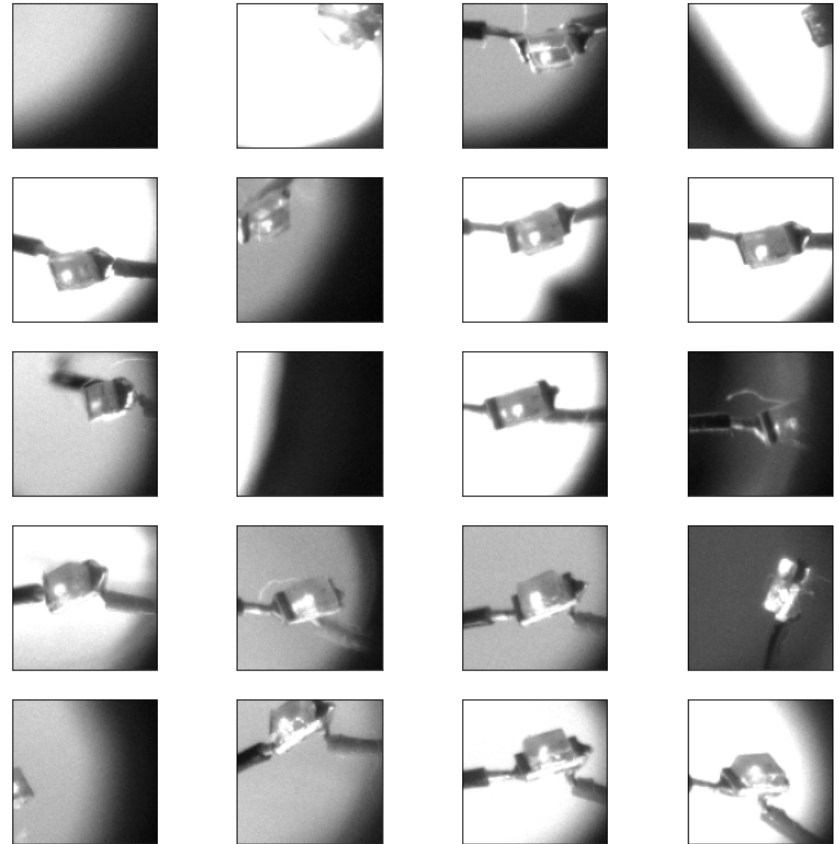# Simulation of the multi-view imaging system with differentiable ray tracing

August 2021

Calibration

- Fitting nuisance parameters
  - 23 x 5 (mirror positions + orientations)
  - 3 (sensor position)
 - 3 (cloud position)
- → need to fit ~120 nuisance parameters

100 x 100 pixel images
(centered wrt expected position of the object on the sensor without nuisance parameters)
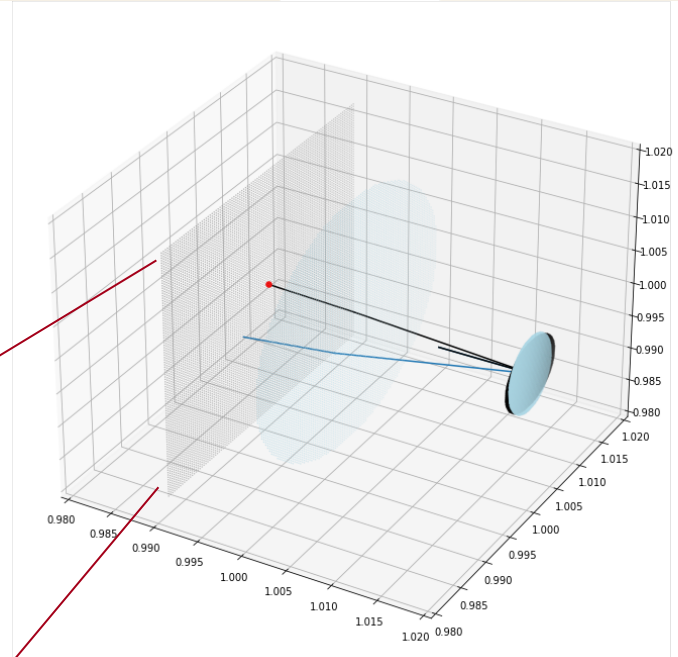
Toy Problem

- Aiming to fit the mirror normal so that the object position on the sensor matches the target
- Gradient based optimization
  - Backpropagation through the simulator

Sensor

Lens

Target

Object

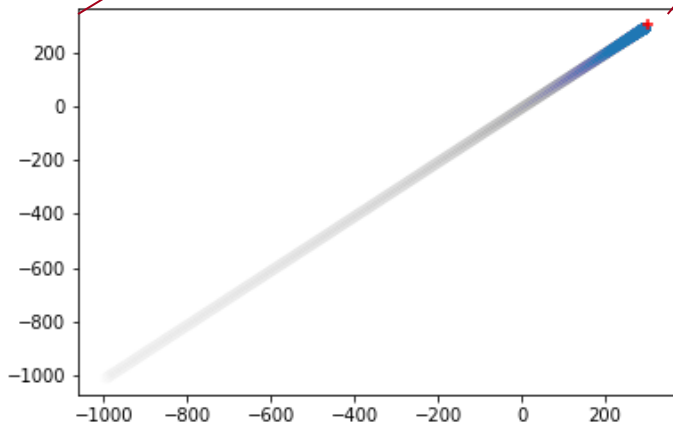Mirror

Object position on the sensor
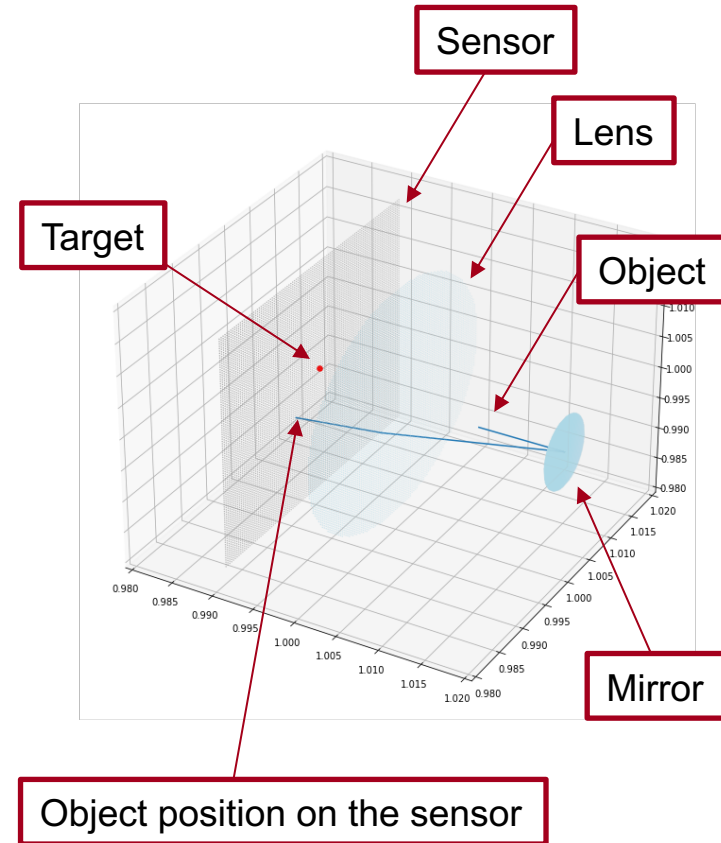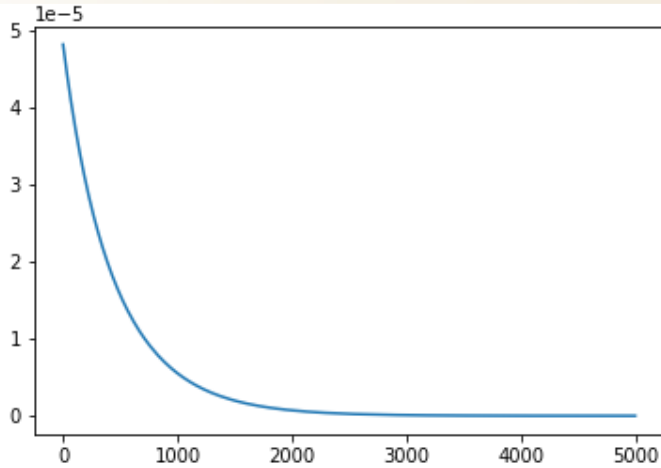
Toy Problem

Training loss
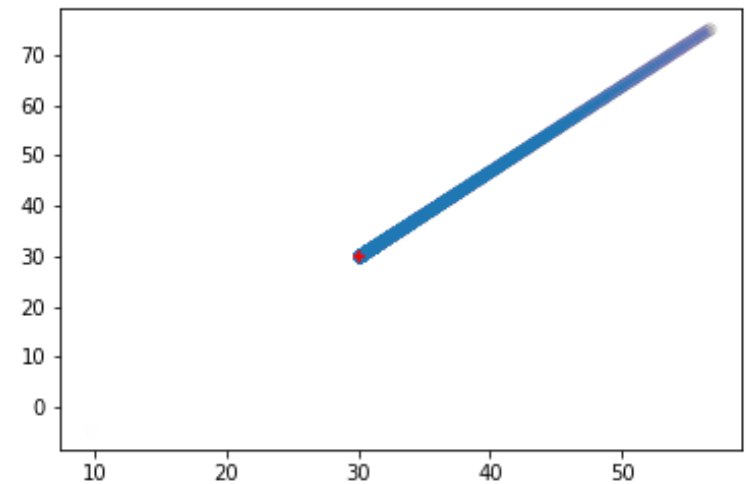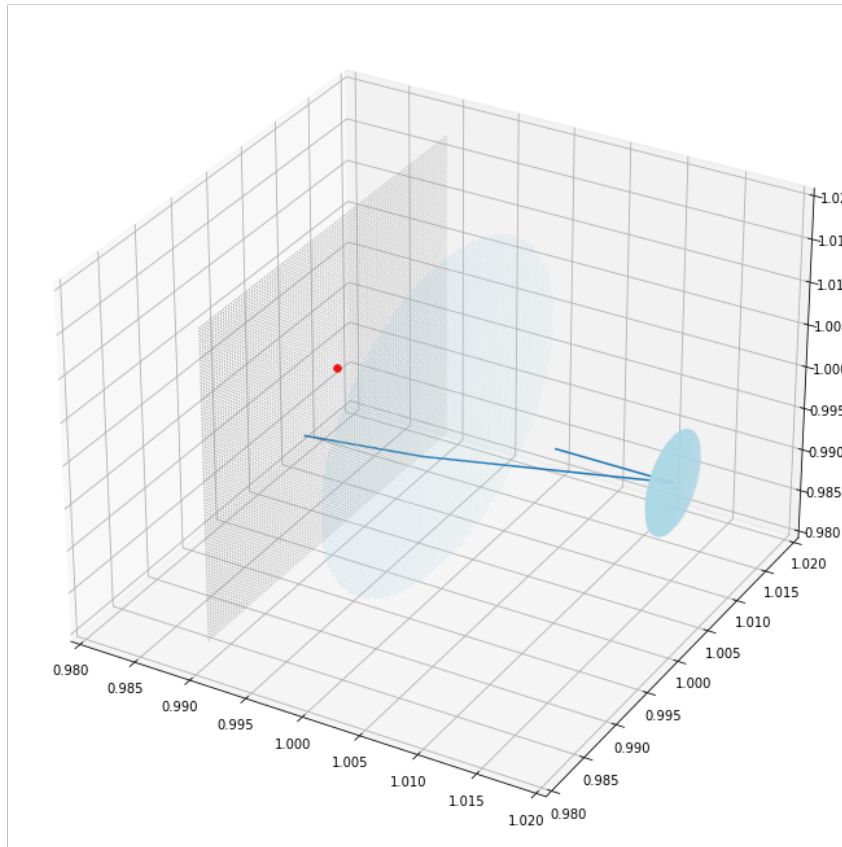L2 norm between the target and object position on the sensor

Blue: before optimization
Black: after optimization

Position of the object on the sensor over the course of optimization

4

Toy Problem

- Similar setup but optimizing the direction of a ray

Position of the object on the sensor over the course of optimization

Next steps

1. Calibrating the simulator from captured images
2. 3d reconstruction
   1. Our backward ray tracing implementation enables simple integration with neural-based reconstruction algorithms (surface and volumetric reconstruction)