Paris Session 2022

Bipolar VSC-HVDC: Impact of single-pole DC faults on healthy pole under weak AC network conditions

SC B4 – DC Systems and Power Electronics

PS1-2 – Fault Ride-Through & Clearing in VSC HVDC

- Question 1.4 -

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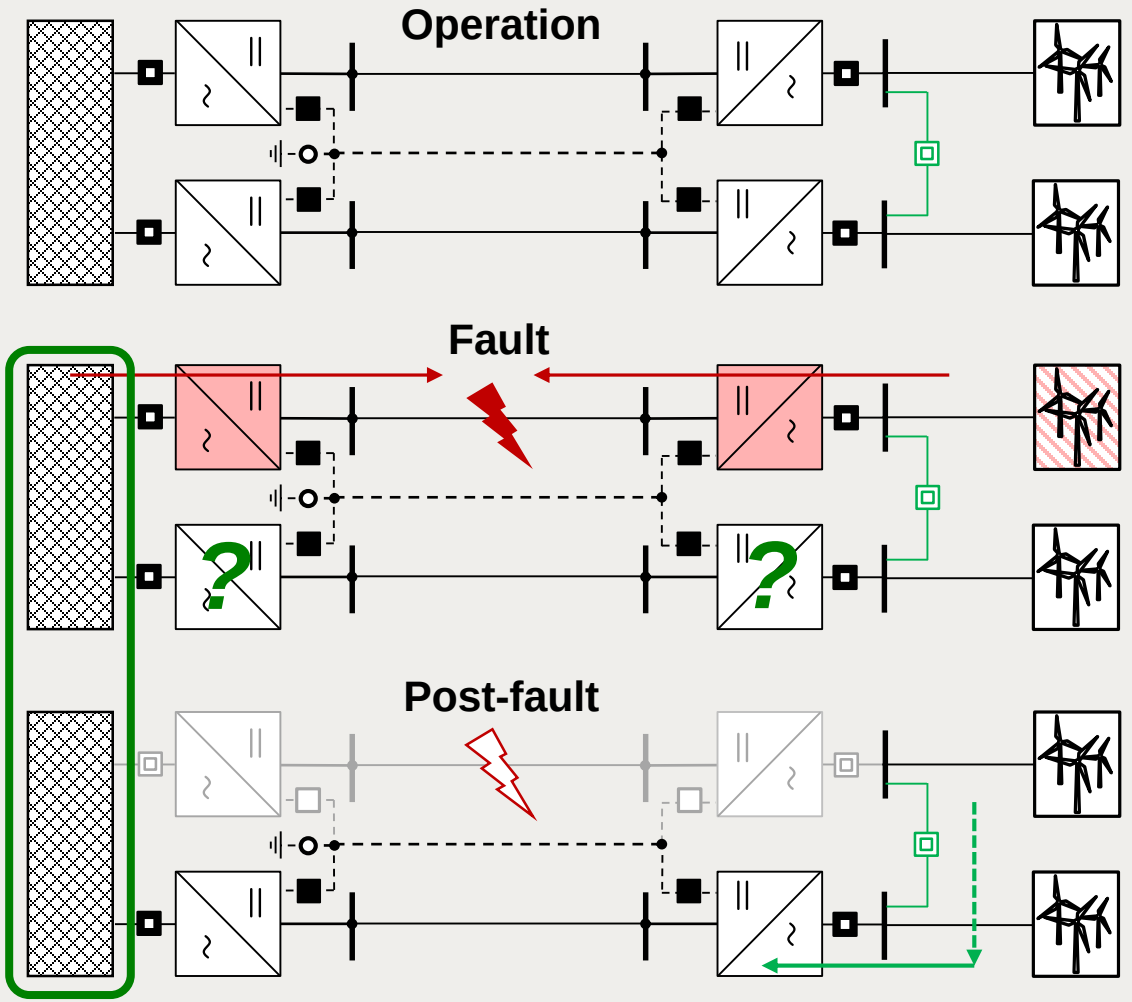
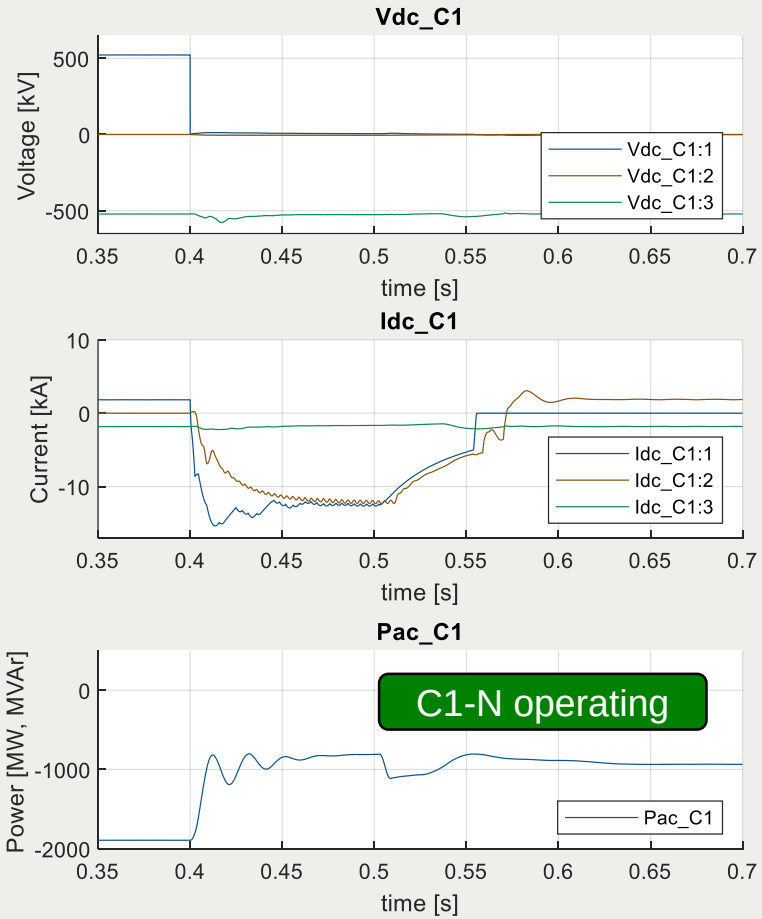
- ***Q1.4:*** *Impact of **reduced AC system inertia and short circuit level** on the **secure and reliable operation of HVDC converters**?*
- ***Q1.4:*** ***Design considerations** to support the **reliable operation of HVDC** in weak systems?*

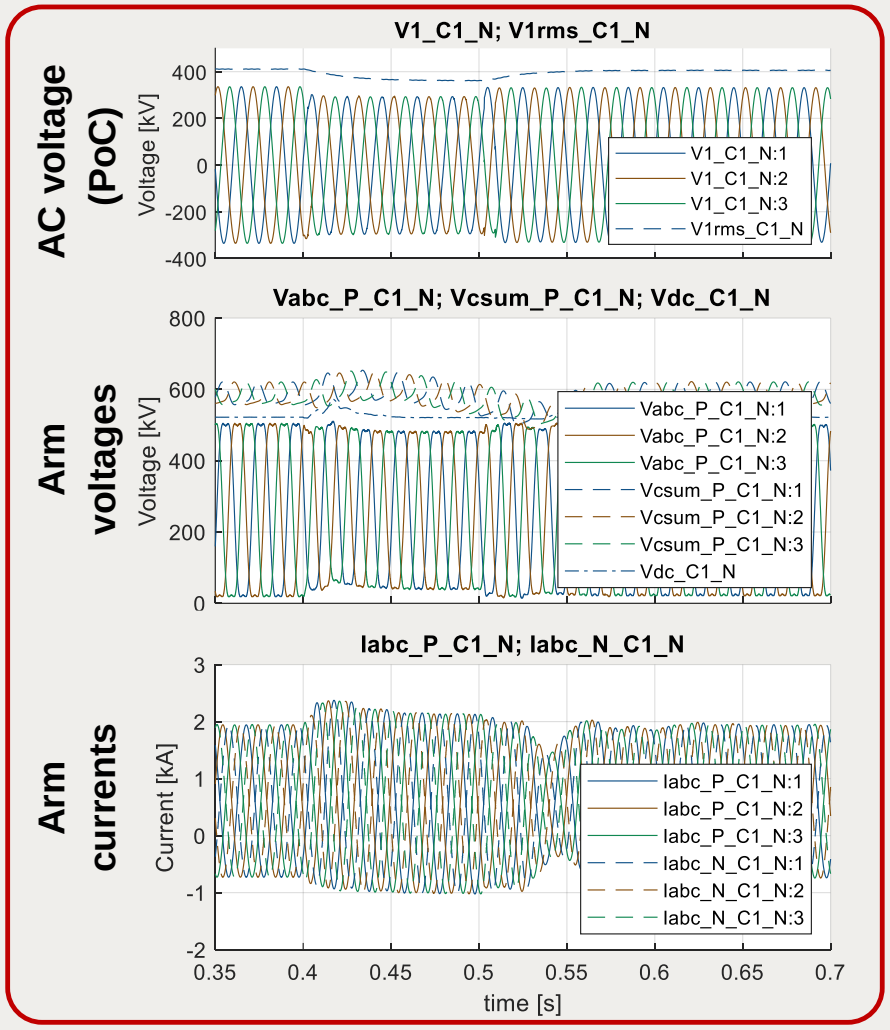
- Often proposed for increased reliability: **Bipolar VSC-HVDC** links (e.g. for **offshore wind farm** connection)
- Target: **Single-pole DC fault** should not lead to a disconnection of the other pole

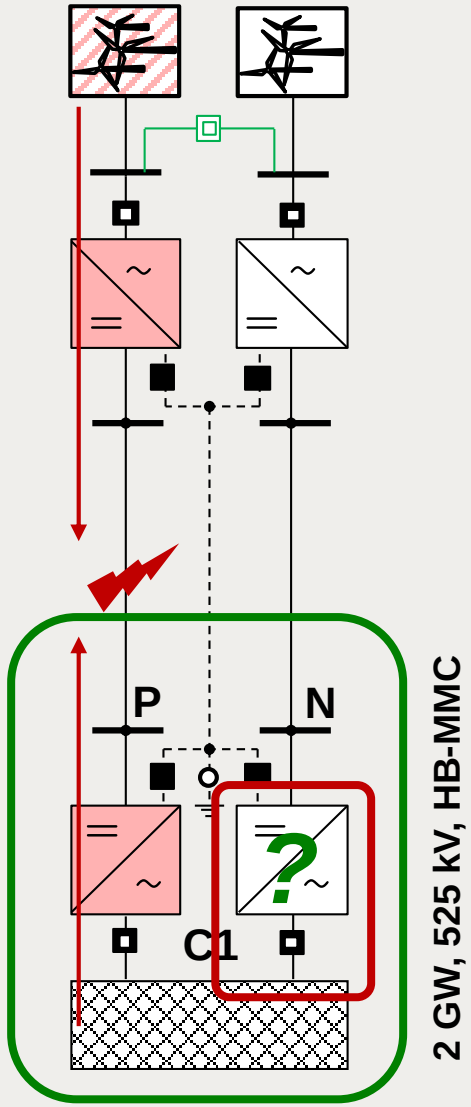
➢ **Investigated here:** Impact of AC network strength on pole coupling during faults



Bipolar VSC-HVDC: Impact of single-pole DC faults on healthy pole under strong (30 GVA) AC network conditions



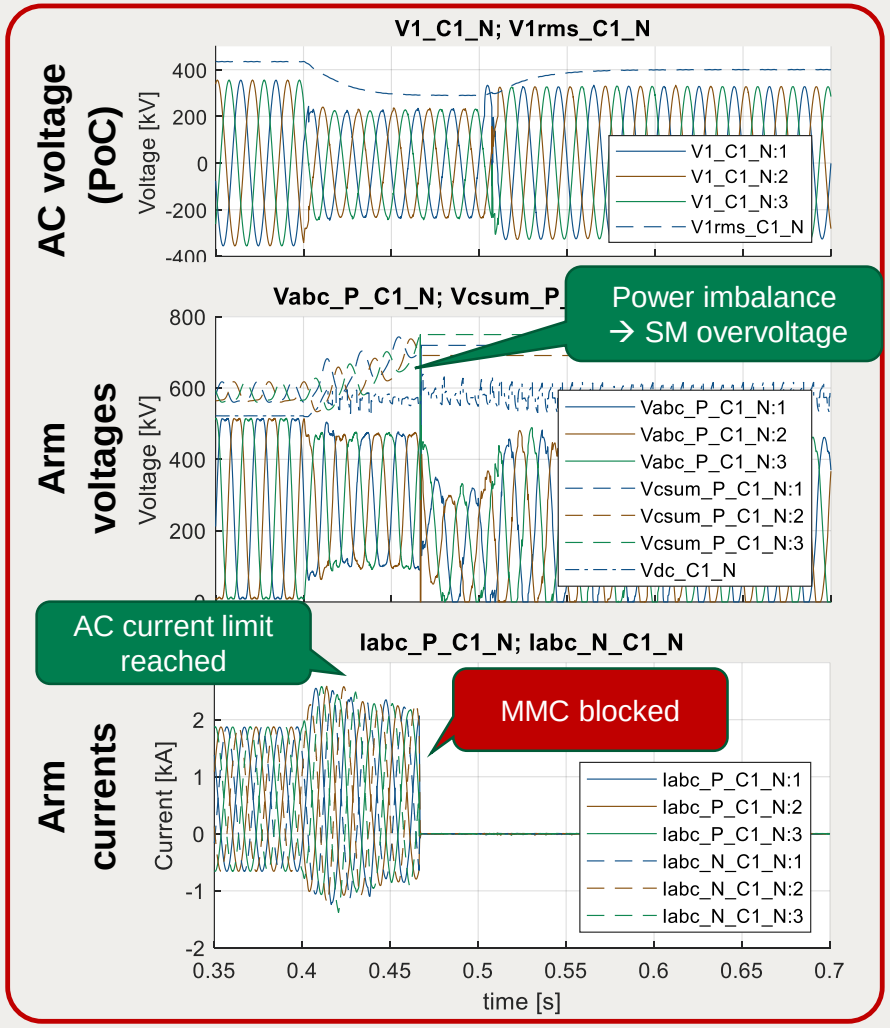


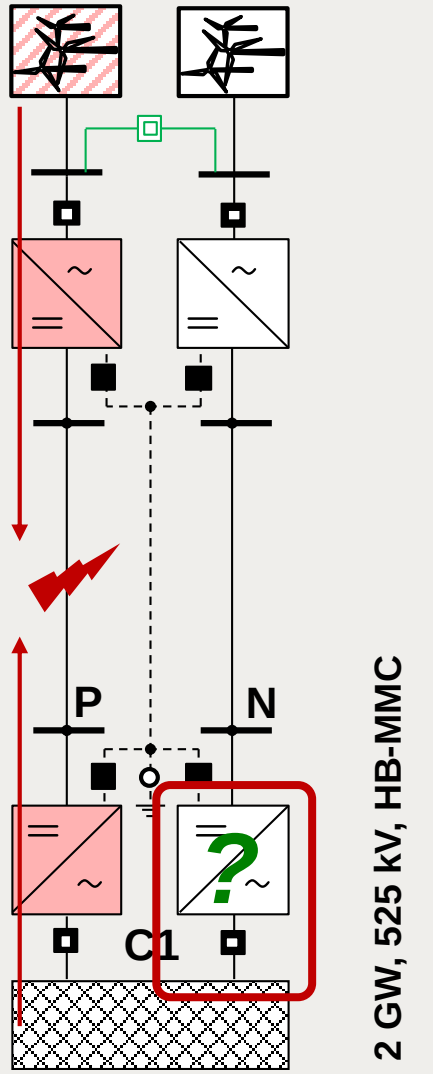


Bipolar VSC-HVDC: Impact of single-pole DC faults on healthy pole under moderate/weak (7.5 GVA) AC network conditions

- **Observed for weak AC networks: Healthy pole MMC blocks due to AC-side interactions caused by DC fault**
- **Thus: To achieve expected or desired reliability/redundancy of bipolar HVDC system → further measures required**

- **Possible mitigation strategies:**
  - Coordinated use of DC chopper
  - Adapted converter design/control
  - Use of fault-blocking converters (FB, hybrid HB/FB, etc.)
- **Further challenges:**
  - Power loss in multi-terminal HVDC
  - Interactions on offshore side (very weak grid) in case that P- and N-pole windfarms are coupled
  - Grid-Forming MMCs → interactions following DC faults?





Group Discussion Meeting