Spraying of Glass Plates for the DHCAL

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Digital Hadron Calorimeter: DHCAL

Hadron Calorimeter for PFA application

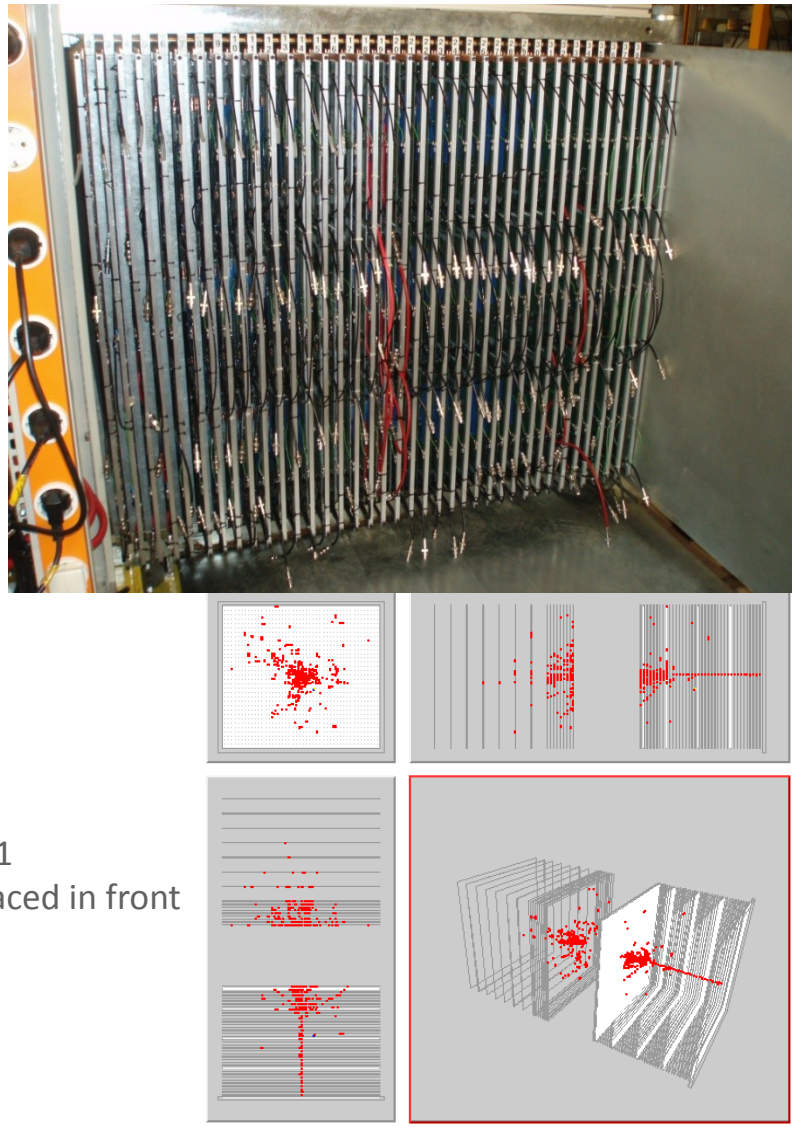
Resistive Plate Chambers as active elements
Extremely fine readout segmentation 1 x 1 cm
1 – bit resolution per channel (digital readout)
Steel plates as absorber

The DHCAL in numbers

Each layer 96 x 95 cm^2
38 layers in the DHCAL + 14 layers in the TCMT (tail catcher)
Each layer with 9216 channels
Total number of channels 350,208 + 129024 = 479,232

Status

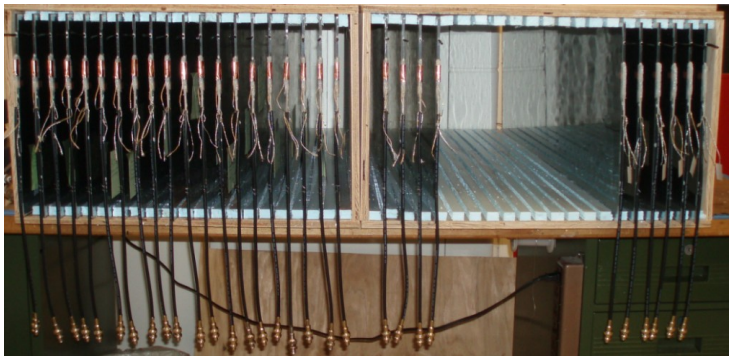
Construction completed
2 successful test beam periods in October 2010 and January 2011
Currently taking data with the CALICE Silicon – Tungsten ECAL placed in front
Additional standalone runs in June and possibly later…



RPC design and construction

Design

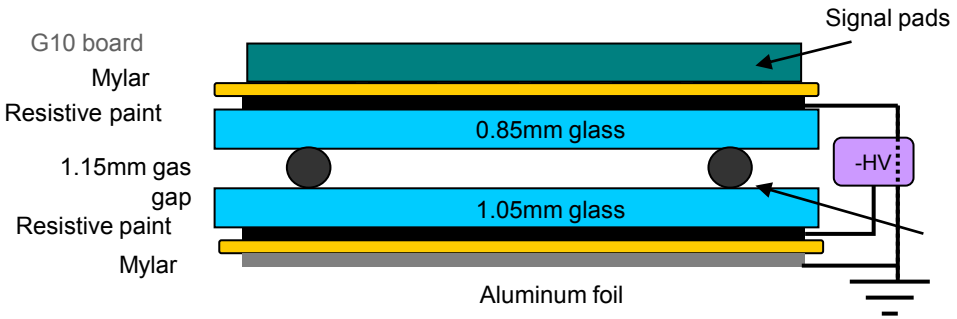
Standard 2 plate design with glass as resistive plates
Readout on anode side
Outside of chamber coated with resistive paint to apply HV

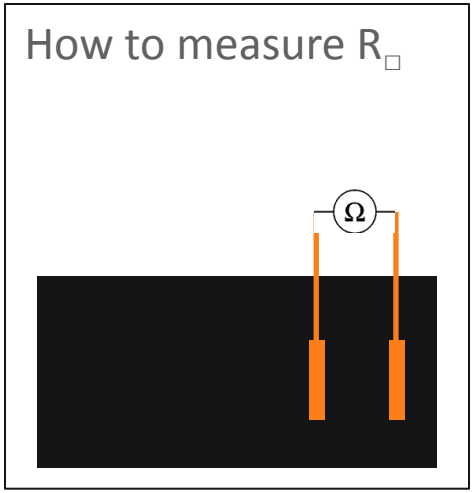


Challenges

Maintain uniform gas gap (→ precision assembly fixtures)
Bring the HV out as far as possible to rim, w/out break downs
Provide uniform surface resistivity in the range on 1 – 5 MΩ/□

→ Higher resistivity impacts the rate capability
→ Lower resistivity increases the pad multiplicity





Spraying glass

Constraints on resistive paint

Tunable resistivity in the range of 1 – 5 MΩ/□
Easily applicable
Resistivity **not** dependent on humidity (very important!!!)

Paint

Used commercial spray (LICRON) in the past, but new product not useful
Identified some 2-component 'artist paint' → satisfies constraints
Paint needs to be mixed appropriately and sprayed (with spraying gun)

Spraying booth

Built large booth to exhaust (non-toxic) fumes
Movement of spraying gun controlled with step motors (~ 2minutes/plate)

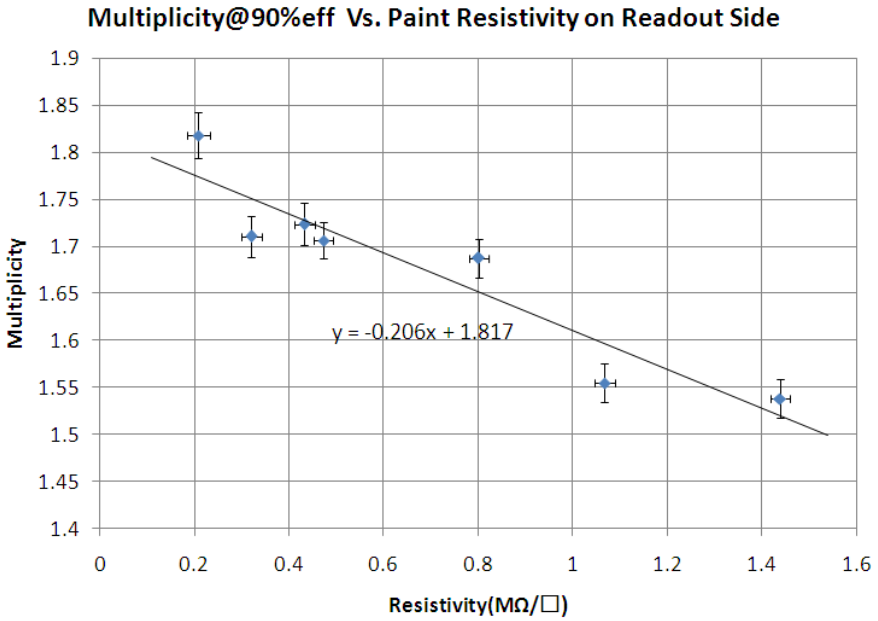
Spraying procedure

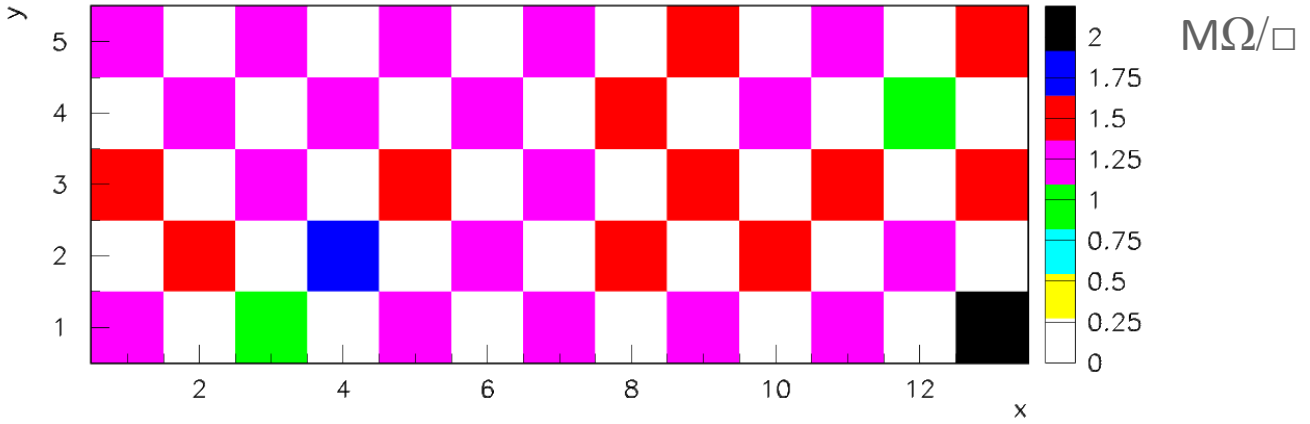
1-botton operation
Could spray up to 8 plates in one day

Results

Uniformity obtained by adjusting

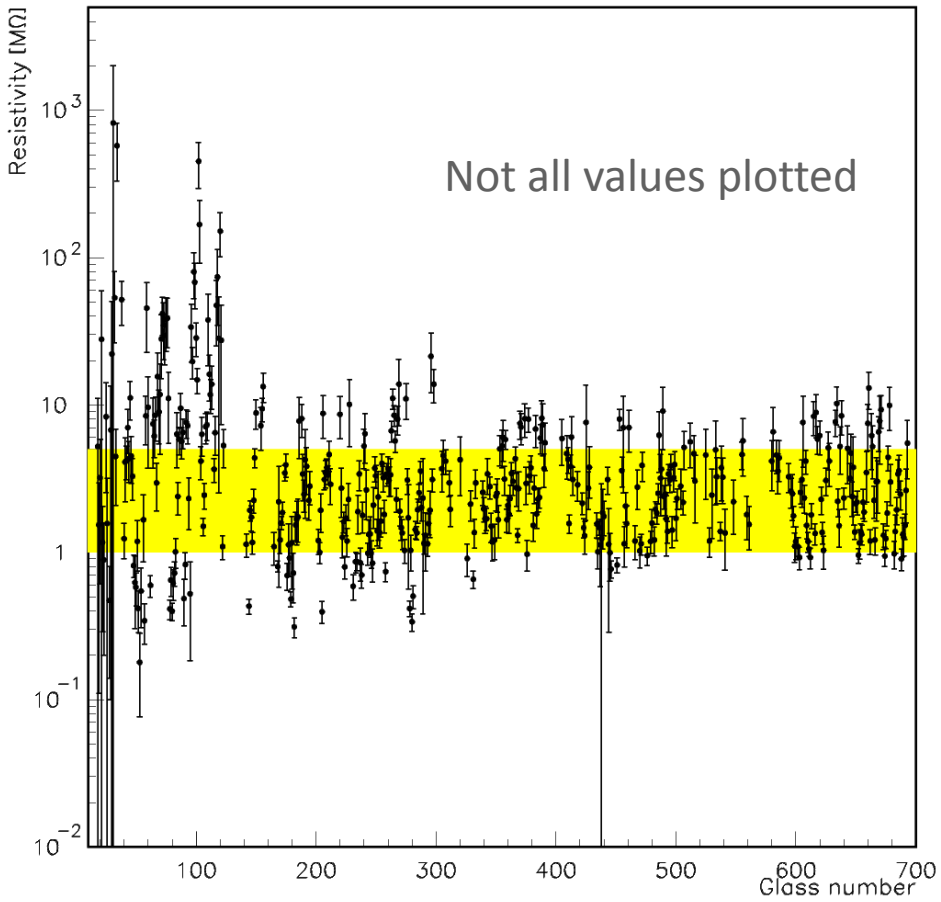
- Speeds
- Distance to glass plate
- Order of spraying
- Air flow in booth





Overall values adjusted by

- Adding water to the mixture
- Modifying the ratio of the two components

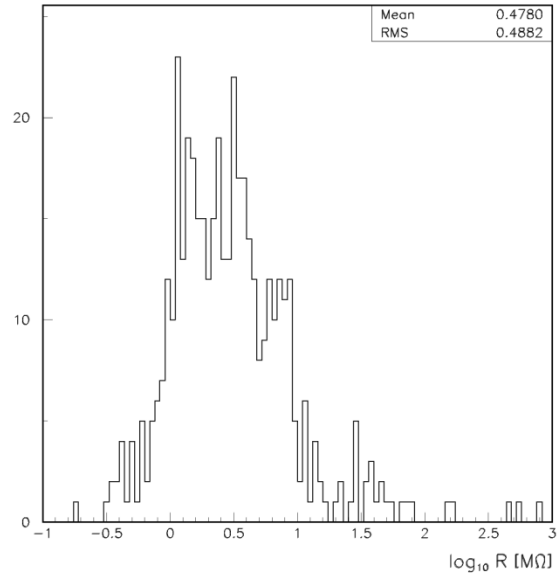


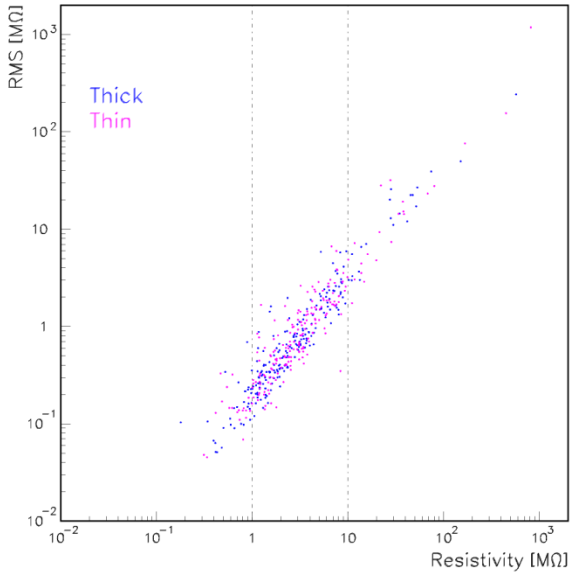
For DHCAL + TCMT needed

~400 sheets of glass

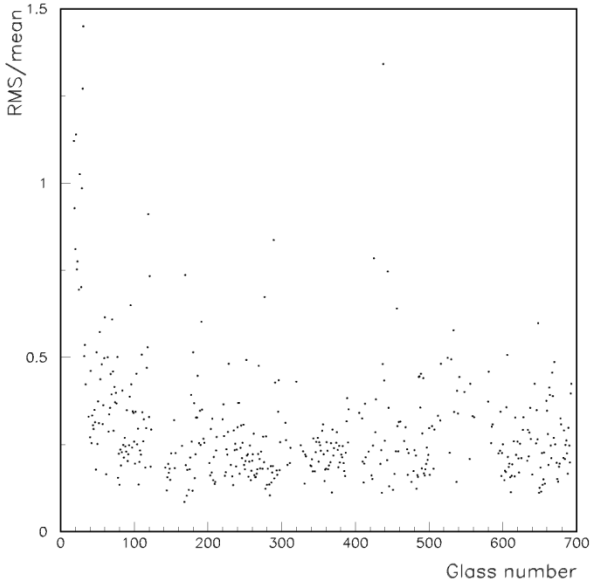
Efficiency was poor ~ 60%

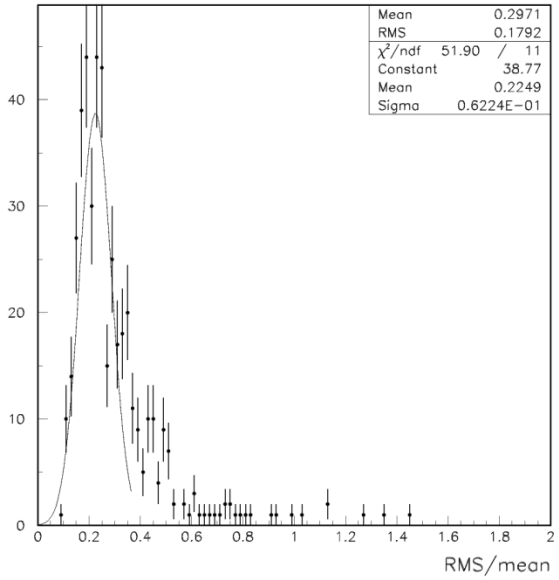
Environment (pressure, humidity, temperature) was poorly controlled. Better control needed for better reliability



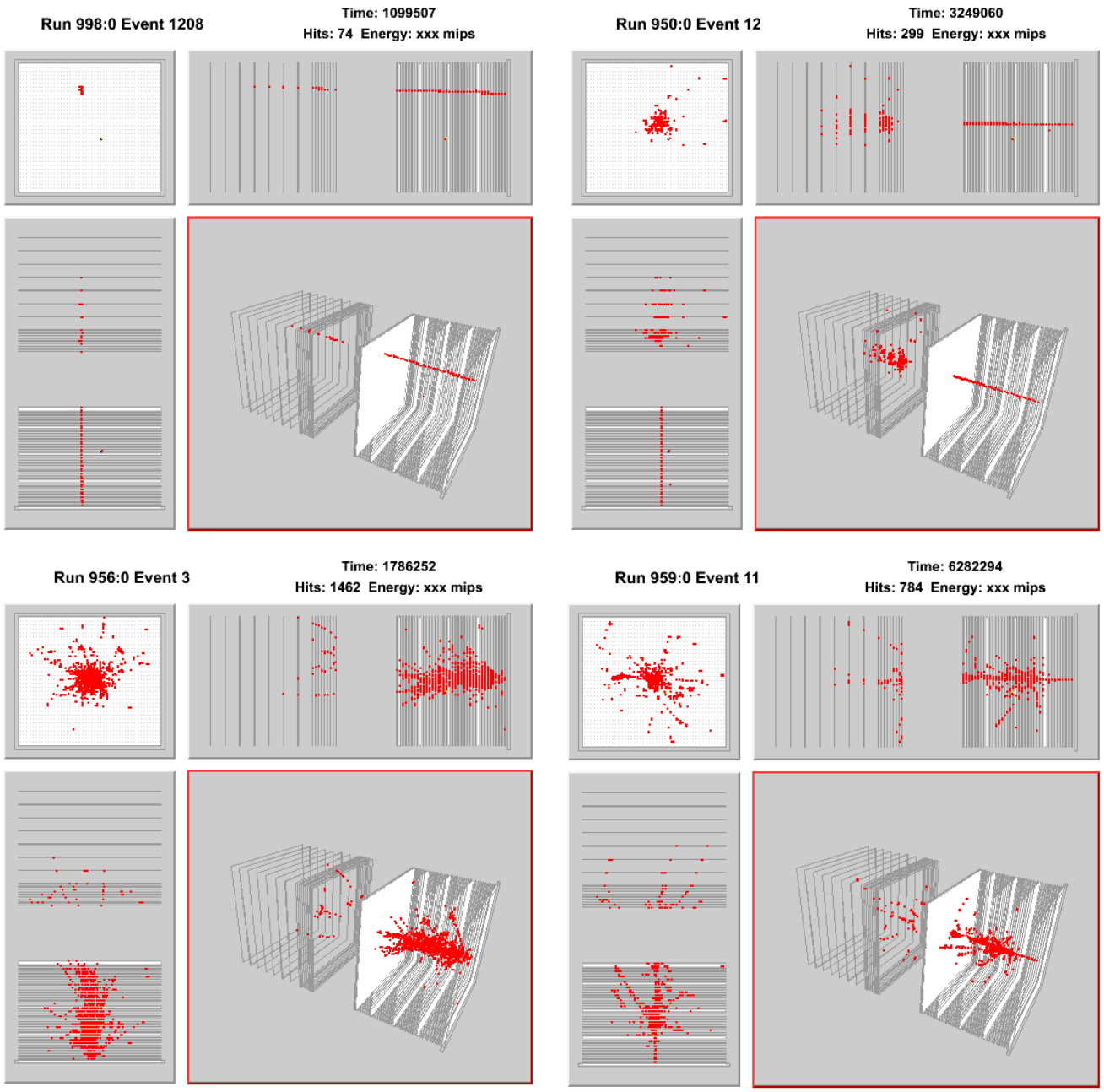


RMS related to mean value





Note: not all plates measured and included



A few nice events to conclude…