Back to the future (of small sensors)

LENS R&D

- One man systems engineering company
- Active in space since 1996 (some may have seen me before)
- Founded 13th of March 2012
- ESA business incubator working on sun sensors for solar concentrator applications
- Weak spot for small satellite technologies

Introduction

- Modern sensors can be very small
- Interfaces dictate minimum size
- Multiple sensor systems are sometimes a viable option
- Best solution depends on application but lowest price is determined by volume.

Small sensors and interfaces

- Smallest sun sensor developed (when at TNO) was 2,5*2,5*1,6 mm^3
- 0,1 degree accuracy at 1cm baseline requires 5 Micrometer accurate mounting.
- What to do with electrical connections for small sensors (connector is larger then sensor)

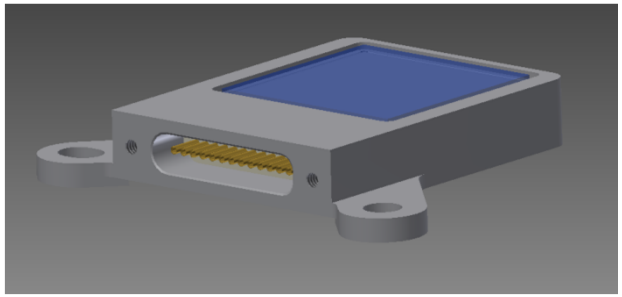
➢ comparatively large package even for small sensor

Why MEMS

- Small size
- Repeatability
- Low recurring costs

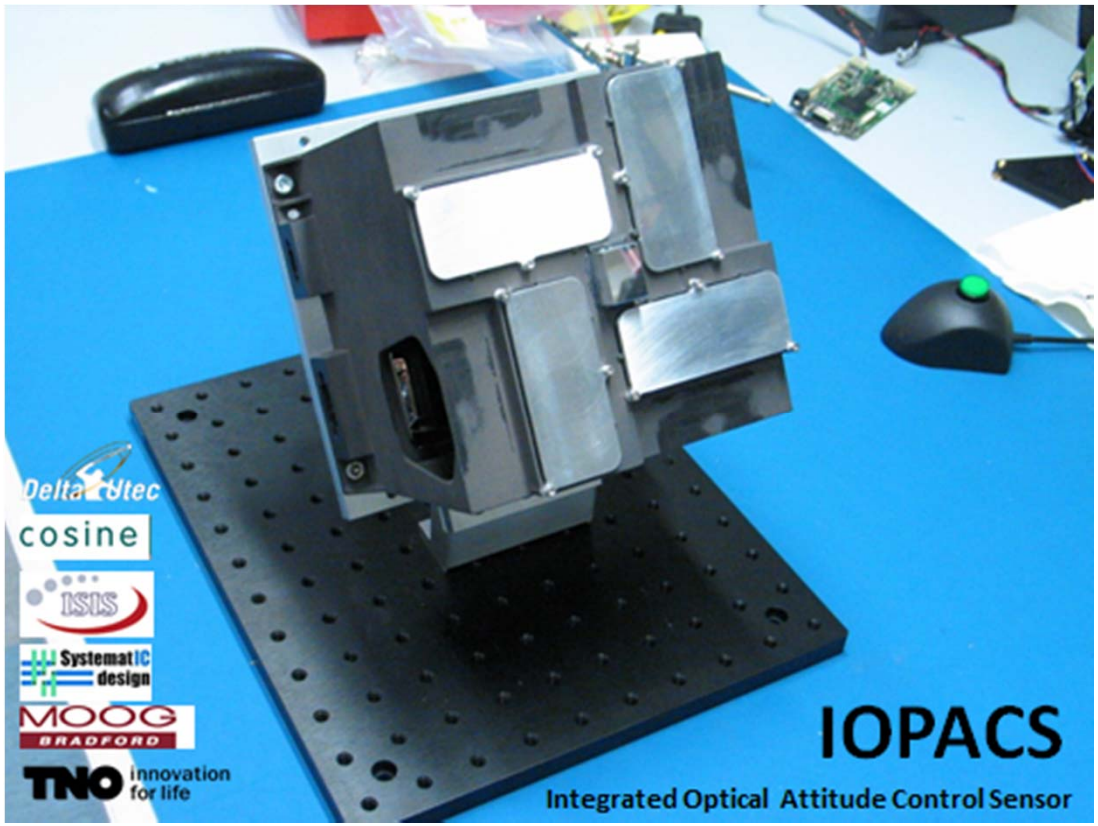
BiSon 45 (billig sonnesensor)

- >±45 degrees (typically ±47)
- 0,3 degrees accuracy (including mounting)
- 4*4cm mounting patern
- 1cm² detector + temperature sensor



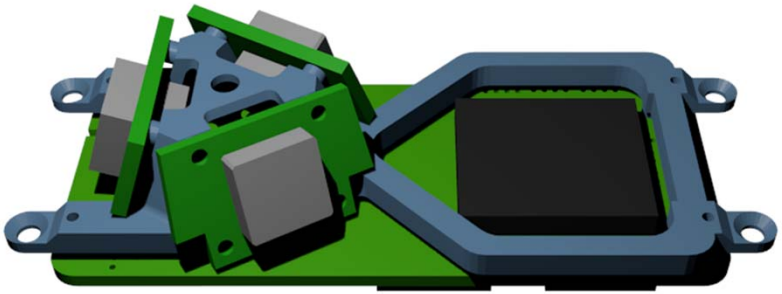
Muliple aperture baffled startracker (MABS)

- Integrated system
  - 4 independant startrackers



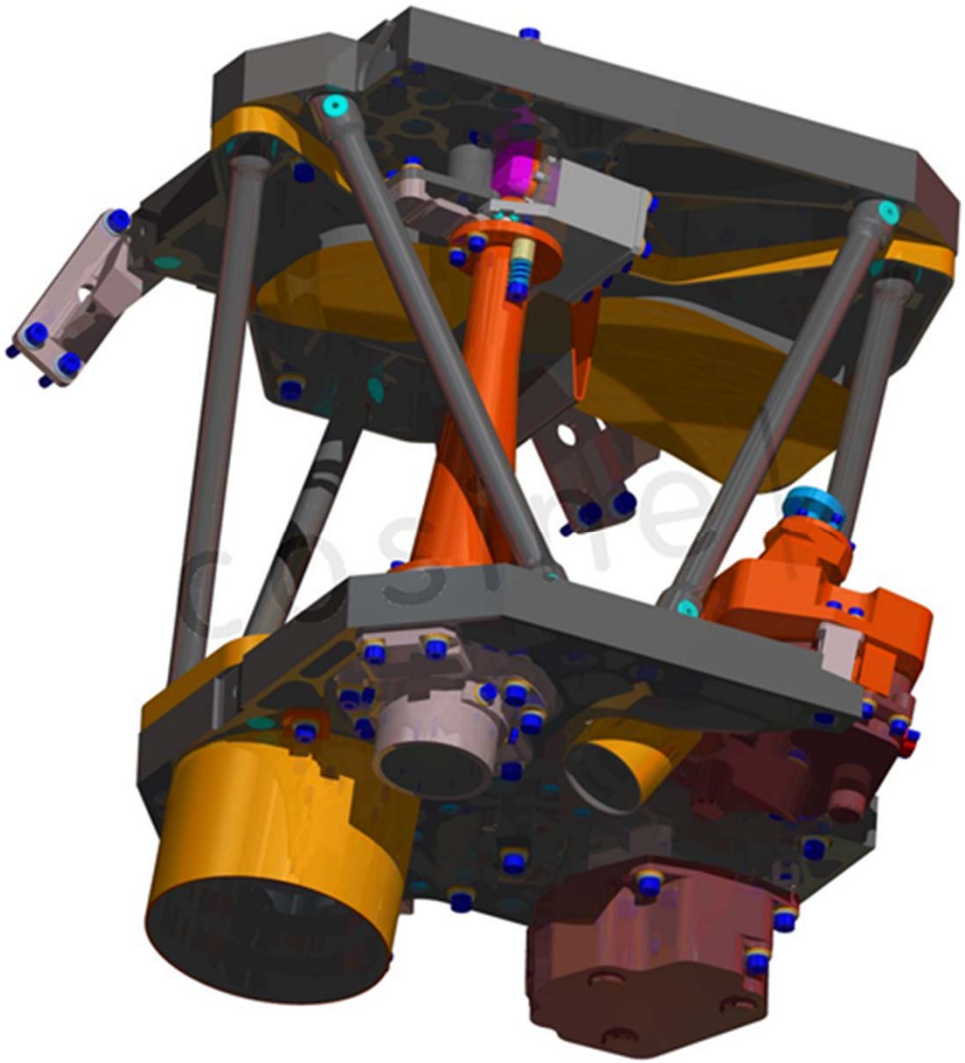
IMU

- Integrated system
  - 4 single axis gyro's
  - 4 accelerometers

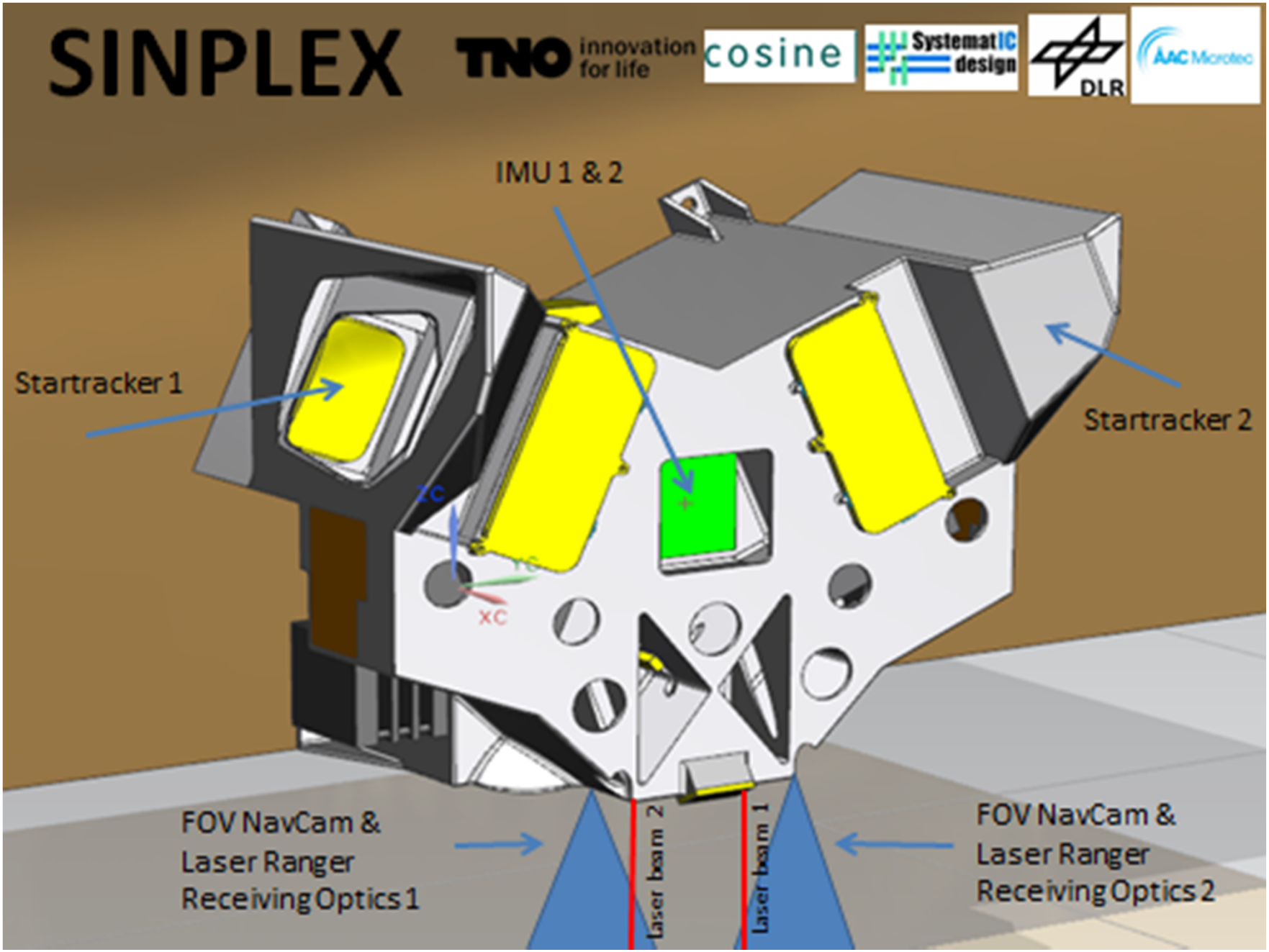


SILAT

- Integrated system
  - Single photon altimeter
  - High resolution camera
  - Stereo Camera



Transform into higly integrated system


SINPLEX
TNO innovation for life
cosine
SystematIC design
DLR
AAC Microtec
IMU 1 & 2
Startracker 1
Startracker 2
ZC
YC
XC
FOV NavCam &
Laser Ranger
Receiving Optics 1
Laser beam 2
Laser beam 1
FOV NavCam &
Laser Ranger
Receiving Optics 2

Sinplex advantages

- Very good co-alignment.
- Very compact.
- Weight optimised.
- Complete system in a package.
- Best off, from all (international) partners.

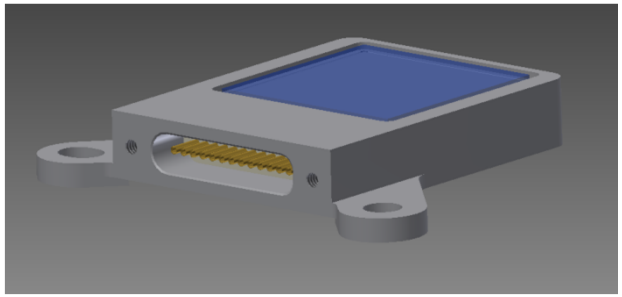
Sinplex disadvantages

- Production more complicated to manage
- Different qualification tests for different systems
- No high volume application (yet)
  - Asteroid landing for research and mining?
  - Rendezvous and docking?

➢ Only acceptable for high end missions ?

BiSon 45 versus LenSS2

- dual sensor device (sun + temperature)
- BiSon optimised for terrestrial applications
  - High rell / low cost (target €200 @10.000 pcs)
- Space version LenSS2
  - High rell / low cost (target €2000 @ 100 pcs)



Conclusion

- A small sensor does not determine the size of the system but interfaces and packaging do.
- Sensor integration saves mass, volume and interface issues at spacecraft level.
- High level of integration is possible but seems only acceptable for demanding applications.
- ROI and price are mainly driven by volume.

Thank you for your attention

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