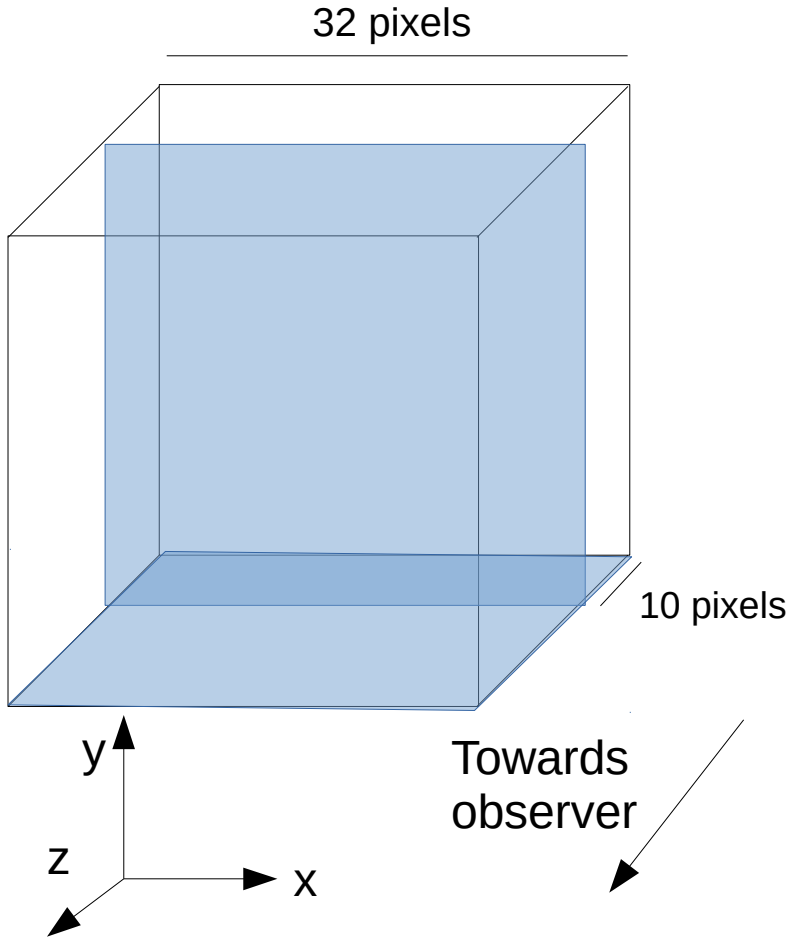# POLARIS axes & rotations

(Sanity checks)

Mock cube with constant B, n, n_{cr}

32 pixels

10 pixels

y

z

x

Towards observer

- Example tests of a 32^3 cube
- Break symmetry with slices with n_{cr} = 0 (at y = 0 and at z = 10) – helps identify axes at a glance
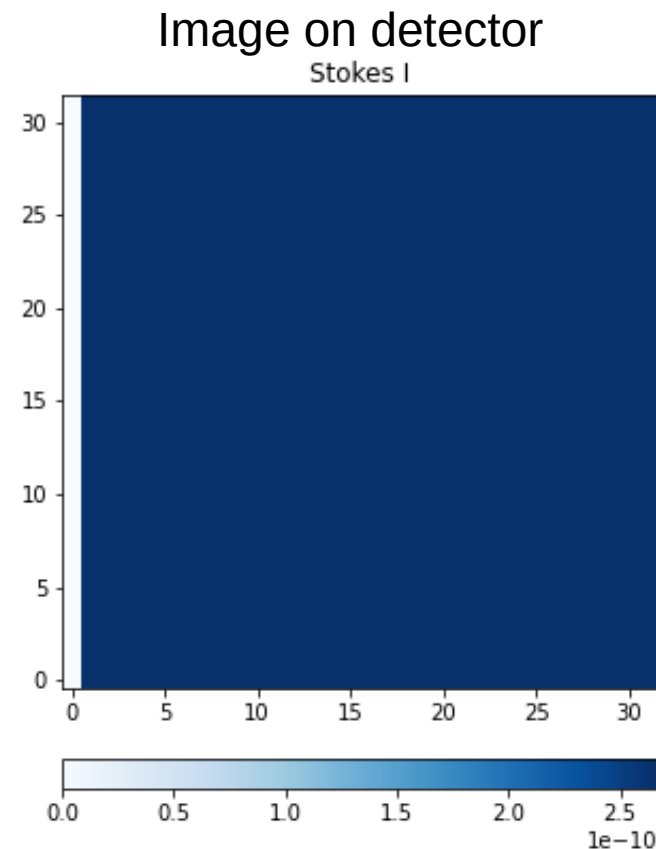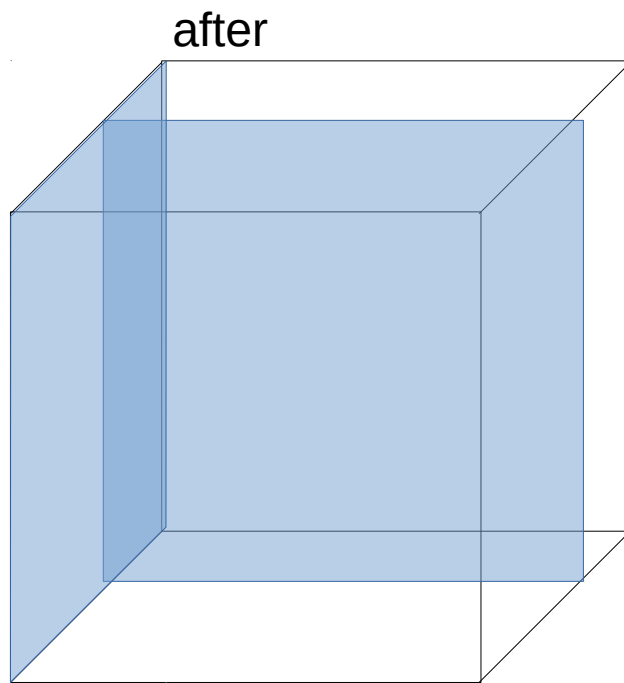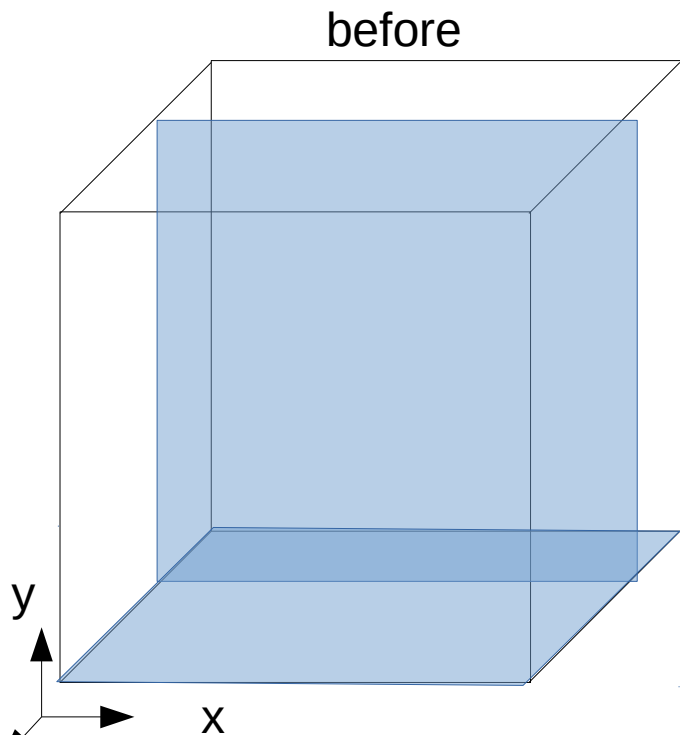- Run octree conversion and POLARIS synchrotron emission (various detectors, i.e. observer locations)

Detector rotated around x by 90°

before

after

Image on detector

Stokes I
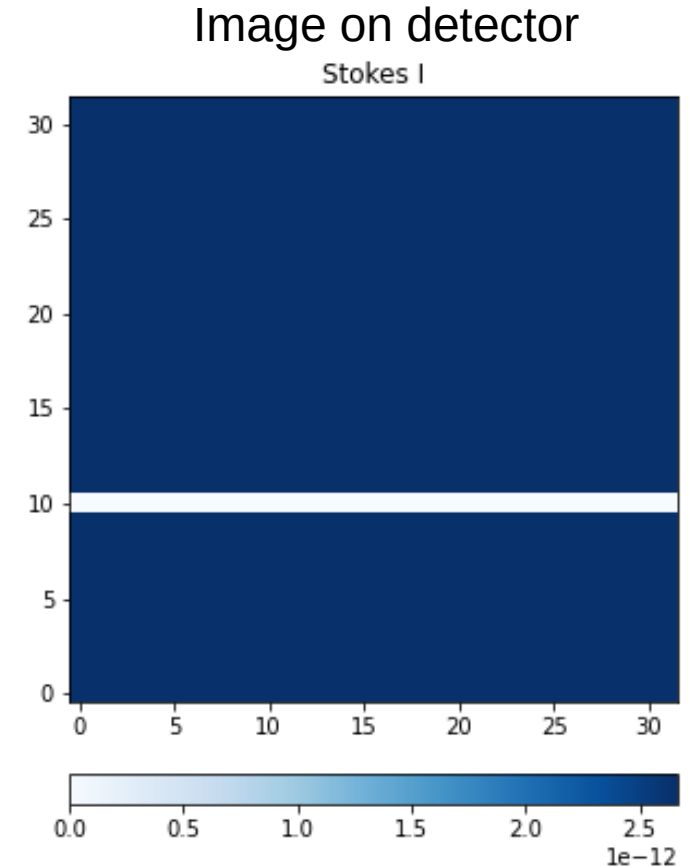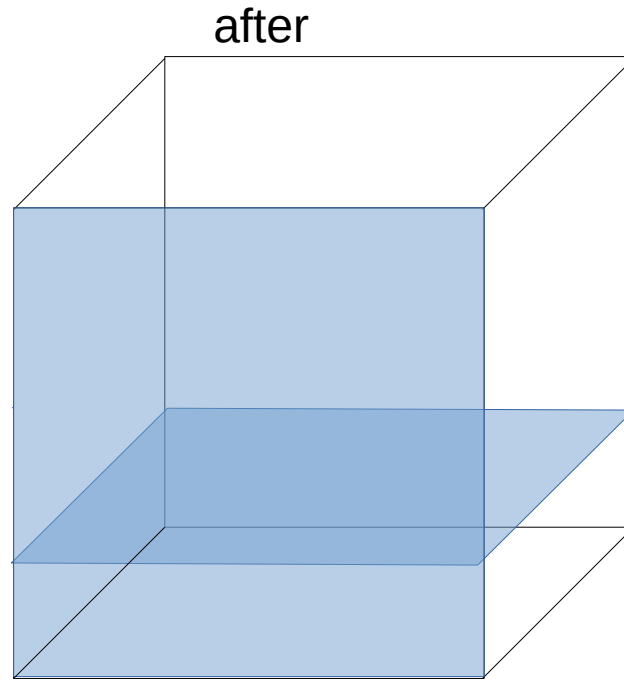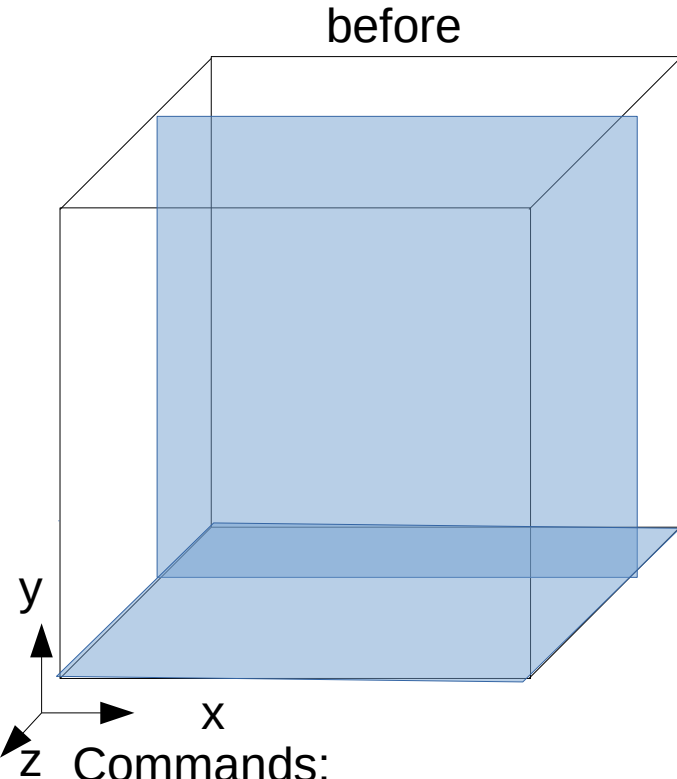
y
x
z
Commands:
<axis1> 1 0 0
<axis2> 0 0 1
<detector_sync nr_pixel = "32">   29.9   29.9   1   1   90.0   0.0   6.0e+22

Detector rotated around z by 90º

before

after

Image on detector

Stokes I
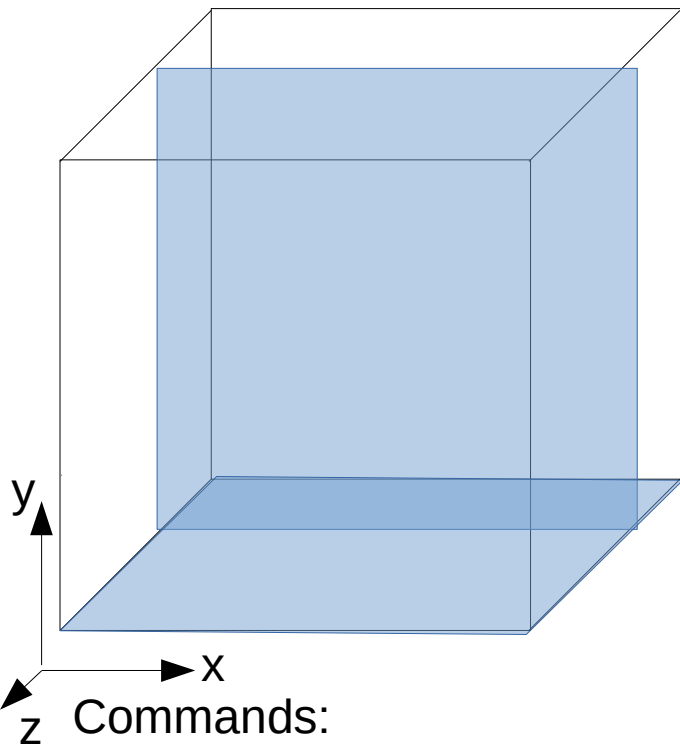

y

x

z

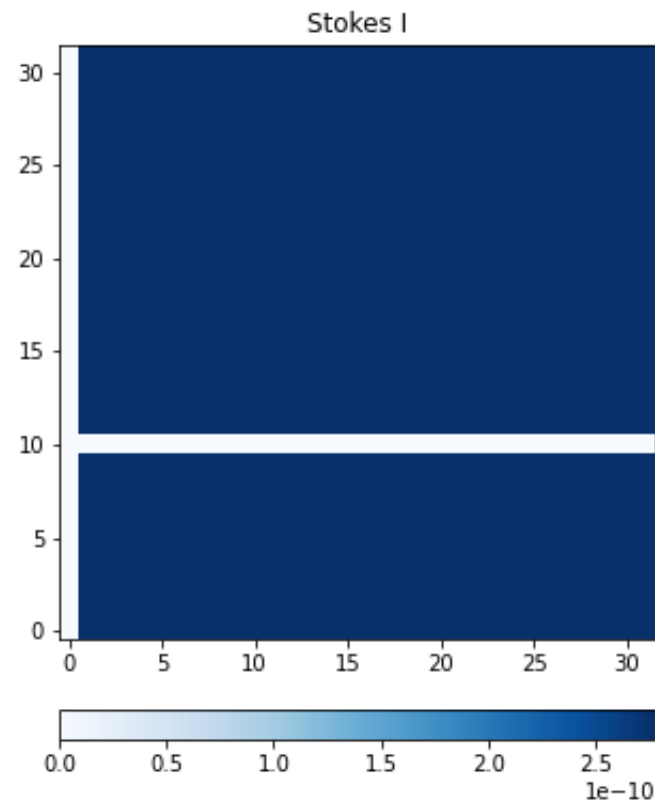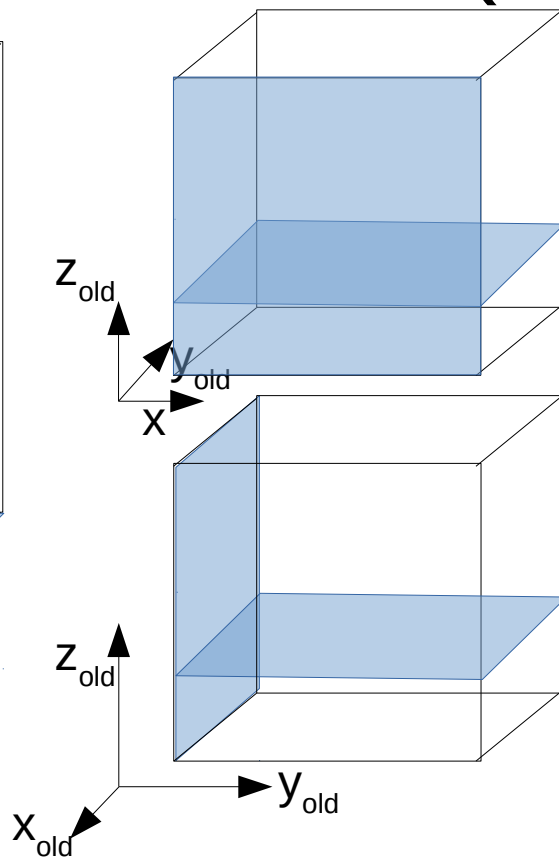Commands:

<axis1> 1 0 0

<axis2> 0 0 1

<detector_sync nr_pixel = "32">   29.9   29.9   1   1   0.0   90.0   6.0e+22

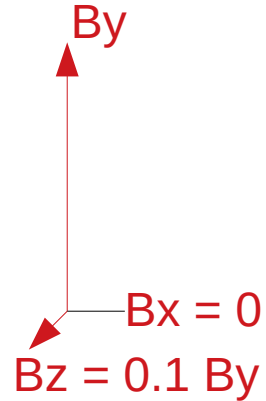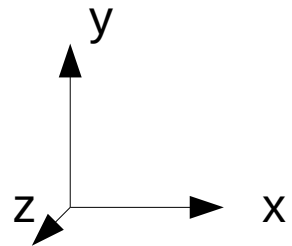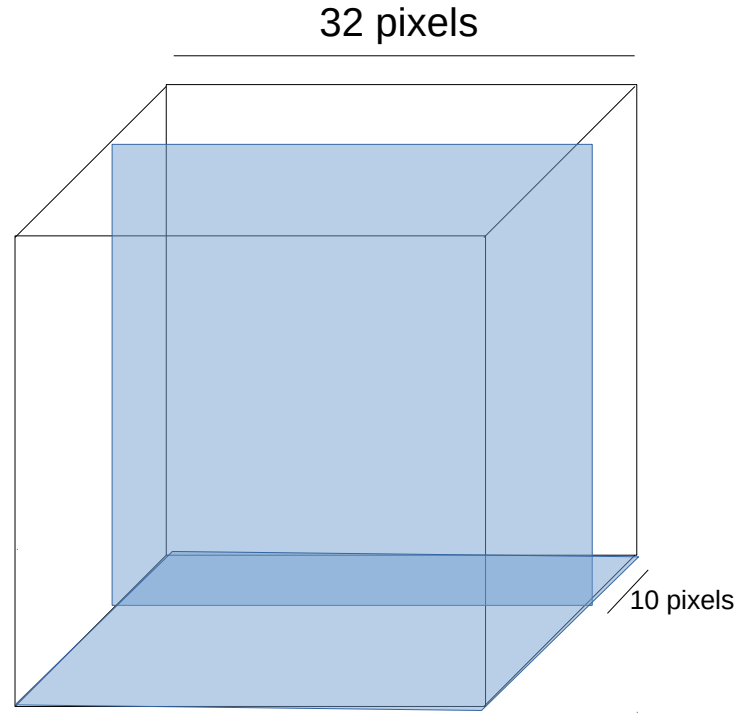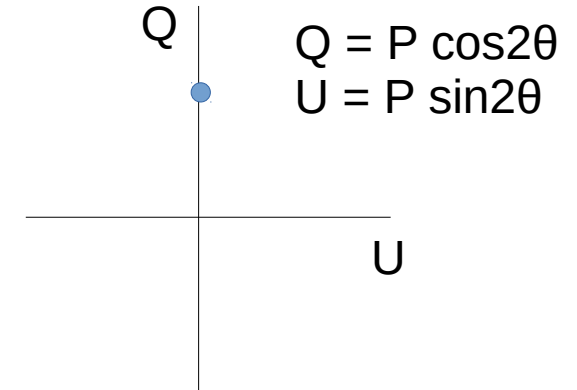# Detector rotated first around x by 90° and then around (old) z by 90°

Commands:
<axis1> 1 0 0
<axis2> 0 0 1
<detector_sync nr_pixel = "32">   29.9   29.9   1   1   90.0 90.0   6.0e+22

Magnetic field vector

32 pixels

By

Bx = 0

Bz = 0.1 By

10 pixels
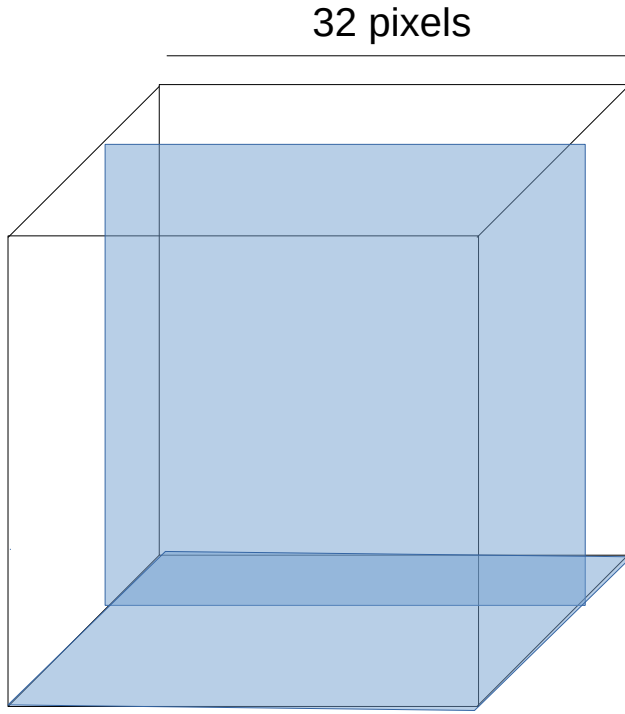
y

z x

Polarization angle defined in POLARIS (derived from these tests - not what is shown in manual)

y (North)

θ

x

Q

U

$Q = P \cos 2\theta$

$U = P \sin 2\theta$
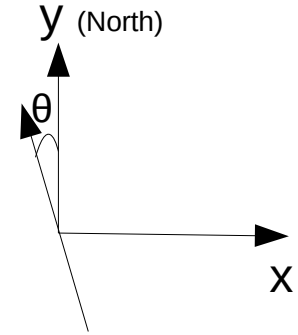
Stokes parameters, no rotation

32 pixels

By

Bx = 0

Bz = 0.1 By

Observed:
θ = 0°
Q > 0
U = 0

y
z
x

Stokes for rotation around x by 90°

before

after

By

Bx = 0

Bz = 0.1 By

y

x

z
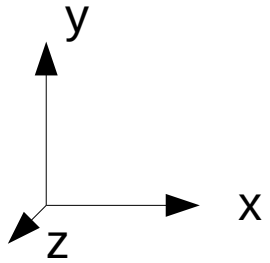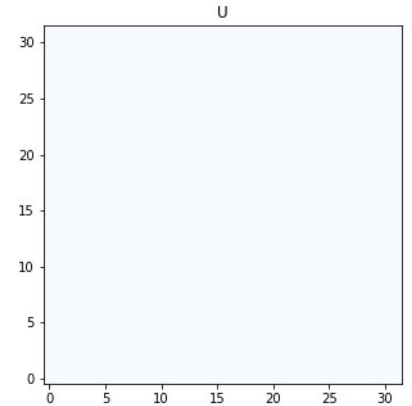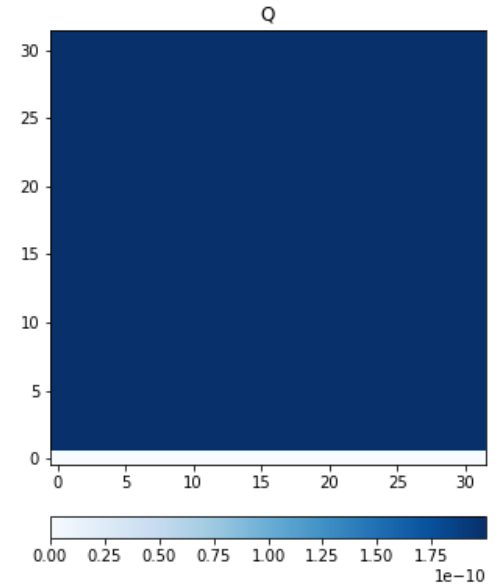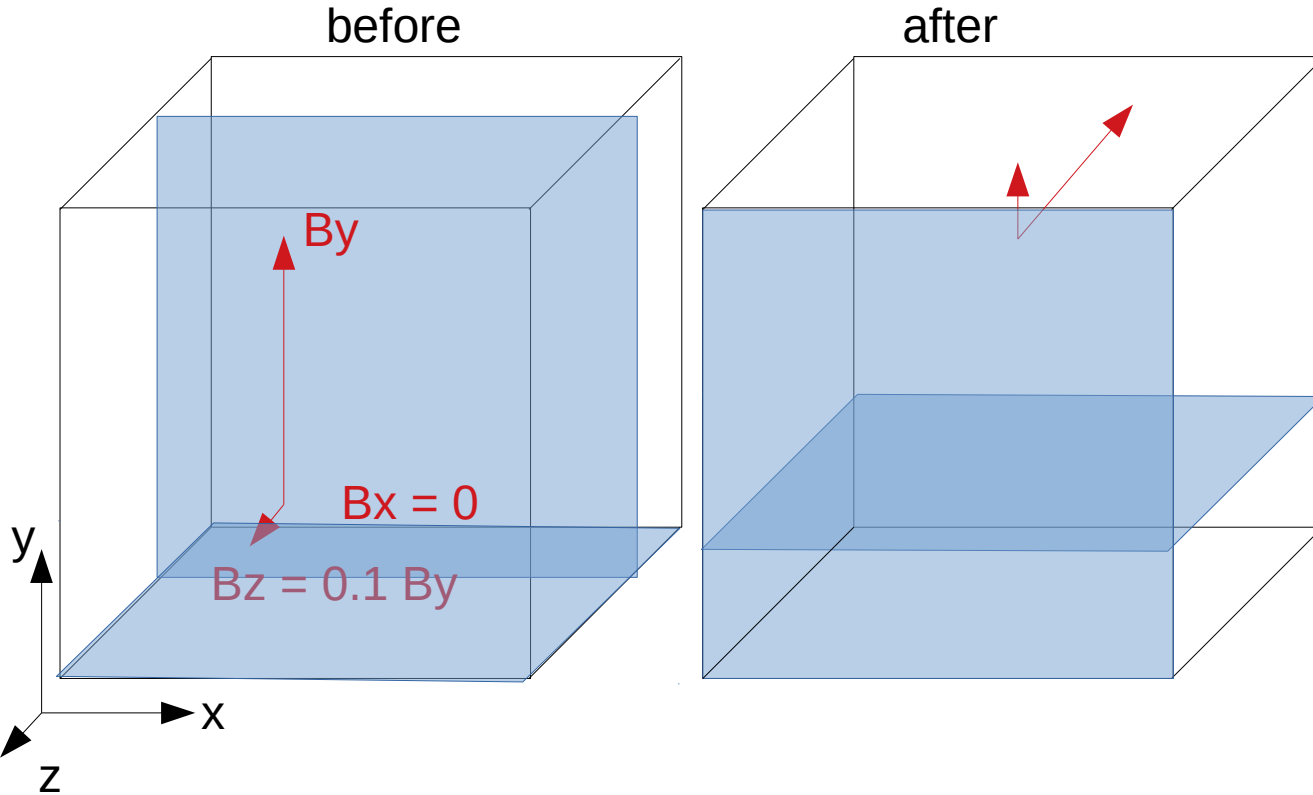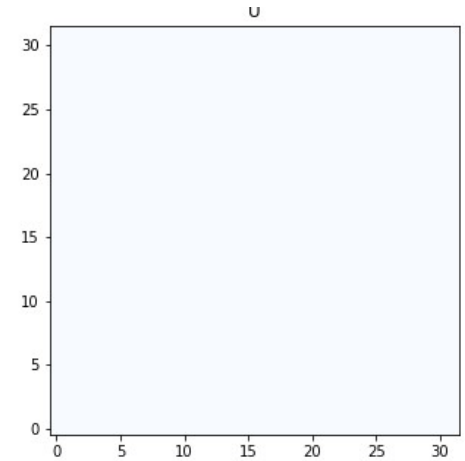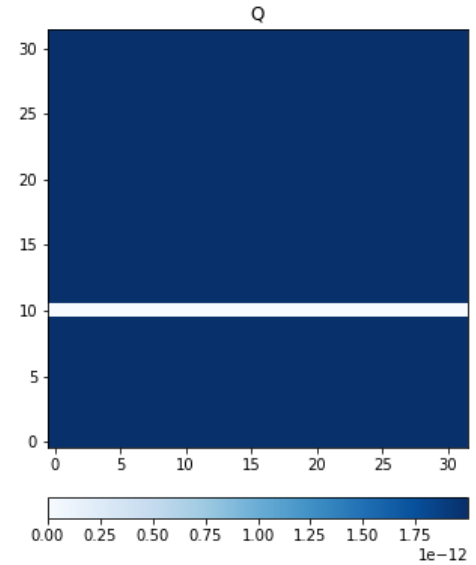
Observed:
θ = 0°
Q > 0
U = 0

Stokes for rotation around z by 90º
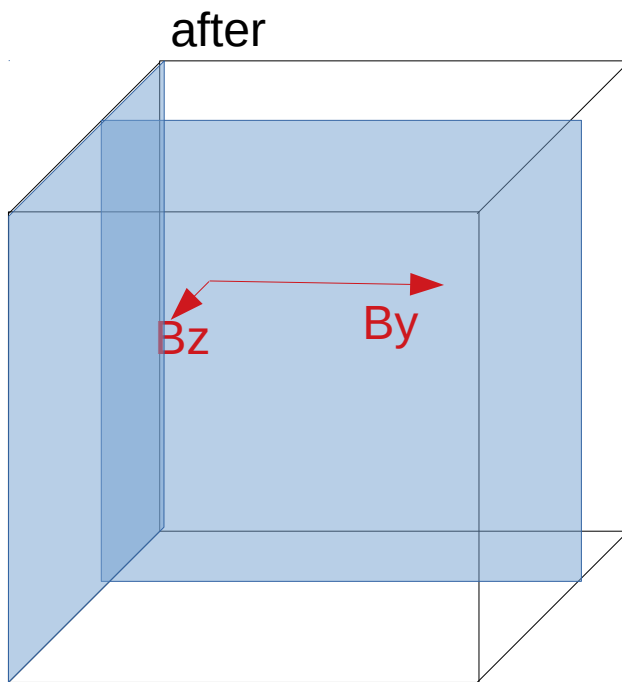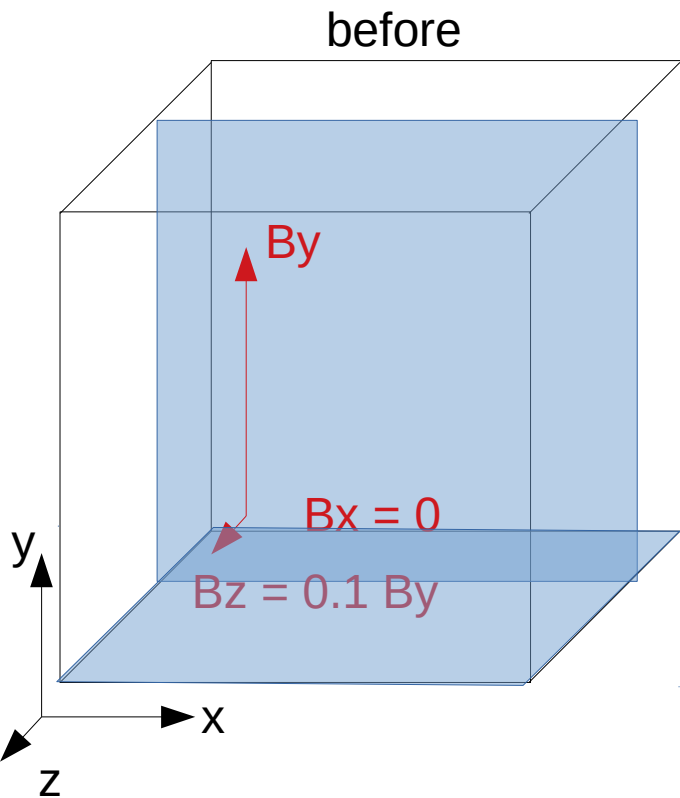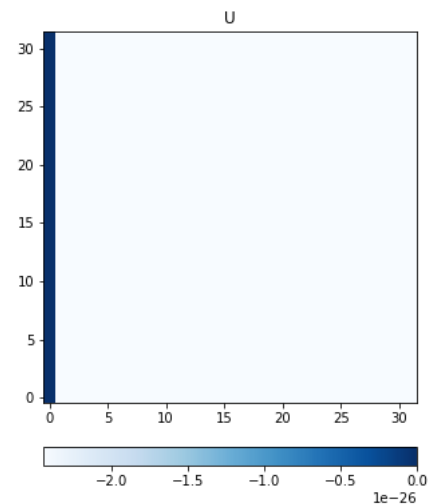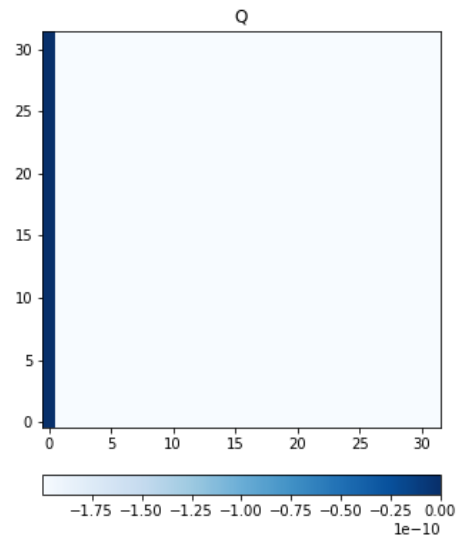
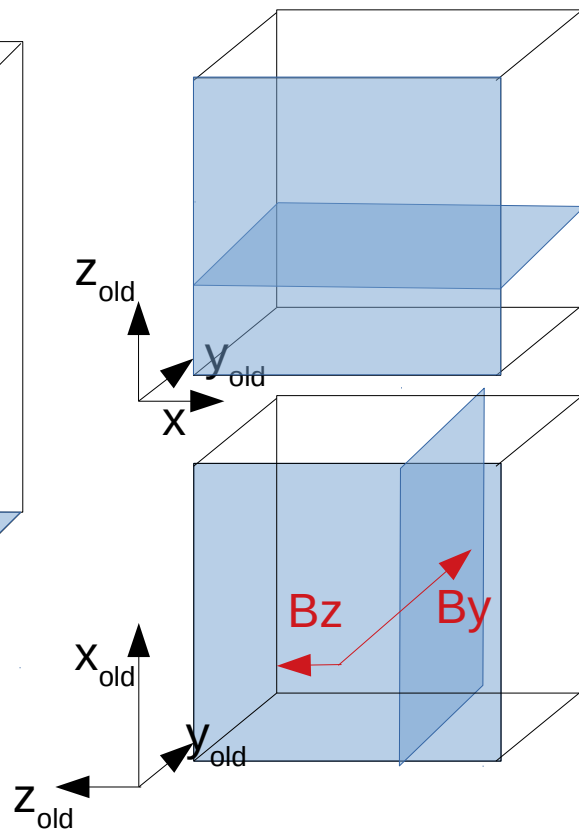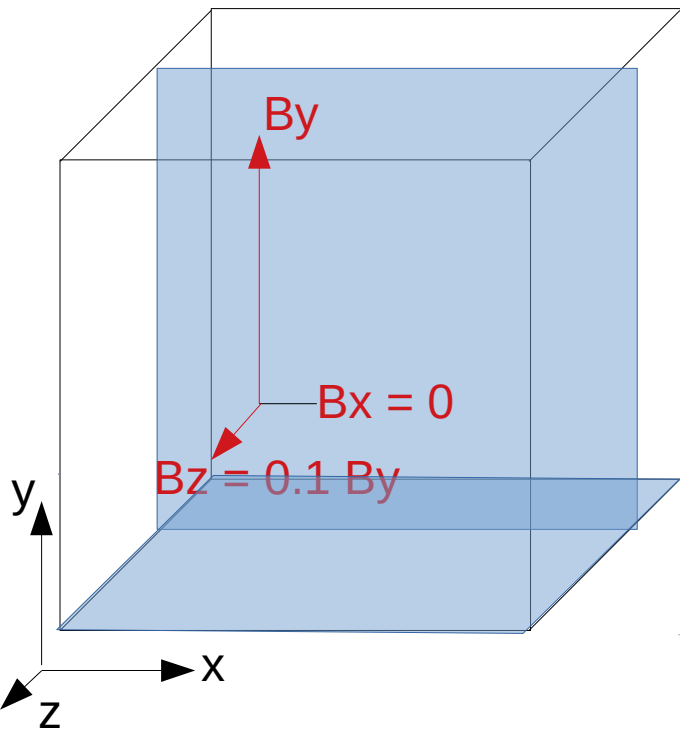# Detector rotated first around x by 90° and then around (old) z by 90°

Observed:
θ = 276°
Q < 0
U < 0
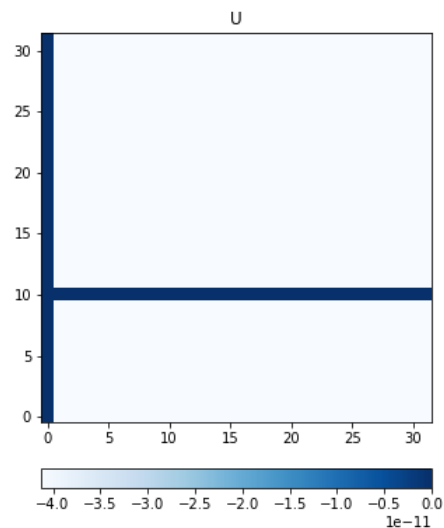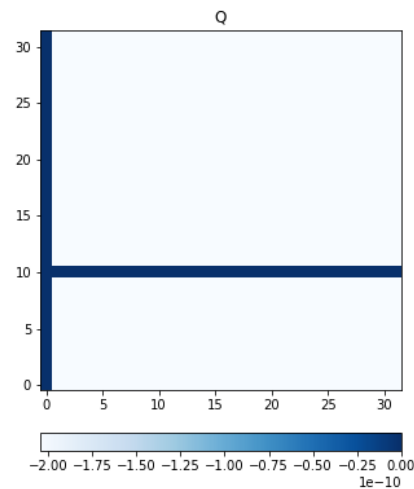
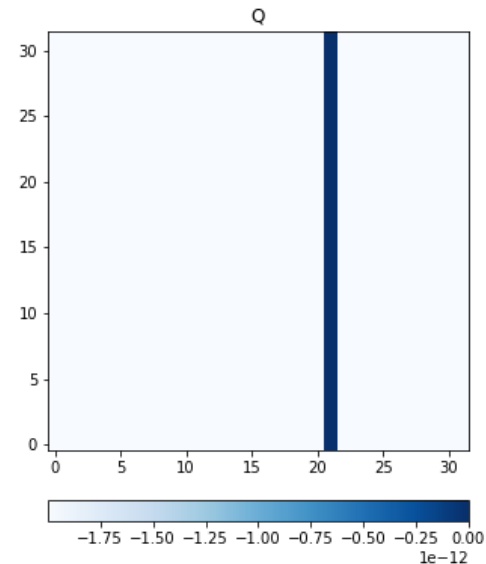# Detector rotated first around x by 90° and then around (old) y by 90°

By

Bx = 0

Bz = 0.1 By

Observed:
θ = 90°
Q < 0
U = 0

RM convention

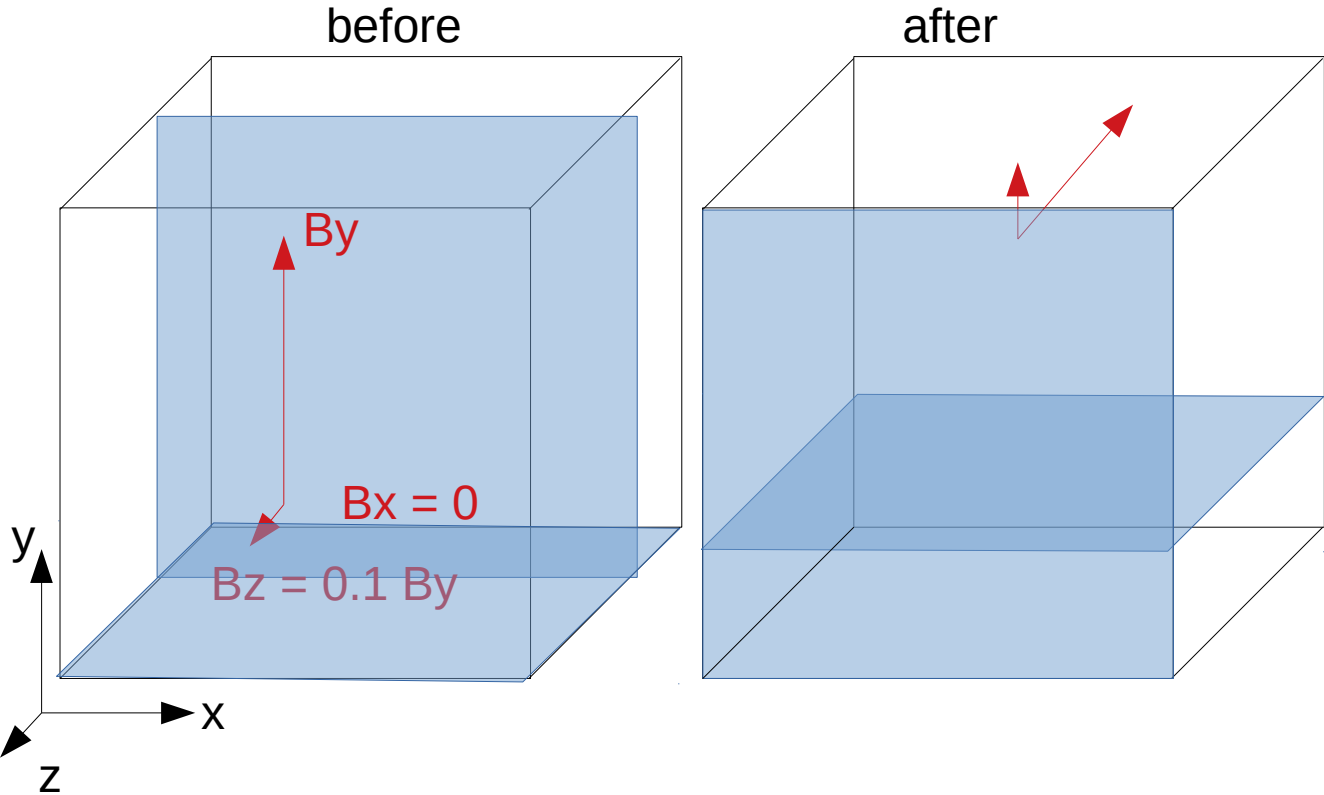32 pixels

10 pixels

By

Bx = 0

Bz = 0.1 By

y

z   x
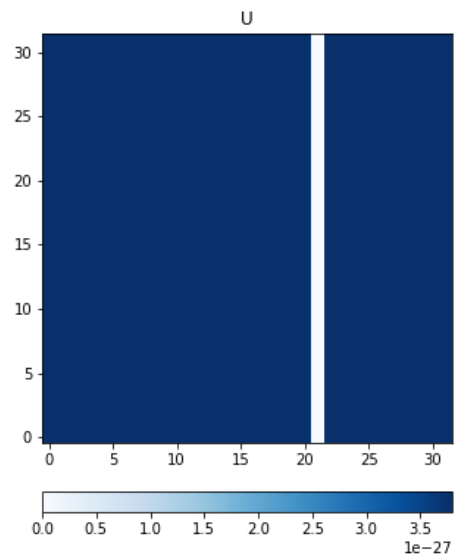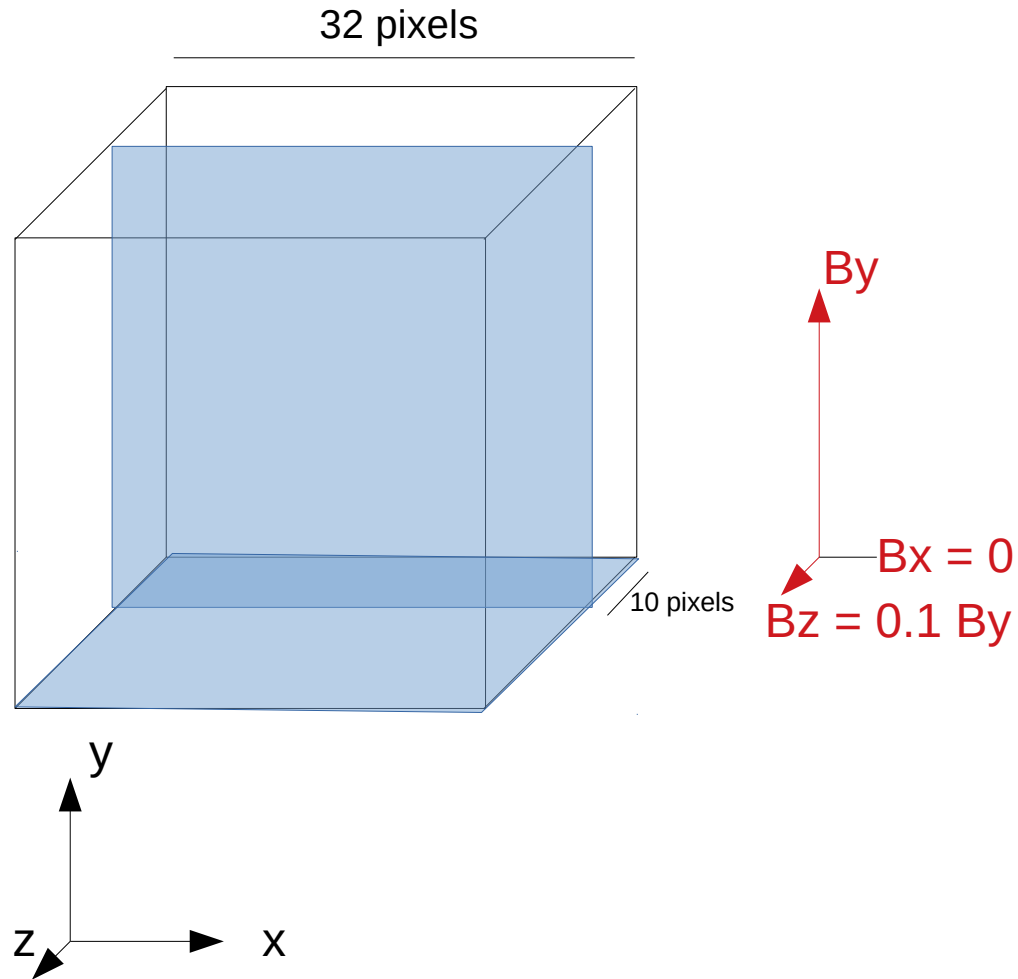
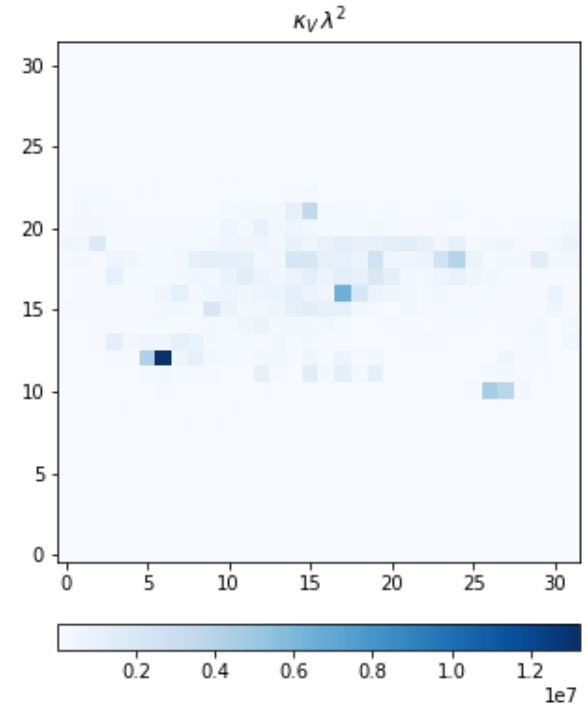Negative if B points towards observer, positive otherwise (manual 4.113)

… but no '-' according to Reissl+2019 paper??

$$\kappa_{\rm V}(\lambda, \vartheta) = -\frac{1}{2\pi}\frac{n_{\rm th}e^2 B}{m_{\rm e}^2 c^4}\lambda^2 \cos(\vartheta).$$
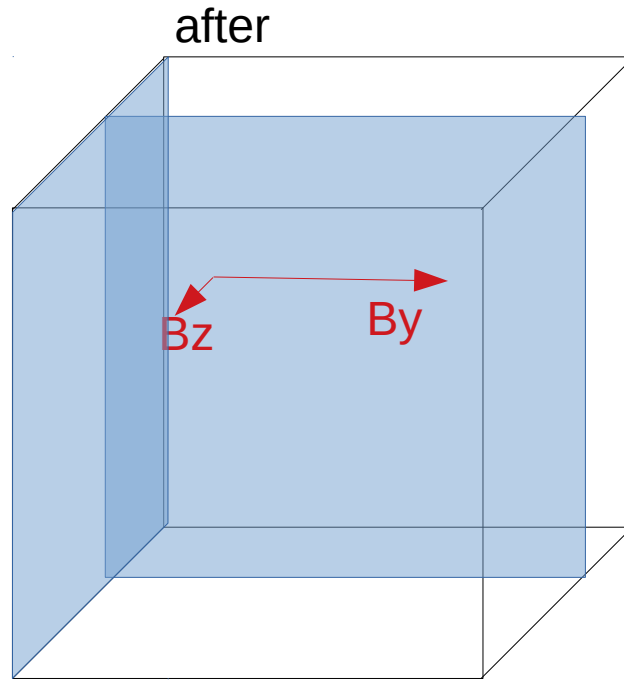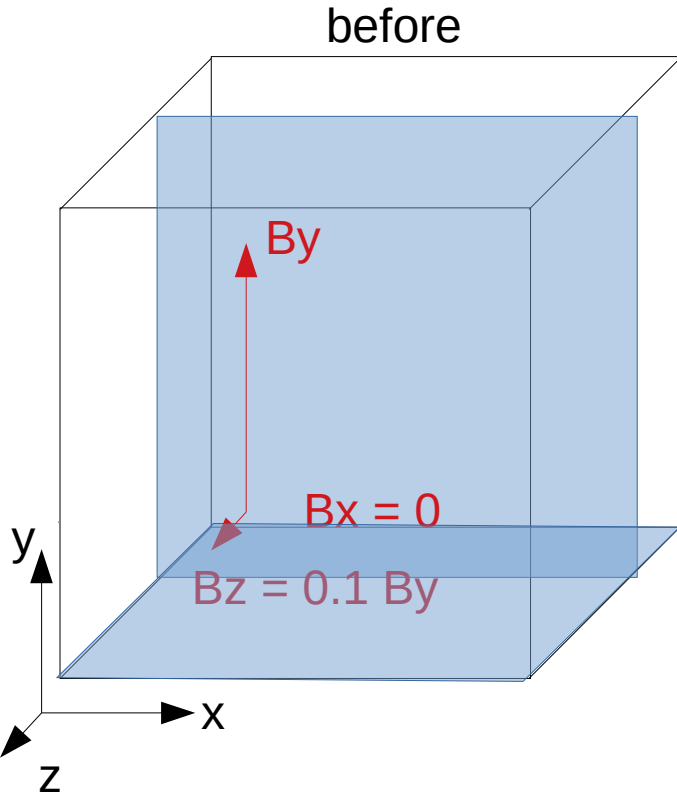
κ$_V$λ^2 for rotation around x by 90°

$κ_Vλ^2$ for rotation around z by 90°

before

after

By

Bz

By

Bx = 0

Bz = 0.1 By

y

x

z

$K_V < 0$

$κ_Vλ^2$