



Phase 2 Power Supply and Mechanics

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Outline

- Phase 2 Power Supply Status
 - Design review
 - Backplanes
- Phase 2 Mechanics Status
 - Design
- System Test
- Production status

Phase 2 Power Supply

V2 PSU Design

Features

Input

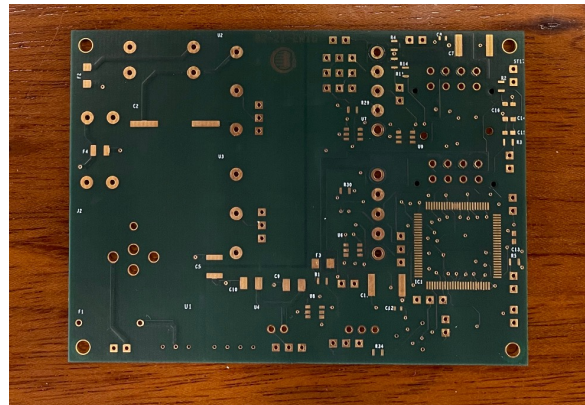
- 48V (3.1 A max), Isolated GND

Outputs with isolated GND from input

- 3.3V (20 A) for DigiOpt12
- 5 V (20 A) for PACE
- 3.3V (0.7 A) for PACE Boot and SC FPGAs
- 2.2 V (5A) for DigiOpt12

4 Temperature sensors (T1..T4)

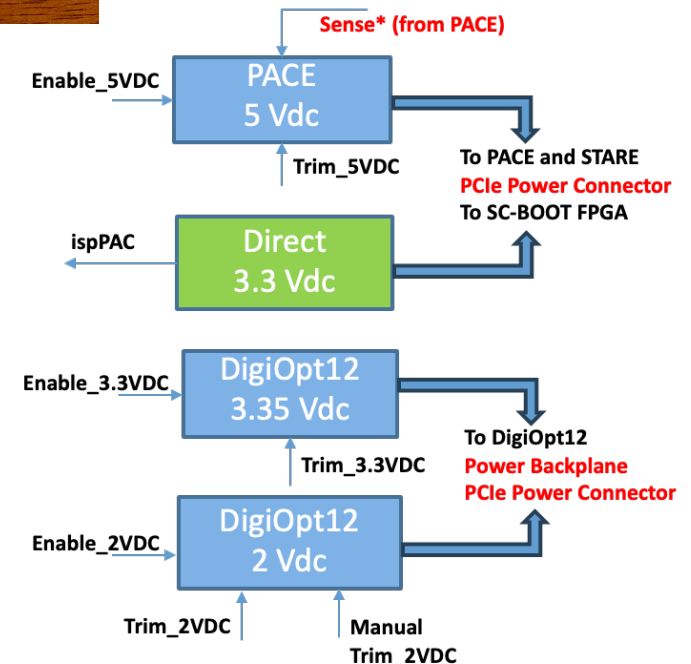
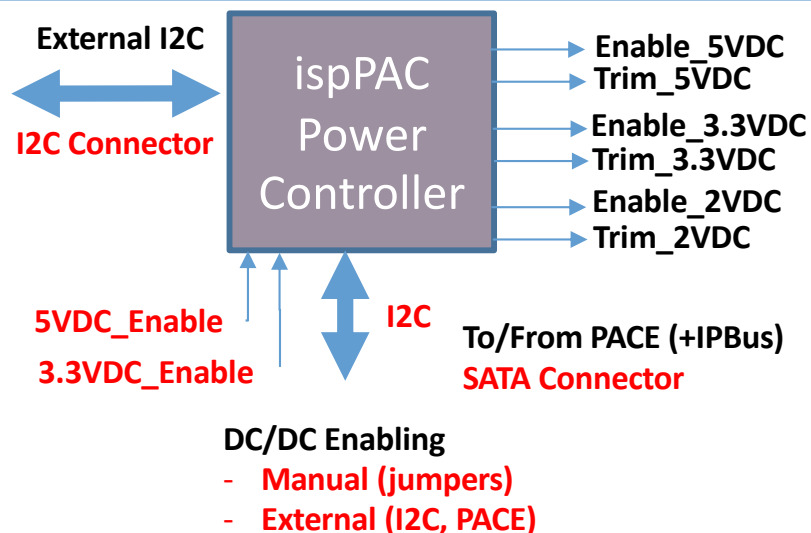
V2 PSU Dimensions



90 x 65 mm²

- 51% less than Ph1 PSU

V2 PSU Slow Control

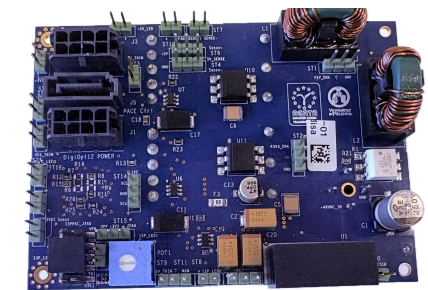
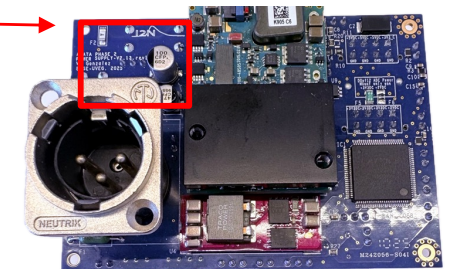
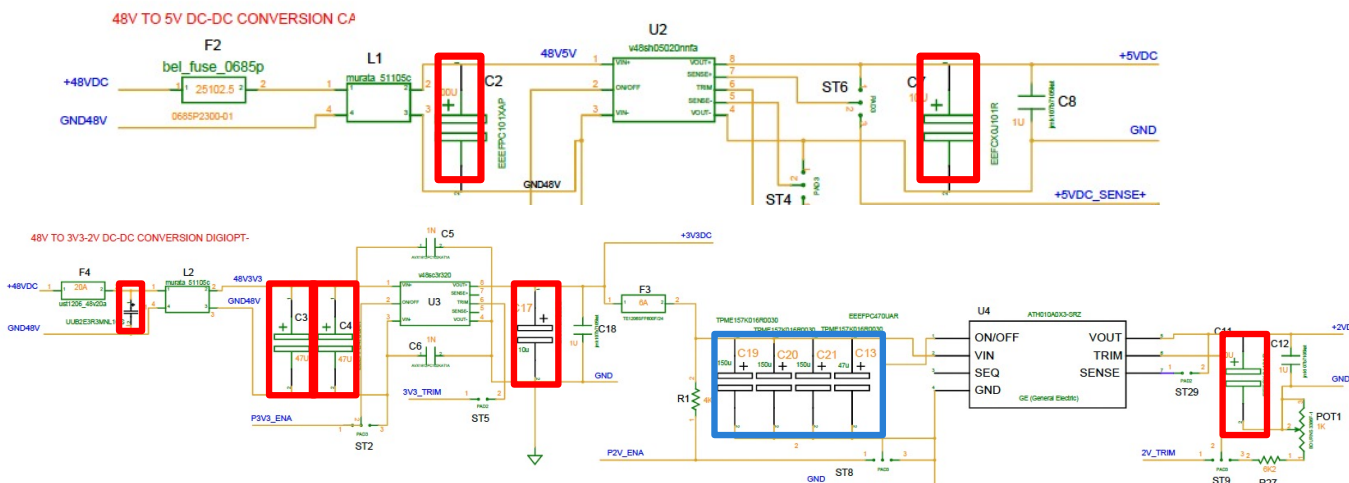
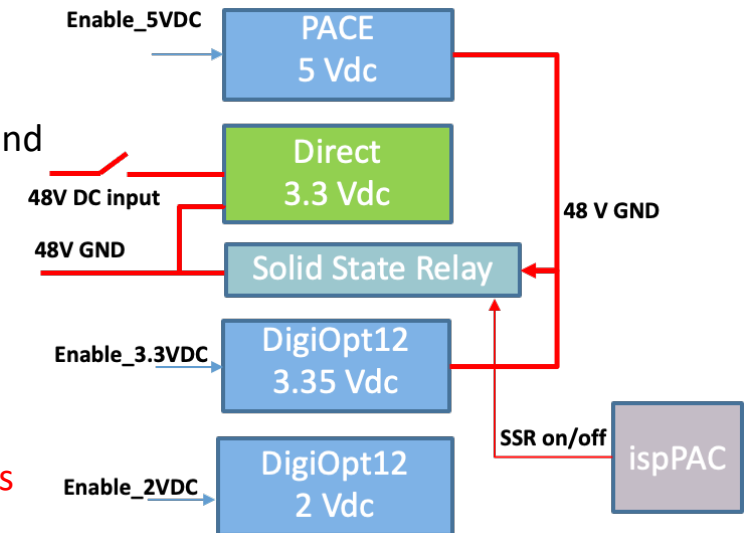


Phase 2 Power Supply

PSU V2 versions

Design modifications

- V2.5 (prototype t12.2 rev2)
 - Modify de 2V trace to increase current capacity for future demand of DigiOpt12 boards
 - Fix DC/DC drill diameters to fit different models for component obsolescence/availability
 - Solid State Relay added to allow control of power input
 - **First production batch of 50 units**
- V2.6 (prototype t13 rev1)
 - Design modified due to obsolescence/availability of components
 - Improve DC/DC stability
 - **V2.6 (prototype t13_rev2)**
 - Capacitor replacement

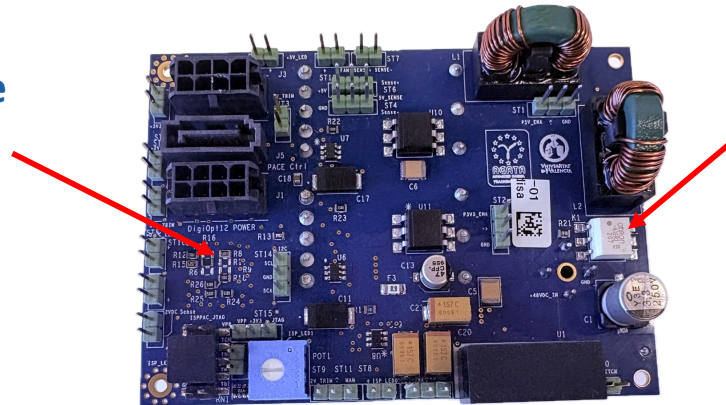
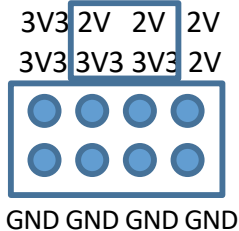


V2.6 (prototype t13_rev1)

Phase 2 Power Supply

From PSU V2.5-t11

Selection by fuse



SS Relay

POWER UP SEQUENCE

GENERAL SWITCH

Direct 3V3DC_C
ON

PSU: ispPAC **ON**
PACE: BOOT and
SC FPGAs **ON**

PACE->SSR ON (i2C)

5V, 3.3V connected to
48V GND

Not powered up

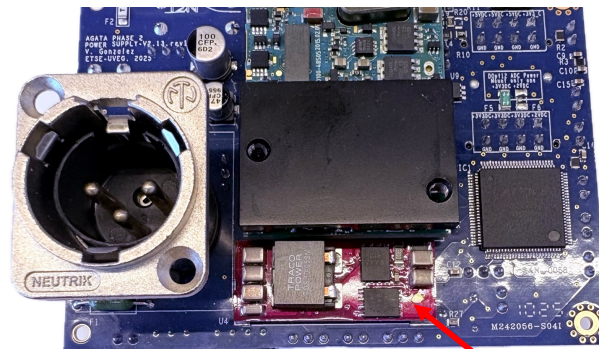
PACE-> 5V, 3V3 and 2V enabled(*)
through SATA or i2C

Voltages power up in the appropriate sequence

(*) DigiOpt12 3V3 and 2V power up
simultaneously

PSU Operation modes

- On/off
 - Manual
 - Remote
 - ispPAC
 - Local i2C
 - PACE
 - Voltage Trimming
 - Automatic by ispPAC for all voltages
 - Also manual for 2V
- Presently, automatic timed booting from IspPAC
- Firmware modification to let PACE control booting up



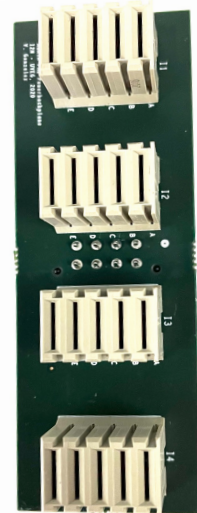
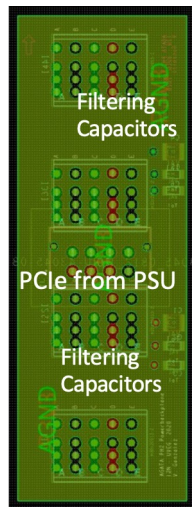
2Vdc 20 A

Phase 2 Power Supply

Backplanes

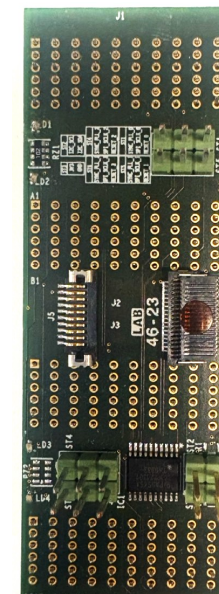
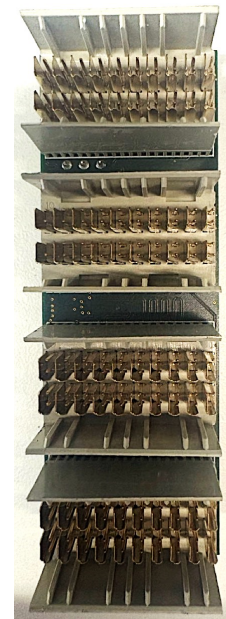
POWER BACKPLANE

- Distributes +3.3V and +2V to DigiOpt12
- Capacitors for additional filtering



SIGNAL BACKPLANE

- Distributes to CLKs, SynPat, SPI, i2C to DigiOpt12
- FireFly connection to PACE
- Additional local I2C Access
 - Through I2C bridge
- Several redesigns up to **V2.5 production**

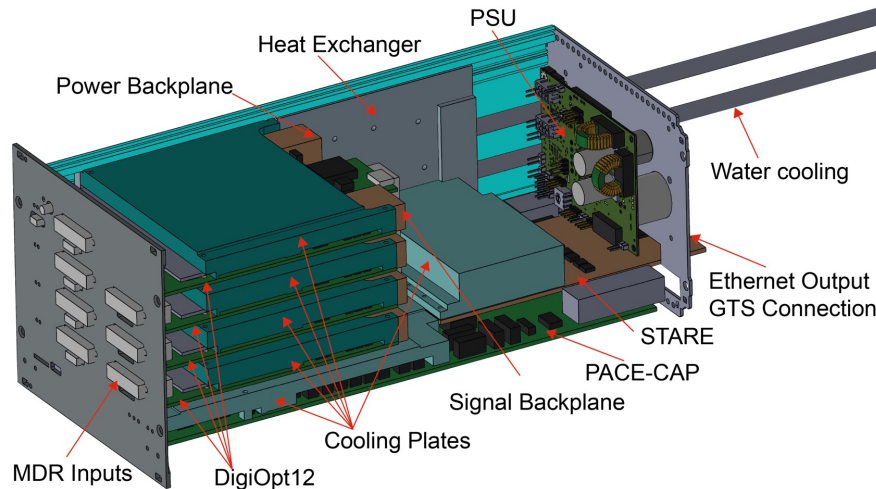


Firefly cable
from PACE

i2C Bridge

Phase 2 Mechanics

Design

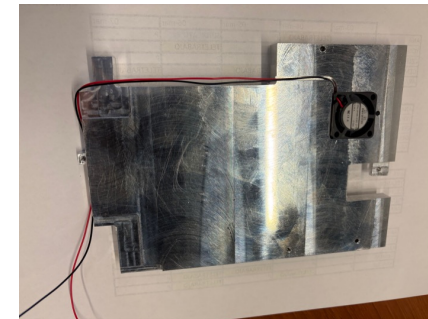
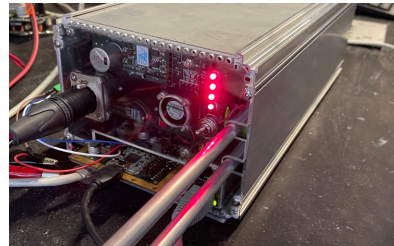
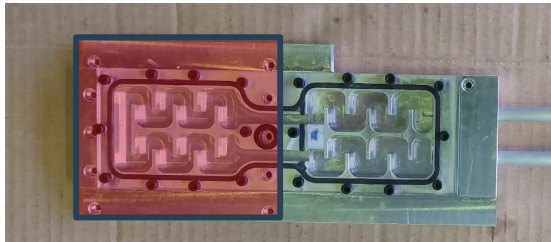


- Schroff commercial parts for boxes and subracks
- Custom parts for cooling blocks and heat exchanger

- Fan in PACE cooling block to lower temperature around DC/DC converters.

- Heat Exchanger alodine treated

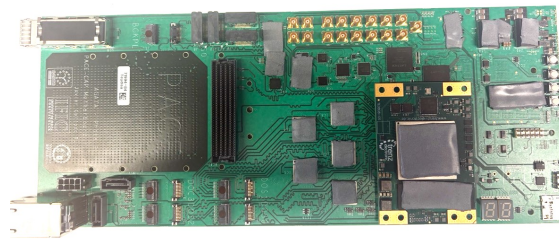
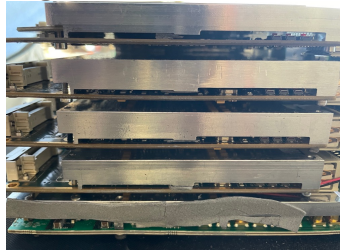
- Fan at rear panel



- Increase heat dissipation using box sides

- Thermal Pads on top and bottom layers

- Cut out to place USB programmer

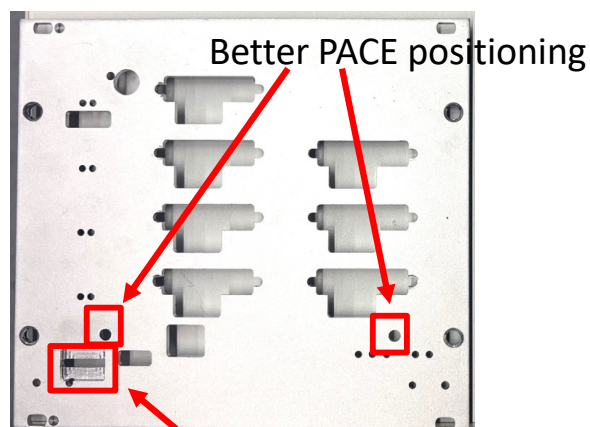
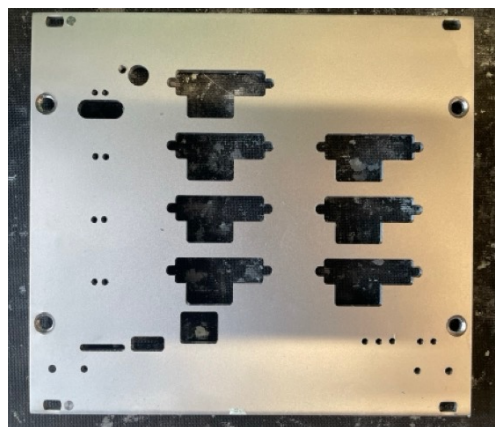


Phase 2 Mechanics

Design update

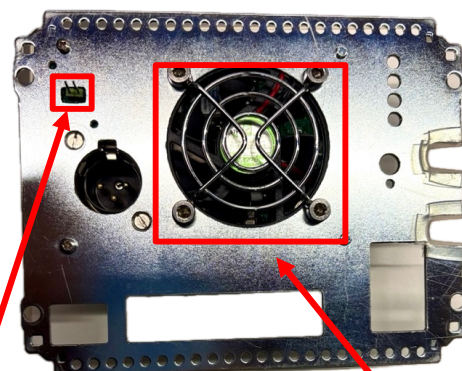
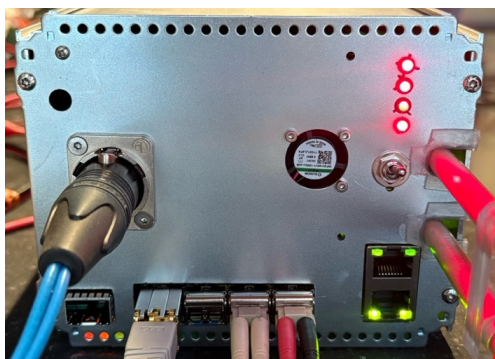
Front and rear panels

New Front Panel



Better SD card insertion/extraction

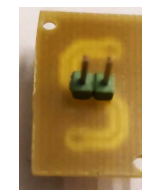
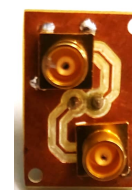
New Rear Panel



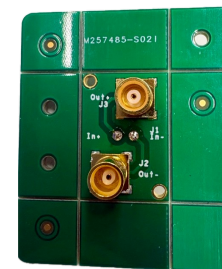
Cutout modified for trigger connector

Bigger fan

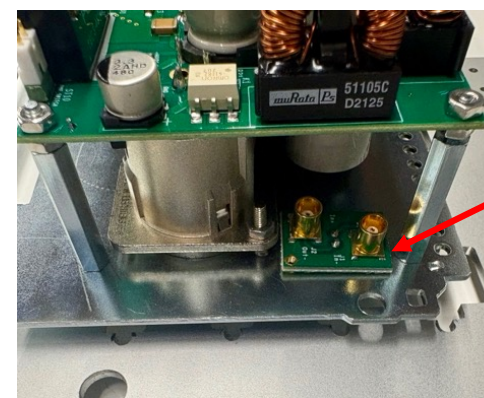
Trigger input connector



Prototype



Production



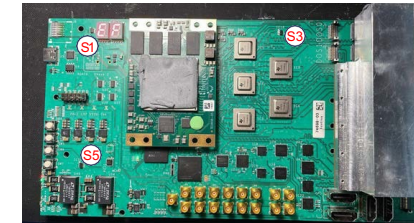
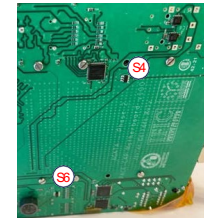
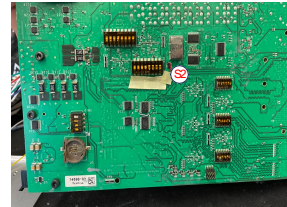
Placement
in the PSU

System test

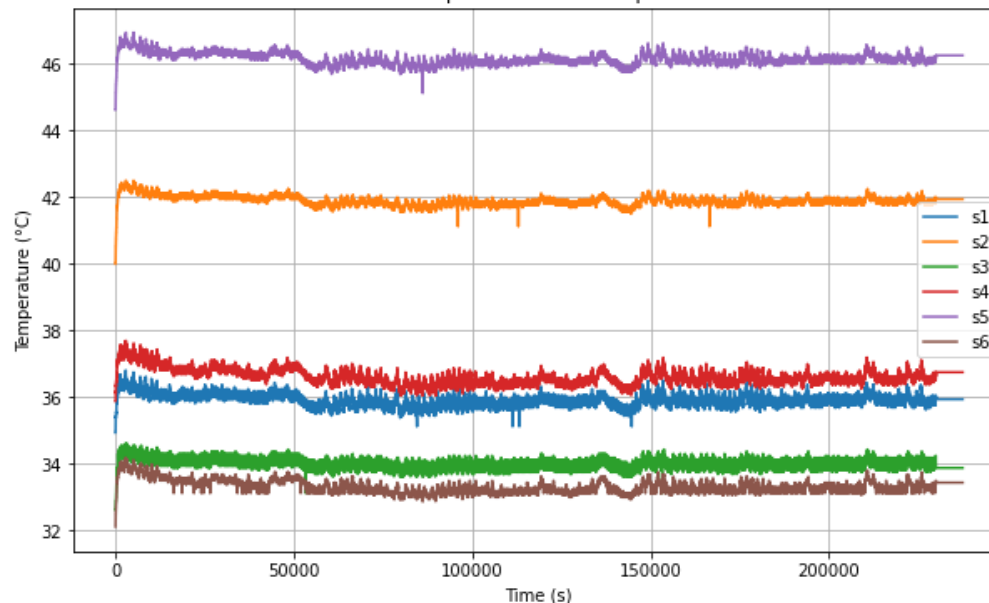
Thermal tests

Tests with box closed (PACE prod. t58)

- $V_{cc} = 48\text{ V}$, $I_{cc} = 2.10\text{ A}$
- With new bigger fan
- Running for 3 days



Sensor temperatures with Graphite Foam



Small fan

	PACE	PACE_SC_temp
48:	36.94 °C (S1)	
49:	45.81 °C (S2)	
4A:	36.44 °C (S3)	
4C:	47.56 °C (S4)	
4D:	48.62 °C (S5)	
4E:	40.94 °C (S6)	

Big fan

	PACE	PACE_SC_temp
48:	35.94 °C (S1)	=> ~ -1°C
49:	41.94 °C (S2)	=> ~ -3°C
4A:	33.88 °C (S3)	=> ~ -3°C
4C:	36.75 °C (S4)	=> ~ -9°C
4D:	46.24 °C (S5)	=> ~ -2°C
4E:	33.44 °C (S6)	=> ~ -7°C

Temperature
reduction in all
sensors

Production status



Backplane

- Power backplane: 135 units
- Signal backplane: 135 units

PSU (110 units)

- PSUv2.5: 50 units
- PSUv2.6 (t13_rev2): **PCB ready for production (30 units GANIL + 30 units INFN to be produced)**

Mechanics

- Boxes: **105** (+15) units
- Crates: **35** (+5) units
- Cooling plates + heat exchangers:
 - **137** (+109) PACE cooling blocks
 - **143** (+65) STARE cooling blocks
 - 240 DigiTopt12 cooling blocks
 - **139** (+74) Heat exchanger (84 to be sent for alodine treatment)
 - **81** (+79) Front panels
 - 1 Rear panel -> prototype with new fan

Assembly

- **240** DigiTopt12 with cooling blocks

Cables

- Firefly, HDMI, PCIe and SATA, LEDs, switches

Thank you for your attention