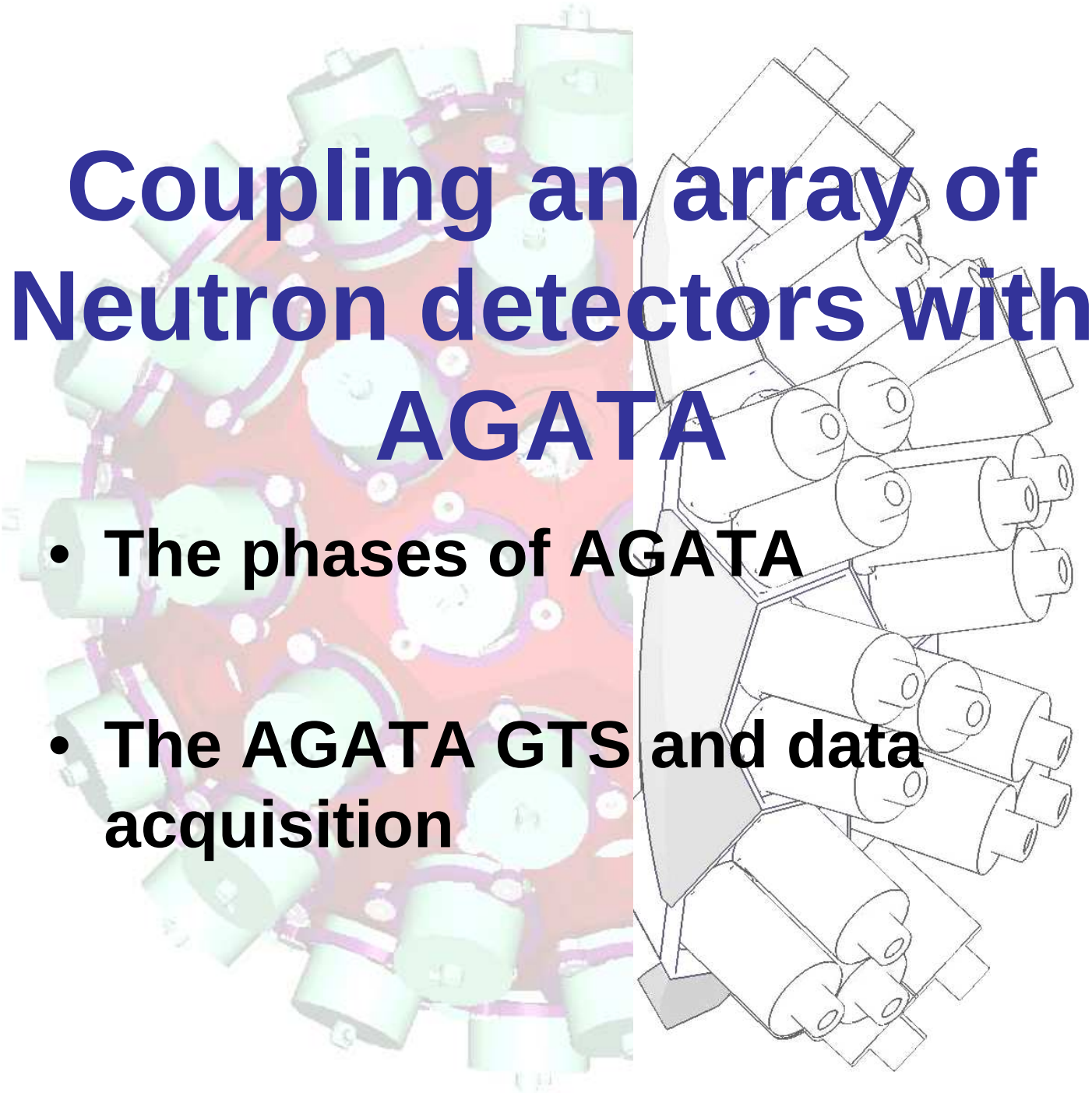
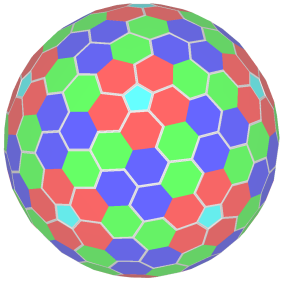
Coupling an array of Neutron detectors with AGATA

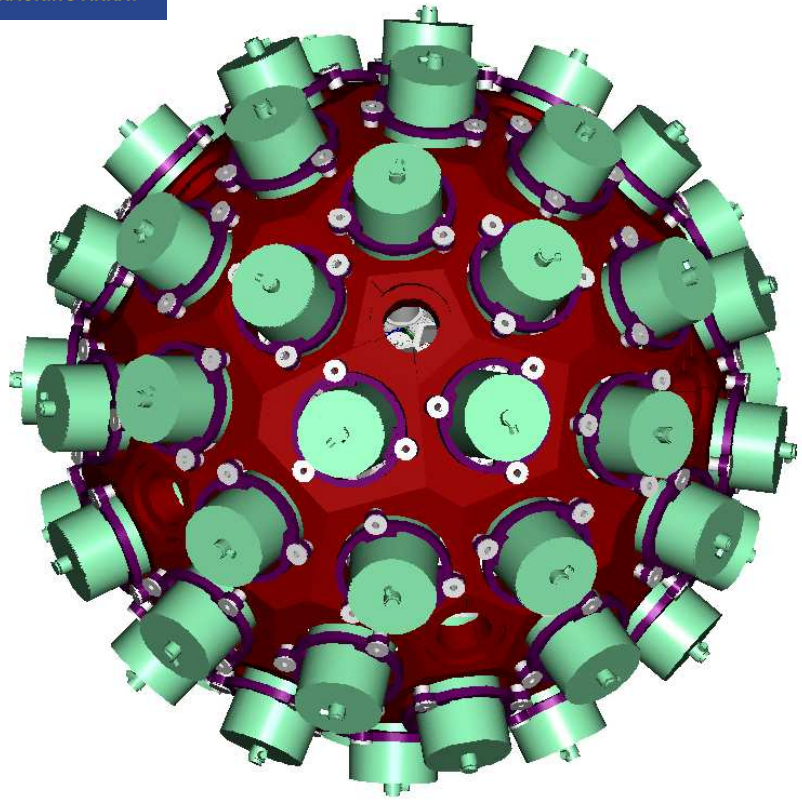


- The phases of AGATA
- The AGATA GTS and data acquisition

AGATA

(**A**dvanced **GA**mma **T**racking **A**rray)





180 hexagonal crystals	3 shapes	
60 triple-clusters	all equal	
Inner radius (Ge)	23.5 cm	
Amount of germanium	362 kg	
Solid angle coverage	82 %	
36-fold segmentation	6480 segments	
Singles rate	~50 kHz	
Efficiency:	43% (M_γ=1)	28% (M_γ=30)
Peak/Total:	58% (M_γ=1)	49% (M_γ=30)

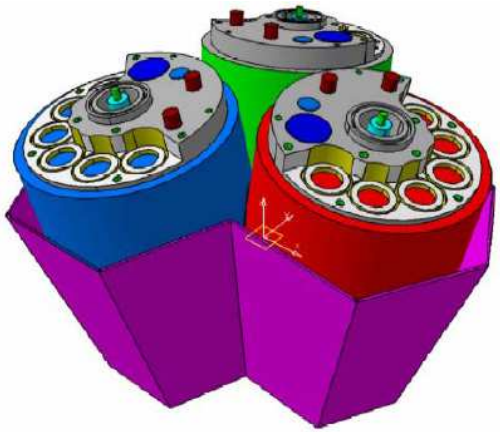
6660 high-resolution digital electronics channels

High throughput DAQ

Pulse Shape Analysis → position sensitive operation mode

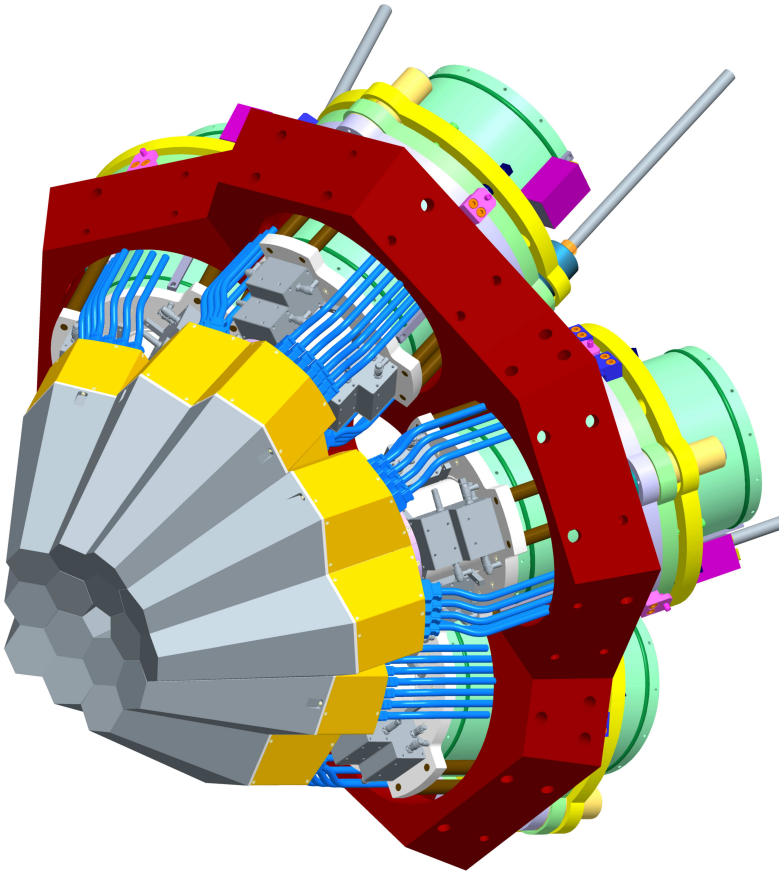
γ-ray tracking algorithms to achieve maximum efficiency

Coupling to ancillary detectors for added selectivity



The AGATA Demonstrator

Objective of the final R&D phase 2003-2008



1 symmetric triple-cluster

5 asymmetric triple-clusters

15 36-fold segmented crystals
540 segments
555 high resolution digital-channels

Eff. 3 - 8 % @ $M_\gamma = 1$
Eff. 2 - 4 % @ $M_\gamma = 30$

Operate in real time ACQ,
Pulse Shape Analysis and γ-ray Tracking

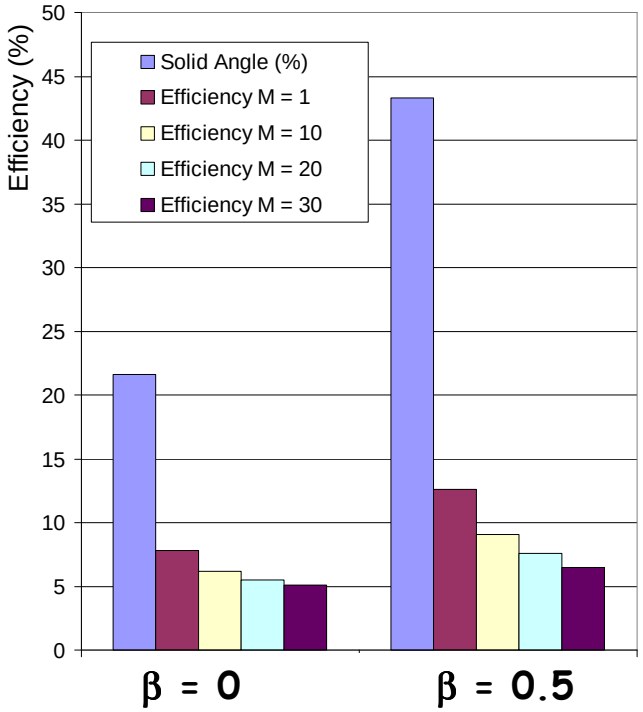
Hosting sites:

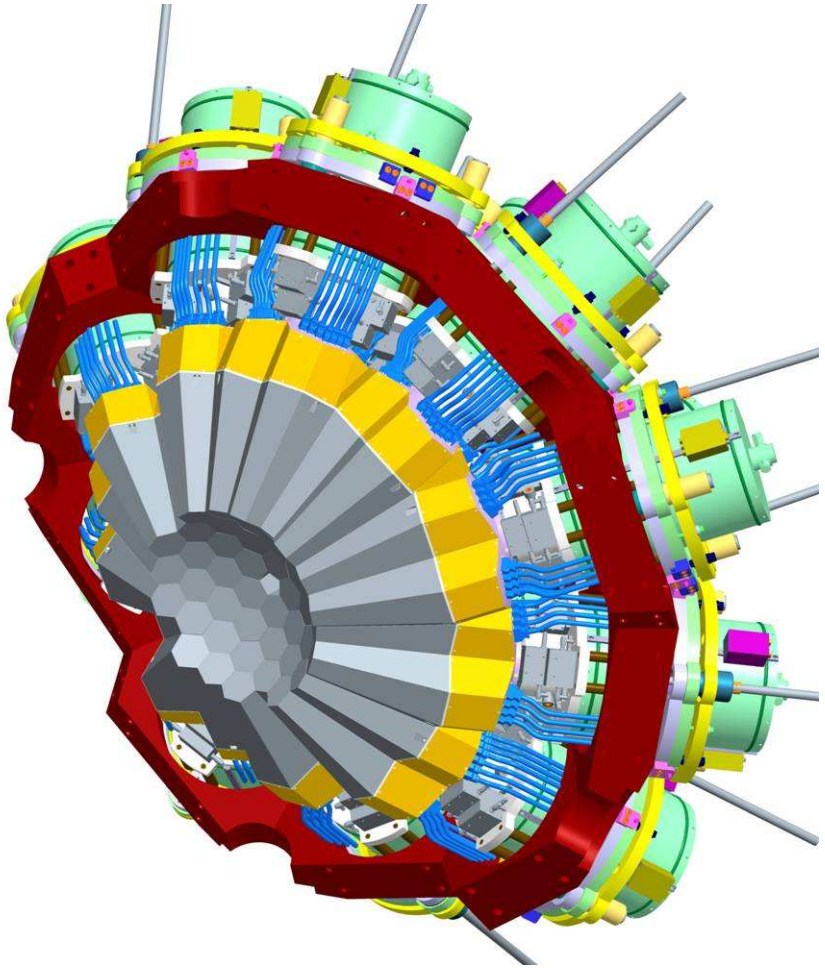
LNL → 2008
GANIL → 2010
GSI → 2012

The AGATA 1π

Objective of phase 2 (2009-2011)

- Next phase of the AGATA construction:
- Phase 2 (1π)→ 15 triple Clusters
- The first “real” tracking array
- Used at **FAIR-HISPEC**, **SPIRAL2**, **SPES, HI-SIB**
- Coupled to spectrometer, beam tracker, LCP arrays …

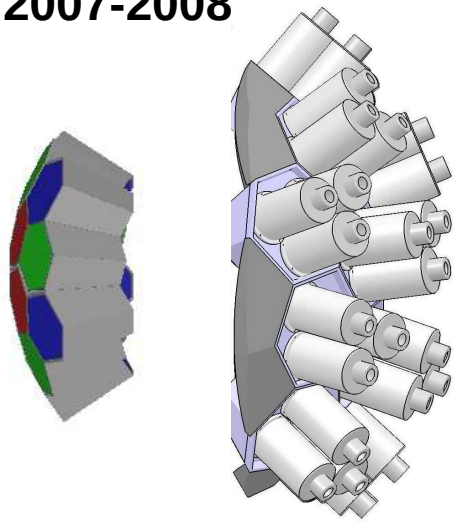




AGATA 1π

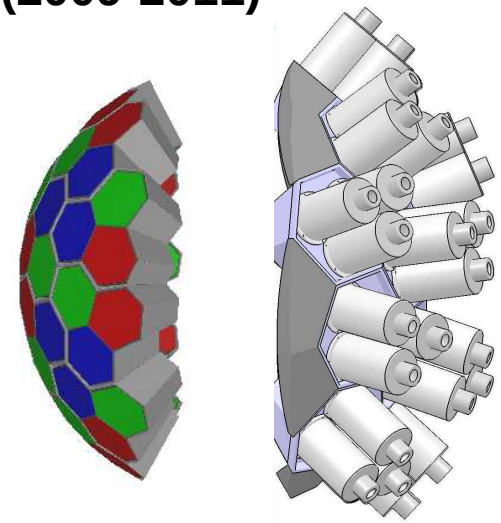
The Phases of AGATA-180 + N-WALL

2007-2008



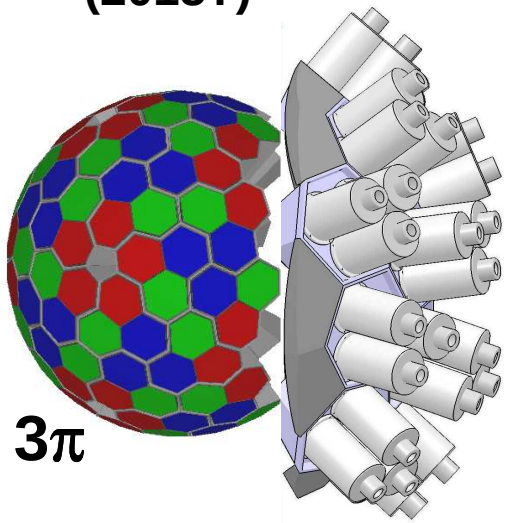
15 capsules ~3%

(2009-2011)

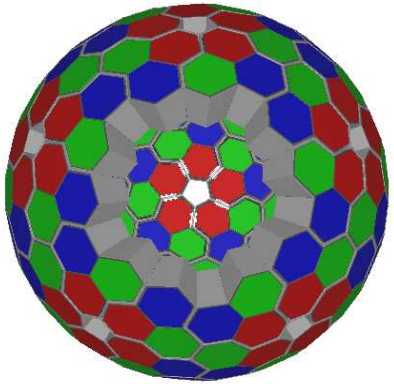


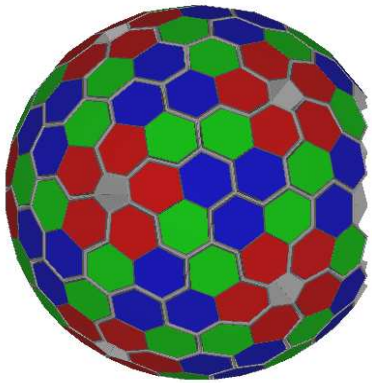
45 capsules ~9%

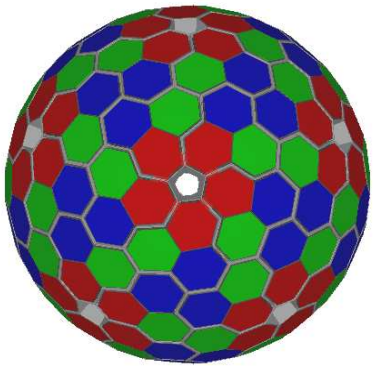
(2015?)

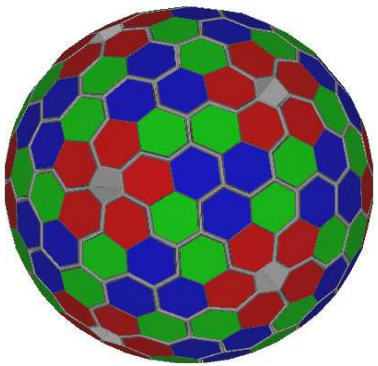


135 capsules ~30%

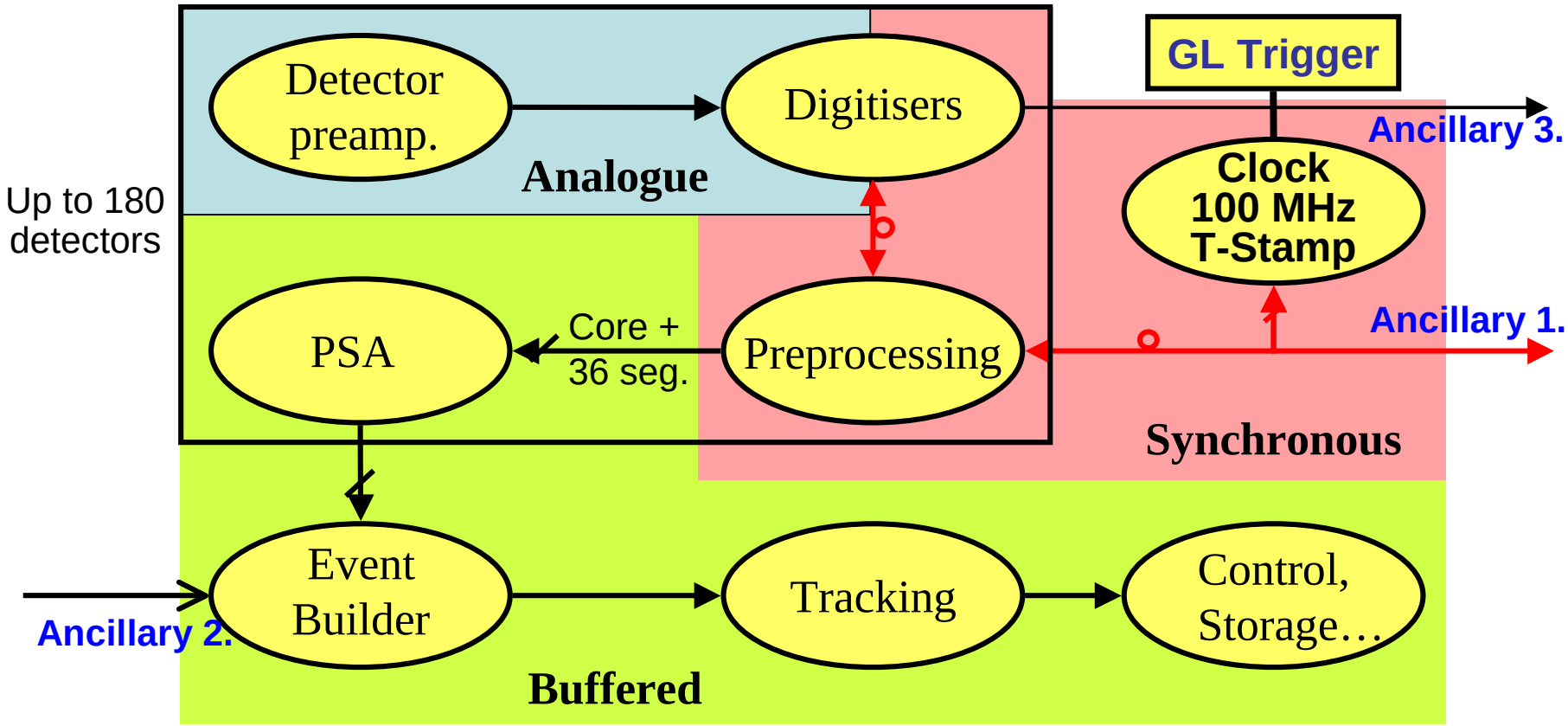








Structure of AGATA Data Processing

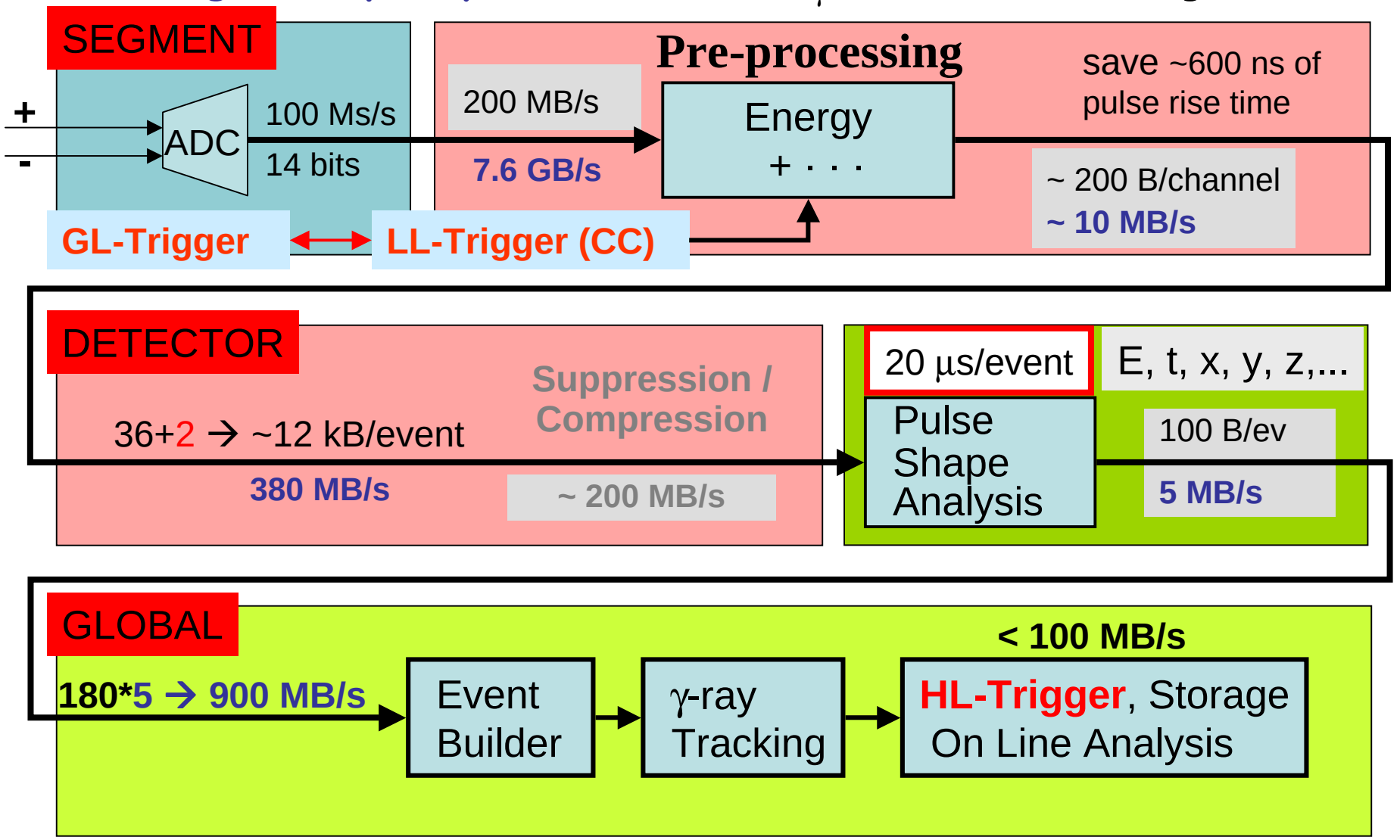


Other detectors

1. interface to GTS via mezzanine
2. merge time-stamped data into event builder
3. prompt local trigger available from digitisers

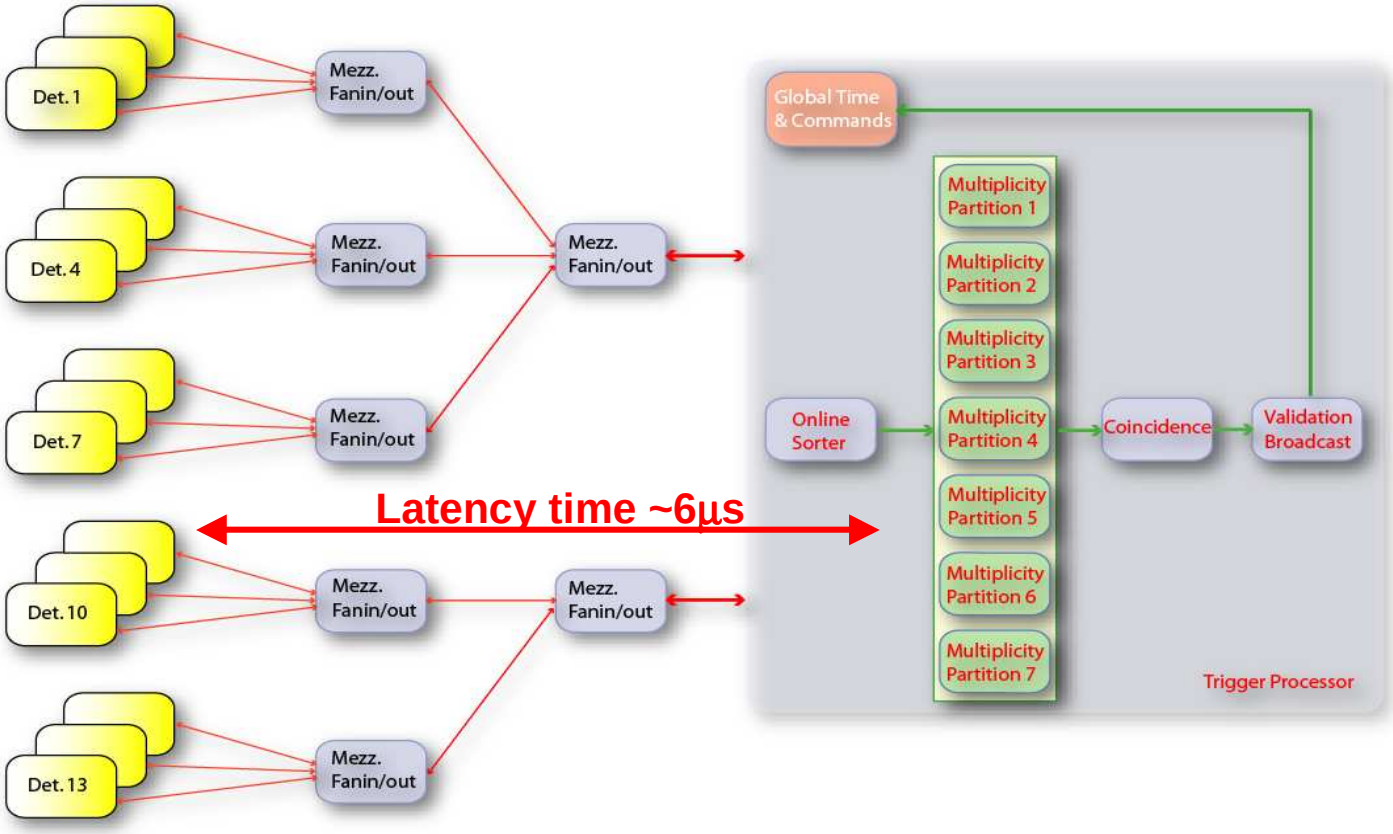
Data rates in AGATA 4π

High multiplicity → 300 kHz of M_γ = 30 → 50 kHz singles



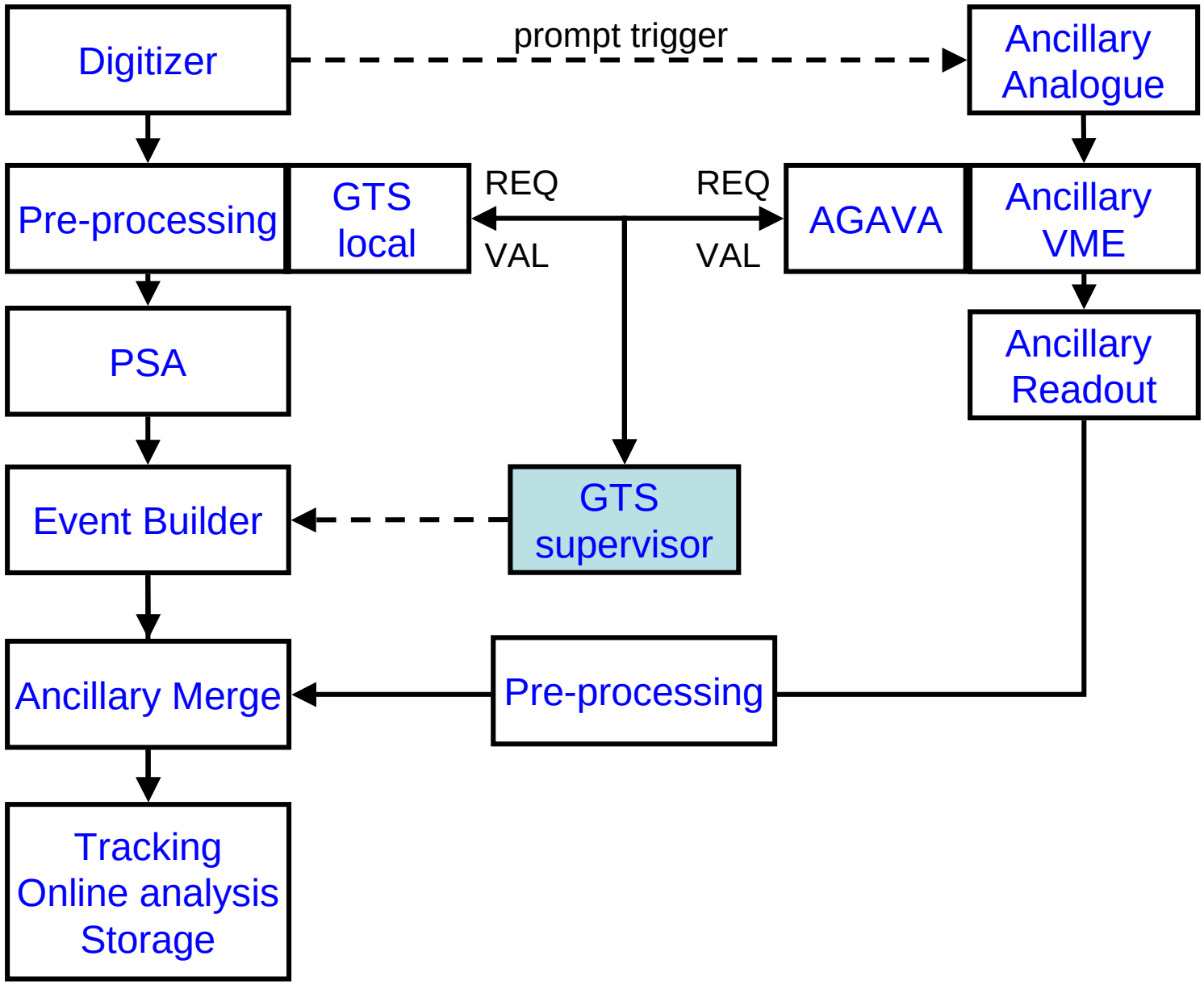
GL-Trigger to reduce event rate to whatever value PSA will be able to manage

Block Diagram of Central Trigger Processor

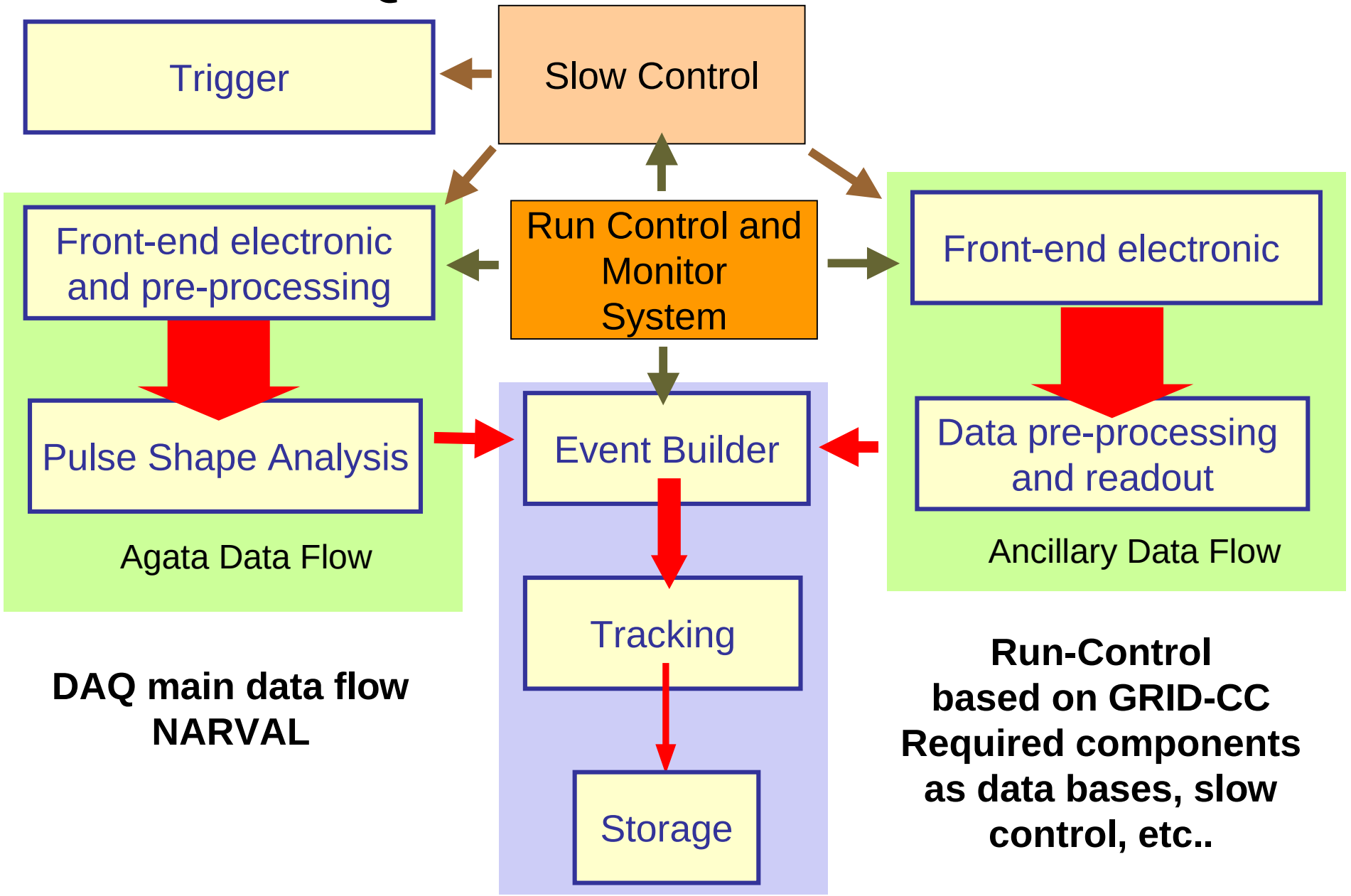


- Fully pipelined → no dead time introduced
- High performance → can sort 250 requests in one clock cycle
- Coincidences among partitions done in C in a CPU (PPC or external using PCI Express link)

AGATA and Other Detectors



DAQ General Overview



DAQ main data flow NARVAL

Run-Control based on GRID-CC Required components as data bases, slow control, etc..

Summary:

- Synchronization with the AGATA GTS
- Participation in the AGATA Trigger
- Large latency time

✓Recommended to go for fully digital (sampling) systems

✓Required analog/digital buffering to match the latency time

✓On-line discrimination required for high level trigger
→ pre-processing required

Note: The N-wall is a very efficient detector also for gamma-rays → large counting rates