



## Modelling the VISTA Infrared Camera

16<sup>th</sup> ECLS Workshop,  
ESTEC

October 2002

### Feedback from User Experiences of ESARAD 5.1.3 and ESATAN at RAL from the VISTA project

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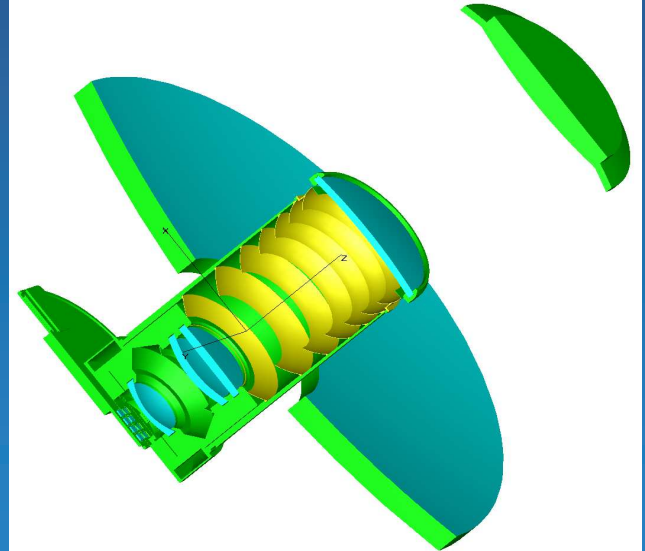
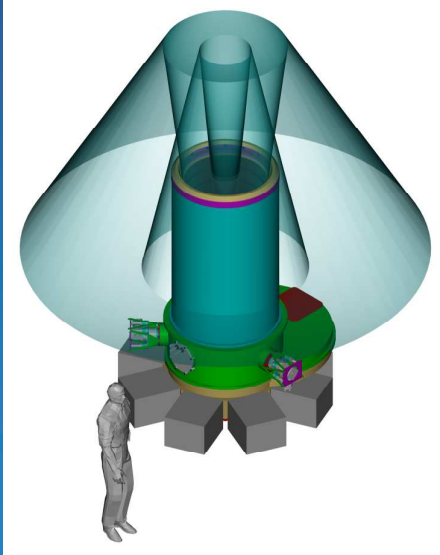
This presentation briefly covers

- An overview of the VISTA telescope and IR Camera
- A summary of the thermal modelling
- Feedback on our experiences of using ESARAD 5.1.3 and ESATAN for this project (and others)

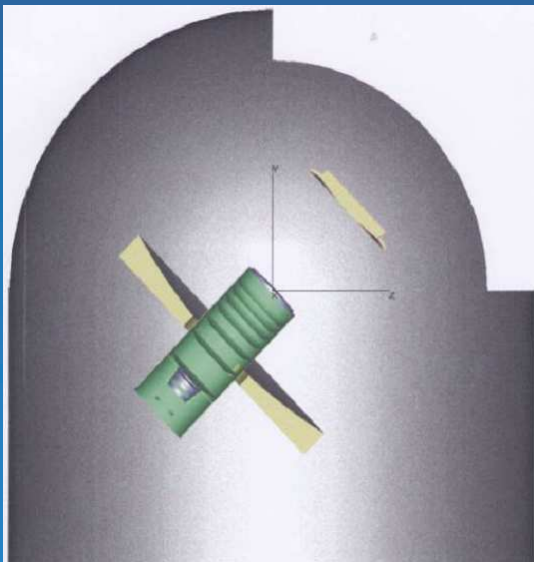


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## Visible and Infrared Survey Telescope for Astronomy



The VISTA IR Camera forms part of the UK contribution to the European Southern Observatory



Cerro Paranal, Chile; alt 4200m





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### Interesting Features

- Detectors 77K
- Cryostat internal structure < 190K
- Structure visible from detectors <120K
- Mass 2700 kg
- Detector dissipation 160mW plus 10W 'warm' electronics
- Heat lift required, 220W at 80K. Provided by 3 Gifford/McMahon cryocoolers
- Power, no limit (not specified), about 30kW
- LN<sub>2</sub> only available for cool-down (need 1200 litres)
- No MLI
- Service interval, 12months
- Design / Analysis currently on-going



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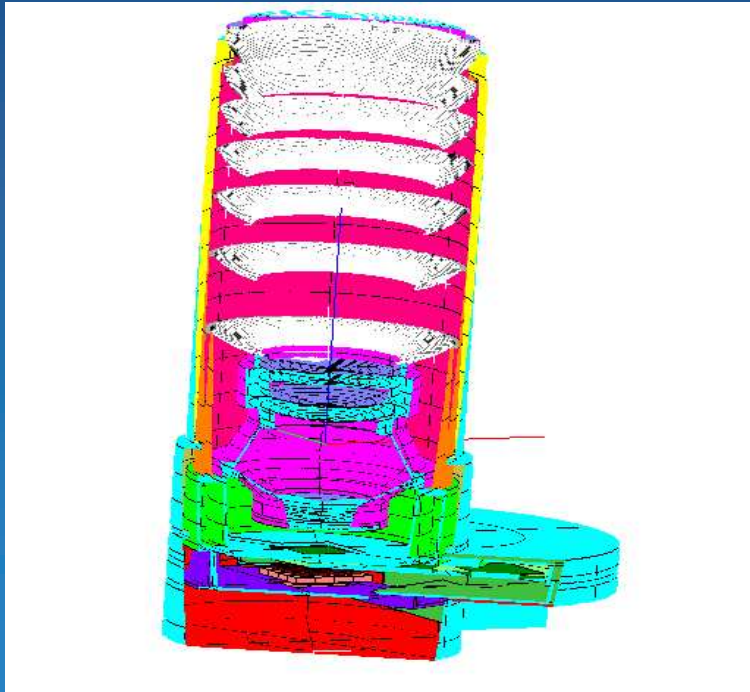
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### Summary of Thermal Modelling

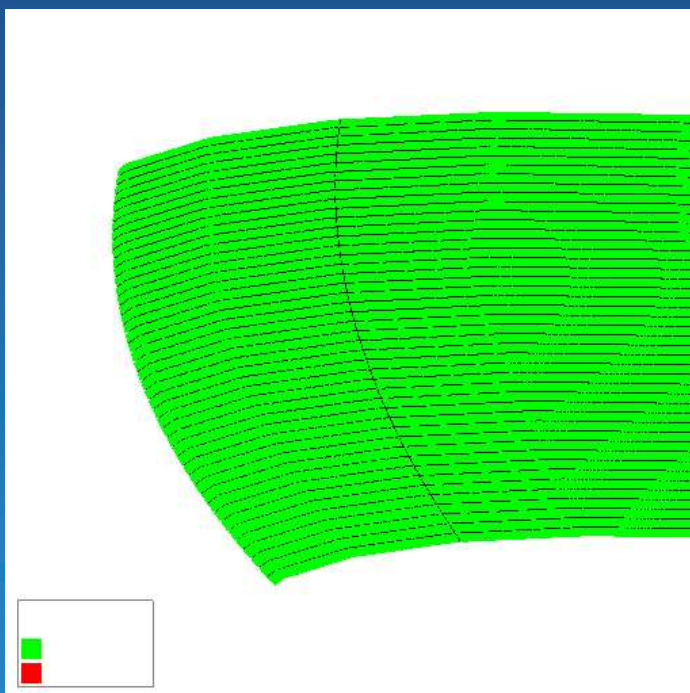
- ESARAD and ESATAN exclusively used
- Pentium 4 PC for ESARAD  
Sun Workstation for ESATAN
- Model size;  
2600 Nodes  
310,000 GRs, 5500GLs  
Temperature dependent properties used throughout
- Coolers modelled as boundaries with temperatures dependent on heat load.



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ESARAD Model of  
VISTA Camera



Ellipsoidal baffles  
each constructed  
from 45 'linked'  
CONES





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### Comments relating to ESARAD 5.1.3

- The text edit mode is a real improvement to productivity
- The introduction of Analysis Case and the generation of the ESATAN input file is good and easy to use
- The display of pointing vectors and rotation axes for assemblies is very helpful; primary and secondary axes could have different colours
- Animation of the mission within the visualisation module is very useful
- It doesn't always start!



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With the text edit mode a number of productivity issues arise

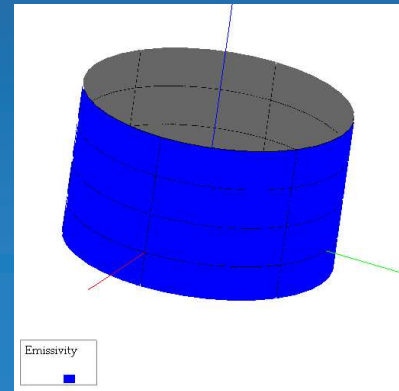
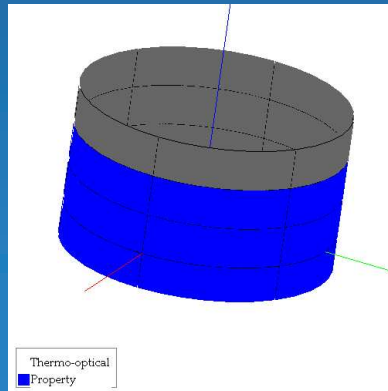
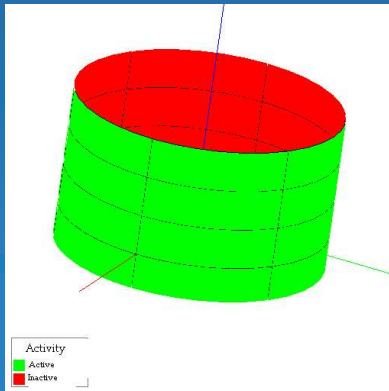
- 'Re-loading' the geometry causes all the radiative case and analysis case definitions to be deleted as well as deleting any calculated results.
- Updating a radiative case definition automatically deletes any existing results.  
Again, the user should have the choice to delete, or to keep existing results 'marked' as 'inconsistent'



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A number of small 'productivity' problems still remain

- When transforming a shell rotations can only be about the SCS. For anything other than simple rotations this is 'so less than intuitive' that it is rarely used. Use of intermediate axes would solve this.
- Visualisation of active shells with undefined properties!

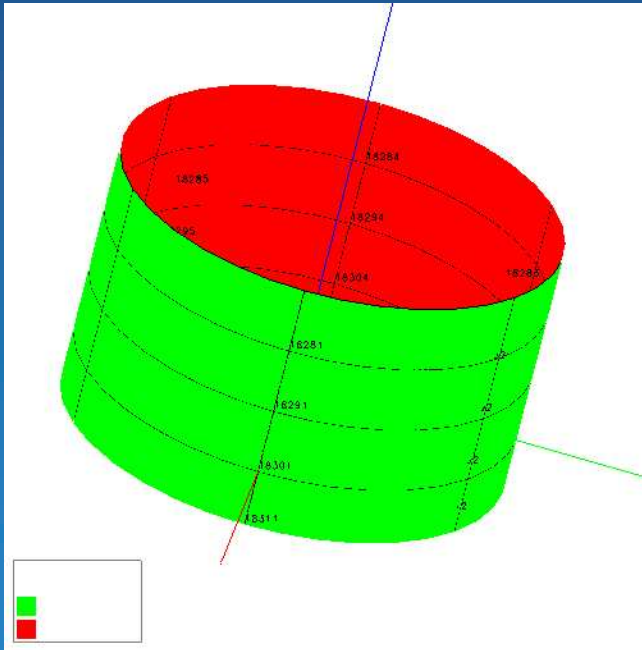


Suggestions for ESARAD future developments and/or productivity improvements

On a minor scale,

- A new shell; surface of rotation based on an equation of a line, especially important for antennas and reflectors
- For 'fixed' geometries can the 'GRs' calculated for one radiative case be used for others.
- Memory leaks when outputting ESATAN file in analysis cases
- ESARAD to use node numbers up to 10 digits to make it consistent with ESATAN
- Reporting the orbit  $\beta$ -angle would be very useful
- Angle of incidence dependent optical properties





### Improved Node Numbering

- Node numbering on a shell is always sequential.
- It would be useful to 'step' between 'rows' or 'rings'.
- The model shown could then be modelled using 1 shell rather than 4.



ESATAN is mature and stable.

It would be improved further by

- Limiting temperature minima to absolute zero within the solution routine (SOLVFM and others?). Temperatures of -9000°C were initially output, followed by >10E10°C when cryocooler heat lift was simulated.
- Inform users of the differences/limitations between PcESATAN and the UNIX version. GNU compiler appears to be limiting





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### Future developments

- Automatic conductor generation, what's happening?
- Missions, when will there be improvements to
  - more intuitive main body pointing?
  - definition of the mission as an orbital arc or series of arcs (ie not necessarily a complete orbit)?
- Link to CAD/FEA tools. There is a strong link between CAD tools and structural tools but no link to ESARAD. This would represent the single most important development to 'our' tools



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