# Guide_Bot

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# Guide_Bot

## What problem motivated this work?

Easy to simulate and optimize a guide system ...

... but time consuming.

Not in CPU time, but simply writing the code!

Write a program which automates the slow part:

Writing the code

# Guide_Bot

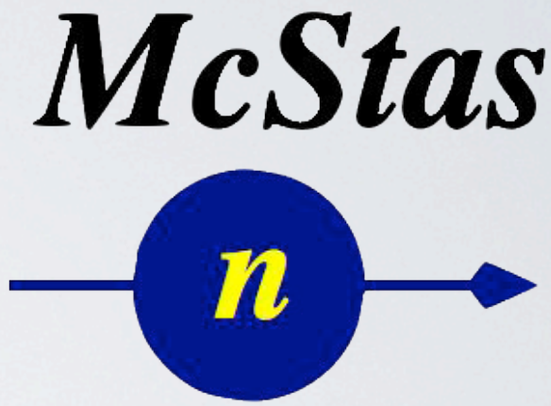
## My usual approach

Write McStas instrument file

Write iFit optimization file

Write iFit visualization file

Write iFit bash scripts for cluster





Many things usually hardcoded or inconsistent

# Guide_Bot

## Guide_Bot workflow

Open Guide_Bot in MATLAB

Type in the demands and requirements

Upload the resulting directory to the cluster

Launch the script named launch all

Download the result and launch analyze all

McStas

MATLAB

iFit

Takes around 10 min of coding time

Always done consistently

# Guide_Bot

## Demands in input

Information concerning the wanted beam

- Sample size (width and height)
- Divergence requirement (horizontal and vertical)
- Wavelength interval for optimization
- Distance from moderator to sample
- Distance from guide end to sample

# Guide_Bot

## Requirements in input

Information concerning the facility restrictions

- Moderator size (width and height)
- Earliest possible guide start
- Latest possible guide start
- Source spectrum (only ESS cold/thermal)

# Guide_Bot

## Geometry in input

Basic geometry of the guides to be optimized

"I want a feeder system consisting of a parabola and a gap for the chopper followed by an elliptic guide"

P G E

# Guide_Bot

## Geometry in input

Basic geometry of the guides to be optimized

"I want a feeder system consisting of a **p**arabola and a **g**ap for the chopper followed by an **e**lliptic guide"

P G E

# Guide_Bot

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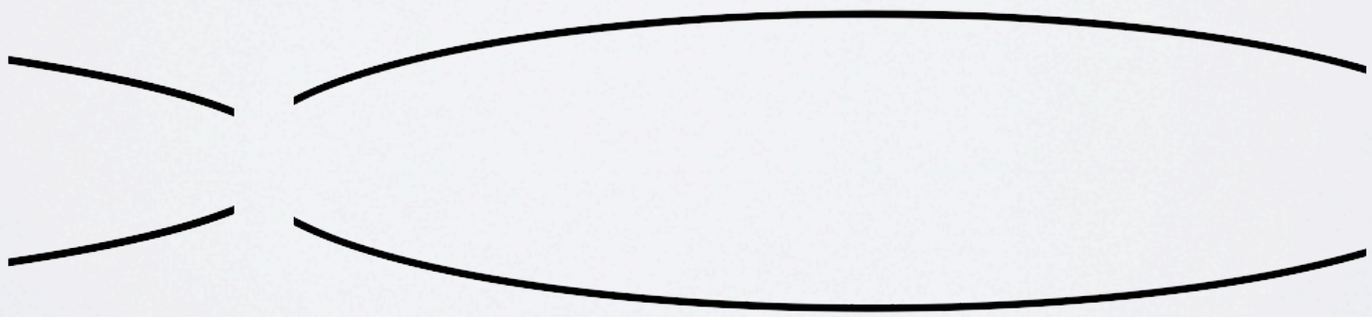
"I want a feeder system consisting of a **p**arabola and a **g**ap for the chopper followed by an **e**lliptic guide"

P G E



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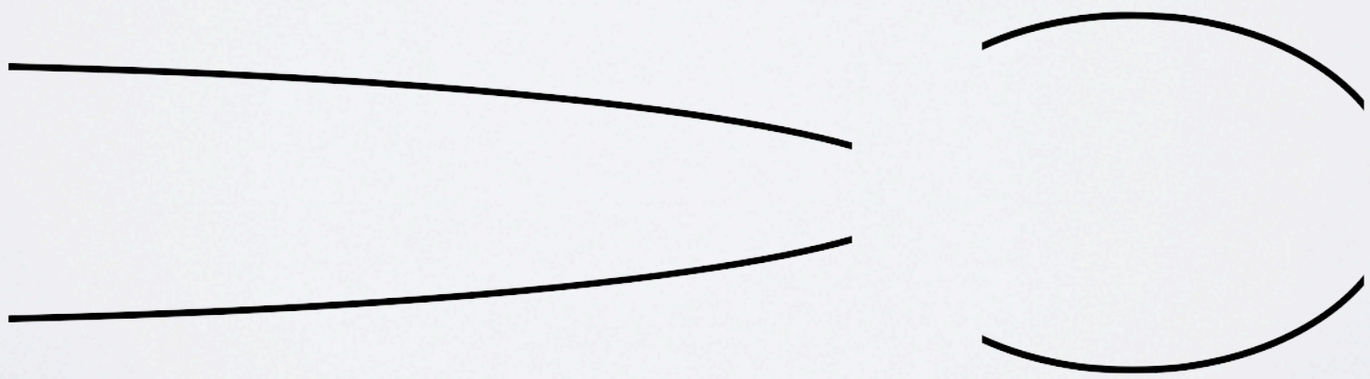


# Guide_Bot

## Geometry in input

Basic geometry of the guides to be optimized

"I want a feeder system consisting of a **p**arabola and a **g**ap for the chopper followed by an **e**lliptic guide"

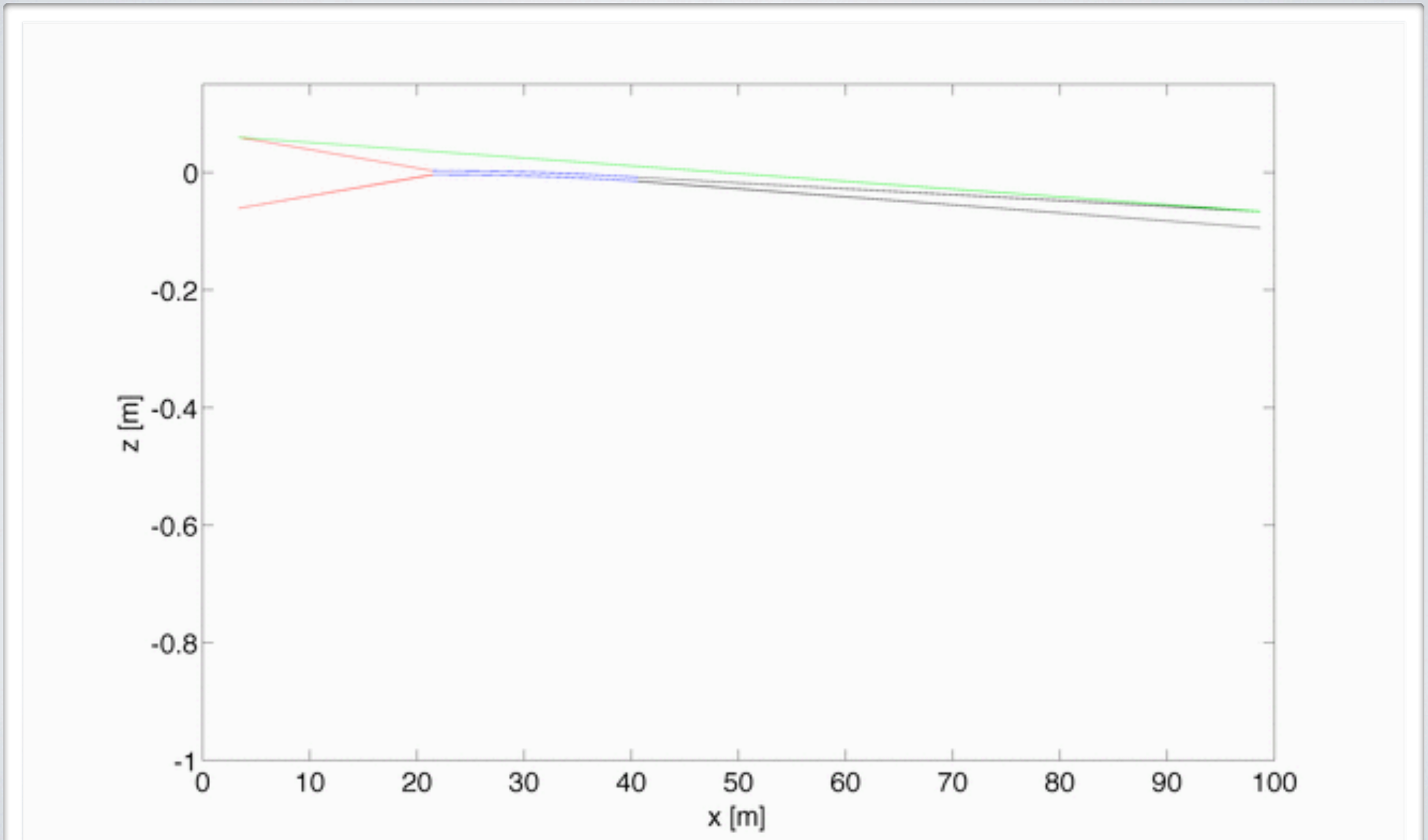
# Guide_Bot

## Geometry in input

| Name | Code | Options |
|---|---|---|
| Straight guide | S | reflectivity |
| Elliptic guide | E | reflectivity |
| Parabolic guide | P | reflectivity |
| Curved guide | C | curvature, direction |
| Kink | K | rotation, direction |
| Gap | G | |
| Selene | Selene | Slit type, reflectivity |
| Bender | B | curvature, blades |
| Elliptic guide with beamstop | Es | reflectivity |

# Guide_Bot

## S K S optimization



# Guide_Bot

## Restricting the parameter space

P G E

P G(start=6.5) E

P G(start=6.5,maxlength=0.5) E

P G(start=6.5,length=0.15) E

P G(start=6.5,length=0.15) E(m=5)

# Guide_Bot

## Restricting the parameter space

| | |
|---|---|
| start | Start of the element from the moderator [m] |
| length | Length of the element [m] |
| StartWidth | Width at start of element [m] |
| StartHeight | Height at start of element [m] |
| EndWidth | Width at end of element [m] |
| EndHeight | Height at end of element [m] |

max or min before sets optimizer limits instead

enable or disable “conventional wisdom”

# Guide_Bot

## CAMEA

P G E S K S E

```
P
G(start=6.5,length=0.1)
E(maxStartWidth=0.030)
S(minlength=1)
K(minstart=66,maxstart=96,maxlength=2.5)
S(minlength=1,maxlength=12)
E
```

### Demands

| | |
|---|---|
| Sample size H | 15mm |
| Sample size V | 15mm |
| Divergence H | ±0.75° |
| Divergence V | ±1.00° |
| Wavelength | 1.65 - 6.40Å |
| Length | 170m |
| Sample - guide | 60cm |

# Guide_Bot

## CAMEA

PGESKSE

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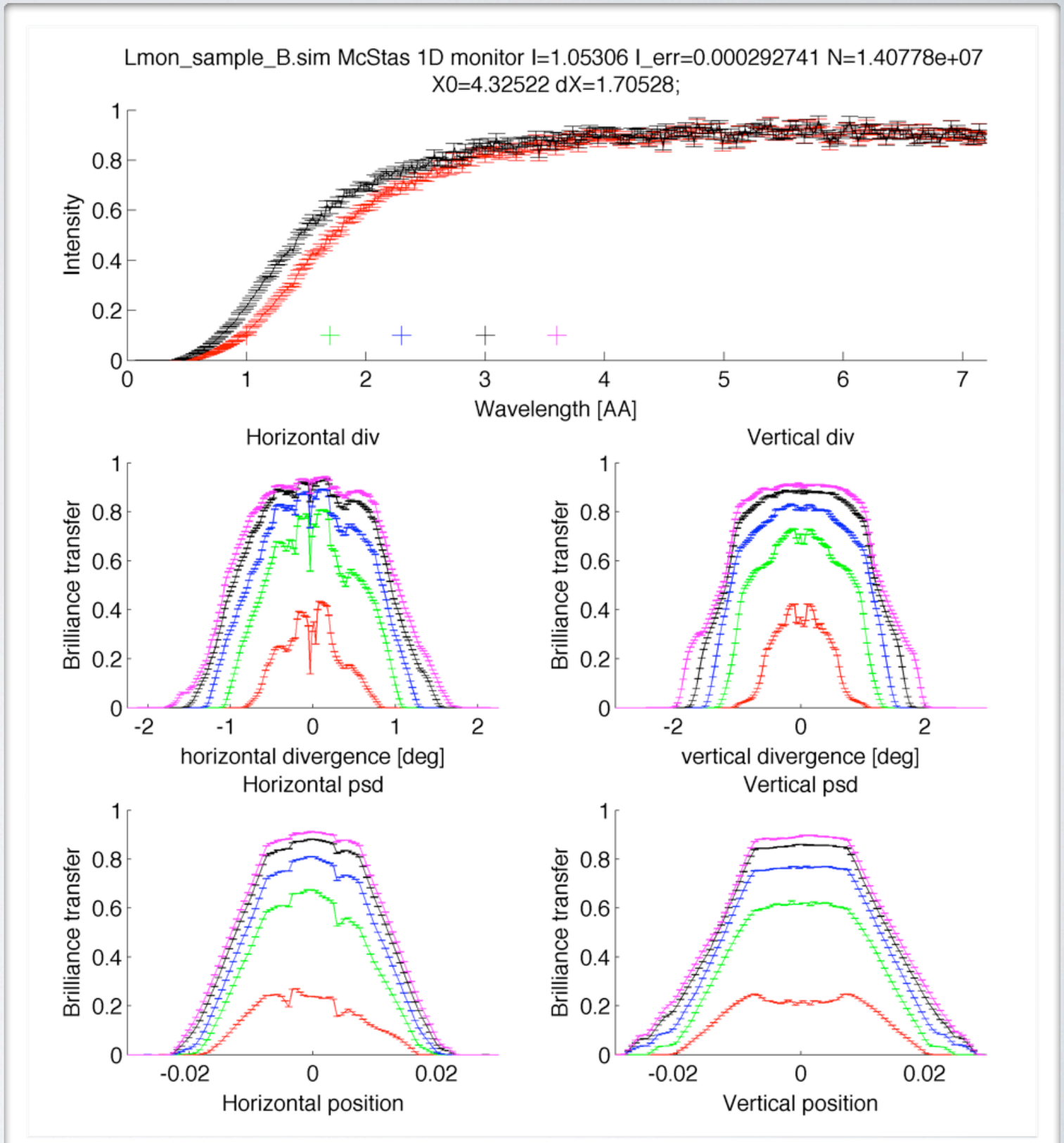

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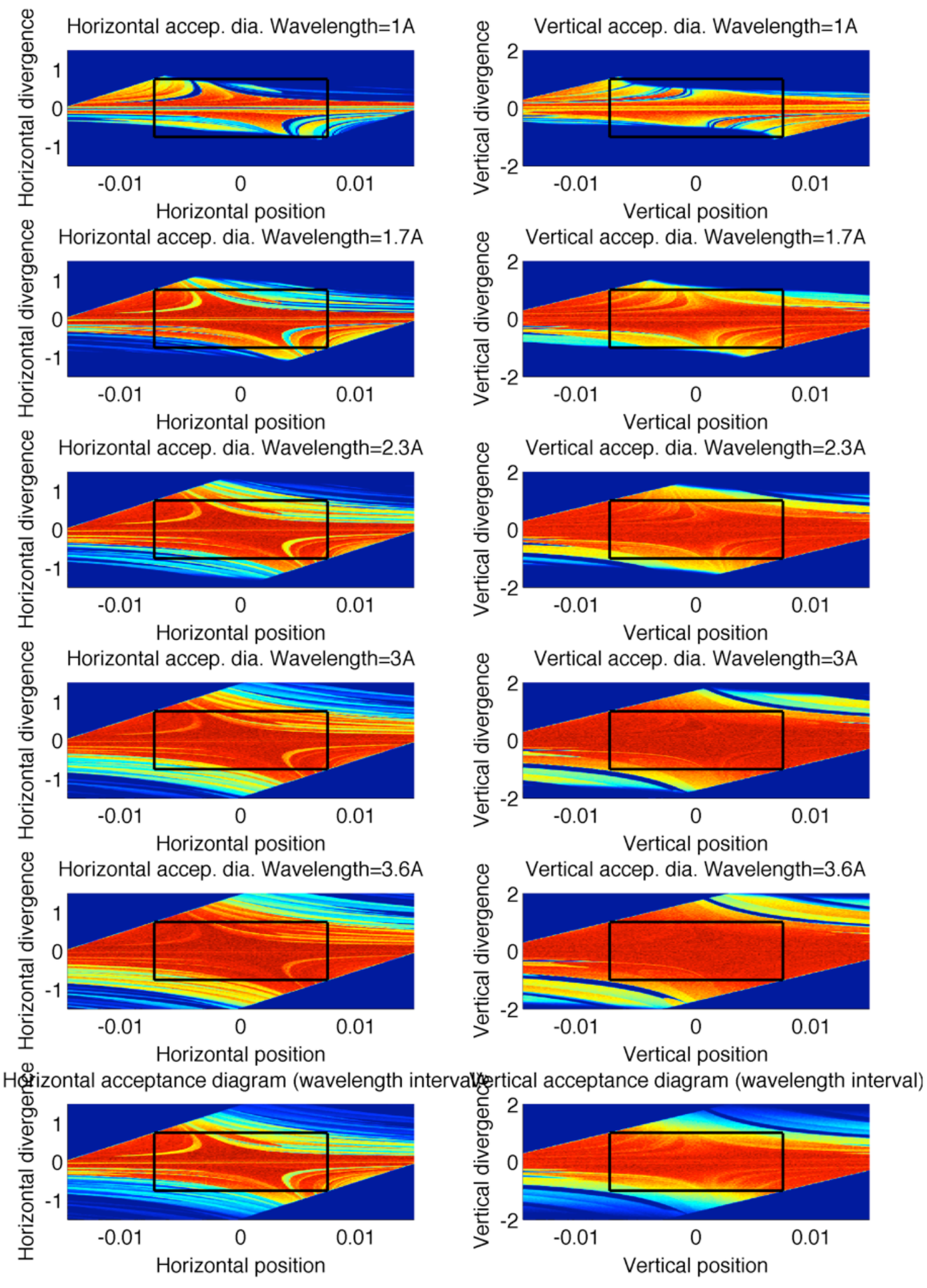

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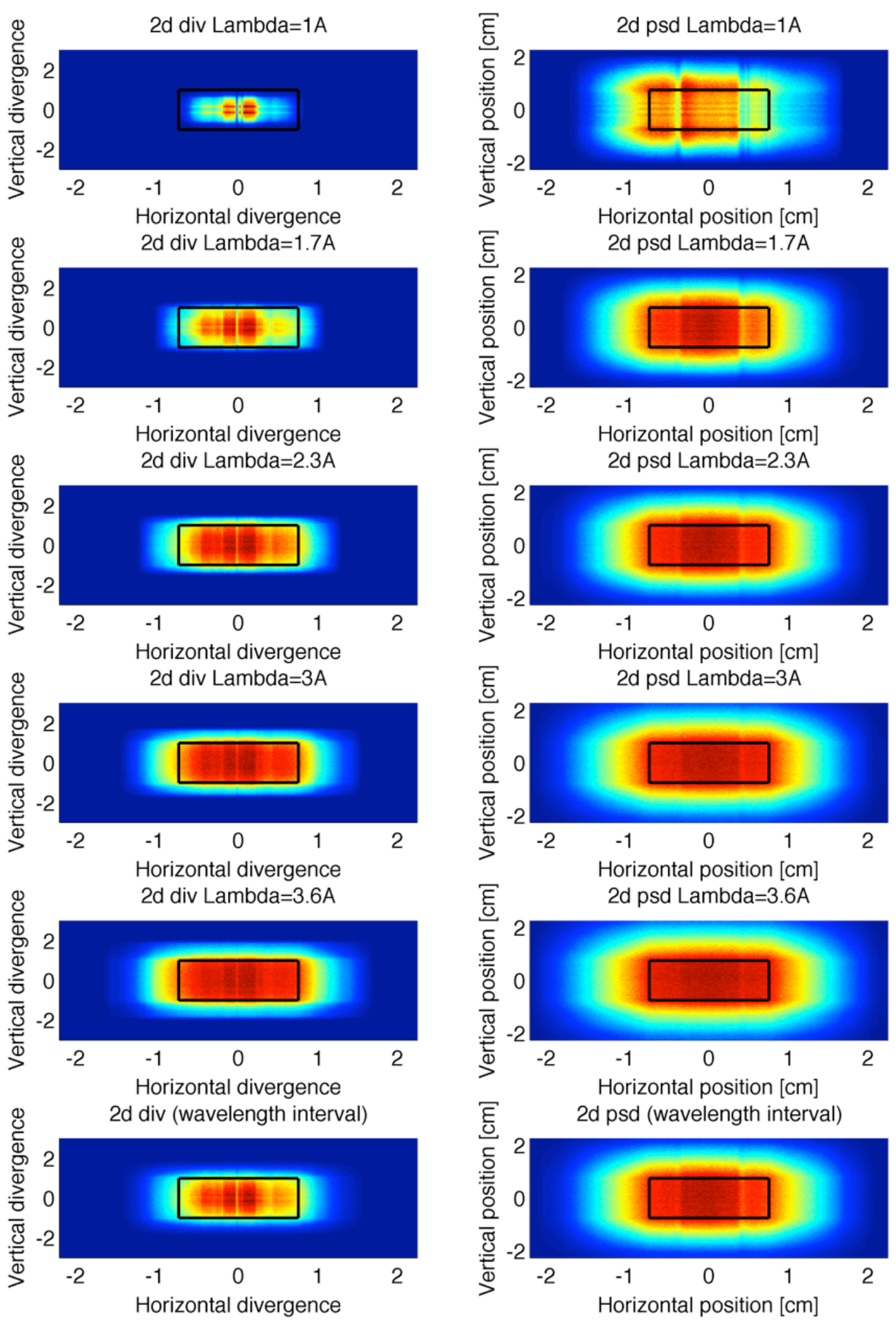


# Example

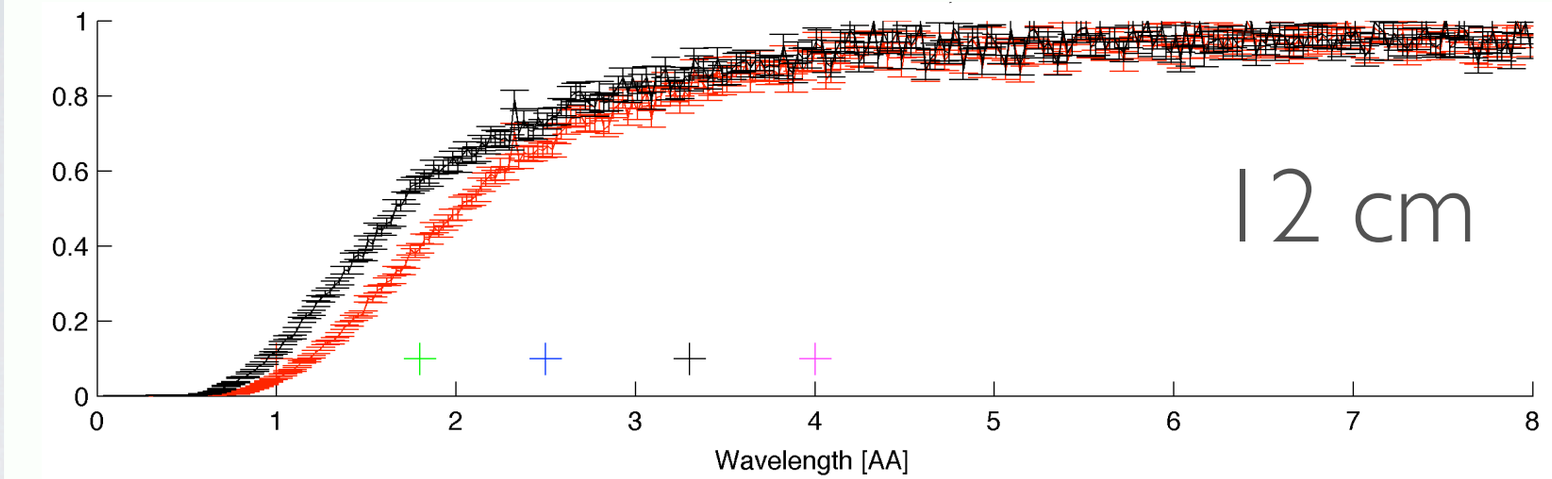
E G E

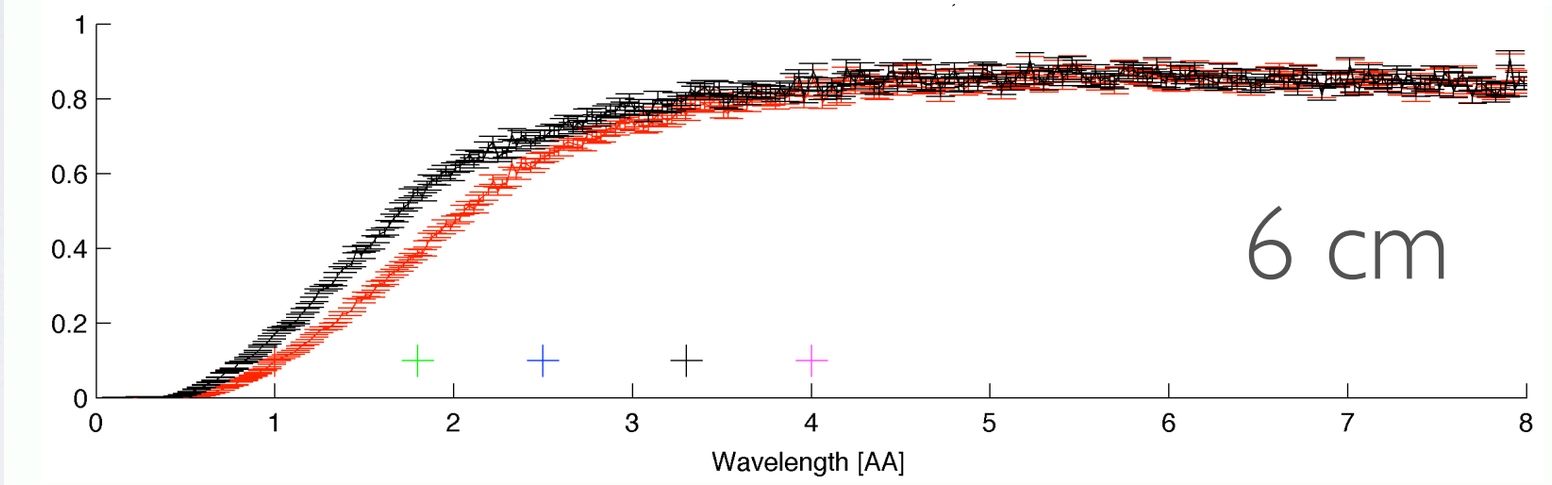
```
E G(maxlength = 2.5) E
```

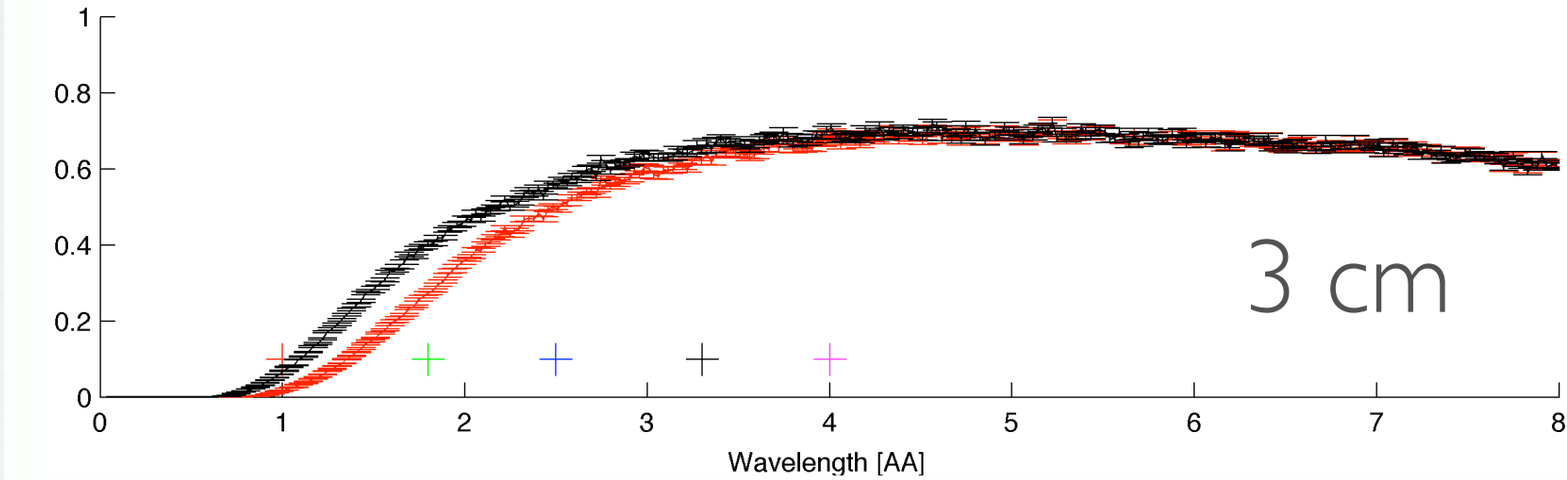
## Demands

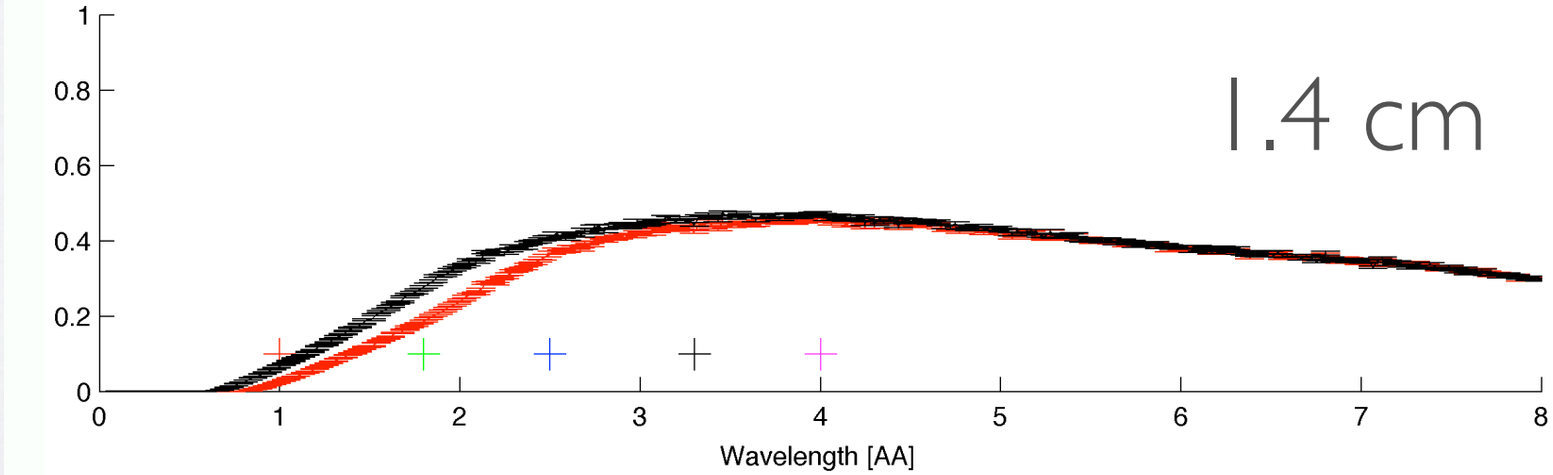
| | |
|---|---|
| Sample size H | 10mm |
| Sample size V | 10mm |
| Divergence H | ±1.25° |
| Divergence V | ±1.25° |
| Wavelength | 1 - 4Å |
| Length | 80m |
| Sample - guide | 50cm |

m = 4



# Guide_Bot

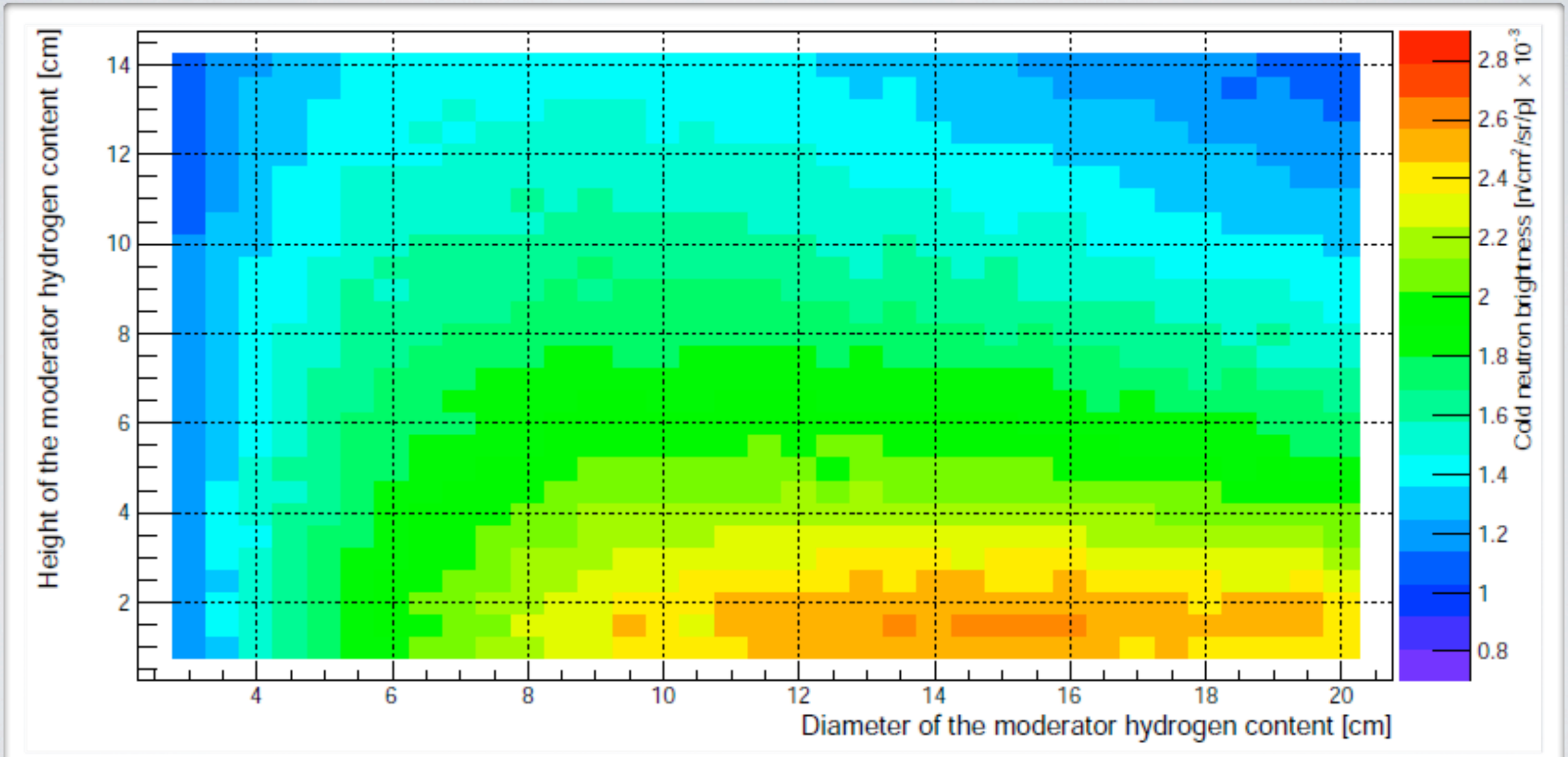
## Running a larger project

- Enter a project name
- Enter several geometry input strings
- May even scan demands or requirements

- Get a directory with nicely ordered results
- Get a script for starting everything at once
- Get a script for analyzing and plotting everything

# Guide_Bot

## Moderator data



# Guide_Bot

## Moderator scan

Instrument: CAMEA

Input string: P G E K E

Parabolic - Gap - Elliptic - Kink - Elliptic

```
P(maxStartWidth=0.07,maxStartHeight=0.07)
G(start=6.5,length=0.1)
E(maxStartWidth=0.030)
K(start=88,minlength=0.1,maxlength=2.5)
E
```

| | |
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# Guide_Bot

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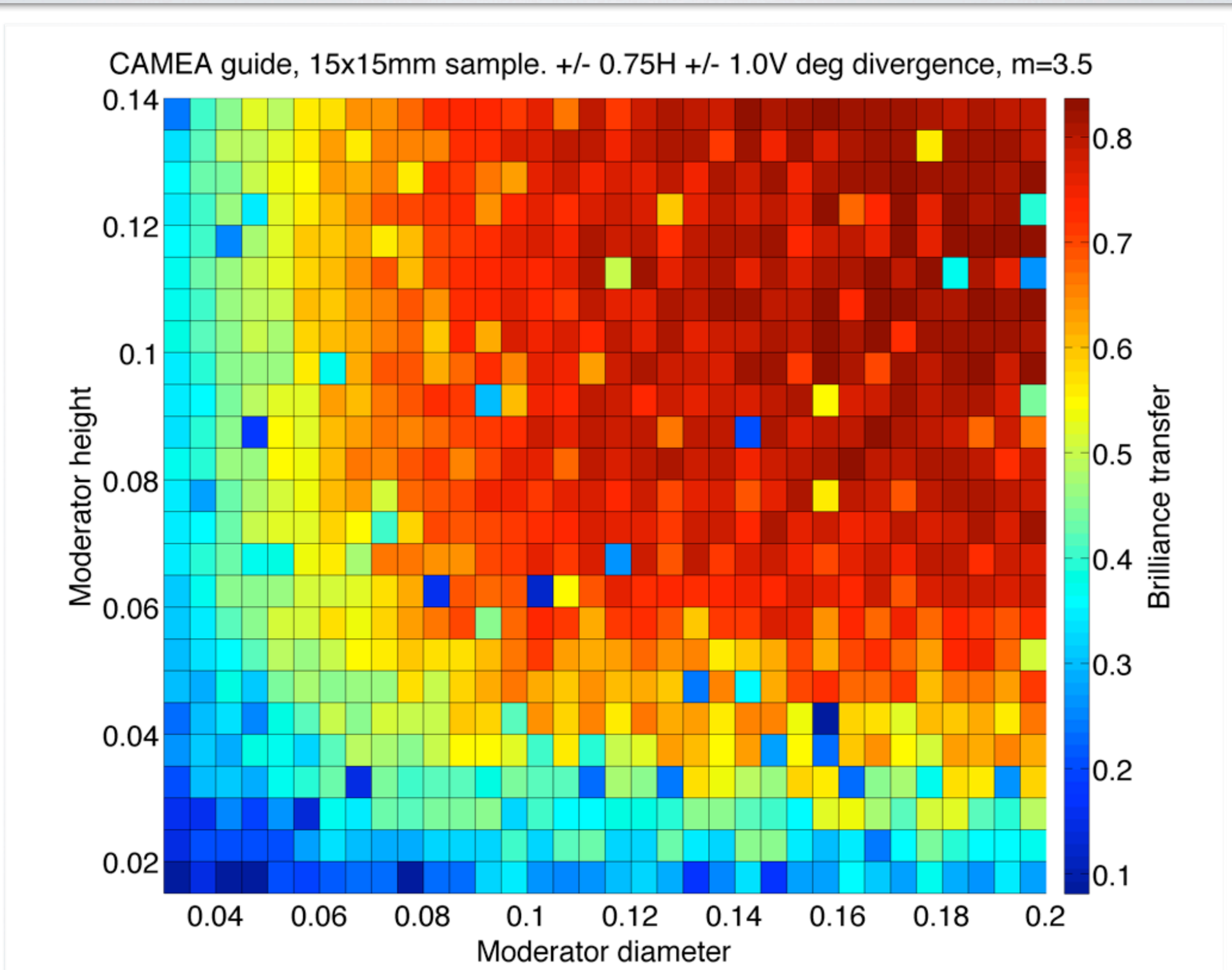

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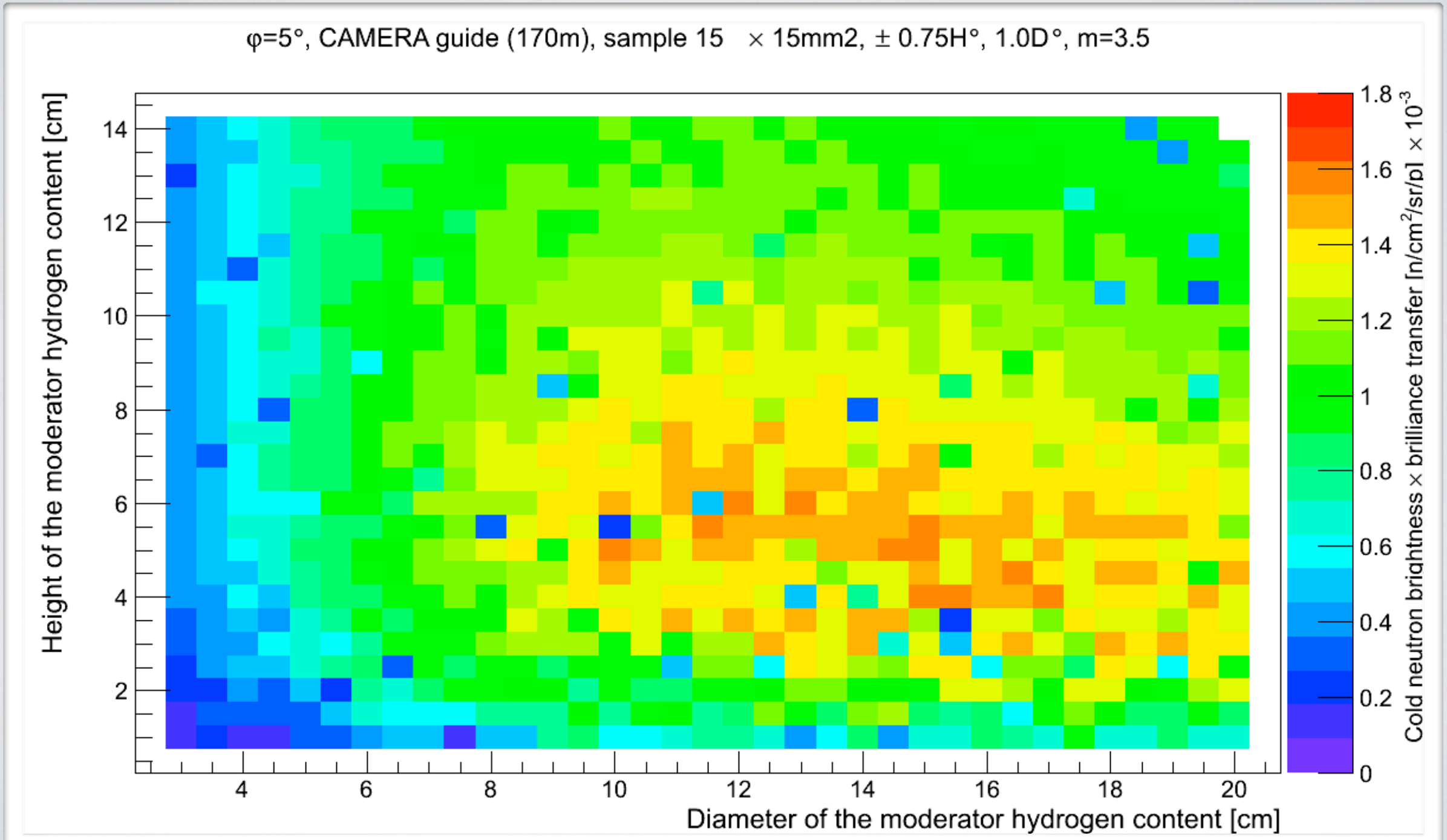

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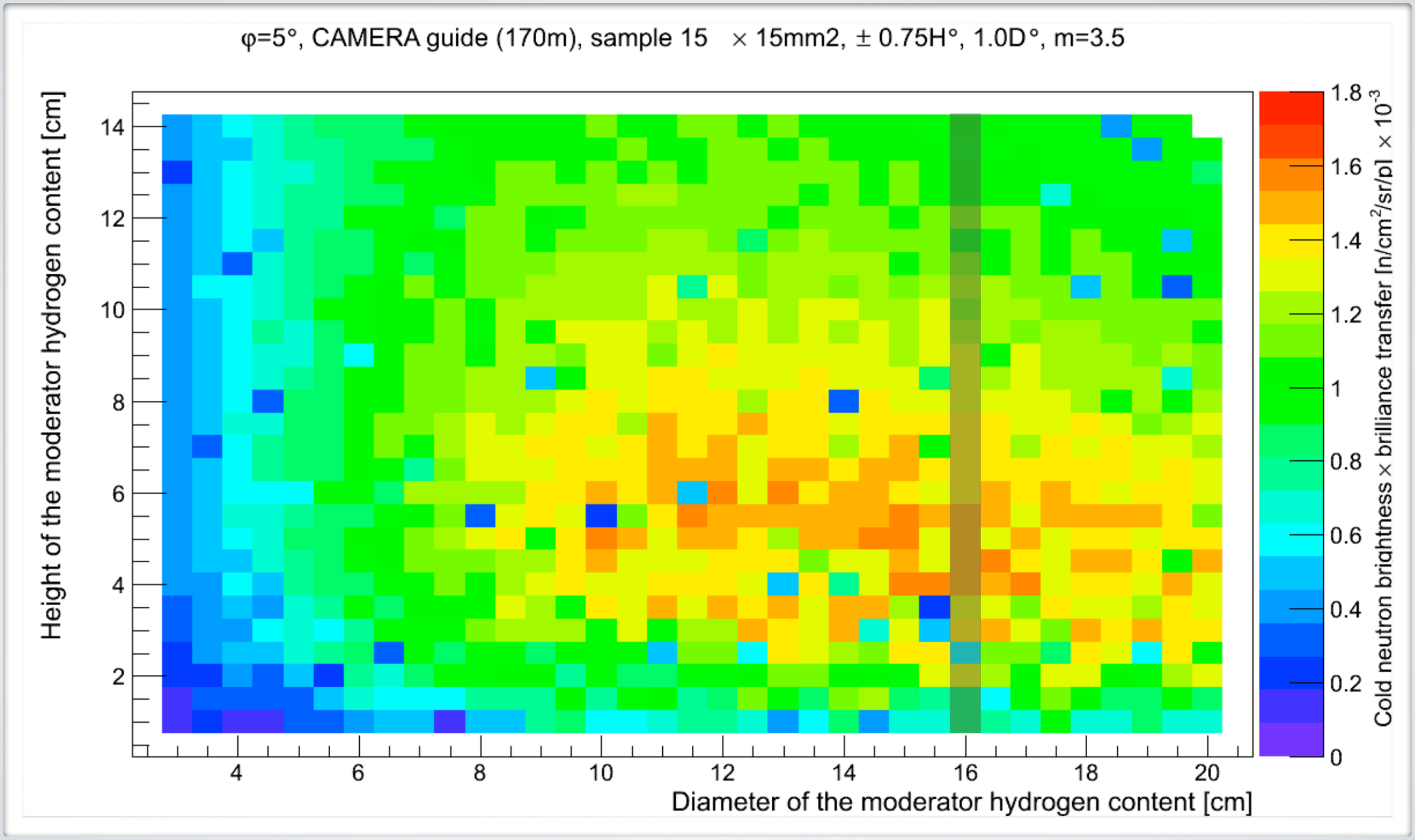

# CAMEA

## Scan of moderator height

### Sample

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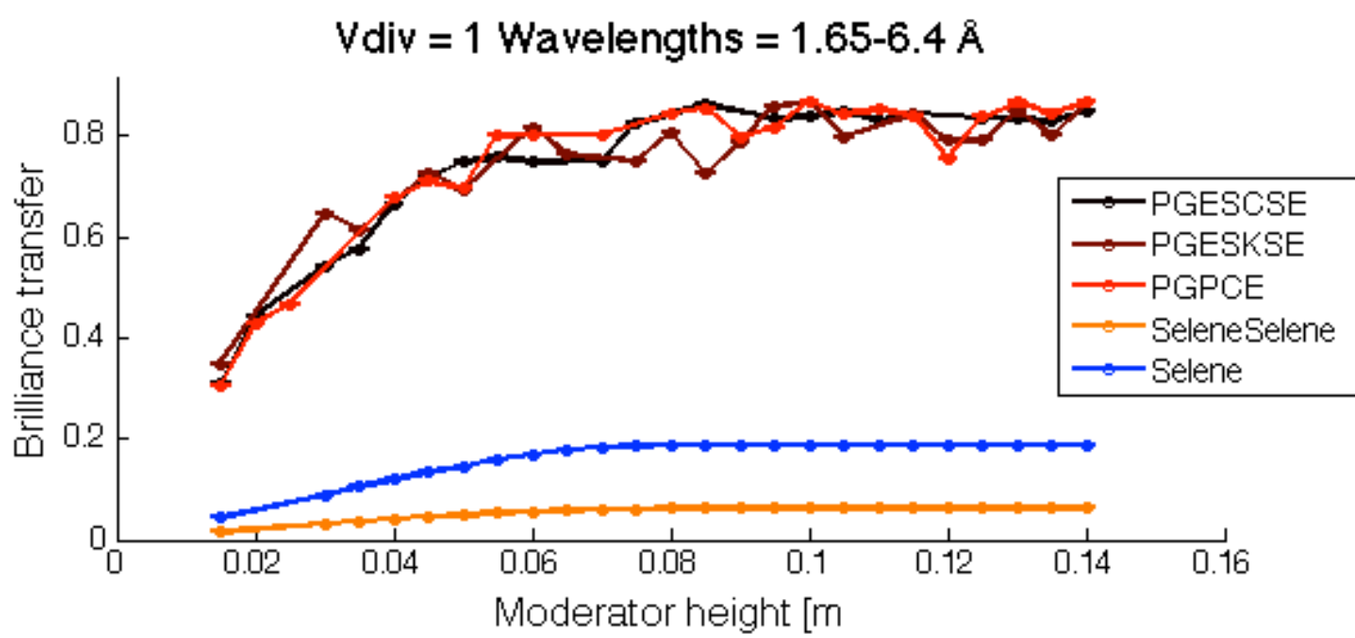
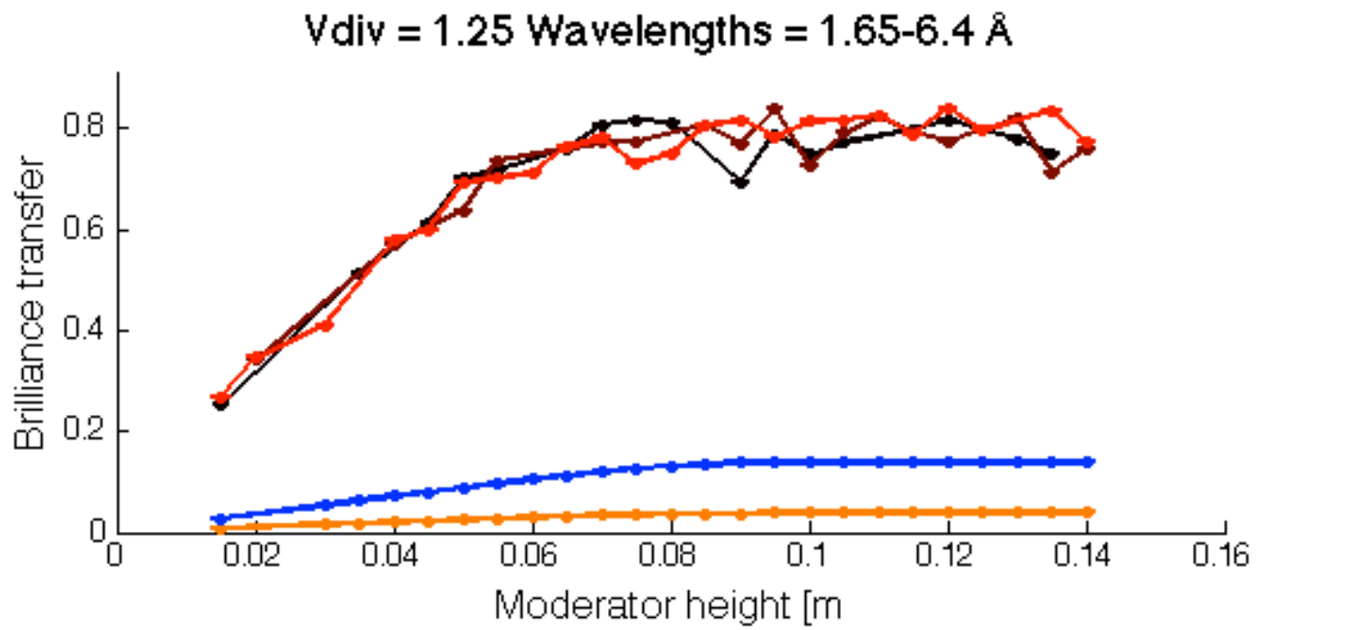
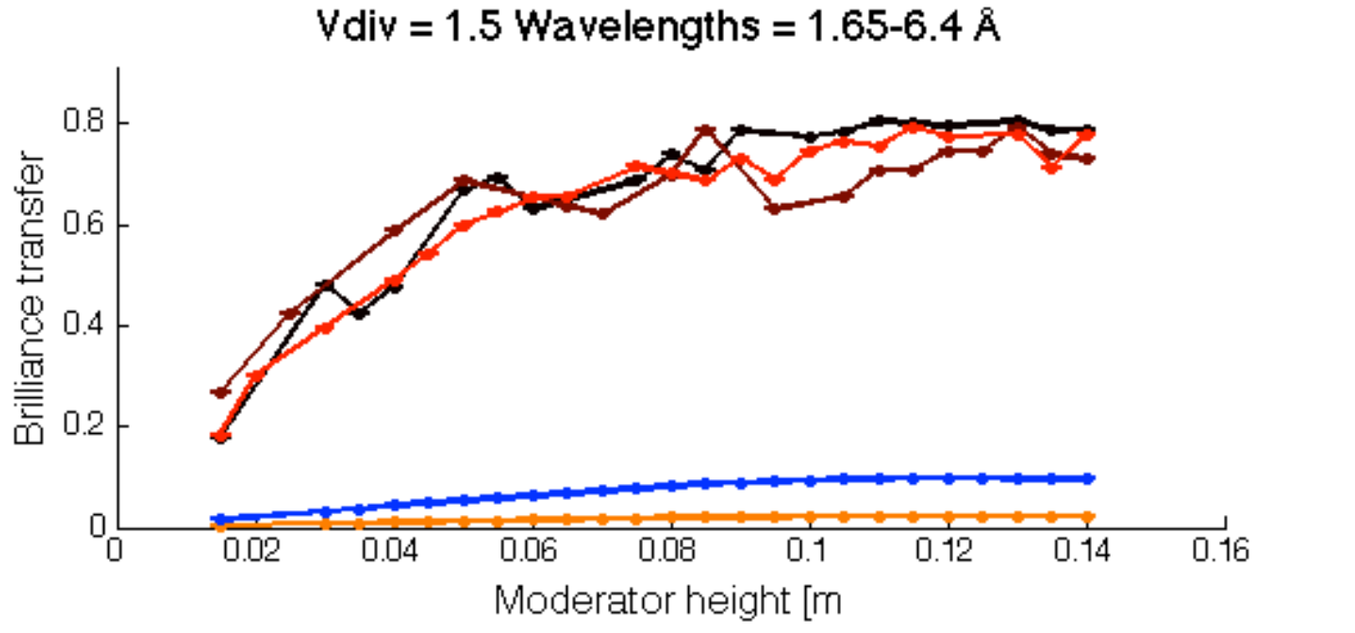
| Length | 170m |
| Sample - guide | 60cm |
| Conventional | m = 3.5 |
| Selene | m = 6 |



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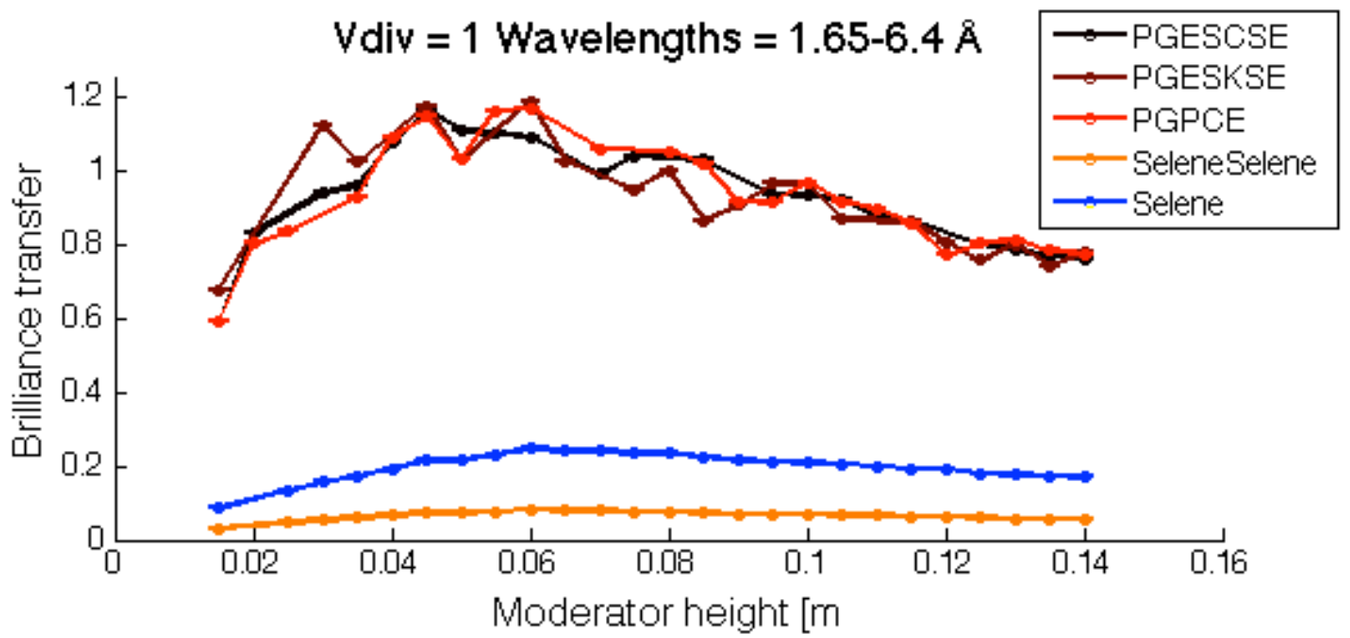


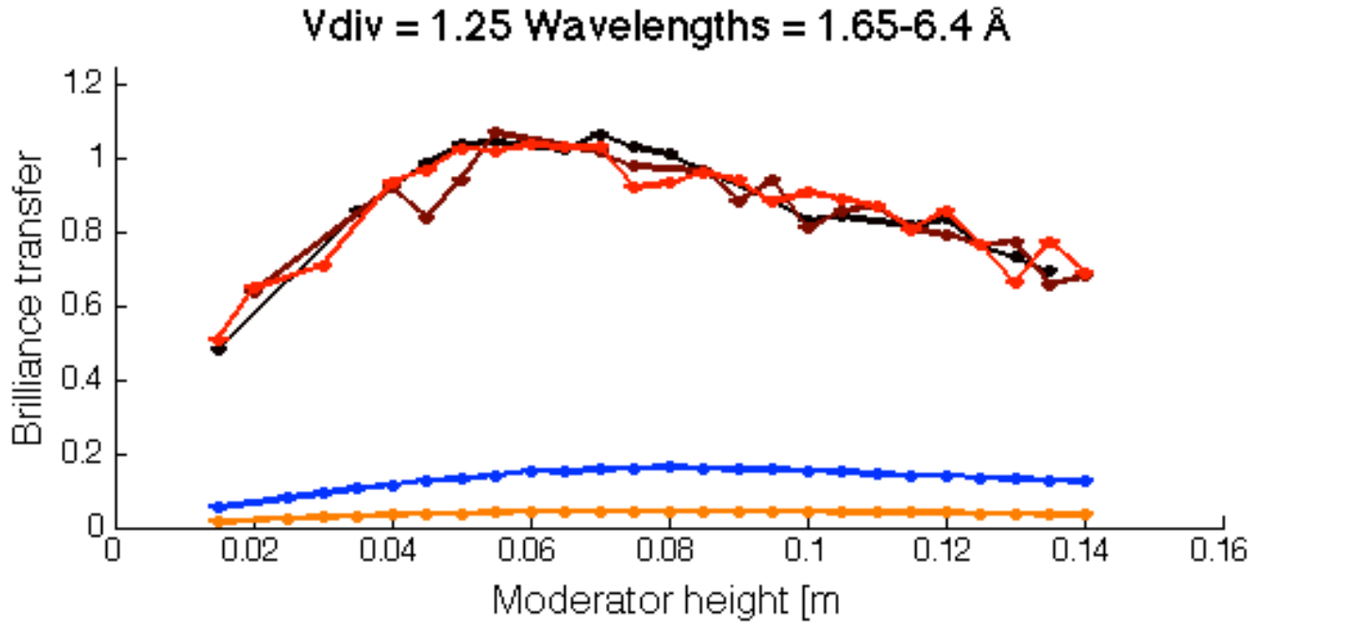


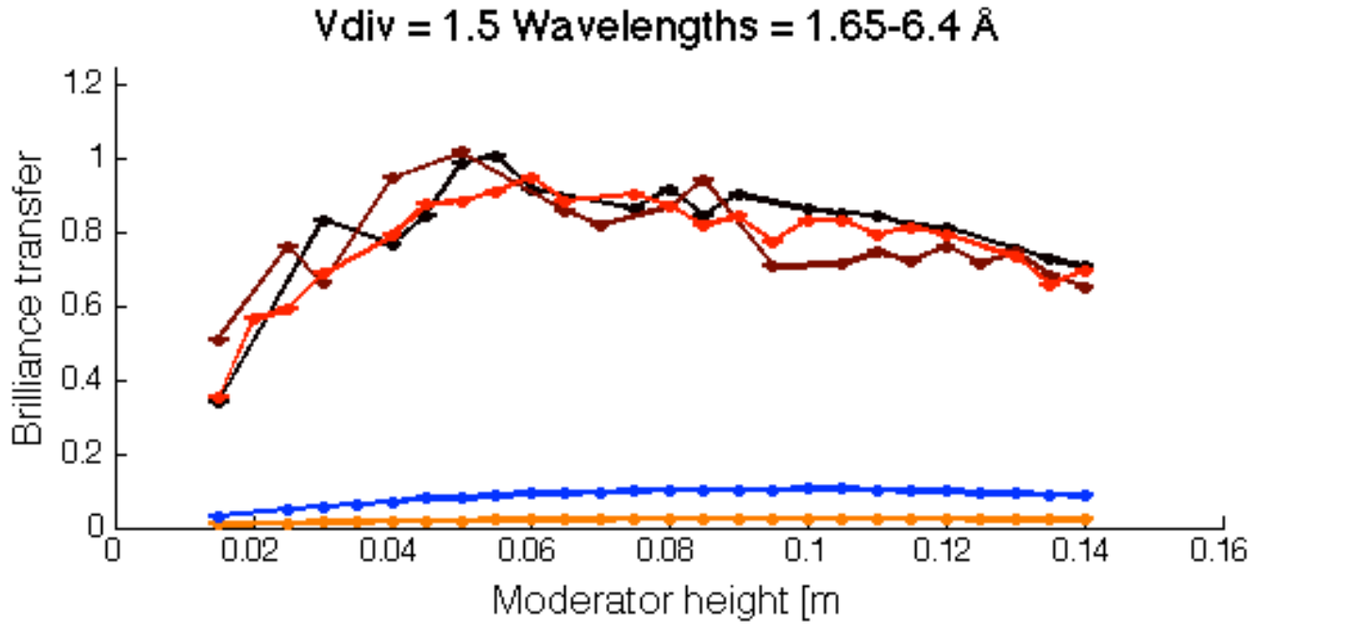

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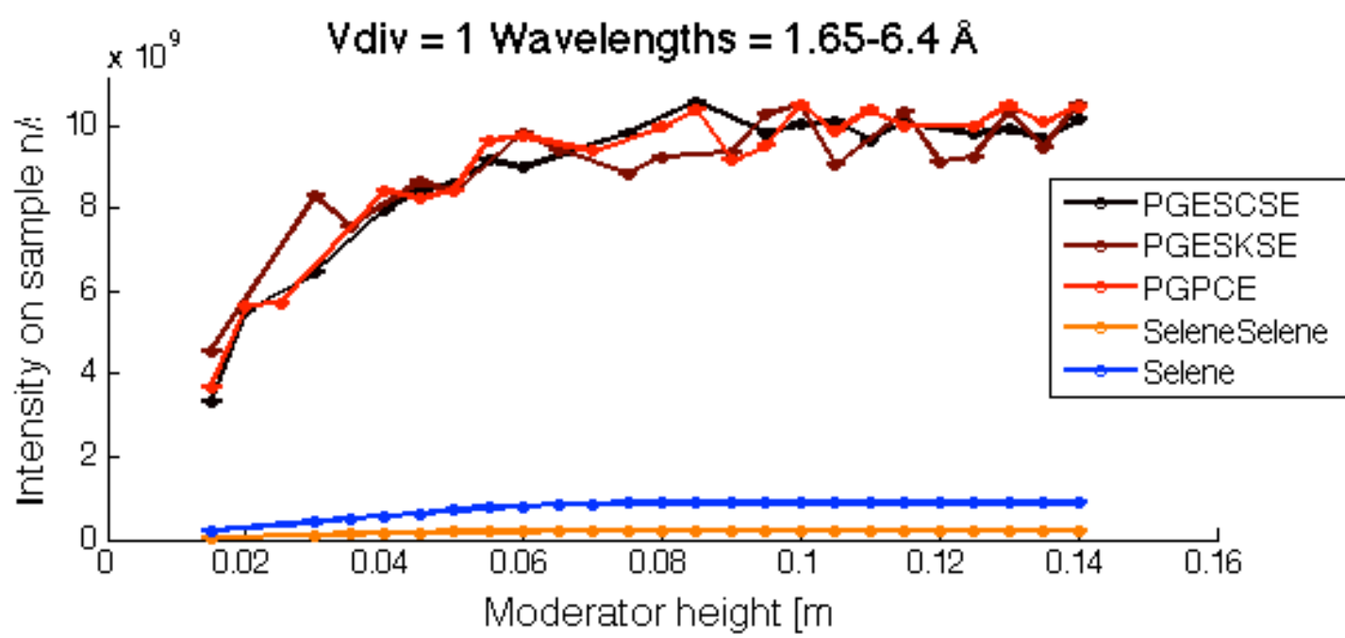


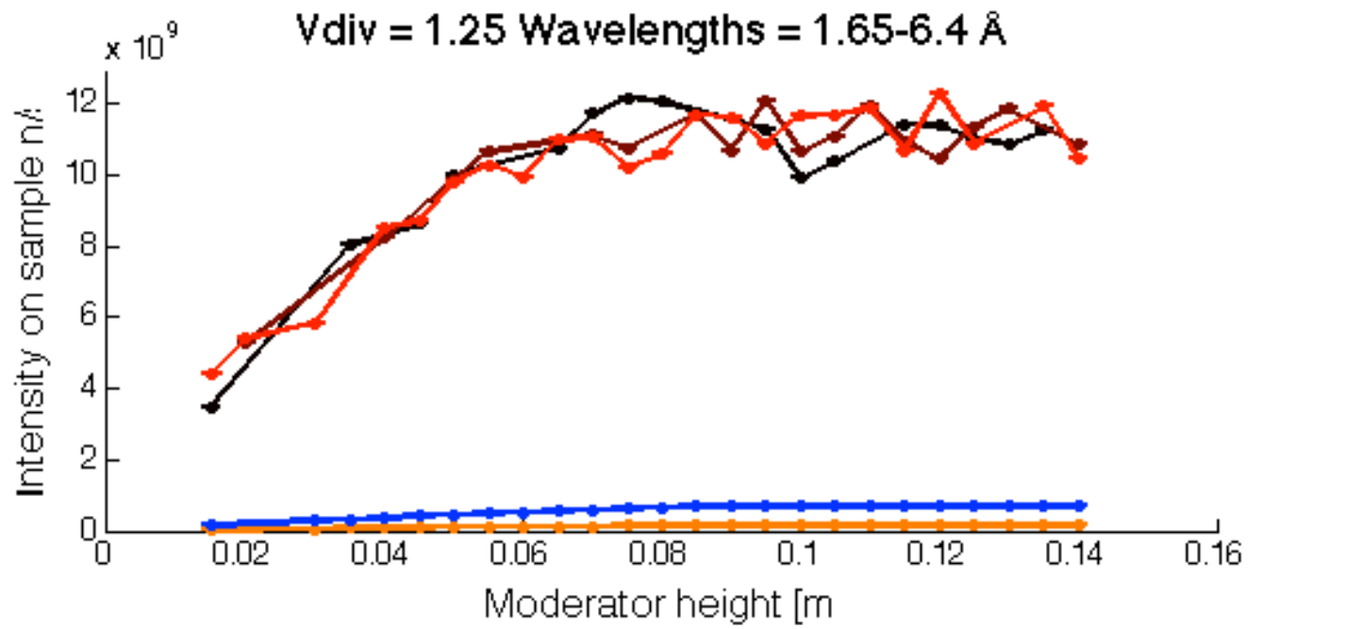


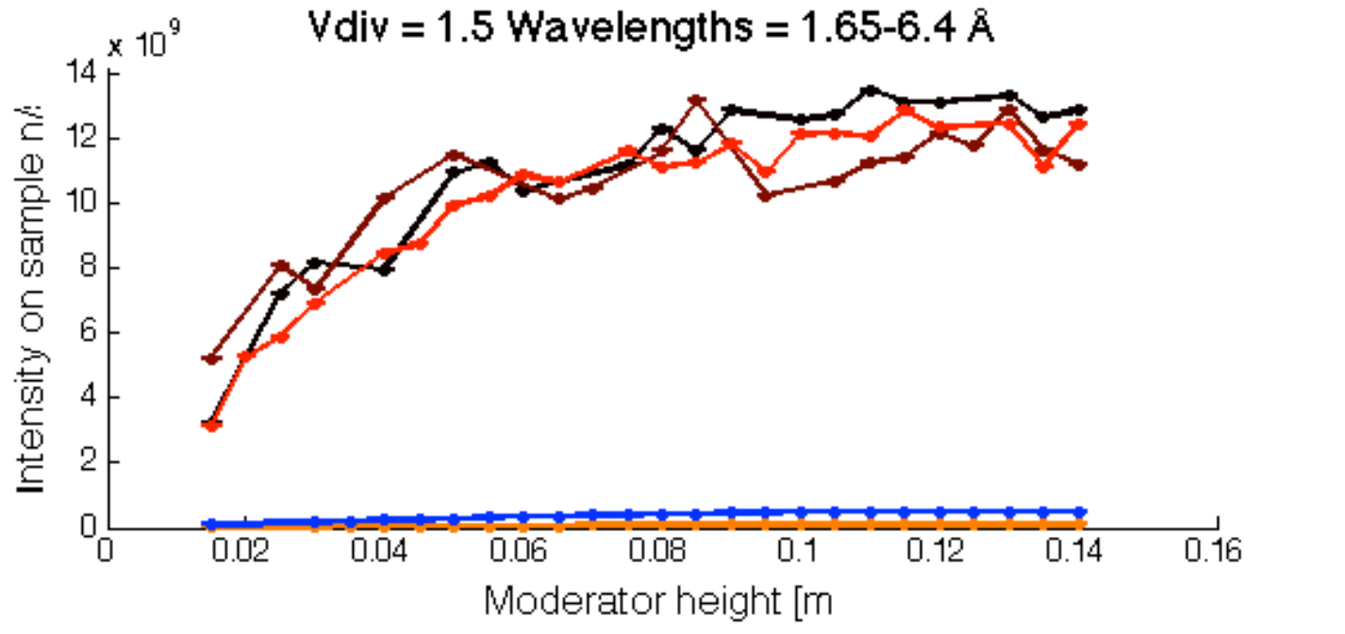

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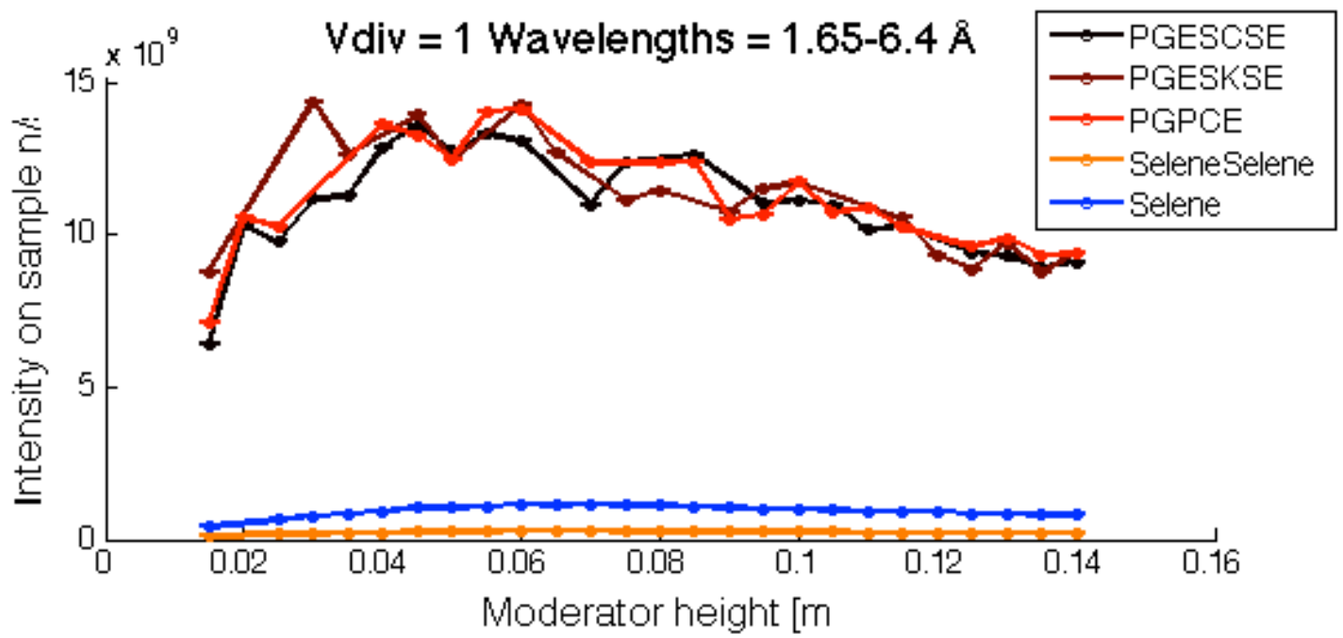
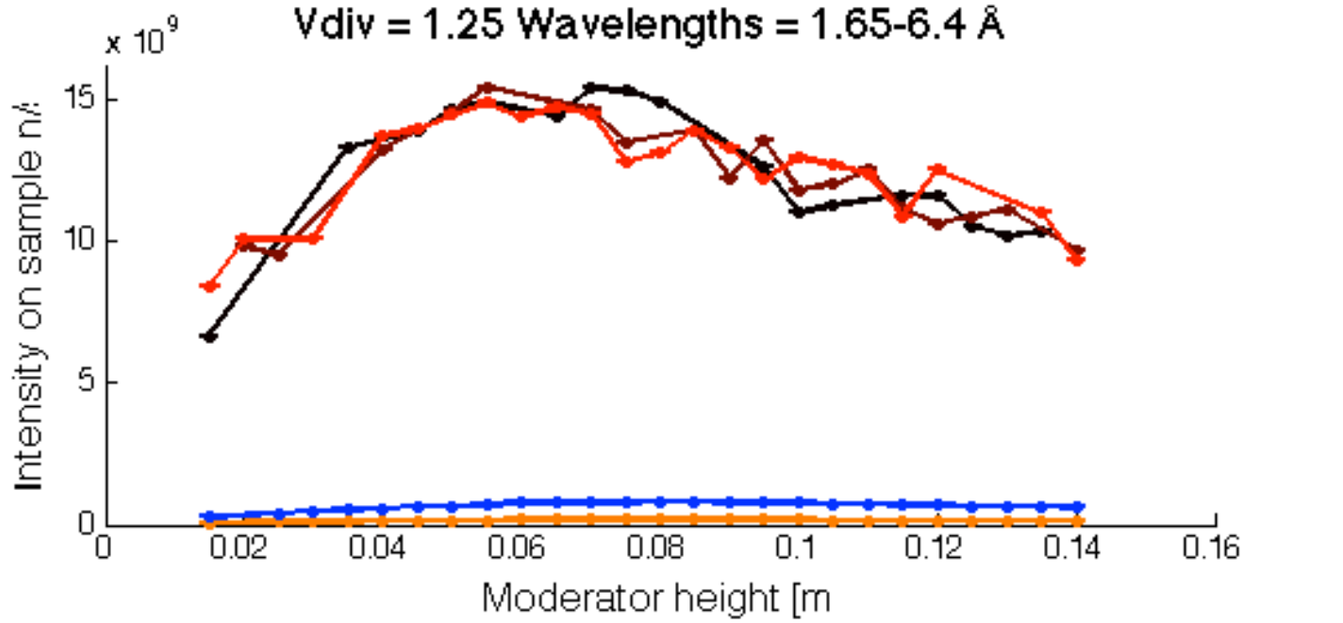
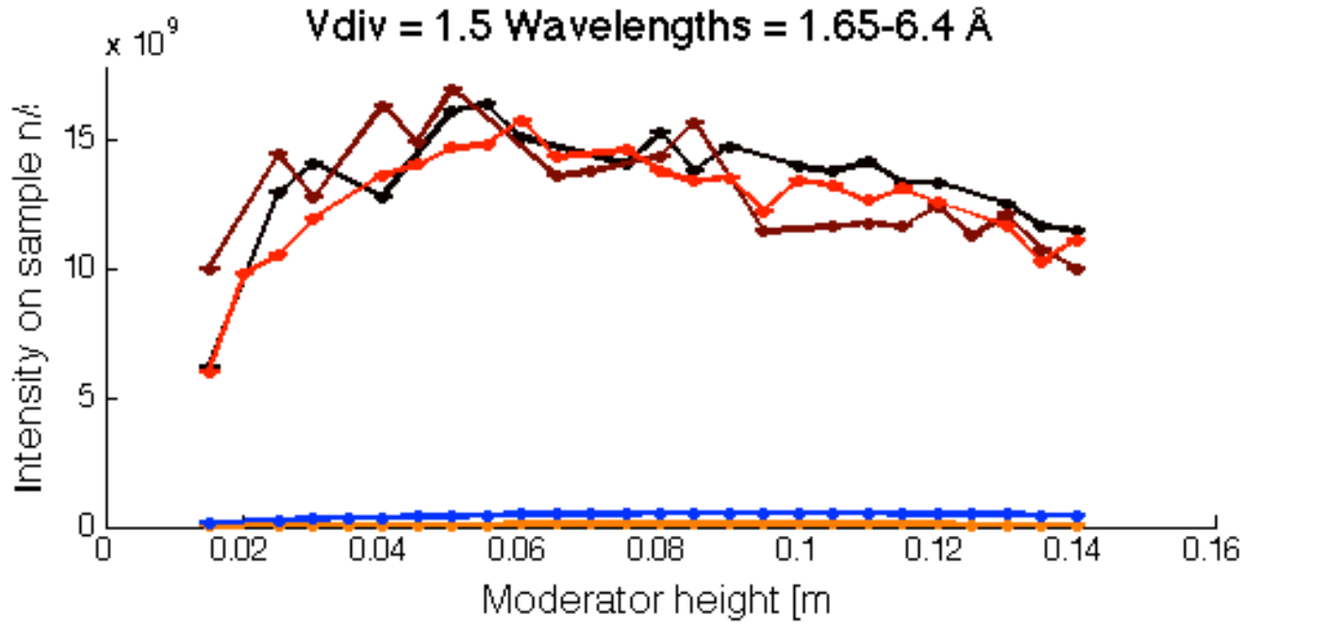


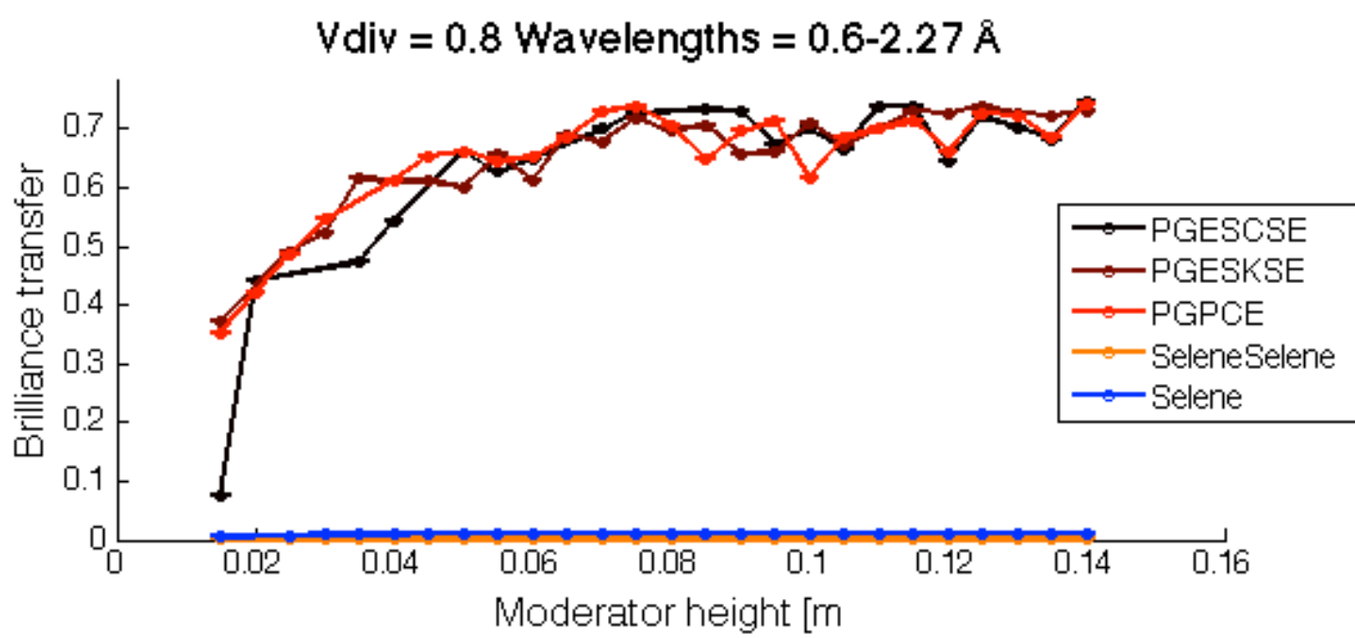
# Heimdal

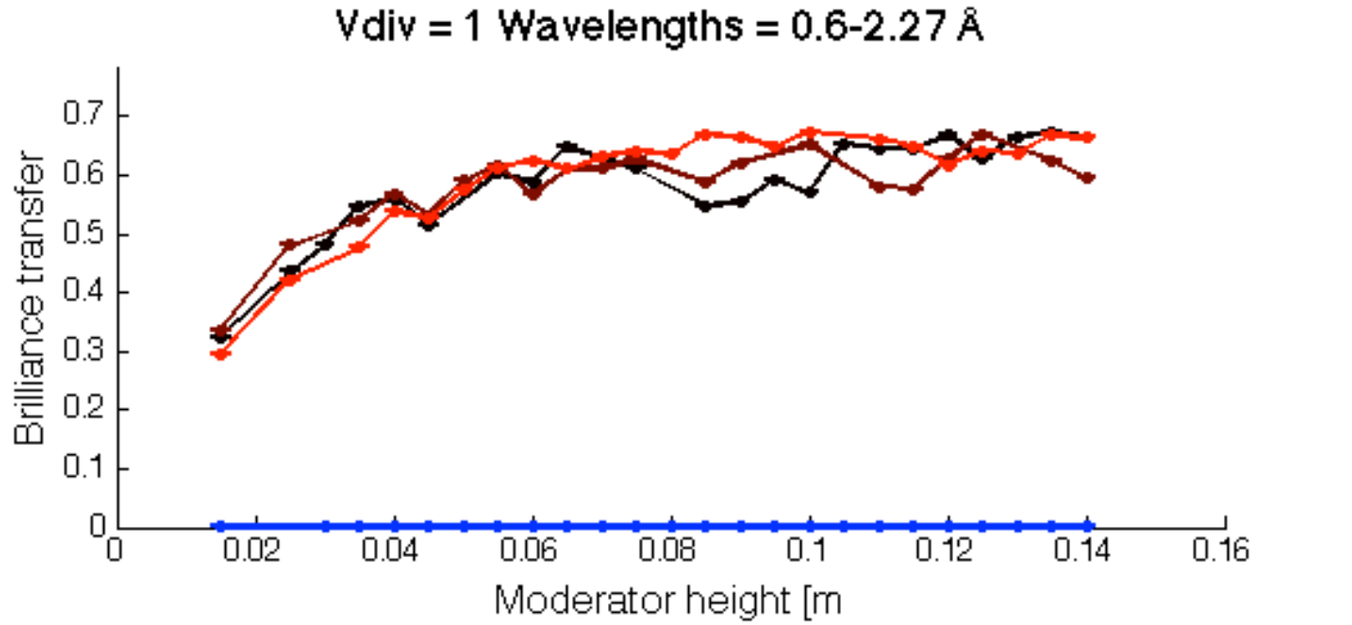
## Scan of moderator height

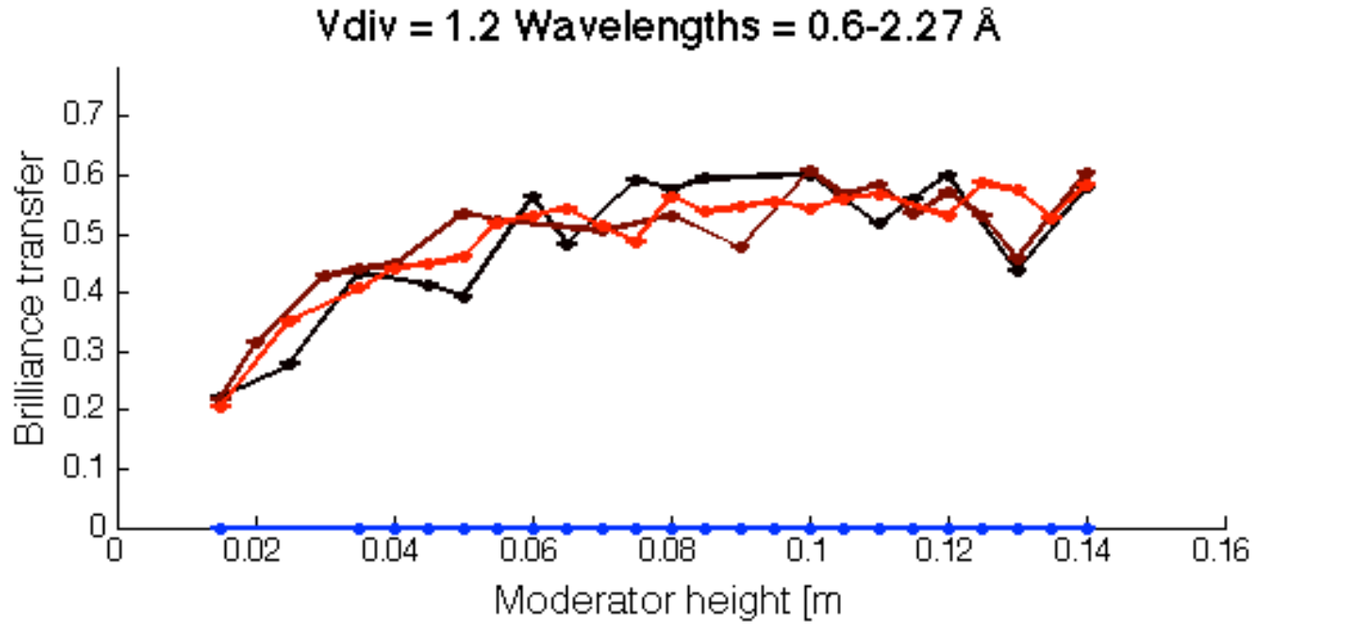
### Sample

| | |
|---|---|
| Sample size H | 5 mm |
| Sample size V | 15 mm |
| Divergence H | ±0.487° |
| Divergence V | ? |
| Wavelength | 0.6 - 2.27 Å |
| Length | 167.3 m |
| Sample - guide | 60 cm |

| | |
|---|---|
| Conventional | m = 5 |
| Selene | m = 6 |



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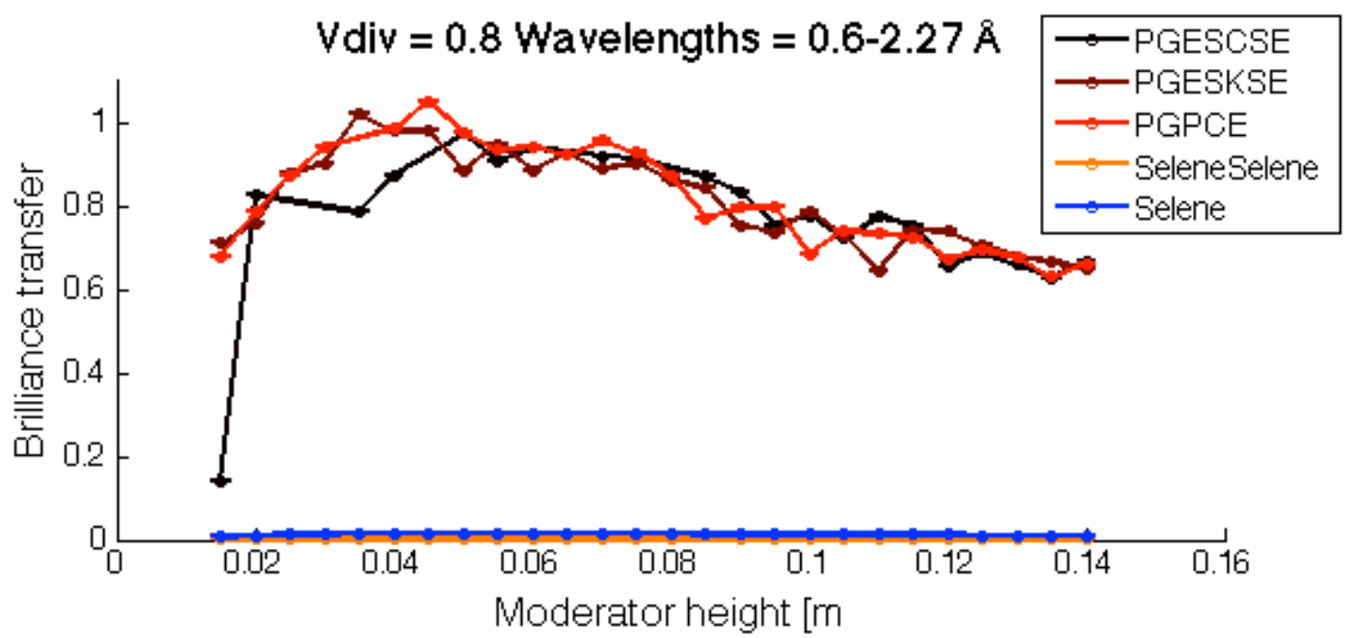


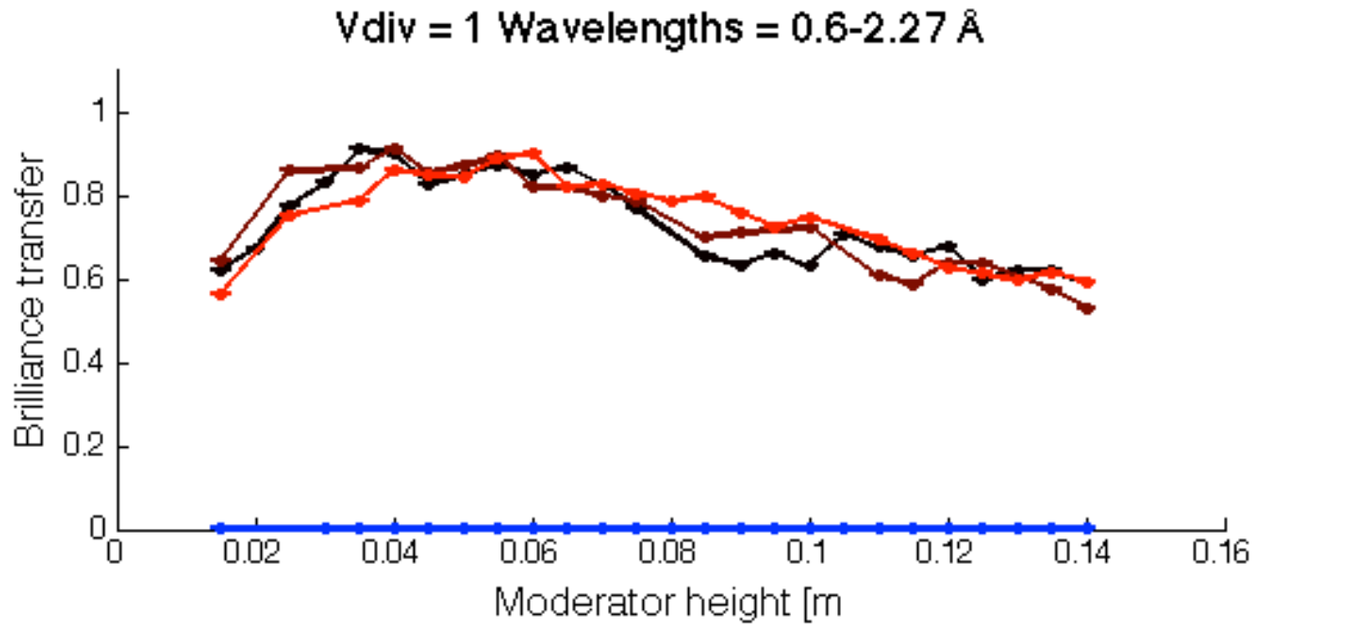


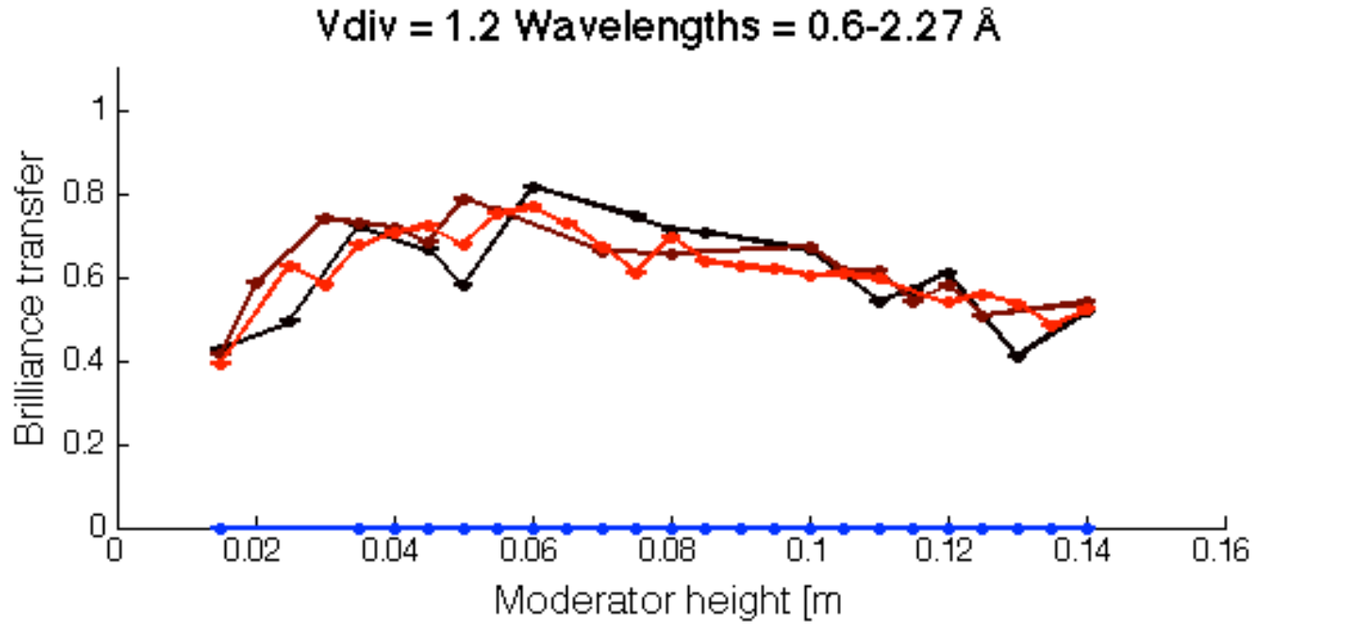

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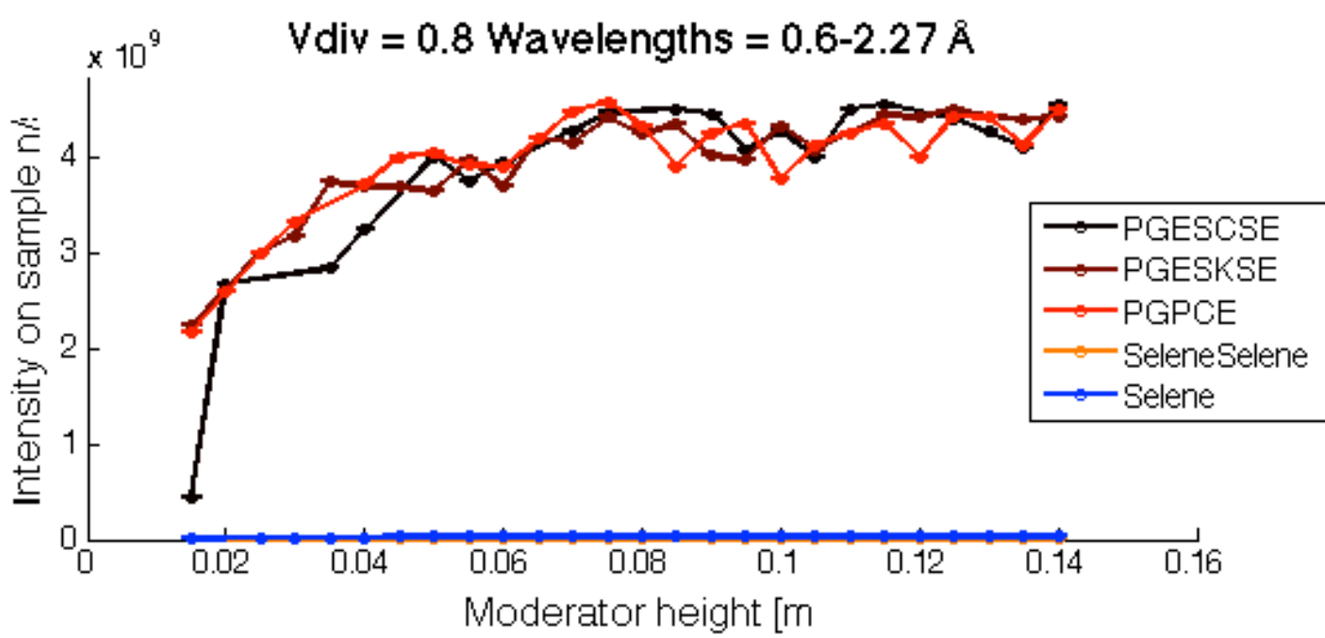


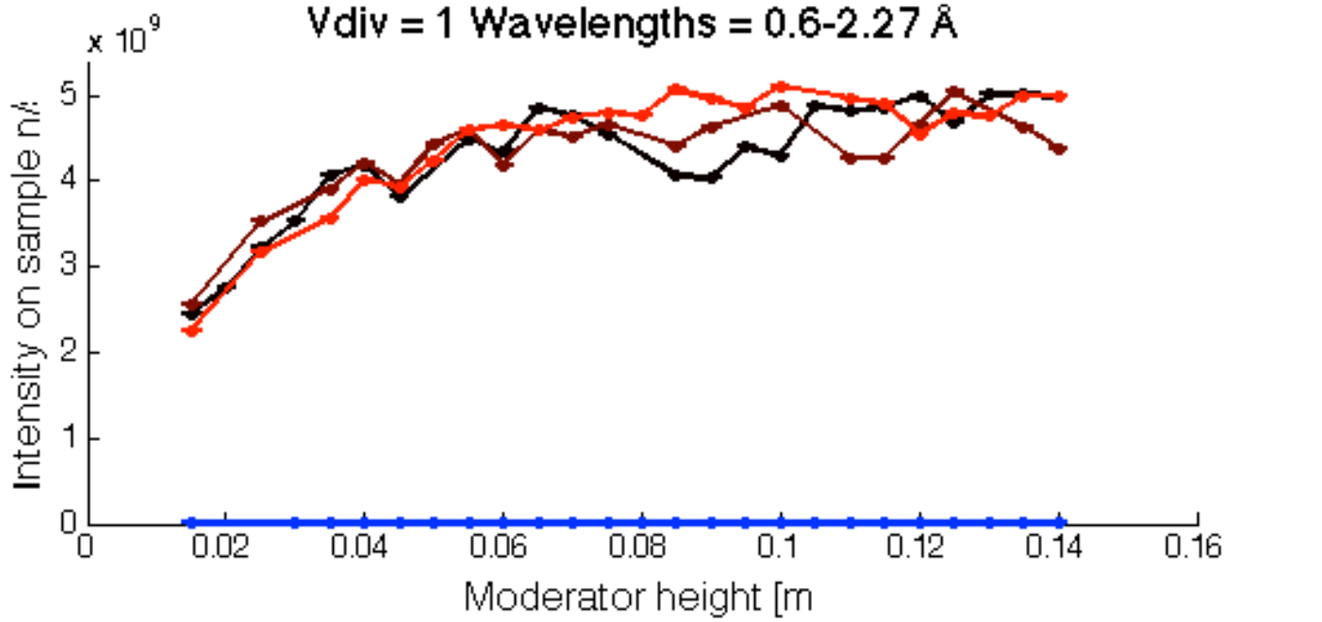


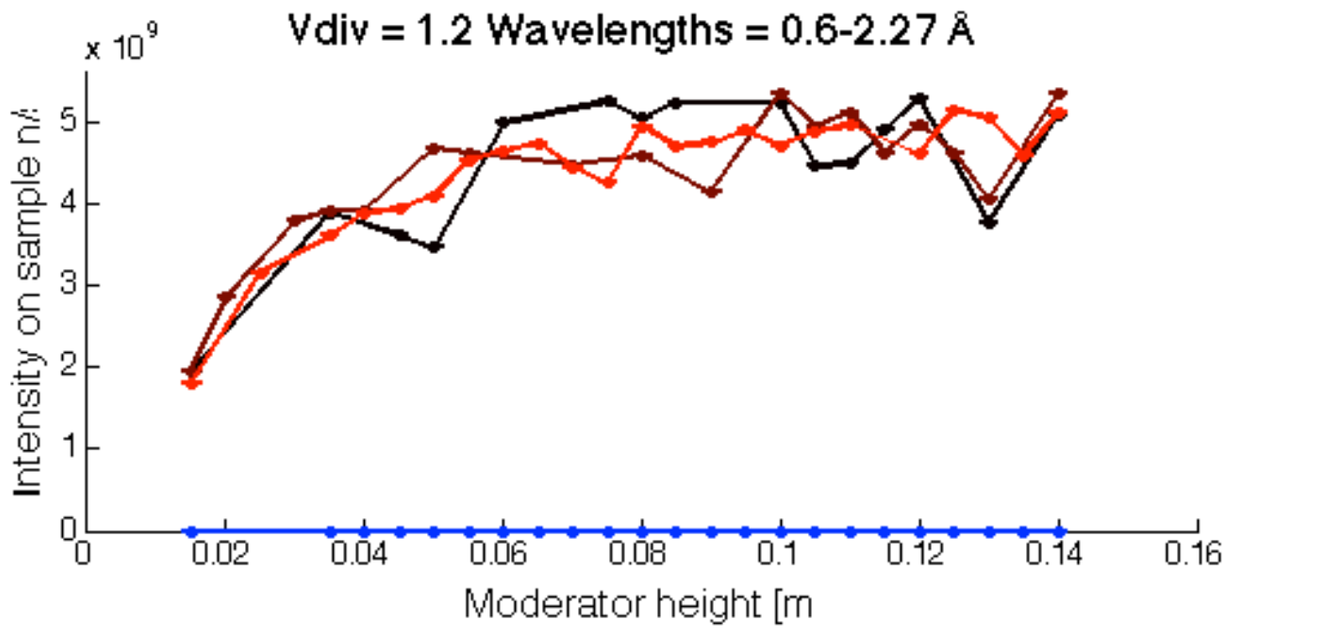

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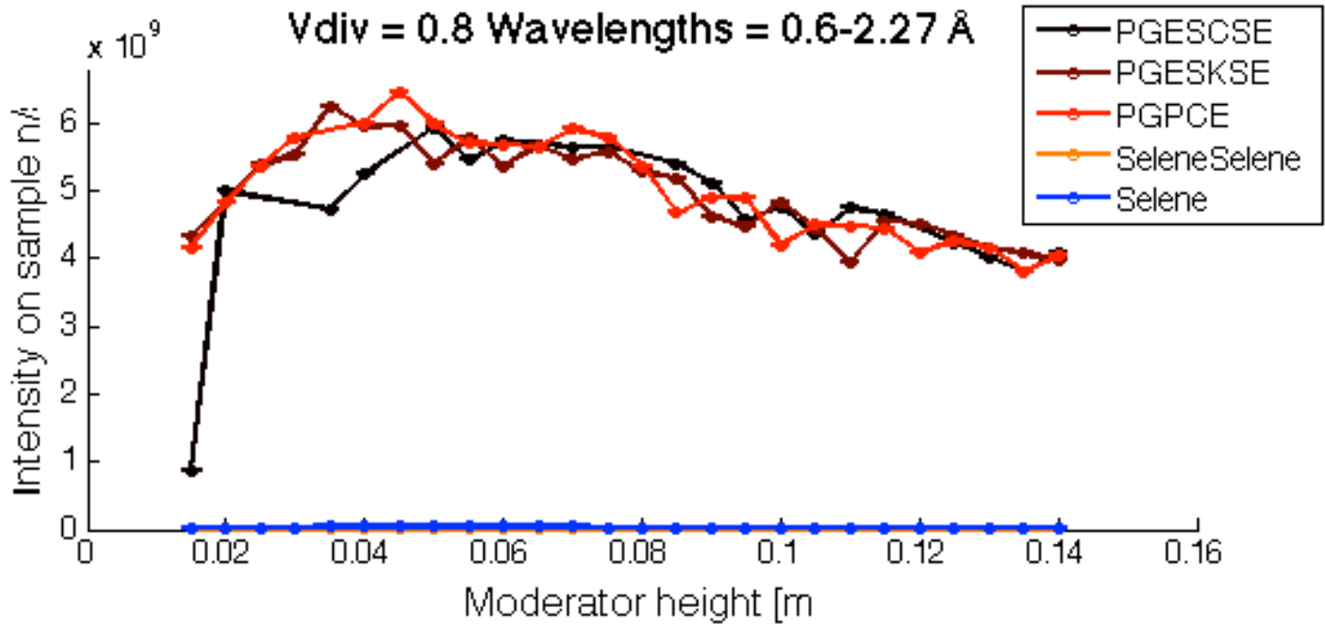
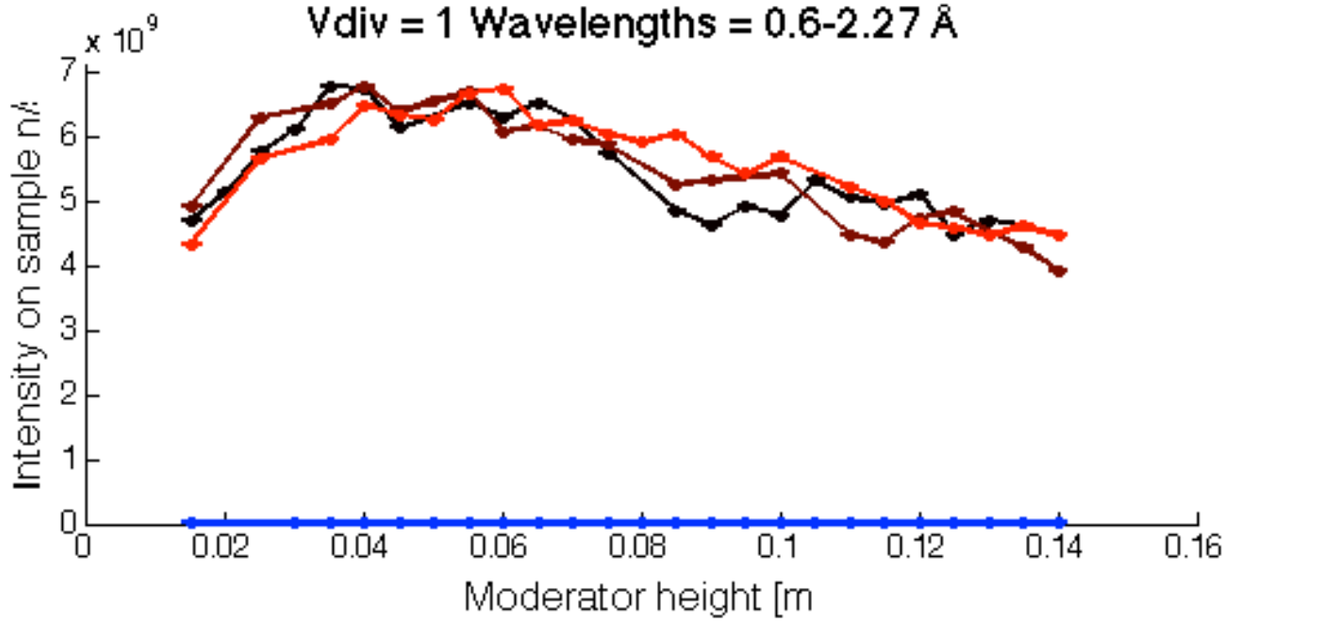
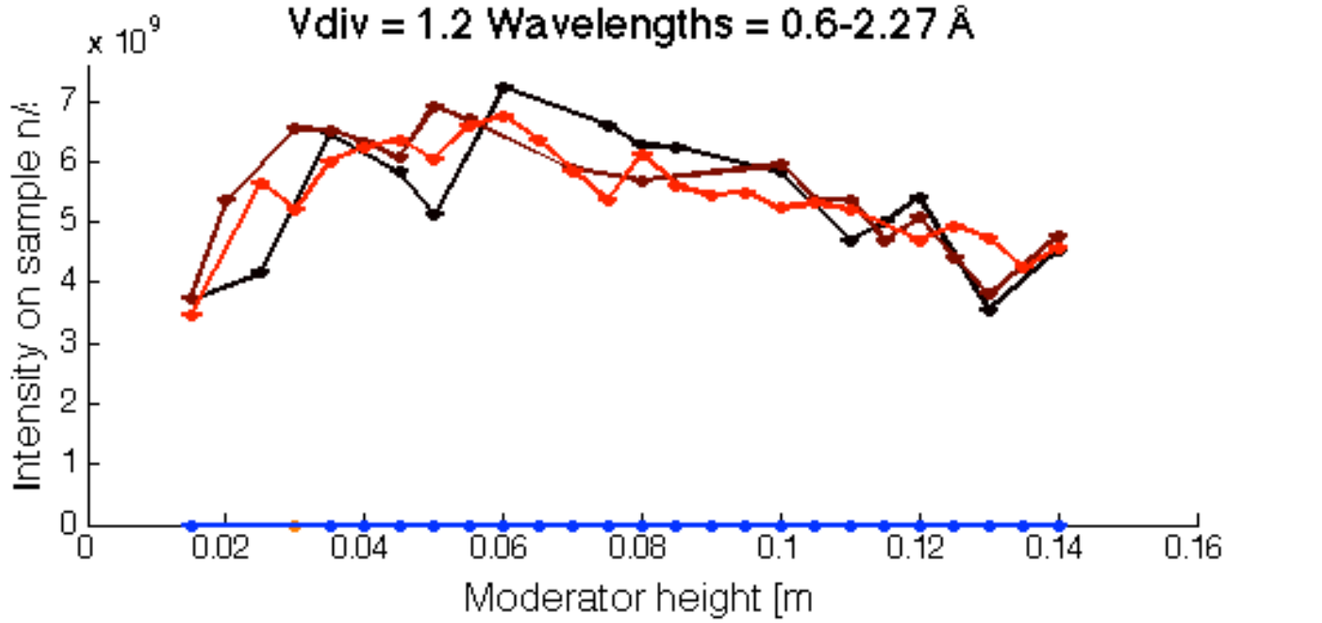
| Selene | m = 6 |



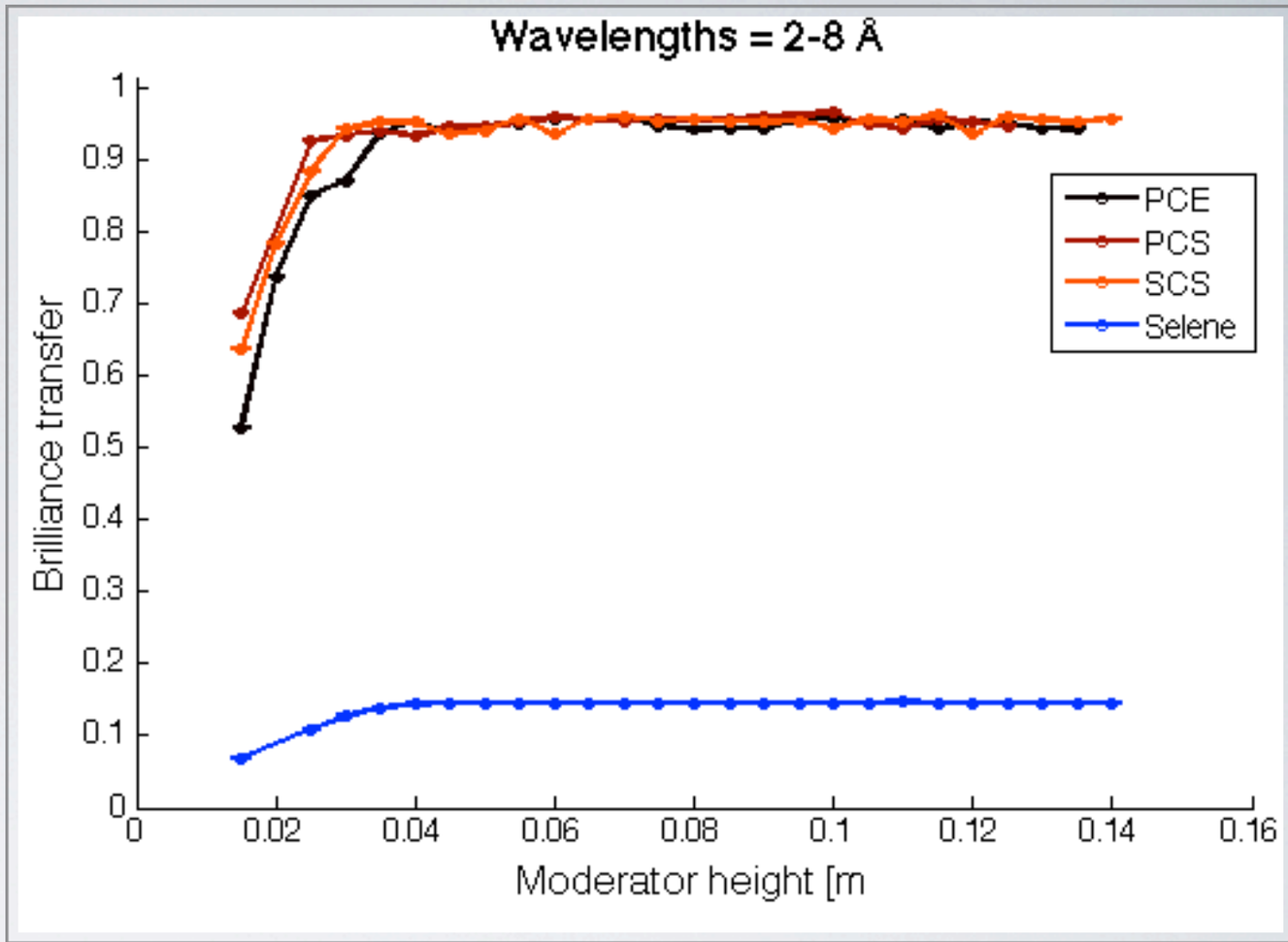
# SANS

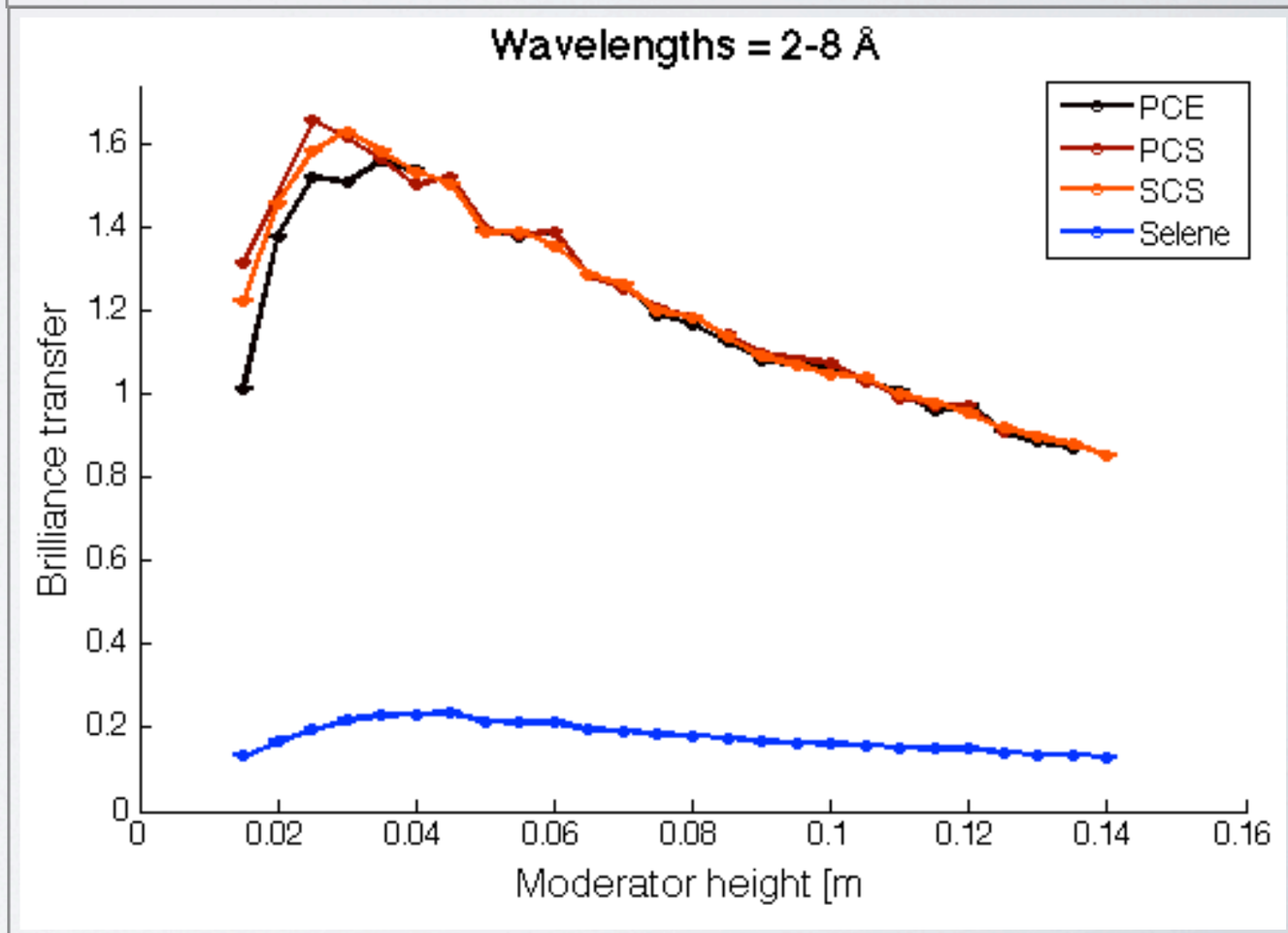
## Scan of moderator height

| Sample | |
|---|---|
| Sample size H | 10 mm |
| Sample size V | 10 mm |
| Divergence H | ±0.4° |
| Divergence V | ±0.4° |
| Wavelength | 2 - 8 Å |
| Length | 10 m |
| Sample - guide | 0 cm |

Conventional m = 2.5

Selene m = calculated



# SANS

## Scan of moderator height

### Sample

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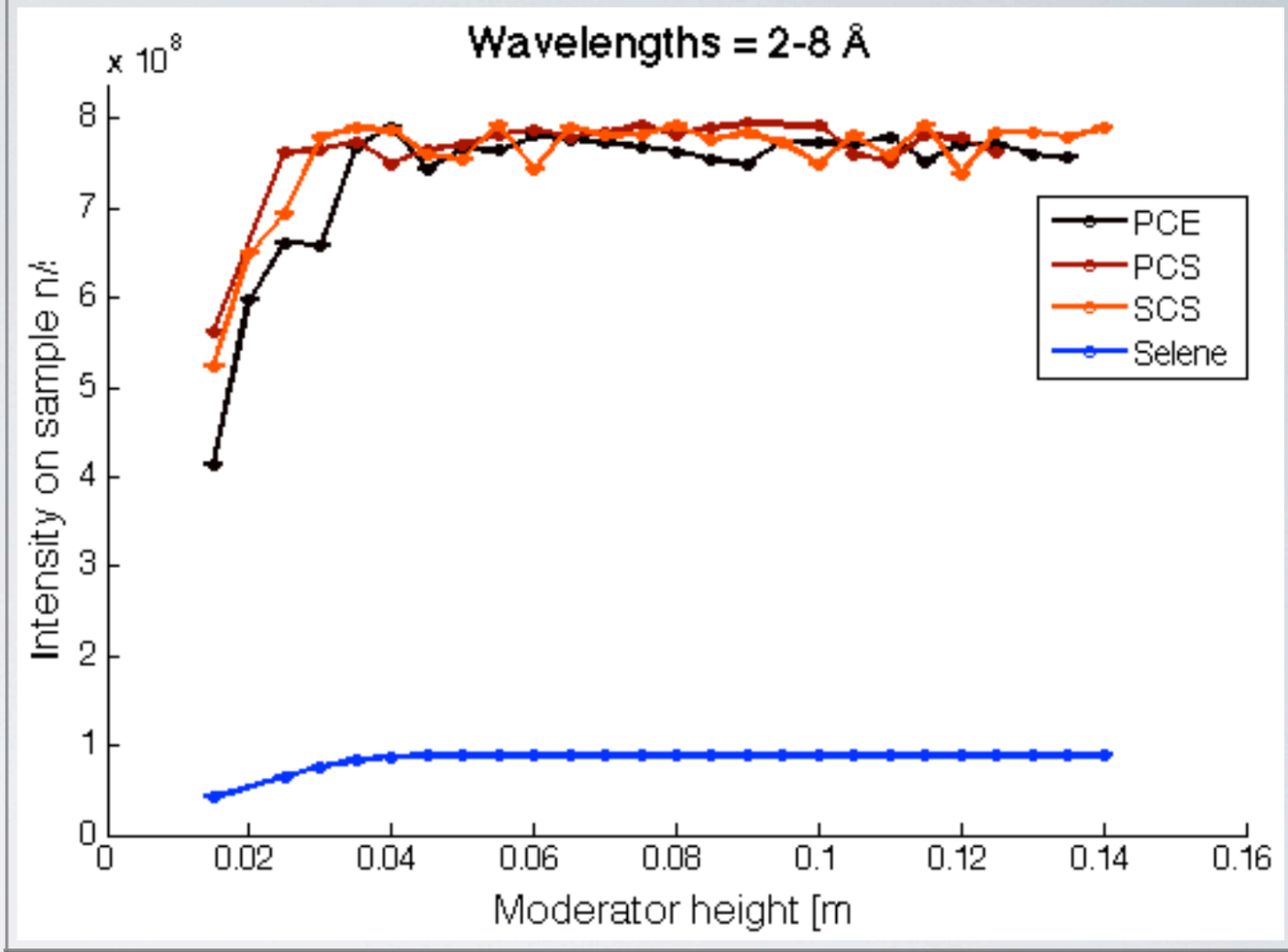


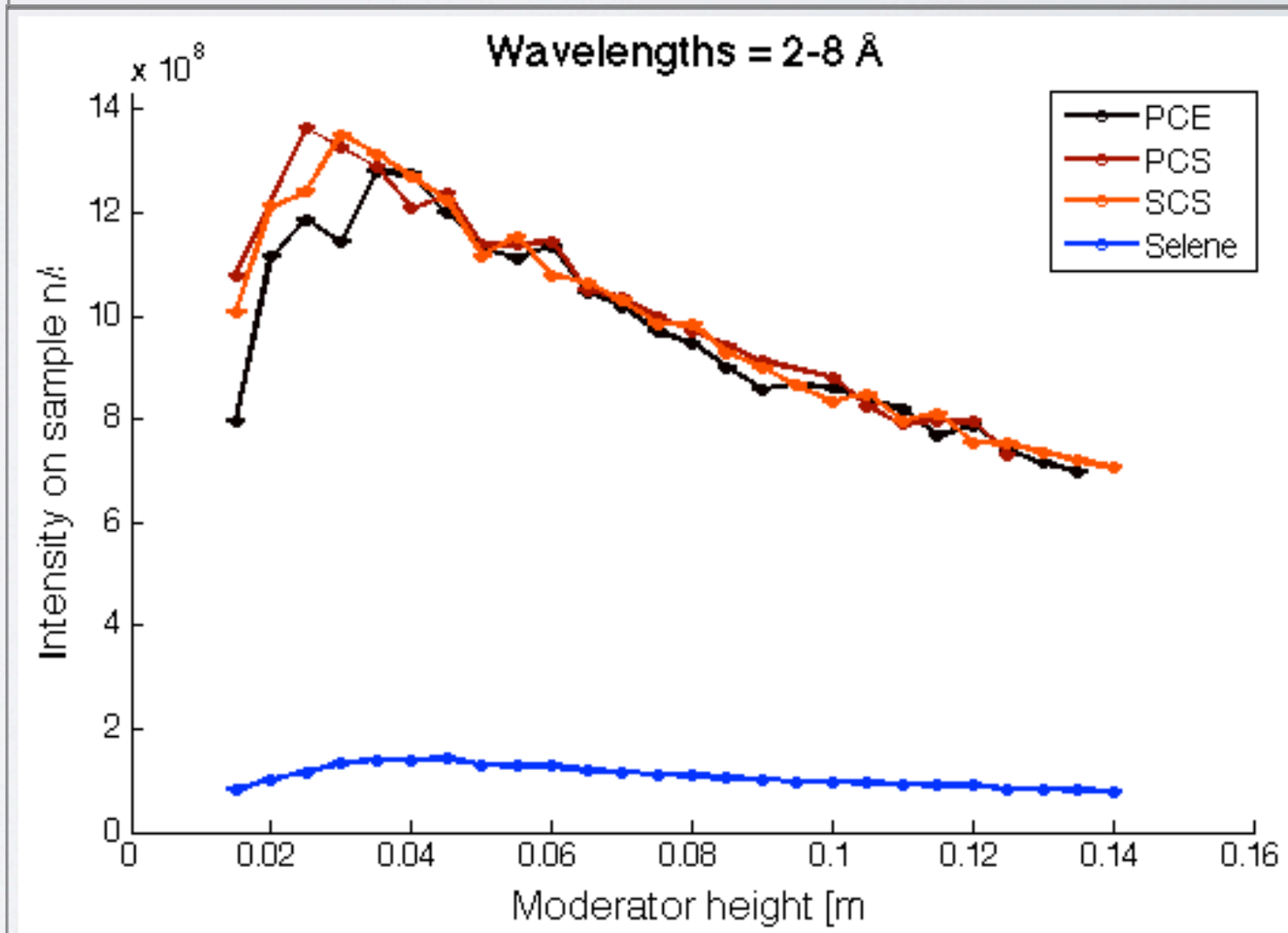

# Guide_Bot

## Conclusions from moderator scan

- No perfect moderator size for all instruments
- The perfect moderator height was not 12 cm
- Conventional guides struggle with the pancake
- Need to try some unconventional guides

# Guide_Bot

## Conclusions on Guide_Bot idea

Was it worth it to use 7 months on this program?

CAMEA, Heimdal, SANS, ODIN and more at once
All of these better than I could have done before

My output is primarily limited by CPU time

If a sudden change in baseline is made (e.g. moderator)
all my previous work can be re-optimized very easily.

# Guide_Bot

## Still missing

More than once out of line of sight

Coating optimizer

Windows support

The remaining modules

# Guide_Bot

Mads Bertelsen - University of Copenhagen
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mail me to get into the closed beta!