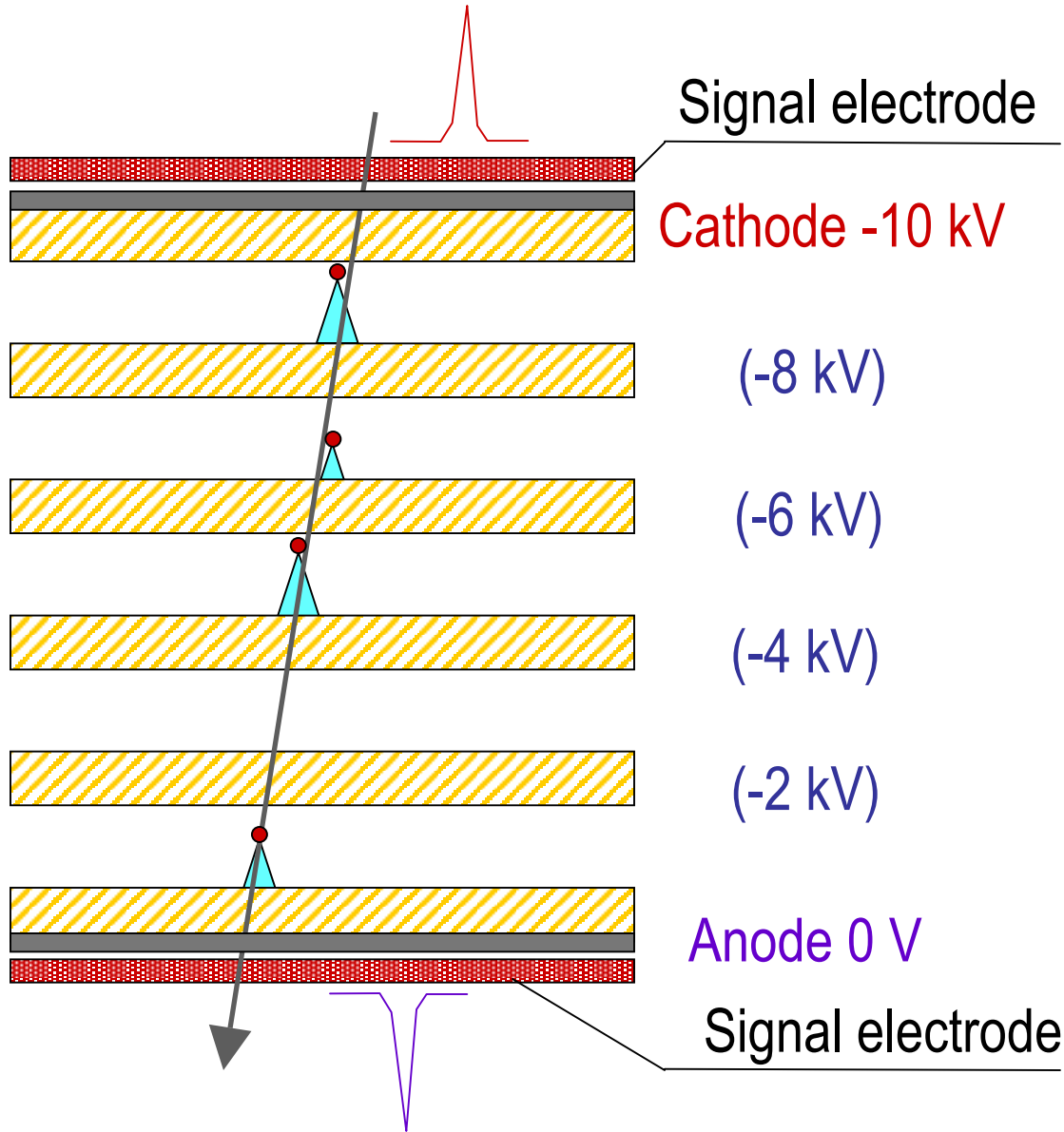


# MRPC detector as polarimeter for dEDM

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- Characteristic of detector
- Time Resolution
- Electronics
- Possible R&D
- Plans

# 1996: LAA MULTIGAP RESISTIVE PLATE CHAMBER (R&D project to improve Resistive Plate Chambers)



Stack of equally-spaced resistive plates with voltage applied to external surfaces (all internal plates electrically floating)

Pickup electrodes on external surfaces (resistive plates transparent to fast signal)

Internal plates take correct voltage - initially due to electrostatics but kept at correct voltage by flow of electrons and positive ions - feedback principle that dictates equal gain in all gas gaps

# Characteristic of MRPC (from ALICE-TOF)

Double stack

- each stack has 5 gaps  
(i.e. 10 gaps in total)

250 micron gaps with spacers  
made from fishing line

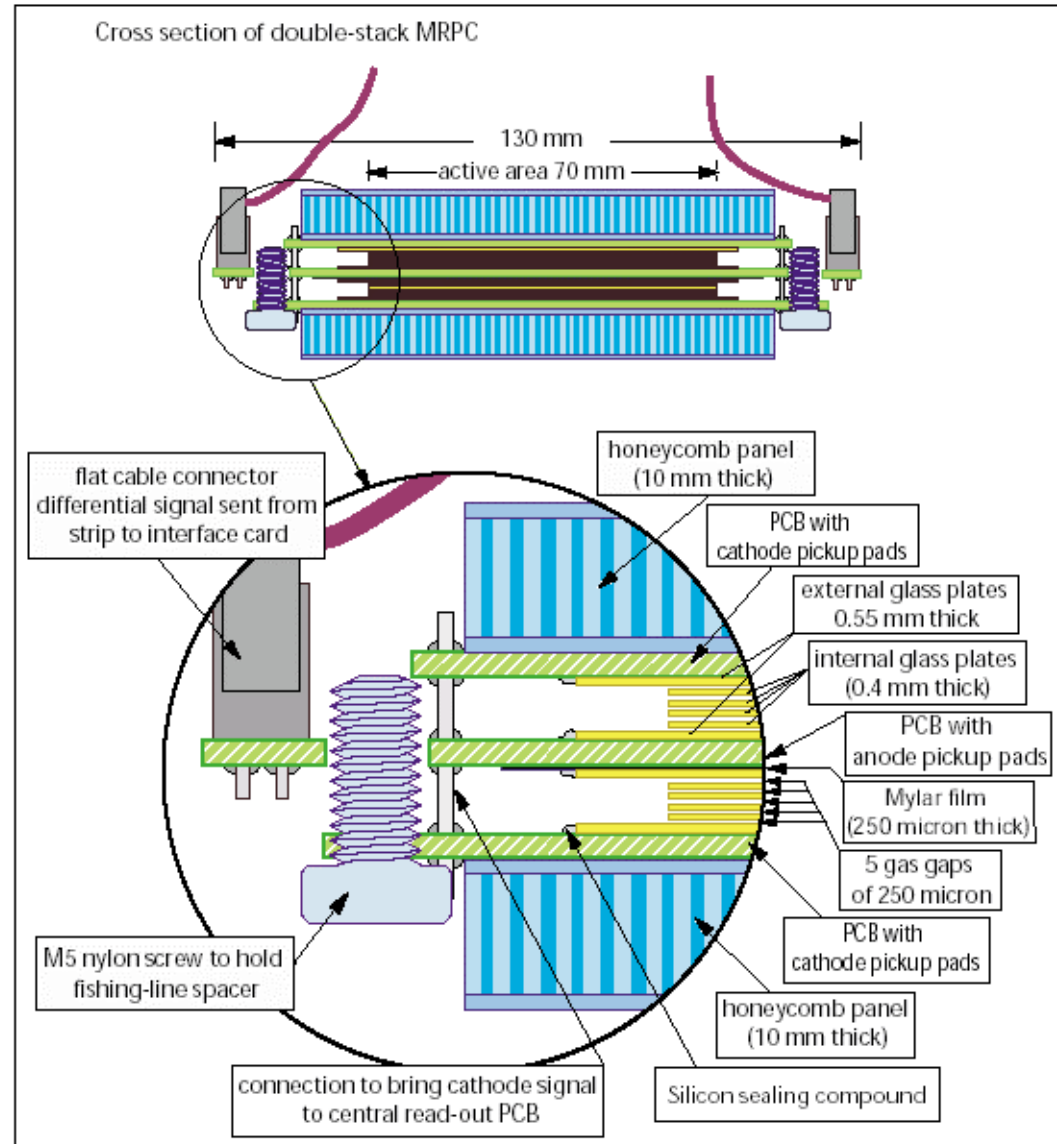
Resistive plates 'off-the-  
shelf' soda lime glass

400 micron internal glass

550 micron external glass

Resistive coating

5 M $\Omega$ /square



# Time Resolution



## Kinematics

Elastic – First Excited Level (4.4 MeV)

$Q_d = 10^\circ$  (LAB) - TOF over 2 m

$T_d = 200 \text{ MeV} \rightarrow \Delta \text{TOF} = 140 \text{ ps}$

$T_d = 400 \text{ MeV} \rightarrow \Delta \text{TOF} = 50 \text{ ps}$

$T_d = 600 \text{ MeV} \rightarrow \Delta \text{TOF} = 20 \text{ ps}$

## COSY TEST

**250 ps / 10 m TOF  $\equiv$  50 ps / 2 m TOF**

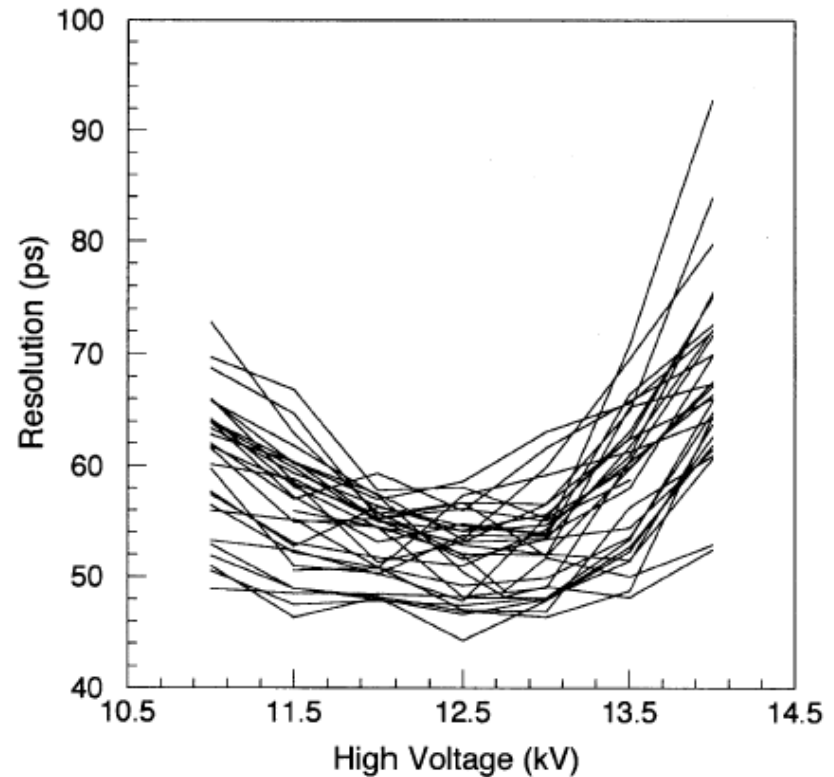


Fig. 5. Time resolution as a function of total applied voltage in 30 pads (from five different MRPC strips).

*NIM A532, (2004), 611*

# Efficiency and rate capability

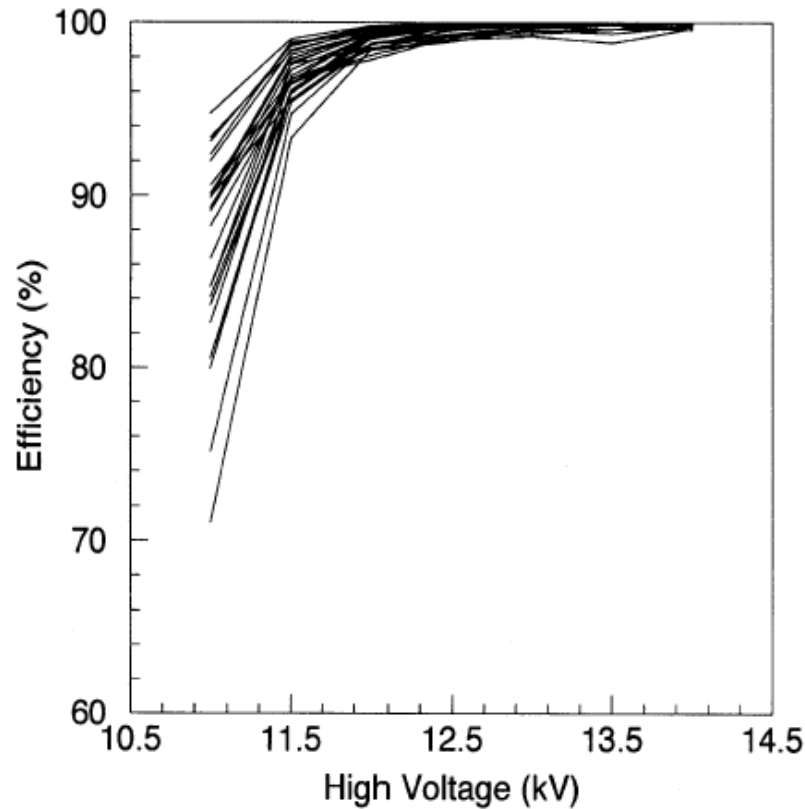


Fig. 7. Efficiency as a function of total applied voltage in 30 pads (from five different MRPC strips).

10 gap MRPC can be easily used up to continuous flux of  $1 \text{ kHz/cm}^2$

This good rate capability (for an RPC) due to small amount of charge generated by through-going particles.

Higher rate capability could be reached by using material with lower resistivity

# Electronics and R&D

- FEE : NINO ASIC chip (*NIM A533, (2004), 183*)
- TDC : based on HPTDC chip developed at CERN (*NIM A533, (2004), 178*) and commercialized by CAEN V1190 and V1290 9U VME
- Two different cards: one with NINO and the other with HPTDC: **can we integrate NINO and HPTDC on the same card ?**
- We want to study also the possibility to **use a different TDC chip like ACAM TDC-F1 chip**

# Summary

**MRPC**

- High efficiency ( $> 99\%$ )
- Excellent time resolution ( $\sim 50$  ps)
- Excellent rate capability ( $\sim 1$  KHz/cm<sup>2</sup>)
- Spatial resolution  $O(1\text{cm})$
- Well established technique with ample know-how available (ALICE-TOF)

**An excellent candidate for the dEDM polarimeter.**

**We could build two detectors:**

**One for the start + One for the stop**

**or**

**We can use a plastic scintillator as target**

# Our plans

- In the next months we will ask for funding to INFN to participate to COSY test-beam and to build and test a prototype with MRPC.
- If our request will be accepted, money will be available in early 2008 (w/ the possibility to anticipate some minor costs this year).
- We would like also to explore the possibility to get some funding from the 7th European Research Programme (FP7).