Wire-scanner status and plans

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CERN BE/BI

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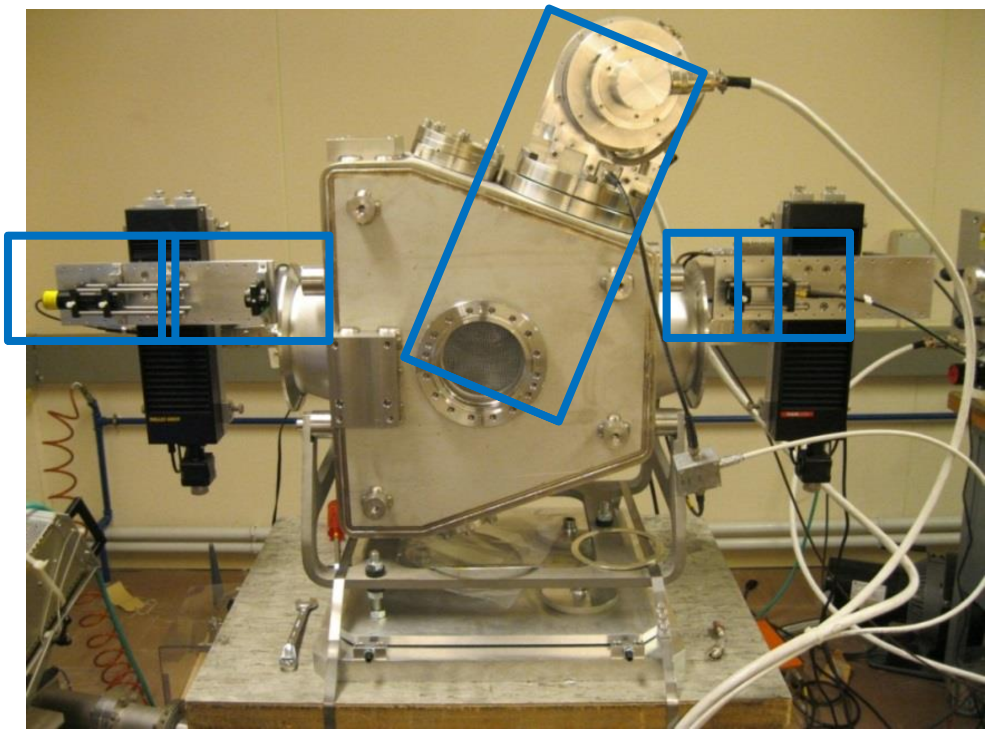
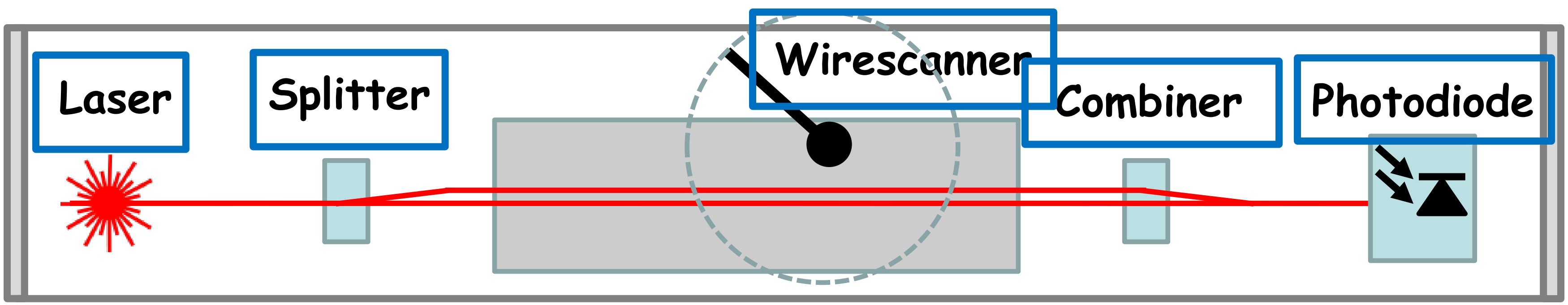
Wirescanner calibration

PS Wirescanner calibration bench

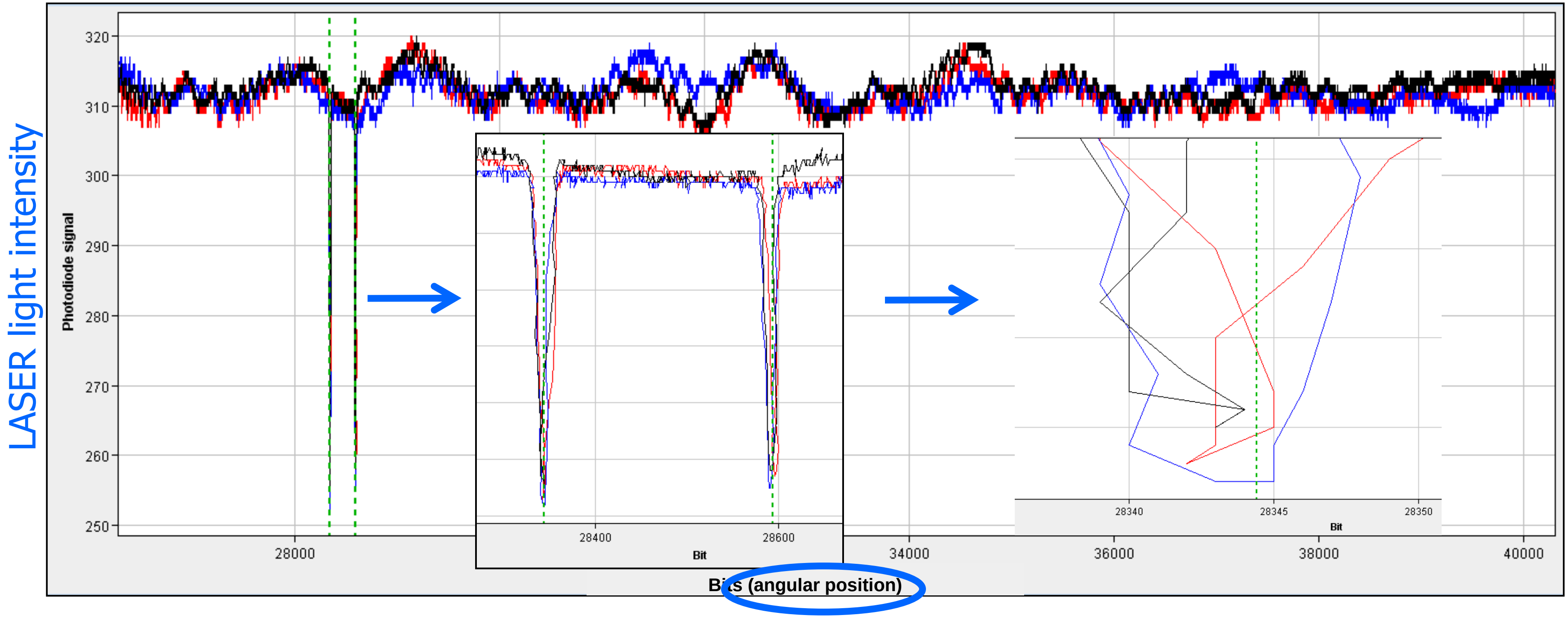




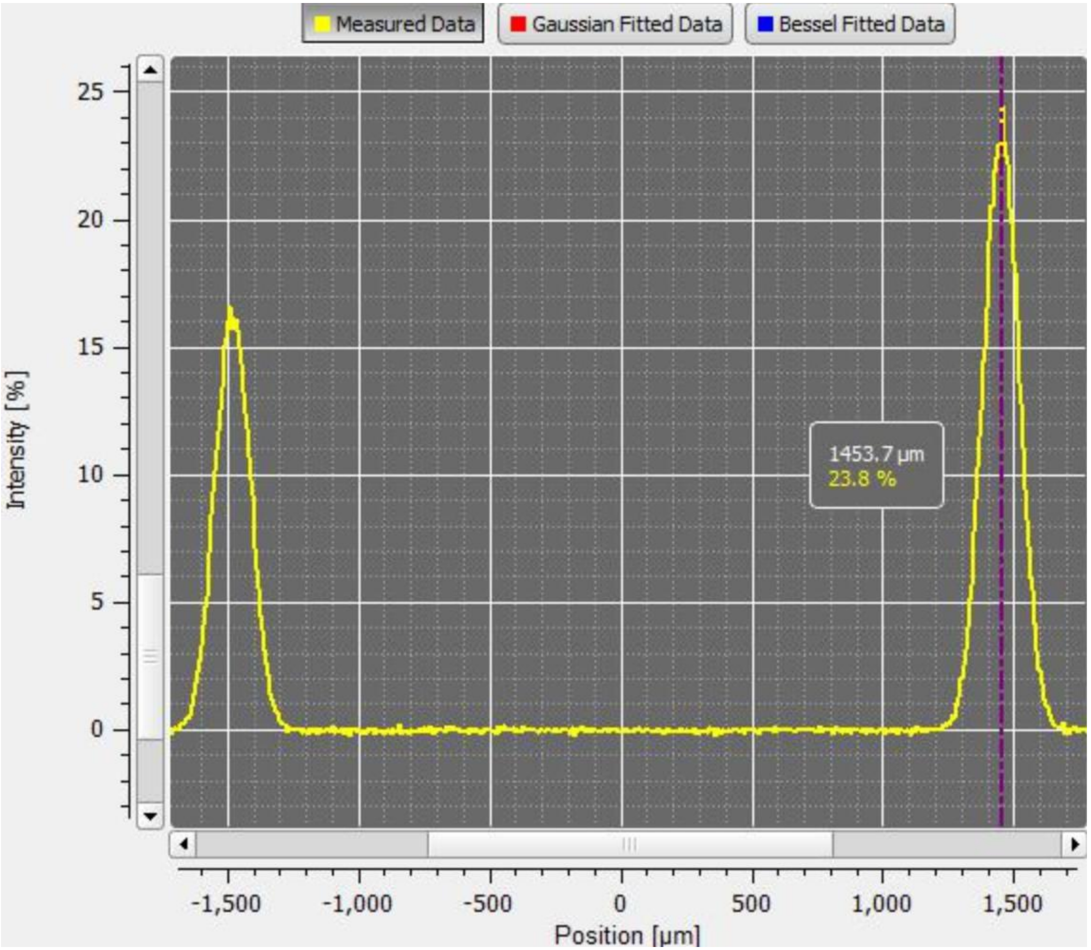
Wirescanner calibration

PS Wirescanner calibration procedure

1. We move the laser/photodiode system from -50mm to +50mm with fixed step. At each position we record the photodiode signal vs potentiometer values (angular position) while the WS moves. We repeat different measurements for each position.



LASER light intensity versus position



Measured and calculated difference between LASER beams 2.9 mm

LASER beam difference derived wire scanner measurements in 2.8 mm

Difference indicate calibration data fitting not understood to this accuracy

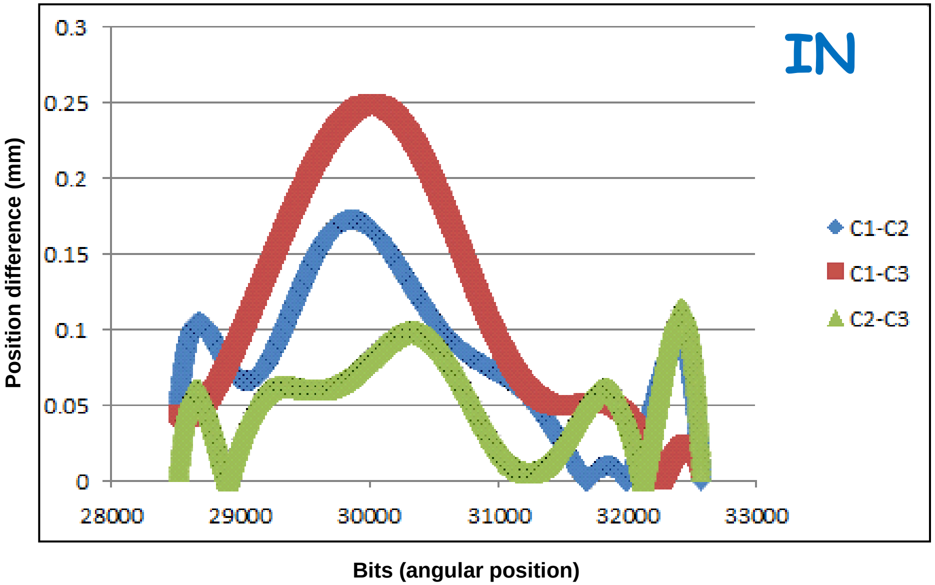
Calibration reliability

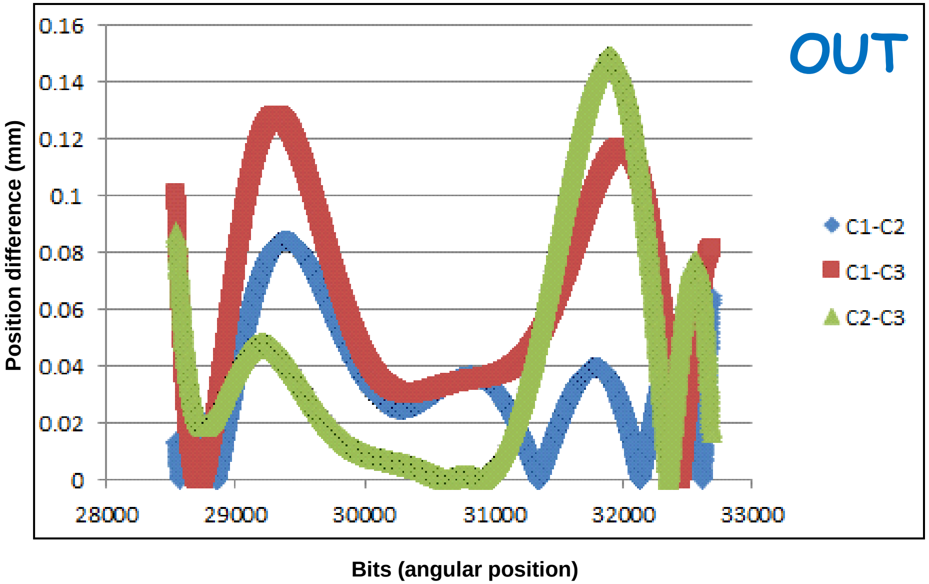
Calibration reliability can influence the determination of the wirescanner beam profile width measurement.

Running several calibrations shows different levels of reproducibility depending on the wirescanner speed and movement.

15m/s

Calibration done under vacuum!





average absolute error

90µm **50µm**

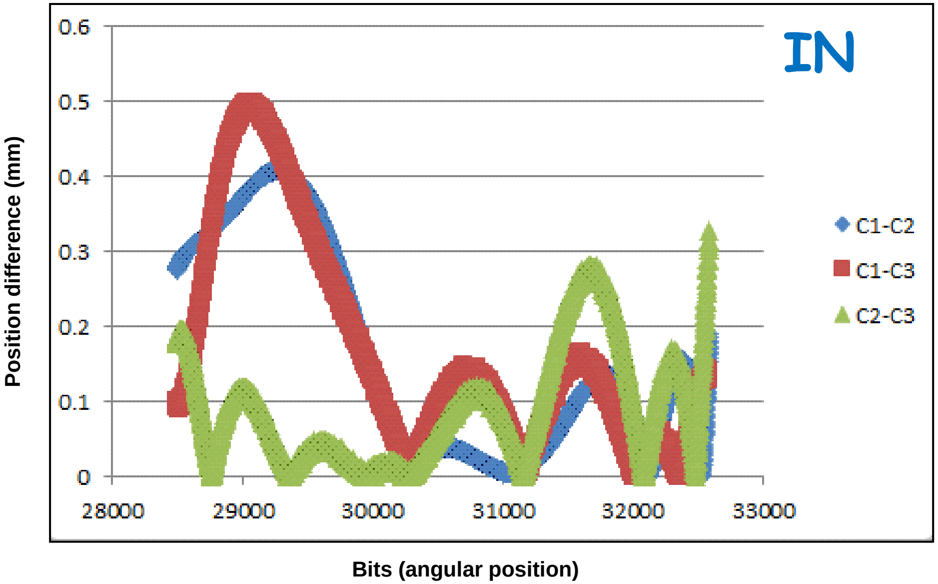
Calibration reliability

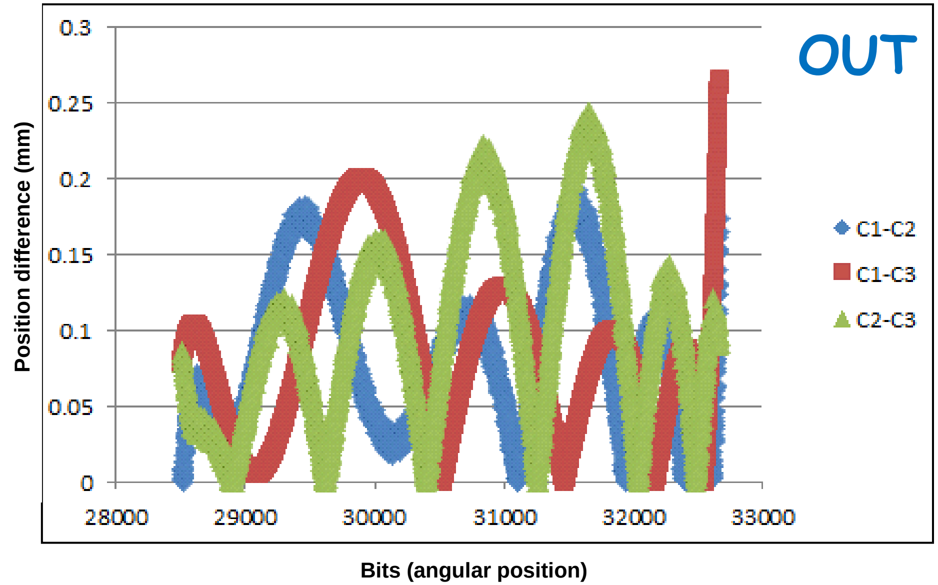
Calibration reliability can influence the determination of the wirescanner beam profile width measurement.

Running several calibrations shows different levels of reproducibility depending on the wirescanner speed and movement.

10m/s

Calibration done under vacuum!



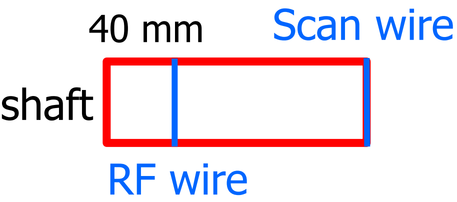


Relative accuracy: **average absolute error**

150µm

100µm

SPS scanner RF measurement



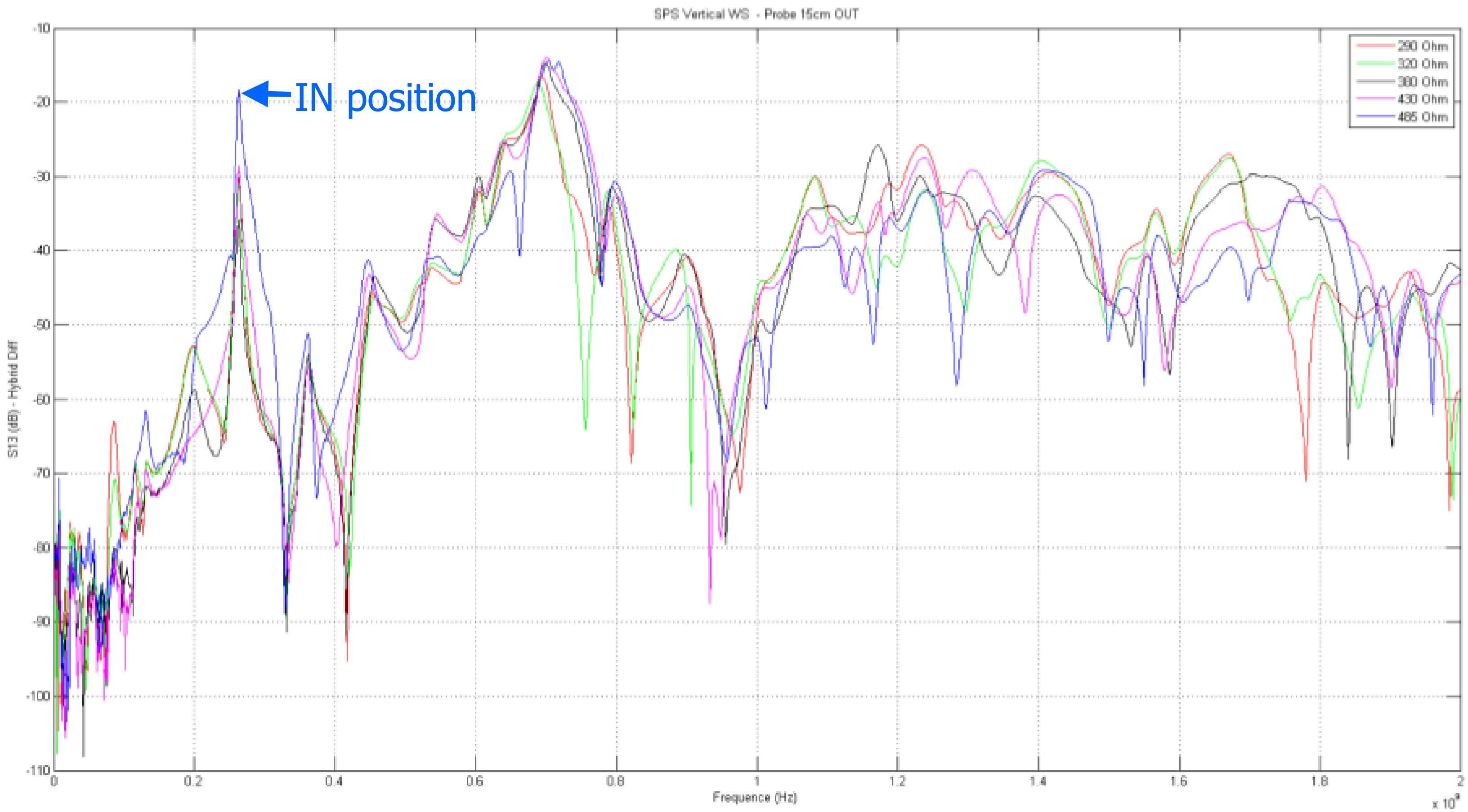
Delta signal with the probe 15 cm out from the flange

NO METAL WIRE ACROSS THE FORK

3 db = ratio of 2

284 Ohm = Home position

482 Ohm = IN position



E.Piselli – J.Kuczerowski

SPS scanner RF measurement results

ΣW: hybrid sum signal with metallic wire
ΣNW: hybrid sum signal without metallic wire
ΔW: hybrid delta signal with metallic wire
ΔNW: hybrid delta signal without metallic wire

15cm @ 300±100MHz Peak

WS Position [Ω]	ΣW [dB]	ΣNW [dB]	ΣW-ΣNW [dB]	ΔW [dB]	ΔNW [dB]	ΔW-ΔNW [dB]
290	-33.8	-24.7	-9.1	-34.6	-30.2	-4.4
320	-32.5	-26.8	-5.7	-33.9	-30.9	-3.0
380	-36.4	-27.8	-8.6	-37.2	-36.0	-1.2
430	-26.0	-27.7	1.7	-28.1	-28.6	0.5
485	-15.2	-16.5	1.3	-16.9	-18.3	1.4

25cm @ 300±100MHz Peak

WS Position [Ω]	ΣW [dB]	ΣNW [dB]	ΣW-ΣNW [dB]	ΔW [dB]	ΔNW [dB]	ΔW-ΔNW [dB]
290	-71.0	-65.6	-5.4	-65.3	-60.6	-4.7
320	-71.0	-66.2	-4.8	-66.8	-61.0	-5.8
380	-73.0	-71.3	-1.7	-66.0	-61.0	-5.0
430	-66.2	-68.2	2.0	-67.2	-63.9	-3.3
485	-54.5	-55.1	0.6	-53.8	-53.0	-0.8

E.Piselli – J.Kuczerowski

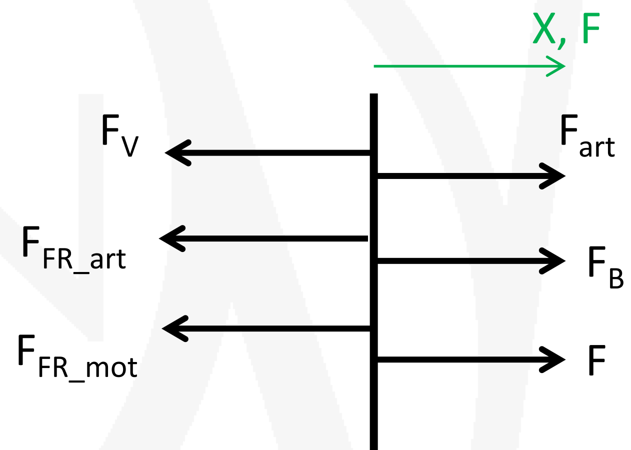
System characterisation

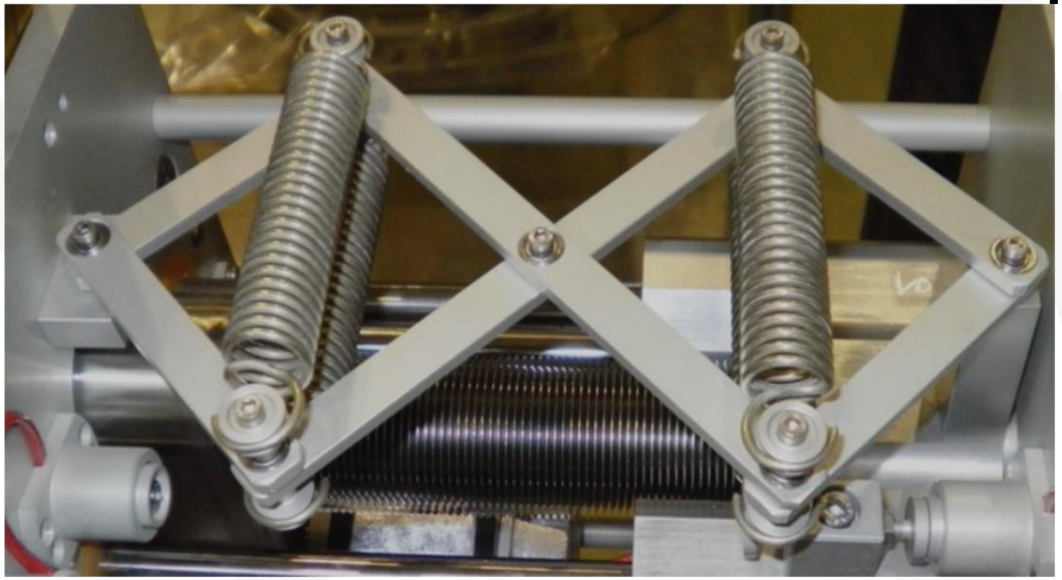
F_{FR_mot} = eq. resistent force in the x direction generated by motor friction
F_{FR_art} = eq. resistent force in the x direction generated by the articulation's friction
F_V = vacuum force
F_{art} = force generated by the spring system
F_B = bellow force
F = force added to the system in the experimental measurements

$$\cancel{F} + F_B + F_{art} = F_V + \cancel{F}_{FR\_art} + \cancel{F}_{FR\_mot}$$

Goal: $F_B + F_{art} = F_V$

or al least: $|F_B + F_{art} - F_V| < F_{FR\_art} + F_{FR\_mot}$





System characterisation

Articulation force

Force needed: $F_{art} = F_V - F_B$

Force generated by the articulation:

$$l = l_0 + x$$

$$a = \frac{l}{4}$$

$$\begin{cases} a = d \cdot \cos\alpha \\ b = d \cdot \sin\alpha \end{cases}$$

$$\sin\alpha = \sqrt{1 - (\cos\alpha)^2}$$

$$b = d \cdot \sqrt{1 - (\cos\alpha)^2} = d \cdot \sqrt{1 - \frac{a^2}{d^2}} = \sqrt{d^2 - a^2}$$

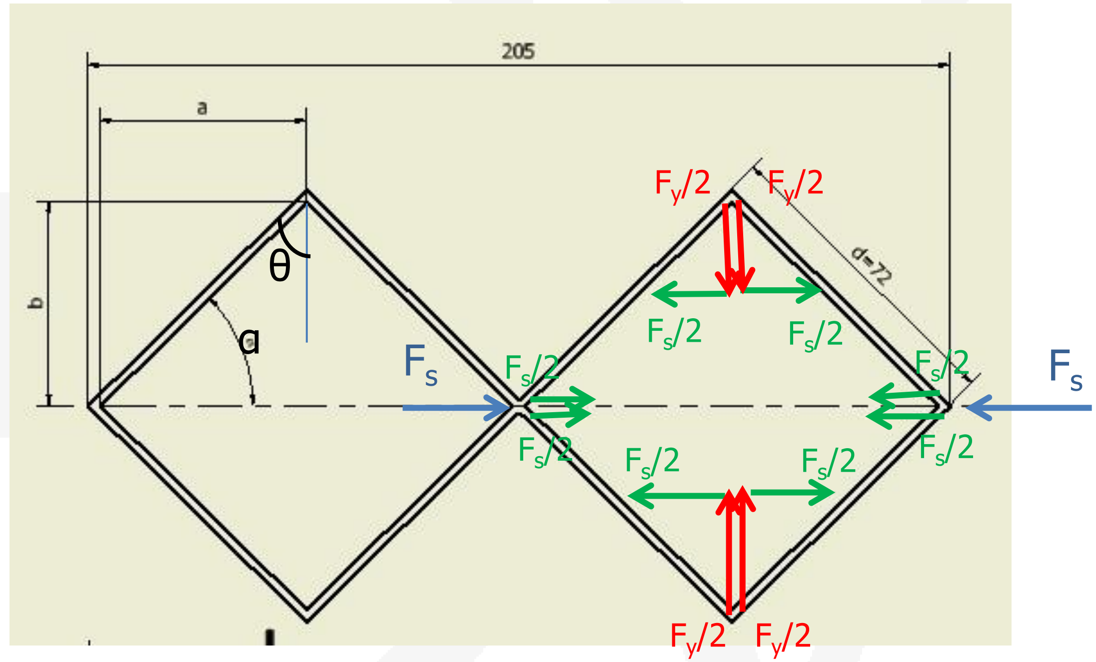
$$b = \sqrt{d^2 - \frac{l^2}{16}}$$

$$\frac{F_s}{2} = \frac{F_y}{2} \cdot \tan\vartheta$$

$$F_s = F_y \cdot \cot\alpha$$

$$\cot\alpha = \frac{\cos\alpha}{\sin\alpha} = \frac{a}{b}$$

$$F_y = k_s \cdot \left(2(b + v) - b_{free}\right)$$



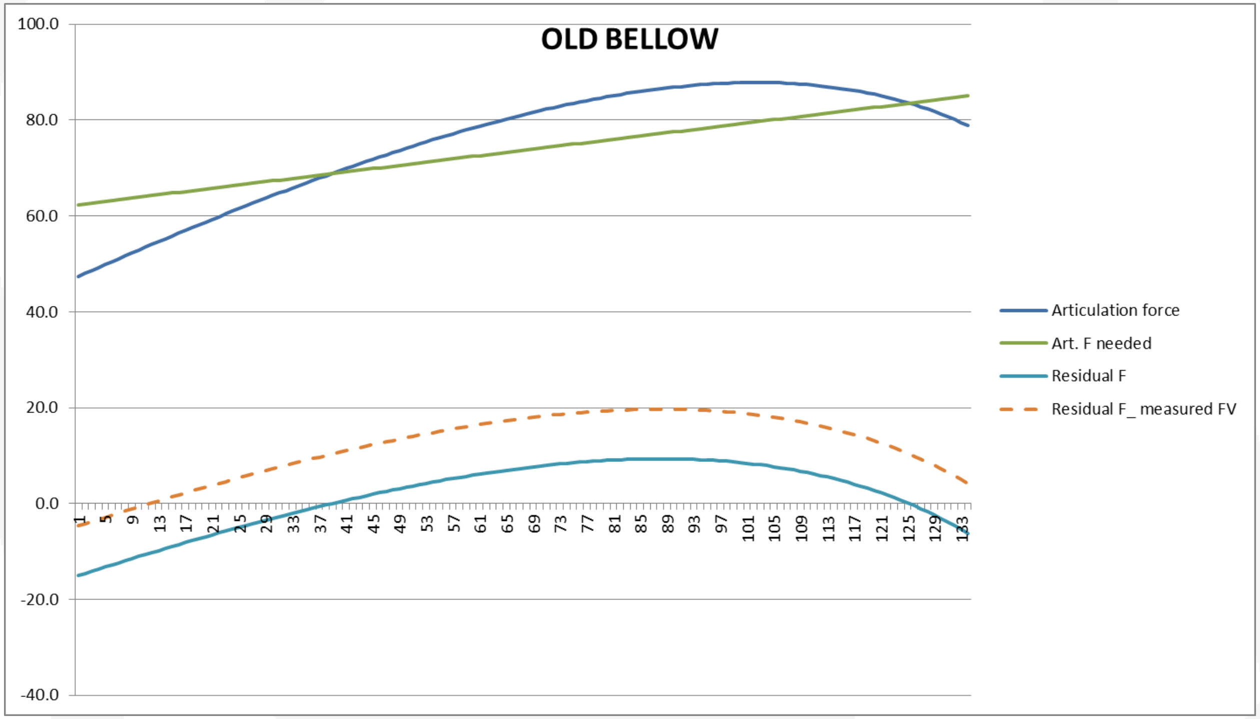
$$F_{art} = n \cdot F_s = \frac{\boldsymbol{l \cdot k_s}}{\boldsymbol{2 \cdot b}} \cdot \left[\boldsymbol{2 \cdot (b + v) - b_{free}}\right]$$

n= number of springs per square = 2

k_s = spring rate of the articulation system's springs

OLD bellow

Residual force: $|F_B + F_{art} - F_V| < F_{FR\_art} + F_{FR\_mot}$



The unbalanced force, to be compensated by the motor, in addiction to the friction, is **between 9.3 and – 15 [N]** with the given values, and between -4.7 and 19.7 [N] using the measured vacuum force (dashed line).

LHC scanner

- New bellows and compensation spring
  - Number of scans to be save for 40000 (old 10000)
  - Standard new type of spring possible to use
- Status and planning
  - 10 new bellows have arrive at CERN
  - Bellow welding finished week 12
  - All mounted and ready for installation week 15
    - Vacuum test of bellows may be introduced before assembly
    - System tests need to be done each scanner
      - Execution of about 1000 scans
      - Check of power consumption and slip of position