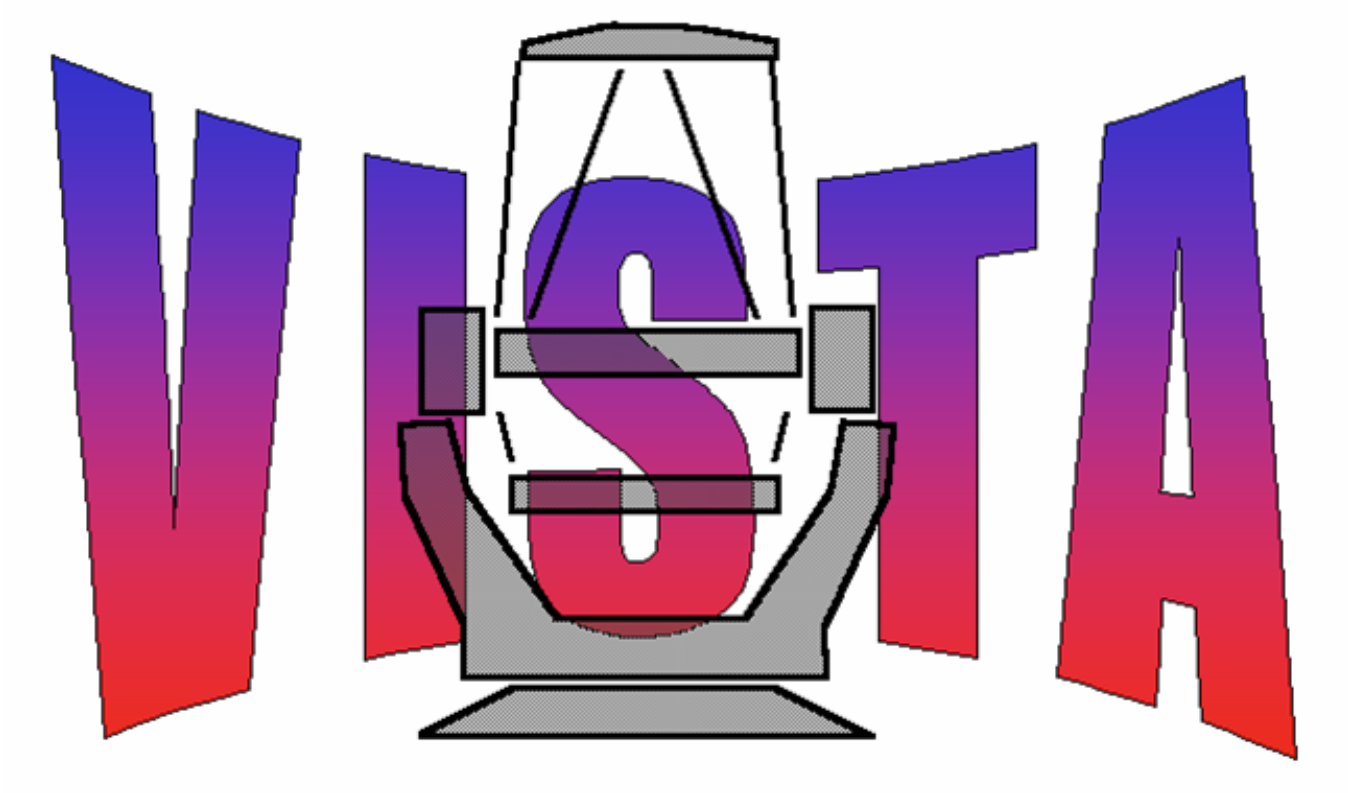


VISTA and its capabilities

Jim Emerson

VISTA Principal Investigator
Queen Mary University of London

What is VISTA for?

Multicolour wide field imaging

- Find objects for 8-metre telescopes to study in detail
- Do science from surveys
- In Southern hemisphere
- In near-IR (Z,Y,J,H,Ks)
- In Visible (subject to funding of DarkCam)

Survey Speed

Surveys need to be FAST: Needs Depth & Area

- Depth: large primary
- Depth: good image quality & small pixels
- Depth: Good site
- Depth: high throughput
- Area: large FOV without impacting the above

VISTA Basics

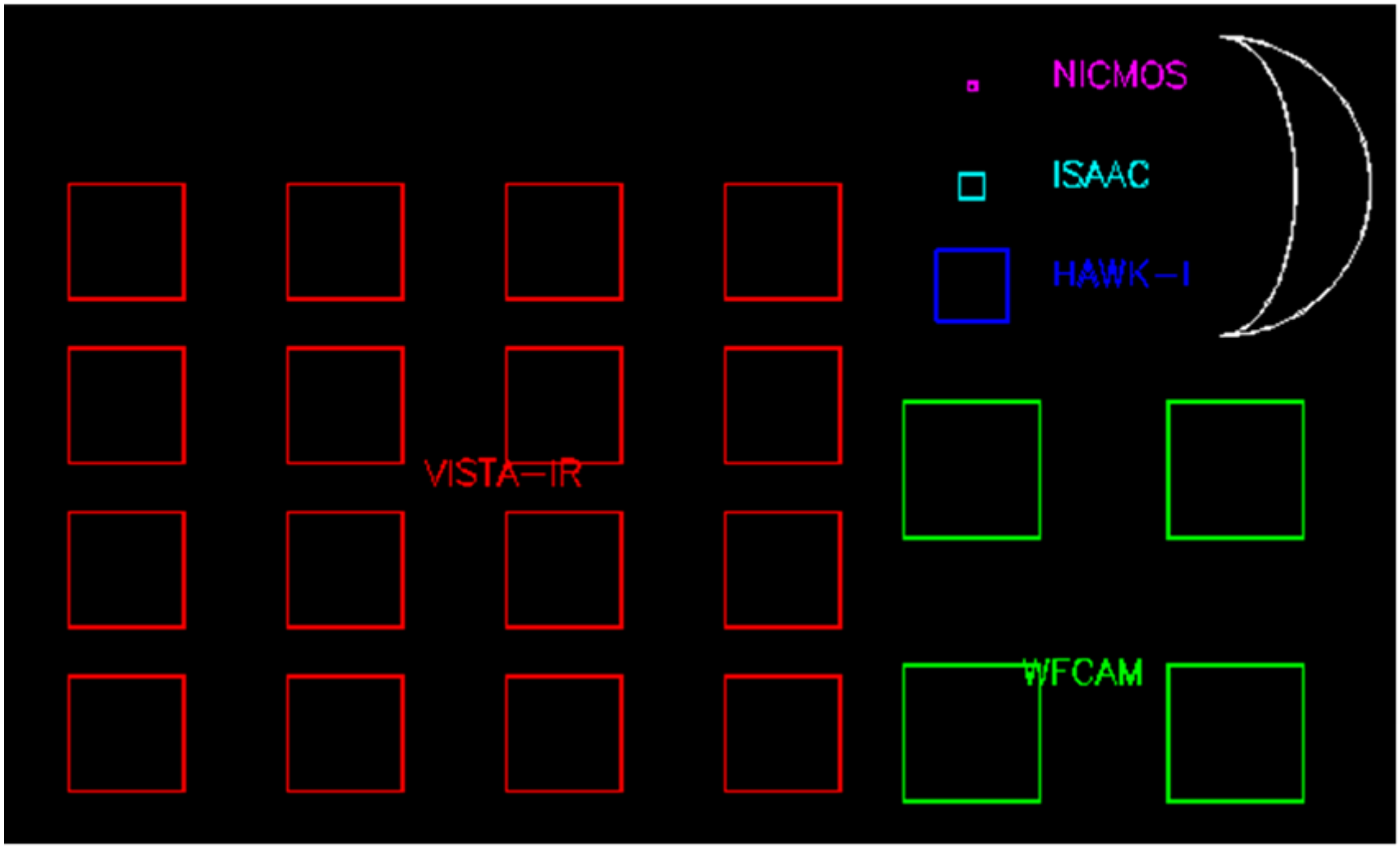
Sky depth (A)

- 4m primary mirror
- Optics design + focal plane with 0.34”/pixel VIRGO detectors (HgCdTe 0.84-2.5μm) from Raytheon
- ESO’s Cerro Paranal Observatory
- Good QE even at short IR wavelengths => ZYJHKs

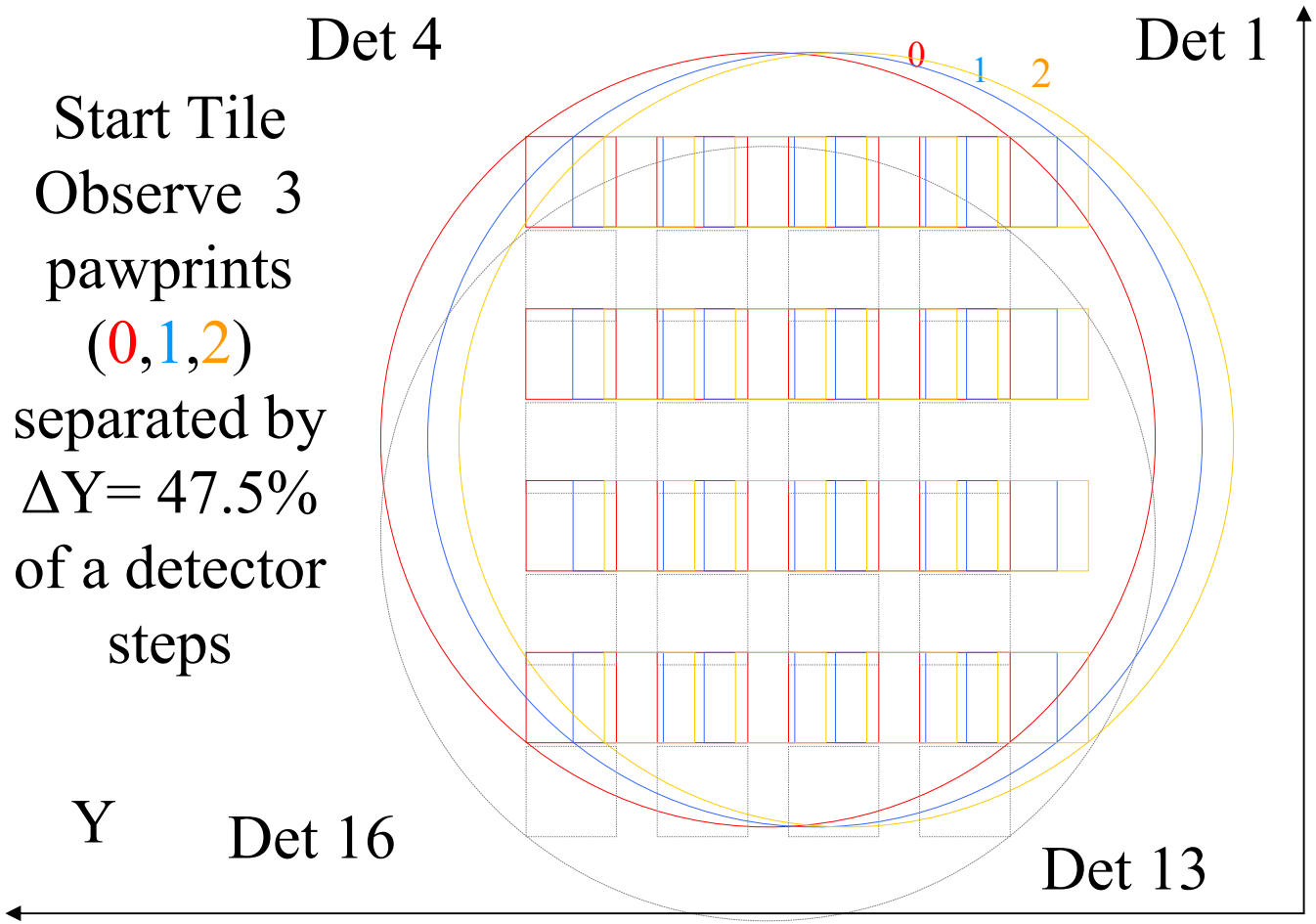
Sky area (Ω)

- 1.67 degree diam IR FOV–> sky area at focal plane
- Current IR detectors not buttable
  - At least not buttable enough to make it worthwhile
- 4x4 sparse array of 2x2k pixel VIRGOs -> 0.6 deg^2 ‘pawprint’ => 1.5 deg^2 tile (next slide)

Near-IR Bands & Pawprint



Tiling - Infilling the Pawprints

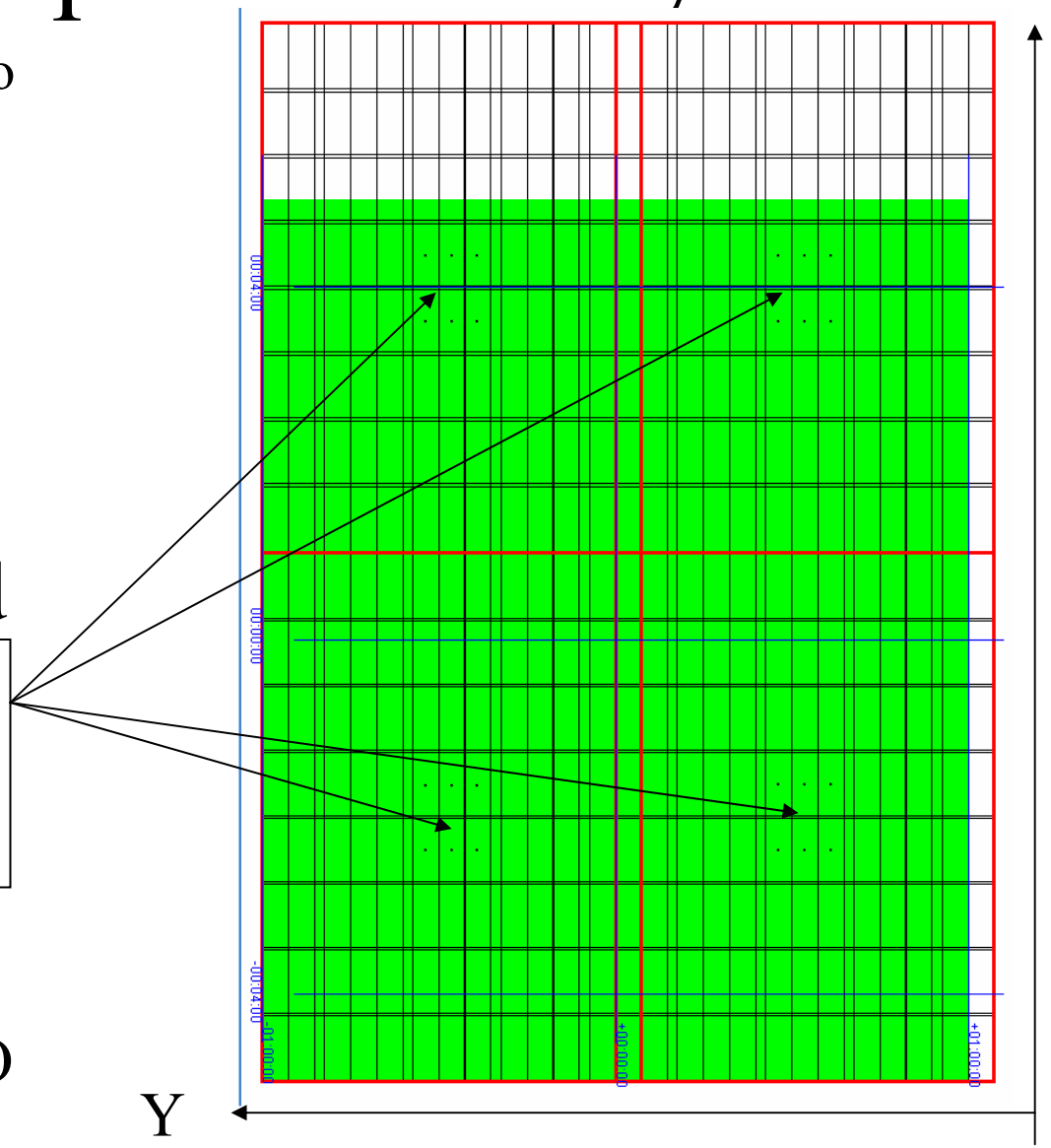


After 3x2=6 steps 1.5 x 1.0 deg^2 sky is (almost) uniformly tiled (by 2 pixels) except at edges

Detector pattern on sky

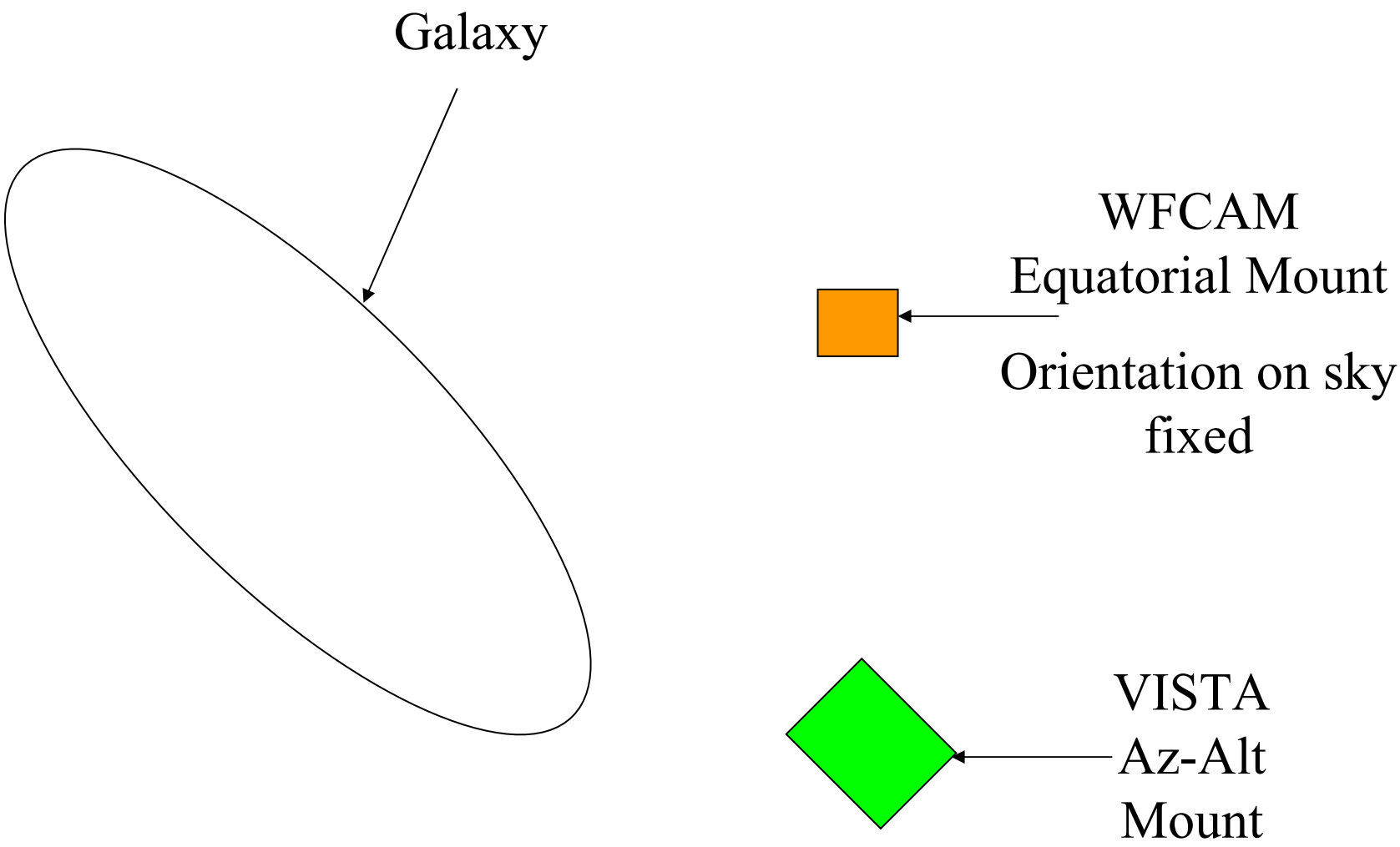
- Required: 2.5°x 2.0° (green shaded)
- Made of 4 tiles (red outlines)
- Achieved (outer red outline)

Optical axis Positions



Plot from Survey Area Definition Tool – to be delivered to ESO

VISTA cf WFCAM



Exposure Time Calculator

to be delivered to ESO

VISTA IR Camera: Exposure Time Calculator

Input Flux Distribution

(•) Power law:
Type: f_lambda
alpha: -2.0
( ) Blackbody:
Temperature: 10000 Kelvin
( ) Single line:
Wavelength: 1500.0 nm (in the range [900.0-2500.0] nm)
Flux: 1.0e-16 ergs/s/cm2
Width: 1.00 nm

Object Magnitude: (•) Vega: Value: 18.00 (per square arcsec for extended sources)
( ) AB: Value: 18.00
( ) Flux: Value: 1.0e-13 (ergs/s/cm2)

Spatial Distribution:
Aperture: 2.0 arcsec (diameter)
(•) Point Source
( ) Extended Source

Instrument Setup

Filter: J

Sky Conditions

Brightness: mag/arcsec2 [default dark sky: J = 15.6 H = 14.4 Ks = 13.2]
Airmass: 1.20 sec z
Seeing: 0.80 arcsec
Extinction: 0.05 mag/unit airmass

Observing Setup

Detector on-chip integration (DIT): 10.0 seconds
(•) Object exposure time: 60.0 seconds
( ) S/N Ratio: 20.0
( ) Observing Strategy:
Exposure coadds (Ndit): 6
Exposure loops (Nexp): 1
Microstepping pattern (NxM): 1x1
Jitter pattern (Njitter): 1
Number of pointings (Npaw): 6

Expected Performance

Filter	Adopted Sky Brightness (mag/square arcsec)	Number of exposures	15 min/5-s limit
Z	18.5	15	23.8
Y	17.2	15	22.5
J	16	90	22.2
H	14.1	90	21.0
K_s	13	90	19.8

- Assuming: 1.2 airmass,
- median seeing 0.66” at 0.5μm,
- photometry in 1.6 ” diameter software aperture.

How fast will it survey?

- Active optics runs “concurrently”, no overhead.
- Overheads on a tile depend on adopted combination of filter changes, jittering, tiling,
- Typical observing minute: 6 x (integrate - 10s + readout - 1s), coadd + save, jitter move - 3s, guider lock - 1s, repeat => 70 seconds
- Exposure Time Calculator also calculates survey efficiency for given observing strategy. (ignoring time in telescope slews to next observed field) .

(UK-centric) ground based wide field survey facilities

- In North (Hawaii & La Palma)
  - IR: WFCAM on 3.8m UKIRT, 0.2 □deg
  - Visible: WFC on 2.5m INT, 0.3□deg
- In South (ESO)
  - IR: VIRCAM on 3.9m VISTA, 0.6 □deg
  - Visible: OmegaCam on 2.6m VST, 1□deg
  - [Visible: darkCAM on 3.9m VISTA, 2□deg]

Public Surveys

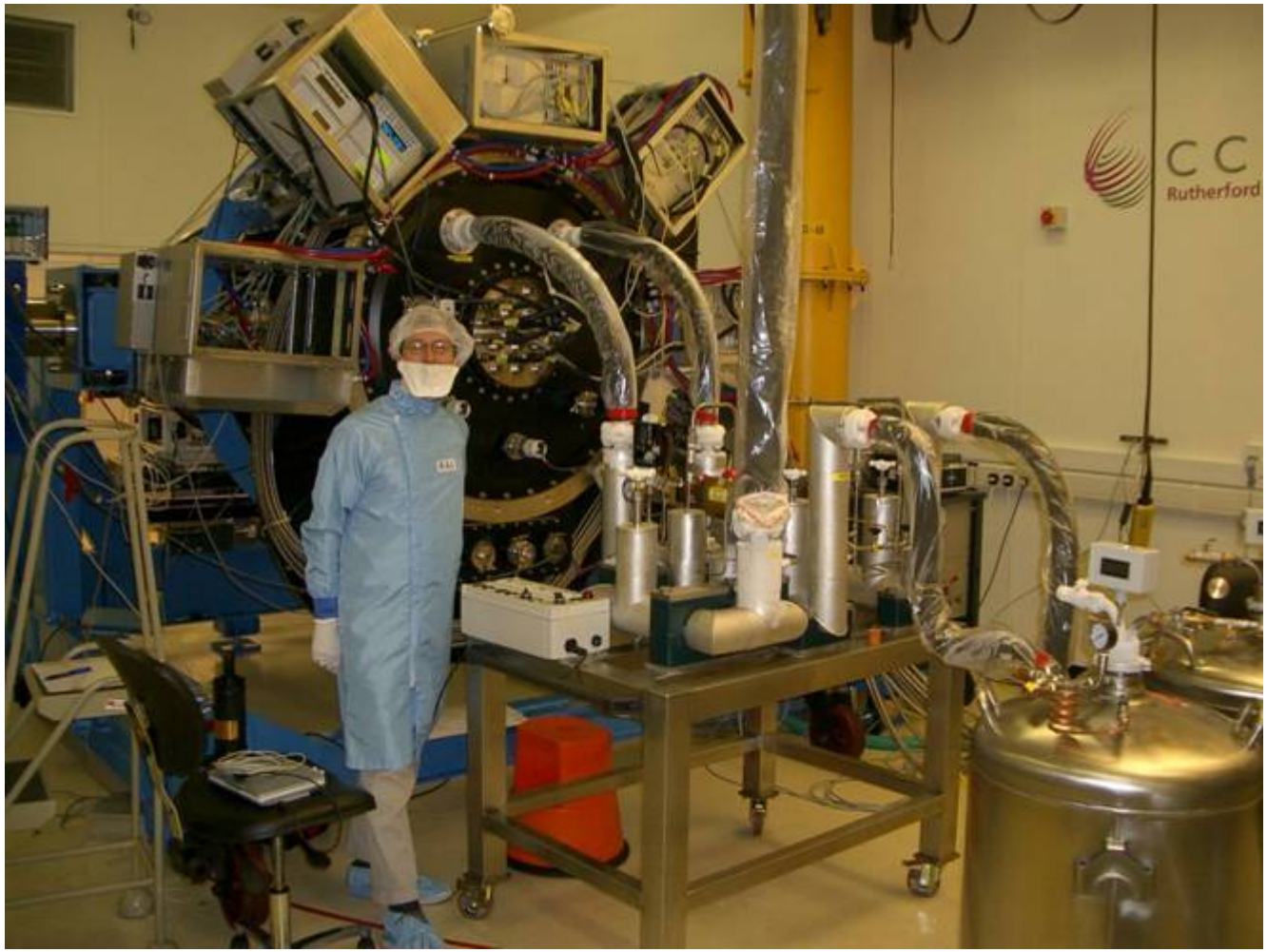
- ESO will allocate 75% of its VISTA time for Large Scale Public Surveys (Chilean time?)
- Public Surveys (usually by a Consortium)
- Remaining 25% ESO time for Private Surveys (PIs)
- Time allocated by specialised ESO Panel(s) + OPC

What might VISTA do?

(example only, ~ 400 clear nights)

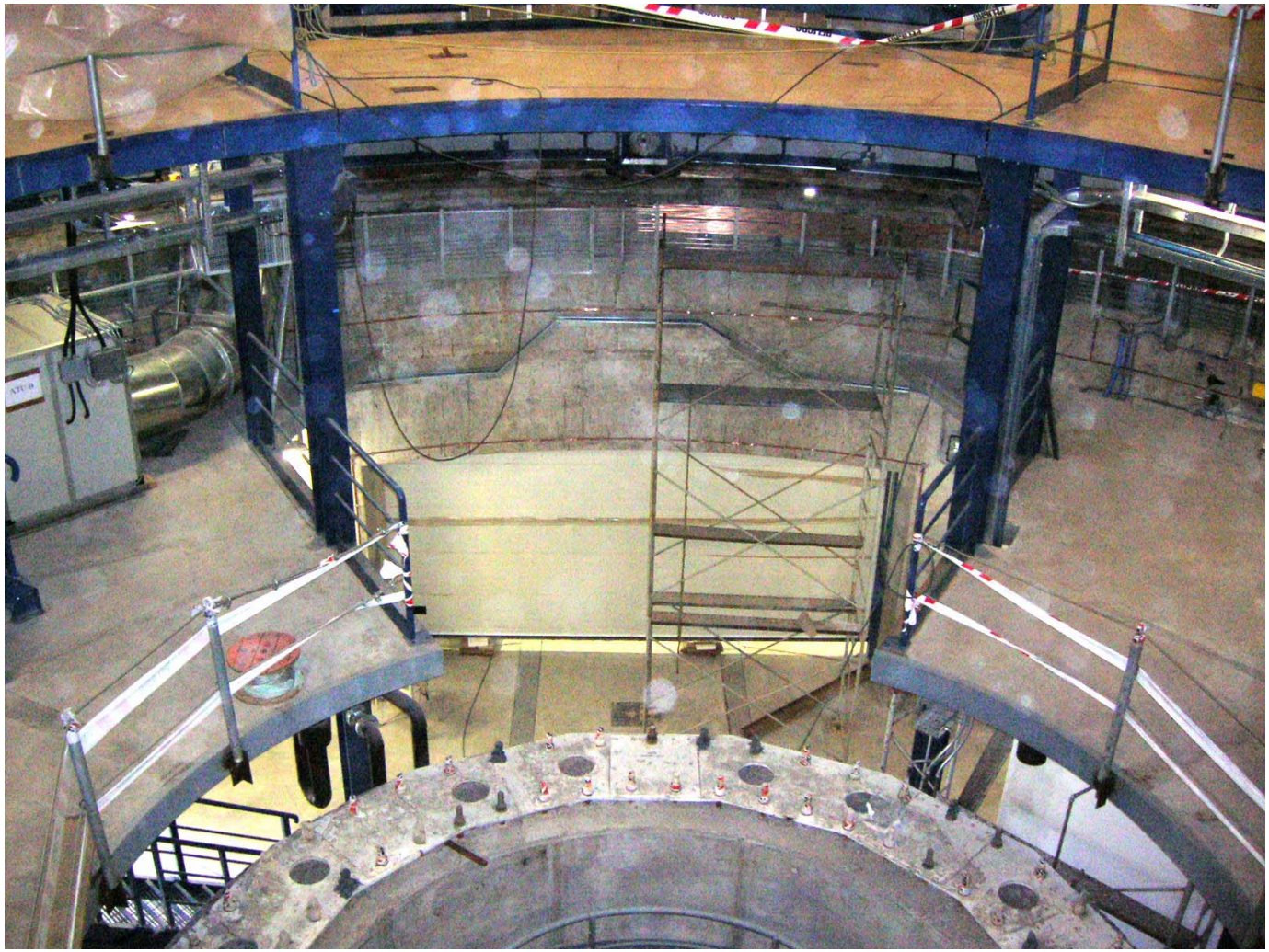
Survey name	Area (deg^2)	Y	J	H	K_s	Clear nights
		(Vega, 5σ)				(exc. overheads)
Very deep	15		23.8	22.5	22.0	55
Deep	100		22.8	21.5	21.0	57
Wide (high-b)	3000	22.0	21.2*	20.0	19.5	100
Wide (plane + MCs)	1500	21.5	20.5*	19.5	19.0	45
Atlas	20000		20.2		18.2	150

Camera + Project scientist



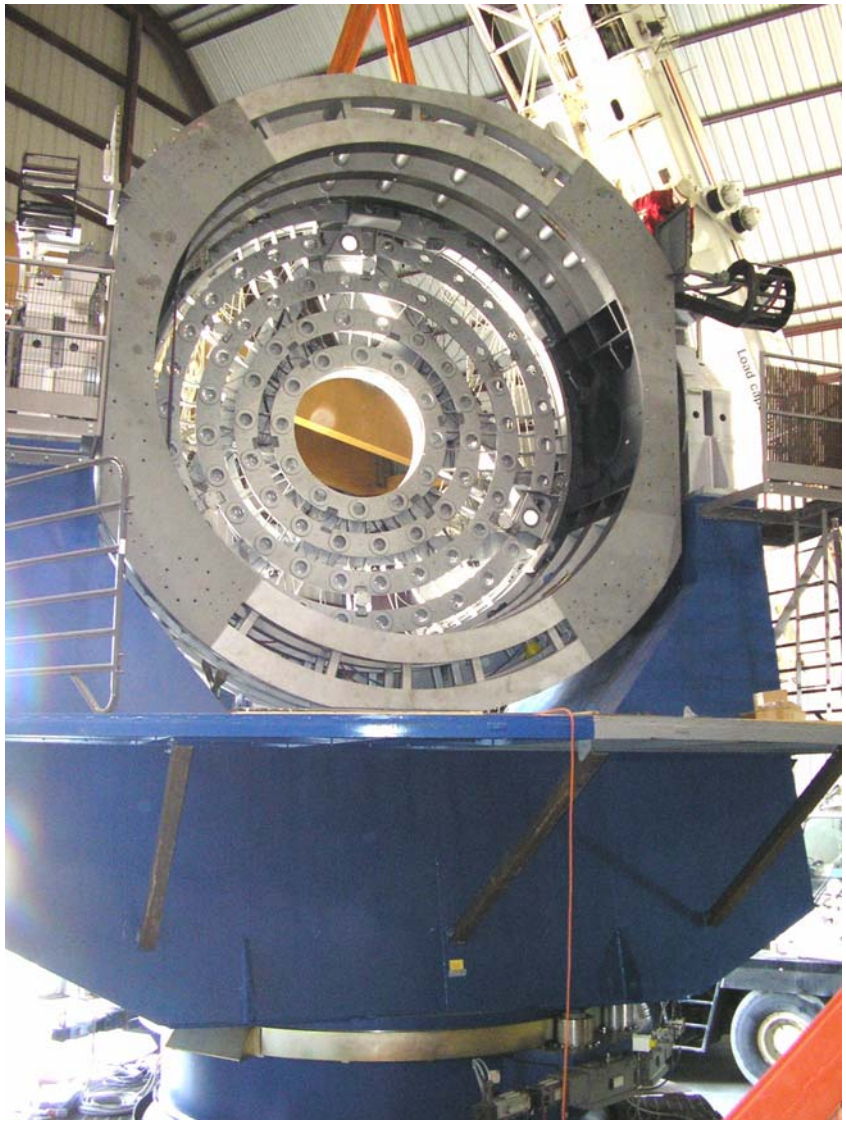
Enclosure

Inside Enclosure



Telescope

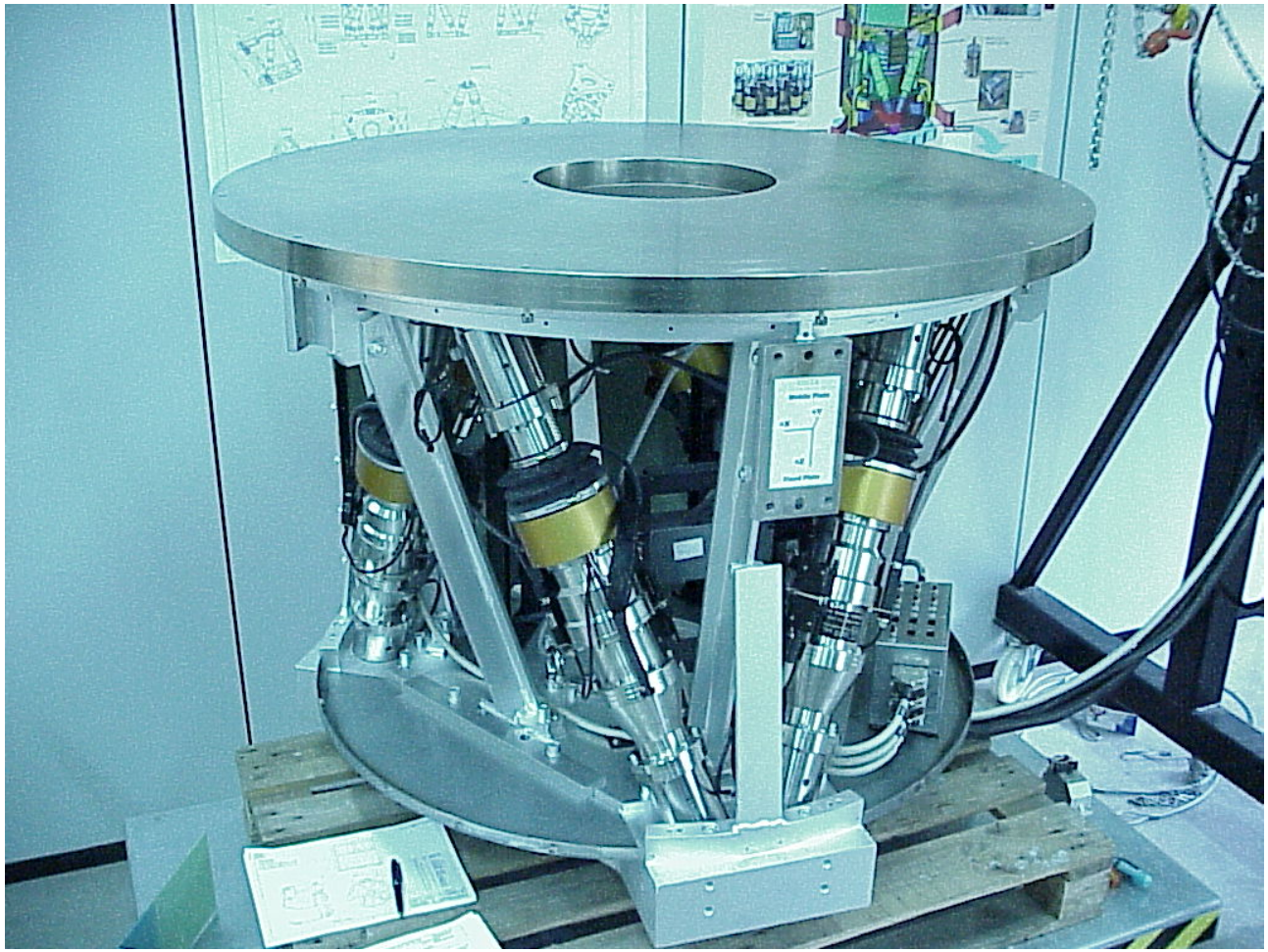
M1 Cell



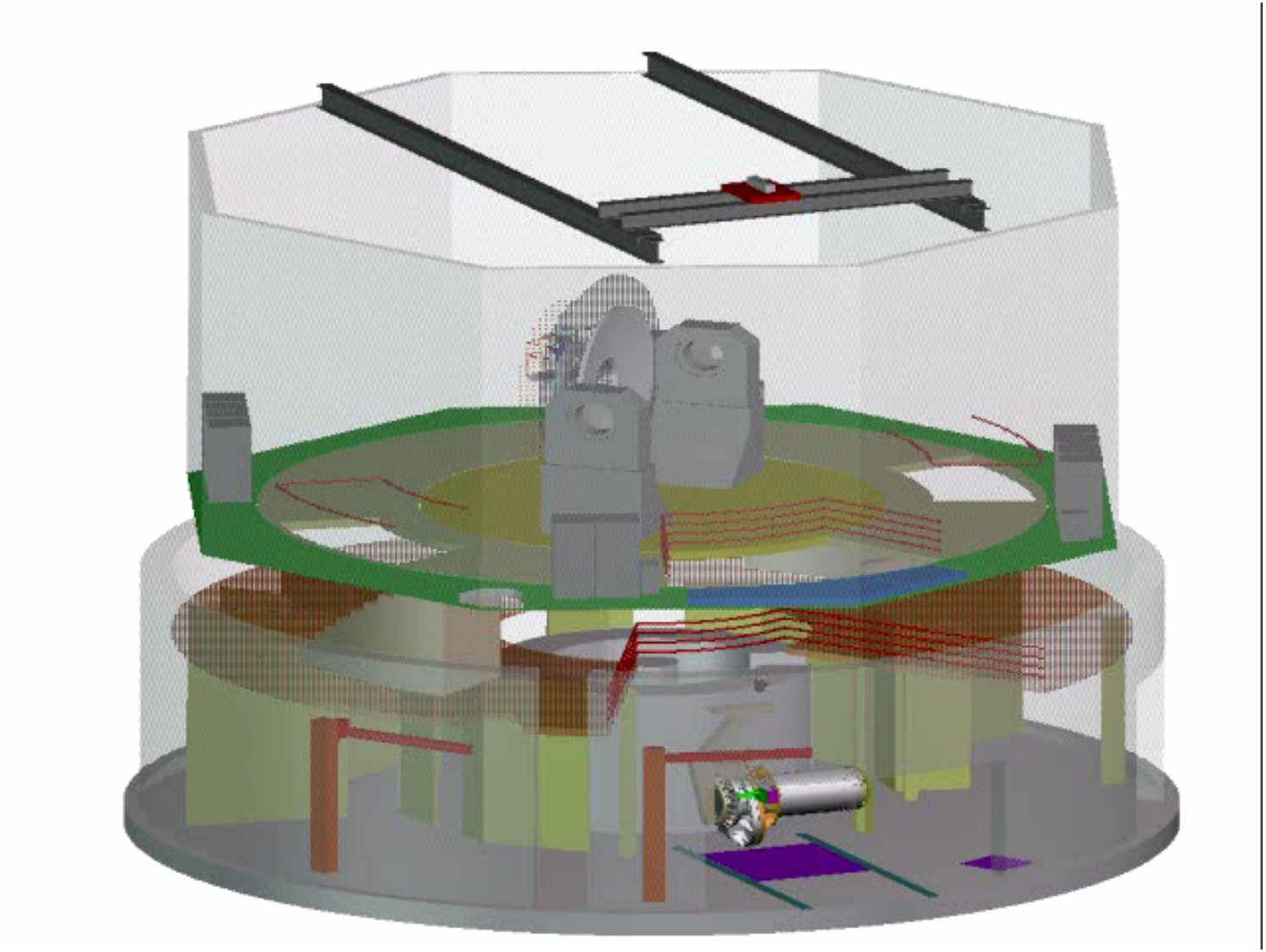
Polishing M1

Coating Plant

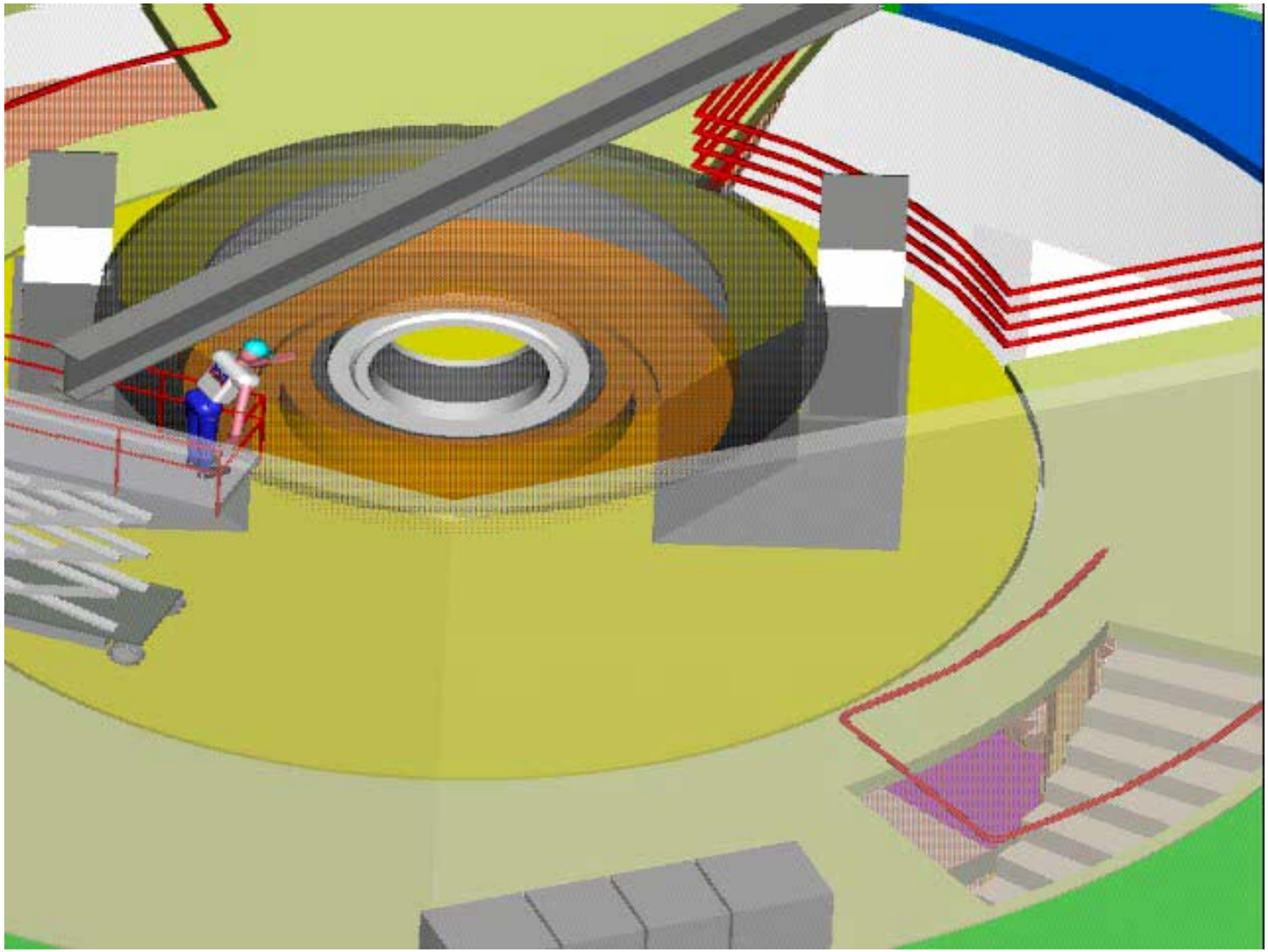
M2 Hexapod Unit



Mounting VIRCAM



Mounting VIRCAM -2



Timescales (subject to change)

- Discussion meeting at Queen Mary 19/20/21 Dec
- ESO: 1st CfP for VISTA Public Surveys – Jan 06
- ESO: VISTA Public Surveys Panel – Jun 06?
- Telescope ready for camera – July 06
- Camera commissioned – Aug 06
- ESO: VISTA Public Surveys to OPC – Oct 06
- System Integrated – Nov 06
- Commissioned & Accepted - Jan 07
- ESO: Science Verification- Feb 07?
- ESO: CfP for other VISTA surveys – Mar 07?
- ESO: VISTA Public Surveys start - Mar07?
- ESO: VISTA open time starts - Sep07 (period 81)?

In Closing….

- VISTA on track for commissioning 4th quarter 2006. Schedule anticipated to be met
- Performance anticipated within specification (+ZY)
- Expect Public Survey Proposals to be sought early in January 2006
- Expect general time to be offered in ESO Period 81 beginning September 2007
- Will be world's leading facility for wide-area NIR surveys, (few deg^2 to hemisphere) for ~ a decade