

Testing real-world performance of ADB

- lighting systems

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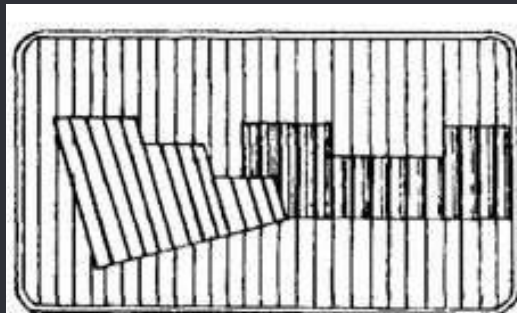
<https://www.linkedin.com/company/sapphire-technical-solutions>



Changes in Automotive Light Testing

The good old days....

1



Evaluation Methods for ADB

- Photometric Measurements
 - Lab – Goniometer
 - Lab/Production Line/ On-vehicle – Camera-based
- Visibility/Glare
 - Track Testing – Illuminance meters and software
- Real-world driving scenarios
- Calculated Performance

NHTSA OVSC: “Office of Vehicle Safety Compliance”

The following is a list of independent test laboratories that have conducted compliance testing under contract with NHTSA's Office of Vehicle Safety Compliance during the previous contract cycle or are currently conducting compliance testing under contract with OVSC.

SAPPHIRE TECHNICAL SOLUTIONS (STS)

FMVSS Testing Capabilities: 108, 125

10230 Rodney Street

Pineville, NC 28134

Phone: 704-889-8080

<https://www.nhtsa.gov/vehicle-manufacturers/compliance-test-laboratories>

NHTSA OVSC Procedures:

TP-108-13 – Dec. 2007

“Laboratory Test Procedure
for FMVSS108”

TP-108-13
DRAFT
December 4, 2007

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

LABORATORY TEST PROCEDURE

FOR

FMVSS 108

Lamps, Reflective Devices, and Associated Equipment



Office of Vehicle Safety Compliance
West Building, NVS222
1200 New Jersey Avenue, SE
Washington, DC 20590

TP-108-13 – Dec. 2007

“Laboratory Test Procedure for FMVSS108”

12.1) Turn Signal Lamps

12.1.1) Front turn signal lamps

12.1.2) Rear turn signal lamps

12.2) Taillamps

12.3) Stop lamps

12.4) Side marker lamps

12.5) Clearance and identification lamps

12.6) Backup lamps

12.7) License plate lamps

12.8) Parking lamps

12.9) High-mounted stop lamps

12.10) Daytime running lamps

12.11) School bus signal lamps

12.12) Reflex reflectors

12.13) Conspicuity systems

12.14) Turn signal operating unit

12.15) Turn signal flasher

12.16) Turn signal pilot indicator

12.17) Headlamp beam switching device

12.18) Upper beam headlamp indicator

12.19) Vehicular hazard warning signal operating unit

12.20) Vehicular hazard warning signal flasher

12.21) Vehicular hazard warning signal pilot indicator

12.22) Sealed beam headlighting systems

12.23) Integral beam headlighting systems

12.24) Replaceable bulb headlighting systems

12.25) Combination headlighting systems

12.26) Motorcycle headlighting systems

12.27) Motorcycle headlamp modulation systems

12.28) Headlamp aimability

12.29) Replaceable light sources

12.30) Headlamp concealment devices

12.31) Replaceable headlamp lens requirements

Current Headlamp Rating Protocols

- Consumer Reports

Subjective

- IIHS

Measured but no stimulus for ADB

- CIE S 021/E:2011 – “Vehicle Headlighting Performance – Method of Assessment”

Calculated only, no ADB

Current Evaluation Methods for ADB

Legal for most of world:

- UN-ECE Reg48 and Reg123/Reg149

Legal for Canada (and similarly Mexico):

- UN-ECE Reg48 and Reg123/149
- and / or
- SAE J3069-2016

- Current Evaluation Methods for ADB

- Legal for the United States:

- NONE!!! Yet.....

Potential Future Evaluation Methods for ADB

NHTSA Proposal:

- Docket No. NHTSA-2018-0090
- NPRM (Notice of Proposed Rulemaking) to permit the certification of ADB lighting

NHTSA NPRM: Test Track Scenarios

ADB TEST MATRIX

Test matrix No.	Stimulus vehicle speed (mph)	Test vehicle speed (mph)	Radius of curve (ft.)	Superelevation (%)
1	60-70	60-70	Straight	0-2
2	0	60-70	Straight	0-2
3	40-45	60-70	Straight	0-2
4	60-70	40-45	Straight	0-2
5	25-30	25-30	320-380	0-2
6	0	25-30	320-380	0-2
7	40-45	40-45	730-790	0-2
8	0	40-45	730-790	0-2
9	30-35	40-45	730-790	0-2
10	40-45	30-35	730-790	0-2
11	50-55	50-55	1,100-1,300	0-2
12	50-55	40-45	1,100-1,300	0-2
13	40-45	50-55	1,100-1,300	0-2

ADB TEST ORIENTATION

Direction	Lane orientation/maneuver	Test matrix No.	Measurement distance (m)
Oncoming	Adjacent	1, 2, 5, 6, 7, 8, 11	15 to 220.
Same Direction	Same Lane	1, 5, 7, 11	30 to 119.9.
Same Direction	Adjacent/Passing	2, 3, 6, 8, 9, 13	15 to 119.9.
Same Direction	Adjacent/Passing	4, 10, 12	30 to 119.9.

TABLE XIX-d—ADAPTIVE DRIVING BEAM PHOTOMETRY REQUIREMENTS ¹

Range (m)	Maximum illuminance oncoming direction (lux)	Maximum illuminance same direction (lux)
15.0 to 29.9	3.1	18.9
30.0 to 59.9	1.8	18.9
60 to 119.9	0.6	4.0
120 to 220	0.3	4.0

¹For purposes of determining conformance with these specifications, an observed value or a calculated value shall be rounded to the nearest 0.1 lux, in accordance with the rounding method of ASTM Practice E29 Using Significant Digits in Test Data to Determine Conformance with Specifications.

* * * * *



What now?

So what do we do while we're waiting??

Docket No. NHTSA-2020-0119

Notice Regarding the Applicability of NHTSA FMVSS Test Procedures to Certifying Manufacturers

Vehicle manufacturers certifying compliance with the safety standards **are not required to follow the compliance test procedures** set forth in the applicable standard. The standards specify the procedures NHTSA would use in compliance testing. However, vehicle manufacturers must exercise **reasonable care** in certifying that their products meet applicable standards. It may be simplest for a manufacturer to establish that it exercised 'reasonable care' if the manufacturer has conducted testing that strictly followed the compliance test procedures set forth in the standard. However, 'reasonable care' might also be shown using modified test procedures if the manufacturer could demonstrate that the modifications were not likely to have had a significant impact on the test results. In addition, **it might be possible to show 'reasonable care' using engineering analyses, computer simulations, and the like.**

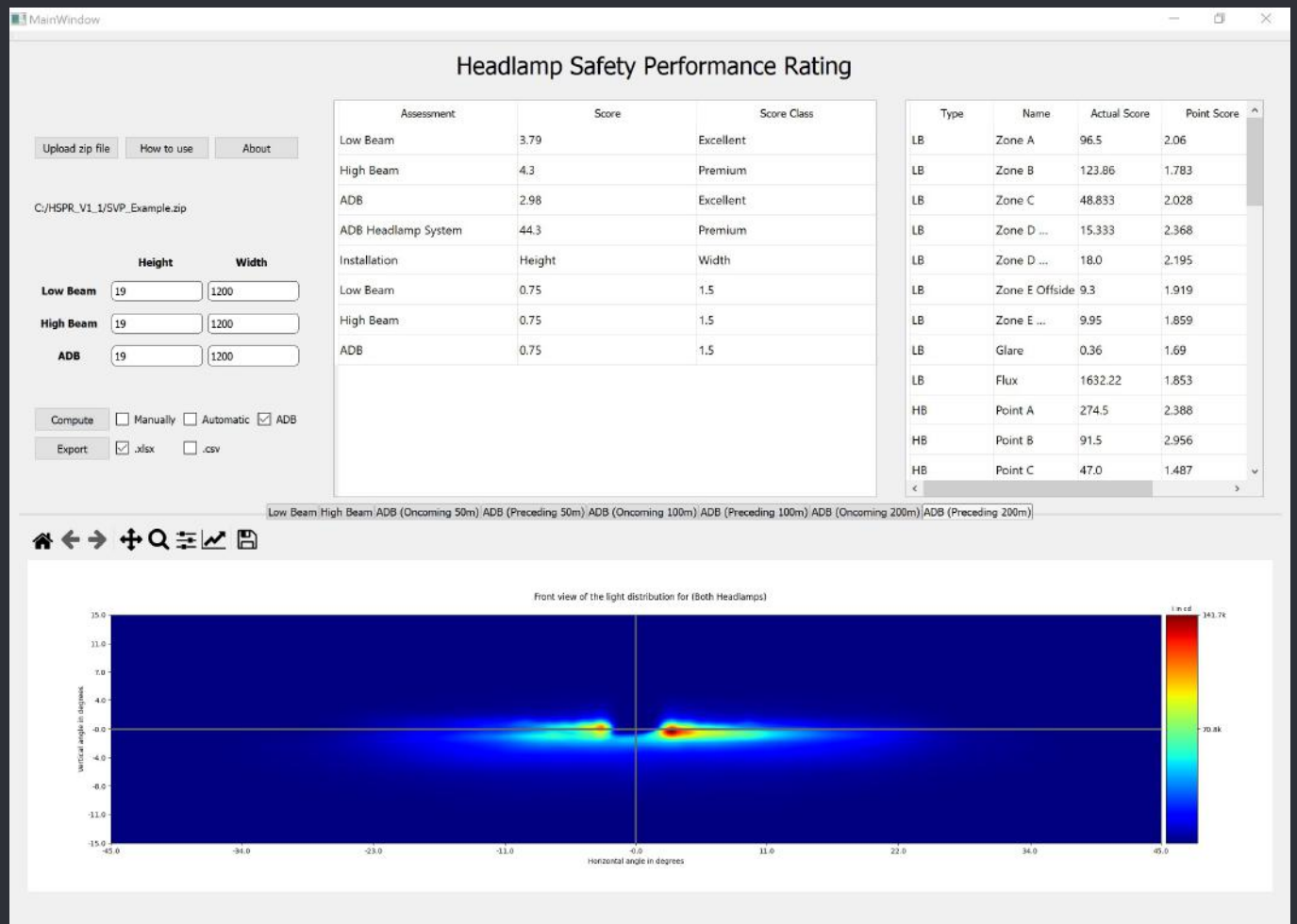
Potential Future Evaluation Methods for ADB

GTB Proposal:

- HSPR – Headlamp Safety Performance Rating (Based on CIE S 021/E:2011)

HSPR Headlamp Safety Performance Rating:

GTB SVP Group and
University of Darmstadt
Germany





RITT

Road Illumination Testing Trailer for SAE
J3069-2016 ADB Testing

RITT

Road Illumination Testing Trailer
for SAE J3069-2016 ADB Testing

www.sapphiresystems.com

STS SAPPHIRE
Technical Solutions

sales@sapphiresystems.com

J3069 Testing

Stimulus Vehicle, can be adapted to many lighting scenarios in future.



J3069 Testing

Opposing stimulus with ADB surrogate vehicle



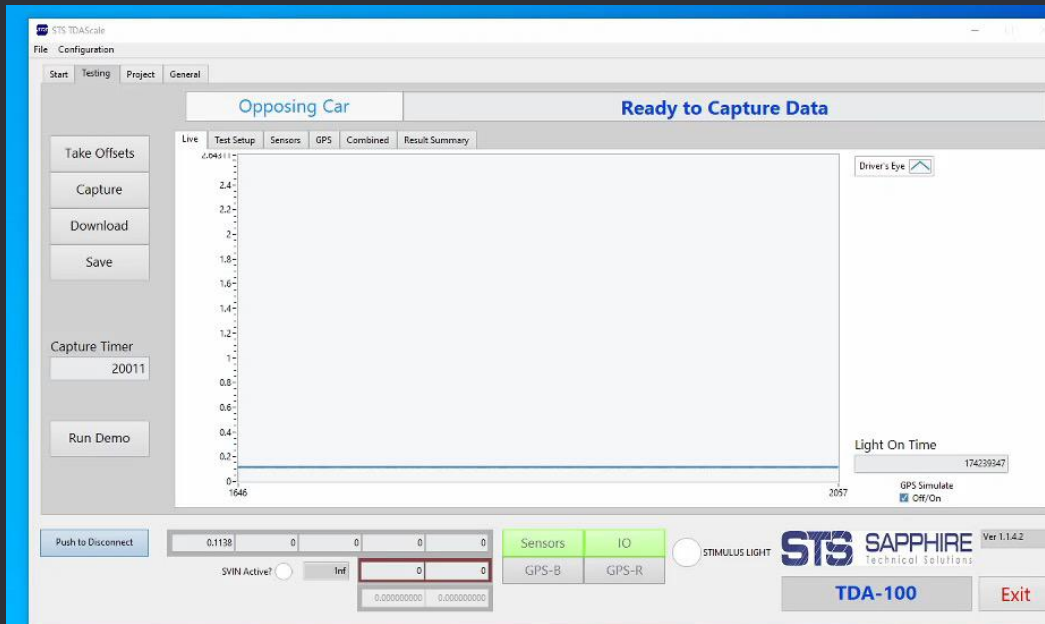
J3069 Testing

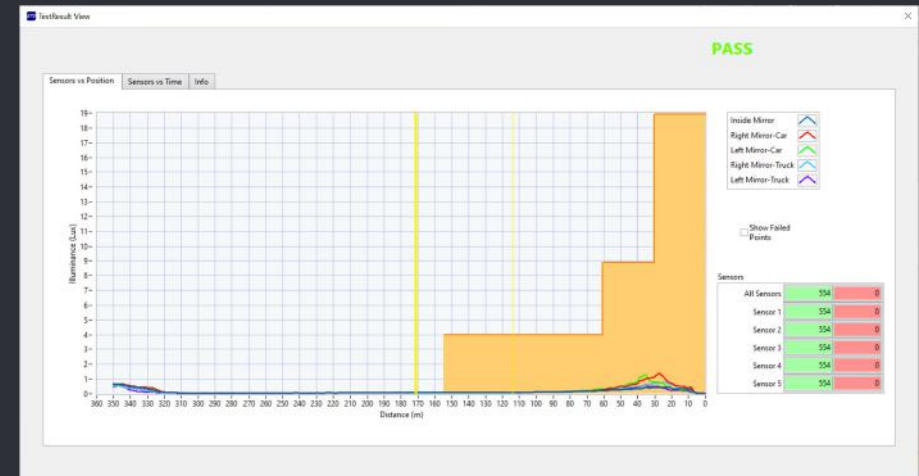
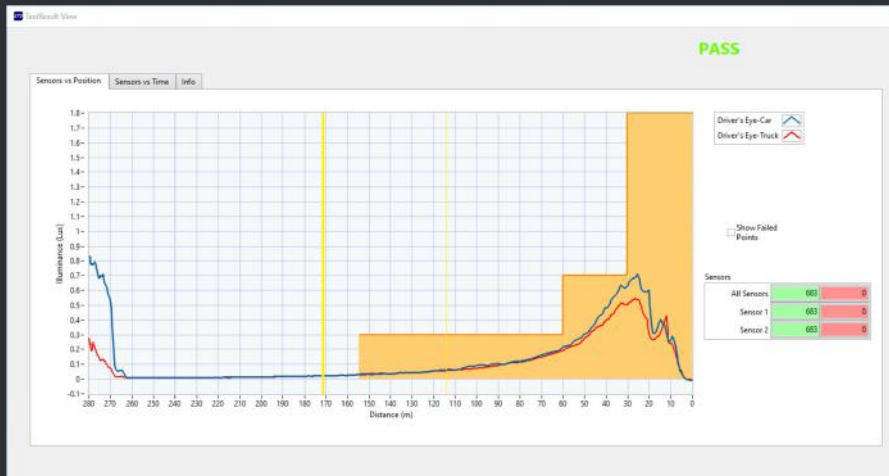
Preceding stimulus with ADB surrogate vehicle in high-ambient light



J3069 Testing

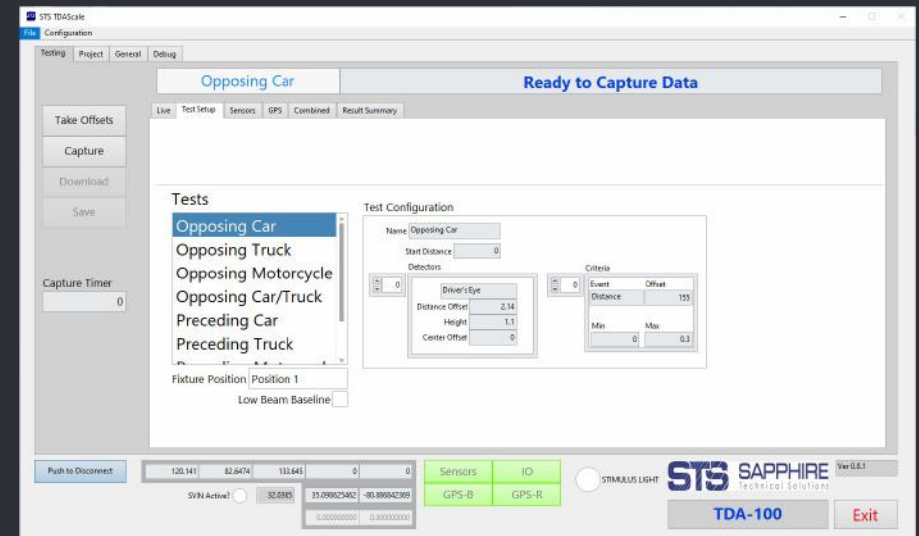
TDA-100 Software





TDA-100/200

System adaptable for future requirements including NPRM from NHTSA for ADB.





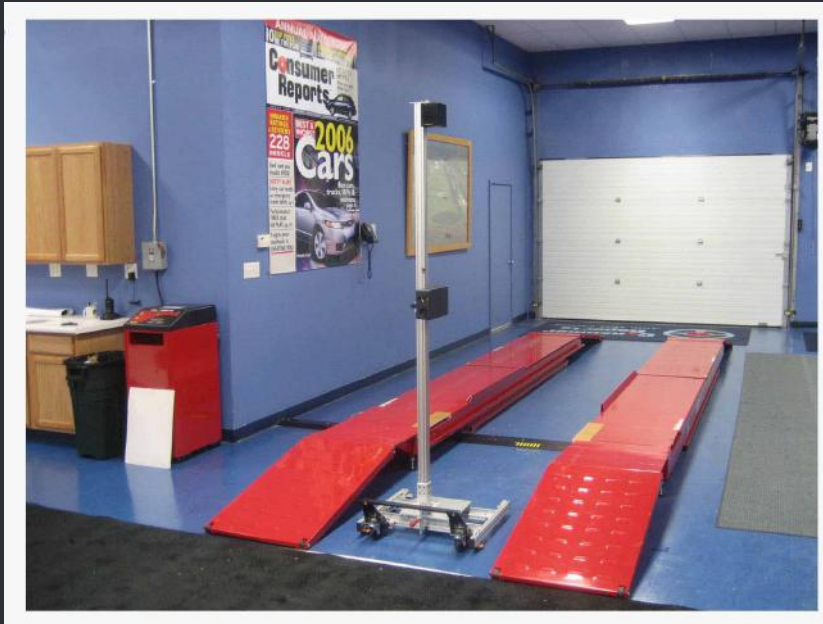
VOA Series

(Visual-Optical Aim)

VOA (Visual-Optical Aim) Camera-based
Photometer

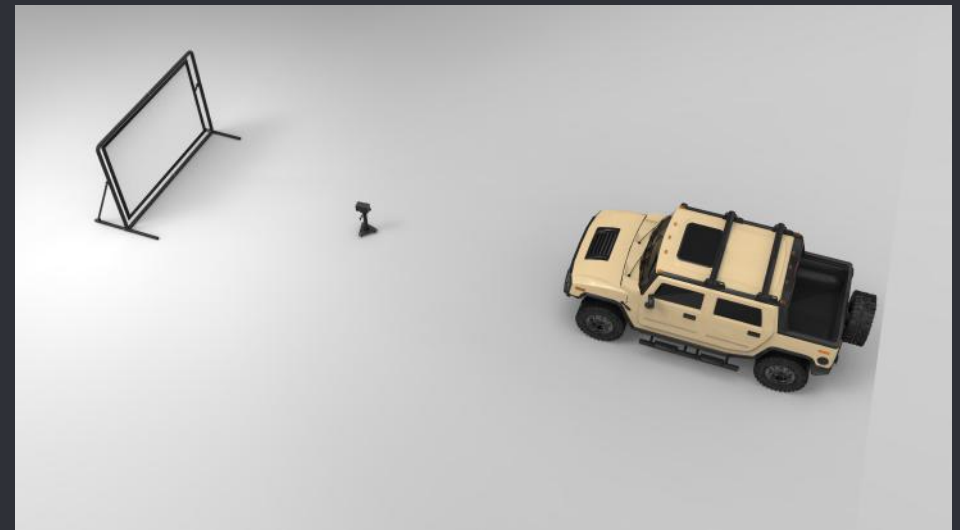
VOA-100

On-vehicle headlamp aiming and photometric measuring system



VOA-160

Portable Camera-based photometer for trackside headlamp aiming



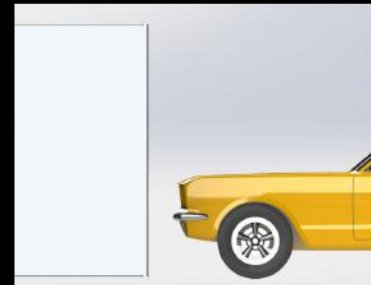


FFP Series

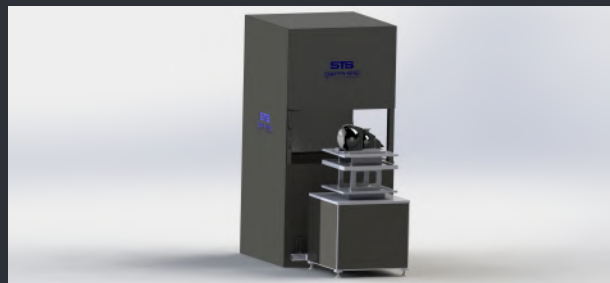
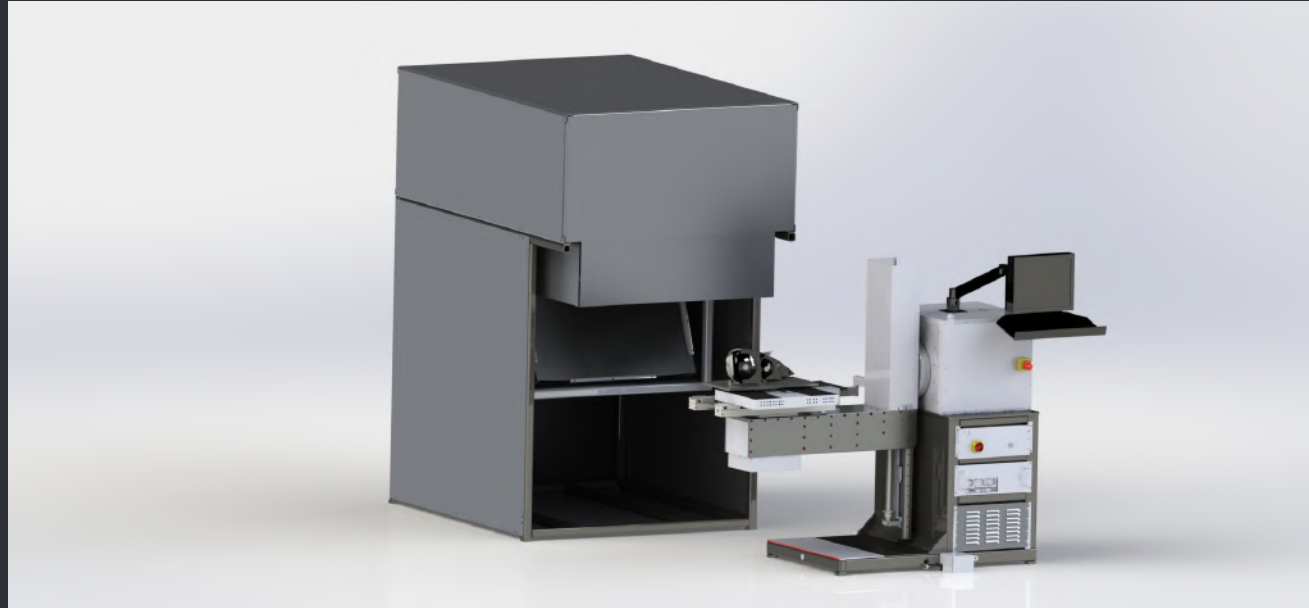
(Patent Pending)

Far-field Photometer for high-speed capture of beam distributions and color of forward and signal lighting

FFP - Adaptable from laboratory to end-of-line vehicle testing!

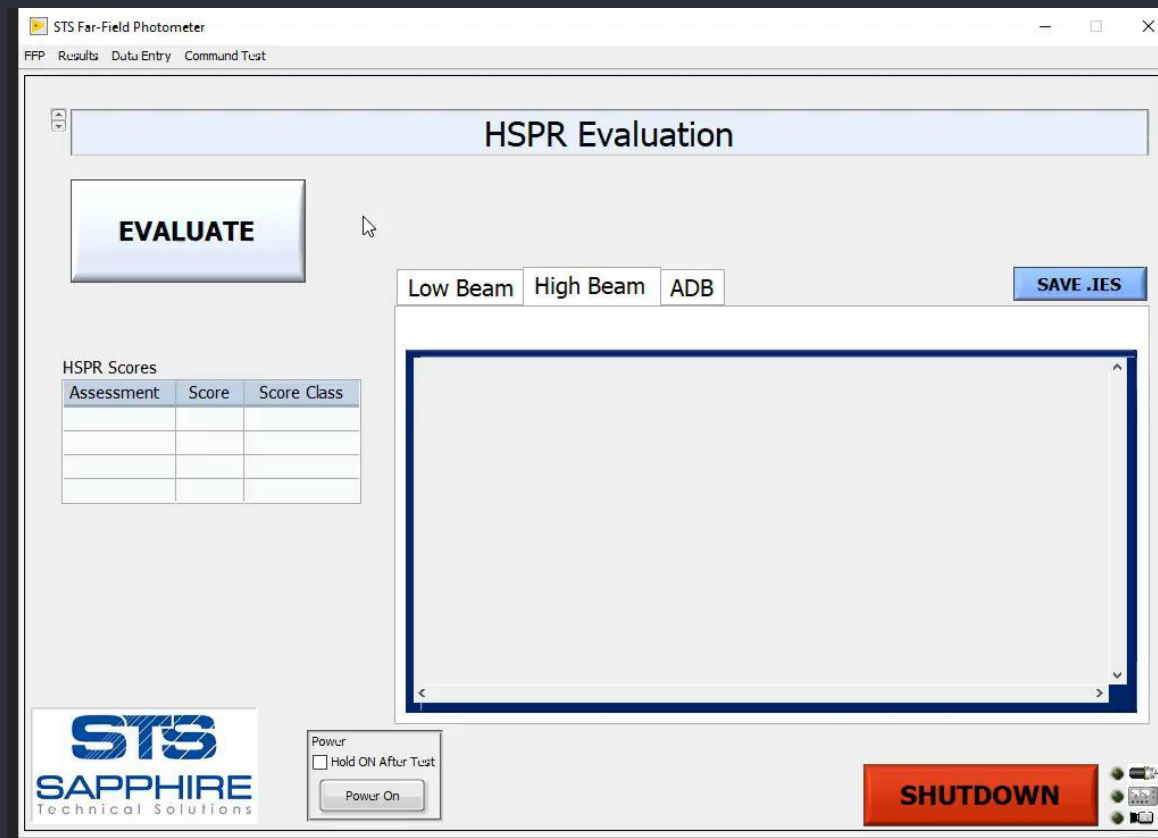


FFP – Adaptable from laboratory to end-of-line vehicle testing!



FFP – Simulation of GTB - HSPR testing

(Video is in real time of capturing data, but images are simulated)



Evaluation Methods for ADB - Summary

- Photometric Measurements
 - Lab – Goniometer
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- Real-world driving scenarios
- Calculated Performance

Thank you!

If you have any questions...



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