WHEN TRUST MATTERS

The future of Bladed

How to meet the needs of the modern digital world simulations

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Agenda

- Bladed Next Gen (v5)
- Flexibility
- Automation
- Collaboration
- Conclusions

Bladed Next Gen an aero-elastic tool designed for automation and use at scale

BLADED

The leading wind turbine design aeroelastic software for both onshore and offshore wind turbines.

100+

INDUSTRIAL CUSTOMERS

rely on Bladed for aeroelastic analysis

30+

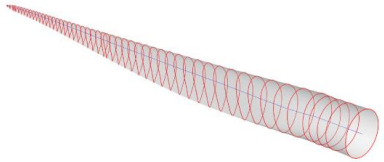
YEARS

of trust and validation from the wind industry

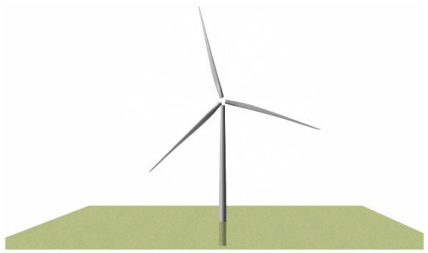
70%

OF TURBINES

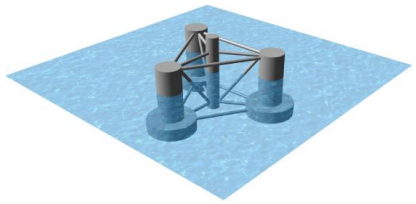
installed in 2023 were designed using Bladed



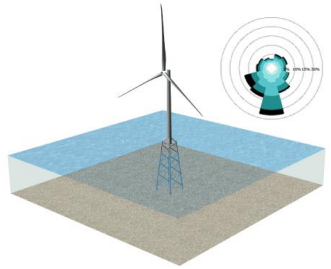
Sub-system design



Wind turbine loads and stability



Offshore foundation coupled analysis



Site suitability and asset optimisation

NORDEX We've got the power.

GE Renewable Energy

MINGYANG

Vestas

GOLDWIND

ENERCON ENERGY FOR THE WORLD

SAIPEM

COWI

EDF renewables

IBERDROLA

DNV

Why Bladed Next Gen (v5)?

Flexibility

Greater control of your turbine modelling

Automation

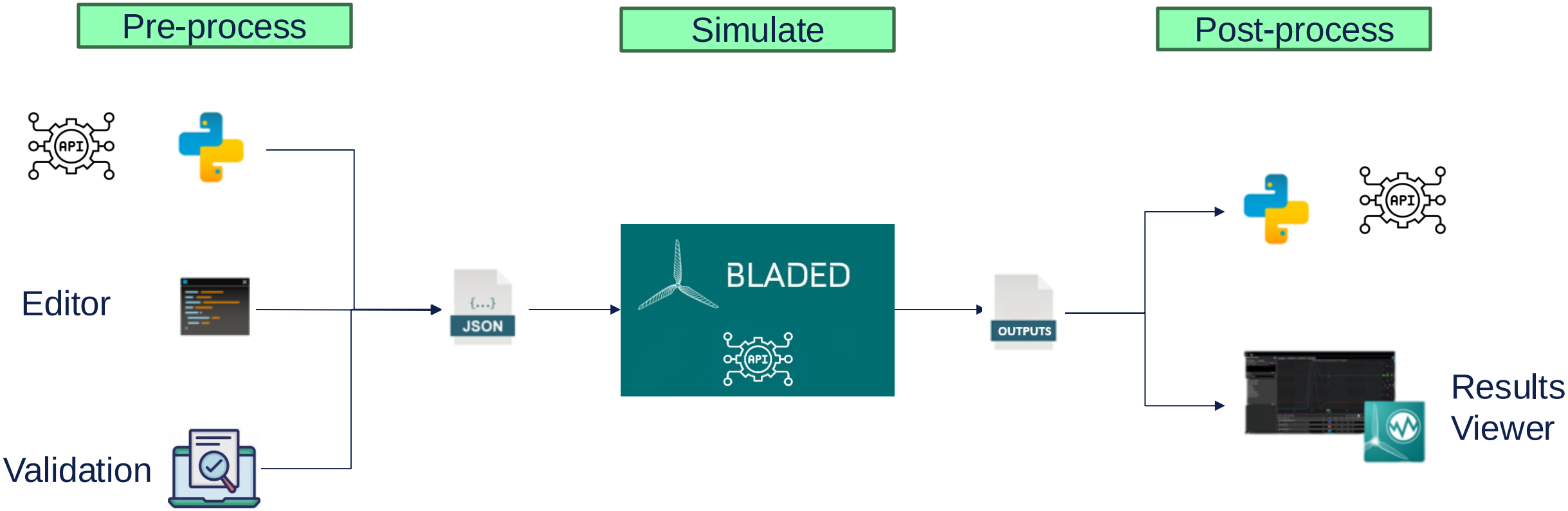
JSON inputs for faster data interchange

Collaboration

Share, store and distribute data efficiently

LCOE and Process Cost Reduction

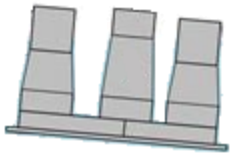
Bladed Next Gen (v5) API First Workflow



Flexibility

Flexible turbine assembly tree

Multimember Structure



Multimember Float

Nacelle (mainframe, drivetrain)

Hub

Pitch System

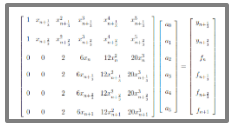
Mooring

Yaw System

Blade

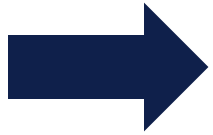
Foundations/Pile

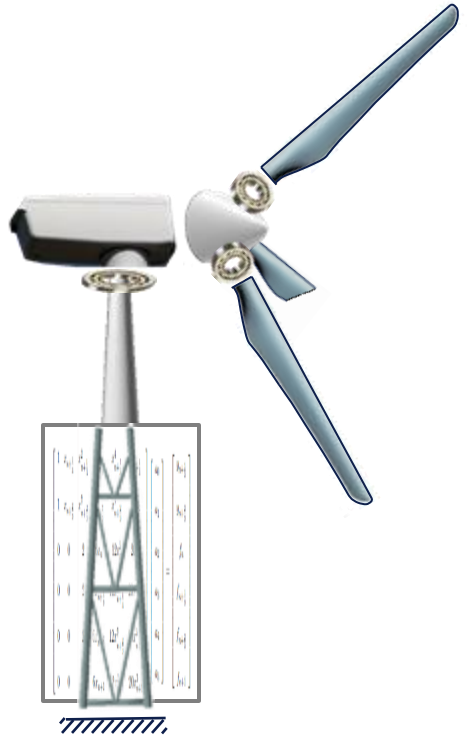
Tower (axisymmetric)



Superelement

External Module

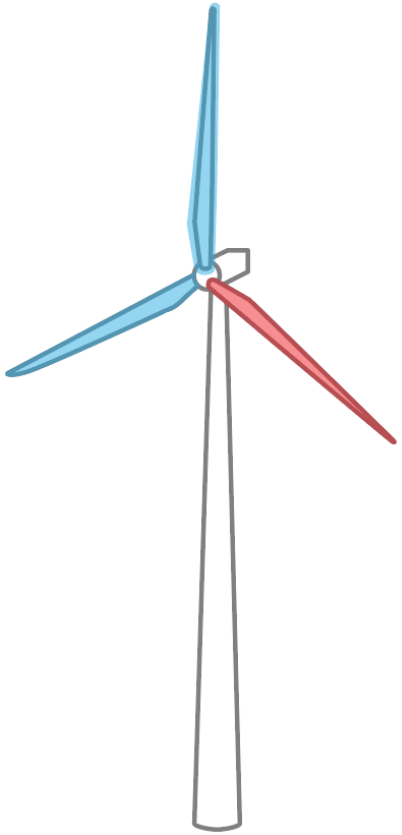




Superelement (jacket + transition piece)
- Tower (axisymmetric)
  - Yaw System
    - Nacelle
      - Hub
        - Pitch System
          - Blade
        - Pitch System
          - Blade
        - Pitch System
          - Blade

DNV

Modelling blades independently

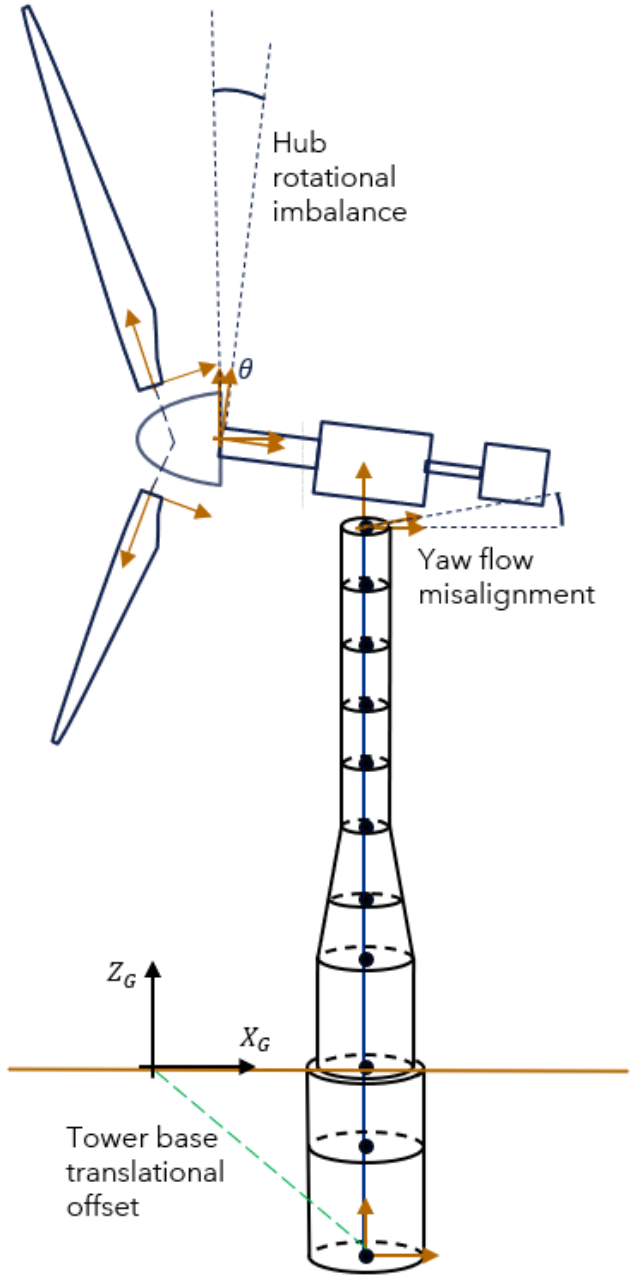


```
"TurbineToModel": {
    "Assembly": {
        "Foundations": {"Component": "#/ComponentDefinitions/my_ground",
            "Jacket": {"Component": "#/ComponentDefinitions/my_jacket",
                "Tower": {"Component": "#/ComponentDefinitions/my_tower",
                    "YawBearing": {"Component": "#/ComponentDefinitions/my_yaw_bearing",
                        "Nacelle": {"Component": "#/ComponentDefinitions/my_nacelle_Assembly",
                            "Hub": {"Component": "#/ComponentDefinitions/my_hub",
                                "PitchSystem1": {"Component": "#/ComponentDefinitions/my_pitch_bearing",
                                    "Blade": {"Component": "#/ComponentDefinitions/my_blade" } },
                                "PitchSystem2": {"Component": "#/ComponentDefinitions/my_pitch_bearing",
                                    "Blade": { "Component": "#/ComponentDefinitions/my_broken_blade" } },
                                "PitchSystem3": {"Component": "#/ComponentDefinitions/my_pitch_bearing",
                                    "Blade": { "Component": "#/ComponentDefinitions/my_blade" } }
                            }
                        }
                    }
                }
            }
        }
    }
},
```

DNV

Model imbalances

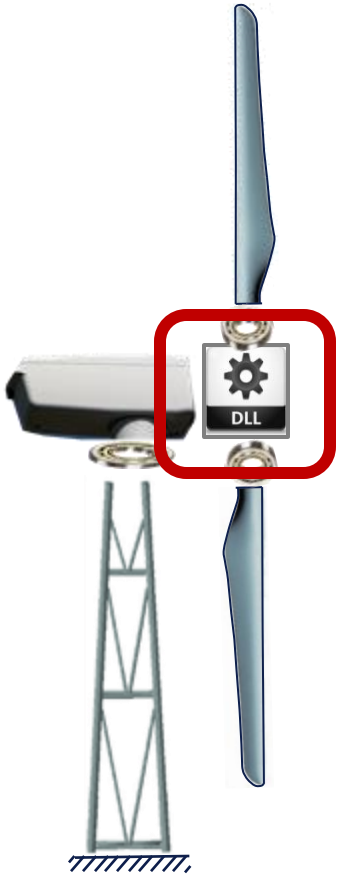
- User can now insert offsets and rotations between components
- Useful to model imbalances or change the model definition



User defined components (future vision)

Bespoke Drivetrain/Generator Model

Experimental Dampers



Custom Teeter Hub

Automation

Input validation and editing support

JSON format enables input files and programming APIs with:

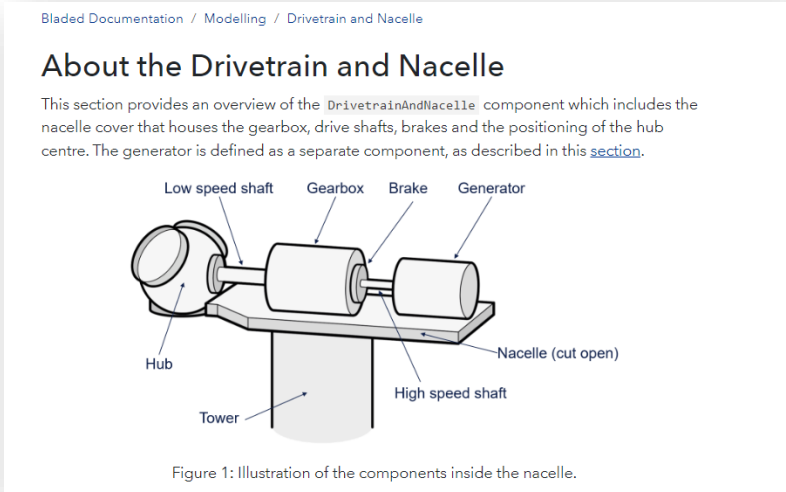
- Error highlights
- Auto-complete
- Mouse tip and docstring documentation
- Same data template across programming languages

```
3
4       "SteadyCalculation": {
5
6       }
7
8   }
```

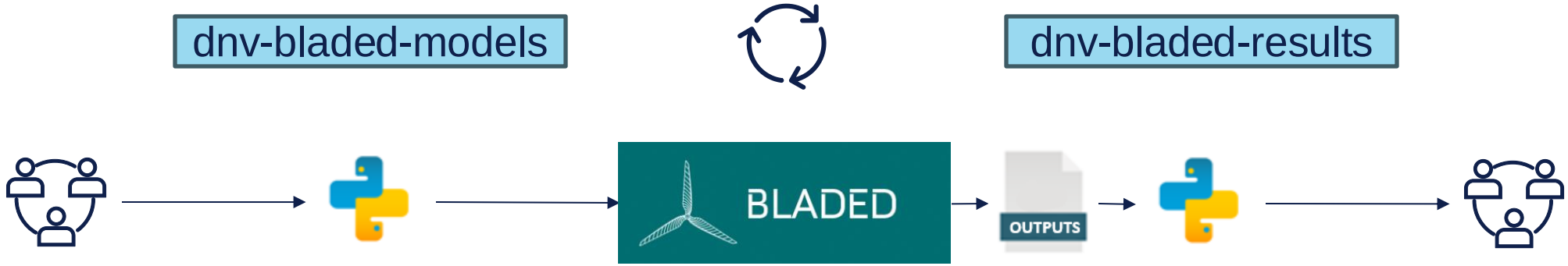
```
3
4       "SteadyCalculation": {
5           "SteadyCalculationType": "PerformanceCoefficients"
6       }
7   }
```

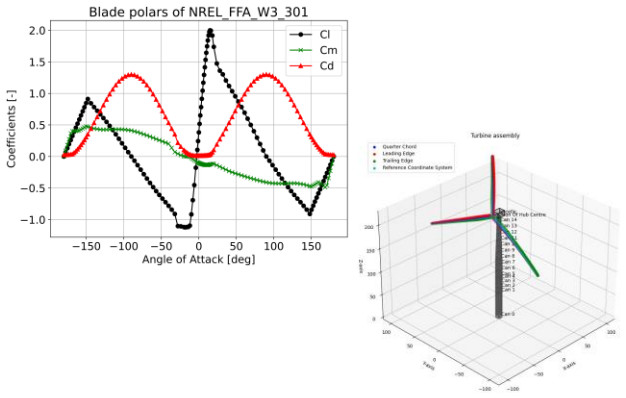
Services for validation of your model before simulation.

Fully documented to take full control of your inputs



Custom workflows with APIs for pre and post processing and optimizations



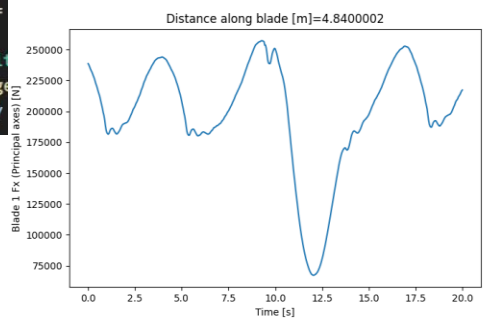


Fast, simple and ready to automate

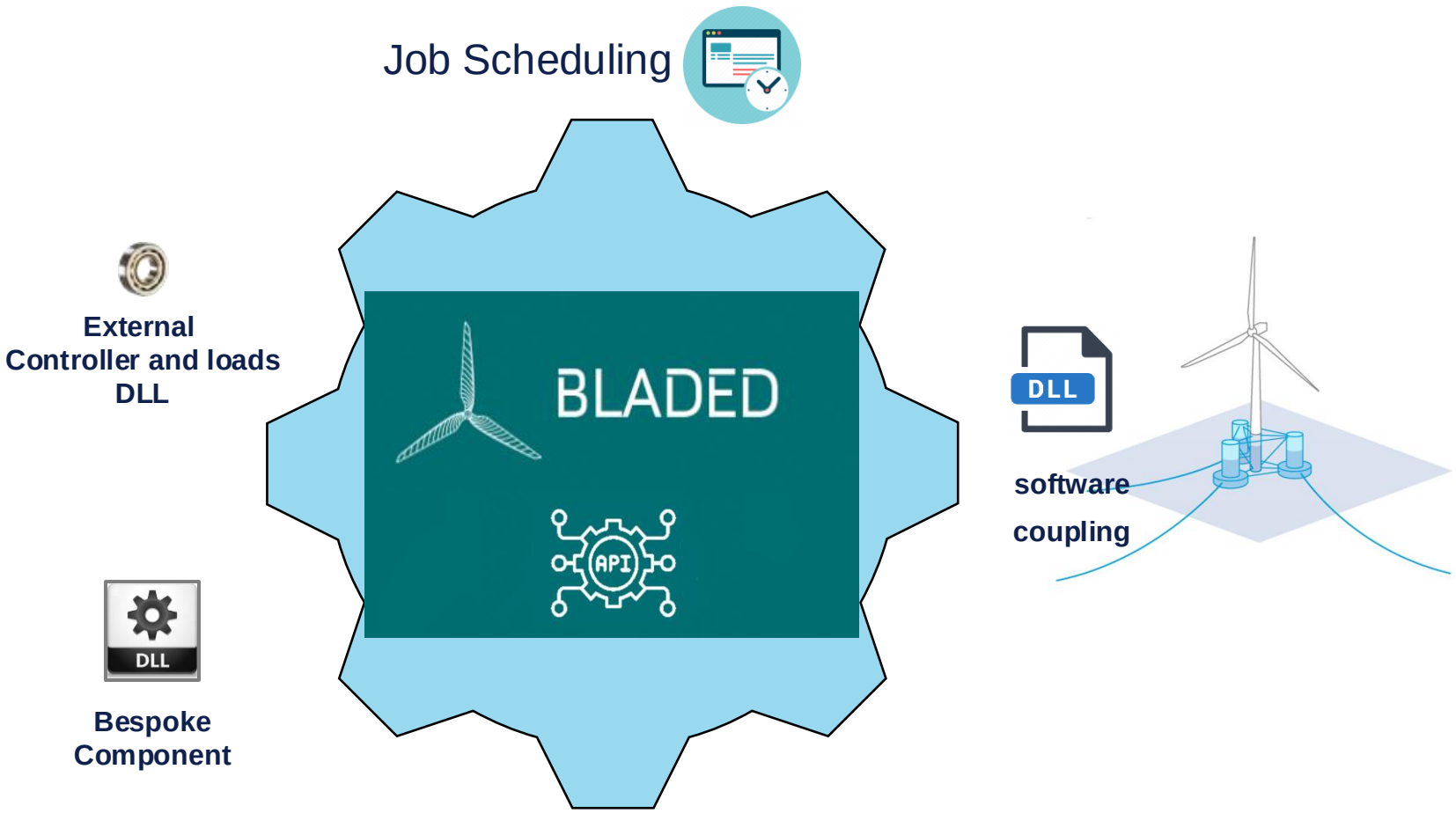
```python
from dnv_bladed_results import ResultsApi

run_name = "powprod"
directory =

run = Result
var = run.g
numpy_array
```



Runtime interfaces for your simulations



Collaboration

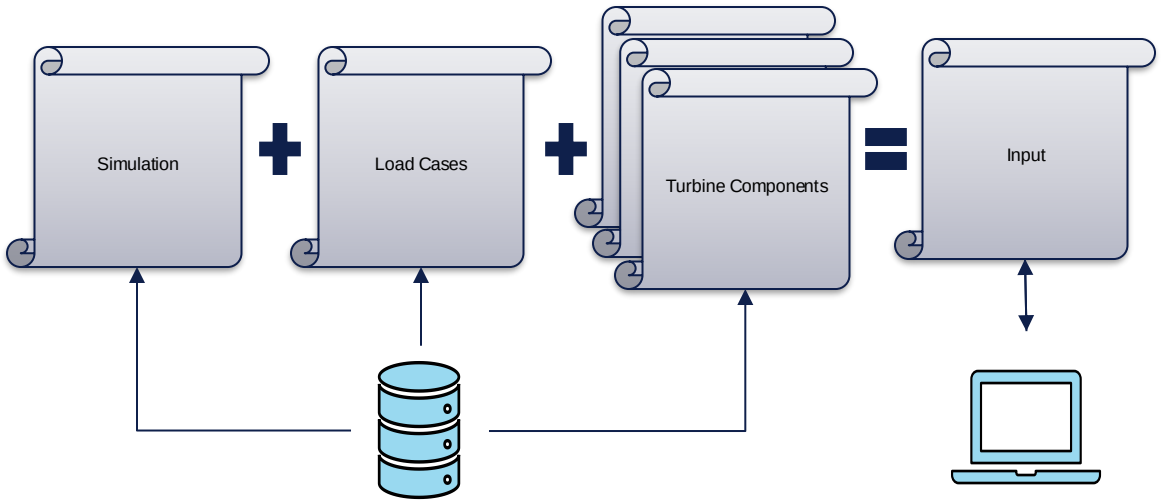
Distributable Data

Manage, store and automatically handle data as you see fit.

Share data across departments with a single source of truth.

Build databases and libraries using a single or several files for:

- Load cases
- Turbine Components (blades, towers, hubs, etc..)
- Aerofoils



Secure Data Sharing

With increased digitalisation and remote processes data security and data sharing becomes more relevant.

This comprises data used to produce surrogate models, for validation, design and simulation data and operational data.

Sharing channels

- Email
- Chat channels
- Remote Storage systems
- Remote Desktops
- Online interfaces

Selective encryption of input data and restriction of outputs

Share data with partners without compromising your IP

Conclusions

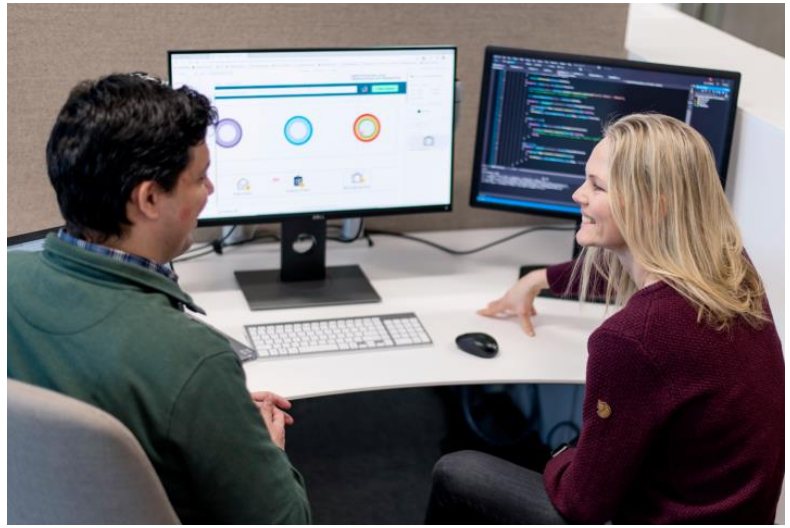
Bladed Next Gen (version 5) is addressing industry challenges

Enabling any type of wind turbine concept while building a software that is fast, well documented and easy to use.

Focusing on interfaces for any coupling and automation needs.

Data sharing features like data distribution and encryption.

Help shape the development of Bladed Next Gen (v5)



Influence the development before Bladed Next Gen (v5) releases:

2025 Onshore / 2026 Offshore

"The benefits of our involvement in Bladed Next Gen development are multiple. Not only do we get to directly show our wishes to the developers in advance, we also have the opportunity to test how the program fulfils them."

Unai San Miguel, Blade Design, Nordex

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