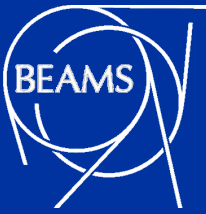




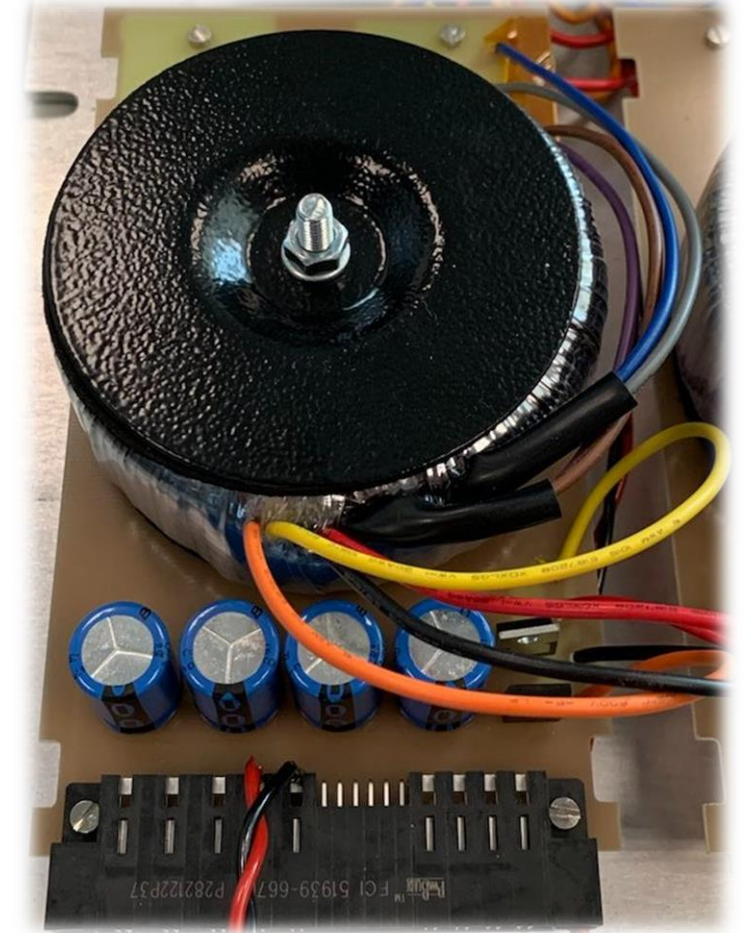
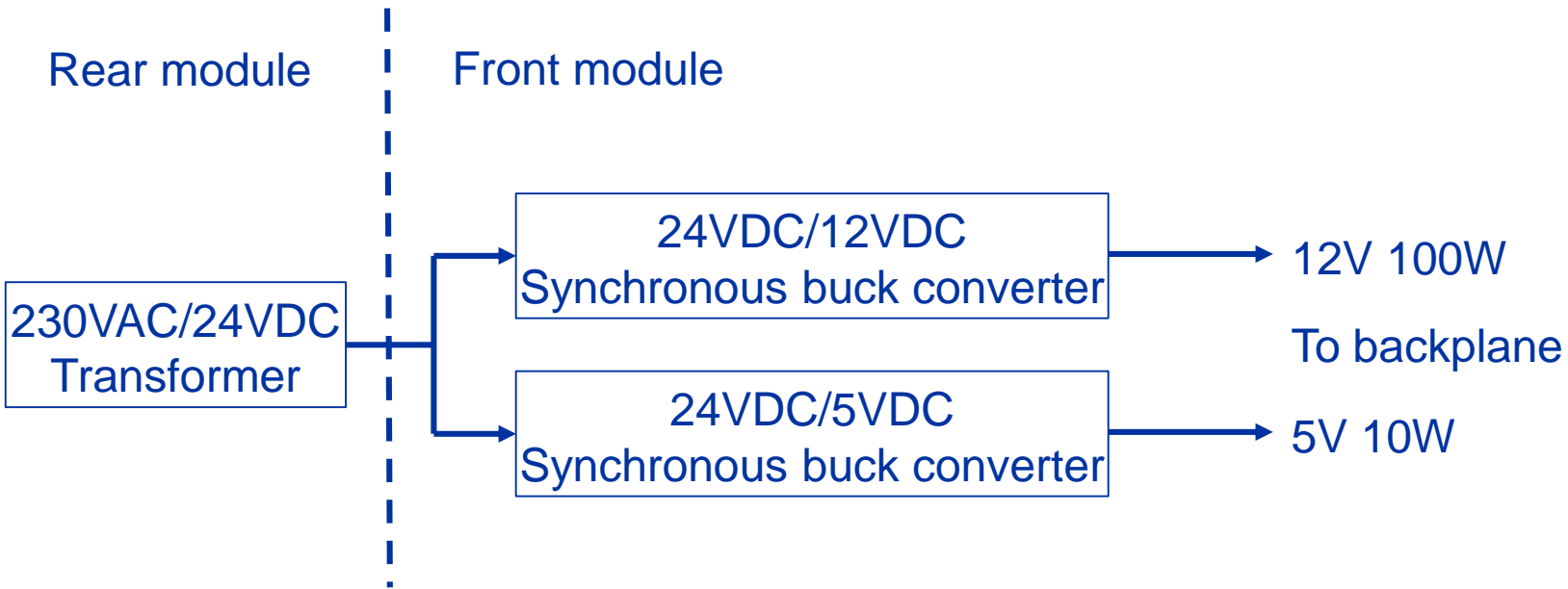
Controls
Electronics &
Mechatronics



RaToPUS DC/DC Converter

RaToPUS v2

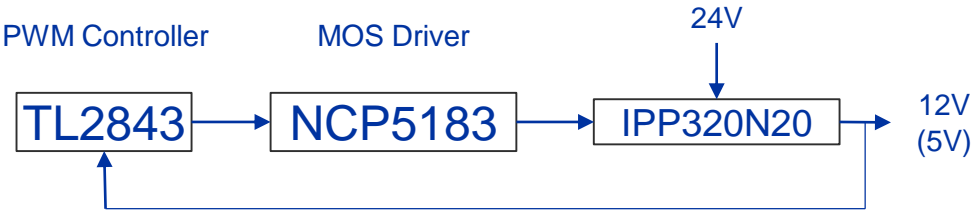
- Thanks to Yves THUREL for support during design phase!
- Two stages: AC/DC followed by DC/DC
 - AC/DC
 - COTS toroidal transformer
 - 24V mainly used in industrial applications
 - No need for safety certification



RaToPUS v2

- DC/DC converters

- Buck topology



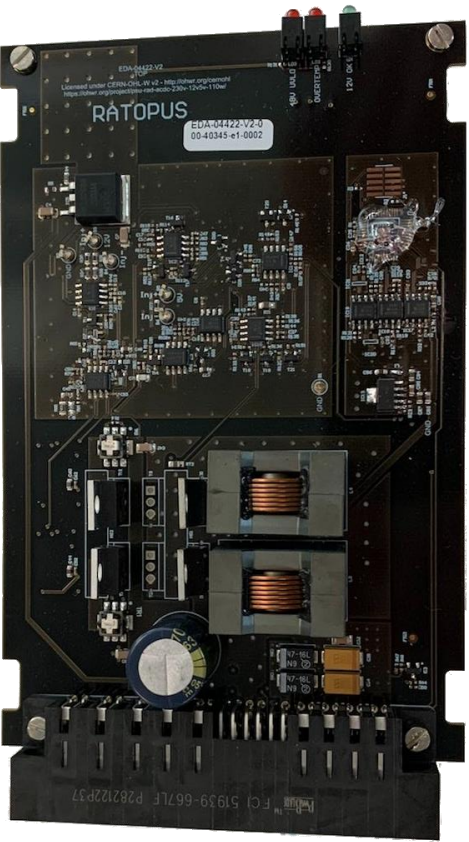
- Same components for both converters

- 24VDC \rightarrow 12VDC

- 100W
- 93% efficiency at full load

- 24VDC \rightarrow 5VDC

- 10W
- 80% efficiency



RaToPUS v2

CHARM tests

- 3 radiation campaigns of DC/DC card at position 13
- Campaign 1:
 - Early failure of PWM controller *UC2843*
 - Went back to *TL2843*
 - *TL2843* initially excluded due to misbehaviour $>65\text{ °C}$ on RaToPUS v1
- Campaign 2:
 - Both units reached 620Gy
 - Suspected failure of *TL2843*'s internal reference
 - Slow drift of output voltage before abrupt drop to 0V
- Campaign 3:
 - Populated board with MOSFETs for synchronous rectification
 - Both units failed at $\sim 200\text{Gy}$
 - Rectification MOSFET blew up on both unit
 - Suspected failure of the *NCP5183* MOSFET driver (dead time conduction)



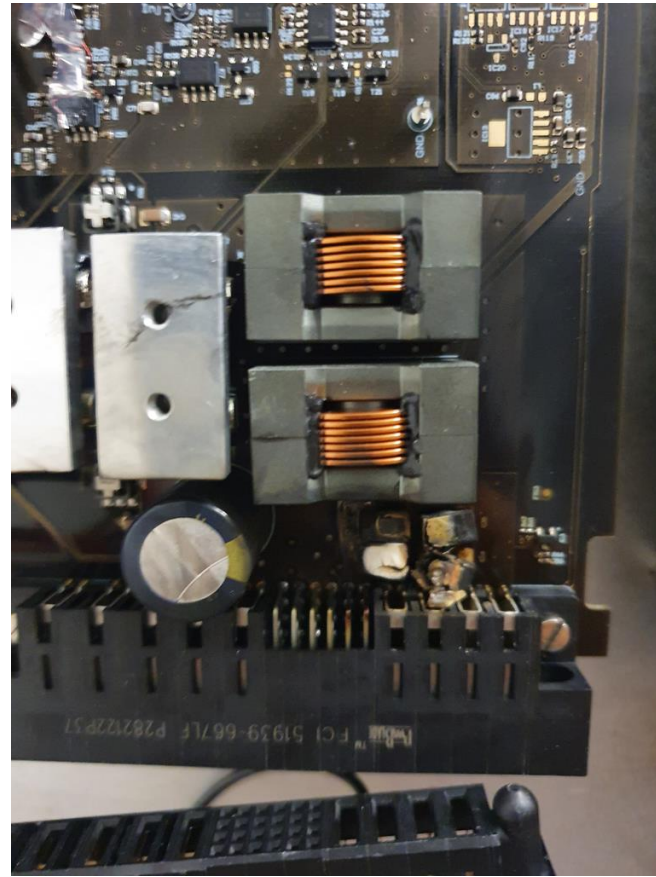
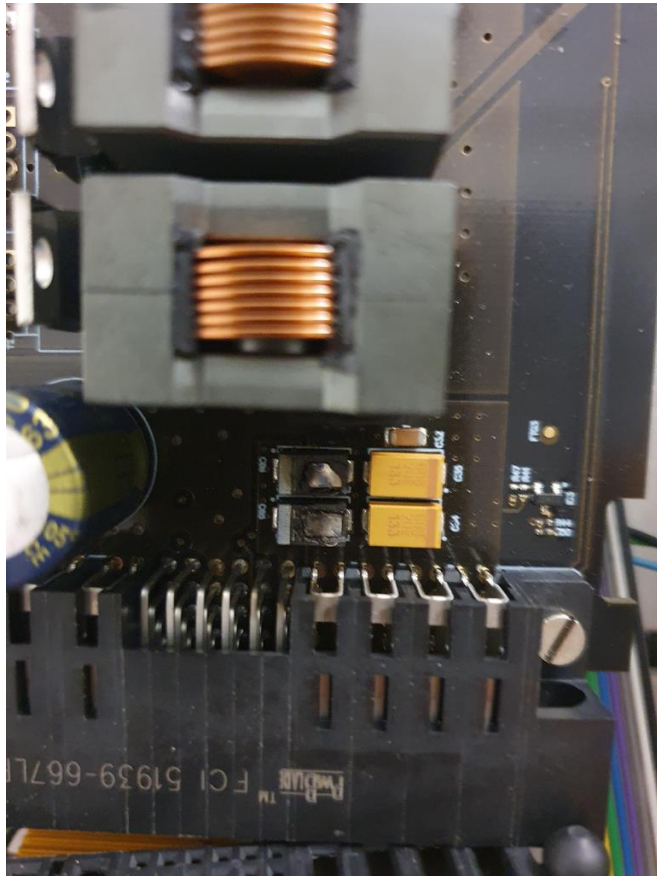
RaToPUS v2

CHARM tests

- Campaign 4:
 - AC/DC stage reached >700Gy
 - One DC/DC unit with external TL1431 voltage reference instead of internal TL2843 reference for 12V converter
 - Reached ~450Gy for both 12V and 5V outputs (while 620Gy were reached in campaign 2)
 - Different position on the rack -> higher flux impact ?
 - One unit with ADC AD7291BCPZ instead of ATSAMD21 micro-controller for voltage/current monitoring
 - ADC reference taken from RADWG database
 - tested at PSI, no destructive event nor functional interrupt reported
 - Use of system board (HYDRA processor) for I2C communication
 - I2C bus stuck after ~200Gy requiring a power-cycle of the RaToPUS unit
 - -> 5V not anymore functional after the power cycle
 - To be checked if caused by the 3.3V LDO used to power the ADC

RaToPUS v2

CHARM tests



RaToPUS v2

- Temperature tests performed
 - Functional up to 85 degrees C
 - Recovers well during cool down
- Plans for future test campaign
 - 3.3V LDO removal, will use a proven LM317 regulator
 - Periodic power cycles will be performed during irradiation