

 **ATLAS**
MATERIAL TESTING SOLUTIONS

AMETEK[®]
MEASUREMENT, COMMUNICATIONS
& TESTING



Atlas sets new standards in weathering technology

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Agenda

- ▀ Comparison Ci4000 to Ci4400
- ▀ New Feature Review
- ▀ A glance on the new User Interface
- ▀ Validation Data Ci4400 - examples
- ▀ Accelerated Outdoor Weathering using intensified natural Sunlight
- ▀ New Atlas “Cool Mirror” Technology
- ▀ Comparison Traditional EMMA to UAEmma



What is the same as the Ci4000?

- Installation Requirements
 - *Electrical configurations, tap water, DI water, compressed air, drains*
- Lamps and filters (including auxiliary filters)
- BPT and BST
- Humidification system
- Sample holders
- General functionality
- Pre-programmed test methods
- Three ports for BPT/BST in rack hub
- Top- and Wall-Mounted LiquiAir

New Feature Overview



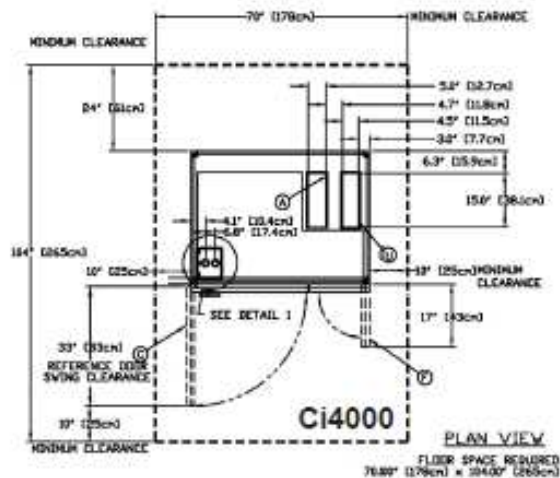
- ▀ Similar Footprint; More Sample Capacity
- ▀ Functional Design Improvements
- ▀ User Convenience Features
- ▀ Improved User Interface
- ▀ Improved Control of Parameters
- ▀ Improved Chamber Uniformity

The Best-In-Class Just Got Even Better

Similar Footprint; More Capacity

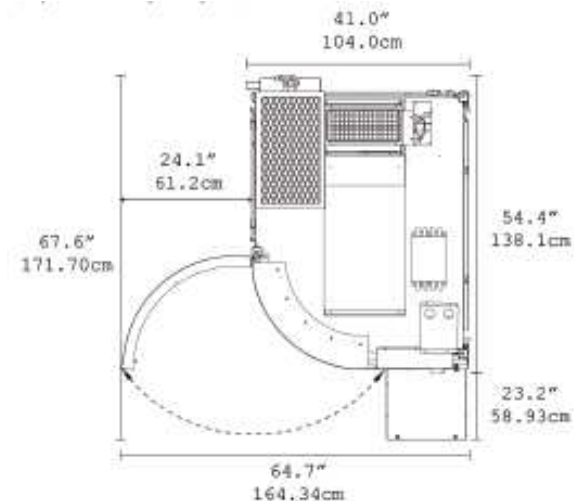
Ci4000

- 68 standard holders (not including BPT or BST)
- 104" x 70" – including required service area
 - 50.6 ft² (4.7 m²)
- 50" wide
- 585 kg (1290 lbs)



Ci4400

- 77 standard holders (not including BPT or BST)
- 92" x 75" – including required service area
 - 47.9 ft² (4.5 m²)
- 41" wide
- 499 kg (1100 lbs)



Functional Design Improvements

- Chamber height raised slightly
 - *No need for casters or leg extensions*
- Chamber door opens wider
 - *Easier maintenance*
 - *Easier lamp installation*
- More efficient air flow
 - *Tier-to-tier*
 - *Around rack circumference*
- Larger rack helps to meet common test methods with lower irradiance



User Convenience Features

- Chamber Door Features
 - *New push-button door opener mechanism*
 - *Lockable latch now standard*
- Chamber/Rack Improvements
 - *Removable rack sections*
 - *Improved access*
- Status Indicator Light
 - *Green – instrument running*
 - *Yellow – instrument stopped (idle – test stopped)*
 - *Red – Stopped (Fault detected)*
- Fold-out tray
 - *For laptops, logbooks, sample racks, consumable items*
- 3-tiered window
- Tilting User Interface Screen
 - *Accommodates users of different heights*

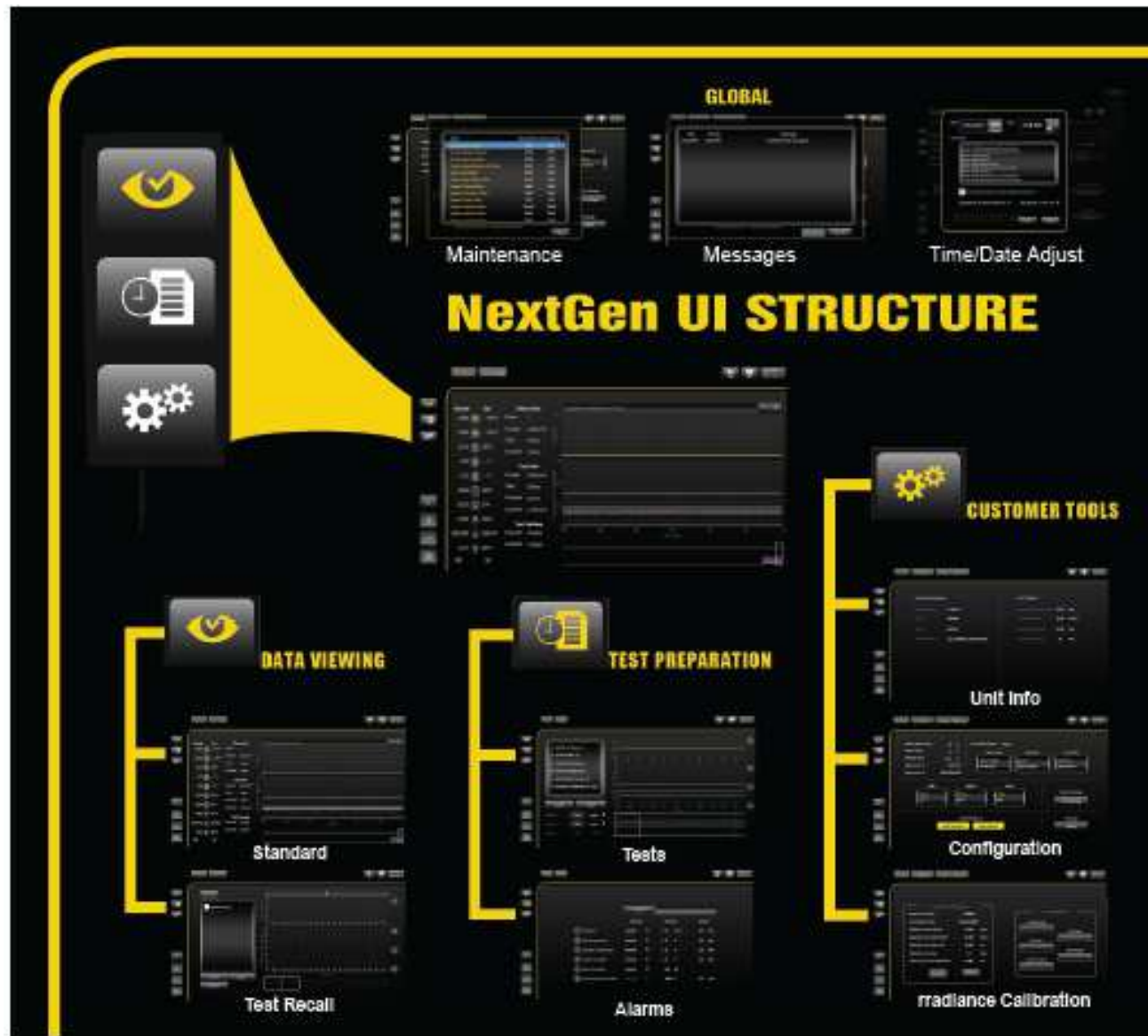


Improved User Interface

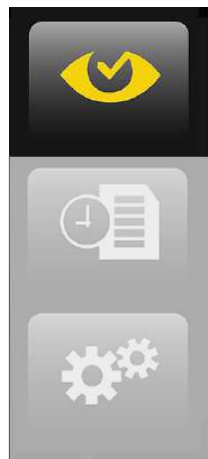
- General Improvements
 - Larger (15" vs 12")
 - Color scheme fits industrial design
 - Use of icons
 - Fewer pages – easier navigation
 - More clear view of data
 - More dynamic movement



Improved User Interface



User Interface – Data Viewing



Data Viewing – Standard (Main) Page

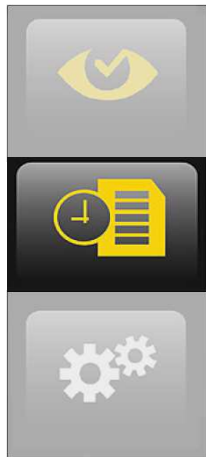
Test parameters, test timing, phase timing, status, trend plot, all on one easy-to-read page



Data Viewing – Test Recall/Data Export

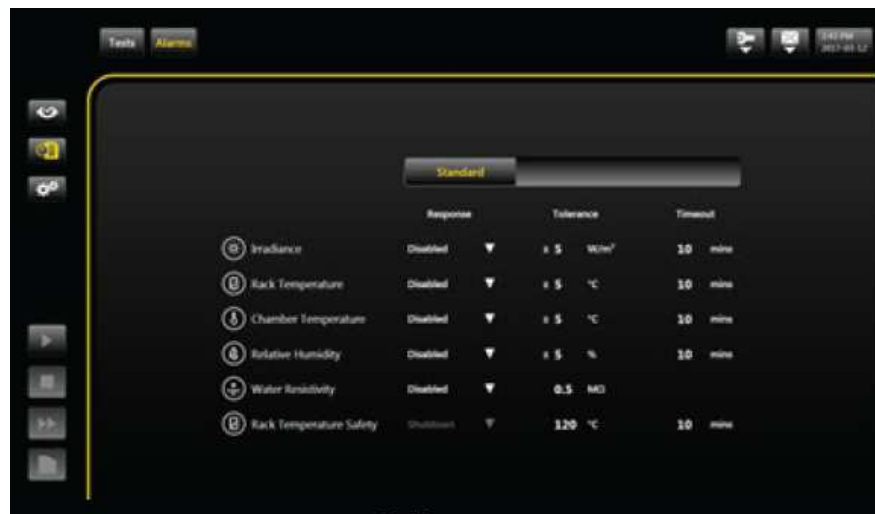
Review saved data files, export to USB thumb drive, delete files

User Interface – Test Preparation



Test Preparation – Test List/Edit Tests

Preview and load tests, edit custom tests, set time, dosage, and schedule stops



Test Preparation – Alarm Settings

Set all alarms and tolerances

User Interface – Customer Tools



Assign “name” to Weather-Ometer, light hours, operating hours, other general information



Assign filters used, BPT/BST configuration, language and network settings



Irradiance calibration information/settings, manual controls of DI cooling water, sprays, and other functions

Validation



Irradiance Uniformity

Wideband (300-400nm)

Average Max	Average Min	Average Range	Average % Uniformity
122.71	122.38	0.33	0.27
82.77	82.51	0.27	0.32
42.73	42.57	0.16	0.38

Narrowband (340nm)

Average max	Average Min	Average Range	Average % Uniformity
1.200	1.184	0.02	1.41
0.814	0.803	0.01	1.42
0.425	0.418	0.01	1.60

BST – Ci4400 vs Ci4000



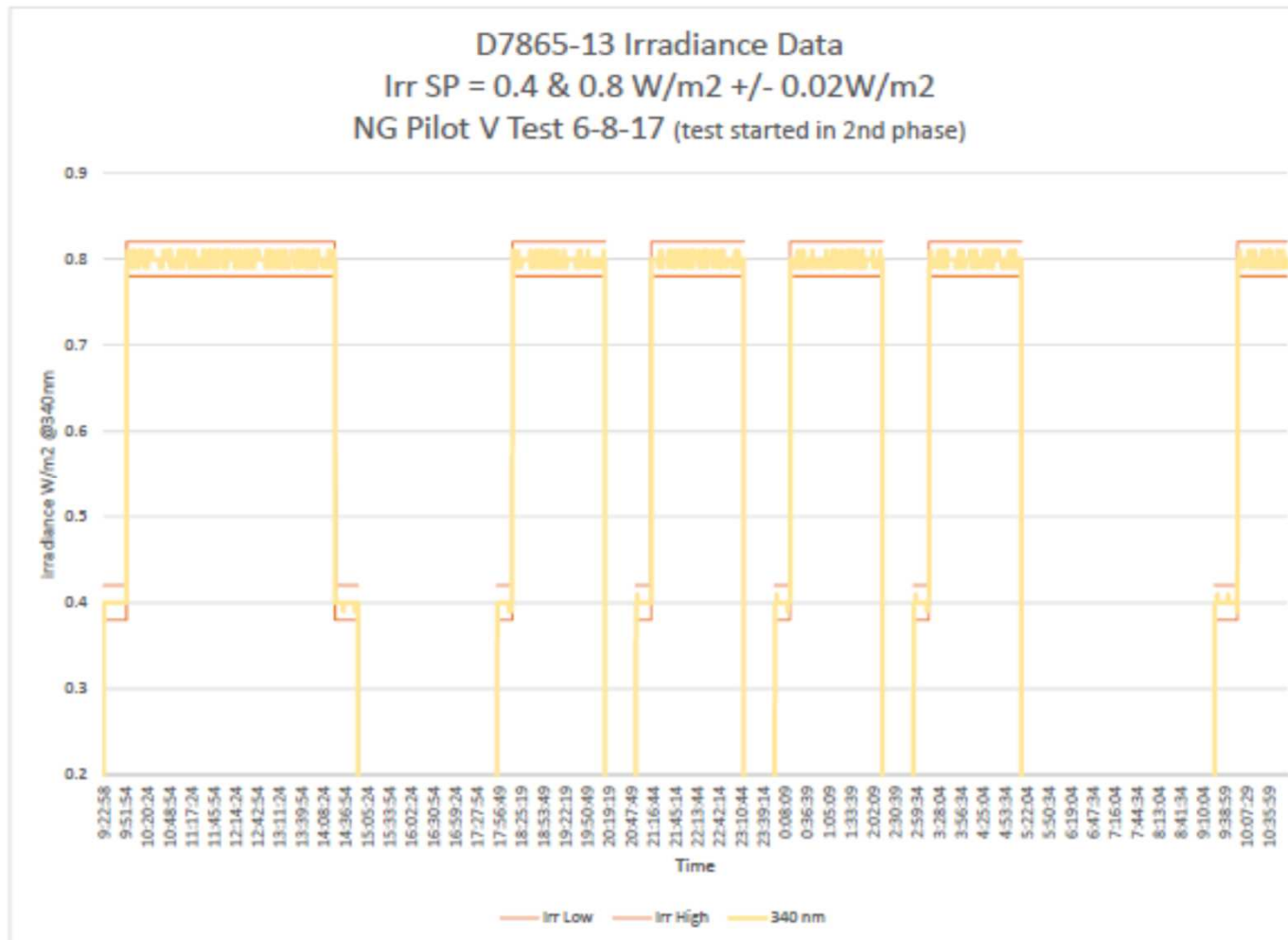
Ci4000 AWSG #8 Averages							
Phase	BST - Mid	BST - Top	BST - Bottom	Max	Min	Range	Avg. Ci4400
1	57.5	58.8	54.2	58.8	54.2	4.6	2.6
2	60.0	60.8	56.2	60.8	56.2	4.7	2.4
3	67.8	68.6	62.8	68.6	62.8	5.9	2.4
4	82.1	82.5	76.6	82.5	76.6	5.9	3.7
5	83.2	83.2	77.4	83.2	77.4	5.8	3.9
6	87.0	86.7	80.4	87.0	80.4	6.6	3.6
7	104.9	102.1	97.7	104.9	97.7	7.2	5.2
8	106.0	105.3	98.7	106.0	98.7	7.3	5.0
9	106.4	106.0	99.1	106.4	99.1	7.3	5.6



Test Method Validation

(ASTM D7869-13 Standard Practice for Xenon Arc Exposure Test with Enhanced Light and Water Exposure for Transportation Coatings)

D7869 - Irradiance

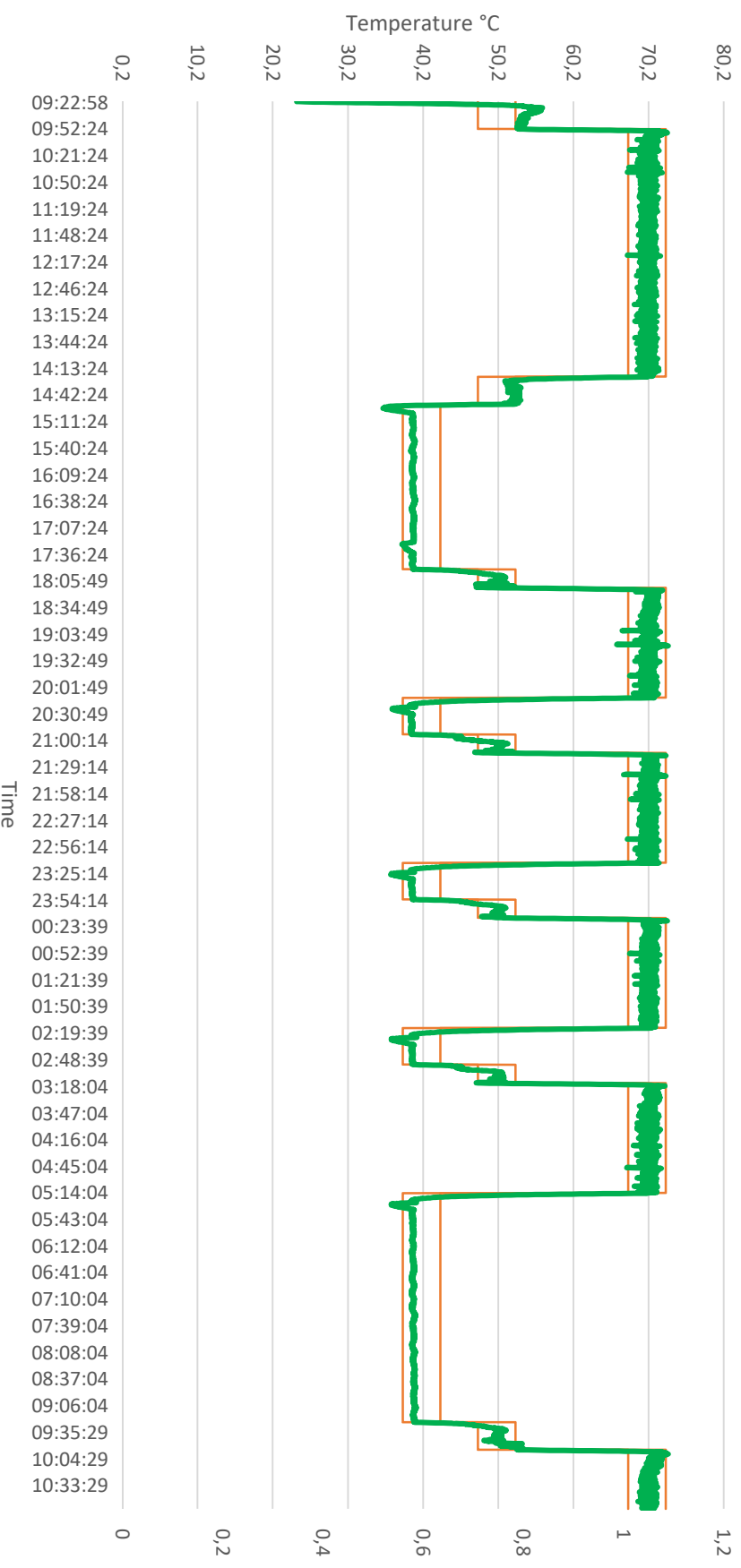


Another way in which we can represent the performance is by also plotting “tolerance bars” around the actual data

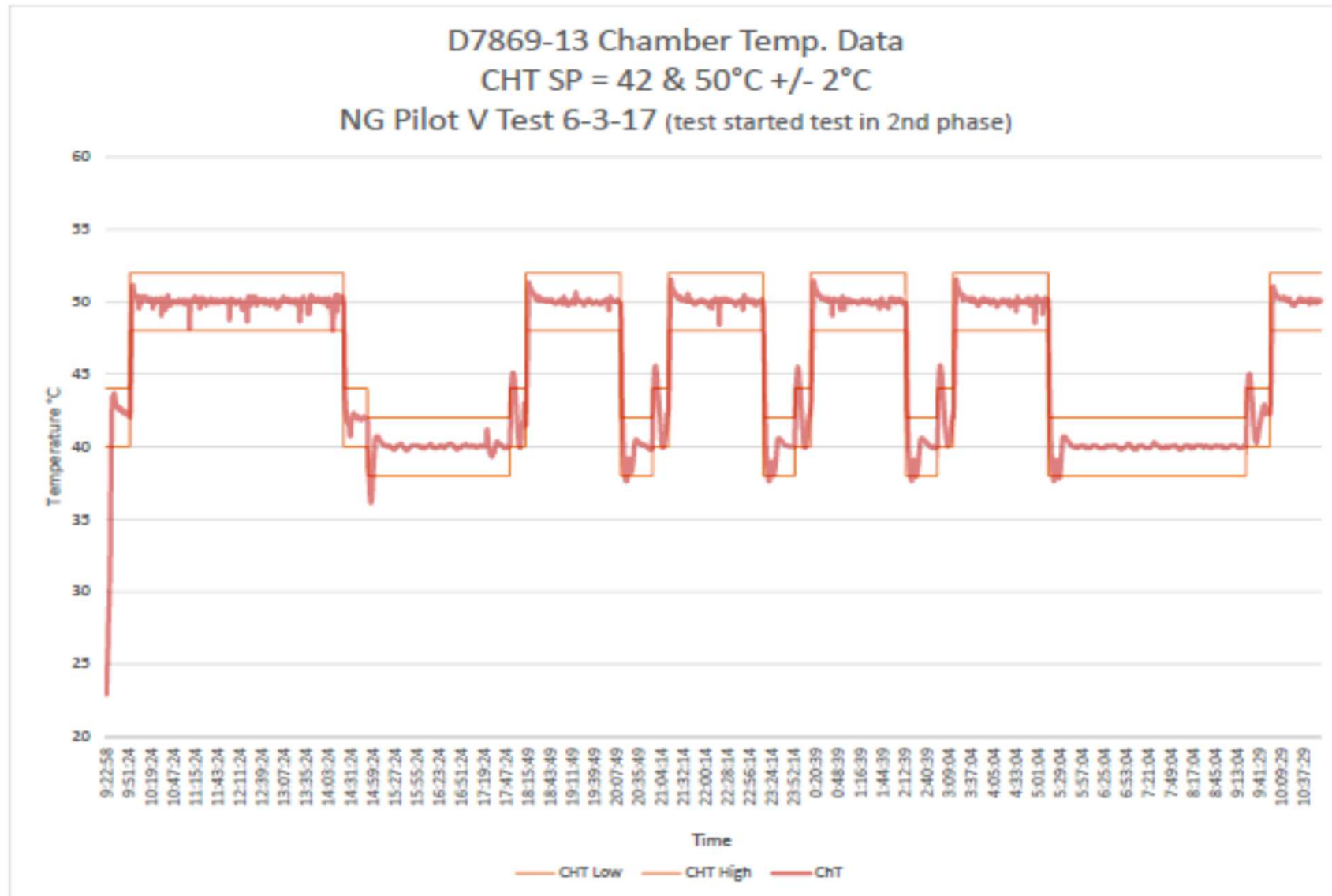
D7869 - BPT



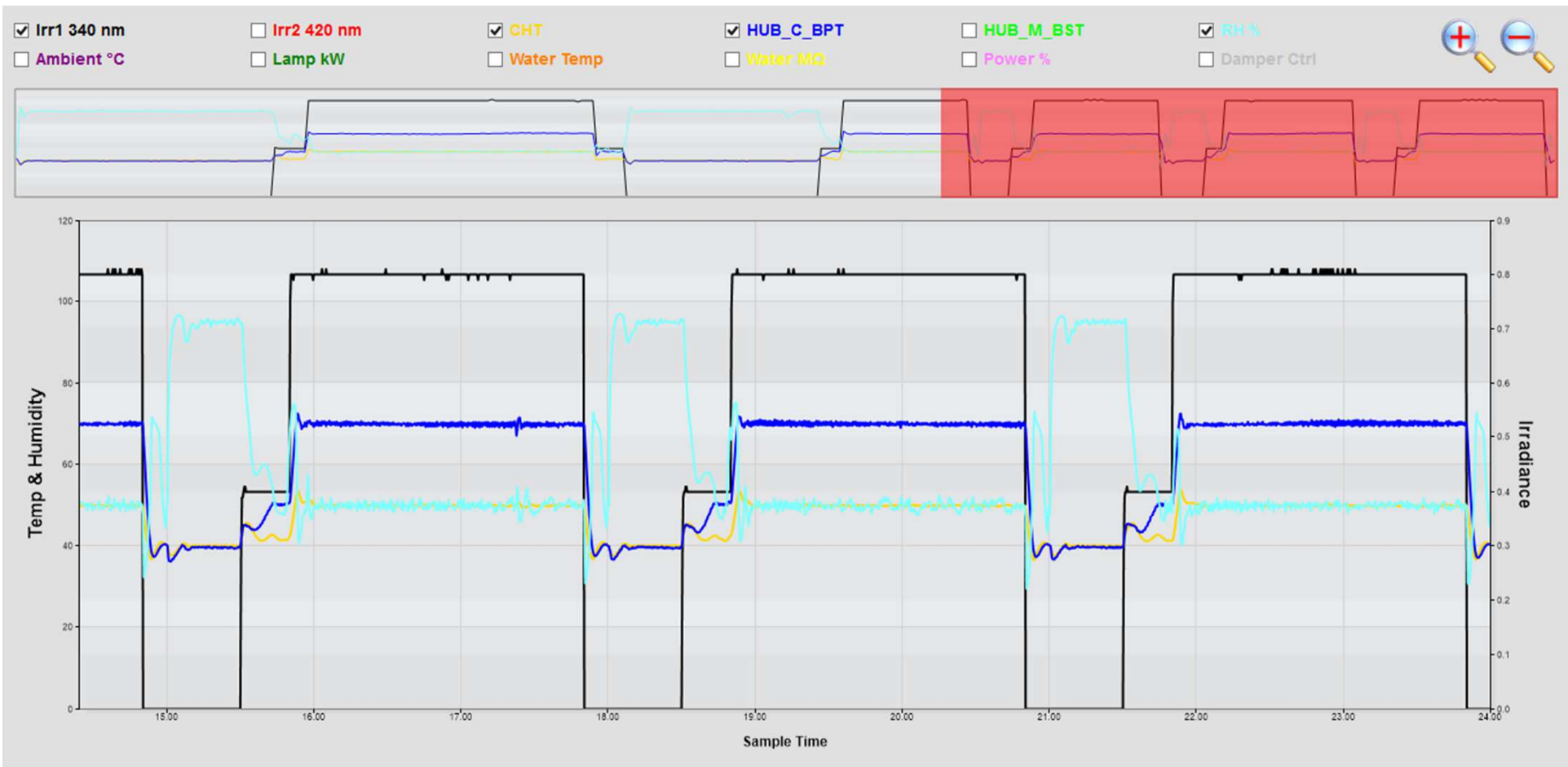
D7869-13 Rack Temp. Data
BPT SP = 50 & 70°C +/- 2°C
NG Pilot V Test 6-8-17 (test started test in 2nd phase)



D7869 – Chamber Temperature



D7869 – Subcycles



Excellent control of all test parameters for this very complex test

SAE J2527 - Polystyrene



SAE J2527	126.4 kJ/m ²	SAE J2527	221.2 kJ/m ²
Specimen Code	Δb^*	Specimen Code	Δb^*
16563-T1	2.13	16563-T1	3.15
16563-T2	2.09	16563-T2	3.28
16563-C1	2.10	16563-C1	3.15
16563-C2	2.21	16563-C2	3.01
16563-B1	2.09	16563-B1	3.24
16563-B2	2.01	16563-B2	3.02
16605-T1	1.90	16605-T1	2.77
16605-T2	1.90	16605-T2	3.02
16605-C1	2.05	16605-C1	2.78
16605-C2	2.06	16605-C2	2.79
16605-B1	1.86	16605-B1	3.04
16605-B2	1.86	16605-B2	2.83
Pilot V-T1	2.25	Pilot V-T1	3.15
Pilot V-T2	2.27	Pilot V-T2	3.21
Pilot V-C1	2.23	Pilot V-C1	3.16
Pilot V-C2	2.28	Pilot V-C2	3.17
Pilot V-B1	2.25	Pilot V-B1	3.26
Pilot V-B2	2.22	Pilot V-B2	3.17

126.4 kJ/m² @ 340nm

Unit #	Average	Range
Ci4000 16563	2.11	0.20
Ci4000 16605	1.94	0.20
Ci4400 Pilot V	2.25	0.06

221.2 kJ/m² @ 340nm

Unit #	Average	Range
Ci4000 16563	3.14	0.27
Ci4000 16605	2.87	0.27
Ci4400 Pilot V	3.19	0.11

This is one example. Much more data has been collected and will be summarized in a future publication.

Summary

- Performance Envelope data shows comparable results with Ci4000
- Tier-to-tier irradiance and temperature uniformity excellent
- Test Method data shows comparable results with Ci4000, with some marked improvements
- WRM testing in initial stages; Preliminary data shows promising results
- Atlas would welcome the opportunity to evaluate specific test methods with the Ci4400 for any customer to show consistent results with current Ci Series Weather-Ometers.



Accelerated Outdoor Weathering

The new cold-mirror technology for the
EMMA/EMMAQUA accelerated Outdoors
weathering systems

Accelerated Weathering

- The practical **reality** is that end-use or outdoor “natural” static testing occurs in real time:
“A one-year Florida equivalent exposure takes approximately 365 days in Miami.”

- The **need** for accelerated testing is driven by economic and competitive concerns.

- Methods of natural acceleration:
 - *maximizing the natural daily/annual radiant exposure:*
 - static exposure angle
 - solar tracking
 - *intensifying natural solar radiation*

Intensified Natural Weathering

EMMA[®]/EMMAQUA[®]

Equatorial **M**ount with **M**irrors for **A**cceleration (-**aqua**.: with water spray)

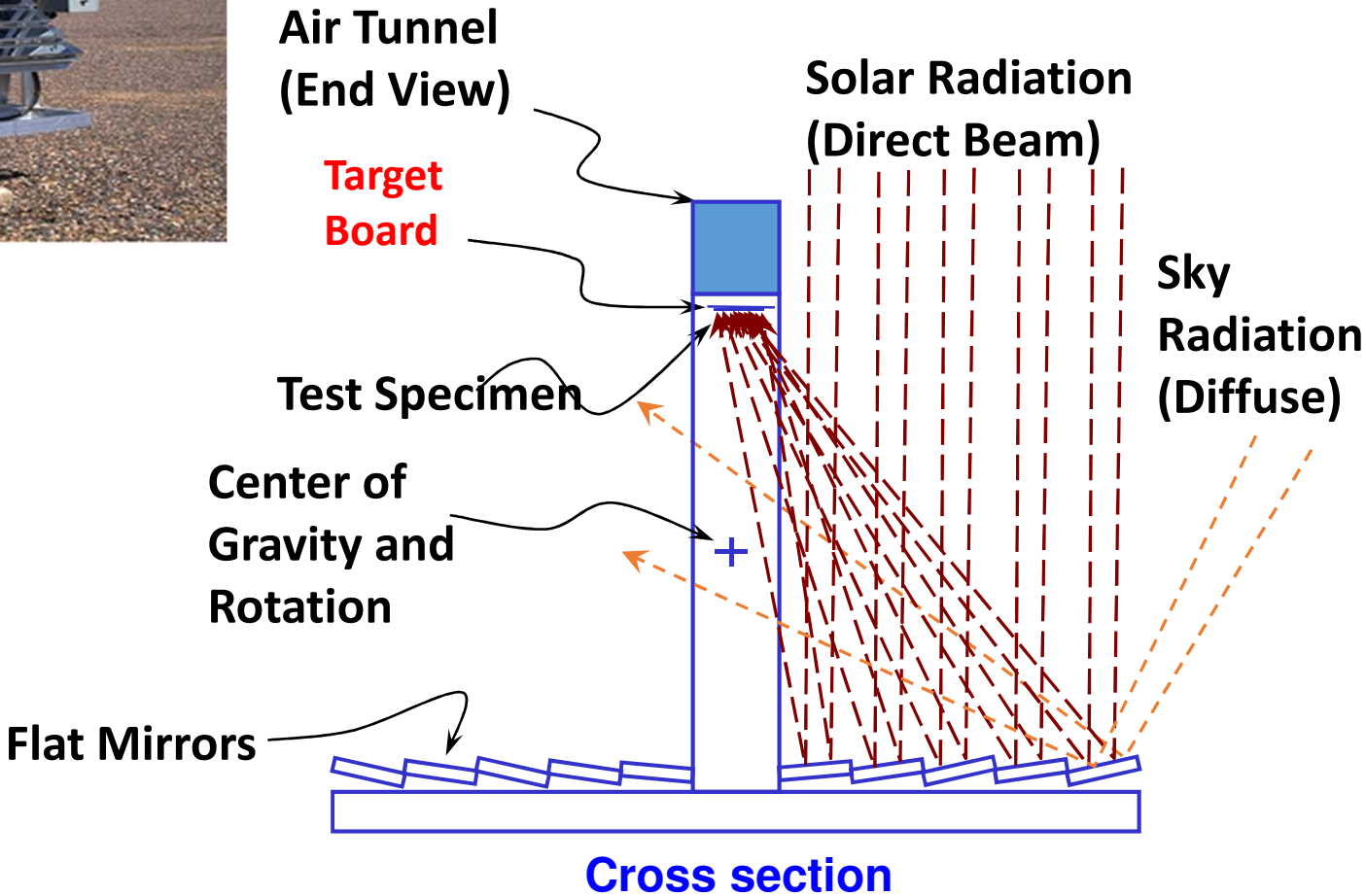


- concentration of natural sunlight with mirrors
- continuous two dimensional tracking of optimum solar angle

ASTM G90
ISO 877-3

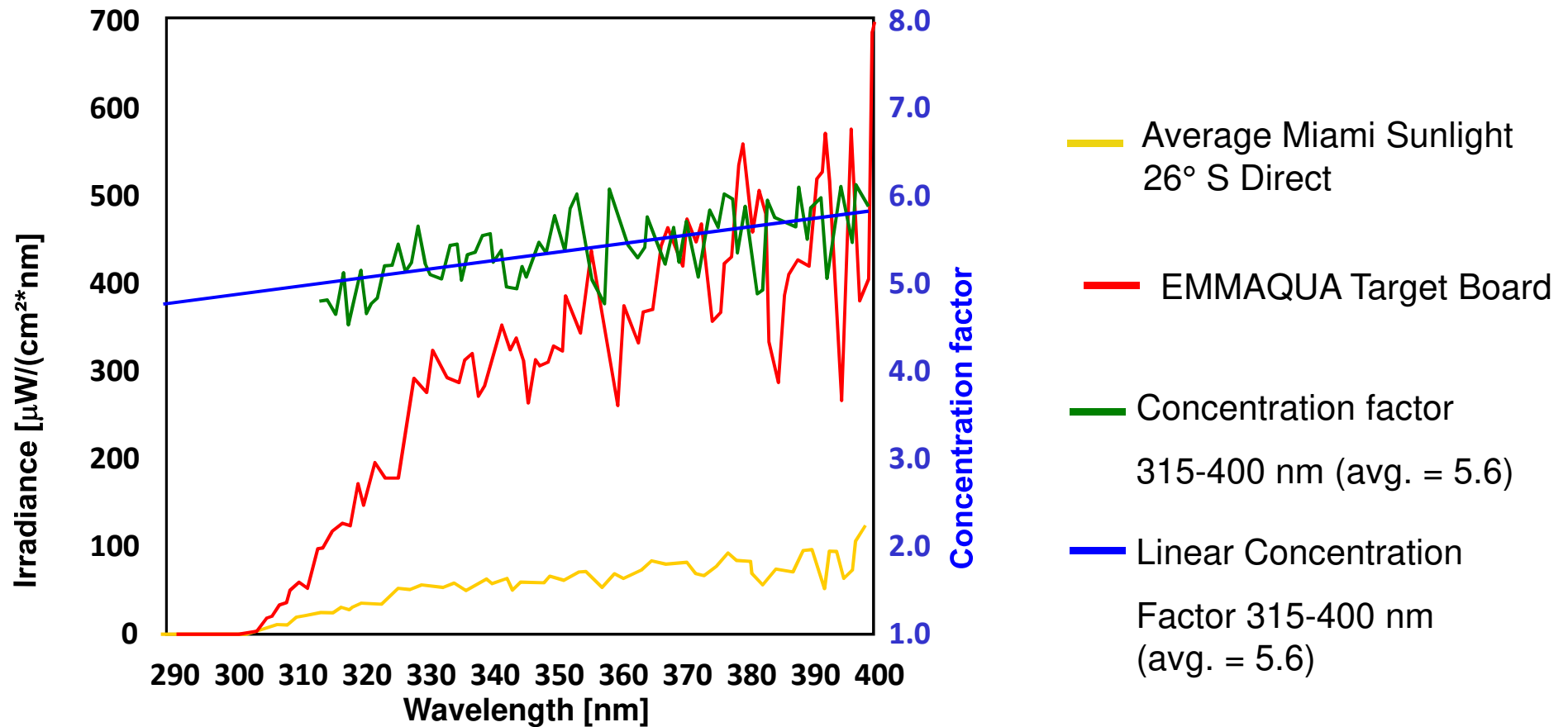


Target board

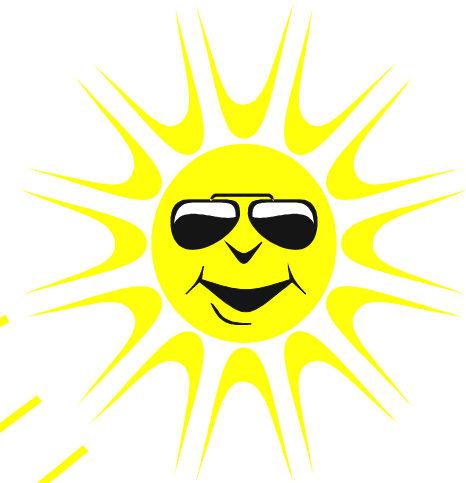
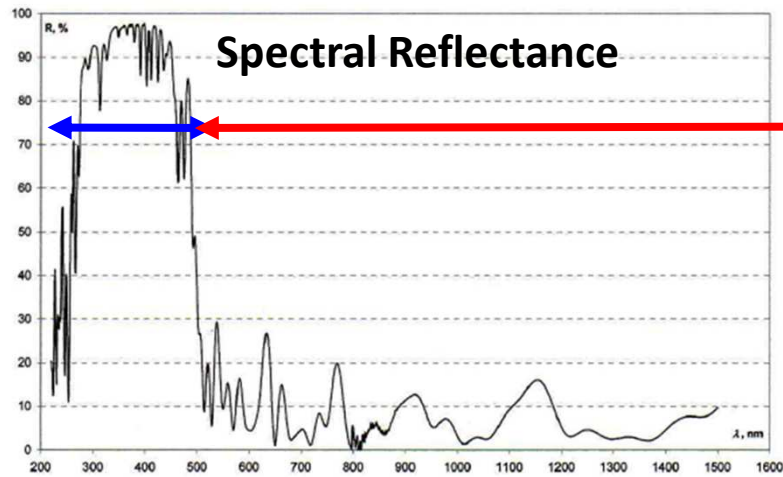


Accelerated outdoor weathering

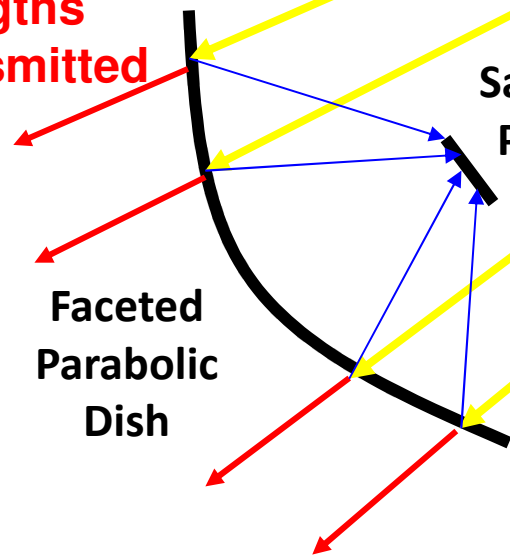
Intensifying the UV Radiation



Atlas' "Cool Mirror" Technology



Visible and Near Infrared Wavelengths are Transmitted



Sample Plane

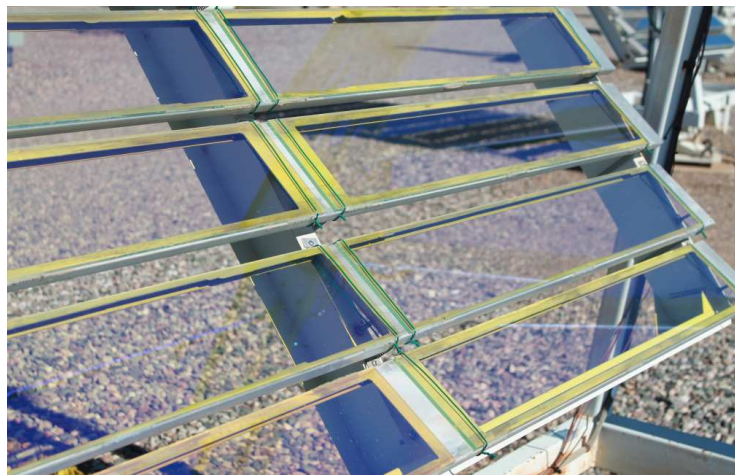
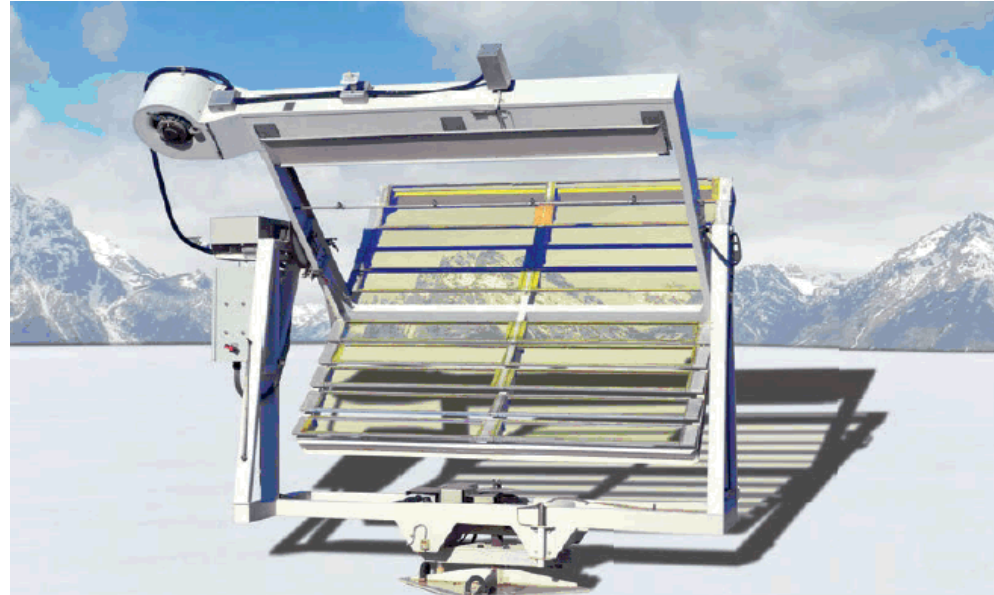
Ultraviolet Wavelengths are Reflected onto Samples



Uniform, Highly Concentrated, Direct Normal, UV Sunlight

Low-Temperature EMMA[®] /EMMAQUA[®]

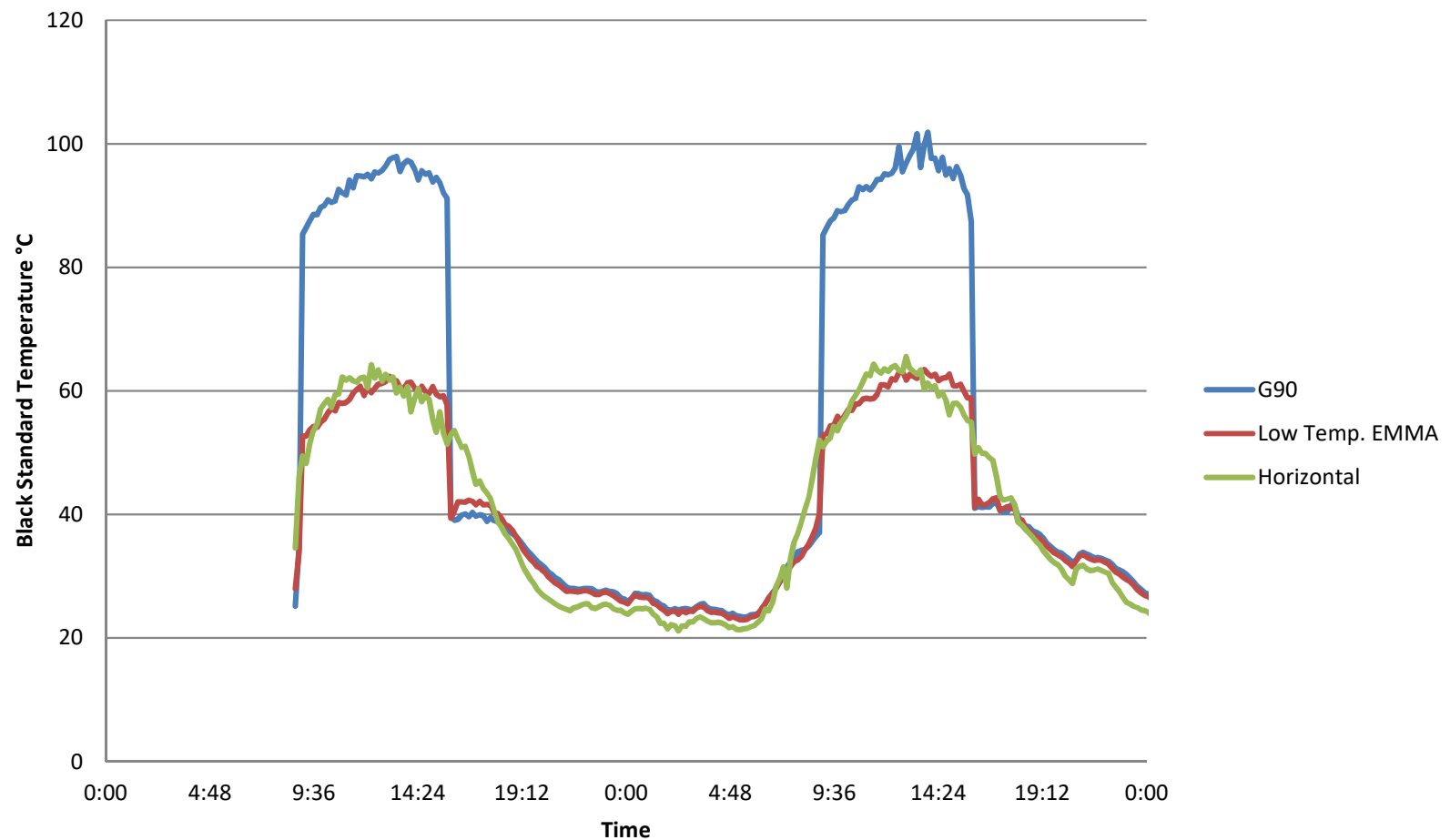
- 10 “Cool Mirrors”
- decrease of IR irradiance
- better control of sample T
- Intensification by a factor of 5 – 6
- conform with most standards (ASTM G90)



LT-EMMA[®]/EMMAQUA[®] Temperature Study



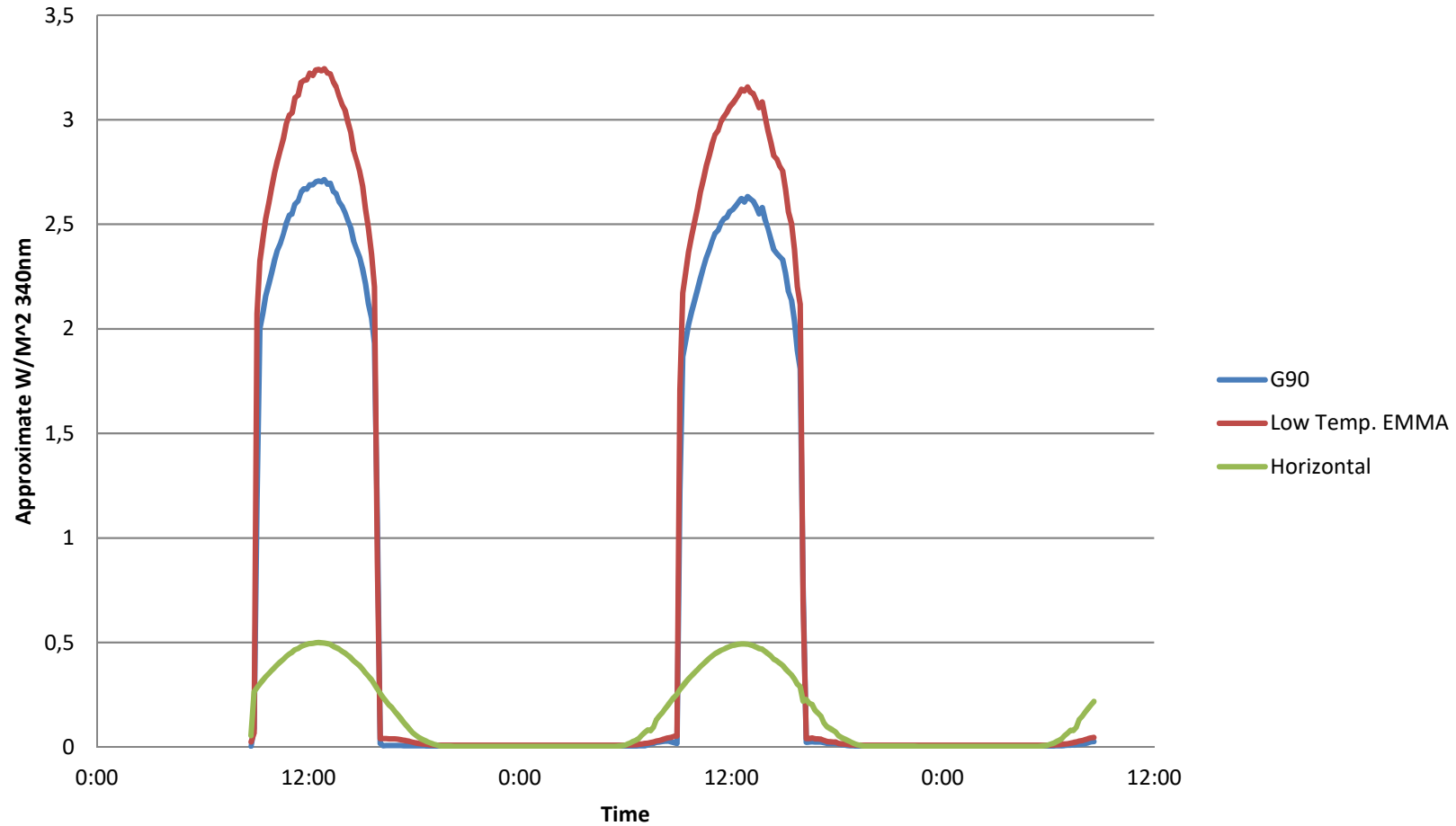
Black Standard Exposure Temperatures - Typical ASTM G90, Horizontal, Low Temperature EMMA[®]



LT-EMMA[®]/EMMAQUA[®] Irradiance



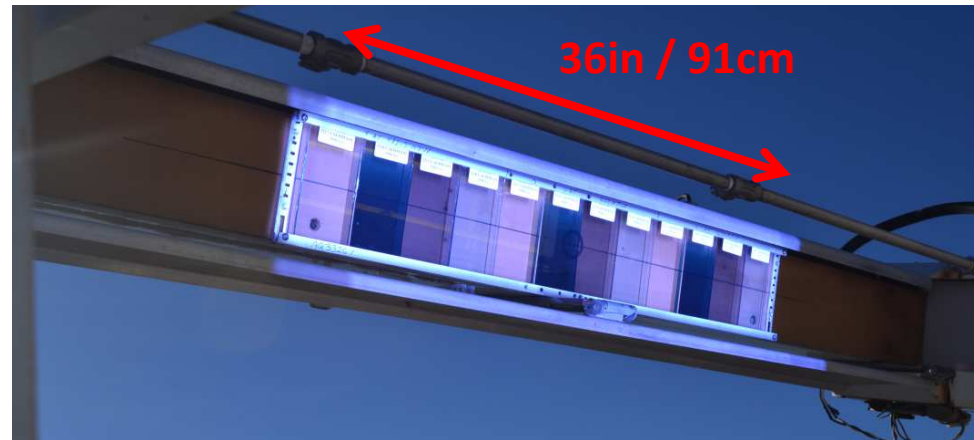
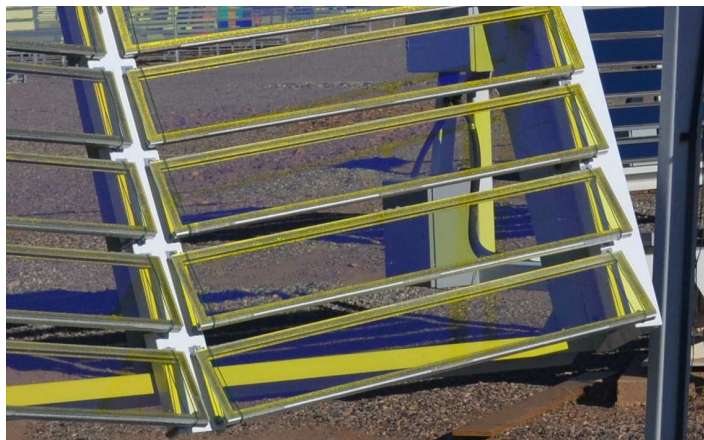
Comparison of Exposure Irradiances - Typical ASTM G90, Horizontal, Low Temperature EMMA[®]



Ultra-Accelerated EMMA (UA-EMMA)



- ▀ 20 “Cool Mirrors“
- ▀ decrease of IR irradiance
- ▀ better control of sample T
- ▀ Intensification by a factor of 10 – 12
- ▀ conform with most standards

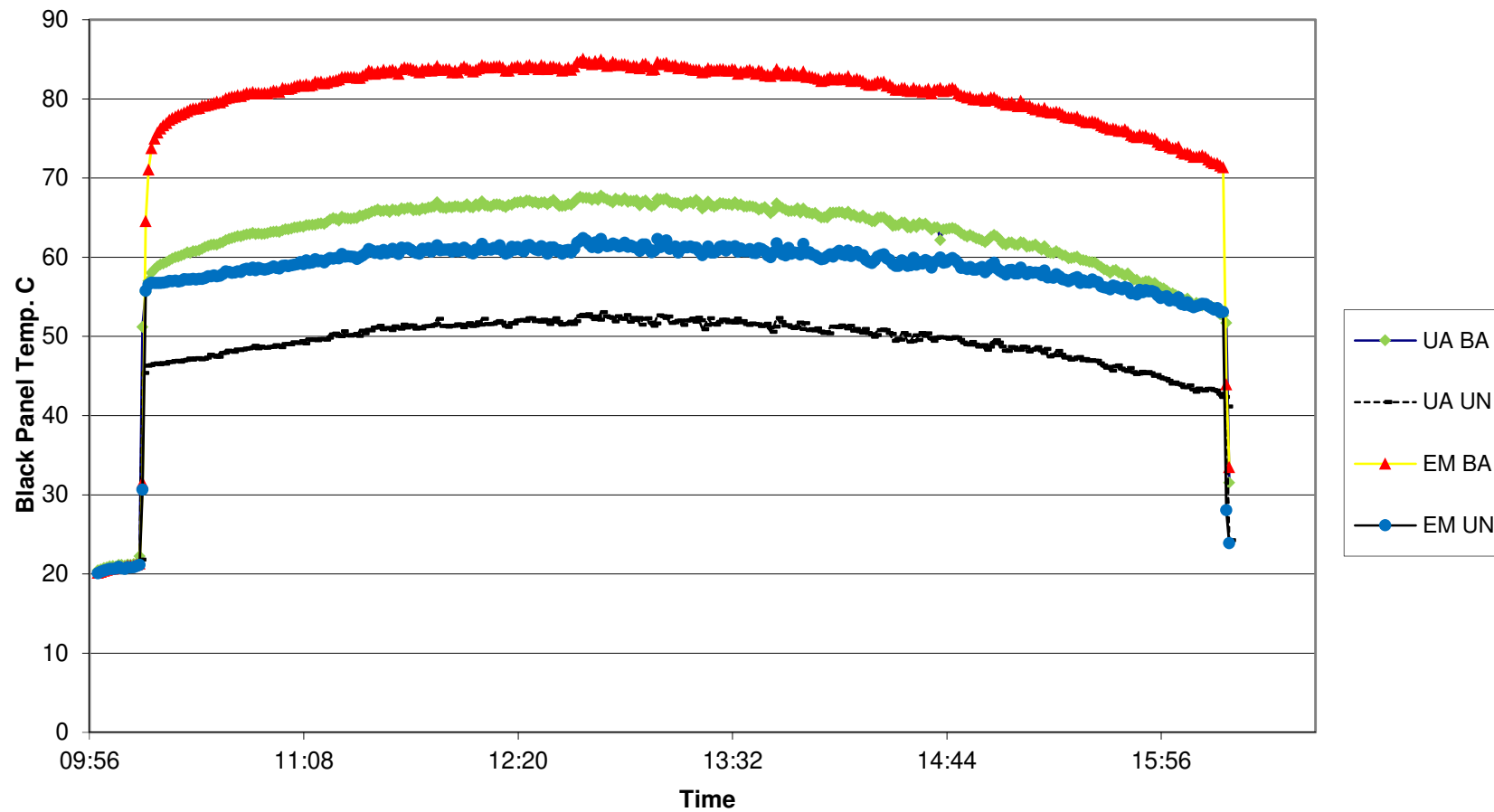


Ultra-Accelerated EMMA



- Black Panel Temperature Performance UA EMMA v. Std EMMA Data

UA EMMA and Standard EMMA 01/22/13
Warm Clear Day

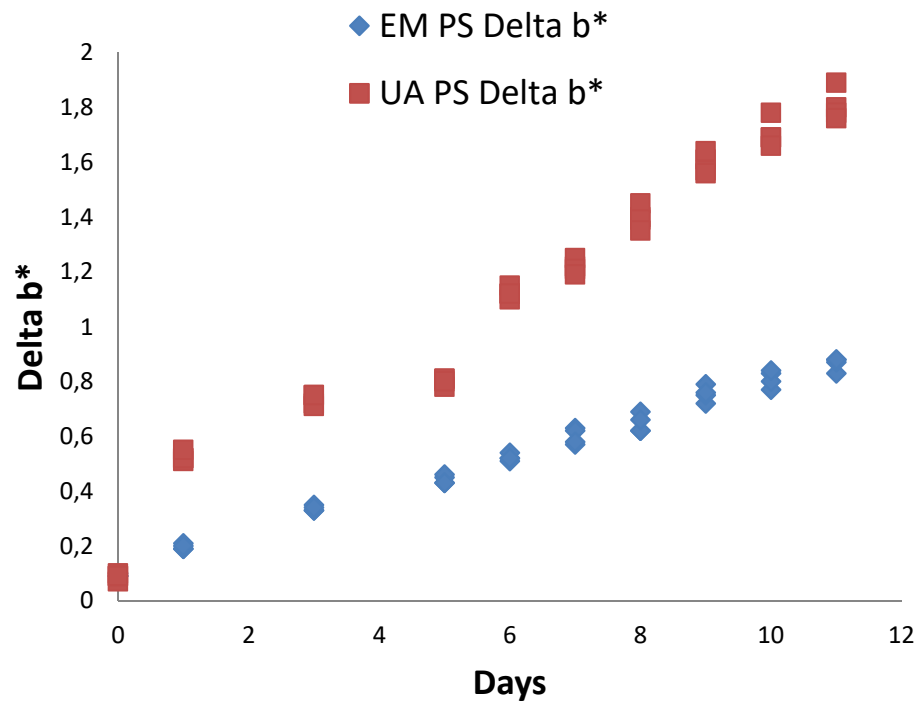


Comparison of Standard EMMA to UA EMMA

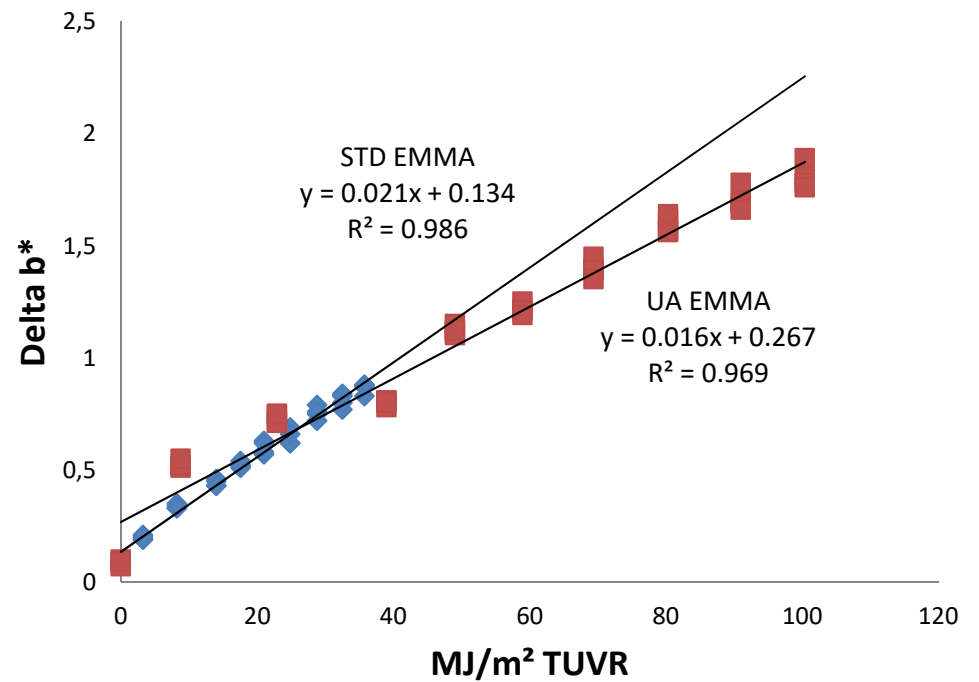


Weathering of reference polystyrene chips:

By Days:



By UV Radiant Exposure:



Summary

- ▀ UA-EMMA is another step in meeting the industry's demands for higher acceleration while not compromising correlation
- ▀ Testing meets the spectral requirements of ASTM G90
- ▀ LT-EMMA = 5-6 X Acceleration factor with temperature of a standard static exposure
- ▀ UA -EMMA = 10-12X Acceleration factor with high correlation
- ▀ UA-EMMA is another advancement of outdoor accelerated testing that can only be provided by Atlas
 - Temperature-Controlled EMMAQUA
 - Moisture-Controlled EMMAQUA
 - UAWS
 - UA-EMMA

Questions and Answers



Thank You!



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