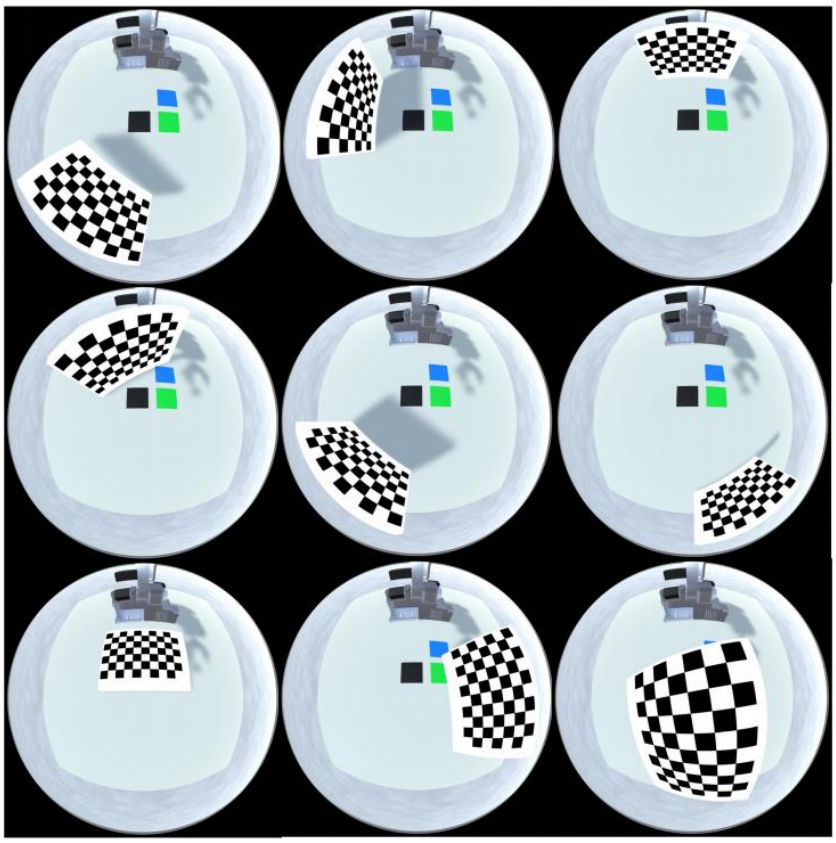
Intrinsic Calibration Process

Preparation

First of all, you need to prepare calibration images. Open the Simulation screen and take series of pictures (you can read “2. Setting up the environment” section in order to understand process of taking pictures). According to the D. Scaramuzza Tutorial from 6 to 10 images should be enough. It was also mentioned there that: “In order to obtain good calibration results, it is suggested the following:

(1) Approach the checkerboard to the fisheye as much as you can (see sample images below). This will improve the calibration and will increase the chances that the Automatic Checkerboard Extraction tool finds all the corners! Make sure that every corner of the checkerboard is visible in each image. For the Automatic Checkerboard Extraction tool, it is furthermore important that a white border is present around the pattern.

(2) Take pictures of the checkerboard in order to cover all the visible area of the camera, e.g. from all around the mirror. By doing this, you allow calibration to compensate for possible misalignments between the camera and mirrors axes. The second and most important reason for doing this is that it helps the automatic detection of the center of the omnidirectional image.”



Omnidirectional camera calibration

For calibration procedure you can use OCamCalib Toolbox for Matlab developed by D. Scaramuzza et al. There's a Step by Step Tutorial which is available online. We will also use the Toolbox extension by S. Urban et al. According to the paper by this extension it becomes possible to achieve a more stable, robust and accurate calibration. So, let's consider calibration procedure in combination with this extension.

(1) **Installation**: Copy the content of the src folder to the main directory of ocam_calib. You should be asked to replace C_calib_data.m and optimizefunction.m => click yes. The first file contains additional variables for statistics. The second file contains additional code lines to save statistics but is actually not used by the improved toolbox.

(2) **Calibration procedure**: a. Add calibration images to the to the main directory of ocam_calib with the same name, but different suffix, for example: image1, image2 …; b. Open Matlab and run ocam_calibUrban.m ! (instead of ocam_calib); c. Press in the following order:

* read names: Typename without suffix, then choose image format;
* extract grid corners: Number of squares along the X direction – 5, Number of squares along the Y direction – 8, Size dX of each square along the X direction – 116, Size dY of each square along the Y direction – 116, image center do not change – press enter, choose automatic grid extraction by pressing enter;
* calibration: Do not change degree of polynomial expansion – press enter.
* robust non-linear refinement (LM least squares);
* Save.