

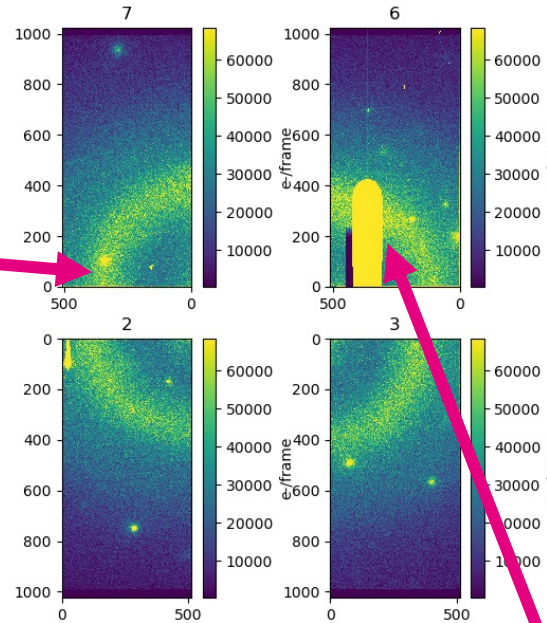
# **CITIUS status report**

## ***supplementary information to Dr. Tono's talk***

Takaki Hatsui

RIKEN SPRING-8 Center

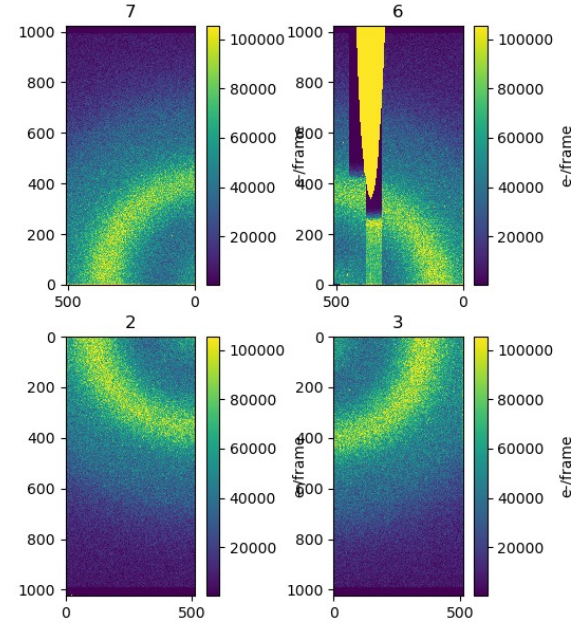
detdata\_MPCCD-8B0-2-005\_2\_114208.h5; tag\_926423821



saturated



detdata\_MPCCD-8B0-2-005\_2\_114208.h5; tag\_926423823



blooming



Sensor damage is also visible for recent years

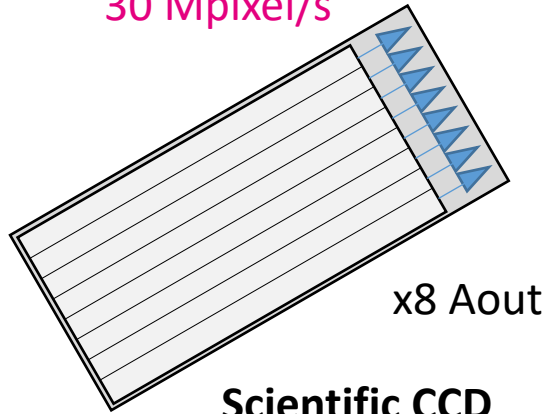
# Our Detector Developments: Silicon Integrating-pixel detectors



**MPCCD**

2009-2011

0.5 Mpixel 60 Hz  
30 Mpixel/s



x8 Aout

**Scientific CCD  
with Teledyne e2v**

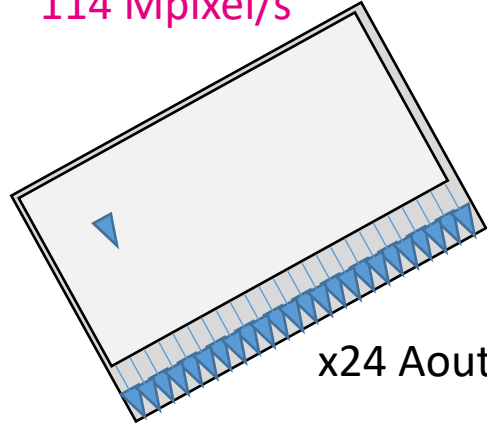
T. Kameshima et al., Rev. Sci. Instrum. 85, 033110 (2014).



**SOPHIAS**

2009-2014

1.9 Mpixel 60 Hz  
114 Mpixel/s

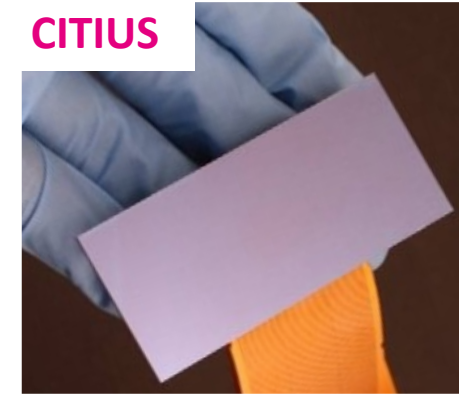


x24 Aout

**SOIPIX with Lapis Semiconductor**

Installed to 10 BLs at SPring-8

T. Hatsui, et.al., IISW proc. 2013



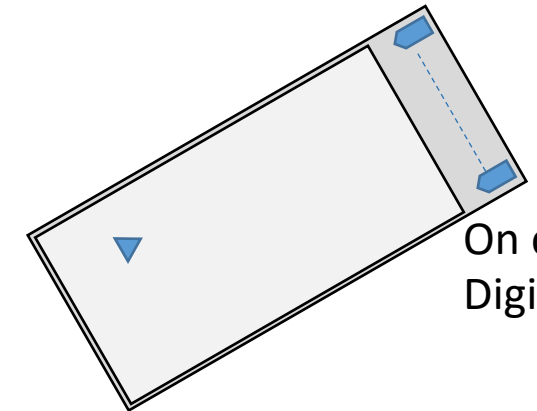
**CITIUS**

**XFEL variant** 2013-

0.28 Mpixel 5,000 Hz  
1400 Mpixel/s

**SR variant**

0.28 Mpixel 17,400 Hz  
4872 Mpixel/s



On chip ADCs  
Digital Out

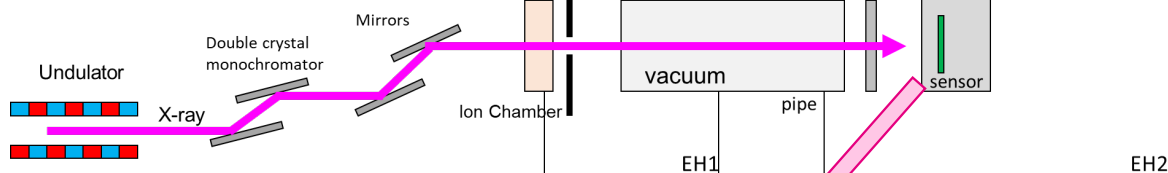
**Dedicated CMOS Image Sensor with Sony**

T. Hatsui, et.al., in preparation

# CITIUS at SPring-8

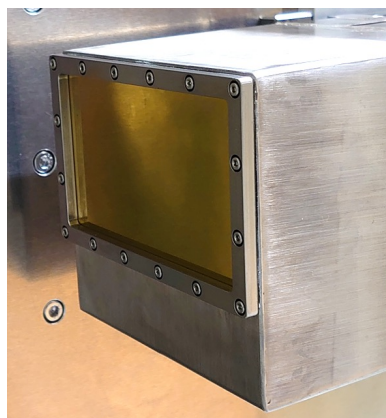
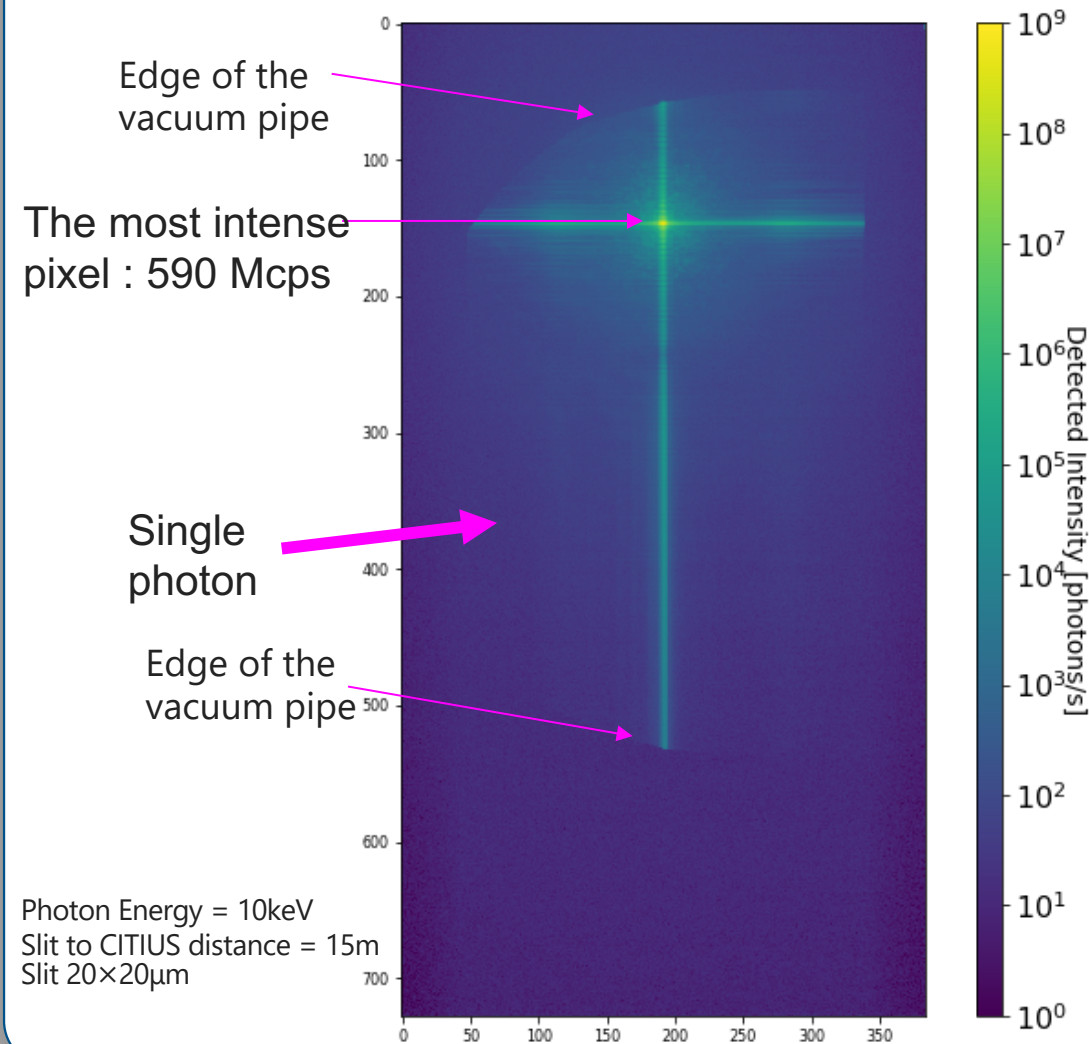
## SPring-8 BL29XU

side view



Photon Energy = 10keV  
 Slit to CITIUS distance = 15m  
 Slit  $20 \times 20 \mu\text{m}$

## Radiation hardness demonstrated

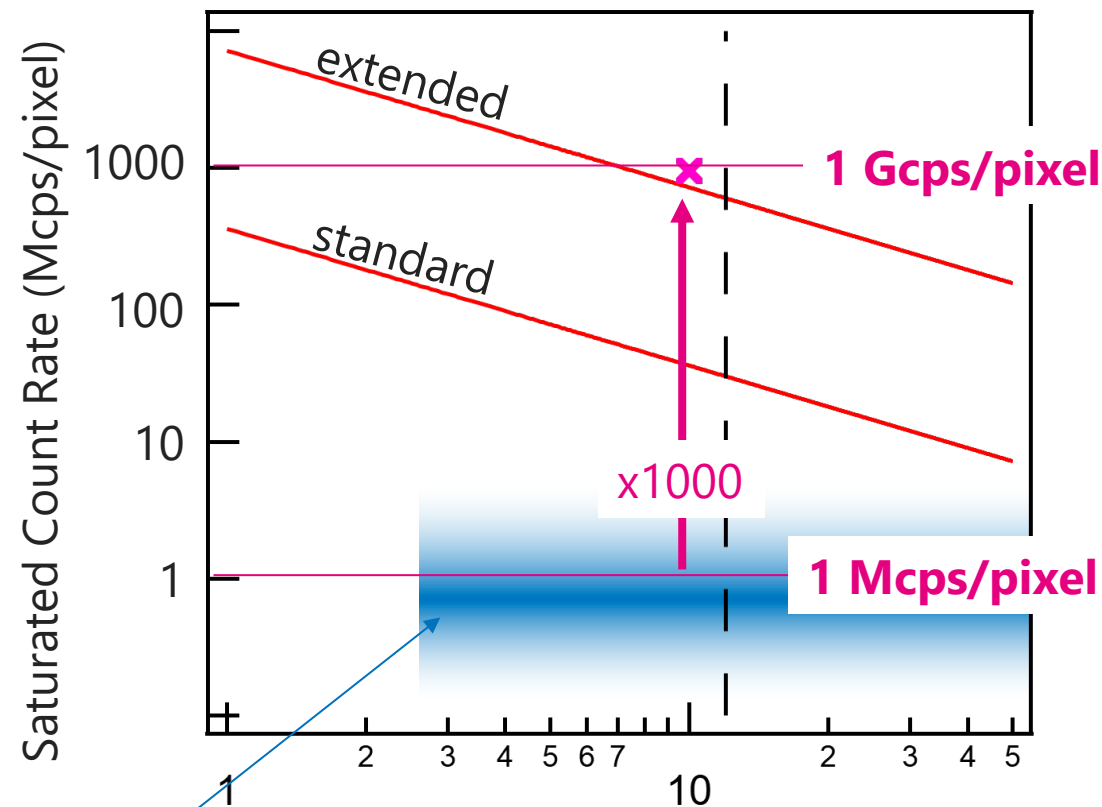
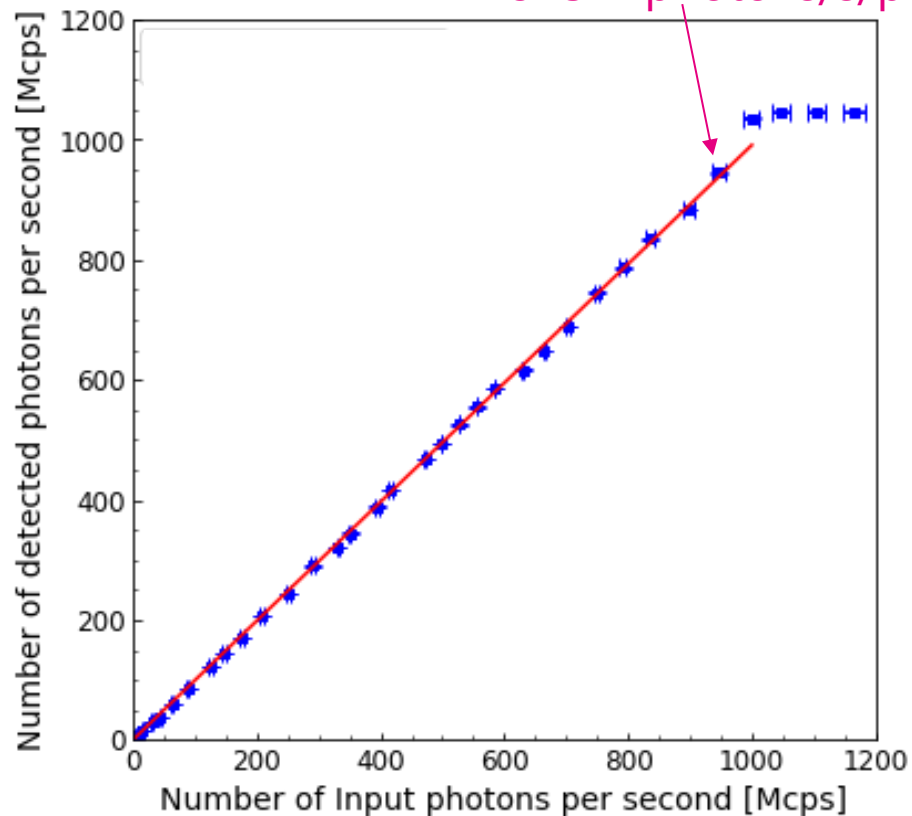


840k pixel

# Counting Capability

Photon Energy = 10 keV  
Linear plot

Saturated sensor output  
945 Mphotons/s/pixel

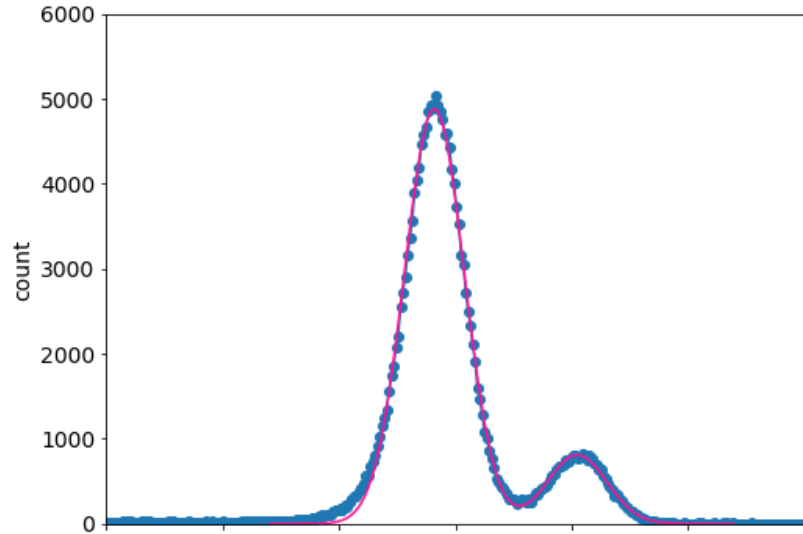


Photon Counting

Photon Energy (keV)  
Si thickness: 650  $\mu\text{m}$

# Energy Resolution and Peak Signal

Important performance for SACLA



Peak Signal  
(MPCCD)

- 3-4 Me-
- blooming



CITIUS for  
SACLA

- 28-30 Me-
- no-blooming

Cu  $K\alpha$ ,  $K\beta$  line

Energy resolution 410 eV FWHM by single event analysis

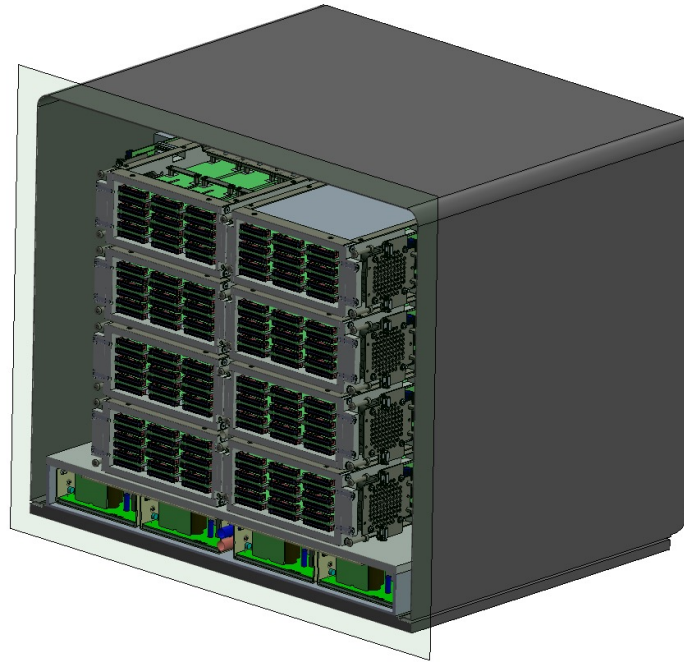
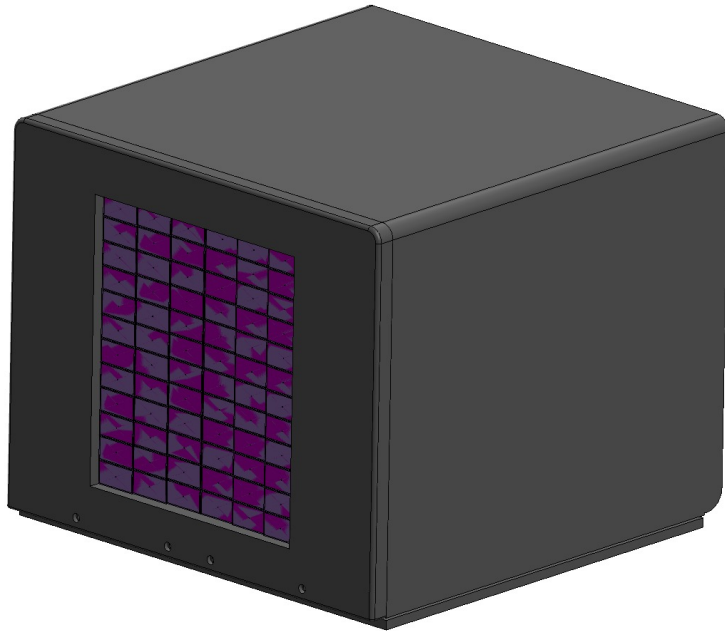
700 eV FWHM by droplet analysis



# CITIUS 20.2M

## CITIUS Detector Performance

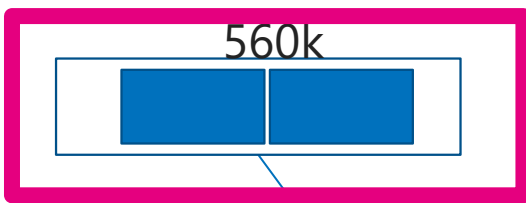
Largest System	Pixel Number	20.2 Mpixel
	Image Area	325 x 363 mm



Thermal Stress Evaluation

# Camera Head Variants

SACLA



560k

280k

840k

2.2M

2.8M for WAXS

SACLA

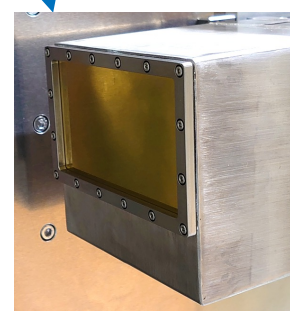
20.2M

— 9M — — 10M —

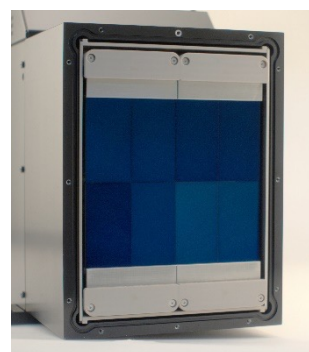


prototype

96 × 36 mm × 196 mm<sup>3</sup>

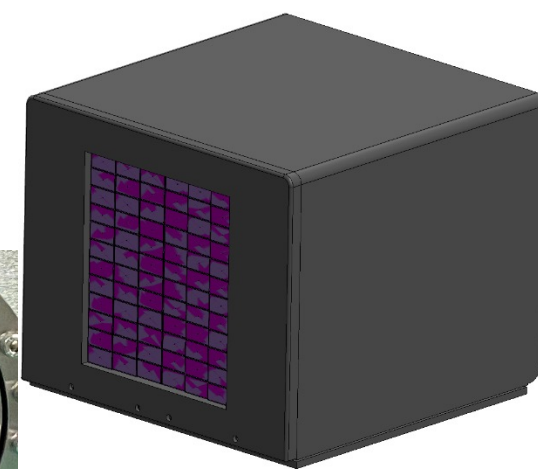
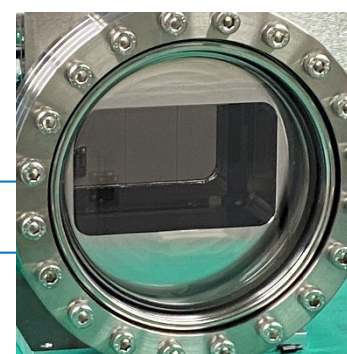


prototype



prototype

Vacuum Options





# Summary

- 560 k linear & 20.2M detectors are to be installed.
  - Any other camera head you need?
- Installation plan is now under discussion. Your inputs are deeply welcome.