2D detector timing and beam information requirements

- Contents:
  - Brief 2D detector DAQ summary
  - Detector timing and beam information requirements
  - Questions to timing system group

EDMS Nr.: D0000000123826 1 Rev: A Ver: 1 Status: Released Dat.: 12.11.2008

2D detector DAQ summary

- Next slides briefly explain 2D detector DAQ

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2D detector and DAQ summary

- Three 2D pixel detectors proposed for XFEL
  - AGPID (formerly HPAD)
  - LPD
  - DEPFET

- All have similar design concept
  - Sensor
  - ASIC
  - ADC
  - Readout

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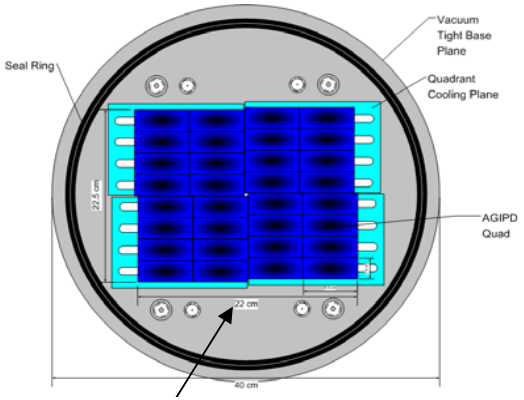
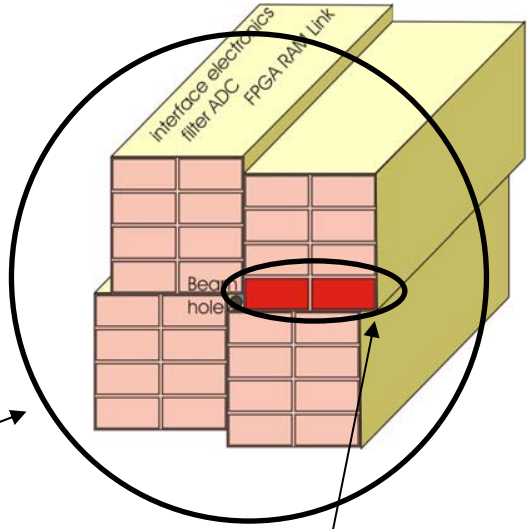
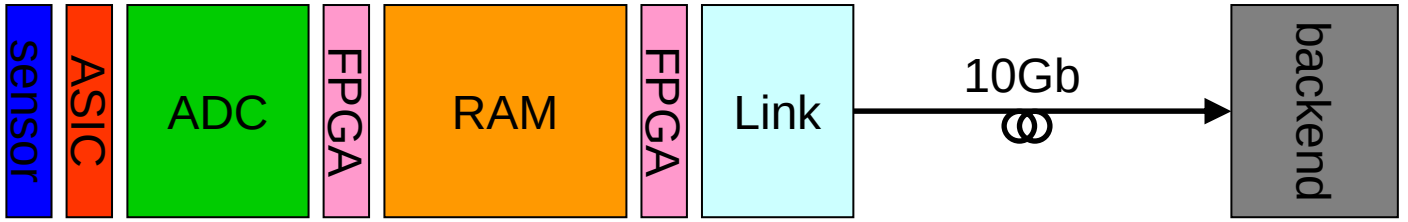
AGIPD data processing overview



1M silicon pixels



Front End Electronics (16 modules/Mpixel)



Digitize Pipeline to RAM

Formatting

Transfer out

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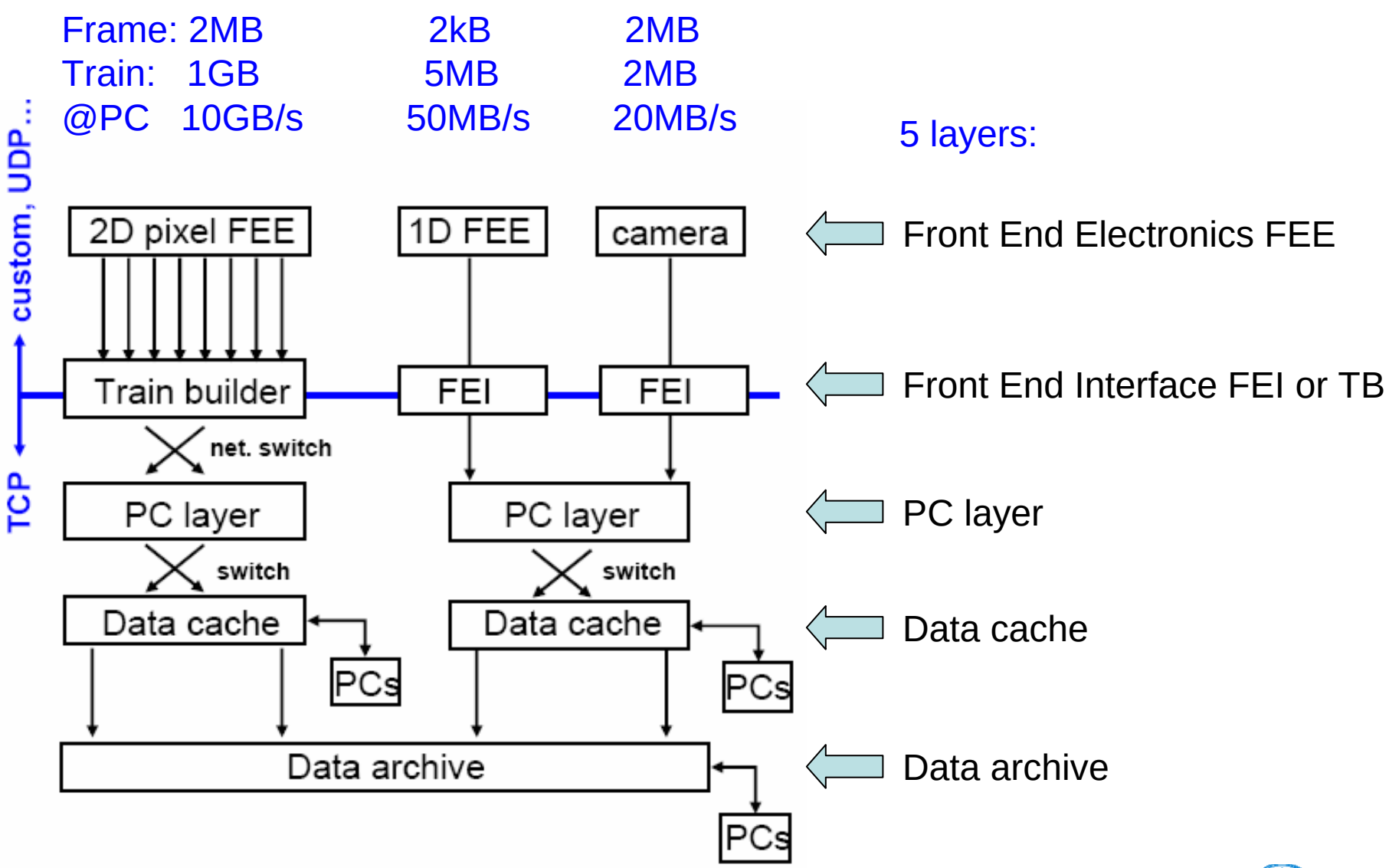
XFEL readout architecture (9.2009)



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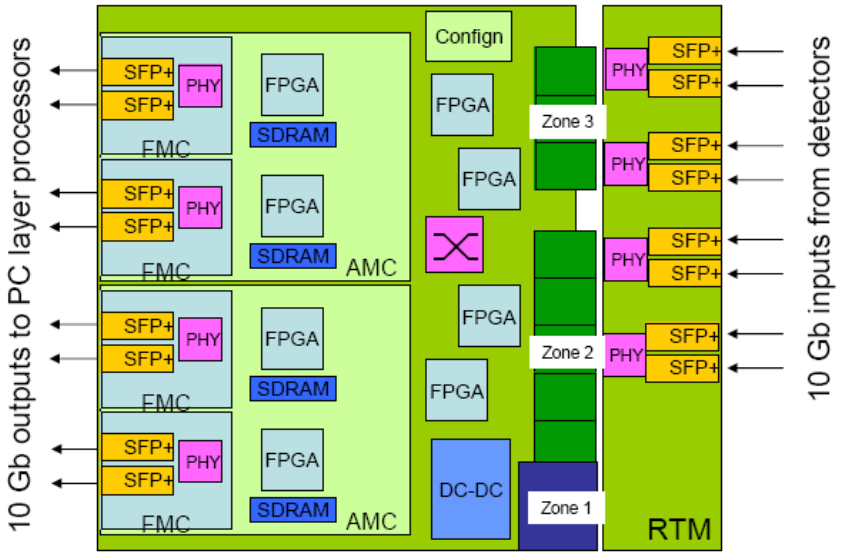
2D detector to backend connection



x 2 = 1Mpixel detector

- Train builder
  - Train building = rebuilds and orders frames into single contiguous train
  - Protocol conversion = custom hardware-hardware input, TCP output
  - Processing = maybe pedestal correction, zero suppression, trigger sum counting, etc.
  - Implementation = currently ATCA + AMCs (i.e. ATCA crate)

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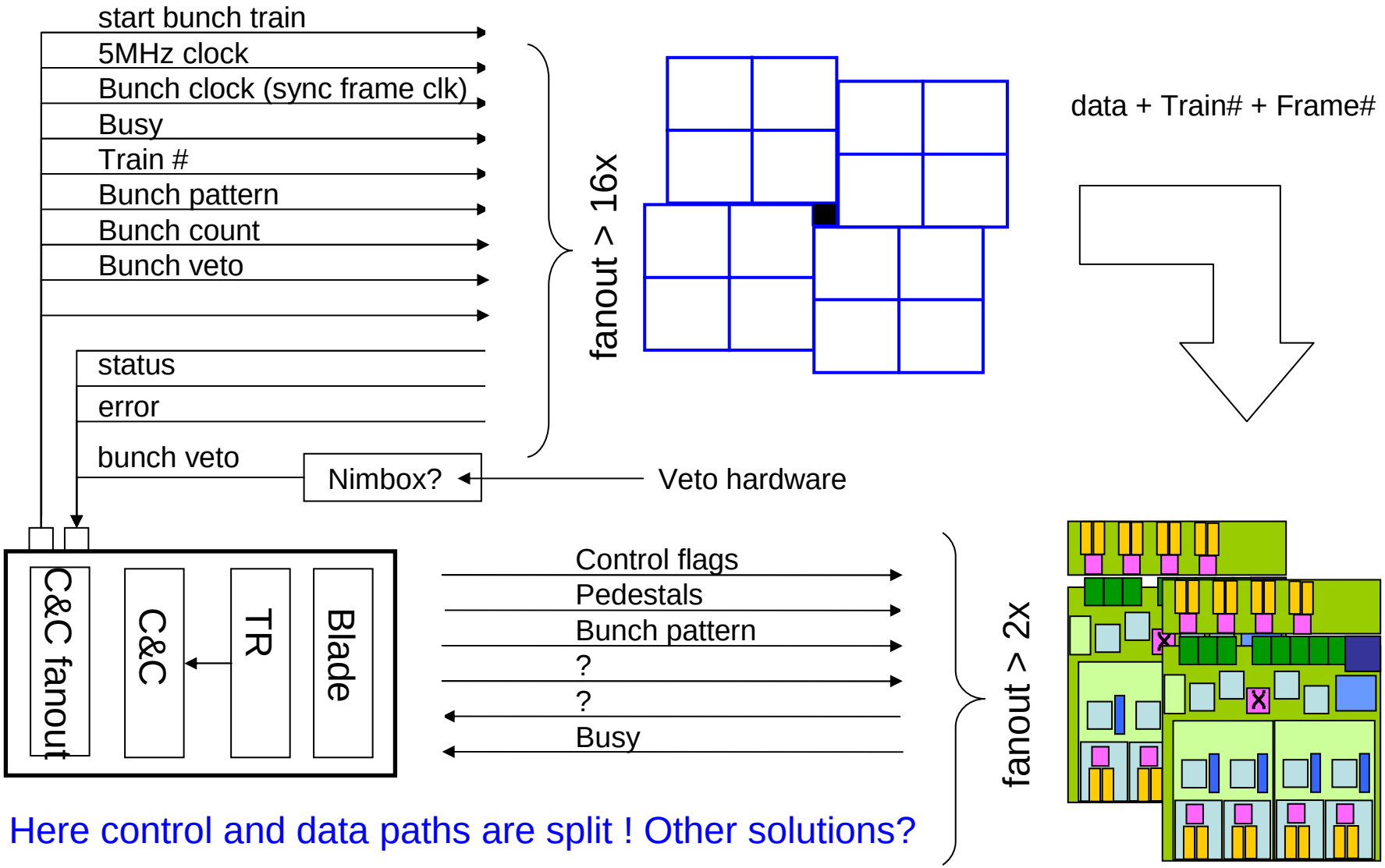
C&C signals and connections – basic idea



Here control and data paths are split ! Other solutions?

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Detector timing and beam information requirements

- Next slides list current understanding of required
  - Signals (triggers)
  - Clocks
  - Beam information (telegrams)
  - Other information (experiment specific configuration)

- The slides are a best guess at the current understanding = may be incorrect, incomplete, …

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List of assumptions made

- Note that in this talk it is implicitly assumed that Signals and Clocks are distributed between the C&C and FEE and C&C and TB by physical Cables !!!

- Note that Beam and Other information are both referred to as simply Information. It is implicitly assumed that Information is distributed between the C&C and FEE and C&C and TB by TCP IP connections.

- Note that Information transmission also has timing requirements:
  - Configuration information must precede with some time allowance the train to which it applies.
  - So called Snapshot information can be transferred at any time, but may be cleared or collected at the source after the end train signal?

EDMS Nr.: D0000000123826 1 Rev: A Ver: 1 Status: Released Dat.: 12.11.2008

C&C To FEE

- Signals
  - Start bunch train – derived from timing system and modified by C&C
  - End bunch train – derived from timing system and modified by C&C
  - Status
    - Busy – not needed as start bunch train drives acquisition and C&C will block (modify) distribution if error state exists
  - More ?
- Clocks
  - Bunch clock (nominally 5 MHz) – derived from timing system
  - Standalone 5 MHz clock
  - Bunch veto clock
  - More ?
- Beam information
  - Train number – derived from timing system
  - Number of bunches – derived from timing system
  - Bunch pattern (3000 words or ID) – derived from timing system
  - Calibration pattern (3000 words or ID)
  - Veto disable pattern (3000 words or ID)
  - More ?

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FEE to C&C

- Signals
  - Status
    - Error (ASIC, ADC, logic, link, …)
    - State (configure, active, idle, …)
  - More ?
- Clocks
  - None ?
- Other information
  - snapshot - to allow debug & monitoring
    - Registers
    - Counters
  - More ?

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C&C to TB

- Signals - See J.Coughlan's talk
  - ?
- Clocks - See J.Coughlan's talk
  - ?
- Beam information - See J.Coughlan's talk
  - ?

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TB to C&C

- Signals - See J.Coughlan's talk
  - ?
- Clocks - See J.Coughlan's talk
  - ?

See J.Coughlan's talk

- Other information
  - snapshot - to allow debug & monitoring
    - Registers
    - Counters
  - ?

EDMS Nr.: D0000000123826 1 Rev: A Ver: 1 Status: Released Dat.: 12.11.2008

Questions to timing system group

- How is notification of non delivery of a train performed?
- How is notification of non delivery of a pulse, many pulses, or pulses at the end of train performed?
- What are the signal and clock resolutions and jitters?
- What is the maximum time between start train and the first bunch arriving?
- How do the experiments know that the timing system is incorrect (not connected, not working, etc.)? During a run and on startup?
- When will experiment timing receiver specs. be available?
- What is the production time line for timing receivers ?
- Do the experiments send data back to the timing system?

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Questions to detector and TB groups

- Do the experiments need more than start train, end train, pulse clock, bunch occupancy telegrams, etc?

EDMS Nr.: D0000000123826 1 Rev: A Ver: 1 Status: Released Dat.: 12.11.2008

Spare slides

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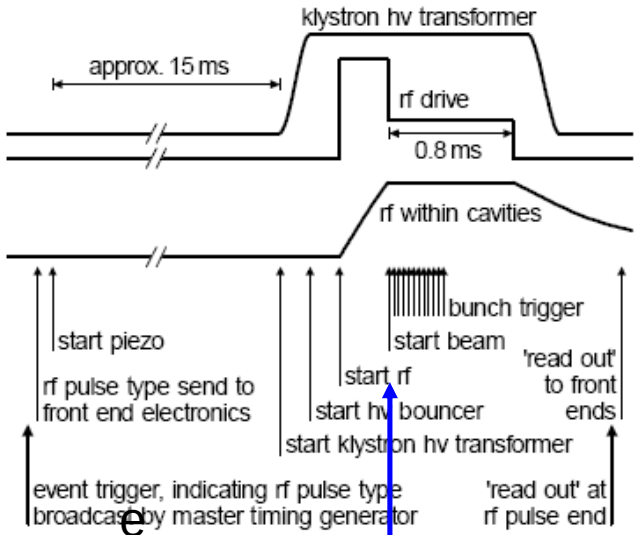
Timing Triggers and Events

Timing schematic of
e-machine RF events



- The TR generates triggers and events
  - Trigger = a single pulse on an output connector
  - An event = Trigger + accompanying (telegram) data
  - Telegram = bunch occupancy pattern + ?

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Implementation issues

- Signals and clocks = differential cable pairs
- Beams and other information = ethernet

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Aim of timing and C&C meeting

- Timing – Wednesday pm
  - Meet groups – get communication going
  - Understand status of timing system to be used by the experiments
  - Describe our requirements
  - Ask questions

- C&C – Thursday am
  - Resolve separate or combined C&C issue
  - Provisional specification of C&C
  - Start writing in-kind proposal

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