Development of superconducting tunnel junction X-ray detector with high absorption yields utilizing silicon pixel absorber (SPA-STJ)

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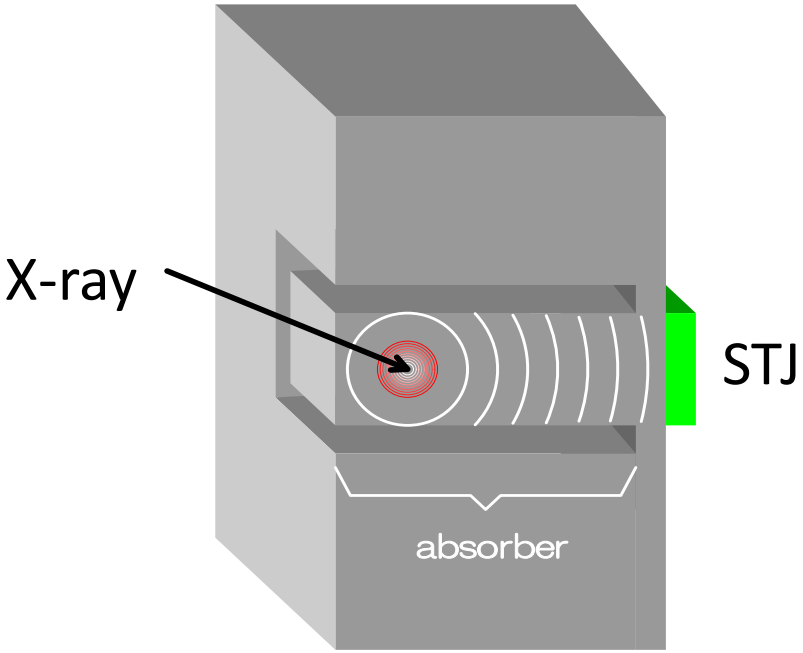
Application

- Materials analysis of diluted elements
  - X-ray fluorescence spectroscopy (XRF)
  - X-ay absorption spectroscopy (XAS)

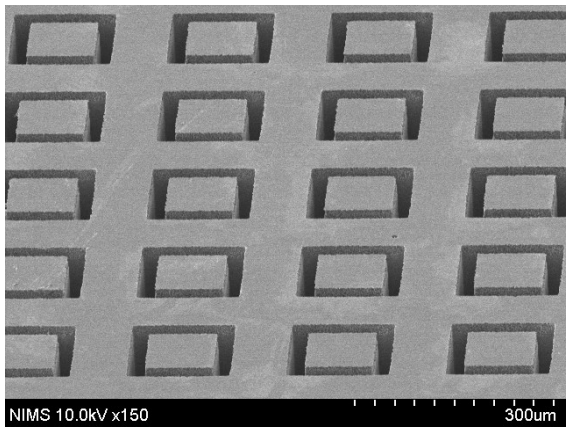
Requirements

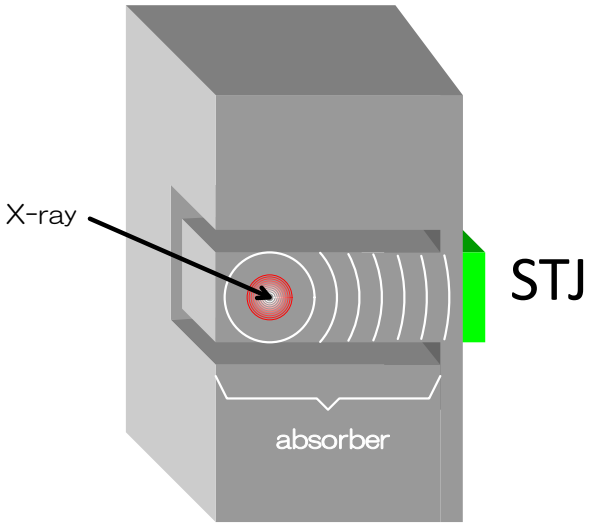
- **Wide energy range, 0.1 – 20 keV**
- Large area, > 1mm^2
- High energy resolution , < 130 eV @ 5.9 keV
- High count rarte, > 1M cps
- Easy operation

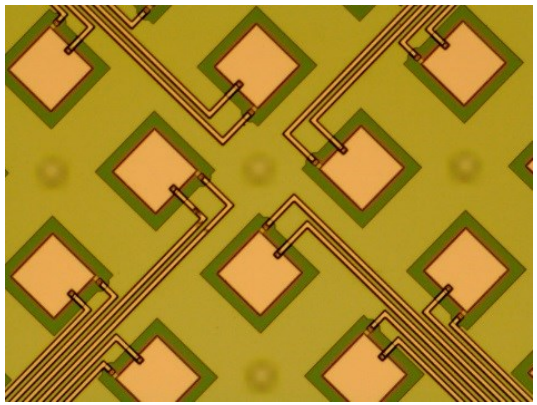


superconducting tunnel junction detector with Si pixel absorber (SPA-STJ)

Fabrication







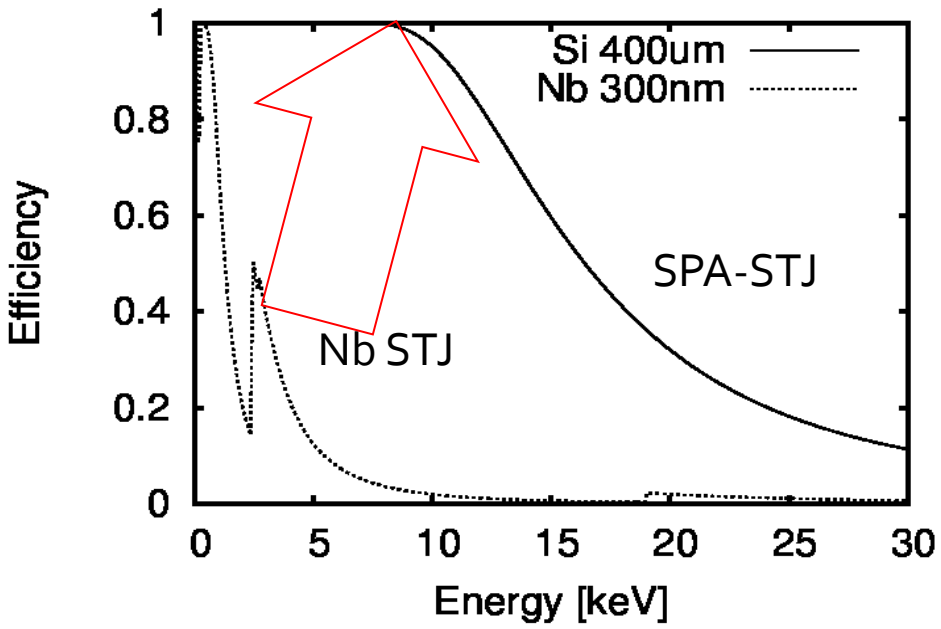
substrate 400μm
absorber size 100μm x 100μm
trench width 30μm
trench depth 350νm

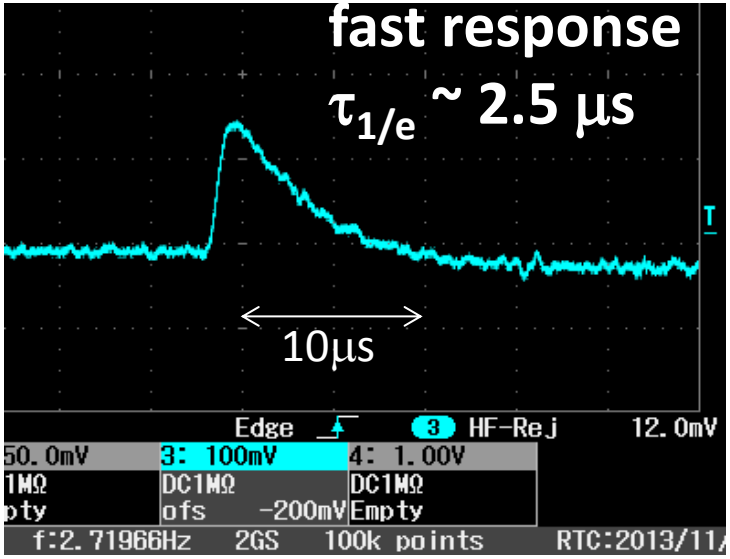
layer: Nb – Al/ AlOx / Al / Nb
Jc : 200 A cm^{-2}
pixel size: 100μm x 100μm

- 100 STJ pixels are fabricated in **CRAVITY**, **c**lean**r**oom for **a**nalog and digital superconducti**vity** in AIST.
- Deep trench is formed using deep RIE apparatus in NIMS nanotechnology platform of nano-fabrication.
- Fabrication yield is larger than 90 %

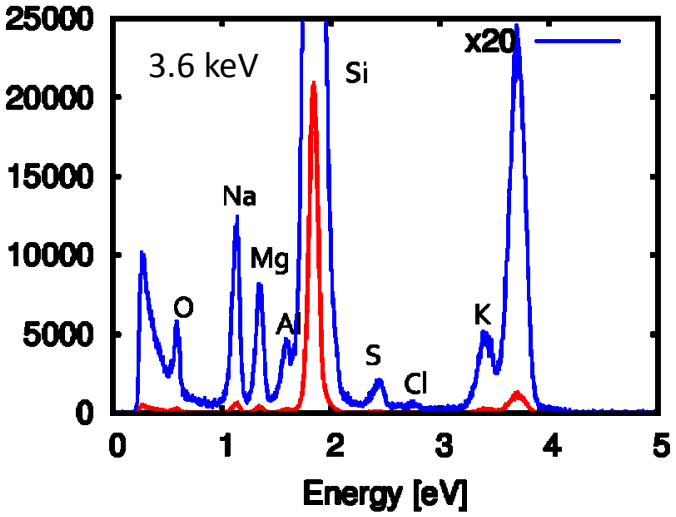
Results

high sensitivity





nice response function



X-ray absorption spectrum of low density atom