

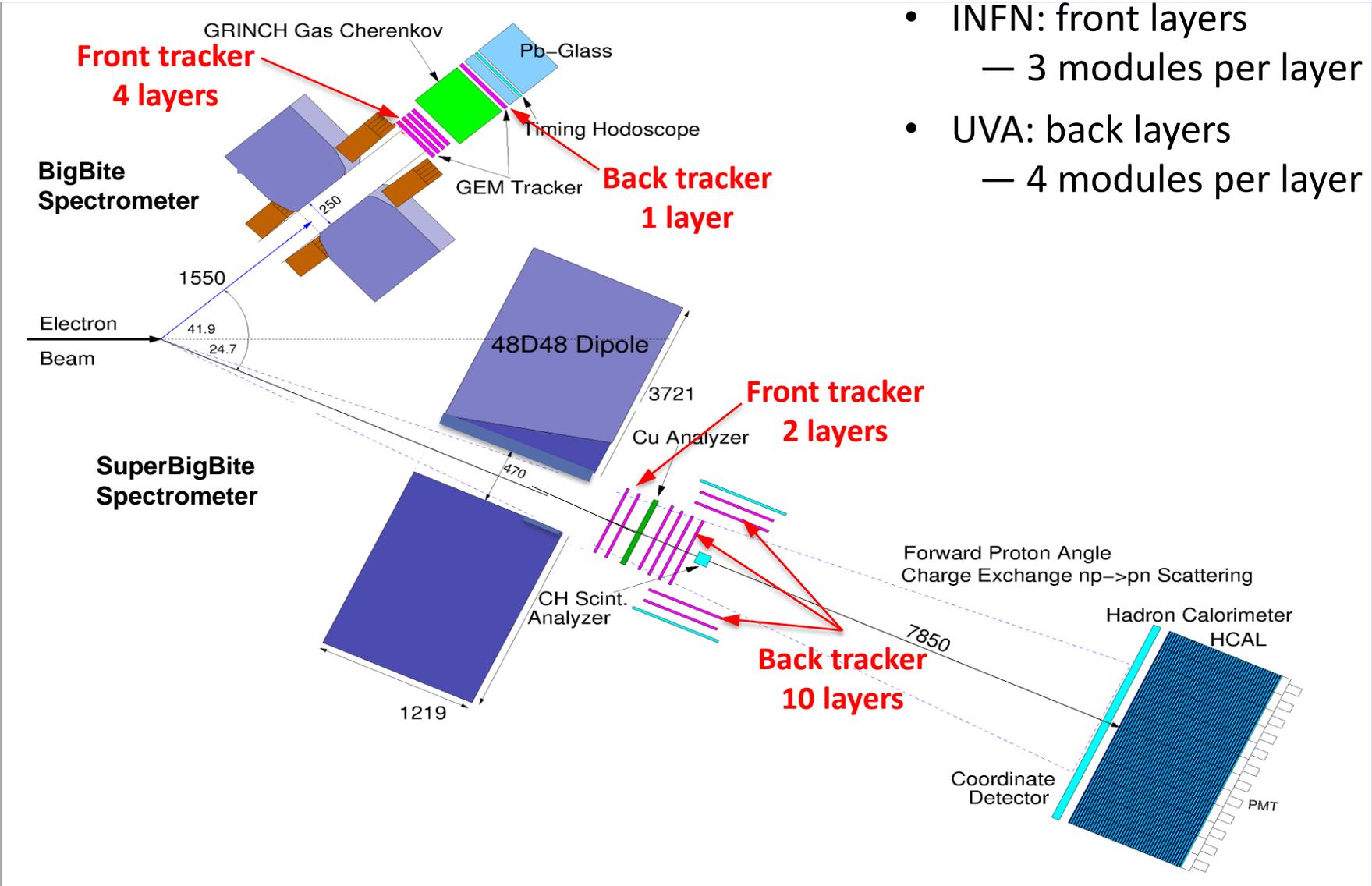
Gas Distribution and Monitoring System for the GEM Detectors

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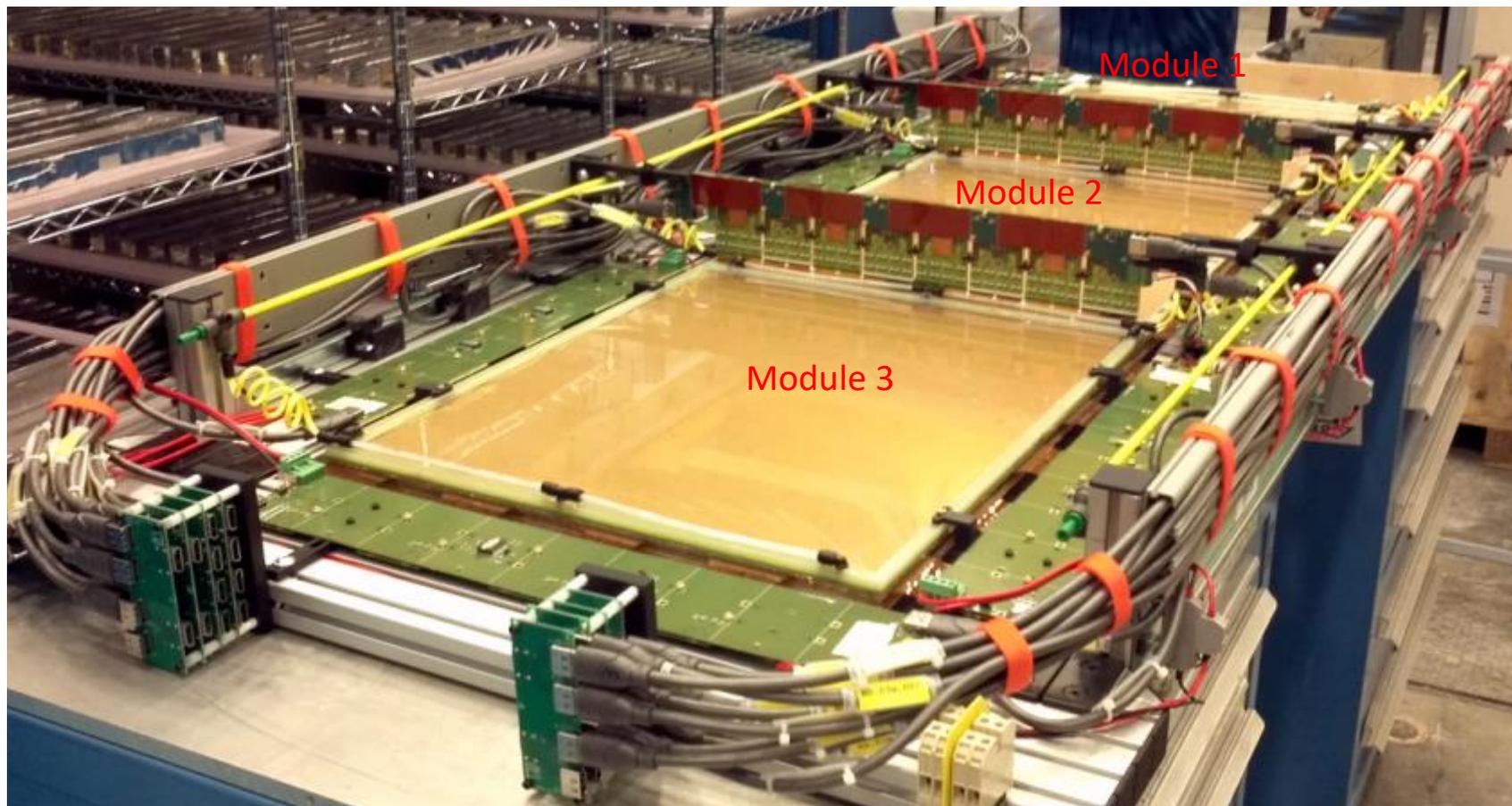
- GEM detectors
- Design and development of the gas distribution and monitoring system
- Procurement status
- Conclusion

GEMs in the BigBite and Super BigBite Spectrometers



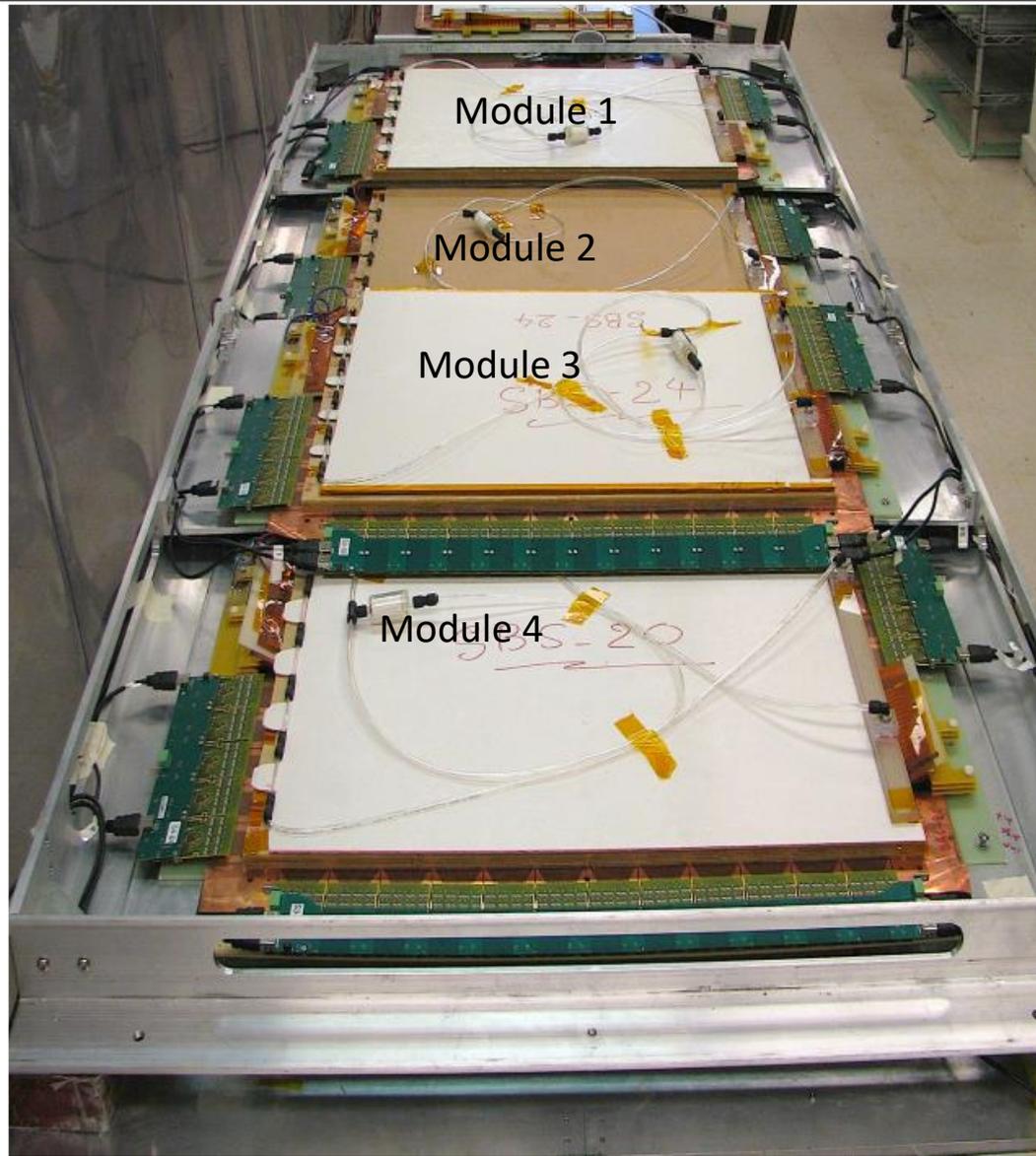
- INFN: front layers
 - 3 modules per layer
- UVA: back layers
 - 4 modules per layer

Gas Distribution for INFN Front Tracker Layers



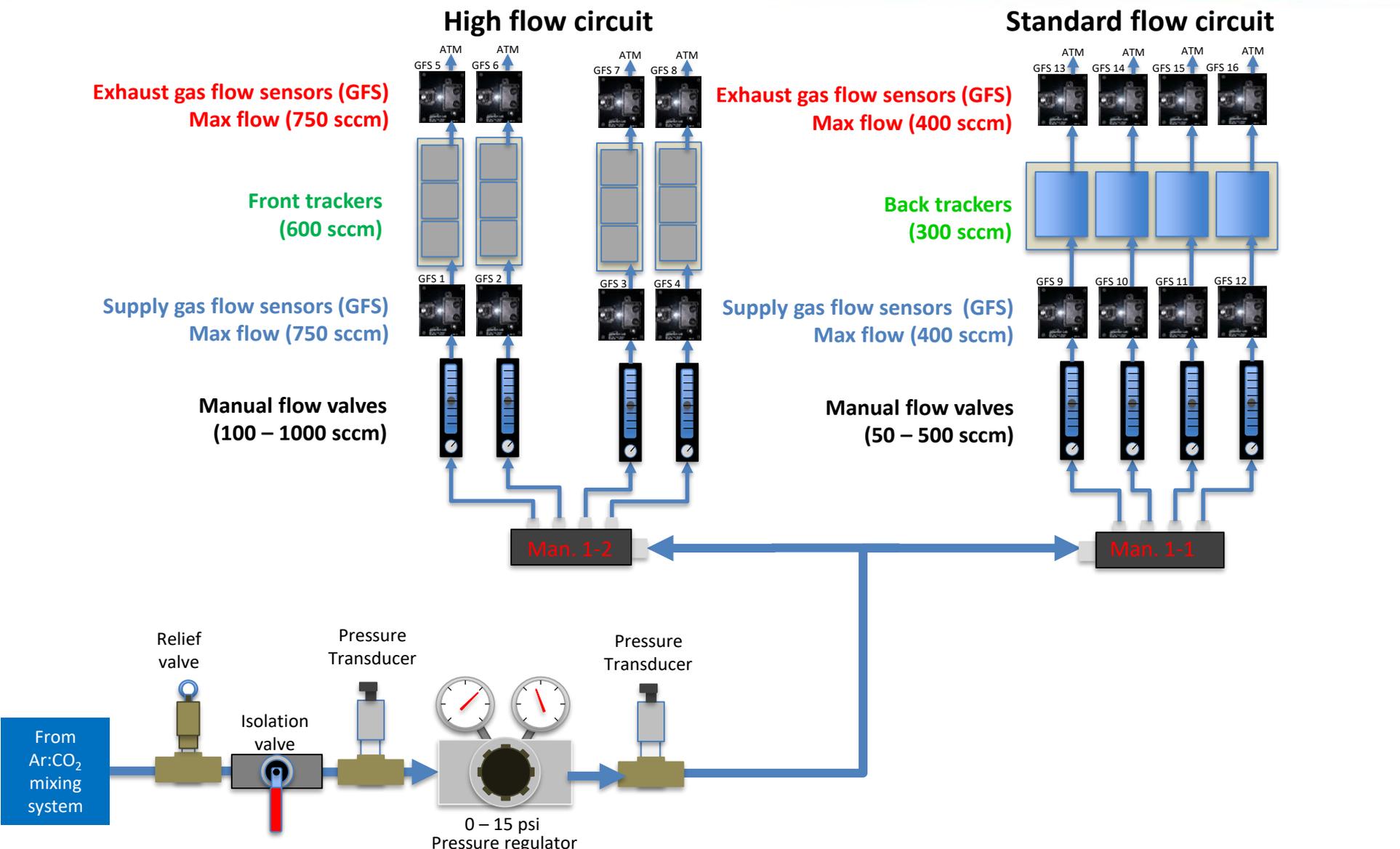
- Ar:CO₂ (70:30) gas
- Each layer has a gas line
 - Gas flows through the three modules within the layer
- Gas flow requirement ~600 sccm/layer

Gas Distribution for UVA Back Tracker Layers

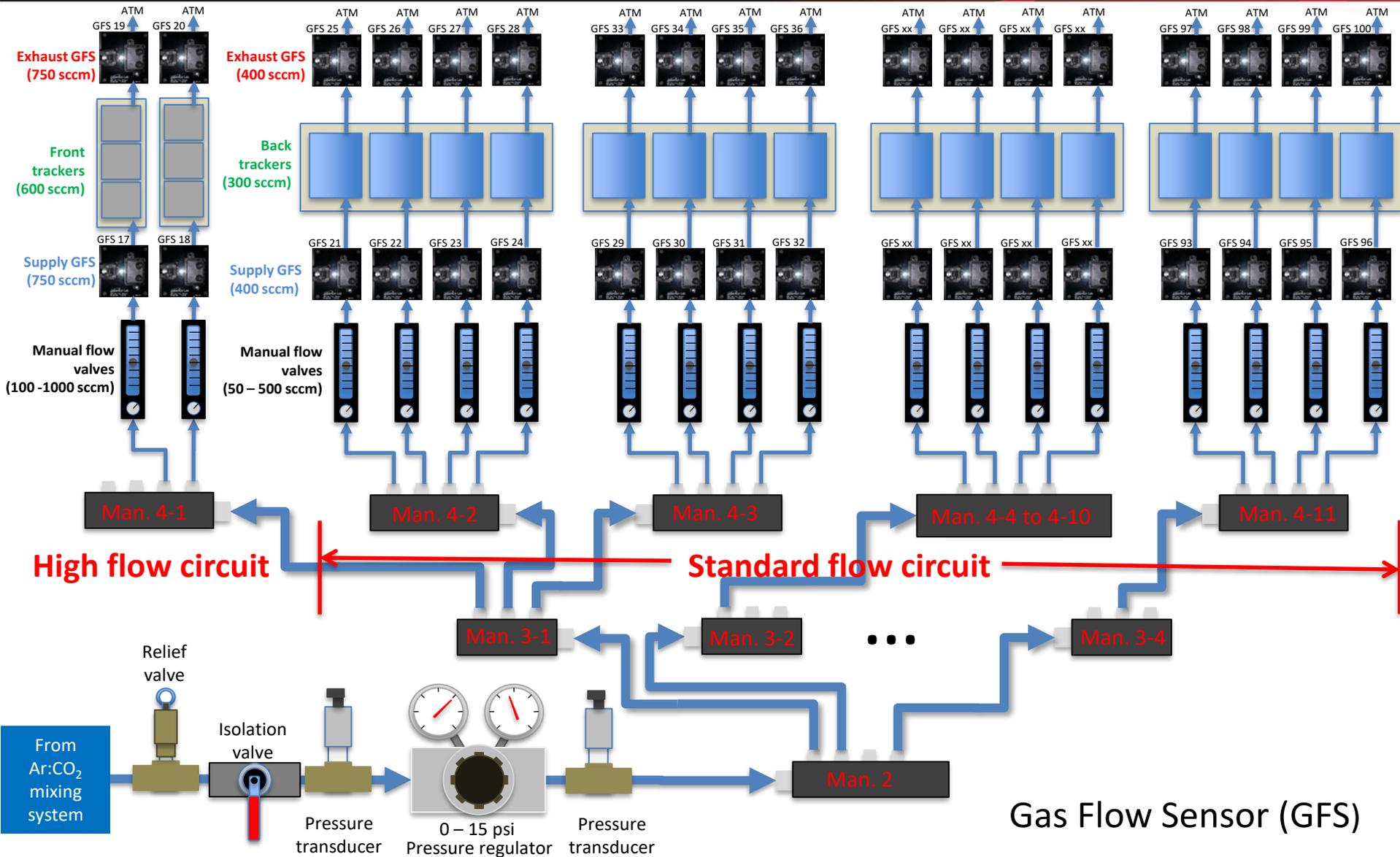


- Ar:CO₂ (70:30) gas
- Each module has a gas line
- Gas flow requirement ~300 sccm/module

DSG Design of Gas Distribution for GEMs in BigBite



DSG Design of Gas Distribution for GEMs in Super BigBite



DSG Design of Flow Readout System

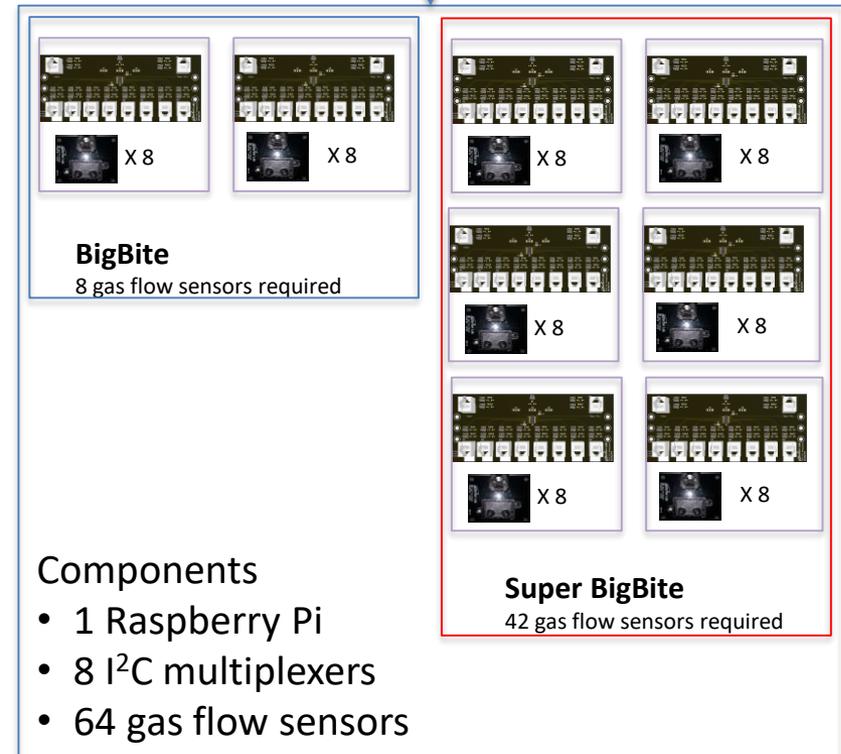
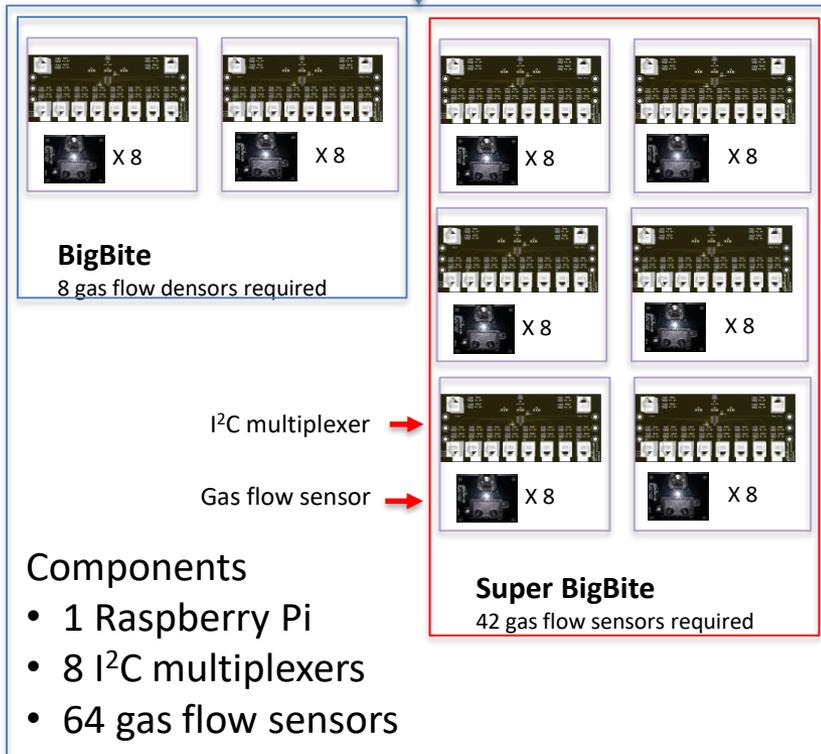
Supply Monitoring

Exhaust Monitoring



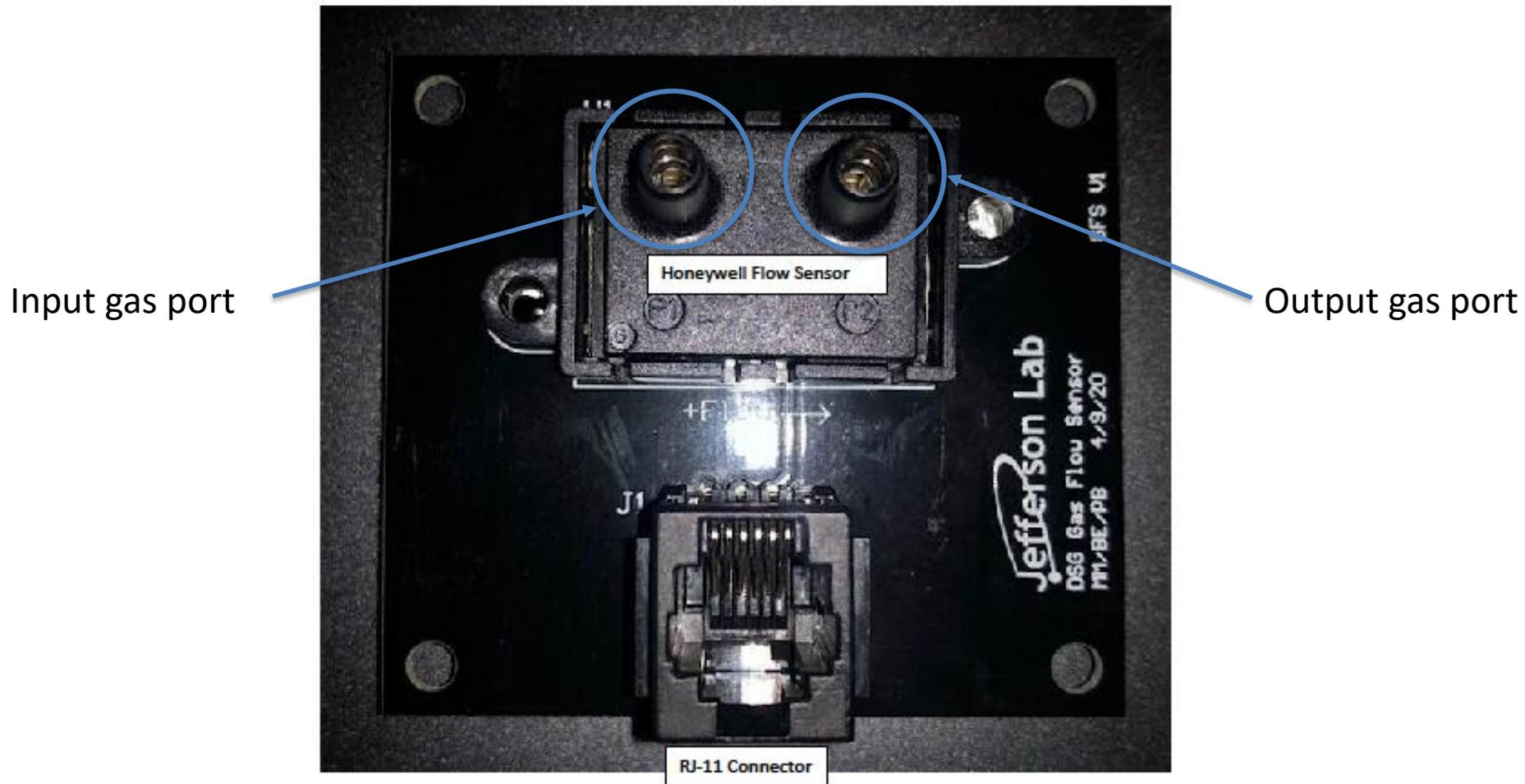
Raspberry Pi 4 Single Board Computers

- Low cost (\$50)
- Small size
- Runs Linux



Maximum system capacity

DSG Gas Flow Sensor Board



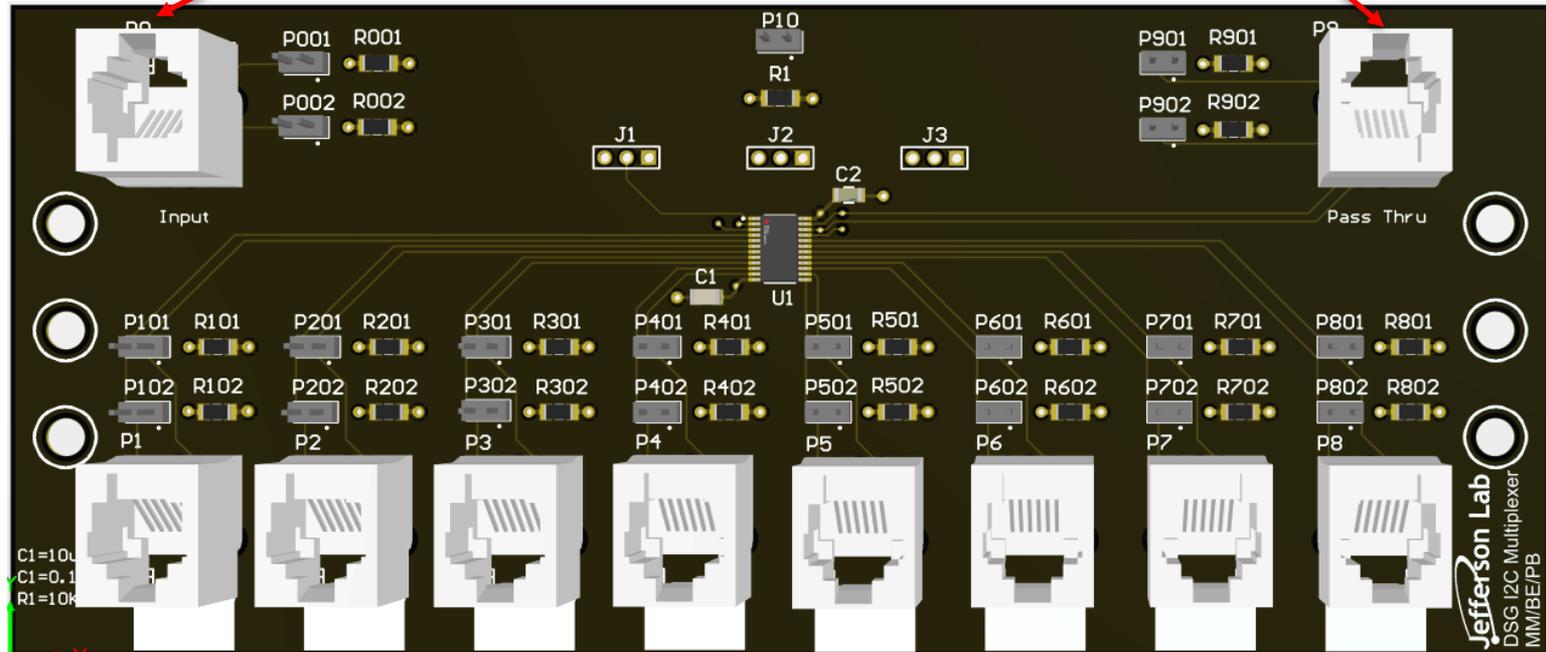
DSG gas flow sensor board

[See Development of Readout Electronics note](#)

DSG 8-Channel I²C Multiplexer Board

Input data/power connector

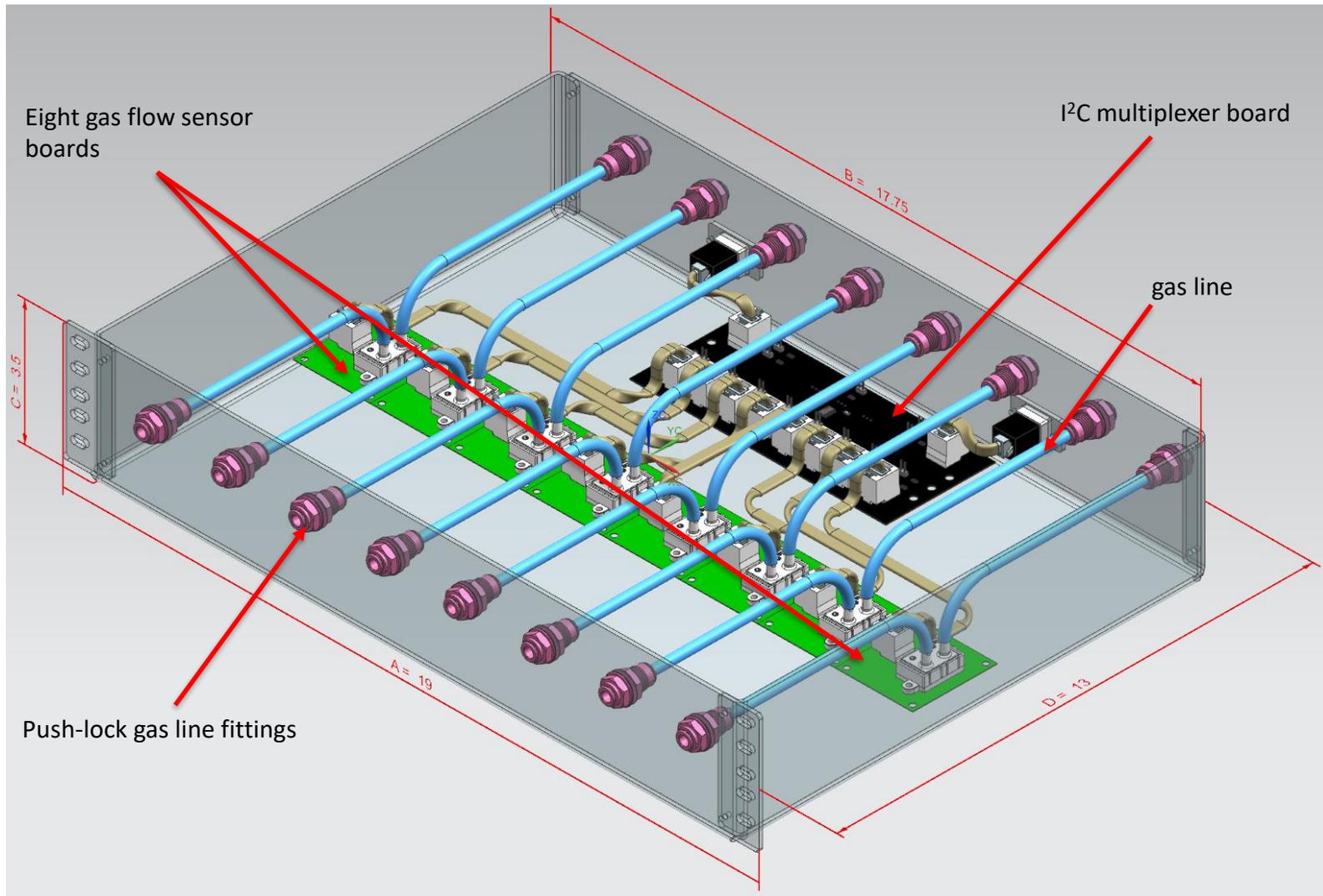
Pass through data/power connector



Output data/power connector to flow sensors

- Controls readback data from eight gas flow sensor boards
- Receives and provides power and data through RJ-11 connectors

DSG Designed Rack Mountable Chassis



Sixteen rack mountable chassis for housing components

Readout Cost Comparison

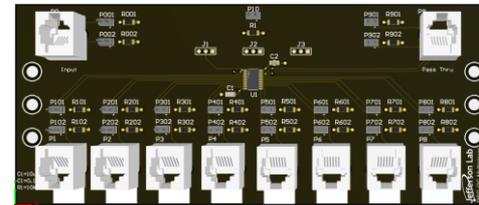


VS



Raspberry Pi

+



I²C Mux

+



Gas
Flow
Sensor

Standard industrial flow meter

- MKS 579 ~\$1600
- 100-channel system > \$160,000

DSG flow readout solution

- **DSG Gas Flow Sensor cost ~\$100**
- **100-channel system ~ \$20,000**

Procurement Status

Flow component	Need Supply + Exhaust			Ordered	Received	Outstanding	Cost/unit	Total Cost
	BBS	SBS	Spares					
Gas flow sensor (750 sccm)	8	4	8	20	10	10	\$95	\$1900
Manual flow valve (100 – 1000 sccm)	4	2	2	8	8	0	\$49	\$392
Gas flow sensor (400 sccm)	8	84	8	100	36	64	\$95	\$9500
Manual flow valve (50 – 500 sccm)	4	42	2	48	48	0	\$49	\$2352

Conclusion

- DSG is designing and developing the gas distribution and monitoring system for the GEM detectors
 - Mechanical components procured
 - Panel component design underway
 - Readout component procurement started
 - All gas flow sensor board components ordered
 - I²C multiplexer board design under review
 - Controls and monitoring software in development

Thank You