

Experiences from blade-mounted Ice detector development

Winterwind 2015, Piteå, Sweden

Company: Labkotec Oy

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Content of the presentation

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2. Testing and certification of Ice detectors
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Blade-mounted Ice detector 1994

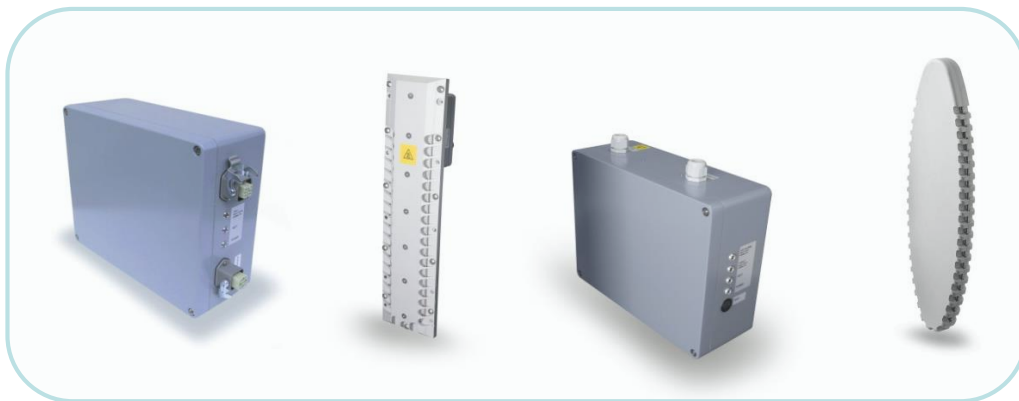
First ever blade-mounted Ice detector was delivered by Labko Oy (nowadays Labkotec Oy) to Finland, Pyhätunturi, 1994.

→ Start blade heating



Figure BF. The first blade mounted ice detector delivered by Labko Oy. Pyhätunturi test station 1994.

Labkotec's nacelle-mounted ice detectors



	LID-3210C Control Unit and Ice Sensor	LID-3210D Control Unit with <ul style="list-style-type: none"> - Ice Alarm LED - Test button 	LID/IS Ice Sensor <ul style="list-style-type: none"> - Sensitivity improved 	LID-3300IP Control Unit <ul style="list-style-type: none"> - Web server (remote access) LID/ISD Ice Sensor <ul style="list-style-type: none"> - Sensitivity further improved
1994 ->	2002..2008	1Q/2008...2014	4Q/2008..2014	1Q/2010..

LID-3300IP updates

New enclosure design:

- Hinges added to enclosure to ease installation and maintenance

New software version:

- Log file for easier diagnostics and troubleshooting.



Testing and certification of ice detectors

Challenge:

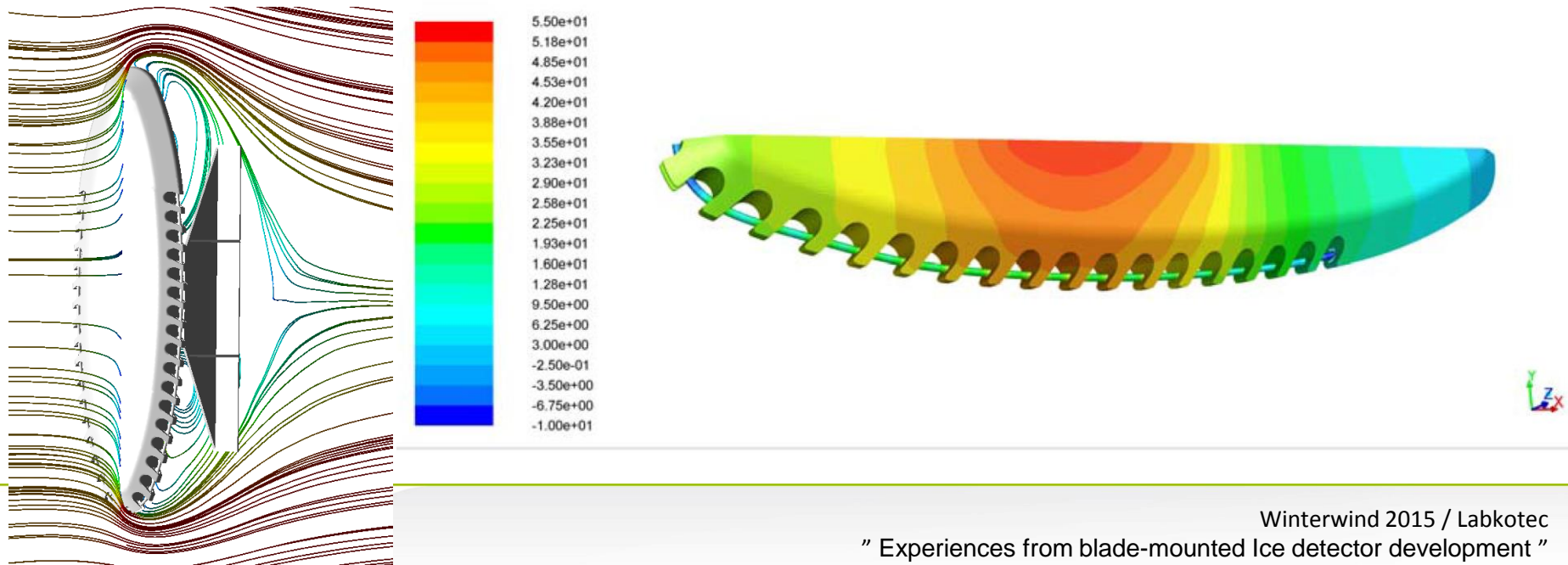
Lack of standards, published best practices and test methods for icing and ice detection testing.

Consequences:

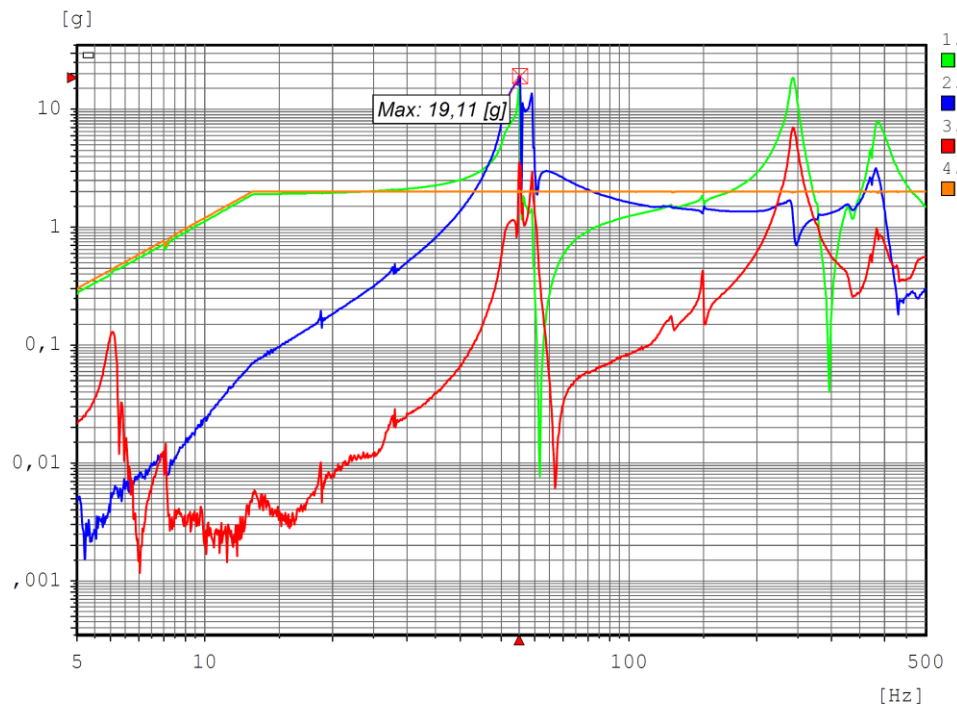
In-house methods need to be used to verify and improve the functionality of nacelle and blade-mounted ice detectors.

Without any related standards, methods have to be certificated by neutral third party like GL Renewables.

Optimizing design parameters by CFD modeling and Ansys simulation



Vibration tests



Test methods:

- Sinusoidal vibration, IEC 60068-2-6, Test Fc (2007-12)
- Vibration, broad-band random, IEC 60068-2-64, Test Fh (2008-04)
- Shock, IEC 60068-2-27, Test Ea (2008-02)

Summary:

- Operated normally during and after the tests.

Field tests



Puijo meteorological station,
Finland 2009-2014



Hyytiälä meteorological mast,
Finland 2014

Component Certificate

CC-GL-013A-2014 GL Renewables Certification (GL RC)

Normative references:
GL Rules and guidelines –
IV Industrial Services-Part 1
“Guideline for the the Certification of Wind Turbines”,
edition 2010.

Ice Detector LID-3300IP has been assessed by GL Renewables Certification (GL RC), concerning the Design, the “Implementation of the design requirements in Production and Erection” IPE, the prototype Testing and manufacturer’s quality system.

The GL certificate is valid for Ice Detectors with Software version of v1.30 and newer.



LID-3300IP

GL certificate:

- “Safe to use in wind turbine”
- “Detects in-cloud and freezing rain ice”.

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Certificate



Certificate no.

CU 72131267 01

License Holder:

Labkotec Oy
Myllyhaantie 6
FI-33960 Pirkkala
Finland

Manufacturing Plant:

Jotel Oy
Ilkontie 1
36241 Kangasala
Finland

Test report no.: USA-AF 31282519 001

Client Reference: Jarkko Latonen

Tested to:

UL 61010-1:2004 R10.08
IEC 61010-2-010:2003
CAN/CSA-C22.2 NO. 61010-1-04+GI1 (R2009)
CAN/CSA-C22.2 NO. 61010-2-010-04 (R2009)

Certified Product: Ice Detector for Wind Turbines

License Fee - Units

Model Designation: 1) Control Unit: LID-3300IP 7
2) Ice Sensor Unit: LID/ISD Ice Sensor

Rated Voltage: 1) AC 230V, 50/60Hz (Load: AC 230V)
2) AC 230V

Rated Power: 1) 7VA (Load: 350W)
2) 350W

Protection Class: I
Ingress Protection: IP65

Special Remarks: To be installed with an AC 230V wind turbine power system only.

Appendix: 1, 1-5

Licensed Test mark:



Date of Issue
(day/mo/yr)
26/04/2013

LID-3300IP

UL/CSA certificate:

- "Safe to use in wind turbine"
- Now selling also in USA and Canada.

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Blade-mounted ice detection advantages



Detecting ice DIRECTLY on wind turbine blades will have the following advantages:

- Immediate indication of ice (compared to rather slow response of in-direct methods)
- As a result of fast response, increased safety aspect and possibility to optimize blade heating
- Monitoring ice layer growing and disappearing allows ice alarm levels to be adjusted stepwise
- In case of turbine shut-down due to ice, automatic start-up after ice has disappeared.

Labkotec's aspects on blade-mounted ice detection



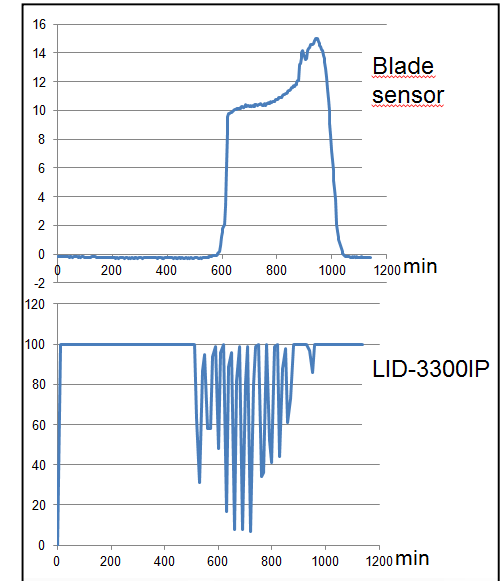
- Reliable radio communication
- Dependable ice detection in different conditions
- Modular parts can be replaced extending sensor's life time
- Wide sensor for detecting ice during blade pitching
- Easy and fast installation inside the nacelle
- Fast installation on the blade surface
- Wear resistant against sand and dirt
- Impact resistant against hail and rocks.

Our experiences of radio communication between blade and nacelle

- We had custom designed antennas and radios inside the nacelle and on the blade
- The testing took place in a multi-megawatt turbine and the tested distance was about 45 m
- We tested the radio communication on all blade positions: stands still, speeds up, slows down, idles, adjusts pitch and is located behind the tower
- **According to our field test all transferred data were received.**

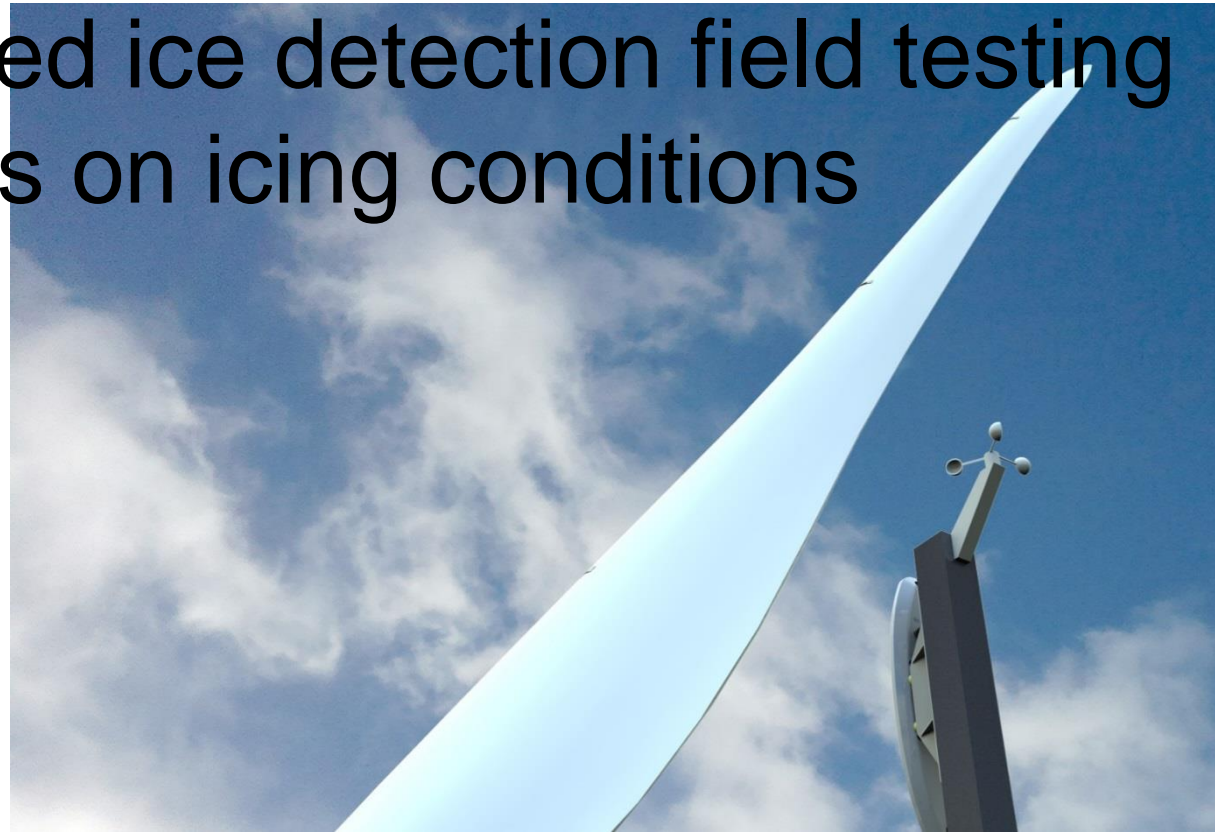
Labkotec Blade-mounted Ice detector

- Labkotec is developing an ice detector for wind turbine blade
- Tests have been going on since 2011 in
 - In-house icing laboratory
 - Weather chamber
 - Icing wind tunnel
 - Met mast and station
 - Wind turbines
- For more information,
- please contact tatu.muukkonen@labkotec.fi



Blade-mounted ice detection field testing results on icing conditions

- We can detect the ice on the blade surface
- We can monitor ice layer while it's growing
- We can monitor ice layer while it's disappearing.



Summary

- Labkotec is a pioneer and market leader in wind turbine ice detection.
- Labkotec has and will introduce new innovations for ice detection regardless of the fact that no standards, published best practices or test methods exist for icing or ice detection testing
- Labkotec is developing blade-mounted Ice detector to detect ice directly on wind turbine blades.

2014
50
Labkotec
1964