# **FAST KICKER STATUS**

## **Fabio Marcellini**

On behalf of LNF fast kickers study group\*

\* D. Alesini, F. Marcellini P. Raimondi, S. Guiducci.

#### **RFSEP – RF Separators**

**Milestones of the Task** 

- 1. Design and tests of a strip line kicker for beam injection in DAFNE storage rings.
- 2. Study of a strip line kicker for ILC damping ring.

# new DA $\Phi$ NE injection kickers: design





### Advantages of elliptical cross section and tapered stripline (2/3)

The **elliptical cross section** was originally chosen to minimize the variation of the vertical dimension of the beam pipe between the injection region and the adjacent dipole region and to **increase the deflection efficiency**.



c) the **reflection coefficient** at high frequency (short pulses) because of smoother transition between feedthrough coax line and stripline.

# injection kicker parameters

PARAMETERS		45	
Beam Energy E [MeV]	510	40-	5 ns 2 ns
Time spacing between bunches [ns]	2.7	35-	
Deflection [mrad]	5	옷 30 - 문	
Total deflecting voltage VT [MV]	2.5		
Total kicker length L [cm]	~90	15 20 is nd. 15	
Voltage per strip [kV]	45	<u>ج</u> 10	
Input pulse length [ns]	~ 5	5	
Pulse length "seen" by bunches [ns]	~10	0 1	2 3 4 5 6 7 8
Max rep rate [Hz]	10		time [nsec]
100 90 80 70 60 40 30 20 10 0	2 4 6 time	* injected bunch o stored bunches 4 0 1 1 1 1 1 1 1 1 1 1 1 1 1	

## R&D on HV feedthrough



#### **HV tests**

When HV is applied the **possibility of discharges** is higher in the **end-section** of the kicker electrodes, where the electrode itself is closer to the vacuum tube.



HV 50 Ohm (wide band) **commercial feedthroughs do not exist** and an R&D activity has been necessary. The wide band of the feedthroughs is important to **keep low the beam impedance** of the kicker even well beyond the frequency spectrum of the input pulse.

Short stripline for HV tests





Different feedthroughs have been mounted on this stripline for HV test and RF measurements

### **HV tests**

Several FID GmbH HV pulser have been tested up to the final version under specification: 45 kV, flat top 5 ns





A *commercial feedthrough* (not 50 Ohm) has been initially tested *without success*.





An *HV feedthrough at 50 Ohm has been designed, realized and tested at LNF* with complete *success* up to 50 kV with the FID pulser.



## HV tests on the new kickers (1/3)





## HV tests on the new kickers (2/3)



Old pulser (LNF)





## HV tests on the new kickers (3/3)

New pulser (FID)



Old pulser (LNF)



## RF test (Network Anal.) on the new injection kickers

#### Connectors for RF test with NA







## Installation in the DA $\Phi$ NE rings (Nov. 07)





#### ILC kickers: uniformity of the deflecting field (2/4)



the non-uniformity of the deflecting field affects the distribution of the particle in the bunch. This effect has been studied and results are reported for example in: https://wiki.lepp.cornell.edu/ilc/bin/view/Public/DampingRings/KEKWorkshopTalks

## Tapered strip advantages on beam coupling and transfer impedance



# **Future programs**

- Beam *coupling impedance* measurements on fast kickers (wire method)
- Substitution of the old pulser (long pulse) with the FID pulsers (positron ring)



- Installation in DAFNE of "*dump" kickers* (2 more kickers already built).

-This will allow to *make tests* on the beam with pulsers of different types.



# CONCLUSIONS

DA $\Phi$ NE new stripline injection kickers successfully installed in the collider.

**ILC kickers studies in progress** 

**Future programs:** 

fast FID pulsers installation"dump" kickers installation in DAFNE