TwinLab II – Accelerating Digitalization of Hydropower Research

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HydroCen Fagutvalgsmøte, 06.04.22

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NORWEGIAN RESEARCH CENTRE FOR HYDRO POWER TECHNOLOGY

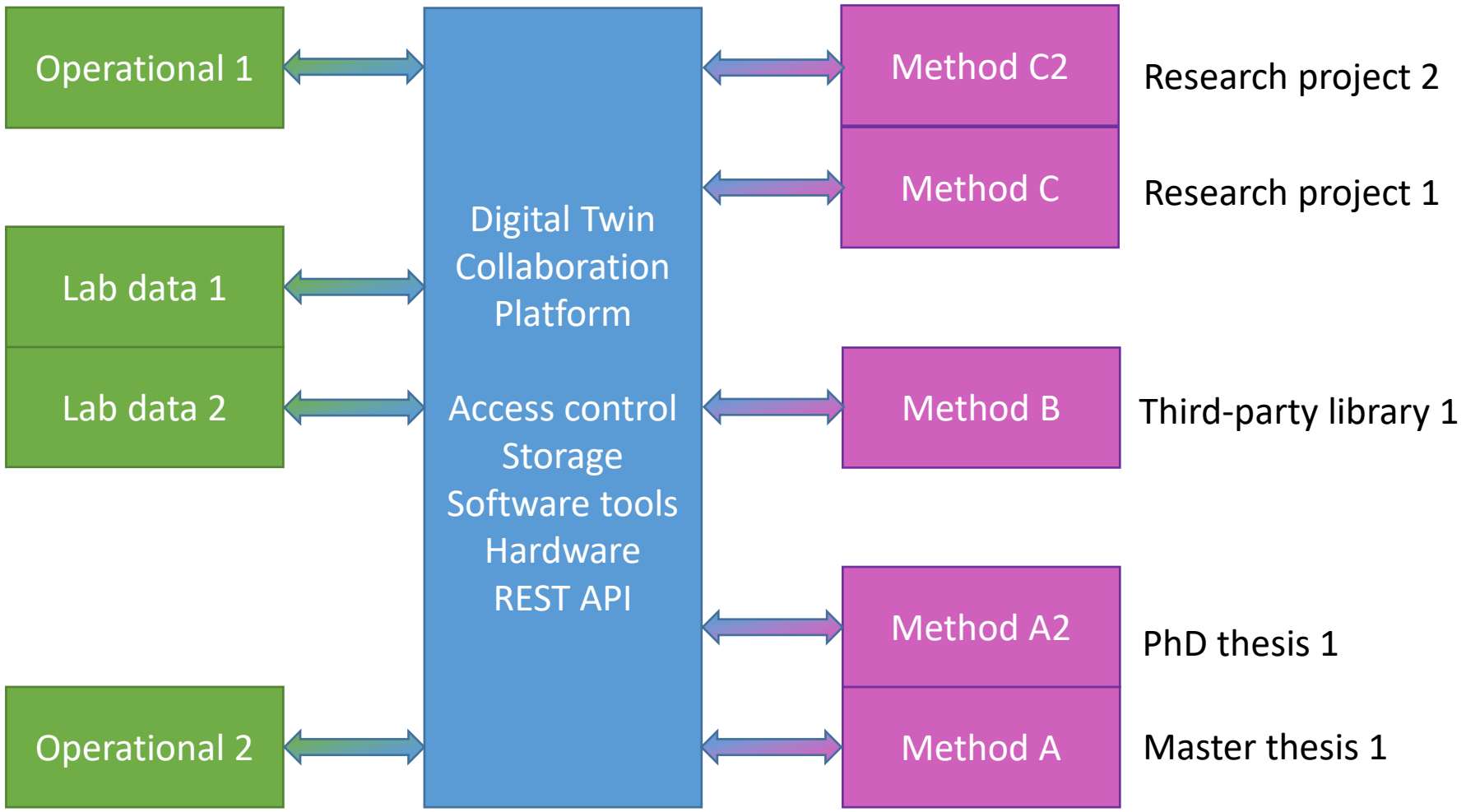
FME CENTRE FOR ENVIRONMENT-FRIENDLY ENERGY RESEARCH
The Research Council of Norway

Exchange of data

Lab sensors

Inlet temperature
Inlet pipe flow
Inlet pipe pressure
Differential pressure inlet-outlet
Generator torque
Friction torque
Runner speed
Runner angular position
Guide vane position
Barometer

Inlet spiral casing
Upper turbine cover
Vaneless space
Vaneless space
Vaneless space
Draft tube cone, upper plane
Draft tube cone, upper plane
Draft tube cone, lower plane
Draft tube cone, lower plane
Turbine bearing (radial direction)
Turbine bearing (axial direction)
Guide vane shaft



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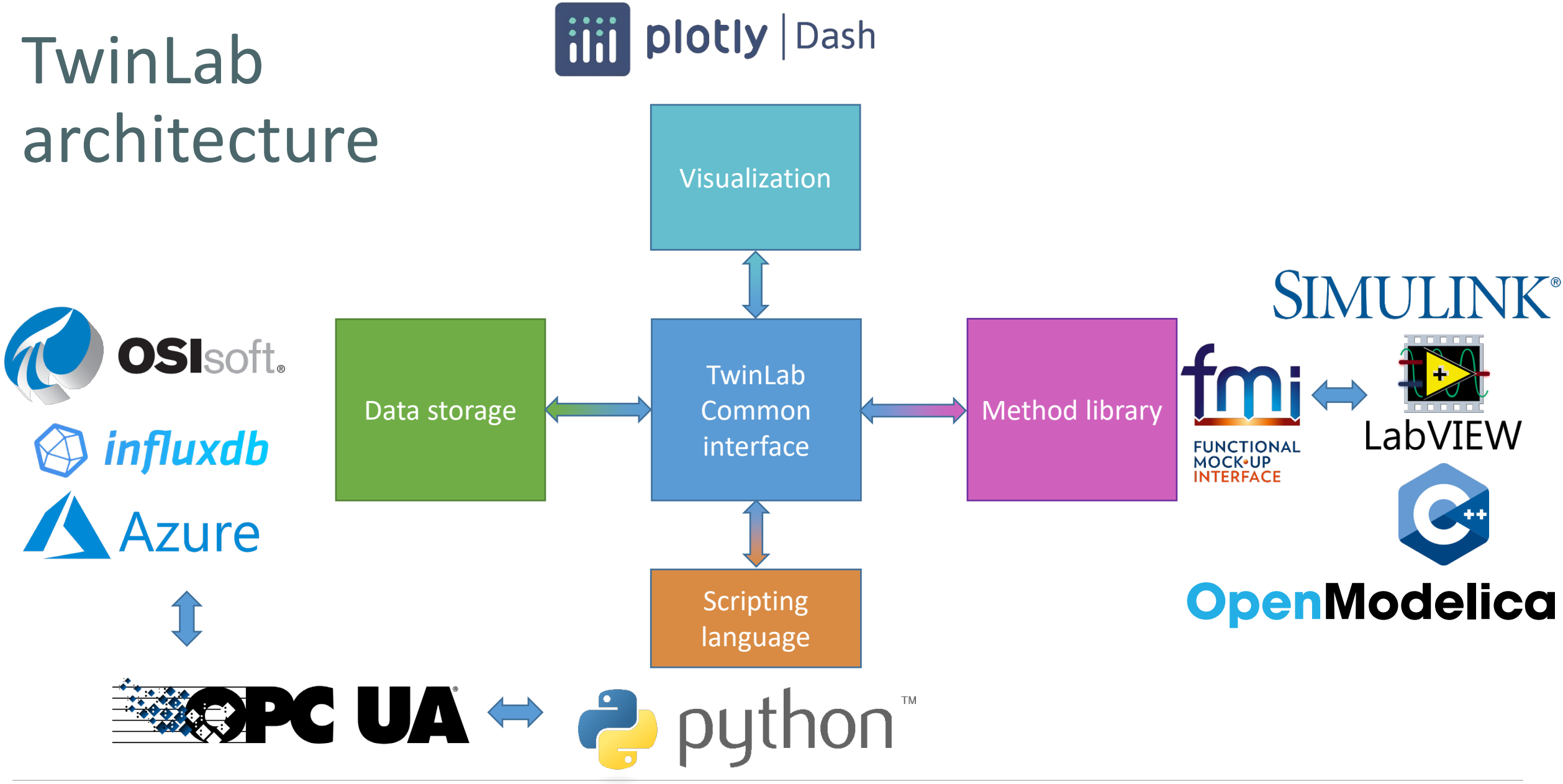
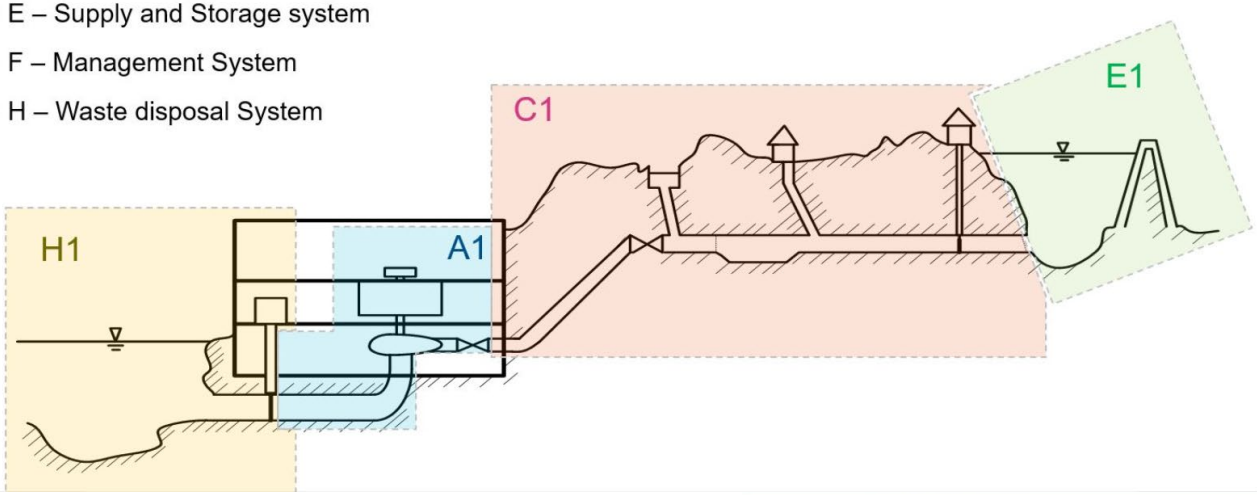
TwinLab architecture

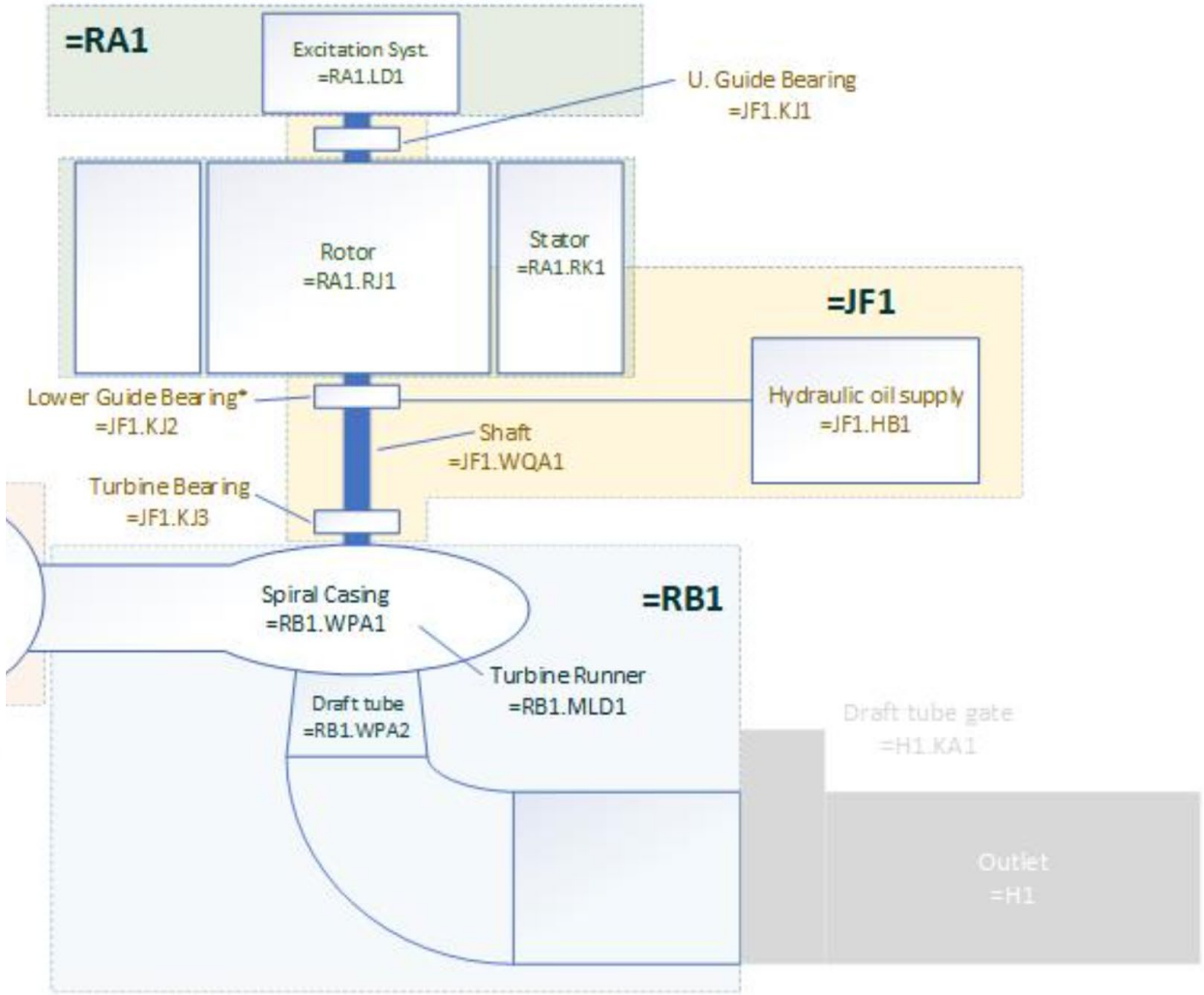


Use of standards and APIs

=RA1 Generator System
=JF1 Shaft System
=KA1 Main Inlet Valve S.
=RB1 Turbine System
=PG1 Protection System

- A – Transforming system
- B – Electricity transport system
- C – Energy Transport system
- D – Support system
- E – Supply and Storage system
- F – Management System
- H – Waste disposal System





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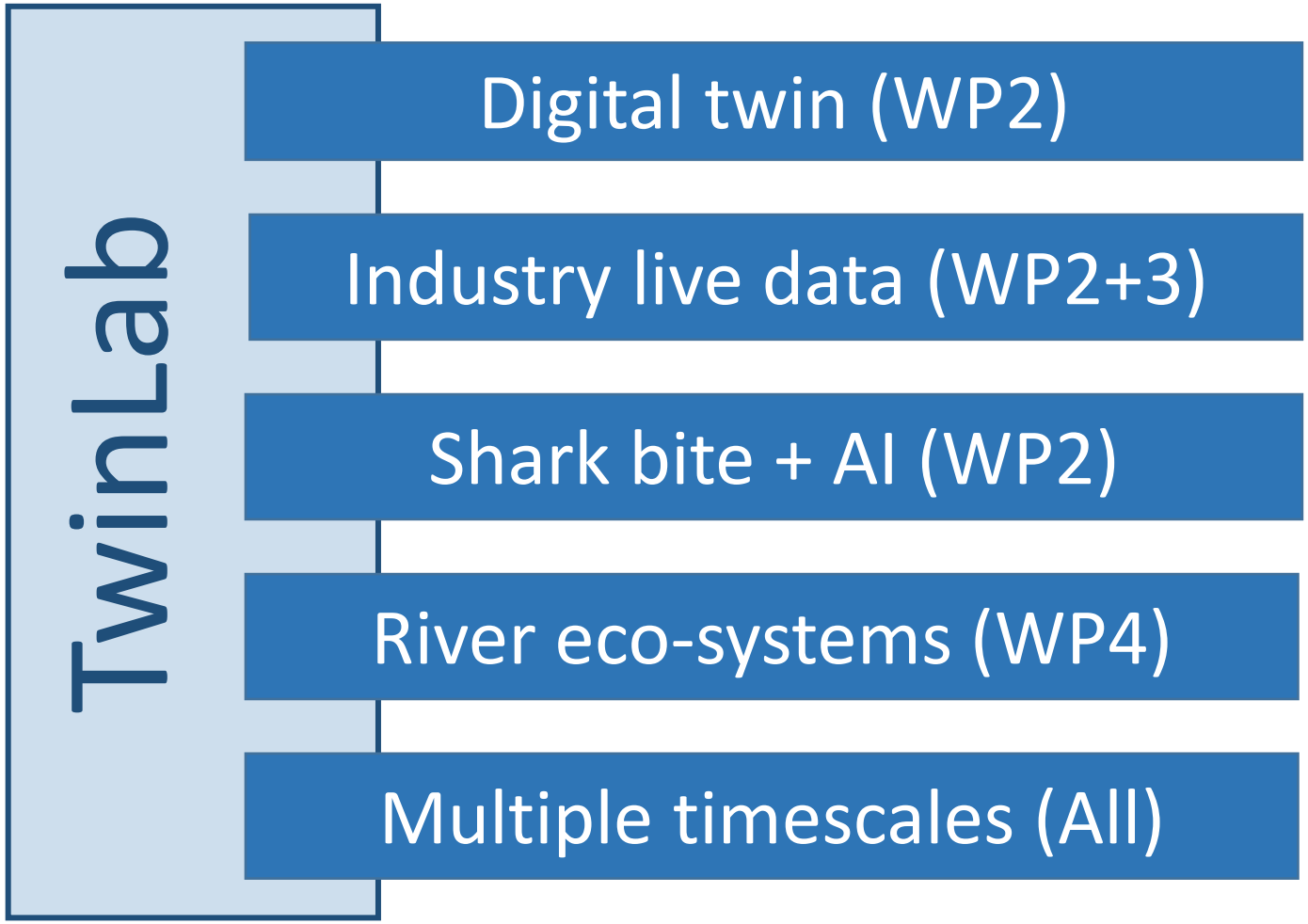
TwinLab II – Digitalization platform utilization



Results

Improved workflow

Verification of algorithms

Direct transfer value to the industry

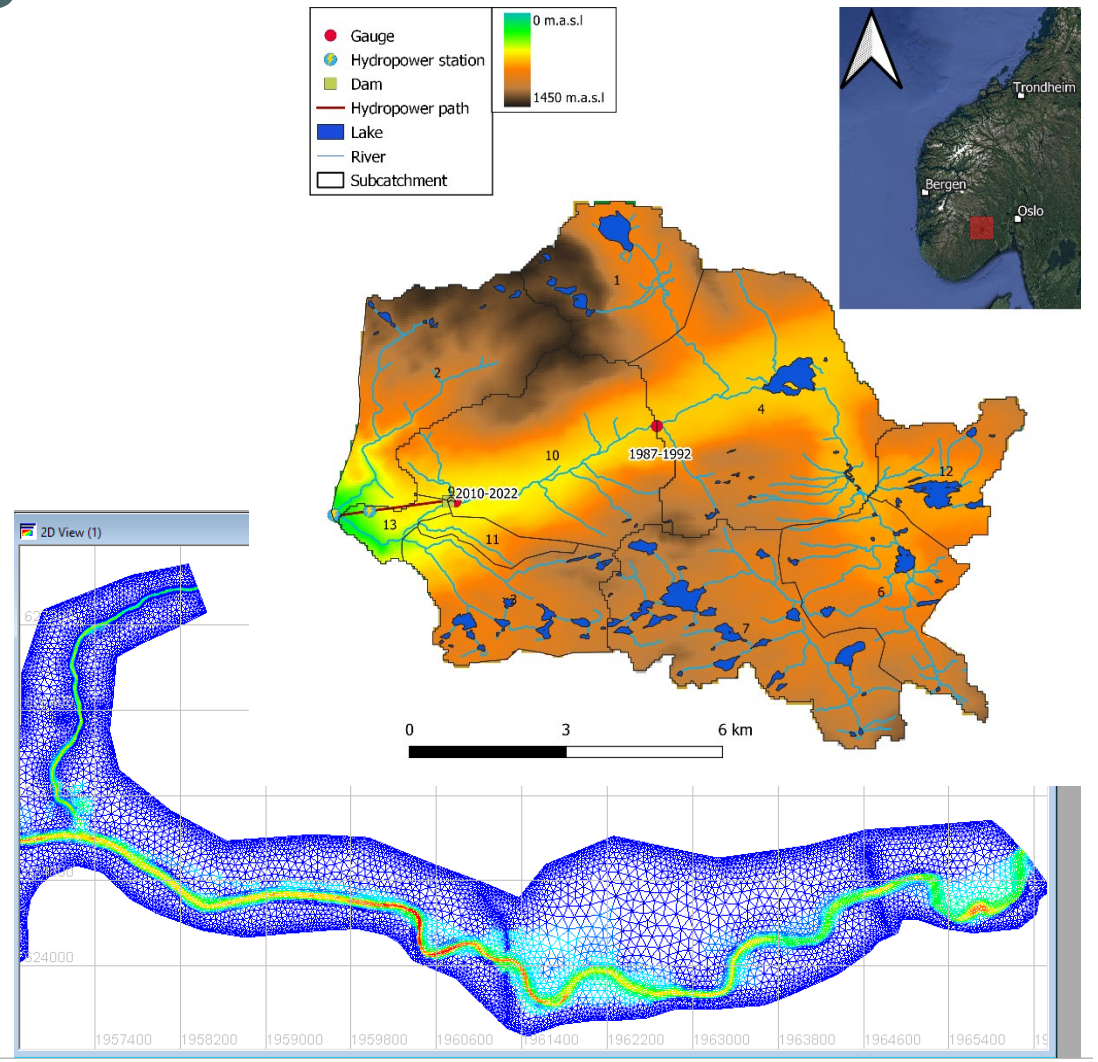
Real-time measurement data

- Waterpower laboratory NTNU
- Grunnåi (Skagerak)
- Porjus (Vattenfall)

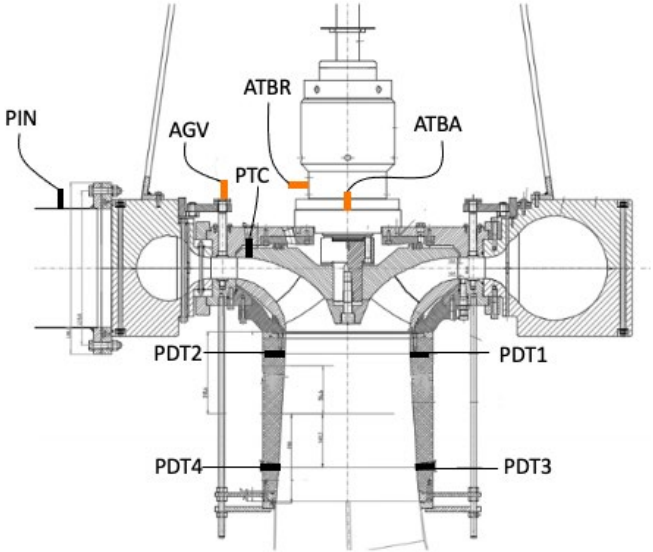
- Use cases
  - Real-time efficiency estimation
  - Testing various methods for RT analysis of data

Proof-of-concept river digital twin

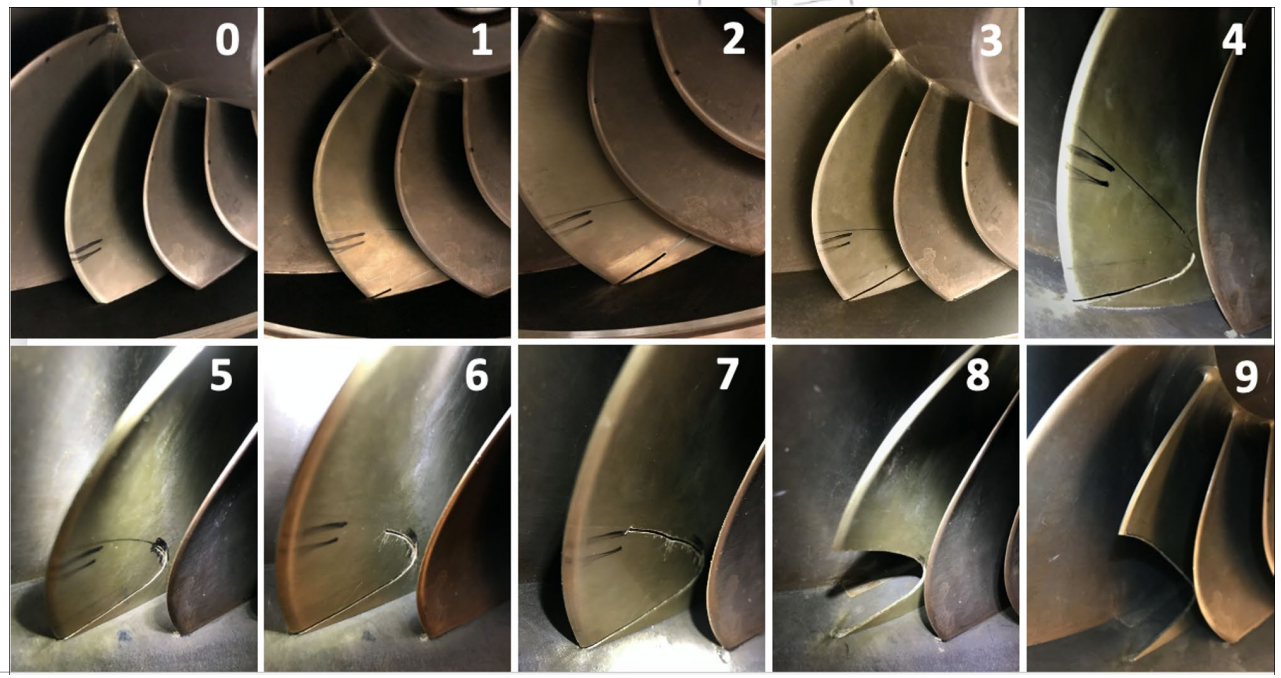
- Linking in TwinLab
  - Hydrological model
  - Operational data
  - Hydraulic model of river
- Can be coupled with habitat models to assess environmental impacts



Francis shark bite detection



- Dataset from a model runner with a cut on the blade to represent a crack development
- Detected at a rather late stage by timeseries and frequency domain analysis
- Apply AI and statistical methods to investigate whether the cut can be detected earlier



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