university of groningen

kvi - center for advanced radiation technology

Cooling for EMC digitzers;

EMC Readout.

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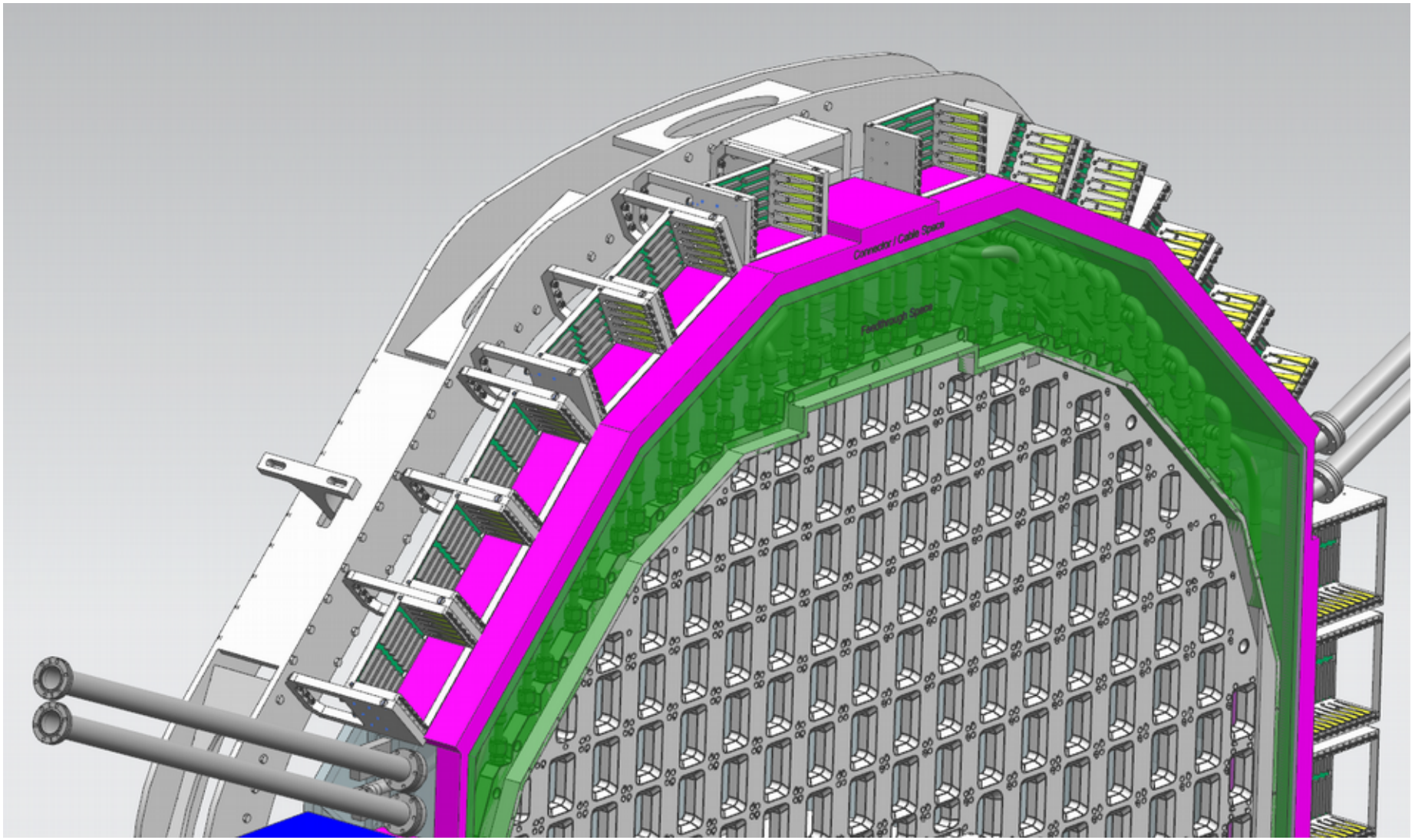
for the PANDA collaboration

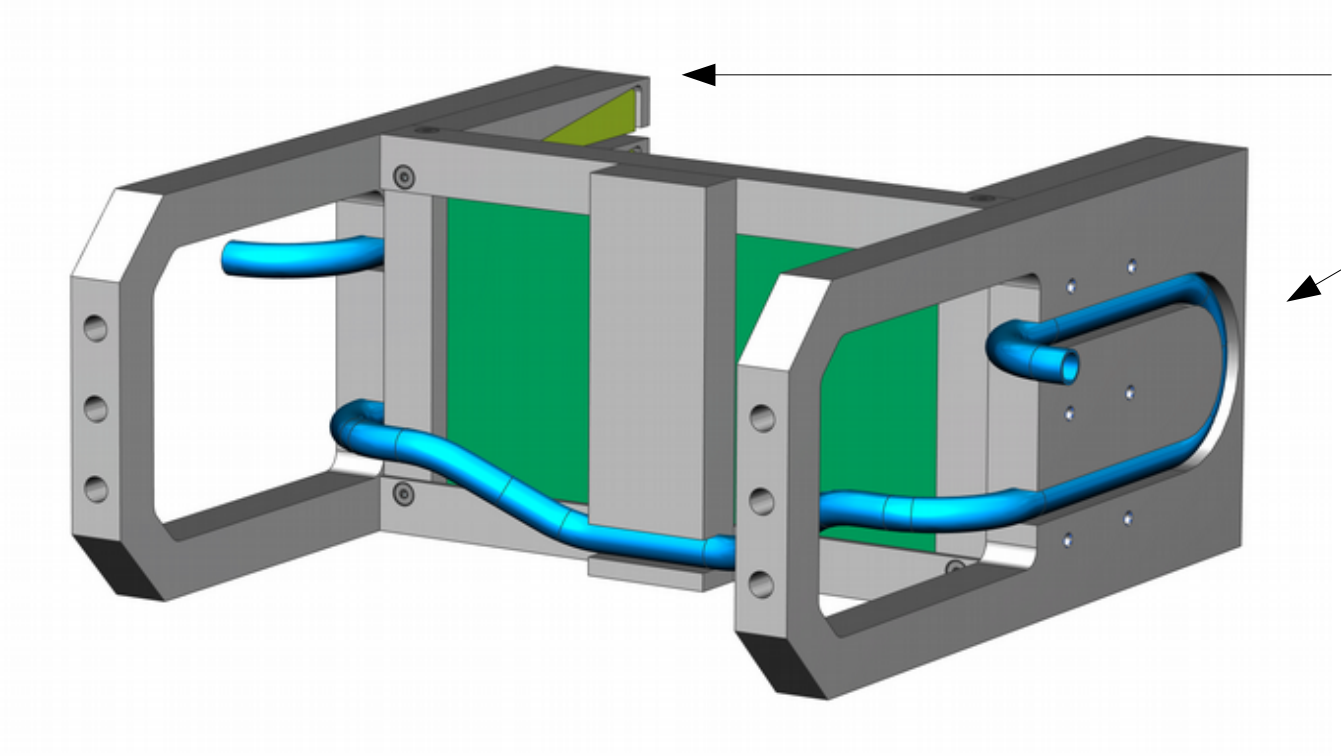
Digitizers for the Fw. End-cap



About 217 digitizers in 22 water-cooled crates

Crate Cooling

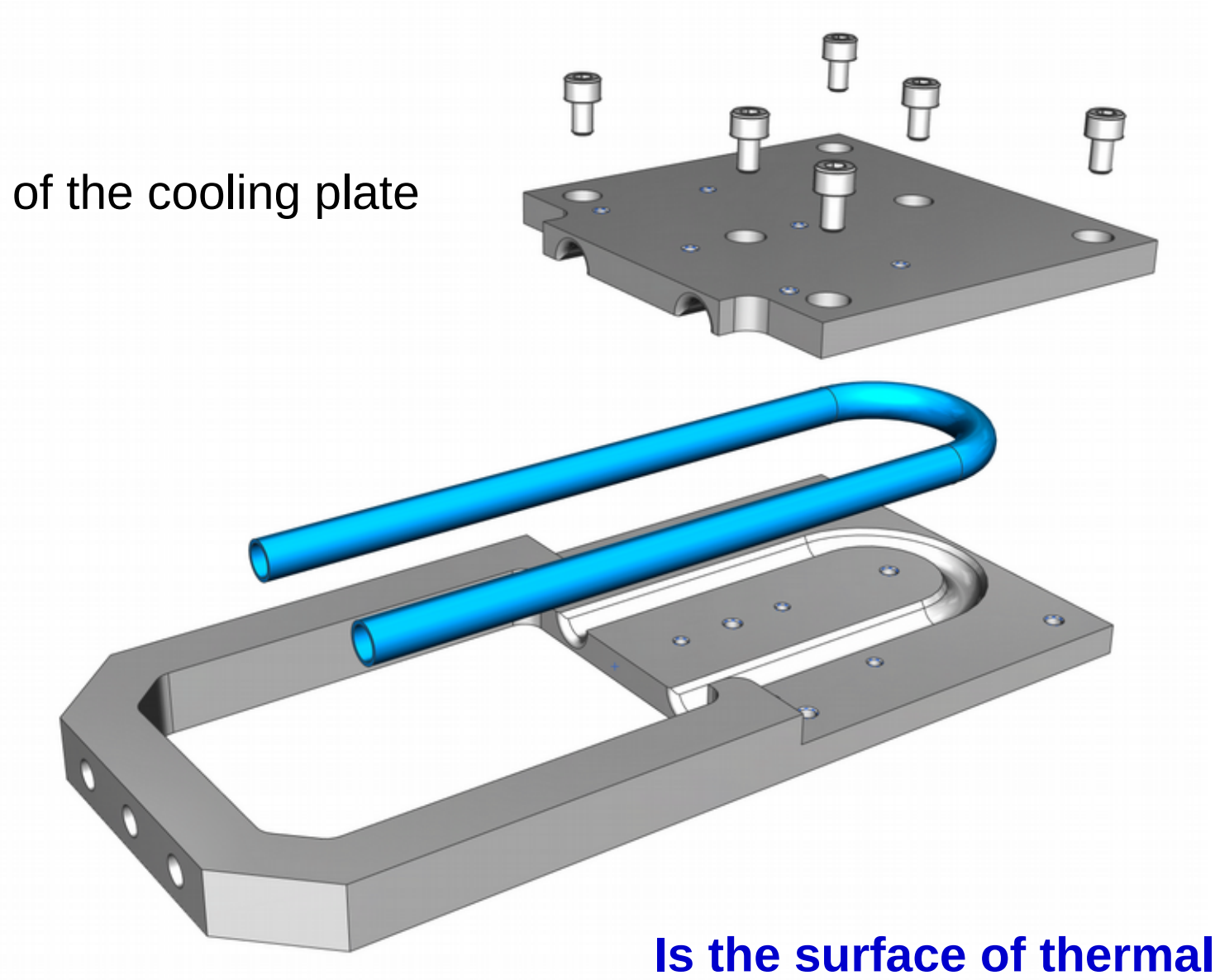
Back view of the crate



Can a single aluminium pipe can be used to cool several crates (avoid joints)?

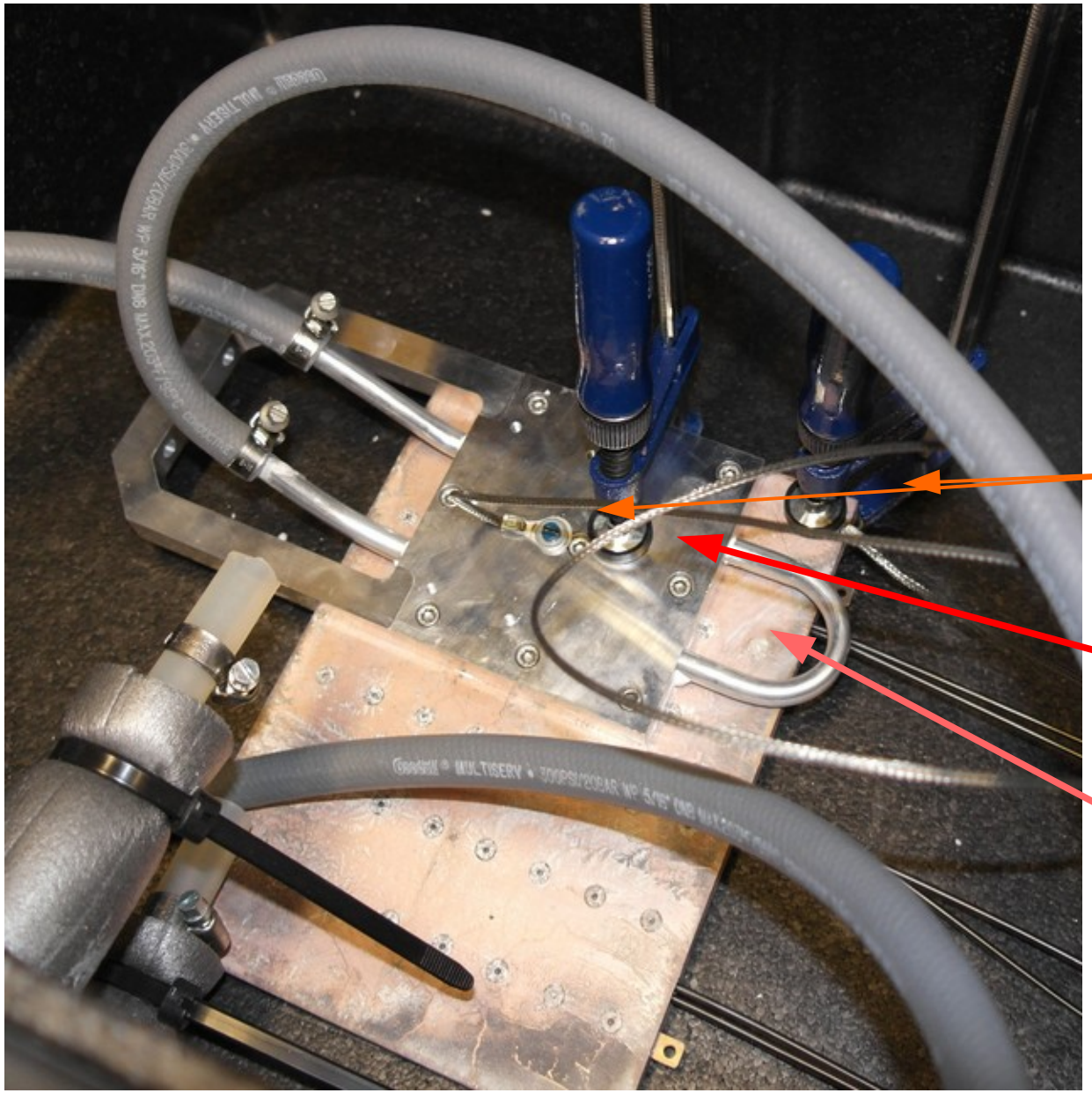
Crate Cooling

Design of the cooling plate



Is the surface of thermal contact between the pipe and the plate enough?

Test Set-up



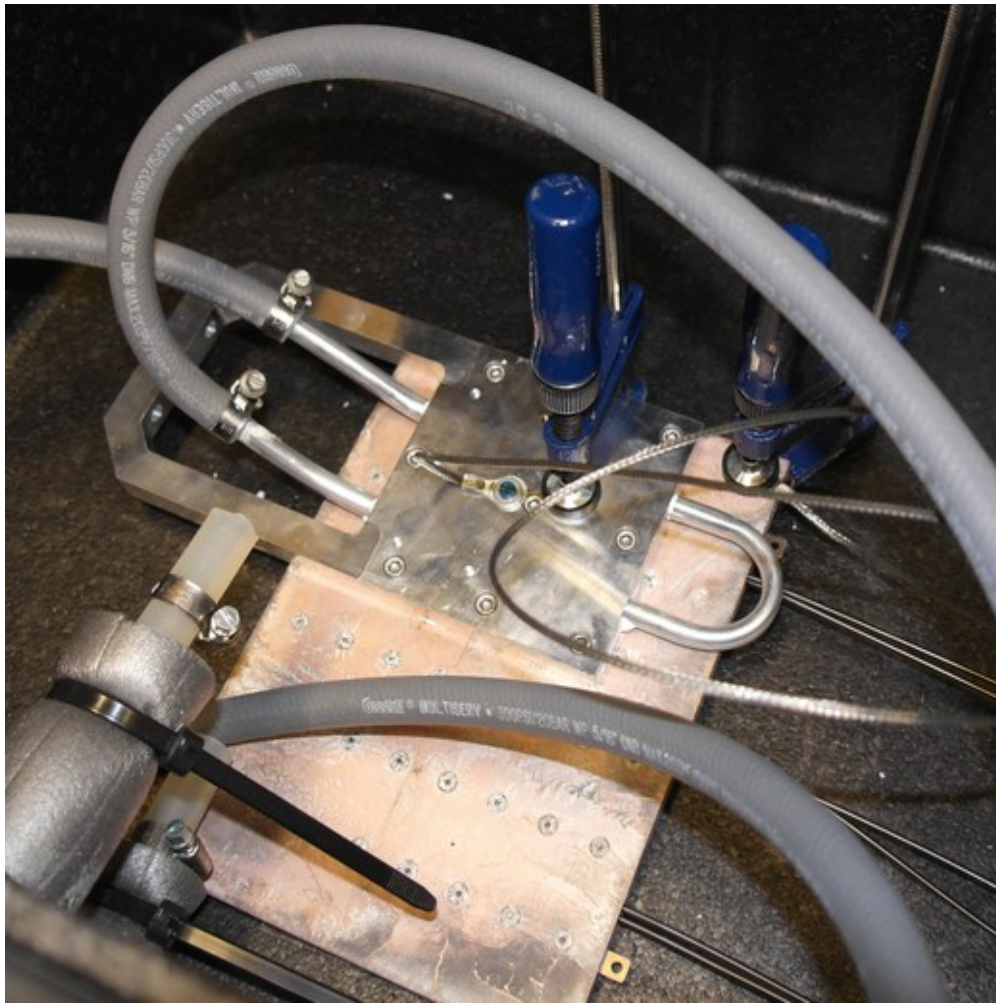
Temperature sensors

Cooling plate

Heating plate (~250 W)

Water flow: ~0.04 l/s
Re ~ 5600 (turbulent flow)

Measurements



- T_{in} = 13 ºC
- T_{out} = 13 ºC
- T_{heater} = 40 ºC
- T_{plate} = 28 ºC

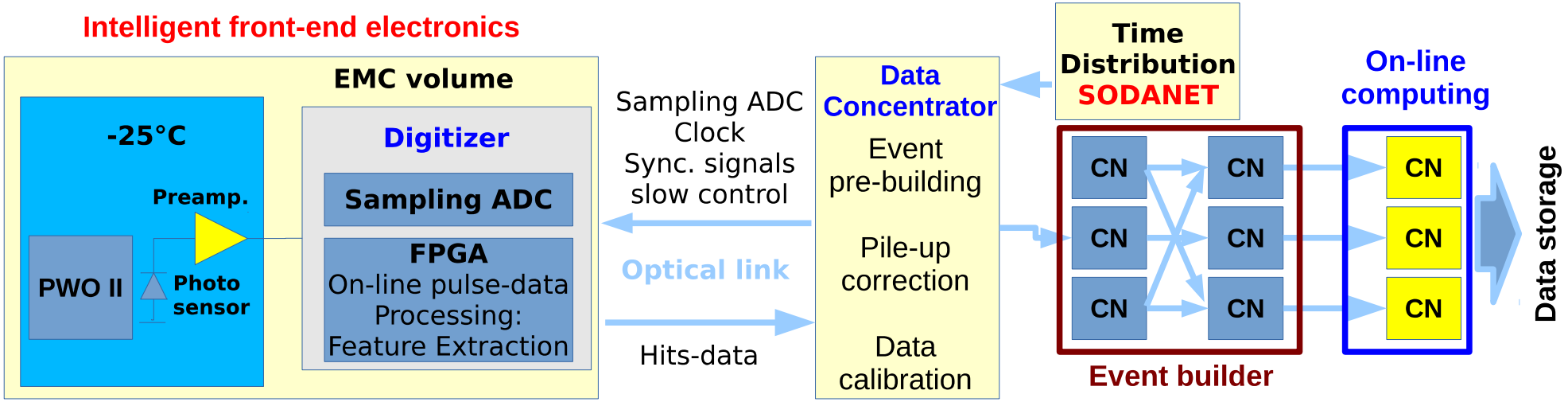
Preliminary conclusions:

- **Cooling power of the plate is sufficient (however, close to the limit)**
- **Same water can be used to cool several crates**

Tests with the crate with mounted digitizes will be performed to verify the results.

EMC Readout.

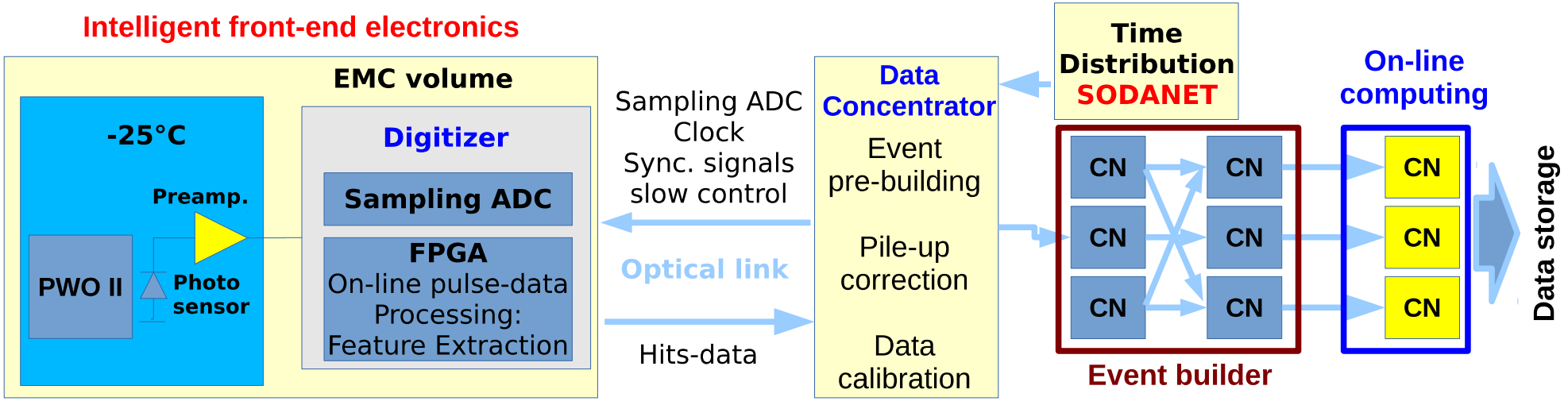
EMC Readout



Components of the EMC readout:

- Intelligent front-end **digitizer**
- Time-distribution system
- Data concentrators
- Burst-building network
- On-line computing

EMC Readout



Components of the EMC readout:

- Intelligent front-end **digitizer**
- Time-distribution system
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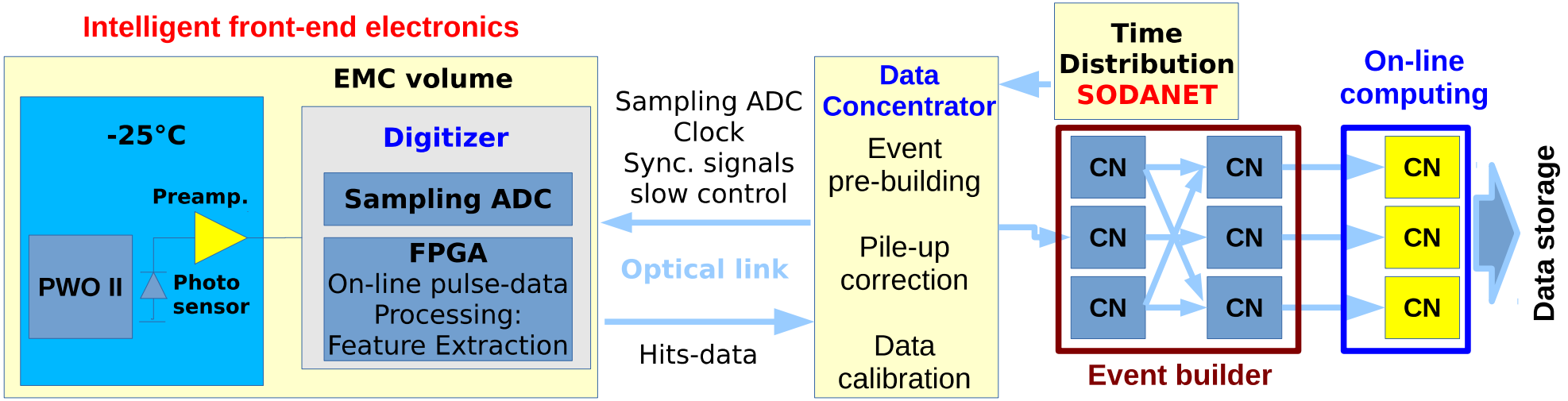
- On-line computing

Ready for test measurements

- Hardware: ready (fw. End-cap)
- Firmware: ready
  - Pulse-detection and feature-extraction to be optimized (~0.1 fte for implementation)
  - Pile-up recovery to be designed and implemented (~0.3 fte for implementation)

EMC Readout



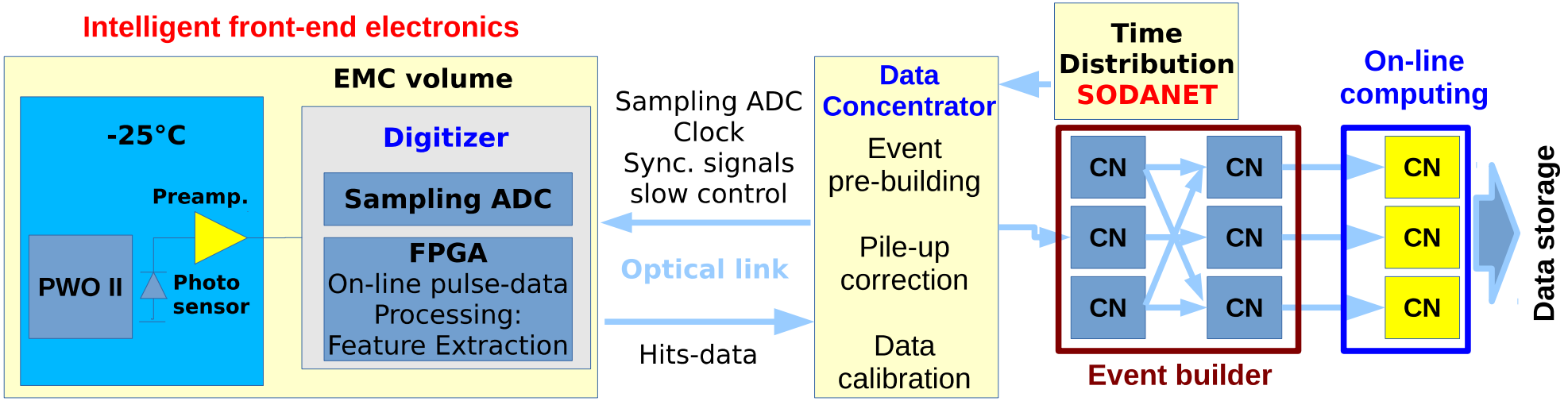
Components of the EMC readout:

- Intelligent front-end **digitizer**
- Time-distribution system
- Data concentrators
- Burst-building network
- On-line computing

Ready for test measurements

- Hardware: to be designed (same as EMC DC);
  TRBv3 can be used for tests
- Firmware: ready
  - All components are implemented and tested (EMC, STT/DIRC)
- Software: to be integrated into the PANDA run control
  Exists scalable (not user-friendly) control system (tests)

EMC Readout



Components of the EMC readout:

- Intelligent front-end **digitizer**
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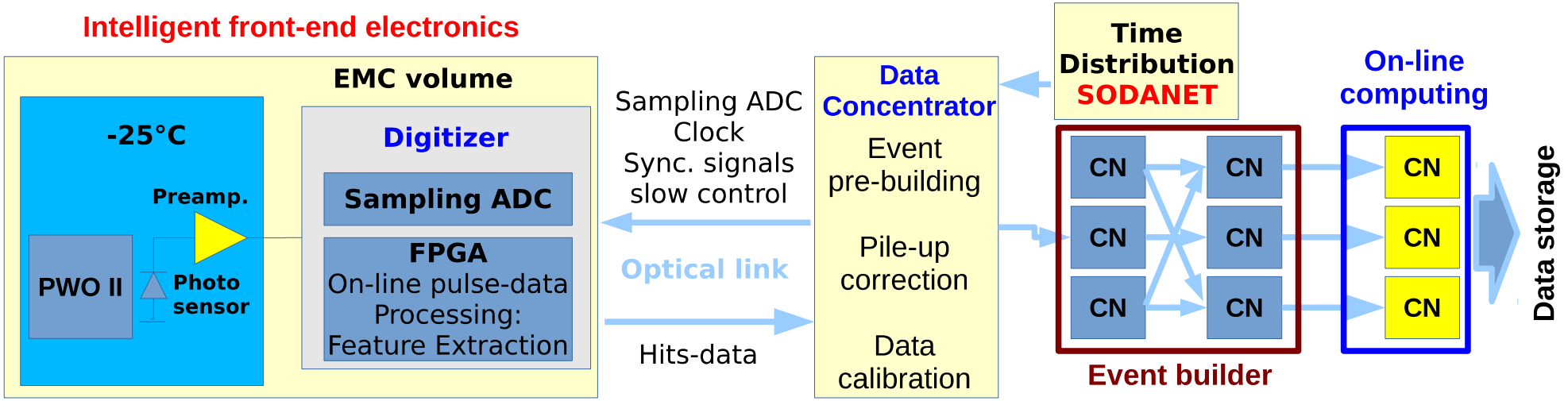
EMC Readout



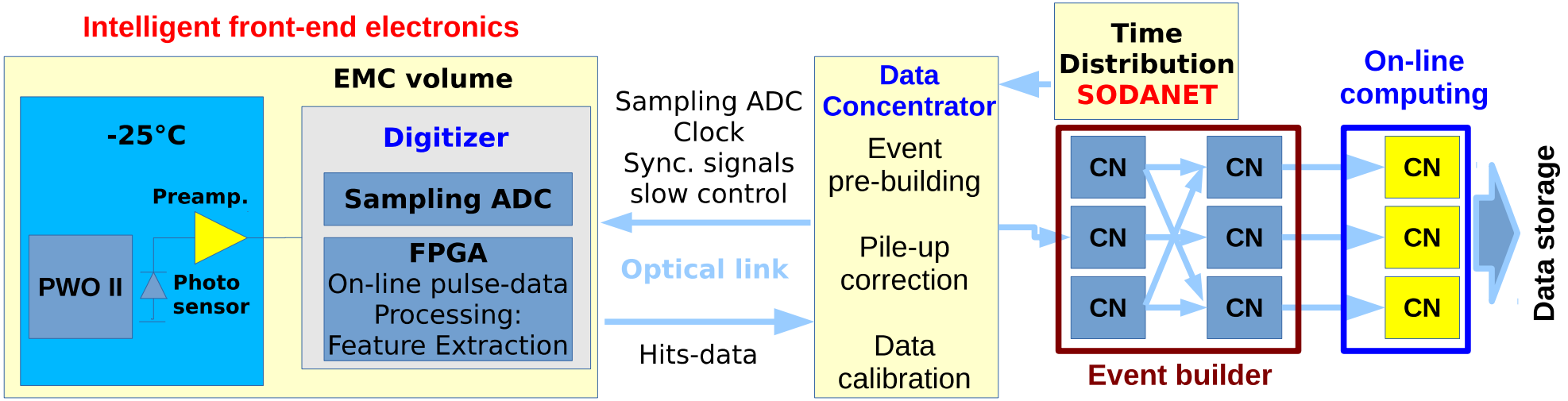
Components of the EMC readout:

- Intelligent front-end **digitizer**
- Time-distribution system
- Data concentrators
- Burst-building network
- On-line computing

Tests not yet possible

- Hardware: CN, EMC DC
- Firmware: ???
  - IP cores for distributed clustering: done
  - Communication protocols: ???
  - Network topology: ???
- Software:
  - Slow control of the network topology: ???

EMC Readout



Components of the EMC readout:

- Intelligent front-end **digitizer**
- Time-distribution system
- Data concentrators
- Burst-building network
- On-line computing

Does not exists

- Hardware: CN, GPU, ...
- Firmware: ???
  - IP cores for distributed clustering: done
  - Communication protocols: ???
  - Topology: ???
- Software:
  - Slow control of the network: ???
  - DAQ software: ???

Summary

Cooling of the EMC digitizers is feasible with the current design of the cooling plate. Test with crate is being prepared.

Required EMC-readout activities:

- **Optimization of input stage of the Fw-endcap digitizer, feature-extraction:** Bochum, Uppsala, Stockholm, Mainz, KVI-CART
- **Pile-up recovery (once pulse-shape is fixed, know pulse-shape stability):** KVI-CART
- **Hardware (Digitizers, DC, burst-building network?, SODANET?):** Uppsala
- **Implementation of distributed clustering:** KVI-CART
- **Topology of the burst-building network:** KVI-CART, ???
- **Run control:** ???
- **DAQ software:** ???
- **Communication protocols for DAQ (slow control, data transfer):** ???