

# Mauna Kea GL Seeing Campaign

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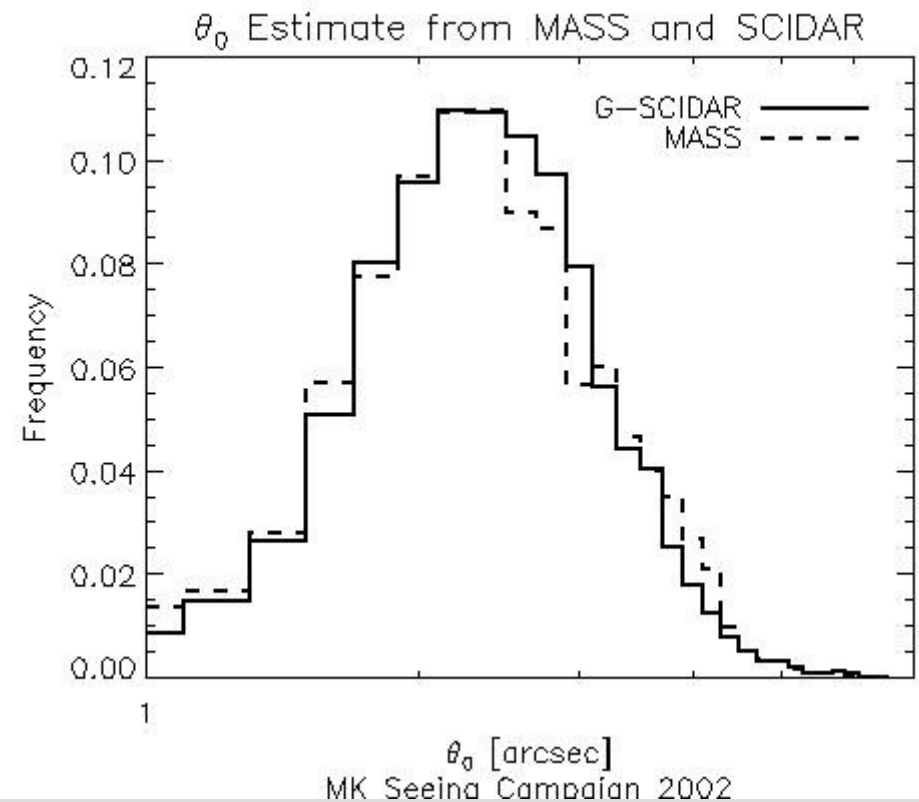
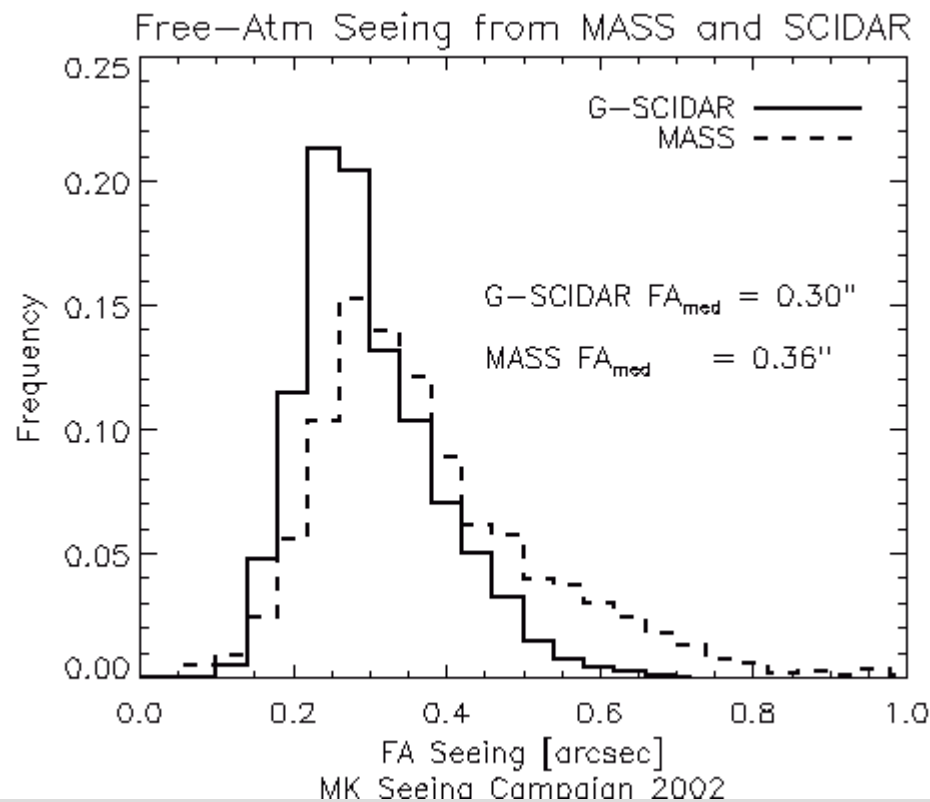
Seeing Symposium  
Kona, Hawaii  
2007 March 20-22

# Motivation

- Gemini Ground-Layer AO
  - Gemini GLAO Study by Durham, NRC-HIA, and U of Arizona
    - Correcting for only the lowest layers provides a 'seeing corrected' image over large fields of view.
  - Gemini-S/Gemini-N?
    - Cerro Pachon study by Vernin et al. (2000)
    - Need data for Mauna Kea -> This study
  - Technical issues are driven by strength, location, and speed of GL
    - e.g. Gains to be had?
    - e.g. Adaptive Secondary appropriately conjugated?

# Past results suggest excellent free-seeing at MK

- G-SCIDAR and MASS data Oct/Dec 2002



Free seeing defined as integrated seeing above 1km

# Goals of the MK GL Study?

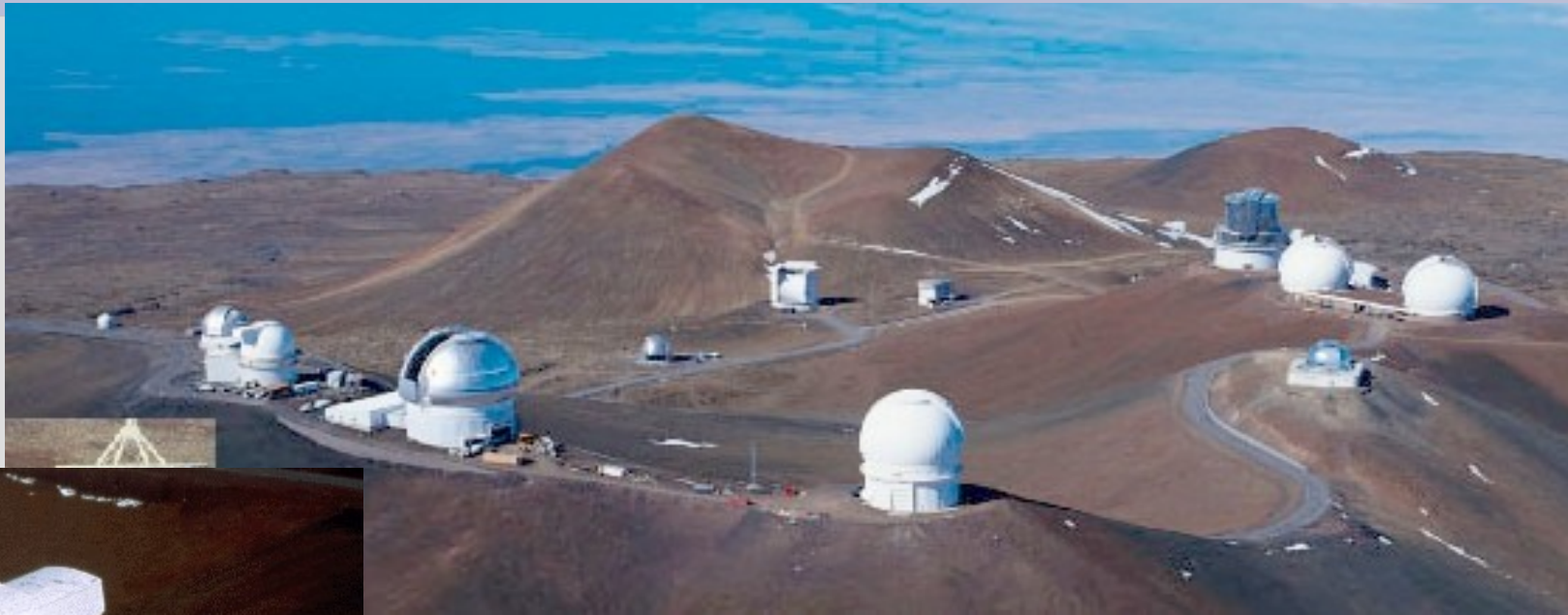
- 12 month study period
  - ~1000 hours of  $C_N^2(h)$  within the first kilometer
  - Altitude resolution between 20-100 meters within first kilometer
  - Turbulence velocity profiles for a subset of the turbulence SLODAR/LOLAS profiles.
  - A data set of supplemental observations (e.g. DIMM, weather, etc.)
- Instrumentation
  - A combined LOLAS and SLODAR operated by MK Sites technician

# Who

- Durham (SLODAR)
  - Richard Wilson & Tim Butterley
- UNAM (LOLAS)
  - Remy Avila & Jose Luis Aviles
- UH/IfA (operations)
  - Don Weir & Mark Chun



# Location



- UH2.2m Coudé Roof
  - next to Gemini
  - ~12m off the ground
  - ~8m from the southern edge of the dome.

# Current Status

- SLODAR and telescope
  - Integration/Commissioning Sept 2006
  - ~35 night of data from Oct 06 to Feb 07
  - 12800+ profiles
  - 8-layers in GL plus FA seeing
  - Altitude resolutions between 40m and 100m
- LOLAS
  - Initial tests in Sept 2006
    - achieved resolutions of 25m
  - New optics and exchange mechanism
  - Integration with SLODAR and telescope last week
    - Resolution ~ 20 meters...

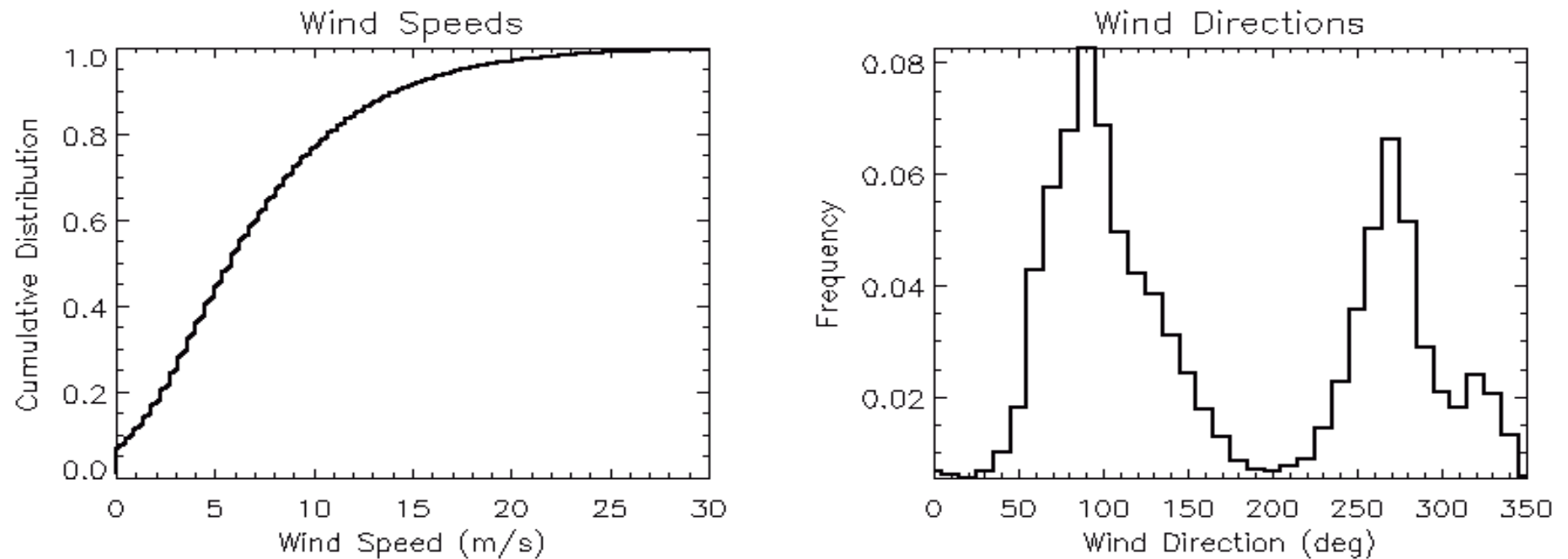
# Lessons Learned

- Buy a good OTA and mount
- Hire the right person to take care of the instrument...



# Meade-mount wind limitation

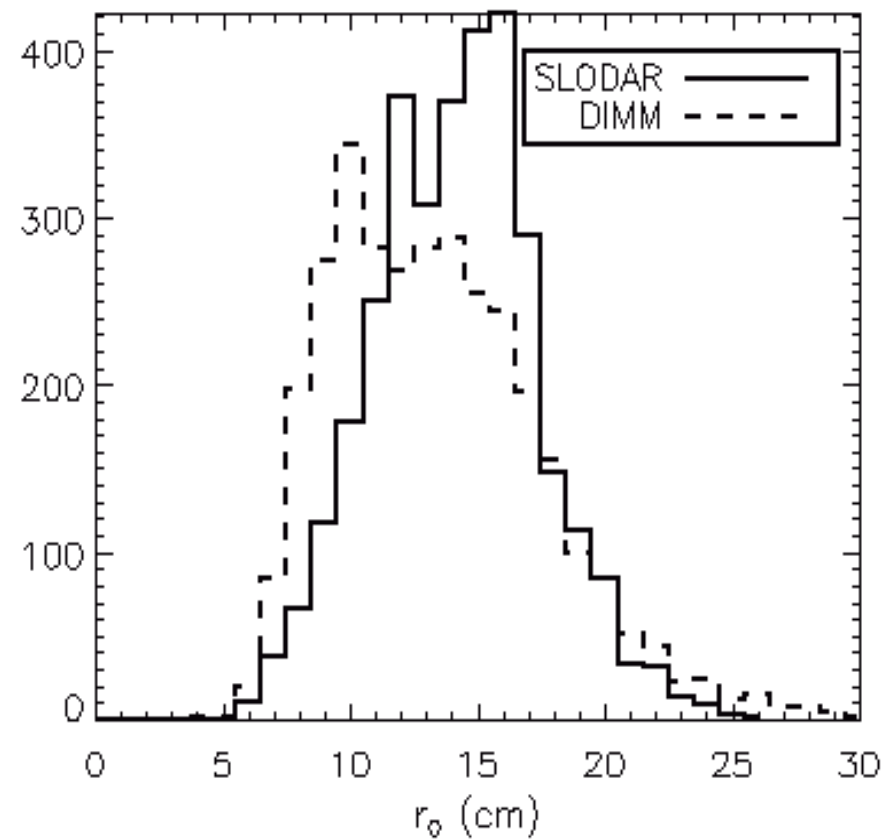
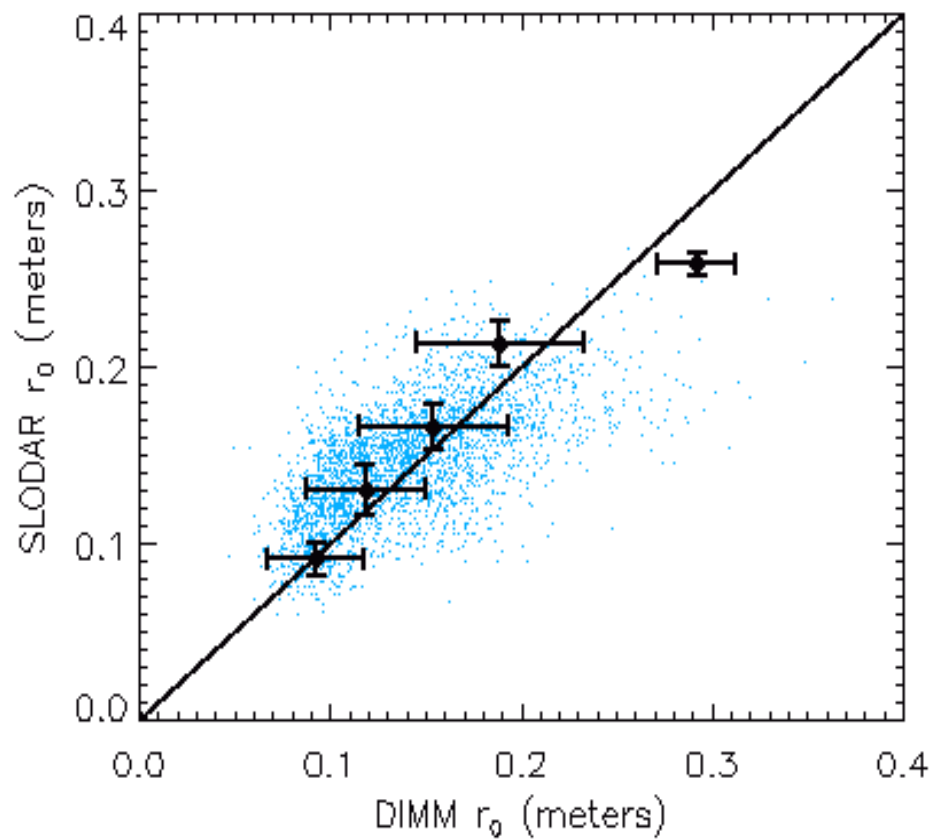
CFHT Weather Tower Wind Velocities (1996–2006)



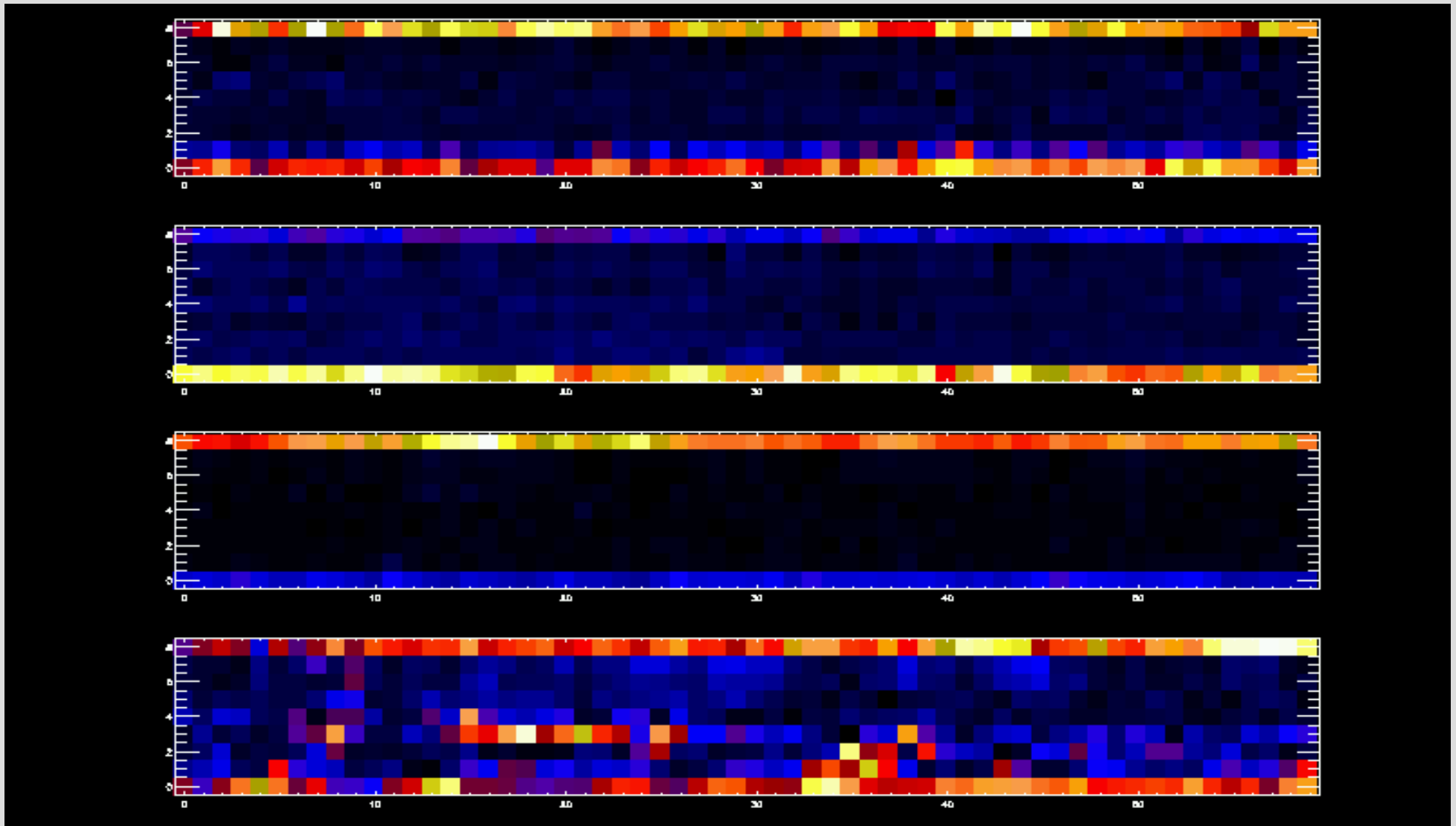
- Operation up to 30-35 mph winds
- This is an ~90% wind condition on Mauna Kea

# Comparison to DIMM

Comparison of simultaneous SLODAR and DIMM Seeing Measurements



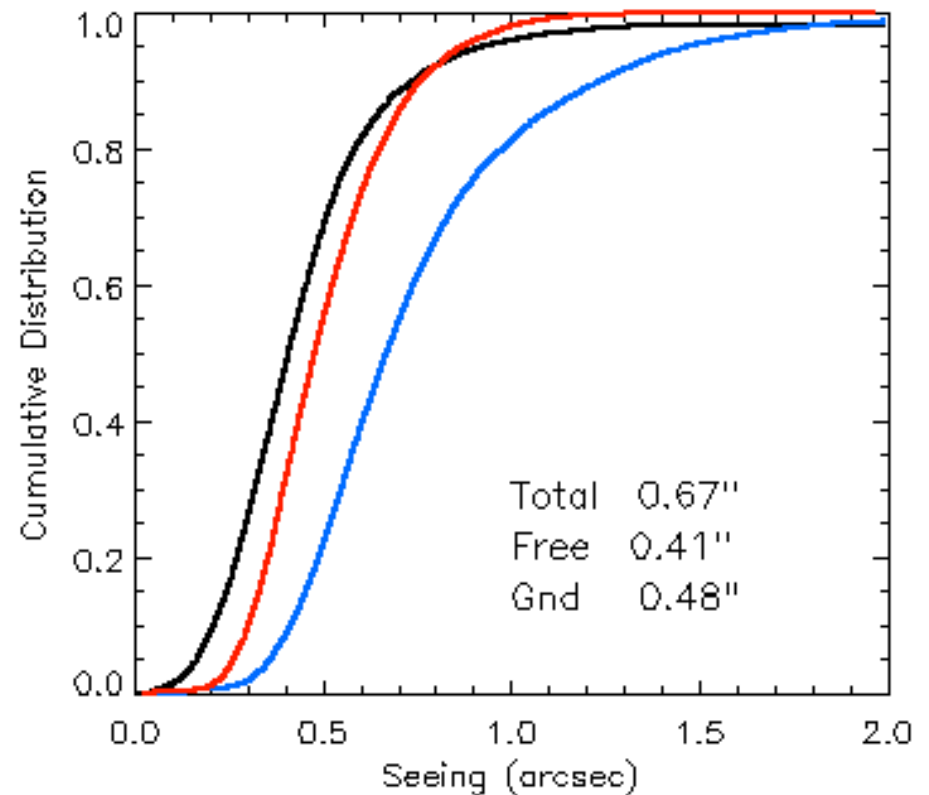
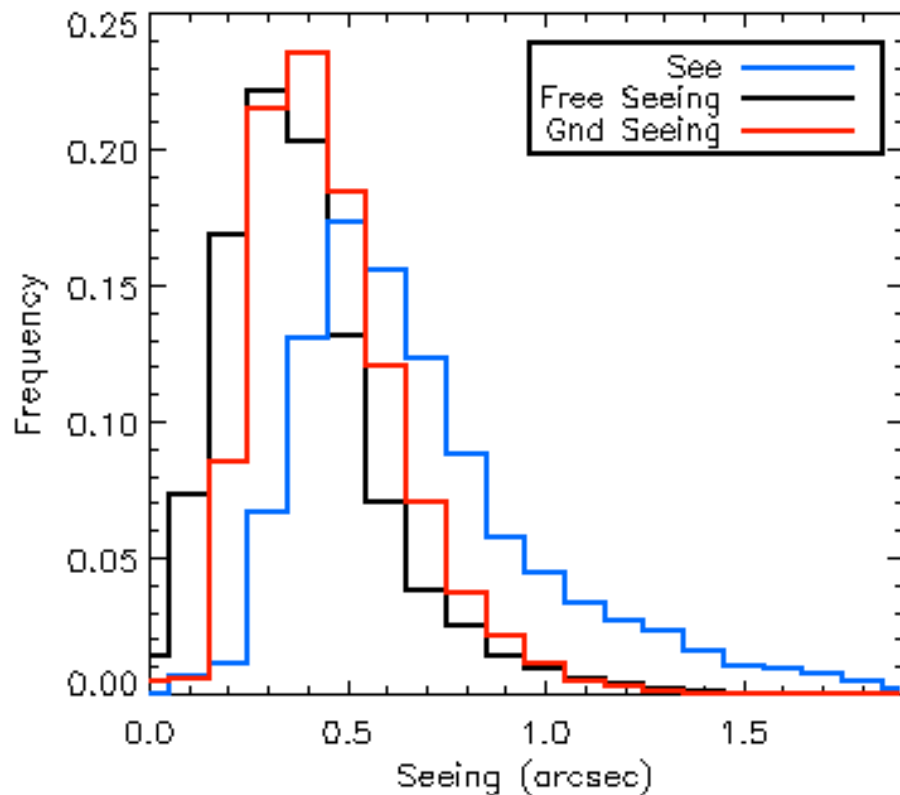
# GL morphologies



# GL and FA Seeing

## MK Seeing Distributions (SLODAR/LOLAS)

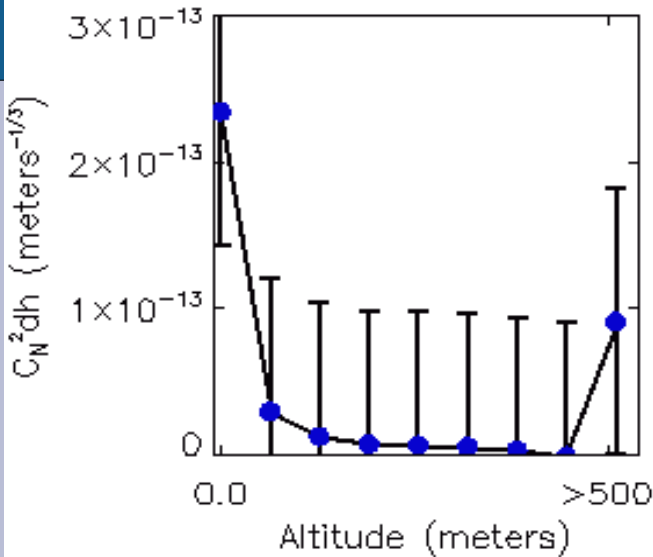
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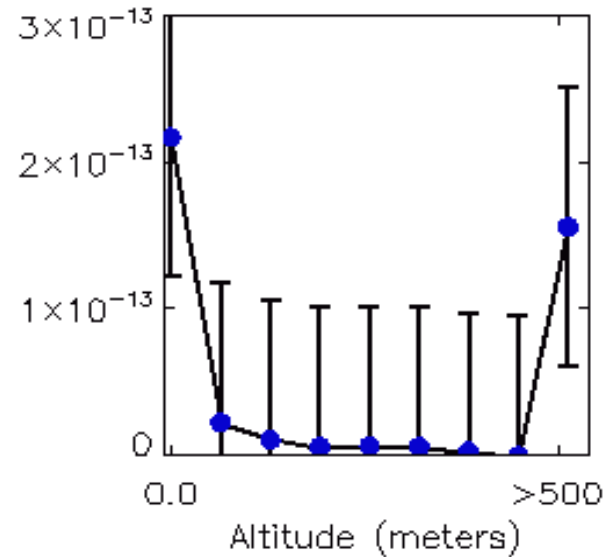
# Example Profiles

FA-seeing Quartile Profiles

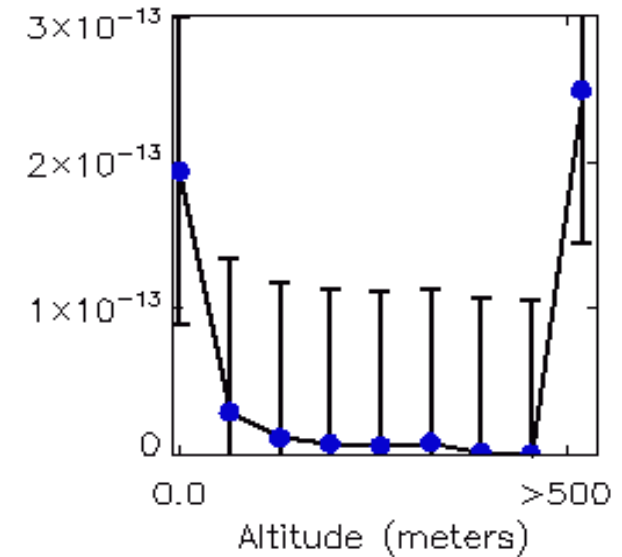
25% best



Median



75% worst



- The GL is uncorrelated with FA
- The GL profile 0-500m is very stable

# Next few months...

- Build up LOLAS data base
  - Interleaving sets of SLODAR/LOLAS
  - LOLAS with wide pairs
    - Try to understand first 100 meters.
    - First element is at the altitude of the top of Gemini dome.
  - Temporal analysis
    - turbulence velocity analysis
    - As expected,  $v_{GL}$  looks to be well correlated with ground winds

# Related talks...

- Remy Avila: “Low Layer SCIDAR: a turbulence profiler for the first kilometer with very high altitude-resolution”
- Aziz Ziad: “MOSP: Monitor of Outer Scale Profile”
- Richard Wilson: “SLODAR turbulence profiling”



# Ground vs. Free Seeing

