Hand-Eye Calibration

- Algorithm used to calculate transformation between camera and gripper: *A New Technique for Fully Autonomous and Efficient 3D Robotics Hand/Eye Calibration, Tsai & Lenz.*
- Test with 2 different patterns (checkerboards with 1.5mm and 2mm)
- Number of images used: 4 (minimum is 3)
- Robot: KINOVA Jaco (6 DOF)
- Robot Poses (Hhand2world):

Pose1 = -0.9715 0.2363 -0.0169 0.6747 0.2368 0.9707 -0.0409 -332.6500 0.0067 -0.0437 -0.9990 236.4020 0 0 0 1.0000	Pose2 = -0.9988 0.0500 -0.0003 0.1139 0.0500 0.9980 -0.0391 -332.0150 -0.0017 -0.0390 -0.9992 237.3870 0 0 0 1.0000
Pose3 = -0.9452 0.3264 -0.0080 0.0701 0.3265 0.9446 -0.0328 -332.0580 -0.0032 -0.0336 -0.9994 237.2600 0 0 0 1.0000	Pose4 = -0.9750 0.2181 0.0430 -0.3588 0.2222 0.9607 0.1665 -341.0010 -0.0050 0.1719 -0.9851 234.1550 0 0 0 1.0000

- Intrinsic Parameters

Pattern 1.5mm	Pattern 2mm
Focal Length: [149.2908 148.2856] Principal Point: [178.2811 186.4692] Radial Distortion: [-0.2441 0.0726]	Focal Length: [156.0418 155.7529] Principal Point: [178.5604 181.8043] Radial Distortion: [-0.2486 0.0614]

- Results

Pattern 1.5mm	Pattern 2mm
Hcam2gripper = -0.9610 -0.2506 -0.1166 2.9793 0.2002 -0.3403 -0.9187 -27.0224 0.1905 -0.9063 0.3773 72.1070 0 0 0 1.0000 **err*** = 0.1720 3.3877	**Hcam2gripper** = -0.9366 -0.3242 -0.1325 0.0802 0.1738 -0.1017 -0.9795 -42.6685 0.3041 -0.9405 0.1516 62.6967 0 0 0 1.0000 **err*** = 0.1555 4.0220

*err(1) – residual rotation error; err(2) – residual translation error. err=Ax-b. (linear least square technique)

- The algorithm was tested with 24 combinations of the 4 images.
- For the 24 trials the following error histograms were obtained (left -1.5mm; right-2mm).