mfSANS開発の現状

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Instrument scientists
Neutron scattering
Device development
Medical doctors

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Summary of the status of mfSANS@JRR-3/JAEA

Monochromatic neutron focusing SANS

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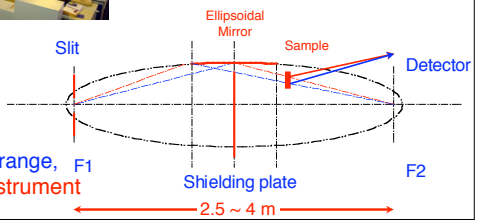
Focusing = compact → many SANS instruments

SANS-U@JRR-3: 32 m
SANS-J: 20 m

Focusing = compact

mfSANS@JRR-3: 2.5 m



- Focusing:
  - Not for gain
  - Not for low-Q
- Conventional Q-range, with compact instrument

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Many SANS instruments anywhere

Ubiquitous instrument

- Combined with:
  - many mfSANS modules,
  - mini-reflectometers,
  - mini-powder machines??
- RFQ accelerator + DTL ≈3-11MeV
  - Li or Be target

JRR-3, J-PARC, ≈1MW reactor, small accelerator

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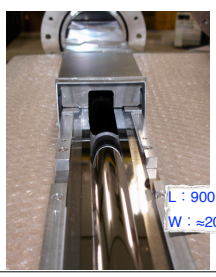
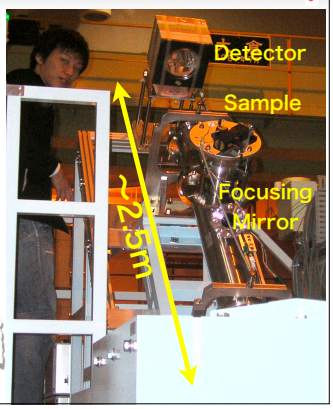
Prototype focusing SANS@JRR-3

- 2.5 m between focal points
- short radius 20 mm
- 2.5 Qc supermirror coating
- ≈1/6 of an arc (66 deg)





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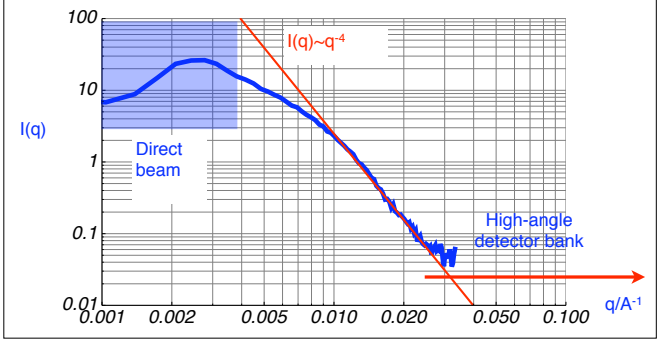
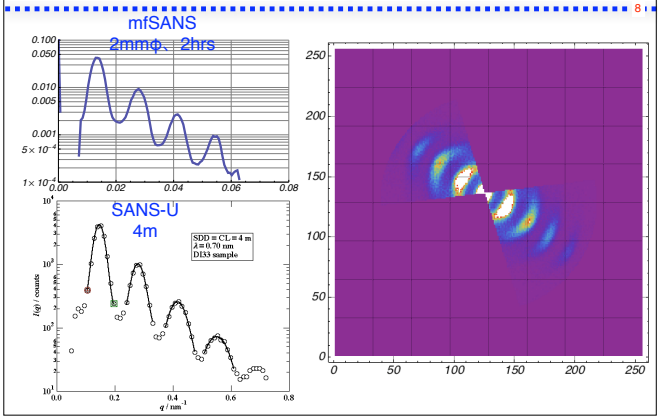
Ni powder 20nm

Preliminary data

- Q_{min} = 5×10^{-3} A^{-1} using 2mmø aperture.



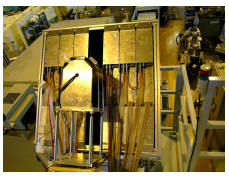
Micro-phase separated block

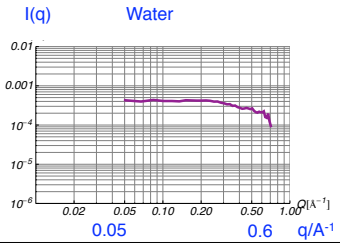


wider-angle scattering

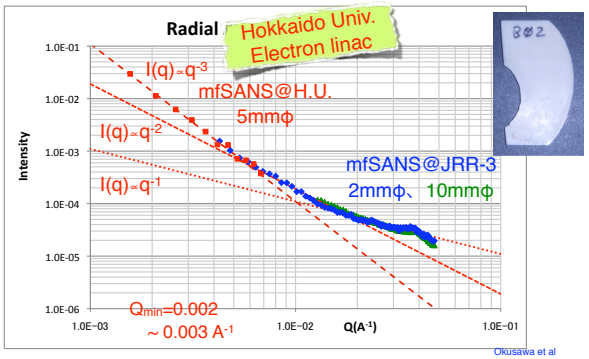
Preliminary data

- 48 Linear position sensitive detectors at higher angle
  - 1/2 inch dia, 600 mm in length
  - GE made
  - 2 noisy detectors





Bovine bone, cross section SANS preliminary analysis



Okusawa et al

Bent Si monochromator

How to branch beam?

- Velocity selector:
  - ○ : High intensity ∝ Δλ/λ ≈ 5-20 %
  - × : Needs guide-end.
- PG: Not good for high-intensity low-angular divergence.
- Bent Si monochromator
  - resolution too high, Δλ/λ ≈ 1%
  - strongly bent, Δλ/λ ≈ 3%?

"Focusing concept" to phase space tailoring

New concept

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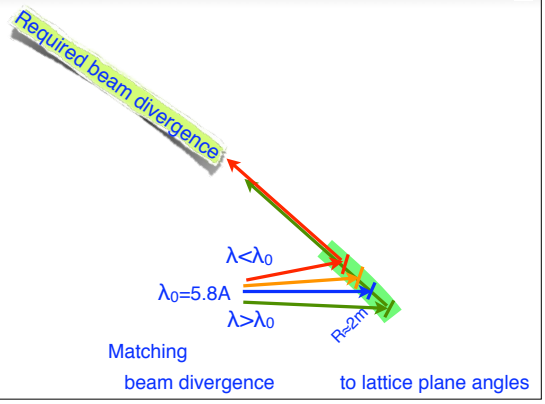

Δλ/λ vs bent radius R; Preliminary result

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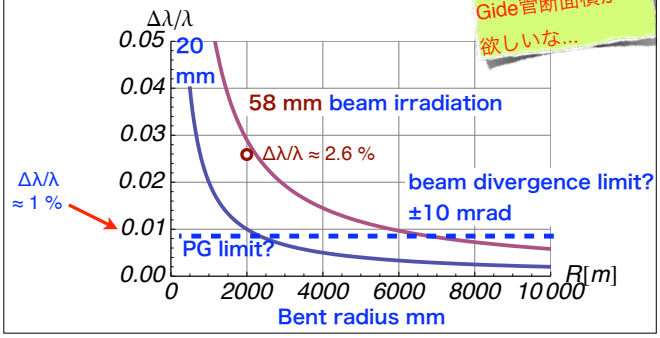
Bent perfect crystal
+ Large beam divergence

もっと大きな
Gide管断面積が
欲しいな…



First generation bender

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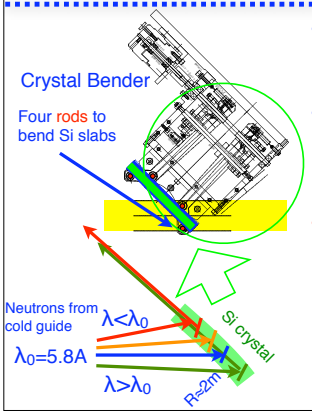

- Bent perfect Si crystal (111)
  - FAD (fully asymmetric diffraction geometry)
  - 5.8A
- R ≈ 2m?
  - usually R≈10~20m
  - Extremely small bent radius
  - 120 mm× 20 mm ×0.5 t ×30 slabs,
- Low performance; why?

Peak reflectivity of Si≈100% at 5.8 A

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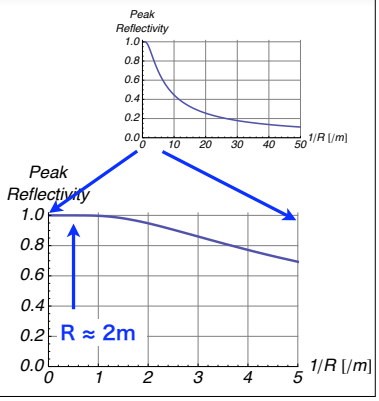
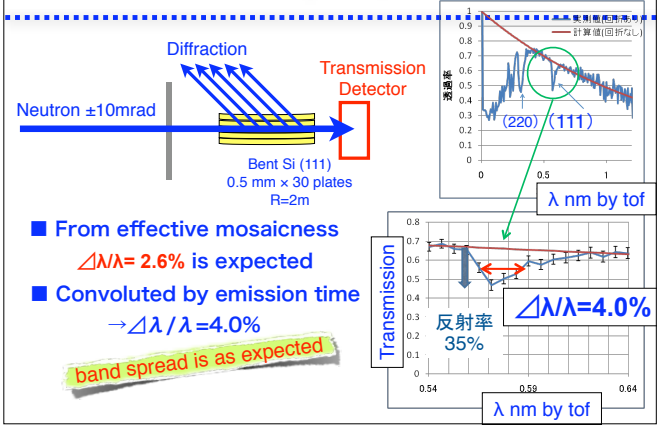
- In theory:
- Peak reflectivity ≈ 100%
  at 5.8 A
  bent R ≈ 1m or more.
- absorption: 120 mm
  ≈ 30%

Peak reflectivityは
問題ない、はず?



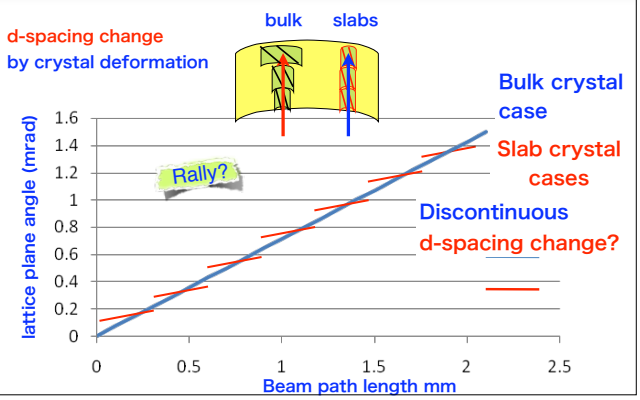
⊿λ/λ= 2.6% obtained as expected; TOF at Hokkaido Linac



- From effective mosaicness
  ⊿λ/λ= 2.6% is expected
- Convoluted by emission time
  →⊿λ/λ=4.0%

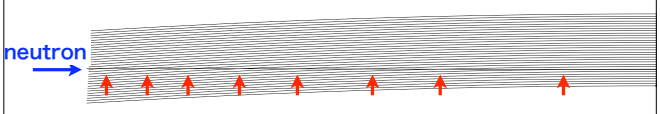
band spread is as expected

Stacking of crystals: no good?

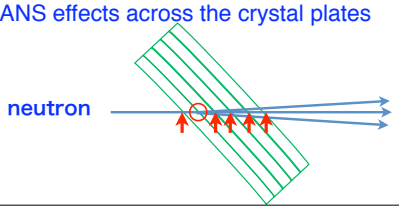


SANS; when crossing boundaries

- SANS effects along the crystal plates

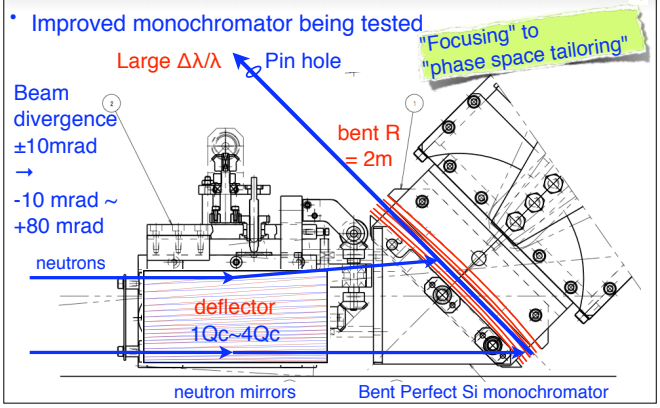


- SANS effects across the crystal plates



New monochromator with a beam deflector

- Improved monochromator being tested



Summary

- Current status of mfSANS
  - Good performance achieved,
  - except for monochromator performance
- Bent crystals for high-intensity monochromator

Future direction!
many possibilities

- Large beam divergence ≈ large Δλ/λ ≈ high intensity
  - Supermirror deflector to enhance beam divergence
- Poor performance of the stacked bent silicone monochromator
  - bent locally by the bending rod; solved.
  - stacking of crystals???
    - deformation of slabs; repeated d-spacing variation
      - **lead to poor performance**
    - SANS when crossing slab surfaces
  - Solution
    - new stacking method?