



ACOUSTICS

**NL Camera for Partial Discharge
Detection
Training**

Agenda



1. Company Brief
2. Customers
3. Operating the NL Camera
4. NL Analytics & Software Options
5. Competitor Comparison
6. Case Studies

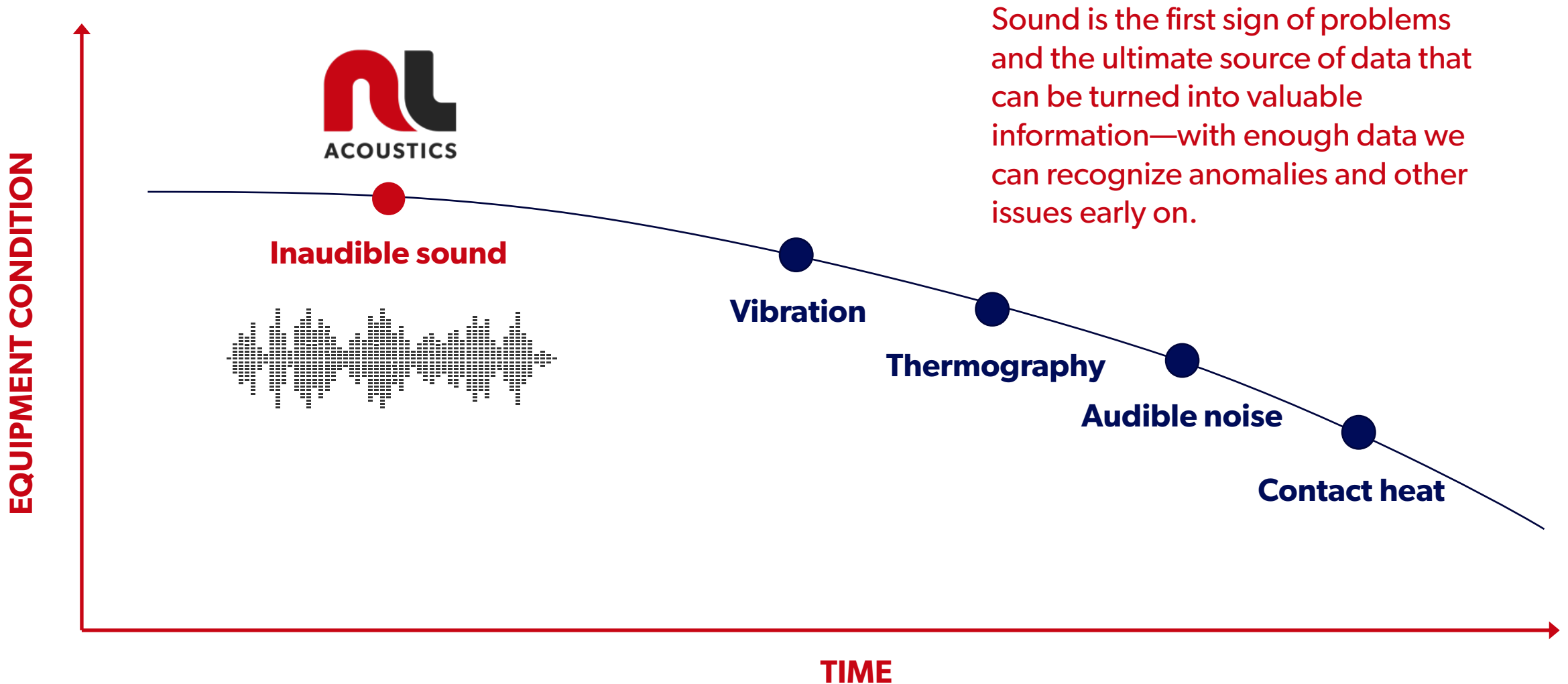
The Problem and Our Solution



Assets emit a certain type of sound before they begin to **break down**. Often, these are sounds that we cannot hear or are difficult to locate in noisy environments.

Our unmatched, intelligent, comprehensive acoustic maintenance solutions detect the issues before it is too late. **We turn sound into value with information that saves money, time, resources and prevents catastrophic failures.**

Sounds Inaudible to the Human Ear



Sound is the first sign of problems and the ultimate source of data that can be turned into valuable information—with enough data we can recognize anomalies and other issues early on.

The Company



- NL Acoustics is the leading provider of acoustics-based maintenance solutions
- Privately owned company founded in 2015
- HQ, R&D, and Manufacturing in Helsinki, Finland
- Patented and proven solutions for:
 - Electric partial discharge location
 - Site maintenance and leak location
 - Ongoing asset maintenance
- Developing unprecedented machine learning-powered analytics and cloud reporting





Customers



Some of Our Customers



Atlas Copco: "The NL Camera saved the users 50% of their time."

"Included in the Airbus service manual in 2020."



UPM





Operating the NL Camera





<https://youtu.be/3ez2wG6-NTI>

Practical Considerations to Remember

- With an NL Camera with **both Air and Power modes**, make sure you are using the correct mode for your use case
- In **multi-source** mode, the NL Camera always shows analytics for the strongest sound source, for closer analytics, use **single-source mode**
- **Reflections:** if the source moves when moving the camera, it is a reflection
- **Hidden sound sources:** the camera can sometimes show sound sources inside cabinets and other closures
- **Filters:** the camera's operating distance is greater outdoors where there is rarely high-frequency background noise and where PDs usually occur:
 - **Norm (10–30 kHz):** The best alternative for all cases with little background noise. Offers the best detection distance.
 - **High (20–30 kHz):** Offers good detection distance while filtering out most background noise.
 - **Ultr (30–65 kHz):** Effectively filters out background noise at the expense of reduced detection distance. Only to be used at short distances.



Guidelines for Good Measurements



1. Get close to the component under inspection.
2. Try all the different filters (Norm, High, Ultr) to see if you can detect something.
3. If the camera focuses on some disruptive sound source that is not PD (no PRPD is shown), try to look at the component under inspection from a different angle and use the zoom functionality to get the disruptive sound source outside the field of view.
4. If the camera does not find any significant sound source with any of the filters (the dB level is below approximately 0 dB) then there is no sign of any significant external PD on the component. The presence of internal PD cannot be ruled out entirely.

Main Use Cases for the NL Camera PD

Extremely well suited:

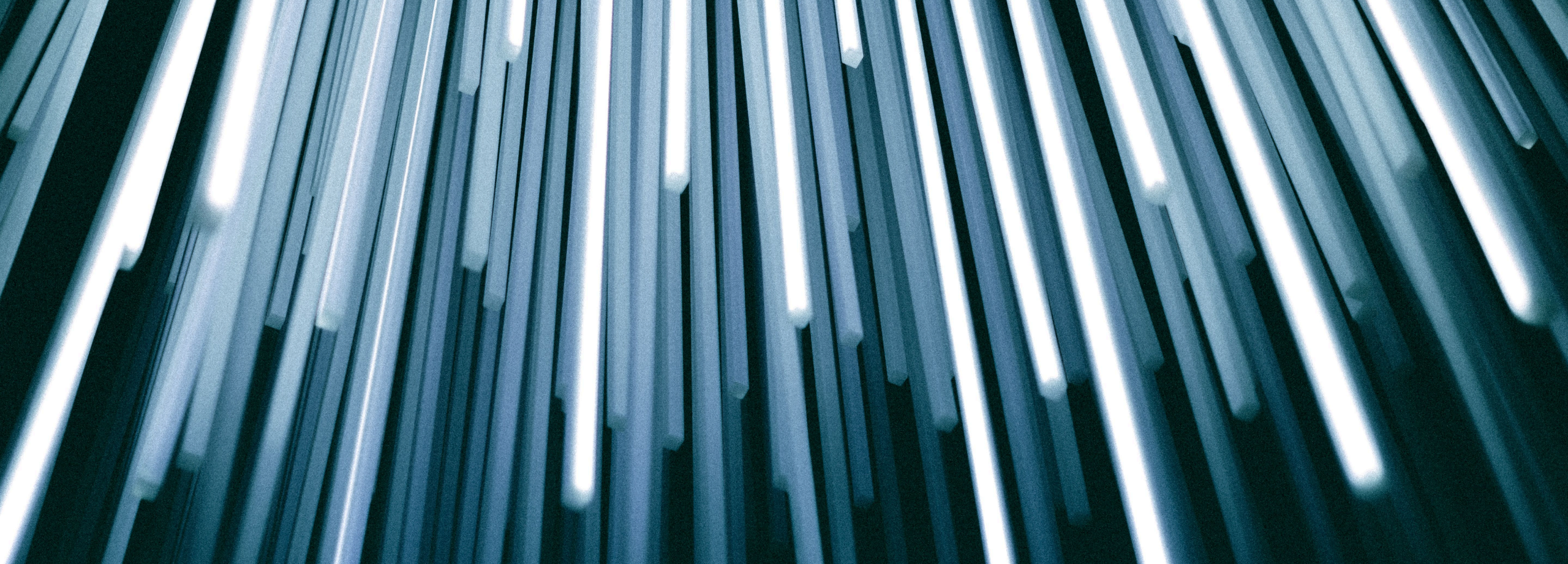
- Early-stage PD detection in air-insulated substations in transmission, distribution, and generation. Example use cases: damaged or polluted insulators, broken strands on wires, and installation faults
- Early-stage PD detection in power lines

Well suited:

- Detecting leakage of pressurized gases in HV **equipment**, for example:
 - An SF6 leak of 0.8 kg per day was detected on a 400 kV power transformer bushing from a distance of approx. 10 meters
 - This equals 0.09 liters/minute (normalized to atmospheric pressure). The resulting pressure drop was 10% over 14 days
 - This is close to the minimum detectable SF6 leak size. This means that much smaller leaks are not likely to be detected unless the measurement distance is decreased
 - Medium-voltage SF6 switchgear often uses lower pressures than high-voltage SF6 switchgear. If the pressure is close to atmospheric pressure, leaks may not cause enough sound for acoustic detection
- Detecting PDs in metal-enclosed switchgear

Not best suited for:

- Acoustics cameras in general are not best suited for:
 - GIS (gas insulated switchgear)
 - Internal discharges deep inside components, such as transformers or bushings



NL Analytics & Software Options



On-Camera Analytics for PD




- Recognizes the sounds partial discharges emit and distinguishes them from other sounds
- Reliably pinpoints partial discharges and shows their exact location clearly on the screen
- Automatically displays the PD pattern that depicts the type of the located partial discharge
- Presents the sound level that also indicates the strength and stage of the partial discharge

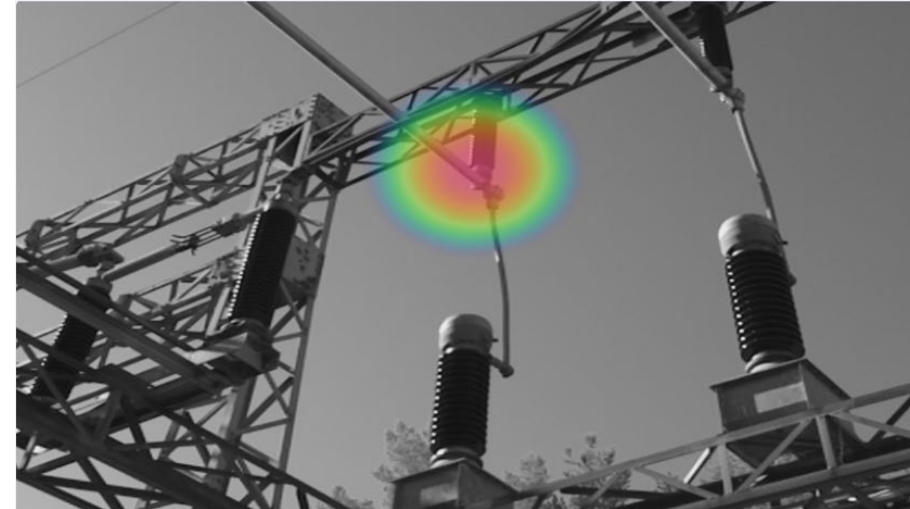


<https://youtu.be/ImTgVPzqbgz>

NL Analytics: NL Cloud Demo



- You can find the report generation tool in the NL Cloud: <https://view.nlacoustics.com/>
- For instructions in the system, press 
- You can try the tool with a **demo account**
Username: demo1
Password: wA024S71p9ZC



Details

Label:

AC100011_00034_180521_0901_0034

Serial:

ACTEST02

ID:

79

Creation date:

2018-05-21 09:02:13 GMT+0300

Synchronisation date:

2020-10-08 11:37:58 GMT+0300

NL Analytics Software Options



Feature	NL Cloud	NL Camera Viewer Pro	NL Camera Viewer
Included with the NL Camera	x		x
Partial discharge recognition	x	x	x
PRPD pattern	x	x	x
Partial discharge type	x	x	
Partial discharge severity	x	x	
Sound pressure level	x	x	x
Dynamic range slider	x	x	x
Automatically generate PDF reports	x	x	
Store and back up NL Camera snapshots	x		
Data export to MS Excel	x	x	
Data transmission	Wi-Fi data transfer between camera and NL Cloud Optional USB flash drive	Wi-Fi data transfer between camera and PC Optional USB flash drive	USB flash drive
Supported NL Camera version	Supports all	AC13xxxx	AC13xxxx
Supported NL Camera software version	Supports all	201201	200417
Supported languages	Czech, Danish, Dutch, English, Estonian, Finnish, French, German, Greek, Hungarian, Italian, Japanese, Korean, Norwegian, Polish, Portuguese, Russian, Simplified Chinese, Spanish, Swedish, Thai, Traditional Chinese, Turkish, Vietnamese		



NL Camera PD Competitor Comparison



Nondestructive Partial Discharge Detection Methods



NL Camera's competitors in PD detection

Acoustic methods: Conventional ultrasonic probes, other acoustic cameras



Can be used for detecting PDs but are very limited for this purpose

Missing analytics makes them less noteworthy competitors

Thermal cameras (IR)



Have their limitations for PD detection

Detect only certain PD types, typically at a very late stage

Ultraviolet cameras (UV)



NL Camera's main competitor in PD

Have their own limitations in PD detection, such as the requirement for a direct line of sight

Other not directly competing PD detection technologies

- Conventional galvanic measurements
- TEV (Transient Earth Voltage) sensors: some TEV instruments are sold with an additional ultrasonic probe (conventional ultrasonic probe)
- UHF detection

PD Detection: NL Camera vs. Conventional Ultrasonic Instruments vs. Other Acoustic Cameras



Feature	NL Camera	Conventional ultrasonic methods	Other acoustic cameras
PD localization	✓	✗	✓
PD recognition	✓	✗ (Listen to manually with headphones)	✓ / ✗
PRPD pattern	✓	✗	✓ / ✗
PD type classification	✓	✗	✓ / ✗
PD severity assessment	✓	✗	✗
Detection distance	Up to 130 meters	Typically up to 20 meters	Typically up to 50 meters
Required training	Minimal	Extensive	Extensive
Other	Only acoustic camera with extensive analysis and severity assessment with recommended actions*	Not very practical without analysis* Typically very limited detection range due to high detection frequency range	Not very practical without analysis*

* [Read more on why extensive analytics is especially important in partial discharge detection.](#)

PD Detection: NL Camera vs. Thermal (IR) Cameras



Feature	NL Camera	Thermal (IR) Cameras
PD types detected	All (internal discharges up to some degree)	Only the following PD types: - surface discharges - near-surface internal discharges
PD localization	✓	✓
PD recognition	✓	✗ (shows only heat sources)
PD pattern	✓	✗
PD type classification	✓	✗
PD severity assessment	✓	✗
Works without direct line of sight	✓	✗
Detection distance	Up to 130 meters outside	Good Image resolution limits what is visible, may be hard to detect small heat source far away
Required training	Minimal	Extensive
Other		Recognize PDs at a very late stage when they have already started to generate heat

NL Camera vs. UV "Corona" Cameras



Feature	NL Camera	UV Cameras
PD types detected	All (internal discharges up to some degree)	PD types that are in direct line of sight: <ul style="list-style-type: none"> • discharge into air (corona) • discharges between components • Surface discharges
PD localization	✓	✓
PD recognition	✓	✗ (shows only UV sources)
PD pattern	✓	✗
PD type classification	✓	✗
PD severity assessment	✓	✗
Works without direct line of sight	✓	✗
Detection distance	Up to 130 meters outside	Hundreds of meters Zoom functionality
Required training	Minimal	Extensive
Other		The more affordable versions do not work in daylight. Daylight versions are very expensive.

PD Detection Summary



Benefits of the NL Camera over other acoustic instruments

Benefits

Locates the most critical problems quickly
Enables surveying fully operational grids
Reports and severity assessment for informed maintenance and repair plans
Requires minimal training

Enabling features of the NL Camera

Automatic PD localization, recognition and PRPD pattern
Detection range up to 130 meters
Included cloud or offline software offer extensive analysis, severity assessment, and action recommendations
Intuitive user interface

Benefits of the NL Camera over thermal cameras

Benefits

Detects problems extensively at an early stage
Locates all types of partial discharges
Severity assessment

Enabling features of the NL Camera

Detects partial discharges before they begin to generate heat
Does not require direct line of sight, automatic PD recognition
NL Analytics

Benefits of the NL Camera over UV cameras

Benefits

Detects problems extensively during regular working hours
Locates all types of partial discharges
Severity assessment

Enabling features of the NL Camera

Detects all types of partial in the daylight without a direct line of sight
Does not require direct line of sight, automatic PD recognition
NL Analytics



Case Studies

Case E.ON Sweden



Client: The Swedish branch of E.ON Group, a Germany-based energy provider currently operating across Europe. In 2020, E.ON's workforce of 78,126 people was spread across 12 different countries, and the group garnered sales that amounted to 60,944 million euros.

Problem: Need for a troubleshooting device in power lines and substations that would be easy to use and would deliver clear results.

NL Solution: The NL Camera for partial discharge detection.

Results: E.ON Sweden was won over by the ease of use of the NL Camera and its accompanying NL Cloud software as well as by its clear results on several occasions. As a result, E.ON Sweden considers the solutions to be the perfect addition to surveys and troubleshooting in power lines and substations.

"With the NL Camera, you have better availability at your facility and can act before faults become severe."



Case Grid Solutions & GE Renewable Energy Italy



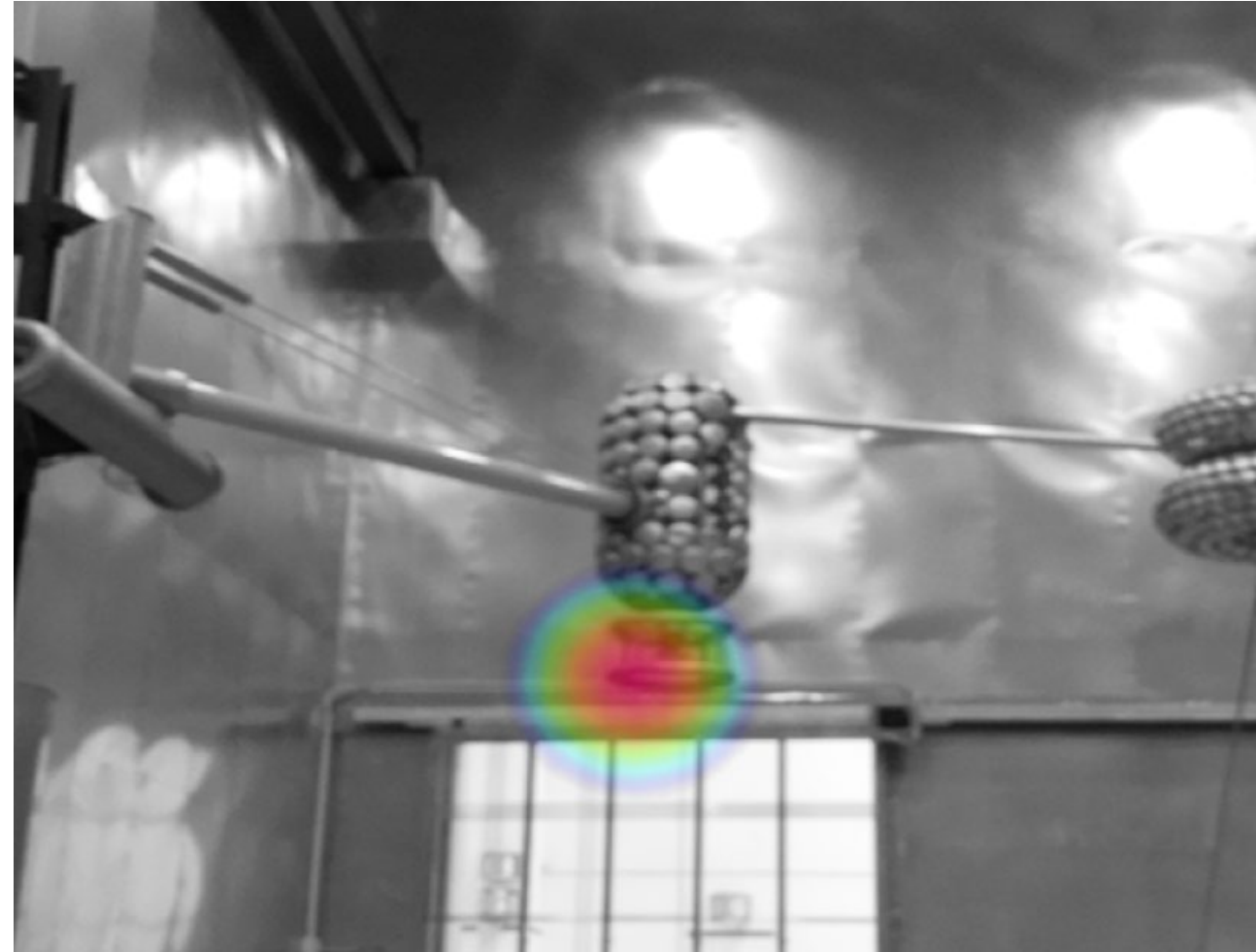
Client: [Grid Solutions](#) is a GE Renewable Energy business that ensures power utilities and industries globally have the best equipment, systems, and services for reliable and efficient energy production and distribution. Grid Solutions' over 13,000 employees worldwide also focus on implementing the transition to greener, renewable energy.

Problem: Grid Solutions & GE Renewable Energy Italy needed a device that could detect sources of disturbance, such as floating and corona discharge, in their HV labs

NL Solution: The NL Camera for partial discharge detection.

Results: The NL Camera immediately answered GE Grid Solutions Italy's needs by finding sources of disturbance such as negative polarity corona effects in the HV labs. The camera delighted its users with its easy functions, lightweight body, and high-quality images.

"The camera is very lightweight. It has a few functions, but they are perfectly clear."



Case Kibali Gold Mine



Client: Kibali Gold Mine owned by Kibali Gold Mines SA and operated by Barrick Gold. Located in a remote part of the Democratic Republic of Congo.

Problem: Due to being so isolated, the Kibali Mine has to be almost completely self-sufficient and produce its electricity, gas, steam, and air locally—as well as inspect the installations locally.

NL Solution: The NL Camera dual mode for partial discharge detection and air leak detection.

Results: The NL Camera helps Kibali mine meet its demands of self-sufficiency while keeping the operations running reliably, reducing downtime, and improving the energy efficiency.

“The NL Camera was purchased for the dual ability of inspecting the electrical as well as the gas/steam installations.”

Questions?

**Additional material on the NL Acoustics
YouTube channel and on our website.**



ACOUSTICS

THANK YOU!

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