

WP3 – Tween Tests

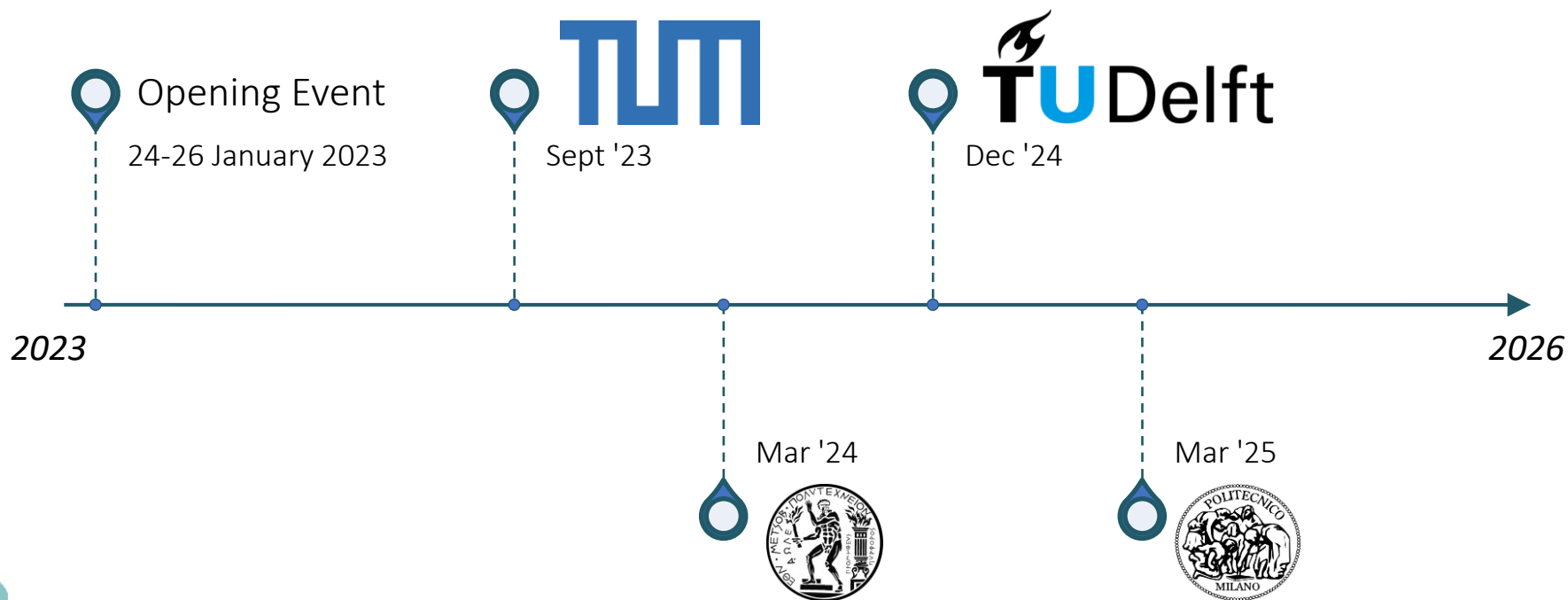
Wake Control Experiments
Planning

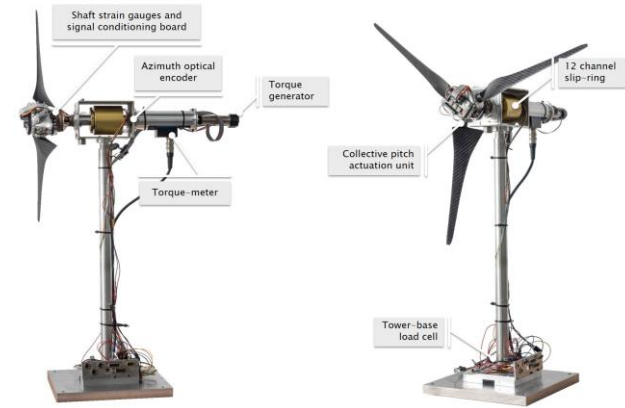


Marinos Manolesos, Franz V. Mühle
Grand Opening Event, Athens, 25 January 2023



Co-funded by the
European Union





2023

2026

What?

- Parametric test of Helix wake control with Static Tilt and Dynamic Yaw

How?

- Two turbines tested, the downstream one acting as a sensor

Inflow?

- Uniform, Low Turbulence
- 1x ABL

Wake measurements?

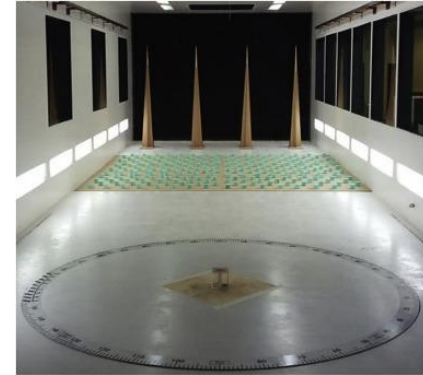
- Some, using FRAP (Fast-Response-Aerodynamic Probe)

Objective?

- Select optimal Wake control strategy



March '24



2023

2026

What?

- Investigation of single blade near wake (1D-2D)

How?

- Single turbine + robotic arm PIV

Inflow?

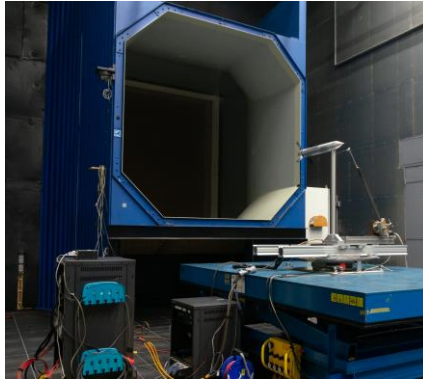
- Uniform, Low Turbulence
- 2x ABL

Wake measurements?

- Yes, using robotic arm PIV

Objective?

- Details of vortex/wake formation when using optimal strategy



2023

2026

What?

- Investigation of 3 blade wake interactions in the near wake (1D-2D)

How?

- Single turbine + PTV

Inflow?

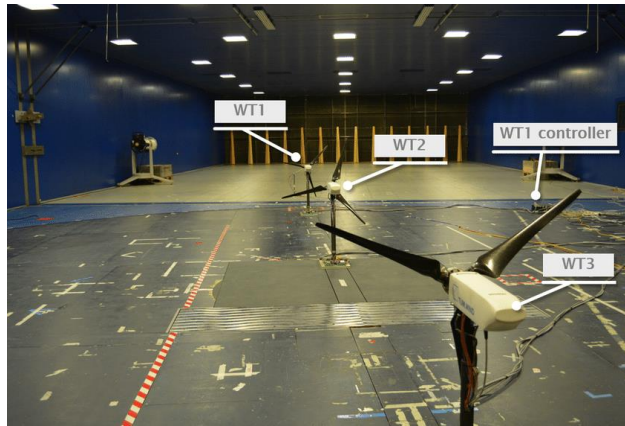
- Uniform, Low Turbulence
- No ABL, but floor added

Wake measurements?

- Yes, large scale PTV, 5cm wide slices of the complete wake

Objective?

- Details of vortex interactions in the near wake when using optimal strategy



Mar '25

2023

2026

What?

- Optimal strategy in a wind Farm environment

How?

- 3 Turbines + turntable

Inflow?

- Uniform, Low Turbulence
- 1x ABL

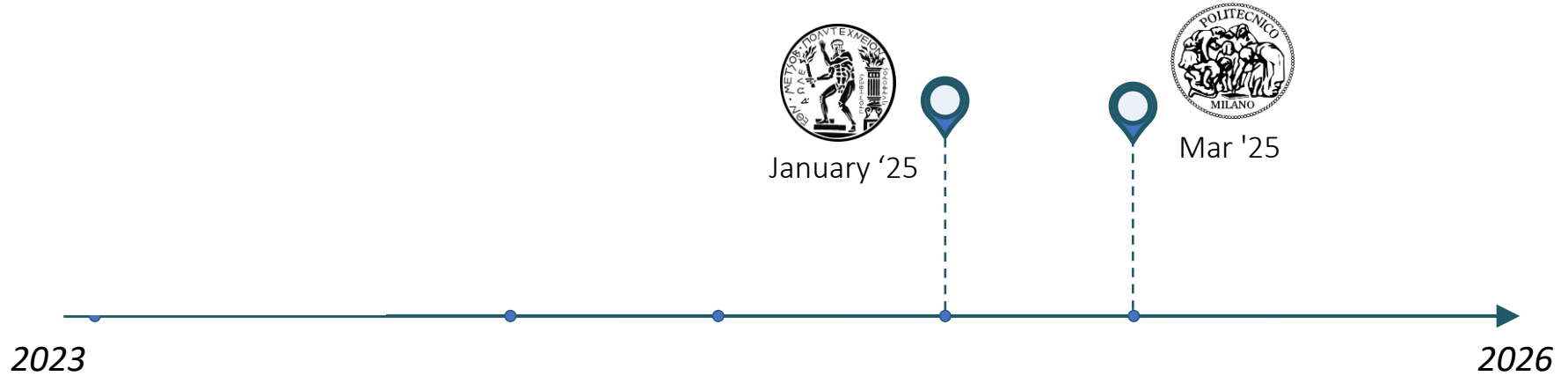
Wake measurements?

- No

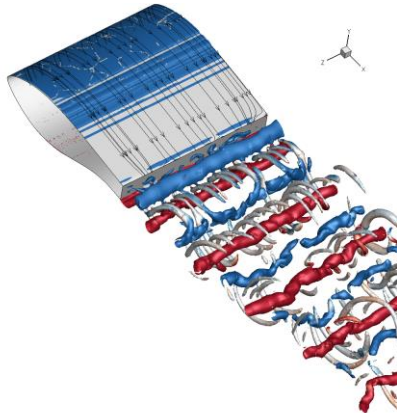
Objective?

- Optimal strategy in a wind farm context, + Wind direction change

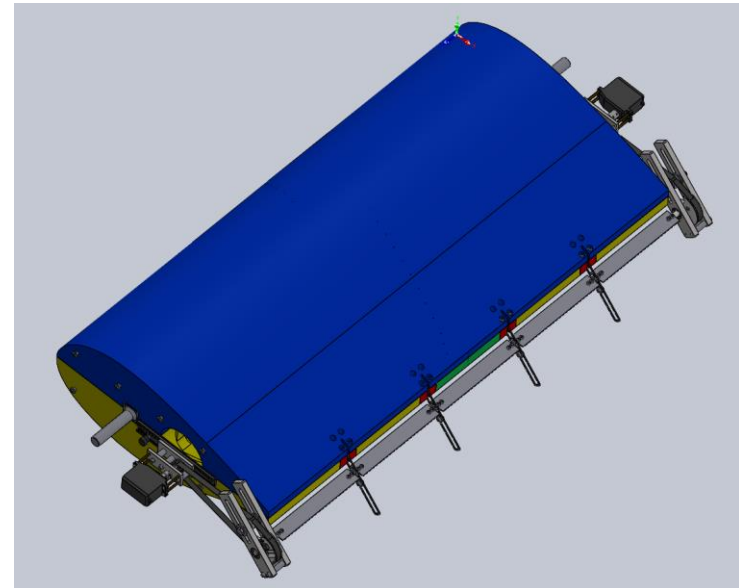
Flow control for flatback profiles



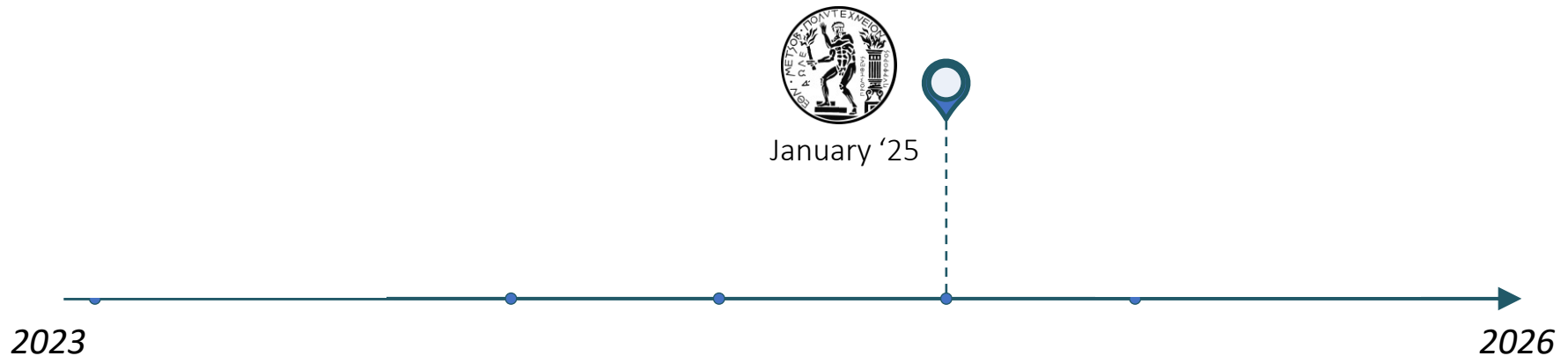
1. AR = 0.2
2. AR = 0.5
3. AR = 1.0
4. AR = 2.0



VortZ: -10 -8 -6 -4 -2 0 2 4 6 8 10



Flow control for flatback profiles



What?

- Extensive tests of BL airfoil with multiple control options at $Re=1.0-1.5M$
- DES study

Measurements?

- Transient pressure measurements on wing surface and trailing edge
- Pressure wake rake
- Stereo PIV in the wake

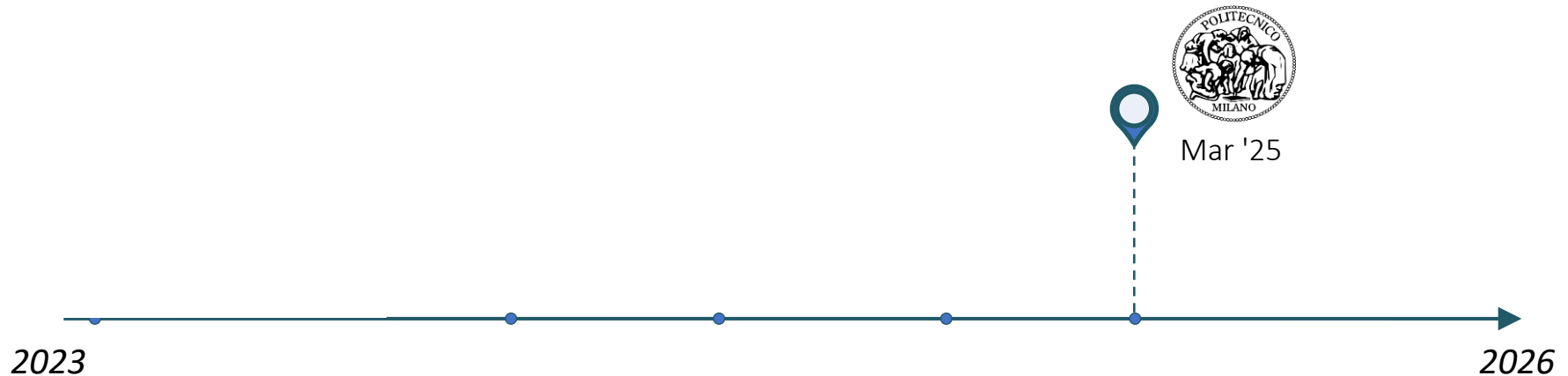
Options?

- Robotic arm PIV, if available (if yes, test will be moved to Spring 2024)

Objective

- Identification of most promising control option

Flow control for flatback profiles



What?

- BL airfoil tests with selected control options up to $Re=1.8M$

Measurements?

- Transient pressure measurements on wing surface and trailing edge
- Hot wire on traverse

Objective

- Tunnel benchmarking
- Higher Re number tests
- Correlations in the wake

Thank you!

Questions?