Development of an innovative Wind Energy Concept with SIMPACK

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User Meeting 2011

Salzburg

Company profile

- Project development wind energy
- Technical operation of wind turbines

New

Development of
Wind power plants

Conditon monitoring
of WEC

Maintenance of WEC

Aim of the Company

- Development of Renewable Power Plants (RPP) consists out of several Wind Energy Converter (WEC) from view of an operator
- Design, assembly and operation of WEC prototypes
- Assist serial production of WEC
- Licensing

RPP Development

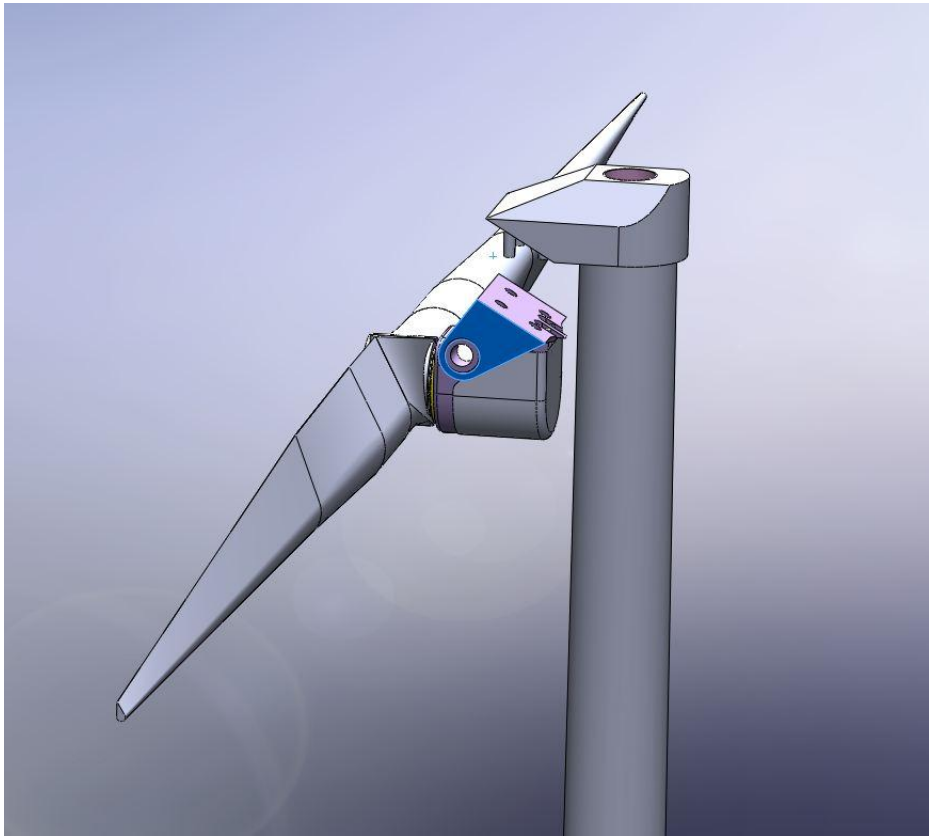
Aim

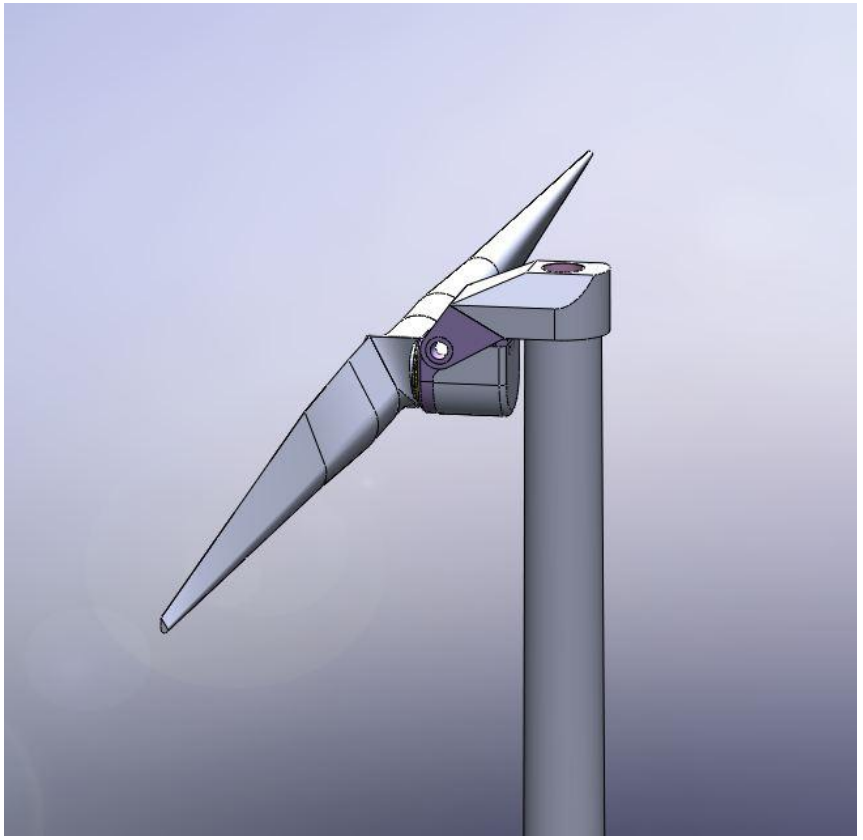
- 3.4 MW WEC also usable for difficult to access sides
- Universal platform for different drive train concepts
- Grouping of single WEC to power plants (RPP)
- Minimization of Cost of Energy

Strategy

- System simplification through WEC clustering
- Avoid external cranes for installation and maintenance
- Optimization of size and mass of components
- Simplification of service and maintenance

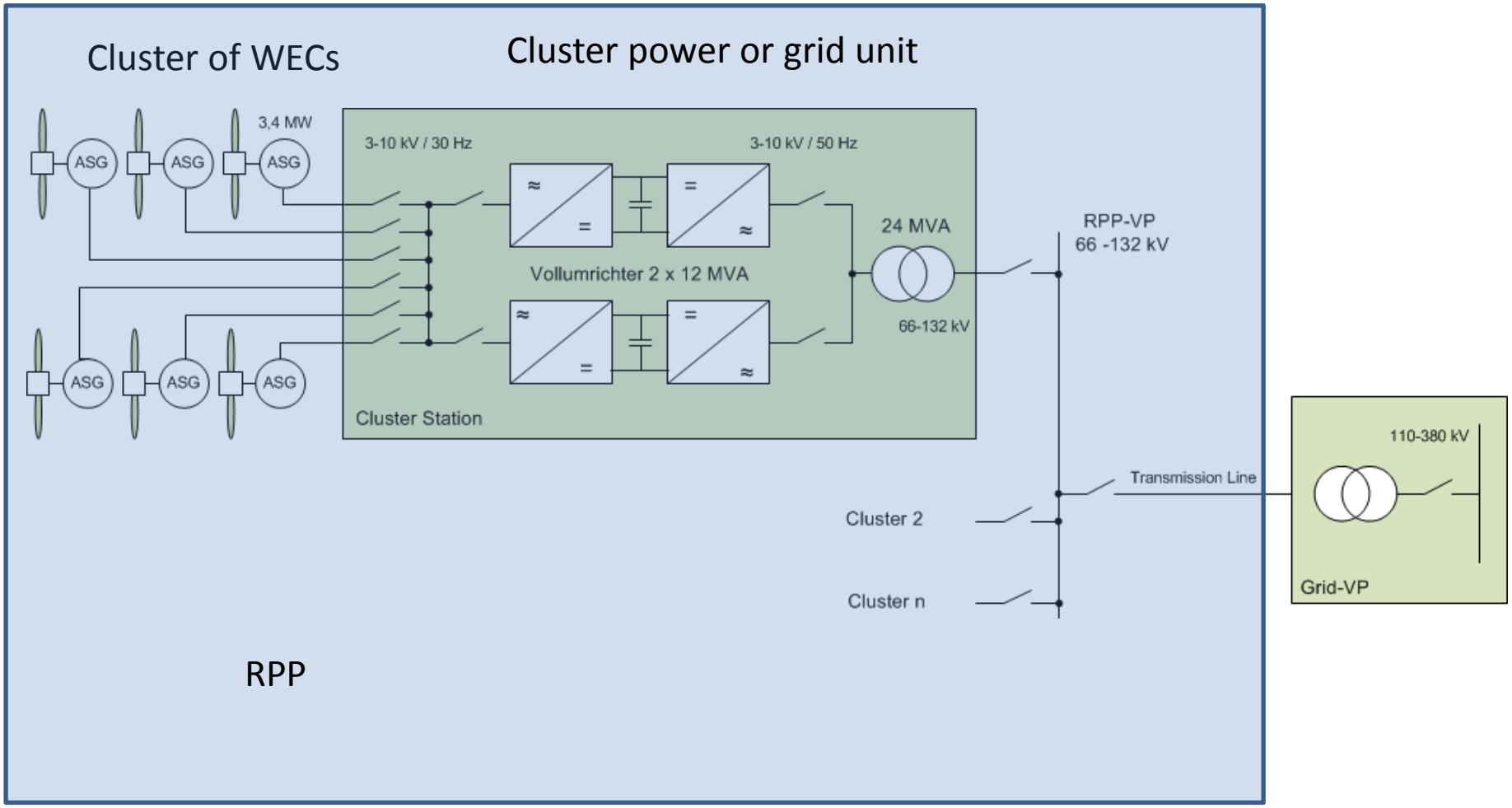
SkyWind Conzept





Usage of tower as crane (**SkyLift**)

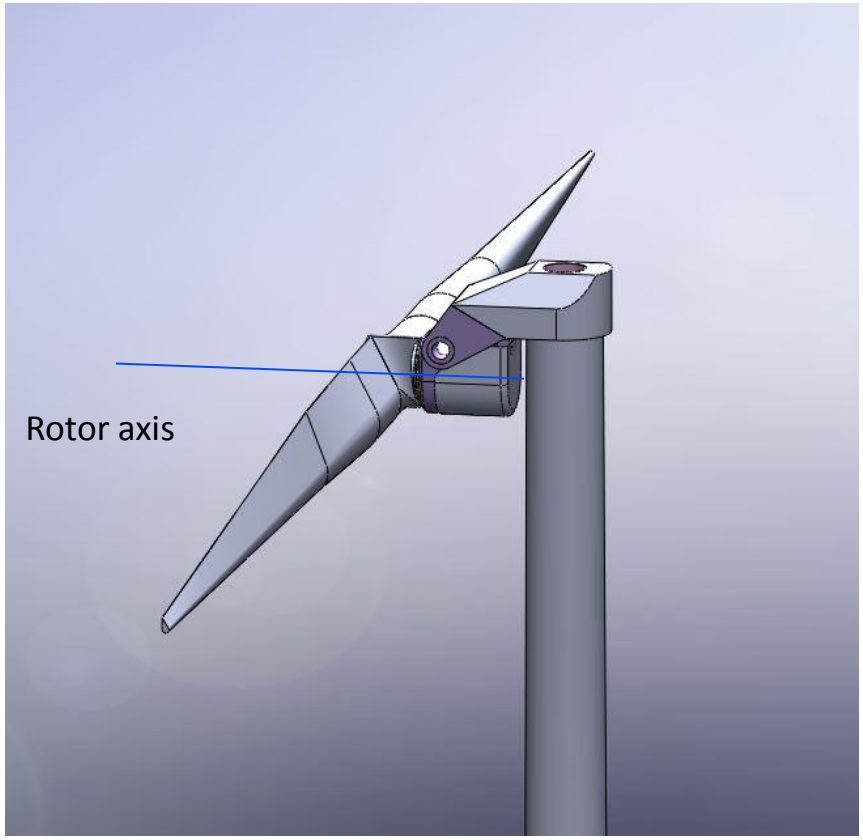
Renewable Power Plant

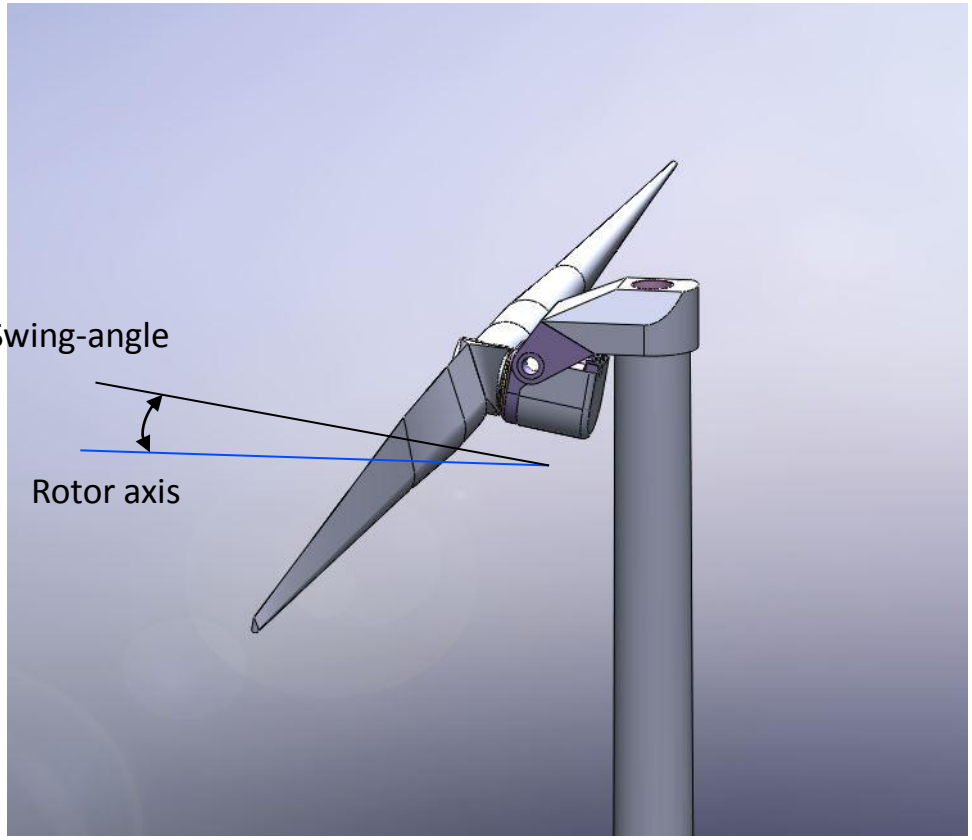


SkyWind Conzept

- SkyWind 3.4
  - Energy Converter
- SkyFormer
  - Grid Connection System
- SkyControl
  - Cluster Control
- SkyMount
  - Installation System for Tower and SkyLift
- SkyLift
  - Lift System for Service and Maintenance purposes

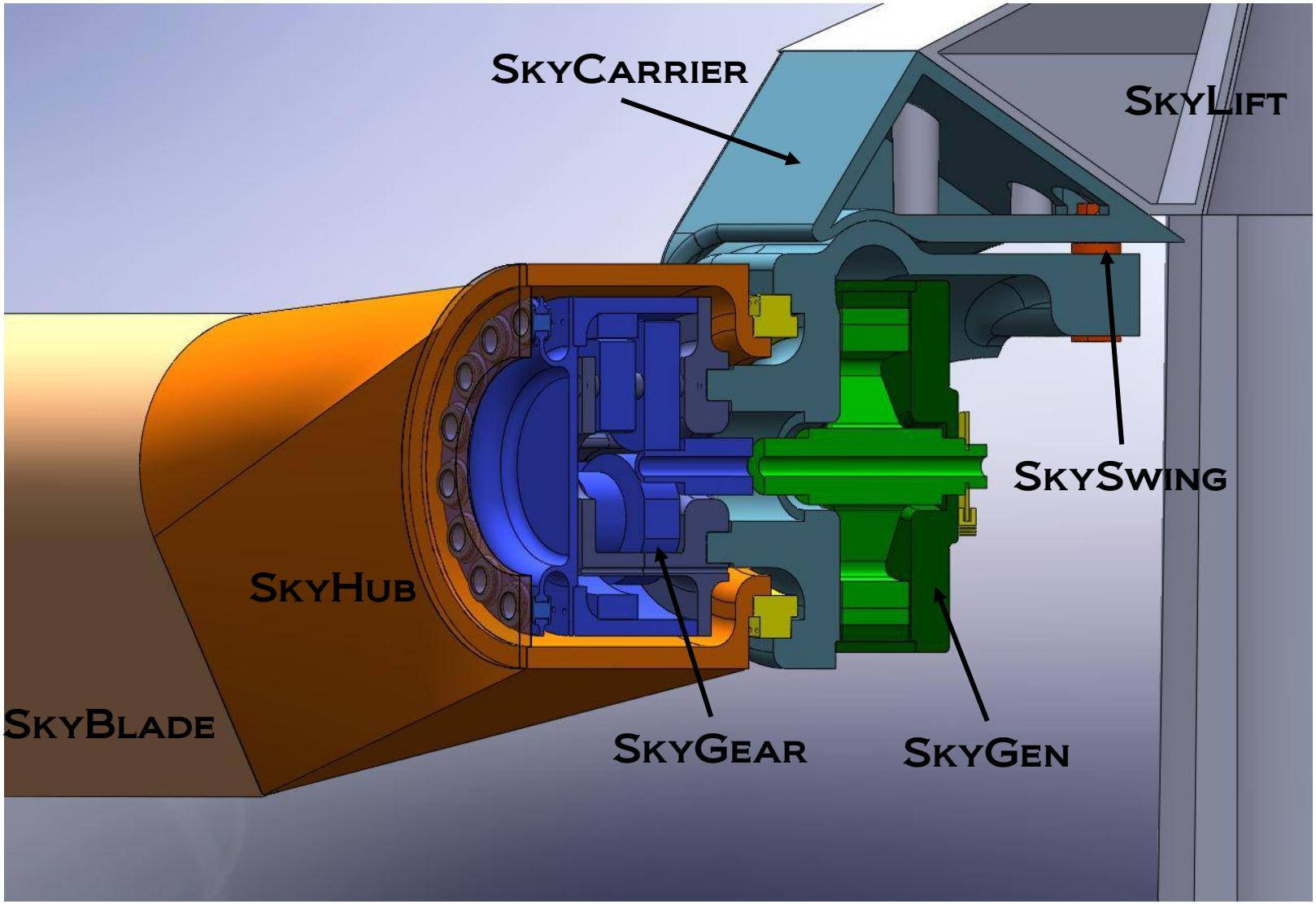
SkyWind Conzept





WEC with control of elastic cuppling to tower (**SkySwing**)

SkyWind 3.4 Design



Development tools

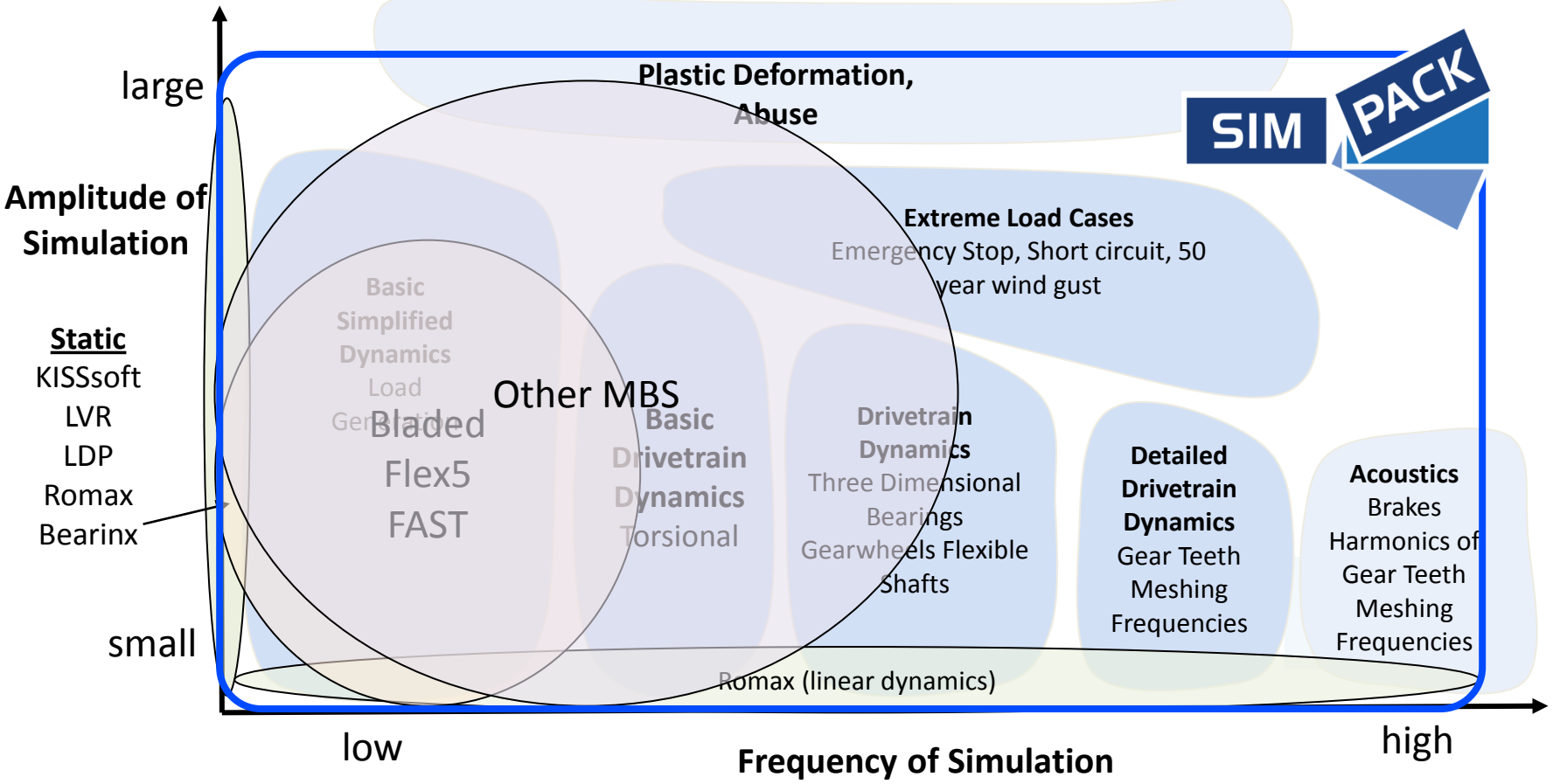
How can we develop such an new and complex system ?

Challenge is to calculate the dynamic behavior of the complete system:

- Aerodynamics of rotor blade
- Gearbox
- Generator
- Swing system
- Converter
- Control system

“Specialized” software for wind turbine development like Bladed or Flex5 offer advantages in terms of supporting a “smooth” certification process, but are more or less limited to existing technical solution

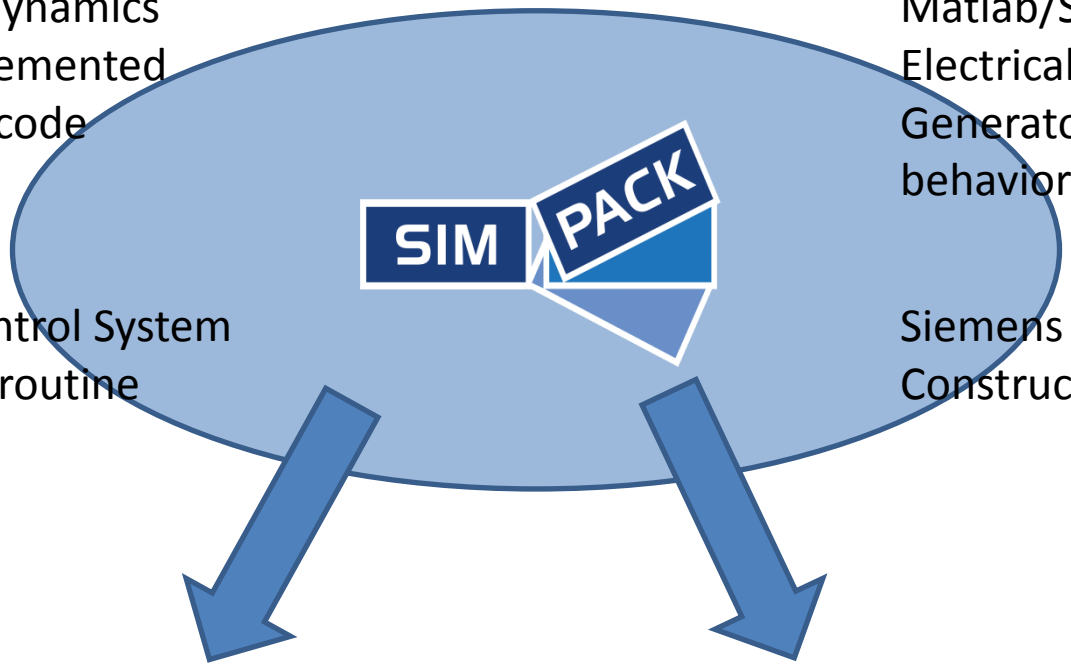
Wind Turbine Application Areas



as Key Tool in WEC Design

Rotor aerodynamics
BET as implemented
or external code

Matlab/Simulink
Electrical system
Generator and grid
behavior



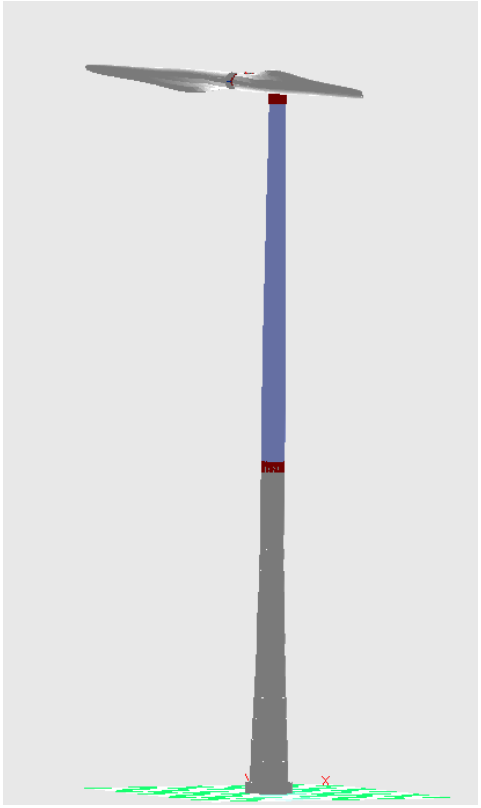
External Control System
as DLL user routine

Siemens NX and Nastran
Construction and FEM

Understanding of
dynamic behavior of
complete system

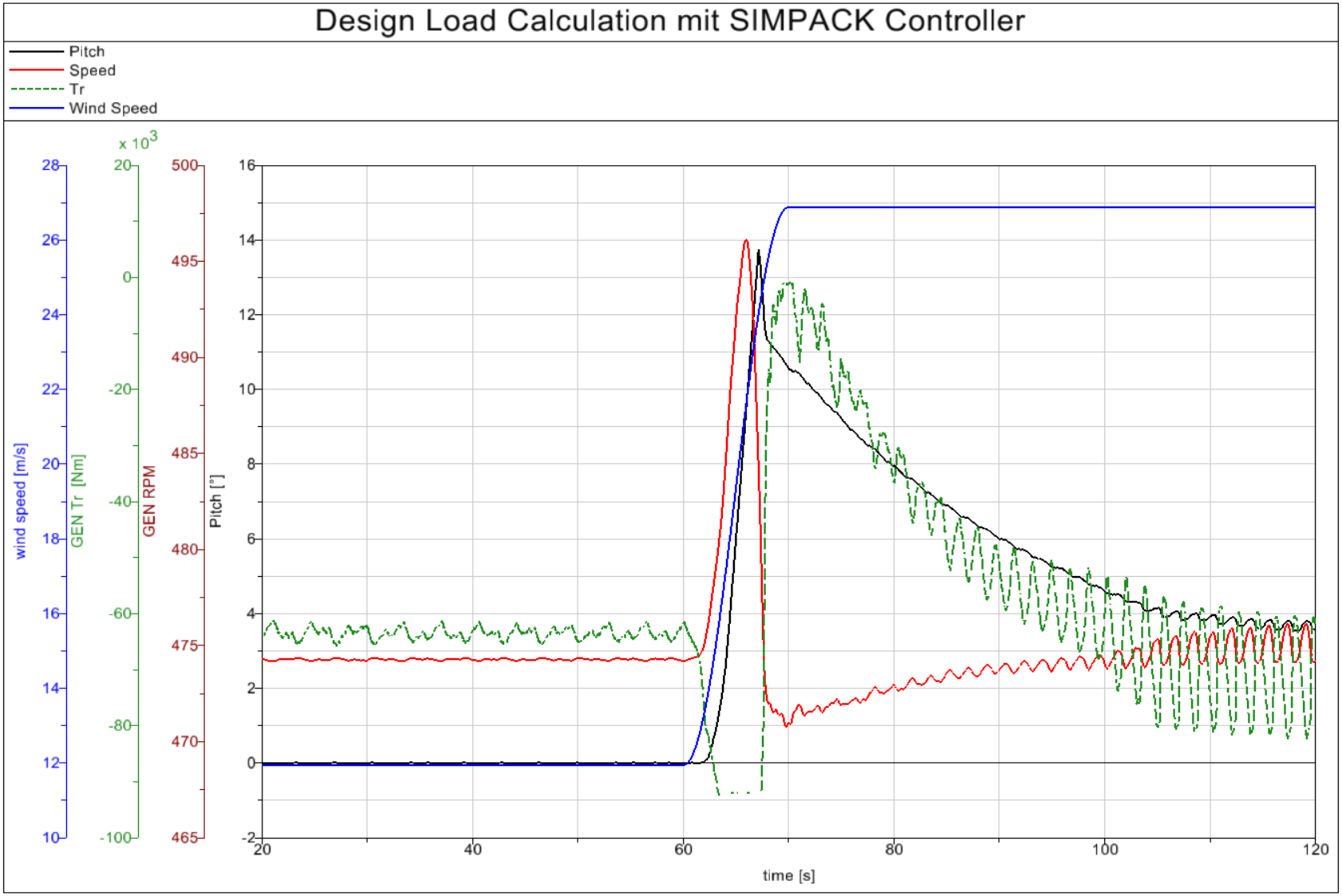
Loads from load cases
according to certification body

Model Topology

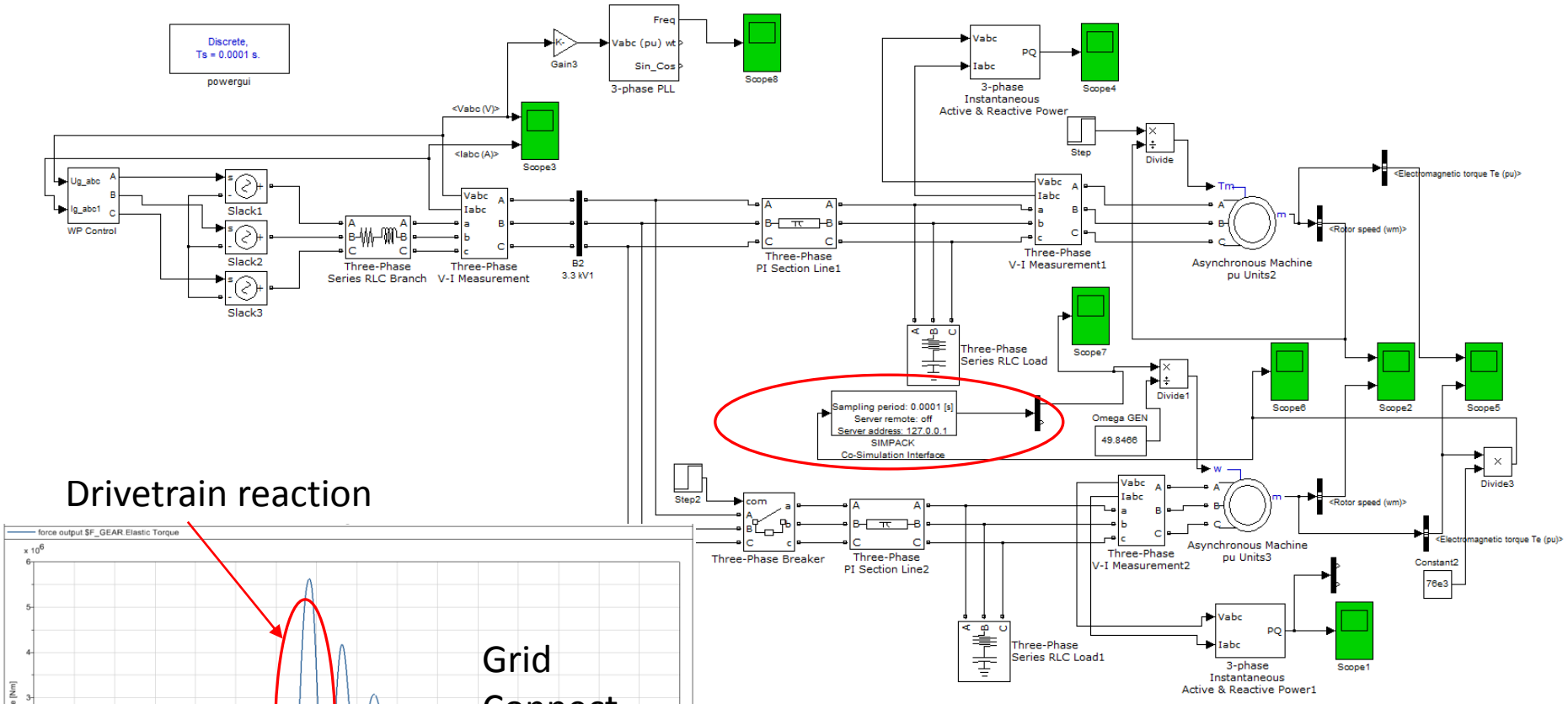


Rotorblade1
Pitch-Bearing1
0 DOF
Gamma (about z)
Rotorblade 2
Pitch-Bearing 2
0 DOF
Pitch Regler
Sky Hub
Main Bearing
Alpha (about x)
Sky Gear
Sky GEN
Generator Controler
Alpha (about x)
Hub Carrier
6DoF
Carrier Interface
Turbine Carrier
Nacelle Interface
0 DOF
1DoF: Gamma (about z)
Yaw-Bearing
Tower (Flexible Body) Steel-Part
0 DOF
Tower (Flexible Body) Concrete-Part
0 DoF
Foundation
6 DOF
FE 43:Bushing
Cx, Cy, Cz
Calpha, Cbeta, Cgamma

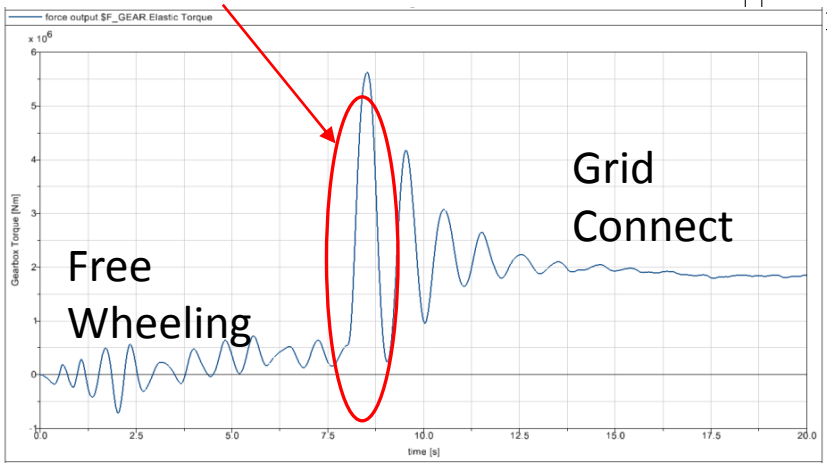
Simulation Results



Co-Simulation “SIMAT”



Drivetrain reaction



Summary

- “State of the art” simulates existing wind turbines with MBS software to understand the behavior of the turbine
- To design and evaluate new concepts efficiently, the complete system needs to be simulated with different levels of model quality
- Due to a combination of elastic components, need for accurate representation of rotor aerodynamics, need for specialized control mechanism and generator/grid behavior, simulation of an RPP system requires a flexible MBS software with excellent interfaces to other codes/routines etc.
- First simulations show the potential of SIMPACK to support the understanding of new WEC concepts and support a efficient design process
- Due to the great number of load cases which need to be calculated, model quality has to be adjusted according to calculation time
- Post processing capabilities of SIMPACK could be improved → SIMPACK 9.0 ?

Thank your for your attention

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