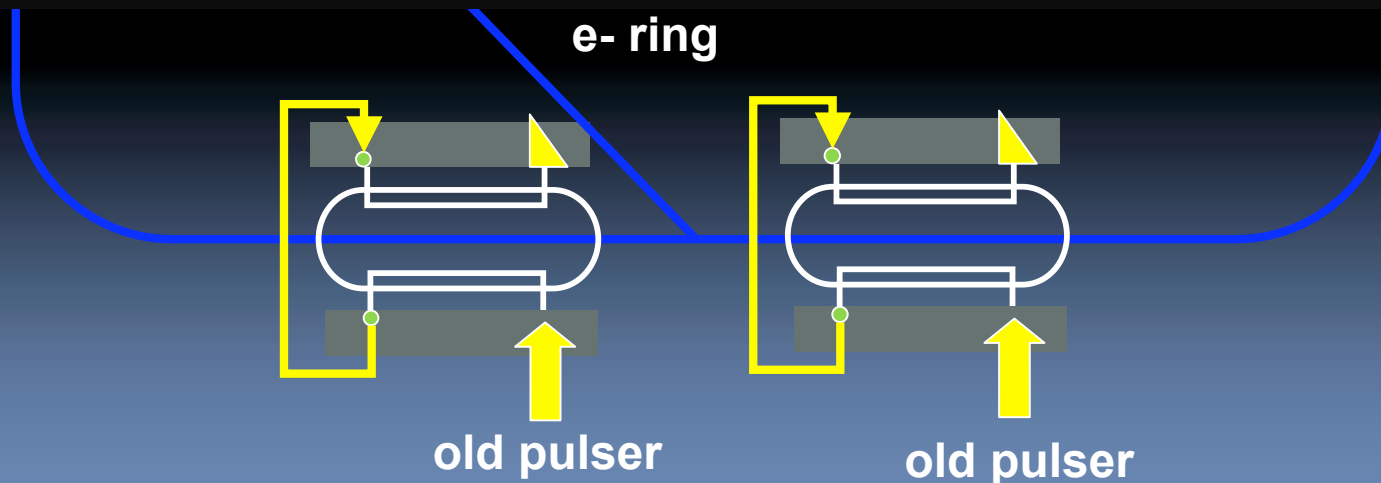
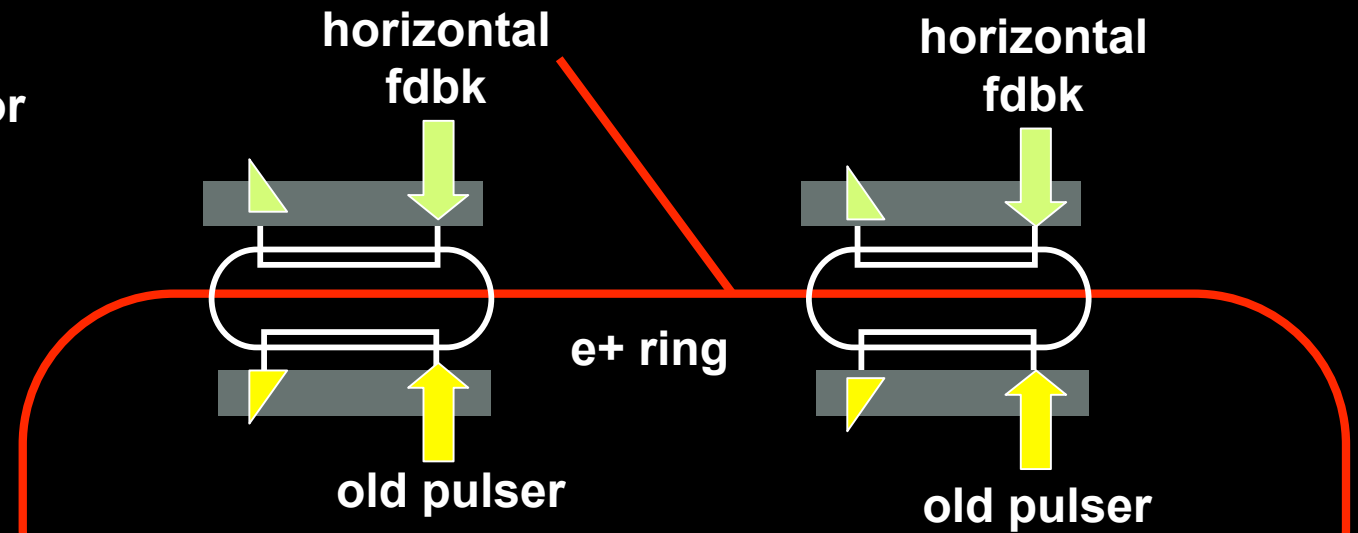




# Present situation

We are now waiting for two new 24kV FIDs.

They are at the moment under test at FID GmbH.



# CONCLUSIONS

- The new DAFNE injection kickers, installed one year ago, work well and are very versatile devices. Used with both FID and old DAFNE pulsed and even as a feedback kicker!
- Reliability problems of the fast pulse generators by FID remain to be solved, we hope with the 24kV units.
- A tapered stripline kicker has been designed for ATF, mechanical drawings already done. Ready to be realized.
- A new shielded bellows designed for the DAFNE upgrade as well. It could be easily readapted to different chamber cross sections and a version with cooling is also available.
- Together with the new injection kicker, it contributed to lower the machine impedance, as bunch length measurements have shown.

# Kickers and Septum parameters

S. Guiducci

# Kickers parameters

	DAFNE	LER	HER
Deflection (mrad)	5	0.9	0.8
E (GeV)	0.51	4	7
Strip length (m)	0.73	1.03	1.62
Voltage /strip (kV)	45	45	45
BSC @kicker (mm)	25	15	11
Tot. pulse length (ns)	11	15	24