

Halogen and LED Retrofits Tests



The tests were performed using the portable diagnostic device with photometry (luminance) camera

Device is devoted for PTI (and on road) tests

Test take app. 1 min. per headlamp

„Positive results” test

Below are presented test results selected to confirm possibility of proper quality (basic R112 requirements) of beam pattern produced by headlamps equipped with LEDr in relations to type approved halogen bulbs.

Tests were focused basically on „approved” that time (spring 2021) OEM (H7) headlamps. They were supplemented with tests of type approved headlamps replacements.

In second part are presented results with H4 headlamps and LEDr intentionally selected as meeting requirements.

In third part choice of „negative” examples is presented.

The selected headlamps and LEDr are not representative to all headlamps and LEDr's present on the market but confirm that it is possible successfully use LEDr. Results allow to see the difference inside beam pattern for halogen bulb and some LEDr.

It is also the demonstration of quick and effective test method and the tool to check the possibility of safe use of LEDr in real road condition.

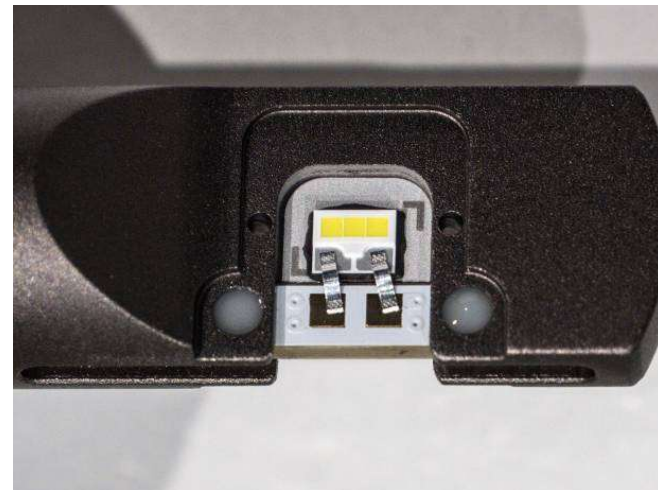
Tests were performed
with type approved
halogen bulb
and with LED retrofits of
different design



Halogen

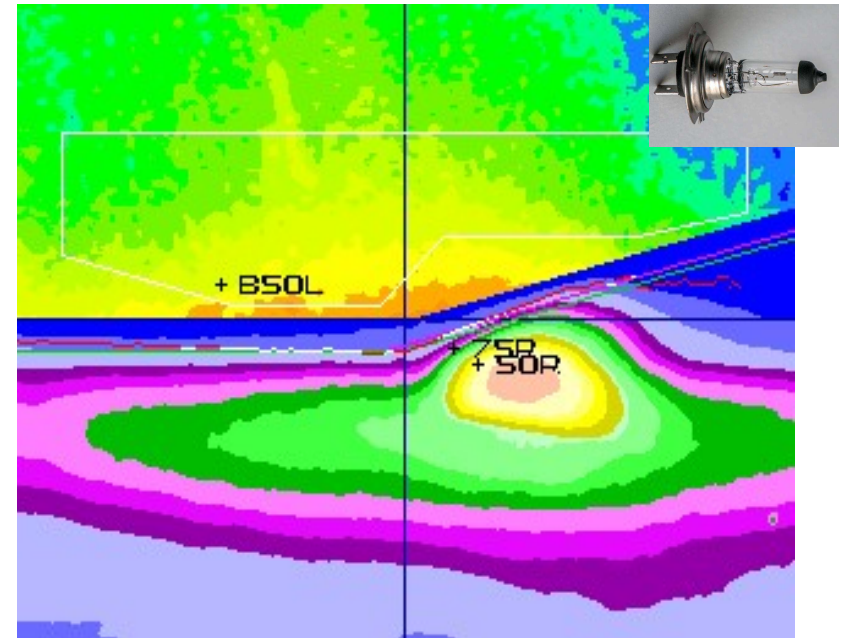


*LEDr 1 „approved” in Germany
in the time of the test*

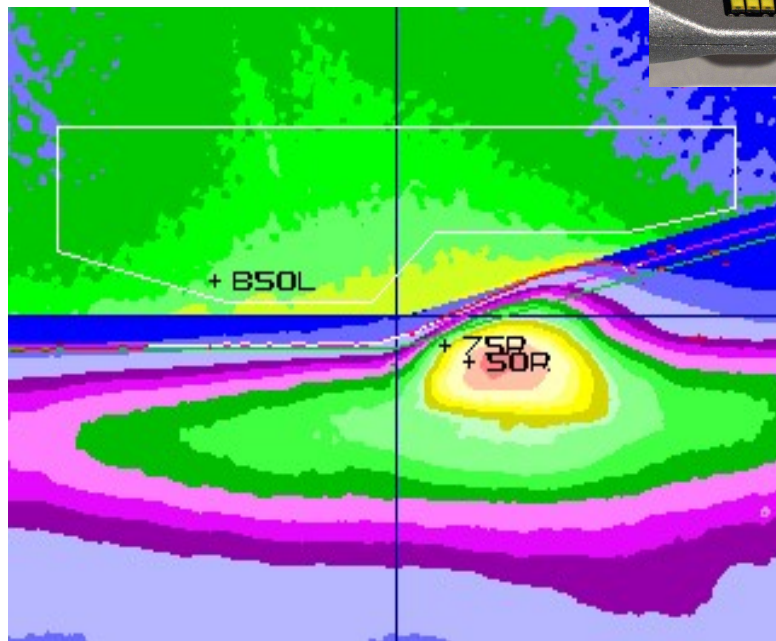


LEDr 2

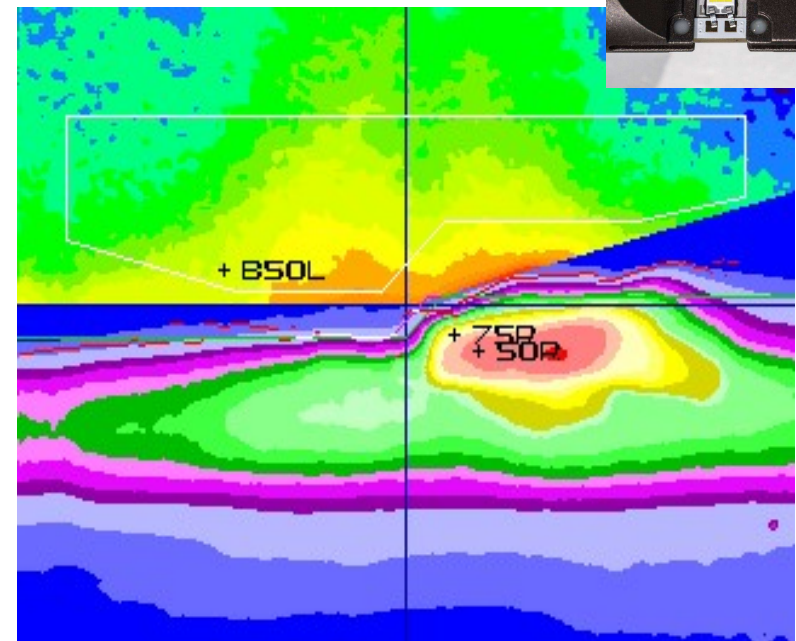
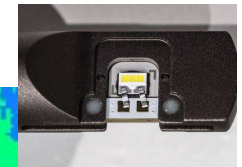
Headlamp H7A



Halogen

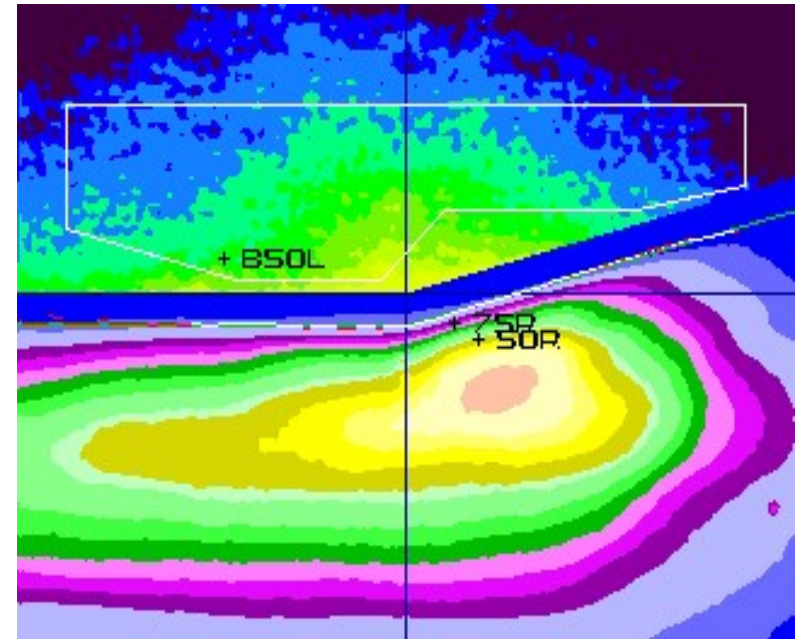


LEDr 1

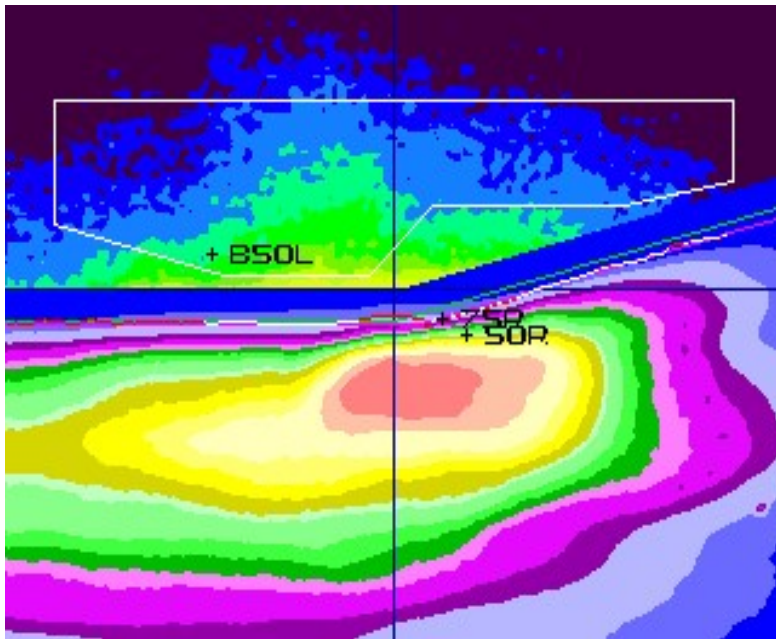


LEDr 2

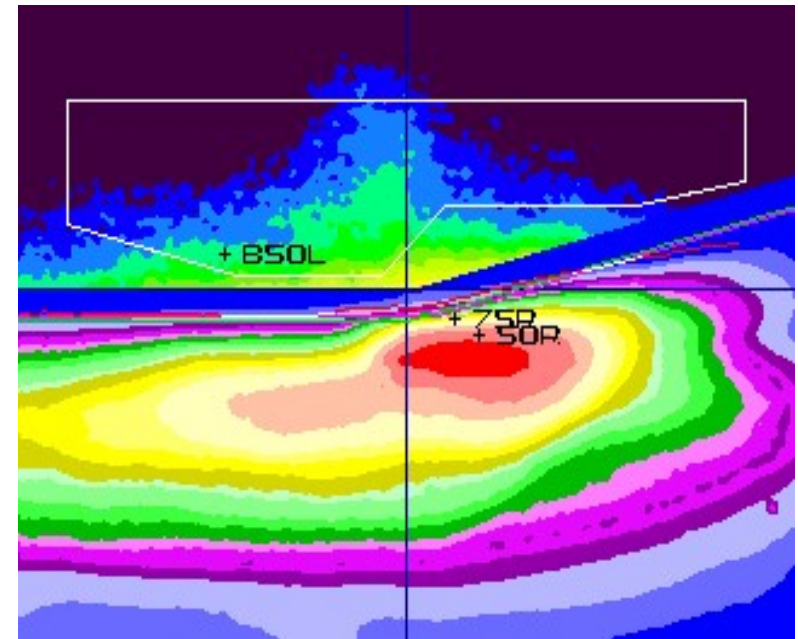
H7B



Halogen

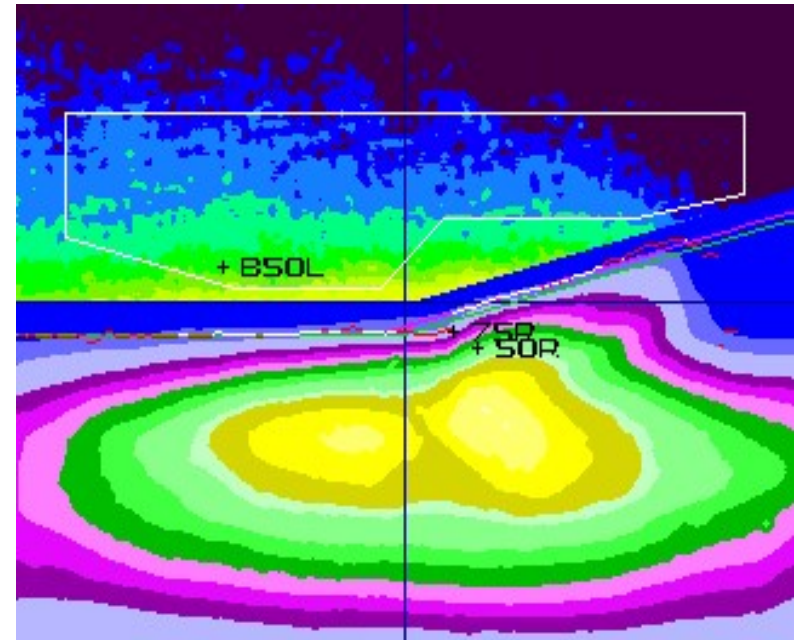


LEDr 1

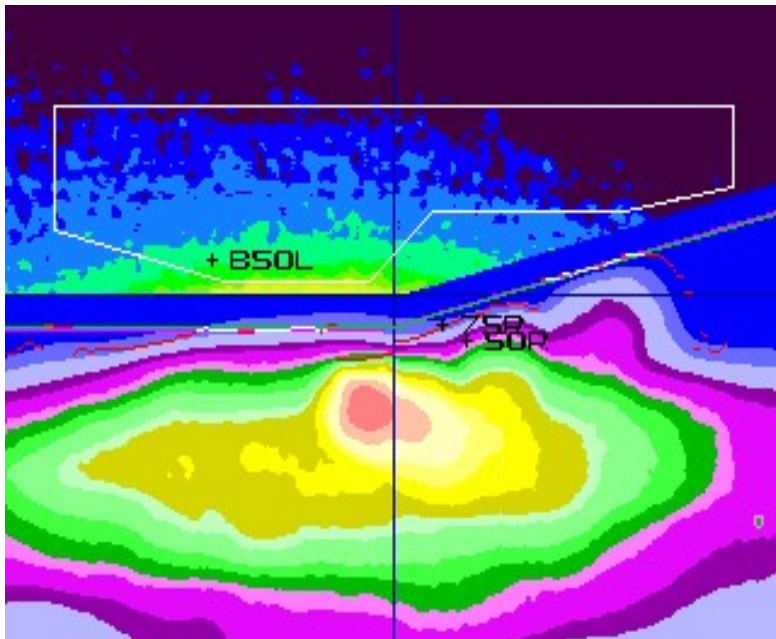


LEDr 2

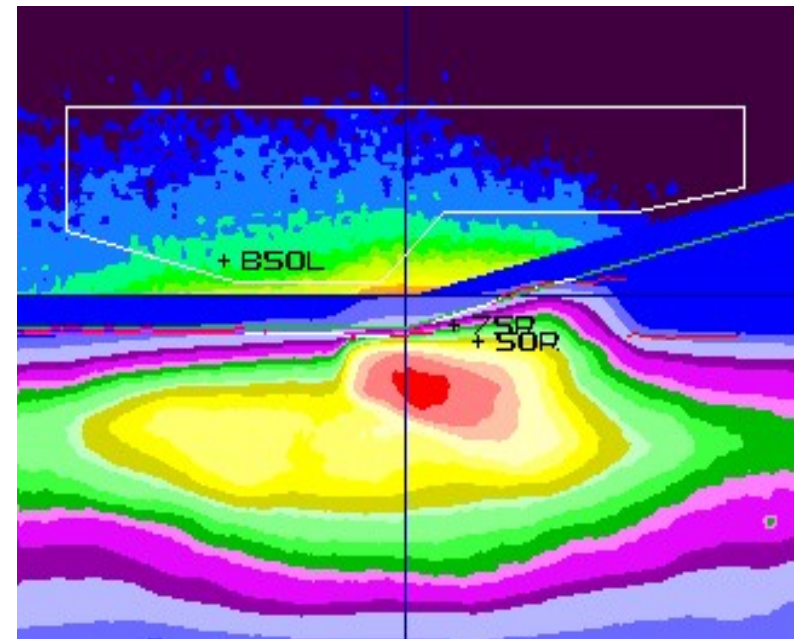
H7C



Halogen

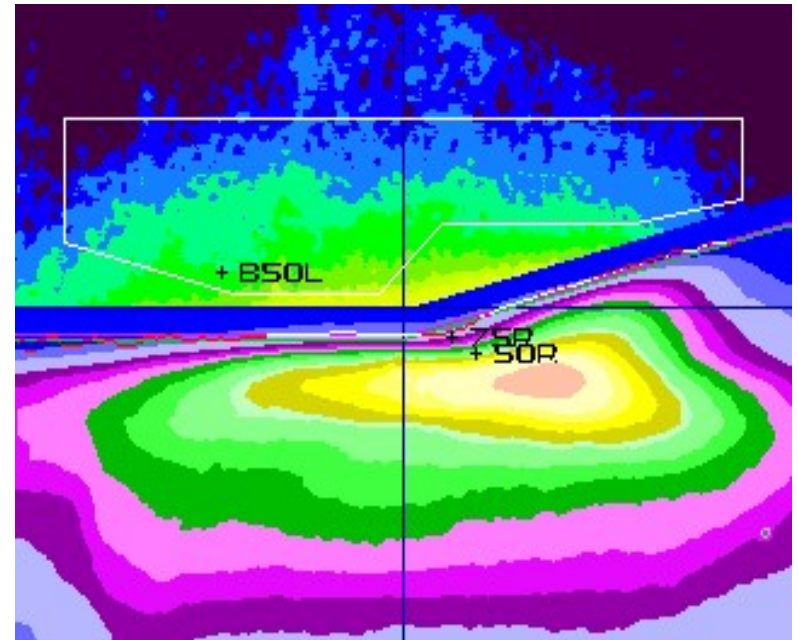


LEDr 1

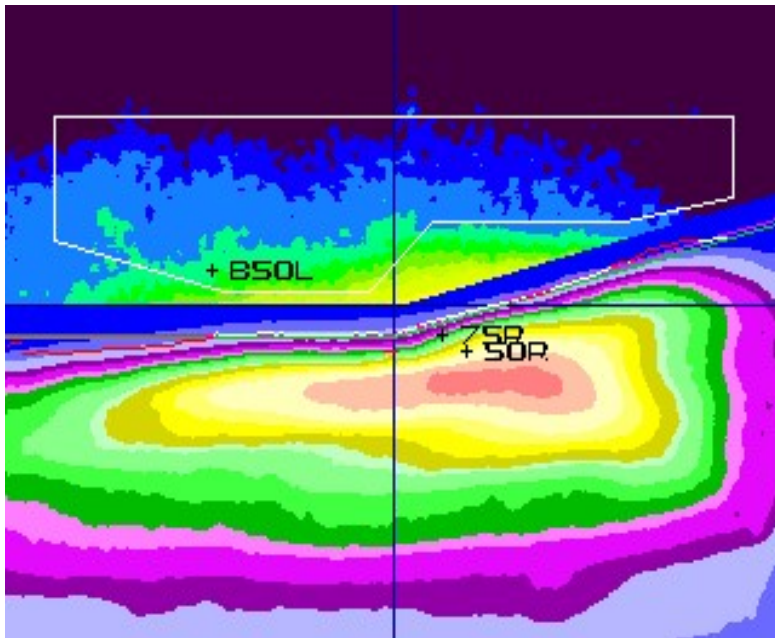


LEDr 2

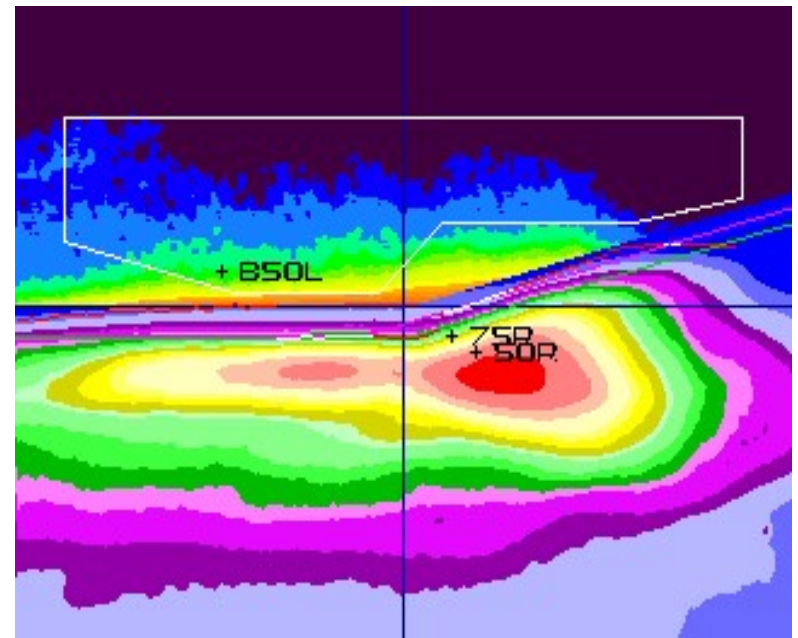
H7D



Halogen

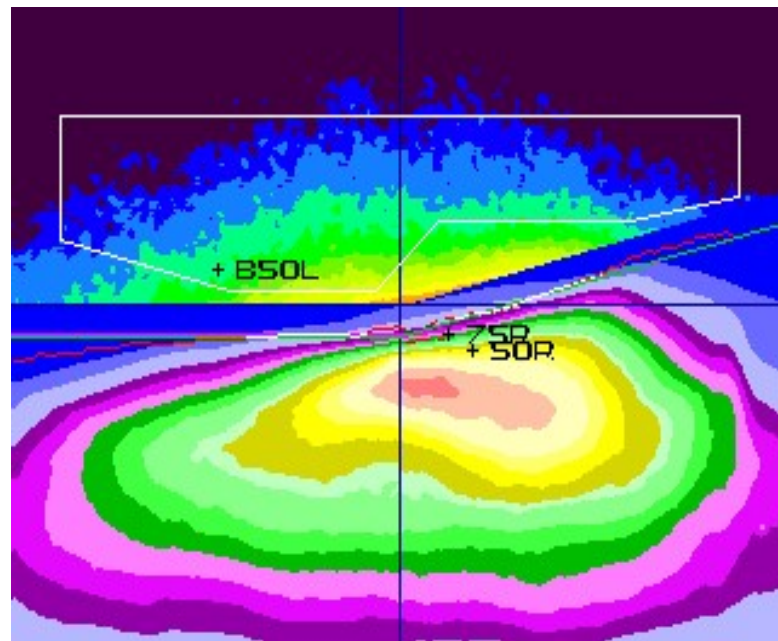


LEDr 1

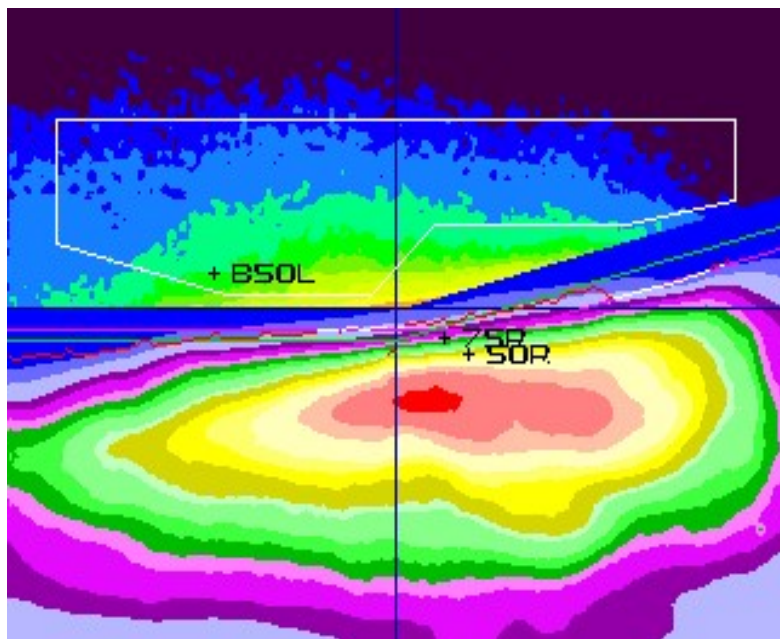


LEDr 2

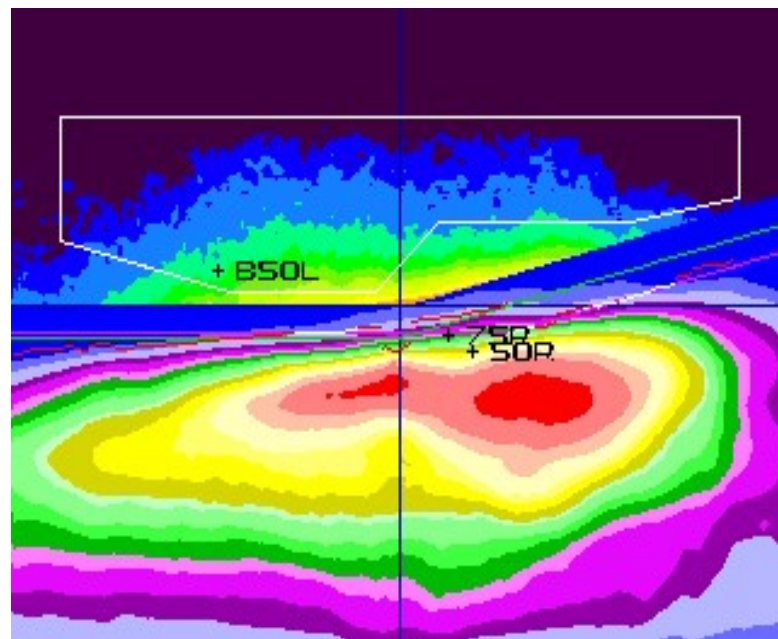
H7E



Halogen

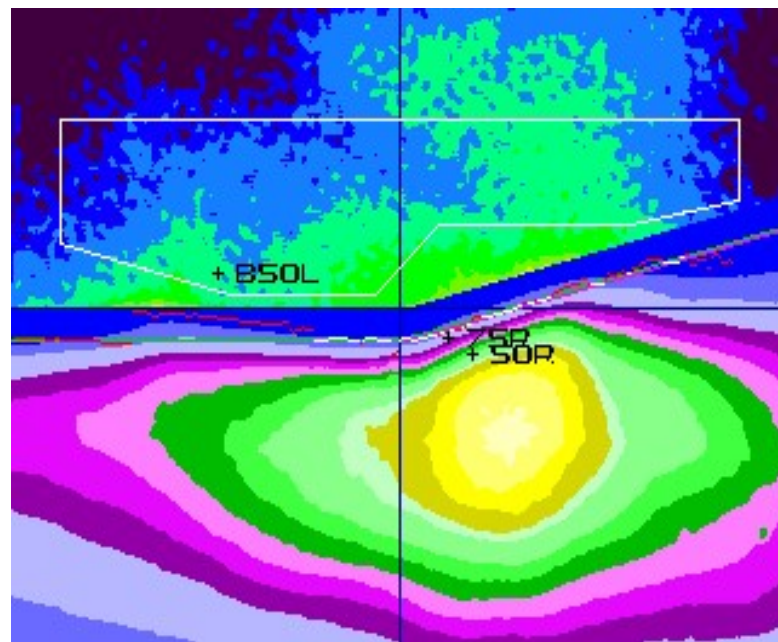


LEDr 1

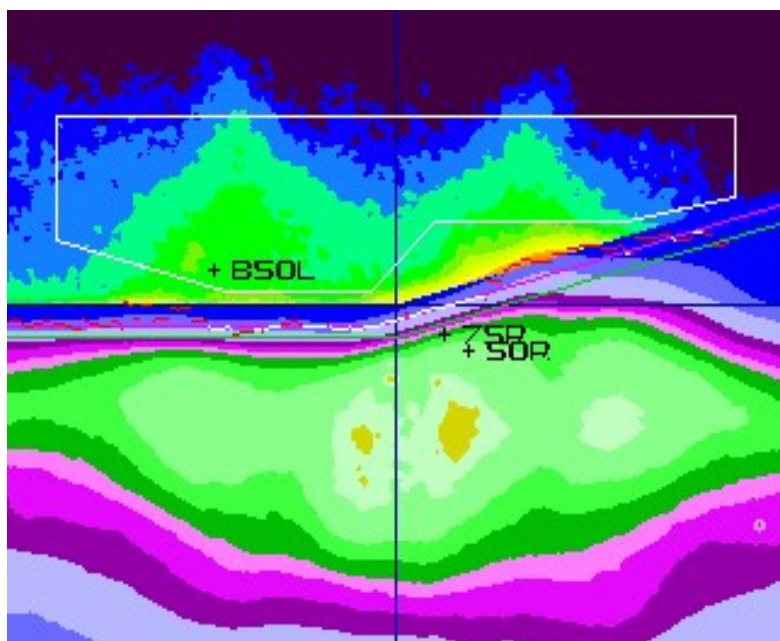


LEDr 2

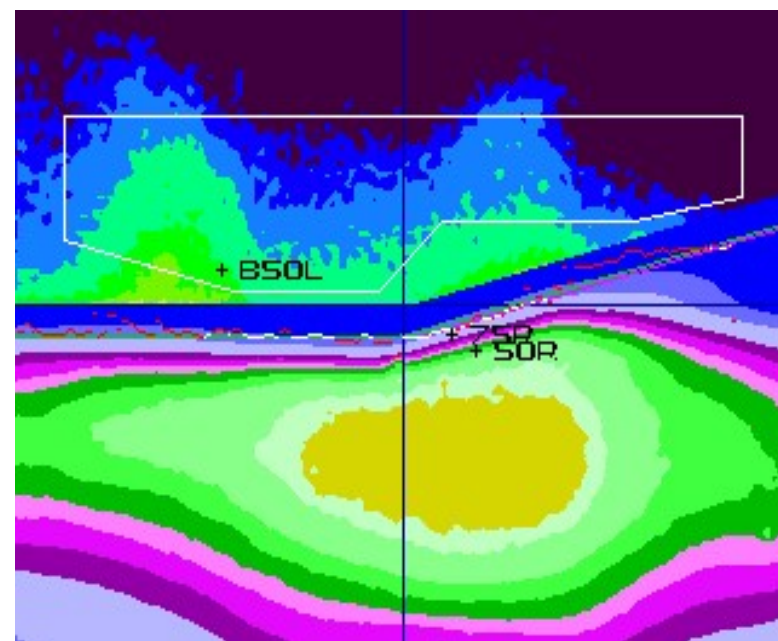
H7F



Halogen

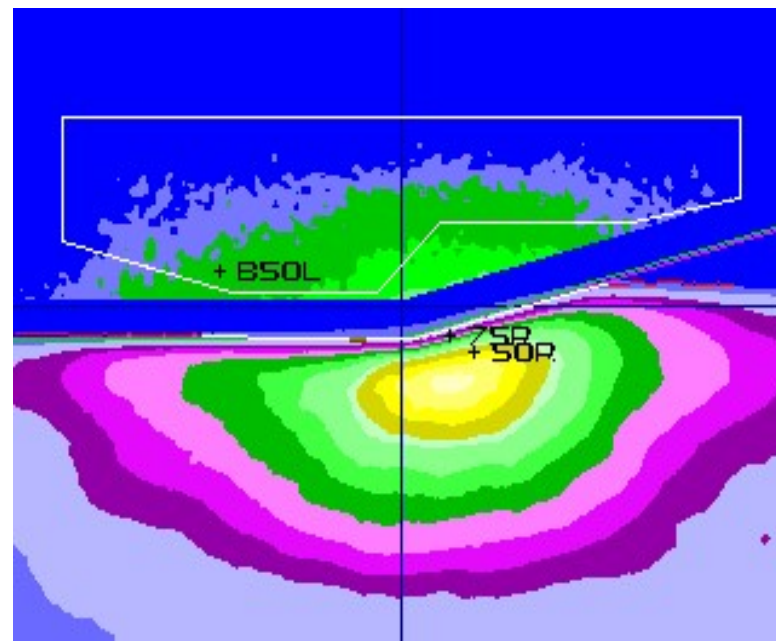


LEDr 1

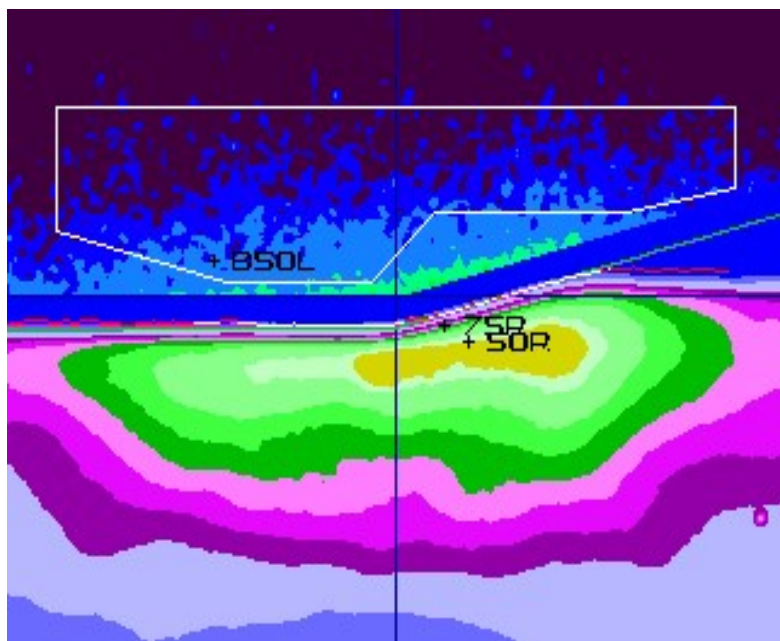


LEDr 2

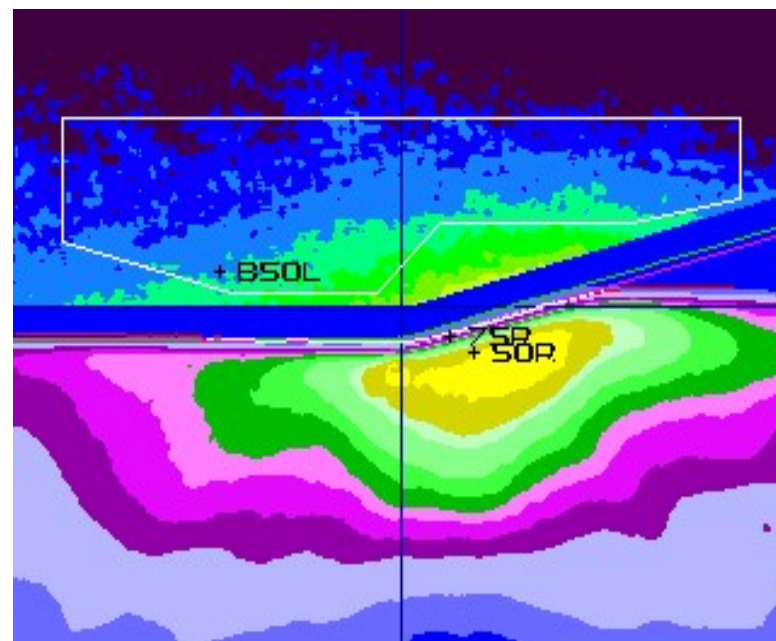
H7G



Halogen

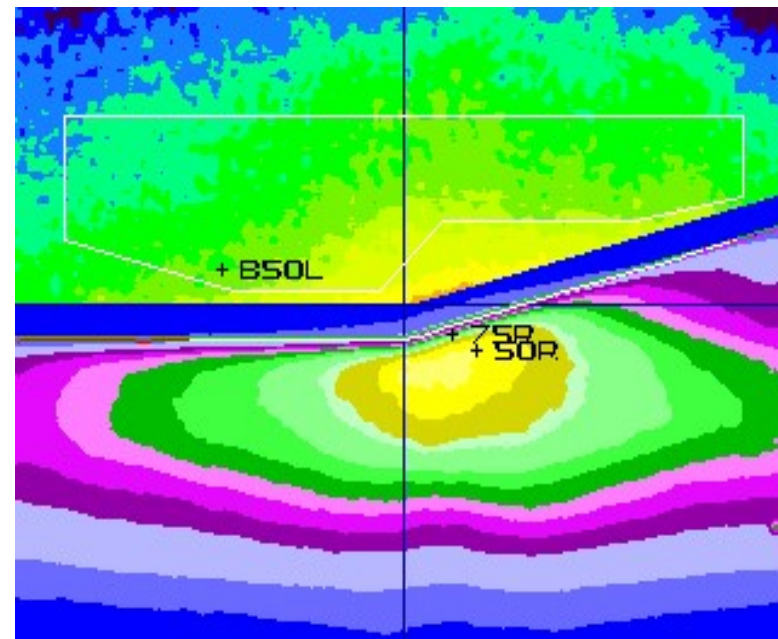
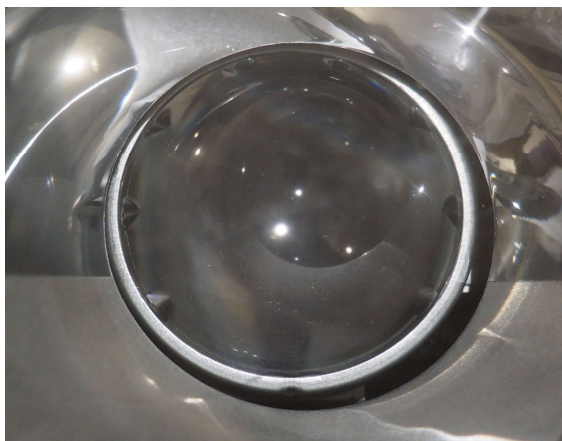


LEDr 1

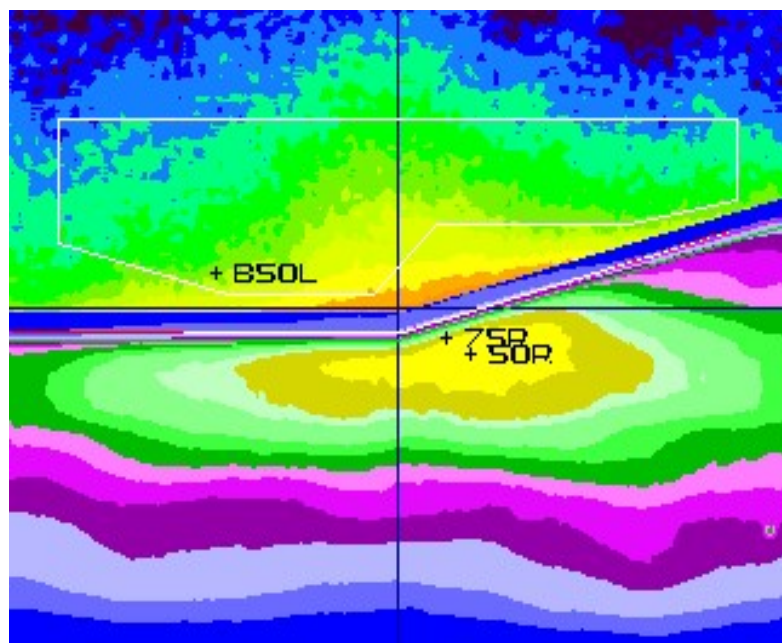


LEDr 2

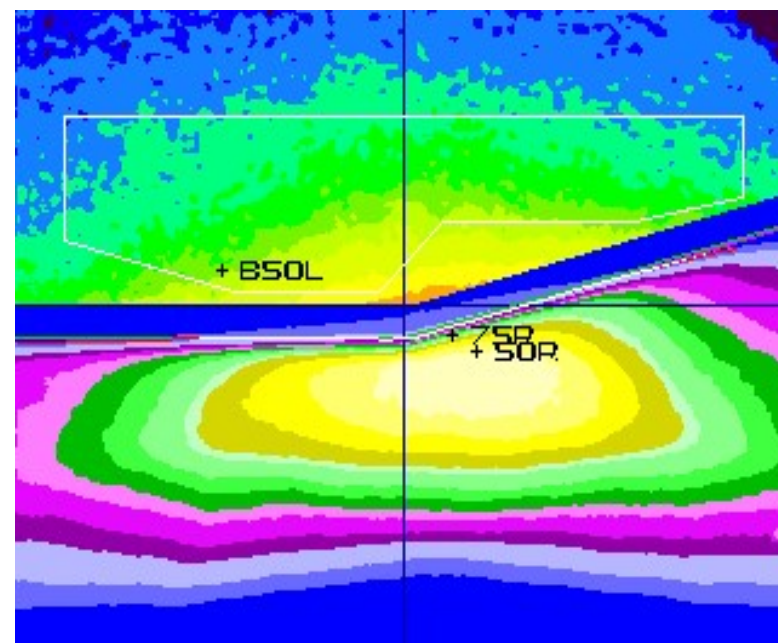
H7H



Halogen



LEDr 1



LEDr 2

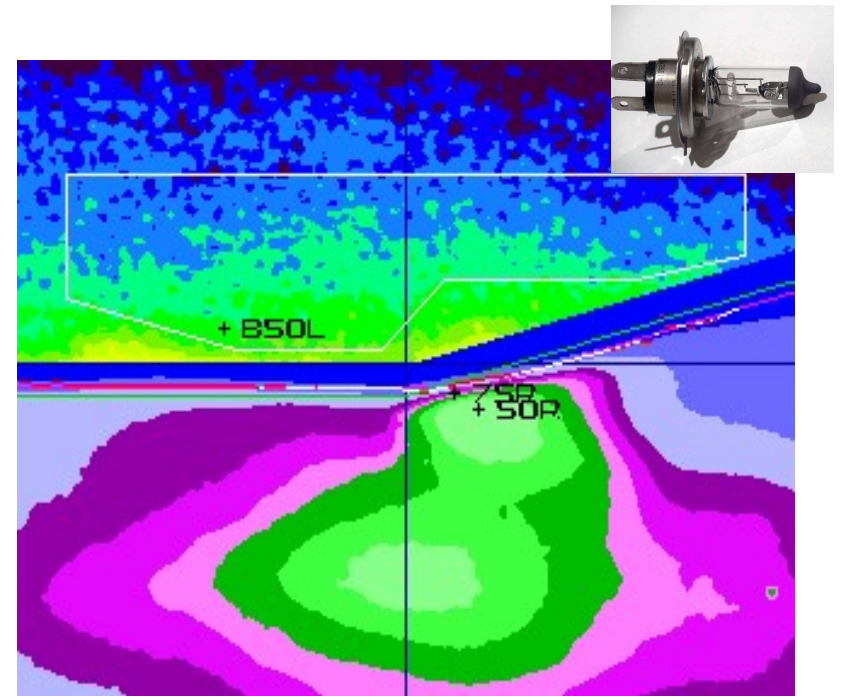
H4 examples

The tested H4 headlamps and LED retrofits were not on any LED replacements list in the day of the test (spring 2021).

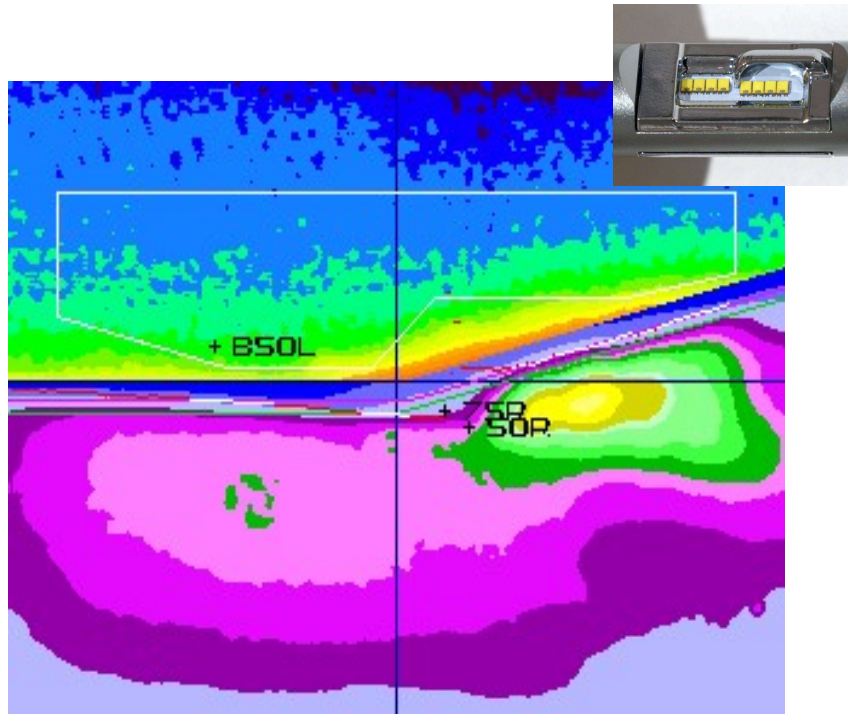
Tests were carried out with OEM headlamps and some their type approved replacements.

Results are selected to show possibility of improvement of the road illumination without additional glare.

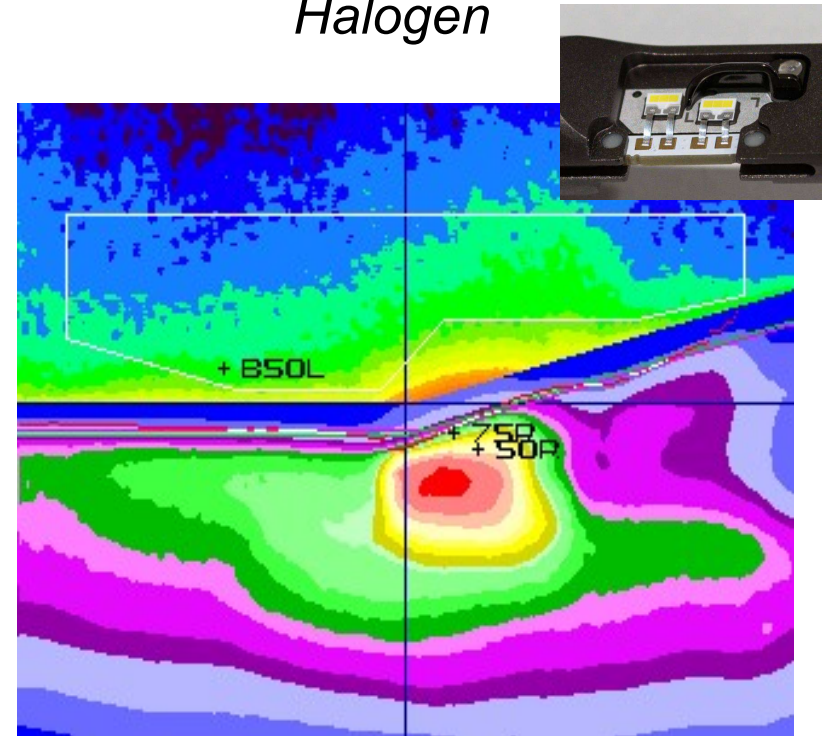
H4A (Parabolic)



Halogen

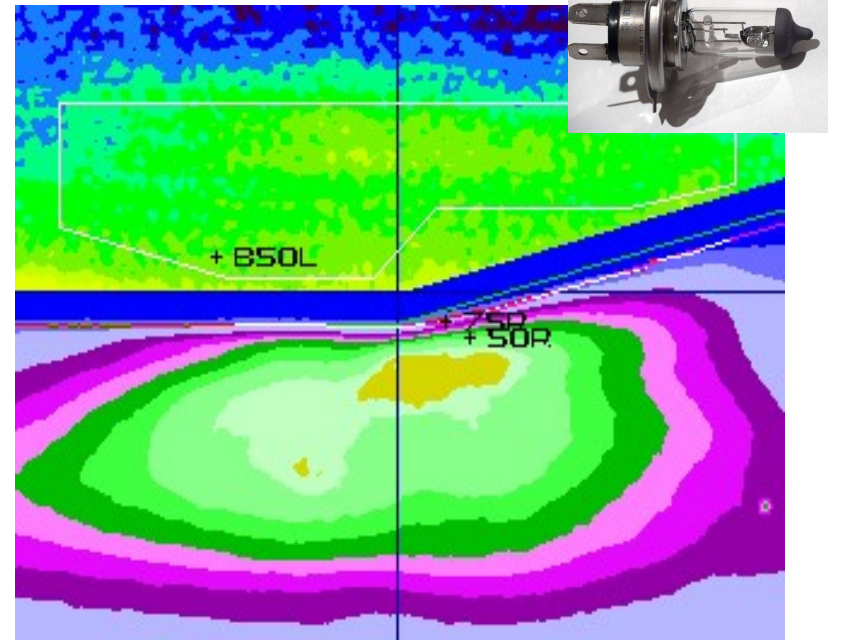


LEDr 3

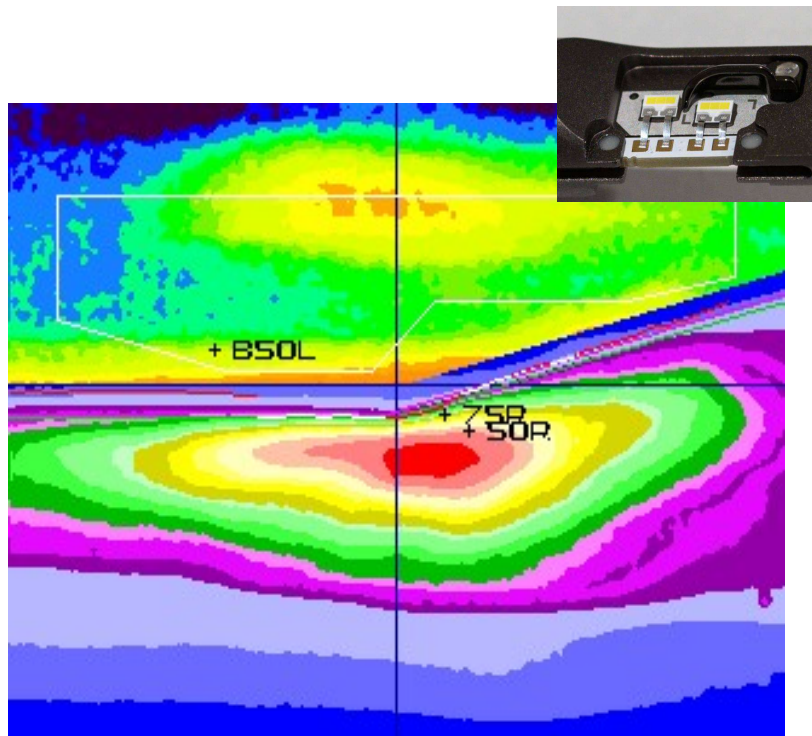


LEDr 4

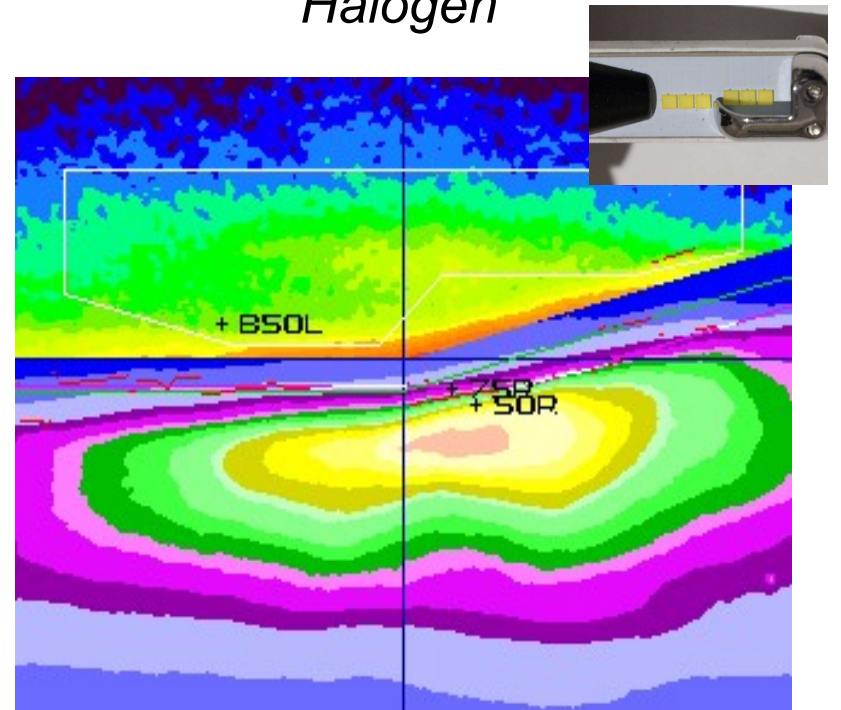
H4B (FF)



Halogen

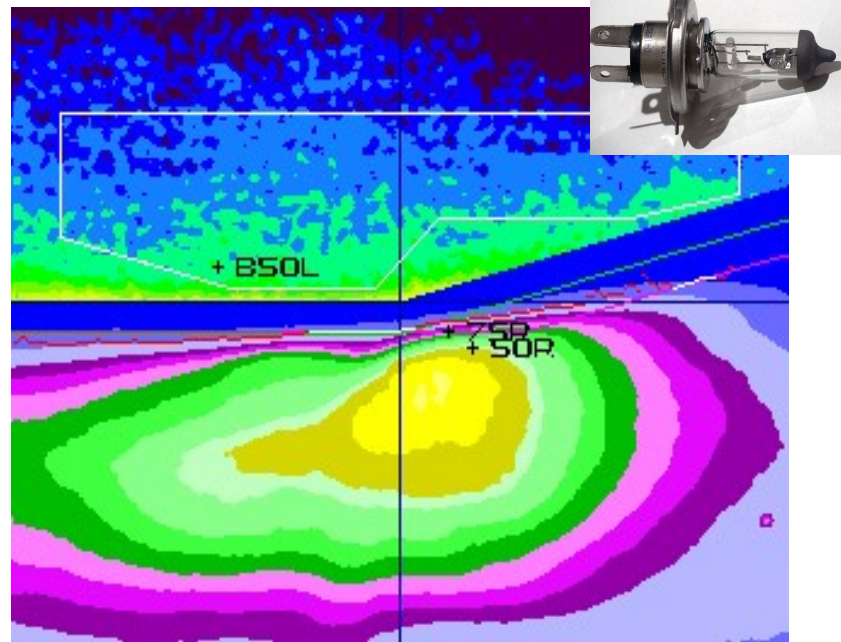


LEDr 4

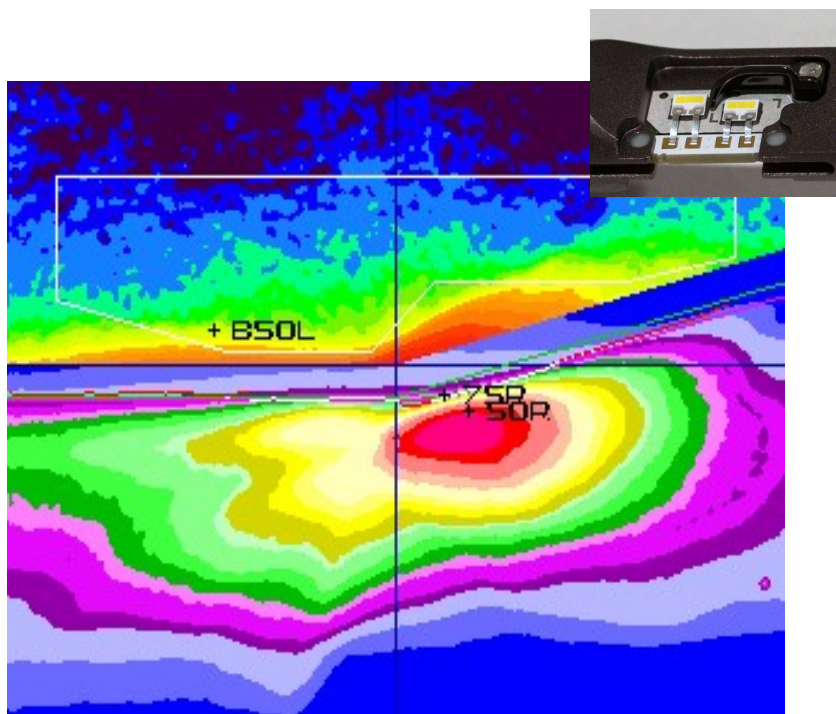


LEDr 5

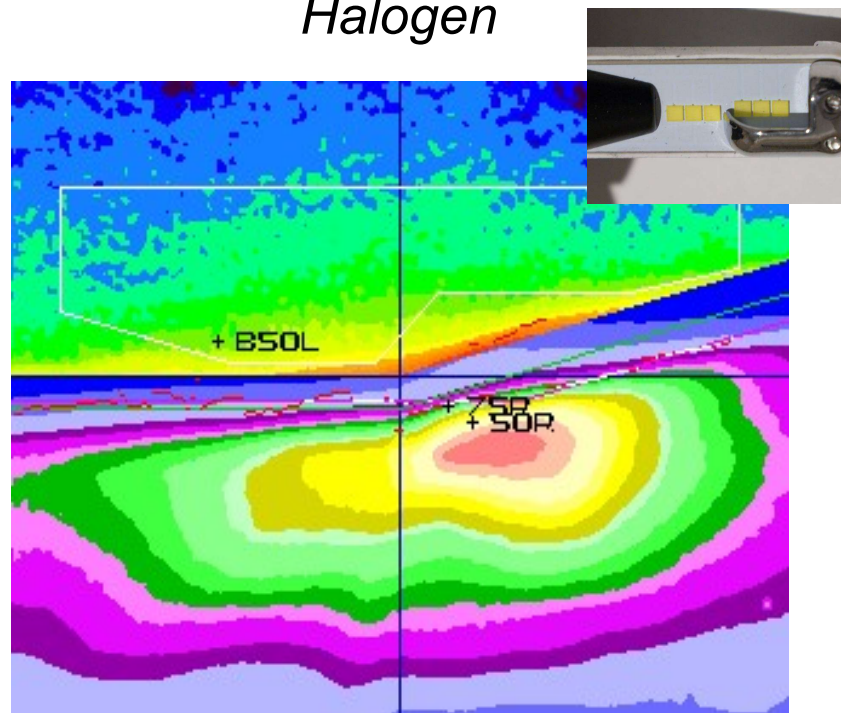
H4C



Halogen

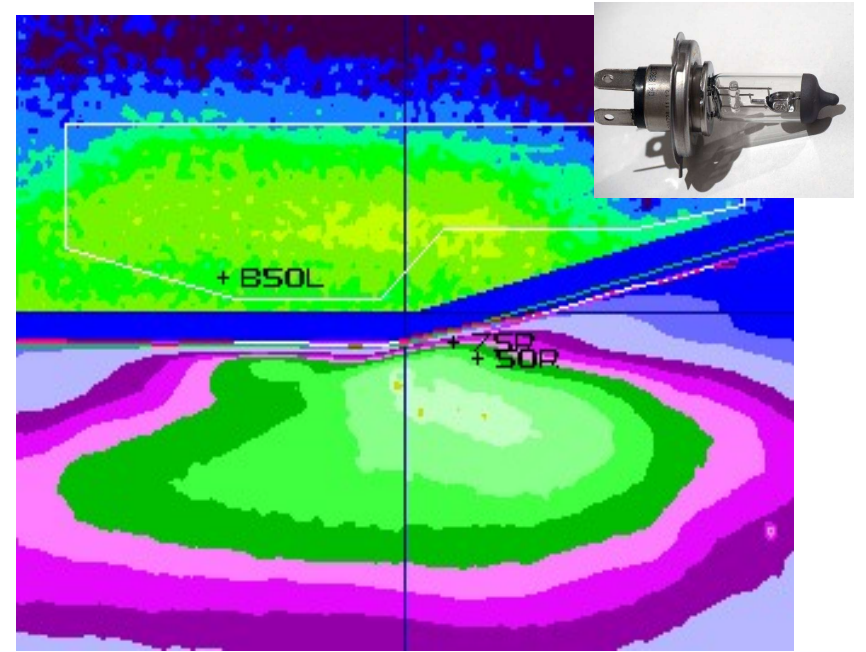


LEDr 4

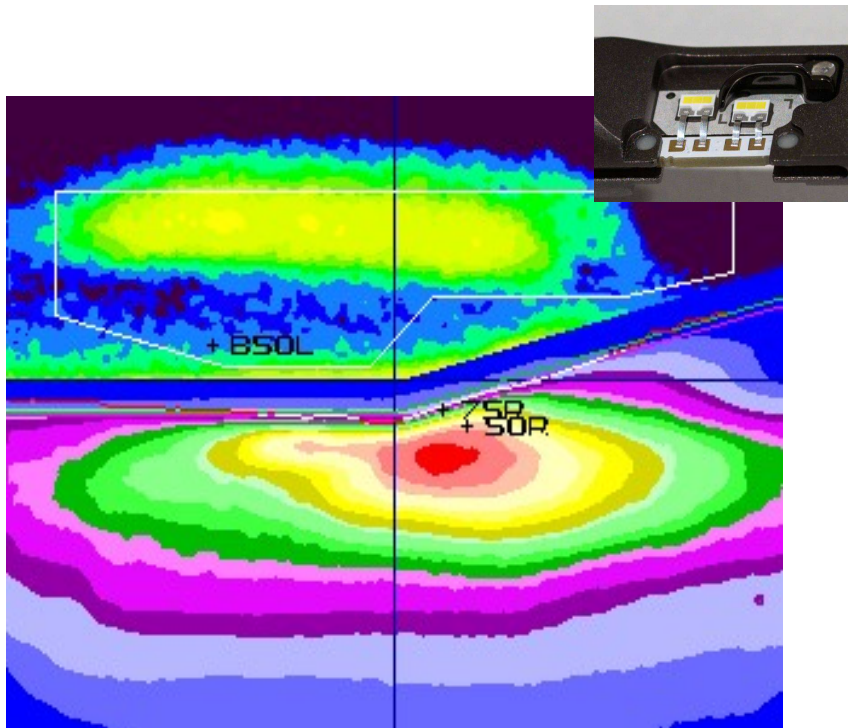


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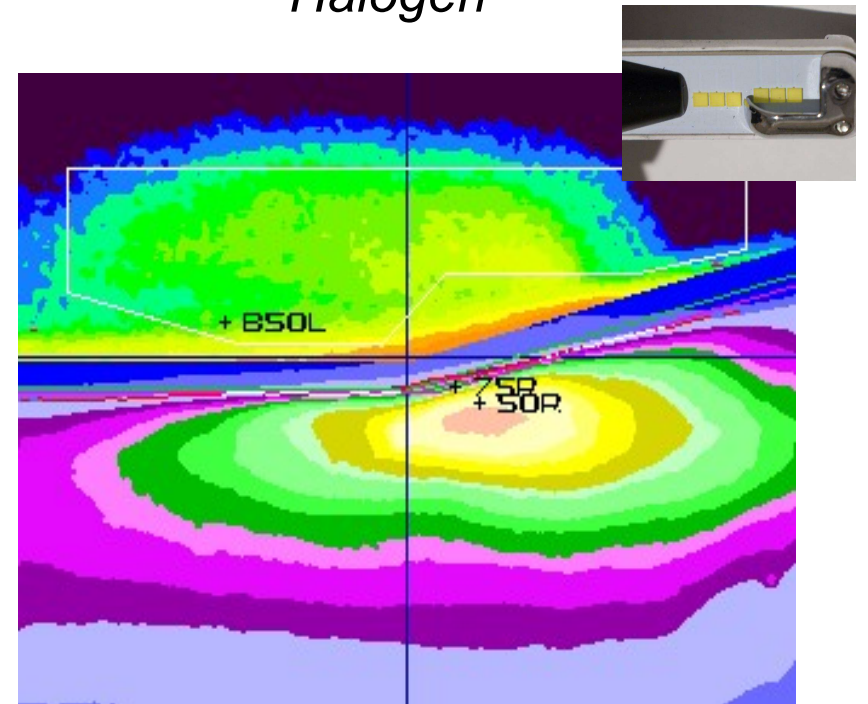
H4D



Halogen

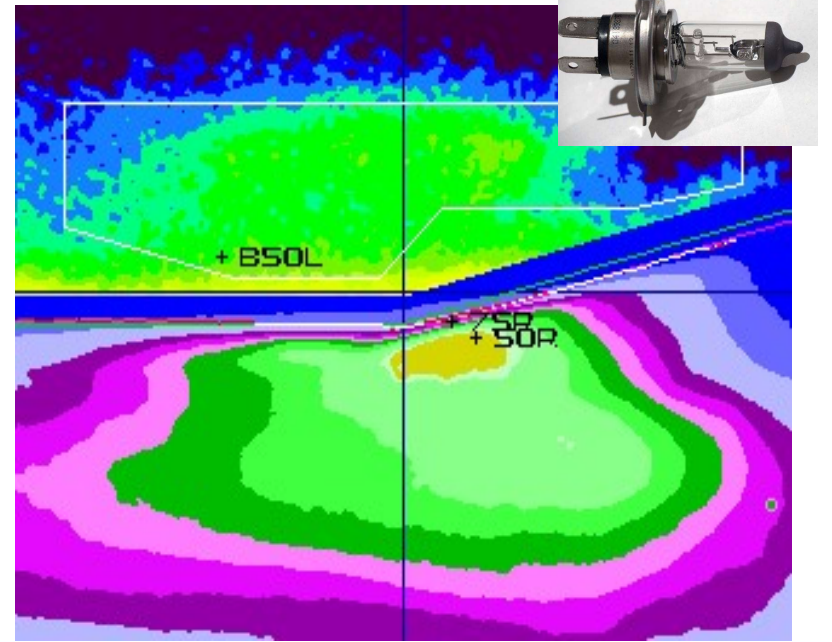


LEDr 4

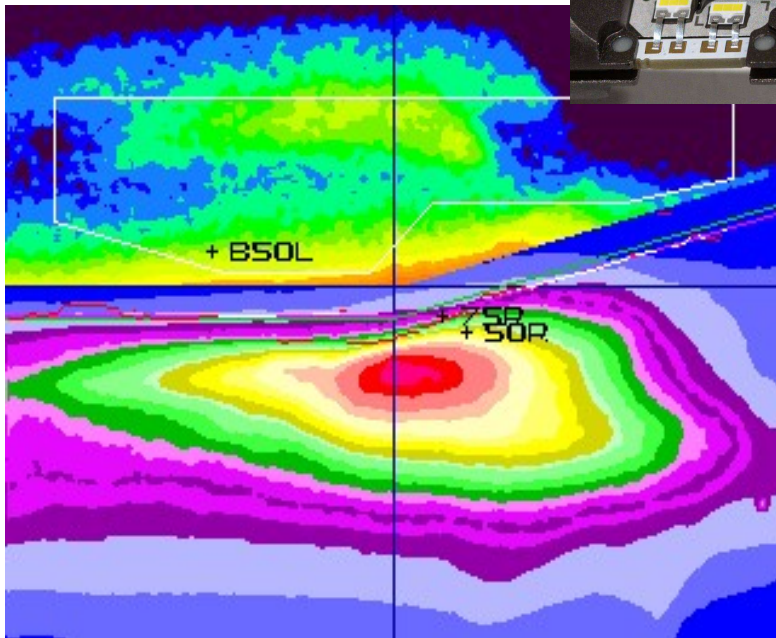
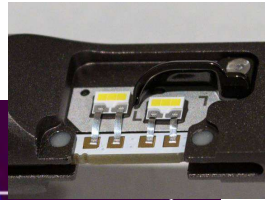


LEDr 5

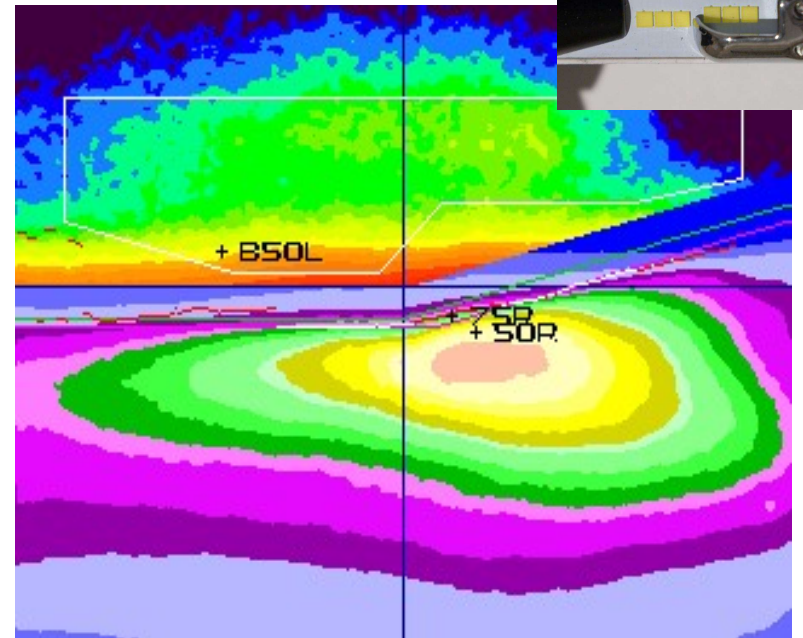
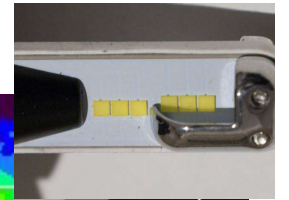
H4D



Halogen

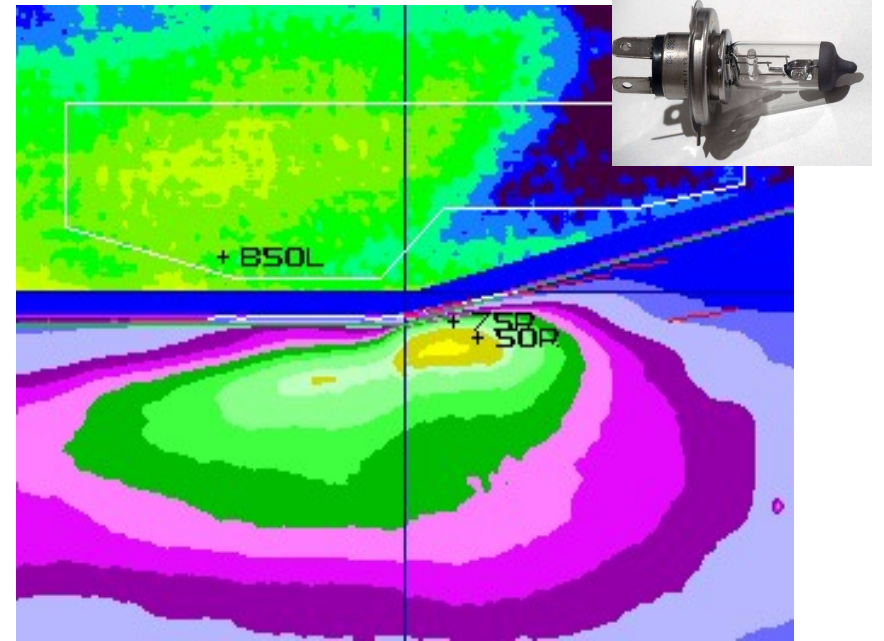


LEDr 4

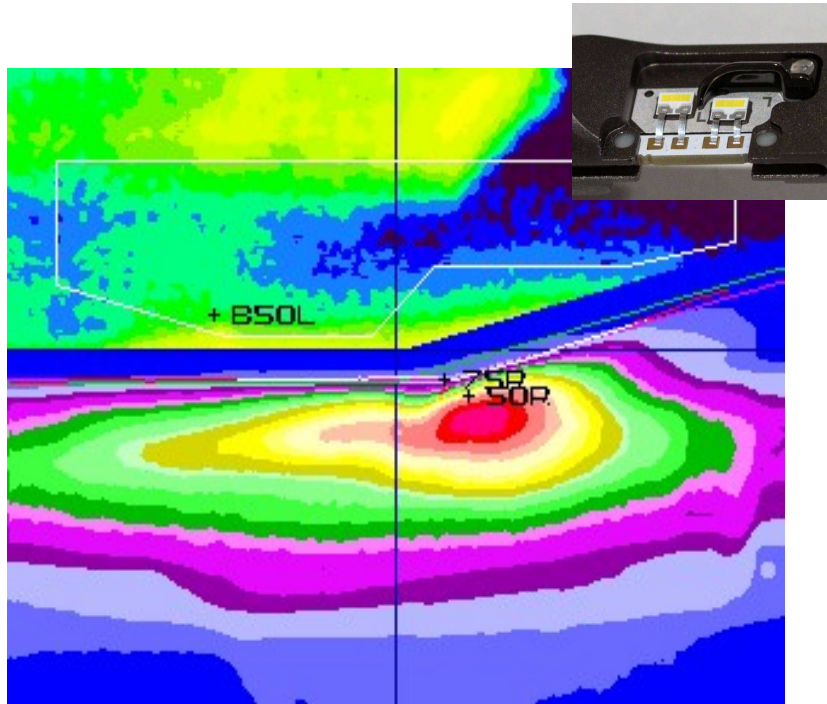


LEDr 5

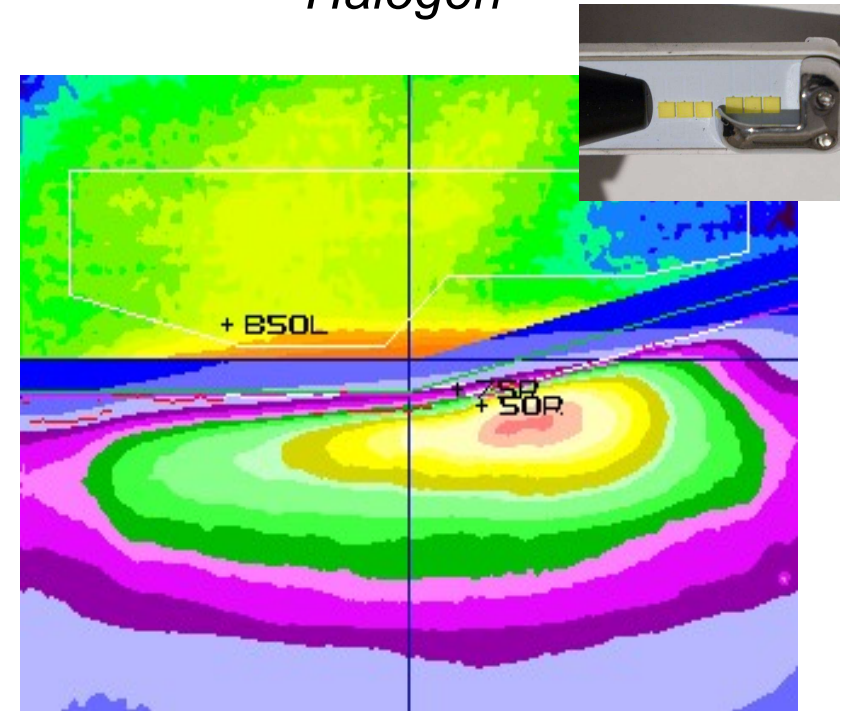
H4D



Halogen

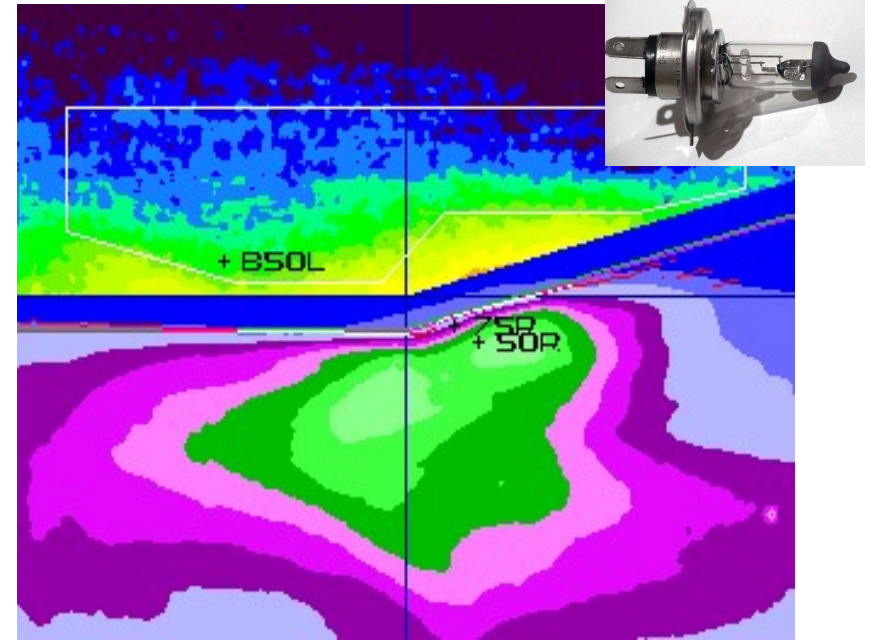


LEDr 4

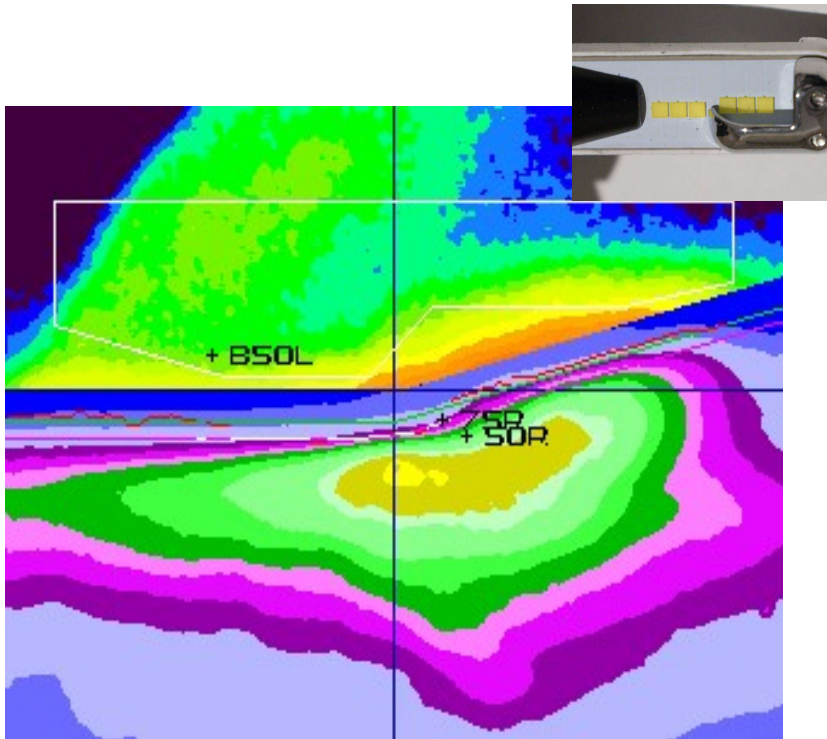


LEDr 5

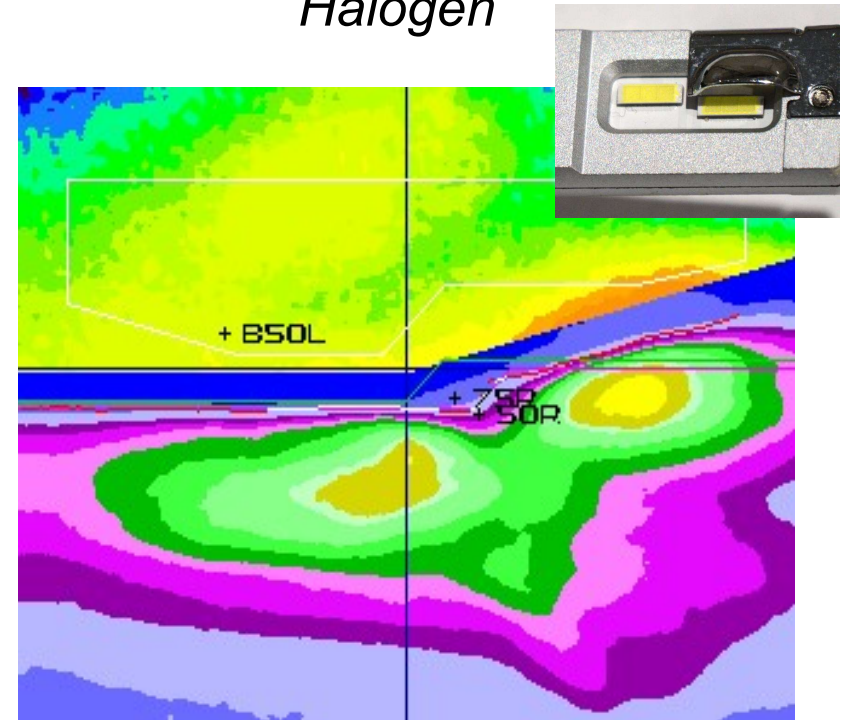
H4D



Halogen

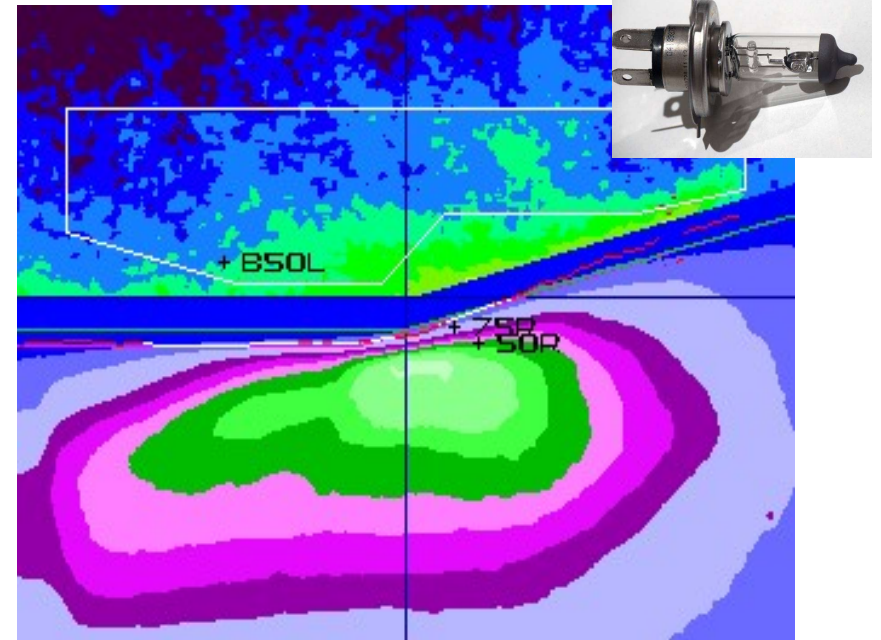


LEDr 5

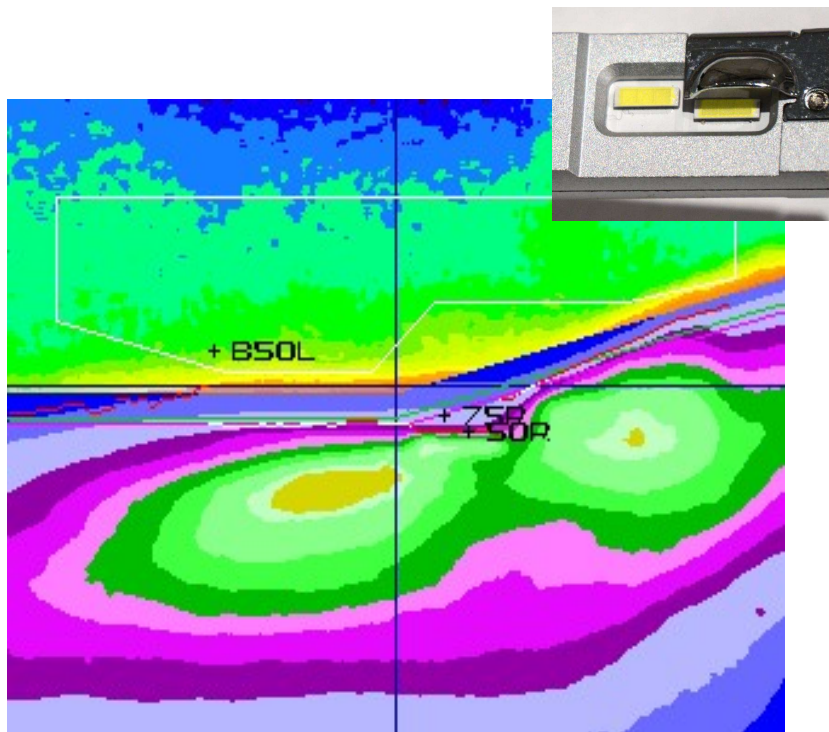
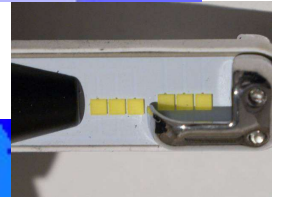


LEDr 6

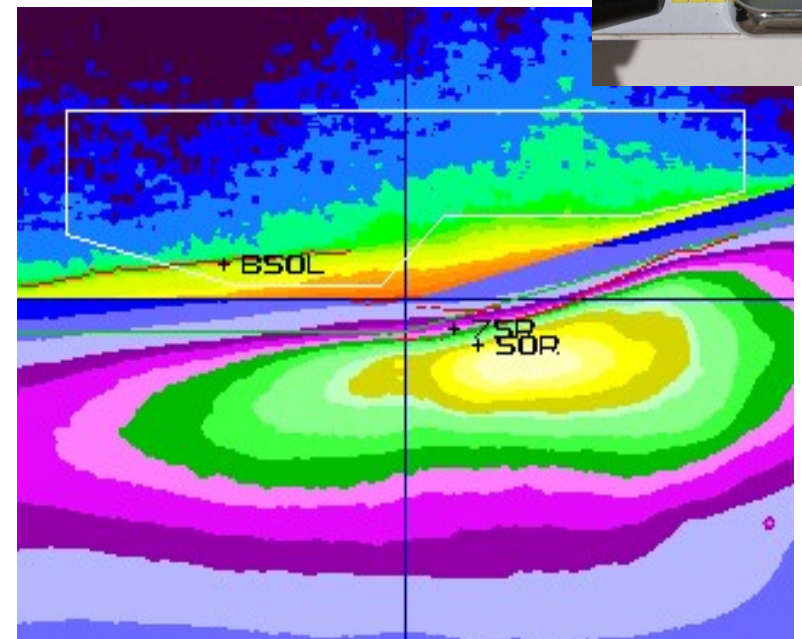
H4E



Halogen

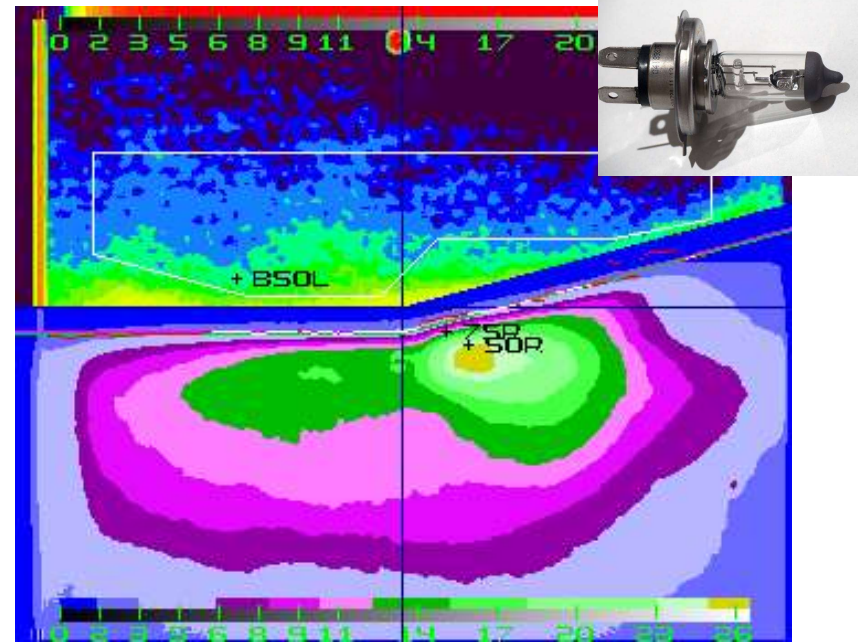


LEDr 6

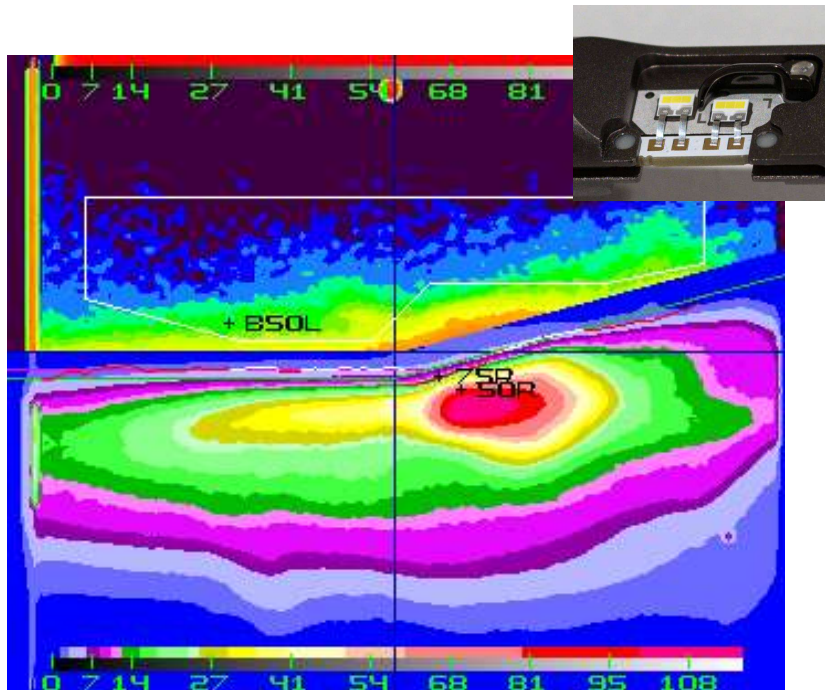


LEDr 5

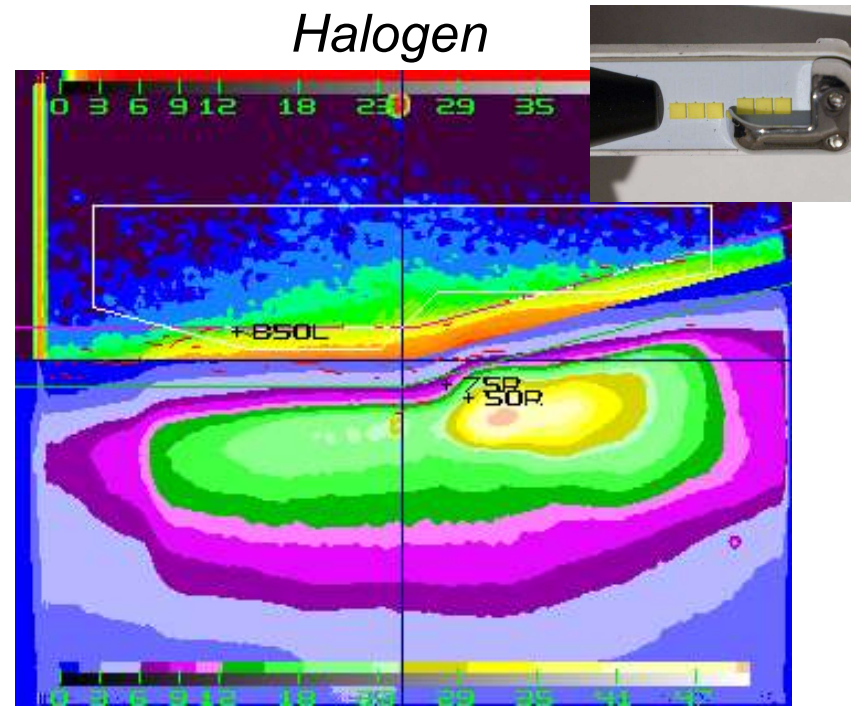
H4F



Halogen



LEDr 4



LEDr 5

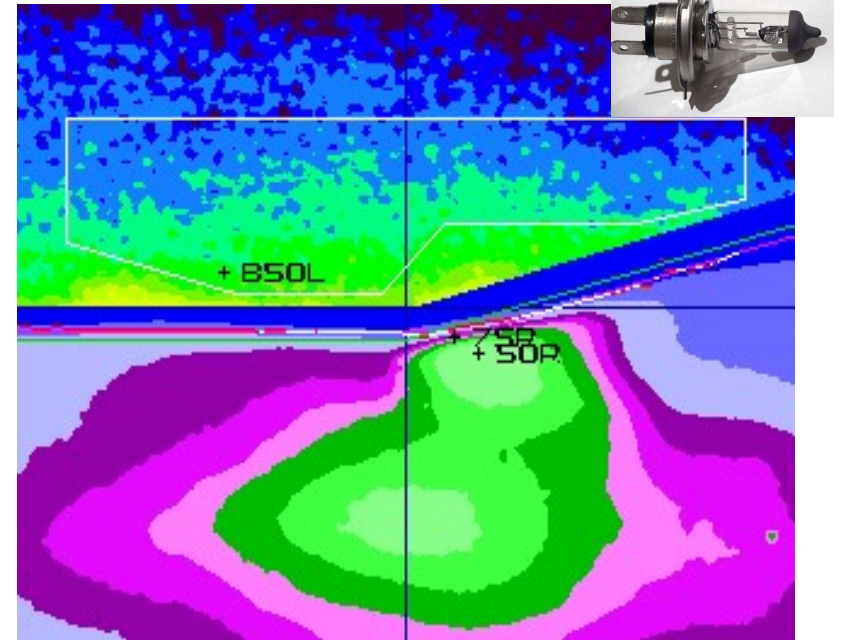
Some examples of adverse effects of using LED retrofits

Below are presented examples of adverse effects of LEDr

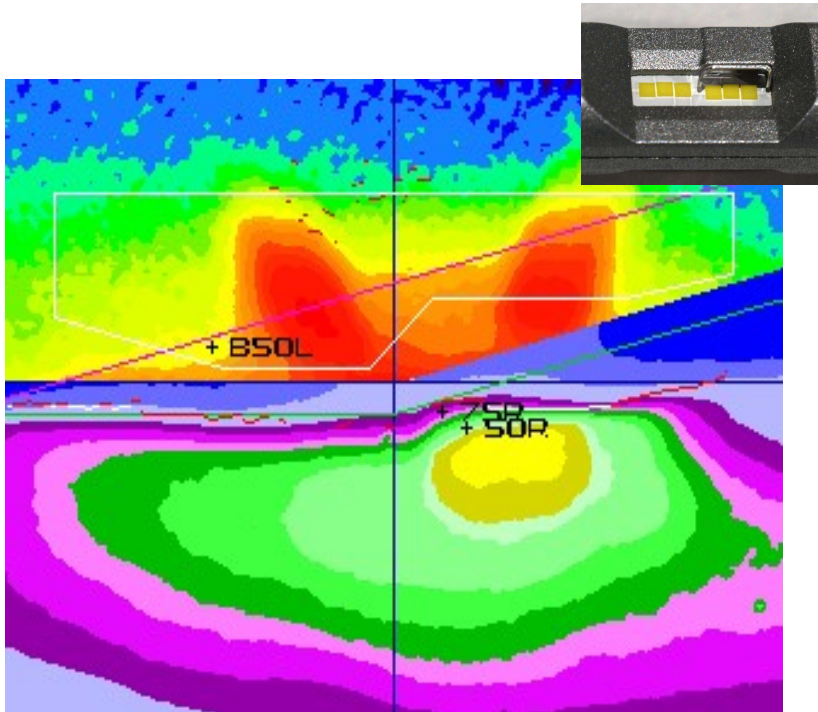
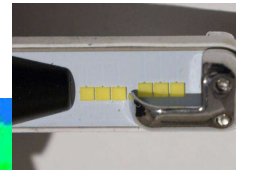
Pairs headlamp/LEDr were selected to show also unfavorable effects especially in glare zone

Because there are so many different retrofits on the market the choice is not representative to any definable technical parameter.

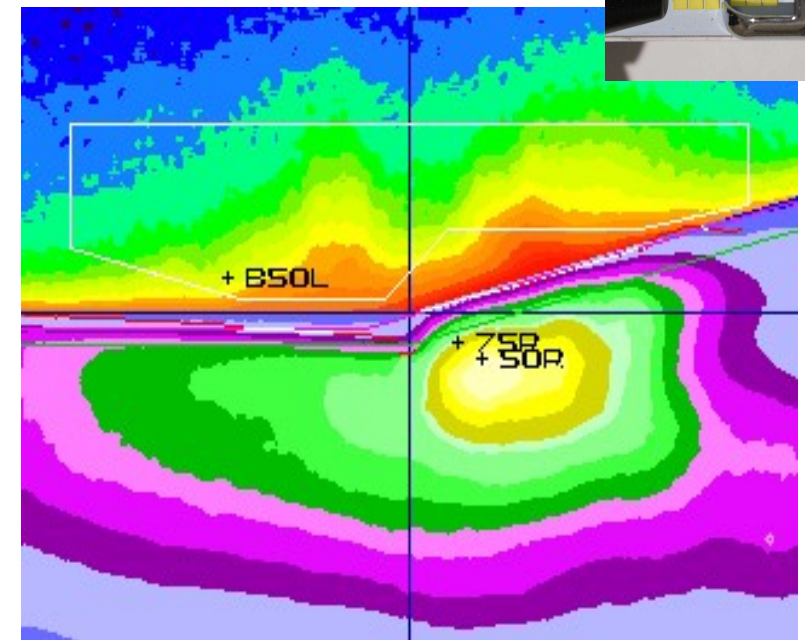
H4 Parabolic



Halogen

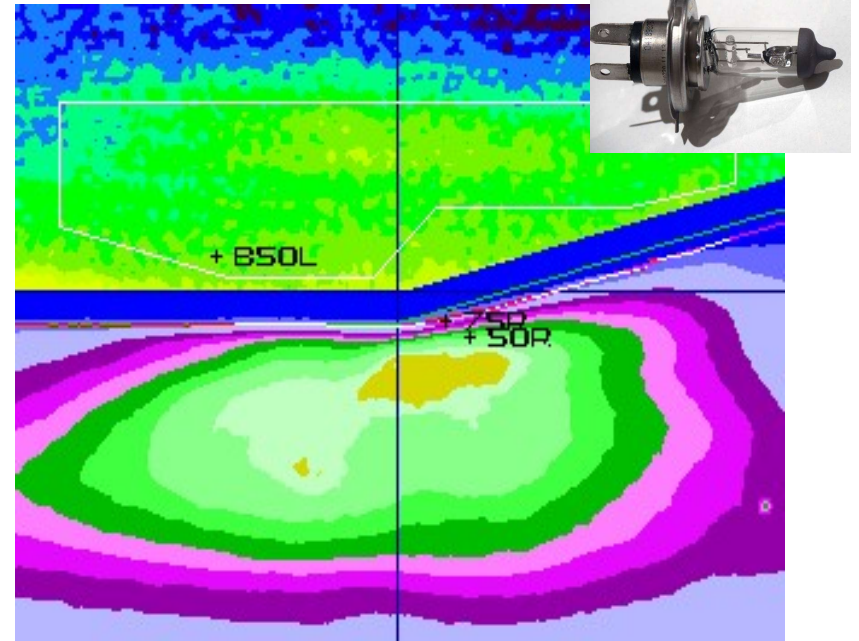


LEDr 7

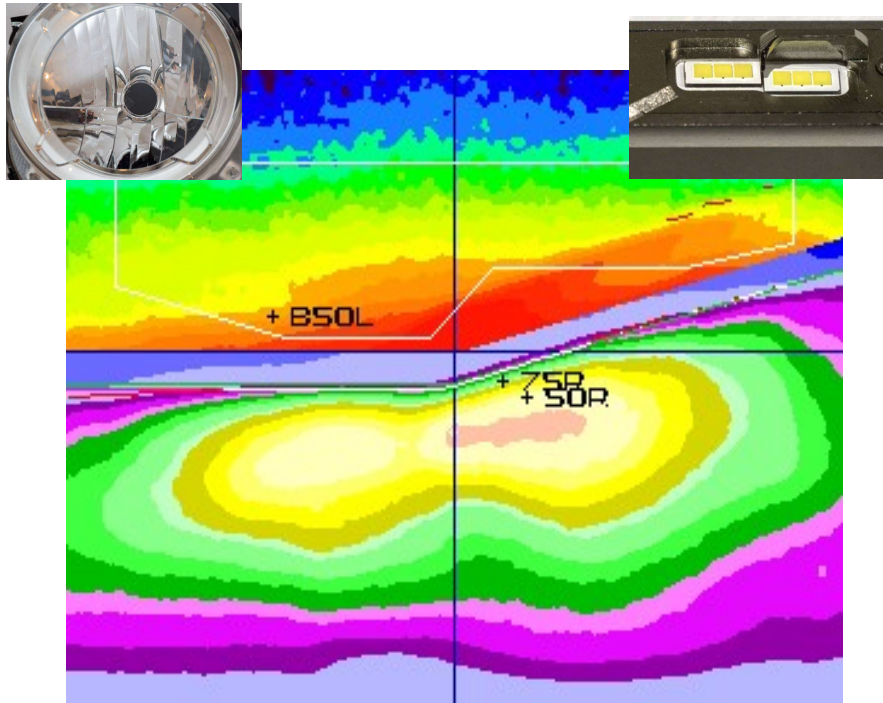


LEDr 5

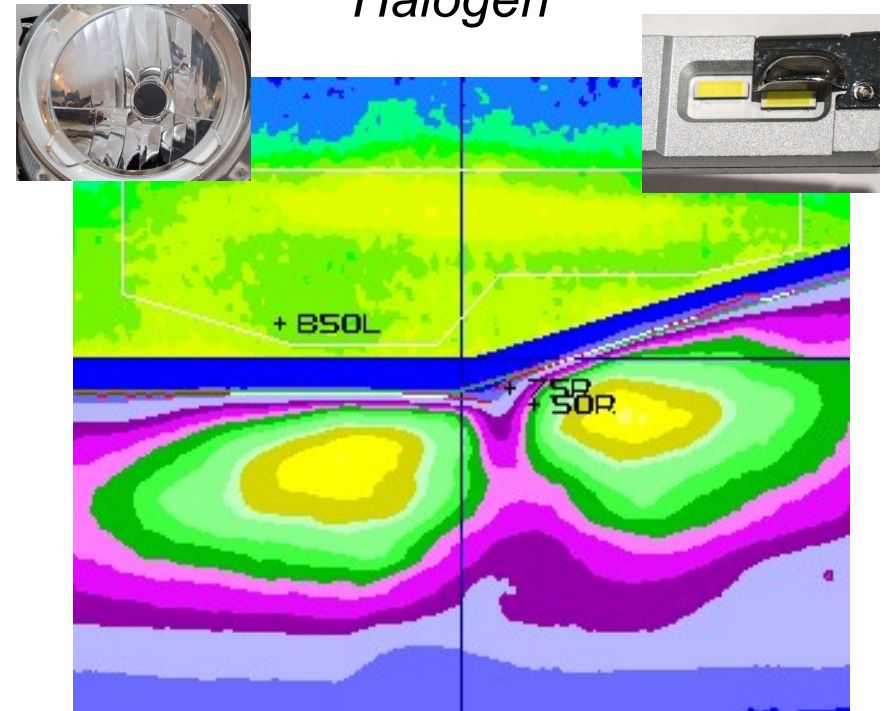
H4C



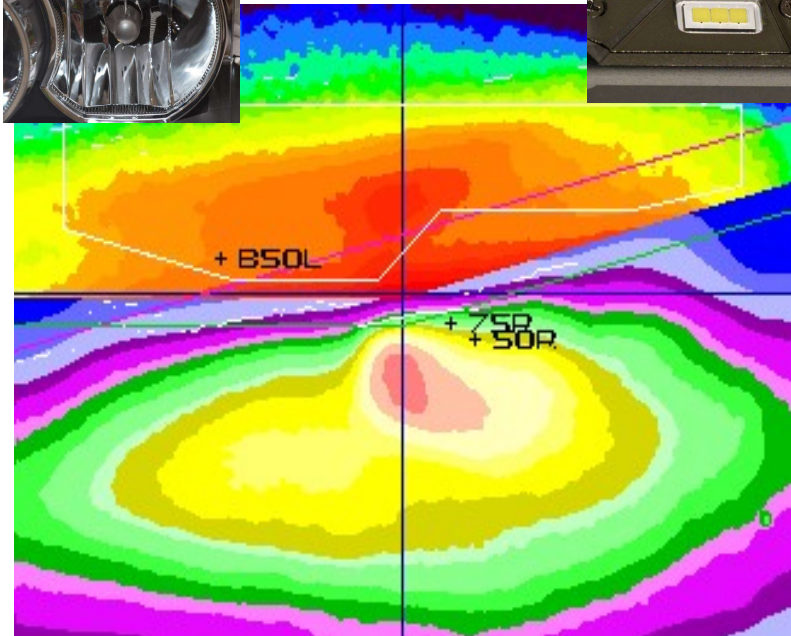
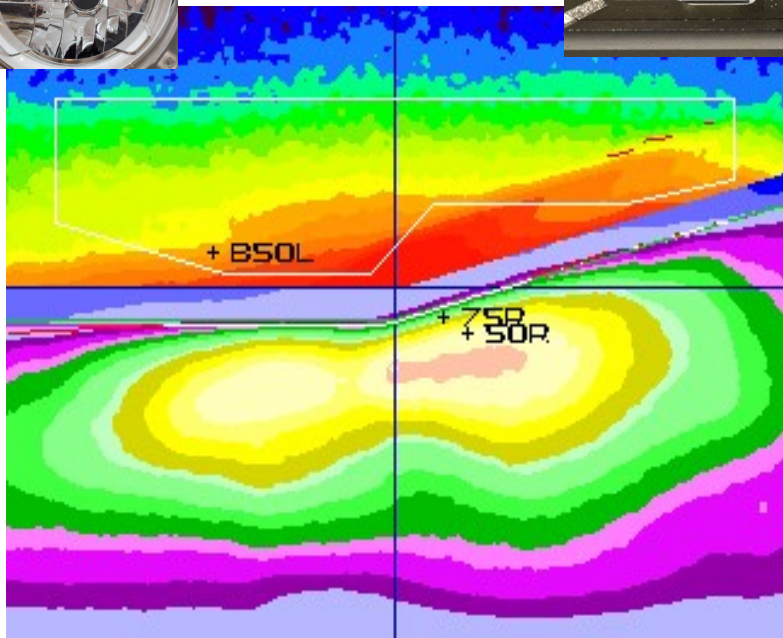
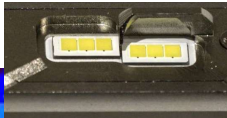
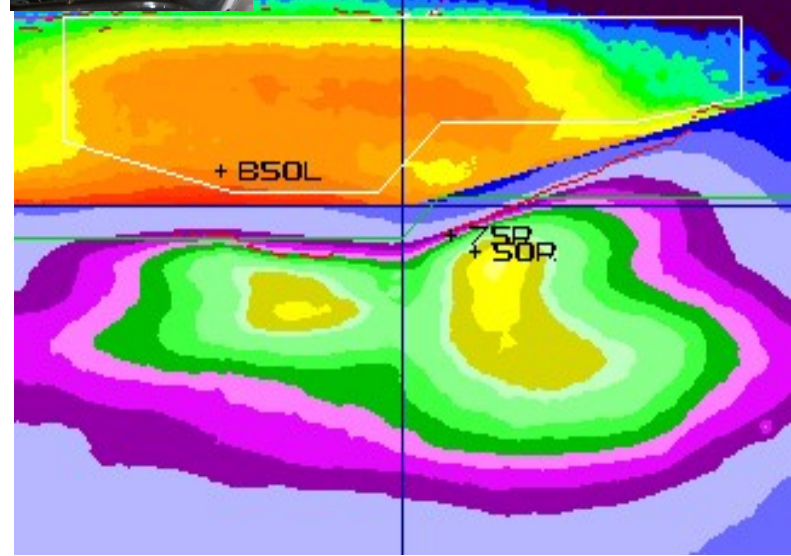
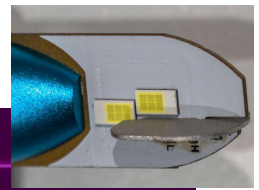
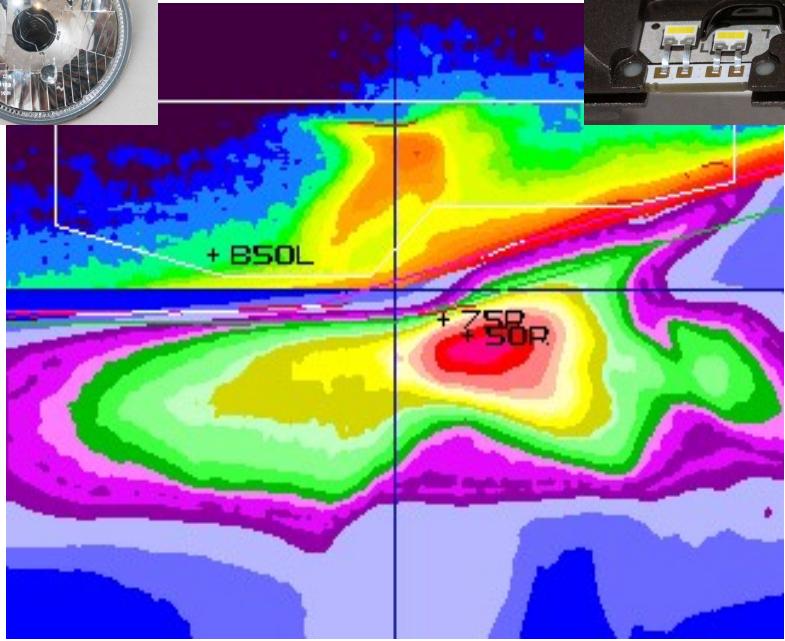
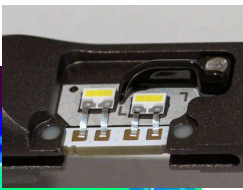
Halogen

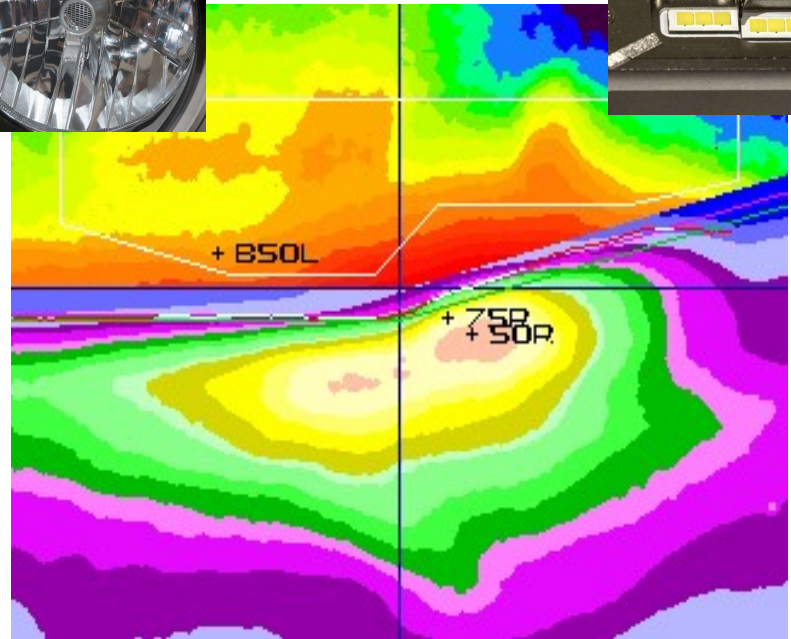
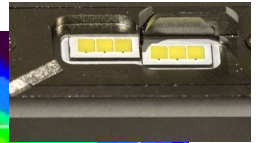
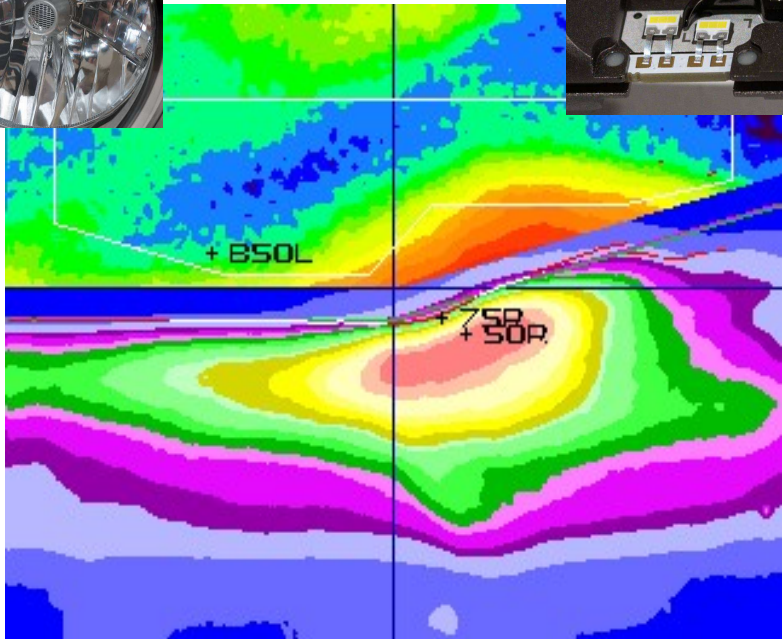
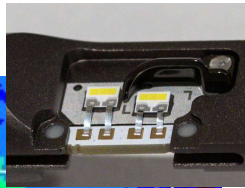
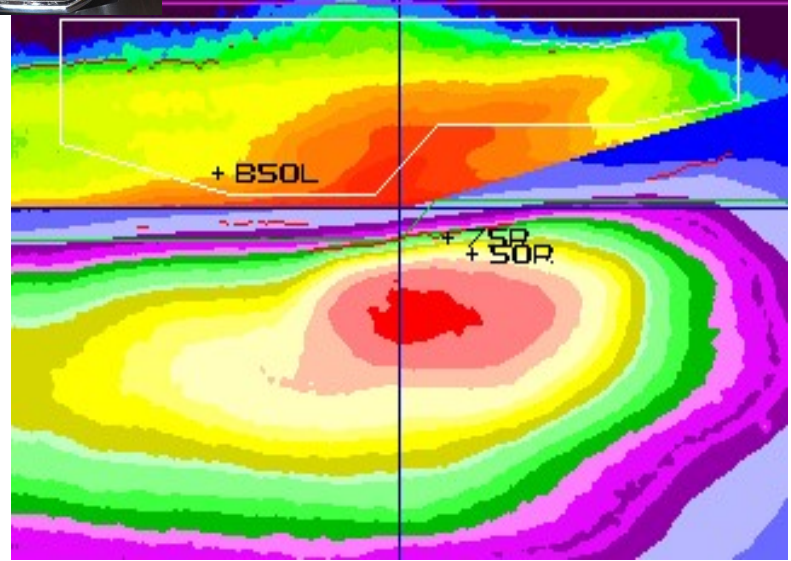
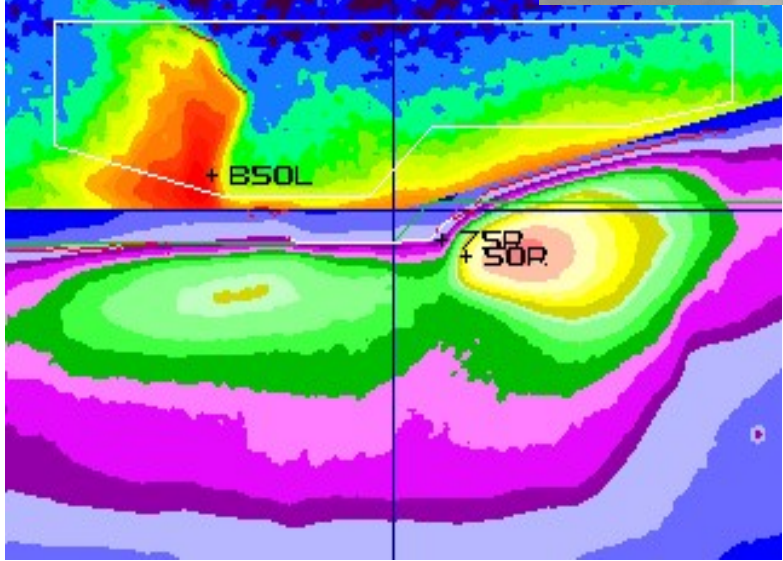


LEDr 6



LEDr 7





Observations

Some tested headlamps emitted proper beam (according R 112) with variety of replacements.

Some other were much more sensitive to tested LEDr's

Most (tested) FF design (H4 and H7) show improvement in road illumination.

Projection design (not very many tested) show rather road illumination impairment or not very strong improvement which significantly depend on LEDr used. In projection design glare was usually much properly controlled for most tested LEDr's when some of this LEDr's (H7) in reflection design caused very high glare.

Summary

There was too small and not representative sample of headlamps and LEDr's to generalize conclusions. Especially the tests were not prepared to check the specific design features of LEDr's. They were rather of an overview nature.

Interesting is basic comparison between OEM headlamp and its non OEM but type approved replacement for different pairs. It indicates that even the same geometric dimensions and a similar reflector arrangement can direct the light in a significantly different way.

It is probably result of possibility to specific creation of reflecting areas of each individual headlamp design. For this reason, it seems that it may be very difficult to create one universal retrofit design pattern for all headlamps as it need some general assumptions and simplifications.

It looks like more complex issue that should be treated individually for each individual reflector design. In fact, FF technology allow to use any small part of the surface of the reflector to direct the light where you want, and gives the designer a lot of freedom in this despite some more general rules. The use of general simplified rules and statistical measures may be unreliable in this case.

Therefore, it seems necessary to carry out much more in-depth research and analysis, which will allow to determine more detail the mechanisms governing changes in light beam distribution when replacing the type approved halogen light source with a LED retrofit for headlamps and especially passing beam.