VFAT2 hybrid and SRS design & production

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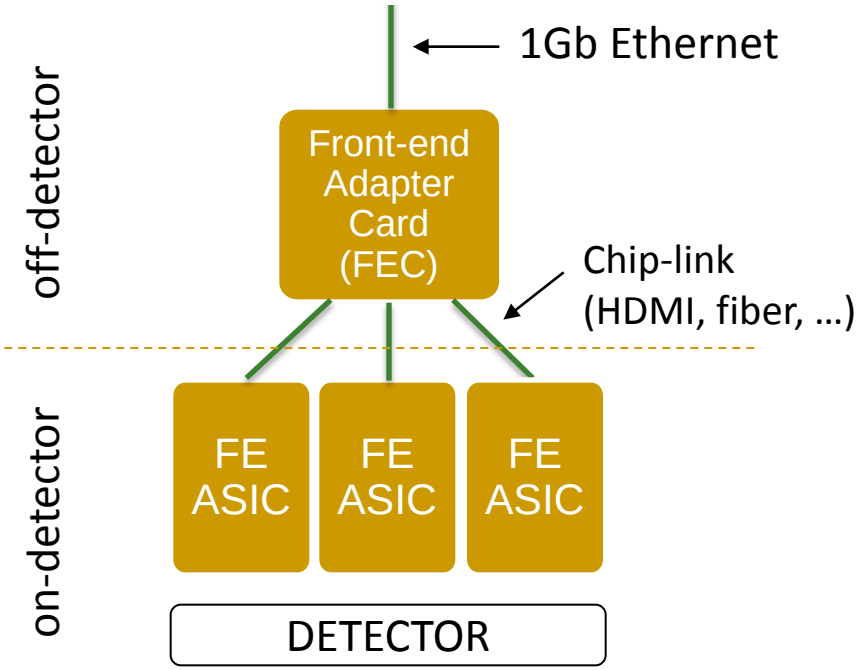
Outline

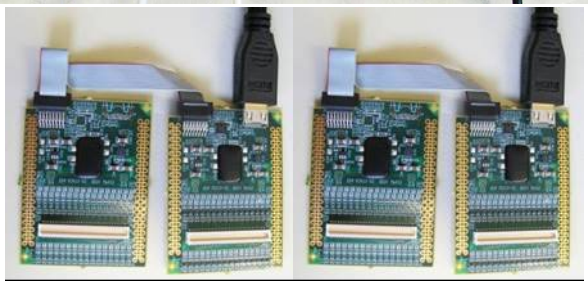
- Scalable Readout System (SRS) overview
- VFAT2 integration
  - VFAT2 Hybrids
  - Digital adapter card
- Summary

Scalable Readout System

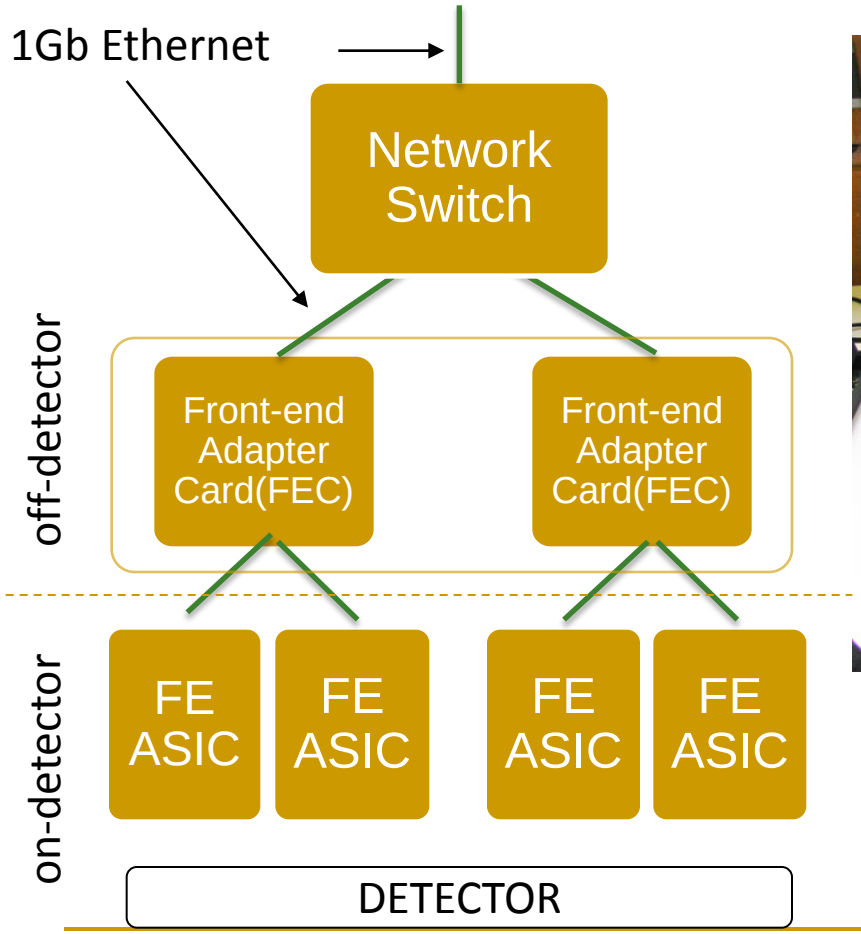
- Product of the RD51 Collaboration for the Development of Micro-Pattern Gas Detectors Technologies
- General purpose multi-channel readout solution for a wide range of detector types, detector complexities, and different experimental environments.
- Scalable - size
  - Only point-to-point links. No busses
  - Star topology
- Scalable - application
  - Allows the use of different front-ends
  - Can integrate different sub-detectors DAQ in the same system
- Cost effective
  - Use of cost effective components from high-volume markets (eg. HDMI cables, PCIe connectors, Cat5/6 UTP cables, …)

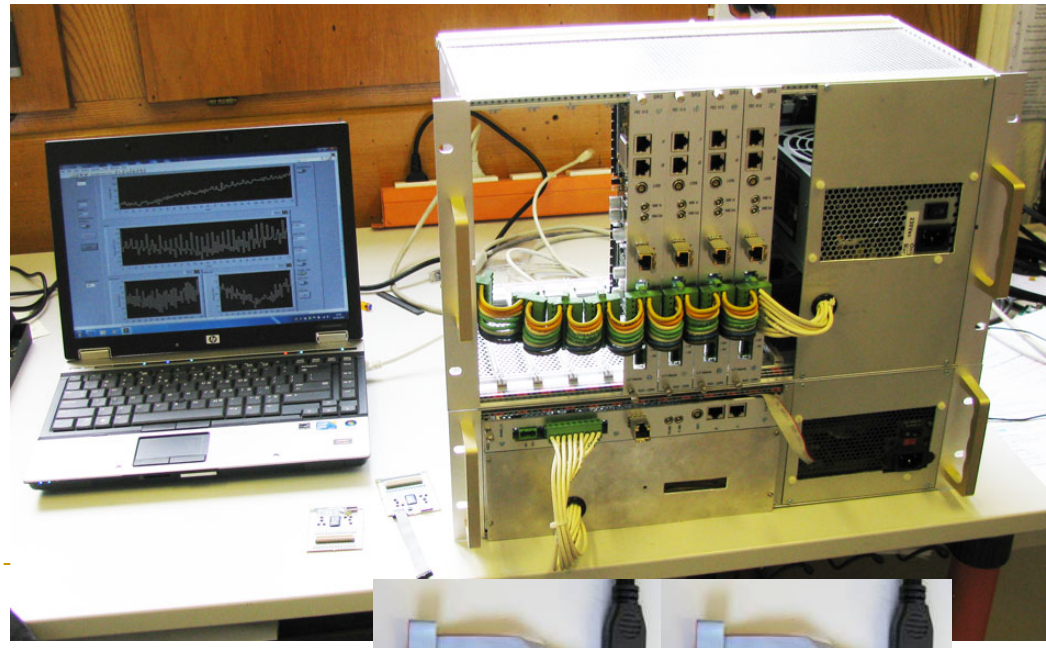
Scalability Concept
System Size (small)

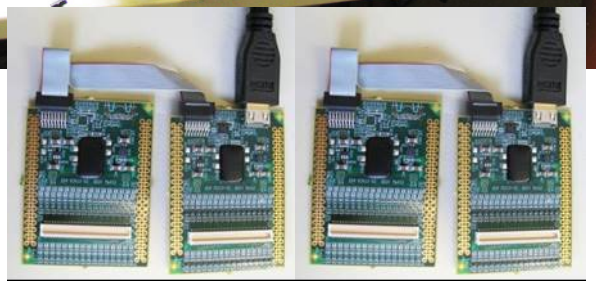




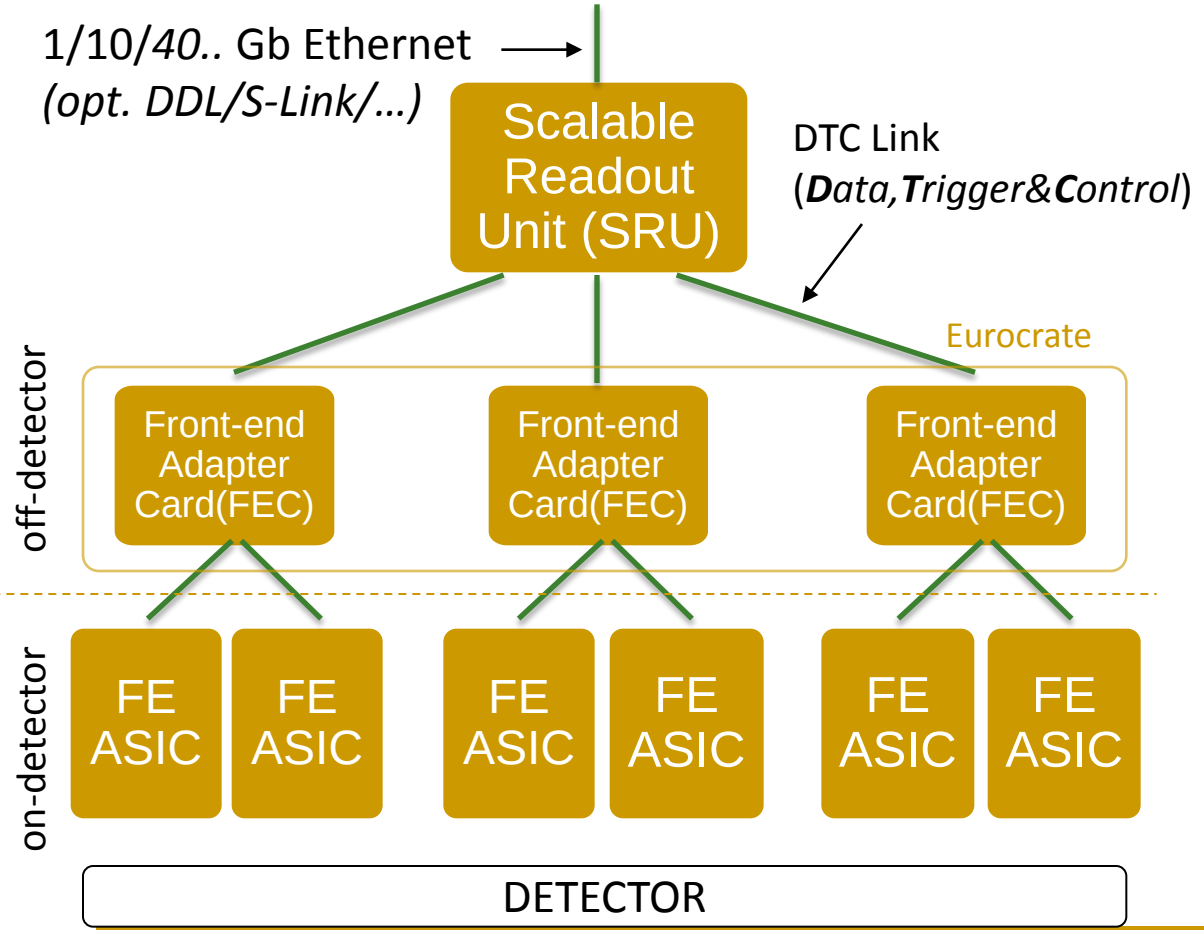
Scalability Concept
System Size (medium)

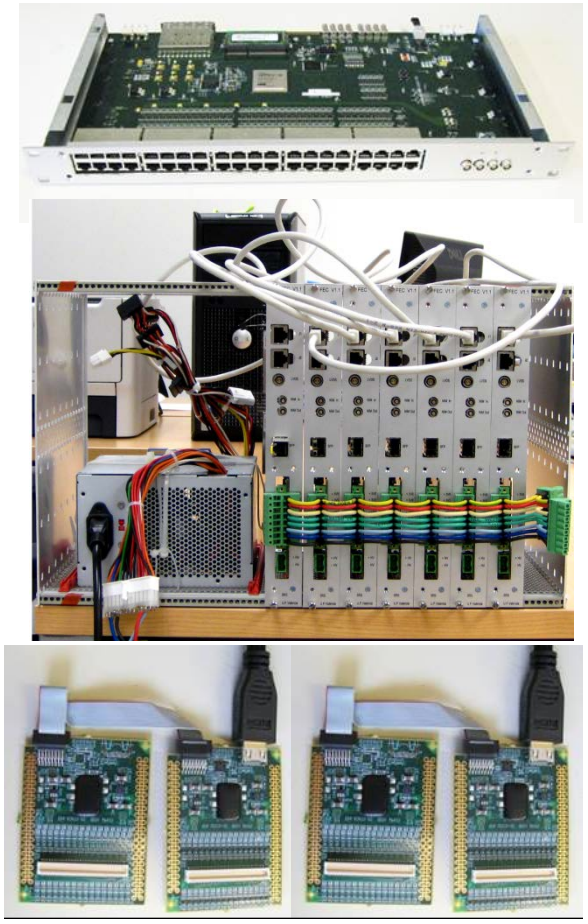




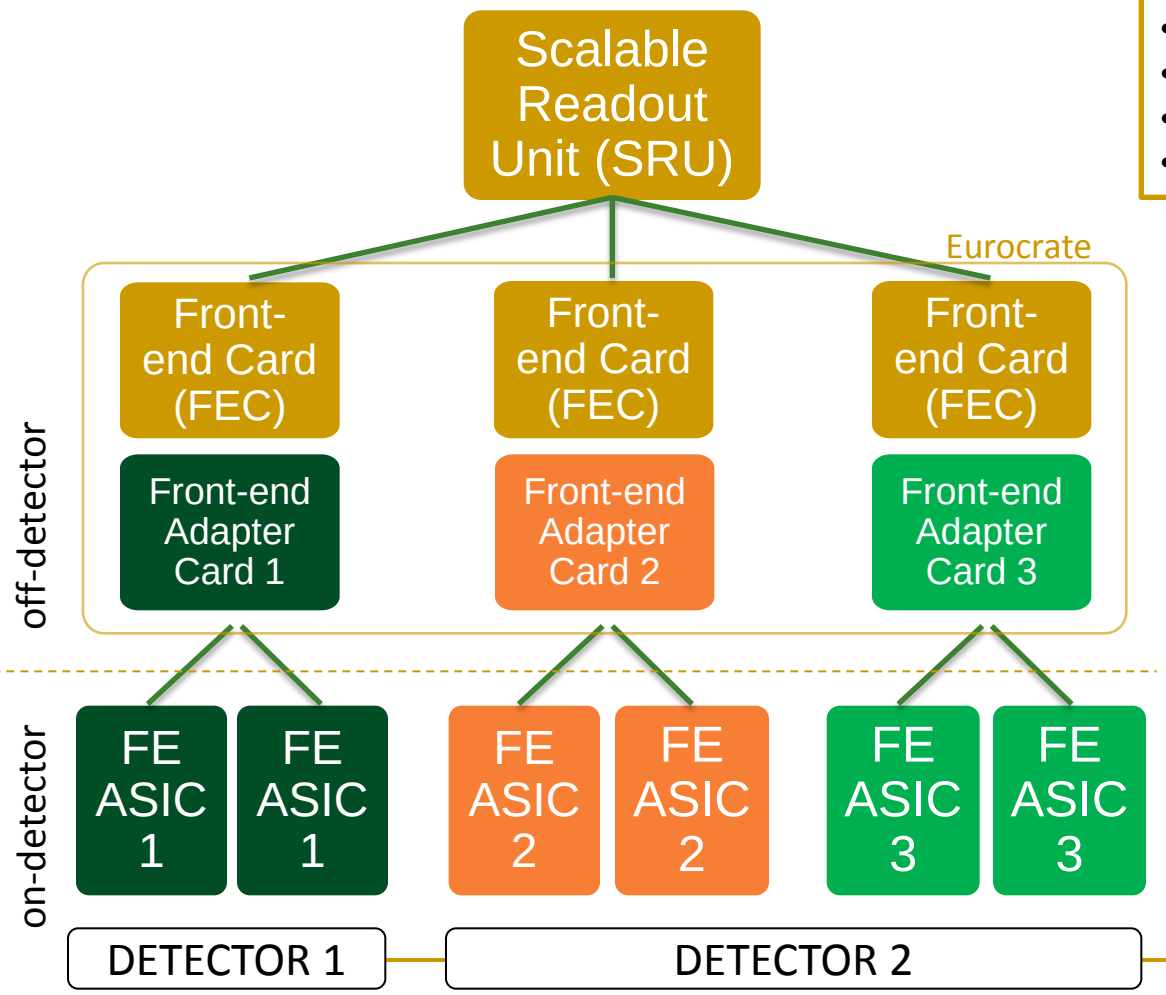


Scalability Concept
System Size (large)



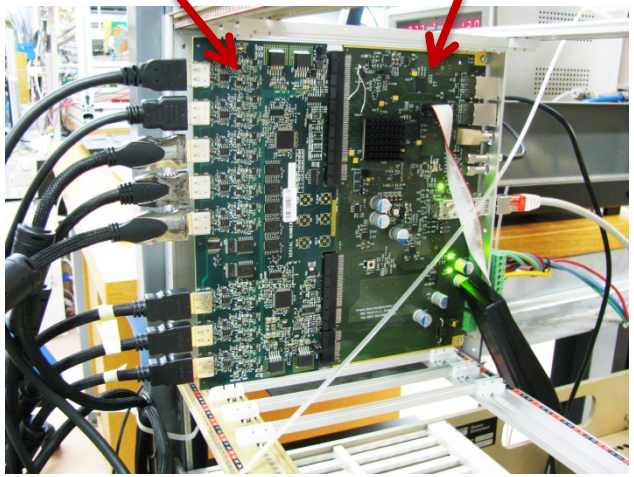


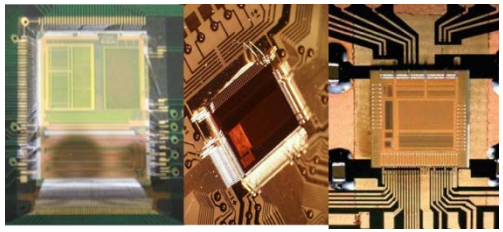
Scalability Concept Application



Front-end adapter
- ADC card
- digital FE card (VFAT)
- GBT receiver
- …

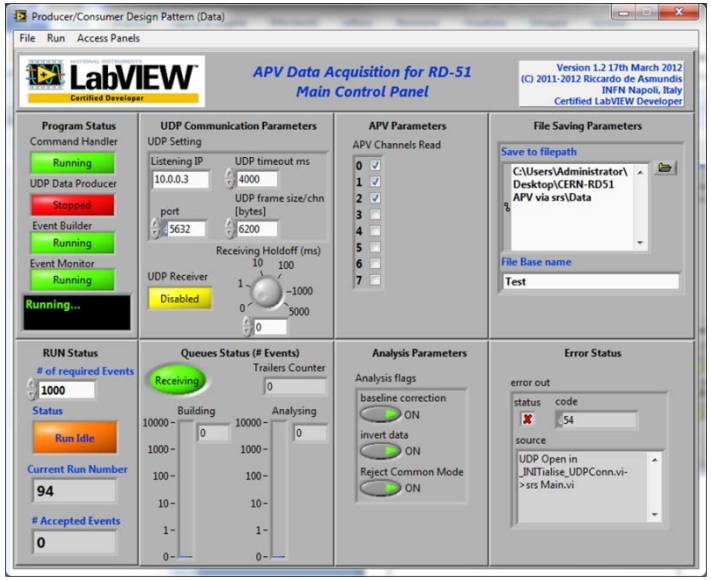
Front-end FPGA card (SRS standard)
- SRS DAQ & control
- application specific firmware



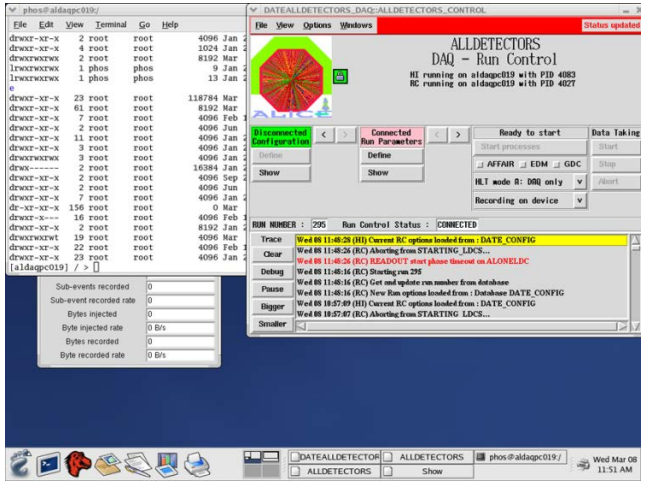


Online software for SRS

SRS-Labview

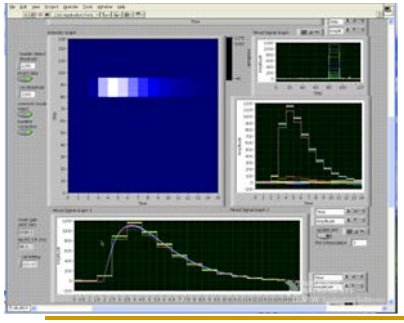


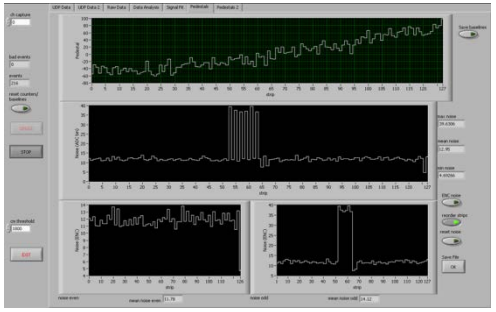
DATE , MMDAQ , RCDAQ (Linux based)

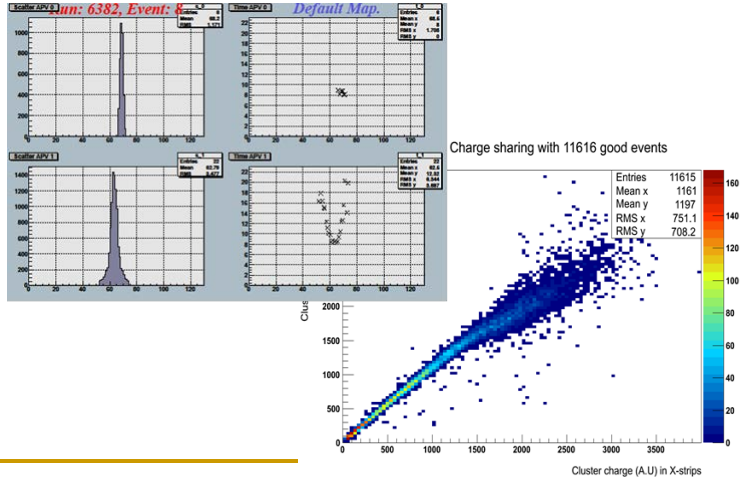


Root Analysis: Event statistics, distributions, cuts and fits

Online Monitoring: pulse-shape, x-y plots, pedestals, noise

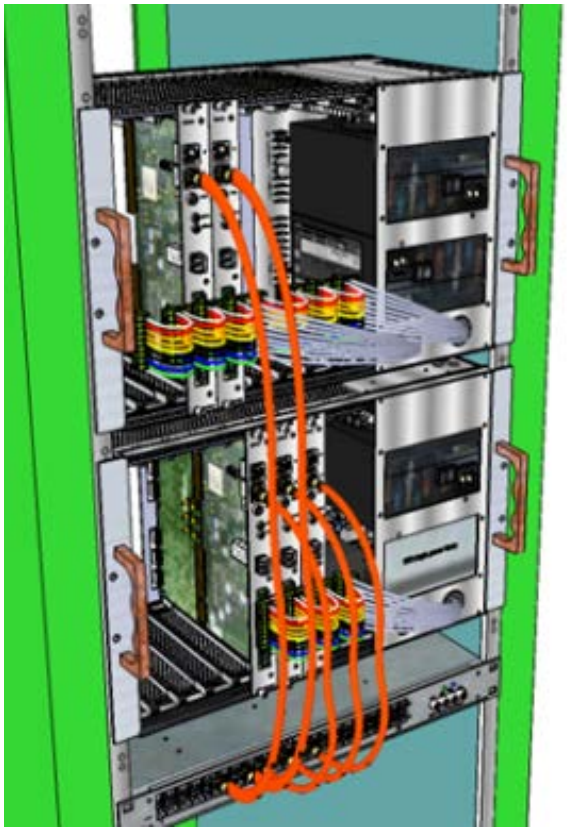






Present and Future

Current SRS implementation

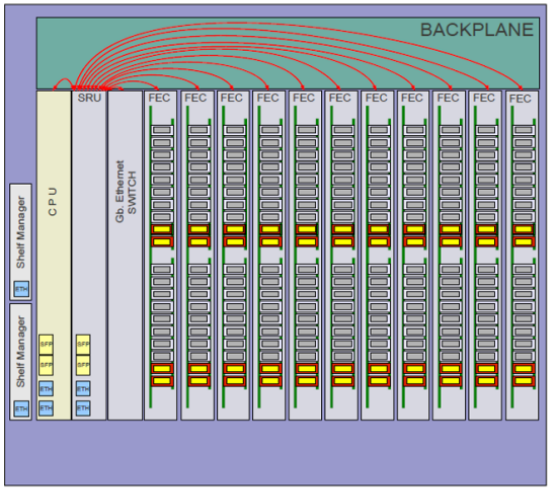


Eurocrate build
- CERN store

Rack systems
- up to **5 Crates = 82 k channels**
- parallel FEC readout
- via 1 Gb DTC links (Data-Trigger-Control)

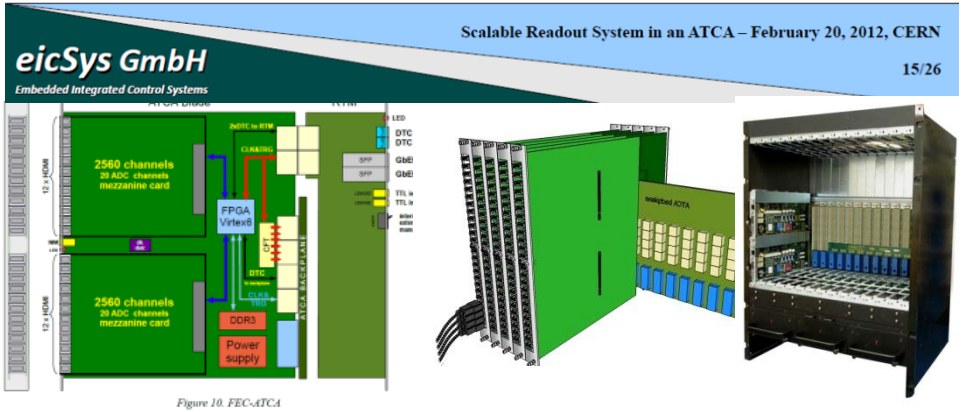
1 SRU / Rack (cluster concentrator)
- 40 DTC links input
- 10 Gb to DAQ
- 1 Gb Slow Controls
- 1 Gb Monitoring
- 1 TTC for trigger

ATCA 14 slots Crate – SRS



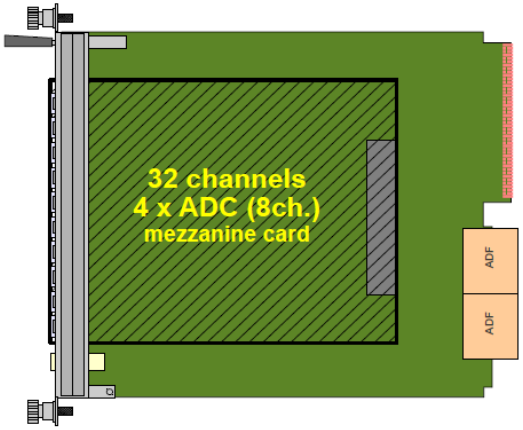
- **11** FEC-ATCA blades
- **64** ADC ch. per FEC board
- **704** ADC channels in shelf
- **67 k** ! channels per shelf
- **1** SRU blade in the shelf
- remote programing
- optional CPU in the shelf

+ 2 FEC-ATCA in no CPU&Switch



xTCA SRS (Small Systems)

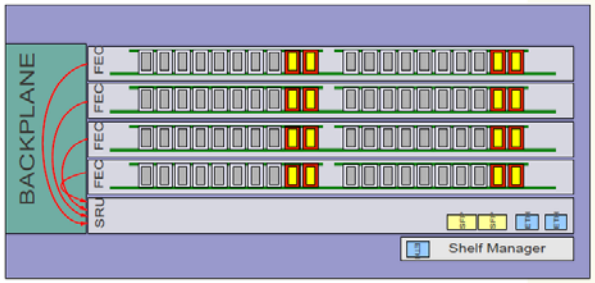
mTCA.4 – FEC board



Suitable for small systems
4-10 slots crate

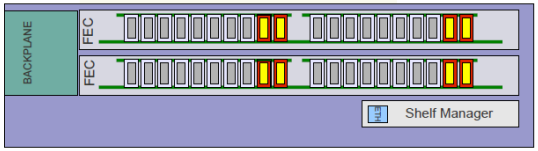
ATCA 5 slot – solution for a small system

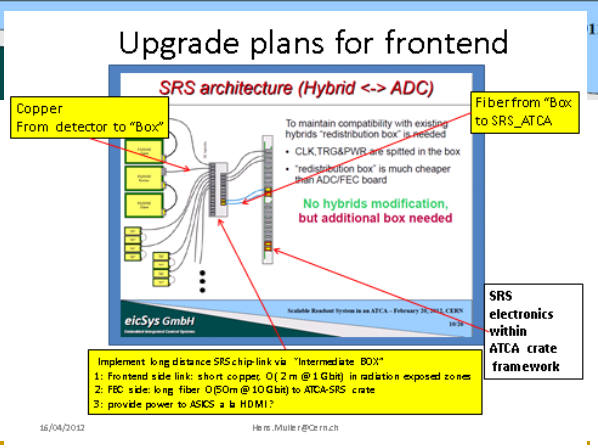
- **4** FEC-ATCA blades
- **256** ADC channels in shelf
- **32768** channels per shelf
- **1** SRU blade in the shelf



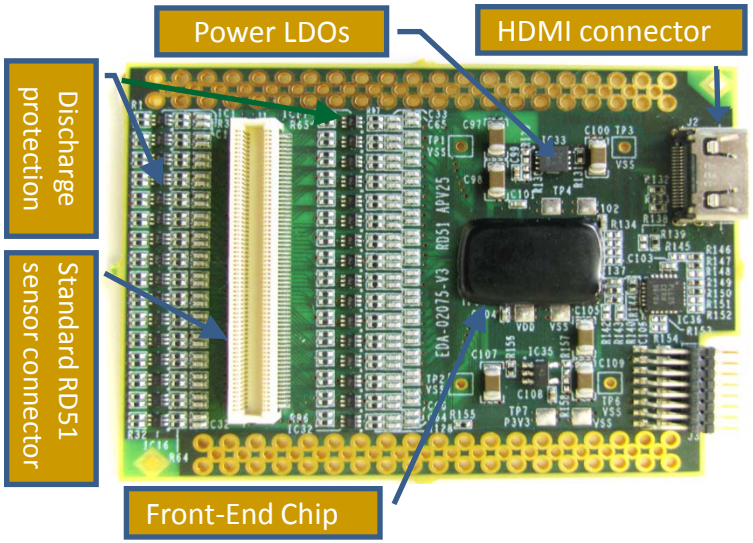
ATCA 2 slot – solution for a small system

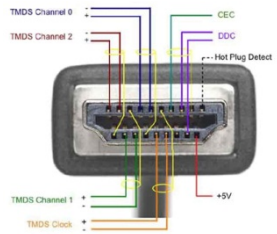
- **2** FEC-ATCA blades
- **128** ADC channels in shelf
- **16384** channels per shelf

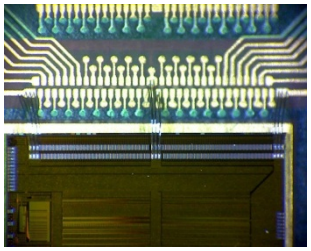




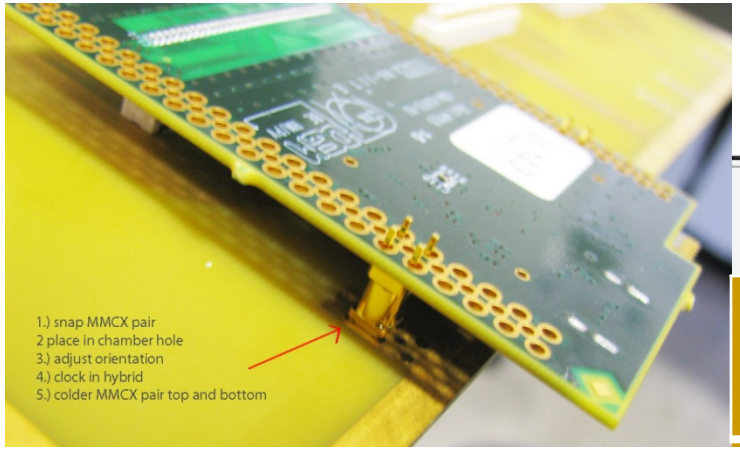
SRS Hybrids

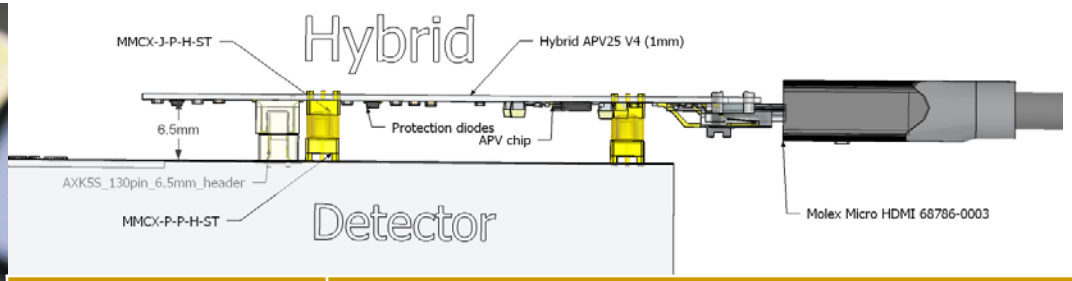






- standard RD51 connector
- discharge protection
- micro-HDMI
  - clk & trg
  - data links
  - dcs (I2C)
- industry-ready design
- purchase through CERN store



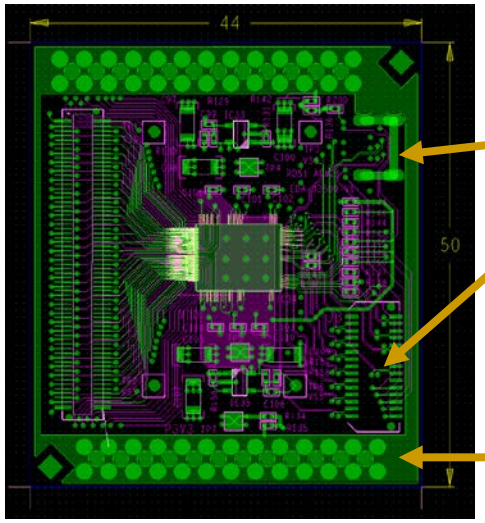


Samtec MMCX coax connector

GND connection (< 2mohm)
middle pin can be used for power
mechanical connection

VFAT2 Hybrid

Short version – no input protection

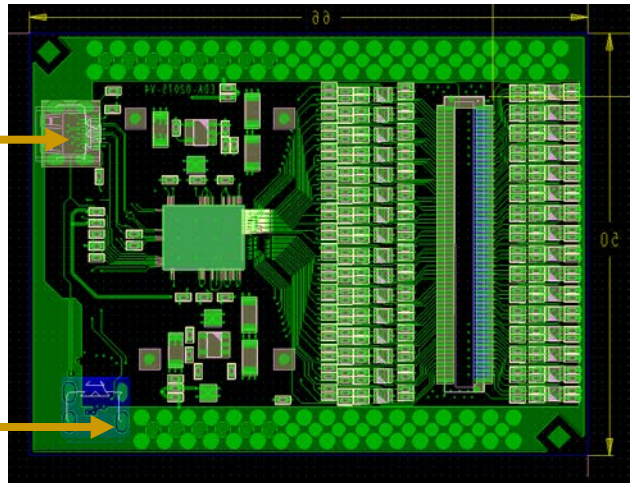


HDMI conn. (micro)

Optional stacking conn.
for *cable-less* connection

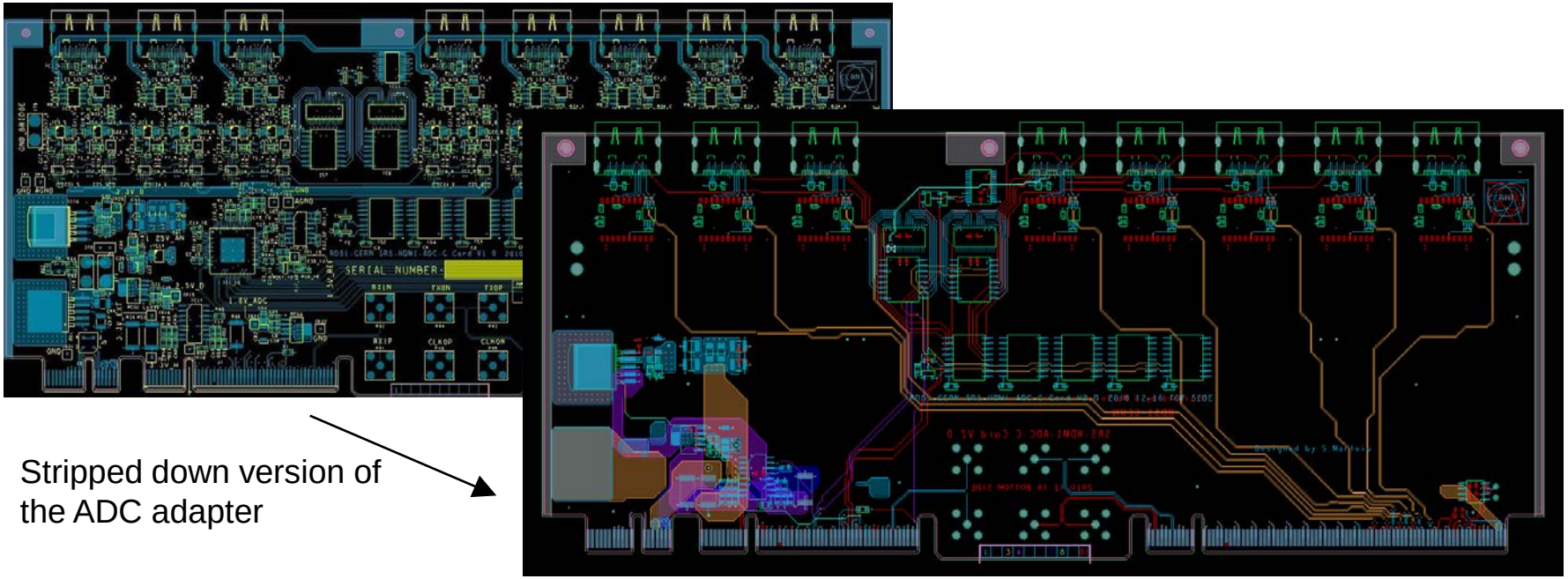
Power option via
MMCX connectors

Long version – full RD51 compatibility



- schematic done
- layout under design (1 week)
- production and assembly (2-3 months (??))

Digital Adapter Card



Stripped down version of the ADC adapter

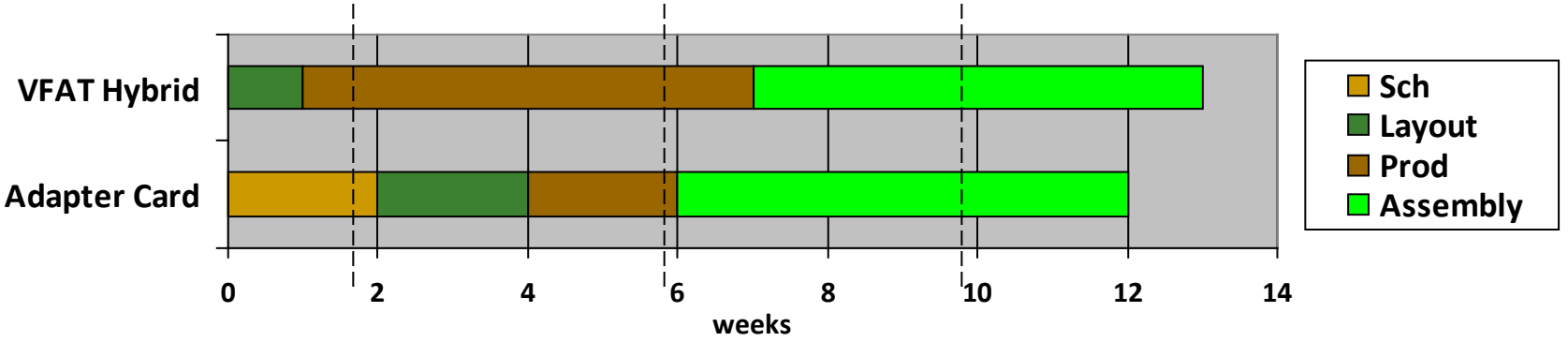
- schematic under design (1-2 weeks)
- layout (2 weeks)
- production (2 weeks – prototyping service (pool))
- assembly (1 – 1.5 months (??))

FW and SW

- Firmware
  - Reuse of the SRS standard modules (GbEthernet, buffering, slow-control)
  - Application specific fw – VFAT2 Frame decoder and Event Builder - considerably simpler than APV fw
- Software
  - Fast track: connecting existing LabView SRSDAQ to Turbo LV sw
  - Other: DATE, CMS DAQ, ?

Summary

Tentative timeline:



Workload:

- Hardware
  - RD51: S. Martoiu (until end June 2012)
  - CERN DEM: William Billereau
  - External: Intrasys (layout), ELTOS/PCB-Pool (prod), Hybrid SA/other (assembly)
- SW & FW
  - ??

Summary

- Production of SRS base components externalized. Purchase via CERN store
- First pilot run due in mid 2012
- Design of VFAT2 SRS components well advanced. Production synchronized with VFAT2 and SRS availability
- Full VFAT2 SRS system (HW & SW) may be ready for Aug-Sep. 2012
- Possible upgrade path with xTCA, optical, GBT, …
- A lot of interest from RD51 for VFAT2/VFAT3/GdSP

Spare

SRS Front-End Overview

Front-End Hybrids
(on-detector)
- APV25
- VFAT
- BEETLE
- …

Chip-links
- HDMI
  - analog (APV/Beetle)
  - digital (VFAT/Beetle)
- optical (GBT, …)
- …

Front-end adapter
- ADC card
- digital FE card (VFAT)
- GBT receiver
- …

Front-end FPGA card
(SRS standard)
modular firmware:
- SRS DAQ & control
- application specific FW