

A 960 x 960 Fast Frame Store CCD Detector for X-ray Photon Correlation Spectroscopy

John Weizeorick^{1*}, Tim Madden¹, Suresh Narayanan¹, Sufeng Niu¹, Alec Sandy¹, Devis Contarato², Peter Denes², Dioniso Doering², John Joseph², Patrick McVittie², Victoria Moeller-Chan²

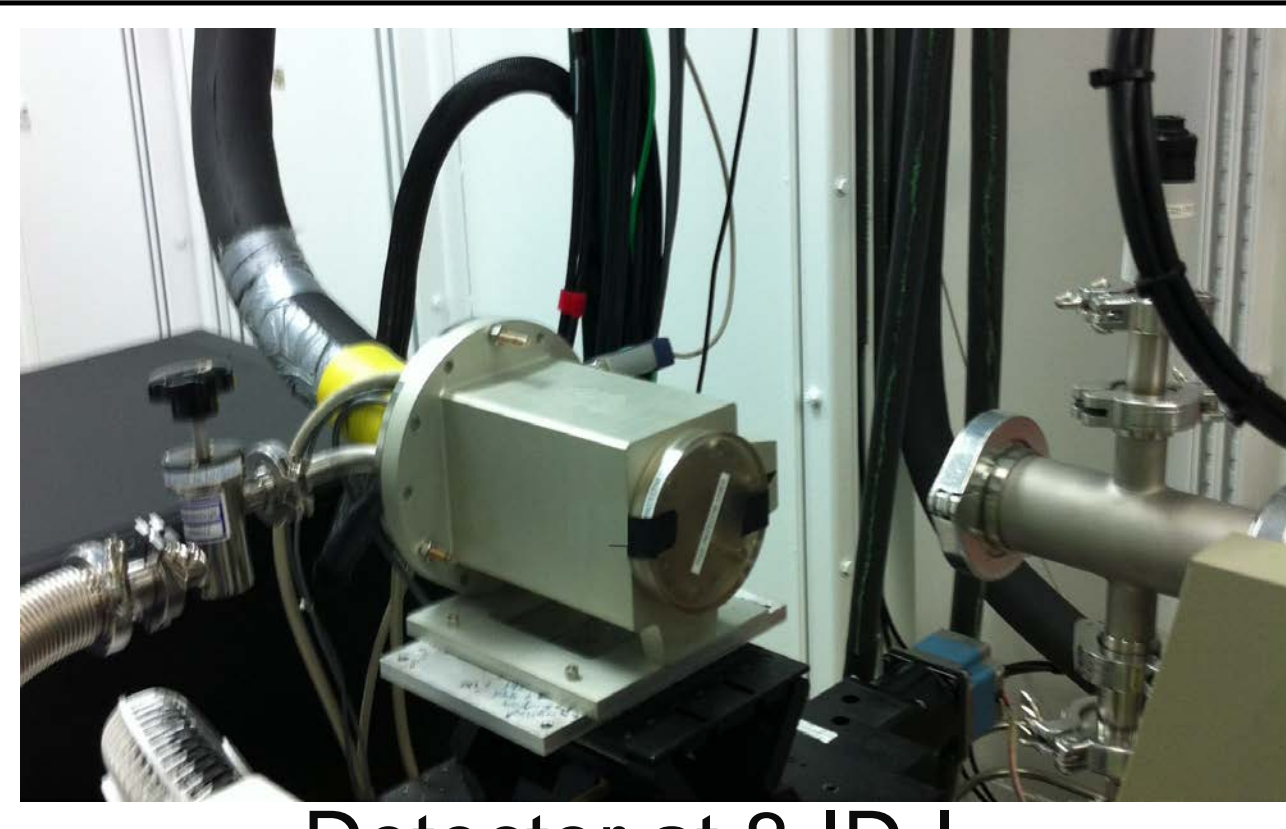
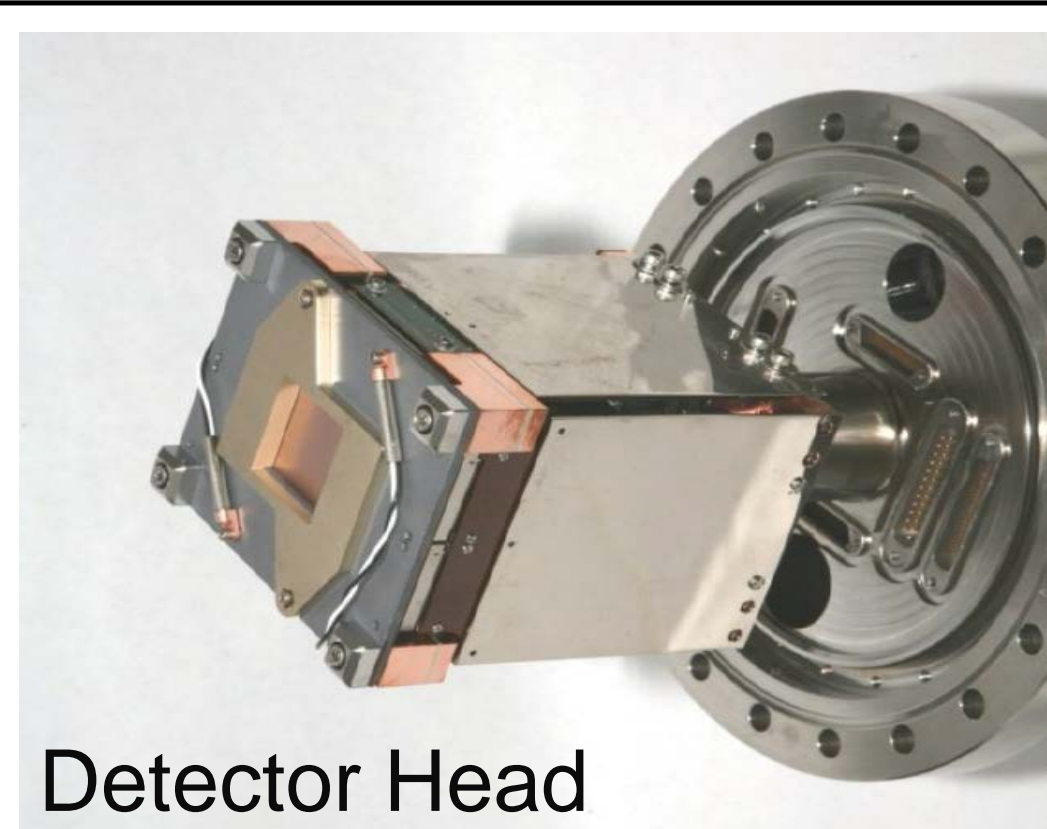
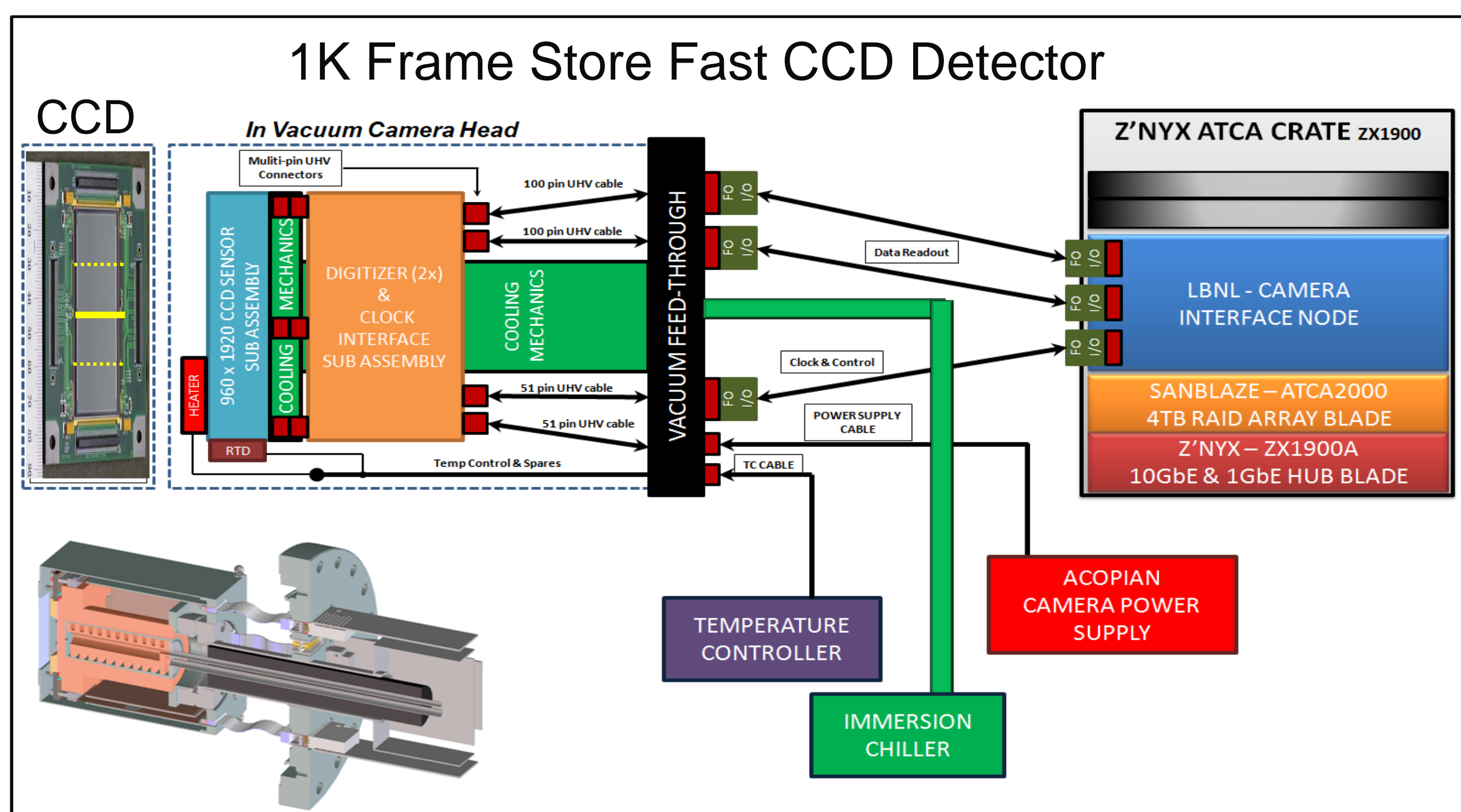
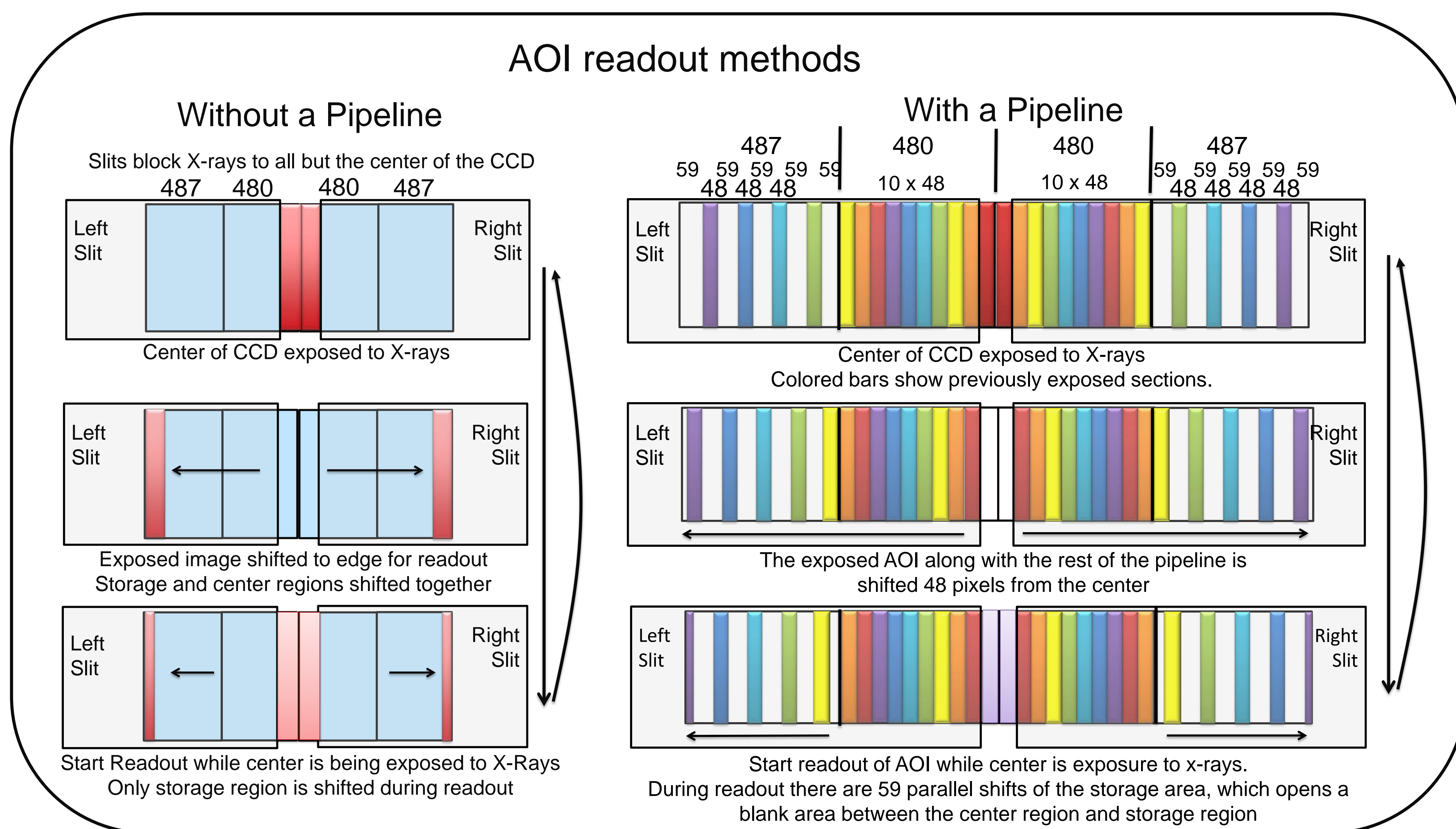
¹ Argonne National Laboratory, Argonne, IL 60439

² Lawrence Berkeley National Laboratory, Berkeley, CA 94720

*weizeor@aps.anl.gov

A 960x960 Frame Store Fast Charge-Coupled Device (CCD) x-ray detector is being used for x-ray photon correlation spectroscopy (XPCS) at the Advanced Photon Source (APS) on the 8-ID-I beam line. The detector is typically operated in either the 960 x 960 pixel mode at 100 frames per second (fps) or in the 960x90 pixel mode at 1000 fps. The vacuum subsystems consist of a top board with a custom CCD sensor, two digitizer boards with 12 custom readout chips, and a CCD clock driver board. The digitized data from the detector head is sent to a Camera Interface Node located inside an Advanced Telecommunication Computing Architecture (ATCA) chassis. One or more processor blades in the ATCA chassis use the Message Passing Interface (MPI) protocol to perform real time parallel processing on the incoming data. When the image processing is complete, the data is stored where it is available for further processing.

Features	1kFSCCD
Area	Full mode: 1920 x 960 (58 mm x 29 mm) Frame Store modes: 960 x 960 (29 mm x 29 mm) 960 x 90 (29 mm x 2.7 mm)
Sensor Thickness	250 μm – 350 μm
Pixel Size	30 μm x 30 μm
Current Readout Modes at 8-ID-I	1920 x 960 @ 50 fps 960 x 960 @ 100 fps : 960 x 90 @ 1000 fps
QE	Near 1 at 8keV
Full Well	~900k e ⁻ per pixel
Gain	6 eV/ADU for 8x 24 eV/ADU for 2x
Custom Readout IC (fCRIC)	15 bits = 13 bits data, 2bits gain
ADC rate of fCRICs	1 – 2 MHz



Detector Head

Detector at 8-ID-I

