Control and Data Acquisition Software Upgrade for JET Gamma-Ray Diagnostics

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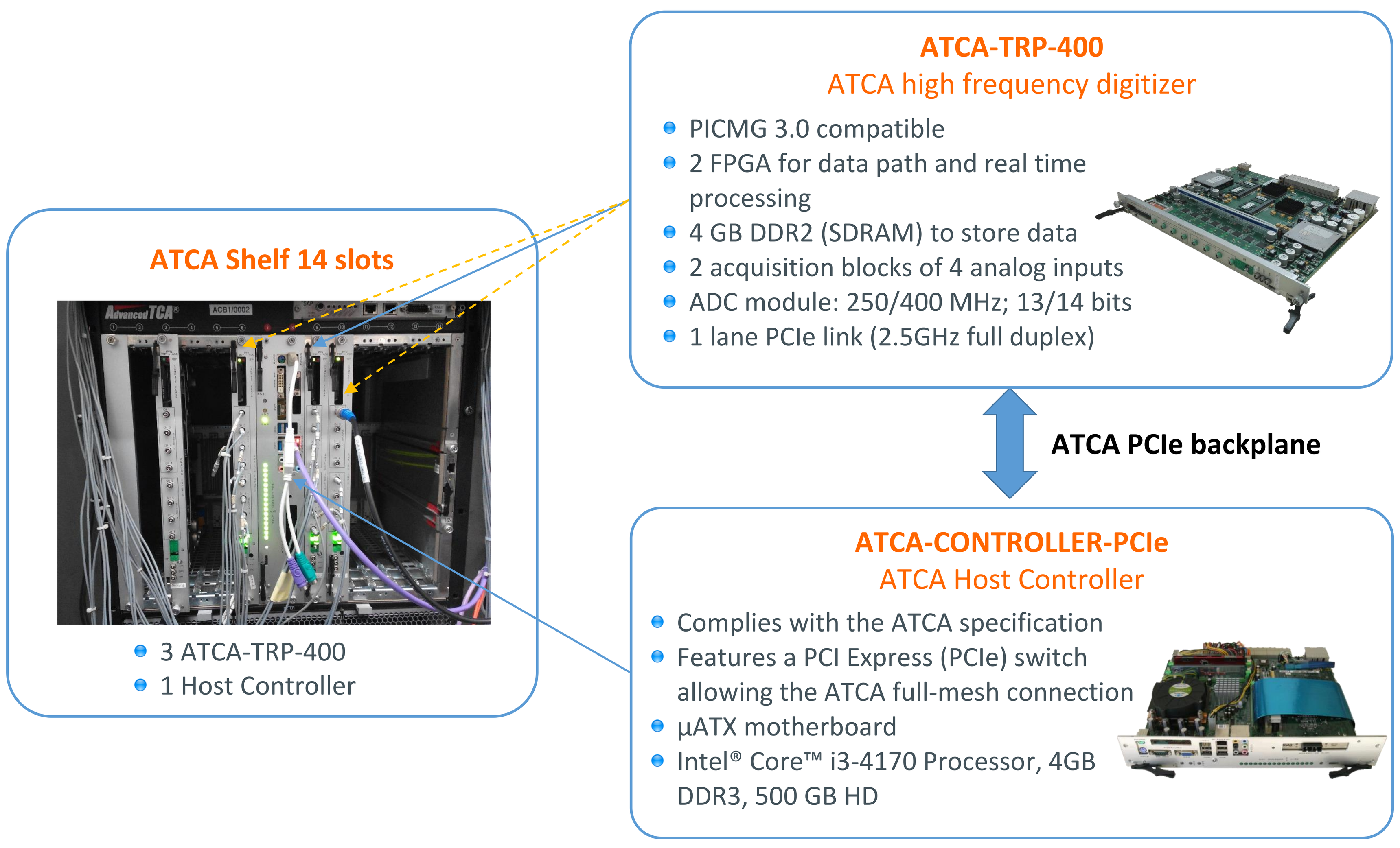
** See the Appendix of F. Romanelli et al., Proceedings of the 25th IAEA Fusion Energy Conference 2014, Saint Petersburg, Russia*

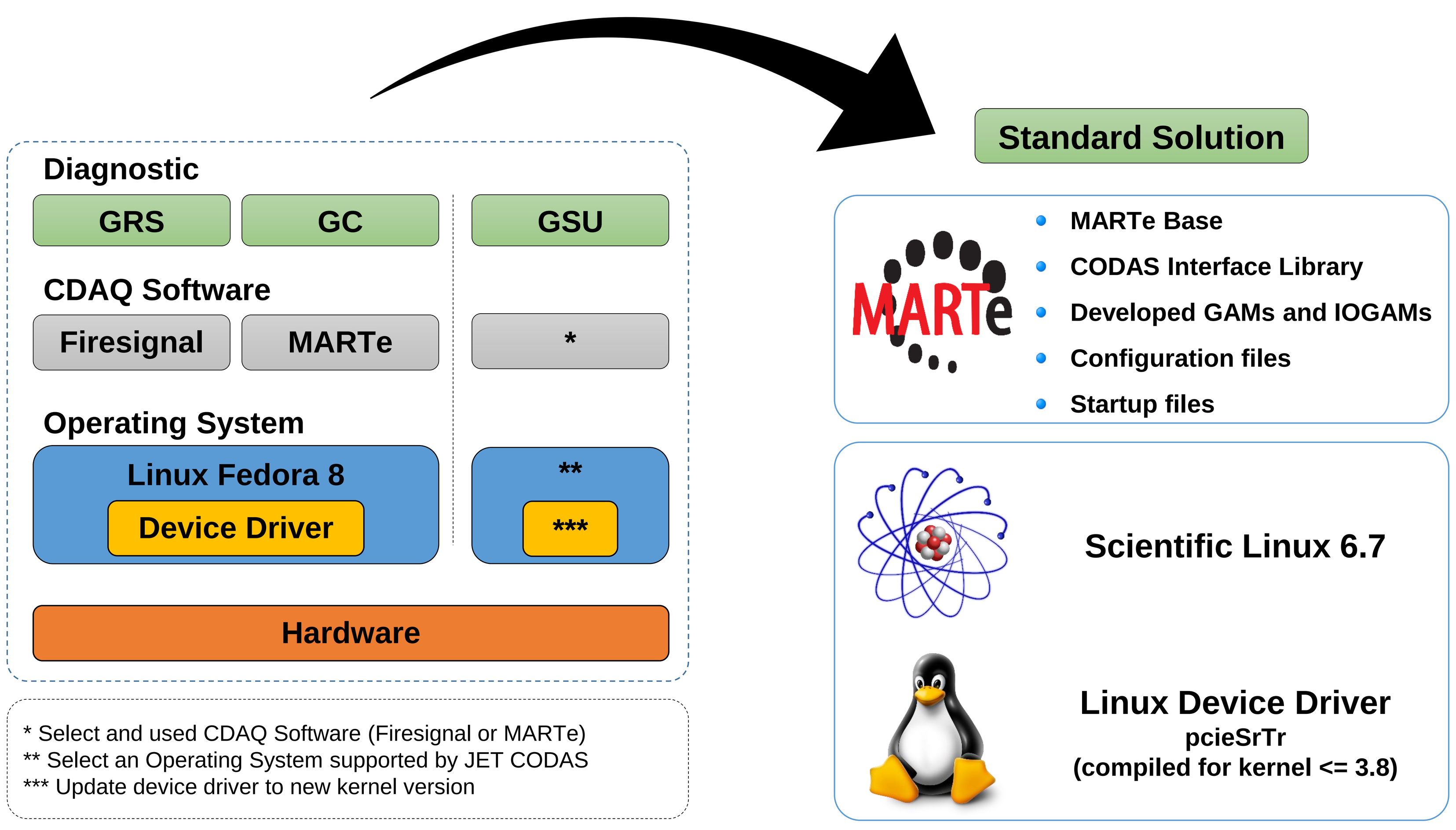
Introduction

- The **Gamma-Ray Spectrometer** (GRS), **Gamma Camera** (GC) JET diagnostics have **similar Control and Data Acquisition Systems** (CDAQs) but the installed **CDAQ software** that interfaces these diagnostics to JET COntrol and Data Acquisition System (CODAS) **is different**, implying **higher maintenance costs**. While the GRS was implemented using FireSignal, GC used Multi-threaded Application Real-Time executor (MARTe) framework.
- Benefiting from the Gamma Camera Upgrade (GCU) and new **Gamma-Ray Spectrometer Upgrade** (GSU) installation and commissioning, the software uniformization of the three diagnostics was evaluated, aiming at **software standardization** for **easier maintenance**. The **MARTe framework was selected as CDAQ** software and **Scientific Linux as Operating System**.
- This work describes the **software standardization** process between the diagnostics towards the usage of the **same CDAQ software as well as the same OS for the controllers**, which allows the operator to **minimize the maintenance time**, avoiding the need for system specific expertise.

Hardware environment



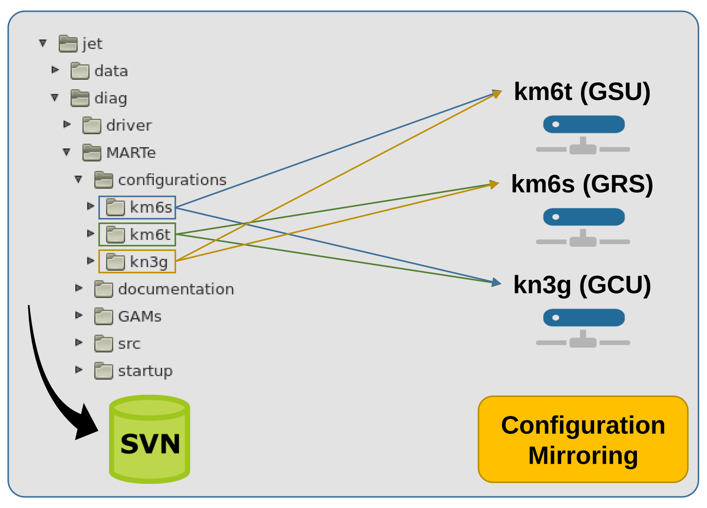
Standardization Process



* Select and used CDAQ Software (Firesignal or MARTe)
** Select an Operating System supported by JET CODAS
*** Update device driver to new kernel version

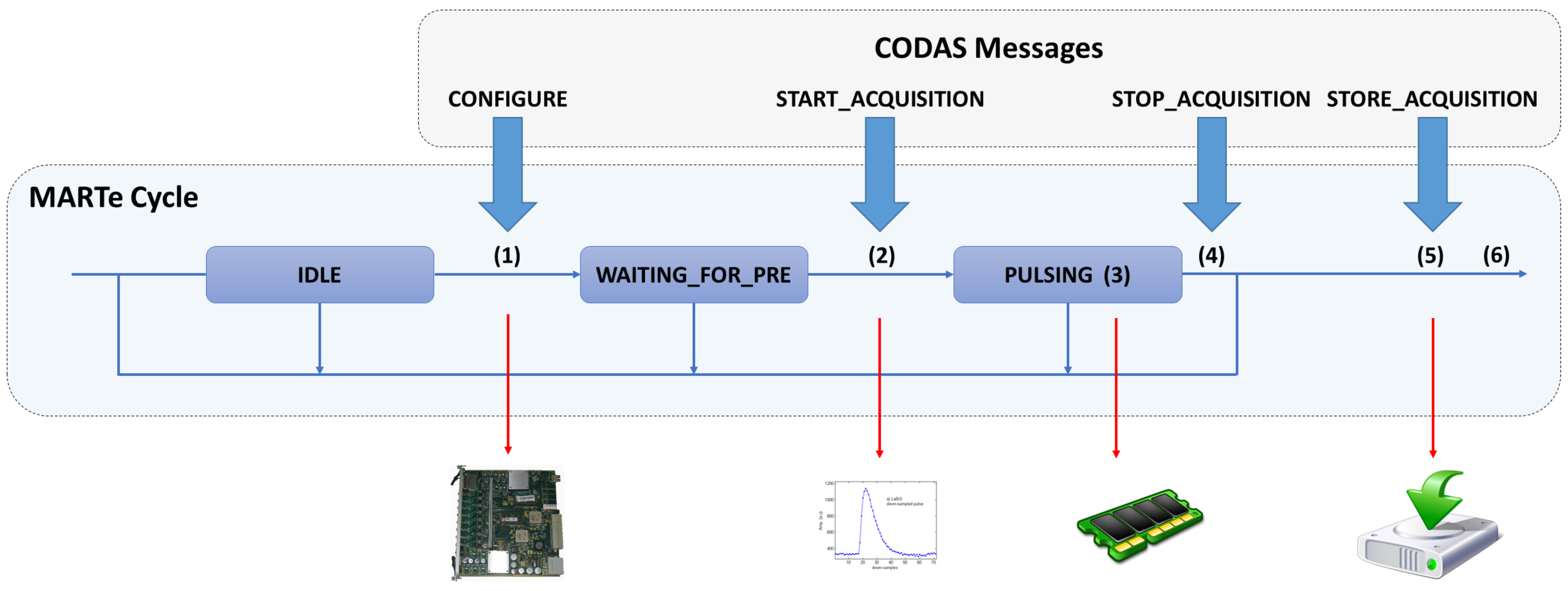
Software Architecture

Directory Structure



- This example shows the installed directory structure, which is **hierarchically organized**
- Using this approach, the configurations and also other data, can be **mirrored between the other diagnostics**, which makes all diagnostics **hard-drives compatibles** which contributes to reduce the maintenance expertise.
- Also, during the development phase all code is **synchronized with svn**, enabling a fast installation of a new diagnostic.

MARTe integration with JET CODAS



(1) Receive the **configurations** from the pulse schedule editor (Level-1) and set on configured boards.

(2) Receive the trigger to **start acquisition** and configure boards to start acquiring to memory

(3) Acquire **data to board memory**

(4) Receive the command to **stop the acquisition** to memory

(5) Launch threads to get data from board memory and **store in the host hard drive**. To make the system stable, the threads (one per channel) run sequentially, avoiding out of memory crashes.

(6) Several minutes after send the STORE_ACQUISITION message, CODAS **retrieves the data** to JET Data Archiver.

Conclusions

- The usage of the same hardware may **minimize the number of spare modules** and **reduces the device driver maintenance expertise**.
- The software standardization, also **minimize the system specific expertise** and **can reduce the data backup devices**, providing data mirroring between devices which enable the usage of a disk from one diagnostic in each other. In few steps, the configured startup diagnostic can be changed.
- The replacement of a malfunctional hard disk can be done using a backup from other diagnostic **avoid the maintenance of 3 diagnostic backups**.
- The tests show that **MARTe environment is a valuable and stable framework to manage non-real time diagnostics** like the presented. During the pulsing state the data is stored to memory and at the end is copied to the host hard-drive.
- The presented solution was **successfully tested** for Scientific **Linux 32 and 64 bits** and is fully running from JET Pulse #91137@20/07/2016

Main References:

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