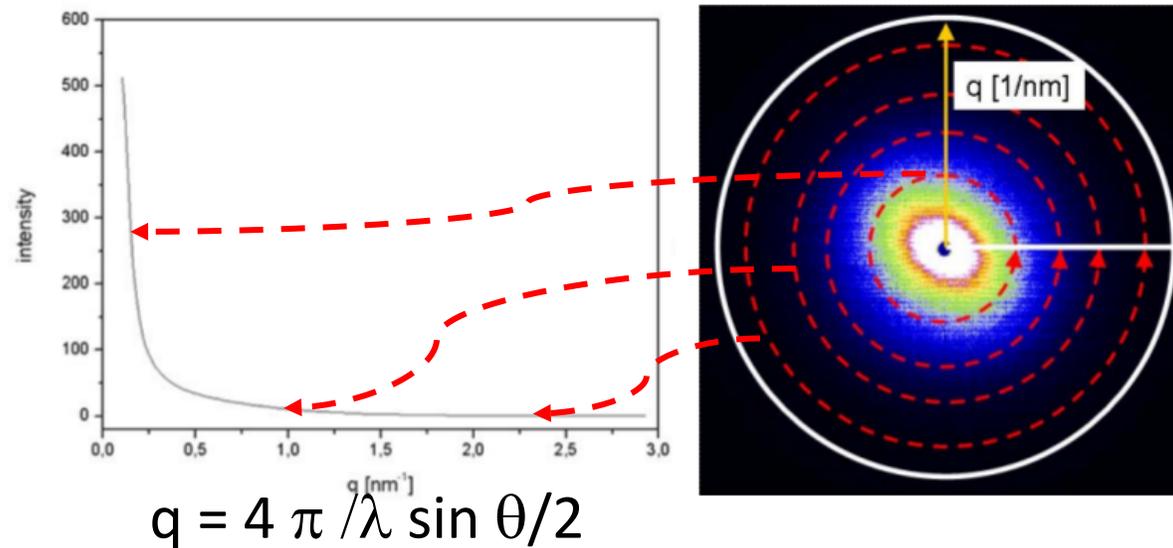
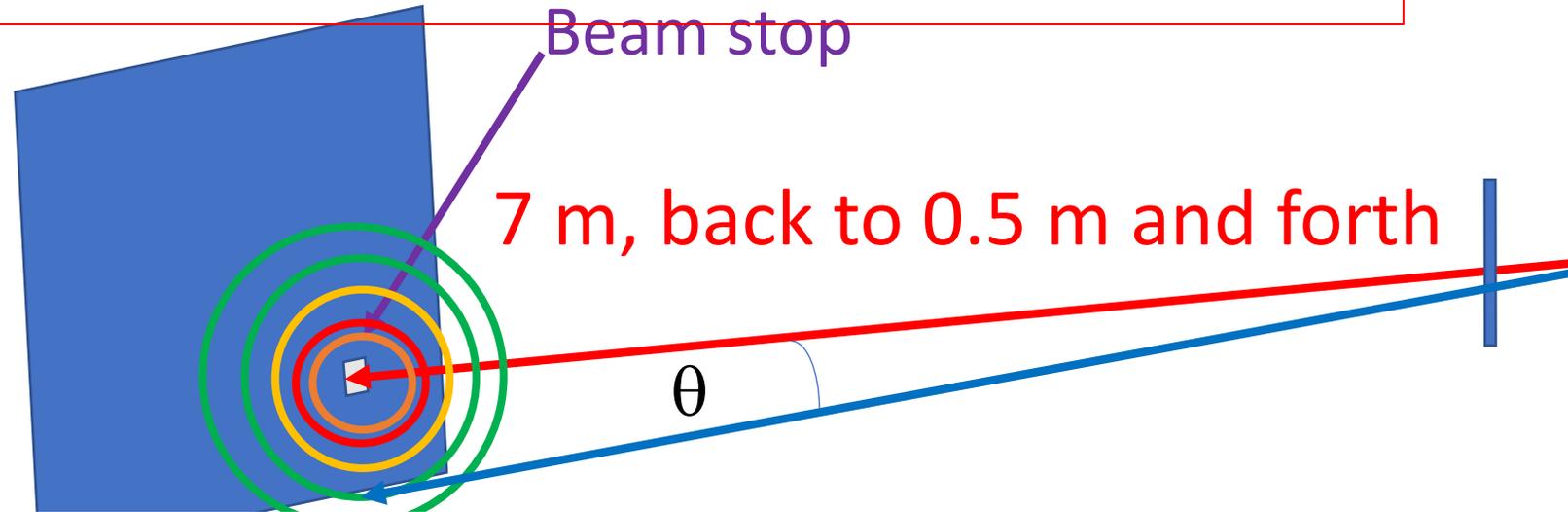


Diffusion de RX aux Petits Angles: quelques remarques sur l'acquisition et le traitement

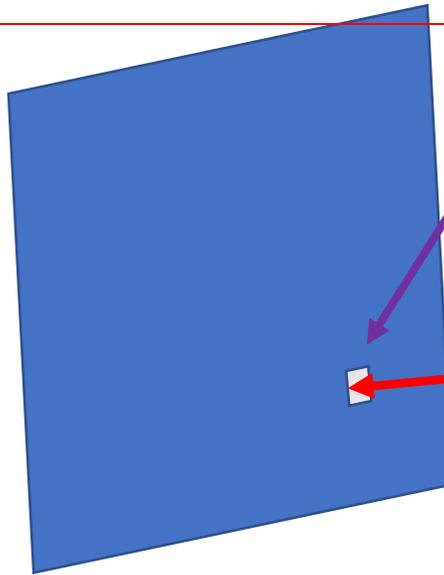
Neutrons also, often similar protocols

From 2D to 1D spectrum: principle



From 2D to 1D spectrum: **the qmin**

- around the beam stop!



Beam stop: from $400(\text{H}) * 80(\text{V}) \text{ um}^2$
to $175 (\text{H}) * 25(\text{V}) \text{ um}^2$

7 m, back to 0.5 m and forth



Macro:

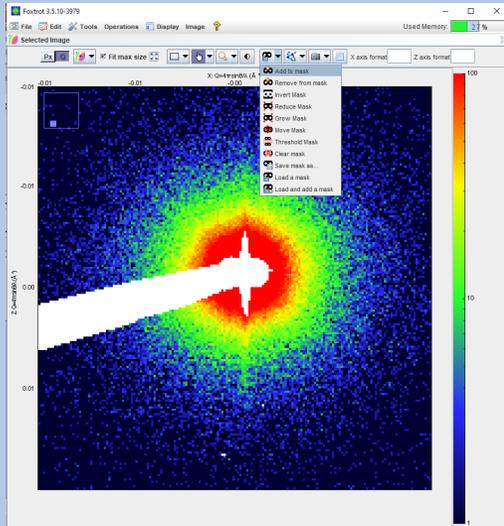
Load and choose mask

```
run("loadmask", "D:\\Foxtrot-3.5.10-3979-2021-03-05-092257\\resources\\masks\\mask_BAGRenard_mars2022.txt");  
run("azimuthalIntegration", "(abscissaStep=1.0, stepType=Px, sigmaType=POISSON, xRefined=false, pixelSplit=false  
, normalize=true, mi=[i11-c-c09__dt__mi_diode.8b], normalizationFactor=1.0)");
```

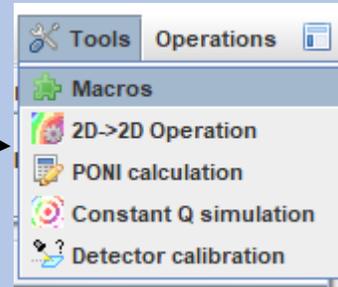
Transmission bag

Thickness correction- absolute units 0.02)

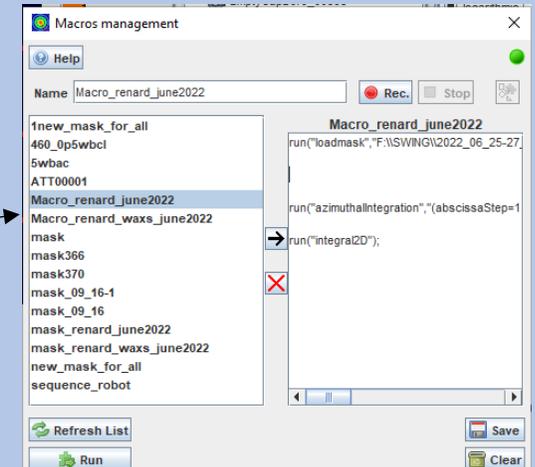
Make different **mask** and change the mask bag



Change and save the mask shape

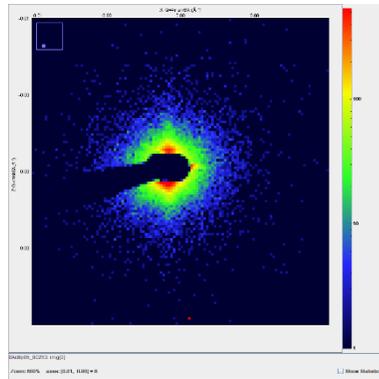
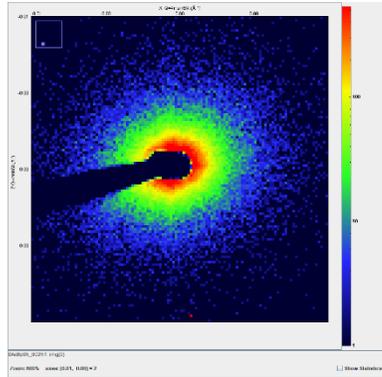
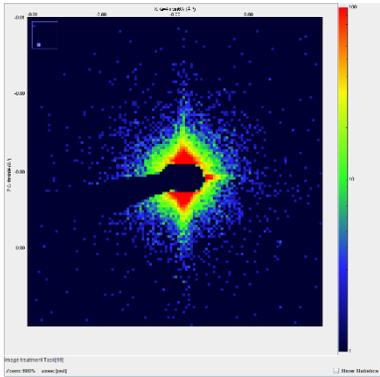


Load the new mask In macro

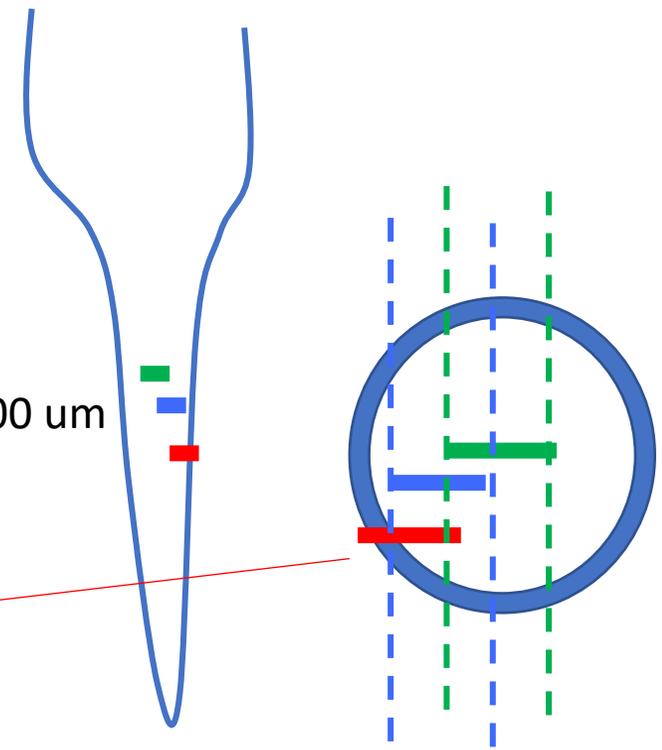


Anisotropy around the beam stop

0,5wt% CNC in BmimCl/H₂O(90wt:10wt)

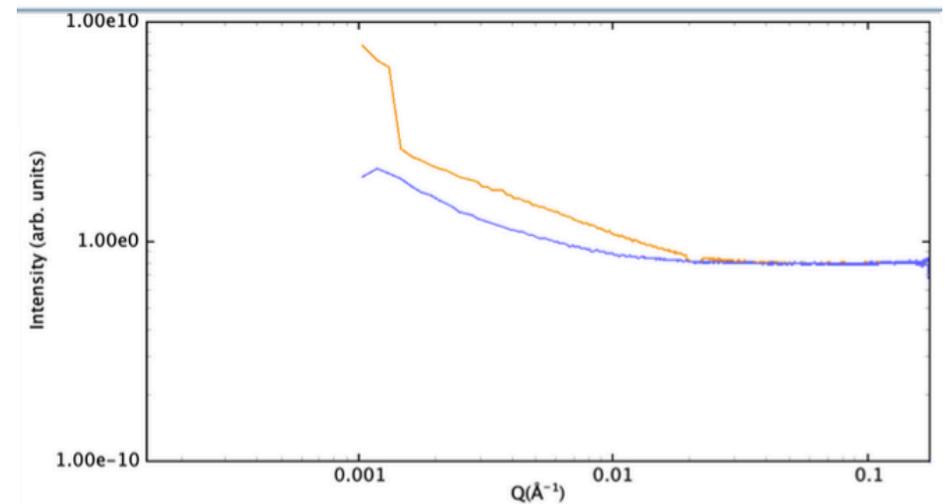
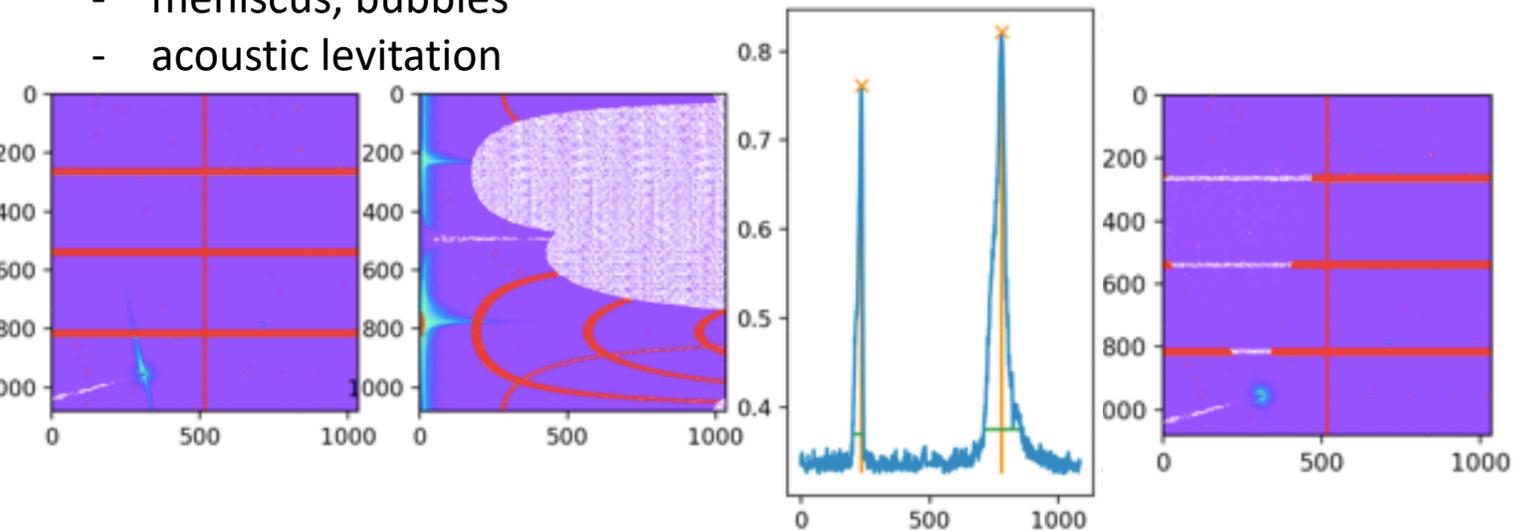


! beam : 500 um x 100 um

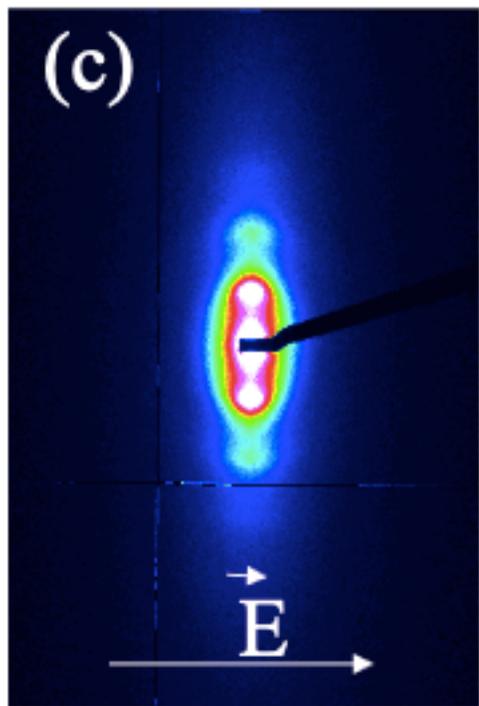


« Spikes » : Evelyne Lutton

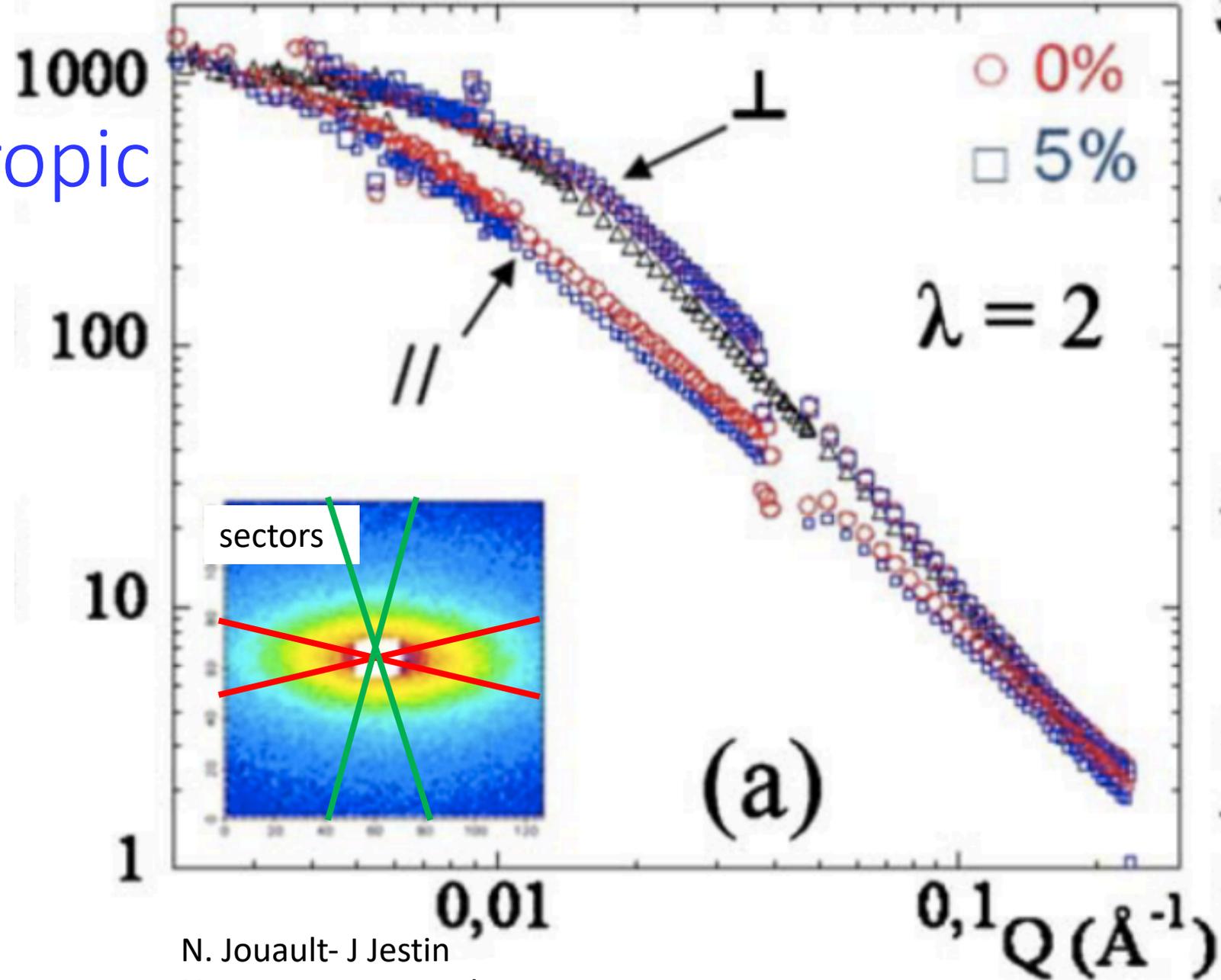
- Capillary
- meniscus, bubbles
- acoustic levitation



Clearly anisotropic



P. Davidson - Ivan Dozov,
nematic + field



N. Jouault- J Jestin
Nanocomp. + stretching

QUESTIONS ?

From 2D to 1D spectrum: **the qmin**

Around the beam stop:

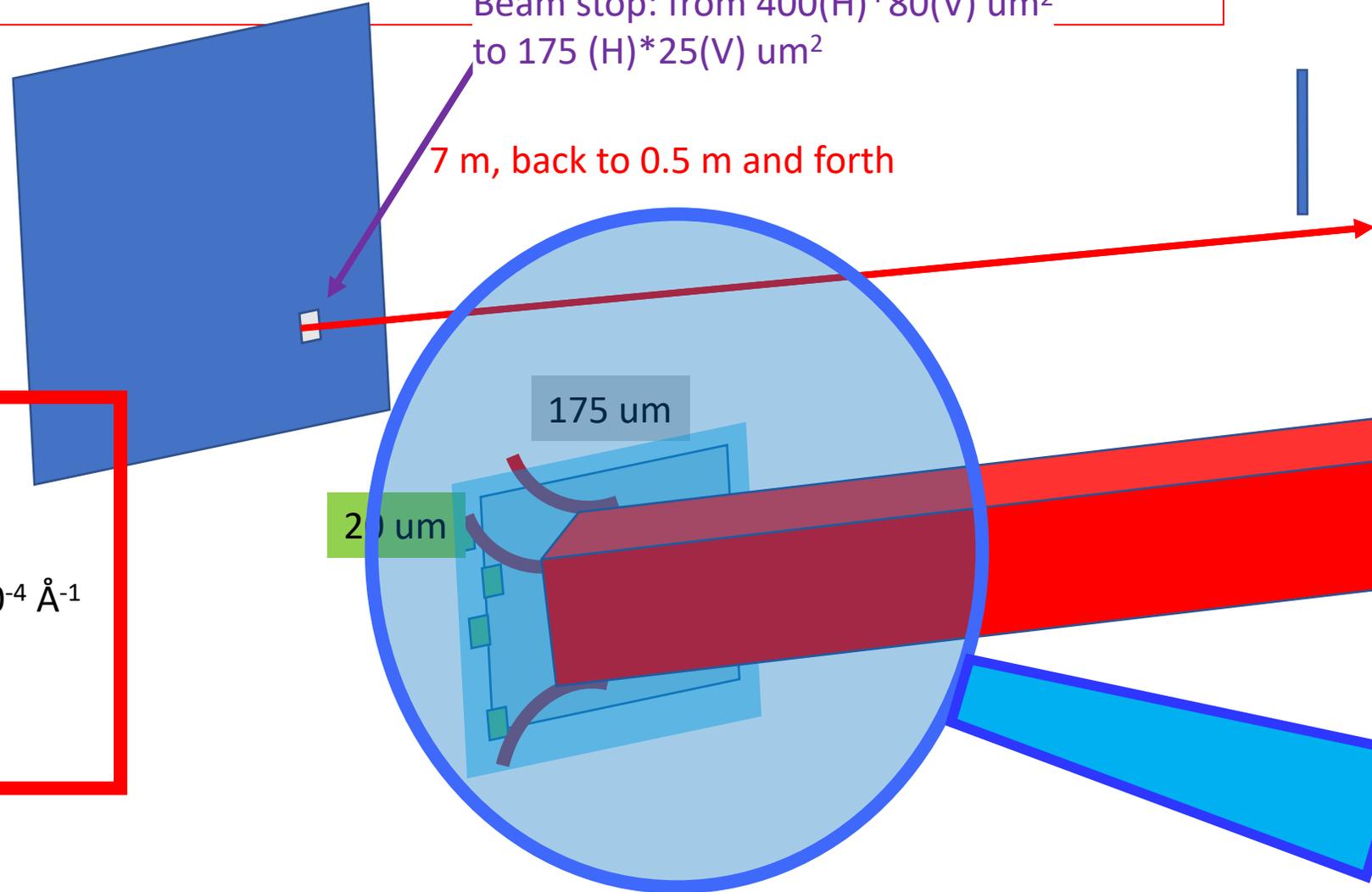
- Mask
- Very tiny and intricate!!
- >> first points uncertain

- Lower energy
- higher λ lower Q_{\min} ;
- Eg 8 keV (/12 keV) >> $Q_{\min} = 6.5 \cdot 10^{-4} \text{ \AA}^{-1}$

- **!! transmission**

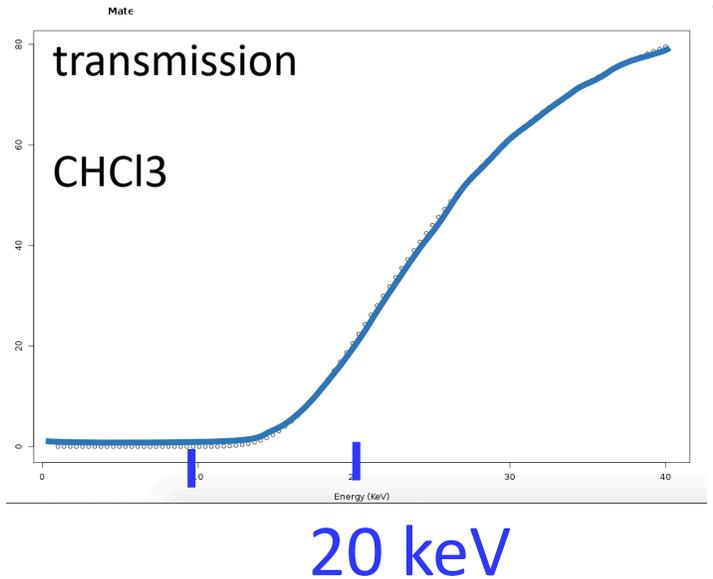
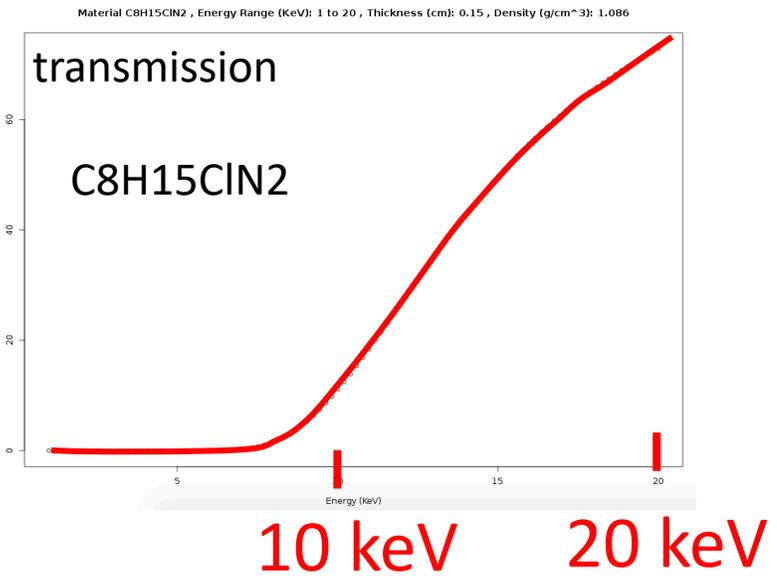
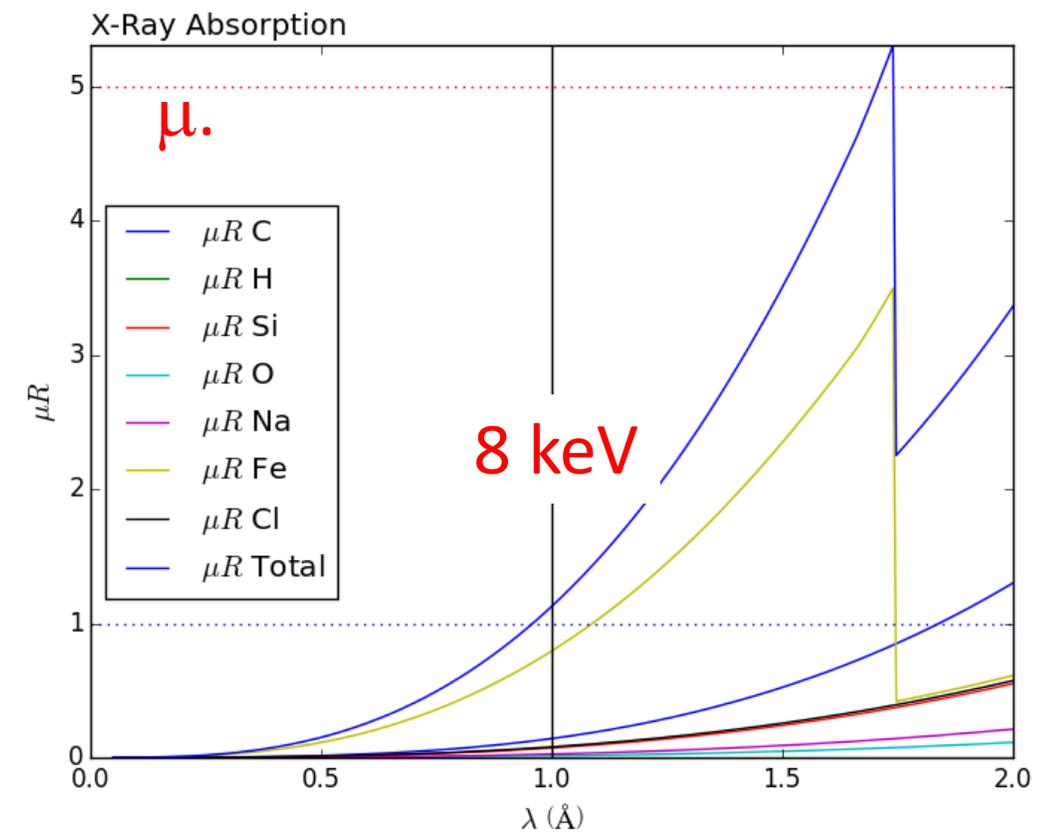
Beam stop: from $400(H) \cdot 80(V) \text{ \mu m}^2$
to $175(H) \cdot 25(V) \text{ \mu m}^2$

7 m, back to 0.5 m and forth



Low transmission
at low energy!
 $\neq e l^{\text{on}}$ density: Electronic cloud

Transmission = $\text{Exp}(-\mu \cdot e)$



From 2D to 1D spectrum: **the qmin**

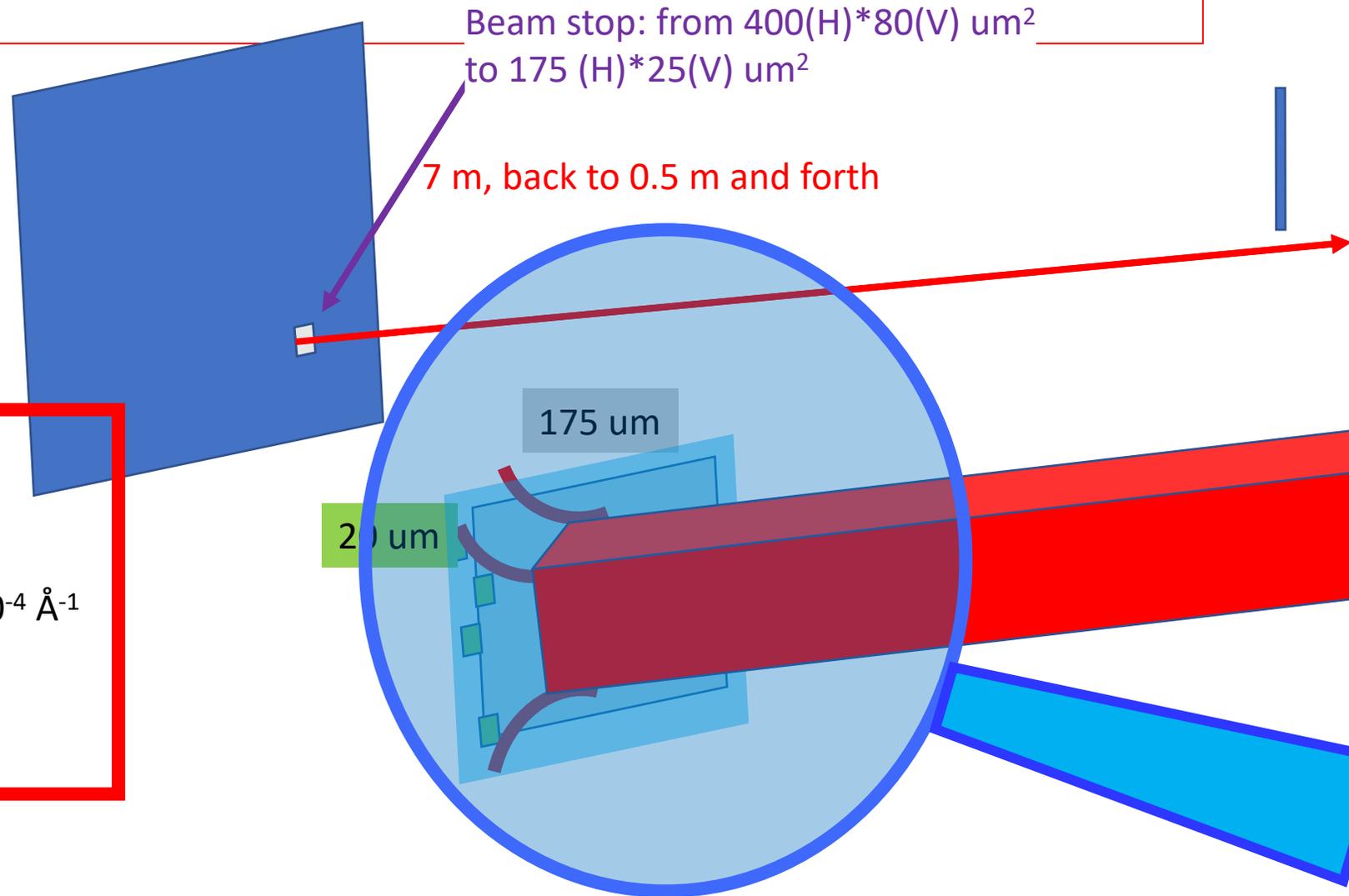
Around the beam stop:

- Mask
- Very tiny and intricate!!
- >> first points uncertain

- Lower energy
- higher λ lower Q_{\min} ;
- Eg 8 keV (/12 keV) >> $Q_{\min} = 6.5 \cdot 10^{-4} \text{ \AA}^{-1}$

- **!! transmission**

USAXS !
ESRF ID 02



Neutrons vs X rays

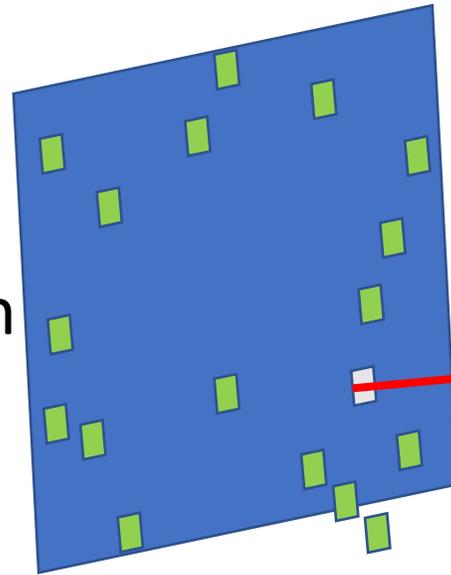
- Neutrons:
- Beam better defined (10 – 15 mm), « quieter » situation, slower acquisition : time to improve...
- transmission $< >$ density of protons ($>$ incoherent scattering $>>$)
- USANS: 10^{-5} \AA^{-1} , multifocus – multislots, (TPA), Bonze and Hart camera, Kookaburra ANSTO

Measured at high q

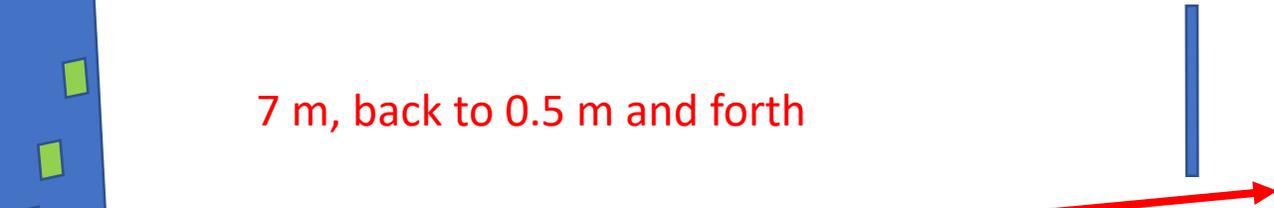
QUESTIONS ?

From 2D to 1D spectrum: **the q_{\max}**

- Around the edges
- **Sometimes very few**
- >> last points uncertain

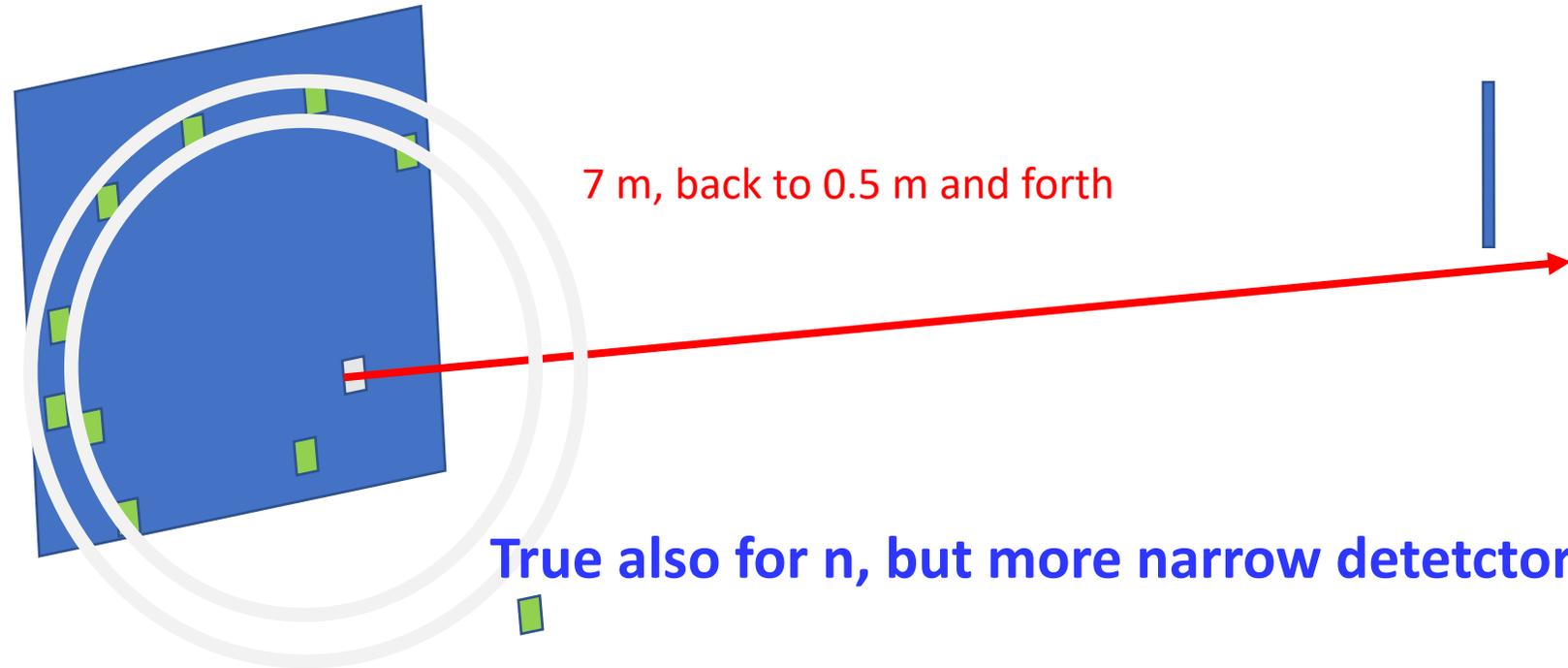
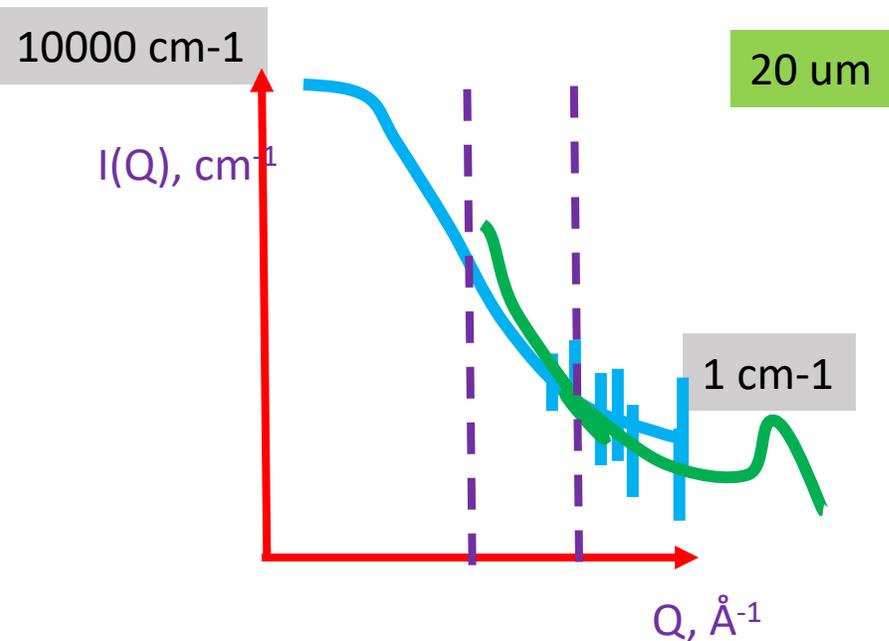


7 m, back to 0.5 m and forth



From 2D to 1D spectrum: **the q_{max}**

- Around the edges
- Sometimes very few
- >> last points uncertain!



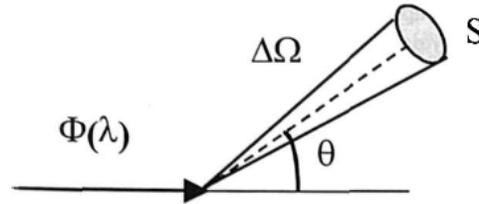
Solution: 2nd configuration GO TO larger q !

NO LIMITS !!

Overlapping. >> exact thickness, transmission

QUESTIONS ?

Treated intensity(cm^{-1}) : **absolute units**



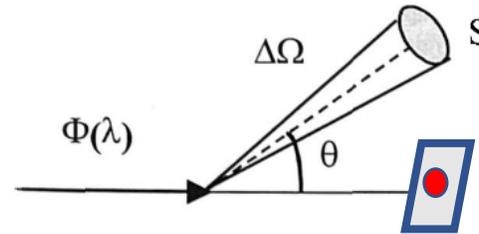
Neutrons or photons

- $I(\theta) = F(\lambda) \cdot d\sigma/d\Omega(\theta) \cdot S/D_{\text{det}}^2$
- Neutron(**photon**) = neutron. cm^{-2} cm^2 steradian

- $I(q) = S \cdot e \cdot F_0 \cdot t \cdot \text{Eff.}_{\text{detector}} \cdot \text{Tr} \cdot \frac{d\Omega}{2\pi r dr} \cdot \frac{1}{V_{\text{sample}}} \cdot d\sigma/d\Omega(q)$
- Neutron = Area Thickness Flux. Duration Transmission $\frac{2\pi r dr}{D_{\text{detector}}^2}$
 Monitor.
 $\text{cm}^2 \text{ cm}$ $\text{n. cm}^{-2} \cdot \text{sec}^{-1}$ sec. steradian cm^{-1}

Treated intensity(cm^{-1}) : **absolute measurements**

- Example : use of Foxtrot for this equation



- Diode on beam stop measures transmitted beam $S. e. F_0. t. \text{Eff}_{\text{diode}}. \text{Tr}$

- Coefficient ($< > \text{Eff}_{\text{detector}} / \text{Eff}_{\text{diode}}$), see next slide

- $\gg \gg 1/V \text{d}\sigma/\text{d}\Omega(\mathbf{q}), \text{cm}^{-1}$

- $I(\mathbf{q}) = S. e. F_0. t. \text{Eff}_{\text{detector}}. \text{Tr} \frac{\Delta\Omega}{2\pi r dr} \frac{1}{V_{\text{sample}}} \text{d}\sigma/\text{d}\Omega(\mathbf{q})$

- Neutron = Area Thick^{ness} Flux. Duration Transmission $2\pi r dr / D_{\text{detector}}^2$

Monitor.

$\text{cm}^2 \text{cm}$

$\text{n. cm}^{-2}. \text{sec}^{-1}$

sec.

steradian

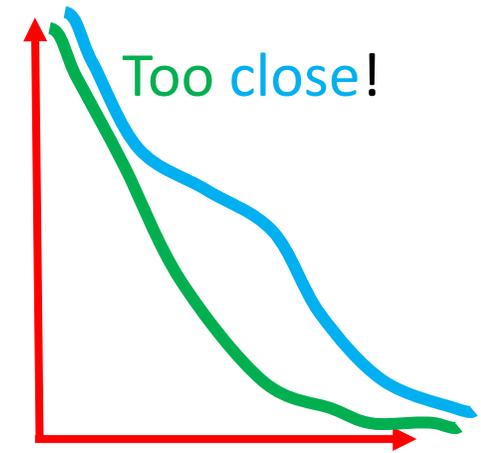
cm^{-1}

QUESTIONS ?

1D sp., treatment: **container scattering subtraction**

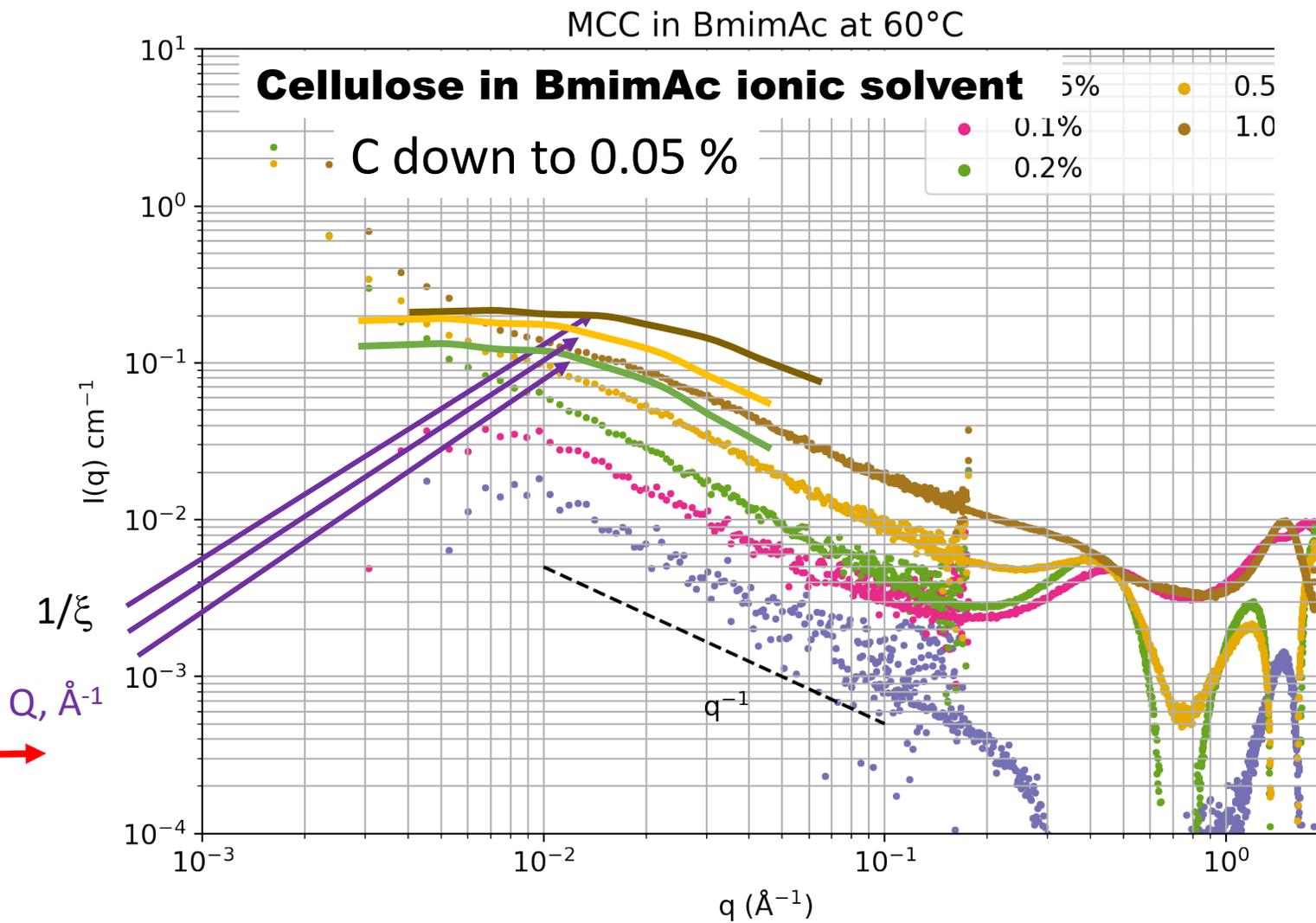
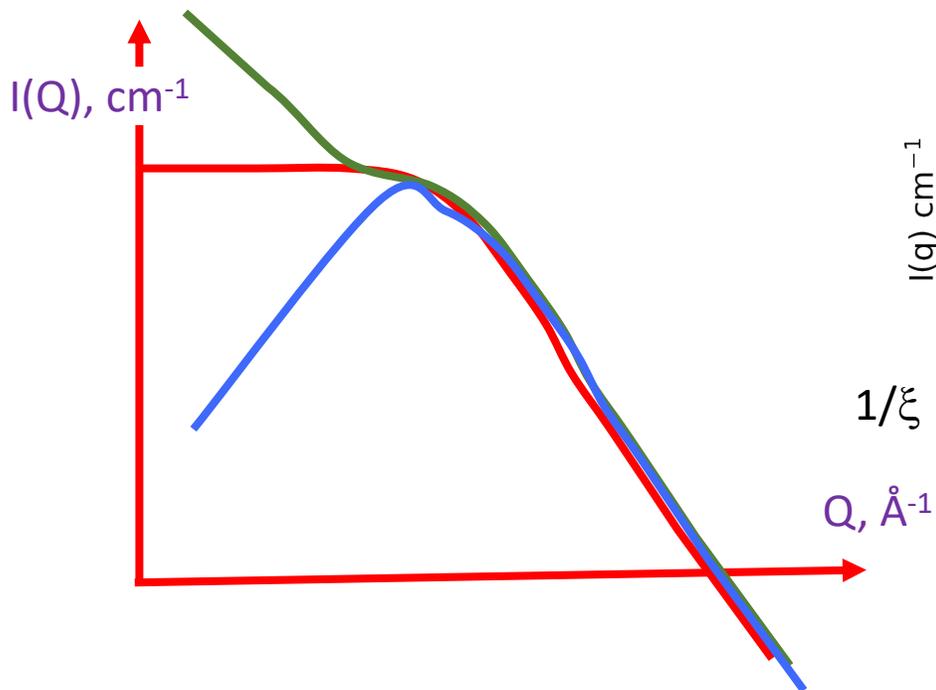
large q

- 1/ Pbs: exact transmission, variable thickness...
- variable glass wall thickness...
- **> ? Measure empty capillary then fill** SAME HEIGHT, POSITION ?)
- More regular capillaries (thicker \gg 16 keV, thinner : flat)
- 3/ **Other materials:**
 - quartz (cf A. Banc) abit better, expensive
 - Capton: ! porous... \gg leaks, flexible \gg flattens ! \gg thickness varies
 - XENOCS / XEUSS low noise cells.
 - **CHECK: overlapp over two configurations**
- 3/. **Through flow capillary** :same thickness...glass / liquid
 - > ! If SAME place ...
 - > reduce radiation damage by flowing ...
 - BUT : bubbles, cleaning...cf D. Renard, P. Roblin
 - !! requires very low viscosity (cf. H. Mameri)



Neutrons:
much more reproducible
Thanks to Helma!

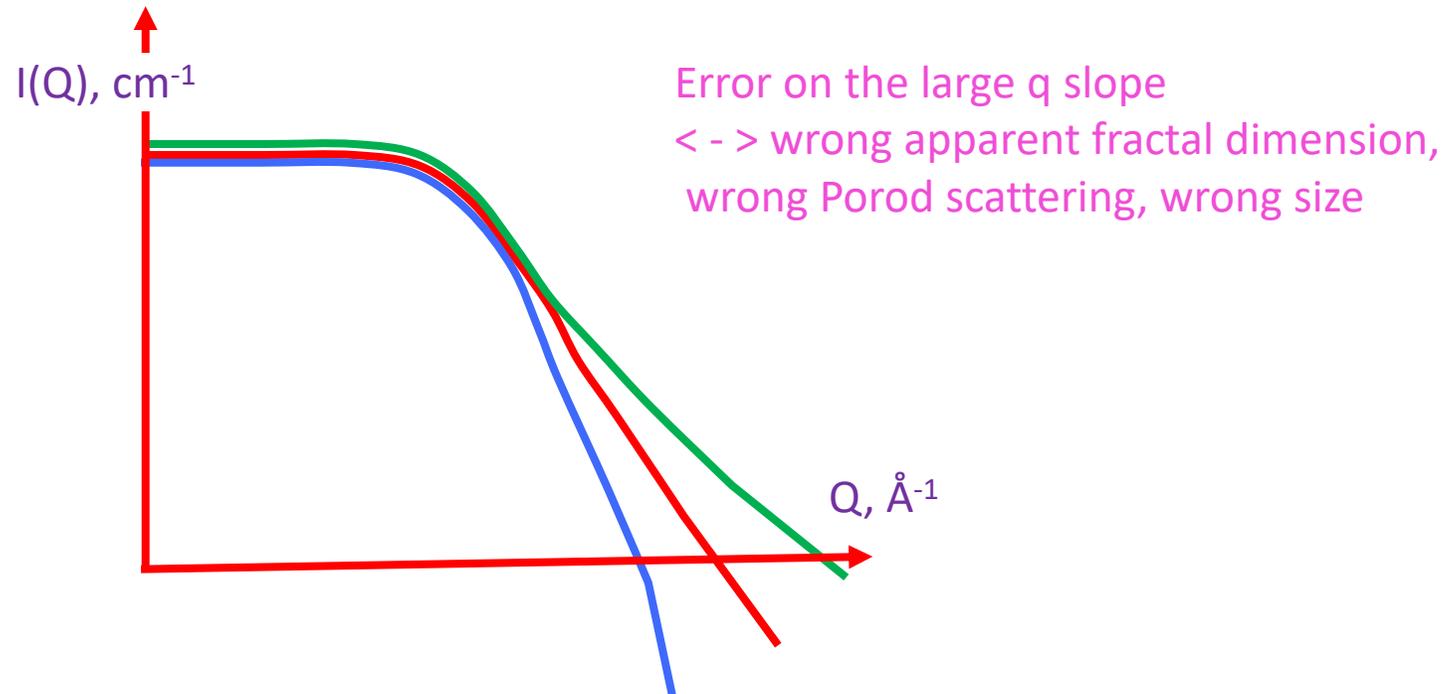
large q



1D sp., treatment: **background subtraction, large q**

X rays: « ideal blank » = buffer ?---- Large q

- ??? Exact thickness, good container subtraction, $\times 1 - \phi_{\text{solute}}$?
- **Neutron:** incoherent background = nb protons (H)/ vol. Calculate., better.
- Consequences:



QUESTIONS ?

Non homogeneous sample

- From one spot to another.
- - > clever average?
- Absolute units difficult

Neutron: stable, wide beam

Non homogeneity: big beam > averaged! more simple! But....

Empty cell: usually reproducible

Thickness : very accurate Absolute units easier

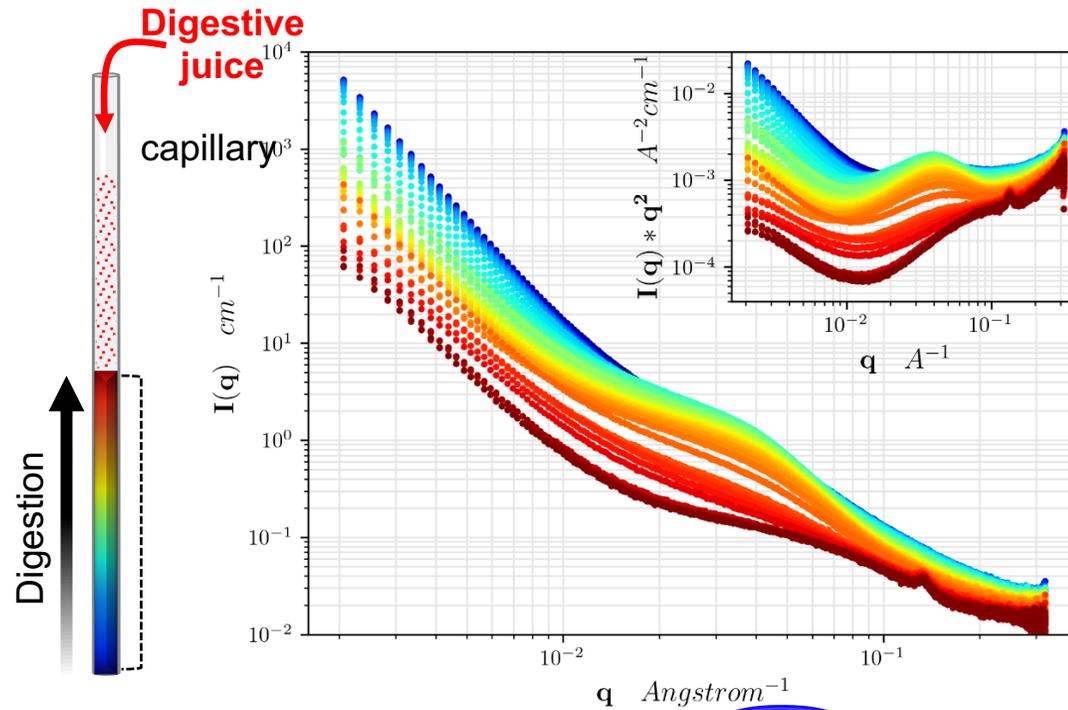
Spikes »: exist :

1/ meniscus :=(

2/ foams :=) > wall profile.

Non homogeneous sample

- From one spot to another.
- - > clever average?
- Absolute units difficult



Neutron: stable, wide beam

Non homogeneity: big beam > averaged! more simple! But....

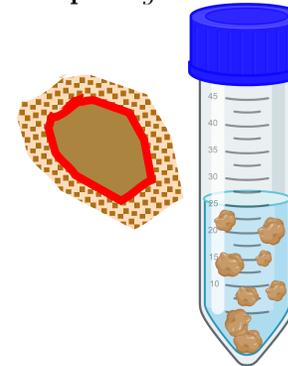
Empty cell: usually reproducible

Thickness : very accurate Absolute units easier

Spikes »: exist :

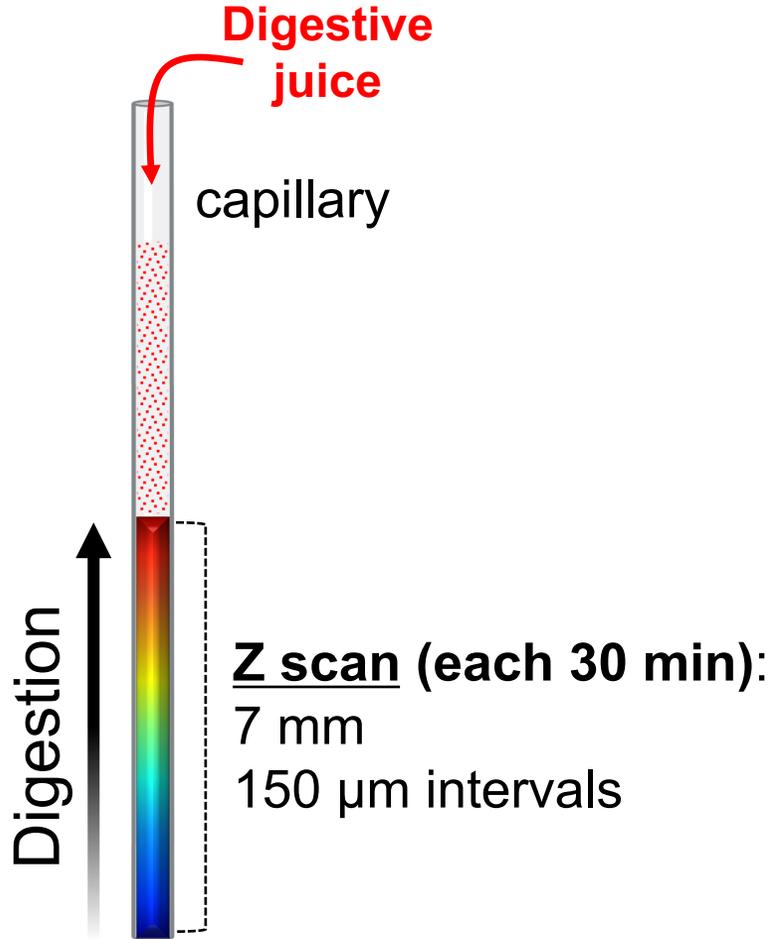
1/ meniscus :=(

2/ foams :=) > wall profile.

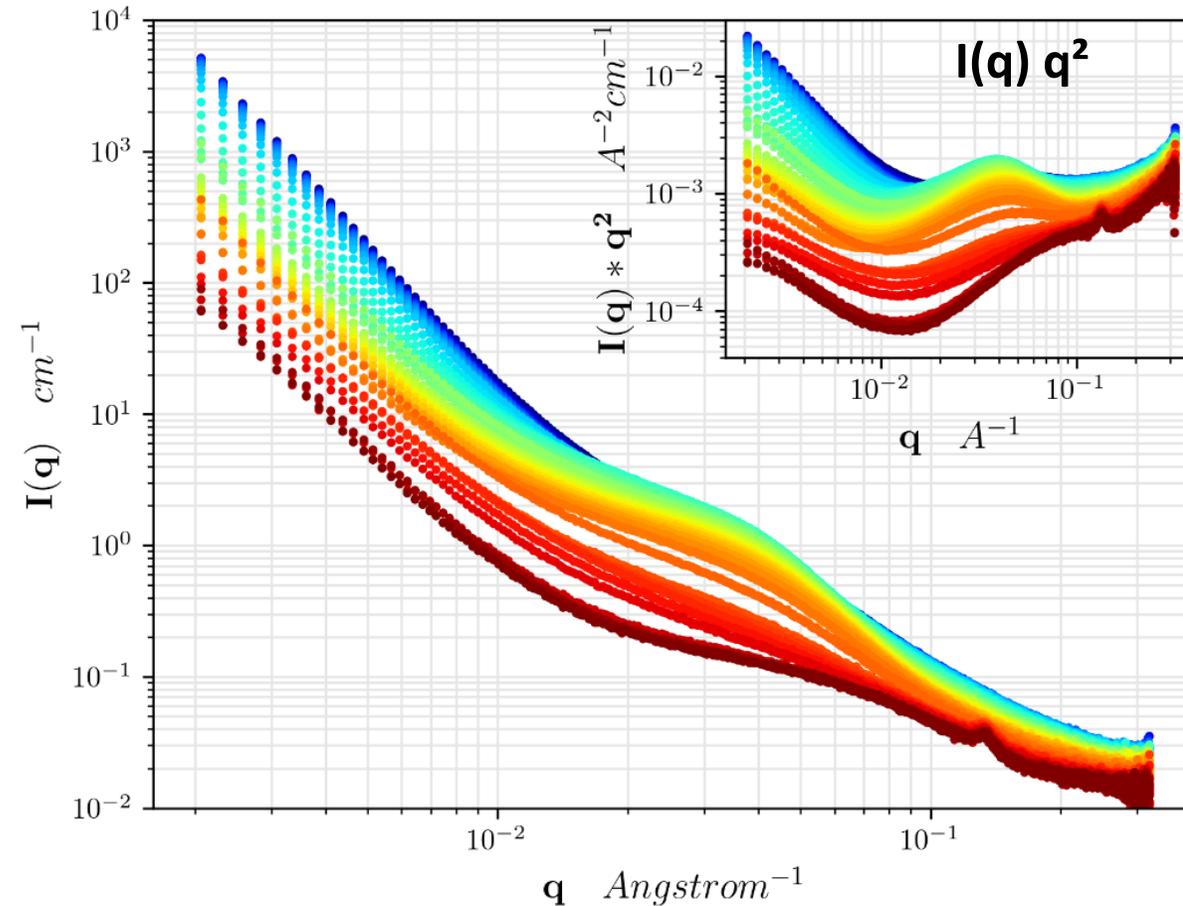


SAXS: Digestion

SWING @ Synchrotron SOLEIL

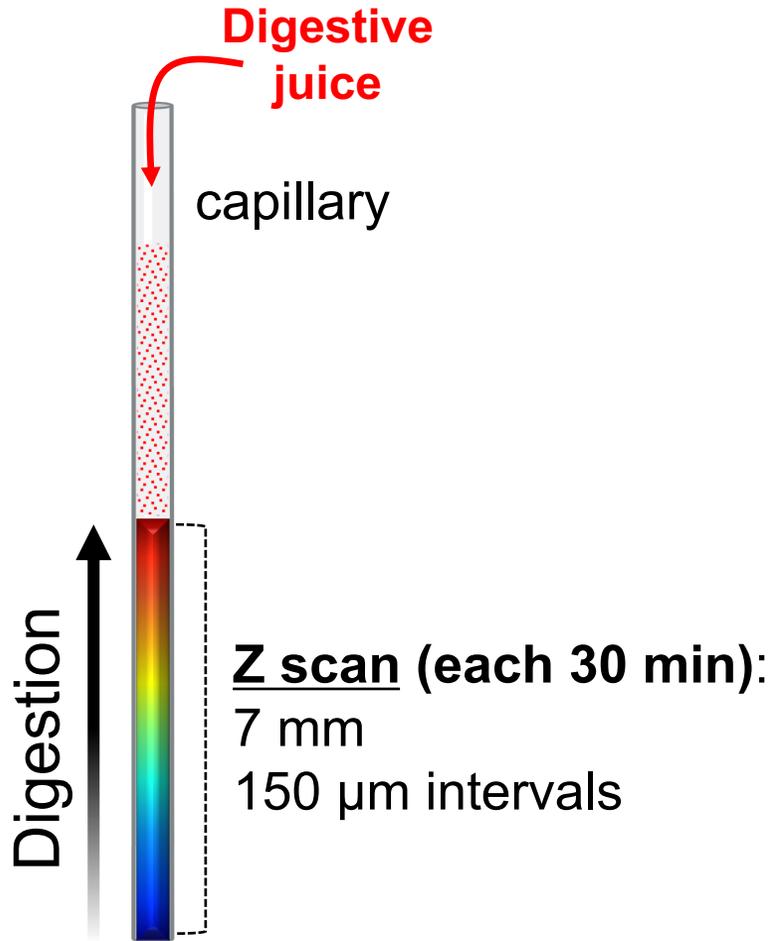


Z scan at
 $t = \text{Gastric } 3.5 \text{ h} + \text{Intestinal } 15.5 \text{ h}$

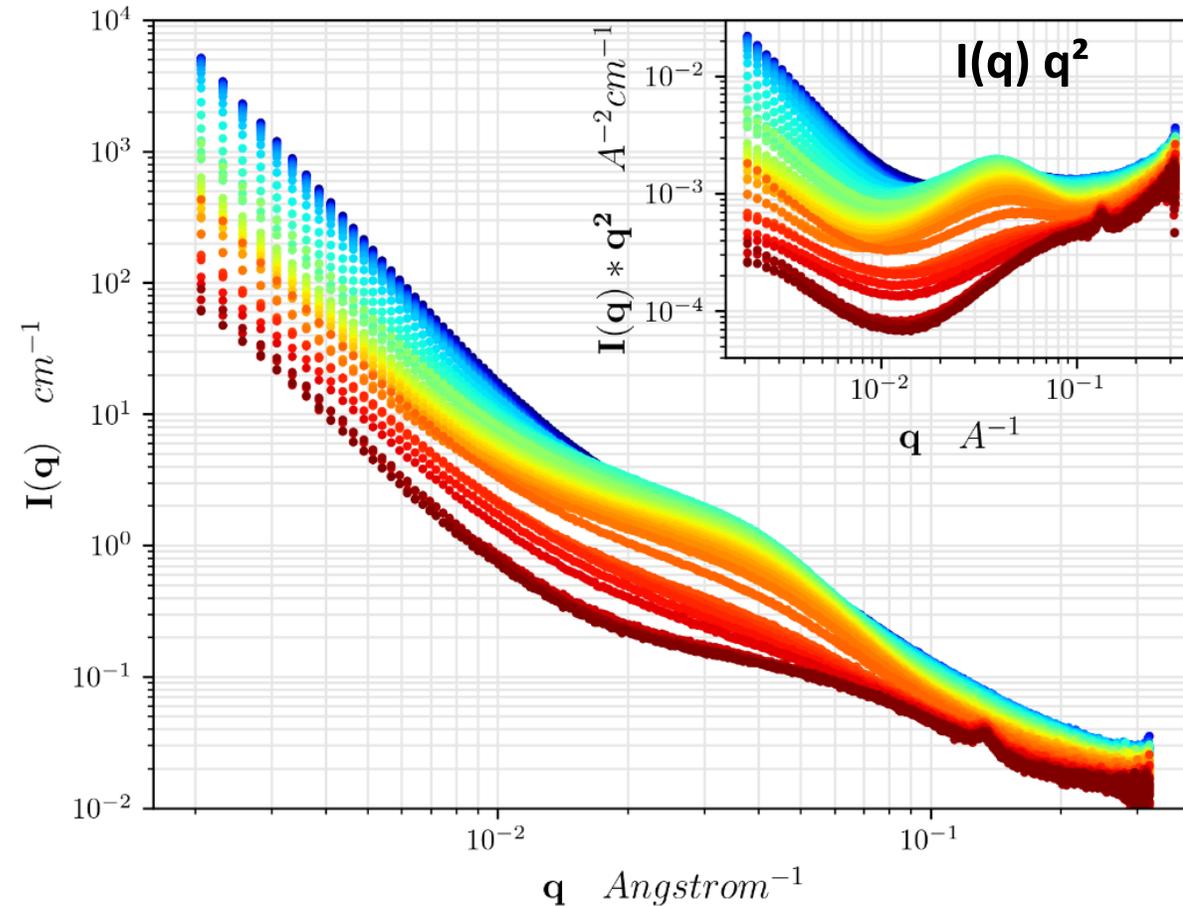


SAXS: Digestion

SWING @ Synchrotron SOLEIL



Z scan at
 $t = \text{Gastric } 3.5 \text{ h} + \text{Intestinal } 15.5 \text{ h}$



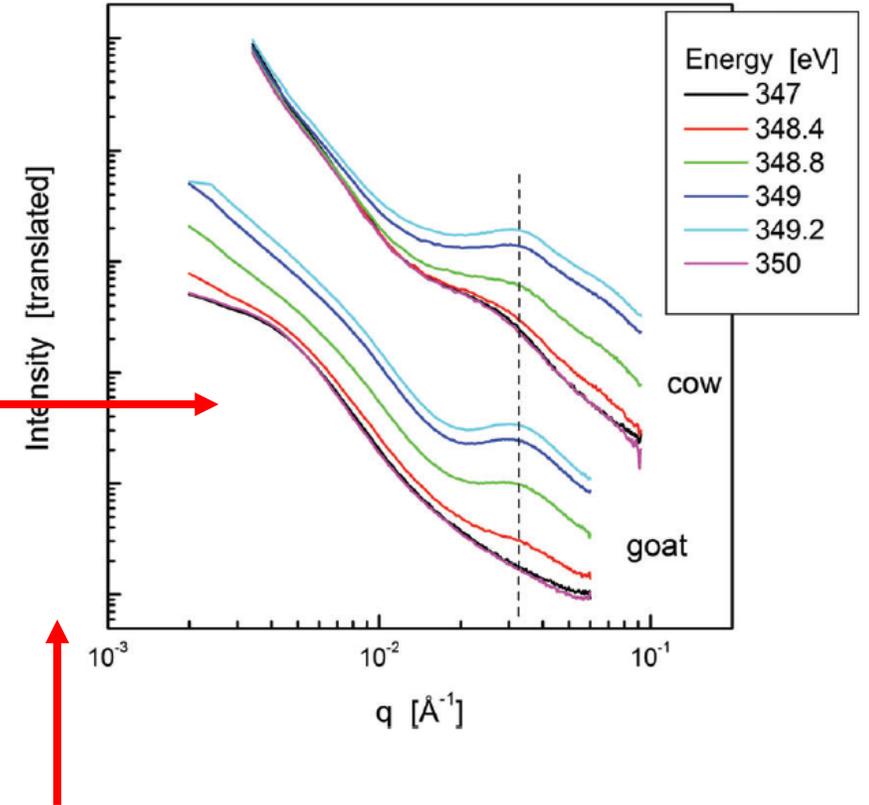
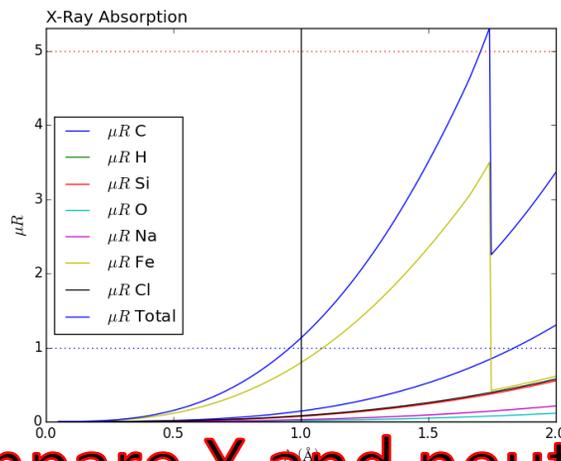
Treated intensity(cm^{-1}) : **varying scattering length density ($\sim N(e^-)/\text{vol} = \text{density ?}$) and contrast**

- NIST website...
- ! Metallic ions not always so **large**
- **ASAXS** Close to absorption: ? Cs^+ , Ca^{2+} ...
- **RSOXS** Resonant soft X-ray scattering ...see C, N, O

... but low photon energy !

> typical absorption length about 500 nm!

- >> ultra-thin cell, thin films...



divide by contrast : compare X and neutrons

So many other things...

- Anisotropic scattering: not today...
- but remember to look at the 2d plot!
- Thank you !