

## MAP YOUR PRODUCT DNA

DESIGN LIMIT NATURE OF FAILURE ACTUAL LIFE

Real-time DNA Map under simultaneous stress interactions using automated stress and performance trending algorithms

### KXC INSPIRATION

#### Risk Control ...

Replicate real world complexity through controlled simultaneous stress interactions.

Replace meaningless test-to-pass with a deterministic and stress focused test-to-limit to map the Product DNA: limits, failures, life.

Use the Product DNA as the baseline to analyze and respond to every field failure, controlling risk while maintaining your credibility, reliability and profitability.

### KXC TECHNOLOGY

#### Simultaneous stress interactions ...

KXC profiles and controls all Stress-Drivers (interfaces) simultaneously.

KXC triggers internal stress interactions to reveal complex failure mechanisms. It monitors and trends failure criteria to determine the real-time gap to failure.

KXC intelligent algorithms map the Nature of Failure on an X-Y plane, correlating the Design Limit with the Actual Life.

### KXC PROMISE

#### Reduce cost and development time ...

Consolidate and combine your development verification plans to save time and cost.

Replicate complex operating conditions in every test to replace multiple, isolated, non-interactive test plans.

Eliminate the need for additional HALT and HASS equipment and resources.

### KXC COMMITMENT

#### Set a new reliability norm ...

Providing OEMs with an All-in-One solution, to develop and demand the Product DNA in their new LASTENHEFTE and SORs.

Providing OEMs, Tier-ones and part suppliers with a common and repeatable reliability measure and benchmark throughout the product life cycle (R&D, production, field).

Providing research facilities and test labs the means to accelerate learning and follow OEM's demands to map the Product DNA.

### Rapid integration with cooling systems

- Electronic & Mechanical Water Pumps
- Thermal Management Modules
- Seals, Bearings, Hoses & Connectors
- Flow & Pressure Control Valves
- Radiators, Heat Exchangers & Gas Tanks
- Electronics & Sensors

### Fluid type

- Non-Radioactive Water and Water-Glycol
- Automotive coolant

### Contamination type

- Sand particles: 0.2 to 2 mm

### Contamination control technology

- Particle size, distribution, concentration
- Kepstrum's vision sensor
- Closed loop adaptive control

### Special monitoring

- Unit Under Test noise level

### Stress-Drivers (controlled interfaces)

Simultaneous profiling and closed loop control of interface parameters:

- Contamination: 0.5 to 5 g/L
- Pressure: 1 to 10 bar
- Flow: 30 to 600 lpm
- Fluid Temperature: -50 to 140°C
- Ambient Temperature: -60 to 180°C
- Vibration & Shock: 3-axis OEM profiles
- Input signal: PWM, current, voltage

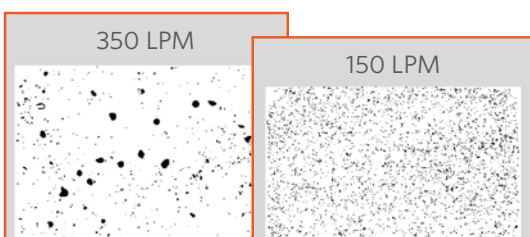
### Failure Criteria (monitored parameters)

Simultaneous monitoring, measuring, recording and analyzing the failure criteria to determine the real-time gap to failure:

- Electronics: temperature, vibration
- Electrical: resistance, current, voltage
- Hydraulics: leakage, flow, pressure
- Mechanical: strain, force, torque, response

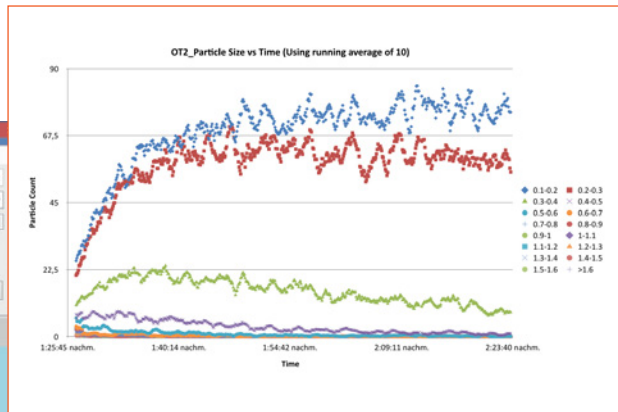
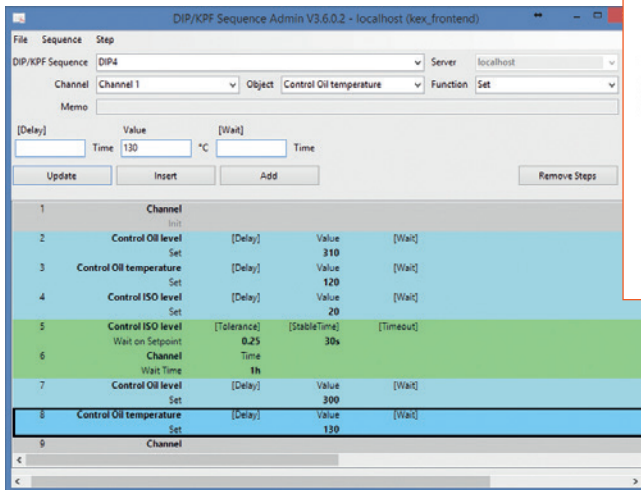
### Special interface

- Modal vibration



Vision Sensor Output

### KXC DNA Sequence Profiler (DSP)



### Design Intent Profile (DIP)

DIP is a user-defined cycle, specifying the Unit Under Test operating conditions.

### Design Limit Test (DLT)

DLT is the closed loop controlled Stress-Driver (interface) profiling algorithm.

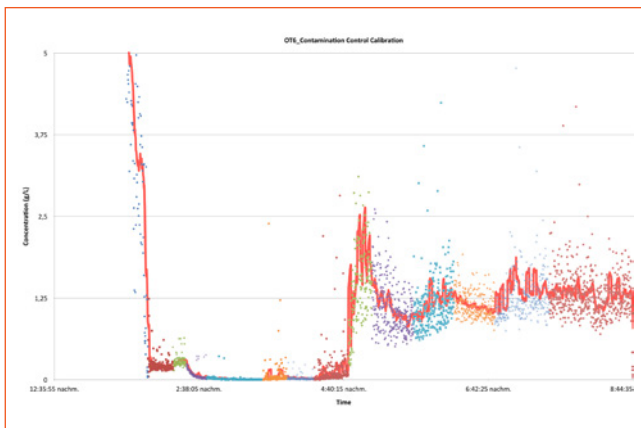
It is formulated to measure the real-time gap to failure. It automatically adjusts the Stress-Driver setpoints.

The Design Limit and Nature of Failure are generated in a matter of hours.

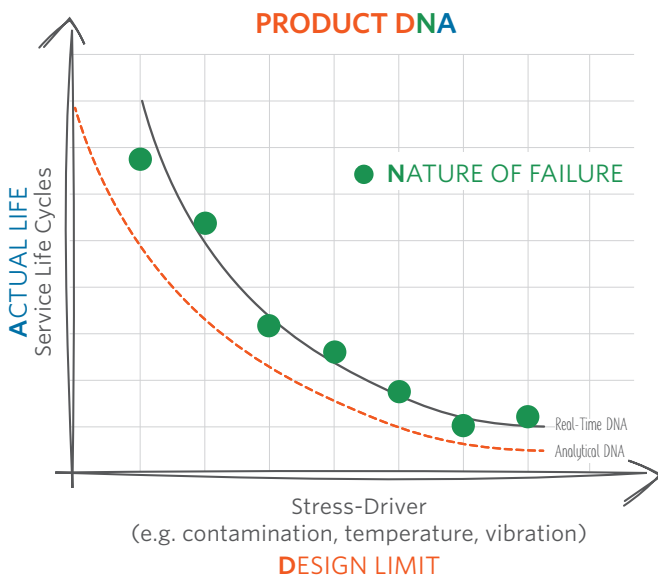
### DNA Sequence Profiler (DSP)

DSP combines DIP and DLT, automating the DNA sequence profiling to map the Product DNA.

- Install the product into KXC
- Upload the DNA Sequence
- Map the Product DNA



KXC Design Limit Test Output  
(e.g. Contamination Stress-Driver Profiling)



### Product DNA

Product DNA is generated by an intelligent post processing algorithm operated by DSP.

It analyzes the DLT information to map the Nature of Failure on an X-Y plane, correlating the Design Limit with the Actual Life.

Contamination Stress-Driver technology is the latest controlled interface parameter added to the KXC line of All-in-One qualification units.

### KXC Controls Risk to Eliminate Recalls

By using KXC from research to production, you create a repeatable benchmark of product reliability to control risk and eliminate recalls.

KXC is powered by Intelligent Reliability, a proven, stress focused, deterministic methodology to control risk of new designs for high volume production without the need for historical information.