

# SRS update

- 1.) SRS Hardware
- 2.) R&D results
- 3.) R&D plans

Zaragoza RD51 meeting, WG5

8 July 2013

# SRS hardware

- > 40 different teams/users/systems so far
- so far MPGD detector test systems < 16k ch
- New trend SRS: larger systems > 16k ch
- New trend SRS: Timepix, Beetle, VFAT, pixel, etc
- SRS-ATCA systems for ATLAS,ALICE,NEXT for 15.08
- New SRS service electronics ( HV, trigger) progressing

## CERN store SRS orders

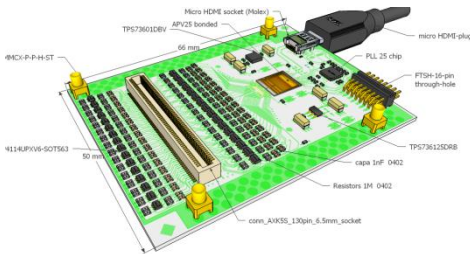
- SRS stock mostly sold out
- new production awaited ( 30 systems)

# SRS commercial

- **PRISMA electronics, GR:** SRS cards and crates for CERN store
- **NEOHM IT:** SRS hybrid mounting, bonding, testing
- **ELTOS IT:** high precision PCBs
- **Rentron GR:** production crate panels and profiles
- **EicSys GE:** SRS-ATCA systems
- **TELSA SA CH:** component mounting , large cards and large BGA

# Confirmed new SRS production 7/2013

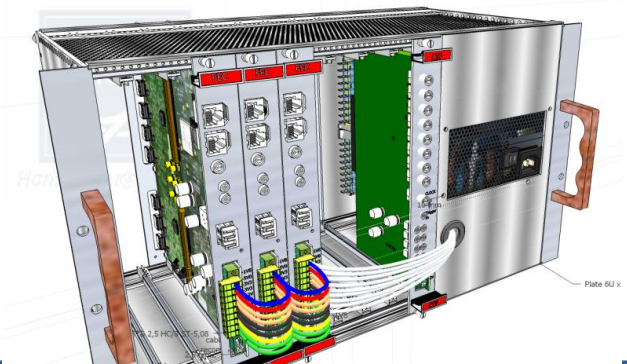
500 APV hybrids



15 Minicrates AB



12 Euro-Crates HP



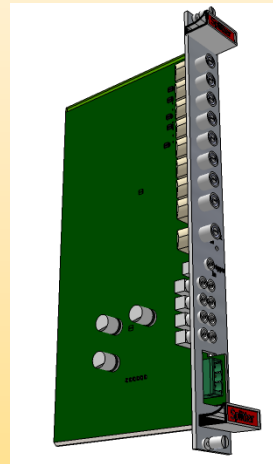
30x FEC V3



30x ADC



5 CTF cards



20 SRU boxes



10 FEC V6



Not yet via CERN store

# New Minicrate AB



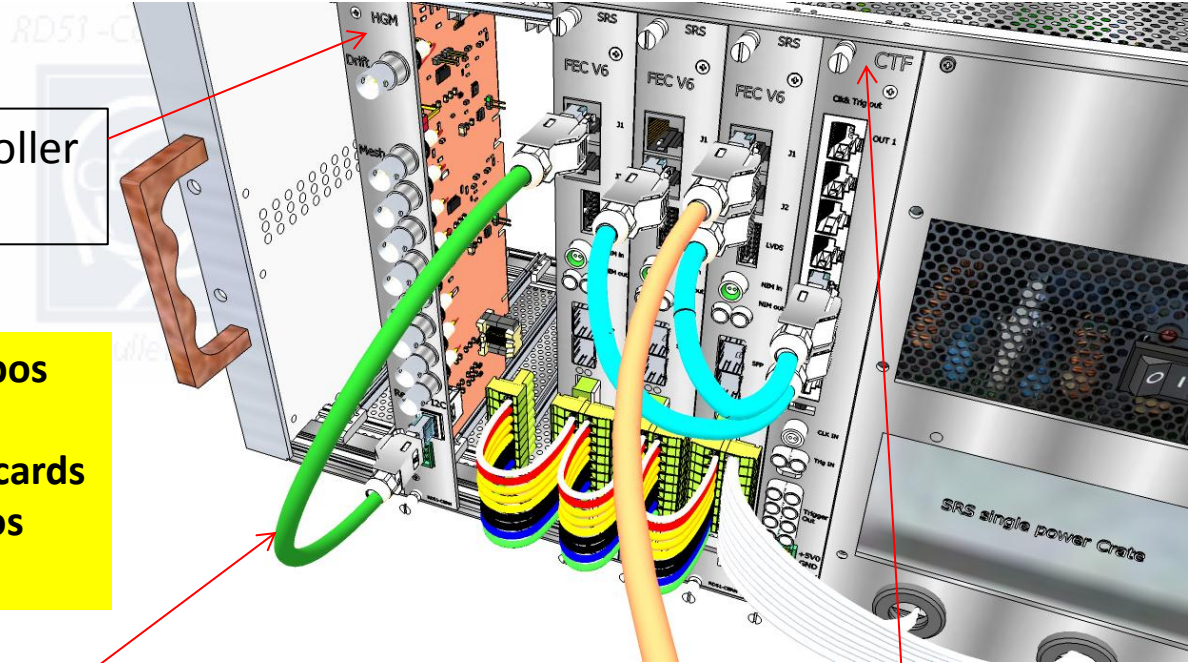
- New AutoCad files by CERN store
- All mechanical parts by 1 producer
- Assembly by PRISMA
- Logistics much simplified
- Expect faster re-stock

**Now 2 slots for 2 Combos**

→ Up to 2 x 2048 channels/Minicrate



# SRS Eurocrates for larger systems



High Voltage Generator/controller for MicroMegs

**HP Crate: power for 4 FEC –Combos ( 8k APV channels)**  
**Subrack option for 3U cards**  
**FP Crate: power for 8 FEC-Combos (16 k APV channels)**

Remote I2C via network cable for service cards

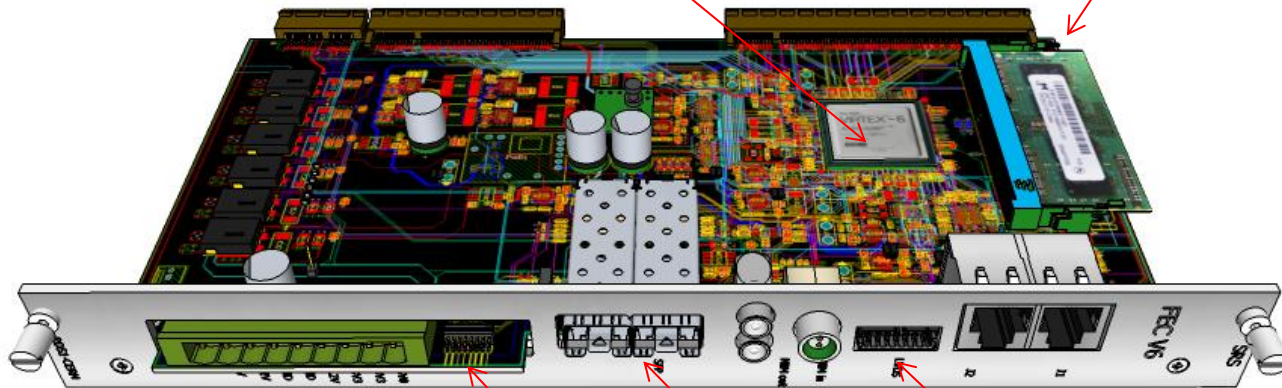
CTF card (Slot 9) for clock & trigger distribution/generation

# New FEC V6

PCB routed 100% by AES , Madrid  
10 prototypes to be produced at material cost to SRS developers  
Medium term, replace FEC V3 (CERN store )

Virtex 6 , LX130T FPGA  
faster, more resources

Plugin SODIMM  
2 GB



New I/O connector

Jtag

2 x SFP+

# Dcard = Digital SRS adapter card

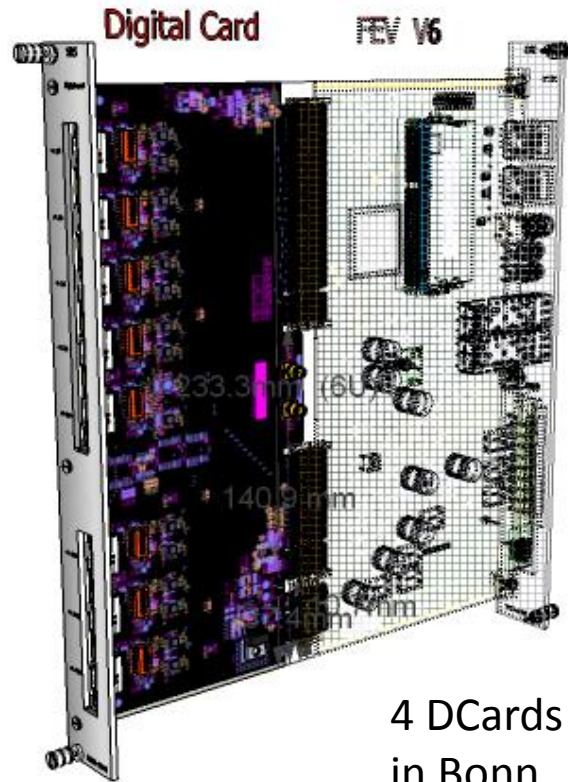
SRS adapter card for digital chips

designed for VFAT

now also use now by  
ALICE ITS for SRS test  
of pixel chips

8 x HDMI ports  
( = ADC card )

1 Dcard at IFIN Bucharest  
preparing from VMM readout



4 DCards mounted  
in Bonn

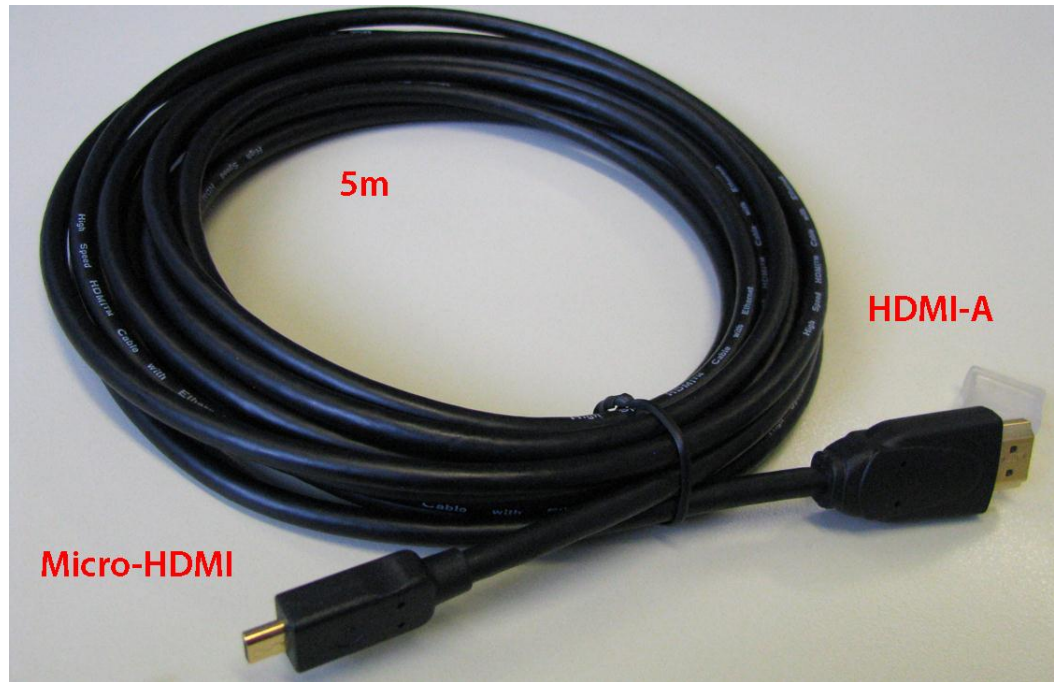


Photo:  
Dcard mounted  
at Bonn Inst .Phys



# New 5 m HDMI cables for SRS

New special production for SRS: 5 m cable assemblies HDMI A-D by SEA  
CERN store SCEM 07.89.00.220.2



→ SRS

← Hybrid

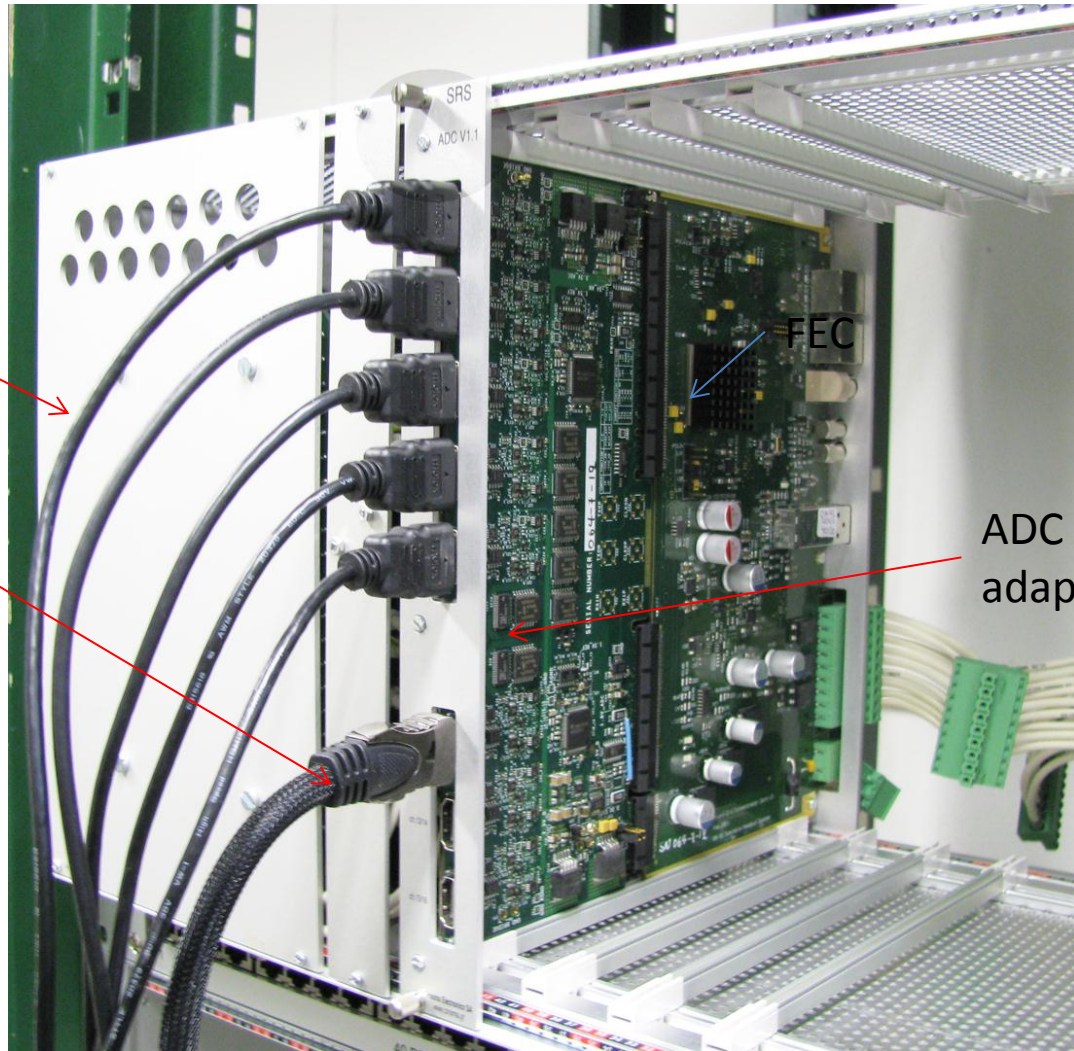
# Backside Eurocrate:

Up to 8 HDMI cables per adapter card

extendible up 30m



Couplers for HDMI -A-A cables SCEM 07.89.00.217.9



FEC

ADC or Digital adapter

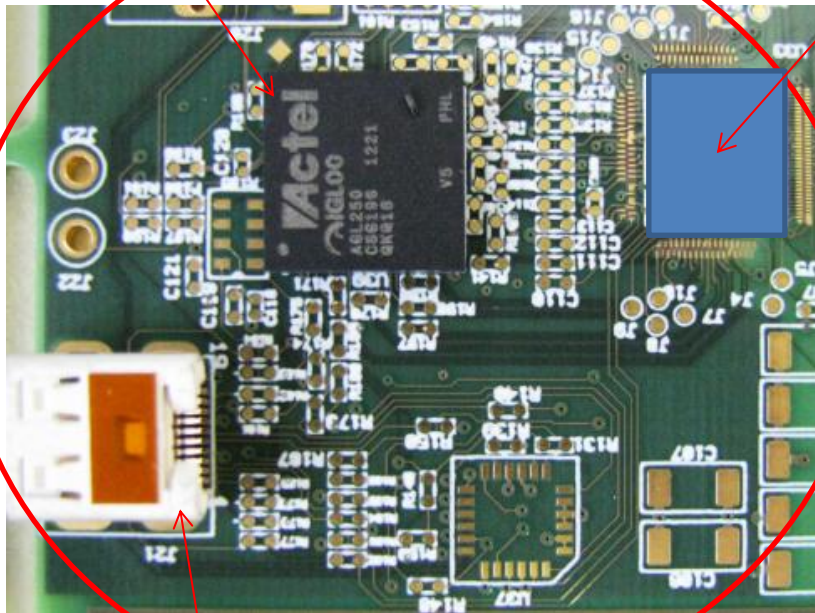
# Beetle hybrid

a longer story..

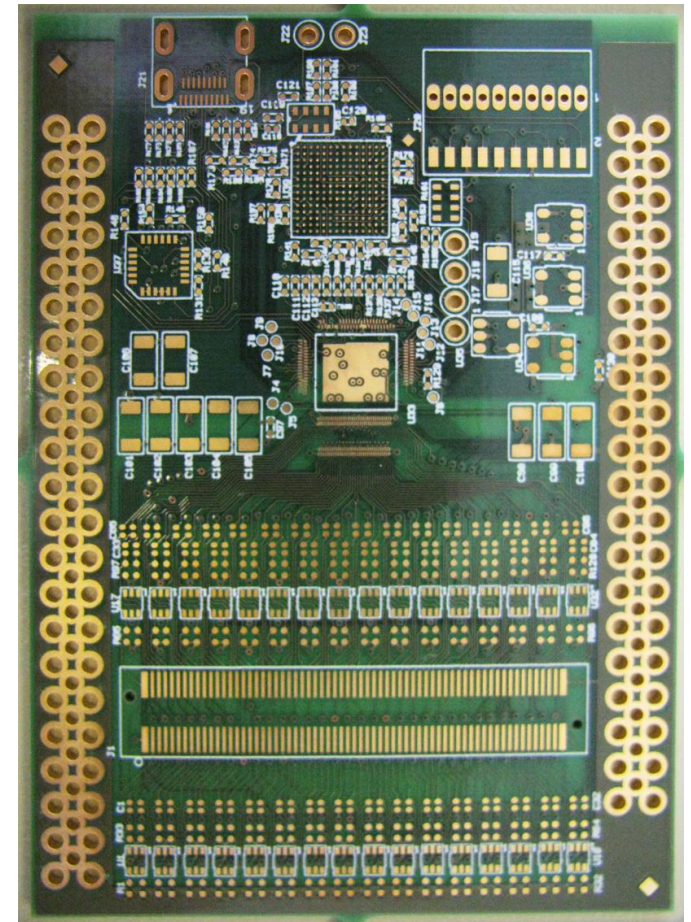
32 ELTOS PCB arrived, bonding to be made by NEOHM

Actel Igloo

designed like APV hybrid, more layers



Beetle chip  
128 channels



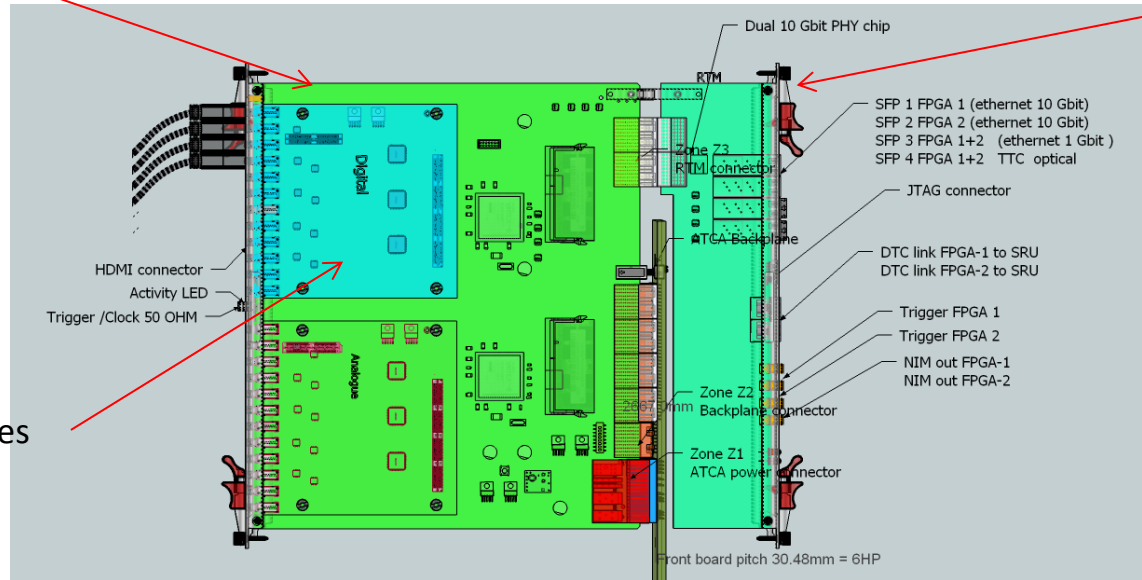
# SRS-ATCA startup

see extra slides by EicSys GmbH

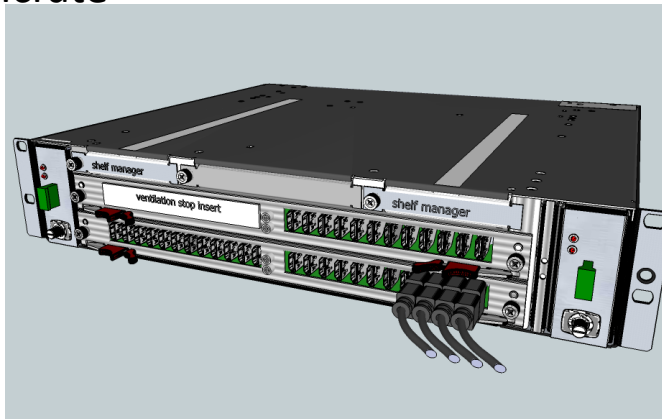
SRS ATCA blades

RTM modules

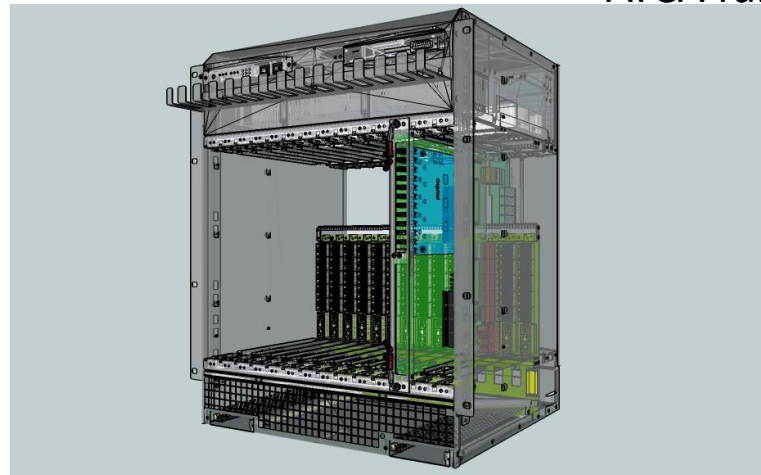
SRS\_ATCA mezzanines



ATCA Minicrate

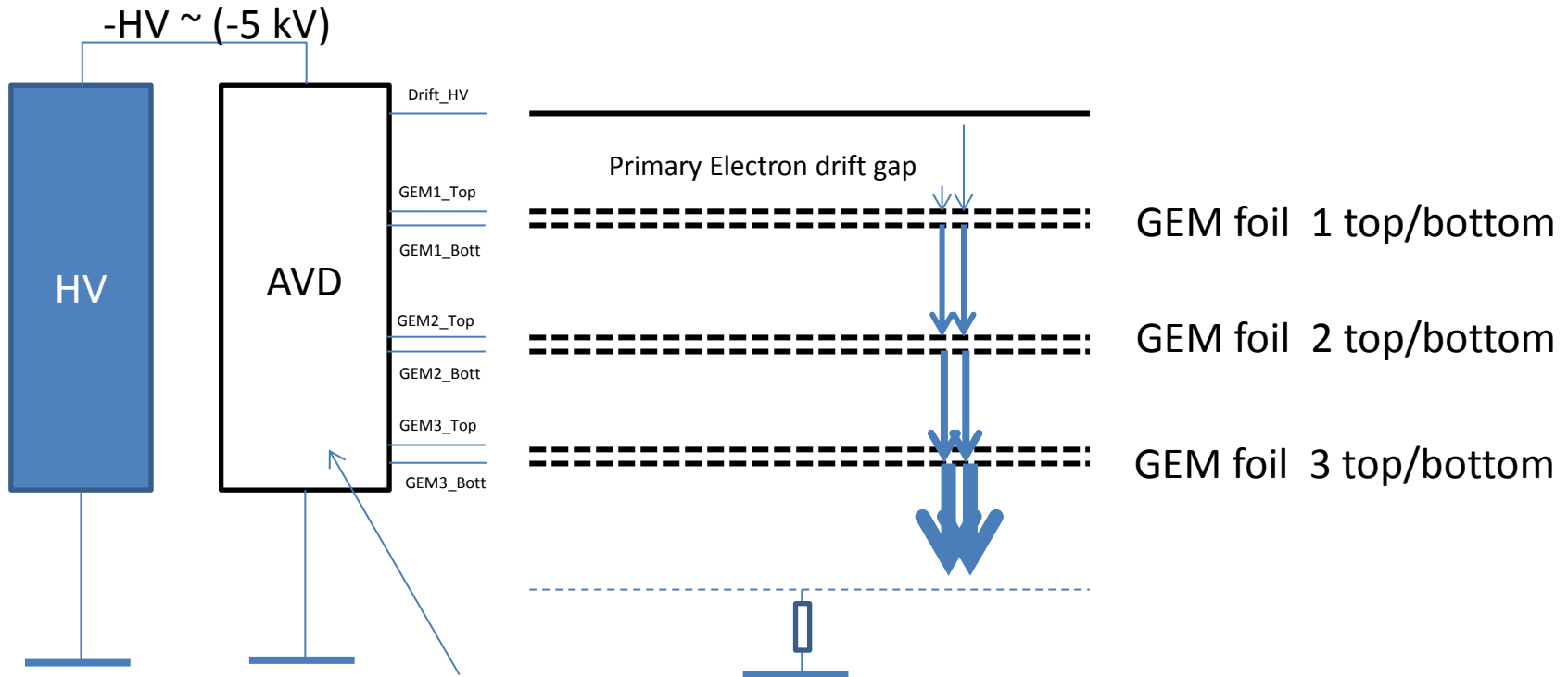


ATCA full crates



# R&D on MPGD electronics

# Active Voltage divider for GEMs



## Principle inside AVD:

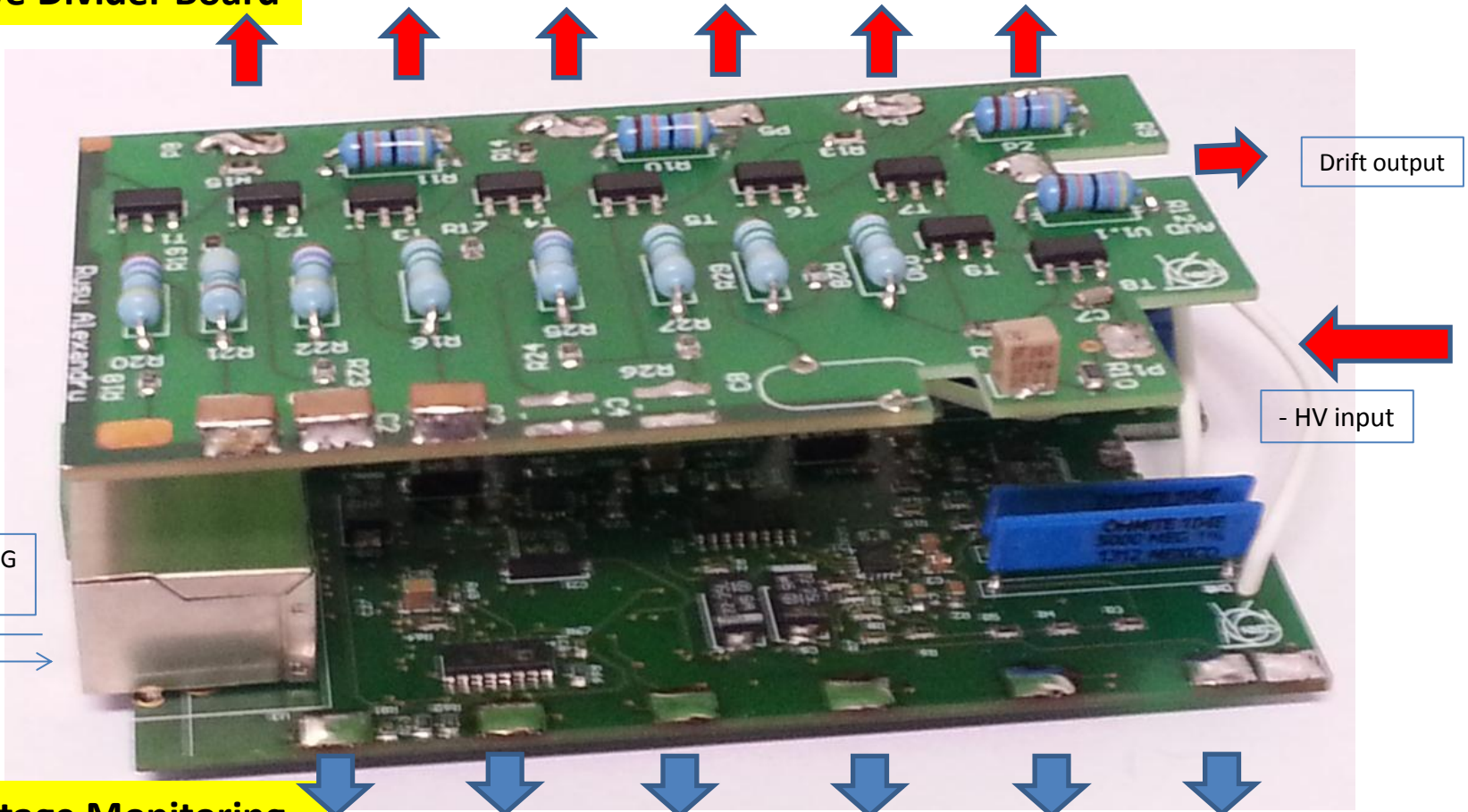
- high-ohmic resistor divider as bias for HV Transistors to obtain low-impedance output voltages
- GigaOHM dividers and instrumentation amplifiers for analogue Voltage monitoring ( static and dynamic
- monitoring readout via remote I2C cable to SRS FEC card



# Electronics inside AVD box

**AVD Active Divider Board**

- HV outputs to GEM foils



Drift output

- HV input

Remote JTAG  
to SRS

**VM Voltage Monitoring**

Monitoring outputs HV/2000



# AVD

## active voltage divider/monitor for GEMs

- Monitor all Voltages via SRS (via remote I2C)

### AVD online Display from SRS

```
=====ACTIVE VOLTAGE DIVIDER MODULE (AVD)=====
-----
          HIGH VOLTAGE READOUT DISPLAY
-----

VOLTAGE OUTPUTS                PARAMETERS
-----

DRIFT      : 4985 V              V_Drift    : 947 V
GEM1 TOP   : 4038 V              V_GEM1     : 454 V
GEM1 BOTTOM : 3584 V              V_Transfer1 : 952 V
GEM2 TOP   : 2632 V              V_GEM2     : 479 V
GEM2 BOTTOM : 2153 V              V_Transfer1 : 874 V
GEM3 TOP   : 1279 V              V_GEM3     : 488 V
GEM3 BOTTOM : 791 V               V_Induction : 791 V
TEMP IC2   : 50.25 C
TEMP IC8   : 38.50 C
TEMP SHT25 : 48.77 C
HUM SHT25  : 14.32 %
```

```
AVD Run 114 - DATE and TIME is: wed Jul 3 15:13:32 2013
```

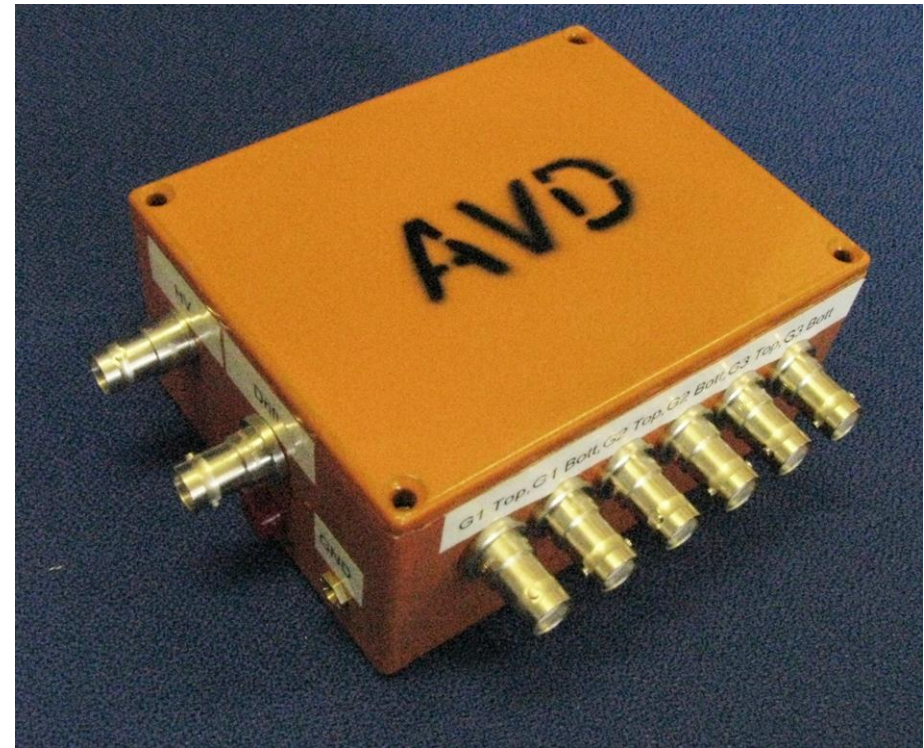


Photo of AVD Prototype

# Average HV monitoring AVD Online Ramp up

```
=====ACTIVE VOLTAGE DIVIDER MODULE (AVD)=====
```

```
-----  
HIGH VOLTAGE READOUT DISPLAY  
-----
```

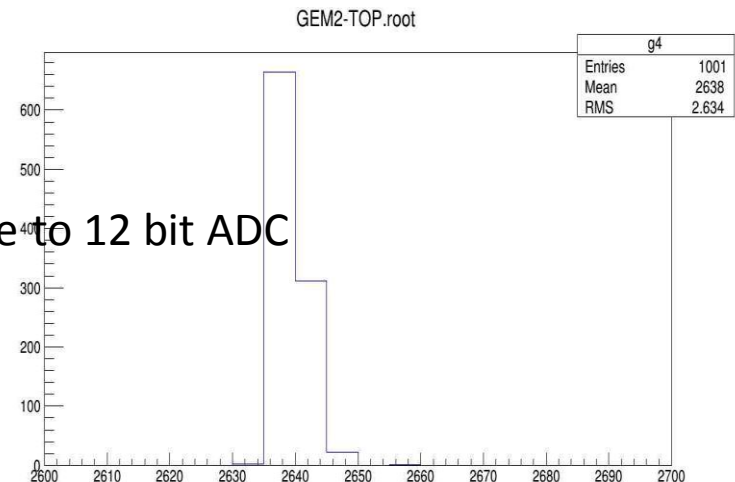
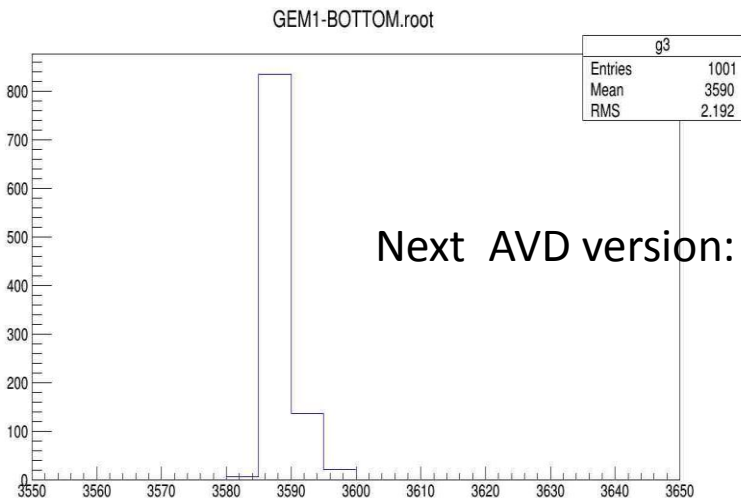
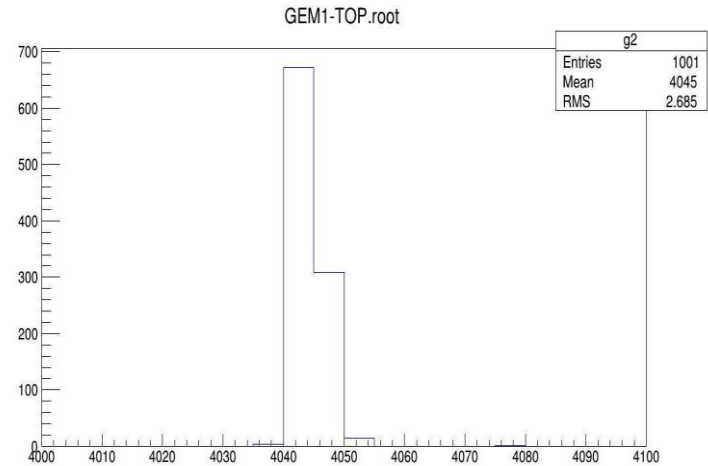
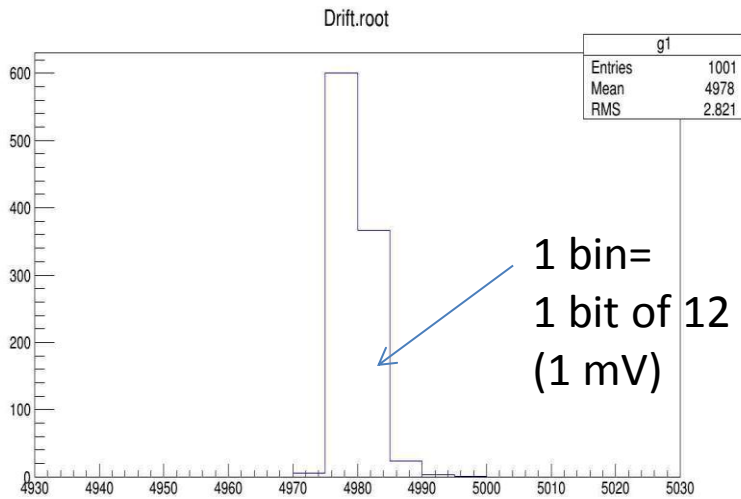
```
VOLTAGE OUTPUTS
```

```
PARAMETERS
```

```
-----  
DRIFT      : 0 V      V_Drift     : 0 V  
GEM1 TOP   : 0 V      V_GEM1     : 0 V  
GEM1 BOTTOM : 0 V      V_Transfer1 : 0 V  
GEM2 TOP   : 0 V      V_GEM2     : 0 V  
GEM2 BOTTOM : 0 V      V_Transfer1 : 0 V  
GEM3 TOP   : 0 V      V_GEM3     : 0 V  
GEM3 BOTTOM : 0 V      V_Induction : 0 V  
TEMP IC2   : 50.25 C  
TEMP IC8   : 38.25 C  
TEMP SHT25 : 48.73 C  
HUM SHT25  : 14.51 %
```

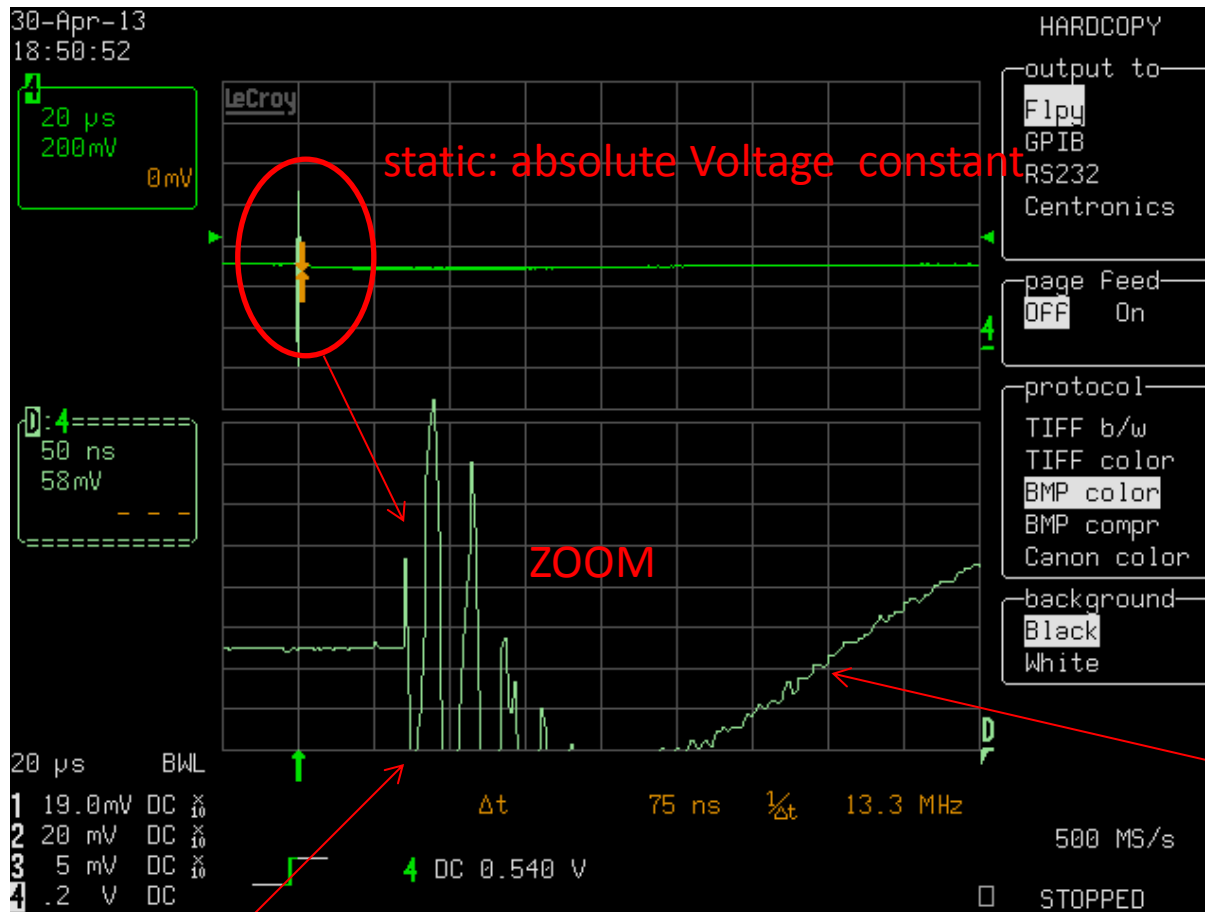
```
AVD Run 19 - DATE and TIME is: wed Jul 3 15:11:46 2013
```

# AVD – VOLTAGE : ROOT PLOTS



Next AVD version: upgrade to 12 bit ADC

# Dynamic readout pulsed short circuit on GEM foil



HV regulation  
on us timescale

Dynamic: 15 ns Charge -ringing in HV cable between AVD and Foil  
➔ High Voltage clipping diodes added in new design

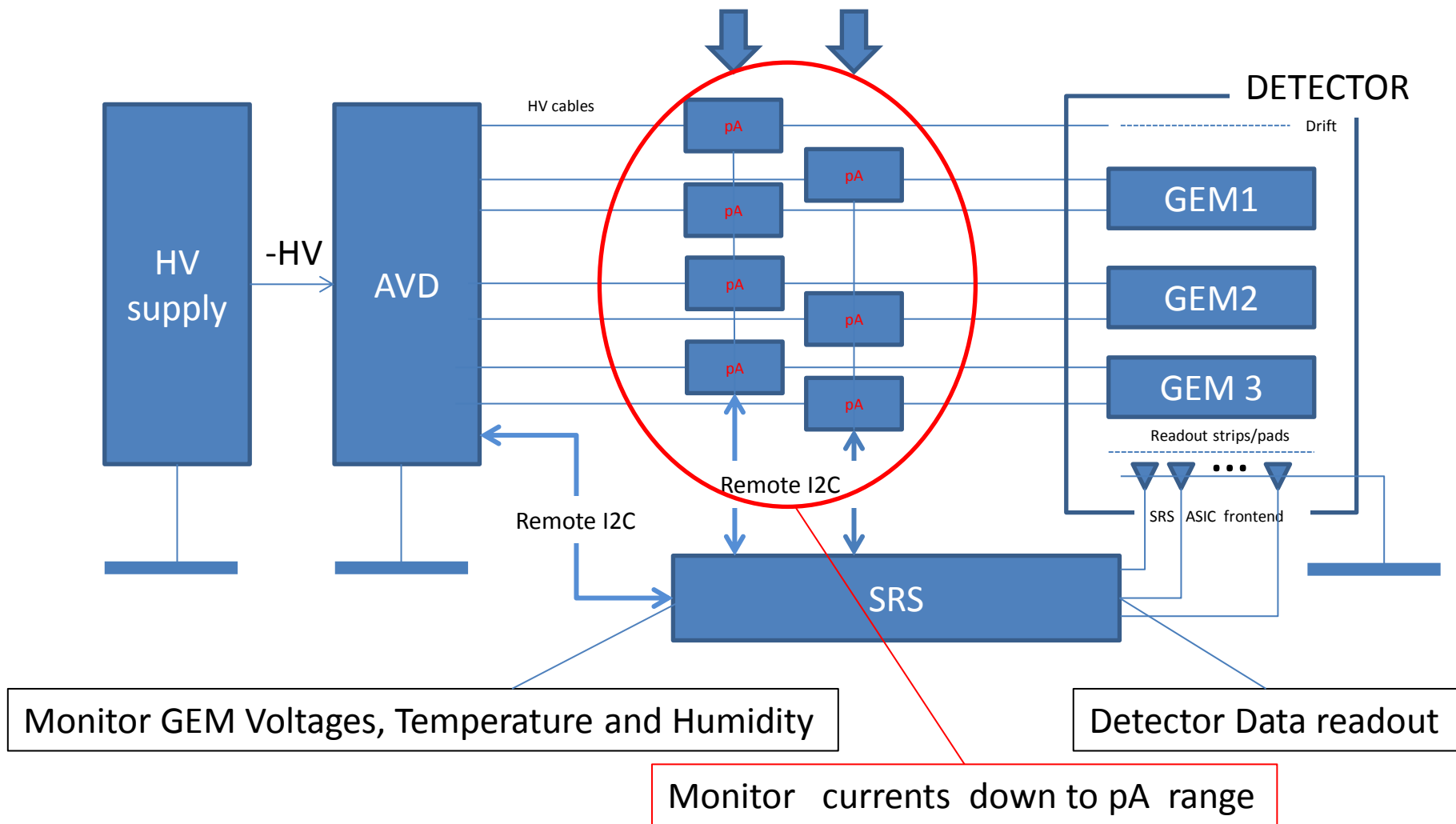
# More projects

- I2C switch box : readout of AVD and pA boxes via single SRS line (started)
- pA box: Current monitoring range 10 pA -100  $\mu$ A ( summer student)
- HGM: SRS card , programmable High Voltage for mesh grounded MicroMegs ( engineer from IFIN Bucharest))

## **depending on manpower**

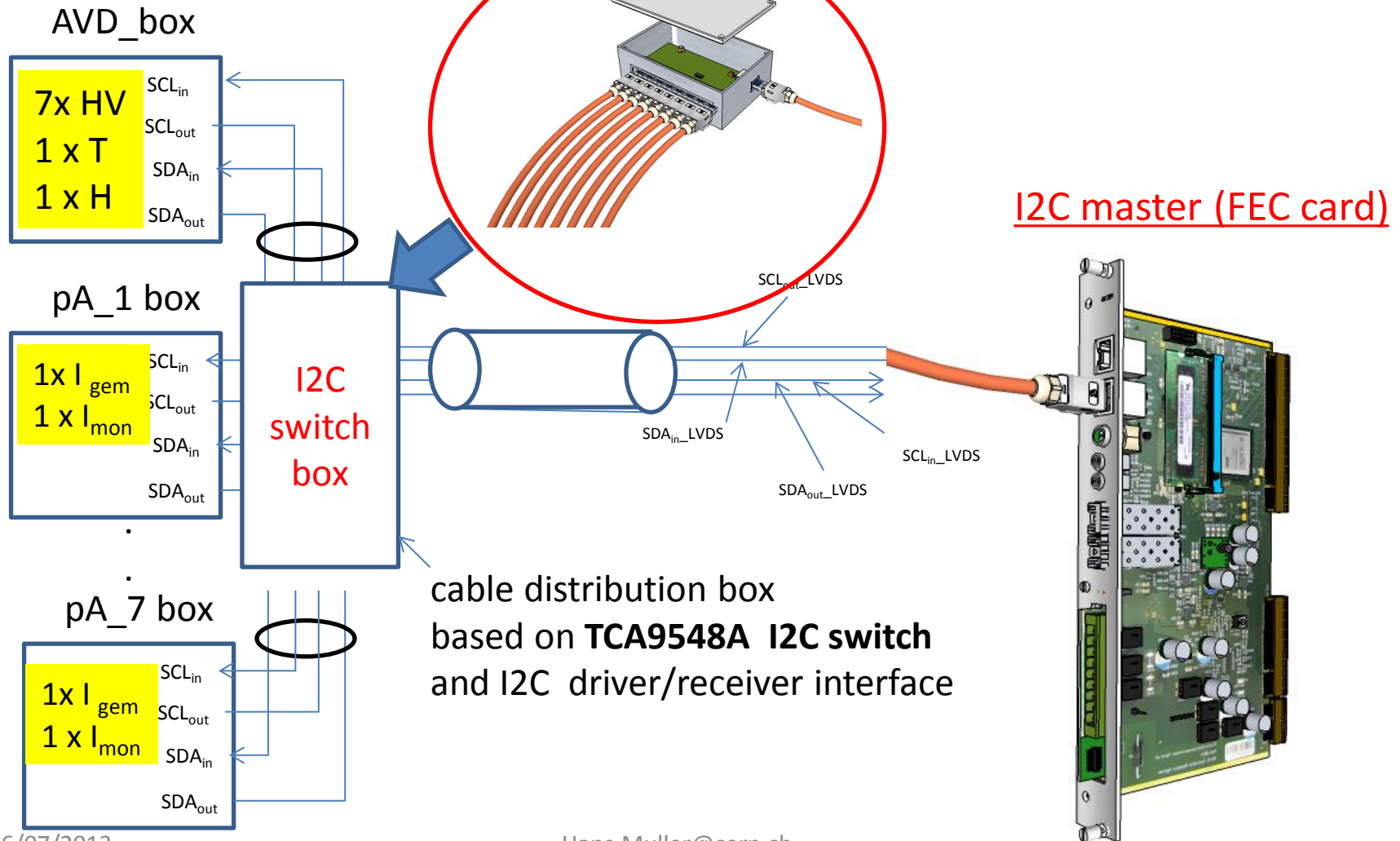
- QSA frontend: quad signal amplifier 2 GHz ,factor 20, for MPGD's (proto exist, to be revised)
- TPB trigger pickup box: generates triggers from Meshes ( already working , small upgrade)
- I-GEM: Anode current summing hybrid for GEMs (new, planned)
- Shaper-Discriminator: SRS card 50 OHM triggers from TPB (planned )

# Addition of **picoAmp** boxes to I2C readout



# I2C for 8 boxes (AVD and pA)

8 x I2C slaves

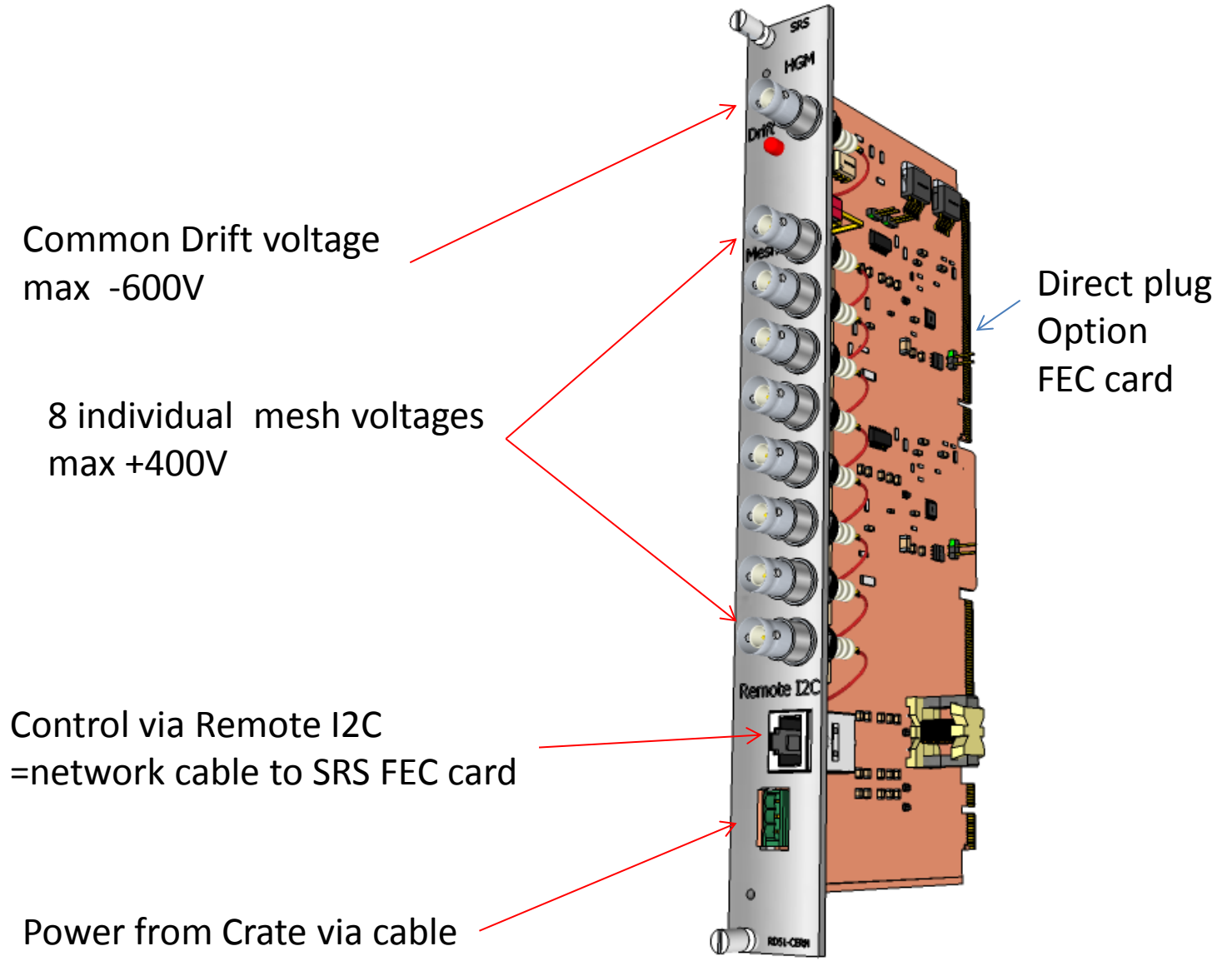


# HGM SRS C-card project

- SRS-embedded HV for MicroMega Detectors
- Common Drift up -600 Volt programmable
- 8 x grounded mesh up + 400V
- Individ. programmable range 10 bit over 200V
- Readback of HV via remote I2C from SRS



# HGM preview



Thank you