

BornAgain quick start

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MLZ is a cooperation between:

Outline

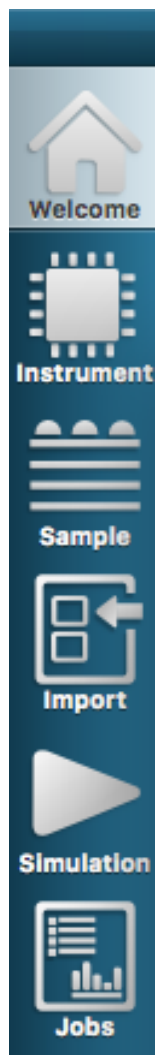
- GUI overview
- GUI quick start: first simulation
- Python quick start: first simulation
- Embedded particles, particle positioning
- Particle rotation
- Particles with size distribution

Templates and solutions

```
$ git clone https://github.com/scgmlz/BornAgain-tutorial.git
```

```
$ cd BornAgain-tutorial/quickstart
```

GUI Overview



← Create new or load saved project

← Define beam and detector parameters

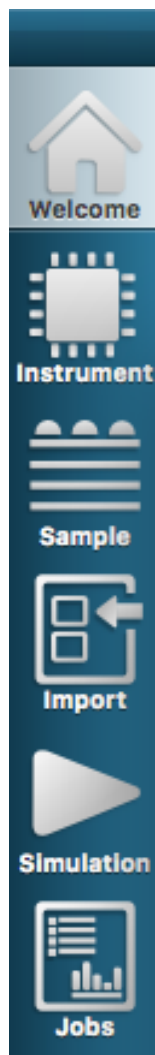
← Define sample

← Import experimental data

← Set up and run simulation; export to Python script

← View results

GUI Overview



← Create new or load saved project

← Define beam and detector parameters (tomorrow, G. Pospelov)

← Define sample

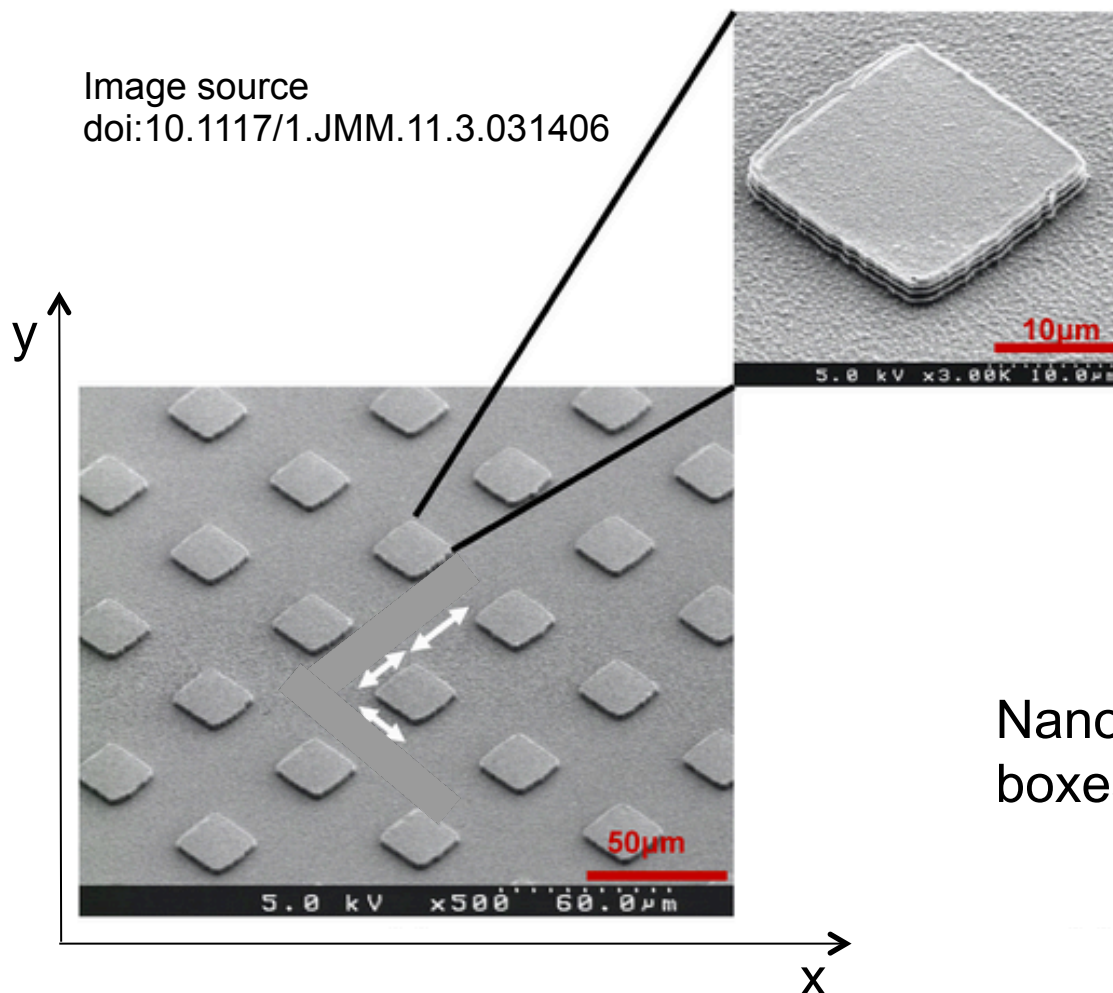
← Import experimental data (tomorrow)

← Set up and run simulation; export to Python script

← View results

Exercise1: Si Nano dots on Si substrate

Image source
doi:10.1117/1.JMM.11.3.031406



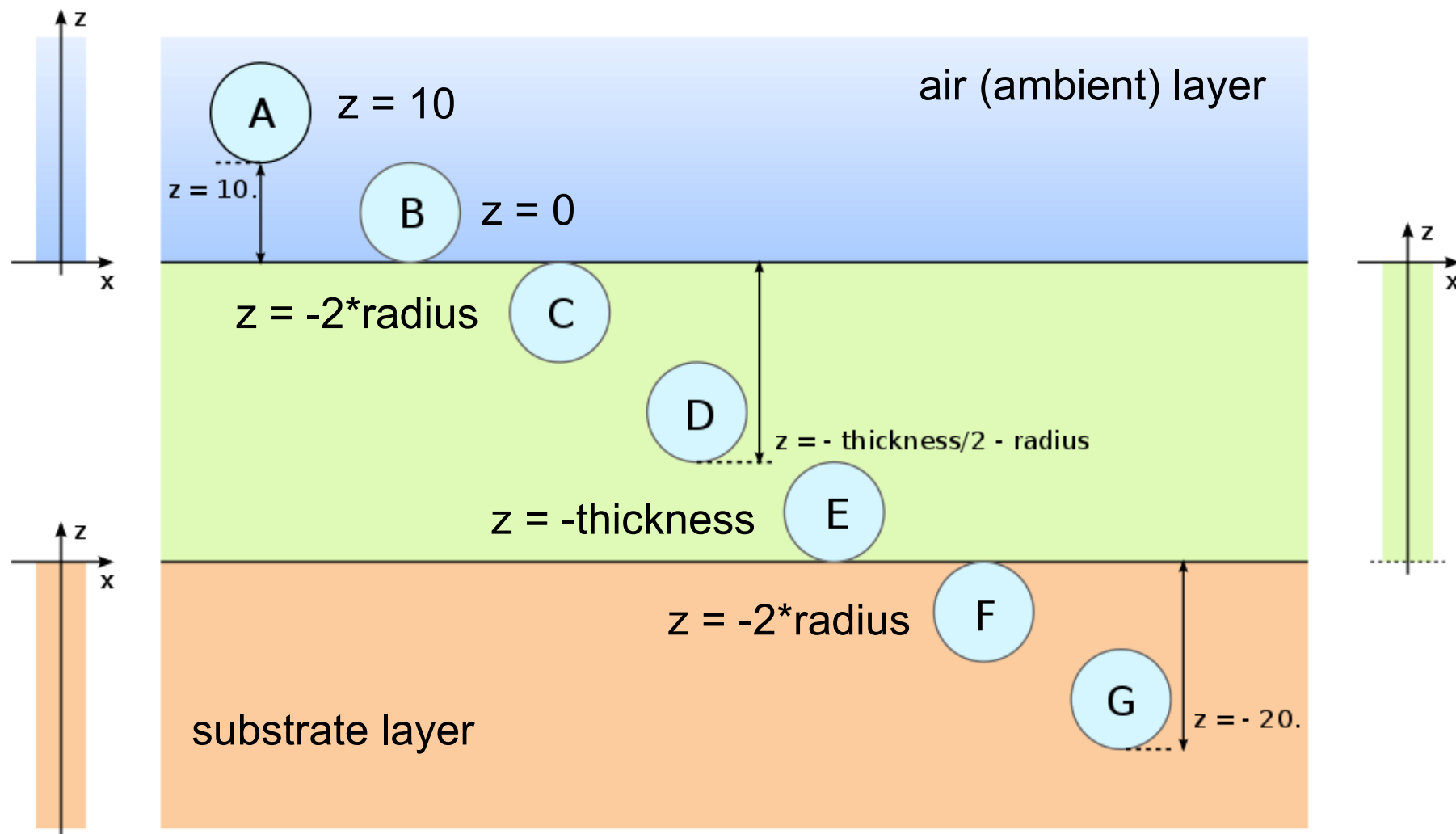
Simulation parameters

Wavelength:
 $\lambda(\text{Cu } K_{\alpha}) = 1.54 \text{ \AA}$

Index of refraction:
 $\delta_{\text{Si}} = 7.6 \times 10^{-6}$
 $\beta_{\text{Si}} = 1.7 \times 10^{-7}$

Nano dots:
 boxes 20 nm x 20 nm x 10 nm

Particle positioning



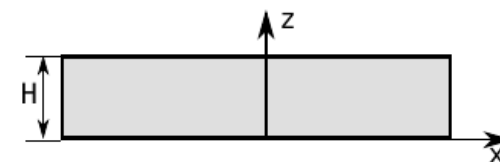
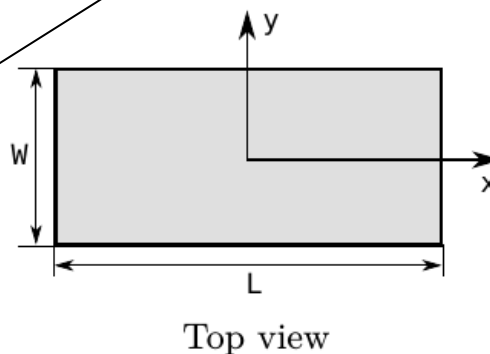
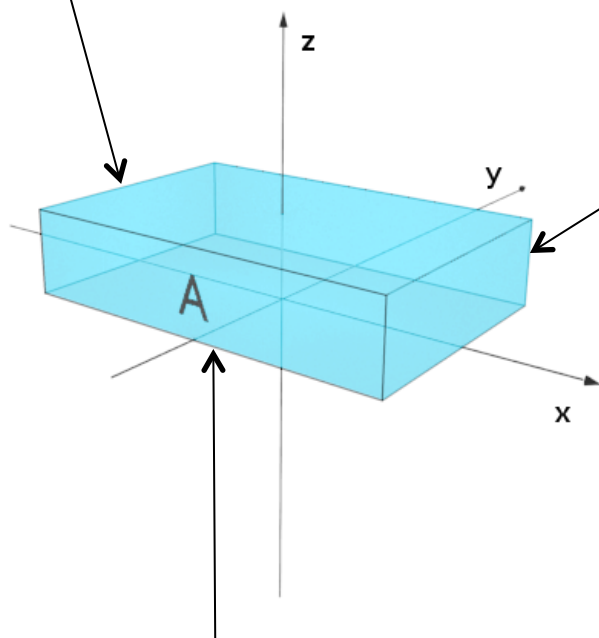
http://www.bornagainproject.org/documentation/usage/scripting/particles_positioning

Exercise 2: Particle positioning

Particle rotation: particle in BornAgain

width along the Y axis

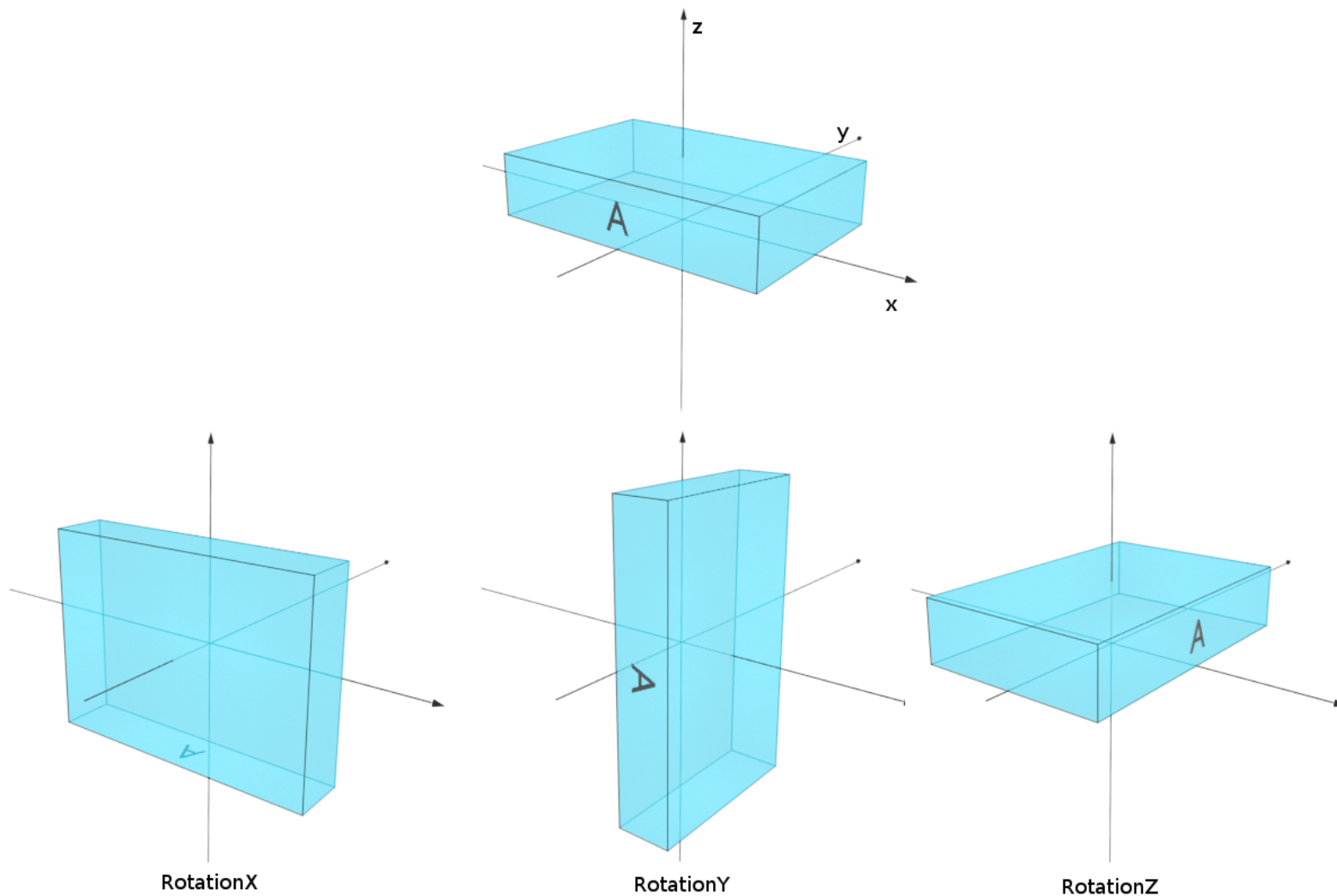
height along the Z axis



length along the X axis (parallel to the beam direction)

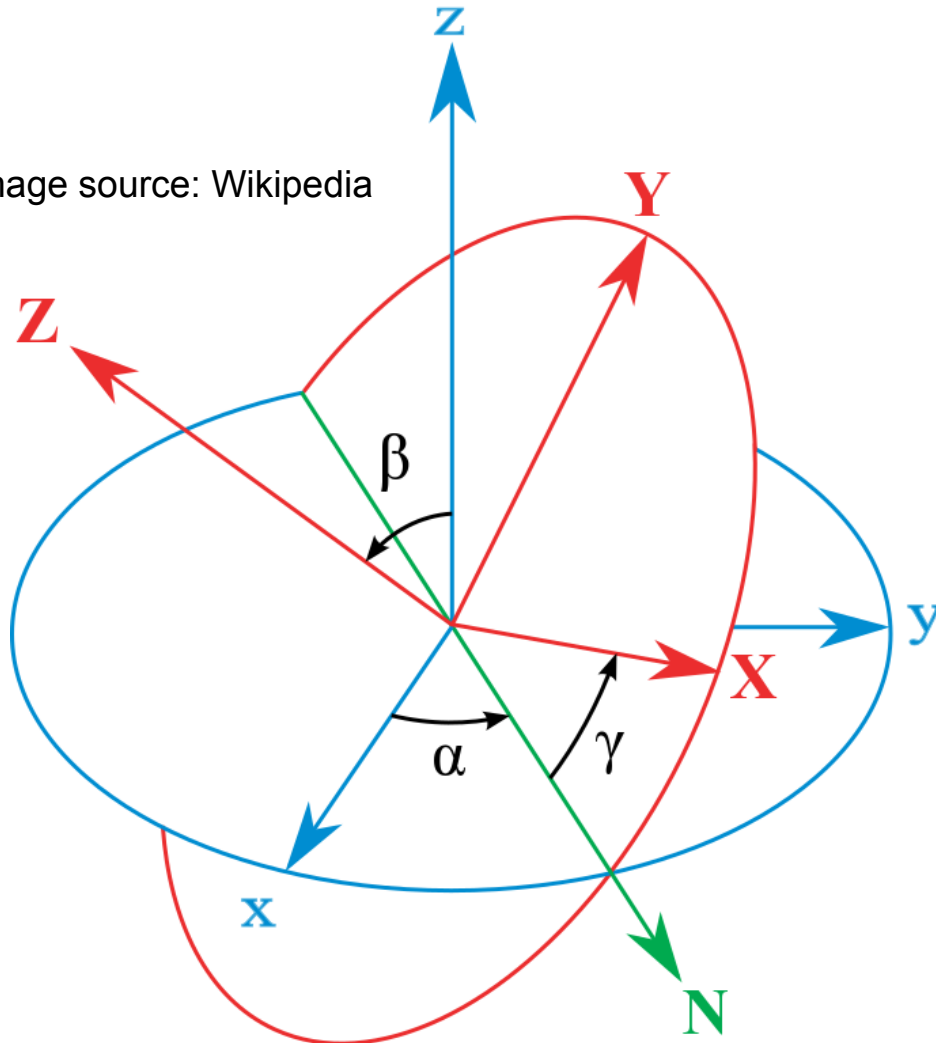
http://www.bornagainproject.org/documentation/usage/scripting/particles_rotation

Particle rotation: rotation classes



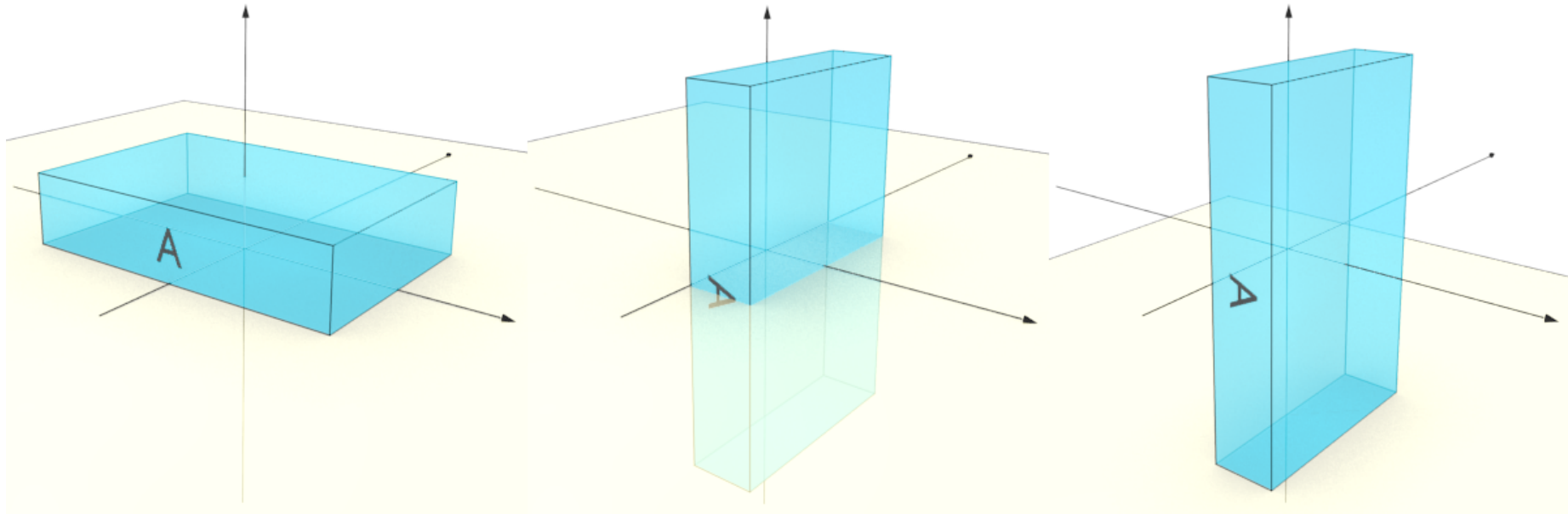
Particle rotation: Euler rotation

Image source: Wikipedia



x, y, z – original coordinate system
 X, Y, Z – rotated coordinate system
 $N = Z \times z$ – vector product

Particle rotation: warning



Rotation may shift the particle along Z axis.

➔ Particle position may need to be adjusted with respect to the layer coordinate system

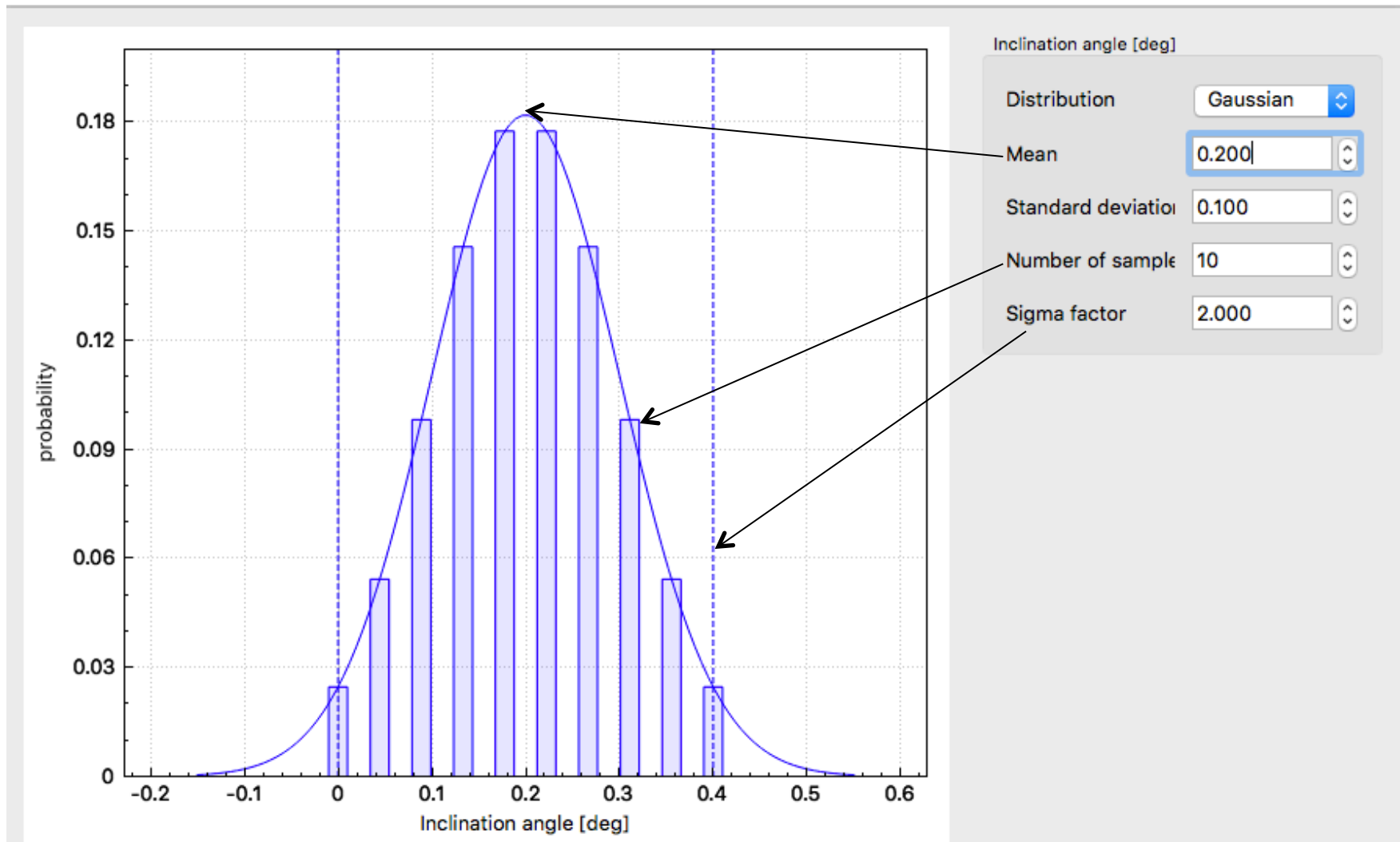
Exercise 3: Particle rotation

1D Distributions in BornAgain

- DistributionGate (min, max)
- DistributionLorentz (mean, hwhm)
- DistributionGaussian (mean, std_dev)
- DistributionLogNormal (median, scale_param)
- DistributionCosine (mean, sigma)

Custom distribution can be created manually.

Parameters of the distribution



Exercise 4: Particles with size distribution