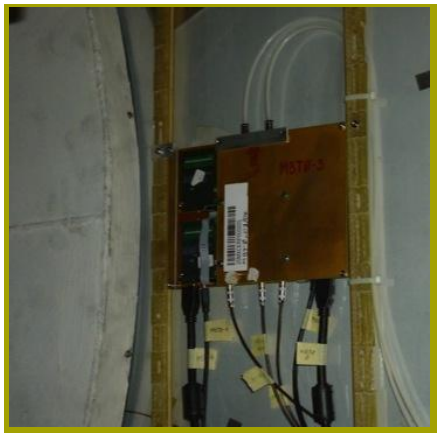
David Berge, Raffaele Giordano, George Glonti, George Iakovidis, Paolo Iengo, Vincenzo Izzo, Yousuke Kataoka, Kostas Kordas, Antonios Leisos, Stefanos Leontsinis, Sabrina Perrella, Givi Sekhniaidze, Ourania Sidiropoulou, Mimmo della Volpe, Andre Zibell,
SRS development: Hans Muller, Sorin



Marcin Byszewski
On behalf of the MAMMA collaboration.

Running Micromegas in ATLAS: status update of DAQ integration and plans

The Goal

Compare data from the test chambers with ATLAS data

(take these data with no impact on ATLAS data taking)

1. Stand-alone, random trigger (until September 2012)
   - Convenient, Track matching not possible
2. Trigger from ATLAS, data separate ('parasitic')
   - Offline synchronisation
3. Fully integrated with TDAQ in ATLAS partition
   - Most of our event fragments empty

A lot of discussions and support from CTP / TDAQ / run coordination / Sysadmins. Thank you.

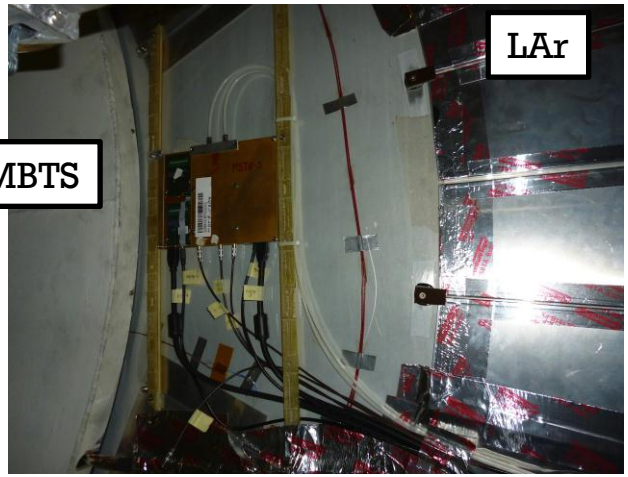
Micromegas test chambers

Installed Feb 2012, read out in stand-alone random trigger mode

Test chambers description and readout in stand alone mode see Joerg Wotschack's presentation in Run Weekly 24/7/2012 https://indico.cern.ch/conferenceDisplay.py?confId=194946

MBTS, side A

- Front of the LAr calorimeter cryo
  - r ≈ 1 m
  - z = 3.5 m
- One 9x4.5 cm^2
  - X-V (2 readout gas gaps)

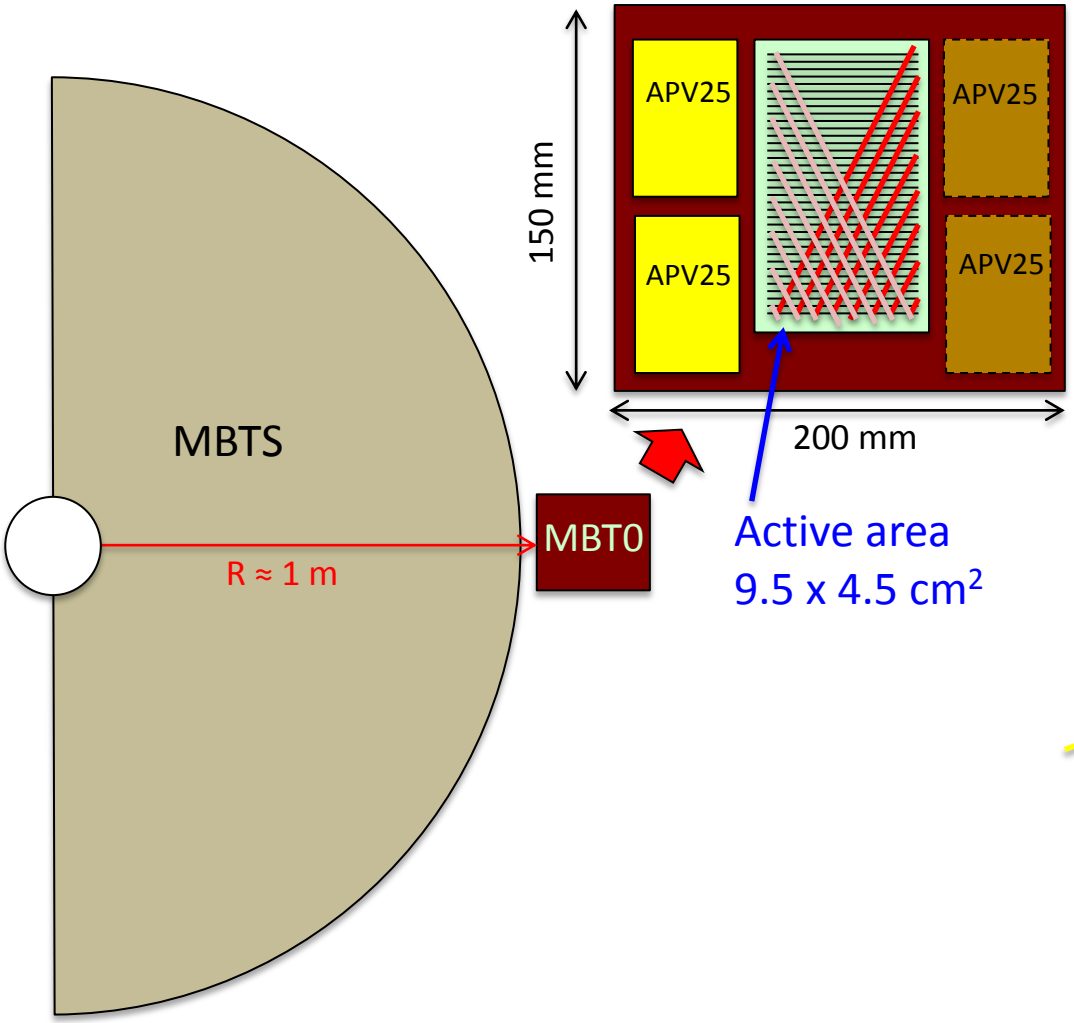


Small Wheel, sec. 9, side A, CSC

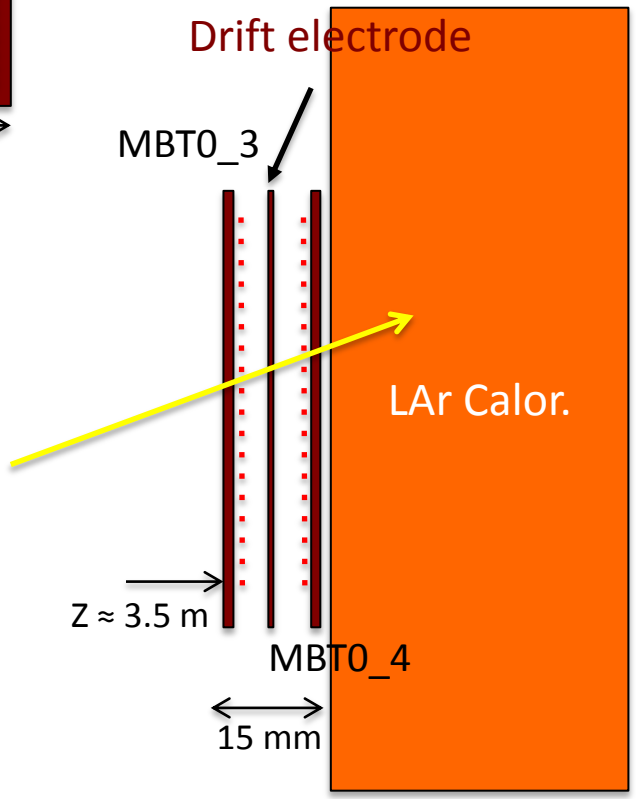
- r = 1.7 -1.8 m
- Four 9x9 cm^2 chambers
  - X, Y, XY, XUV
  - Only three read out
    - 1 FEC limit
    - Power supply limits and SRU firmware

EIL1 MDTs

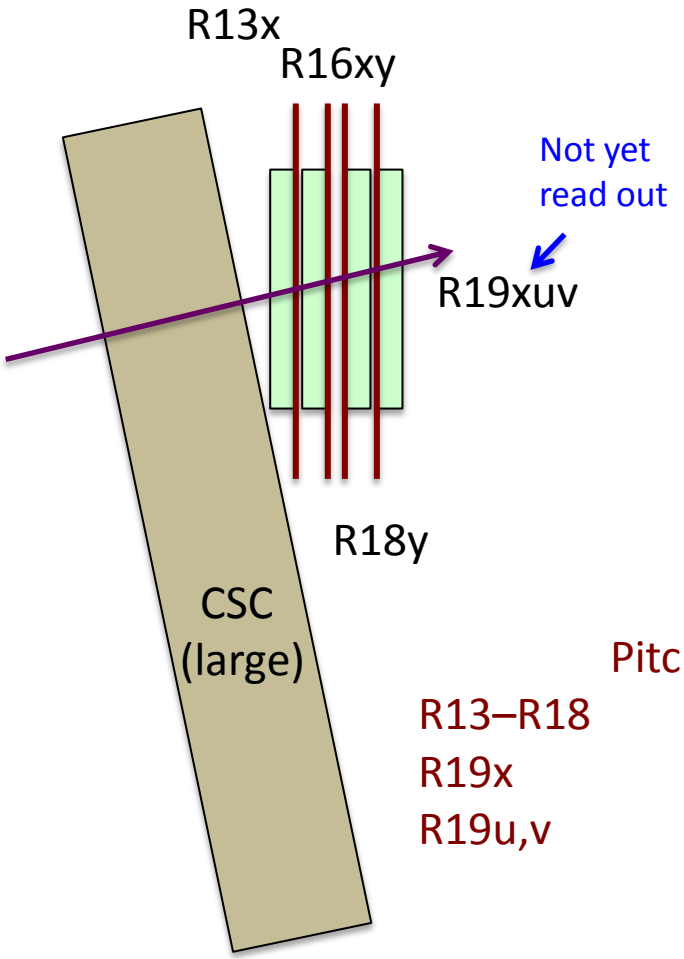
MBT chambers (LAr ecal)



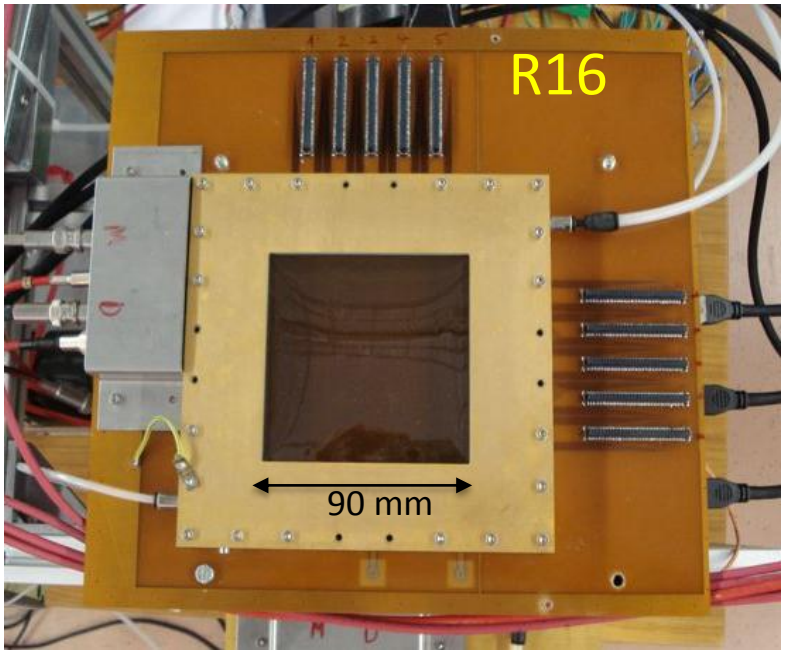
2 drift gaps of 4.5 mm each
2 x 190 x(phi)-strips (0.5 mm pitch)
2 x 66 v-strips (1.5 mm pitch)



MMs on Small Wheel II



	Pitch (µm)
R13–R18	250
R19x	350
R19u,v	100

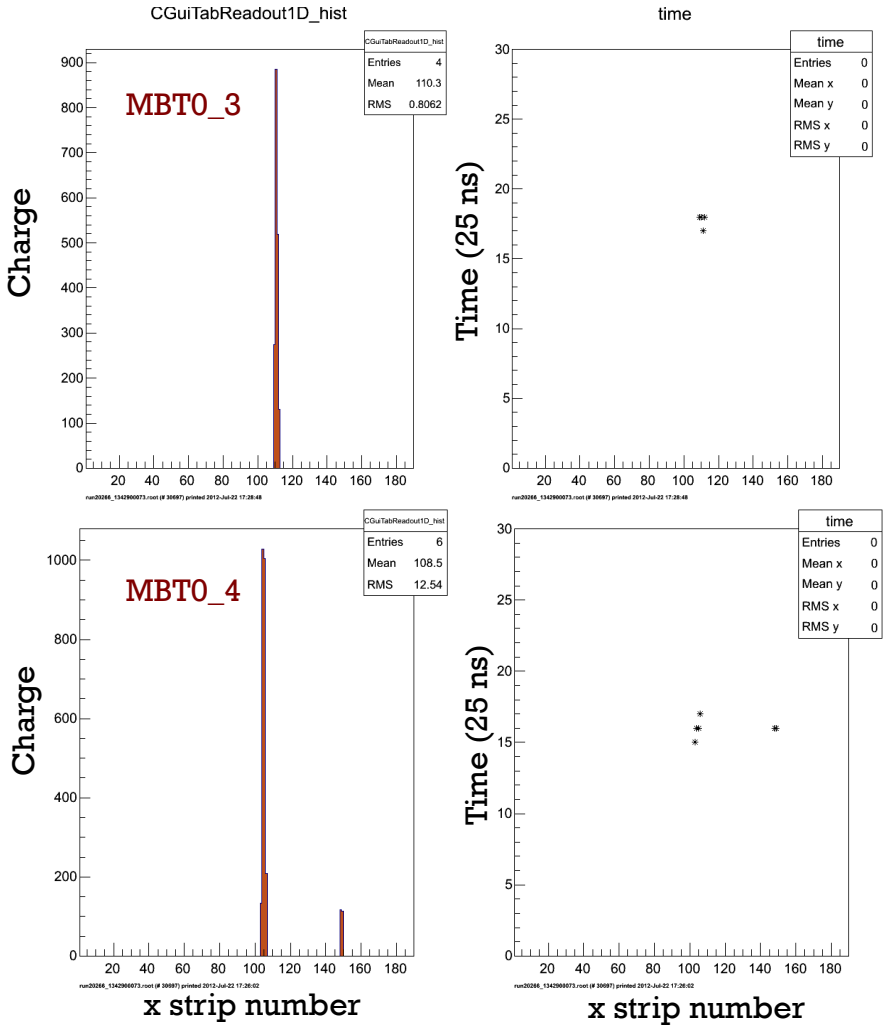


R16, chamber with 2D readout
active area: 9 x 9 cm^2

Some typical events displays

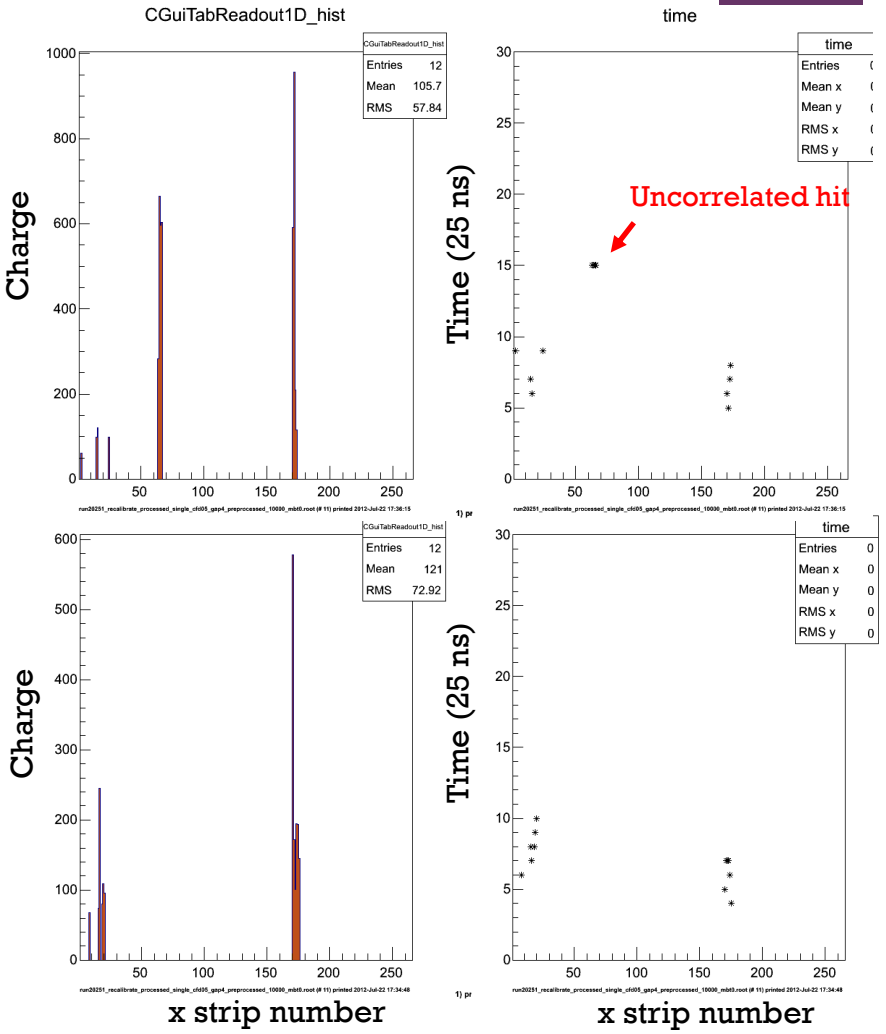
$L = 3.3 \times 10^{30}\ cm^{-2}\ s^{-1}$

(≈1/1000 triggers with activity)



$L = 3.3 \times 10^{33}\ cm^{-2}\ s^{-1}$

(≈each trigger with activity)



Rates / Occupancy / data size

MBT0

- Rates:
  - ≈20 kHz/cm^2 @ L=10^{33} cm^{-2} s^{-1}
  - 7 strips (16 time bins)
- 10kHz readout
  - (100kHz * 0.1 due to slow readout)
- Up to 10MB/s

  by varying time window and data reduction mode (36GB/h)
- Total data:

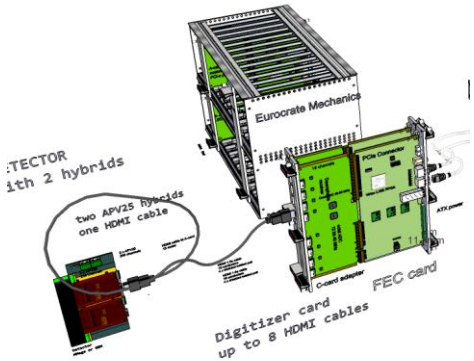
  for 10 weeks, 5 days, 10h runs

  17 TB of LV1 data

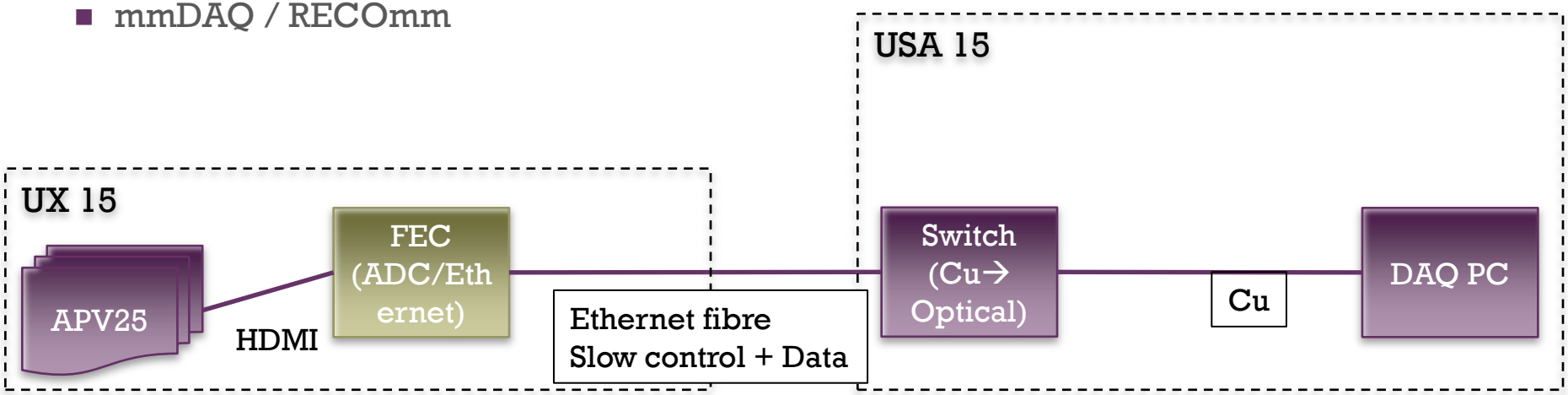
SW

- Rate:
  - 30 Hz/cm^2 @ L = 10^{33} cm^{-2} s^{-1}
  - Majority (90%) of events with uncorrelated hits

Current readout: ½ ROD

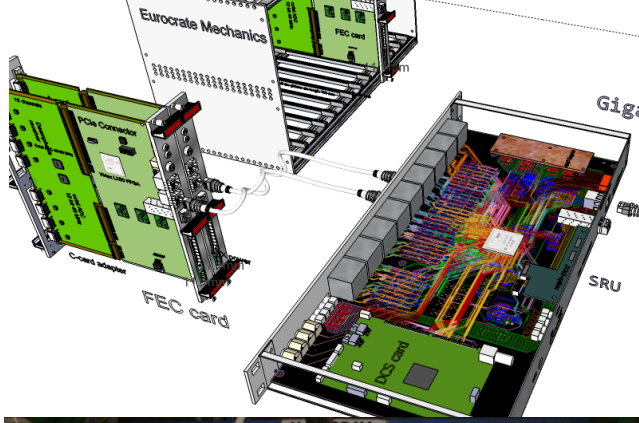


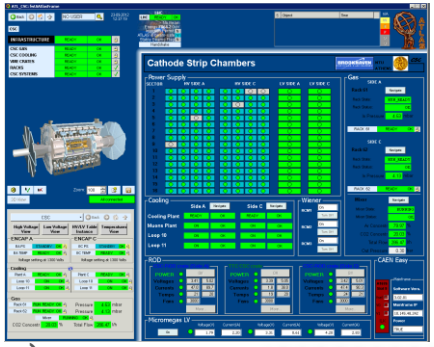
- SRS – based ROD:
  - RD51's SRS system https://espace.cern.ch/rd51-wg5/srs/default.aspx
    - APV25 chips (CMS Si tracker) (16+4)
    - HDMI cables (10)
    - SRS FEC (ADC, Ethernet)
- Data to a DAQ PC in USA15
- mmDAQ / RECOmm

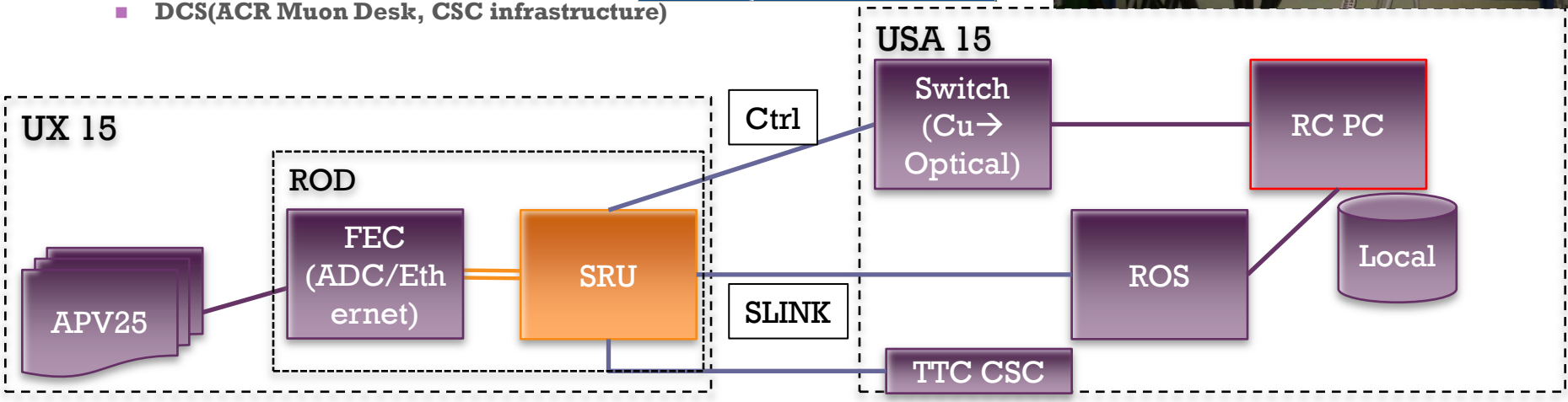


SRS – based Readout

- Front end electronics:
  - APV25 chips (CMS tracker, no other choice)
  - HDMI cables (LV, data)
- **ROD** in UX15:
  - SRS FEC – digitization, peak finding, **zero suppression**
  - **DTC link to SRU**
  - **SRU – EB, TTC, LV1, DCS , SLINK**
- **USA15**
  - **CSC TTC, DATA, DTC fibres**
  - **Run Control Application (on RC PC)**
  - **ROS**
  - **DCS(ACR Muon Desk, CSC infrastructure)**





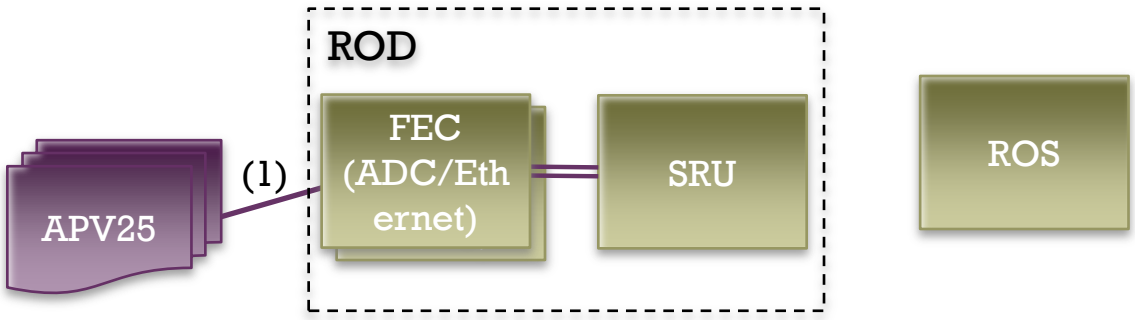


Configuration

- Not in ATLAS partition
  - There is no way of getting LV2/EF information to our ROS (event selection)
  - MM partition fully described in TDAQ OKS database
  - Reading out 10% of LV1 triggers (slow APV data transfer)
  - Pre-selection on SRU possible
    - Send only events with APV data
    - Possibly select on FEC event size
  - Store all read out data

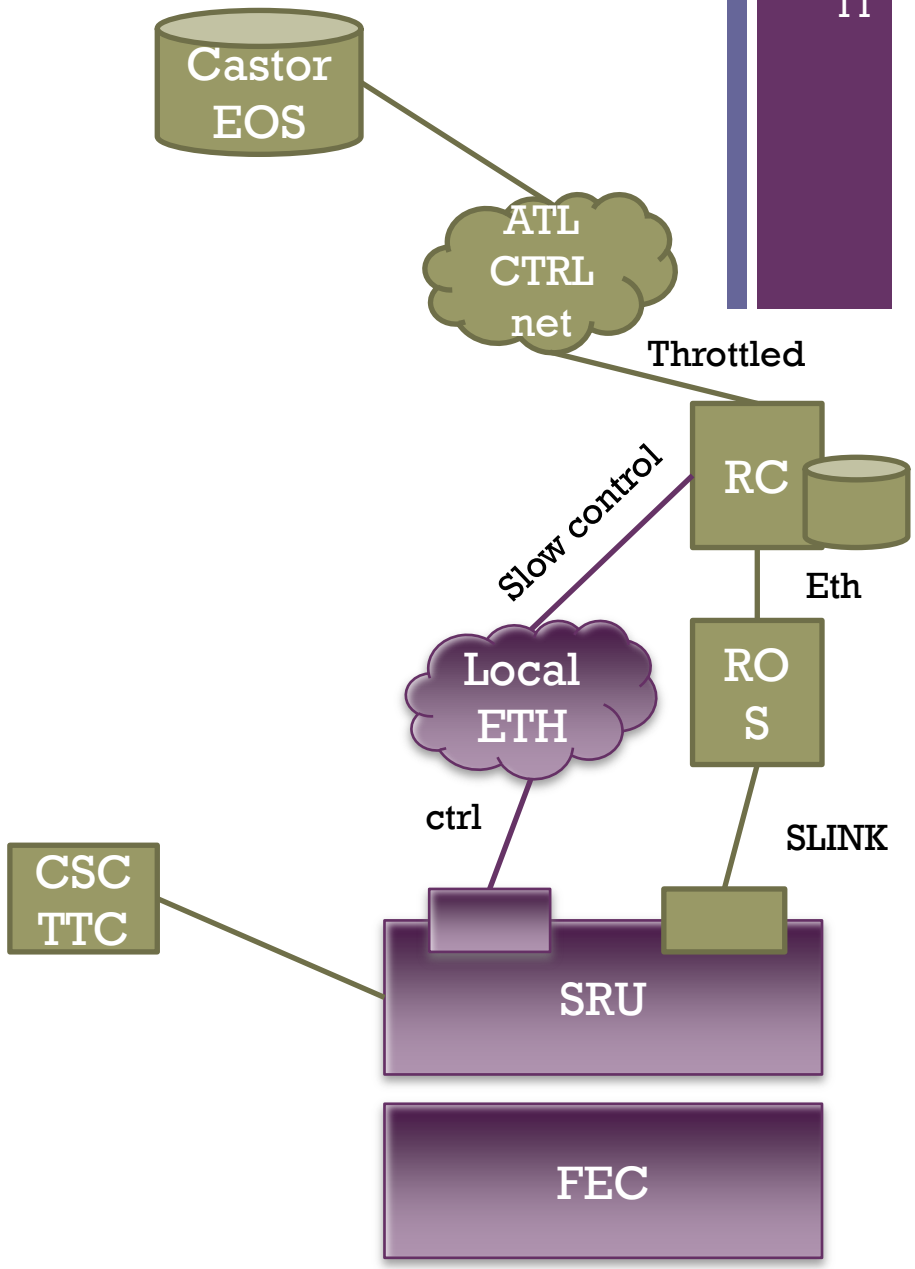
- Switch to SW-only readout

- We could switch back to TDAQ-compliance mode, if we want
  - into fully integrated mode
  - and serve all LV1 if in ATLAS partition



Run Modes

- **Physics**
  - **ATLAS LV1, 10%**
  - **Data to SLink-ROS-RC PC-HDD**
  - **Offline synchronisation of LV1**
  - **Throttled data transfer to storage (Castor)**
  - **All APV / SW-only runs**
- Calibration
  - Off-run
  - Internal / CSC triggers
  - On FEC measurement of ZS pedestals
  - RC PC storage of pedestals (read from FEC)
- APV calibration (rare)
  - Internal triggers
  - ZS in bypass mode
  - SRU in bypass mode to Ethernet port
  - Display / Verify raw APV frames



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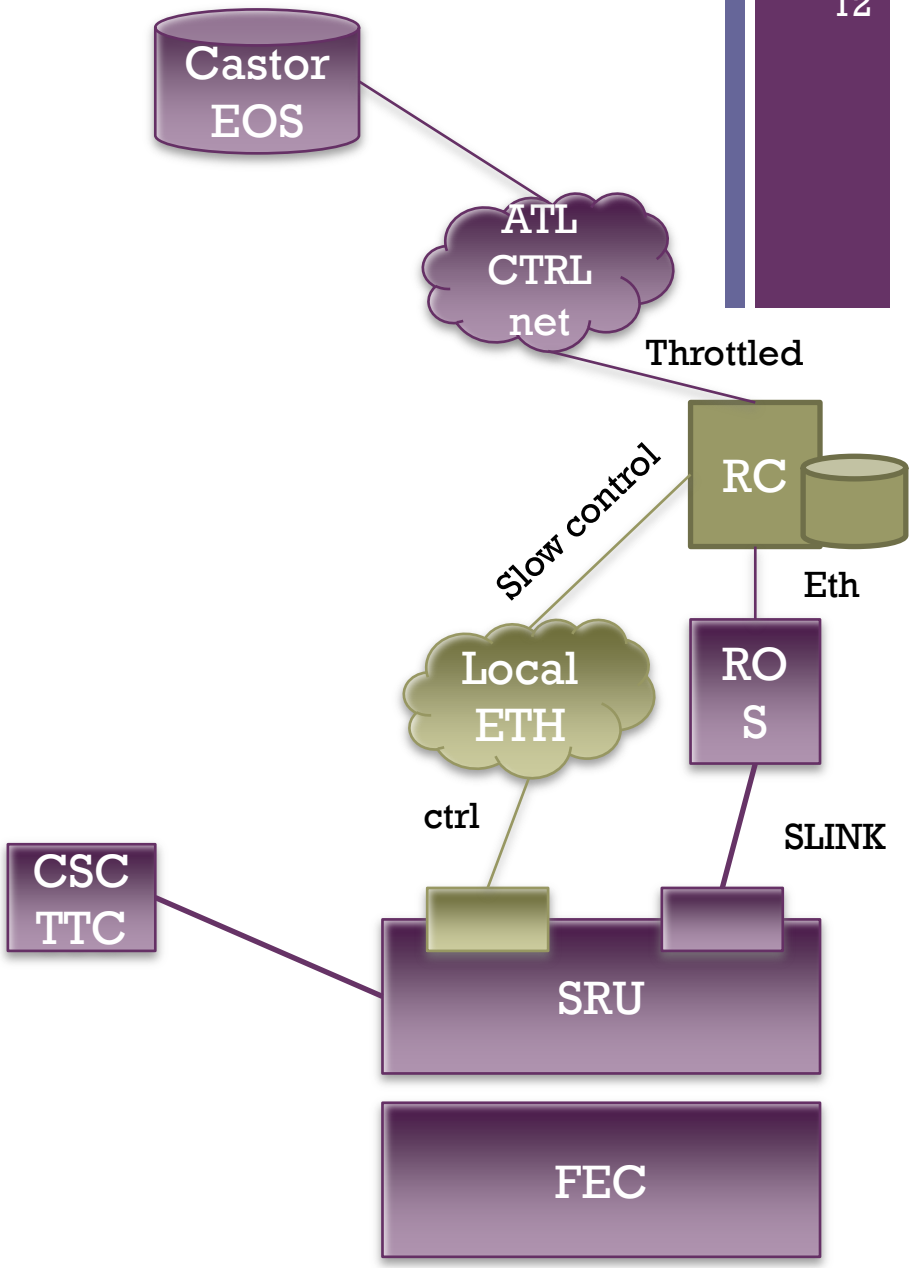
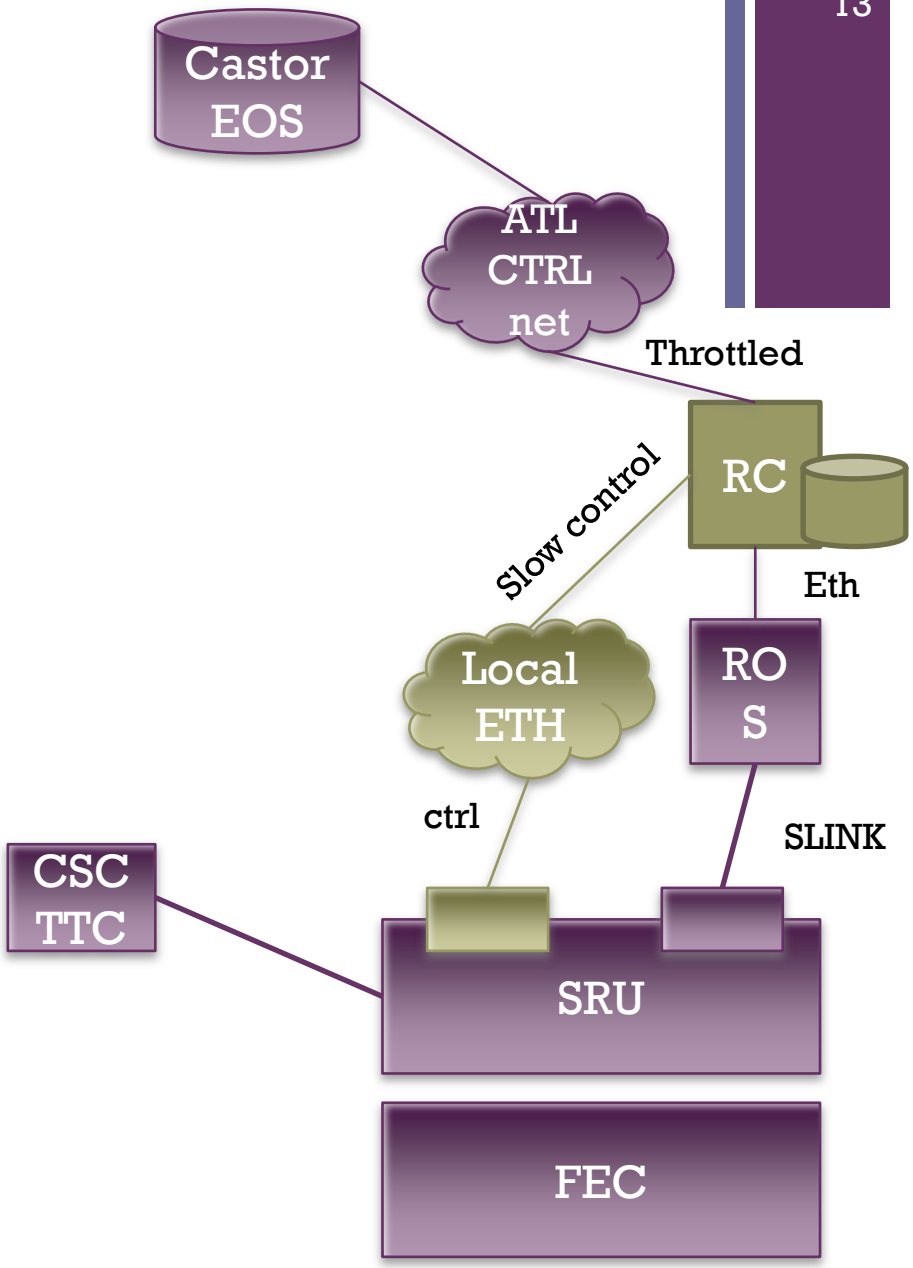
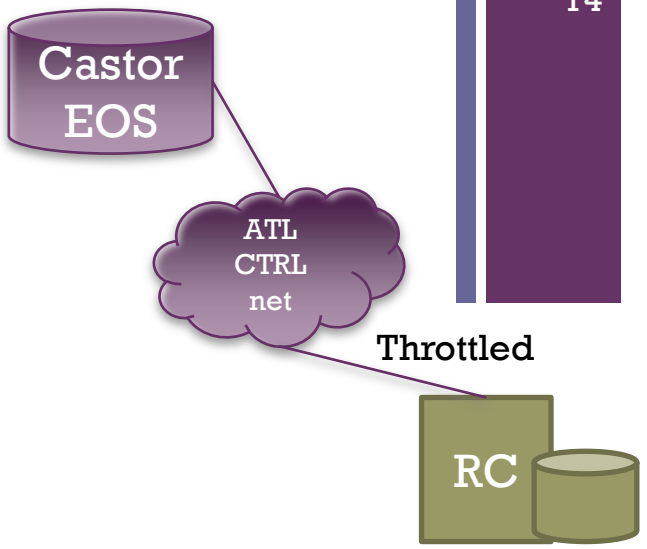


Run Modes

- Physics
  - ATLAS LV1, 10%
  - Data to SLink-ROS-RC PC-HDD
  - Offline synchronisation of LV1
  - Throttled data transfer to storage (Castor)
  - All APV / SW-only runs
- Calibration
  - Off-run
  - Internal / CSC triggers
  - On FEC measurement of ZS pedestals
  - RC PC storage of pedestals (read from FEC)
- **APV calibration (rare runs)**
  - **Internal triggers**
  - **FEC ZS in bypass mode (RAW data of one APV)**
  - **SRU in bypass mode (to Ethernet port)**
  - **Display / Verify raw APV frames**



Offline synchronisation



- Before data analysis
- Save all RAW events
  - ATLAS synchronisation at our convenience
  - Max of 16TB of data (SW+MBTS) for 10 weeks of 10h ATLAS runs daily (SW+ MBT0)
  - We will get that space
  - Throttled speed of output to storage will limit data taking
- **Dedicated SW-only runs**
  - This data will by compared to ATLAS data

Current status

- ATLAS compliant ROD based on SRS
  - But run in a different mode
- Readout synchronised with ATLAS triggers
  - There is no way of getting LV2/EF information from TDAQ
- 1 FEC (MBT0 + SW chambers)
  - Power supply
  - To be switched to SW only
- RC-PC with storage space is being prepared
  - **Time to debug**

Next steps: to data analysis

- Run planning to be made (9 weeks)
  - MBT0/SW runs
  - dedicated SW runs (re-cabling 4th chamber)
- DAQ commissioning
  - ✓ Verify APV settings (raw data)
  - Verify FEC ZS pedestals
  - ✓ Stability (not to disturb the Muon shifter's sleep)
  - Write data decoder (ATLAS -> ROOT for EventBrowser)
- Data preparation / Offline Synchronisation
  - Select based on Timestamp + LV1ID (ATLAS and MM)
  - Select events with CSC tracks
  - ATHENA jobs
  - mmDAQ root files feed to RECOmm
- Data analysis
- (Write Manual / Documentation)

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- Run planning to be made (9 weeks)
  - MBT0/SW runs
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  - ATHENA jobs
  - mmDAQ root files feed to RECOmm
- Data analysis
- (Write Manual / Documentation)

Thank you

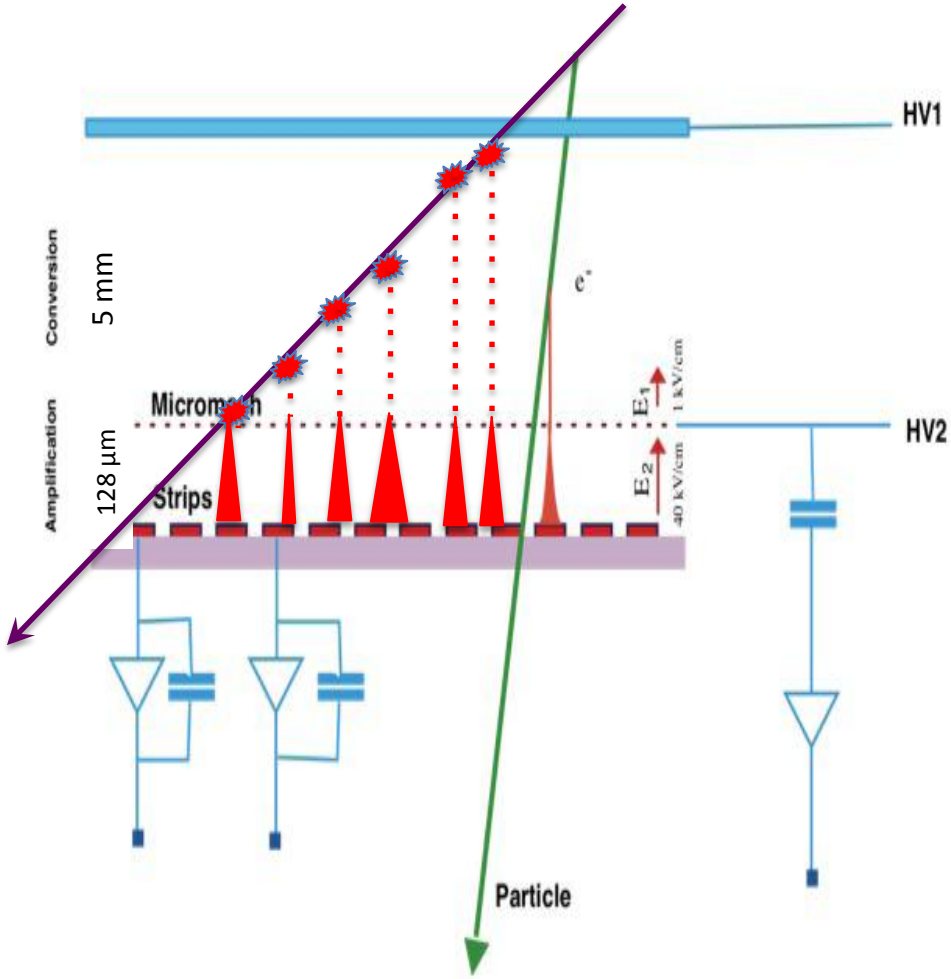
Backup slides

Micromegas principle

- Parallel-plate chamber

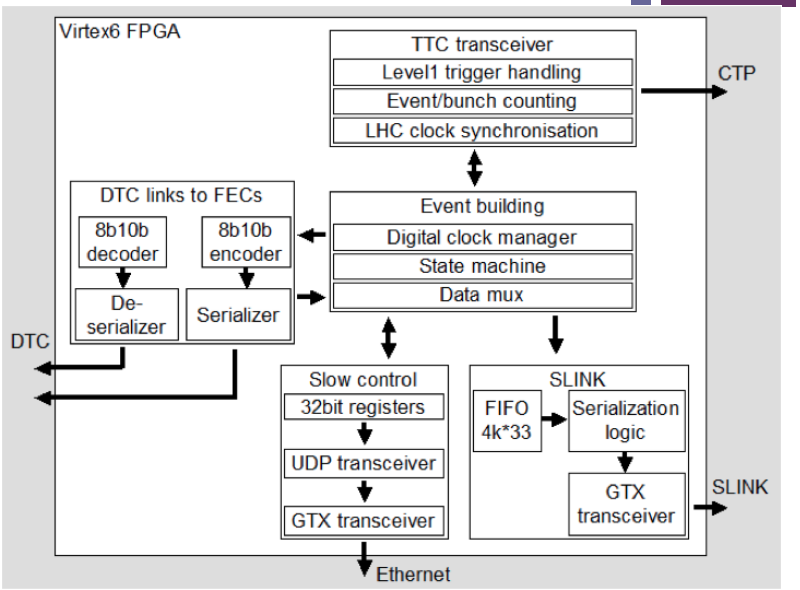
  Conversion & drift region (typically a few mm) with moderate electric field of 100–1000 V/cm

  Amplification in a narrow (128 µm) gap with high electrical field (40–50 kV/cm)
- With drift velocities of 5 cm/µs (or 20 ns/mm) electrons need 100 ns drift time to reach the mesh (for a 5 mm gap)
- By measuring the arrival time of the signals a MM functions like a TPC => Track vectors for inclined tracks



SRU

- SRU
  - Virtex 6,
  - TTCrx chip,
  - 4 SFP ports
  - 40 DTC links



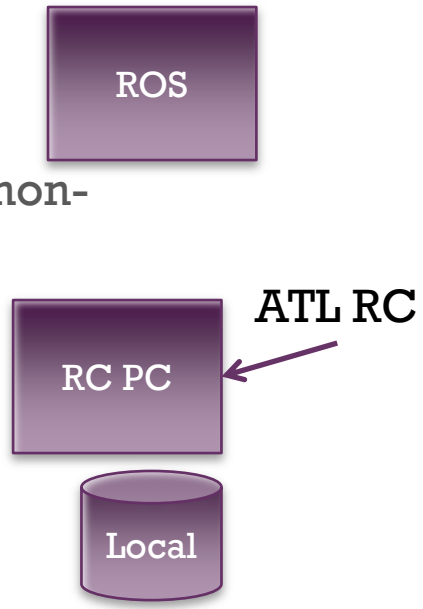
- EB, and TTC LVL1 Accept treatment
  - Process first, buffer others
- TTC
  - SRU uses onboard TTCrx chip to receive BC clock, L1A, ECR, BCR and trigger type
  - Connect to CSC TTC partition with unique TTC address
  - Additional user-programmable offset value for BCID
- S-LINK
  - HOLA emulator on Virtex 6 board

Configuration (1): TDAQ

1) Fully integrated solution required much more work (MM and TDAQ) without clear advantage for data analysis.

2) Parasitic mode
   - LVL1A from CSC TTC crate
   - Sub-detector ID : RPC 0x65 (side A), data channel 0xFF (non-existent, ignored by decoder)
   - Separate MM partition for ROS local storage
     - **Offline synchronization with ATLAS data**

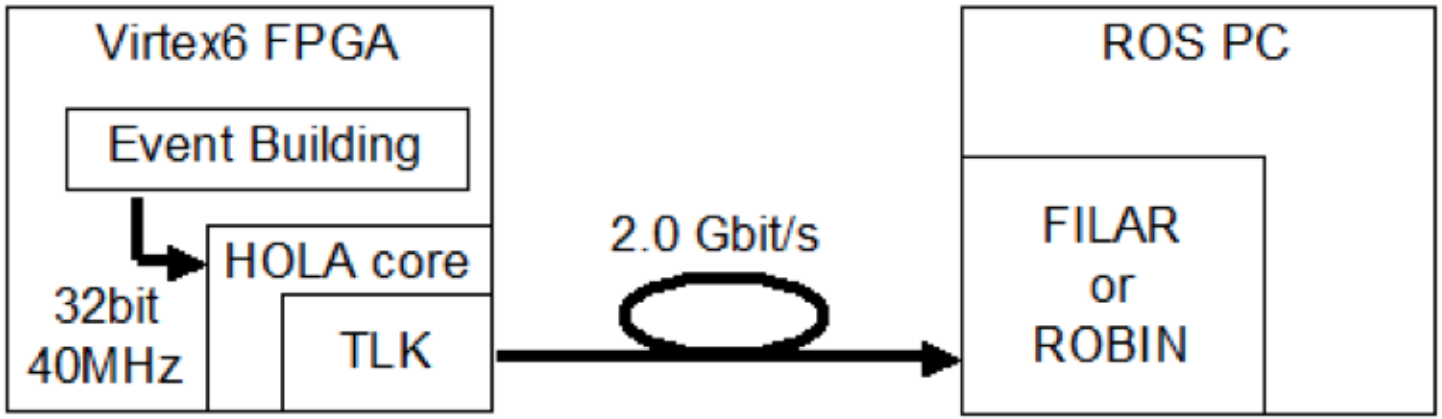
3) Parasitic with RCD in ATLAS partition
   - Send UDP packages to our ROD (e.g., to set RunNumber)
   - (Always returns with success)



SLINK implementation

(M. Della Volpe, R. Giordano, V. Izzo, S. Perrella)

- Event data are transmitted using SLINK to the data aquisition system (formerly HOLA based)
- No need of a seperate HOLA daughter card, due to the implementation of the serialisation logic in the Virtex6 FPGA (GTX transceiver)
- Data transfer to a standard ROS PC tested successfully with both FILAR and ROBIN pci cards. Valid ATLAS frames are received.



DTC Links

(A. Martinez)

- Transmit TTC clock to FEC Cards
- Foreward triggers with fixed latency, synchronous to the clock
- Carry Slow Control commands to FEC and APV chip, ...
- Return detector event data at 640 Mbit/s
- Hot plug ability and automatic resynchronisation