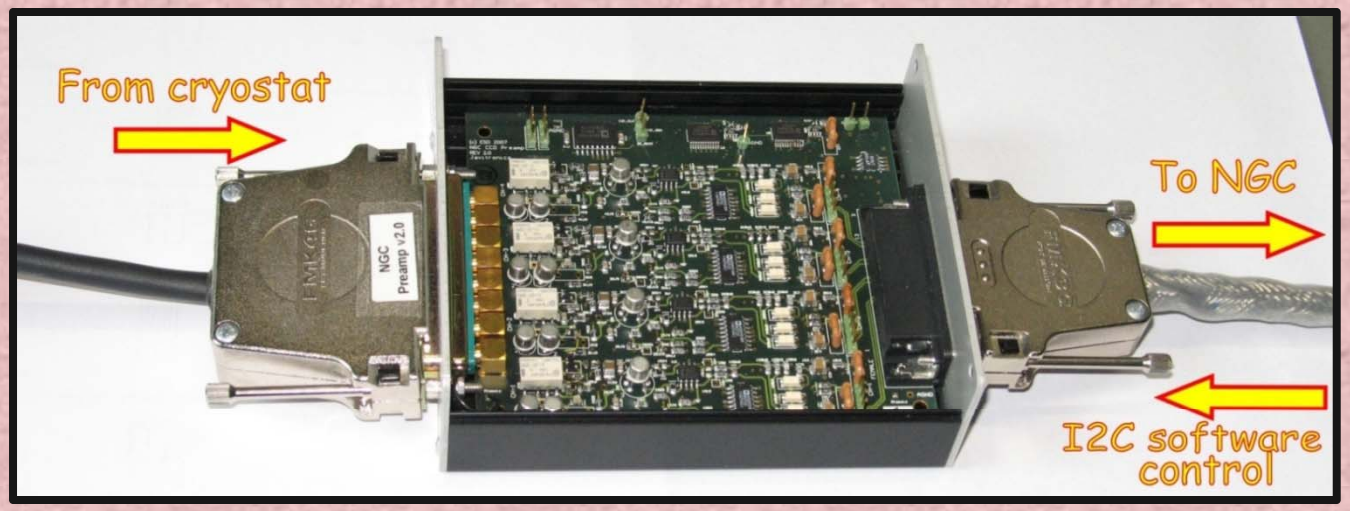
# NGC preamp for CCDs

- High-impedance JFET input
- Low-noise performance: detector limited
- Single-end or differential input (MUSE)
- Differential output
- 16 software selectable gains per channel
- 8 software selectable bandwidths per channel
- Software input short for calibration
- 4 channels, expandable design
- Compact size: 10 x 12 x 4 cm

Via I2C bus with only two lines



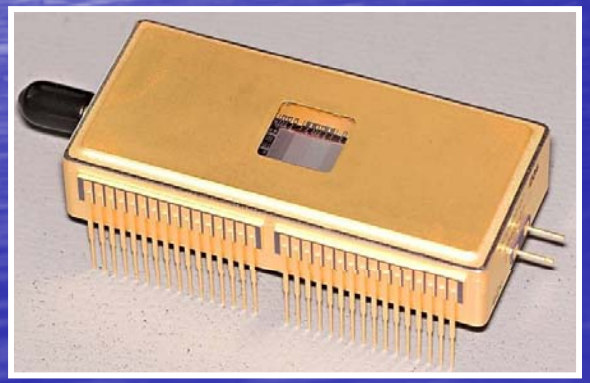
# NGC for Adaptive Optics

16 July 2008

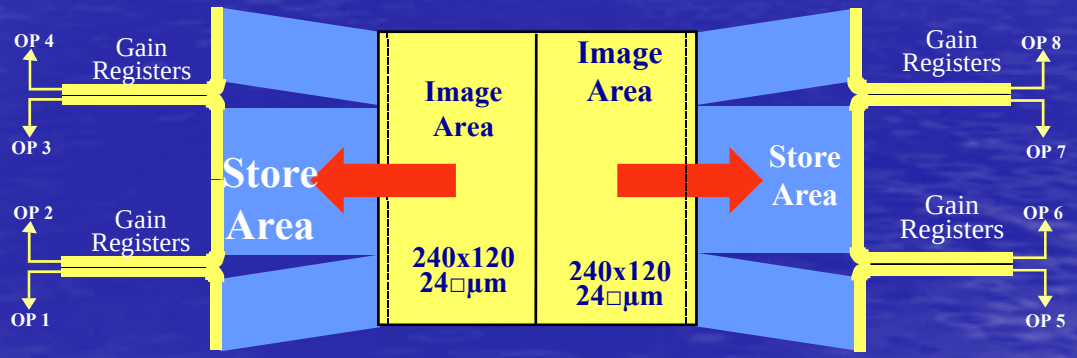
Javier Reyes

# NGC AO Scope of Application

- Scientific NGC
  - Designed to control as many different detectors as possible: e2v, MIT, H1RG, H2RG, HiVisi, Calico...
- NGC for AO
  - Focus on only one type of detector: LLL (Low Light Level) CCDs, i.e. e2v CCD220/CCD219
- Under the same name, NGC, two different front-end electronics focused on two different applications but with some commonalities at user level.



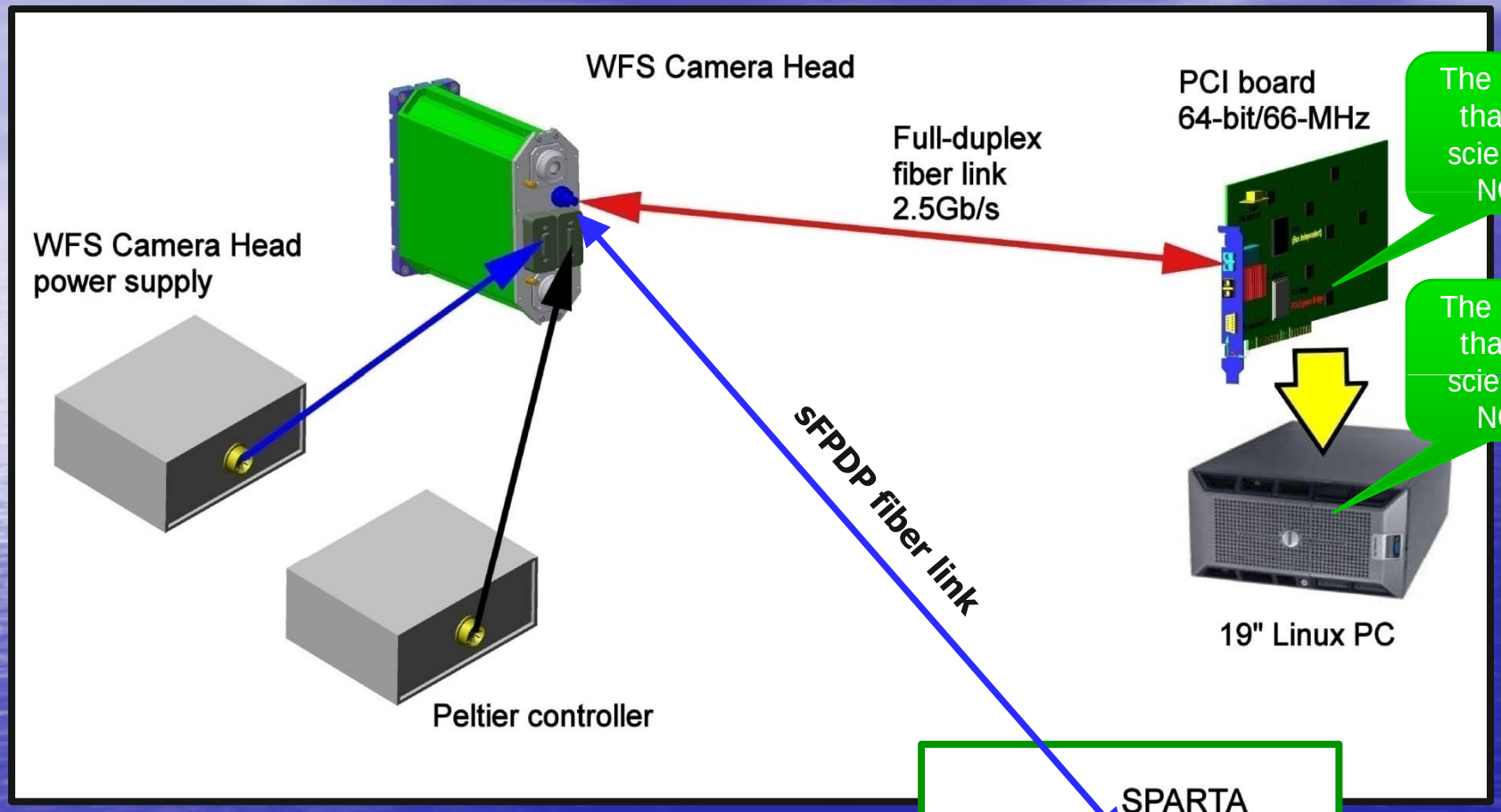
CCD220



# The design challenges

- Very fast read-out speed: up to 1500 fps
- Very low read-out noise.
  - Effective read noise <1e- (goal <0.2e-)
- Very stable high-voltage clocks
- Low power consumption
- Reduce volume: 19 x 23.5 x 7.5 cm

# The system architecture

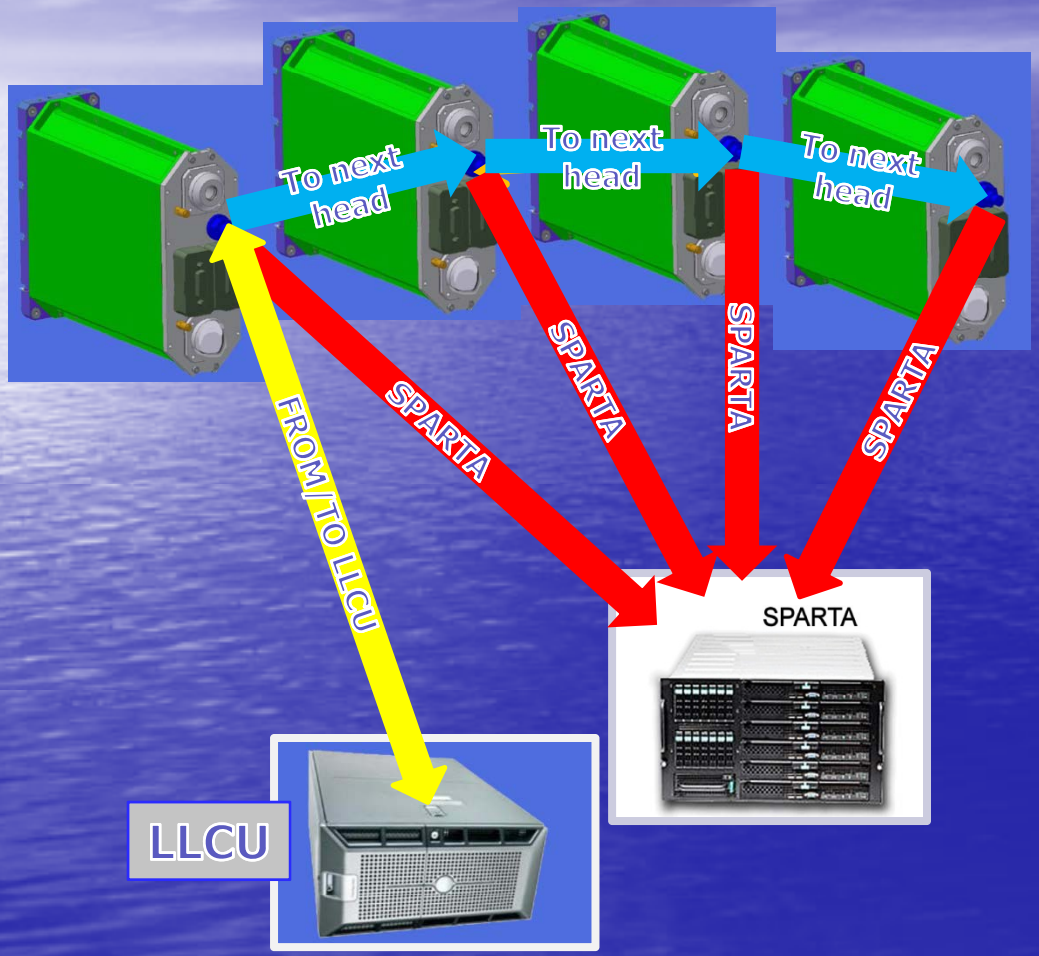



SPARTA, not an NGC component

SPARTA: Standard Platform for Adaptive Optics Real Time Applications

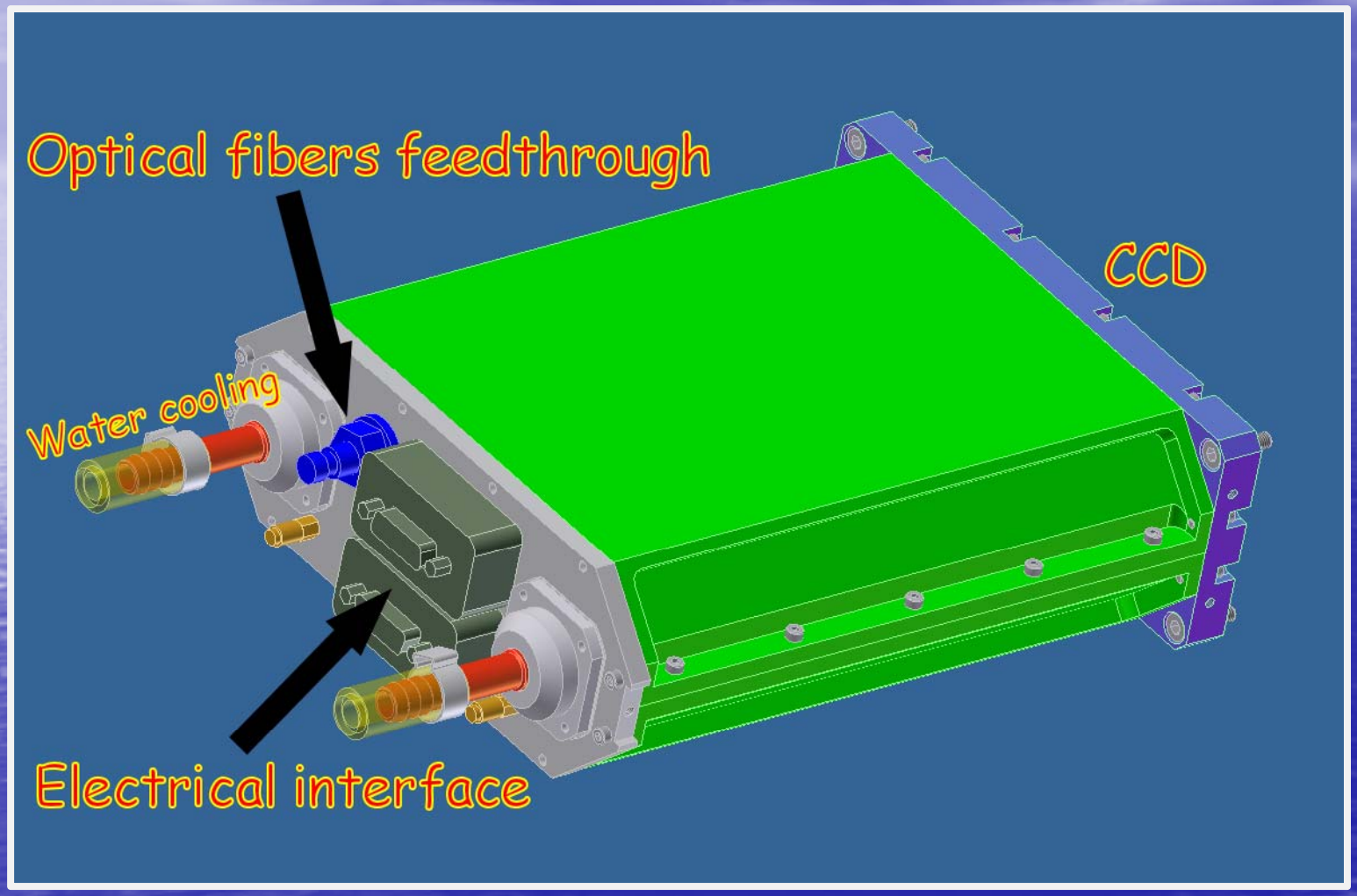
# The connection topology

## NGC AO multi-head scenario



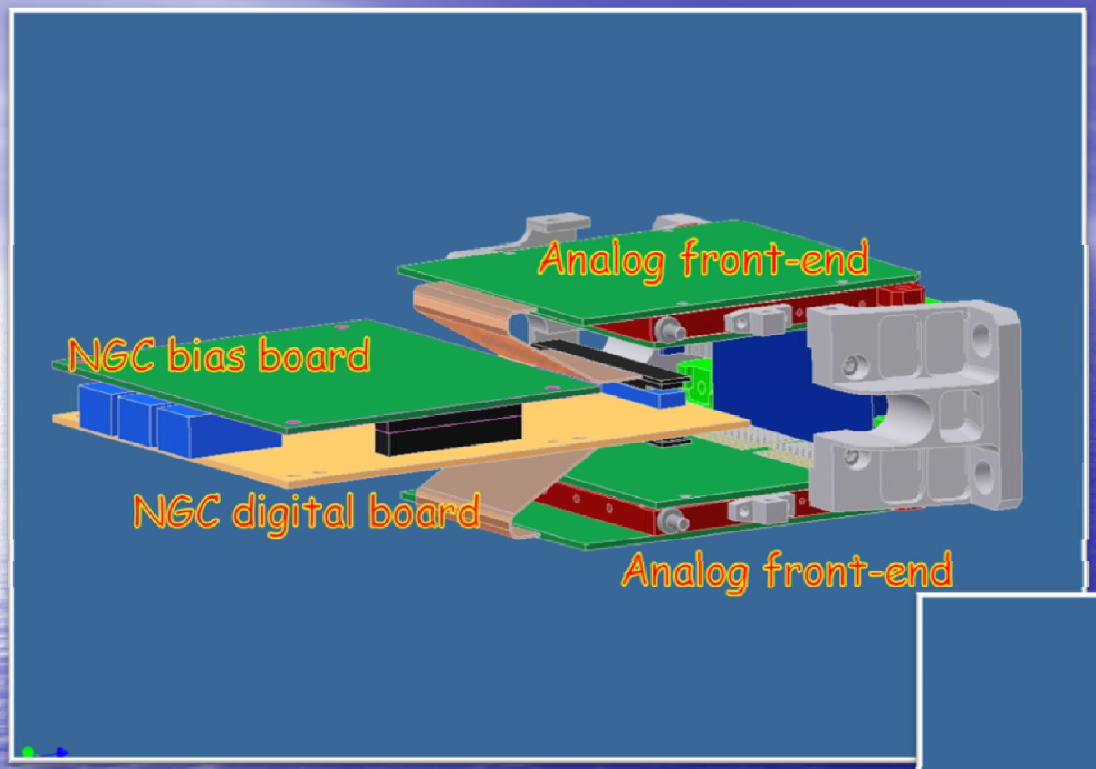

- At user level, homogeneous interface to scientific and AO NGC
- NGC WFS head control by NGC LLCU
  - Fiber link at 1310nm
  - 2.5 Gb/s line rate
  - Xilinx Aurora protocol
- Image frames delivered to SPARTA
  - Fiber link at 850nm
  - 2.5 Gb/s line rate
  - 1.4 Gb/s pixel rate
- sFPDP protocol

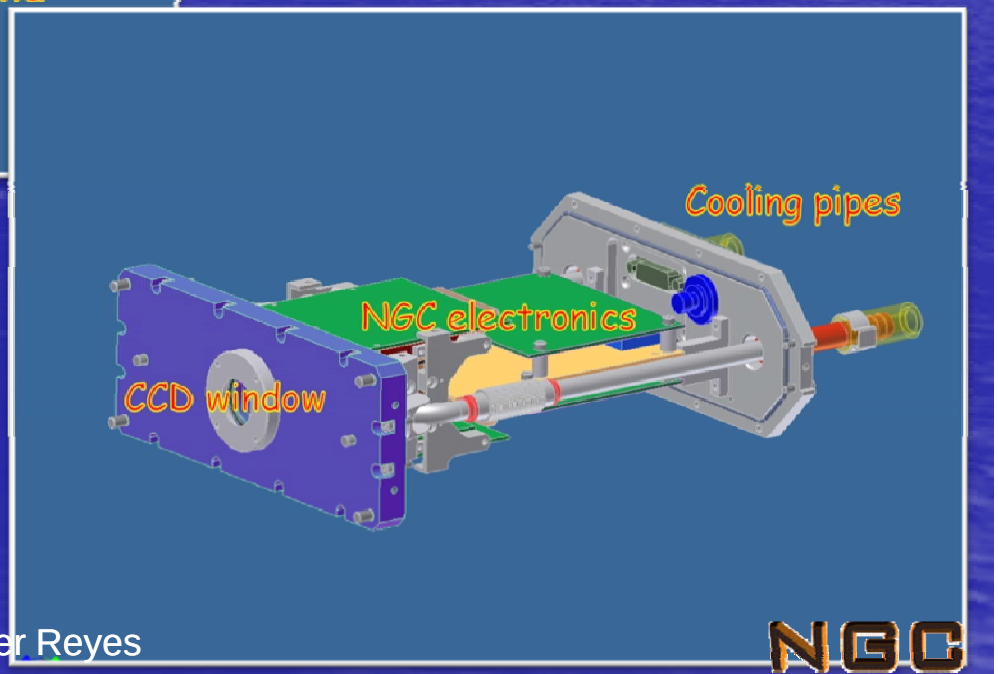
# The NGC AO WFS head




Mechanical design by Ralf Conzelmann

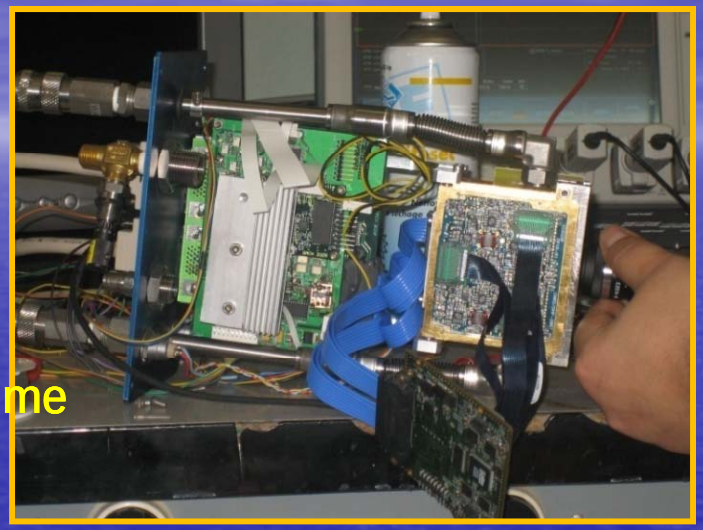
# The interior of the WFS head



# The history of the development


Opticon OCAM camera

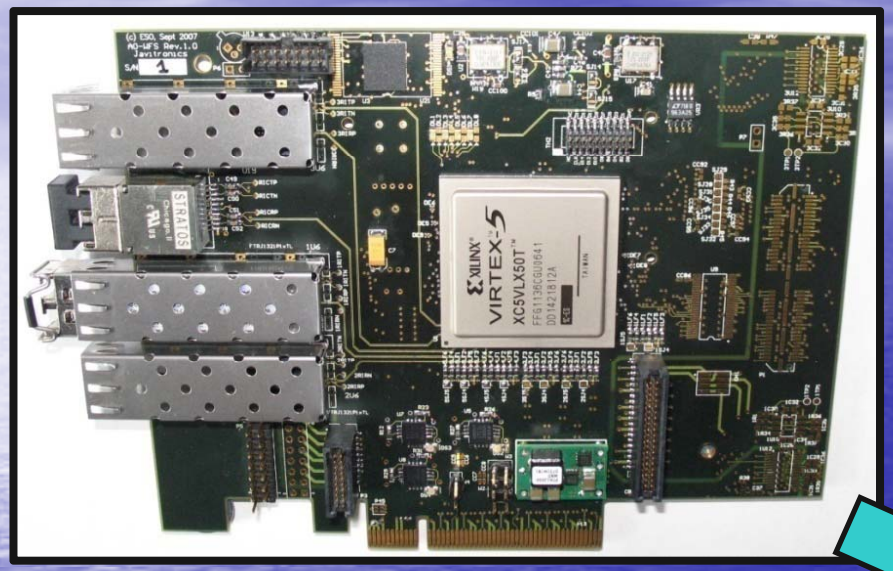


First light with prototype camera


- Development of front-end electronics to validate CCD220
- Development of high-voltage phase clock electronics
- I/F via CameraLink

# The current prototype hardware

ESO NGC control and comm. board

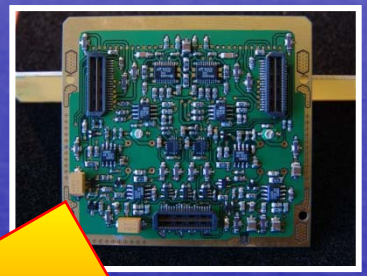


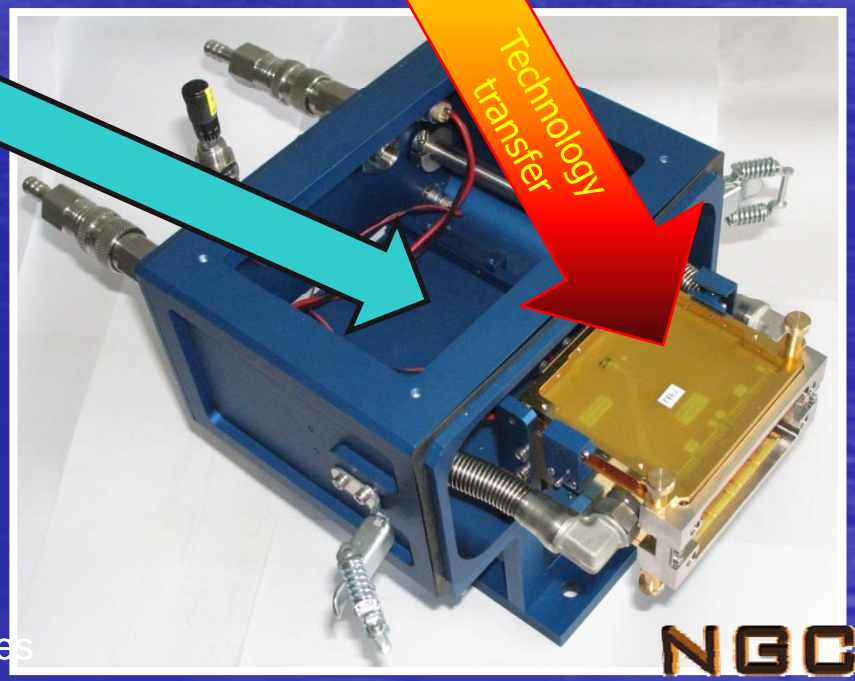

Technology transfer from Opticon OCAM is key

OCAM development (Marseille/OHP)

Video acq. board

Clock board

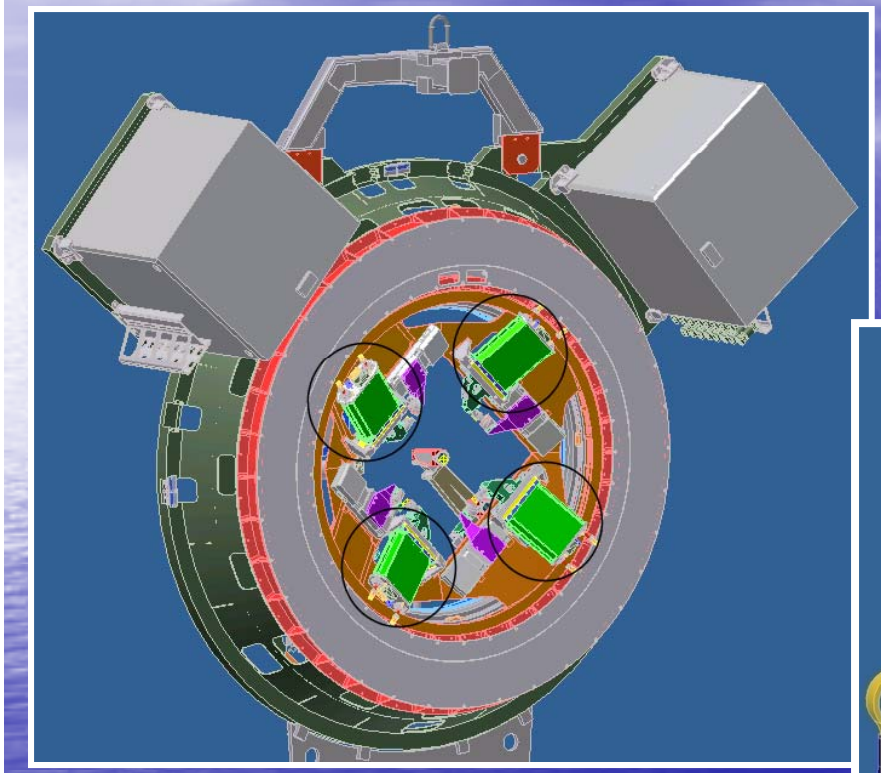





- Xilinx Virtex-5 FPGA
- 8 channels read-out ports
- 4 optical transceivers
- Digital sine wave generation
- Adjustable clock delay
- Over-illumination protection

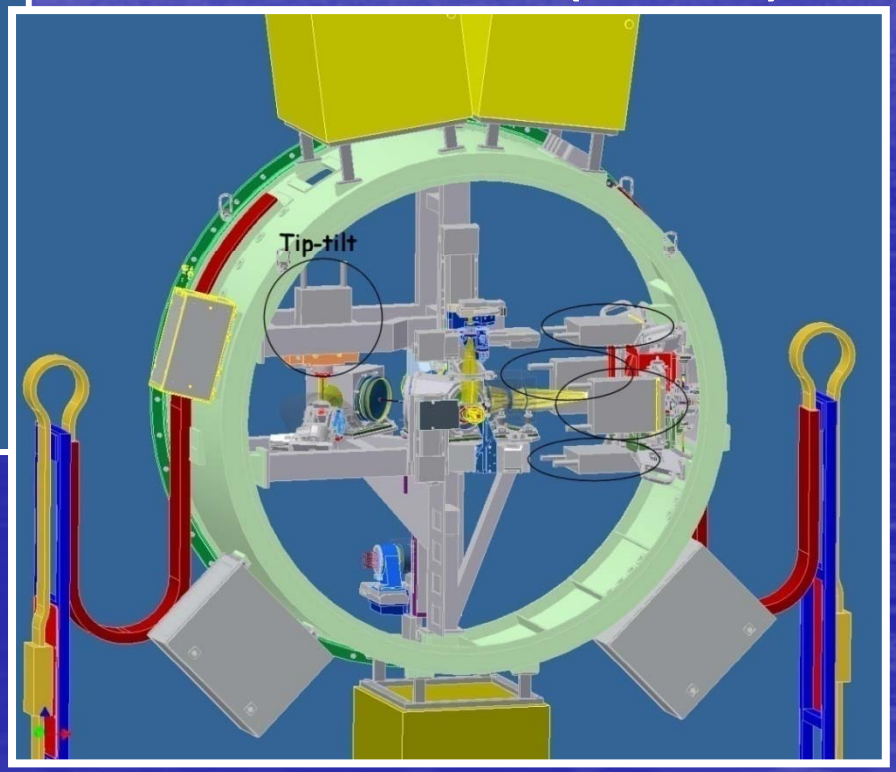
# The AO WFS head in GRAAL and GALACSI

GRAAL (MUSE)



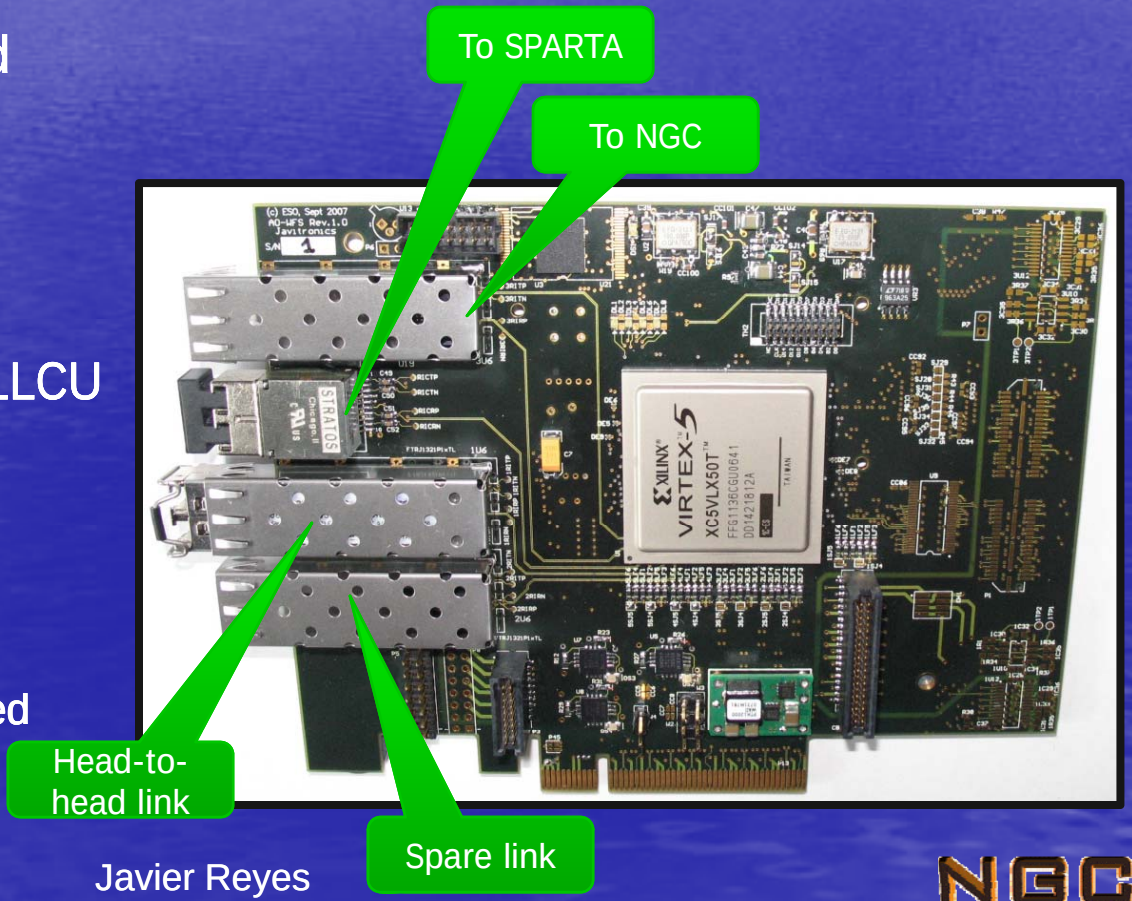
- The NGC WFS is one common LRU
- About 20 systems to be produced
  *(15 + spares)*
- First WFS in last quarter of 2010

GALACSI (HAWK-I)



# External I/F Sparta & VLTI

- Scientific NGC interface to VLTI
  - Xilinx Aurora data link level protocol
  - 1310nm mono mode fiber
  - 2.5Gb/s line rate speed
  - 8b/10 encoding
  - PMC based
- AO NGC
  - Same link as above to LLCU
  - SPARTA fiber interface
    - Serial FPDP protocol
    - Low latency: 4..6us
    - 850nm multimode fiber
    - 3.125 Gb/s line rate speed
    - 8b/10b encoding



# Thanks

- ICD NGC AO: VLT-TRE-ICD-14850-4286
- NGC web page: http://www.eso.org/projects/ngc/
- SPARTA-NGC IF: VLT-SPE-ESO-16100-3729