# Xcam CCD Camera with e2v Technologies CCD42-90 or CCD44-82

## Introduction

Xcam specialises in producing custom and prototype CCD cameras for leading-edge science experiments all over the world. Xcam has produced a peltier and water-cooled camera that will house the e2v Technologies CCD42-90 or CCD44-82 sensors. The CCD42-90, and the similar CCD44-82 are very large CCDs which are usually built into large arrays and cryogenically-cooled for use as large telescope focal plane arrays. However, some experiments which have short integration times, can use these CCDs built into this type of housing. This camera is available as a single camera unit, but can form a dual unit camera with the use of a common mounting plate.

## General Features

**CCD types available** (subject to availability from e2v Technologies)**:**

- Front-illuminated (FI)
- Back illuminated (BI)
- Deep depletion (DD)
- Red-enhanced
- Coated for wavelength sensitivity optimisation
- Uncoated for good soft x-ray response


**Fig 1: Xcam Single Camera Unit**

Xcam can advise on the most appropriate CCD for your application and you should consult us with details of your requirements for further information.

Warning: Do not contemplate buying a back-illuminated CCD for soft X-ray photon-counting work, unless you have discussed with us first, as for most photon-counting applications back-illuminated CCDs are not suitable.

**Cooling**: Peltier and water cooling to cool CCD down to -45C; water connections are vacuum and pressure-tested

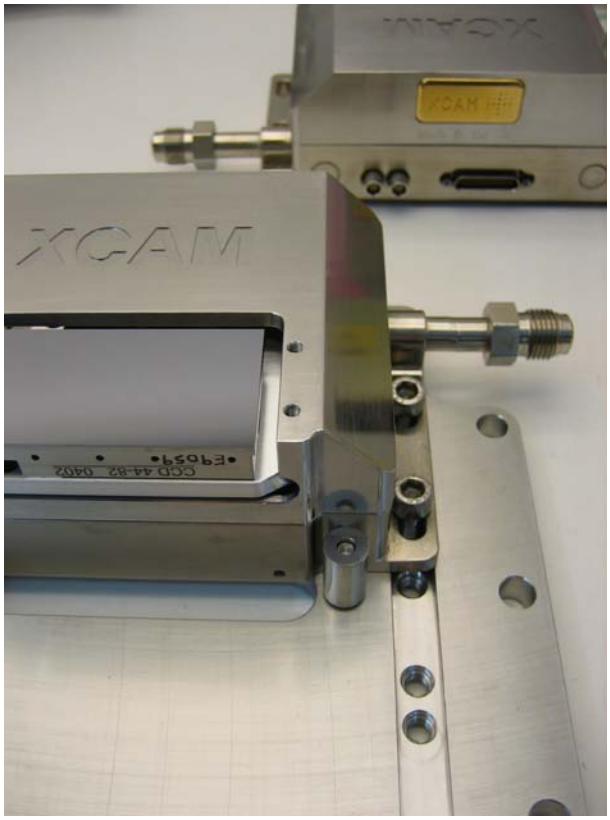


**Fig 2: Xcam Single Unit on Base Plate in Foreground with Sensor Exposed to view, and (background) Alternative Orientation**

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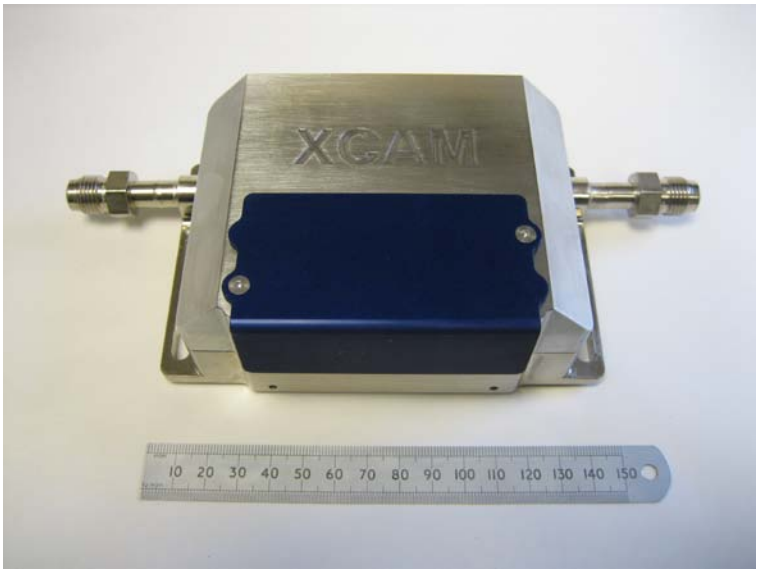
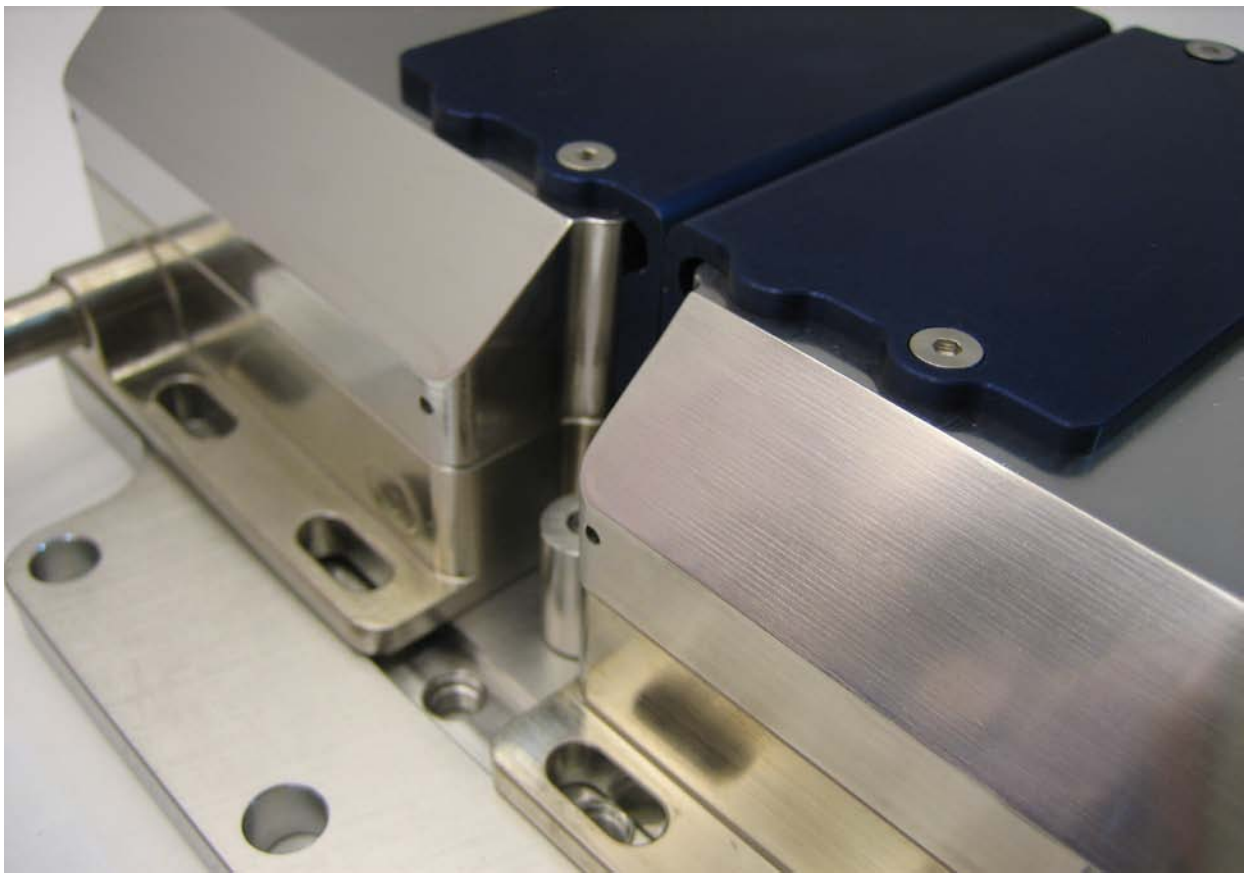
**Vacuum-Compatible Construction**: All vacuum compatible materials and processes are used, and can be adjusted to suit customer's preferences or requirements. Camera can reside inside vacuum chamber or interface via an O-ring seal. Camera can be locally pumped if required.




**Software/Hardware Triggering** to start Erase and Integration sequences, to operate with your experiment. Custom triggering schemes are catered for.

**Full Software Control**: Options available are (1) Xcam application software (2) user-written software to call .dlls to control system or (3) Xcam written custom control software.

**Extended Dynamic Range Operation** available for use in challenging environments eg Free Electron Laser experiments in which single photon detection is required in outer part of image, and full-well capability in centre of image.



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## Single Unit Camera

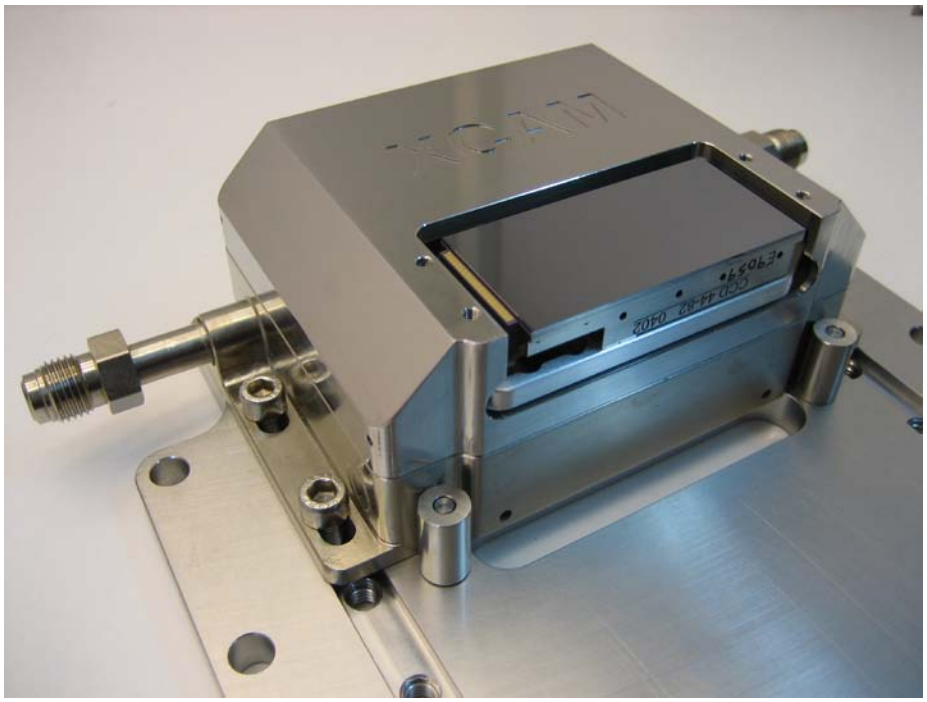


**Fig 3: Single Unit Camera (left) showing CCD Sensor details**

**Fig 4:Single Unit Camera (below) in use inside vacuum chamber**


## Features of the Single Unit CCD44-82 Camera

- Pixel size 15 microns square
- Number of pixels 4096 x 2048
- Image area 61.4mm x 30.7mm
- Full well capacity 200 ke-/pixel
- Read-out speed (CCD limited) 1MHz
- 2 low noise output nodes

## Features of the Single Unit CCD42-90 Camera

- Pixel size 13.5 microns square
- Number of pixels 4608 x 2048
- Image area 67.3mm x 28.2mm
- Full well capacity 150 ke-/pixel
- Read-out speed (CCD limited) 1MHz
- 2 low noise output nodes

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## Alternative Format Single Unit Camera

This format of camera head is used only as a single unit camera, and has an O ring seal to interface to a customer's vacuum system. Water and peltier cooling cool the CCD down to -45C. A separate pumping port permits local pumping.

**Fig 5: Alternative Format Single CCD camera, showing sensor and water and vacuum pipes**

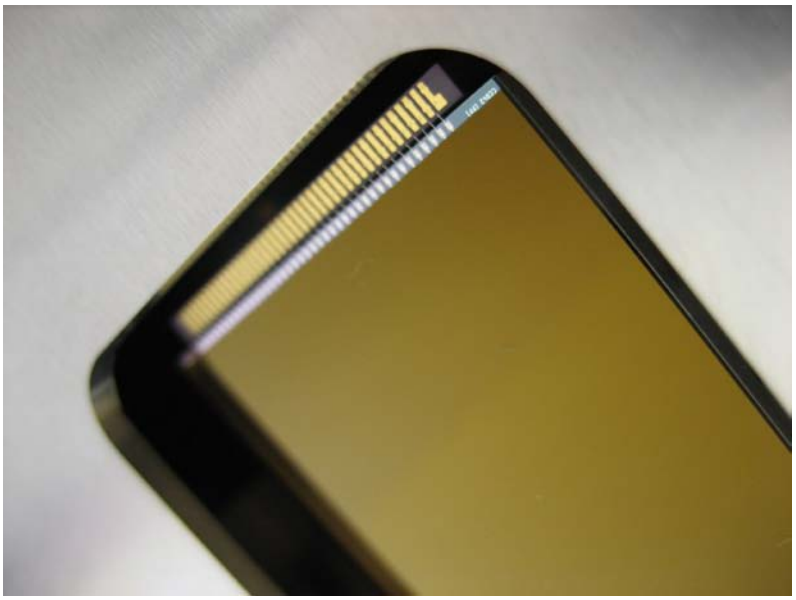

**Fig 6: Sensor Detail**

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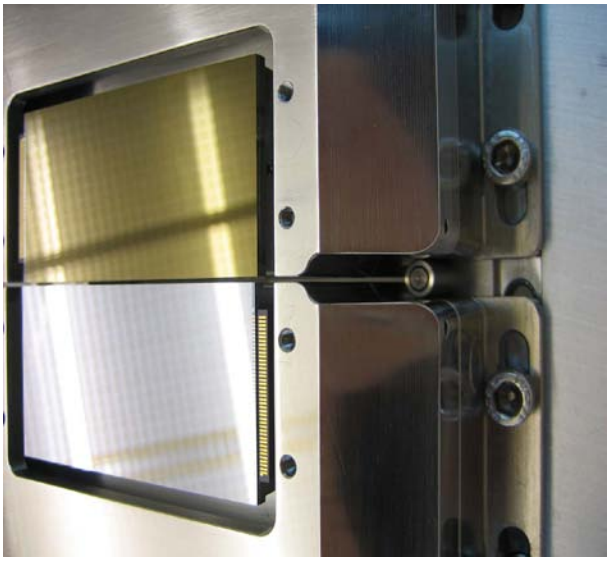
## The Dual Camera Configuration



The configurable camera design variant allows its use in a dual camera configuration by mounting the cameras to a base plate as shown left. In this option the two CCDs are separated by an adjustable slit, the dimensions of which are separated by precisely machined gauge bushes shown. The difference in colours of the two CCDs in this instance is due to different coatings on the CCD surfaces, to optimise performance at particular wavelengths.

**Fig 7: Dual CCD camera; the two CCDs are different colours due to different coatings on the respective CCDs to optimise performance in different wavelength regimes**

## Features of the Dual Unit Camera

Total number of pixels 4608 x 4096 for the CCD42-90 or 4096 x 4096 for the CCD44-82
Total image area 67.3mm x 56.4mm (plus slit width and dead space) for the CCD42-90 or 61.4mm x 61.4 mm for the CCD44-82

Minimum slit width is 300 microns

Distance from edge of image area to edge of CCD package is 300 microns for each CCD

Maximum slit width is user-definable

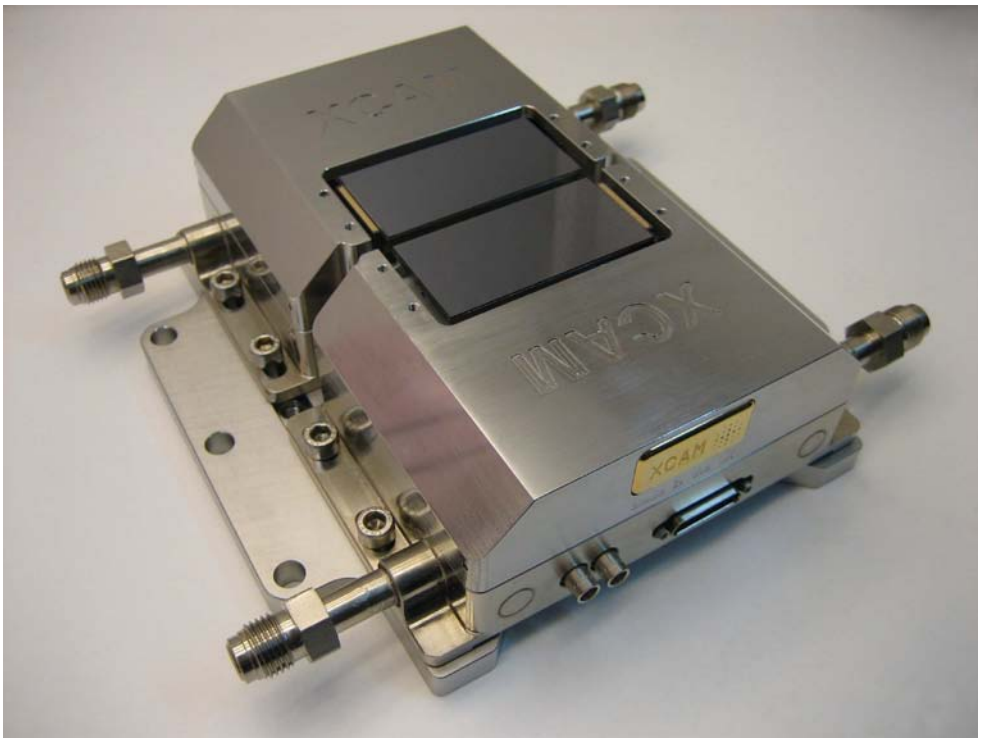


**Fig 8: Dual Unit Camera on Base Plate, showing Sensors**

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Fig 9: Showing Gauge Bush detail used to precisely set CCD separation down to 300 microns

Fig 10: Showing Gauge Bush detail

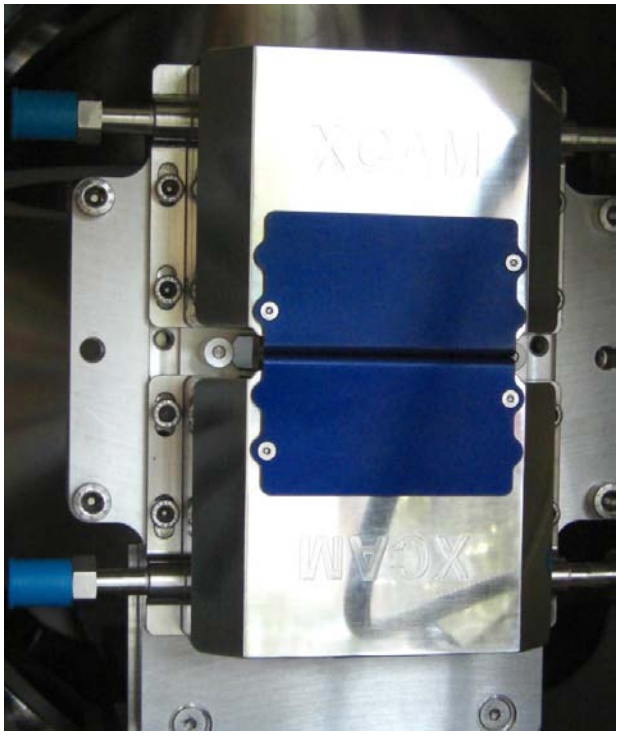

Fig 11: Showing Dual Unit CCD camera with protective finger guards, and water cooling pipes exiting from both sides

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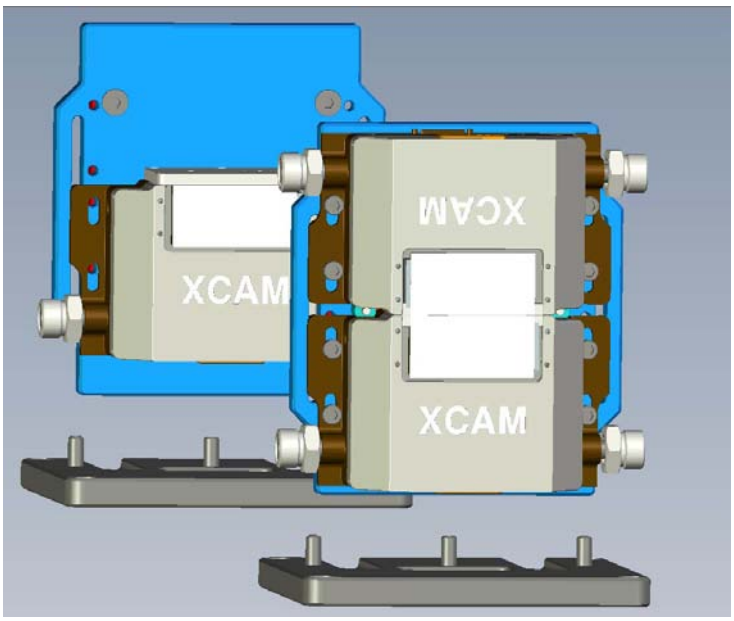
## Multiple Camera Combinations




The design of the camera permits their use in a number of configurations, such as the configuration below.

Multi-Synchronisation sequencer cards permit multiple CCDs to be operated in synchronisation for low noise performance.

Recent software developments enable multiple CCD camera systems to be operated with a single PC through the XCAM software.

**Fig 12: Shows possible use of 3 camera units for diffraction experiment**

**Alternative configuration for higher frame rates** (subject to availability of suitably packaged CCDs)

- 4 CCD camera with adjustable central hole.
- 4 off 42-40 CCD (2048x2048 15 microns)
- 8 output nodes for faster frame rates
- >2 frames per second (2x2 binned)
- Low noise operation
- Vacuum compatible construction to suit
- Ideal for Sax/Wax (small angle x-ray diffraction)

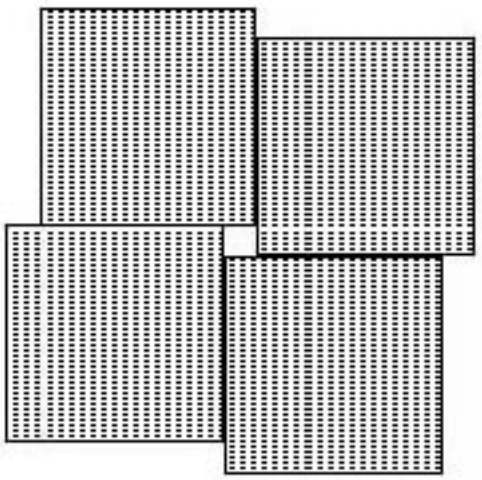


**Fig 13: Possible 4 CCD configuration of 42-40s (subject to availability) with adjustable central hole**

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## Testing and Transport

Because CCDs are sensitive to moisture and must not be cooled in air for testing, Xcam provides transport containers that double as test containers when purged with a dry gas, permitting testing at temperatures down to -20C. As the CCDs are very delicate and of high cost, the transport containers are built to be substantial to protect the camera during movement and storage. All CCDs have a protective finger guard which is left in place until the CCD is ready to be used to avoid damage to the delicate wirebonds during experimental set-up procedures.


**Fig 14: Single Unit CCD Camera on Transport base, showing electrical connections which permit testing in the dry gas purged container**

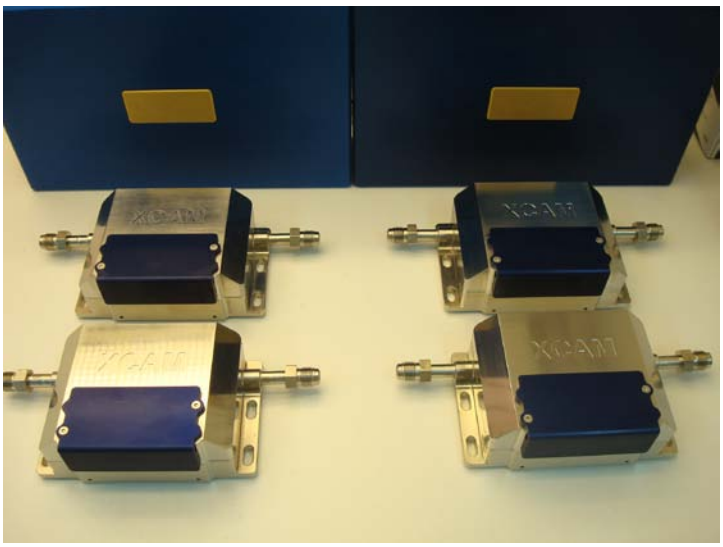

**Fig 15: 4 Single Camera Units with 2 Transport boxes behind.**

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