

Quality Control for CMS Drift Tubes in Aachen

Wire Tension and Wire Position

- Requirements and detector parameters
- Quality control in Aachen
 - ▷ Wire tension
 - ▷ Wire position
- Summary

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III. Phys. Inst. A RWTH Aachen
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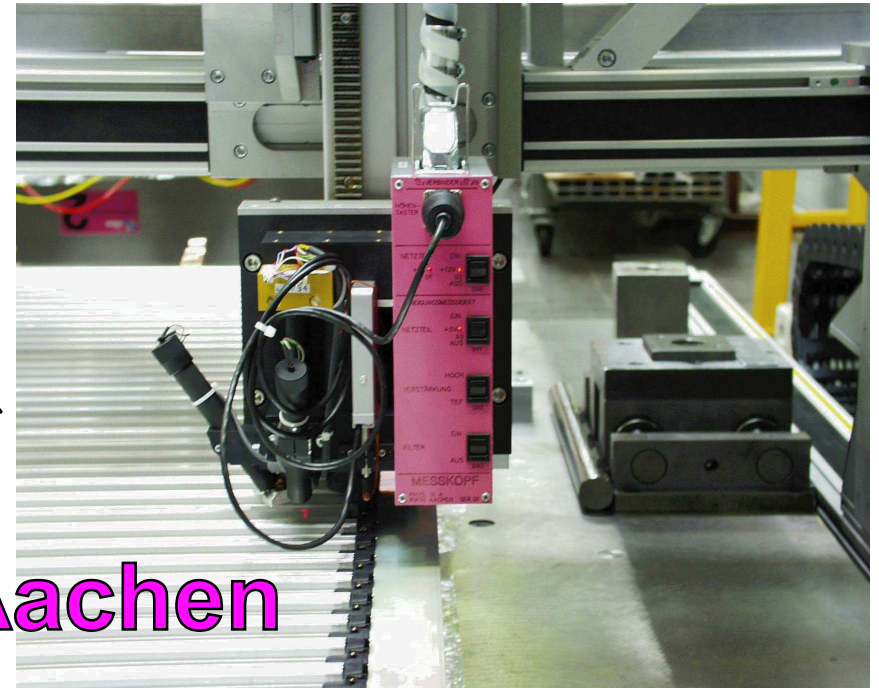
detector parameters

- spatial resolution per chamber: $100\ \mu\text{m}$
... per cell: $250\ \mu\text{m}$
- precision in positioning the **anode wires**:
 $\pm 100\ \mu\text{m}$

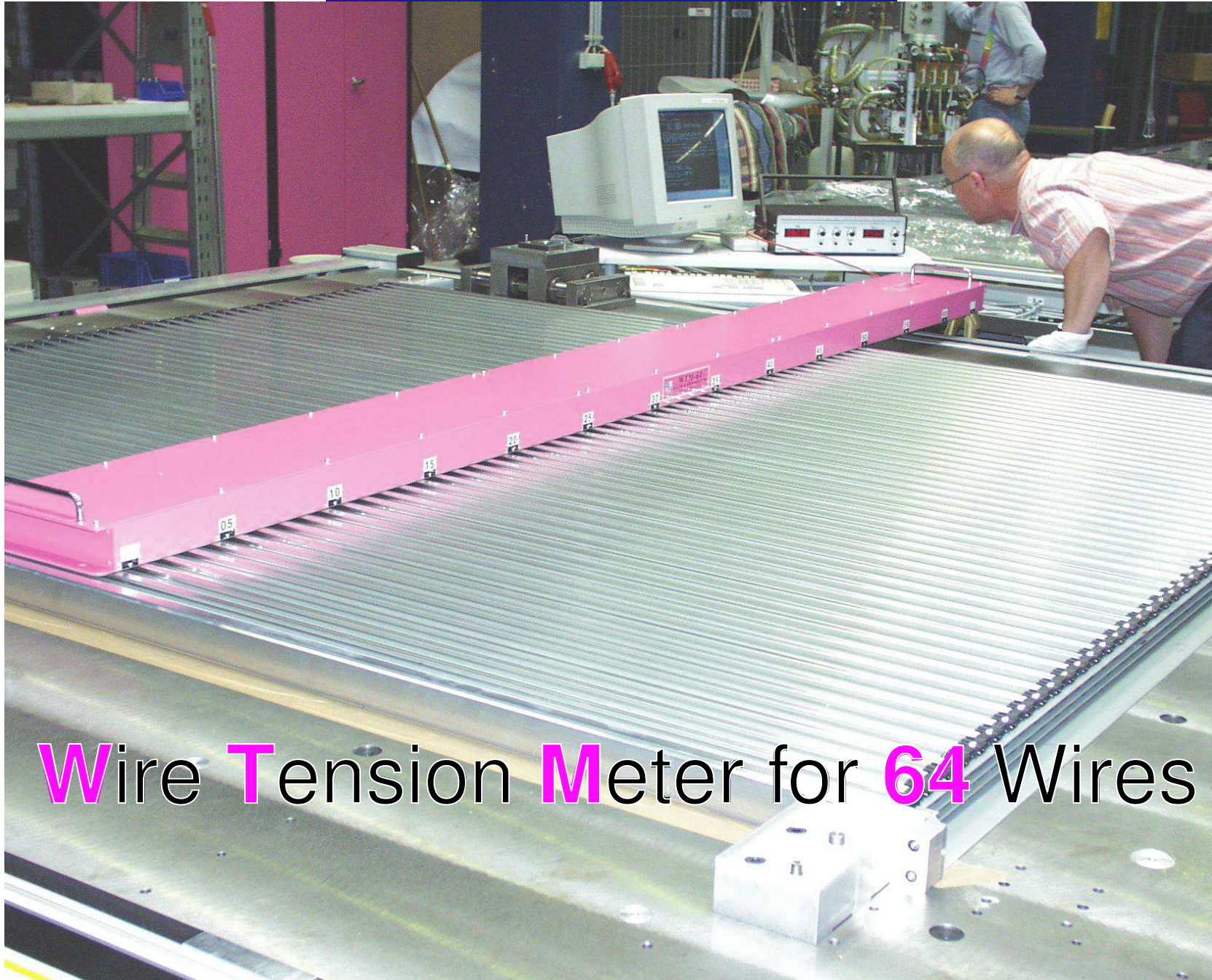
wire tension



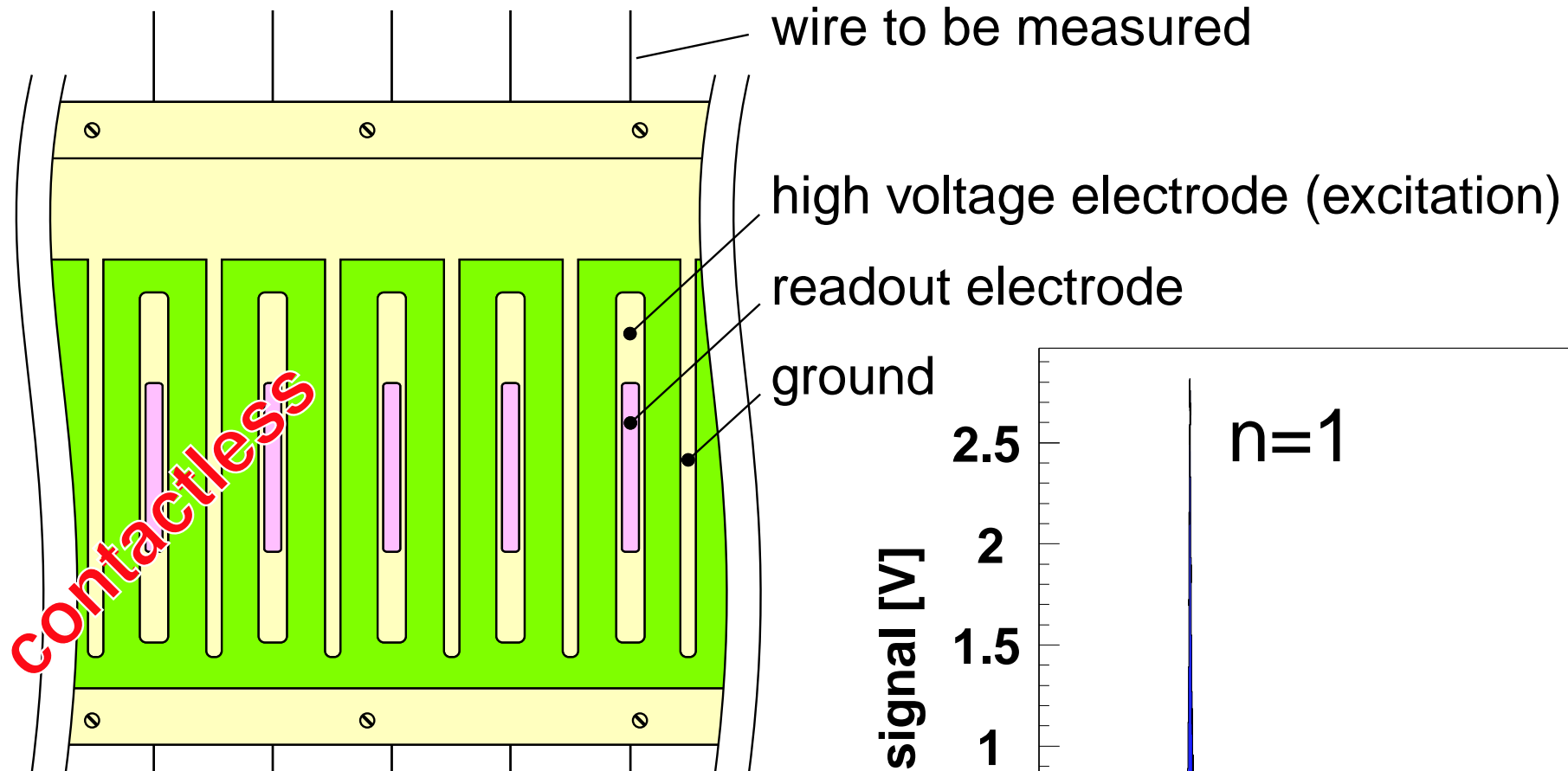
wire position



quality control in Aachen

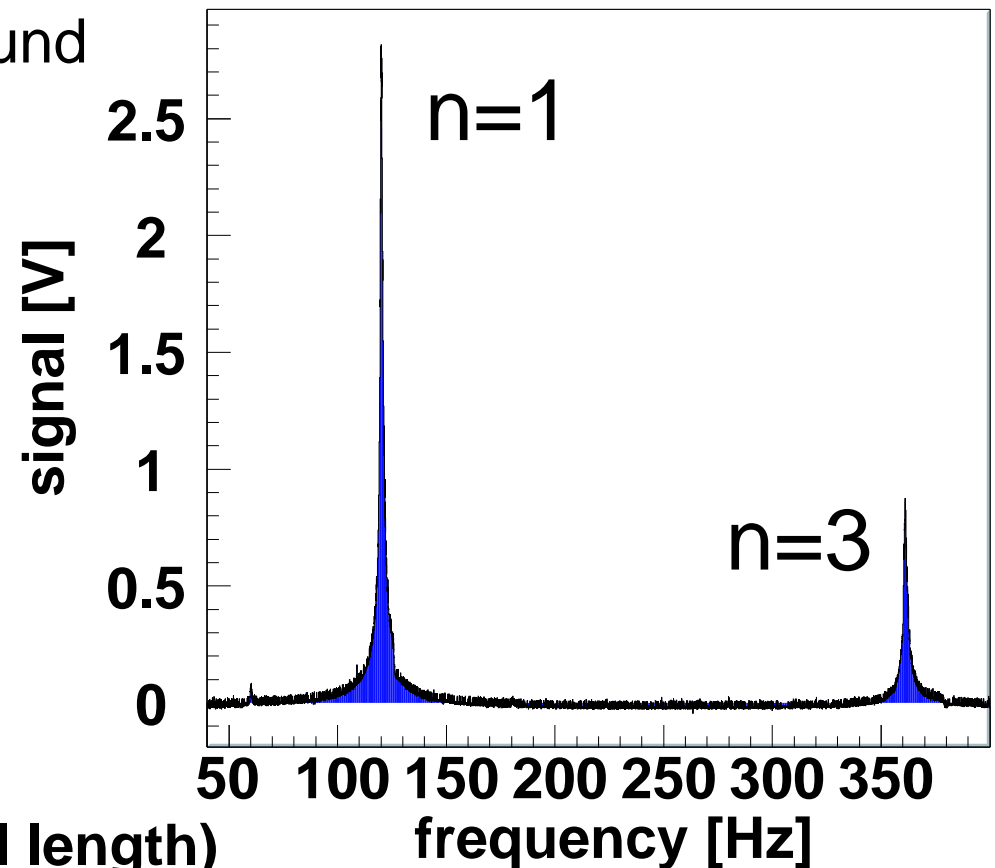


Wire Tension Meter for 64 Wires

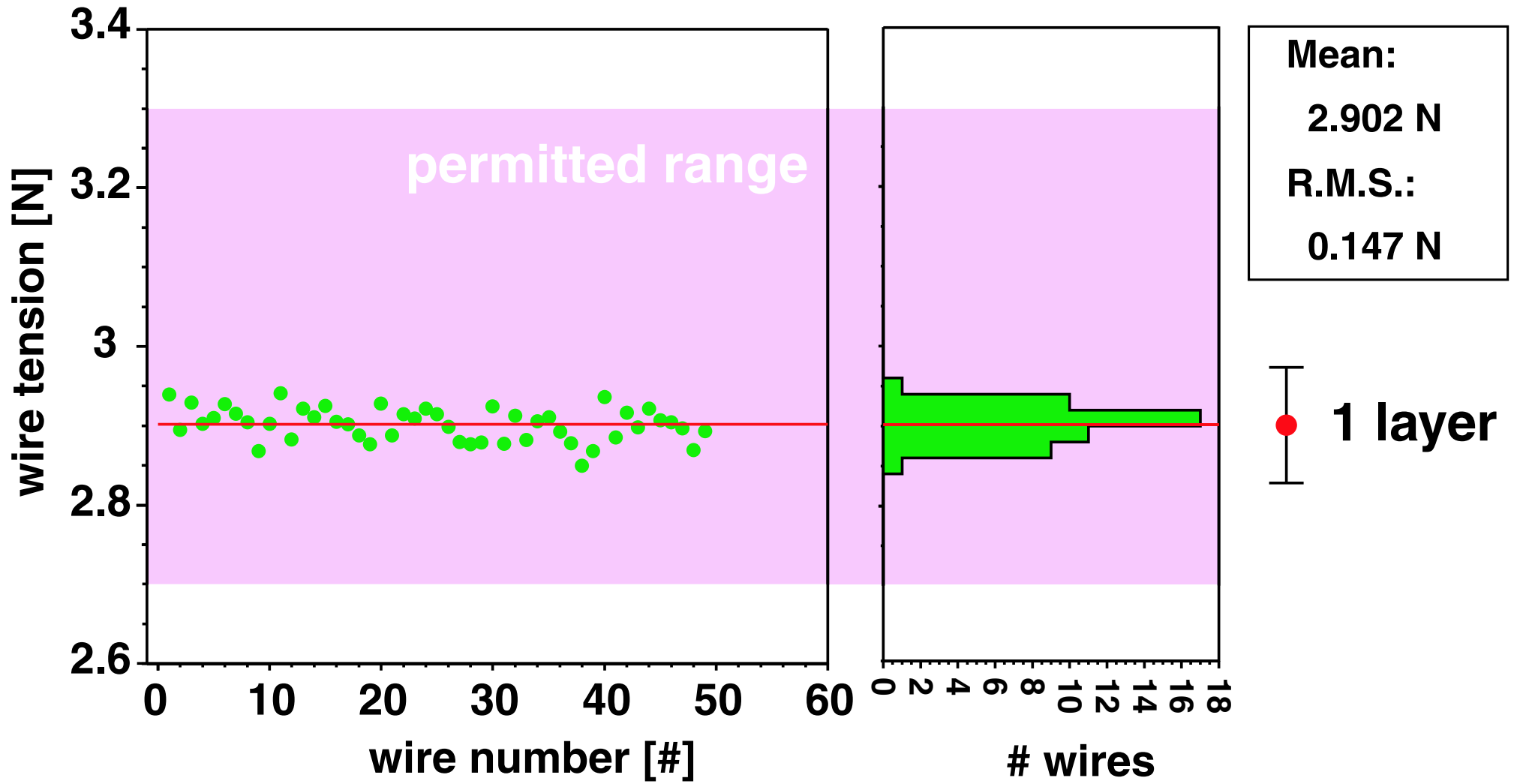


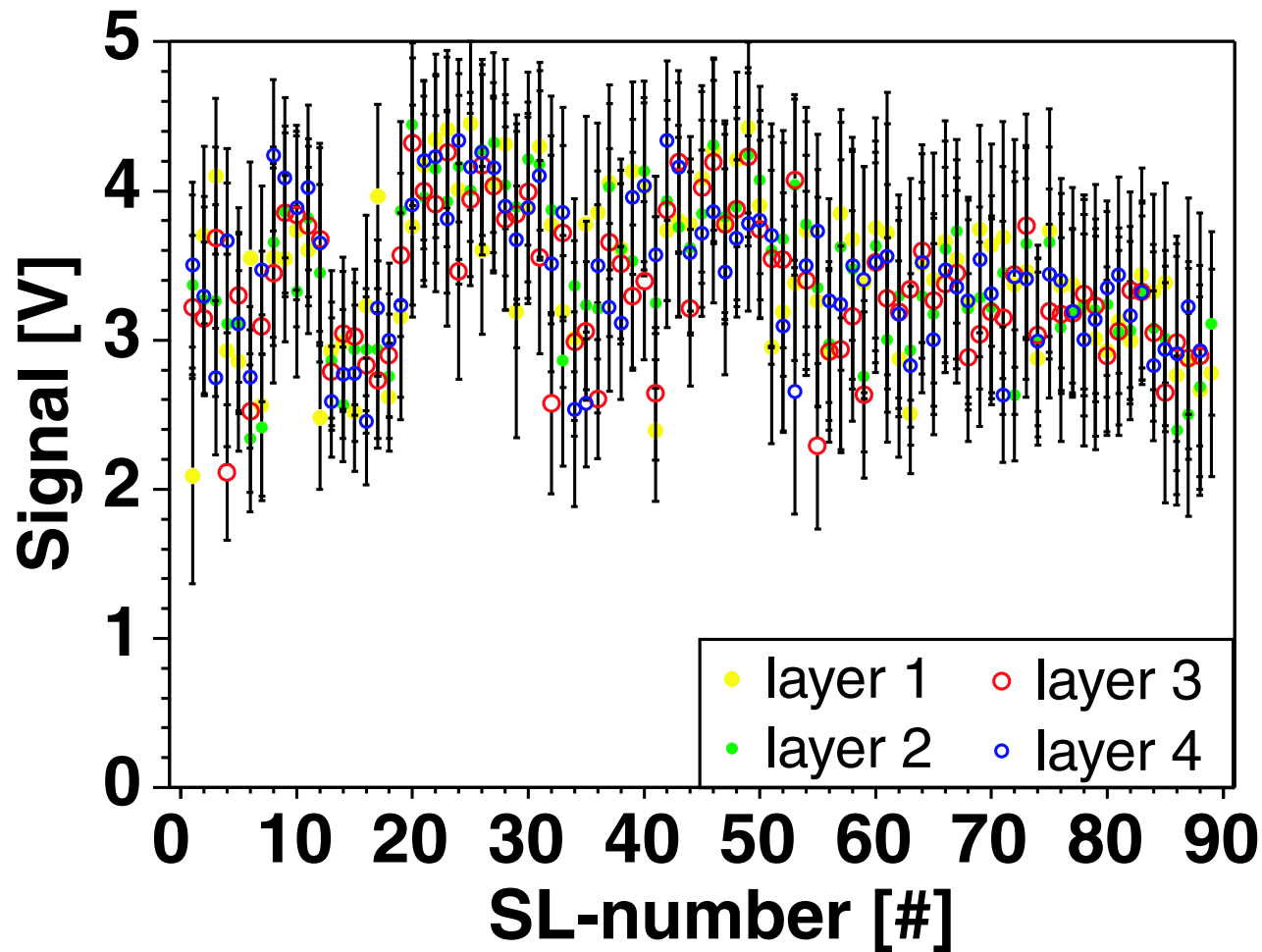
$$F = \mu \cdot \left(\frac{2 \cdot f \cdot l}{n} \right)^2$$

(μ linear density; f resonance freq.; l length)

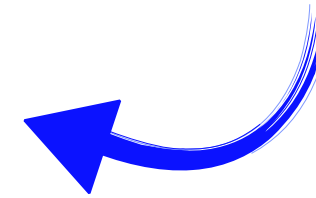


Single Layer

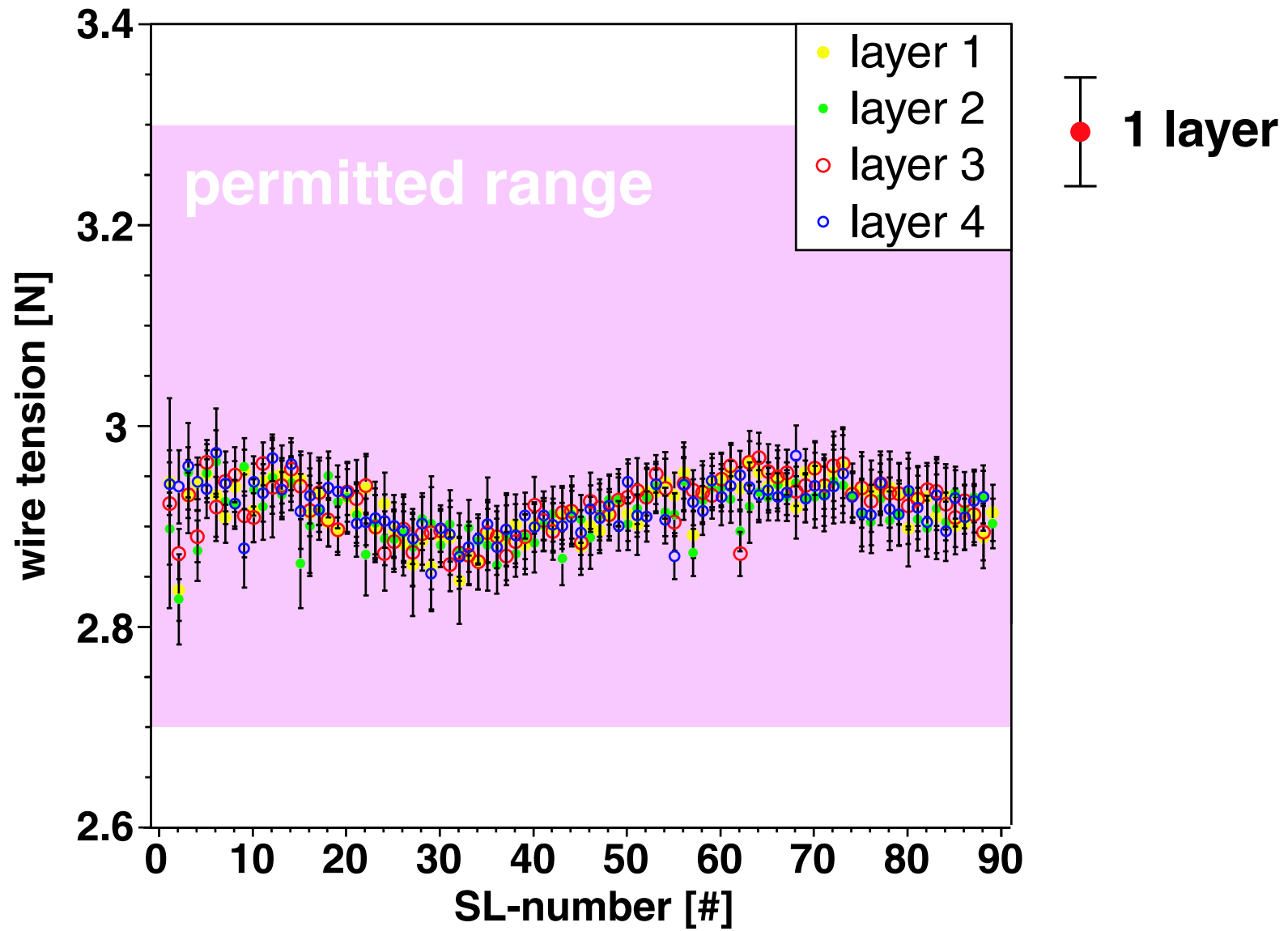




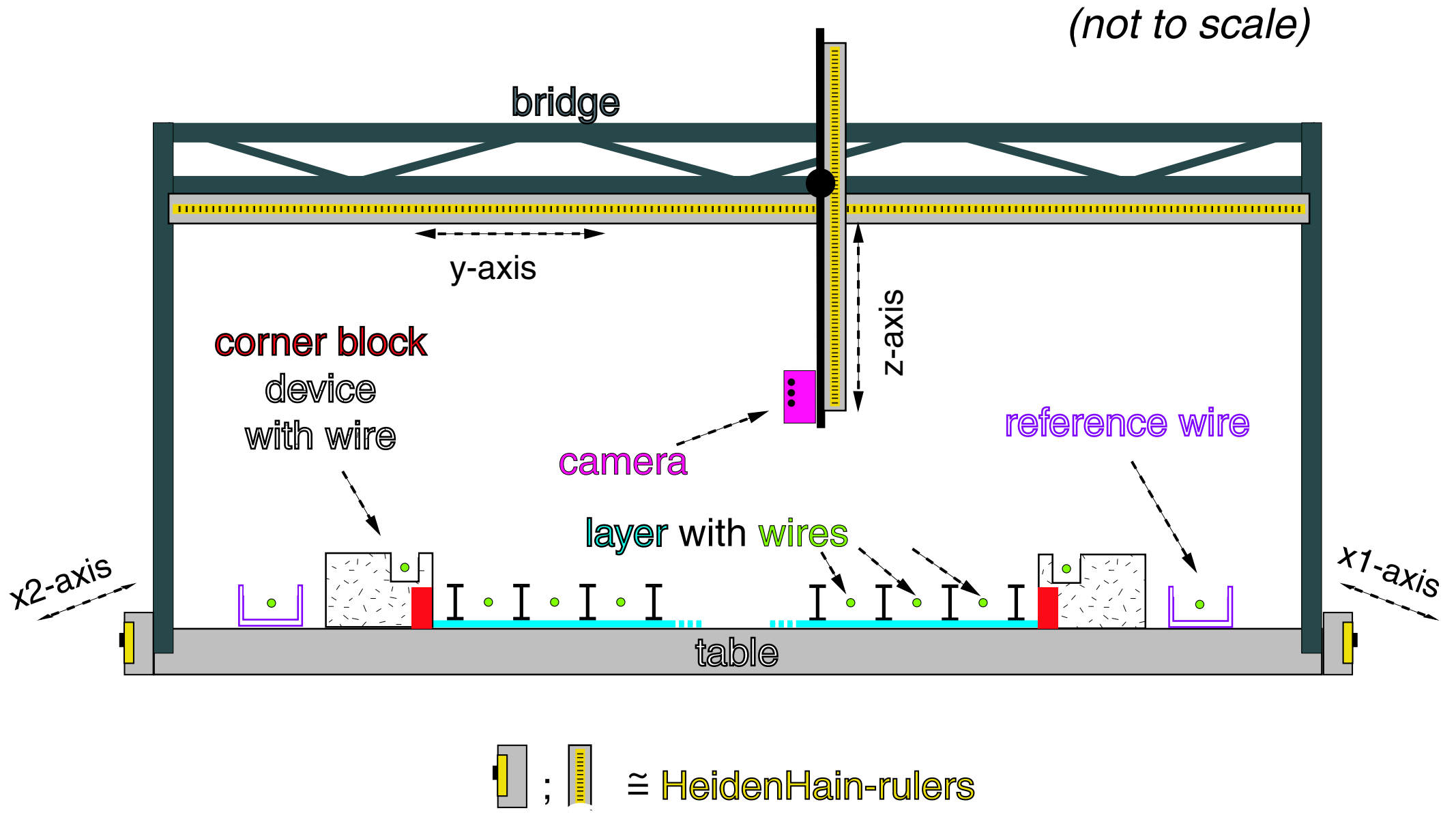
signal well within
2 to 5 V!



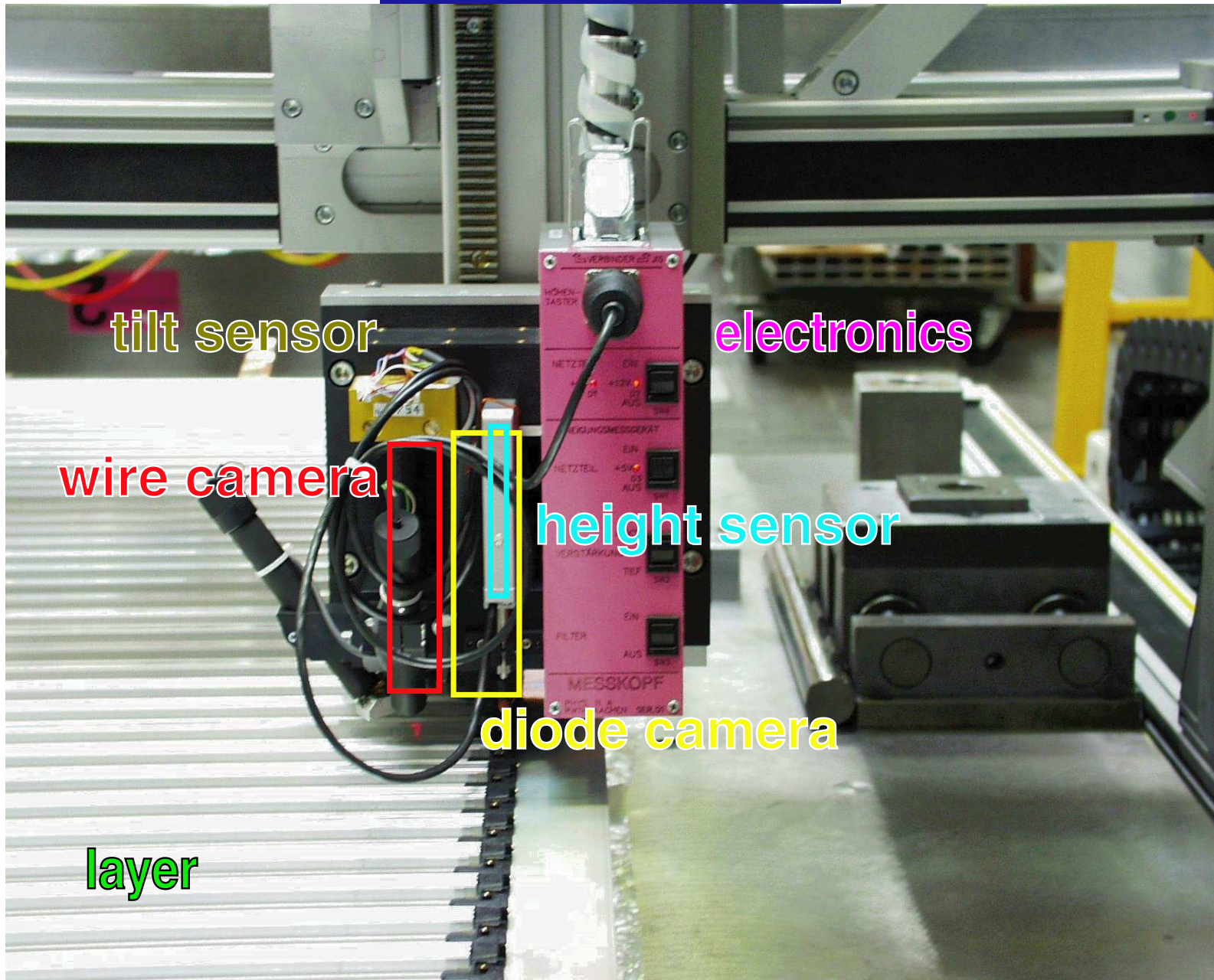
measurement accuracy
is about 0.006 N (0.2%)!



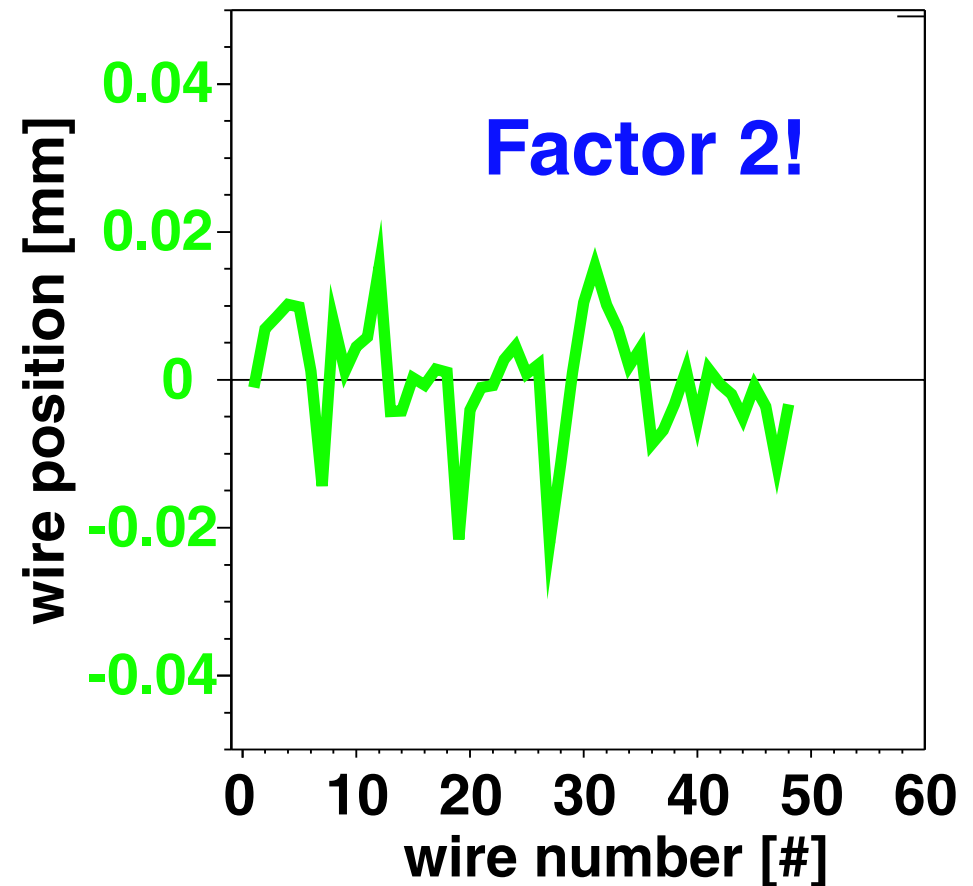
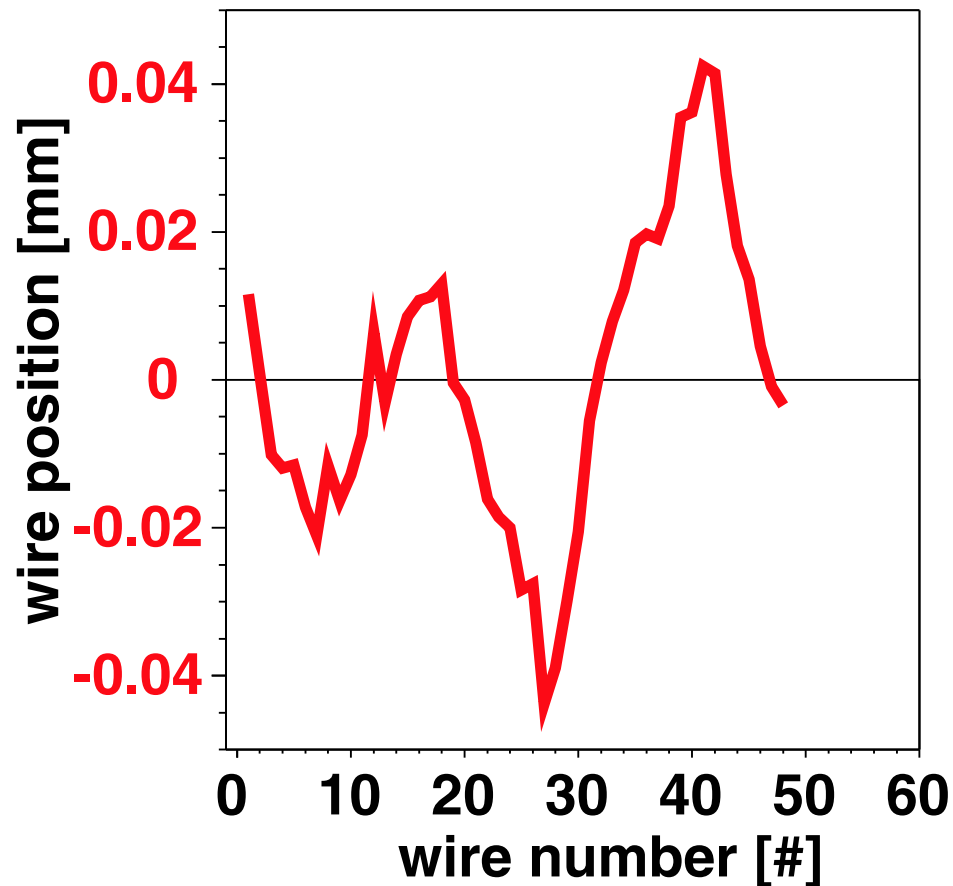
Wire Position: Measuring Principle



Measuring Head



relative measurement

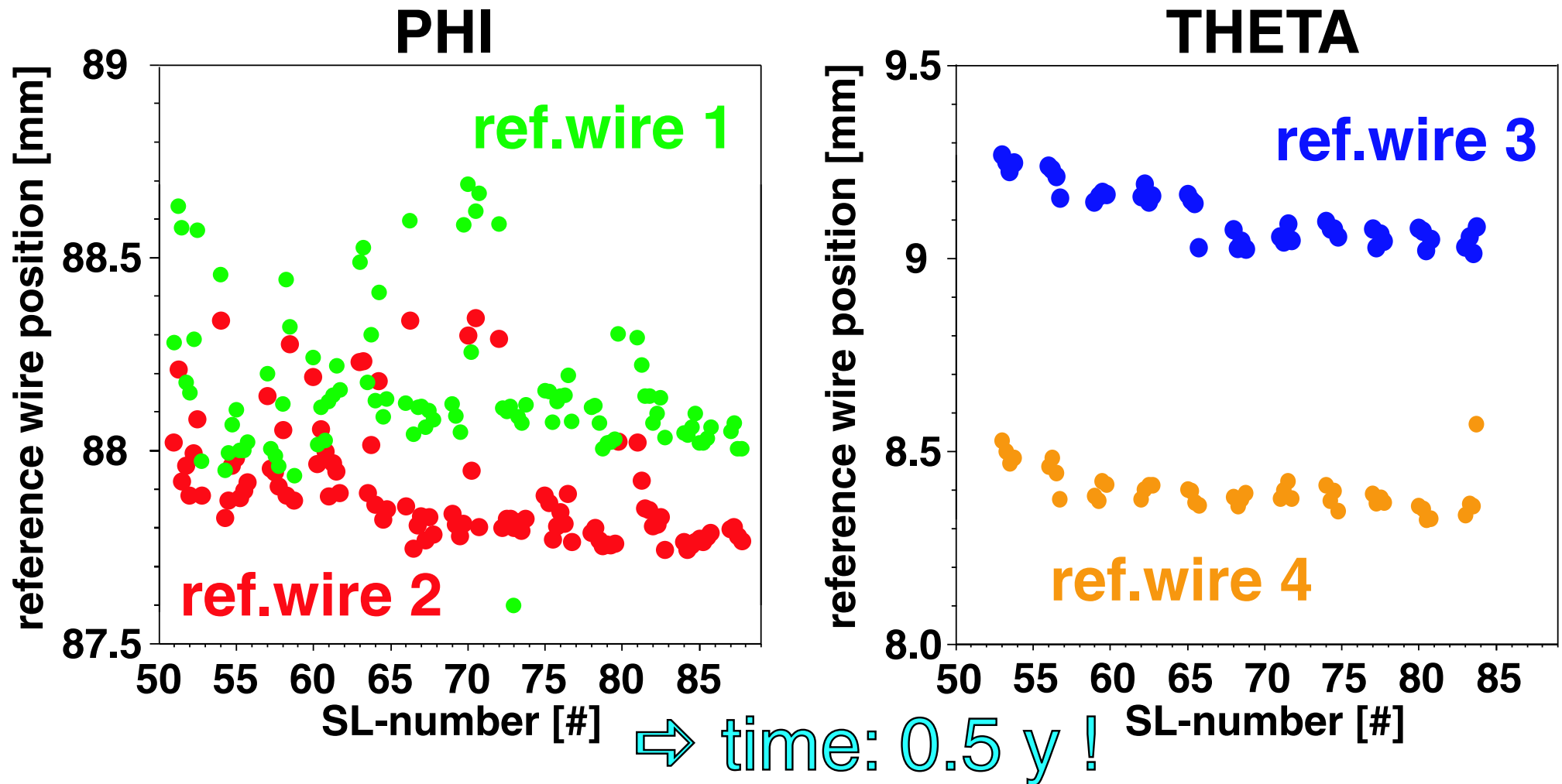


(corrections: tilt, bridge shape, long. deviations
 ⇒ absolute correction about 0.420 mm)

without and ...

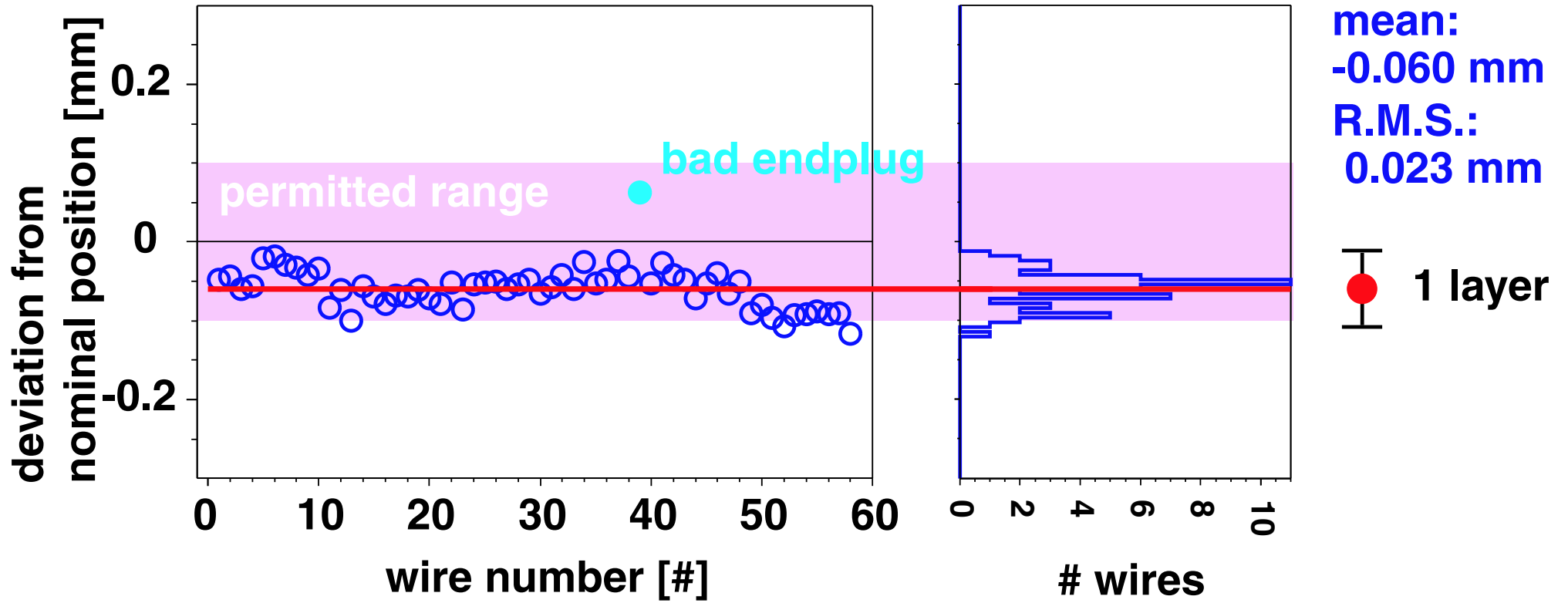
.... **with** calibration.

⇒ **success!!!**

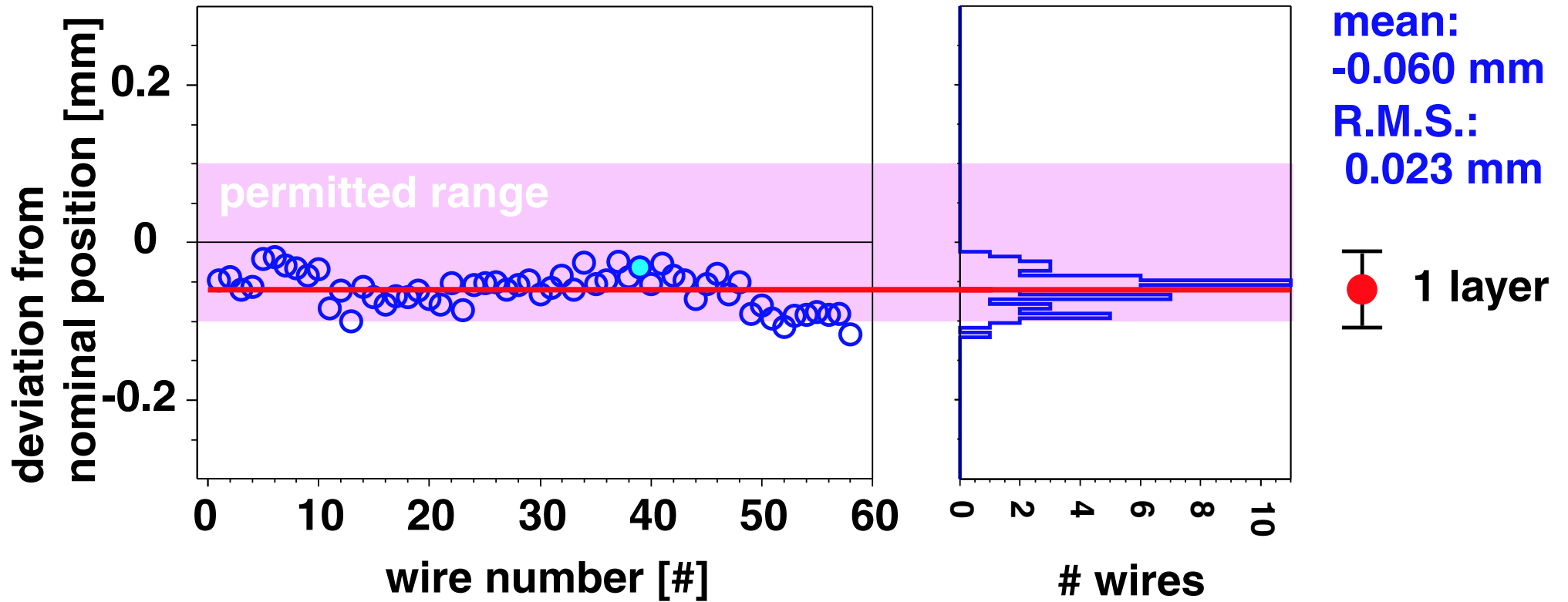


- absolute measurement with respect to table
- PHI (y-axis) is not as well under control as THETA (x-axis) because suspension of axes is different.

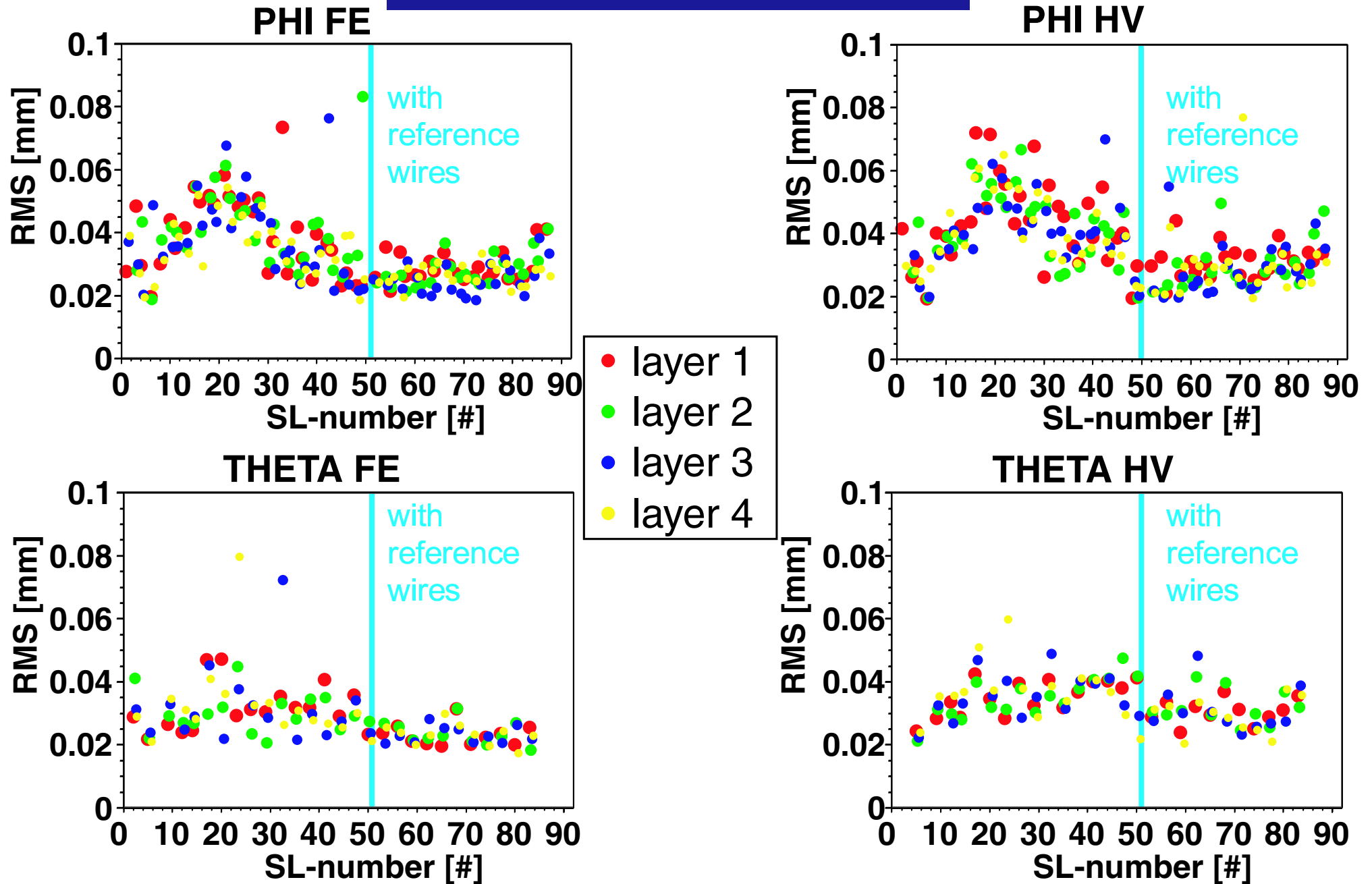
Single Layer

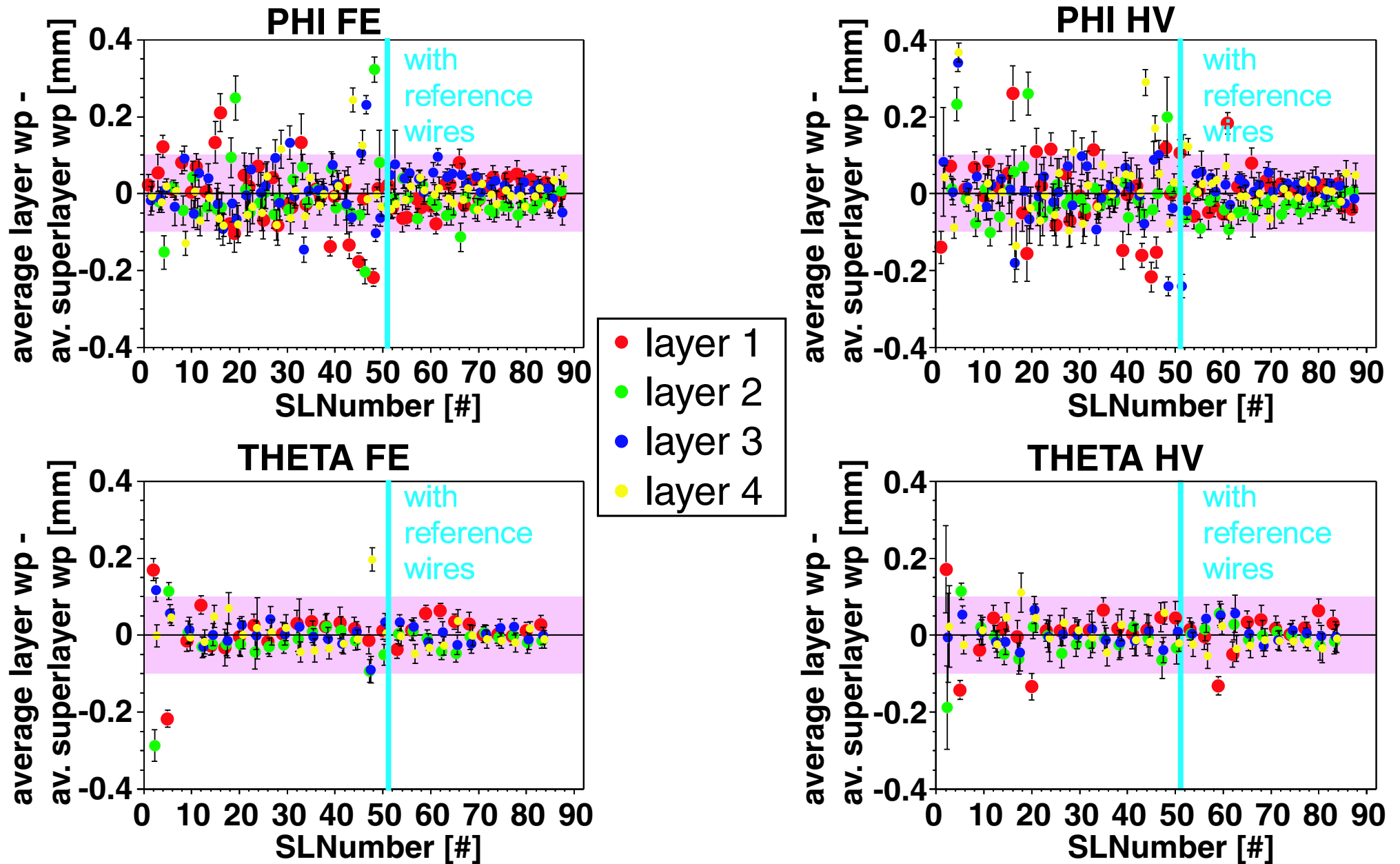


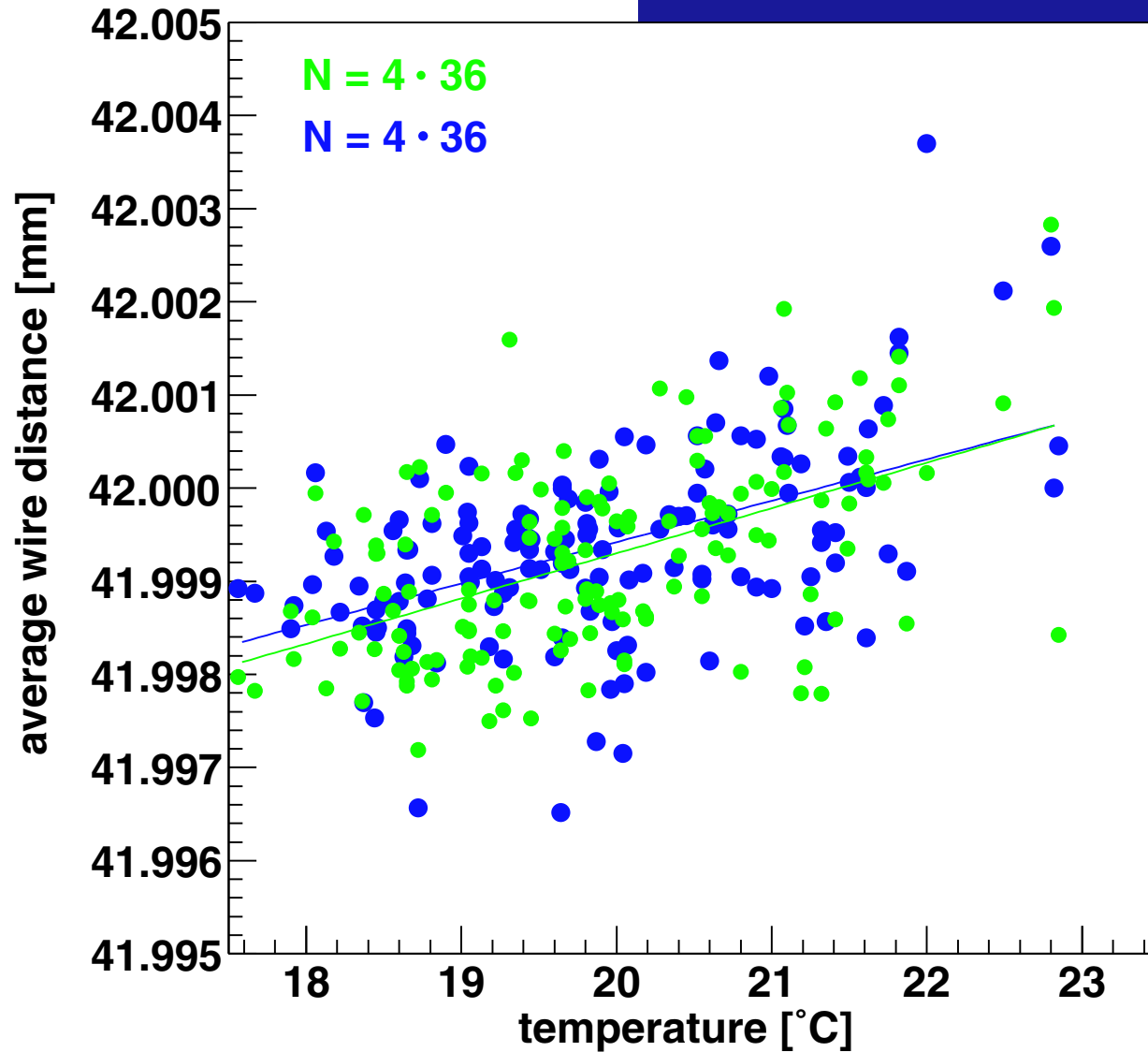
absolute measurement with respect to corner blocks



absolute measurement with respect to corner blocks






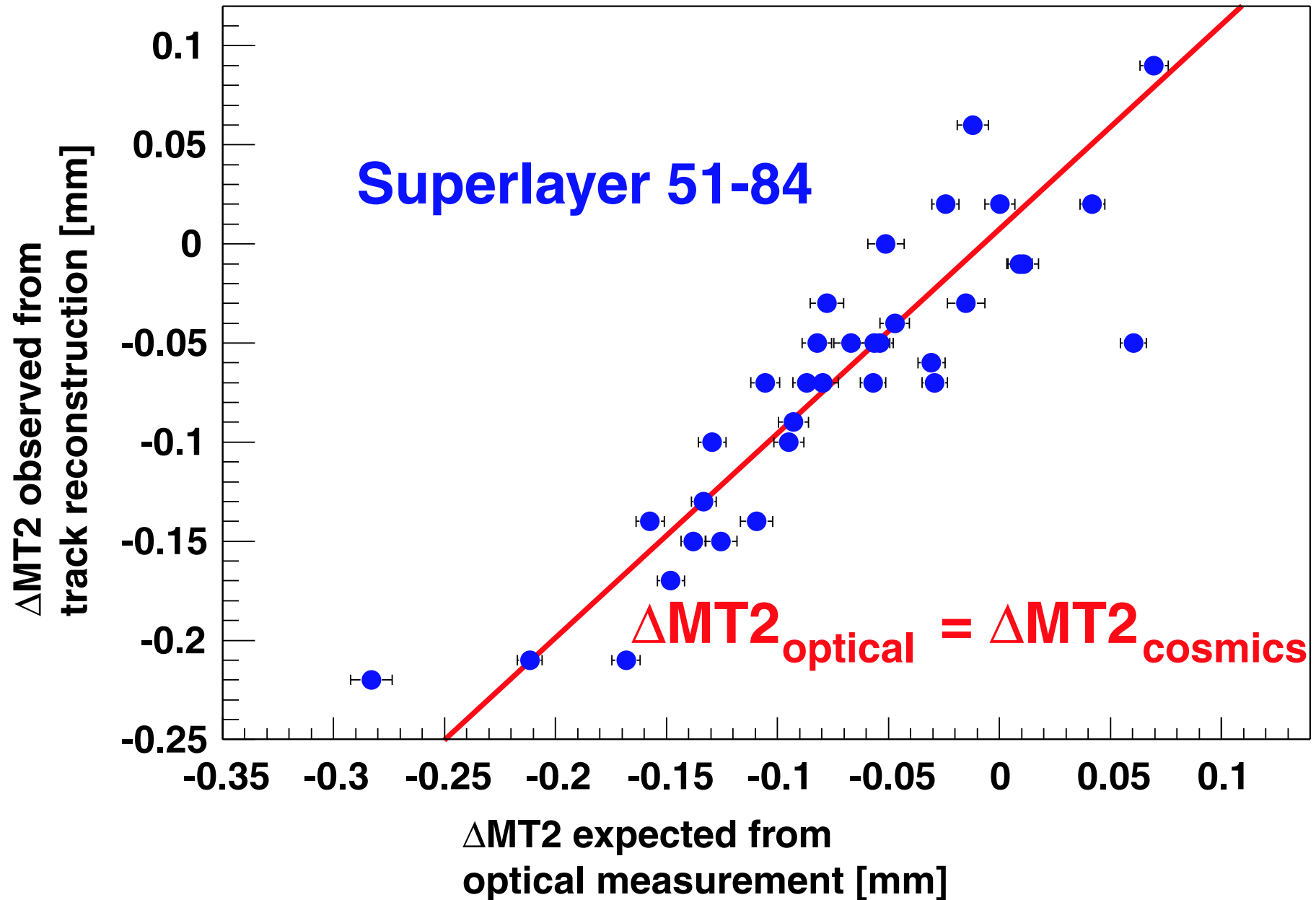


good
agreement!

$$l = l_0 \cdot (1 + \alpha \cdot T[\text{°K}])$$

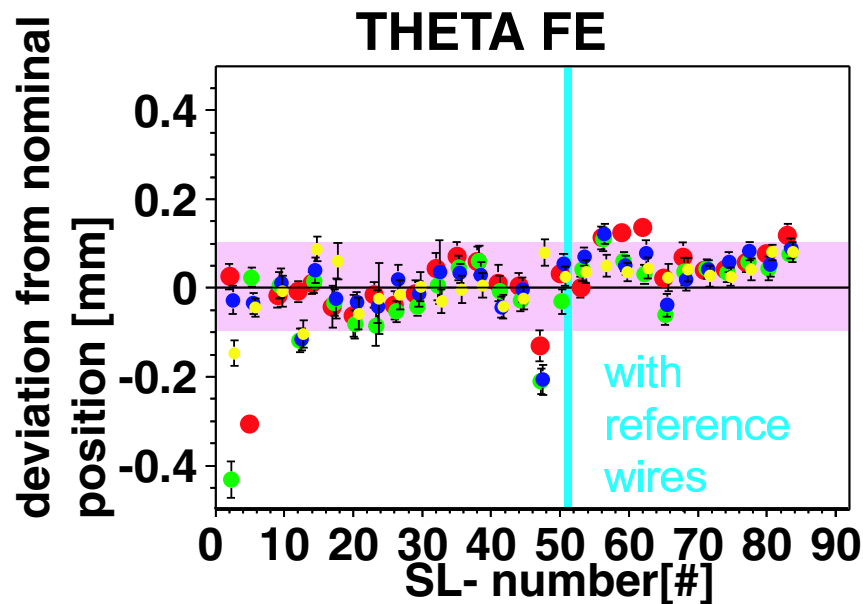
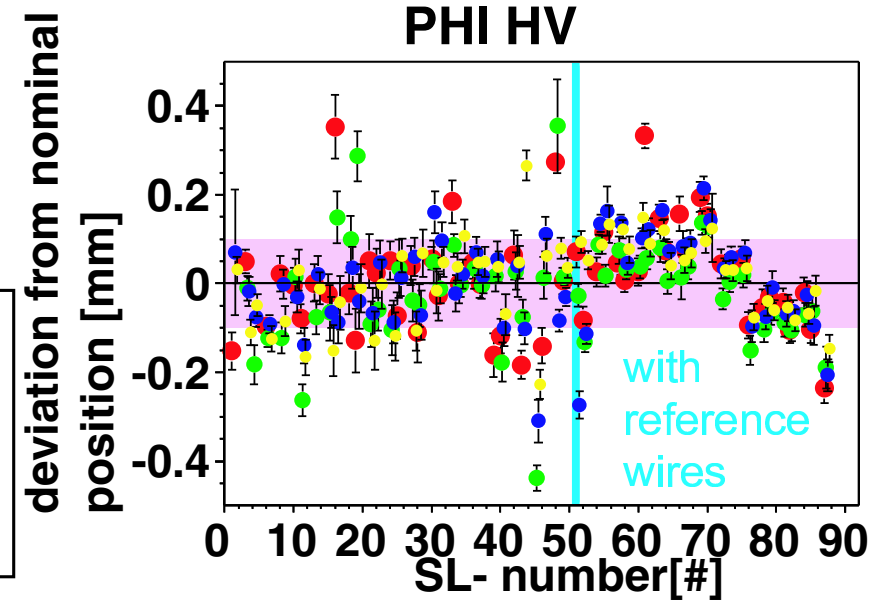
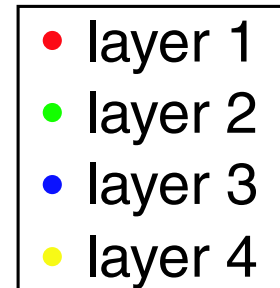
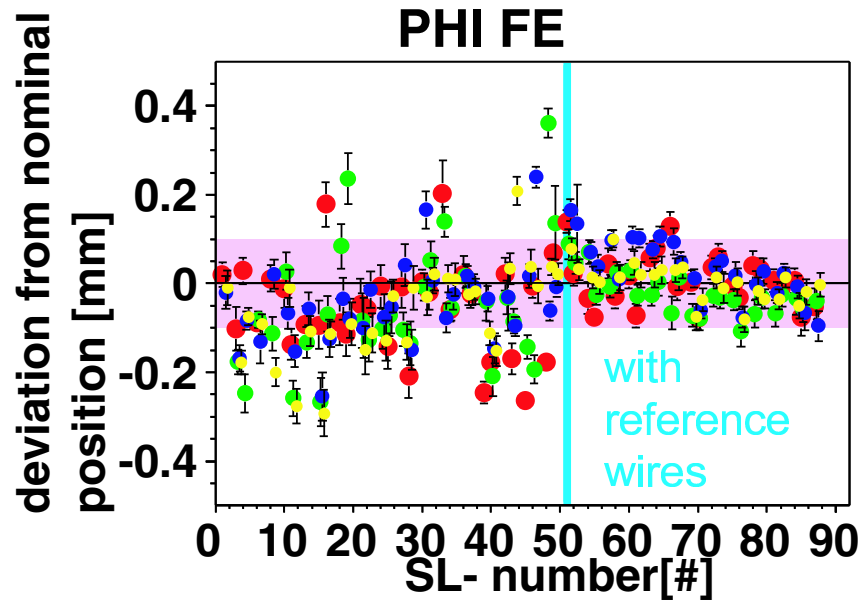
$$\alpha_{\text{expected}} = 11.1 \cdot 10^{-6} \text{ K}^{-1}$$


$$\alpha_{\text{meas.}} = (11.1 \pm 0.5) \cdot 10^{-6} \text{ K}^{-1}$$



- **Wire Tension:**
 - Measurement **accuracy very good**.
 - Tension **well in allowed range** of 2.7 N -3.3 N ($\pm 10\%$).
- **Wire Position:**
 - **Absolute position** measurement thanks to reference wires.
 - Wire position is **within ± 0.100 mm** (QC requirement fulfilled).
 - **Consistent thermal dependence** of wire distance.
 - **Good agreement** with cosmics data.

BACKUP



1 layer

