Complementary Detectors: NEDA + DIAMANT

Alain Goasduff
on behalf of the NEDA - DIAMANT collaborations

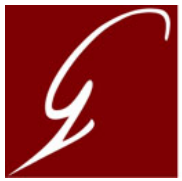
University of Padova - INFN Padova

Agata Week 2018
Sept. 13, 2018



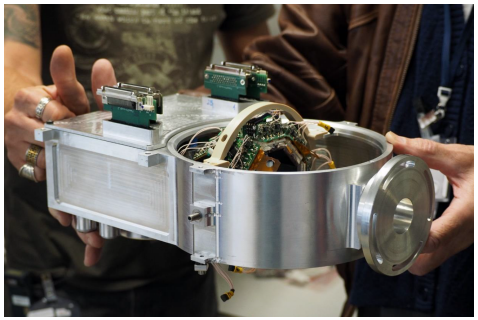


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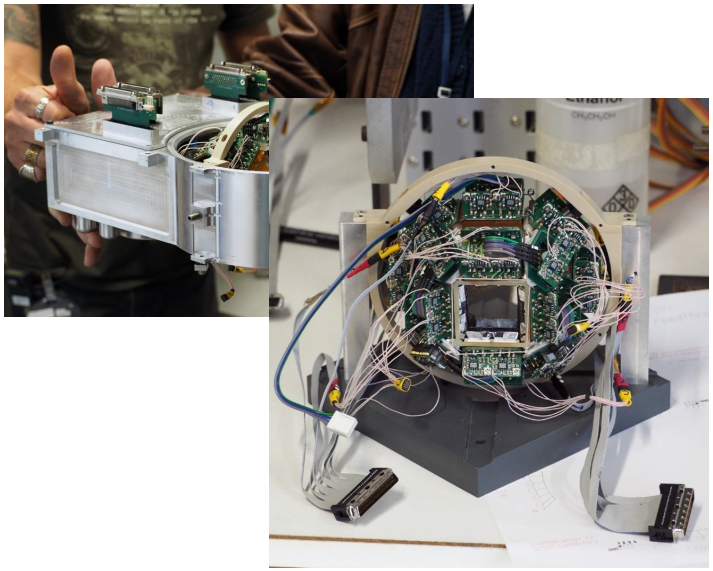
Dipartimento
di Fisica
e Astronomia
Galileo Galilei

The DIAMANT array



- **60 CsI detectors**

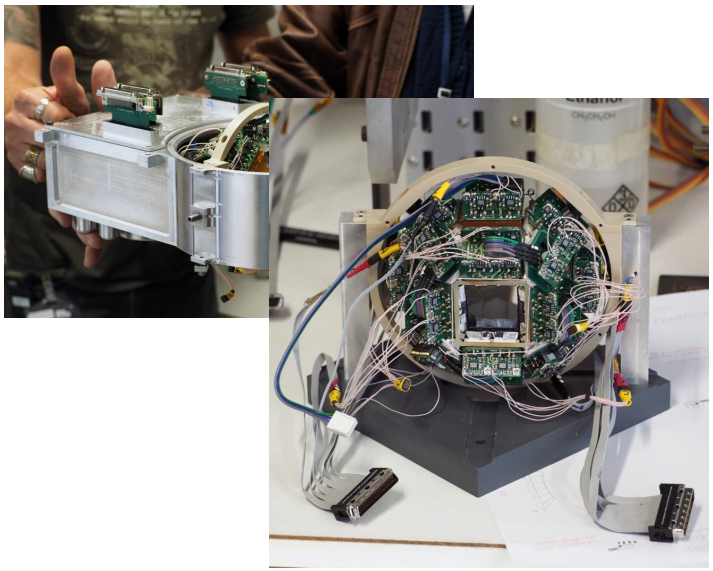
The DIAMANT array

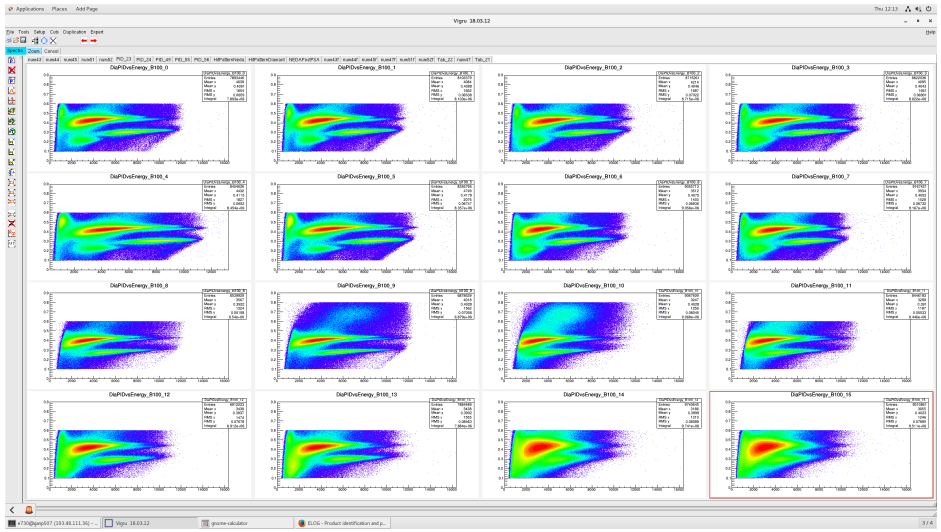


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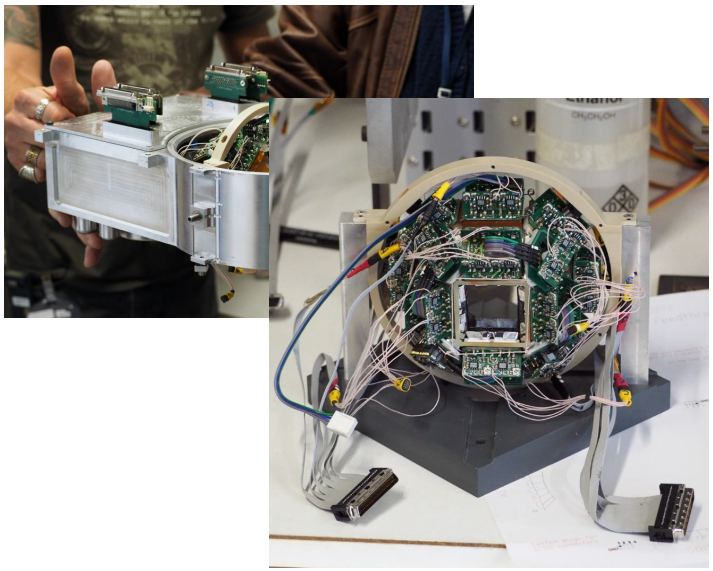
- **60 CsI detectors**
- Particle identification through 2 Tpz. Filter

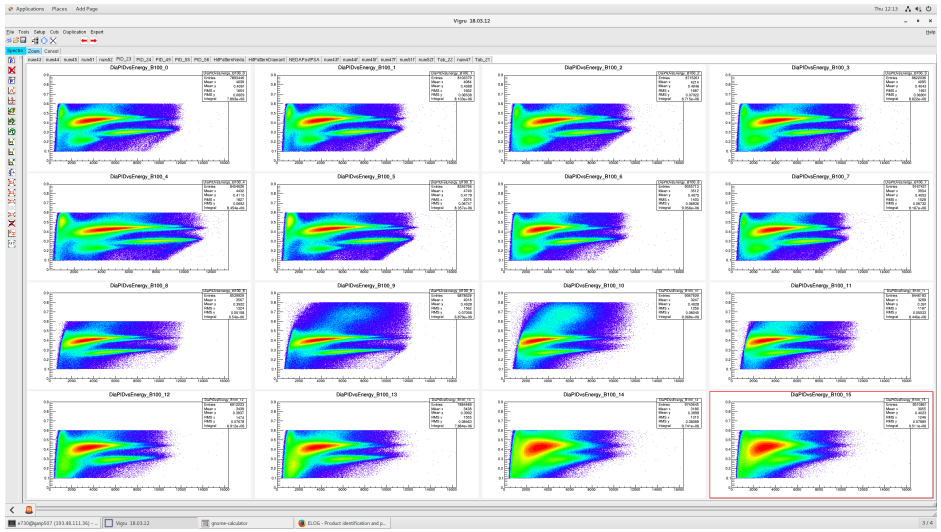




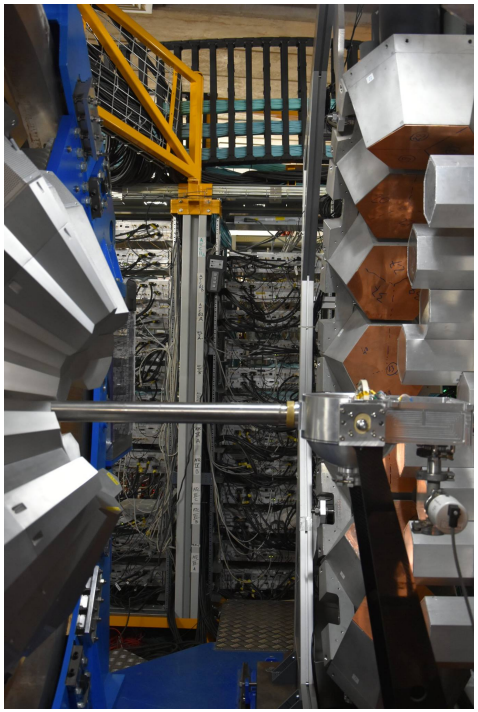
The DIAMANT array

- **60 CsI detectors**
- Particle identification through 2 Tpz. Filter
- Completely trigger less



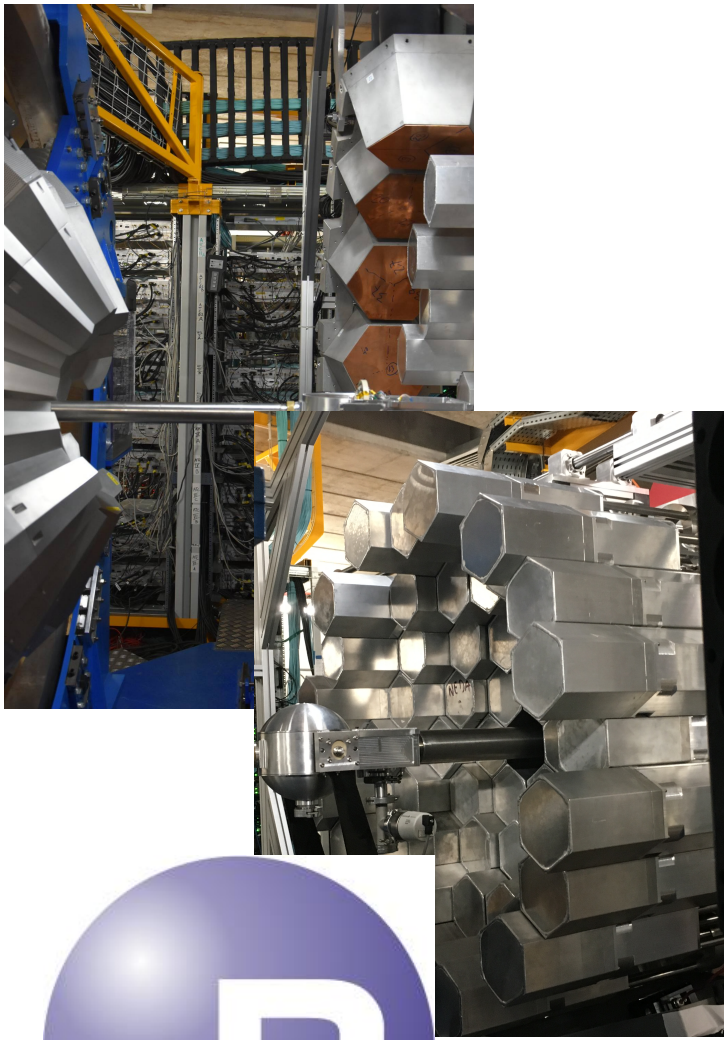


The NEDA-NeutronWall array



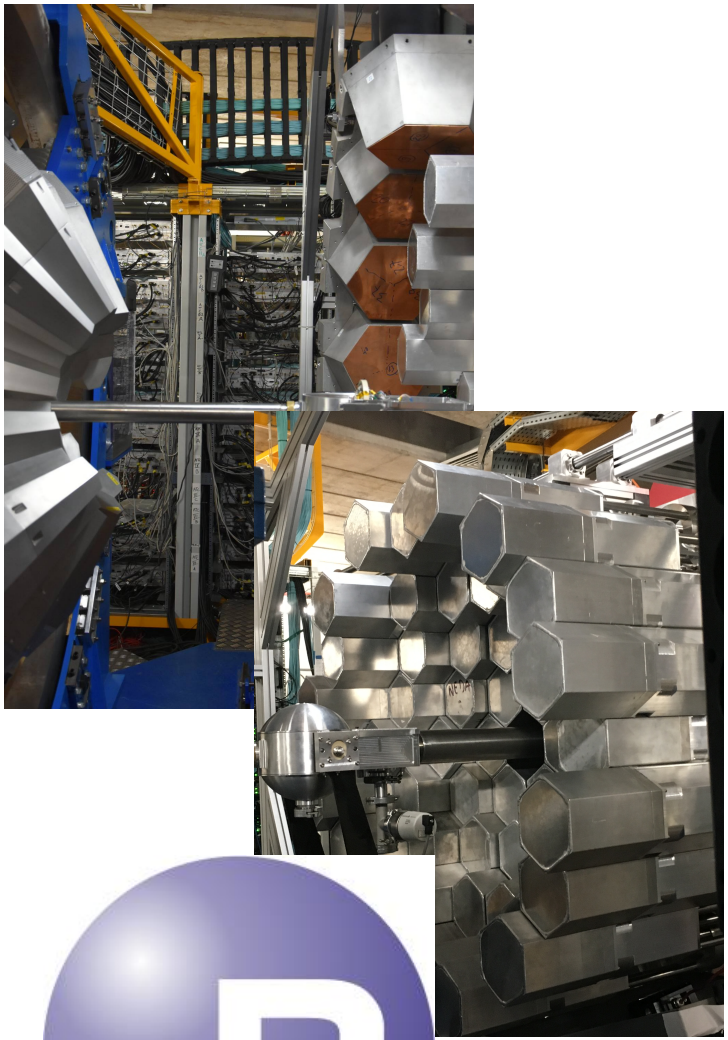
- **96 detectors** :
  - 42 NeutronWall (650 mm)

The NEDA-NeutronWall array



- **96 detectors** :
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  - 54 NEDA (510 mm)

The NEDA-NeutronWall array



- **96 detectors** :
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  - 54 NEDA (510 mm)
- High quality home made detectors

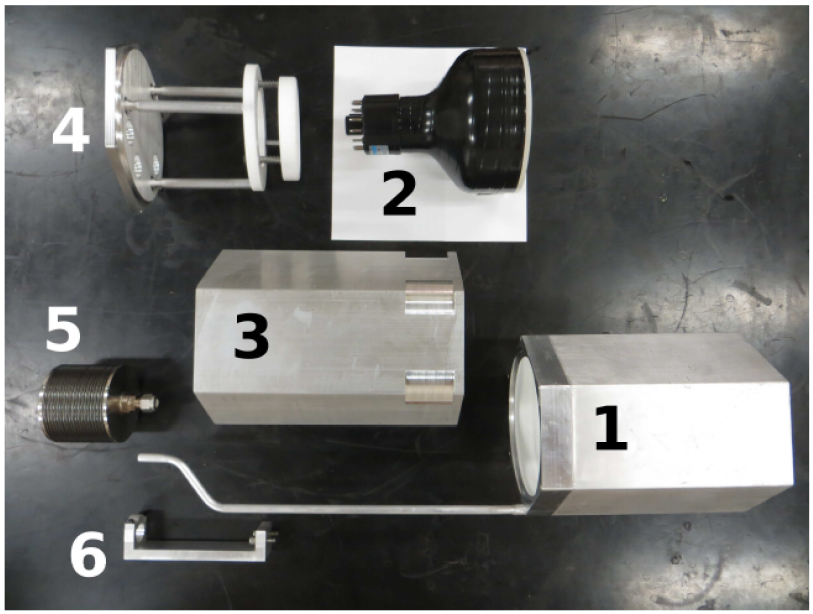
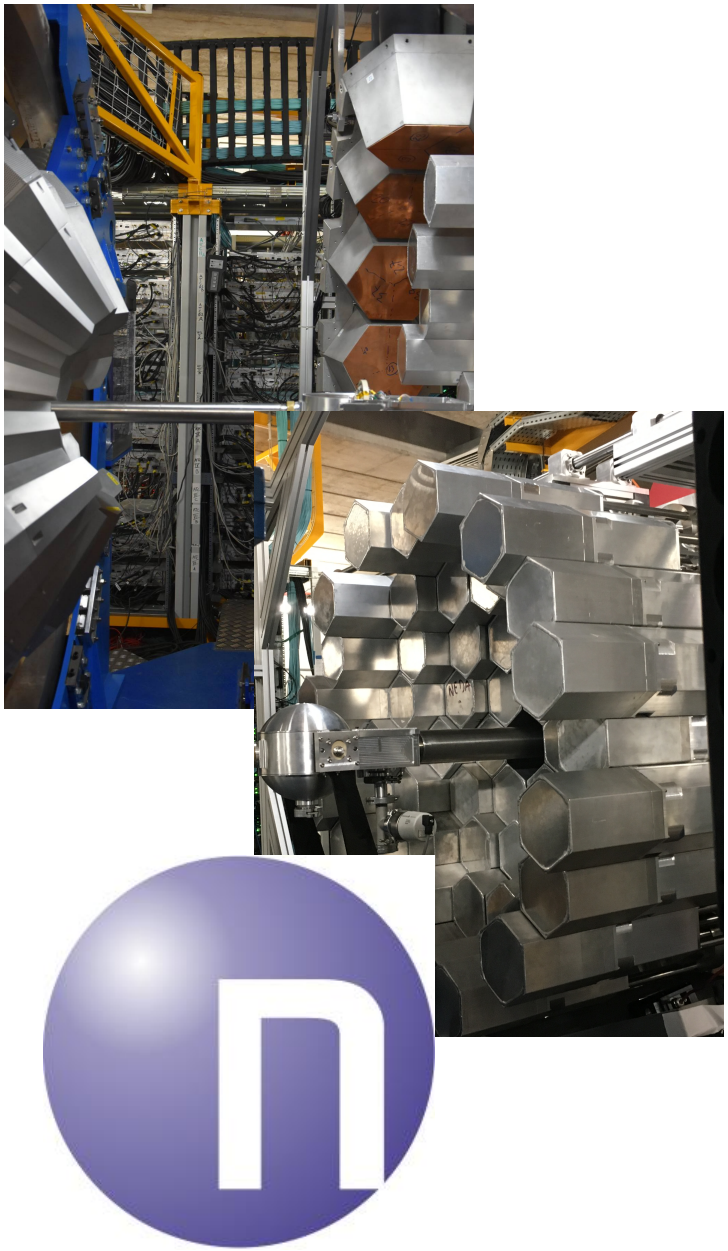
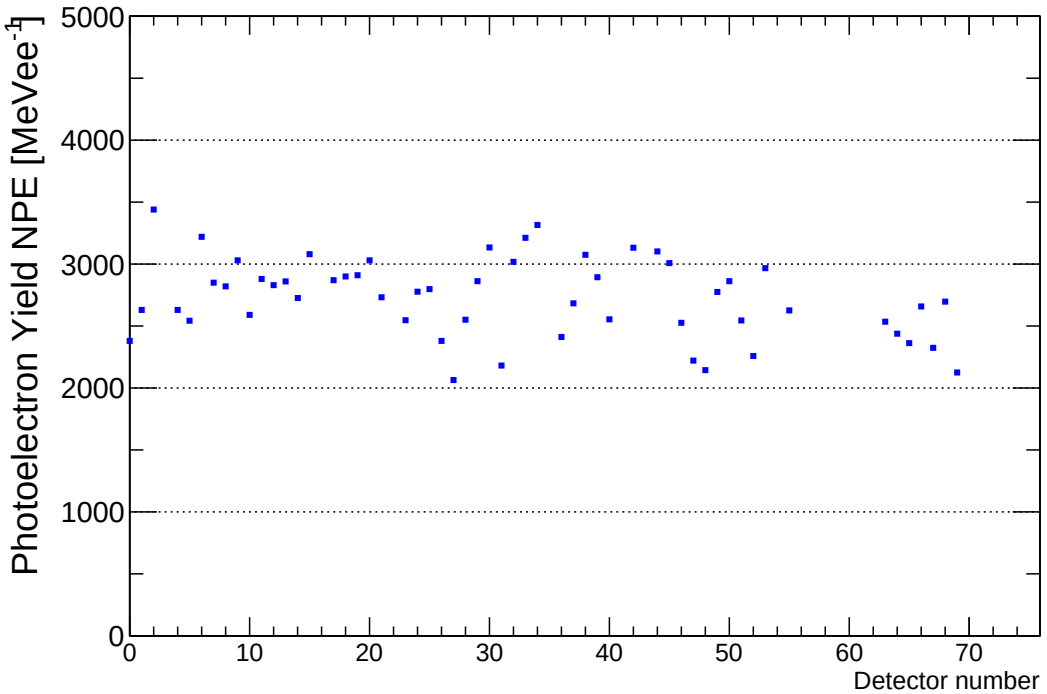


Fig. 1. Elements used for the construction of the NEDA detector: detector cell, with extension pipe (1); PMT (2); PMT housing (3); PMT pusher (4); the bellow (5) and the support for the bellow (6).

The NEDA-NeutronWall array



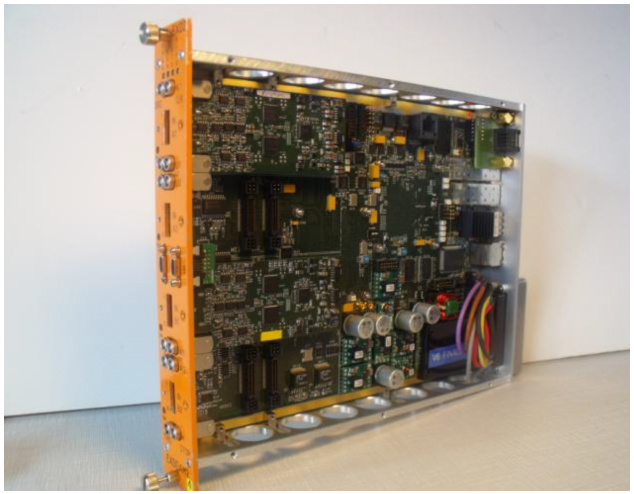
- **96 detectors** :
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The NEDA and DIAMANT FEE : NUMEXO2

NUMEXO2 Digitizers :

- 16 channels NIM modules :
  - 4 differential channels / mezzanine

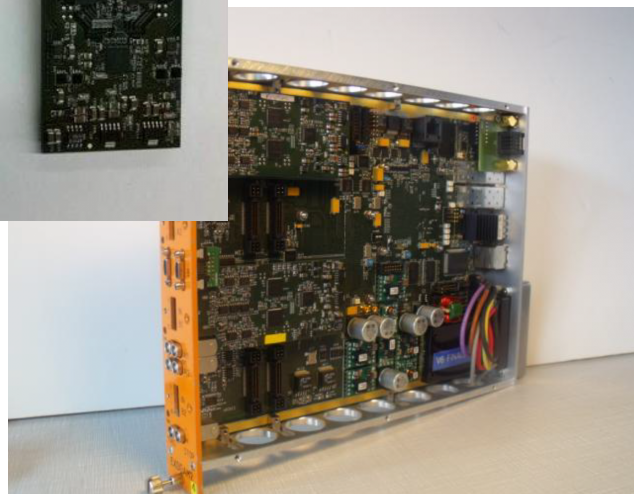


The NEDA and DIAMANT FEE : NUMEXO2

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  - HDMI inputs



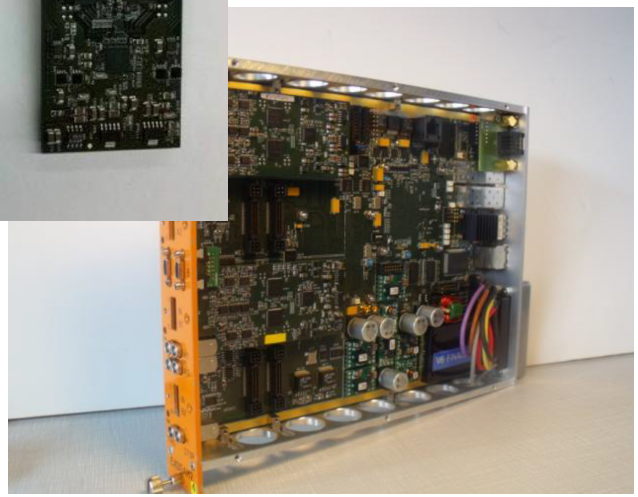


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  - Signal processing : Xillinx Virtex6
  - Time-stamping & Readout : Xillinx Virtex5

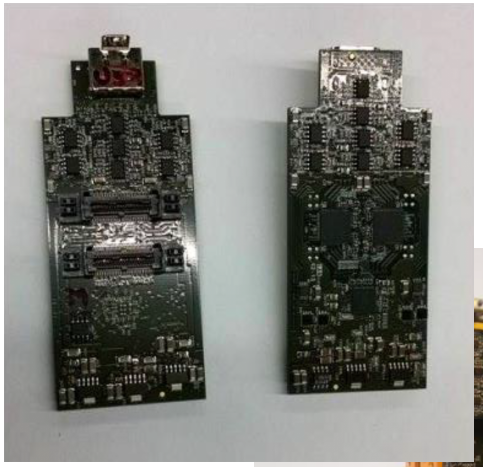


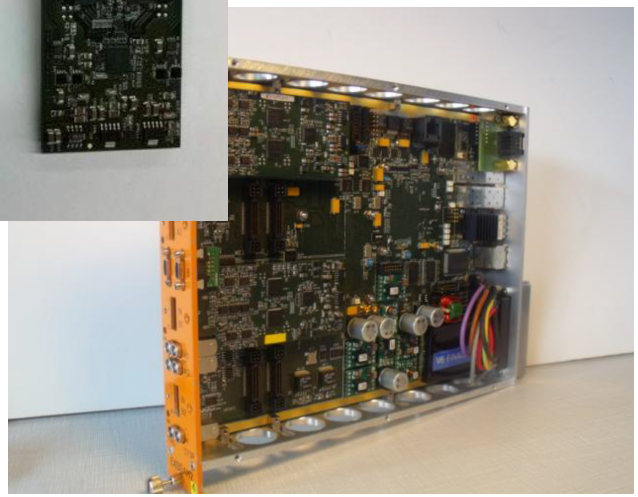


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  - Time-stamping & Readout : Xillinx Virtex5
- Readout :
  - Ethernet ($\Longrightarrow$ DIAMANT)
  - Optical Fiber ($\Longrightarrow$ NEDA)

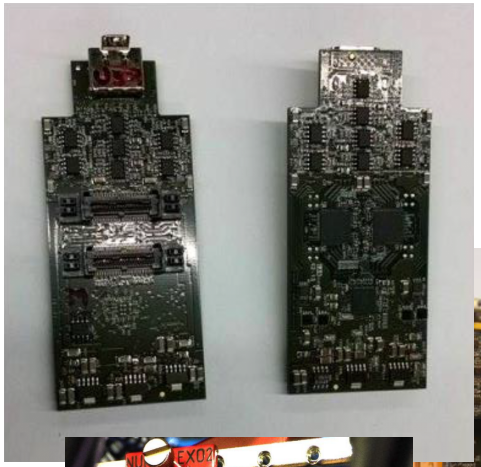


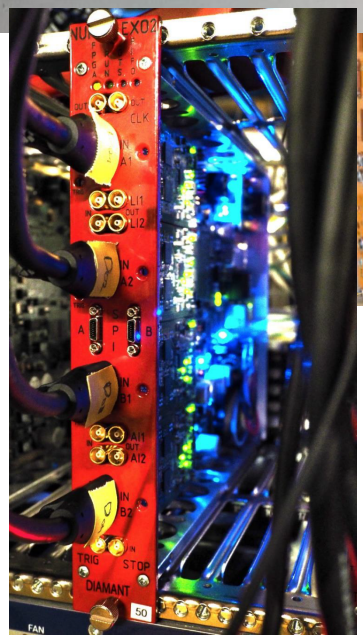


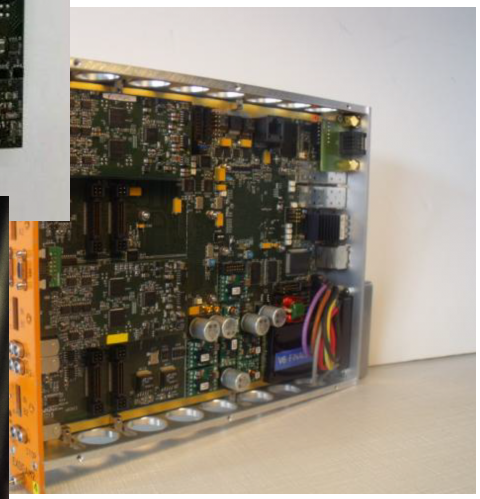
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NUMEXO2 Digitizers :

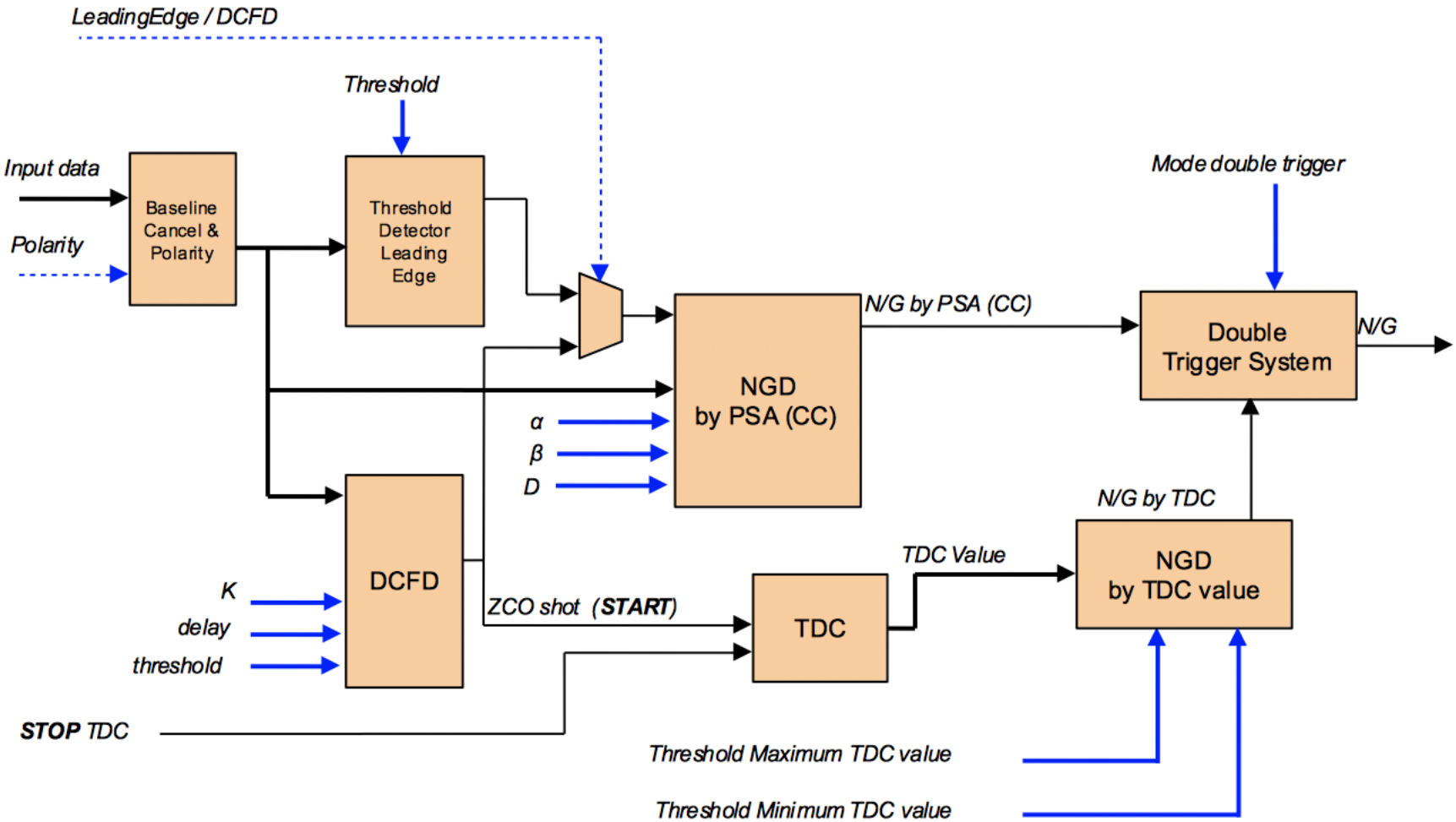
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- Readout :
  - Ethernet ($\Longrightarrow$ DIAMANT)
  - Optical Fiber ($\Longrightarrow$ NEDA)
- GTS leaf implementation





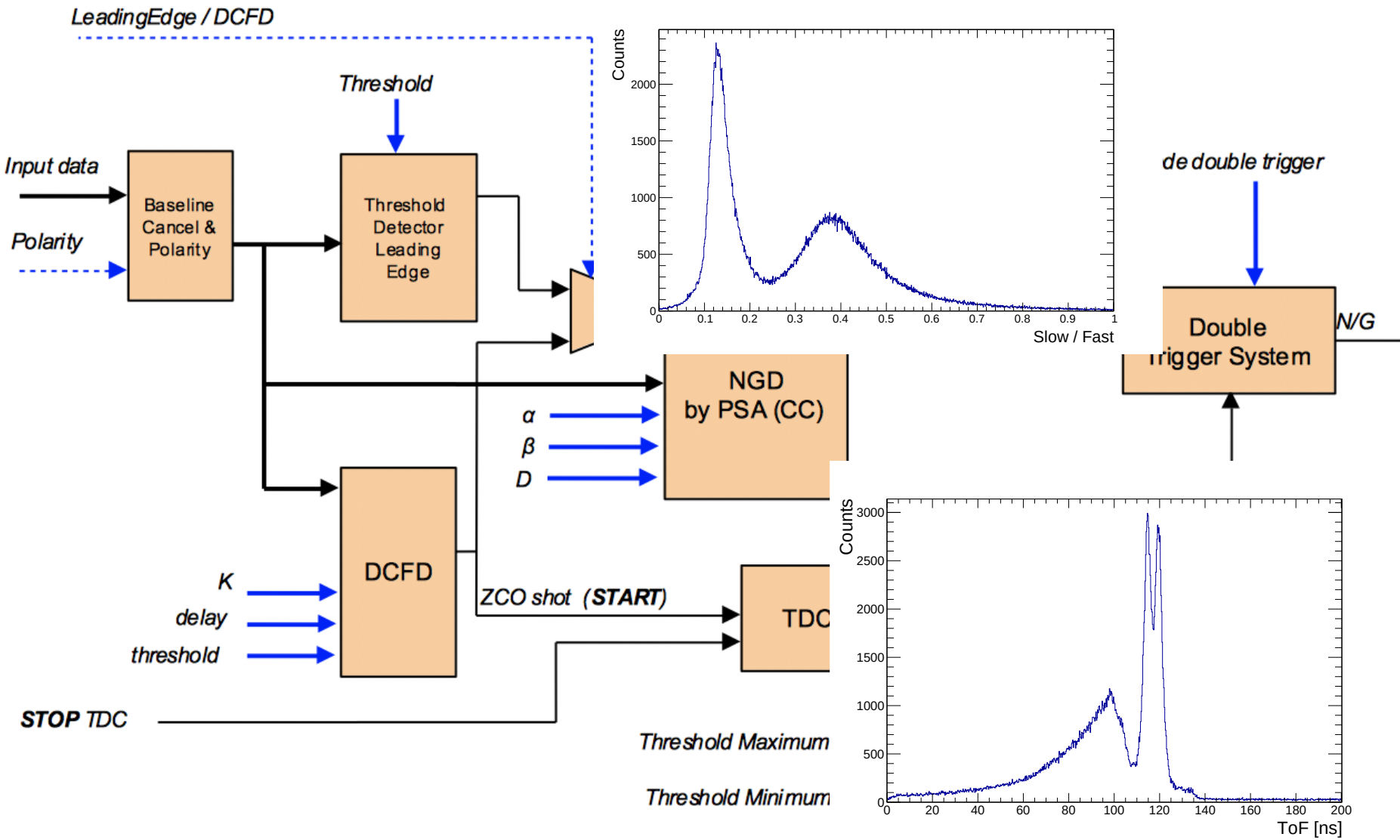


The NEDA Virtex 6 firmware



Courtesy of J. M. Deltoro

The NEDA Virtex 6 firmware



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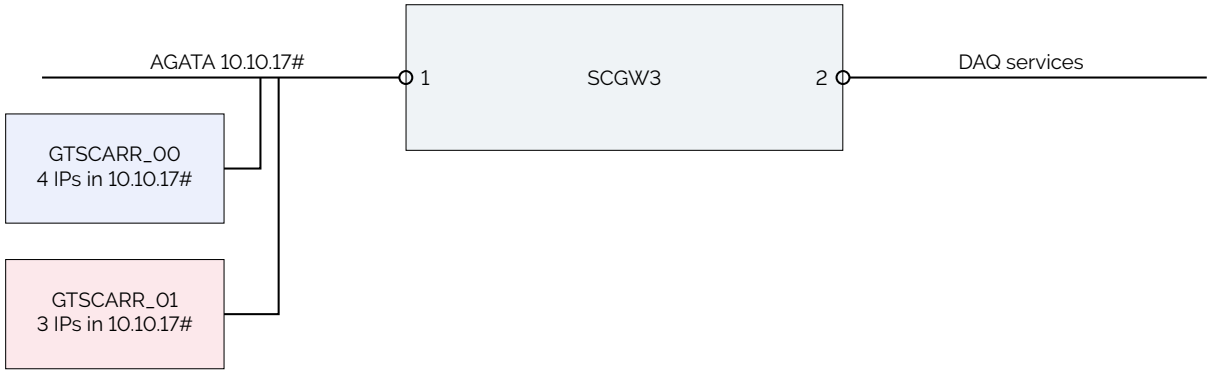
Coupling with AGATA



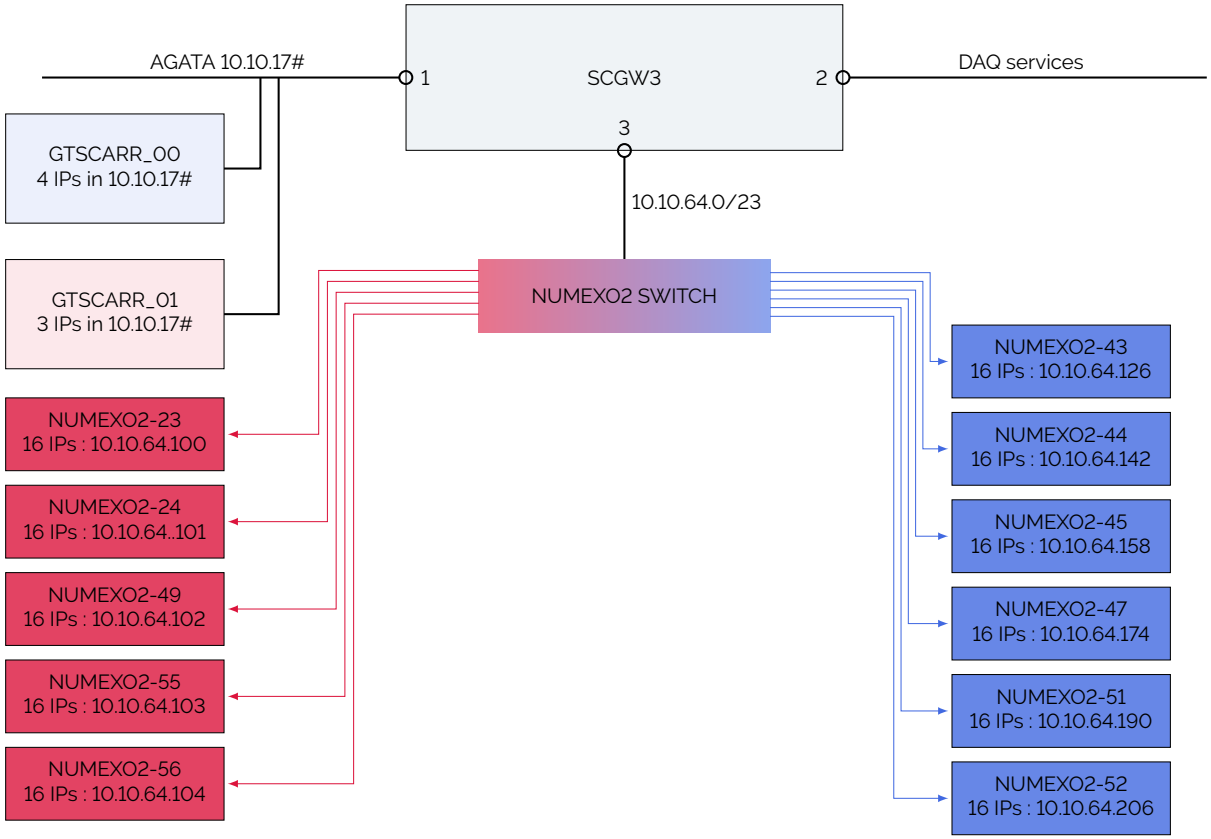
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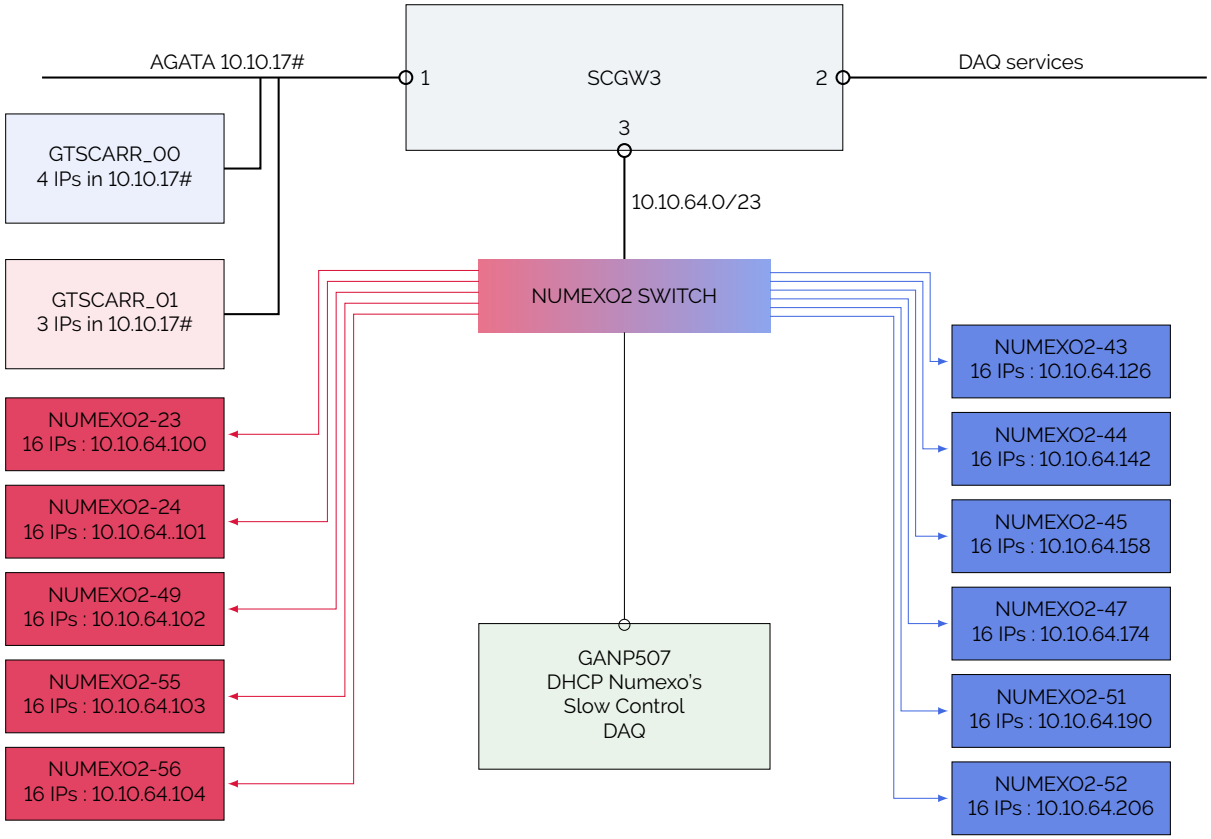
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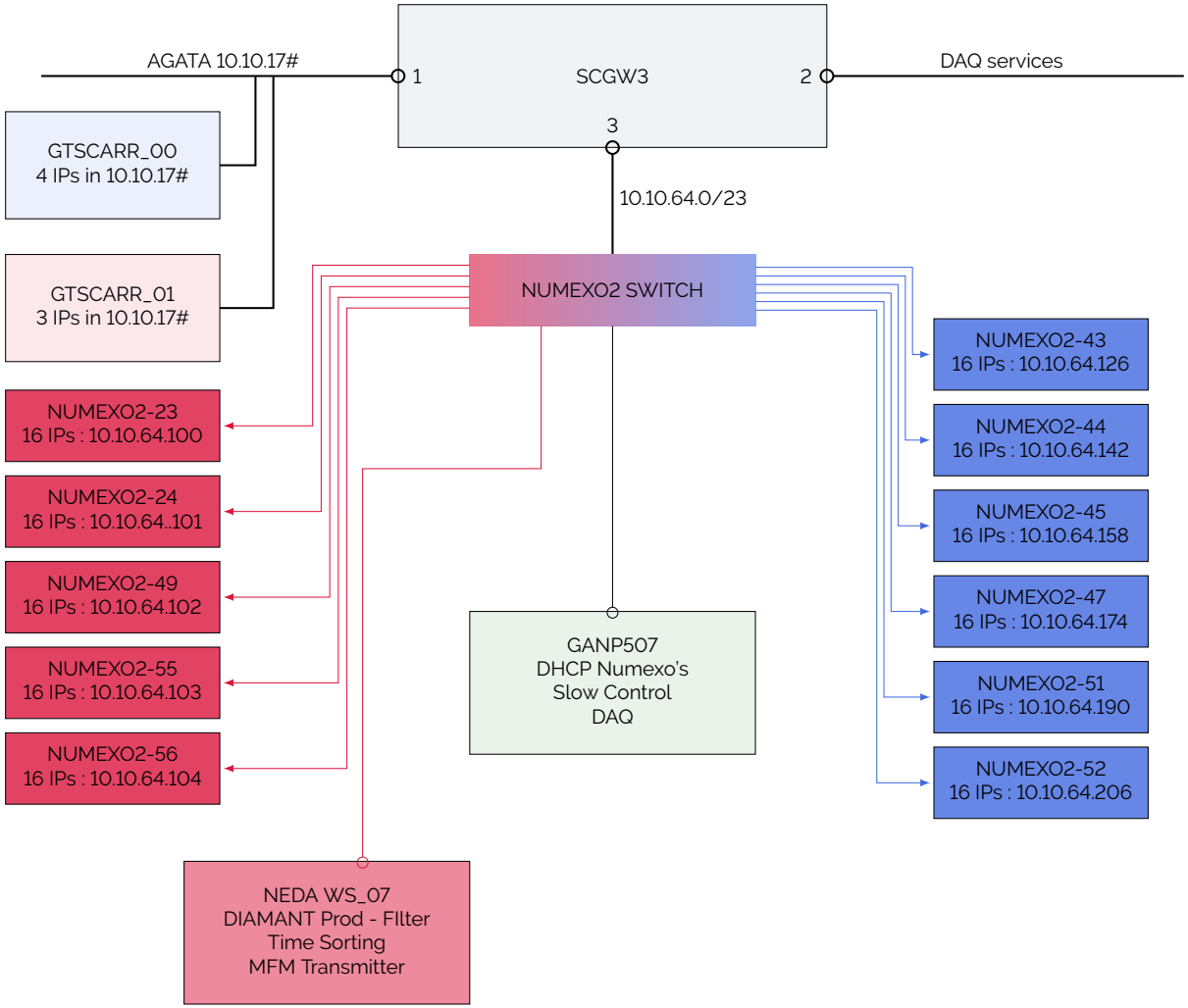
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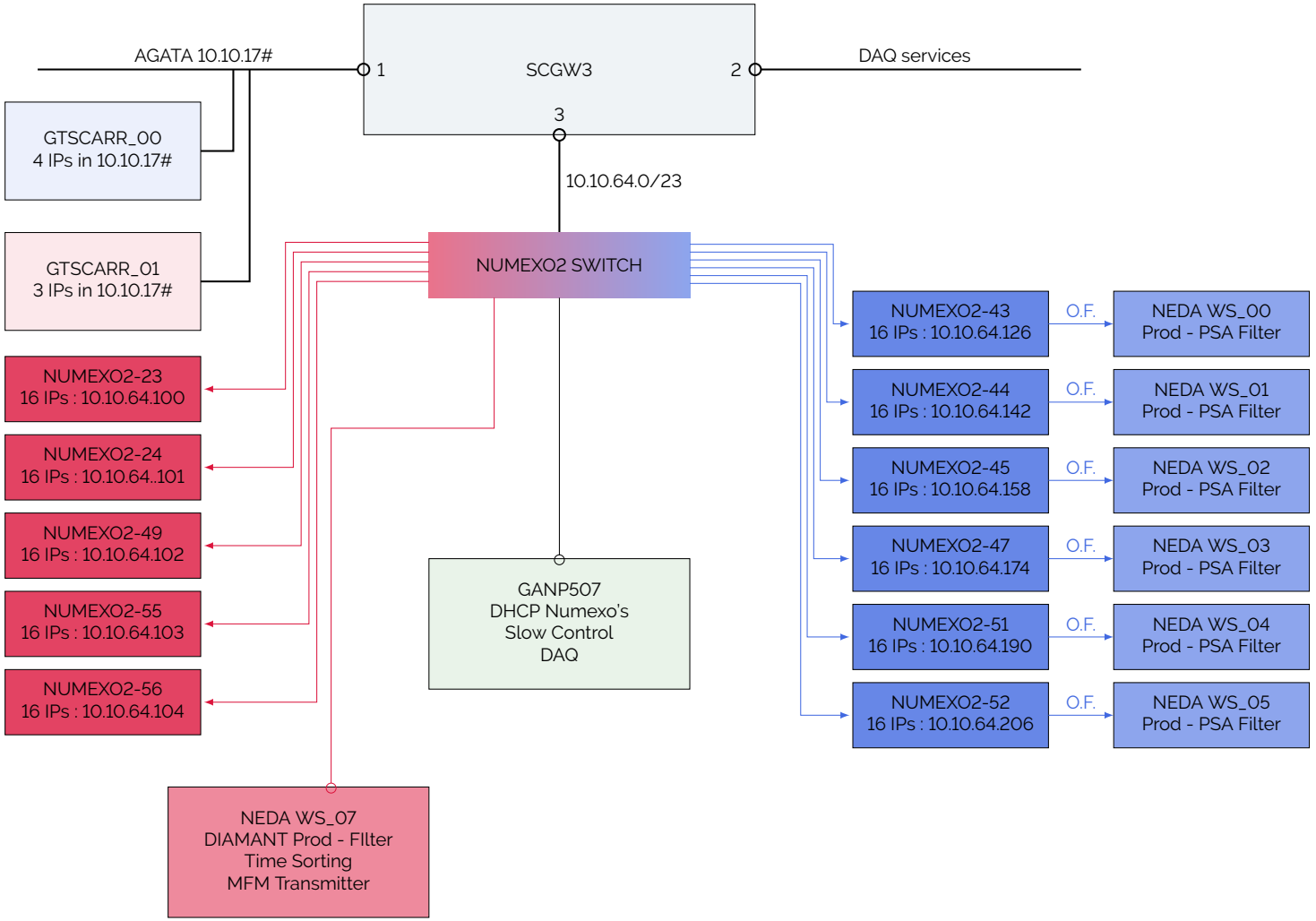
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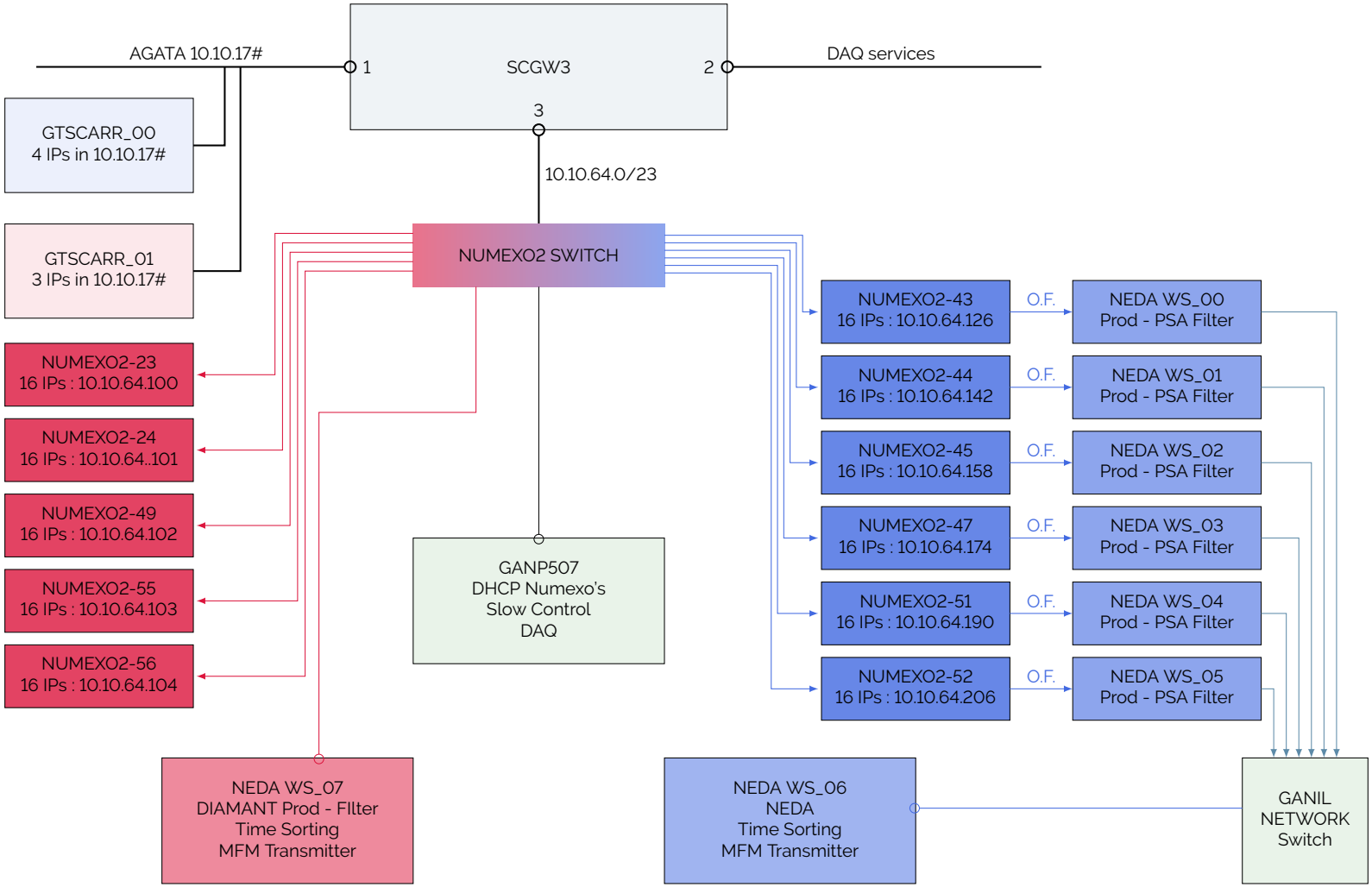
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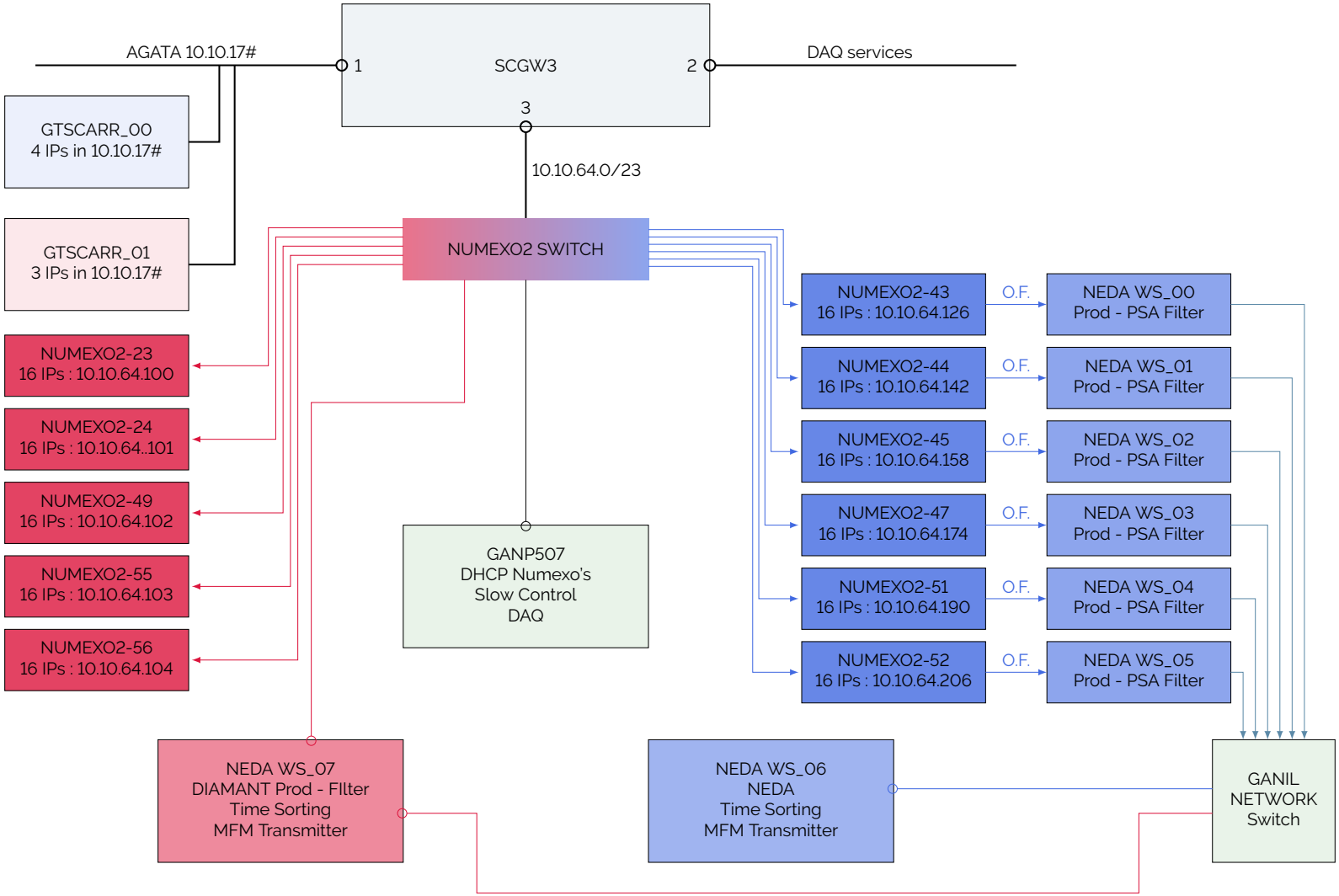
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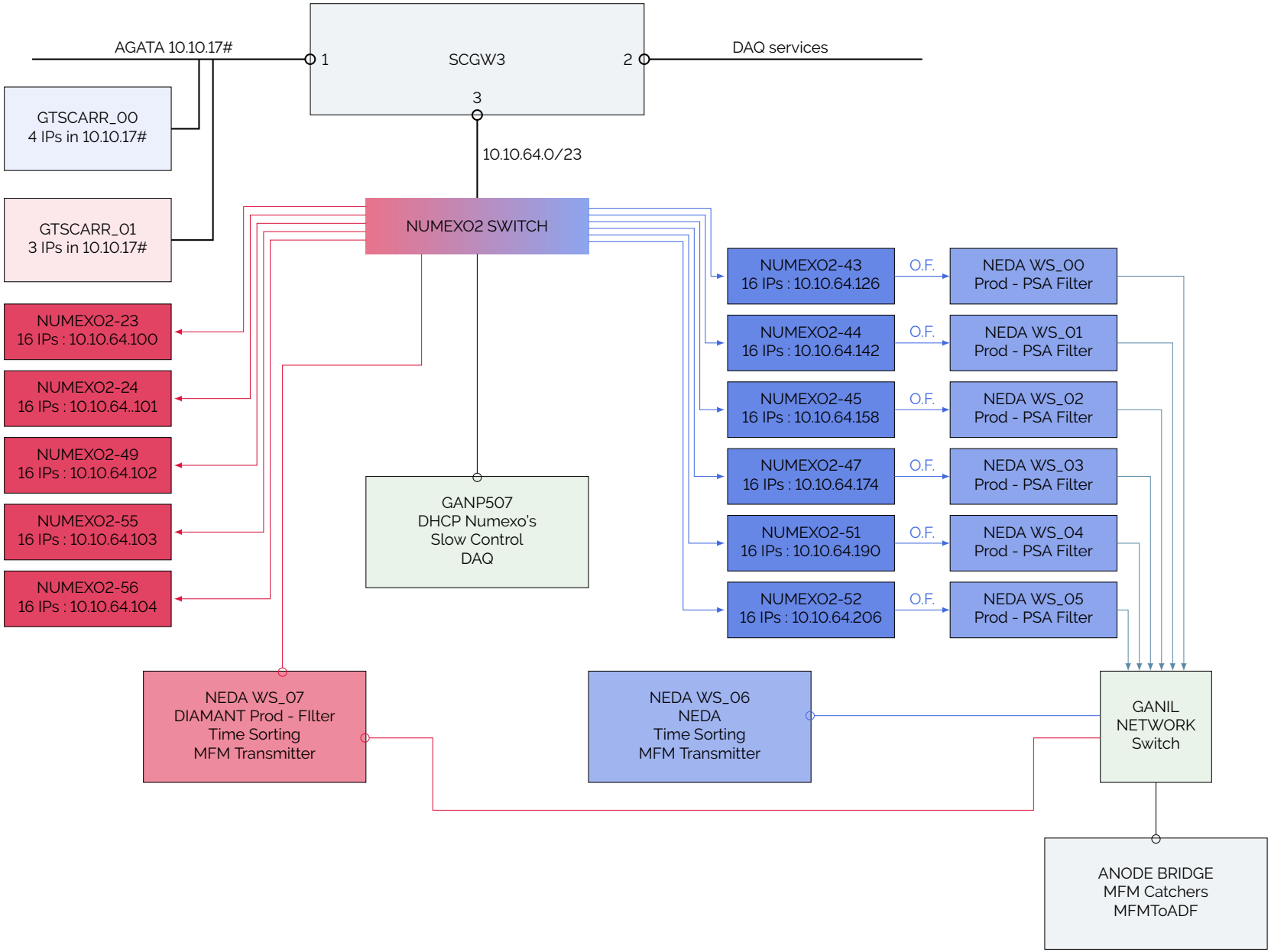
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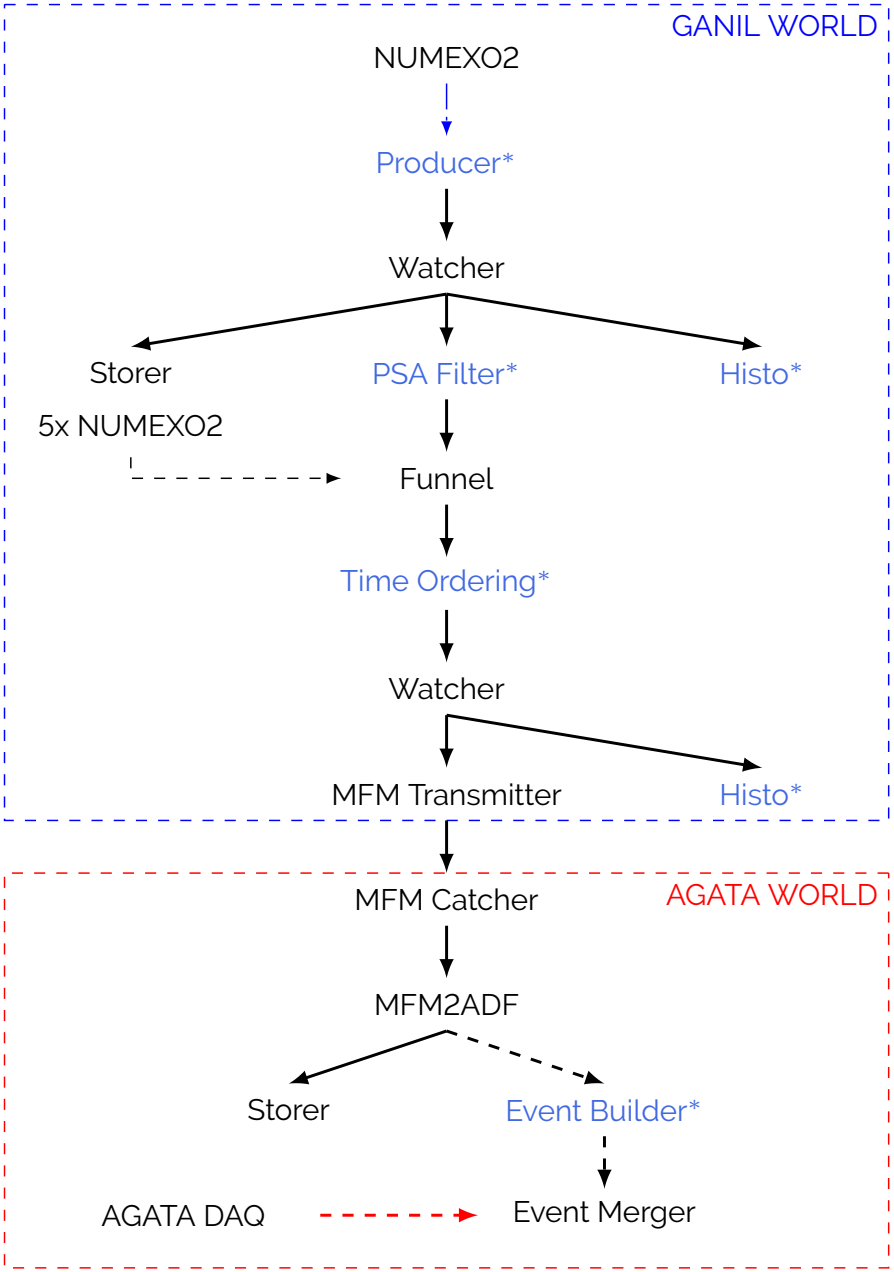
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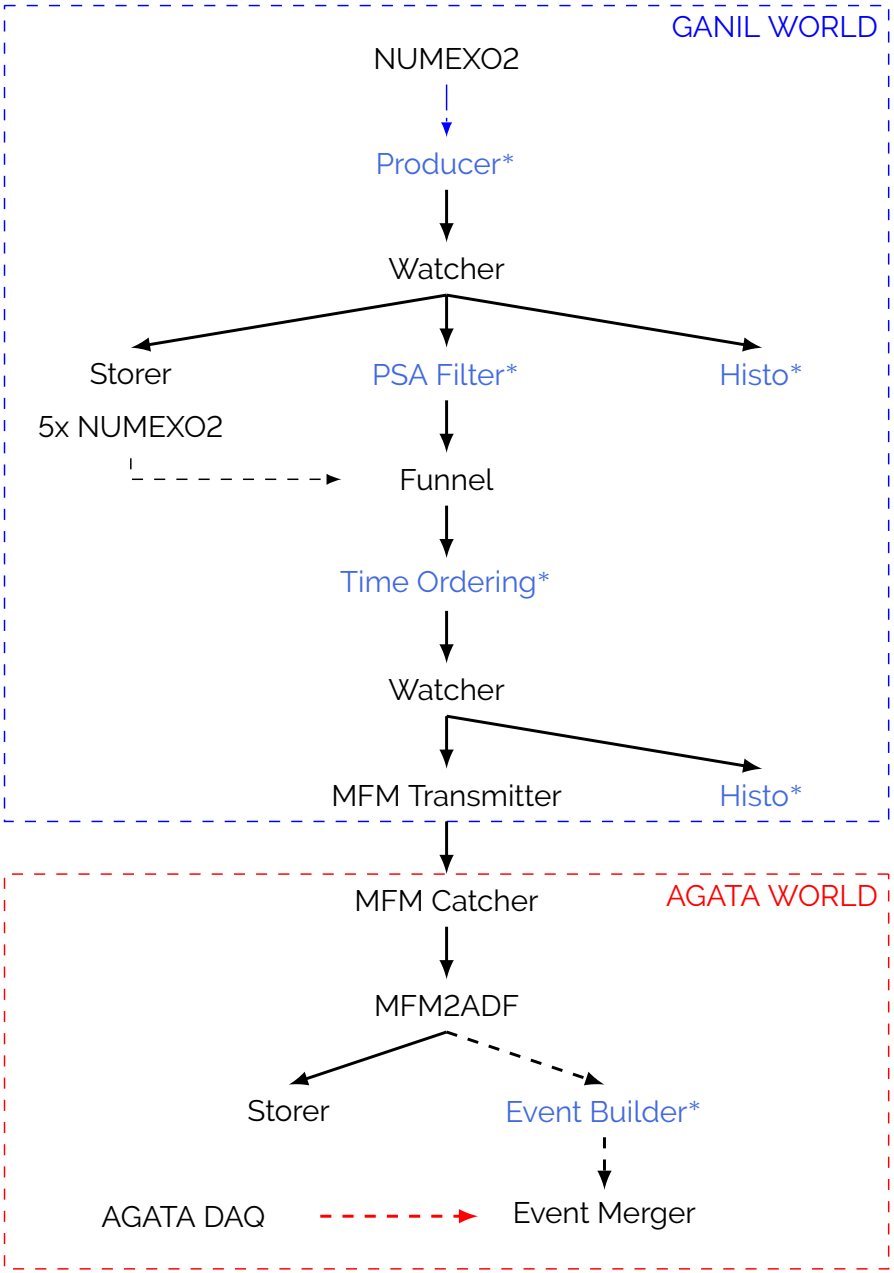
Coupling with AGATA



Data Acquisition - NEDA

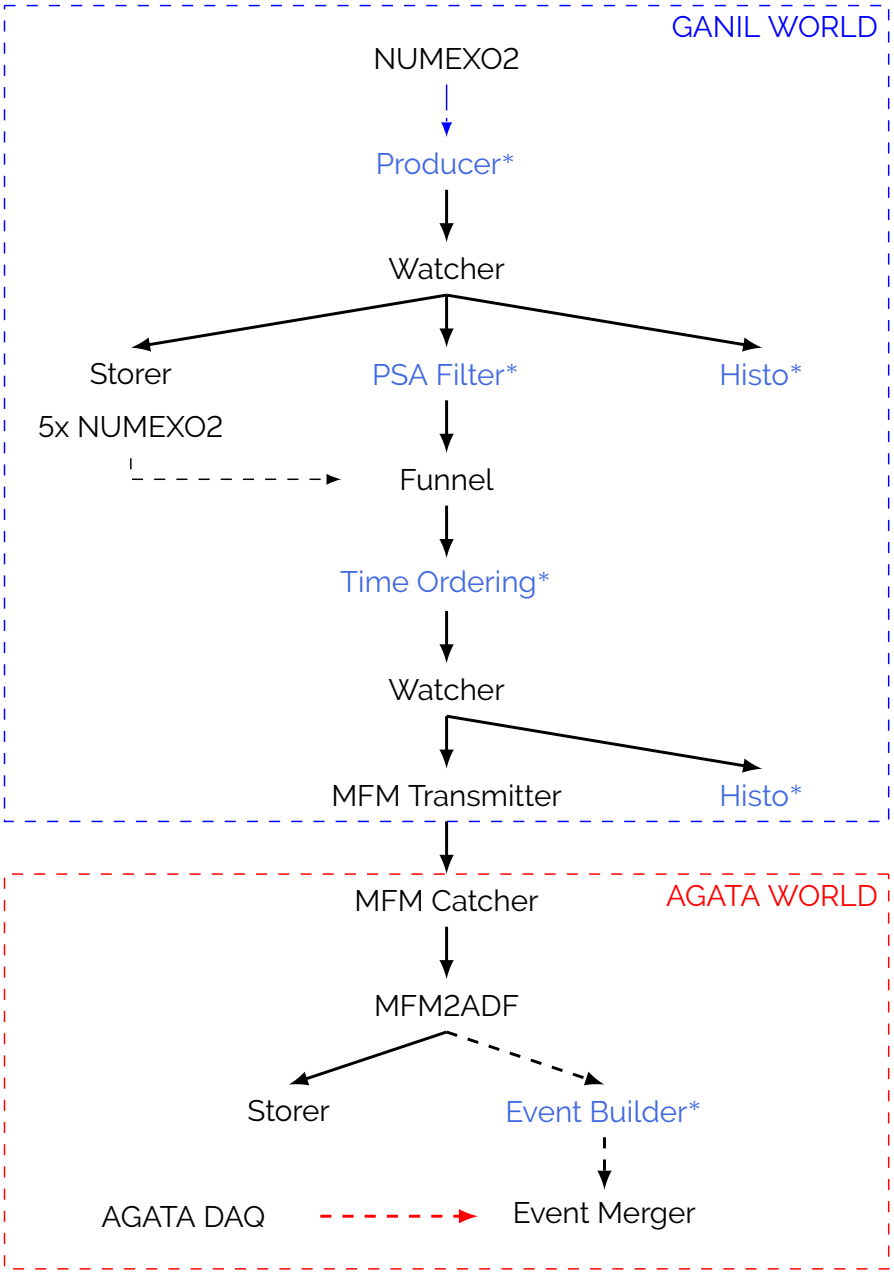


Data Acquisition - NEDA



Expected rates for the typical experiment :
$\sim$ 180 Hz / detector / 1 pnA (1γ-1n trigger)
$\Longrightarrow$ $\sim$ 1.5 MB/s of traces / board

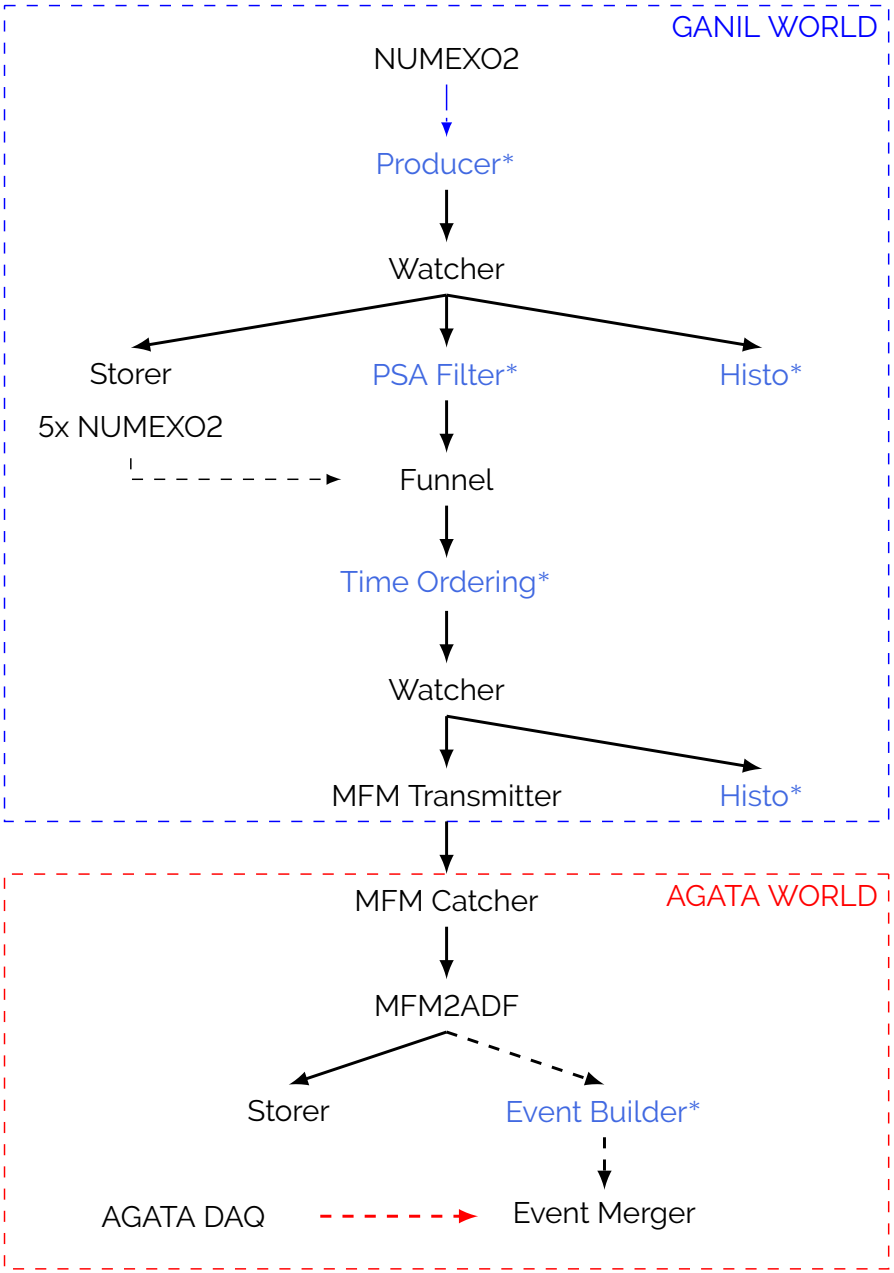
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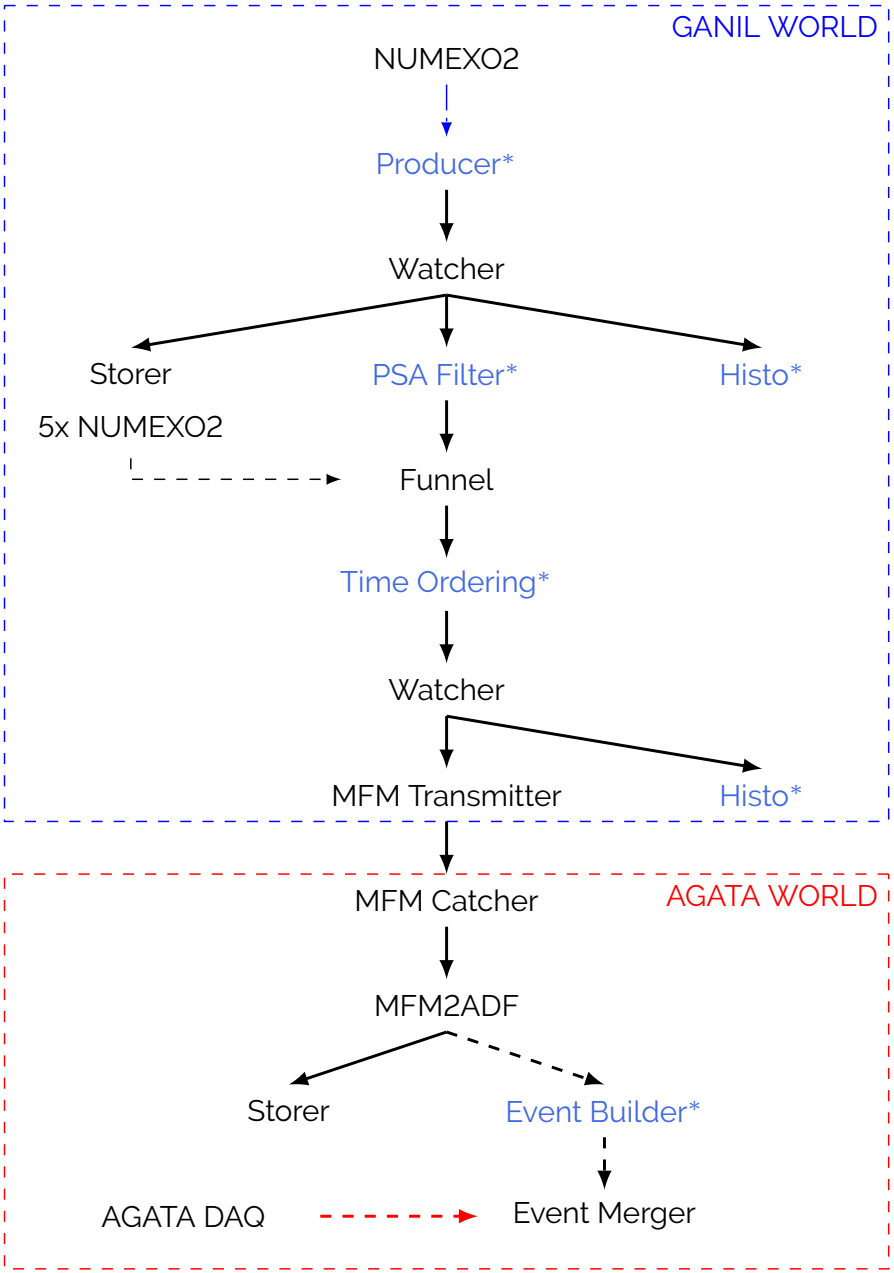
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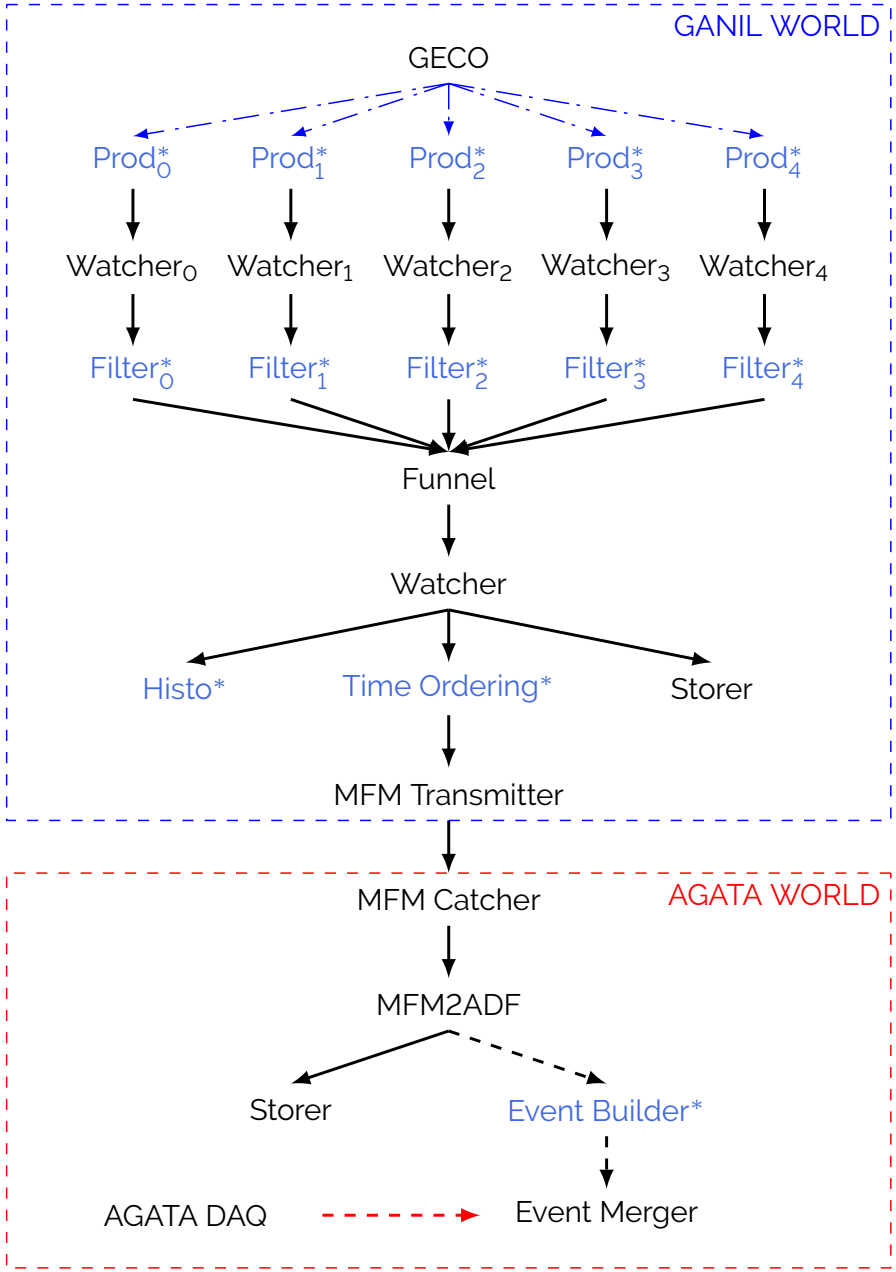
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TP Validations : About 50-60 % of the neutrons
$\Longrightarrow$ $\sim$ 1.6 MB/s of traces (/board)
$\Longrightarrow$ $\sim$ 0.15 MB/s of post-PSA
$\Longrightarrow$ $\sim$ 0.24 MB/s on ADF Storer

Data Acquisition - DIAMANT



Issues encountered and **solved**

- NEDA PCIe Producer

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- Data transfer from GANIL world (NARVAL) to AGATA world (DCOD)
  - Small MFM frames (42 bytes and 32 bytes) compared to VAMOS++

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- Idle rates of the NUMEXOs $\sim$ 100 kHz

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Issues encountered and **solved**

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- Trigger processor channel identification $\Longrightarrow$ **Overlapping GTS-IDs are not OK**

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- Validation rate of AGATA > 2 kHz / crystals

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- Idle rates of the NUMEXOs $\sim$ 100 kHz $\Longrightarrow$ **Solved during commissioning**
- Trigger processor channel identification $\Longrightarrow$ **Overlapping GTS-IDs are not OK**
- Validation rate of AGATA > 2 kHz / crystals
  - > 1 kHz / crystals $\Longrightarrow$ **No traces for AGATA**

Issues encountered and **solved**

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  - $\Longrightarrow$ **Variable buffer sizes for MFM Transmitter (GANIL world)**
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- Idle rates of the NUMEXOs $\sim$ 100 kHz $\Longrightarrow$ **Solved during commissioning**
- Trigger processor channel identification $\Longrightarrow$ **Overlapping GTS-IDs are not OK**
- Validation rate of AGATA > 2 kHz / crystals
  - > 1 kHz / crystals $\Longrightarrow$ **No traces for AGATA**
  - > 4 kHz / crystals $\Longrightarrow$ **More restrictive conditions on neutron selection PSA/PSA & TOF**

Thank you for your attention

Thanks to the AGATA, NEDA, DIAMANT Collaborations
GANIL GAP and GPI