

# A modular approach to data reduction

Brian R. Pauw

# Data corrections

Abbrv.	Corrects	$\sigma_r$	$\sigma_a$	CCD	IP	DD	WD	Cx.
DS	Data formats (Fabio)							0
DZ	De-Zingering							2
FF	Flat-field							1
DT	Deadtime							2
GA	Non-linear response							1
TI	Time							0
DC	Darkcurrent							0
FL	Flux							0
TR	Transmission							0
GD	Geometric distortion							3
SP	Spherical distortion / area dilation							1
PO	Polarization							1
SA	Sample self-absorption							1-3
BG	Background subtraction							0
TH	Sample thickness							0
AU	Absolute intensity scaling							1
MK	Mask pixels							0
MS	Multiple scattering							3
SM	Smearing							3
(ave.)	Azimuthal averaging							

**How about a modular approach?**

## 2D Data

- + relative uncertainties
- + absolute uncertainty

parameter  
database

Abbrv.
DS
DZ
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SA
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AU
MK
MS
SM
(ave.)

2D Data

- + relative uncertainties
- + absolute uncertainty



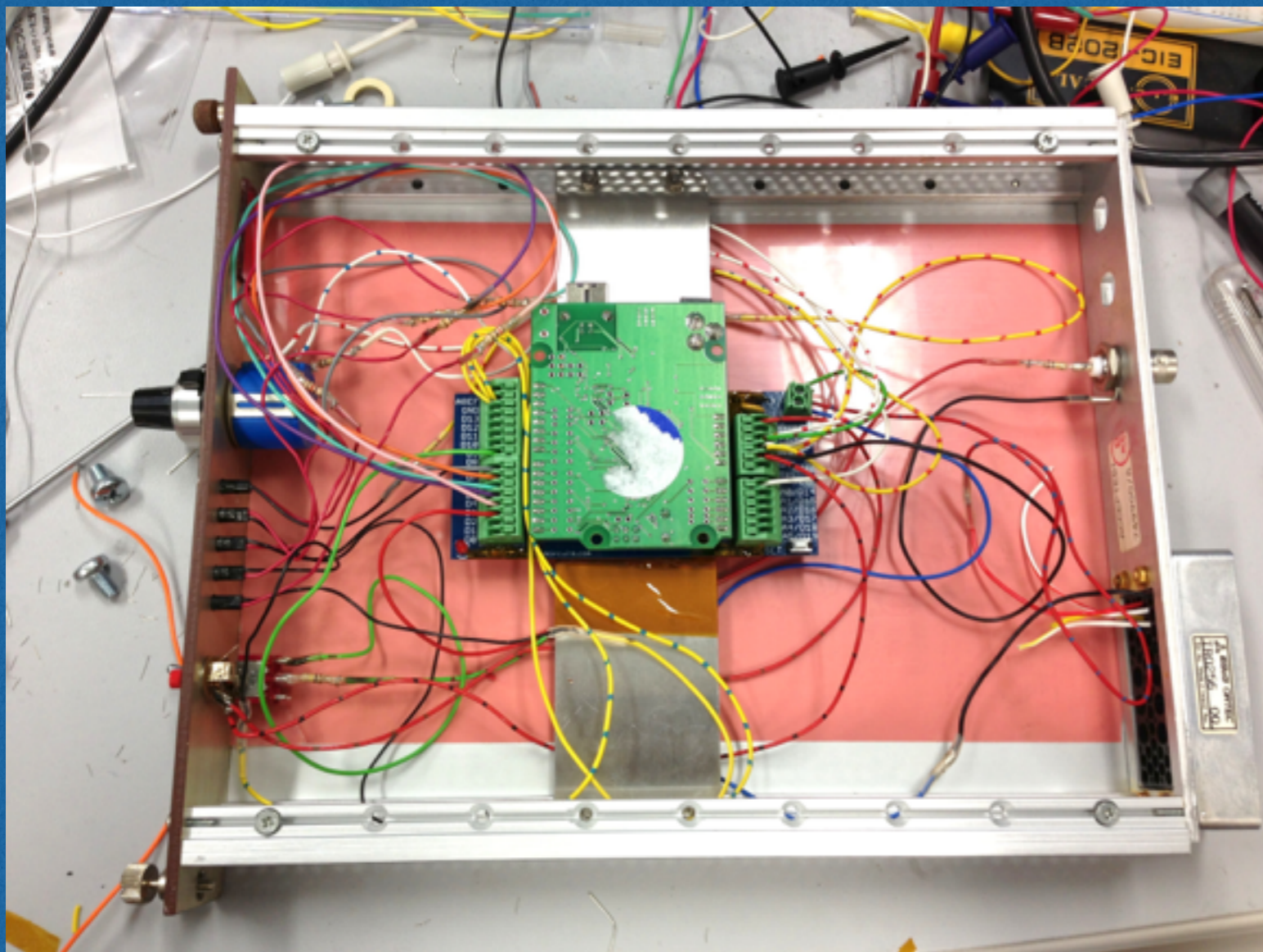
Azimuthal  
Averaging

Uncertainty is...

**max**

- Poisson/counting statistics
- standard error (in bin)
- 1% intensity

# Modular



## *Benefits:*

- Flexible
- Easy to check
- Easy to modify

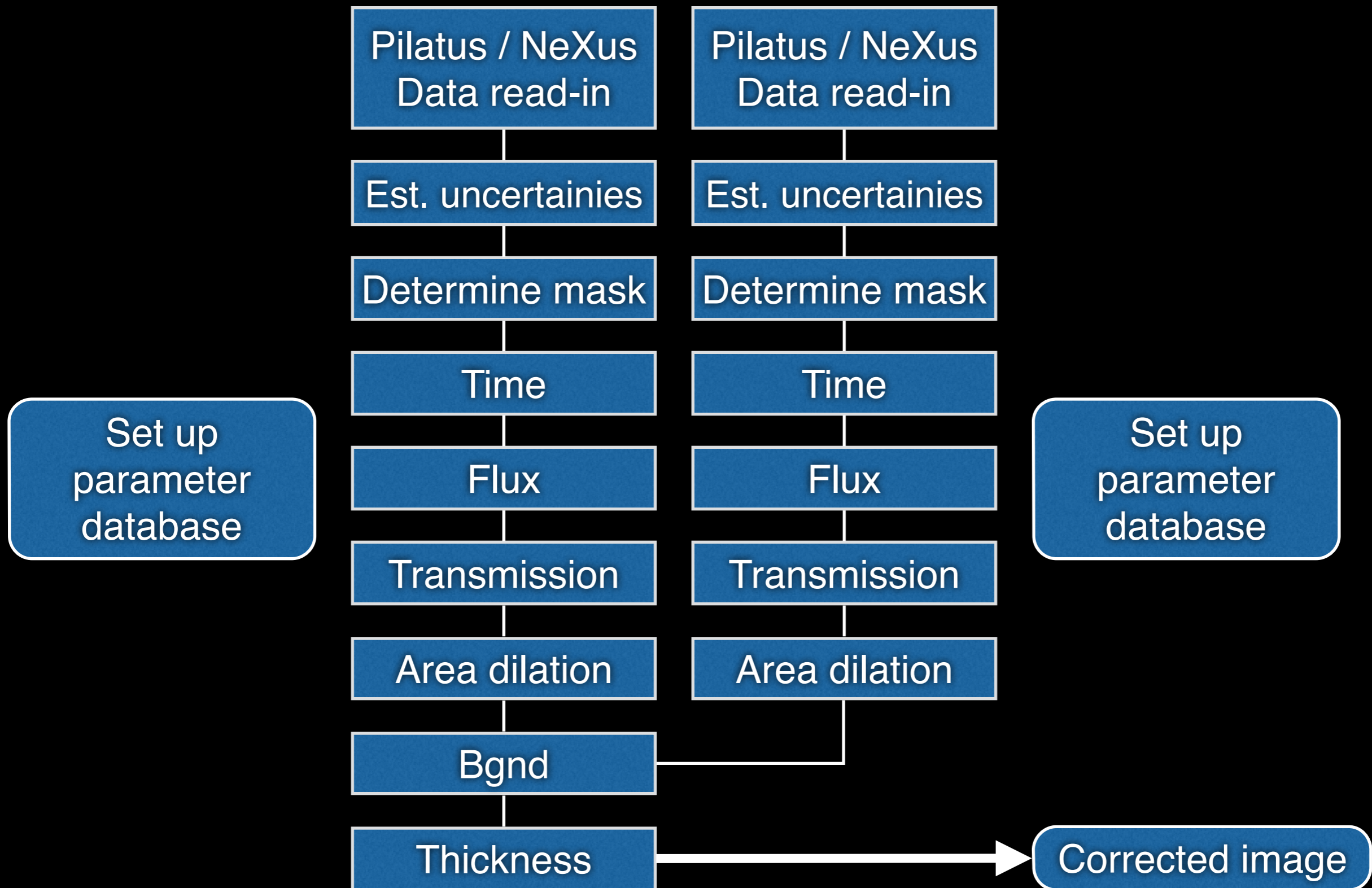
## *Drawbacks:*

- Slower
- Inefficient  
uncertainty  
propagation?
- More?

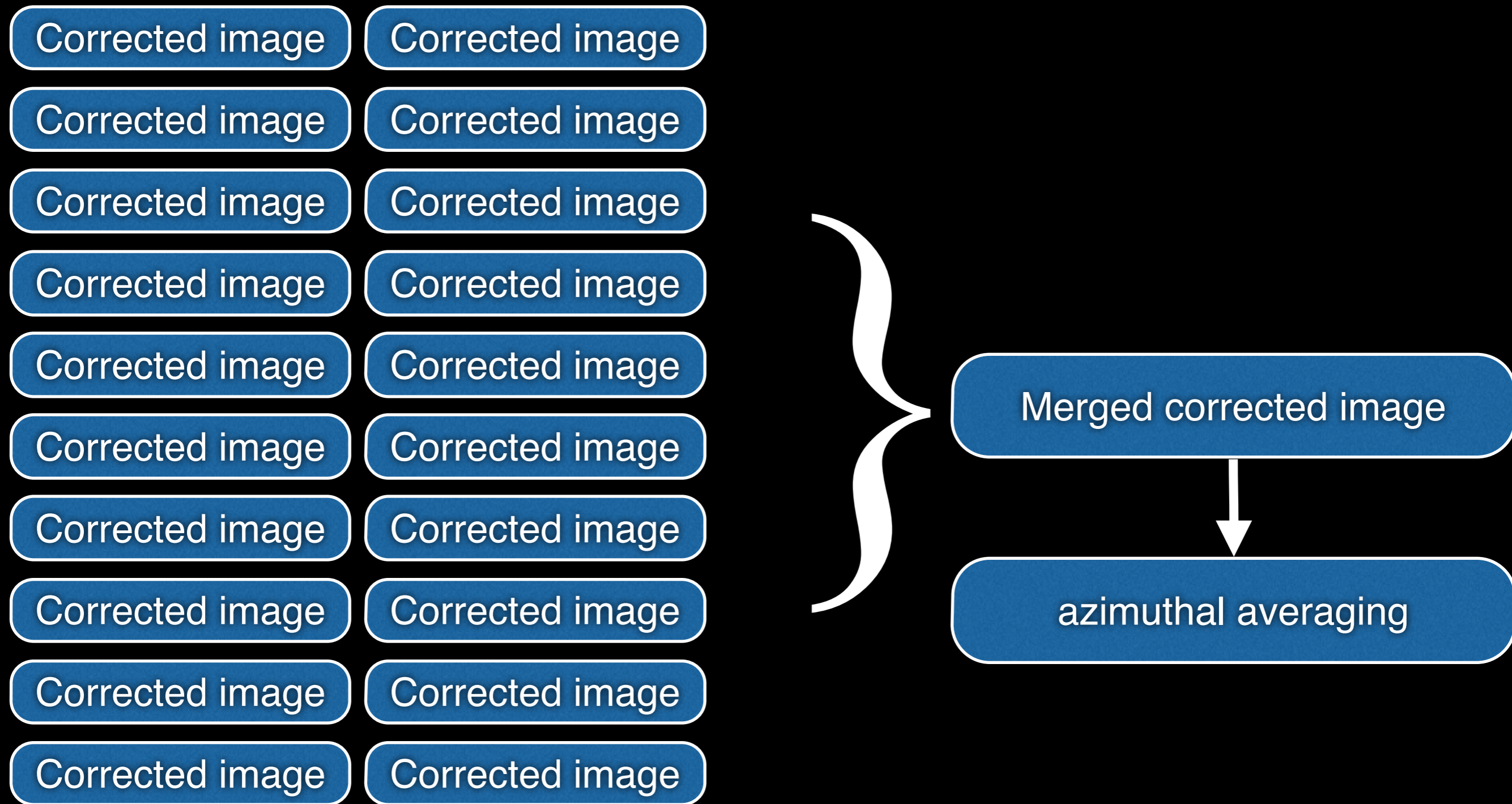


# Modular case example 1: Diamond I22

# Modular case example 1: Diamond I22

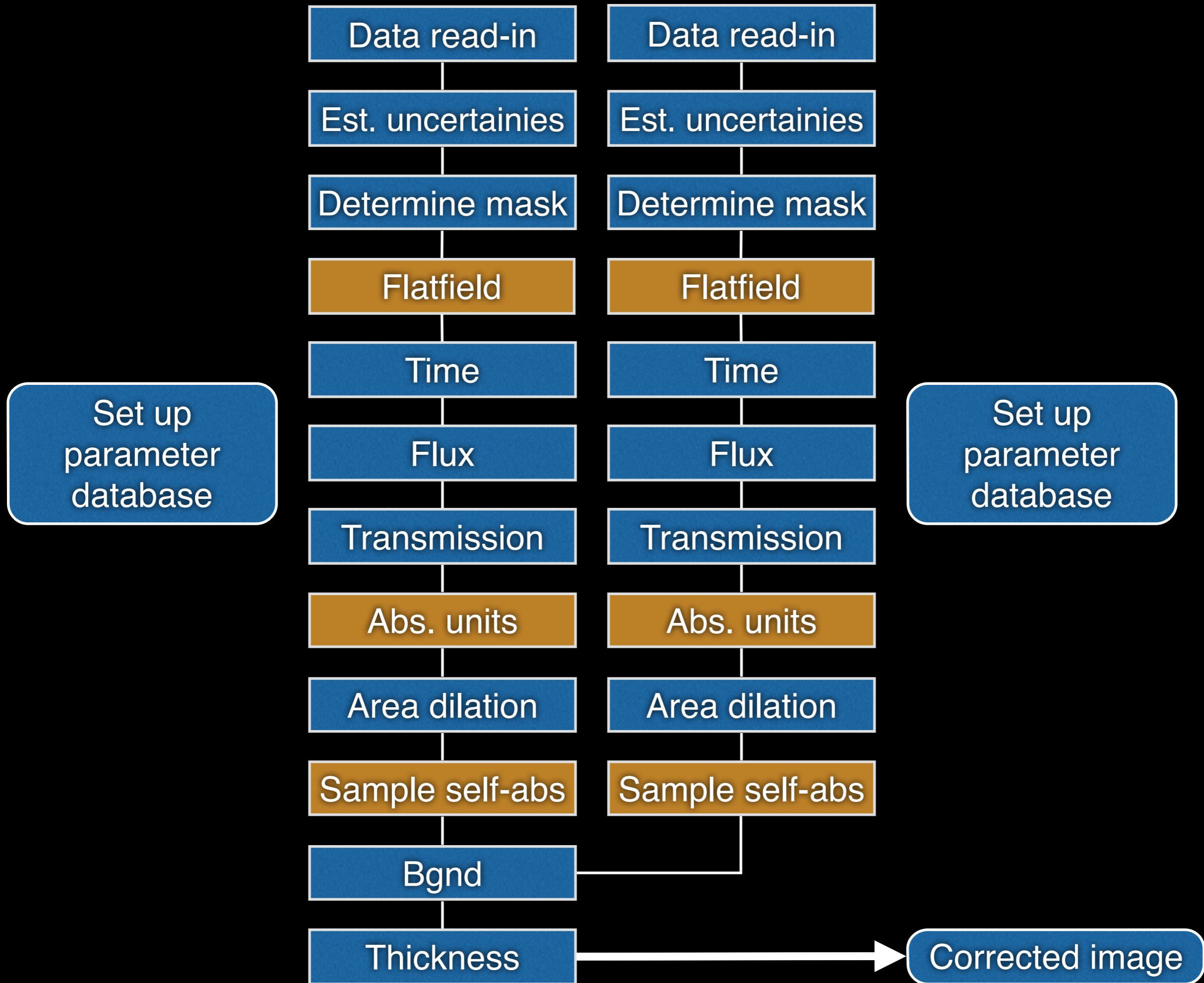


# Modular case example 1: Diamond I22



# Modular case example 2: Bruker SAXS





**Is all that really necessary?**

<b>Abbrv.</b>	<b>Corrects</b>
<b>DS</b>	<b>Data formats (Fabio)</b>
<b>DZ</b>	<b>De-Zingering</b>
<b>FF</b>	<b>Flat-field</b>
<b>DT</b>	<b>Deadtime</b>
<b>GA</b>	<b>Non-linear response</b>
<b>TI</b>	<b>Time</b>
<b>DC</b>	<b>Darkcurrent</b>
<b>FL</b>	<b>Flux</b>
<b>TR</b>	<b>Transmission</b>
<b>GD</b>	<b>Geometric distortion</b>
<b>SP</b>	<b>Spherical distortion / area dilation</b>
<b>PO</b>	<b>Polarization</b>
<b>SA</b>	<b>Sample self-absorption</b>
<b>BG</b>	<b>Background subtraction</b>
<b>TH</b>	<b>Sample thickness</b>
<b>AU</b>	<b>Absolute intensity scaling</b>
<b>MK</b>	<b>Mask pixels</b>
<b>MS</b>	<b>Multiple scattering</b>
<b>SM</b>	<b>Smearing</b>
<b>(ave.)</b>	<b>Azimuthal averaging</b>

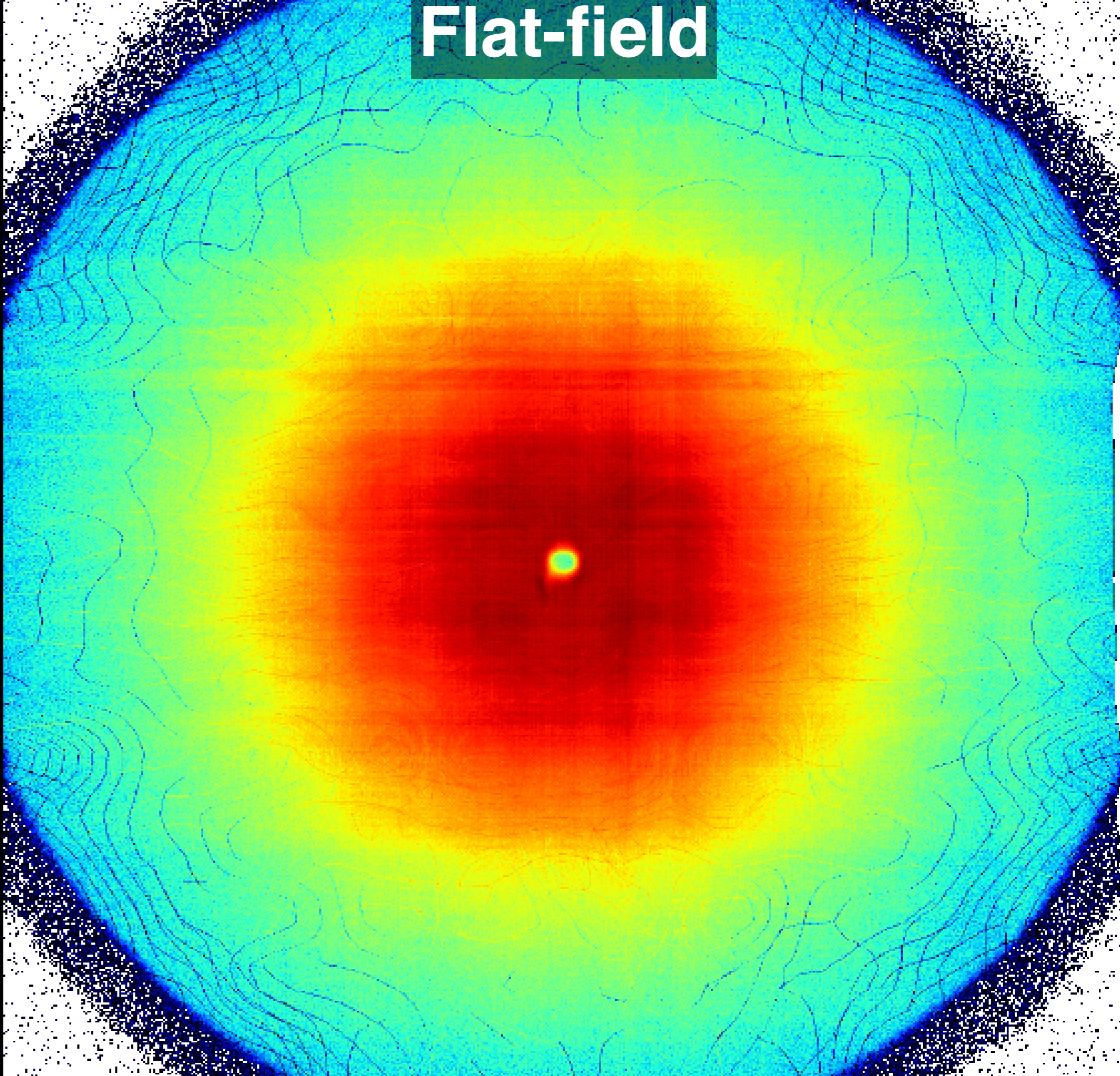
<b>Abbrev.</b>	<b>Corrects</b>
<b>DS</b>	<b>Data formats (Fabio)</b>
<b>DZ</b>	<b>De-Zingering</b>
<b>FF</b>	<b>Flat-field</b>
<b>DT</b>	<b>Deadtime</b>
<b>GA</b>	<b>Non-linear response</b>
<b>TI</b>	<b>Time</b>
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<b>Abbrv.</b>	<b>Corrects</b>
<b>DS</b>	<b>Data formats (Fabio)</b>
<b>DZ</b>	<b>De-Zingering</b>
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<b>(ave.)</b>	<b>Azimuthal averaging</b>

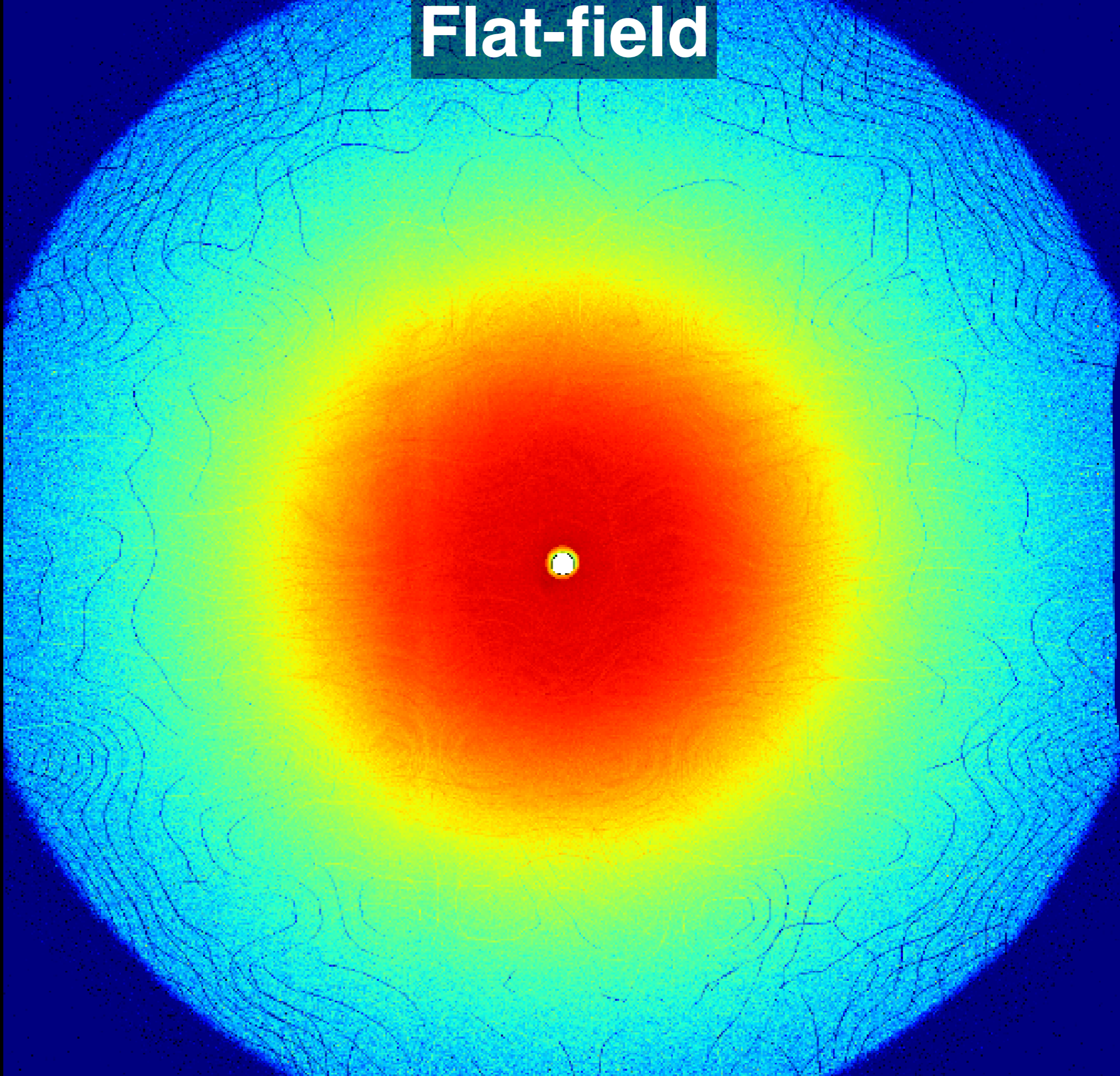


# Flat-field



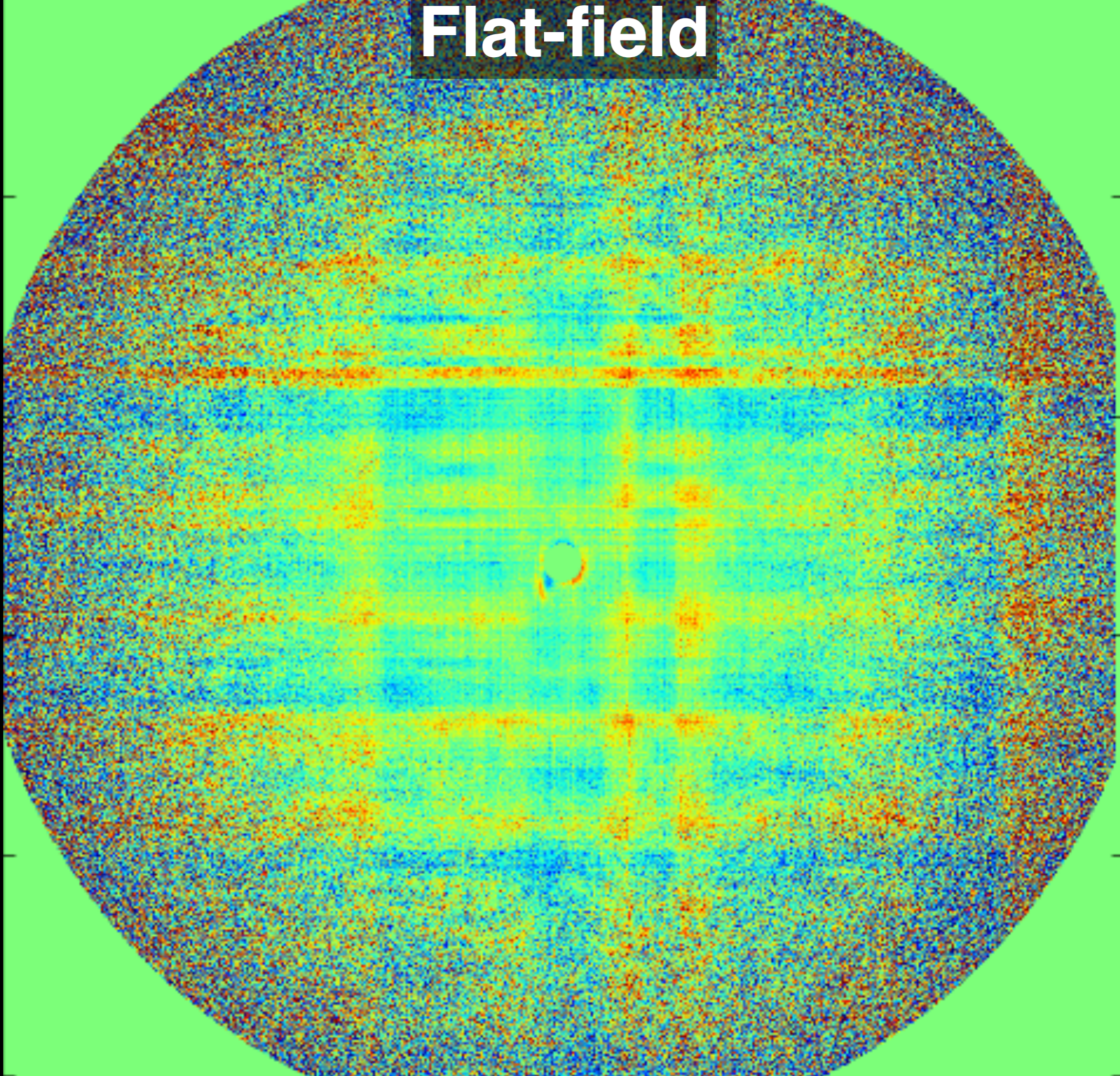
Abbrv.
DS
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(ave.)

# Flat-field



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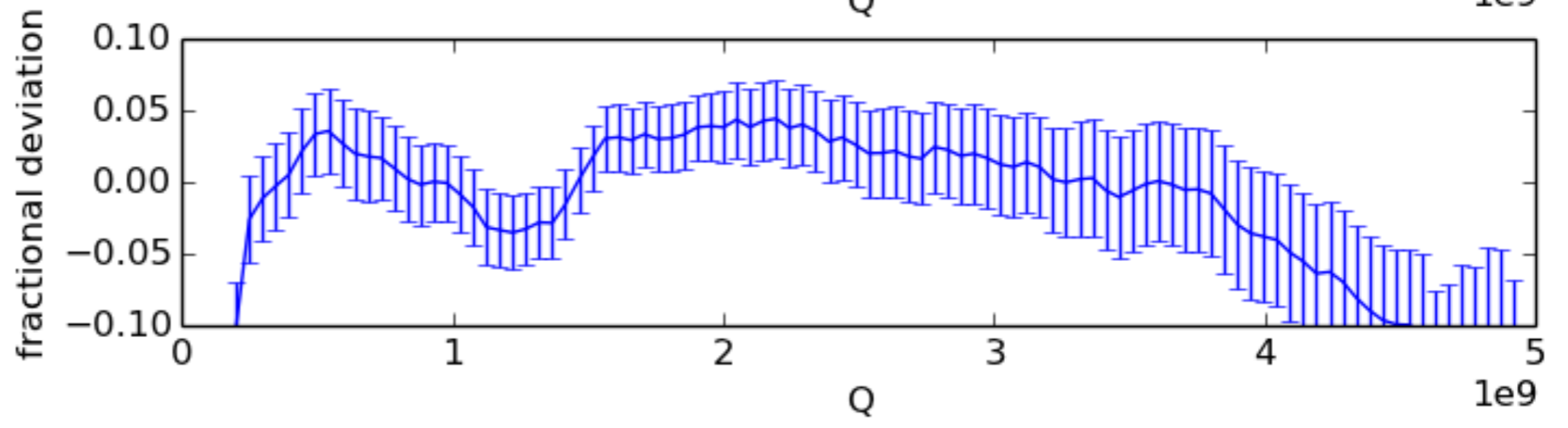
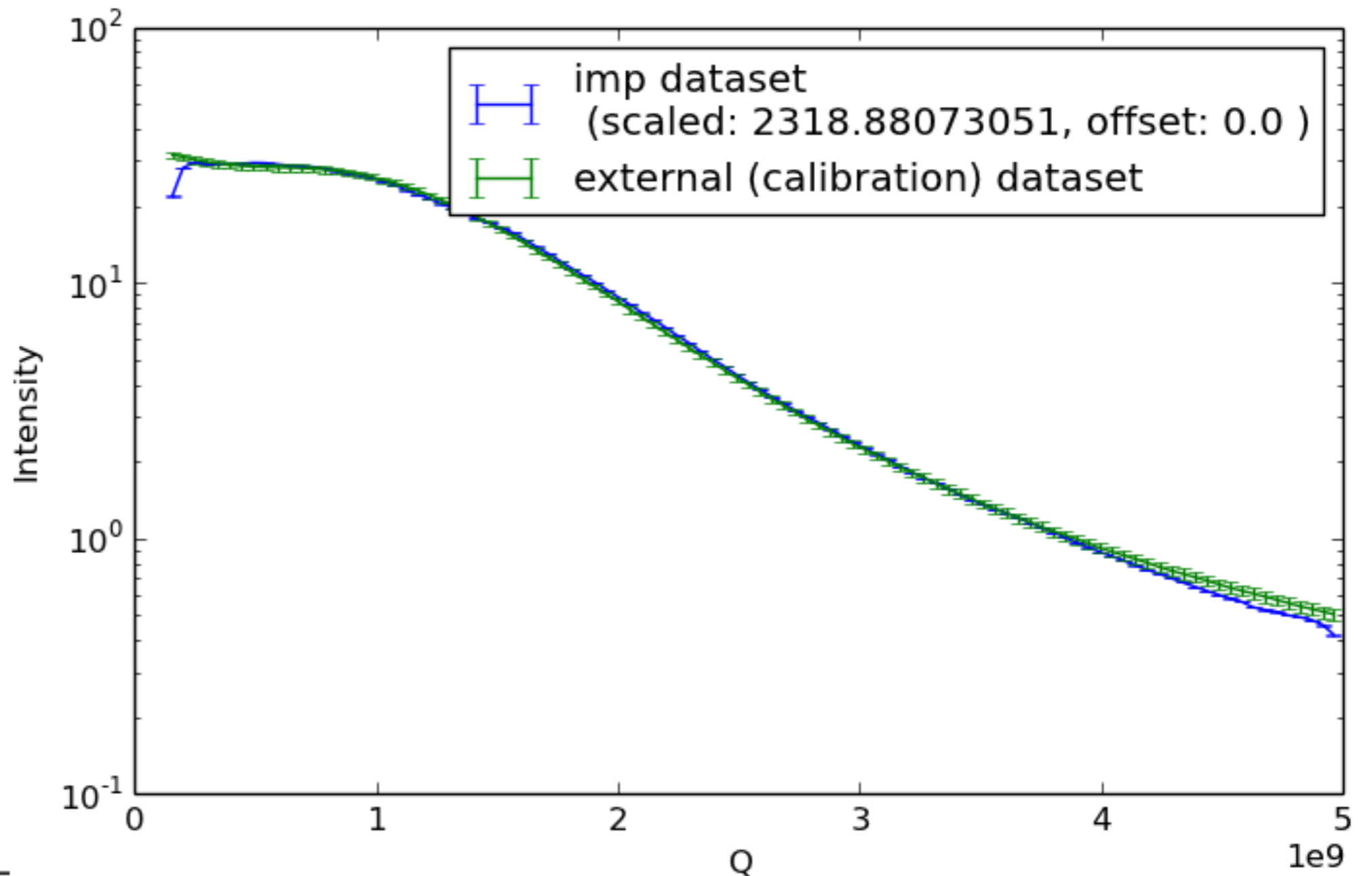
# Flat-field



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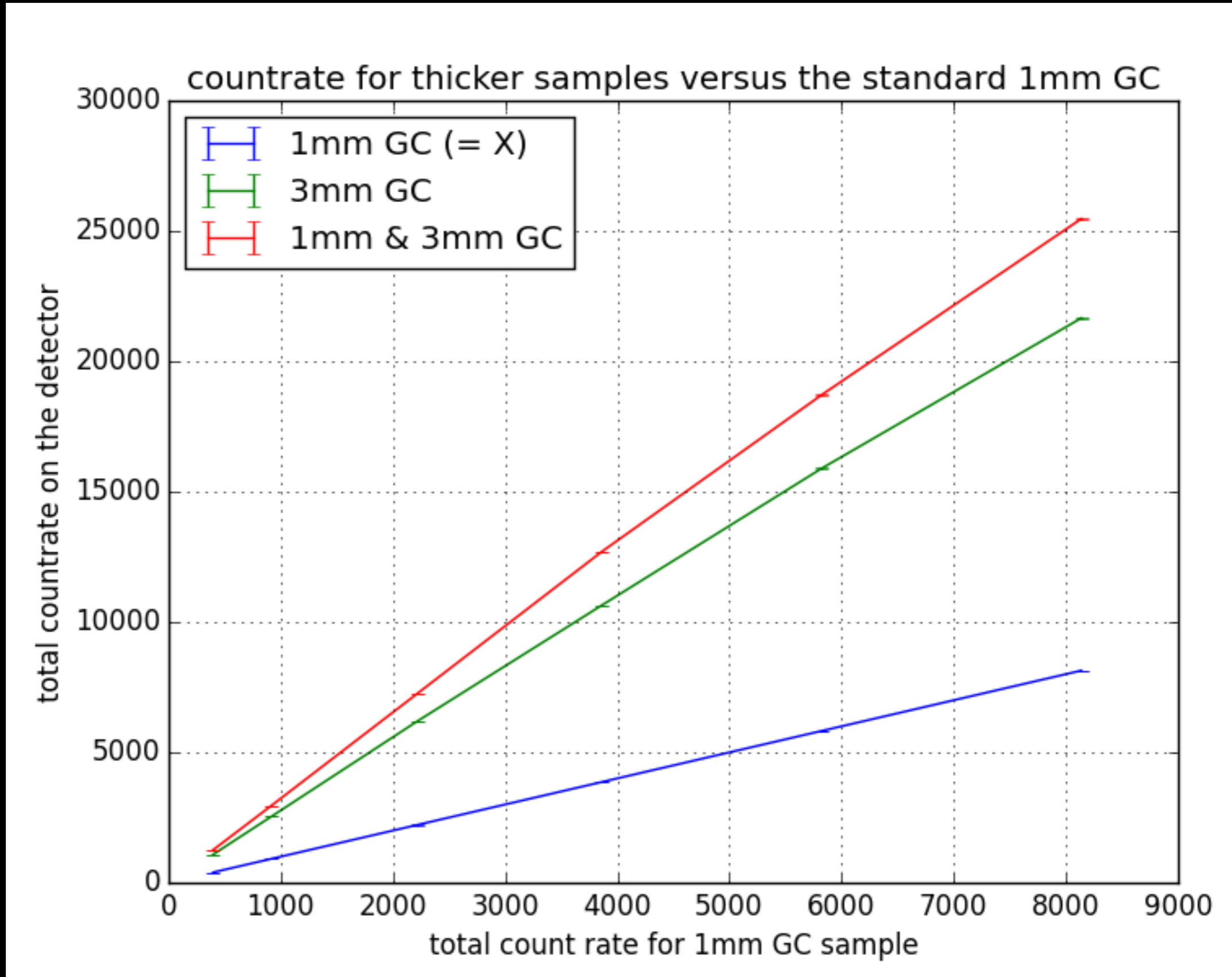


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<b>DS</b>	<b>Data formats (Fabio)</b>
<b>DZ</b>	<b>De-Zingering</b>
<b>FF</b>	<b>Flat-field</b>
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<b>GA</b>	<b>Non-linear response</b>
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<b>TR</b>	<b>Transmission</b>
<b>GD</b>	<b>Geometric distortion</b>
<b>SP</b>	<b>Spherical distortion / area dilation</b>
<b>PO</b>	<b>Polarization</b>
<b>SA</b>	<b>Sample self-absorption</b>
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<b>MS</b>	<b>Multiple scattering</b>
<b>SM</b>	<b>Smearing</b>
<b>(ave.)</b>	<b>Azimuthal averaging</b>



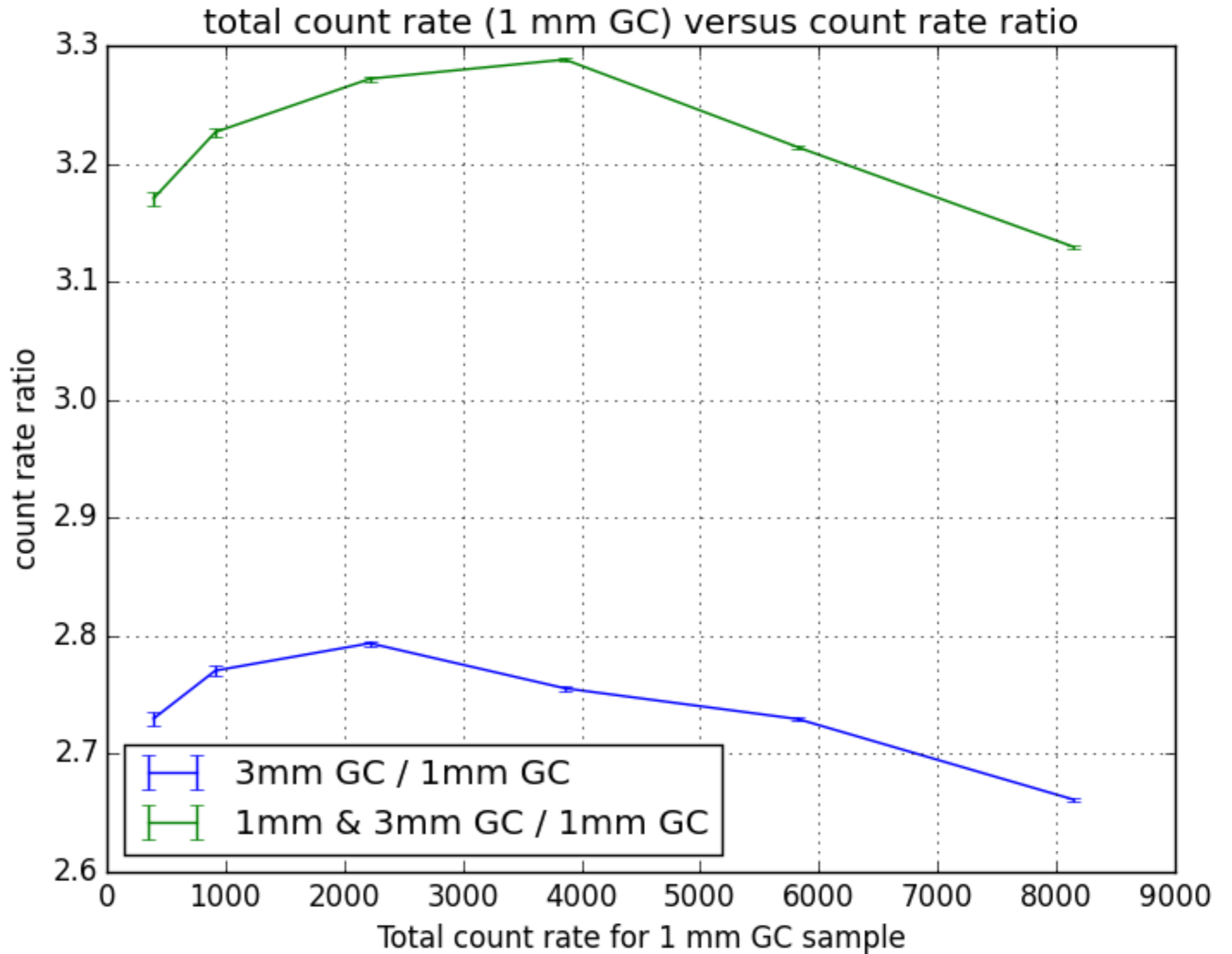
# Deadtime

Abbrv.
DS
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AU
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(ave.)



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FF
DT
GA
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PO
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(ave.)



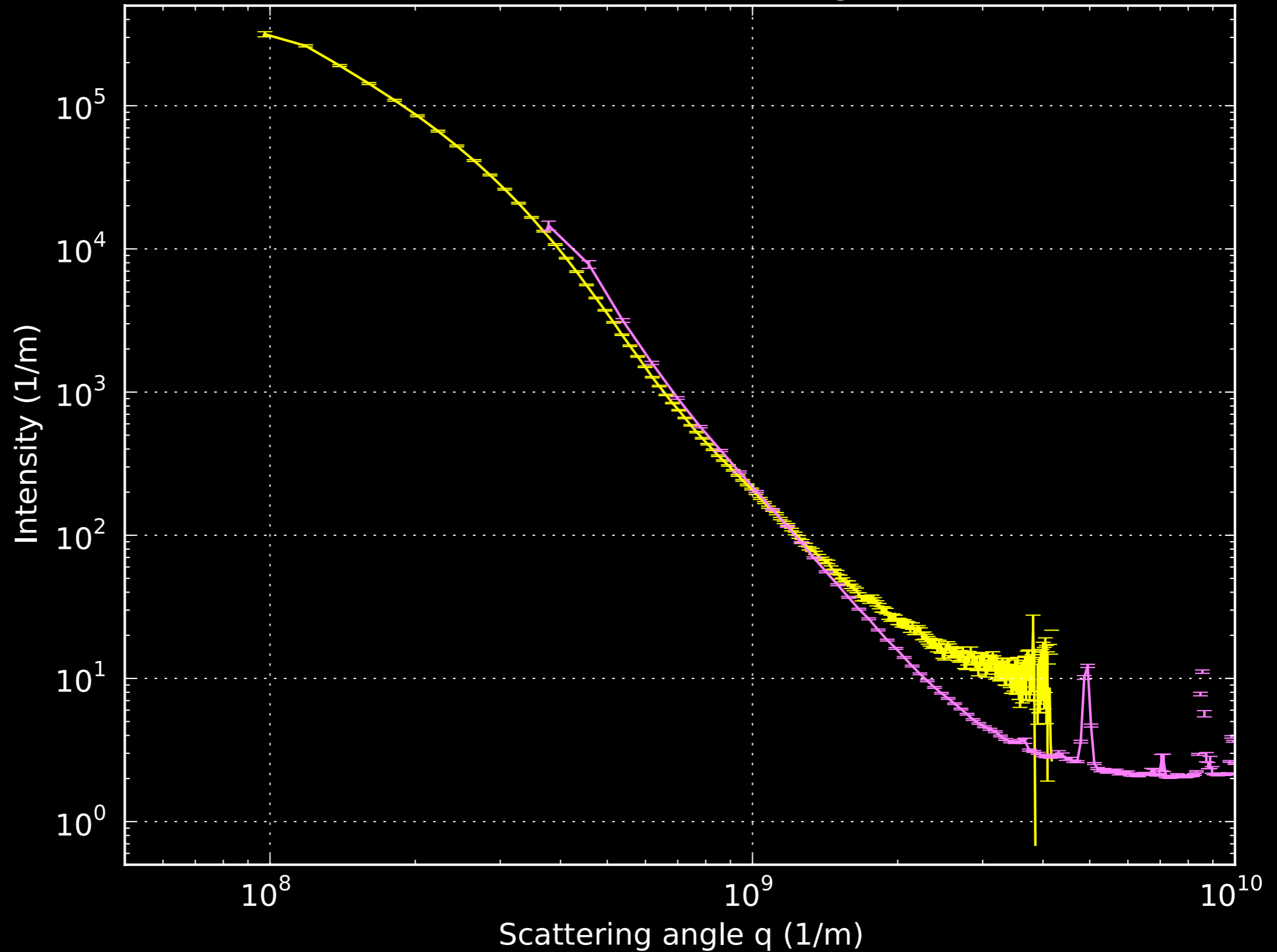


<b>Abbrv.</b>	<b>Corrects</b>
<b>DS</b>	<b>Data formats (Fabio)</b>
<b>DZ</b>	<b>De-Zingering</b>
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<b>MK</b>	<b>Mask pixels</b>
<b>MS</b>	<b>Multiple scattering</b>
<b>SM</b>	<b>Smearing</b>
<b>(ave.)</b>	<b>Azimuthal averaging</b>



# Darkcurrent

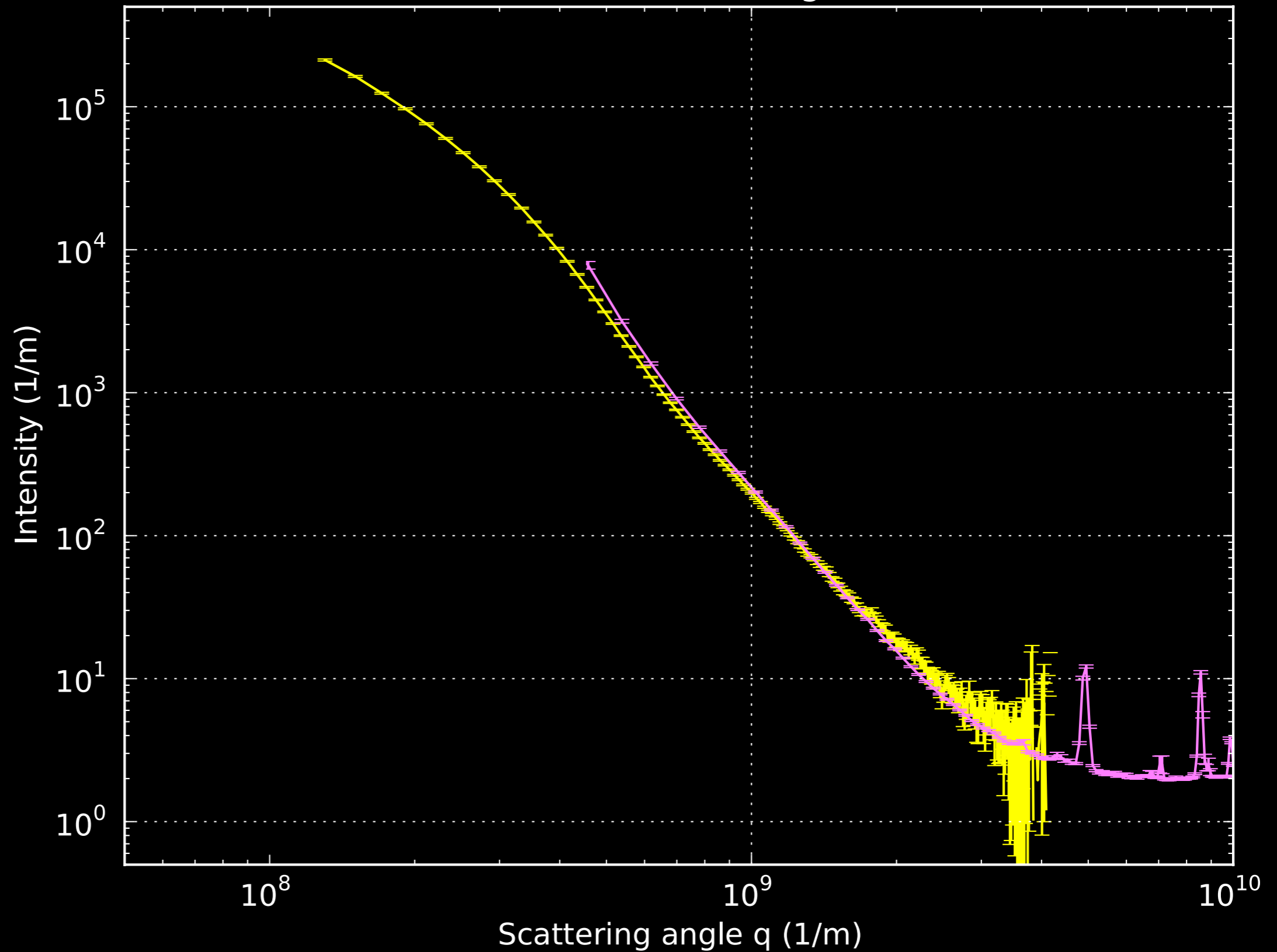
without darkcurrent / natural background correction



Abbrev.
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(ave.)

# Darkcurrent

with darkcurrent / natural background correction



Abbrv.

DS

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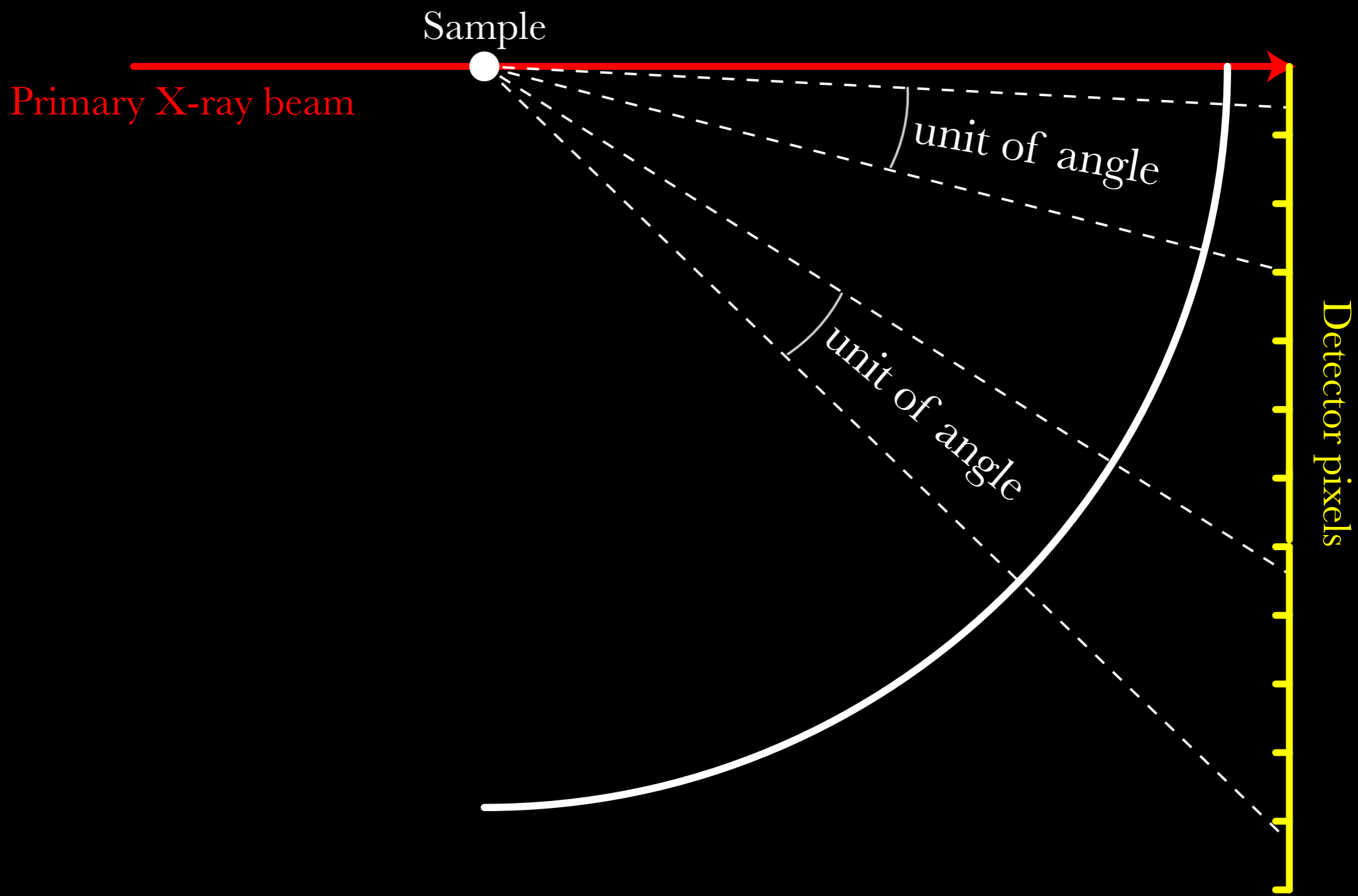
(ave.)

<b>Abbrev.</b>	<b>Corrects</b>
<b>DS</b>	<b>Data formats (Fabio)</b>
<b>DZ</b>	<b>De-Zingering</b>
<b>FF</b>	<b>Flat-field</b>
<b>DT</b>	<b>Deadtime</b>
<b>GA</b>	<b>Non-linear response</b>
<b>TI</b>	<b>Time</b>
<b>DC</b>	<b>Darkcurrent</b>
<b>FL</b>	<b>Flux</b>
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<b>MS</b>	<b>Multiple scattering</b>
<b>SM</b>	<b>Smearing</b>
<b>(ave.)</b>	



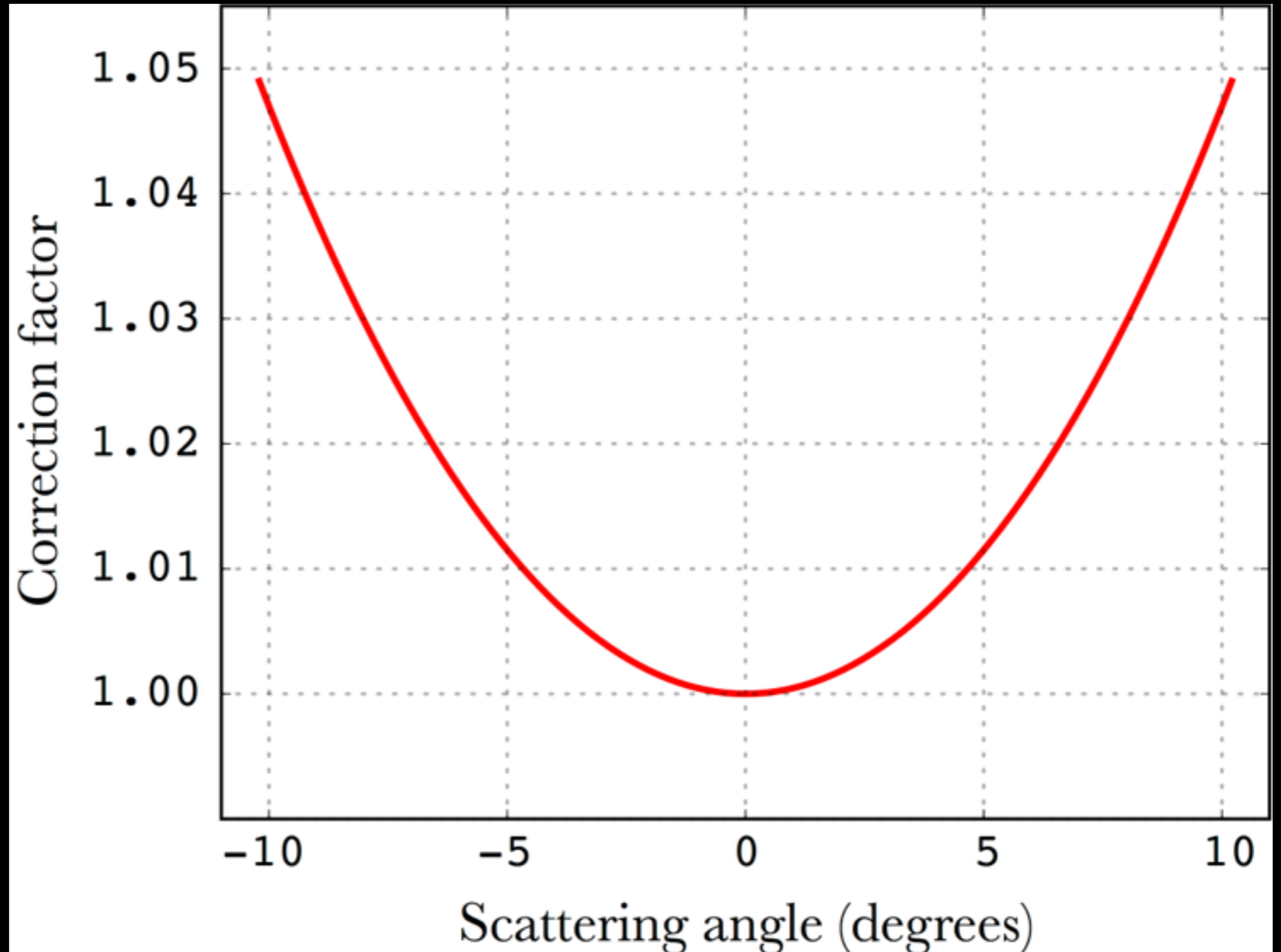
# Spherical distortion / area dilation

Abbrv.
DS
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(ave.)



# Spherical distortion / area dilation

Abbrv.
DS
DZ
FF
DT
GA
TI
DC
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TR
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SP
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BG
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MK
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SM
(ave.)



<b>Abbrv.</b>	<b>Corrects</b>
<b>DS</b>	<b>Data formats (Fabio)</b>
<b>DZ</b>	<b>De-Zingering</b>
<b>FF</b>	<b>Flat-field</b>
<b>DT</b>	<b>Deadtime</b>
<b>GA</b>	<b>Non-linear response</b>
<b>TI</b>	<b>Time</b>
<b>DC</b>	<b>Darkcurrent</b>
<b>FL</b>	<b>Flux</b>
<b>TR</b>	<b>Transmission</b>
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<b>MK</b>	<b>Mask pixels</b>
<b>MS</b>	<b>Multiple scattering</b>
<b>SM</b>	<b>Smearing</b>
<b>(ave.)</b>	



# Polarization

Abbrv.

DS

DZ

FF

DT

GA

TI

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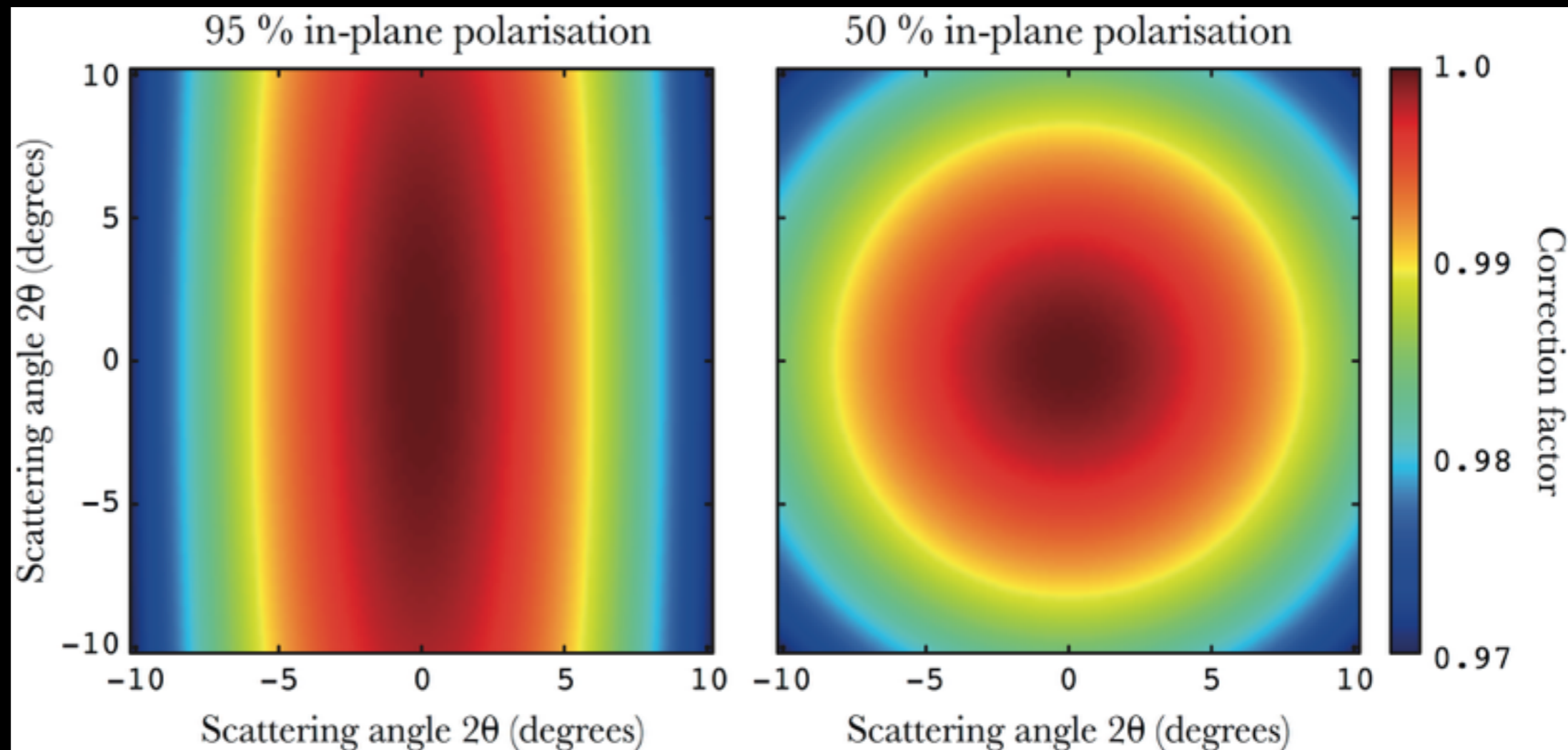
AU

MK

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SM

(ave.)





<b>Abbrv.</b>	<b>Corrects</b>
<b>DS</b>	<b>Data formats (Fabio)</b>
<b>DZ</b>	<b>De-Zingering</b>
<b>FF</b>	<b>Flat-field</b>
<b>DT</b>	<b>Deadtime</b>
<b>GA</b>	<b>Non-linear response</b>
<b>TI</b>	<b>Time</b>
<b>DC</b>	<b>Darkcurrent</b>
<b>FL</b>	<b>Flux</b>
<b>TR</b>	<b>Transmission</b>
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<b>SP</b>	<b>Spherical distortion / area dilation</b>
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<b>SA</b>	<b>Sample self-absorption</b>
<b>BG</b>	<b>Background subtraction</b>
<b>TH</b>	<b>Sample thickness</b>
<b>AU</b>	<b>Absolute intensity scaling</b>
<b>MK</b>	<b>Mask pixels</b>
<b>MS</b>	<b>Multiple scattering</b>
<b>SM</b>	<b>Smearing</b>
<b>(ave.)</b>	



# Sample self-absorption

Abbrv.

DS

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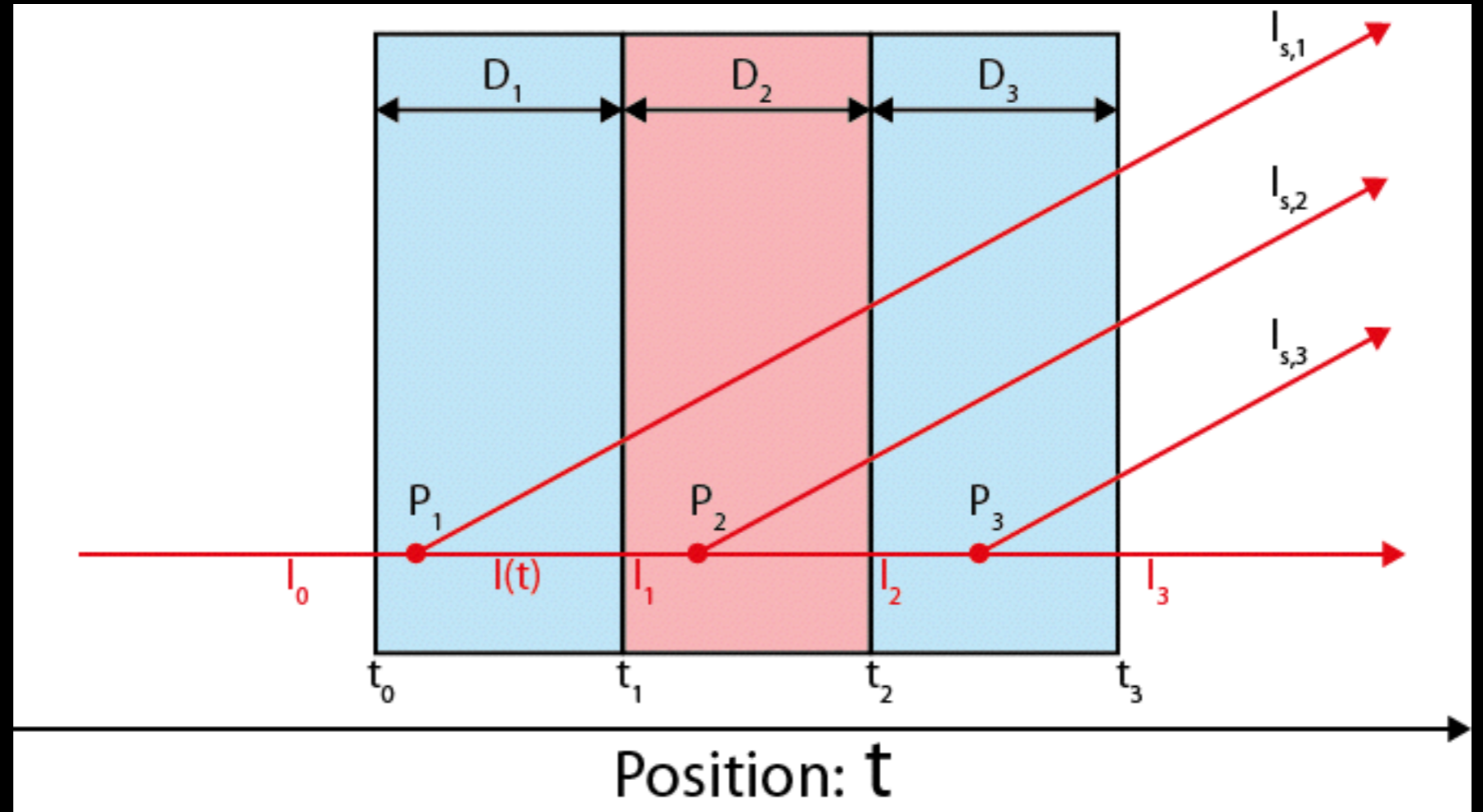
AU

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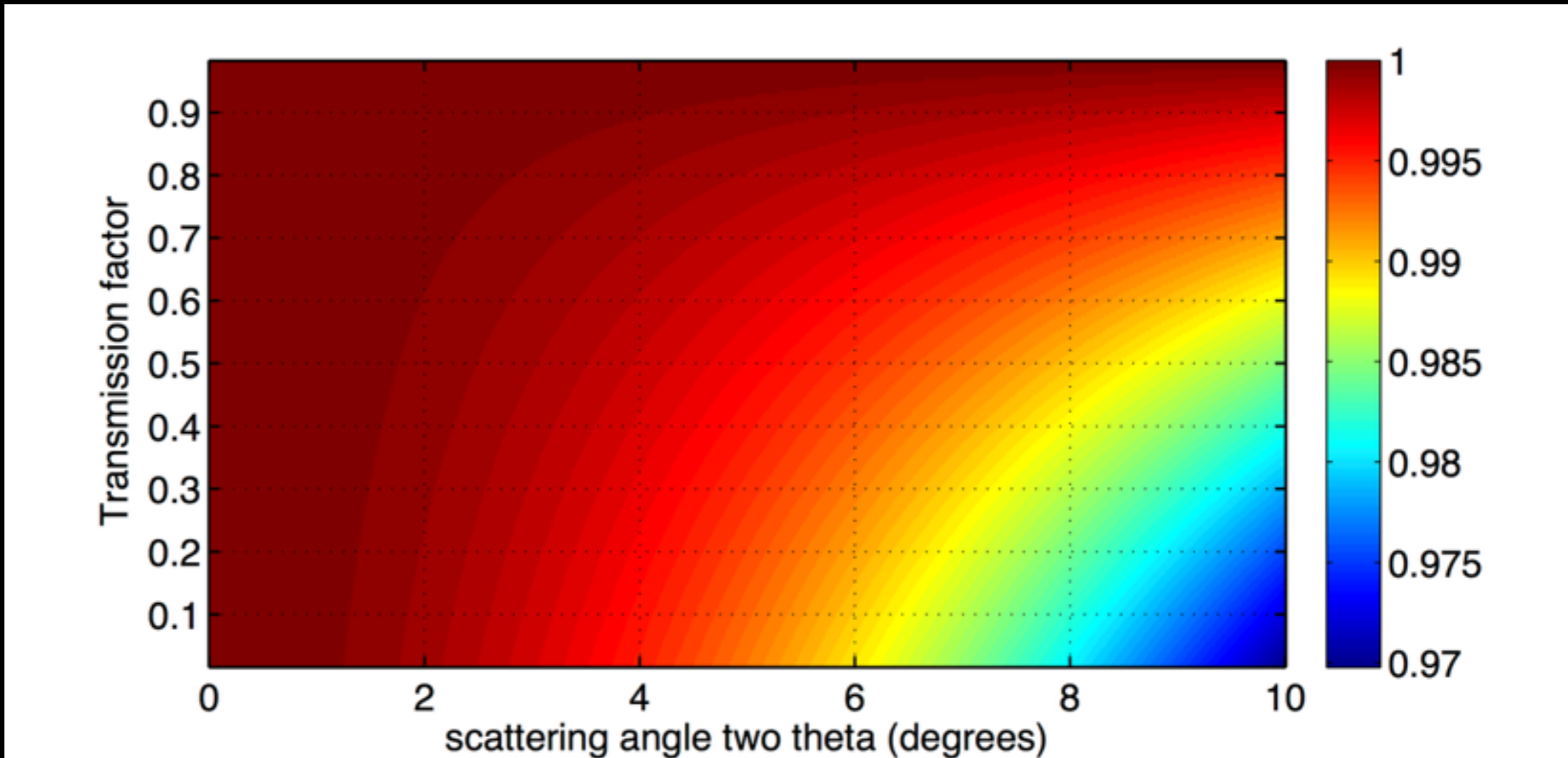
SM

(ave.)



# Sample self-absorption

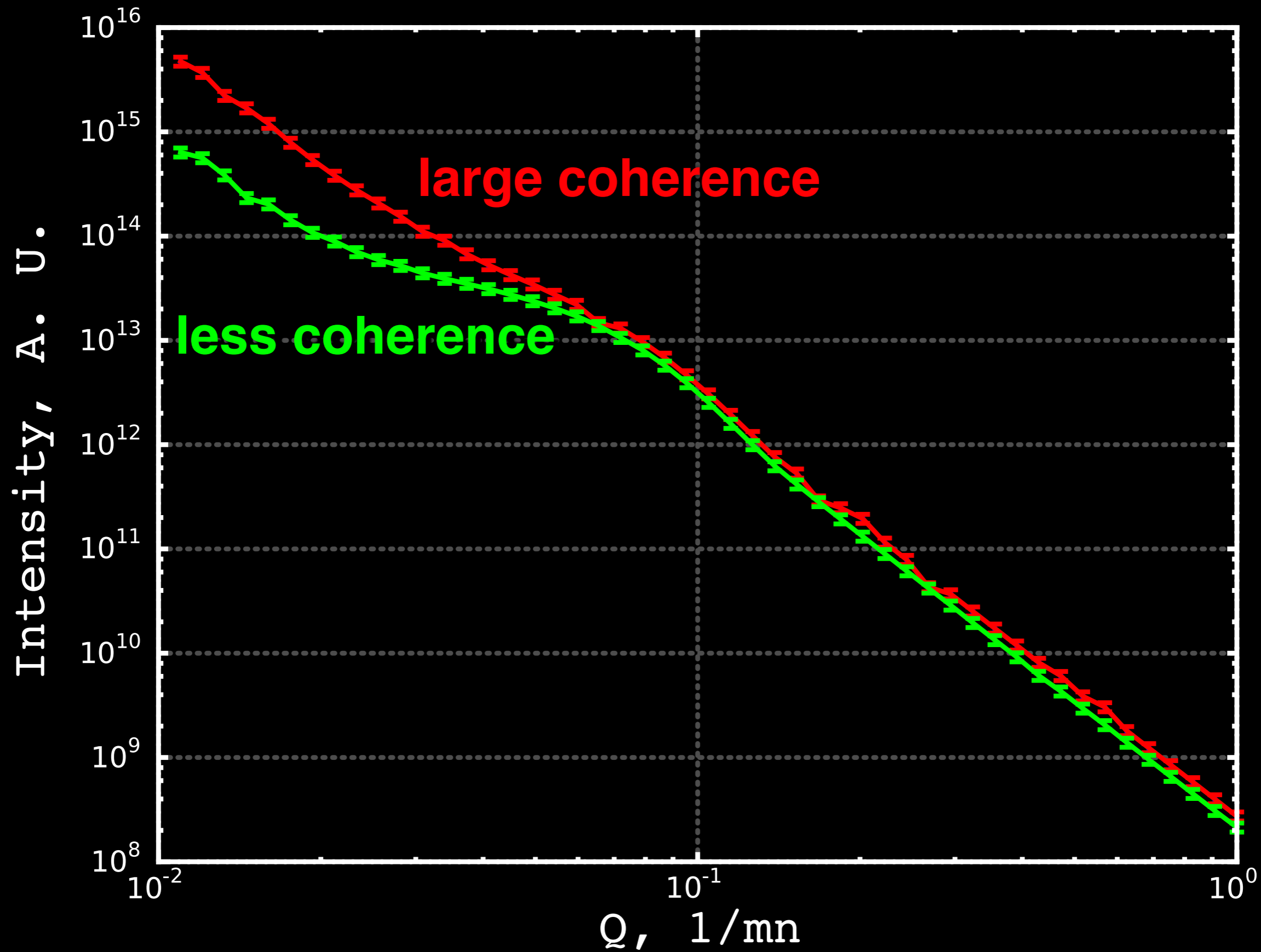
Abbrv.
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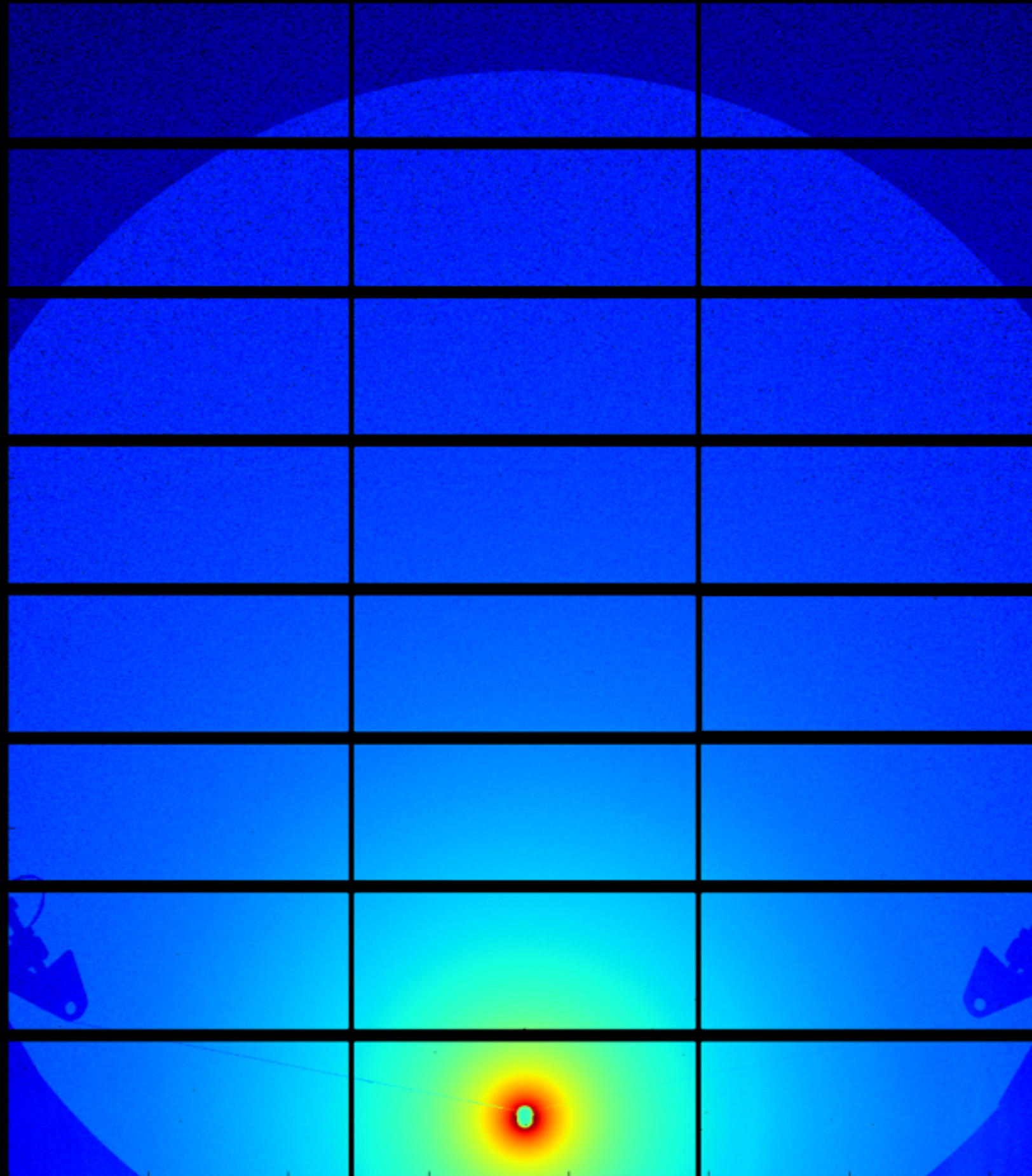
**Final question:**

**Do we need to take coherence into account?**

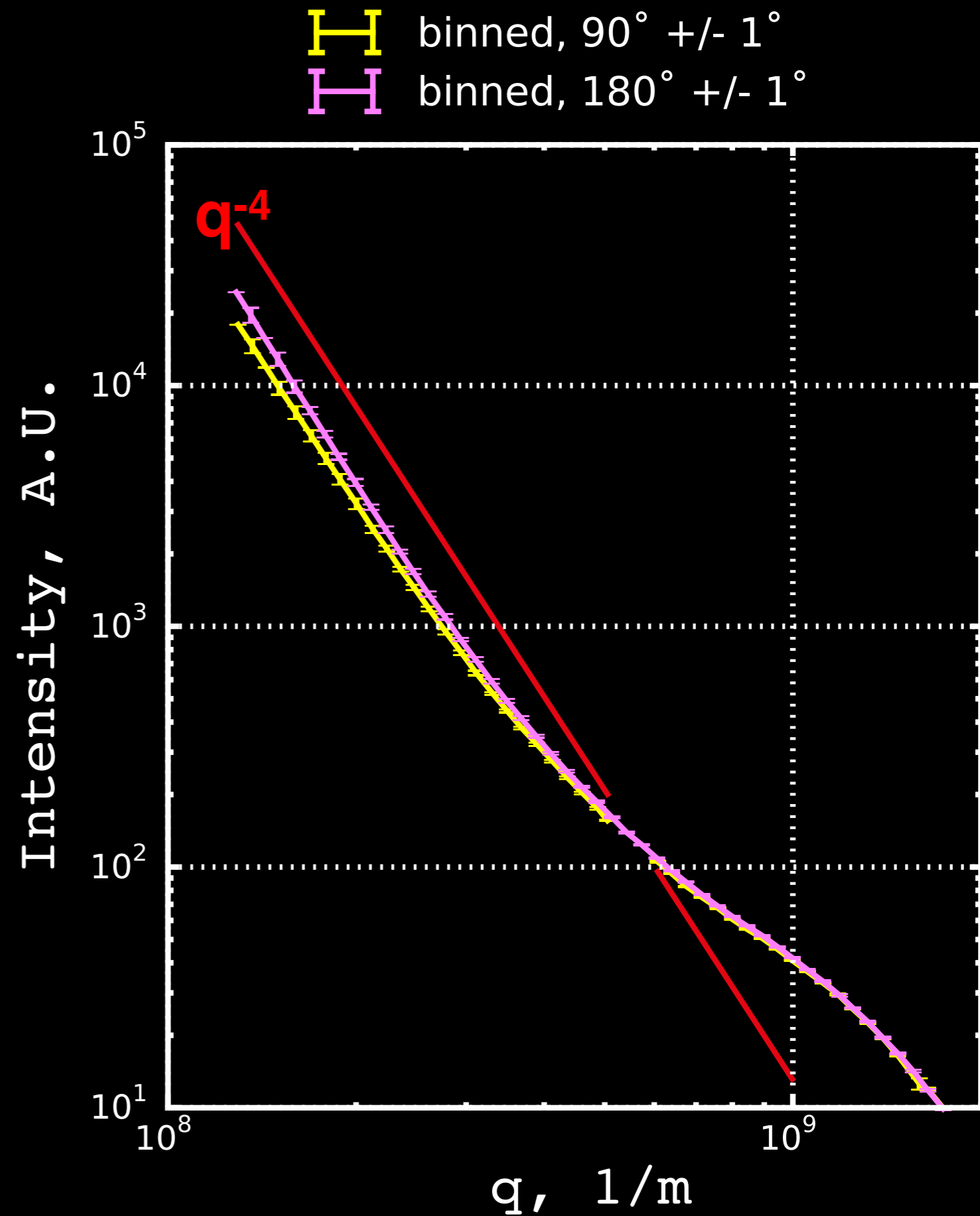
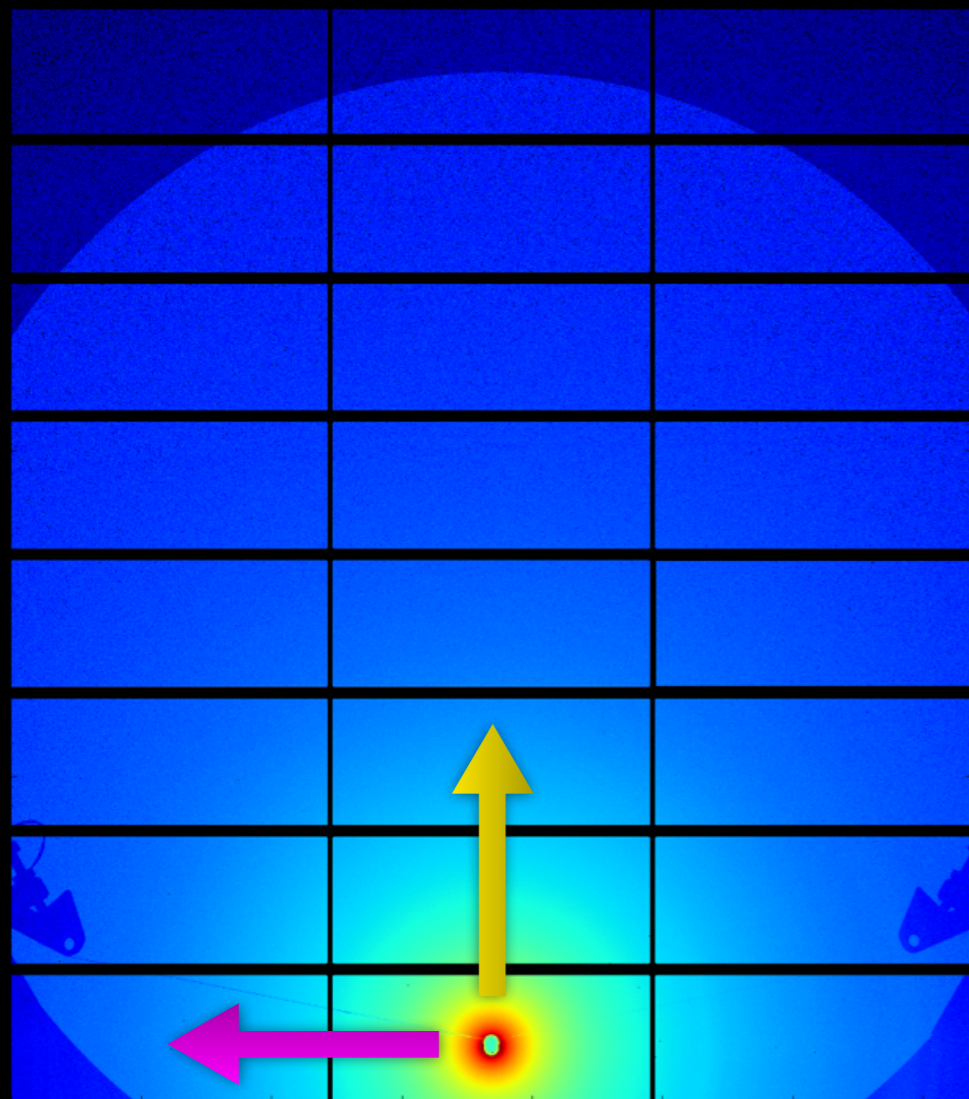
# simulated effect of coherence



# coherence



# coherence



# Thank you for your attention!

B. Abécassis

J. W. Andreasen

L. Benning

I. Bressler

P. Butler

D. Fujita

D. Goldberg

T. Hatano

P. Høghøj

S. Hiraide

M. Hollamby

J. Ilavsky

B. B. Iversen

A. Jackson

P. Jemian

J. Kieffer

H. Kitazawa

E. A. Klop

P. Kozikowski

H. Mamiya

Y. Matsushita

N. Miura

K. Miyano

P. Moriarty

K. Mortensen

Y. Oba

M. Ohnuma

J. S. Pedersen

A. Pratt

A. Rennie

J. Rosalie

Y. Sakka

K. Sakurai

Z. Schnepp

A. Smith

T. Stawski

J. Stirling

G. Stoclet

M. Sugiyama

M. Tanaka

M. Takata

S. Tardif

A. Thünemann

K. Tsuchiya

M. E. Vigild

Y. Zhang

<http://www.lookingatnothing.com/>