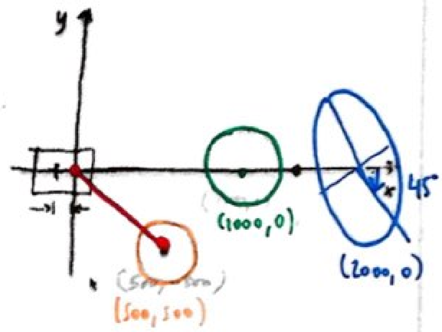
```
        [-100.0**2,  200.0**2 ]]))

if __name__ == '__main__':
    # Robot constants.
    scanner_displacement = 30.0

    # Filter constants.
    measurement_distance_stddev = 200.0  # Distance measurement error of cylinders.
    measurement_angle_stddev = 15.0 / 180.0 * pi  # Angle measurement error.
    Qt_measurement_covariance = \
        np.diag([measurement_distance_stddev**2,
                 measurement_angle_stddev**2])

    # Define a particle: position (x, y) and orientation.
    p = Particle(np.array([-scanner_displacement, 0.0, 0.0]))
    add_landmarks(p)
    N = p.number_of_landmarks()

  * # Compute expected measurements.
    for i in xrange(N):
        print "Landmark", i,
        em = p.h_expected_measurement_for_landmark(i, scanner_displacement)
        print "Expected range:", em[0], "bearing (deg)", em[1]/pi*180
        H, Ql = p.H_Ql_jacobian_and_measurement_covariance_for_landmark(
            i, Qt_measurement_covariance, scanner_displacement)
        print "Covariance of measurement:\n", Ql

    # Compute correspondence likelihoods.
    # Define a set of measurements: (range, bearing).
    print "Measurement likelihoods"
    measurements = [
        ("Close to landmark 0", np.array([500*sqrt(2), -pi/4])),
        ("exactly between landmark 1 and 2", np.array([1500.0, 0.0]))
        ]
    for (text, m) in measurements:
        print "Likelihoods for measurement", text
        likelihoods = p.compute_correspondence_likelihoods(
            m, N, Qt_measurement_covariance, scanner_displacement)
        print likelihoods
```

Ln 140 Col 20




```
Python 2.7.3 |EPD_free 7.3-2 (32-bit)| (default, Apr 12 2012, 11:28:34)
[GCC 4.0.1 (Apple Inc. build 5493)] on darwin
Type "copyright", "credits" or "license()" for more information.
>>> ================================ RESTART ================================
>>>
Landmark 0 ----------
 Expected range: 707.106781187 bearing [deg] -45.0
 Covariance of measurement:
[[  5.00000000e-04   0.00000000e+00]
 [  0.00000000e+00   8.85389195e-02]]
Landmark 1 ----------
 Expected range: 1000.0 bearing [deg] 0.0
 Covariance of measurement:
[[  5.00000000e-04   0.00000000e+00]
 [  0.00000000e+00   7.85389195e-02]]
Landmark 2 ----------
 Expected range: 2000.0 bearing [deg] 0.0
 Covariance of measurement:
[[  4.00000000e-04  -5.00000000e+00]
 [ -5.00000000e+00   .85389195e-02]]
Measurement likelihoods ----------
Likelihoods for measurement close to landmark 0
[0.00239203770345262276, 2.12155838872494534e-05, 4.8262617714869e-10]
Likelihoods for measurement exactly between landmark 1 and 2
[1.3664163924358227e-07, 0.00020447619108492608, 0.00041908533374704956]
>>>
```

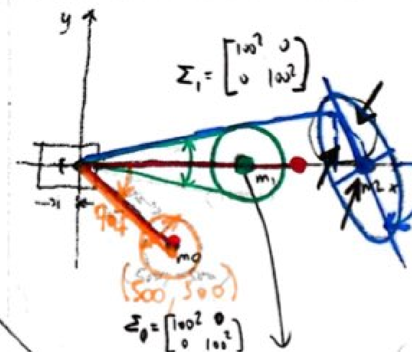
Ln 26 Col 1

Q_{t0} ←

Q_{t1} —

Q_{t2} —

Correlation between range (D_{t2}) and bearing angle (ϕ_{t2})

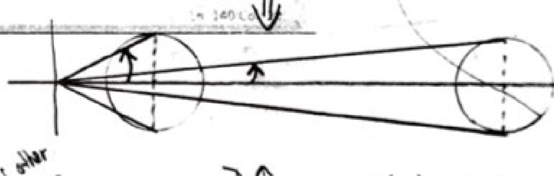


$$\Sigma_K = \begin{bmatrix} \sigma^2_{x_{tK}} & 0 \\ 0 & \sigma^2_{y_{tK}} \end{bmatrix}$$

$$\Sigma_2 = \begin{bmatrix} 200^2 & -(100)^2 \\ -(100)^2 & 200^2 \end{bmatrix}$$

The further the point is the lesser the uncertainty in the bearing angle

⇓



$D_{tK}\uparrow$ → uncertainty $\phi_{tK}\downarrow$

If the bearing angle gets larger the distance gets smaller → thats why the − in the term $-5'0000 \Rightarrow \phi \uparrow D \downarrow$

⇒