# The ADHOQ detector on the way to $R^2PC$

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SNOWMASS August 2005

# The cast of characters

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# Reliability of the RPC's

- Parallel plate counters are in principle devices that should be extremely reliable.
- In practice things did not go the way one would expected with streamer regime devices.
- Bakelite showed problems, that were connected also with operational misuse.
- Glass also did not perform that well  in BELLE.
- As of now, hopes for the Mylar lined bakelite advocated by  a Chinese groups are very high.

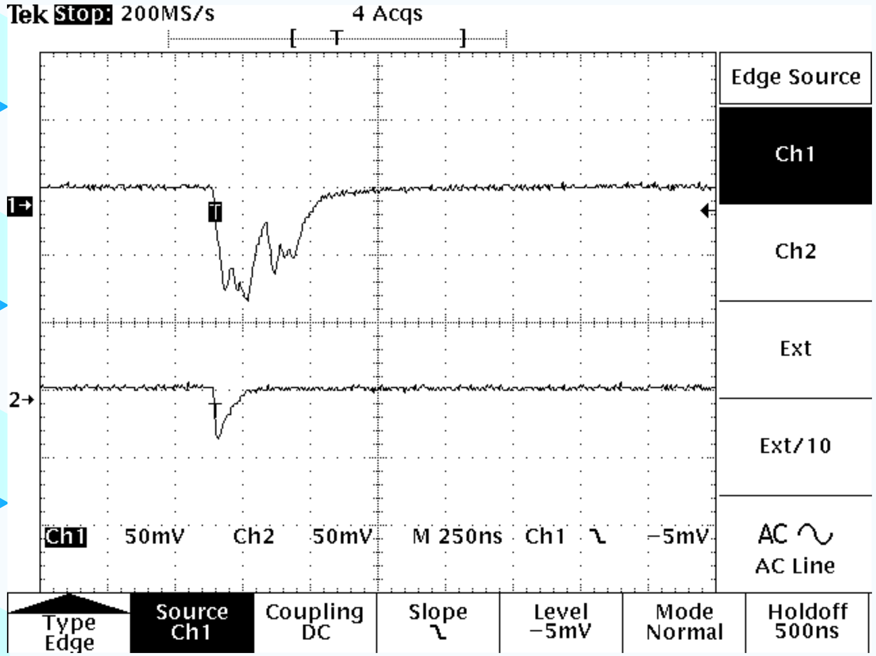
# The RPC working environment

- Given the field shape of a parallel plate chamber, one is forced to use very electronegative (and thus chemically aggressive) gases.
- This in turn might harm the electrode surfaces and cause loss of performances.
- If one were able to operate a RPC without using Freon type gasses, we believe that the reliability of the device would surely improve.

# Quenching the streamers

- As mentioned before, streamer confinement is usually obtained by the electrode resistivity (voltage drop upon discharge) and by using gasses that eat-up electrons.
- We believe that the second function can be achieved mechanically using a mesh that would divide the gas volumes into cells, the division being impervious to discharge electrons.
- We tested this idea and I will show the data we obtained in the following.

# Quenching the streamer (cont.)




- **Here we can see the pulses of a 2mm gas gap filled with Argon/Isobutane 95-5 (%) mix @ 6000 V.**
- **The upper trace refers to a normal glass RPC.**
- **The lower trace refers to a glass RPC in which a mechanical quencher was at work.**
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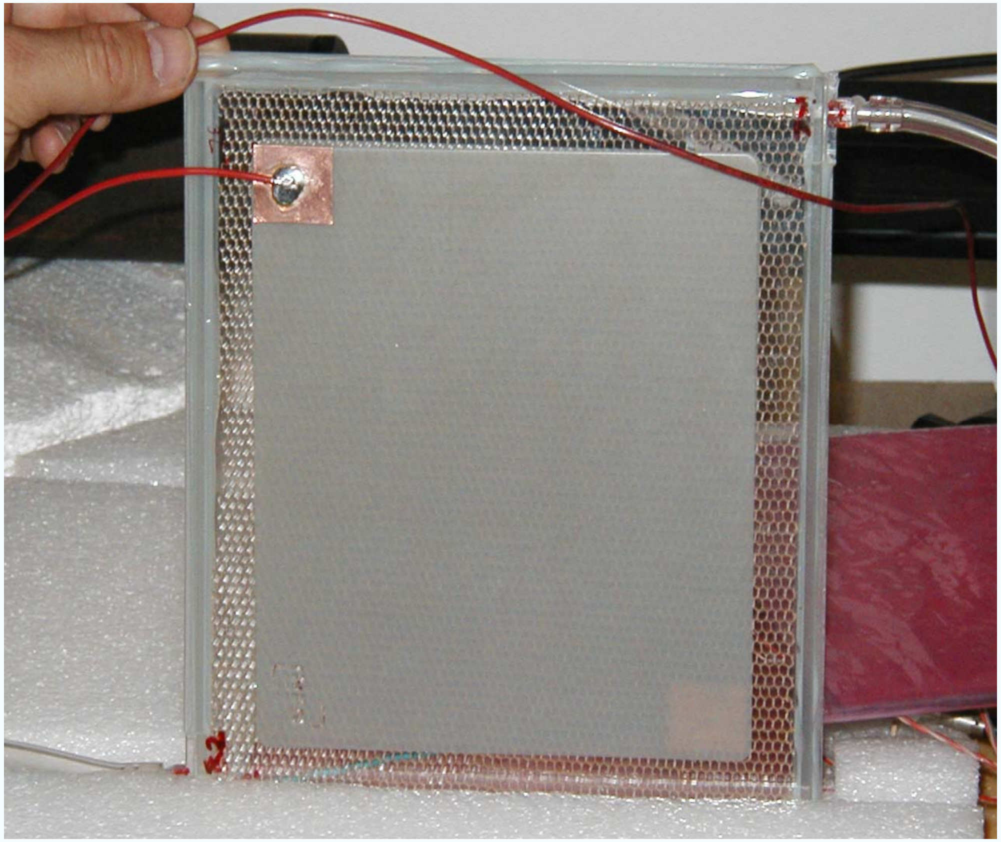
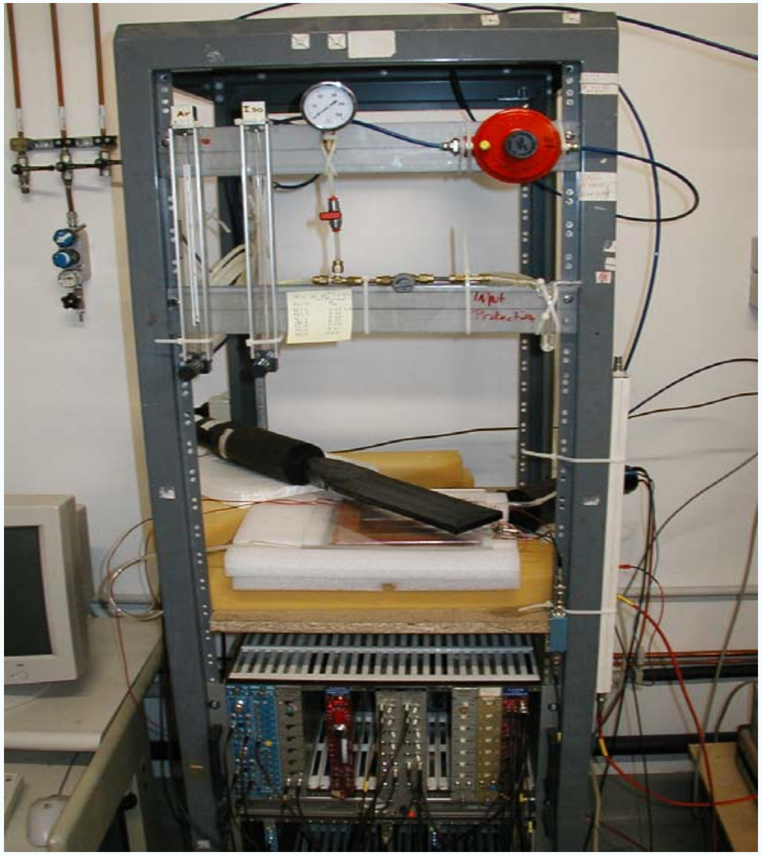
# Mechanically Quenched RPC



- The material needed to quench must be a very good electrical insulator.
- It has to be mechanically sturdy.
- It has to be resistant to chemicals and possibly non flammable.
- A material like that does exist and is routinely produced : it is used as a filler material in plane wings: ECA-I

# Test Setup

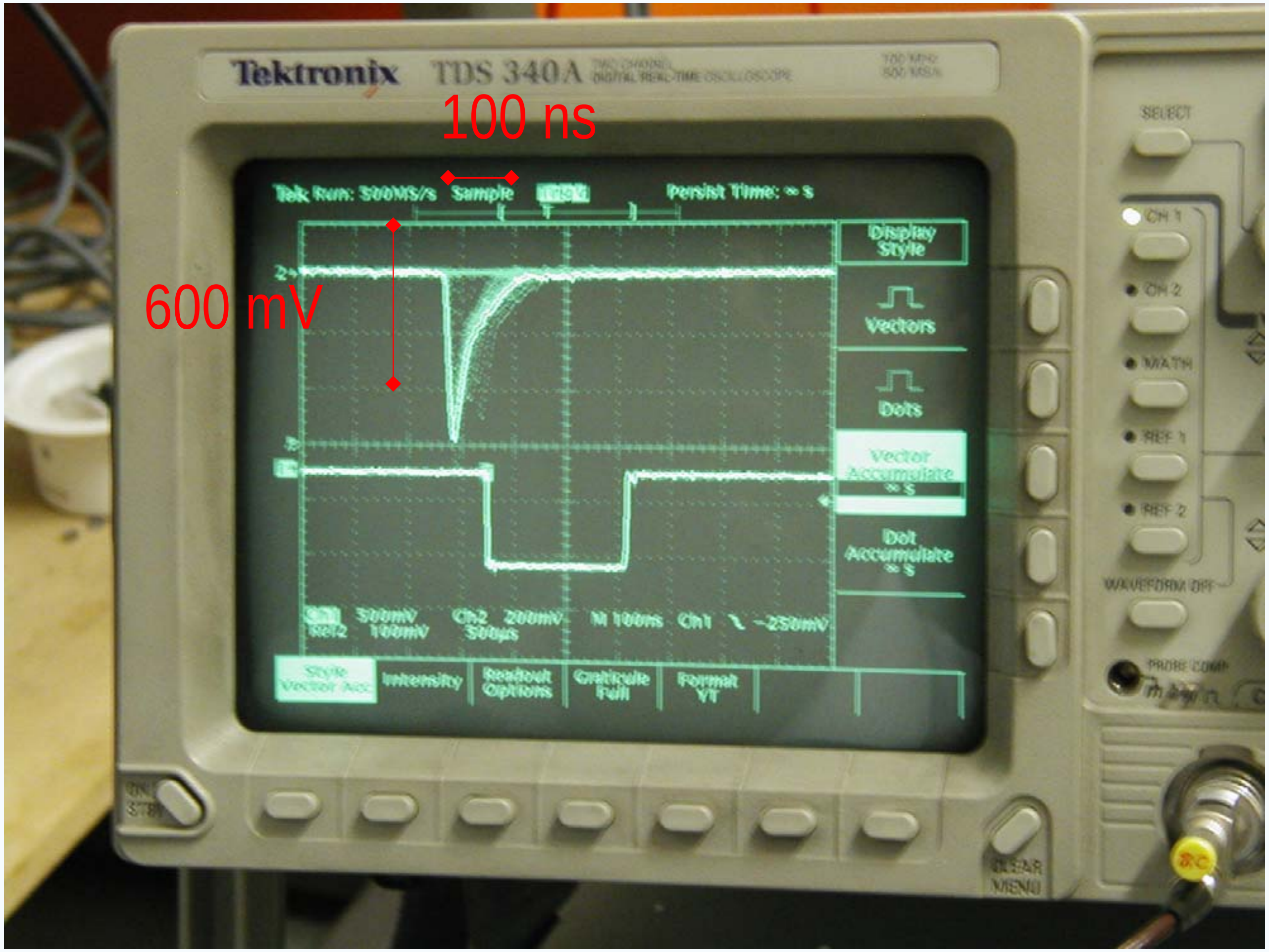


- Test 8x8 $cm^2$ area defined by two scintillator trigger counters.

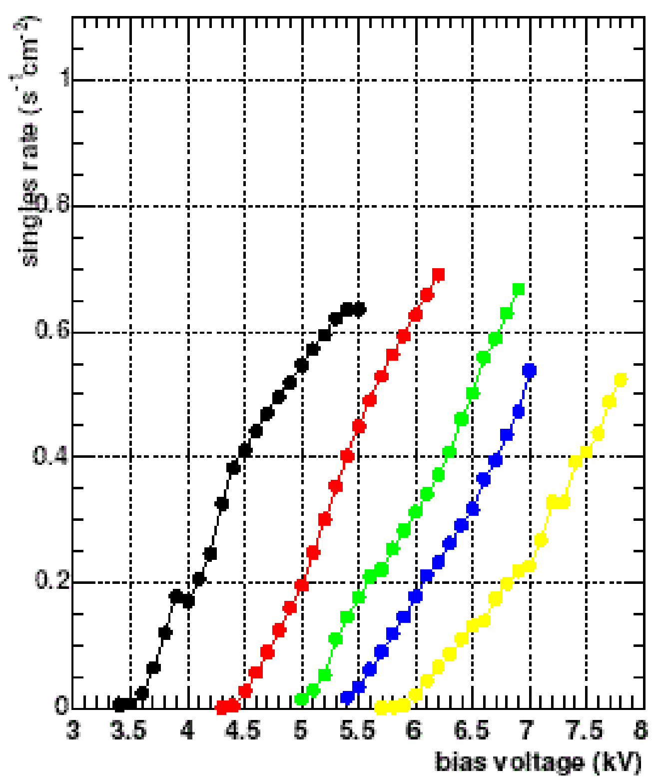
  One 18x18 $cm^2$ single pad for digital (30 mV threshold) and analog readout

- Gas Mixes Ar/Iso flowing at about 5 l/h
- Two chambers:
  - 2 mm glasses

# 2 mm glass chamber: preliminary results

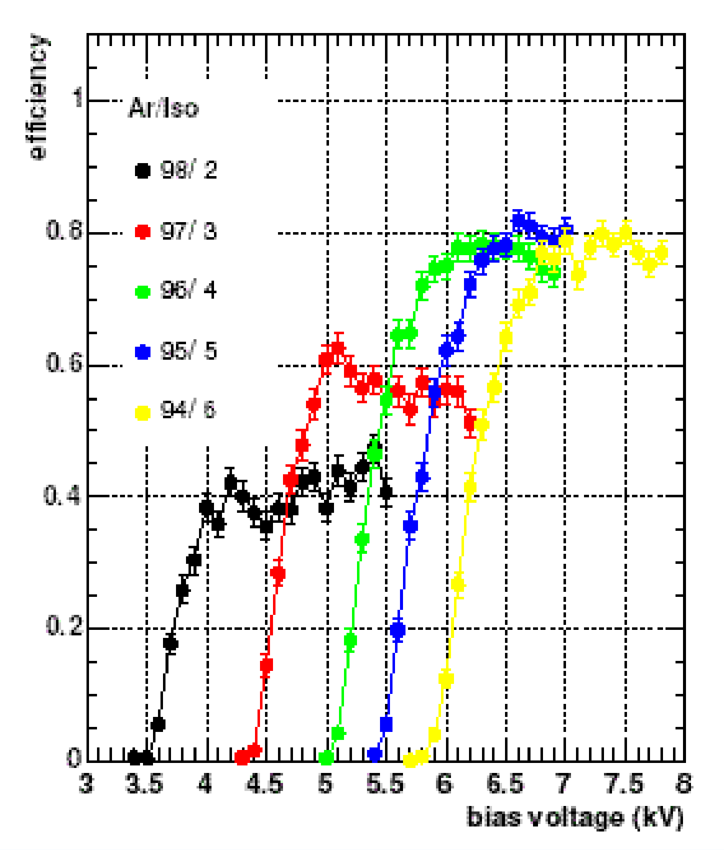


# 2 mm glass chamber: preliminary results



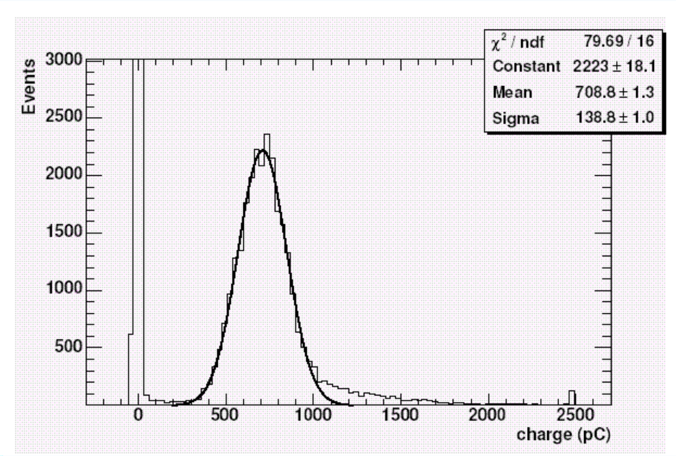

- The results obtained measuring the single rates were reasonable.
- As a matter of fact singles rate were a factor of three higher than traditional RPC, but still about few KHz/m$^2$
- Yet, one has to stress that , in case of a very resistive electrode material this would mean a loss of effective gap voltage.

# 2 mm glass chamber: preliminary results



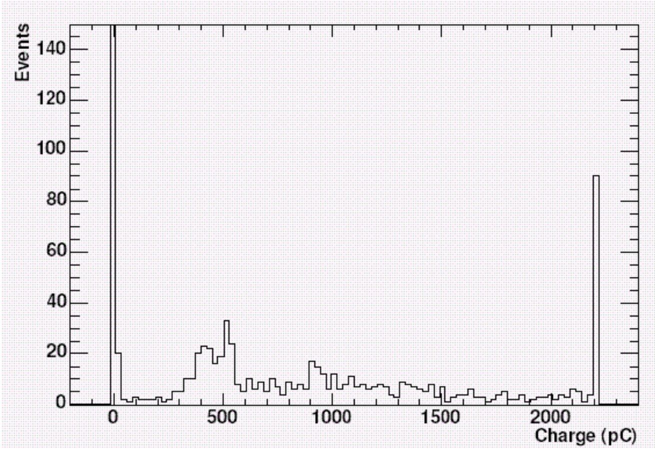

- Here are few efficiency plateaux for different gas mixtures.
- The ADHOQ devices start working with a minimum amount of quencher of 2-3%.
- The top efficiency is about 80% and comes about with more than 4% quenching gas ( Isobutane)

# 2 mm glass chamber: preliminary results

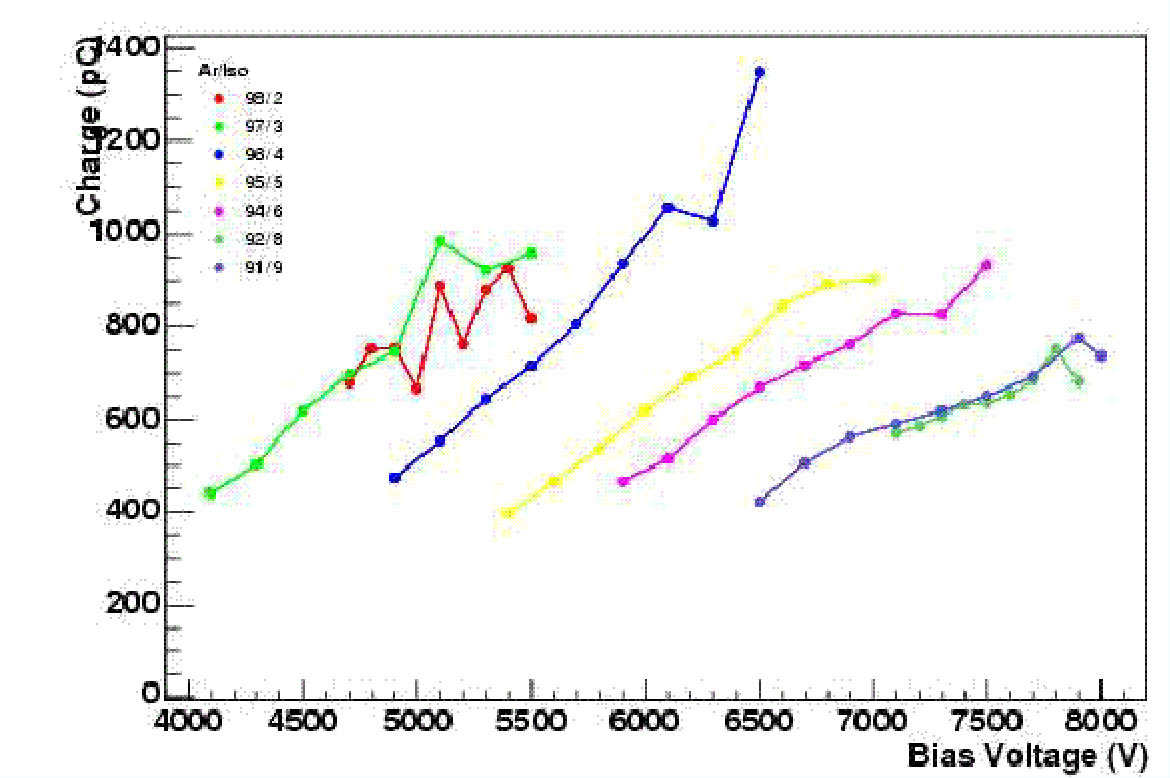



- Here is pulse height for the ADHOQ device at 95-5 % Argon-Isobutane mix.
- The limiting effect on the on the streamer is clear.

- Here is the amplitude for a normal RPC with the same mix:
- The Geiger effect is clear: many times the chamber is completely illuminated by the discharge.

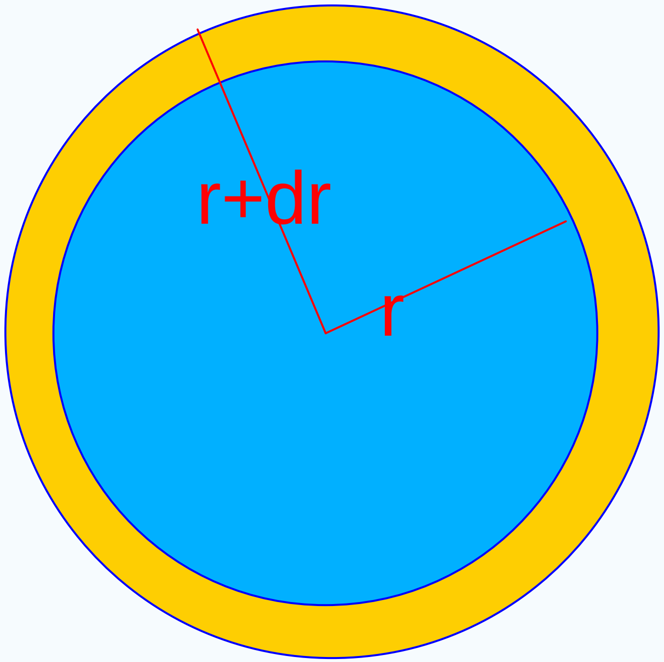


# Collected charge vs. H.V.




- Here too, the typical behavior of a saturated regime is clear
- The collected charge is linear vs. the bias voltage.

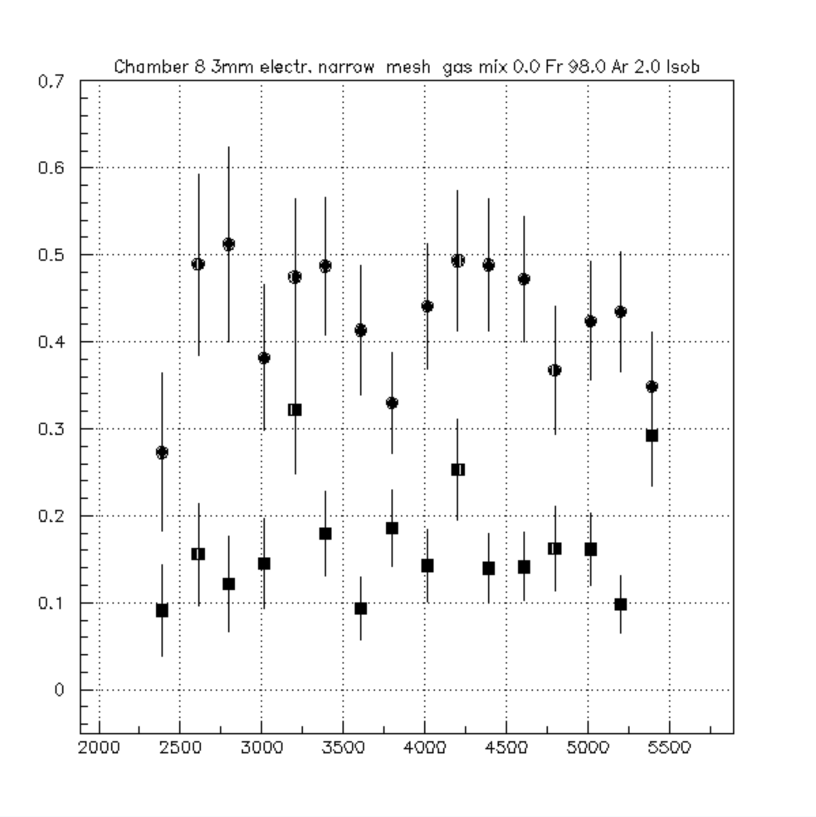
# 2 mm glass chamber: preliminary results




- **Approximation of a single hexagonal cell:**
- **$1-\varepsilon = 2\pi r dr / \pi r^2 = 2dr / r$**
- **20% inefficiency**
  **→ $dr = 0.1\ r \approx 0.15$ mm**

**of the order of the honeycomb thickness**

# What about changing mesh size




- Here are the data collected at LNF.
- The mesh, for the full circle, is 7 times bigger than the full square.

# Where do we stand

- As of now, it seems that the idea of mechanically quenching streamers works.
- We have a quite big phase space to explore:
  - Mesh size
  - Gas Mixtures
  - Electrode materials
  - ……
- The stability of the detector in principle should be checked, but I would not anticipate troubles , giving that the device operate mainly out of a noble gas.

# Conclusions

- The idea of mechanically quenching the streamer in a parallel plate counter seems worth a try.
- The very first results are, in my opinion, encouraging
- The honeycomb structure might proven a big simplification in the construction/assembly phase of the detectors.
- The R&D work on this device has just started: reliability, construction of large area detectors, test of different electrode material have to be carried out. The basic idea seems to hold the promise of a reliable, easy to build and operate detector.