Bundesamt für
Kartographie und Geodäsie

Multi-colour activities at TIGO-SLR

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Overview

- The TIGO-SLR system
- Two-colour calibration and measurement
- Wavelength-dependent refraction of BBO
- Ranging at Fraunhofer lines
- Conclusion

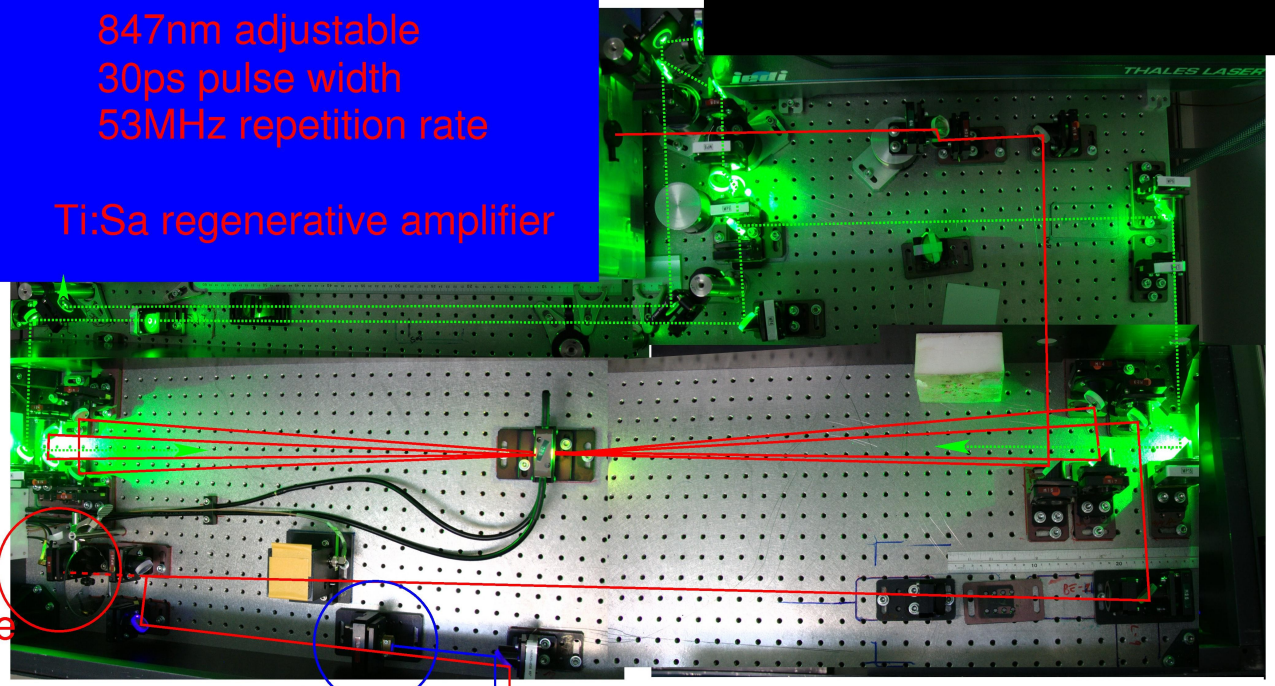
The TIGO-SLR system

Laser setup

Ti:Sa oscillator
847nm adjustable
30ps pulse width
53MHz repetition rate

Ti:Sa regenerative amplifier

Nd:YAG pumplaser @532nm
120mJ per pulse
100Hz repetition rate



start diode

SHG BBO

>10mJ per pulse @847nm

to telescope

Telescope

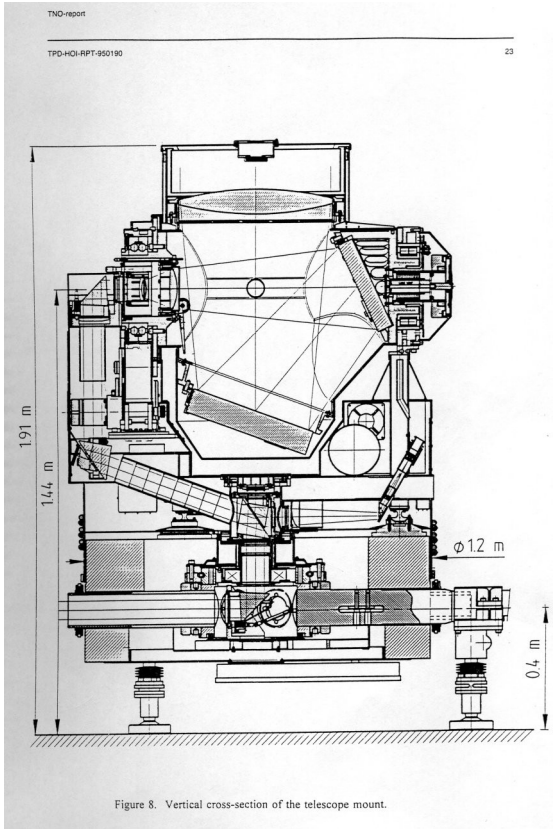
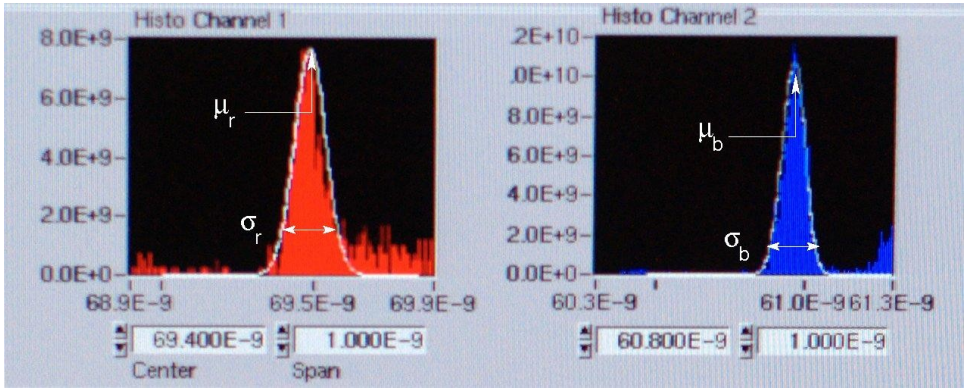
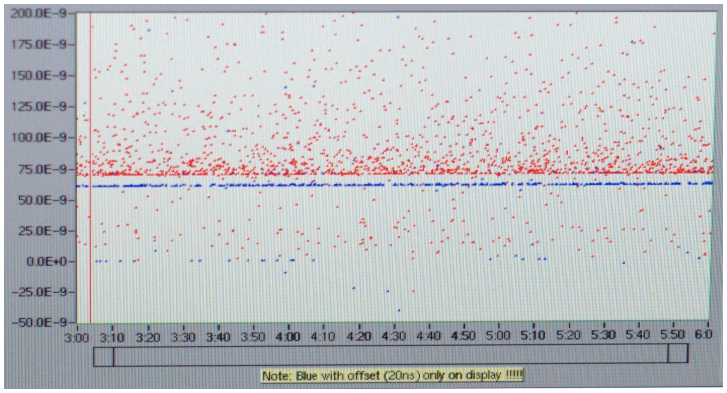


Figure 8. Vertical cross-section of the telescope mount.

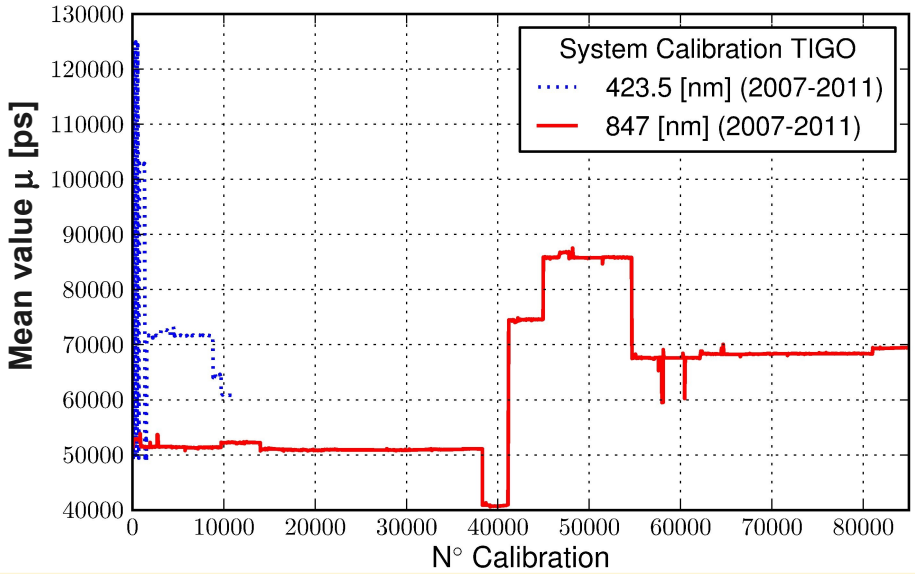
Two-colour calibration

Typical two-colour calibration: histogram and residues

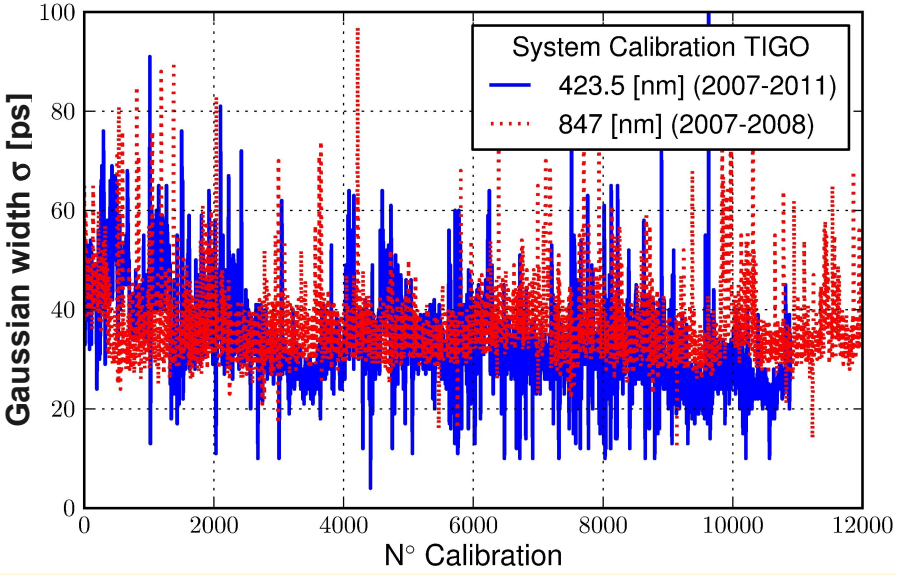




Stability of mean value μ

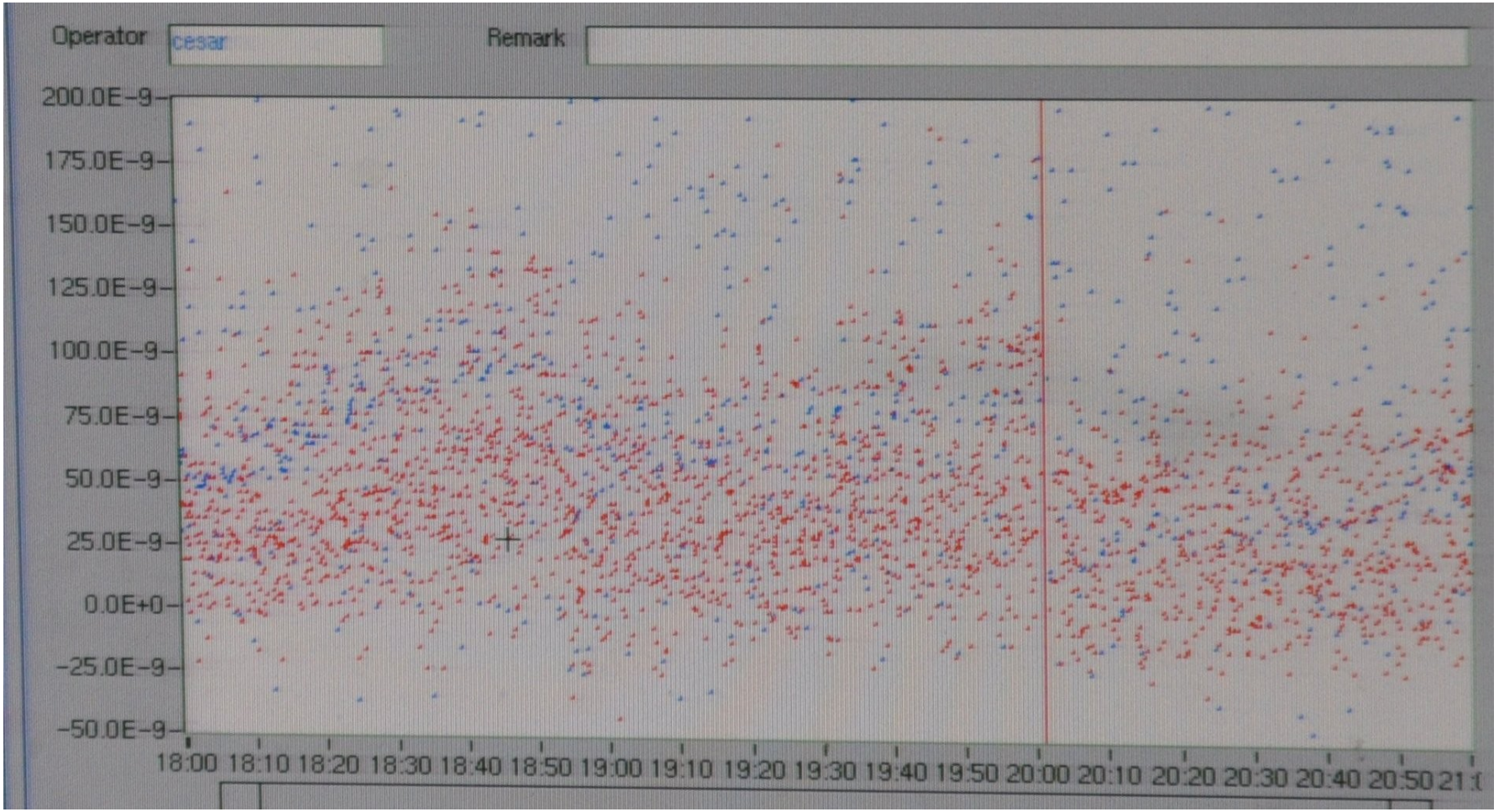


Stability of Gaussian width σ



C. Guaitiao et al., to be submitted

Example of two-colour measurement



Example: Residues of two-colour ranging on terrasarx

Challenge: Measure both colours simultaneously

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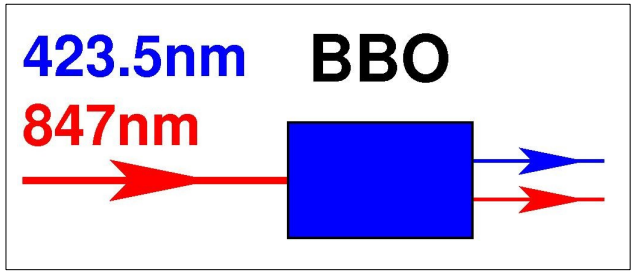
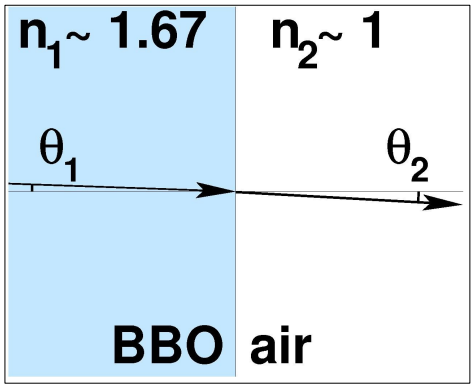
λ-dependence of BBO's refractive index



Second harmonic generation

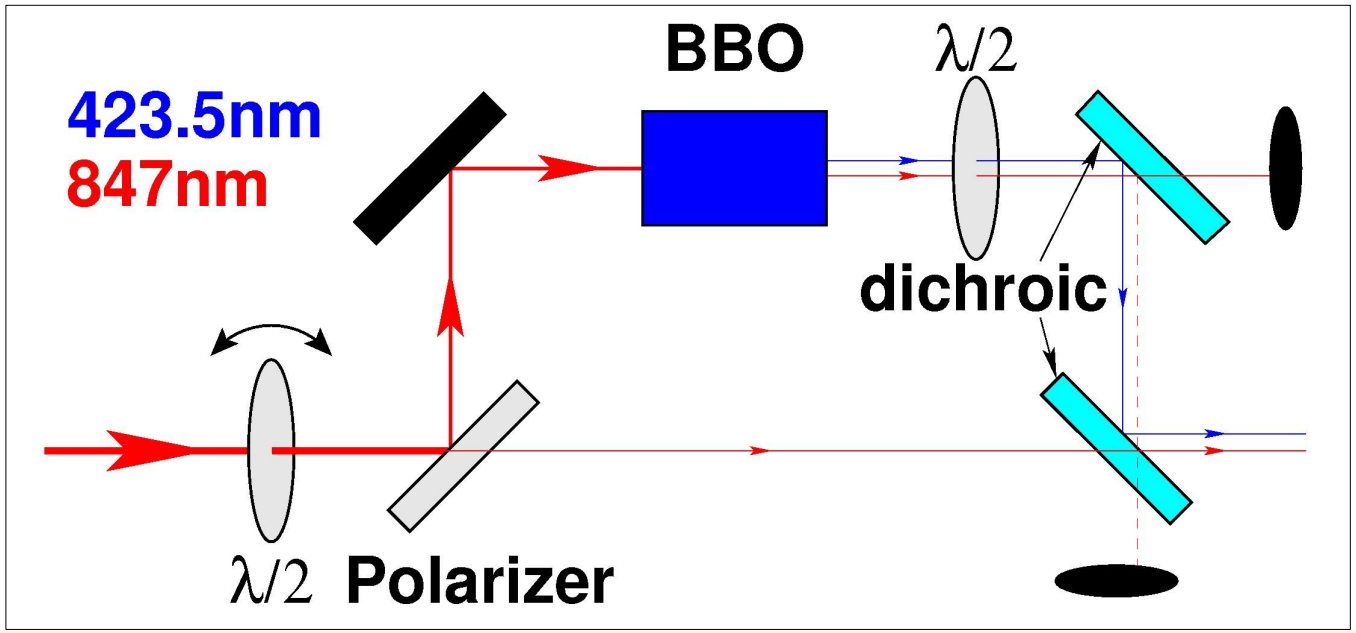


Surface misaligned by θ_1

BBO	n_z
423.5nm	1.689
847nm	1.660

http://refractiveindex.info/

Relative deviation: 1.7%



Snell's law for small θ_1:

$$\theta_2 = \frac{n_2}{n_1}\theta_1$$

Aberration $\Delta\theta_2$
of red and blue beam:

$$\frac{\Delta\theta_2}{\theta_1} \approx \frac{100''}{1^\circ}$$

Ranging at Fraunhofer lines

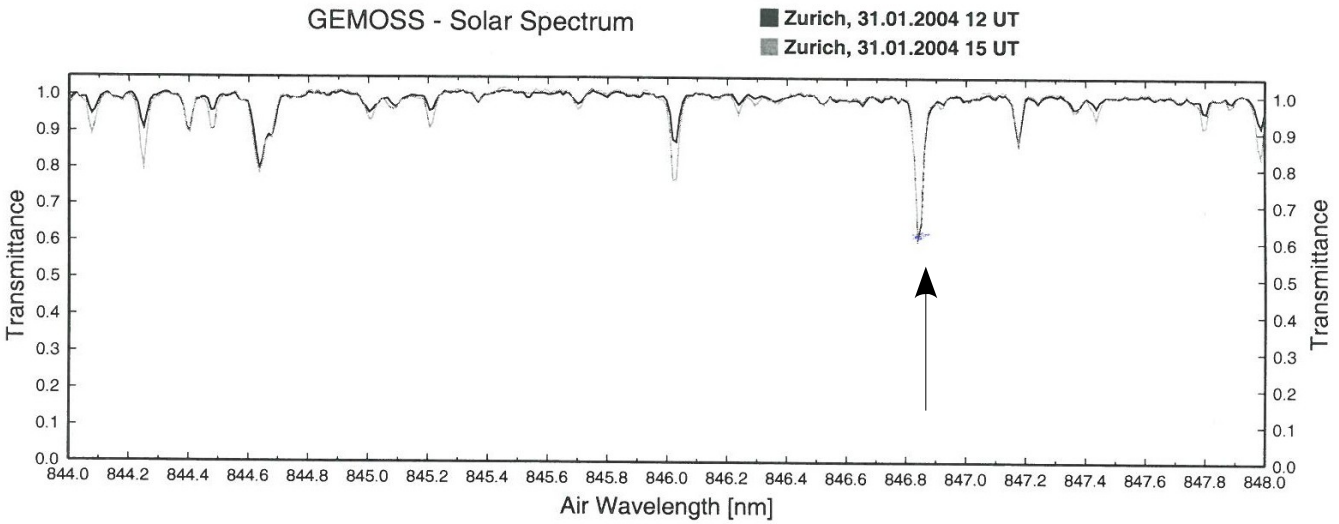
Fraunhofer lines of atomic hydrogen in solar spectrum at:

$$\lambda = \left(\frac{1}{(n')^2} - \frac{1}{n^2} \right) \cdot 91.16\text{nm}$$

Fraunhofer lines in the vicinity of 847nm, 423.5nm:

Balmer series (n' = 2) at n = 5: **434.0nm** (Fraunhofer line G')

Paschen series (n' = 3) at n = 17: **846.8nm**



A. Somieski
PhD-thesis
ETH Zurich 2005

Strong noise reduction expected at these wavelengths.

Conclusions

- Stability of two-colour calibrations
- Correct beam-aberration at second harmonic generation
- Low-noise measurements at Fraunhofer lines

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Acknowledgements

http://www.tigo.cl

Earthquake history of Concepción

1570-02-08, town destroyed by earthquake, 20 years after foundation

87

1657-03-15, town destroyed by earthquake and tsunami

73

1730-07-08, town destroyed by earthquake and tsunami

21

1751-05-25, town destroyed by earthquake and tsunami, decision of relocation of town (Concepción of today)

84

1835-02-20, 60% destruction of town, tsunami along the coast 30°-43°S, testified by Charles Darwin

33

1868-08-13, coastal zone destroyed by tsunami, epicenter 2000km north

71

1939-01-24, town destroyed, earthquake Mw 8-9

21

1960-05-21/22, town destroyed, earthquake Mw 9.5+8, tsunami

49

2010-02-27, town destroyed, earthquake Mw 8.8, tsunami

Each day without earthquake is one day less until the next!