

Run to failure experiment C4 - digital twin informs true system, true system not allowed to explore

In this work remaining useful life (RUL) refers to the total flight time possible for a single mission. Hypothesis here is that the true system should never fail now. But I see that true system will select an explored trajectory if the digital twin passes it, this might be risky, we need to consider dynamic risk. This is in contract 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. 4th simulation in this track, the true system is not allowed to explore trajectories now, and micro updates are made to the rul when some (not all) digital twin missions do not result in success.

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;

```

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

```

% load initial trajectory, catch edge case that the first trajectory
% explores rather than exploits
load_trajectory;
while trajectory.path_time > rul_init
    load_trajectory;
end

for i = 1:n_missions
    if i < 20 && i >= 11
        lookback = 8;
        horizon = 3;
    elseif i >= 21 && i < 30
        lookback = 10;
        horizon = 4;
    elseif i >= 31
        lookback = 12;
        horizon = 6;
    end

    ruls(i) = rul_hat;

    % I don't think this should ever execute now that the digital twin is
    % selecting trajectories for the true system
    if end_sim == 1
        disp("[INFO] no more valid trajectories. ending simulation.")
        break;
    end
    if trajectory.path_time > rul_hat
        load_trajectory;
        while trajectory.path_time > rul_init
            load_trajectory;
        end
        %fprintf("[INFO] TrueSystem selecting trajectory: <%d> with path_time: %.2f to explore
        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\ttrue_hat: %.2f\tflight_time: %.2f\tdistance: %.2f\tR0: %.2f\tQ: %.2f\tReq: %.2f\n", i, mission_id, true_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);
end

```

```

        %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_r

```

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

```

updated = true;

```

```

while updated
    load_trajectory;
    if isempty(trajjectory))
        disp("[INFO] no more valid trajectories. ending simulation.")
        break;
    end
    if trajectory.path_time > rul_hat
        fprintf("[INFO] DigitalTwin selecting trajectory: <%d> with path_time: %.2f to expl
    else
        fprintf("[INFO] DigitalTwin selecting trajectory: <%d> with path_time: %.2f that me
    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);
        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_

```

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
end

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

```

update rul

```
if low_soc == 1
    fprintf('[WARN] DigitalTwin low soc threshold exceeded once, adjusting rul_hat')
    rul_hat = rul_hat - .5;
end
if pos_err == 1
    fprintf('[WARN] DigitalTwin pos err threshold exceeded once, adjusting rul_hat')
    rul_hat = rul_hat - 1.0;
end

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

if pos_err > 1
    fprintf('[WARN] DigitalTwin position error threshold exceeded on i: %d\tmission_id: %d\n',
    temp = mean(times(:)) - 1;
    res = max(temp, rul_hat - 2);
    fprintf('[INFO] updating RUL from %.2f to %.2f', rul_hat, res)
    rul_hat = mean(times(:)) - 1; % rul is now 1 minute less than the digital twin flight
    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    trajectory
    updated = false;
    if mean(times(:)) - 1 > rul_hat
        fprintf('[INFO] new RUL update is available, %.2f replaces %.2f\n', mean(times(
        rul_hat = mean(times(:)) - 1;
    end
end
if updated
    fprintf('[INFO] selecting new trajectory to repeat DigitalTwin simulation')
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,m
    if fail_count == 10
        fprintf('[INFO] fail_count reached limit. Stopping simulation.')
        end_sim = 1;
        break;
    end
end
end
```

```

clear('battery_actual', 'battery_observed', 'ctrl_err', 'current', 'current_rs', 'eucli
end
end

```

```

[INFO] TrueSystem selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 18.00
[INFO] simulating true system on i: 1
[INFO] updating degradation parameter variance on i: 1
[INFO] updating degradation parameter values via random sampling on i: 1
[INFO] i: 1 mission_id: 964 rul_hat: 18.00 flight_time: 17.63 distance: 1283.84 R0: 0.00018 Q: 14.17 Req: 0.21788
[INFO] success on i: 1 mission_id: 964
[INFO] digital twin degradation parameters: 0.0029 14.8198 0.2559
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 18.00
[INFO] simulating digital twin on i 1, mission_id: 964
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0020 13.8957 0.2306
[INFO] simulating digital twin on i 1, mission_id: 964
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0020 15.2594 0.2824
[INFO] simulating digital twin on i 1, mission_id: 964
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0011 13.6033 0.2460
[INFO] simulating digital twin on i 1, mission_id: 964
[INFO] digital twin degradation parameters: 0.0011 13.6033 0.2460
[INFO] DigitalTwin mean parameter values: R0 = 0.00199 Q = 14.39 Req = 0.25371
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 1 mission_id: 964
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 18.00
[INFO] simulating true system on i: 2
[INFO] updating degradation parameter variance on i: 2
[INFO] updating degradation parameter values via random sampling on i: 2
[INFO] i: 2 mission_id: 965 rul_hat: 18.00 flight_time: 14.83 distance: 1083.24 R0: 0.00021 Q: 15.03 Req: 0.25887
[INFO] success on i: 2 mission_id: 965
[INFO] digital twin degradation parameters: 0.0014 15.2557 0.2337
[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 18.00
[INFO] simulating digital twin on i 2, mission_id: 965
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0017 15.3390 0.2571
[INFO] simulating digital twin on i 2, mission_id: 965
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0008 13.6344 0.2498
[INFO] simulating digital twin on i 2, mission_id: 965
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0008 13.4943 0.2532
[INFO] simulating digital twin on i 2, mission_id: 965
[INFO] digital twin degradation parameters: 0.0008 13.4943 0.2532
[INFO] DigitalTwin mean parameter values: R0 = 0.00114 Q = 14.43 Req = 0.24845
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 2 mission_id: 965
trajectory <15> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 18.00
[INFO] simulating true system on i: 3
[INFO] updating degradation parameter variance on i: 3
[INFO] updating degradation parameter values via random sampling on i: 3
[INFO] i: 3 mission_id: 966 rul_hat: 18.00 flight_time: 17.63 distance: 1283.69 R0: 0.00048 Q: 15.50 Req: 0.21285
[INFO] success on i: 3 mission_id: 966
[INFO] digital twin degradation parameters: 0.0005 15.1901 0.2488
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 18.00
[INFO] simulating digital twin on i 3, mission_id: 966
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0009 14.4677 0.2474
[INFO] simulating digital twin on i 3, mission_id: 966
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0008 15.3485 0.2593

```



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[INFO] simulating digital twin on i 3, mission_id: 966
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0011 15.5000 0.2257
[INFO] simulating digital twin on i 3, mission_id: 966
[INFO] digital twin degradation parameters: 0.0011 15.5000 0.2257
[INFO] DigitalTwin mean parameter values: R0 = 0.00081 Q = 15.13 Req = 0.24529
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 3 mission_id: 966
trajectory <11> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 18.00
[INFO] simulating true system on i: 4
[INFO] updating degradation parameter variance on i: 4
[INFO] updating degradation parameter values via random sampling on i: 4
[INFO] i: 4 mission_id: 967 rul_hat: 18.00 flight_time: 16.36 distance: 1218.74 R0: 0.00240 Q: 15.50 Req: 0.21026
[INFO] success on i: 4 mission_id: 967
[INFO] digital twin degradation parameters: 0.0013 15.5000 0.2344
[INFO] DigitalTwin selecting trajectory: <20> with path_time: 19.65 to explore constraint boundary < 18.00
[INFO] simulating digital twin on i 4, mission_id: 967
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0024 15.5000 0.2203
[INFO] simulating digital twin on i 4, mission_id: 967
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0008 15.2645 0.2374
[INFO] simulating digital twin on i 4, mission_id: 967
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0036 15.3475 0.2470
[INFO] simulating digital twin on i 4, mission_id: 967
[INFO] digital twin degradation parameters: 0.0036 15.3475 0.2470
[INFO] DigitalTwin mean parameter values: R0 = 0.00200 Q = 15.40 Req = 0.23477
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 4 mission_id: 967
trajectory <20> selected for TrueSystem
[INFO] new RUL update is available, 18.64 replaces 18.00
[INFO] simulating true system on i: 5
[INFO] updating degradation parameter variance on i: 5
[INFO] updating degradation parameter values via random sampling on i: 5
[INFO] i: 5 mission_id: 968 rul_hat: 18.64 flight_time: 17.63 distance: 1283.71 R0: 0.00190 Q: 14.78 Req: 0.25135
[INFO] success on i: 5 mission_id: 968
[INFO] digital twin degradation parameters: 0.0003 15.5000 0.2046
[INFO] DigitalTwin selecting trajectory: <20> with path_time: 19.65 to explore constraint boundary < 18.64
[INFO] simulating digital twin on i 5, mission_id: 968
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0012 13.9558 0.2315
[INFO] simulating digital twin on i 5, mission_id: 968
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0014 15.5000 0.2194
[INFO] simulating digital twin on i 5, mission_id: 968
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0024 15.5000 0.2296
[INFO] simulating digital twin on i 5, mission_id: 968
[INFO] digital twin degradation parameters: 0.0024 15.5000 0.2296
[INFO] DigitalTwin mean parameter values: R0 = 0.00134 Q = 15.11 Req = 0.22125
stop code counts: low_soc: 1 pos_err: 0 success: 3
[WARN] DigitalTwin low soc threshold exceeded once, adjusting rul_hat
[INFO] digital twin mission success on i: 5 mission_id: 968
trajectory <20> selected for TrueSystem
[INFO] new RUL update is available, 18.42 replaces 18.14
[INFO] simulating true system on i: 6
[INFO] updating degradation parameter variance on i: 6
[INFO] updating degradation parameter values via random sampling on i: 6
[INFO] i: 6 mission_id: 969 rul_hat: 18.42 flight_time: 17.63 distance: 1283.81 R0: 0.00048 Q: 15.50 Req: 0.25252
[INFO] success on i: 6 mission_id: 969
[INFO] digital twin degradation parameters: 0.0007 15.0386 0.2352
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 18.42
[INFO] simulating digital twin on i 6, mission_id: 969

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[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0011 14.5491 0.2287
[INFO] simulating digital twin on i 6, mission_id: 969
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0008 13.3976 0.2297
[INFO] simulating digital twin on i 6, mission_id: 969
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0013 14.0397 0.2479
[INFO] simulating digital twin on i 6, mission_id: 969
[INFO] digital twin degradation parameters: 0.0013 14.0397 0.2479
[INFO] DigitalTwin mean parameter values: R0 = 0.00095 Q = 14.26 Req = 0.23539
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 6 mission_id: 969
trajectory <3> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 18.42
[INFO] simulating true system on i: 7
[INFO] updating degradation parameter variance on i: 7
[INFO] updating degradation parameter values via random sampling on i: 7
[INFO] i: 7 mission_id: 970 rul_hat: 18.42 flight_time: 17.84 distance: 1302.04 R0: 0.00090 Q: 14.84 Req: 0.21355
[INFO] success on i: 7 mission_id: 970
[INFO] forecasting degradation values: r_mu: 0.001947 q_mu: 15.955235 m_mu: 0.256409
[INFO] digital twin degradation parameters: 0.0012 15.5000 0.2418
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 18.42
[INFO] simulating digital twin on i 7, mission_id: 970
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0027 16.8266 0.3001
[INFO] simulating digital twin on i 7, mission_id: 970
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0031 16.2893 0.2925
[INFO] simulating digital twin on i 7, mission_id: 970
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0011 15.3822 0.2937
[INFO] simulating digital twin on i 7, mission_id: 970
[INFO] digital twin degradation parameters: 0.0011 15.3822 0.2937
[INFO] DigitalTwin mean parameter values: R0 = 0.00202 Q = 16.00 Req = 0.28203
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 7 mission_id: 970
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 18.42
[INFO] simulating true system on i: 8
[INFO] updating degradation parameter variance on i: 8
[INFO] updating degradation parameter values via random sampling on i: 8
[INFO] i: 8 mission_id: 971 rul_hat: 18.42 flight_time: 14.83 distance: 1083.31 R0: 0.00159 Q: 14.88 Req: 0.24885
[INFO] success on i: 8 mission_id: 971
[INFO] forecasting degradation values: r_mu: 0.001443 q_mu: 14.957437 m_mu: 0.223932
[INFO] digital twin degradation parameters: 0.0012 14.7151 0.2169
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 18.42
[INFO] simulating digital twin on i 8, mission_id: 971
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0014 14.4804 0.2502
[INFO] simulating digital twin on i 8, mission_id: 971
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0017 15.8052 0.2214
[INFO] simulating digital twin on i 8, mission_id: 971
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0014 16.0018 0.2507
[INFO] simulating digital twin on i 8, mission_id: 971
[INFO] digital twin degradation parameters: 0.0014 16.0018 0.2507
[INFO] DigitalTwin mean parameter values: R0 = 0.00140 Q = 15.25 Req = 0.23481
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 8 mission_id: 971
trajectory <3> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 18.42
[INFO] simulating true system on i: 9
[INFO] updating degradation parameter variance on i: 9

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[INFO] updating degradation parameter values via random sampling on i: 9
[INFO] i: 9 mission_id: 972 rul_hat: 18.42 flight_time: 17.84 distance: 1302.17 R0: 0.00121 Q: 15.50 Req: 0.24954
[INFO] success on i: 9 mission_id: 972
[INFO] forecasting degradation values: r_mu: 0.001349 q_mu: 14.567386 m_mu: 0.258926
[INFO] digital twin degradation parameters: 0.0017 15.5000 0.2866
[INFO] DigitalTwin selecting trajectory: <20> with path_time: 19.65 to explore constraint boundary < 18.42
[INFO] simulating digital twin on i 9, mission_id: 972
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0009 14.4729 0.2917
[INFO] simulating digital twin on i 9, mission_id: 972
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: -0.0005 14.0451 0.2555
[INFO] simulating digital twin on i 9, mission_id: 972
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0015 13.1046 0.2684
[INFO] simulating digital twin on i 9, mission_id: 972
[INFO] digital twin degradation parameters: 0.0015 13.1046 0.2684
[INFO] DigitalTwin mean parameter values: R0 = 0.00088 Q = 14.28 Req = 0.27557
  stop code counts: low_soc: 3 pos_err: 0 success: 1
[WARN] DigitalTwin low soc threshold exceeded on i: 9 mission_id: 972
[INFO] updating RUL from 18.42 to 17.89
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] DigitalTwin selecting trajectory: <20> with path_time: 19.65 to explore constraint boundary < 17.89
[INFO] simulating digital twin on i 9, mission_id: 972
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0011 13.5723 0.2882
[INFO] simulating digital twin on i 9, mission_id: 972
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0017 14.3617 0.2423
[INFO] simulating digital twin on i 9, mission_id: 972
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0014 15.9485 0.2639
[INFO] simulating digital twin on i 9, mission_id: 972
[INFO] digital twin degradation parameters: 0.0014 15.9485 0.2639
[INFO] DigitalTwin mean parameter values: R0 = 0.00143 Q = 14.25 Req = 0.26569
  stop code counts: low_soc: 3 pos_err: 0 success: 1
[WARN] DigitalTwin low soc threshold exceeded on i: 9 mission_id: 972
[INFO] updating RUL from 17.89 to 17.72
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] DigitalTwin selecting trajectory: <20> with path_time: 19.65 to explore constraint boundary < 17.72
[INFO] simulating digital twin on i 9, mission_id: 972
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0015 15.2038 0.2341
[INFO] simulating digital twin on i 9, mission_id: 972
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0024 16.5890 0.2309
[INFO] simulating digital twin on i 9, mission_id: 972
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: -0.0006 14.5079 0.2726
[INFO] simulating digital twin on i 9, mission_id: 972
[INFO] digital twin degradation parameters: -0.0006 14.5079 0.2726
[INFO] DigitalTwin mean parameter values: R0 = 0.00119 Q = 15.56 Req = 0.25035
  stop code counts: low_soc: 1 pos_err: 0 success: 3
[WARN] DigitalTwin low soc threshold exceeded once, adjusting rul_hat
[INFO] digital twin mission success on i: 9 mission_id: 972
  trajectory <20> selected for TrueSystem
[INFO] new RUL update is available, 18.56 replaces 17.22
[INFO] simulating true system on i: 10
[INFO] updating degradation parameter variance on i: 10
[INFO] updating degradation parameter values via random sampling on i: 10
[INFO] i: 10 mission_id: 973 rul_hat: 18.56 flight_time: 17.63 distance: 1283.78 R0: 0.00120 Q: 14.03 Req: 0.21230
[INFO] success on i: 10 mission_id: 973
[INFO] forecasting degradation values: r_mu: 0.000323 q_mu: 15.137244 m_mu: 0.258785
[INFO] digital twin degradation parameters: 0.0018 15.3743 0.2377
[INFO] DigitalTwin selecting trajectory: <2> with path_time: 19.92 to explore constraint boundary < 18.56

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[INFO] simulating digital twin on i 10, mission_id: 973
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0002 15.7373 0.2439
[INFO] simulating digital twin on i 10, mission_id: 973
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0000 15.1612 0.2934
[INFO] simulating digital twin on i 10, mission_id: 973
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0007 14.8138 0.2548
[INFO] simulating digital twin on i 10, mission_id: 973
[INFO] digital twin degradation parameters: 0.0007 14.8138 0.2548
[INFO] DigitalTwin mean parameter values: R0 = 0.00068 Q = 15.27 Req = 0.25745
stop code counts: low_soc: 1 pos_err: 0 success: 3
[WARN] DigitalTwin low soc threshold exceeded once, adjusting rul_hat
[INFO] digital twin mission success on i: 10 mission_id: 973
trajectory <2> selected for TrueSystem
[INFO] new RUL update is available, 18.88 replaces 18.06
[INFO] simulating true system on i: 11
[INFO] updating degradation parameter variance on i: 11
[INFO] updating degradation parameter values via random sampling on i: 11
[INFO] i: 11 mission_id: 974 rul_hat: 18.88 flight_time: 16.36 distance: 1218.75 R0: 0.00095 Q: 14.25 Req: 0.24619
[INFO] success on i: 11 mission_id: 974
[INFO] forecasting degradation values: r_mu: 0.001325 q_mu: 13.873067 m_mu: 0.242263
[INFO] digital twin degradation parameters: 0.0012 14.5077 0.2591
[INFO] DigitalTwin selecting trajectory: <20> with path_time: 19.65 to explore constraint boundary < 18.88
[INFO] simulating digital twin on i 11, mission_id: 974
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0019 15.3957 0.2220
[INFO] simulating digital twin on i 11, mission_id: 974
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0010 12.5170 0.2584
[INFO] simulating digital twin on i 11, mission_id: 974
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0013 13.6336 0.2121
[INFO] simulating digital twin on i 11, mission_id: 974
[INFO] digital twin degradation parameters: 0.0013 13.6336 0.2121
[INFO] DigitalTwin mean parameter values: R0 = 0.00137 Q = 14.01 Req = 0.23788
stop code counts: low_soc: 3 pos_err: 0 success: 1
[WARN] DigitalTwin low soc threshold exceeded on i: 11 mission_id: 974
[INFO] updating RUL from 18.88 to 17.42
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 11, mission_id: 974
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0001 12.9471 0.2289
[INFO] simulating digital twin on i 11, mission_id: 974
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0011 12.5541 0.2391
[INFO] simulating digital twin on i 11, mission_id: 974
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0019 13.5717 0.2300
[INFO] simulating digital twin on i 11, mission_id: 974
[INFO] digital twin degradation parameters: 0.0019 13.5717 0.2300
[INFO] DigitalTwin mean parameter values: R0 = 0.00111 Q = 13.18 Req = 0.22755
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 11 mission_id: 974
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 12
[INFO] updating degradation parameter variance on i: 12
[INFO] updating degradation parameter values via random sampling on i: 12
[INFO] i: 12 mission_id: 975 rul_hat: 17.42 flight_time: 14.83 distance: 1083.44 R0: 0.00149 Q: 15.50 Req: 0.23478
[INFO] success on i: 12 mission_id: 975
[INFO] forecasting degradation values: r_mu: 0.000228 q_mu: 13.885410 m_mu: 0.245011
[INFO] digital twin degradation parameters: 0.0002 12.7511 0.2281

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[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 12, mission_id: 975
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0009 14.4146 0.2515
[INFO] simulating digital twin on i 12, mission_id: 975
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0009 15.0890 0.2550
[INFO] simulating digital twin on i 12, mission_id: 975
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0006 13.8515 0.2236
[INFO] simulating digital twin on i 12, mission_id: 975
[INFO] digital twin degradation parameters: 0.0006 13.8515 0.2236
[INFO] DigitalTwin mean parameter values: R0 = 0.00065 Q = 14.03 Req = 0.23954
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 12 mission_id: 975
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 13
[INFO] updating degradation parameter variance on i: 13
[INFO] updating degradation parameter values via random sampling on i: 13
[INFO] i: 13 mission_id: 976 rul_hat: 17.42 flight_time: 14.83 distance: 1083.54 R0: 0.00079 Q: 15.11 Req: 0.22410
[INFO] success on i: 13 mission_id: 976
[INFO] forecasting degradation values: r_mu: 0.001014 q_mu: 14.739896 m_mu: 0.227896
[INFO] digital twin degradation parameters: 0.0014 14.9915 0.2296
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 13, mission_id: 976
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0010 14.7331 0.2437
[INFO] simulating digital twin on i 13, mission_id: 976
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0009 12.6798 0.2196
[INFO] simulating digital twin on i 13, mission_id: 976
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0012 15.4885 0.2514
[INFO] simulating digital twin on i 13, mission_id: 976
[INFO] digital twin degradation parameters: 0.0012 15.4885 0.2514
[INFO] DigitalTwin mean parameter values: R0 = 0.00114 Q = 14.47 Req = 0.23607
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 13 mission_id: 976
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 14
[INFO] updating degradation parameter variance on i: 14
[INFO] updating degradation parameter values via random sampling on i: 14
[INFO] i: 14 mission_id: 977 rul_hat: 17.42 flight_time: 13.94 distance: 1048.01 R0: 0.00043 Q: 15.43 Req: 0.24749
[INFO] success on i: 14 mission_id: 977
[INFO] forecasting degradation values: r_mu: 0.001053 q_mu: 14.744682 m_mu: 0.222721
[INFO] digital twin degradation parameters: 0.0009 14.7637 0.2223
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 14, mission_id: 977
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0005 13.9400 0.2389
[INFO] simulating digital twin on i 14, mission_id: 977
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0009 15.8339 0.2072
[INFO] simulating digital twin on i 14, mission_id: 977
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0005 15.8391 0.2463
[INFO] simulating digital twin on i 14, mission_id: 977
[INFO] digital twin degradation parameters: 0.0005 15.8391 0.2463
[INFO] DigitalTwin mean parameter values: R0 = 0.00068 Q = 15.09 Req = 0.22867
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 14 mission_id: 977
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.42

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[INFO] simulating true system on i: 15
[INFO] updating degradation parameter variance on i: 15
[INFO] updating degradation parameter values via random sampling on i: 15
[INFO] i: 15 mission_id: 978 rul_hat: 17.42 flight_time: 13.94 distance: 1047.75 R0: 0.00038 Q: 14.98 Req: 0.26614
[INFO] success on i: 15 mission_id: 978
[INFO] forecasting degradation values: r_mu: 0.000456 q_mu: 15.356848 m_mu: 0.243558
[INFO] digital twin degradation parameters: 0.0016 14.3803 0.2703
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 17.42
[INFO] simulating digital twin on i 15, mission_id: 978
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0003 14.6227 0.2451
[INFO] simulating digital twin on i 15, mission_id: 978
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0002 17.1125 0.2467
[INFO] simulating digital twin on i 15, mission_id: 978
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0003 15.3462 0.2334
[INFO] simulating digital twin on i 15, mission_id: 978
[INFO] digital twin degradation parameters: 0.0003 15.3462 0.2334
[INFO] DigitalTwin mean parameter values: R0 = 0.00060 Q = 15.37 Req = 0.24888
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 15 mission_id: 978
trajectory <3> selected for TrueSystem
[INFO] simulating true system on i: 16
[INFO] updating degradation parameter variance on i: 16
[INFO] updating degradation parameter values via random sampling on i: 16
[INFO] i: 16 mission_id: 979 rul_hat: 17.42 flight_time: 17.84 distance: 1302.08 R0: 0.00135 Q: 15.50 Req: 0.24400
[INFO] success on i: 16 mission_id: 979
[INFO] forecasting degradation values: r_mu: -0.000109 q_mu: 15.317075 m_mu: 0.255199
[INFO] digital twin degradation parameters: 0.0002 14.8996 0.2452
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 17.42
[INFO] simulating digital twin on i 16, mission_id: 979
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: -0.0000 16.5953 0.2556
[INFO] simulating digital twin on i 16, mission_id: 979
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0001 14.2522 0.2629
[INFO] simulating digital twin on i 16, mission_id: 979
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: -0.0013 14.5759 0.2706
[INFO] simulating digital twin on i 16, mission_id: 979
[INFO] digital twin degradation parameters: -0.0013 14.5759 0.2706
[INFO] DigitalTwin mean parameter values: R0 = -0.00026 Q = 15.08 Req = 0.25858
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 16 mission_id: 979
trajectory <3> selected for TrueSystem
[INFO] simulating true system on i: 17
[INFO] updating degradation parameter variance on i: 17
[INFO] updating degradation parameter values via random sampling on i: 17
[INFO] i: 17 mission_id: 980 rul_hat: 17.42 flight_time: 16.36 distance: 1218.64 R0: 0.00097 Q: 14.99 Req: 0.24857
[INFO] success on i: 17 mission_id: 980
[INFO] forecasting degradation values: r_mu: 0.000676 q_mu: 15.593285 m_mu: 0.255191
[INFO] digital twin degradation parameters: 0.0008 14.7010 0.2268
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 17, mission_id: 980
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0013 14.8492 0.2375
[INFO] simulating digital twin on i 17, mission_id: 980
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0022 17.1934 0.2421
[INFO] simulating digital twin on i 17, mission_id: 980
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0006 17.0459 0.2465
[INFO] simulating digital twin on i 17, mission_id: 980
[INFO] digital twin degradation parameters: 0.0006 17.0459 0.2465

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[INFO] DigitalTwin mean parameter values: R0 = 0.00121 Q = 15.95 Req = 0.23824
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 17 mission_id: 980
trajectory <11> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 18
[INFO] updating degradation parameter variance on i: 18
[INFO] updating degradation parameter values via random sampling on i: 18
[INFO] i: 18 mission_id: 981 rul_hat: 17.42 flight_time: 16.36 distance: 1218.67 R0: 0.00275 Q: 15.38 Req: 0.24645
[INFO] success on i: 18 mission_id: 981
[INFO] forecasting degradation values: r_mu: 0.000670 q_mu: 15.888571 m_mu: 0.267475
[INFO] digital twin degradation parameters: 0.0004 15.5000 0.2787
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 18, mission_id: 981
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: -0.0001 15.9973 0.2916
[INFO] simulating digital twin on i 18, mission_id: 981
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0011 15.3340 0.2730
[INFO] simulating digital twin on i 18, mission_id: 981
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0001 17.3627 0.2392
[INFO] simulating digital twin on i 18, mission_id: 981
[INFO] digital twin degradation parameters: 0.0001 17.3627 0.2392
[INFO] DigitalTwin mean parameter values: R0 = 0.00038 Q = 16.05 Req = 0.27061
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 18 mission_id: 981
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 19
[INFO] updating degradation parameter variance on i: 19
[INFO] updating degradation parameter values via random sampling on i: 19
[INFO] i: 19 mission_id: 982 rul_hat: 17.42 flight_time: 13.94 distance: 1047.67 R0: 0.00080 Q: 15.33 Req: 0.23339
[INFO] success on i: 19 mission_id: 982
[INFO] forecasting degradation values: r_mu: 0.002241 q_mu: 15.664309 m_mu: 0.251482
[INFO] digital twin degradation parameters: 0.0023 15.5000 0.2710
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 19, mission_id: 982
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0019 15.5821 0.2572
[INFO] simulating digital twin on i 19, mission_id: 982
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0017 16.2404 0.2581
[INFO] simulating digital twin on i 19, mission_id: 982
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0019 15.8630 0.2667
[INFO] simulating digital twin on i 19, mission_id: 982
[INFO] digital twin degradation parameters: 0.0019 15.8630 0.2667
[INFO] DigitalTwin mean parameter values: R0 = 0.00192 Q = 15.80 Req = 0.26326
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 19 mission_id: 982
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 20
[INFO] updating degradation parameter variance on i: 20
[INFO] updating degradation parameter values via random sampling on i: 20
[INFO] i: 20 mission_id: 983 rul_hat: 17.42 flight_time: 14.83 distance: 1083.15 R0: 0.00217 Q: 15.23 Req: 0.24564
[INFO] success on i: 20 mission_id: 983
[INFO] forecasting degradation values: r_mu: 0.000647 q_mu: 15.238395 m_mu: 0.248007
[INFO] digital twin degradation parameters: 0.0001 15.3975 0.2409
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 20, mission_id: 983
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0018 15.6614 0.2793
[INFO] simulating digital twin on i 20, mission_id: 983

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[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: -0.0006 15.2545 0.2495
[INFO] simulating digital twin on i 20, mission_id: 983
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0020 15.5943 0.2431
[INFO] simulating digital twin on i 20, mission_id: 983
[INFO] digital twin degradation parameters: 0.0020 15.5943 0.2431
[INFO] DigitalTwin mean parameter values: R0 = 0.00083 Q = 15.48 Req = 0.25319
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 20 mission_id: 983
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 21
[INFO] updating degradation parameter variance on i: 21
[INFO] updating degradation parameter values via random sampling on i: 21
[INFO] i: 21 mission_id: 984 rul_hat: 17.42 flight_time: 13.58 distance: 1020.93 R0: 0.00183 Q: 15.19 Req: 0.24991
[INFO] success on i: 21 mission_id: 984
[INFO] forecasting degradation values: r_mu: 0.001916 q_mu: 15.662754 m_mu: 0.246507
[INFO] digital twin degradation parameters: 0.0003 15.5000 0.1941
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 21, mission_id: 984
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0016 16.6417 0.2388
[INFO] simulating digital twin on i 21, mission_id: 984
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0034 16.2076 0.2428
[INFO] simulating digital twin on i 21, mission_id: 984
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0012 15.3156 0.2521
[INFO] simulating digital twin on i 21, mission_id: 984
[INFO] digital twin degradation parameters: 0.0012 15.3156 0.2521
[INFO] DigitalTwin mean parameter values: R0 = 0.00164 Q = 15.92 Req = 0.23197
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 21 mission_id: 984
trajectory <11> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 22
[INFO] updating degradation parameter variance on i: 22
[INFO] updating degradation parameter values via random sampling on i: 22
[INFO] i: 22 mission_id: 985 rul_hat: 17.42 flight_time: 16.36 distance: 1218.80 R0: 0.00047 Q: 15.15 Req: 0.25183
[INFO] success on i: 22 mission_id: 985
[INFO] forecasting degradation values: r_mu: 0.002132 q_mu: 15.162708 m_mu: 0.250903
[INFO] digital twin degradation parameters: 0.0028 15.5000 0.2461
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 22, mission_id: 985
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0028 15.0641 0.2421
[INFO] simulating digital twin on i 22, mission_id: 985
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0023 14.3832 0.2519
[INFO] simulating digital twin on i 22, mission_id: 985
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0016 14.5974 0.2652
[INFO] simulating digital twin on i 22, mission_id: 985
[INFO] digital twin degradation parameters: 0.0016 14.5974 0.2652
[INFO] DigitalTwin mean parameter values: R0 = 0.00239 Q = 14.89 Req = 0.25133
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 22 mission_id: 985
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 23
[INFO] updating degradation parameter variance on i: 23
[INFO] updating degradation parameter values via random sampling on i: 23
[INFO] i: 23 mission_id: 986 rul_hat: 17.42 flight_time: 13.58 distance: 1021.03 R0: 0.00145 Q: 15.50 Req: 0.23249
[INFO] success on i: 23 mission_id: 986

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[INFO] forecasting degradation values: r_mu: 0.001892 q_mu: 15.228564 m_mu: 0.255694
[INFO] digital twin degradation parameters: 0.0021 14.5172 0.2647
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 23, mission_id: 986
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0002 15.6921 0.2558
[INFO] simulating digital twin on i 23, mission_id: 986
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0022 14.8563 0.2318
[INFO] simulating digital twin on i 23, mission_id: 986
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0026 14.8838 0.2509
[INFO] simulating digital twin on i 23, mission_id: 986
[INFO] digital twin degradation parameters: 0.0026 14.8838 0.2509
[INFO] DigitalTwin mean parameter values: R0 = 0.00177 Q = 14.99 Req = 0.25079
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 23 mission_id: 986
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 24
[INFO] updating degradation parameter variance on i: 24
[INFO] updating degradation parameter values via random sampling on i: 24
[INFO] i: 24 mission_id: 987 rul_hat: 17.42 flight_time: 13.58 distance: 1020.92 R0: 0.00159 Q: 15.50 Req: 0.28147
[INFO] success on i: 24 mission_id: 987
[INFO] forecasting degradation values: r_mu: 0.002009 q_mu: 15.319168 m_mu: 0.236476
[INFO] digital twin degradation parameters: 0.0010 15.0015 0.2505
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 24, mission_id: 987
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0018 16.2567 0.2239
[INFO] simulating digital twin on i 24, mission_id: 987
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0013 16.8698 0.2449
[INFO] simulating digital twin on i 24, mission_id: 987
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0018 14.6271 0.2522
[INFO] simulating digital twin on i 24, mission_id: 987
[INFO] digital twin degradation parameters: 0.0018 14.6271 0.2522
[INFO] DigitalTwin mean parameter values: R0 = 0.00146 Q = 15.69 Req = 0.24288
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 24 mission_id: 987
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 25
[INFO] updating degradation parameter variance on i: 25
[INFO] updating degradation parameter values via random sampling on i: 25
[INFO] i: 25 mission_id: 988 rul_hat: 17.42 flight_time: 13.94 distance: 1047.82 R0: 0.00174 Q: 13.19 Req: 0.23669
[INFO] success on i: 25 mission_id: 988
[INFO] forecasting degradation values: r_mu: 0.001880 q_mu: 15.680698 m_mu: 0.267786
[INFO] digital twin degradation parameters: 0.0041 15.5000 0.2398
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 25, mission_id: 988
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0024 15.5733 0.2692
[INFO] simulating digital twin on i 25, mission_id: 988
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0019 15.0469 0.2842
[INFO] simulating digital twin on i 25, mission_id: 988
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0016 15.3748 0.2705
[INFO] simulating digital twin on i 25, mission_id: 988
[INFO] digital twin degradation parameters: 0.0016 15.3748 0.2705
[INFO] DigitalTwin mean parameter values: R0 = 0.00250 Q = 15.37 Req = 0.26593
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 25 mission_id: 988

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trajectory <11> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 26
[INFO] updating degradation parameter variance on i: 26
[INFO] updating degradation parameter values via random sampling on i: 26
[INFO] i: 26 mission_id: 989 rul_hat: 17.42 flight_time: 16.36 distance: 1218.68 R0: 0.00146 Q: 14.33 Req: 0.25164
[INFO] success on i: 26 mission_id: 989
[INFO] forecasting degradation values: r_mu: 0.001703 q_mu: 13.627554 m_mu: 0.230535
[INFO] digital twin degradation parameters: 0.0033 13.9794 0.2215
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 26, mission_id: 989
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0005 14.8143 0.2333
[INFO] simulating digital twin on i 26, mission_id: 989
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0008 13.7060 0.2107
[INFO] simulating digital twin on i 26, mission_id: 989
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0021 13.5096 0.2311
[INFO] simulating digital twin on i 26, mission_id: 989
[INFO] digital twin degradation parameters: 0.0021 13.5096 0.2311
[INFO] DigitalTwin mean parameter values: R0 = 0.00170 Q = 14.00 Req = 0.22417
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 26 mission_id: 989
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 27
[INFO] updating degradation parameter variance on i: 27
[INFO] updating degradation parameter values via random sampling on i: 27
[INFO] i: 27 mission_id: 990 rul_hat: 17.42 flight_time: 14.83 distance: 1083.41 R0: 0.00181 Q: 15.20 Req: 0.23951
[INFO] success on i: 27 mission_id: 990
[INFO] forecasting degradation values: r_mu: 0.002040 q_mu: 14.667486 m_mu: 0.237598
[INFO] digital twin degradation parameters: 0.0010 14.6010 0.2265
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 27, mission_id: 990
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0027 14.8636 0.2226
[INFO] simulating digital twin on i 27, mission_id: 990
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0018 15.2037 0.2704
[INFO] simulating digital twin on i 27, mission_id: 990
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0018 15.5519 0.2260
[INFO] simulating digital twin on i 27, mission_id: 990
[INFO] digital twin degradation parameters: 0.0018 15.5519 0.2260
[INFO] DigitalTwin mean parameter values: R0 = 0.00180 Q = 15.06 Req = 0.23635
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 27 mission_id: 990
trajectory <11> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 28
[INFO] updating degradation parameter variance on i: 28
[INFO] updating degradation parameter values via random sampling on i: 28
[INFO] i: 28 mission_id: 991 rul_hat: 17.42 flight_time: 16.36 distance: 1218.76 R0: 0.00172 Q: 14.50 Req: 0.25551
[INFO] success on i: 28 mission_id: 991
[INFO] forecasting degradation values: r_mu: 0.001026 q_mu: 15.637163 m_mu: 0.236095
[INFO] digital twin degradation parameters: 0.0007 14.7417 0.2325
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 28, mission_id: 991
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0009 15.8904 0.2432
[INFO] simulating digital twin on i 28, mission_id: 991
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0005 15.4681 0.2476
[INFO] simulating digital twin on i 28, mission_id: 991

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[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0013 14.7880 0.2566
[INFO] simulating digital twin on i 28, mission_id: 991
[INFO] digital twin degradation parameters: 0.0013 14.7880 0.2566
[INFO] DigitalTwin mean parameter values: R0 = 0.00083 Q = 15.22 Req = 0.24500
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 28 mission_id: 991
trajectory <11> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 29
[INFO] updating degradation parameter variance on i: 29
[INFO] updating degradation parameter values via random sampling on i: 29
[INFO] i: 29 mission_id: 992 rul_hat: 17.42 flight_time: 16.36 distance: 1218.67 R0: 0.00116 Q: 14.19 Req: 0.23306
[INFO] success on i: 29 mission_id: 992
[INFO] forecasting degradation values: r_mu: 0.002080 q_mu: 14.053194 m_mu: 0.250248
[INFO] digital twin degradation parameters: 0.0020 13.9895 0.2461
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.42
[INFO] simulating digital twin on i 29, mission_id: 992
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0042 14.9837 0.2456
[INFO] simulating digital twin on i 29, mission_id: 992
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0020 14.2757 0.2501
[INFO] simulating digital twin on i 29, mission_id: 992
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0017 14.6323 0.2354
[INFO] simulating digital twin on i 29, mission_id: 992
[INFO] digital twin degradation parameters: 0.0017 14.6323 0.2354
[INFO] DigitalTwin mean parameter values: R0 = 0.00248 Q = 14.47 Req = 0.24429
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 29 mission_id: 992
trajectory <11> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.42
[INFO] simulating true system on i: 30
[INFO] updating degradation parameter variance on i: 30
[INFO] updating degradation parameter values via random sampling on i: 30
[INFO] i: 30 mission_id: 993 rul_hat: 17.42 flight_time: 16.36 distance: 1218.66 R0: 0.00303 Q: 13.53 Req: 0.24801
[INFO] success on i: 30 mission_id: 993
[INFO] forecasting degradation values: r_mu: 0.001168 q_mu: 13.724228 m_mu: 0.237319
[INFO] digital twin degradation parameters: 0.0018 13.7962 0.2182
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 17.42
[INFO] simulating digital twin on i 30, mission_id: 993
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0006 13.9705 0.2470
[INFO] simulating digital twin on i 30, mission_id: 993
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0027 13.6670 0.2336
[INFO] simulating digital twin on i 30, mission_id: 993
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0008 12.5488 0.2440
[INFO] simulating digital twin on i 30, mission_id: 993
[INFO] digital twin degradation parameters: 0.0008 12.5488 0.2440
[INFO] DigitalTwin mean parameter values: R0 = 0.00148 Q = 13.50 Req = 0.23566
stop code counts: low_soc: 1 pos_err: 0 success: 3
[WARN] DigitalTwin low soc threshold exceeded once, adjusting rul_hat
[INFO] digital twin mission success on i: 30 mission_id: 993
trajectory <3> selected for TrueSystem
[INFO] simulating true system on i: 31
[INFO] updating degradation parameter variance on i: 31
[INFO] updating degradation parameter values via random sampling on i: 31
[INFO] i: 31 mission_id: 994 rul_hat: 16.92 flight_time: 14.83 distance: 1083.23 R0: 0.00148 Q: 15.09 Req: 0.21806
[INFO] success on i: 31 mission_id: 994
[INFO] forecasting degradation values: r_mu: 0.003107 q_mu: 13.027969 m_mu: 0.246740
[INFO] digital twin degradation parameters: 0.0038 12.7164 0.2306
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.92

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[INFO] simulating digital twin on i 31, mission_id: 994
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0028 12.1463 0.2618
[INFO] simulating digital twin on i 31, mission_id: 994
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0032 12.6038 0.2619
[INFO] simulating digital twin on i 31, mission_id: 994
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0034 12.2675 0.2545
[INFO] simulating digital twin on i 31, mission_id: 994
[INFO] digital twin degradation parameters: 0.0034 12.2675 0.2545
[INFO] DigitalTwin mean parameter values: R0 = 0.00329 Q = 12.43 Req = 0.25221
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 31 mission_id: 994
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.92
[INFO] simulating true system on i: 32
[INFO] updating degradation parameter variance on i: 32
[INFO] updating degradation parameter values via random sampling on i: 32
[INFO] i: 32 mission_id: 995 rul_hat: 16.92 flight_time: 13.94 distance: 1047.97 R0: 0.00047 Q: 13.94 Req: 0.25513
[INFO] success on i: 32 mission_id: 995
[INFO] forecasting degradation values: r_mu: 0.001021 q_mu: 13.993257 m_mu: 0.226341
[INFO] digital twin degradation parameters: 0.0013 14.0349 0.2027
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.92
[INFO] simulating digital twin on i 32, mission_id: 995
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0018 13.6568 0.2215
[INFO] simulating digital twin on i 32, mission_id: 995
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0003 14.1409 0.2294
[INFO] simulating digital twin on i 32, mission_id: 995
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0005 14.5358 0.2368
[INFO] simulating digital twin on i 32, mission_id: 995
[INFO] digital twin degradation parameters: 0.0005 14.5358 0.2368
[INFO] DigitalTwin mean parameter values: R0 = 0.00098 Q = 14.09 Req = 0.22260
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 32 mission_id: 995
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.92
[INFO] simulating true system on i: 33
[INFO] updating degradation parameter variance on i: 33
[INFO] updating degradation parameter values via random sampling on i: 33
[INFO] i: 33 mission_id: 996 rul_hat: 16.92 flight_time: 13.58 distance: 1020.95 R0: 0.00220 Q: 14.11 Req: 0.23778
[INFO] success on i: 33 mission_id: 996
[INFO] forecasting degradation values: r_mu: 0.000365 q_mu: 12.628249 m_mu: 0.235540
[INFO] digital twin degradation parameters: 0.0008 13.4676 0.2201
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.92
[INFO] simulating digital twin on i 33, mission_id: 996
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0003 13.3114 0.2474
[INFO] simulating digital twin on i 33, mission_id: 996
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: -0.0005 12.3778 0.2255
[INFO] simulating digital twin on i 33, mission_id: 996
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0005 13.3047 0.2362
[INFO] simulating digital twin on i 33, mission_id: 996
[INFO] digital twin degradation parameters: 0.0005 13.3047 0.2362
[INFO] DigitalTwin mean parameter values: R0 = 0.00029 Q = 13.12 Req = 0.23229
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 33 mission_id: 996
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.92
[INFO] simulating true system on i: 34

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[INFO] updating degradation parameter variance on i: 34
[INFO] updating degradation parameter values via random sampling on i: 34
[INFO] i: 34 mission_id: 997 rul_hat: 16.92 flight_time: 13.58 distance: 1020.78 R0: 0.00039 Q: 15.24 Req: 0.25446
[INFO] success on i: 34 mission_id: 997
[INFO] forecasting degradation values: r_mu: 0.002297 q_mu: 12.676842 m_mu: 0.232137
[INFO] digital twin degradation parameters: 0.0020 11.4780 0.2365
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.92
[INFO] simulating digital twin on i 34, mission_id: 997
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0016 12.2606 0.2214
[INFO] simulating digital twin on i 34, mission_id: 997
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0035 12.2092 0.2298
[INFO] simulating digital twin on i 34, mission_id: 997
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0017 13.1960 0.2320
[INFO] simulating digital twin on i 34, mission_id: 997
[INFO] digital twin degradation parameters: 0.0017 13.1960 0.2320
[INFO] DigitalTwin mean parameter values: R0 = 0.00219 Q = 12.29 Req = 0.22993
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 34 mission_id: 997
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.92
[INFO] simulating true system on i: 35
[INFO] updating degradation parameter variance on i: 35
[INFO] updating degradation parameter values via random sampling on i: 35
[INFO] i: 35 mission_id: 998 rul_hat: 16.92 flight_time: 13.58 distance: 1020.90 R0: 0.00189 Q: 15.04 Req: 0.26278
[INFO] success on i: 35 mission_id: 998
[INFO] forecasting degradation values: r_mu: -0.000066 q_mu: 13.981023 m_mu: 0.243193
[INFO] digital twin degradation parameters: 0.0005 12.7867 0.2457
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 16.92
[INFO] simulating digital twin on i 35, mission_id: 998
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0005 15.1689 0.2576
[INFO] simulating digital twin on i 35, mission_id: 998
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: -0.0008 13.5162 0.2418
[INFO] simulating digital twin on i 35, mission_id: 998
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: -0.0005 13.9368 0.2573
[INFO] simulating digital twin on i 35, mission_id: 998
[INFO] digital twin degradation parameters: -0.0005 13.9368 0.2573
[INFO] DigitalTwin mean parameter values: R0 = -0.00008 Q = 13.85 Req = 0.25060
stop code counts: low_soc: 1 pos_err: 0 success: 3
[WARN] DigitalTwin low soc threshold exceeded once, adjusting rul_hat
[INFO] digital twin mission success on i: 35 mission_id: 998
trajectory <3> selected for TrueSystem
[INFO] new RUL update is available, 16.70 replaces 16.42
[INFO] simulating true system on i: 36
[INFO] updating degradation parameter variance on i: 36
[INFO] updating degradation parameter values via random sampling on i: 36
[INFO] i: 36 mission_id: 999 rul_hat: 16.70 flight_time: 14.83 distance: 1083.15 R0: 0.00174 Q: 14.87 Req: 0.26726
[INFO] success on i: 36 mission_id: 999
[INFO] forecasting degradation values: r_mu: 0.000824 q_mu: 14.421541 m_mu: 0.240752
[INFO] digital twin degradation parameters: 0.0007 14.2471 0.2513
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.70
[INFO] simulating digital twin on i 36, mission_id: 999
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0029 14.4390 0.2446
[INFO] simulating digital twin on i 36, mission_id: 999
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0008 14.7606 0.2348
[INFO] simulating digital twin on i 36, mission_id: 999
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0015 15.4275 0.2417

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[INFO] simulating digital twin on i 36, mission_id: 999
[INFO] digital twin degradation parameters: 0.0015 15.4275 0.2417
[INFO] DigitalTwin mean parameter values: R0 = 0.00148 Q = 14.72 Req = 0.24310
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 36 mission_id: 999
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.70
[INFO] simulating true system on i: 37
[INFO] updating degradation parameter variance on i: 37
[INFO] updating degradation parameter values via random sampling on i: 37
[INFO] i: 37 mission_id: 1000 rul_hat: 16.70 flight_time: 13.94 distance: 1047.75 R0: 0.00189 Q: 14.18 Req: 0.25098
[INFO] success on i: 37 mission_id: 1000
[INFO] forecasting degradation values: r_mu: 0.000566 q_mu: 15.304011 m_mu: 0.267457
[INFO] digital twin degradation parameters: 0.0005 15.2750 0.2578
[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 to explore constraint boundary < 16.70
[INFO] simulating digital twin on i 37, mission_id: 1000
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0006 16.0592 0.2479
[INFO] simulating digital twin on i 37, mission_id: 1000
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0008 14.7327 0.2604
[INFO] simulating digital twin on i 37, mission_id: 1000
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0007 15.7855 0.2583
[INFO] simulating digital twin on i 37, mission_id: 1000
[INFO] digital twin degradation parameters: 0.0007 15.7855 0.2583
[INFO] DigitalTwin mean parameter values: R0 = 0.00066 Q = 15.46 Req = 0.25608
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 37 mission_id: 1000
trajectory <15> selected for TrueSystem
[INFO] simulating true system on i: 38
[INFO] updating degradation parameter variance on i: 38
[INFO] updating degradation parameter values via random sampling on i: 38
[INFO] i: 38 mission_id: 1001 rul_hat: 16.70 flight_time: 13.58 distance: 1020.92 R0: 0.00144 Q: 13.93 Req: 0.25666
[INFO] success on i: 38 mission_id: 1001
[INFO] forecasting degradation values: r_mu: 0.001355 q_mu: 14.667705 m_mu: 0.263320
[INFO] digital twin degradation parameters: 0.0018 14.6685 0.2545
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.70
[INFO] simulating digital twin on i 38, mission_id: 1001
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0011 14.0738 0.2680
[INFO] simulating digital twin on i 38, mission_id: 1001
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0014 14.4753 0.2565
[INFO] simulating digital twin on i 38, mission_id: 1001
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0010 14.2081 0.2521
[INFO] simulating digital twin on i 38, mission_id: 1001
[INFO] digital twin degradation parameters: 0.0010 14.2081 0.2521
[INFO] DigitalTwin mean parameter values: R0 = 0.00131 Q = 14.36 Req = 0.25780
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 38 mission_id: 1001
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.70
[INFO] simulating true system on i: 39
[INFO] updating degradation parameter variance on i: 39
[INFO] updating degradation parameter values via random sampling on i: 39
[INFO] i: 39 mission_id: 1002 rul_hat: 16.70 flight_time: 13.94 distance: 1047.75 R0: 0.00282 Q: 14.32 Req: 0.23923
[INFO] success on i: 39 mission_id: 1002
[INFO] forecasting degradation values: r_mu: 0.001434 q_mu: 14.225226 m_mu: 0.269729
[INFO] digital twin degradation parameters: 0.0011 14.7766 0.2641
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 16.70
[INFO] simulating digital twin on i 39, mission_id: 1002
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0010 13.6880 0.2819

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[INFO] simulating digital twin on i 39, mission_id: 1002
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0011 14.4422 0.2524
[INFO] simulating digital twin on i 39, mission_id: 1002
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0011 14.5680 0.2563
[INFO] simulating digital twin on i 39, mission_id: 1002
[INFO] digital twin degradation parameters: 0.0011 14.5680 0.2563
[INFO] DigitalTwin mean parameter values: R0 = 0.00106 Q = 14.37 Req = 0.26368
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 39 mission_id: 1002
trajectory <3> selected for TrueSystem
[INFO] new RUL update is available, 16.84 replaces 16.70
[INFO] simulating true system on i: 40
[INFO] updating degradation parameter variance on i: 40
[INFO] updating degradation parameter values via random sampling on i: 40
[INFO] i: 40 mission_id: 1003 rul_hat: 16.84 flight_time: 13.94 distance: 1047.68 R0: 0.00318 Q: 14.75 Req: 0.26769
[INFO] success on i: 40 mission_id: 1003
[INFO] forecasting degradation values: r_mu: 0.002213 q_mu: 14.714552 m_mu: 0.258828
[INFO] digital twin degradation parameters: 0.0020 14.4194 0.2594
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.84
[INFO] simulating digital twin on i 40, mission_id: 1003
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0027 15.2054 0.2718
[INFO] simulating digital twin on i 40, mission_id: 1003
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0021 14.4202 0.2642
[INFO] simulating digital twin on i 40, mission_id: 1003
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0029 15.1523 0.2685
[INFO] simulating digital twin on i 40, mission_id: 1003
[INFO] digital twin degradation parameters: 0.0029 15.1523 0.2685
[INFO] DigitalTwin mean parameter values: R0 = 0.00244 Q = 14.80 Req = 0.26597
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 40 mission_id: 1003
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 41
[INFO] updating degradation parameter variance on i: 41
[INFO] updating degradation parameter values via random sampling on i: 41
[INFO] i: 41 mission_id: 1004 rul_hat: 16.84 flight_time: 13.58 distance: 1021.05 R0: 0.00306 Q: 14.50 Req: 0.27064
[INFO] success on i: 41 mission_id: 1004
[INFO] forecasting degradation values: r_mu: 0.003079 q_mu: 15.029792 m_mu: 0.275133
[INFO] digital twin degradation parameters: 0.0031 15.4245 0.2611
[INFO] DigitalTwin selecting trajectory: <6> with path_time: 18.81 to explore constraint boundary < 16.84
[INFO] simulating digital twin on i 41, mission_id: 1004
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0032 14.8567 0.2635
[INFO] simulating digital twin on i 41, mission_id: 1004
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0033 15.1959 0.2892
[INFO] simulating digital twin on i 41, mission_id: 1004
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0032 15.3186 0.2776
[INFO] simulating digital twin on i 41, mission_id: 1004
[INFO] digital twin degradation parameters: 0.0032 15.3186 0.2776
[INFO] DigitalTwin mean parameter values: R0 = 0.00318 Q = 15.20 Req = 0.27286
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 41 mission_id: 1004
trajectory <6> selected for TrueSystem
[INFO] new RUL update is available, 17.78 replaces 16.84
[INFO] simulating true system on i: 42
[INFO] updating degradation parameter variance on i: 42
[INFO] updating degradation parameter values via random sampling on i: 42
[INFO] i: 42 mission_id: 1005 rul_hat: 17.78 flight_time: 13.94 distance: 1047.88 R0: 0.00214 Q: 15.20 Req: 0.25688

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[INFO] success on i: 42 mission_id: 1005
[INFO] forecasting degradation values: r_mu: 0.003261 q_mu: 15.084033 m_mu: 0.274897
[INFO] digital twin degradation parameters: 0.0038 14.6536 0.2675
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.78
[INFO] simulating digital twin on i 42, mission_id: 1005
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0039 14.7738 0.2848
[INFO] simulating digital twin on i 42, mission_id: 1005
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0034 15.0608 0.2914
[INFO] simulating digital twin on i 42, mission_id: 1005
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0041 13.9810 0.2784
[INFO] simulating digital twin on i 42, mission_id: 1005
[INFO] digital twin degradation parameters: 0.0041 13.9810 0.2784
[INFO] DigitalTwin mean parameter values: R0 = 0.00378 Q = 14.62 Req = 0.28051
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 42 mission_id: 1005
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.78
[INFO] simulating true system on i: 43
[INFO] updating degradation parameter variance on i: 43
[INFO] updating degradation parameter values via random sampling on i: 43
[INFO] i: 43 mission_id: 1006 rul_hat: 17.78 flight_time: 13.94 distance: 1047.82 R0: 0.00179 Q: 14.17 Req: 0.25380
[INFO] success on i: 43 mission_id: 1006
[INFO] forecasting degradation values: r_mu: 0.003869 q_mu: 14.653300 m_mu: 0.282943
[INFO] digital twin degradation parameters: 0.0048 15.2490 0.2882
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.78
[INFO] simulating digital twin on i 43, mission_id: 1006
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0043 14.7739 0.2812
[INFO] simulating digital twin on i 43, mission_id: 1006
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0042 14.5045 0.2792
[INFO] simulating digital twin on i 43, mission_id: 1006
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0037 14.6110 0.2830
[INFO] simulating digital twin on i 43, mission_id: 1006
[INFO] digital twin degradation parameters: 0.0037 14.6110 0.2830
[INFO] DigitalTwin mean parameter values: R0 = 0.00424 Q = 14.78 Req = 0.28292
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 43 mission_id: 1006
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 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: 1007 rul_hat: 17.78 flight_time: 13.94 distance: 1047.69 R0: 0.00379 Q: 13.72 Req: 0.25053
[INFO] success on i: 44 mission_id: 1007
[INFO] forecasting degradation values: r_mu: 0.004213 q_mu: 14.377590 m_mu: 0.263840
[INFO] digital twin degradation parameters: 0.0044 14.3538 0.2571
[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: 1007
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0036 14.1859 0.2519
[INFO] simulating digital twin on i 44, mission_id: 1007
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0043 14.4546 0.2702
[INFO] simulating digital twin on i 44, mission_id: 1007
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0036 14.5174 0.2625
[INFO] simulating digital twin on i 44, mission_id: 1007
[INFO] digital twin degradation parameters: 0.0036 14.5174 0.2625
[INFO] DigitalTwin mean parameter values: R0 = 0.00394 Q = 14.38 Req = 0.26042
stop code counts: low_soc: 0 pos_err: 0 success: 4

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[INFO] digital twin mission success on i: 44 mission_id: 1007
      trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 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: 1008 rul_hat: 17.78 flight_time: 13.94 distance: 1047.67 R0: 0.00320 Q: 14.41 Req: 0.25624
[INFO] success on i: 45 mission_id: 1008
[INFO] forecasting degradation values: r_mu: 0.003918 q_mu: 13.860596 m_mu: 0.264660
[INFO] digital twin degradation parameters: 0.0038 13.6139 0.2776
[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 17.78
[INFO] simulating digital twin on i 45, mission_id: 1008
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0038 14.3866 0.2706
[INFO] simulating digital twin on i 45, mission_id: 1008
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0040 14.6819 0.2594
[INFO] simulating digital twin on i 45, mission_id: 1008
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0041 13.4596 0.2576
[INFO] simulating digital twin on i 45, mission_id: 1008
[INFO] digital twin degradation parameters: 0.0041 13.4596 0.2576
[INFO] DigitalTwin mean parameter values: R0 = 0.00392 Q = 14.04 Req = 0.26630
      stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 45 mission_id: 1008
      trajectory <15> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <15> with path_time: 17.63 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: 1009 rul_hat: 17.78 flight_time: 17.63 distance: 1283.77 R0: 0.00231 Q: 14.54 Req: 0.27967
[INFO] success on i: 46 mission_id: 1009
[INFO] forecasting degradation values: r_mu: 0.004405 q_mu: 13.725547 m_mu: 0.255470
[INFO] digital twin degradation parameters: 0.0048 13.2436 0.2537
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.78
[INFO] simulating digital twin on i 46, mission_id: 1009
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0051 13.8954 0.2641
[INFO] simulating digital twin on i 46, mission_id: 1009
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0047 13.3687 0.2636
[INFO] simulating digital twin on i 46, mission_id: 1009
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0037 14.0855 0.2607
[INFO] simulating digital twin on i 46, mission_id: 1009
[INFO] digital twin degradation parameters: 0.0037 14.0855 0.2607
[INFO] DigitalTwin mean parameter values: R0 = 0.00457 Q = 13.65 Req = 0.26054
      stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 46 mission_id: 1009
      trajectory <11> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 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: 1010 rul_hat: 17.78 flight_time: 16.36 distance: 1218.87 R0: 0.00317 Q: 13.60 Req: 0.26060
[INFO] success on i: 47 mission_id: 1010
[INFO] forecasting degradation values: r_mu: 0.003408 q_mu: 14.015584 m_mu: 0.265567
[INFO] digital twin degradation parameters: 0.0034 14.0597 0.2730
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.78
[INFO] simulating digital twin on i 47, mission_id: 1010
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0035 14.7530 0.2628
[INFO] simulating digital twin on i 47, mission_id: 1010
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0035 13.7618 0.2650

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[INFO] simulating digital twin on i 47, mission_id: 1010
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0038 13.4756 0.2672
[INFO] simulating digital twin on i 47, mission_id: 1010
[INFO] digital twin degradation parameters: 0.0038 13.4756 0.2672
[INFO] DigitalTwin mean parameter values: R0 = 0.00355 Q = 14.01 Req = 0.26701
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 47 mission_id: 1010
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.78
[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: 1011 rul_hat: 17.78 flight_time: 13.94 distance: 1047.77 R0: 0.00227 Q: 14.55 Req: 0.24676
[INFO] success on i: 48 mission_id: 1011
[INFO] forecasting degradation values: r_mu: 0.003766 q_mu: 13.805066 m_mu: 0.261563
[INFO] digital twin degradation parameters: 0.0027 14.5035 0.2603
[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 17.78
[INFO] simulating digital twin on i 48, mission_id: 1011
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0037 13.9372 0.2643
[INFO] simulating digital twin on i 48, mission_id: 1011
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0043 13.9482 0.2610
[INFO] simulating digital twin on i 48, mission_id: 1011
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0043 14.6904 0.2618
[INFO] simulating digital twin on i 48, mission_id: 1011
[INFO] digital twin degradation parameters: 0.0043 14.6904 0.2618
[INFO] DigitalTwin mean parameter values: R0 = 0.00378 Q = 14.27 Req = 0.26185
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 48 mission_id: 1011
trajectory <15> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 17.78
[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: 1012 rul_hat: 17.78 flight_time: 17.63 distance: 1283.78 R0: 0.00263 Q: 14.62 Req: 0.25955
[INFO] success on i: 49 mission_id: 1012
[INFO] forecasting degradation values: r_mu: 0.003223 q_mu: 14.375944 m_mu: 0.250804
[INFO] digital twin degradation parameters: 0.0025 14.3312 0.2528
[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 17.78
[INFO] simulating digital twin on i 49, mission_id: 1012
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0029 14.0906 0.2584
[INFO] simulating digital twin on i 49, mission_id: 1012
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0032 14.6487 0.2556
[INFO] simulating digital twin on i 49, mission_id: 1012
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0031 13.5440 0.2537
[INFO] simulating digital twin on i 49, mission_id: 1012
[INFO] digital twin degradation parameters: 0.0031 13.5440 0.2537
[INFO] DigitalTwin mean parameter values: R0 = 0.00291 Q = 14.15 Req = 0.25513
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 49 mission_id: 1012
trajectory <15> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 17.78
[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: 1013 rul_hat: 17.78 flight_time: 17.63 distance: 1283.83 R0: 0.00320 Q: 13.86 Req: 0.26413
[INFO] success on i: 50 mission_id: 1013
[INFO] forecasting degradation values: r_mu: 0.003064 q_mu: 14.614226 m_mu: 0.257795
[INFO] digital twin degradation parameters: 0.0028 15.3118 0.2576

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[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 17.78
[INFO] simulating digital twin on i 50, mission_id: 1013
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0027 14.0580 0.2634
[INFO] simulating digital twin on i 50, mission_id: 1013
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0034 14.2746 0.2802
[INFO] simulating digital twin on i 50, mission_id: 1013
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0035 14.7806 0.2726
[INFO] simulating digital twin on i 50, mission_id: 1013
[INFO] digital twin degradation parameters: 0.0035 14.7806 0.2726
[INFO] DigitalTwin mean parameter values: R0 = 0.00311 Q = 14.61 Req = 0.26846
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 50 mission_id: 1013
trajectory <15> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 17.78
[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: 1014 rul_hat: 17.78 flight_time: 17.63 distance: 1283.91 R0: 0.00171 Q: 14.11 Req: 0.26472
[INFO] success on i: 51 mission_id: 1014
[INFO] forecasting degradation values: r_mu: 0.002839 q_mu: 13.893232 m_mu: 0.266492
[INFO] digital twin degradation parameters: 0.0029 13.4779 0.2705
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.78
[INFO] simulating digital twin on i 51, mission_id: 1014
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0031 13.8768 0.2692
[INFO] simulating digital twin on i 51, mission_id: 1014
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0025 14.1130 0.2637
[INFO] simulating digital twin on i 51, mission_id: 1014
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0020 13.7691 0.2618
[INFO] simulating digital twin on i 51, mission_id: 1014
[INFO] digital twin degradation parameters: 0.0020 13.7691 0.2618
[INFO] DigitalTwin mean parameter values: R0 = 0.00262 Q = 13.81 Req = 0.26630
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 51 mission_id: 1014
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.78
[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: 1015 rul_hat: 17.78 flight_time: 14.83 distance: 1083.56 R0: 0.00254 Q: 14.32 Req: 0.26586
[INFO] success on i: 52 mission_id: 1015
[INFO] forecasting degradation values: r_mu: 0.002109 q_mu: 13.769490 m_mu: 0.261705
[INFO] digital twin degradation parameters: 0.0020 13.5559 0.2739
[INFO] DigitalTwin selecting trajectory: <20> with path_time: 19.65 to explore constraint boundary < 17.78
[INFO] simulating digital twin on i 52, mission_id: 1015
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0022 14.3594 0.2747
[INFO] simulating digital twin on i 52, mission_id: 1015
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0026 13.6424 0.2575
[INFO] simulating digital twin on i 52, mission_id: 1015
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0025 13.4326 0.2539
[INFO] simulating digital twin on i 52, mission_id: 1015
[INFO] digital twin degradation parameters: 0.0025 13.4326 0.2539
[INFO] DigitalTwin mean parameter values: R0 = 0.00232 Q = 13.75 Req = 0.26500
stop code counts: low_soc: 4 pos_err: 0 success: 0
[WARN] DigitalTwin low soc threshold exceeded on i: 52 mission_id: 1015
[INFO] updating RUL from 17.78 to 17.44
[INFO] selecting new trajectory to repeat DigitalTwin simulation

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[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.44
[INFO] simulating digital twin on i 52, mission_id: 1015
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0022 13.8650 0.2699
[INFO] simulating digital twin on i 52, mission_id: 1015
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0022 13.3255 0.2678
[INFO] simulating digital twin on i 52, mission_id: 1015
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0023 13.7350 0.2587
[INFO] simulating digital twin on i 52, mission_id: 1015
[INFO] digital twin degradation parameters: 0.0023 13.7350 0.2587
[INFO] DigitalTwin mean parameter values: R0 = 0.00231 Q = 13.59 Req = 0.26258
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 52 mission_id: 1015
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.44
[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: 1016 rul_hat: 17.44 flight_time: 13.58 distance: 1021.01 R0: 0.00289 Q: 14.09 Req: 0.26062
[INFO] success on i: 53 mission_id: 1016
[INFO] forecasting degradation values: r_mu: 0.002339 q_mu: 13.964174 m_mu: 0.263389
[INFO] digital twin degradation parameters: 0.0021 13.3992 0.2598
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.44
[INFO] simulating digital twin on i 53, mission_id: 1016
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0030 14.3577 0.2707
[INFO] simulating digital twin on i 53, mission_id: 1016
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0027 14.1719 0.2686
[INFO] simulating digital twin on i 53, mission_id: 1016
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0020 14.2808 0.2550
[INFO] simulating digital twin on i 53, mission_id: 1016
[INFO] digital twin degradation parameters: 0.0020 14.2808 0.2550
[INFO] DigitalTwin mean parameter values: R0 = 0.00245 Q = 14.05 Req = 0.26353
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 53 mission_id: 1016
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.44
[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: 1017 rul_hat: 17.44 flight_time: 13.94 distance: 1047.81 R0: 0.00356 Q: 13.77 Req: 0.26034
[INFO] success on i: 54 mission_id: 1017
[INFO] forecasting degradation values: r_mu: 0.002764 q_mu: 13.842228 m_mu: 0.269577
[INFO] digital twin degradation parameters: 0.0026 13.3602 0.2697
[INFO] DigitalTwin selecting trajectory: <6> with path_time: 18.81 to explore constraint boundary < 17.44
[INFO] simulating digital twin on i 54, mission_id: 1017
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0030 13.9022 0.2778
[INFO] simulating digital twin on i 54, mission_id: 1017
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0027 13.9506 0.2862
[INFO] simulating digital twin on i 54, mission_id: 1017
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0033 13.4967 0.2771
[INFO] simulating digital twin on i 54, mission_id: 1017
[INFO] digital twin degradation parameters: 0.0033 13.4967 0.2771
[INFO] DigitalTwin mean parameter values: R0 = 0.00288 Q = 13.68 Req = 0.27770
stop code counts: low_soc: 4 pos_err: 0 success: 0
[WARN] DigitalTwin low soc threshold exceeded on i: 54 mission_id: 1017
[INFO] updating RUL from 17.44 to 17.33
[INFO] selecting new trajectory to repeat DigitalTwin simulation

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[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.33
[INFO] simulating digital twin on i 54, mission_id: 1017
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0029 14.1641 0.2669
[INFO] simulating digital twin on i 54, mission_id: 1017
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0030 14.4970 0.2567
[INFO] simulating digital twin on i 54, mission_id: 1017
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0023 14.2844 0.2676
[INFO] simulating digital twin on i 54, mission_id: 1017
[INFO] digital twin degradation parameters: 0.0023 14.2844 0.2676
[INFO] DigitalTwin mean parameter values: R0 = 0.00287 Q = 14.11 Req = 0.26708
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 54 mission_id: 1017
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.33
[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: 1018 rul_hat: 17.33 flight_time: 13.94 distance: 1047.66 R0: 0.00337 Q: 14.38 Req: 0.28201
[INFO] success on i: 55 mission_id: 1018
[INFO] forecasting degradation values: r_mu: 0.003083 q_mu: 13.975990 m_mu: 0.269298
[INFO] digital twin degradation parameters: 0.0025 13.6488 0.2688
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.33
[INFO] simulating digital twin on i 55, mission_id: 1018
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0029 14.4151 0.2634
[INFO] simulating digital twin on i 55, mission_id: 1018
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0032 14.3323 0.2717
[INFO] simulating digital twin on i 55, mission_id: 1018
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0028 14.0194 0.2672
[INFO] simulating digital twin on i 55, mission_id: 1018
[INFO] digital twin degradation parameters: 0.0028 14.0194 0.2672
[INFO] DigitalTwin mean parameter values: R0 = 0.00285 Q = 14.10 Req = 0.26779
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 55 mission_id: 1018
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.33
[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: 1019 rul_hat: 17.33 flight_time: 13.94 distance: 1047.82 R0: 0.00324 Q: 14.50 Req: 0.26699
[INFO] success on i: 56 mission_id: 1019
[INFO] forecasting degradation values: r_mu: 0.002849 q_mu: 14.187373 m_mu: 0.284238
[INFO] digital twin degradation parameters: 0.0026 13.9228 0.2850
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.33
[INFO] simulating digital twin on i 56, mission_id: 1019
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0029 13.7360 0.2817
[INFO] simulating digital twin on i 56, mission_id: 1019
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0032 14.5101 0.2939
[INFO] simulating digital twin on i 56, mission_id: 1019
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0024 14.4872 0.2863
[INFO] simulating digital twin on i 56, mission_id: 1019
[INFO] digital twin degradation parameters: 0.0024 14.4872 0.2863
[INFO] DigitalTwin mean parameter values: R0 = 0.00278 Q = 14.16 Req = 0.28672
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 56 mission_id: 1019
trajectory <11> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.33

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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: 1020 rul_hat: 17.33 flight_time: 16.36 distance: 1218.90 R0: 0.00420 Q: 14.08 Req: 0.27380
[INFO] success on i: 57 mission_id: 1020
[INFO] forecasting degradation values: r_mu: 0.003407 q_mu: 14.067932 m_mu: 0.269225
[INFO] digital twin degradation parameters: 0.0039 13.9280 0.2665
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.33
[INFO] simulating digital twin on i 57, mission_id: 1020
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0036 13.8153 0.2697
[INFO] simulating digital twin on i 57, mission_id: 1020
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0032 13.9212 0.2739
[INFO] simulating digital twin on i 57, mission_id: 1020
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0038 14.4584 0.2627
[INFO] simulating digital twin on i 57, mission_id: 1020
[INFO] digital twin degradation parameters: 0.0038 14.4584 0.2627
[INFO] DigitalTwin mean parameter values: R0 = 0.00362 Q = 14.03 Req = 0.26818
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 57 mission_id: 1020
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.33
[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: 1021 rul_hat: 17.33 flight_time: 14.83 distance: 1083.78 R0: 0.00373 Q: 14.14 Req: 0.26215
[INFO] success on i: 58 mission_id: 1021
[INFO] forecasting degradation values: r_mu: 0.004365 q_mu: 13.985268 m_mu: 0.262465
[INFO] digital twin degradation parameters: 0.0052 14.0622 0.2593
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 17.33
[INFO] simulating digital twin on i 58, mission_id: 1021
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0044 13.7608 0.2523
[INFO] simulating digital twin on i 58, mission_id: 1021
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0040 13.7722 0.2651
[INFO] simulating digital twin on i 58, mission_id: 1021
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0046 13.7261 0.2672
[INFO] simulating digital twin on i 58, mission_id: 1021
[INFO] digital twin degradation parameters: 0.0046 13.7261 0.2672
[INFO] DigitalTwin mean parameter values: R0 = 0.00455 Q = 13.83 Req = 0.26099
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 58 mission_id: 1021
trajectory <3> selected for TrueSystem
[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: 1022 rul_hat: 17.33 flight_time: 13.58 distance: 1020.99 R0: 0.00388 Q: 13.57 Req: 0.27167
[INFO] success on i: 59 mission_id: 1022
[INFO] forecasting degradation values: r_mu: 0.004371 q_mu: 14.284432 m_mu: 0.267529
[INFO] digital twin degradation parameters: 0.0046 13.8167 0.2778
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.33
[INFO] simulating digital twin on i 59, mission_id: 1022
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0049 14.3885 0.2652
[INFO] simulating digital twin on i 59, mission_id: 1022
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0044 14.5185 0.2628
[INFO] simulating digital twin on i 59, mission_id: 1022
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0048 14.5076 0.2673
[INFO] simulating digital twin on i 59, mission_id: 1022

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[INFO] digital twin degradation parameters: 0.0048 14.5076 0.2673
[INFO] DigitalTwin mean parameter values: R0 = 0.00465 Q = 14.31 Req = 0.26825
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 59 mission_id: 1022
trajectory <11> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.33
[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: 1023 rul_hat: 17.33 flight_time: 16.36 distance: 1218.74 R0: 0.00416 Q: 13.68 Req: 0.26648
[INFO] success on i: 60 mission_id: 1023
[INFO] forecasting degradation values: r_mu: 0.004510 q_mu: 13.642449 m_mu: 0.280897
[INFO] digital twin degradation parameters: 0.0044 13.9613 0.2796
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.33
[INFO] simulating digital twin on i 60, mission_id: 1023
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0040 13.6493 0.2864
[INFO] simulating digital twin on i 60, mission_id: 1023
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0050 13.8161 0.2793
[INFO] simulating digital twin on i 60, mission_id: 1023
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0044 13.7558 0.2858
[INFO] simulating digital twin on i 60, mission_id: 1023
[INFO] digital twin degradation parameters: 0.0044 13.7558 0.2858
[INFO] DigitalTwin mean parameter values: R0 = 0.00444 Q = 13.80 Req = 0.28277
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 60 mission_id: 1023
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.33
[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: 1024 rul_hat: 17.33 flight_time: 14.83 distance: 1083.63 R0: 0.00463 Q: 13.21 Req: 0.27144
[INFO] success on i: 61 mission_id: 1024
[INFO] forecasting degradation values: r_mu: 0.004827 q_mu: 13.555497 m_mu: 0.276372
[INFO] digital twin degradation parameters: 0.0044 13.4141 0.2850
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.33
[INFO] simulating digital twin on i 61, mission_id: 1024
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0049 13.5182 0.2743
[INFO] simulating digital twin on i 61, mission_id: 1024
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0052 13.7253 0.2783
[INFO] simulating digital twin on i 61, mission_id: 1024
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0047 13.6605 0.2749
[INFO] simulating digital twin on i 61, mission_id: 1024
[INFO] digital twin degradation parameters: 0.0047 13.6605 0.2749
[INFO] DigitalTwin mean parameter values: R0 = 0.00481 Q = 13.58 Req = 0.27813
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 61 mission_id: 1024
trajectory <11> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 17.33
[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: 1025 rul_hat: 17.33 flight_time: 16.36 distance: 1218.77 R0: 0.00449 Q: 13.99 Req: 0.27399
[INFO] success on i: 62 mission_id: 1025
[INFO] forecasting degradation values: r_mu: 0.005127 q_mu: 13.369773 m_mu: 0.274051
[INFO] digital twin degradation parameters: 0.0049 13.2140 0.2691
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.33
[INFO] simulating digital twin on i 62, mission_id: 1025
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0049 13.5663 0.2716

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[INFO] simulating digital twin on i 62, mission_id: 1025
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0053 13.8096 0.2785
[INFO] simulating digital twin on i 62, mission_id: 1025
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0051 13.3368 0.2833
[INFO] simulating digital twin on i 62, mission_id: 1025
[INFO] digital twin degradation parameters: 0.0051 13.3368 0.2833
[INFO] DigitalTwin mean parameter values: R0 = 0.00503 Q = 13.48 Req = 0.27562
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 62 mission_id: 1025
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 17.33
[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: 1026 rul_hat: 17.33 flight_time: 14.83 distance: 1083.76 R0: 0.00453 Q: 13.88 Req: 0.27455
[INFO] success on i: 63 mission_id: 1026
[INFO] forecasting degradation values: r_mu: 0.005948 q_mu: 13.444219 m_mu: 0.276656
[INFO] digital twin degradation parameters: 0.0063 13.5045 0.2783
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.33
[INFO] simulating digital twin on i 63, mission_id: 1026
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0063 13.1988 0.2712
[INFO] simulating digital twin on i 63, mission_id: 1026
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0053 13.9594 0.2730
[INFO] simulating digital twin on i 63, mission_id: 1026
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0063 13.5937 0.2698
[INFO] simulating digital twin on i 63, mission_id: 1026
[INFO] digital twin degradation parameters: 0.0063 13.5937 0.2698
[INFO] DigitalTwin mean parameter values: R0 = 0.00606 Q = 13.56 Req = 0.27306
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 63 mission_id: 1026
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.33
[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: 1027 rul_hat: 17.33 flight_time: 13.58 distance: 1021.10 R0: 0.00553 Q: 13.92 Req: 0.28153
[INFO] success on i: 64 mission_id: 1027
[INFO] forecasting degradation values: r_mu: 0.005687 q_mu: 13.376253 m_mu: 0.278810
[INFO] digital twin degradation parameters: 0.0058 13.4247 0.2745
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.33
[INFO] simulating digital twin on i 64, mission_id: 1027
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0051 13.3711 0.2795
[INFO] simulating digital twin on i 64, mission_id: 1027
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0054 13.4871 0.2737
[INFO] simulating digital twin on i 64, mission_id: 1027
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0055 13.4047 0.2762
[INFO] simulating digital twin on i 64, mission_id: 1027
[INFO] digital twin degradation parameters: 0.0055 13.4047 0.2762
[INFO] DigitalTwin mean parameter values: R0 = 0.00546 Q = 13.42 Req = 0.27597
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 64 mission_id: 1027
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.33
[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: 1028 rul_hat: 17.33 flight_time: 13.94 distance: 1047.81 R0: 0.00513 Q: 13.65 Req: 0.27101

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[INFO] success on i: 65 mission_id: 1028
[INFO] forecasting degradation values: r_mu: 0.006196 q_mu: 13.481825 m_mu: 0.286394
[INFO] digital twin degradation parameters: 0.0065 13.6378 0.2887
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.33
[INFO] simulating digital twin on i 65, mission_id: 1028
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0066 13.4906 0.2846
[INFO] simulating digital twin on i 65, mission_id: 1028
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0062 13.8037 0.2816
[INFO] simulating digital twin on i 65, mission_id: 1028
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0060 13.7531 0.2898
[INFO] simulating digital twin on i 65, mission_id: 1028
[INFO] digital twin degradation parameters: 0.0060 13.7531 0.2898
[INFO] DigitalTwin mean parameter values: R0 = 0.00631 Q = 13.67 Req = 0.28616
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 65 mission_id: 1028
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 17.33
[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: 1029 rul_hat: 17.33 flight_time: 13.94 distance: 1047.73 R0: 0.00501 Q: 13.66 Req: 0.27465
[INFO] success on i: 66 mission_id: 1029
[INFO] forecasting degradation values: r_mu: 0.006071 q_mu: 13.401355 m_mu: 0.281162
[INFO] digital twin degradation parameters: 0.0060 12.7905 0.2796
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.33
[INFO] simulating digital twin on i 66, mission_id: 1029
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0056 13.2425 0.2797
[INFO] simulating digital twin on i 66, mission_id: 1029
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0057 13.2329 0.2739
[INFO] simulating digital twin on i 66, mission_id: 1029
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0060 13.2717 0.2832
[INFO] simulating digital twin on i 66, mission_id: 1029
[INFO] digital twin degradation parameters: 0.0060 13.2717 0.2832
[INFO] DigitalTwin mean parameter values: R0 = 0.00583 Q = 13.13 Req = 0.27910
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 66 mission_id: 1029
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 17.33
[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: 1030 rul_hat: 17.33 flight_time: 13.58 distance: 1021.16 R0: 0.00542 Q: 13.94 Req: 0.28163
[INFO] success on i: 67 mission_id: 1030
[INFO] forecasting degradation values: r_mu: 0.006189 q_mu: 13.198865 m_mu: 0.274799
[INFO] digital twin degradation parameters: 0.0062 12.9017 0.2757
[INFO] DigitalTwin selecting trajectory: <6> with path_time: 18.81 to explore constraint boundary < 17.33
[INFO] simulating digital twin on i 67, mission_id: 1030
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0063 12.9669 0.2801
[INFO] simulating digital twin on i 67, mission_id: 1030
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0063 13.0976 0.2689
[INFO] simulating digital twin on i 67, mission_id: 1030
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0060 12.9523 0.2731
[INFO] simulating digital twin on i 67, mission_id: 1030
[INFO] digital twin degradation parameters: 0.0060 12.9523 0.2731
[INFO] DigitalTwin mean parameter values: R0 = 0.00621 Q = 12.98 Req = 0.27444
stop code counts: low_soc: 4 pos_err: 0 success: 0

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[WARN] DigitalTwin low soc threshold exceeded on i: 67 mission_id: 1030
[INFO] updating RUL from 17.33 to 16.46
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.46
[INFO] simulating digital twin on i 67, mission_id: 1030
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0062 13.2190 0.2761
[INFO] simulating digital twin on i 67, mission_id: 1030
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0071 13.2787 0.2753
[INFO] simulating digital twin on i 67, mission_id: 1030
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0067 13.2204 0.2724
[INFO] simulating digital twin on i 67, mission_id: 1030
[INFO] digital twin degradation parameters: 0.0067 13.2204 0.2724
[INFO] DigitalTwin mean parameter values: R0 = 0.00650 Q = 13.17 Req = 0.27423
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 67 mission_id: 1030
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.46
[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: 1031 rul_hat: 16.46 flight_time: 13.58 distance: 1021.27 R0: 0.00594 Q: 13.57 Req: 0.27735
[INFO] success on i: 68 mission_id: 1031
[INFO] forecasting degradation values: r_mu: 0.006610 q_mu: 13.452141 m_mu: 0.284919
[INFO] digital twin degradation parameters: 0.0069 13.6380 0.2797
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.46
[INFO] simulating digital twin on i 68, mission_id: 1031
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0072 13.5062 0.2844
[INFO] simulating digital twin on i 68, mission_id: 1031
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0066 13.6909 0.2860
[INFO] simulating digital twin on i 68, mission_id: 1031
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0068 12.9713 0.2844
[INFO] simulating digital twin on i 68, mission_id: 1031
[INFO] digital twin degradation parameters: 0.0068 12.9713 0.2844
[INFO] DigitalTwin mean parameter values: R0 = 0.00685 Q = 13.45 Req = 0.28362
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 68 mission_id: 1031
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.46
[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: 1032 rul_hat: 16.46 flight_time: 14.83 distance: 1083.80 R0: 0.00588 Q: 13.44 Req: 0.27737
[INFO] success on i: 69 mission_id: 1032
[INFO] forecasting degradation values: r_mu: 0.006599 q_mu: 13.541684 m_mu: 0.283896
[INFO] digital twin degradation parameters: 0.0064 13.7331 0.2822
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.46
[INFO] simulating digital twin on i 69, mission_id: 1032
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0069 14.0444 0.2841
[INFO] simulating digital twin on i 69, mission_id: 1032
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0071 13.3057 0.2894
[INFO] simulating digital twin on i 69, mission_id: 1032
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0062 13.5273 0.2829
[INFO] simulating digital twin on i 69, mission_id: 1032
[INFO] digital twin degradation parameters: 0.0062 13.5273 0.2829
[INFO] DigitalTwin mean parameter values: R0 = 0.00664 Q = 13.65 Req = 0.28464
stop code counts: low_soc: 0 pos_err: 0 success: 4

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[INFO] digital twin mission success on i: 69 mission_id: 1032
      trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.46
[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: 1033 rul_hat: 16.46 flight_time: 14.83 distance: 1083.71 R0: 0.00577 Q: 13.32 Req: 0.27996
[INFO] success on i: 70 mission_id: 1033
[INFO] forecasting degradation values: r_mu: 0.006997 q_mu: 13.302162 m_mu: 0.287057
[INFO] digital twin degradation parameters: 0.0066 13.0206 0.2902
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.46
[INFO] simulating digital twin on i 70, mission_id: 1033
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0067 13.2608 0.2879
[INFO] simulating digital twin on i 70, mission_id: 1033
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0070 13.6777 0.2853
[INFO] simulating digital twin on i 70, mission_id: 1033
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0070 13.4769 0.2897
[INFO] simulating digital twin on i 70, mission_id: 1033
[INFO] digital twin degradation parameters: 0.0070 13.4769 0.2897
[INFO] DigitalTwin mean parameter values: R0 = 0.00682 Q = 13.36 Req = 0.28827
      stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 70 mission_id: 1033
      trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.46
[INFO] simulating true system on i: 71
[INFO] updating degradation parameter variance on i: 71
[INFO] updating degradation parameter values via random sampling on i: 71
[INFO] i: 71 mission_id: 1034 rul_hat: 16.46 flight_time: 13.58 distance: 1021.11 R0: 0.00580 Q: 13.49 Req: 0.27724
[INFO] success on i: 71 mission_id: 1034
[INFO] forecasting degradation values: r_mu: 0.007058 q_mu: 13.290781 m_mu: 0.282391
[INFO] digital twin degradation parameters: 0.0071 13.3938 0.2835
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.46
[INFO] simulating digital twin on i 71, mission_id: 1034
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0072 13.4799 0.2835
[INFO] simulating digital twin on i 71, mission_id: 1034
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0067 13.3127 0.2783
[INFO] simulating digital twin on i 71, mission_id: 1034
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0074 12.8692 0.2810
[INFO] simulating digital twin on i 71, mission_id: 1034
[INFO] digital twin degradation parameters: 0.0074 12.8692 0.2810
[INFO] DigitalTwin mean parameter values: R0 = 0.00706 Q = 13.26 Req = 0.28156
      stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 71 mission_id: 1034
      trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.46
[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: 1035 rul_hat: 16.46 flight_time: 13.94 distance: 1047.80 R0: 0.00670 Q: 13.53 Req: 0.28910
[INFO] success on i: 72 mission_id: 1035
[INFO] forecasting degradation values: r_mu: 0.007069 q_mu: 13.202901 m_mu: 0.284123
[INFO] digital twin degradation parameters: 0.0071 13.0494 0.2871
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.46
[INFO] simulating digital twin on i 72, mission_id: 1035
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0071 13.1047 0.2810
[INFO] simulating digital twin on i 72, mission_id: 1035
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0067 12.7333 0.2820

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[INFO] simulating digital twin on i 72, mission_id: 1035
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0073 13.0244 0.2920
[INFO] simulating digital twin on i 72, mission_id: 1035
[INFO] digital twin degradation parameters: 0.0073 13.0244 0.2920
[INFO] DigitalTwin mean parameter values: R0 = 0.00706 Q = 12.98 Req = 0.28553
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 72 mission_id: 1035
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.46
[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: 1036 rul_hat: 16.46 flight_time: 13.94 distance: 1047.76 R0: 0.00672 Q: 14.05 Req: 0.27698
[INFO] success on i: 73 mission_id: 1036
[INFO] forecasting degradation values: r_mu: 0.007420 q_mu: 13.465110 m_mu: 0.292149
[INFO] digital twin degradation parameters: 0.0074 13.8239 0.2983
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.46
[INFO] simulating digital twin on i 73, mission_id: 1036
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0071 13.0386 0.2955
[INFO] simulating digital twin on i 73, mission_id: 1036
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0069 12.9306 0.2918
[INFO] simulating digital twin on i 73, mission_id: 1036
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0078 13.7696 0.2847
[INFO] simulating digital twin on i 73, mission_id: 1036
[INFO] digital twin degradation parameters: 0.0078 13.7696 0.2847
[INFO] DigitalTwin mean parameter values: R0 = 0.00733 Q = 13.39 Req = 0.29257
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 73 mission_id: 1036
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.46
[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: 1037 rul_hat: 16.46 flight_time: 13.94 distance: 1047.84 R0: 0.00728 Q: 13.68 Req: 0.28608
[INFO] success on i: 74 mission_id: 1037
[INFO] forecasting degradation values: r_mu: 0.007805 q_mu: 13.428458 m_mu: 0.281190
[INFO] digital twin degradation parameters: 0.0082 13.8250 0.2855
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.46
[INFO] simulating digital twin on i 74, mission_id: 1037
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0074 13.7367 0.2899
[INFO] simulating digital twin on i 74, mission_id: 1037
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0073 13.6373 0.2795
[INFO] simulating digital twin on i 74, mission_id: 1037
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0077 13.2062 0.2875
[INFO] simulating digital twin on i 74, mission_id: 1037
[INFO] digital twin degradation parameters: 0.0077 13.2062 0.2875
[INFO] DigitalTwin mean parameter values: R0 = 0.00765 Q = 13.60 Req = 0.28559
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 74 mission_id: 1037
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.46
[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: 1038 rul_hat: 16.46 flight_time: 13.94 distance: 1047.78 R0: 0.00770 Q: 13.42 Req: 0.28407
[INFO] success on i: 75 mission_id: 1038
[INFO] forecasting degradation values: r_mu: 0.008288 q_mu: 13.305271 m_mu: 0.287735
[INFO] digital twin degradation parameters: 0.0086 13.0879 0.2838

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[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.46
[INFO] simulating digital twin on i 75, mission_id: 1038
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0086 13.2764 0.2811
[INFO] simulating digital twin on i 75, mission_id: 1038
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0077 13.0736 0.2934
[INFO] simulating digital twin on i 75, mission_id: 1038
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0081 13.3762 0.2888
[INFO] simulating digital twin on i 75, mission_id: 1038
[INFO] digital twin degradation parameters: 0.0081 13.3762 0.2888
[INFO] DigitalTwin mean parameter values: R0 = 0.00825 Q = 13.20 Req = 0.28675
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 75 mission_id: 1038
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.46
[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: 1039 rul_hat: 16.46 flight_time: 13.58 distance: 1021.11 R0: 0.00739 Q: 13.73 Req: 0.29288
[INFO] success on i: 76 mission_id: 1039
[INFO] forecasting degradation values: r_mu: 0.008526 q_mu: 13.266789 m_mu: 0.288216
[INFO] digital twin degradation parameters: 0.0085 13.5164 0.2844
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.46
[INFO] simulating digital twin on i 76, mission_id: 1039
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0089 13.0918 0.2831
[INFO] simulating digital twin on i 76, mission_id: 1039
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0085 13.2075 0.2879
[INFO] simulating digital twin on i 76, mission_id: 1039
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0088 13.3221 0.2965
[INFO] simulating digital twin on i 76, mission_id: 1039
[INFO] digital twin degradation parameters: 0.0088 13.3221 0.2965
[INFO] DigitalTwin mean parameter values: R0 = 0.00869 Q = 13.28 Req = 0.28800
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 76 mission_id: 1039
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.46
[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: 1040 rul_hat: 16.46 flight_time: 13.58 distance: 1021.27 R0: 0.00829 Q: 13.30 Req: 0.28751
[INFO] success on i: 77 mission_id: 1040
[INFO] forecasting degradation values: r_mu: 0.008951 q_mu: 13.684369 m_mu: 0.295974
[INFO] digital twin degradation parameters: 0.0091 13.6319 0.2880
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.46
[INFO] simulating digital twin on i 77, mission_id: 1040
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0091 13.3174 0.2966
[INFO] simulating digital twin on i 77, mission_id: 1040
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0091 13.3906 0.2910
[INFO] simulating digital twin on i 77, mission_id: 1040
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0092 13.2459 0.2982
[INFO] simulating digital twin on i 77, mission_id: 1040
[INFO] digital twin degradation parameters: 0.0092 13.2459 0.2982
[INFO] DigitalTwin mean parameter values: R0 = 0.00911 Q = 13.40 Req = 0.29345
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 77 mission_id: 1040
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.46

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[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: 1041 rul_hat: 16.46 flight_time: 13.58 distance: 1021.24 R0: 0.00890 Q: 12.85 Req: 0.28368
[INFO] success on i: 78 mission_id: 1041
[INFO] forecasting degradation values: r_mu: 0.009680 q_mu: 13.395268 m_mu: 0.295426
[INFO] digital twin degradation parameters: 0.0094 13.4178 0.2933
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.46
[INFO] simulating digital twin on i 78, mission_id: 1041
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0098 13.2407 0.2981
[INFO] simulating digital twin on i 78, mission_id: 1041
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0094 13.0866 0.2897
[INFO] simulating digital twin on i 78, mission_id: 1041
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0097 13.2642 0.3050
[INFO] simulating digital twin on i 78, mission_id: 1041
[INFO] digital twin degradation parameters: 0.0097 13.2642 0.3050
[INFO] DigitalTwin mean parameter values: R0 = 0.00956 Q = 13.25 Req = 0.29650
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 78 mission_id: 1041
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.46
[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: 1042 rul_hat: 16.46 flight_time: 13.58 distance: 1021.20 R0: 0.00906 Q: 13.40 Req: 0.28800
[INFO] success on i: 79 mission_id: 1042
[INFO] forecasting degradation values: r_mu: 0.010284 q_mu: 12.954934 m_mu: 0.292275
[INFO] digital twin degradation parameters: 0.0104 13.0029 0.2985
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.46
[INFO] simulating digital twin on i 79, mission_id: 1042
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0104 12.6676 0.2978
[INFO] simulating digital twin on i 79, mission_id: 1042
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0105 13.3818 0.2902
[INFO] simulating digital twin on i 79, mission_id: 1042
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0106 13.0208 0.2850
[INFO] simulating digital twin on i 79, mission_id: 1042
[INFO] digital twin degradation parameters: 0.0106 13.0208 0.2850
[INFO] DigitalTwin mean parameter values: R0 = 0.01050 Q = 13.02 Req = 0.29286
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 79 mission_id: 1042
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.46
[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: 1043 rul_hat: 16.46 flight_time: 13.58 distance: 1021.17 R0: 0.00933 Q: 13.46 Req: 0.29490
[INFO] success on i: 80 mission_id: 1043
[INFO] forecasting degradation values: r_mu: 0.010784 q_mu: 13.338585 m_mu: 0.295228
[INFO] digital twin degradation parameters: 0.0105 13.3108 0.2919
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 16.46
[INFO] simulating digital twin on i 80, mission_id: 1043
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0111 13.1824 0.2991
[INFO] simulating digital twin on i 80, mission_id: 1043
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0105 13.7137 0.2842
[INFO] simulating digital twin on i 80, mission_id: 1043
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0109 13.4438 0.2911

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[INFO] simulating digital twin on i 80, mission_id: 1043
[INFO] digital twin degradation parameters: 0.0109 13.4438 0.2911
[INFO] DigitalTwin mean parameter values: R0 = 0.01074 Q = 13.41 Req = 0.29160
stop code counts: low_soc: 1 pos_err: 0 success: 3
[WARN] DigitalTwin low soc threshold exceeded once, adjusting rul_hat
[INFO] digital twin mission success on i: 80 mission_id: 1043
trajectory <3> selected for TrueSystem
[INFO] new RUL update is available, 16.81 replaces 15.96
[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: 1044 rul_hat: 16.81 flight_time: 13.58 distance: 1021.28 R0: 0.00972 Q: 13.19 Req: 0.27264
[INFO] success on i: 81 mission_id: 1044
[INFO] forecasting degradation values: r_mu: 0.011409 q_mu: 13.369463 m_mu: 0.299340
[INFO] digital twin degradation parameters: 0.0110 13.3583 0.3049
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.81
[INFO] simulating digital twin on i 81, mission_id: 1044
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0115 13.2223 0.2992
[INFO] simulating digital twin on i 81, mission_id: 1044
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0118 13.0193 0.3017
[INFO] simulating digital twin on i 81, mission_id: 1044
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0115 13.4500 0.2993
[INFO] simulating digital twin on i 81, mission_id: 1044
[INFO] digital twin degradation parameters: 0.0115 13.4500 0.2993
[INFO] DigitalTwin mean parameter values: R0 = 0.01145 Q = 13.26 Req = 0.30130
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 81 mission_id: 1044
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.81
[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: 1045 rul_hat: 16.81 flight_time: 13.94 distance: 1047.85 R0: 0.01045 Q: 13.10 Req: 0.27908
[INFO] success on i: 82 mission_id: 1045
[INFO] forecasting degradation values: r_mu: 0.011997 q_mu: 13.098286 m_mu: 0.284736
[INFO] digital twin degradation parameters: 0.0119 13.1569 0.2860
[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 to explore constraint boundary < 16.81
[INFO] simulating digital twin on i 82, mission_id: 1045
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0117 13.2684 0.2854
[INFO] simulating digital twin on i 82, mission_id: 1045
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0120 12.9250 0.2841
[INFO] simulating digital twin on i 82, mission_id: 1045
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0121 13.2048 0.2767
[INFO] simulating digital twin on i 82, mission_id: 1045
[INFO] digital twin degradation parameters: 0.0121 13.2048 0.2767
[INFO] DigitalTwin mean parameter values: R0 = 0.01192 Q = 13.14 Req = 0.28306
stop code counts: low_soc: 3 pos_err: 0 success: 1
[WARN] DigitalTwin low soc threshold exceeded on i: 82 mission_id: 1045
[INFO] updating RUL from 16.81 to 16.47
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.47
[INFO] simulating digital twin on i 82, mission_id: 1045
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0124 12.8202 0.2811
[INFO] simulating digital twin on i 82, mission_id: 1045
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0117 13.0992 0.2897
[INFO] simulating digital twin on i 82, mission_id: 1045
[INFO] resampling for twin run # 4

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[INFO] digital twin degradation parameters: 0.0119 12.9685 0.2833
[INFO] simulating digital twin on i 82, mission_id: 1045
[INFO] digital twin degradation parameters: 0.0119 12.9685 0.2833
[INFO] DigitalTwin mean parameter values: R0 = 0.01201 Q = 13.02 Req = 0.28270
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 82 mission_id: 1045
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.47
[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: 1046 rul_hat: 16.47 flight_time: 13.94 distance: 1047.78 R0: 0.01085 Q: 13.38 Req: 0.28845
[INFO] success on i: 83 mission_id: 1046
[INFO] forecasting degradation values: r_mu: 0.012592 q_mu: 12.964719 m_mu: 0.284678
[INFO] digital twin degradation parameters: 0.0125 13.1234 0.2779
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.47
[INFO] simulating digital twin on i 83, mission_id: 1046
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0130 12.8025 0.2868
[INFO] simulating digital twin on i 83, mission_id: 1046
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0126 12.6945 0.2891
[INFO] simulating digital twin on i 83, mission_id: 1046
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0122 12.4782 0.2781
[INFO] simulating digital twin on i 83, mission_id: 1046
[INFO] digital twin degradation parameters: 0.0122 12.4782 0.2781
[INFO] DigitalTwin mean parameter values: R0 = 0.01257 Q = 12.77 Req = 0.28296
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 83 mission_id: 1046
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.47
[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: 1047 rul_hat: 16.47 flight_time: 14.83 distance: 1083.83 R0: 0.01161 Q: 13.34 Req: 0.28294
[INFO] success on i: 84 mission_id: 1047
[INFO] forecasting degradation values: r_mu: 0.012903 q_mu: 12.874440 m_mu: 0.283605
[INFO] digital twin degradation parameters: 0.0129 12.6886 0.2848
[INFO] DigitalTwin selecting trajectory: <3> with path_time: 17.83 to explore constraint boundary < 16.47
[INFO] simulating digital twin on i 84, mission_id: 1047
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0132 12.7581 0.2803
[INFO] simulating digital twin on i 84, mission_id: 1047
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0130 13.0517 0.2850
[INFO] simulating digital twin on i 84, mission_id: 1047
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0127 12.7016 0.2793
[INFO] simulating digital twin on i 84, mission_id: 1047
[INFO] digital twin degradation parameters: 0.0127 12.7016 0.2793
[INFO] DigitalTwin mean parameter values: R0 = 0.01294 Q = 12.80 Req = 0.28235
stop code counts: low_soc: 4 pos_err: 0 success: 0
[WARN] DigitalTwin low soc threshold exceeded on i: 84 mission_id: 1047
[INFO] updating RUL from 16.47 to 16.25
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.25
[INFO] simulating digital twin on i 84, mission_id: 1047
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0130 13.1273 0.2824
[INFO] simulating digital twin on i 84, mission_id: 1047
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0130 13.0642 0.2843
[INFO] simulating digital twin on i 84, mission_id: 1047
[INFO] resampling for twin run # 4

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[INFO] digital twin degradation parameters: 0.0129 12.7388 0.2778
[INFO] simulating digital twin on i 84, mission_id: 1047
[INFO] digital twin degradation parameters: 0.0129 12.7388 0.2778
[INFO] DigitalTwin mean parameter values: R0 = 0.01287 Q = 12.91 Req = 0.28092
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 84 mission_id: 1047
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.25
[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: 1048 rul_hat: 16.25 flight_time: 14.83 distance: 1083.78 R0: 0.01188 Q: 13.10 Req: 0.28910
[INFO] success on i: 85 mission_id: 1048
[INFO] forecasting degradation values: r_mu: 0.013739 q_mu: 12.852228 m_mu: 0.283963
[INFO] digital twin degradation parameters: 0.0138 12.8638 0.2873
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.25
[INFO] simulating digital twin on i 85, mission_id: 1048
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0138 12.7582 0.2854
[INFO] simulating digital twin on i 85, mission_id: 1048
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0135 12.9669 0.2863
[INFO] simulating digital twin on i 85, mission_id: 1048
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0137 12.7640 0.2818
[INFO] simulating digital twin on i 85, mission_id: 1048
[INFO] digital twin degradation parameters: 0.0137 12.7640 0.2818
[INFO] DigitalTwin mean parameter values: R0 = 0.01369 Q = 12.84 Req = 0.28519
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 85 mission_id: 1048
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.25
[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: 1049 rul_hat: 16.25 flight_time: 13.94 distance: 1047.73 R0: 0.01223 Q: 13.29 Req: 0.29405
[INFO] success on i: 86 mission_id: 1049
[INFO] forecasting degradation values: r_mu: 0.014219 q_mu: 12.943719 m_mu: 0.282893
[INFO] digital twin degradation parameters: 0.0141 12.5744 0.2810
[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 to explore constraint boundary < 16.25
[INFO] simulating digital twin on i 86, mission_id: 1049
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0143 13.1357 0.2917
[INFO] simulating digital twin on i 86, mission_id: 1049
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0140 13.0611 0.2826
[INFO] simulating digital twin on i 86, mission_id: 1049
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0141 13.1229 0.2829
[INFO] simulating digital twin on i 86, mission_id: 1049
[INFO] digital twin degradation parameters: 0.0141 13.1229 0.2829
[INFO] DigitalTwin mean parameter values: R0 = 0.01411 Q = 12.97 Req = 0.28453
stop code counts: low_soc: 4 pos_err: 0 success: 0
[WARN] DigitalTwin low soc threshold exceeded on i: 86 mission_id: 1049
[INFO] updating RUL from 16.25 to 16.24
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.24
[INFO] simulating digital twin on i 86, mission_id: 1049
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0141 13.0521 0.2785
[INFO] simulating digital twin on i 86, mission_id: 1049
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0142 12.8432 0.2884
[INFO] simulating digital twin on i 86, mission_id: 1049
[INFO] resampling for twin run # 4

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[INFO] digital twin degradation parameters: 0.0143 12.8420 0.2797
[INFO] simulating digital twin on i 86, mission_id: 1049
[INFO] digital twin degradation parameters: 0.0143 12.8420 0.2797
[INFO] DigitalTwin mean parameter values: R0 = 0.01418 Q = 12.97 Req = 0.28235
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 86 mission_id: 1049
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.24
[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: 1050 rul_hat: 16.24 flight_time: 14.83 distance: 1083.66 R0: 0.01302 Q: 13.58 Req: 0.29146
[INFO] success on i: 87 mission_id: 1050
[INFO] forecasting degradation values: r_mu: 0.014741 q_mu: 13.096944 m_mu: 0.287758
[INFO] digital twin degradation parameters: 0.0147 13.0476 0.2953
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 16.24
[INFO] simulating digital twin on i 87, mission_id: 1050
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0146 13.0286 0.2911
[INFO] simulating digital twin on i 87, mission_id: 1050
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0146 13.2034 0.2874
[INFO] simulating digital twin on i 87, mission_id: 1050
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0145 13.1450 0.2907
[INFO] simulating digital twin on i 87, mission_id: 1050
[INFO] digital twin degradation parameters: 0.0145 13.1450 0.2907
[INFO] DigitalTwin mean parameter values: R0 = 0.01463 Q = 13.11 Req = 0.29113
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 87 mission_id: 1050
trajectory <9> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 16.24
[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: 1051 rul_hat: 16.24 flight_time: 13.47 distance: 994.76 R0: 0.01378 Q: 12.80 Req: 0.29248
[INFO] success on i: 88 mission_id: 1051
[INFO] forecasting degradation values: r_mu: 0.015736 q_mu: 13.236985 m_mu: 0.288202
[INFO] digital twin degradation parameters: 0.0158 13.3703 0.2863
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.24
[INFO] simulating digital twin on i 88, mission_id: 1051
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0158 13.6116 0.2804
[INFO] simulating digital twin on i 88, mission_id: 1051
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0157 13.3455 0.2877
[INFO] simulating digital twin on i 88, mission_id: 1051
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0160 13.1452 0.2764
[INFO] simulating digital twin on i 88, mission_id: 1051
[INFO] digital twin degradation parameters: 0.0160 13.1452 0.2764
[INFO] DigitalTwin mean parameter values: R0 = 0.01582 Q = 13.37 Req = 0.28269
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 88 mission_id: 1051
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.24
[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: 1052 rul_hat: 16.24 flight_time: 13.58 distance: 1021.10 R0: 0.01444 Q: 12.56 Req: 0.30000
[INFO] success on i: 89 mission_id: 1052
[INFO] forecasting degradation values: r_mu: 0.016359 q_mu: 12.887422 m_mu: 0.293451
[INFO] digital twin degradation parameters: 0.0164 12.8014 0.2886
[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 to explore constraint boundary < 16.24
[INFO] simulating digital twin on i 89, mission_id: 1052

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[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0163 12.7137 0.2925
[INFO] simulating digital twin on i 89, mission_id: 1052
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0165 13.3651 0.2936
[INFO] simulating digital twin on i 89, mission_id: 1052
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0164 12.9683 0.2852
[INFO] simulating digital twin on i 89, mission_id: 1052
[INFO] digital twin degradation parameters: 0.0164 12.9683 0.2852
[INFO] DigitalTwin mean parameter values: R0 = 0.01641 Q = 12.96 Req = 0.28997
stop code counts: low_soc: 3 pos_err: 0 success: 1
[WARN] DigitalTwin low soc threshold exceeded on i: 89 mission_id: 1052
[INFO] updating RUL from 16.24 to 16.28
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.28
[INFO] simulating digital twin on i 89, mission_id: 1052
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0163 12.8497 0.2790
[INFO] simulating digital twin on i 89, mission_id: 1052
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0163 13.0765 0.2941
[INFO] simulating digital twin on i 89, mission_id: 1052
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0163 12.8022 0.2881
[INFO] simulating digital twin on i 89, mission_id: 1052
[INFO] digital twin degradation parameters: 0.0163 12.8022 0.2881
[INFO] DigitalTwin mean parameter values: R0 = 0.01632 Q = 12.92 Req = 0.28658
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 89 mission_id: 1052
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.28
[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: 1053 rul_hat: 16.28 flight_time: 14.83 distance: 1083.65 R0: 0.01497 Q: 12.72 Req: 0.29336
[INFO] success on i: 90 mission_id: 1053
[INFO] forecasting degradation values: r_mu: 0.017182 q_mu: 12.729785 m_mu: 0.304707
[INFO] digital twin degradation parameters: 0.0172 12.7245 0.3043
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 16.28
[INFO] simulating digital twin on i 90, mission_id: 1053
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0172 12.8713 0.3058
[INFO] simulating digital twin on i 90, mission_id: 1053
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0173 13.1079 0.3025
[INFO] simulating digital twin on i 90, mission_id: 1053
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0172 12.8996 0.3047
[INFO] simulating digital twin on i 90, mission_id: 1053
[INFO] digital twin degradation parameters: 0.0172 12.8996 0.3047
[INFO] DigitalTwin mean parameter values: R0 = 0.01724 Q = 12.90 Req = 0.30433
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 90 mission_id: 1053
trajectory <9> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 16.28
[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: 1054 rul_hat: 16.28 flight_time: 13.47 distance: 994.86 R0: 0.01596 Q: 12.59 Req: 0.29273
[INFO] success on i: 91 mission_id: 1054
[INFO] forecasting degradation values: r_mu: 0.018076 q_mu: 12.446871 m_mu: 0.302996
[INFO] digital twin degradation parameters: 0.0181 12.4534 0.3019
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.28
[INFO] simulating digital twin on i 91, mission_id: 1054

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[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0182 12.6530 0.3027
[INFO] simulating digital twin on i 91, mission_id: 1054
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0180 12.8751 0.3076
[INFO] simulating digital twin on i 91, mission_id: 1054
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0182 12.4402 0.3126
[INFO] simulating digital twin on i 91, mission_id: 1054
[INFO] digital twin degradation parameters: 0.0182 12.4402 0.3126
[INFO] DigitalTwin mean parameter values: R0 = 0.01813 Q = 12.61 Req = 0.30618
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 91 mission_id: 1054
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.28
[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: 1055 rul_hat: 16.28 flight_time: 14.83 distance: 1084.00 R0: 0.01662 Q: 12.34 Req: 0.28971
[INFO] success on i: 92 mission_id: 1055
[INFO] forecasting degradation values: r_mu: 0.019110 q_mu: 12.217252 m_mu: 0.298355
[INFO] digital twin degradation parameters: 0.0192 12.1882 0.2976
[INFO] DigitalTwin selecting trajectory: <15> with path_time: 17.63 to explore constraint boundary < 16.28
[INFO] simulating digital twin on i 92, mission_id: 1055
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0191 12.2491 0.3096
[INFO] simulating digital twin on i 92, mission_id: 1055
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0191 12.1046 0.2954
[INFO] simulating digital twin on i 92, mission_id: 1055
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0190 12.2377 0.2941
[INFO] simulating digital twin on i 92, mission_id: 1055
[INFO] digital twin degradation parameters: 0.0190 12.2377 0.2941
[INFO] DigitalTwin mean parameter values: R0 = 0.01912 Q = 12.19 Req = 0.29917
stop code counts: low_soc: 4 pos_err: 0 success: 0
[WARN] DigitalTwin low soc threshold exceeded on i: 92 mission_id: 1055
[INFO] updating RUL from 16.28 to 15.29
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.29
[INFO] simulating digital twin on i 92, mission_id: 1055
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0192 12.4901 0.3044
[INFO] simulating digital twin on i 92, mission_id: 1055
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0193 11.9463 0.3052
[INFO] simulating digital twin on i 92, mission_id: 1055
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0191 12.1003 0.2962
[INFO] simulating digital twin on i 92, mission_id: 1055
[INFO] digital twin degradation parameters: 0.0191 12.1003 0.2962
[INFO] DigitalTwin mean parameter values: R0 = 0.01916 Q = 12.19 Req = 0.29995
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 92 mission_id: 1055
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.29
[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: 1056 rul_hat: 15.29 flight_time: 14.83 distance: 1083.70 R0: 0.01742 Q: 12.91 Req: 0.28789
[INFO] success on i: 93 mission_id: 1056
[INFO] forecasting degradation values: r_mu: 0.020034 q_mu: 12.012557 m_mu: 0.305924
[INFO] digital twin degradation parameters: 0.0201 12.2189 0.3047
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.29
[INFO] simulating digital twin on i 93, mission_id: 1056

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[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0199 12.0000 0.3040
[INFO] simulating digital twin on i 93, mission_id: 1056
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0200 12.0679 0.3044
[INFO] simulating digital twin on i 93, mission_id: 1056
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0199 11.8629 0.3033
[INFO] simulating digital twin on i 93, mission_id: 1056
[INFO] digital twin degradation parameters: 0.0199 11.8629 0.3033
[INFO] DigitalTwin mean parameter values: R0 = 0.01998 Q = 12.04 Req = 0.30412
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 93 mission_id: 1056
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.29
[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: 1057 rul_hat: 15.29 flight_time: 13.94 distance: 1047.66 R0: 0.01800 Q: 12.88 Req: 0.28698
[INFO] success on i: 94 mission_id: 1057
[INFO] forecasting degradation values: r_mu: 0.021026 q_mu: 12.174283 m_mu: 0.299594
[INFO] digital twin degradation parameters: 0.0211 12.1006 0.2978
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.29
[INFO] simulating digital twin on i 94, mission_id: 1057
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0210 11.9564 0.3052
[INFO] simulating digital twin on i 94, mission_id: 1057
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0211 12.3459 0.3023
[INFO] simulating digital twin on i 94, mission_id: 1057
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0211 12.3478 0.3016
[INFO] simulating digital twin on i 94, mission_id: 1057
[INFO] digital twin degradation parameters: 0.0211 12.3478 0.3016
[INFO] DigitalTwin mean parameter values: R0 = 0.02107 Q = 12.19 Req = 0.30170
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 94 mission_id: 1057
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.29
[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: 1058 rul_hat: 15.29 flight_time: 13.94 distance: 1047.76 R0: 0.01912 Q: 12.44 Req: 0.29886
[INFO] success on i: 95 mission_id: 1058
[INFO] forecasting degradation values: r_mu: 0.021923 q_mu: 12.167126 m_mu: 0.290228
[INFO] digital twin degradation parameters: 0.0220 11.9858 0.2902
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.29
[INFO] simulating digital twin on i 95, mission_id: 1058
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0220 12.4407 0.2933
[INFO] simulating digital twin on i 95, mission_id: 1058
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0220 12.1435 0.2908
[INFO] simulating digital twin on i 95, mission_id: 1058
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0219 12.2640 0.3056
[INFO] simulating digital twin on i 95, mission_id: 1058
[INFO] digital twin degradation parameters: 0.0219 12.2640 0.3056
[INFO] DigitalTwin mean parameter values: R0 = 0.02196 Q = 12.21 Req = 0.29499
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 95 mission_id: 1058
trajectory <9> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.29
[INFO] simulating true system on i: 96
[INFO] updating degradation parameter variance on i: 96

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[INFO] updating degradation parameter values via random sampling on i: 96
[INFO] i: 96 mission_id: 1059 rul_hat: 15.29 flight_time: 13.47 distance: 994.87 R0: 0.01999 Q: 12.56 Req: 0.30391
[INFO] success on i: 96 mission_id: 1059
[INFO] forecasting degradation values: r_mu: 0.022982 q_mu: 12.027879 m_mu: 0.298556
[INFO] digital twin degradation parameters: 0.0228 12.3099 0.2943
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.29
[INFO] simulating digital twin on i 96, mission_id: 1059
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0230 11.8486 0.3006
[INFO] simulating digital twin on i 96, mission_id: 1059
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0231 12.1985 0.3055
[INFO] simulating digital twin on i 96, mission_id: 1059
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0228 12.0327 0.2918
[INFO] simulating digital twin on i 96, mission_id: 1059
[INFO] digital twin degradation parameters: 0.0228 12.0327 0.2918
[INFO] DigitalTwin mean parameter values: R0 = 0.02294 Q = 12.10 Req = 0.29808
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 96 mission_id: 1059
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.29
[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: 1060 rul_hat: 15.29 flight_time: 13.32 distance: 985.54 R0: 0.02097 Q: 12.67 Req: 0.29669
[WARN] true system position error threshold exceeded on i: 97 mission_id: 1060
[INFO] forecasting degradation values: r_mu: 0.024192 q_mu: 12.108549 m_mu: 0.301780
[INFO] digital twin degradation parameters: 0.0243 11.9898 0.3049
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.29
[INFO] simulating digital twin on i 97, mission_id: 1060
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0241 11.7458 0.3094
[INFO] simulating digital twin on i 97, mission_id: 1060
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0239 11.7860 0.2919
[INFO] simulating digital twin on i 97, mission_id: 1060
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0241 11.4106 0.3048
[INFO] simulating digital twin on i 97, mission_id: 1060
[INFO] digital twin degradation parameters: 0.0241 11.4106 0.3048
[INFO] DigitalTwin mean parameter values: R0 = 0.02411 Q = 11.73 Req = 0.30273
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 97 mission_id: 1060
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.29
[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: 1061 rul_hat: 15.29 flight_time: 14.83 distance: 1083.77 R0: 0.02199 Q: 12.23 Req: 0.29495
[INFO] success on i: 98 mission_id: 1061
[INFO] forecasting degradation values: r_mu: 0.025387 q_mu: 12.181926 m_mu: 0.297386
[INFO] digital twin degradation parameters: 0.0253 12.1123 0.2873
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.29
[INFO] simulating digital twin on i 98, mission_id: 1061
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0254 12.3450 0.2991
[INFO] simulating digital twin on i 98, mission_id: 1061
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0254 12.1896 0.2967
[INFO] simulating digital twin on i 98, mission_id: 1061
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0253 12.4598 0.3034
[INFO] simulating digital twin on i 98, mission_id: 1061
[INFO] digital twin degradation parameters: 0.0253 12.4598 0.3034

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[INFO] DigitalTwin mean parameter values: R0 = 0.02532 Q = 12.28 Req = 0.29663
      stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 98 mission_id: 1061
      trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.29
[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: 1062 rul_hat: 15.29 flight_time: 13.94 distance: 1047.79 R0: 0.02276 Q: 12.19 Req: 0.29652
[INFO] success on i: 99 mission_id: 1062
[INFO] forecasting degradation values: r_mu: 0.026473 q_mu: 12.000640 m_mu: 0.299086
[INFO] digital twin degradation parameters: 0.0265 11.9345 0.2950
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.29
[INFO] simulating digital twin on i 99, mission_id: 1062
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0265 11.6026 0.2868
[INFO] simulating digital twin on i 99, mission_id: 1062
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0265 11.7552 0.3067
[INFO] simulating digital twin on i 99, mission_id: 1062
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0266 11.8476 0.2943
[INFO] simulating digital twin on i 99, mission_id: 1062
[INFO] digital twin degradation parameters: 0.0266 11.8476 0.2943
[INFO] DigitalTwin mean parameter values: R0 = 0.02652 Q = 11.78 Req = 0.29571
      stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 99 mission_id: 1062
      trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.29
[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: 1063 rul_hat: 15.29 flight_time: 14.83 distance: 1083.97 R0: 0.02360 Q: 12.32 Req: 0.31024
[INFO] success on i: 100 mission_id: 1063
[INFO] forecasting degradation values: r_mu: 0.027502 q_mu: 12.147224 m_mu: 0.300420
[INFO] digital twin degradation parameters: 0.0275 12.4486 0.3066
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 to explore constraint boundary < 15.29
[INFO] simulating digital twin on i 100, mission_id: 1063
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0275 12.5662 0.2967
[INFO] simulating digital twin on i 100, mission_id: 1063
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0273 12.1689 0.3029
[INFO] simulating digital twin on i 100, mission_id: 1063
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0275 12.0596 0.2936
[INFO] simulating digital twin on i 100, mission_id: 1063
[INFO] digital twin degradation parameters: 0.0275 12.0596 0.2936
[INFO] DigitalTwin mean parameter values: R0 = 0.02743 Q = 12.31 Req = 0.29997
      stop code counts: low_soc: 2 pos_err: 0 success: 2
[WARN] DigitalTwin low soc threshold exceeded on i: 100 mission_id: 1063
[INFO] updating RUL from 15.29 to 15.32
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.32
[INFO] simulating digital twin on i 100, mission_id: 1063
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0274 12.2477 0.3046
[INFO] simulating digital twin on i 100, mission_id: 1063
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0274 12.2035 0.2980
[INFO] simulating digital twin on i 100, mission_id: 1063
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0277 12.1870 0.2948

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[INFO] simulating digital twin on i 100, mission_id: 1063
[INFO] digital twin degradation parameters: 0.0277 12.1870 0.2948
[INFO] DigitalTwin mean parameter values: R0 = 0.02749 Q = 12.17 Req = 0.29775
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 100 mission_id: 1063
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.32
[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: 1064 rul_hat: 15.32 flight_time: 14.83 distance: 1084.18 R0: 0.02478 Q: 12.47 Req: 0.31476
[INFO] success on i: 101 mission_id: 1064
[INFO] forecasting degradation values: r_mu: 0.028572 q_mu: 12.140003 m_mu: 0.307345
[INFO] digital twin degradation parameters: 0.0286 12.2829 0.3133
[INFO] DigitalTwin selecting trajectory: <11> with path_time: 16.38 to explore constraint boundary < 15.32
[INFO] simulating digital twin on i 101, mission_id: 1064
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0286 11.9755 0.3109
[INFO] simulating digital twin on i 101, mission_id: 1064
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0287 12.1345 0.3126
[INFO] simulating digital twin on i 101, mission_id: 1064
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0285 12.1798 0.3065
[INFO] simulating digital twin on i 101, mission_id: 1064
[INFO] digital twin degradation parameters: 0.0285 12.1798 0.3065
[INFO] DigitalTwin mean parameter values: R0 = 0.02859 Q = 12.14 Req = 0.31083
stop code counts: low_soc: 2 pos_err: 0 success: 2
[WARN] DigitalTwin low soc threshold exceeded on i: 101 mission_id: 1064
[INFO] updating RUL from 15.32 to 15.30
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 101, mission_id: 1064
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0286 12.0547 0.3042
[INFO] simulating digital twin on i 101, mission_id: 1064
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0286 11.9354 0.3005
[INFO] simulating digital twin on i 101, mission_id: 1064
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0285 12.5398 0.3054
[INFO] simulating digital twin on i 101, mission_id: 1064
[INFO] digital twin degradation parameters: 0.0285 12.5398 0.3054
[INFO] DigitalTwin mean parameter values: R0 = 0.02858 Q = 12.18 Req = 0.30414
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 101 mission_id: 1064
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.30
[INFO] simulating true system on i: 102
Bumping sigmax
[INFO] updating degradation parameter variance on i: 102
[INFO] updating degradation parameter values via random sampling on i: 102
[INFO] i: 102 mission_id: 1065 rul_hat: 15.30 flight_time: 14.83 distance: 1084.01 R0: 0.02541 Q: 12.16 Req: 0.29496
[INFO] success on i: 102 mission_id: 1065
[INFO] forecasting degradation values: r_mu: 0.029845 q_mu: 12.094384 m_mu: 0.318659
[INFO] digital twin degradation parameters: 0.0298 12.5178 0.3170
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 102, mission_id: 1065
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0299 11.9893 0.3236
[INFO] simulating digital twin on i 102, mission_id: 1065
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0298 11.5730 0.3165
[INFO] simulating digital twin on i 102, mission_id: 1065

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[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0299 12.3510 0.3251
[INFO] simulating digital twin on i 102, mission_id: 1065
[INFO] digital twin degradation parameters: 0.0299 12.3510 0.3251
[INFO] DigitalTwin mean parameter values: R0 = 0.02987 Q = 12.11 Req = 0.32053
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 102 mission_id: 1065
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.30
[INFO] simulating true system on i: 103
Bumping sigmax
[INFO] updating degradation parameter variance on i: 103
[INFO] updating degradation parameter values via random sampling on i: 103
[INFO] i: 103 mission_id: 1066 rul_hat: 15.30 flight_time: 14.83 distance: 1083.80 R0: 0.02674 Q: 12.53 Req: 0.31564
[INFO] success on i: 103 mission_id: 1066
[INFO] forecasting degradation values: r_mu: 0.030616 q_mu: 11.996135 m_mu: 0.310098
[INFO] digital twin degradation parameters: 0.0308 12.0400 0.3077
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 103, mission_id: 1066
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0307 11.9342 0.3177
[INFO] simulating digital twin on i 103, mission_id: 1066
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0305 11.8798 0.3082
[INFO] simulating digital twin on i 103, mission_id: 1066
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0305 12.2136 0.3092
[INFO] simulating digital twin on i 103, mission_id: 1066
[INFO] digital twin degradation parameters: 0.0305 12.2136 0.3092
[INFO] DigitalTwin mean parameter values: R0 = 0.03065 Q = 12.02 Req = 0.31068
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 103 mission_id: 1066
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.30
[INFO] simulating true system on i: 104
Bumping sigmax
[INFO] updating degradation parameter variance on i: 104
[INFO] updating degradation parameter values via random sampling on i: 104
[INFO] i: 104 mission_id: 1067 rul_hat: 15.30 flight_time: 13.27 distance: 977.23 R0: 0.02784 Q: 12.21 Req: 0.31647
[WARN] true system position error threshold exceeded on i: 104 mission_id: 1067
[INFO] forecasting degradation values: r_mu: 0.032136 q_mu: 12.130364 m_mu: 0.331212
[INFO] digital twin degradation parameters: 0.0319 12.2208 0.3326
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 104, mission_id: 1067
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0323 12.6035 0.3281
[INFO] simulating digital twin on i 104, mission_id: 1067
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0320 12.3449 0.3271
[INFO] simulating digital twin on i 104, mission_id: 1067
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0321 11.9876 0.3317
[INFO] simulating digital twin on i 104, mission_id: 1067
[INFO] digital twin degradation parameters: 0.0321 11.9876 0.3317
[INFO] DigitalTwin mean parameter values: R0 = 0.03209 Q = 12.29 Req = 0.32990
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 104 mission_id: 1067
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.30
[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: 1068 rul_hat: 15.30 flight_time: 14.83 distance: 1084.10 R0: 0.02871 Q: 12.35 Req: 0.30879
[INFO] success on i: 105 mission_id: 1068

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[INFO] forecasting degradation values: r_mu: 0.033322 q_mu: 11.871821 m_mu: 0.334642
[INFO] digital twin degradation parameters: 0.0332 11.6601 0.3361
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 105, mission_id: 1068
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0332 11.7898 0.3371
[INFO] simulating digital twin on i 105, mission_id: 1068
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0336 11.8708 0.3293
[INFO] simulating digital twin on i 105, mission_id: 1068
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0333 11.9864 0.3398
[INFO] simulating digital twin on i 105, mission_id: 1068
[INFO] digital twin degradation parameters: 0.0333 11.9864 0.3398
[INFO] DigitalTwin mean parameter values: R0 = 0.03331 Q = 11.83 Req = 0.33556
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 105 mission_id: 1068
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.30
[INFO] simulating true system on i: 106
Bumping sigma_max
[INFO] updating degradation parameter variance on i: 106
[INFO] updating degradation parameter values via random sampling on i: 106
[INFO] i: 106 mission_id: 1069 rul_hat: 15.30 flight_time: 14.83 distance: 1084.25 R0: 0.02966 Q: 12.12 Req: 0.31502
[INFO] success on i: 106 mission_id: 1069
[INFO] forecasting degradation values: r_mu: 0.034456 q_mu: 12.013172 m_mu: 0.330642
[INFO] digital twin degradation parameters: 0.0345 12.0333 0.3290
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 106, mission_id: 1069
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0344 12.0014 0.3255
[INFO] simulating digital twin on i 106, mission_id: 1069
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0345 12.0755 0.3328
[INFO] simulating digital twin on i 106, mission_id: 1069
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0345 11.8276 0.3302
[INFO] simulating digital twin on i 106, mission_id: 1069
[INFO] digital twin degradation parameters: 0.0345 11.8276 0.3302
[INFO] DigitalTwin mean parameter values: R0 = 0.03446 Q = 11.98 Req = 0.32938
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 106 mission_id: 1069
trajectory <9> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.30
[INFO] simulating true system on i: 107
Bumping sigma_max
[INFO] updating degradation parameter variance on i: 107
[INFO] updating degradation parameter values via random sampling on i: 107
[INFO] i: 107 mission_id: 1070 rul_hat: 15.30 flight_time: 13.47 distance: 994.79 R0: 0.03068 Q: 11.99 Req: 0.32161
[INFO] success on i: 107 mission_id: 1070
[INFO] forecasting degradation values: r_mu: 0.035413 q_mu: 12.069993 m_mu: 0.328547
[INFO] digital twin degradation parameters: 0.0356 12.2869 0.3307
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 107, mission_id: 1070
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0355 12.3714 0.3234
[INFO] simulating digital twin on i 107, mission_id: 1070
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0354 12.0632 0.3258
[INFO] simulating digital twin on i 107, mission_id: 1070
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0353 12.3880 0.3319
[INFO] simulating digital twin on i 107, mission_id: 1070
[INFO] digital twin degradation parameters: 0.0353 12.3880 0.3319
[INFO] DigitalTwin mean parameter values: R0 = 0.03545 Q = 12.28 Req = 0.32796

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stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 107 mission_id: 1070
trajectory <9> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.30
[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: 1071 rul_hat: 15.30 flight_time: 13.47 distance: 994.89 R0: 0.03180 Q: 11.76 Req: 0.31321
[INFO] success on i: 108 mission_id: 1071
[INFO] forecasting degradation values: r_mu: 0.036491 q_mu: 11.897568 m_mu: 0.332416
[INFO] digital twin degradation parameters: 0.0364 11.5980 0.3312
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 108, mission_id: 1071
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0367 11.4723 0.3366
[INFO] simulating digital twin on i 108, mission_id: 1071
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0365 11.6869 0.3372
[INFO] simulating digital twin on i 108, mission_id: 1071
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0364 11.4270 0.3268
[INFO] simulating digital twin on i 108, mission_id: 1071
[INFO] digital twin degradation parameters: 0.0364 11.4270 0.3268
[INFO] DigitalTwin mean parameter values: R0 = 0.03652 Q = 11.55 Req = 0.33295
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 108 mission_id: 1071
trajectory <9> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.30
[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: 1072 rul_hat: 15.30 flight_time: 13.47 distance: 994.82 R0: 0.03319 Q: 12.08 Req: 0.31710
[INFO] success on i: 109 mission_id: 1072
[INFO] forecasting degradation values: r_mu: 0.037583 q_mu: 11.700598 m_mu: 0.331268
[INFO] digital twin degradation parameters: 0.0376 12.0157 0.3212
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 109, mission_id: 1072
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0376 11.9674 0.3279
[INFO] simulating digital twin on i 109, mission_id: 1072
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0376 11.2229 0.3267
[INFO] simulating digital twin on i 109, mission_id: 1072
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0377 11.2647 0.3383
[INFO] simulating digital twin on i 109, mission_id: 1072
[INFO] digital twin degradation parameters: 0.0377 11.2647 0.3383
[INFO] DigitalTwin mean parameter values: R0 = 0.03762 Q = 11.62 Req = 0.32854
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 109 mission_id: 1072
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.30
[INFO] simulating true system on i: 110
Bumping sigmax
[INFO] updating degradation parameter variance on i: 110
[INFO] updating degradation parameter values via random sampling on i: 110
[INFO] i: 110 mission_id: 1073 rul_hat: 15.30 flight_time: 14.83 distance: 1084.04 R0: 0.03434 Q: 12.00 Req: 0.30721
[INFO] success on i: 110 mission_id: 1073
[INFO] forecasting degradation values: r_mu: 0.038899 q_mu: 11.849104 m_mu: 0.329974
[INFO] digital twin degradation parameters: 0.0390 11.8488 0.3362
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 110, mission_id: 1073
[INFO] resampling for twin run # 2

```

```

[INFO] digital twin degradation parameters: 0.0388 12.3428 0.3283
[INFO] simulating digital twin on i 110, mission_id: 1073
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0387 12.0862 0.3301
[INFO] simulating digital twin on i 110, mission_id: 1073
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0389 11.9783 0.3344
[INFO] simulating digital twin on i 110, mission_id: 1073
[INFO] digital twin degradation parameters: 0.0389 11.9783 0.3344
[INFO] DigitalTwin mean parameter values: R0 = 0.03885 Q = 12.06 Req = 0.33227
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 110 mission_id: 1073
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.30
[INFO] simulating true system on i: 111
Bumping sigma_max
[INFO] updating degradation parameter variance on i: 111
[INFO] updating degradation parameter values via random sampling on i: 111
[INFO] i: 111 mission_id: 1074 rul_hat: 15.30 flight_time: 13.94 distance: 1047.95 R0: 0.03557 Q: 11.84 Req: 0.31257
[INFO] success on i: 111 mission_id: 1074
[INFO] forecasting degradation values: r_mu: 0.040261 q_mu: 11.756033 m_mu: 0.321853
[INFO] digital twin degradation parameters: 0.0402 11.8749 0.3255
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 111, mission_id: 1074
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0403 11.6970 0.3139
[INFO] simulating digital twin on i 111, mission_id: 1074
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0402 11.7386 0.3224
[INFO] simulating digital twin on i 111, mission_id: 1074
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0402 11.9876 0.3297
[INFO] simulating digital twin on i 111, mission_id: 1074
[INFO] digital twin degradation parameters: 0.0402 11.9876 0.3297
[INFO] DigitalTwin mean parameter values: R0 = 0.04023 Q = 11.82 Req = 0.32286
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 111 mission_id: 1074
trajectory <9> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.30
[INFO] simulating true system on i: 112
Bumping sigma_max
[INFO] updating degradation parameter variance on i: 112
[INFO] updating degradation parameter values via random sampling on i: 112
[INFO] i: 112 mission_id: 1075 rul_hat: 15.30 flight_time: 13.47 distance: 994.79 R0: 0.03713 Q: 11.71 Req: 0.31683
[INFO] success on i: 112 mission_id: 1075
[INFO] forecasting degradation values: r_mu: 0.041666 q_mu: 11.556600 m_mu: 0.315086
[INFO] digital twin degradation parameters: 0.0417 11.4012 0.3150
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 112, mission_id: 1075
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0418 11.5098 0.3114
[INFO] simulating digital twin on i 112, mission_id: 1075
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0418 11.7749 0.3125
[INFO] simulating digital twin on i 112, mission_id: 1075
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0416 11.9093 0.3152
[INFO] simulating digital twin on i 112, mission_id: 1075
[INFO] digital twin degradation parameters: 0.0416 11.9093 0.3152
[INFO] DigitalTwin mean parameter values: R0 = 0.04173 Q = 11.65 Req = 0.31354
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 112 mission_id: 1075
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.30
[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: 1076 rul_hat: 15.30 flight_time: 13.27 distance: 977.10 R0: 0.03836 Q: 11.80 Req: 0.31304
[WARN] true system position error threshold exceeded on i: 113 mission_id: 1076
[INFO] forecasting degradation values: r_mu: 0.043203 q_mu: 11.383587 m_mu: 0.313585
[INFO] digital twin degradation parameters: 0.0433 11.9719 0.3011
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 113, mission_id: 1076
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0431 11.4060 0.3144
[INFO] simulating digital twin on i 113, mission_id: 1076
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0431 11.5602 0.3197
[INFO] simulating digital twin on i 113, mission_id: 1076
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0432 11.4760 0.3109
[INFO] simulating digital twin on i 113, mission_id: 1076
[INFO] digital twin degradation parameters: 0.0432 11.4760 0.3109
[INFO] DigitalTwin mean parameter values: R0 = 0.04320 Q = 11.60 Req = 0.31152
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 113 mission_id: 1076
trajectory <14> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.30
[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: 1077 rul_hat: 15.30 flight_time: 14.83 distance: 1084.05 R0: 0.03940 Q: 11.63 Req: 0.31944
[INFO] success on i: 114 mission_id: 1077
[INFO] forecasting degradation values: r_mu: 0.044911 q_mu: 11.442146 m_mu: 0.320463
[INFO] digital twin degradation parameters: 0.0450 11.3678 0.3195
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 114, mission_id: 1077
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0448 11.5627 0.3133
[INFO] simulating digital twin on i 114, mission_id: 1077
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0449 11.0900 0.3270
[INFO] simulating digital twin on i 114, mission_id: 1077
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0449 11.5619 0.3191
[INFO] simulating digital twin on i 114, mission_id: 1077
[INFO] digital twin degradation parameters: 0.0449 11.5619 0.3191
[INFO] DigitalTwin mean parameter values: R0 = 0.04490 Q = 11.40 Req = 0.31972
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 114 mission_id: 1077
trajectory <13> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.30
[INFO] simulating true system on i: 115
```

Bumping sigmax

```
[INFO] updating degradation parameter variance on i: 115
[INFO] updating degradation parameter values via random sampling on i: 115
[INFO] i: 115 mission_id: 1078 rul_hat: 15.30 flight_time: 13.93 distance: 1047.81 R0: 0.04085 Q: 11.50 Req: 0.32405
[INFO] success on i: 115 mission_id: 1078
[INFO] forecasting degradation values: r_mu: 0.046235 q_mu: 11.220733 m_mu: 0.315451
[INFO] digital twin degradation parameters: 0.0463 11.0893 0.3176
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 115, mission_id: 1078
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0461 10.8246 0.3170
[INFO] simulating digital twin on i 115, mission_id: 1078
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0461 11.0734 0.3171
[INFO] simulating digital twin on i 115, mission_id: 1078
```

```

[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0461 11.4887 0.3176
[INFO] simulating digital twin on i 115, mission_id: 1078
[INFO] digital twin degradation parameters: 0.0461 11.4887 0.3176
[INFO] DigitalTwin mean parameter values: R0 = 0.04618 Q = 11.12 Req = 0.31732
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 115 mission_id: 1078
trajectory <9> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.30
[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: 1079 rul_hat: 15.30 flight_time: 13.47 distance: 994.92 R0: 0.04242 Q: 11.47 Req: 0.32393
[INFO] success on i: 116 mission_id: 1079
[INFO] forecasting degradation values: r_mu: 0.047858 q_mu: 11.189974 m_mu: 0.321054
[INFO] digital twin degradation parameters: 0.0477 11.2502 0.3267
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 116, mission_id: 1079
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0480 10.9938 0.3155
[INFO] simulating digital twin on i 116, mission_id: 1079
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0480 11.1841 0.3156
[INFO] simulating digital twin on i 116, mission_id: 1079
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0478 11.2765 0.3223
[INFO] simulating digital twin on i 116, mission_id: 1079
[INFO] digital twin degradation parameters: 0.0478 11.2765 0.3223
[INFO] DigitalTwin mean parameter values: R0 = 0.04787 Q = 11.18 Req = 0.32000
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 116 mission_id: 1079
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.30
[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: 1080 rul_hat: 15.30 flight_time: 13.25 distance: 974.39 R0: 0.04329 Q: 11.55 Req: 0.32326
[WARN] true system position error threshold exceeded on i: 117 mission_id: 1080
[INFO] forecasting degradation values: r_mu: 0.049603 q_mu: 11.033312 m_mu: 0.326259
[INFO] digital twin degradation parameters: 0.0495 10.9534 0.3226
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.30
[INFO] simulating digital twin on i 117, mission_id: 1080
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0498 10.8909 0.3262
[INFO] simulating digital twin on i 117, mission_id: 1080
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0497 11.2178 0.3246
[INFO] simulating digital twin on i 117, mission_id: 1080
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0497 10.7384 0.3332
[INFO] simulating digital twin on i 117, mission_id: 1080
[INFO] digital twin degradation parameters: 0.0497 10.7384 0.3332
[INFO] DigitalTwin mean parameter values: R0 = 0.04967 Q = 10.95 Req = 0.32665
stop code counts: low_soc: 3 pos_err: 0 success: 1
[WARN] DigitalTwin low soc threshold exceeded on i: 117 mission_id: 1080
[INFO] updating RUL from 15.30 to 13.68
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 to explore constraint boundary < 13.68
[INFO] simulating digital twin on i 117, mission_id: 1080
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0496 11.2782 0.3246
[INFO] simulating digital twin on i 117, mission_id: 1080
[INFO] resampling for twin run # 3

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[INFO] digital twin degradation parameters: 0.0497 11.2051 0.3281
[INFO] simulating digital twin on i 117, mission_id: 1080
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0495 10.9494 0.3164
[INFO] simulating digital twin on i 117, mission_id: 1080
[INFO] digital twin degradation parameters: 0.0495 10.9494 0.3164
[INFO] DigitalTwin mean parameter values: R0 = 0.04961 Q = 11.04 Req = 0.32557
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 117 mission_id: 1080
trajectory <13> selected for TrueSystem
[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: 1081 rul_hat: 13.68 flight_time: 13.25 distance: 974.42 R0: 0.04494 Q: 11.53 Req: 0.32567
[WARN] true system position error threshold exceeded on i: 118 mission_id: 1081
[INFO] forecasting degradation values: r_mu: 0.050871 q_mu: 11.103444 m_mu: 0.326386
[INFO] digital twin degradation parameters: 0.0509 11.1135 0.3315
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 to explore constraint boundary < 13.68
[INFO] simulating digital twin on i 118, mission_id: 1081
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0510 10.9210 0.3343
[INFO] simulating digital twin on i 118, mission_id: 1081
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0508 10.9116 0.3291
[INFO] simulating digital twin on i 118, mission_id: 1081
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0509 10.7068 0.3318
[INFO] simulating digital twin on i 118, mission_id: 1081
[INFO] digital twin degradation parameters: 0.0509 10.7068 0.3318
[INFO] DigitalTwin mean parameter values: R0 = 0.05087 Q = 10.91 Req = 0.33165
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 118 mission_id: 1081
trajectory <13> selected for TrueSystem
[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: 1082 rul_hat: 13.68 flight_time: 13.29 distance: 994.75 R0: 0.04665 Q: 11.55 Req: 0.31685
[INFO] success on i: 119 mission_id: 1082
[INFO] forecasting degradation values: r_mu: 0.052603 q_mu: 11.098407 m_mu: 0.327338
[INFO] digital twin degradation parameters: 0.0528 11.6913 0.3254
[INFO] DigitalTwin selecting trajectory: <5> with path_time: 13.30 that meets constraint: path_time < 13.68
[INFO] simulating digital twin on i 119, mission_id: 1082
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0525 11.1368 0.3267
[INFO] simulating digital twin on i 119, mission_id: 1082
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0527 10.6062 0.3280
[INFO] simulating digital twin on i 119, mission_id: 1082
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0526 10.6556 0.3265
[INFO] simulating digital twin on i 119, mission_id: 1082
[INFO] digital twin degradation parameters: 0.0526 10.6556 0.3265
[INFO] DigitalTwin mean parameter values: R0 = 0.05265 Q = 11.02 Req = 0.32665
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 119 mission_id: 1082
trajectory <5> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <5> with path_time: 13.30 that meets constraint: path_time < 13.68
[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: 1083 rul_hat: 13.68 flight_time: 13.30 distance: 994.82 R0: 0.04784 Q: 11.00 Req: 0.32221
[INFO] success on i: 120 mission_id: 1083

```

```

[INFO] forecasting degradation values: r_mu: 0.054253 q_mu: 11.236175 m_mu: 0.329003
[INFO] digital twin degradation parameters: 0.0543 11.1055 0.3369
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 13.68
[INFO] simulating digital twin on i 120, mission_id: 1083
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0543 11.5184 0.3302
[INFO] simulating digital twin on i 120, mission_id: 1083
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0543 11.3970 0.3327
[INFO] simulating digital twin on i 120, mission_id: 1083
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0541 11.0670 0.3272
[INFO] simulating digital twin on i 120, mission_id: 1083
[INFO] digital twin degradation parameters: 0.0541 11.0670 0.3272
[INFO] DigitalTwin mean parameter values: R0 = 0.05425 Q = 11.27 Req = 0.33176
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 120 mission_id: 1083
trajectory <10> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 13.68
[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: 1084 rul_hat: 13.68 flight_time: 13.25 distance: 974.40 R0: 0.04941 Q: 10.91 Req: 0.32661
[WARN] true system position error threshold exceeded on i: 121 mission_id: 1084
[INFO] forecasting degradation values: r_mu: 0.055691 q_mu: 10.701555 m_mu: 0.330082
[INFO] digital twin degradation parameters: 0.0557 10.9327 0.3319
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 13.68
[INFO] simulating digital twin on i 121, mission_id: 1084
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0556 10.9183 0.3225
[INFO] simulating digital twin on i 121, mission_id: 1084
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0558 10.8261 0.3339
[INFO] simulating digital twin on i 121, mission_id: 1084
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0556 10.7508 0.3299
[INFO] simulating digital twin on i 121, mission_id: 1084
[INFO] digital twin degradation parameters: 0.0556 10.7508 0.3299
[INFO] DigitalTwin mean parameter values: R0 = 0.05569 Q = 10.86 Req = 0.32956
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 121 mission_id: 1084
trajectory <9> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 13.68
[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: 1085 rul_hat: 13.68 flight_time: 13.47 distance: 994.91 R0: 0.05128 Q: 11.26 Req: 0.32816
[INFO] success on i: 122 mission_id: 1085
[INFO] forecasting degradation values: r_mu: 0.057335 q_mu: 10.551266 m_mu: 0.337532
[INFO] digital twin degradation parameters: 0.0573 10.8613 0.3287
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 13.68
[INFO] simulating digital twin on i 122, mission_id: 1085
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0573 10.3853 0.3399
[INFO] simulating digital twin on i 122, mission_id: 1085
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0572 10.5685 0.3354
[INFO] simulating digital twin on i 122, mission_id: 1085
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0573 11.0344 0.3348
[INFO] simulating digital twin on i 122, mission_id: 1085
[INFO] digital twin degradation parameters: 0.0573 11.0344 0.3348
[INFO] DigitalTwin mean parameter values: R0 = 0.05727 Q = 10.71 Req = 0.33472

```



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stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 122 mission_id: 1085
trajectory <9> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 13.68
[INFO] simulating true system on i: 123
Bumping sigma_x
[INFO] updating degradation parameter variance on i: 123
[INFO] updating degradation parameter values via random sampling on i: 123
[INFO] i: 123 mission_id: 1086 rul_hat: 13.68 flight_time: 13.47 distance: 994.93 R0: 0.05279 Q: 11.09 Req: 0.32723
[INFO] success on i: 123 mission_id: 1086
[INFO] forecasting degradation values: r_mu: 0.059170 q_mu: 10.717798 m_mu: 0.334785
[INFO] digital twin degradation parameters: 0.0590 10.9730 0.3356
[INFO] DigitalTwin selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 13.68
[INFO] simulating digital twin on i 123, mission_id: 1086
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0592 10.7272 0.3342
[INFO] simulating digital twin on i 123, mission_id: 1086
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0594 10.4411 0.3320
[INFO] simulating digital twin on i 123, mission_id: 1086
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0592 11.1813 0.3361
[INFO] simulating digital twin on i 123, mission_id: 1086
[INFO] digital twin degradation parameters: 0.0592 11.1813 0.3361
[INFO] DigitalTwin mean parameter values: R0 = 0.05918 Q = 10.83 Req = 0.33446
stop code counts: low_soc: 0 pos_err: 1 success: 3
[WARN] DigitalTwin pos err threshold exceeded once, adjusting rul_hat
[INFO] digital twin mission success on i: 123 mission_id: 1086
trajectory <10> selected for TrueSystem
[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: 1087 rul_hat: 13.18 flight_time: 6.37 distance: 481.32 R0: 0.05476 Q: 11.34 Req: 0.33967
[INFO] success on i: 124 mission_id: 1087
[INFO] forecasting degradation values: r_mu: 0.060941 q_mu: 10.492318 m_mu: 0.333084
[INFO] digital twin degradation parameters: 0.0610 10.4198 0.3340
[INFO] DigitalTwin selecting trajectory: <4> with path_time: 12.49 that meets constraint: path_time < 13.18
[INFO] simulating digital twin on i 124, mission_id: 1087
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0609 10.5343 0.3313
[INFO] simulating digital twin on i 124, mission_id: 1087
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0609 10.8014 0.3335
[INFO] simulating digital twin on i 124, mission_id: 1087
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0609 10.3270 0.3303
[INFO] simulating digital twin on i 124, mission_id: 1087
[INFO] digital twin degradation parameters: 0.0609 10.3270 0.3303
[INFO] DigitalTwin mean parameter values: R0 = 0.06094 Q = 10.52 Req = 0.33227
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 124 mission_id: 1087
trajectory <4> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <4> with path_time: 12.49 that meets constraint: path_time < 13.18
[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: 1088 rul_hat: 13.18 flight_time: 12.46 distance: 929.14 R0: 0.05673 Q: 10.99 Req: 0.33131
[INFO] success on i: 125 mission_id: 1088
[INFO] forecasting degradation values: r_mu: 0.063080 q_mu: 10.618257 m_mu: 0.343912
[INFO] digital twin degradation parameters: 0.0632 10.9574 0.3379
[INFO] DigitalTwin selecting trajectory: <14> with path_time: 14.81 to explore constraint boundary < 13.18
[INFO] simulating digital twin on i 125, mission_id: 1088
[INFO] resampling for twin run # 2

```

```

[INFO] digital twin degradation parameters: 0.0633 10.6681 0.3417
[INFO] simulating digital twin on i 125, mission_id: 1088
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0629 10.5188 0.3516
[INFO] simulating digital twin on i 125, mission_id: 1088
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0630 10.5056 0.3373
[INFO] simulating digital twin on i 125, mission_id: 1088
[INFO] digital twin degradation parameters: 0.0630 10.5056 0.3373
[INFO] DigitalTwin mean parameter values: R0 = 0.06312 Q = 10.66 Req = 0.34215
stop code counts: low_soc: 3 pos_err: 0 success: 1
[WARN] DigitalTwin low_soc threshold exceeded on i: 125 mission_id: 1088
[INFO] updating RUL from 13.18 to 13.49
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 13.49
[INFO] simulating digital twin on i 125, mission_id: 1088
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0631 10.1027 0.3472
[INFO] simulating digital twin on i 125, mission_id: 1088
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0630 10.8193 0.3439
[INFO] simulating digital twin on i 125, mission_id: 1088
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0630 10.7439 0.3464
[INFO] simulating digital twin on i 125, mission_id: 1088
[INFO] digital twin degradation parameters: 0.0630 10.7439 0.3464
[INFO] DigitalTwin mean parameter values: R0 = 0.06306 Q = 10.54 Req = 0.34373
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 125 mission_id: 1088
trajectory <9> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 13.49
[INFO] simulating true system on i: 126
Bumping sigmax
[INFO] updating degradation parameter variance on i: 126
[INFO] updating degradation parameter values via random sampling on i: 126
[INFO] i: 126 mission_id: 1089 rul_hat: 13.49 flight_time: 13.47 distance: 994.80 R0: 0.05835 Q: 10.57 Req: 0.32702
[INFO] success on i: 126 mission_id: 1089
[INFO] forecasting degradation values: r_mu: 0.065381 q_mu: 10.693758 m_mu: 0.334322
[INFO] digital twin degradation parameters: 0.0653 10.5512 0.3318
[INFO] DigitalTwin selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 13.49
[INFO] simulating digital twin on i 126, mission_id: 1089
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0653 10.6345 0.3365
[INFO] simulating digital twin on i 126, mission_id: 1089
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0655 10.6025 0.3435
[INFO] simulating digital twin on i 126, mission_id: 1089
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0655 10.9987 0.3294
[INFO] simulating digital twin on i 126, mission_id: 1089
[INFO] digital twin degradation parameters: 0.0655 10.9987 0.3294
[INFO] DigitalTwin mean parameter values: R0 = 0.06539 Q = 10.70 Req = 0.33528
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 126 mission_id: 1089
trajectory <9> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 13.49
[INFO] simulating true system on i: 127
Bumping sigmax
Bumping sigmax
Bumping sigmax
Bumping sigmax
[INFO] updating degradation parameter variance on i: 127
[INFO] updating degradation parameter values via random sampling on i: 127
[INFO] i: 127 mission_id: 1090 rul_hat: 13.49 flight_time: 11.98 distance: 858.63 R0: 0.06016 Q: 10.91 Req: 0.33342
[WARN] true system position error threshold exceeded on i: 127 mission_id: 1090

```

```

[INFO] forecasting degradation values: r_mu: 0.067460 q_mu: 10.426809 m_mu: 0.330759
[INFO] digital twin degradation parameters: 0.0673 10.0553 0.3325
[INFO] DigitalTwin selecting trajectory: <13> with path_time: 13.94 to explore constraint boundary < 13.49
[INFO] simulating digital twin on i 127, mission_id: 1090
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0674 10.5780 0.3338
[INFO] simulating digital twin on i 127, mission_id: 1090
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0675 10.1638 0.3252
[INFO] simulating digital twin on i 127, mission_id: 1090
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0675 10.0063 0.3293
[INFO] simulating digital twin on i 127, mission_id: 1090
[INFO] digital twin degradation parameters: 0.0675 10.0063 0.3293
[INFO] DigitalTwin mean parameter values: R0 = 0.06741 Q = 10.20 Req = 0.33022
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 127 mission_id: 1090
trajectory <13> selected for TrueSystem
[INFO] simulating true system on i: 128
Bumping sigmax
Bumping sigmax
Bumping sigmax
Bumping sigmax
Bumping sigmax
[INFO] updating degradation parameter variance on i: 128
[INFO] updating degradation parameter values via random sampling on i: 128
[INFO] i: 128 mission_id: 1091 rul_hat: 13.49 flight_time: 9.74 distance: 654.55 R0: 0.06257 Q: 10.42 Req: 0.33462
[WARN] true system position error threshold exceeded on i: 128 mission_id: 1091
[INFO] forecasting degradation values: r_mu: 0.069591 q_mu: 10.440771 m_mu: 0.337849
[INFO] digital twin degradation parameters: 0.0695 10.8851 0.3335
[INFO] DigitalTwin selecting trajectory: <4> with path_time: 12.49 that meets constraint: path_time < 13.49
[INFO] simulating digital twin on i 128, mission_id: 1091
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0697 10.4365 0.3402
[INFO] simulating digital twin on i 128, mission_id: 1091
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0698 10.7909 0.3312
[INFO] simulating digital twin on i 128, mission_id: 1091
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0696 10.7070 0.3302
[INFO] simulating digital twin on i 128, mission_id: 1091
[INFO] digital twin degradation parameters: 0.0696 10.7070 0.3302
[INFO] DigitalTwin mean parameter values: R0 = 0.06966 Q = 10.70 Req = 0.33378
stop code counts: low_soc: 0 pos_err: 2 success: 2
[WARN] DigitalTwin position error threshold exceeded on i: 128 mission_id: 1091
[INFO] updating RUL from 13.49 to 11.49
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] DigitalTwin selecting trajectory: <16> with path_time: 6.38 that meets constraint: path_time < 10.03
[INFO] simulating digital twin on i 128, mission_id: 1091
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0696 10.5129 0.3338
[INFO] simulating digital twin on i 128, mission_id: 1091
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0694 10.1727 0.3472
[INFO] simulating digital twin on i 128, mission_id: 1091
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0696 10.2029 0.3452
[INFO] simulating digital twin on i 128, mission_id: 1091
[INFO] digital twin degradation parameters: 0.0696 10.2029 0.3452
[INFO] DigitalTwin mean parameter values: R0 = 0.06954 Q = 10.40 Req = 0.33910
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 128 mission_id: 1091
trajectory <16> selected for TrueSystem
[INFO] TrueSystem selecting trajectory: <16> with path_time: 6.38 that meets constraint: path_time < 10.03
[INFO] simulating true system on i: 129

```

```

Bumping sigmax
[INFO] updating degradation parameter variance on i: 129
[INFO] updating degradation parameter values via random sampling on i: 129
[INFO] i: 129 mission_id: 1092 rul_hat: 10.03 flight_time: 6.37 distance: 481.31 R0: 0.06426 Q: 10.48 Req: 0.33944
[INFO] success on i: 129 mission_id: 1092
[INFO] forecasting degradation values: r_mu: 0.072279 q_mu: 10.119402 m_mu: 0.340726
[INFO] digital twin degradation parameters: 0.0724 9.9260 0.3434
[INFO] DigitalTwin selecting trajectory: <16> with path_time: 6.38 that meets constraint: path_time < 10.03
[INFO] simulating digital twin on i 129, mission_id: 1092
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0724 9.8039 0.3387
[INFO] simulating digital twin on i 129, mission_id: 1092
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0724 10.0995 0.3436
[INFO] simulating digital twin on i 129, mission_id: 1092
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0725 10.0128 0.3352
[INFO] simulating digital twin on i 129, mission_id: 1092
[INFO] digital twin degradation parameters: 0.0725 10.0128 0.3352
[INFO] DigitalTwin mean parameter values: R0 = 0.07240 Q = 9.96 Req = 0.34024
stop code counts: low_soc: 0 pos_err: 4 success: 0
[WARN] DigitalTwin position error threshold exceeded on i: 129 mission_id: 1092
[INFO] updating RUL from 10.03 to 8.03
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] digital twin rul_hat: 2.59 does not meet the threshold: 10.00 on i,mission 129,1092 with fail_count 1
[INFO] DigitalTwin selecting trajectory: <7> with path_time: 0.91 that meets constraint: path_time < 2.59
[INFO] simulating digital twin on i 129, mission_id: 1092
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0722 10.1990 0.3378
[INFO] simulating digital twin on i 129, mission_id: 1092
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0721 9.8826 0.3473
[INFO] simulating digital twin on i 129, mission_id: 1092
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0722 10.0819 0.3422
[INFO] simulating digital twin on i 129, mission_id: 1092
[INFO] digital twin degradation parameters: 0.0722 10.0819 0.3422
[INFO] DigitalTwin mean parameter values: R0 = 0.07226 Q = 10.04 Req = 0.34064
stop code counts: low_soc: 0 pos_err: 0 success: 4
[INFO] digital twin mission success on i: 129 mission_id: 1092
trajectory <7> selected for TrueSystem
[INFO] digital twin rul_hat: 2.59 does not meet the threshold: 10.00 on i,mission 129,1092 with fail_count 2
[INFO] TrueSystem selecting trajectory: <7> with path_time: 0.91 that meets constraint: path_time < 2.59
[INFO] simulating true system on i: 130
Bumping sigmax
[INFO] updating degradation parameter variance on i: 130
[INFO] updating degradation parameter values via random sampling on i: 130
[INFO] i: 130 mission_id: 1093 rul_hat: 2.59 flight_time: 0.91 distance: 69.47 R0: 0.06671 Q: 10.67 Req: 0.33398
[INFO] success on i: 130 mission_id: 1093
[INFO] forecasting degradation values: r_mu: 0.074446 q_mu: 9.996620 m_mu: 0.344639
[INFO] digital twin degradation parameters: 0.0744 10.1423 0.3342
[INFO] DigitalTwin selecting trajectory: <7> with path_time: 0.91 that meets constraint: path_time < 2.59
[INFO] simulating digital twin on i 130, mission_id: 1093
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0745 10.1083 0.3383
[INFO] simulating digital twin on i 130, mission_id: 1093
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0745 10.1140 0.3387
[INFO] simulating digital twin on i 130, mission_id: 1093
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0744 10.3971 0.3422
[INFO] simulating digital twin on i 130, mission_id: 1093
[INFO] digital twin degradation parameters: 0.0744 10.3971 0.3422
[INFO] DigitalTwin mean parameter values: R0 = 0.07445 Q = 10.19 Req = 0.33834
stop code counts: low_soc: 0 pos_err: 1 success: 3

```

```

[WARN] DigitalTwin pos err threshold exceeded once, adjusting rul_hat
[INFO] digital twin mission success on i: 130 mission_id: 1093
      trajectory <7> selected for TrueSystem
[INFO] digital twin rul_hat: 2.09 does not meet the threshold: 10.00 on i,mission 130,1093 with fail_count 3
[INFO] TrueSystem selecting trajectory: <7> with path_time: 0.91 that meets constraint: path_time < 2.09
[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: 1094 rul_hat: 2.09 flight_time: 0.91 distance: 69.45 R0: 0.06896 Q: 10.55 Req: 0.33368
[INFO] success on i: 131 mission_id: 1094
[INFO] forecasting degradation values: r_mu: 0.077035 q_mu: 10.071559 m_mu: 0.345372
[INFO] digital twin degradation parameters: 0.0770 10.1741 0.3451
[INFO] DigitalTwin selecting trajectory: <7> with path_time: 0.91 that meets constraint: path_time < 2.09
[INFO] simulating digital twin on i 131, mission_id: 1094
[INFO] resampling for twin run # 2
[INFO] digital twin degradation parameters: 0.0769 9.8665 0.3403
[INFO] simulating digital twin on i 131, mission_id: 1094
[INFO] resampling for twin run # 3
[INFO] digital twin degradation parameters: 0.0770 10.5117 0.3461
[INFO] simulating digital twin on i 131, mission_id: 1094
[INFO] resampling for twin run # 4
[INFO] digital twin degradation parameters: 0.0770 10.0396 0.3466
[INFO] simulating digital twin on i 131, mission_id: 1094
[INFO] digital twin degradation parameters: 0.0770 10.0396 0.3466
[INFO] DigitalTwin mean parameter values: R0 = 0.07697 Q = 10.15 Req = 0.34452
      stop code counts: low_soc: 0 pos_err: 4 success: 0
[WARN] DigitalTwin position error threshold exceeded on i: 131 mission_id: 1094
[INFO] updating RUL from 2.09 to 0.09
[INFO] selecting new trajectory to repeat DigitalTwin simulation
[INFO] digital twin rul_hat: -0.68 does not meet the threshold: 10.00 on i,mission 131,1094 with fail_count 4
[INFO] returning empty table
[INFO] no more valid trajectories. ending simulation.
Unrecognized table variable name 'path_time'.

```

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

```

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

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

```

update rul

```

updated = false;
if low_soc > 1
    fprintf('[WARN] digital twin low soc threshold exceeded on i: %d\tmission_id: %d\n', i, mis
    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
% 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\n', i, mission_id, rul_hat, rul_threshold);
    if fail_count == 10
        fprintf('[INFO] fail_count reached limit. Stopping simulation.')
        end_sim = 1;
        %break;
    end
end
end
clear('trajectory', 'battery_actual', 'battery_observed', 'ctrl_err', 'current', 'current_rul');

```