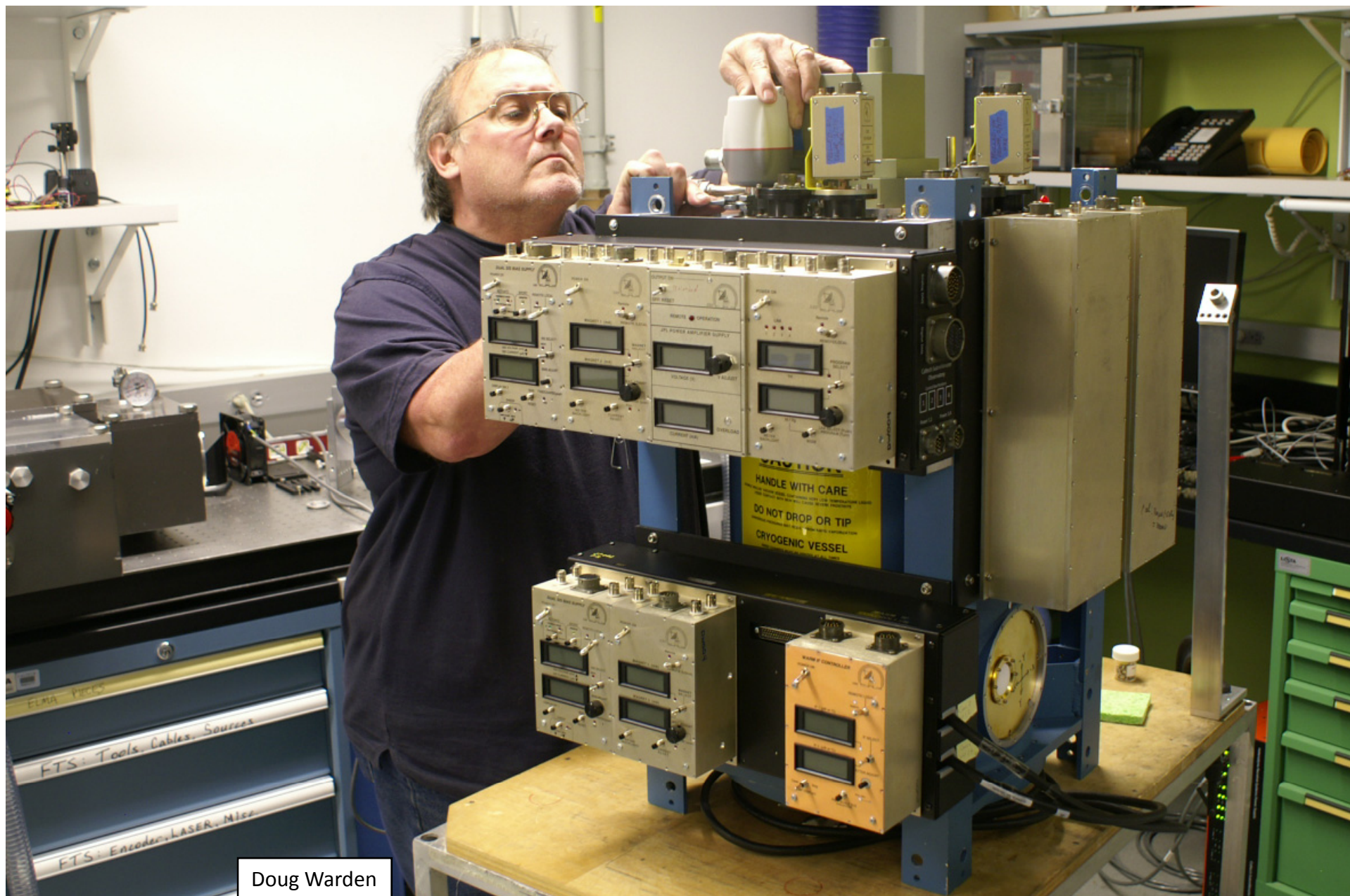


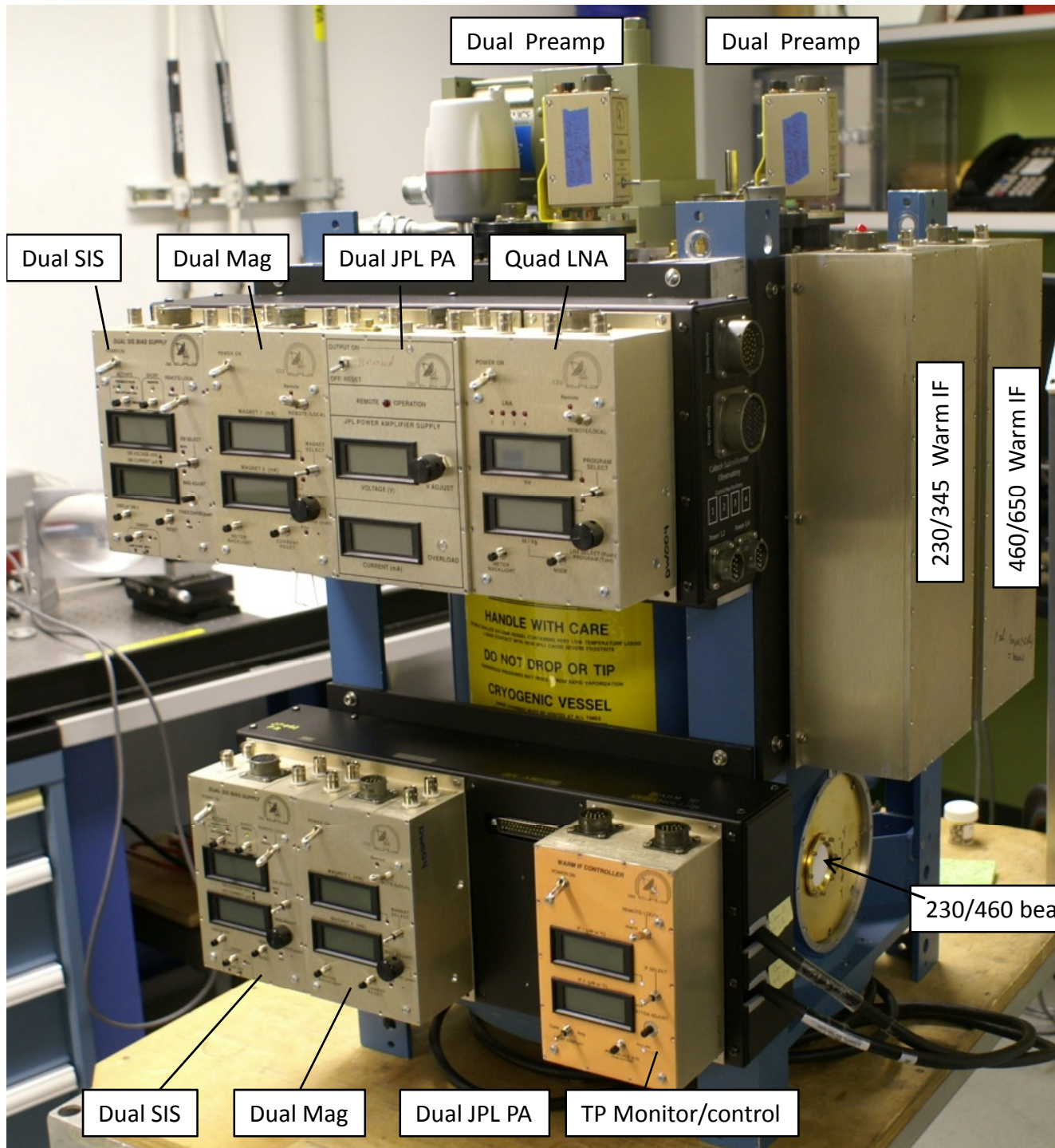
## 230/460 Cryostat with (Remotely Programmable) Bias Electronics

Frank Rice, Doug Warden, Jeff Groseth, James Parker, Kevin Cooper



Doug Warden



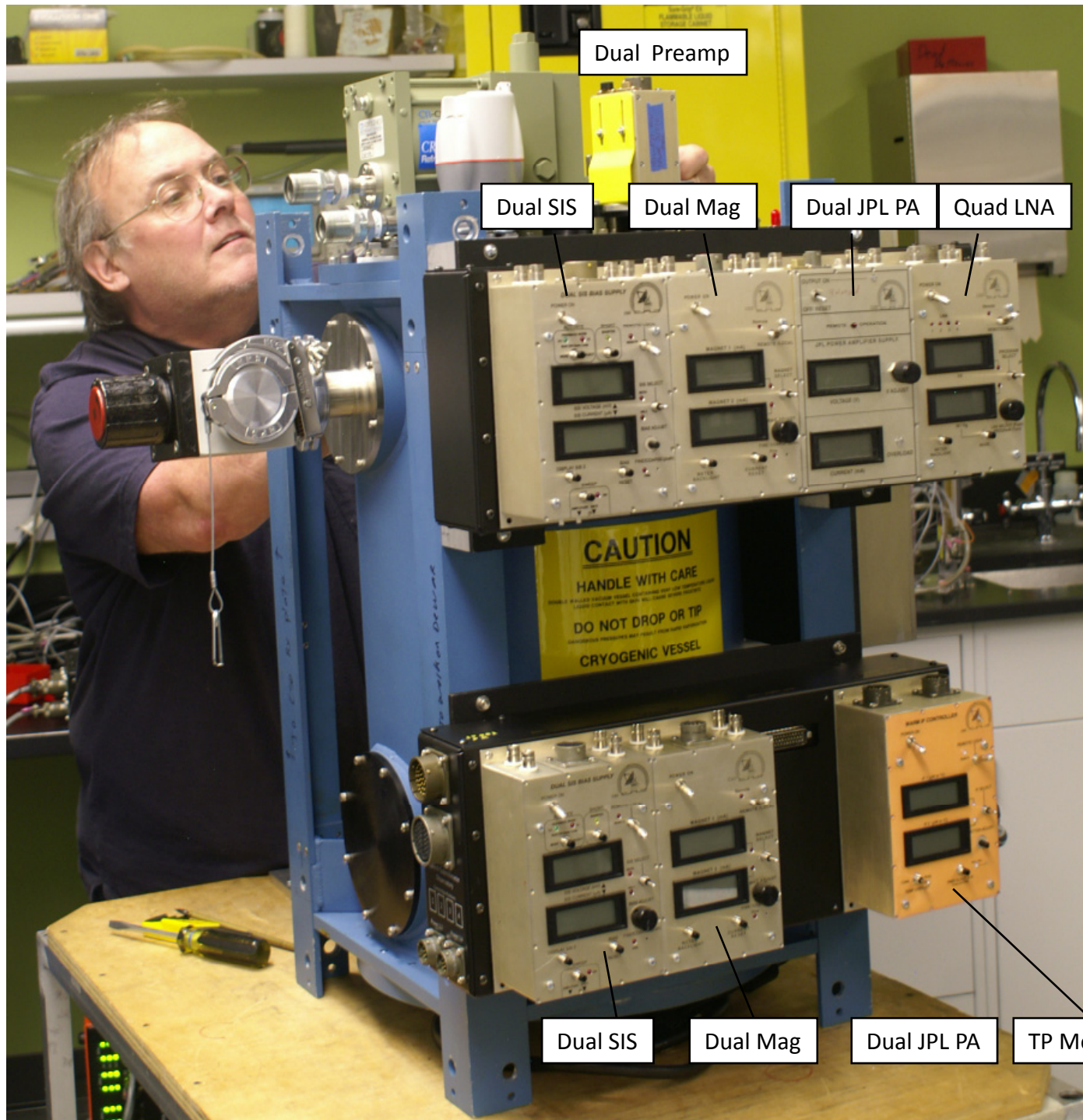


The bias electronics connects to a set of 'black boxes'. Aside from a mechanical interface the 'black boxes' serve as an interface to the data acquisition of choice (PXI 6229/6225) .

#### Inventory/Cryostat:

- Dual SIS (2)
- Dual Magnet (2)
- Quad LNA (1)
- Dual JPL PA 2)
- TP Monitor and control (1)
- 19" External Power supply (1) (not shown)

230/460 beams or 345/650 beams

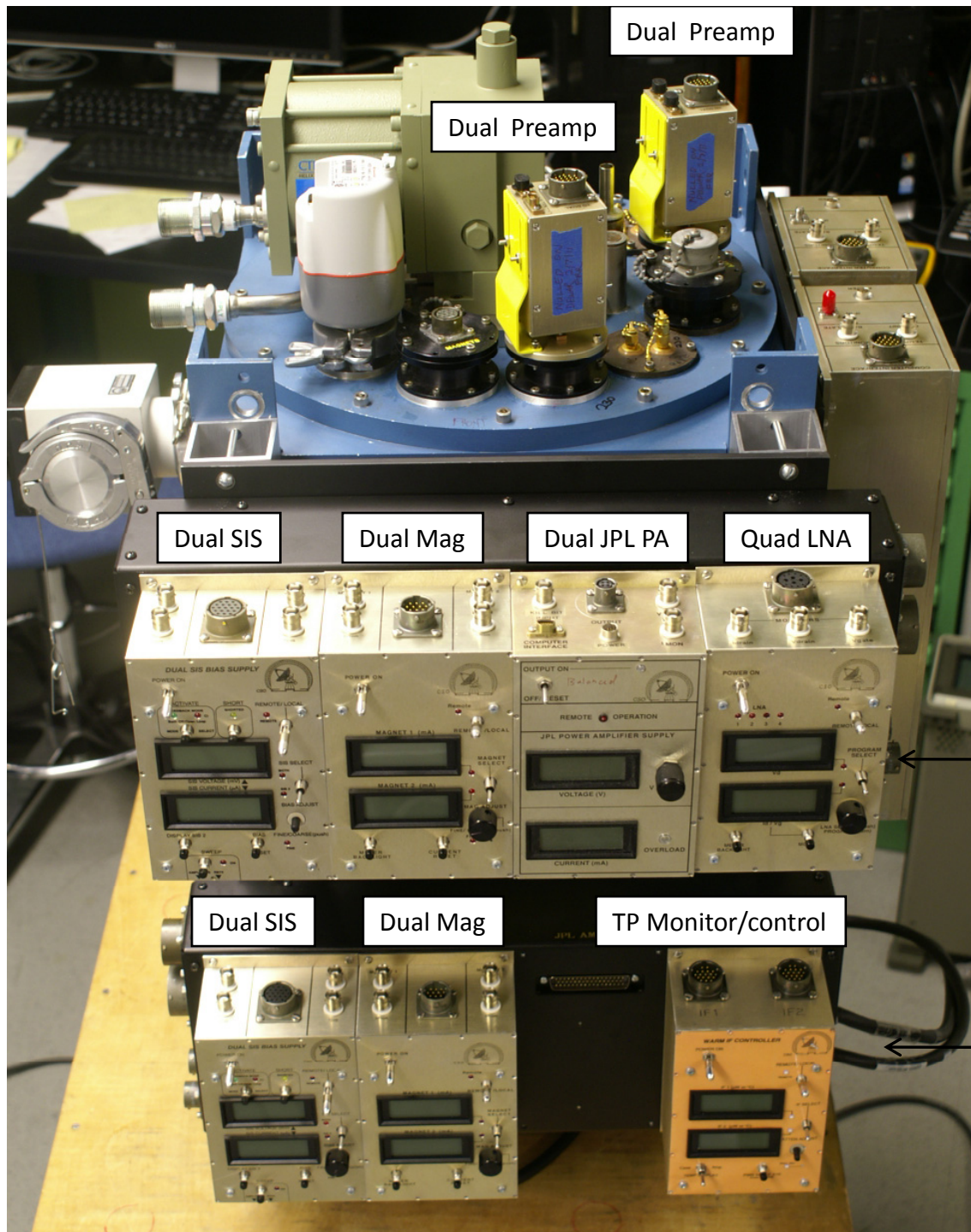


The bias electronics connects to a set of 'black boxes'. Aside from a mechanical interface the 'black boxes' serve as an interface to the data acquisition of choice (PXI 6229/6225).

Inventory/Cryostat:

- Dual SIS (2)
- Dual Magnet (2)
- Quad LNA (1)
- Dual JPL PA (2)
- TP Monitor and control (1)
- 19" External Power supply (1)  
(not shown)





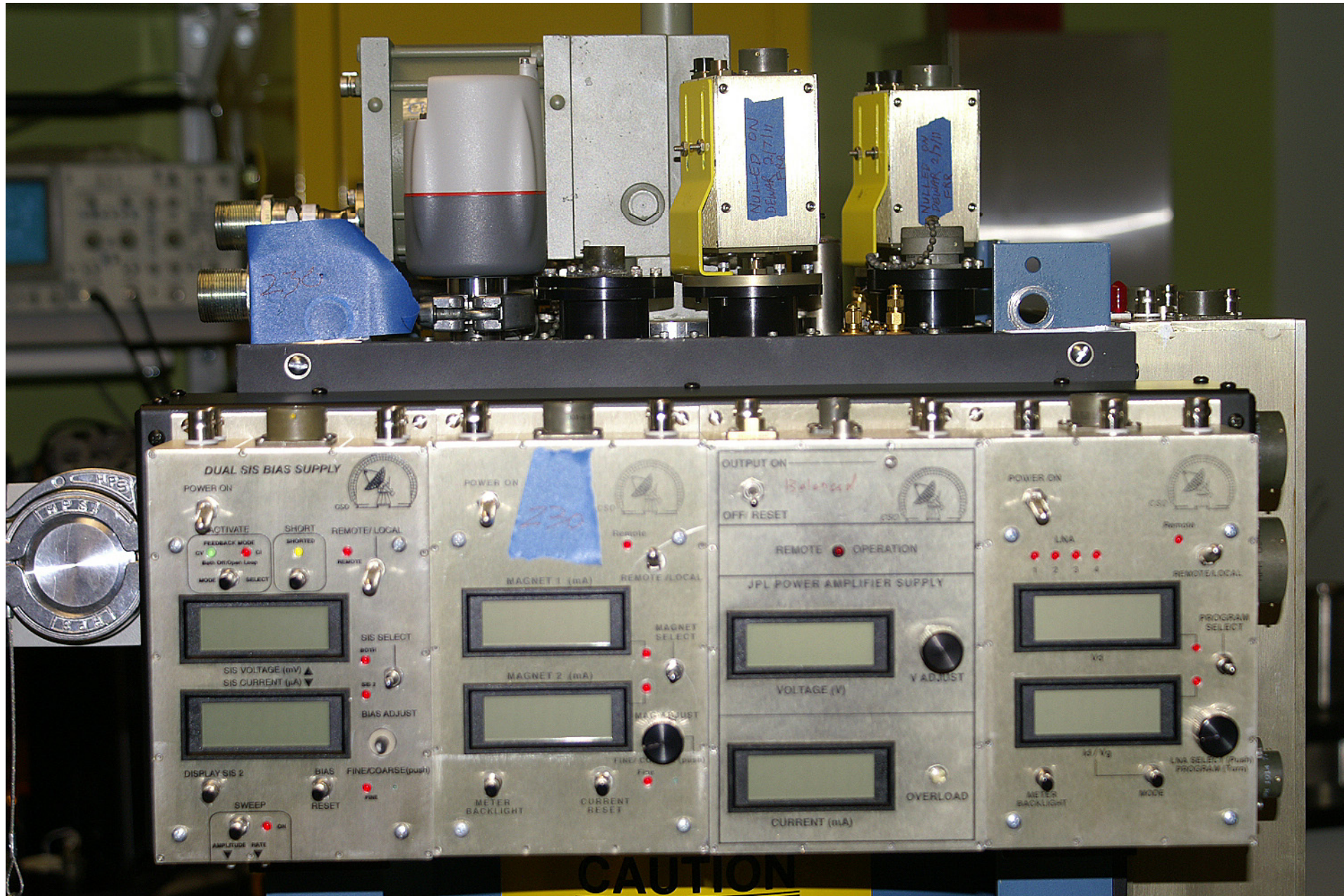
Top View

230/345 toward Top Cryostat

460/650 toward Bottom Cryostat

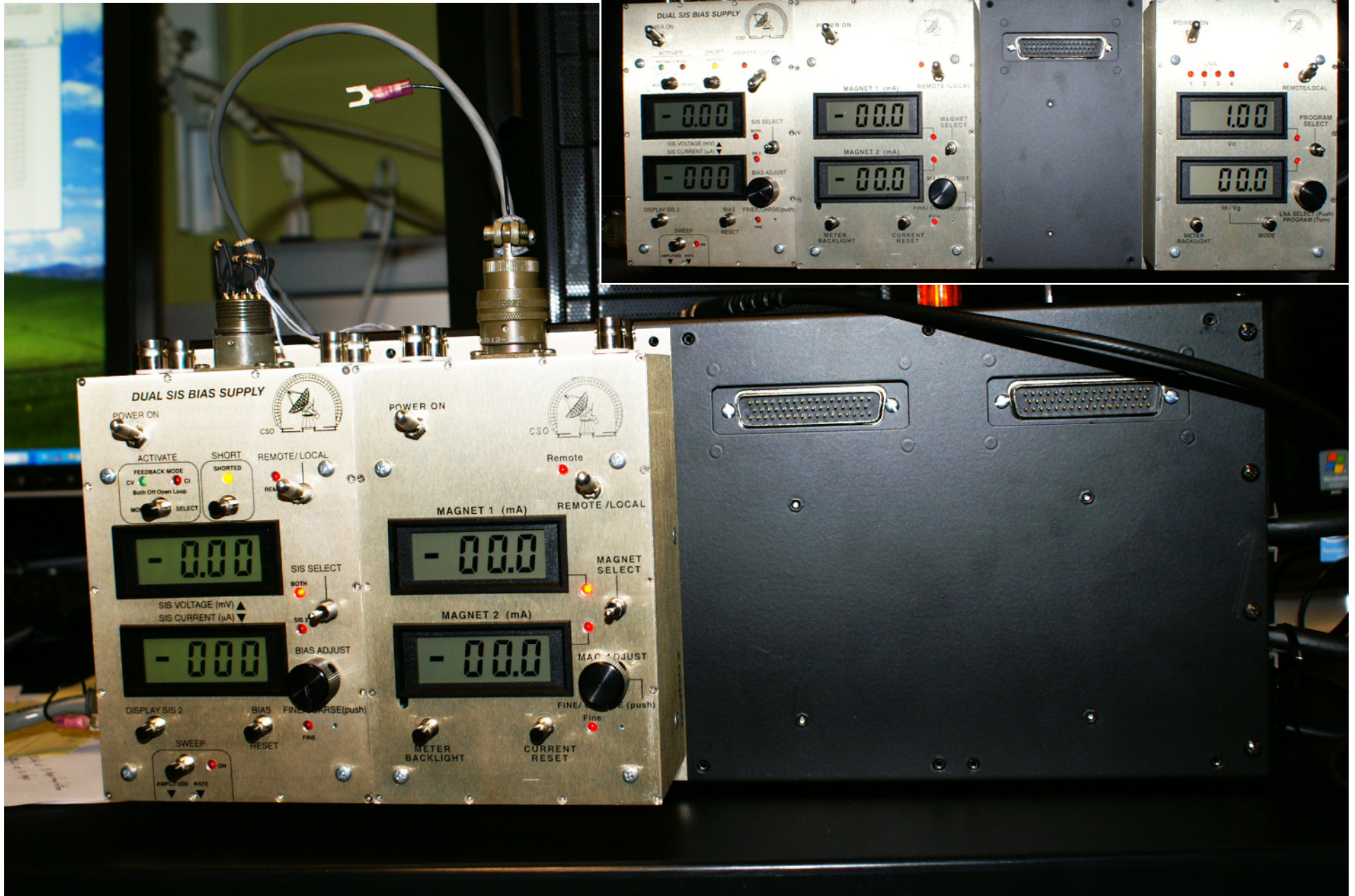


Close up.

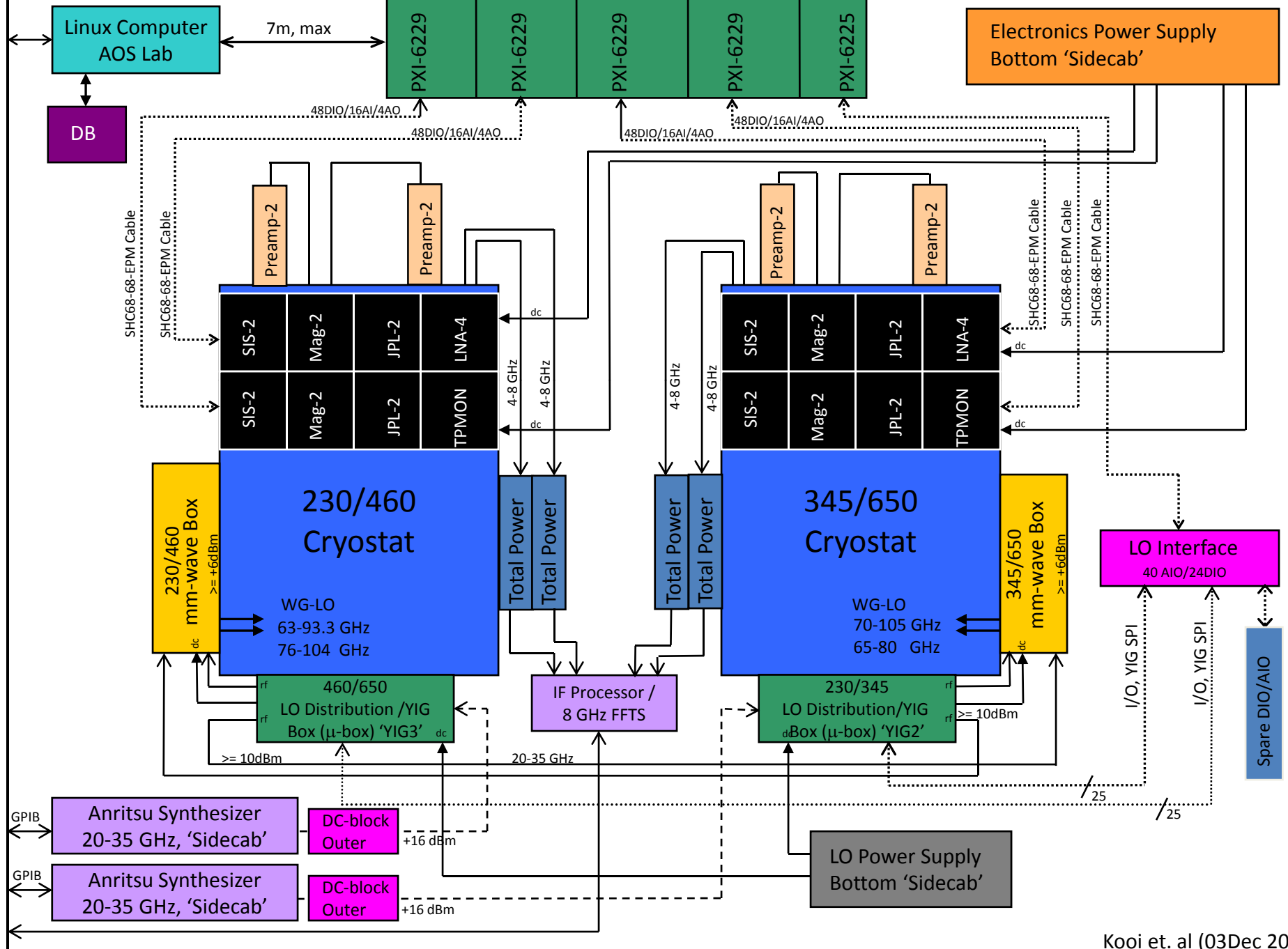




Black Boxes under (successful) test



# Sidecab Layout



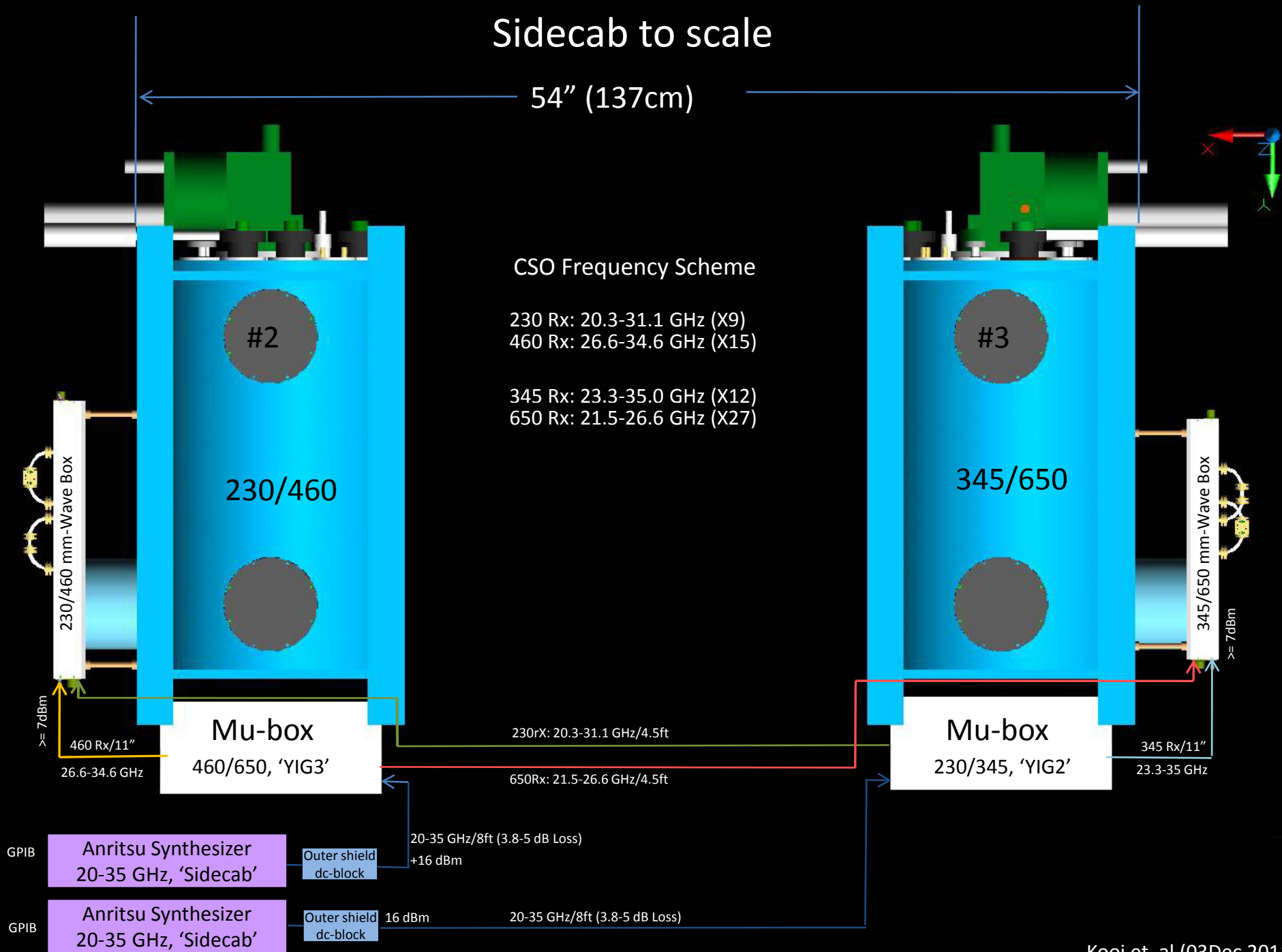
# Sidecab to scale

54" (137cm)

## CSO Frequency Scheme

230 Rx: 20.3-31.1 GHz (X9)  
460 Rx: 26.6-34.6 GHz (X15)

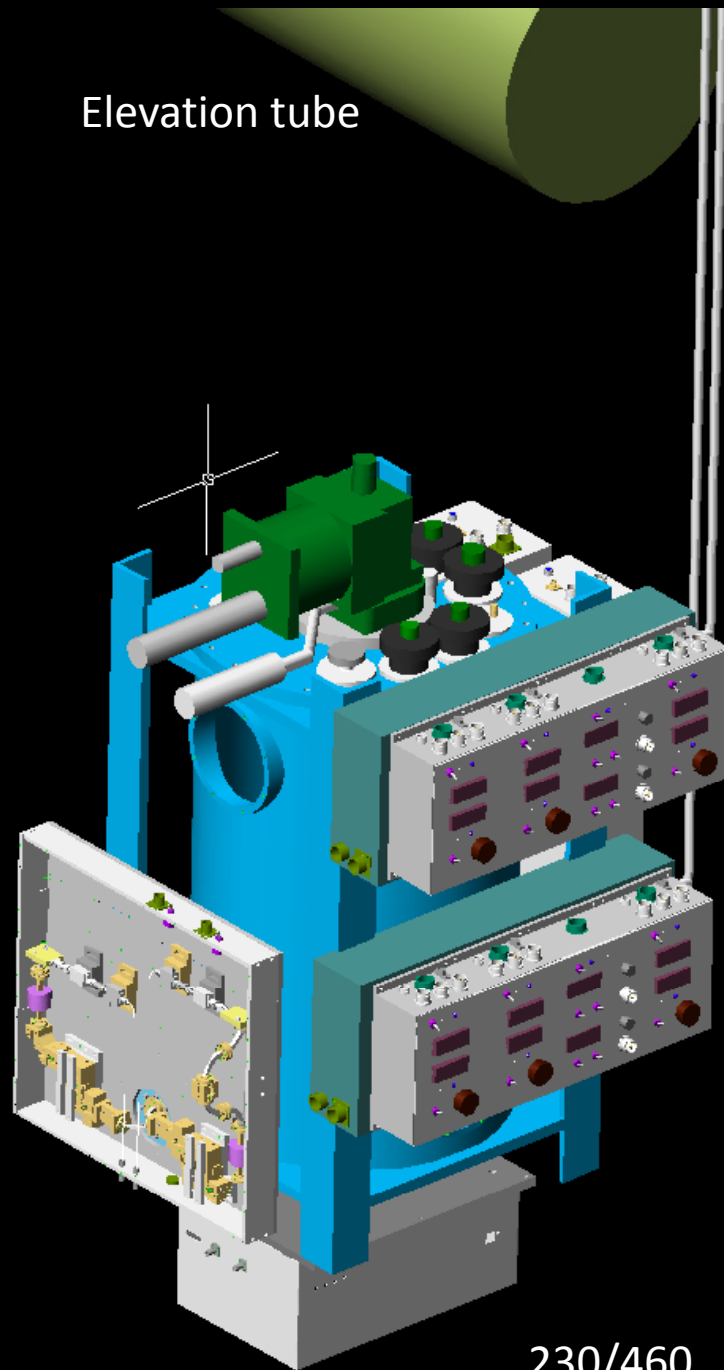
345 Rx: 23.3-35.0 GHz (X12)  
650 Rx: 21.5-26.6 GHz (X27)



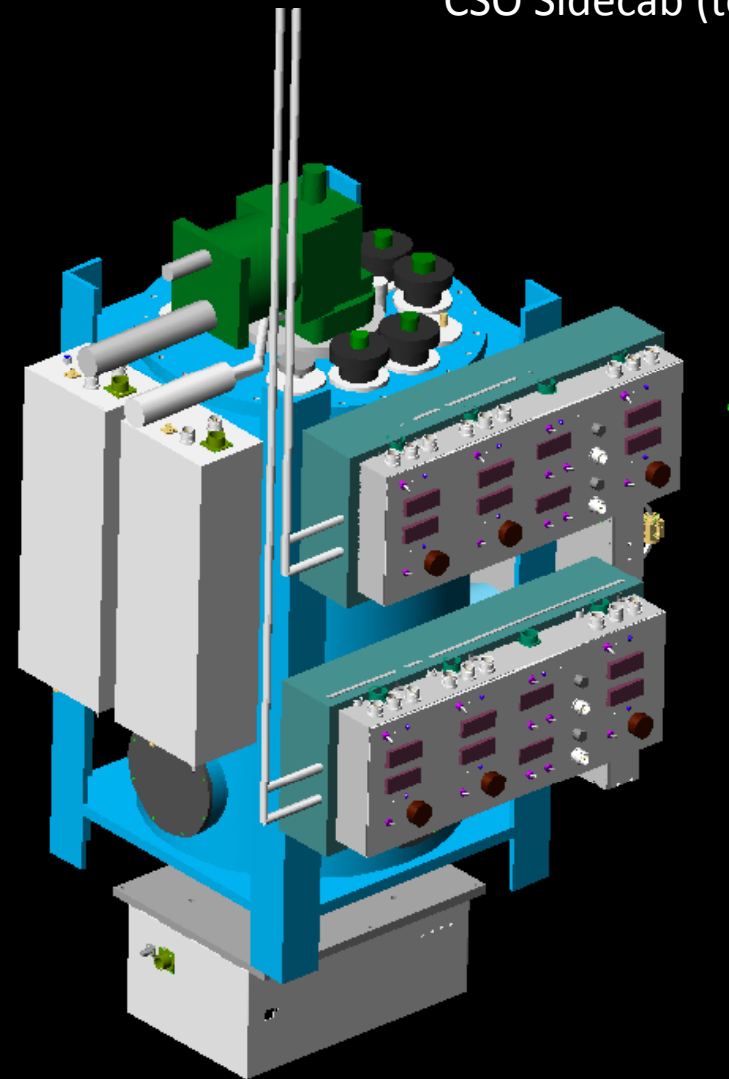


Elevation tube

CSO Sidecab (to scale)



230/460

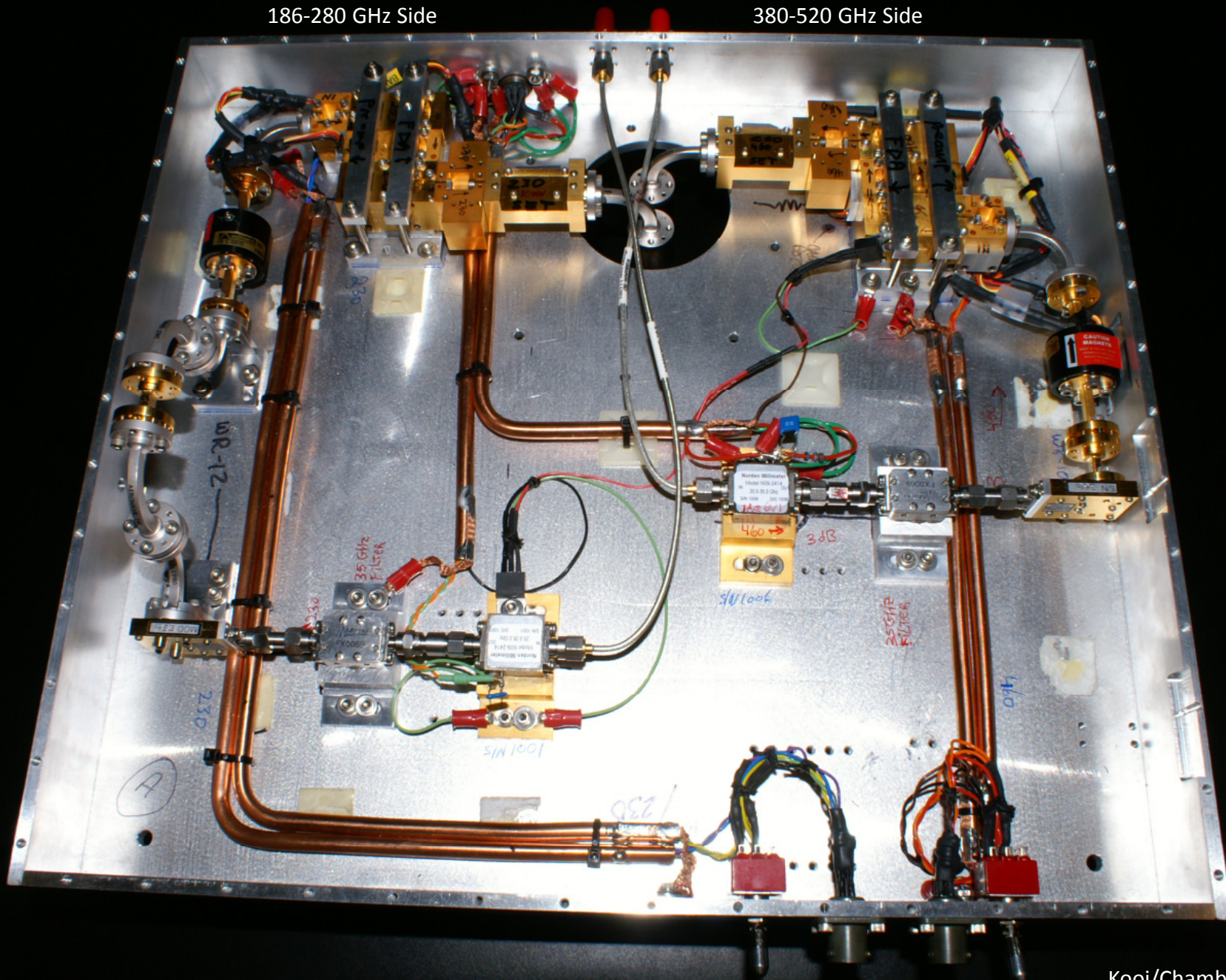


345/650

# Synthesized LO 230/460 mmWave Box

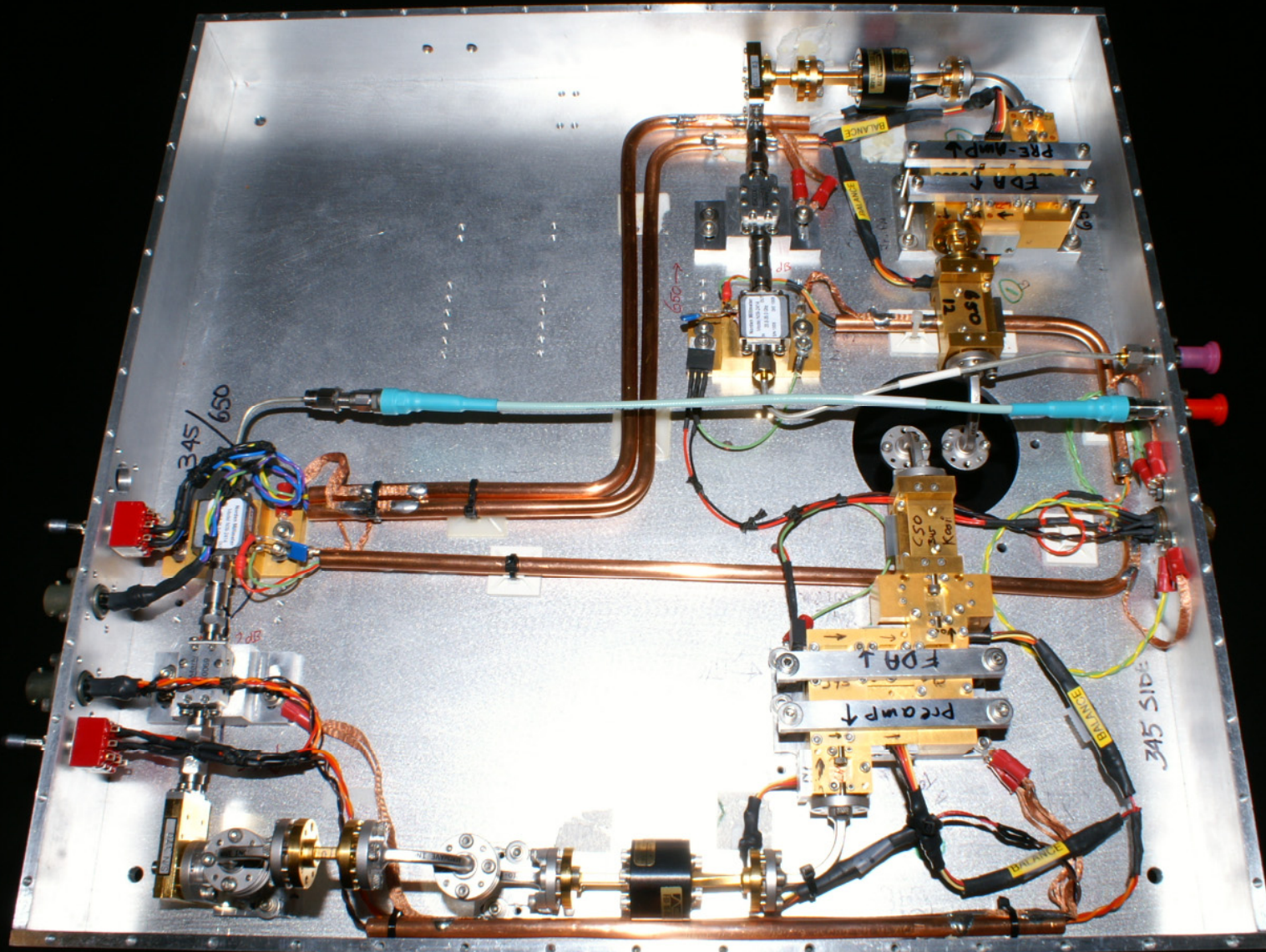
186-280 GHz Side

380-520 GHz Side



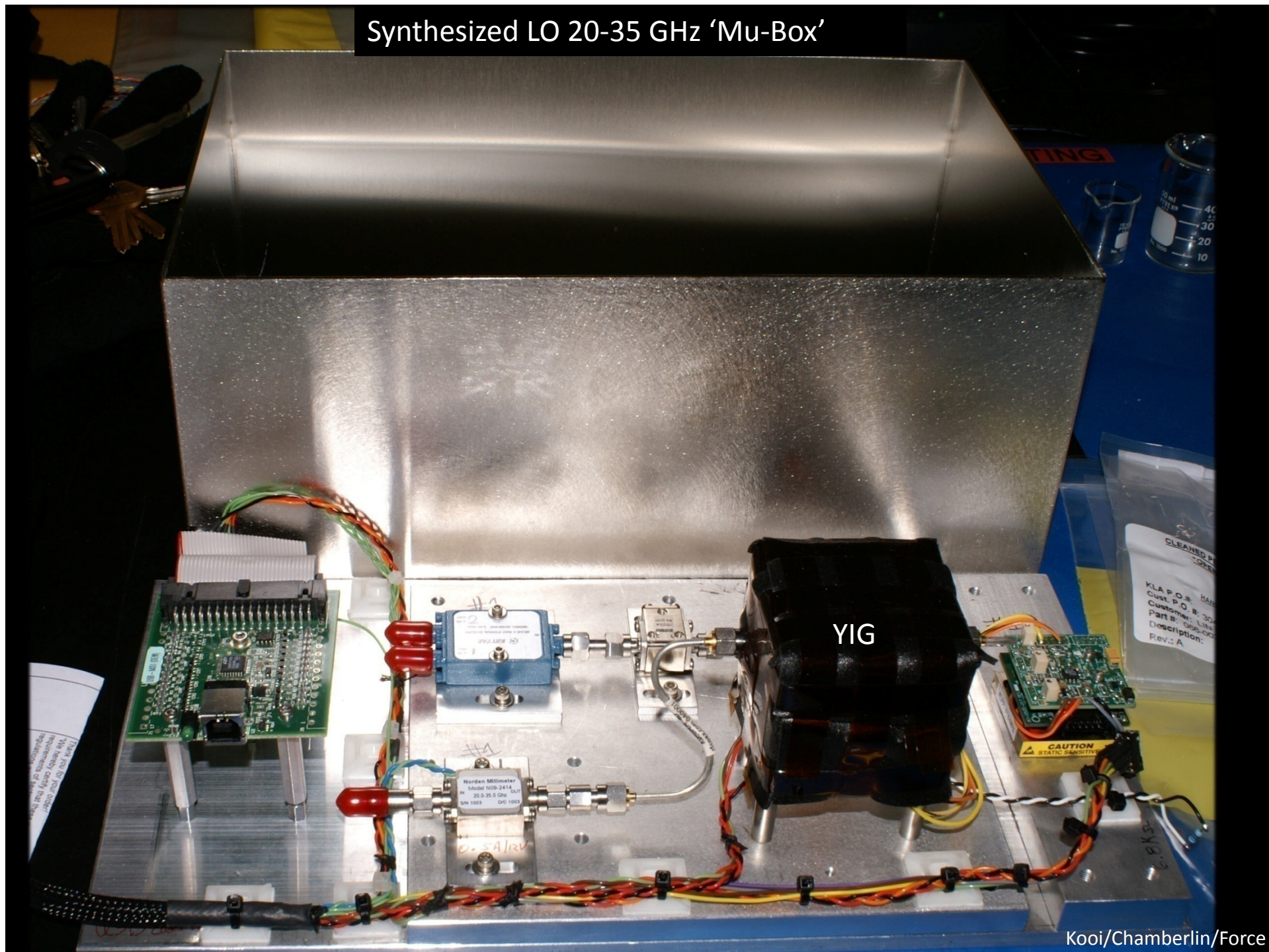


# Synthesized LO 345/650 mmWave Box



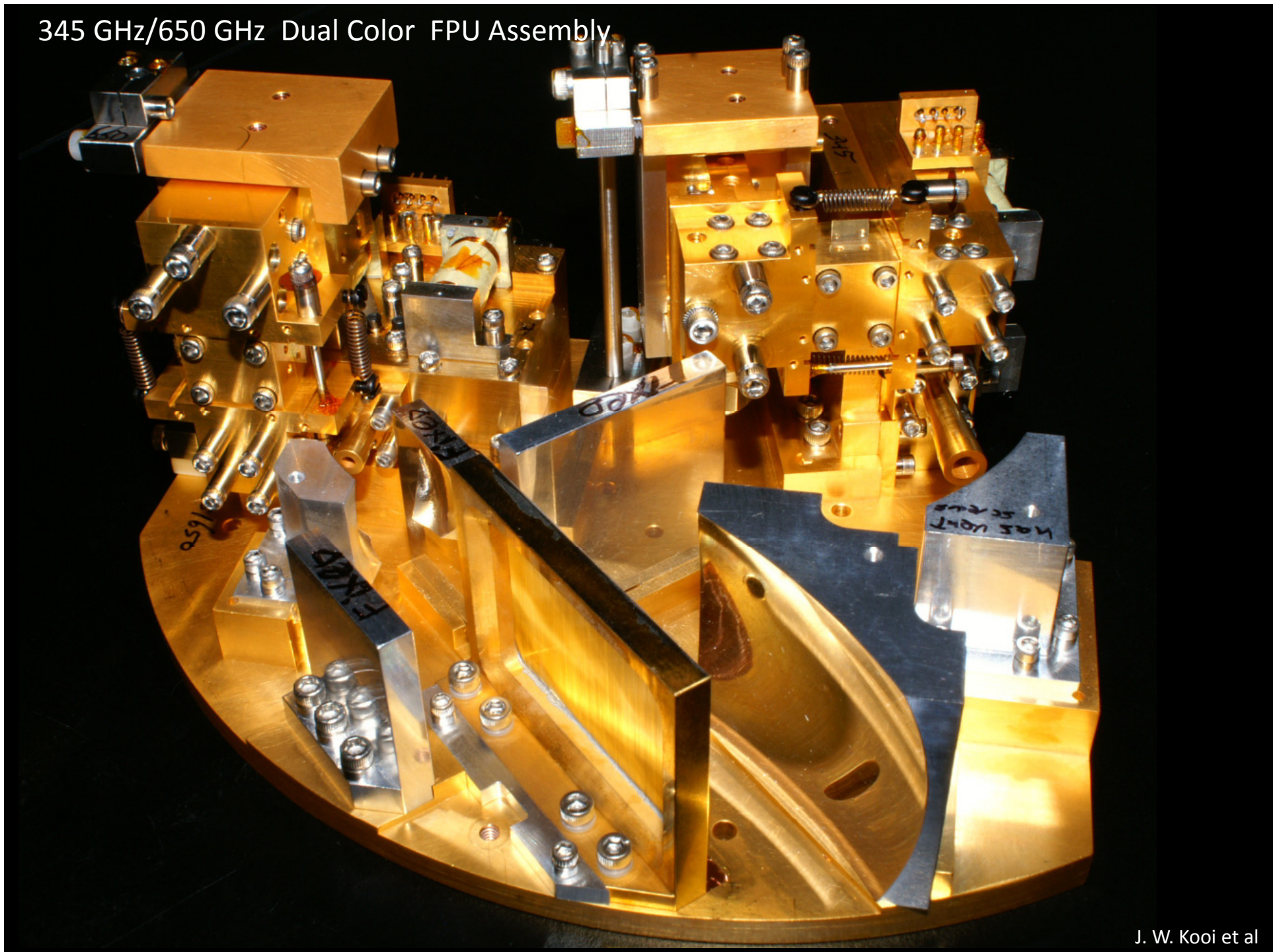


# Synthesized LO 20-35 GHz 'Mu-Box'



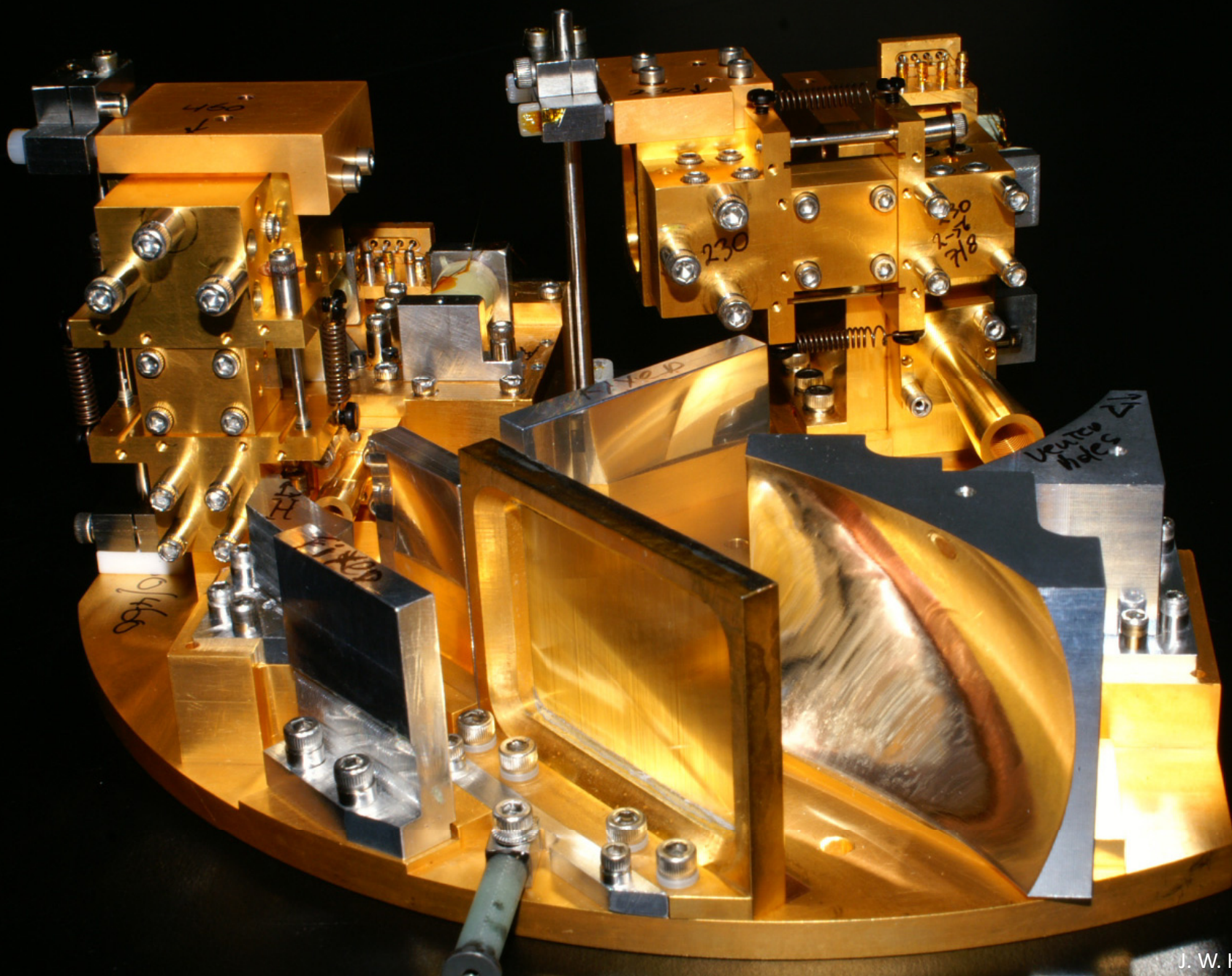


345 GHz/650 GHz Dual Color FPU Assembly





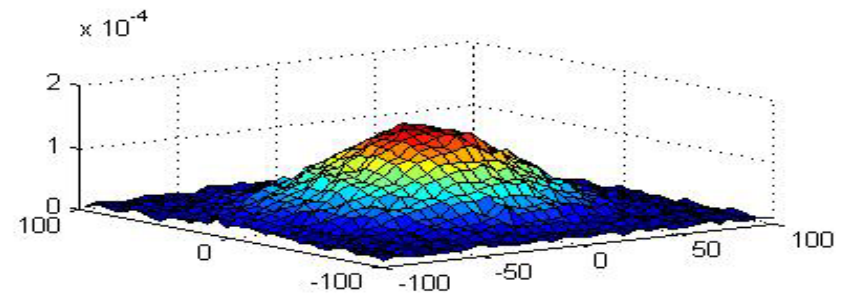
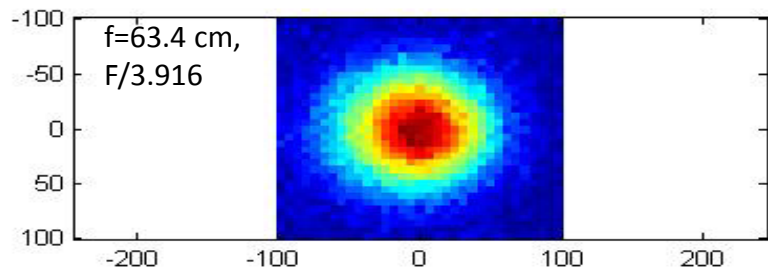
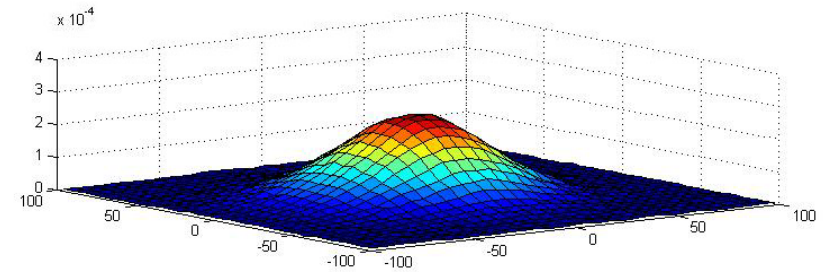
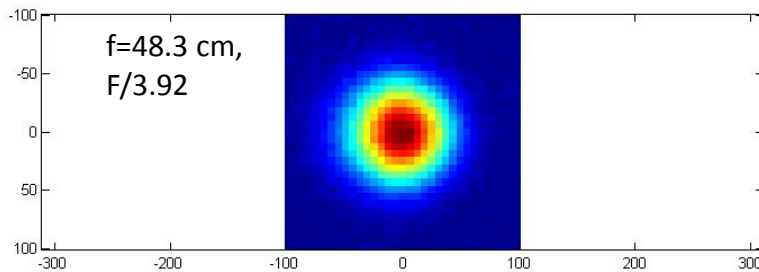
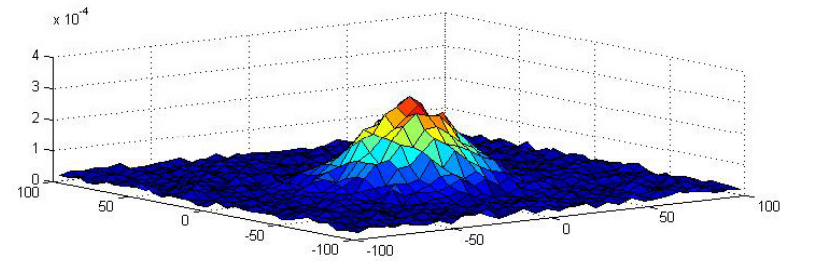
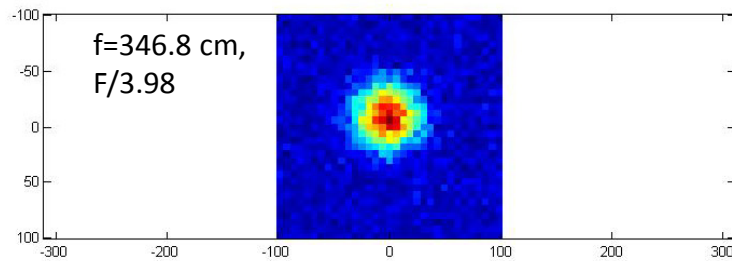
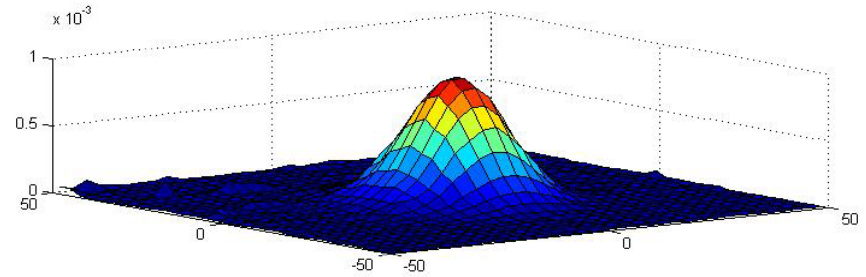
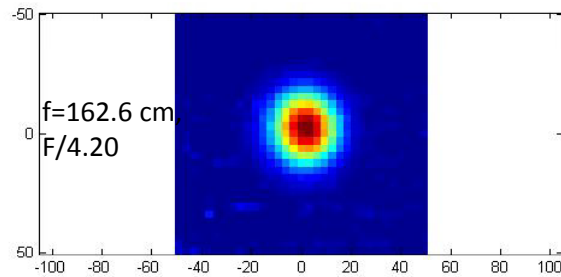
# 230 GHz/460 GHz Dual Color FPU Assembly





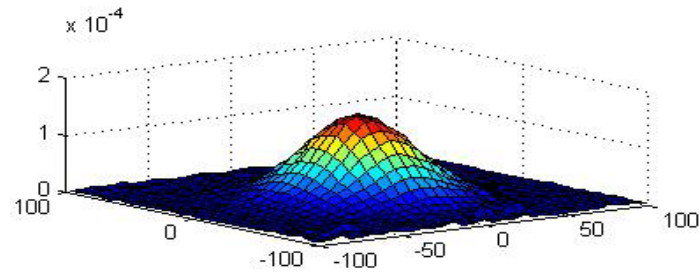
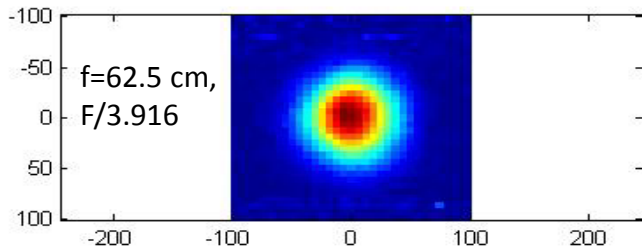
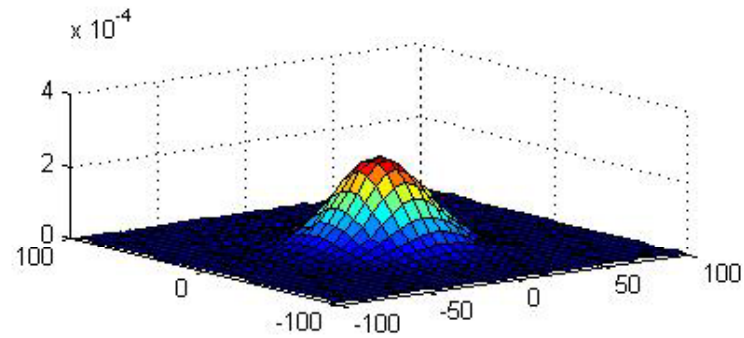
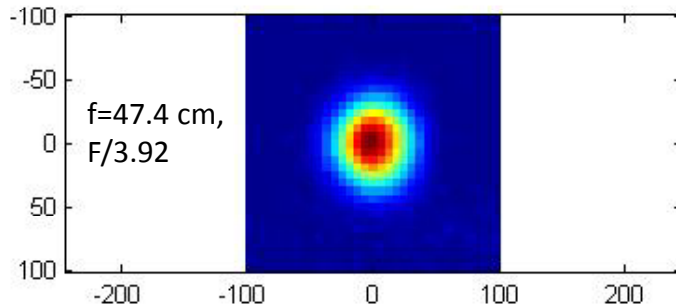
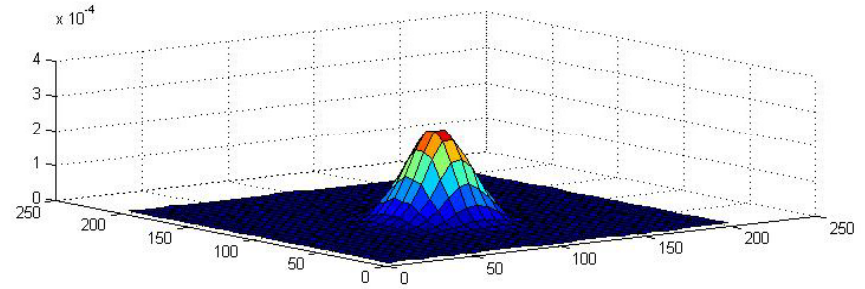
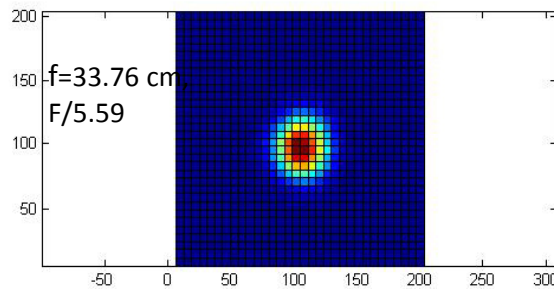
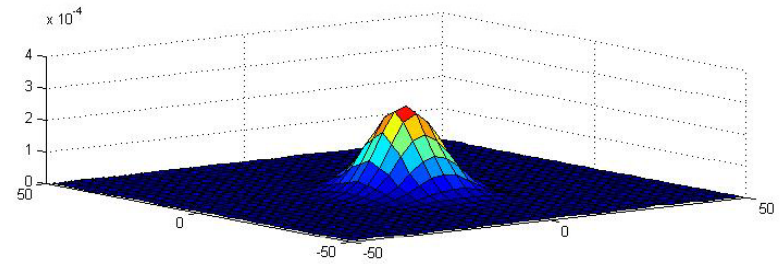
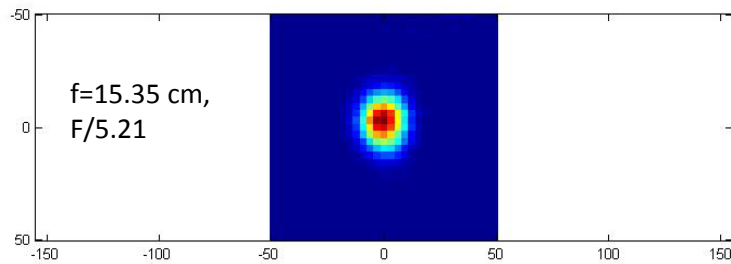
# 345 Mixer Beam Measurements (Direct detection mode) at 4 distances Cryostat

$$\langle f/D \rangle = 3.951 \pm 0.031 \text{ (Design: F3/3 – F/4.0)}$$



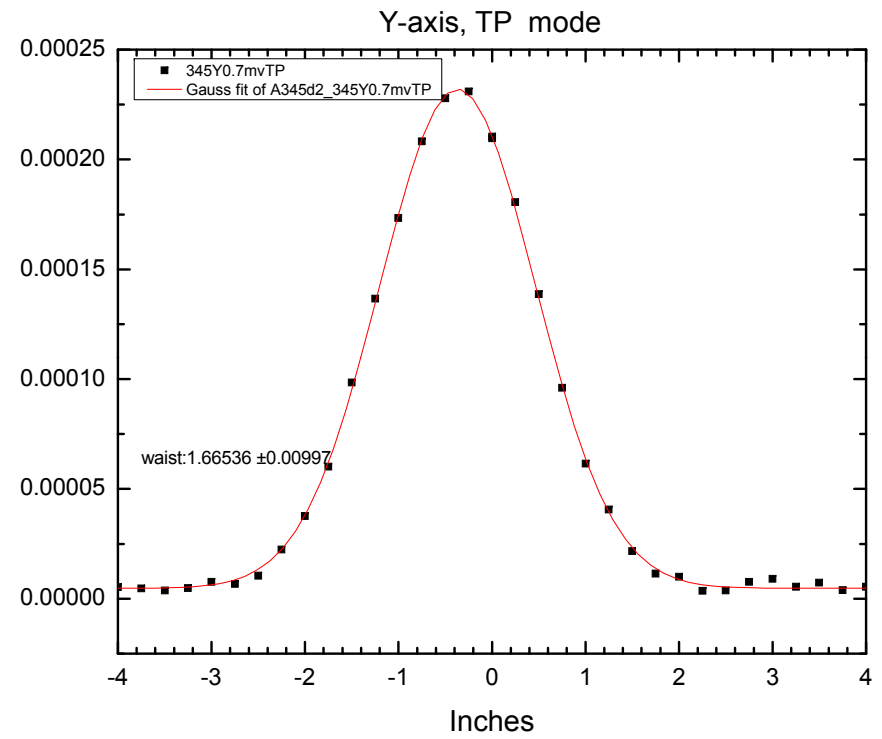
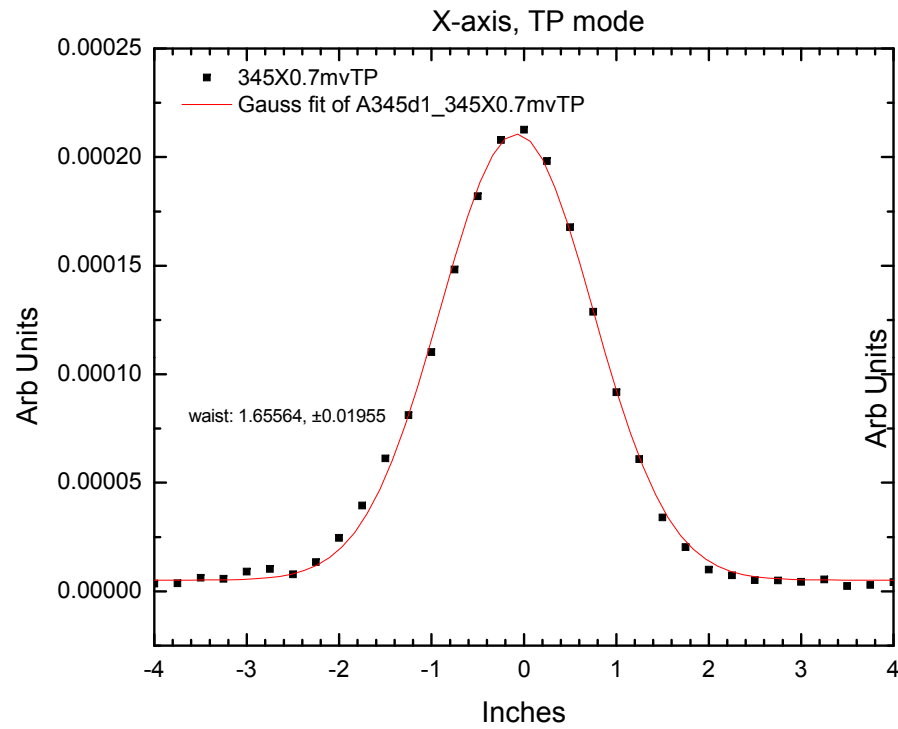
# 650 Mixer Beam Measurements (Direct detection mode) at 4 distances Cryostat

$$\langle f/D \rangle = 5.41 \pm 0.159 \text{ (Design: } F/4.7 - F/5.0 \text{)}$$



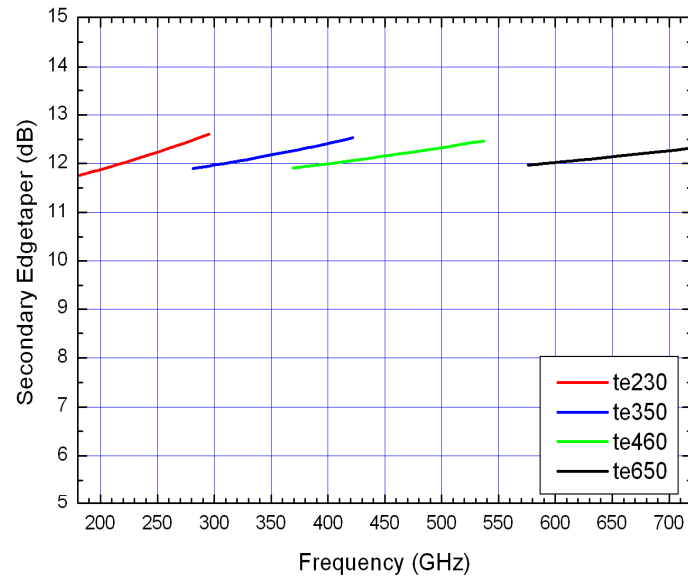


## 650 Beam Example, Cross Cut (Direct Detection Mode)

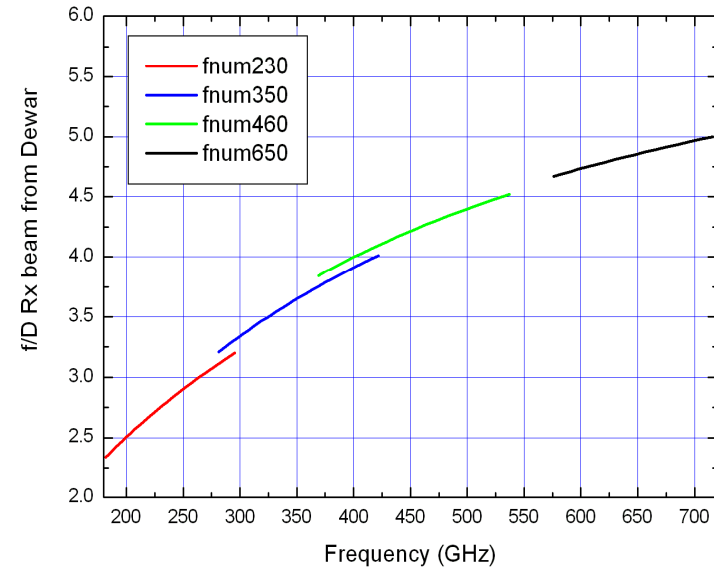




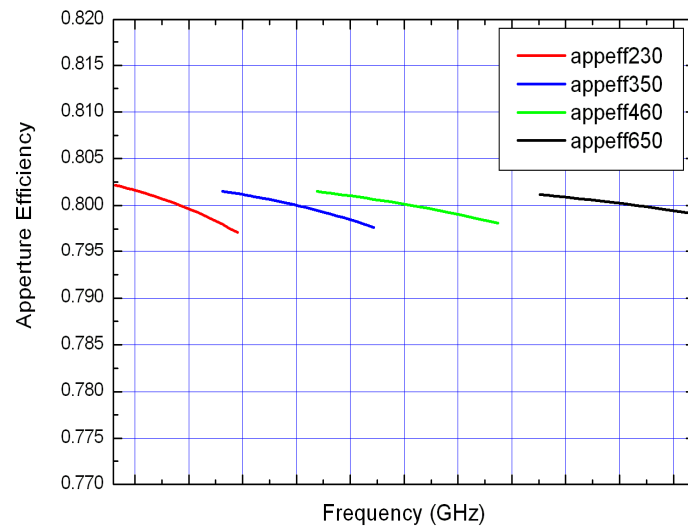
# CSO Sidecab Rx Design Parameters



Secondary edgetaper of the proposed sidecab optics configuration.



f/D ratio of the Receiver beams just outside the cryostat. Below 230 GHz, there will be some vignetting ( $\leq 1\%$ ) on the 5<sup>th</sup> mirror due to the fast beam

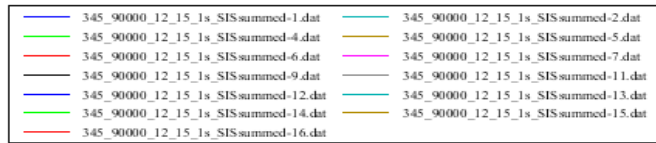
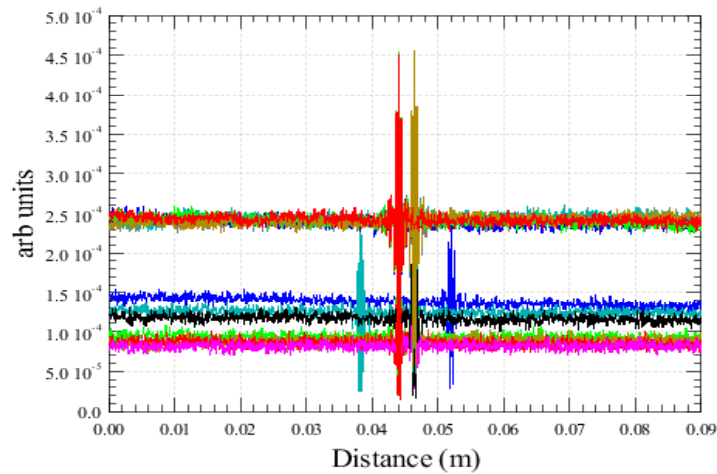


Aperture efficiency with a fixed 5<sup>th</sup> mirror – Cryostat focal distance

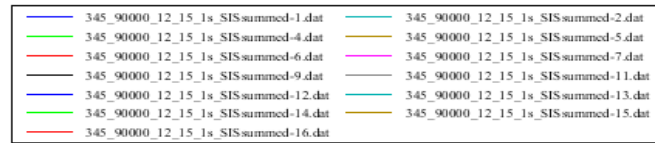
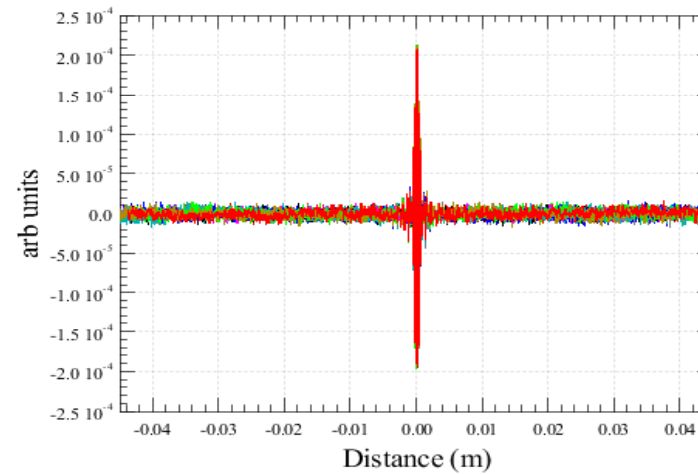


# 280-420 GHz Balanced Mixer FTS measurements

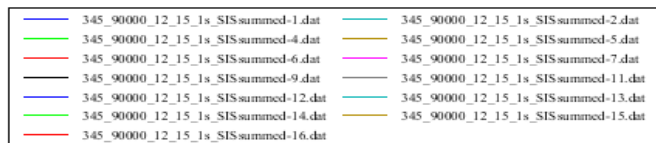
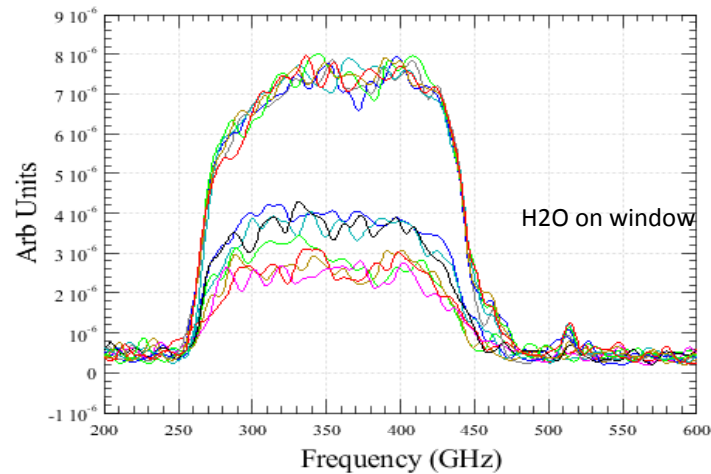
Uncorrected Inteferogram



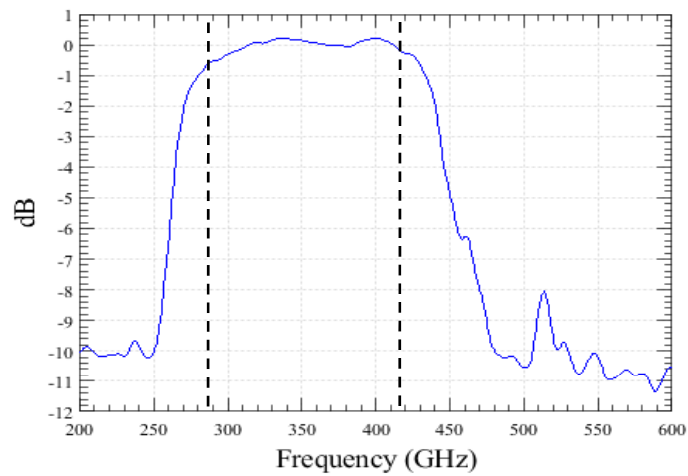
Corrected Inteferogram



Individual Spectra



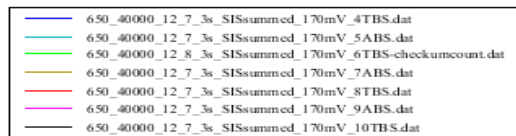
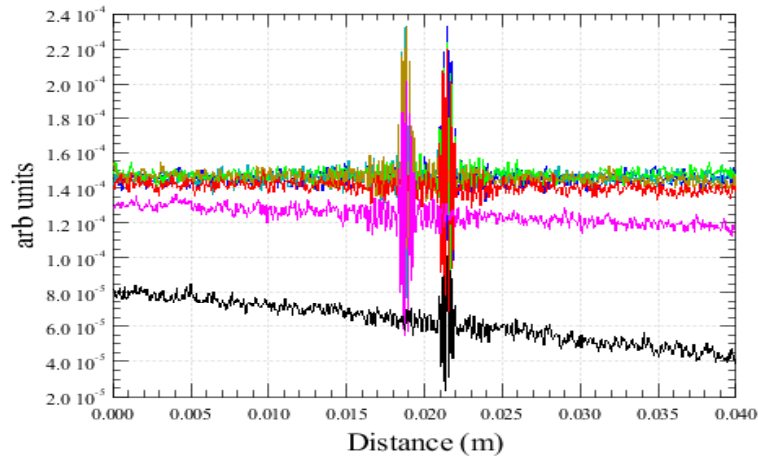
Normalized Averaged Spectra



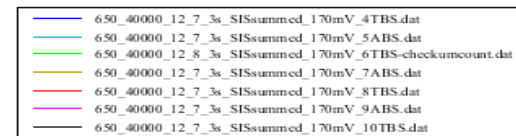
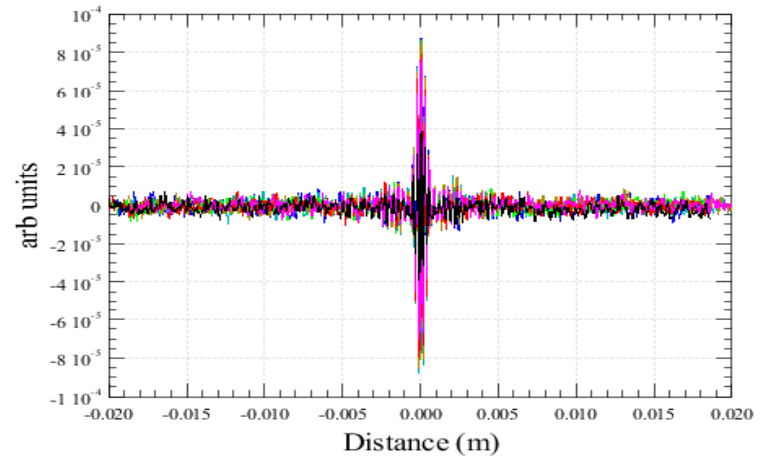
Mean

# 570-730 GHz Balanced Mixer FTS measurements

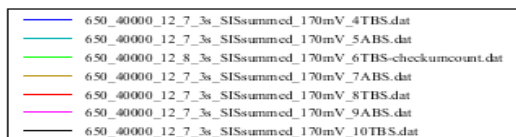
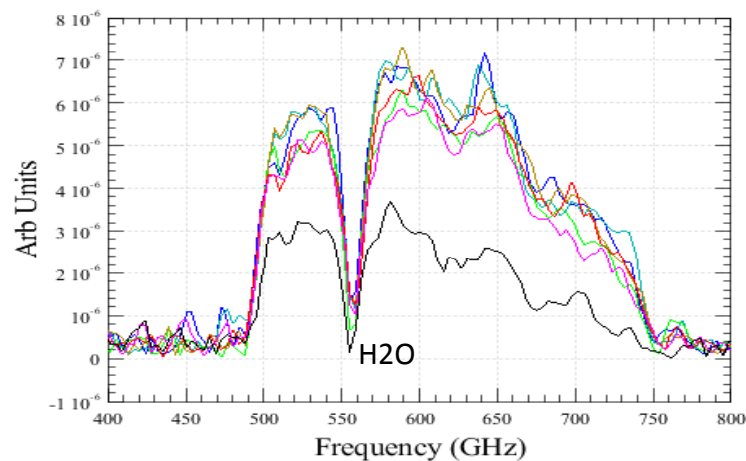
Uncorrected Inteferogram



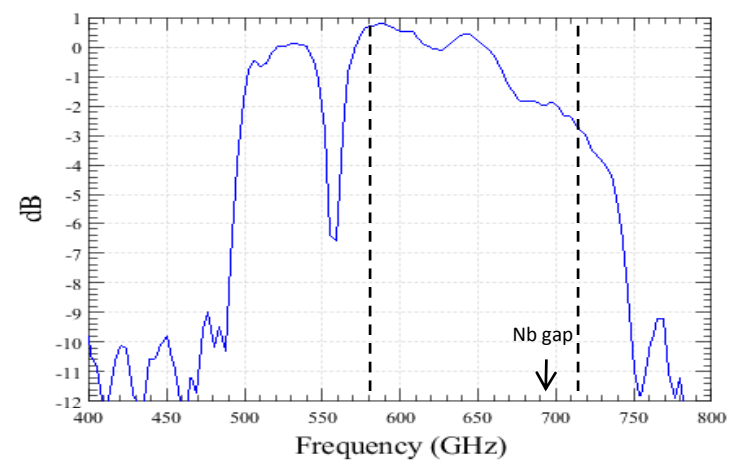
Corrected Inteferogram



Individual Spectra

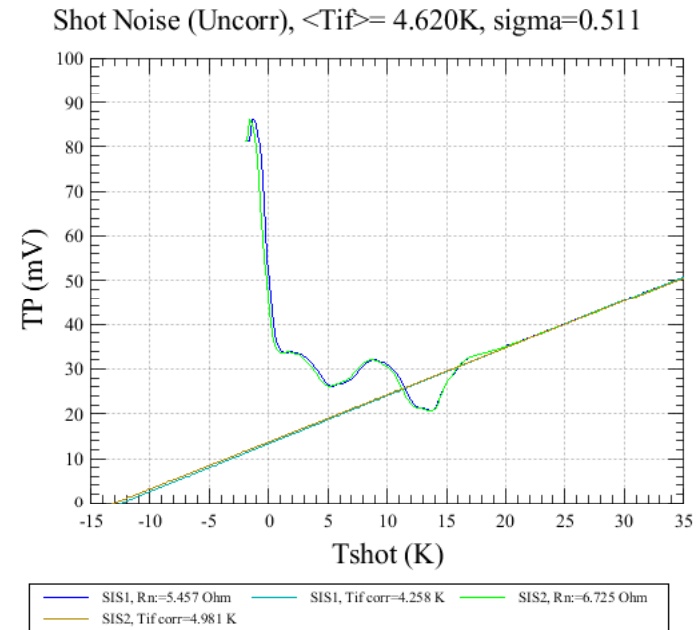
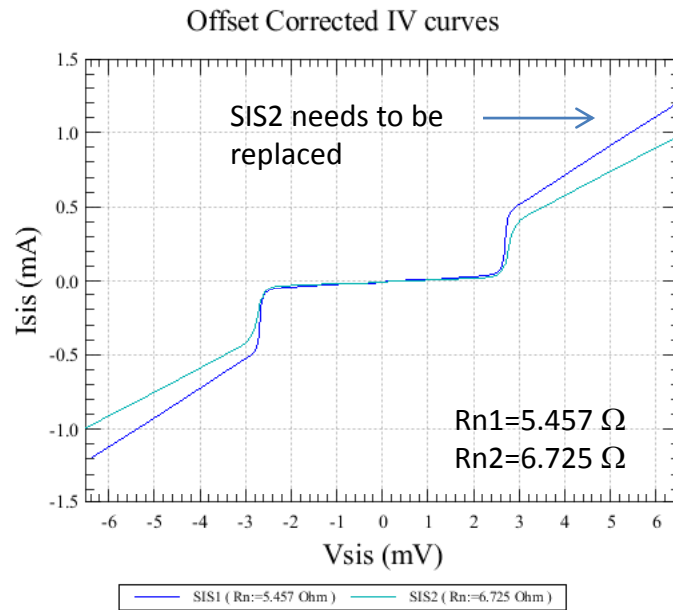


Normalized Averaged Spectra

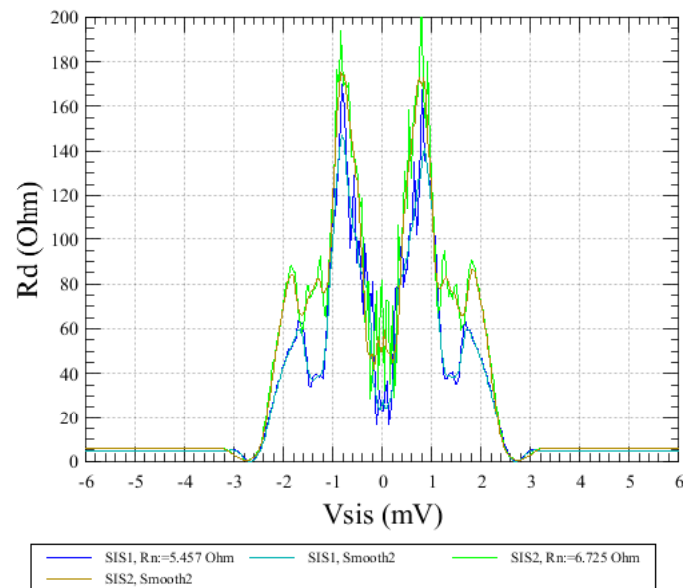




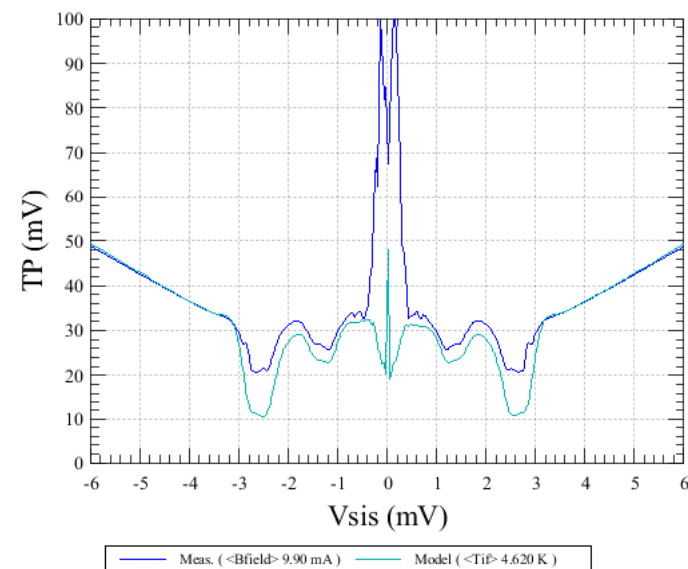
# 280-420 GHz Balanced Mixer IF Noise measurements ( $T_{if}=4.62K \pm 0.5K$ )



Dynamic Resistance, Bfield1: -9.93mA, Bfield2: 9.88mA

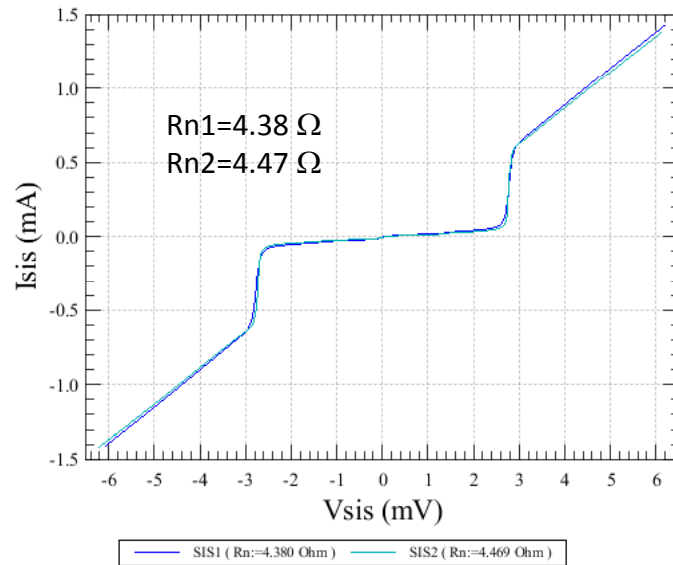


IF Output Power, Gain=69.63dB,  $r_{tun}=20.0\%$ ,  $I_{mar}=80.0\%$

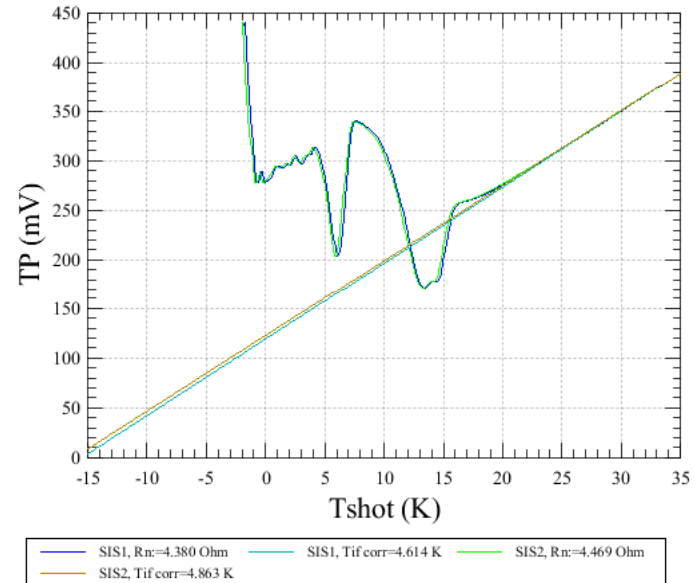


# 570-730 GHz Balanced Mixer IF Noise measurements ( $T_{if}=4.74 \pm 0.17K$ )

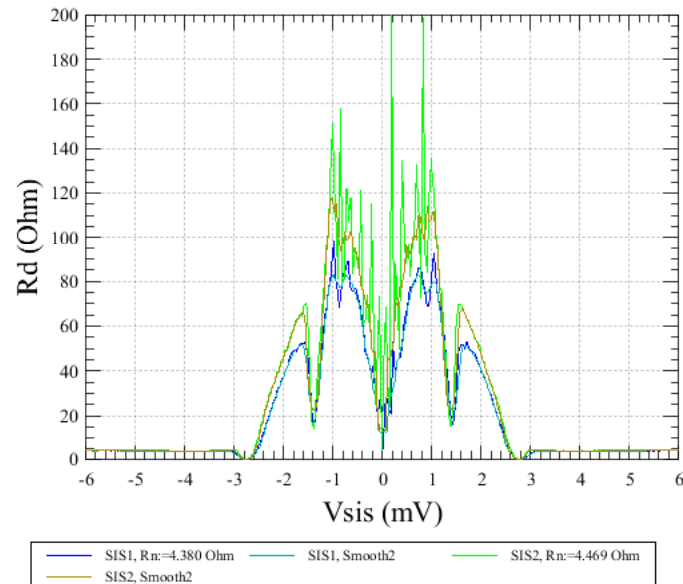
Offset Corrected IV curves



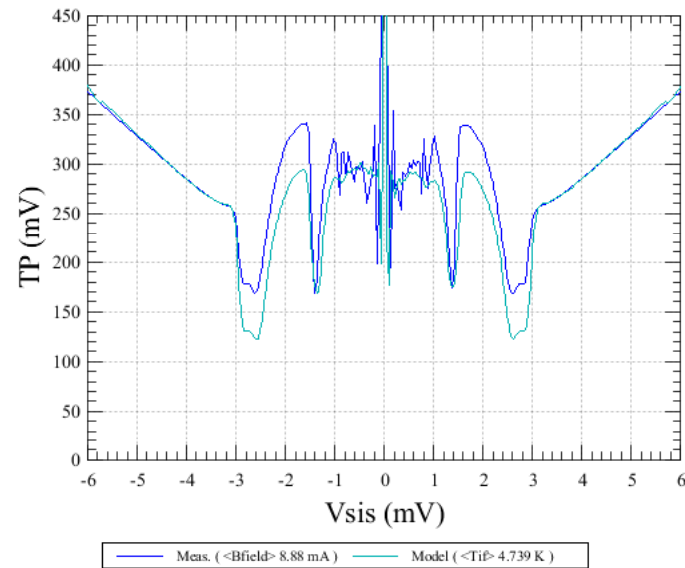
Shot Noise (Uncorr),  $\langle T_{if} \rangle = 4.739K$ ,  $\sigma = 0.176$



Dynamic Resistance, Bfield1: 8.45mA, Bfield2: 9.32mA



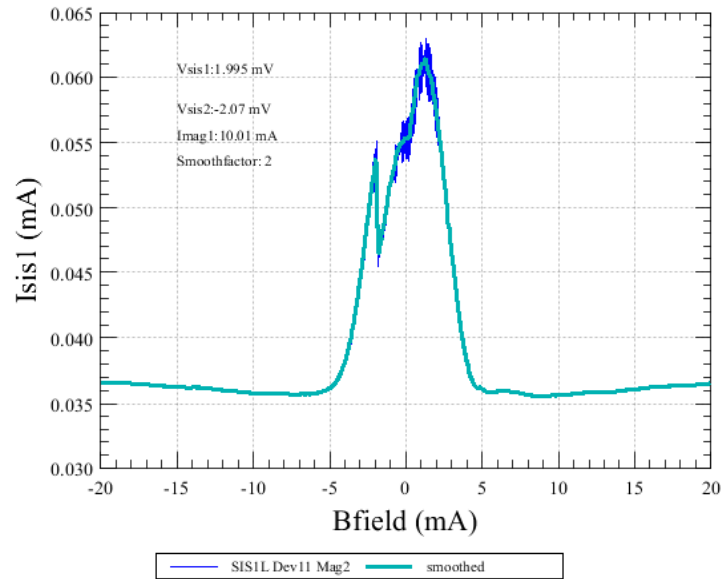
IF Output Power, Gain=79.13dB,  $r_{\text{tun}}=50.0\%$ ,  $\text{Imar}=50.0\%$



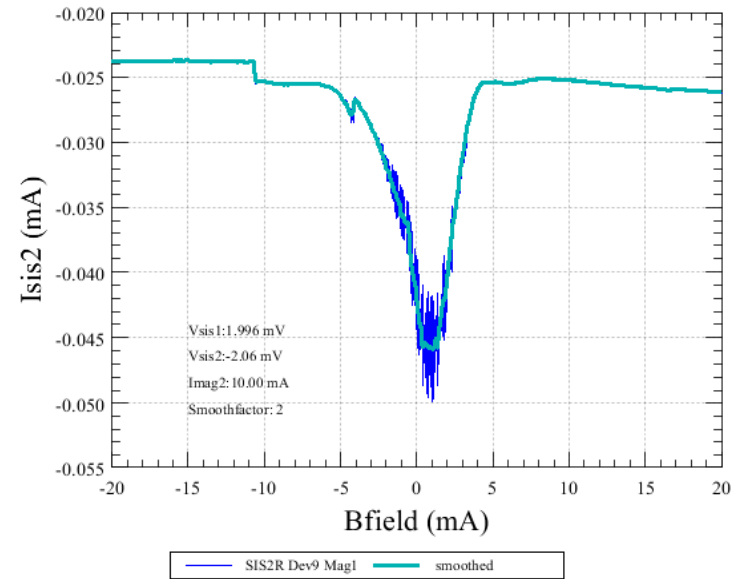


## 345 Balanced mixer/Magnet Characteristics

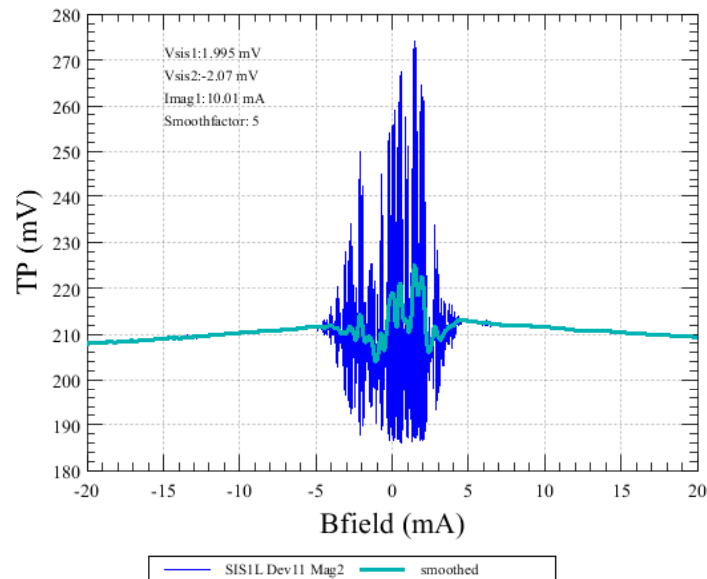
Isis1 as a function of Bfield



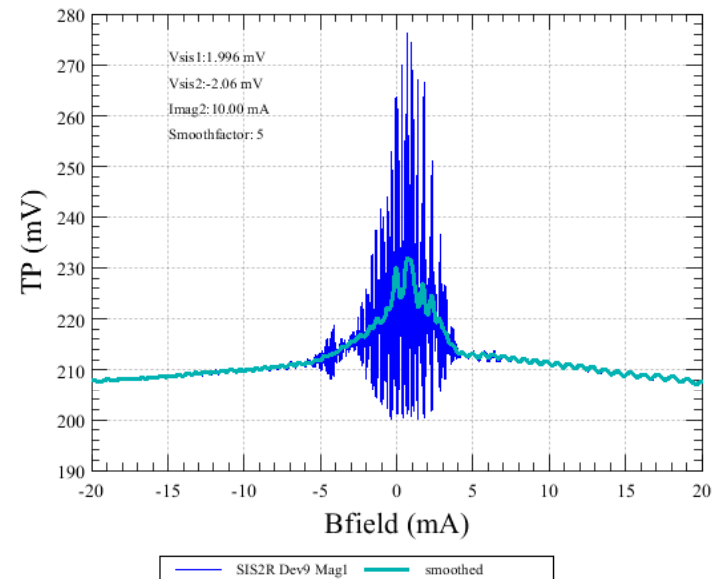
Isis2 as a function of Bfield



TP as a function of Bfield

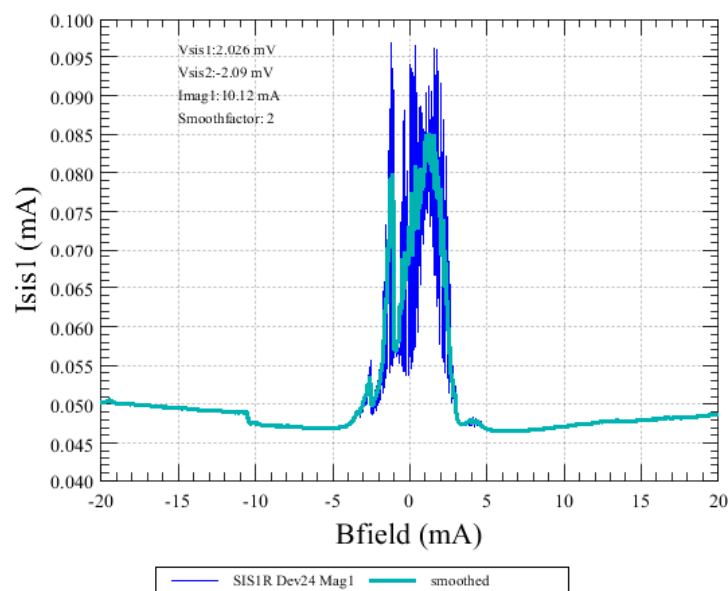


TP as a function of Bfield

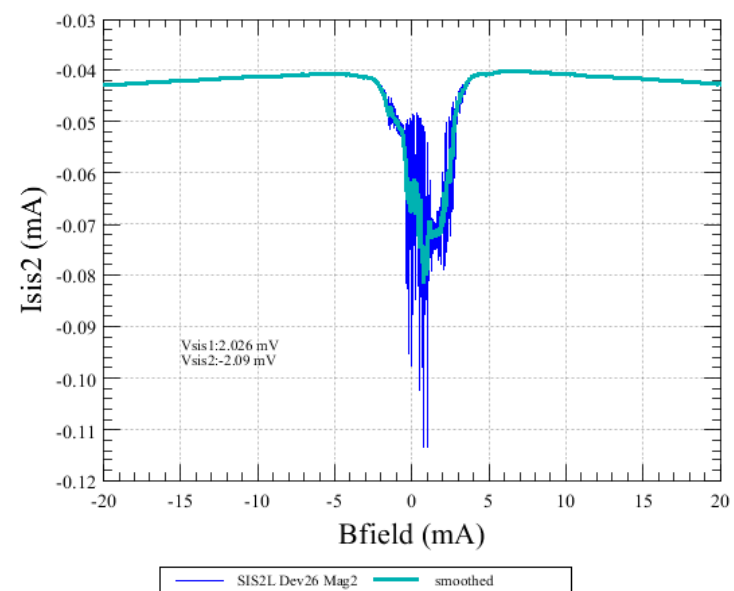


## 650 Balanced mixer/Magnet Characteristics

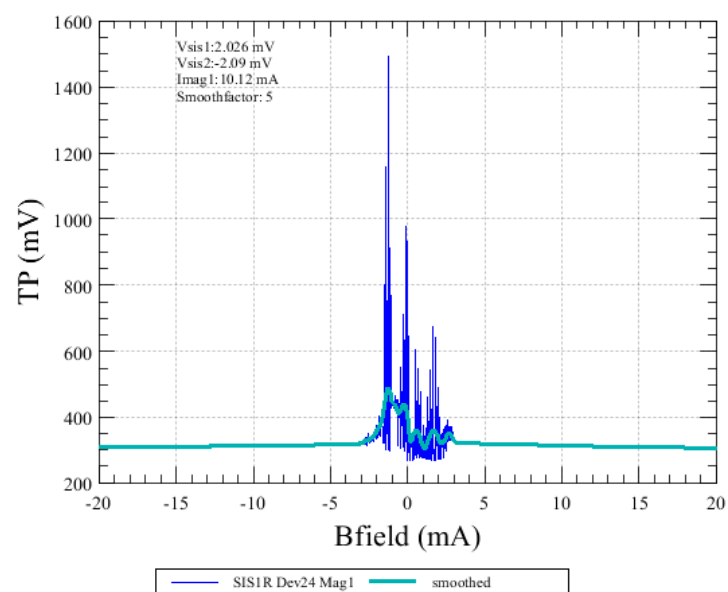
Isis1 as a function of Bfield



Isis2 as a function of Bfield



TP as a function of Bfield



TP as a function of Bfield

