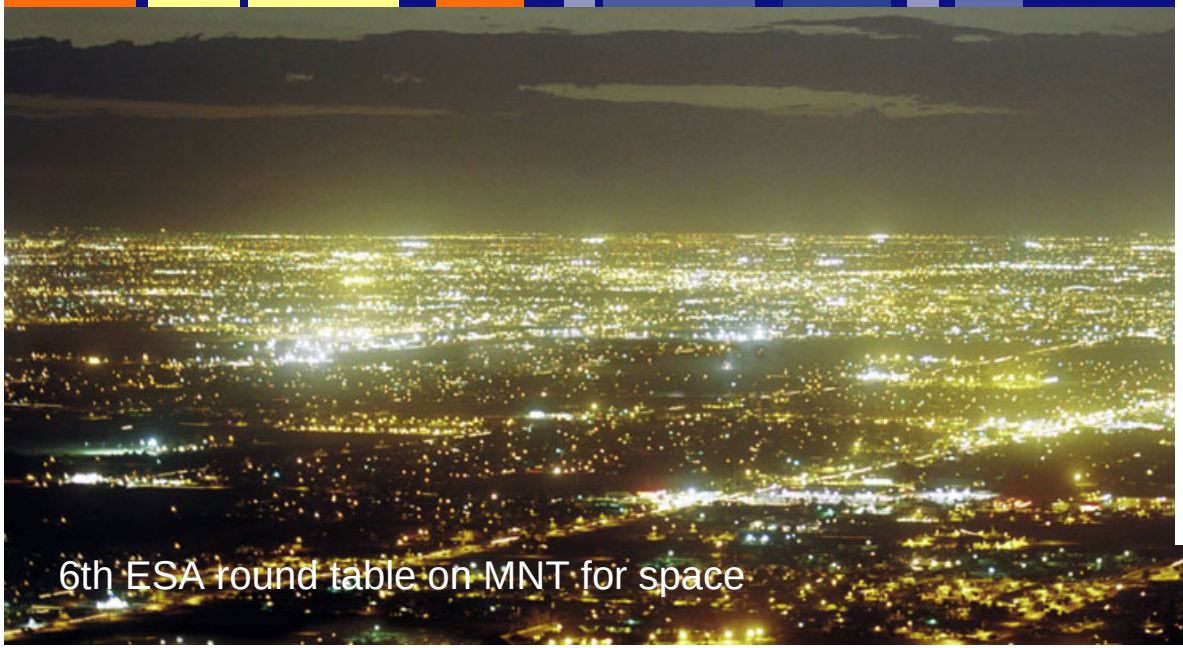
The attitude control sensor for microsats

Multi aperture baffled startracker

TNO | Knowledge for business



6th ESA round table on MNT for space

Attitude control sensors for microsats

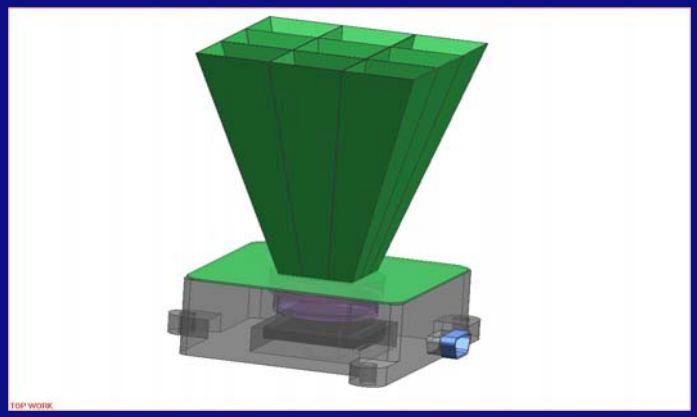
- Sunsensors (small and getting smaller)
- Magnetometers (small and getting smaller)
- Gyro's (big but getting smaller)
- Starsensors getting smaller but **BIG** baffle

Startrackers

- Main attitude sensors for many satellites
- Baffle is the largest mechanical component
- Small field of view
  - Small baffle
  - Large optics for high accuracy (dim stars needed)
  - Reduced roll accuracy
- Wide field of view
  - Worse sun exclusion angle
  - Smaller optics
  - Better roll accuracy
  - Requires high pixel count detector for large accuracy

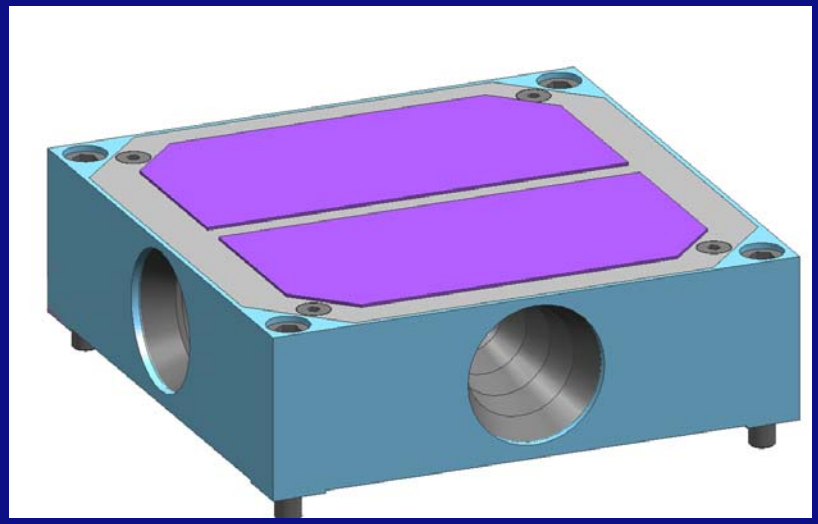
Multi aperture baffled startracker (patented)

- Small optics
- High accuracy
- Largely reduced baffle size
- Sun Blinding of one aperture acceptable (100% availability)
- Roll accuracy can be as good as X,Y accuracy
- Small star catalog (brightest stars only)



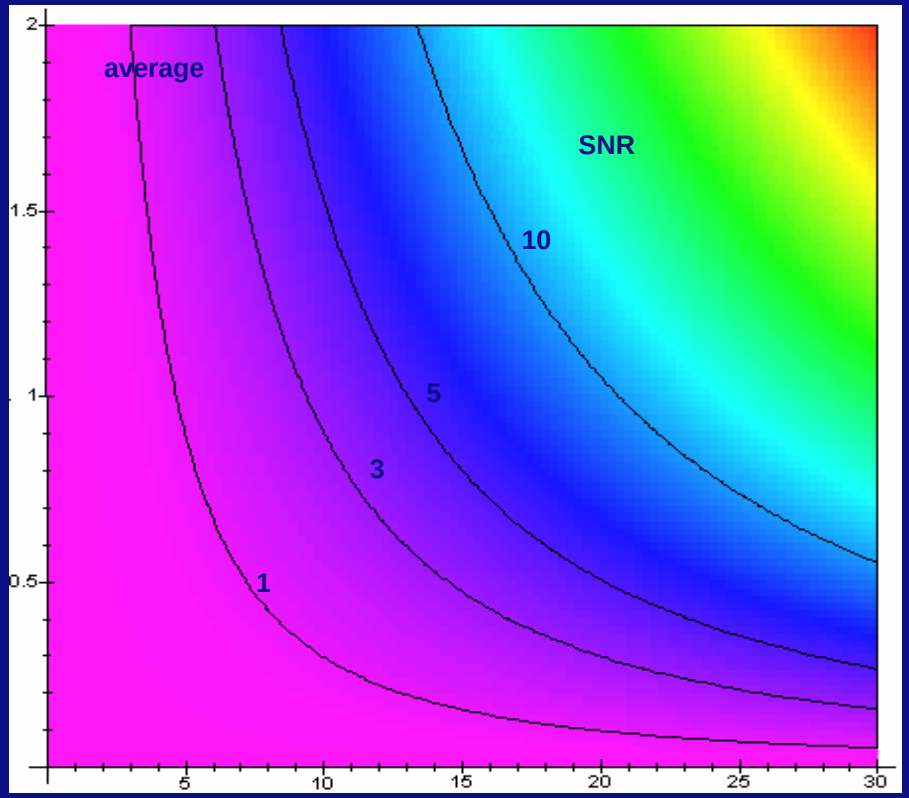
Autonomous versions can be compact

- Autonomous power supply
- Wireless data interface
- Orthogonal apertures
  - Minimum baffle size
  - Balanced accuracies
- Transmission optics



Radiometry (First calculations)

Aperture
cm²



FOV degrees

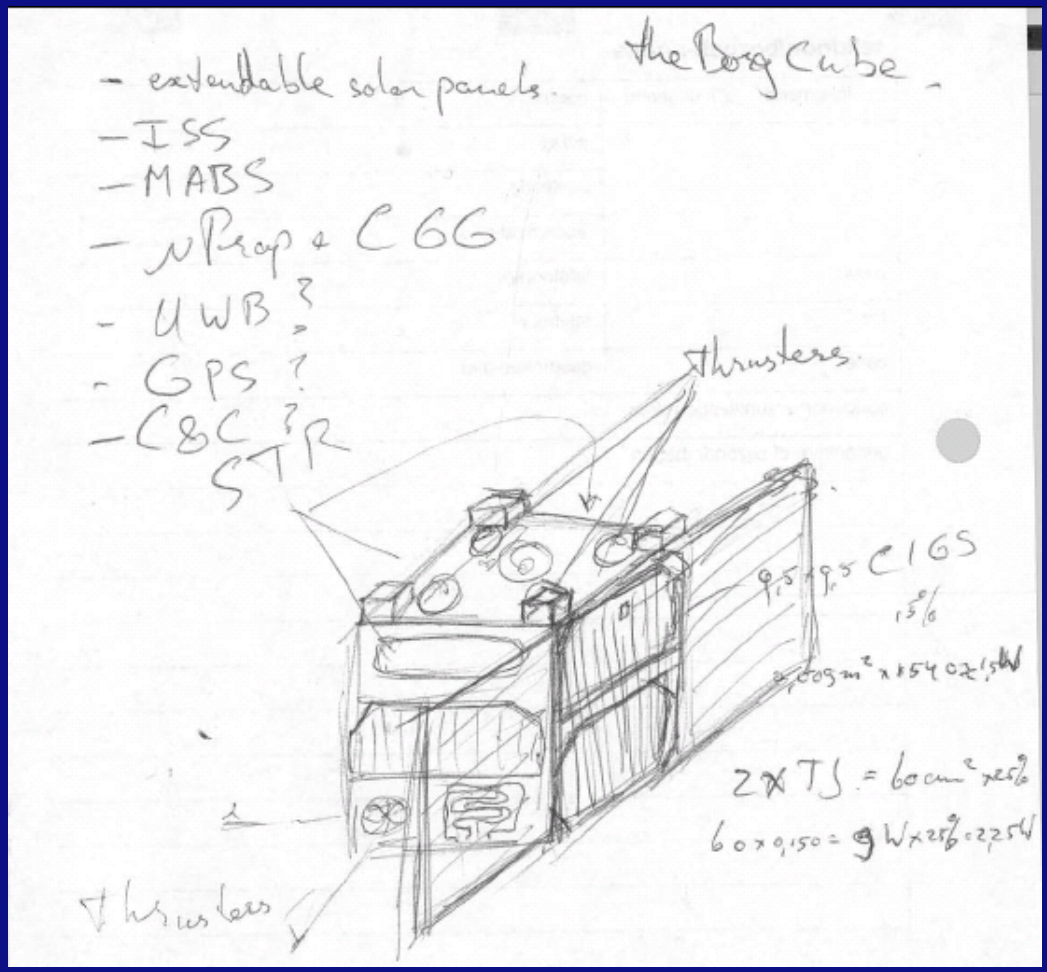
- 1cm² aperture enough @ 15° FOV for 5 stars average
- 1 minute of arc or less obtainable

Integration into micro or even nanosats possible

- **Single cubesat unit**
- **Two units for science paylaod**

- **Major components under development within**

MicroNed



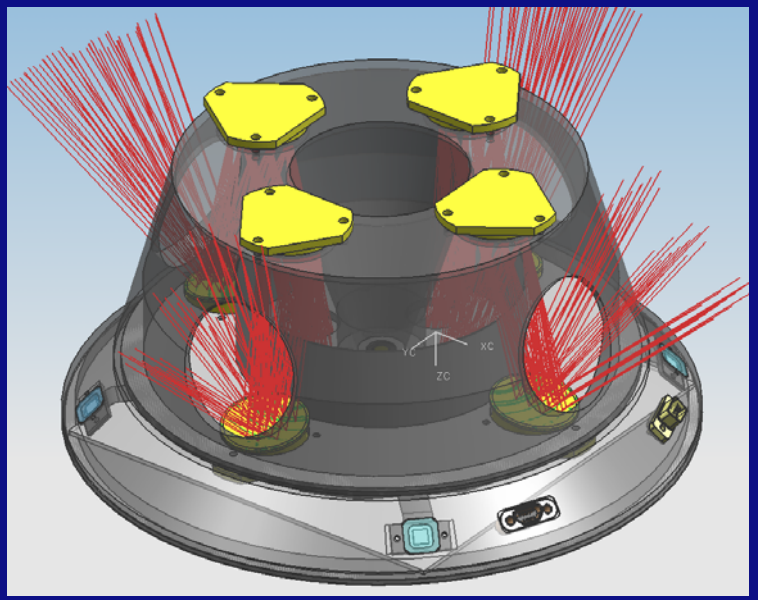
Integrated Optical Attitude Control Sensors IOpACS

- Several combinations possible
  - 3 startrackers and one high accuracy sunsensor (using a sun attenuation filter for one of the apertures)
  - 3 startrackers and one earthsensor (increasing the FOV for one of the apertures
  - 3 startrackers one thermal earthsensor (adding a microbolometer camera)
  - 4 startrackers 1 earthsensor (visible or thermal) and 4 sunsensors
- Reduced number of interfaces
- Increased autonomy and COTS approach likely

Integrated sensor system on basis of MABS

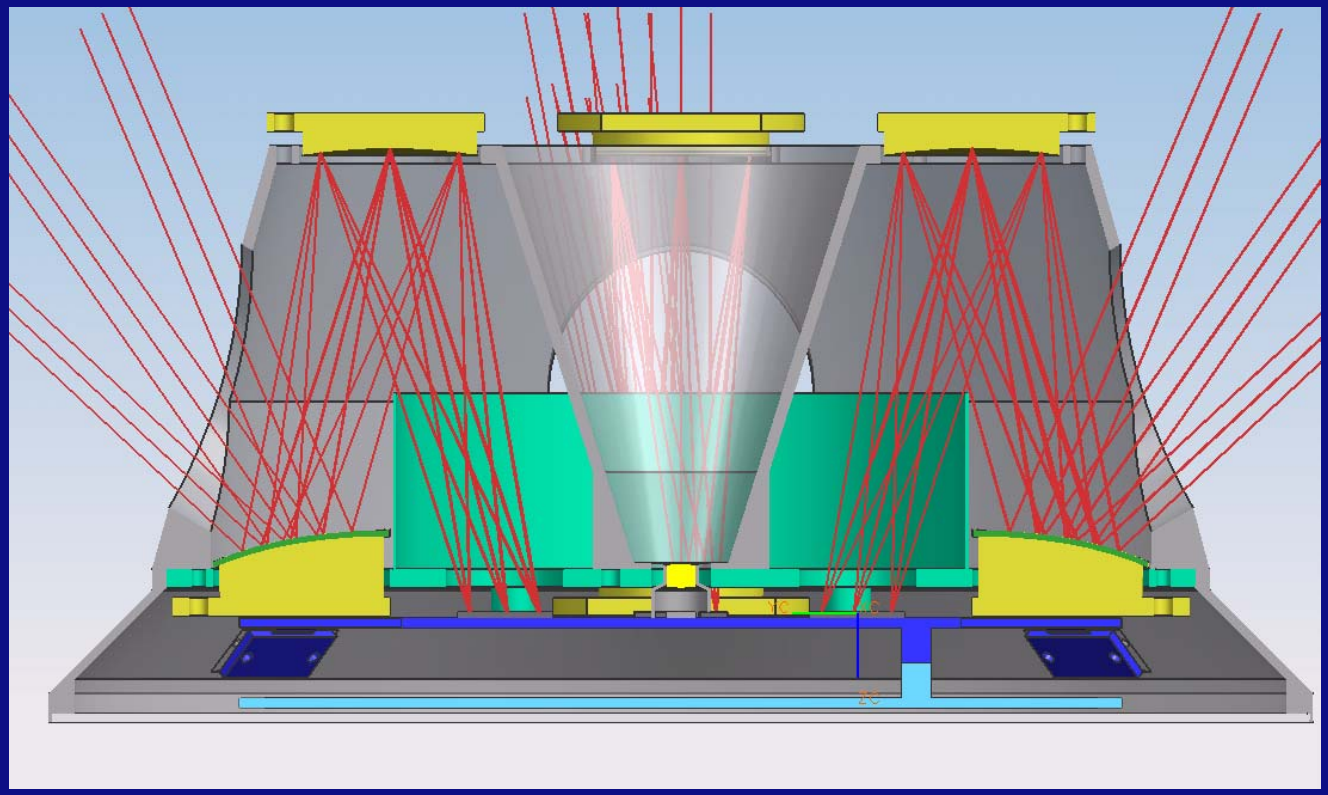
- Four startracker ports (100% availability)
- Four sunsensor (semi hemispherical coverage)
- 1 Earth sensor

- Compact (r=10cm h=10cm)
- Accurate (5 arc seconds)
- Cost effective



MABS Based systems
Grown up performance for small satellites.

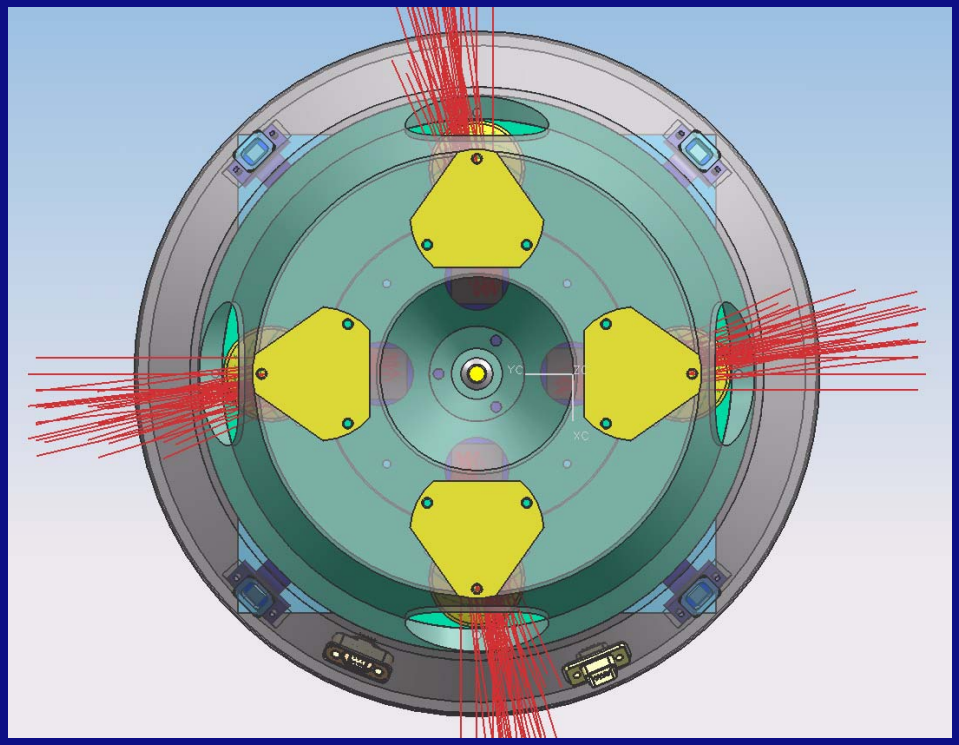
IOACS mechanical assembly



- Mirrors in central structure
- stiffener plate supports mirrors and detector circuits
- signal processing on second layer

Summary of IOACS properties

- Accurate (order of 5”)
- stable
- Balanced accuracy's
- hemispherical field of view for sunsensors
- sun blinding tolerant
- compact
- rigid
- cost effective recurring production



MABS Based systems
Grown up performance for small satellites.

Thank you for your attention.

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Working towards smaller systems .