Burn-in and Life test

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Yelo - company information

- Based in Northern Ireland
- Opened January 1983 (35 years in Business)
- Privately owned & profitable
- 60 staff
  - (Mechanical Engineers, Electronic Engineers, Software Developers, Production Staff, Sales/Marketing, Finance/Admin)
- Systems are sold all over the world (primarily USA and China)
- Cater for Low Power Telecoms/Data Center and High Power Industrial Devices

2019

ISO 9001 Quality Management

FM61310

Yelo - New Facility

- Yelo is based in Northern Ireland, in a new 25,000 sq ft Manufacturing Facility. This opened in July 2017.

- New sales and customer support office to open in China in 2019/20

Burn-in and life test system range

Y1000 Low Power System

LIV Tester

Y2000 High Power System

Burn-in – the background

- To be commercially successful, optoelectronic devices need to be reliable.
- In the very early days of laser manufacture…
  - there was an unfeasibly high reject rate.
  - there were so many possible failure mechanisms not understood.
  - manufacturing control was poor.
- Today…
  - laser manufacture has a much higher yield.
- However…
  - the consequences of a premature laser failure can still be very expensive since they are incorporated into such a wide variety of complex (and often very expensive) equipment.

What are the failures causes?

- It can be argued that there are two major mechanisms that result in a failed laser.
  - Lasers emit light at very high intensity from a very small area
    - The emitting surface can be damaged by the high electric fields present, which appears as a drop in emission. One cannot detect the likelihood of the laser experiencing facet damage other than through subjecting the laser to high emissions for an extended time - preferably at an elevated temperature.
  - Device overheating
    - This is usually caused by either the laser chip not being properly soldered onto its heat sink (there may an air void under the chip) or the laser heat sink itself is not properly bonded onto its larger heat sink.
- In either case, the deterioration can be very slow or catastrophic.

Manifestation of failure

- How does failure manifest itself?
  - Reduced output power
  - Shift in threshold current
  - Change in beam divergence
  - Difficulty focusing to previously attained spot sizes
  - Ultimate failure to lase
- With burn-in, we can ensure that only good, known devices make it to the customer?

Burn-in

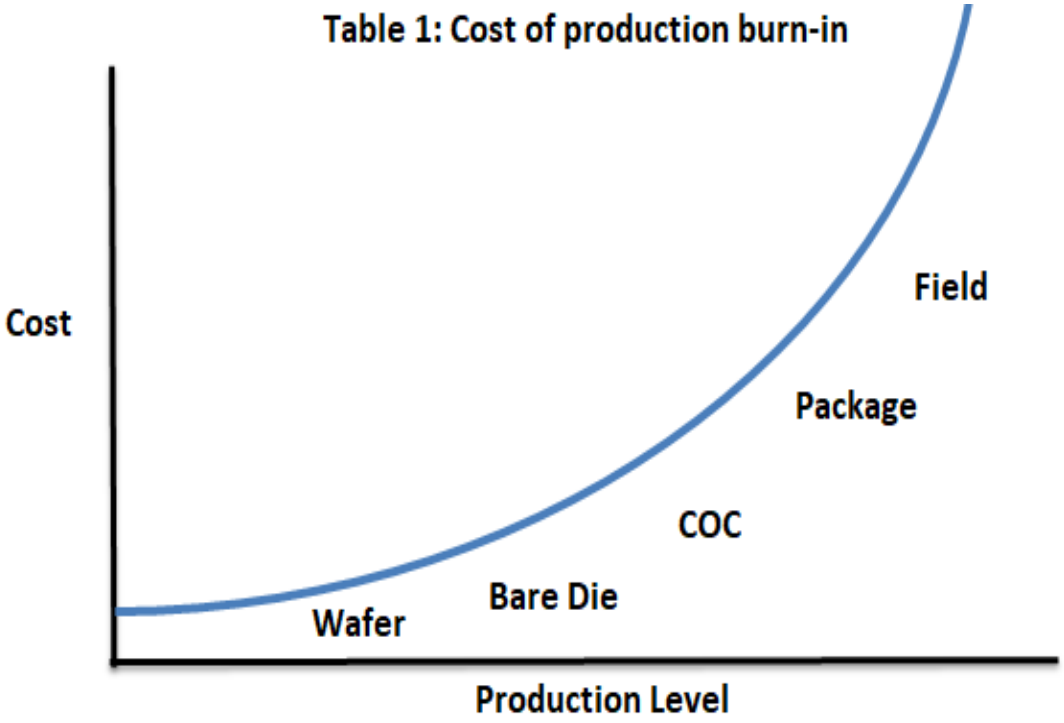
- ***Burn-in involves running components under a continuous period of operation, under controlled conditions, to…***
  - **Identify infant mortalities**
    - devices that will fail very early in their use
  - **Stabilize operating parameters**
    - thus ensuring that every device shipped meets quality standards

Device screening criteria

- There are 4 common screening criteria for detecting a failed laser. These parameters either refer to an absolute number on post burn-in or change pre and post burn-in.
  - Threshold Current (Ith)
  - Optical Output Power at Specified Operating Current
  - Current Required to Achieve Specified Optical Output
  - Slope Efficiency

Production Consideration

- The earlier that burn-in and test is done in the manufacturing process – the more cost effective it becomes



Challenges being faced

- As device manufacturers continue to push back along the production cost curve, new challenges are being faced by burn-in equipment manufacturers
  - Device Power Dissipation
    - ° C / Watt / mm²
  - Size of device (getting smaller!)
  - Methods on how to probe the device (electrical & force)
  - Baseplate
    - manufacturing limitations on surface flatness
  - Thermal resistance
- Output light management

Solutions for thermal management

25 → 150° C (Low Power)

- Chilled Air
- Ambient Air

20 → 80° C (High Power)

- Water cooled base plate
- Direct water cooling
- TEC control

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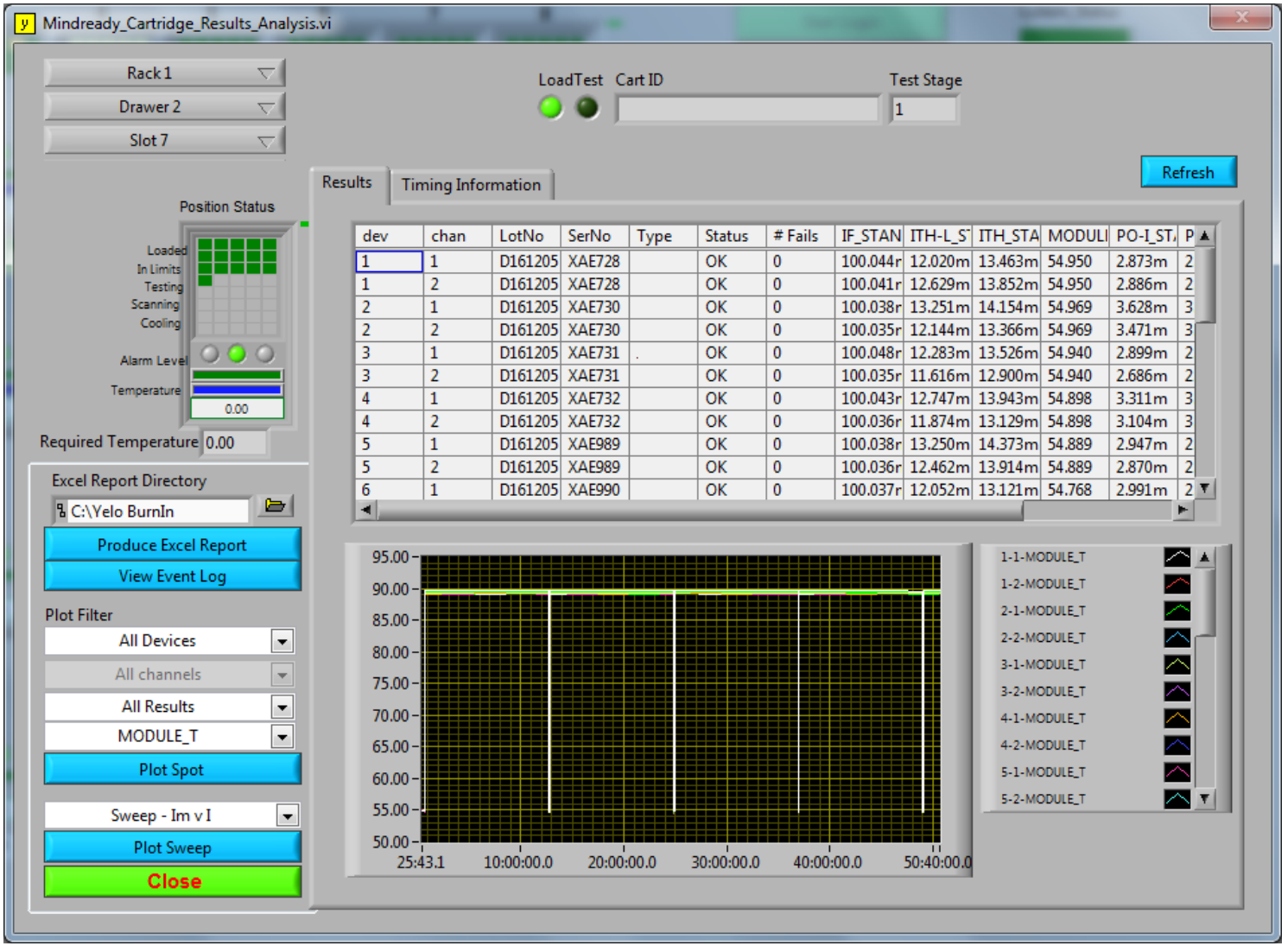
TYPICAL TESTS

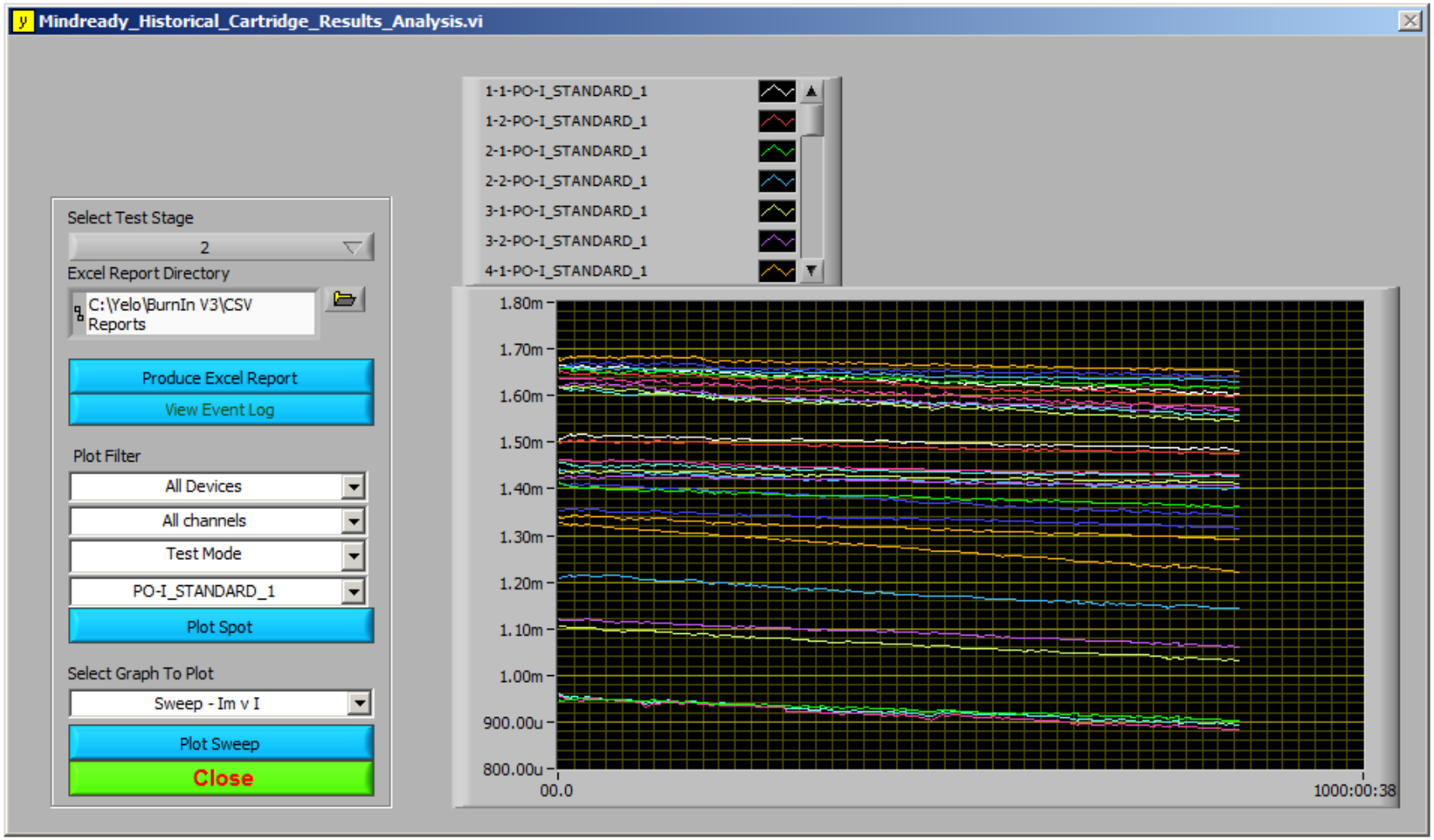
Typical tests for burn-in

- LIV
  - Temperature cycling, burn-in at one temperature, measure at a different temperature.
- Wavelength
- In-situ monitoring of
  - Variation of light output over time (constant current)
  - Variation of current over time (constant power)

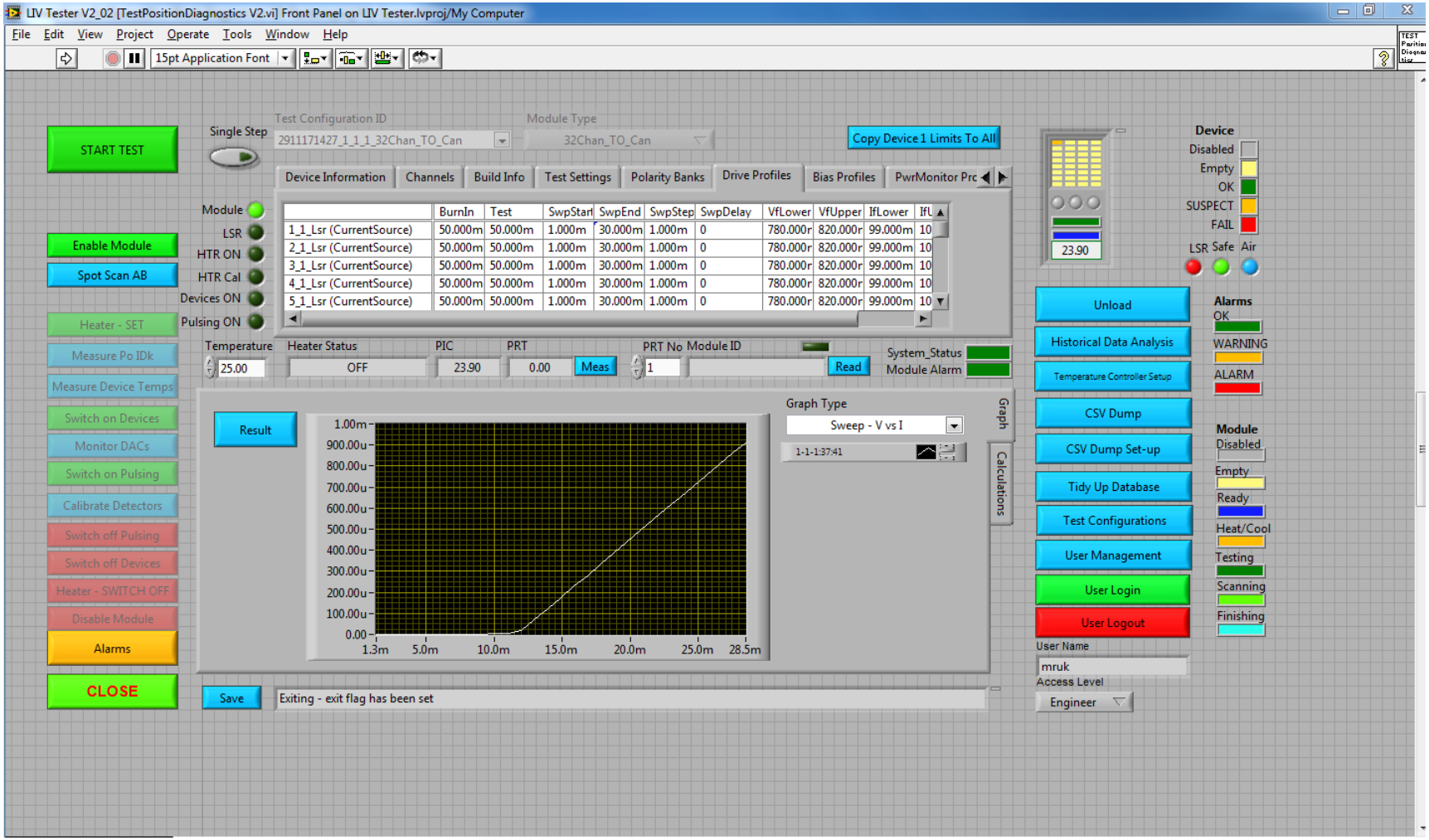
Temperature cycling for LIV



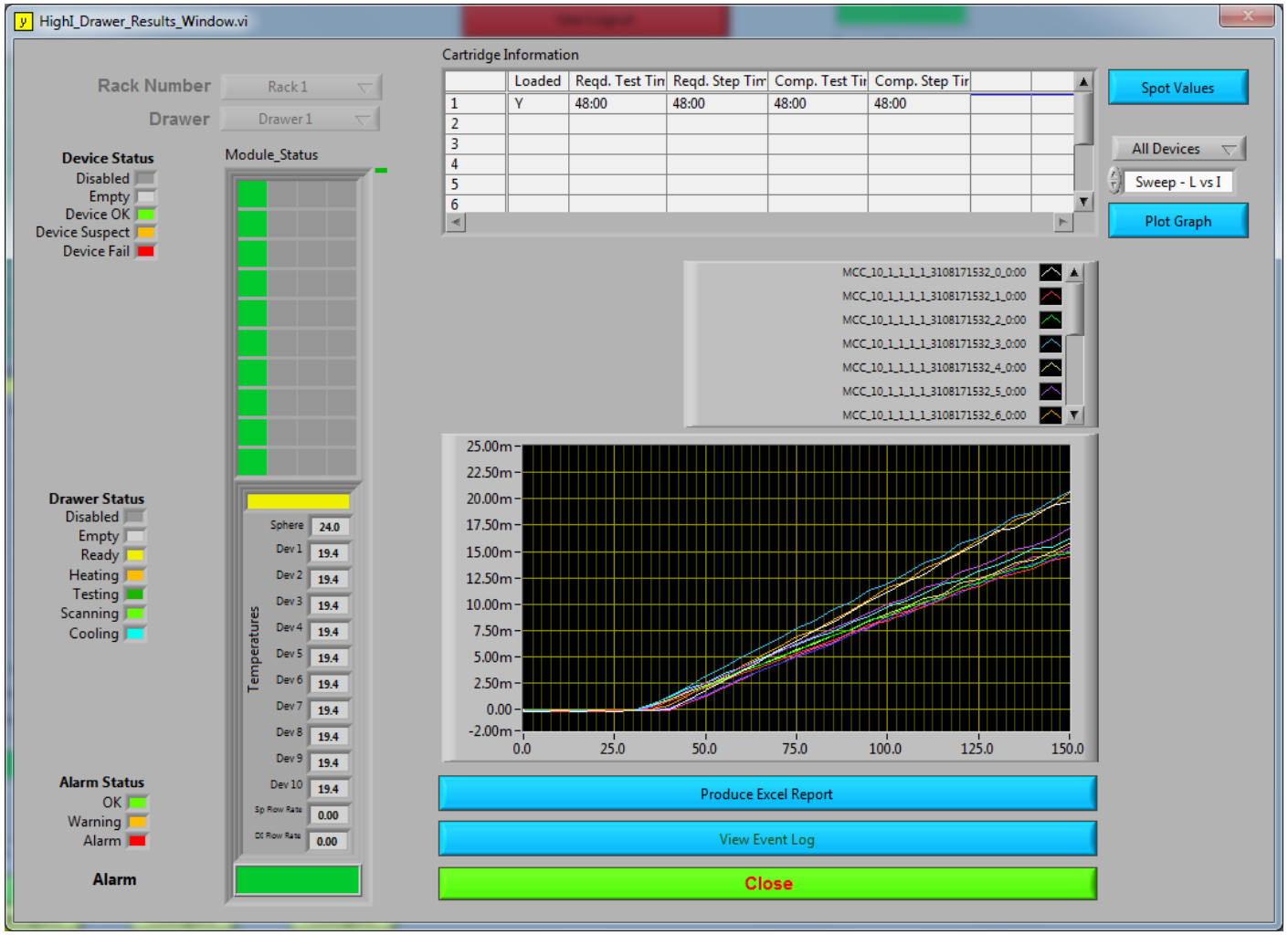
Variation of light output over time



LIV sweep


LIV Tester V2_02 [TestPositionDiagnostics V2.vi] Front Panel on LIV Tester.lvproj/My Computer
File Edit View Project Operate Tools Window Help
15pt Application Font
START TEST
Single Step
Test Configuration ID
2911171427_1_1_1_32Chan_TO_Can
Module Type
32Chan_TO_Can
Copy Device 1 Limits To All
Device Information
Channels
Build Info
Test Settings
Polarity Banks
Drive Profiles
Bias Profiles
PwrMonitor Prc
Module
LSR
HTR ON
HTR Cal
Devices ON
Pulsing ON
Enable Module
Spot Scan AB
Heater - SET
Measure Po IDk
Measure Device Temps
Switch on Devices
Monitor DACs
Switch on Pulsing
Calibrate Detectors
Switch off Pulsing
Switch off Devices
Heater - SWITCH OFF
Disable Module
Alarms
CLOSE
BurnIn Test SwpStart SwpEnd SwpStep SwpDelay VfLower VfUpper IfLower
1_1_Lsr (CurrentSource) 50.000m 50.000m 1.000m 30.000m 1.000m 0 780.000r 820.000r 99.000m
2_1_Lsr (CurrentSource) 50.000m 50.000m 1.000m 30.000m 1.000m 0 780.000r 820.000r 99.000m
3_1_Lsr (CurrentSource) 50.000m 50.000m 1.000m 30.000m 1.000m 0 780.000r 820.000r 99.000m
4_1_Lsr (CurrentSource) 50.000m 50.000m 1.000m 30.000m 1.000m 0 780.000r 820.000r 99.000m
5_1_Lsr (CurrentSource) 50.000m 50.000m 1.000m 30.000m 1.000m 0 780.000r 820.000r 99.000m
Temperature
25.00
Heater Status
OFF
PIC
23.90
PRT
0.00
Meas
PRT No
1
Module ID
Read
System_Status
Module Alarm
Result
Graph Type
Sweep - V vs I
Graph
Calculations
1.00m 900.00u 800.00u 700.00u 600.00u 500.00u 400.00u 300.00u 200.00u 100.00u 0.00
1.3m 5.0m 10.0m 15.0m 20.0m 25.0m 28.5m
Save
Exiting - exit flag has been set
23.90
Device
Disabled
Empty
OK
SUSPECT
FAIL
LSR Safe Air
Unload
Historical Data Analysis
Temperature Controller Setup
CSV Dump
CSV Dump Set-up
Tidy Up Database
Test Configurations
User Management
User Login
User Logout
User Name
mruk
Access Level
Engineer
Alarms
OK
WARNING
ALARM
Module
Disabled
Empty
Ready
Heat/Cool
Testing
Scanning
Finishing

LIV sweep for Threshold



Summary

- Low Power Burn-in up to 1A available today.
- High Power Burn-in up to 500A available today.
- Flexible fixture design to handle many different device types and packages in same test system.
- Different approaches to thermal management

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ANY QUESTIONS?

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