The Hard X-ray Detector (HXD) onboard Astro-E2

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OUTLINE

1. I introduce Astro-E2.
2. I will explain how to observe of Hard X-ray photons.
3. I will show the construction, the performance, and the current status of HXD.
4. I will discuss a science topic with HXD.

   Hard X-ray Observation of Black hole

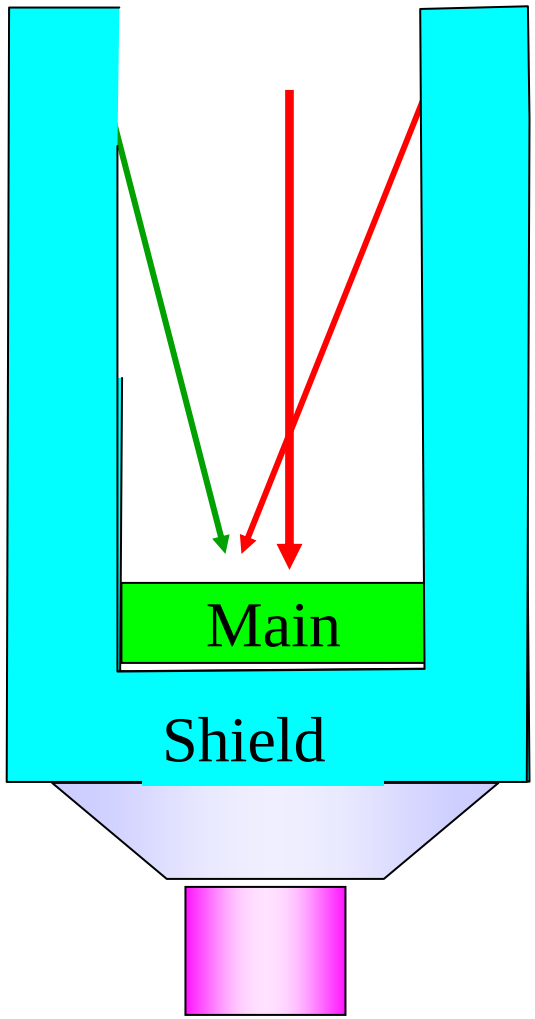
Astro-E2 and Hard X-ray Dtector

Astro-E2:
Japanese 5th cosmic X-ray satellite.
Recovery mission of Astro-E.
It will be launched in February, 2005.

XRT : 1250cm^2 (by 5 units at 7 keV)
XIS : 0.4-12keV, Imaging & Spectroscopy
XRS : 0.4-10keV, Spectroscopy, dE~10eV
HXD : 10-600 keV, Spectroscopy

We have started rebuilding HXD.

Observation technique of Hard X-ray



Hard X-ray photon

(above 10 keV)

Charged particle

1.Scintillator (high Z)

2.Active Shield by crystal

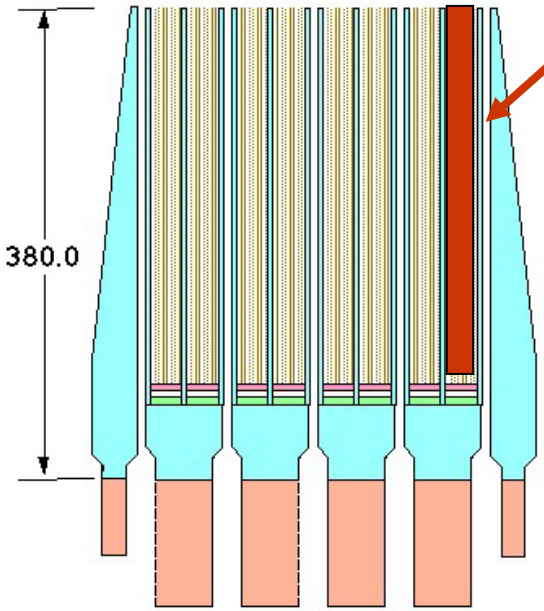
3.Phoswich technique

4.well-type phoswich

Construction of HXD

X-ray photons

PCuS collimator



Cross section of the HXD

- Absorber(GSO)/shield(BGO)

+ low energy absorber(PIN diodes)

→ **HXD covers from 10 to 600keV**

Incredibly wide !!

- Collimator (PCuS)

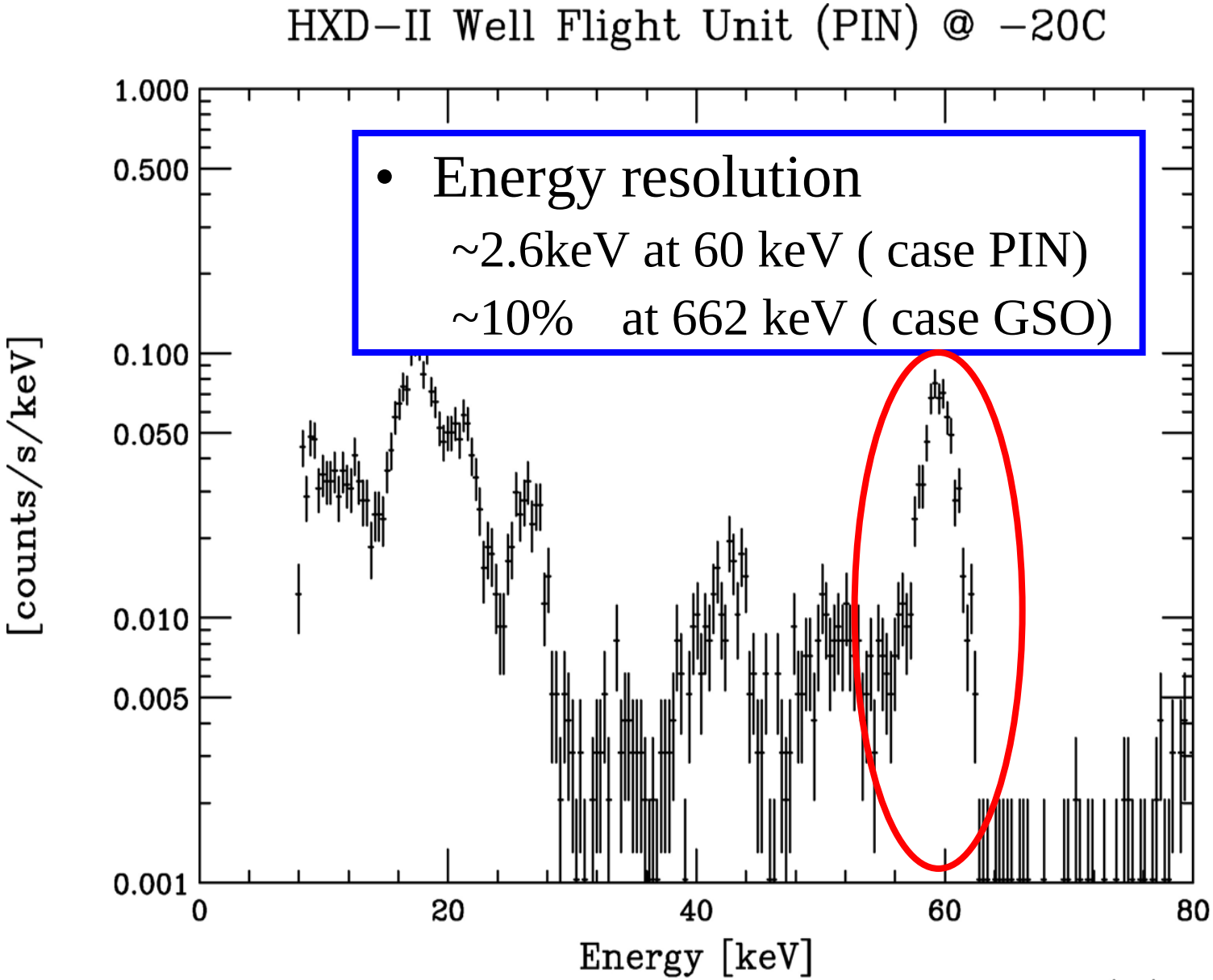
→ **0.5deg (<100 keV), 4deg(>200 keV)**

Size : 55 x 40 x 65 cm^3

Weight : ~200 kg

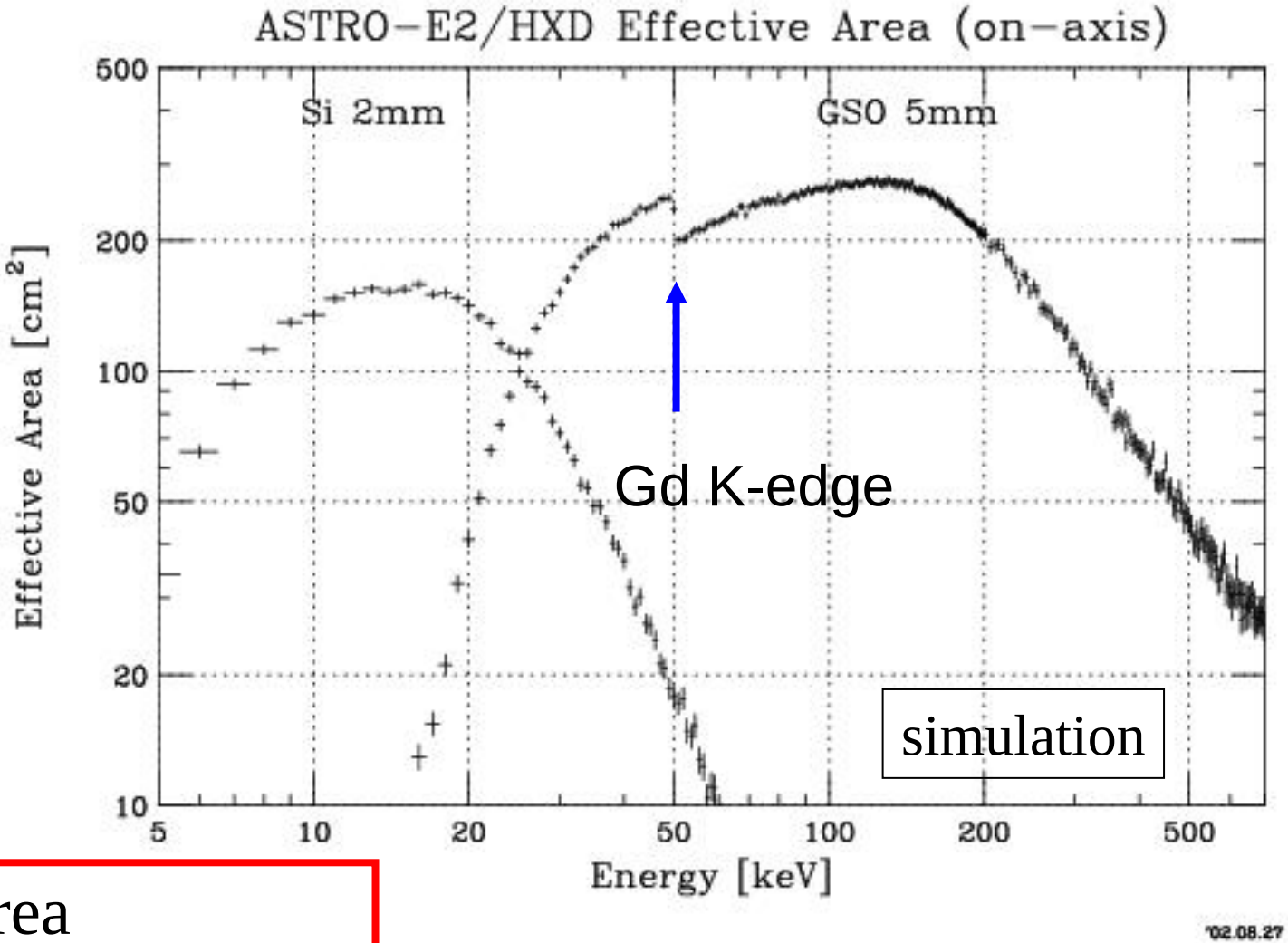
- Compound eye configuration (4x4)
- BGO shield counters

Performance of HXD



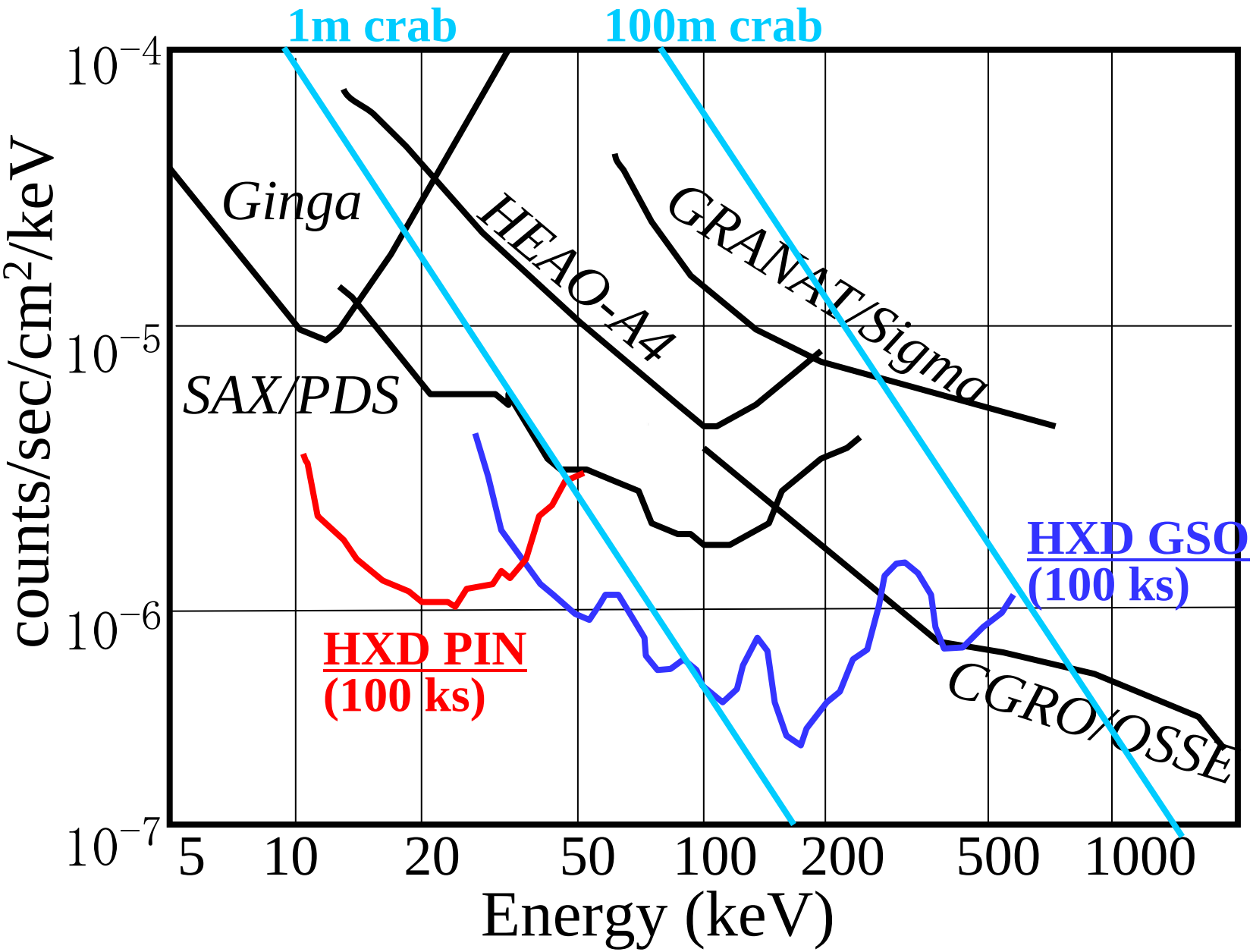
- Energy resolution
  - ~2.6keV at 60 keV (case PIN)
  - ~10% at 662 keV (case GSO)

Performance of HXD



- Effective area
  - 160 cm^2 below 30 keV
  - 330 cm^2 above 40keV

Continuum Sensitivity



Current Status of HXD

DIRECT
Hand
made!

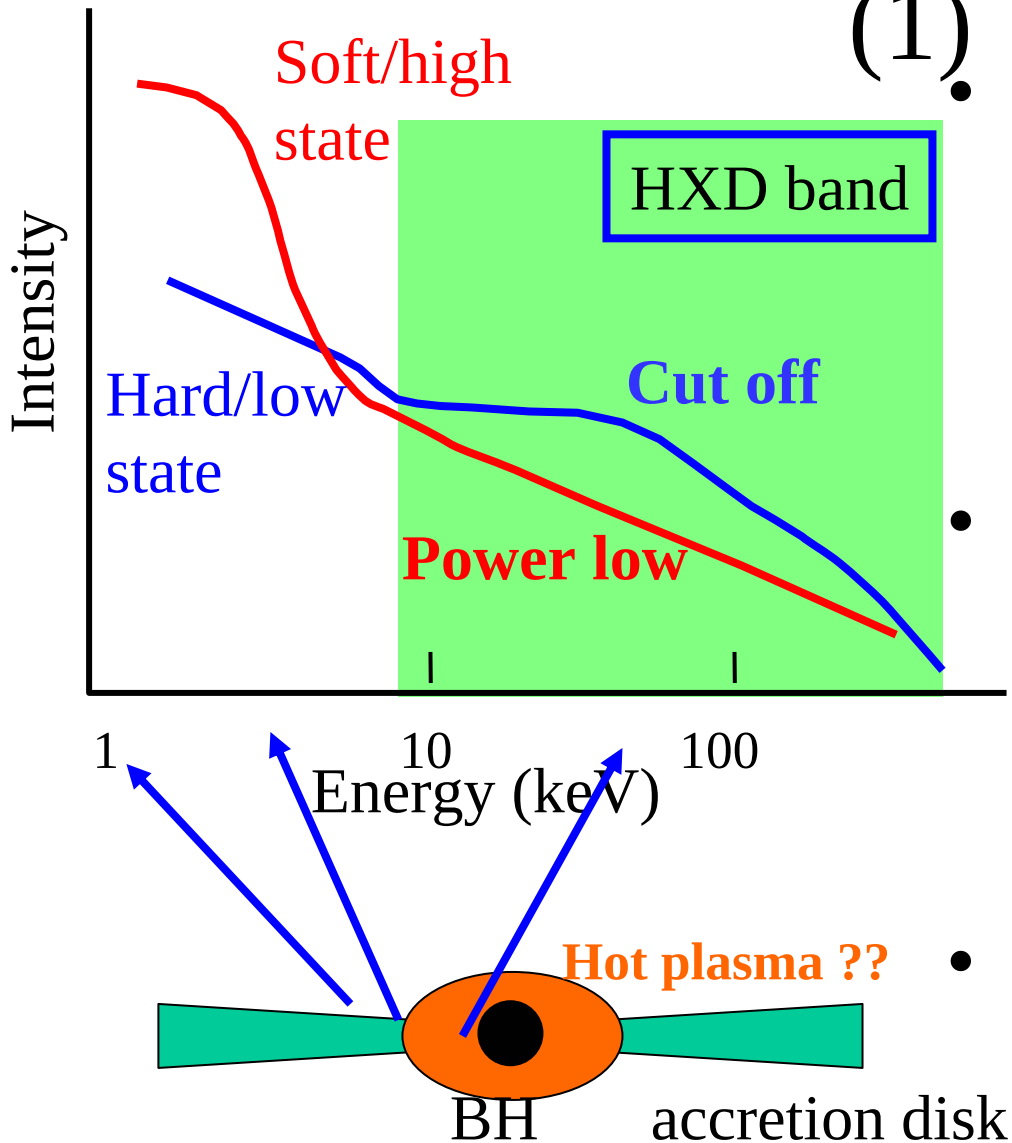
F
fabrication is finished.

Flight electronics
function test finished.

HXD
onboard Astro-E2

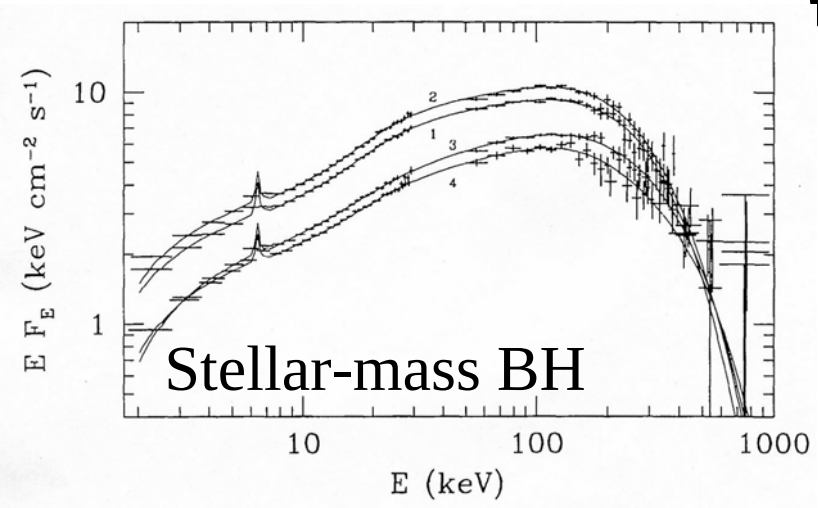
Astro-E2 1st integration test was finished Nov 6, 2003.
All functions are working well.

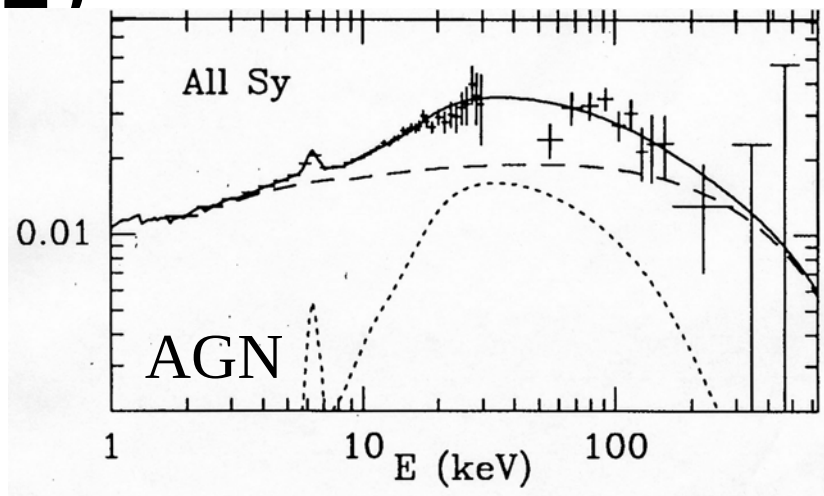
Science example: Hard X-ray observation of Black Hole (1)



- Hard X-ray emission come from more inner region of accretion disk.
- Energy cut off at ~100 keV at the hard state.
  - Electron energy?
  - Electron density?
- At the soft state ?

Hard X-ray observation of Black Hole (2)





Gierlinski et.al, MNRAS, 288, 958,(1997)

Zdziarski et.al, ApJ, 438, L63(1995)

- What is the origin of ~100keV cut off ?
  - → Thermal Compton?
  - → Synchrotron X-ray from Jet?

High accuracy observation is needed!