JCMT New Instrument program

JCMT User Meeting,
NAOJ, Japan, April 2016

James Clerk Maxwell Telescope
East Asian Observatory

Instrument panel meeting

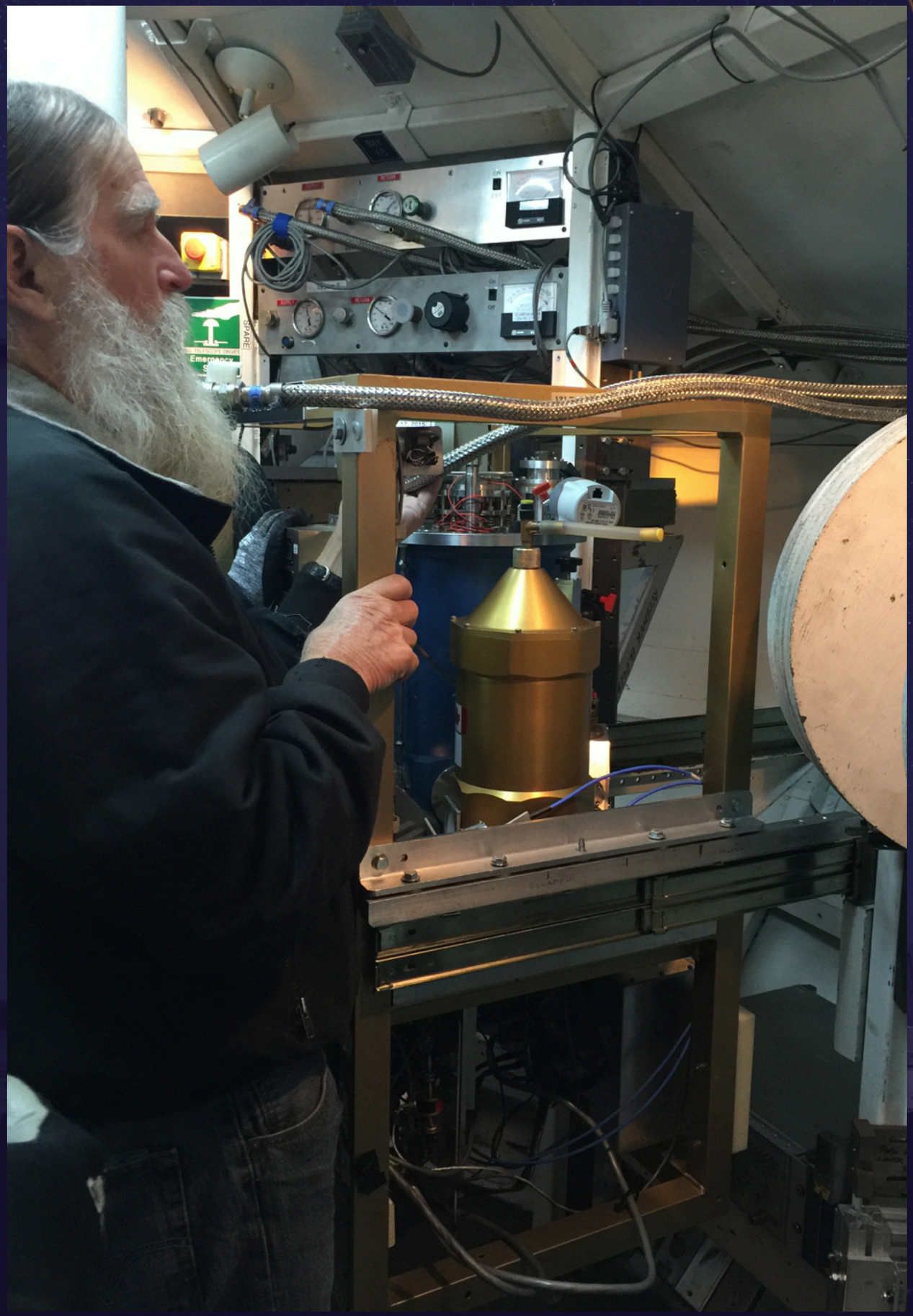
- Instrument panel members:
  - Richard Hills (Chair, MRAO, UK)
  - Sheng-Cai Shi (PMO, China) Satoru Iguchi (NAOJ, Japan)
  - Jeong-Won Lee (KASI, Korea) Ming-Tang Chen (ASIAA, TW)
  - Gary Fuller (Manchester, UK) Wayne Holland (STFC, UK)
  - Scott Chapman (Dalhousie, Canada)
- Two-day meeting: March 7 and 8, ASIAA, Taipei
- Panel report: JCMTB(16.04)05

Summary

- PI Instruments: Paths for Time-Pilot and Gismo-2 were proposed and endoreded by the Boards.
- 230 GHz replacement options confirmed to proceed
- SCUBA-2 upgrade proceeds, future replacement options to be studied.
- New 345 GHz heterodyne array to be pushed
- EAO and JCMT partner instrument interests presented

Summary on PI instruments

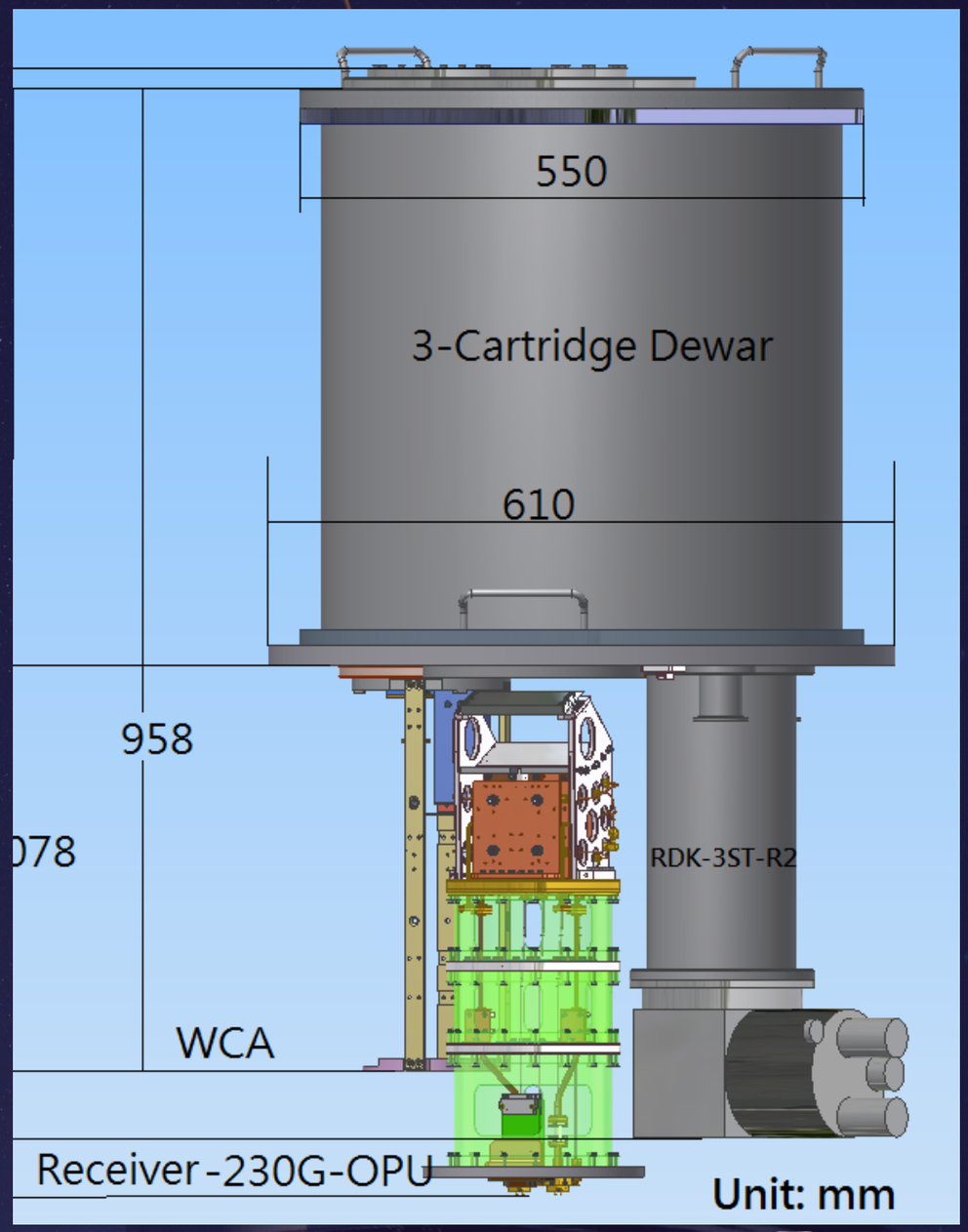
- Time-Pilot: PI instrument, EAO community interest as a facility instrument appear to be weak. Significant engineering challenges/ concerns. Unfunded.
- Gismo-2: Possible facility instrument and backup continuum instrument for SCUBA-2. Pending further funding situation and negotiation.

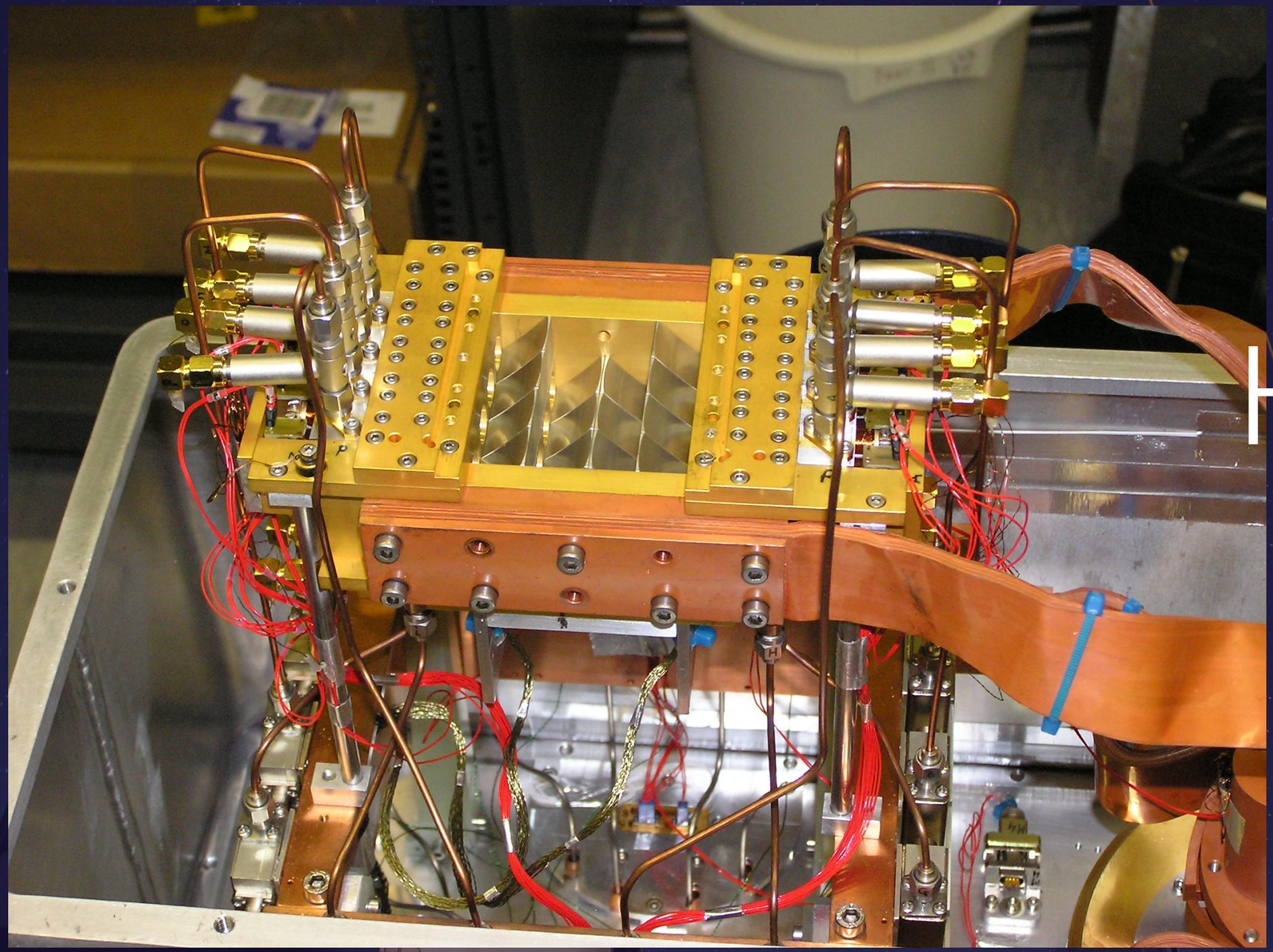

Emergency
SPARE


HIA RECEIVER

New 230GHz receiver

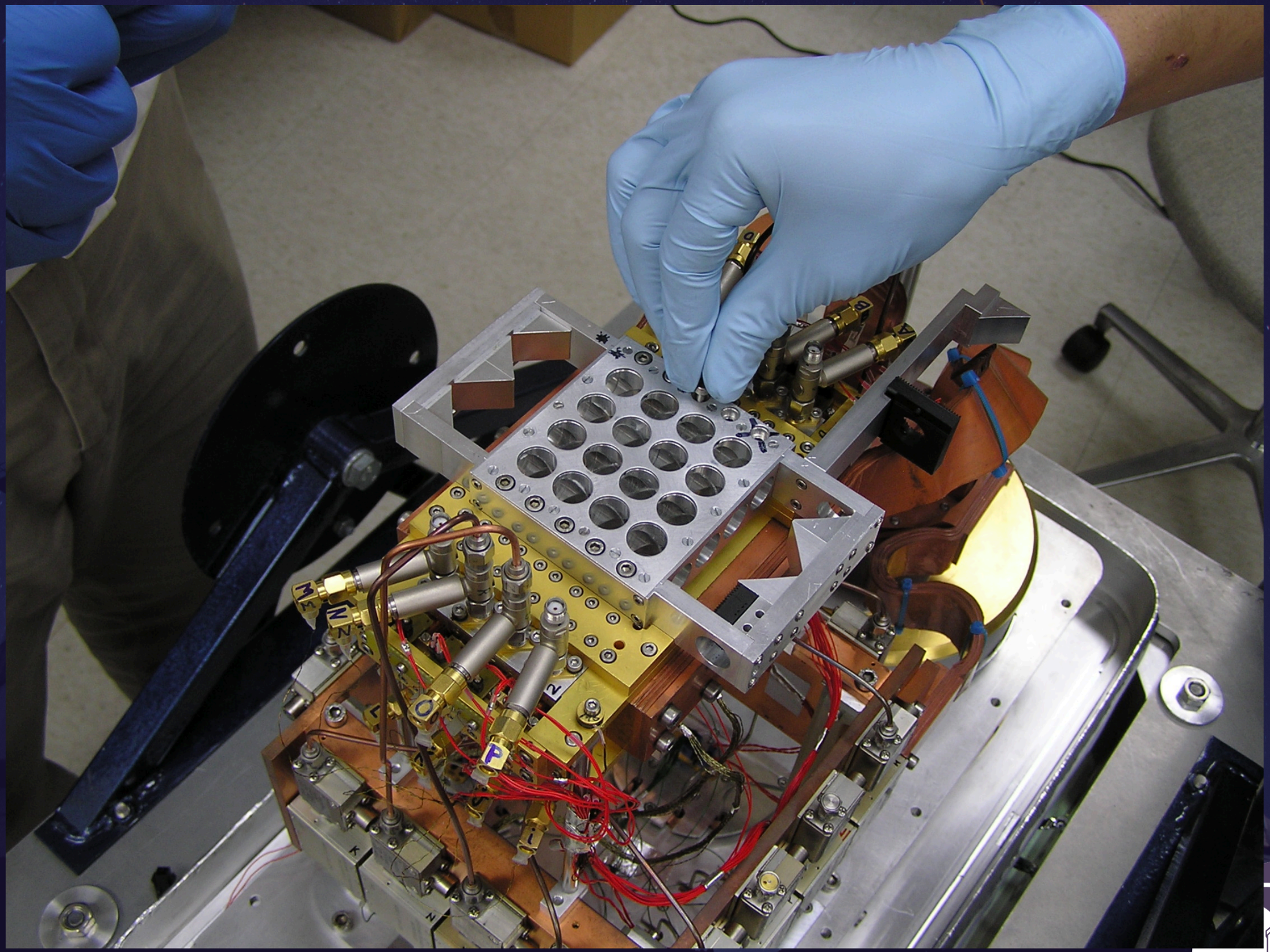
- Frequency range 215 - 280GHz, IF bandwidth 4 - 8 GHz, dual-polarization, side-band separating receiver
- Closed-cycle cooling essential
- ALMA 3-cartridge test dewar available plus ALMA cartridge
- Mechanical and optical design underway
- Estimated installation/commissioning before end of 2017
- Compatible with VLBI + PI needs, test bed for future ALMA/ASTE experiments





HARP

- Mixer block with integrated feed horns
- Refocusing mirrors
- LO injection (not shown) by mylar
- Pixels separated by 30” on the sky (2x HPBW)



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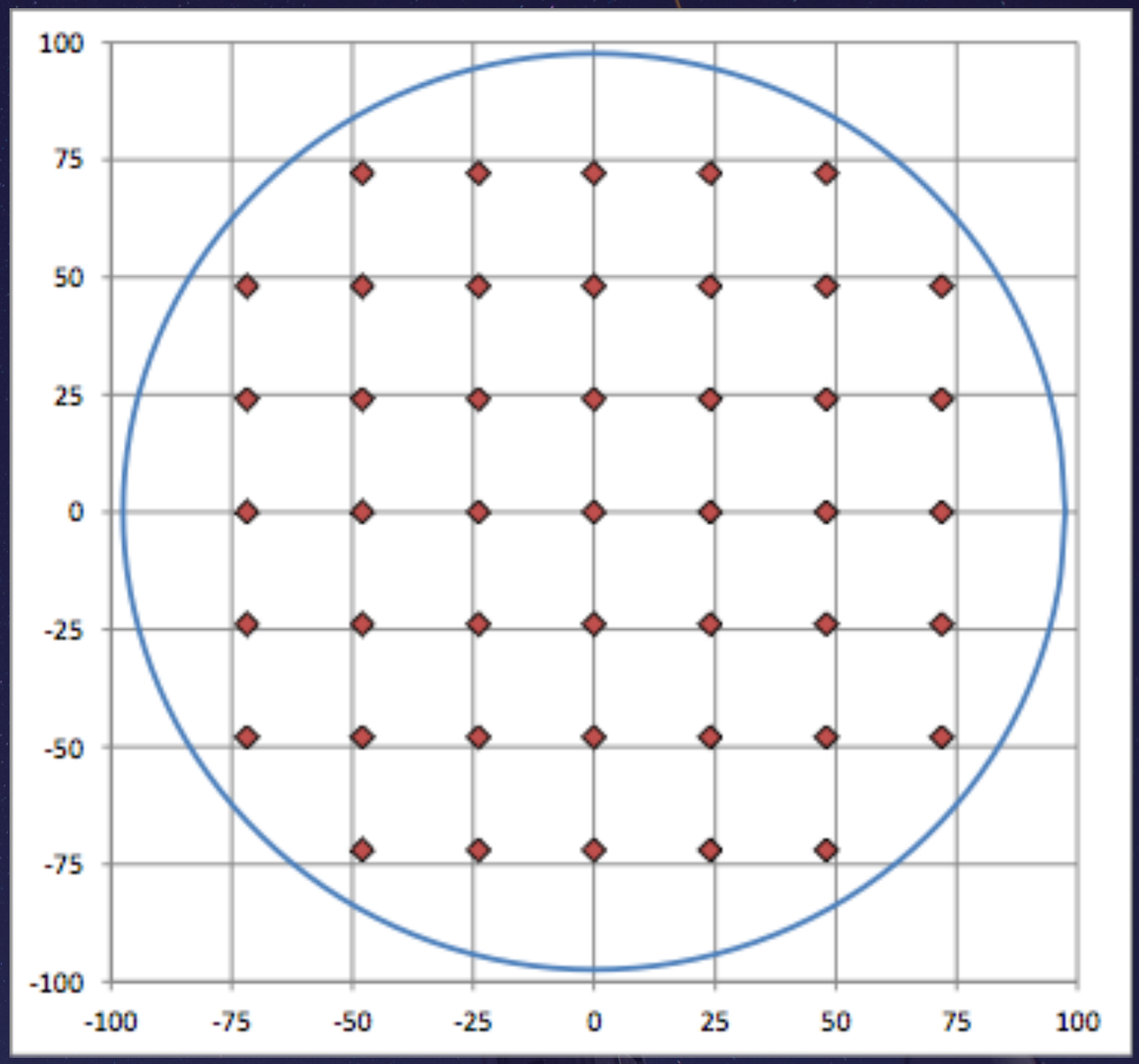
New 345GHz heterodyne array

- Number of Pixels:
  - Must be >> 16. But >> 100 is probably not practical without some radically new approach.
- Recall that mapping speed goes as N / (Tsys/ηb)2
- Noise Temperature
  - ALMA band 7 had Trx (SSB) ~ 65K. This suggests goal of ~ 50K. Would give Tsys < 200K in good cond.?
- Polarization / Sidebands
  - Aim at dual polarization with a grid and two arrays or in mixer blocks.
  - Single side-band essential (to get sensitivity & cal).
  - Two side-band “nice to have” e.g. multiple lines.

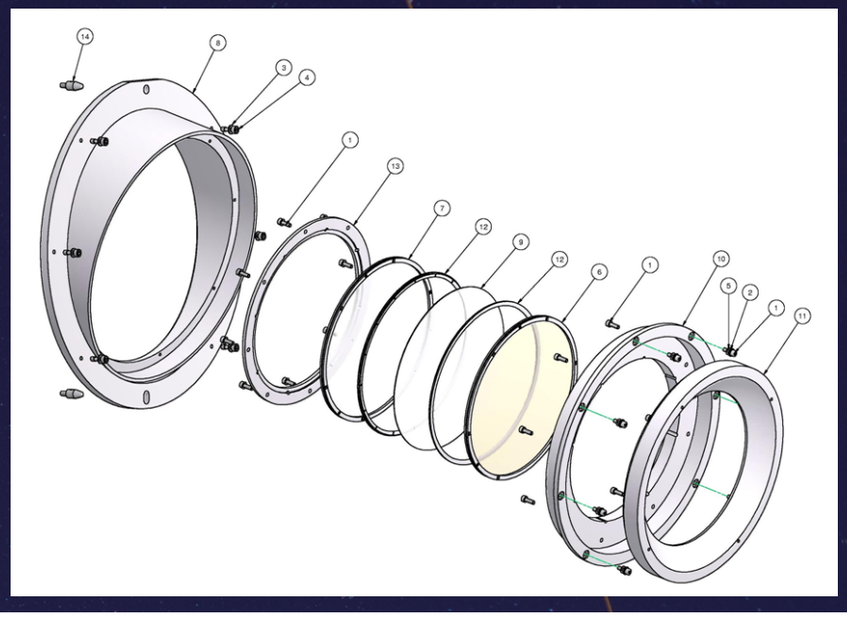
New 345GHz heterodyne array

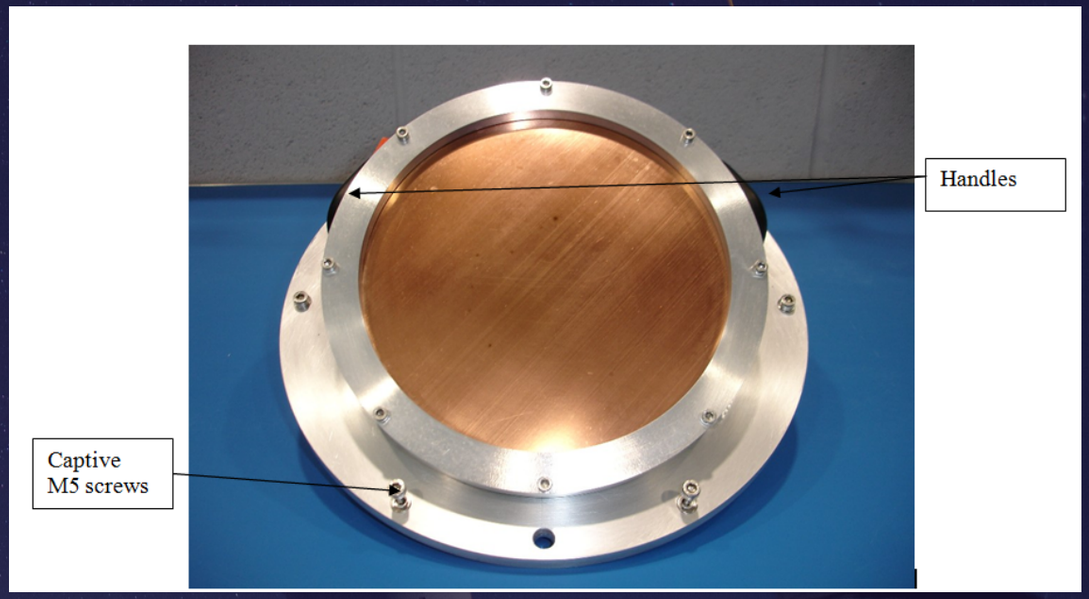
- Possible architecture:
  - 7x7 with 4 corners removed.
  - Gives 45 pixels on 24 arcsec spacing
  - Possibly x2 for second polarization or frequency



SCUBA-2 upgrades

- Filter modeling suggests possible x2 decrease in optical loading
- Cost ~ £10K, fabrication and installation within 6 months -
- Filter replacement only a day (+ 3 week warm-up and cool-down)
- Modeling underway - results soon

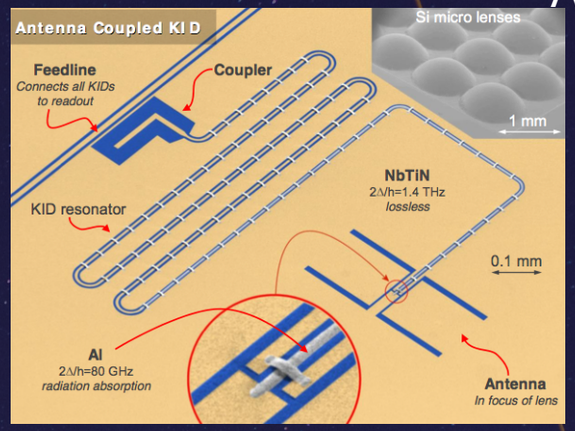




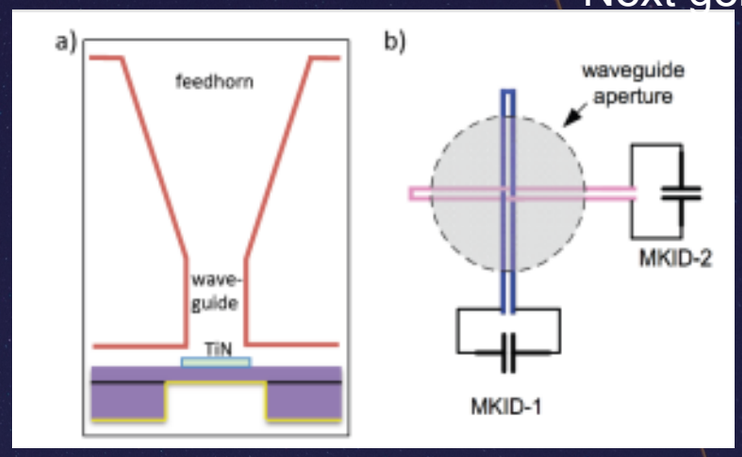
Options for new arrays

- TES new 32 x 40 sub-arrays (most likely based on GSFC BUG architecture)
- Larger TES arrays 40 x 40 (increase pixel count by factor of ~2) using larger 6 inch wafer. So far only NIST has this process worked out (making Advanced ACTPol detectors)
- KID arrays at least 40 x 40 sub-arrays
- [could move 450 to Fλ/2 spacing - 80 x 80 sub-arrays]
- Horn coupled KID arrays with 2Fλ spacing
- (See Griffin,Bock, Gear 2002)
- Dual-Polarisation sensitive KID array (BLASTpol pixel)
- 2 KIDs per pixel

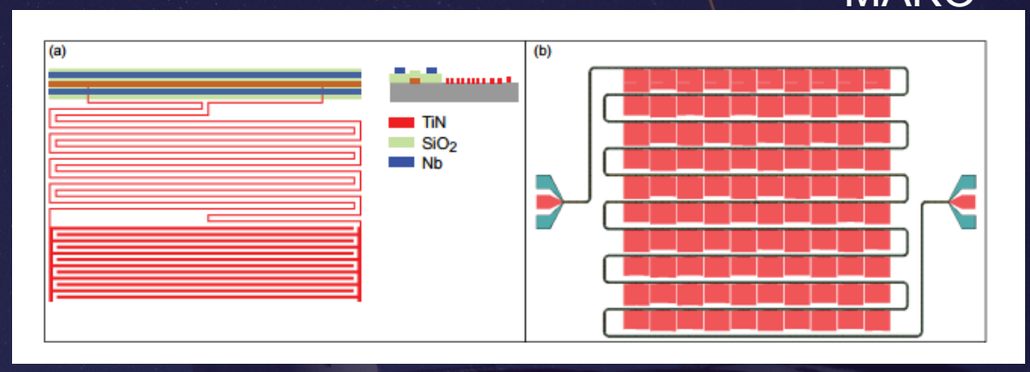
AMKID



Next gen BLASTpol



MAKO



Projects in EA Regions

Summary on Instrument

- 230GHz: proceeding with replacement - ALMA 3-cartridge dewar; seeking better mixers, aim for late 2017 installation
- SCUBA-2: proceeding with filter investigation and replacement, study on possible array replacements
- 345GHz: studying on possible options from EA regions
- Spectrometer: will need replacement eventually - cost the only issue.