Optics as used at LION – Part 2 (updated)

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Redoing optical simulations for the LION beamline experimental conditions

Include the key part of the beam window seal since this partially occludes the optical system view of the first millimetre (approx.) of the light from the deposited energy in the liquid scintillator.

Match the lenses and key spacings, apertures etc. as closely as practical to those used at LION.

Using Ansys ZEMAX OpticStudio (premium) 2024R1.00

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Redoing optical simulations for the LION beamline experimental conditions

The length of liquid scintillator in front of the BK7 window is now correct, as is the effective diameter of the window. ✓

The lenses are now the correct specification. ✓

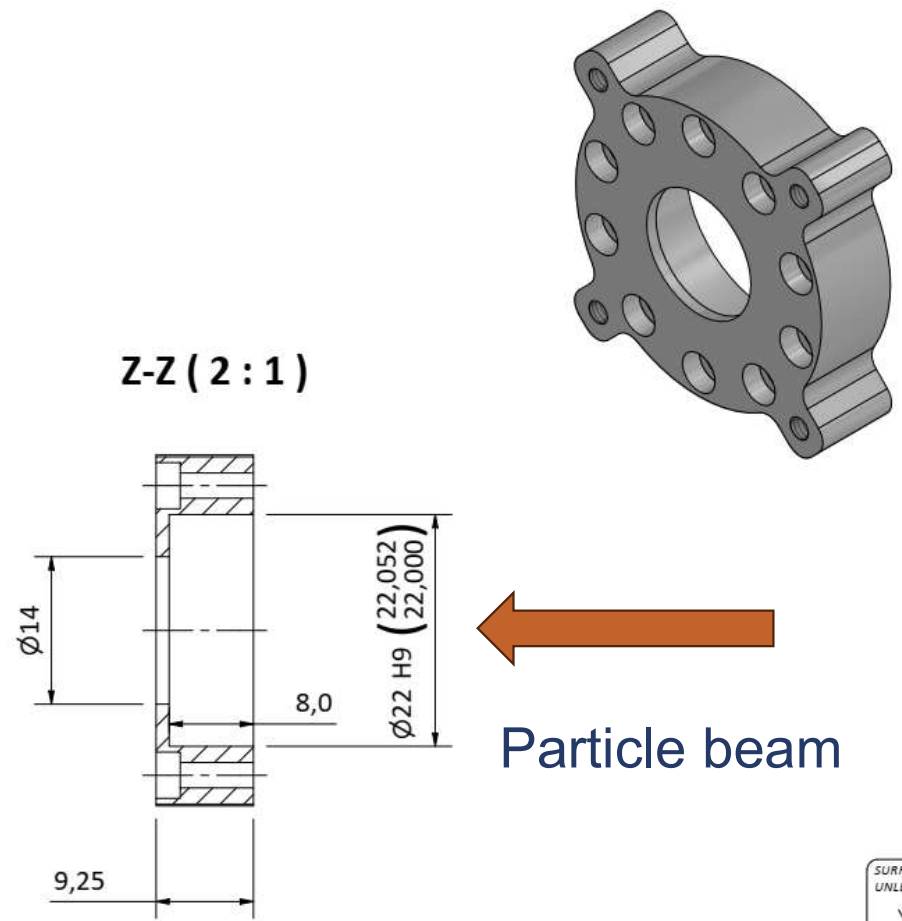10^7 primary optical photons traced per source segment (Maximum source length = 7.5 mm.)

Images have 207 μm pixels in x-axis (60 camera pixels), 100 μm pixels in y-axis.

WARNING: these results follow my latest check where a simulation error was found in previous data. Still treat as qualitative but indicative!

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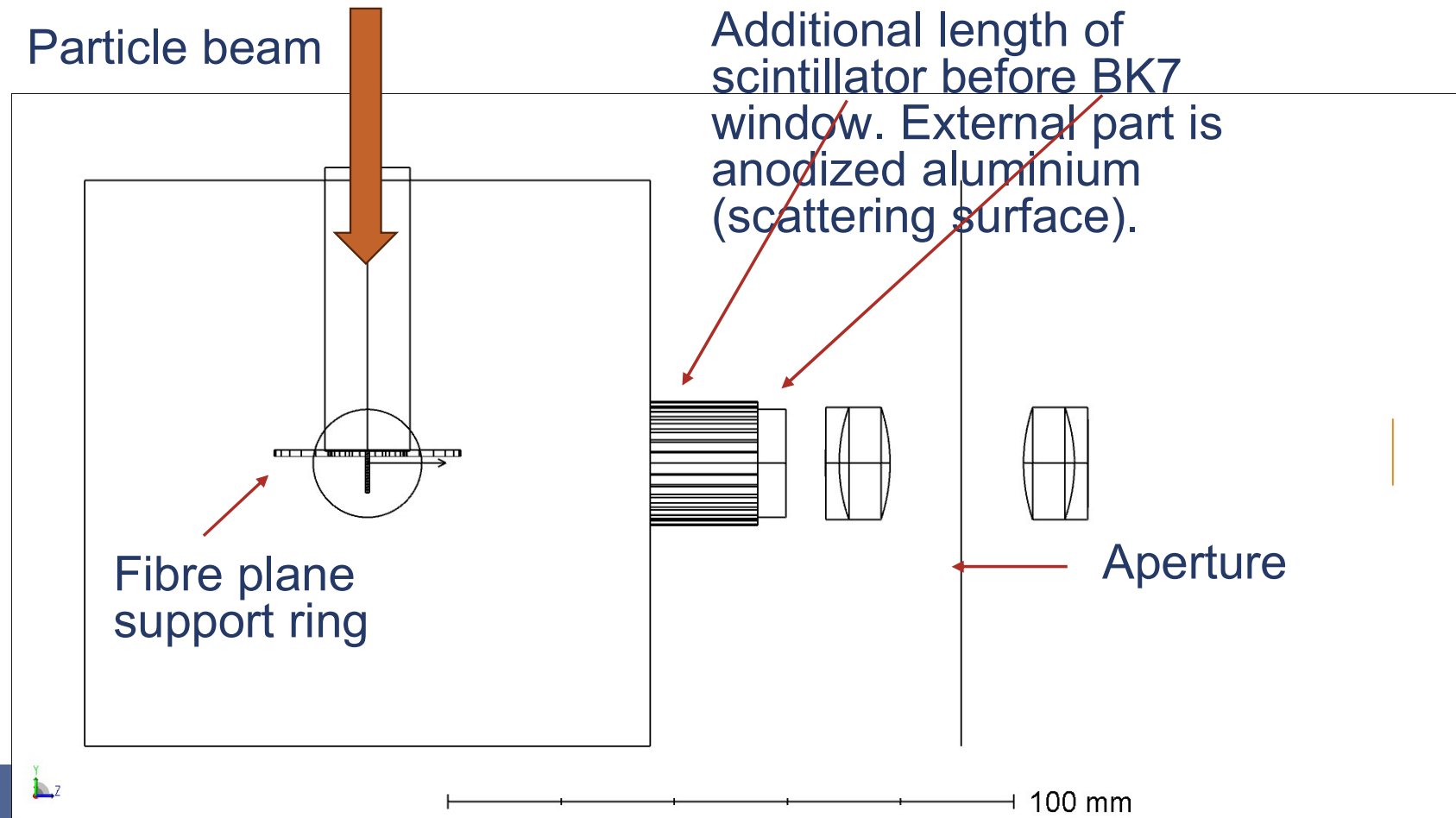University of London
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Occluding effect of "Beam Window Seal Mk II"

This item (drawing #M1024-025) provides a seal for the Kapton™ beam entrance window & is the support for the fibre planes.
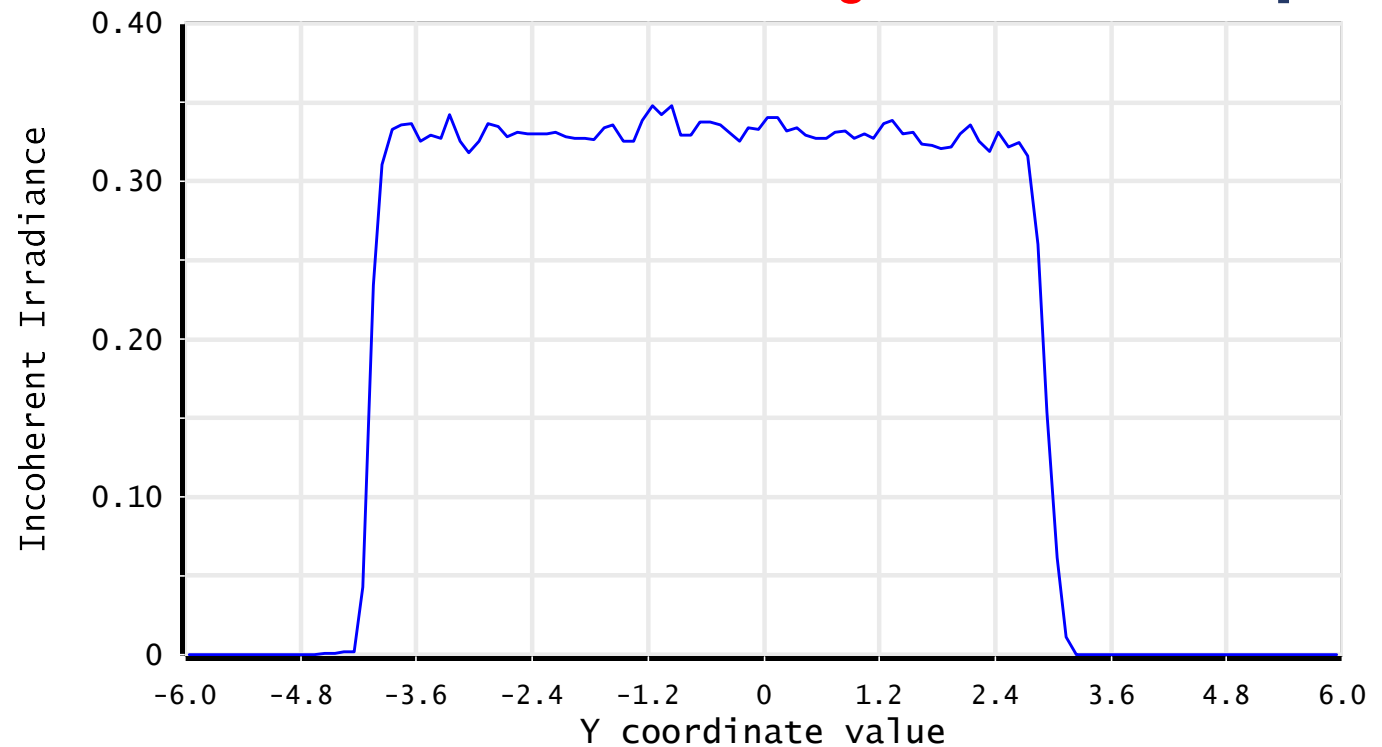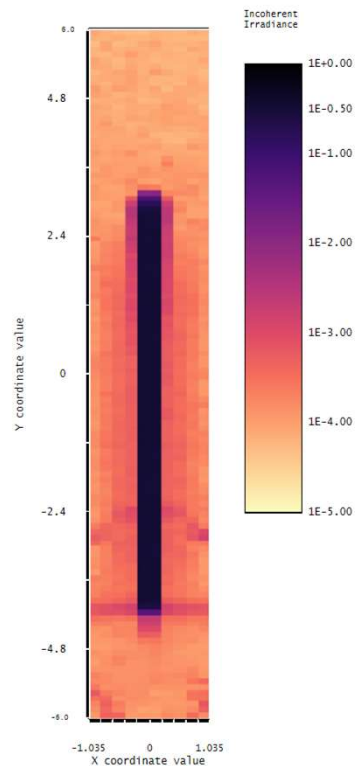
It is black anodised aluminium.

Z-Z (2 : 1)

Ø14

Ø22 H9 (22,052) (22,000)

8,0

9,25

Particle beam

SURFACE TEXTURE
UNLESS STATED:
√ Ra 3,2

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Occluding effect of "Beam Window Seal Mk II"

Particle beam

Additional length of scintillator before BK7 window. External part is anodized aluminium (scattering surface).

Fibre plane support ring

Aperture

100 mm
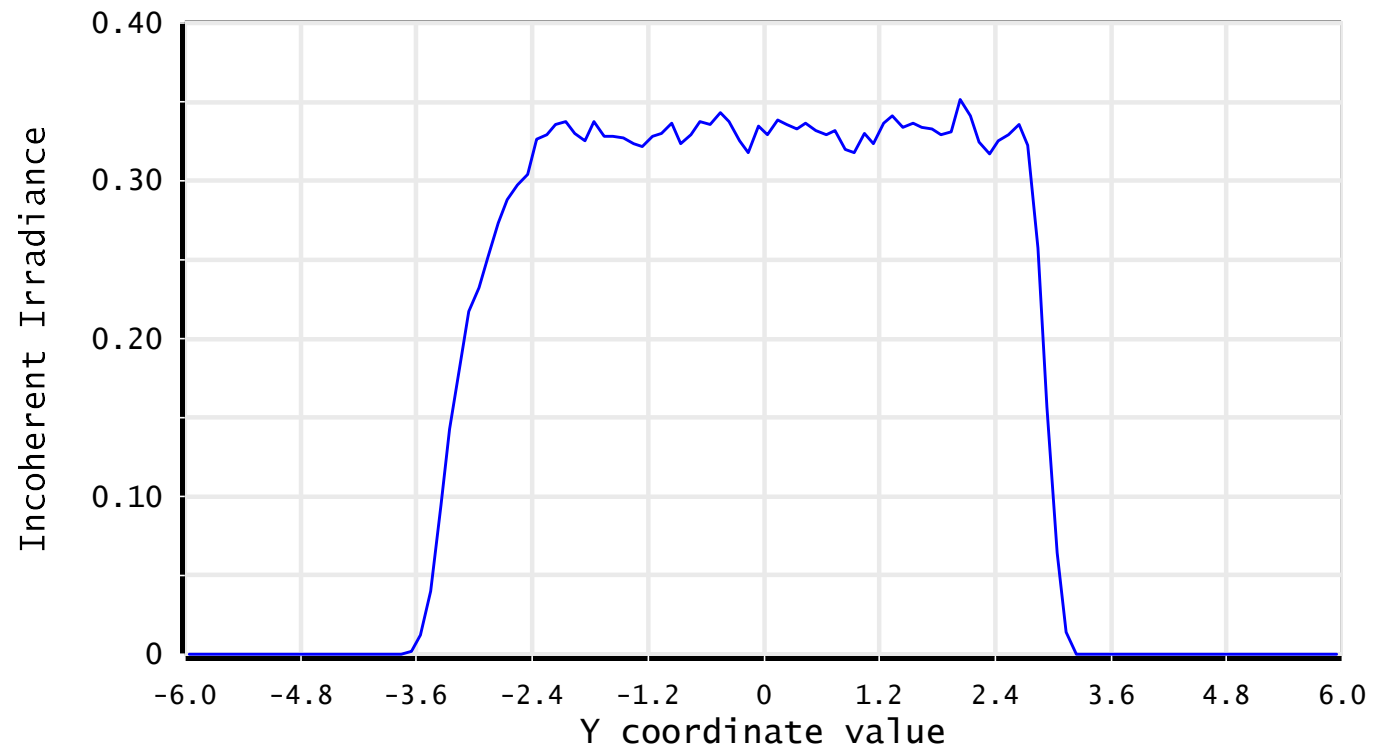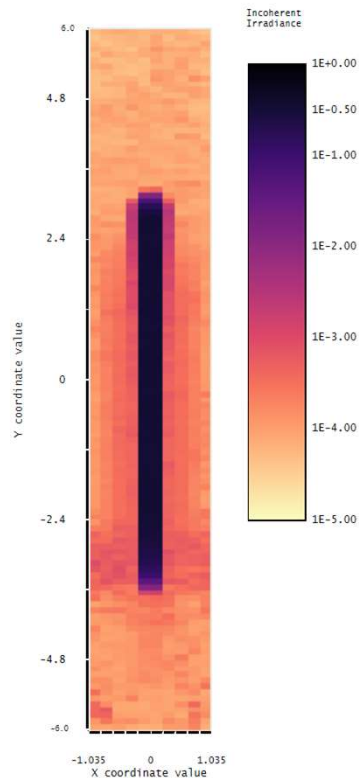
No occluding window seal (0.1 mm Ø beam with uniform intensity per segment). Polychromatic

60 camera pixels averaged per column, central column shown below, image dimensions in [mm]

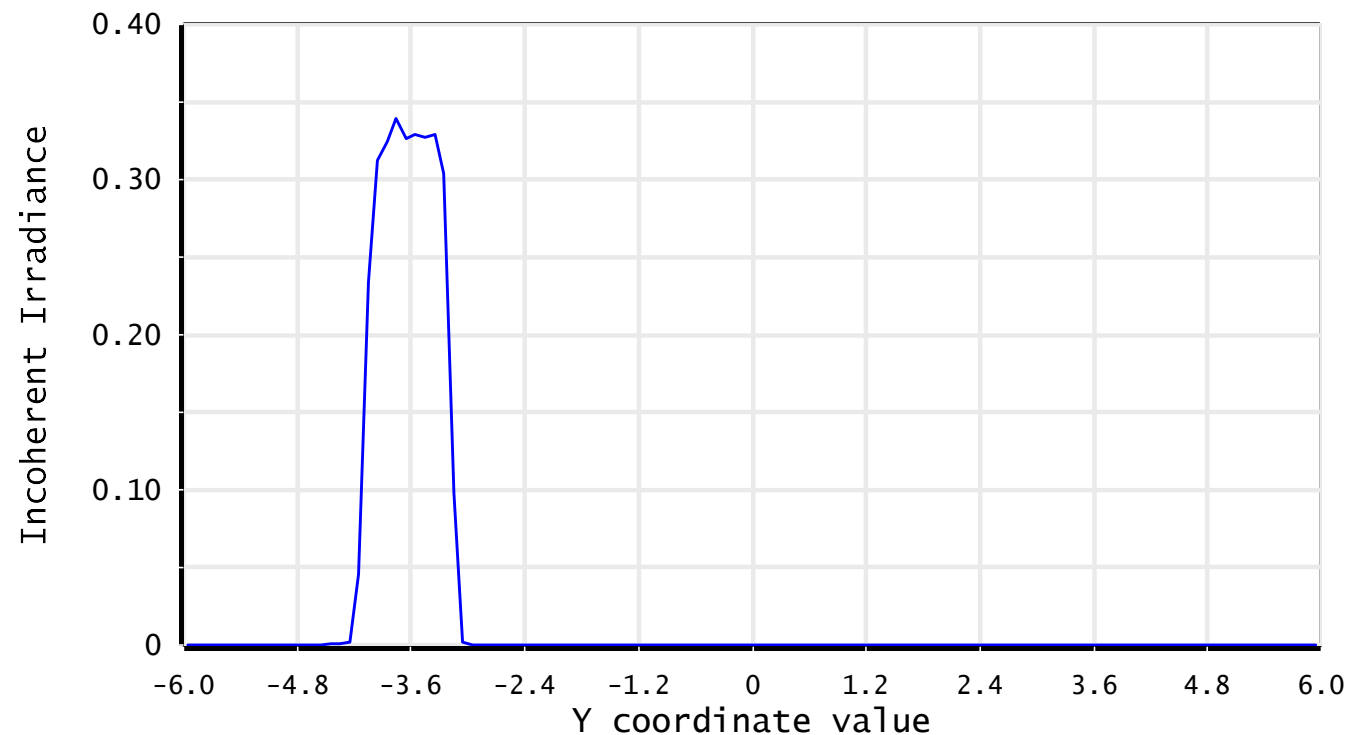# With occluding window seal (0.1 mm Ø beam with uniform intensity per segment). Polychromatic

60 camera pixels averaged per column, central column shown below, image dimensions in [mm]

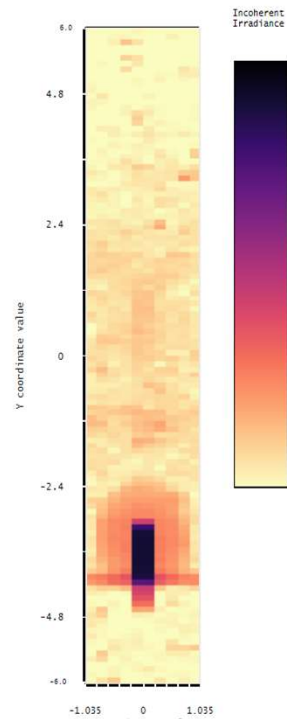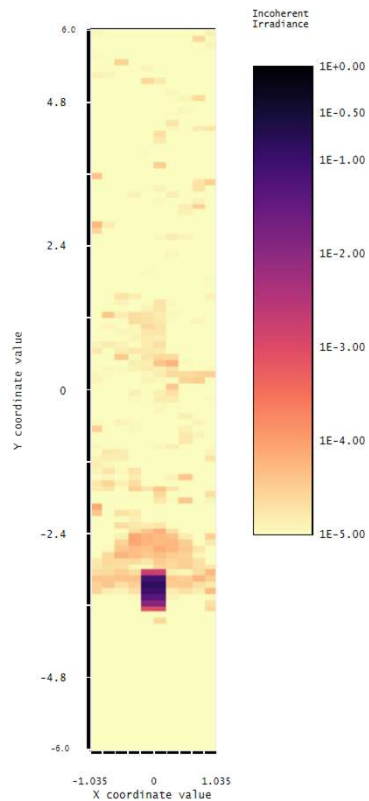Queen Mary
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No occluding window seal (0.1 mm Ø beam with first 1.0 mm emitting). Polychromatic

60 camera pixels averaged per column, central column shown below, image dimensions in [mm]

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With occluding window seal (0.1 mm Ø beam with first 1.0 mm emitting). Polychromatic

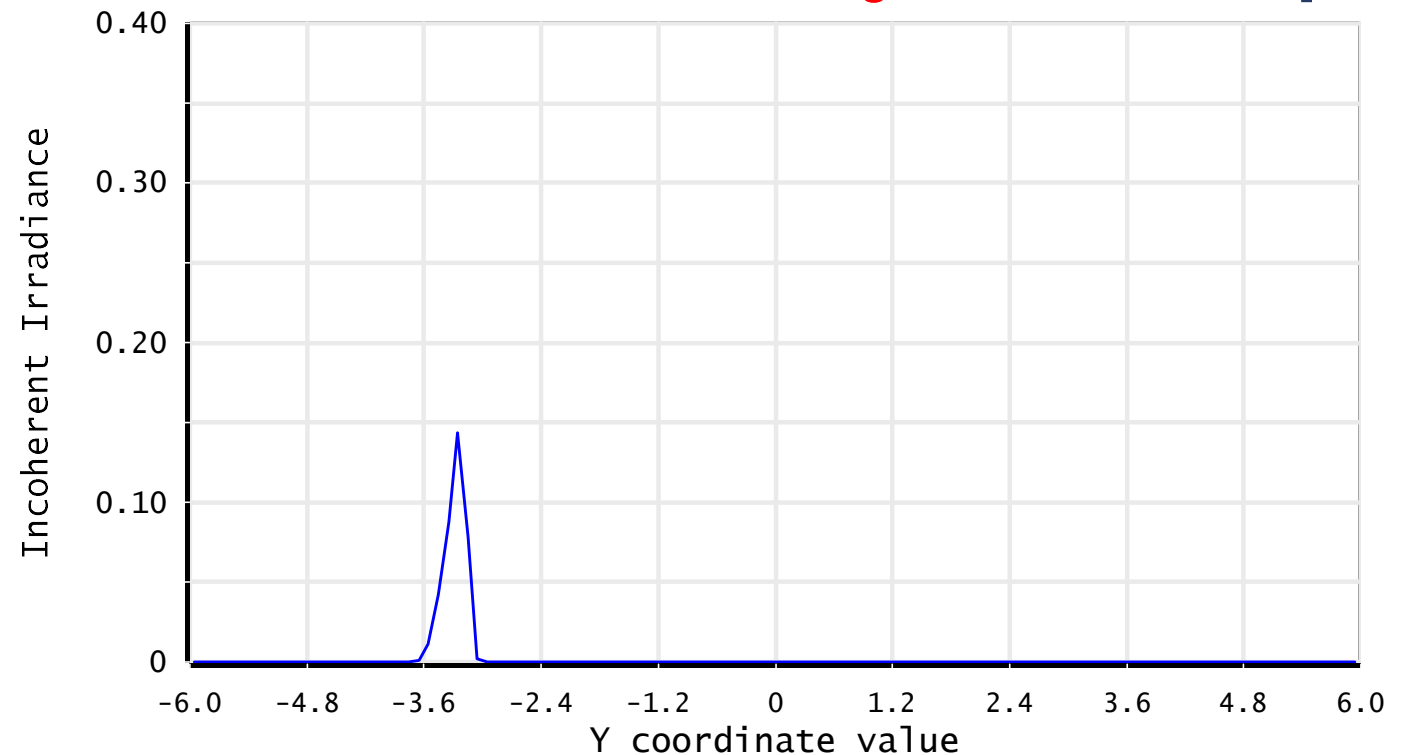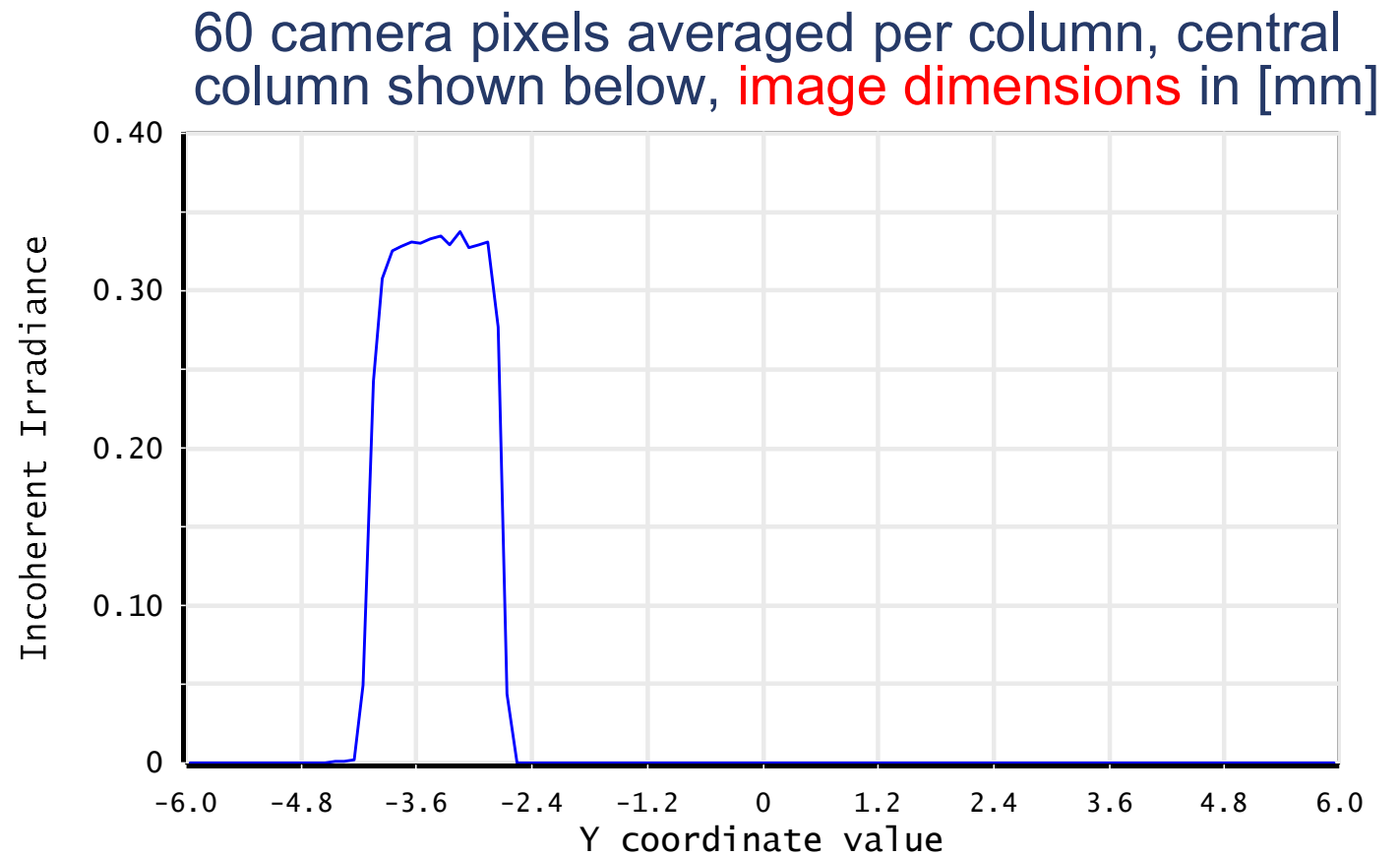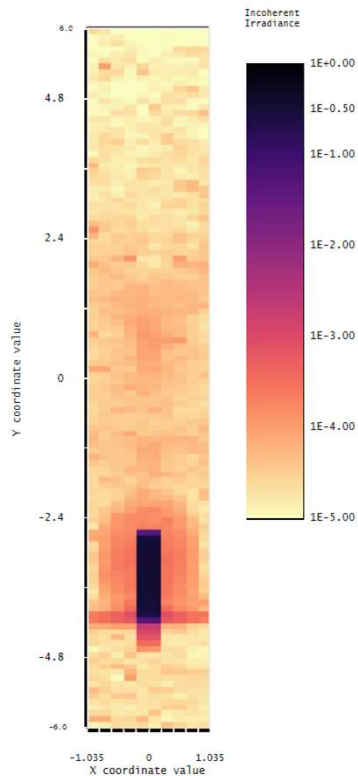60 camera pixels averaged per column, central column shown below, image dimensions in [mm]

No occluding window seal (0.1 mm Ø beam with first 1.5 mm emitting). Polychromatic
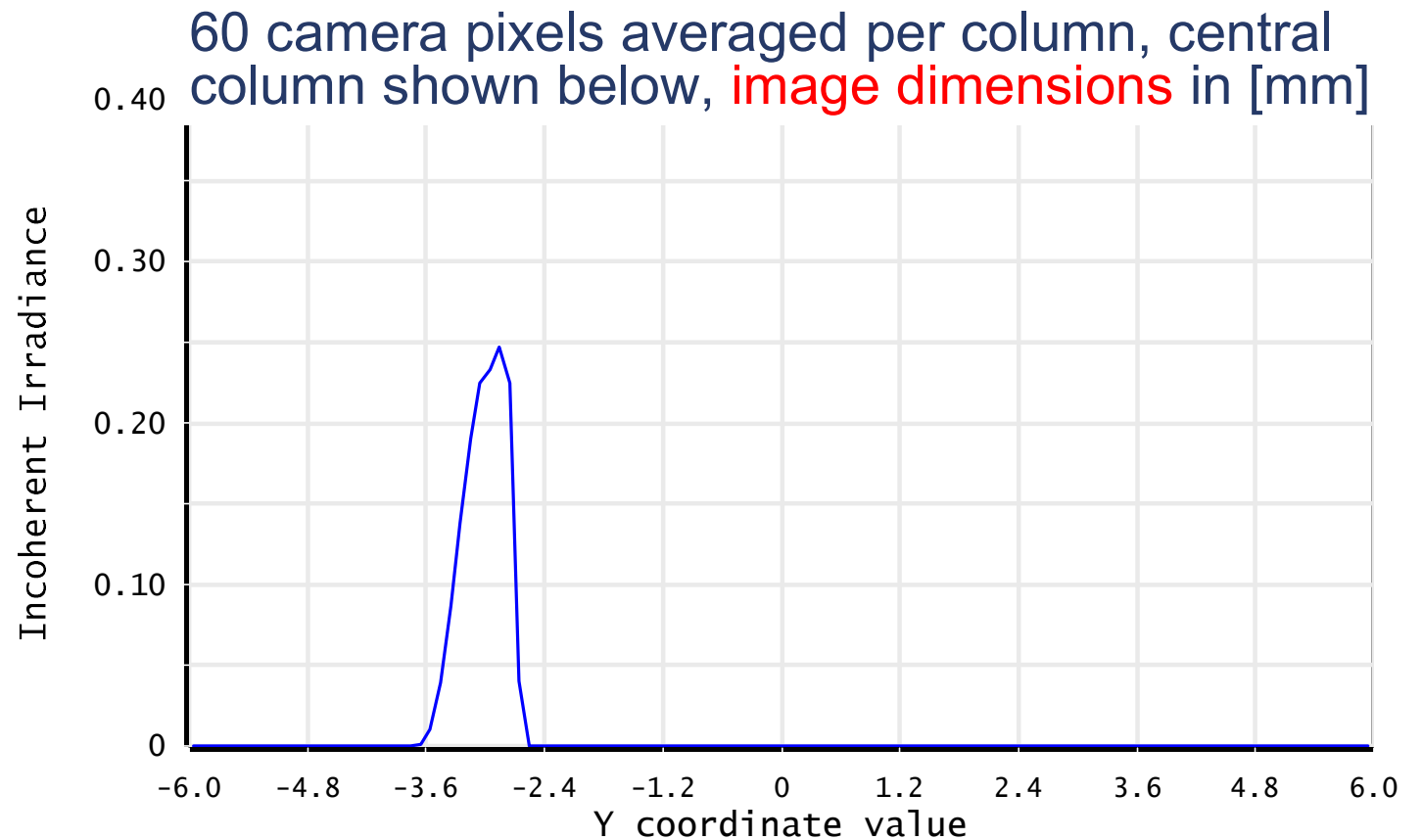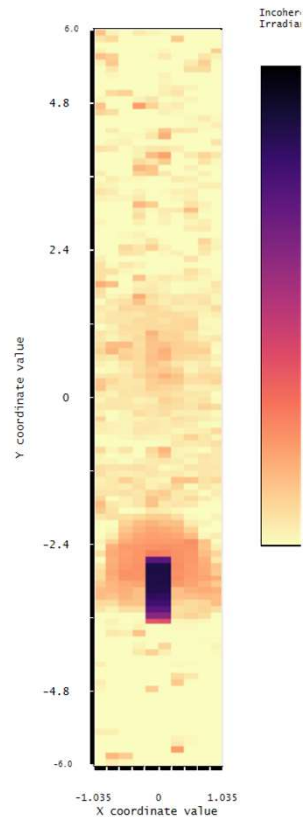

60 camera pixels averaged per column, central column shown below, image dimensions in [mm]

With occluding window seal (0.1 mm Ø beam with first 1.5 mm emitting). Polychromatic

60 camera pixels averaged per column, central column shown below, image dimensions in [mm]

Image magnification and further work

Using sequential raytracing, the paraxial magnification of the system is determined by ZEMAX to be -0.871 (i.e. the image is slightly smaller than the object and is inverted).

Further work

Double check optical configuration details against the LION beamline logbook where possible;

Provide quantitative numeric data from these simulations, or those that I am instructed to perform ☺.