



UNIVERSITY OF
CAMBRIDGE

Stuck at the crossroads: where to now in interferometry implementation?

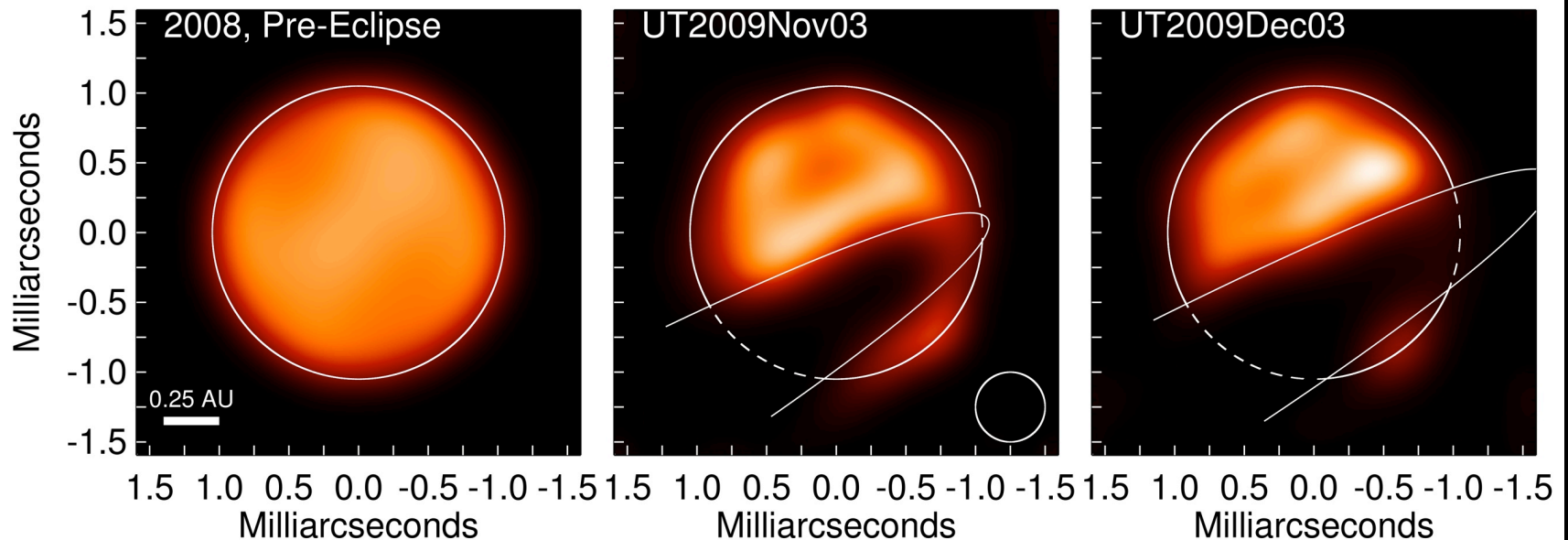
David Buscher

Chris Haniff

WHERE ARE WE NOW?

Interferometric science has made great strides in the last decade

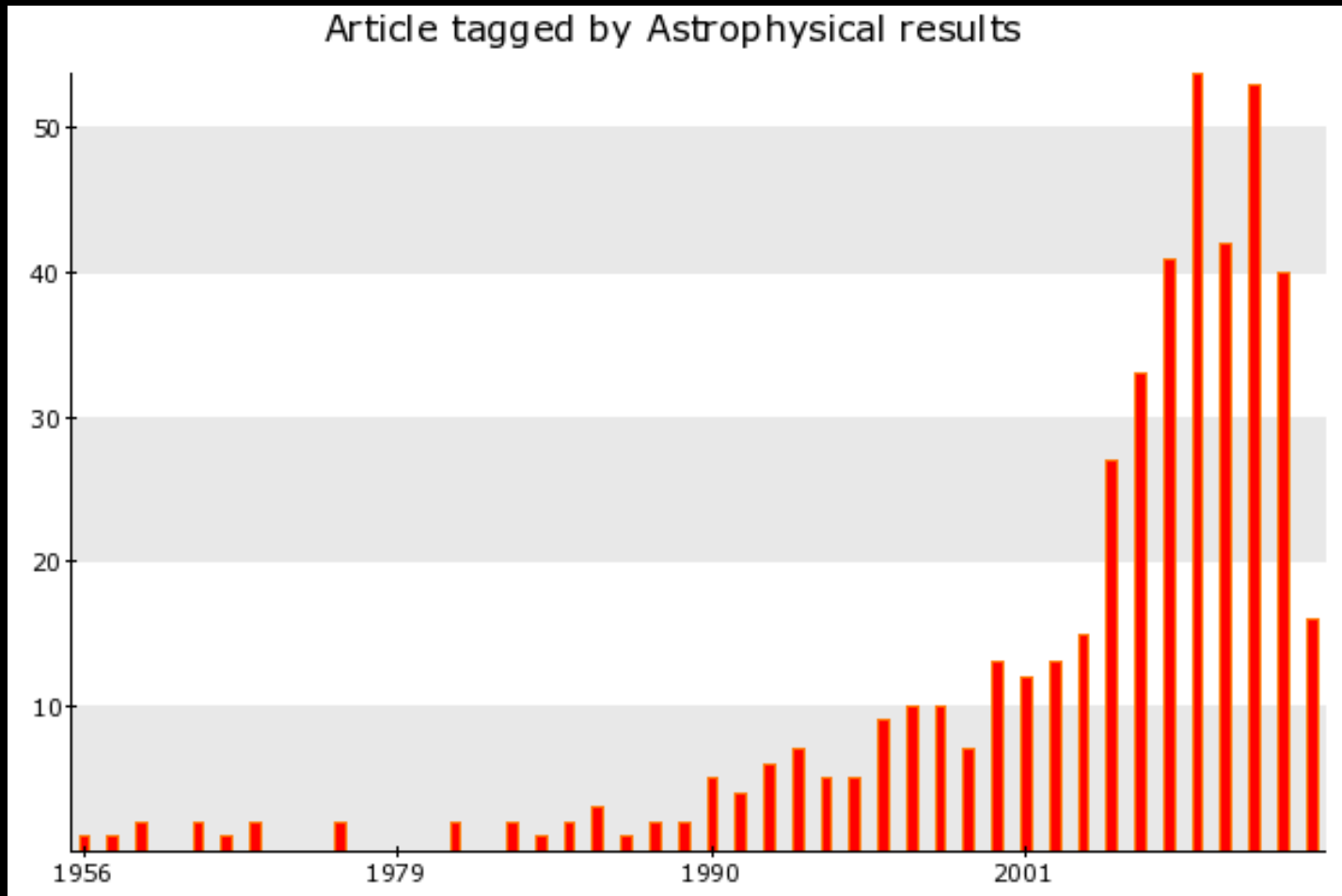
Epsilon Aurigae Eclipse (CHARA-MIRC)



Technical progress has not been as good

- Limiting magnitude
 - 2003 (IOTA) $K=7$
 - 2013 (VLTI/CHARA) $K \sim 9$
- Imaging/number of telescopes
 - 2003 (NPOI) $N=6$
 - 2013 (CHARA/NPOI) $N=6$
- Max baseline
 - 2003 (CHARA) $B=330\text{m}$
 - 2013 (CHARA) $B=330\text{m}$

Science output is stagnating



Where will we be in 2023?



We are becalmed



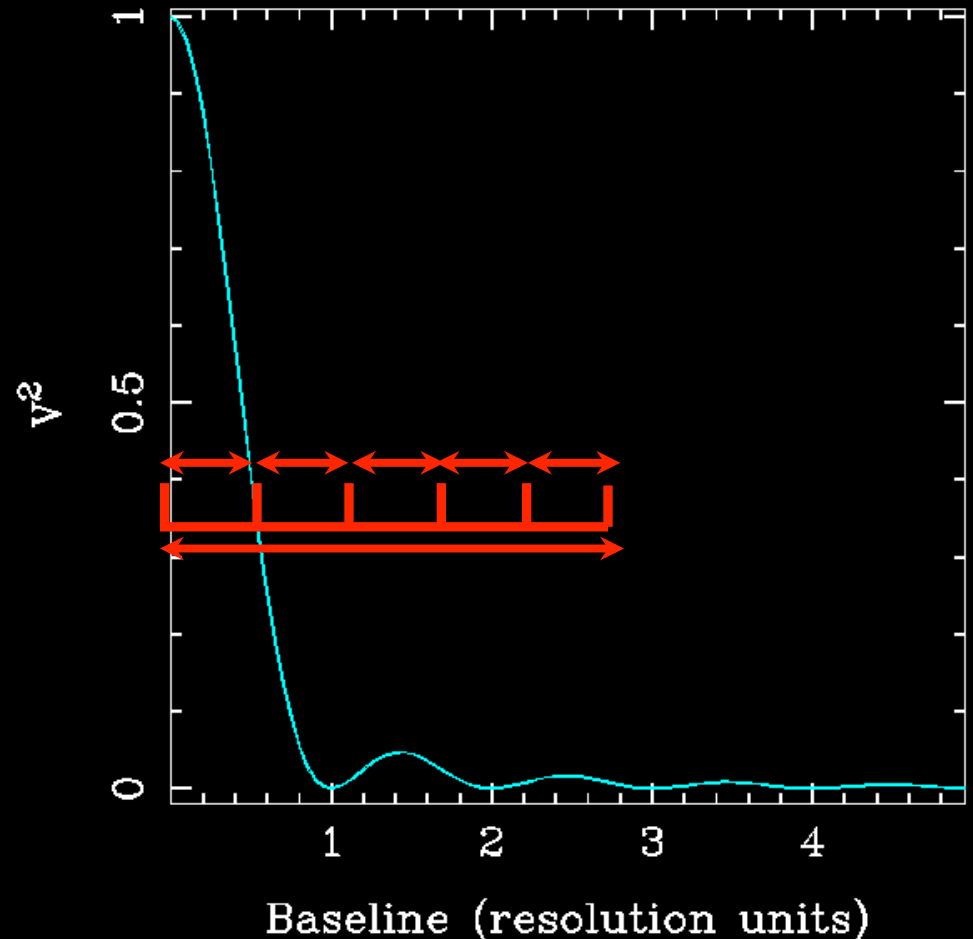
New science will come from new technical capabilities

- Better imaging (not astrometry)
- Fainter targets
- Longer baselines
- Higher dynamic range
- ...

**WHERE WILL TECHNICAL
IMPROVEMENTS COME FROM?**

Imaging needs more telescopes

- Number of u-v points
- Baseline bootstrapping
- Use parallel combiners for large N



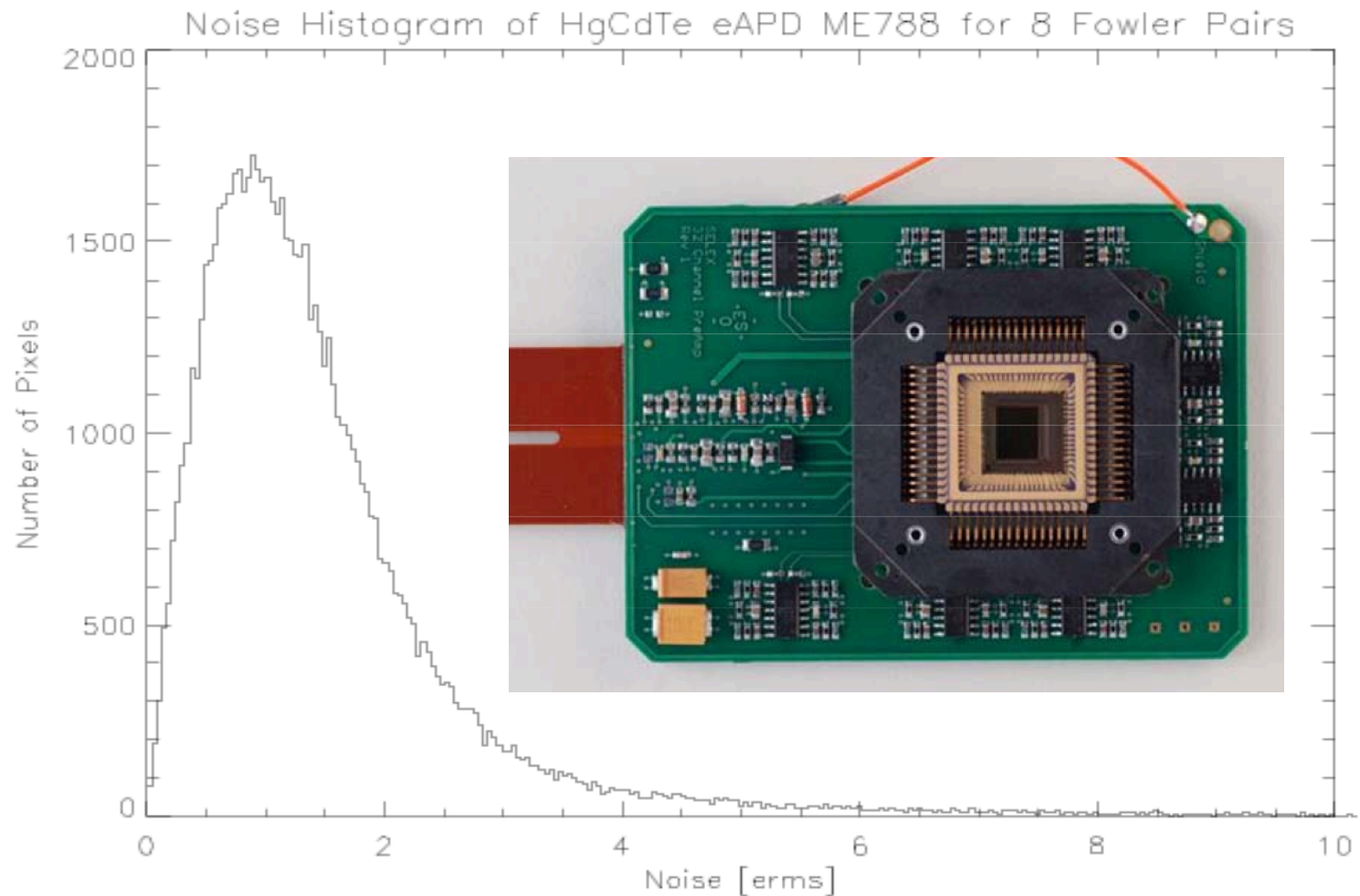
Imaging needs movable telescopes



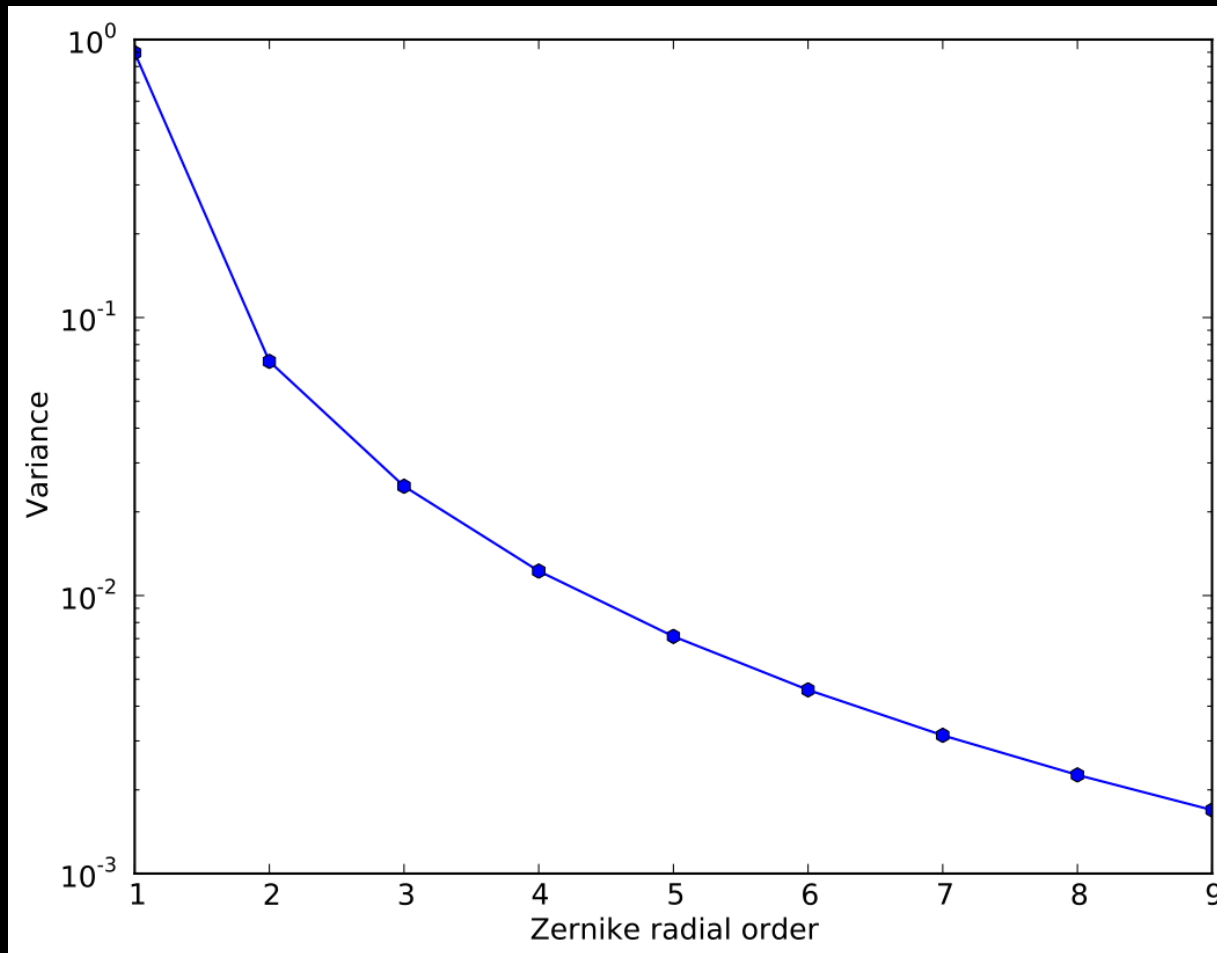
To go faint we need to be able to drive the active systems

- Limiting factor is fringe acquisition/tracking
- Good seeing (spatial/temporal) is a must
- Infrastructure must preserve the coherent photons

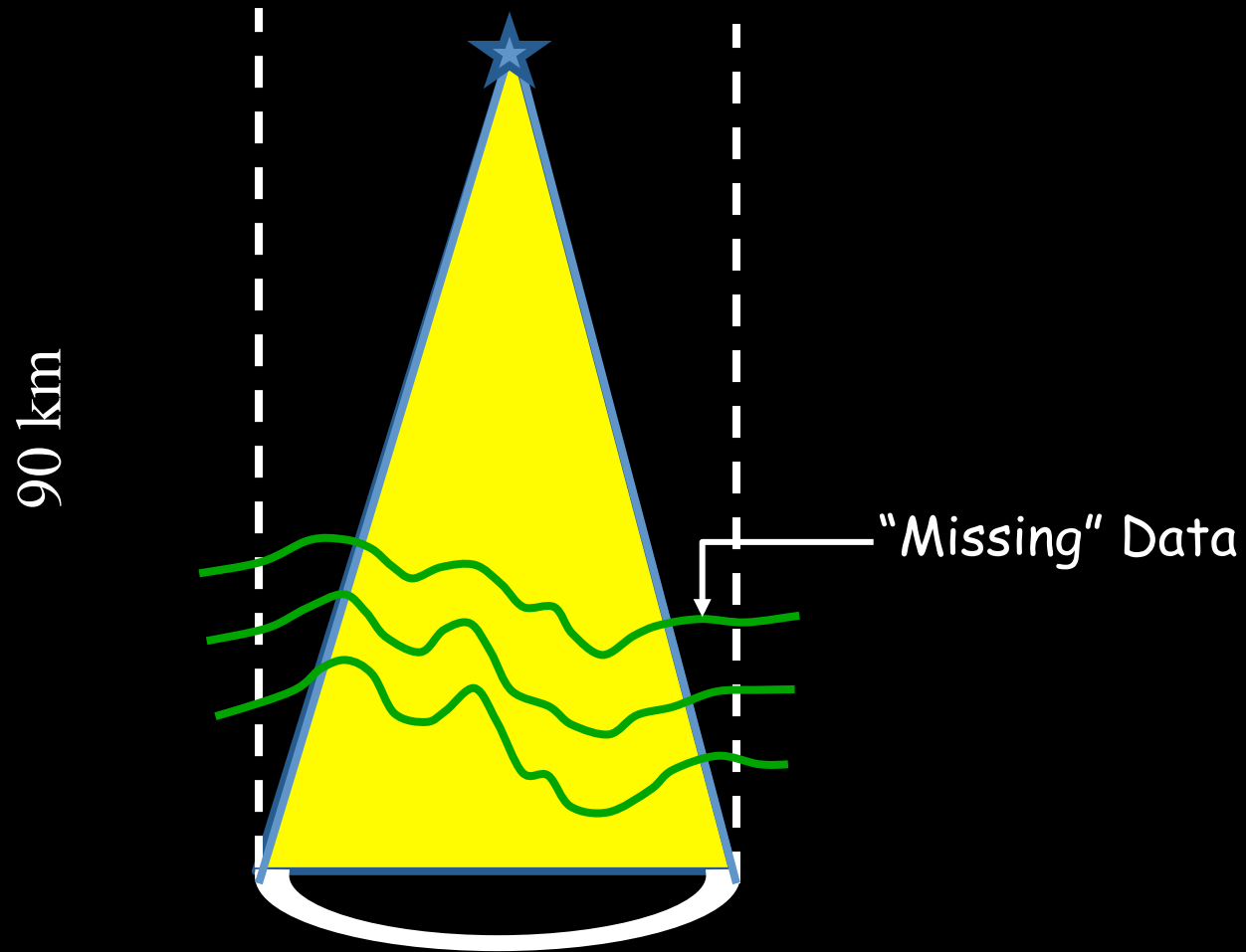
We can go fainter now



Bigger telescopes need more photons to drive the A0



Laser guide stars can help



Cost per telescope becomes a limiting factor

- Telescope + enclosure + foundation costs scale as $\sim D^2 - D^3$
- Lightweight telescopes?
- Wind loading → enclosure & foundation costs will then dominate



Longer baselines require only a
suitable site



A vision for a mid-scale array

- R-L band operation, spectrally-dispersed
- 10-15 movable telescopes
- 1.5-2m diameter
- Low-order NGS AO
- eAPD spatially-filtered fringe tracker, $H \sim 14-15$
- Max baseline $\sim 500\text{m}$
- Good seeing

Inter-continental collaboration will be needed

- Cost ~ \$100M
- US decadal will come too late
 - NSF Mid-scale
 - Private funds
- ESO will be overrunning on E-ELT
 - Institutional funds?
 - Go direct to EU?
- Chinese involvement?

Using a developed site will make
significant savings



