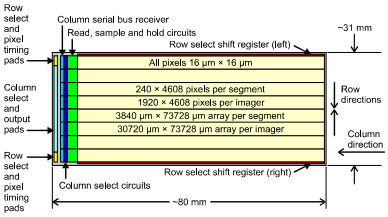
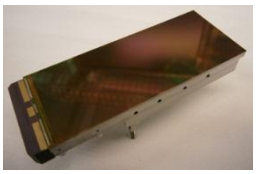
**Bringing Life to Technology: Space and Astronomy Imaging**

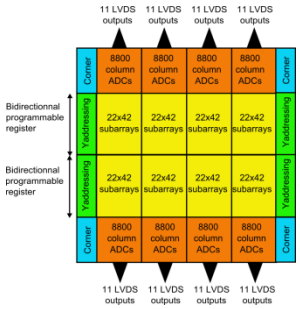
# e2v CCD & CMOS Sensors for Astronomy and Space:
## *From Silicon to the Stars*

## Backthinned, low-noise, CMOS Imagers




- Sensor: 1920 x 4608 16 µm square pixels.
- 8 segments for parallel read-out
- Independent access of left and right sides
- Multiple ROI mode for 20 fps sampling rate
- Noise floor < $3e^-_{RMS}$ and low dark current.
- Backthinned for 90% QE
- Saturation signal (node) ~ 18 ke-



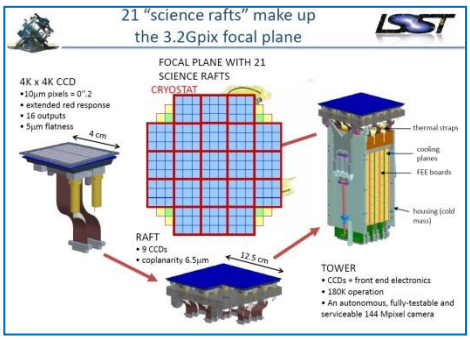



**LGSD** architecture 1760 X 1680

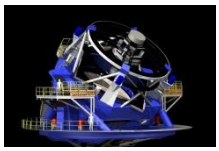
- Designed for AO WFS
- 20X20 pixel sub-arrays
- 24 um pixels
- Backthinned for high QE
- < 3 e- read-noise target
- LGSD (later) & NGSD ("1/4"-size)

## Red Sensitive CCDs

- 4k X 4k 10 µm format
- 189 science sensors
- 100 µm thick; 5 um flat
- High precision SiC buttable package
- 16 outputs; 2 s readout
- 5 e- read-noise




Pictures courtesy: LSST



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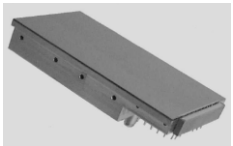
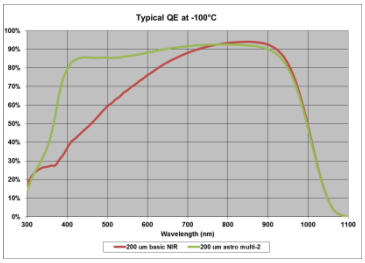
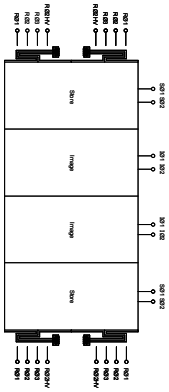


- 2k X 4k, 15 µm pixels
- 200 µm thick
- 2.5 e- noise floor
- Precision Buttable package




## Custom EMCCDs



**Main features**

- 4k X 4k image area
- 12 µm pixels
- Split frame transfer sections
- 8 EMCCD outputs
- Sub-electron readout noise
- Real and dummy outputs
- Min. 4 fps at 10 MHz pixel rates
- Designed for photon counting
- Non-inverted (non-MPP) operation at cryo temperatures
- Backthinned for high spectral response; 90% peak
- Alternate formats possible; TBC

103 mm die length

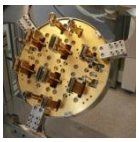
**Preliminary performance:**

- Full images recorded
- Very low Clock-induced-charge
- CTE good with unit gain; lower serial CTE with gain (as usual)
- Gain characteristics being measured

**Status:**

- Design complete
- Frontside devices characterised
- Backside devices in progress
- Production test being established
- Completion due early-2015

## Systems for Astronomy: More than Just Sensors

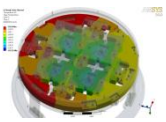


Lower view with sensors installed

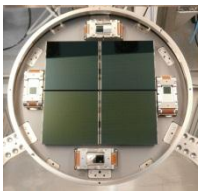
OSU cryogenic camera

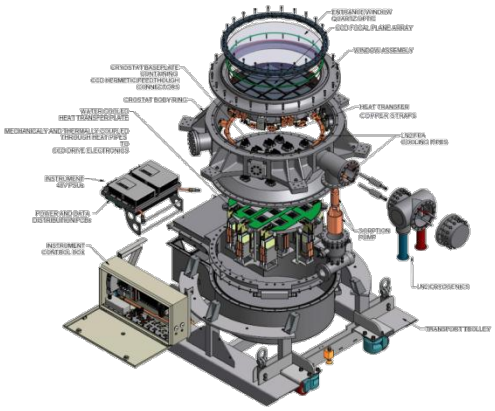
**e2v detector mounting plate:**
Four 9k x 9k Science CCDs
Four 1k x 1k FT Guide CCDs
Precision Silicon Carbide plate
Surfaces co-planar to 40 µm p-v

It fits in the metrology machine!



Thermal & mechanical FEA



All sensors assembled onto plate

Three complete focal plane assemblies delivered to OSU