Welcome to
22481 Introduction to medical imaging

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Department of Health Technology
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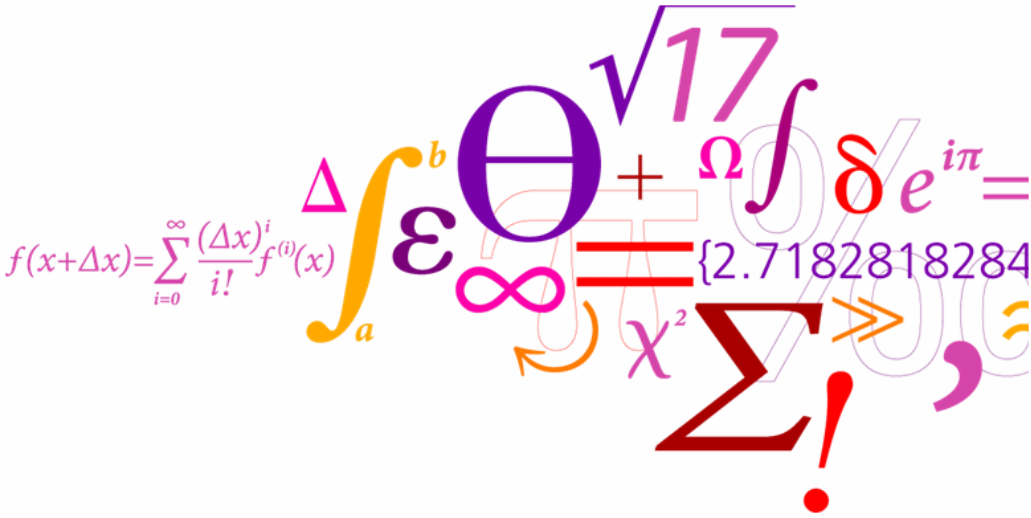
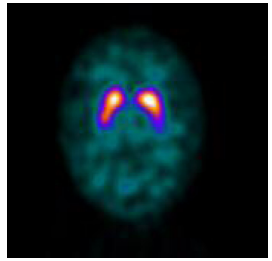


Content

- Medical imaging and course objectives
- The plot
- Format of the course
- COVID-19
- SIS
- This afternoon



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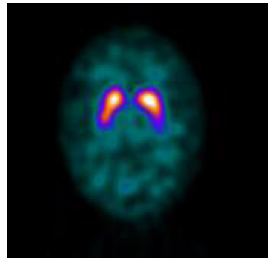

What is medical imaging?

Tomographic (tomo = slice) images of living tissue
Projection (or shadow) images of living tissue

What does the images show?

- Structure or anatomy:
  - Organs (lungs, heart, liver, bones, blood vessels, etc)
- Functionality:
  - Blood flow (occlusion in vessels, perfusion, etc)

What does medical imaging reveal?

- A broken bone
- Cancer
- Occlusion of blood vessels (Atherosclerosis)
- Heart (dis)functionality
- Muscle (dis)functionality
- Pregnancy follow-up
- Brain function
- and much more.....

Imaging modalities

- Sound:
  -
- X-ray:
  -
  -
- Radioactive tracers (Nuclear medicine):
  -
  -
- Radio waves:
  -

Course objectives

In short:

- Understand X-ray, CT, PET, US and MRI
- Be able to work with real images in MATLAB
- Do laboratory work (?)
- Do independent and team-wise project work
- Write an impressive report

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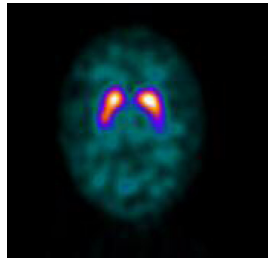


Looking for the unknown

(Photo removed)

An image says a thousand words, but you need to know the words

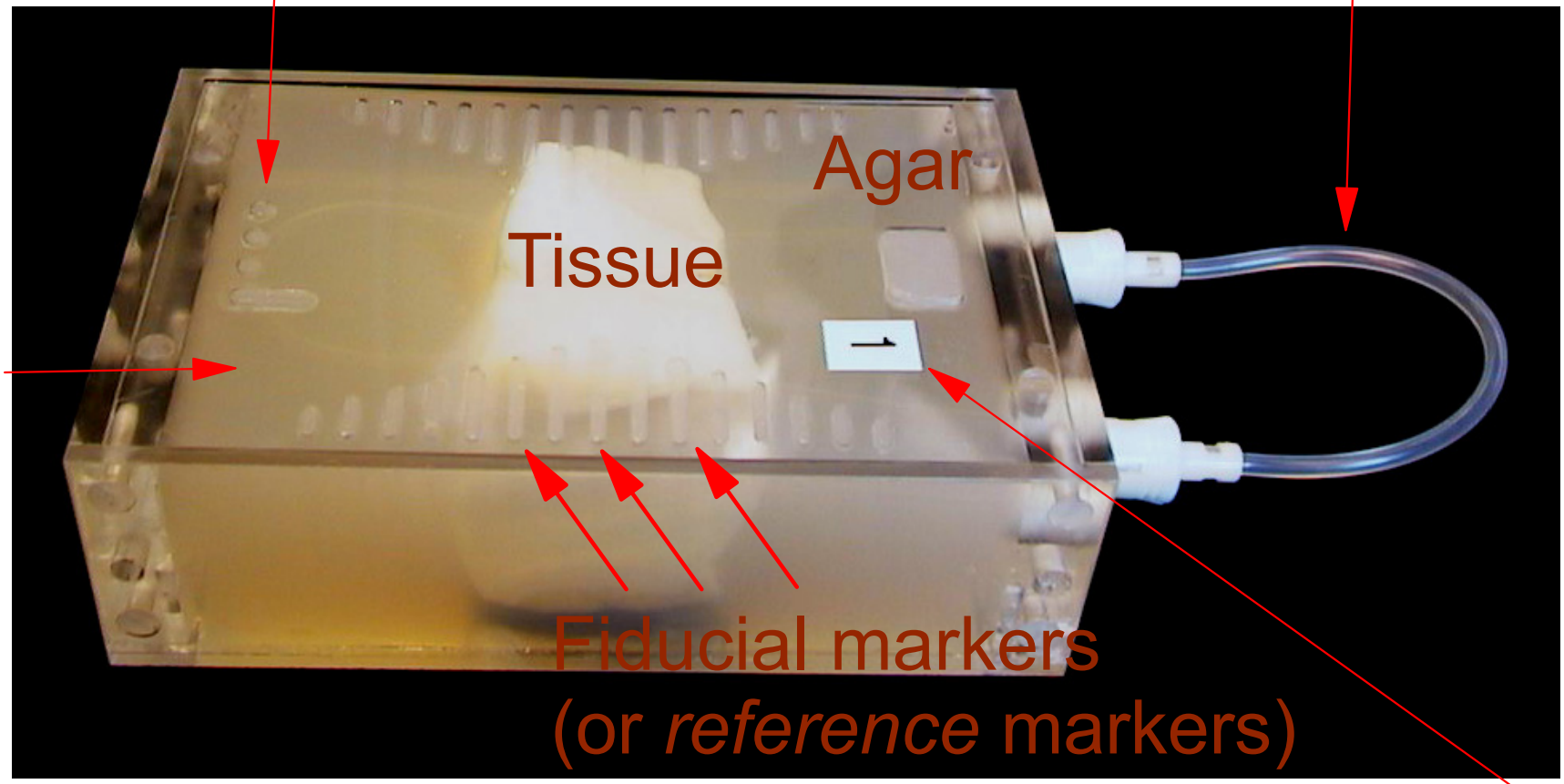
(Photo removed)

Source: Wikipedia

The phantoms

(Photo removed)

Tissue in agar block



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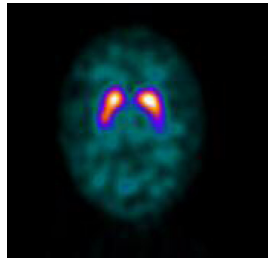


The main flow of the course

- You will get:
  - A photograph of the phantom surface
  - Medical imaged from hospital(s) and DTU
  - Photograps of sliced tissue to make a reference
- You will:
  - Maybe do some home experiments
  - Do some image handling, processing and analysis
  - Study the physics of the imaging modalities
  - Make a final report on the above and based on 4 assignments

(Photo removed)

The time line

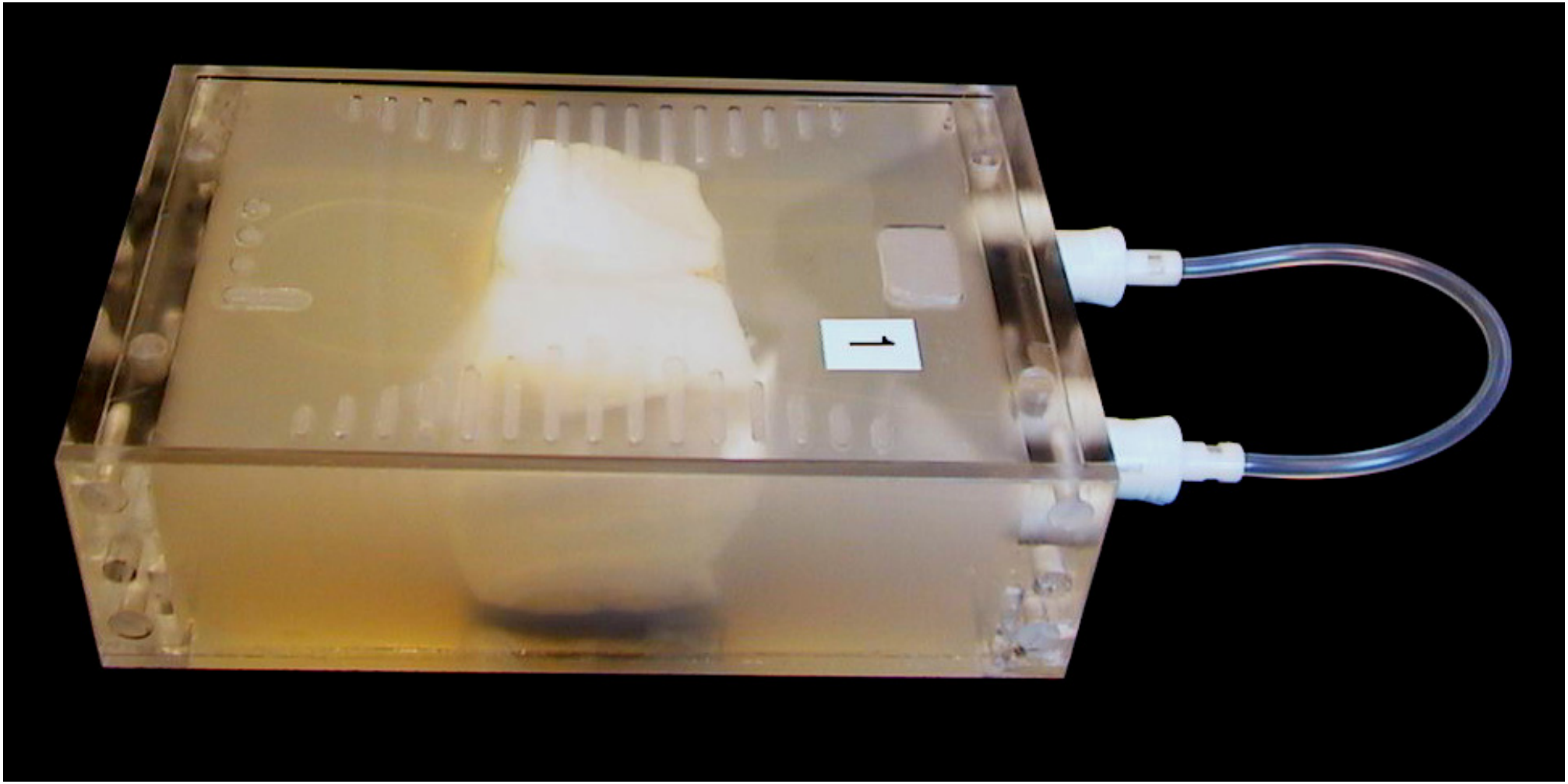
Lectures etc 13-14:30	Data recording & analysis 14:30-17:00 and home	Assignments Home
September	Top photo	0
MRI	MRI	1
PET	X-ray	
X-ray & CT	CT & PET	2
US	US	3
MRI	Slicing	4
December		Final report

Next Thursday

Next module at Frederiksberg hospital:

- Planar X-ray and MRI
- Work on Assignment A2

Which objects to identify?



Which objects to identify?

All things within the limit of the acrylic box

The main flow of the course

Study the imaging techniques!!!

(Photo removed)

Format of the course: *Homepage*

courses.healthtechnology.dtu.dk/22481

(how to nagivate in these pages)

Format of the course: *The plan*

5	Thursday 29-Sep-2016	12:30-13:00	341.21	jw	Short X-ray & CT	X-ray & CT & Practical guide
		13:00-14:30	341.21	jw	X-ray & CT (da)	X-ray & CT & Practical guide
		14:30-17:00	349.019	LM, AEJ	Handling data. Processing MRI and X-ray data	Practical guide. Submit: A2

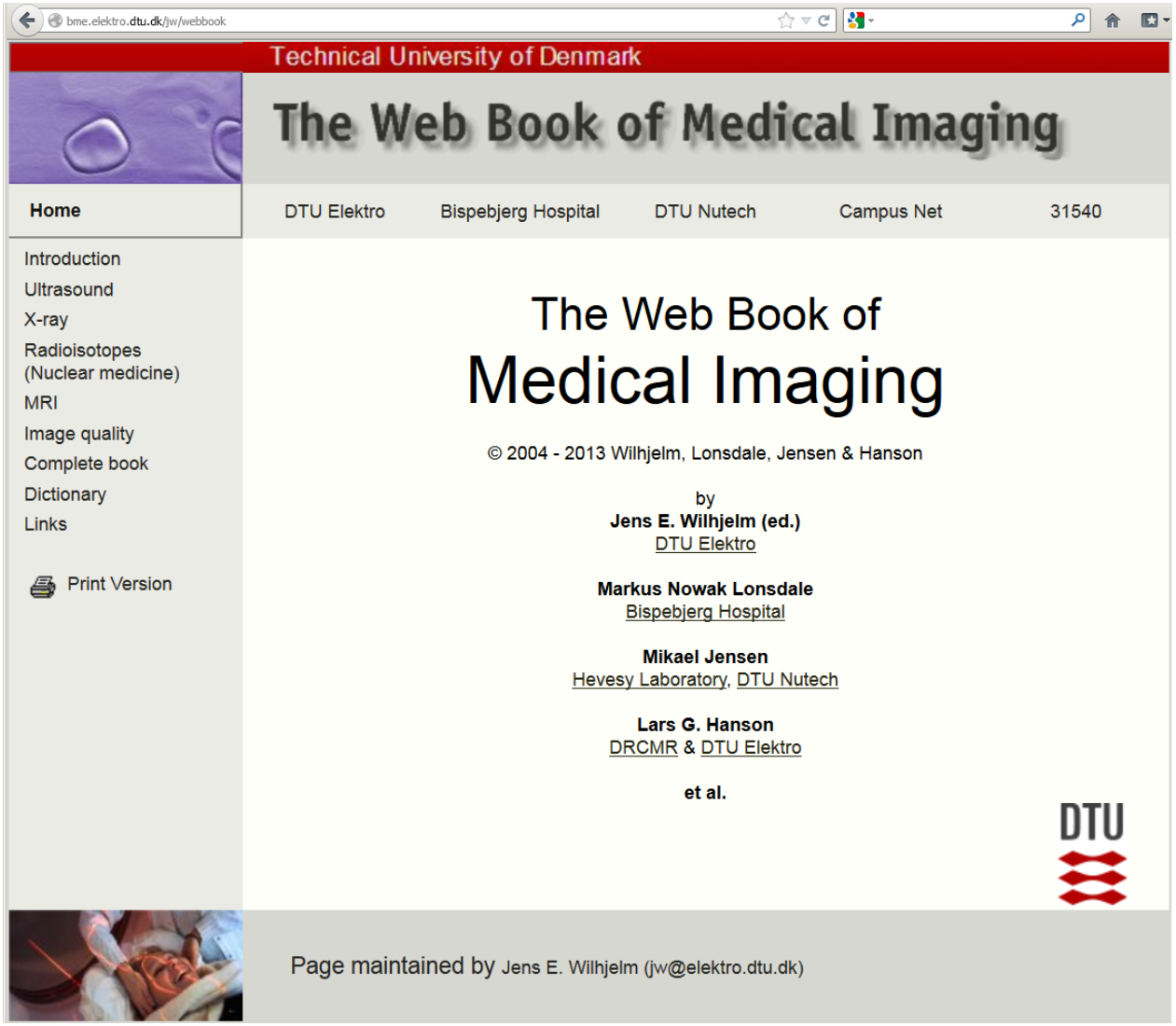
Read in advance to lecture. Otherwise it might be very fustrating for you.

We do not have "grupperegning". We have project work!
So all rehearsal for the exam is on your own!

Language

- Normally English lectures
- All written material is in English
- During project work, guidance is in Danish/English
- Report language is your choice
- Please consider writing assignments 1 to 4 in English

The Web Book of Medical Imaging



Peer-review

Set-up:

- Assignments 1 and 2 are individual and will be *peer reviewed*.
- Assignments 3 and 4 are team-wise and will be reviewed by TAs.

Procedure for Assignment 1:

- All students opload their reports
- Each report is then sent to three different students:
  1. Each student have to use a scoring sheet (Rubric) to score each of the three reports
  2. All reviews are meant to be double-blinded so:
     - No name in text, in properties nor in file name
  3. I will oversee the entire process
  4. Problems in Learn or CampusNet (Inside):
     - Please ask TAs to help.
     - Pease document these!

Report writing

- Reading and writing reports have to be to seperate processes.
- If citing text, there is only one way: In quotes (that is: "bla bla") with reference immediately after the end-quote. Otherwise, it will be considered plagarism and treated as such!
- When does the work start?

Report writing

- Reading and writing reports have to be to seperate processes.
- If citing text, there is only one way: In quotes (that is: "bla bla") with reference immediately after the end-quote. Otherwise, it will be considered plagarism and treated as such!
- When does the work start? In about an hour!

Exam

Type:

- 24 problems MC exam lasting 2 hours (in English)
- Designed so that remembering how to solve a problem does not help much. The process of leaning is important!
- Exam problems and solutions for 5 previous years are available.

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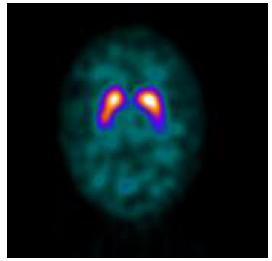

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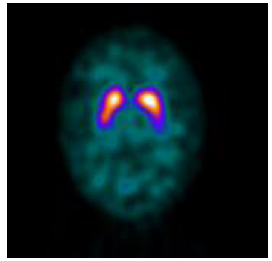

COVID-19

- Follow general rules
- Access to kitchen - but keep nice and tidy, please

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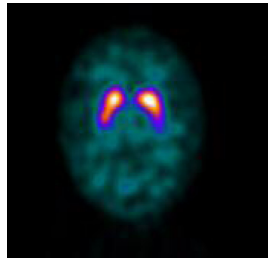

The SIS toolbox
(self-contained image structure)

SIS: zoom on 2D example

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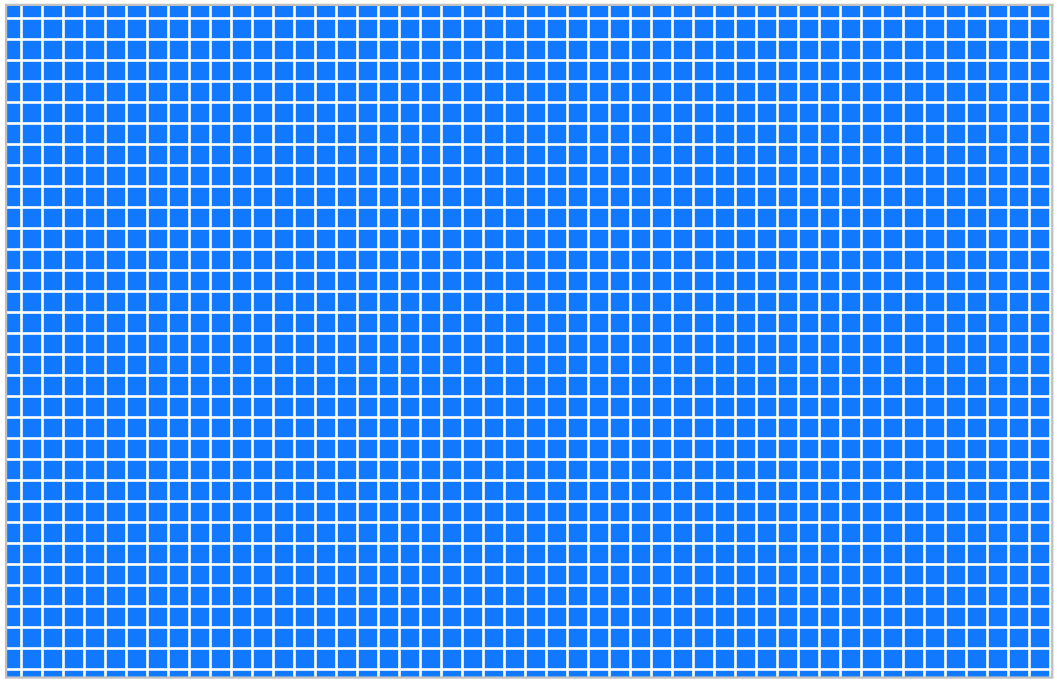

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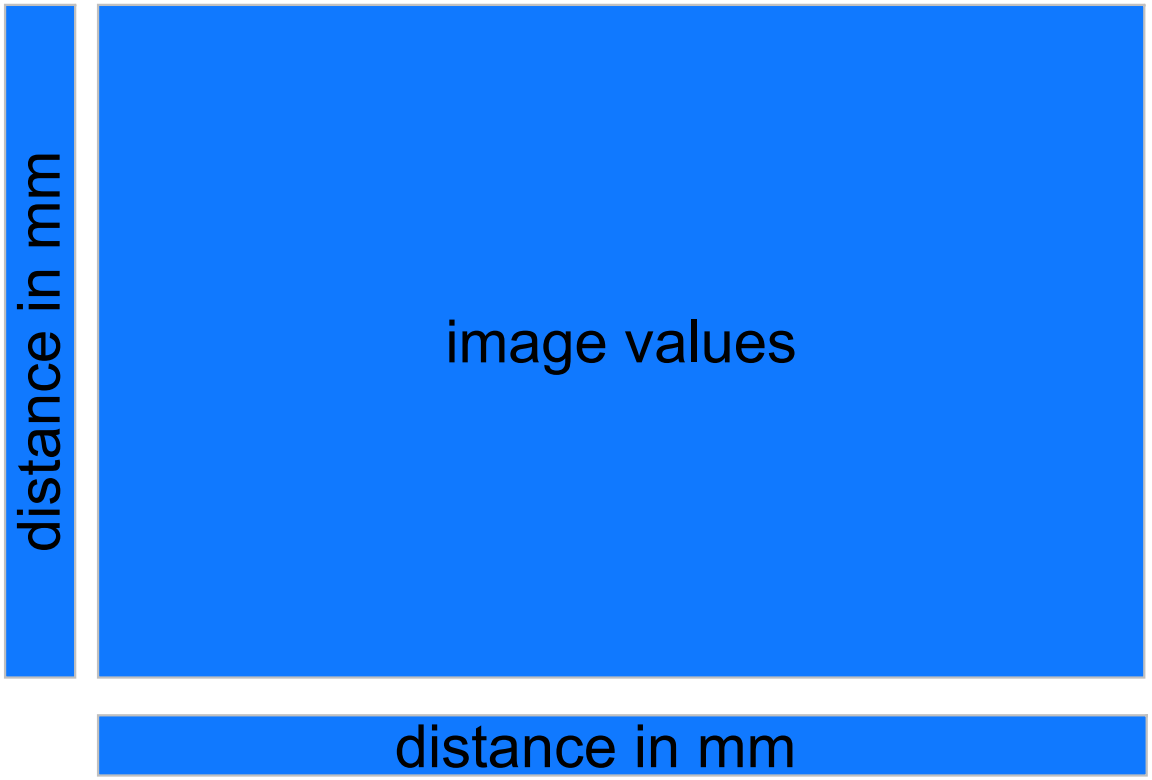

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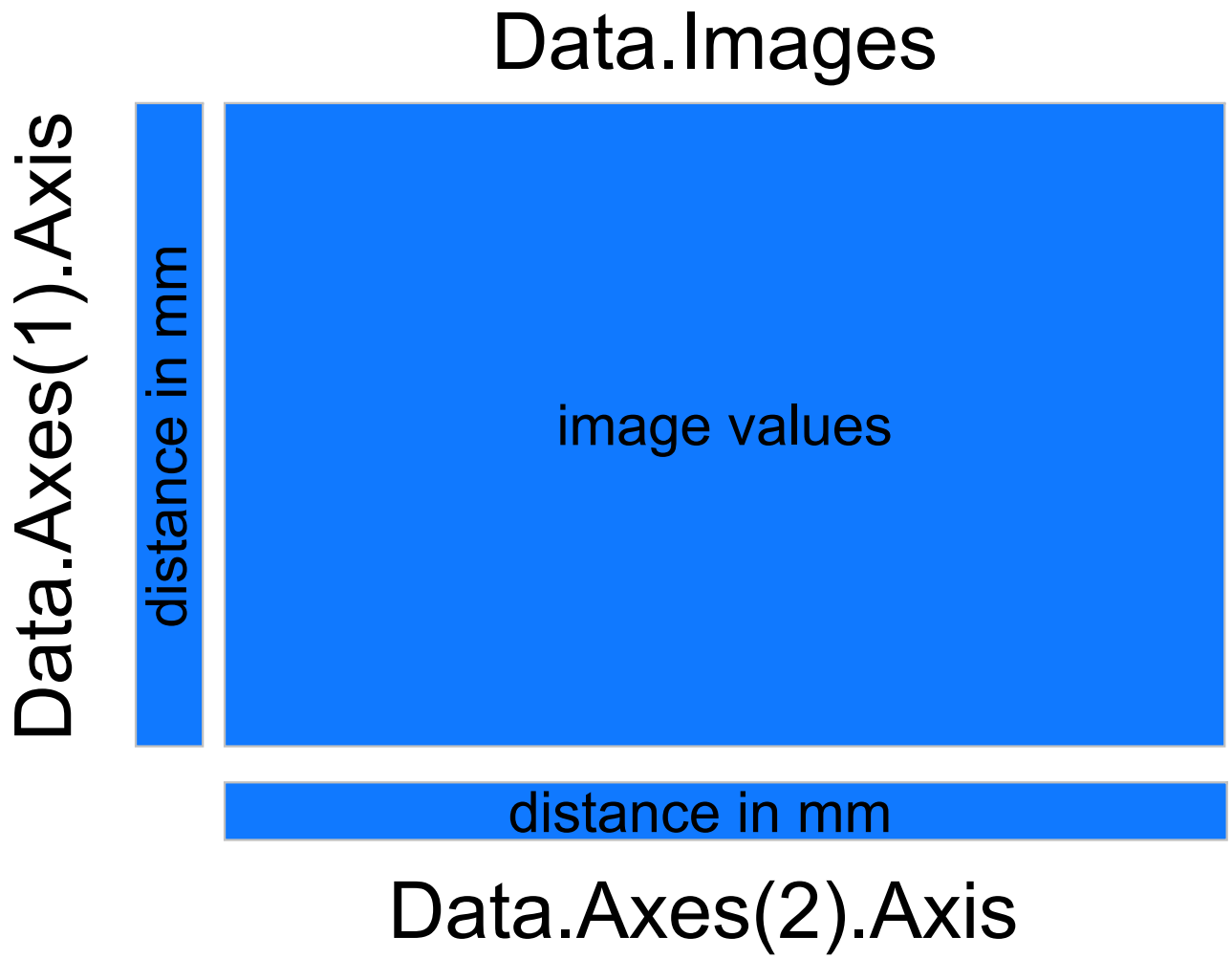

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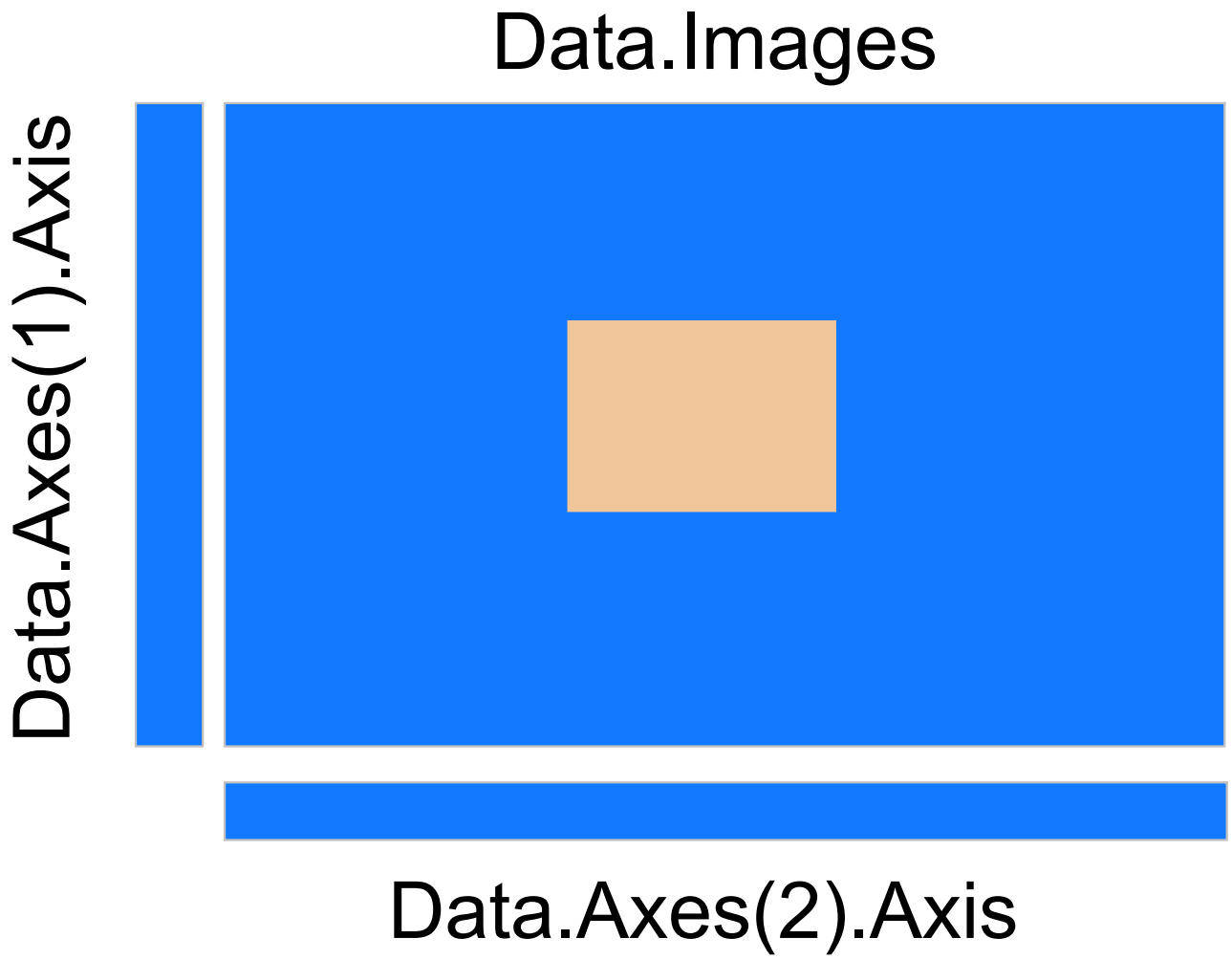

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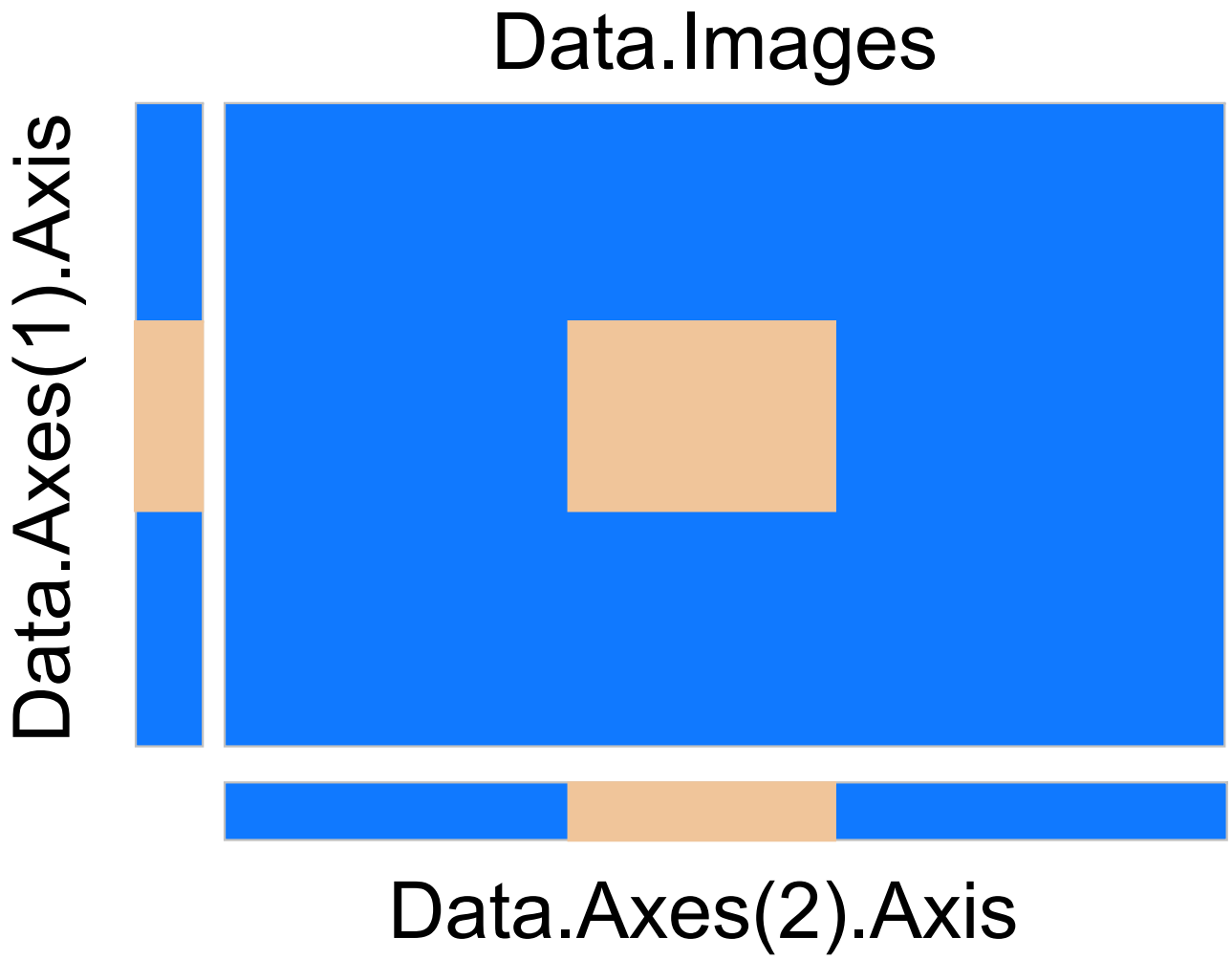
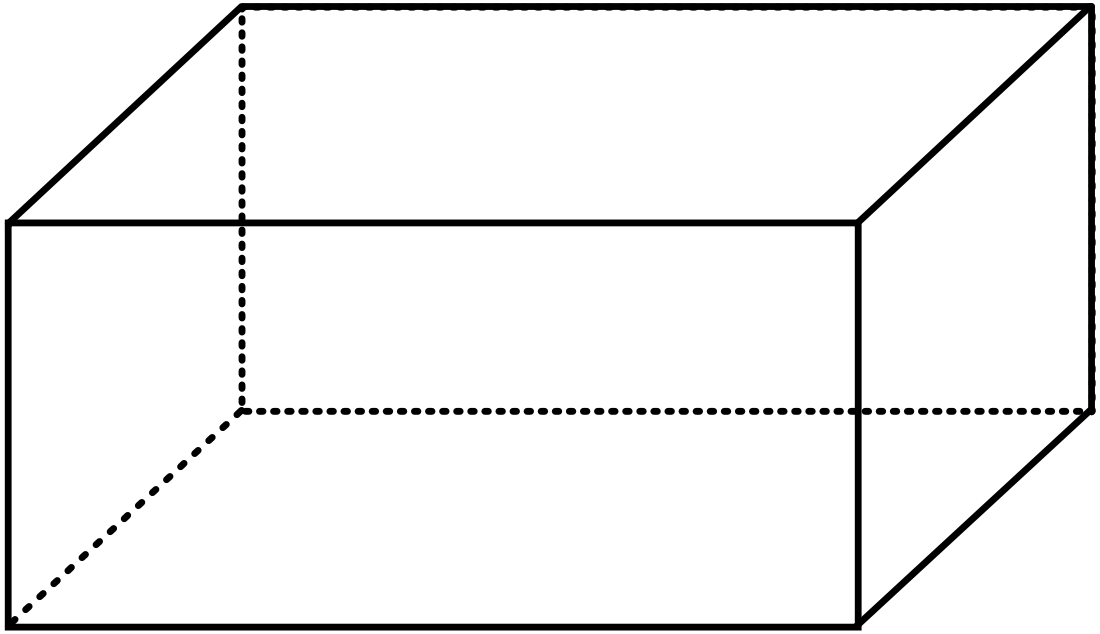


The SIS structure

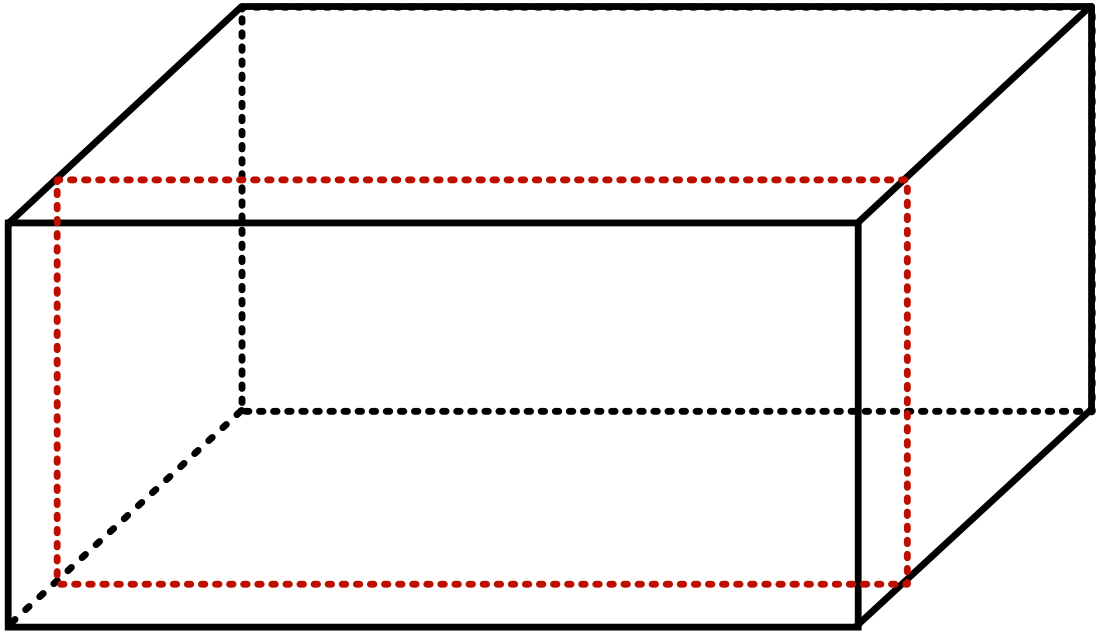
Main fields:

Data.Images: [100x200x50 double]
Data.ImageType: 'intensity'
Data.Axes: [1x3 struct]
Data.ImagesLabel: 'Magnitude'
Data.ImagesSymbol: 'HV'
Data.ImagesUnit: 'HU'
Data.Date: 7.3329e+005
Data.Object: 'Phantom 1'
Data.Operator: 'mnl'
Data.Where: 'Bispebjerg Hospital'
Data.ScannerType: 'CT'
Data.Settings: (e.g. DICOM header)

SIS: 3D example



SIS: 3D example



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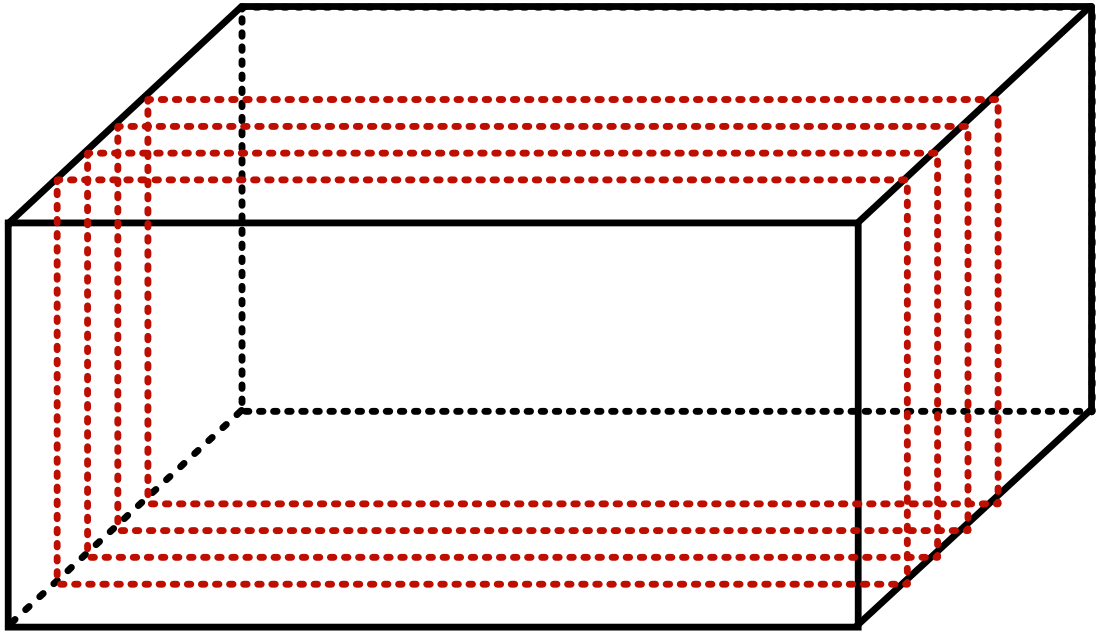

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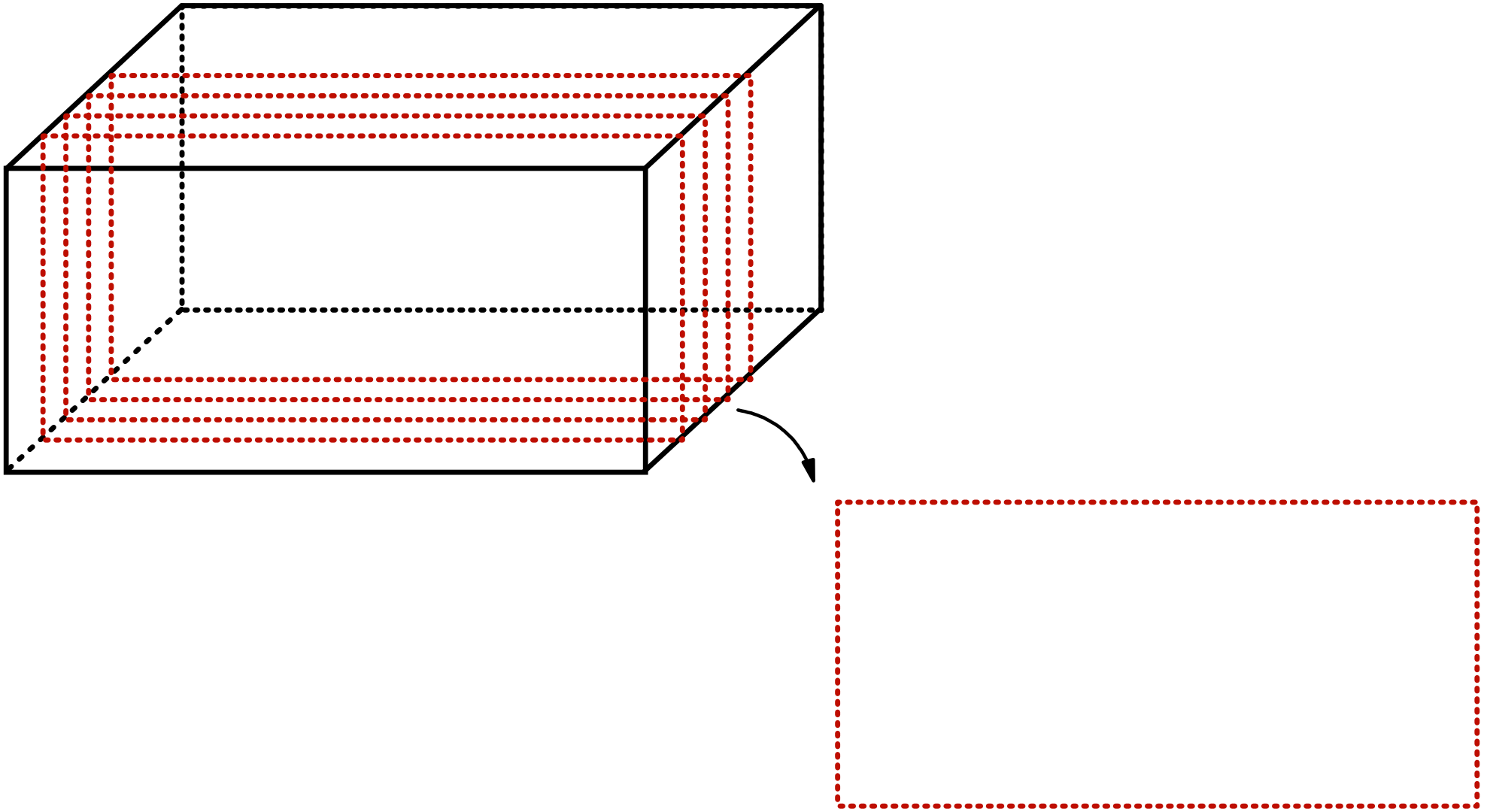

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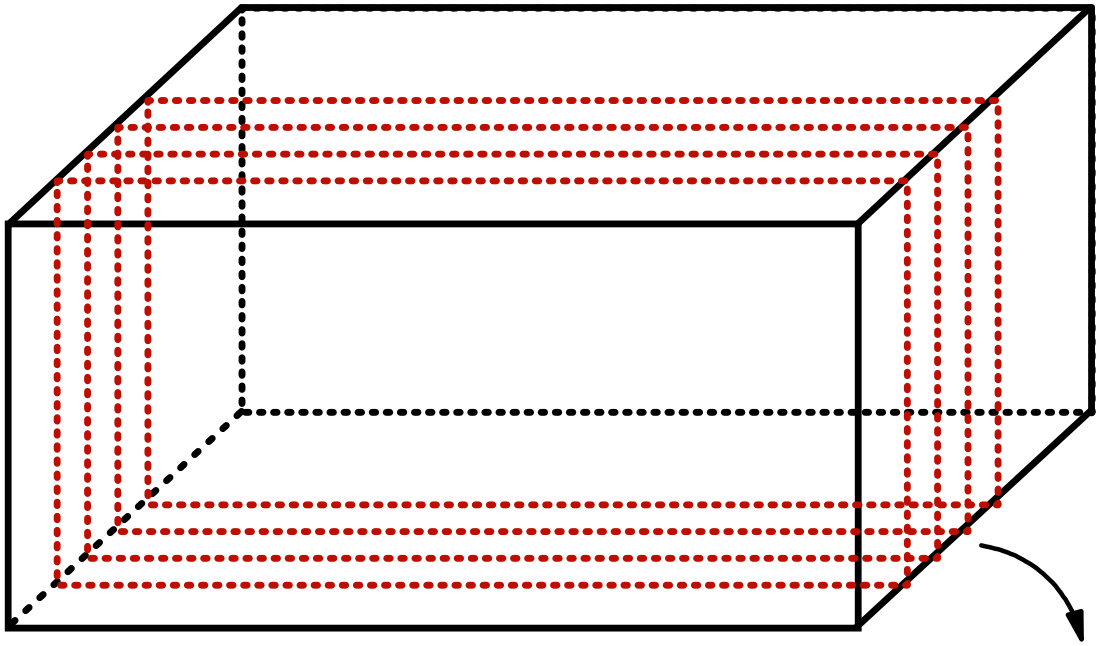
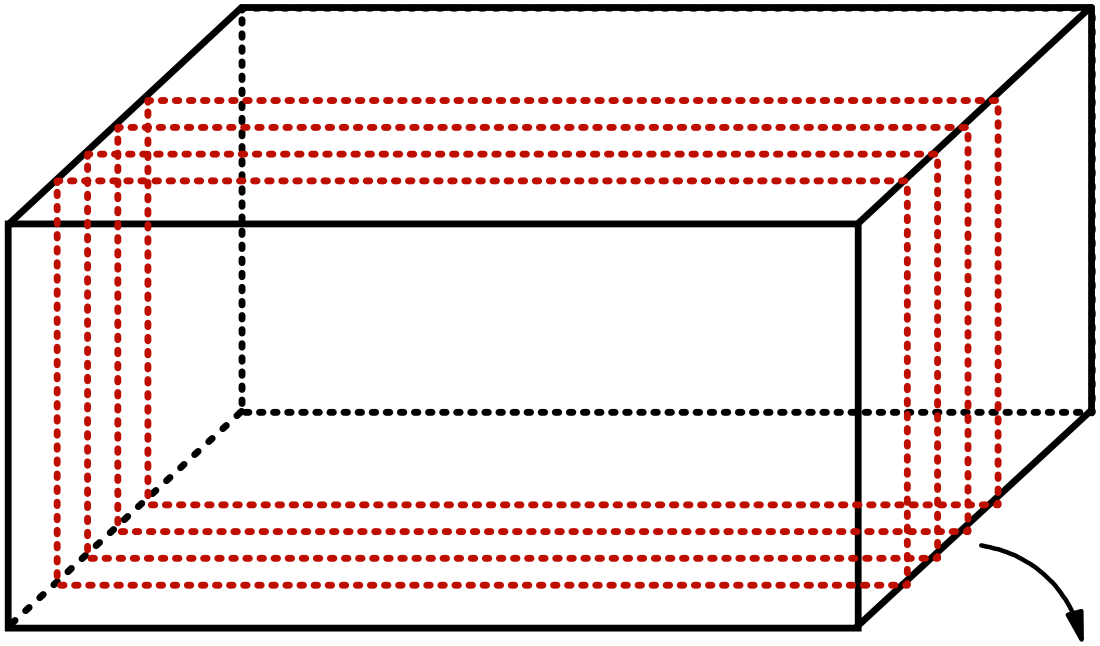


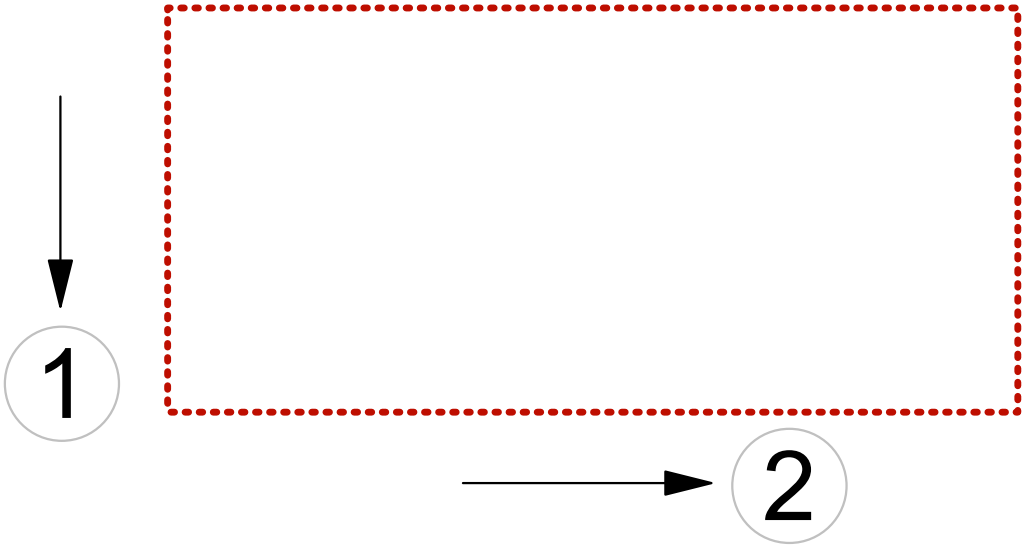
Data.Images(1 , ,)

1

SIS: 3D example



Data.Images(1 , 2 ,)



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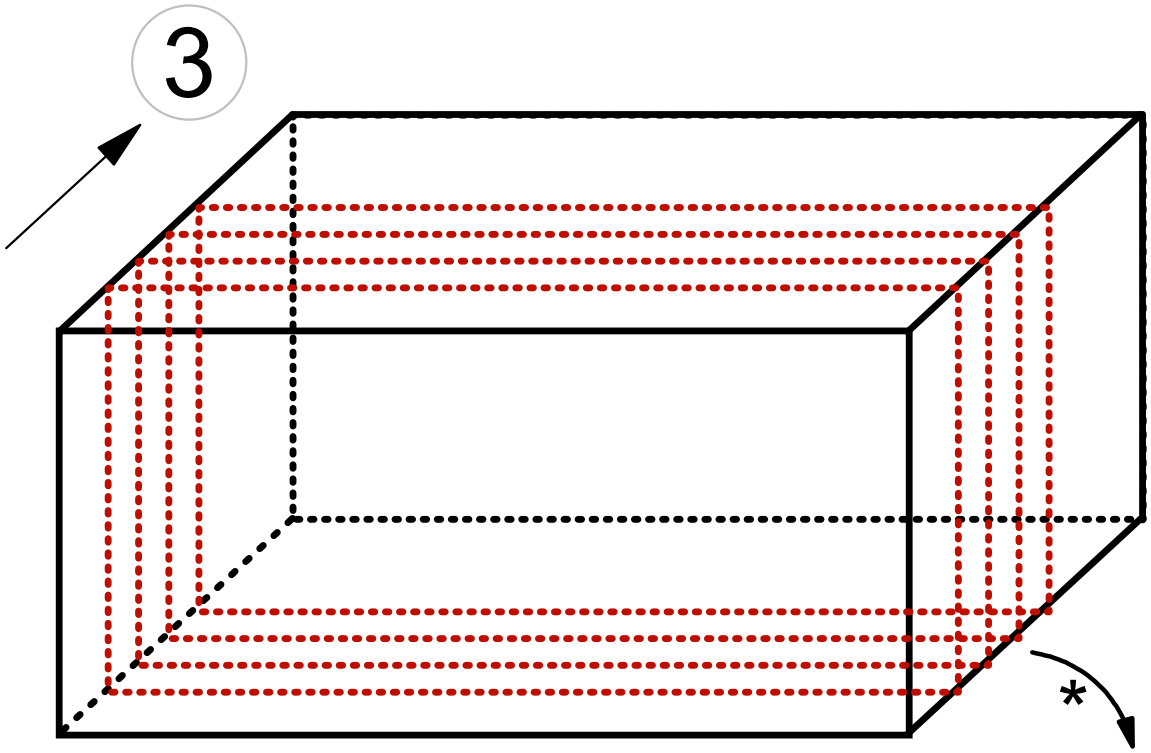
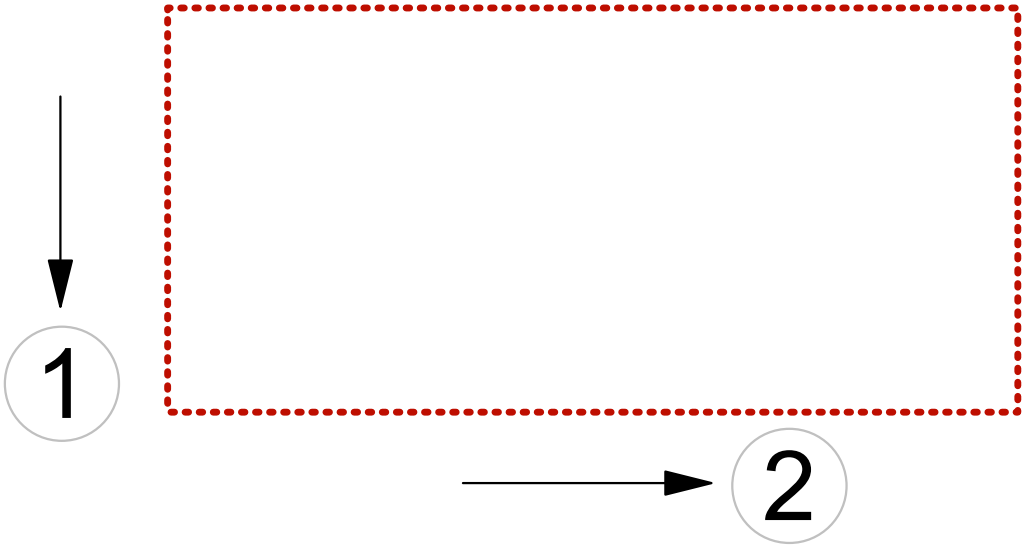


Data.Images(1 , 2 , 3)



* By sis_zoom

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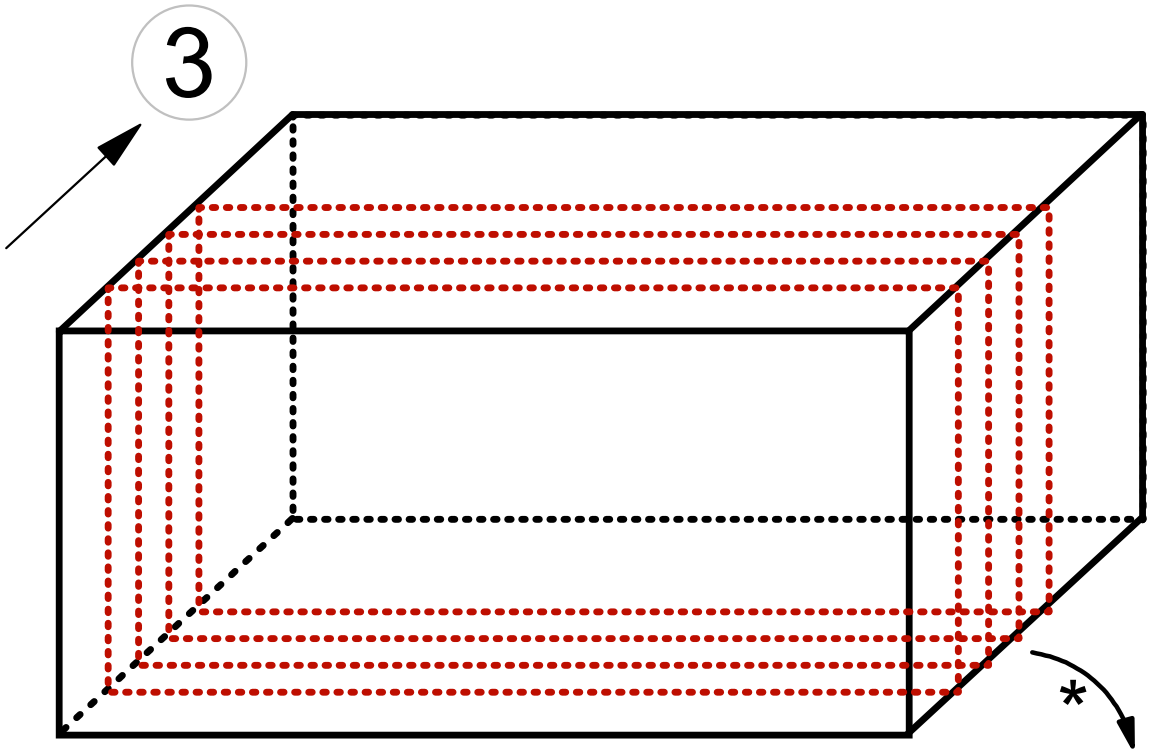
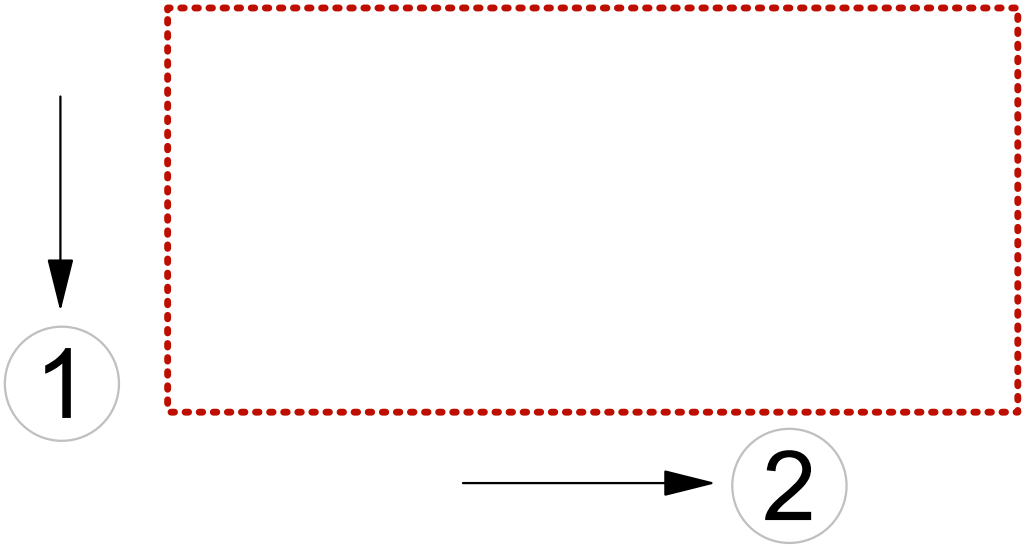


3 is fixed for this image

Data.Images(1 , 2 , 3)



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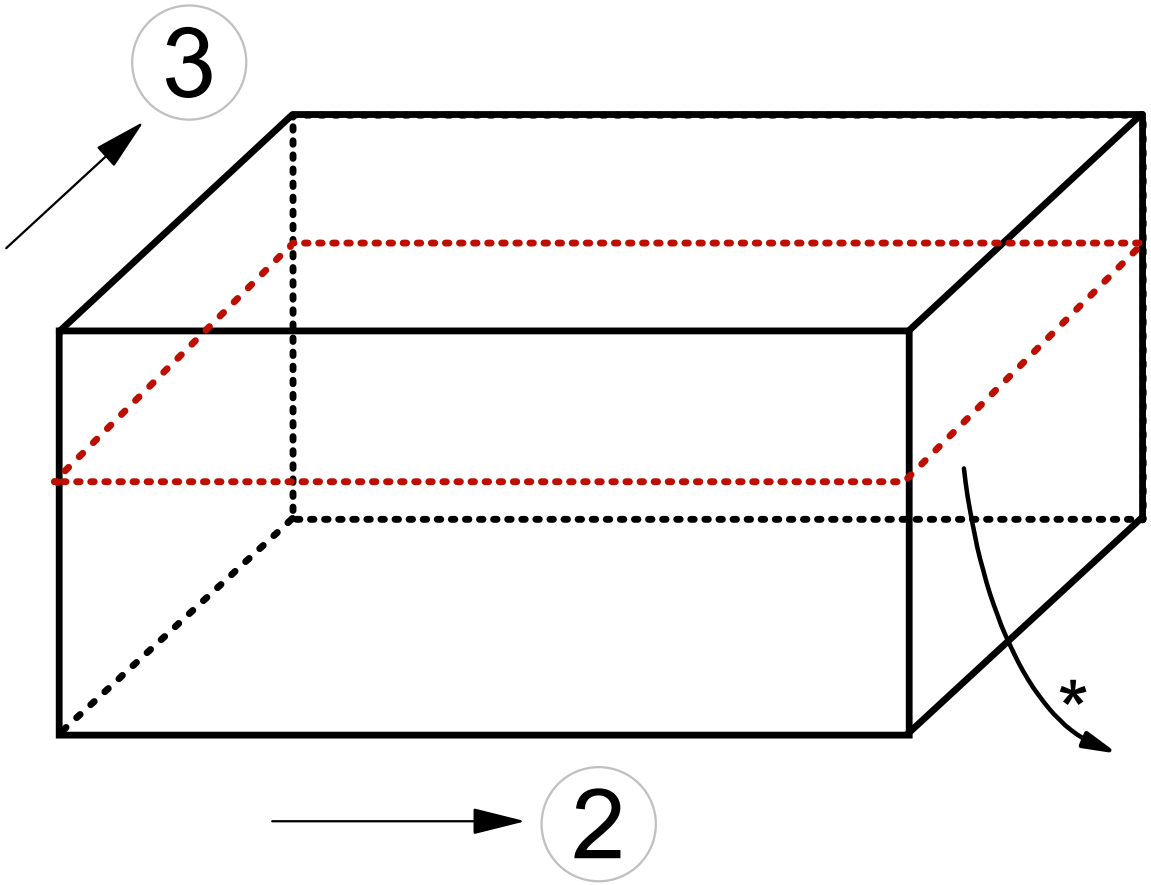
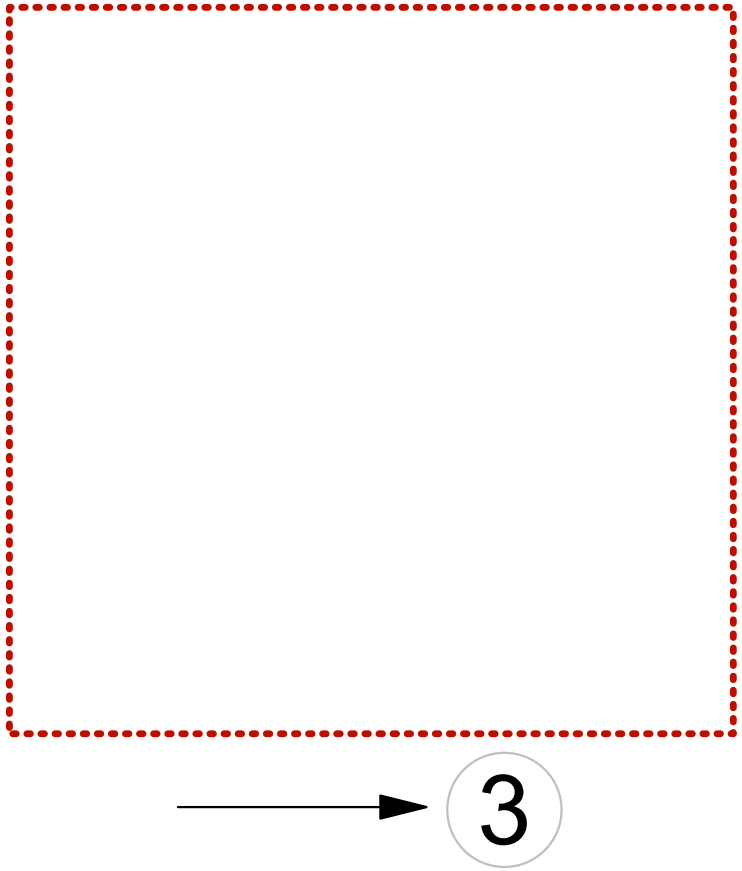


1 is fixed for this image



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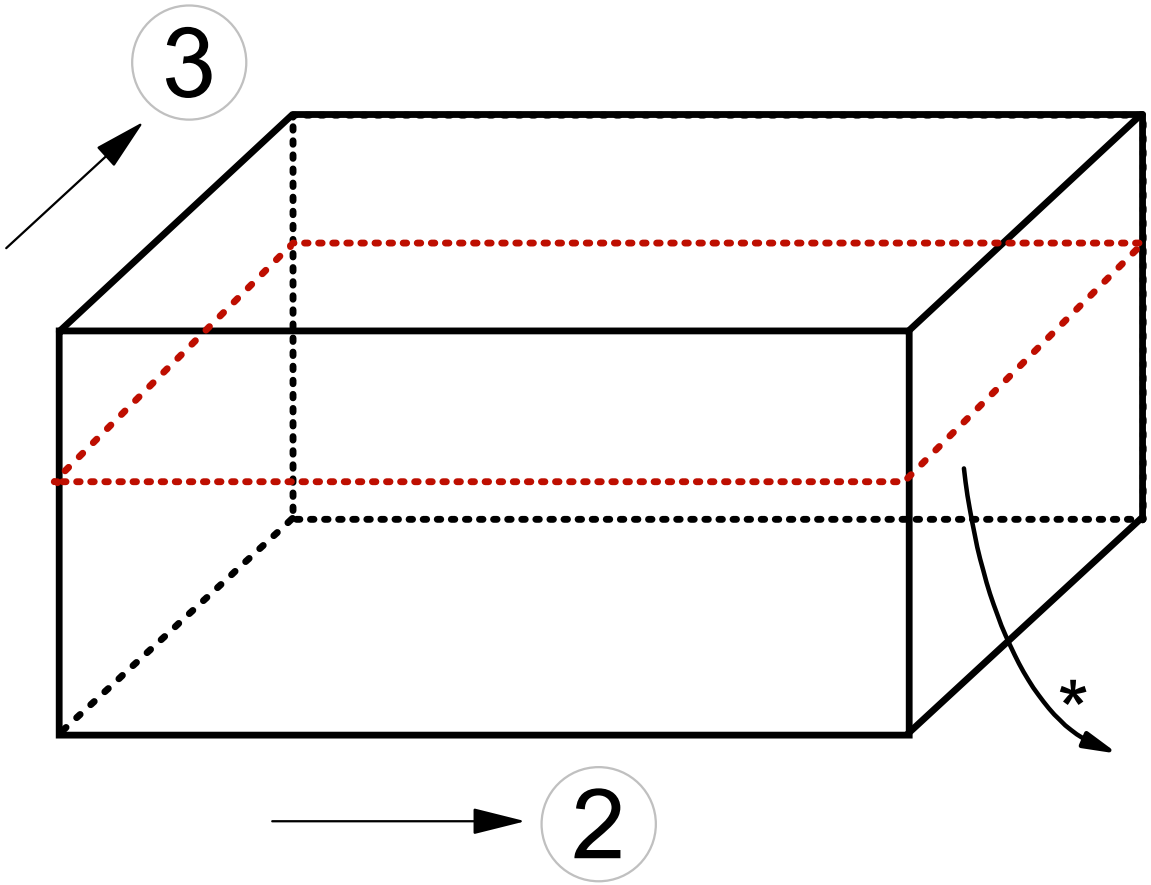

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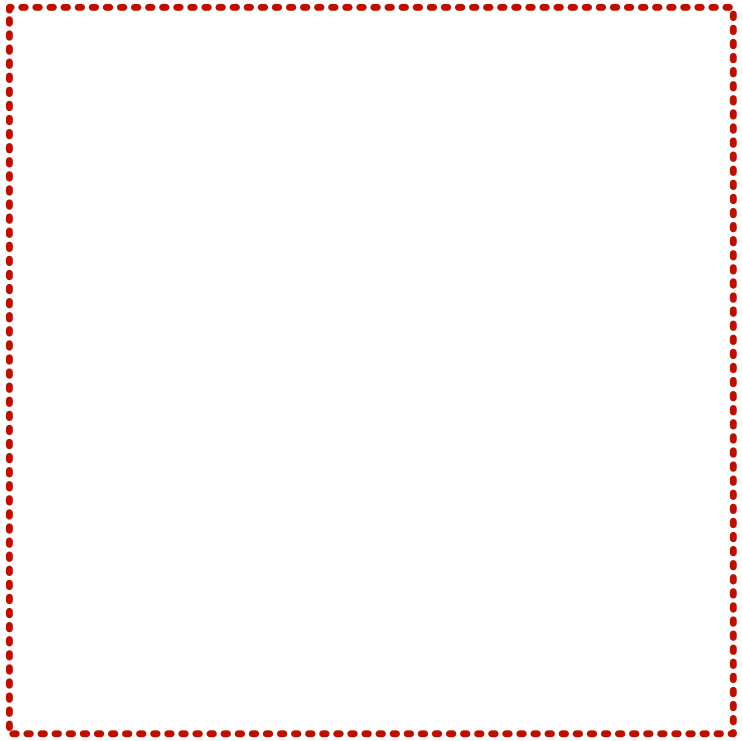

Data.Images(1 , 2 , 3)

* By sis_zoom

(New image)

SIS: 3D example

DataIn.Images is
100 by 50 by 25

```
DataOut = sis_zoom( DataIn, [45 1 1], [45 50 25], 'iii')
```

output input start stop mode

SIS: 3D example

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```
DataOut = sis_zoom( DataIn, [45 1 1], [45 50 25], 'iii')
```

output input start stop mode

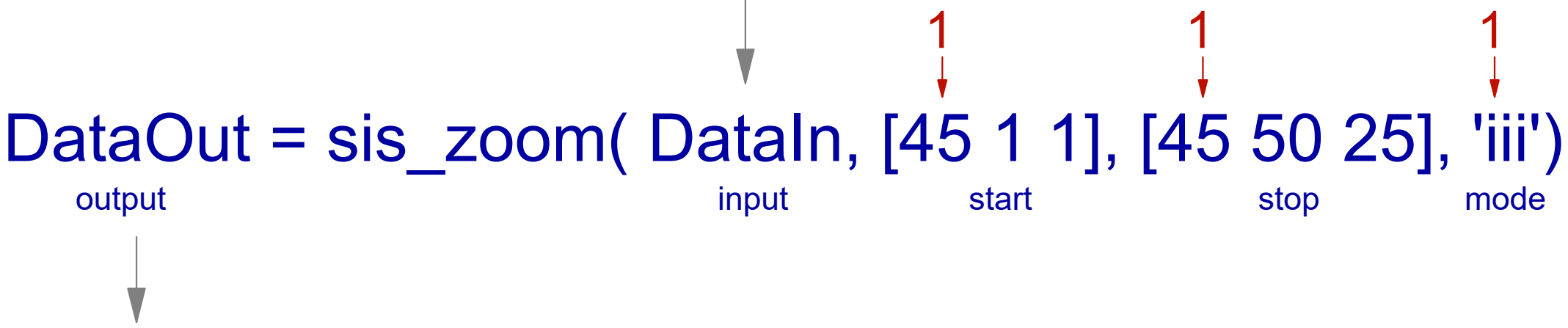
DataOut.Images is:

1 by 50 by 25 which is changed to 50 by 25

- Dimension 1 disappears
- Dimension 2 becomes dimension 1
- Dimension 3 becomes dimension 2
- (50 by 25 can be changed to 25 by 50 via sis_reorder)

SIS: 3D example

DataIn.Images is
100 by 50 by 25



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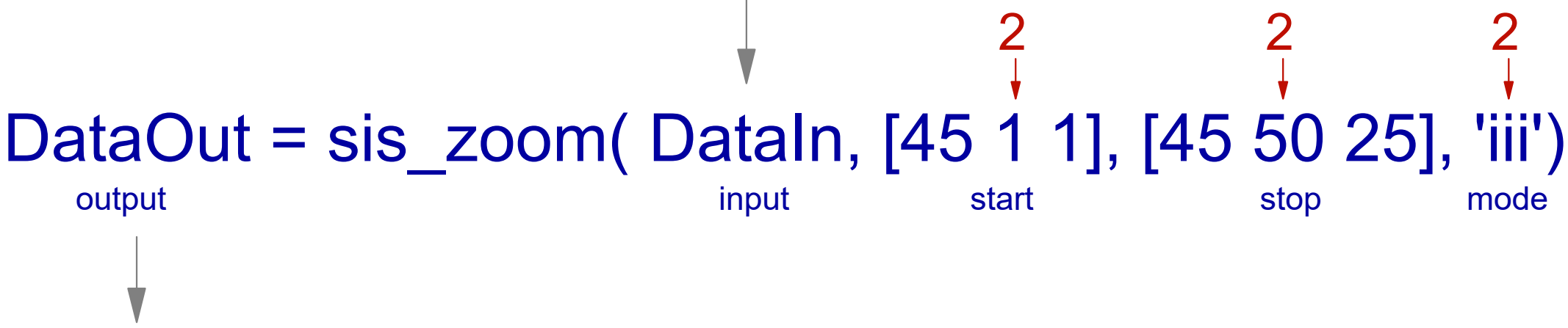

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Dimension 1 disappears

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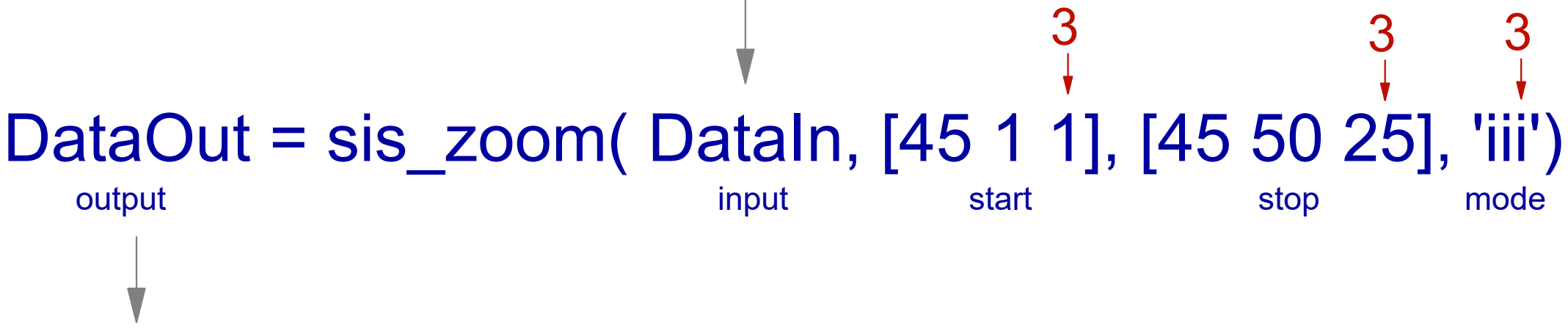
100 by 50 by 25



DataOut.Images is:

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Dimension 1 disappears

Dimension 2 becomes dimension 1

Dimension 3 becomes dimension 2

(50 by 25 can be changed to 25 by 50 via sis_reorder)

SIS: What do you need?

- MATLAB (ideal is 2017a, but others may also work)
- Image processing toolbox (plus more?)

Teaching assistants
-how can they help?

Here you need Oraculus:

```
MyImage = ones(3,3);
MyImage = 3*MyInage;
```

Here you might need a teaching assistant (TA):

```
MyImage = ones(3,3);
imagesc( [1 5 6], [22 23 50], MyImage); colorbar;
```

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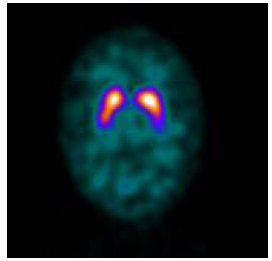

Møde om Kandidatuddannelsen

Torsdag, 29. September 2022
kl 17:15 - 19:00
?

This afternoon

You are here

17:00

Forming teams

349.005

(two phantoms at a time, starting with teams 1 and 2)

Optical scanning of phantom

Jens E. Wilhjelm

349.019,025,034

(all other teams)

Treasure hunt
(see the plan)

Try examples in SIS guide

Work with data from optical scanning
(homepage)

Cecilie & Alberte

Team establishment

(only for those not in a team)

Procedure:

- If you are a bachelor from MedTek, try to form team
- If not a bachelor from MedTek OR not forming a team with only MedTek:
  - Come to me right now
  - Presentation round
  - Forming of teams

All teams:

- Within 1 hour, submit to jwil@dtu.dk a mail with:
  - Team members name and study ID
  - Team title, if you so desire

The last slide of today

My basic philosophy:

- I hear, and I forget
- I see, and I know where to look for it later
- I write & draw, and I remember
- I do, and I understand

and ...

- We do not teach *biomedical engineering*, we teach you to be *a biomedical engineer*