Characterization of Triple-GEM in Argon-based Gas Mixtures

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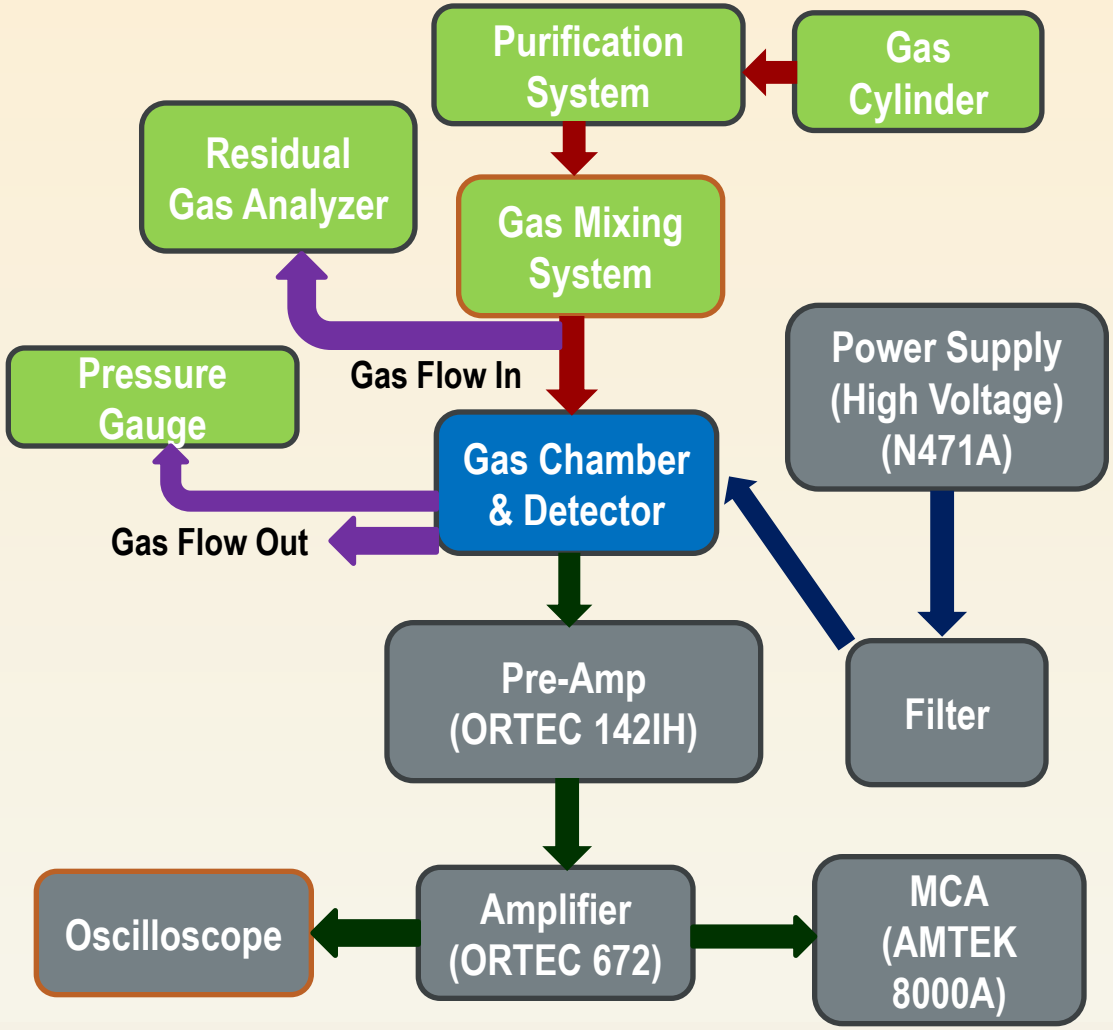
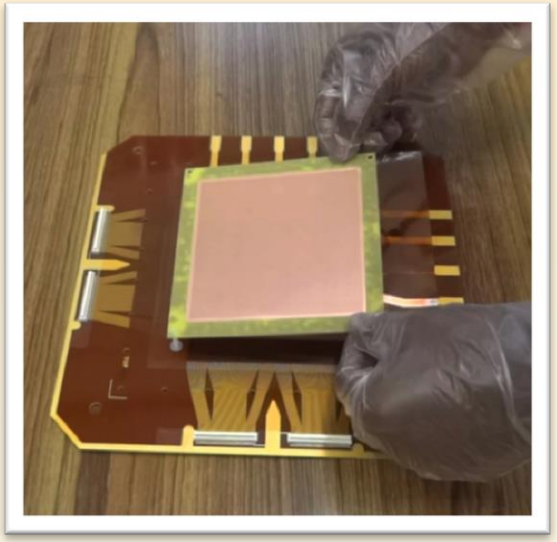
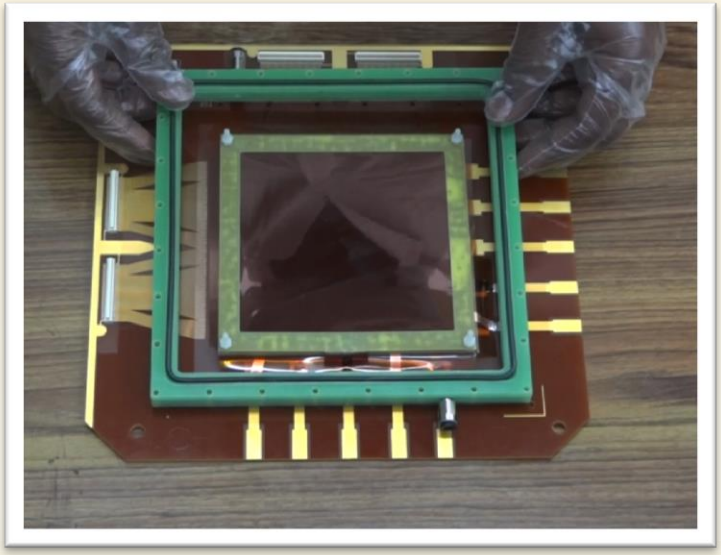
Schematic Setup

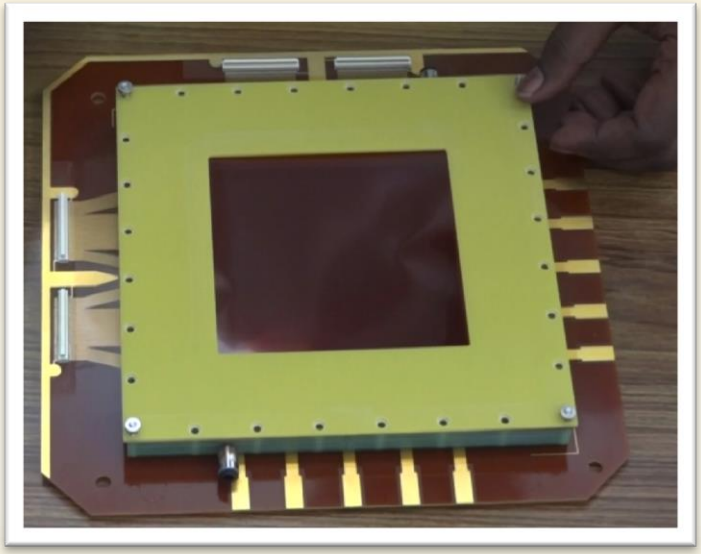


Triple-GEM Assembly

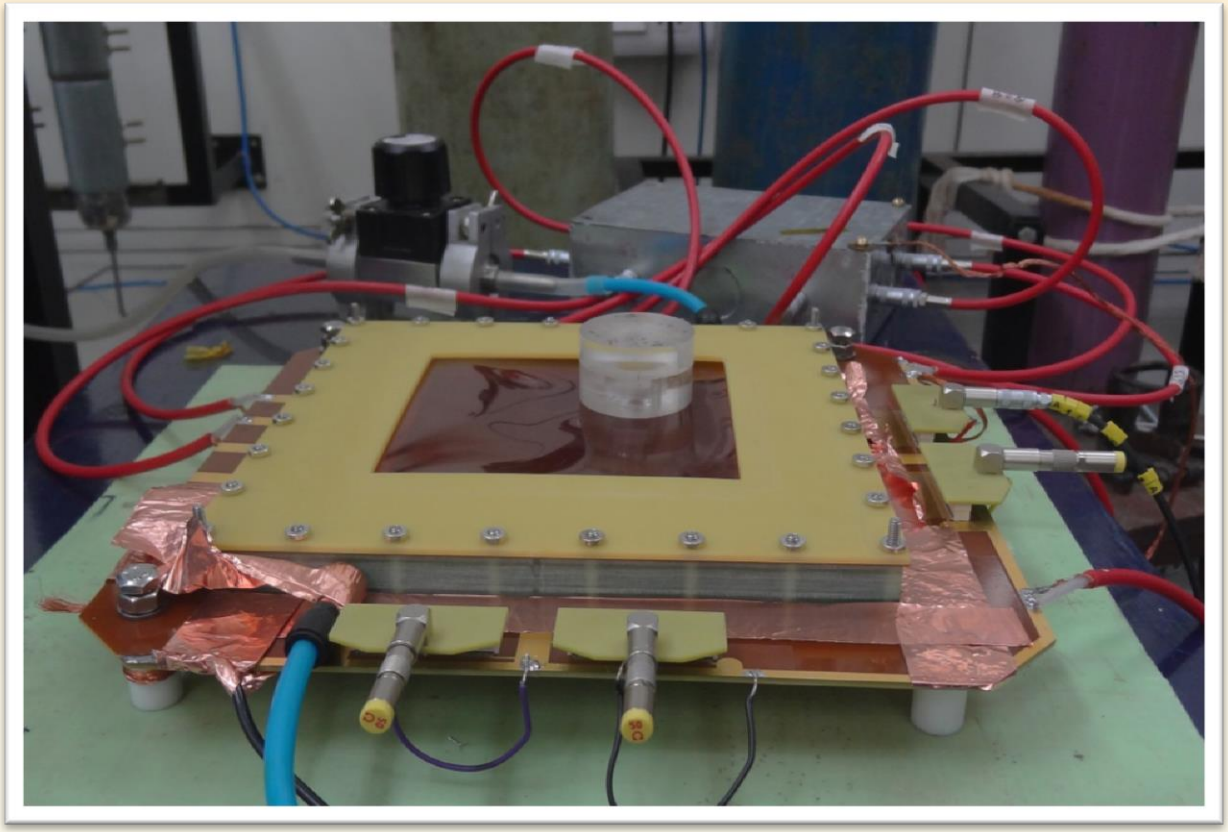
- Components procured from CERN Workshop
- GEM stages tested for HV tolerance





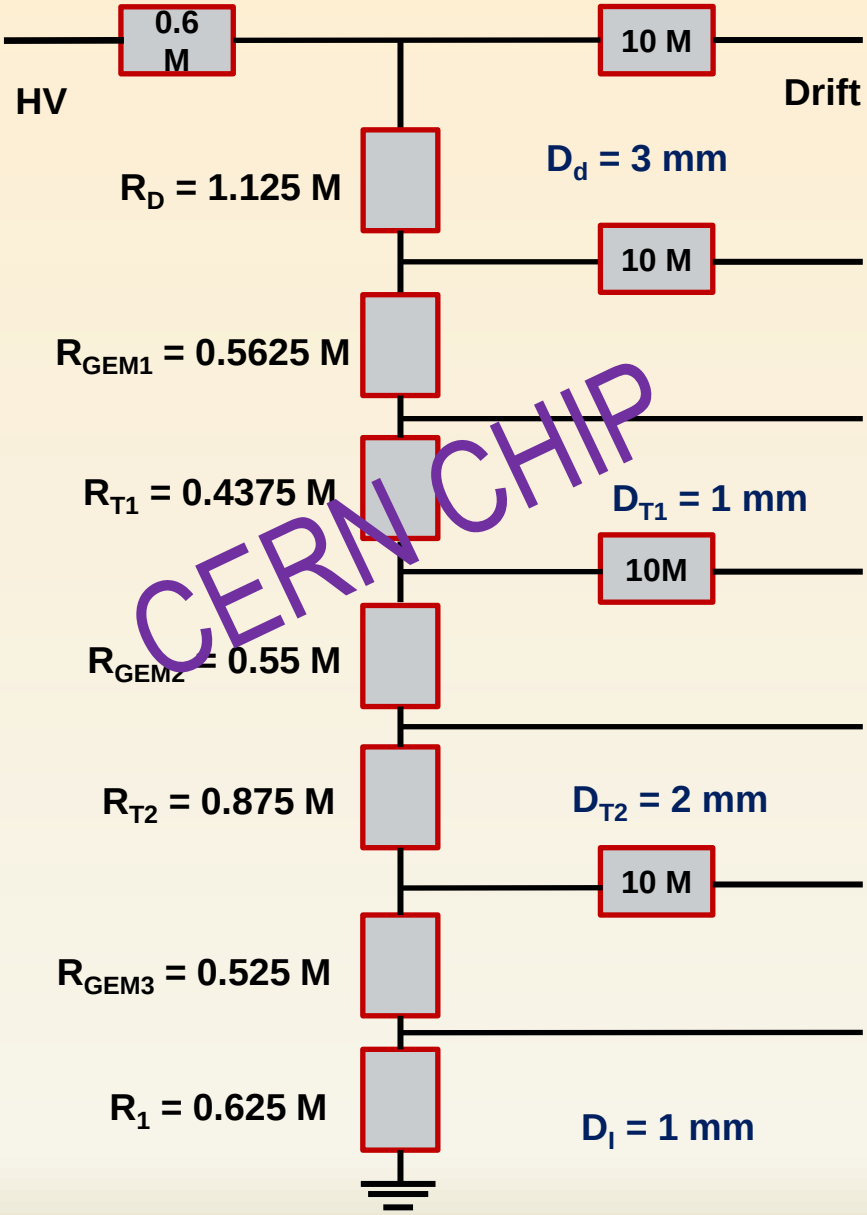


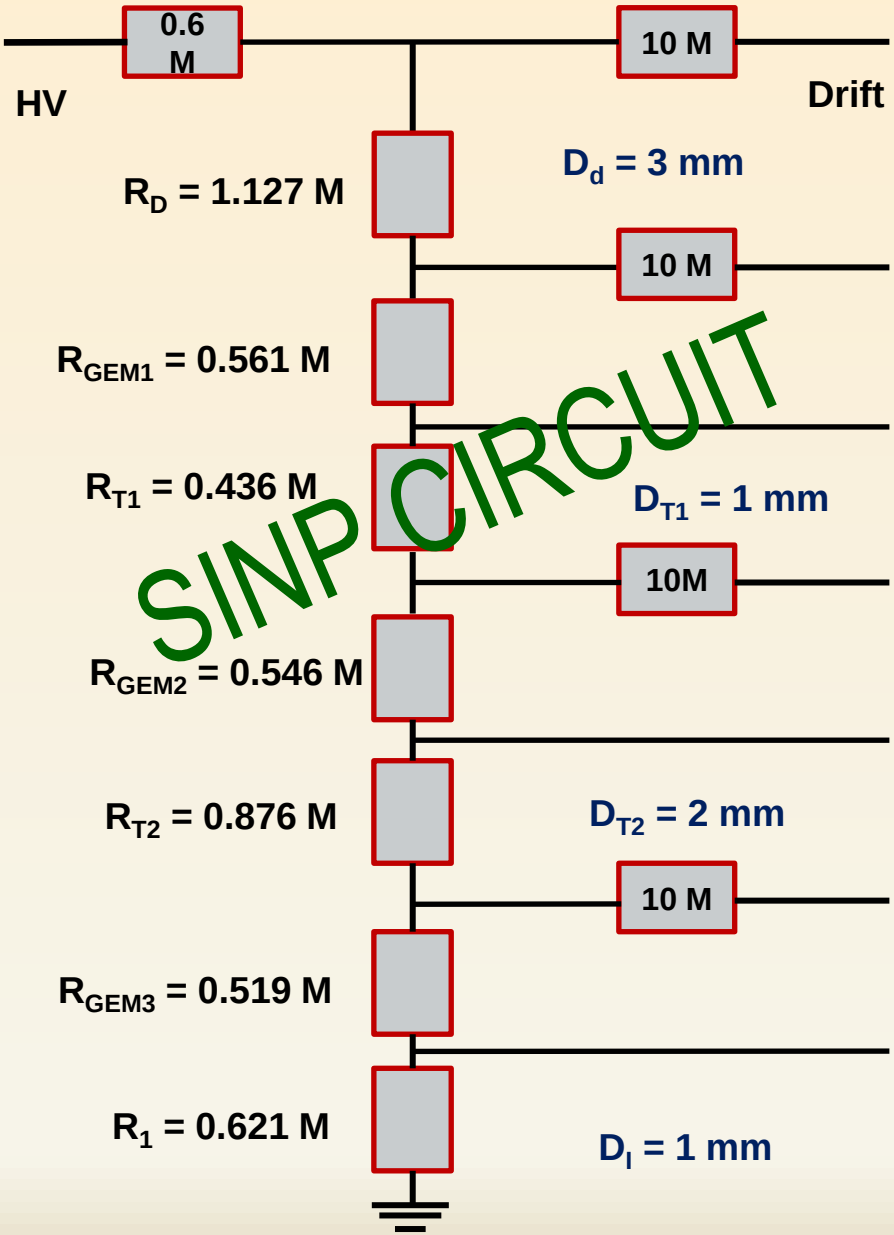
Triple-GEM Test



- Test done with 55Fe source
- Gas mixture Ar/CO2 (70:30/80:20/90:10) at STP

HV Divider

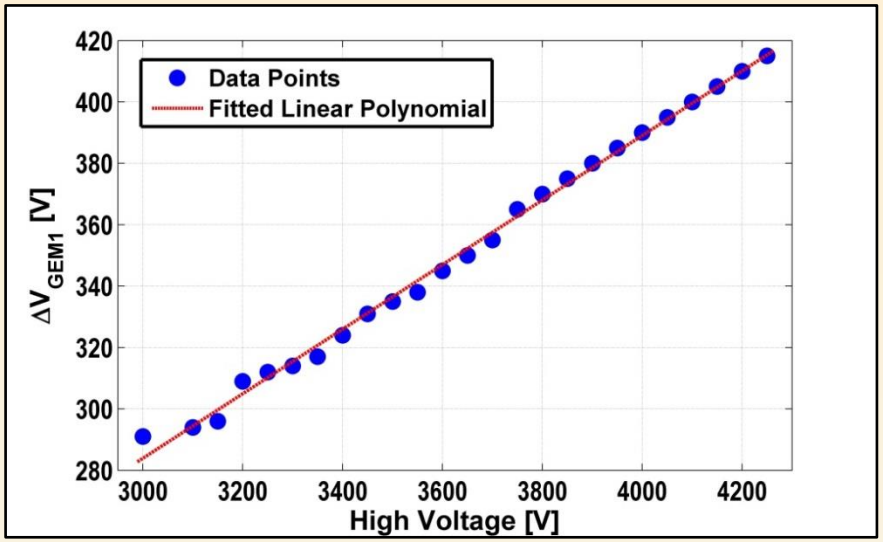

0.6 M
10 M
HV
Drift
R_D = 1.125 M
D_d = 3 mm
10 M
R_{GEM1} = 0.5625 M
R_{T1} = 0.4375 M
D_{T1} = 1 mm
10M
R_{GEM2} = 0.55 M
R_{T2} = 0.875 M
D_{T2} = 2 mm
10 M
R_{GEM3} = 0.525 M
R_1 = 0.625 M
D_I = 1 mm
CERN CHIP

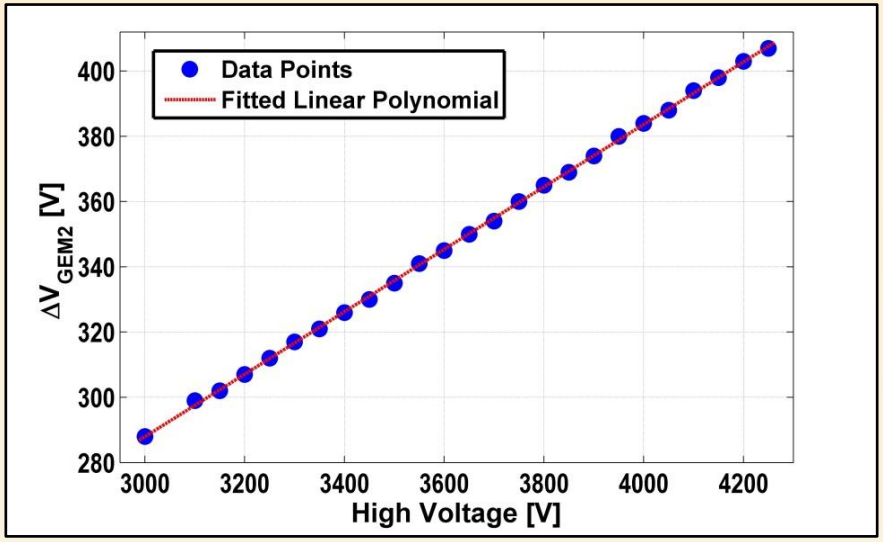

0.6 M
10 M
HV
Drift
R_D = 1.127 M
D_d = 3 mm
10 M
R_{GEM1} = 0.561 M
R_{T1} = 0.436 M
D_{T1} = 1 mm
10M
R_{GEM2} = 0.546 M
R_{T2} = 0.876 M
D_{T2} = 2 mm
10 M
R_{GEM3} = 0.519 M
R_1 = 0.621 M
D_I = 1 mm
SINP CIRCUIT

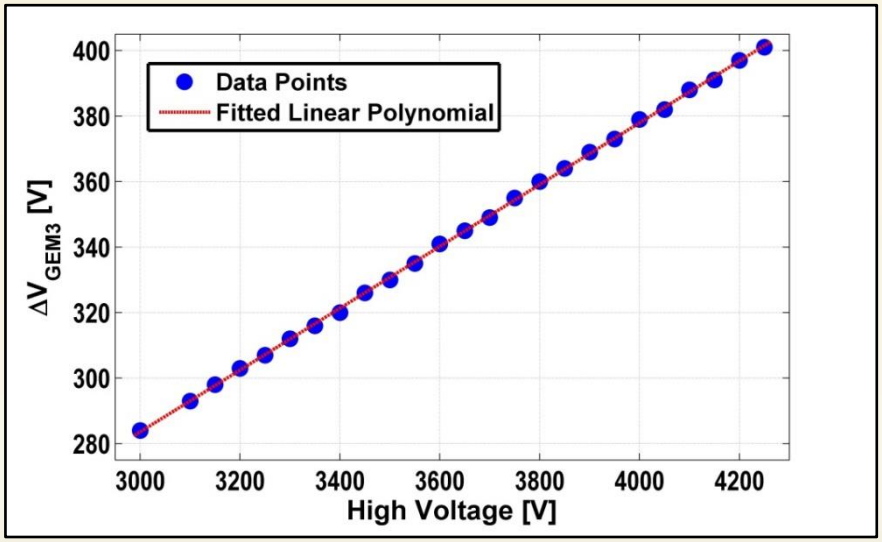
Voltage & Current Readings

High Voltage (V)	Current (μAmp)	Voltage at Drift (V)	Voltage at G1 Top (V)	Voltage at G1 Bottom (V)	Voltage at G2 Top (V)	Voltage at G2 Bottom (V)	Voltage at G3 Top (V)	Voltage at G3 Bottom (V)
3000	566	2560	1911	1662	1404	1117	628	344
3050	574.5	2600	1984	1687	1429	1136	638	350
3100	584.5	2650	2010	1715	1451	1152	649	356
3150	593.5	2690	2040	1744	1475	1173	660	362
3200	603.5	2730	2080	1771	1498	1191	670	367
3250	612.5	2770	2110	1798	1521	1210	680	373
3300	622.5	2820	2140	1826	1544	1228	691	379
3350	631	2860	2170	1853	1568	1246	701	385
3400	640.5	2900	2205	1881	1591	1265	711	391
3450	650.5	2950	2240	1909	1615	1285	722	396
3500	659.5	2990	2270	1936	1637	1302	732	402
3550	669.5	3035	2305	1967	1664	1323	744	408
3600	678.5	3080	2340	1995	1688	1343	755	414
3650	688	3120	2370	2020	1711	1361	765	420
3700	698	3160	2400	2045	1734	1380	775	426
3750	706.5	3210	2440	2070	1758	1398	786	431
3800	715.5	3250	2470	2100	1782	1417	797	437
3850	725.5	3290	2500	2130	1805	1436	807	443
3900	734.5	3340	2540	2160	1828	1454	818	449
3950	744	3380	2570	2185	1853	1473	828	455
4000	753	3420	2600	2210	1875	1491	839	460
4050	762.5	3460	2630	2235	1895	1507	847	465
4100	772	3510	2670	2270	1923	1529	860	472
4150	782	3540	2695	2290	1942	1544	868	477
4200	790.5	3590	2730	2320	1970	1567	881	484
4250	801	3630	2760	2345	1988	1581	889	488

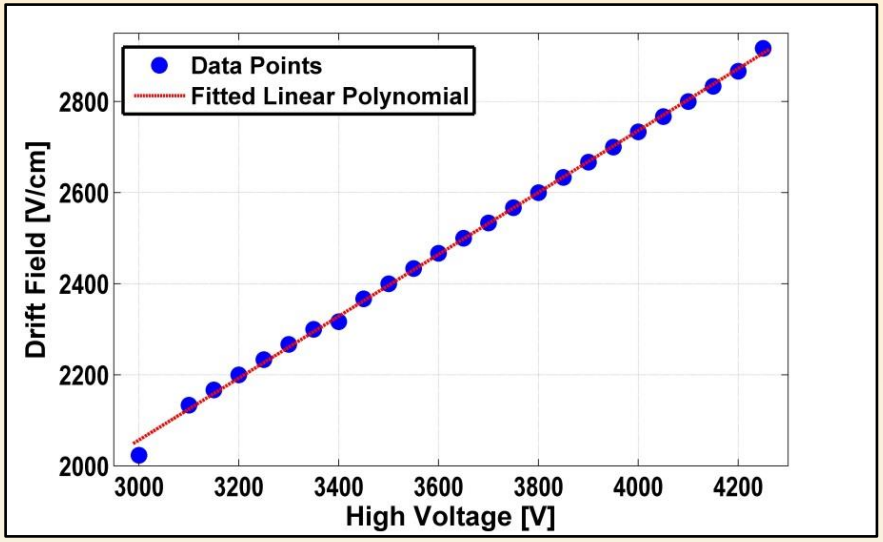
Voltage Distributions in GEMs

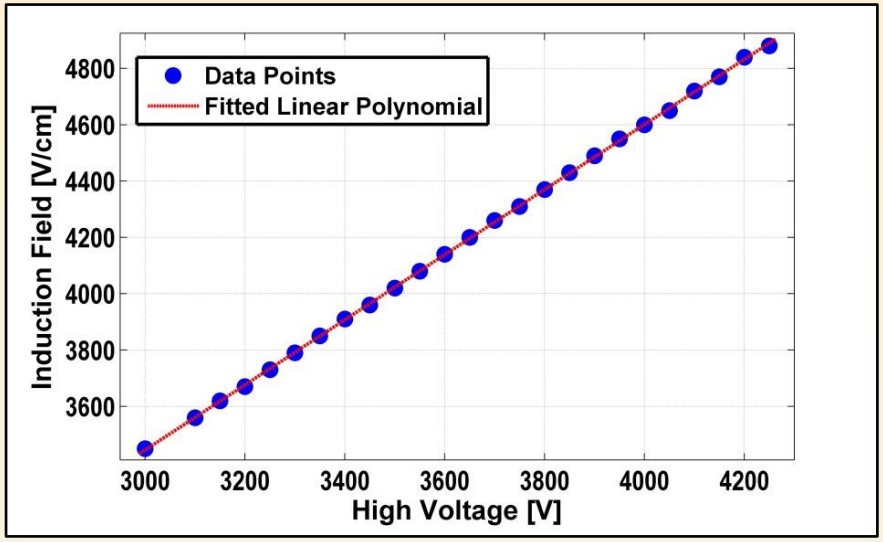


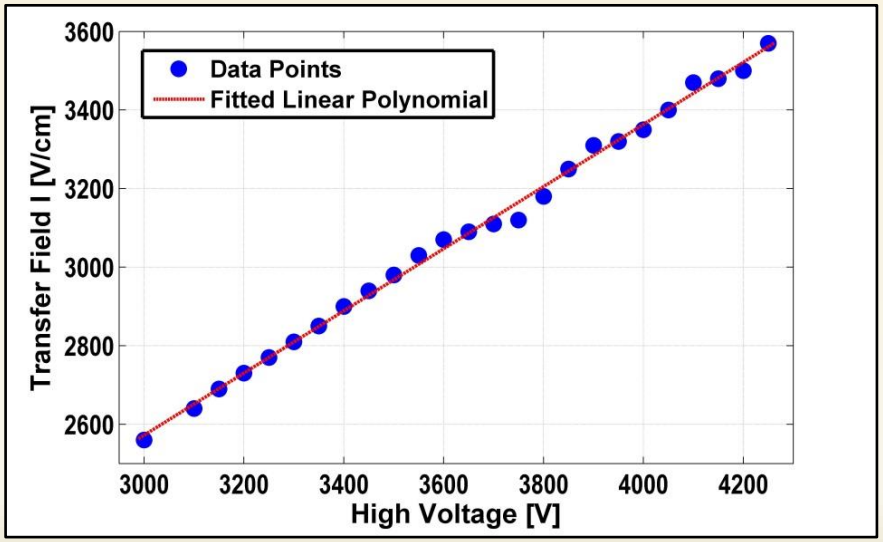


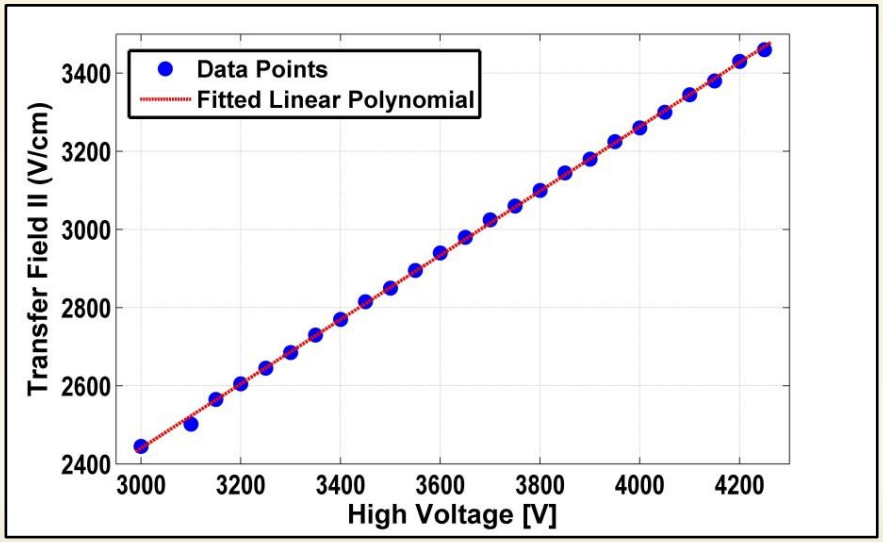


Field Configurations

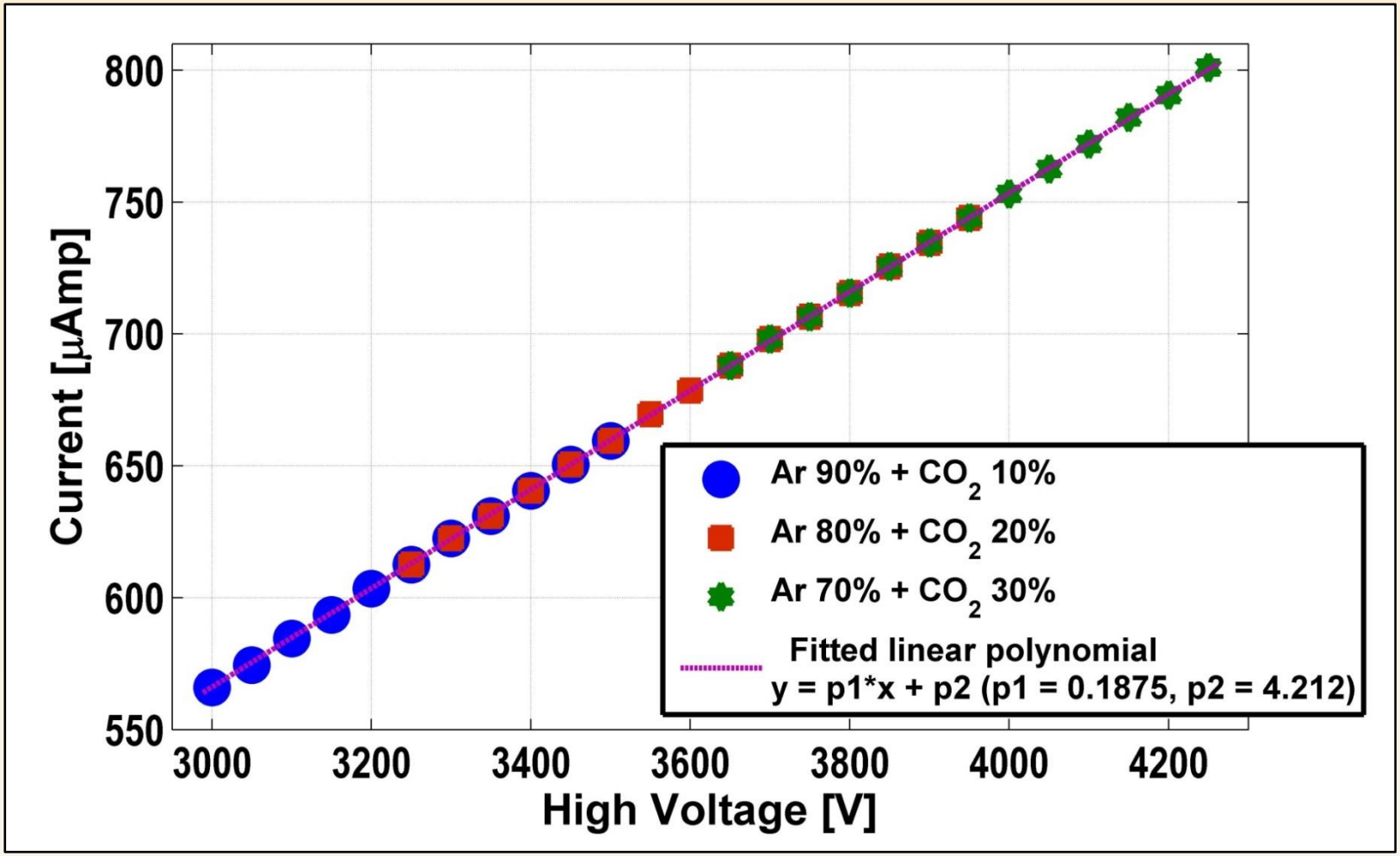




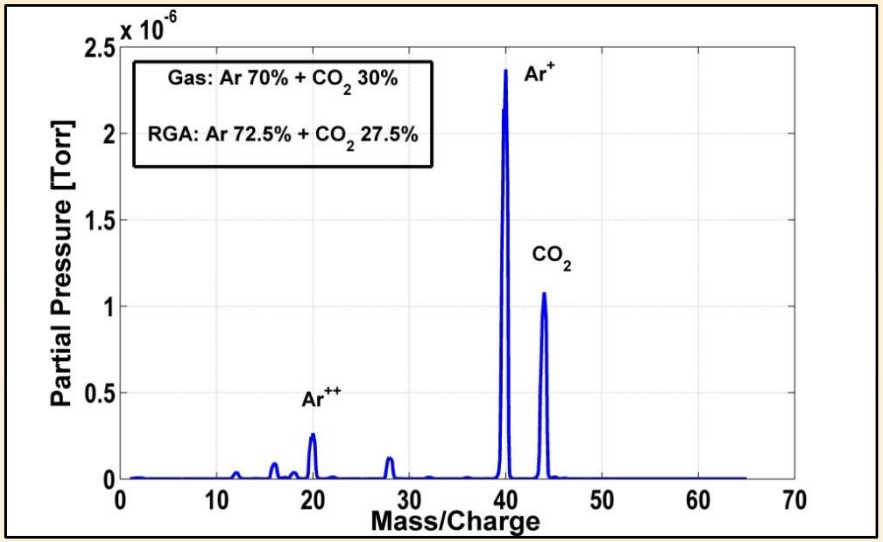


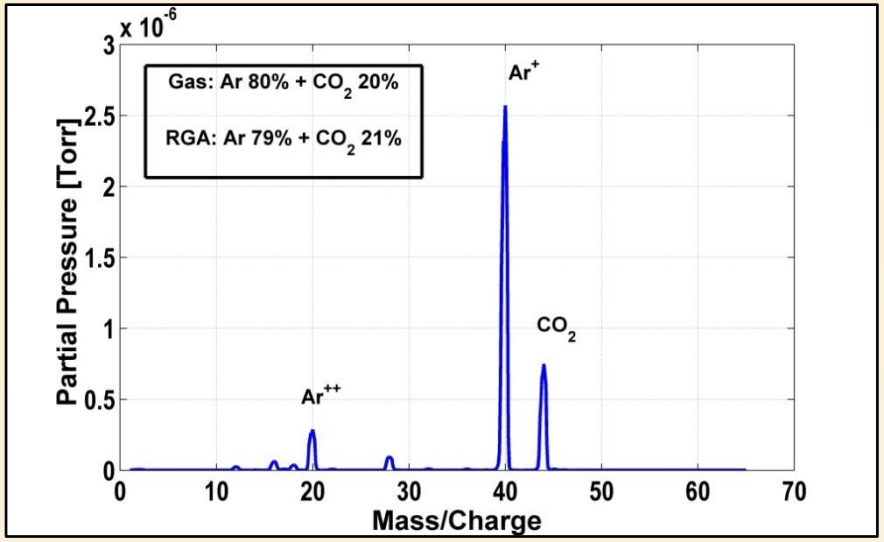


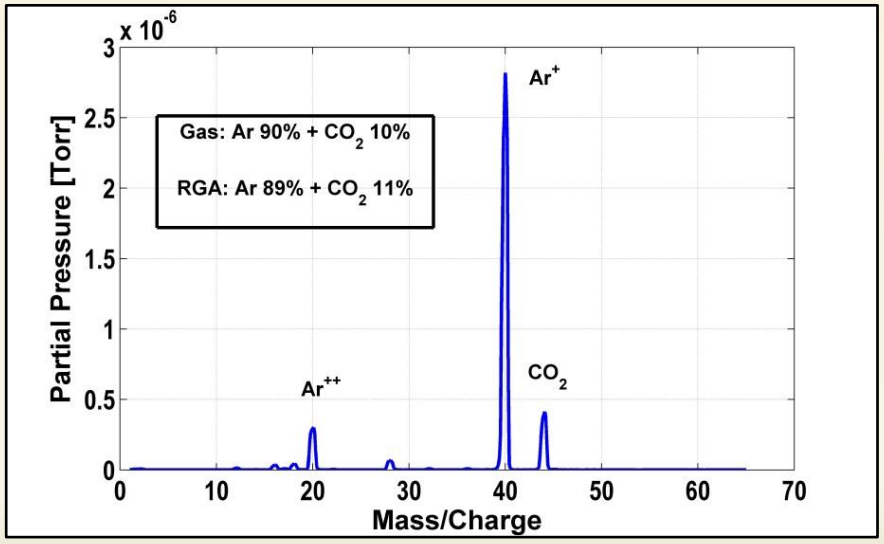
Voltage-Current Characteristics



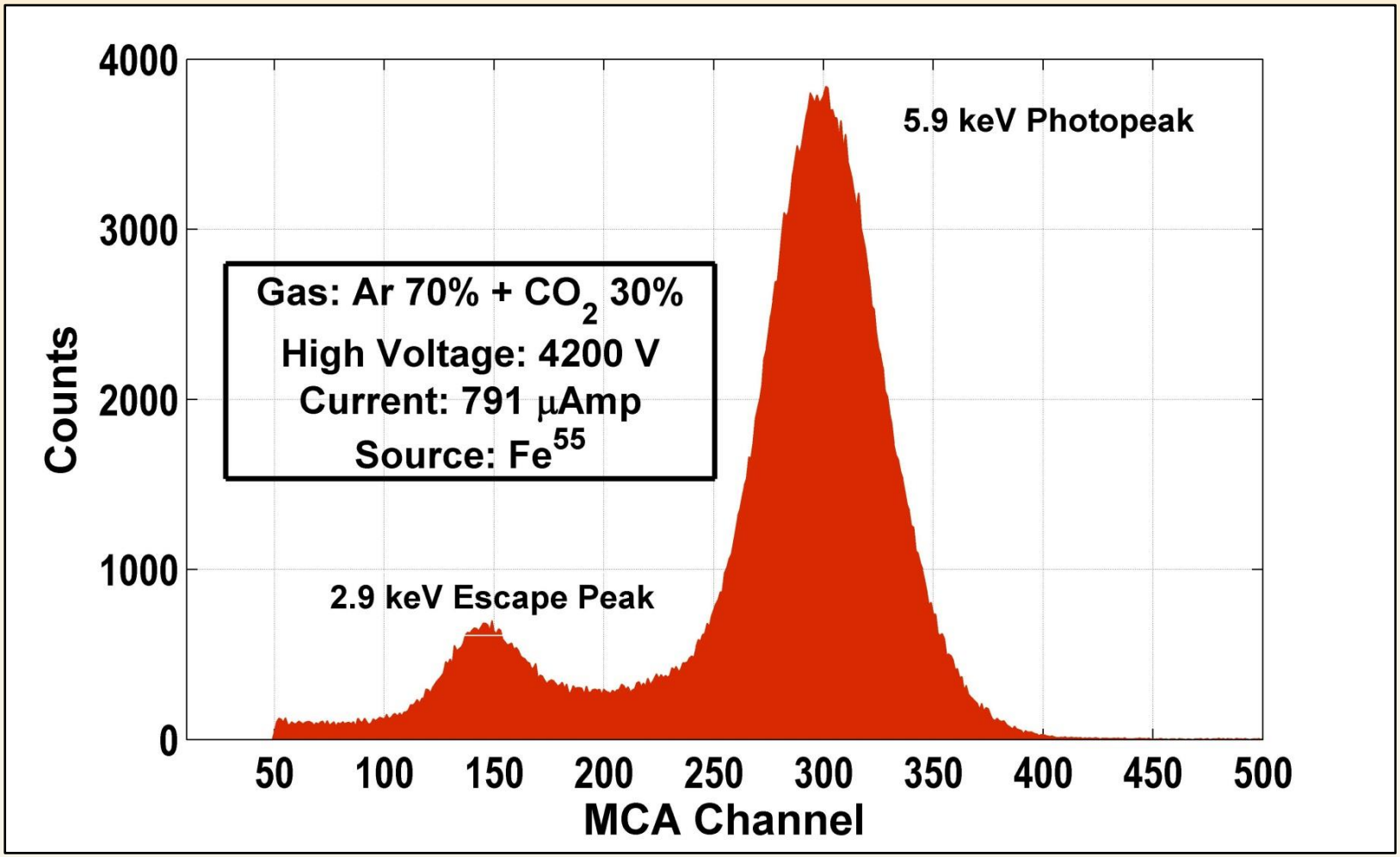
Gas Mixtures with RGA



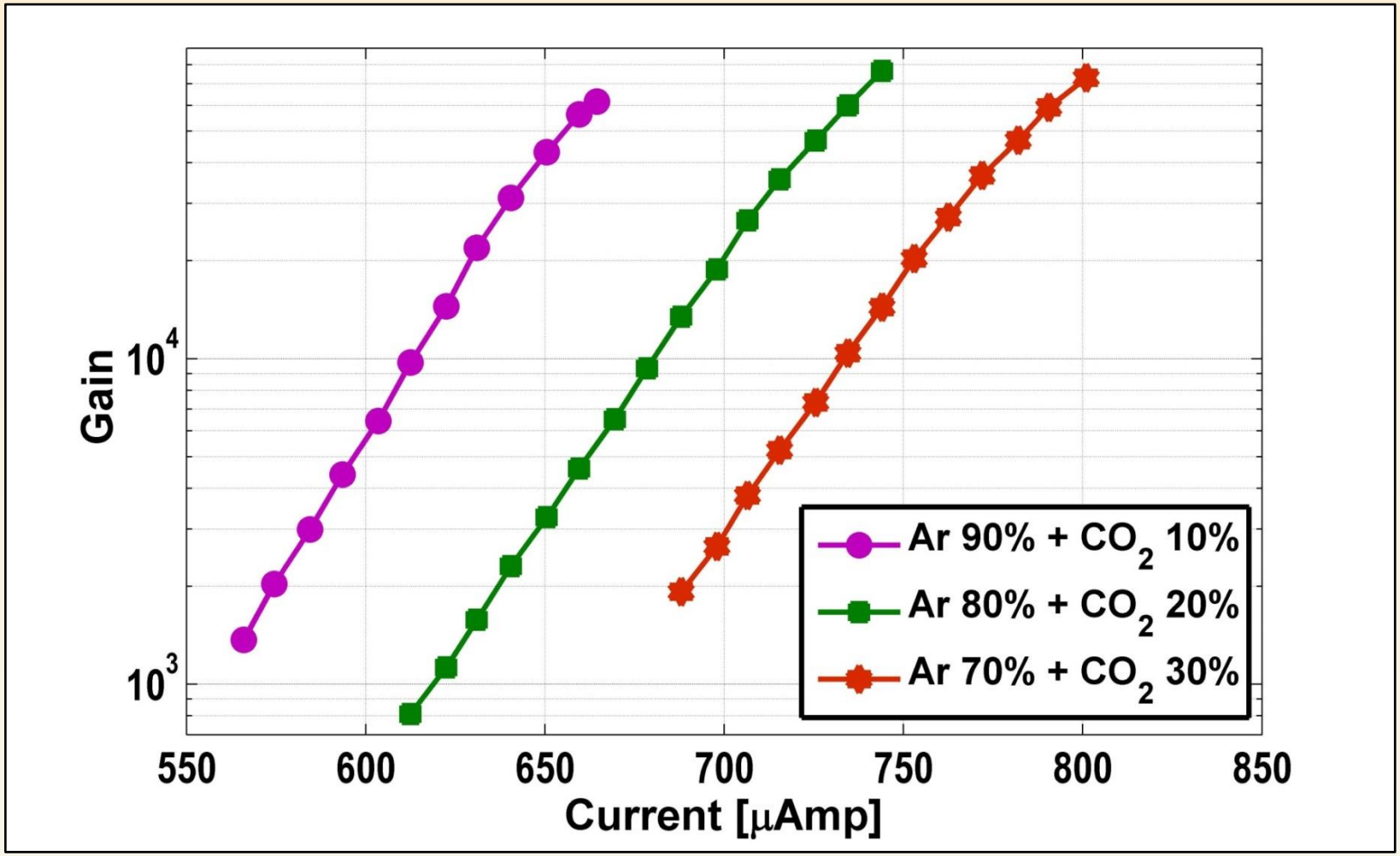




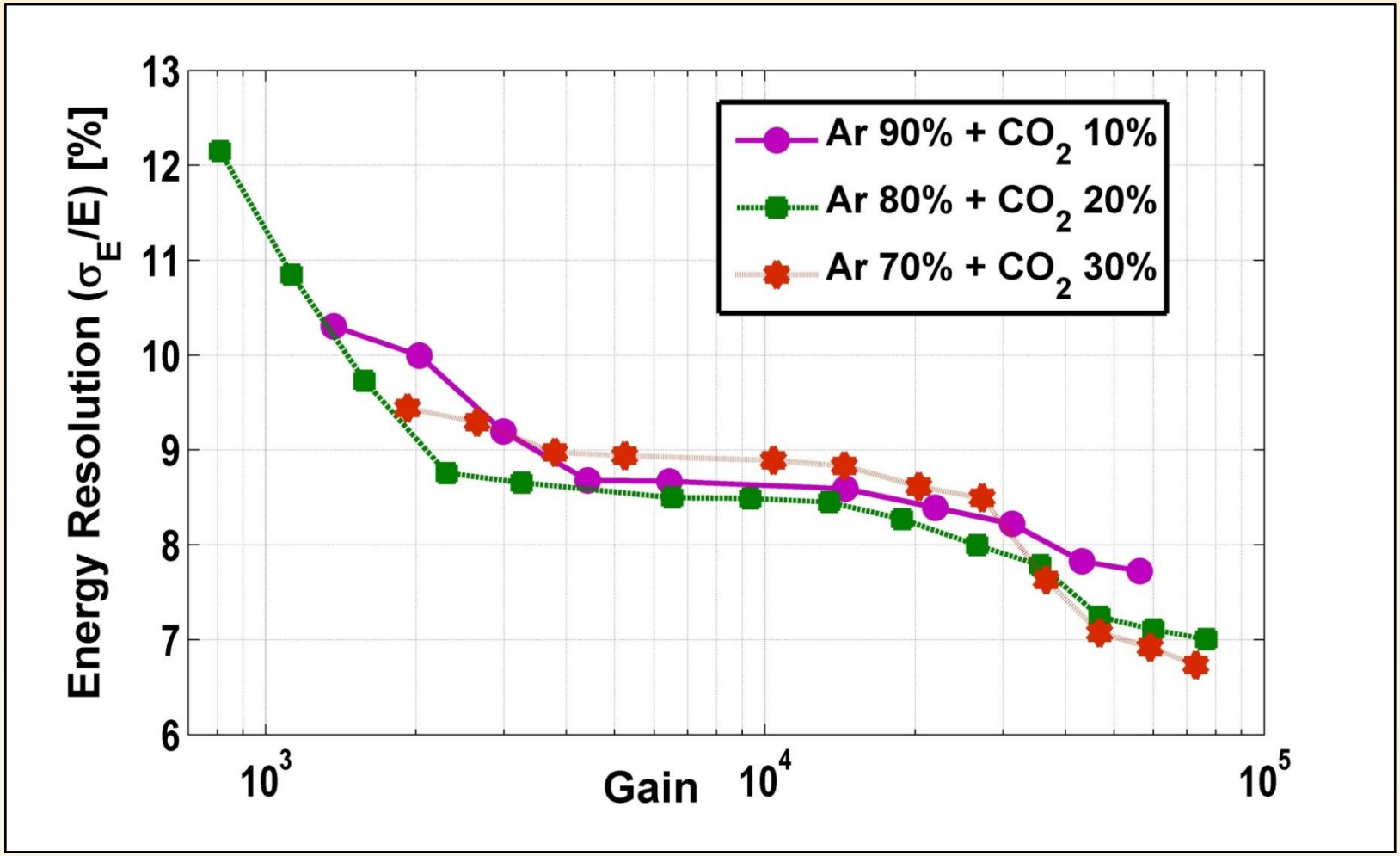
Pulse Height Spectrum of 55Fe



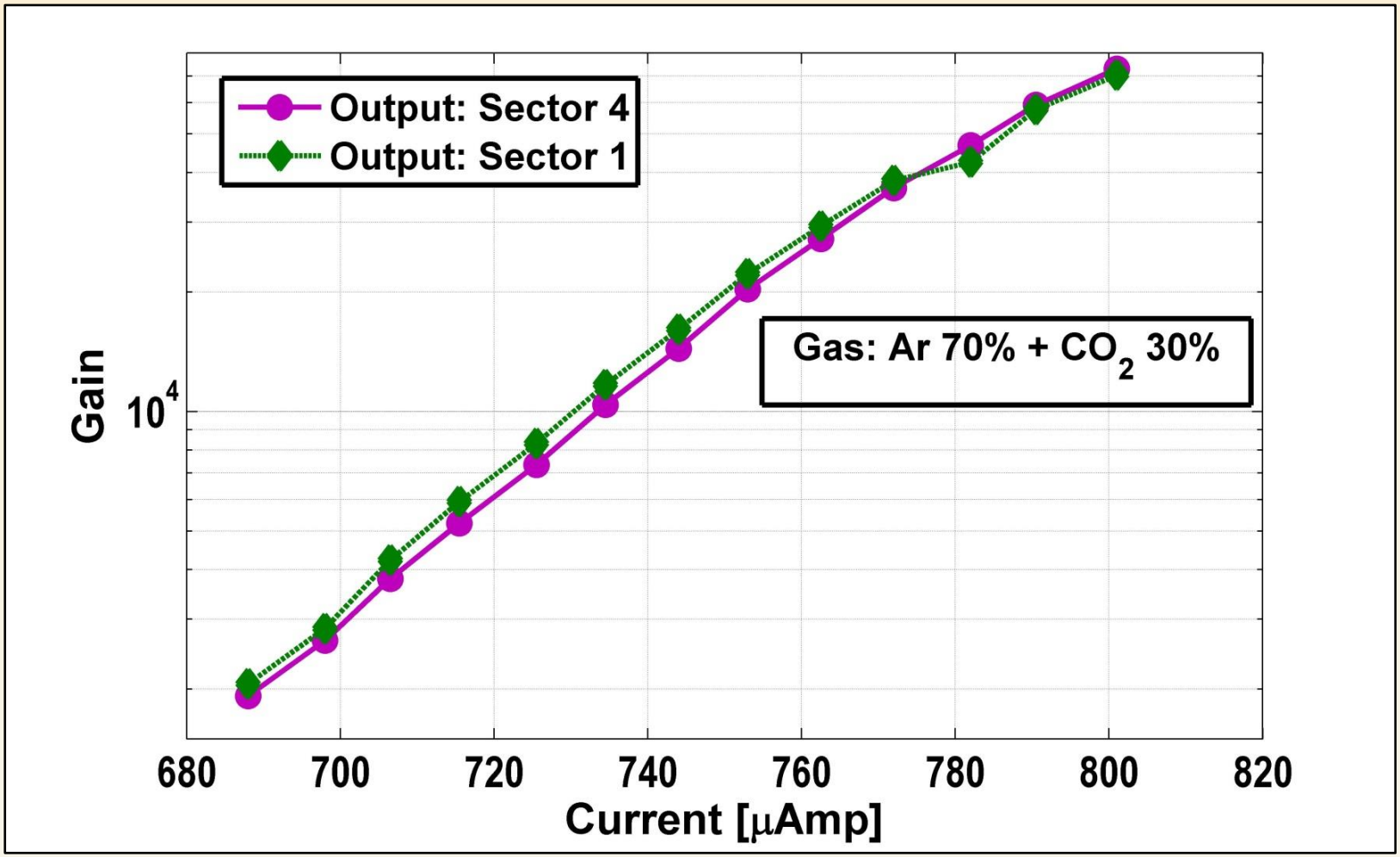
Gain Comparison



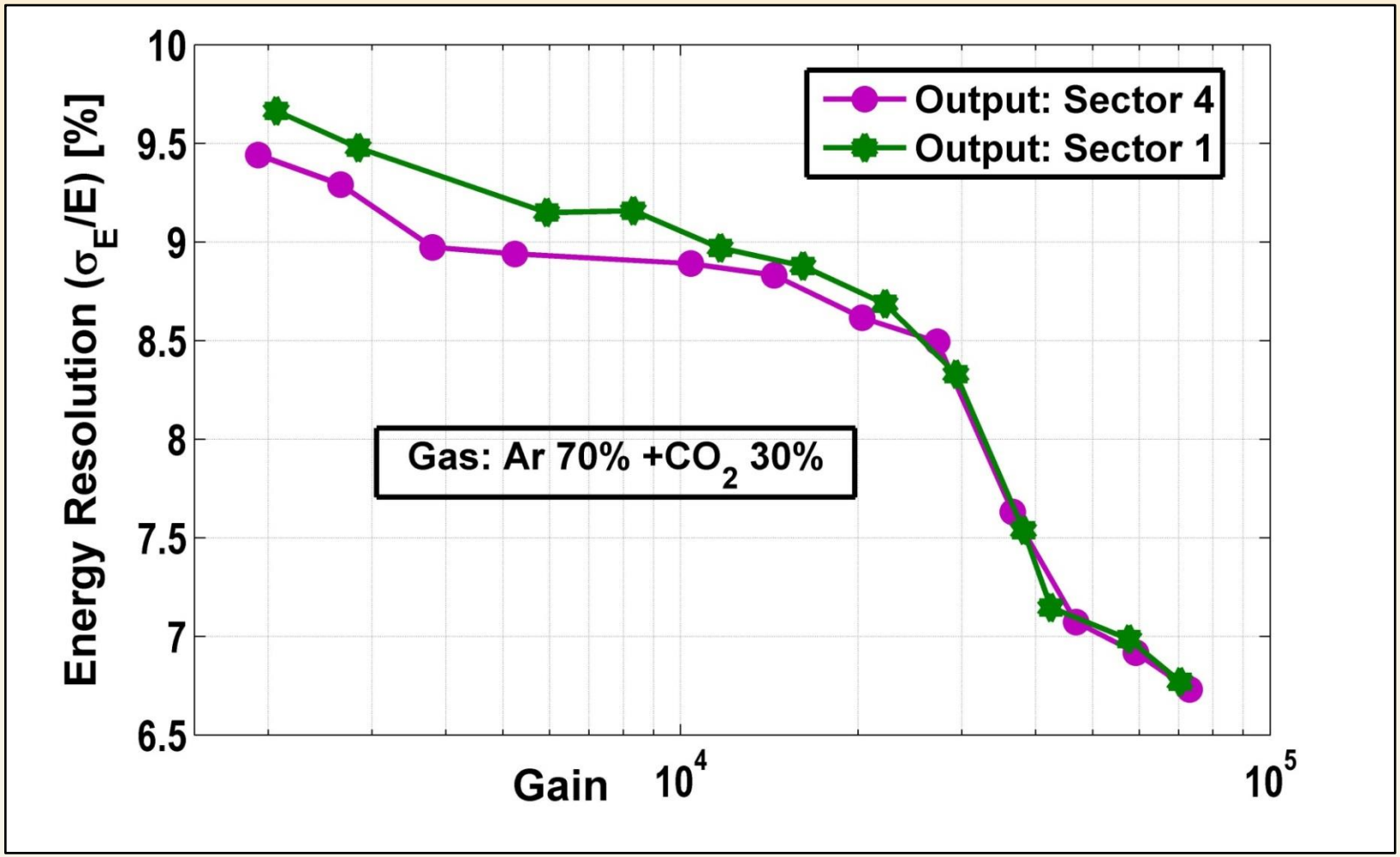
Energy Resolution Comparison



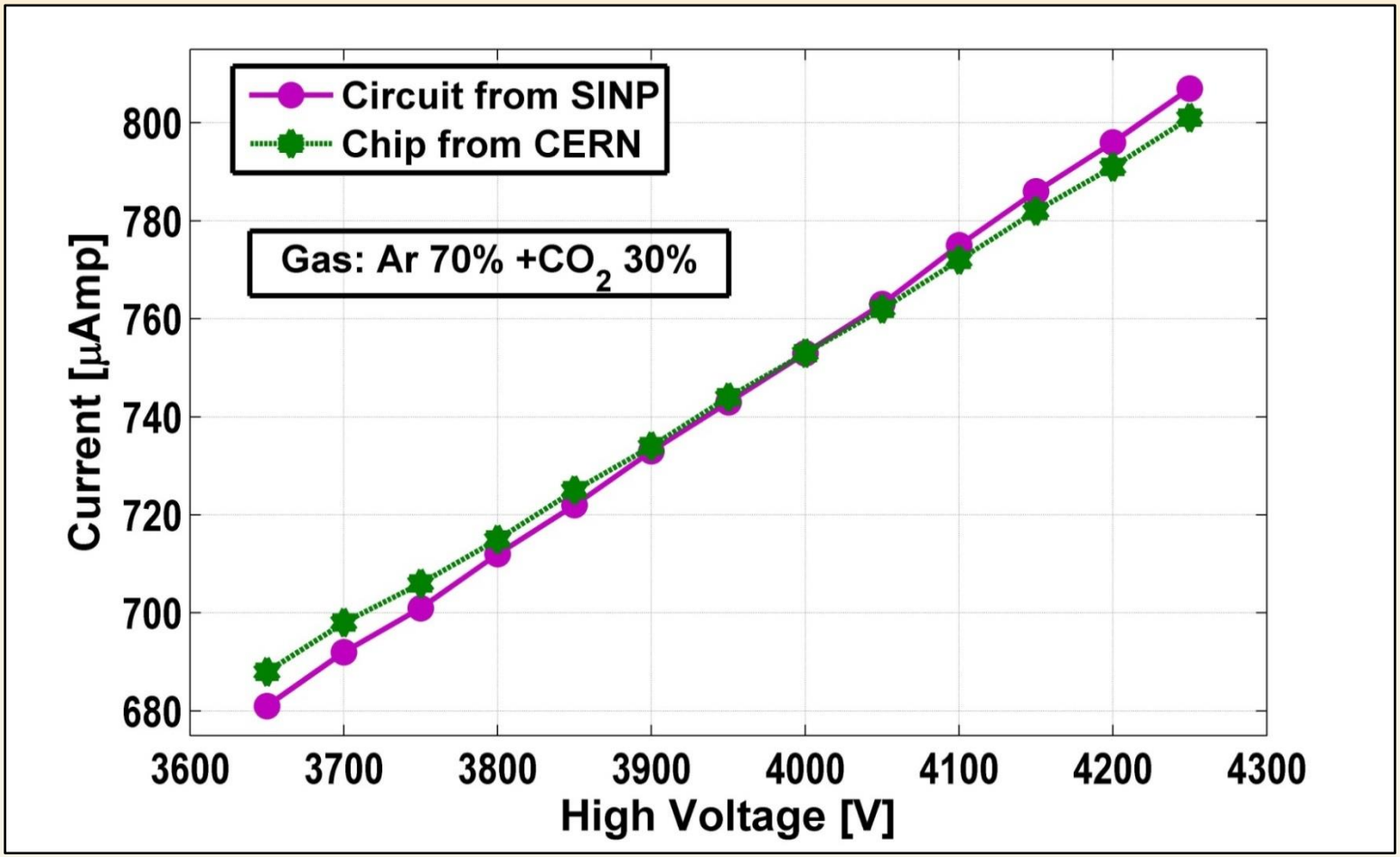
Gain Uniformity



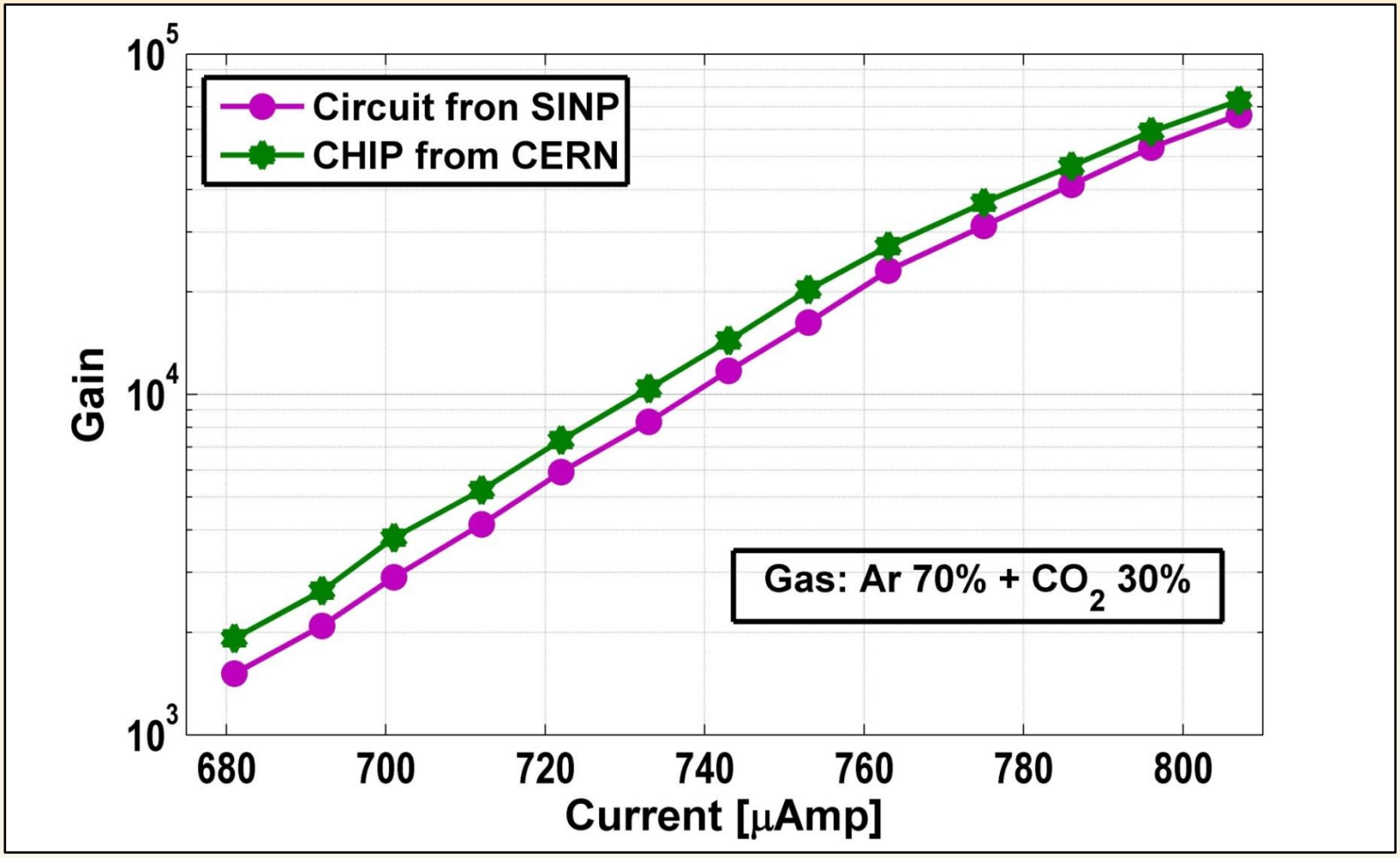
Energy Resolution Uniformity



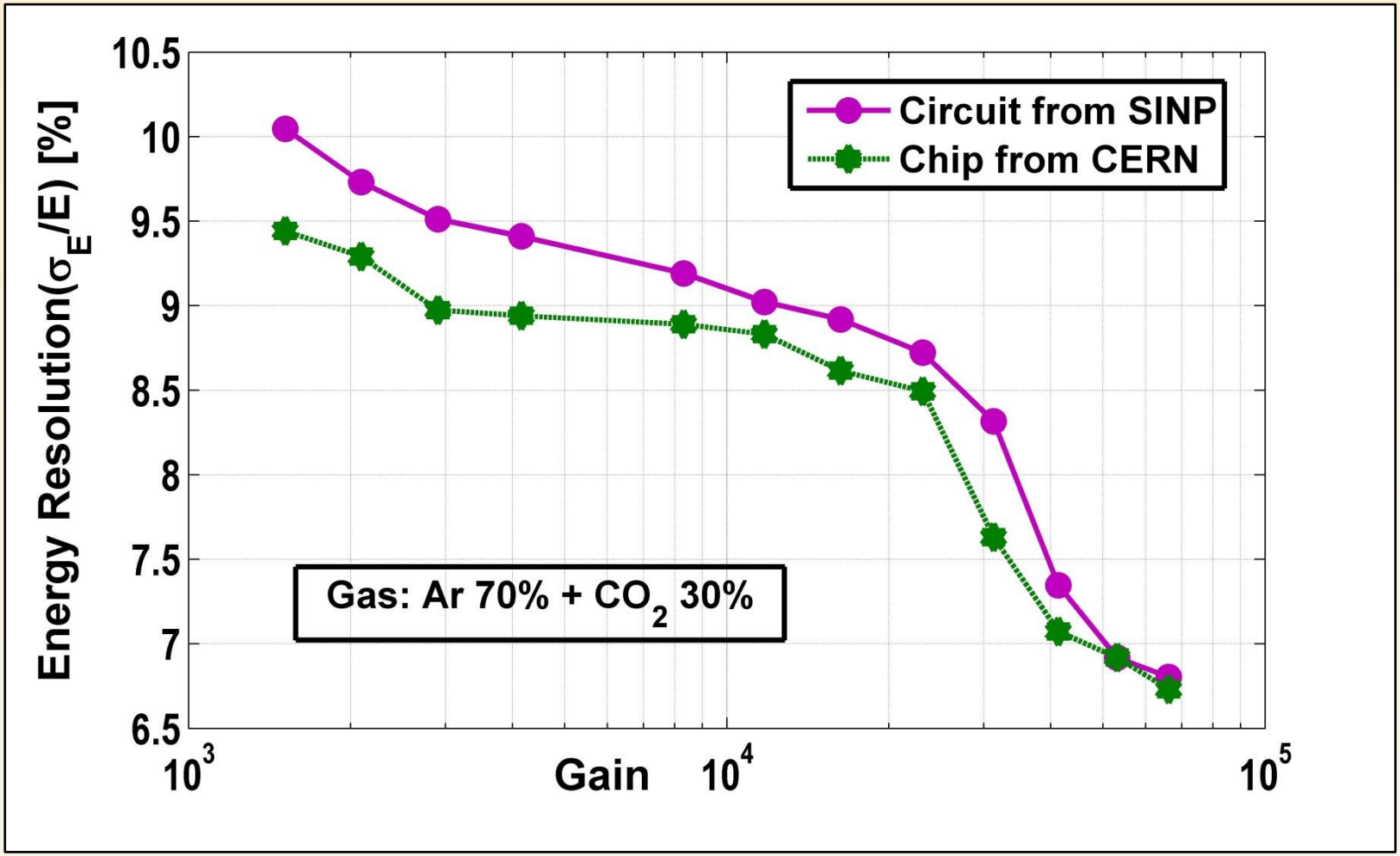
Voltage-Current Characteristics of Two Dividers



Gain with Two Dividers



Energy Resolution with Two Dividers



Remarks

Summary of Work

- Triple-GEM components procured from CERN have been assembled at SINP with 3:1:2:1 configuration.
- The prototype has been supplied HV through a home-grown divider circuit and CERN-made ceramic chip.
- Gain and energy resolution have been determined for Ar+CO2 gas mixture with three different mixture percentages.

Future Plan

- Procurement of CF4 gas is under progress. The new measurements with CF4 will be started soon.
- CAMAC based Multi-parameter data acquisition has been purchased which will be used to start measurements on spatial and time resolutions.

Acknowledgements

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Thank You All !!