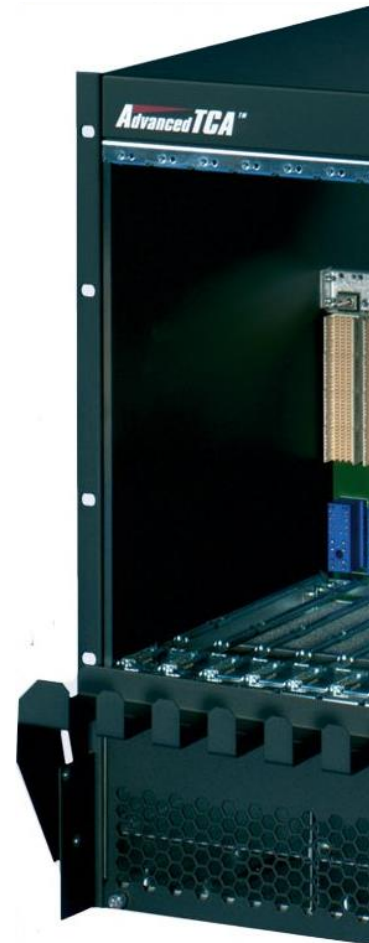


Evaluation of vertically cooled shelves from Schroff

xTCA IG Meeting

CERN EP-ESE-BE

Vincent Bobillier, Stefan Haas, Markus Joos,
Julian Mendez, Sylvain Mico and Francois Vasey



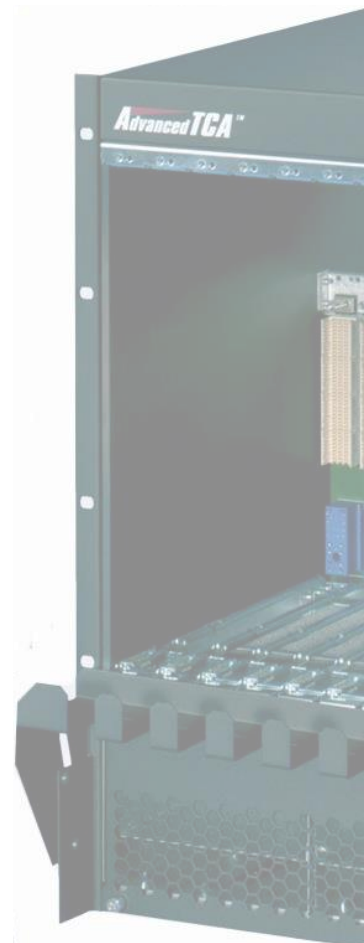
AdvancedTCA status

☐ Specifications

- 14 ATCA slots (400W) with RTM (50W)
- Vertical or Horizontal cooling
- Dual Star or Full Mesh topology
- 40Gbps or 100Gbps backplane
- Bussed IPMB
- 1 Shelf man. included

☐ Timescale

	Horizontal shelf	Vertical shelf
▪ Technical specification	Q4 2016	Q4 2016
▪ Technical evaluation	Q1-Q2 2017	NA
▪ CERN price enquiry	Q2 2017	Q2 2017
▪ Select contractor (pre-series)	NA	Q3 2017
▪ Final qualification	NA	Q2 2018
▪ ATCA Shelf Procurement contract ready for purchase orders by Q2/Q3 2018		



AdvancedTCA Status: Selected crate

Pentair/Schroff ATCA shelves

- 14 ATCA slots w. RTM
- Vertical or Horizontal cooling
- DS or FM topology
- 40 or 100G backplane
- Bussed IPMB
- 1 Shelf man. included

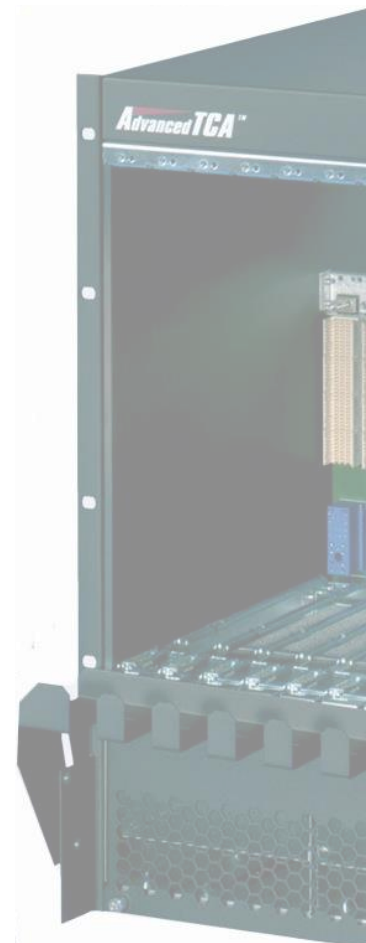
Type A	Price FCA (Euro)	Type B	Price FCA (Euro)
Batch of 1	EUR 6,586.00	Batch of 1	EUR 7,736.00
Batch of 2	EUR 6,242.00	Batch of 2	EUR 7,405.00
Batch of 5	EUR 5,886.00	Batch of 5	EUR 7,102.00
Batch of 10	EUR 5,603.00	Batch of 10	EUR 6,806.00

Type A: Vertical airflow, Dual Star Bkpl 40G, 1 shelf man.

Type B: Vertical airflow, Full mesh Bkpl 40G, 1 shelf man.

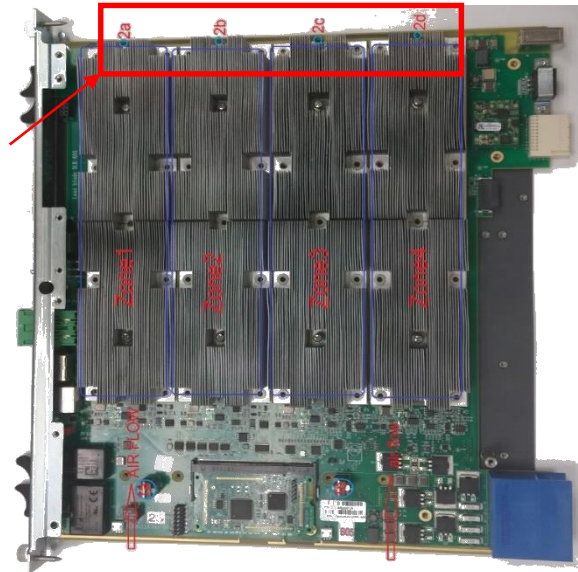
Cost increase for 100G: 15%

Discount for std horizontal airflow: 1.5%

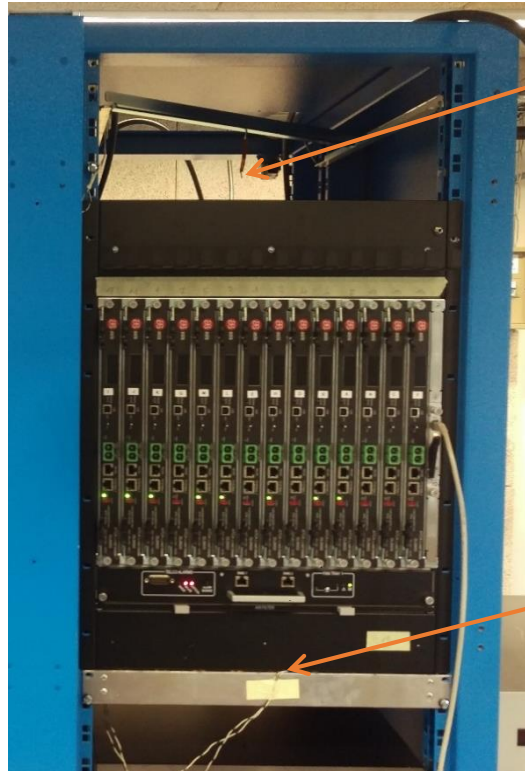


Cooling qualification

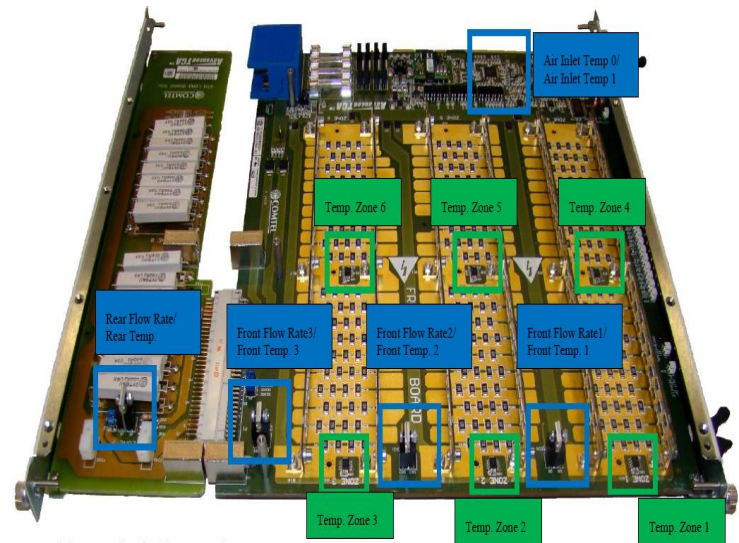
Air temperature sensors (top)



Crate outlet T sensor

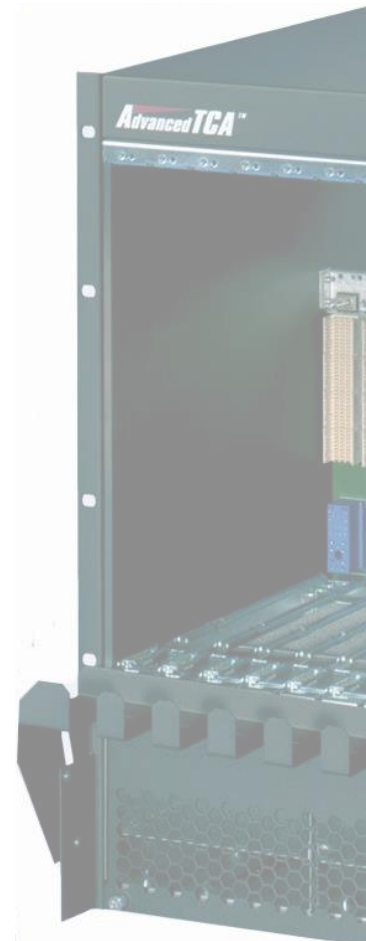
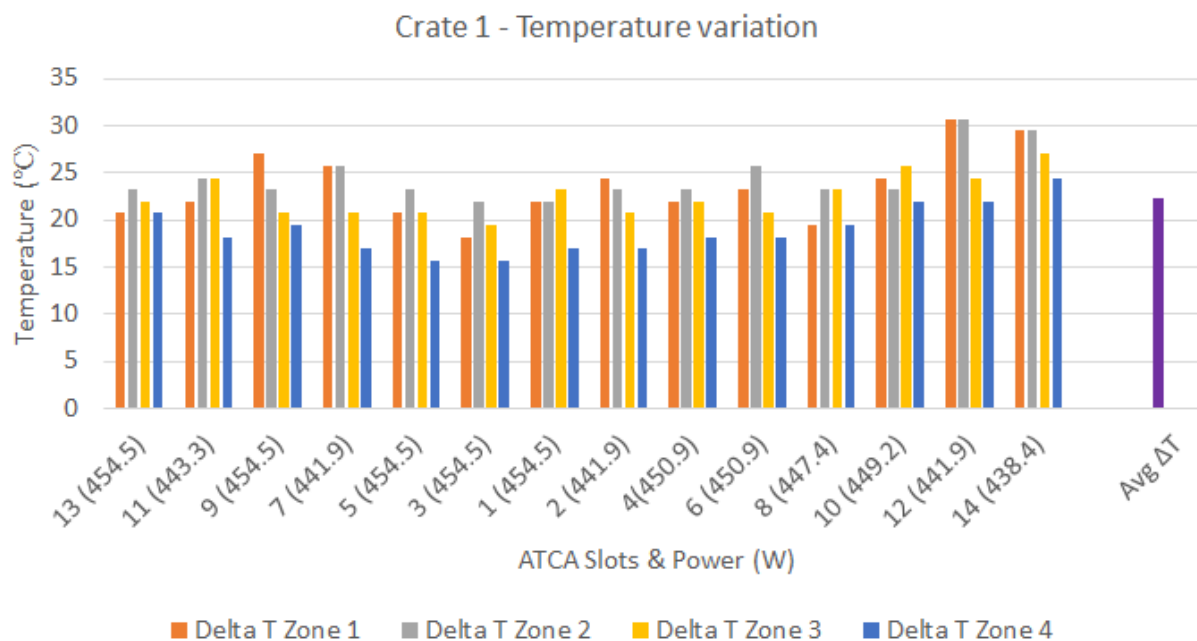


Crate inlet T sensor



Cooling qualification

- ❑ Cooling performance measured using the ASIS load blade @450W
 - Fan speed at 100%



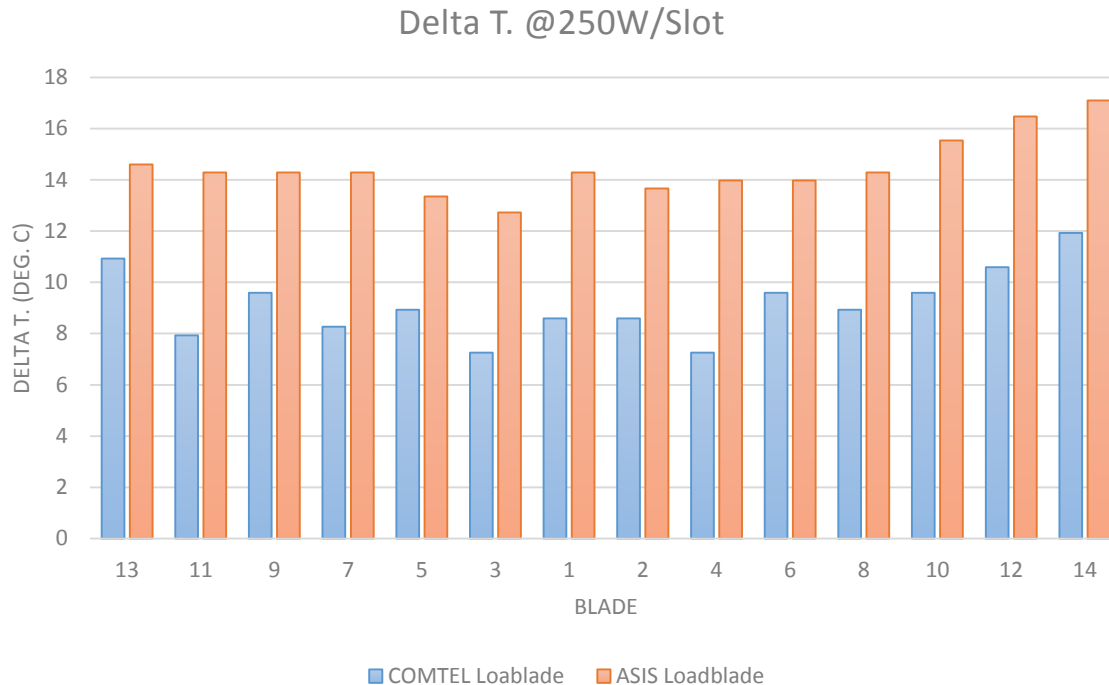
Well below the 35 deg. C specified

Cooling qualification

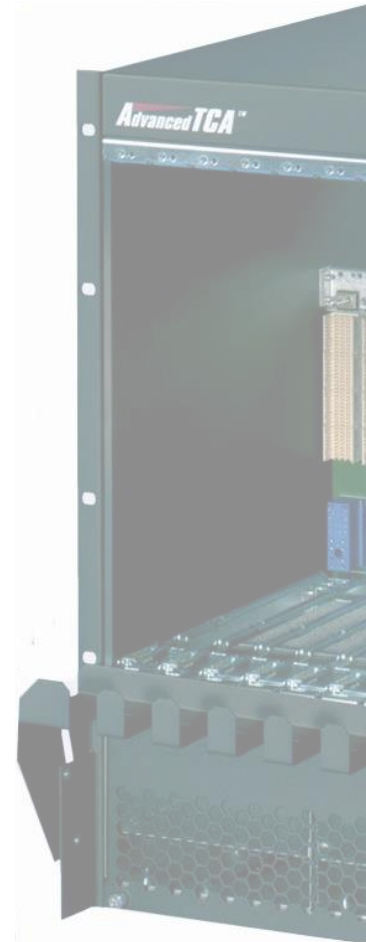
☐ Comtel vs. Asis cooling

- Load blades @250W
- Fans @100%

Comtel average: 9.2 deg.C
Asis average: 14.5 deg. C



Good cooling capacity



Cooling study

❑ Optic must be cooled enough in order to work below 50 deg. C

● **A word of caution to backend board designers:**

- Do not preselect your favorite on-board optics module
- VL+ is presently considering freezing module type and giving you advance notice
- Run your optics cool or make it replaceable
- Running at elevated temperature is possible, but will affect life-time
 - Data from one supplier (T is heatsink temperature)
 - $T < 50 \text{degC}$ will result in $< 1\%$ wearout failures in 15 years (to which random failures will add $\sim 3.7\%$)
 - $T < 57 \text{degC}$ will result in $< 10\%$

ACES 2018

francois.vasey@cern.ch

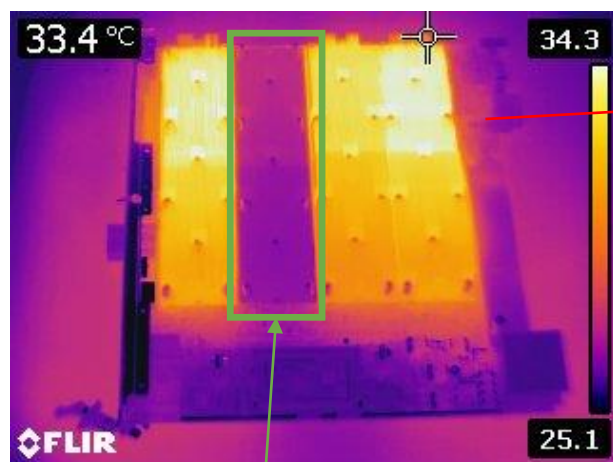
17

Is it possible to keep a “cold” zone on ATCA blade located in the selected crate ?

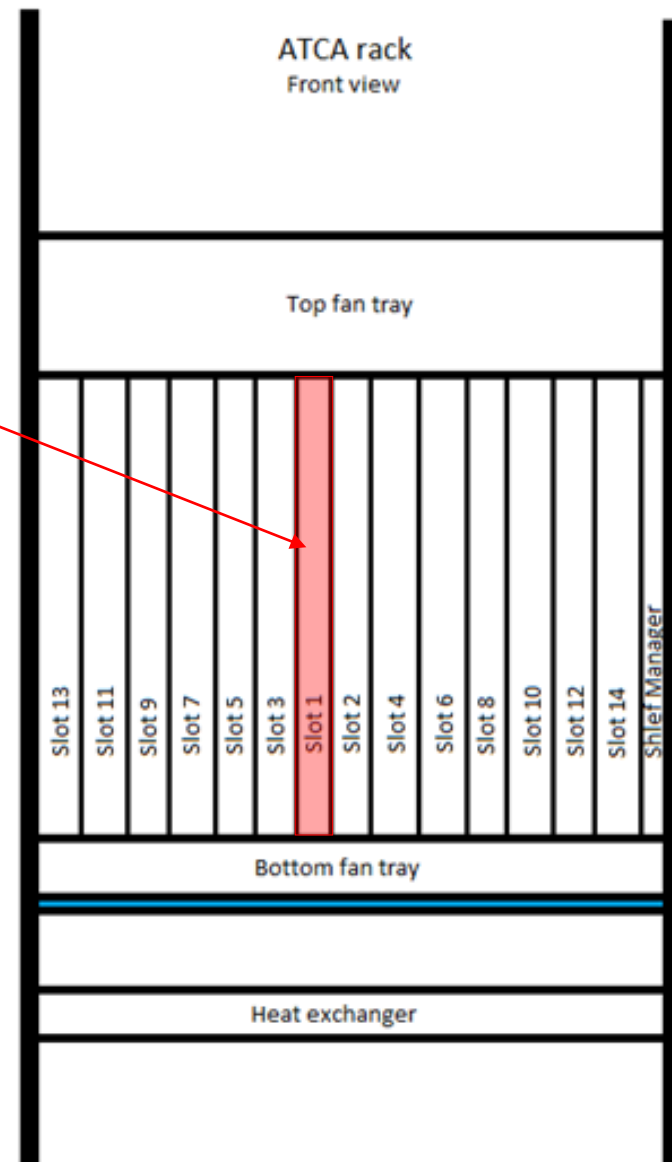


Cooling study

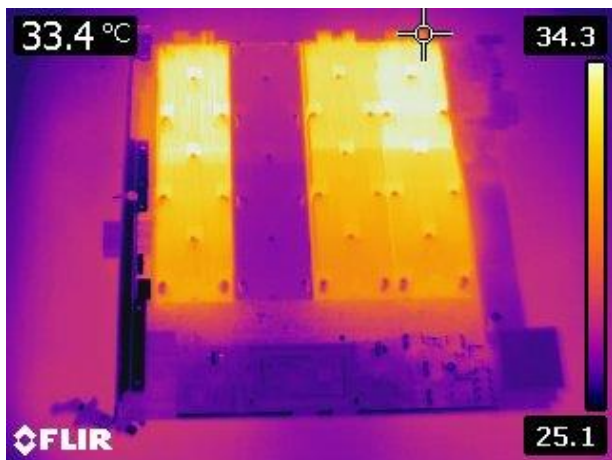
- ❑ Dissipate homogeneously 450W per slots except in the slot under test



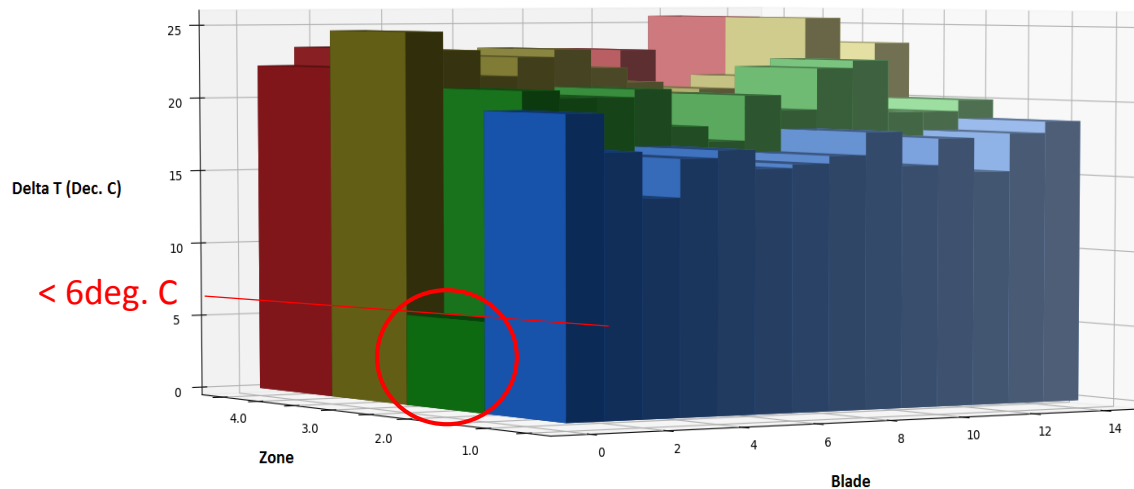
Is it a safe place for the optic?



Cooling study

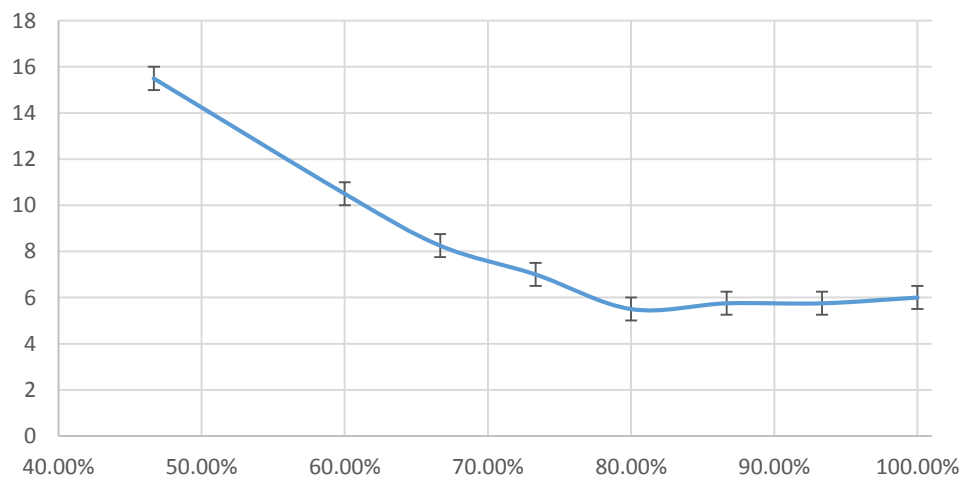


Fan at max. speed



< 6deg. C

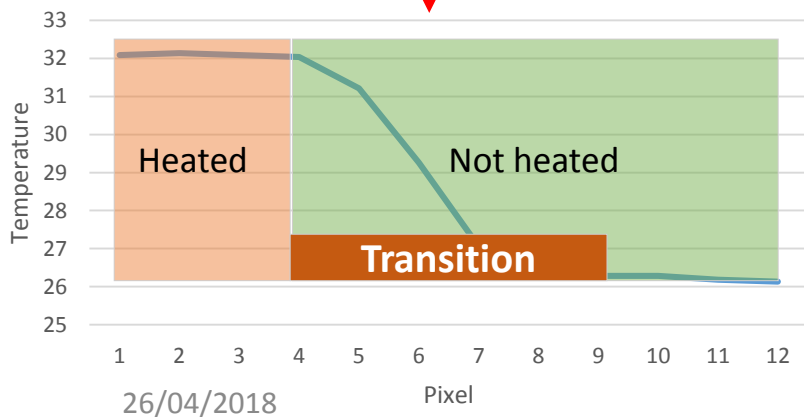
0W zone - delta T.



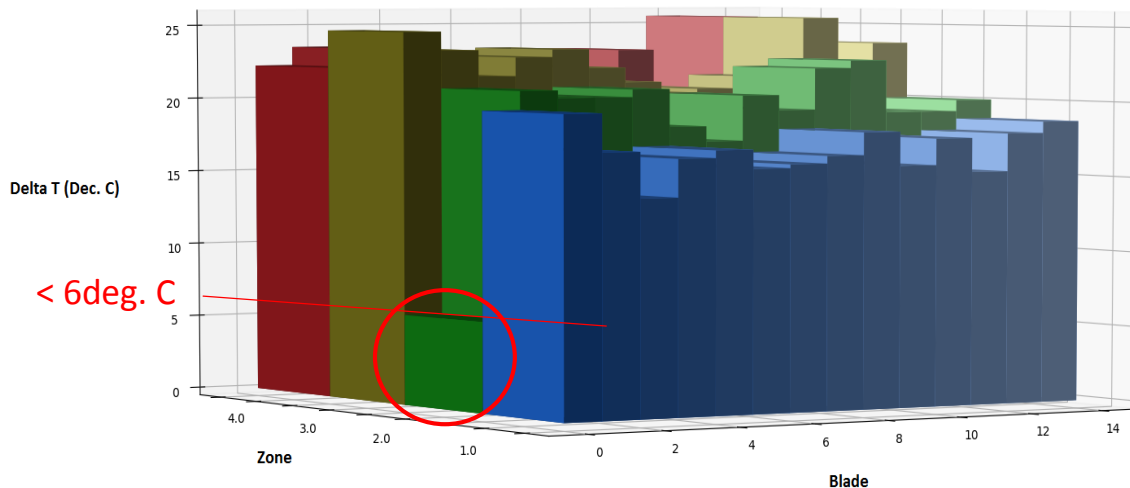
Cooling study



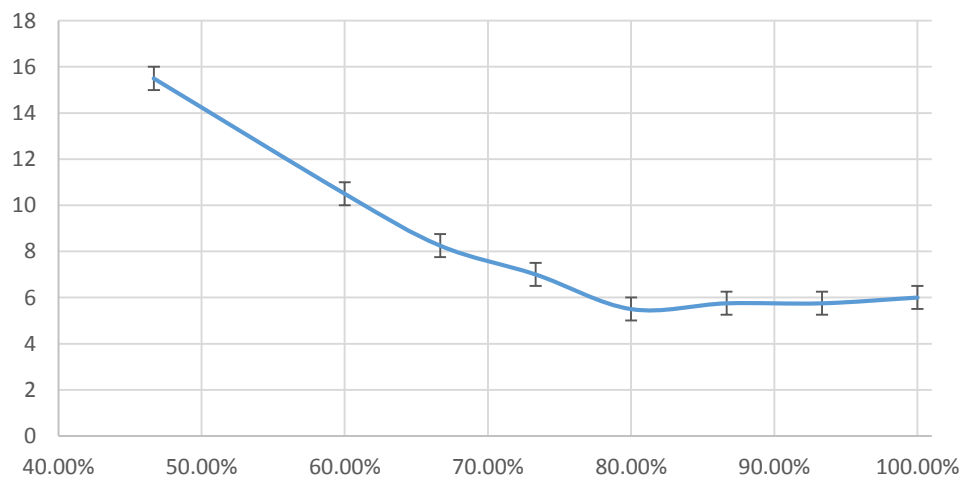
1px = 0.13cm
5px = 0.65cm



Fan at max. speed



OW zone - delta T.



Cooling study

❑ Optic must be cooled enough in order to work below 50 deg. C

● **A word of caution to backend board designers:**

- Do not preselect your favorite on-board optics module
- VL+ is presently considering freezing module type and giving you advance notice
- Run your optics cool or make it replaceable
- Running at elevated temperature is possible, but will affect life-time
 - Data from one supplier (T is heatsink temperature)
 - T<50degC will result in <1% wearout failures in 15 years (to which random failures will add ~3.7%)
 - T<57degC will result in <10%

ACES 2018

francois.vasey@cern.ch

17

Is it possible to keep a “cold” zone on ATCA blade located in the selected crate ?

Looks positive !

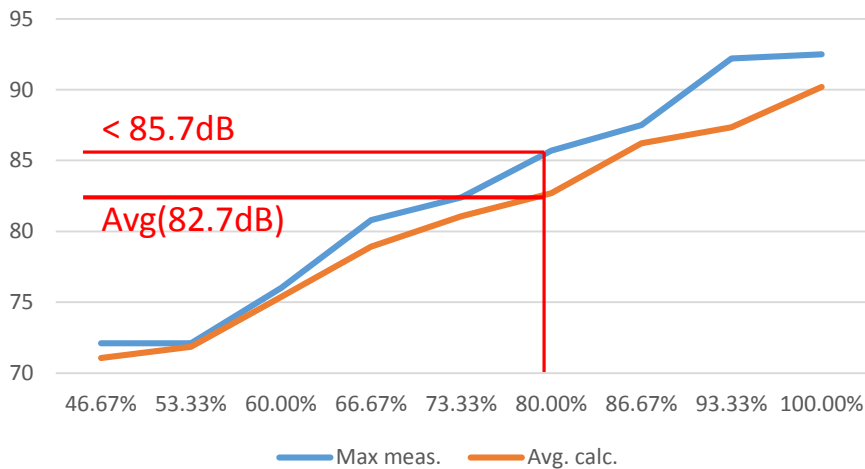


Cooling vs. noise

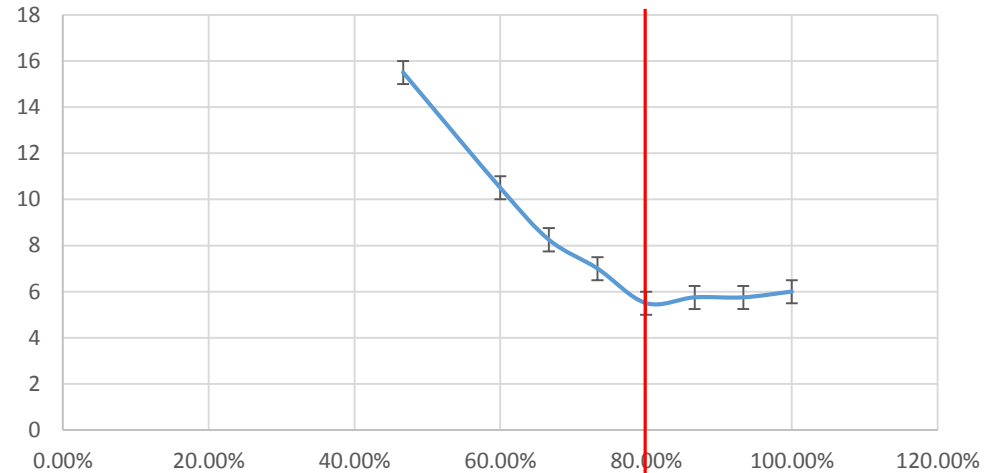
- ☐ Selected fan speed = 80%
 - Low gain above this fan speed
 - Within the spec (delta T. < 35 deg. C)

- ☐ Noise around 82.7db (average) at 1m
 - Without noise isolation
 - From Claudio's talk (ACES), a gain of up to 10db can be achieved using noise isolation

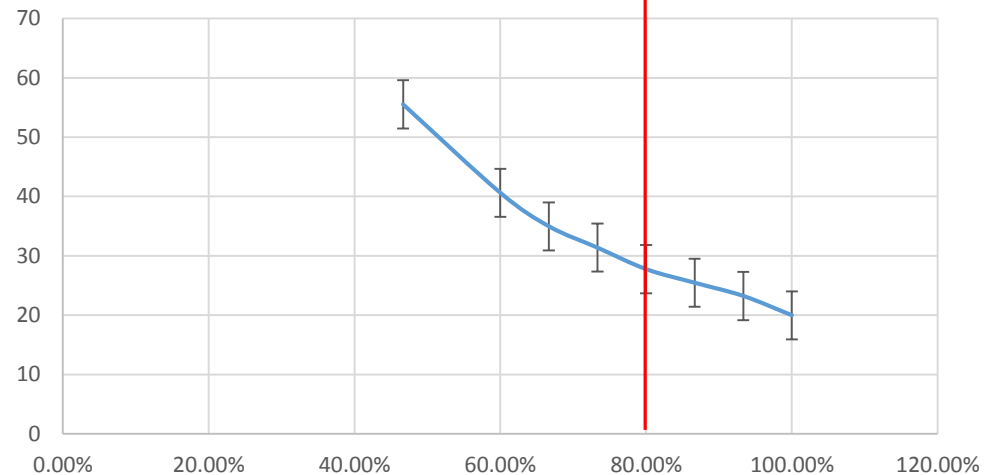
Noise



0W zone - delta T.

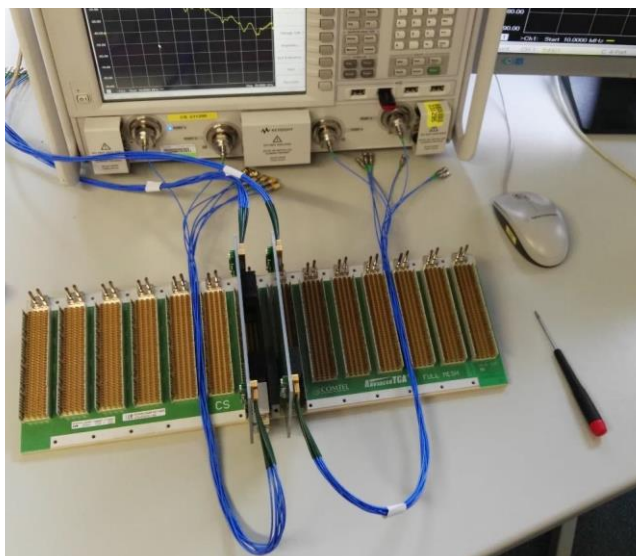


Average delta T.



Backplane quality

- ❑ Qualification using the ieee standard (100G-KR4 / 40G-KR4)
 - Performed out of the crate
 - Using qualified adapter cards
 - Using a VNA
 - Selected links: Between slots 1 and 2 and 1 and 14

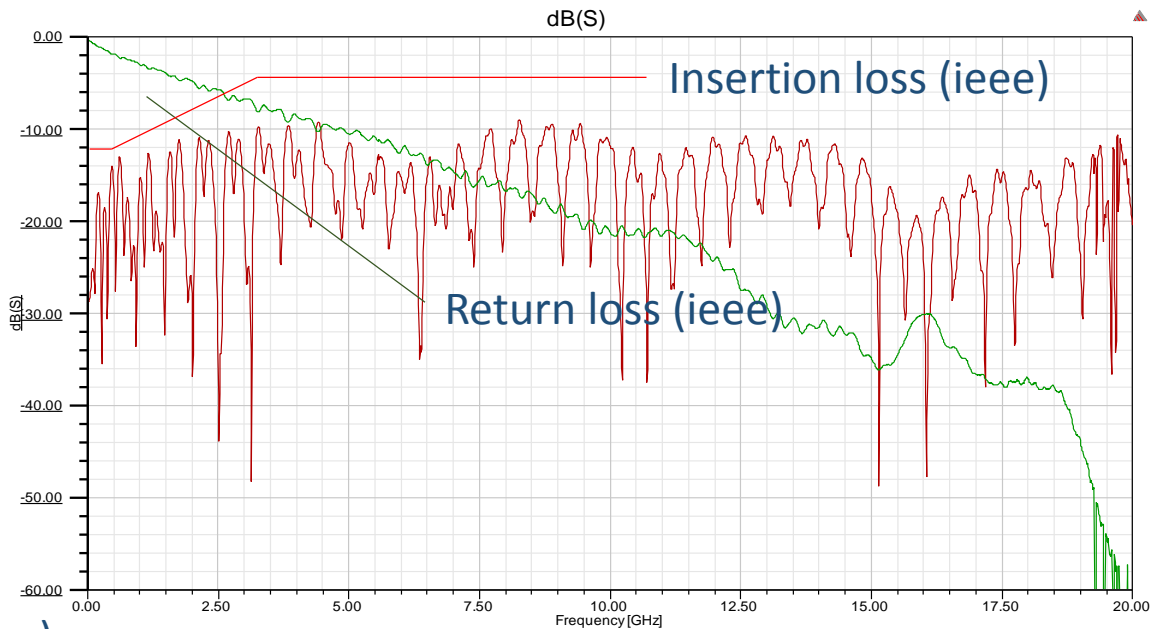


	Node	Node	Node	Node	Node	Node	Hub Star 1	Hub Star 2	Node	Node	Node	Node	Node	Node
Physical Slot	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Logical Slot	13	11	9	7	5	3	1	2	4	6	8	10	12	14

Backplane quality

Slot 1 to 14

Schroff 40G



Comtel Air+plane
backplane

Summary

❑ Cooling study

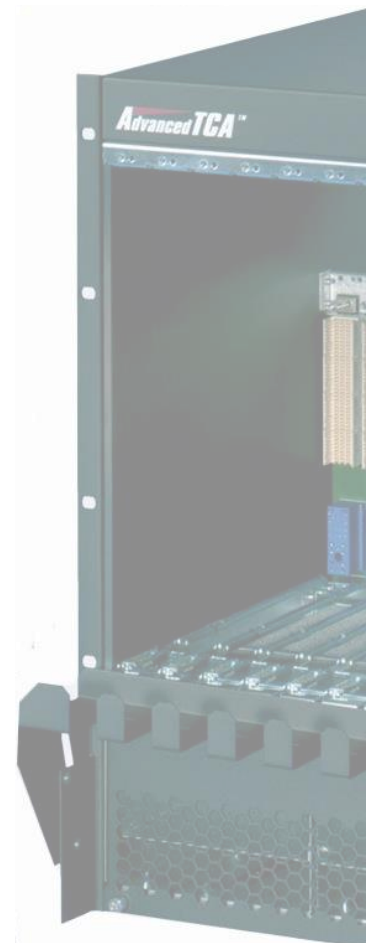
- Cooling a column to get a low delta T. seems feasible
- Firmware and placement/layout have to be thought in term of cooling

❑ Backplane quality

- Within the IEEE 40G-KR4 standards
- Qualification at 100Gbps still have to be done (DS ordered)

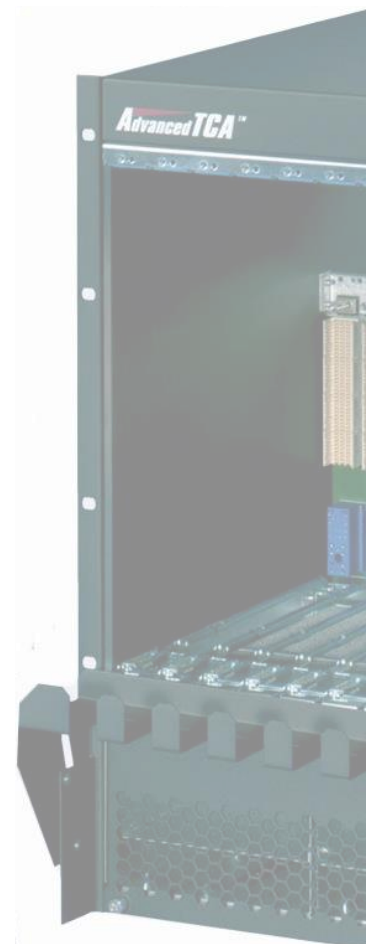
❑ Procurement status

- Qualification is on-going
- Measurements from the first crate are encouraging
- Goal: Contract to be ready in June 2018



Thank you

julian.mendez@cern.ch



AdvancedTCA blade cooling

□ Placement proposal:

