

Title: Array Site Reports

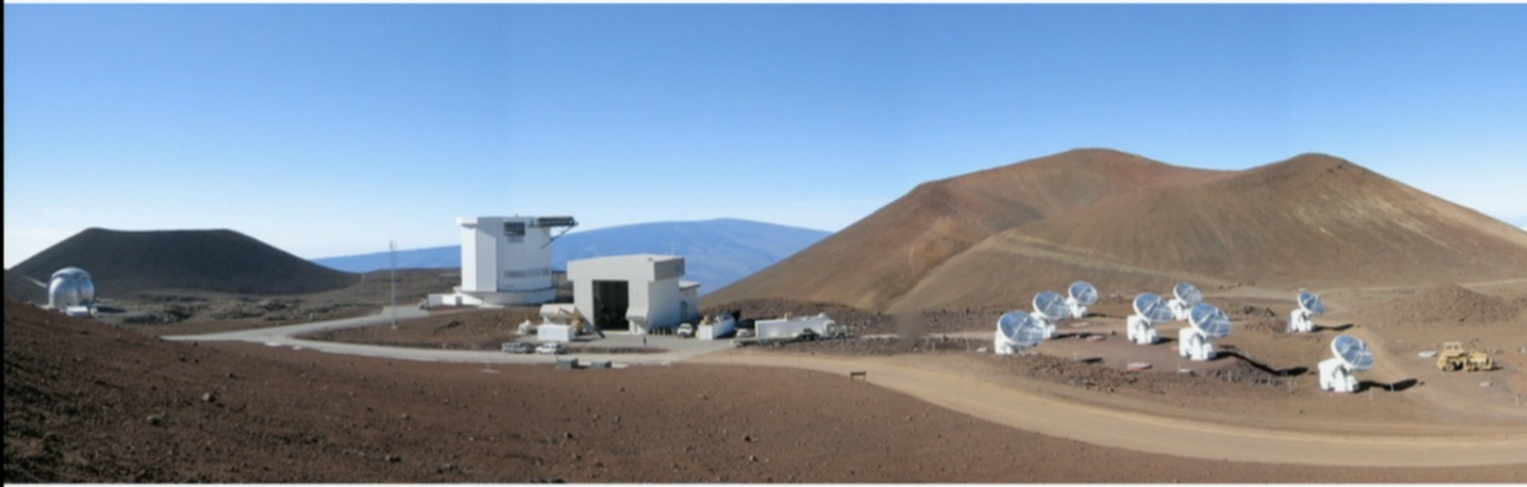
Date: Nov 13, 2014 09:50 AM

URL: <http://pirsa.org/14110099>

Abstract:



# Submillimeter Array EHT site update



Jonathan Weintroub  
SMA, SAO & CfA  
EHT2014  
13 November 2104



## A vibrant and growing EHT group at SAO



Toscanini et al., 2014



GORDON AND BETTY  
**MOORE**  
FOUNDATION



# SMA equipped with T4 Science H-maser

also references JCMT.

BVA XCO and 5115A Allan Variance Test Set



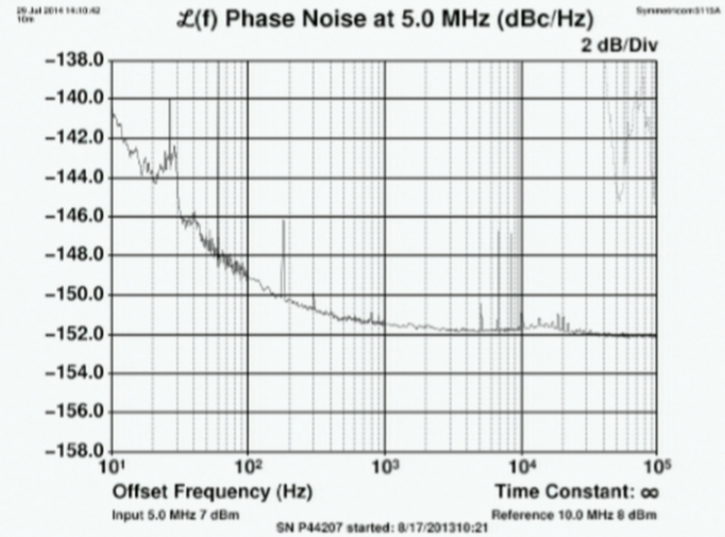
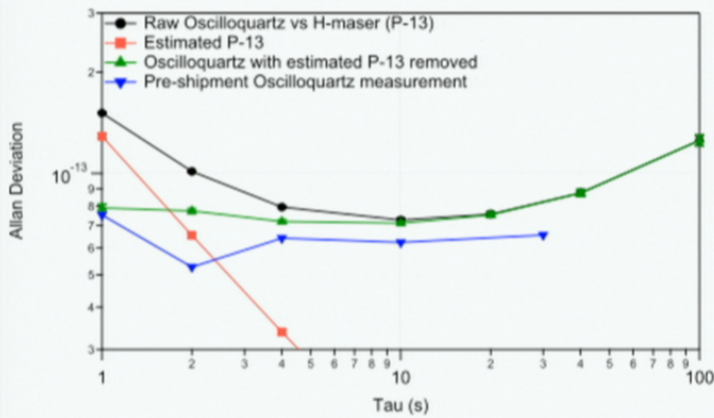
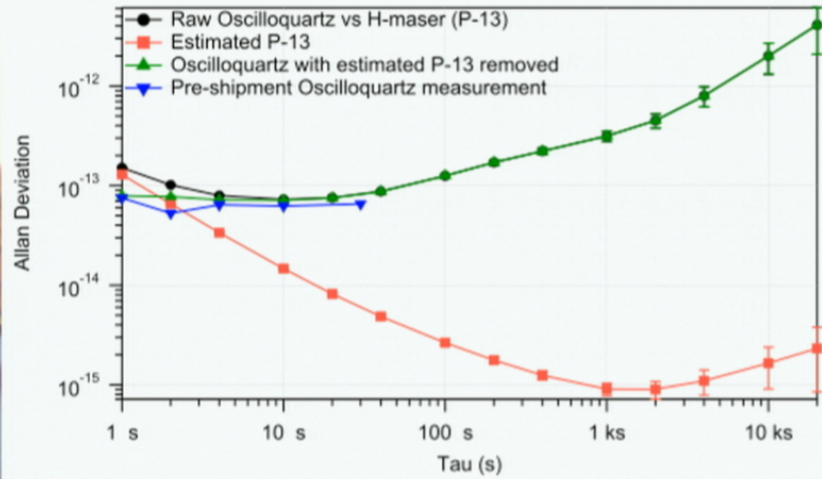
TAU0: 1E-2 (NEQ BW: 50 Hz)

tau:	1 adev:	1.267e-13	err: +/-1.38e-15
tau:	2 adev:	9.88e-14	err: +/-1.52e-15
tau:	4 adev:	8.47e-14	err: +/-1.85e-15
tau:	10 adev:	7.24e-14	err: +/-2.50e-15
tau:	20 adev:	7.66e-14	err: +/-3.74e-15
tau:	40 adev:	8.8e-14	err: +/-6.08e-15

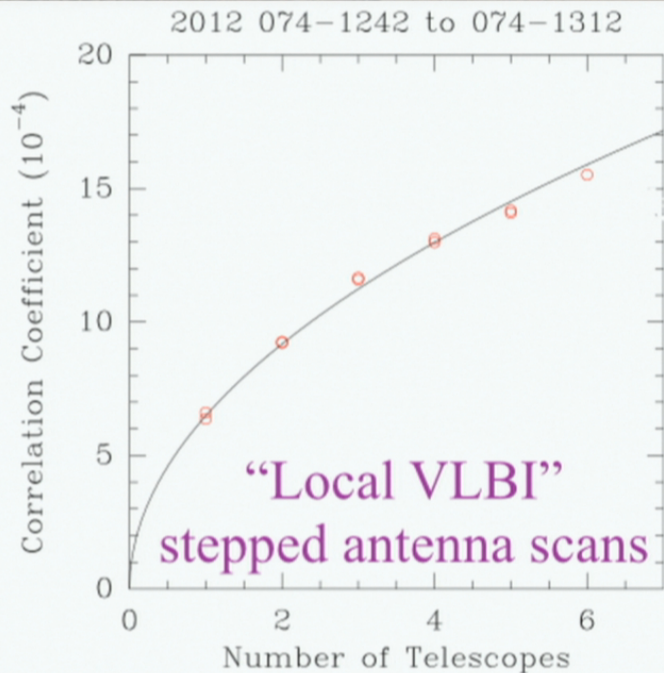
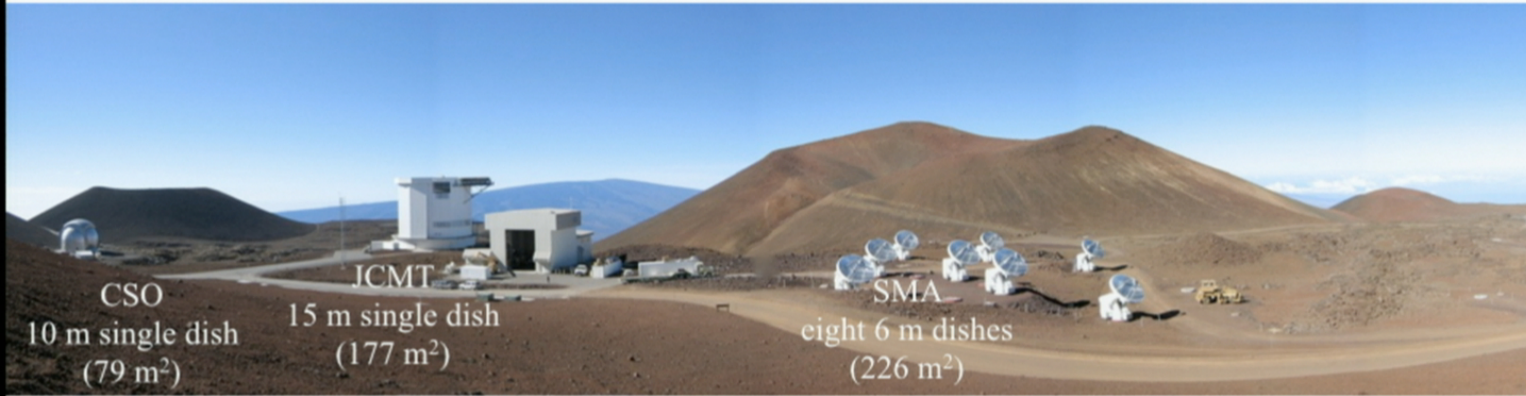


# Checking out the 8607 BVA at SAO

Selfie, SAO Maser Lab



# SMA 4 Gb/s (1 GHz) Phased Array (PhRInGES)



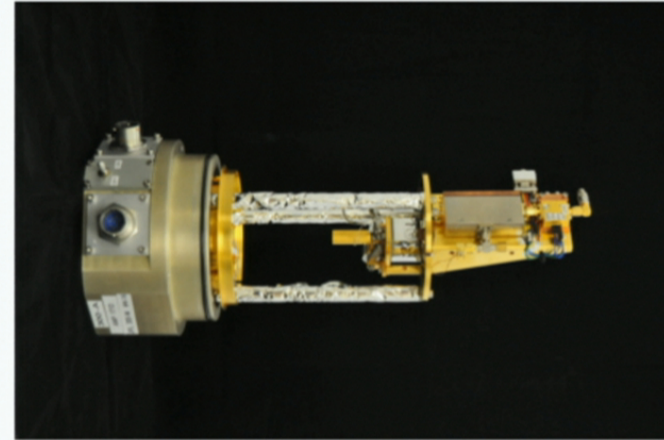
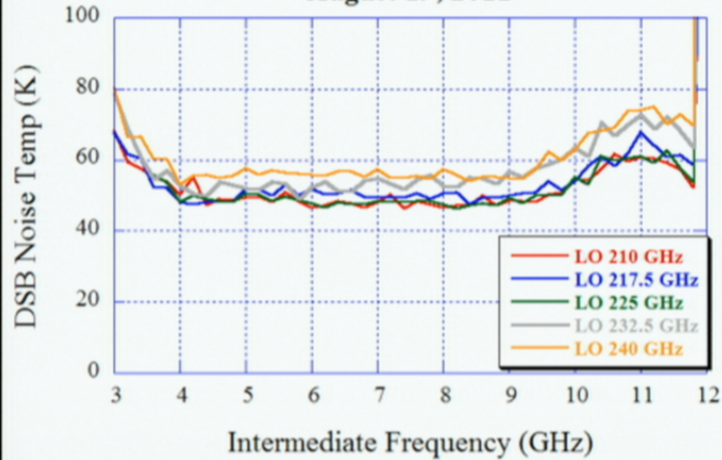
(CARMA,  
PdBI, ALMA also have  
phased arrays)

This system was developed using  
CASPER open source technology  
<https://casper.berkeley.edu>

# Wideband SIS junction receivers

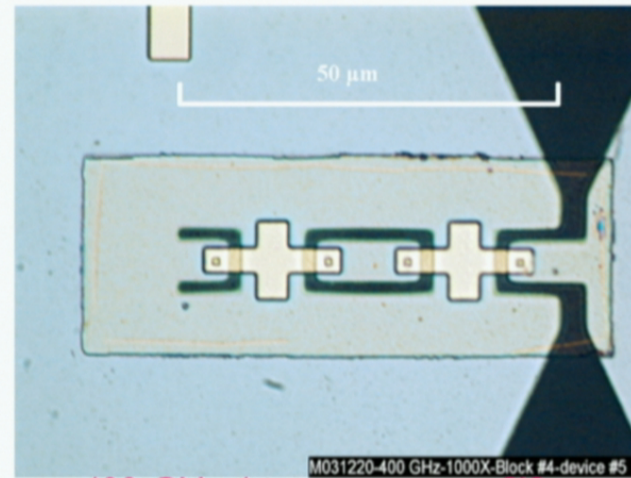
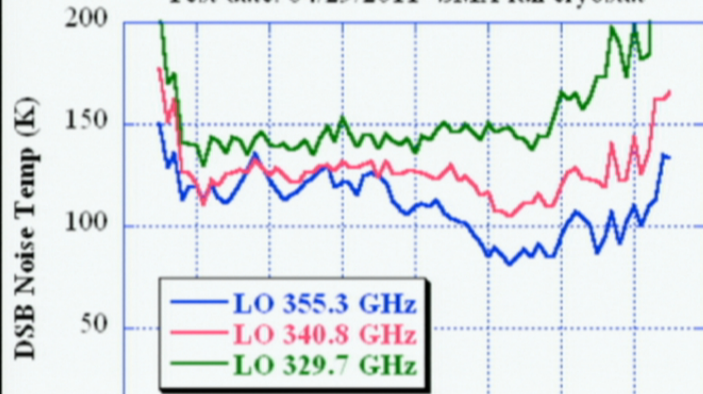
E. Tong, IF amplifiers from S. Weinreb

Performance of 200-H insert  
using ASIAA 3-junction array  
August 19, 2011



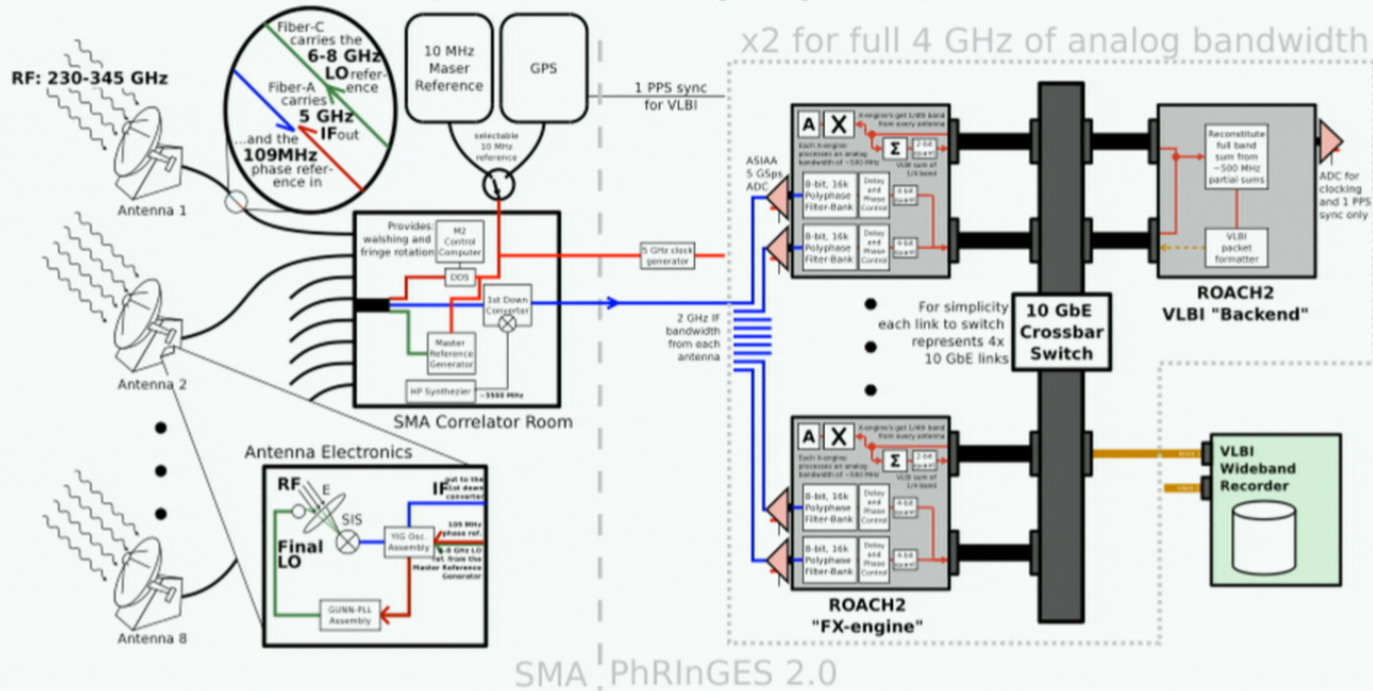
SMA receiver insert to demonstrate 300 GHz

Intermediate Frequency (GHz)  
Device: JPL M031220-S4-3-14  
Test date: 04/29/2011 SMA full cryostat



400 GHz 4-junction series SIS array

## SWARM: SMA Wideband Astronomical ROACH2 Machine (16 Gb/s or 4 GHz per Quadrant)



Will be connected to run in parallel with existing correlator, doubling bandwidth. Additional benefits:

1. high spectral res with no sacrifice of bandwidth,
2. smaller footprint for phase-in of SWARM2 etc,
3. native VLBI support over full 4 GHz band, and
4. better correlator efficiency with 8 bit ADC

Feature	Specification	Remarks
Number of antennas	8	2 receivers each.
Bandwidth per receiver	2 GHz	Dual polarization in each side band.
Number of sidebands	2	90-270 Walsh splits SBs, Rx are DSB
Simultaneous receivers	2	Dual frequency or dual polarization 230 & 345 GHz
Baselines	56	28 per Rx, full Stokes, 112 total
Spectral resolution	140 kHz	2.3 GHz Nyquist / 16384 channels
Fastest dump rate	0.65 s	Single full Walsh cycle
Phased array bandwidth	4 GHz	2 GHz × dual pol.



# One Quadrant SWARM Installed at SMA

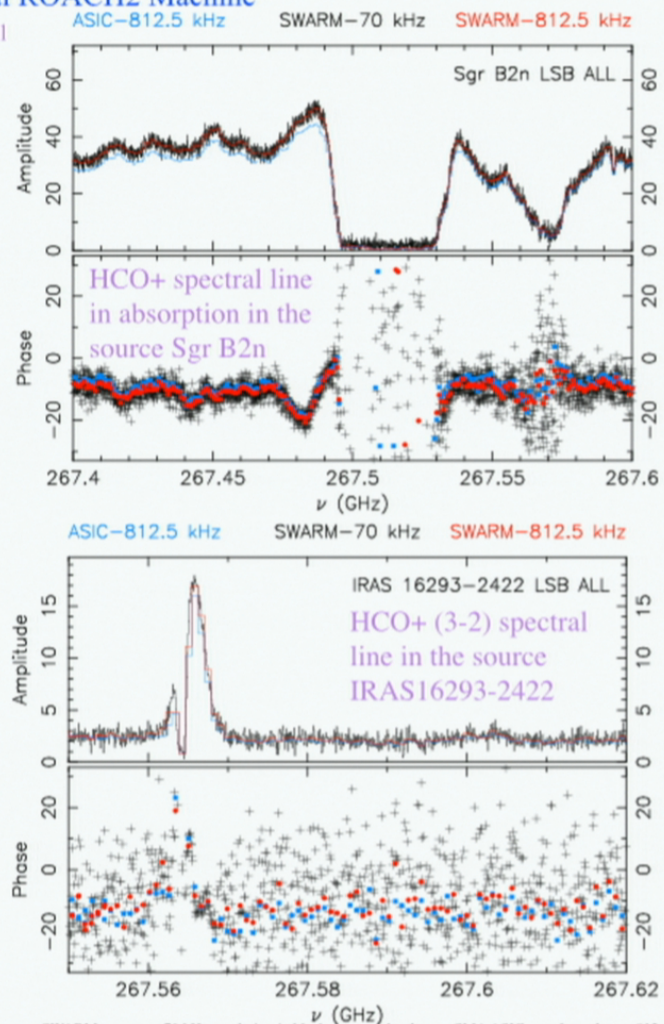
“SWARM=SMA Wideband Astronomical ROACH2 Machine”

SWARM will be released for science at SMA on 15 November. Phased array features will enable 8 Gb/s EHT VLBI in March 2015, 32 Gb/s in 2016, and 64 Gb/s in 2017



BDC due to Kubo, Chilson, Test, Yamaguchi

- 8% of the rack space and 5% of the power of ASIC correlator
- additional space and power savings in IF, cooling
- Same bandwidth, substantially enhanced spectral resolution
- VLBI Phased Array capability over the full bandwidth.



:SWARM spectra at 70 kHz resolution in black compared to legacy SMA ASIC correlator data at 812.5 kHz resolution in blue. Red plots show SWARM vector averaged to the same resolution as ASIC.

# SMA status, and goals for March 2015

- SMA has participated in EHT since 2006 initially without Aeff: supporting observations with CSO and JCMT. 4 Gb/s (1 GHz) phased array since 2009
- SMA staff are experienced in EHT operations, have confidence in site coherence, and are versed and equipped to check it.
- SWARM (Primiani, Vertatschitsch, K. Young, MacMahon, SWARM Team) will support non-VLBI science @ SMA **day after tomorrow**
- March 2015: SMA to contribute 8 Gb/s in single polarization, JCMT to offer other pol at same BW
- SWARM is running in “half bandwidth” (actually 6/11) mode. This is sufficient for 8 Gb/s EHT ops in March
- VLBI features for SWARM still in development: Phased Array Summing (MacMahon), DBE, (Vertatschitsch), “rate transformation”, rechannelization
- Rate transformation is challenging. We are looking at possibility to handle this (partly) in DiFX (Blackburn, Rosenfeld, Crew, etc)
- Longer term: 32 Gb/s (2016), 64 Gb/s (2017): DSB and Dual Pol VLBI (A.Young)
- 1.3 mm Dual Polarization at SMA requires two 4-antenna phased sub-arrays, because 1.3 mm is natively single polarization.