



European Coordination for Accelerator Research and Development

## PUBLICATION

# ATCA Carrier Board with Dedicated IPMI Controller

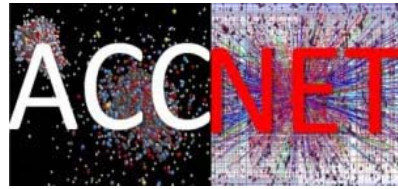
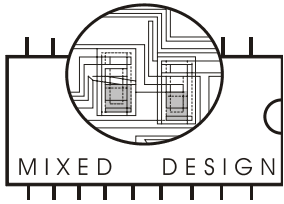
Perek, P (TUL) *et al*

15 November 2010

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This work is part of EuCARD Work Package **10: SC RF technology for higher intensity proton accelerators and higher energy electron linacs.**

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# ATCA Carrier Board with Dedicated IPMI Controller (1)

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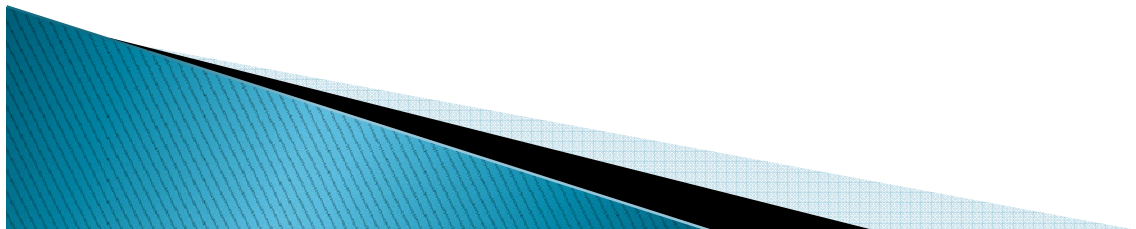
Department of Microelectronics and Computer Science

Lodz, Poland

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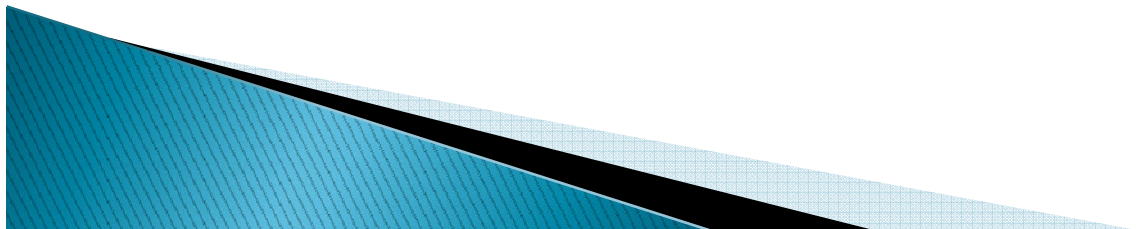
# Outline

- ▶ ATCA-based LLRF Control System of XFEL
- ▶ Intelligent Platform Management Controller
- ▶ Previous and current IPMC solutions
- ▶ Summary



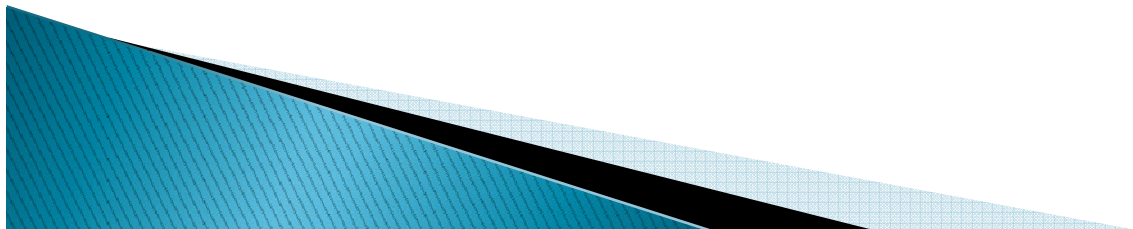
# LLRF Control System of XFEL

- ▶ Tasks of LLRF system of XFEL accelerator:
  - Control of the cavity resonance frequency,
  - Data acquisition,
  - High-frequency signal processing.
- ▶ This system requires stable continuous operation.
- ▶ It was decided to build the prototype system based on ATCA specification.

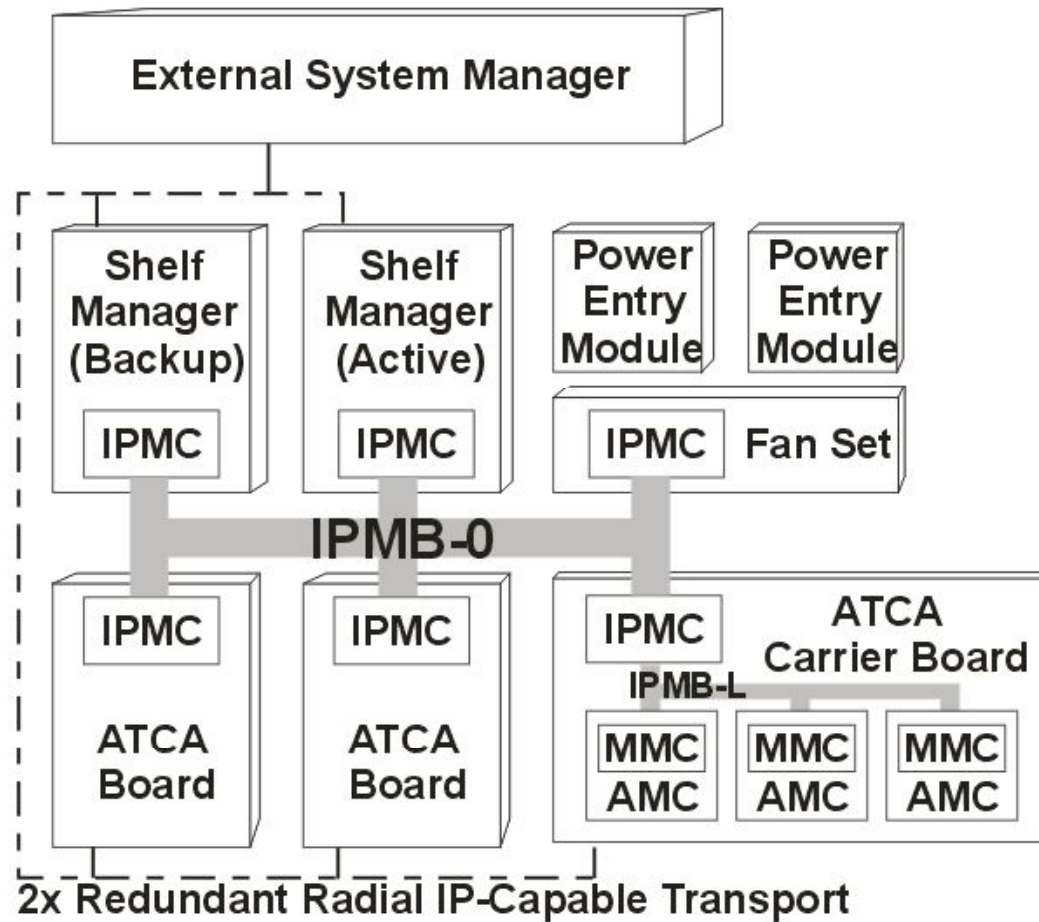


# ATCA standard

- ▶ ATCA standard ensures high level of:
  - Reliability,
  - Availability,
  - Serviceability.
- ▶ Modular design allows flexible configuration.
- ▶ Hot Swap mechanism allows modules exchange during normal system operation.
- ▶ Providing all these functionalities is possible thanks to use of a complex IPMI management system.

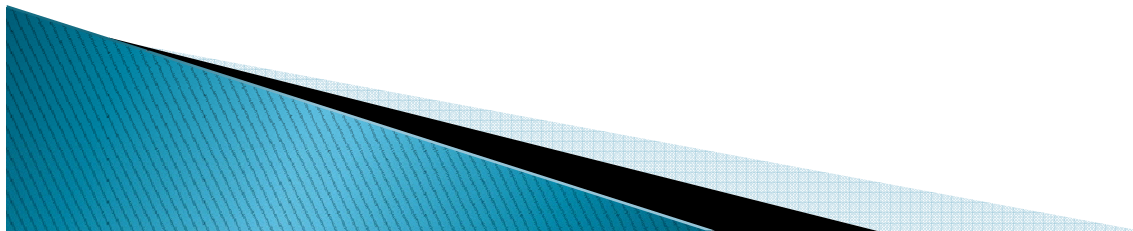


# Intelligent Platform Management in ATCA shelf



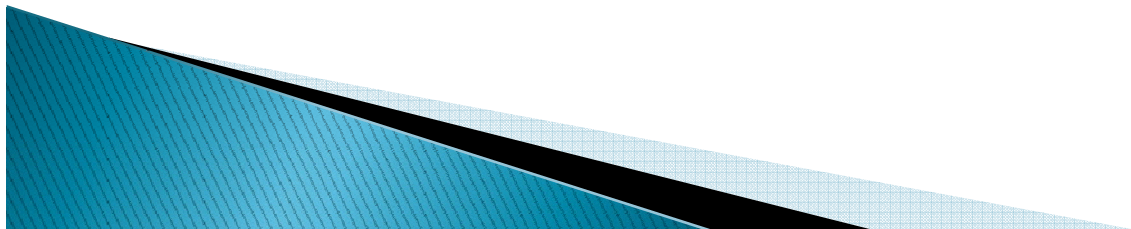
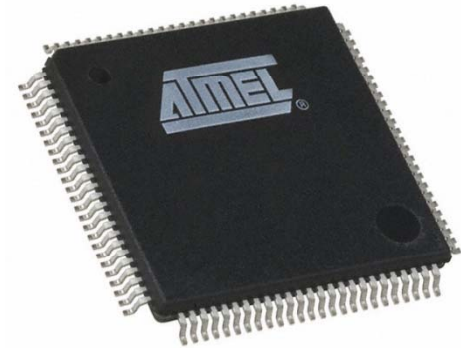
# The Role of IPMC

- ▶ Control of hot-swap activation and deactivation,
- ▶ Management of on-board sensors,
- ▶ Early detection of faults – event generation,
- ▶ Electronic Keying management,
- ▶ Supervision of Advanced Mezzanine Cards.



# Previous solutions of IPMC

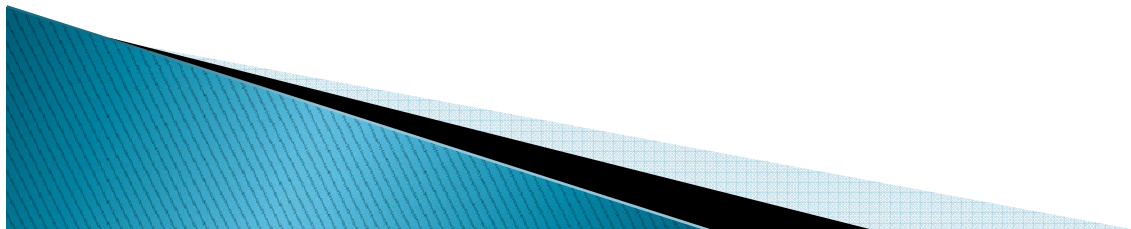
- ▶ IPMC consists of two devices:
  - Atmel Atmega1281
  - Xilinx Spartan 3
- ▶ Faults of microcontroller:
  - Only one built-in I2C interface
  - Small number of I/O pins
  - Low frequency of CPU operation
  - Small amount of RAM





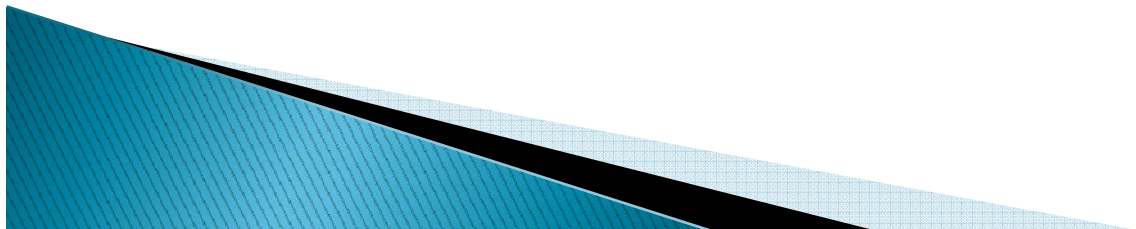
# Renesas H8S/2166

- ▶ Microcontroller dedicated for management systems in telecommunication applications
- ▶ Essential features:
  - 16-bit CPU operating at a frequency of 32 MHz
  - ROM: 512 kbytes, RAM: 40kbytes
  - Six-channel I2C bus interface
  - General I/O pins: 106
- ▶ Meets all the requirements



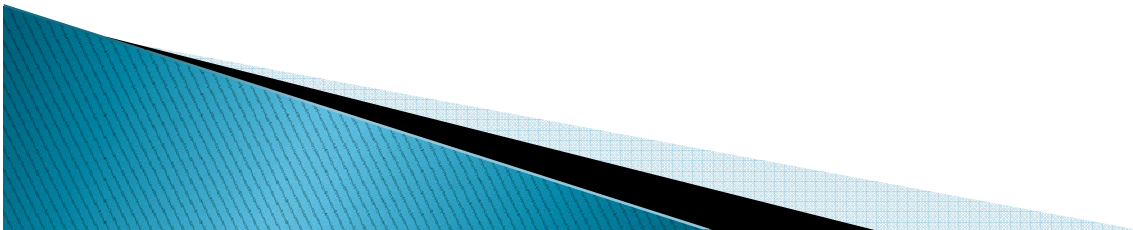
# Summary

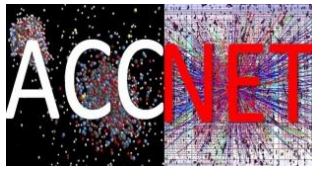
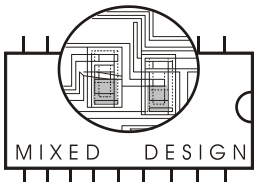
- ▶ Greater clock frequency speeds up the operation of the device
- ▶ Six I2C channels provide stable and parallel communication with all the components on the IPMB
- ▶ Single-device IPMC
  - Increases the reliability
  - Facilitates the software development and maintenance
  - Removes the need for interfacing between devices



# THE END

- ▶ Questions?
- ▶ Comments?





**Report of RFTech presentation during  
Mixdes conference  
(June 26-27, Wrocław, Poland)**

**Title of presentation:**  
ATCA Carrier Board with Dedicated IPMI Controller

**Presenter:**

Piotr Perek (student)

Department of Microelectronics and Computer Science

Technical University of Lodz

Lodz, Poland



Piotr Perek presented a new solution of Intelligent Platform Management Controller for ATCA Carrier Board for prototype of LLRF control system of XFEL accelerator. In accordance with ATCA specification each ATCA Board must be equipped with IPMC what gives the possibility of its management and control. Presented solution of IPMC is based on Renesas microcontroller dedicated for management in telecommunication systems such as ATCA or MicroTCA. In comparison with previously used IPMCs presented solution ensures more stable communication over IPMBs and also more reliable and faster operation.

**Abstract:** The Advanced Telecommunications Computing Architecture (ATCA) specification allows to meet the newest trends in high speed communication technologies. Furthermore, it provides manageability, availability and exceptional reliability at 99.999% level. Therefore, this architecture is perfect to use in control systems of complex projects like the Free-Electron Laser in Hamburg (FLASH) or the X-ray Free Electron Laser (X-FEL) that work with high-frequency signal processing, use high-speed communication protocols such as PCIe, Gigabit Ethernet or RocketIO and require continuous stable operation. Modular construction allows for flexible system configuration. What is worth emphasizing, in contrast to previous solutions like, VME (Versa Module Eurocard), it is possible to change the system configuration without the need for power shutdown. Hot-plug functionality is delivered by Intelligent Platform Management Interface (IPMI) system. For this reason, all ATCA units, which can be replaced in the field should have Intelligent Platform Management Controller (IPMC) that provides IPMI functionality.

The paper presents the newest solution of IPMC for Carrier Board for LLRF control system of XFEL accelerator. A microcontroller dedicated for IPMI management in ATCA systems fulfills the role of IPMC in this module.

**Index Term:** Intelligent Platform Management Interface, Advanced Telecommunications Computing Architecture, Carrier Board, X-ray Free Electron Laser, IPMC

**Remarks:** During the conference the author expanded one's knowledge on the subject of xTCA systems and also operation principles of LLRF control system. Furthermore he familiarized oneself with the newest trends in the field of embedded systems and computation techniques.

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