Transmission calibration of the Dewar gate valve for XRISM Resolve

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Talk plan

1. Introduction

2. Measurement
   a. Stainless mesh
   b. Be filter

3. Summary
1. Intro: Hitomi/SXS result

Crab spectrum

Energy (keV)

Tsujimoto+18
1. Intro: Gate valve (GV)

Roles of GV
1. To keep Dewar vacuum on the ground
2. To protect from initial outgassing in the orbit

✔ All Hitomi/SXS data were taken through GV.
✔ All XRISM/Resolve initial data will be taken through GV

Need to calibrate GV transmission
1. Intro: GV components

Top view

- a. Stainless mesh

Side view

- b. ~300 µm thick Be filter

X-rays

Dewar

(Yoshida+17)
2 Measurement

a. Stainless mesh
2-a. Stainless mesh: Setup

Date: 2019 2/4-19

Place: X-ray Beamline, ISAS/JAXA

Detector Stage \(< 9\text{m}\)

Slit Stage

\(~27\text{m}\)

X-ray Generator

(lizuka+18)
2-a. Stainless mesh: Setup

Metal target
(Ti, Cu, Pt, Mo, Ag)

X-ray Generator
2-a. Stainless mesh: Setup

Double Crystal Monochromator (DCM)

Monochromatic X-rays

Polychromatic X-rays
2-a. Stainless mesh: Setup

Measuring Chamber

Detector stage

PC

Sample stage

CCD

Sample stage

PC

Detector stage
2-a. Stainless mesh: Result

We shall update SXS CalDB

Energy (eV)

transmission

New model (circle)

Current CalDB (square)
2 Measurement

b. Be filter
2-b. Be filter: Setup

Date: 2017 2/25-2/27
Place: KEK Photon Factory (synchrotron facility )

6.5GeV
(KEK HP)

2.5GeV
2-b. Be filter: Setup

Beamline
2-b. Be filter: Setup
2-b. Be filter: Setup

Detector  Be filter

Chamber
2-b. Be filter: Result

✓ Model assuming pure Be PE absorption

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<tr>
<th>Miller index</th>
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<tr>
<td>002</td>
<td>3.460</td>
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<tr>
<td>013</td>
<td>6.057</td>
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Minor PE absorption edges by contaminants
Bragg Diffraction Features (BDFs)

Model assuming pure Be PE absorption

(Yoshida+17)
2-b. Be filter: Model

✔ Model including minor PE abs. and BDFs

\[ T(E) = T_{P.E.}^{(Be)}(E) \cdot T_{P.E.}^{(minor)}(E) \cdot \prod_{i=1}^{6} BDF(E) \]

\[ \text{Crystal Atomic} \]

\[ T(E) = T_{P.E.}^{(Be)}(E) \cdot T_{P.E.}^{(minor)}(E) \cdot \prod_{i=1}^{6} BDF(E) \]

Residuals (1e-2)

Energy (keV)

(Yoshida+17)

Considering BDFs is essential
3. Summary & Future

Measured transmission of two components of GV

a. Stainless mesh
   Current CalDB has been something wrong
   We shall update CalDB of Hitomi/SXS

b. Be filter
   We found considering BDFs is essential for microcalorimeter calibration
References

• Tsujimoto et al. (2018), PASJ
• Yoshida et al. (2017), Proc. of SPIE
• Hoshino et al. (2017), Proc. of SPIE
• Eckart et al. (2016), SXS Cal. Report Document
1. Intro: GV components

- a. Stainless mesh
- b. ~300μm thick Be filter

10% uncertainty for thickness

No significant difference

Top view

Side view

X-rays
2-b. Be filter: Model

BDF energy is determined by **Miller indices**

Describes planes in crystal lattice

How to find the Miller indices

1. Determine the intercepts \((1/2, 1, 2/3)\)
2. Take the reciprocals \((2, 1, 3/2)\)
3. Make these integers \((4 \ 2 \ 3)\) × 2

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2-b. Be filter: model

- Photoelectric absorption edge (Mn, Fe, Ni)
- BDFs

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