Scaled feedhorn beams

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Feedhorn design

- MCMC horn design has many inputs
  - Stop
  - Penalty function for optimization (you can optimize the horn many different ways)
  - Frequencies
  - Waveguide diameter
  - Output aperture diameter
- The 6.8 mm horn was optimized for a 13˚ stop, optimized on efficiency, and optimized from 75-165 GHz
  - Also usually run for 300+ optimizations for full optimization
  - This design is optimized with only 30 optimizations
- Fully optimizing and changing these parameters to fit the specific instrument/goals can further tune feedhorns for improved performance over this 6.8 mm design

Assumptions

- Band is 95/155 GHz from CDT
  - 6.8 mm horn design has a waveguide cutoff at 78 GHz (this is adjustable in the horn design)
- f/# Linear scaling with horn aperture
  - 5.3 mm pixel size design scaled to 6.8 mm pixel size compared to actual 6.8 mm pixel size design shows that f/# is underestimated with this method
  - This means we may be able to achieve the same performance with smaller pixel sizes
- Horn aperture is pixel size-100 um (for sidewall)

Scaling 6.8 mm design

95 GHz Band

Pixel Size	# Pixels	f/# at -8dB	f/# at -10dB	Stop angle -8dB	Stop angle -10dB	Spillover -8dB	Spillover -10dB
8.6 mm	169	1.45	1.30	19.1˚	21.1˚	0.139	0.115
9.4 mm	147	1.58	1.42	17.5˚	19.4˚	0.118	0.099

155 GHz Band

Pixel Size	Spillover	Edge Taper (dB)
8.6 mm	0.086	-22.0
9.4 mm	0.077	-22.7

Average Beam Profiles

- Scale angle by horn aperture size relative to 6.8 mm