

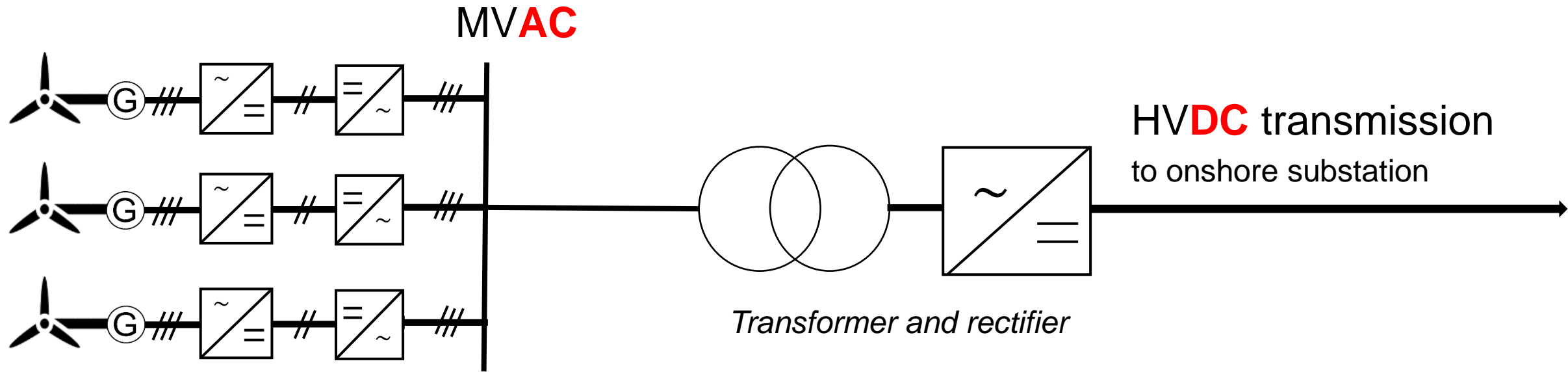
Alessandra Follo, Oscar Saborío-Romano, Elisabetta Tedeschi, Nicolaos A. Cutululis

Design and Control of All-DC Offshore Wind Power Plant with MMC-based High-Power Converters

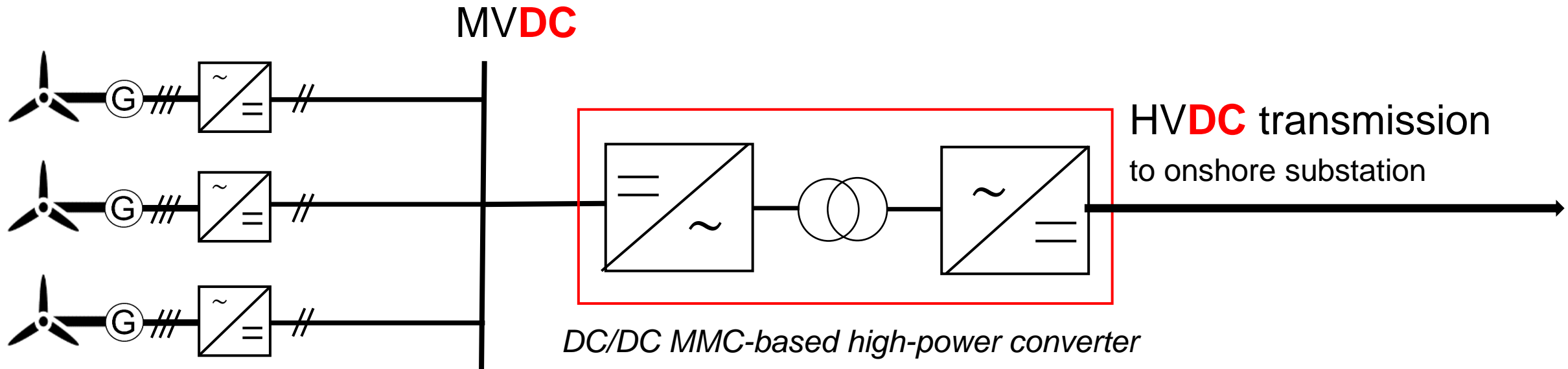
Outline

- Motivation
- All-DC offshore wind power plant design
- Coordinated control strategy
- Results
- Conclusion

Motivation – All-DC OWPP

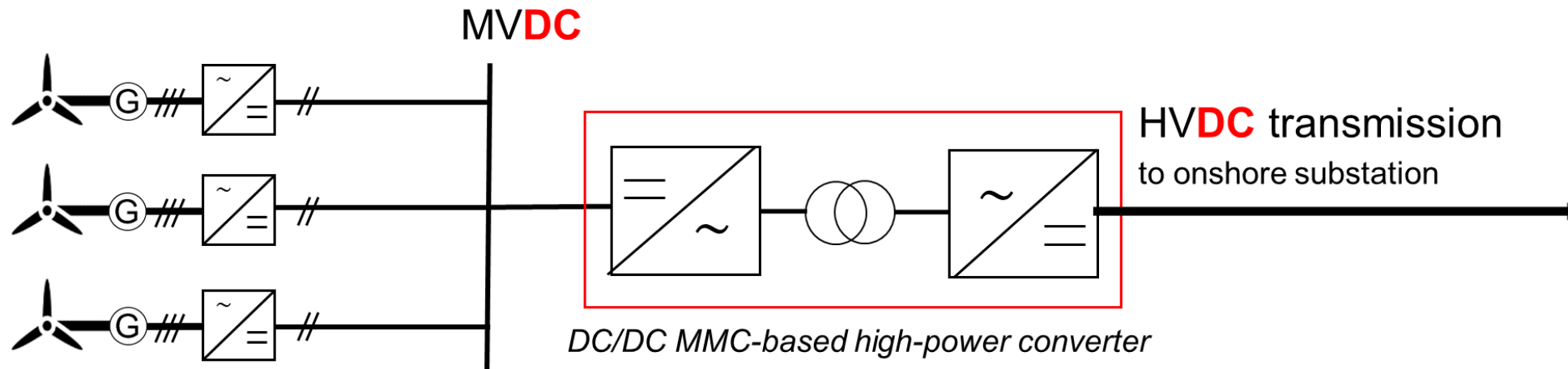


Motivation – All-DC OWPP

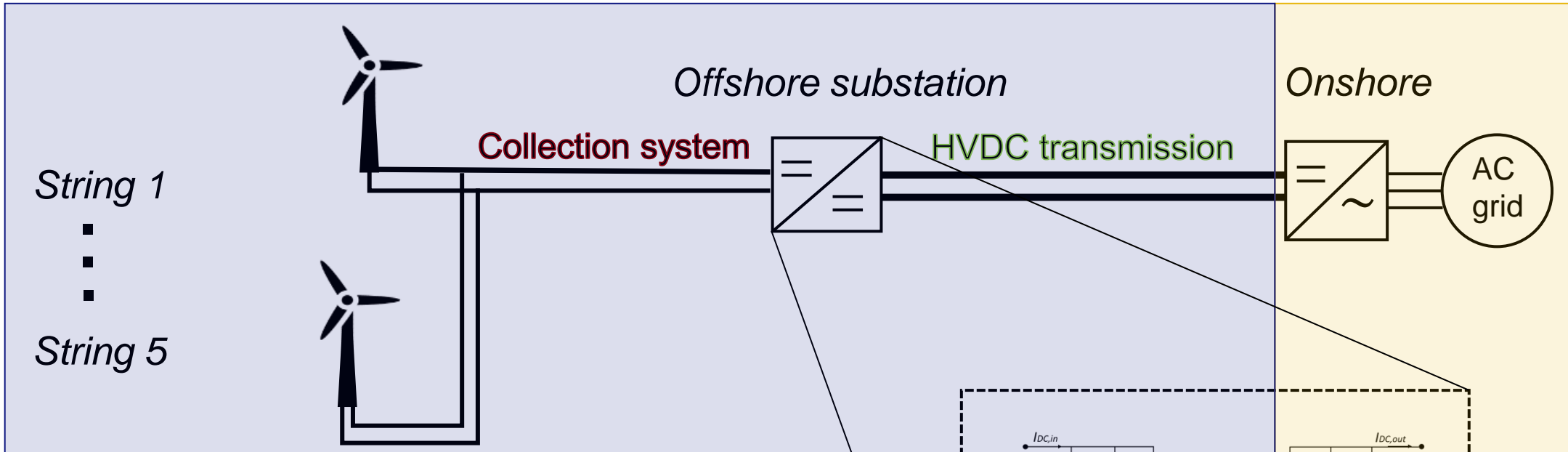


Motivation – All-DC OWPP with MMC

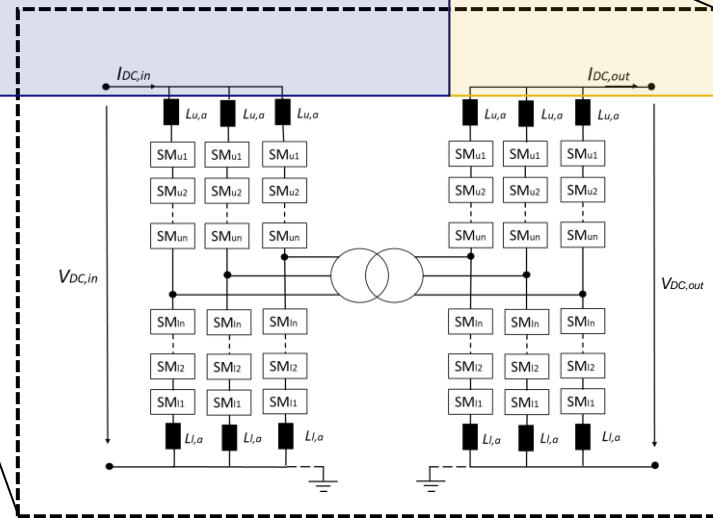
- OWPP size is increasing
- Need of converters fully controllable and capable of managing large power



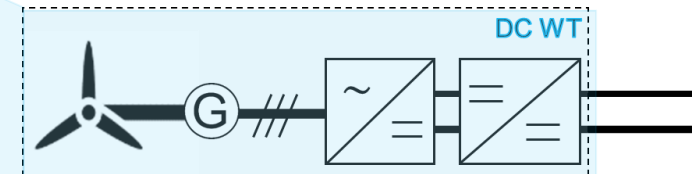
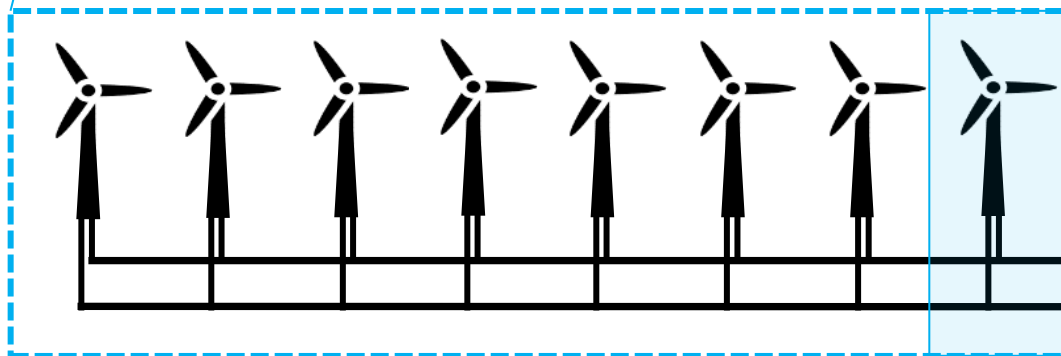
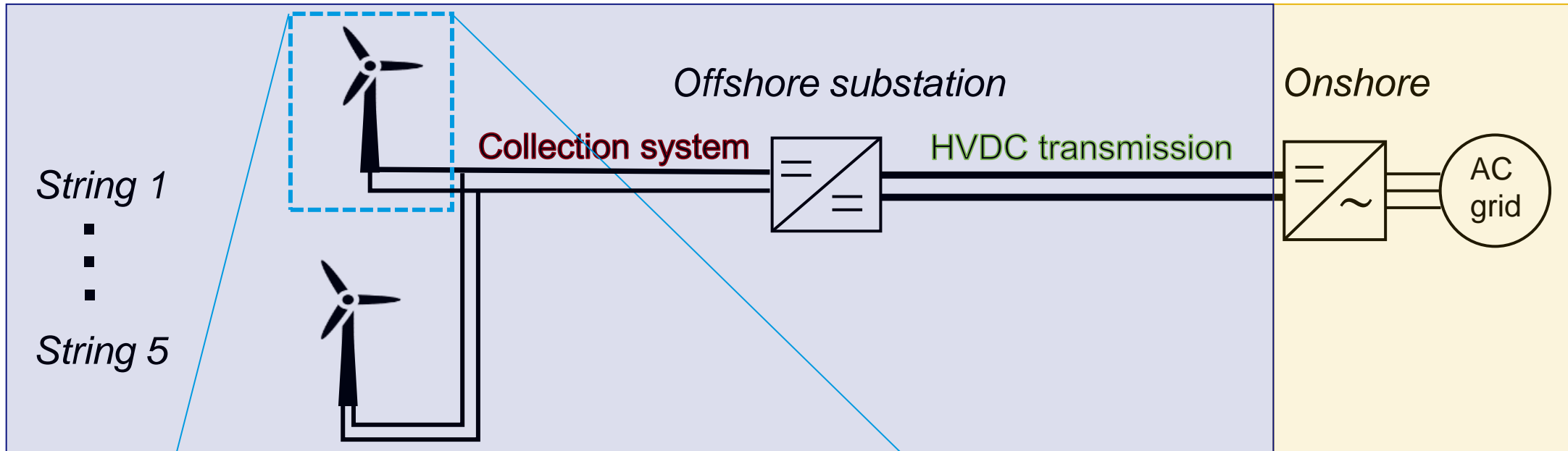
All-DC offshore wind power plant design



- Half-bridge sub-modules.
- MMC is modelled as average model converter.

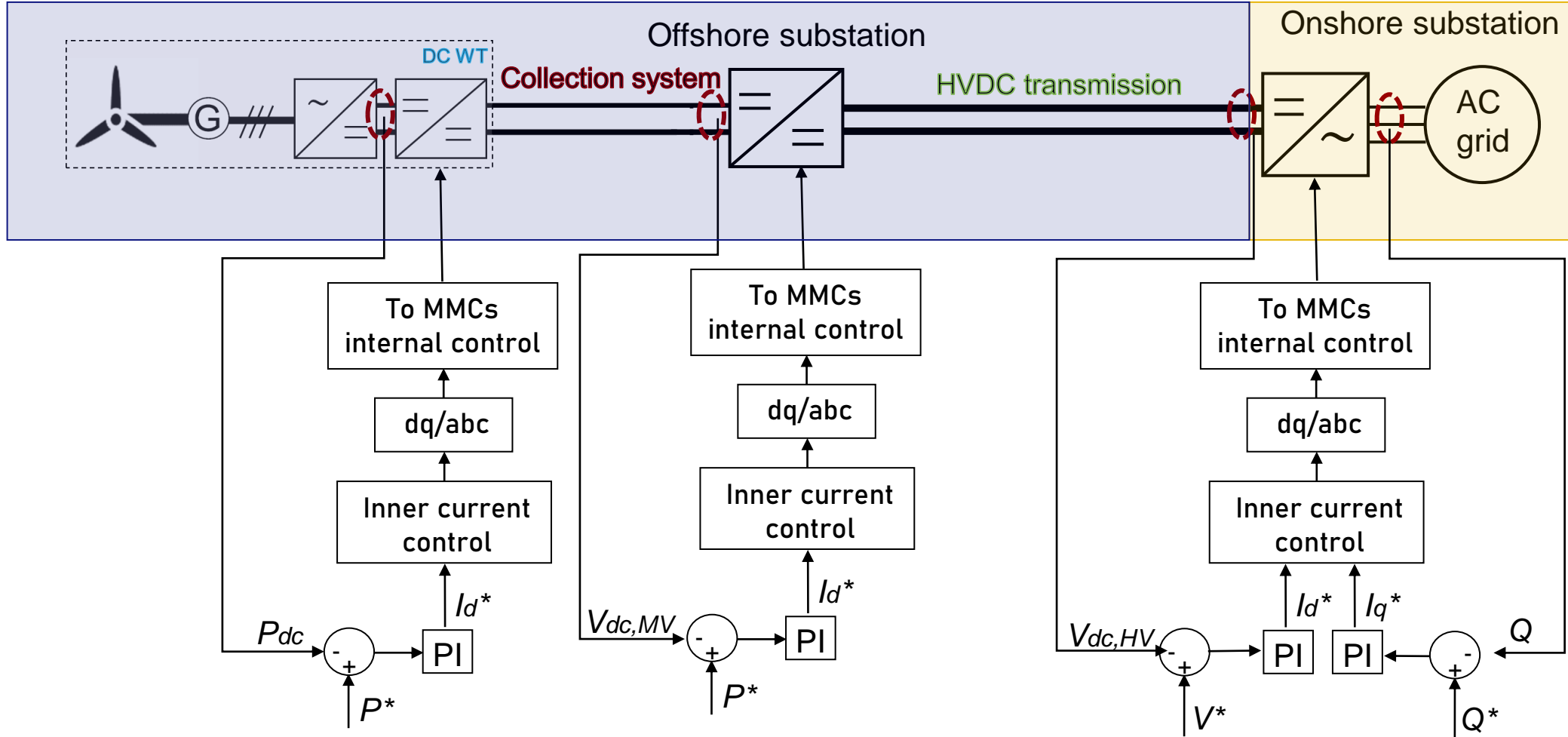


Simulation of 600MW all-DC OWPP

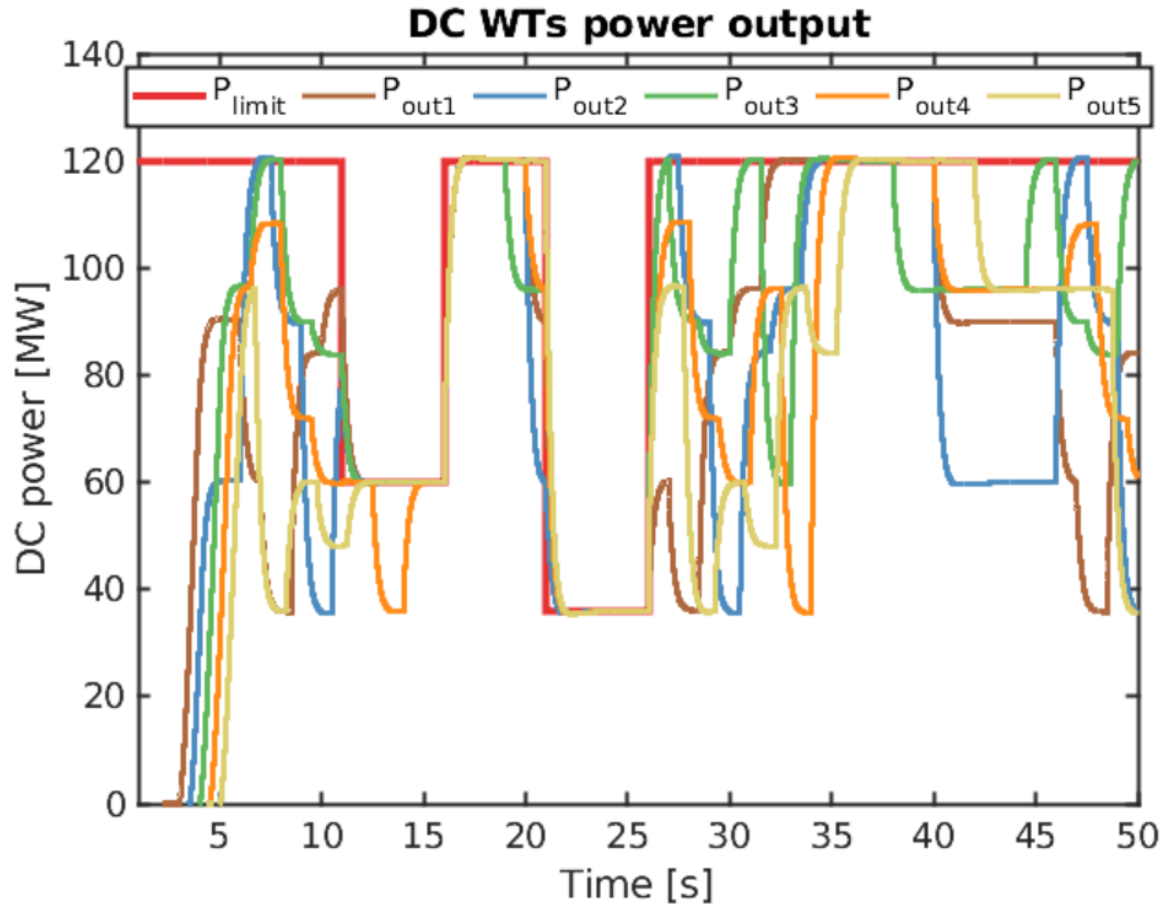
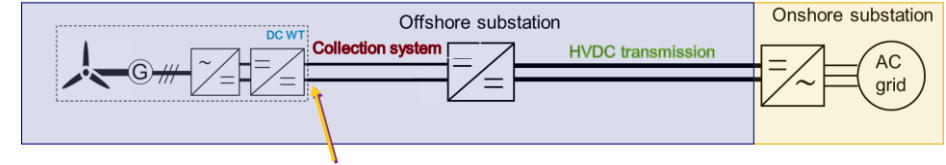


WT generator and AC/DC converter are modelled as current source.

Coordinated control strategy

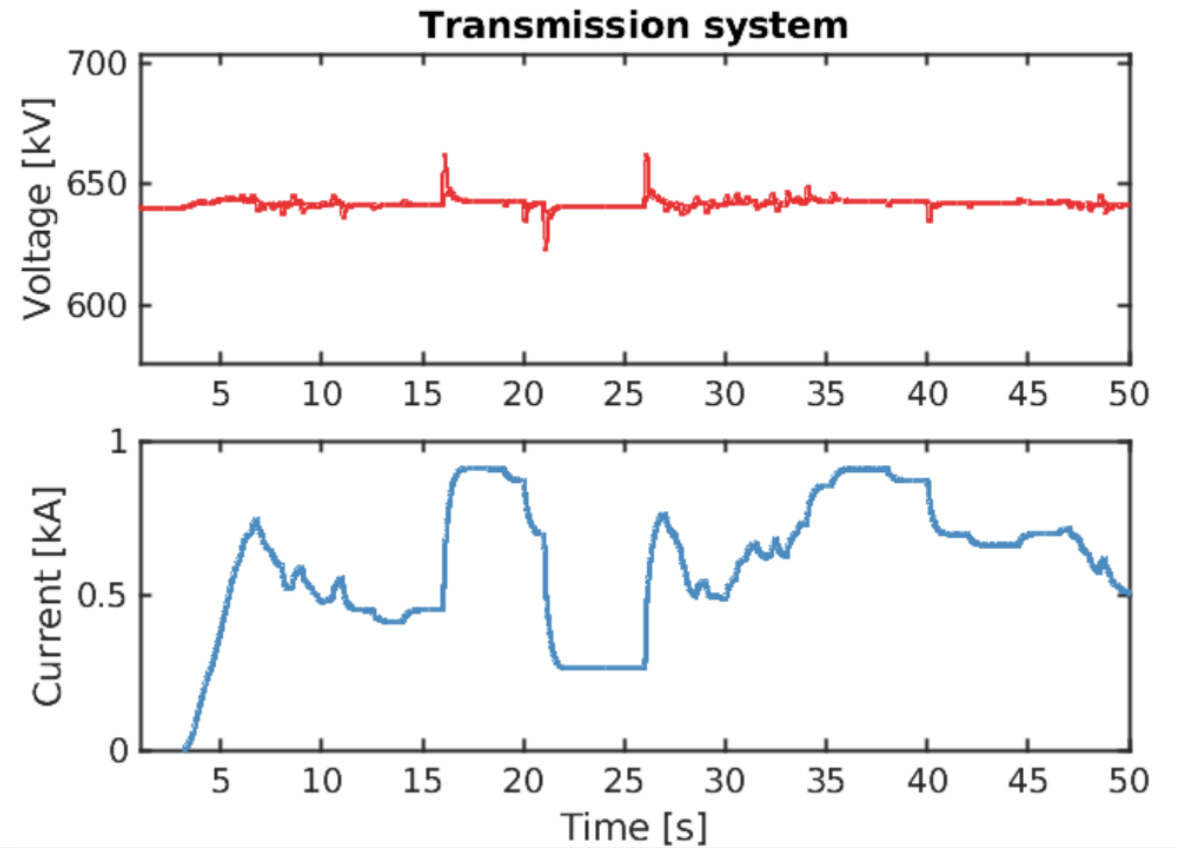
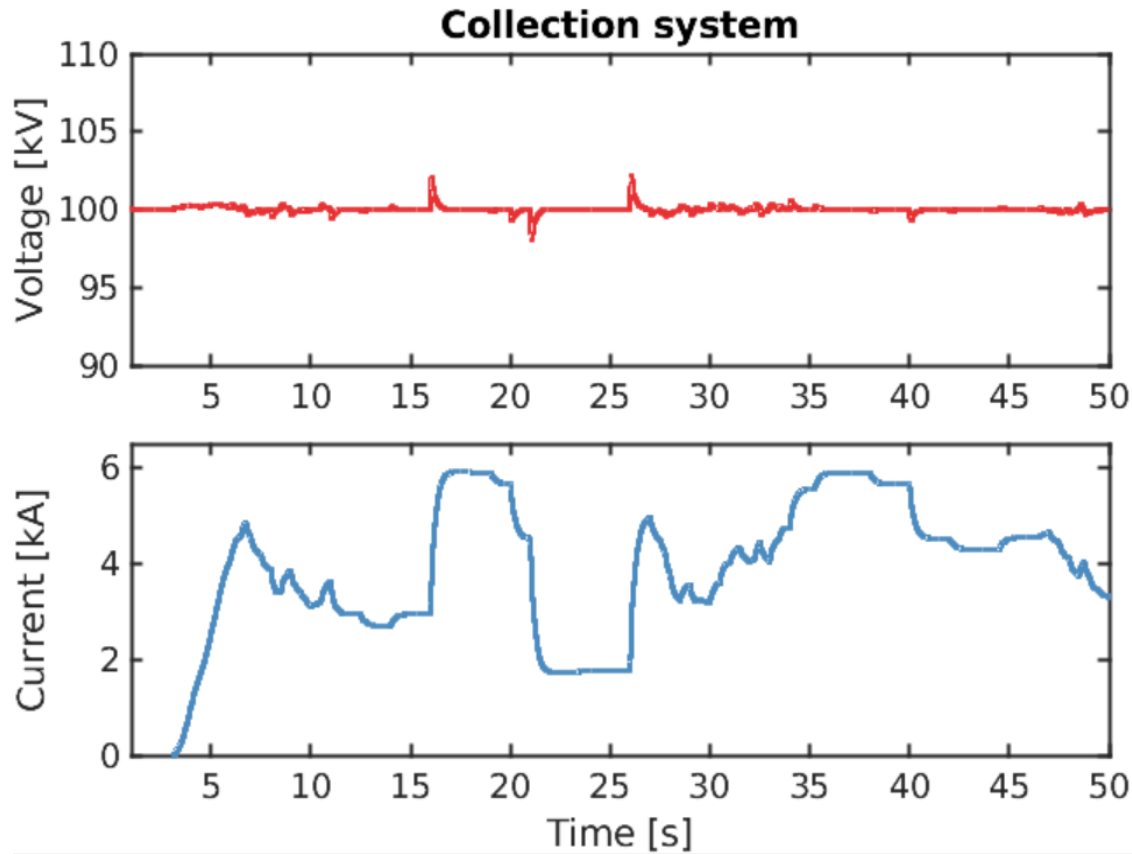


Simulation results – DC power



- Power output of individual WT string.
- Power limiter imposed on power output of WT strings.
- Rapid and large wind speed variations.

Simulation results – Control of DC links voltage



Conclusion

- All-DC OWPP topology with MMC-based high-power converters is feasible, even if it requires advanced control.
- Coordinated control strategy is effective with rapidly changing wind speed and large power variations, and it maintains the DC voltages within safety limits.
- Further research could look into response to transient phenomena.

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