Uva GEM R&D Update

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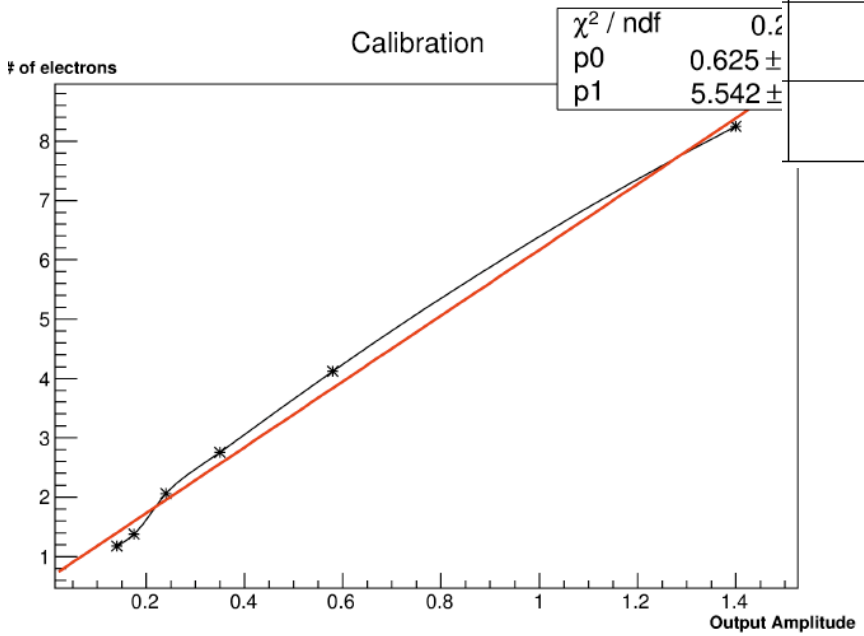
Status

- First chamber under testing now.
  - First chamber had a short in a sector, sector isolated, the rest of the chamber is OK
- Construction of second chamber complete, will be turned on soon.
  - Shorted sections discovered in two foils during construction
  - Bad Foil #1: 1 sector shorted –likely due to contamination during soldering
  - Bad Foil #2: 3 sectors shorted – likely due to metal dust from the stretcher screws.
- Design for the modified prototypes completed; the order for the foils placed
- Italian APV readout system setup at UVa and is working well
- After the short with the 1st chamber and the shorts in the foils:
  - Writing operating procedures for chambers
  - Modifications to the stretcher
  - Modified construction procedure
  - Installed HV trip feature, at +1μA (over ~ 800 μA operating current)

Chamber Gain Calibration

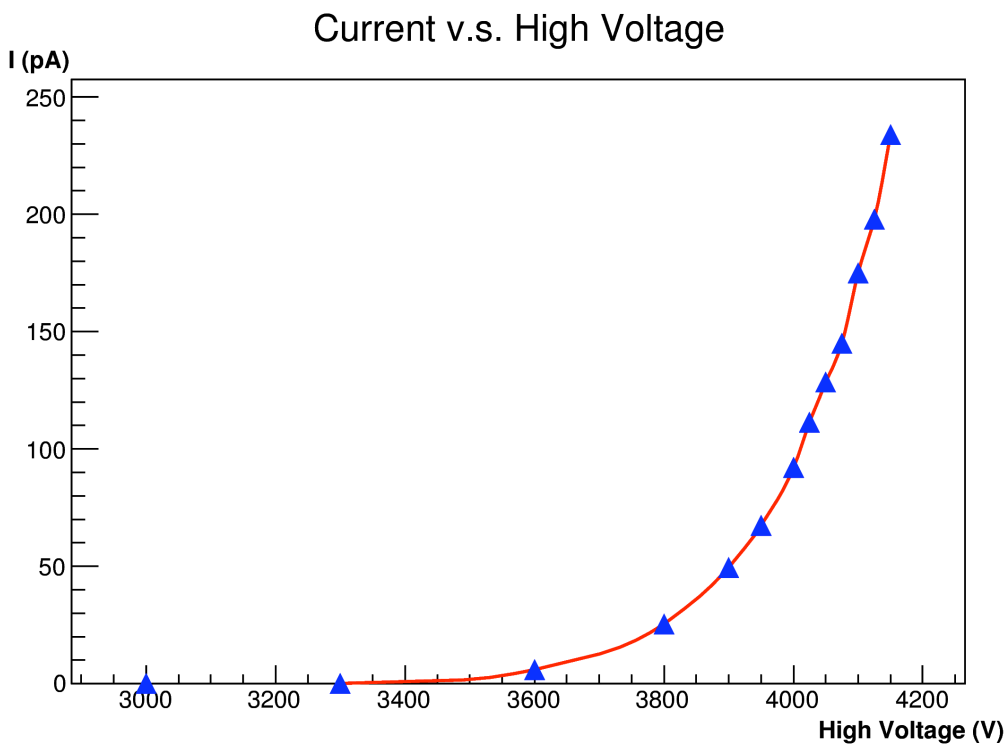
First calibrate the analog amplifier

Value of Capacitance (pF)	Total Charge (C)	# of Electrons	Output Signal (mV)
3.3	1.32×10^{-12}	8.25×10^{6}	1400
1.65	6.6×10^{-13}	4.125×10^{6}	580
1.1	4.4×10^{-13}	2.75×10^{6}	350
0.825	3.3×10^{-13}	2.0625×10^{6}	240
0.55	2.2×10^{-13}	1.375×10^{6}	175
0.47	1.88×10^{-13}	1.175×10^{6}	140



Chamber Gain Calibration

- Then measure the amplified signal (detected over 128 strips) from the 55Fe source
- 55Fe (5.9 kev photons) generate about 200 primary electrons.
- Use the calibrated amplified signal to calculate the gain.
- Cross calibrate the gains from the small prototype and the big prototype using the current measurement from the readout (from 128 stripes)
    - current measurement accuracy ~ 10 pA.


Current v.s. High Voltage
I (pA)
250
200
150
100
50
0
3000
3200
3400
3600
3800
4000
4200
High Voltage (V)

: 1. Testing with β Source

2. Picoammeter range was set to 2nA; Average per 100 counts.

3. High Voltage: 4149.24V

Testing Results

D	216	195.1	197.7	174	153.8	155.7	214	191.8	193.7	169	136.1	141	16	4.8	6.7
	194			153			191			134			4		
	183			140			176			120			0		
C	282	264.1	264.3	206	182.4	183.3	207	185.2	185.7	170	144.6	148.3	46	36.6	35.7
	264			182			185			143			37		
	247			162			165			132			24		
B	242	234.7	234	85	62.9	65	174	157	159.3	195	163.9	168.3	180	168.7	168
	235			62			156			162			169		
	225			48			148			148			155		
A	190	188.1	188.3	62	58.1	58.3	207	205	205	149	146.6	145.7	162	160.1	160.3
	188			58			205			147			160		
	187			55			203			141			159		
	1			2			3			4			5		

Very preliminary results for gain calibration

Voltage	Gain
4150	1200
4200	1600
4250	2000
4300	2600
4350	3500
4400	4600

CMS Prototype Gain measurements with the divider