ATCA cooling tests

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xTCA IG meeting – 25 February 2015

Outline

Project motivations and goals

- Check LHC rack cooling capabilities
- Temperature and air speed monitoring
- Possible improvements

Hardware and software status

- Install and implement rack equipment and hardware
- T, p and air velocity sensors installation and reading
- LabView implementation and user interface

Preliminary tests schedule

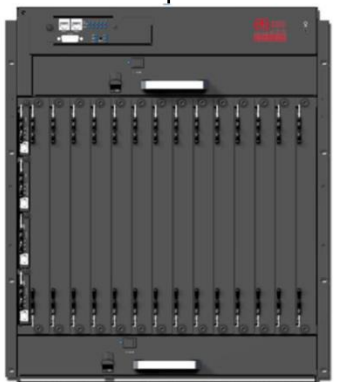
Project motivations

Vertical air flow cooling test on a standard LHC rack

- Cooling capabilities of the LHC rack need to be checked moving from VME Crates to ATCA shelves
- Rack turbines capabilities are lower than the fans system integrated in the ATCA shelves. Removal of the turbines is an option that we would like to check
- Temperature and air velocity gradients in the rack must be checked (room temperature long term effect?)
- Identify potential in-rack bottlenecks and airflow resistance sources. Propose possible alternatives/fixes to remove them and test these adaptations. If required and possible run complementary simulations to confirm solution improvement.

Hardware: schematic connection

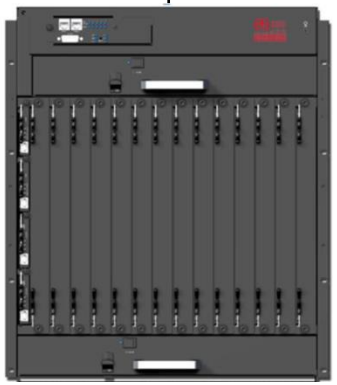
Ethernet
ATCA 1
14x 350 W =4.9kW



power setting
T sensors reading
power sensors reading
fan control

Ethernet

ATCA 2



fan contorl

USB

Agilent 34870

30 x
T sensors PT100

2 x
p sensors

USB

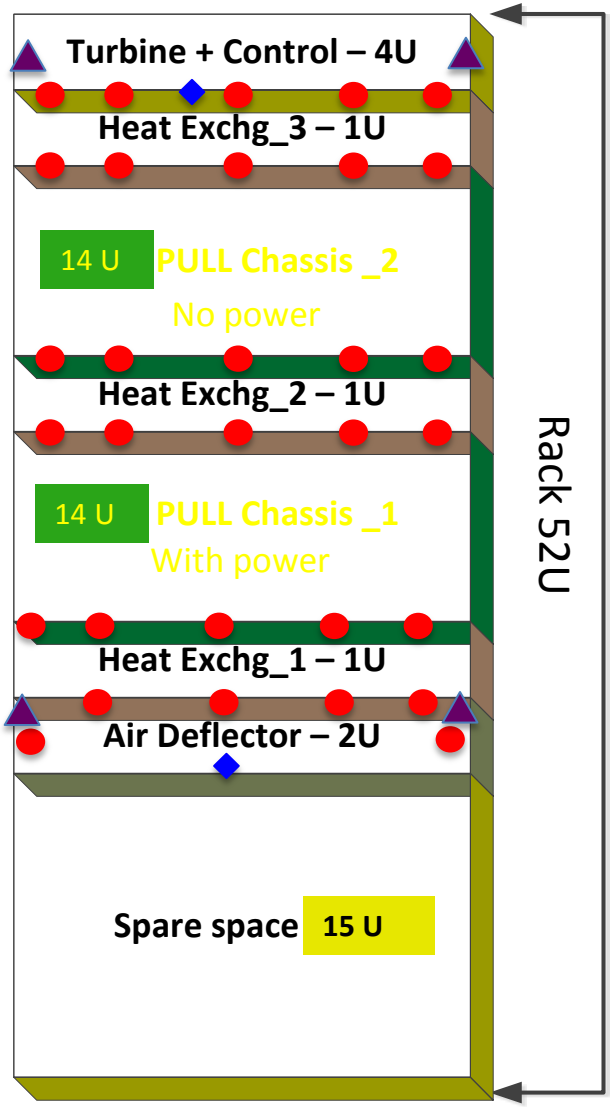
6 x
air velocity sensors

Sensors Layout

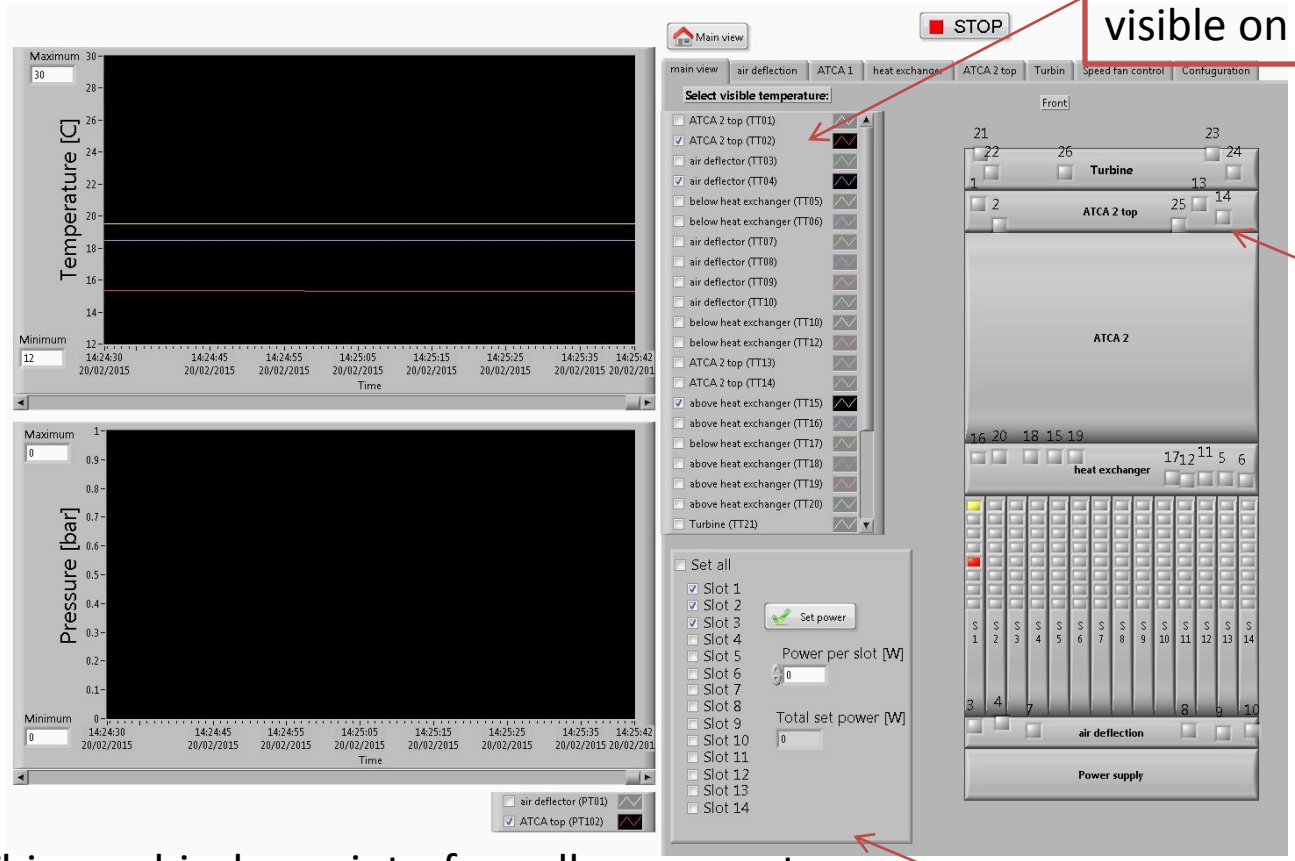
- Temperature sensors
- Pressure sensors
- Velocity sensors

ATCA Chassis 1 - 8 temperature sensors per blade,
14 blades: 112 temperature sensors

The sensors layout could change according to the kind of tests we have to carry out.



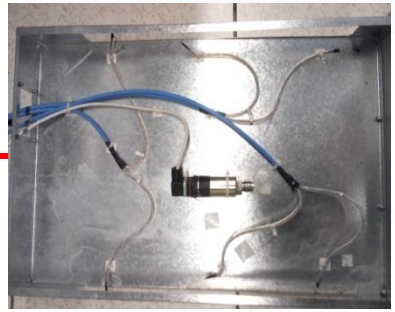
LabVIEW Program- Main view



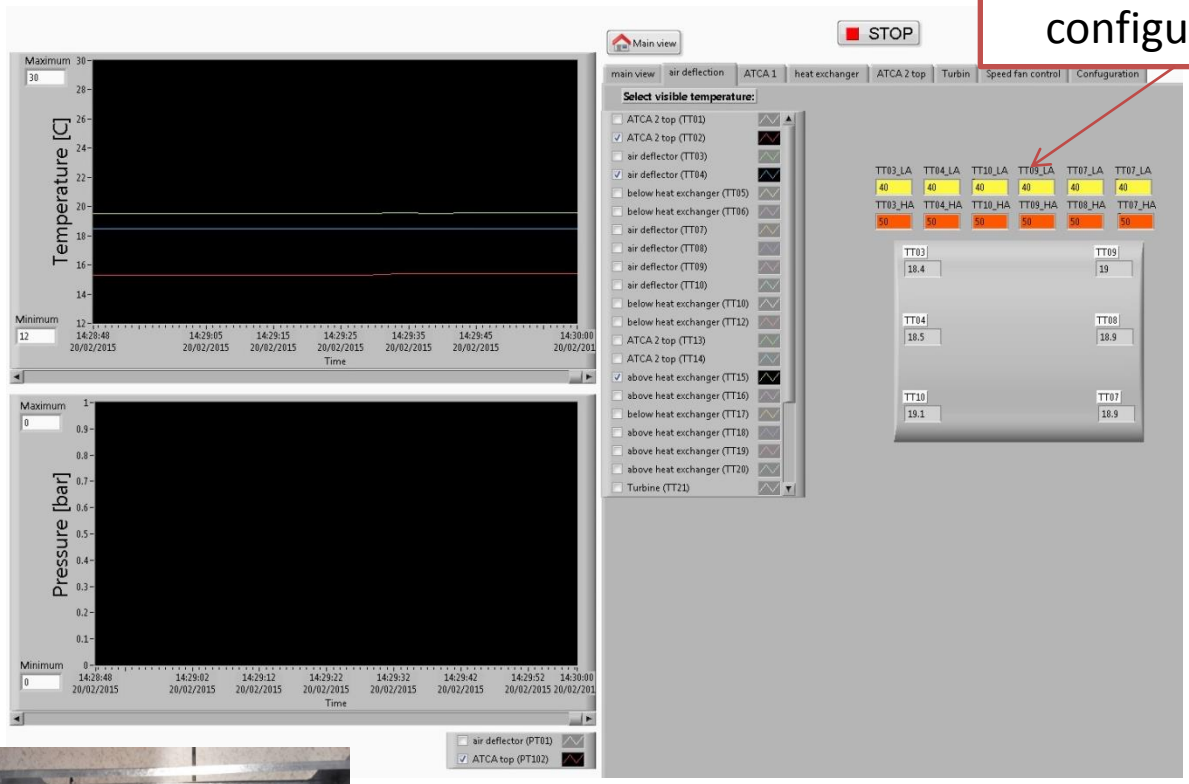
This graphical user interface allows users to:

- see low and high alarms
- set a power
- select temperature visible on the trend plots

LabVIEW Program- air deflector

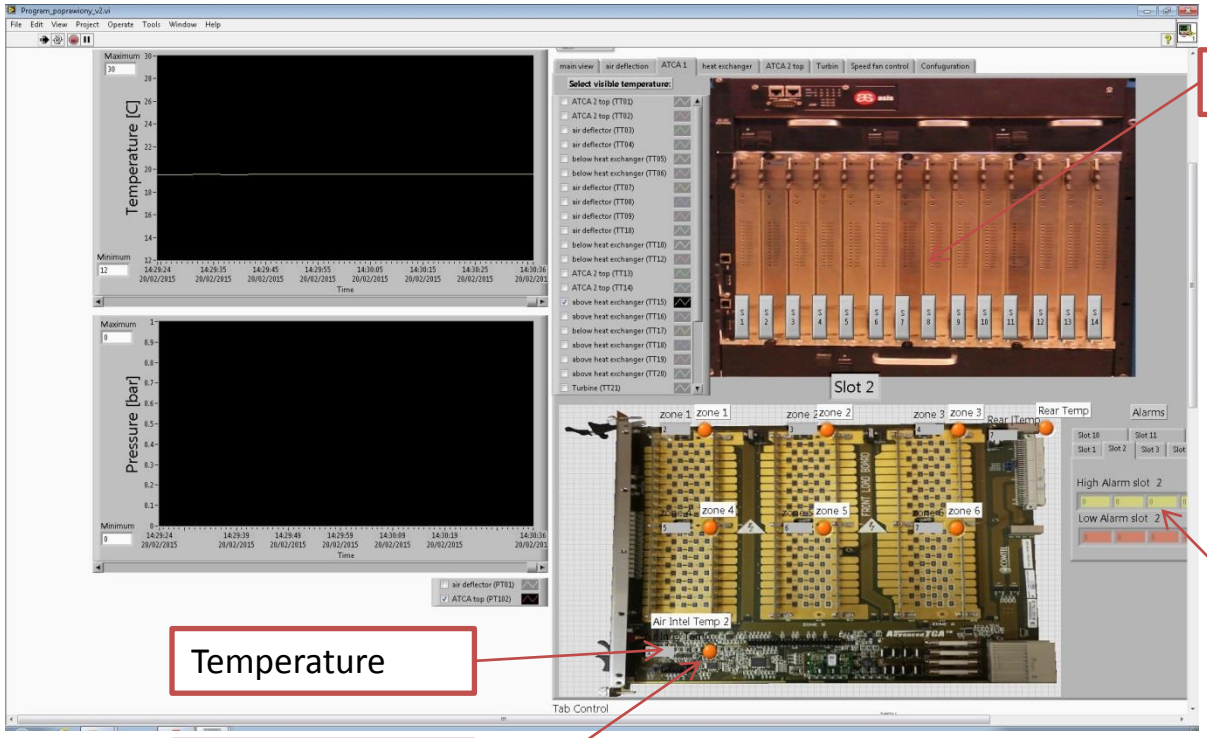


Sensors inside deflector



- T and p measurements inside the air deflector
- Set Temp alarms and warnings
- Panels optimization ongoing

LabVIEW Program- ATCA 1



Selection slot

Temperature

On/off visibility temperature on the graph

Alarm configuration

This panel allows users to:

- check low and high levels alarm
- set the power dissipated by the blades
- select the temperature to be displayed on the graph

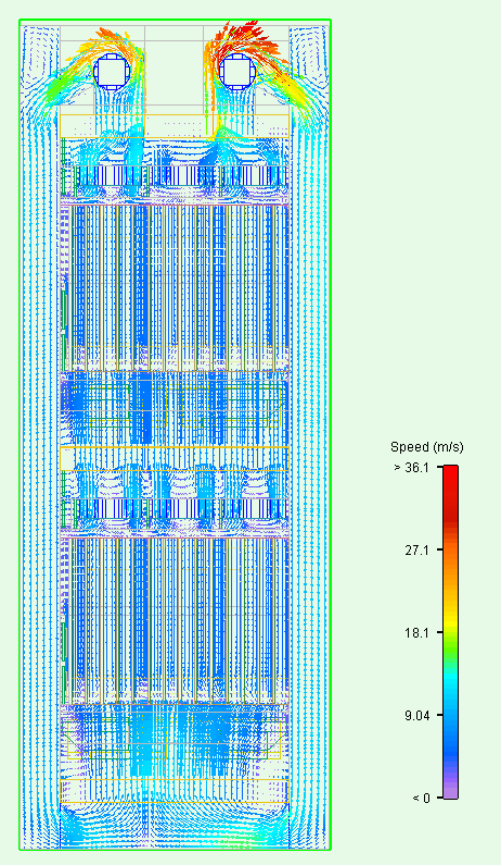
List of tests

- Evaluate the thermal performance by measuring the distribution of temperatures, air velocity and pressure in the rack volume with different "rack layouts and functional settings
- Identify any hot spots or high air speed locations

  - ATCA load blades from 0 W to full power: 350W
  - Rack turbines performance at different speed of the ATCA fans system

Verify simulation outcome and proposed adaptations and, where p
alternative improvements

  - Remove the turbines blowers repeat the tests
  - Small mechanical modification to improve the air circulation (reduce noise?)
  - Different Heat echangers?



The commissioning of the control system is ongoing and we could start the tests at the end of this week

Summary

The ATCA cooling tests and measurements are important to identity any possible cooling or mechanical issues the integration of 2 ATCA chassis in a standard LHC rack may cause

The test rack is being equipped with ATCA chassis, HX and all the sensors

We identified a preliminary list of tests we would like to make to assess the cooling capability of the rack in its standard configuration

According to the results, we would like to apply some mechanical modifications on the rack and check the new performance

We plan to start the tests this week and get the first results very soon