

# Activities on GEM detector development at NISER-IoP, India

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# Motivation

- Fabrication and systematic studies of GEM for ALICE TPC up gradation
- Long term test of GEM
- Measurement of Ageing of GEM and other gas detectors
- Measure the gain and energy resolution for different configuration
- Measure the spark rate and the spark probability
- Provision to build gas filled detectors e.g. GEM, RPC, MRPC etc.
- To join CBM, INO and other HEP experiments



# EHEP Lab status at NISER

- New lab development in progress
- IOP lab is being used for the time being
- Ar+CO<sub>2</sub> (70:30), Argon, Isobutane, Freon (R134a) procured
- Gas mixing system exists
- Laminar flow table exists
- Required electronic modules (like Electronic rack, NIM Crate, HV module, Discriminator, Spectroscopic Amp, SCA, MCA, Pico-ammeter, Multi-meter etc.) procured
- One bakelite RPC detector is ready
- Studies on plastic scintillator detector is going on
- Experiments for Int. M.Sc. and Pre-doc student is going on in the present lab



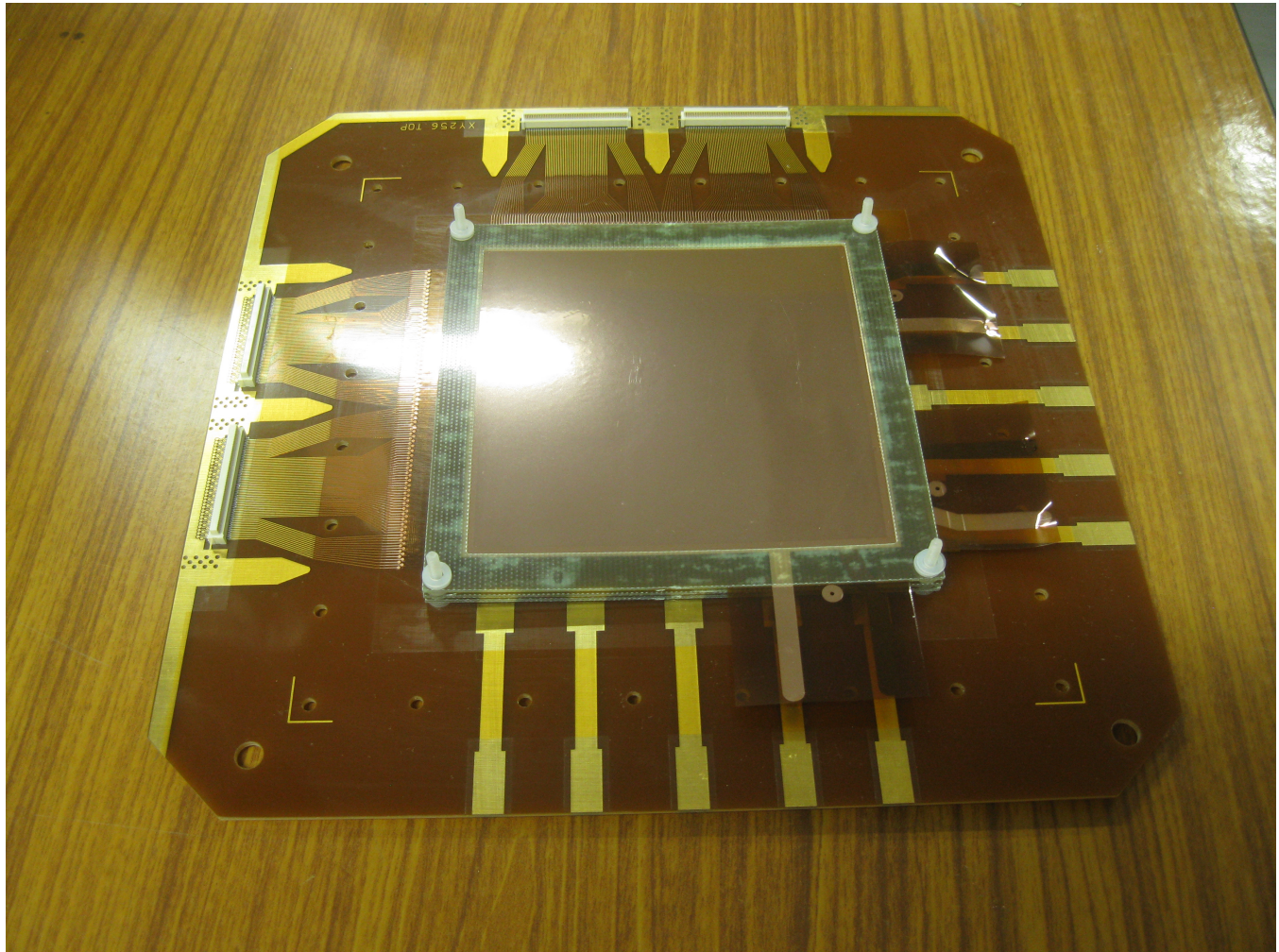
# Building of standard triple GEM detector

# Components



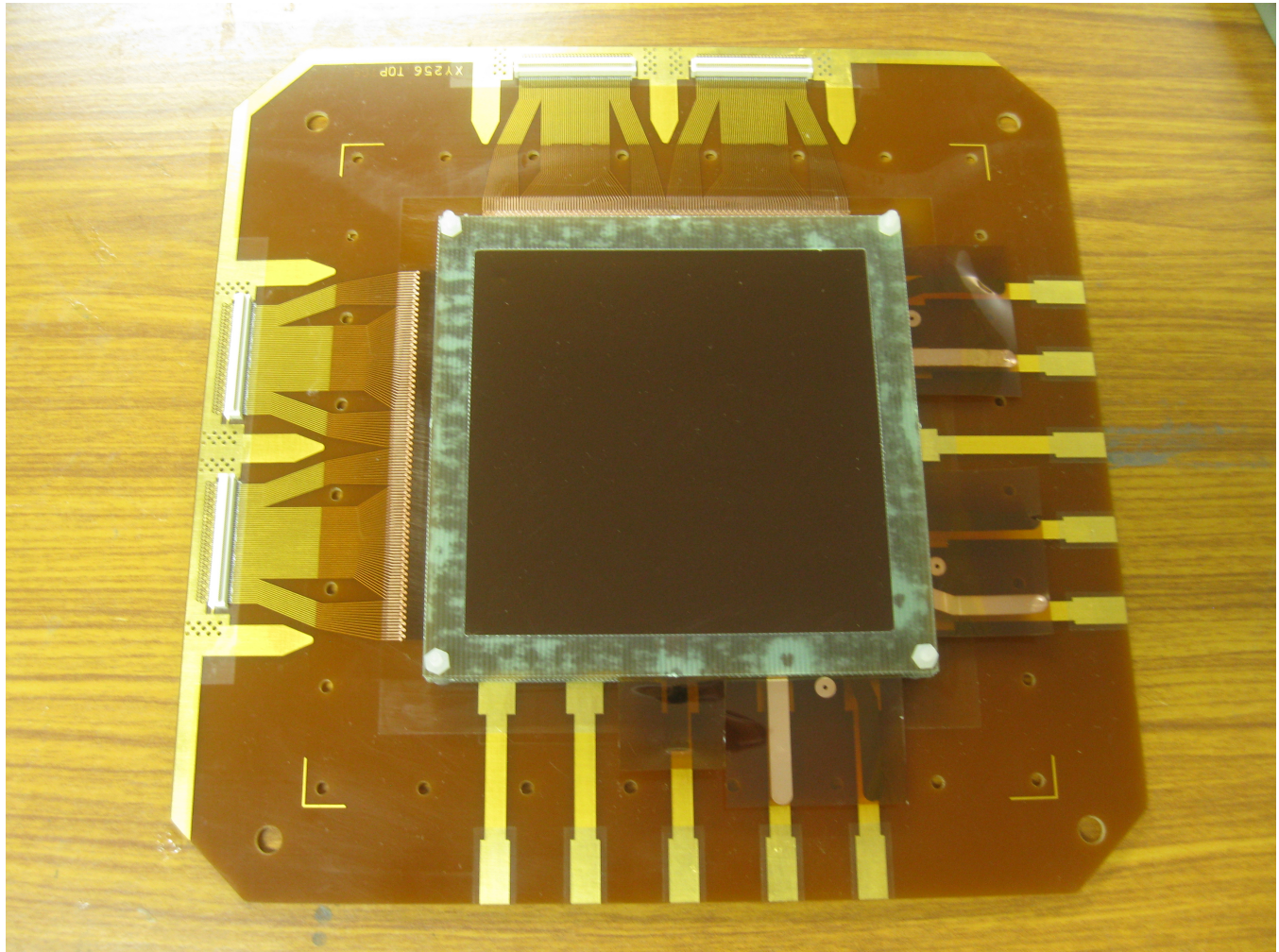


# GEMs on readout plane



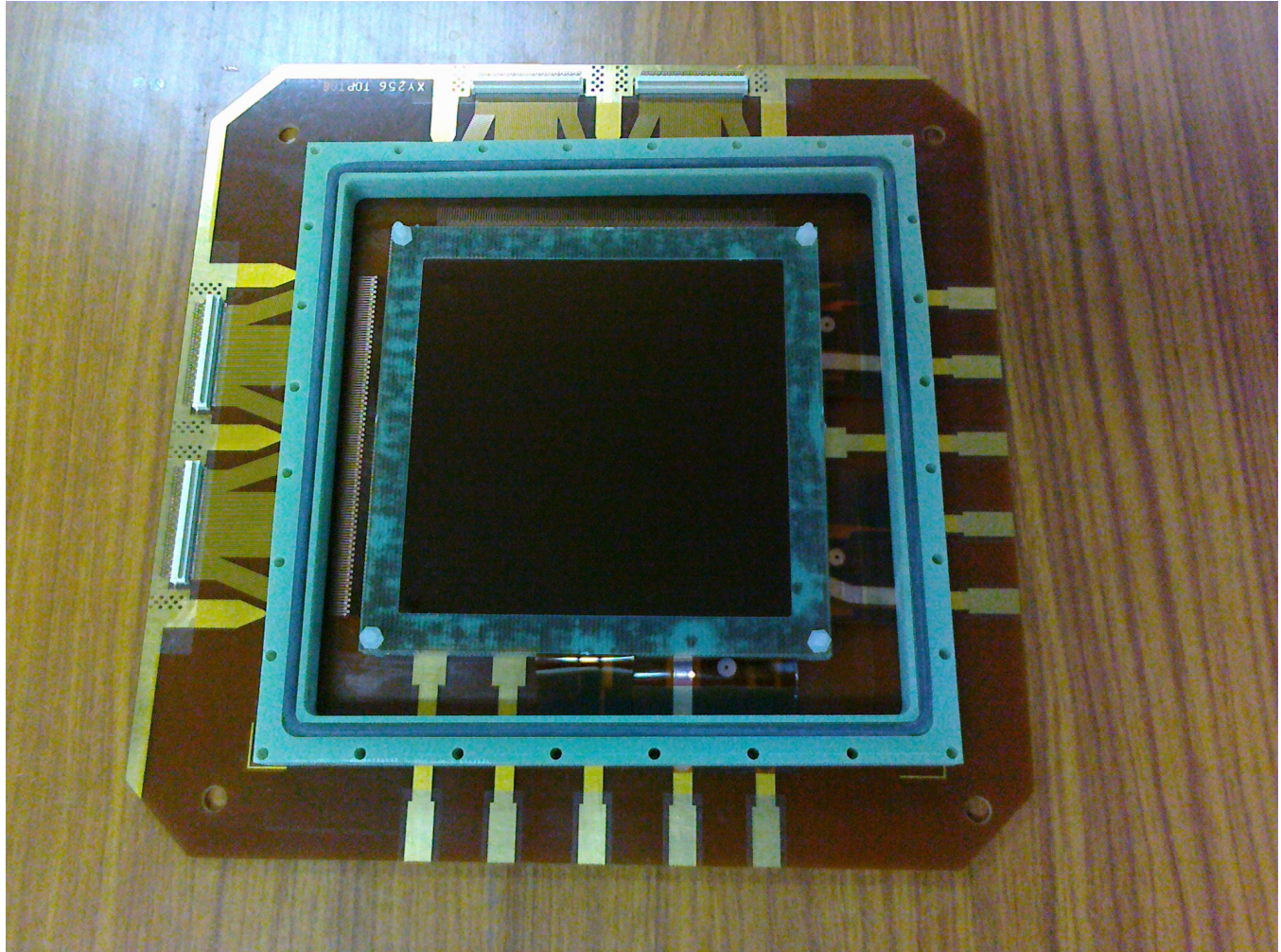


# Drift plane is placed



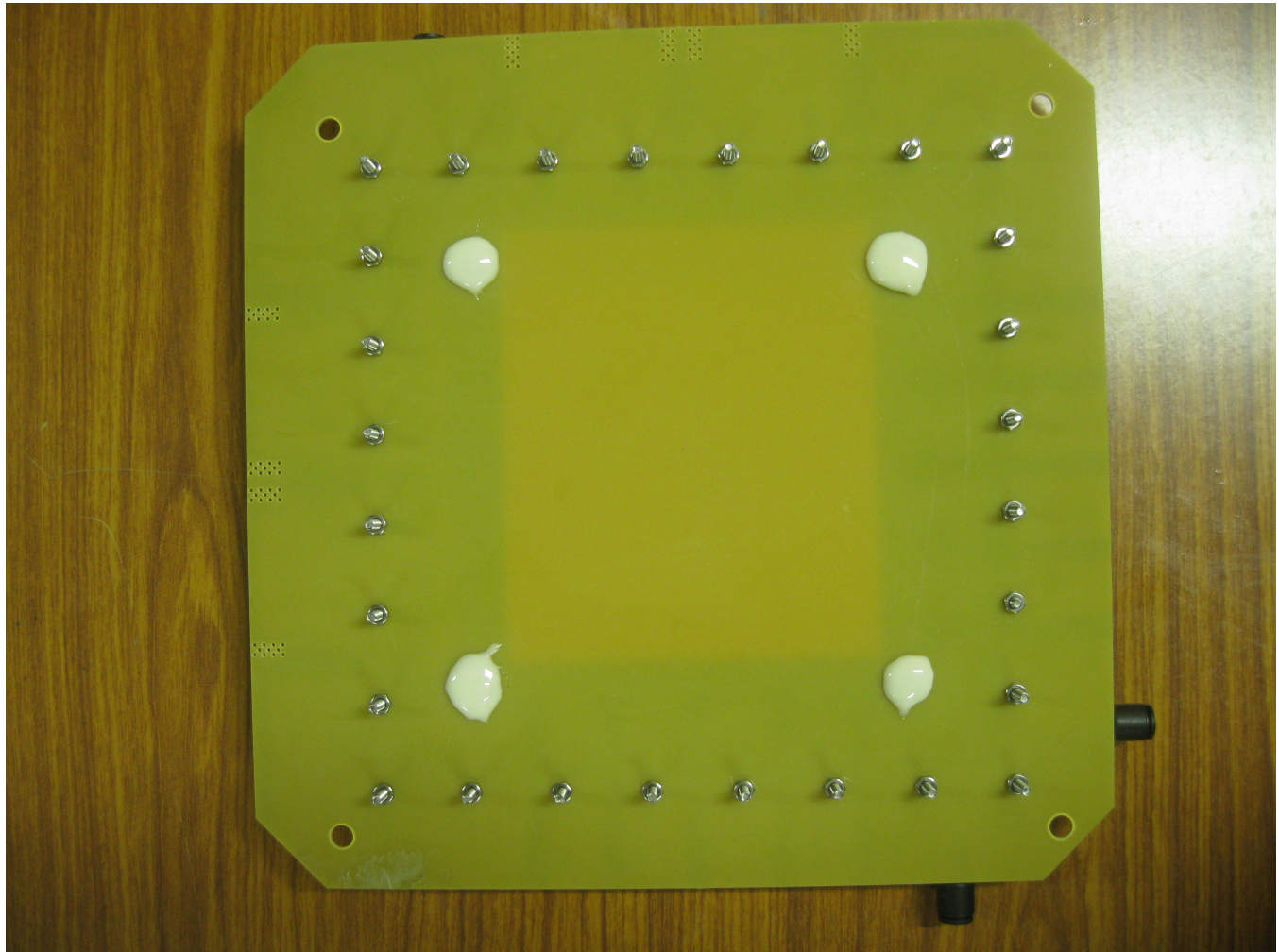


# Frame is placed

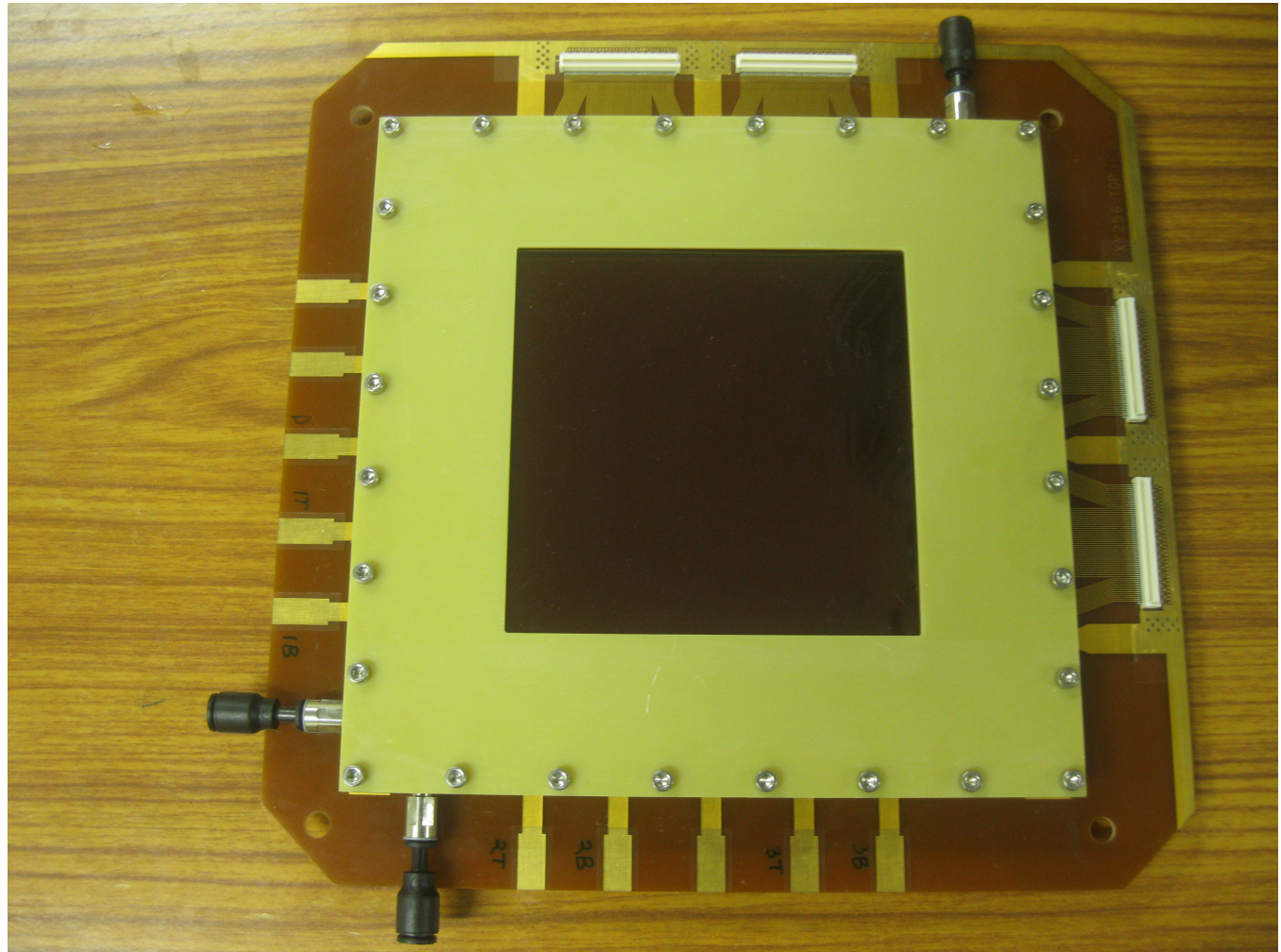




# Gluing at the bottom

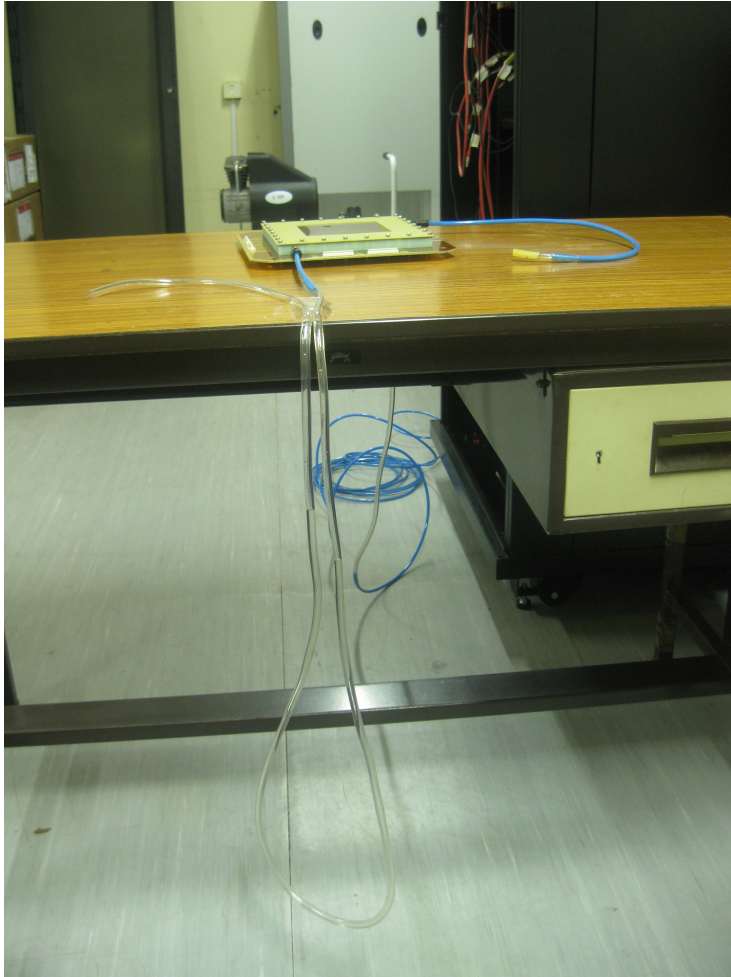


# Assembled GEM

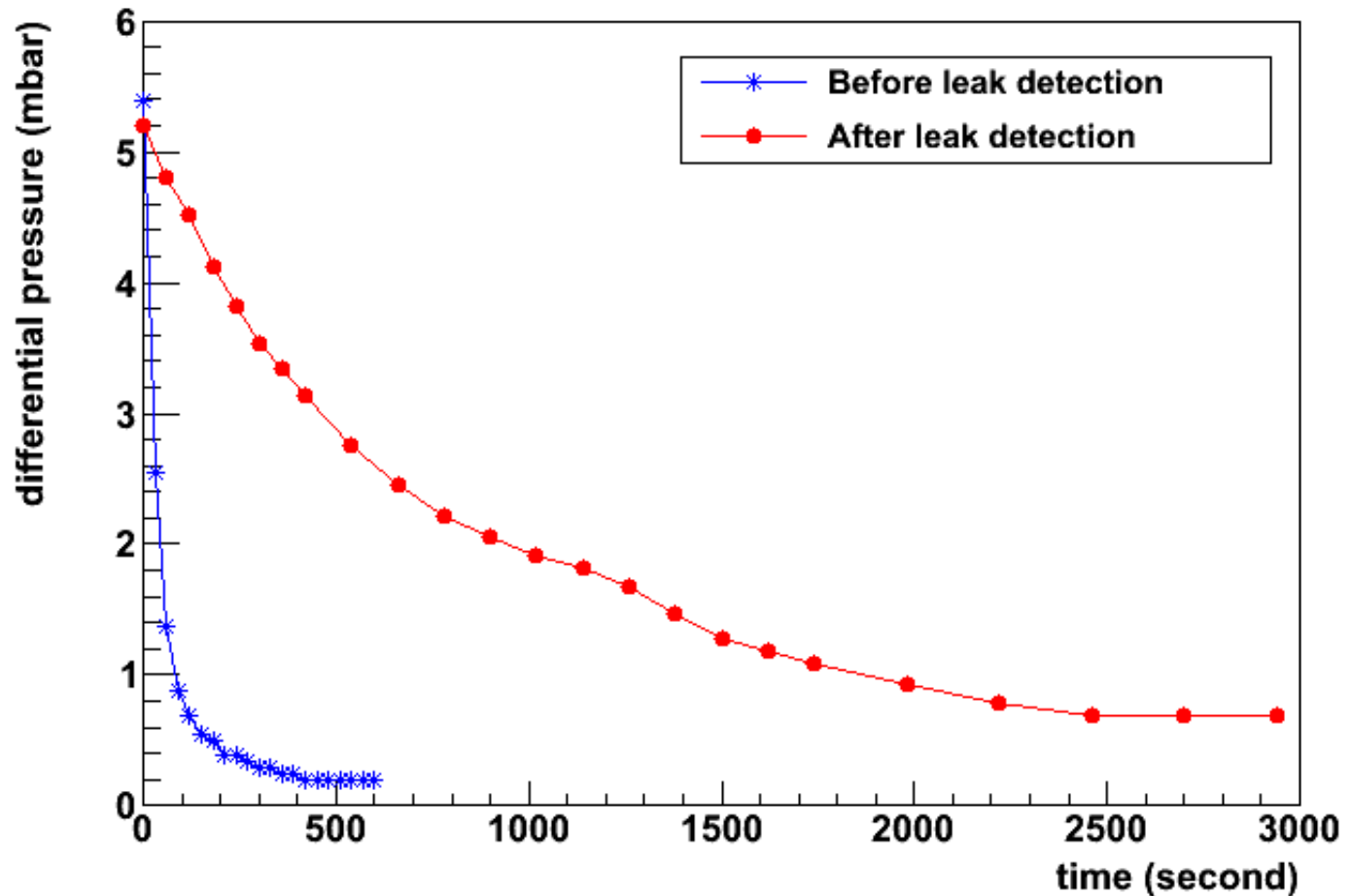




# Leak test with water manometer

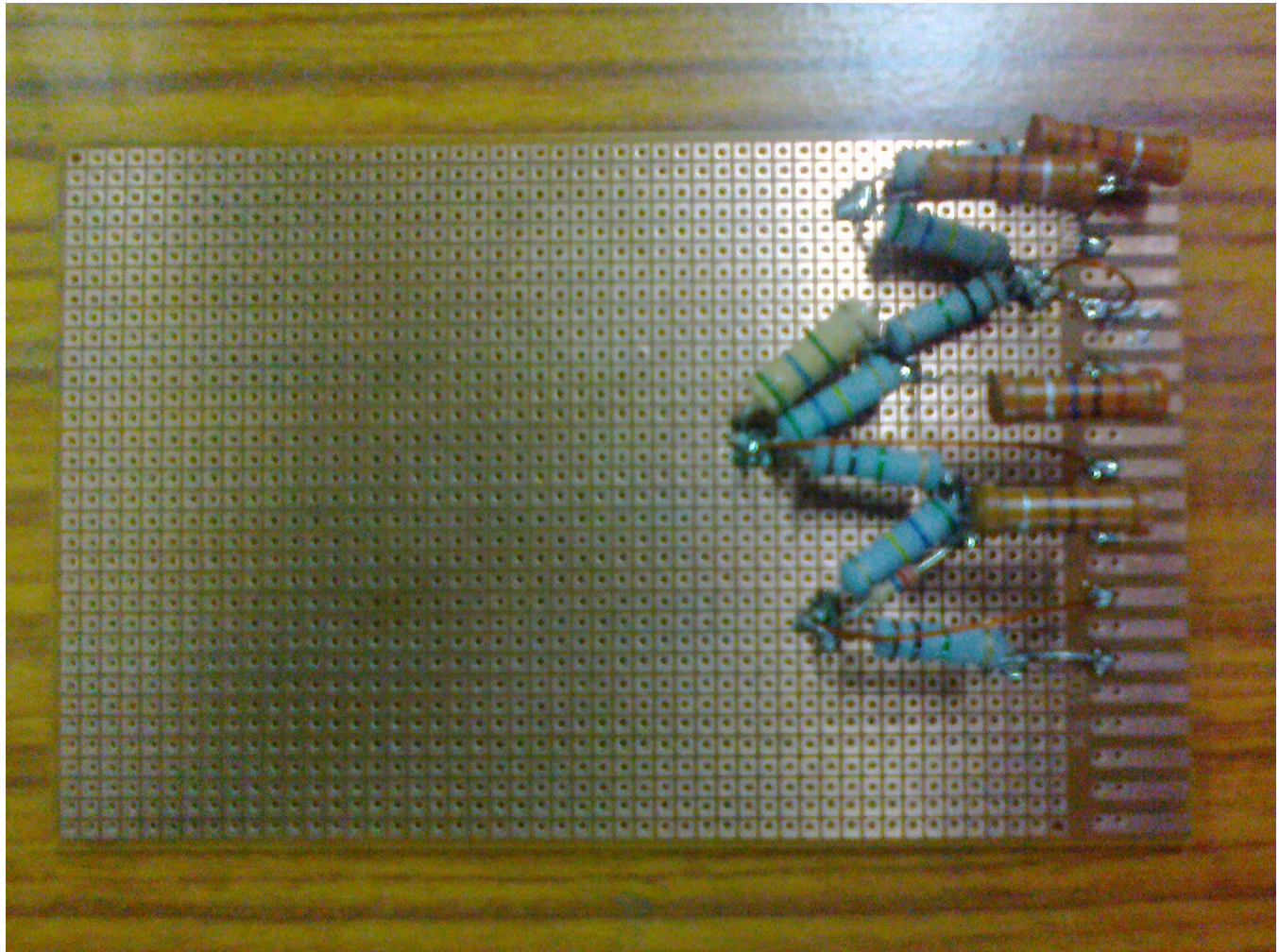


# Leak rate with time



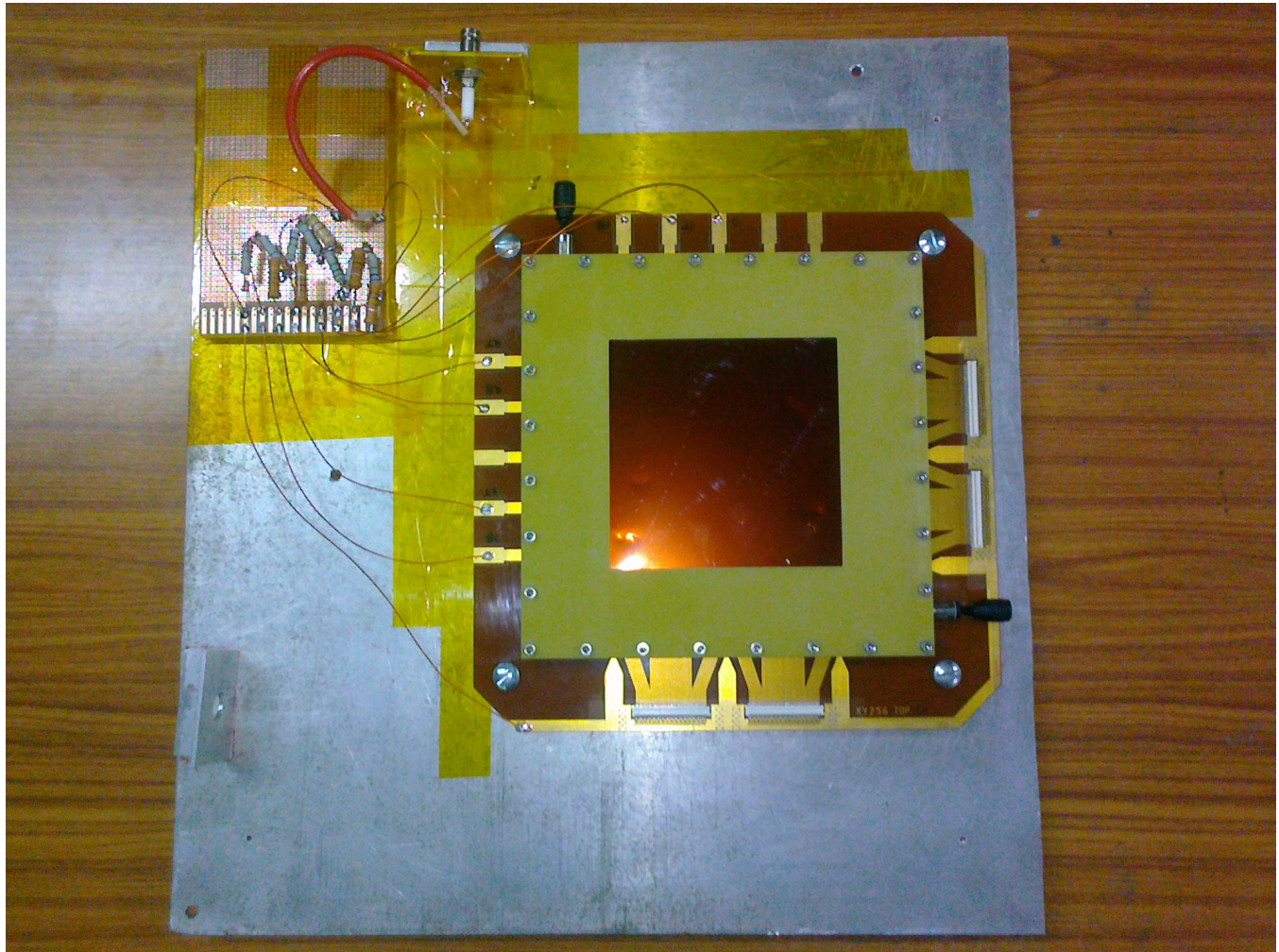


# Voltage divider circuit



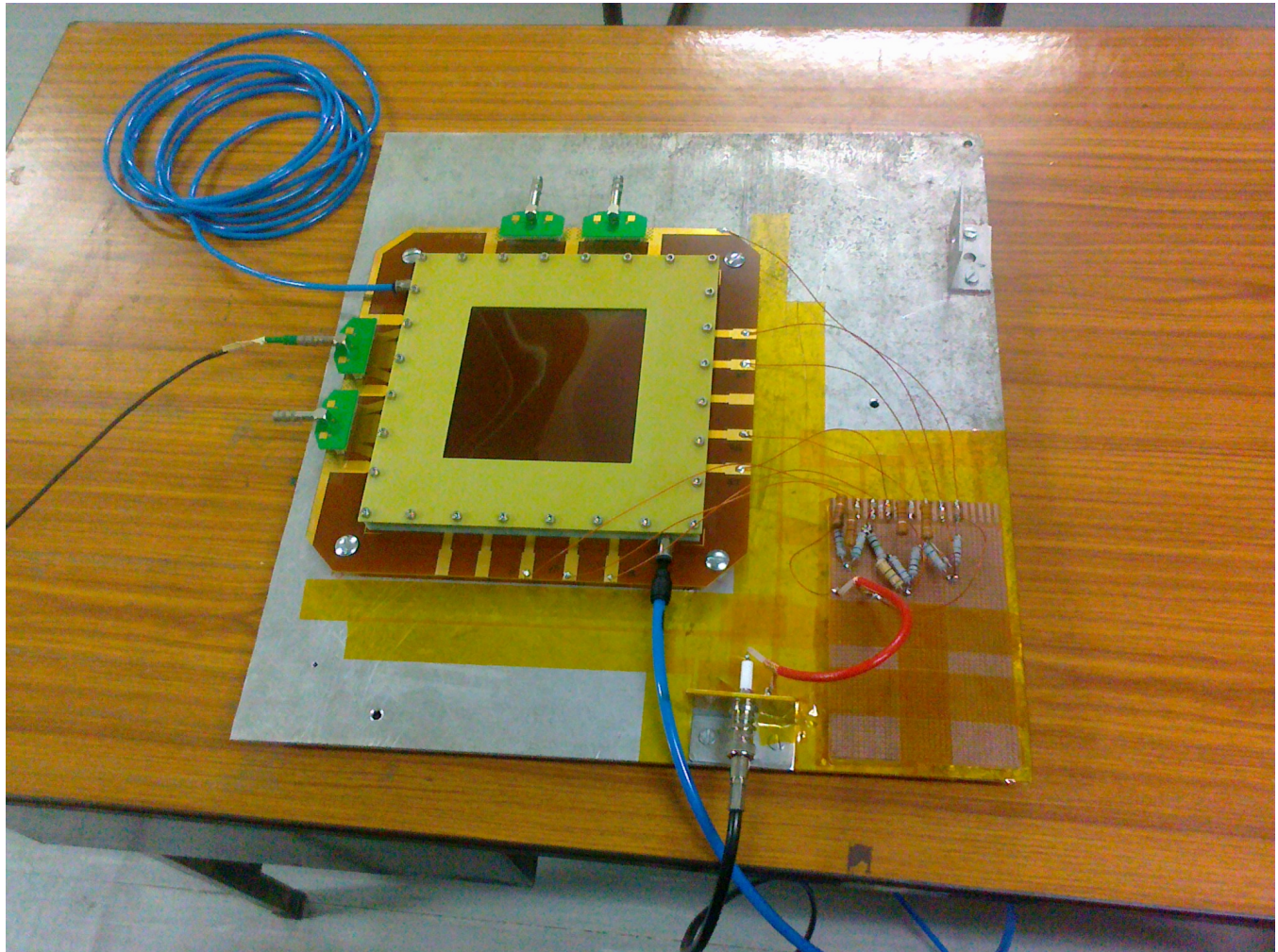


# GEM with HV connections

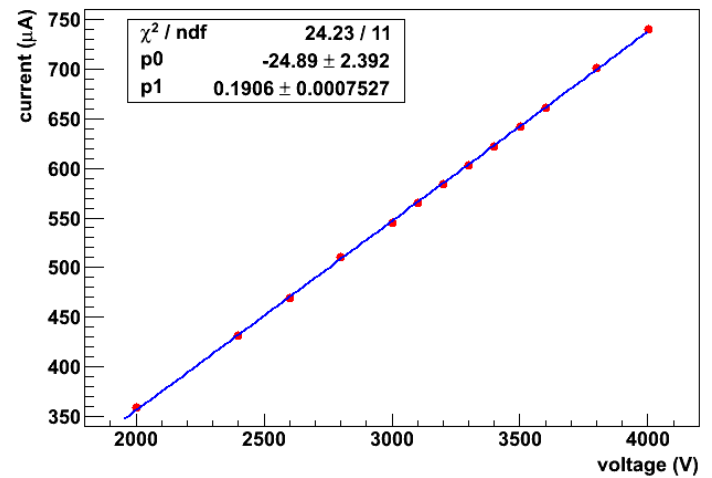
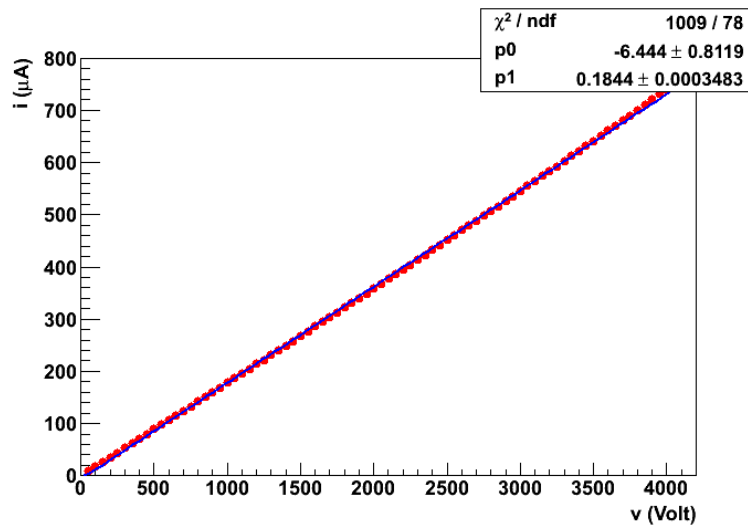




# Complete GEM detector with HV



# I-V plot

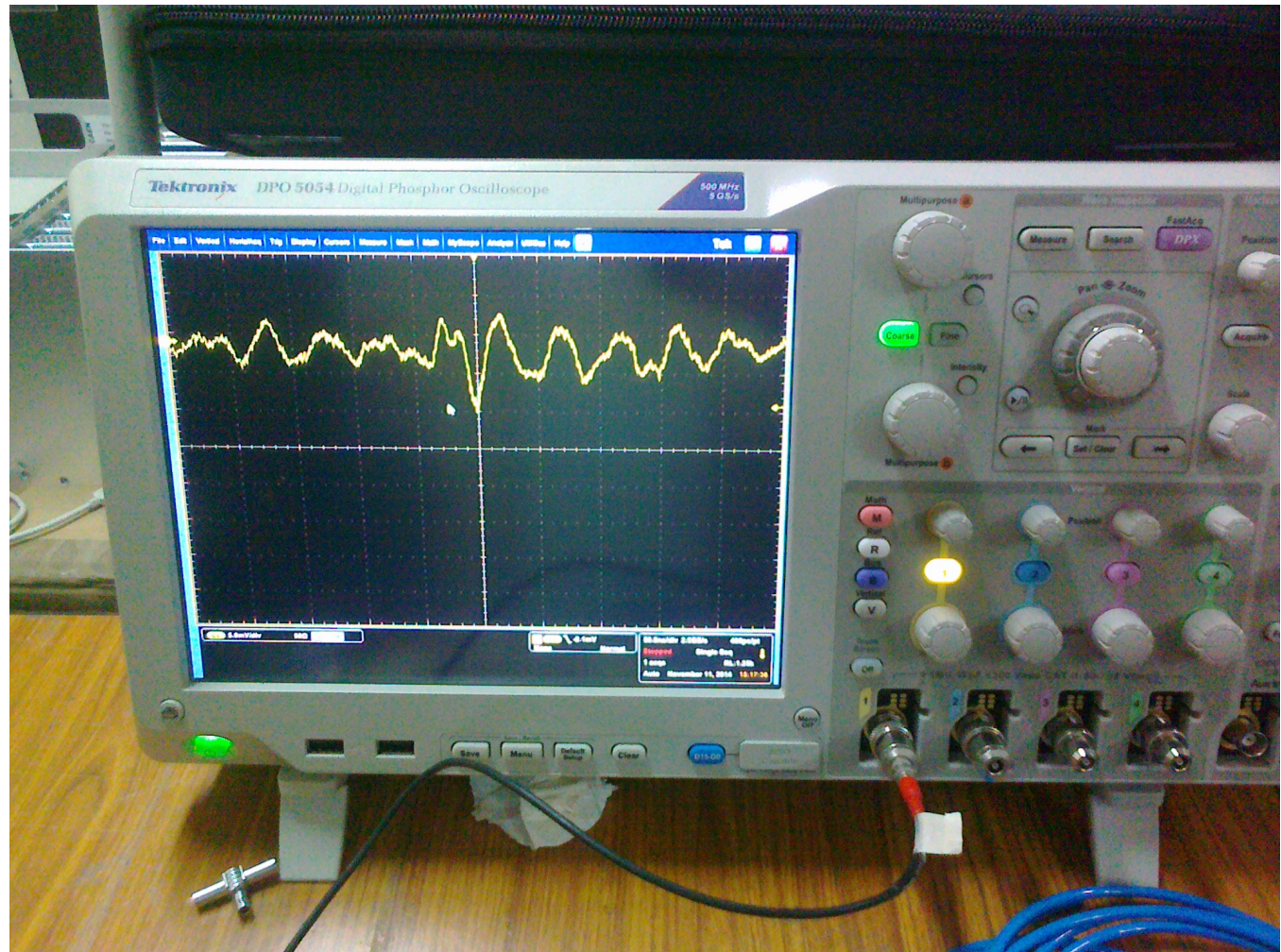




# Cosmic tests



# Cosmic signals without pre-amp

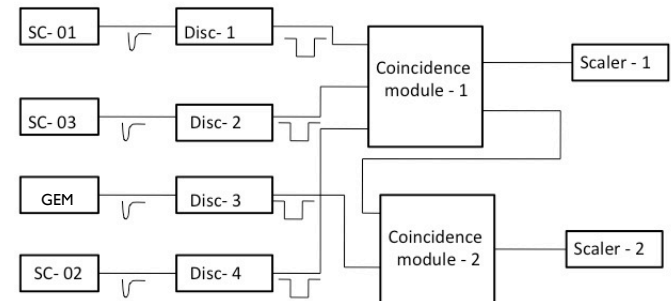




# Efficiency measurement set-up



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Block diagram for efficiency measurement

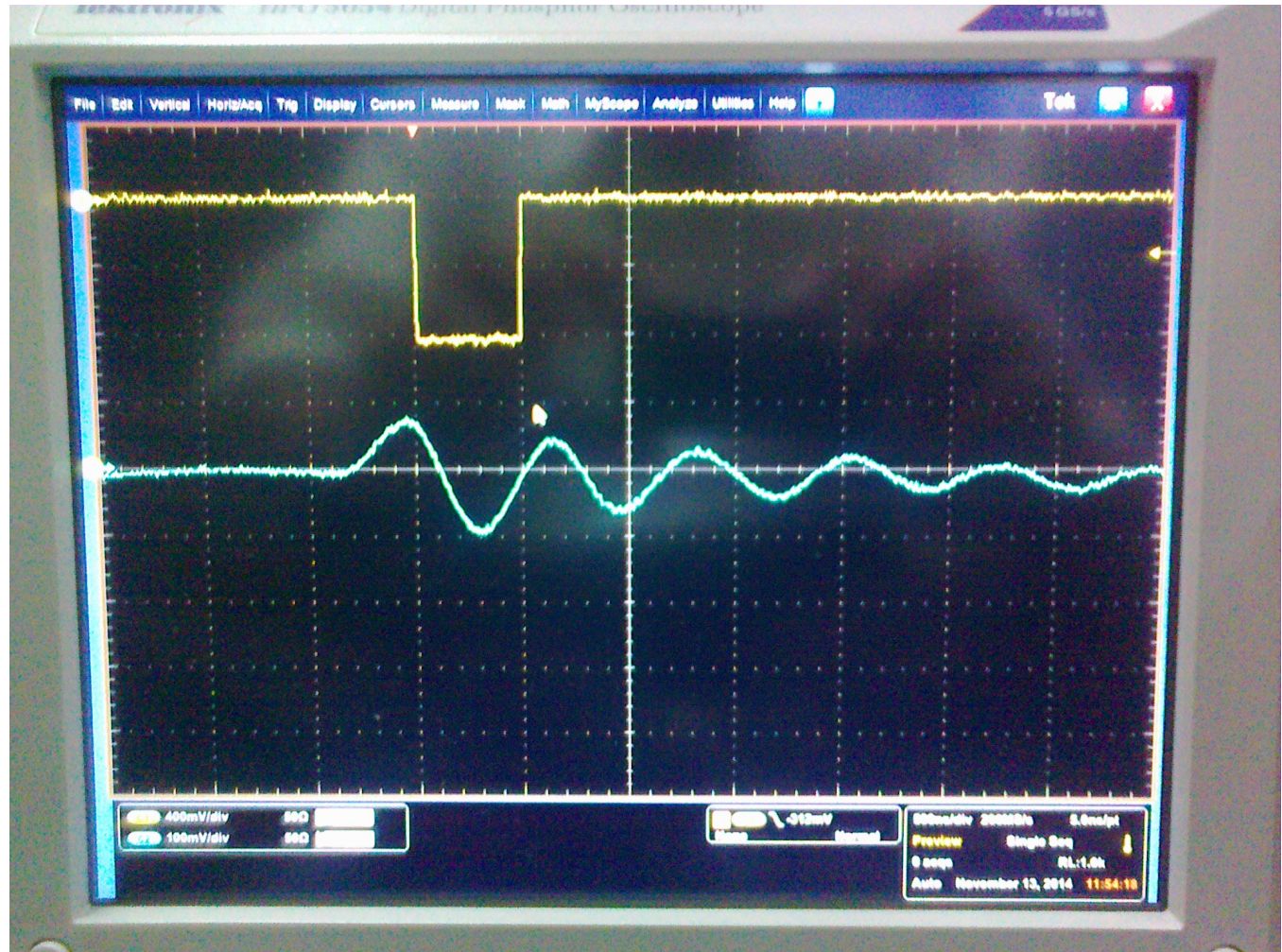
Trigger (3F) :  $Sc01 \times Sc03 \times Sc02$

4F :  $Trigger (3F) \times GEM$

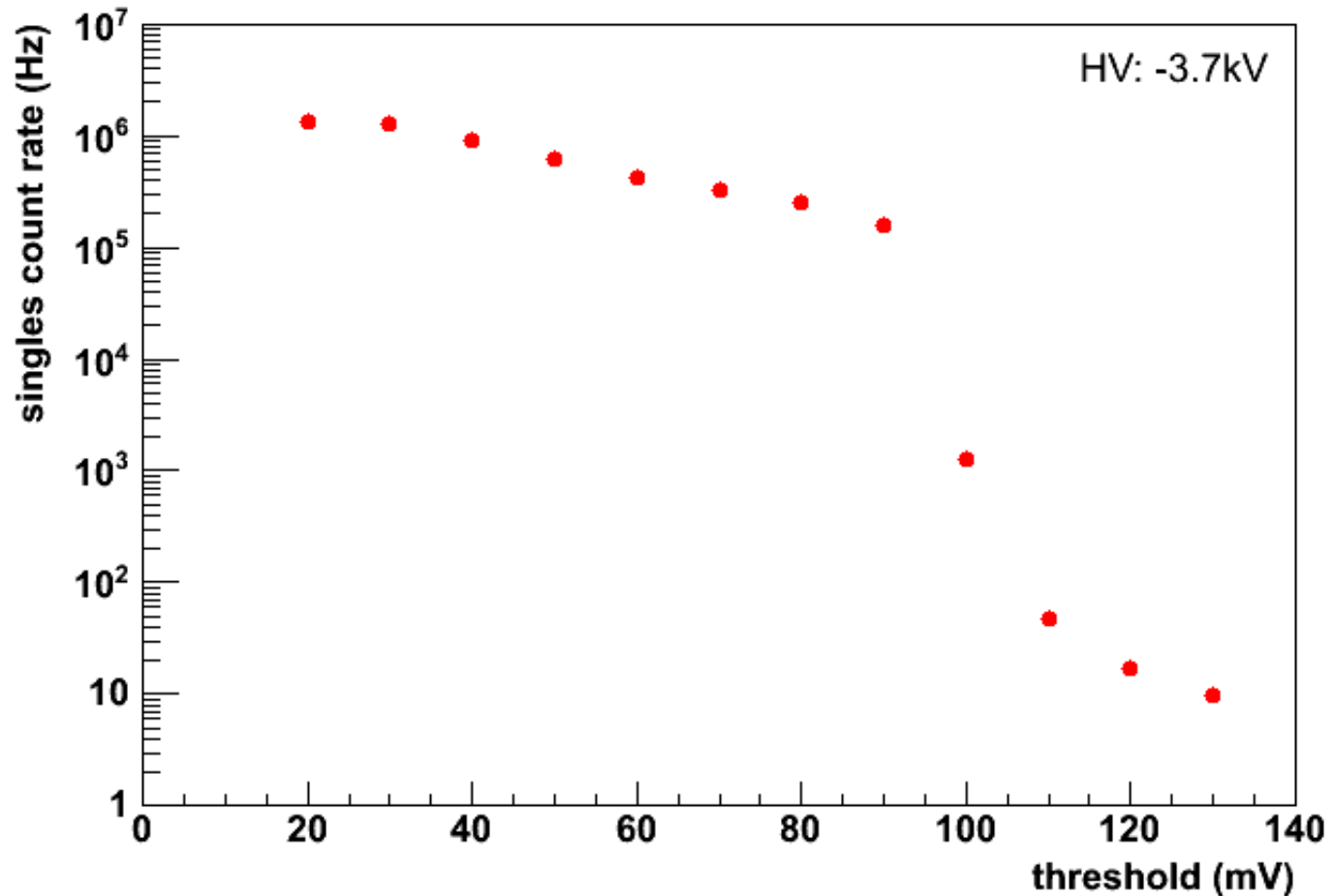
Efficiency :  $4F/3F$



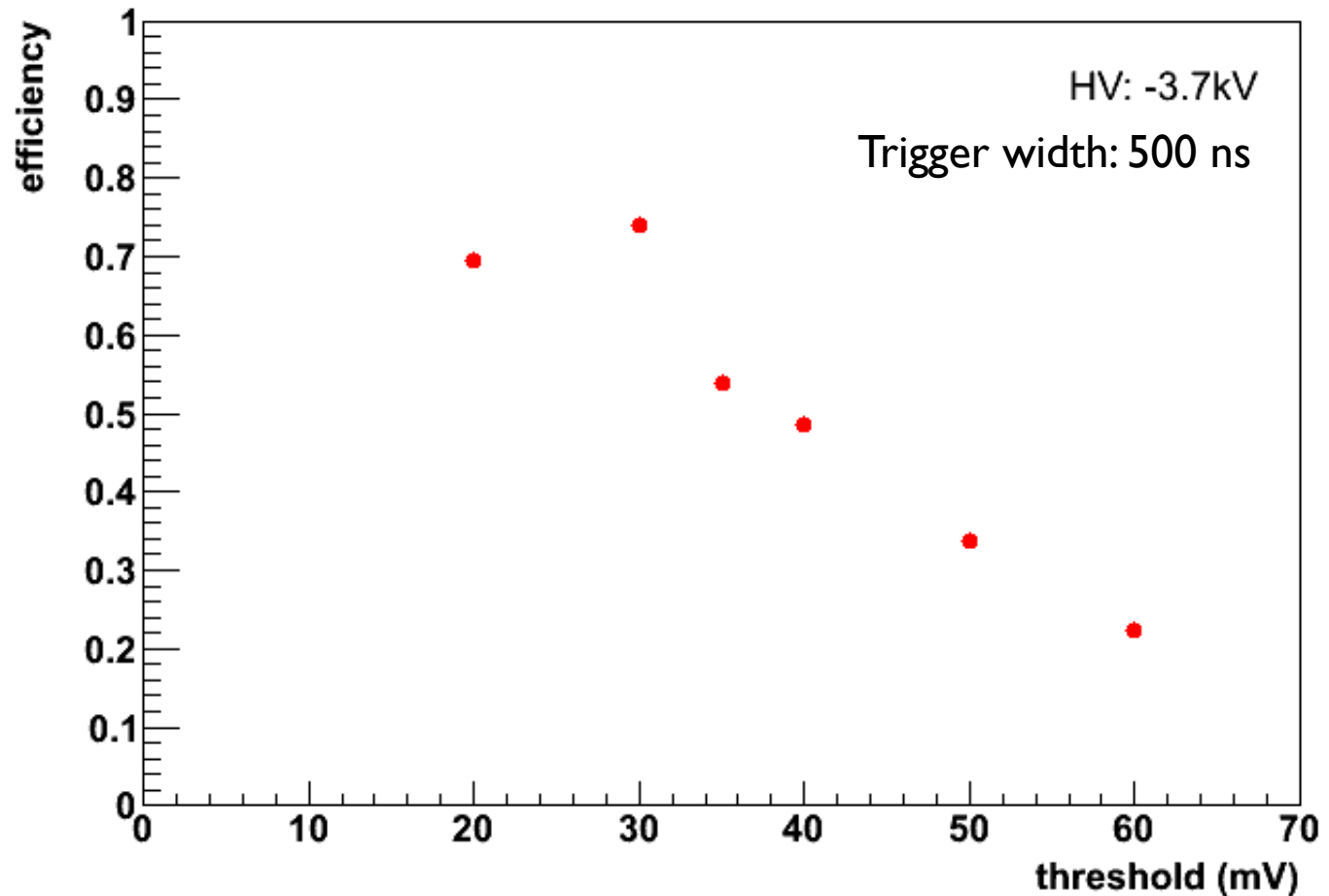
# Signals in coincidence with trigger



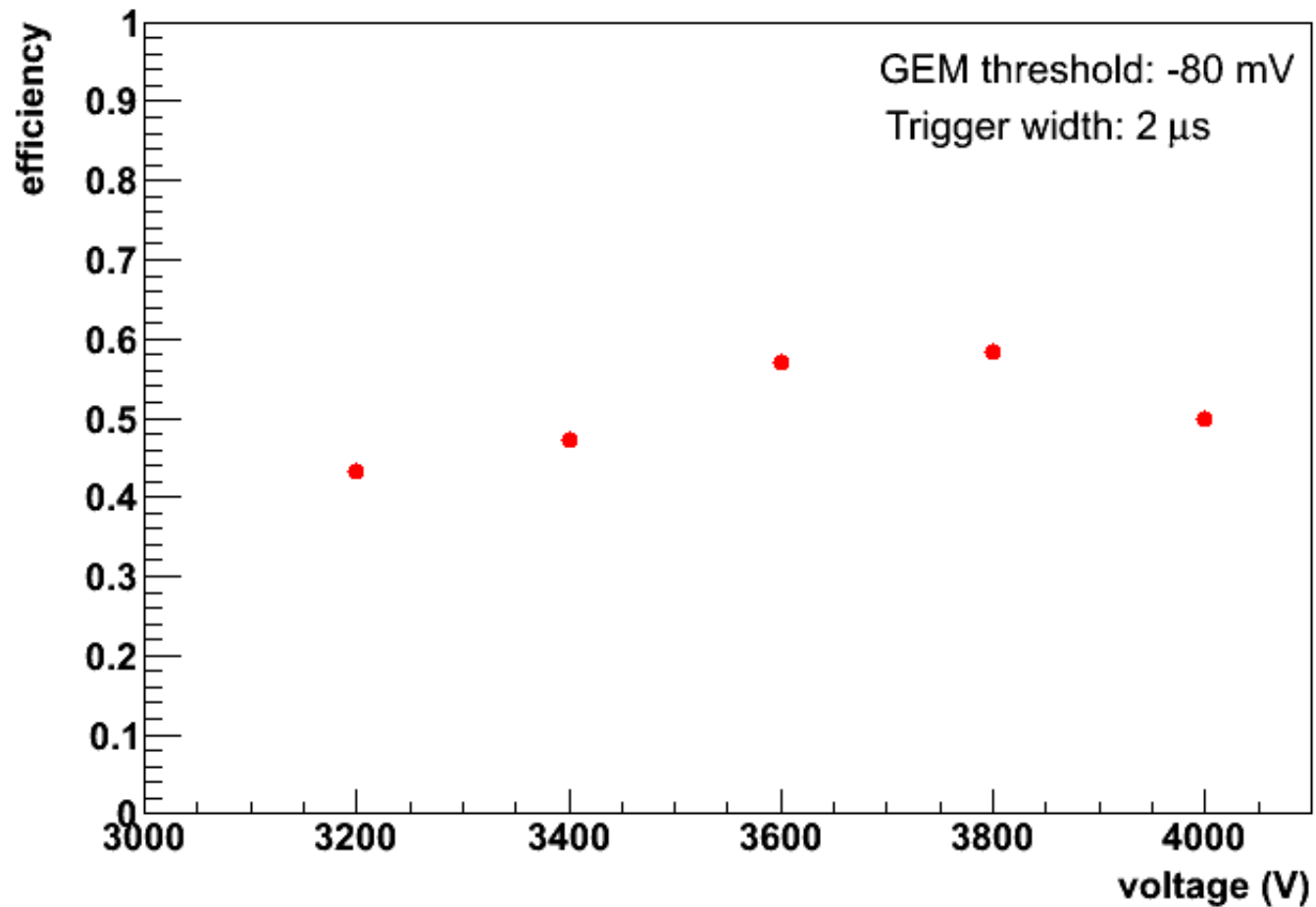
# Singles count rate vs. threshold



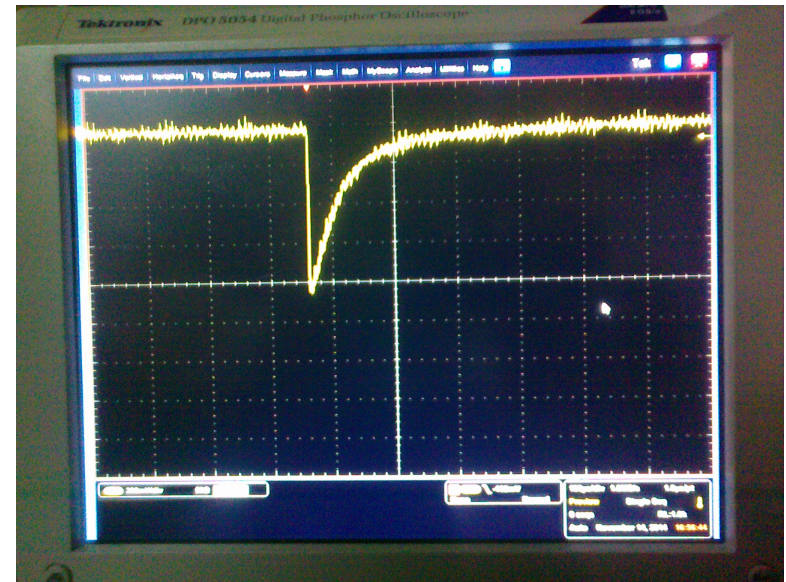
# Efficiency Vs. threshold



# Efficiency vs. voltage

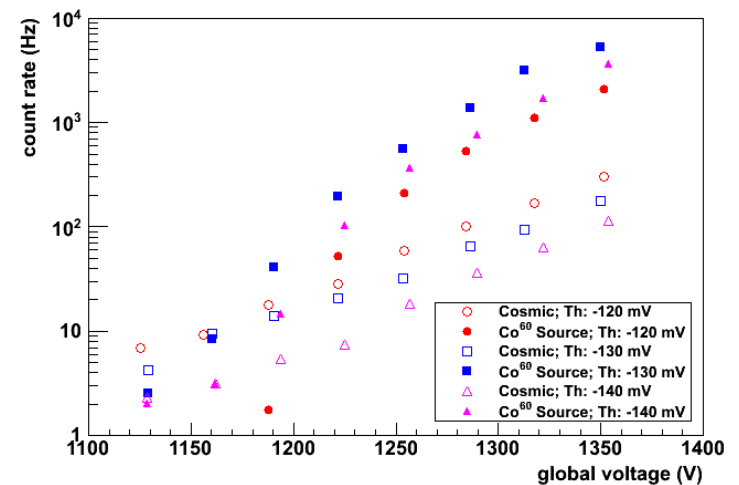
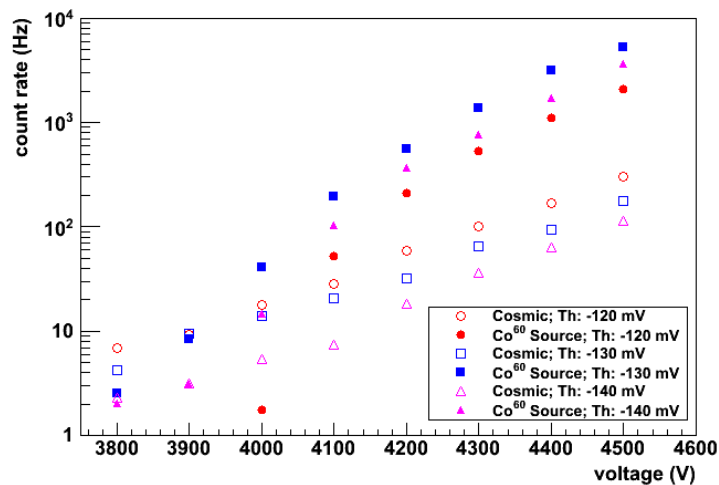






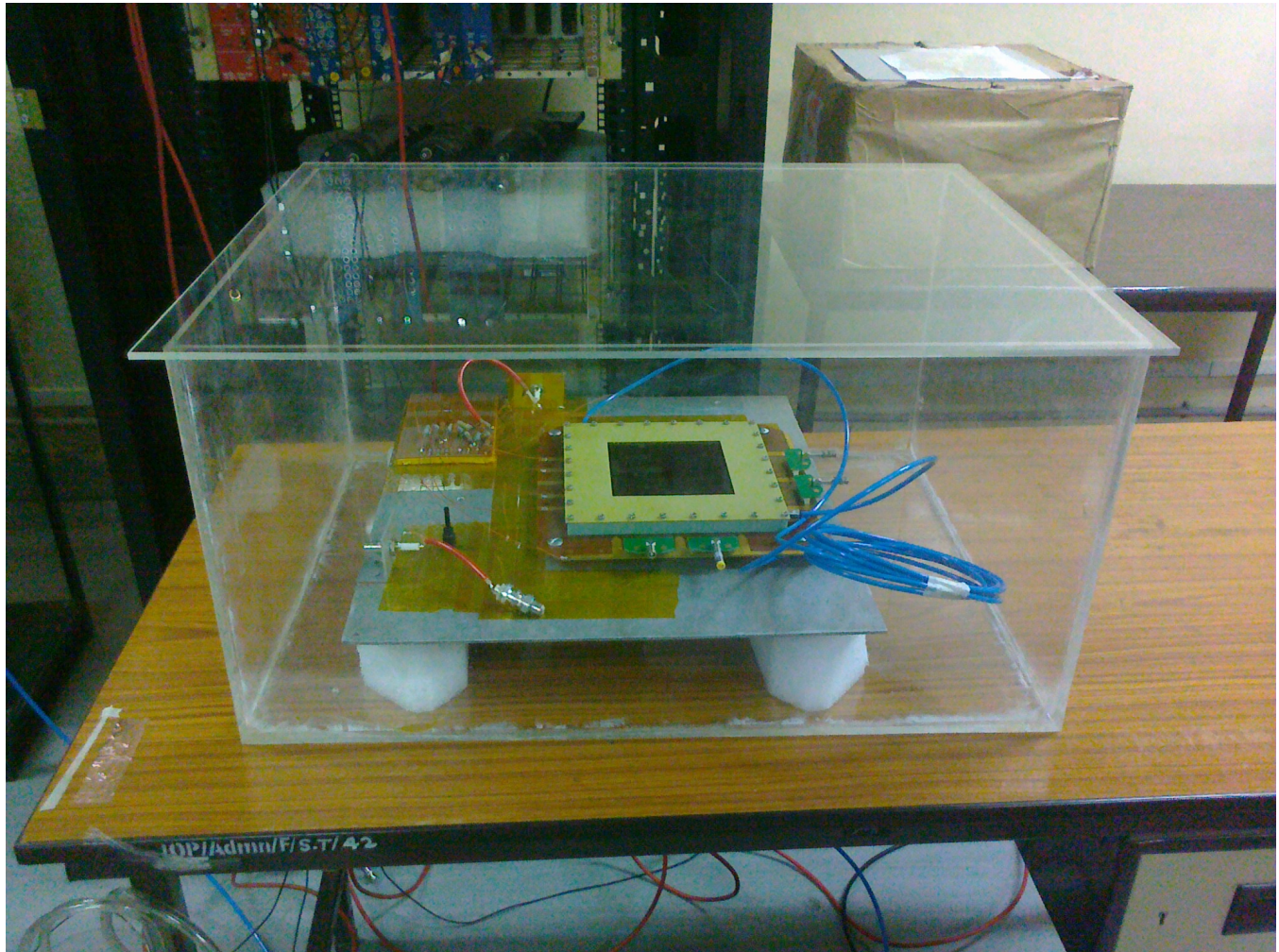
300 mV/div, 100  $\mu$ s/div, 50 $\Omega$  termination  
Preamp: Ortec-142IH

# Count rate vs. voltage

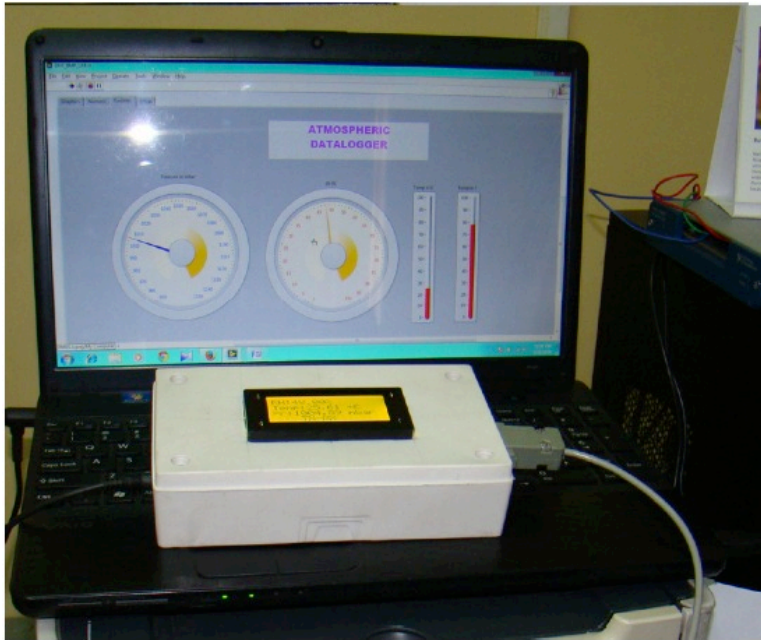




# Complete detector in the box



# Data Logger



Hardware



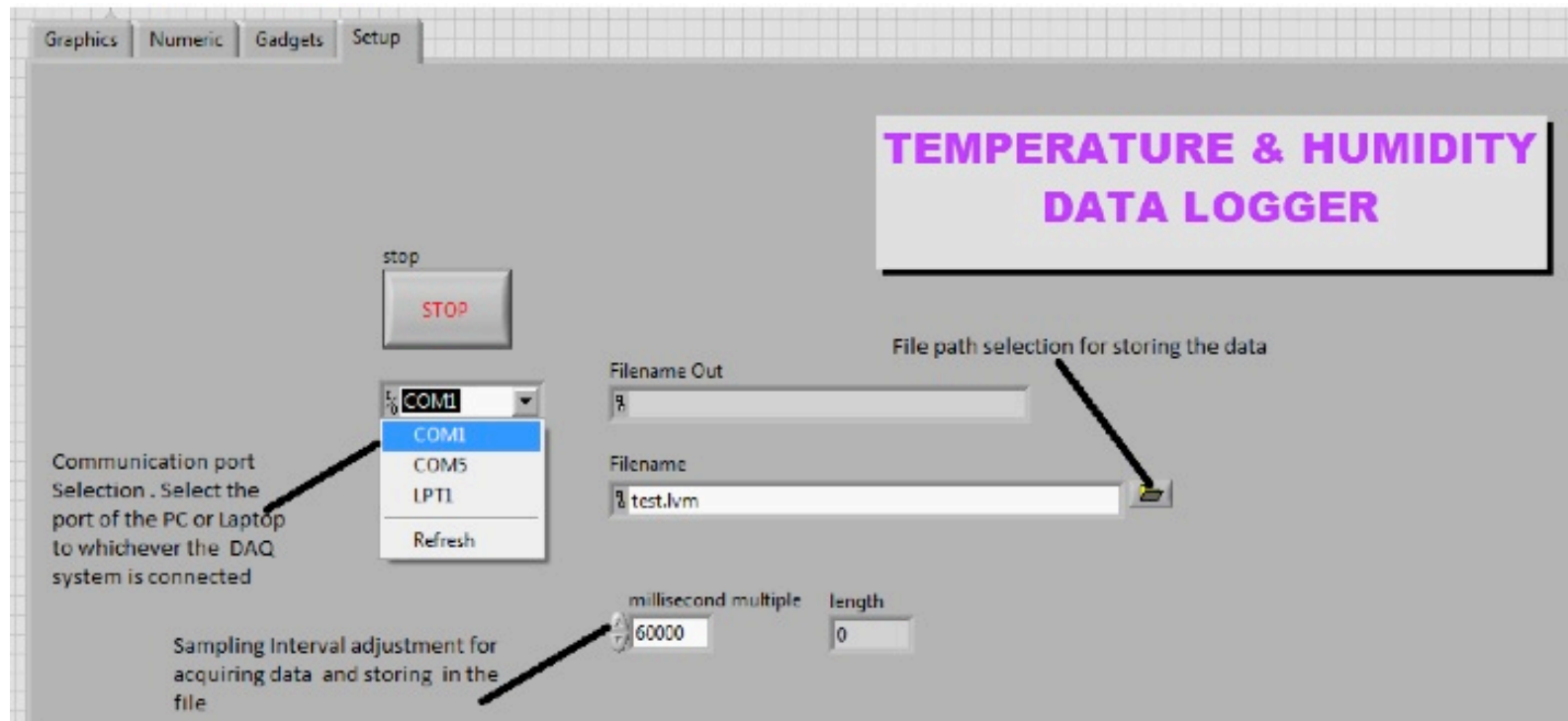
The LCD Display unit is consisting of 16×4 line Alphanumeric Display. The Display unit is Backlighted for better visibility.

# The parameters for the Data logger

- Temperature: Measurement of temperature can be done with 0.25°C assured accuracy. The rated full range of measurement is from 0°C to 150°C. It has very low self-heating with resolution ~ 0.01°C.
- RH: Measurement of RH can be done with 1% resolution and with 4% accuracy. The stability varies  $\pm 1\%$  RH/Year and the hysteresis is 1% RH.
- Pressure: Measurement of pressure can be done with a range: 300-1100hPa (+9000 m to -500 m above sea level). Low noise: 0.06hPa (0.5m) in ultra low power mode 0.03hPa (0.25m) ultra high resolution mode  $< 0.1\text{m}$  possible with software averaging algorithm.



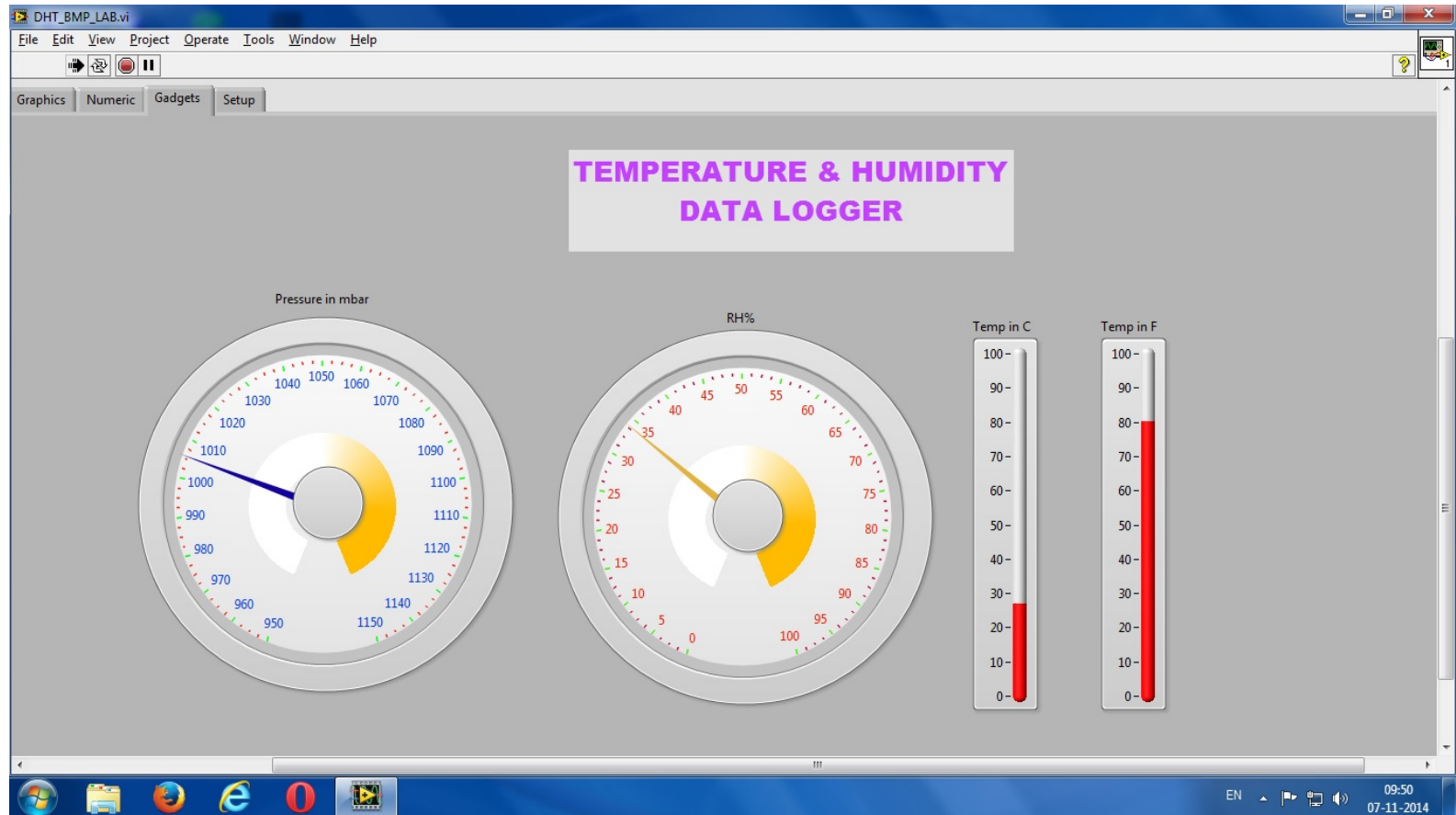
# The set-up tab



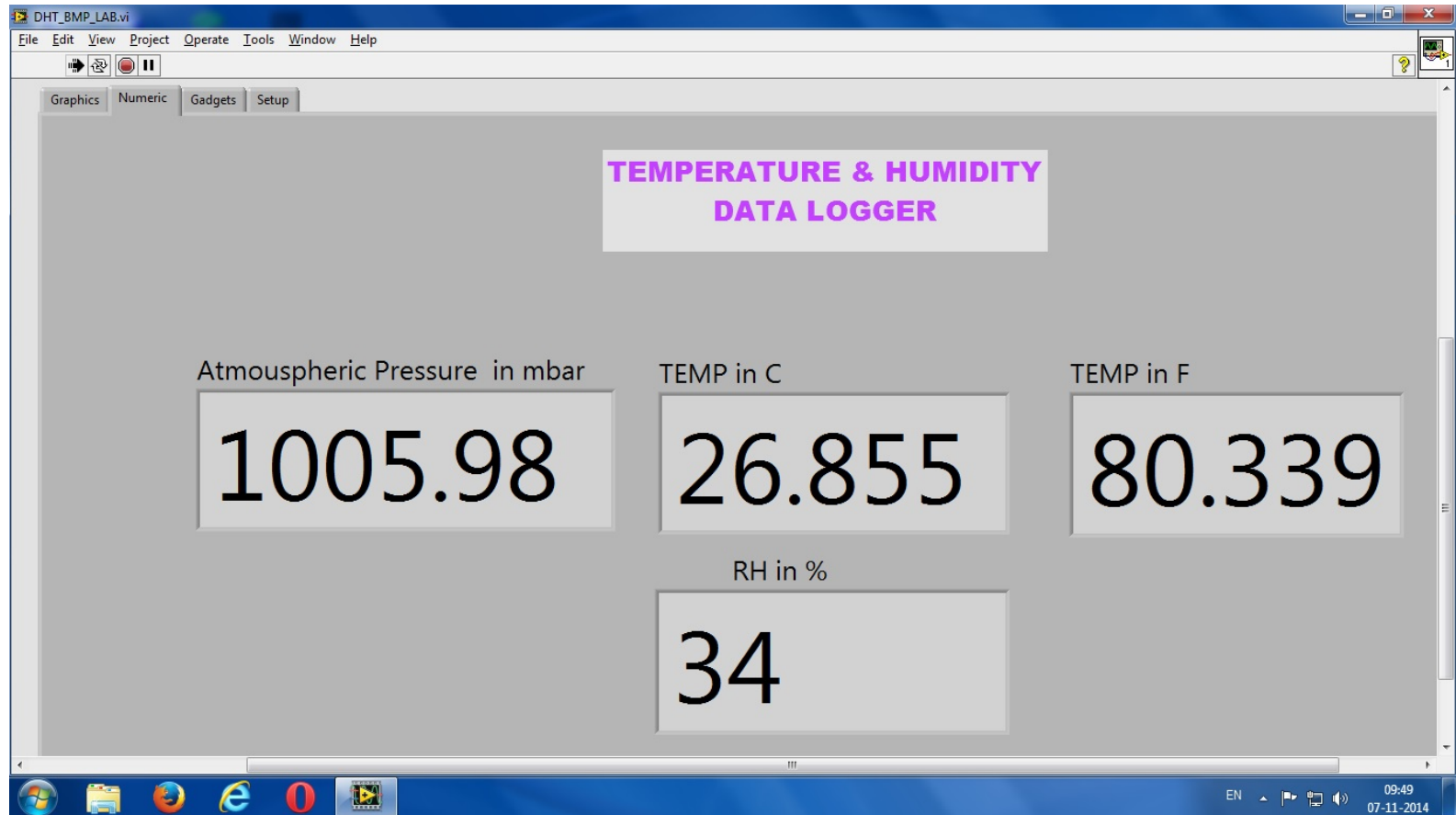
# The software operations

- The communication port (COM PORT) needs to be selected properly.
- The sampling interval in msec needs to be entered by the user.
- The file path needs to be entered for data storing.

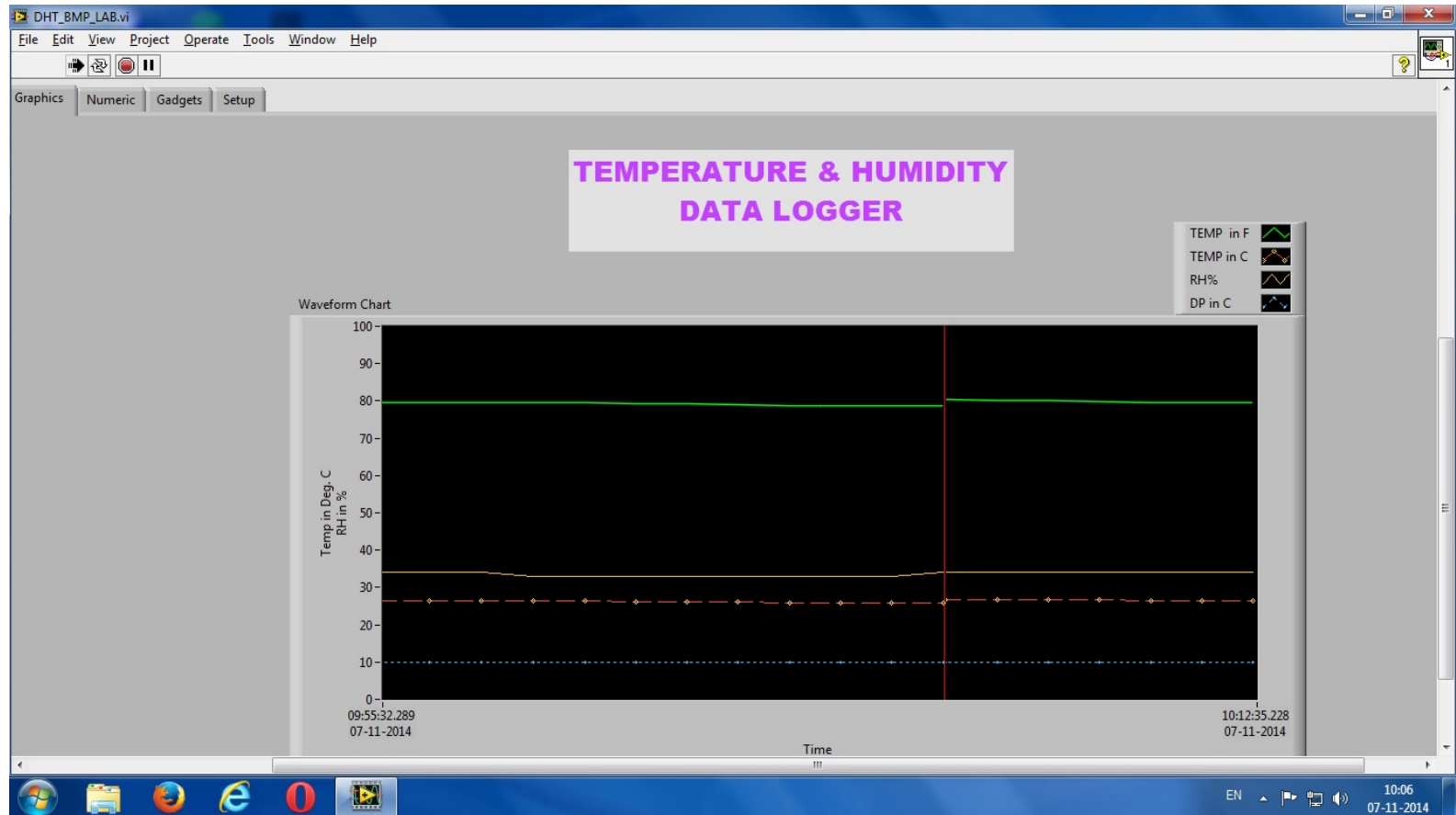
# The gadget tab



# The numeric tab

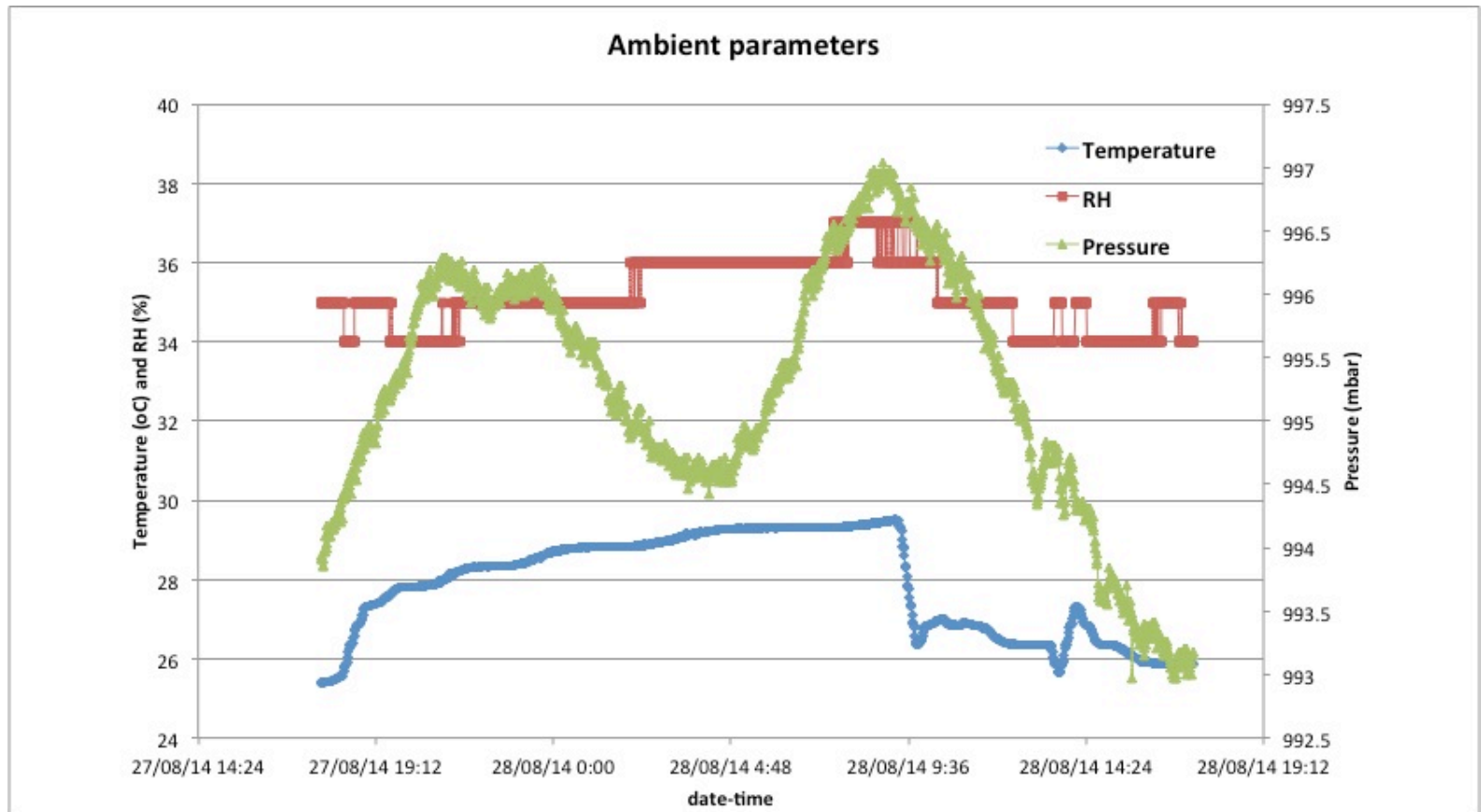


# The graphic tab

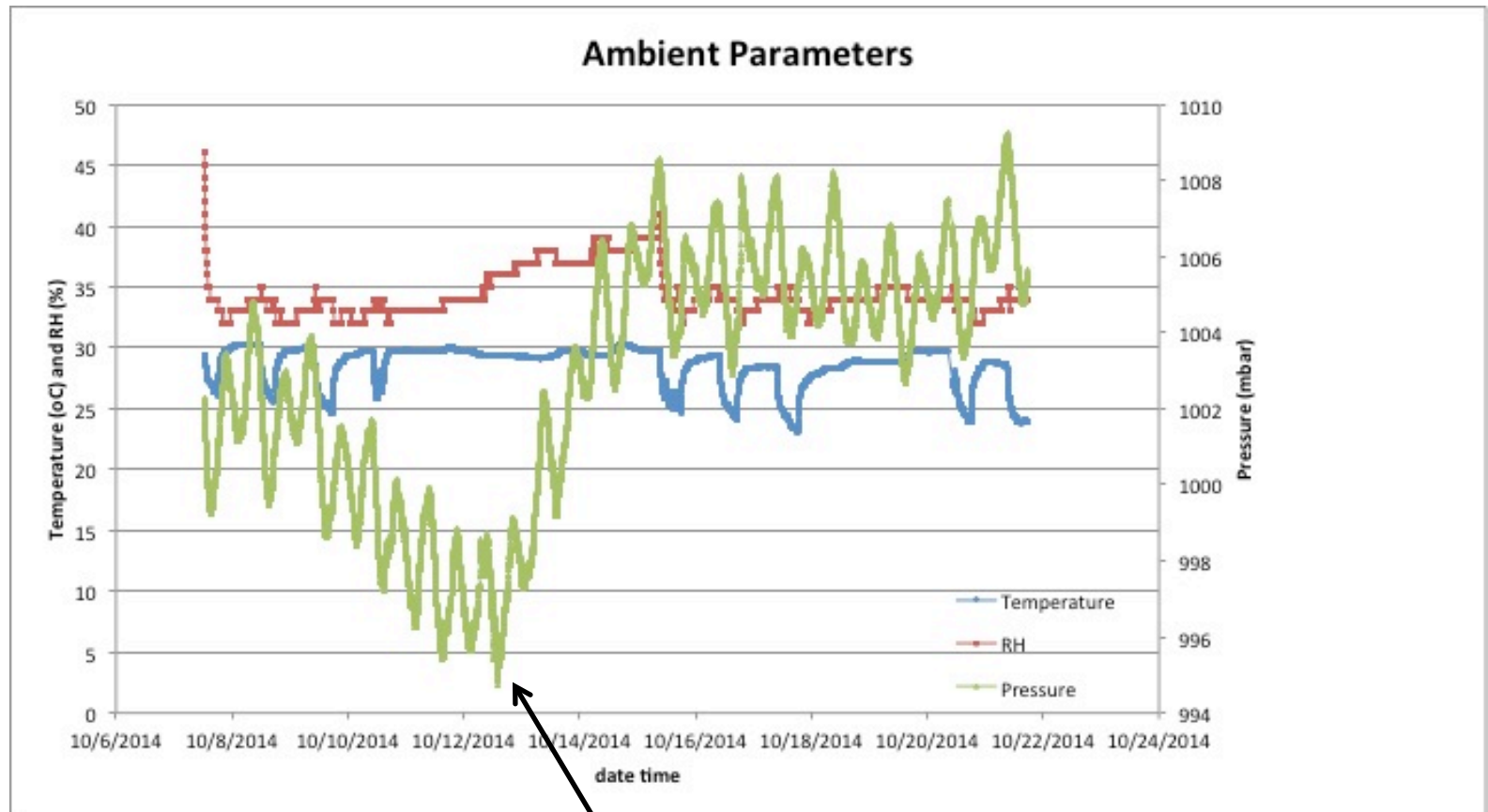




# Temperature, pressure and RH measured in 24 hours as a function of date-time



# Temperature, pressure and RH measured continuously for 15 day, as a function of date-time



Signature of cyclone Hudhud on 12 October, 2014

# Summary

- GEM related activities started
- Materials for 5 triple GEM detectors are obtained from CERN
- One 10cm X 10cm triple GEM detector has been assembled
- Efficiency measured with cosmic rays
- Noise problem : to be removed
- Measurement done with Co<sup>60</sup> source
- A Data logger to monitor and record the ambient parameters such as temperature, relative humidity and pressure has been developed
- Long term measurement of ambient parameters has been performed

# Acknowledgement

Thanks to the RD-5I collaboration  
particularly Rui, Eraldo, Silvia for help





**Thank you**