Gas Distribution for Super Bigbite and BigBite Spectrometers, SBS and BBS

Marc McMullen
Detector Support Group
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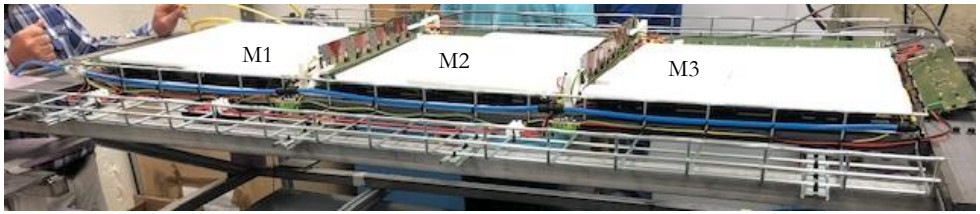
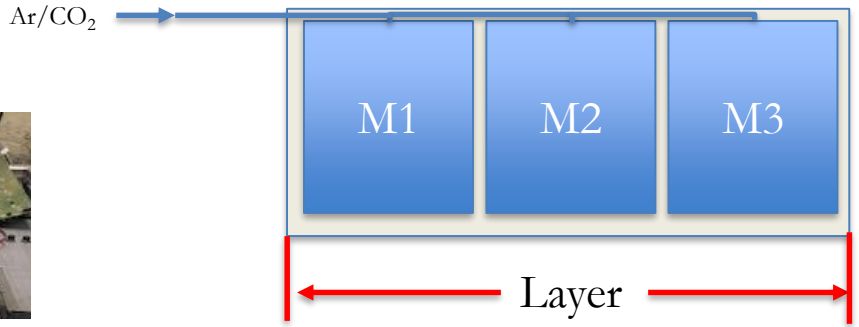
- Hall A SBS/BBS gas distribution diagram
- UVA GEM testing in EEL 124

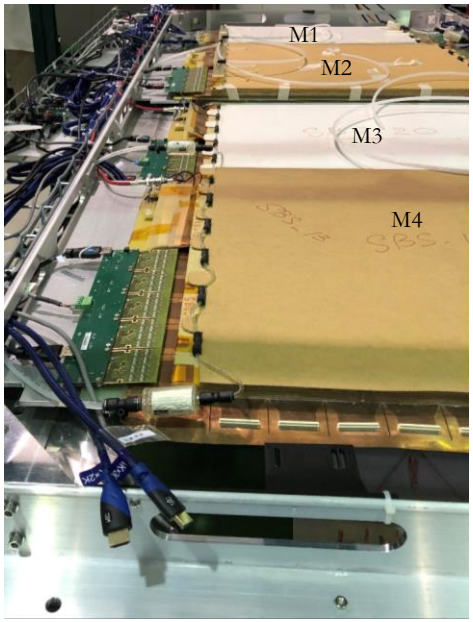
GEM Configurations

INFN Layer Configuration
3 Modules Per Layer
1 Gas Line Per Layer



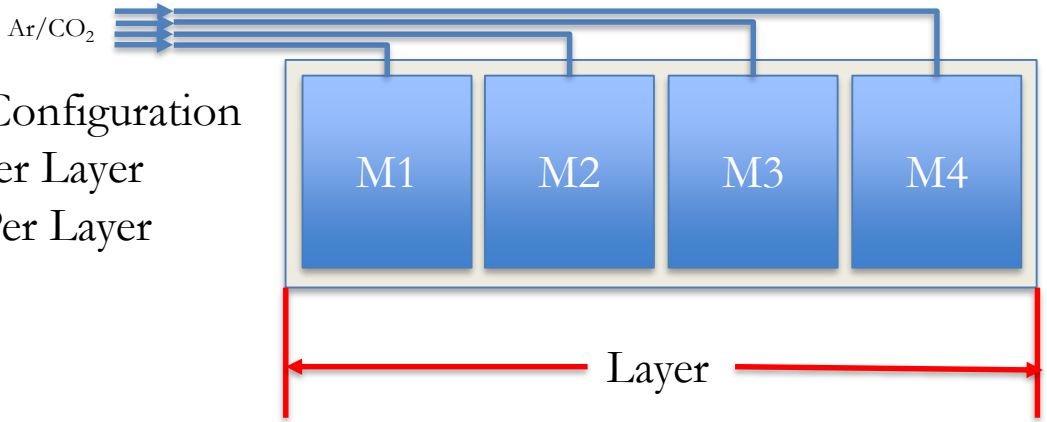
INFN GEM Layer: Modules (M) 1-3





UVA GEM Layer: Modules (M) 1-4

UVA Layer Configuration
4 Modules Per Layer
4 Gas Line Per Layer



SBS/BB GEM Gas Needs for Gen + Gen-RP

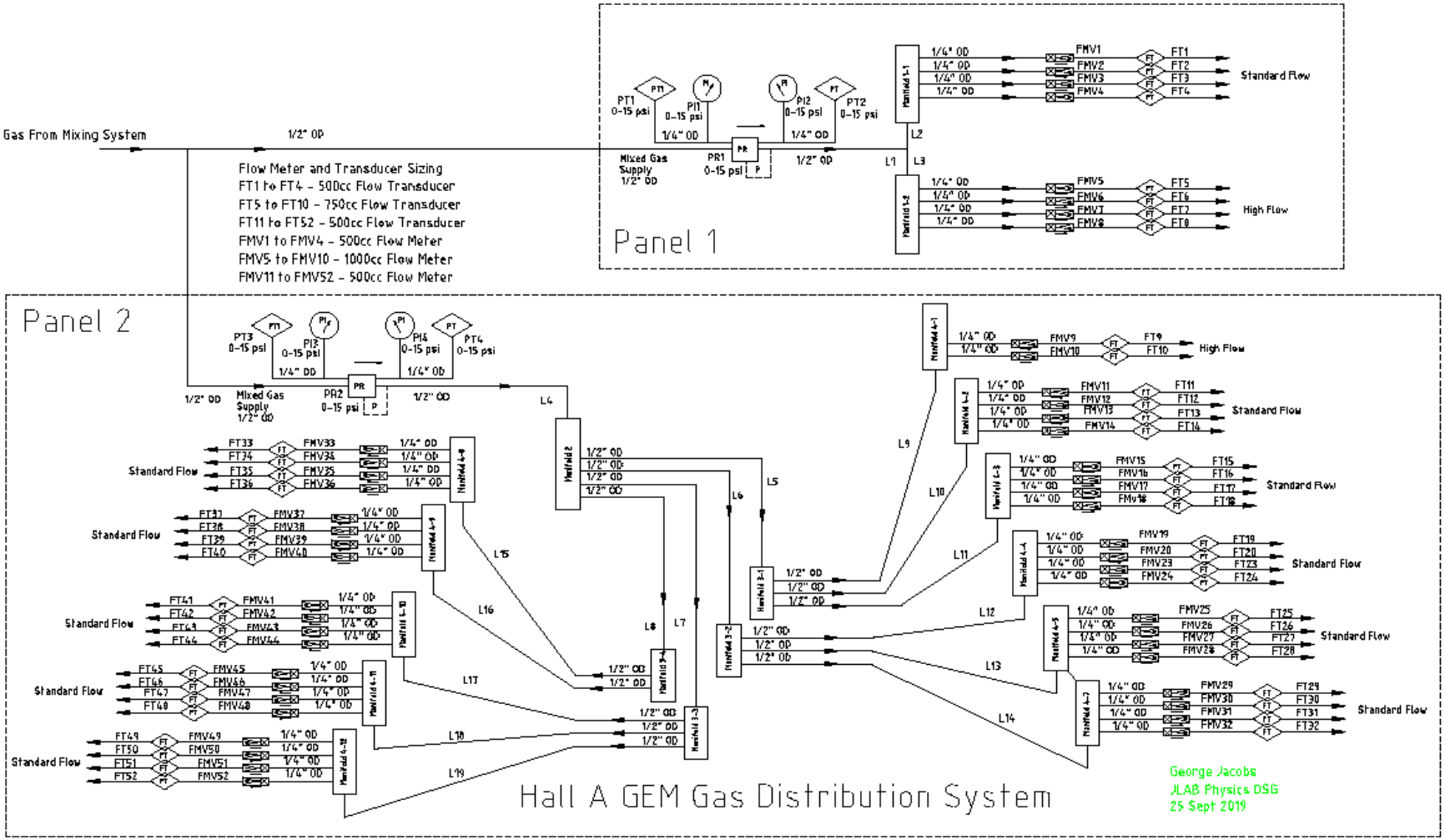
- INFN GEM
  - 18 GEM modules
    - ✓ Requires 2.4 L/h
  - 6 INFN Layers @ 3 modules per layer
    - ✓ 1 additional spare line (7 total gas lines)
  - One gas line per layer
- UVA GEM
  - 44 GEM modules
    - ✓ Requires 3.4 L/h
  - 10 UVA Layers @ 4 modules per layer
    - ✓ + 4 additional spare module
  - One gas line per module
- All modules will use Ar:CO_2 (70:30)
- Mixing system developed by Hall A
  - Distribution system developed by DSG

GMn + GEn-RP Experiment Gas Distribution

- All modules require 5 volume exchanges per hour
- INFN Layer (2.4 L x 5 vol. exchanges per hour)
  - Each **layer** gets its own gas line
- UVA Layer (3.4 L x 5 vol. exchanges per hour)
  - Each **module** gets its own gas line
- Total flow is 964 L/h
- All module/layer supply lines will be ¼" nylon
- Manifold supply lines will be ½"

Big Bite Arm	Super Big Bite Arm
• 4 INFN Tracker Layers – 12 modules (4 gas lines) – 144 L/h (5 vol. exchanges)	• 2 INFN Tracker Layers – 6 modules (2 gas lines) – 72 L/h (5 vol. exchanges)
• 1 UVA Tracker Layer – 4 modules (4 gas lines) – 68 L/h (5 vol. exchanges)	• 10 UVA Tracker Layer – 40 modules (40 gas lines) – 680 L/h (5 vol. exchanges)

Hall A GEM Gas Distribution



Hall A SBS/BB Gas Distribution Estimate

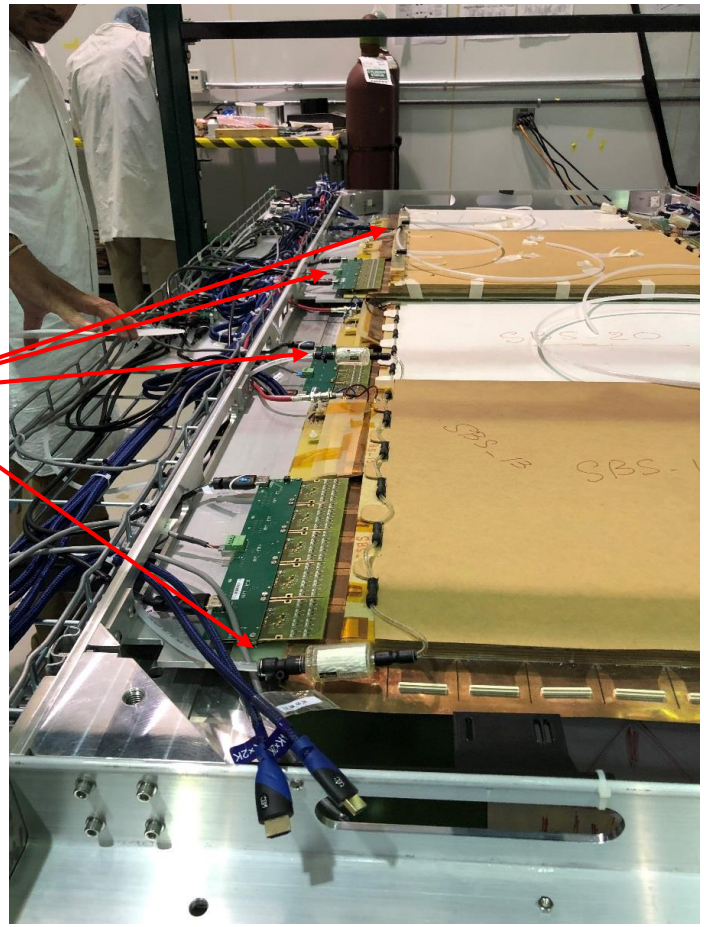
	A	B	C	D	E	F
1	Component	Part#	Description	# of units	Cost per unit	Total Cost
2	PR1 and PR2	McMaster 1888k1	0-15 psi low pressure regulator	2	$94.00	$188.00
3	PI1 to PI4	McMaster 3846k99	0-15 psi gauge	4	$18.13	$72.52
4	PT1 to PT4	626-07-GH-P1-E4-S1	0-15 psig transducer	4	$135.00	$540.00
5						
6	Manifold 1	McMaster 5975k19	1/2 NPT to 6 of 3/8 NPT out (1/2 tube)	1	$33.06	$33.06
7	Panel 1	GUESTIMATE	Holds manifold 1, PR1, PI1-2, PT1-2	1	$100.00	$100.00
8	Manifold 2	McMaster 5975k15	3/8 npt to 5 of 1/4 npt out (FWD)	2	$23.95	$47.90
9	Panel 2	GUESTIMATE	Holds manifold 2, FMV/FT, needle valves	1	$250.00	$250.00
10	Manifold 3	McMaster 5975k36	1/2 npt to 3 of 3/8 npt (2nd and 3rd)	4	$29.28	$117.12
11	Panel 3	GUESTIMATE	Holds manifold 3	1	$100.00	$100.00
12	Manifold 4	McMaster 5975k12	3/8 npt into 4 of 1/4 npt out	12	$21.20	$254.40
13	Panel 4	GUESTIMATE	Holds Manifold 4, FMV and FT	12	$150.00	$1,800.00
14						
15	FMV5 to 10	Dwyer RMA-13-ssv	For the larger volume GEMs	6	$48.00	$288.00
16	FMV1 to 4, FMV11 to 50	Dwyer RMA-12-ssv	GEMs	44	$48.00	$2,112.00
17	1/8 npt to 1/4" push loc	McMaster 5779k108	For FMV connections	120	$3.16	$379.20
18						
19	FT1 t0 4, FT11 to 50	Honeywell Zephyr	0-400 sccm flow transducer	44	$91.66	$4,033.04
20	FT5 to 10	Honeywell Zephyr	0-750 sccm flow transducer	6	$95.36	$572.16
21						$0.00
22	1/4" push lok, bulkhead	McMaster 5779k677	line to GEMs, 17/32" dia hole	58	$5.45	$316.10
23	1/4 npt to 1/2" comp	B-810-1-4	PR1 in and out	2	$13.00	$26.00
24	1/4 npt to 1/4 posh lok	Mcmaster 5779k108	For gauges and transducers	64	$3.16	$202.24
25	1/2" npt plug	McMaster 4464k564	1/2" npt plug	12	$2.70	$32.40
26	1/4 FNPT union	4464k352	gauge and transducer connections	4	$3.83	$15.32
27	1/4 fnpt tee	4464k48	gauge and transducer connections	2	$7.80	$15.60
28	1/4 push lok Tee	5779k34	gauge and transducer connections	2	$4.88	$9.76
29	3/8 npt to 1/2 push lok	McMaster 5779k121	for 1/2" tubing runs	36	$7.80	$280.80
30	3/8 npt plug	McMaster 4464k563	for unused 3/8 npt openings	16	$2.00	$32.00
31	1/4" push lok union	McMaster 5779k14	for flow transducer connections	120	$3.20	$384.00
32	1/2 npt to 1/2 push loc	McMaster 5779k122	1/2" npt to 1/2" push lock	12	$8.20	$98.40
33	1/4" push lok caps	McMaster 5779k473	push lok cap for tubing	24	$2.18	$52.32
34	1/4" push lok plugs	McMaster 5779k54	push lok plug for fitting	24	$1.18	$28.32
35	1/2" push lok 90 deg					
36	1/4" tubing		guestimate of 40 ft per line	2400	$0.48	$1,152.00
37	Tygon 1/4"	1/4" OD x 3/16 ID tygon	guestimate of 0.5 ft per line	25	$0.98	$24.50
38	1/2" tubing		guestimate of 40 ft per line	200	$1.61	$322.00
39	Panel supports			15	$50.00	$750.00
40	misc			1	$1,500.00	$1,500.00
41	labels			1	$450.00	$450.00
42	Readback cables and electronics					$5,000.00
43						
44			FMV System Estimate			$11,973.96
45						
46			FMV plus FT System Estimate			$21,579.16

UVA GEM Testing in EEL 124 Clean Room

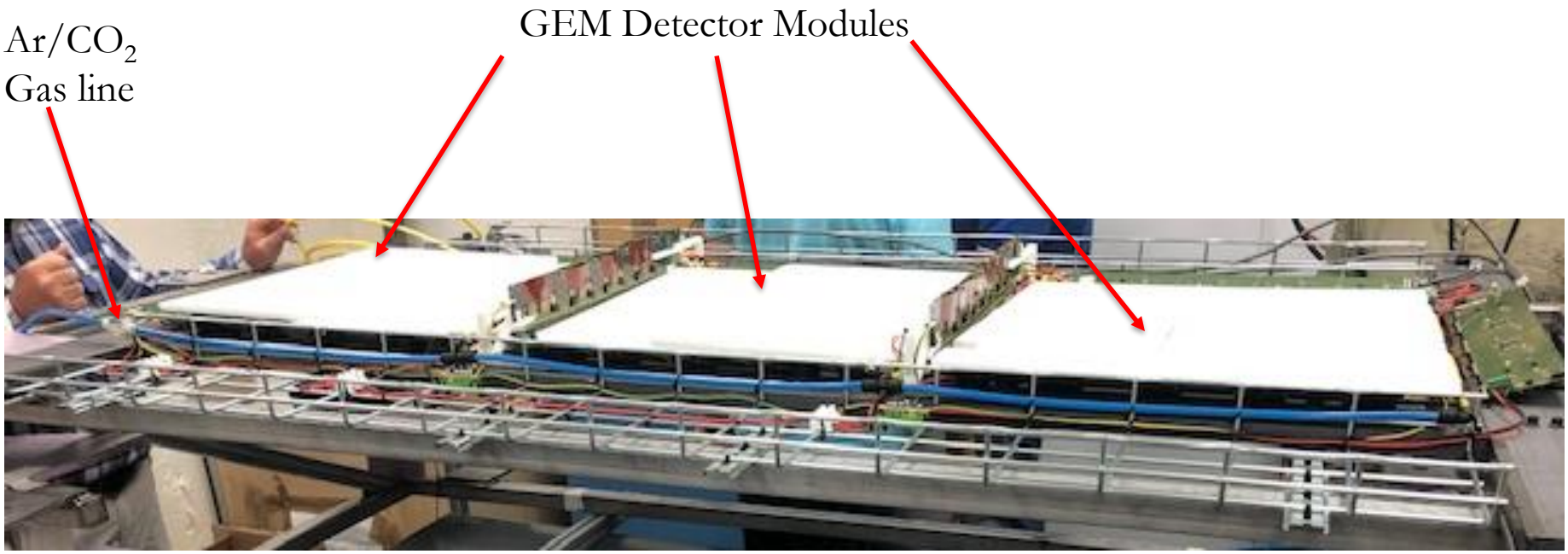
Gas distribution using rotameters

4 x ¼” tube supply to GEM module using push-lock connection

Gas supply to manifold



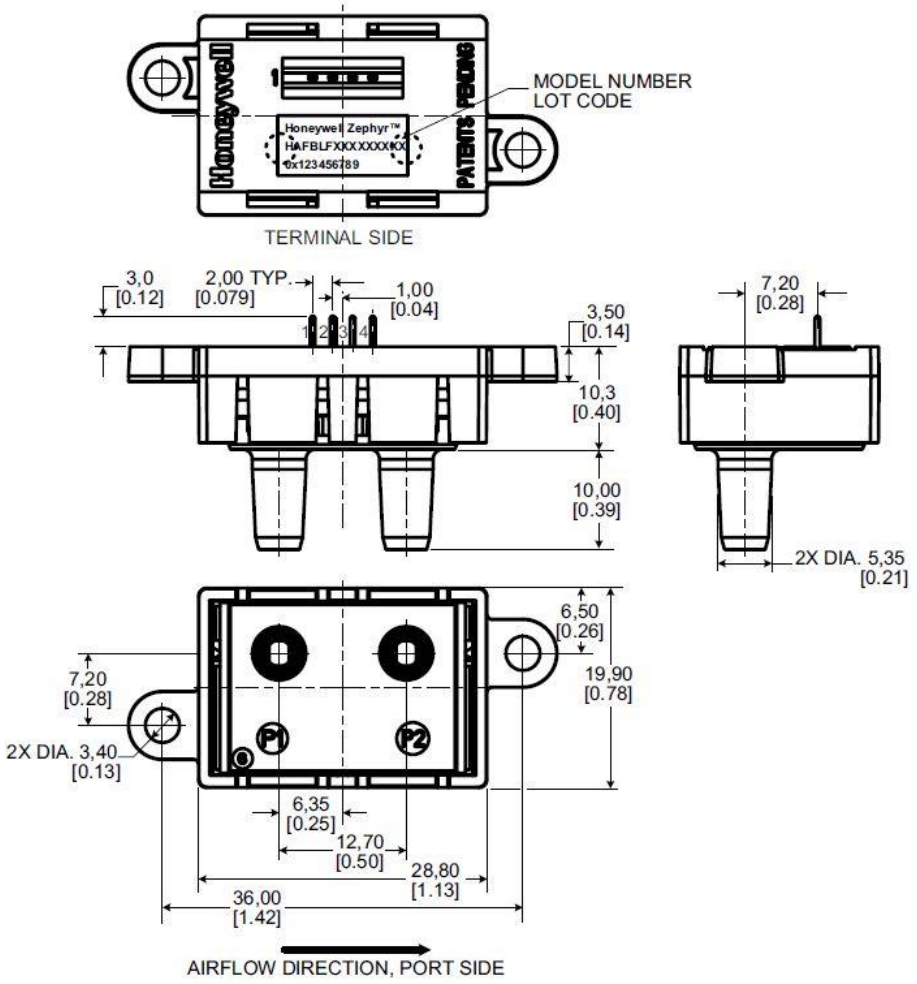
INFN GEM Layer Assembly in the Test Lab



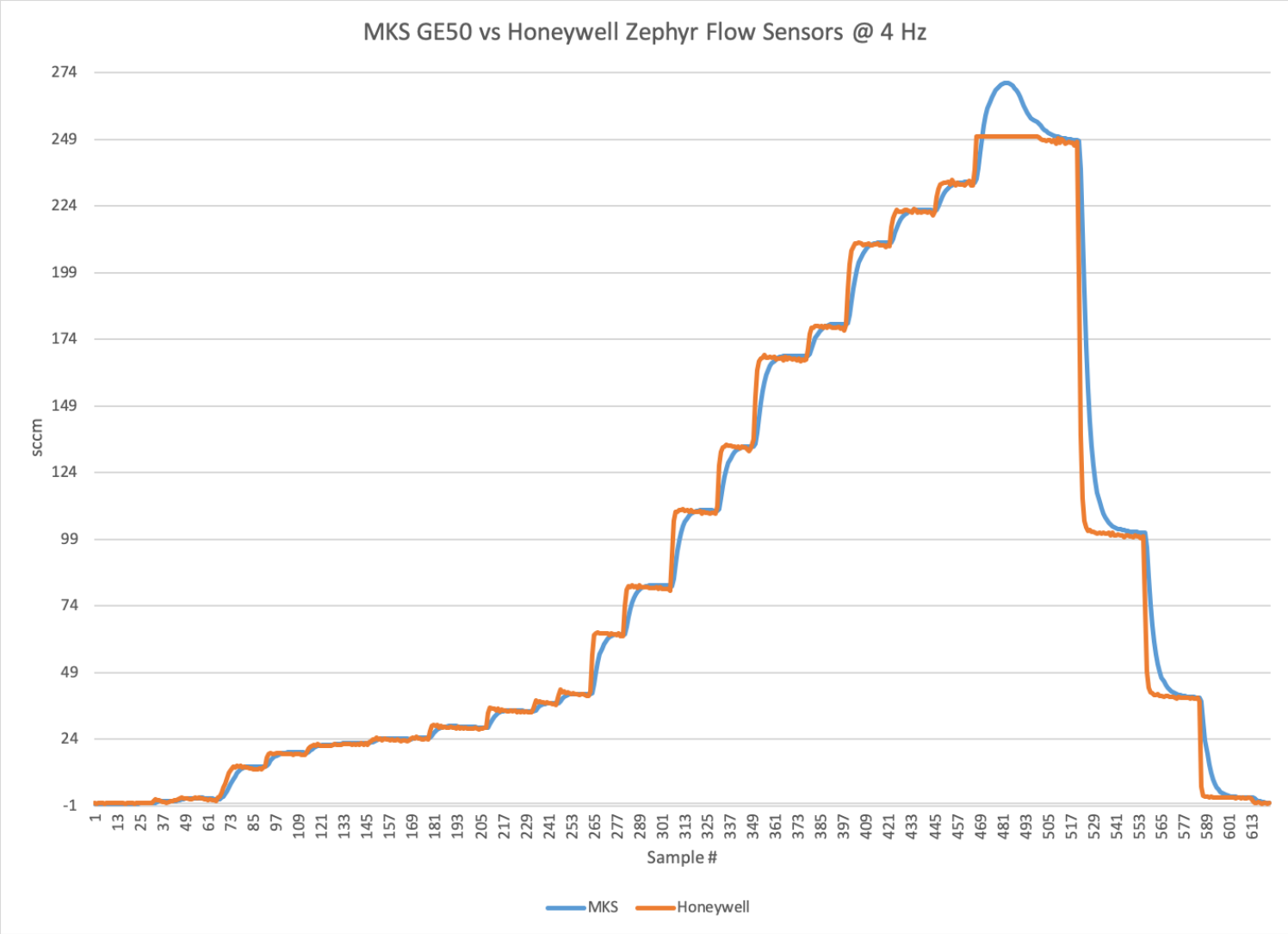
- Each layer contains 3 GEM modules
- A single 1/4 gas line supplies the layer with Ar/CO_2 mixture (70:30)

Flow Control and Monitoring

- Hall A requires monitored flow for all distribution circuits (48)
- DSG has identified viable option on market to measure mass flow and provide output signal that can be monitored and used in EPICS for alarms
  - DSG design will include individual manual valves for each line.



Honeywell Zephyr Evaluation



Conclusion

- DSG will design and build Hall A gas distribution system
  - SBS/BB gas distribution has multiple configurations
  - Gas distribution system will need to be designed to support changes
  - Design will include flow control and remote monitoring for each GEM module
- DSG is developing cost list for material and equipment
- Flow sensors have arrived and are being tested