



85 Σ 205



11.3°C
[-1 A 45]

MF

Combined Visible, LWIR & Corona Inspection

Integrated or Separate?



MULTI-SPECTRAL INSPECTIONS

Channel	VISUAL	THERMAL	UVc (Corona)
What can be seen?	e.g. Missing / Incorrectly installed components. HNO ₃ powder	Temperature gradients (hotspots)	UV signatures of Corona and arcing activity
HV Requirements	N/A	Current dependent	Voltage dependent
Limitations	Requires suitable resolving power	False positives possible / Requires suitable thermal resolving power	Few source of interference / Requires suitable visible resolving power

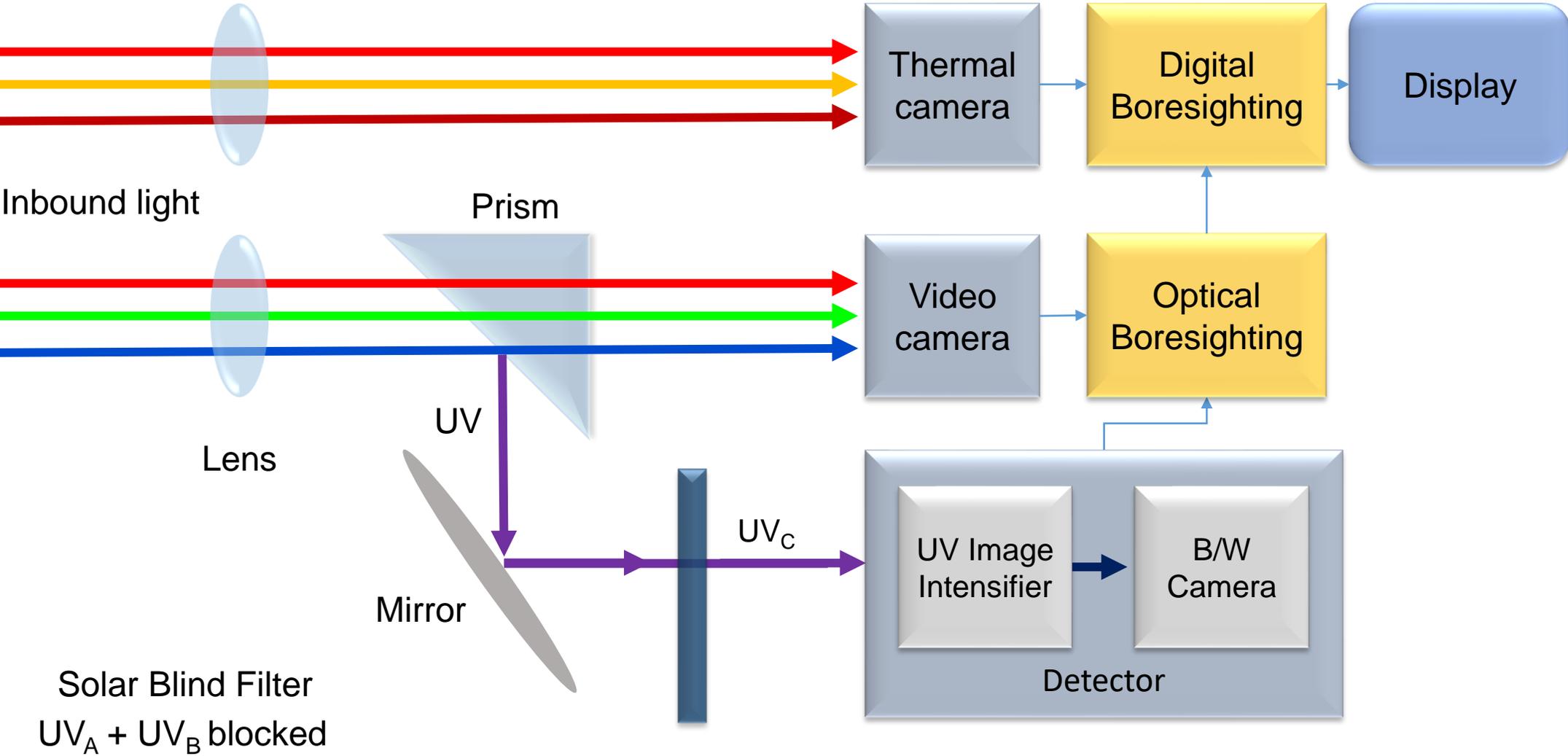
- Customers who perform corona inspection are also required to perform thermal inspections to find hotspots. Sometimes the same person has to do both.

WHY MULTI-SPECTRAL CAMERAS?

- It made sense to combine the cameras into one tool, making inspections faster and more effective.
- The thermal view with no corona overlay can show hotspots, while a corona discharge will clearly contrast with the thermal view in color and dynamic appearance.
- If corona and a hotspot co-locate then that information can be used to more accurately assess the cause of the fault.



HIGH ACCURACY ALIGNMENT



MAINTENANCE PRIORITY - THERMAL

- A hotspot is assessed as to how much hotter it is than other components of its type and its operating specifications.
 - Mainly qualitative differences in temperature are used for HV inspections.
- The maintenance priority is then assigned based on the likelihood of that component failing before a scheduled outage.



EPRI FIELD GUIDE FOR DISCHARGE INSPECTION

- Some users erroneously think that the discharge intensity (count) is somehow related to the fault severity, as the measure temperature is in thermal.
 - This is faulty logic.
 - All the discharge intensity is related to is the rate of damage at the time of observation.
- As the conditions (weather, etc) at the discharge point changes it will affect the discharge intensity, ranging from extinction to ultra.
 - Therefore trending is of little value!
- The recurring UV blobs are just discharge location indicators.

EPRI FIELD GUIDE FOR DISCHARGE INSPECTION

- The US EPRI® teaches a protocol to assign maintenance priority.
- Discharges are assessed based on the likelihood of them causing an outage in the short term or damage to hardware which will result in an outage in the long term.
- The inspector needs to know if a discharge at the discharge location can cause damage which would compromise the system.
- How far along the damage has progressed is determined by visual inspection of the discharge point and surrounding hardware.

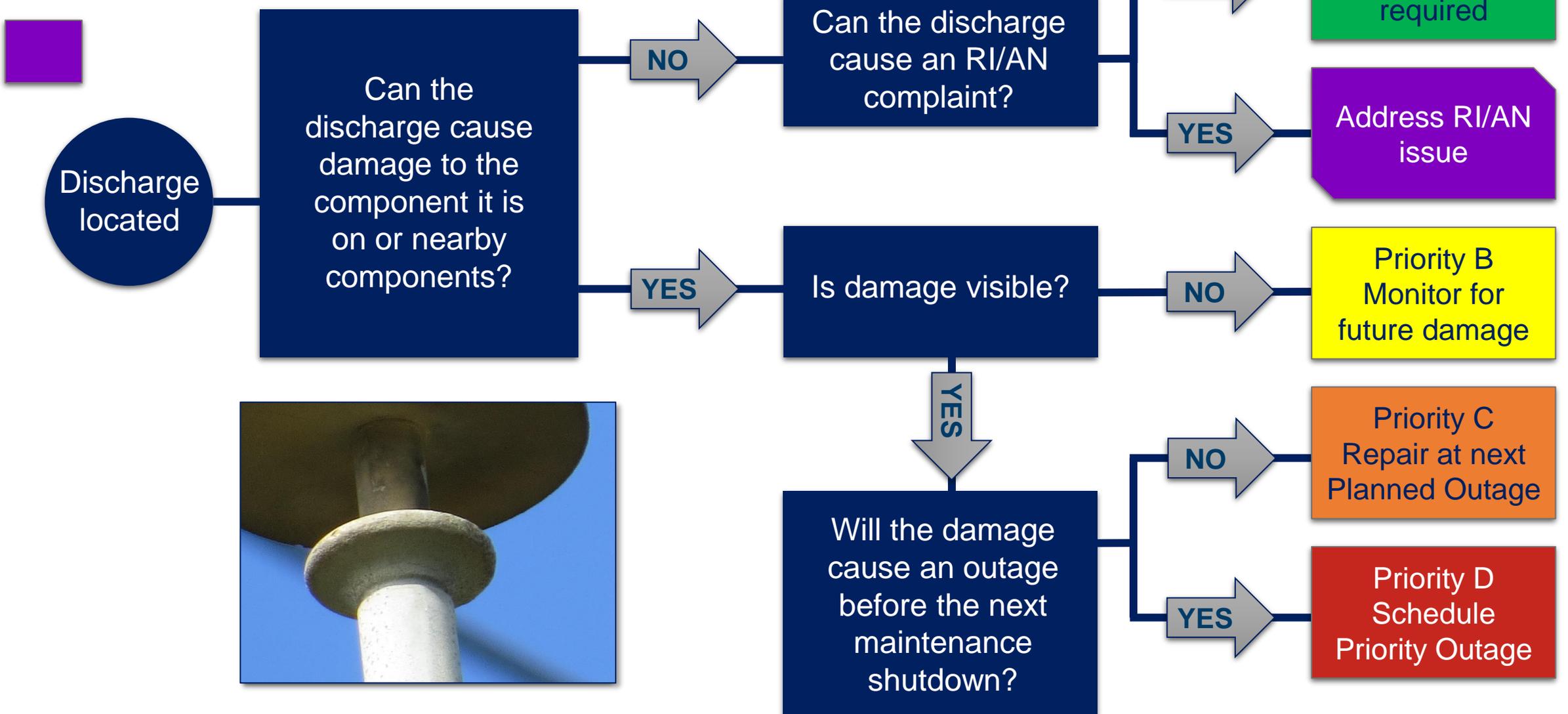
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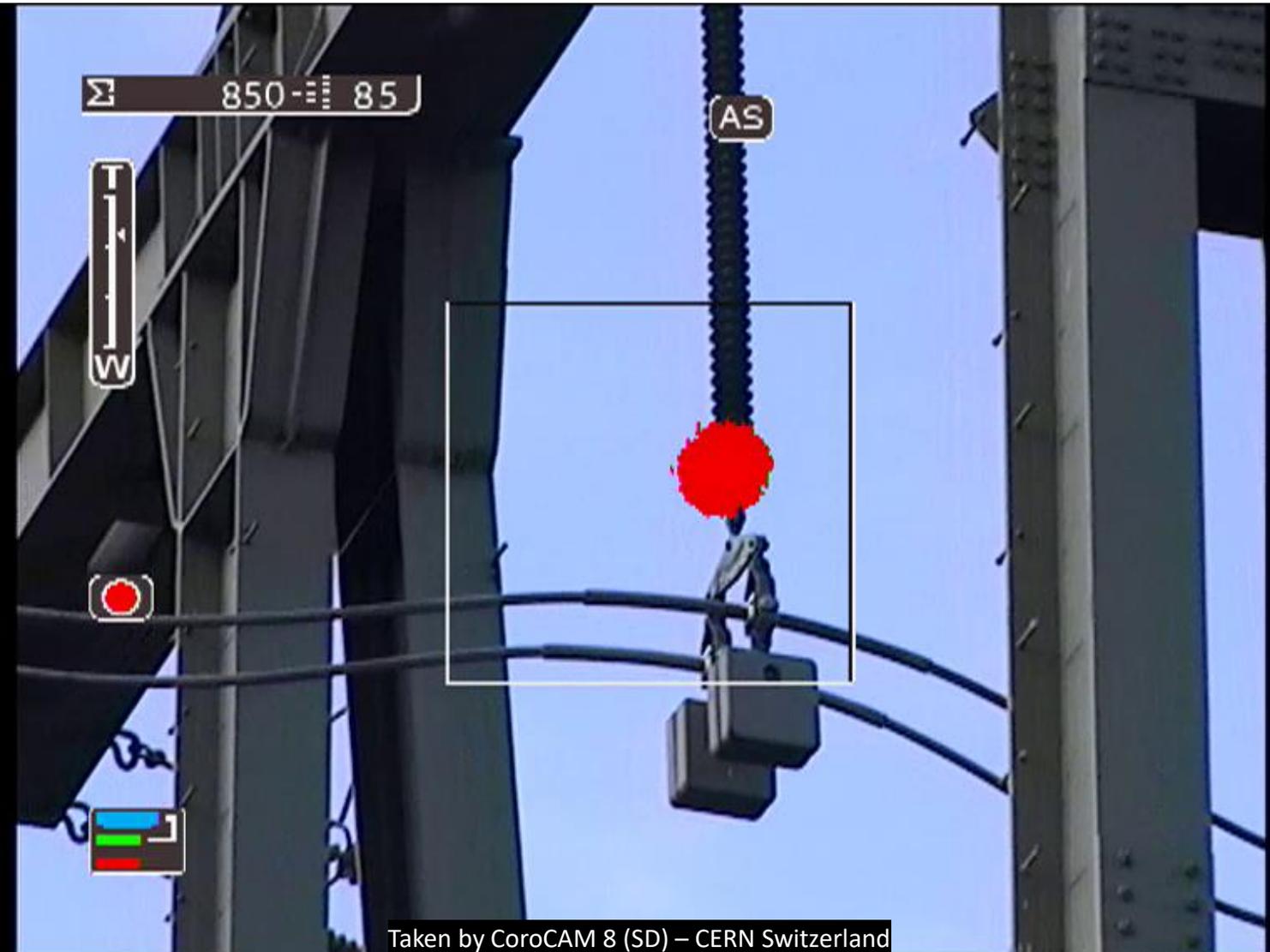
**Field Guide: Daytime Discharge
Inspection of Transmission
and Distribution Overhead
Lines and Substations**

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EPRI FIELD GUIDE - DECISION TREE



CORONA AND HOTSPOT CO-LOCATION



Consider this image, it shows a potential end fitting discharge, a visual close up of the insulator did not indicate any visual damage.

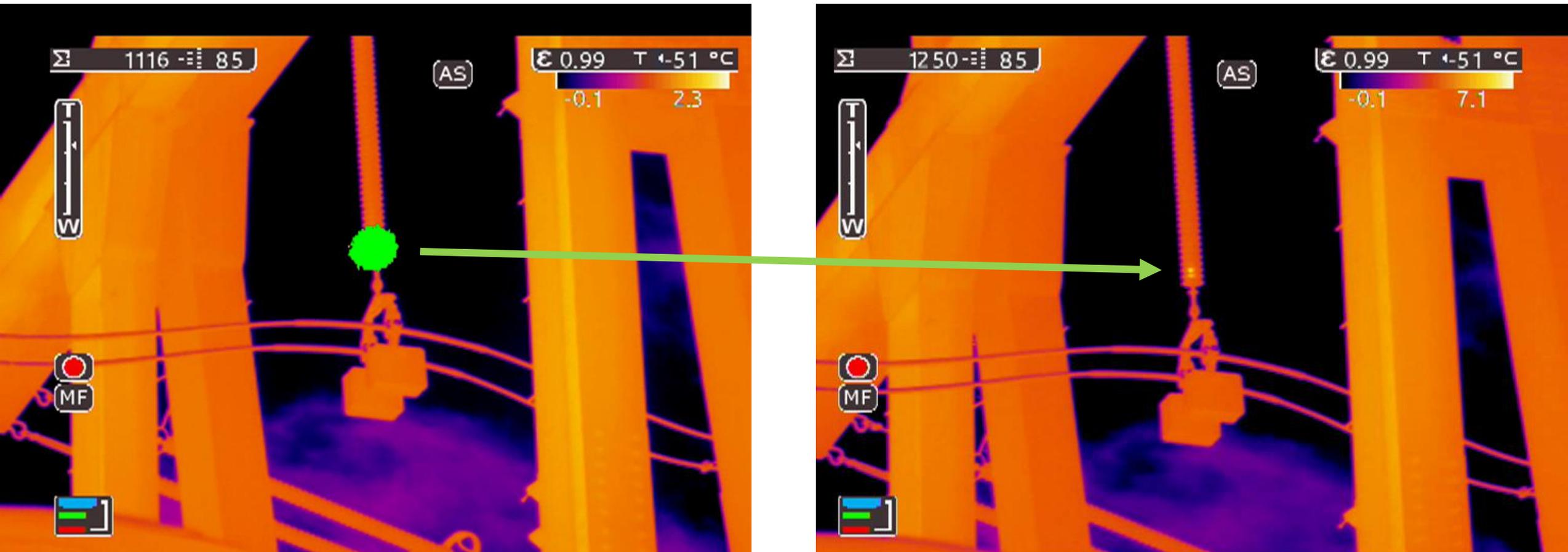
Since no visible damage is present yet, the failure would not be considered to be far along the 4-10 years timeframe from inception to failure due to an end fitting discharge.

Applying the US EPRI priority rating protocol would result in the following:

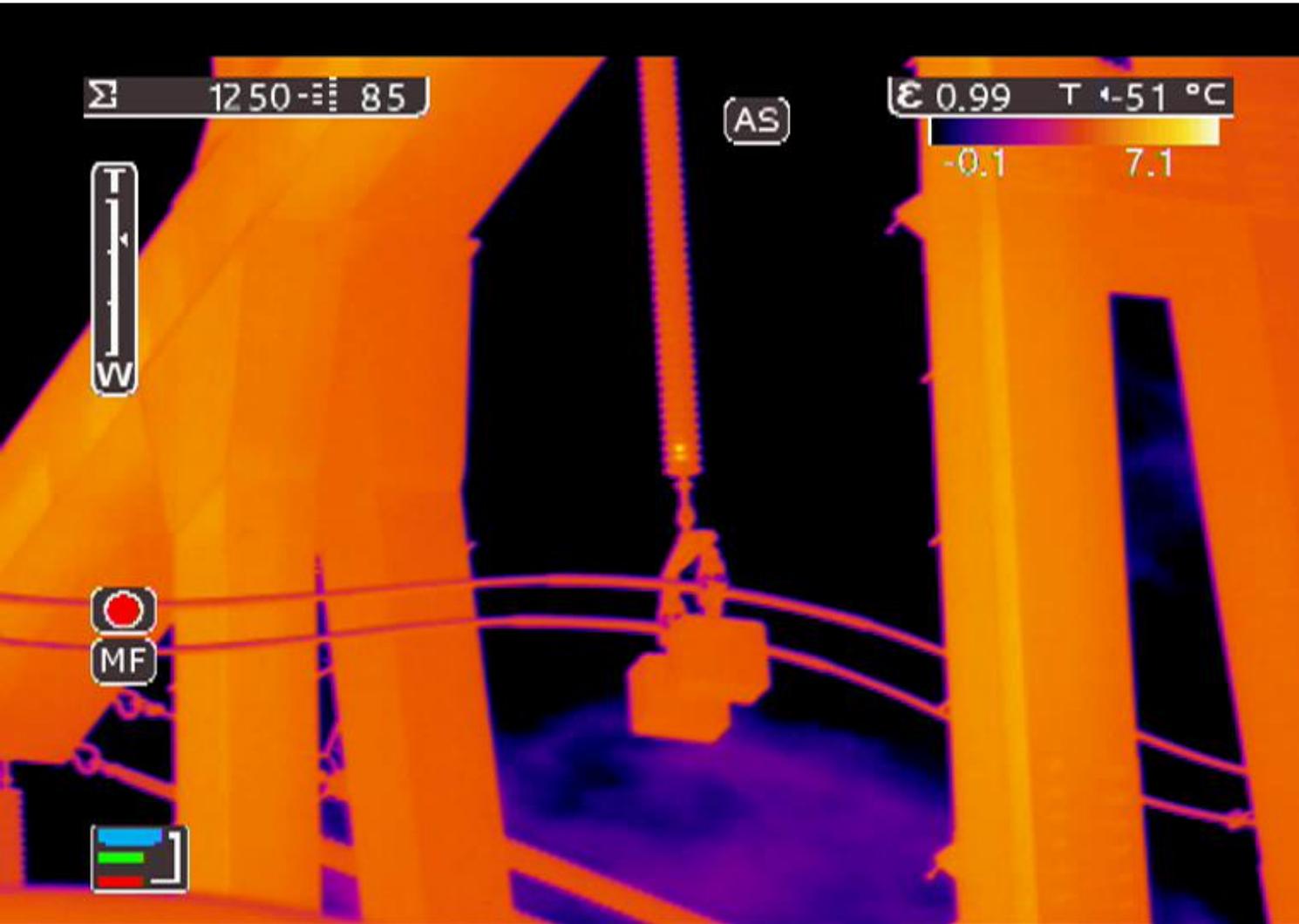
Priority B - Monitor for future damage.

CORONA AND HOTSPOT CO-LOCATION

Removing the UV overlay shows the co-location of a hotspot, but not at the point identified.



CORONA AND HOTSPOT CO-LOCATION



The hotspot is not at the end fitting, but further up the shaft, at the 2nd / 3rd shed.

This indicates that the discharge is actually from internal tracking.

Internal tracking can cause a failure anywhere between 0 to 2 years from inception, with no visual signature.

Therefore priority C or D should be applied.

CORONA AND HOTSPOT CO-LOCATION

Using a UV/Visible only camera would not have successfully avoided the outage which could have resulted!



KEY VALUE POINTS

- Do three inspections at the same time. Visual, Corona & Thermal.
- Get correlated FOV's, which are easier to interpret.
- Co-located UV & Thermal can be used to determine the type of discharge activity.
- Learn one camera system, not two separate ones.
- Carry one type of commercial battery and charger.

INSPECTION FREQUENCY

- Installation qualification inspections should be done when the construction of a new line or substation has been completed before transfer to operations group.
- To prove that the hardware is corona free.
- Thereafter a "1 year in operation" inspection should be performed to ensure no latent faults have made their appearance.
- After the "1 year in operation" inspection the inspection frequency depends on a number of factors.



INSPECTION FREQUENCY

This varies from situation to situation depending on:

- HV hardware used (Glass/Porcelain insulators vs Polymer)
- The weather conditions (Dry vs Rainy)
- The age of the infrastructure (New vs Old)
- Manpower and equipment available (Inspectors vs Analysts)
- Accessibility of the location
- Frequency of outages



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