



Aachen



CMS BARREL MUON DT CHAMBERS

*Gas Rack for
Calibration of
Pressure Sensors
- Start of
Commissioning -*

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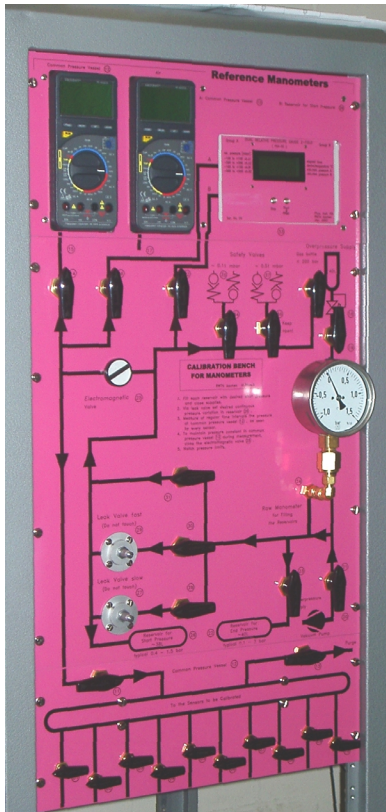


Fig. 1: Front panel of calibration rack, suited for simultaneous calibration of 20 sensors (= 10 manifolds) plus 6 reference manometers.



Fig. 2: Side of the calibration rack, with 10 manifold units with integrated pressure sensors to be calibrated. Each unit is connected via one flexible tube and one flat cable.

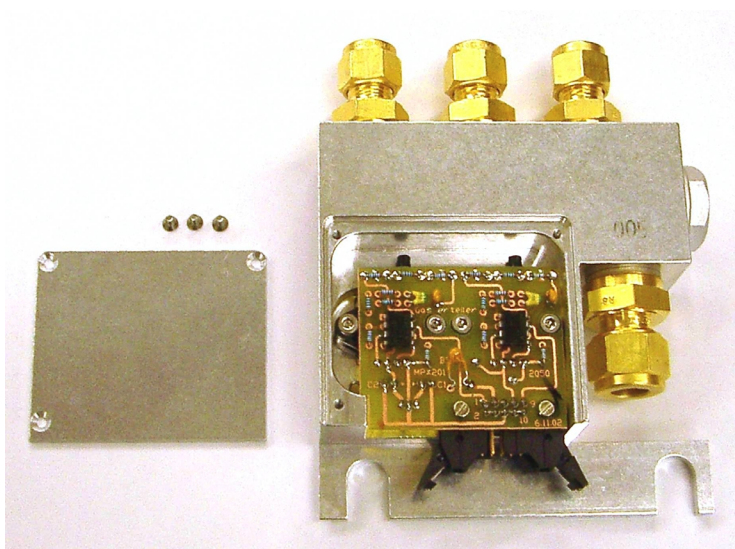


Fig. 3: One manifold with removed cover, to show the preamplifier circuit. The two sensors are under it.

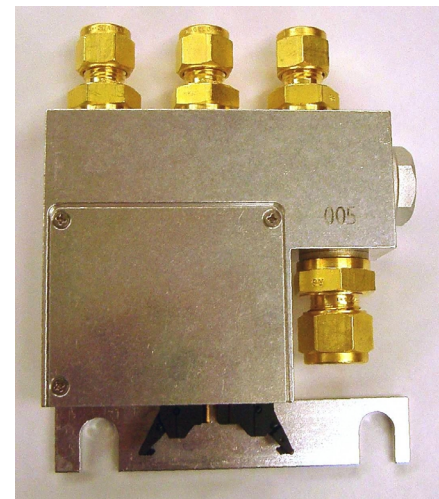


Fig. 4: One manifold 1:3, as it will be installed on the drift chamber.

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In the following, show curves from the first commissioning test of the 6 sensors built in the calibration rack. 2 high precision Baratron's of 15 bar range, the others are small Motorola sensors: 2 of +/- 0.5 bar range and 2 of +/-0.1 bar range. Only the Baratron's were already calibrated.

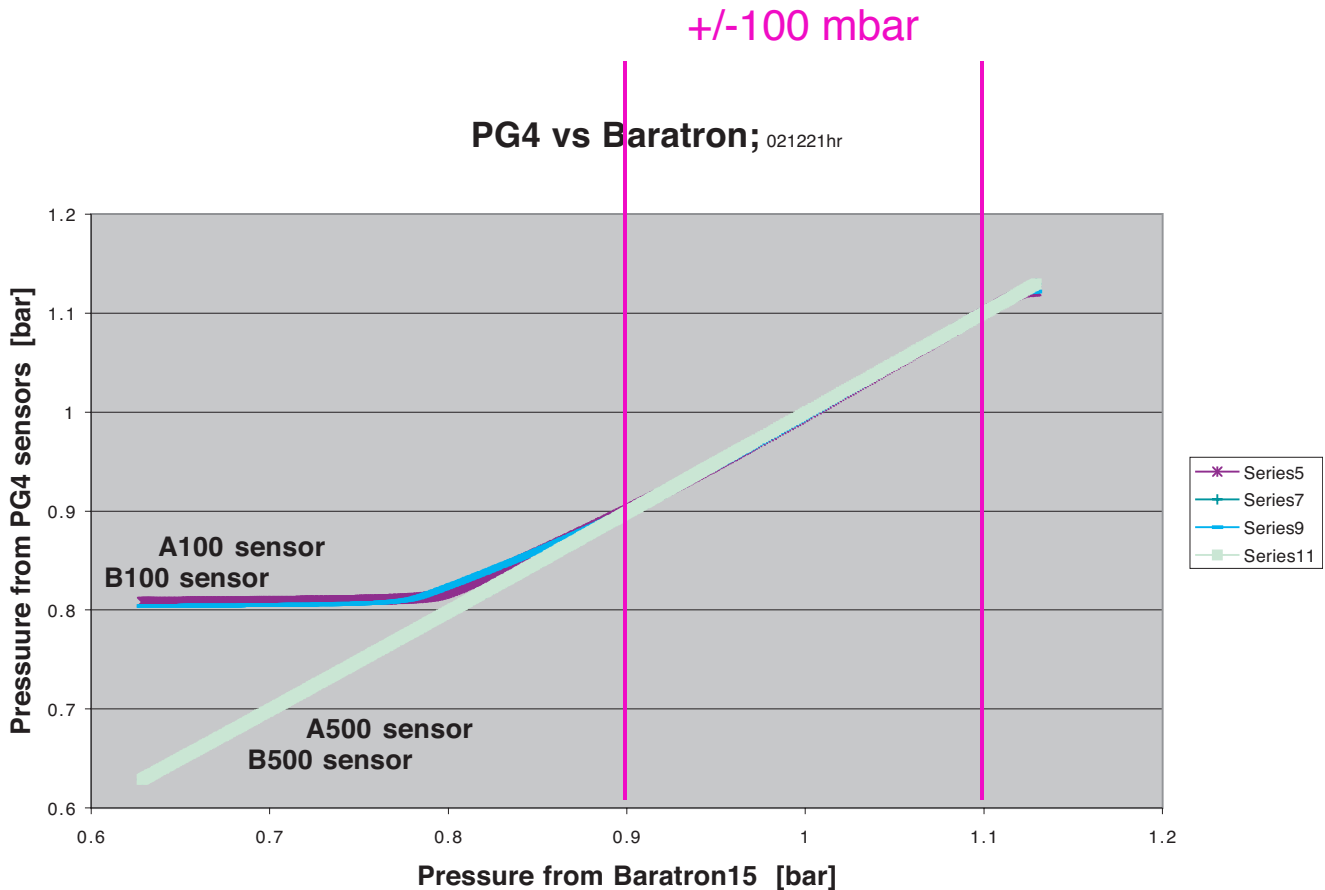


Fig. 4: The small sensors look very linear, in this coarse scale. Note that the 100 mbar sensors do also work outside the 100 mbar range.

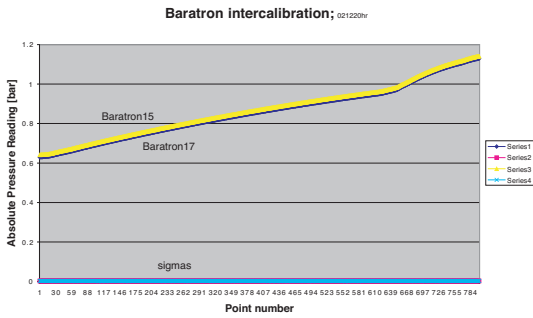


Fig. 5: 2 Baratrons vs. time. The measurement was accelerated in the last phase. All following curves are shown with this same x-axis and each point shown is the average of 100 readings.

Difference (2 Baratrons) 021220hr; average of 100 readings per point.
Single pressure +/-1.55 mbar; differences 2 Baratrons 12.21 +/- 0.21 mbar

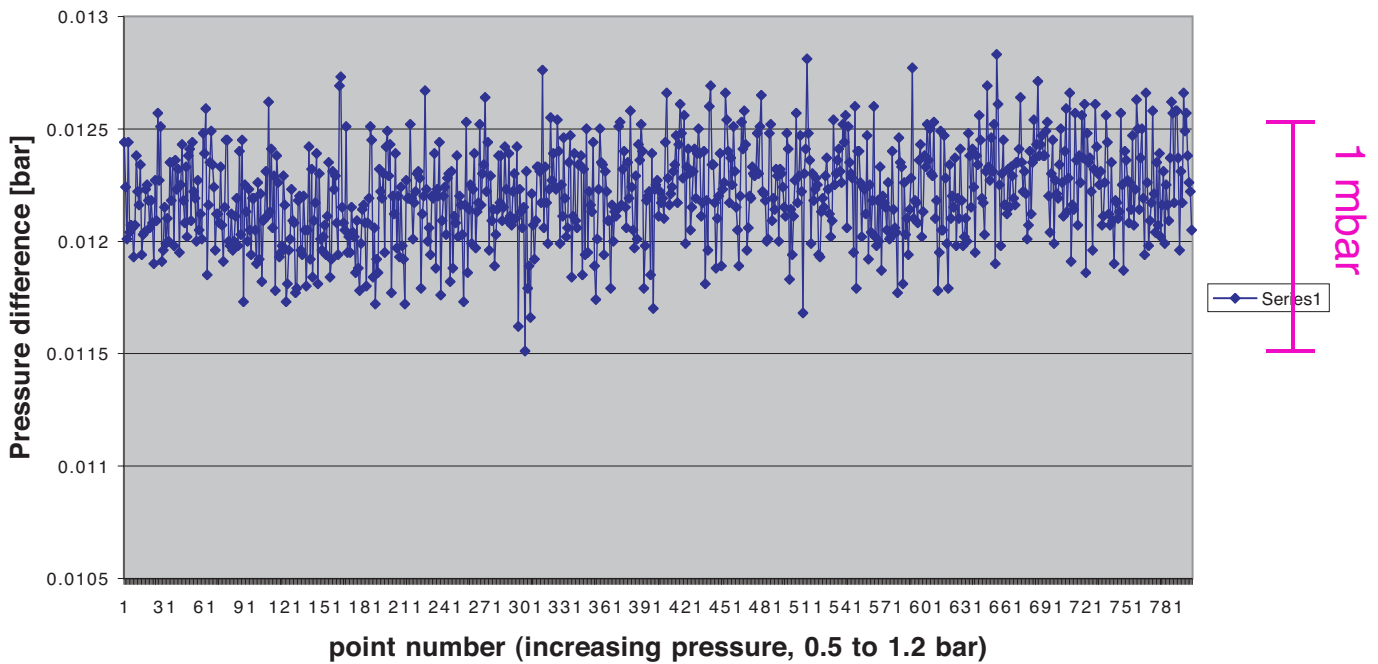


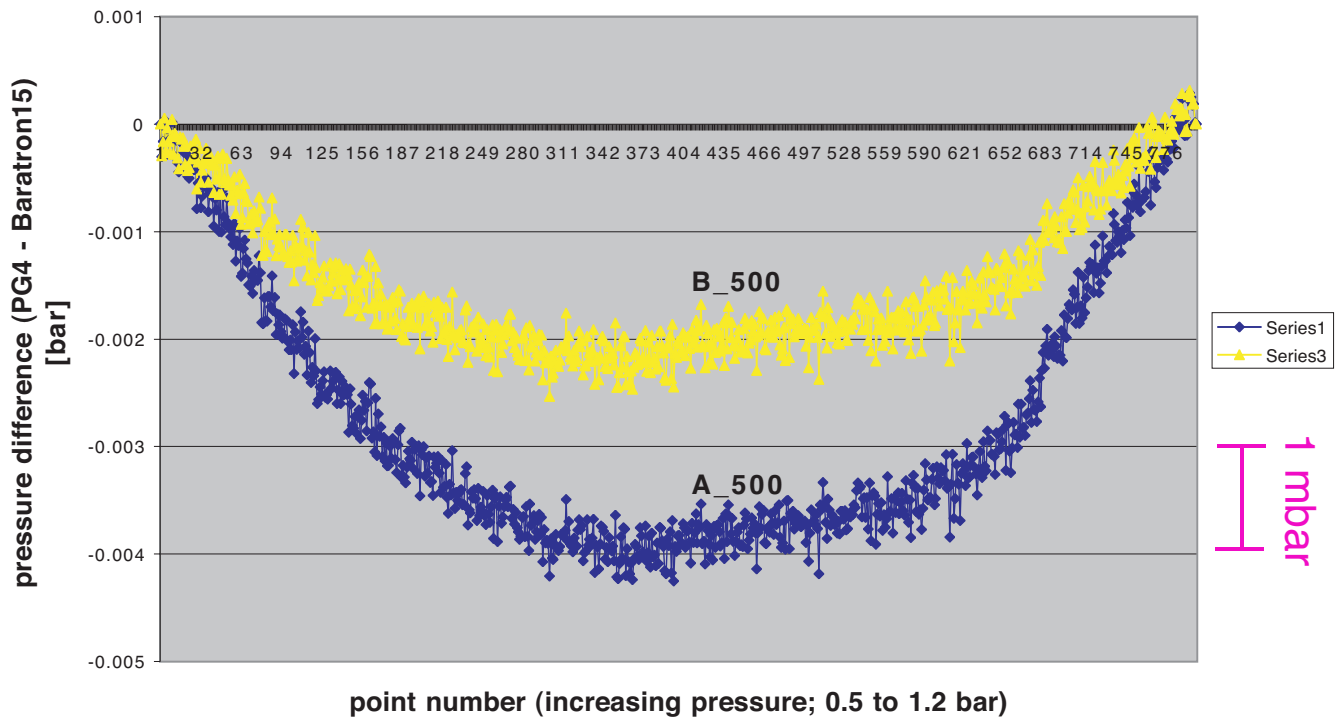
Fig. 6: Difference between the readings of the two Baratrons. Note the systematic average difference of 12.2 mbar (calibration); these differences of averages fluctuate by +/-0.21 mbar.



Motorola - Baratron



Difference PG4(500 mbar sensors) to Baratron15; 021220hr



Difference PG4(100 mbar sensors) to Baratron15; 021220hr

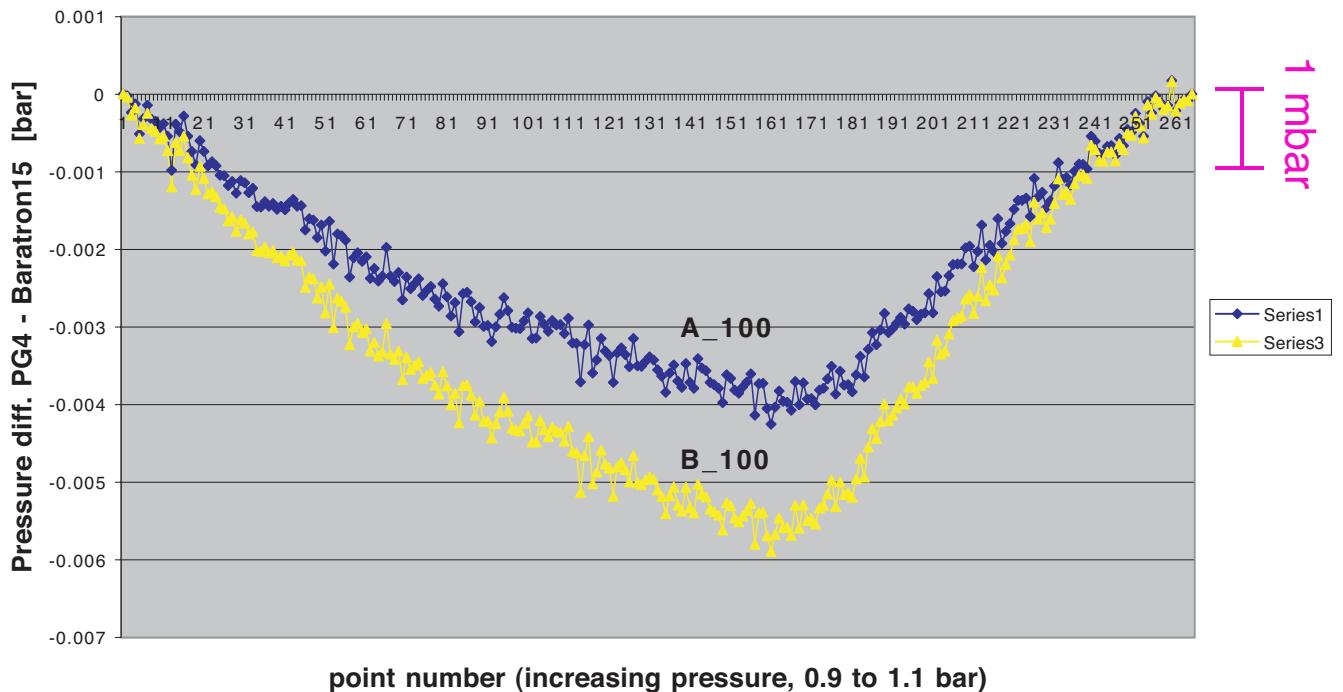


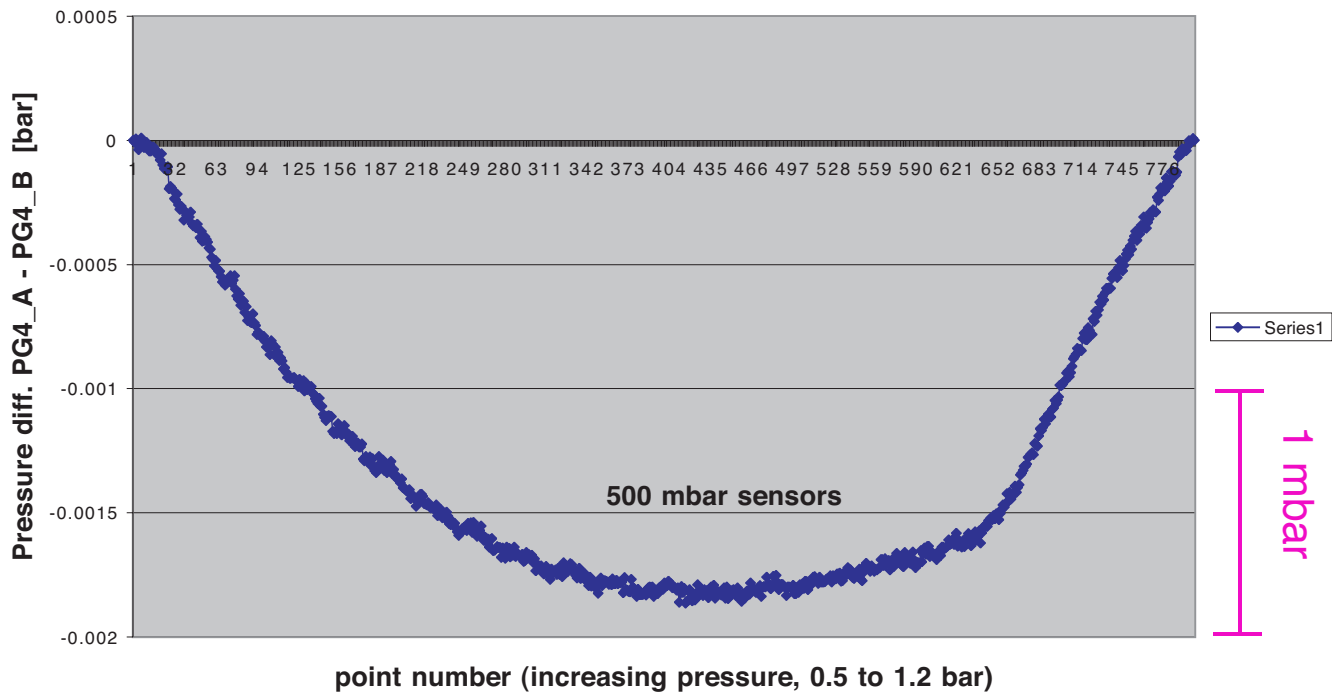
Fig. 7: Nonlinearity of the Motorola sensors. The endpoints are defined to agree with the Baratron, the others scaled accordingly. The nonlinearity reaches 6 mbar, while the fluctuations are around 0.3-0.4 mbar, but are systematically correlated.



Motorola - Motorola



Difference PG4 sensors; 021221hr



Difference PG4_A - PG4_B sensors; 011221hr

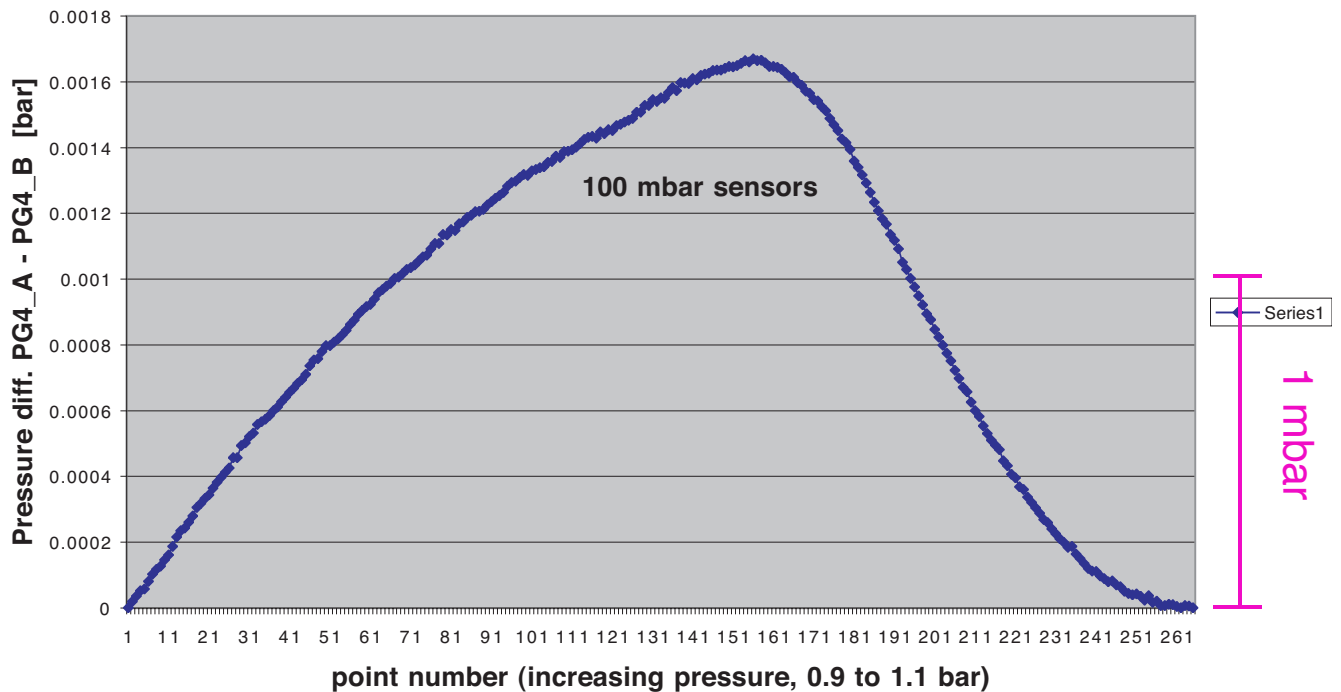


Fig. 8: As for Fig. 7, but now the difference between Motorola sensors is shown. The fluctuations are indeed very small: $<\sim 0.05$ mbar (top) and $<\sim 0.02$ mbar (bottom curve).



Conclude



DONE:

- **First measurement** made to commission the gas rack for pressure sensor calibration.
- **Looked at 2 Baratron (calibrated) and 4 Motorola (uncalibrated) sensors.**
- **Measurement:** at >800 pressure values, read each sensor 100 times and recorded the average. Scaled the reading of the Motorola sensors to match the pressure of the reference manometer (Baratron) at two points (very coarse “linear calibration”).

RESULTS:

- **Baratron - Baratron:** systematically ~ 12 mbar difference (offset in calibration; can be removed by present calibration).
- **Baratron - Baratron:** statistically ~ 0.21 mbar fluctuations in difference of average of 100 measurements.
- **Motorola - Baratron:** systematic 0-6 mbar nonlinearity of Motorola sensor (“linear calibration” too coarse).
- **Motorola - Baratron:** statistically ~ 0.2 mbar fluctuations in difference of average of 100 measurements - but correlated between Motorola sensors (are relative pressures).
- **Motorola - Motorola:** systematically 0-2 mbar difference (calibration)
- **Motorola - Motorola:** statistically $\ll \sim 0.05$ mbar ($\ll \sim 0.02$ mbar) fluctuations in difference of average of 100 measurements, for 500 mbar (100 mbar) sensors. **Better than Baratrons, here!**