Testing on Zoomband mode in DiFX

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Greenland Telescope (GLT)

- Construct a VLBI station at a summit station in Greenland
- Project team consists of ASIAA, SAO, MIT Haystack and NRAO
- Partner of the Event Horizon Telescope (EHT) and ALMA Phasing Project (APP)
- Aiming at a direct imaging of the shadow of the supper massive black hole in M87
- ALMA-NA prototype 12 m antenna
- 230, 350 GHz frequency for VLBI, THz for single-dish use
- Retrofitting ongoing for the extremely cold temperature (-50 deg)
- Commissioning and first light at Thule in 2016-2017

Submm VLBI with GLT
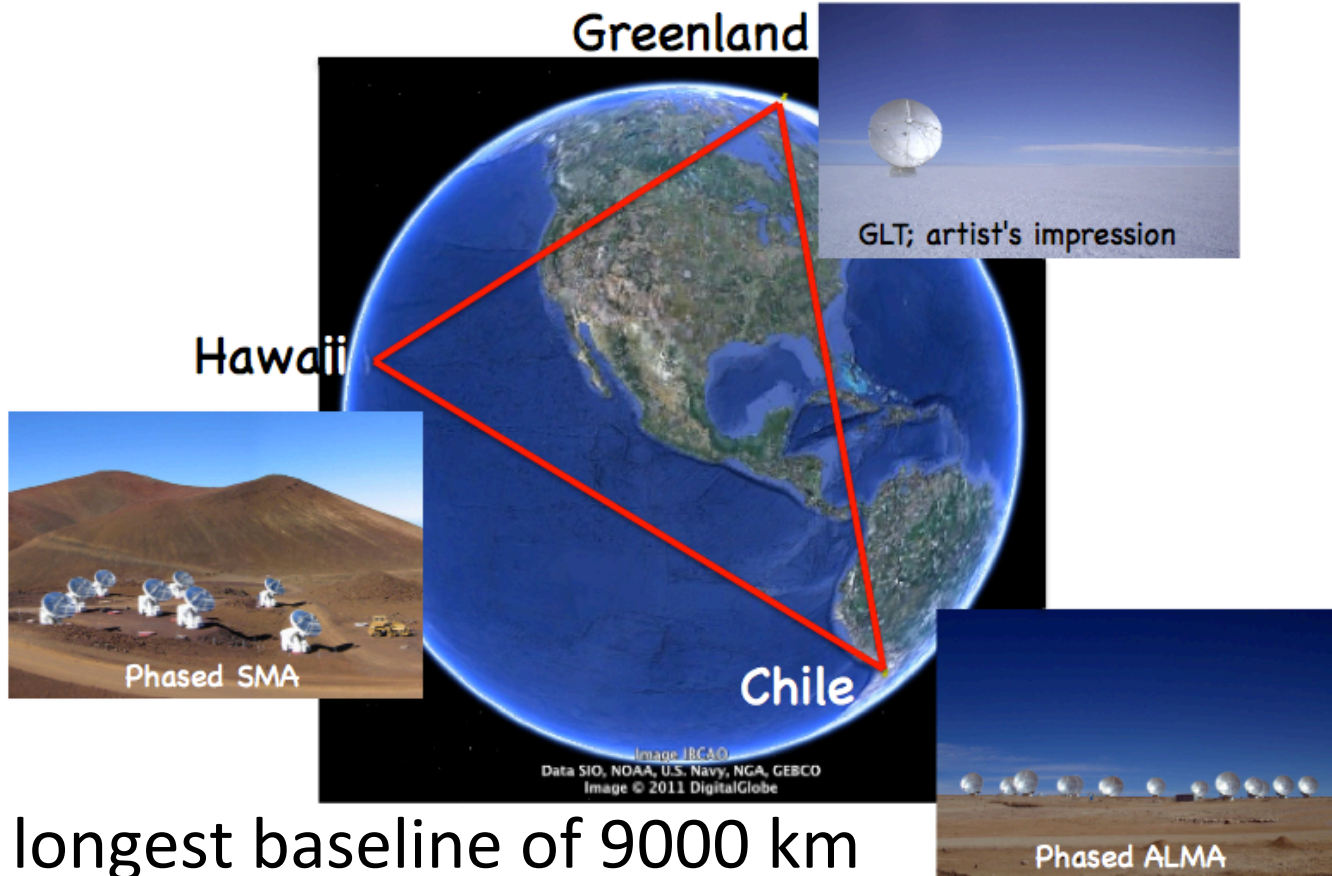
The longest baseline of 9000 km
Achieve angular resolution of 20 mas
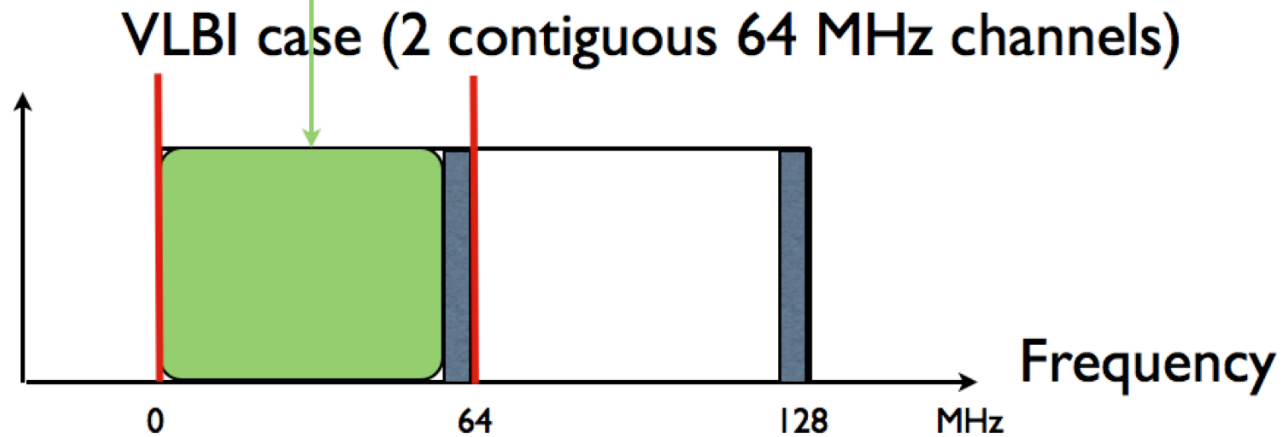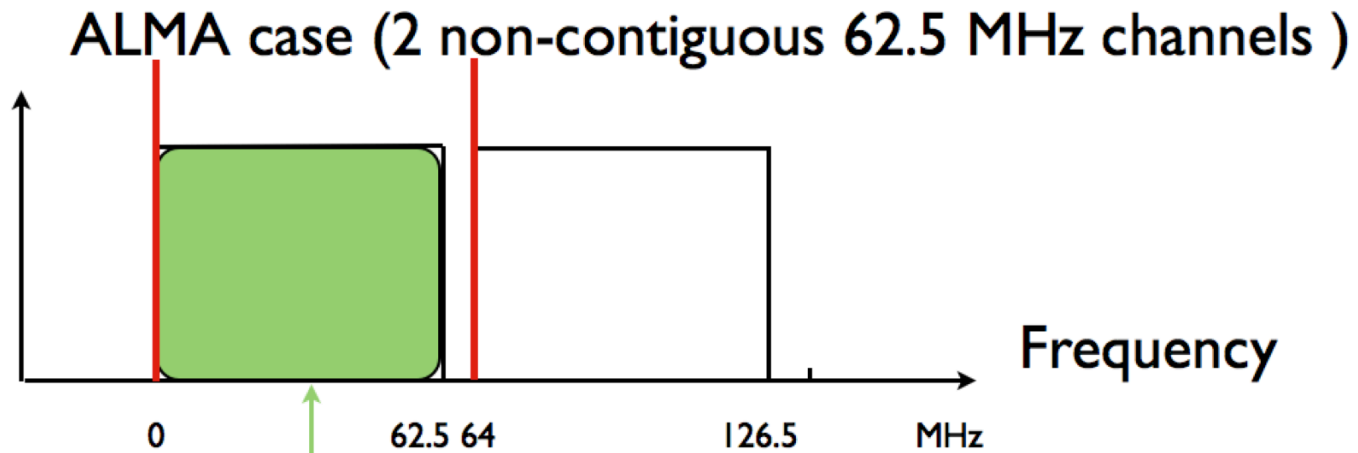(M87 BH shadow 40mas) with 350GHz.

Antenna test in Socorro (2012)

- Antenna re-testing
- Porting control software from SMA
- Functional test
- Installing optical guidescope and pointing test (~2 arcsec rms errors)

Zoomband mode in DiFX

- Correlation of data taken in different sampling scheme (e.g. ALMA 62.5 MHz vs 64 MHz)
- Zoomband mode in DiFX gives a solution: adjust frequency coverage to correlate

Zoomband correlation example

ALMA case (2 non-contiguous 62.5 MHz channels)

Frequency

0   62.5 64   126.5   MHz

VLBI case (2 contiguous 64 MHz channels)

Frequency

0   64   128   MHz

Zoomband mode testing

- We have evaluated correlation with Zoomband mode using simulated data (Nicolas Pradel [AUT], H.N)

- Related activities in DiFX group in ASIAA:
  - Automatic zoom frequency selection program [Nicolas Pradel (AUT), Zheng Meyar-Zhao]
  - Simulators 'enoise' (expanded 'anoise' from Geoff Crew) and 'Datasim' development [Cheng-Yu Kuo, Zheng Meyar-Zhao]

Zoom band testing: method to test

- Perform several realizations of simulation including ALMA (62.5MHz channel) and VLBI (32 or 64 MHz channel) stations.
- Correlate data with zoomband (ALMA-VLBI) and without zoomband (VLBI-VLBI), and derive fundamental quantities (amplitudes, phase, closure phase, delay, rate)
- Compare the results from the correlation between with and without zoomband.

Zoomband testing simulation setup (one example)

- ALMA-CARMA-SMA vs APEX-CARMA-SMA
- ALMA: 62.5 MHz x 32 IF channels
- Others: 64 MHz x 32 IF channles
- Correlation zooming 32MHz for ALMA-CARMA-SMA
- Correlation without zooming for APEX-CARMA-SMA
- Scan for 4 s pointing to M87
- Statistics were taken over 32 IF channels
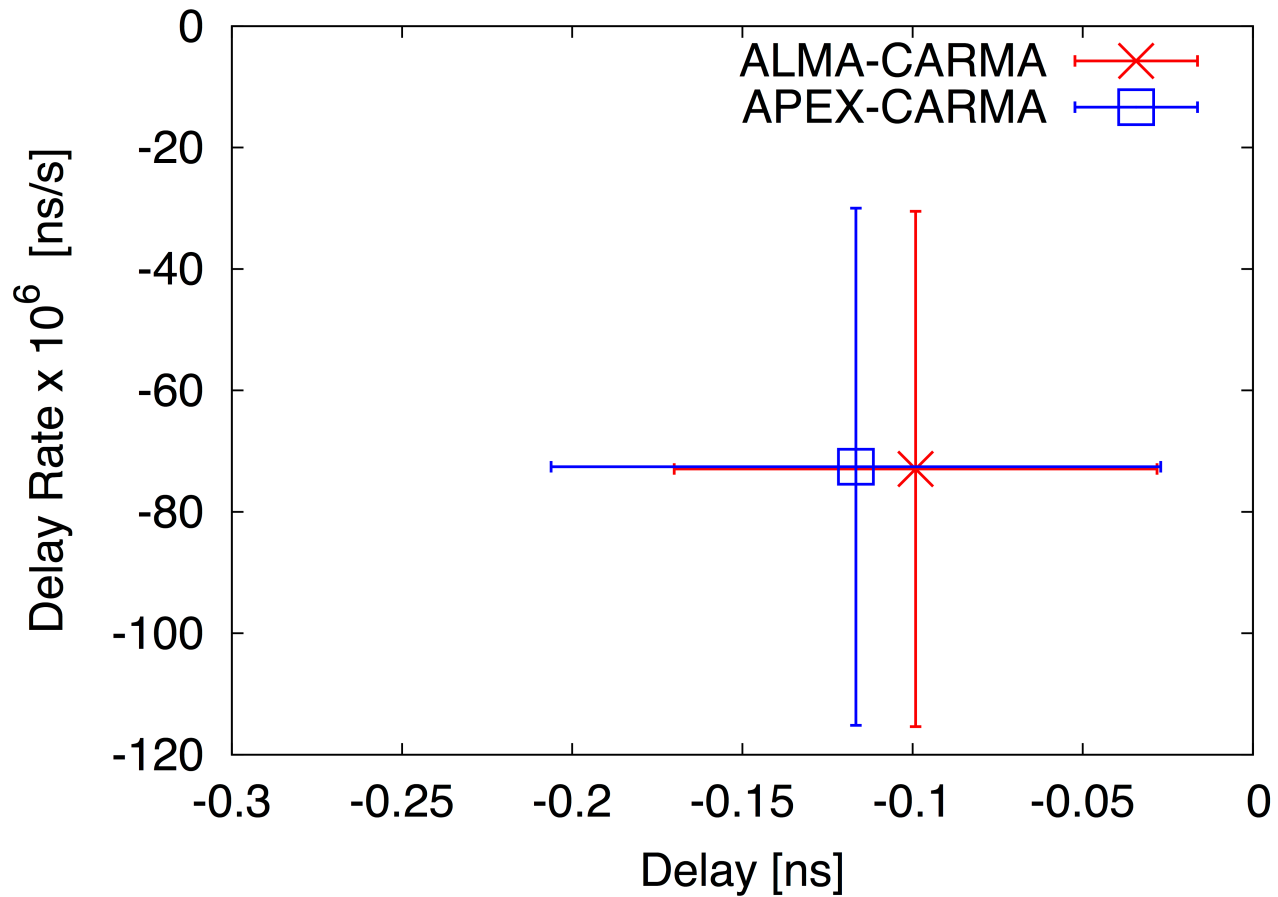- Analysis has been done with AIPS
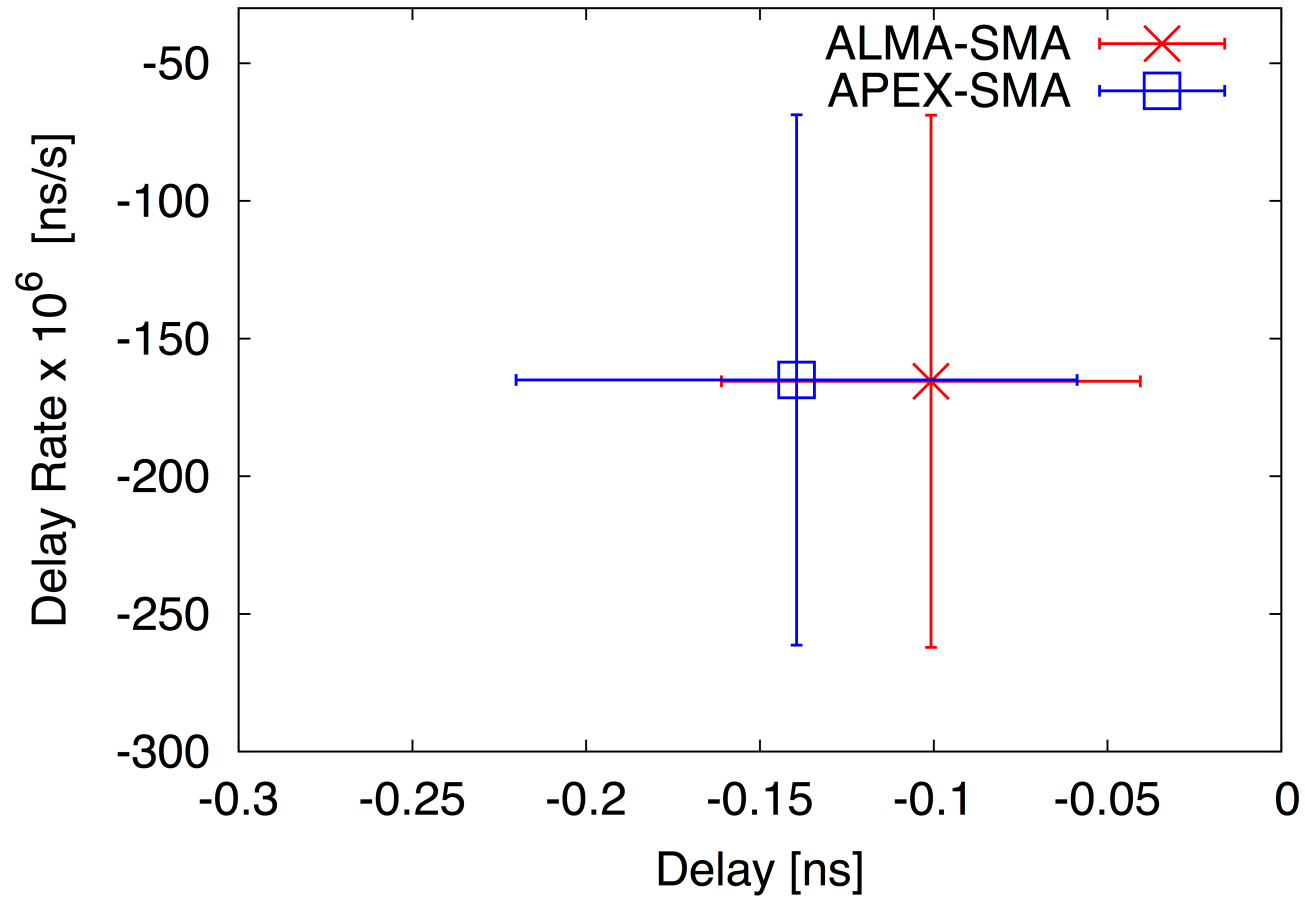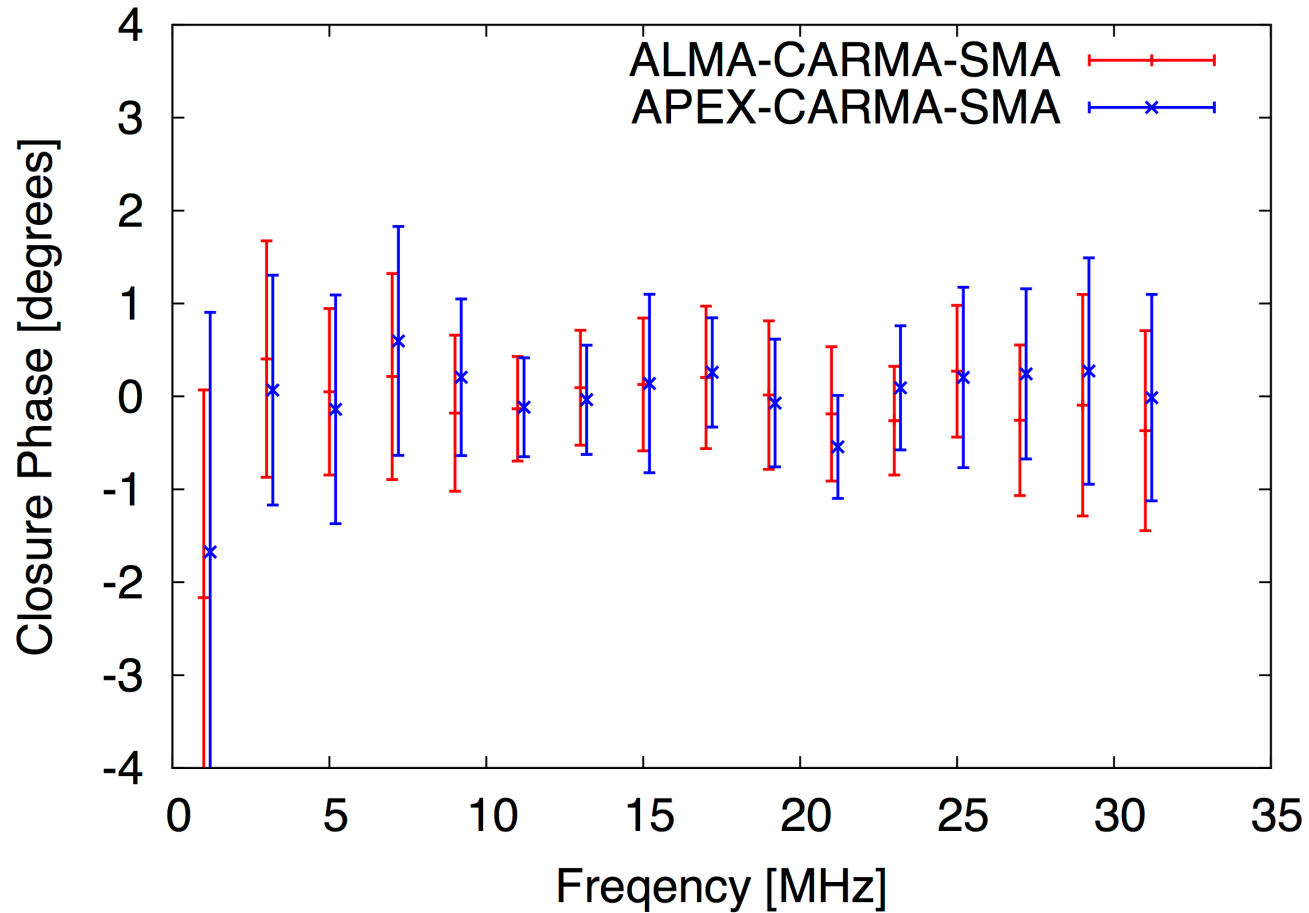
Correlation amplitude
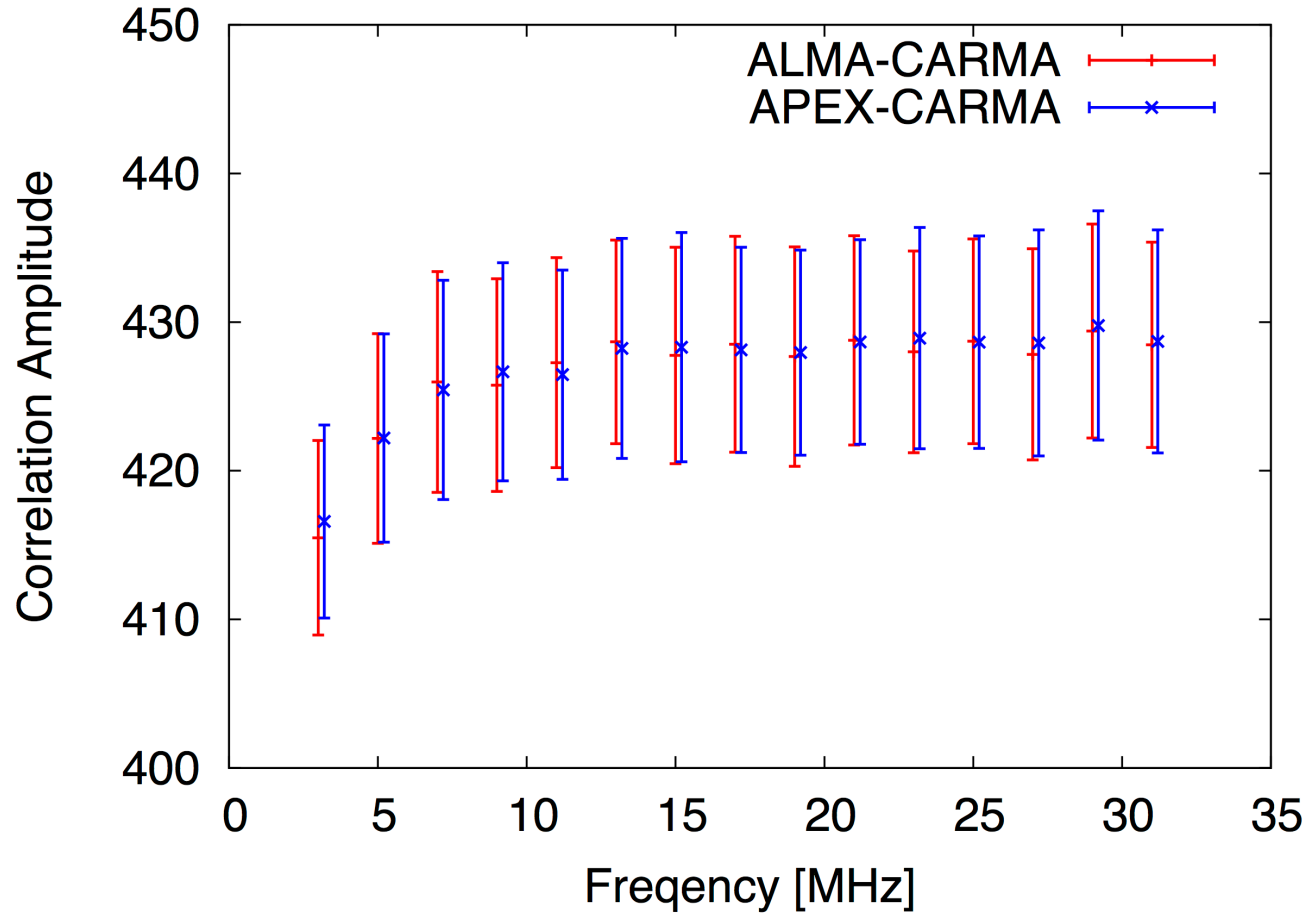
Correlation amplitude
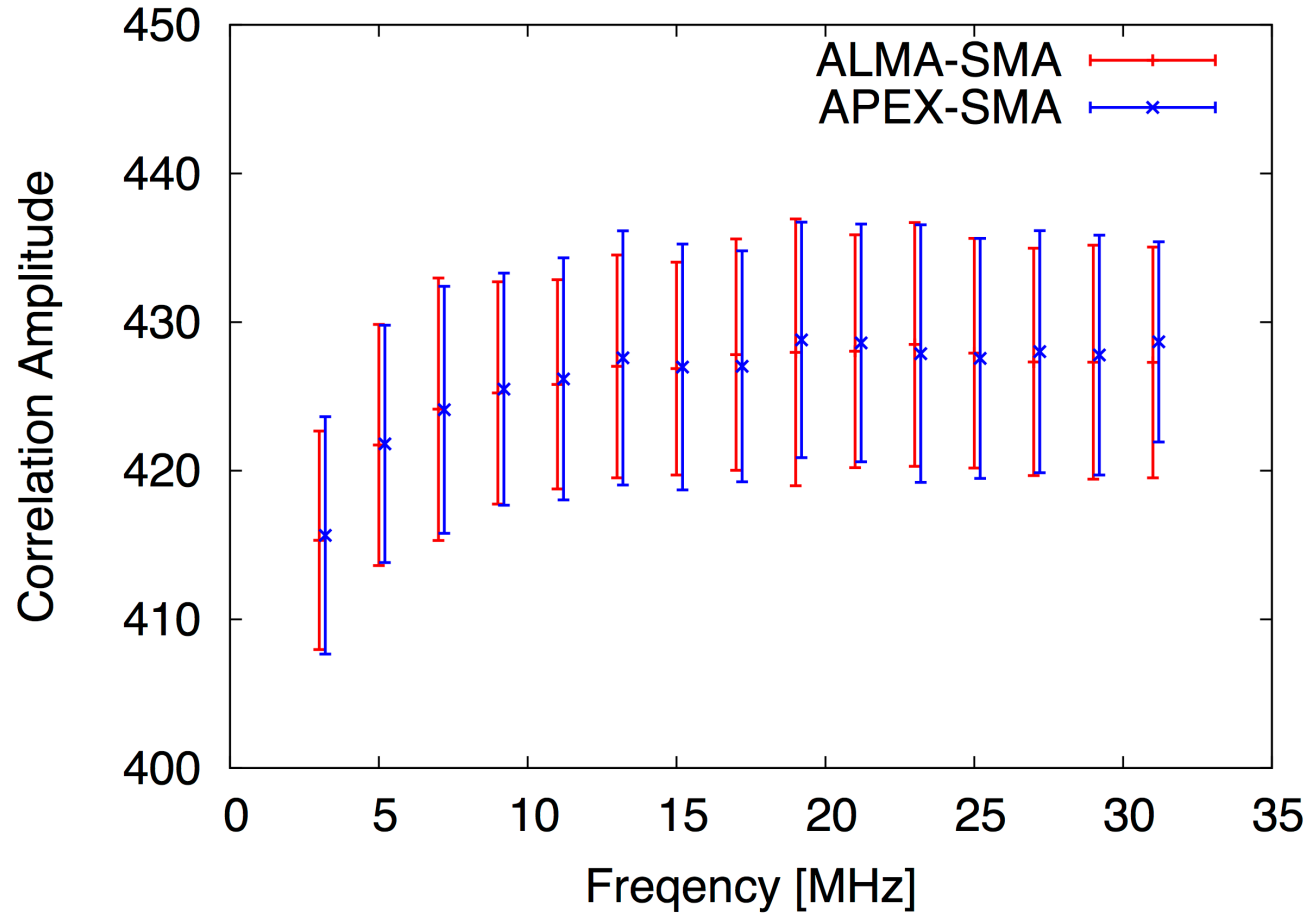
Delay and rate

Delay and rate

Closure phase

Summary

- We have made 4s simulations with and without ALMA station (62.5MHz channel).

- We have performed statistical tests (K-S test) to compare correlations with and without zoomband mode.

- No statistically significant differences were found in correlation results.