

# Run to failure experiment C1

In this work remaining useful life (RUL) refers to the total flight time possible for a single mission. This is in contrast to some of our previous work where RUL referred to the entire life of the UAV across multiple missions. This time the digital twin is simulated multiple times for a distribution.

## Simulation Steps

The first step is to load the models, provide an initial RUL estimate (using manufacturers information on the battery is a good starting place), and load some workspace variables. 1D polynomial fitting is used to approximate the degradation rate, and thereby predict the mean of the future degradation value distribution. These predicted values are then passed to a digital twin, which is simulated multiple times to generate a monte carlo distribution of variables tracked such as ending state of charge and voltage and mission outcome. The RUL is updated based on the result of the digital twin simulation, and then the new RUL is used by the real system for trajectory selection. The steps are as follows:

- 1.

## Uncertainty Quantification

## Trajectories

## load main workspace

```
end_sim = 0;
fail_count = 0;
low_soc_count = 0;
pos_err_count = 0;

addpath(genpath(pwd));
load_db_params;
conn = database(datasource_name, user_name, password);

% load UAV airframe
uav_sern = 'X001';
octomodel = get_airframe(conn, uav_sern);

% load battery
battery_sern = 'B001';
battery = get_battery(conn, battery_sern);
batterytwin = get_battery(conn, battery_sern);
```

```

% load motors
[Motor1, Motor2, Motor3, Motor4, Motor5, Motor6, Motor7, Motor8] = get_motors(conn, octomodel.i
[Motortwin1, Motortwin2, Motortwin3, Motortwin4, Motortwin5, Motortwin6, Motortwin7, Motortwin8

% initial rul estimate, used as baseline in rul updates where the minimum
% value is taken to ensure rul_hat never exceeds this value
rul_init = 18.0;
rul_hat = rul_init;

% minimum rul
rul_threshold = 10.0;

% load base directory
load_base_workspace;

%load_trajectory; % load individually

```

## Initialize some variables

```

% for poly fitting
lookback = 6;

% how far into the future to look
horizon = 2;

% number of missions (can be oversized)
n_missions = 250;

% keep track of delta over time
% number of missions, 3 degradation parameters, 2 coefficients to save
% (slope & intercept)
polys = zeros(n_missions, 3, 2);

% keep track of degradation parameter values for poly fitting
q_deg = zeros(n_missions, 1);
r_deg = zeros(n_missions, 1);
m_deg = zeros(n_missions, 1);

% variance gets tighter over time, a pseudo-hack...
r_var_vals = [.001:-.00001:.0001];
q_var_vals = [.9:-.01:.2];
m_var_vals = [.02:-.00025:.0025];

% keep track of rul
ruls = zeros(n_missions, 1);

```

## Main Loop

```

% loop
% accelerated is 80
% normal is 300
for i = 44:n_missions
    if i < 20 && i >= 11

```

```

        lookback = 8;
        horizon = 3;
elseif i >= 21
    lookback = 10;
    horizon = 4;
end

ruls(i) = rul_hat;
load_trajectory;
if end_sim == 1
    disp("[INFO] no more valid trajectories. ending simulation.")
    break;
end
if trajectory.path_time > rul_hat
    fprintf("[INFO] TrueSystem selecting trajectory: <%d> with path_time: %.2f to explore c
else
    fprintf("[INFO] TrueSystem selecting trajectory: <%d> with path_time: %.2f that meets c
end
sys = "TrueSystem";
octomodel.sampletime = true_sample_rate;
fprintf('[INFO] simulating true system on i: %d\n', i)
%tic
sim('truesystem.slx');
%toc

```

## update degradation parameters for saving

- assign values from the current run to the arrays for saving

```

q_deg(i) = battery.Q;
r_deg(i) = battery.R0;
m_deg(i) = Motor2.Req;

```

## update variance

```

fprintf('[INFO] updating degradation parameter variance on i: %d\n', i)
if i <= length(r_var_vals)
    r_var = r_var_vals(i);
else
    r_var = .0001;
end
if i <= length(q_var_vals)
    q_var = q_var_vals(i);
else
    q_var = .25;
end
if i <= length(m_var_vals)
    m_var = m_var_vals(i);
else
    m_var = .005;
end

```

## sample the degradation parameters and update

```

fprintf('[INFO] updating degradation parameter values via random sampling on i: %d\n', i)
battery.R0 = max(abs(normrnd(rdeg(i), r_var)), .0001);
battery.Q = min(abs(normrnd(qdeg(i), q_var)), 15.5);
Motor2.Req = max(abs(normrnd(mdeg(i), m_var)), .001);

```

## write telemetry data to database

```

distance = calculatedistance([pos_actual.Data(:,1) pos_actual.Data(:,2)]);
mission_id = table2array(select(conn, 'select id from mission_tb mt order by id desc limit 1'));
if isempty(mission_id)
    mission_id = 1;
else
    mission_id = mission_id + 1;
end
start = table2array(select(conn, 'select mt.dt_stop from mission_tb mt order by dt_stop desc limit 1'));
if isempty(start)
    start = datetime(now, 'ConvertFrom', 'datetime');
end
start = datetime(start, 'InputFormat', 'yyyy-MM-dd HH:mm:ss');
start = dateshift(start, 'start', 'second');
start = start + hours(1);
stop = start + seconds(flight_time.Data(end, 1)*60);

fprintf("[INFO] i: %d\tmission_id: %d\tfuel_hat: %.2f\tflight_time: %.2f\tdistance: %.2f\tR0: %.2f\tQ: %.2f\tReq: %.2f\n", i, mission_id, fuel_hat, flight_time, distance, R0, Q, Req);

write_mission_data;
write_battery_data;
write_flight_data;

if any(stop_code.Data(:,1)) == 1 && ~any(stop_code.Data(:,3)) == 1
    fprintf('[WARN] true system low soc threshold exceeded on i: %d\tmission_id: %d\n', i, mission_id);
    %break;
end

if any(stop_code.Data(:,2)) == 1
    fprintf('[WARN] true system position error threshold exceeded on i: %d\tmission_id: %d\n', i, mission_id);
    %break;
end

if any(stop_code.Data(:,3)) == 1
    fprintf('[INFO] success on i: %d\tmission_id: %d\n', i, mission_id);
end

clear('trajectory', 'battery_actual', 'battery_observed', 'ctrl_err', 'current', 'current_r0', 'current_q', 'current_req');

```

## define placeholder variables

```

twin_ctr = 1;
twin_count = 4;
times = zeros(1, twin_count);
vs = zeros(1, twin_count);
socs = zeros(1, twin_count);
r0s = zeros(1, twin_count);

```

```

qs = zeros(1, twin_count);
ms = zeros(1, twin_count);
dist = zeros(1, twin_count);
errs = zeros(1, twin_count);
degs = zeros(3, twin_count);
codes = zeros(3, twin_count);

```

## Update twin degradation parameters

```

if i > lookback
    x = double(((i - (lookback-1)):1:i)');
    r_poly = polyfit(x, smoothdata(r_deg(x), 'rlowess', 5), 1);
    q_poly = polyfit(x, smoothdata(q_deg(x), 'rlowess', 5), 1);
    m_poly = polyfit(x, smoothdata(m_deg(x), 'rlowess', 5), 1);

    polys(i, 1, :) = r_poly;
    polys(i, 2, :) = q_poly;
    polys(i, 3, :) = m_poly;

    r_mu = polyval(r_poly, i + horizon);
    q_mu = polyval(q_poly, i + horizon);
    m_mu = polyval(m_poly, i + horizon);
    fprintf('[INFO] forecasting degradation values: r_mu: %.6f\tq_mu: %.6f\tm_mu: %.6f', r_mu, q_mu, m_mu);
    batterytwin.R0 = max(abs(normrnd(r_mu, r_var)), .0001);
    batterytwin.Q = min(abs(normrnd(q_mu, q_var)), 15.5);
    Motortwin2.Req = max(abs(normrnd(m_mu, m_var)), .001);
else
    batterytwin.R0 = max(abs(normrnd(rdeg(i), r_var)), .0001);
    batterytwin.Q = min(abs(normrnd(qdeg(i), q_var)), 15.5);
    Motortwin2.Req = max(abs(normrnd(mdeg(i), m_var)), .001);
end
fprintf("[INFO] digital twin degradation parameters: %.4f\t%.4f\t%.4f", batterytwin.R0, batterytwin.Q, Motortwin2.Req);
write_degradation_data;

```

## now simulate digital twin

```

load_trajectory;
if trajectory.path_time > rul_hat
    fprintf("[INFO] DigitalTwin selecting trajectory: <%d> with path_time: %.2f to explore", trajectory.id, trajectory.path_time);
else
    fprintf("[INFO] DigitalTwin selecting trajectory: <%d> with path_time: %.2f that meets", trajectory.id, trajectory.path_time);
end
sys = "DigitalTwin";
octomodel.sampletime = twin_sample_rate;
for twin_ctr=1:twin_count
    fprintf('[INFO] simulating digital twin on i %d, mission_id: %d\n', i, mission_id);
    out = sim('digitaltwin1c.slx');
    % get the output from each parallel worker
    times(twin_ctr) = flight_time.Data(end);
    vs(twin_ctr) = battery_actual.Data(end, 1);
    socs(twin_ctr) = battery_actual.Data(end, 2);
    r0s(twin_ctr) = battery_actual.Data(end, 3);
    qs(twin_ctr) = battery_actual.Data(end, 6);
    ms(twin_ctr) = motors.Data(end, 1);
end

```

```

errs(twin_ctr) = mean(euclidean_pos_err);
dist(twin_ctr) = calculatedistance([pos_actual.Data(:,1) pos_actual.Data(:,2)]);
degs(:, twin_ctr) = [batterytwins.R0 batterytwins.Q Motortwin2.Req]';
codes(:, twin_ctr) = [any(stop_code.Data(:,1)); any(stop_code.Data(:,2)); any(stop_code

```

## write digital twin parameters to db

```
write_twin_params_data;
```

## resample the degradation parameters for the next digital twin simulation

```

if twin_count > 1 && twin_ctr < twin_count
    fprintf('[INFO] resampling for twin run # %d', twin_ctr + 1);
    if i > lookback
        batterytwins.R0 = normrnd(r_mu, r_var);
        batterytwins.Q = normrnd(q_mu, q_var);
        Motortwin2.Req = normrnd(m_mu, m_var);
    else
        batterytwins.R0 = max(abs(normrnd(rdeg(i), r_var)), .00075);
        batterytwins.Q = min(abs(normrnd(qdeg(i), q_var)), 15.5);
        Motortwin2.Req = max(abs(normrnd(mdeg(i), m_var)), .001);
    end
end
fprintf('[INFO] digital twin degradation parameters: %.4f\t%.4f\t%.4f", batterytwins.R0,
end

low_soc = sum(codes(1,:) == 1);
pos_err = sum(codes(2,:) == 1);
success = sum(codes(3,:) == 1);
fprintf('[INFO] digital twin mean parameter values: R0 = %.5f\t Q = %.2f\t Req = %.5f\n\t s

```

## update rul

```

updated = false;
if low_soc > 1
    fprintf('[WARN] digital twin low soc threshold exceeded on i: %d\tmission_id: %d\n', i, mission_id);
    fprintf('[INFO] updating RUL from %.2f to %.2f', rul_hat, min(mean(times(:)) - 1));
    rul_hat = mean(times(:)) - 1; % rul is now 1 minute less than the digital twin flight time
    updated = true;
end

if pos_err > 1
    fprintf('[WARN] digital twin position error threshold exceeded on i: %d\tmission_id: %d\n', i, mission_id);
    fprintf('[INFO] updating RUL from %.2f to %.2f', rul_hat, min(mean(times(:)) - 1));
    rul_hat = mean(times(:)) - 1; % rul is now 1 minute less than the digital twin flight time
    updated = true;
end

if success >= 3 && pos_err < 2 && low_soc < 2
    fprintf('[INFO] digital twin mission success on i: %d\tmission_id: %d\n', i, mission_id);
    if mean(times(:)) - 1 > rul_hat
        fprintf('[INFO] new RUL update is available, %.2f replaces %.2f\n', mean(times(:)), rul_hat);
        rul_hat = mean(times(:)) - 1;
    end
end

```

```

elseif ~updated
    fprintf('[WARN] digital twin mission uncertain on i: %d\tmission_id: %d, rul_hat: %.2f'
end
% otherwise, end of life was never reached so the current rul estimate
% is the best estimate

if rul_hat <= rul_threshold
    fail_count = fail_count + 1;
    fprintf('[INFO] digital twin rul_hat: %.2f does not meet the threshold: %.2f on i,mission_id: %d'
    if fail_count == 10
        fprintf('[INFO] fail_count reached limit. Stopping simulation.')
        end_sim = 1;
        break;
    end
end
clear('trajectory', 'battery_actual', 'battery_observed', 'ctrl_err', 'current', 'current_err')
end

```

```

[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.78
[INFO] simulating true system on i: 44
[INFO] updating degradation parameter variance on i: 44
[INFO] updating degradation parameter values via random sampling on i: 44
[INFO] i: 44 mission_id: 675 rul_hat: 17.78 flight_time: 16.36 distance: 1218.60 R0: 0.00266 Q: 13.70 Req: 0.27072
[INFO] success on i: 44 mission_id: 675
[INFO] forecasting degradation values: r_mu: 0.001411 q_mu: 14.032027 m_mu: 0.270302
[INFO] digital twin degradation parameters: 0.0008 13.1725 0.2831
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.78
[INFO] simulating digital twin on i 44, mission_id: 675
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0012 13.5524 0.2419
[INFO] simulating digital twin on i 44, mission_id: 675
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0018 13.8973 0.2685
[INFO] simulating digital twin on i 44, mission_id: 675
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0016 13.3649 0.2636
[INFO] simulating digital twin on i 44, mission_id: 675
[INFO] digital twin degradation parameters: 0.0016 13.3649 0.2636
[INFO] digital twin mean parameter values: R0 = 0.00137 Q = 13.50 Req = 0.26425
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 44 mission_id: 675
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.78
[INFO] simulating true system on i: 45
[INFO] updating degradation parameter variance on i: 45
[INFO] updating degradation parameter values via random sampling on i: 45
[INFO] i: 45 mission_id: 676 rul_hat: 17.78 flight_time: 14.83 distance: 1083.72 R0: 0.00170 Q: 13.26 Req: 0.25593
[INFO] success on i: 45 mission_id: 676
[INFO] forecasting degradation values: r_mu: 0.002082 q_mu: 13.894258 m_mu: 0.279002
[INFO] digital twin degradation parameters: 0.0022 14.3278 0.2798
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.78
[INFO] simulating digital twin on i 45, mission_id: 676
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0014 13.4522 0.2731
[INFO] simulating digital twin on i 45, mission_id: 676
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0014 13.7696 0.2709
[INFO] simulating digital twin on i 45, mission_id: 676
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0019 13.6815 0.2753
[INFO] simulating digital twin on i 45, mission_id: 676
[INFO] digital twin degradation parameters: 0.0019 13.6815 0.2753

```

```

[INFO] digital twin mean parameter values: R0 = 0.00174 Q = 13.81 Req = 0.27479
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 45 mission_id: 676
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.78
[INFO] simulating true system on i: 46
[INFO] updating degradation parameter variance on i: 46
[INFO] updating degradation parameter values via random sampling on i: 46
[INFO] i: 46 mission_id: 677 rul_hat: 17.78 flight_time: 13.94 distance: 1047.73 R0: 0.00283 Q: 14.28 Req: 0.24886
[INFO] success on i: 46 mission_id: 677
[INFO] forecasting degradation values: r_mu: 0.002086 q_mu: 13.432114 m_mu: 0.275347
[INFO] digital twin degradation parameters: 0.0012 12.5480 0.2981
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.78
[INFO] simulating digital twin on i 46, mission_id: 677
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0016 12.9163 0.2801
[INFO] simulating digital twin on i 46, mission_id: 677
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0029 12.6701 0.2714
[INFO] simulating digital twin on i 46, mission_id: 677
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0020 12.5357 0.2827
[INFO] simulating digital twin on i 46, mission_id: 677
[INFO] digital twin degradation parameters: 0.0020 12.5357 0.2827
[INFO] digital twin mean parameter values: R0 = 0.00193 Q = 12.67 Req = 0.28310
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 46 mission_id: 677
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.78
[INFO] simulating true system on i: 47
[INFO] updating degradation parameter variance on i: 47
[INFO] updating degradation parameter values via random sampling on i: 47
[INFO] i: 47 mission_id: 678 rul_hat: 17.78 flight_time: 13.94 distance: 1047.83 R0: 0.00237 Q: 14.41 Req: 0.25262
[INFO] success on i: 47 mission_id: 678
[INFO] forecasting degradation values: r_mu: 0.002393 q_mu: 13.588475 m_mu: 0.263553
[INFO] digital twin degradation parameters: 0.0021 13.0742 0.2669
[INFO] DigitalTwin selecting trajectory: <20> with path_time: 19.65 to explore constraint boundary < 17.78
[INFO] simulating digital twin on i 47, mission_id: 678
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0026 13.3666 0.2644
[INFO] simulating digital twin on i 47, mission_id: 678
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0030 13.6414 0.2547
[INFO] simulating digital twin on i 47, mission_id: 678
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0019 13.5137 0.2619
[INFO] simulating digital twin on i 47, mission_id: 678
[INFO] digital twin degradation parameters: 0.0019 13.5137 0.2619
[INFO] digital twin mean parameter values: R0 = 0.00241 Q = 13.40 Req = 0.26199
stop code counts: low_soc: 4 pos_err: 0 success: 0
[WARN] digital twin low soc threshold exceeded on i: 47 mission_id: 678
[INFO] updating RUL from 17.78 to 16.98
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.98
[INFO] simulating true system on i: 48
[INFO] updating degradation parameter variance on i: 48
[INFO] updating degradation parameter values via random sampling on i: 48
[INFO] i: 48 mission_id: 679 rul_hat: 16.98 flight_time: 13.94 distance: 1047.90 R0: 0.00333 Q: 14.10 Req: 0.26128
[INFO] success on i: 48 mission_id: 679
[INFO] forecasting degradation values: r_mu: 0.002775 q_mu: 13.769035 m_mu: 0.260679
[INFO] digital twin degradation parameters: 0.0016 13.4360 0.2492
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.98
[INFO] simulating digital twin on i 48, mission_id: 679
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0036 14.5424 0.2597
[INFO] simulating digital twin on i 48, mission_id: 679
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0026 14.1206 0.2647

```



```

[INFO] simulating digital twin on i 48, mission_id: 679
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0032 14.1037 0.2485
[INFO] simulating digital twin on i 48, mission_id: 679
[INFO] digital twin degradation parameters: 0.0032 14.1037 0.2485
[INFO] digital twin mean parameter values: R0 = 0.00274 Q = 14.05 Req = 0.25552
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 48 mission_id: 679
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.98
[INFO] simulating true system on i: 49
[INFO] updating degradation parameter variance on i: 49
[INFO] updating degradation parameter values via random sampling on i: 49
[INFO] i: 49 mission_id: 680 rul_hat: 16.98 flight_time: 14.83 distance: 1083.45 R0: 0.00236 Q: 13.90 Req: 0.27386
[INFO] success on i: 49 mission_id: 680
[INFO] forecasting degradation values: r_mu: 0.003626 q_mu: 13.725411 m_mu: 0.259673
[INFO] digital twin degradation parameters: 0.0032 13.2059 0.2614
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 16.98
[INFO] simulating digital twin on i 49, mission_id: 680
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0038 13.3313 0.2731
[INFO] simulating digital twin on i 49, mission_id: 680
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0037 13.9481 0.2521
[INFO] simulating digital twin on i 49, mission_id: 680
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0041 13.8889 0.2504
[INFO] simulating digital twin on i 49, mission_id: 680
[INFO] digital twin degradation parameters: 0.0041 13.8889 0.2504
[INFO] digital twin mean parameter values: R0 = 0.00369 Q = 13.59 Req = 0.25924
stop code counts: low_soc: 1 pos_err: 0 success: 3
[INFO] digital twin mission success on i: 49 mission_id: 680
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.98
[INFO] simulating true system on i: 50
[INFO] updating degradation parameter variance on i: 50
[INFO] updating degradation parameter values via random sampling on i: 50
[INFO] i: 50 mission_id: 681 rul_hat: 16.98 flight_time: 14.83 distance: 1083.75 R0: 0.00290 Q: 14.06 Req: 0.26279
[INFO] success on i: 50 mission_id: 681
[INFO] forecasting degradation values: r_mu: 0.003502 q_mu: 13.647870 m_mu: 0.260048
[INFO] digital twin degradation parameters: 0.0030 13.5153 0.2660
[INFO] DigitalTwin selecting trajectory: <6> with path_time: 18.81 to explore constraint boundary < 16.98
[INFO] simulating digital twin on i 50, mission_id: 681
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0047 14.2736 0.2614
[INFO] simulating digital twin on i 50, mission_id: 681
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0033 13.3614 0.2665
[INFO] simulating digital twin on i 50, mission_id: 681
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0031 13.4585 0.2669
[INFO] simulating digital twin on i 50, mission_id: 681
[INFO] digital twin degradation parameters: 0.0031 13.4585 0.2669
[INFO] digital twin mean parameter values: R0 = 0.00355 Q = 13.65 Req = 0.26518
stop code counts: low_soc: 3 pos_err: 0 success: 1
[WARN] digital twin low soc threshold exceeded on i: 50 mission_id: 681
[INFO] updating RUL from 16.98 to 17.18
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.18
[INFO] simulating true system on i: 51
[INFO] updating degradation parameter variance on i: 51
[INFO] updating degradation parameter values via random sampling on i: 51
[INFO] i: 51 mission_id: 682 rul_hat: 17.18 flight_time: 13.94 distance: 1047.82 R0: 0.00319 Q: 13.98 Req: 0.26106
[INFO] success on i: 51 mission_id: 682
[INFO] forecasting degradation values: r_mu: 0.003078 q_mu: 13.733211 m_mu: 0.255233
[INFO] digital twin degradation parameters: 0.0035 13.4647 0.2641
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.18
[INFO] simulating digital twin on i 51, mission_id: 682

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[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0031 13.8795 0.2817
[INFO] simulating digital twin on i 51, mission_id: 682
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0030 13.1106 0.2696
[INFO] simulating digital twin on i 51, mission_id: 682
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0034 13.4740 0.2749
[INFO] simulating digital twin on i 51, mission_id: 682
[INFO] digital twin degradation parameters: 0.0034 13.4740 0.2749
[INFO] digital twin mean parameter values: R0 = 0.00324 Q = 13.48 Req = 0.27257
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 51 mission_id: 682
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.18
[INFO] simulating true system on i: 52
[INFO] updating degradation parameter variance on i: 52
[INFO] updating degradation parameter values via random sampling on i: 52
[INFO] i: 52 mission_id: 683 rul_hat: 17.18 flight_time: 13.94 distance: 1047.85 R0: 0.00266 Q: 13.70 Req: 0.25274
[INFO] success on i: 52 mission_id: 683
[INFO] forecasting degradation values: r_mu: 0.003797 q_mu: 13.871248 m_mu: 0.248677
[INFO] digital twin degradation parameters: 0.0036 13.4605 0.2534
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.18
[INFO] simulating digital twin on i 52, mission_id: 683
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0045 13.9352 0.2466
[INFO] simulating digital twin on i 52, mission_id: 683
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0044 13.4241 0.2536
[INFO] simulating digital twin on i 52, mission_id: 683
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0035 13.7151 0.2438
[INFO] simulating digital twin on i 52, mission_id: 683
[INFO] digital twin degradation parameters: 0.0035 13.7151 0.2438
[INFO] digital twin mean parameter values: R0 = 0.00399 Q = 13.63 Req = 0.24934
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 52 mission_id: 683
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.18
[INFO] simulating true system on i: 53
[INFO] updating degradation parameter variance on i: 53
[INFO] updating degradation parameter values via random sampling on i: 53
[INFO] i: 53 mission_id: 684 rul_hat: 17.18 flight_time: 16.36 distance: 1218.52 R0: 0.00264 Q: 14.31 Req: 0.26326
[INFO] success on i: 53 mission_id: 684
[INFO] forecasting degradation values: r_mu: 0.003265 q_mu: 13.952465 m_mu: 0.258140
[INFO] digital twin degradation parameters: 0.0034 13.8187 0.2600
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.18
[INFO] simulating digital twin on i 53, mission_id: 684
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0042 14.3474 0.2645
[INFO] simulating digital twin on i 53, mission_id: 684
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0031 14.0212 0.2598
[INFO] simulating digital twin on i 53, mission_id: 684
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0033 13.6369 0.2557
[INFO] simulating digital twin on i 53, mission_id: 684
[INFO] digital twin degradation parameters: 0.0033 13.6369 0.2557
[INFO] digital twin mean parameter values: R0 = 0.00351 Q = 13.96 Req = 0.26002
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 53 mission_id: 684
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.18
[INFO] simulating true system on i: 54
[INFO] updating degradation parameter variance on i: 54
[INFO] updating degradation parameter values via random sampling on i: 54
[INFO] i: 54 mission_id: 685 rul_hat: 17.18 flight_time: 16.36 distance: 1218.70 R0: 0.00366 Q: 15.01 Req: 0.25796
[INFO] success on i: 54 mission_id: 685

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[INFO] forecasting degradation values: r_mu: 0.003066 q_mu: 14.251030 m_mu: 0.261055
[INFO] digital twin degradation parameters: 0.0031 13.7173 0.2698
[INFO] DigitalTwin selecting trajectory: <6> with path_time: 18.81 to explore constraint boundary < 17.18
[INFO] simulating digital twin on i 54, mission_id: 685
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0040 13.8497 0.2626
[INFO] simulating digital twin on i 54, mission_id: 685
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0036 14.3055 0.2766
[INFO] simulating digital twin on i 54, mission_id: 685
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0044 14.3022 0.2482
[INFO] simulating digital twin on i 54, mission_id: 685
[INFO] digital twin degradation parameters: 0.0044 14.3022 0.2482
[INFO] digital twin mean parameter values: R0 = 0.00376 Q = 14.04 Req = 0.26429
stop code counts: low_soc: 2 pos_err: 0 success: 2
[WARN] digital twin low soc threshold exceeded on i: 54 mission_id: 685
[INFO] updating RUL from 17.18 to 17.59
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.59
[INFO] simulating true system on i: 55
[INFO] updating degradation parameter variance on i: 55
[INFO] updating degradation parameter values via random sampling on i: 55
[INFO] i: 55 mission_id: 686 rul_hat: 17.59 flight_time: 16.36 distance: 1218.55 R0: 0.00304 Q: 13.64 Req: 0.26807
[INFO] success on i: 55 mission_id: 686
[INFO] forecasting degradation values: r_mu: 0.003758 q_mu: 14.906486 m_mu: 0.264492
[INFO] digital twin degradation parameters: 0.0047 14.6488 0.2627
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 17.59
[INFO] simulating digital twin on i 55, mission_id: 686
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0040 15.2759 0.2702
[INFO] simulating digital twin on i 55, mission_id: 686
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0036 15.0609 0.2625
[INFO] simulating digital twin on i 55, mission_id: 686
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0033 15.1350 0.2649
[INFO] simulating digital twin on i 55, mission_id: 686
[INFO] digital twin degradation parameters: 0.0033 15.1350 0.2649
[INFO] digital twin mean parameter values: R0 = 0.00391 Q = 15.03 Req = 0.26507
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 55 mission_id: 686
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.59
[INFO] simulating true system on i: 56
[INFO] updating degradation parameter variance on i: 56
[INFO] updating degradation parameter values via random sampling on i: 56
[INFO] i: 56 mission_id: 687 rul_hat: 17.59 flight_time: 13.94 distance: 1047.80 R0: 0.00396 Q: 14.16 Req: 0.26945
[INFO] success on i: 56 mission_id: 687
[INFO] forecasting degradation values: r_mu: 0.003321 q_mu: 13.719017 m_mu: 0.271917
[INFO] digital twin degradation parameters: 0.0034 13.7369 0.2671
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.59
[INFO] simulating digital twin on i 56, mission_id: 687
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0030 14.2121 0.2686
[INFO] simulating digital twin on i 56, mission_id: 687
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0042 13.6573 0.2704
[INFO] simulating digital twin on i 56, mission_id: 687
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0029 13.4417 0.2660
[INFO] simulating digital twin on i 56, mission_id: 687
[INFO] digital twin degradation parameters: 0.0029 13.4417 0.2660
[INFO] digital twin mean parameter values: R0 = 0.00339 Q = 13.76 Req = 0.26800
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 56 mission_id: 687
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.59

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[INFO] simulating true system on i: 57
[INFO] updating degradation parameter variance on i: 57
[INFO] updating degradation parameter values via random sampling on i: 57
[INFO] i: 57 mission_id: 688 rul_hat: 17.59 flight_time: 13.58 distance: 1020.95 R0: 0.00388 Q: 14.29 Req: 0.27696
[INFO] success on i: 57 mission_id: 688
[INFO] forecasting degradation values: r_mu: 0.003973 q_mu: 14.226573 m_mu: 0.270678
[INFO] digital twin degradation parameters: 0.0029 14.1696 0.2728
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.59
[INFO] simulating digital twin on i 57, mission_id: 688
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0035 14.4954 0.2700
[INFO] simulating digital twin on i 57, mission_id: 688
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0042 13.9000 0.2609
[INFO] simulating digital twin on i 57, mission_id: 688
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0043 14.6323 0.2805
[INFO] simulating digital twin on i 57, mission_id: 688
[INFO] digital twin degradation parameters: 0.0043 14.6323 0.2805
[INFO] digital twin mean parameter values: R0 = 0.00373 Q = 14.30 Req = 0.27103
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 57 mission_id: 688
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.59
[INFO] simulating true system on i: 58
[INFO] updating degradation parameter variance on i: 58
[INFO] updating degradation parameter values via random sampling on i: 58
[INFO] i: 58 mission_id: 689 rul_hat: 17.59 flight_time: 16.36 distance: 1218.87 R0: 0.00315 Q: 13.91 Req: 0.26605
[INFO] success on i: 58 mission_id: 689
[INFO] forecasting degradation values: r_mu: 0.004082 q_mu: 14.408081 m_mu: 0.273911
[INFO] digital twin degradation parameters: 0.0046 13.9279 0.2639
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.59
[INFO] simulating digital twin on i 58, mission_id: 689
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0037 13.9904 0.2731
[INFO] simulating digital twin on i 58, mission_id: 689
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0034 14.4138 0.2787
[INFO] simulating digital twin on i 58, mission_id: 689
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0042 13.7780 0.2708
[INFO] simulating digital twin on i 58, mission_id: 689
[INFO] digital twin degradation parameters: 0.0042 13.7780 0.2708
[INFO] digital twin mean parameter values: R0 = 0.00398 Q = 14.03 Req = 0.27161
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 58 mission_id: 689
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.59
[INFO] simulating true system on i: 59
[INFO] updating degradation parameter variance on i: 59
[INFO] updating degradation parameter values via random sampling on i: 59
[INFO] i: 59 mission_id: 690 rul_hat: 17.59 flight_time: 13.94 distance: 1047.78 R0: 0.00380 Q: 14.48 Req: 0.27531
[INFO] success on i: 59 mission_id: 690
[INFO] forecasting degradation values: r_mu: 0.004131 q_mu: 14.028357 m_mu: 0.269565
[INFO] digital twin degradation parameters: 0.0041 14.4474 0.2638
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.59
[INFO] simulating digital twin on i 59, mission_id: 690
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0048 14.2621 0.2723
[INFO] simulating digital twin on i 59, mission_id: 690
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0039 14.2667 0.2650
[INFO] simulating digital twin on i 59, mission_id: 690
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0044 14.1185 0.2758
[INFO] simulating digital twin on i 59, mission_id: 690
[INFO] digital twin degradation parameters: 0.0044 14.1185 0.2758

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[INFO] digital twin mean parameter values: R0 = 0.00428 Q = 14.27 Req = 0.26923
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 59 mission_id: 690
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.59
[INFO] simulating true system on i: 60
[INFO] updating degradation parameter variance on i: 60
[INFO] updating degradation parameter values via random sampling on i: 60
[INFO] i: 60 mission_id: 691 rul_hat: 17.59 flight_time: 13.94 distance: 1047.83 R0: 0.00441 Q: 13.59 Req: 0.27179
[INFO] success on i: 60 mission_id: 691
[INFO] forecasting degradation values: r_mu: 0.004166 q_mu: 14.339400 m_mu: 0.280368
[INFO] digital twin degradation parameters: 0.0048 14.3743 0.2787
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.59
[INFO] simulating digital twin on i 60, mission_id: 691
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0043 14.2976 0.2803
[INFO] simulating digital twin on i 60, mission_id: 691
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0044 14.7617 0.2827
[INFO] simulating digital twin on i 60, mission_id: 691
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0048 13.7106 0.2780
[INFO] simulating digital twin on i 60, mission_id: 691
[INFO] digital twin degradation parameters: 0.0048 13.7106 0.2780
[INFO] digital twin mean parameter values: R0 = 0.00459 Q = 14.29 Req = 0.27994
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 60 mission_id: 691
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.59
[INFO] simulating true system on i: 61
[INFO] updating degradation parameter variance on i: 61
[INFO] updating degradation parameter values via random sampling on i: 61
[INFO] i: 61 mission_id: 692 rul_hat: 17.59 flight_time: 14.83 distance: 1083.71 R0: 0.00373 Q: 14.03 Req: 0.27473
[INFO] success on i: 61 mission_id: 692
[INFO] forecasting degradation values: r_mu: 0.004665 q_mu: 13.976099 m_mu: 0.282818
[INFO] digital twin degradation parameters: 0.0048 14.0947 0.2785
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.59
[INFO] simulating digital twin on i 61, mission_id: 692
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0044 14.0757 0.2946
[INFO] simulating digital twin on i 61, mission_id: 692
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0045 14.1703 0.2776
[INFO] simulating digital twin on i 61, mission_id: 692
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0052 13.6854 0.2839
[INFO] simulating digital twin on i 61, mission_id: 692
[INFO] digital twin degradation parameters: 0.0052 13.6854 0.2839
[INFO] digital twin mean parameter values: R0 = 0.00471 Q = 14.01 Req = 0.28365
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 61 mission_id: 692
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.59
[INFO] simulating true system on i: 62
[INFO] updating degradation parameter variance on i: 62
[INFO] updating degradation parameter values via random sampling on i: 62
[INFO] i: 62 mission_id: 693 rul_hat: 17.59 flight_time: 13.58 distance: 1020.98 R0: 0.00442 Q: 13.81 Req: 0.28638
[INFO] success on i: 62 mission_id: 693
[INFO] forecasting degradation values: r_mu: 0.004669 q_mu: 13.983566 m_mu: 0.285516
[INFO] digital twin degradation parameters: 0.0044 13.9700 0.2983
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.59
[INFO] simulating digital twin on i 62, mission_id: 693
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0042 14.2825 0.2871
[INFO] simulating digital twin on i 62, mission_id: 693
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0049 13.9027 0.2867
[INFO] simulating digital twin on i 62, mission_id: 693

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[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0052 13.3238 0.2778
[INFO] simulating digital twin on i 62, mission_id: 693
[INFO] digital twin degradation parameters: 0.0052 13.3238 0.2778
[INFO] digital twin mean parameter values: R0 = 0.00471 Q = 13.87 Req = 0.28744
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 62 mission_id: 693
[INFO] TrueSystem selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 17.59
[INFO] simulating true system on i: 63
[INFO] updating degradation parameter variance on i: 63
[INFO] updating degradation parameter values via random sampling on i: 63
[INFO] i: 63 mission_id: 694 rul_hat: 17.59 flight_time: 17.84 distance: 1302.26 R0: 0.00434 Q: 13.71 Req: 0.26634
[INFO] success on i: 63 mission_id: 694
[INFO] forecasting degradation values: r_mu: 0.004832 q_mu: 13.614802 m_mu: 0.289531
[INFO] digital twin degradation parameters: 0.0045 13.5016 0.2863
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.59
[INFO] simulating digital twin on i 63, mission_id: 694
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0045 13.9905 0.2851
[INFO] simulating digital twin on i 63, mission_id: 694
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0055 13.5100 0.2830
[INFO] simulating digital twin on i 63, mission_id: 694
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0046 13.8765 0.2943
[INFO] simulating digital twin on i 63, mission_id: 694
[INFO] digital twin degradation parameters: 0.0046 13.8765 0.2943
[INFO] digital twin mean parameter values: R0 = 0.00477 Q = 13.72 Req = 0.28716
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 63 mission_id: 694
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.59
[INFO] simulating true system on i: 64
[INFO] updating degradation parameter variance on i: 64
[INFO] updating degradation parameter values via random sampling on i: 64
[INFO] i: 64 mission_id: 695 rul_hat: 17.59 flight_time: 13.94 distance: 1047.85 R0: 0.00501 Q: 13.37 Req: 0.27132
[INFO] success on i: 64 mission_id: 695
[INFO] forecasting degradation values: r_mu: 0.004708 q_mu: 13.229030 m_mu: 0.276012
[INFO] digital twin degradation parameters: 0.0040 13.1078 0.2800
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.59
[INFO] simulating digital twin on i 64, mission_id: 695
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0048 12.6468 0.2832
[INFO] simulating digital twin on i 64, mission_id: 695
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0052 13.0717 0.2770
[INFO] simulating digital twin on i 64, mission_id: 695
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0050 13.3329 0.2790
[INFO] simulating digital twin on i 64, mission_id: 695
[INFO] digital twin degradation parameters: 0.0050 13.3329 0.2790
[INFO] digital twin mean parameter values: R0 = 0.00475 Q = 13.04 Req = 0.27979
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 64 mission_id: 695
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.59
[INFO] simulating true system on i: 65
[INFO] updating degradation parameter variance on i: 65
[INFO] updating degradation parameter values via random sampling on i: 65
[INFO] i: 65 mission_id: 696 rul_hat: 17.59 flight_time: 14.83 distance: 1083.58 R0: 0.00501 Q: 13.54 Req: 0.28020
[INFO] success on i: 65 mission_id: 696
[INFO] forecasting degradation values: r_mu: 0.005334 q_mu: 13.458220 m_mu: 0.272378
[INFO] digital twin degradation parameters: 0.0053 13.6367 0.2690
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.59
[INFO] simulating digital twin on i 65, mission_id: 696
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0052 13.7689 0.2748

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[INFO] simulating digital twin on i 65, mission_id: 696
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0055 13.0825 0.2685
[INFO] simulating digital twin on i 65, mission_id: 696
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0054 13.3678 0.2775
[INFO] simulating digital twin on i 65, mission_id: 696
[INFO] digital twin degradation parameters: 0.0054 13.3678 0.2775
[INFO] digital twin mean parameter values: R0 = 0.00538 Q = 13.46 Req = 0.27245
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 65 mission_id: 696
[INFO] TrueSystem selecting trajectory: <6> with path_time: 18.81 to explore constraint boundary < 17.59
[INFO] simulating true system on i: 66
[INFO] updating degradation parameter variance on i: 66
[INFO] updating degradation parameter values via random sampling on i: 66
[INFO] i: 66 mission_id: 697 rul_hat: 17.59 flight_time: 17.80 distance: 1281.88 R0: 0.00549 Q: 14.06 Req: 0.27644
[WARN] true system low soc threshold exceeded on i: 66 mission_id: 697
[INFO] forecasting degradation values: r_mu: 0.005416 q_mu: 13.149002 m_mu: 0.278244
[INFO] digital twin degradation parameters: 0.0060 13.4146 0.2790
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.59
[INFO] simulating digital twin on i 66, mission_id: 697
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0053 13.2386 0.2784
[INFO] simulating digital twin on i 66, mission_id: 697
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0053 13.5918 0.2791
[INFO] simulating digital twin on i 66, mission_id: 697
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0064 13.0750 0.2804
[INFO] simulating digital twin on i 66, mission_id: 697
[INFO] digital twin degradation parameters: 0.0064 13.0750 0.2804
[INFO] digital twin mean parameter values: R0 = 0.00573 Q = 13.33 Req = 0.27922
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 66 mission_id: 697
[INFO] TrueSystem selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 17.59
[INFO] simulating true system on i: 67
[INFO] updating degradation parameter variance on i: 67
[INFO] updating degradation parameter values via random sampling on i: 67
[INFO] i: 67 mission_id: 698 rul_hat: 17.59 flight_time: 17.84 distance: 1302.25 R0: 0.00551 Q: 13.50 Req: 0.27877
[INFO] success on i: 67 mission_id: 698
[INFO] forecasting degradation values: r_mu: 0.006055 q_mu: 13.420346 m_mu: 0.277053
[INFO] digital twin degradation parameters: 0.0056 13.3546 0.2780
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 17.59
[INFO] simulating digital twin on i 67, mission_id: 698
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0060 13.6421 0.2759
[INFO] simulating digital twin on i 67, mission_id: 698
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0063 13.8800 0.2776
[INFO] simulating digital twin on i 67, mission_id: 698
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0060 13.3003 0.2796
[INFO] simulating digital twin on i 67, mission_id: 698
[INFO] digital twin degradation parameters: 0.0060 13.3003 0.2796
[INFO] digital twin mean parameter values: R0 = 0.00597 Q = 13.54 Req = 0.27777
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 67 mission_id: 698
[INFO] TrueSystem selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 17.59
[INFO] simulating true system on i: 68
[INFO] updating degradation parameter variance on i: 68
[INFO] updating degradation parameter values via random sampling on i: 68
[INFO] i: 68 mission_id: 699 rul_hat: 17.59 flight_time: 17.78 distance: 1298.88 R0: 0.00565 Q: 13.69 Req: 0.27464
[WARN] true system low soc threshold exceeded on i: 68 mission_id: 699
[INFO] forecasting degradation values: r_mu: 0.006555 q_mu: 13.336603 m_mu: 0.280709
[INFO] digital twin degradation parameters: 0.0071 13.3193 0.2792

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[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 17.59
[INFO] simulating digital twin on i 68, mission_id: 699
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0068 13.1053 0.2821
[INFO] simulating digital twin on i 68, mission_id: 699
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0067 13.0854 0.2800
[INFO] simulating digital twin on i 68, mission_id: 699
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0064 13.4580 0.2774
[INFO] simulating digital twin on i 68, mission_id: 699
[INFO] digital twin degradation parameters: 0.0064 13.4580 0.2774
[INFO] digital twin mean parameter values: R0 = 0.00676 Q = 13.24 Req = 0.27968
stop code counts: low_soc: 2 pos_err: 0 success: 2
[WARN] digital twin low soc threshold exceeded on i: 68 mission_id: 699
[INFO] updating RUL from 17.59 to 16.69
[INFO] TrueSystem selecting trajectory: <15> with path_time: 17.63 to explore constraint boundary < 16.69
[INFO] simulating true system on i: 69
[INFO] updating degradation parameter variance on i: 69
[INFO] updating degradation parameter values via random sampling on i: 69
[INFO] i: 69 mission_id: 700 rul_hat: 16.69 flight_time: 17.64 distance: 1283.88 R0: 0.00578 Q: 13.63 Req: 0.27895
[INFO] success on i: 69 mission_id: 700
[INFO] forecasting degradation values: r_mu: 0.006553 q_mu: 13.192647 m_mu: 0.276808
[INFO] digital twin degradation parameters: 0.0069 13.3075 0.2780
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.69
[INFO] simulating digital twin on i 69, mission_id: 700
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0067 13.5629 0.2785
[INFO] simulating digital twin on i 69, mission_id: 700
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0062 13.2879 0.2765
[INFO] simulating digital twin on i 69, mission_id: 700
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0065 13.1444 0.2742
[INFO] simulating digital twin on i 69, mission_id: 700
[INFO] digital twin degradation parameters: 0.0065 13.1444 0.2742
[INFO] digital twin mean parameter values: R0 = 0.00658 Q = 13.33 Req = 0.27680
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 69 mission_id: 700
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.69
[INFO] simulating true system on i: 70
[INFO] updating degradation parameter variance on i: 70
[INFO] updating degradation parameter values via random sampling on i: 70
[INFO] i: 70 mission_id: 701 rul_hat: 16.69 flight_time: 14.83 distance: 1083.62 R0: 0.00601 Q: 13.62 Req: 0.27866
[INFO] success on i: 70 mission_id: 701
[INFO] forecasting degradation values: r_mu: 0.006586 q_mu: 13.473862 m_mu: 0.281801
[INFO] digital twin degradation parameters: 0.0065 13.4418 0.2819
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.69
[INFO] simulating digital twin on i 70, mission_id: 701
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0068 13.4137 0.2834
[INFO] simulating digital twin on i 70, mission_id: 701
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0065 13.0999 0.2753
[INFO] simulating digital twin on i 70, mission_id: 701
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0061 13.4241 0.2801
[INFO] simulating digital twin on i 70, mission_id: 701
[INFO] digital twin degradation parameters: 0.0061 13.4241 0.2801
[INFO] digital twin mean parameter values: R0 = 0.00647 Q = 13.34 Req = 0.28020
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 70 mission_id: 701
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.69
[INFO] simulating true system on i: 71
[INFO] updating degradation parameter variance on i: 71

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[INFO] updating degradation parameter values via random sampling on i: 71
[INFO] i: 71 mission_id: 702 rul_hat: 16.69 flight_time: 13.94 distance: 1047.88 R0: 0.00619 Q: 13.44 Req: 0.28045
[INFO] success on i: 71 mission_id: 702
[INFO] forecasting degradation values: r_mu: 0.007088 q_mu: 13.329483 m_mu: 0.283009
[INFO] digital twin degradation parameters: 0.0073 13.8168 0.2838
[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 to explore constraint boundary < 16.69
[INFO] simulating digital twin on i 71, mission_id: 702
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0071 13.2147 0.2825
[INFO] simulating digital twin on i 71, mission_id: 702
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0071 12.9783 0.2824
[INFO] simulating digital twin on i 71, mission_id: 702
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0073 13.2153 0.2842
[INFO] simulating digital twin on i 71, mission_id: 702
[INFO] digital twin degradation parameters: 0.0073 13.2153 0.2842
[INFO] digital twin mean parameter values: R0 = 0.00720 Q = 13.31 Req = 0.28322
stop code counts: low_soc: 3 pos_err: 0 success: 1
[WARN] digital twin low soc threshold exceeded on i: 71 mission_id: 702
[INFO] updating RUL from 16.69 to 16.53
[INFO] TrueSystem selecting trajectory: <15> with path_time: 17.63 to explore constraint boundary < 16.53
[INFO] simulating true system on i: 72
[INFO] updating degradation parameter variance on i: 72
[INFO] updating degradation parameter values via random sampling on i: 72
[INFO] i: 72 mission_id: 703 rul_hat: 16.53 flight_time: 17.64 distance: 1283.80 R0: 0.00690 Q: 12.98 Req: 0.27686
[INFO] success on i: 72 mission_id: 703
[INFO] forecasting degradation values: r_mu: 0.006976 q_mu: 13.378768 m_mu: 0.277216
[INFO] digital twin degradation parameters: 0.0072 13.4774 0.2772
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.53
[INFO] simulating digital twin on i 72, mission_id: 703
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0070 13.1891 0.2763
[INFO] simulating digital twin on i 72, mission_id: 703
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0069 13.6030 0.2793
[INFO] simulating digital twin on i 72, mission_id: 703
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0071 13.4157 0.2754
[INFO] simulating digital twin on i 72, mission_id: 703
[INFO] digital twin degradation parameters: 0.0071 13.4157 0.2754
[INFO] digital twin mean parameter values: R0 = 0.00708 Q = 13.42 Req = 0.27706
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 72 mission_id: 703
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.53
[INFO] simulating true system on i: 73
[INFO] updating degradation parameter variance on i: 73
[INFO] updating degradation parameter values via random sampling on i: 73
[INFO] i: 73 mission_id: 704 rul_hat: 16.53 flight_time: 13.94 distance: 1047.87 R0: 0.00657 Q: 13.55 Req: 0.28508
[INFO] success on i: 73 mission_id: 704
[INFO] forecasting degradation values: r_mu: 0.007577 q_mu: 13.172080 m_mu: 0.284534
[INFO] digital twin degradation parameters: 0.0075 13.5652 0.2873
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.53
[INFO] simulating digital twin on i 73, mission_id: 704
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0075 13.2324 0.2883
[INFO] simulating digital twin on i 73, mission_id: 704
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0075 13.2867 0.2933
[INFO] simulating digital twin on i 73, mission_id: 704
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0078 13.3784 0.2805
[INFO] simulating digital twin on i 73, mission_id: 704
[INFO] digital twin degradation parameters: 0.0078 13.3784 0.2805
[INFO] digital twin mean parameter values: R0 = 0.00759 Q = 13.37 Req = 0.28735

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stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 73 mission_id: 704
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.53
[INFO] simulating true system on i: 74
[INFO] updating degradation parameter variance on i: 74
[INFO] updating degradation parameter values via random sampling on i: 74
[INFO] i: 74 mission_id: 705 rul_hat: 16.53 flight_time: 13.94 distance: 1047.97 R0: 0.00725 Q: 13.07 Req: 0.27364
[INFO] success on i: 74 mission_id: 705
[INFO] forecasting degradation values: r_mu: 0.007201 q_mu: 13.598101 m_mu: 0.285751
[INFO] digital twin degradation parameters: 0.0075 13.4086 0.2961
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.53
[INFO] simulating digital twin on i 74, mission_id: 705
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0072 13.4090 0.2878
[INFO] simulating digital twin on i 74, mission_id: 705
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0070 13.8130 0.2861
[INFO] simulating digital twin on i 74, mission_id: 705
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0068 12.9919 0.2843
[INFO] simulating digital twin on i 74, mission_id: 705
[INFO] digital twin degradation parameters: 0.0068 12.9919 0.2843
[INFO] digital twin mean parameter values: R0 = 0.00711 Q = 13.41 Req = 0.28858
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 74 mission_id: 705
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.53
[INFO] simulating true system on i: 75
[INFO] updating degradation parameter variance on i: 75
[INFO] updating degradation parameter values via random sampling on i: 75
[INFO] i: 75 mission_id: 706 rul_hat: 16.53 flight_time: 14.83 distance: 1083.71 R0: 0.00790 Q: 13.49 Req: 0.28225
[INFO] success on i: 75 mission_id: 706
[INFO] forecasting degradation values: r_mu: 0.007876 q_mu: 12.906141 m_mu: 0.273883
[INFO] digital twin degradation parameters: 0.0081 12.5578 0.2810
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.53
[INFO] simulating digital twin on i 75, mission_id: 706
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0078 12.9435 0.2642
[INFO] simulating digital twin on i 75, mission_id: 706
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0083 13.0426 0.2839
[INFO] simulating digital twin on i 75, mission_id: 706
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0082 12.9090 0.2692
[INFO] simulating digital twin on i 75, mission_id: 706
[INFO] digital twin degradation parameters: 0.0082 12.9090 0.2692
[INFO] digital twin mean parameter values: R0 = 0.00809 Q = 12.86 Req = 0.27457
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 75 mission_id: 706
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.53
[INFO] simulating true system on i: 76
[INFO] updating degradation parameter variance on i: 76
[INFO] updating degradation parameter values via random sampling on i: 76
[INFO] i: 76 mission_id: 707 rul_hat: 16.53 flight_time: 13.94 distance: 1047.82 R0: 0.00800 Q: 13.68 Req: 0.27801
[INFO] success on i: 76 mission_id: 707
[INFO] forecasting degradation values: r_mu: 0.008543 q_mu: 13.011183 m_mu: 0.283929
[INFO] digital twin degradation parameters: 0.0087 13.0290 0.2801
[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 to explore constraint boundary < 16.53
[INFO] simulating digital twin on i 76, mission_id: 707
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0085 13.4805 0.2870
[INFO] simulating digital twin on i 76, mission_id: 707
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0085 13.0805 0.2844
[INFO] simulating digital twin on i 76, mission_id: 707
[INFO] resampling for twin run # 4

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[INFO] digital twin degradation parameters: 0.0086 13.1246 0.2809
[INFO] simulating digital twin on i 76, mission_id: 707
[INFO] digital twin degradation parameters: 0.0086 13.1246 0.2809
[INFO] digital twin mean parameter values: R0 = 0.00858 Q = 13.18 Req = 0.28308
stop code counts: low_soc: 3 pos_err: 0 success: 1
[WARN] digital twin low soc threshold exceeded on i: 76 mission_id: 707
[INFO] updating RUL from 16.53 to 16.48
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.48
[INFO] simulating true system on i: 77
[INFO] updating degradation parameter variance on i: 77
[INFO] updating degradation parameter values via random sampling on i: 77
[INFO] i: 77 mission_id: 708 rul_hat: 16.48 flight_time: 13.94 distance: 1047.90 R0: 0.00875 Q: 13.25 Req: 0.27848
[INFO] success on i: 77 mission_id: 708
[INFO] forecasting degradation values: r_mu: 0.008975 q_mu: 13.239675 m_mu: 0.280768
[INFO] digital twin degradation parameters: 0.0089 13.1187 0.2791
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 16.48
[INFO] simulating digital twin on i 77, mission_id: 708
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0088 13.1287 0.2742
[INFO] simulating digital twin on i 77, mission_id: 708
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0088 12.8864 0.2782
[INFO] simulating digital twin on i 77, mission_id: 708
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0087 13.0629 0.2793
[INFO] simulating digital twin on i 77, mission_id: 708
[INFO] digital twin degradation parameters: 0.0087 13.0629 0.2793
[INFO] digital twin mean parameter values: R0 = 0.00881 Q = 13.05 Req = 0.27768
stop code counts: low_soc: 4 pos_err: 0 success: 0
[WARN] digital twin low soc threshold exceeded on i: 77 mission_id: 708
[INFO] updating RUL from 16.48 to 16.49
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.49
[INFO] simulating true system on i: 78
[INFO] updating degradation parameter variance on i: 78
[INFO] updating degradation parameter values via random sampling on i: 78
[INFO] i: 78 mission_id: 709 rul_hat: 16.49 flight_time: 14.83 distance: 1083.84 R0: 0.00876 Q: 13.06 Req: 0.28990
[INFO] success on i: 78 mission_id: 709
[INFO] forecasting degradation values: r_mu: 0.009791 q_mu: 13.171789 m_mu: 0.283546
[INFO] digital twin degradation parameters: 0.0094 13.0738 0.2761
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 16.49
[INFO] simulating digital twin on i 78, mission_id: 709
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0095 13.0281 0.2798
[INFO] simulating digital twin on i 78, mission_id: 709
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0095 12.6556 0.2864
[INFO] simulating digital twin on i 78, mission_id: 709
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0103 13.7276 0.2811
[INFO] simulating digital twin on i 78, mission_id: 709
[INFO] digital twin degradation parameters: 0.0103 13.7276 0.2811
[INFO] digital twin mean parameter values: R0 = 0.00968 Q = 13.12 Req = 0.28086
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 78 mission_id: 709
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.49
[INFO] simulating true system on i: 79
[INFO] updating degradation parameter variance on i: 79
[INFO] updating degradation parameter values via random sampling on i: 79
[INFO] i: 79 mission_id: 710 rul_hat: 16.49 flight_time: 14.83 distance: 1083.61 R0: 0.00909 Q: 13.03 Req: 0.27553
[INFO] success on i: 79 mission_id: 710
[INFO] forecasting degradation values: r_mu: 0.010220 q_mu: 13.031716 m_mu: 0.285472
[INFO] digital twin degradation parameters: 0.0102 12.7254 0.2760
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 16.49
[INFO] simulating digital twin on i 79, mission_id: 710
[INFO] resampling for twin run # 2

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[INFO] digital twin degradation parameters: 0.0103 13.3298 0.2770
[INFO] simulating digital twin on i 79, mission_id: 710
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0103 13.1572 0.2859
[INFO] simulating digital twin on i 79, mission_id: 710
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0103 12.8997 0.2891
[INFO] simulating digital twin on i 79, mission_id: 710
[INFO] digital twin degradation parameters: 0.0103 12.8997 0.2891
[INFO] digital twin mean parameter values: R0 = 0.01027 Q = 13.03 Req = 0.28200
stop code counts: low_soc: 3 pos_err: 0 success: 1
[WARN] digital twin low soc threshold exceeded on i: 79 mission_id: 710
[INFO] updating RUL from 16.49 to 16.50
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.50
[INFO] simulating true system on i: 80
[INFO] updating degradation parameter variance on i: 80
[INFO] updating degradation parameter values via random sampling on i: 80
[INFO] i: 80 mission_id: 711 rul_hat: 16.50 flight_time: 14.83 distance: 1083.75 R0: 0.00965 Q: 13.65 Req: 0.28400
[INFO] success on i: 80 mission_id: 711
[INFO] forecasting degradation values: r_mu: 0.010609 q_mu: 12.908465 m_mu: 0.279902
[INFO] digital twin degradation parameters: 0.0105 13.0105 0.2853
[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 to explore constraint boundary < 16.50
[INFO] simulating digital twin on i 80, mission_id: 711
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0105 13.0659 0.2795
[INFO] simulating digital twin on i 80, mission_id: 711
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0109 12.5564 0.2806
[INFO] simulating digital twin on i 80, mission_id: 711
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0109 12.7847 0.2768
[INFO] simulating digital twin on i 80, mission_id: 711
[INFO] digital twin degradation parameters: 0.0109 12.7847 0.2768
[INFO] digital twin mean parameter values: R0 = 0.01069 Q = 12.85 Req = 0.28054
stop code counts: low_soc: 4 pos_err: 0 success: 0
[WARN] digital twin low soc threshold exceeded on i: 80 mission_id: 711
[INFO] updating RUL from 16.50 to 16.15
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.15
[INFO] simulating true system on i: 81
[INFO] updating degradation parameter variance on i: 81
[INFO] updating degradation parameter values via random sampling on i: 81
[INFO] i: 81 mission_id: 712 rul_hat: 16.15 flight_time: 13.94 distance: 1047.94 R0: 0.00989 Q: 13.23 Req: 0.28232
[INFO] success on i: 81 mission_id: 712
[INFO] forecasting degradation values: r_mu: 0.011101 q_mu: 13.373965 m_mu: 0.283177
[INFO] digital twin degradation parameters: 0.0111 13.2230 0.2813
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.15
[INFO] simulating digital twin on i 81, mission_id: 712
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0118 14.2258 0.2889
[INFO] simulating digital twin on i 81, mission_id: 712
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0113 13.0544 0.2803
[INFO] simulating digital twin on i 81, mission_id: 712
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0110 13.5078 0.2856
[INFO] simulating digital twin on i 81, mission_id: 712
[INFO] digital twin degradation parameters: 0.0110 13.5078 0.2856
[INFO] digital twin mean parameter values: R0 = 0.01129 Q = 13.50 Req = 0.28402
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 81 mission_id: 712
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.15
[INFO] simulating true system on i: 82
[INFO] updating degradation parameter variance on i: 82
[INFO] updating degradation parameter values via random sampling on i: 82
[INFO] i: 82 mission_id: 713 rul_hat: 16.15 flight_time: 13.94 distance: 1047.91 R0: 0.01022 Q: 13.16 Req: 0.29325

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[INFO] success on i: 82 mission_id: 713
[INFO] forecasting degradation values: r_mu: 0.011356 q_mu: 13.348619 m_mu: 0.284559
[INFO] digital twin degradation parameters: 0.0114 13.3939 0.2878
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.15
[INFO] simulating digital twin on i 82, mission_id: 713
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0114 13.2421 0.2744
[INFO] simulating digital twin on i 82, mission_id: 713
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0111 13.2686 0.2887
[INFO] simulating digital twin on i 82, mission_id: 713
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0113 13.4142 0.2801
[INFO] simulating digital twin on i 82, mission_id: 713
[INFO] digital twin degradation parameters: 0.0113 13.4142 0.2801
[INFO] digital twin mean parameter values: R0 = 0.01130 Q = 13.33 Req = 0.28275
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 82 mission_id: 713
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.15
[INFO] simulating true system on i: 83
[INFO] updating degradation parameter variance on i: 83
[INFO] updating degradation parameter values via random sampling on i: 83
[INFO] i: 83 mission_id: 714 rul_hat: 16.15 flight_time: 13.58 distance: 1021.15 R0: 0.01071 Q: 13.42 Req: 0.29705
[INFO] success on i: 83 mission_id: 714
[INFO] forecasting degradation values: r_mu: 0.011870 q_mu: 12.836055 m_mu: 0.289971
[INFO] digital twin degradation parameters: 0.0118 13.1343 0.2947
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.15
[INFO] simulating digital twin on i 83, mission_id: 714
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0119 12.9668 0.2934
[INFO] simulating digital twin on i 83, mission_id: 714
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0120 13.0057 0.2884
[INFO] simulating digital twin on i 83, mission_id: 714
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0119 12.2728 0.2841
[INFO] simulating digital twin on i 83, mission_id: 714
[INFO] digital twin degradation parameters: 0.0119 12.2728 0.2841
[INFO] digital twin mean parameter values: R0 = 0.01191 Q = 12.84 Req = 0.29016
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 83 mission_id: 714
[INFO] TrueSystem selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 16.15
[INFO] simulating true system on i: 84
[INFO] updating degradation parameter variance on i: 84
[INFO] updating degradation parameter values via random sampling on i: 84
[INFO] i: 84 mission_id: 715 rul_hat: 16.15 flight_time: 17.60 distance: 1284.47 R0: 0.01144 Q: 13.47 Req: 0.28475
[WARN] true system low soc threshold exceeded on i: 84 mission_id: 715
[INFO] forecasting degradation values: r_mu: 0.012127 q_mu: 13.295046 m_mu: 0.300154
[INFO] digital twin degradation parameters: 0.0120 13.1719 0.3024
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.15
[INFO] simulating digital twin on i 84, mission_id: 715
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0119 13.2025 0.2990
[INFO] simulating digital twin on i 84, mission_id: 715
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0120 13.2296 0.2947
[INFO] simulating digital twin on i 84, mission_id: 715
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0122 12.7514 0.3009
[INFO] simulating digital twin on i 84, mission_id: 715
[INFO] digital twin degradation parameters: 0.0122 12.7514 0.3009
[INFO] digital twin mean parameter values: R0 = 0.01202 Q = 13.09 Req = 0.29924
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 84 mission_id: 715
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.15

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[INFO] simulating true system on i: 85
[INFO] updating degradation parameter variance on i: 85
[INFO] updating degradation parameter values via random sampling on i: 85
[INFO] i: 85 mission_id: 716 rul_hat: 16.15 flight_time: 14.83 distance: 1083.72 R0: 0.01191 Q: 13.13 Req: 0.28696
[INFO] success on i: 85 mission_id: 716
[INFO] forecasting degradation values: r_mu: 0.012678 q_mu: 13.275236 m_mu: 0.294910
[INFO] digital twin degradation parameters: 0.0127 13.3783 0.2902
[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 to explore constraint boundary < 16.15
[INFO] simulating digital twin on i 85, mission_id: 716
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0127 13.2790 0.2891
[INFO] simulating digital twin on i 85, mission_id: 716
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0128 12.9713 0.3029
[INFO] simulating digital twin on i 85, mission_id: 716
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0128 13.3414 0.2929
[INFO] simulating digital twin on i 85, mission_id: 716
[INFO] digital twin degradation parameters: 0.0128 13.3414 0.2929
[INFO] digital twin mean parameter values: R0 = 0.01273 Q = 13.24 Req = 0.29378
stop code counts: low_soc: 1 pos_err: 0 success: 3
[INFO] digital twin mission success on i: 85 mission_id: 716
[INFO] new RUL update is available, 16.58 replaces 16.15
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.58
[INFO] simulating true system on i: 86
[INFO] updating degradation parameter variance on i: 86
[INFO] updating degradation parameter values via random sampling on i: 86
[INFO] i: 86 mission_id: 717 rul_hat: 16.58 flight_time: 14.83 distance: 1083.71 R0: 0.01254 Q: 13.62 Req: 0.29457
[INFO] success on i: 86 mission_id: 717
[INFO] forecasting degradation values: r_mu: 0.013428 q_mu: 13.179614 m_mu: 0.295725
[INFO] digital twin degradation parameters: 0.0135 13.0441 0.2963
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 16.58
[INFO] simulating digital twin on i 86, mission_id: 717
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0137 12.8746 0.2938
[INFO] simulating digital twin on i 86, mission_id: 717
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0134 12.6911 0.2986
[INFO] simulating digital twin on i 86, mission_id: 717
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0134 13.1998 0.2997
[INFO] simulating digital twin on i 86, mission_id: 717
[INFO] digital twin degradation parameters: 0.0134 13.1998 0.2997
[INFO] digital twin mean parameter values: R0 = 0.01352 Q = 12.95 Req = 0.29711
stop code counts: low_soc: 4 pos_err: 0 success: 0
[WARN] digital twin low soc threshold exceeded on i: 86 mission_id: 717
[INFO] updating RUL from 16.58 to 16.38
[INFO] TrueSystem selecting trajectory: <15> with path_time: 17.63 to explore constraint boundary < 16.38
[INFO] simulating true system on i: 87
[INFO] updating degradation parameter variance on i: 87
[INFO] updating degradation parameter values via random sampling on i: 87
[INFO] i: 87 mission_id: 718 rul_hat: 16.38 flight_time: 17.64 distance: 1284.08 R0: 0.01301 Q: 12.97 Req: 0.29348
[INFO] success on i: 87 mission_id: 718
[INFO] forecasting degradation values: r_mu: 0.013977 q_mu: 13.717731 m_mu: 0.298621
[INFO] digital twin degradation parameters: 0.0138 13.4587 0.2965
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 16.38
[INFO] simulating digital twin on i 87, mission_id: 718
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0141 13.6071 0.2955
[INFO] simulating digital twin on i 87, mission_id: 718
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0142 14.4011 0.2995
[INFO] simulating digital twin on i 87, mission_id: 718
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0139 13.3646 0.3035

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[INFO] simulating digital twin on i 87, mission_id: 718
[INFO] digital twin degradation parameters: 0.0139 13.3646 0.3035
[INFO] digital twin mean parameter values: R0 = 0.01400 Q = 13.71 Req = 0.29873
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 87 mission_id: 718
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 16.38
[INFO] simulating true system on i: 88
[INFO] updating degradation parameter variance on i: 88
[INFO] updating degradation parameter values via random sampling on i: 88
[INFO] i: 88 mission_id: 719 rul_hat: 16.38 flight_time: 13.47 distance: 994.78 R0: 0.01358 Q: 13.01 Req: 0.28929
[INFO] success on i: 88 mission_id: 719
[INFO] forecasting degradation values: r_mu: 0.014792 q_mu: 13.181652 m_mu: 0.297112
[INFO] digital twin degradation parameters: 0.0150 13.0439 0.2967
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 16.38
[INFO] simulating digital twin on i 88, mission_id: 719
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0148 12.9306 0.2939
[INFO] simulating digital twin on i 88, mission_id: 719
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0147 13.3081 0.2988
[INFO] simulating digital twin on i 88, mission_id: 719
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0146 12.7049 0.2969
[INFO] simulating digital twin on i 88, mission_id: 719
[INFO] digital twin degradation parameters: 0.0146 12.7049 0.2969
[INFO] digital twin mean parameter values: R0 = 0.01476 Q = 13.00 Req = 0.29658
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 88 mission_id: 719
[INFO] TrueSystem selecting trajectory: <15> with path_time: 17.63 to explore constraint boundary < 16.38
[INFO] simulating true system on i: 89
[INFO] updating degradation parameter variance on i: 89
[INFO] updating degradation parameter values via random sampling on i: 89
[INFO] i: 89 mission_id: 720 rul_hat: 16.38 flight_time: 17.18 distance: 1244.26 R0: 0.01417 Q: 12.52 Req: 0.29776
[WARN] true system low soc threshold exceeded on i: 89 mission_id: 720
[INFO] forecasting degradation values: r_mu: 0.015486 q_mu: 13.099947 m_mu: 0.299256
[INFO] digital twin degradation parameters: 0.0155 13.0034 0.3058
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.38
[INFO] simulating digital twin on i 89, mission_id: 720
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0155 13.3049 0.2950
[INFO] simulating digital twin on i 89, mission_id: 720
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0155 13.7871 0.2917
[INFO] simulating digital twin on i 89, mission_id: 720
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0155 13.0425 0.2951
[INFO] simulating digital twin on i 89, mission_id: 720
[INFO] digital twin degradation parameters: 0.0155 13.0425 0.2951
[INFO] digital twin mean parameter values: R0 = 0.01552 Q = 13.28 Req = 0.29691
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 89 mission_id: 720
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 16.38
[INFO] simulating true system on i: 90
[INFO] updating degradation parameter variance on i: 90
[INFO] updating degradation parameter values via random sampling on i: 90
[INFO] i: 90 mission_id: 721 rul_hat: 16.38 flight_time: 13.47 distance: 994.69 R0: 0.01530 Q: 12.67 Req: 0.29699
[INFO] success on i: 90 mission_id: 721
[INFO] forecasting degradation values: r_mu: 0.016160 q_mu: 12.520116 m_mu: 0.299519
[INFO] digital twin degradation parameters: 0.0161 13.0143 0.3022
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.38
[INFO] simulating digital twin on i 90, mission_id: 721
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0162 12.7969 0.2986
[INFO] simulating digital twin on i 90, mission_id: 721
[INFO] resampling for twin run # 3

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[INFO] digital twin degradation parameters: 0.0160 12.5817 0.3073
[INFO] simulating digital twin on i 90, mission_id: 721
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0160 12.4595 0.3045
[INFO] simulating digital twin on i 90, mission_id: 721
[INFO] digital twin degradation parameters: 0.0160 12.4595 0.3045
[INFO] digital twin mean parameter values: R0 = 0.01608 Q = 12.71 Req = 0.30318
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 90 mission_id: 721
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 16.38
[INFO] simulating true system on i: 91
[INFO] updating degradation parameter variance on i: 91
[INFO] updating degradation parameter values via random sampling on i: 91
[INFO] i: 91 mission_id: 722 rul_hat: 16.38 flight_time: 13.47 distance: 994.69 R0: 0.01584 Q: 12.88 Req: 0.29131
[INFO] success on i: 91 mission_id: 722
[INFO] forecasting degradation values: r_mu: 0.017313 q_mu: 12.468954 m_mu: 0.300380
[INFO] digital twin degradation parameters: 0.0173 12.4923 0.3051
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.38
[INFO] simulating digital twin on i 91, mission_id: 722
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0175 12.4562 0.2963
[INFO] simulating digital twin on i 91, mission_id: 722
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0173 12.6836 0.3014
[INFO] simulating digital twin on i 91, mission_id: 722
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0174 12.4863 0.3128
[INFO] simulating digital twin on i 91, mission_id: 722
[INFO] digital twin degradation parameters: 0.0174 12.4863 0.3128
[INFO] digital twin mean parameter values: R0 = 0.01737 Q = 12.53 Req = 0.30389
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 91 mission_id: 722
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.38
[INFO] simulating true system on i: 92
[INFO] updating degradation parameter variance on i: 92
[INFO] updating degradation parameter values via random sampling on i: 92
[INFO] i: 92 mission_id: 723 rul_hat: 16.38 flight_time: 14.83 distance: 1083.84 R0: 0.01652 Q: 12.81 Req: 0.30332
[INFO] success on i: 92 mission_id: 723
[INFO] forecasting degradation values: r_mu: 0.018009 q_mu: 12.421837 m_mu: 0.294926
[INFO] digital twin degradation parameters: 0.0180 12.3931 0.2953
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.38
[INFO] simulating digital twin on i 92, mission_id: 723
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0181 12.0306 0.2945
[INFO] simulating digital twin on i 92, mission_id: 723
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0179 12.2586 0.2963
[INFO] simulating digital twin on i 92, mission_id: 723
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0179 12.1746 0.2873
[INFO] simulating digital twin on i 92, mission_id: 723
[INFO] digital twin degradation parameters: 0.0179 12.1746 0.2873
[INFO] digital twin mean parameter values: R0 = 0.01797 Q = 12.21 Req = 0.29337
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 92 mission_id: 723
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.38
[INFO] simulating true system on i: 93
[INFO] updating degradation parameter variance on i: 93
[INFO] updating degradation parameter values via random sampling on i: 93
[INFO] i: 93 mission_id: 724 rul_hat: 16.38 flight_time: 13.93 distance: 1047.83 R0: 0.01744 Q: 12.71 Req: 0.29575
[INFO] success on i: 93 mission_id: 724
[INFO] forecasting degradation values: r_mu: 0.018835 q_mu: 12.299945 m_mu: 0.302154
[INFO] digital twin degradation parameters: 0.0187 12.6958 0.3009
[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 to explore constraint boundary < 16.38
[INFO] simulating digital twin on i 93, mission_id: 724

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[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0188 12.5705 0.3071
[INFO] simulating digital twin on i 93, mission_id: 724
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0188 12.6239 0.3111
[INFO] simulating digital twin on i 93, mission_id: 724
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0188 12.2360 0.3042
[INFO] simulating digital twin on i 93, mission_id: 724
[INFO] digital twin degradation parameters: 0.0188 12.2360 0.3042
[INFO] digital twin mean parameter values: R0 = 0.01880 Q = 12.53 Req = 0.30580
stop code counts: low_soc: 4 pos_err: 0 success: 0
[WARN] digital twin low soc threshold exceeded on i: 93 mission_id: 724
[INFO] updating RUL from 16.38 to 15.57
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.57
[INFO] simulating true system on i: 94
[INFO] updating degradation parameter variance on i: 94
[INFO] updating degradation parameter values via random sampling on i: 94
[INFO] i: 94 mission_id: 725 rul_hat: 15.57 flight_time: 14.83 distance: 1083.99 R0: 0.01814 Q: 12.83 Req: 0.30306
[INFO] success on i: 94 mission_id: 725
[INFO] forecasting degradation values: r_mu: 0.019807 q_mu: 12.287800 m_mu: 0.303764
[INFO] digital twin degradation parameters: 0.0198 12.3261 0.2975
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.57
[INFO] simulating digital twin on i 94, mission_id: 725
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0197 12.2490 0.2957
[INFO] simulating digital twin on i 94, mission_id: 725
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0200 12.4726 0.2934
[INFO] simulating digital twin on i 94, mission_id: 725
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0197 12.2610 0.2952
[INFO] simulating digital twin on i 94, mission_id: 725
[INFO] digital twin degradation parameters: 0.0197 12.2610 0.2952
[INFO] digital twin mean parameter values: R0 = 0.01981 Q = 12.33 Req = 0.29545
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 94 mission_id: 725
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.57
[INFO] simulating true system on i: 95
[INFO] updating degradation parameter variance on i: 95
[INFO] updating degradation parameter values via random sampling on i: 95
[INFO] i: 95 mission_id: 726 rul_hat: 15.57 flight_time: 13.58 distance: 1021.14 R0: 0.01901 Q: 12.89 Req: 0.29789
[INFO] success on i: 95 mission_id: 726
[INFO] forecasting degradation values: r_mu: 0.020781 q_mu: 12.554523 m_mu: 0.306022
[INFO] digital twin degradation parameters: 0.0208 12.3041 0.3032
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.57
[INFO] simulating digital twin on i 95, mission_id: 726
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0207 12.7504 0.3122
[INFO] simulating digital twin on i 95, mission_id: 726
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0209 12.5458 0.3035
[INFO] simulating digital twin on i 95, mission_id: 726
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0207 12.5842 0.3108
[INFO] simulating digital twin on i 95, mission_id: 726
[INFO] digital twin degradation parameters: 0.0207 12.5842 0.3108
[INFO] digital twin mean parameter values: R0 = 0.02076 Q = 12.55 Req = 0.30744
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 95 mission_id: 726
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.57
[INFO] simulating true system on i: 96
[INFO] updating degradation parameter variance on i: 96
[INFO] updating degradation parameter values via random sampling on i: 96
[INFO] i: 96 mission_id: 727 rul_hat: 15.57 flight_time: 13.94 distance: 1047.78 R0: 0.02004 Q: 12.79 Req: 0.29254

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[INFO] success on i: 96 mission_id: 727
[INFO] forecasting degradation values: r_mu: 0.021781 q_mu: 12.380058 m_mu: 0.303197
[INFO] digital twin degradation parameters: 0.0218 12.4290 0.3024
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 to explore constraint boundary < 15.57
[INFO] simulating digital twin on i 96, mission_id: 727
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0217 12.4491 0.3055
[INFO] simulating digital twin on i 96, mission_id: 727
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0218 12.5791 0.2956
[INFO] simulating digital twin on i 96, mission_id: 727
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0217 11.6120 0.3058
[INFO] simulating digital twin on i 96, mission_id: 727
[INFO] digital twin degradation parameters: 0.0217 11.6120 0.3058
[INFO] digital twin mean parameter values: R0 = 0.02173 Q = 12.27 Req = 0.30234
stop code counts: low_soc: 1 pos_err: 0 success: 3
[INFO] digital twin mission success on i: 96 mission_id: 727
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.57
[INFO] simulating true system on i: 97
[INFO] updating degradation parameter variance on i: 97
[INFO] updating degradation parameter values via random sampling on i: 97
[INFO] i: 97 mission_id: 728 rul_hat: 15.57 flight_time: 13.94 distance: 1047.96 R0: 0.02106 Q: 12.54 Req: 0.29833
[INFO] success on i: 97 mission_id: 728
[INFO] forecasting degradation values: r_mu: 0.022919 q_mu: 12.716638 m_mu: 0.300045
[INFO] digital twin degradation parameters: 0.0228 12.6565 0.3031
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.57
[INFO] simulating digital twin on i 97, mission_id: 728
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0230 12.3615 0.3034
[INFO] simulating digital twin on i 97, mission_id: 728
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0230 12.4961 0.2925
[INFO] simulating digital twin on i 97, mission_id: 728
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0230 12.9187 0.3029
[INFO] simulating digital twin on i 97, mission_id: 728
[INFO] digital twin degradation parameters: 0.0230 12.9187 0.3029
[INFO] digital twin mean parameter values: R0 = 0.02294 Q = 12.61 Req = 0.30048
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 97 mission_id: 728
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 to explore constraint boundary < 15.57
[INFO] simulating true system on i: 98
[INFO] updating degradation parameter variance on i: 98
[INFO] updating degradation parameter values via random sampling on i: 98
[INFO] i: 98 mission_id: 729 rul_hat: 15.57 flight_time: 16.36 distance: 1218.88 R0: 0.02204 Q: 12.34 Req: 0.29865
[INFO] success on i: 98 mission_id: 729
[INFO] forecasting degradation values: r_mu: 0.024100 q_mu: 12.594874 m_mu: 0.300629
[INFO] digital twin degradation parameters: 0.0239 12.8699 0.3015
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.57
[INFO] simulating digital twin on i 98, mission_id: 729
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0240 12.7556 0.3006
[INFO] simulating digital twin on i 98, mission_id: 729
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0242 12.8718 0.3047
[INFO] simulating digital twin on i 98, mission_id: 729
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0240 12.5633 0.3019
[INFO] simulating digital twin on i 98, mission_id: 729
[INFO] digital twin degradation parameters: 0.0240 12.5633 0.3019
[INFO] digital twin mean parameter values: R0 = 0.02404 Q = 12.77 Req = 0.30219
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 98 mission_id: 729
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.57

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[INFO] simulating true system on i: 99
Bumping sigmax
[INFO] updating degradation parameter variance on i: 99
[INFO] updating degradation parameter values via random sampling on i: 99
[INFO] i: 99 mission_id: 730 rul_hat: 15.57 flight_time: 14.83 distance: 1083.83 R0: 0.02299 Q: 12.55 Req: 0.30344
[INFO] success on i: 99 mission_id: 730
[INFO] forecasting degradation values: r_mu: 0.025271 q_mu: 12.567826 m_mu: 0.298427
[INFO] digital twin degradation parameters: 0.0253 12.4359 0.3046
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.57
[INFO] simulating digital twin on i 99, mission_id: 730
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0254 12.1757 0.2892
[INFO] simulating digital twin on i 99, mission_id: 730
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0253 12.3301 0.2939
[INFO] simulating digital twin on i 99, mission_id: 730
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0253 12.4456 0.2973
[INFO] simulating digital twin on i 99, mission_id: 730
[INFO] digital twin degradation parameters: 0.0253 12.4456 0.2973
[INFO] digital twin mean parameter values: R0 = 0.02531 Q = 12.35 Req = 0.29626
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 99 mission_id: 730
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.57
[INFO] simulating true system on i: 100
Bumping sigmax
[INFO] updating degradation parameter variance on i: 100
[INFO] updating degradation parameter values via random sampling on i: 100
[INFO] i: 100 mission_id: 731 rul_hat: 15.57 flight_time: 14.83 distance: 1083.73 R0: 0.02350 Q: 11.87 Req: 0.30137
[INFO] success on i: 100 mission_id: 731
[INFO] forecasting degradation values: r_mu: 0.026250 q_mu: 12.440640 m_mu: 0.302102
[INFO] digital twin degradation parameters: 0.0263 12.2651 0.3046
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.57
[INFO] simulating digital twin on i 100, mission_id: 731
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0263 12.2684 0.2978
[INFO] simulating digital twin on i 100, mission_id: 731
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0263 12.2744 0.3094
[INFO] simulating digital twin on i 100, mission_id: 731
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0264 12.4644 0.3000
[INFO] simulating digital twin on i 100, mission_id: 731
[INFO] digital twin degradation parameters: 0.0264 12.4644 0.3000
[INFO] digital twin mean parameter values: R0 = 0.02633 Q = 12.32 Req = 0.30294
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 100 mission_id: 731
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.57
[INFO] simulating true system on i: 101
Bumping sigmax
[INFO] updating degradation parameter variance on i: 101
[INFO] updating degradation parameter values via random sampling on i: 101
[INFO] i: 101 mission_id: 732 rul_hat: 15.57 flight_time: 14.83 distance: 1083.71 R0: 0.02477 Q: 12.22 Req: 0.30479
[INFO] success on i: 101 mission_id: 732
[INFO] forecasting degradation values: r_mu: 0.027138 q_mu: 11.687671 m_mu: 0.304519
[INFO] digital twin degradation parameters: 0.0273 11.8733 0.3102
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.57
[INFO] simulating digital twin on i 101, mission_id: 732
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0270 11.7839 0.3061
[INFO] simulating digital twin on i 101, mission_id: 732
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0273 11.9625 0.3078
[INFO] simulating digital twin on i 101, mission_id: 732
[INFO] resampling for twin run # 4

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[INFO] digital twin degradation parameters: 0.0271 11.5687 0.2943
[INFO] simulating digital twin on i 101, mission_id: 732
[INFO] digital twin degradation parameters: 0.0271 11.5687 0.2943
[INFO] digital twin mean parameter values: R0 = 0.02716 Q = 11.80 Req = 0.30461
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 101 mission_id: 732
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.57
[INFO] simulating true system on i: 102
Bumping sigma_max
[INFO] updating degradation parameter variance on i: 102
[INFO] updating degradation parameter values via random sampling on i: 102
[INFO] i: 102 mission_id: 733 rul_hat: 15.57 flight_time: 14.83 distance: 1083.73 R0: 0.02548 Q: 12.53 Req: 0.30590
[INFO] success on i: 102 mission_id: 733
[INFO] forecasting degradation values: r_mu: 0.028525 q_mu: 12.078430 m_mu: 0.302467
[INFO] digital twin degradation parameters: 0.0285 12.1142 0.3105
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 to explore constraint boundary < 15.57
[INFO] simulating digital twin on i 102, mission_id: 733
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0285 11.7983 0.3045
[INFO] simulating digital twin on i 102, mission_id: 733
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0286 12.3034 0.2948
[INFO] simulating digital twin on i 102, mission_id: 733
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0286 11.8624 0.3006
[INFO] simulating digital twin on i 102, mission_id: 733
[INFO] digital twin degradation parameters: 0.0286 11.8624 0.3006
[INFO] digital twin mean parameter values: R0 = 0.02855 Q = 12.02 Req = 0.30259
stop code counts: low_soc: 3 pos_err: 0 success: 1
[WARN] digital twin low soc threshold exceeded on i: 102 mission_id: 733
[INFO] updating RUL from 15.57 to 15.09
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.09
[INFO] simulating true system on i: 103
Bumping sigma_max
[INFO] updating degradation parameter variance on i: 103
[INFO] updating degradation parameter values via random sampling on i: 103
[INFO] i: 103 mission_id: 734 rul_hat: 15.09 flight_time: 13.47 distance: 994.83 R0: 0.02663 Q: 12.41 Req: 0.31434
[INFO] success on i: 103 mission_id: 734
[INFO] forecasting degradation values: r_mu: 0.029343 q_mu: 12.338490 m_mu: 0.308753
[INFO] digital twin degradation parameters: 0.0293 12.0010 0.3029
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.09
[INFO] simulating digital twin on i 103, mission_id: 734
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0294 11.8170 0.3099
[INFO] simulating digital twin on i 103, mission_id: 734
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0293 12.6134 0.3045
[INFO] simulating digital twin on i 103, mission_id: 734
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0293 12.1041 0.3053
[INFO] simulating digital twin on i 103, mission_id: 734
[INFO] digital twin degradation parameters: 0.0293 12.1041 0.3053
[INFO] digital twin mean parameter values: R0 = 0.02932 Q = 12.13 Req = 0.30567
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 103 mission_id: 734
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.09
[INFO] simulating true system on i: 104
Bumping sigma_max
[INFO] updating degradation parameter variance on i: 104
[INFO] updating degradation parameter values via random sampling on i: 104
[INFO] i: 104 mission_id: 735 rul_hat: 15.09 flight_time: 13.93 distance: 1048.00 R0: 0.02760 Q: 12.50 Req: 0.30988
[INFO] success on i: 104 mission_id: 735
[INFO] forecasting degradation values: r_mu: 0.030455 q_mu: 12.020170 m_mu: 0.314090
[INFO] digital twin degradation parameters: 0.0306 11.9508 0.3194
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.09

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[INFO] simulating digital twin on i 104, mission_id: 735
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0305 11.9266 0.3176
[INFO] simulating digital twin on i 104, mission_id: 735
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0305 12.2786 0.3162
[INFO] simulating digital twin on i 104, mission_id: 735
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0305 11.8517 0.3086
[INFO] simulating digital twin on i 104, mission_id: 735
[INFO] digital twin degradation parameters: 0.0305 11.8517 0.3086
[INFO] digital twin mean parameter values: R0 = 0.03055 Q = 12.00 Req = 0.31545
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 104 mission_id: 735
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.09
[INFO] simulating true system on i: 105
Bumping sigmax
[INFO] updating degradation parameter variance on i: 105
[INFO] updating degradation parameter values via random sampling on i: 105
[INFO] i: 105 mission_id: 736 rul_hat: 15.09 flight_time: 13.30 distance: 982.65 R0: 0.02874 Q: 11.97 Req: 0.30566
[WARN] true system position error threshold exceeded on i: 105 mission_id: 736
[INFO] forecasting degradation values: r_mu: 0.031323 q_mu: 12.102333 m_mu: 0.317695
[INFO] digital twin degradation parameters: 0.0316 11.9467 0.3273
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.09
[INFO] simulating digital twin on i 105, mission_id: 736
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0313 12.0485 0.3201
[INFO] simulating digital twin on i 105, mission_id: 736
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0315 11.6929 0.3278
[INFO] simulating digital twin on i 105, mission_id: 736
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0314 11.9651 0.3171
[INFO] simulating digital twin on i 105, mission_id: 736
[INFO] digital twin degradation parameters: 0.0314 11.9651 0.3171
[INFO] digital twin mean parameter values: R0 = 0.03145 Q = 11.91 Req = 0.32306
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 105 mission_id: 736
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.09
[INFO] simulating true system on i: 106
Bumping sigmax
[INFO] updating degradation parameter variance on i: 106
[INFO] updating degradation parameter values via random sampling on i: 106
[INFO] i: 106 mission_id: 737 rul_hat: 15.09 flight_time: 13.30 distance: 982.67 R0: 0.02982 Q: 12.39 Req: 0.30730
[WARN] true system position error threshold exceeded on i: 106 mission_id: 737
[INFO] forecasting degradation values: r_mu: 0.032425 q_mu: 11.968547 m_mu: 0.317313
[INFO] digital twin degradation parameters: 0.0324 12.1520 0.3179
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 to explore constraint boundary < 15.09
[INFO] simulating digital twin on i 106, mission_id: 737
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0325 12.0406 0.3243
[INFO] simulating digital twin on i 106, mission_id: 737
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0323 11.9687 0.3176
[INFO] simulating digital twin on i 106, mission_id: 737
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0322 12.2806 0.3314
[INFO] simulating digital twin on i 106, mission_id: 737
[INFO] digital twin degradation parameters: 0.0322 12.2806 0.3314
[INFO] digital twin mean parameter values: R0 = 0.03234 Q = 12.11 Req = 0.32278
stop code counts: low_soc: 3 pos_err: 0 success: 1
[WARN] digital twin low soc threshold exceeded on i: 106 mission_id: 737
[INFO] updating RUL from 15.09 to 15.25
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.25
[INFO] simulating true system on i: 107

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Bumping sigmax
[INFO] updating degradation parameter variance on i: 107
[INFO] updating degradation parameter values via random sampling on i: 107
[INFO] i: 107 mission_id: 738 rul_hat: 15.25 flight_time: 13.47 distance: 994.75 R0: 0.03076 Q: 12.17 Req: 0.30818
[INFO] success on i: 107 mission_id: 738
[INFO] forecasting degradation values: r_mu: 0.033498 q_mu: 12.267804 m_mu: 0.314846
[INFO] digital twin degradation parameters: 0.0335 12.6723 0.3106
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.25
[INFO] simulating digital twin on i 107, mission_id: 738
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0335 12.6276 0.3250
[INFO] simulating digital twin on i 107, mission_id: 738
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0334 12.1075 0.3174
[INFO] simulating digital twin on i 107, mission_id: 738
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0335 12.7660 0.3230
[INFO] simulating digital twin on i 107, mission_id: 738
[INFO] digital twin degradation parameters: 0.0335 12.7660 0.3230
[INFO] digital twin mean parameter values: R0 = 0.03346 Q = 12.54 Req = 0.31902
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 107 mission_id: 738
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.25
[INFO] simulating true system on i: 108
Bumping sigmax
[INFO] updating degradation parameter variance on i: 108
[INFO] updating degradation parameter values via random sampling on i: 108
[INFO] i: 108 mission_id: 739 rul_hat: 15.25 flight_time: 13.47 distance: 994.75 R0: 0.03185 Q: 12.21 Req: 0.31671
[INFO] success on i: 108 mission_id: 739
[INFO] forecasting degradation values: r_mu: 0.034531 q_mu: 12.222198 m_mu: 0.313832
[INFO] digital twin degradation parameters: 0.0345 12.7042 0.3172
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.25
[INFO] simulating digital twin on i 108, mission_id: 739
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0346 12.1227 0.3134
[INFO] simulating digital twin on i 108, mission_id: 739
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0348 12.1037 0.3186
[INFO] simulating digital twin on i 108, mission_id: 739
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0346 12.6194 0.3165
[INFO] simulating digital twin on i 108, mission_id: 739
[INFO] digital twin degradation parameters: 0.0346 12.6194 0.3165
[INFO] digital twin mean parameter values: R0 = 0.03464 Q = 12.39 Req = 0.31640
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 108 mission_id: 739
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.25
[INFO] simulating true system on i: 109
Bumping sigmax
[INFO] updating degradation parameter variance on i: 109
[INFO] updating degradation parameter values via random sampling on i: 109
[INFO] i: 109 mission_id: 740 rul_hat: 15.25 flight_time: 14.83 distance: 1084.24 R0: 0.03318 Q: 12.04 Req: 0.32189
[INFO] success on i: 109 mission_id: 740
[INFO] forecasting degradation values: r_mu: 0.035687 q_mu: 12.166747 m_mu: 0.317251
[INFO] digital twin degradation parameters: 0.0358 12.2910 0.3177
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.25
[INFO] simulating digital twin on i 109, mission_id: 740
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0357 11.7802 0.3194
[INFO] simulating digital twin on i 109, mission_id: 740
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0357 12.0242 0.3197
[INFO] simulating digital twin on i 109, mission_id: 740
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0356 11.8297 0.3085

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[INFO] simulating digital twin on i 109, mission_id: 740
[INFO] digital twin degradation parameters: 0.0356 11.8297 0.3085
[INFO] digital twin mean parameter values: R0 = 0.03571 Q = 11.98 Req = 0.31632
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 109 mission_id: 740
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.25
[INFO] simulating true system on i: 110
Bumping sigma_x
[INFO] updating degradation parameter variance on i: 110
[INFO] updating degradation parameter values via random sampling on i: 110
[INFO] i: 110 mission_id: 741 rul_hat: 15.25 flight_time: 14.83 distance: 1084.16 R0: 0.03443 Q: 11.49 Req: 0.31206
[INFO] success on i: 110 mission_id: 741
[INFO] forecasting degradation values: r_mu: 0.037266 q_mu: 12.281050 m_mu: 0.325192
[INFO] digital twin degradation parameters: 0.0371 12.7335 0.3246
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.25
[INFO] simulating digital twin on i 110, mission_id: 741
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0374 11.9925 0.3315
[INFO] simulating digital twin on i 110, mission_id: 741
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0374 11.7618 0.3243
[INFO] simulating digital twin on i 110, mission_id: 741
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0372 12.3202 0.3209
[INFO] simulating digital twin on i 110, mission_id: 741
[INFO] digital twin degradation parameters: 0.0372 12.3202 0.3209
[INFO] digital twin mean parameter values: R0 = 0.03727 Q = 12.20 Req = 0.32533
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 110 mission_id: 741
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.25
[INFO] simulating true system on i: 111
Bumping sigma_x
[INFO] updating degradation parameter variance on i: 111
[INFO] updating degradation parameter values via random sampling on i: 111
[INFO] i: 111 mission_id: 742 rul_hat: 15.25 flight_time: 13.30 distance: 982.71 R0: 0.03566 Q: 11.79 Req: 0.30767
[WARN] true system position error threshold exceeded on i: 111 mission_id: 742
[INFO] forecasting degradation values: r_mu: 0.038435 q_mu: 11.578080 m_mu: 0.317861
[INFO] digital twin degradation parameters: 0.0384 11.4478 0.3115
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.25
[INFO] simulating digital twin on i 111, mission_id: 742
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0385 11.8262 0.3207
[INFO] simulating digital twin on i 111, mission_id: 742
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0386 11.3958 0.3135
[INFO] simulating digital twin on i 111, mission_id: 742
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0384 11.9239 0.3244
[INFO] simulating digital twin on i 111, mission_id: 742
[INFO] digital twin degradation parameters: 0.0384 11.9239 0.3244
[INFO] digital twin mean parameter values: R0 = 0.03847 Q = 11.65 Req = 0.31753
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 111 mission_id: 742
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.25
[INFO] simulating true system on i: 112
Bumping sigma_x
[INFO] updating degradation parameter variance on i: 112
[INFO] updating degradation parameter values via random sampling on i: 112
[INFO] i: 112 mission_id: 743 rul_hat: 15.25 flight_time: 13.93 distance: 1047.75 R0: 0.03685 Q: 11.93 Req: 0.31526
[INFO] success on i: 112 mission_id: 743
[INFO] forecasting degradation values: r_mu: 0.039933 q_mu: 11.444506 m_mu: 0.315146
[INFO] digital twin degradation parameters: 0.0398 11.3609 0.3060
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.25
[INFO] simulating digital twin on i 112, mission_id: 743
[INFO] resampling for twin run # 2

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[INFO] digital twin degradation parameters: 0.0401 11.1046 0.3200
[INFO] simulating digital twin on i 112, mission_id: 743
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0399 11.4652 0.3187
[INFO] simulating digital twin on i 112, mission_id: 743
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0401 11.1767 0.3217
[INFO] simulating digital twin on i 112, mission_id: 743
[INFO] digital twin degradation parameters: 0.0401 11.1767 0.3217
[INFO] digital twin mean parameter values: R0 = 0.03998 Q = 11.28 Req = 0.31662
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 112 mission_id: 743
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.25
[INFO] simulating true system on i: 113
Bumping sigmax
[INFO] updating degradation parameter variance on i: 113
[INFO] updating degradation parameter values via random sampling on i: 113
[INFO] i: 113 mission_id: 744 rul_hat: 15.25 flight_time: 13.93 distance: 1047.93 R0: 0.03827 Q: 11.89 Req: 0.31084
[INFO] success on i: 113 mission_id: 744
[INFO] forecasting degradation values: r_mu: 0.041246 q_mu: 11.485944 m_mu: 0.316603
[INFO] digital twin degradation parameters: 0.0413 11.5889 0.3174
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 to explore constraint boundary < 15.25
[INFO] simulating digital twin on i 113, mission_id: 744
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0413 11.5143 0.3203
[INFO] simulating digital twin on i 113, mission_id: 744
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0411 11.4990 0.3210
[INFO] simulating digital twin on i 113, mission_id: 744
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0413 11.4649 0.3073
[INFO] simulating digital twin on i 113, mission_id: 744
[INFO] digital twin degradation parameters: 0.0413 11.4649 0.3073
[INFO] digital twin mean parameter values: R0 = 0.04128 Q = 11.52 Req = 0.31649
stop code counts: low_soc: 4 pos_err: 0 success: 0
[WARN] digital twin low soc threshold exceeded on i: 113 mission_id: 744
[INFO] updating RUL from 15.25 to 14.49
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 14.49
[INFO] simulating true system on i: 114
Bumping sigmax
[INFO] updating degradation parameter variance on i: 114
[INFO] updating degradation parameter values via random sampling on i: 114
[INFO] i: 114 mission_id: 745 rul_hat: 14.49 flight_time: 13.47 distance: 994.82 R0: 0.03937 Q: 11.77 Req: 0.31417
[INFO] success on i: 114 mission_id: 745
[INFO] forecasting degradation values: r_mu: 0.042750 q_mu: 11.437152 m_mu: 0.315916
[INFO] digital twin degradation parameters: 0.0430 11.4552 0.3202
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 14.49
[INFO] simulating digital twin on i 114, mission_id: 745
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0428 11.6966 0.3250
[INFO] simulating digital twin on i 114, mission_id: 745
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0427 11.0302 0.3240
[INFO] simulating digital twin on i 114, mission_id: 745
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0428 11.1554 0.3131
[INFO] simulating digital twin on i 114, mission_id: 745
[INFO] digital twin degradation parameters: 0.0428 11.1554 0.3131
[INFO] digital twin mean parameter values: R0 = 0.04282 Q = 11.33 Req = 0.32060
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 114 mission_id: 745
[INFO] TrueSystem selecting trajectory: <8> with path_time: 13.31 that meets constraint: path_time < 14.49
[INFO] simulating true system on i: 115
Bumping sigmax
[INFO] updating degradation parameter variance on i: 115

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[INFO] updating degradation parameter values via random sampling on i: 115
[INFO] i: 115 mission_id: 746 rul_hat: 14.49 flight_time: 13.27 distance: 989.93 R0: 0.04075 Q: 11.66 Req: 0.31950
[INFO] success on i: 115 mission_id: 746
[INFO] forecasting degradation values: r_mu: 0.044067 q_mu: 11.670732 m_mu: 0.317026
[INFO] digital twin degradation parameters: 0.0440 11.9190 0.3188
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 14.49
[INFO] simulating digital twin on i 115, mission_id: 746
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0441 11.4490 0.3207
[INFO] simulating digital twin on i 115, mission_id: 746
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0442 12.2892 0.3195
[INFO] simulating digital twin on i 115, mission_id: 746
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0440 11.7210 0.3120
[INFO] simulating digital twin on i 115, mission_id: 746
[INFO] digital twin degradation parameters: 0.0440 11.7210 0.3120
[INFO] digital twin mean parameter values: R0 = 0.04406 Q = 11.84 Req = 0.31776
    stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 115 mission_id: 746
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 14.49
[INFO] simulating true system on i: 116
Bumping sigmax
[INFO] updating degradation parameter variance on i: 116
[INFO] updating degradation parameter values via random sampling on i: 116
[INFO] i: 116 mission_id: 747 rul_hat: 14.49 flight_time: 13.93 distance: 1047.96 R0: 0.04219 Q: 11.64 Req: 0.31378
[INFO] success on i: 116 mission_id: 747
[INFO] forecasting degradation values: r_mu: 0.045547 q_mu: 11.333920 m_mu: 0.319033
[INFO] digital twin degradation parameters: 0.0456 11.5328 0.3242
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 14.49
[INFO] simulating digital twin on i 116, mission_id: 747
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0457 11.3472 0.3181
[INFO] simulating digital twin on i 116, mission_id: 747
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0457 10.7067 0.3168
[INFO] simulating digital twin on i 116, mission_id: 747
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0458 11.2161 0.3162
[INFO] simulating digital twin on i 116, mission_id: 747
[INFO] digital twin degradation parameters: 0.0458 11.2161 0.3162
[INFO] digital twin mean parameter values: R0 = 0.04571 Q = 11.20 Req = 0.31884
    stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 116 mission_id: 747
[INFO] TrueSystem selecting trajectory: <8> with path_time: 13.31 that meets constraint: path_time < 14.49
[INFO] simulating true system on i: 117
Bumping sigmax
[INFO] updating degradation parameter variance on i: 117
[INFO] updating degradation parameter values via random sampling on i: 117
[INFO] i: 117 mission_id: 748 rul_hat: 14.49 flight_time: 13.27 distance: 990.06 R0: 0.04311 Q: 11.29 Req: 0.32327
[INFO] success on i: 117 mission_id: 748
[INFO] forecasting degradation values: r_mu: 0.047100 q_mu: 11.407079 m_mu: 0.316005
[INFO] digital twin degradation parameters: 0.0471 11.5631 0.3166
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 14.49
[INFO] simulating digital twin on i 117, mission_id: 748
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0471 11.0154 0.3199
[INFO] simulating digital twin on i 117, mission_id: 748
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0471 11.5709 0.3133
[INFO] simulating digital twin on i 117, mission_id: 748
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0471 11.6706 0.3061
[INFO] simulating digital twin on i 117, mission_id: 748
[INFO] digital twin degradation parameters: 0.0471 11.6706 0.3061

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[INFO] digital twin mean parameter values: R0 = 0.04711 Q = 11.46 Req = 0.31400
      stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 117 mission_id: 748
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 14.49
[INFO] simulating true system on i: 118
Bumping sigmax
[INFO] updating degradation parameter variance on i: 118
[INFO] updating degradation parameter values via random sampling on i: 118
[INFO] i: 118 mission_id: 749 rul_hat: 14.49 flight_time: 13.93 distance: 1047.81 R0: 0.04503 Q: 11.53 Req: 0.31801
[INFO] success on i: 118 mission_id: 749
[INFO] forecasting degradation values: r_mu: 0.048189 q_mu: 11.093600 m_mu: 0.318771
[INFO] digital twin degradation parameters: 0.0483 11.1280 0.3108
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 14.49
[INFO] simulating digital twin on i 118, mission_id: 749
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0483 10.9433 0.3129
[INFO] simulating digital twin on i 118, mission_id: 749
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0481 10.8845 0.3230
[INFO] simulating digital twin on i 118, mission_id: 749
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0482 11.1692 0.3209
[INFO] simulating digital twin on i 118, mission_id: 749
[INFO] digital twin degradation parameters: 0.0482 11.1692 0.3209
[INFO] digital twin mean parameter values: R0 = 0.04825 Q = 11.03 Req = 0.31691
      stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 118 mission_id: 749
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 14.49
[INFO] simulating true system on i: 119
Bumping sigmax
[INFO] updating degradation parameter variance on i: 119
[INFO] updating degradation parameter values via random sampling on i: 119
[INFO] i: 119 mission_id: 750 rul_hat: 14.49 flight_time: 13.27 distance: 977.30 R0: 0.04668 Q: 11.17 Req: 0.31725
[WARN] true system position error threshold exceeded on i: 119 mission_id: 750
[INFO] forecasting degradation values: r_mu: 0.050223 q_mu: 11.350010 m_mu: 0.319870
[INFO] digital twin degradation parameters: 0.0501 11.5674 0.3248
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 14.49
[INFO] simulating digital twin on i 119, mission_id: 750
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0502 11.1974 0.3237
[INFO] simulating digital twin on i 119, mission_id: 750
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0502 11.3118 0.3171
[INFO] simulating digital twin on i 119, mission_id: 750
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0503 11.5623 0.3222
[INFO] simulating digital twin on i 119, mission_id: 750
[INFO] digital twin degradation parameters: 0.0503 11.5623 0.3222
[INFO] digital twin mean parameter values: R0 = 0.05023 Q = 11.41 Req = 0.32194
      stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 119 mission_id: 750
[INFO] TrueSystem selecting trajectory: <8> with path_time: 13.31 that meets constraint: path_time < 14.49
[INFO] simulating true system on i: 120
Bumping sigmax
[INFO] updating degradation parameter variance on i: 120
[INFO] updating degradation parameter values via random sampling on i: 120
[INFO] i: 120 mission_id: 751 rul_hat: 14.49 flight_time: 13.27 distance: 990.04 R0: 0.04769 Q: 11.35 Req: 0.33070
[INFO] success on i: 120 mission_id: 751
[INFO] forecasting degradation values: r_mu: 0.051778 q_mu: 11.115300 m_mu: 0.323665
[INFO] digital twin degradation parameters: 0.0518 10.9043 0.3334
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 14.49
[INFO] simulating digital twin on i 120, mission_id: 751
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0518 10.9144 0.3251
[INFO] simulating digital twin on i 120, mission_id: 751

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[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0518 11.1164 0.3253
[INFO] simulating digital twin on i 120, mission_id: 751
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0519 10.7643 0.3247
[INFO] simulating digital twin on i 120, mission_id: 751
[INFO] digital twin degradation parameters: 0.0519 10.7643 0.3247
[INFO] digital twin mean parameter values: R0 = 0.05183 Q = 10.92 Req = 0.32712
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 120 mission_id: 751
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 14.49
[INFO] simulating true system on i: 121
Bumping sigmax
[INFO] updating degradation parameter variance on i: 121
[INFO] updating degradation parameter values via random sampling on i: 121
[INFO] i: 121 mission_id: 752 rul_hat: 14.49 flight_time: 13.47 distance: 994.94 R0: 0.04977 Q: 11.49 Req: 0.32479
[INFO] success on i: 121 mission_id: 752
[INFO] forecasting degradation values: r_mu: 0.053113 q_mu: 10.996605 m_mu: 0.332011
[INFO] digital twin degradation parameters: 0.0531 11.1287 0.3373
[INFO] DigitalTwin selecting trajectory: <8> with path_time: 13.31 that meets constraint: path_time < 14.49
[INFO] simulating digital twin on i 121, mission_id: 752
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0530 10.4972 0.3283
[INFO] simulating digital twin on i 121, mission_id: 752
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0531 10.9034 0.3278
[INFO] simulating digital twin on i 121, mission_id: 752
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0532 10.5925 0.3296
[INFO] simulating digital twin on i 121, mission_id: 752
[INFO] digital twin degradation parameters: 0.0532 10.5925 0.3296
[INFO] digital twin mean parameter values: R0 = 0.05311 Q = 10.78 Req = 0.33072
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 121 mission_id: 752
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 14.49
[INFO] simulating true system on i: 122
Bumping sigmax
[INFO] updating degradation parameter variance on i: 122
[INFO] updating degradation parameter values via random sampling on i: 122
[INFO] i: 122 mission_id: 753 rul_hat: 14.49 flight_time: 13.25 distance: 974.41 R0: 0.05136 Q: 11.26 Req: 0.32074
[WARN] true system position error threshold exceeded on i: 122 mission_id: 753
[INFO] forecasting degradation values: r_mu: 0.055243 q_mu: 10.943250 m_mu: 0.331029
[INFO] digital twin degradation parameters: 0.0552 10.9685 0.3364
[INFO] DigitalTwin selecting trajectory: <8> with path_time: 13.31 that meets constraint: path_time < 14.49
[INFO] simulating digital twin on i 122, mission_id: 753
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0552 11.1052 0.3363
[INFO] simulating digital twin on i 122, mission_id: 753
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0554 10.8139 0.3312
[INFO] simulating digital twin on i 122, mission_id: 753
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0552 10.7918 0.3324
[INFO] simulating digital twin on i 122, mission_id: 753
[INFO] digital twin degradation parameters: 0.0552 10.7918 0.3324
[INFO] digital twin mean parameter values: R0 = 0.05523 Q = 10.92 Req = 0.33407
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 122 mission_id: 753
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 14.49
[INFO] simulating true system on i: 123
Bumping sigmax
[INFO] updating degradation parameter variance on i: 123
[INFO] updating degradation parameter values via random sampling on i: 123
[INFO] i: 123 mission_id: 754 rul_hat: 14.49 flight_time: 13.93 distance: 1047.89 R0: 0.05272 Q: 11.75 Req: 0.32704
[INFO] success on i: 123 mission_id: 754

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[INFO] forecasting degradation values: r_mu: 0.057023 q_mu: 10.974156 m_mu: 0.329773
[INFO] digital twin degradation parameters: 0.0571 10.8585 0.3271
[INFO] DigitalTwin selecting trajectory: <8> with path_time: 13.31 that meets constraint: path_time < 14.49
[INFO] simulating digital twin on i 123, mission_id: 754
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0569 10.5109 0.3300
[INFO] simulating digital twin on i 123, mission_id: 754
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0570 11.0442 0.3302
[INFO] simulating digital twin on i 123, mission_id: 754
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0571 11.1993 0.3231
[INFO] simulating digital twin on i 123, mission_id: 754
[INFO] digital twin degradation parameters: 0.0571 11.1993 0.3231
[INFO] digital twin mean parameter values: R0 = 0.05703 Q = 10.90 Req = 0.32763
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 123 mission_id: 754
[INFO] TrueSystem selecting trajectory: <8> with path_time: 13.31 that meets constraint: path_time < 14.49
[INFO] simulating true system on i: 124
Bumping sigma_x
[INFO] updating degradation parameter variance on i: 124
[INFO] updating degradation parameter values via random sampling on i: 124
[INFO] i: 124 mission_id: 755 rul_hat: 14.49 flight_time: 13.28 distance: 990.22 R0: 0.05472 Q: 10.79 Req: 0.33440
[INFO] success on i: 124 mission_id: 755
[INFO] forecasting degradation values: r_mu: 0.058643 q_mu: 11.343475 m_mu: 0.331119
[INFO] digital twin degradation parameters: 0.0586 11.3744 0.3325
[INFO] DigitalTwin selecting trajectory: <8> with path_time: 13.31 that meets constraint: path_time < 14.49
[INFO] simulating digital twin on i 124, mission_id: 755
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0586 10.9108 0.3362
[INFO] simulating digital twin on i 124, mission_id: 755
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0586 11.6544 0.3282
[INFO] simulating digital twin on i 124, mission_id: 755
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0588 11.1420 0.3256
[INFO] simulating digital twin on i 124, mission_id: 755
[INFO] digital twin degradation parameters: 0.0588 11.1420 0.3256
[INFO] digital twin mean parameter values: R0 = 0.05865 Q = 11.27 Req = 0.33060
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 124 mission_id: 755
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 to explore constraint boundary < 14.49
[INFO] simulating true system on i: 125
Bumping sigma_x
[INFO] updating degradation parameter variance on i: 125
[INFO] updating degradation parameter values via random sampling on i: 125
[INFO] i: 125 mission_id: 756 rul_hat: 14.49 flight_time: 14.37 distance: 1066.74 R0: 0.05681 Q: 11.07 Req: 0.32865
[WARN] true system low soc threshold exceeded on i: 125 mission_id: 756
[INFO] forecasting degradation values: r_mu: 0.060595 q_mu: 10.696918 m_mu: 0.336000
[INFO] digital twin degradation parameters: 0.0606 11.2114 0.3341
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 14.49
[INFO] simulating digital twin on i 125, mission_id: 756
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0605 10.5510 0.3445
[INFO] simulating digital twin on i 125, mission_id: 756
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0606 10.5244 0.3338
[INFO] simulating digital twin on i 125, mission_id: 756
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0607 10.3680 0.3391
[INFO] simulating digital twin on i 125, mission_id: 756
[INFO] digital twin degradation parameters: 0.0607 10.3680 0.3391
[INFO] digital twin mean parameter values: R0 = 0.06057 Q = 10.66 Req = 0.33789
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 125 mission_id: 756

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[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 14.49
[INFO] simulating true system on i: 126
Bumping sigma_x
[INFO] updating degradation parameter variance on i: 126
[INFO] updating degradation parameter values via random sampling on i: 126
[INFO] i: 126 mission_id: 757 rul_hat: 14.49 flight_time: 13.25 distance: 974.38 R0: 0.05797 Q: 11.03 Req: 0.33399
[WARN] true system position error threshold exceeded on i: 126 mission_id: 757
[INFO] forecasting degradation values: r_mu: 0.062793 q_mu: 10.919215 m_mu: 0.337247
[INFO] digital twin degradation parameters: 0.0627 10.9986 0.3381
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 to explore constraint boundary < 14.49
[INFO] simulating digital twin on i 126, mission_id: 757
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0629 10.8900 0.3340
[INFO] simulating digital twin on i 126, mission_id: 757
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0628 10.8694 0.3417
[INFO] simulating digital twin on i 126, mission_id: 757
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0628 10.7089 0.3365
[INFO] simulating digital twin on i 126, mission_id: 757
[INFO] digital twin degradation parameters: 0.0628 10.7089 0.3365
[INFO] digital twin mean parameter values: R0 = 0.06280 Q = 10.87 Req = 0.33755
stop code counts: low_soc: 3 pos_err: 0 success: 1
[WARN] digital twin low soc threshold exceeded on i: 126 mission_id: 757
[INFO] updating RUL from 14.49 to 13.72
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 13.72
[INFO] simulating true system on i: 127
Bumping sigma_x
Bumping sigma_x
Bumping sigma_x
Bumping sigma_x
[INFO] updating degradation parameter variance on i: 127
[INFO] updating degradation parameter values via random sampling on i: 127
[INFO] i: 127 mission_id: 758 rul_hat: 13.72 flight_time: 11.94 distance: 853.64 R0: 0.06028 Q: 11.08 Req: 0.33220
[WARN] true system position error threshold exceeded on i: 127 mission_id: 758
[INFO] forecasting degradation values: r_mu: 0.064623 q_mu: 10.803773 m_mu: 0.338118
[INFO] digital twin degradation parameters: 0.0646 10.6191 0.3307
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 13.72
[INFO] simulating digital twin on i 127, mission_id: 758
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0647 10.4396 0.3447
[INFO] simulating digital twin on i 127, mission_id: 758
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0647 10.4121 0.3434
[INFO] simulating digital twin on i 127, mission_id: 758
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0646 10.8793 0.3392
[INFO] simulating digital twin on i 127, mission_id: 758
[INFO] digital twin degradation parameters: 0.0646 10.8793 0.3392
[INFO] digital twin mean parameter values: R0 = 0.06462 Q = 10.59 Req = 0.33952
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 127 mission_id: 758
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 13.72
[INFO] simulating true system on i: 128
Bumping sigma_x
[INFO] updating degradation parameter variance on i: 128
[INFO] updating degradation parameter values via random sampling on i: 128
[INFO] i: 128 mission_id: 759 rul_hat: 13.72 flight_time: 13.25 distance: 974.34 R0: 0.06270 Q: 10.90 Req: 0.33117
[WARN] true system position error threshold exceeded on i: 128 mission_id: 759
[INFO] forecasting degradation values: r_mu: 0.066669 q_mu: 10.622716 m_mu: 0.340926
[INFO] digital twin degradation parameters: 0.0666 10.7274 0.3375
[INFO] DigitalTwin selecting trajectory: <8> with path_time: 13.31 that meets constraint: path_time < 13.72
[INFO] simulating digital twin on i 128, mission_id: 759
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0666 10.8319 0.3433

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[INFO] simulating digital twin on i 128, mission_id: 759
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0668 10.3996 0.3364
[INFO] simulating digital twin on i 128, mission_id: 759
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0667 10.7895 0.3451
[INFO] simulating digital twin on i 128, mission_id: 759
[INFO] digital twin degradation parameters: 0.0667 10.7895 0.3451
[INFO] digital twin mean parameter values: R0 = 0.06667 Q = 10.69 Req = 0.34057
    stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 128 mission_id: 759
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 13.72
[INFO] simulating true system on i: 129
Bumping sigma_max
Bumping sigma_max
Bumping sigma_max
[INFO] updating degradation parameter variance on i: 129
[INFO] updating degradation parameter values via random sampling on i: 129
[INFO] i: 129 mission_id: 760 rul_hat: 13.72 flight_time: 6.82 distance: 506.89 R0: 0.06423 Q: 11.19 Req: 0.33849
[WARN] true system position error threshold exceeded on i: 129 mission_id: 760
[INFO] forecasting degradation values: r_mu: 0.069132 q_mu: 10.709284 m_mu: 0.339781
[INFO] digital twin degradation parameters: 0.0691 10.5657 0.3423
[INFO] DigitalTwin selecting trajectory: <8> with path_time: 13.31 that meets constraint: path_time < 13.72
[INFO] simulating digital twin on i 129, mission_id: 760
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0692 10.9404 0.3427
[INFO] simulating digital twin on i 129, mission_id: 760
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0693 11.1721 0.3303
[INFO] simulating digital twin on i 129, mission_id: 760
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0690 10.4786 0.3298
[INFO] simulating digital twin on i 129, mission_id: 760
[INFO] digital twin degradation parameters: 0.0690 10.4786 0.3298
[INFO] digital twin mean parameter values: R0 = 0.06914 Q = 10.79 Req = 0.33627
    stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 129 mission_id: 760
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 13.72
[INFO] simulating true system on i: 130
Bumping sigma_max
Bumping sigma_max
Bumping sigma_max
Bumping sigma_max
[INFO] updating degradation parameter variance on i: 130
[INFO] updating degradation parameter values via random sampling on i: 130
[INFO] i: 130 mission_id: 761 rul_hat: 13.72 flight_time: 1.04 distance: 87.35 R0: 0.06662 Q: 10.70 Req: 0.33184
[WARN] true system position error threshold exceeded on i: 130 mission_id: 761
[INFO] forecasting degradation values: r_mu: 0.071381 q_mu: 10.830692 m_mu: 0.339797
[INFO] digital twin degradation parameters: 0.0713 11.0290 0.3379
[INFO] DigitalTwin selecting trajectory: <8> with path_time: 13.31 that meets constraint: path_time < 13.72
[INFO] simulating digital twin on i 130, mission_id: 761
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0714 10.7279 0.3431
[INFO] simulating digital twin on i 130, mission_id: 761
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0714 10.7775 0.3396
[INFO] simulating digital twin on i 130, mission_id: 761
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0714 10.7203 0.3345
[INFO] simulating digital twin on i 130, mission_id: 761
[INFO] digital twin degradation parameters: 0.0714 10.7203 0.3345
[INFO] digital twin mean parameter values: R0 = 0.07138 Q = 10.81 Req = 0.33877
    stop code counts: low_soc: 0 pos_err: 4 success: 0
[WARN] digital twin position error threshold exceeded on i: 130 mission_id: 761
[INFO] updating RUL from 13.72 to 2.94

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[INFO] digital twin rul_hat: 2.94 does not meet the threshold: 10.00 on i,mission 130,761 with fail_count 1
[INFO] TrueSystem selecting trajectory: <7> with path_time: 0.91 that meets constraint: path_time < 2.94
[INFO] simulating true system on i: 131
Bumping sigmax
[INFO] updating degradation parameter variance on i: 131
[INFO] updating degradation parameter values via random sampling on i: 131
[INFO] i: 131 mission_id: 762 rul_hat: 2.94 flight_time: 0.91 distance: 69.49 R0: 0.06911 Q: 10.64 Req: 0.33633
[INFO] success on i: 131 mission_id: 762
[INFO] forecasting degradation values: r_mu: 0.073665 q_mu: 10.562239 m_mu: 0.340444
[INFO] digital twin degradation parameters: 0.0736 10.7113 0.3399
[INFO] DigitalTwin selecting trajectory: <19> with path_time: 4.33 to explore constraint boundary < 2.94
[INFO] simulating digital twin on i 131, mission_id: 762
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0737 10.5607 0.3400
[INFO] simulating digital twin on i 131, mission_id: 762
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0736 10.3305 0.3356
[INFO] simulating digital twin on i 131, mission_id: 762
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0738 10.5122 0.3451
[INFO] simulating digital twin on i 131, mission_id: 762
[INFO] digital twin degradation parameters: 0.0738 10.5122 0.3451
[INFO] digital twin mean parameter values: R0 = 0.07367 Q = 10.53 Req = 0.34016
stop code counts: low_soc: 0 pos_err: 4 success: 0
[WARN] digital twin position error threshold exceeded on i: 131 mission_id: 762
[INFO] updating RUL from 2.94 to 0.25
[INFO] digital twin rul_hat: 0.25 does not meet the threshold: 10.00 on i,mission 131,762 with fail_count 2
[INFO] returning empty table
[INFO] no more valid trajectories. ending simulation.

```

\*\*\*\*\* end of simulation code

### test sim digital twin (for testing)

```

i = 1;
sys = "DigitalTwin";
octomodel.sampletime = true_sample_rate;
sprintf('[INFO] simulating digital twin on mission: %d', i);
tic
sim('digitaltwin1c.slx');
toc

```

```
clear('trajectory', 'battery_actual', 'battery_observed', 'ctrl_err', 'current', 'current_rs',
```

### test sim true system (for testing)

```

i = 1;
sys = "TrueSystem";
octomodel.sampletime = true_sample_rate;
sprintf('[INFO] simulating true system on mission: %d', i);
tic
sim('truesystem.slx');
toc

```

## define placeholder variables

```
twin_ctr = 1;
twin_count = 4;
times = zeros(1, twin_count);
vs = zeros(1, twin_count);
socs = zeros(1, twin_count);
r0s = zeros(1, twin_count);
qs = zeros(1, twin_count);
ms = zeros(1, twin_count);
dist = zeros(1, twin_count);
errs = zeros(1, twin_count);
degs = zeros(3, twin_count);
codes = zeros(3, twin_count);
```

## Update twin degradation parameters

```
if i > lookback
    x = double(((i - (lookback-1)):1:i)');
    r_poly = polyfit(x, smoothdata(r_deg(x), 'rlowess', 5), 1);
    q_poly = polyfit(x, smoothdata(q_deg(x), 'rlowess', 5), 1);
    m_poly = polyfit(x, smoothdata(m_deg(x), 'rlowess', 5), 1);

    polys(i, 1, :) = r_poly;
    polys(i, 2, :) = q_poly;
    polys(i, 3, :) = m_poly;

    r_mu = polyval(r_poly, i + horizon);
    q_mu = polyval(q_poly, i + horizon);
    m_mu = polyval(m_poly, i + horizon);
    fprintf('[INFO] forecasting degradation values: r_mu: %.6f\tq_mu: %.6f\tm_mu: %.6f', r_mu,
    batterytwin.R0 = max(abs(normrnd(r_mu, r_var)), .0001);
    batterytwin.Q = min(abs(normrnd(q_mu, q_var)), 15.5);
    Motortwin2.Req = max(abs(normrnd(m_mu, m_var)), .001);
else
    batterytwin.R0 = max(abs(normrnd(rdeg(i), r_var)), .0001);
    batterytwin.Q = min(abs(normrnd(qdeg(i), q_var)), 15.5);
    Motortwin2.Req = max(abs(normrnd(mdeg(i), m_var)), .001);
end
```

```
[INFO] forecasting degradation values: r_mu: 0.000624 q_mu: 14.595722 m_mu: 0.275376
```

```
fprintf("[INFO] digital twin degradation parameters: %.4f\t%.4f\t%.4f", batterytwin.R0, batterytwin.Q, Motortwin2.Req)
```

```
[INFO] digital twin degradation parameters: 0.0005 14.3990 0.2686
```

```
write_degradation_data;
```

## now simulate digital twin

```
load_trajectory;
if trajectory.path_time > rul_hat
    fprintf("[INFO] DigitalTwin selecting trajectory: <%d> with path_time: %.2f to explore cons
```



```
else
```

```
    fprintf("[INFO] DigitalTwin selecting trajectory: <%d> with path_time: %.2f that meets cons  
end
```

```
[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 17.78
```

```
sys = "DigitalTwin";
```

```
octomodel.sampletime = twin_sample_rate;
```

```
for twin_ctr=1:twin_count
```

```
    fprintf('[INFO] simulating digital twin on i %d, mission_id: %d\n', i, mission_id)
```

```
    out = sim('digitaltwin1c.slx');
```

```
    %           get the output from each parallel worker
```

```
    times(twin_ctr) = flight_time.Data(end);
```

```
    vs(twin_ctr) = battery_actual.Data(end, 1);
```

```
    socs(twin_ctr) = battery_actual.Data(end, 2);
```

```
    r0s(twin_ctr) = battery_actual.Data(end, 3);
```

```
    qs(twin_ctr) = battery_actual.Data(end, 6);
```

```
    ms(twin_ctr) = motors.Data(end, 1);
```

```
    errs(twin_ctr) = mean(euclidean_pos_err);
```

```
    dist(twin_ctr) = calculatedistance([pos_actual.Data(:,1) pos_actual.Data(:,2)]);
```

```
    degs(:, twin_ctr) = [batterytwin.R0 batterytwin.Q Motortwin2.Req]';
```

```
    codes(:, twin_ctr) = [any(stop_code.Data(:,1)); any(stop_code.Data(:,2)); any(stop_code.Data
```

## write digital twin parameters to db

```
write_twin_params_data;
```

## resample the degradation parameters for the next digital twin simulation

```
if twin_count > 1 && twin_ctr < twin_count
```

```
    fprintf('[INFO] resampling for twin run # %d', twin_ctr + 1);
```

```
    if i > lookback
```

```
        batterytwin.R0 = normrnd(r_mu, r_var);
```

```
        batterytwin.Q = normrnd(q_mu, q_var);
```

```
        Motortwin2.Req = normrnd(m_mu, m_var);
```

```
    else
```

```
        batterytwin.R0 = max(abs(normrnd(rdeg(i), r_var)), .00075);
```

```
        batterytwin.Q = min(abs(normrnd(qdeg(i), q_var)), 15.5);
```

```
        Motortwin2.Req = max(abs(normrnd(mdeg(i), m_var)), .001);
```

```
    end
```

```
end
```

```
fprintf("[INFO] digital twin degradation parameters: %.4f\t%.4f\t%.4f", batterytwin.R0, bat
```

```
end
```

```
[INFO] simulating digital twin on i 43, mission_id: 674
```

```
[INFO] resampling for twin run # 2
```

```
[INFO] digital twin degradation parameters: 0.0004 14.3348 0.2667
```

```
[INFO] simulating digital twin on i 43, mission_id: 674
```

```
[INFO] resampling for twin run # 3
```

```
[INFO] digital twin degradation parameters: 0.0010 14.2433 0.2805
```

```
[INFO] simulating digital twin on i 43, mission_id: 674
```

```
[INFO] resampling for twin run # 4
```

```
[INFO] digital twin degradation parameters: 0.0012 14.5204 0.2780
```

```
[INFO] simulating digital twin on i 43, mission_id: 674
```

```
[INFO] digital twin degradation parameters: 0.0012 14.5204 0.2780
```

```

low_soc = sum(codes(1,:) == 1);
pos_err = sum(codes(2,:) == 1);
success = sum(codes(3,:) == 1);
fprintf("[INFO] digital twin mean parameter values: R0 = %.5f\t Q = %.2f\t Req = %.5f\n\t stop

```

```

[INFO] digital twin mean parameter values: R0 = 0.00076  Q = 14.37  Req = 0.27346
stop code counts: low_soc: 0 pos_err: 0  success: 4

```

## update rul

```

updated = false;
if low_soc > 1
    fprintf('[WARN] digital twin low soc threshold exceeded on i: %d\tmission_id: %d\n', i, mission_id);
    fprintf('[INFO] updating RUL from %.2f to %.2f', rul_hat, min(mean(times(:)) - 1));
    rul_hat = mean(times(:)) - 1; % rul is now 1 minute less than the digital twin flight time
    updated = true;
end

if pos_err > 1
    fprintf('[WARN] digital twin position error threshold exceeded on i: %d\tmission_id: %d\n', i, mission_id);
    fprintf('[INFO] updating RUL from %.2f to %.2f', rul_hat, min(mean(times(:)) - 1));
    rul_hat = mean(times(:)) - 1; % rul is now 1 minute less than the digital twin flight time
    updated = true;
end

if success >= 3 && pos_err < 2 && low_soc < 2
    fprintf('[INFO] digital twin mission success on i: %d\tmission_id: %d\n', i, mission_id);
    if mean(times(:)) - 1 > rul_hat
        fprintf('[INFO] new RUL update is available, %.2f replaces %.2f\n', mean(times(:)) - 1, rul_hat);
        rul_hat = mean(times(:)) - 1;
    end
elseif ~updated
    fprintf('[WARN] digital twin mission uncertain on i: %d\tmission_id: %d, rul_hat: %.2f remains\n', i, mission_id, rul_hat);
end

```

```

[INFO] digital twin mission success on i: 43 mission_id: 674

```

```

% otherwise, end of life was never reached so the current rul estimate
% is the best estimate

if rul_hat <= rul_threshold
    fail_count = fail_count + 1;
    fprintf('[INFO] digital twin rul_hat: %.2f does not meet the threshold: %.2f on i,mission %d\n', i, mission_id, rul_hat);
    if fail_count == 10
        fprintf('[INFO] fail_count reached limit. Stopping simulation.')
        end_sim = 1;
        %break;
    end
end

clear('trajectory', 'battery_actual', 'battery_observed', 'ctrl_err', 'current', 'current_rul', 'end_sim');

```

