

# INT9 - dUT1 determination between the geodetic observatories AGGO and Wettzell



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# Motivation for a dUT1 determination between Wettzell and AGGO (Argentinean German Geodetic Observatory)

- Demonstration that baseline configuration is sufficient for UT1 determination
- VLBI system at AGGO needed to be re-initiated to routine

VLBI operations after moving from Chile to Argentina in 2018

- Currently, UT1 determination is done only with northern hemisphere stations.

Contribution of AGGO could be beneficial due to its location in the southern hemisphere

- Regular in-house VLBI sessions between Wettzell, AGGO and O'Higgins

# Geodetic observatory Wettzell, Germany

3 VLBI Radio Telescopes, 2 Satellite Laser Ranging Systems,  
Ring laser, IGS stations, Gravimetry, Local + Regional GeoSensorStations



20 m RTW (Wz)  
RHCP S/X band



13.2 m TTW2 (Ws)  
Broadband Receiver  
2 – 14 GHz (lin. Pol.)

13.2 m TTW2 (Wn)  
S/X/Ka band  
Dual circular pol.

# Geodetic observatory AGGO, Argentina

Complete „small“ geodetic fundamental station



- VLBI radio telescope
- Satellite Laser Ranging System
- GNSS Reference Stations
- Absolute & Superconducting gravity meter
- Time & Frequency Lab



# Geodetic observatory AGGO, Argentina

## Status of VLBI at AGGO:

- 2018 various test sessions and start of INT9 sessions
- 2019 return to normal VLBI operations (additional sessions with Wettzell and O'Higgins)
- Improvements are planned with new UPS system (electric power grid instable)
- Still analog backend. Upgrade with DBBC-2 intended in 2019
- Argentinean operators are employed starting March 1, 2019
- AGGO is scheduled as IVS station by IVS and BKG in 2019



## Radio telescope:

- Main dish 6 m diameter
- S/X receiver
- Receiver in primary focus with offset mounting (no blocking of antenna aperture)

# INT9 – Geometry

- Wetzell – AGGO : Difference in longitude  $71^\circ$

→ UT1 determination

Wetzell – AGGO : Difference in latitude  $84^\circ$

→ Polar coordinate estimation may have a significant impact on the solution



# INT9 – Basic setup

- Usage of both Wettzell antennas (Wz and Wn), depending on the availability in conjunction with AGGO
  - Ag – Wz (AGGO – Wettzell, 20 m RTW)
  - Ag – Wn (AGGO – Wettzell, 13.2 m TTW1)
  - Ag – Wn – Wz
- Traditional S/X RHCP setup
- Different observing modes tested (256-16-1, 512-16-2, **1024-16-2**)
- Duration: 2 hours (to get sufficient scans for a solution)
- On Thursday between 16 UT and 18 UT (just before INT-1: Wettzell – Kokee Park)

# INT9 – Simulation

Sessions	Optimized schedule for simulation <sup>1</sup>		Observed schedule for initial phase of INT9			
	Number of Observations	UT1 formal error [ $\mu$ s]	Number of Observations	UT1 formal error [ $\mu$ s]	Stations	Mode / Mbps
wb207q	28	79.191	25	104.72	AgWz	256
wb213q	52	44.717	35	55.74	AgWz	1024
wb256q	36	55.362	29	53.451	AgWn	512
wb263q	129	30.79	123	47.903	AgWnWz	1024
wb277q	129	34.347	102	70.124	AgWnWz	1024

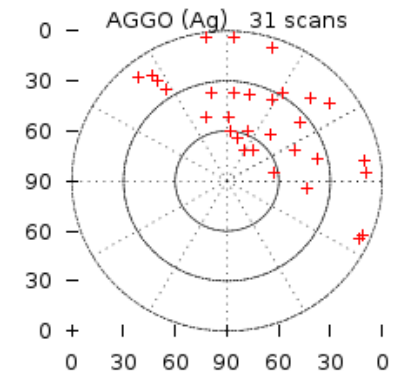
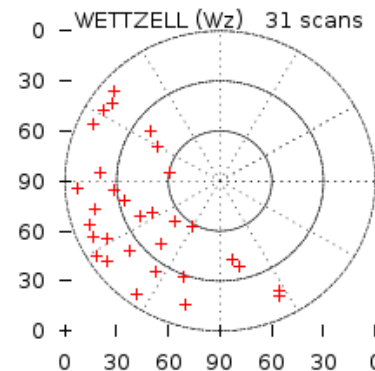
<sup>1</sup>VieSched++ and simulation with VieVS



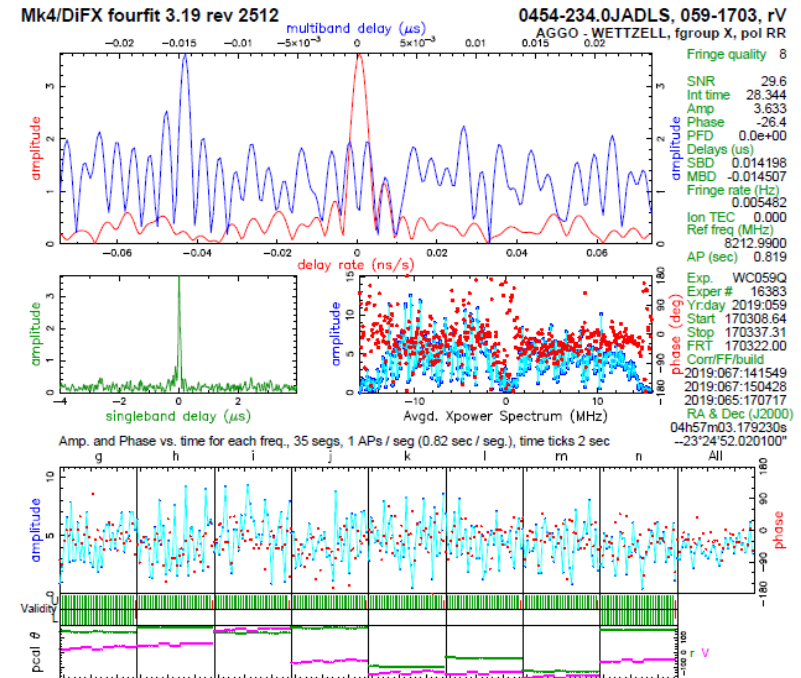
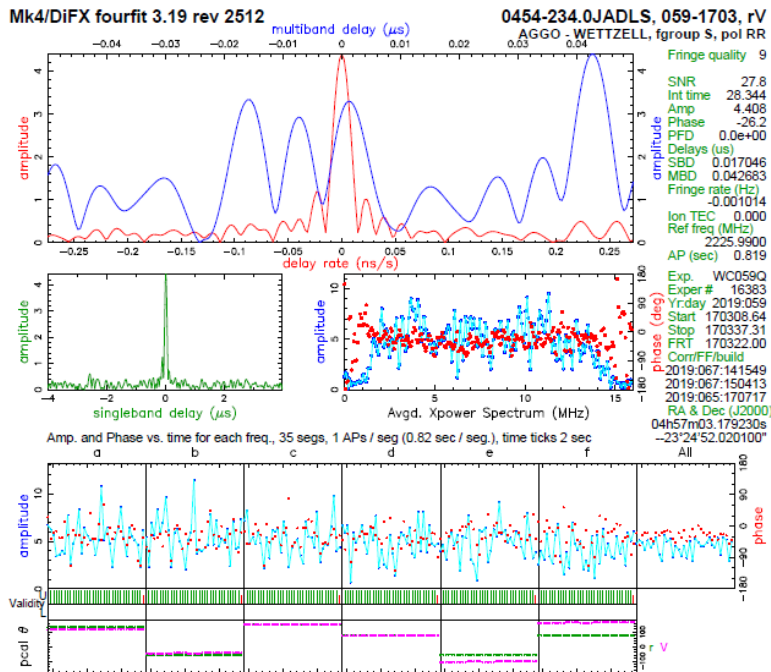
# INT9 - Scheduling

- Scheduling program *sked* used since beginning of trial
- Recently use of *VieSched++*
- Started with (256 Mps, 16 channel, 1 bit) mode
- Goal: Nominal usage of 1 Gbps (1024-16-2) mode, because this mode is preferred to maximize number of scans during observation
- Normally about 35 scans/2h with 1 Gbps
- Low elevation limit: 5°
- SNR targets: X-SNR=20, S-SNR=15

	20 m RTW (Wz)	13.2 m TTW1 (Wn)	6 m AGGO (Ag)
S-SEFD	1150	1050	15000
X-SEFD	750	1400	20000
Az: °/s	4	12	6
El: °/s	1.5	6	2

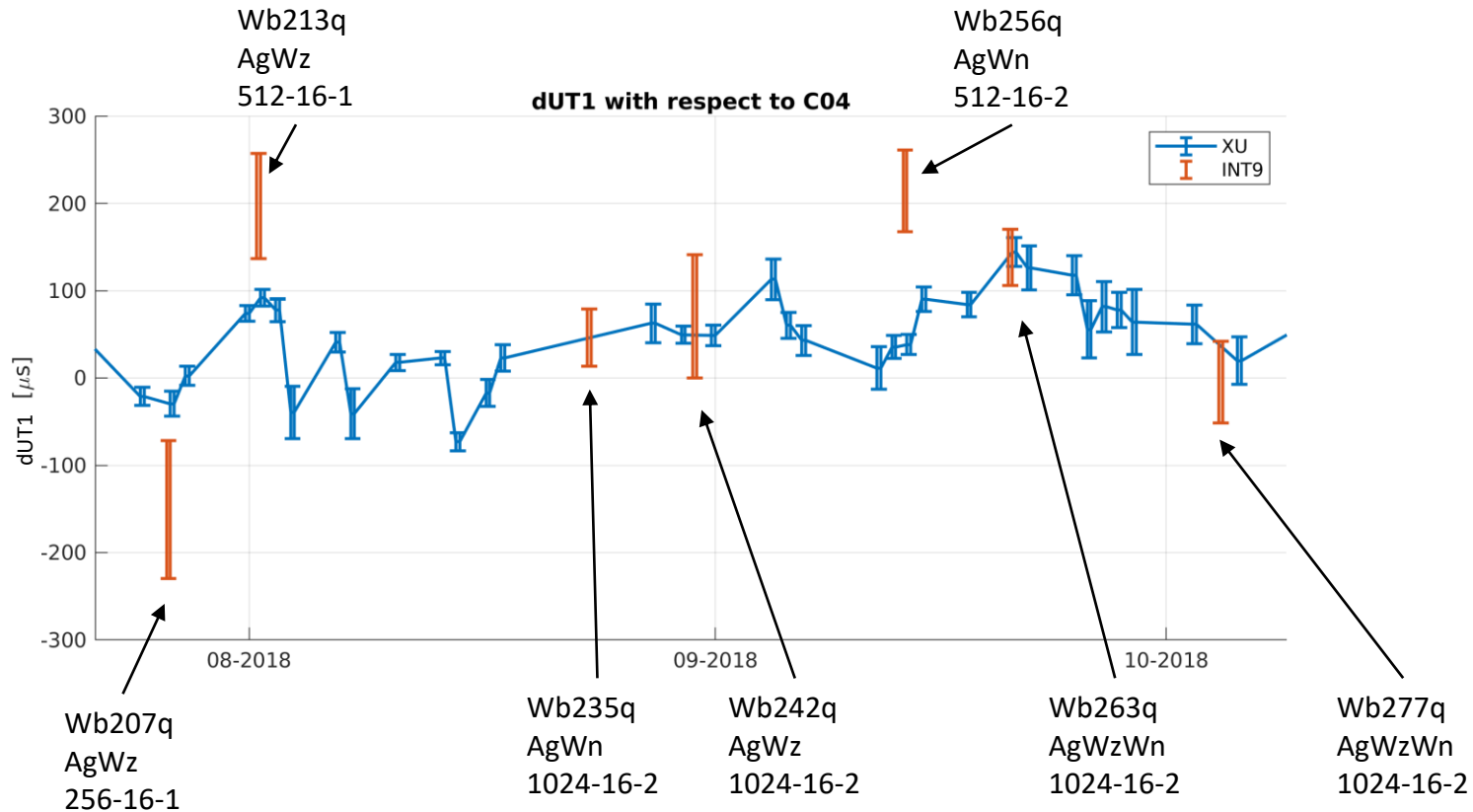


# INT9 - Correlation



- Correlation was done at Bonn correlator in Bonn and partly at Wettzell
- INT9 routine correlation foreseen at GO Wettzell during operational phase II of AGGO (3 years)

# INT9 – Initial preliminary Analysis (VieVS)



# OUTLOOK

- Initial analysis results for INT9 (Wz/Wn – Ag) are encouraging, though not all available sessions are correlated yet.
- Upgrade for AGGO with DBBC-2 planned in 2019
- DBBC-2 might improve system performance (maybe 2 Gbps as option?)
- Evaluation of various parameters (Source selection, RFI, RFI mask, coordinates, ...)
- Triple radio telescope setup might improve UT1 formal error
- AGGO demonstrated its potential to a self-contained estimation of UT1
- Regularisation of INT9 including rapid correlation and data analysis is foreseen in 2019/20

# Thanks for your attention

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