



Cornell University

CALTECH



Lessons from Contemporary Radio Telescopes

Simon Radford

Large Submm Atacama Telescope

Caltech

2005 January 8

Contemporary Telescopes

- IRAM 30 m
- IRAM 15 m / SEST
- JCMT
- CSO / OVRO
- BIMA
- SMA
- GBT
- LMT
- SPT
- HHSMT
- ALMA Vertex / APEX
- ALMA Alcatel
- ALMA J
- ASTE

Figure of Merit

$$D/\sigma$$

- Single parameter
- Measure of difficulty
 - Largeness
 - Smoothness
- Assume other qualities commensurate

	D m	σ μm	D/σ $\div 10^5$	σ/D $\times 10^5$	arcsec
LSAT	25	10	25	0.04	0.08
LSAT	25	18	14	0.07	0.15
HHSMT	10	12	8	0.12	0.25
CSO †	10	13	8	0.13	0.27
LMT †	50	70	7	0.14	0.29
APEX	12	18	7	0.15	0.31
SPT	10	20	5	0.20	0.41
SMA	6	12	5	0.20	0.41
JCMT	15	35	4	0.23	0.48
GBT ‡	100	240	4	0.24	0.50
CSO	10	25	4	0.25	0.52
IRAM	30	75	4	0.25	0.52
GBT †	100	390	3	0.39	0.80
IRAM	15	60	3	0.40	0.83
GBT	100	1200	1	1.20	2.48

Current State of the Art

$$\sigma/D \approx 0.3 \text{ arcsec}$$

- (more) Passive: HHSMT, APEX
- (more) Active: CSO, LMT
- Active surface improvement by 2–4
 - CSO, GBT
- LSAT goal $\sigma/D \leq 0.1 \text{ arcsec}$

Agility

- On the fly mapping
- Sweeping across source to reduce atmospheric fluctuations
- No noise penalty for fast readout
- Don't need to point and stare cf. CCD
- $0.5 - 1 \text{ }^\circ \text{ s}^{-1}$ motion (Holdaway)

Active Structures

- Most of these telescopes incorporate some active systems to improve pointing, etc.
- CSO, GBT (and LMT) have active surfaces
- Open loop, using look up tables
- Gravity, thermal gradients, wind
- Principle distortions are large scale
- To date, no closed loop systems (GBT)
- No active optics – wavefront sensors, etc.