CMS
BARREL MUON
DT CHAMBERS

Status of Production at Aachen

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020923

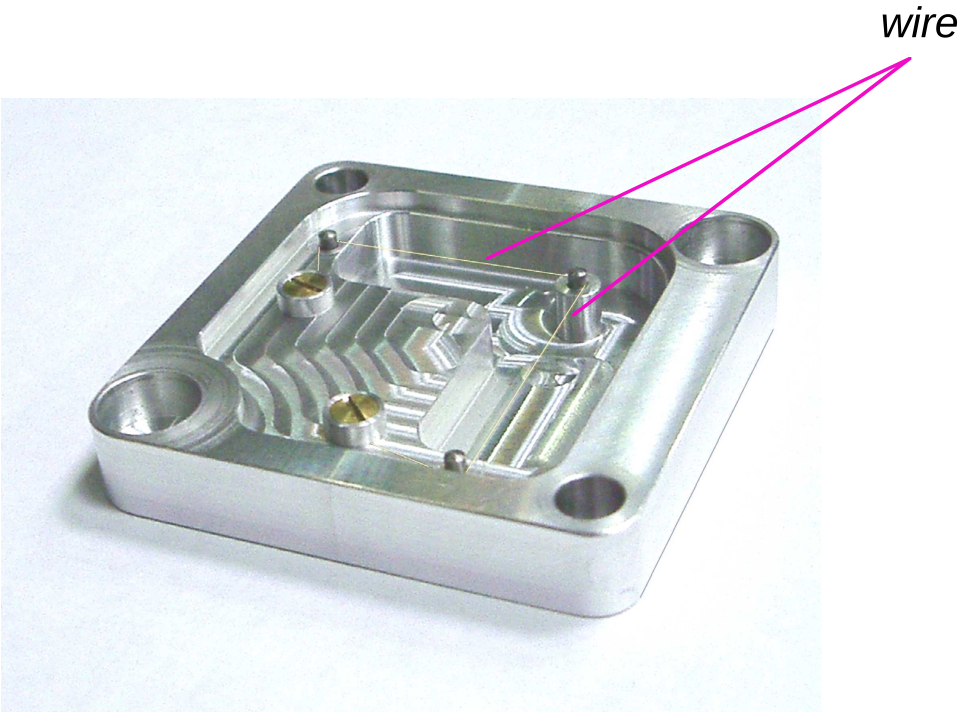
Status

• Summary of SL/DT production:
SLs mech. finished 37 (one of which was damaged)
DTs assembled 8 = 6 „-Z“ and 2 „+Z“
Ship ~4 DTs to CERN in October
Foresee 14 DT + 9 SL by end 2002.

• Had major stop of ~1.5 month for hall climatization upgrade.
• DTs assembled gluing SLs to honeycomb free of stress
• Tooling for gluing „+Z“ DTs finished
• Wire reference on table added (photo)
• Jig for gluing RPC link plates being produced
• SL/DT tests see talk K. Hoepfner.
• O-rings puzzling
• Honeycomb preseries (batch of 30 panels total) accepted by all labs; go ahead given. Delivery of next batch starting in October.
• Honeycomb producer requested a price adjustment (say: increase) of about 5%, related to work on frame assembly; endorsed by collaboration.
• Gas components approved at last CMS Week ordered; majority delivered and shipped to labs.
• Cooling components approved at last CMS Week ordered; delivered and kept at CERN. Available stainless steel tube pieces to be cut and bent, once the 3D modelling is available.
• Approval of hoses/flexible tubes for gas (by safety) still pending... The sample got lost; a new one has been provided last week.
• Ship now components to Torino.
• First gas manifold bodies produced(*); preparing calibration bench for mass production.
• Pressure sensors checked successfully for
- Low supply voltage (5 V - 6 V)
- Neutron irradiation (10 a LHC equiv.)
- Magnetic field (2 T) - surprise: see shift, but resolution maintained.

* For use on chambers; further ones for chamber or patch panel.

Further Reference



Wire Reference Block. *This unit remains permanently attached to the table. The short wire is lower than the borders (protection) and easy to substitute (without loosing the reference position); it permits a measurement of X and of Y coordinates. There are four such Reference Blocks on each table, located near the corner blocks of the SuperLayer.*

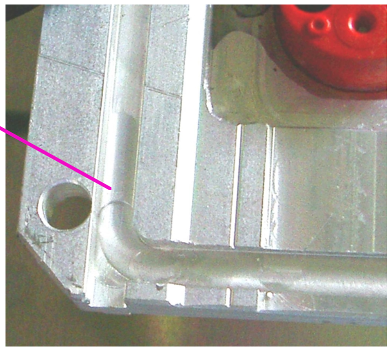
Function: *provide an additional and independent measurement (to the measurement of LED reference points) of a reference on the table, to correlate the wire measurements of different layers.*

O-Rings

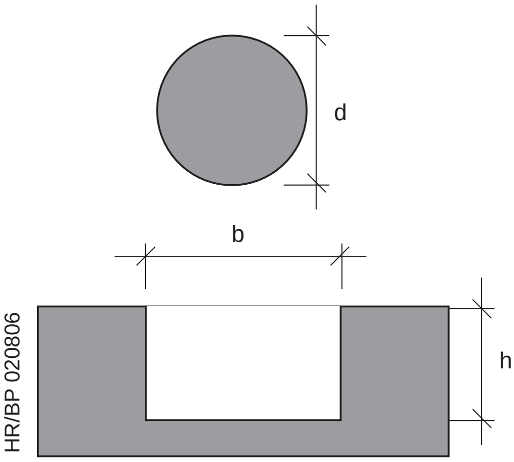
A few symptoms and possible cures:

A ***step****, from machining, is left at the bottom of the groove of some covers (failure from a local firm). Smooth out by hand.*

See nevertheless gas leakage at the end of this groove, when there is no step.



At left, visible ***damage of the o-ring at the corner region****; at the right, the same o-ring a few cm further, i.e. at the straight section, is in good shape. This was not observed at Legnaro; we therefore try their supplier (Dichta/CH). Reduce tension on o-ring by increasing its length.*



O-Ring:
d = 3.53 mm

Groove:
Norm (producer Simrit / D):
h = 2.70 +/- 0.07 mm
b = 4.60 + 0.2 mm

Norm (I), drawing DT:
h = 2.90 (+/- 0.2) mm
b = 4.20 (+/- 0.2) mm

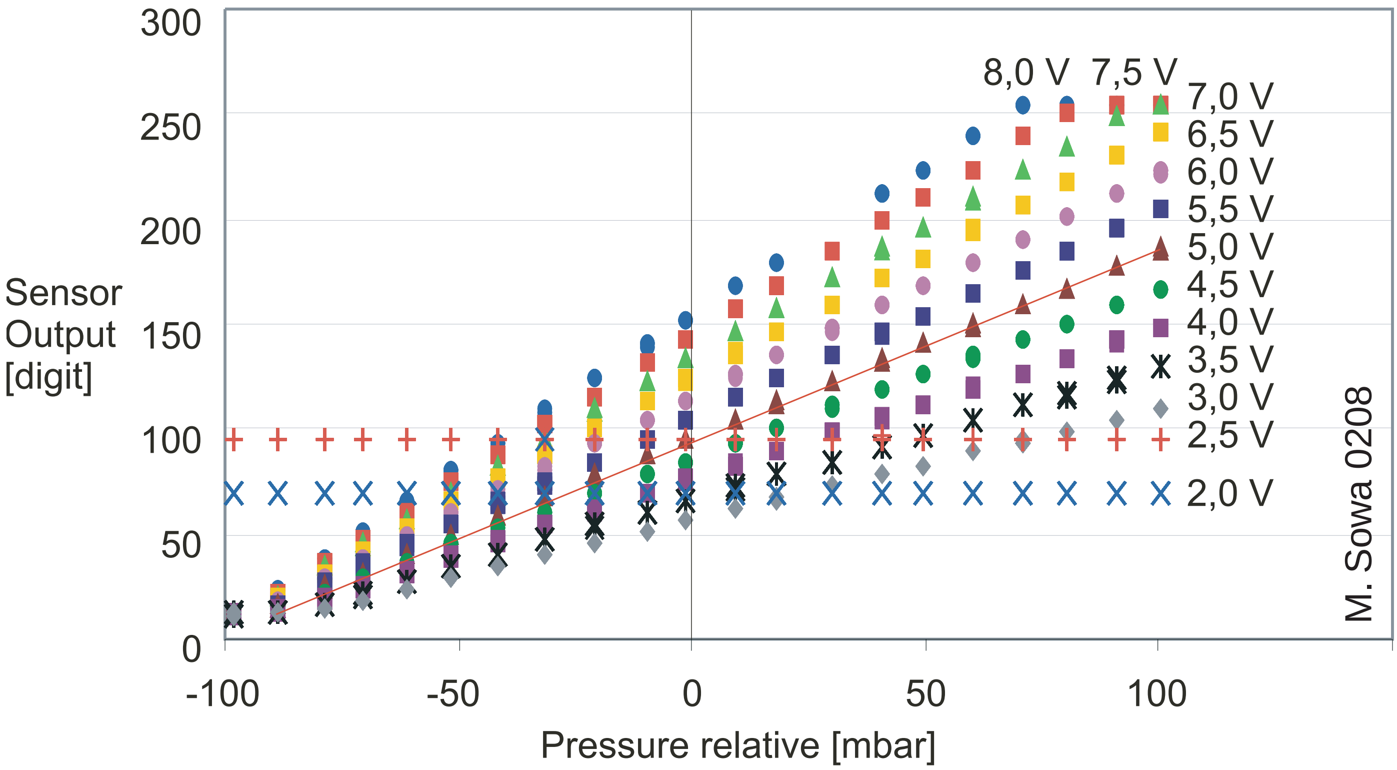
The producer's ***groove specs*** *for the same material (NBR) and hardness (70 shore) found to be different in different countries…*

…understand?

Conclude: *watch behavior of o-ring, to be sure there is no degradation of the gas tightness with time.*

Sensor Test (1)

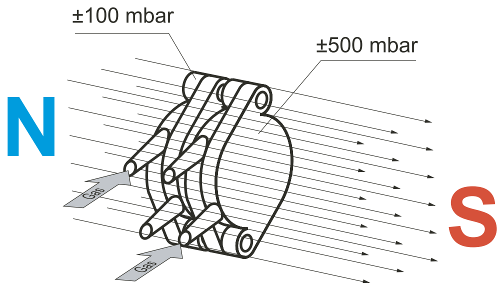
Pressure sensor at low supply voltage? Although the typical supply voltage for these sensors is quoted to be 10 V, since only 5 V - 6 V are available at the chamber, the suitability of the lower voltage had to be checked (C. Willmott). Measurements by M. Sowa have ***validated*** *their functionality (resolution and linearity) at low supply voltage:*



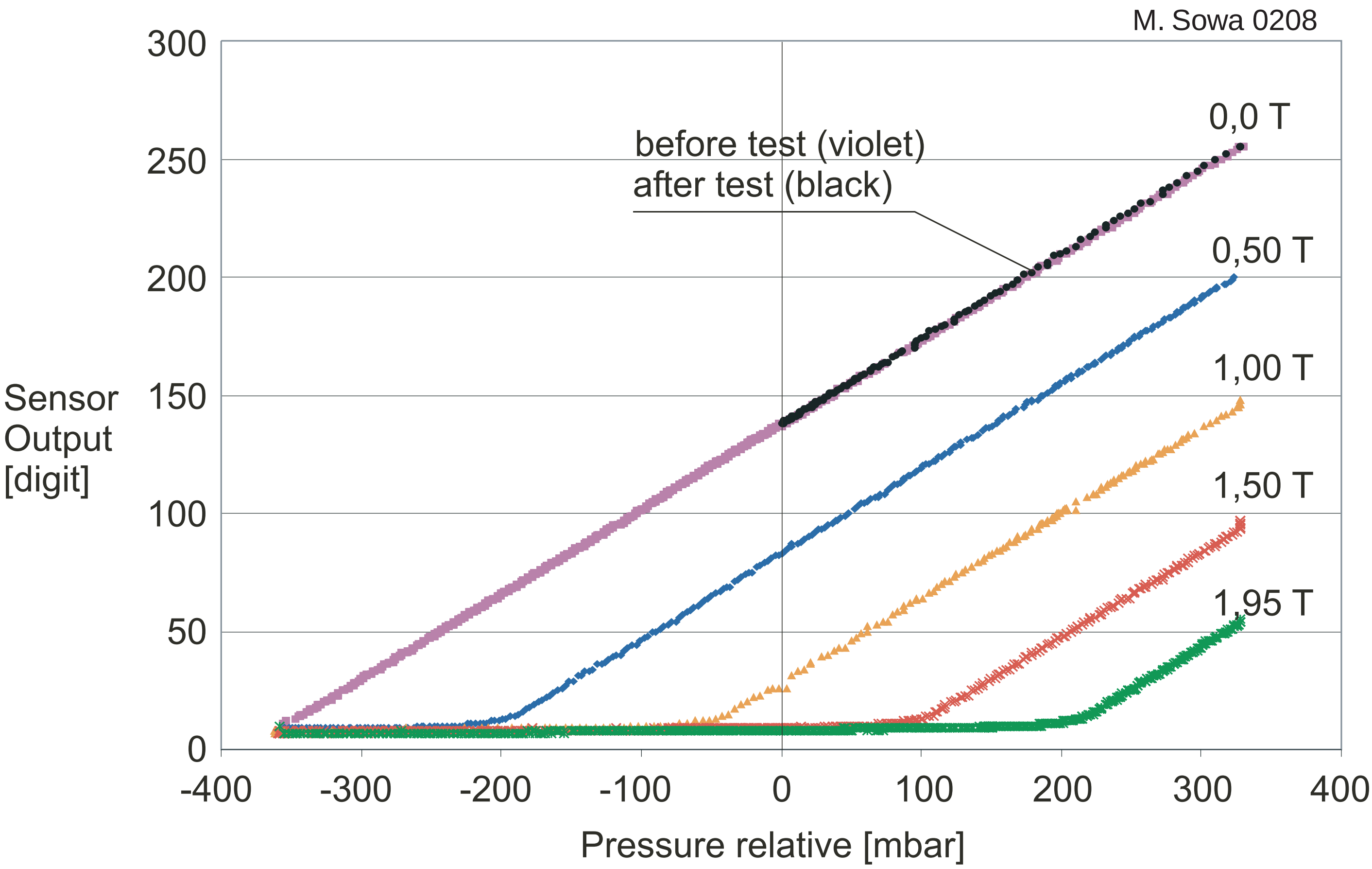
Repeated measurements for each voltage; no hysteresis. Linearity also good at 5 V supply. No signal below 3 V. Need stable supply, since signal is proportional to supply voltage. Diagram shown is for 500 mbar sensor, 8 bit ADC.

Irradiation test. Four sensors (2 of 100 mbar range and 2 of 500 mbar range) were irradiated with ~ 10^{11} neutrons/cm2 (≈10 a LHC) at the CERN PS. No activity and no change in the calibration curves were observed.

Sensor Test (2)

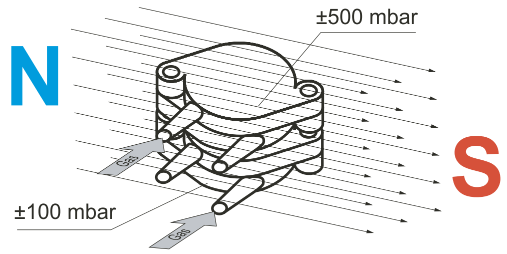


Magnetic field
orthogonal
to sensor

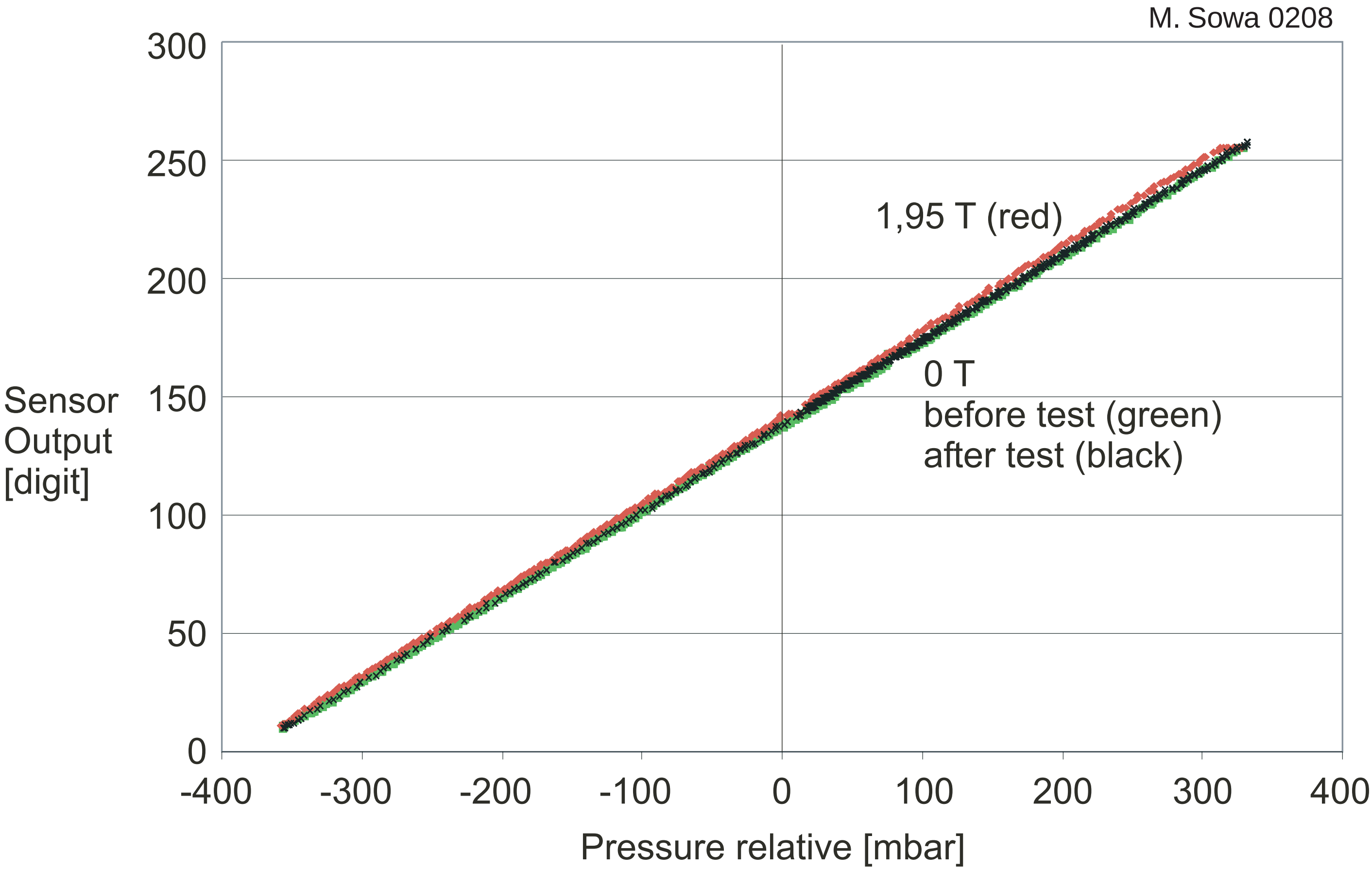


*With magnetic field **orthogonal** to the (500 mbar range) pressure sensor, the sensor maintains its resolution, but the calibration line is shifted. Reversing of the field reverses the shift direction. See same behavior for the 100 mbar range sensor, but with a correspondingly smaller shift of about 35 mbar for 0.5 Tesla.*

Sensor Test (3)



Magnetic field
in plane
of sensor

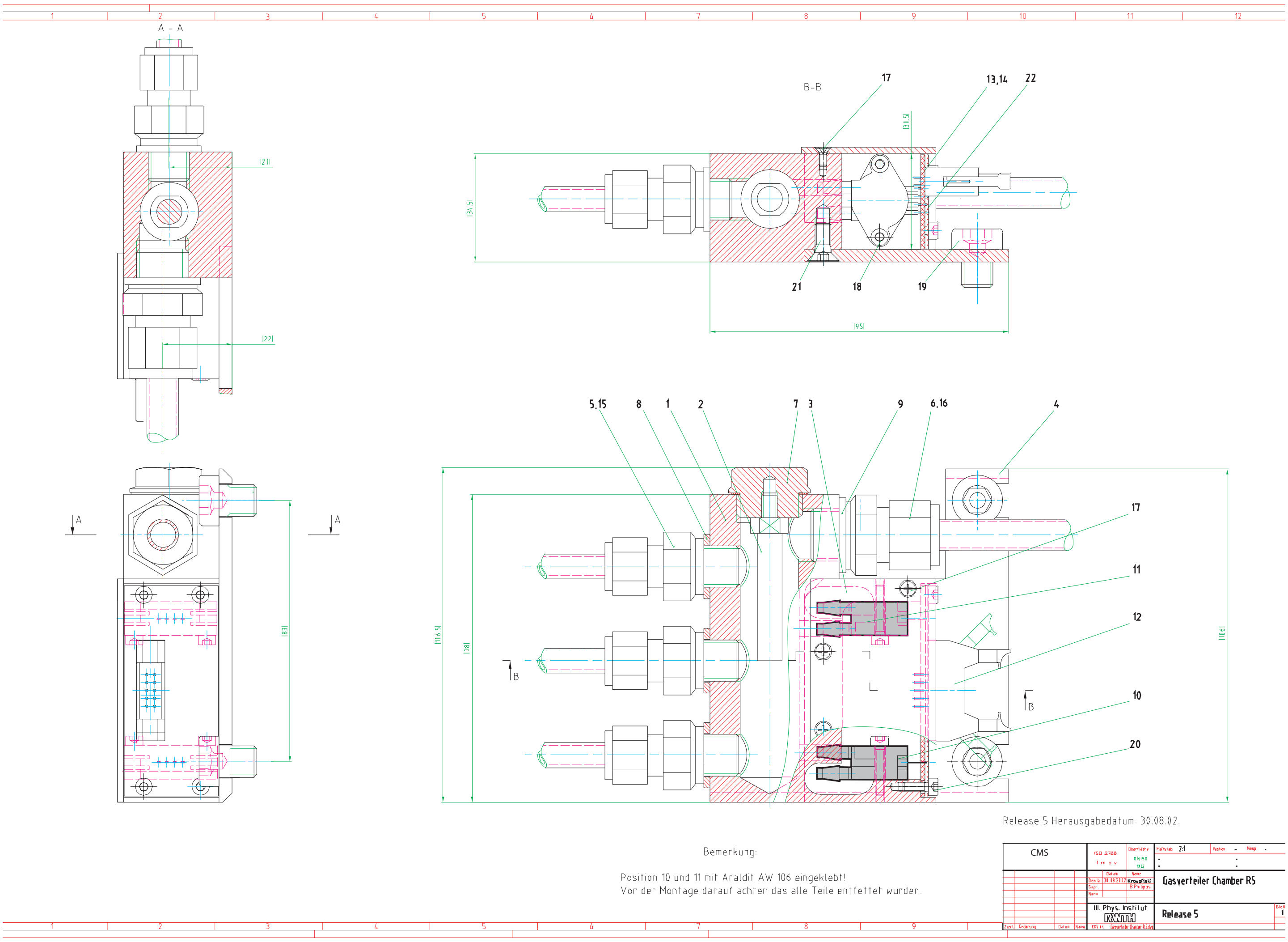


With magnetic field ***parallel*** *to the (500 mbar range) sensor, the sensor maintains its resolution and there is no shift. See same behavior for the 100 mbar range sensor.*

Conclude: choose appropriate orientation of the sensors in their housing.

Housing of Sensors

*At the gas **patch panels**, have field (~1.3 T) in plane perpendicular to the face of the iron. Orient the sensors accordingly, to avoid a shift in the calibration line:*

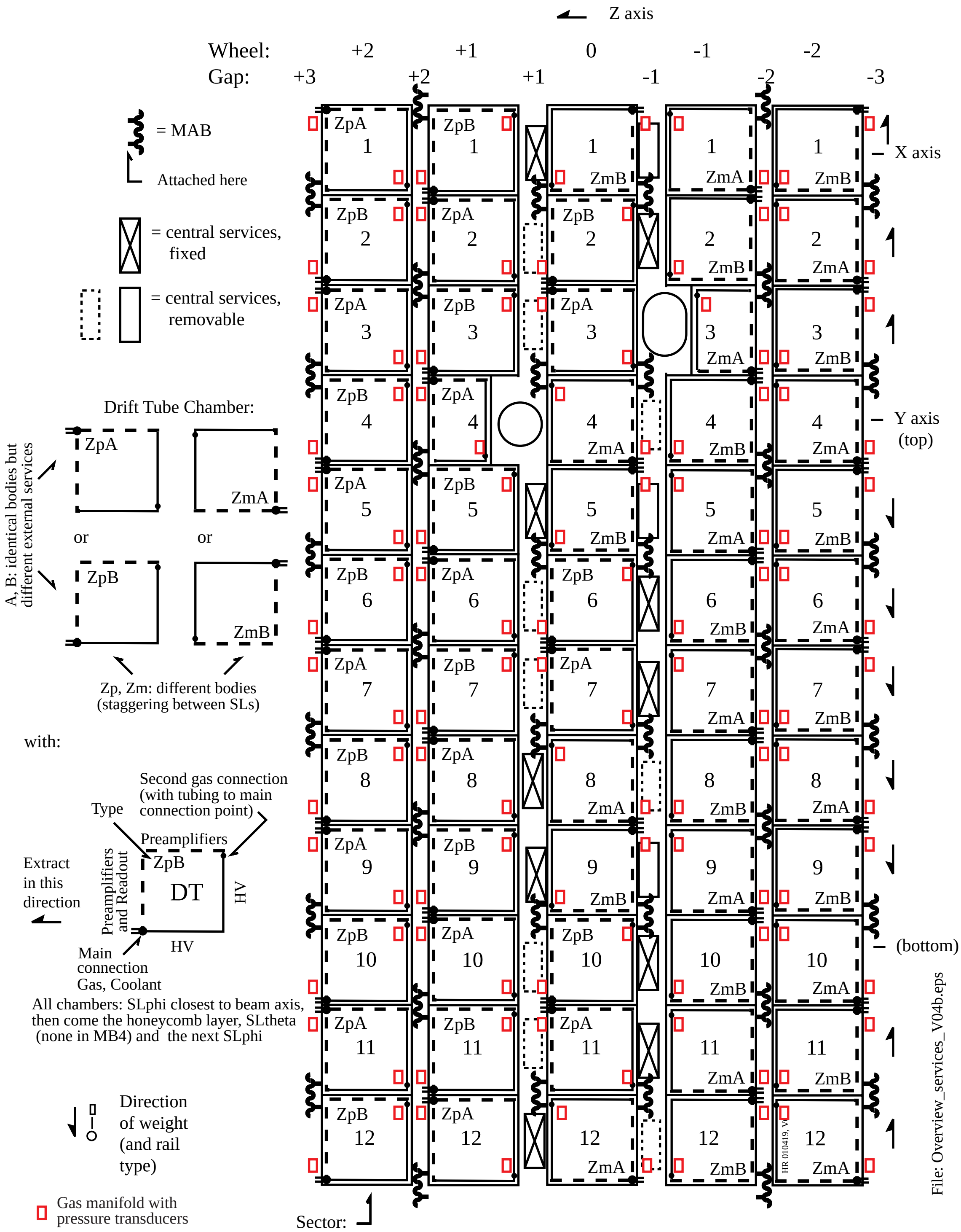


Gas manifold, showing the new orientation of the sensors

*At the **chambers**, the sensors are located at regions of very small field, mostly in the same orientation as above. Use the same housing.*

***Note**: an eventual shift of the calibration line, although small, can be determined (and accounted for) in situ by stopping shortly the gas flow - the pressure is then known to be the same everywhere (the barometric difference is well known).*

Manifold Location



Installation of CMS Barrel Muon Chambers. Sectors as seen from inside. Sectors 4 and 10 have the chambers subdivided in two, at station MB4 (not shown here). The difference between A and B types is the location of gas, coolant, HV and LV external connection; the bodies are identical. The staggering between the SuperLayers is, however, different between the Zp and Zm types (have to extract the chambers in opposite directions in Z+ and Z- wheels, but the wheels have all the same orientation and are made left-right asymmetric to ensure an hermetic coverage in azimuth).