

TeraHertz Array Receivers for Wide Field Spectroscopy on SOFIA

Heterodyne Array/Spectroscopy Focus Group

USA: UofA, CIT, JPL, ASU, NRAO, UVa, UMass

Germany: KOSMA, DLR



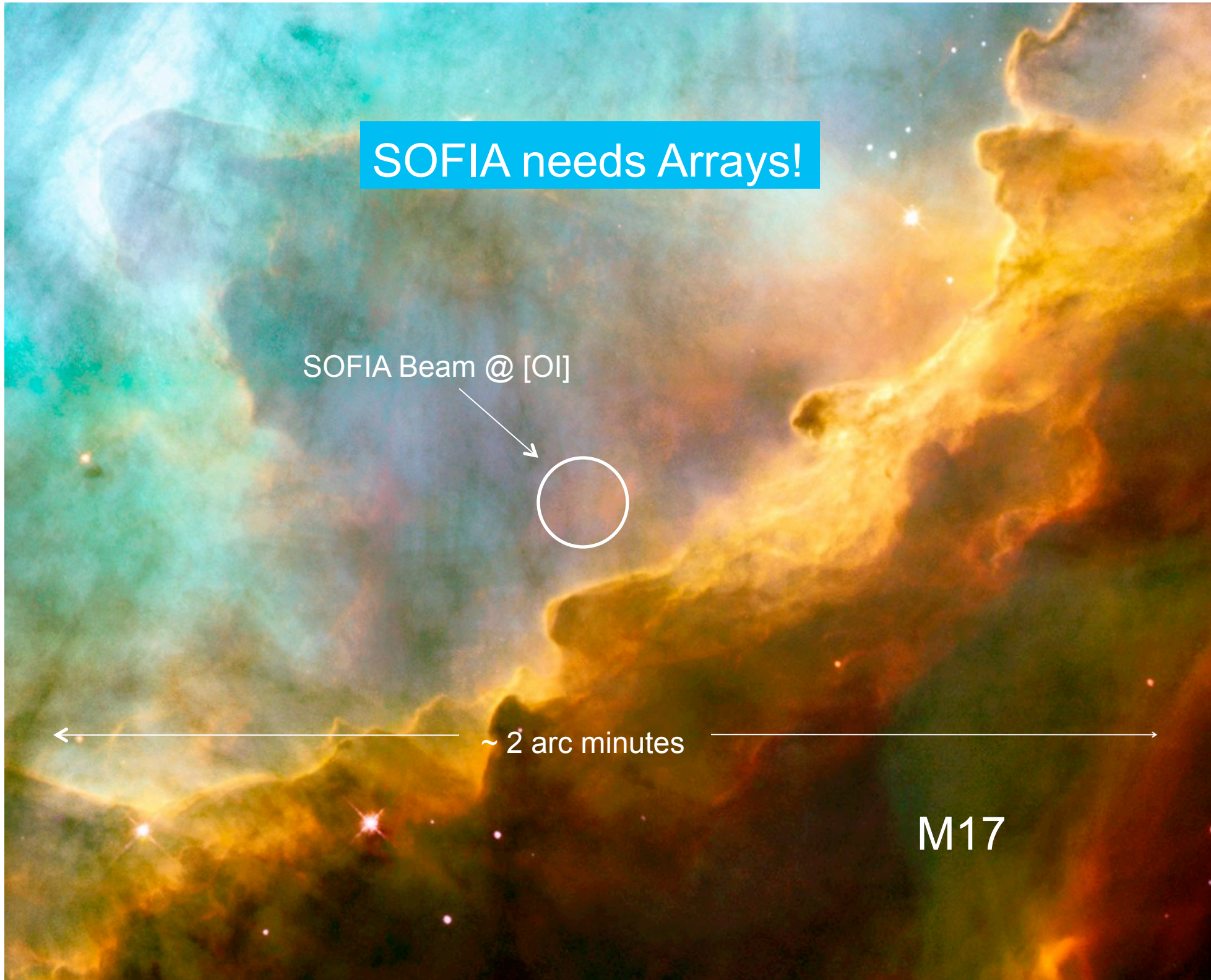
SOFIA needs Arrays!

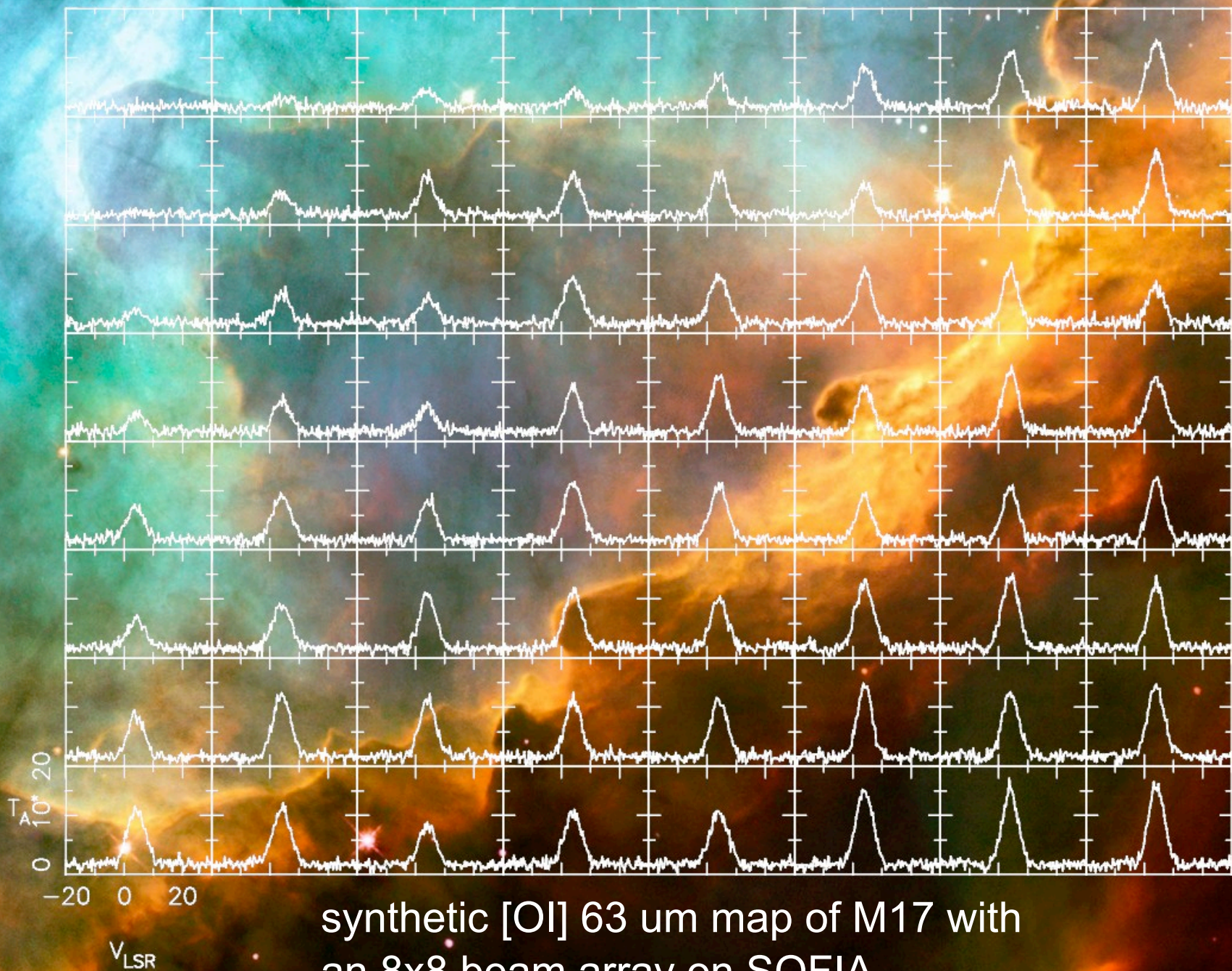
SOFIA Beam @ [OI]



~ 2 arc minutes

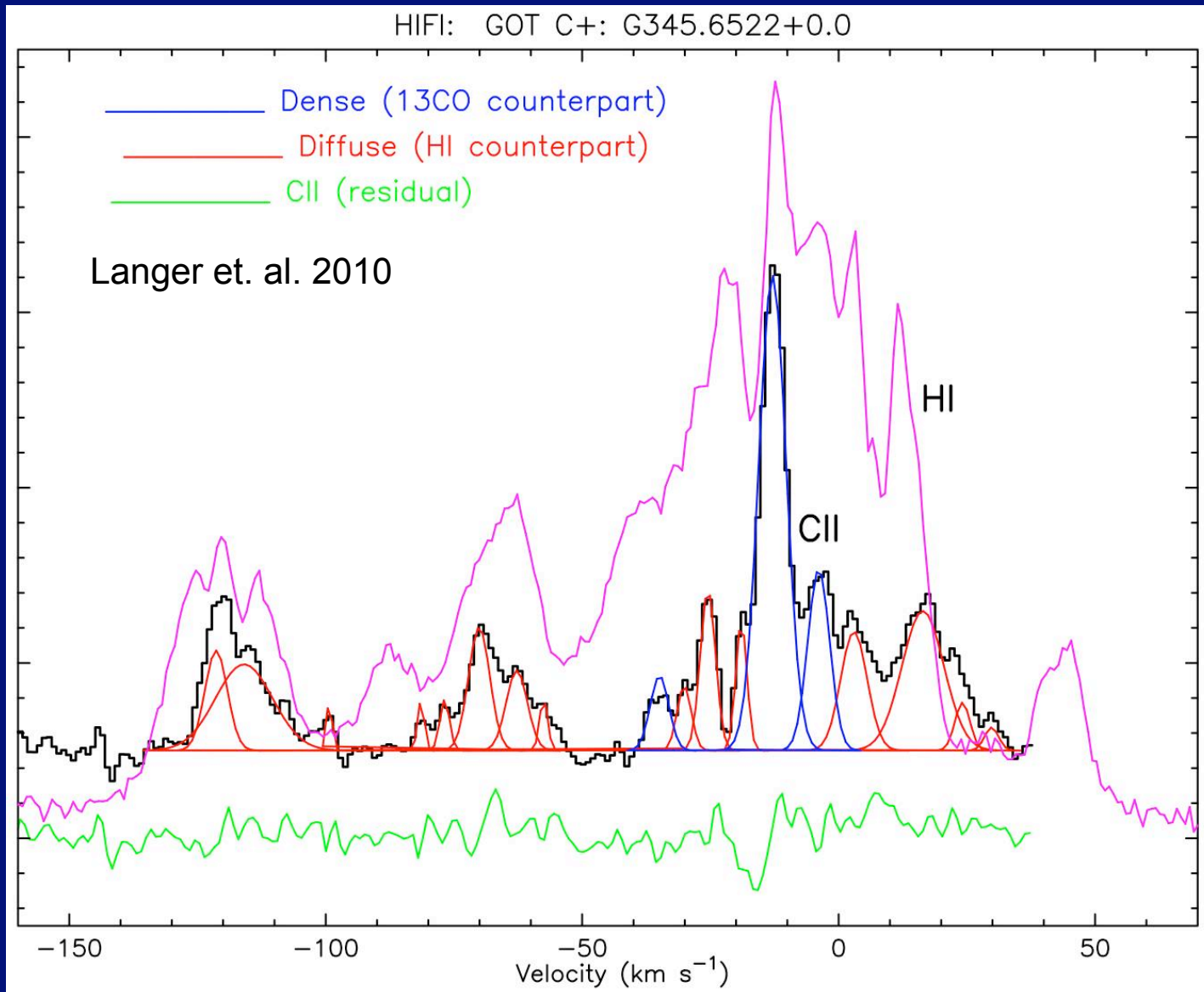
M17

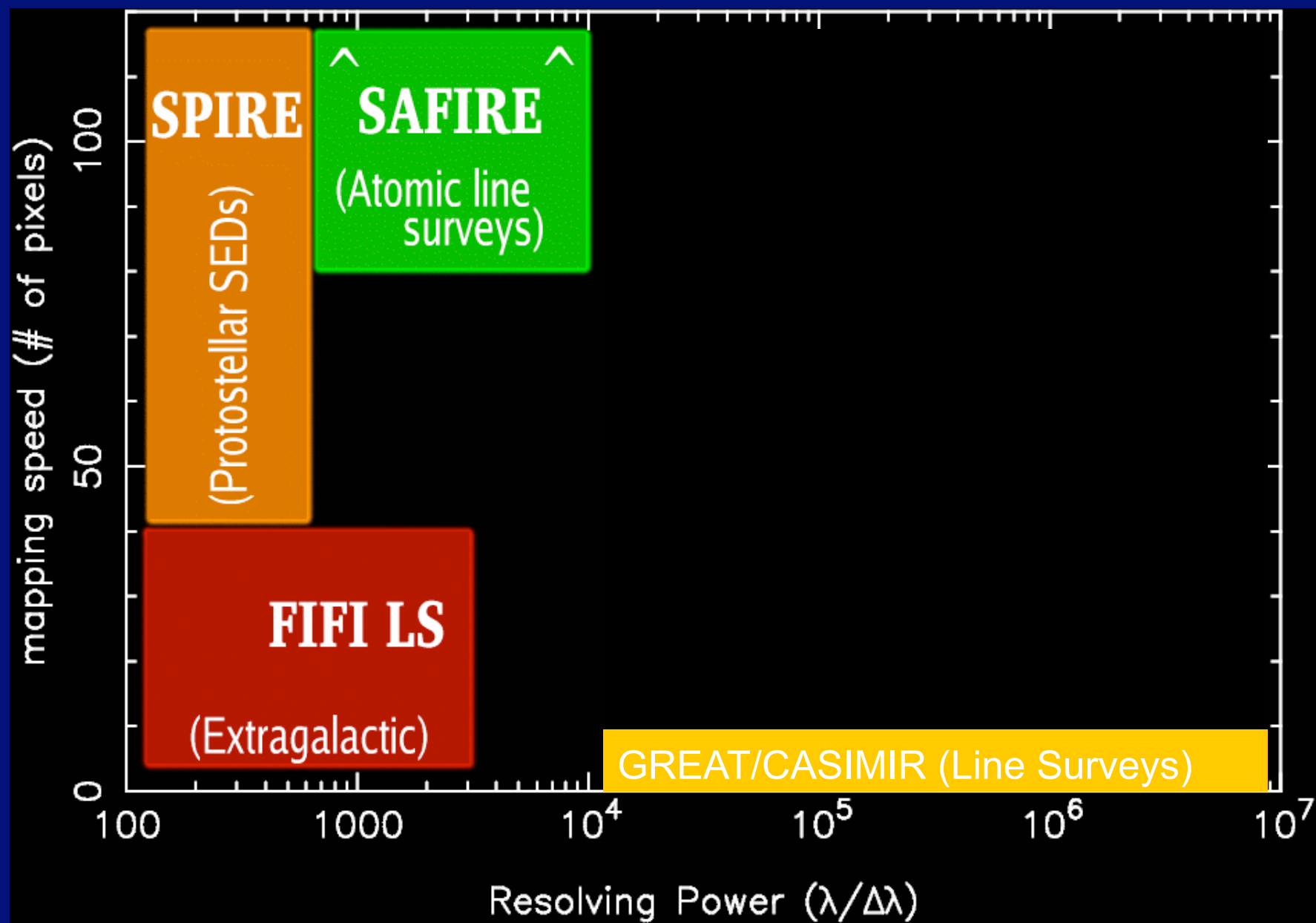


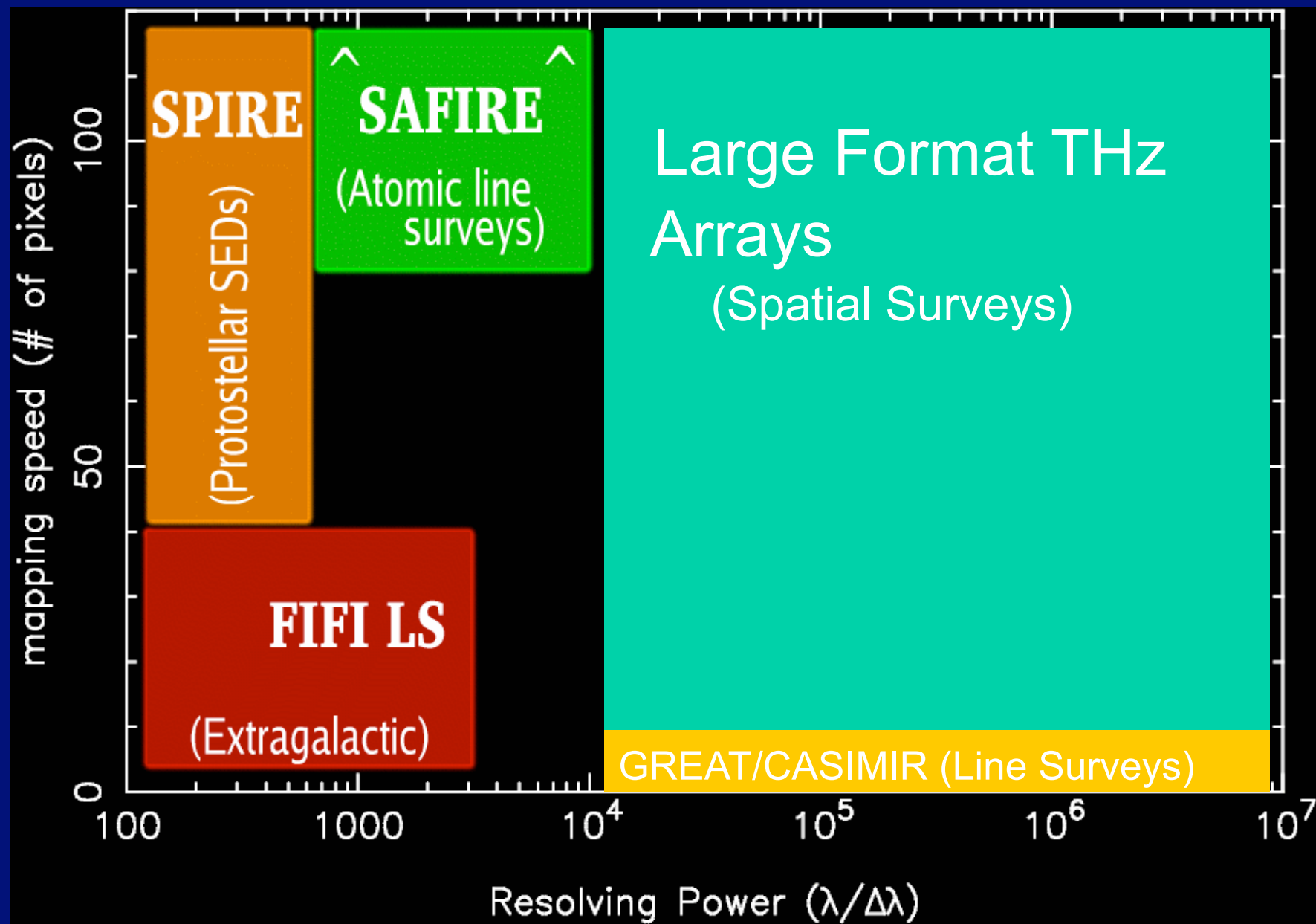


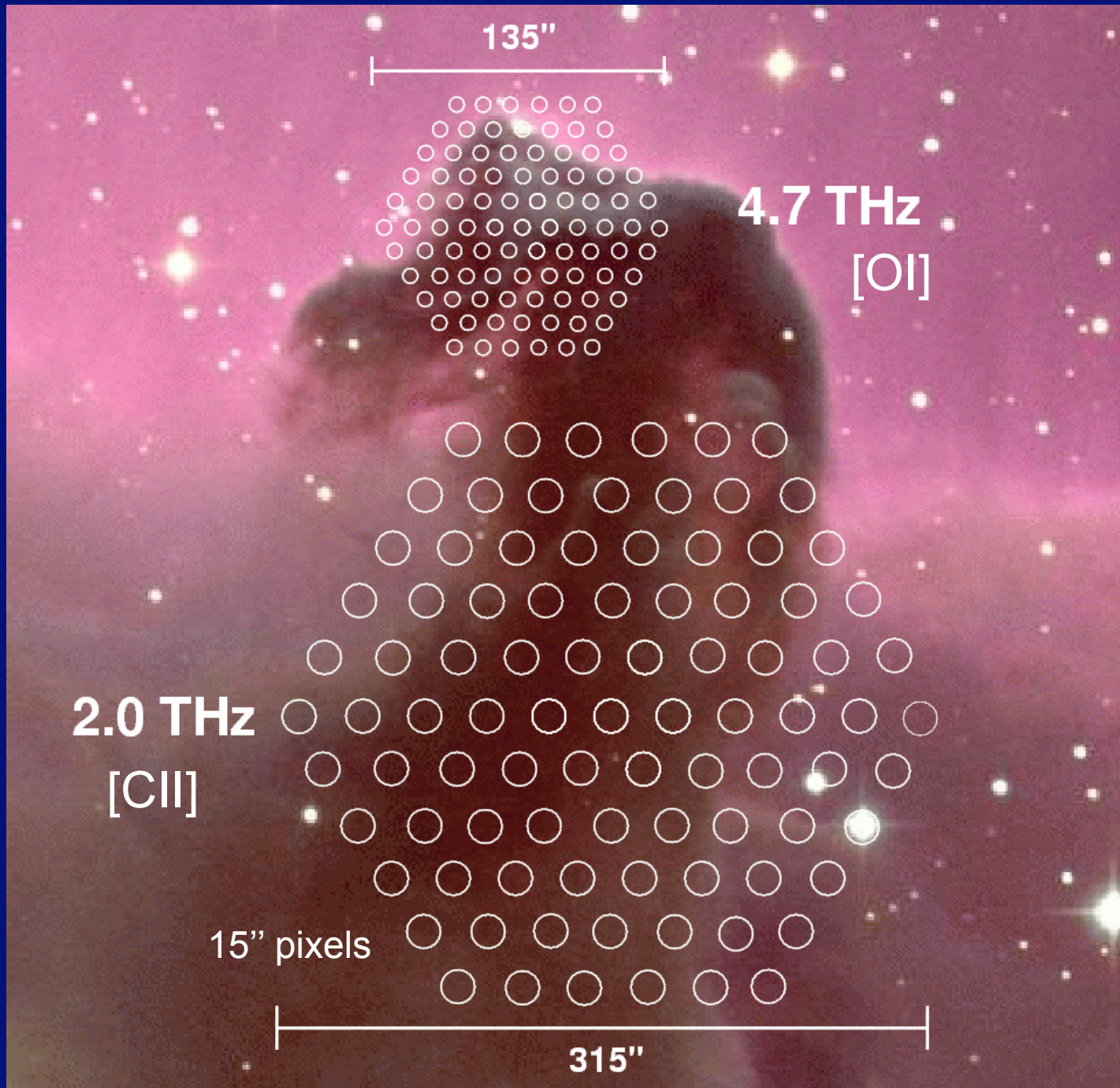
synthetic [OI] 63 um map of M17 with
an 8x8 beam array on SOFIA

Reality is a lot more complicated!







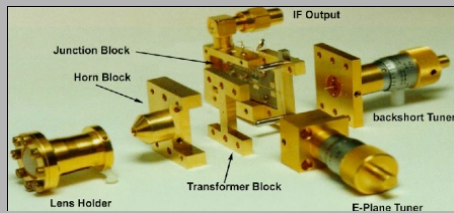


THz Arrays: Why Now?

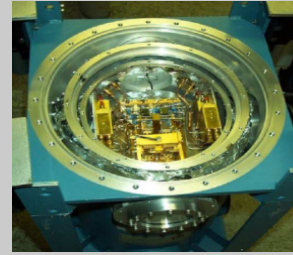
A Confluence of Technologies:

- Mixer technology
- LO technology
- Micromachining
- IF amplifiers
- Digital signal processing

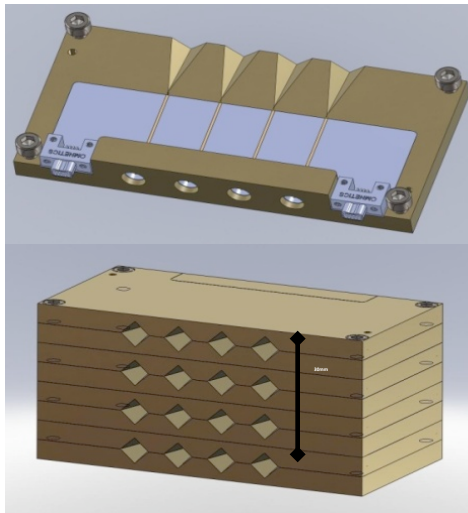
THz Mixer Evolution



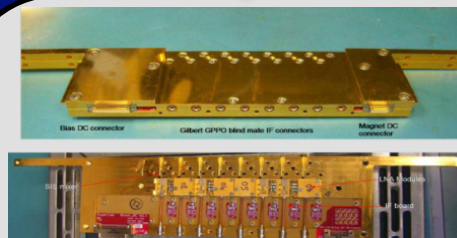
CSO Mixer @ 492GHz: 1990



4 pixel AST/RO array @ 810GHz

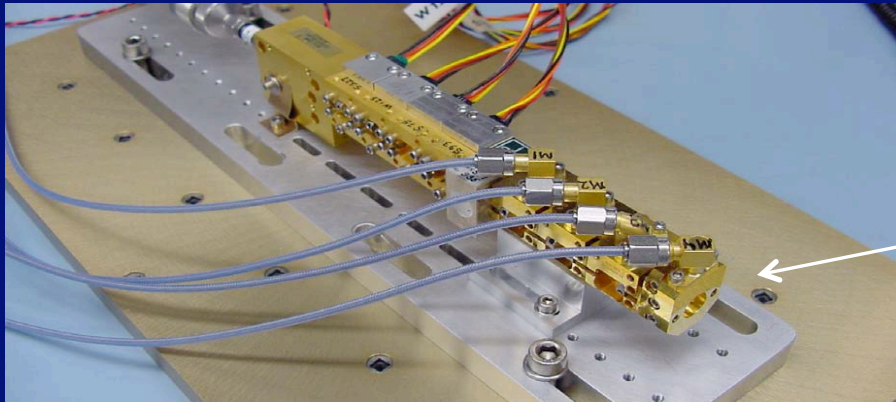


Prototype: 2 THz Stacked
Linear Arrays



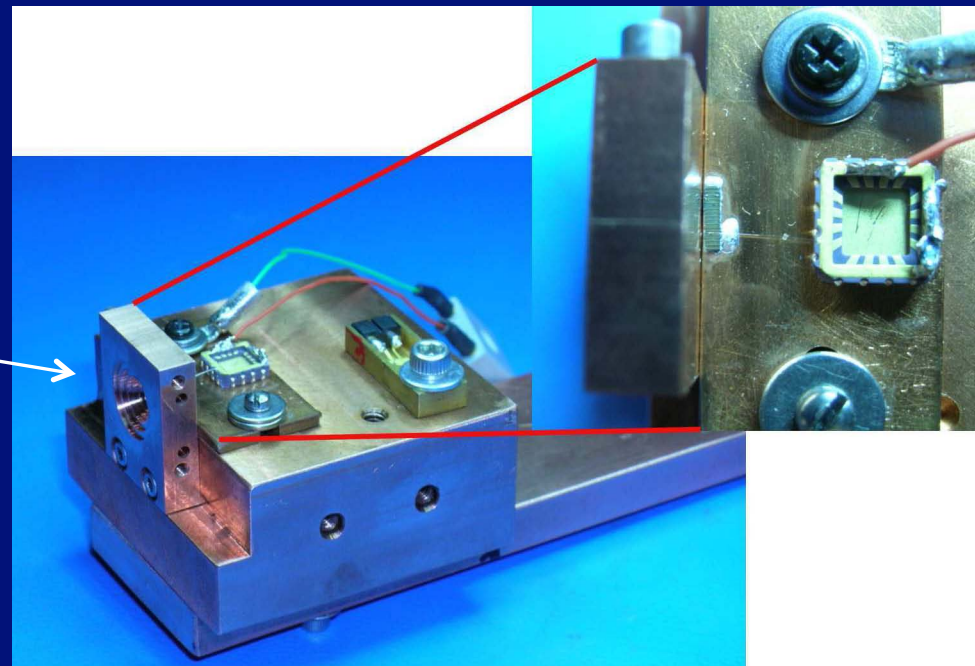
Stacked 1x8 Linear Arrays
@ 350 GHz

LO Sources for Arrays



Frequency Multiplied Sources
Freq. ≤ 2.7
(JPL)

Quantum Cascade Lasers
Freq. ≥ 2.7
(see Hubers et . al. posters)



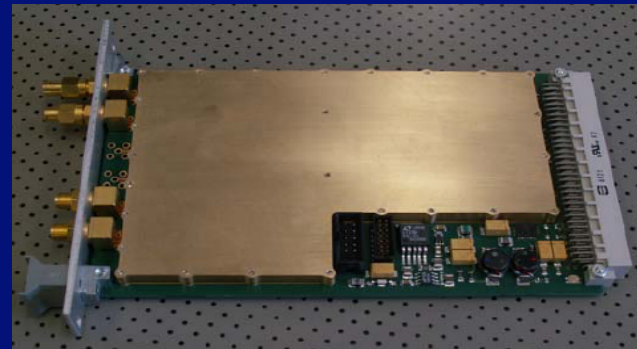
Digital Spectrometers: OTS

Built by Omnisys AB for CASIMIR and SuperCam

- Real-Time FFT system
- Virtex 4 SX55 FPGA
- 2x 1GHz per board
- 1024 channels
- 25W per board
- Ethernet interface
- StratoSTAR spectrometer would use 16 identical boards for 16 x 2GHz operation

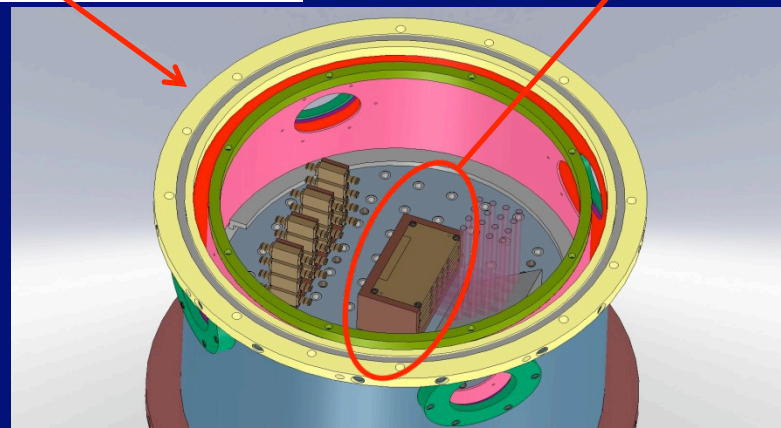
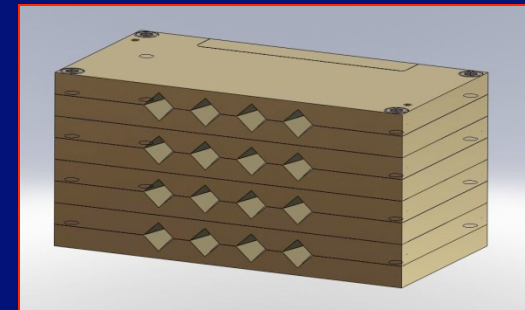
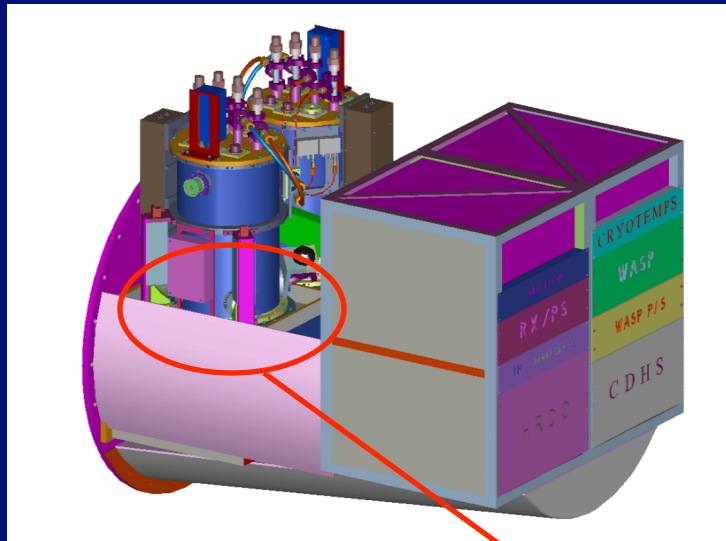


16 x 1GHz Spectrometer



Single FFT Board \geq 2 GHz

Step 1: Upgrade CASIMIR & GREAT to Arrays



16 Pixel Array fits
within EXISTING
Cryo/Optical system

Summary

- Technological advancements now make it possible to construct Large Format Heterodyne THz arrays.
- STEP 1: Upgrades to CASIMIR and/or GREAT could increase their science return by ***more than an order of magnitude per flight***
- STEP 2: A Common Facility Heterodyne Array Platform for SOFIA could be constructed to support arrays of ~100 pixels- dramatically increasing the power of SOFIA.