

Power Supplies for the ATLAS Calorimeters and the New Small Wheels

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Introduction and Disclaimer

- For the calorimeters, the presented projects are for HL-LHC
 - To be installed during LS3
 - Based on the TDRs of the two upgraded detectors
- For the New Small Wheels, the presented developments are for Phase-1 upgrades
 - To be installed during LS2
 - Available very soon
- There are still some unknowns, so what is presented here is to be taken with care

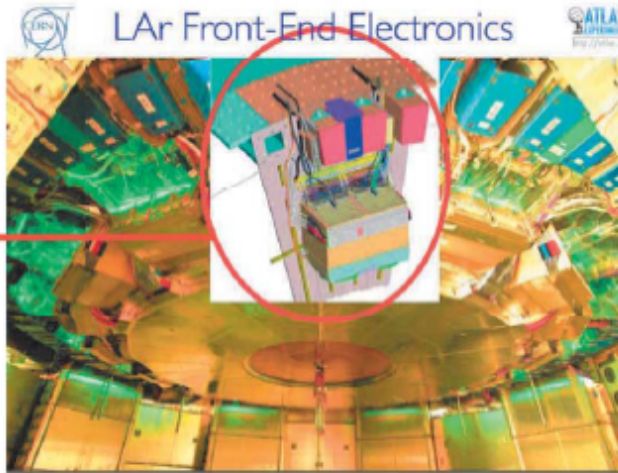
LAr Calorimeter

Actual situation



OCEM – USA15 ($V_{out} = 280V$ DC)

$L = \sim 70$ m

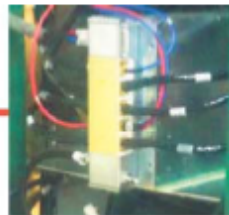


Possible future solution



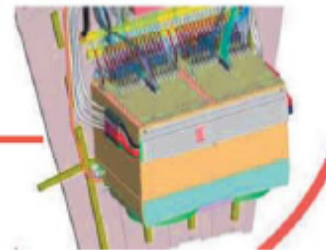
Similar solution
(not necessary identical – USA15)

$L = \sim 60$ m
 $L = \sim 50$ m
 $L = \sim 40$ m



New LVPS
(installed near PP2?)

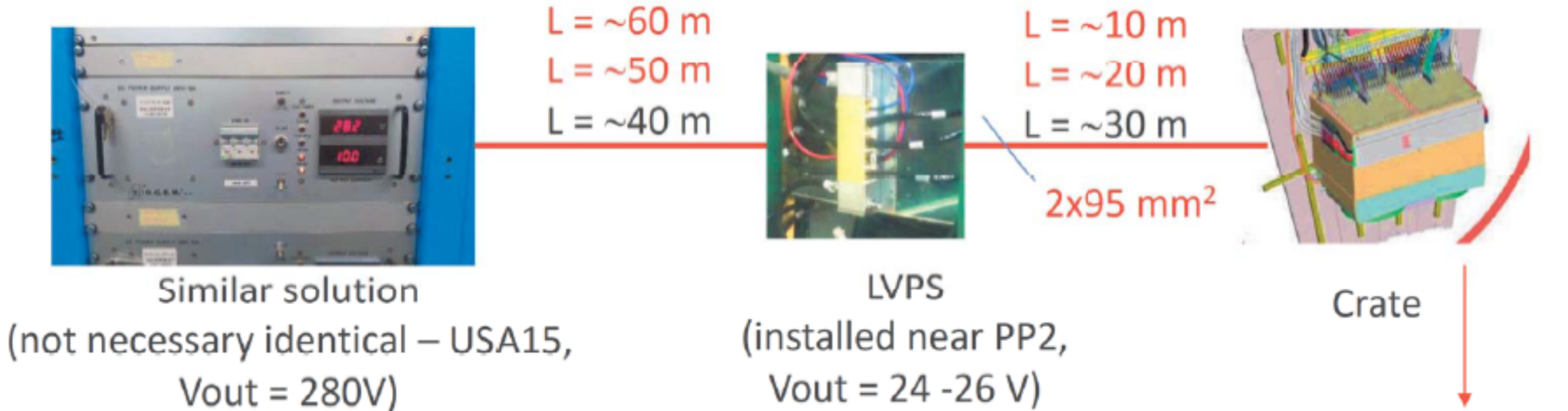
$L = \sim 10$ m
 $L = \sim 20$ m
 $L = \sim 30$ m



Crate

- 3–3.5 kW per FE crate
 - Direct powering impossible
 - Intermediate DC-DC
- Upgraded system
 - POL DC-DC on the FE boards
- New location for the intermediate DC-DC
 - Access all the time
 - B field up to 4 kG
 - Longer cable to reach the FE crate
 - Need POL to accept 24 or 48 V input

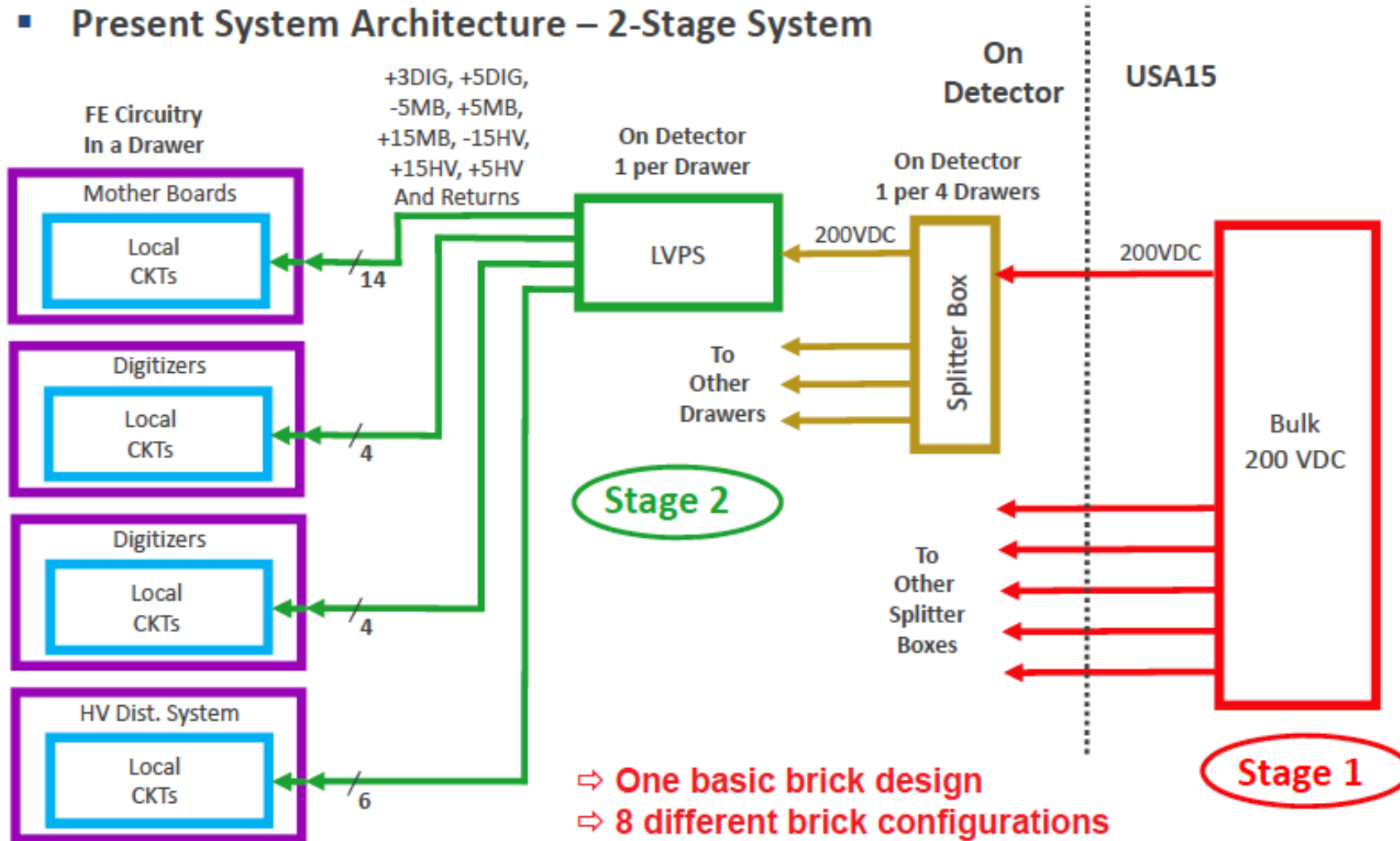
LAr Calorimeter: Base Line



- 280–24 V, $\sim 3\text{--}3.5 \text{ kW}$
- Still some unknowns
 - Qualification of a POL 24–1.2 V DC-DC
 - Final location of the intermediate DC-DC
 - B field up to 4 kG
 - Radiation up to $\sim 100 \text{ krad}$
- Discussions with usual manufacturers
 - Possible commonalities with New Small Wheels (see later)
- Water cooled
- Control
 - ELMB++ ?

Tile Calorimeter

Present System Architecture – 2-Stage System

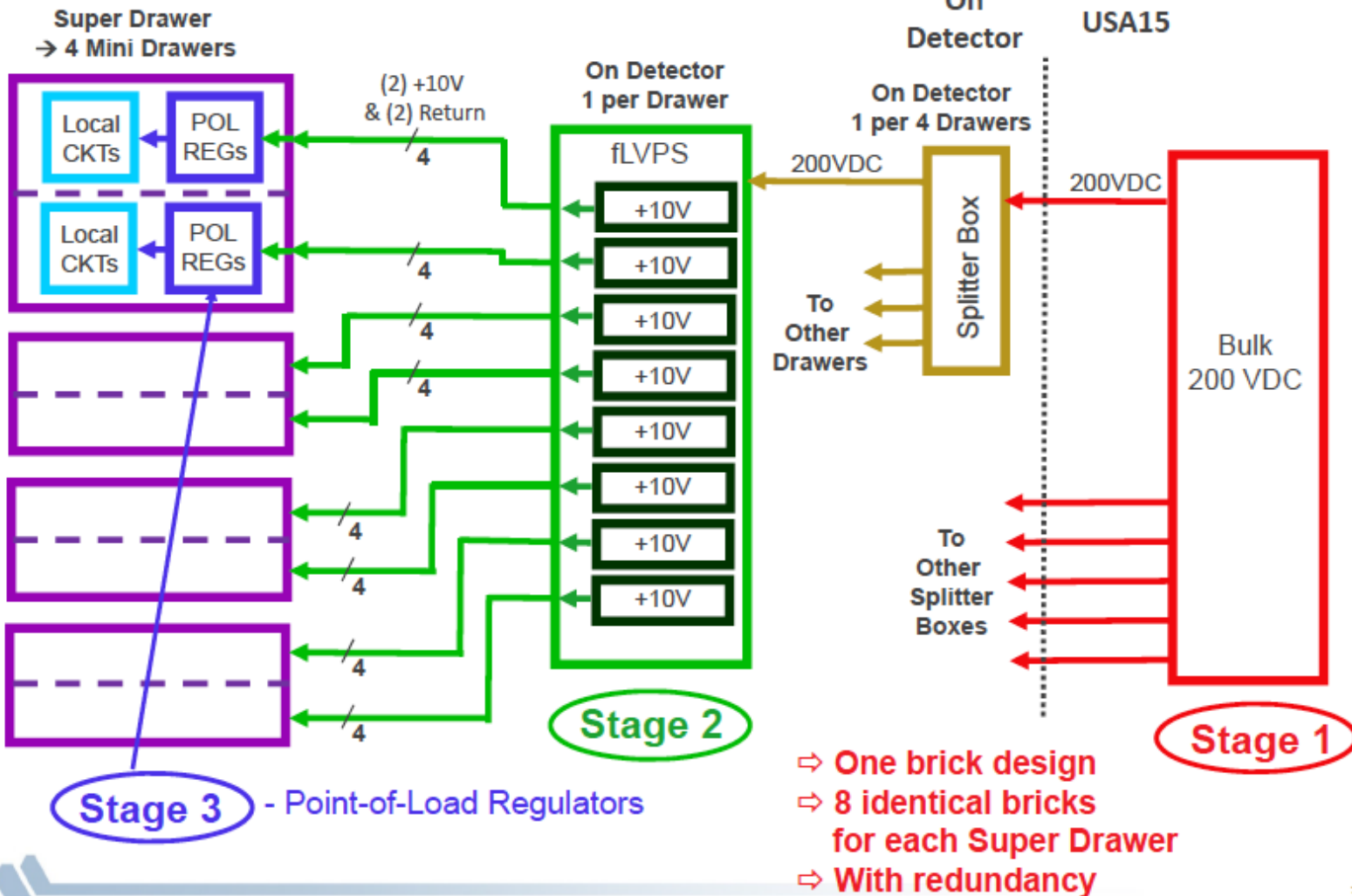


- LVPS designed and built by Argonne
- Low magnetic field and low radiations
- ELMB for control

- ⇒ One basic brick design
- ⇒ 8 different brick configurations for each Super Drawer
- ⇒ No redundancy

Tile Calorimeter

▪ New System Architecture – 3-Stage System



- POL DC-DC on the FE boards
- Same concept for the previous DC-DC
 - Simpler (1 single brick type)

Tile Calorimeter

- New brick specifications:
 - Input: 200VDC, 1.5A max
 - Output: +10V +/- 1V trim
 - ~3.5A nominal, 7A w/redundancy
 - 11A OCP limit
 - 12V OVP limit
 - Control with ELMB++ ?
- Radiations
 - TID: 34 KRad
 - NIEL: 6.6×10^{12} neutrons/cm²
- Home made design and production

New Small Wheels (Phase 1)

- Cannot power directly the front-end boards from the usual CAEN LV system
 - Lack of space for the cables
- POL DC-DC (FEAST) on the FE boards
- Intermediate DC-DC converters on the periphery of the wheels
 - Delivering 12 V for the FEAST
 - Short cables
- Prototypes ordered to CAEN and WIENER
 - Selection of one design for a production in 2018 – 2019 (?)

New Small Wheels (Phase 1)

- Main specifications of the requested prototypes
 - V_{in} : 300 V (?)
 - V_{out} : 12 V
 - 190 W per channel
 - 8 channels in 200x200x90 mm³
 - > 80% efficiency
 - Redundancy (2 channels in parallel)
 - 10 krad
 - $6 \cdot 10^{12}$ NIEL
 - 5 kG

Summary

- NSW DC-DC will be available from industry
 - Might be of interest for others
 - E.g. building block for the LAr calorimeter
- LAr calorimeter moving towards a 280V-24V 3–3.5kW DC-DC
 - Still some unknowns
 - Willing to go to industry to get them
- Tile calorimeter using the same concept as today with simplified bricks
 - Home made design and production