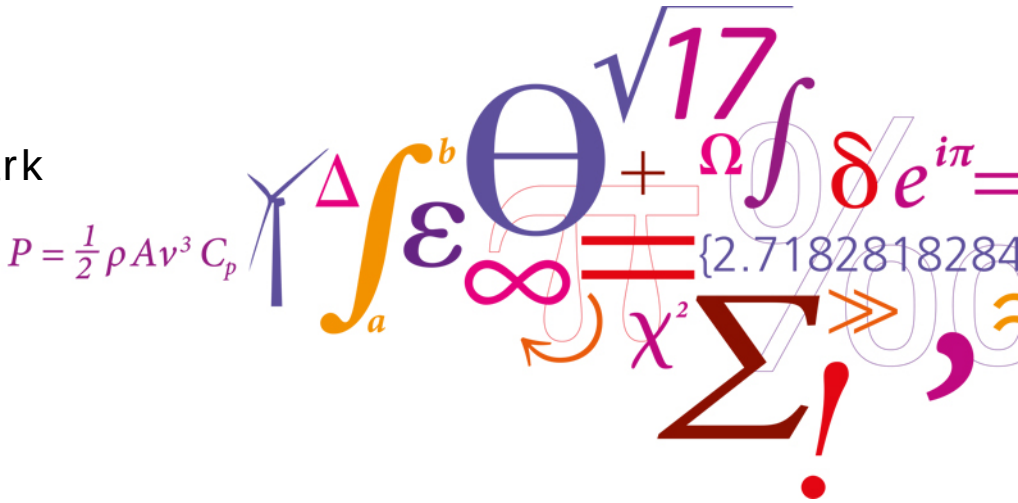
Nacelle lidar and standardisation
Where are we today?

Rozenn Wagner

UniTTe Workshop
15-11-2016
DTU Risø Campus, Roskilde, Denmark



UniTTe

DTU Wind Energy
Department of Wind Energy

From prototype to broadly used tool

2010
- DTU/Avent EUDP project on nacelle lidar for power performance measurement

2013
- Procedure for calibration and uncertainty estimation of 2 beam nacelle lidar
- Procedure for power curve measurement with 2 beam nacelle lidar

2014
- UniTTe: unified turbine testing with profiling lidars

2015
- 2-beam nacelle lidar calibration proposed as commercial service by several measurement institutes
- Generic method for calibration of nacelle lidars

2016
- EUDP power curve procedure adapted by several lidar manufacturers, turbine manufacturers, wind farm developers
- Measurement in induction zone in flat terrain

2017
- Adaptation and test in complex terrain

2009 ... 2016
- Ground based lidars accepted in IEC 61400-12-1
- Annex L:
  - Calibration
  - Classification
  - Monitoring mast
  - uncertainty

Proposal for new standard

TITLE:

Use of nacelle mounted lidars for wind measurements

SCOPE:

• provide the general requirements and guidelines to ensure that the nacelle lidar wind measurements meet the level of quality and confidence required for wind turbine power performance testing.

• independent of the lidar technology

OUTLINE:

Based on EUDP procedure

FORMAT:

Compliant to re-organisation of IEC 61400-12 documents (expected by end of 2017)

The new doc only needs to describe measurement wind characteristics with nacelle lidars

Proposed outline

1. Scope
2. Normative references
3. Terms and definitions
4. Symbols and units
5. Measurement procedure overview
    1. Wind parameters
    2. Air density
6. Nacelle lidar calibration and measurement uncertainty
    1. Verification of beam trajectory;
    2. Inclinometers calibration;
    3. Verification of the sensing range;
    4. Radial wind speed calibration;
    5. Uncertainty of radial wind speed measurement;
7. Preparation for performance measurement – information and documentation pre-requisites
    1. Wind turbine
    2. Test site
    3. Measurement set up
    4. Measurement sector
8. Measurement procedure
    1. Reconstructed wind parameters (wind speed, wind direction, shear, veer, turbulence intensity)
    2. Air density
9. Uncertainty on reconstructed wind parameters
10. Data flow
    1. Data acquisition
    2. Synchronization requirements, data averaging, etc
    3. Data filtering
    4. Data base
11. Derived results
12. Data normalization (air density, shear, veer, turbulence intensity) – if any differences to what is required in the main procedure.
13. Reporting format – relevant tables and figures specific to nacelle lidars (in addition to requirements from main procedure).

Annex A (informative): recommendation for installation of the lidars on the nacelle.

Annex B (informative): nacelle lidar measurement in complex terrain

Annex C (informative): extraction of free wind speed from nacelle lidar measurement within the turbine induction zone

Procedure and time line