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# HVDC REPLICAS

## A suppliers view on different solutions.


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HUGM RTDS USER'S GROUP MEETING

2024 EUROPE USER'S GROUP MEETING

DELFT, NETHERLANDS

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# Replicas and usage

1. Background
2. Replica types and purpose
3. Replica size
4. Additional replica demands
5. Looking on the future



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# 1. Background

## De-risking HVDC projects

**Previous:**

Only offline models supplied to customer

Customer training during FST and commissioning

**Now:**

Same as above, and:

Replica requested in >50 % of all projects (requirement varies depending on planned usage, see next slides)

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# Replica purpose

1. System studies
2. Verification of code changes
3. Maintenance training
4. Operator training
5. Cyber security patch testing

# System studies

Study replica.

1. No redundancy
2. C&P main computers
3. Valve control
4. Minimized I/O boards and cubicles
5. No AUX system computers or I/O
6. Minimized SCM

# Verification of code changes

Study / Verification replica.

1. No redundancy
2. C&P main computers
3. Valve control
4. a. Minimized I/O boards and cubicles
   b. Additional types of I/O one/type
5. a. No AUX system computers or I/O
   b. AUX computers no I/O cubicles
   c. AUX computers and I/O
6. Minimized/Full SCM

# Maintenance training

1. Redundancy
2. C/P computers
3. Valve control
4. I/O Full
5. AUX computers and I/O
6. SCM full

# Operator training

Operator training can be done in all the different replica solutions.
If the purpose is to only train operators a Training Workstation (TWS) solution is more cost effective.

The Training Workstation (TWS) is not using a RTDS and has a limited dynamic response.

1. C/P Main Computers
2. SCM system
3. External PC for dynamic and control feedback

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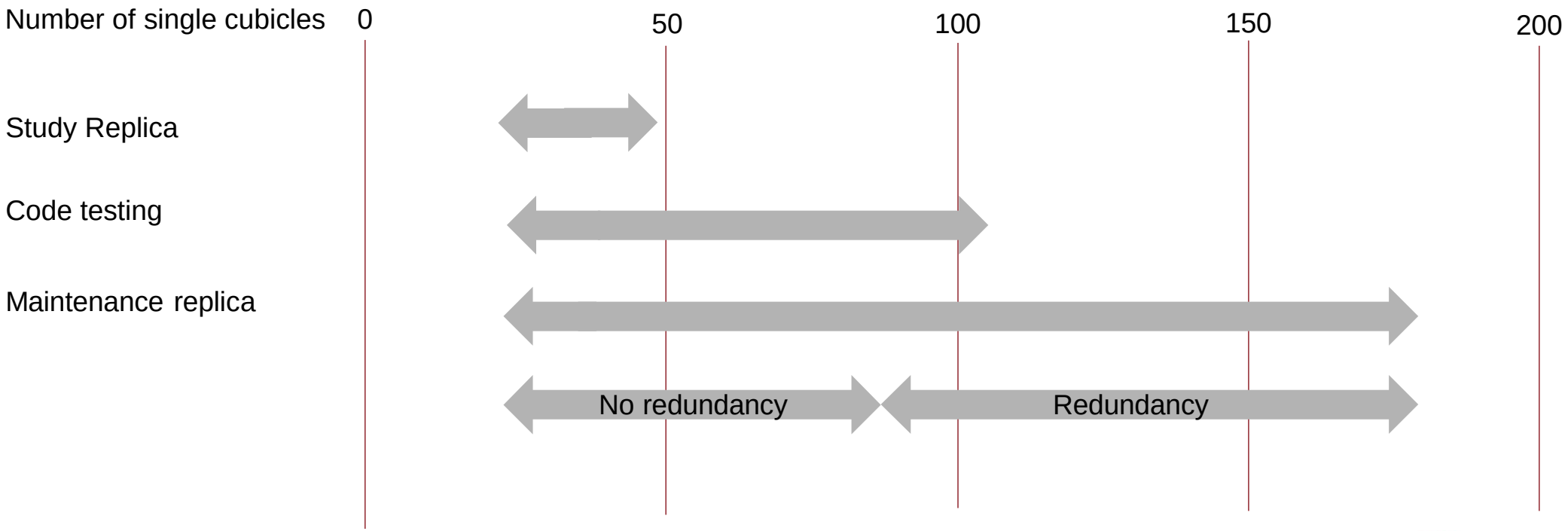
# 3. Replica size one bi-pole station



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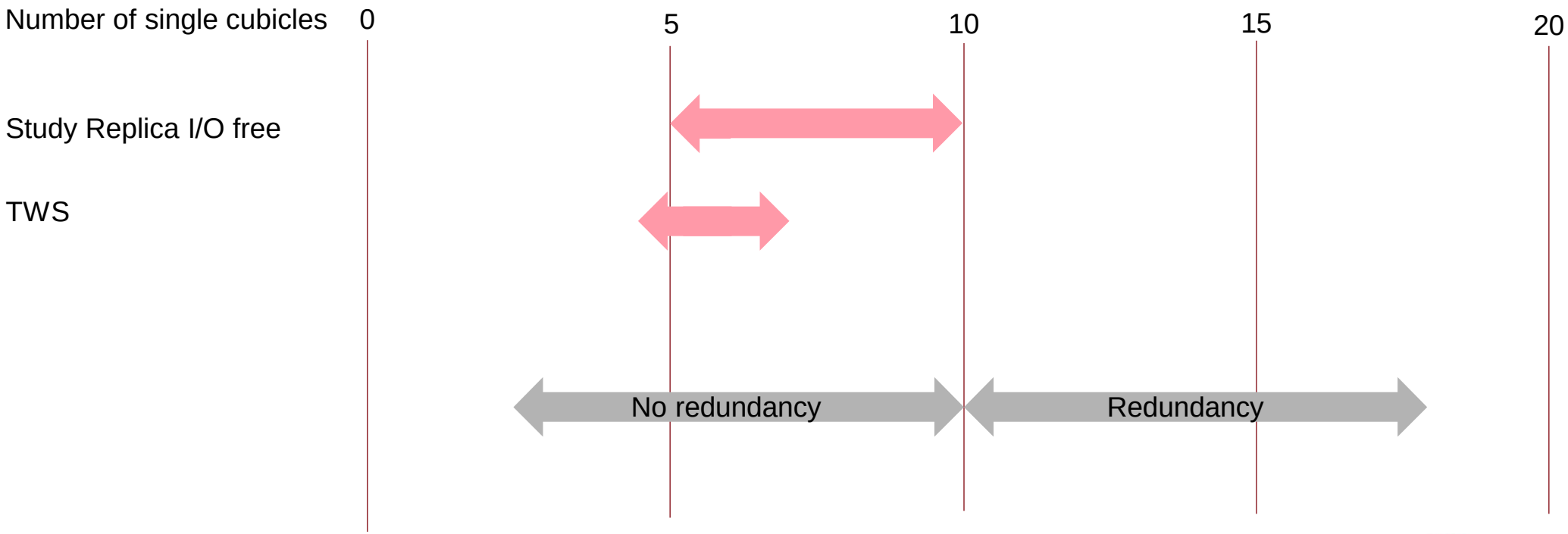



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# 4. Additional replica demands

Additional demands that will add complexity in a replica solution.

External communications

Telecom cubicles

External TFR system

Possibilities for current injection testing

External IEDs

Platforms systems in offshore wind projects

# 5. Future of replicas

| | |
|---|---|
| **I/O free** | Very slim replica for studies that can be used to test changes in the Main applications and also to train operators in how to control an HVDC link. |
| **HIL** | HIL real time simulation will continue to be an important part of HVDC projects for testing of the whole C&P system in FST. |
| **New alternatives** | Different solutions for different needs, not “one fits all”<br><br>More scalable setups required for future grids |

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# Questions