

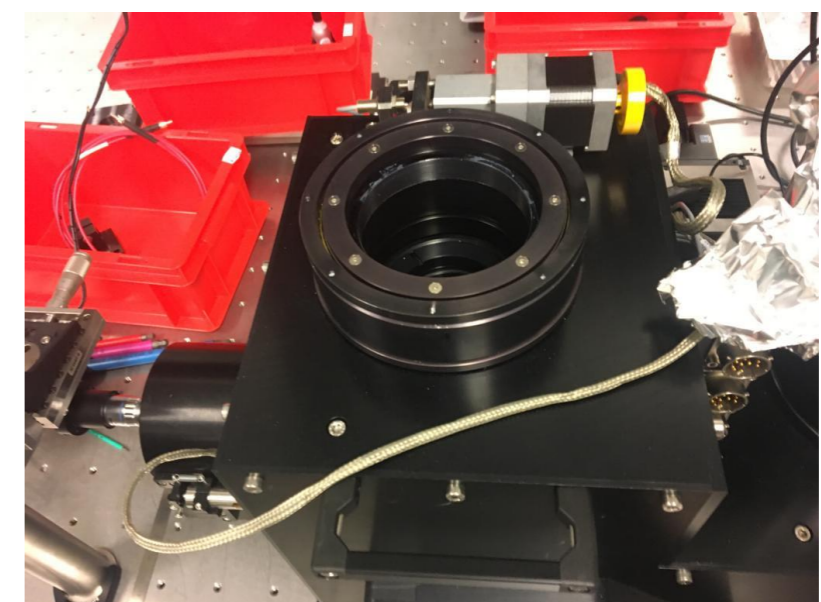
# SYNCHROTRON OBJECTIVE LENSES

Optics and photonics are one of the key technologies for improving the efficiency of Synchrotron Radiation Technology. ASE Optics Europe has experience designing and developing custom optical systems to be integrated into synchrotron beamlines.

**Objective lenses:** for a synchrotron radiation tomography use, after the scintillation screen

Due to the radiation generated by the particle acceleration, the lenses have a replaceable window, partly lead, to protect the optics against radiation and thus extend the life cycle in this harsh environment. Due to the nature of the image reconstruction, it was necessary to guarantee the very low distortion levels, even below 0.1% in some cases.

- Radiation protection window, replaceable
- Focal length: 400nm, 150mm – customizable
- Distortion: <.5%
- Compatible with CCD/CMOS cameras, full-frame
- Custom mechanical interface



**Optical relays to increase the utility of the existing optical systems**

These relays allowed the update of the current sensors without losing resolution due to unsupported optics. The quality of the relay lenses manufactured is such that it does not noticeably deteriorate the contrast or quality, while maintaining the good optical transmission. The mechanical interface was designed and made specially to facilitate its introduction into the beamline optics without affecting the existing elements.

- Radiation protection window, replaceable
- Magnification: 0.5x, 0.8x – customizable
- Distortion: <.5%
- Custom mechanical interface



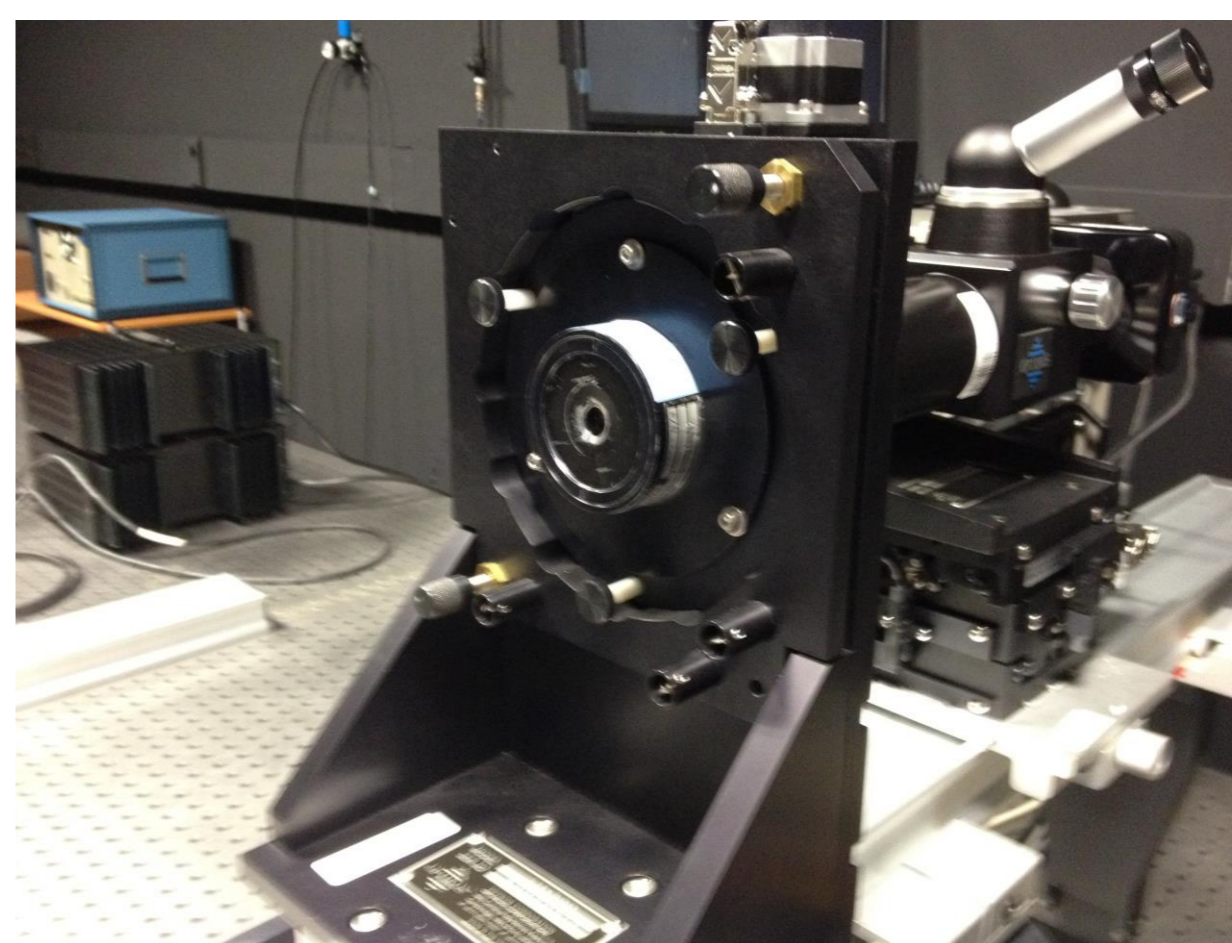
# SYNCHROTRON OBJECTIVE LENSES SPECIFICATIONS

## 0.5X Objective

Projection objective to be installed on the Nano-Imaging branch of the ESRF undulator beamline. This branch address problems in biology, biomedicine and nanotechnology. We designed and developed an objectives which magnifies 0.5 times the visible image generated by a fluorescent screen coupled to another 10X objective on a large scientific CCD camera with a BK7 window of 0,5 mm thickness.

### Specifications:

Specifications	Range
FOV	44mm
NA	0,087
Pupil position	623mm
Pupil position clearance	203mm
Object to objective clearance	420mm
Magnification	0,5 ±1%
Distortion	<0,1%
Transmittance	>86%



## 400 mm Objective

We updated the previous optical system and a thorough tolerance analysis was performed. The mechanical mount was designed based on the tolerance analysis results. The system was simulated in the inverse form to facilitate the analysis and optimization guidance. The materials are all preferred materials, and it has an X-ray absorbing material window.

Specifications	Range
FOV	160mm
Focal length	400mm ±4mm
Pupil diameter	60mm
Exit pupil position	54,2mm
Distance to object	250mm
Vignetting	0%
Distortion	<0,2%
Objective total mechanical length	191,2mm



# SYNCHROTRON OBJECTIVE LENSES SPECIFICATIONS

## 150mm Objective

150mm objective to image at infinity a fluorescent screen. In order to properly evaluate the manufacturability, ASE realized tolerance analysis. The objective included a dismountable front window for X-ray protection. The objective is used in a stable controlled environment, with temperature stability. The objective was assembled by ASE Optics Europe and tested at our facilities.

### Specifications:

Specifications	Range
FOV	70mm
Focal length	150mm $\pm$ 1,5mm
Pupil diameter	50mm
Exit pupil position	10mm
Distance from object to mechanical mount	120mm
Distortion	<0,3%
Transmittance	>80%



### Results

