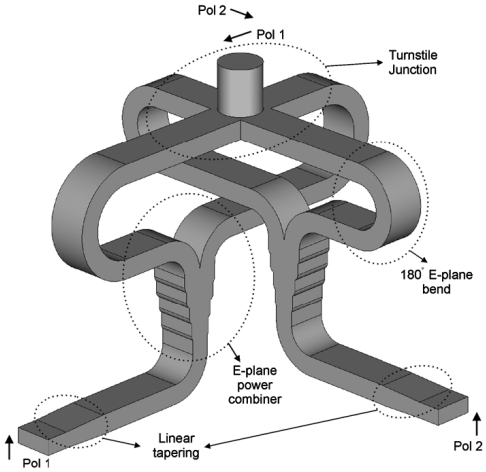
wSMA:
Opportunities of Technical Collaboration

Edward Tong SMA Governing Board Meeting, Dec. 2016

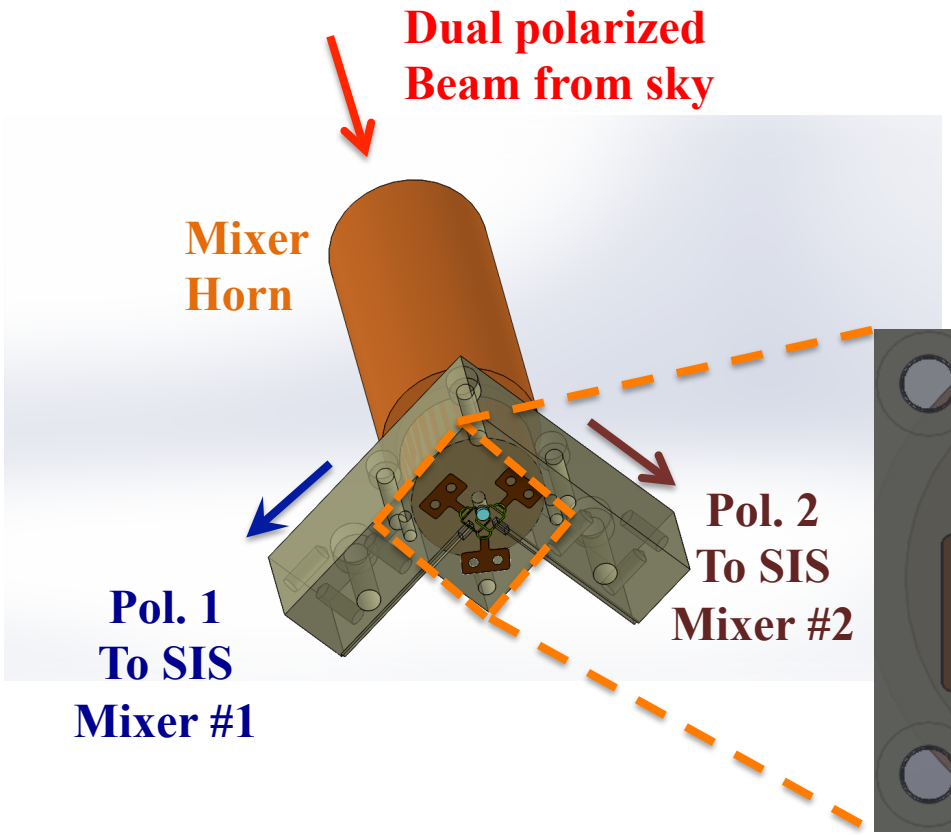
Collaborative Work

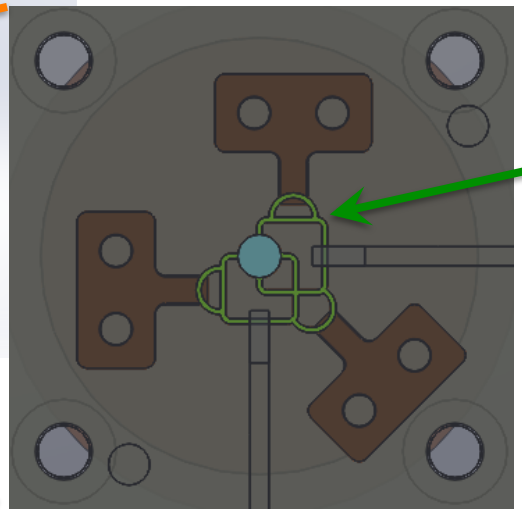
- **Monthly Telecon Cambridge/Hilo/Taipei to coordinate wSMA Development.**
- **Web-based document depository (Twiki) based in Hilo for document/drawing sharing.**
- **Novel Orthomode Transducer Development/Fab.**
- **New SIS mixer based on 4-junction array: Design/Fab.**
- **New IR filter Development in ASIAA.**
- **ASIAA helping and cross-checking cryogenic design.**
- **ASIAA technical staff member may come to Cambridge to work with SAO staff on instrumentation.**
- **SAO/ASIAA Hawaii staff contributing to fiber upgrade, antenna reorganization and system engineering.**
- **Jonathan and Homin continue to communicate on 10 Gbit/sec Analog-Digital Convertor.**

Novel Orthomode Transducer (OMT) Development
SMA: Edward Tong, Lingzhen Zeng, Paul Grimes
ASIAA: Ming-jye Wang, Jimmy Lu, TJ Chen



OMT generally has complex 3-D structure

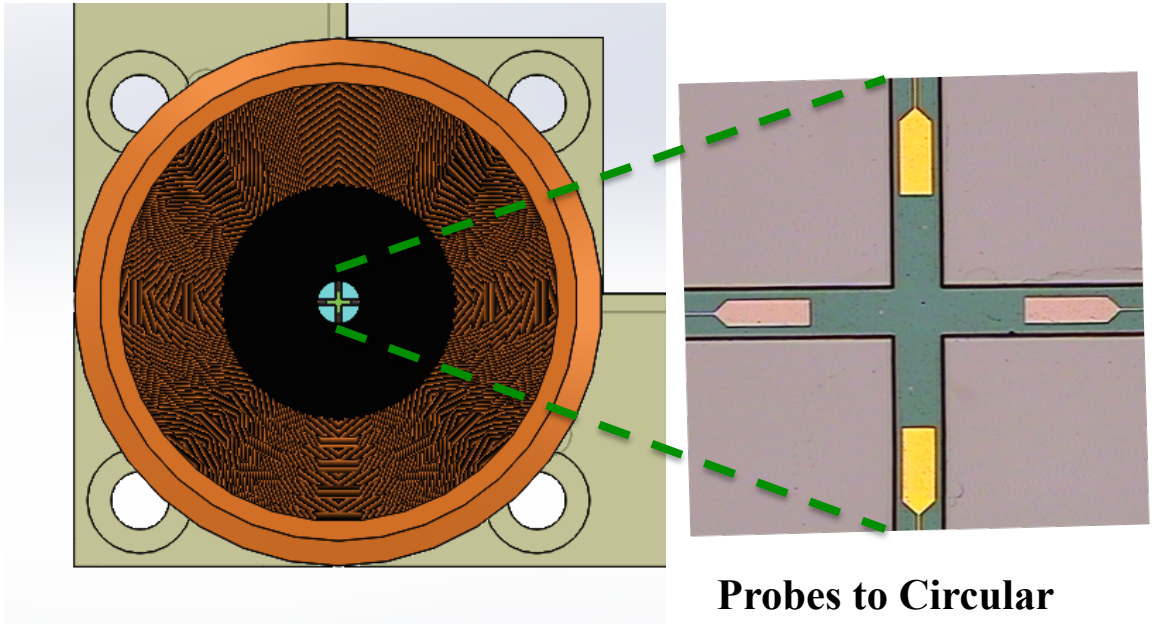




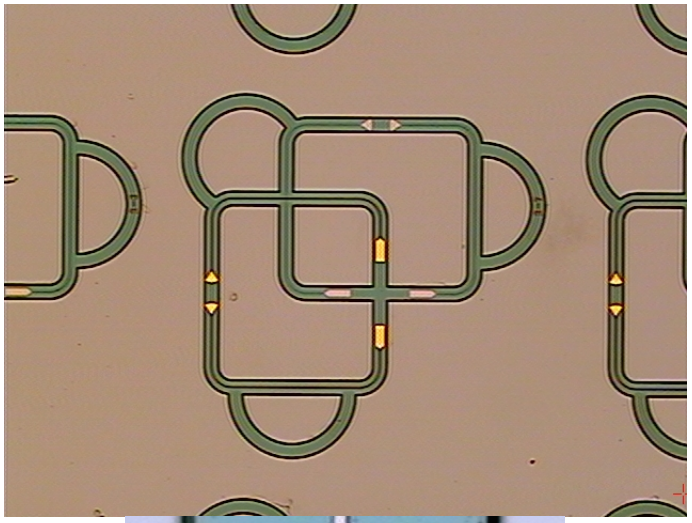
Ultra-thin Silicon circuit

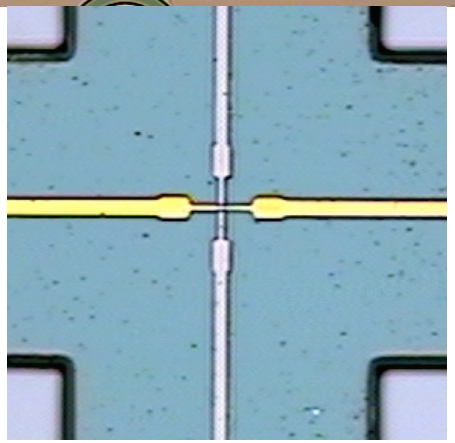
Progress in OMT Fabrication

- Ming-Jye and his team has successfully deposited the circuit and thinned silicon substrate to 8 μm.
- Fabrication process is being fine-tuned.
- Testing in SAO in early 2017.



Probes to Circular Waveguide in horn throat

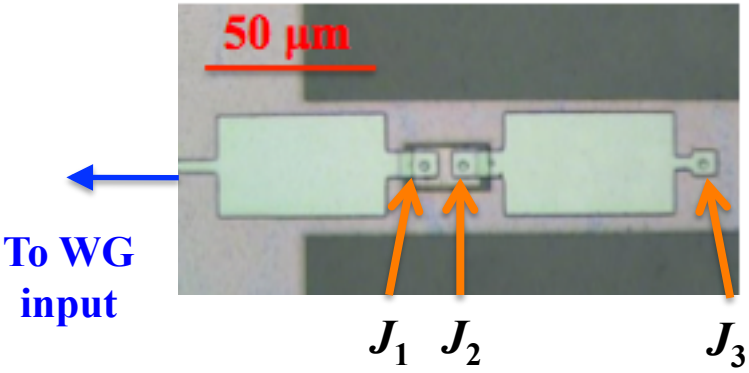




2 μm signal line cross-over on 1 μm thick SiO_2 layer

SIS Junction Mixer Design

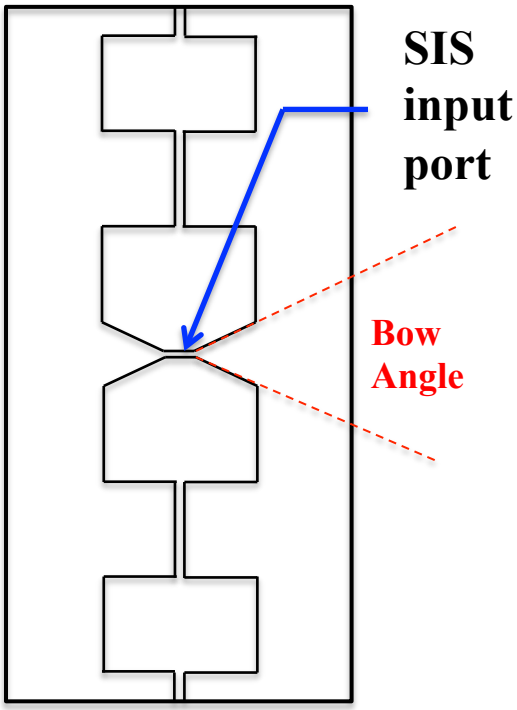
- **Most SIS mixers under use in SMA were fabricated in Taipei.**
- **Except for the 400 GHz Rx, the mixers are based on series-connected SIS junction array to accommodate the wide IF bandwidth.**
- **To further increase IFBW to 18+ GHz, we have to increase the number of junctions in the series array.**



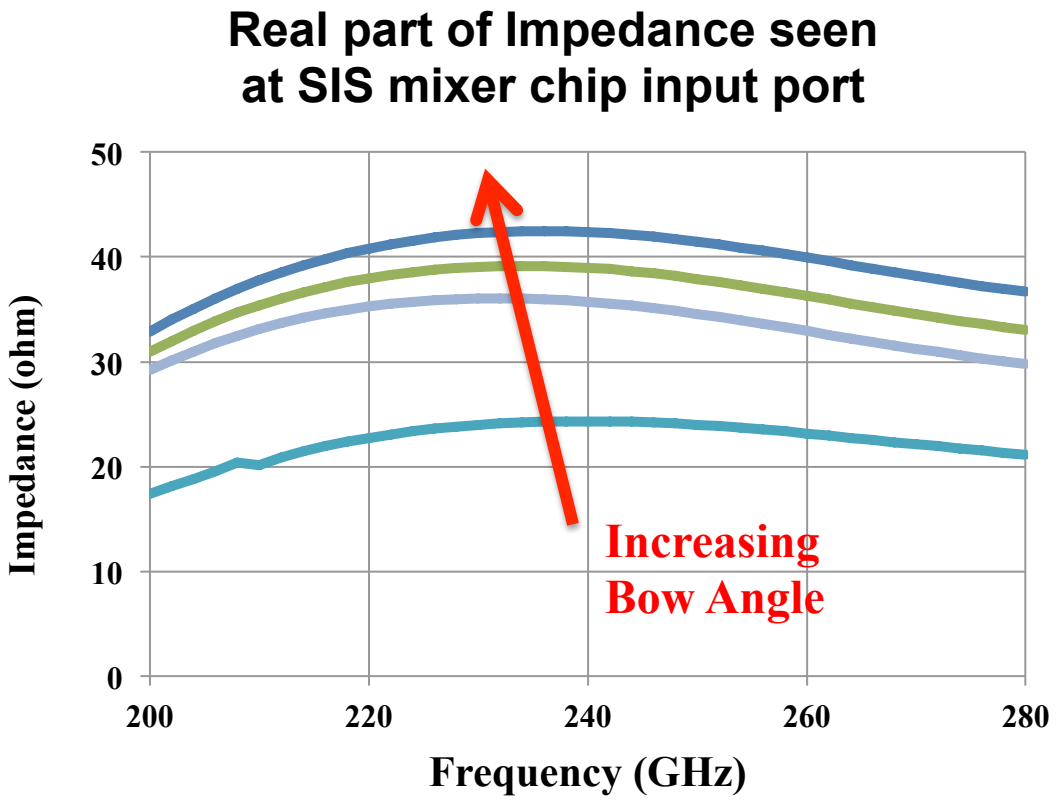
SMA 200 GHz 3-junction SIS mixer

- **More junctions means higher impedance level**
  → waveguide mixer block needs to be re-designed.
- **ASIAA is participating in the electromagnetic simulation work, and is helping out in the mask layout: Ming-Jye Wang & Jimmy Lu**

Some Results of Simulation



SIS Mixer Chip



Data supplied by Jimmy Lu (ASIAA).

Opportunities with Guest/PI Instrument

- **New Receiver System opens the possibility for a Guest/PI instrument in the antenna cabin.**
- **Such instrument may be developed initially for a subset of antennas.**
- **High Frequency Receiver Set (490 GHz? 650 GHz?) --- some groups have expressed some small interest.**
- **Multi-beam Receivers --- Can we leverage this as an ALMA development project?**
- **SAO is working with UMass on low DC power consumption SIS mixer with integrated amplifier --- received best student paper in the ASC conference in September.**
- **SWARM will have enough processing power for a 7-pixel array, each with a 4 – 8 GHz IF.**
- **Further SWARM development will be in sync with ALMA correlator development.**