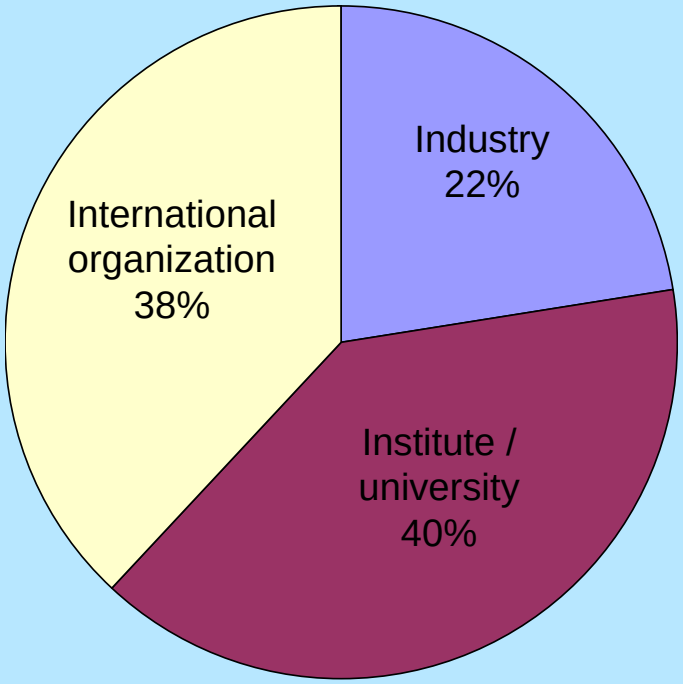
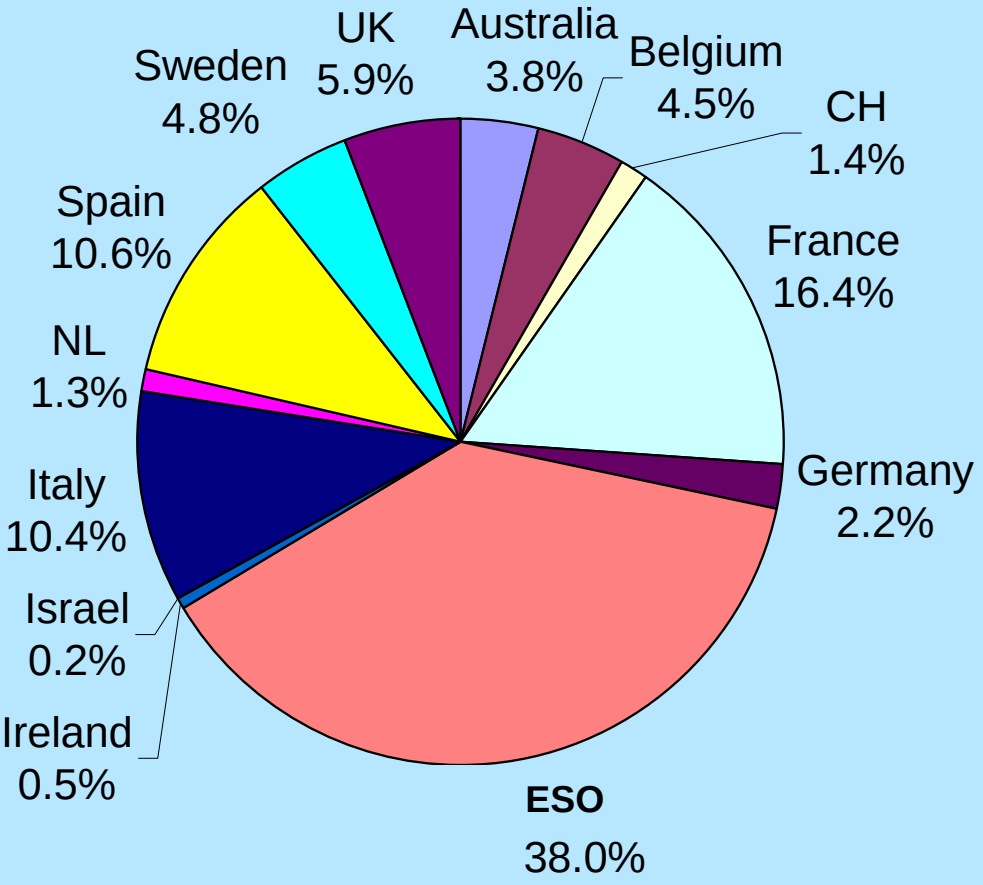

Extremely Large Telescope
Design Study
OPTICON Firenze Meeting
8-10 November 2004

ELT Design Study Original Proposal

- What? *Enabling Technology Development common to any ELT*
- Why? *will provide:*
  - Preparatory work for design & construction
  - ELT Top Level requirements
  - Academic & Industrial Synergy
  - Follow-up of OPTICON technical developments
- How? *an FP6 Proposal:*
  - 39 partners, 47 Work Packages
  - 42 M€ total, 22 M€ requested to EC
  - Timescale 2005-2008

Shares, in % of total estimated budget
(Initial Proposal)





Project Organization

Steering Committee

Project Coordinator
Gilmozzi
[01000]

Technical Advisory Committee

Project Scientist
Salinari, deputy Hook
[02000]

Project Manager
Dierickx, deputy Ardeberg

Project Controller
NN

Secretary
NN

Wavefront control
Noethe,
deputy Devaney
[04000]

Optical fabrication
Dierickx, deputy
Walker
[05000]

Mechanics
Brunetto,
deputy NN
[06000]

Control
Wirenstrand,
deputy Wallace
[07000]

Enclosure &
Infrastructures
Pescador, Quattri
[08000]

Adaptive Optics
Ragazzoni,
deputy Hubin
[09000]

Operations
Spyromilio,
deputy Bridger
[10000]

Instrumentation
Russel, Quirrenbach,
Bacon, Redfern
[11000]

Site selection
Vernin, Muñoz,
Sarazin
[12000]

System Layout,
Analysis & modelling
Andersen, Koch
[13000]

Initial Work Breakdown Structure

#	Title	Lead / Deputy	Budget	EC Request
01	Management	ESO / LUND	1,299	1,147
02*	Science requirements	INAF / Oxford	227	79
04	Wavefront Control	ESO / Grantecan	8,652	4,485
05	Optical fabrication	ESO / UCL	4,590	2,344
06	Mechanics	ESO / t.b.d.	2,918	1,741
07	Control	ESO / Starlink	2,138	1,105
08	Enclosures	Grantecan / ESO	2,717	1,343
09	Adaptive Optics	INAF / ESO	11,513	4,816
10	Science Operation	ESO / UKATC	498	249
11	Instrumentation	UKATC / Leiden / INSU / Galway	2,455	1,310
12	Site characterization	LUAN / IAC / ESO	2,521	1,410
13	Integrated modelling	LUND / ESO	2,160	2,029
	TOTAL k€		41,686	22,058

** : OPTICON Work Package*

Settling down the Contract

- **Mandatory Goal (on EC side):**
  ⇨ fully keep objectives despite only 8 M€ EC funding
- **Basic Strategy:**
  ⇨ more funds from partners ☺
  ⇨ severe WP cuts …. keeping deliverables! ☹
- **5-pronged Approach to cuts:**
  - Focus activities tightly
    e.g. merge 100-m scale atmosphere studies in WP 04 & 12
  - Relaxed Specs with best effort upgrades → **if EC OK!**
  - Less alternatives → **trading cost versus risk**
    e.g. no more Al mirrors
  - Priority to urgent/generic items, *e.g. less on enclosures*
  - Use complementarities with our “coopetitors”
    e.g. leave Coatings to TMT; ⇗cooperation with US

Engineering WP - Overview

#	Title	Topics	Prototypes
04 07	*WF Control* * Control	Phasing, actuator, metrology, PSF Structure, XX-Imaging	APE, WEB
05	Optics	SiC Mirrors	1-m Segments
06	Mechanics	Composites, Maglev	Friction Drives
08	Infrastructure	Enclosures, Wind Analysis	
09	*Adaptive Optics* *	AO Components & Concepts	DM, Algorithms
10	Operations	System Operations	
11	*Instruments* **	Point designs, Concepts, ADC	
12	*Site Studies* *	Site measurements, Modeling	Test equipment
13	Systems	Integrated modelling tools	

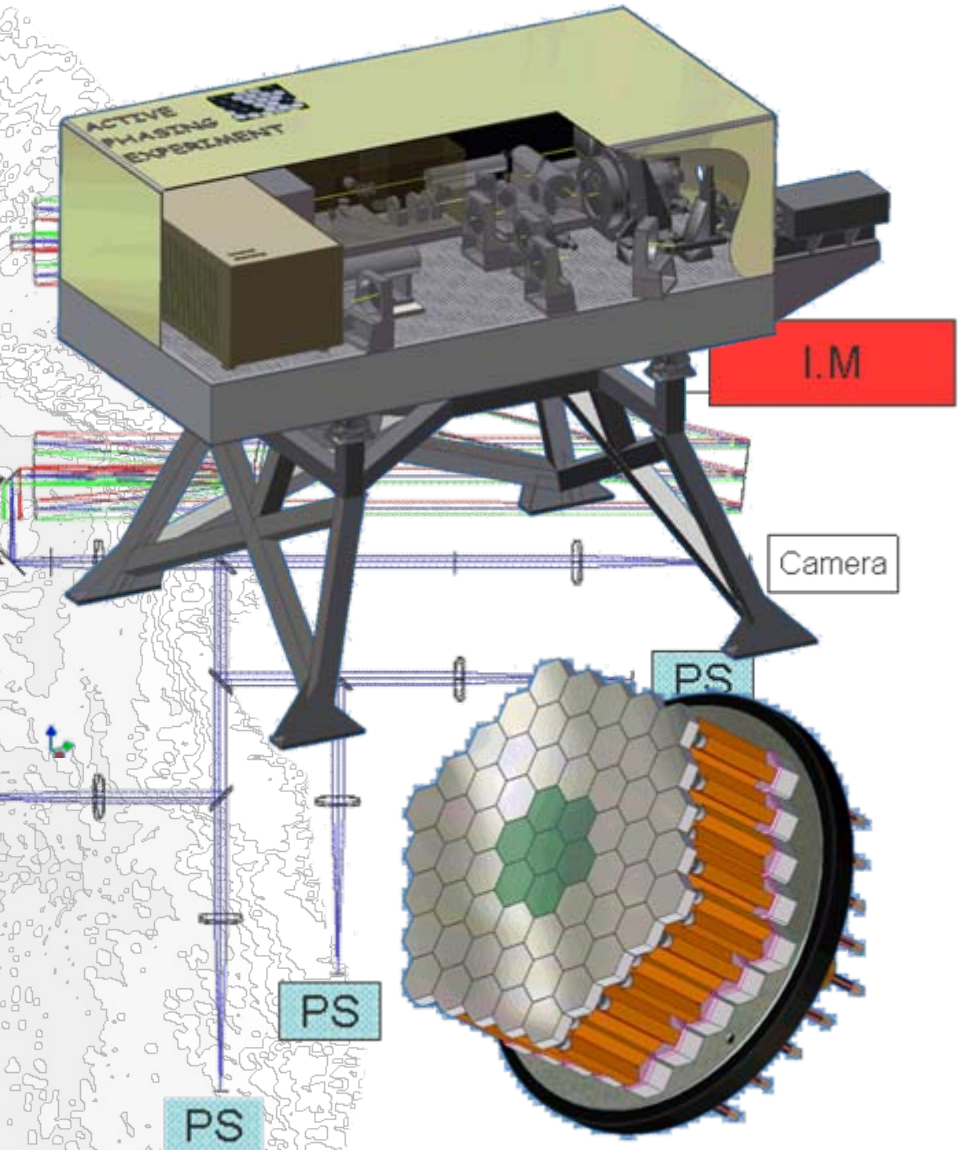
* *1st gen. studies under OPTICON* ** *"warm-up" under OWL Phase A*

Evaluate alternative phasing techniques

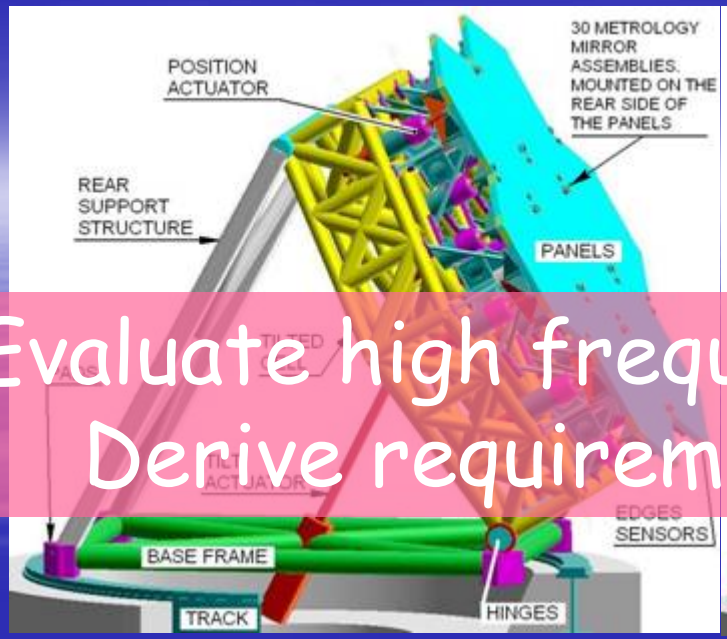
APE

SCOPE :

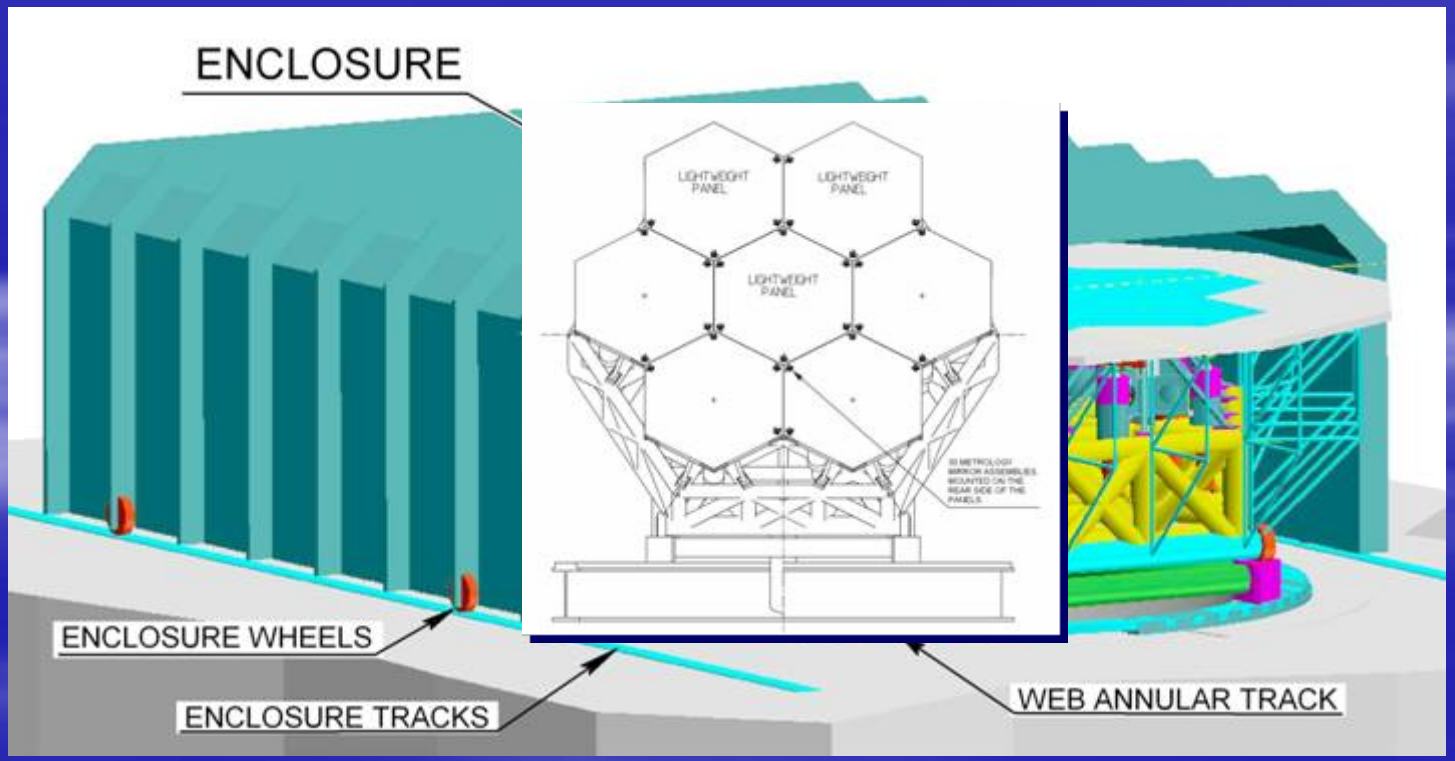
- **Compare the performance of 3 types of wavefront sensors :**
  - **Curvature**
  - **Mach-Zehnder**
  - **Pyramid**
- **within an active optics system which corrects simultaneously Segment and Telescope misalignments, plus deformation of thin meniscus mirrors.**
- **Includes control software testing**



WEB



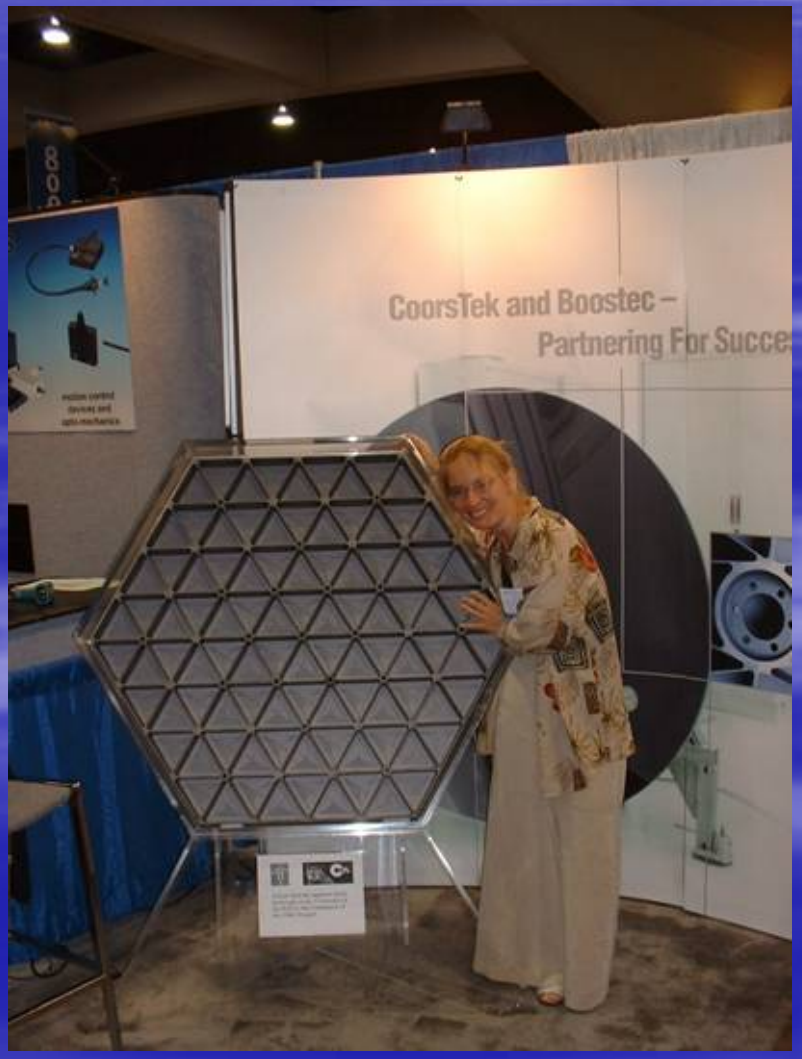
Evaluate high frequency wind effects
Derive requirements & solutions



Silicon Carbide prototypes

Adopt or reject a huge novelty in main optics

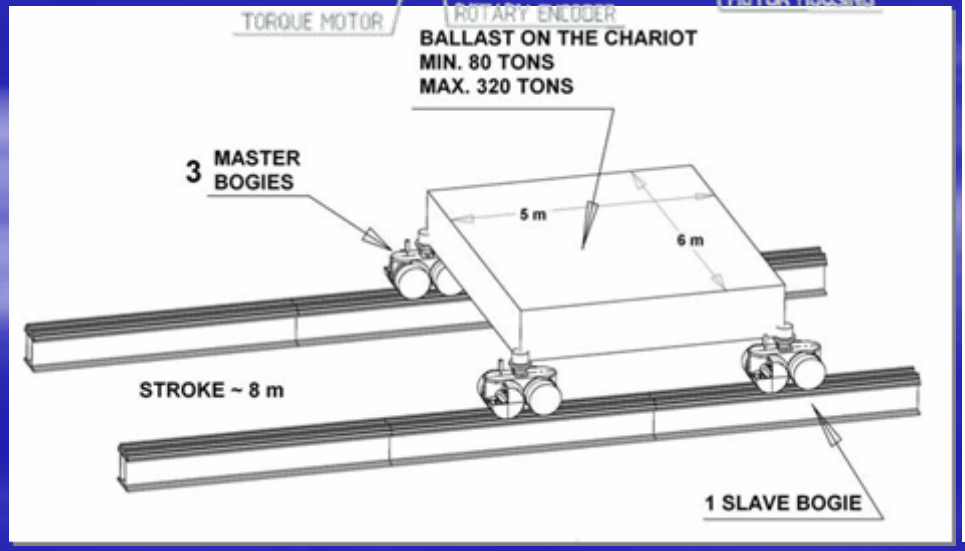
- 8 x 1-m class, different over-coating
  ⇨ 4 blanks already delivered
- Explore over-coating & figuring, check for bimetallic effects
- Huge Advantages over glass
  - stiffer, lighter, better heat transfer
  - higher control bandwidth
  - lighter, stiffer telescope structure
  - well developed, space-qualified
  - potentially cost-effective
- BUT needs full qualification for ELTs

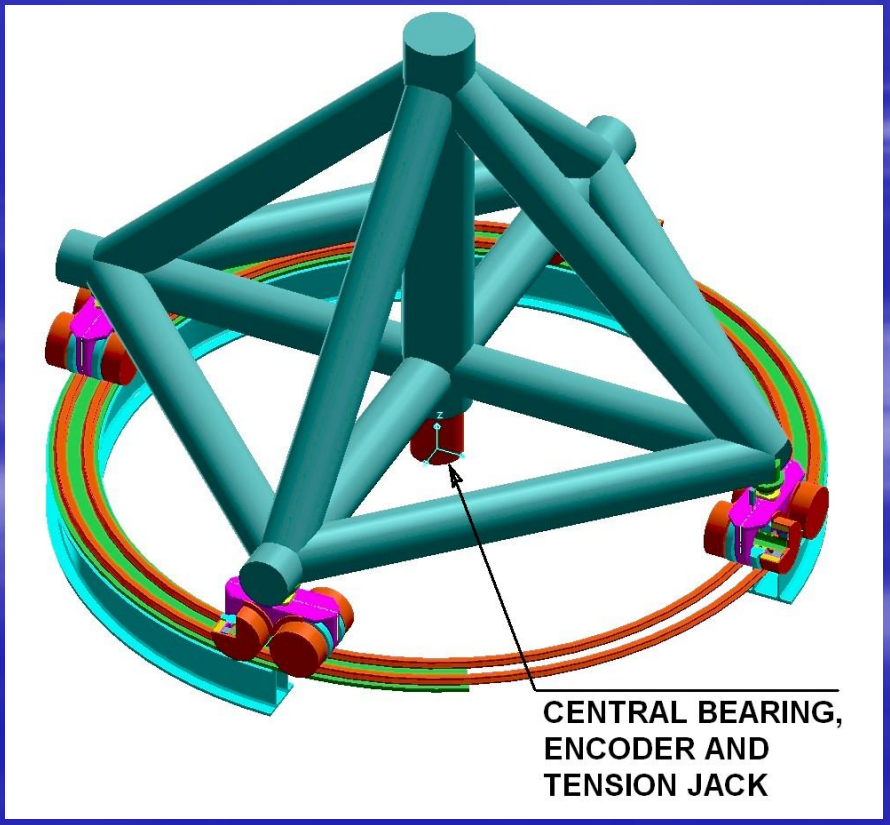


Friction drive breadboard

A mandatory development

Hydraulic pads/tracks not an option !

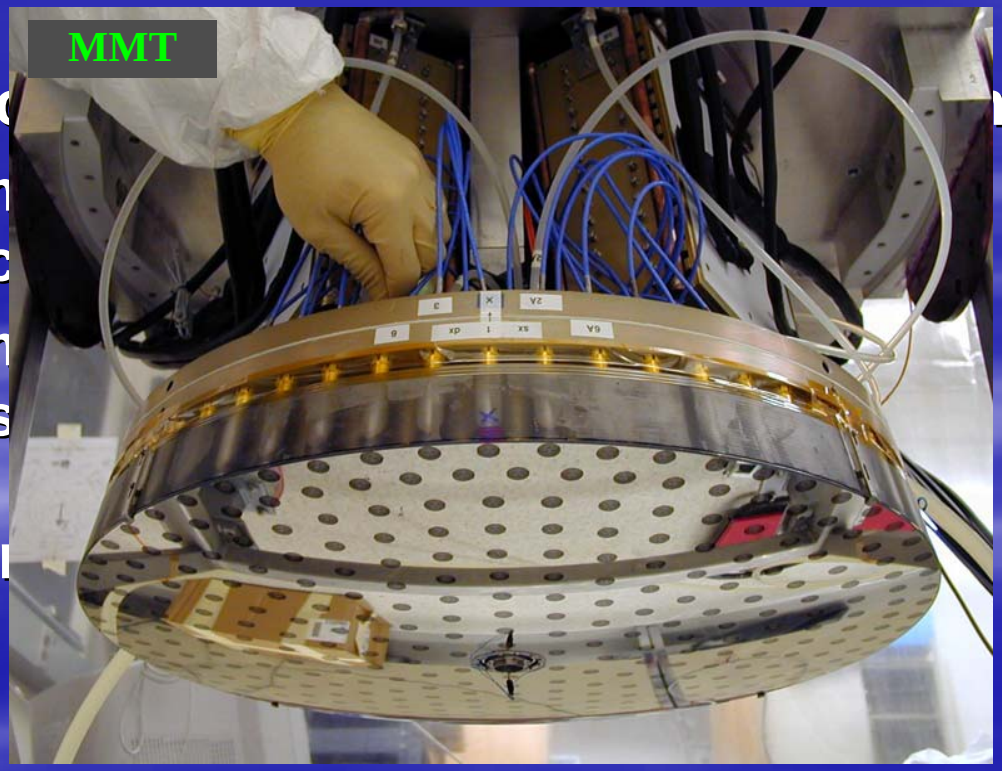




Large Deformable Mirrors

A prerequisite technology for any ELT

- building on the Arcetri et al. development success
- Two wo ding directions
  - 2-4 m
    - ⇨ sc
  - 1-2 m
    - ⇨ es
- Likely



Generic versus specific developments

- most ELT-DS developments essentially generic
  - Site Studies
  - Wavefront Control + Phasing; Wind Effects
  - Optical & Mechanical Materials; Telescope Drives
  - Integrated aspects: Science operation, Telescope System

- Still largely true for Instruments & AO Systems

  ⇨ despite wide size range: 30 to 50 to 60 to 100-m

ELT Instrumentation & AO Systems

Size / Parameter	100-m	60-m	30-m
λ domain	K' – H cryogenic	H – J ~ cryogenic	J – z non cryogenic
A.O.	10x 10^3 act. 400 Hz NGS → LGS	6.9 x 10^3 act. 570 Hz ~ LGS	4.2 x 10^3 act. 870 Hz LGS
F/ (Imager) F/ (IFS)	F/17 F/1.7-3.4	F/22 F/2.2-4.4	F/33 F/3.3-6.6
Detector	IR Array	IR Array	IR Array/CCD


Extremely Large Telescope
Design Study
PROPOSAL UPDATE

Iteration mechanism

Project Office

Guidelines & directives
Draft scope of work
(Annex I to contract)

3

Compile WPs, participants / EC contrib.
Check impact on participants,
Check with EC
Update scope of work
Update directives

6

Compile 2nd iteration
Compile participants / EC contributions
Get participants feedback
Final guidelines & directives

9

Final update of WPs / scope of work
Get participants approval
Submit to EC

1 (top-down)

2 (feedback)

4

5 (feedback)

We are here

7

8 (feedback)

Dec. '04 EC deadline

WP budget iteration
WP scope iteration

WP budget iteration
WP scope iteration
WP re-organization

WP budget iteration
WP scope iteration
WP re-organization

WP Managers

Status as of end October

- 2nd Iteration feedback from WP (12 Nov. deadline)
- Financial Status
  - Request to EC: 13.2 M€ beg. Oct.; 9 M€ as 12 Nov. target
  - 22 M€ expected partners contribution
    ⇨ major increases (ESO, PPARC, IAC) but some uncertains
    ⇨ significant decreases: INAF, INSU, Fogale† (SME)
- Technical Status
  - Relatively little de-scoping: WP Managers resist (good if not always helpful)
  - Work already started by partners, but date for 1st EC funding date bound to be later than official 1/1/05 DS kickoff)

It will work, but it's tough & … moderately rewarding

ELT Design Study

A large European(…+) R&D effort towards ELT enabling technologies

building on the current OPTICON R&D effort on advanced technologies for the present 8-10 m. class Telescopes

with close links to parallel efforts on the other side of the Atlantic, e.g. thru the AURA-ESO MoU & the Italy-US large deformable mirrors joint development