

# Task 52 General Meeting 2023

## Lidar-Assisted Control Working Group

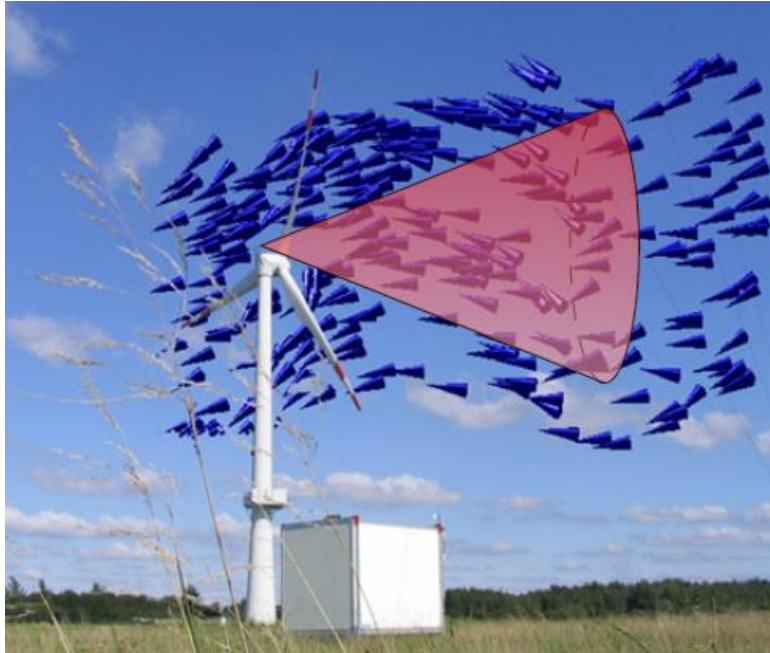
David Schlipf and the Task 52 LAC working group

Online

14.06.2023



# Motivation for Lidar Assisted Control



- wind is changing over space and time
- conventional control reacts after impact
- lidar technology provides wind preview
- better control performance is expected



- Biggest market: one lidar for every wind turbine!
- Development over the last years showed:  
It's not a wonder weapon, quite complex, but still promising!
- Main idea for working group: make application easy!

# Key facts about your working group

- Objectives

- Push the technology by transparency and Open Source Tools
- Recommended Practices on Lidar-Assisted Control

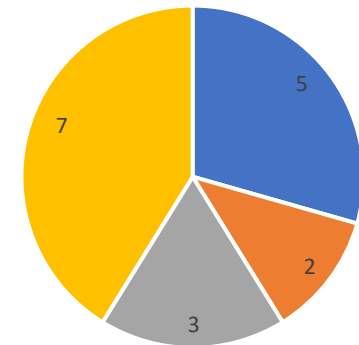
- Approach

- Monthly conference calls
- Work together on code and documents
- Webinars

- Participants:

- 17 active members
- From 7 countries (China, Denmark, France, Germany, Italy, Japan, UK)
- 12 more in mailing list

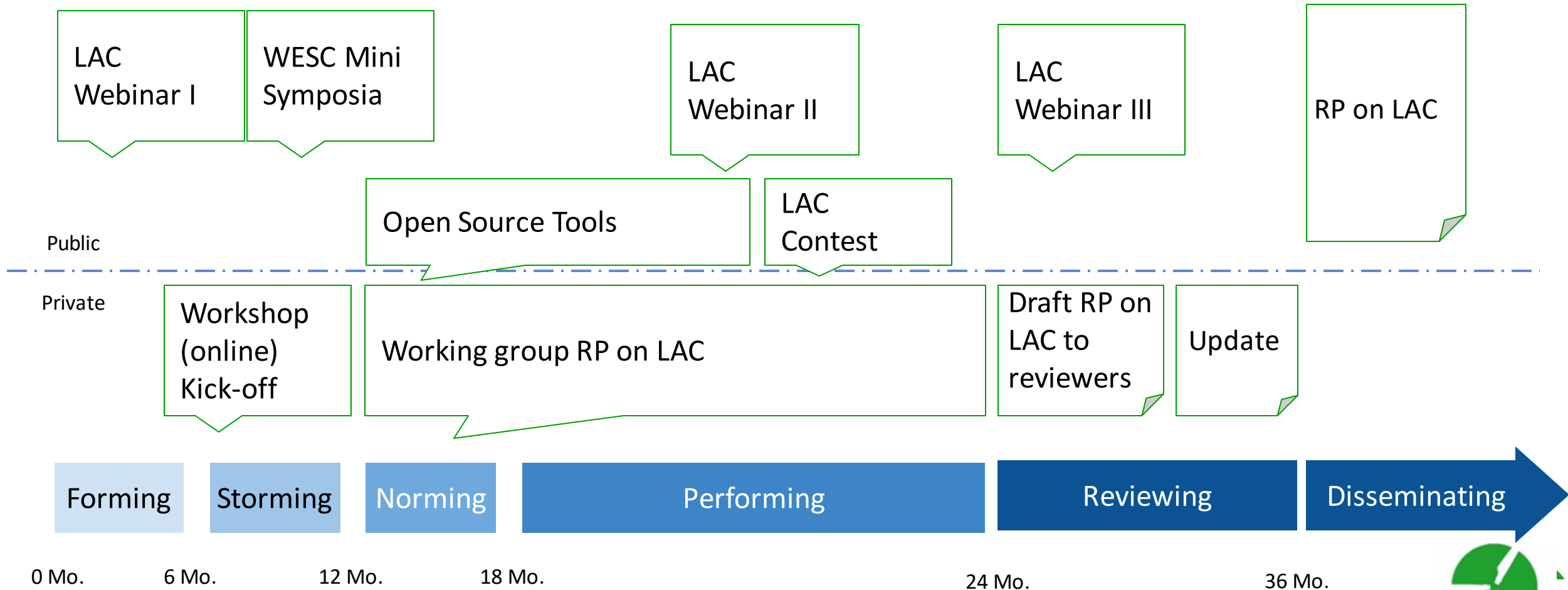
Task 52 working group



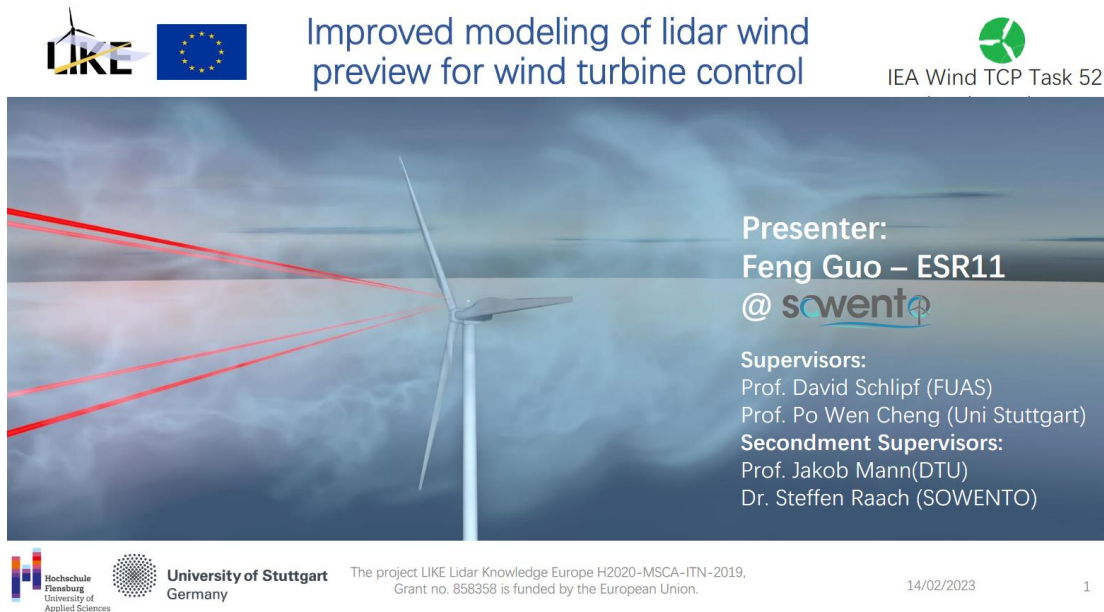
■ Lidar OEM   ■ Turbine OEM  
■ Consultancy   ■ Research





# LAC Working Group




# Highlight 1: Lunch Seminar





The slide features a background image of a wind turbine with red laser beams representing lidar scans. At the top left, there are logos for LIKE and the European Union. At the top right, there is the IEA Wind TCP Task 52 logo. The main title is 'Improved modeling of lidar wind preview for wind turbine control'. The presenter is Feng Guo – ESR11 @ sowento. Supervisors are Prof. David Schlipf (FUAS) and Prof. Po Wen Cheng (Uni Stuttgart). Secondment supervisors are Prof. Jakob Mann (DTU) and Dr. Steffen Raach (SOWENTO). The bottom left contains logos for Hochschule Flensburg and the University of Stuttgart. The bottom right contains the date 14/02/2023 and the page number 1. A small text block at the bottom center states: 'The project LIKE Lidar Knowledge Europe H2020-MSCA-ITN-2019, Grant no. 858358 is funded by the European Union.'

**LIKE**  Improved modeling of lidar wind preview for wind turbine control  IEA Wind TCP Task 52

**Presenter:**  
Feng Guo – ESR11  
@ 

**Supervisors:**  
Prof. David Schlipf (FUAS)  
Prof. Po Wen Cheng (Uni Stuttgart)

**Secondment Supervisors:**  
Prof. Jakob Mann (DTU)  
Dr. Steffen Raach (SOWENTO)

  **University of Stuttgart**  
Germany

The project LIKE Lidar Knowledge Europe H2020-MSCA-ITN-2019,  
Grant no. 858358 is funded by the European Union.

14/02/2023 1



The slide has a dark blue background with a purple-to-blue gradient arc on the right side. The title is 'Lidar-assisted model predictive turbine control'. Below the title, it says 'Challenges on the way to an industrial reality' and 'Dr. Axel Schild, February 2023'. There is a logo in the bottom right corner that looks like a stylized 'iav'.

**Lidar-assisted model predictive turbine control**

Challenges on the way to an industrial reality  
Dr. Axel Schild, February 2023




Slides can be found at Zenodo:  
<https://doi.org/10.5281/zenodo.7683412>

# Highlight 2: Mini Symposia at the WESC



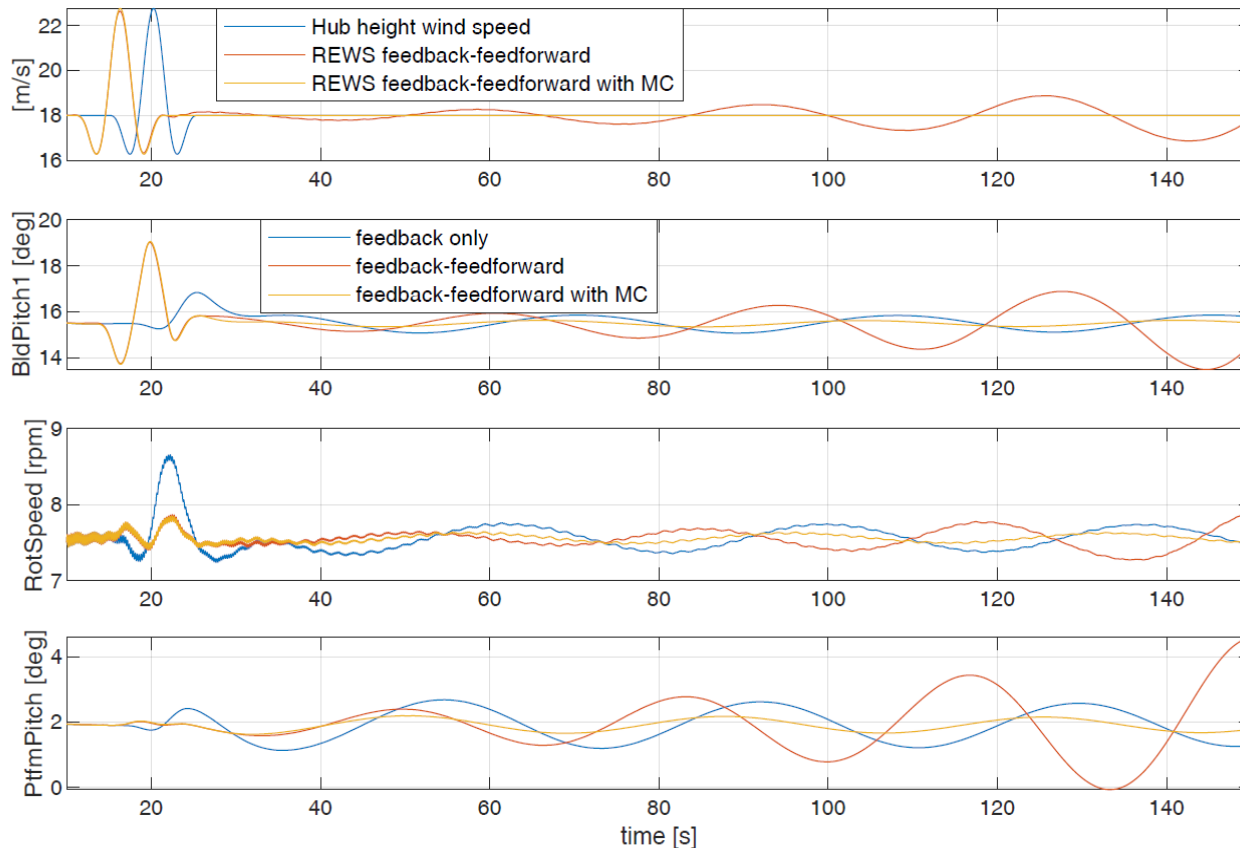
Details see presentation of  
Eric Simley from Day 1



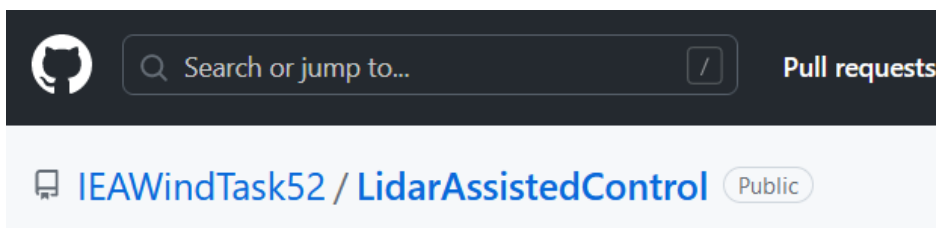
4.6 Mini Symposia: IEA Wind Task 52: Lidar-Assisted Control, Turbulence Estimation, and Digitalization



# Highlight 3: Open Source LAC Tools

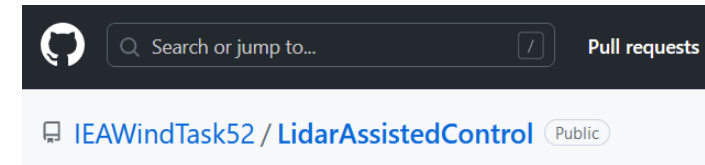
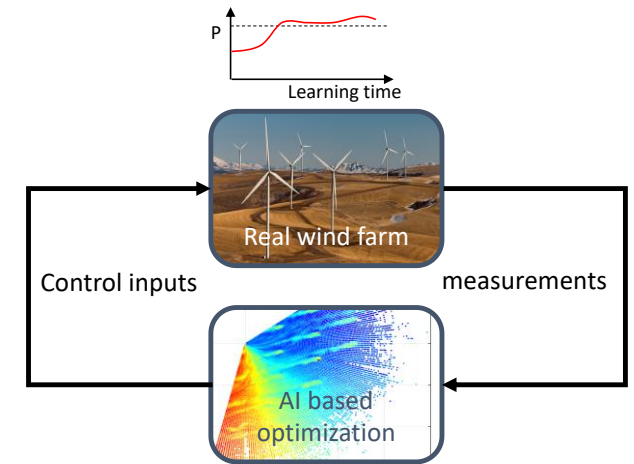


- Open Source code of
  - Very detailed lidar simulator
  - Modified feedback controller (ROSCO)
  - Lidar data processing
  - Feedforward controller
  - 4 Examples with coherent and turbulent wind
- Published at GitHub and presented at ACC 2023



# Plans for next 12 months

- 2. Webinar: Ideas are very welcome!
- Organize workshop with Task 44: Wind Farm Flow Control
- Open Source tools
  - Extend it to make it more useful for a broader audience
  - Main motivation: improved transparency of performance for different methods
- Contest
  - Objective: benchmarking, increase motivation for LAC (industry and research)
  - Different Categories: bottom fixed / floating wind
  - Common cost function as evaluation



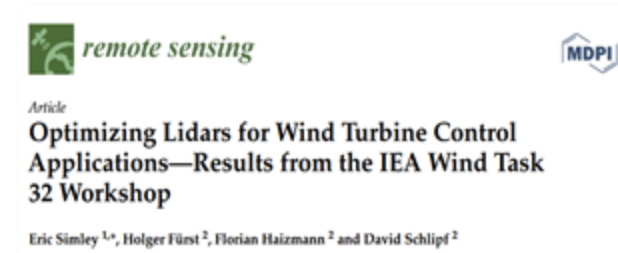
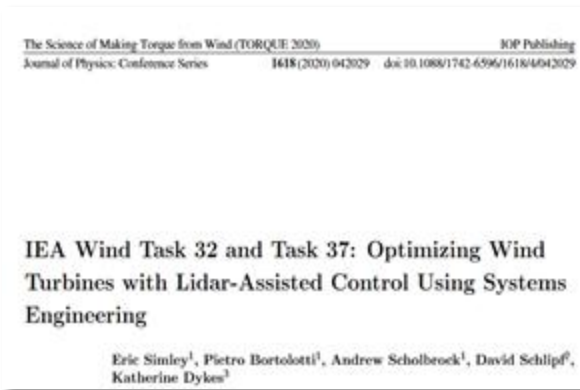
$$\begin{aligned} L(x(t), u(t)) &= Q_1 (\Omega(t) - \Omega_{rated})^2 \\ &+ Q_2 (P_{el}(t) - P_{rated})^2 \\ &+ Q_3 \dot{x}_T^2(t) \\ &+ R_1(v_0(t)) \dot{\theta}^2(t) \\ &+ R_2 \dot{M}_g^2(t) \end{aligned}$$





# Plans for next 12 months

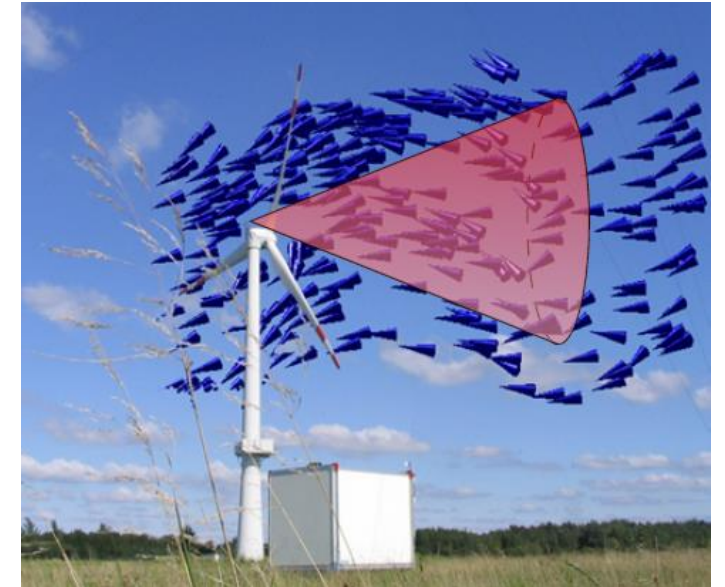
- “Recommended Practices” on LAC
  - Building up on existing documents
  - Define scope content
  - Define connection other documents (load standards, measurement standards)
  - First in person meeting / workshop



# Strategy and context

How does your working group address the overall theme of the task “Large-Scale Deployment of Wind Lidar”?

- Tools and RP help to address complex task of LAC!
- Transparency about potential foster decisions for developers!



Let's work together on getting a lidar on every wind turbine!

