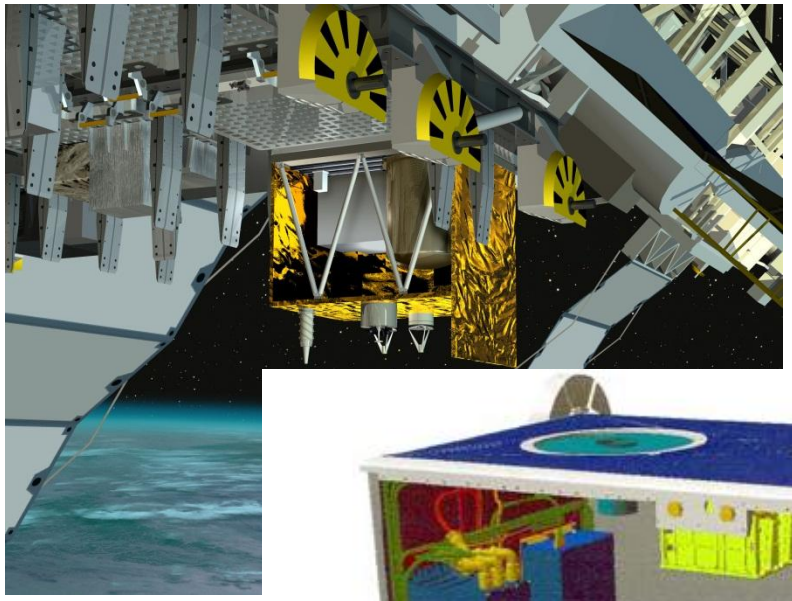
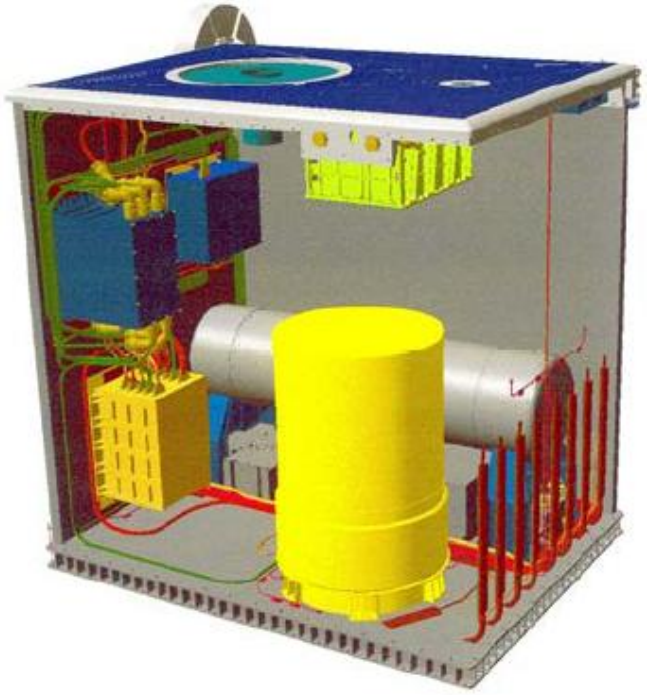
It‘s time to start

the communication between ELT DC and ILRS

Anja Schlicht
Ulrich Schreiber
Ivan Prochazka

ACES
Atomic **C**lock **E**nsemble in **S**pace



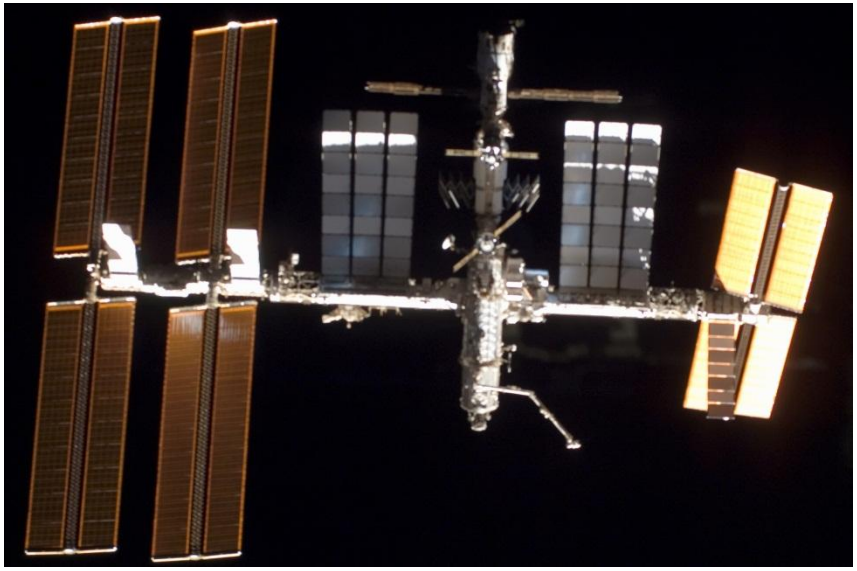


Time generation:
Caesium clock PHARAO
Active hydrogen maser SHM
Frequency comparison unit

Time transfer:
Microwave link MWL
Laser link ELT

GPS

Problems arising with the target



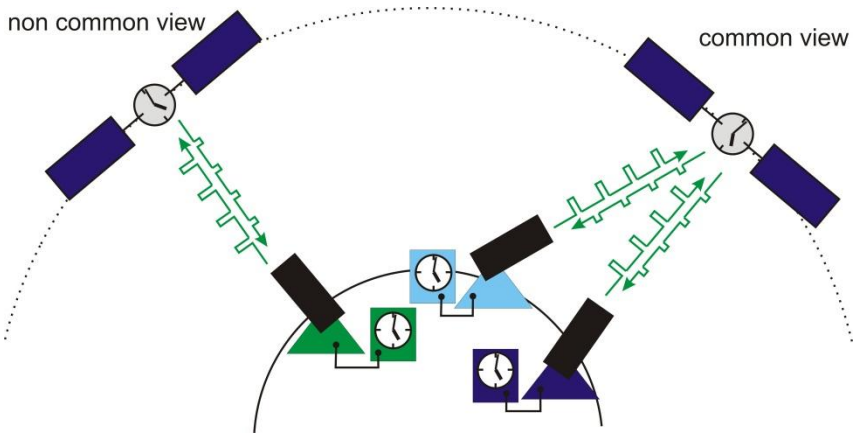
ISS -> handle predictions every 90 minutes

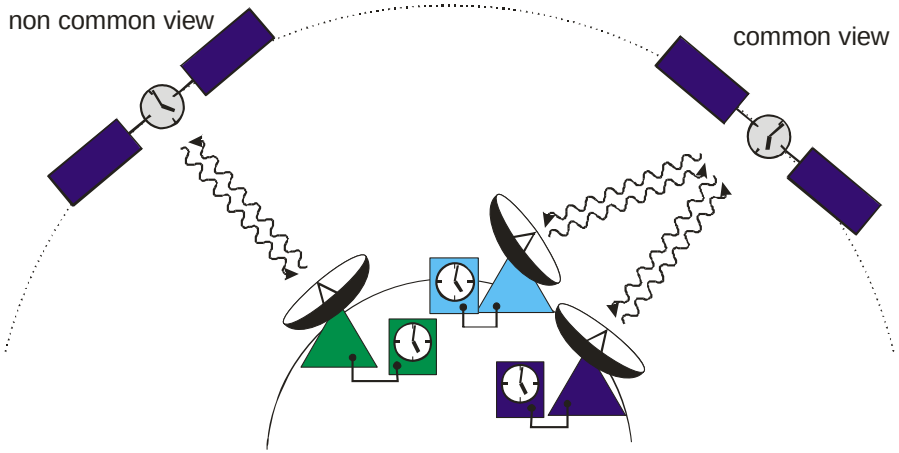
Laser safty -> handle go/nogo flag

Detection priciple -> single photon (Attenuation 10^{13})

Timing window ~ some 100ns with 100Hz

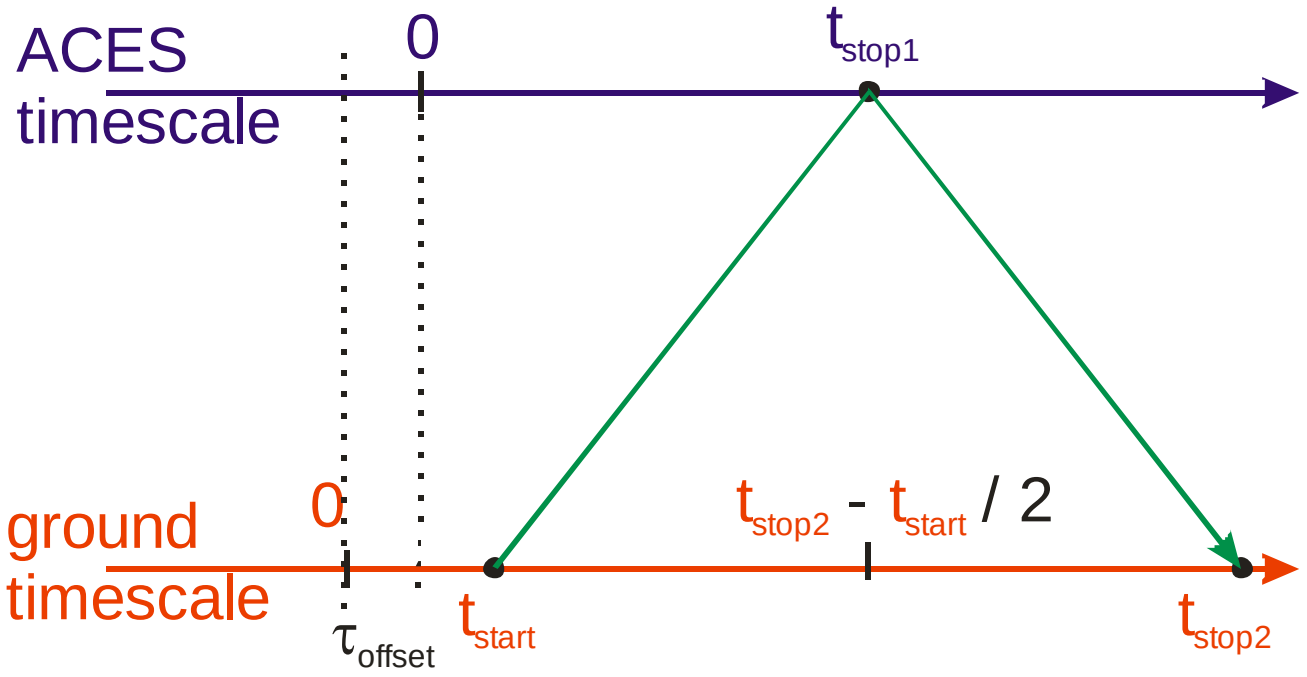
Objectives of ELT





- Comparison of time transfer techniques (SLR, MWL, GNSS)
- Precision 4ps @ 300s (MWL 230fs)
- Accuracy in time transfer 50ps (MWL 100ps)
- Calibration of microwave link

Coupled 2 and 1-way laser ranging

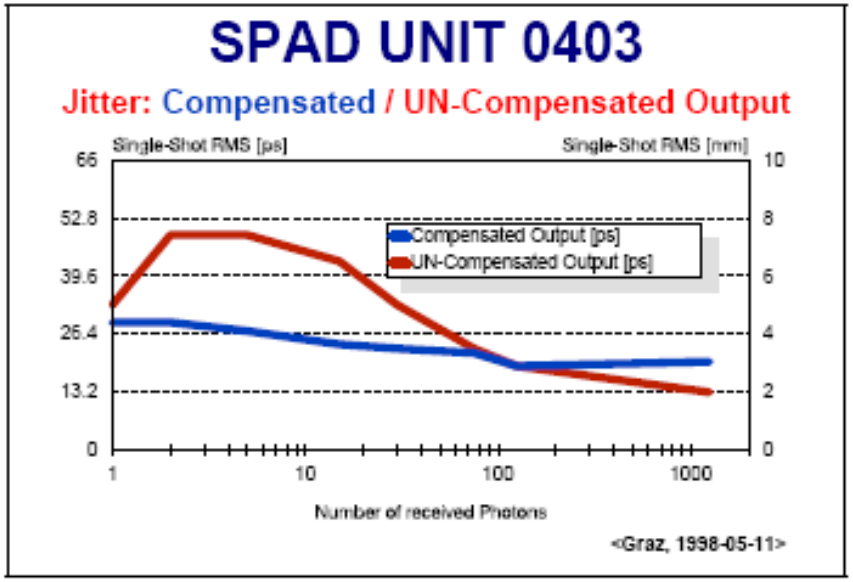


$$\tau_{offset} = t_{stop2} - t_{start} / 2 - t_{stop1} + \tau_{Relativity} + \tau_{Atmosphere} + \tau_{Geometry}$$

All about accuracy!

$\tau_{offset} = (t_{stop2} - t_{start})/2 - t_{stop1}$

Start time in picosecond resolution!!!



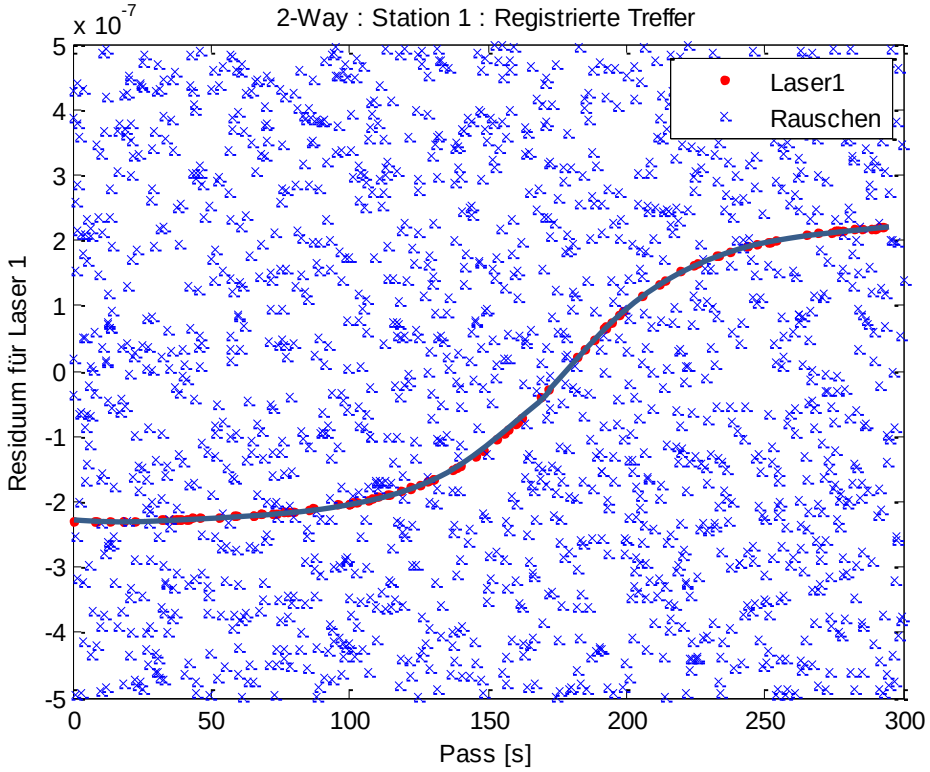
Single photon mode on ground

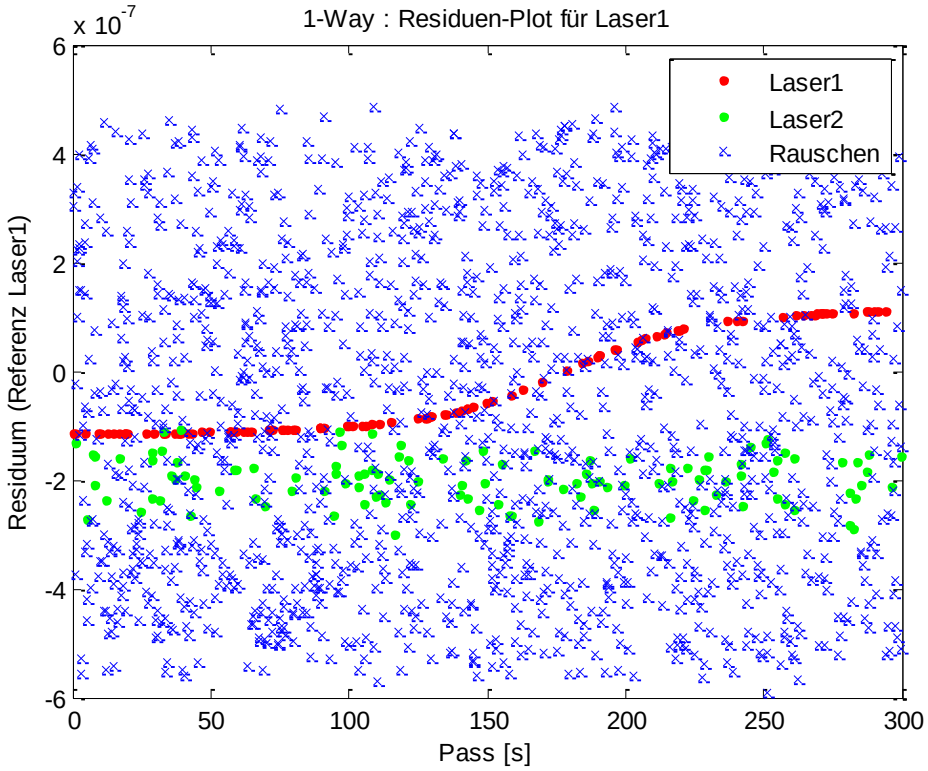
calibration

2-way: usual 2-way calibration
1-way: calibration campagne once
Stability of reference points (time, SLR, GNSS)

Data analysis

$$\tau_{offset} = t_{stop2} - t_{start} / 2 - t_{stop1} + \tau_{Relativity} + \tau_{Atmosphere} + \tau_{Geometry}$$

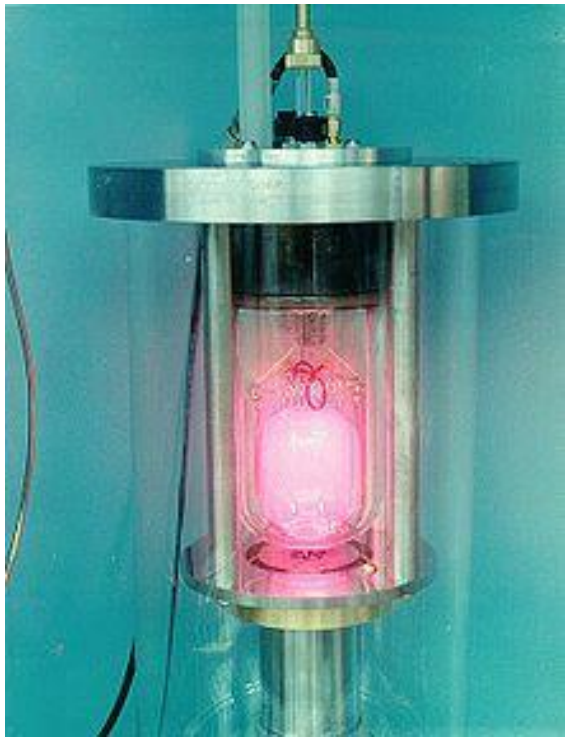




⇒ Please use the full repetition rate of your laser!!!

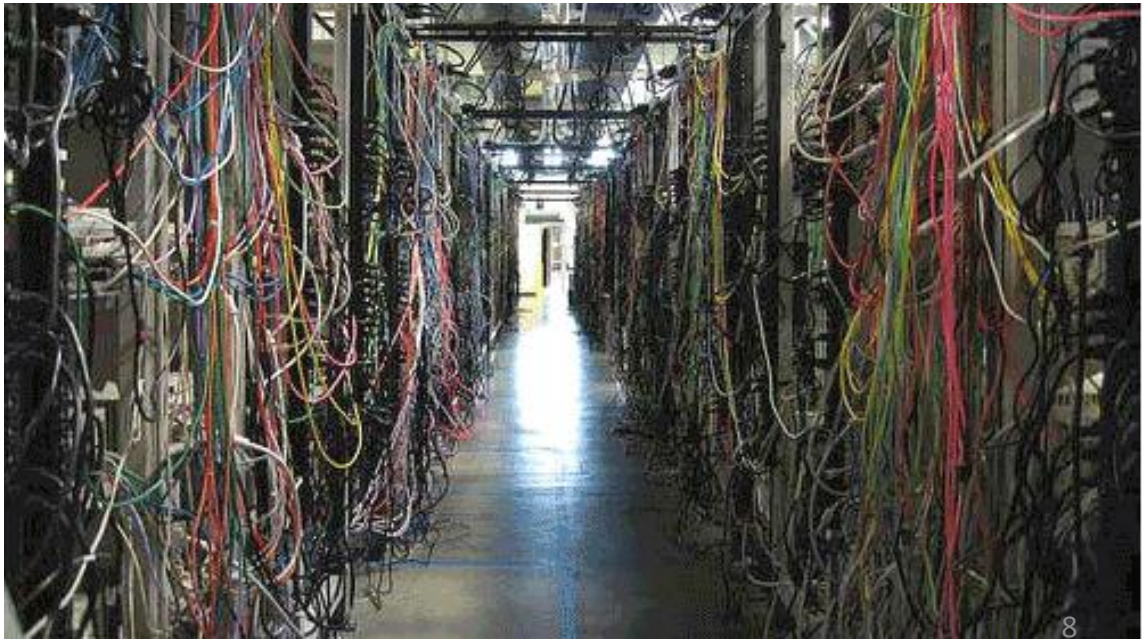
⇒ Please send all fire dates

Timing system / distribution of time



Hydrogen maser

cables



What about a workshop?

- Scientific interest
  - fundamental physics
  - geodesy and time transfer
  - deep space time transfer
- Time & frequency
  - stable clocks
  - ground transmission
  - access to UTC
  - GNSS receiver
- Other methods for time & frequency transfer

Offers of a data center

- Workshop
- Web page
- Data product:

  long time non-common view TTF

Questionnaire

Questionnaire

Information requested for a contribution to time transfer experiments

The ELT Data Center supports ILRS stations, which want to contribute to time transfer experiments. To get an idea on which topic information is needed most, we make this survey. When ever you have questions, please contact

Anja Schlicht (schlicht@bv.tum.de, Tel: ++49-89-28923196, Fax: ++49-89-28923178)
Pierre Exertier (Pierre.Exertier@obs-azur.fr, Tel: ++33-483-618582, Fax: ++33-483-618610)

Contact (Name, Station, e-mail)

_____
_____
_____

Tracking to T2L2:

Are you supporting the T2L2 experiment? _____
_____

While tracking to Jason can you deliver fullrate data with all fire dates and picosecond resolution in start time? If not, what is the problem?

_____
_____

Special ELT aspects:

Are you interested to take part in ELT? _____
_____

Mobile stations

„If we can‘t bring the time to the stations, why don‘t we bring stations to the time!“

contact

Anja Schlicht

Technische Universität München

Arcisstr. 21

80333 Munich

Tel: ++49-89-28923196

Fax: ++49-89-28923178

schlicht@bv.tum.de