

# **Establishment of a TWSTFT link between NICT and PTB**

**TWSTFT Working Group Meeting  
15-16 November 2005  
Delft**

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# **Establishment of a TWSTFT link between NICT and PTB**

The TWSTFT link between NICT and PTB has been established with substantial support from NICT, including provision of hardware, Earth-station design, and remote operation of the station.

## **Milestones**

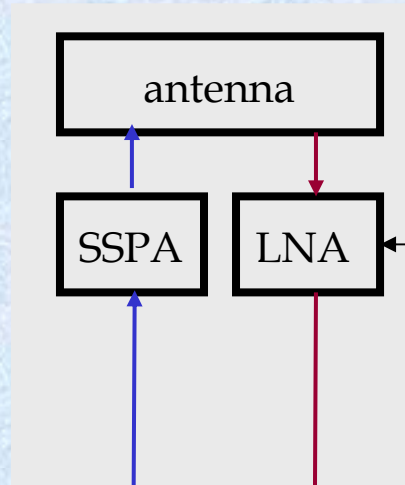
Installation between October 2004 and July 2005

Operation started on 22 July 2005

Regular Operation since 1 November 2005

# NICT Setup

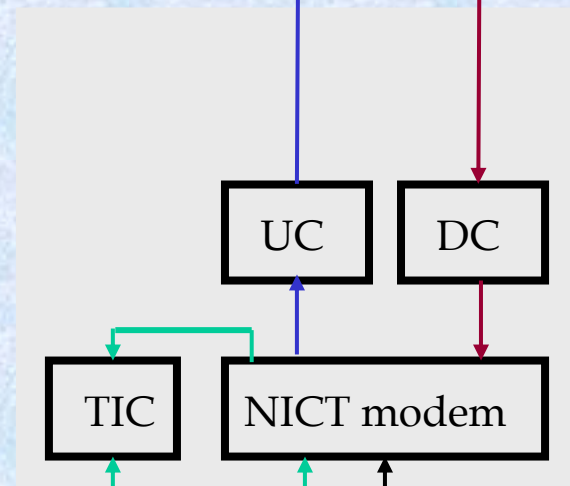
outdoor setup



mounted in a temperature stabilized box

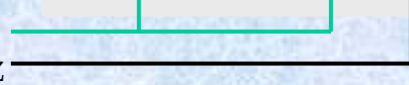
40 m Andrew RF cable

indoor setup



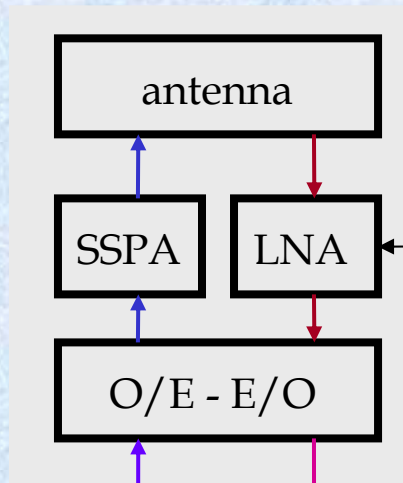
temperature instability <1K

1pps  
10 MHz



# PTB Setup

outdoor setup

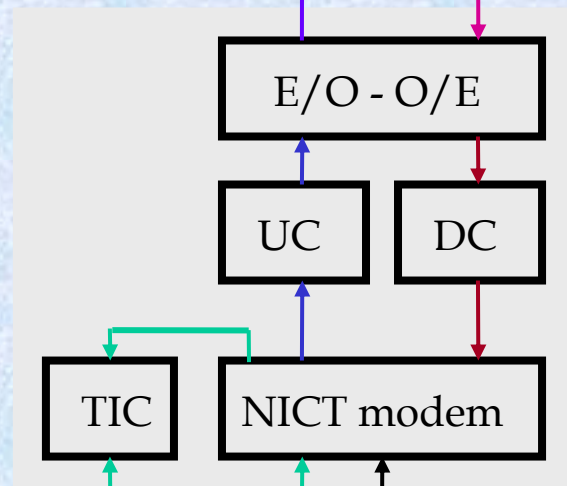


mounted in a temperature stabilized box



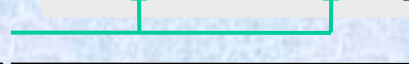
1 km optical fibre cable at PTB

indoor setup



temperature instability <1K

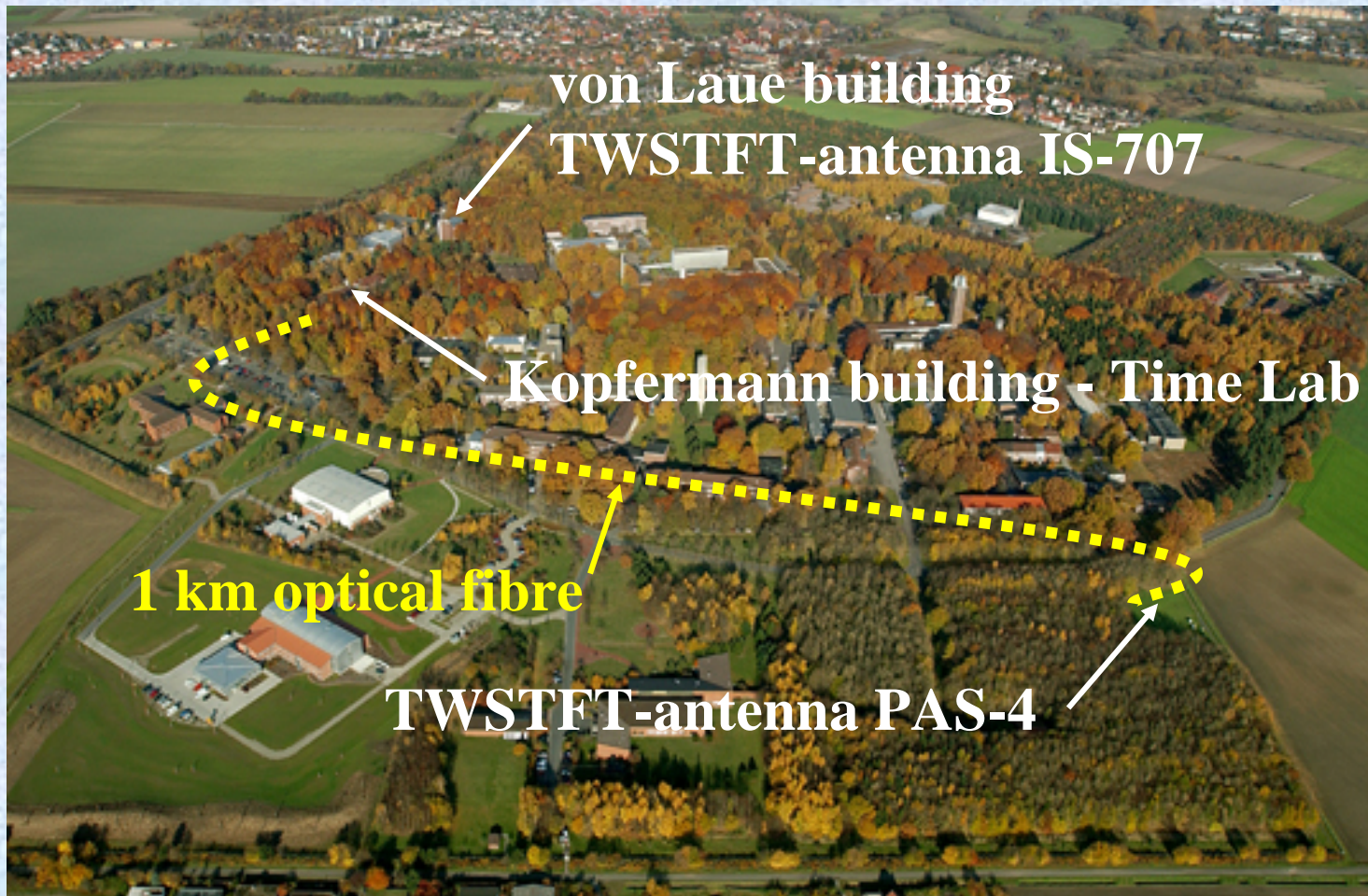
1 pps  
10 MHz





# PTB Setup

## Aerial Photograph PTB



# Indoor Setup

**NICT**

**optical fibre  
E/O - O/E**

**PTB**



**UC - DC**

**modem**





# Outdoor Setup

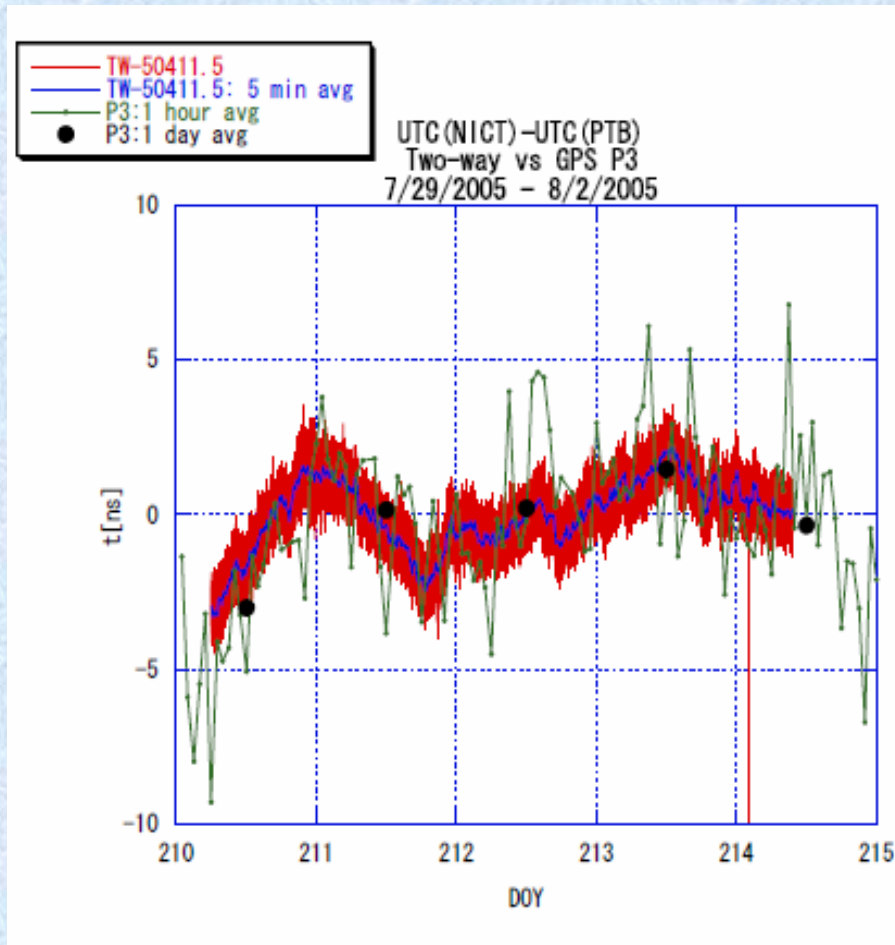
**NICT**



**PTB**



# Link Characteristics



## Comparison

**TWSTFT 1-sec-data**

**TWSTFT 5-min-averaging**

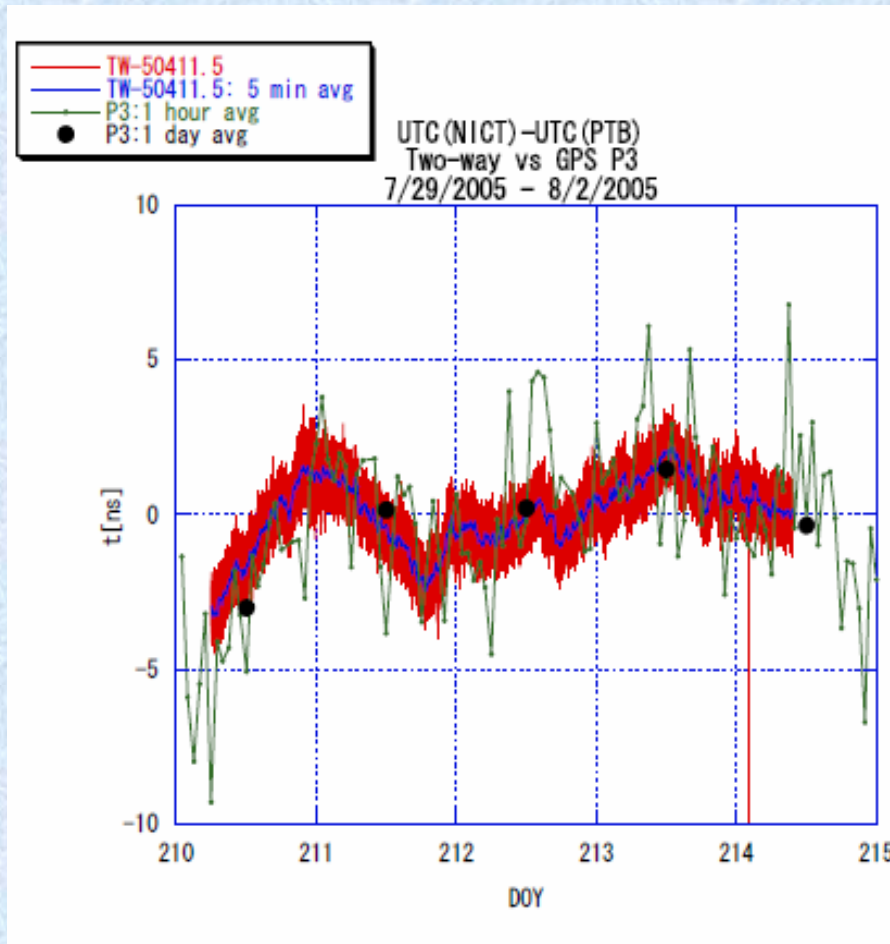
**TAIP3 1-hour-averaging**

**TAIP3 1-day-averaging**

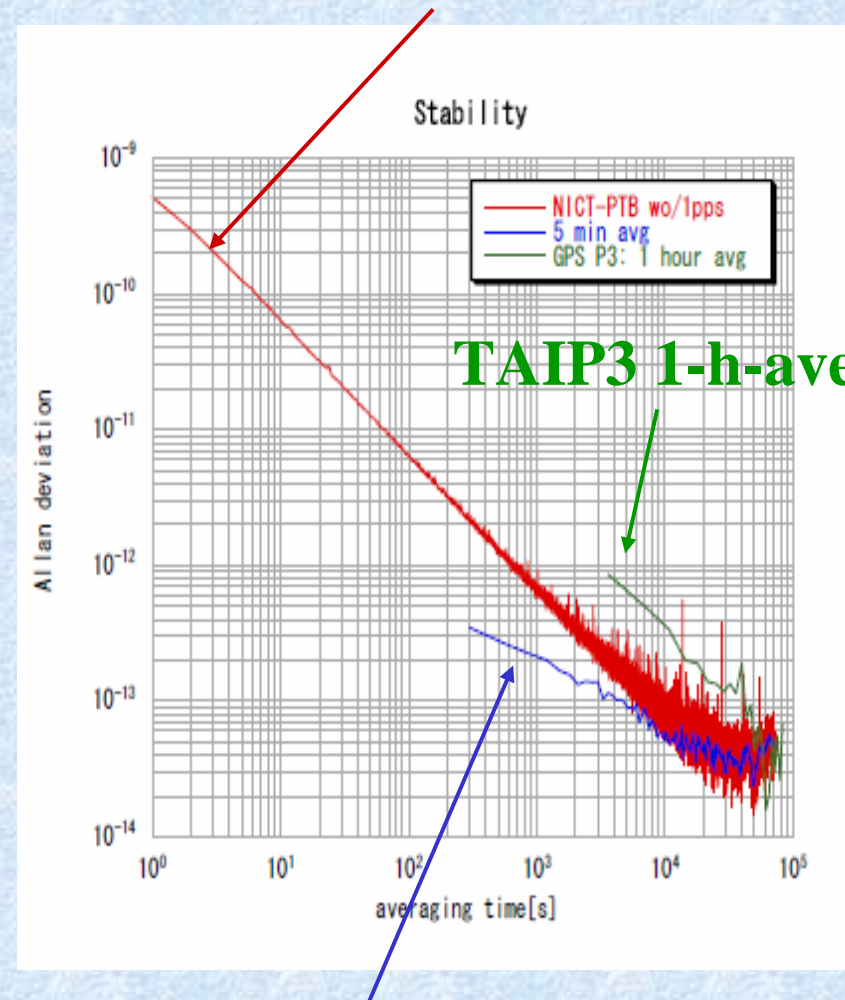


# Link Characteristics

test measurements



TWSTFT 1-sec-data

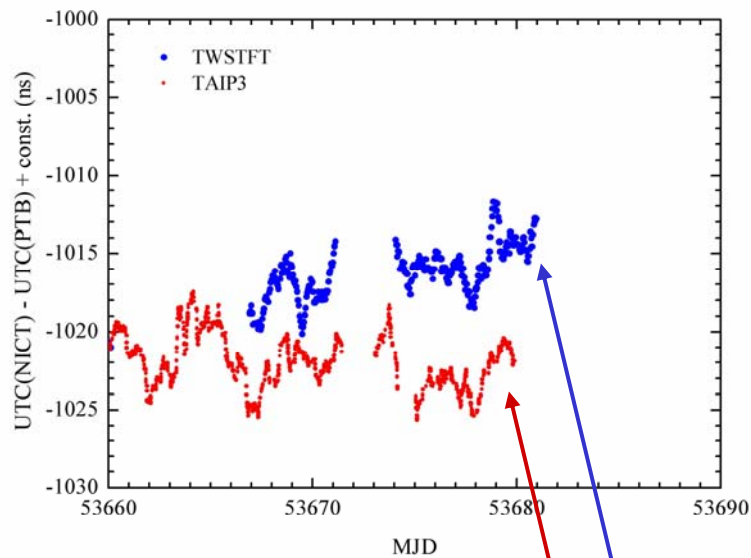


Loc. Ref. PTB-CS2 and HP5071 at NICT TWSTFT 5-min-aver.

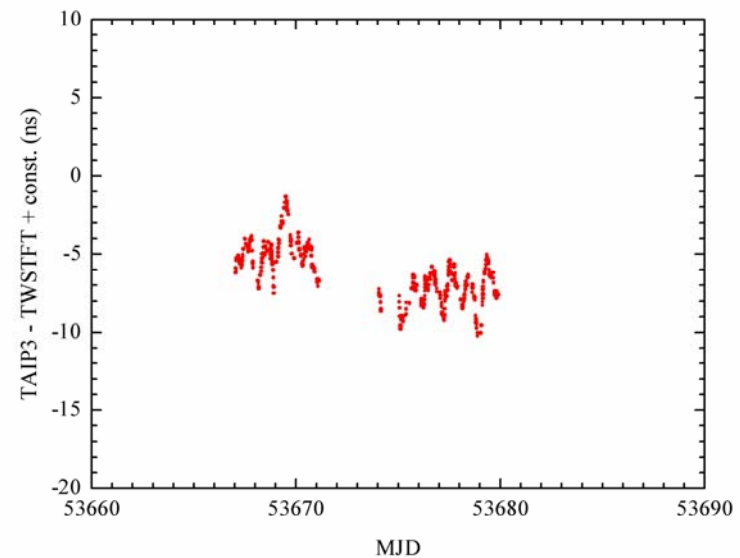
# Link Characteristics

**data processing according to ITU-R recommendations:**

**300 s / sessions, 24 sessions / day**



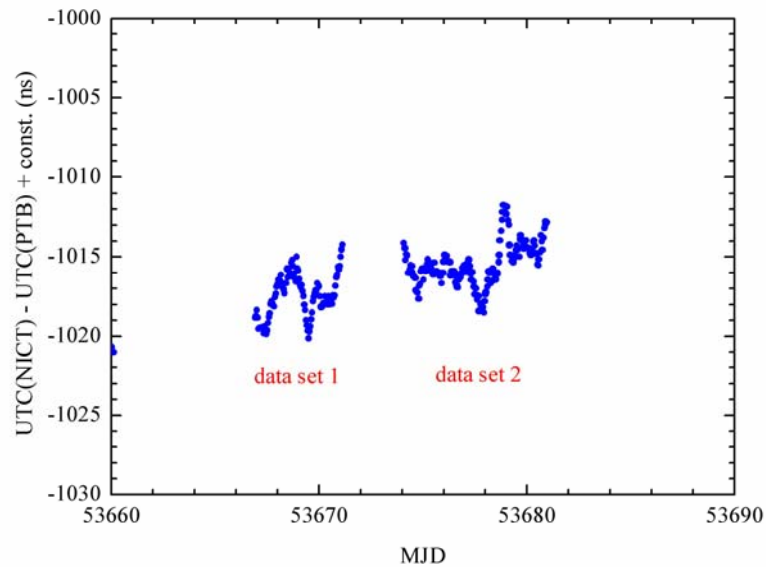
**TWSTFT**  
**TAIP3**



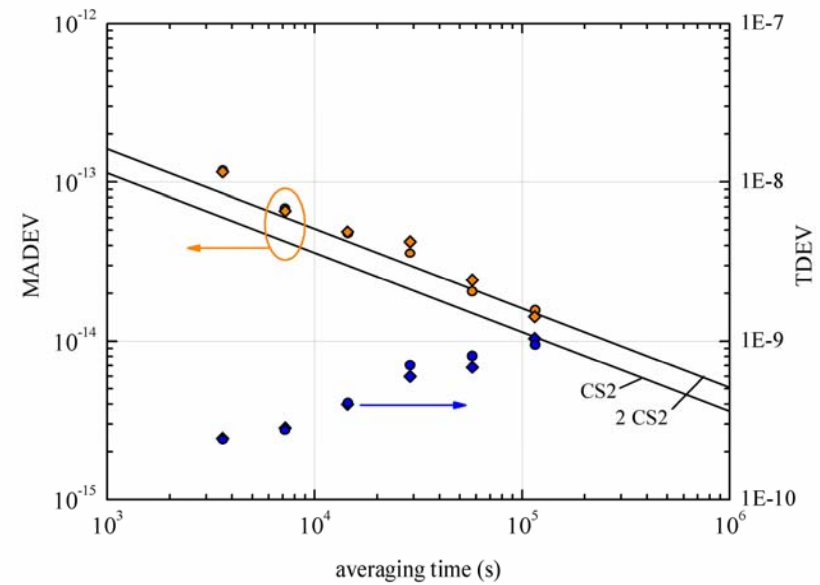
**double difference**  
**TAIP3 - TWSTFT**

# Link Characteristics

## Comparison of Cs-clocks



**TWSTFT**

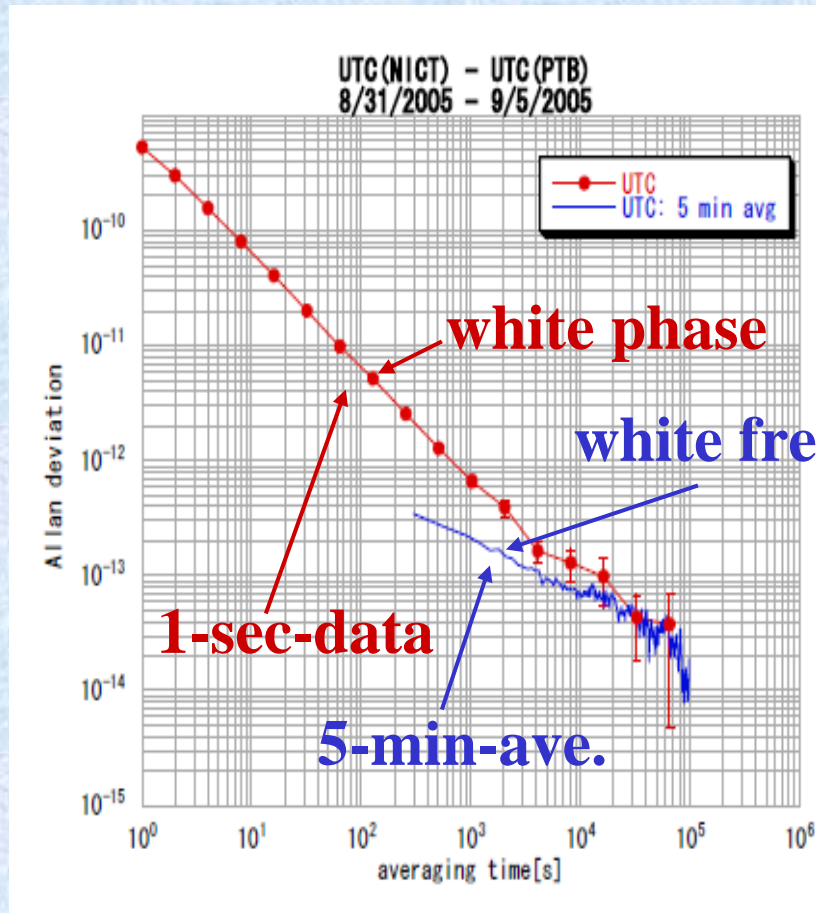


**Allan deviation  
time deviation**

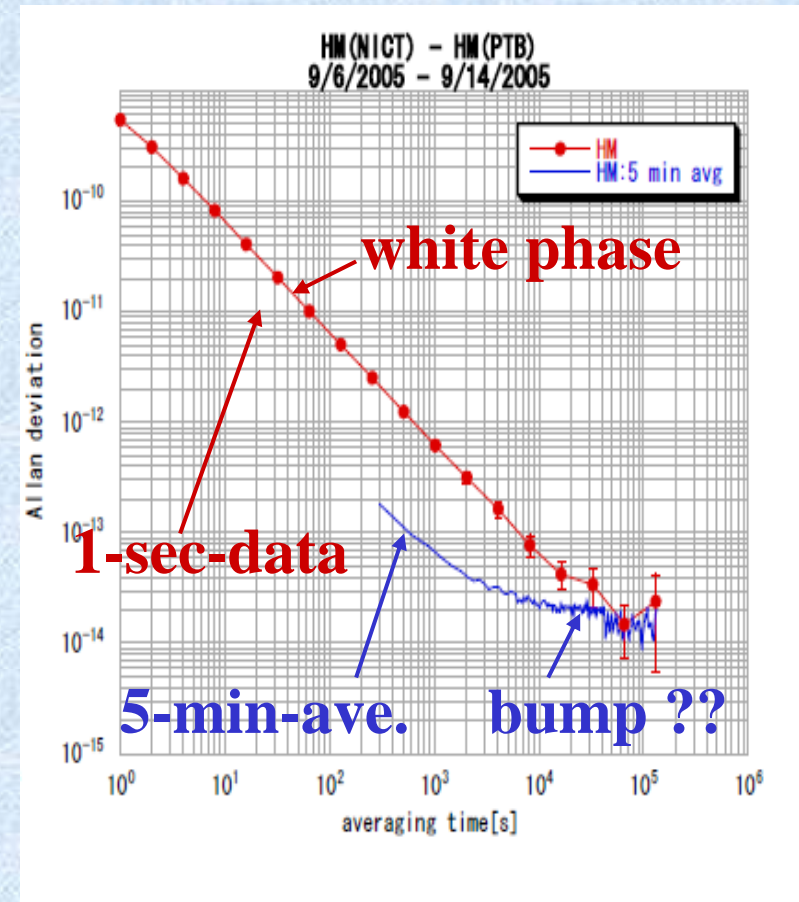


# Comparison

frequency source: Cs-clocks vs. H-maser

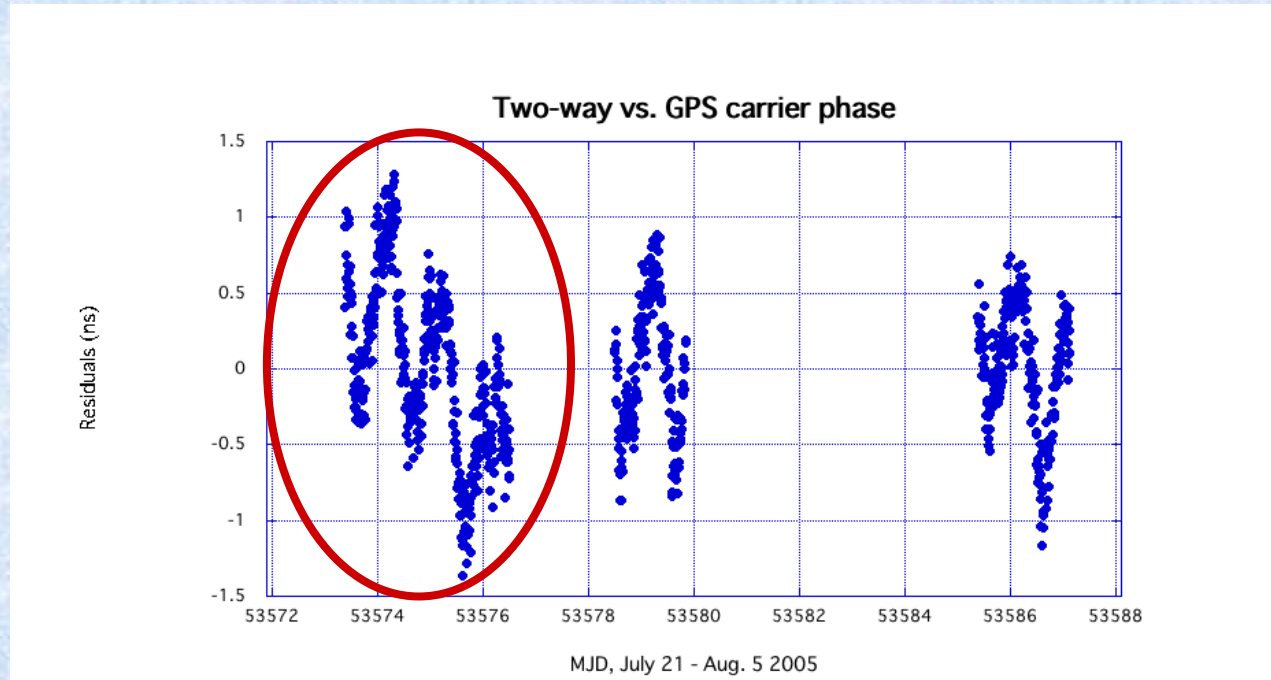


Cs-clocks



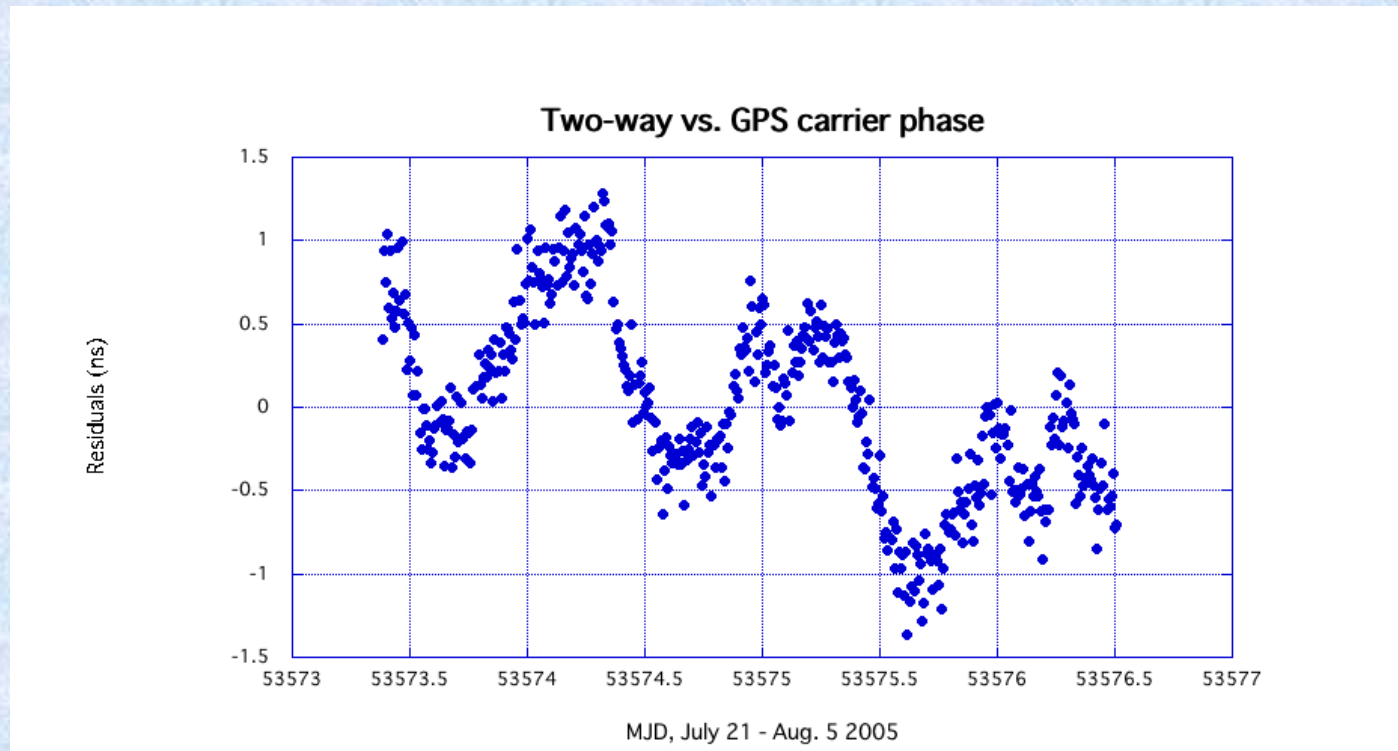
H-maser

# Comparison TWSTFT vs. GPS CP



**diurnals ??**  
**drift ??**

# Comparison TWSTFT vs. GPS CP



**no clear correlation to outdoor-temperature  
environmental conditions to be investigated in more detail**



# Conclusion

## Milestones

TWSTFT link between NICT and PTB established between  
October 2004 and July 2005

Operation started on July 22 2005

Regular Operation since 1 November 2005

## Future Tasks

Investigations of the link instabilities

Calibration with GPS/CircT to enable time transfer