

SF6 Results from MWPC+ThGEM Hybrid readout

1

Anthony C. Ezeribe

The University of Sheffield

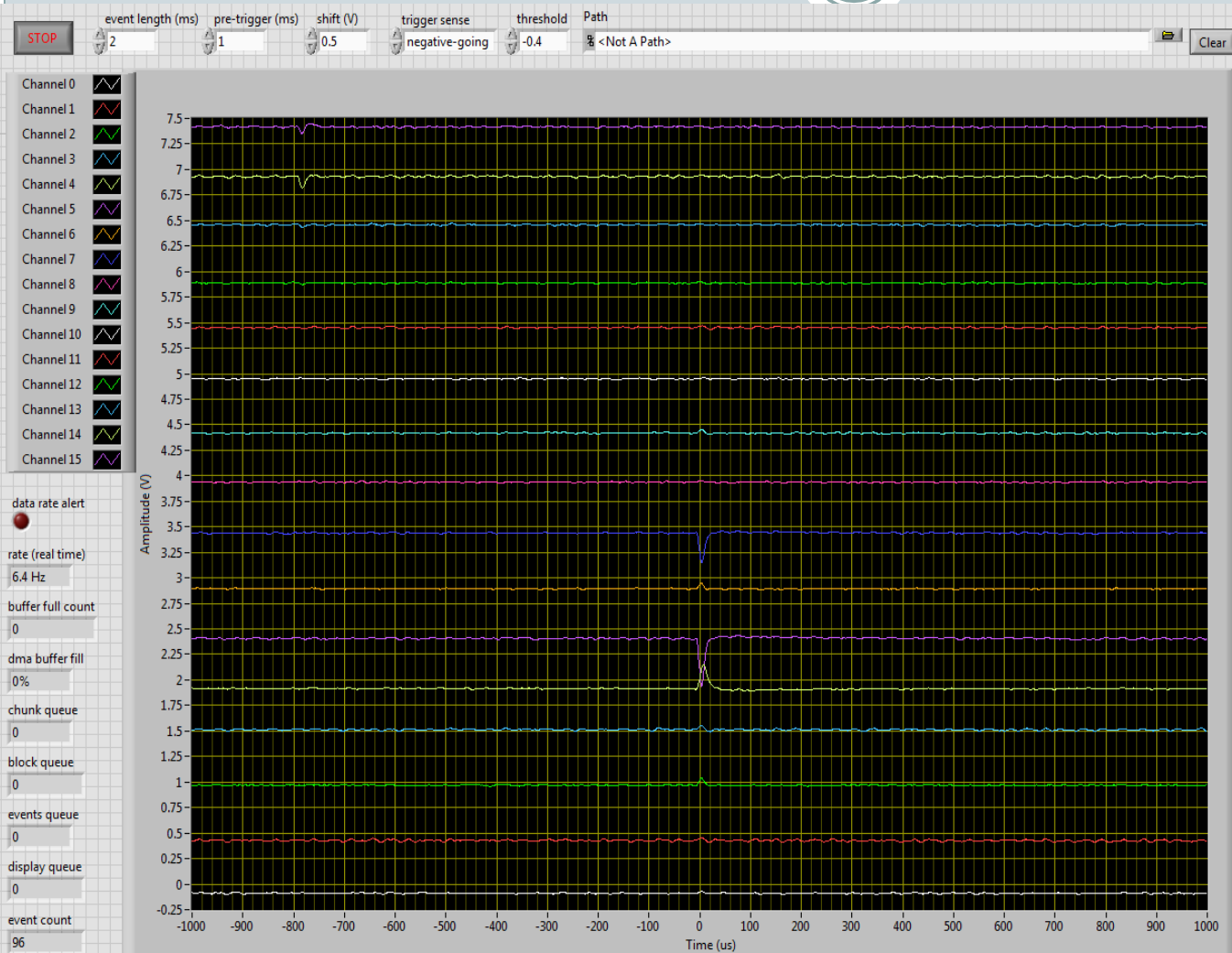
Before now

2

- ❑ We found that all signal channels of our MWPC based detector don't trigger when exposed to 5.5 MeV alpha in 20-40 Torr of SF₆.
- ❑ There was a question whether the operational field (~350 V/cm) was enough to drift the heavier (relative to electrons) SF₆ anions to the wire readout.
- ❑ To test this, we built a new field cage that runs at higher drift field, up to 1000 V/cm.

Result at higher drift field

3



Note: in CF4, we see charge signals on all the channels.

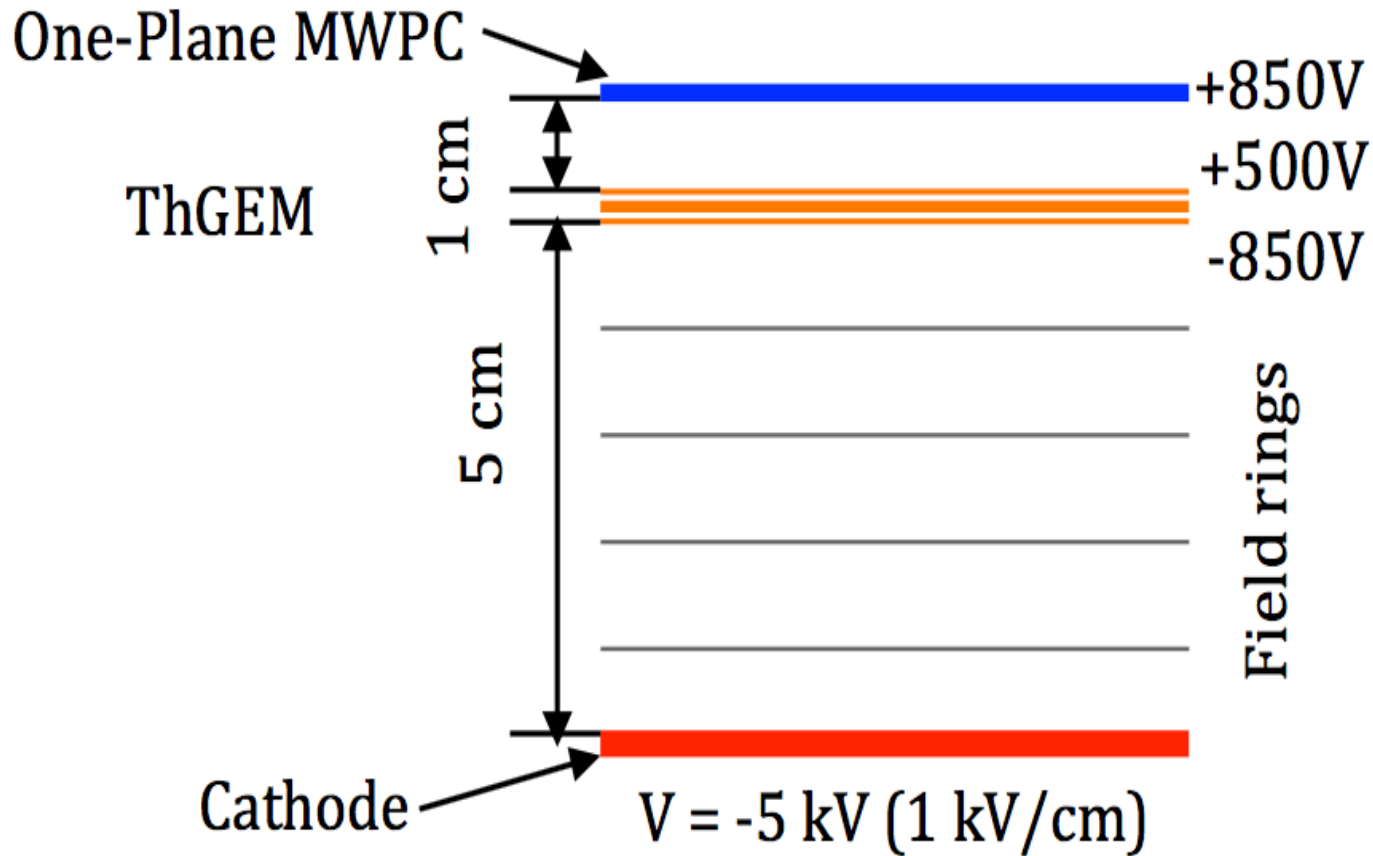
So what else is going on?

4

- ❑ Effects of SF6 quenching on ionization energy of alpha tracks as they slow down?
- ❑ Which requires high gain?
- ❑ To test this, we built a MWPC+ThGEM hybrid detector.

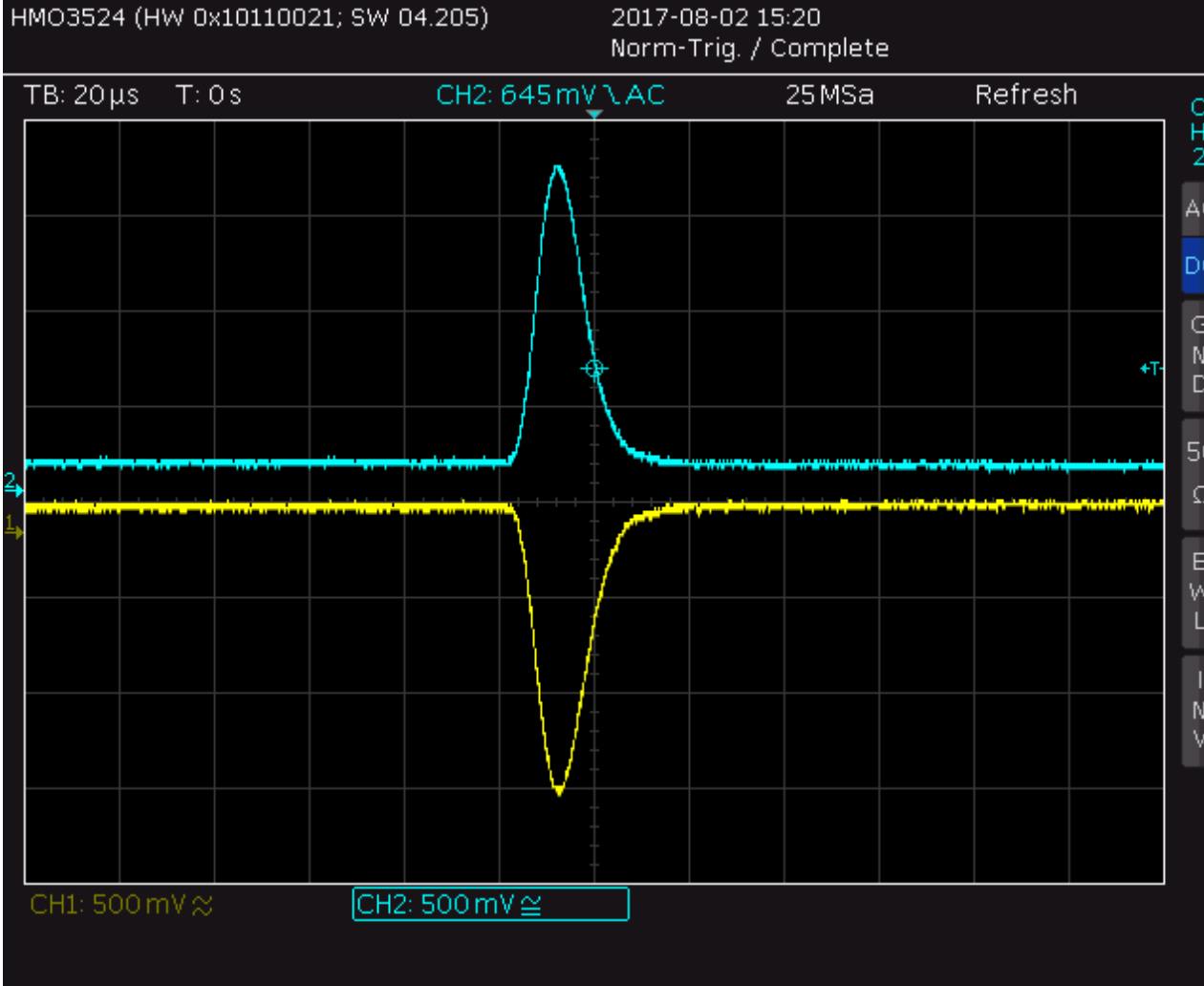
MWPC+ThGEM Hybrid Detector

5



ThGEM Response

6



Gas: SF₆

Pressure: 30 Torr

ThGEM delta-V: 1350 V

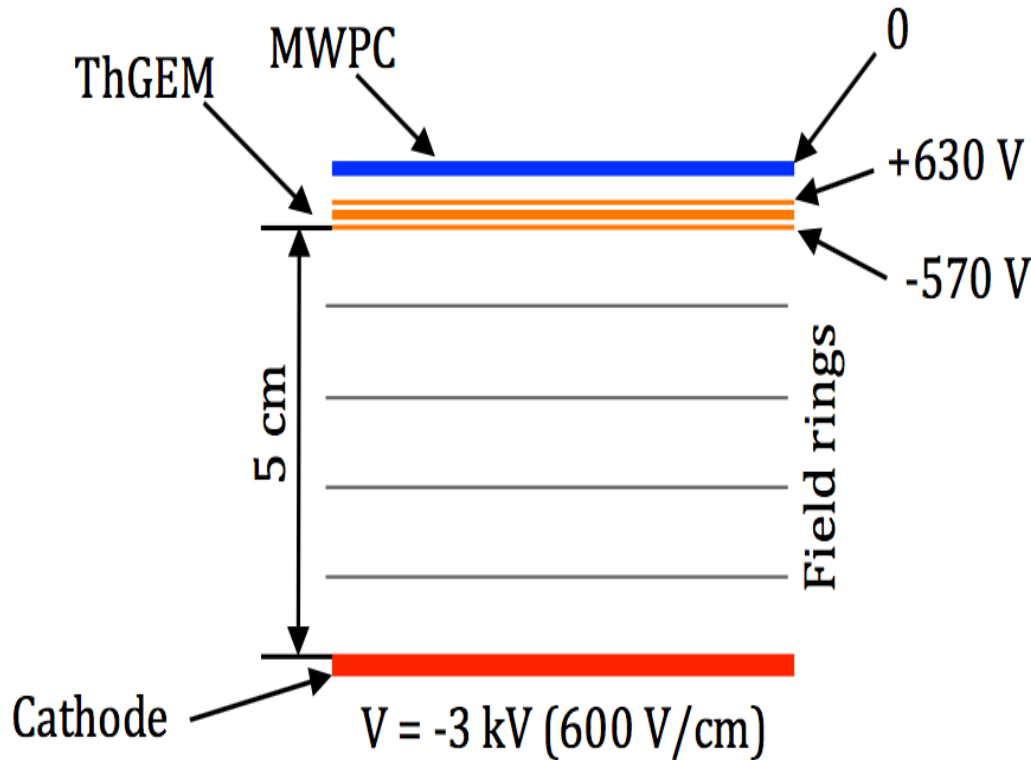
What did we learn?

7

- ❑ Charge signals on the wires are not different from what we observed without the ThGEM in place.
- ❑ Also, ThGEM sparks at avalanche fields $>13,500$ V/cm, so can't run at higher delta-V.
- ❑ Could it be that the electrons re-attach to SF6 before they reach the readout plane?
- ❑ To test this, we built a new MWPC that can allow us to reduce the distance between the ThGEM and the wires down to 1 mm.

What has changed

8



MWPC configuration

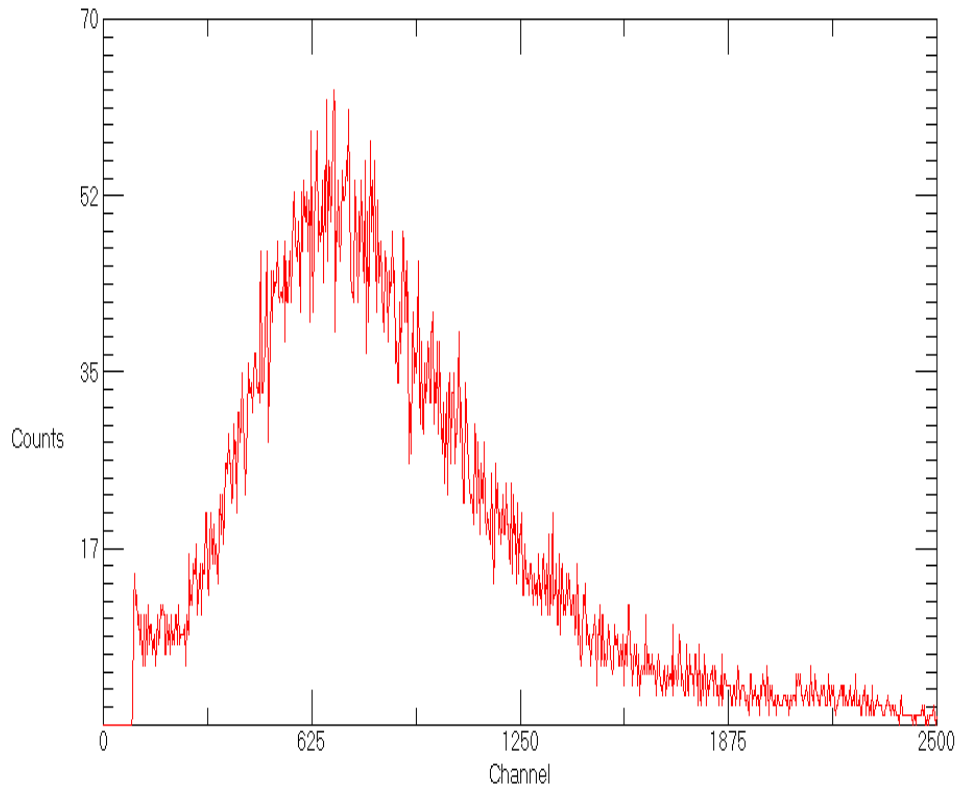


- ThGEM-MWPC distance: 1 mm ; MWPC Wire diameter: $100\text{ }\mu\text{m}$.
- Pitch of the field rings: 1 cm ; Resistors: 33 Mohms .
- Detector fiducial Volume: $2\text{ cm} \times 1.6\text{ cm} \times 10\text{ cm}$.
- ThGEM hole: 0.56 mm ; Rim: 0.05 mm ; Pitch: 0.8 mm ; Thickness: 1 mm

Gas Gain of the ThGEM

9

SF6_Alpha_Result_ThGEM_Only_37mins



Acquired: 09/08/2017 15:05:23

Real Time: 4234.00 s. Live Time: 4202.00 s.

File: C:\User\Hybrid\Alpha_30Torr_SF6_C2000V_U0_D1050V_Peak752_ThrshHold80mV_0908Channels: 8192

Detector: #1 DRIFTY-PC 926

Source: Am-241, 5.5 MeV

Gas: SF6

Pressure: 30 Torr

Range of track: 28 cm

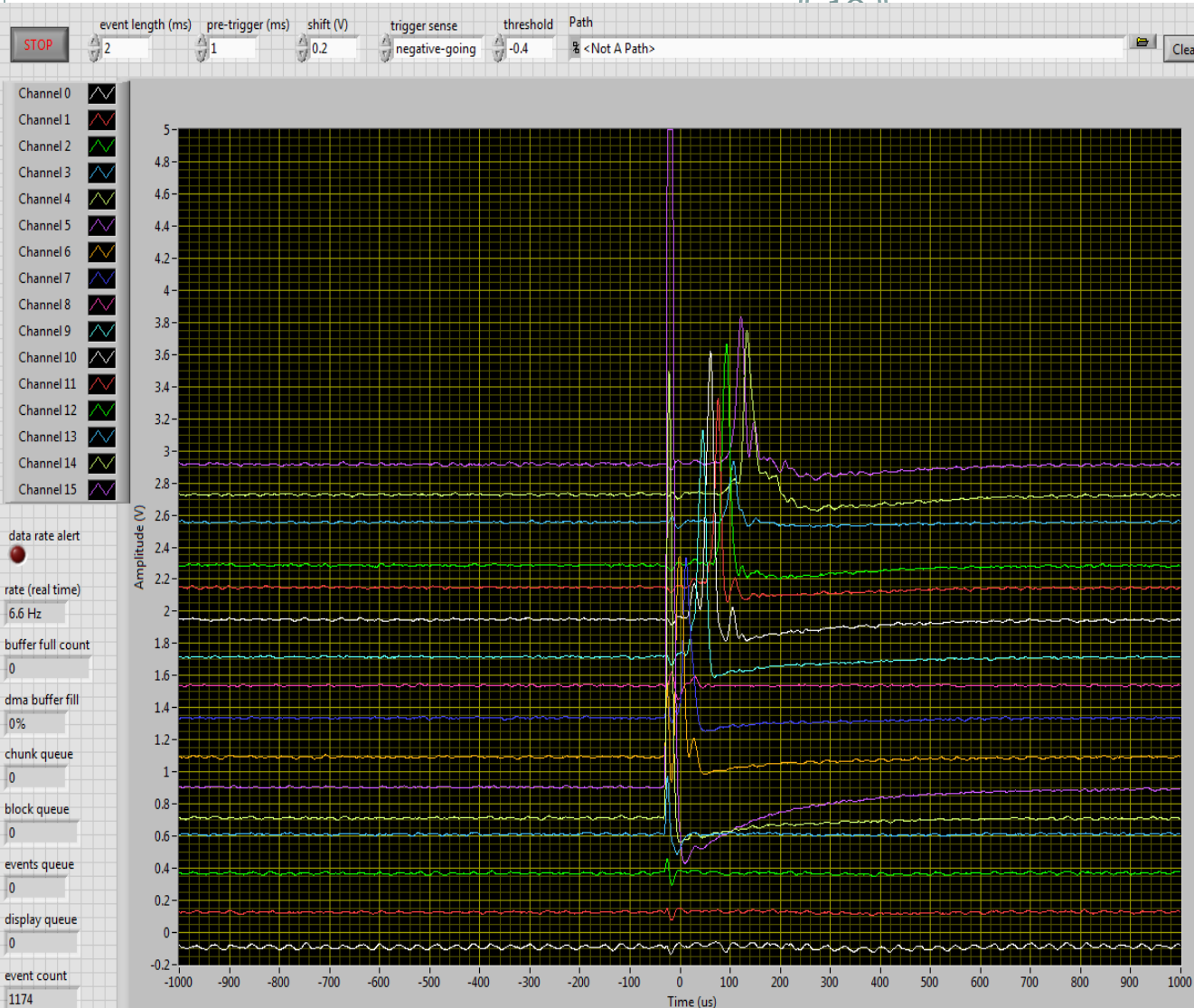
Energy deposited within the fiducial volume (SRIM): 0.34 MeV

ThGEM Delta-V: 1050 V

Peak channel: 752

Gas gain: 1270

Alpha Track

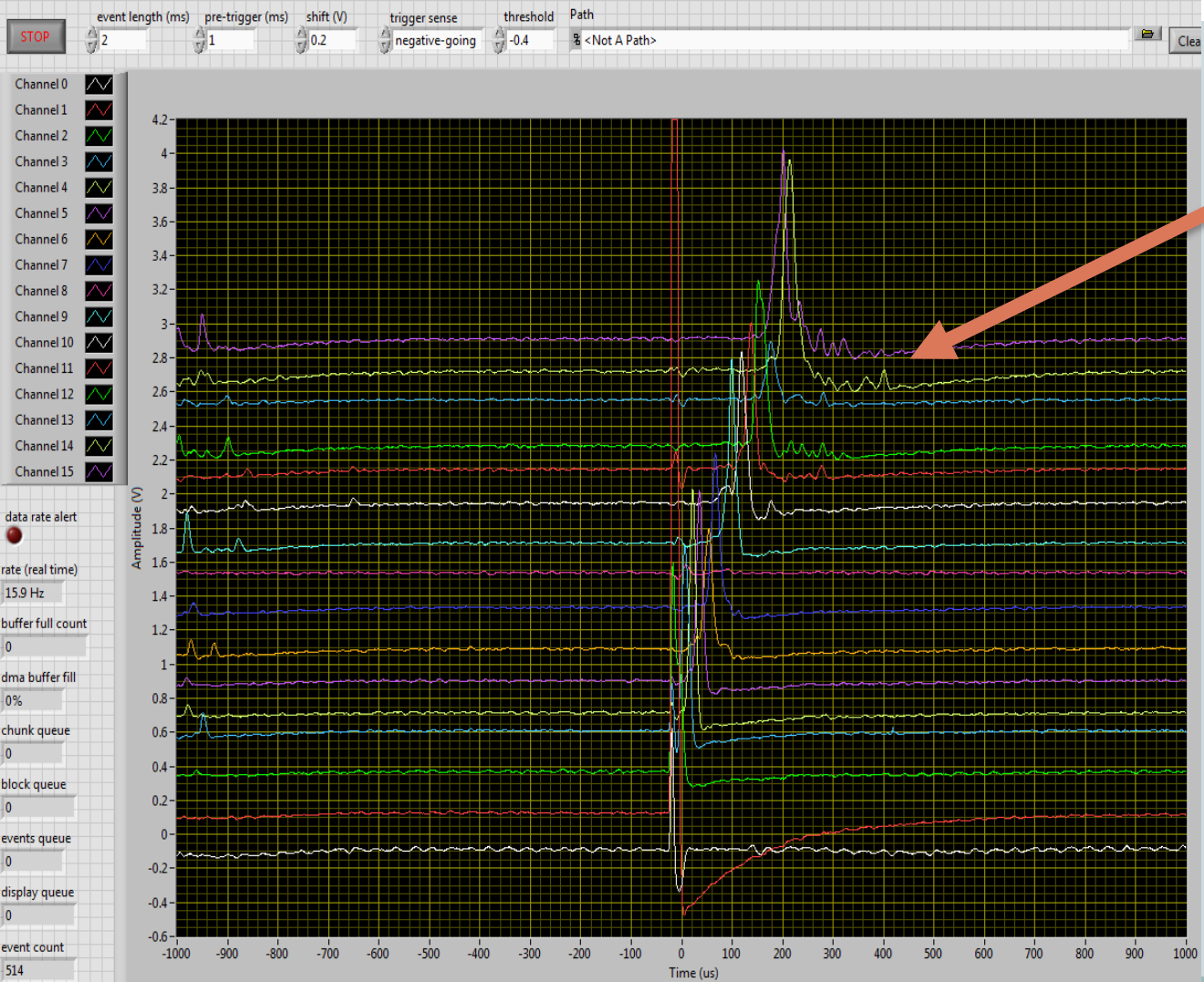


Gas: 30 Torr of SF₆

Charge collected:
cations resulting
from electron
avalanche.

**Can change voltage
bias of the setup to
collect electrons.**

Alpha Track



Hint of slower drifting cations.

What next?

12

We are analyzing the data