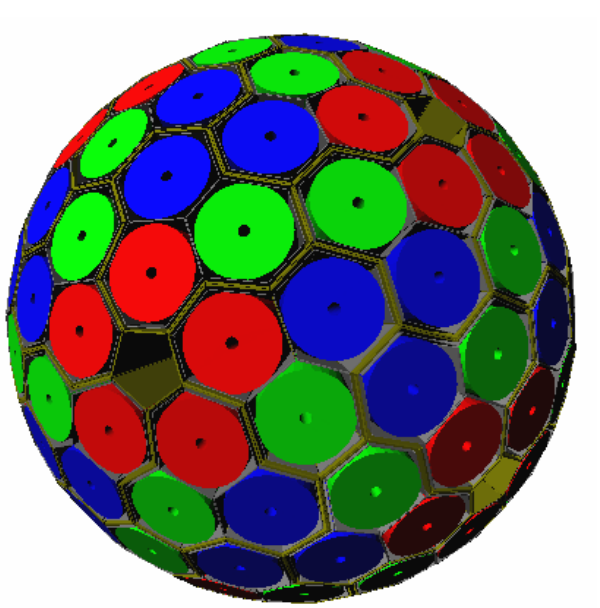
DATA PROCESSING Working Group

"from the preamplifier-output to data storage"

6 working teams

• Digitisation	P. Medina
• Pre-processing hardware	I. Lazarus
• Pre-processing algorithms	W. Gast
• Global Trigger and Synchronisation	M. Bellato
• Data Acquisition	X. Grave
• Run-control + GUI	G. Maron

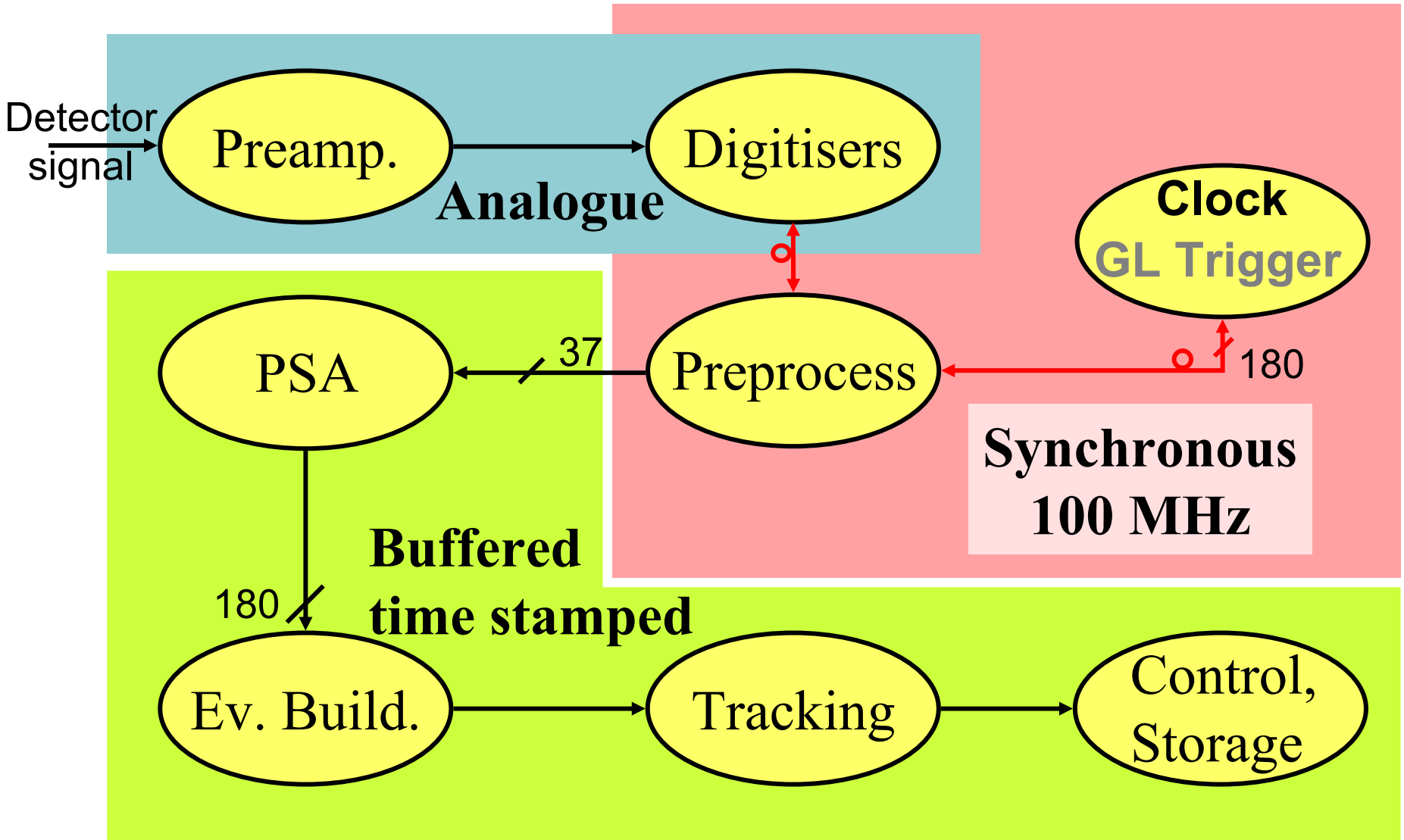
The 4π 180-detector Configuration



180 hexagonal crystals		3 shapes
60 triple-clusters		all equal
Inner radius (Ge)		23.1 cm
Amount of germanium		362 kg
Solid angle coverage		82 %
Efficiency:	43% (M_γ=1)	28% (M_γ=30)
Peak/Total:	58% (M_γ=1)	49% (M_γ=30)

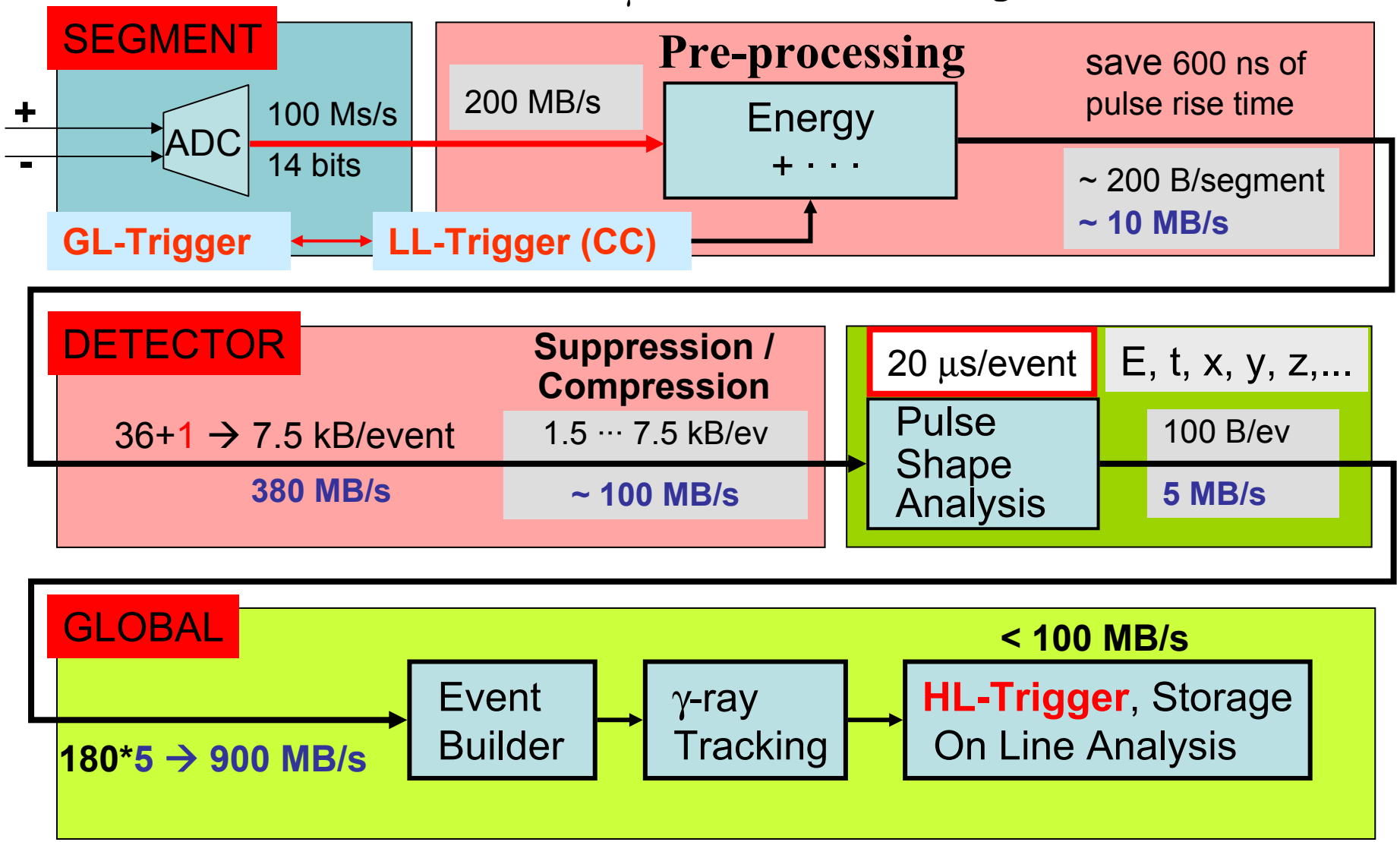
- Event rate @ M_γ = 1 → 3 MHz → ~ 15 kHz singles
  @ M_γ = 30 → 300 kHz → ~ 50 kHz singles
- Possibility to run trigger-less
- System composed of 180 detector units (clusters irrelevant for DP)
- Each unit has 37 electronics channels (total → 6660 channels)

Structure of Electronics and DAQ



Data rates in Full-AGATA

(300 kHz of M_γ = 30 → 50 kHz singles)



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

Counting rates for Demonstrator

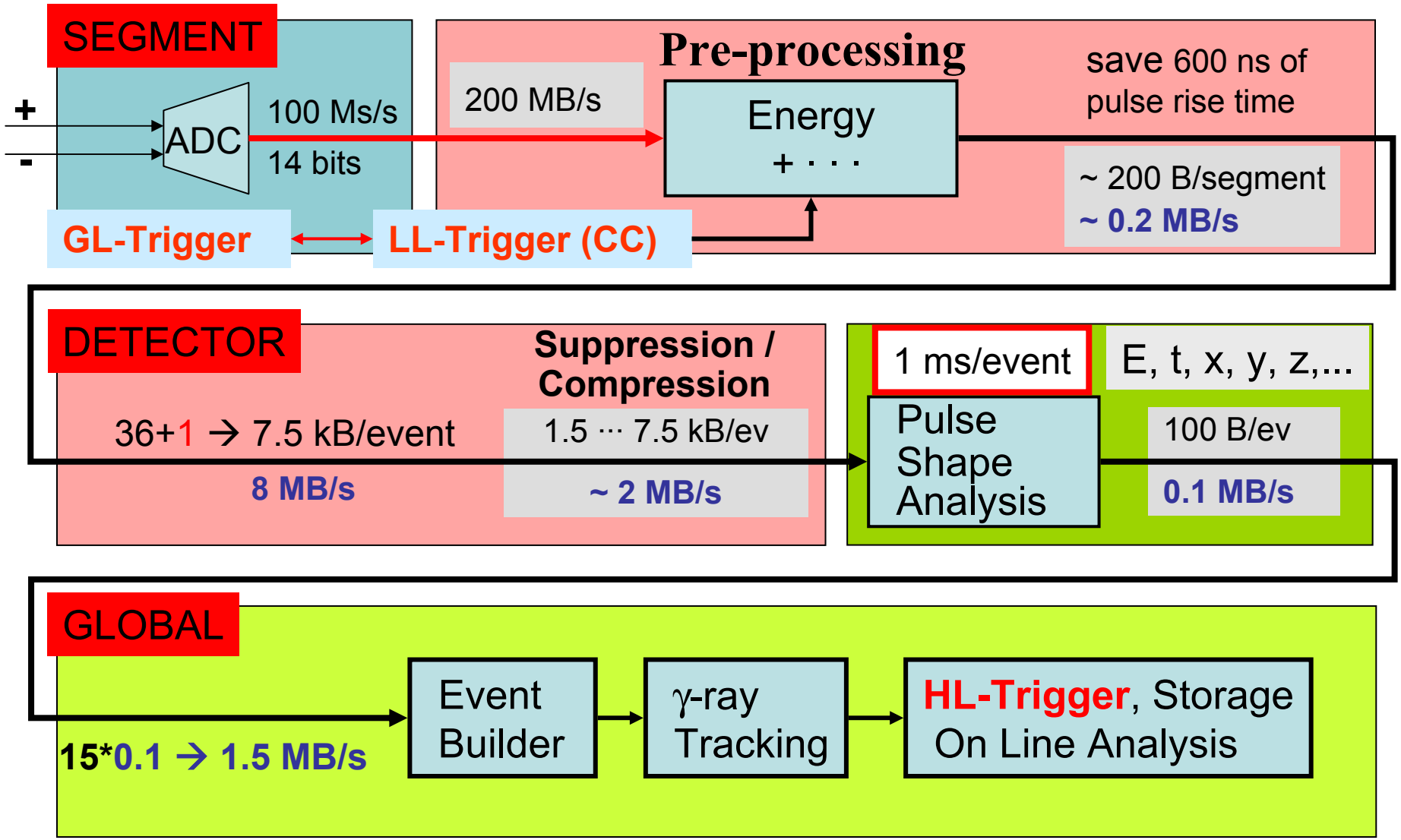
- 15 detectors
- Cascades of M_γ=30 transition E_γ=80 + n*90 keV
- Each detected gamma involves, ~ 1.3 detectors
  (→1.85 det/γ @ M_γ=1)
- With an production rate of 10^5 events/s we get:

Number of detectors requested by trigger	GL-trigger rate (kHz)	Singles rate (kHz)
1	83	14
2	57	12
3	33	8.7
4	15	5

- Triggering on k_d = 4 detectors, is equivalent to k_γ >2 → rate of processed singles reduced by a factor of ~3.
- Coincidences with ancillaries → further reduction

Data rates for Demonstrator

15 detectors, 10 kHz singles, GL-trigger, Ancillary → **1kHz into PSA**



Could easily write out pre-processed events !!!

Digitisation

presented by Patrick Coleman-Smith

- **IReS Strasbourg**
  - ❖**P.Medina**
  - – M.Chambit
  - – R.Baumann
  - – C.Santos
- **CCLRC Daresbury**
  - – P.Coleman-Smith
  - – I.Lazarus
- **Uni. Liverpool**
  - – J.Thornill
  - – D.Wells

Differential input
5 or 20 MeV range
37 signals digitised @ 14 bit, 100 MHz
Housed in 2 water cooled boxes close to Array
Digitised data transmitted to pre-processing level over optical fibre → galvanic isolation

Optional "fast" Local Trigger from CC to ease operation with ancillaries (available from pre-processing).

Development based on experience with TNT2
Some concern for the large power consumption

Pre-processing
presented by Ian Lazarus

- **CCLRC Daresbury**
  - ❖**I.Lazarus**
- **IPN Orsay**
  - P.Edelbruck
  - X.Grave
  - Ch.Oziol
- **CSNSM Orsay**
  - L.Benalleague
  - S.Lhenoret,
  - D.Linget

+ GTS team

- **IKP Juelich**
  - ❖**W.Gast**

Receive global clock from GTS and transmit to Digitisers over synchr. fibre

Generate local trigger from CC

Transmit trigger request to GTS via GTS mezzanine

Calculate energy of CC and of segments

Receive trigger validation from GTS and validate local events

Isolate rise time of signals and transmit data to PSA only for validated events

Development and implementation of algorithms

Implemented into ATCA crates using mezzanines (no CPCI phase)

Potentially able to handle the full singles rate since beginning

Global Trigger and Synchronisation

presented by Marco Bellato

- **INFN Padova**
  - ❖**M.Bellato**
  - – D.Bortolato
  - – R.Isocrate
- **IFJ Kraków**
  - – A.Czermak
  - – B.Dulny
  - – M.Ziblinski
- **IReS Strasbourg**
  - – Ch.Weber

Central point of control for the whole processing system

Generate common 100 MHz clock; transmit clock and time-stamp over optical fibre tree

Receive trigger requests

Generate global trigger and issue validation signals to GTS mezzanines

ATCA crate in synchronous mode

Complex triggers with minimum dead-time

Interaction with other detectors → GTS mezzanines

Simulation of GTS and whole electronics in SystemC

Integration with MC simulations and PSA analysis ???

DAQ

presented by Xavier Grave

- **IPN Orsay**
  - ❖**X.Grave**
  - – N. Barré
  - – Ch.Diarra
  - – H.Harroch
- **CSNSM Orsay**
  - – A.Korichi
  - – E.Legay
- **INFN Legnaro**
  - ❖**G.Maron**
- **Kraków**
  - – J.Grebosz
- **CLRC Daresbury**
  - – V.Pucknell
- **Uni. Liverpool**
  - – J.Cresswell

+ PSA, Tracking and Data analysis teams

Read pre-processed data

Build local event for PSA

Perform PSA

Read data from PSA farm (if PSA farm)

Build Global Event based on event number and/or time stamp

Perform γ-ray tracking

On line analysis, storage

The NARVAL DAQ

Run control, Slow control, GUI,

Farms and farm management, …

This part of the work needs to be organised during this AGATA week !!!

More involvement of host laboratories

Status of prototypes

- GTS mezzanine: Spring 2005
- Pre-processing mezzanines: Summer 2005
- Digitisers: Autumn 2005
- ATCA carrier card: Winter 2005
- GTS processor: Winter 2005

- **All prototypes tested by March 2006**
- **First full processing chain tested by Summer 2006**
- Any needed reprocessing of cards by Autumn 2006
- Production and start delivery → **beginning 2007**

Some problems

- Digitisers, Pre-processing and GTS
  - no time to react if performance not fully in specs
- DAQ:
  - scalability of the NARVAL system
  - start working on Run-control/GUI and
  - integration of PSA & Tracking programs
- Interaction with ancillaries
  - reading their data into AGATA DAQ in Demonstrator Phase??
- Urgent tasks →
  - checking overall consistency of DP system
  - definition of Time plan and Costing