

(A)TCA framework project for SRS electronics

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SRS readout architecture

...will not change

DAQ/Online/Offline
Control, Trigger

Networks 1/10/48 Gbit

COMMON

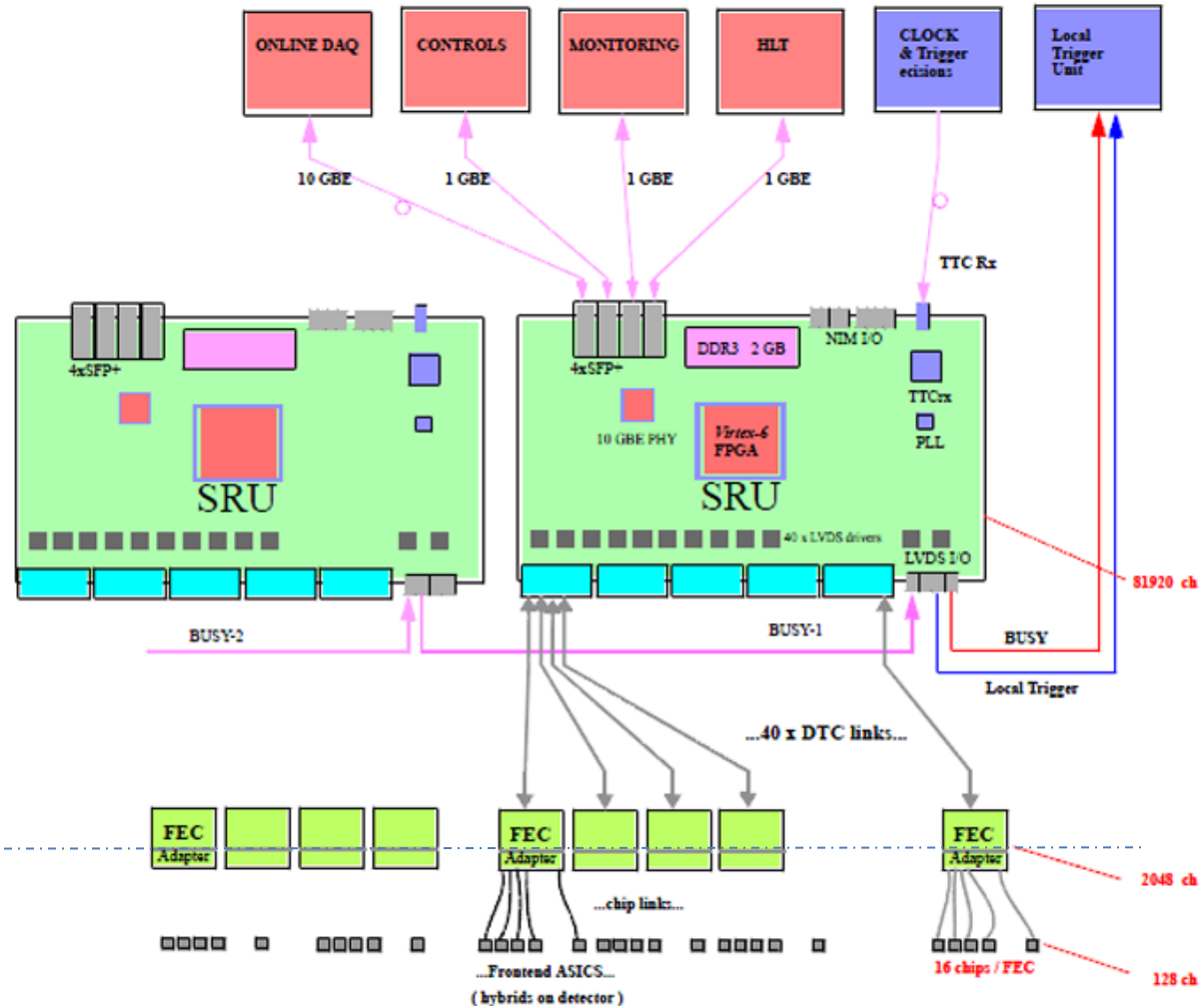
Readout Units

DTC links
Data/Trigger/Control
Service cards
FEC cards
chip-link adapters

Chip links

SPECIFIC

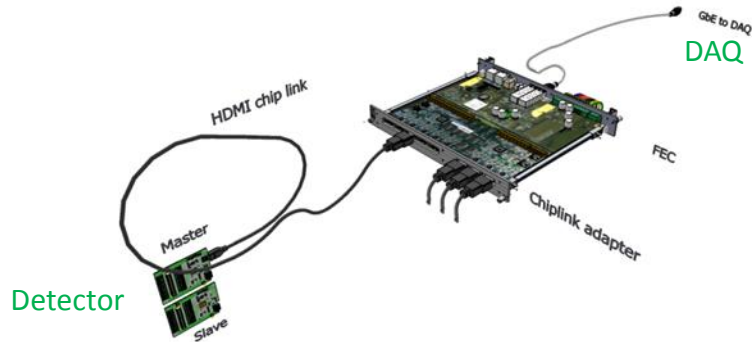
Frontend ASICS/Detectors



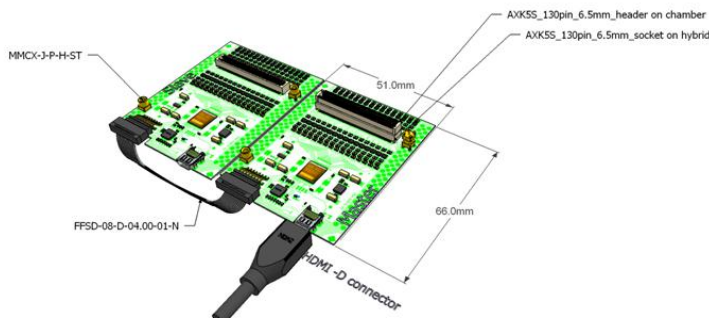
SRS “as is” implementation

BASICS:

table-top Combo = generic FEC card + detector-specific link adapter card



Chip link (HDMI up 25 m) between Combo and detector-resident hybrids, 8 per Combo

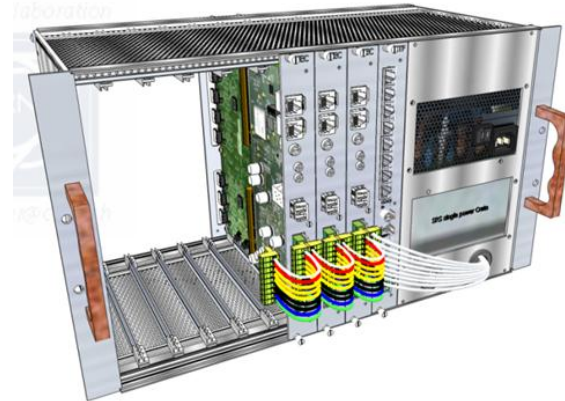


Frontend chips on MPGD carrier, sparc-protected, powered via HDMI.

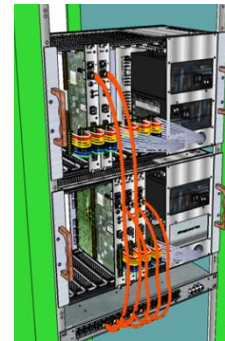
APV25, Beetle, VFAT .. more planned

Systems:

Powered SRS Crates, 6U and 3 U, up 16 k channels/crate
Commercially produced and sold via CERN store



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



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



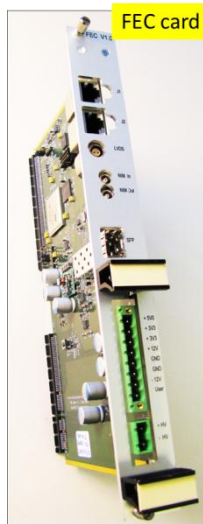
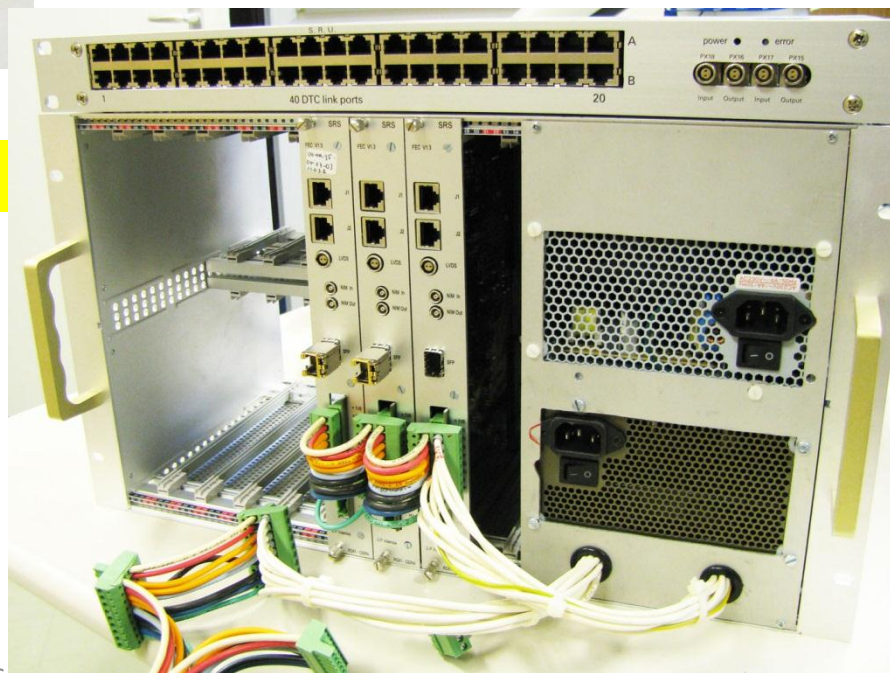
SRS 19" system parts

Minicrate, 5kg, up 4 k channels



SRS sales via CERN store
production via PRISMA

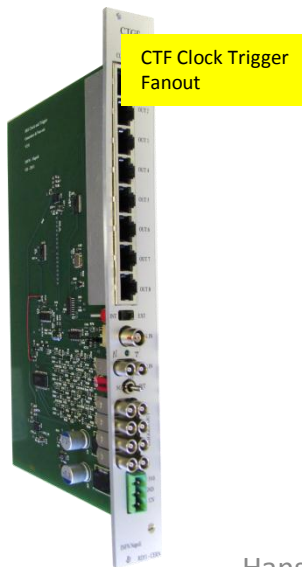
Eurocrate with SRU on top
up 5 crates / rack



FEC card



12 bit Digitizer
16 channels



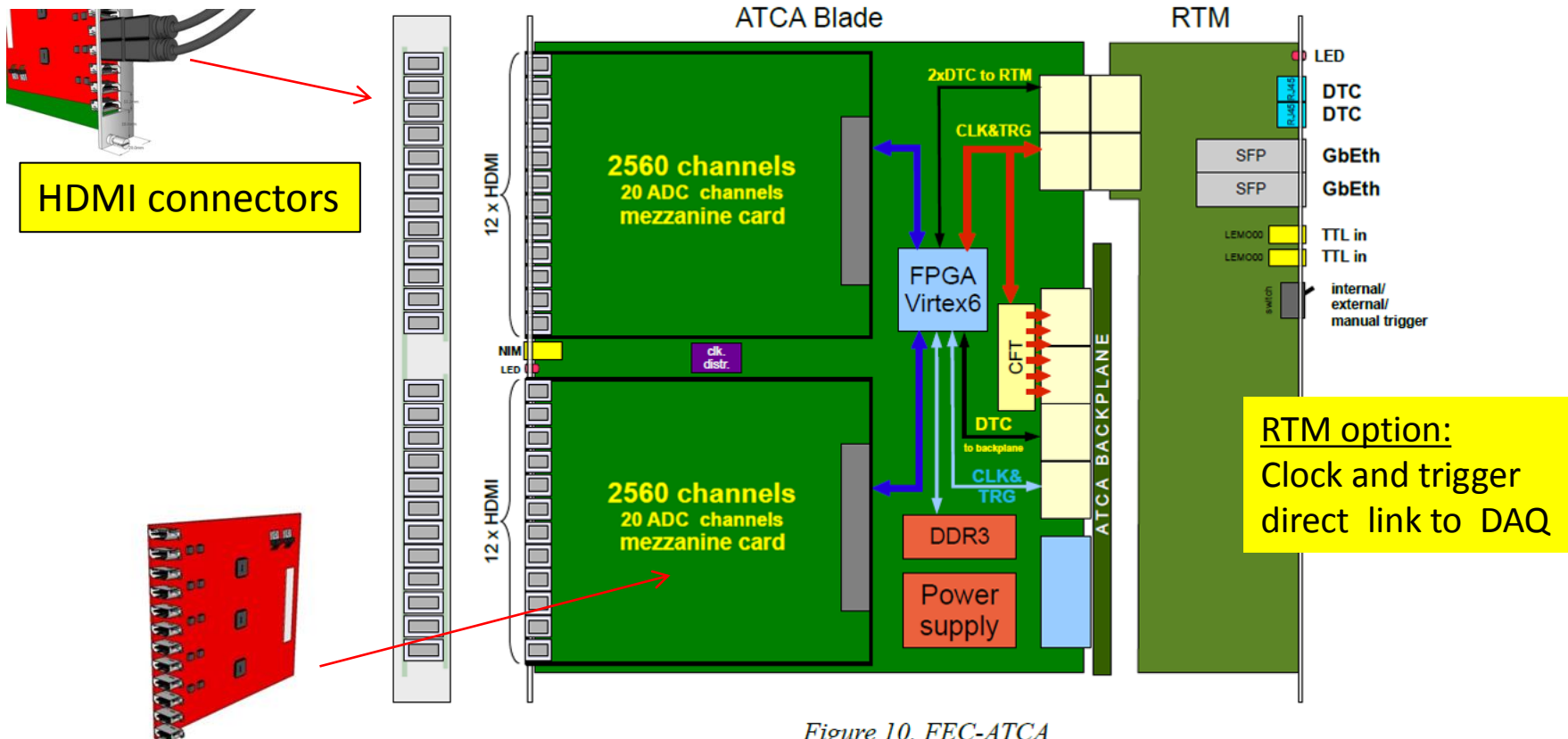
CTF Clock Trigger
Fanout

16/04/2012

Hans.Mueller@cern.ch

Project*: re-map SRS into (A)TCA*

- 1.) higher channel integration => reduce cost/channel for large systems
- 2.) certified crate standard
- 3.) replace DTC cables by backplane



HDMI connectors

Equivalent of SRS ADC card

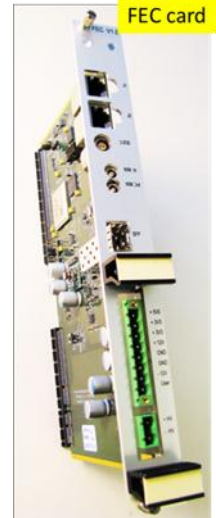
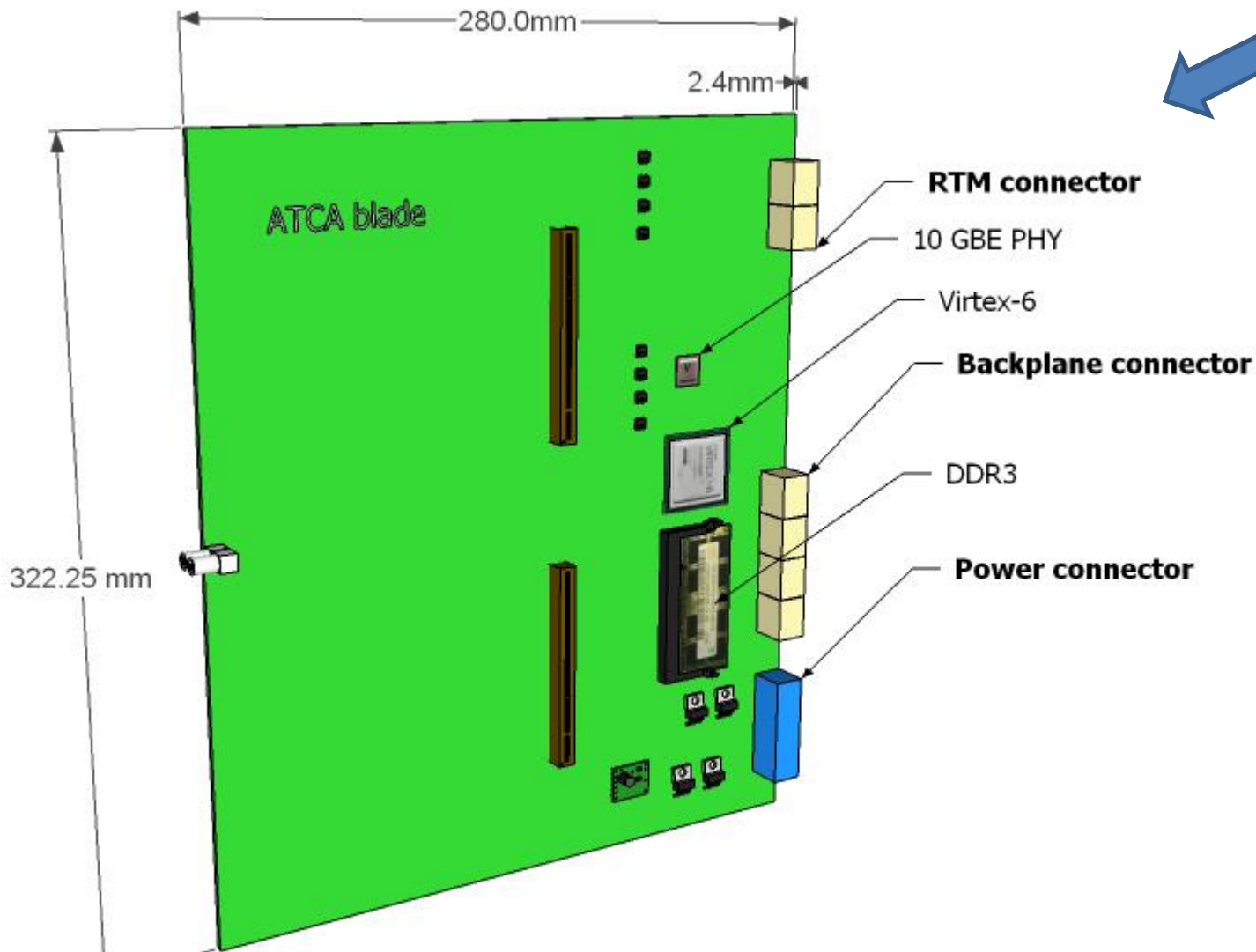
RTM option:
Clock and trigger
direct link to DAQ

Figure 10. FEC-ATCA

* RD51 with EicSsys GmbH Germany

ATCA implementation draft

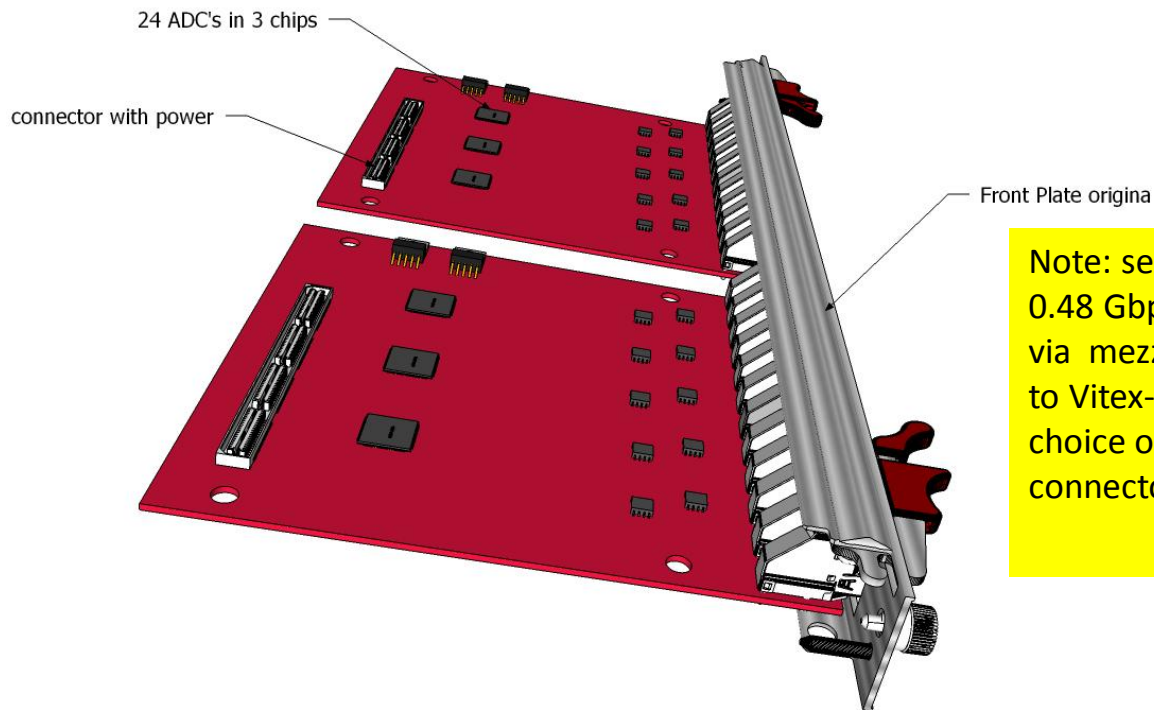
ATCA blade = FEC equivalent



SRS FEC card:
Virtex 5, DDR2
1 Gbit SFP

SADC adapter mezzanine

=equivalent of ADC adapter



Note: serial data from ADCs:
0.48 Gbps on 24 traces
via mezzanine connector
to Vitex-6 on FEC. Careful
choice of PCB material and
connector

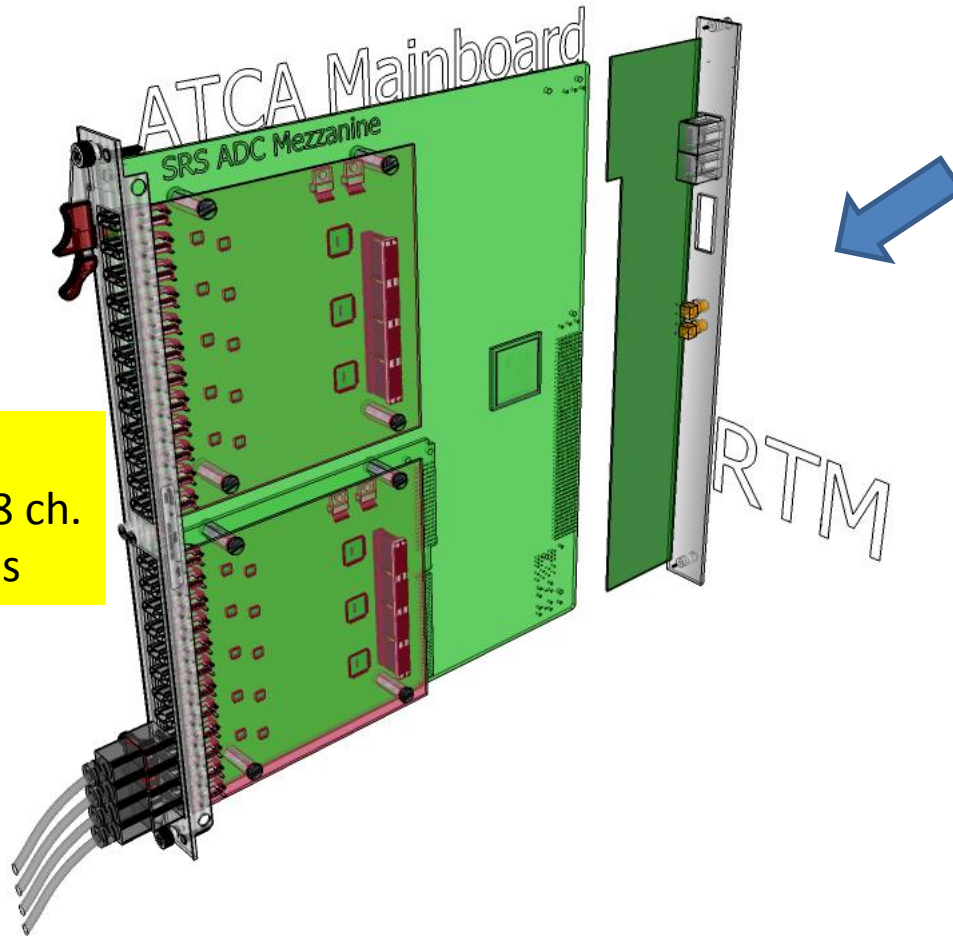


SRS ADC card
8 HDMI ports
16 x ADC 12bit@40 MHz

port of existing ADC card schematics/layout to ATCA formfactor by EicSys

ATCA Blade with SADC adapter

= equivalent of SRS combo (FEC+ADC)



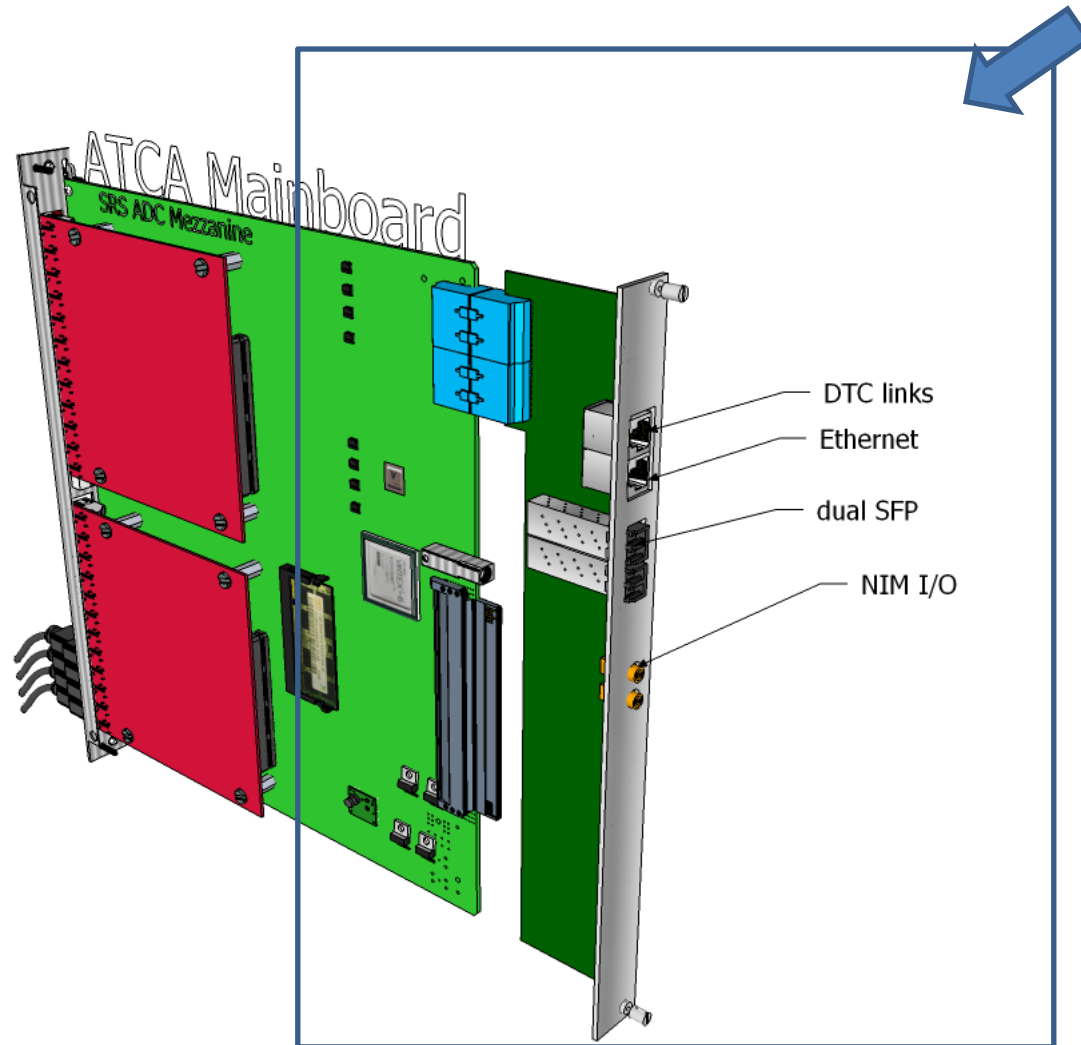
24 HDMI ports
= 48 hybrids 128 ch.
= 6144 channels



SRS FEC + ADC
max 8 HDMI ports
per Combo

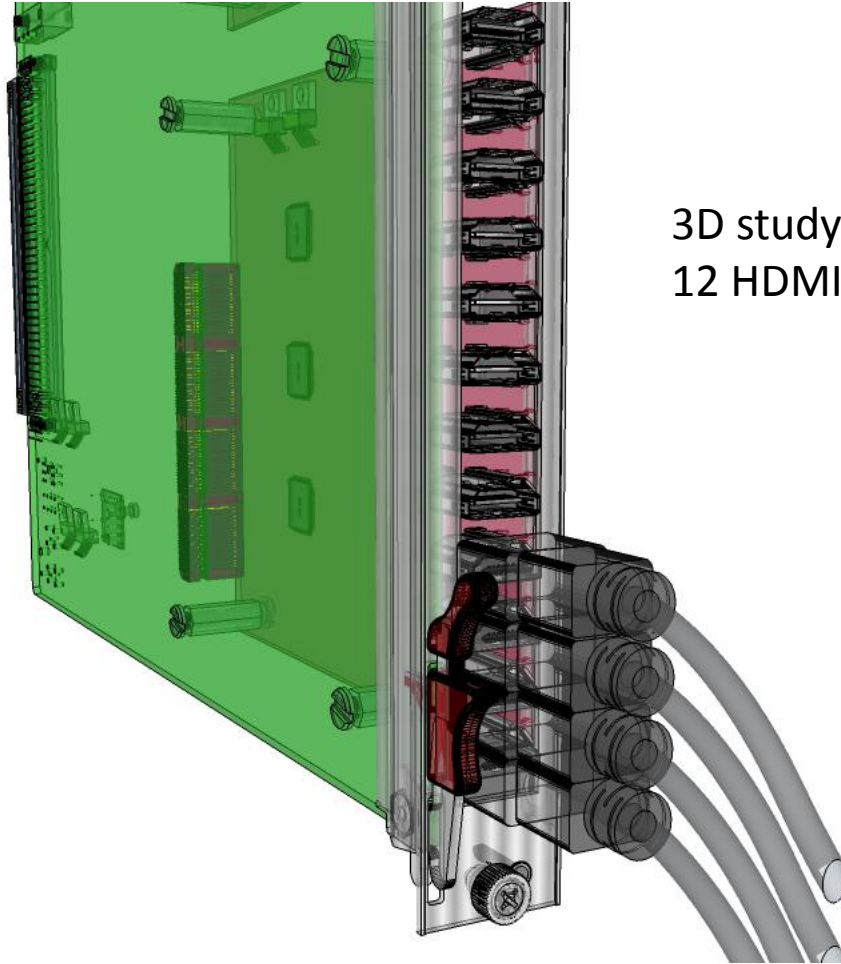
ATCA blade and RTM

= similar CTF for local I/O and trigger options



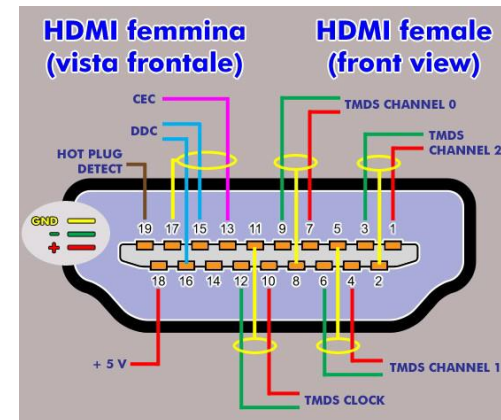
SRS: CTF card
Clock, Trigger
and IO

HDMI- chiplink to Frontend



3D study with ATCA models:
12 HDMI connectors on mezzanine = OK

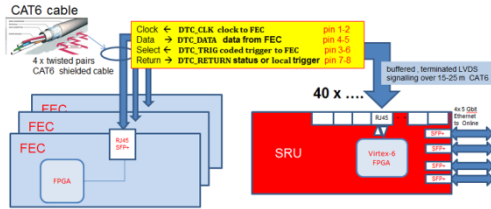
shielded twisted pairs
(3 Gbps) power and I2C
We use als for transmission of analogue data
and don't use the HDMI protocol



RTM and backplane

DTC link via backplane

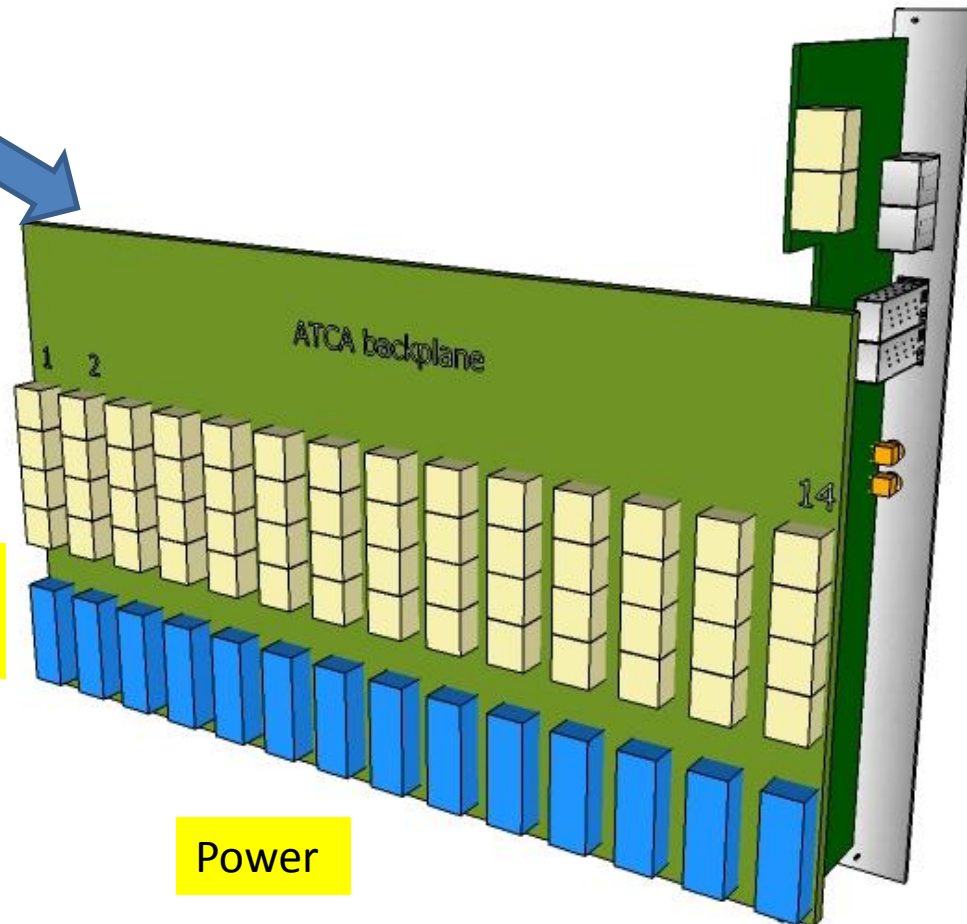
DTC link protocol



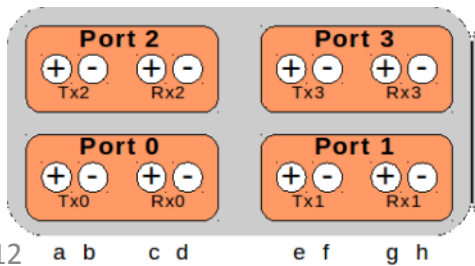
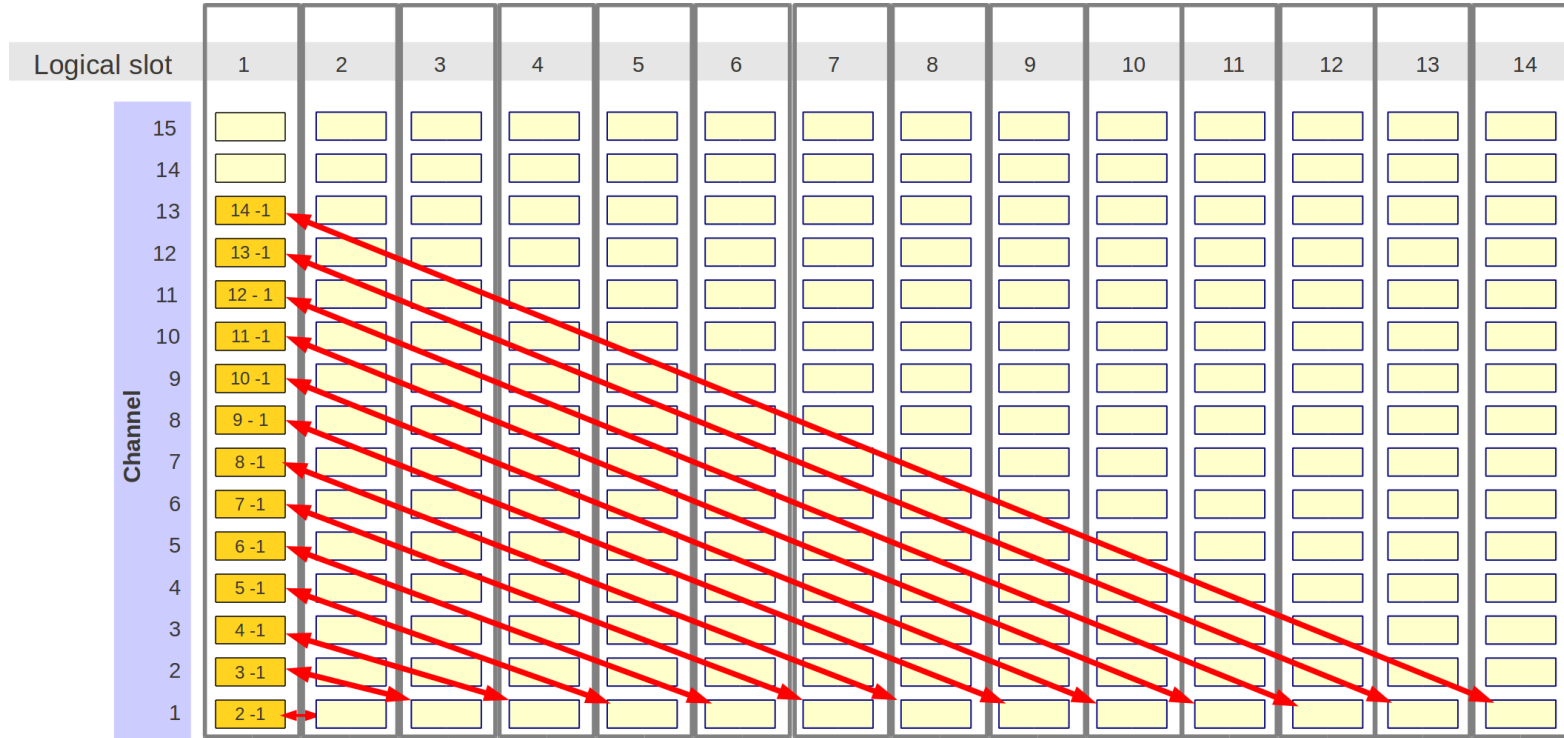
replace DTC cables by backplae fabric

Star-connected
Data links to slot-1

Power



ATCA: -integrated p-p STAR technology

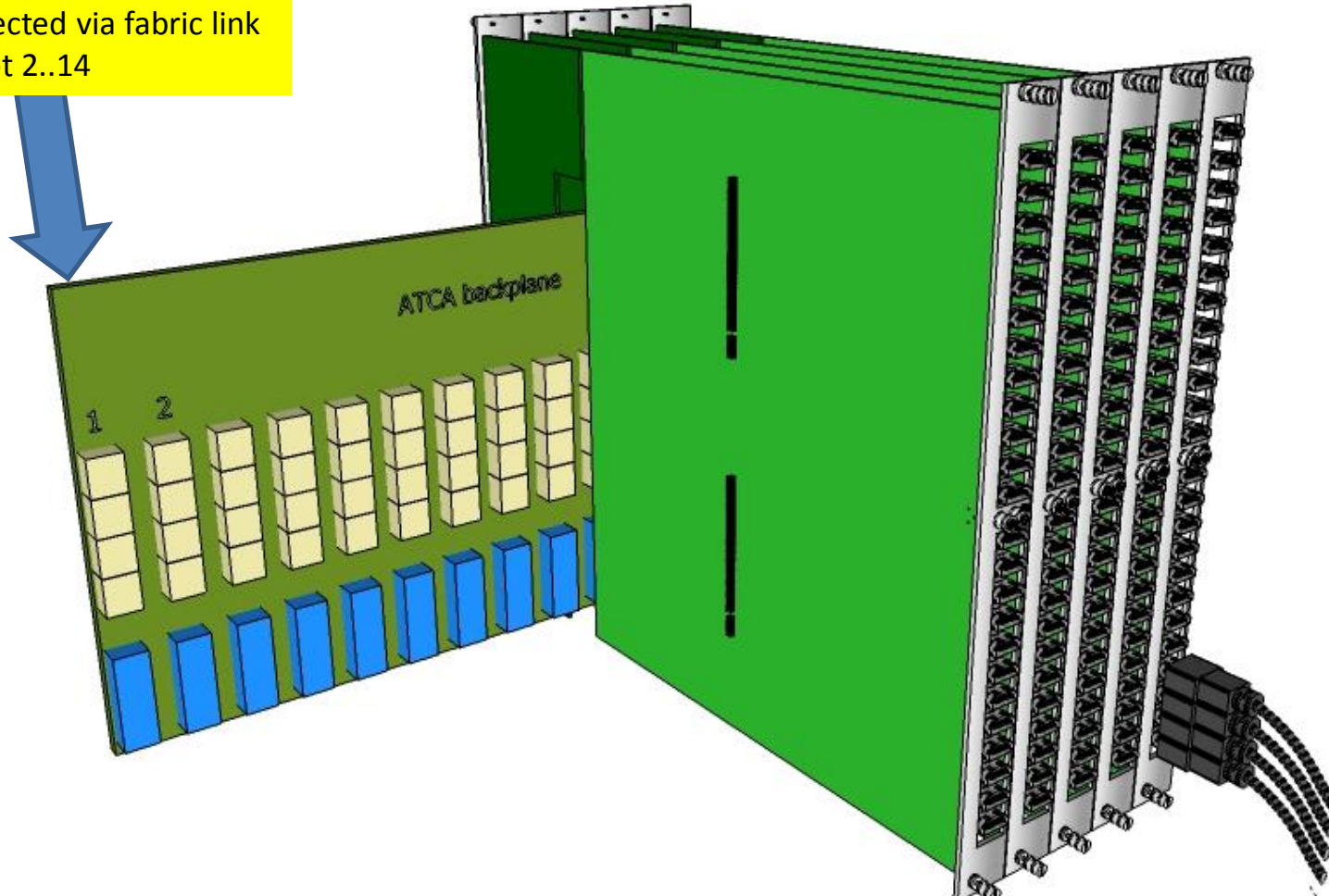


Slot 1 has 8 differential pairs to ALL 13 right-hand slots with clock capability 6 GHz

➔ This fabric is superior to CAT6 based DTC link cables

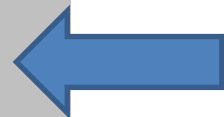
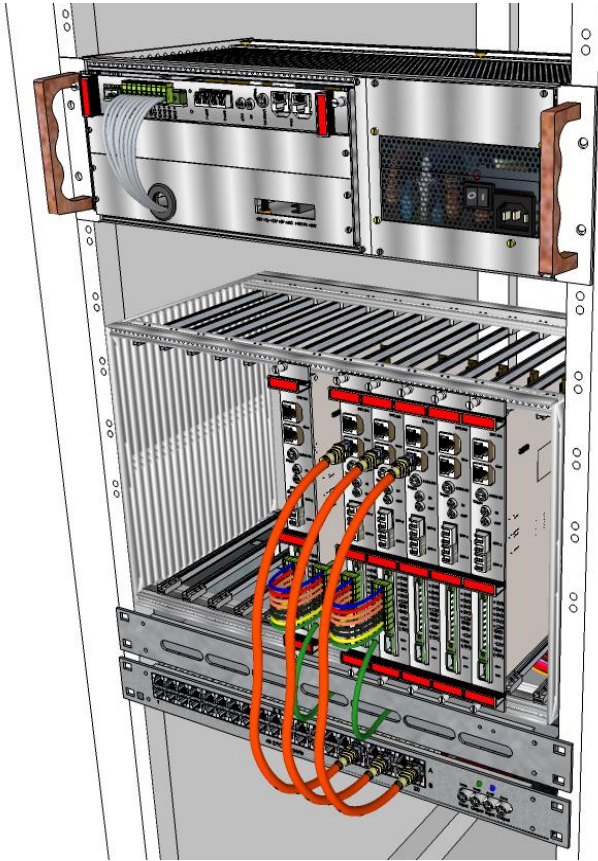
SRS-ATAC blades stack

SLOT 1
Connected via fabric link
to slot 2..14

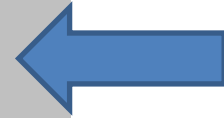


11 Slots a 6144 channels ~ 67 k channels in one Crate

SRS Crate/Rack environments “as is”



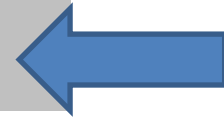
SRS 3U Minicrate: portable,
rack-mountable, Max 4k channels



SRS 6U Eurocrate, rack-mountable
Max 16k channels/crate



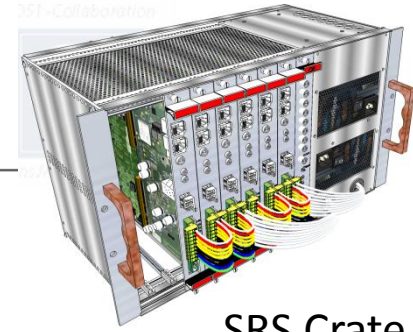
DTC links (CAT6) 1 Gbit/s
40 FEC -> 1 SRU



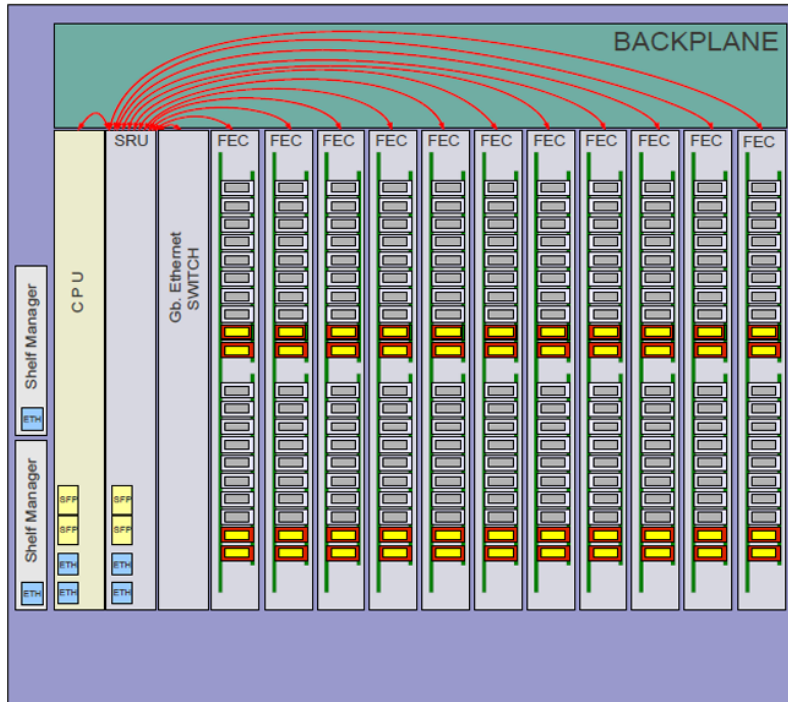
SRU 1U Readout Unit
up to 40 FEC's in 5 crates = 1 Rack
Max 92 k channels / Rack

ATCA equivalent SRS Eurocrate

ATCA 14 slots Crate – SRS



SRS Crate



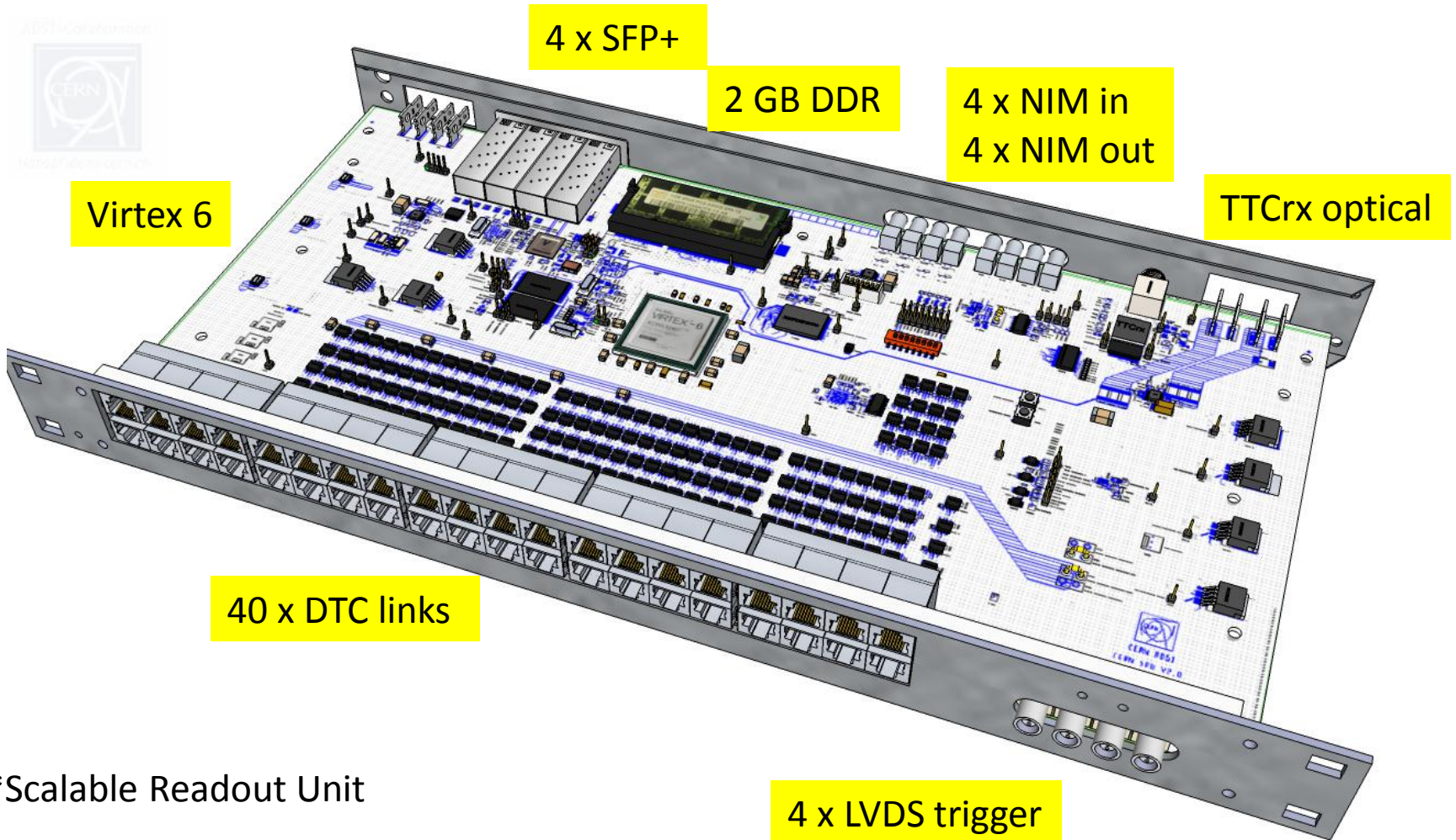
- 11 FEC-ATCA blades
- 64 ADC ch. per FEC board
- 704 ADC channels in shelf
- ~~90412~~ channels per shelf ← 67 k channel/crate
- 1 SRU blade in the shelf
- remote programming
- optional CPU in the shelf

+ 2 FEC-ATCA in no CPU&Switch



Scalable Readout System in an ATCA – February 20, 2012, CERN

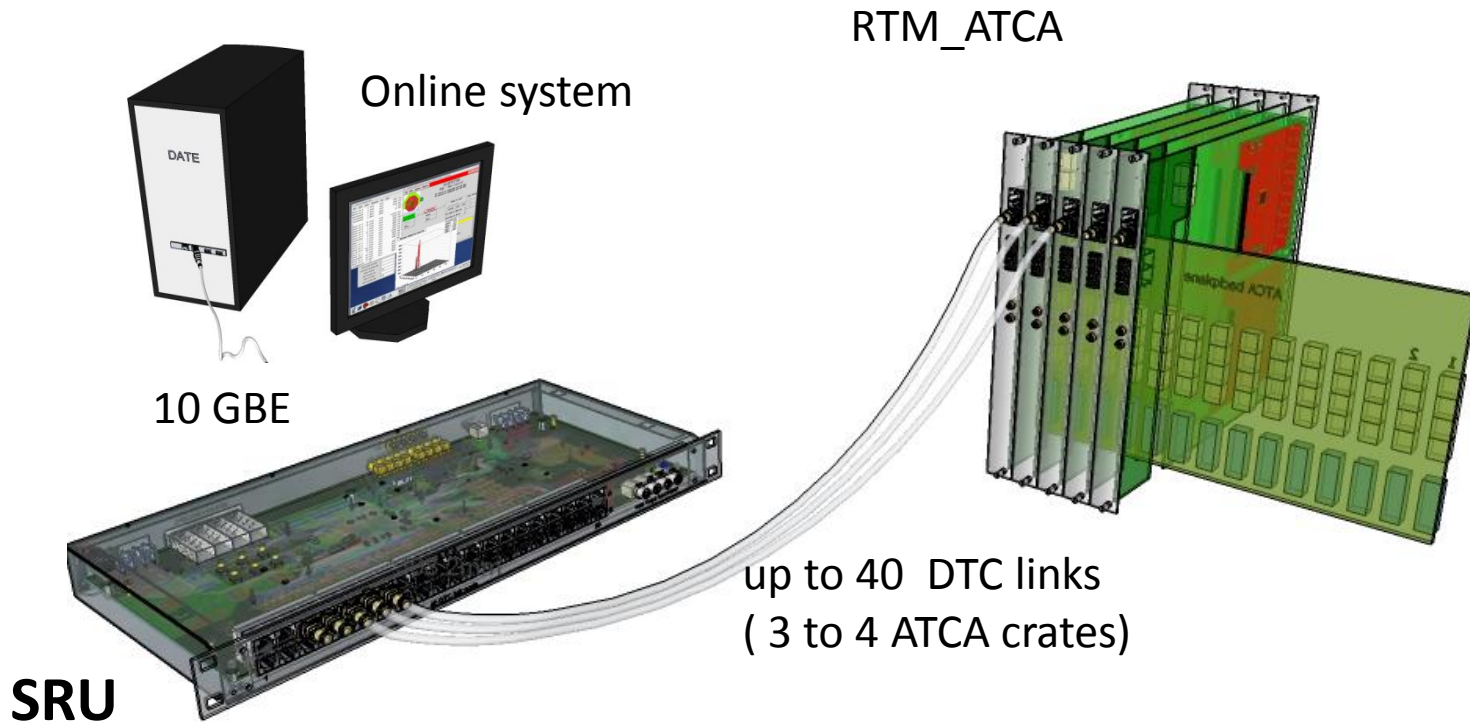
SRU* “as is”



*Scalable Readout Unit

1st Step

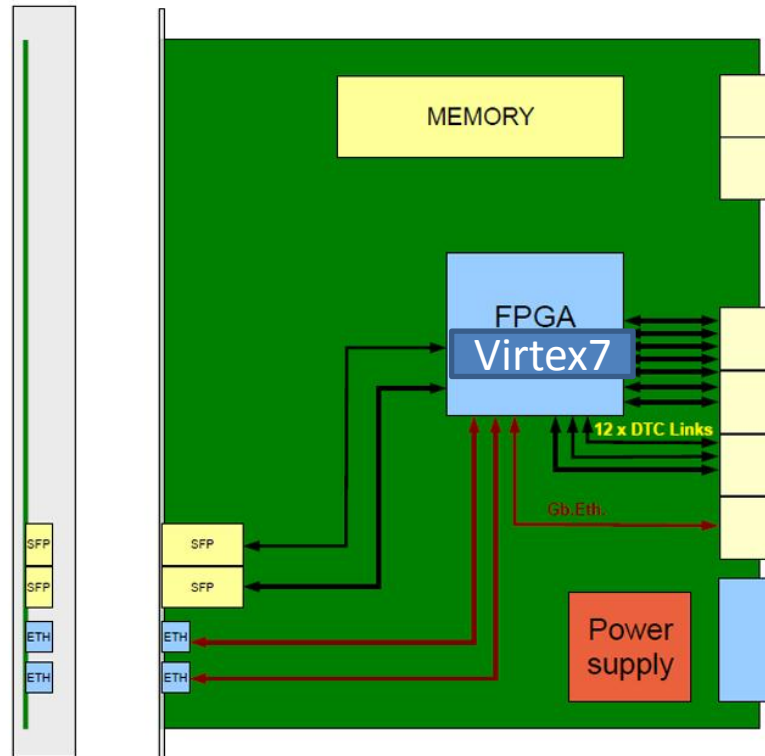
connect existing SRS module via DTC links to RTMs



2nd step: Implement SRU for Slot 2

SRU-ATCA

aim for 48 Gbit/s
optical links to DAQ

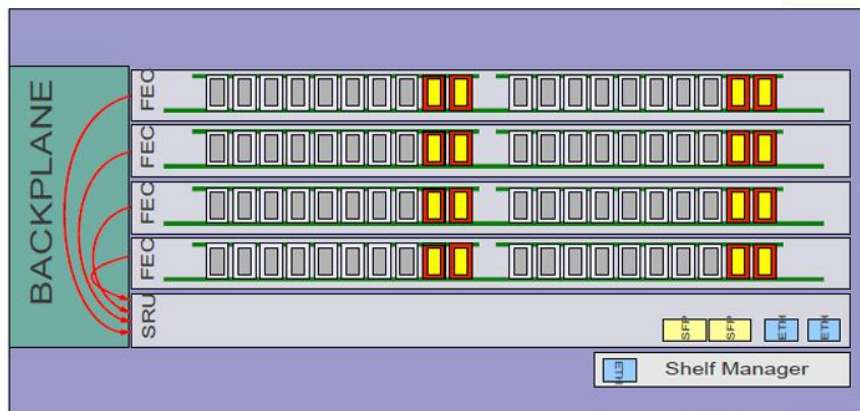
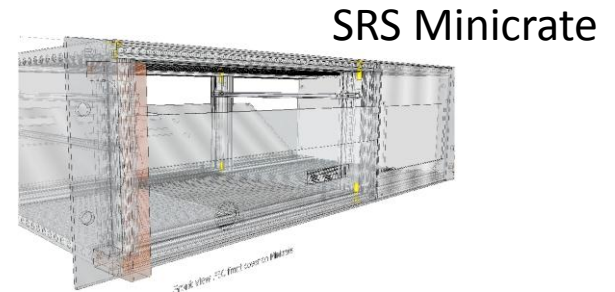


aim for 10 Gbit/s
DTC links via Fabric

ATCS equivalent for SRS Minicrate

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



SRS-ATCA plans

- Large systems will probably prefer SRS-ATCA
- Small systems will probably prefer SRS “as is”
- key clients (large systems) listed for prelim. commitment
- start with basics FEC, ADC for 2012-Q4 ! timeline
- add more basics as requested
- initially keep SRU as external module
- longterm integration of SRU as Slot-2 Module
+ embed DTC links in ATCA backplane fabric
- SRS-ATCA partners*: EicSys, UPV-Valencia, IFIN-HH-Bucharest, CERN

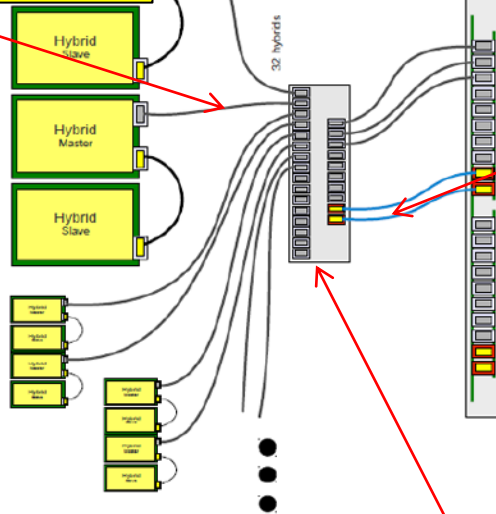
* call for getting involved as partner

Backups

Longterm chiplink plans

SRS architecture (Hybrid <-> ADC)

Copper
From detector to "Box"



To maintain compatibility with existing hybrids "redistribution box" is needed

- CLK, TRG&PWR are spitted in the box
- "redistribution box" is much cheaper than ADC/FEC board

**No hybrids modification,
but additional box needed**

Fiber from "Box
to SRS_ATCA

eicSys GmbH
Embedded Integrated Control Systems

Scalable Readout System in an ATCA – February 20, 2012, CERN

10/26

SRS
electronics
within
ATCA crate
framework

Implement long distance SRS chip-link via "Intermediate BOX"

- 1: Frontend side link: short copper, O(2 m @ 1 Gbit) in radiation exposed zones
- 2: FEC side: long fiber O(50m @ 10 Gbit) to ATCA-SRS crate
- 3: provide power to ASICs a la HDMI ?