BornAgain quick start

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Outline

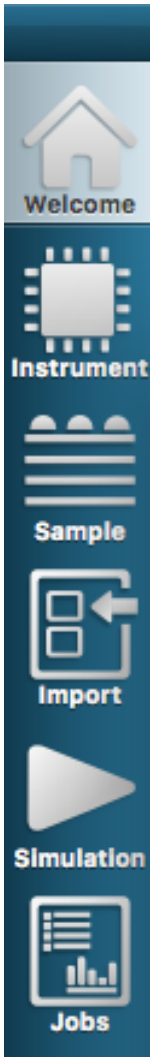
- GUI overview
- GUI quick start: first simulation
- Python quick start: first simulation
- Embedded particles, particle positioning
- Particle rotation
- Particles with size distribution

Templates and solutions

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

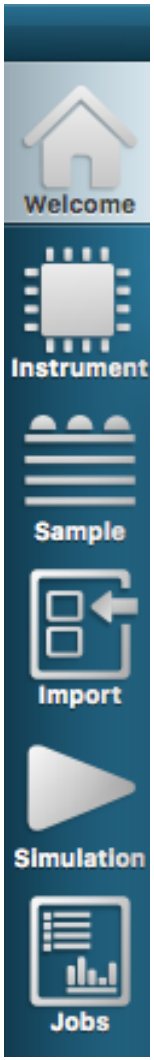
$ cd BornAgain-tutorial/quickstart

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

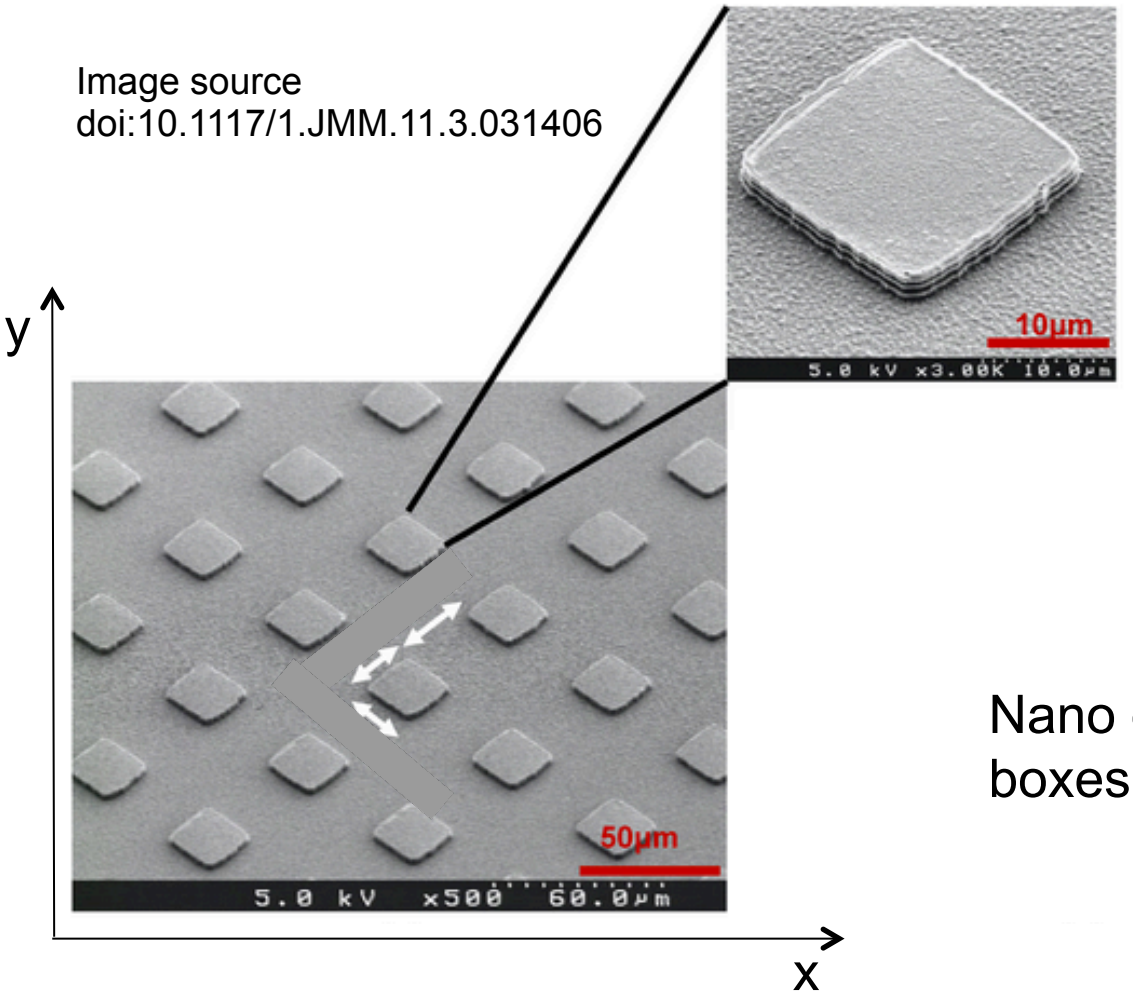
GUI Overview



- 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:

$\lambda(\text{Cu } K_\alpha) = 1.54$ Å

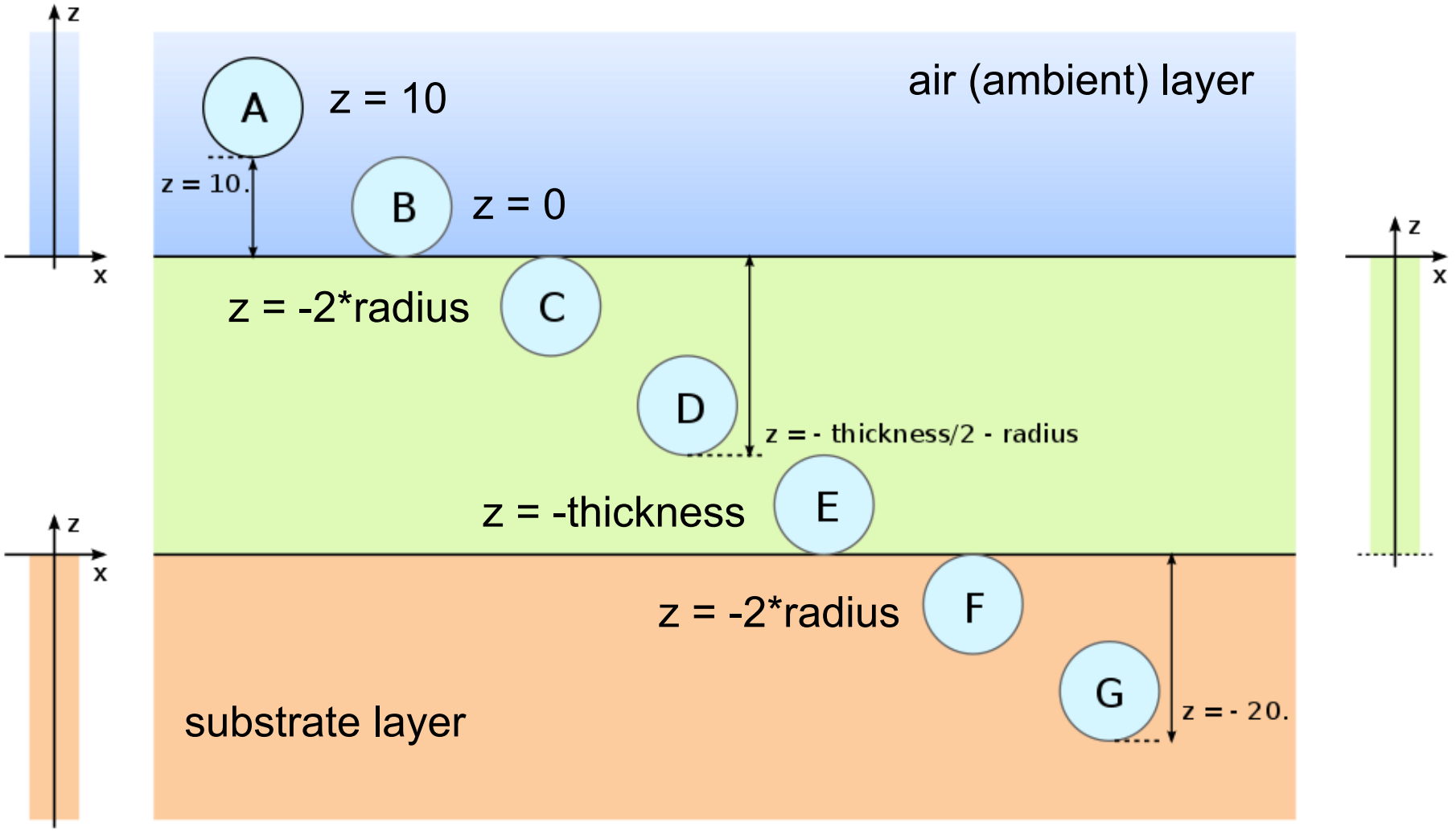
Index of refraction:

$\delta_{Si} = 7.6 \times 10^{-6}$

$\beta_{Si} = 1.7 \times 10^{-7}$

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

Particle positioning



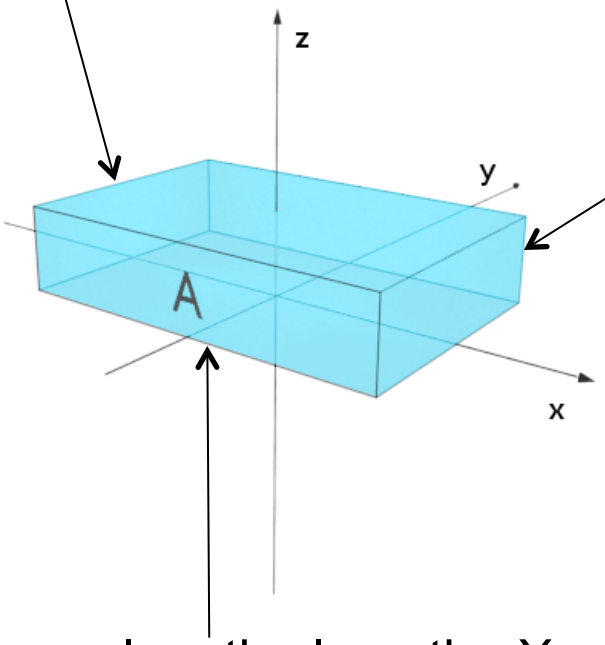
http://www.bornagainproject.org/documentation/usage/scripting/particles_positioning

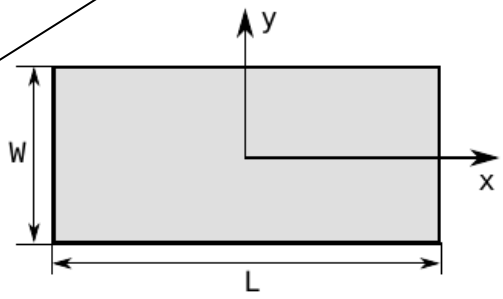
Exercise 2: Particle positioning

Particle rotation: particle in BornAgain

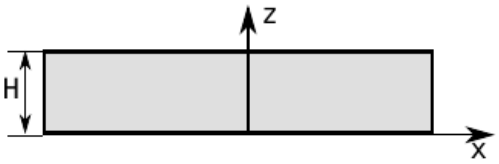
width along the Y axis

height along the Z axis





Top view

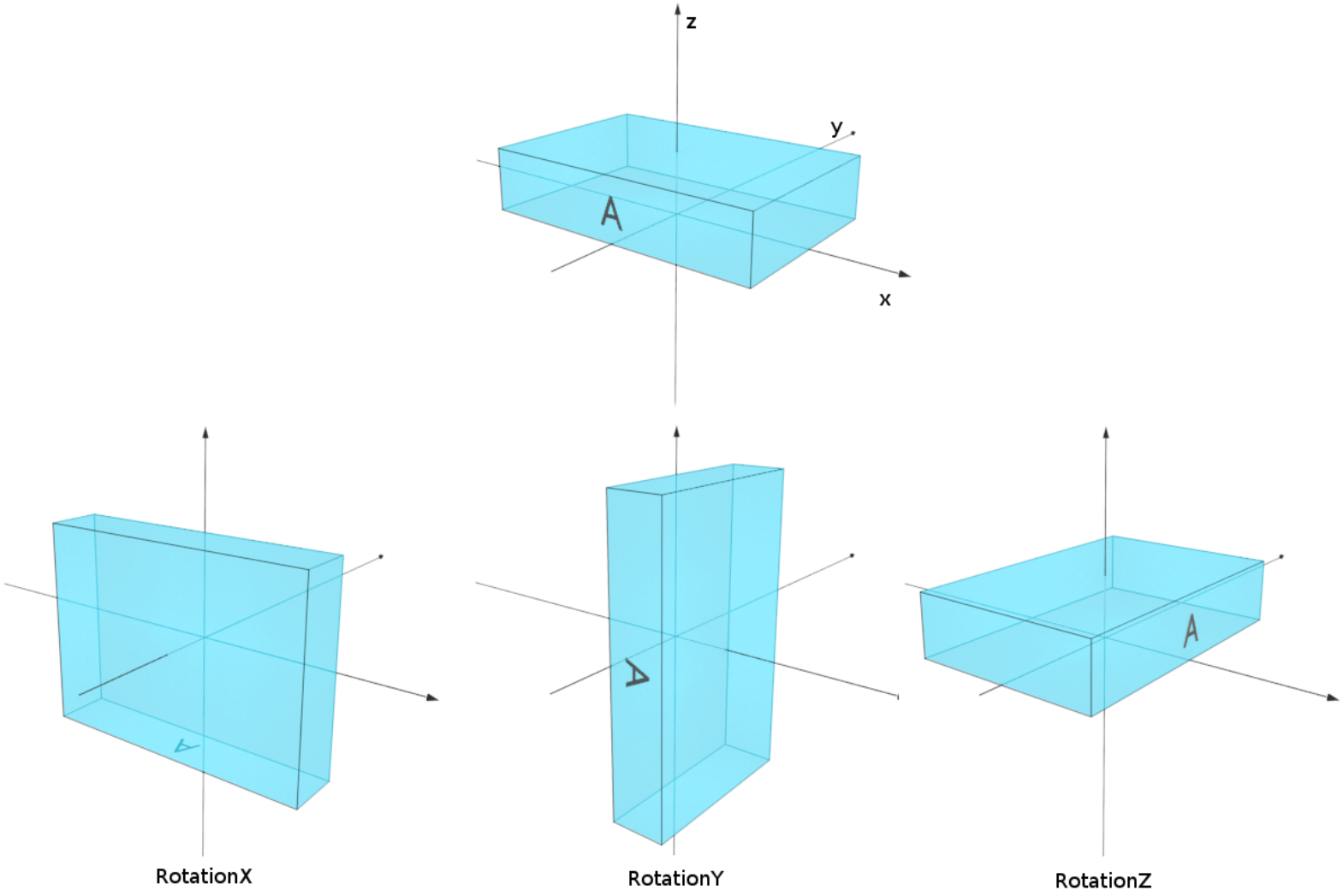


Side view

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

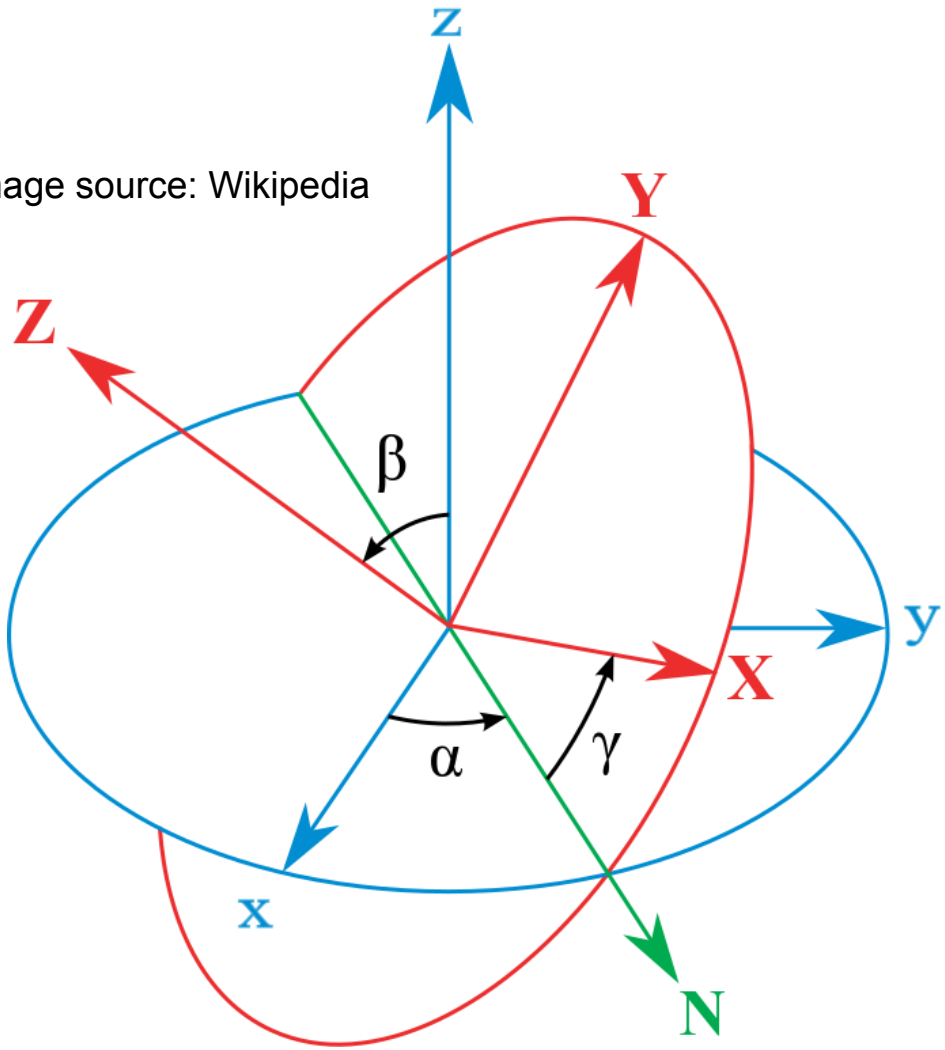
http://www.bornagainproject.org/documentation/usage/scripting/particles_rotation

Particle rotation: rotation classes



Particle rotation: Euler rotation

Image source: Wikipedia

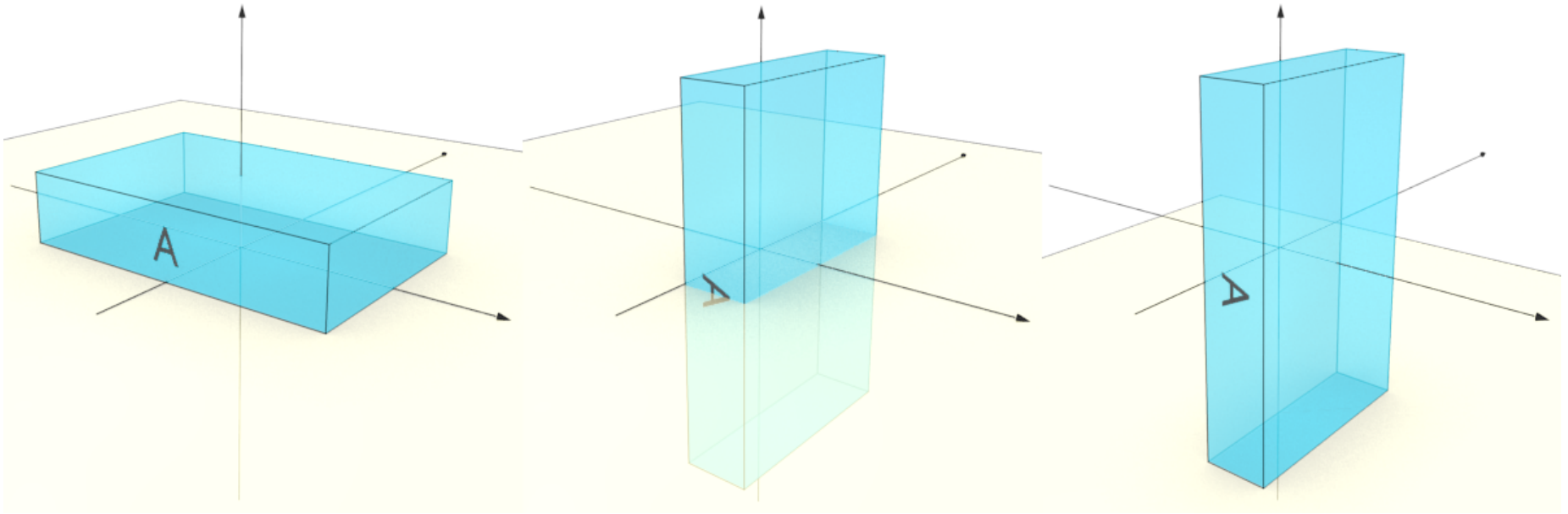


x, y, z – original coordinate system

X, Y, Z – rotated coordinate system

N = Z × 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

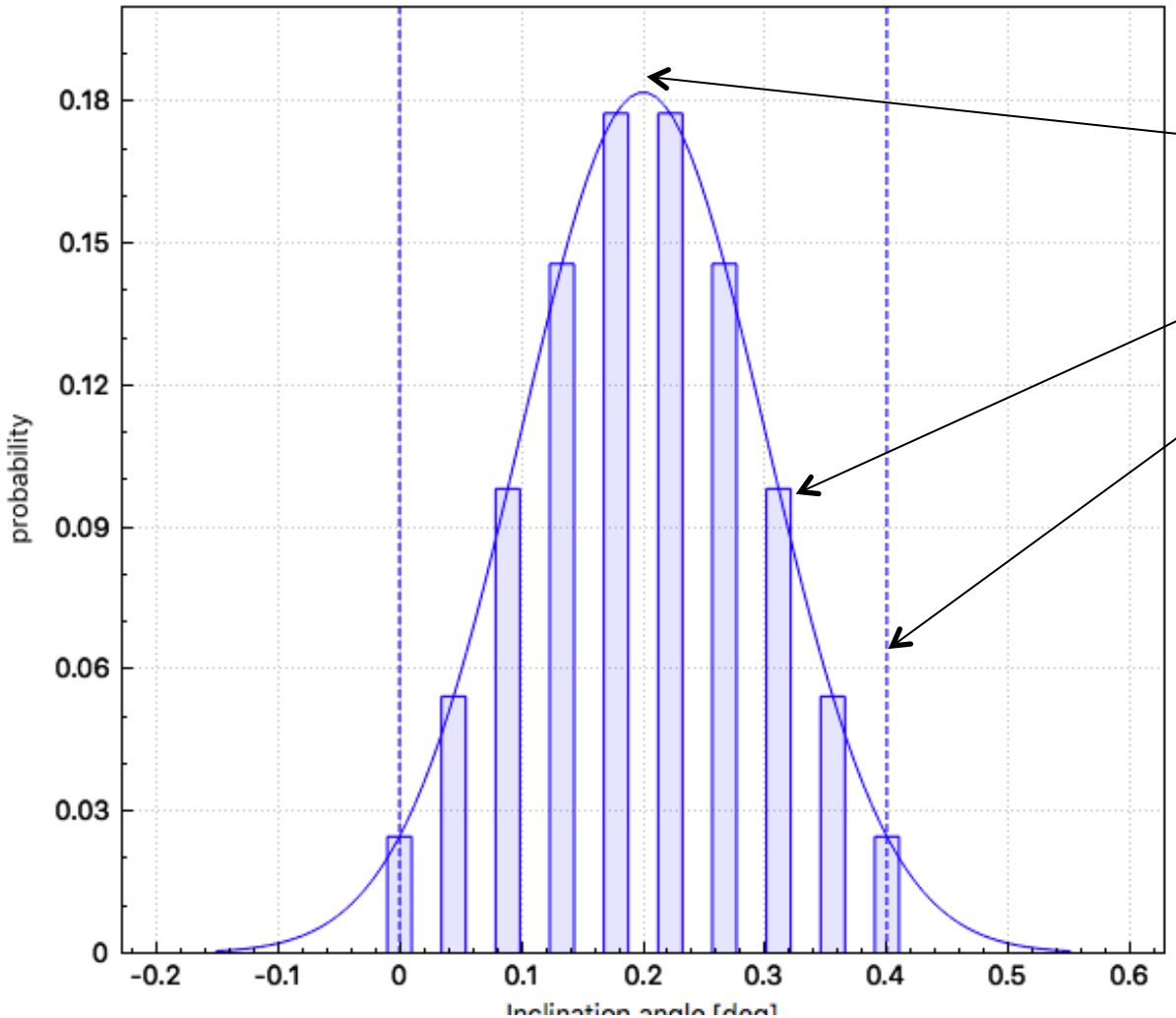
Exercise 3: Particle rotation

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



Inclination angle [deg]

Distribution	Gaussian
Mean	0.200
Standard deviatio	0.100
Number of sample	10
Sigma factor	2.000

Exercise 4: Particles with size distribution