Walkimon URDF DATA
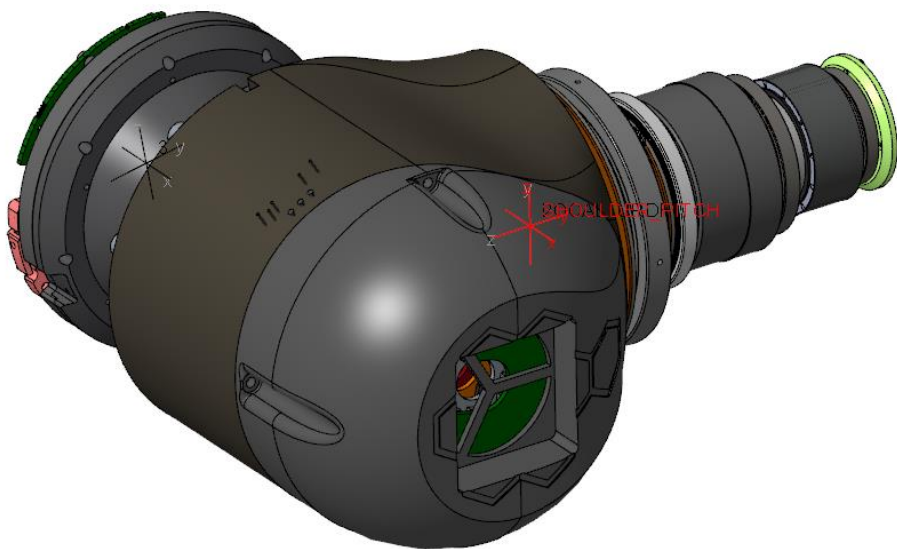
Shoulder_pitch

VOLUME = 4.0842136e+05 MM^3
SURFACE AREA = 3.7139426e+05 MM^2
AVERAGE DENSITY = 4.8059864e-06 KILOGRAM / MM^3
MASS = 1.9628675e+00 KILOGRAM

CENTER OF GRAVITY with respect to SHOULDER_PITCH coordinate frame:
X Y Z   -7.4457212e+00 -3.4107960e+01 1.0978102e-01 MM

INERTIA with respect to SHOULDER_PITCH coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 7.6383030e+03 -8.6277588e+02 1.6694014e+01
Iyx Iyy Iyz -8.6277588e+02 3.5011754e+03 -4.8342538e+01
Izx Izy Izz 1.6694014e+01 -4.8342538e+01 9.2844679e+03

INERTIA at CENTER OF GRAVITY with respect to SHOULDER_PITCH coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 5.3547717e+03 -3.6428926e+02 1.5089568e+01
Iyx Iyy Iyz -3.6428926e+02 3.3923328e+03 -5.5692312e+01
Izx Izy Izz 1.5089568e+01 -5.5692312e+01 6.8921413e+03

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3   3.3261291e+03 5.4197988e+03 6.8933178e+03
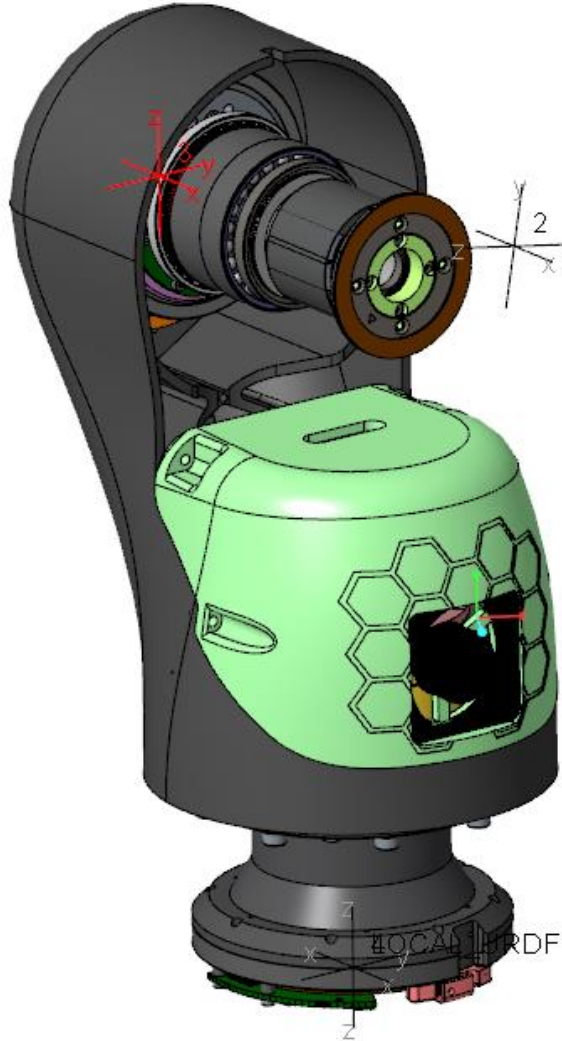
ROTATION MATRIX from SHOULDER_PITCH orientation to PRINCIPAL AXES:
    0.17662   -0.98418   0.01391
    0.98417   0.17637   -0.01735
    0.01462   0.01676   0.99975

ROTATION ANGLES from SHOULDER_PITCH orientation to PRINCIPAL AXES (degrees):
angles about x y z   0.994   0.797   79.826

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 4.1164615e+01 5.2546777e+01 5.9260956e+01 MM

Shoulder_roll

VOLUME = 5.2738006e+05 MM^3
SURFACE AREA = 4.2768894e+05 MM^2
AVERAGE DENSITY = 3.5260739e-06 KILOGRAM / MM^3
MASS = 1.8595811e+00 KILOGRAM

CENTER OF GRAVITY with respect to 3 coordinate frame:
X Y Z   5.8142302e+01 -5.7450803e-02 -7.7477683e+01 MM

INERTIA with respect to 3 coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 2.4939327e+04 -3.1577076e+01 1.2145929e+04
Iyx Iyy Iyz -3.1577076e+01 3.3126505e+04 1.2120711e+00
Izx Izy Izz 1.2145929e+04 1.2120711e+00 1.0918136e+04

INERTIA at CENTER OF GRAVITY with respect to 3 coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 1.3776643e+04 -3.7788675e+01 3.7690171e+03
Iyx Iyy Iyz -3.7788675e+01 1.5677464e+04 9.4893549e+00
Izx Izy Izz 3.7690171e+03 9.4893549e+00 4.6317657e+03

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3   3.2785707e+03 1.5127895e+04 1.5679407e+04

ROTATION MATRIX from 3 orientation to PRINCIPAL AXES:
   -0.33791   0.93952   -0.05591
   -0.00175   0.05878   0.99827
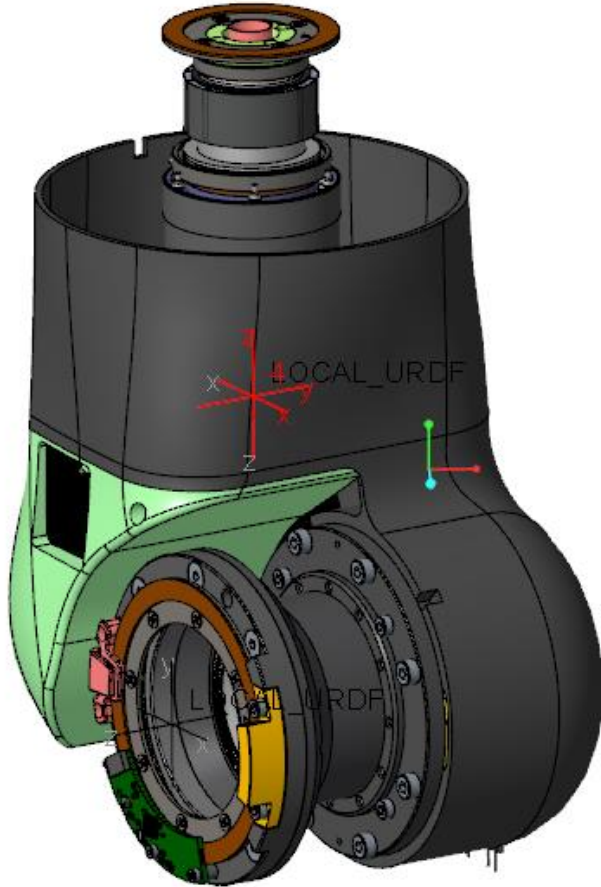   0.94118   0.33742   -0.01822

ROTATION ANGLES from 3 orientation to PRINCIPAL AXES (degrees):
angles about x y z -91.045   -3.205   -109.782

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 4.1988921e+01 9.0194840e+01 9.1824221e+01 MM

Shoulder_yaw

VOLUME = 4.5522556e+05 MM^3
SURFACE AREA = 4.0974002e+05 MM^2
AVERAGE DENSITY = 3.6637021e-06 KILOGRAM / MM^3
MASS = 1.6678109e+00 KILOGRAM

CENTER OF GRAVITY with respect to 4 coordinate frame:
X Y Z   1.4625194e+01 -8.1726720e-01 -2.8333545e+01 MM

INERTIA with respect to 4 coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 7.7880590e+03 1.7632576e+02 1.9116493e+03
Iyx Iyy Iyz 1.7632576e+02 9.0328478e+03 -1.2856149e+02
Izx Izy Izz 1.9116493e+03 -1.2856149e+02 4.0316973e+03

INERTIA at CENTER OF GRAVITY with respect to 4 coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 6.4480435e+03 1.5639093e+02 1.2205359e+03
Iyx Iyy Iyz 1.5639093e+02 7.3372077e+03 -8.9941532e+01
Izx Izy Izz 1.2205359e+03 -8.9941532e+01 3.6738448e+03

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3   3.2086017e+03 6.8801863e+03 7.3703080e+03

ROTATION MATRIX from 4 orientation to PRINCIPAL AXES:
   -0.35380   0.90488   0.23668
    0.03376   -0.24053   0.97005
    0.93471   0.35120   0.05455

ROTATION ANGLES from 4 orientation to PRINCIPAL AXES (degrees):
angles about x y z -86.782   13.691   -111.355

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 4.3861604e+01 6.4228340e+01 6.6476695e+01 MM

elbow
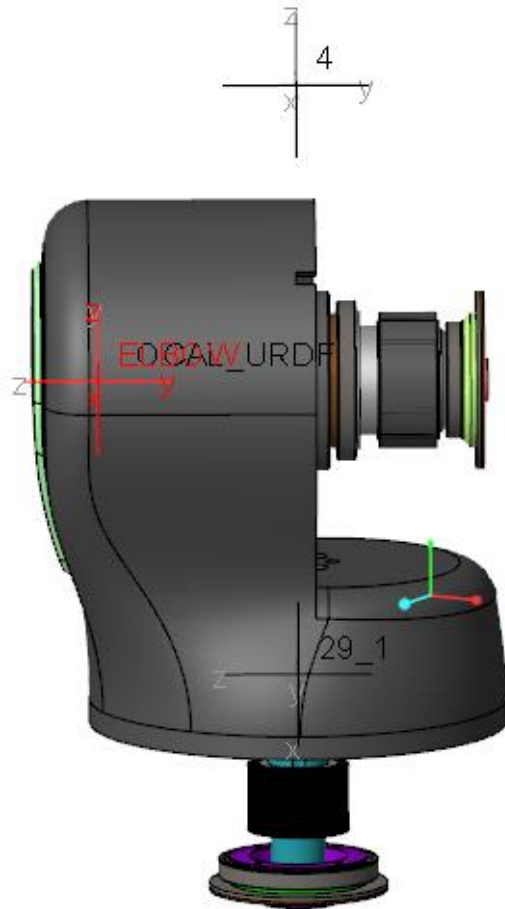
VOLUME = 2.8053180e+05 MM^3
SURFACE AREA = 2.7186630e+05 MM^2
AVERAGE DENSITY = 4.6901240e-06 KILOGRAM / MM^3
MASS = 1.3157289e+00 KILOGRAM

CENTER OF GRAVITY with respect to ELBOW coordinate frame:
X Y Z   -7.6833067e+00 4.0302205e+01 -4.3492779e+01 MM

INERTIA with respect to ELBOW coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 8.9563516e+03 5.2479490e+02 -8.5890698e+02
Iyx Iyy Iyz 5.2479490e+02 6.4205251e+03 3.1020123e+03
Izx Izy Izz -8.5890698e+02 3.1020123e+03 3.9742366e+03

INERTIA at CENTER OF GRAVITY with respect to ELBOW coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 4.3303940e+03 1.1737391e+02 -4.1923199e+02
Iyx Iyy Iyz 1.1737391e+02 3.8539919e+03 7.9573038e+02
Izx Izy Izz -4.1923199e+02 7.9573038e+02 1.7594689e+03

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3   1.4263634e+03 4.1201959e+03 4.3972955e+03

ROTATION MATRIX from ELBOW orientation to PRINCIPAL AXES:
    0.14807   0.07979   -0.98575
   -0.31450   0.94880   0.02955
    0.93764   0.30564   0.16558

ROTATION ANGLES from ELBOW orientation to PRINCIPAL AXES (degrees):
angles about x y z -10.120   -80.317   -28.318

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 3.2925462e+01 5.5959744e+01 5.7810884e+01 MM

Forearm_yaw

VOLUME = 4.1068471e+05 MM^3
SURFACE AREA = 3.5142556e+05 MM^2
AVERAGE DENSITY = 3.6301686e-06 KILOGRAM / MM^3
MASS = 1.4908547e+00 KILOGRAM

CENTER OF GRAVITY with respect to FOREARM_PITCH coordinate frame:
X Y Z -1.1079615e-01 -1.1590836e+01 -7.8160260e+01 MM

INERTIA with respect to FOREARM_PITCH coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 1.7877176e+04 -1.9770838e+01 6.4687772e+00
Iyx Iyy Iyz -1.9770838e+01 1.6853105e+04 -1.0220281e+03
Izx Izy Izz 6.4687772e+00 -1.0220281e+03 2.9445030e+03

INERTIA at CENTER OF GRAVITY with respect to FOREARM_PITCH coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 8.5692128e+03 -1.7856252e+01 1.9379365e+01
Iyx Iyy Iyz -1.7856252e+01 7.7454159e+03 3.2860094e+02
Izx Izy Izz 1.9379365e+01 3.2860094e+02 2.7441921e+03

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3 2.7226222e+03 7.7665726e+03 8.5696260e+03

ROTATION MATRIX from FOREARM_PITCH orientation to PRINCIPAL AXES:
  -0.00351   0.02062   -0.99978
  -0.06529   0.99765   0.02080
   0.99786   0.06535   -0.00215

ROTATION ANGLES from FOREARM_PITCH orientation to PRINCIPAL AXES (degrees):
angles about x y z -95.908   -88.802   -99.654

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 4.2734244e+01 7.2176703e+01 7.5816420e+01 MM

Forearm_pitch
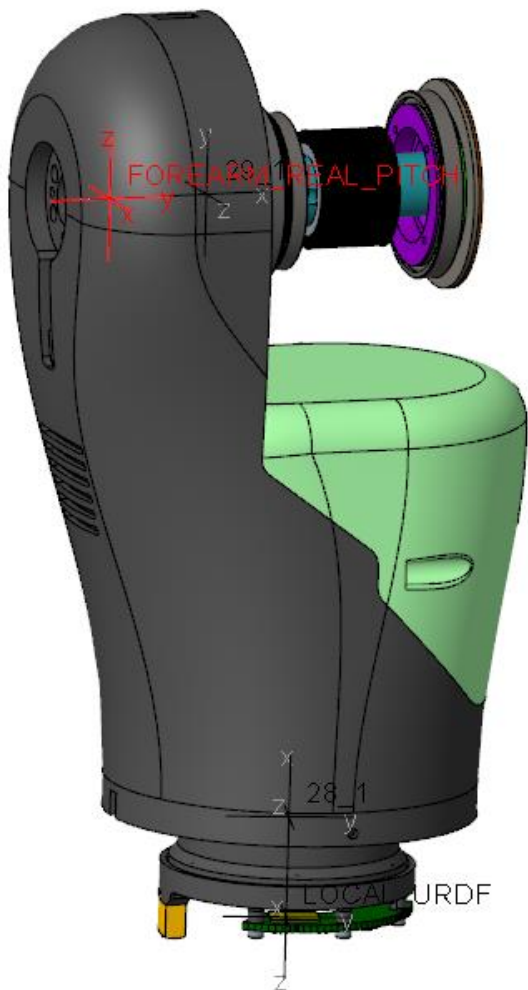
VOLUME = 2.7686053e+05 MM^3
SURFACE AREA = 2.6060639e+05 MM^2
AVERAGE DENSITY = 4.0683345e-06 KILOGRAM / MM^3
MASS = 1.1263612e+00 KILOGRAM

CENTER OF GRAVITY with respect to FOREARM_REAL_PITCH coordinate frame:
X Y Z   -4.6502396e-03 3.8014094e+01 -6.9926878e+01 MM

INERTIA with respect to FOREARM_REAL_PITCH coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 1.2322496e+04 -2.7045258e+01 1.9170832e+00
Iyx Iyy Iyz -2.7045258e+01 1.0311424e+04 3.7157578e+03
Izx Izy Izz 1.9170832e+00 3.7157578e+03 2.9048112e+03

INERTIA at CENTER OF GRAVITY with respect to FOREARM_REAL_PITCH coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 5.1871784e+03 -2.7244370e+01 2.2833496e+00
Iyx Iyy Iyz -2.7244370e+01 4.8037789e+03 7.2165653e+02
Izx Izy Izz 2.2833496e+00 7.2165653e+02 1.2771388e+03

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3   1.1351666e+03 4.9429076e+03 5.1900219e+03

ROTATION MATRIX from FOREARM_REAL_PITCH orientation to PRINCIPAL AXES:
   -0.00185   0.10701   -0.99426
   -0.19303   0.97552   0.10535
    0.98119   0.19211   0.01885

ROTATION ANGLES from FOREARM_REAL_PITCH orientation to PRINCIPAL AXES (degrees):
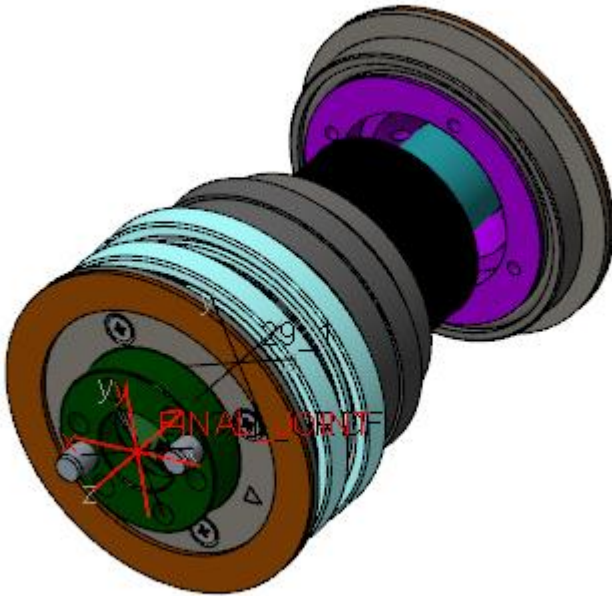angles about x y z -79.856   -83.856   -90.991

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 3.1746142e+01 6.6244892e+01 6.7880611e+01 MM

Forearm_last joint yaw

VOLUME = 4.3878646e+04 MM^3
SURFACE AREA = 5.2821743e+04 MM^2
AVERAGE DENSITY = 6.3735851e-06 KILOGRAM / MM^3
MASS = 2.7966428e-01 KILOGRAM

CENTER OF GRAVITY with respect to FINAL_JOINT coordinate frame:
X Y Z   0.0000000e+00 0.0000000e+00 3.1270570e+01 MM

INERTIA with respect to FINAL_JOINT coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 4.1762123e+02 9.8651826e-02 0.0000000e+00
Iyx Iyy Iyz 9.8651826e-02 4.1763942e+02 0.0000000e+00
Izx Izy Izz 0.0000000e+00 0.0000000e+00 6.0500616e+01

INERTIA at CENTER OF GRAVITY with respect to FINAL_JOINT coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 1.4415192e+02 9.8651826e-02 0.0000000e+00
Iyx Iyy Iyz 9.8651826e-02 1.4417010e+02 0.0000000e+00
Izx Izy Izz 0.0000000e+00 0.0000000e+00 6.0500616e+01

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3   6.0500616e+01 1.4406194e+02 1.4426008e+02

ROTATION MATRIX from FINAL_JOINT orientation to PRINCIPAL AXES:
     0.00000   0.73884   0.67388
     0.00000   -0.67388   0.73884
     1.00000   0.00000   0.00000

ROTATION ANGLES from FINAL_JOINT orientation to PRINCIPAL AXES (degrees):
angles about x y z -90.000   42.367   -90.000

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 1.4708263e+01 2.2696355e+01 2.2711958e+01 MM

Torso yaw
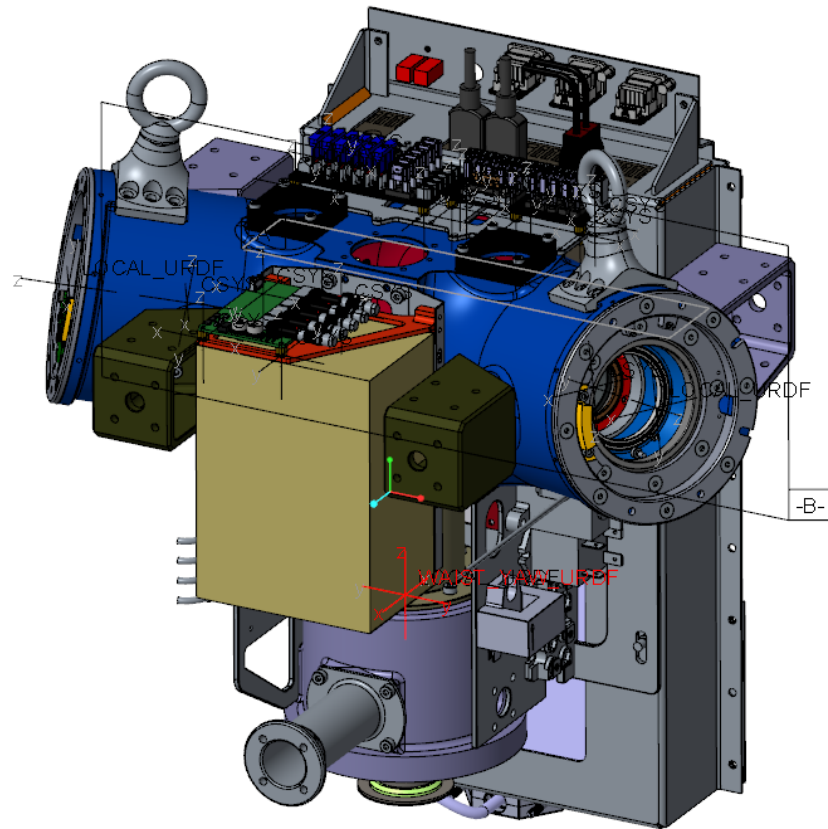
VOLUME = 4.0551122e+06 MM^3
SURFACE AREA = 1.9553402e+06 MM^2
AVERAGE DENSITY = 3.0855606e-06 KILOGRAM / MM^3
MASS = 1.2512295e+01 KILOGRAM

CENTER OF GRAVITY with respect to WAIST_YAW_URDF coordinate frame:
X Y Z -5.9646212e+01 1.4305062e+00 4.2741527e+01 MM

INERTIA with respect to WAIST_YAW_URDF coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 2.3309971e+05 9.1233034e+02 -1.8318131e+04
Iyx Iyy Iyz 9.1233034e+02 2.6720252e+05 -1.0570749e+03
Izx Izy Izz -1.8318131e+04 -1.0570749e+03 1.8479117e+05

INERTIA at CENTER OF GRAVITY with respect to WAIST_YAW_URDF coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 2.1021617e+05 -1.5527214e+02 -5.0216602e+04
Iyx Iyy Iyz -1.5527214e+02 1.9982996e+05 -2.9204792e+02
Izx Izy Izz -5.0216602e+04 -2.9204792e+02 1.4025094e+05

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3 1.1403187e+05 1.9983123e+05 2.3643397e+05

ROTATION MATRIX from WAIST_YAW_URDF orientation to PRINCIPAL AXES:
    0.46281   -0.00172   -0.88646
    0.00385   0.99999   0.00007
   0.88645   -0.00345   0.46281

ROTATION ANGLES from WAIST_YAW_URDF orientation to PRINCIPAL AXES (degrees):
angles about x y z 0.000   -62.431   0.213

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 9.5465103e+01 1.2637559e+02 1.3746320e+02 MM

Head yaw
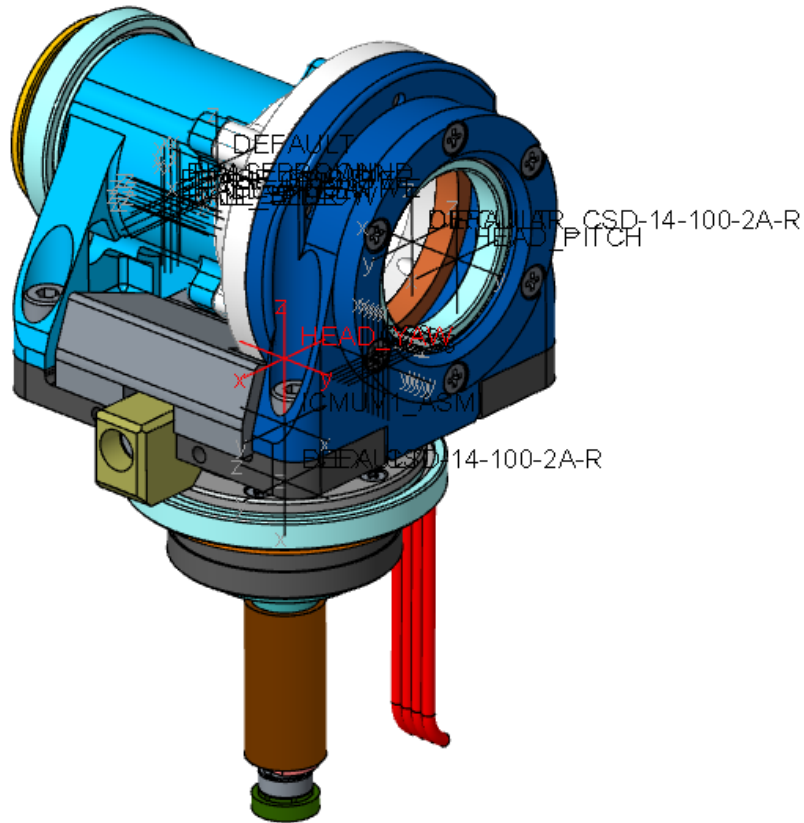
VOLUME = 1.1368397e+05 MM^3
SURFACE AREA = 9.0100890e+04 MM^2
AVERAGE DENSITY = 5.2377357e-06 KILOGRAM / MM^3
MASS = 5.9544662e-01 KILOGRAM

CENTER OF GRAVITY with respect to HEAD_YAW coordinate frame:
X Y Z 1.7665124e-01 -5.6962982e-01 9.6961910e+00 MM

INERTIA with respect to HEAD_YAW coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 5.0019931e+02 1.2343306e-02 -8.9287674e-01
Iyx Iyy Iyz 1.2343306e-02 4.2558237e+02 8.9412269e+00
Izx Izy Izz -8.9287674e-01 8.9412269e+00 2.7144961e+02

INERTIA at CENTER OF GRAVITY with respect to HEAD_YAW coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 4.4402452e+02 -4.7573996e-02 1.2703055e-01
Iyx Iyy Iyz -4.7573996e-02 3.6958221e+02 5.6524326e+00
Izx Izy Izz 1.2703055e-01 5.6524326e+00 2.7123782e+02

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3 2.7091391e+02 3.6990600e+02 4.4402464e+02

ROTATION MATRIX from HEAD_YAW orientation to PRINCIPAL AXES:
-0.00075   0.00054   -1.00000
-0.05719   0.99836   0.00058
 0.99836   0.05719   -0.00072

ROTATION ANGLES from HEAD_YAW orientation to PRINCIPAL AXES (degrees):
angles about x y z-140.767   -89.947   -144.045

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 2.1330166e+01 2.4924375e+01 2.7307511e+01 MM

Head pitch
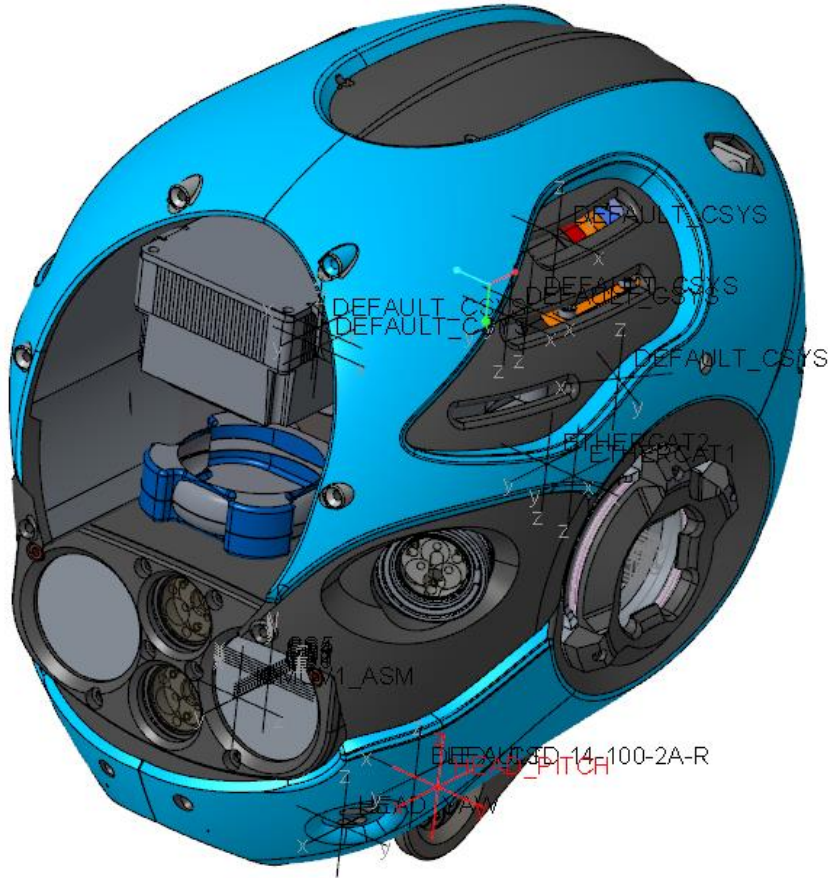
VOLUME = 1.0683415e+06 MM^3
SURFACE AREA = 5.9958122e+05 MM^2
AVERAGE DENSITY = 2.9380576e-06 KILOGRAM / MM^3
MASS = 3.1388490e+00 KILOGRAM

CENTER OF GRAVITY with respect to HEAD_PITCH coordinate frame:
X Y Z   6.5724785e+00 -3.4569915e+01 1.1402826e+02 MM

INERTIA with respect to HEAD_PITCH coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 6.6631055e+04 6.8066704e+02 -3.5583041e+03
Iyx Iyy Iyz 6.8066704e+02 6.0088590e+04 1.2276506e+04
Izx Izy Izz -3.5583041e+03 1.2276506e+04 2.5221425e+04

INERTIA at CENTER OF GRAVITY with respect to HEAD_PITCH coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 2.2067171e+04 -3.2510922e+01 -1.2058990e+03
Iyx Iyy Iyz -3.2510922e+01 1.9140289e+04 -9.6672078e+01
Izx Izy Izz -1.2058990e+03 -9.6672078e+01 2.1334662e+04

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3 1.9132833e+04 2.0447822e+04 2.2961467e+04

ROTATION MATRIX from HEAD_PITCH orientation to PRINCIPAL AXES:
    0.03748   0.59467   0.80309
    0.99723   -0.07398   0.00824
    0.06431   0.80056   -0.59580

ROTATION ANGLES from HEAD_PITCH orientation to PRINCIPAL AXES (degrees):
angles about x y z -179.208   53.426   -86.394

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 7.8073639e+01 8.0712037e+01 8.5529238e+01 MM

Torso roll fixed
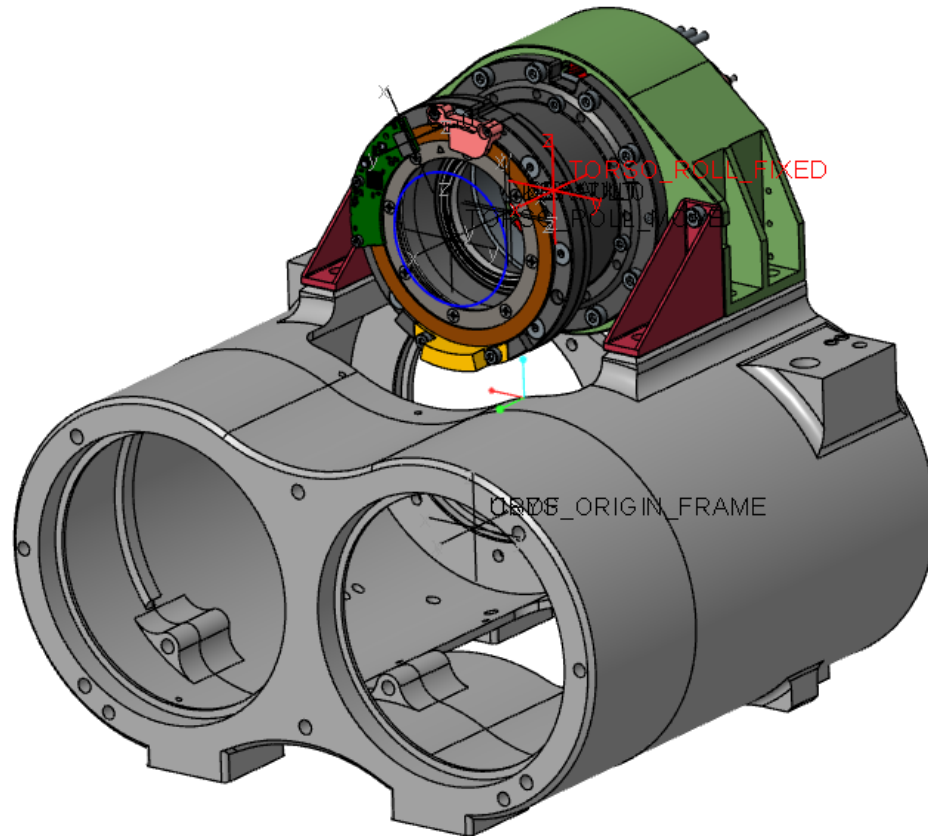
VOLUME = 9.6612646e+05 MM^3
SURFACE AREA = 5.4086234e+05 MM^2
AVERAGE DENSITY = 3.0284953e-06 KILOGRAM / MM^3
MASS = 2.9259094e+00 KILOGRAM

CENTER OF GRAVITY with respect to TORSO_ROLL_FIXED coordinate frame:
X Y Z 2.7038986e+01 -5.1554922e-03 -6.4188178e+01 MM

INERTIA with respect to TORSO_ROLL_FIXED coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 3.7768715e+04 9.9086721e+00 9.4301090e+03
Iyx Iyy Iyz 9.9086721e+00 3.9143447e+04 3.5756843e+00
Izx Izy Izz 9.4301090e+03 3.5756843e+00 2.7059272e+04

INERTIA at CENTER OF GRAVITY with respect to TORSO_ROLL_FIXED coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 2.5713610e+04 9.5008024e+00 4.3519496e+03
Iyx Iyy Iyz 9.5008024e+00 2.4949190e+04 4.5439311e+00
Izx Izy Izz 4.3519496e+03 4.5439311e+00 2.4920120e+04

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3 2.0946866e+04 2.4949171e+04 2.9686883e+04

ROTATION MATRIX from TORSO_ROLL_FIXED orientation to PRINCIPAL AXES:
-0.67425 -0.00106 -0.73851
0.00076 1.00000 -0.00213
0.73851 -0.00200 -0.67424

ROTATION ANGLES from TORSO_ROLL_FIXED orientation to PRINCIPAL AXES (degrees):
angles about x y z 179.819 -47.604 179.910

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 8.4611440e+01 9.2341648e+01 1.0072838e+02 MM

Torso roll move

VOLUME = 6.1911318e+05 MM^3
SURFACE AREA = 4.4885712e+05 MM^2
AVERAGE DENSITY = 3.9264336e-06 KILOGRAM / MM^3
MASS = 2.4309068e+00 KILOGRAM

CENTER OF GRAVITY with respect to TORSO_ROLL_MOVE coordinate frame:
X Y Z   -1.3438629e+01 -2.4995993e-02 7.3562799e+01 MM

INERTIA with respect to TORSO_ROLL_MOVE coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 2.9857616e+04 3.5091583e+01 -1.7677738e+03
Iyx Iyy Iyz 3.5091583e+01 3.3034755e+04 1.6047928e+01
Izx Izy Izz -1.7677738e+03 1.6047928e+01 6.2111222e+03

INERTIA at CENTER OF GRAVITY with respect to TORSO_ROLL_MOVE coordinate frame: (KILOGRAM * MM^2)

INERTIA TENSOR:
Ixx Ixy Ixz 1.6702798e+04 3.5908153e+01 -4.1709274e+03
Iyx Iyy Iyz 3.5908153e+01 1.9440925e+04 1.1578036e+01
Izx Izy Izz -4.1709274e+03 1.1578036e+01 5.7721068e+03

PRINCIPAL MOMENTS OF INERTIA: (KILOGRAM * MM^2)
I1 I2 I3   4.3623453e+03 1.8111835e+04 1.9441649e+04

ROTATION MATRIX from TORSO_ROLL_MOVE orientation to PRINCIPAL AXES:
    0.32020   0.94709   0.02208
   -0.00149   -0.02280   0.99974
    0.94735   -0.32015   -0.00589

ROTATION ANGLES from TORSO_ROLL_MOVE orientation to PRINCIPAL AXES (degrees):
angles about x y z -90.338   1.265   -71.320

RADII OF GYRATION with respect to PRINCIPAL AXES:
R1 R2 R3 4.2361942e+01 8.6317145e+01 8.9429829e+01 MM

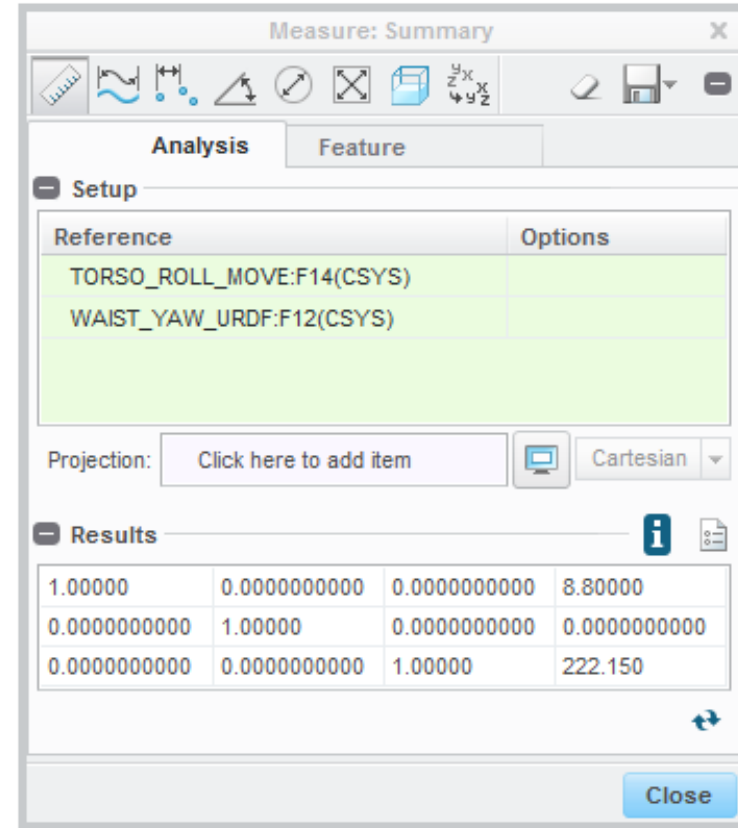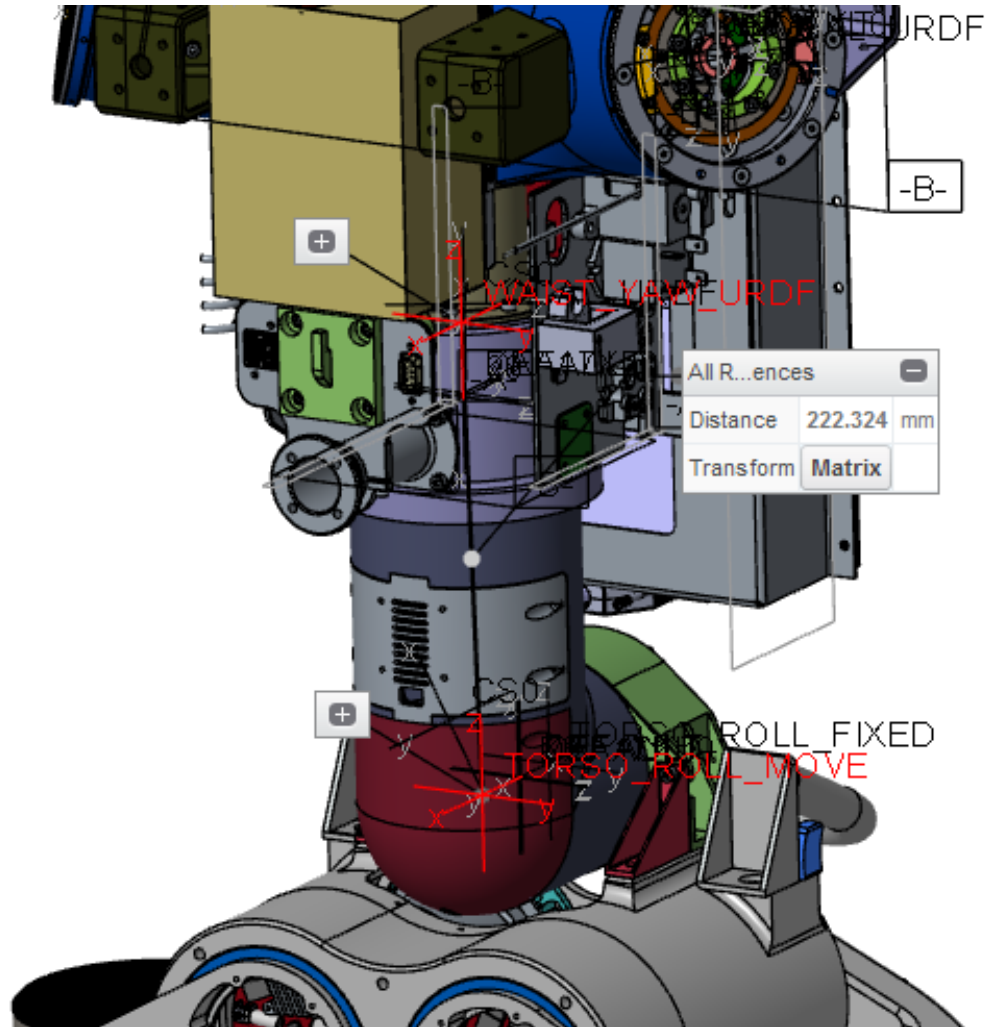# From Joint_URDF_axis to Torso_roll_fixed
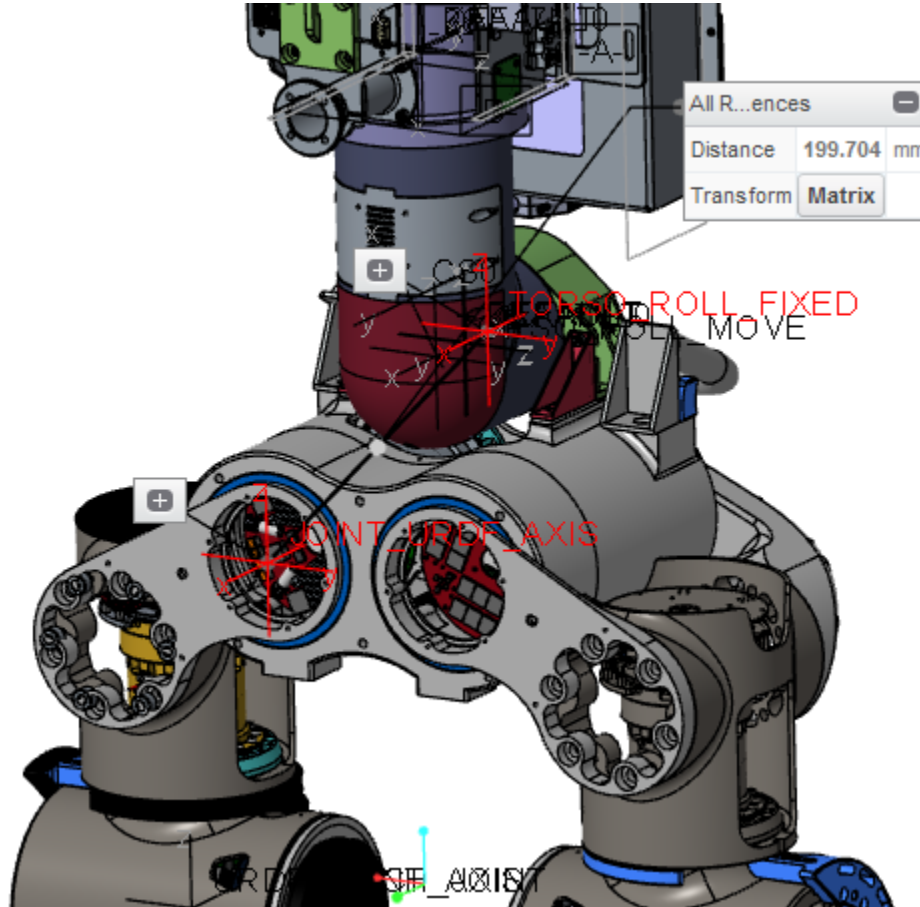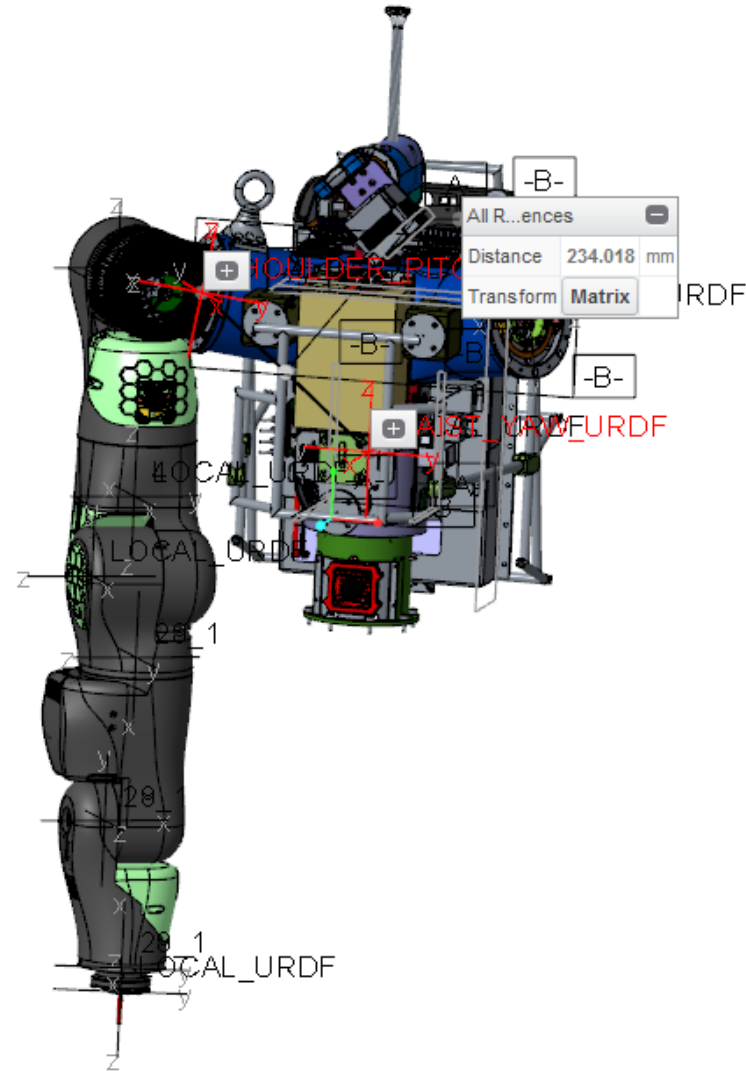
From Joint_URDF_axis to IMU
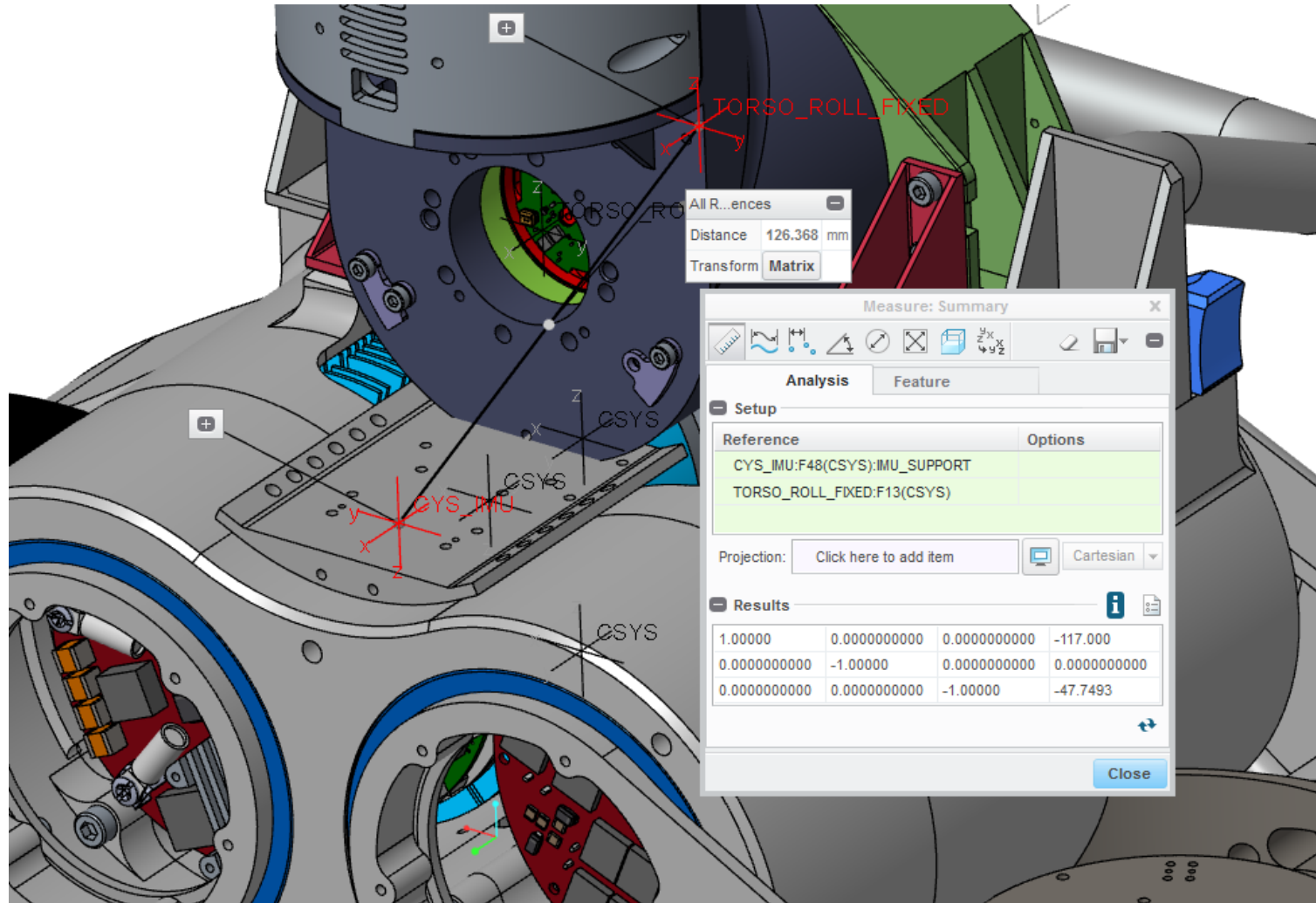
From Cys_IMU to Torso_roll_fixed
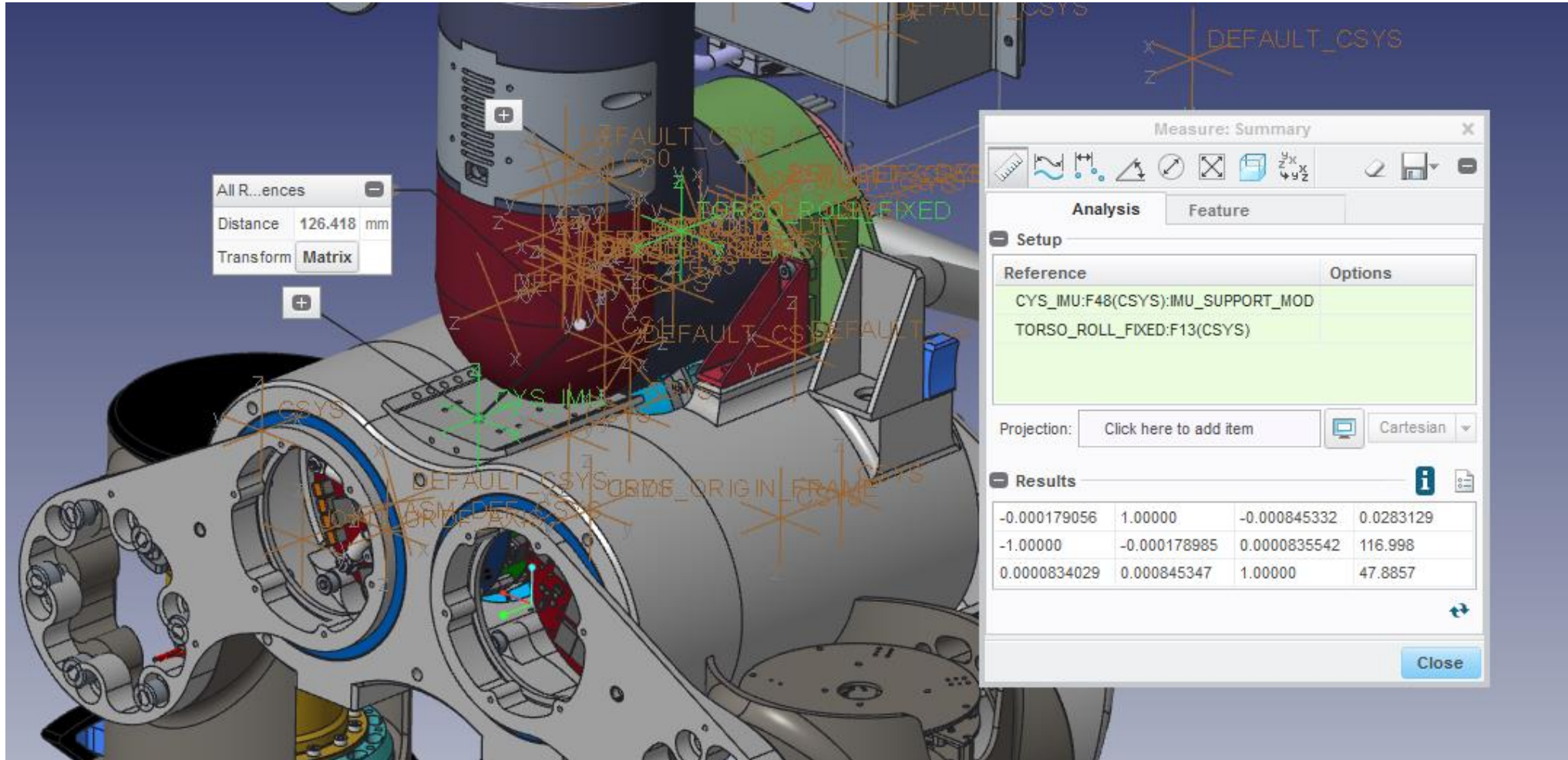
From Torso_roll_fixed to Torso_roll_move
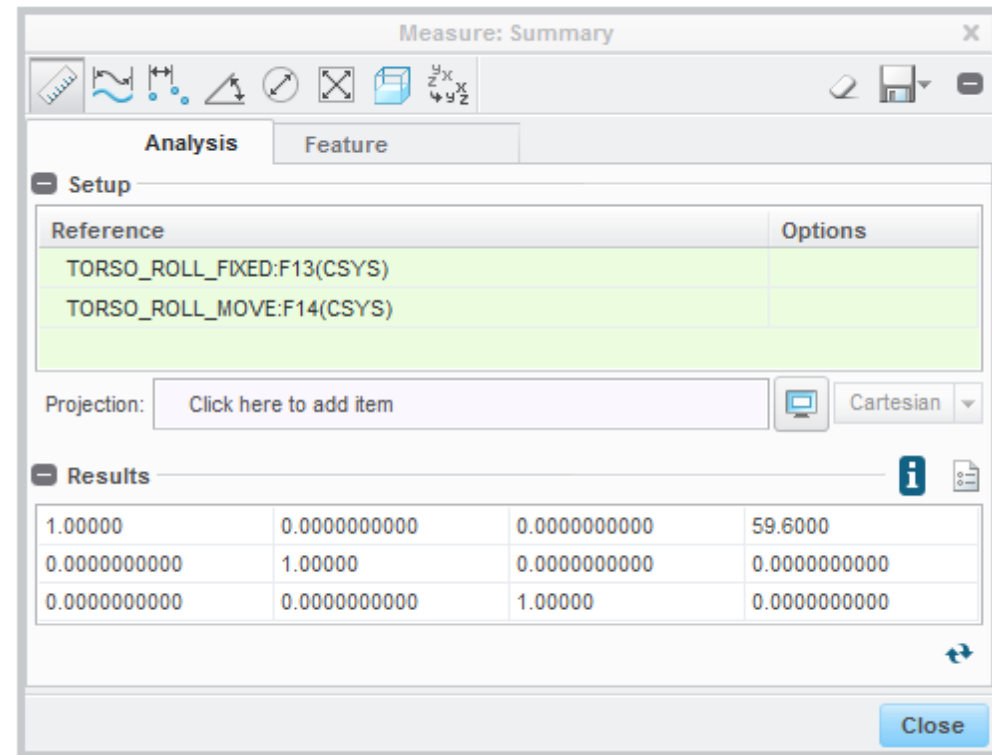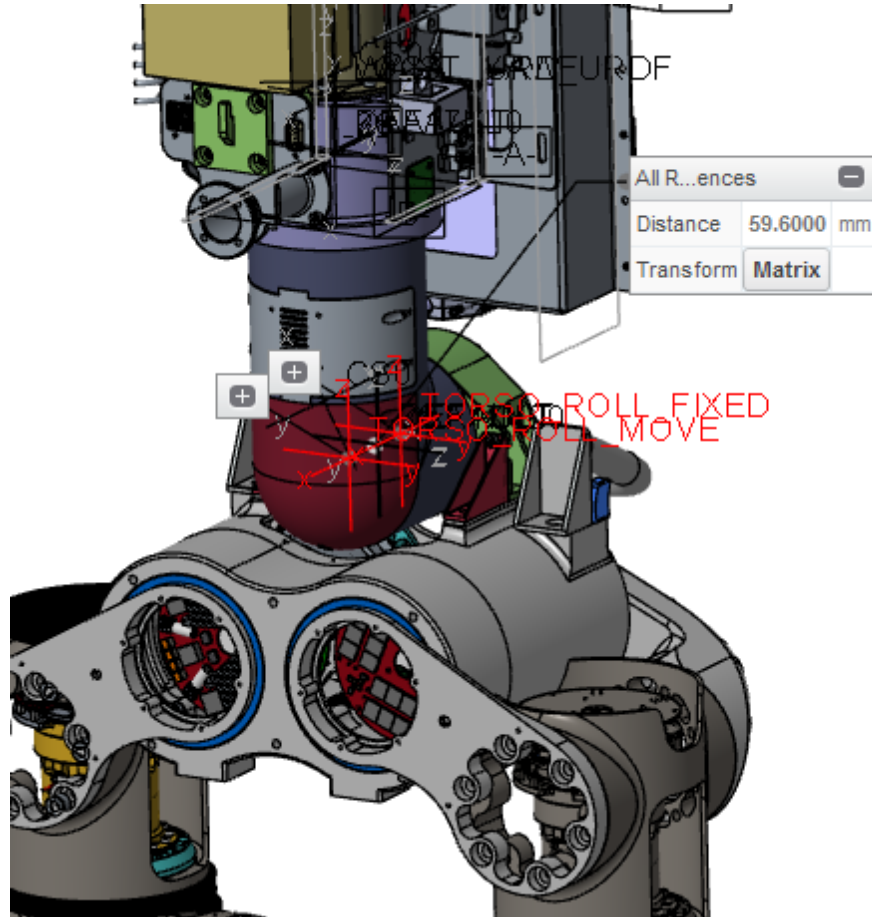
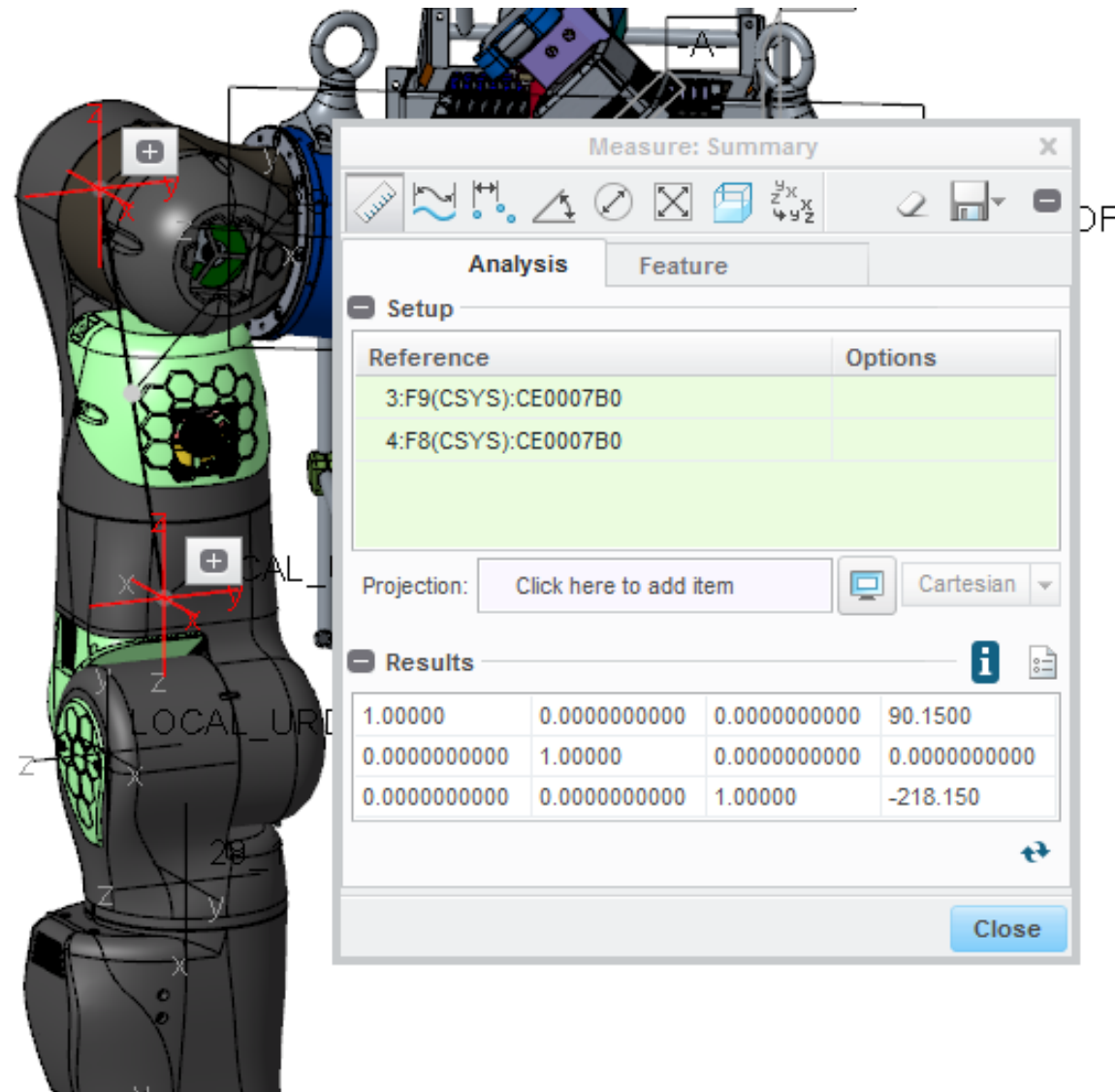# From Torso_roll_move to Torso_roll_fixed
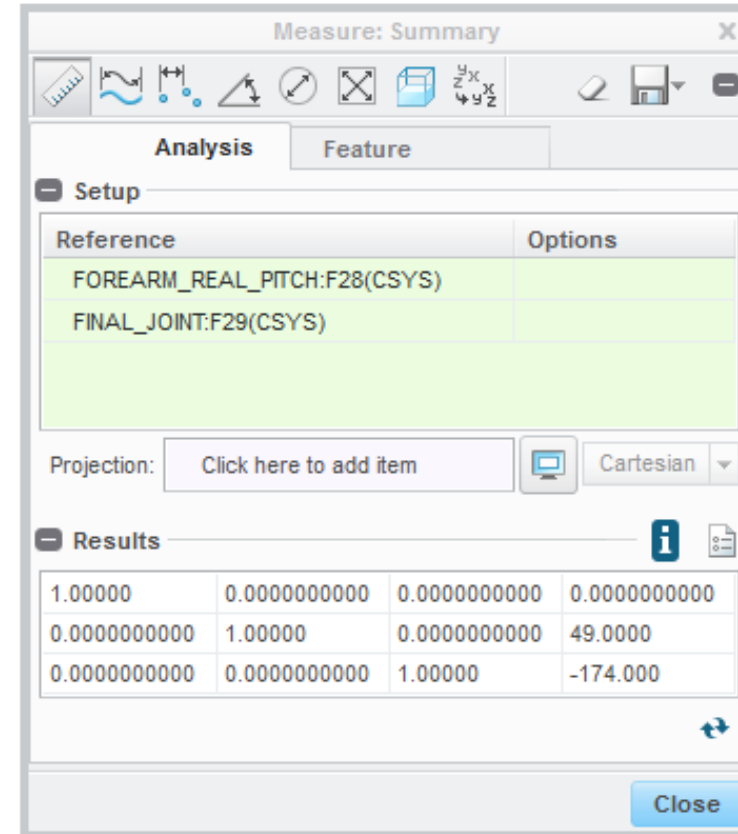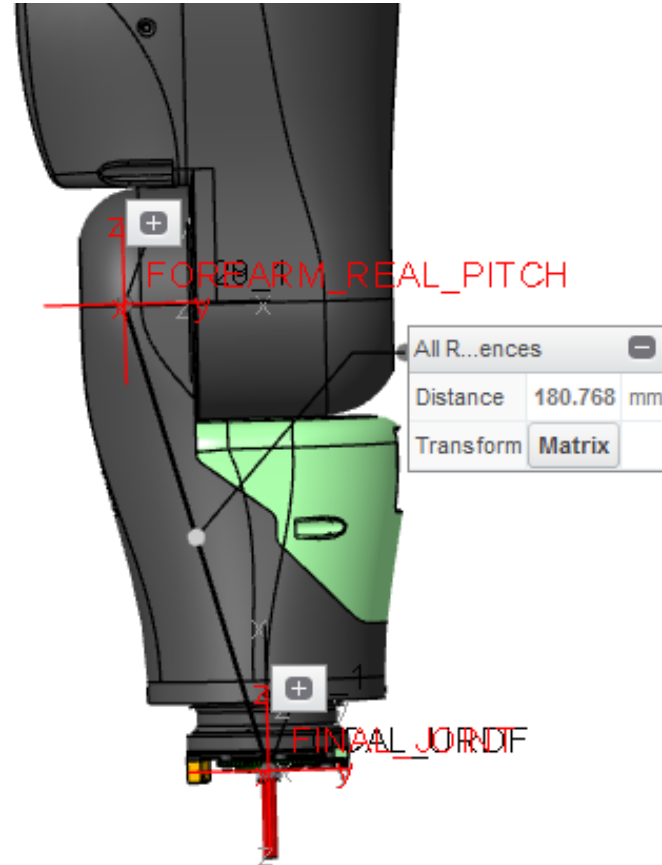
From waist-yaw link to shoulder_pitch

From shoulder_pitch to shoulder_roll
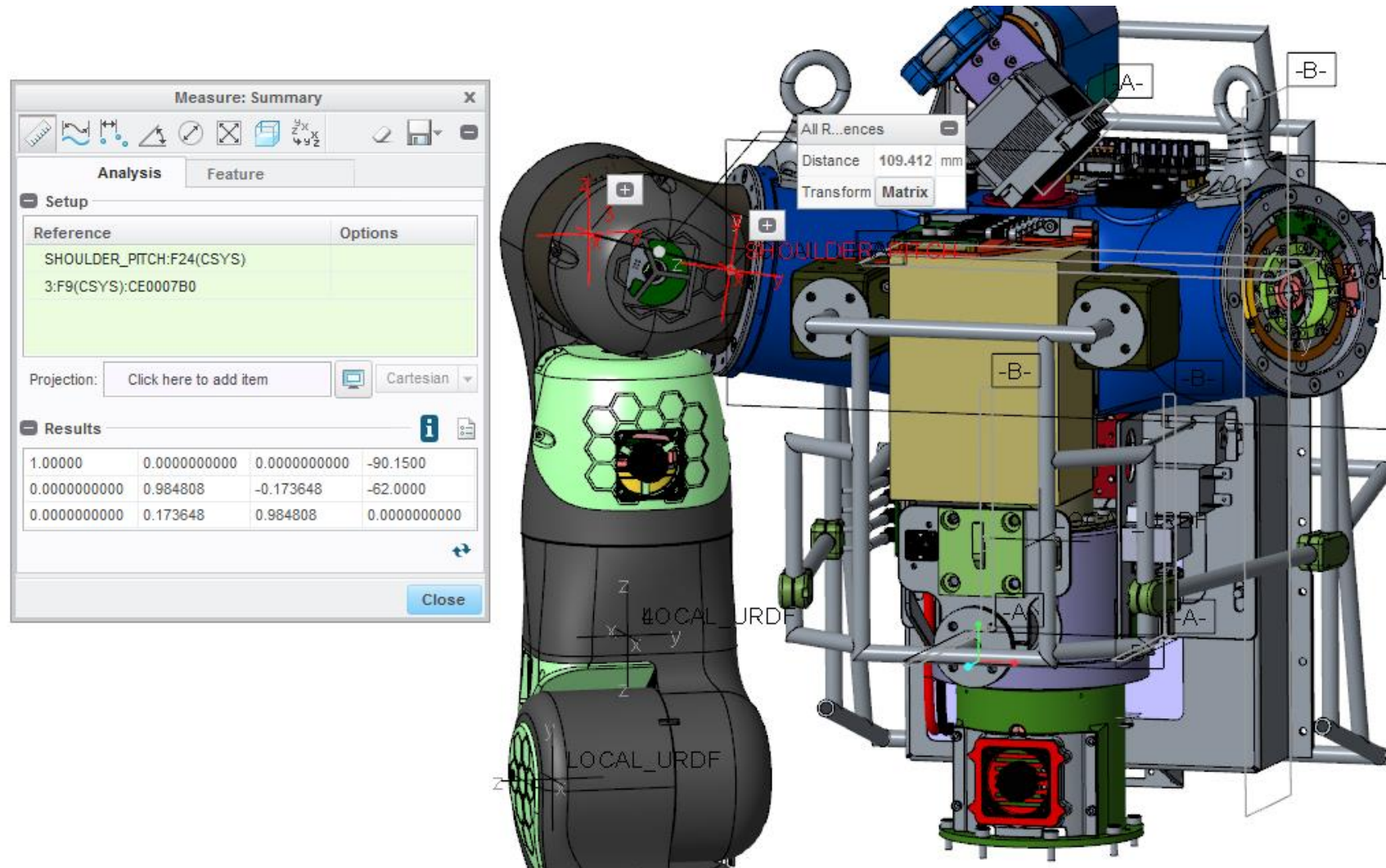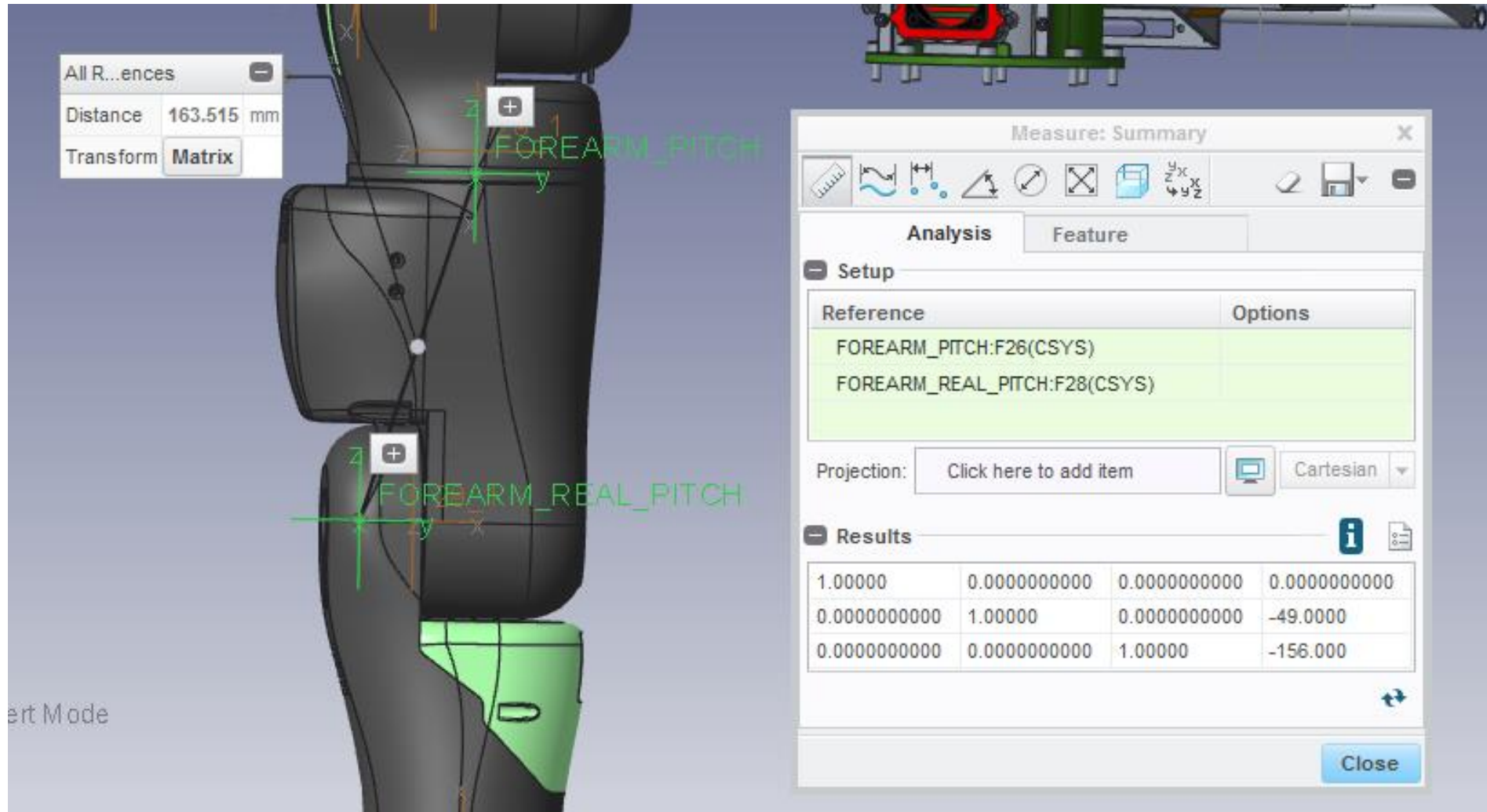
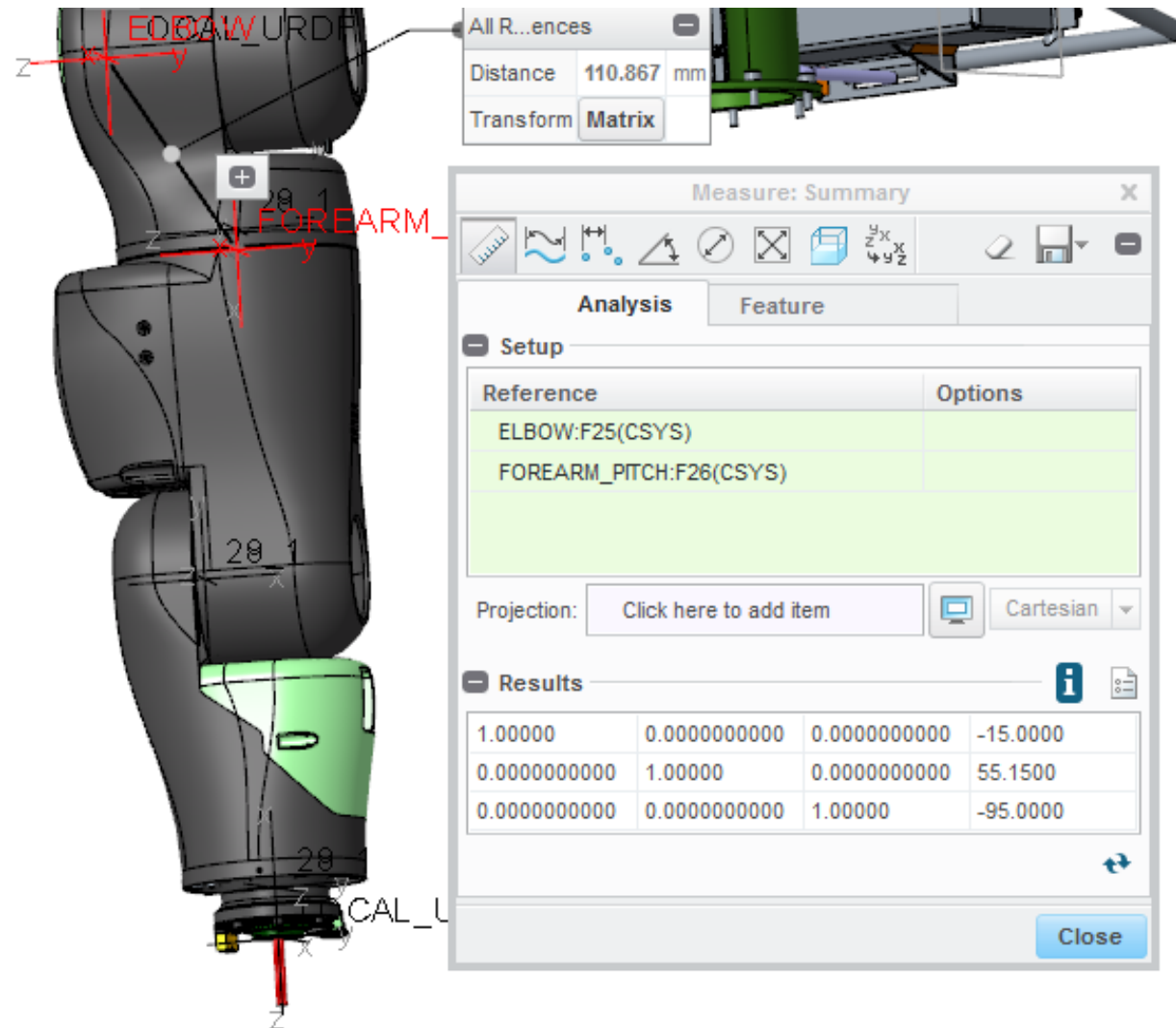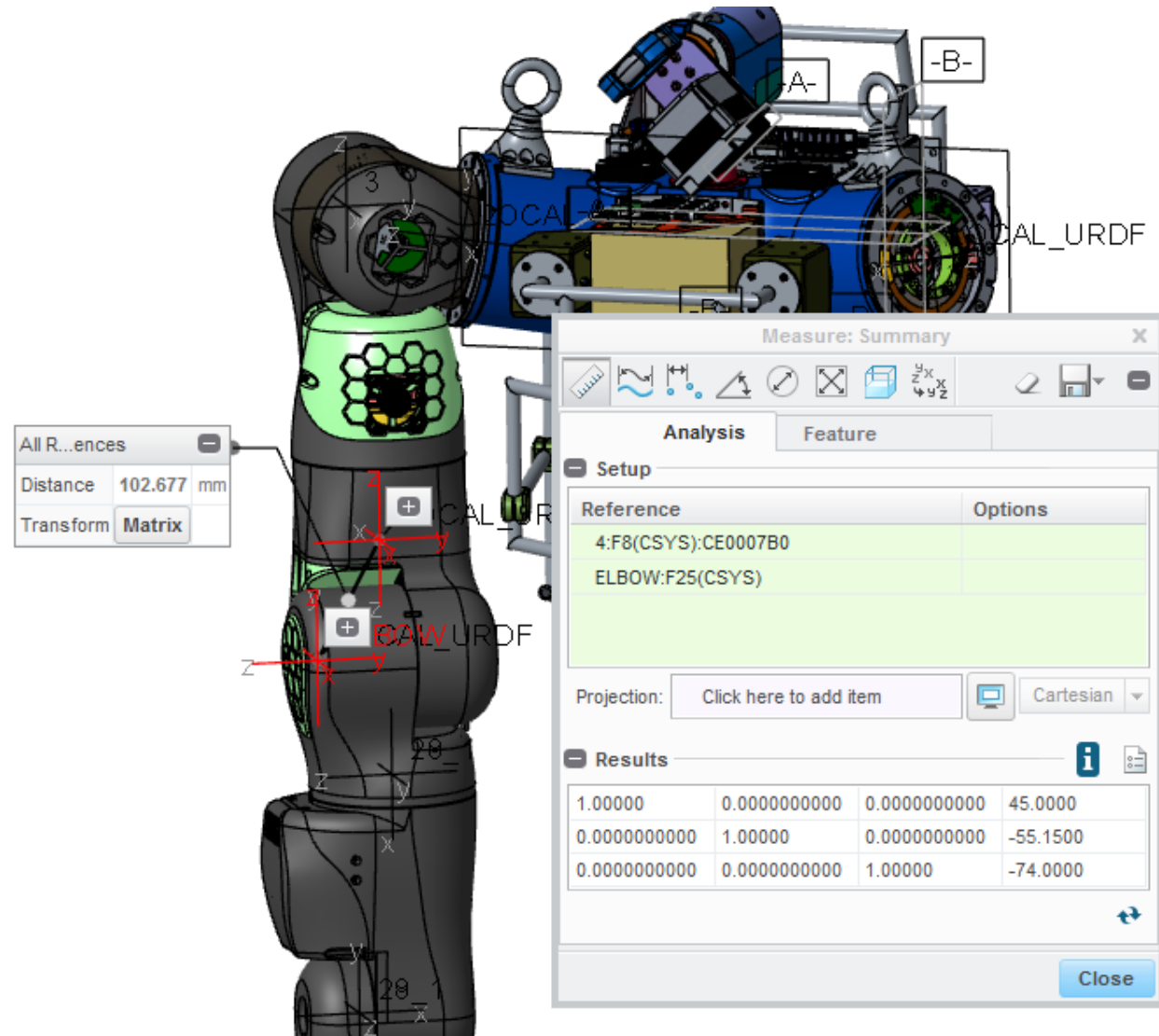# From shoulder_roll to shoulder_yaw

From forearm pitch to last arm yaw

From forearm yaw to forearm pitch

From elbow to forearm yaw

From shoulder-yaw link elbow

From Torso_roll_move to head_yaw

From Torso_roll_move to head_pitch