

## **The AT697E LEON2-FT device integration in IPPM (Integrated Payload data Processing Module)**

*Errico, W.<sup>1</sup>; Iltad, J.<sup>2</sup>; Colonna, A.<sup>1</sup>; Bigongiari, F.<sup>1</sup>*

<sup>1</sup>*Aurelia microelettronica Srl*; <sup>2</sup>*ESA-ESTEC*

The Integrated Payload Data Processing Module (IPPM) is one of the first complex system integrating the LEON2-FT AT697E ASIC that is the ATMEL space device assigned to substitute the TSC21020F for the on board payload data processing.

IPPM is the engineering model of a single module computer designed to easily migrate into a flight module. For each component the availability of the qualified equivalent part has been considered and, for those devices (like SDRAM and Flash) without any space option a dedicated latch up protector circuit has been designed.

On the IPPM board the AT697E CPU is equipped with a large amount of memory and with a wide inter-networking capability. The AT697E device directly controls the PROM, SRAM, SDRAM components mounted on its memory bus. Two Actel RTAX2000 FPGAs realize an AMBA sub system connected to the AT697E PCI bus by an AMBA-PCI Bridge. Two CAN Controllers, a MIL-STD 1553 module and an 8 ports SpaceWire Router are available on the AMBA sub-system that also includes the HW support to allow IPPM to be remotely controlled via SpaceWire.

The main design choices taken in the IPPM project to integrate the AT697E ASIC are summarized below

- A large amount of memory banks (including 256 M byte SDRAM) is connected on the LEON2-FT memory bus.
- A HW support to perform the remote processor, power On/Off and reset is available.
- A large FLASH memory is shared between the CPU and the AMBA sub-system to allow the resident program code to be remotely up-loaded via SpaceWire
- The PCI interface has been utilized to mount several peripheral units in the CPU memory space. The PCI DMA controller has been used to perform direct transfers between SpaceWire and CPU memory.

IPPM has been developed under ESTEC/Aurelia contract (no. 18780/04/NL/JA) and the engineering modules are actually under test.