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Power Consumption Monitoring in ITIM Datacenter

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Aim of work

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The temperature monitoring and the possibilities to reduce the power consumption in Datacenter

Developping additional methods to monitor the operation of air conditioning equipments to prevent some damages that could occur in the cooling system, possible intervention can be so much faster and avoid the appearance of the defects.

We need the monitoring system for our Datacenter that's include a Grid site **RO-14-ITIM**, a MPI Cluster, database servers and the network communication system

Research teams in INCDTIM

- Physics of multifunctional nanostructure systems
- Isotope separation and labeled compounds
- Mass spectrometry, chromatography and ion physics
  - High-Tech Engineering in ATLAS experiment at LHC Cern Geneva
- Molecular and Biomolecular physics
  - Numerical Modeling
  - Structural Analysis in Solids
  - Self-Assembled Molecular and Biomolecular Systems

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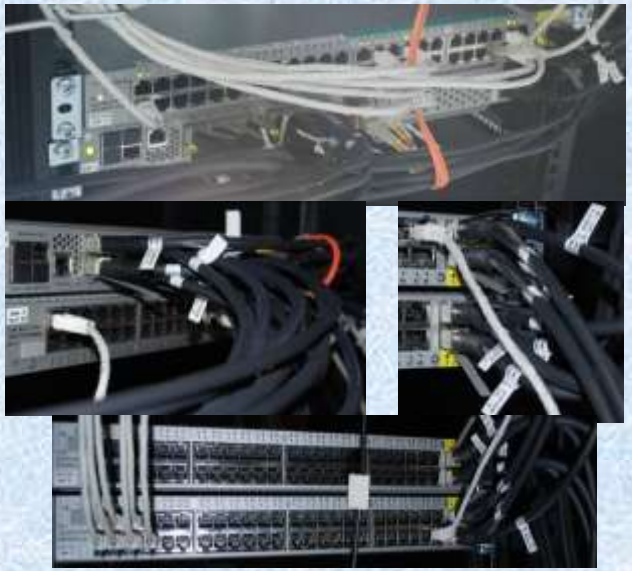
- Grid site **RO-14-ITIM**
  - **Core 250, Storage capacity: 100 TB, Technology 1U + Blade system (IBM & HP)**
- **MPI Cluster**
  - **400 Core, 96 GB / Computer, 450 GB HDD**
- **Network Institute**
  - **Database server**
  - **Communication Server**
  - **Full functional Cisco system**

Network abilities

- **Switch Cisco 6509E**
- ITIM – RoEduNet **10 GB** from 1 Feb. 2011
- Nexus system
  - ~40 GB inside the Grid site
  - ~20 GB between Grid Site and Switch



Monitoring system

The user frequency in the range [0.1 ... 60] second of the three monitored parameters for each component on controlled system.

The followed parameters:

- voltage power supply of the cooling units;
- temperature of the heat transfer of heat exchange circuit;
- state of rotation of the main outside fans that serves the unit, with their propeller motion detection.

“Hardware” part

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An electronic board with its "firmware" called "AVR_NET_IO"

A microcontroller ATmega32 type and completed with an adaptation electronic circuit needed to connect sensors.

Development board with eight digital outputs, four digital inputs and four analog inputs.

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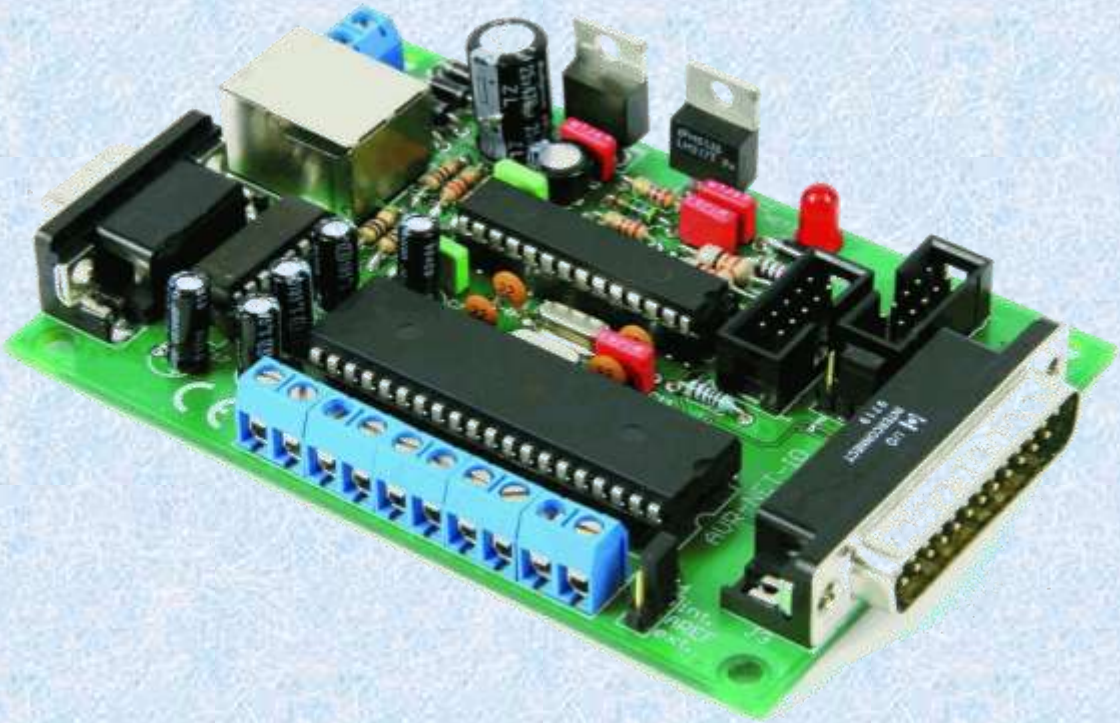
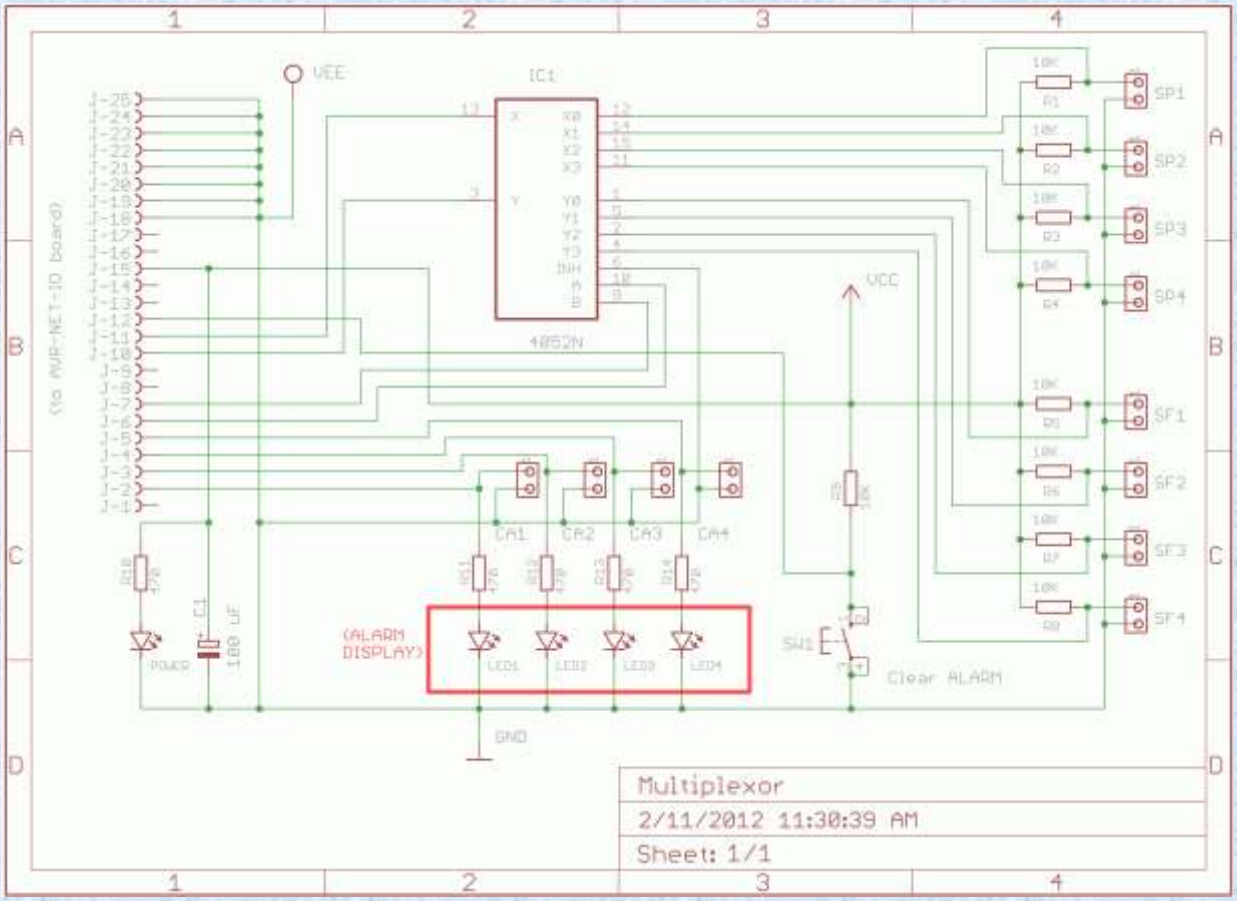


AVR_NET_IO electronic board



Schema of the adaptation circuit

“Software” part

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The virtual device is implemented in software, with a graphic interface, designed to:
- read the watched parameters values
- generates an alarm in case it is identified this need.
- simulates the operation of warning lights panel on the display,
- implements 2 mechanism: an abort command or trigger an alarm by authorized users.

Development board communicates with a computer by Ethernet connection

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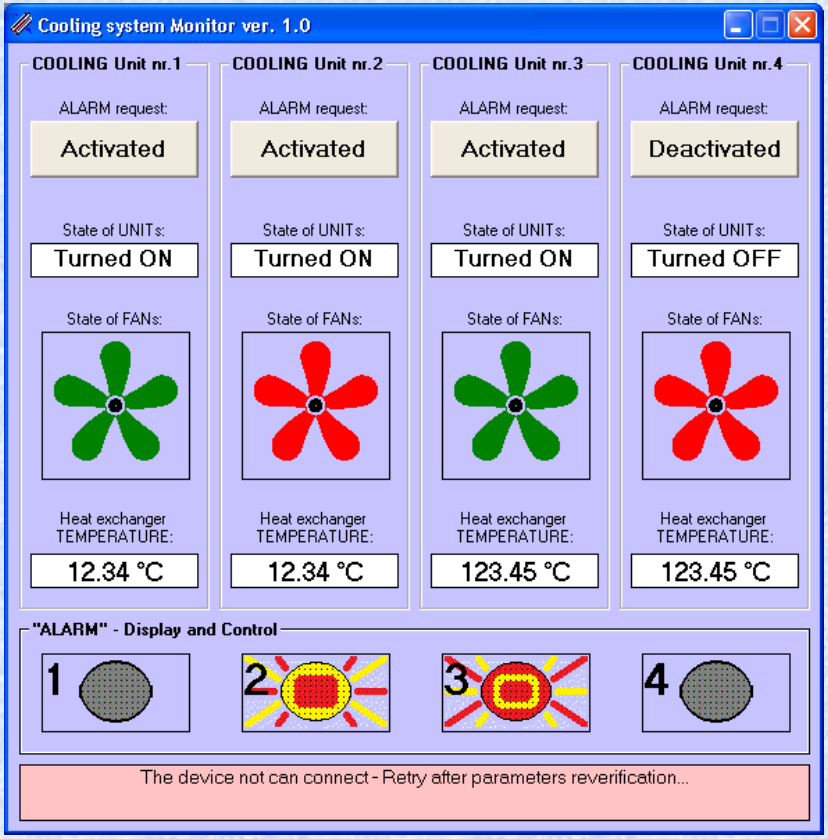
The program:

- generates commands for data acquisition from sensors attached;
- control execution device that relays control panel display or digital multiplexer.



Graphic interface

Temperature monitoring

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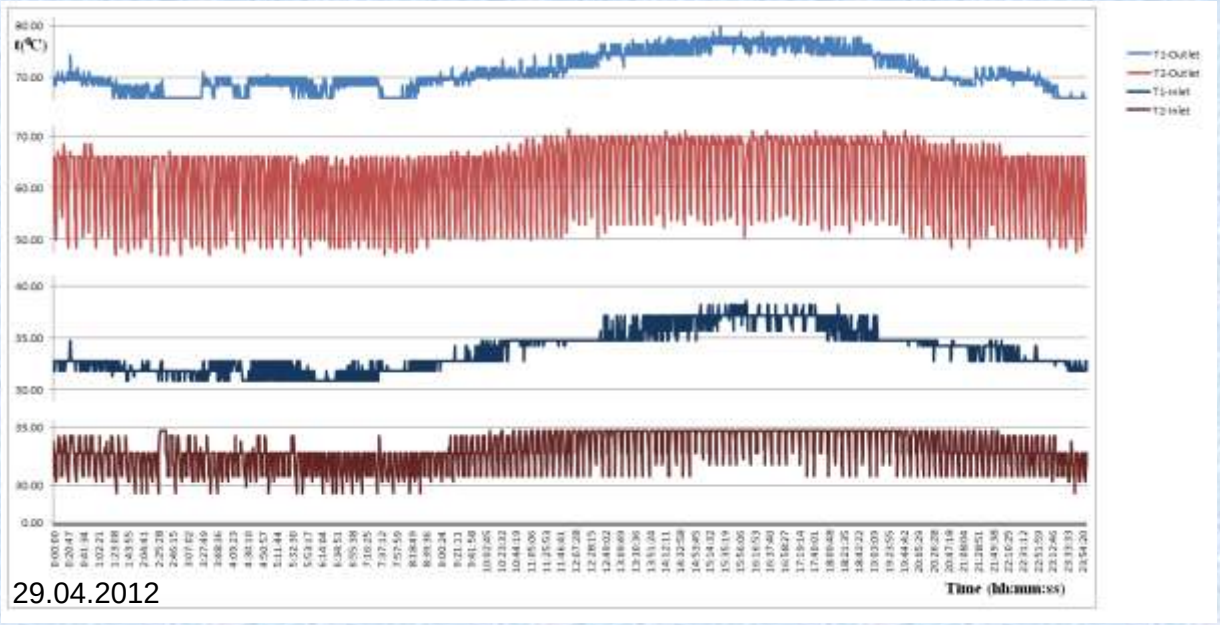
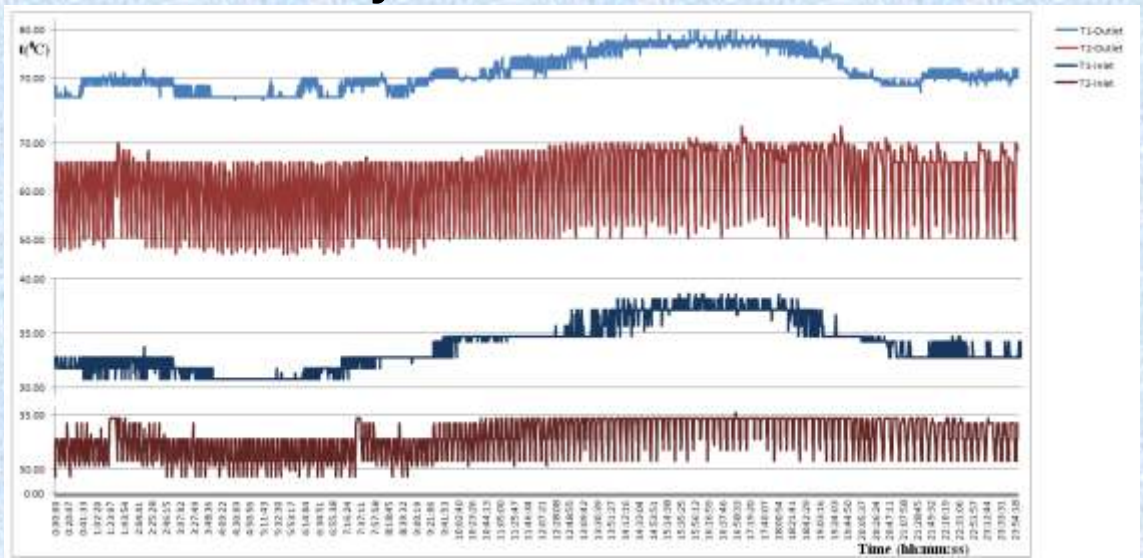


29.04.2012

Refrigerant temperature at the inlet and outlet of the cooling unit, in two different days



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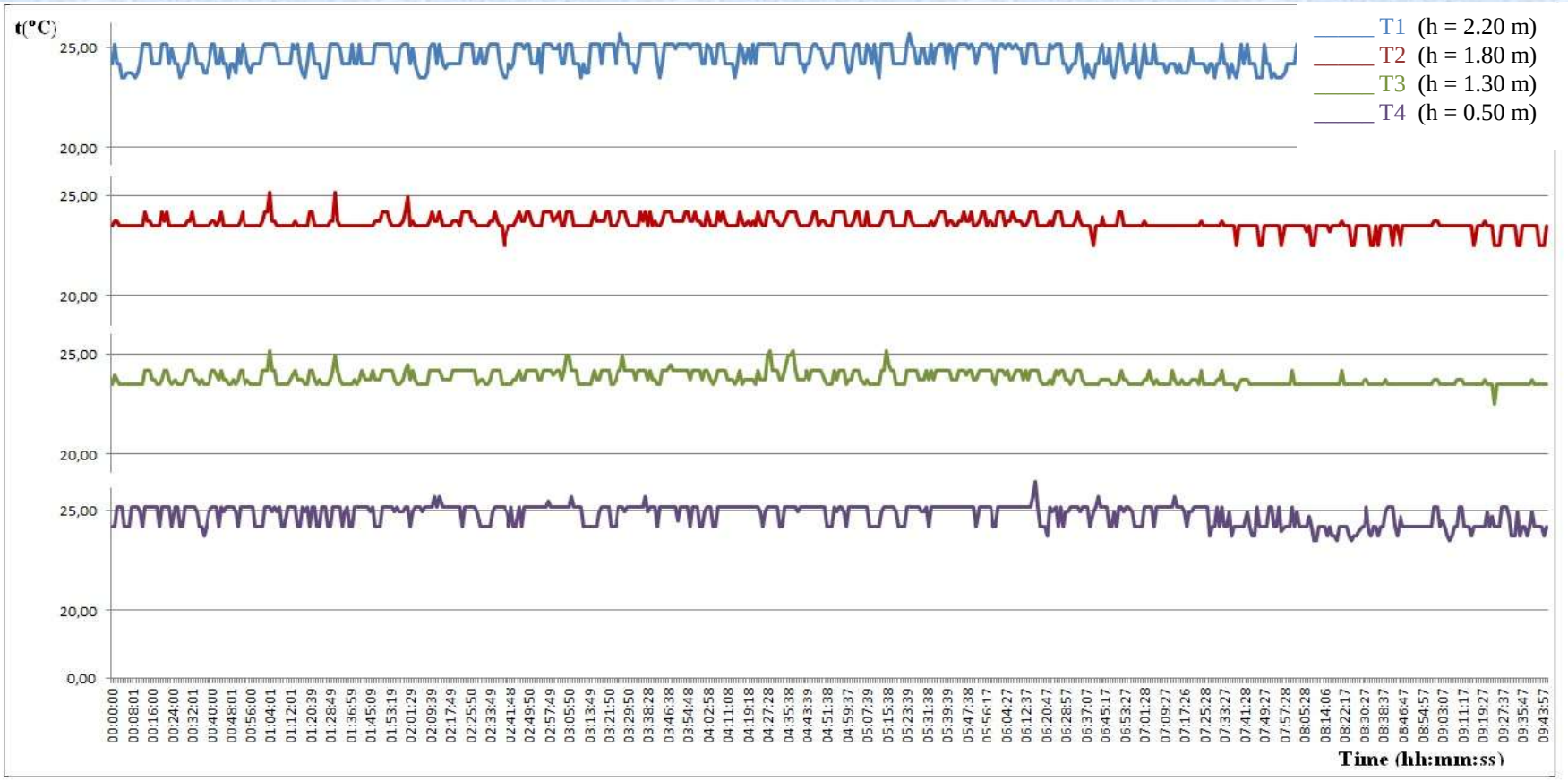

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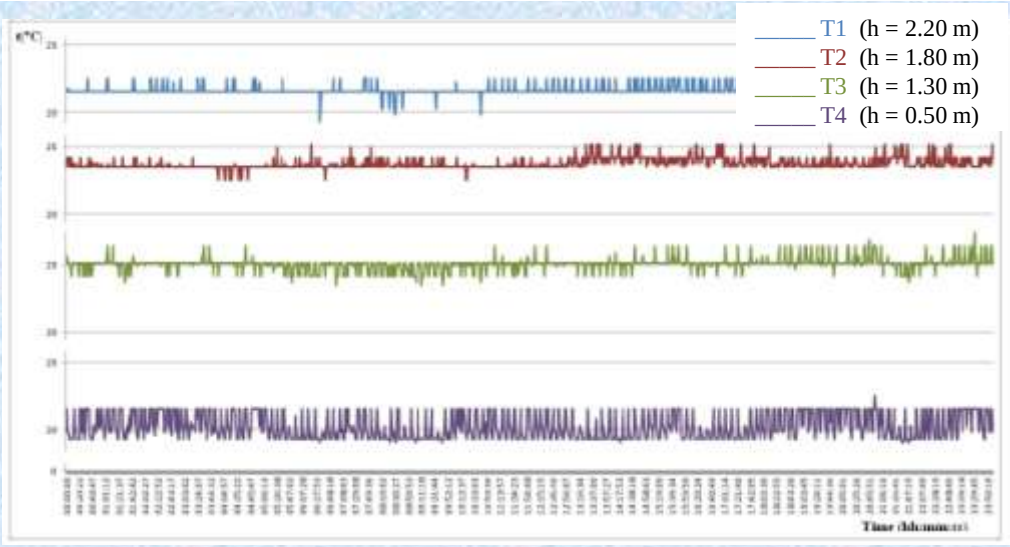
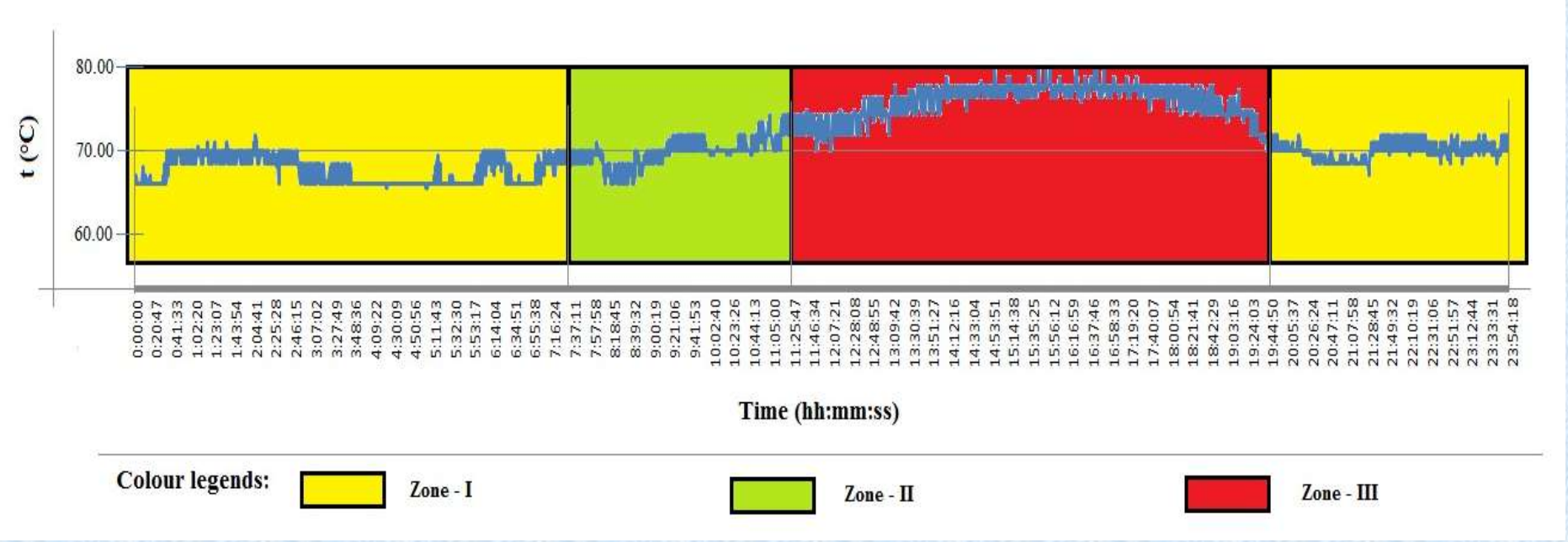


Ambient temperature variation in Datacenter



Test periods for reducing energy consumption

CONCLUSIONS

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- The parameters controlled by complex automation system, will be adjusted to acceptable values while working even for relatively short periods of time. It is possible to detect the problems in the functioning of the cooling devices, with at least 10 minutes before recording by automatic fault protection thereof.

- The alarm starts when the temperature is with minimum 3°C above or below to established working range or / and fan damage.

- Detect situations where the system works with some of the parameters changed significantly from the normal will help to easier system maintenance and ensure improved safety in operation.

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- Refrigerant temperature increase especially at the outlet of the cooling unit, during normal working hours, when multiple tasks are launched.
- In order to reduce the energy consumption we stop some air conditioning systems or some computers and follow the variation of temperature at different times of day.
- These intervals were set so that the economy is high, but the work's Datacenter is not disturbed.

ACKNOWLEDGEMENTS

This work is supported by the Romanian Research and Development Agency through EU12/2009, EU15/2009, TE-76/2011 projects, and the development of the datacenter monitoring capabilities

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Thank you for your attention !