Path Length Dependence of Partons Energy loss in QGP in PbPb Collisions at √s = 5.02TeV
and
Service task: CAEN Power supply test for TPC upgrade

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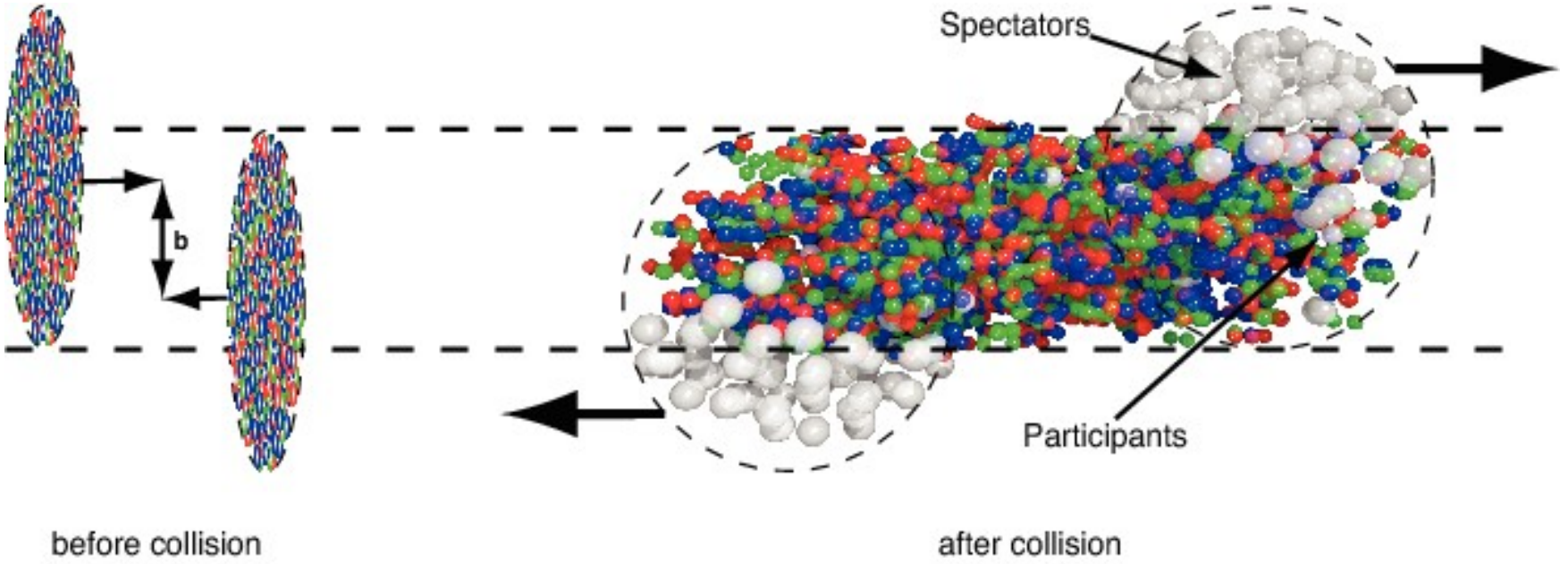
ALICE India Meet-2016

Outline

- **Analysis**
  - **Introduction**
  - **Motivation**
  - **Analysis Method**
  - **Analysis Details**
    Data Sets and Cuts
  - **Results : QA plots**
- **Service task: CAEN power supply test**
- **Summary and Future Plans**

Introduction

Heavy Ion collision at LHC

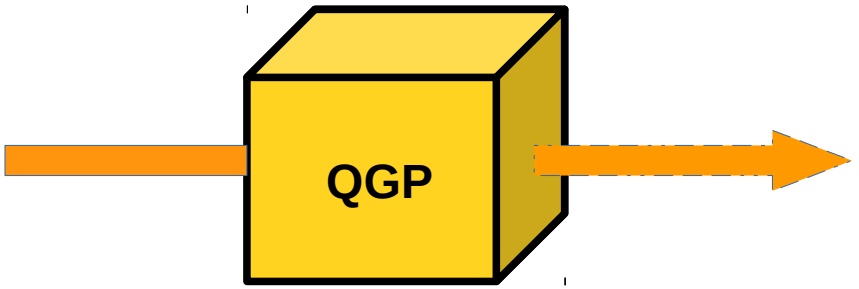


How to measure the matter density?

- Use well calibrated probe beam.
  - hard QCD probe (Jet, J/Ψ, Υ).

- see how it is modified by matter.
  - Strong interaction (less well known !)
    energy loss in matter

- reconstruct matter density and matter properties.
  - Modeling the observed modification.

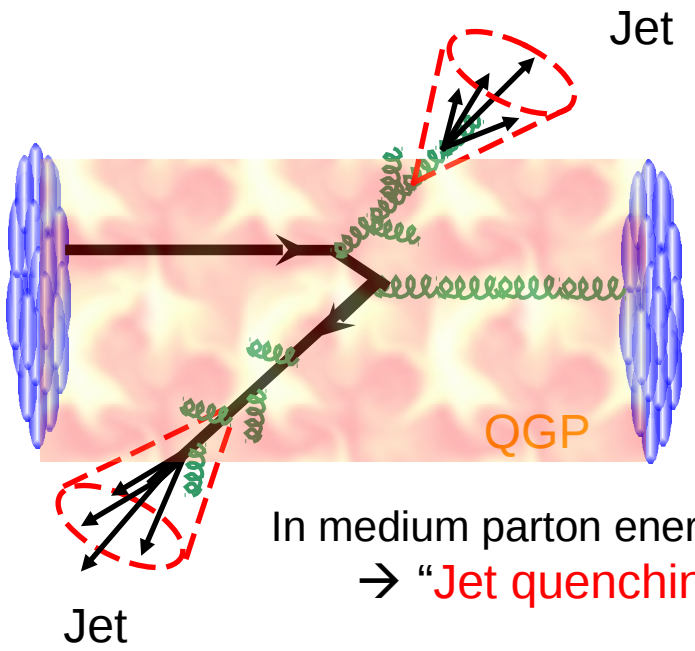


Jets as a tool to understand QGP

- In heavy ion collisions, hard scattered partons fragment into collimated spray of hadrons – **Jets**

- partons loose energy when traversing a medium

Jet(E) → jet (E' = E-ΔE) + soft particles(ΔE)



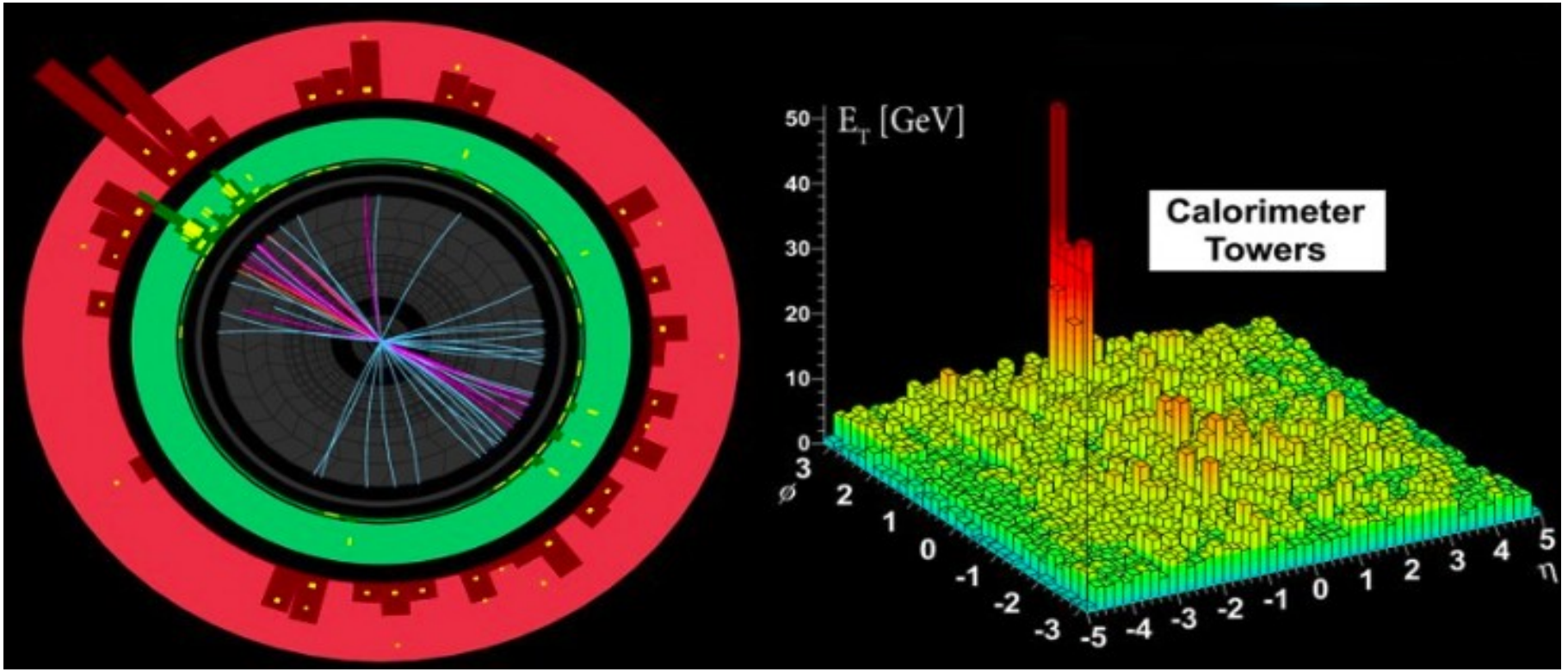
In medium parton energy loss
→ "Jet quenching"

- QCD predicted energy loss ΔE depend on:

jet quenching measures 'stopping power' of QGP

$$\Delta E \sim f(m) \times c_q \times \hat{q} \times L^n \times f(E)$$

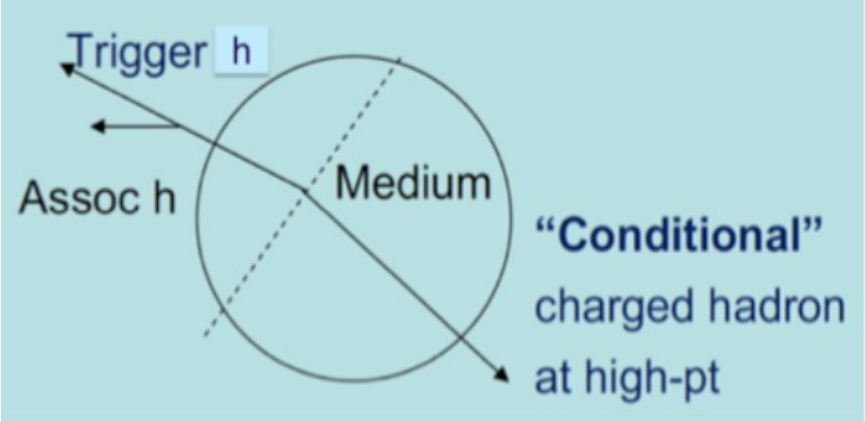
Dijet asymmetry observed in ATLAS and CMS



This figure shows the event display of a highly asymmetric dijet event, with one jet with E_T > 100 GeV and no evident recoiling jet, and with high energy calorimeter cell deposits distributed over a wide azimuthal region, in ATLAS

Analysis Method

- **Two Particle Correlation-** A trigger particle is chosen from a p_T region and associated particles are chosen from another p_T region where p_T assoc < p_T trigger. The associated per-trigger yield is measured as a function of Δφ and Δη.



- Trigger Selection: T1 (primary trigger) is chosen from a p_T range. T2 is searched for in another p_T region such that T1 and T2 are back to back.

- Then in the 2-D space, the azimuthal distribution of associated particles around the high-p_T is plotted ⟶ Raw Correlation

- Raw Correlation with associated tracks in same event (with condition assoc p_T < Trigger particle T1 or T2) : (Δφ, Δη) (**2+1 correlation**)

Data Set and Analysis Cuts

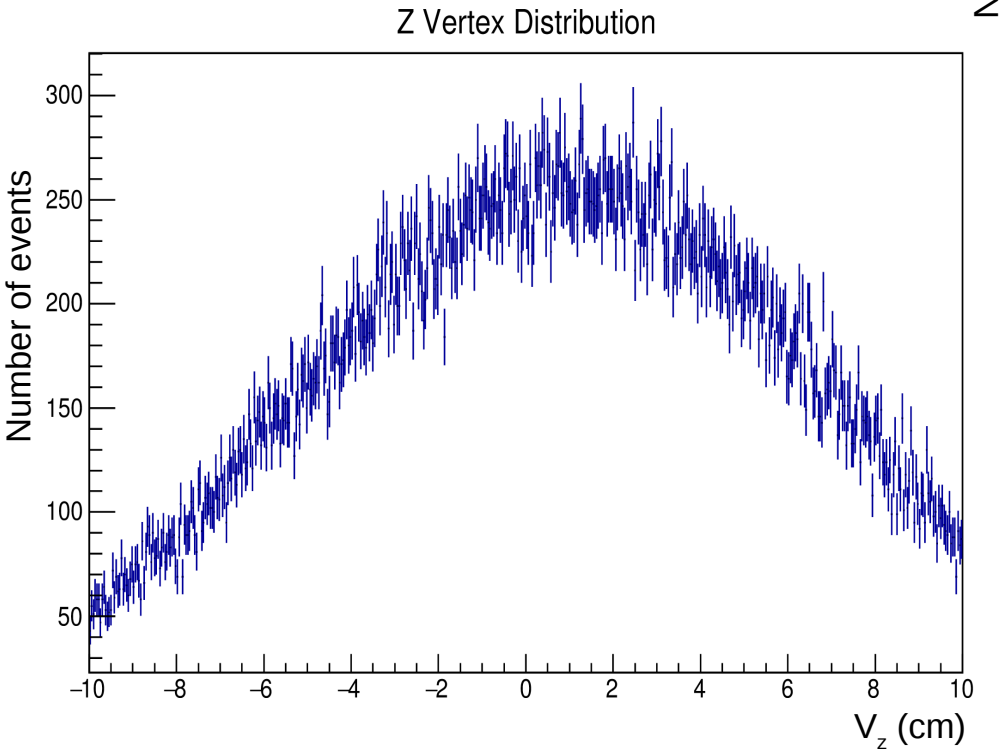
- **Data: PbPb @5.02 TeV**
  Period: LHC15o
  Trigger: INT7
  Run Number: 244918 (Golden Run)
  Number of Events~100k

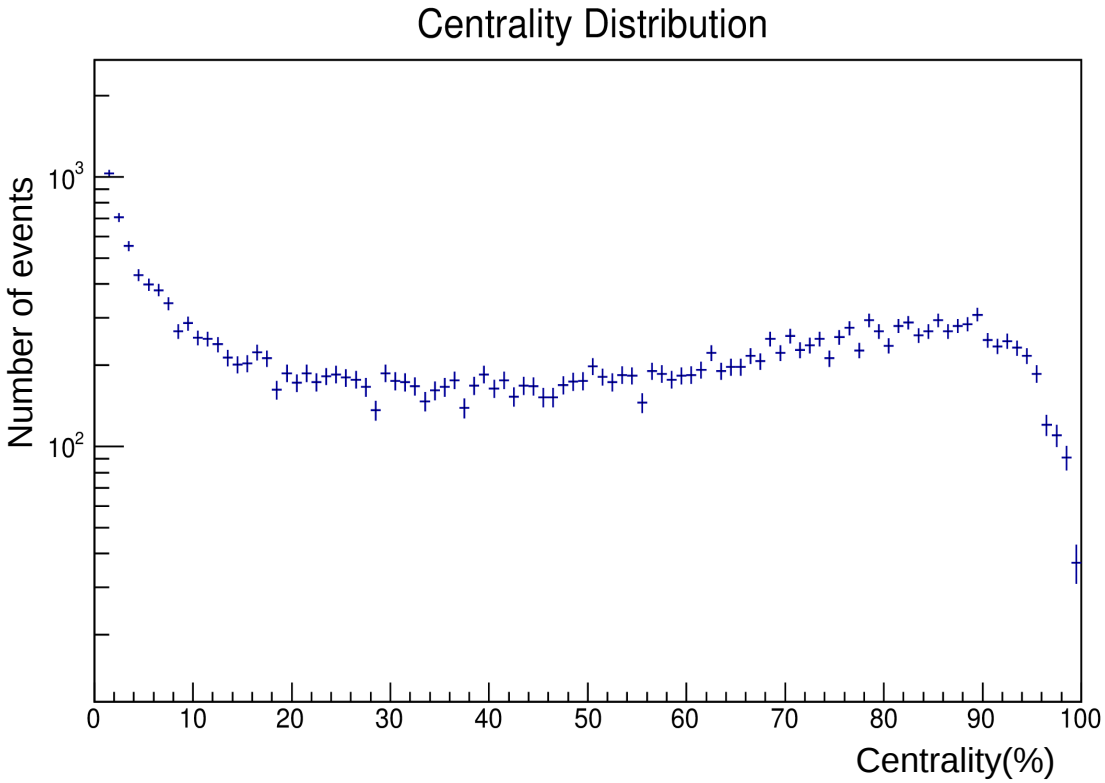
- **Cuts Applied**

  Reconstructed vertex within |Vtx-z| < 10 cm chosen.
  Centrality selection using V0.

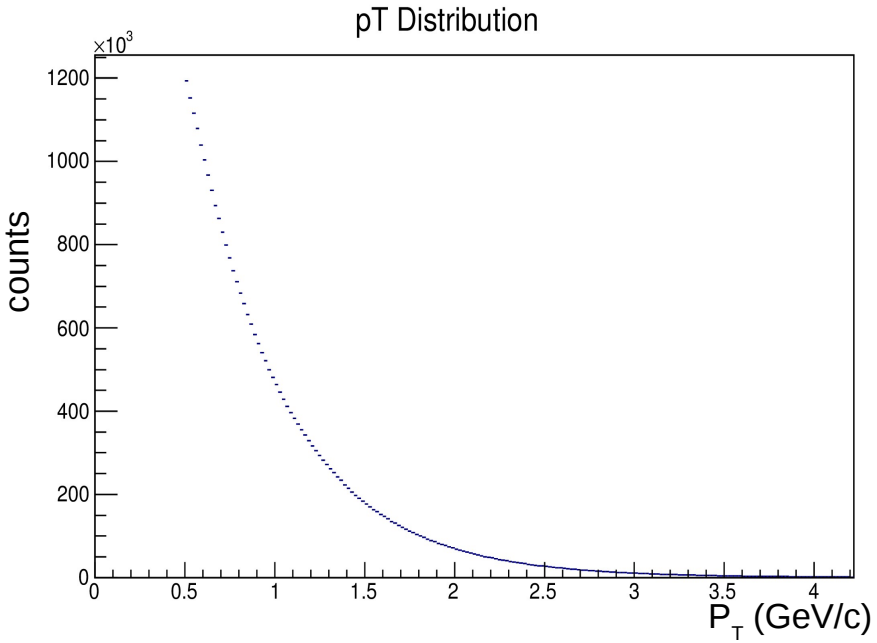
  Track Cuts:
  - Filterbit 768– hybrid tracks
  - $|\eta| < 0.9$
  - Associated particle : p_T asso < p_T trigger1 or 2

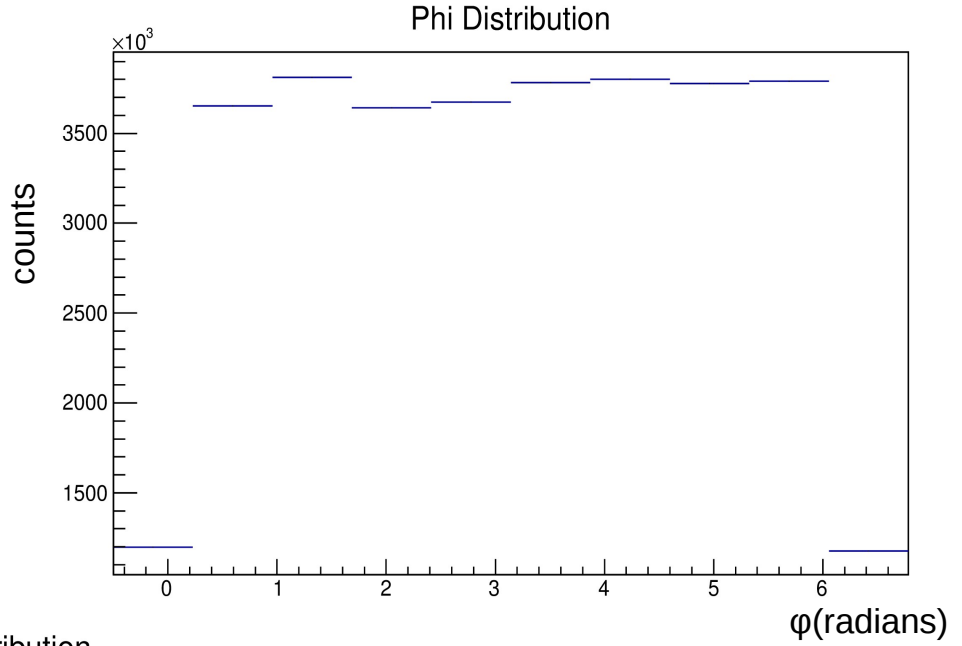
Results: QA Plots

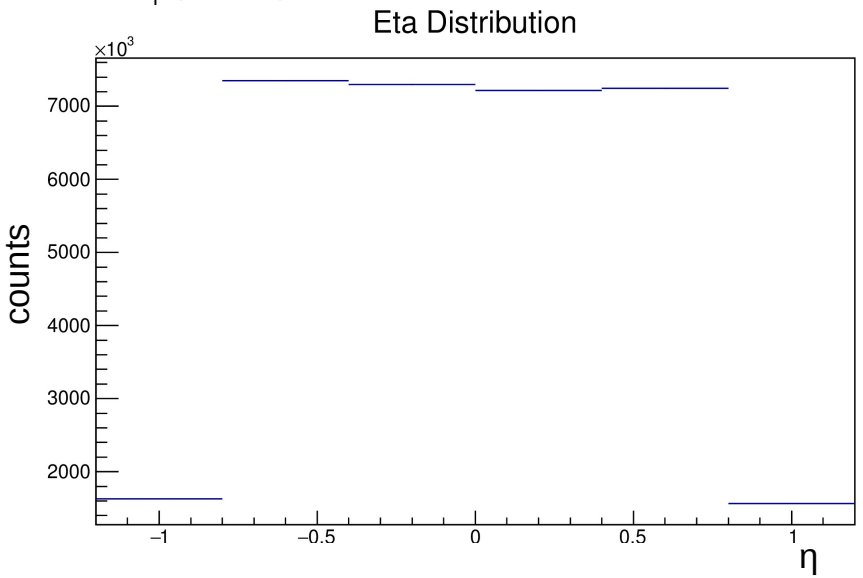




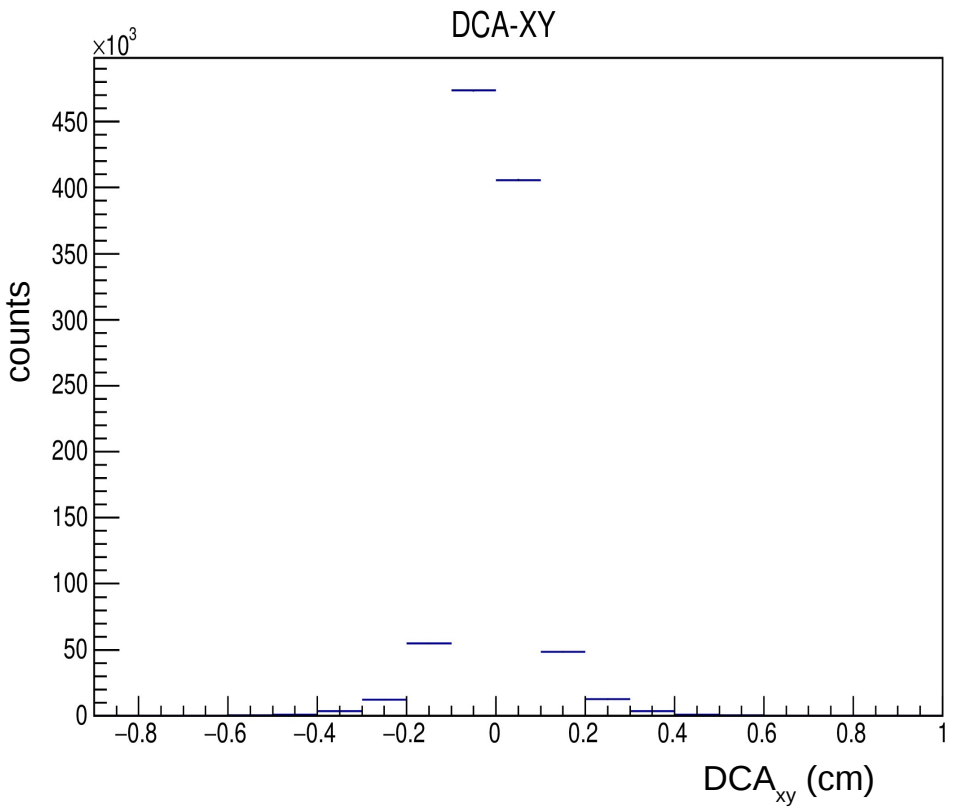
Track QA

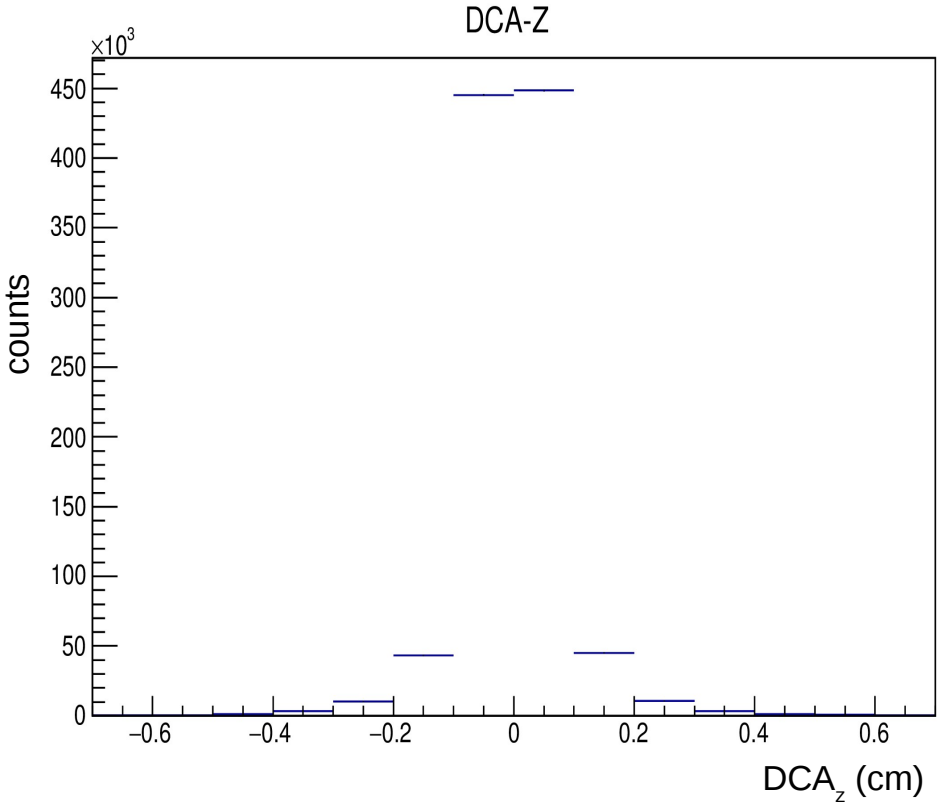

pT Distribution
×10^3
counts
P_T (GeV/c)


Phi Distribution
×10^3
counts
φ(radians)


Eta Distribution
×10^3
counts
η

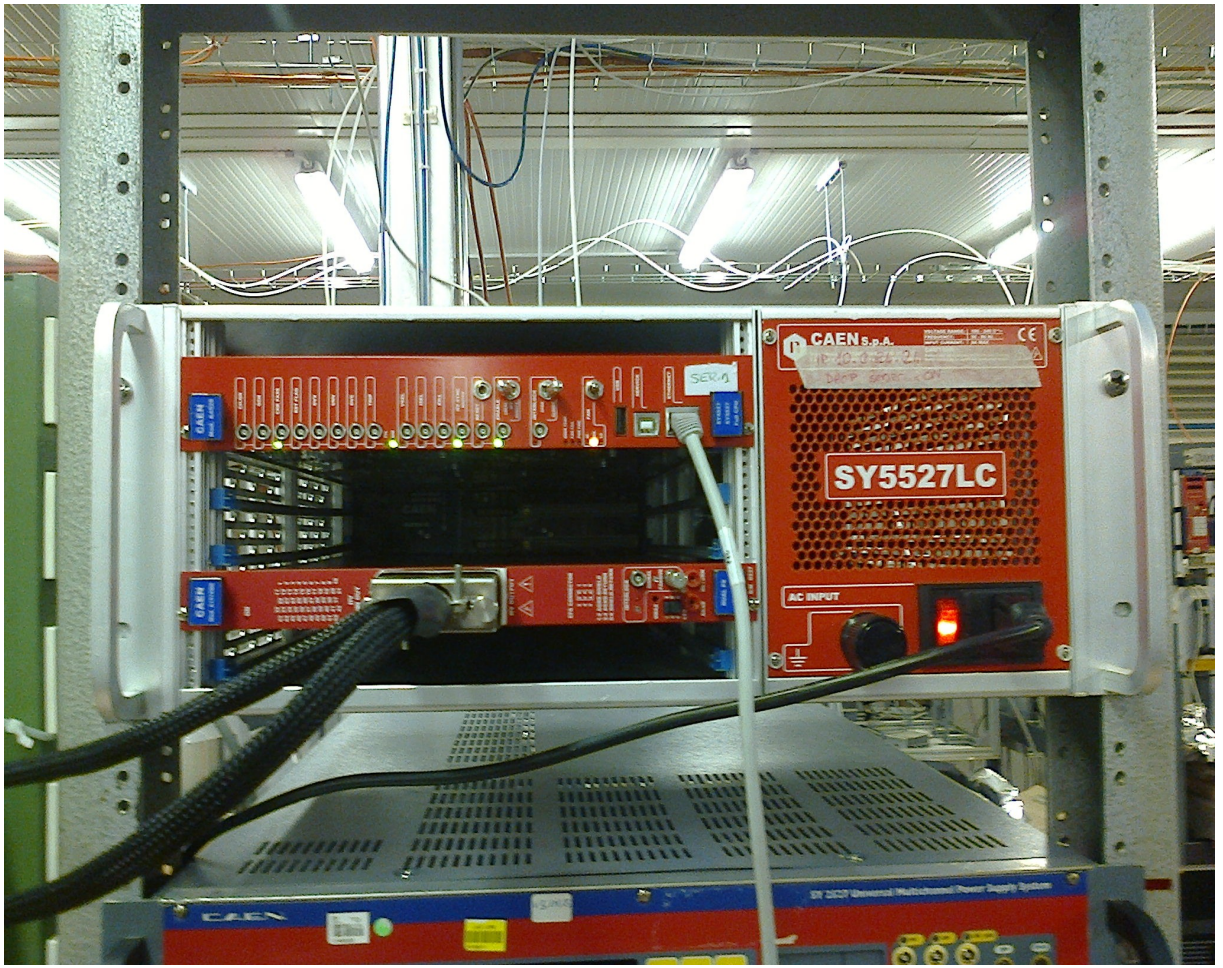
Track QA: DCA





CAEN Power Supply test for TPC upgrade

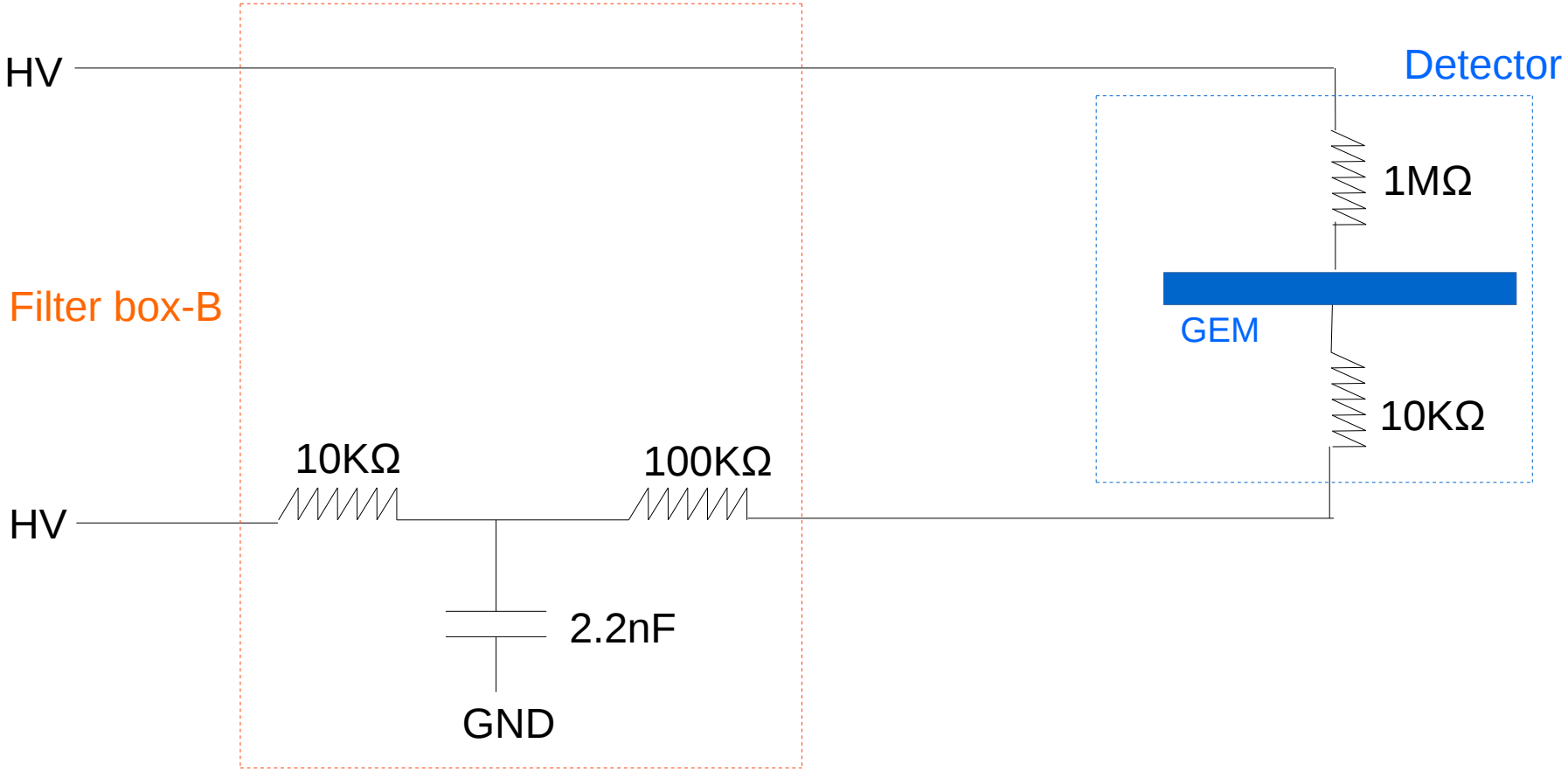
CAEN Power Supply



SY5527LC-**Multichannel Power Supply From CAEN**

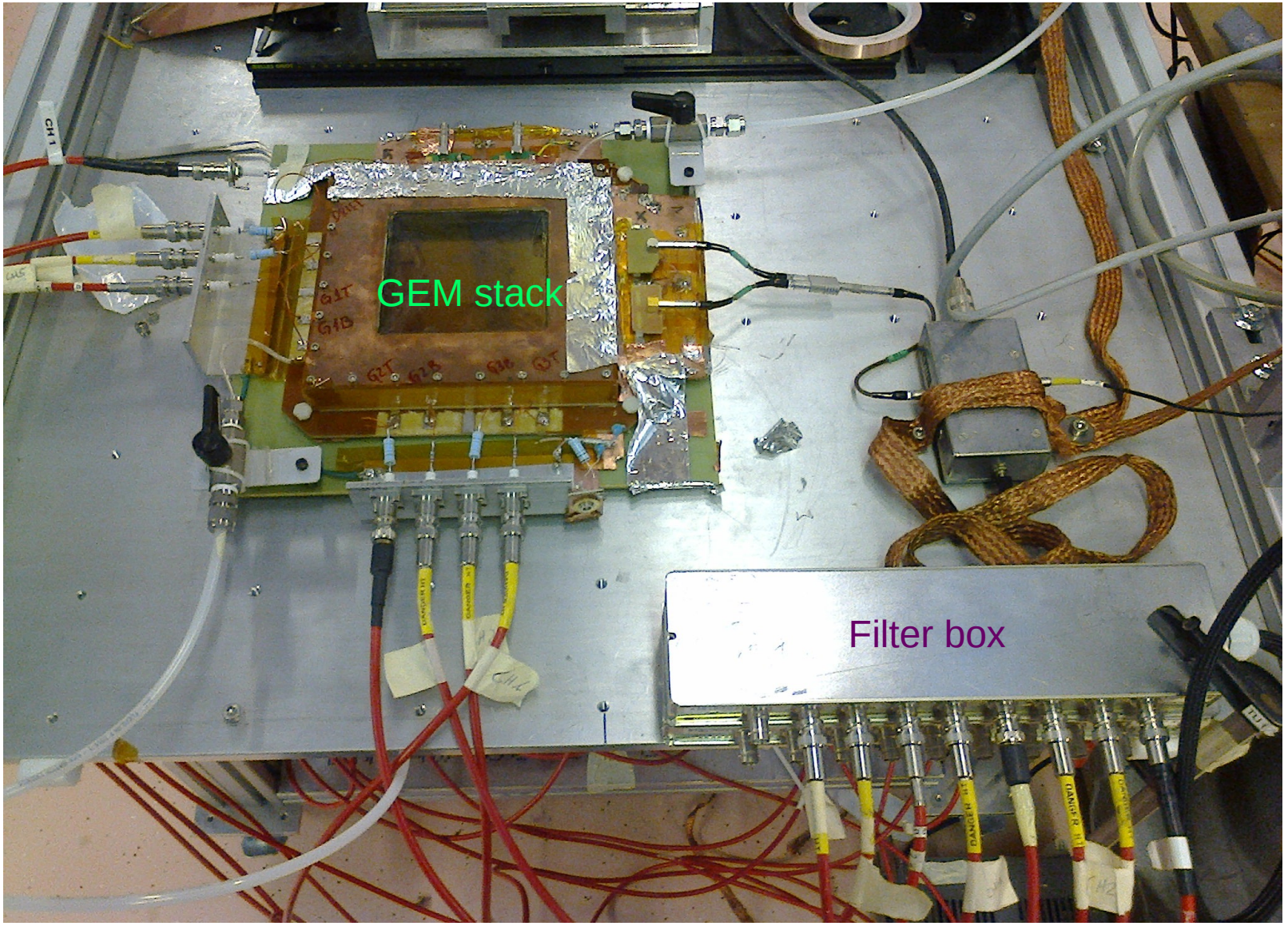
- Prototype for GEM stack.
- High Voltage cascaded power supply.
- Secure access to the system via Internet (can handle remotely)-GECO Software.
- Advanced Trip handling

Test Set-up

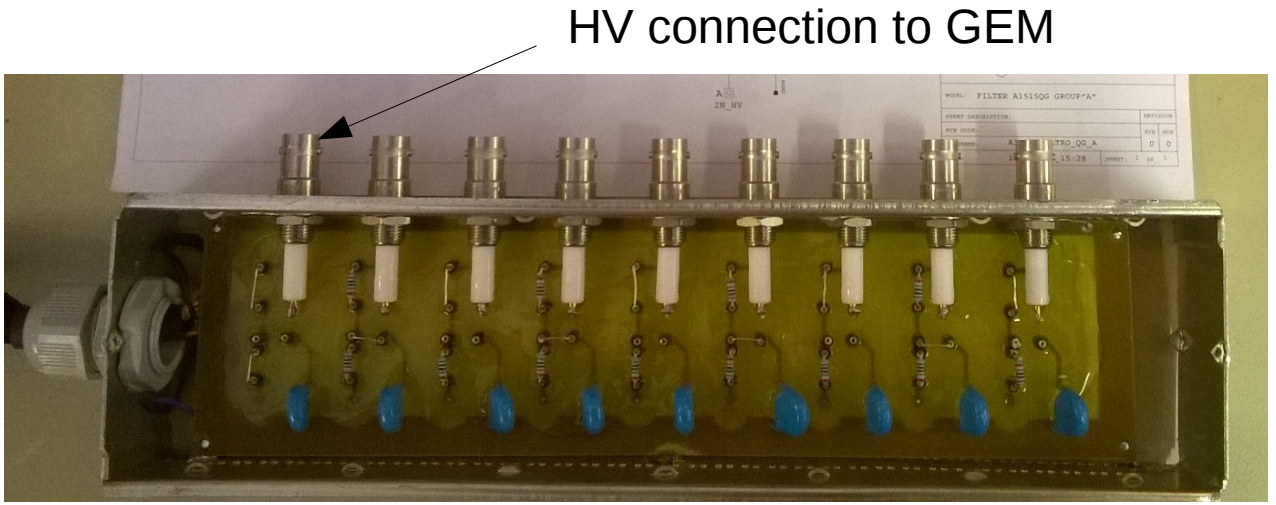


- Triple GEM stack, 10x10cm^2 from RD51.
- 30% CO_2 + 70% Ar.

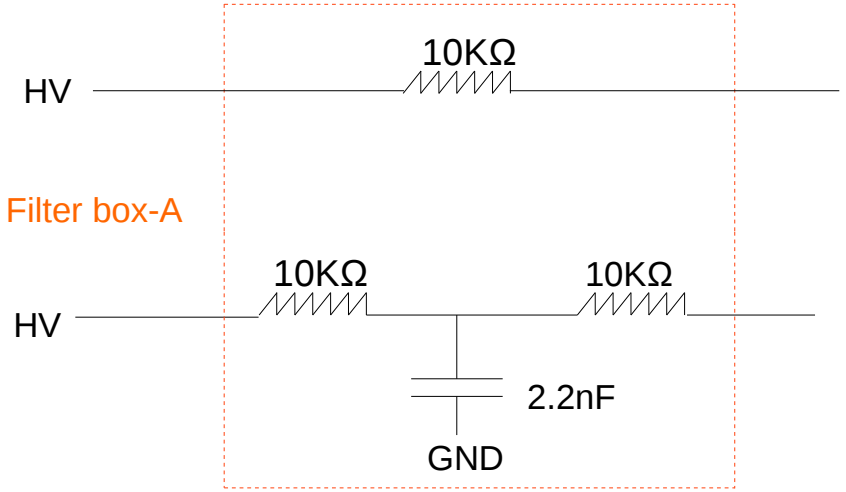
Test Set-up

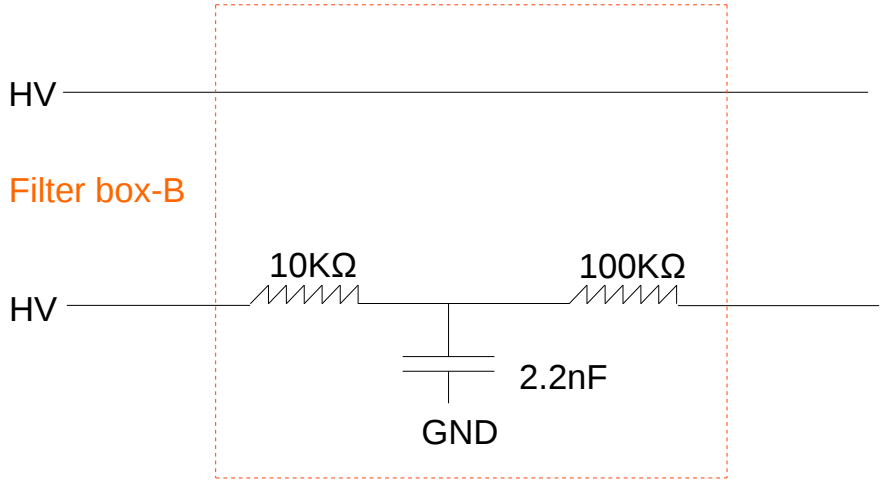


Filter Box



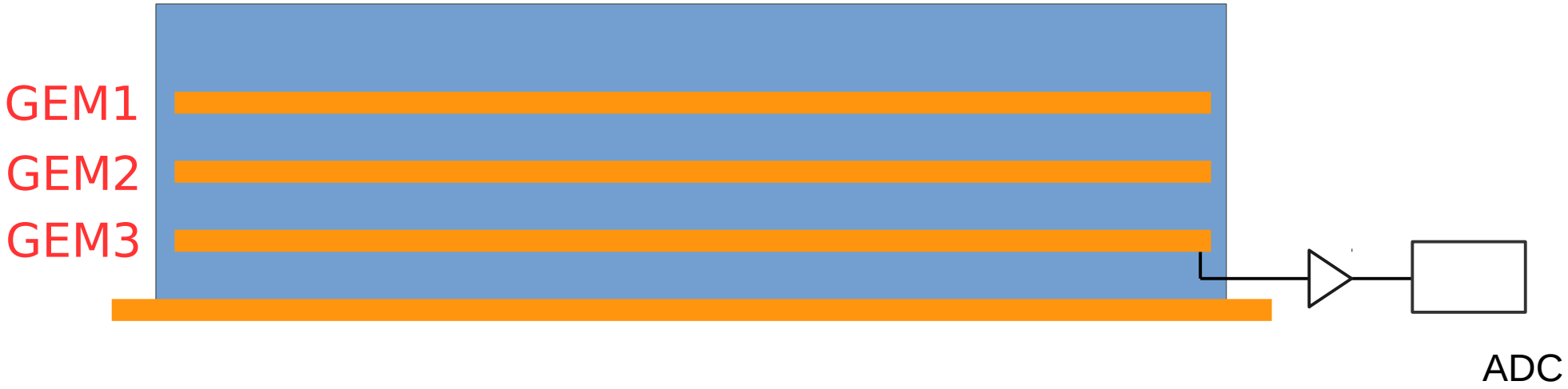
Filter Box-B





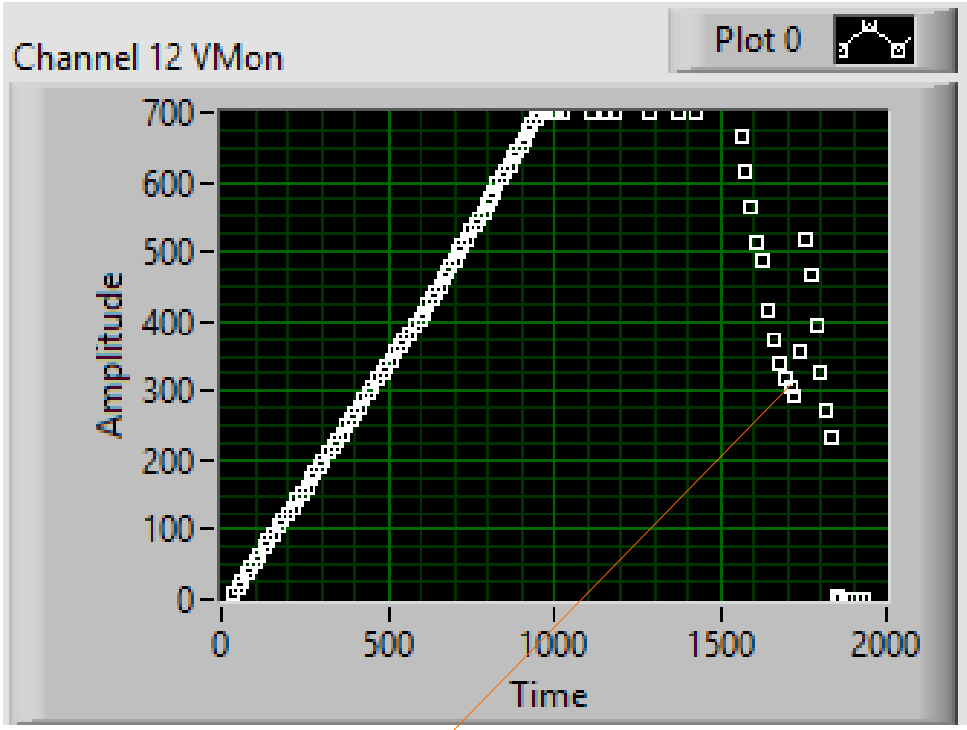
Power Supply Test

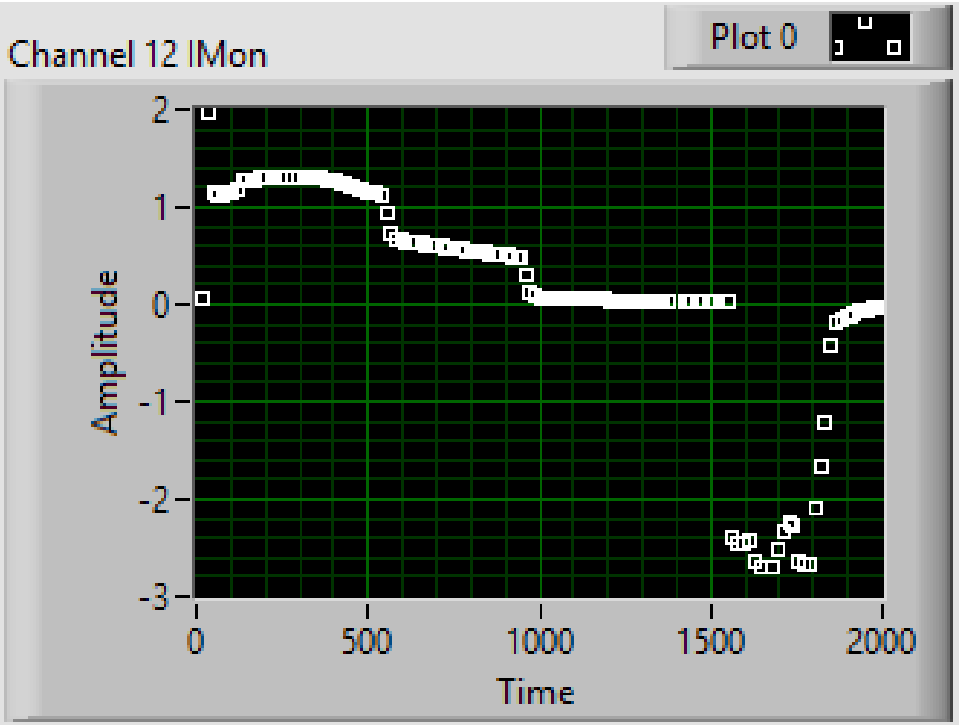
- Several ramp-up and ramp-down speed test.
- Several configurations on the HV side and on detector.
  - Resistance Configurations
  - Long cables
- Trip behavior.



Power Supply Test: Ramp-up/down

- Ramp-up and Ramp-down test. without x ray source.

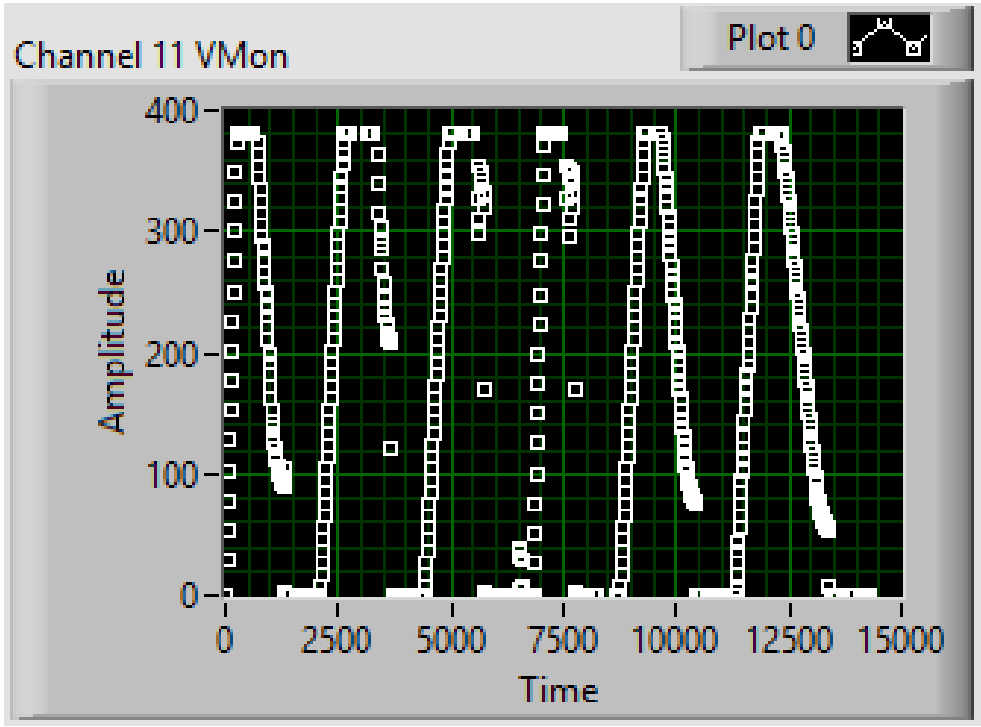


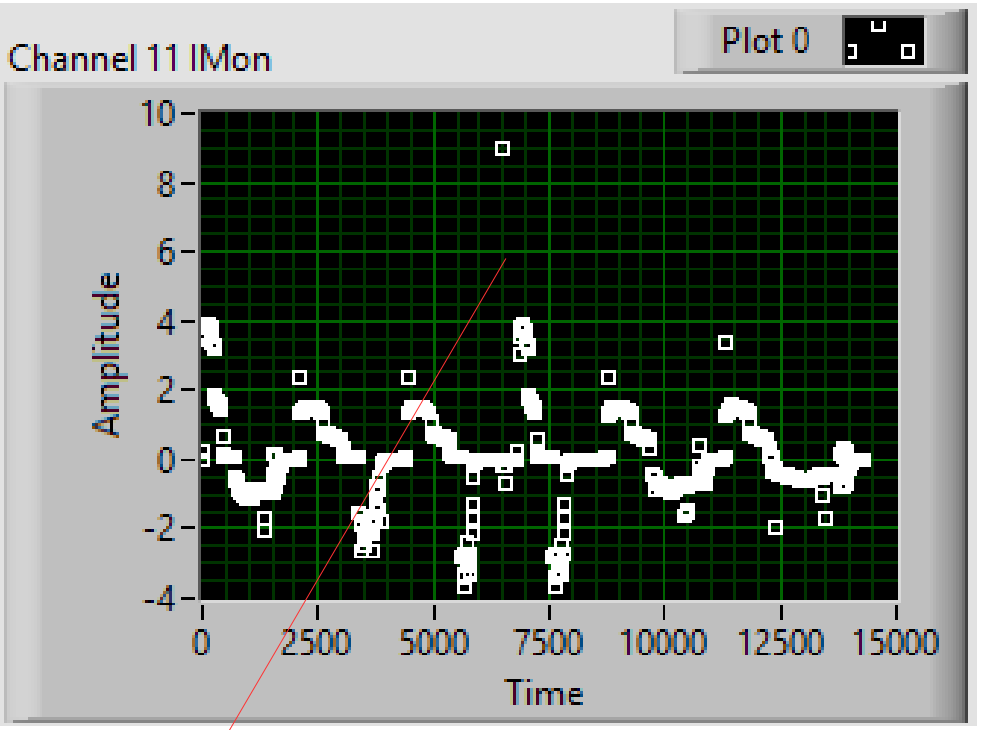


While ramping down there is some fluctuation and discontinuity. This effect observed is a software issue and not in real.

Power Supply Test: Ramp-up/down

- Without x ray source. We test several ramp-Up and ramp-Down speeds. At ramping down speed of 50 V/sec we observed trip.



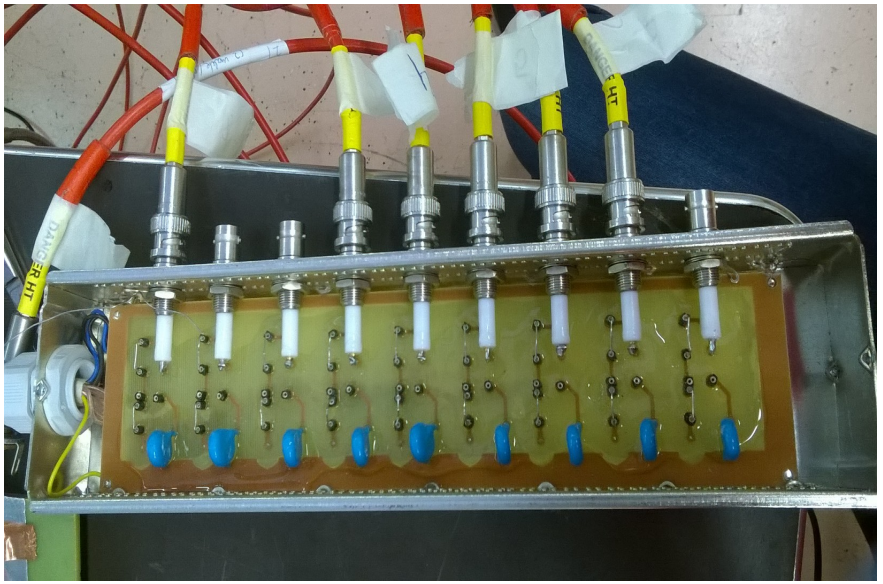


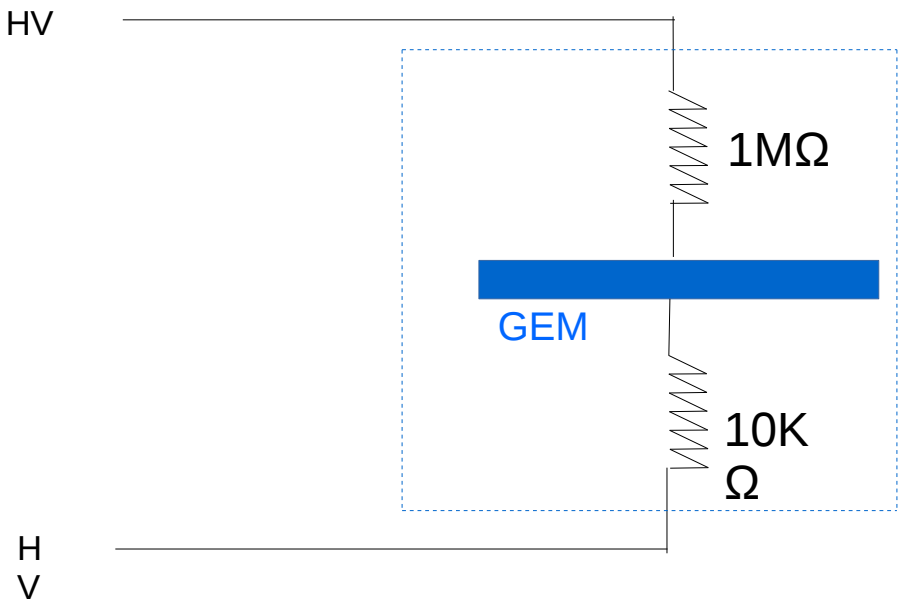
GEM2 top

Tripping

Power Supply Test: Noise

- With Filter the noise Level was 130mV pk-pk
- When we removed the filter box, the noise is increased 900mV pk-pk.

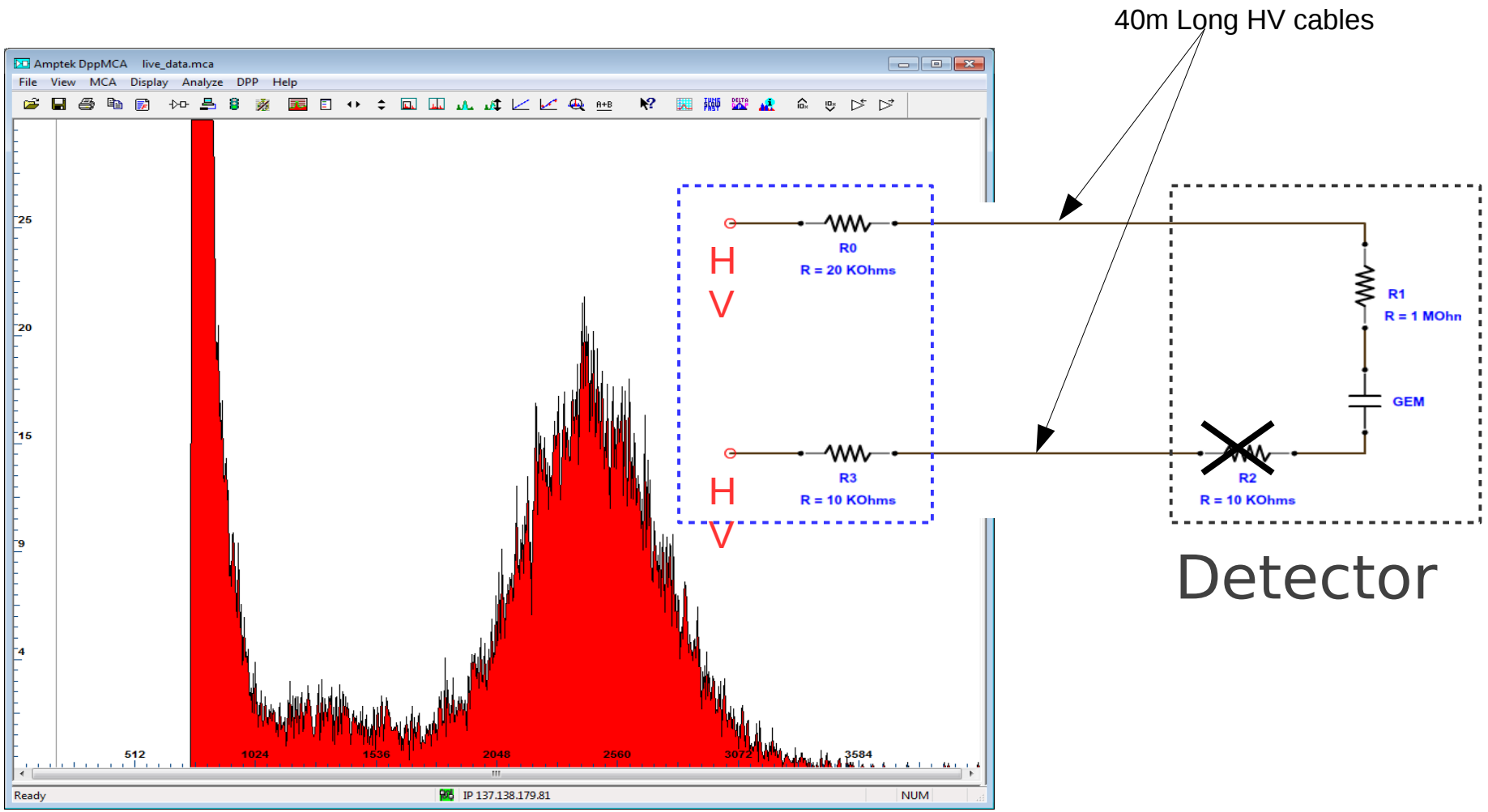




- Then we add 20kΩ to all top channels and 10KΩ to all bottom channels. The noise level dropped to 300mV using long cables.

Power Supply Test: Noise

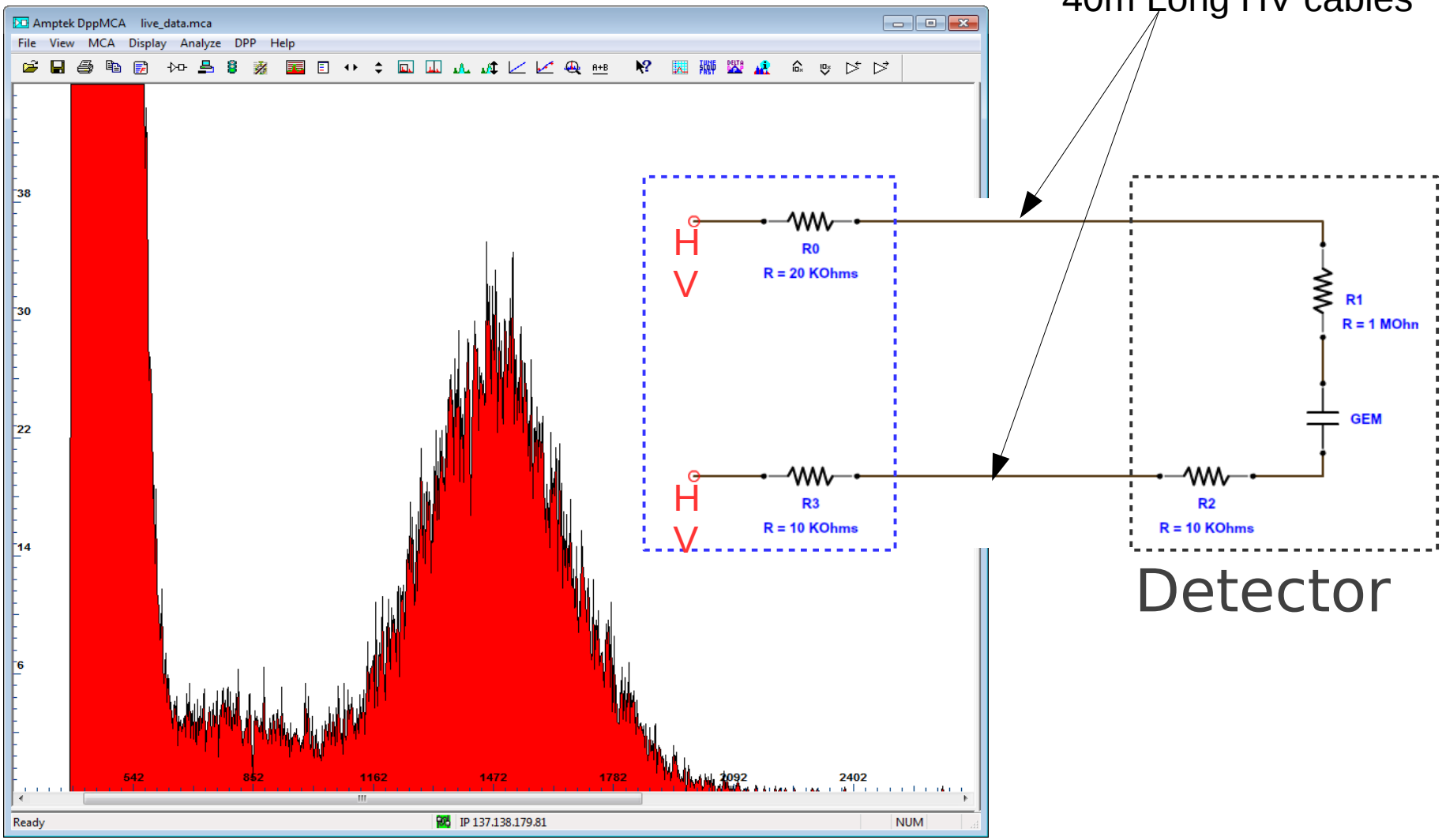
- Spectrum of 55Fe with different configuration on HV side and detector.



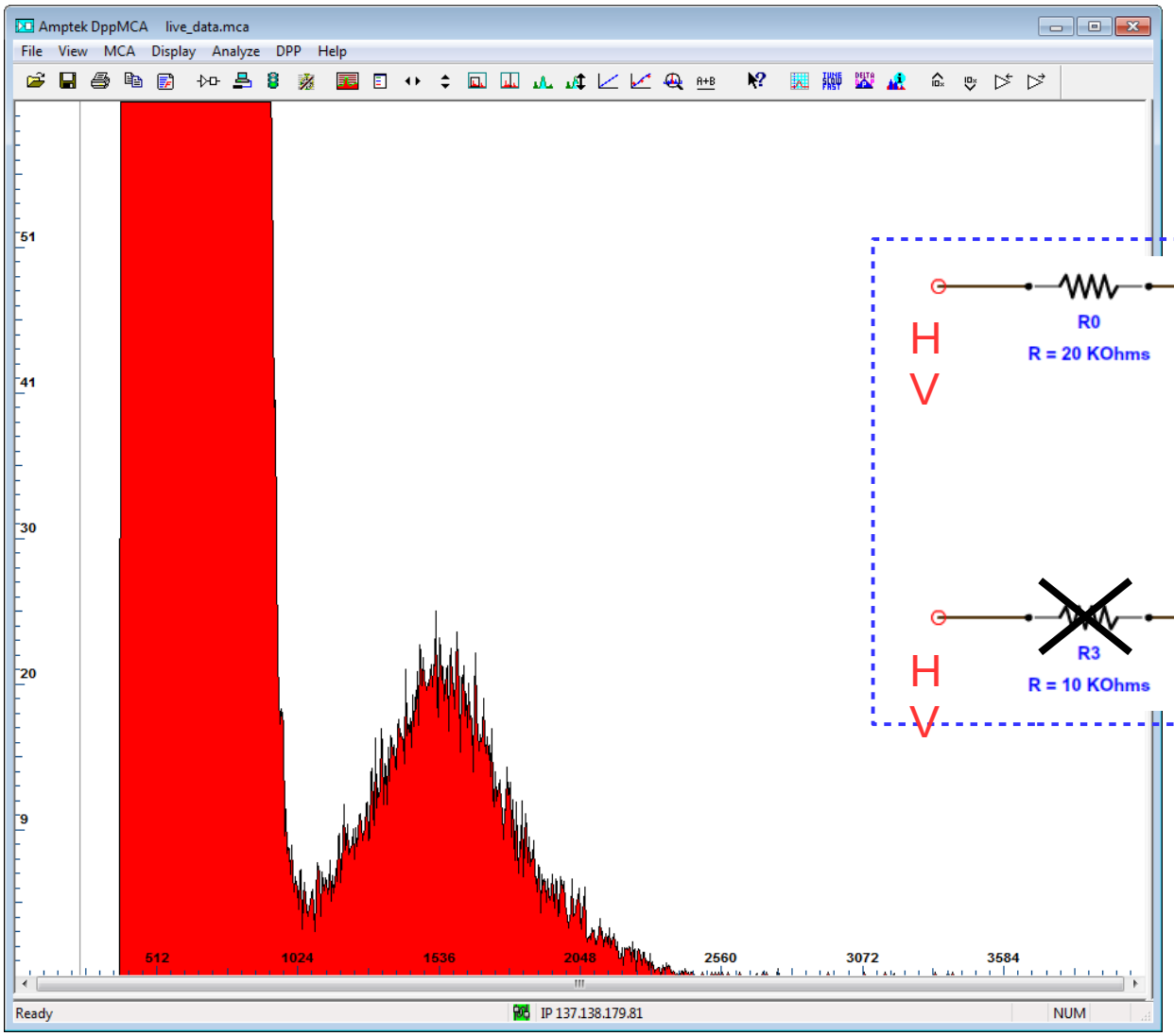
Power Supply Test: Noise

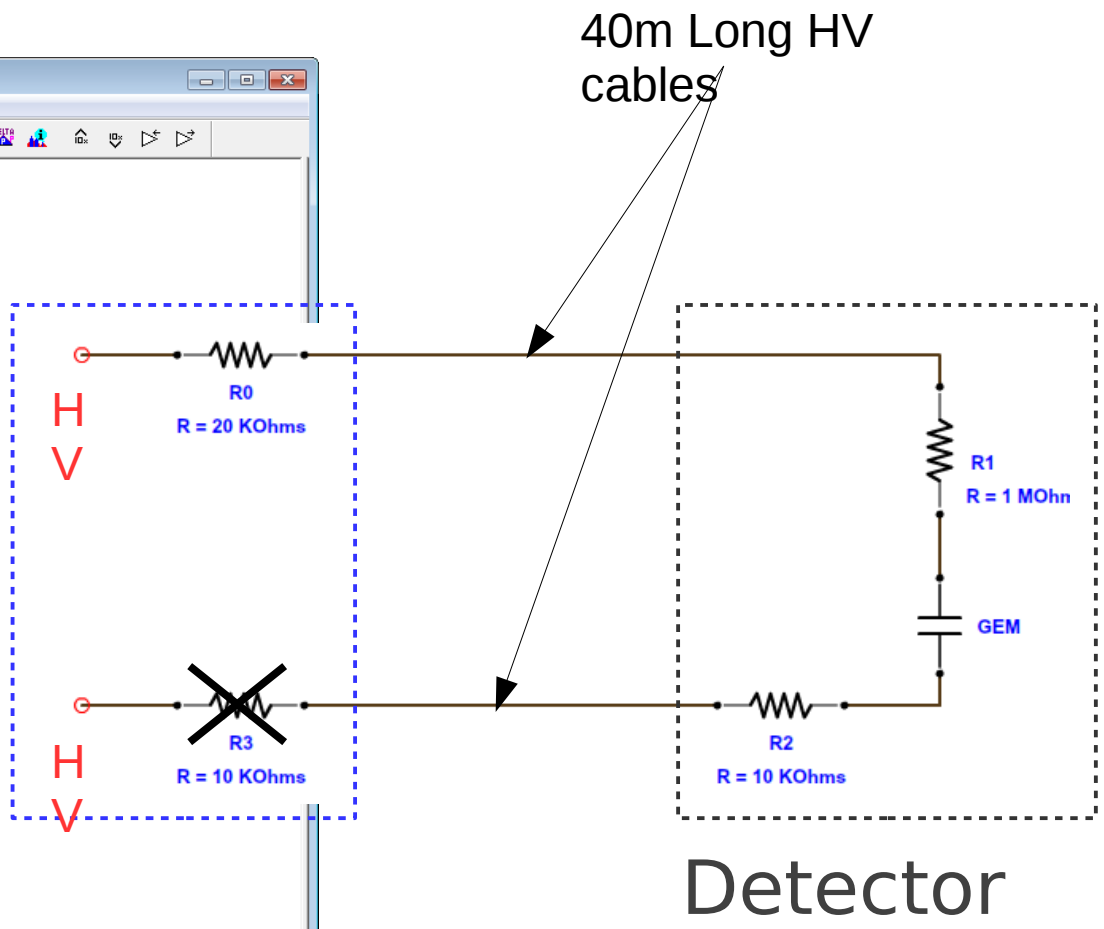
- Gain of amplifier is 100.
- The capacitance of cable used is 3nF
- The noise level is around 300mV pk-pk and rms~60mV
- With long cable the values of I_{mon} and V_{mon} are quite stable.

Power Supply Test: Noise

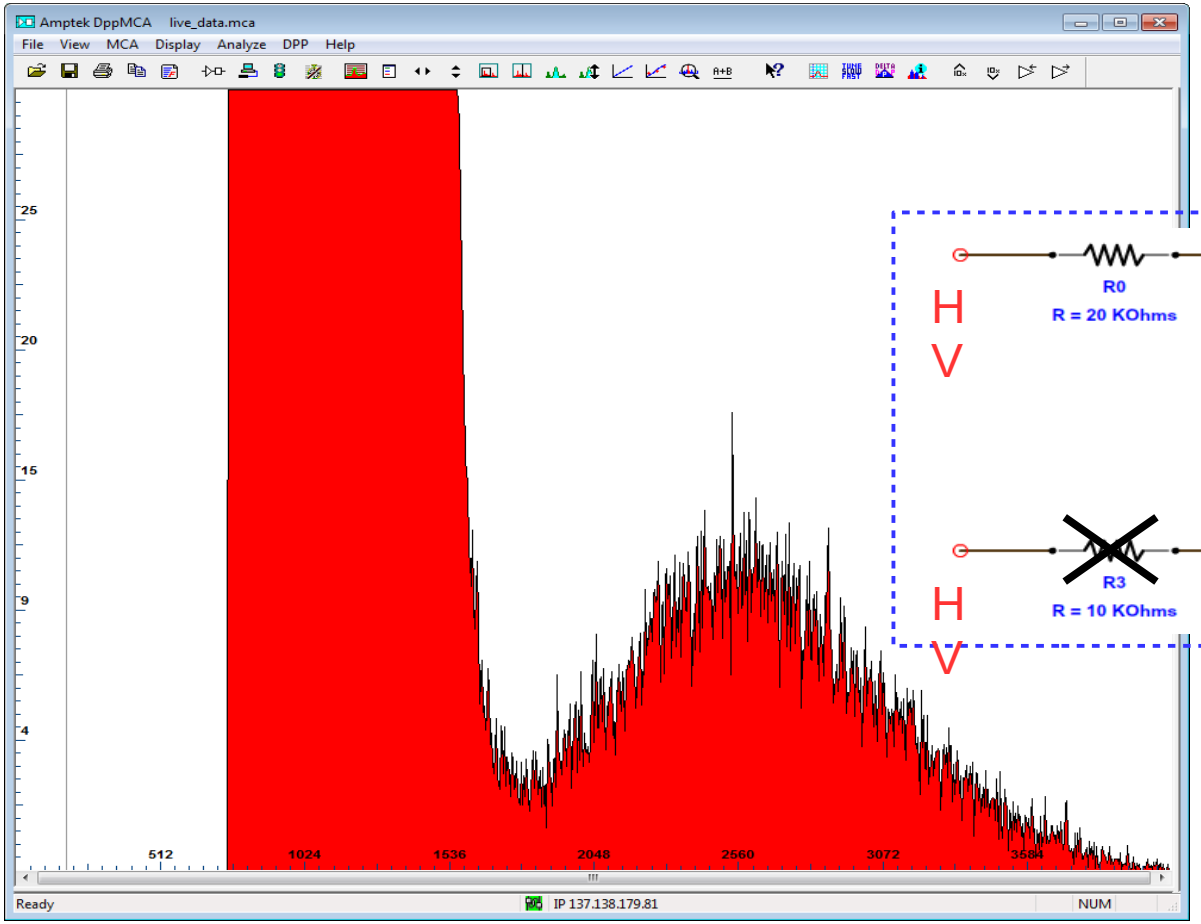


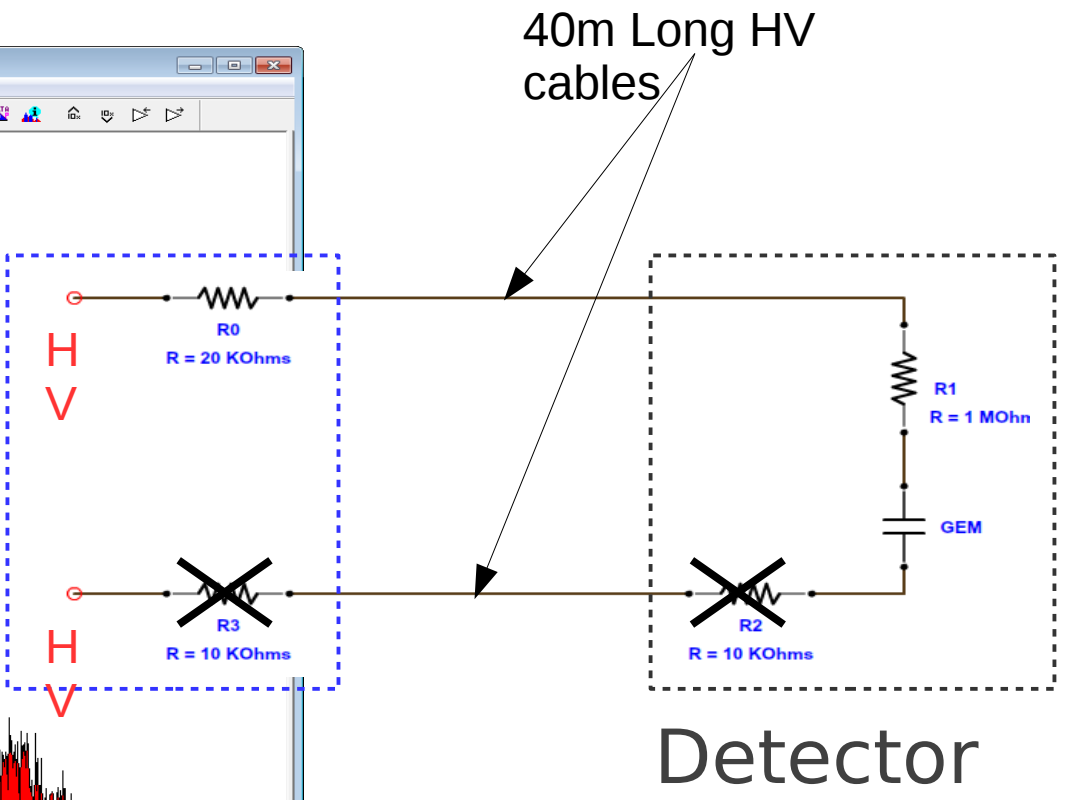
Power Supply Test: Noise





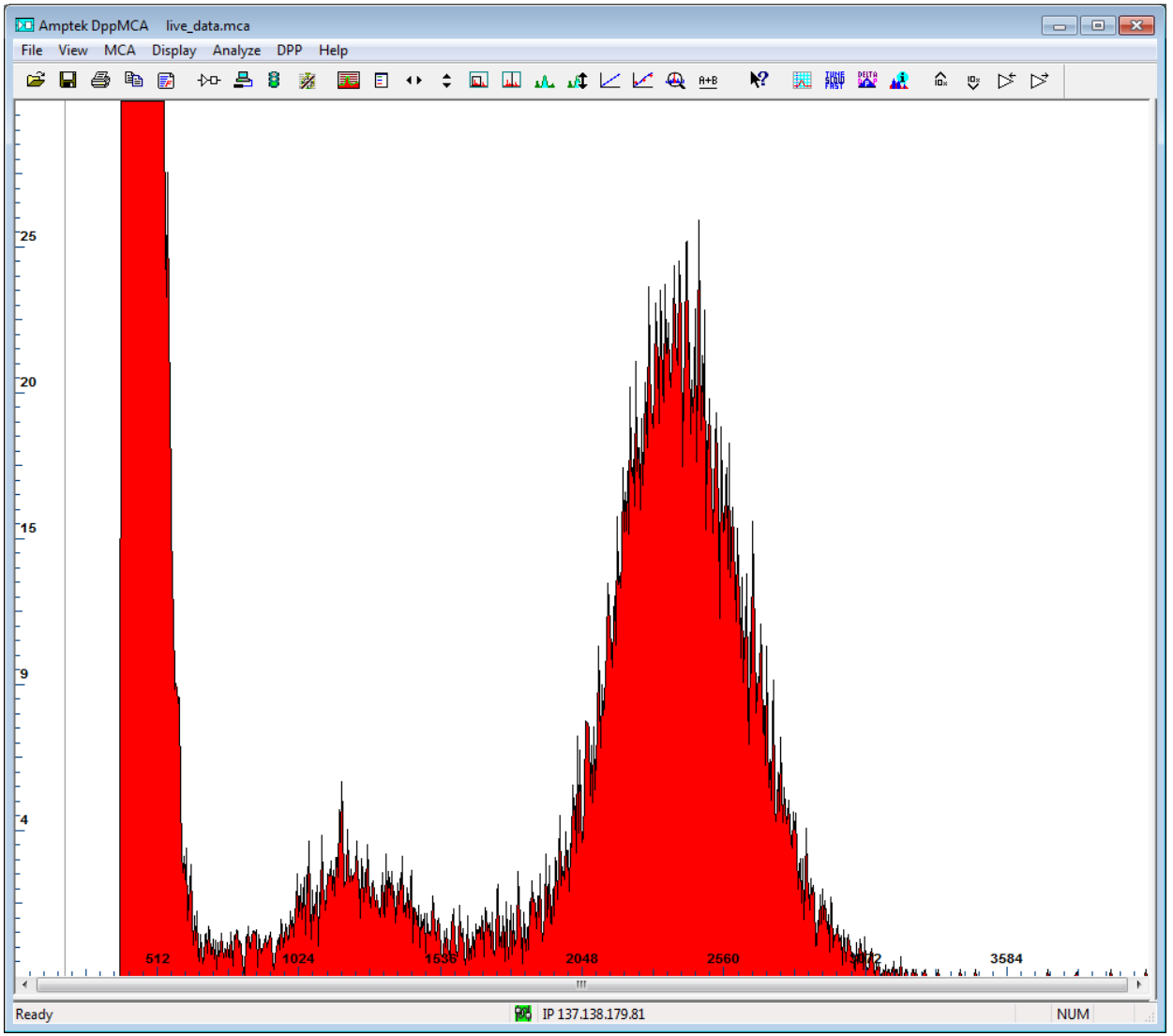
Power Supply Test: Noise





Noise is increased with this configuration.

Power Supply Test: Noise



Filter box group B

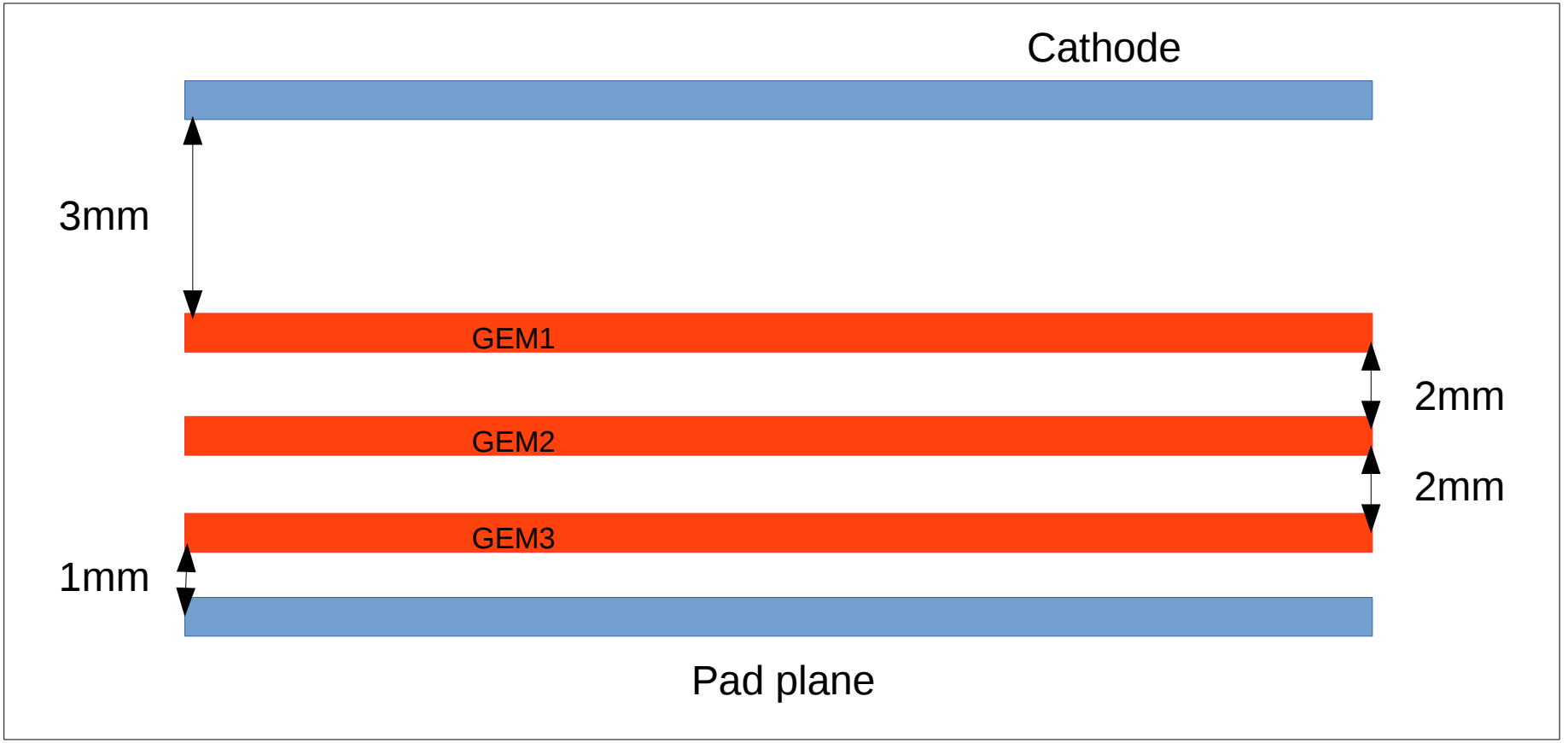
Summary

- Preliminary step- Seen QA plots for single run (Golden Run) and they look reasonably good.
- Next step is to build raw correlation.

- Tested CAEN power supply with several configuration and concluded that we should work with the filter box
- Trip behaviour still needs to be studied in detail.

- I will try to fabricate the silicon hard radiation detector for future detector.

Thank you !



Triple Gem stack