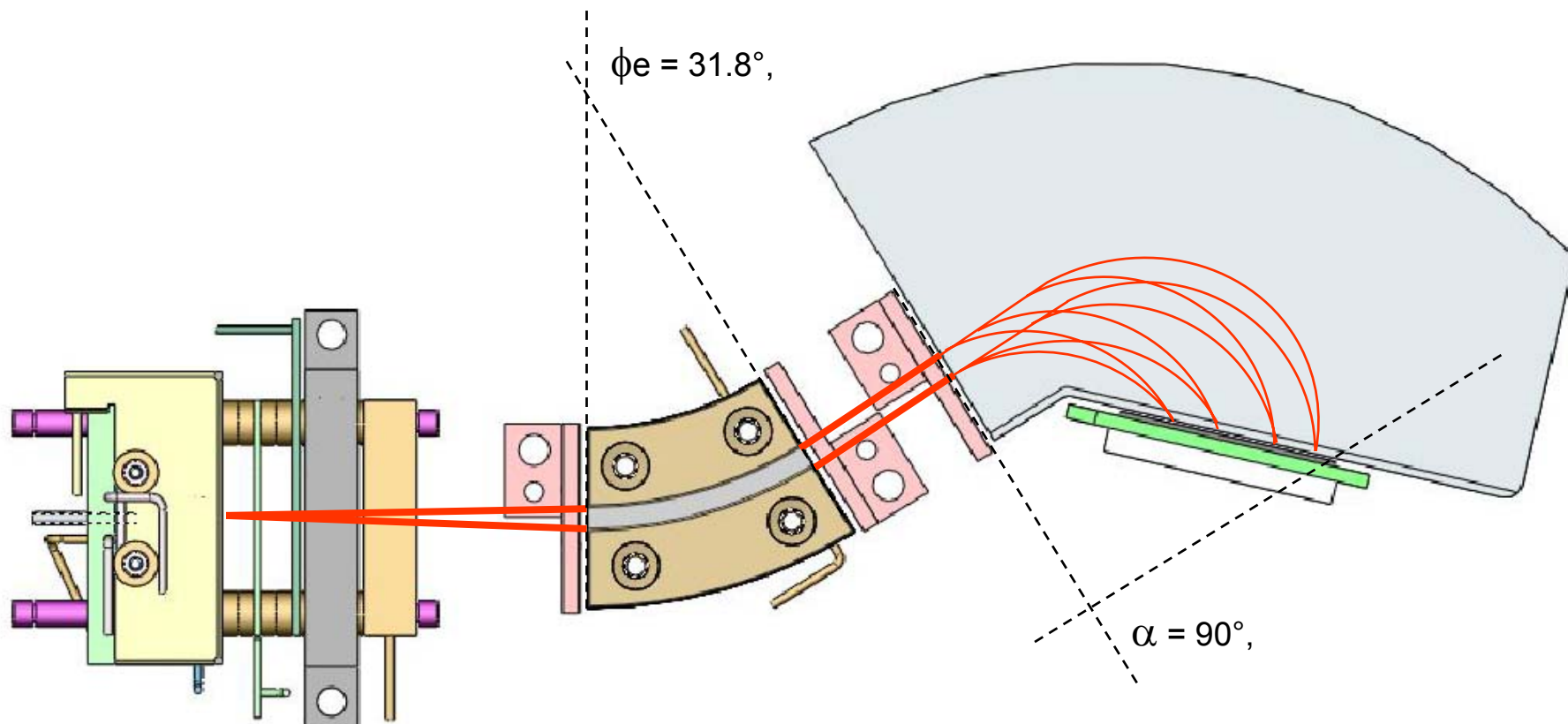


A CCD Detector Array for Direct Ion Measurement

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Mattauch-Herzog MS

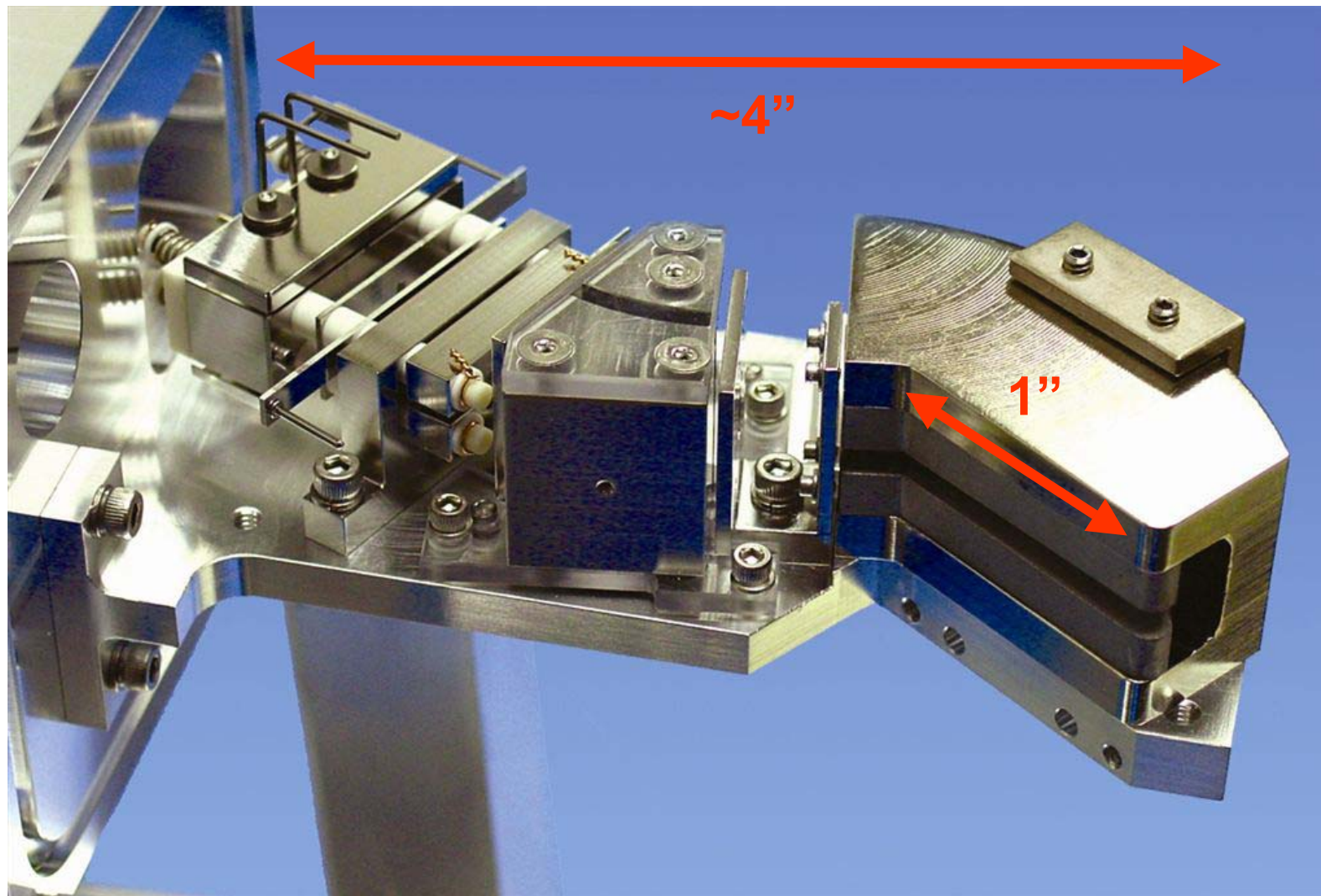


Source

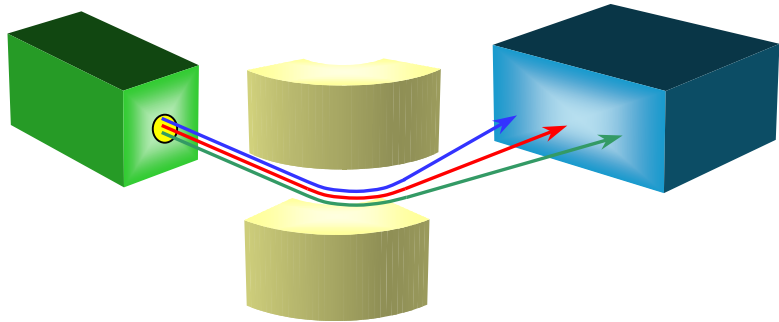
Electrostatic
Sector

Magnetic
Sector

The 1" Focal Plane MS



How to create a Spectrum ?



$$\frac{m}{z} = \frac{B^2 r^2}{2V}$$

Changing **B** magnetic field (slow)

Changing **V** acceleration voltage (scanning)

Collecting all **r** array detector

Simultaneous detection of all m/z

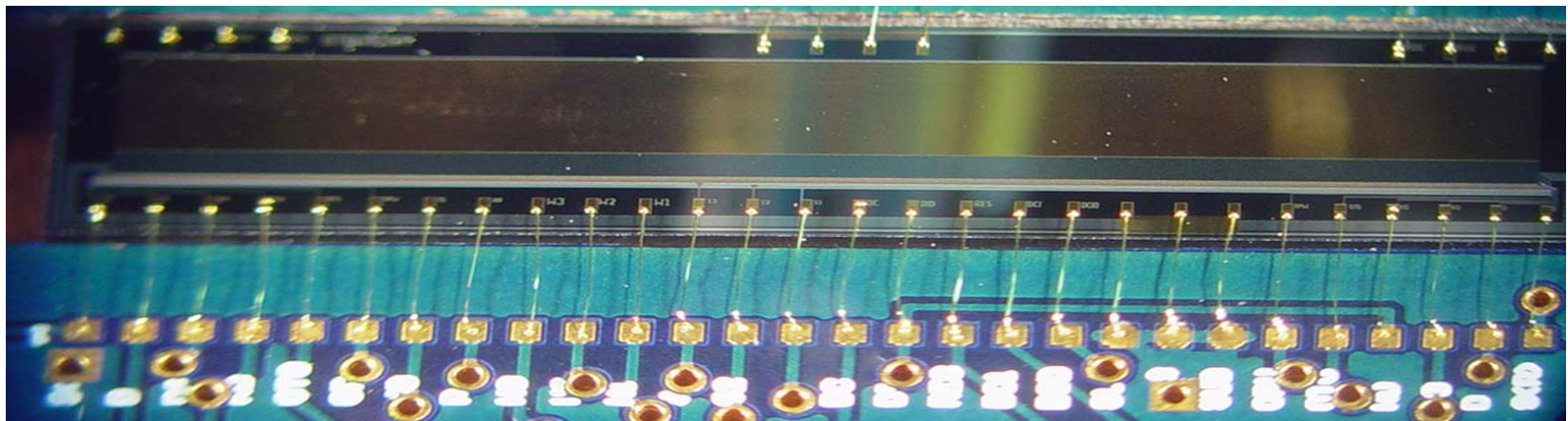
- Ions of all m/z focused onto a plane
- Non – scanning
- Improved duty cycle

Need for array detector

- Strip Charge Detector Array
- Faraday Cup Array
- Electro Optical Ion Detector
- **Charge Coupled Device**

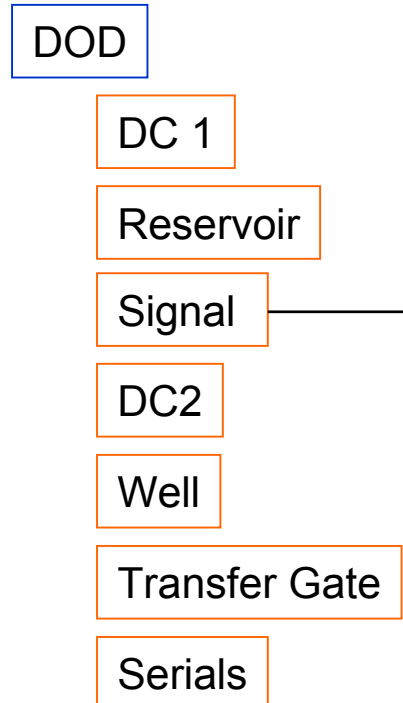
Ion - CCD

- Includes shift register and amplifier
- Eliminates Multiple Conversions
- No post acceleration of e-
- Extremely low noise floor
- Fine resolution pixel pitch 20 μm
 - 1" 1286 detector elements
 - 2" 2598 detector elements



CCD unit cell

Electrode (detector element)

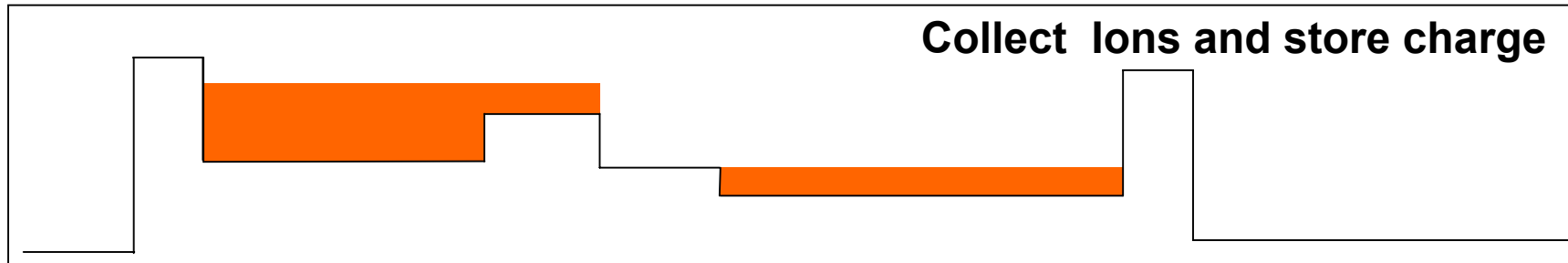
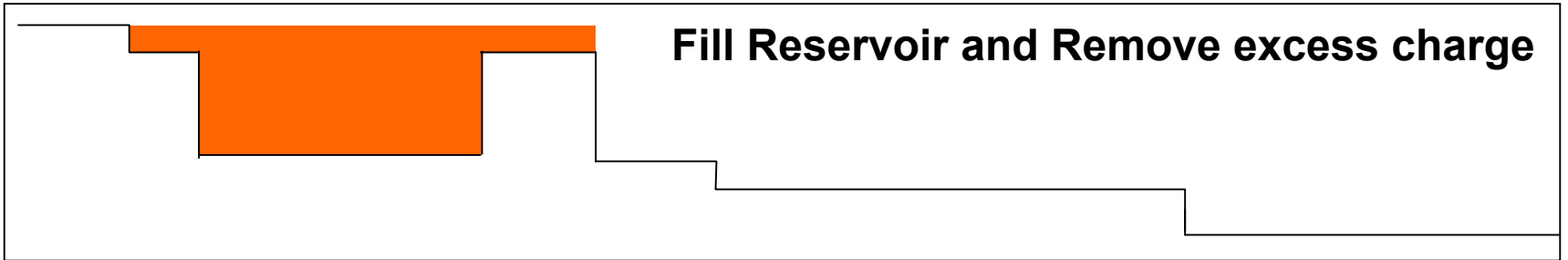
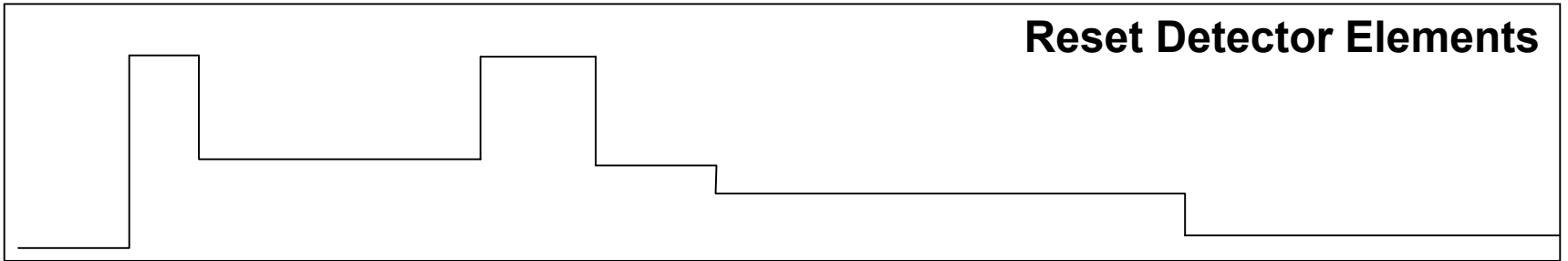


Light sensitive layer replaced with MOS

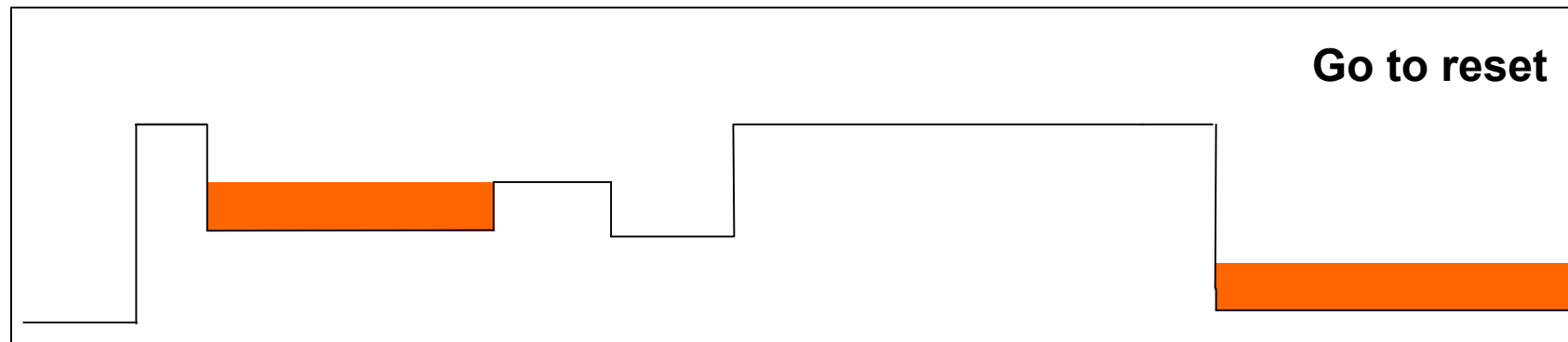
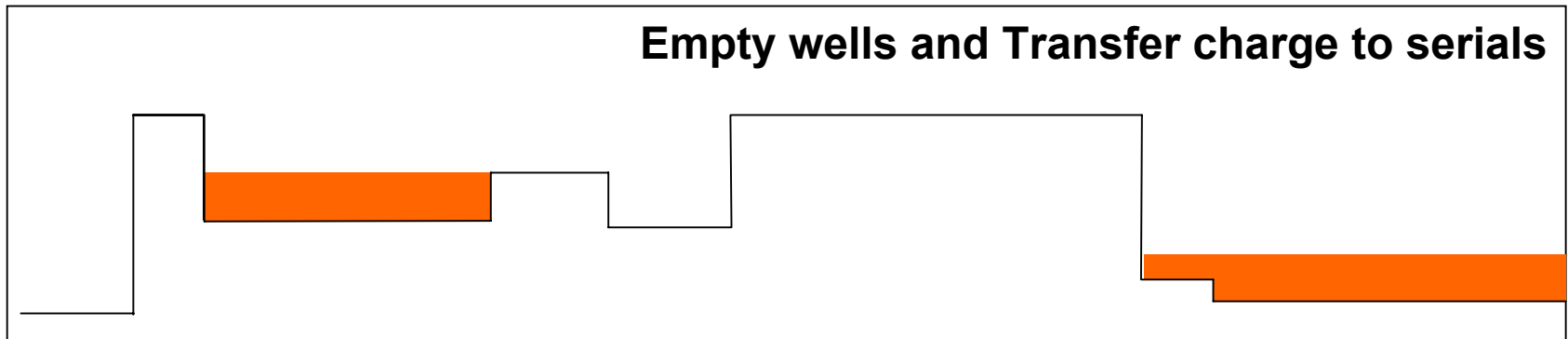
Biased gates create potential wells
appropriate clocking
Stores or moves collected charge

CCD - Spill and Fill

DOD DC 1 Reservoir Signal DC2 Well TG Serials



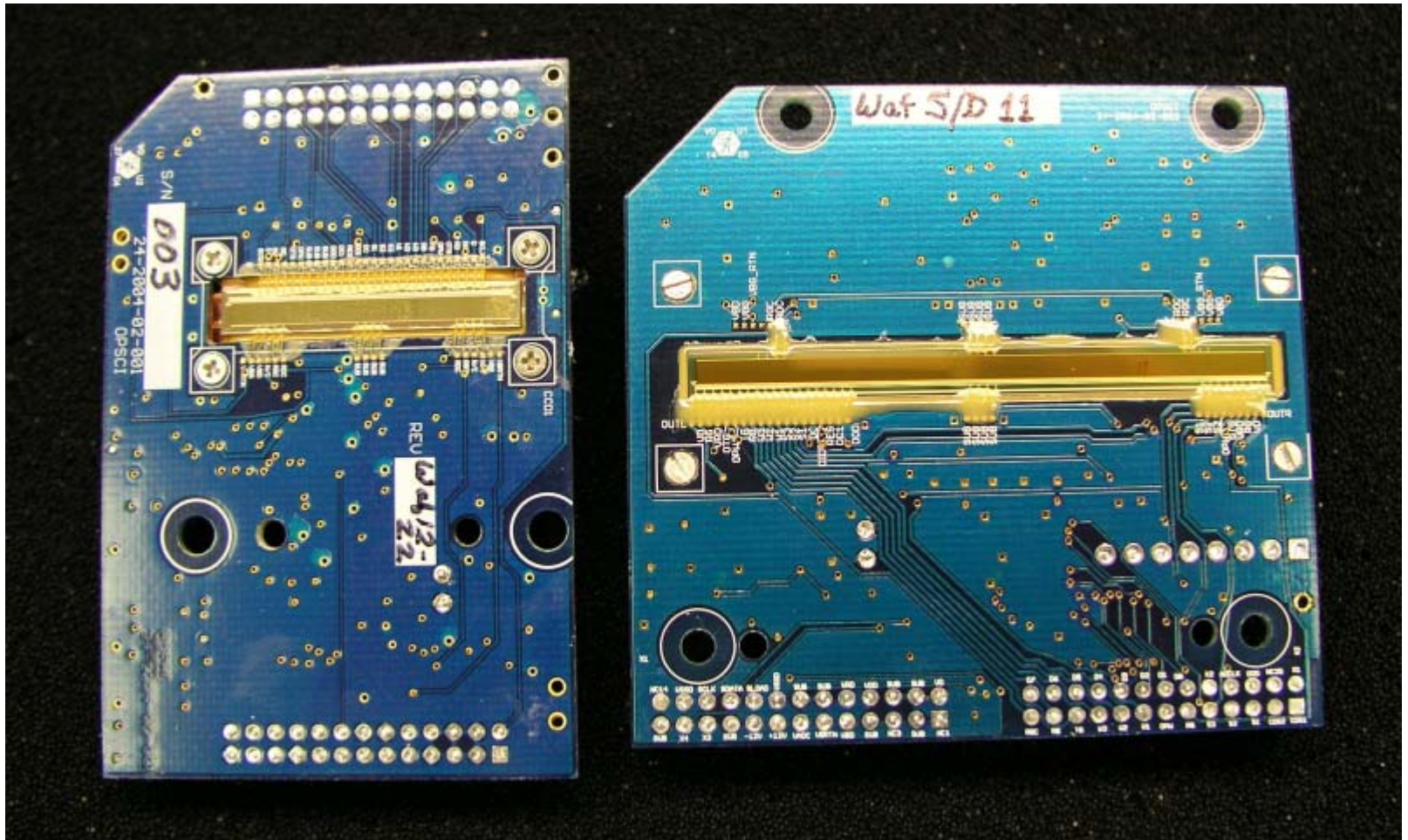
CCD - Spill and Fill continued



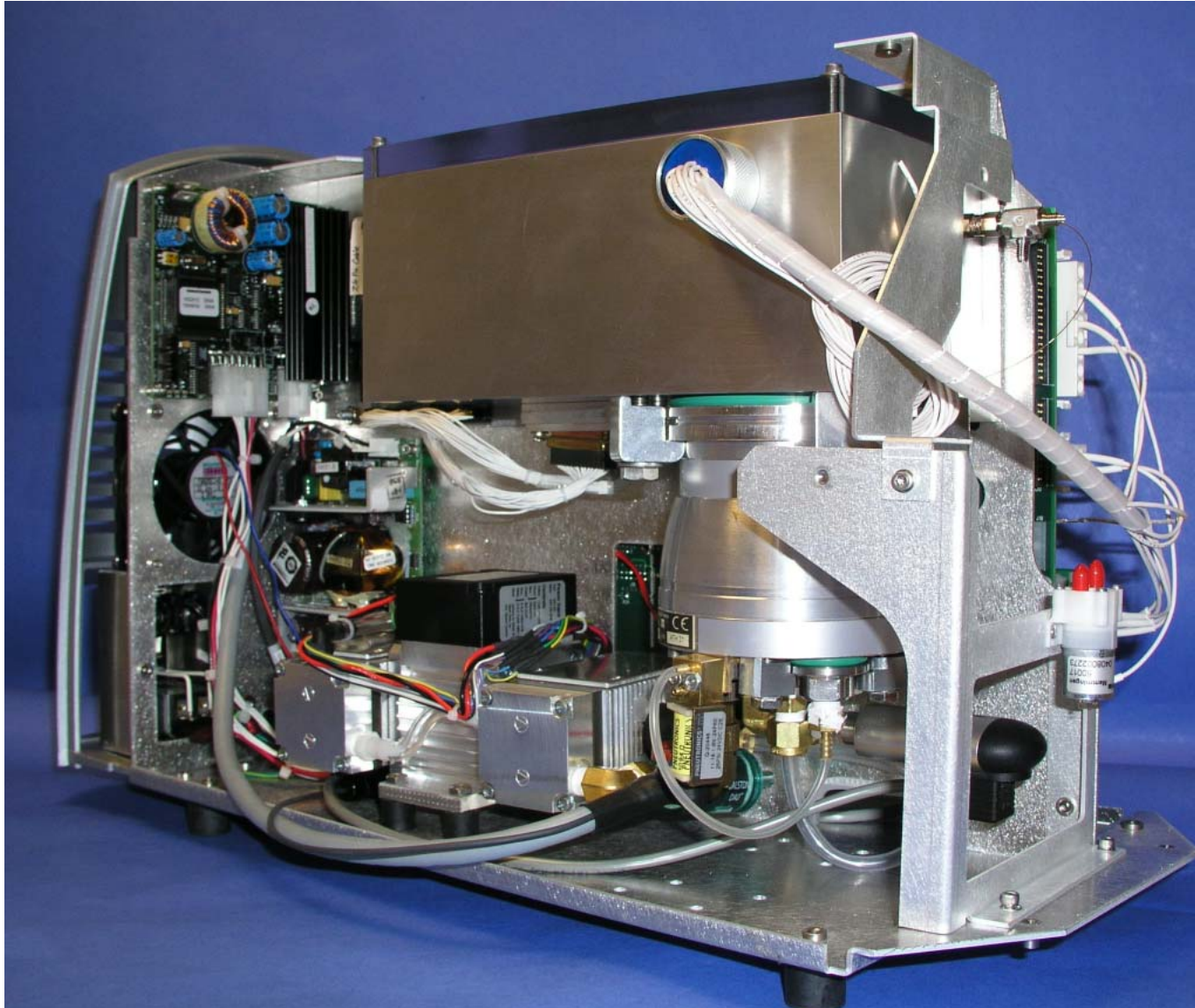
Detector board

1" detector

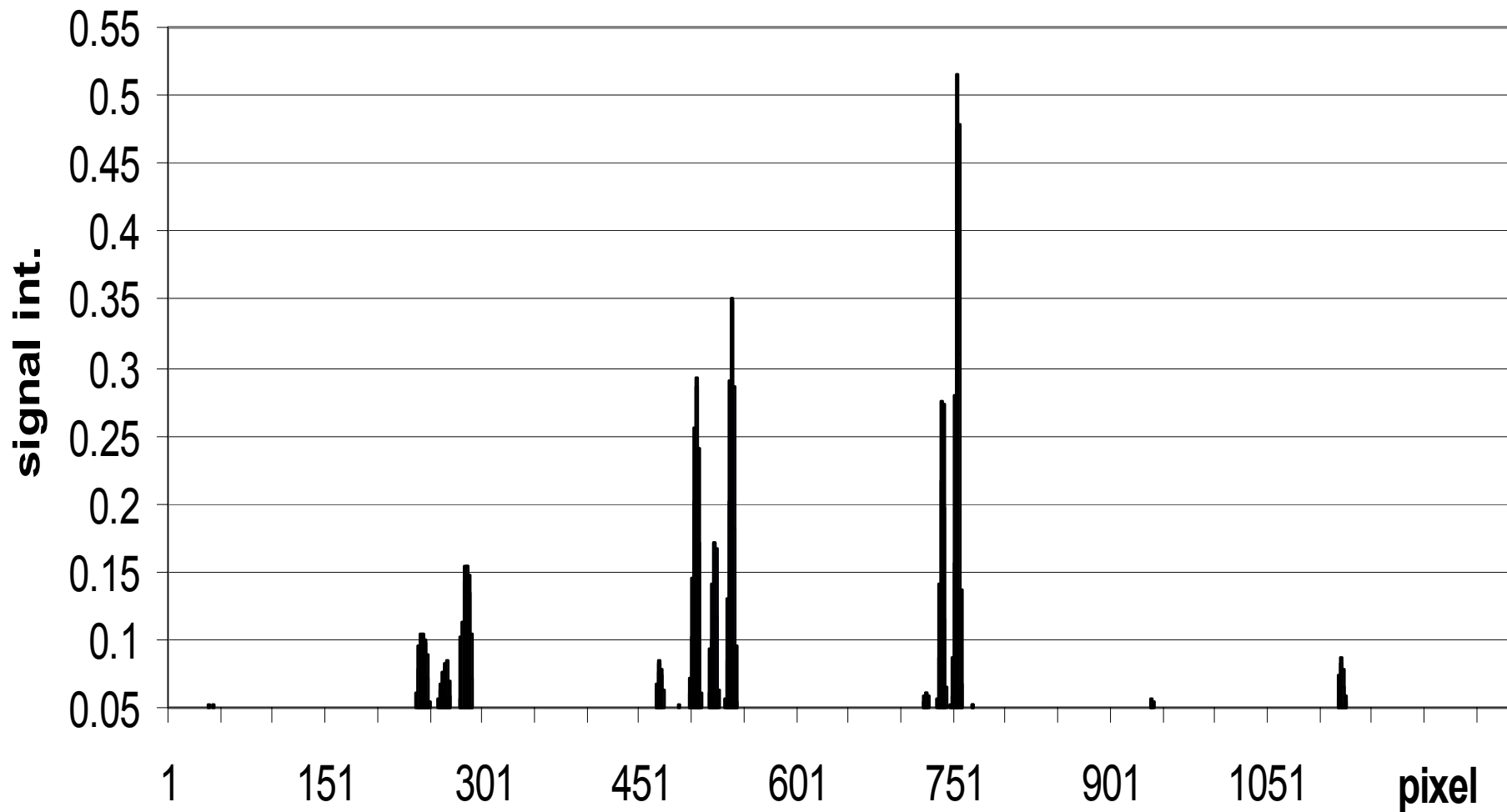
2" detector



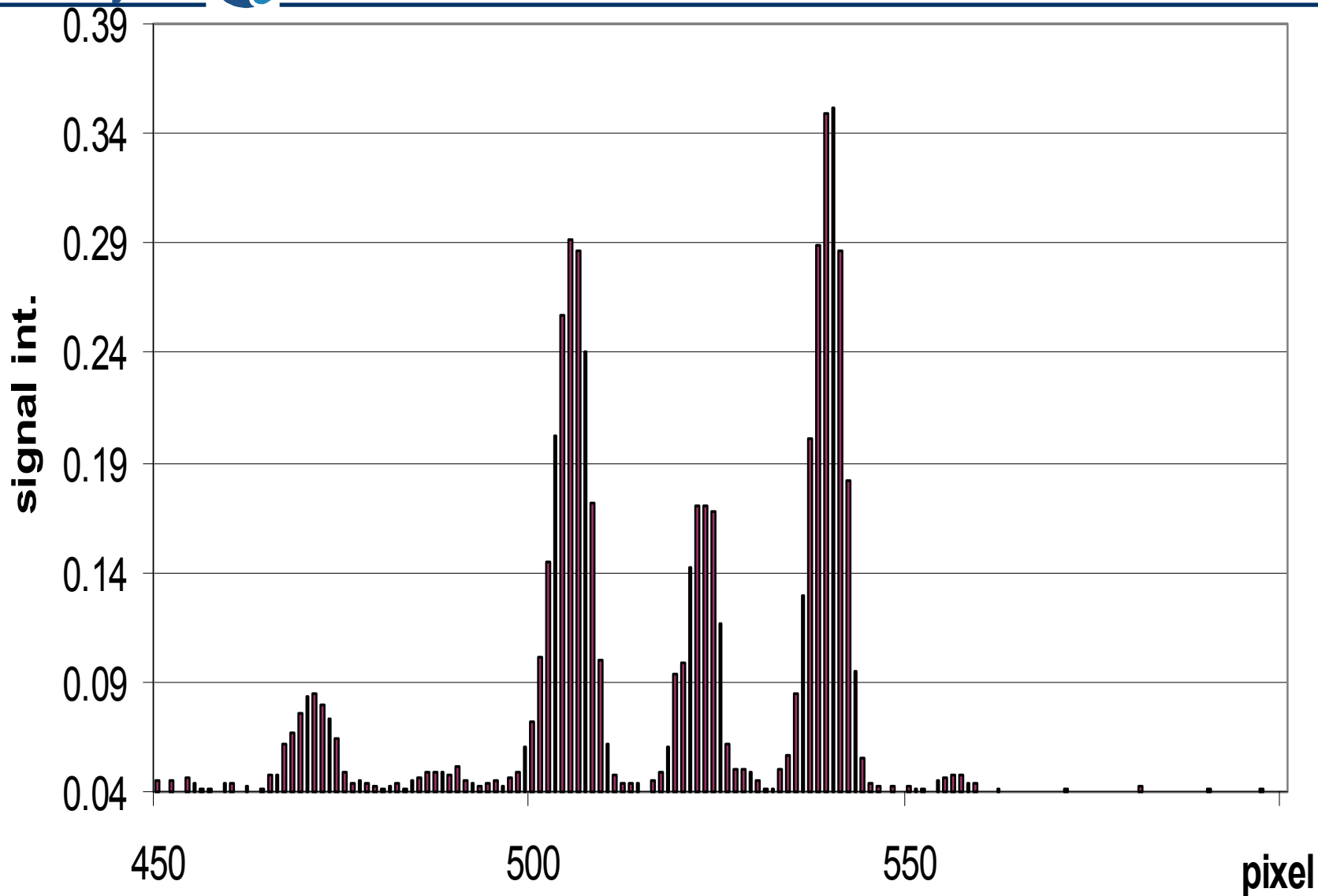
R&D System

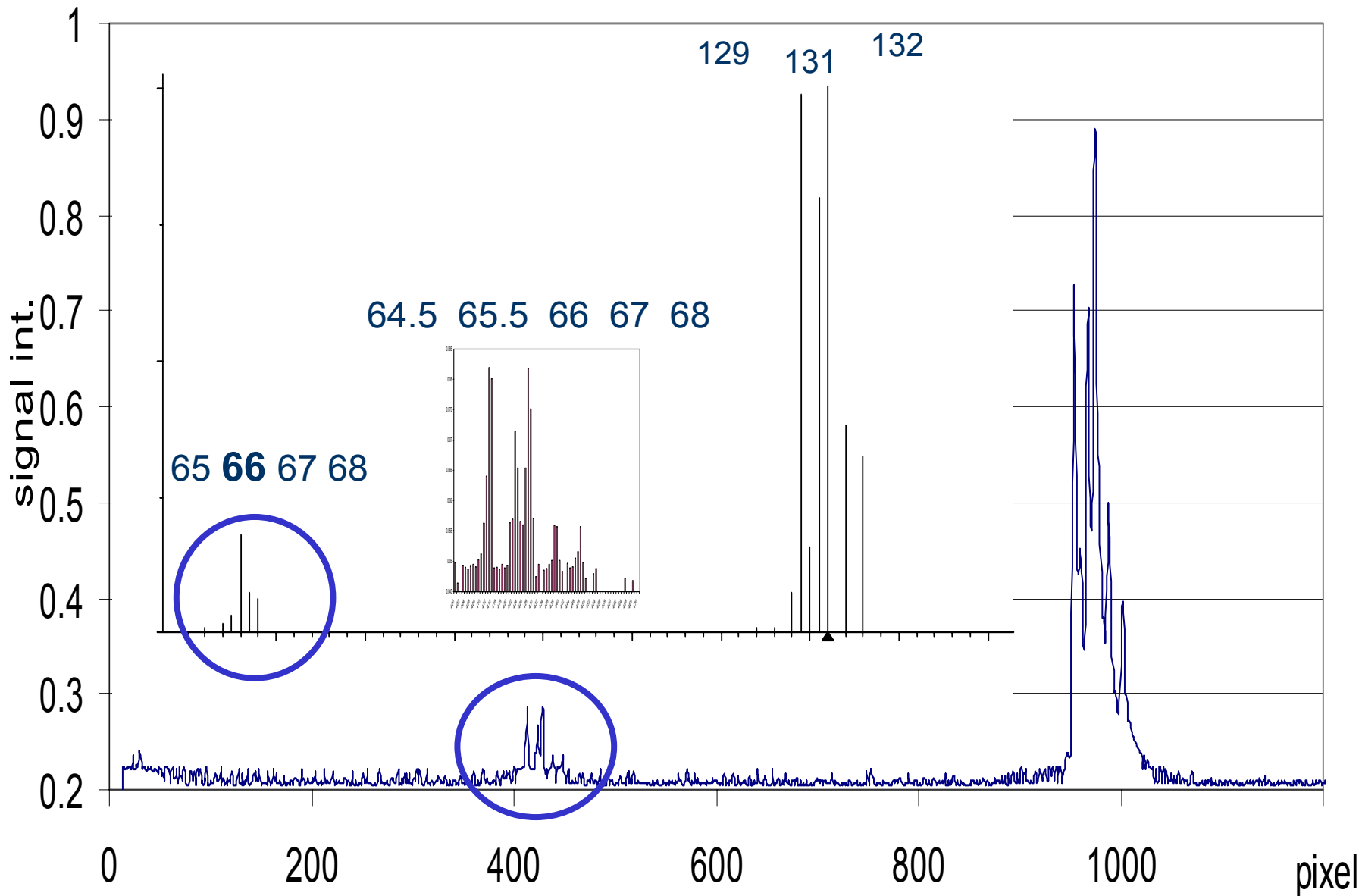


n-Hexane in Helium 100ms frame

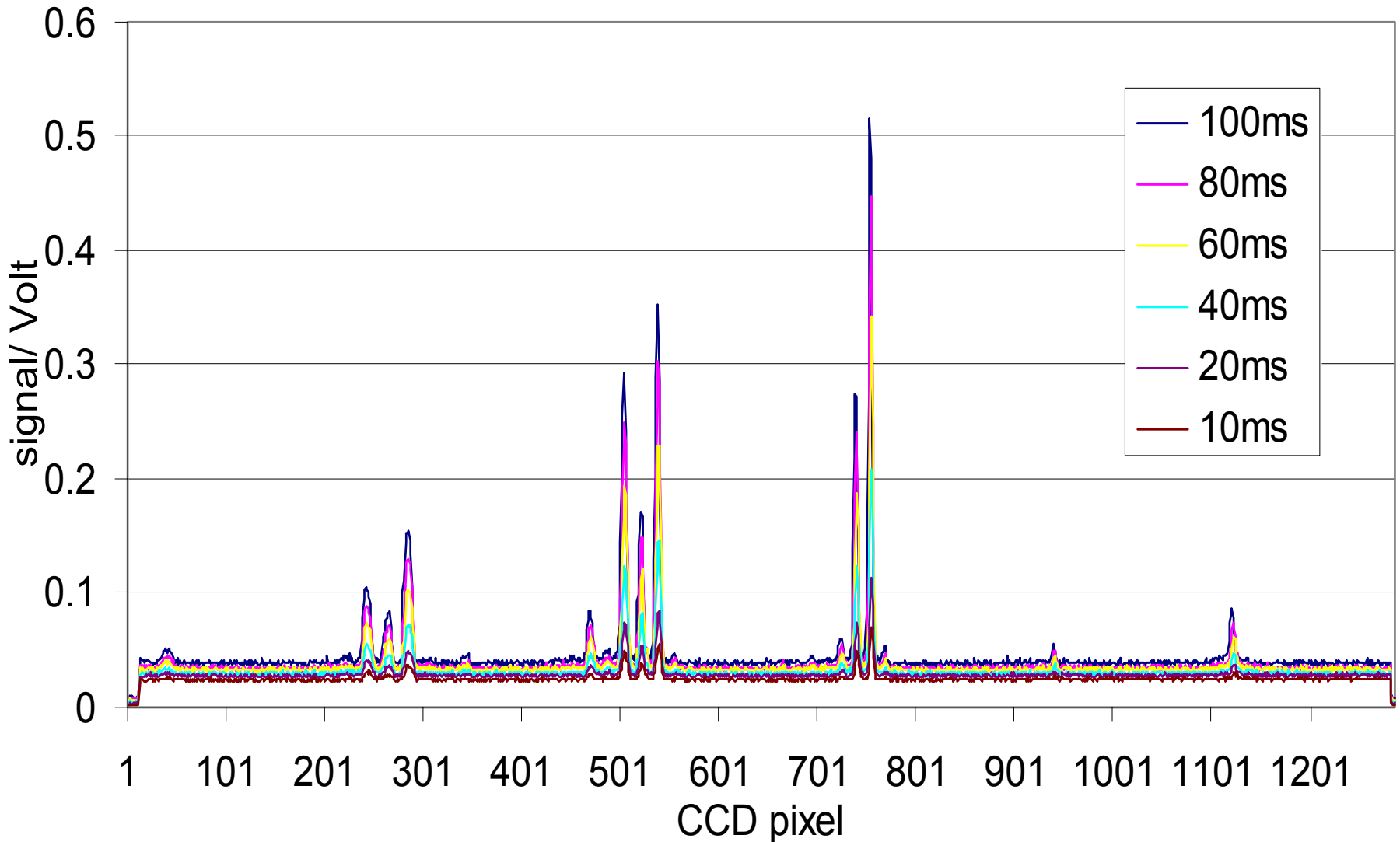


n-Hexane fragment group 39 to 44amu



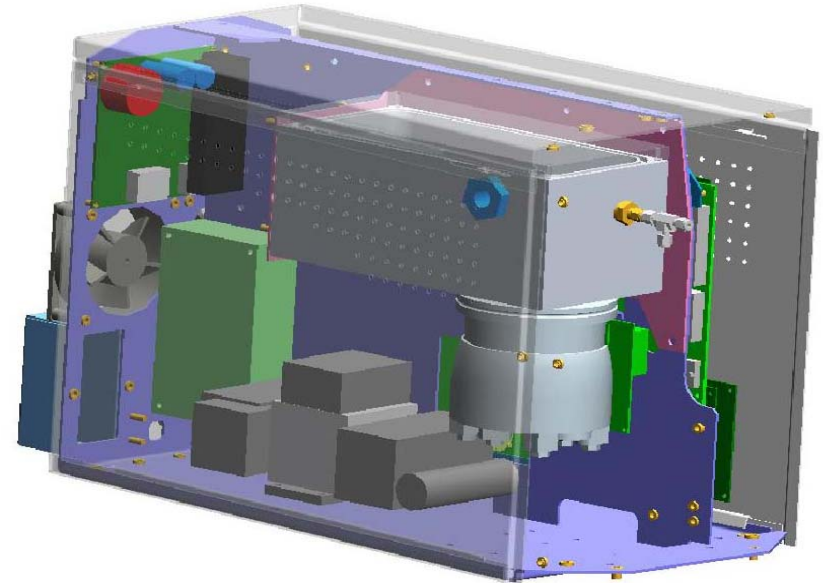
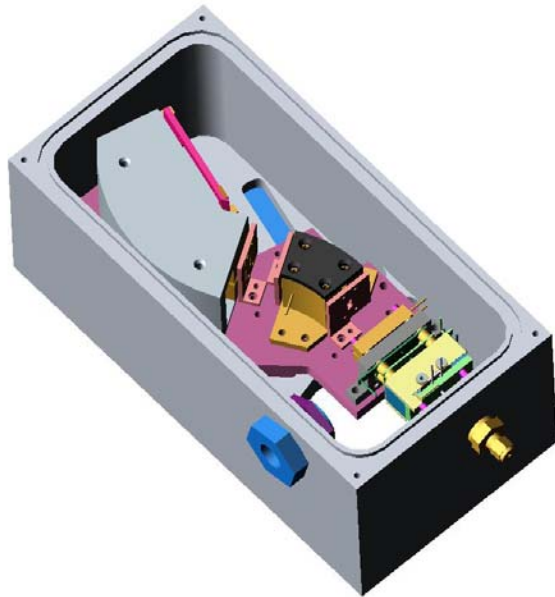


Hexane in Helium



R&D System

- Sector field MS (350 amu)
- pumps and power supplies onboard
- 25 cm x 61 cm X 35 cm
- Complete system 16 kg
- 50 Watts power



- CCD
- Array detector
- Resolution < 1amu
- Full mass spectra in 10 ms
- 100 % Duty cycle

- **CCD**
 - What pitch is needed?
 - What applications ?

- **Sensitivity**
 - Noise

- **Stability**
 - Aging
 - Deposits

**The presented development is based on
patents licensed from JPL**

Mark Wadsworth and Mahadev Sinha

**The R&D team at
OI Analytical /CMS Field Products**