IEA 4E SSL Annex
Interlaboratory Comparison of Measurements of Temporal Light Modulation – Plan

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IEA Technology Collaboration Programme on Energy Efficient End-Use Equipment

Background

Solid State Lighting Annex
Energy Efficient End-use Equipment
International Energy Agency

International Energy Agency
4E – Energy Efficient End-use Equipment
Solid State Lighting Annex

Members (Country governments)

Australia, Denmark, France, Republic of Korea, Sweden, United Kingdom (Oct. 2022)

Objective: Promote solid-state lighting worldwide for energy saving and quality assurance of products

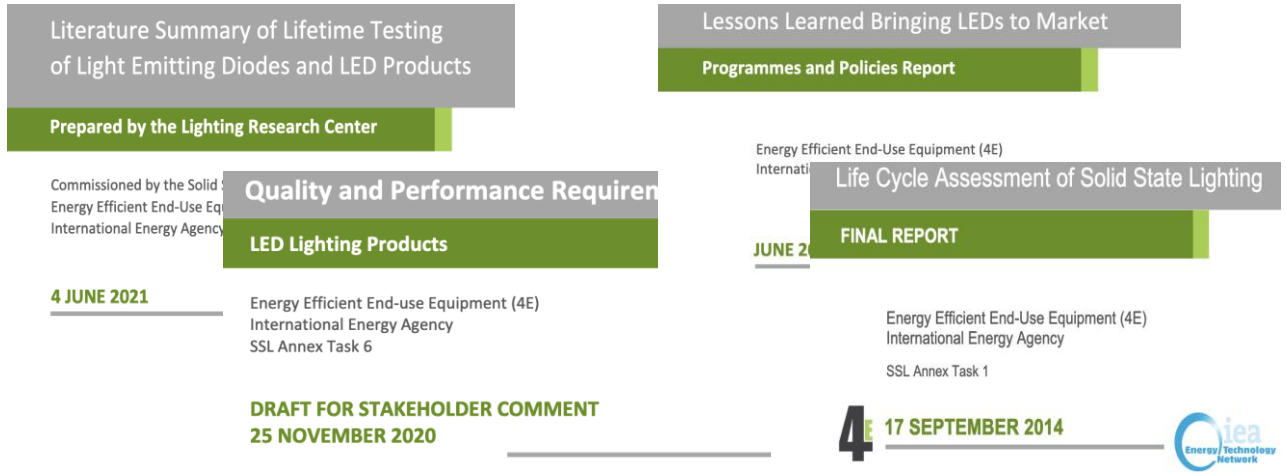
Phase I (2010 – 2014)
Phase II (2014 – 2019)
Phase III (2019 – 2024)

http://ssl.iea-4e.org/

Current Tasks

- Task 1. Human Centric Lighting – Health and Comfort
- Task 2. Lifetime of SSL Lamps and Luminaires
- Task 3. Lighting and Environment
- Task 4. Interlaboratory Comparison of Temporal Light Modulation
- Task 5. Test Methods and Performance Metrics
- Task 6. Quality and Performance Tiers
- Task 7. Smart Solid State Lighting
- Task 8. Database of SSL Products Performance

20 technical reports published since 2012



Background 1 – TLM requirements for products in regulatory programs

- **EU Ecodesign regulation** lighting omnibus has P_{st}^{LM} and SVM requirements. (Dec. 2019, effective Sept 2021)

  - Proposal to be adopted by **Australia** and **New Zealand**

- **US Energy Star** requires reporting of nominated TLM metrics for dimmable lamps under dimmed conditions (2015)
- **California Energy Commission** has TLM limits for dimmable lighting products under dimmed conditions (2016)
- UN Environment **U4E Model Regulations** for lamps has P_{st}^{LM} requirements. (adopted in **Pakistan** 2021, **Tunisia, Bolivia**). Expected to also follow EU with inclusion of SVM.
- Other countries (in **Southern & Eastern Africa**, **Central & South America**) supported by **CLASP** activities
- Proposed adoption of IEC TR 61547-1 and IEC TR 63158 by **China**

The Program

Interlaboratory Comparisons of Measurements of TLM (IC 2022)

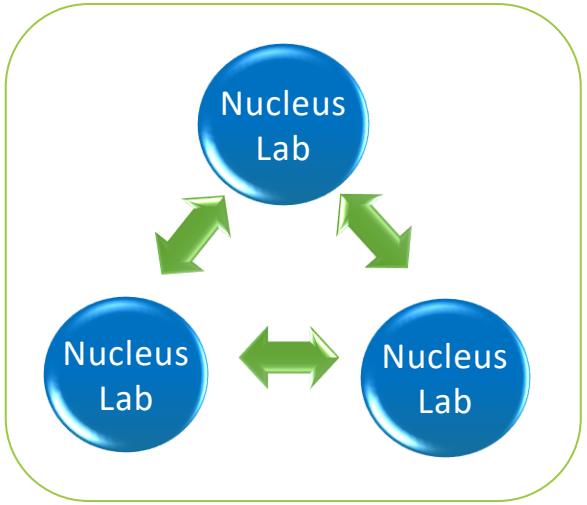
Objectives

- Investigate the level of agreement in measurements of temporal light modulation (TLM) quantities by laboratories worldwide, focusing on measurements of:
  - Short-term flicker index (P_{st}^{LM}) defined in IEC TR 61547-1
  - Stroboscopic effect visibility measure (SVM) defined in IEC TR 63158.
- Provide proficiency test for measurement of P_{st}^{LM} and SVM for accreditation programs
- Promote a harmonised and accurate measurement of TLM quantities globally.

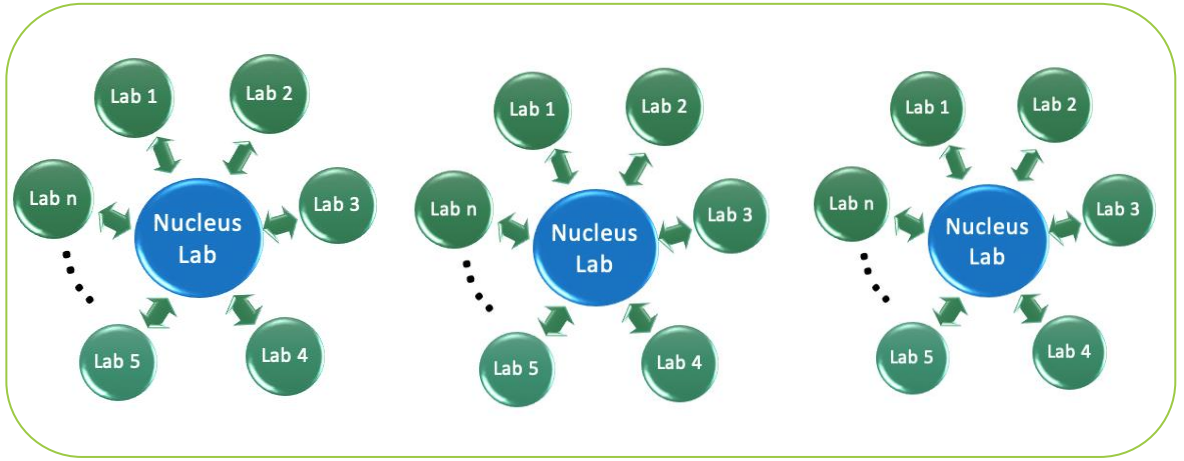
Scheme of IC 2022

Scheme 1

Nucleus Labs Comparison



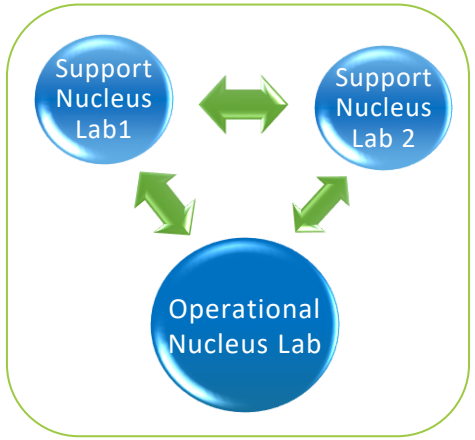
IC 2022 Measurement Rounds



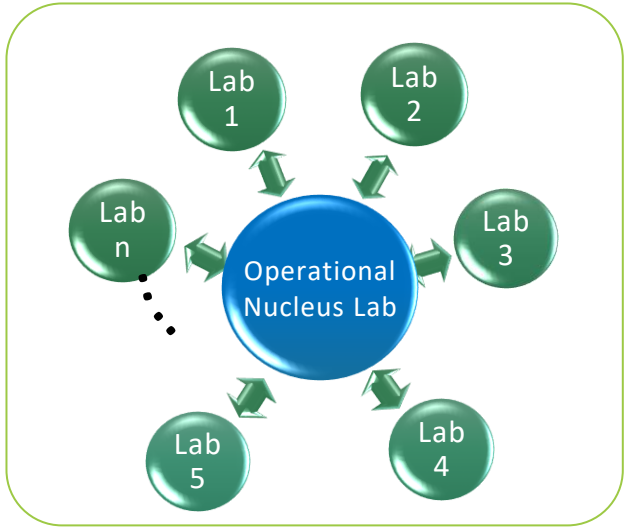
OR

Scheme 2

Nucleus Labs Comparison



IC 2022 Measurement Rounds



Cooperation with EMPIR MetTLM

EMPIR: European Metrology Program for Innovation and Research

MetTLM: Metrology for Temporal Light Modulation

- MetTLM leader: Paul Dekker (VSL, Netherlands)
- Project duration - May 2021 to May 2024
- DTU (SSL Annex Expert member) is a member of MetTLM
- Invitation to IEA 4E-SSL Annex for membership to project stakeholder committee
  - Possibilities to discuss with the project partners regarding matters related to TLM
  - Options to raise questions and influence the direction of the project
  - Invitations to stakeholder meetings held during the project
  - Optional offer to be listed as stakeholder on the project website
  - No formal obligations
- LETTER OF AGREEMENT signed on Nov. 16, 2022 - Steve Coyne is liaison rep for Annex

Contact with China

- May 2022…. Email communication with Wei Zhang, NLTC. She recommends two organizations to run regional comparisons in China:
  1. **National Lighting Test Centre (NLTC).**
  2. **CQC standard (Shanghai) testing technology Co. Ltd**. It is a CNAS recognized testing laboratory controlled by China Certification Centre (CQC). CQC is also interested in the comparison since this may helping to build reliable/comparable results from different laboratories towards certification.
  3. In addition, there will be support from **Beijing Lighting Research Institute** (BLRI), the brother organization of NLTC. BLRI is the secretariat of China national standardization committee on lighting (SAC/TC 224), and also mirror to IEC/TC 34 (The publication organization of IEC TR 61547-1 and IEC TR 63158). BLRI is now adopting IEC TR 61547-1 and IEC TR 63158 as China national standards, experimental verification (testing by different laboratories) can be expected.
- **China Exco representative is from CNIS**. Communication from SSL Annex to CNIS received reply offering Intertek lab to run China's regional comparisons
- Communication with NLTC just before Chinese New Year revealed nothing resolved yet.
- Task 4 Recommends that China run a separate interlab comparison that can be linked to IC 2022. IC2022 will provide protocol documents to China to replicate IC thereby allowing the linking of results.

Interlaboratory Comparisons of Measurements of TLM (IC 2022)

Outline

- **Instruments**: commercially available or custom-made instruments/systems to measure light waveforms, PstLM and SVM of light sources, meeting the requirements in CIE TN 012.
- **Artefacts:** 4 LED lamps + TLM simulator source
- **Measurement quantities**:

  P_{st}^{LM} and SVM, light waveforms

- **Test methods:**

  IEC TR 63158 (for SVM)

  IEC TR 61547-1 (for P_{st}^{LM})

  CIE TN 012:2021 (for data sampling and measurement)

- **Target participants:** Testing labs, lighting manufacturers, instrument manufacturers, research laboratories

Comparison Artefacts (tentative)

Four LED lamp artefacts (ART-1 to ART-4) and one TLM generator source (ART-5) are considered.

The LED lamps will have a bulb shape of A60 with E27 screw base, rated for 230 V AC, 50 Hz, with the following ranges of TLM waveform:

ART-1 to ART-4 (The values are tentative.)

Artefact	PstLM (range)	SVM (range)
Art-1	Low; < 0.1	Low; < 0.1
Art-2	Low; < 0.2	High; 0.4 – 0.9
Art-3	High; > 1.0	Low; < 0.2
Art-4 complex waveform	> 0.5	> 2.0

The LED lamps will be operated under the conditions (ambient temperature, stabilization, operating position) specified in CIE S 025.

Measurement Quantities and Reported Information

	Comparison Quantities	Symbol
1	Short-term flicker index	P_{st}^{LM}
2	Stroboscopic effect visibility measure	M_{VS}

Uncertainties (k=2) of each quantity are also required (though results without uncertainties would also be accepted).

	Optional quantities for comparison	Symbol
15	Percent Flicker (PF)	M_A
16	Flicker Index (FI)	I_F
17	Perceptual Modulation	M_p
18	California Energy Commission (For dimmable products at levels of 100%, 20% and minimum fraction of light output)	
	Percent amplitude modulation unfiltered (same as entry 3 above)	M_A
	Percent amplitude modulation with < 1,000 Hz cut-off	$M_{A,<1\ kHz}$
	Percent amplitude modulation with < 400 Hz cut-off	$M_{A,<400\ Hz}$
	Percent amplitude modulation with < 200 Hz cut-off	$M_{A,<200\ Hz}$
	Percent amplitude modulation with < 90 Hz cut-off	$M_{A,<90\ Hz}$
	Percent amplitude modulation with < 40 Hz cut-off	$M_{A,<40\ Hz}$

	Other results reported
3	Supply voltage measured (and uncertainty)
4	RMS current of the lamp (and uncertainty)
5	Active power of the lamp (and uncertainty)
6	Sampling rate (kHz) (PstLM / SVM)
7	Calculation duration (s) (PstLM / SVM)
8	Optical waveform data (Instructions in Results Report form)
9	Dominant frequency (optional)
10	Modulation depth (optional)
11	Ambient temperature (and uncertainty)

	Other information reported
12	TLM measurement device used
13	Optical input method (sphere or bench)
14	Power supply used

Data Analyses

(1) Differences

$$x\text{-}X$$

x: participants' result
X: reference value

for each participant and for each artefact, for P_{st}^{LM} and M_{VS},

(2) z' score

For proficiency test purposes, z' score (ISO 13528) is calculated by

$$z' = \frac{x - X}{\sqrt{\hat{\sigma}^2 + u_X^2 + u_{\text{drift}}^2}}$$

Where

$\hat{\sigma}$: SDPA value
u_X: standard uncertainty of the reference value
u_{drift}: standard uncertainty for artefact drift calculated by

$$u_{\text{drift}} = \frac{0.8 \cdot \hat{\sigma}}{2\sqrt{3}}$$

SDPA - Standard Deviation for Proficiency Assessment

(3) En number

For proficiency test purposes, En number (ISO/IEC 17043) is calculated by

$$E_n = \frac{x - X}{\sqrt{U_{\text{lab}}^2 + U_{\text{ref}}^2}}$$

where

U_{lab} expanded uncertainty (k=2) of a participant's result
U_{ref} expanded uncertainty (k=2) of the reference value.

Comparison Reports

(1) IC 2022 Technical Protocol

(2) Nucleus Laboratories Comparison Report – issued after completion of the Nucleus Laboratories Comparison

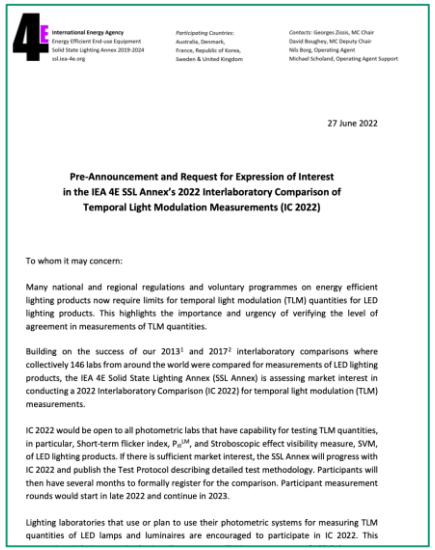
(3) Individual Test Reports (ITR) – issued to each participant after each measurement round is completed. The ITRs may be used for a proficiency test in laboratory accreditation programs that recognize IC 2022.

(4) Final Report – issued, presenting the results comparing measurements of all participants in an anonymous manner. The report will provide results for each artefact type and each of the measurement quantities, and discuss problems observed and considerations made in the results.

Activities: Ascertain Demand/Interest in IC 2022

Pre-announcement and EOI on IC 2022

July 2022 - Pre-announcement distributed by email to our global mailing list



International Energy Agency
Energy Efficient End-use Equipment
Solid State Lighting Annex 2019-2024
ssl.iea-4e.org

Participating Countries:
Australia, Denmark, France, Republic of Korea, Sweden & United Kingdom

Contacts: Georges Zissis, MC Chair; David Boughey, MC Deputy Chair; Nils Borg, Operating Agent; Michael Scholand, Operating Agent Support

27 June 2022

Pre-Announcement and Request for Expression of Interest in the IEA 4E SSL Annex's 2022 Interlaboratory Comparison of Temporal Light Modulation Measurements (IC 2022)

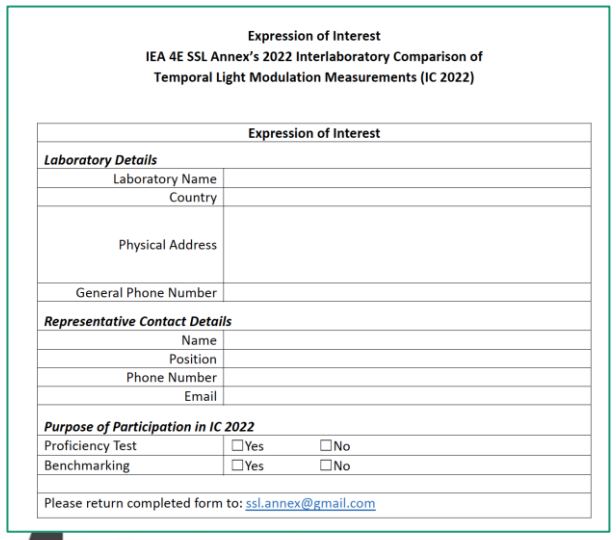
To whom it may concern:

Many national and regional regulations and voluntary programmes on energy efficient lighting products now require limits for temporal light modulation (TLM) quantities for LED lighting products. This highlights the importance and urgency of verifying the level of agreement in measurements of TLM quantities.

Building on the success of our 2013[1] and 2017[2] interlaboratory comparisons where collectively 146 labs from around the world were compared for measurements of LED lighting products, the IEA 4E Solid State Lighting Annex (SSL Annex) is assessing market interest in conducting a 2022 Interlaboratory Comparison (IC 2022) for temporal light modulation (TLM) measurements.

IC 2022 would be open to all photometric labs that have capability for testing TLM quantities, in particular, Short-term flicker index, P_{st}^{LM}, and Stroboscopic effect visibility measure, SVM, of LED lighting products. If there is sufficient market interest, the SSL Annex will progress with IC 2022 and publish the Test Protocol describing detailed test methodology. Participants will then have several months to formally register for the comparison. Participant measurement rounds would start in late 2022 and continue in 2023.

Lighting laboratories that use or plan to use their photometric systems for measuring TLM quantities of LED lamps and luminaires are encouraged to participate in IC 2022. This



Expression of Interest
IEA 4E SSL Annex's 2022 Interlaboratory Comparison of Temporal Light Modulation Measurements (IC 2022)

Expression of Interest		
Laboratory Details		
Laboratory Name		
Country		
Physical Address		
General Phone Number		
Representative Contact Details		
Name		
Position		
Phone Number		
Email		
Purpose of Participation in IC 2022		
Proficiency Test	☐Yes	☐No
Benchmarking	☐Yes	☐No
Please return completed form to: ssl.annex@gmail.com		

Points

- SSL Annex is assessing market interest for an interlaboratory comparison of TLM
- Comparison quantities; P_{st}^{LM} and SVM
- IEC TR 61547-1, IEC TR 631585 and CIE TN 012:2021 as the test methods
- Technical study as well as serving as proficiency test
- Fee: €2400 to €3800 per lab
- Submit completed expression of interest form

Received 21 responses

Europe: Denmark, Germany, France, Sweden, Slovenia

Africa: Uganda

Asia Pacific: Australia

South America: Brazil,

Central America: Costa Rica

- They are testing laboratories, instrument manufacturers, lighting manufacturers, universities and research institutes.
- Most of them are interested in PT
- No labs from China, USA

Nucleus Laboratories

- Discussions with all member countries/laboratories
- Finalised:

Operational Nucleus Laboratory:

Korea Institute of Lighting and ICT (KILT)

- Coordinator: Dr. Hee-Suk Jeong
- Technical contact: Jun-Seok Oh

Supporting Nucleus Laboratory

Technical University of Denmark (DTU)

- Coordinator: Carsten Dam-Hansen
- Technical contact: Carsten Dam-Hansen

Supporting Nucleus Laboratory

National Institute of Standards and Technology (USA)

- Coordinator: Dr. Yoshi Ohno
- Technical contact: Dr. Yoshi Ohno

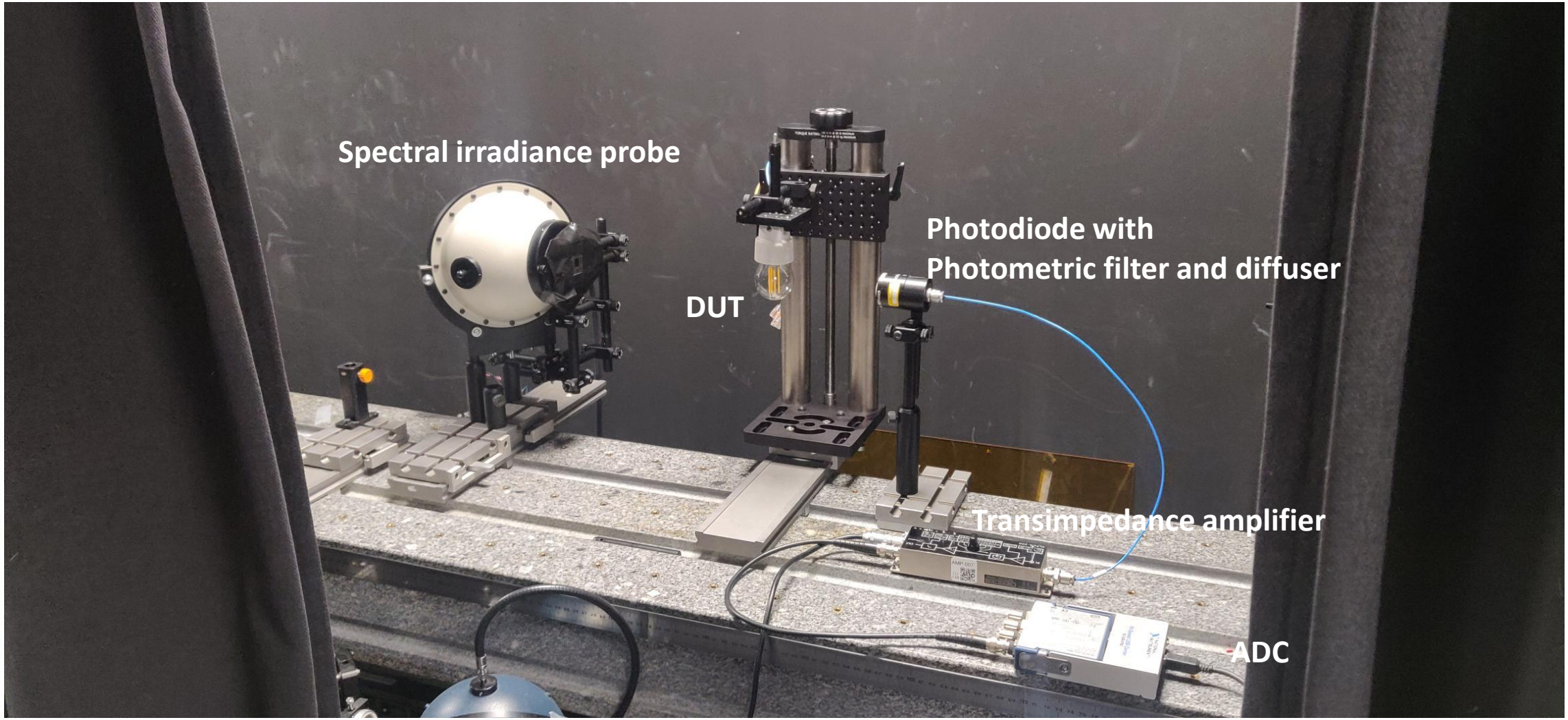
- Now in preparation for Nucleus Laboratory Comparison

Activities: Consistency of test methods used by nucleus labs

Capabilities of Nucleus Lab Equipment

- Need to understand the flexibility of measurement settings and hardware (especially low pass filter) for P_{st}^{LM} and SVM measurements

DTU Measurement setup



DTU Measurement setup

- Hardware:
  - Home constructed

- Software:
  - Matlab script for control and analysis

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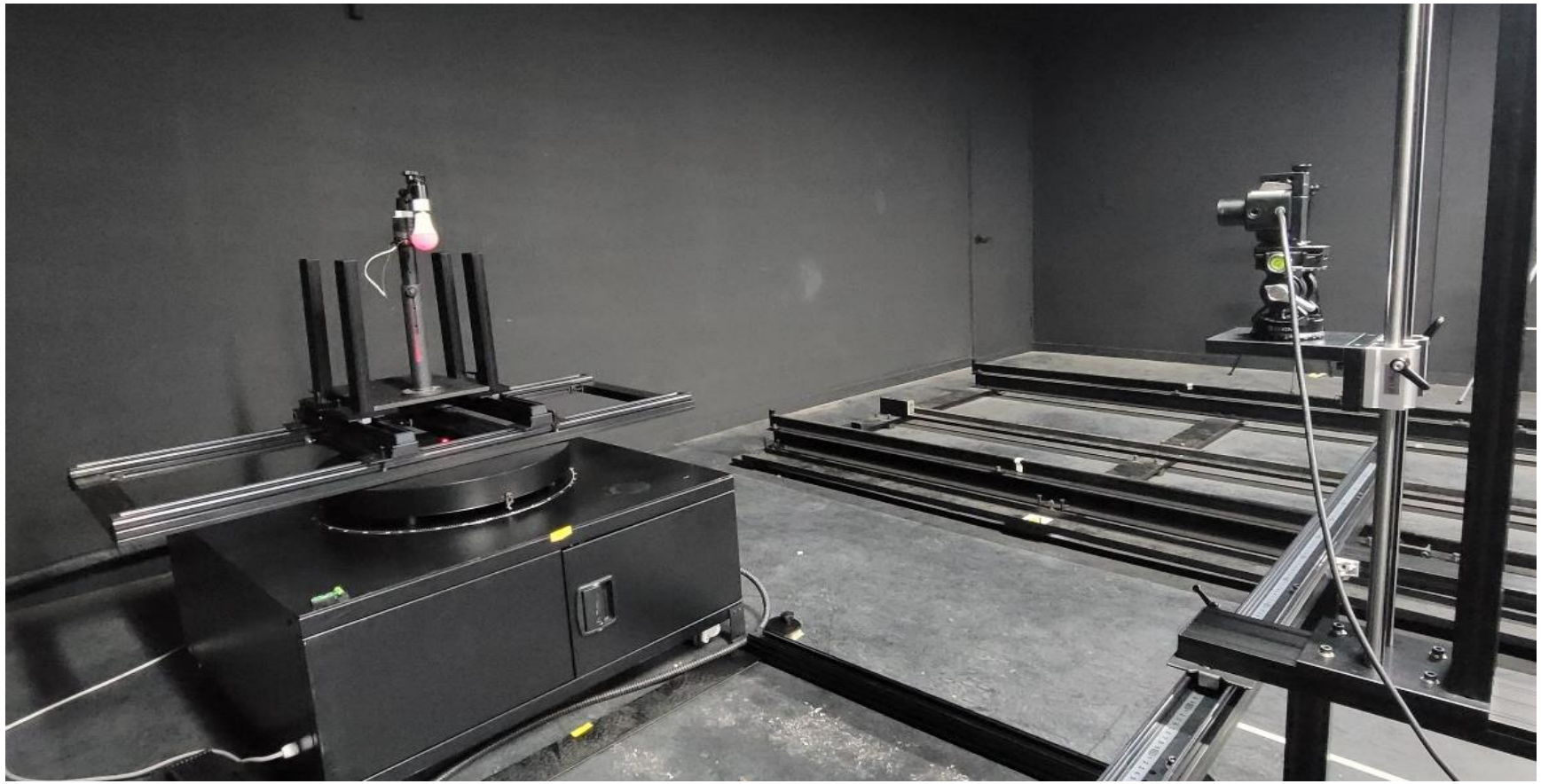
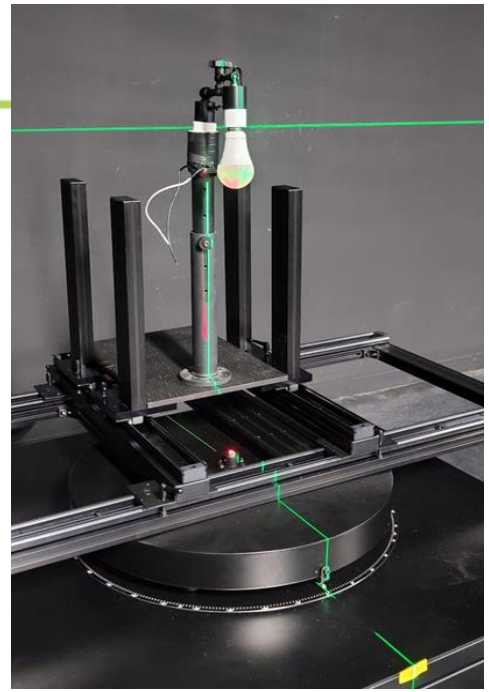
KILT Measurement setup





KILT Measurement Equipment Information

- Hardware:
  - Commercial

- Software:
  - Included

	EVERFINE (Main)	UPRTEK (Sub)
1) Brand/model of your TLM measuring equipment (or home built – including specs of photometer head, I-V amplifier, digitizer)	LFA-3000	MK350S
2) Selection (range) of sampling rate (kHz) you can choose, and the sampling rate you normally use for PstLM and SVM	100k/sec	100k/sec
3) Selection (range) of acquisition duration (s), and the duration you normally use for PstLM and SVM	180s	n/a
4) If you use a low pass filter, its type (analog or digital) and cut-off frequency (kHz) and selections of frequencies if it is selectable	n/a	optional function
5) Optical geometry – photometric bench measuring one direction, or using integrating sphere?	Both possible	one direction
6) PstLM and SVM calculation software - name/version (or home built), if not inclusive in the TLM meter described above	Light Flicker Analyzer (v2.00.124)	uFlicker (v1.0.2.3)
7) Does KILT provide calibration service for TLM, in particular, PstLM and SVM? Or, it is for your research purpose? How long do you have experience measuring TLM?	KILT have been providing domestic certification and testing for lighting products since 2016 but doesn't provide calibration service for TLM.	

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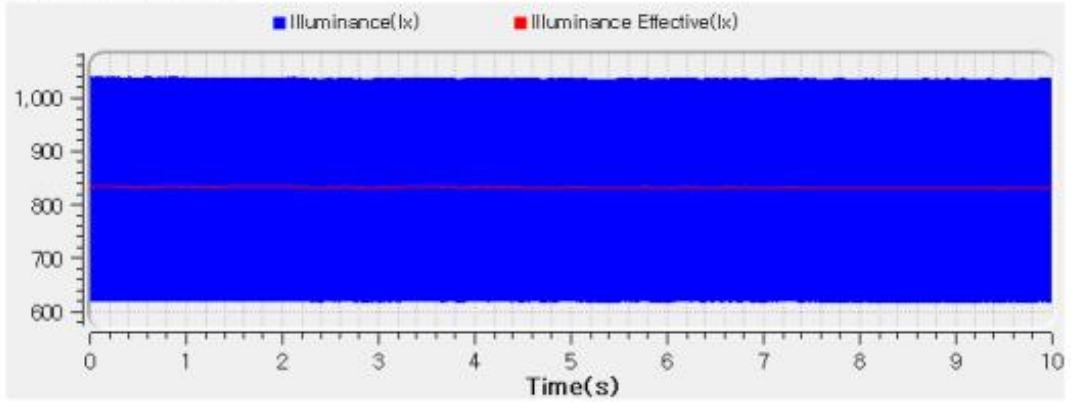
KILT Measurement Equipment Information

Test condition

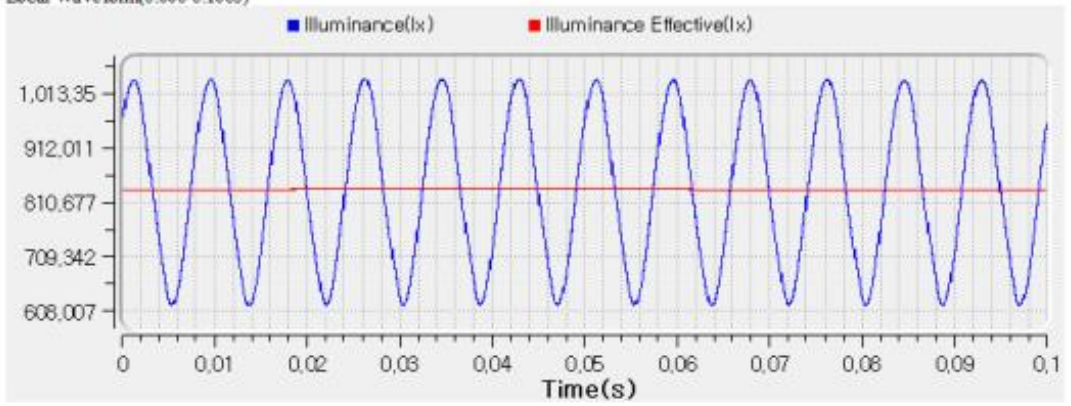
Photometric Type:	Illuminance(lx)	**Test range:**	Range2	**Sampling Mode:**	Software
Samplerate:	100 kS/s	**Sampling Time:**	10.00 s	**Frequency Cal.:**	Input

Test Wave

Global Waveform(0-10.000s)



Local Waveform(0.000-0.100s)



Test Result

Avg(lx) :	832.283	**Max(lx) :**	1.042 k	**Min(lx) :**	615.862
Flicker Index:	0.079	**Percent Flicker:**	25.302%	**Frequency:**	119.972 Hz

KILT Measurement Equipment Information

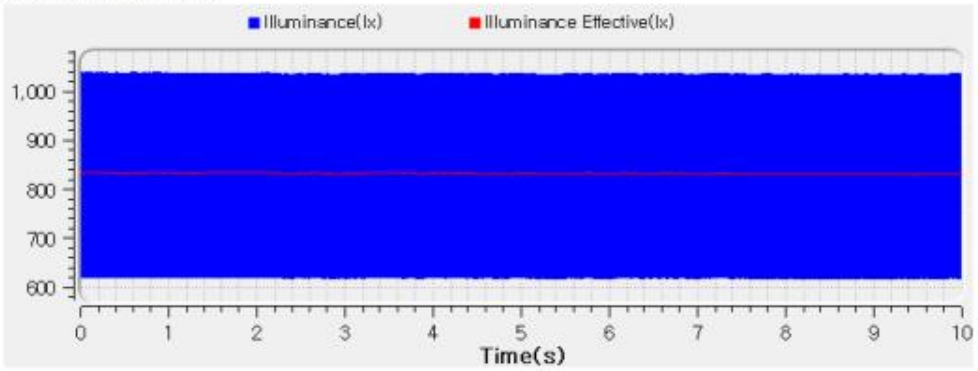
Test condition

Photometric Type: Illuminance(lx) **Test range:** Range2 **Sampling Mode:** Software

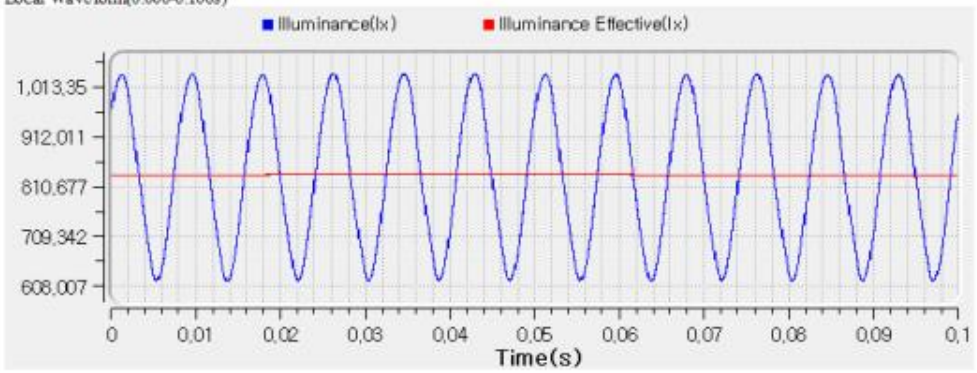
Samplerate: 100 kS/s **Sampling Time:** 10.00 s **Frequency Cal.:** Input

Test Wave

Global Waveform(0-10.000s)



Local Waveform(0.000-0.100s)



Test Result

Avg(lx) : 832.283 **Max(lx) :** 1.042 k **Min(lx) :** 615.862

Flicker Index: 0.079 **Percent Flicker:** 25.302% **Frequency:** 119.972 Hz

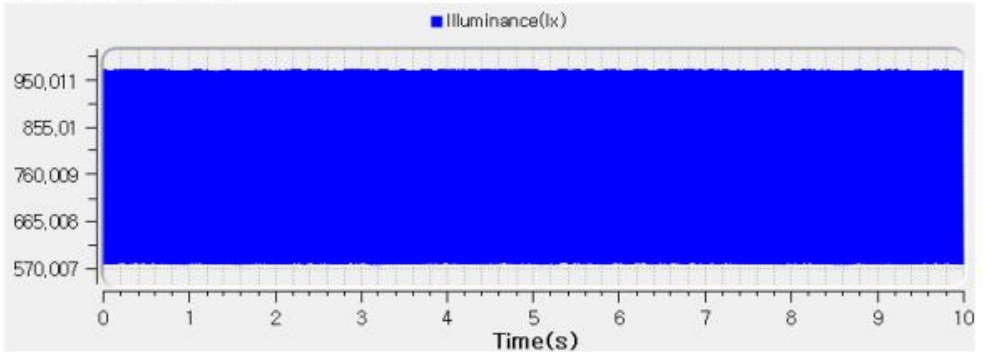
Test condition

Photometric Type: Illuminance(lx) **Test range:** Range2 **Sampling Mode:** Software

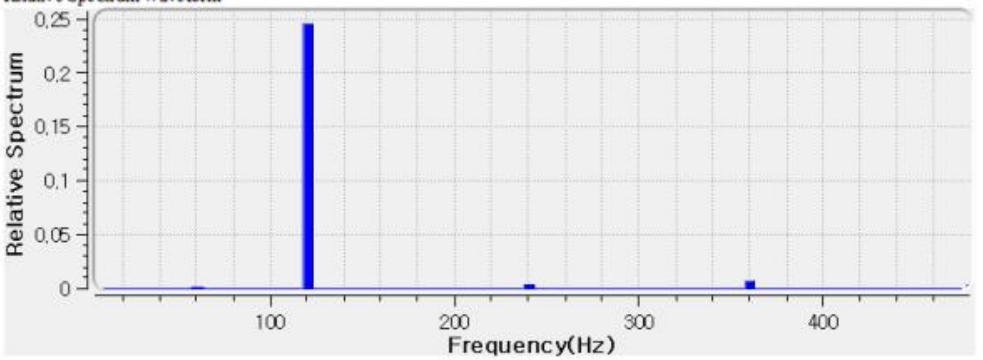
Samplerate: 100 kS/s **Sampling Time:** 10.00 s

Test Wave

Local Waveform(0.000-10.000s)



Relative Spectrum Waveform

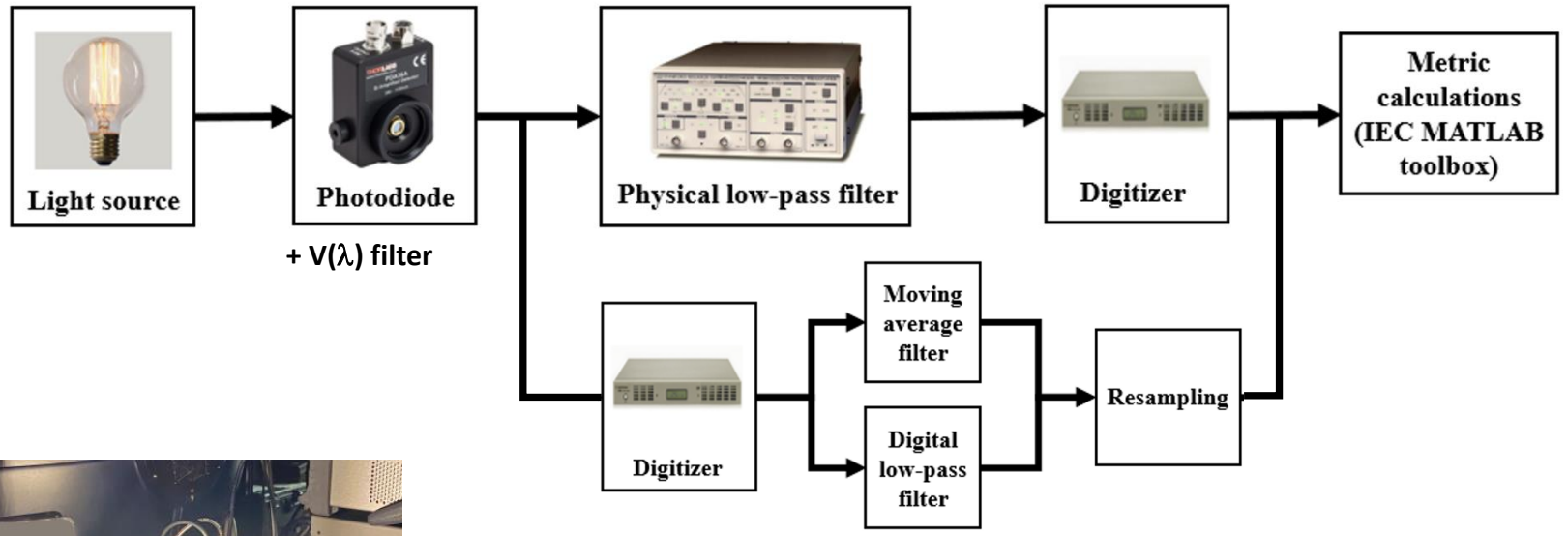


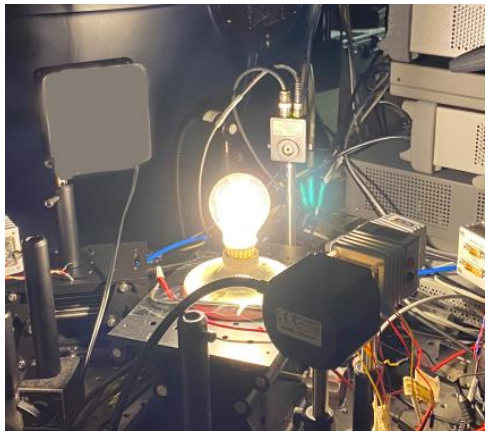
Test Result

Avg(lx) : 779.450 **Max(lx) :** 973.331 **Min(lx) :** 577.493

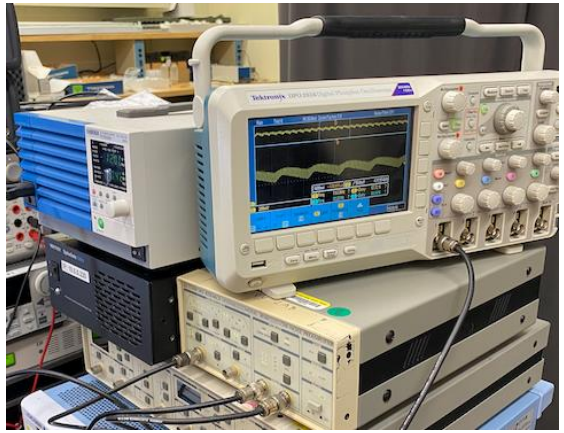
Frequency: 119.971 Hz **SVM:** 0.890 **Visibility:** Not Visible

NIST Measurement Setup





Lamp mount to be modified for base-up



Sampling rate: 5 kHz to 500 kHz
- normally 20 kHz~100 kHz

Sampling duration: 1 s to 180 s

Analog Filter unit (low-pass)
- Cut-off freq. 1 kHz, 3 kHz, 10 kHz
- Roll off 6dB/oct, 12 dB/oct

Digital filter: Butterworth low-pass filter
- Cut-off freq. 1 kHz to 10 kHz
- Roll off 6dB/oct(1), 12 dB/oct(2),…

NIST's study on Measurement of PstLM and SVM

Studied the effects of different measurement conditions on the results of P_{st}^{LM} and SVM for 11 re

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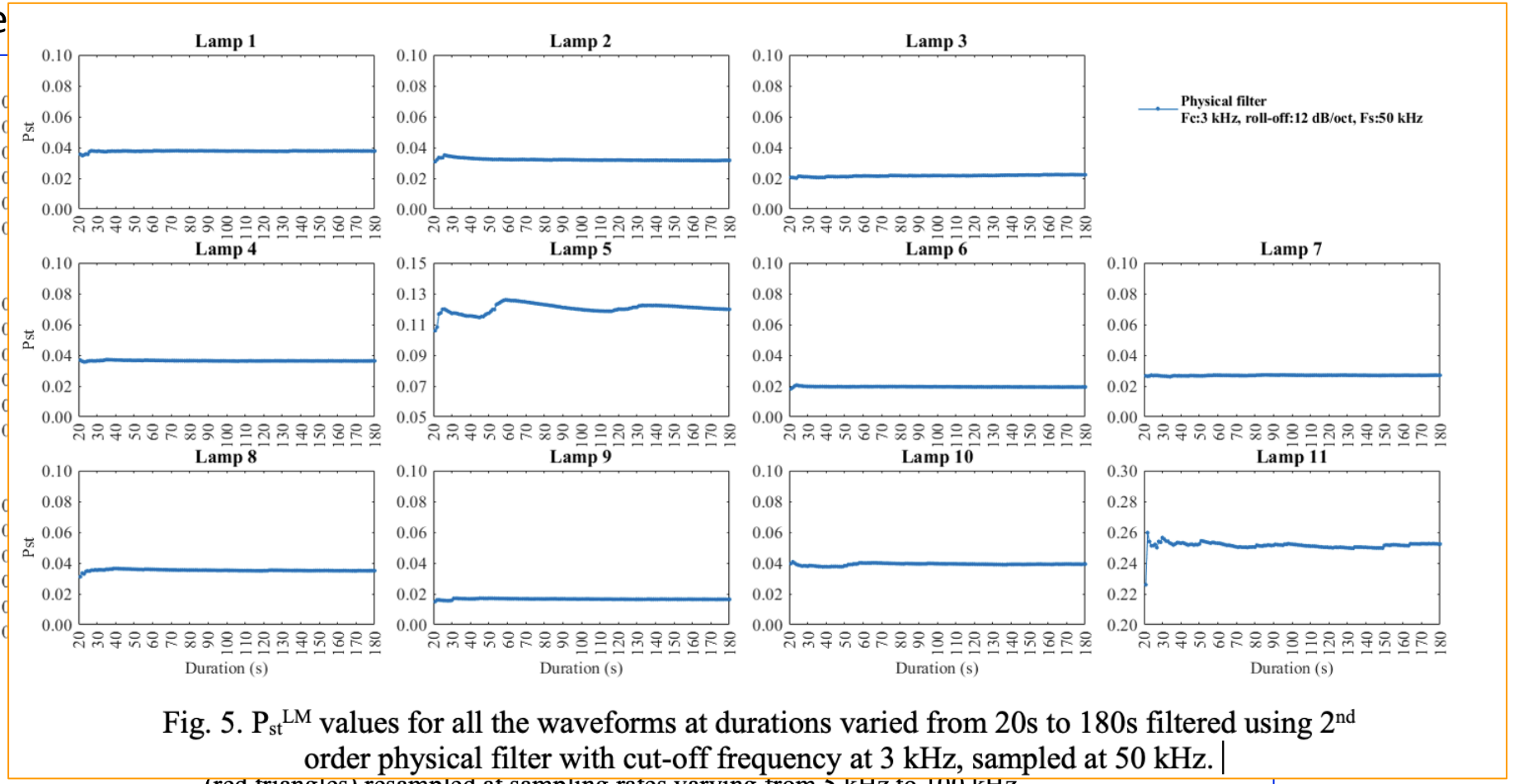


Fig. 5. P_{st}^{LM} values for all the waveforms at durations varied from 20s to 180s filtered using 2nd order physical filter with cut-off frequency at 3 kHz, sampled at 50 kHz.

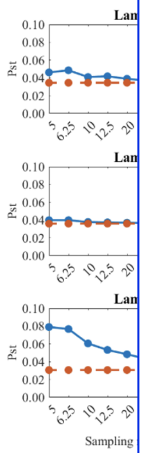
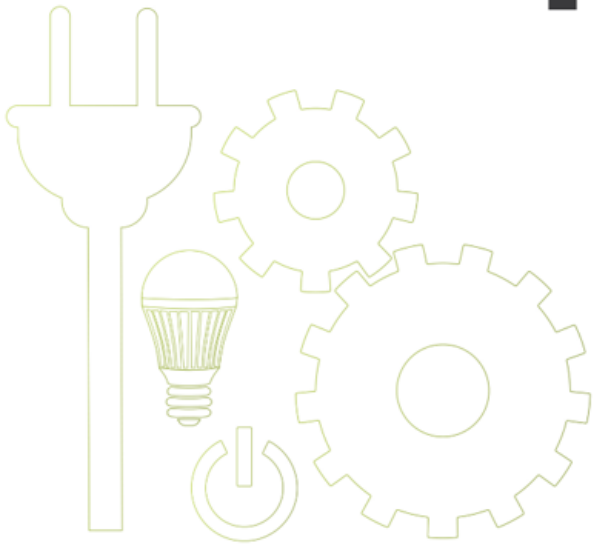


Fig. 3

(red triangles) resampled at sampling rates varying from 5 kHz to 100 kHz.

s filtered using 2nd order physical filter with cut-off frequency at 3 kHz, sampled at 50 kHz.

Activities: Drafting IC 2022 Technical Protocol



Solid State Lighting Annex: Interlaboratory Comparison 2022 (IC 2022) on Measurement of Temporal Light Modulation

Technical Protocol Draft (for Nucleus Lab Comparison)

Energy Efficient End-Use Equipment (4E)
International Energy Agency

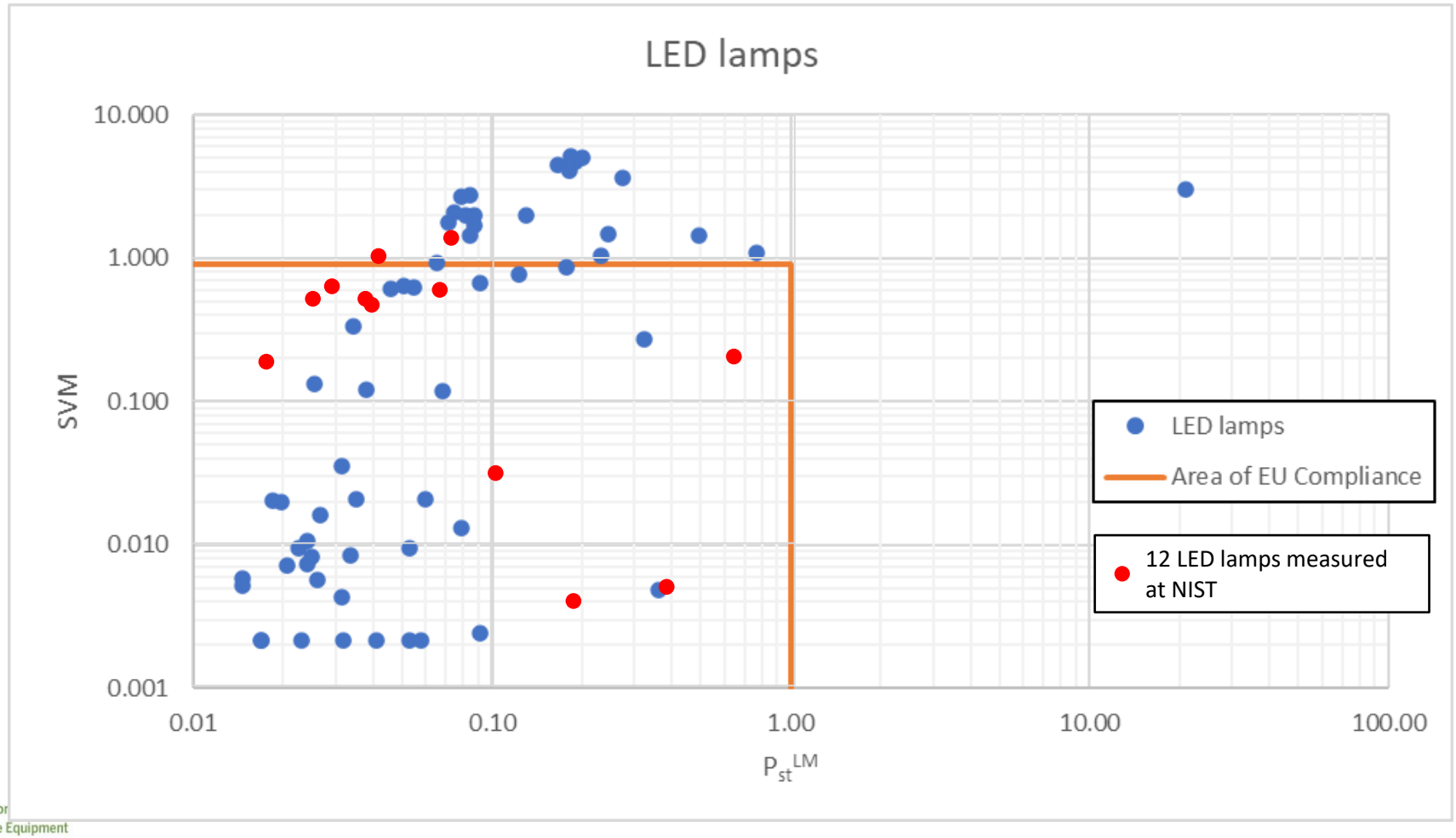
22 March 2023

Activities: Identify Suitable Artefacts

Artefact Identification - Range of P_{st}^{LM} and SVM values of LED lamps

Pre-2020 procurement – Displayed results of lamps tested

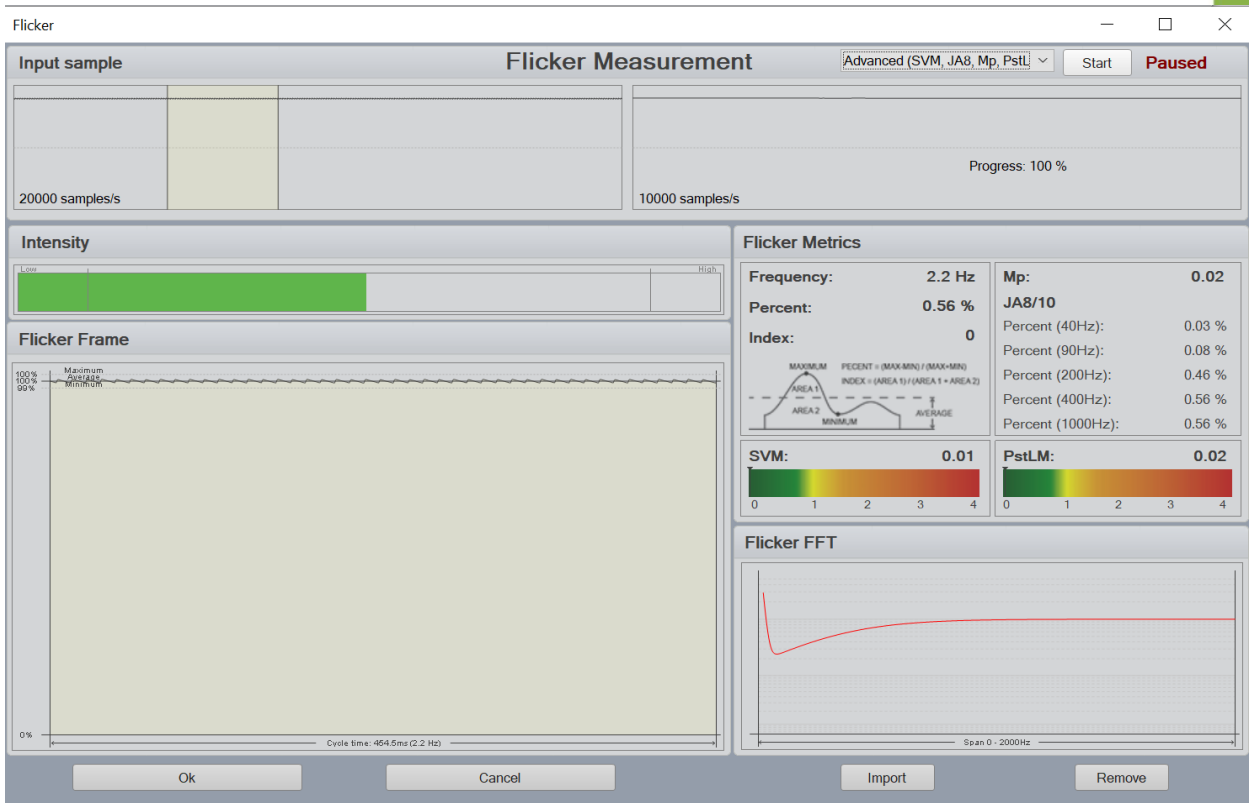
2022 onwards – having difficulty identifying products with high SVM and/or P_{st}^{LM} values



Art-1 (Low PstLM, Low SVM)

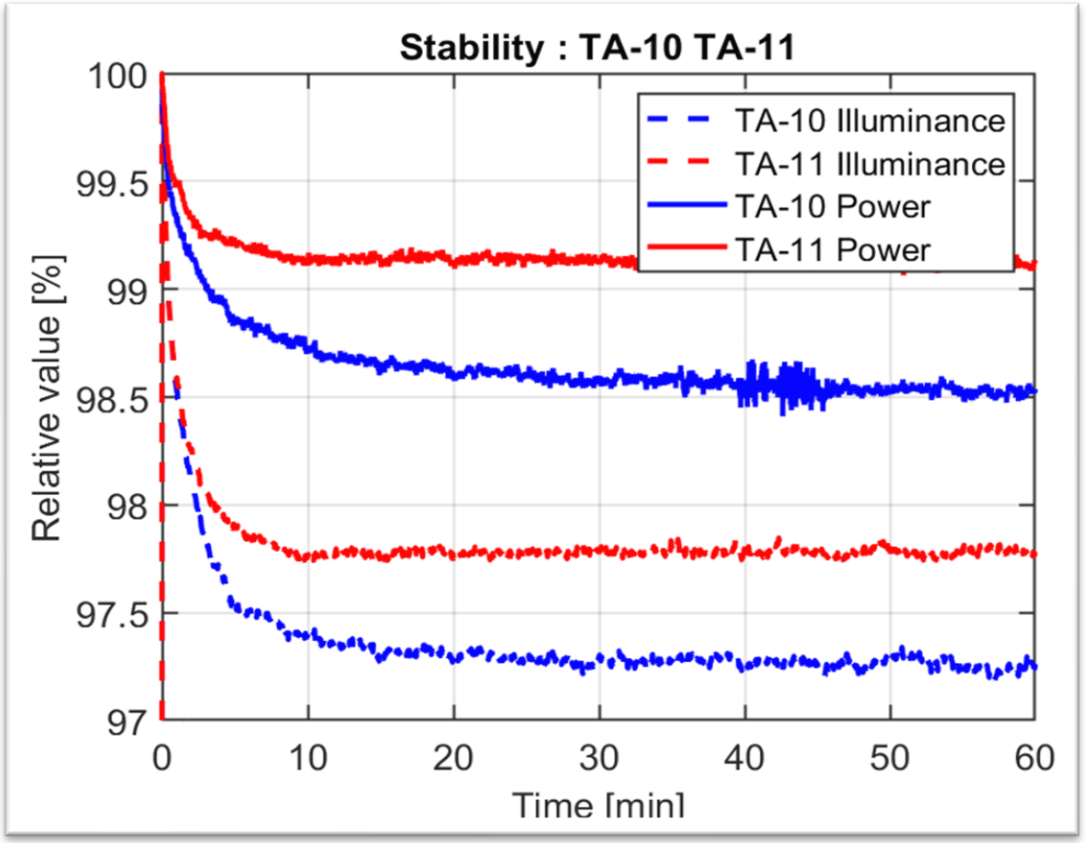
Product Details

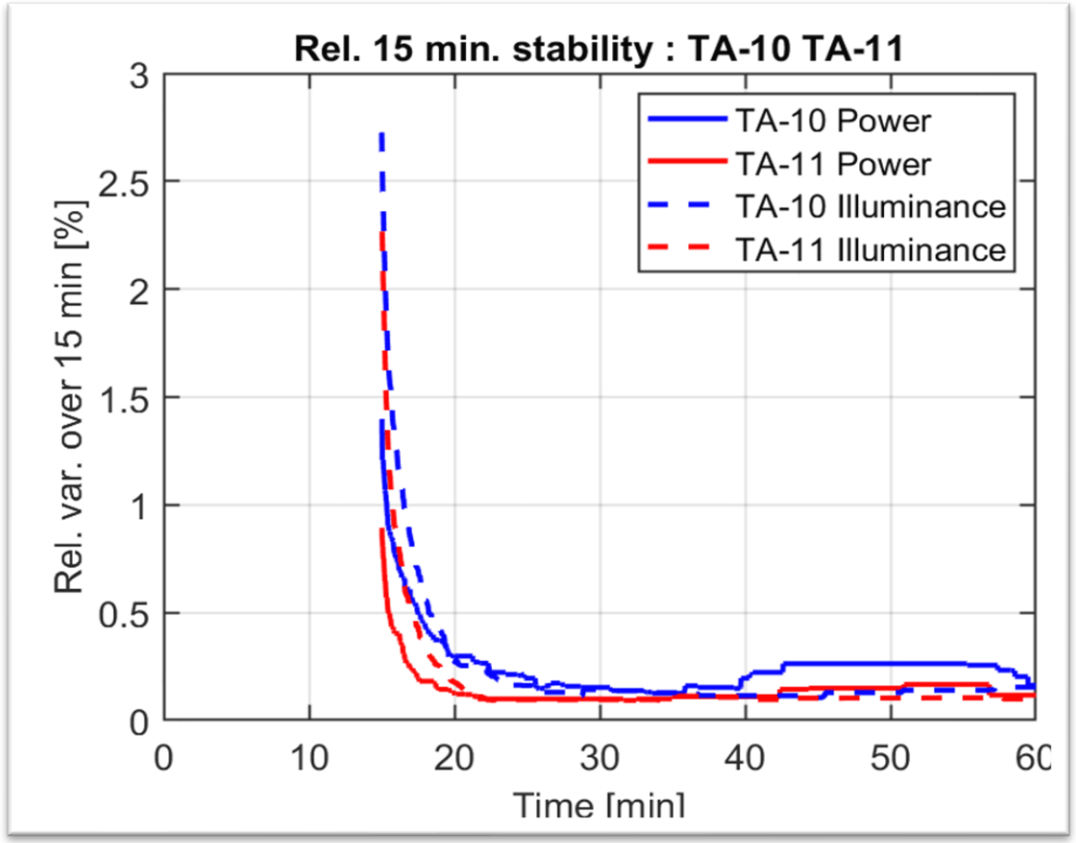
Brand	Crompton Lamps	
Model	GLS-ES-E27 A-Class Energy	
Description	LED filament	
Base Type	E27	
Wattage	3.8	watts
Lifetime		hours
CCT		K
CRI		
Lumens	806	lm
Efficacy (box)	212	lm/W



Art-1 (Low PstLM, Low SVM)

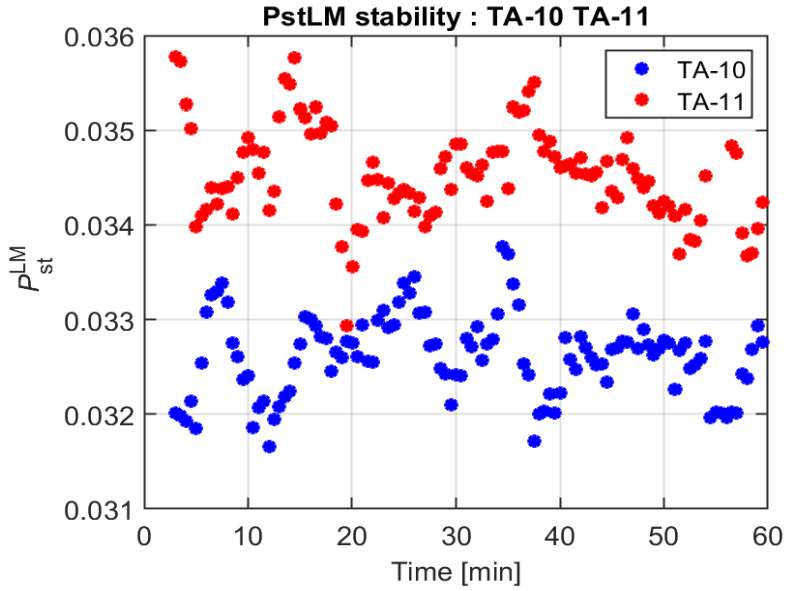
Stability

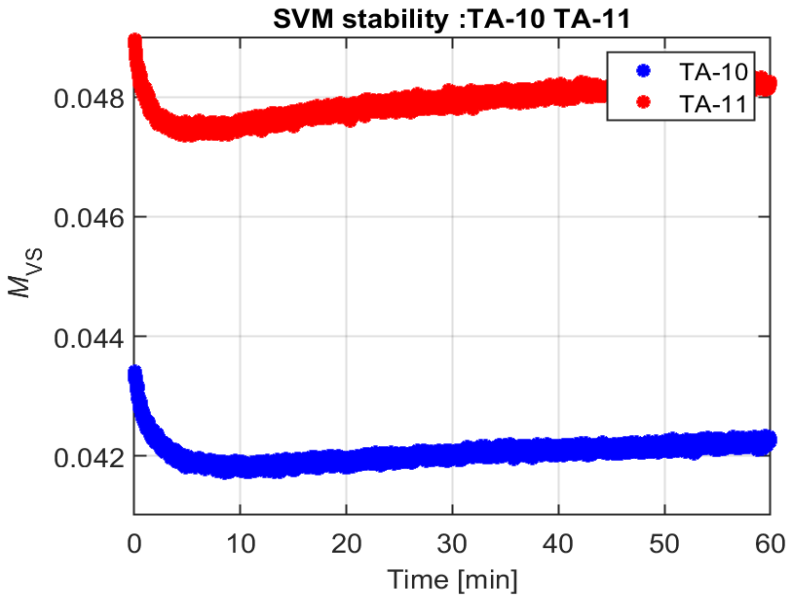


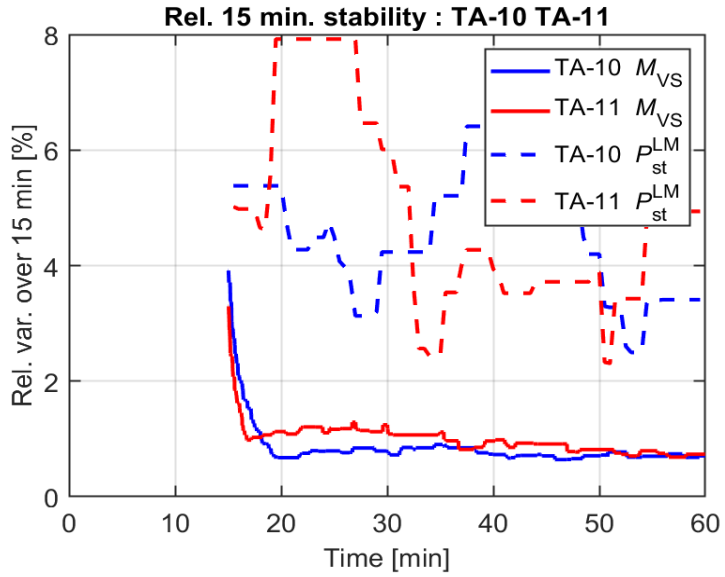


Art-1 (Low PstLM, Low SVM)

Stability

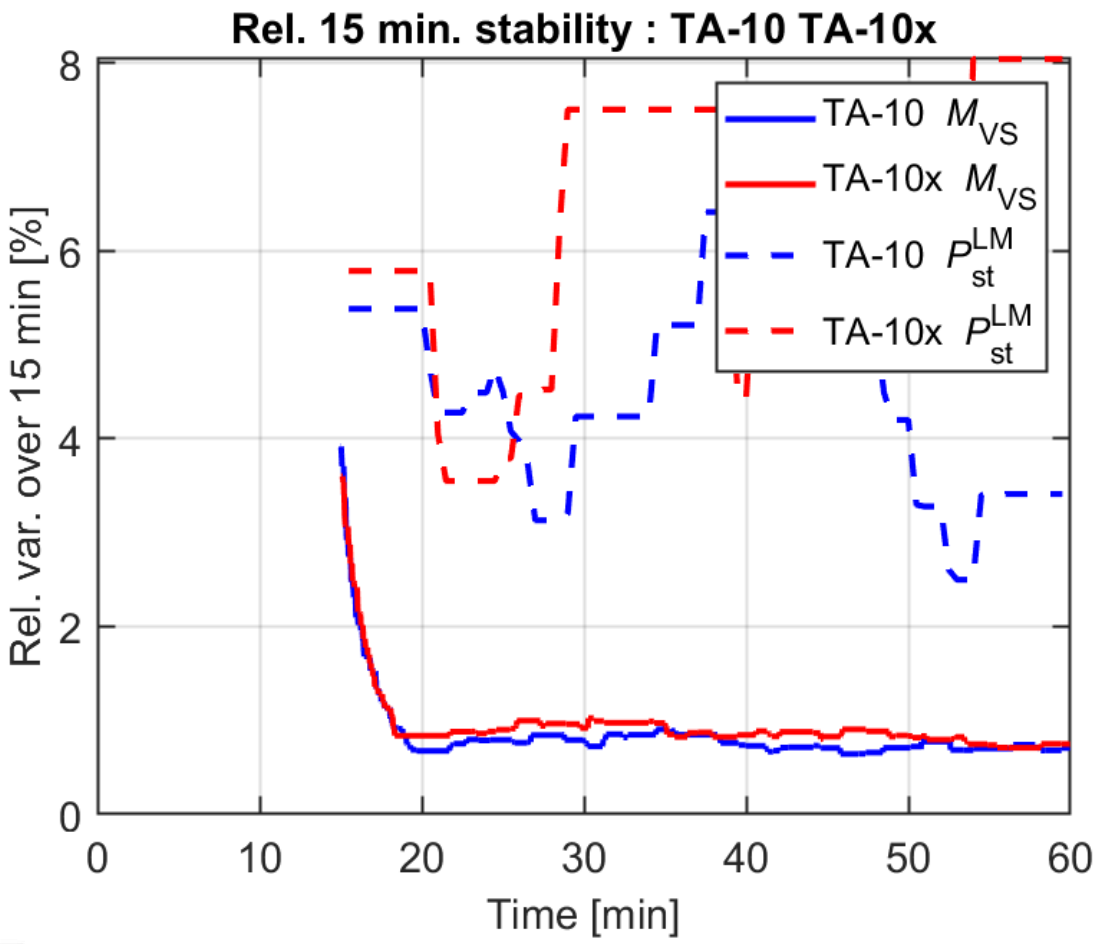


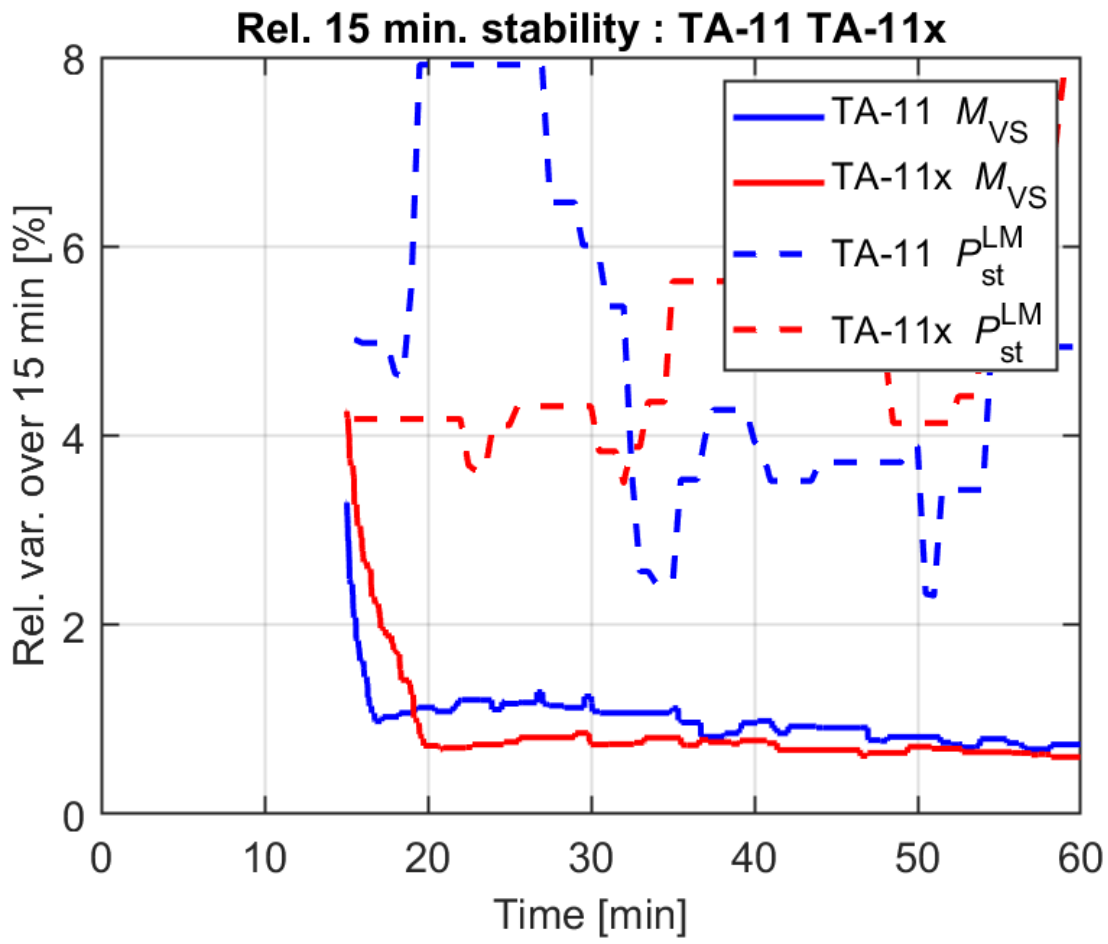




Art-1 (Low PstLM, Low SVM)

Reproducibility

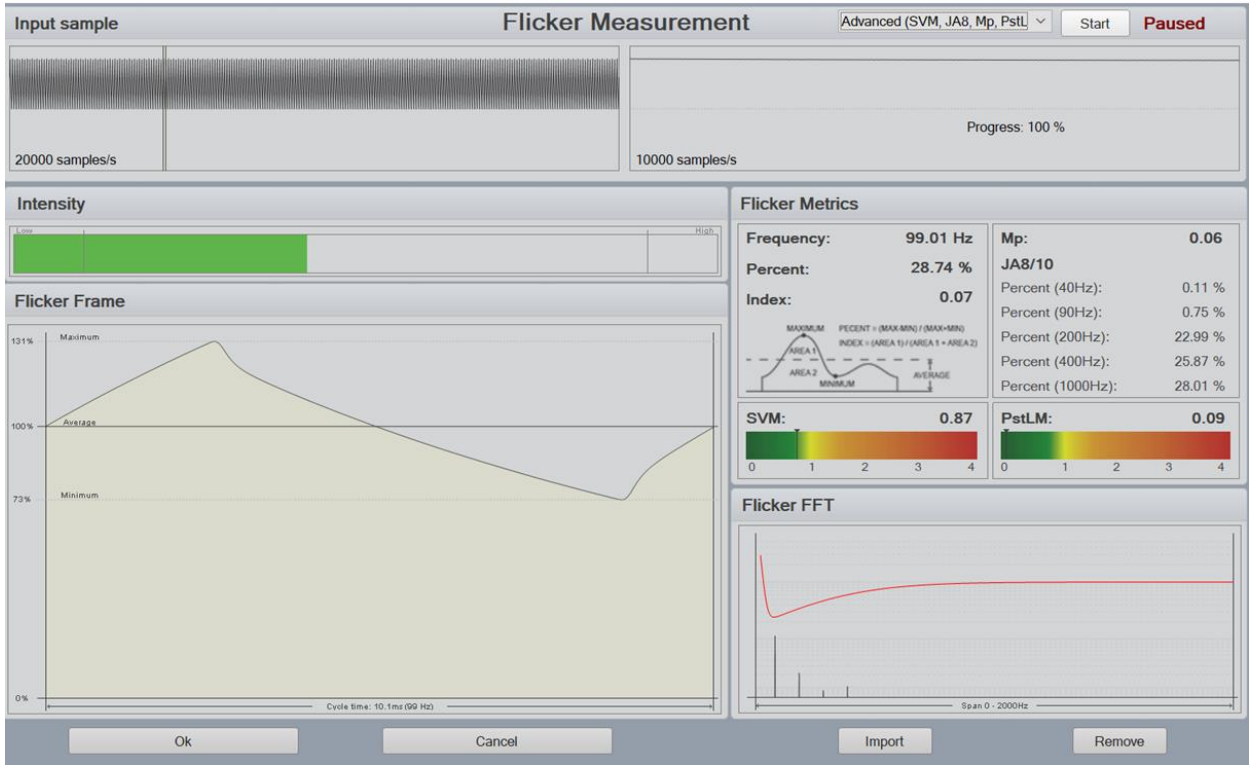




Art-2 (Low PstLM, Mid SVM)

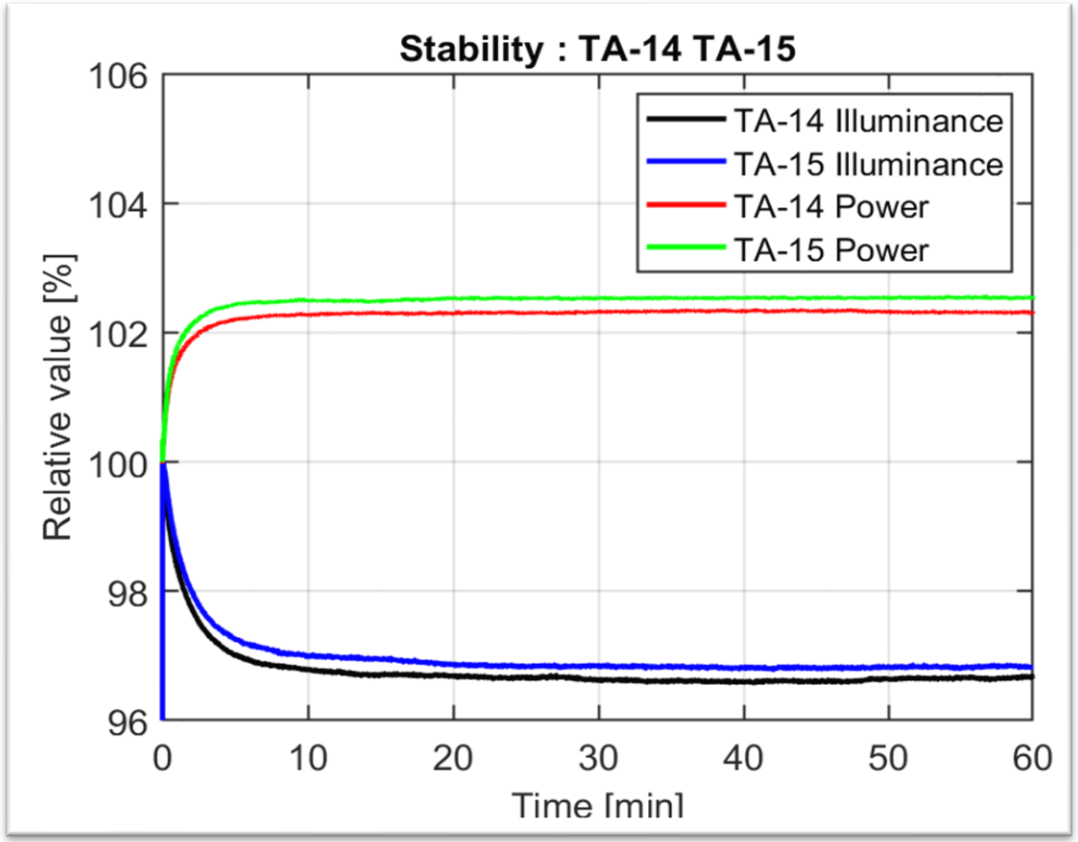
Product Details

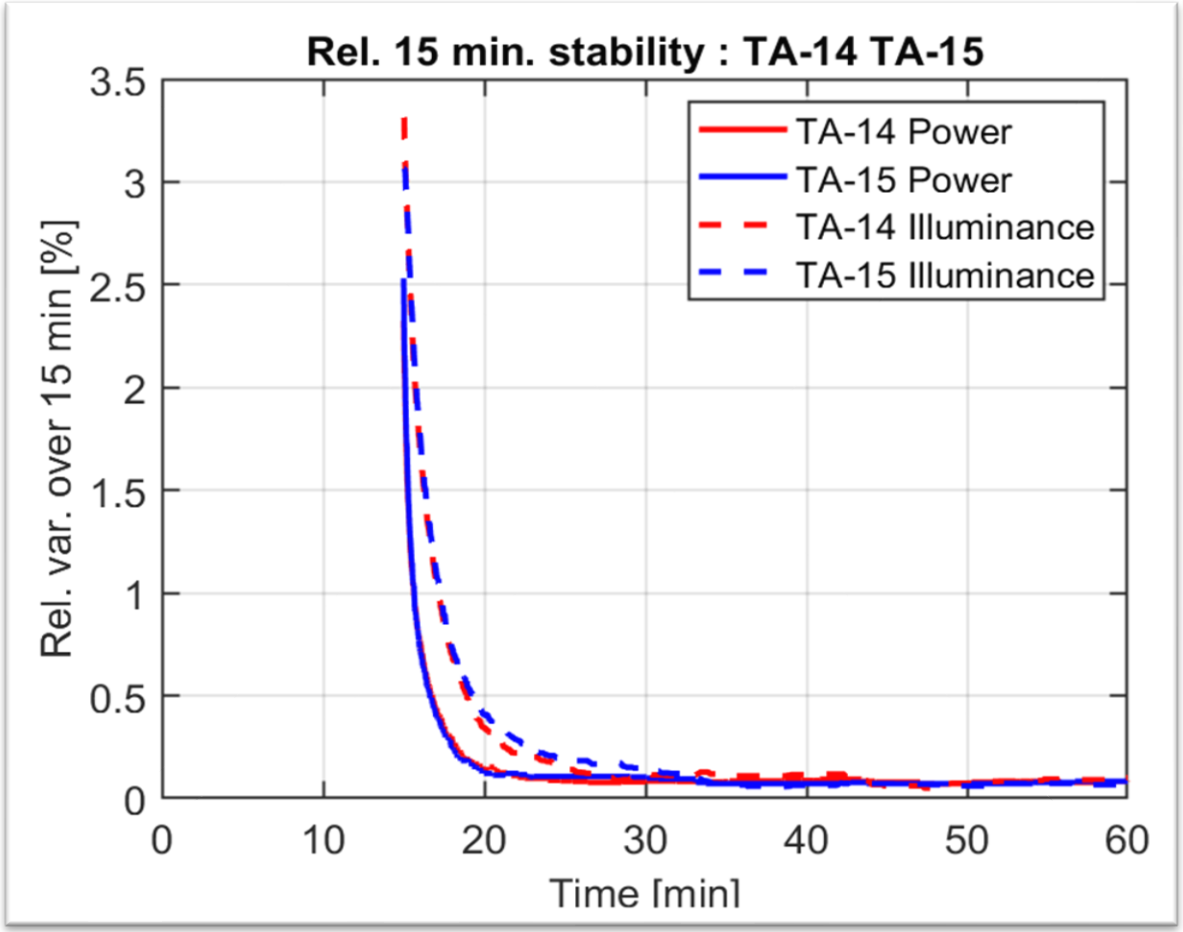
Brand	CALEX Holland	
Model	Clear Spherical Bulb	
Description	Filament	
Base Type	E27	
Wattage	3.5	watts
Lifetime	15,000	hours
CCT	2700	K
CRI		
Lumens	350	lm
Efficacy (box)	100	lm/W



Art-2 (Low PstLM, Mid SVM)

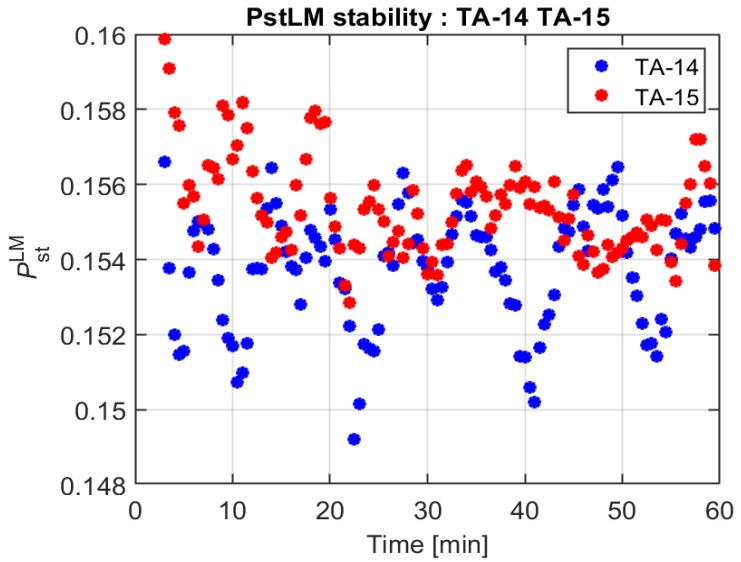
Stability

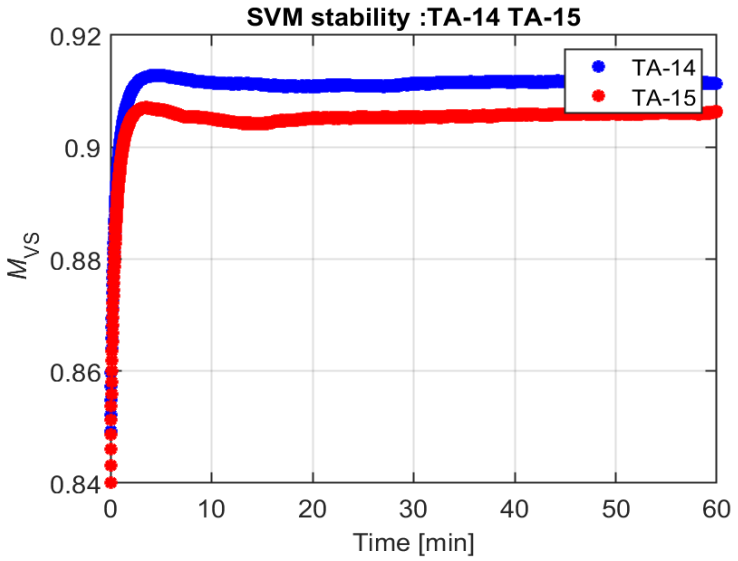


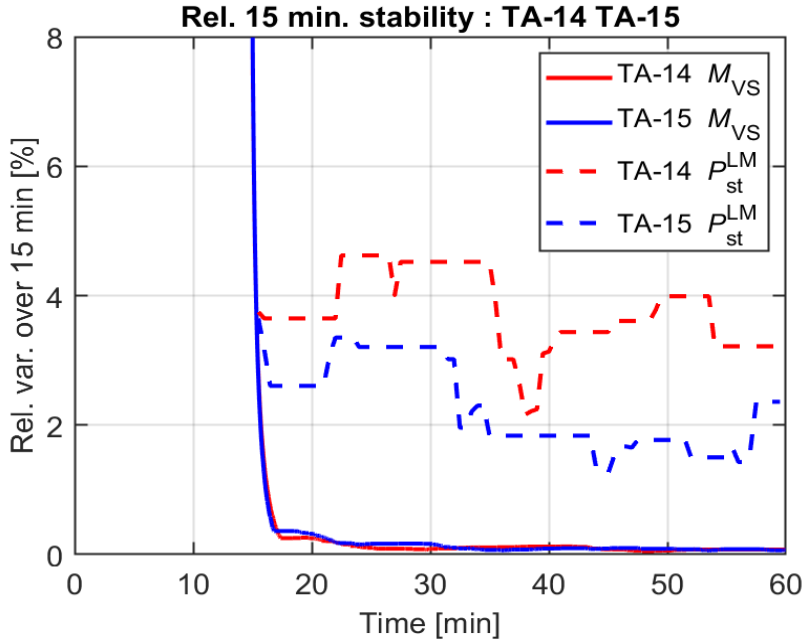


Art-2 (Low PstLM, Mid SVM)

Stability

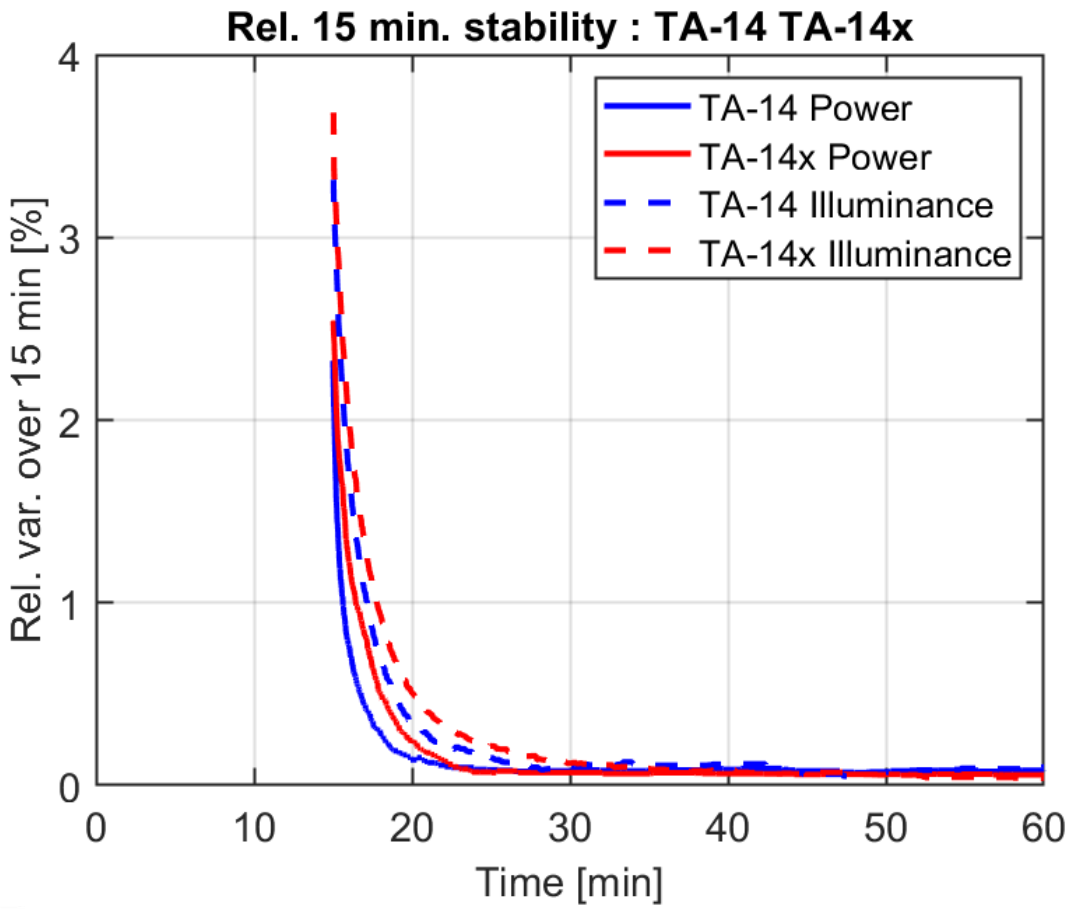


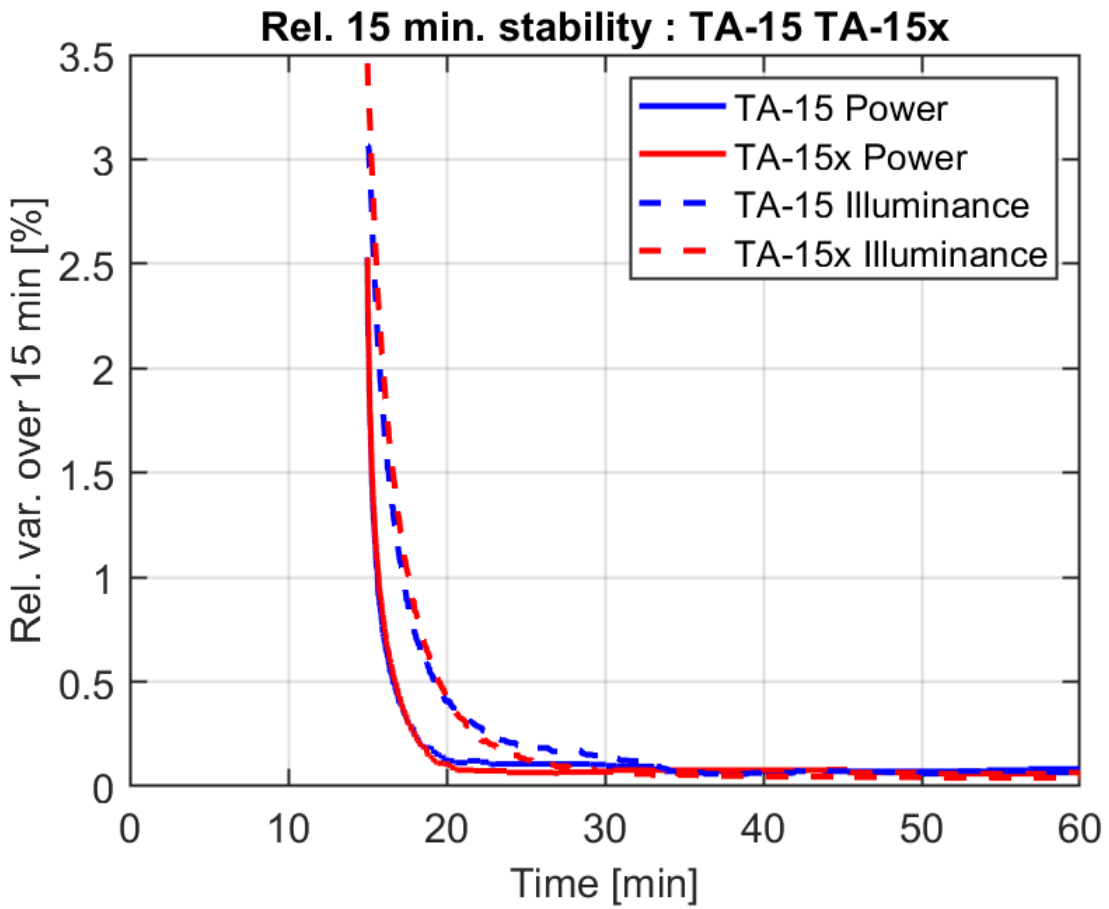




Art-2 (Low PstLM, Mid SVM)

Reproducibility





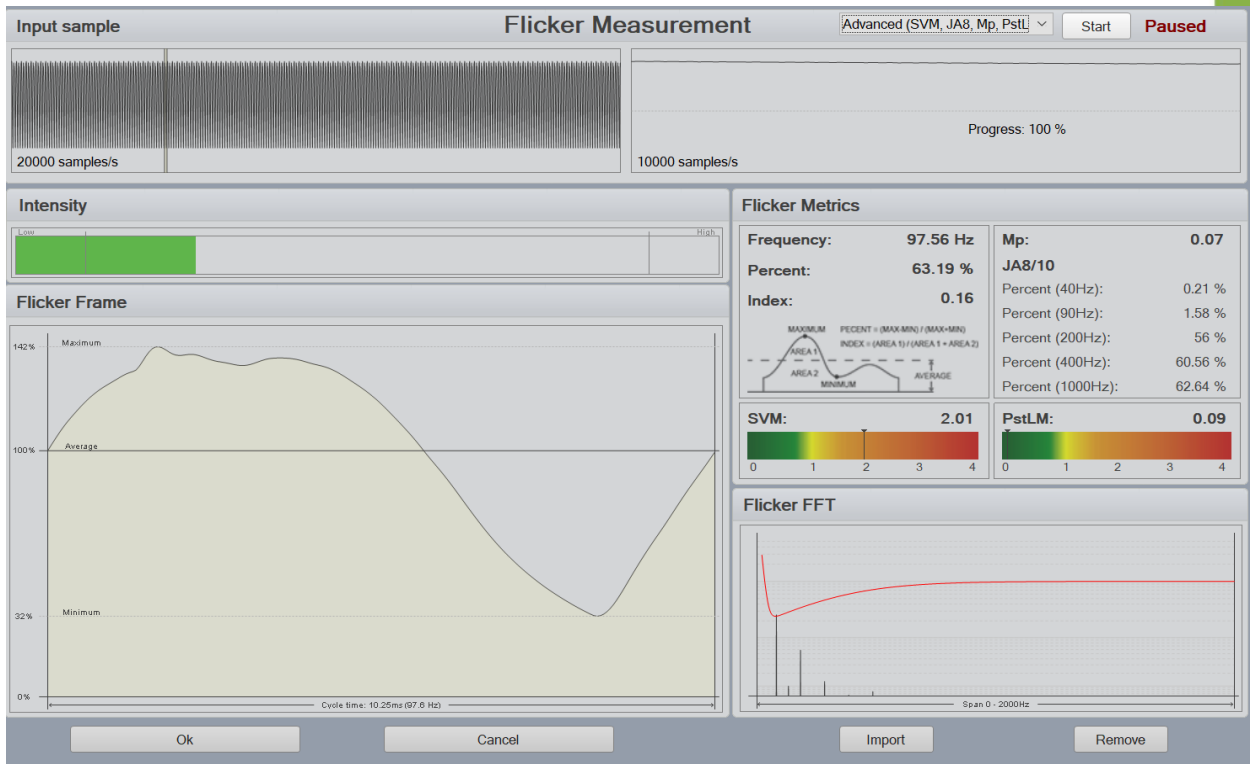
Art-3 (High PstLM, Low SVM)

- Nothing found yet!

Art-4 (Low PstLM, High SVM)

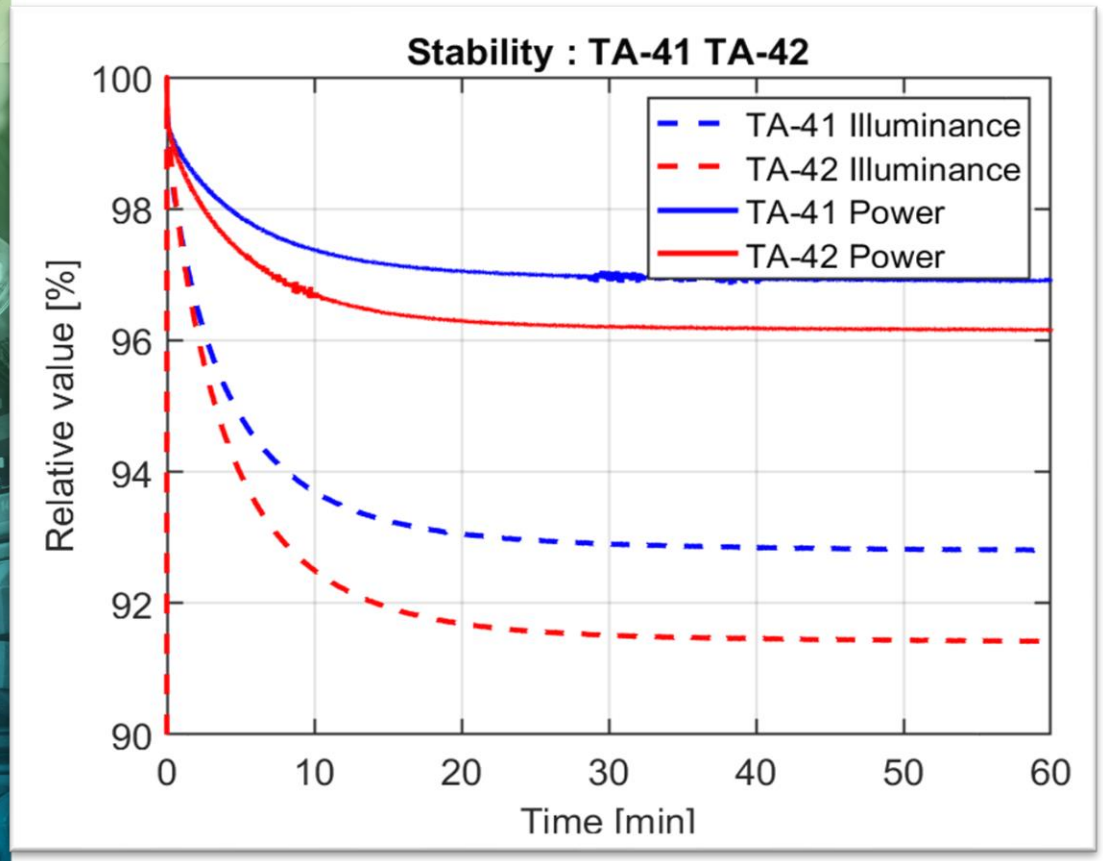
Product Details

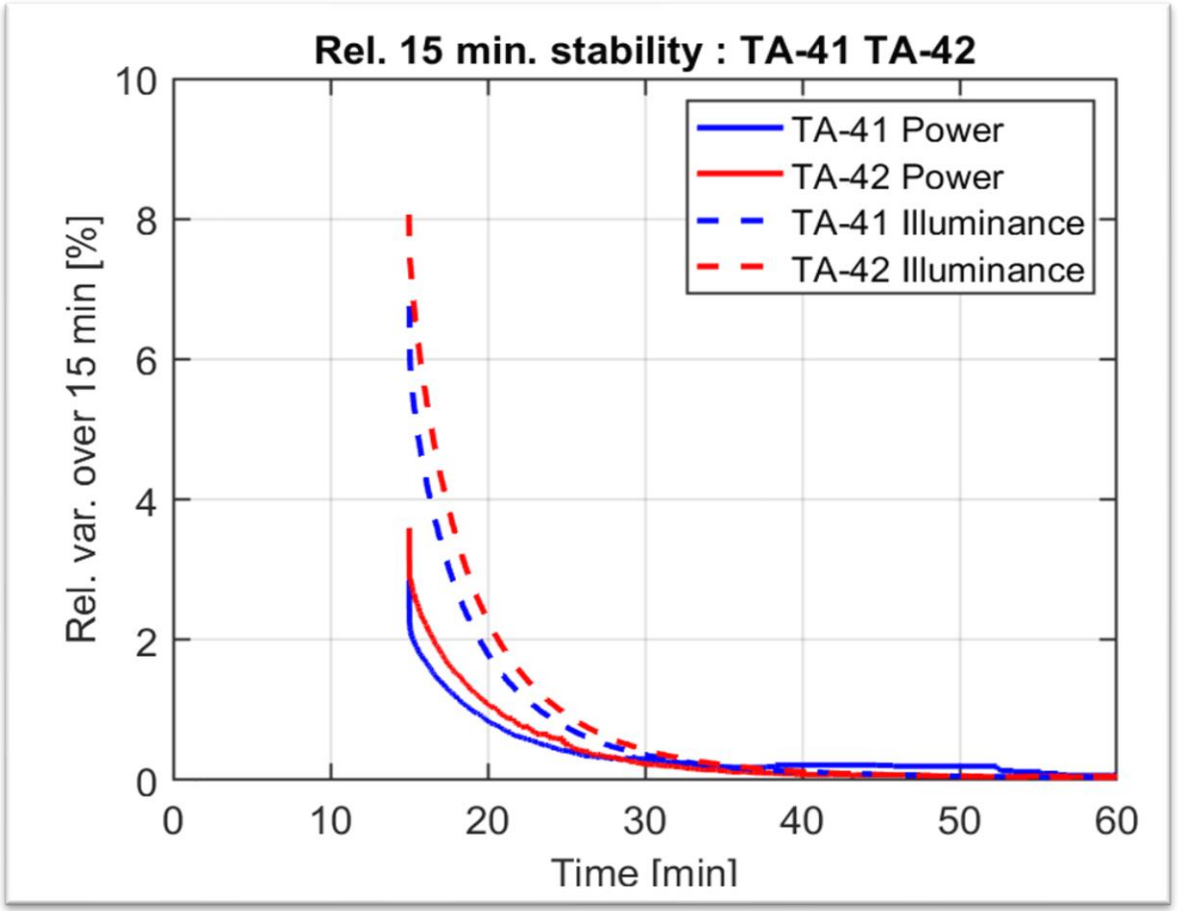
Brand	XG	
Model	XG-2512C 12W	
Description	Clear stick, corn COB	
Base Type	E27	
Wattage	12	watts
Lifetime	10,000	hours
CCT	6500	K
CRI	80	
Lumens	1200	lm
Efficacy (box)	100	lm/W



Art-4 (Low PstLM, High SVM)

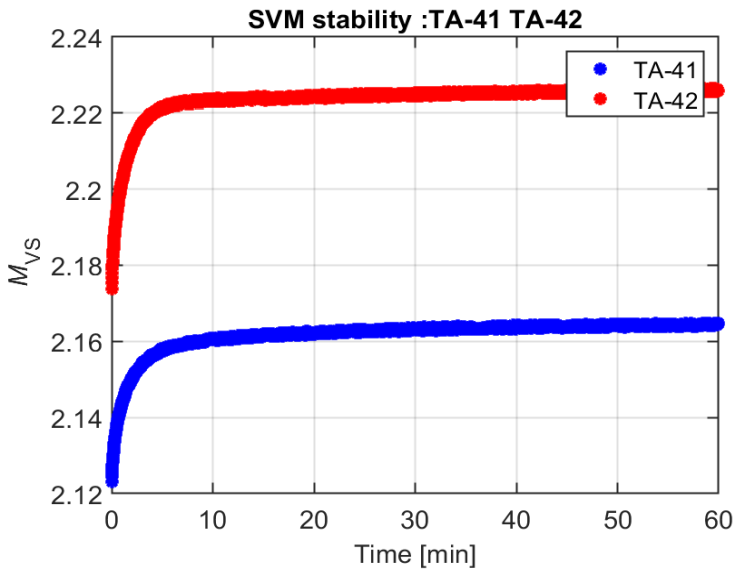
Stability

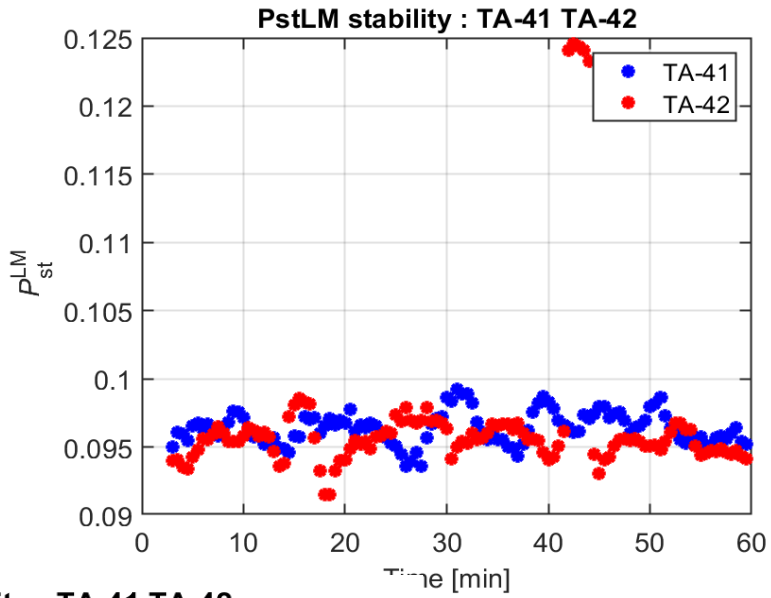


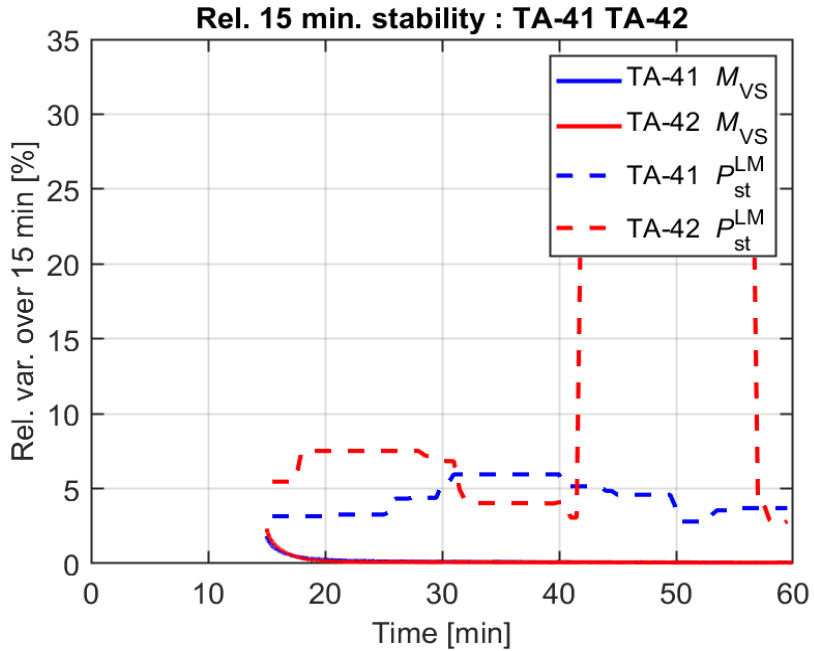


Art-4 (Low PstLM, High SVM)

Stability







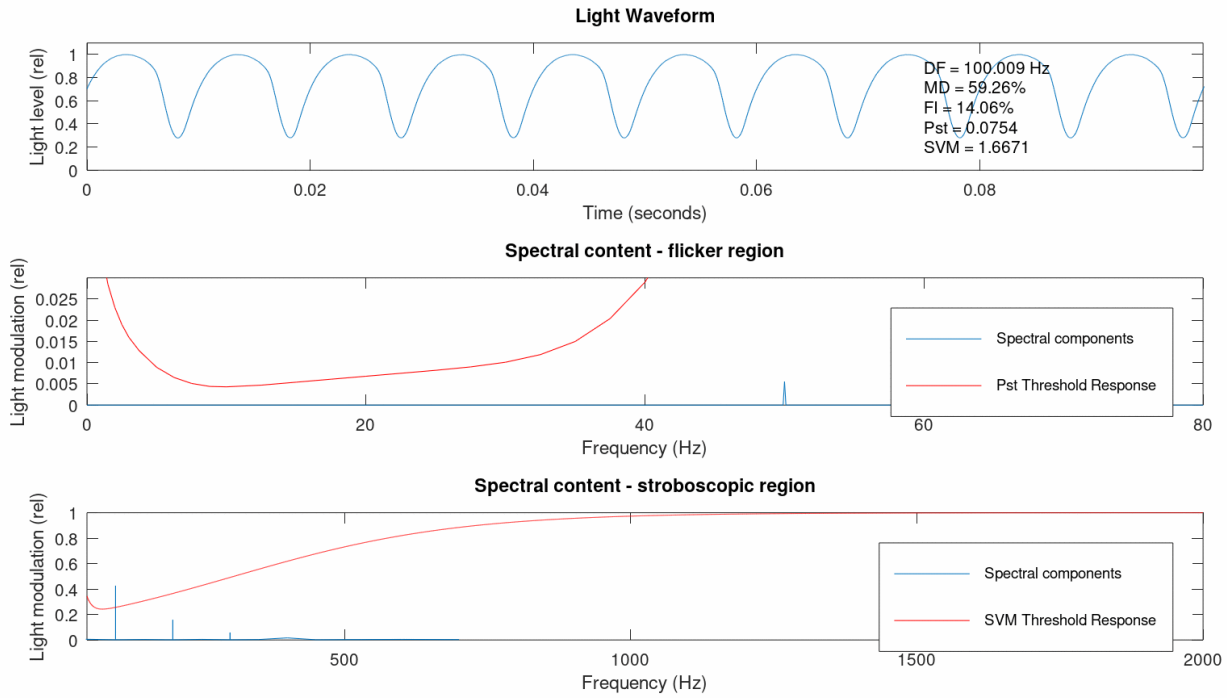
Art-4 (Low PstLM, High SVM)

Reproducibility (to be completed)

Art-4 (Low PstLM, High SVM)

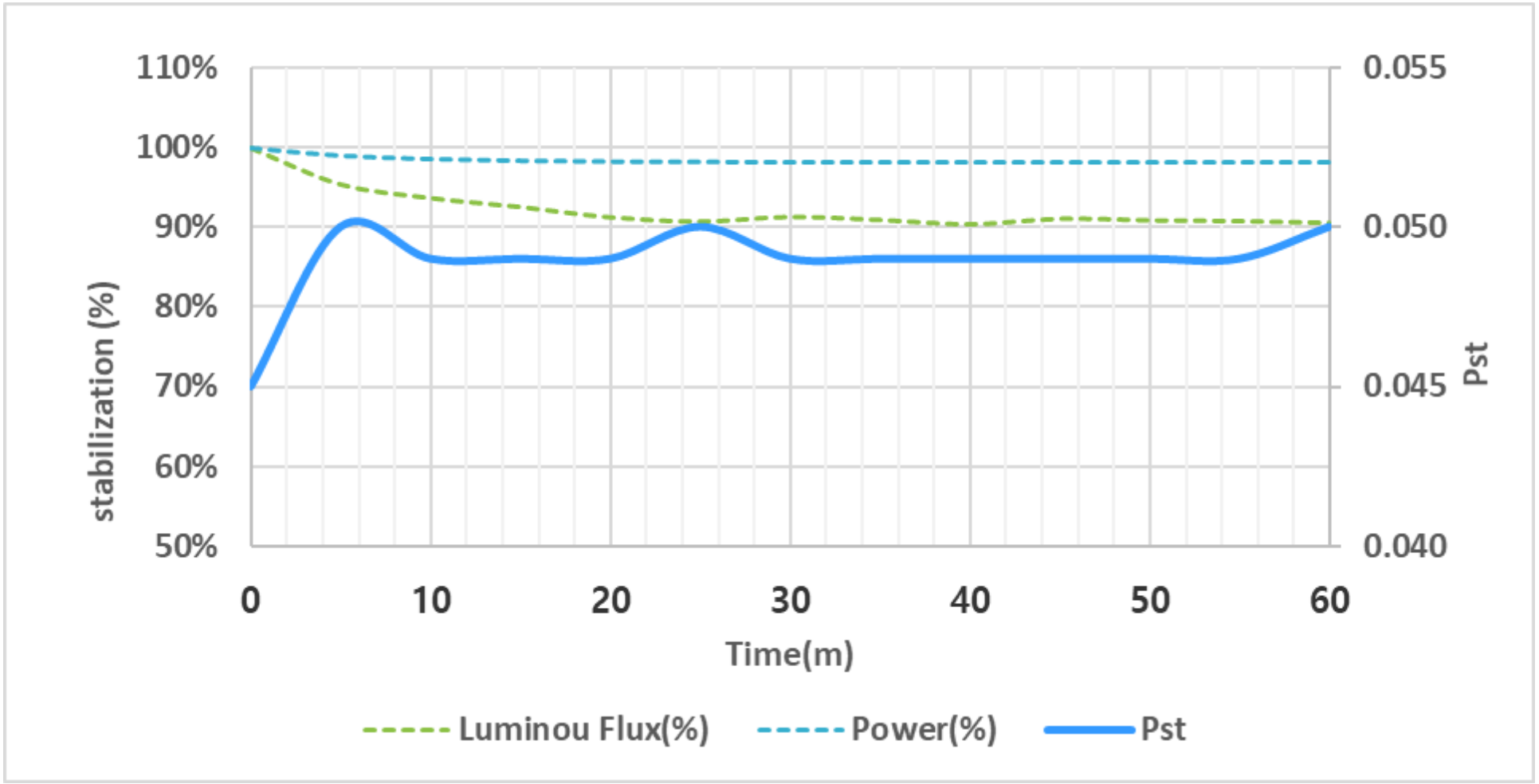
Product Details

Brand	Verbatim	
Model	65959	
Description	Frosted candle (dimmable)	
Base Type	E27	
Wattage	5	watts
Lifetime	15,000	hours
CCT	Warm white	
CRI		
Lumens	480	lm
Efficacy (box)	96	lm/W



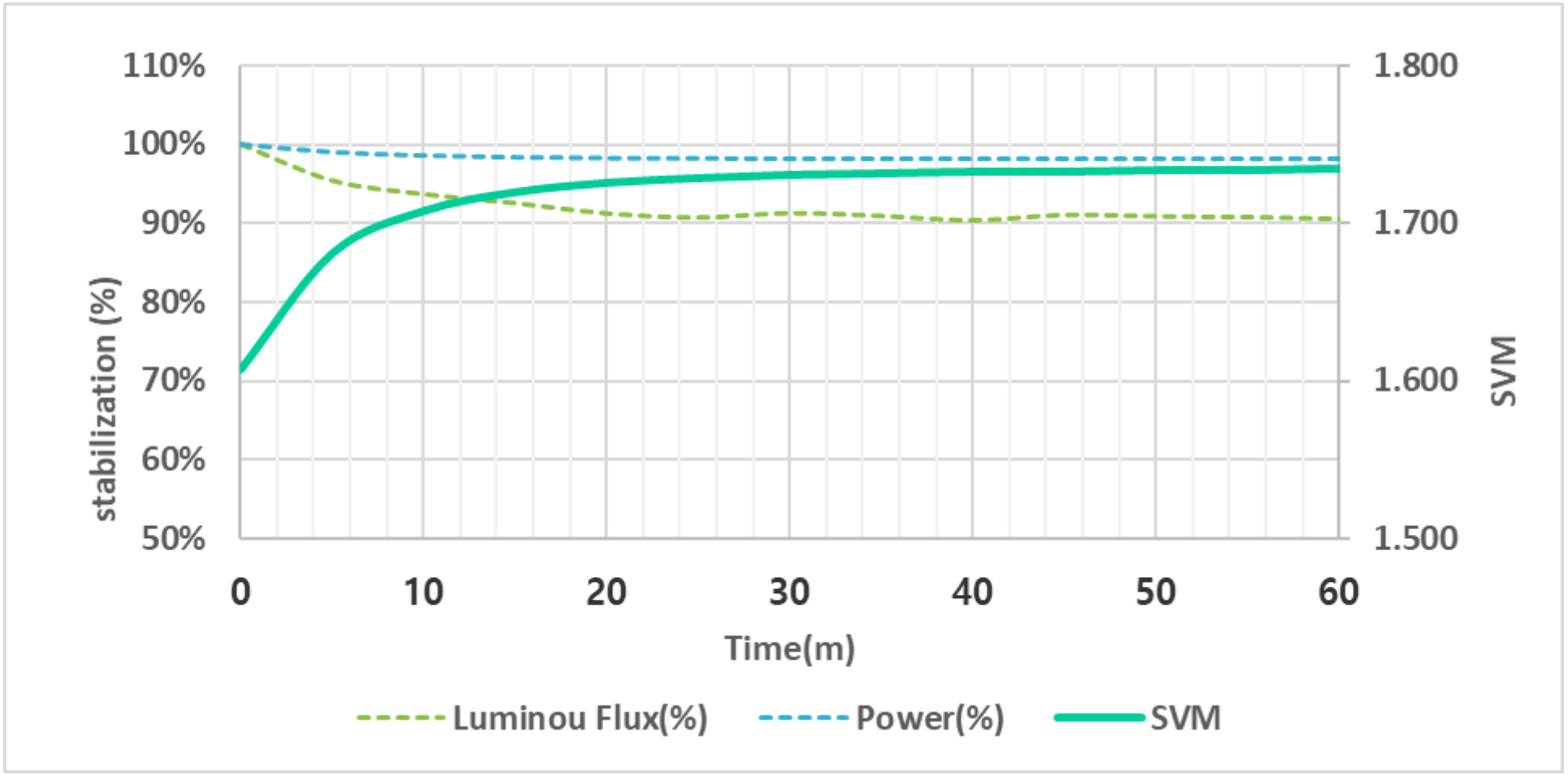
Art-4 (Low PstLM, High SVM)

Stability



Art-4 (Low PstLM, High SVM)

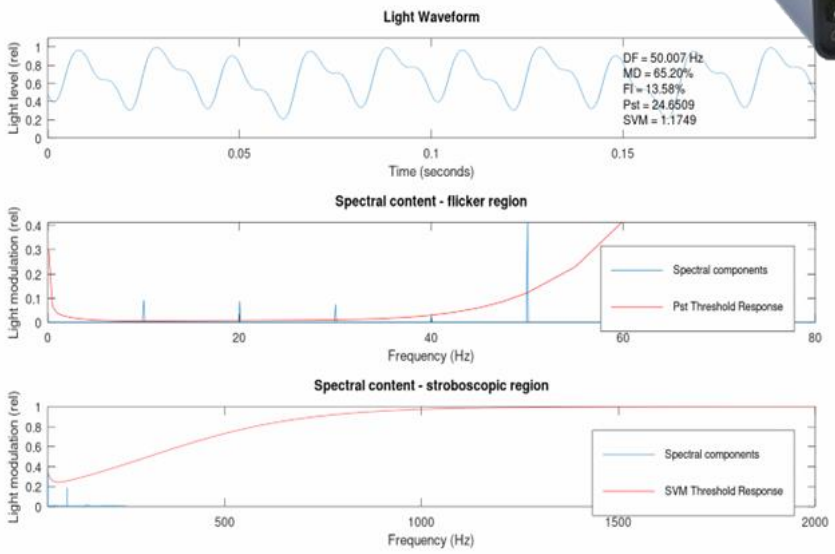
Stability



ART-5 (as Technical Study – tentative)

TLM Generator Source: VISO Systems –
Temporal Light Modulation Simulator “Labarazzi”

- Waveforms: Square, PWM, Sine, Triangle, Sawtooth
- Frequency range: 2 - 10,000 Hz
- Modulation: 1 – 100%
- Duty Cycle (PWM): 1 – 100%
- Programmable waveforms



Waveforms to use (ideas)

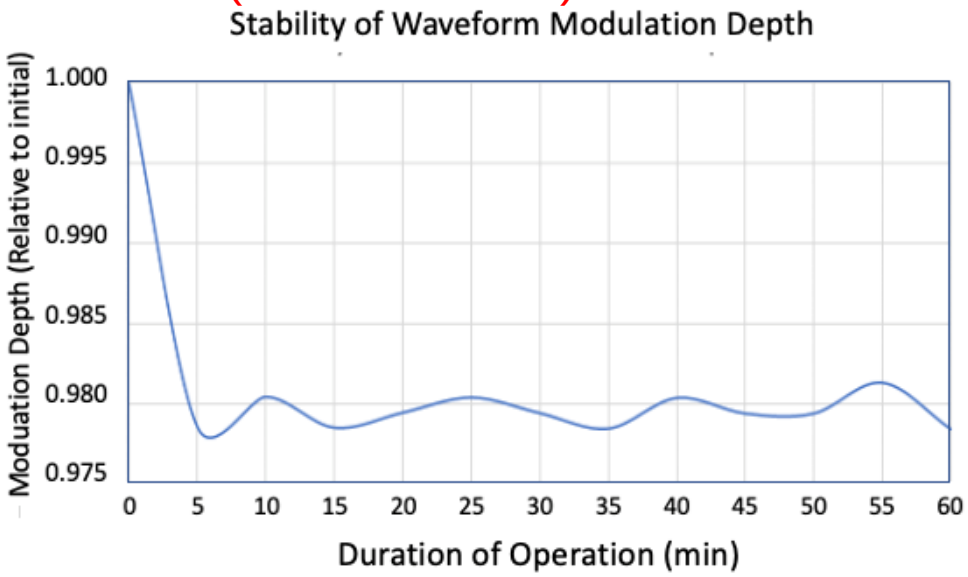
- AC 60 Hz operation (120 Hz)
- Complex programmed waveform
- Some of the verification waveforms in IEC TR 63158

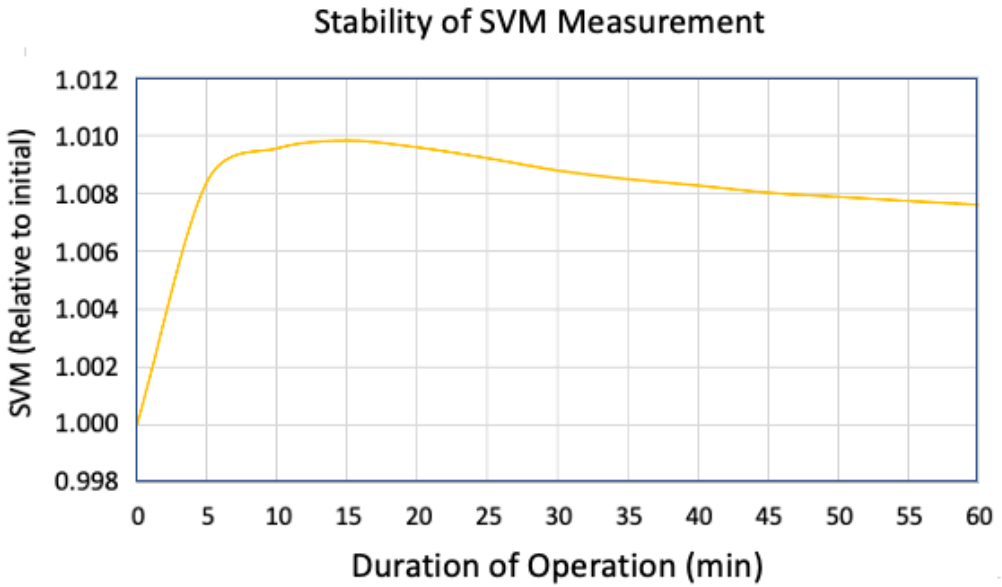
Table A.1 – Specification of the parameters of the verification waveforms

Verification waveform No.	Type of modulation	Modulation frequency f_m Hz	Modulation depth m_{ver}	Reference value of the stroboscopic effect visibility measure SVM^E
VW-sq1	Square pulse – Formula (A.10)	99	0,200 5	1,000
VW-sq2		100	0,201 2	1,000
VW-sq3		100	0,020 1	0,100
VW-sq4		100	0,804 8	4,000
VW-sq5		101	0,201 9	1,000
VW-sn1	Sinusoidal – Formula (A.11)	32	1,000 0	0,991
VW-sn2		100	0,256 3	1,000
VW-sn3		500	0,731 4	1,000
VW-sn4		1 900	0,999 7	1,000

Stability of the TLM simulator output (preliminary test)

100 Hz optical square waveform with 50% modulation depth sampled at 20 kHz (SVM = 2.4848)

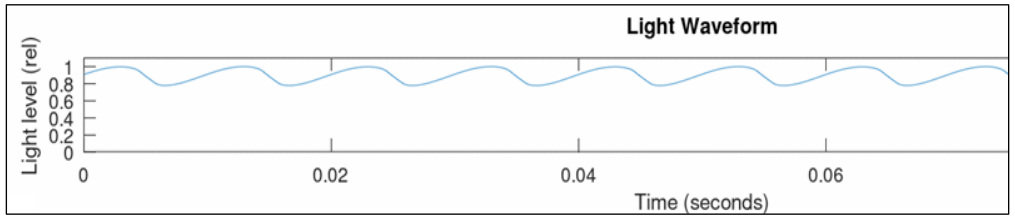


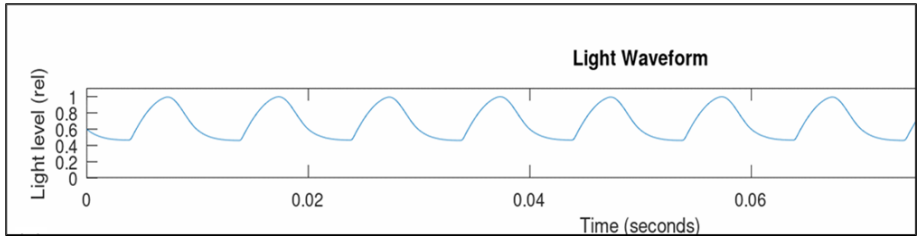


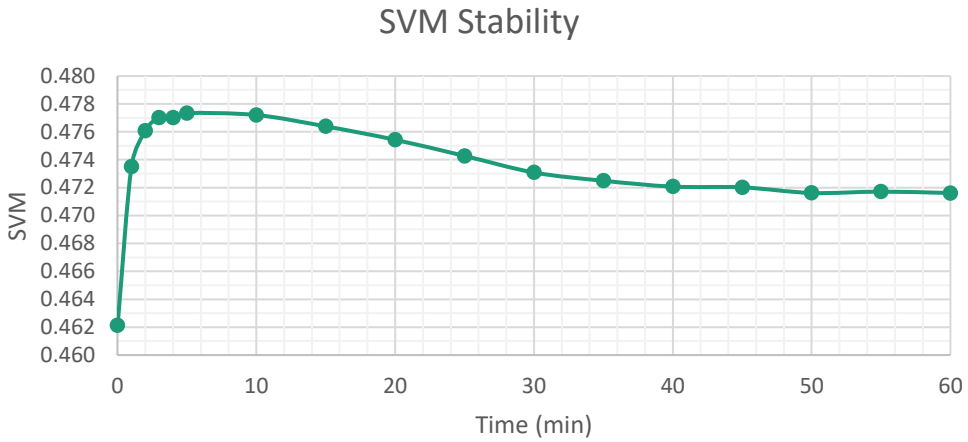
Statistical data of the stability (30 min to 60 min) of the data above

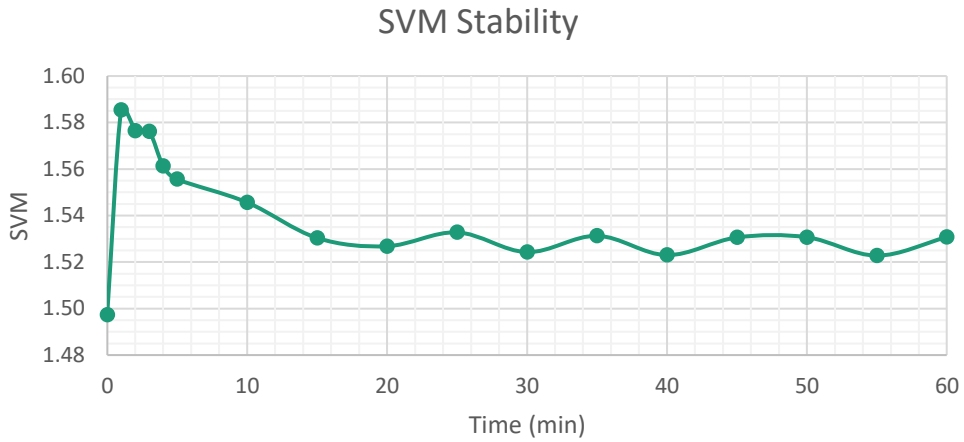
	Mean (Relative to initial)	Std Dev (Relative to initial)	Uncertainty (k=2) (%)	Variance: $\frac{\lvert max - min \rvert}{max}$ (%)
Modulation Depth	0,9796	0,0010	0,21%	0,30%
Calculated SVM	1,0081	0,0004	0,08%	0,12%

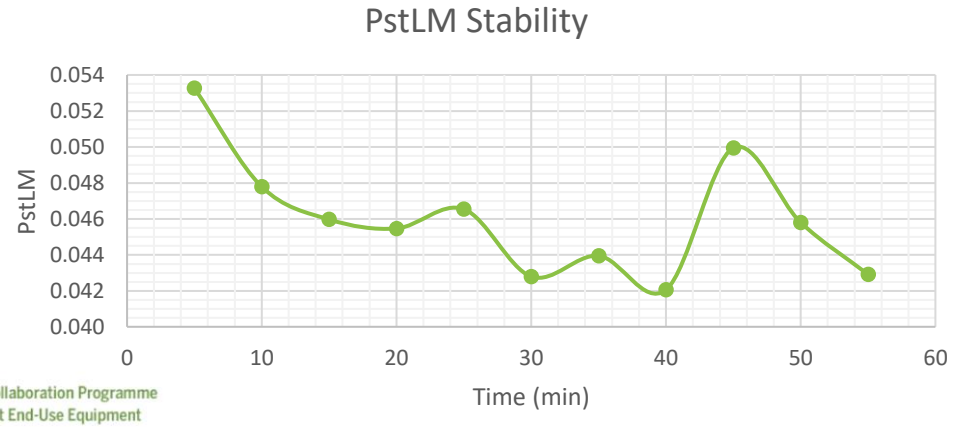
Stability of some LED lamps

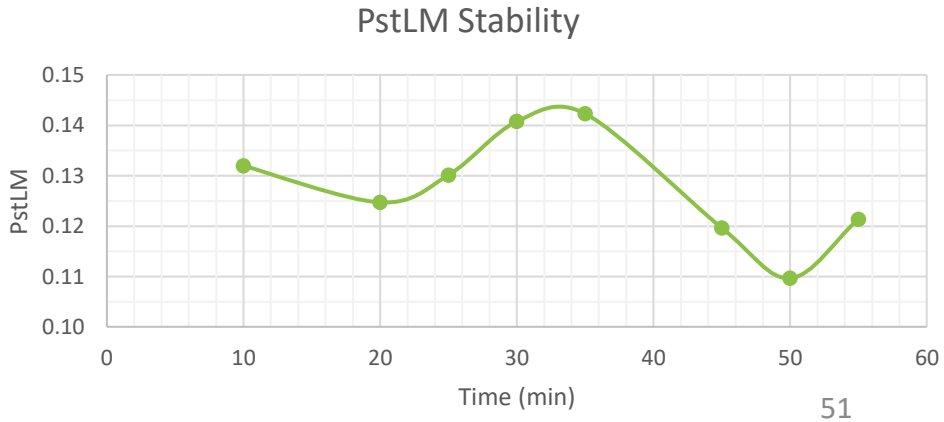






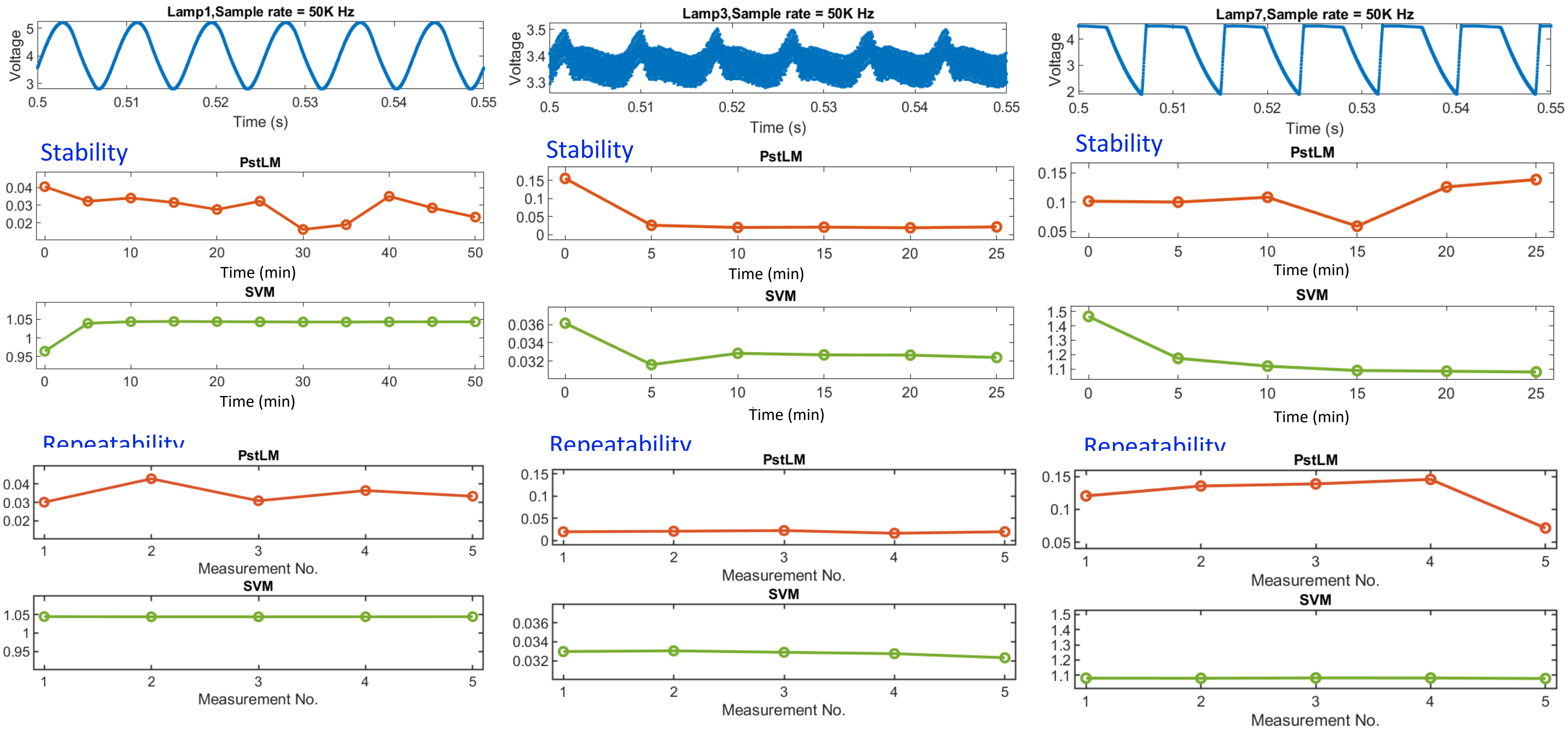






Stability and repeatability of P_{st}^{LM} and SVM of some LED lamps

LED lamps operated at 60 Hz AC power, sampled at 50 kHz, sampling time 60 S, measured at every 5 min. from cold start.



Outreach activities

Recent Conferences, Workshops

- Oct 2022: CIE Tutorial and Expert Symposium on Measurement of TLM (Athens, Greece)
    1. IEA 4E SSL Annex Interlaboratory Comparison of Measurements of Temporal Light Modulation – Plan (Coyne, S. and Ohno, Y.)
    2. Minimising the Uncertainties in the Calculation of Stroboscopic Effect Visibility Measure (Dam-Hansen, C., Coyne, S., Isoardi, G., Ohno, Y.)
- Nov 2022: COARM/CIE USANC Annual Join Conference
    1. TLM Measurements for Characterizing the Standardized Measures for Visibility of Temporal Light Artefacts (Li, Jiaye., Ohno, Y.)
- Feb 2023: CIE Australia Lighting Research Conference (Sydney, Australia)
    1. Measurement of Temporal Light Modulation: Improving Calculation Methods for Stroboscopic Effect Visibility Measure (Coyne, S., Isoardi, G.)

Timeline for IC 2022

Planned Schedule of IC 2022

Year 2022	Year 2023				Year 2024
Sep – Dec	Jan – March	April – June	July – Sep	Oct – Dec	Jan – Aug
Nucleus labs intercomparison					
Nucleus labs identified. Test protocol agreed & artefacts prepared	Nucleus labs (Operational & Supporting) intercomparison	Prepare artefacts for IC 2022	Coordinate IC 2022 laboratories		
Expert Panel & Management Committee					
1) Experts assessment of nucleus lab IC outcomes 2) MC decision on IC2022		Public call for IC 2022			
Participant Laboratories					
			Laboratories participate in IC 2022		
IC 2022 Task Leaders					
Report on Nucleus Laboratory Comparison results			Data analyses and Individual Test Reports		Final Report on IC 2022