

Report on the CCC based HPTD testbeam measurements at PS in 2009

Gergő Hamar (MTA KFKI RMKI, Budapest)

on behalf on the REGARD* + VHMPID-BP groups

Test beam group : G. Bencze, G. Hamar, D. Varga

Students : D. Csallóközi, T. Győri, P. Horváth,
G. Kiss, K. Márton, M. Pék

***REGARD : Rmki-Elte Gaseous detector R & D**

Outline

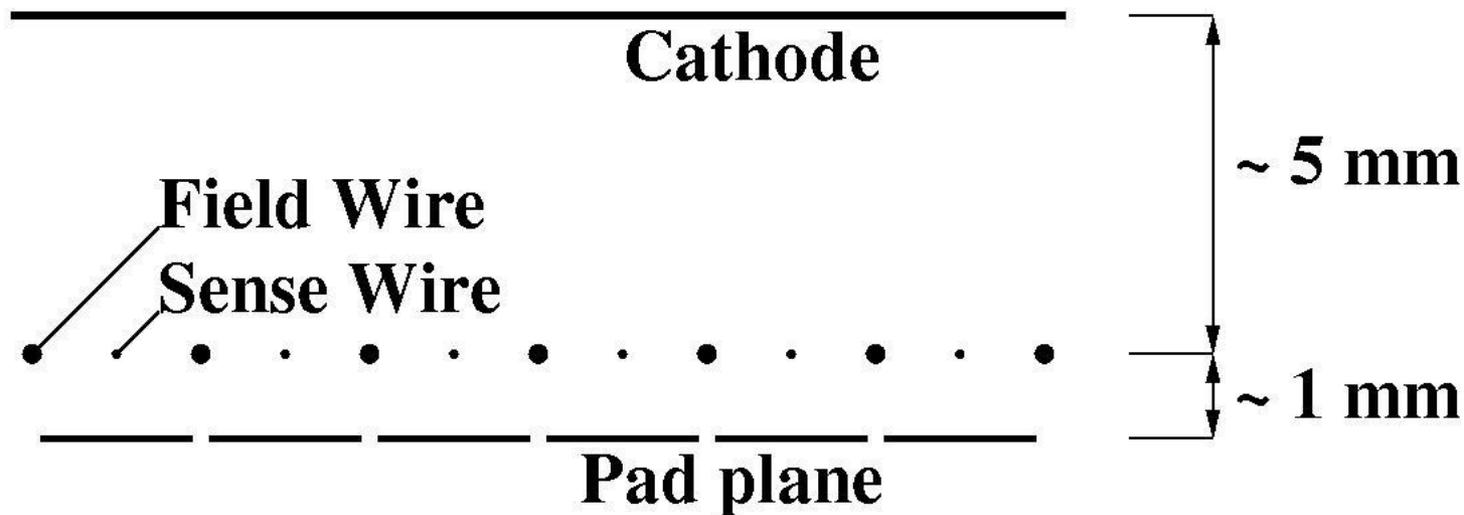
- **Close Cathode Chamber** (reminder)
- **Test beam setup**
- **Aim of the beamtest**
- **Results** (specially from the trigger point of view)
 - Analog signals
 - Efficiency
 - Angular and position resolution
 - Angular variations
- **Progress since the beamtest in 2009**
- **Plans for beamtests in 2010**

Close Cathode Chamber

Development of the **REGARD** Collaboration

(**R**mki-**E**lte **G**aseous detector **R**&**D** Collab.)

(proposed by D.Varga)



- Main parameters:

Sense Wire ~ +1000 V

Field Wire ~ -600 V

Cathode ~ -600 V

Pad plane ~ 0 V

Gas mixture : Ar/CO₂

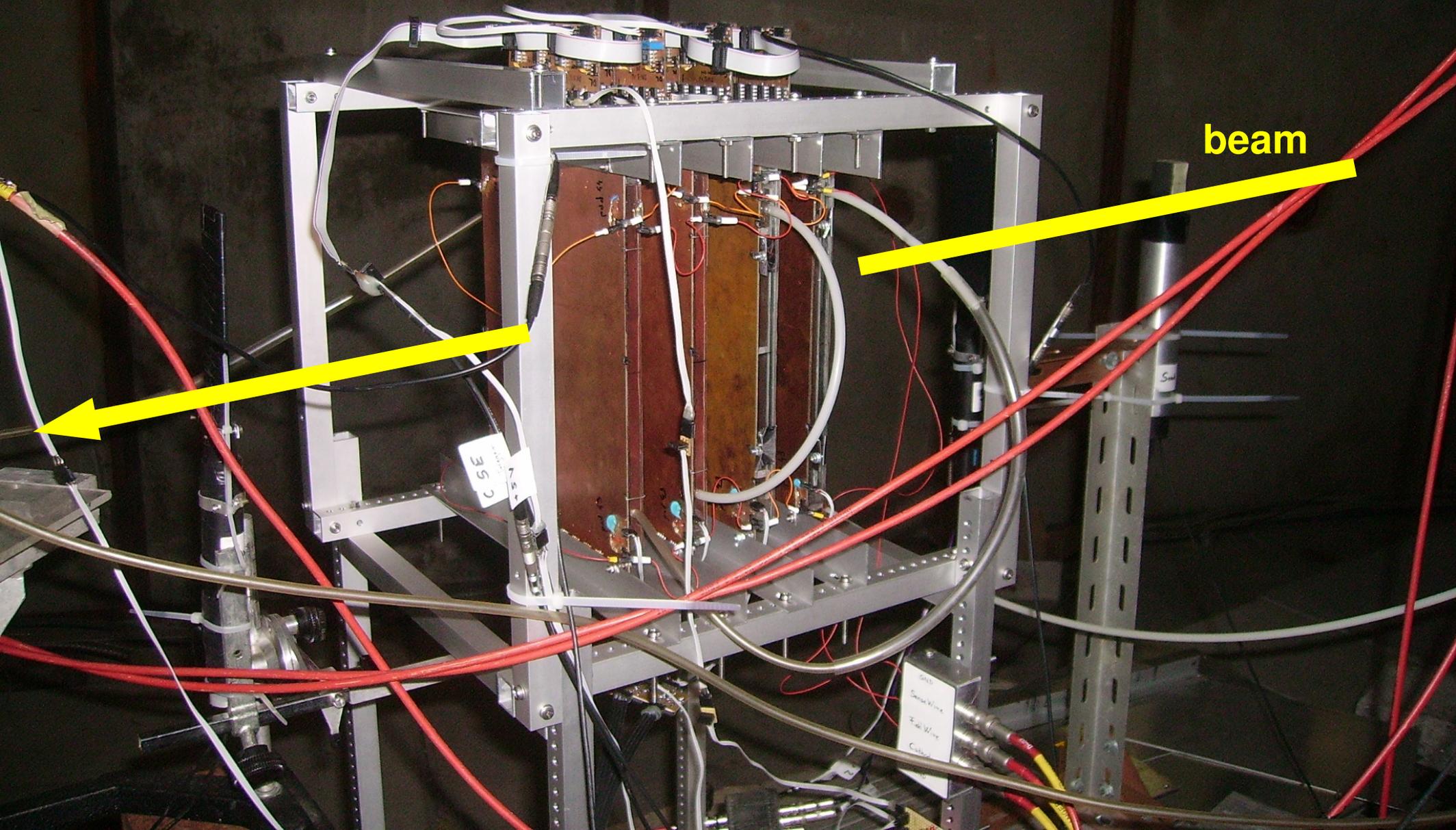
Pad size typically 2-4 mm

Wire distance typically 1-2 mm

Test Beam Setup

(4 layers of CCC)

PS T10
10.2009.



beam

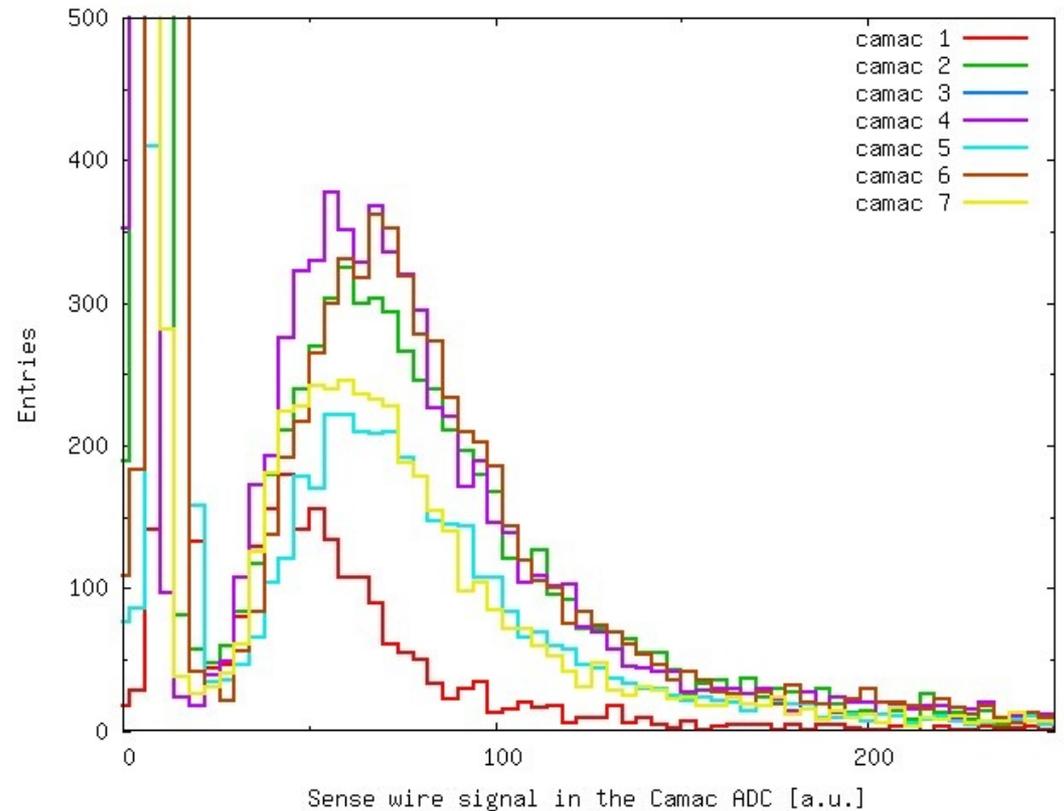
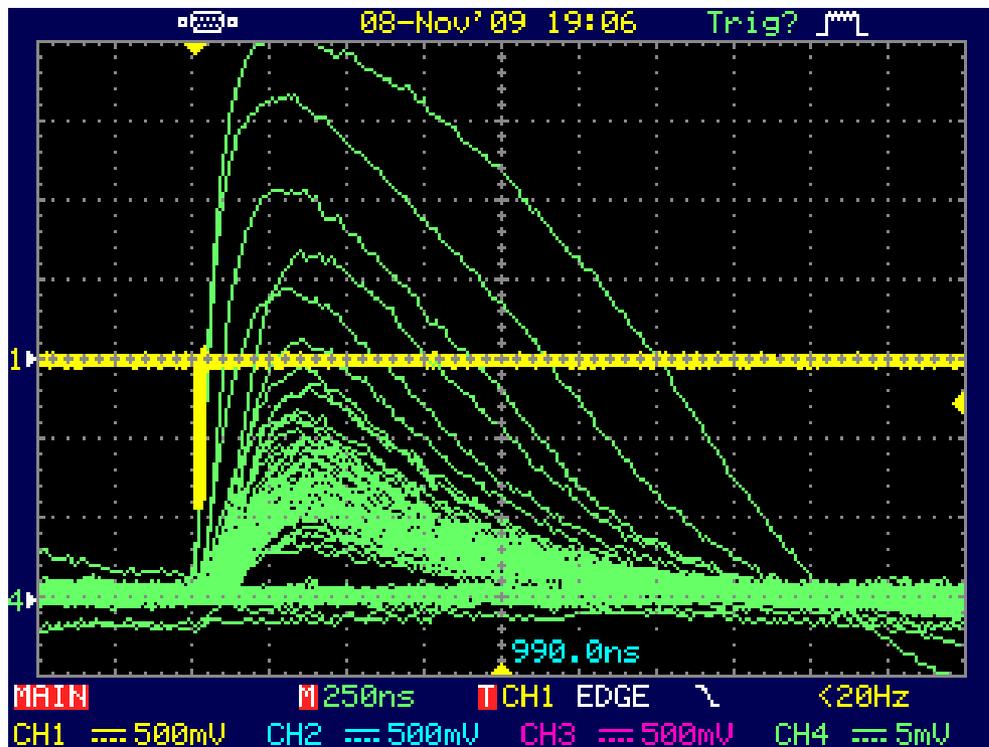
CSE

GND
Sense Wire
Field Wire
Cathode

Measurements

- **4 layers of Close Cathode Chambers, 180 mm x 200 mm**
with pads: 4 mm x 50 mm
- **Digital multiplex readout for pads,**
possibility for analog readout on the sense wires
- **Chambers' High Voltage study**
(gas gain, efficiency, average number of hits, ...)
- **Angle study from 0° to 90°**
- **Absorber study with Al and Pb**
- **Gas mixture: Ar with 10%, 20% CO₂**

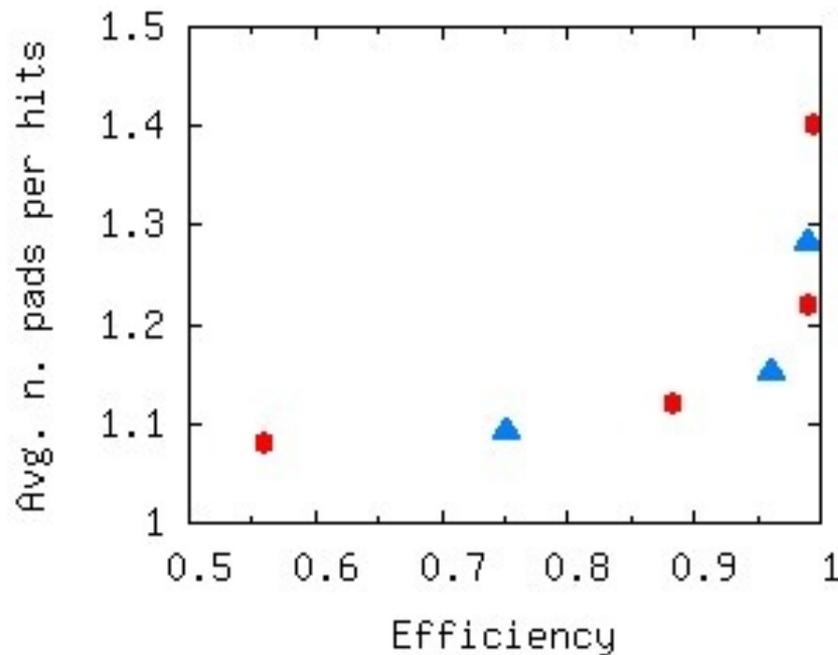
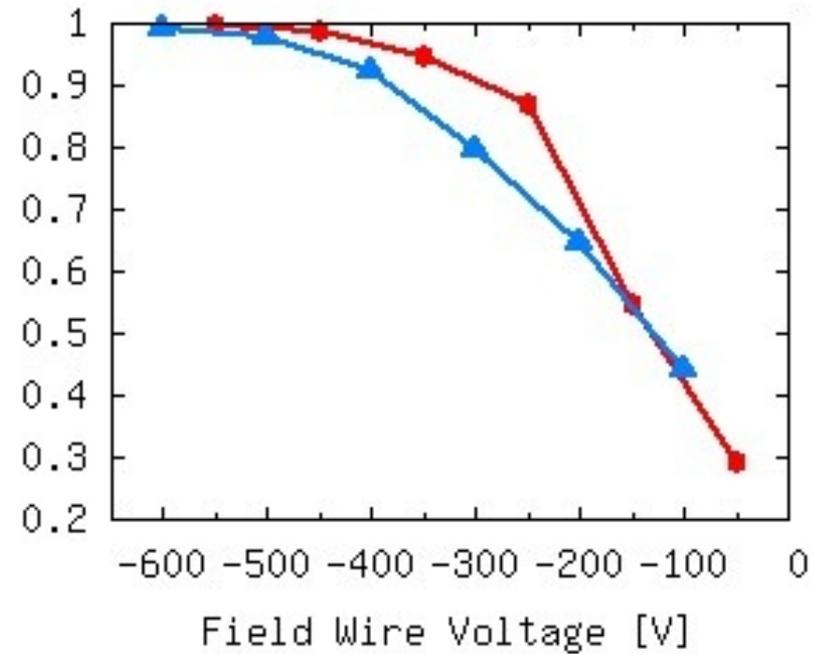
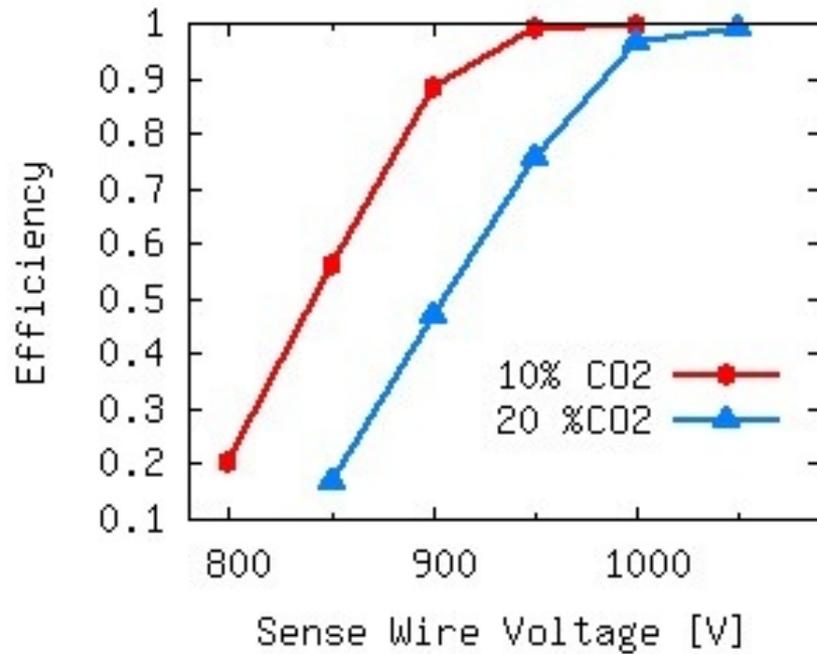
Analog signals of the MIPs from the sense wires



- Oscilloscope screenshot

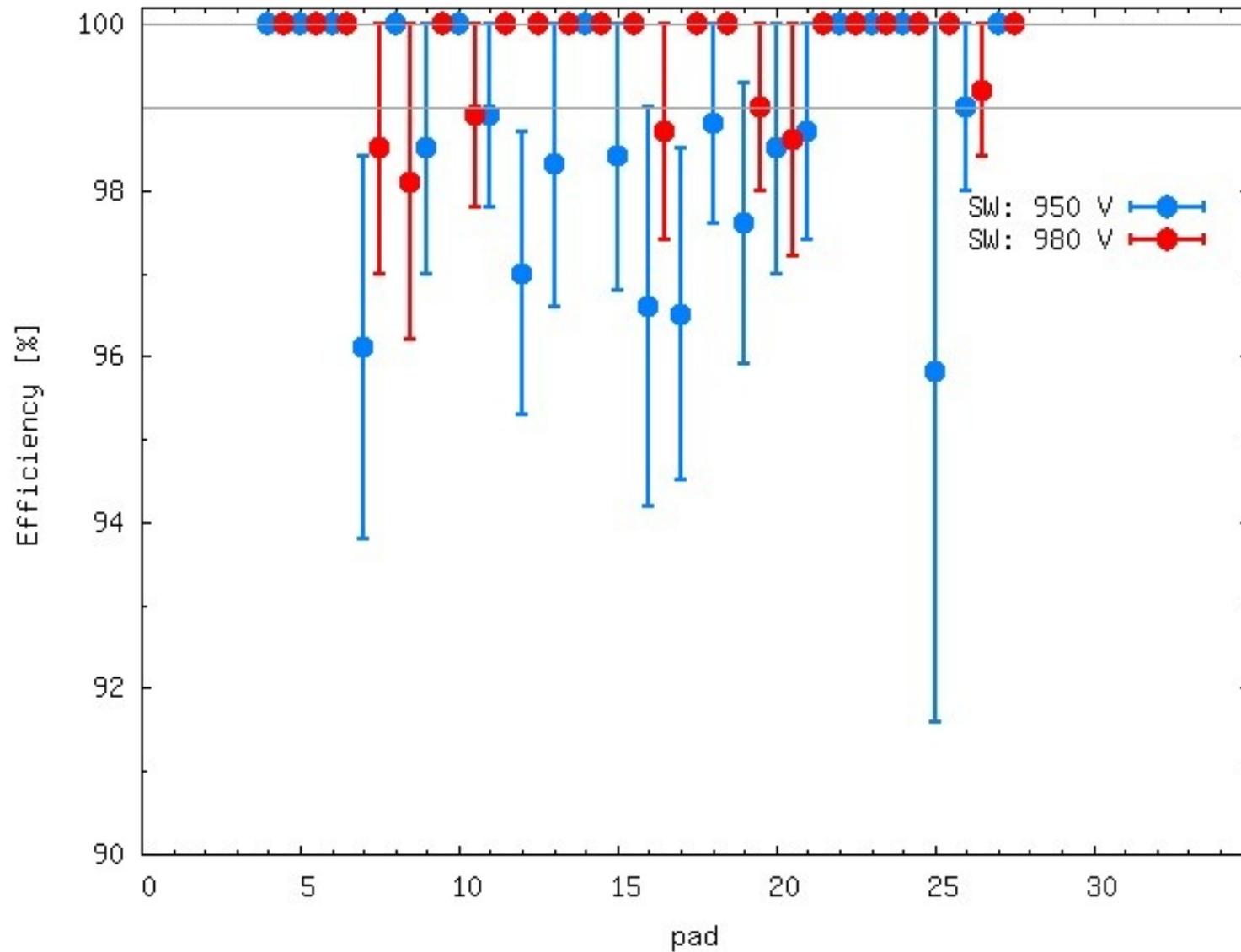
- Charge distribution
(2 channels in all the 4 chambers)

Efficiency, occupancy



No significant differences have been found using different gas mixtures Ar+CO₂ (90:10, 80:20) (only the HV should be different)

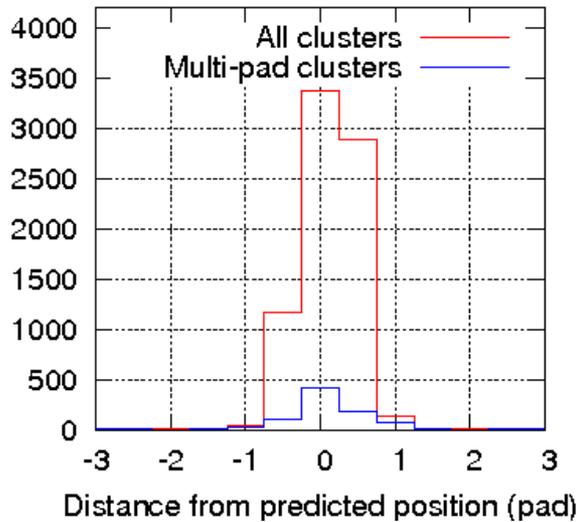
Uniformity of efficiency



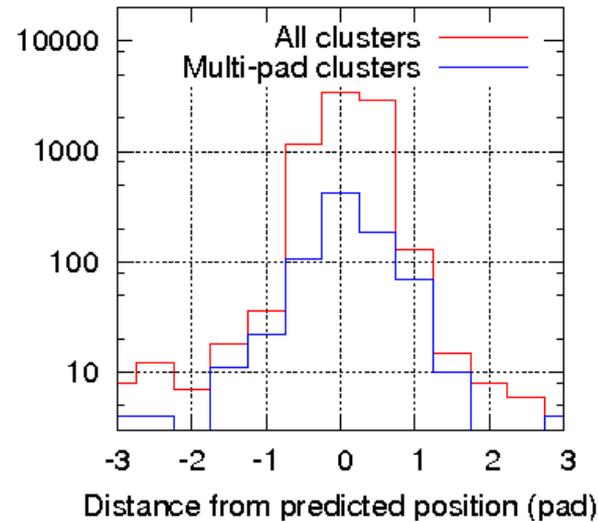
Deviations mostly from electronics

Position and angular resolutions

linear scale

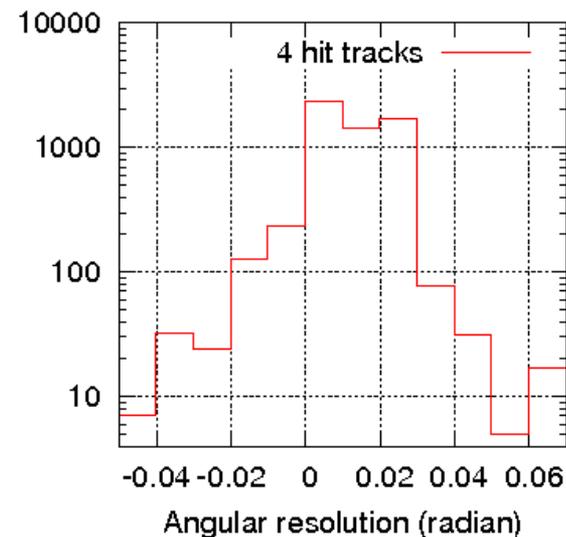
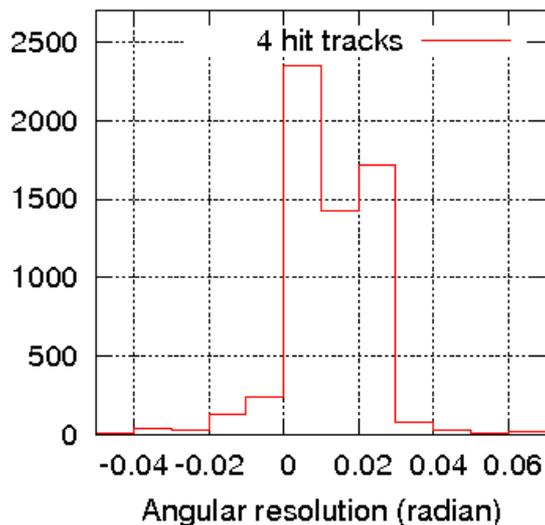


log scale



Position resolution

- Hits (clusters) from three chambers extrapolated to the fourth one
- Position resolution: defined in pad units (4mm pads)

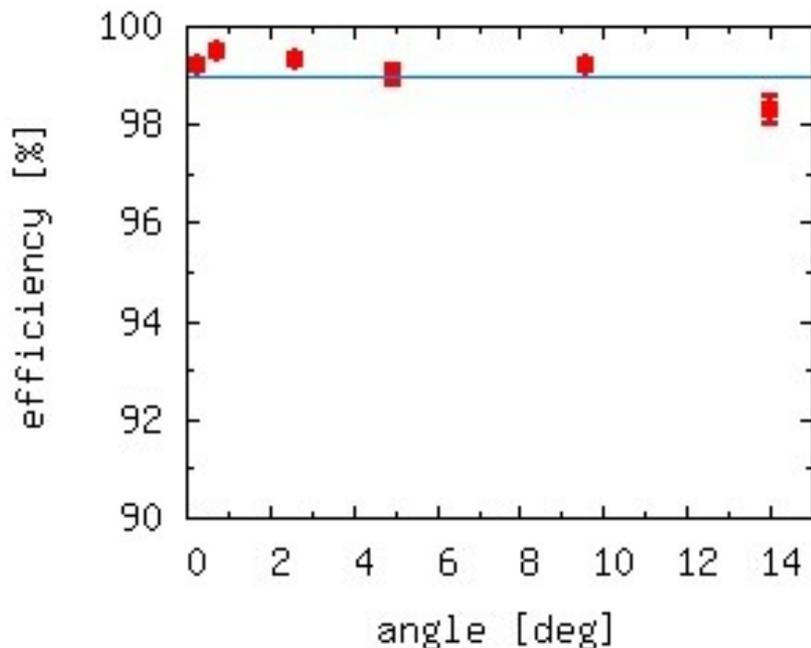
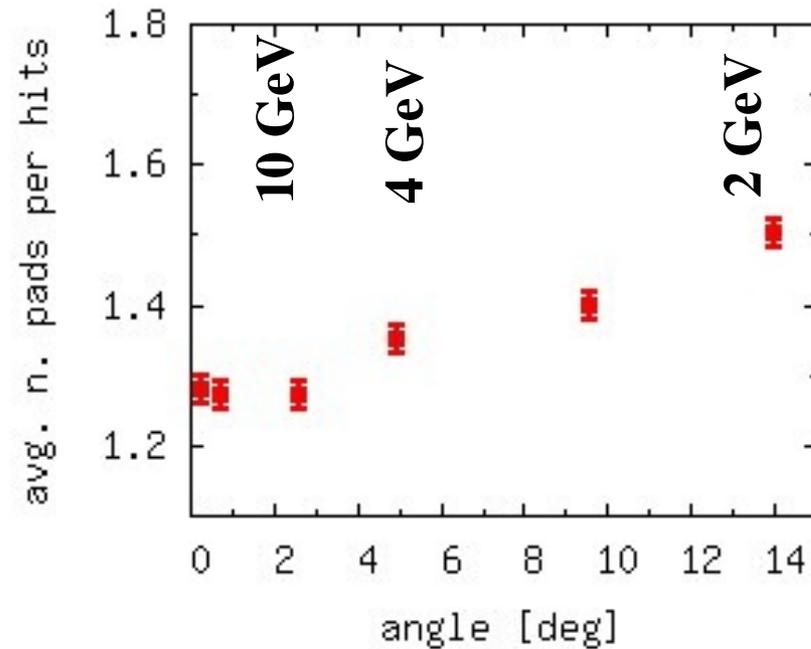
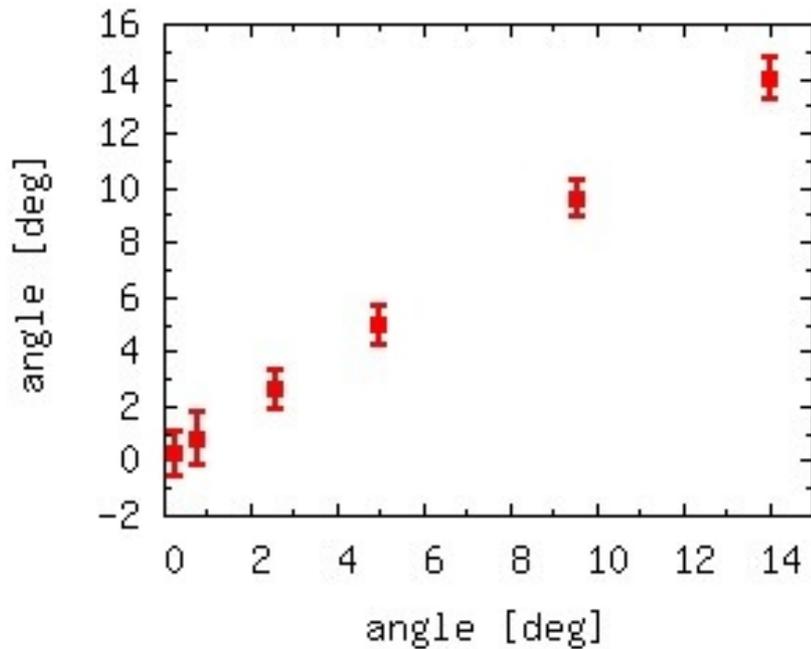


Angular resolution

- Hits (clusters) from four chambers, straight line fit
- Resolution sufficient for triggering purposes.

(Note: 0.05 radian corresponds to 15 GeV at ALICE)

Dependencies on angle of incidence



- Angular resolution: ~ 1.4 deg
remains the same up to 15 deg
- Efficiency is still above 99%
(up to 10 deg)
- Average number of hits:
slightly increases 1.1 \rightarrow 1.5
(feature of the CCC design)

Results from the beamtest (up to now)

- Efficiency: above 99% have been reached
without sparking problems
- Occupancy: average 1.1-1.3 pads hit per particle;
- Position resolution: from straight line fit on tracks,
position : within +/- 0.5 pad
(as expected by design)
- Angular resolution: ~ 1.4 degrees
sufficient for triggering purposes!
- Electronics: mostly working well,
but we still got some problems,
we are testing some new versions

Progress since the beamtest

- **Electronics:**
 - all-SMD designed electronics have been made (easily fit underneath the pads)
 - they are under test at the laboratory at Budapest
- **Chamber design:**
 - 20cm x 20cm CCC is under construction
electronics' connections are underneath the pads (like in the final design)
 - Realization of superpads (wire-groups) for the L0 trigger
- **FPGA readout:**
 - FPGA readout is under test, successful communication with electronics and the current PC readout system
 - see: Csaba Lipusz's talk

Plans for beamtests in 2010

- Test new CCC chambers
- Perform test with 5 or 6 layers of CCCs
- Use the new all-SMD electronics
- Use FPGA readout
- Test FPGA pattern recognition
- Test hardware for L0 triggering possibility
- Test HPTD in magnetic field
- Test TGEM / ReTGEM from different manufacturers