

# Exercise Sheet 1 - Introduction

Yixing Huang, Fabian Wagner, Andreas Maier

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The aim of the entire course is to implement a complete reconstruction pipeline by yourself. Each exercise will build upon the previous exercises. This exercise consists of two parts: in the first part, you should setup your development environment and get familiar with Python. In the second part, you start implementing your first class for the reconstruction pipeline: a grid class. Simply spoken, the grid class will represent an image with additional physical information.

## 1. **PyCharm Setup:** We recommend to use PyCharm as IDE.

- Make sure that a python version 3.x is installed on your computer. It is recommended to use Python 3.7. Higher versions have compatibility problems with PyConrad.
- Download and install PyCharm (community version, which is free to install): <https://www.jetbrains.com/de-de/pycharm/>. Start PyCharm, select “Create New Project”, choose a location on your system and select your python 3.x interpreter.
- Go to **File - Settings - Project Interpreter** and click on the plus symbol. Install the package `pyconrad` and confirm by clicking OK. PyConrad is a python wrapper for the Java reconstruction framework Conrad. We will use pyConrad for visualization with ImageJ, for the SheppLogan phantom creation, and for the cone-beam reconstruction exercise.
- Copy the class `flat_panel_project_utils.py` provided in studOn to your project folder.

## 2. **Utility class:** Import the utility class and test if your interpreter works:

- Create a new python file.
- Add these 3 lines and execute your script. You should now see an image of the Shepp Logan phantom:

```
import flat_panel_project_utils as utils
phantom_test = utils.shepp_logan(512)
utils.show(phantom_test, "My_first_phantom")
```

3. **Grid class:** Create the grid class. This class should represent an image with physical properties.

- Create your class `Grid`.
- Create a constructor `__init__(self, height, width, spacing)` that initializes all non static class variables: height, width, spacing, and origin. Also initialize an empty buffer as 2D numpy array.
- Add the following methods:
  - `set_buffer/get_buffer`
  - `get_origin`
  - `get_spacing`
  - `get_size`
  - `index_to_physical/physical_to_index`
  - `set_at_index/get_at_index`
  - `get_at_physical` (hint: you need to apply interpolation here. You find a already implemented interpolation method in the `utils` class.)

4. **Use your grid class:**

- Create a new python file.
- Now, create an instance of your `Grid` class and fill its content with the information of the Shepp Logan Phantom.
- Test your implemented methods on this phantom.