AGATA Project

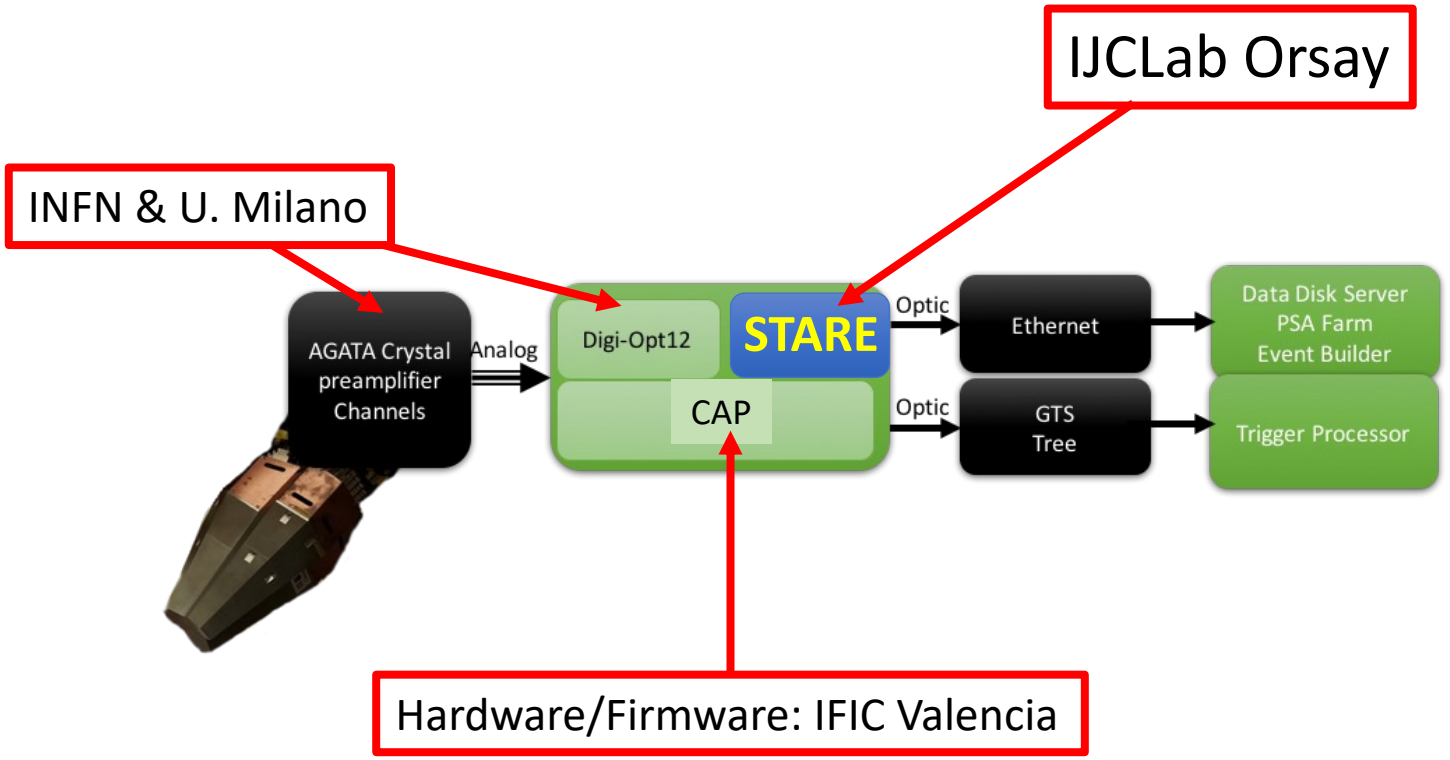
STARE (Serial Transfer And Readout over Ethernet) and EMC @LNL

N. Karkour et al.

Plan

- ✓ STARE Production Status
- ✓ Production Tests Bench :
- ✓ 12 Links Crate for Readout
- ✓ EMC @ LNL

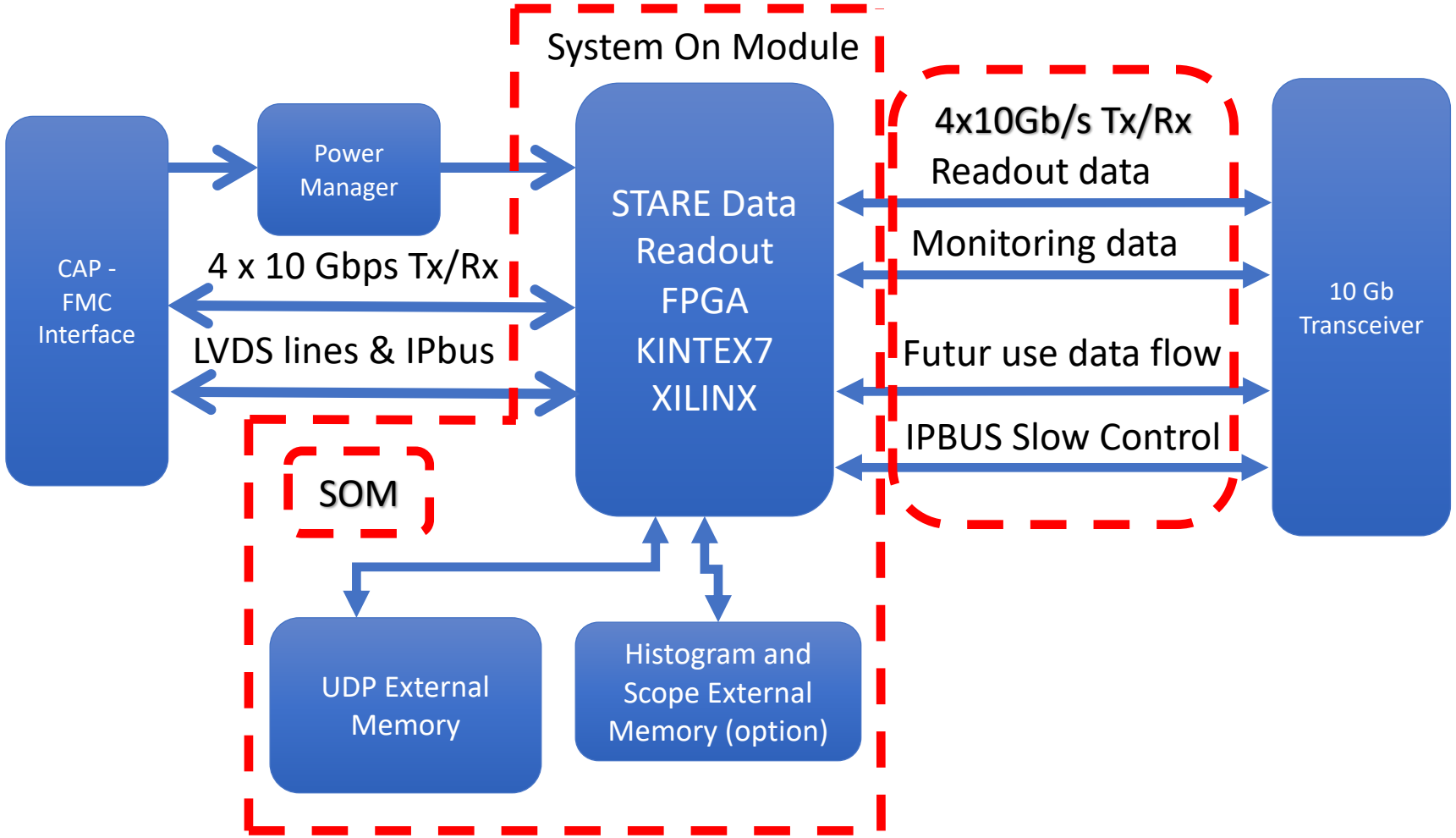
Hardware General Layout

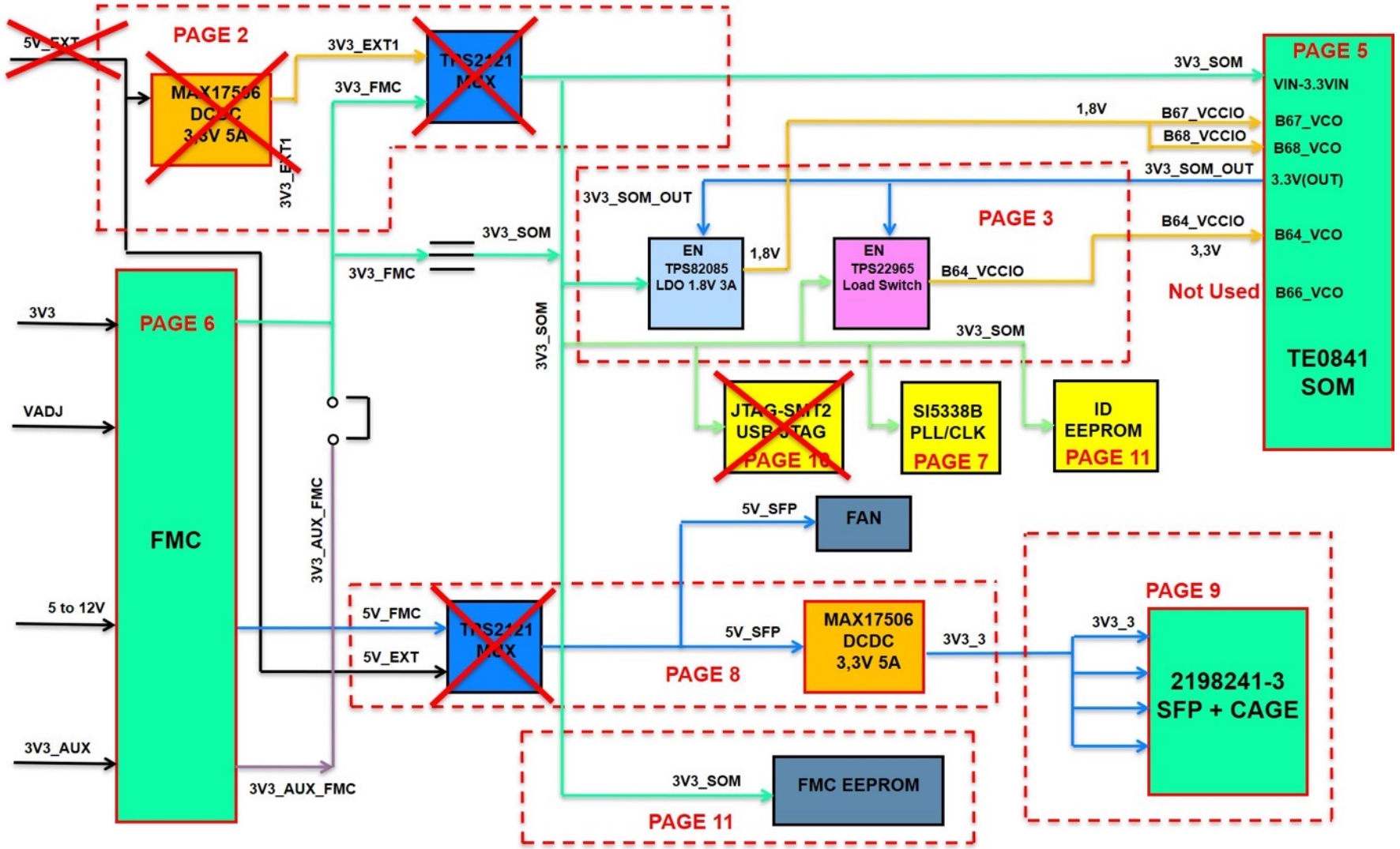


STARE characteristics

- Input data rate from pre-processing : 4 x 10 Gbps (2 for data, 1 for monitoring & 1 spare).
- 2 Power supply sources (Internal and external PSU using hot swap mux)
- Spare LVDS I/O with the pre-processing for future use
- Full clock management inside the SOM and the FMC carrier.
- Network Bandwidth up to 4 x 10 Gbps in parallel.
- 1 Gbps IPBus for slow control.
- Some on board facilities to make local comparisons with the DAQ (raw data storage, local Histograms etc...) .
- With this configuration it is absolutely easy to achieve continuous and comfortable 10 Gbps with monitoring and online analysis using multiple 10 Gbps Tx/Rx.

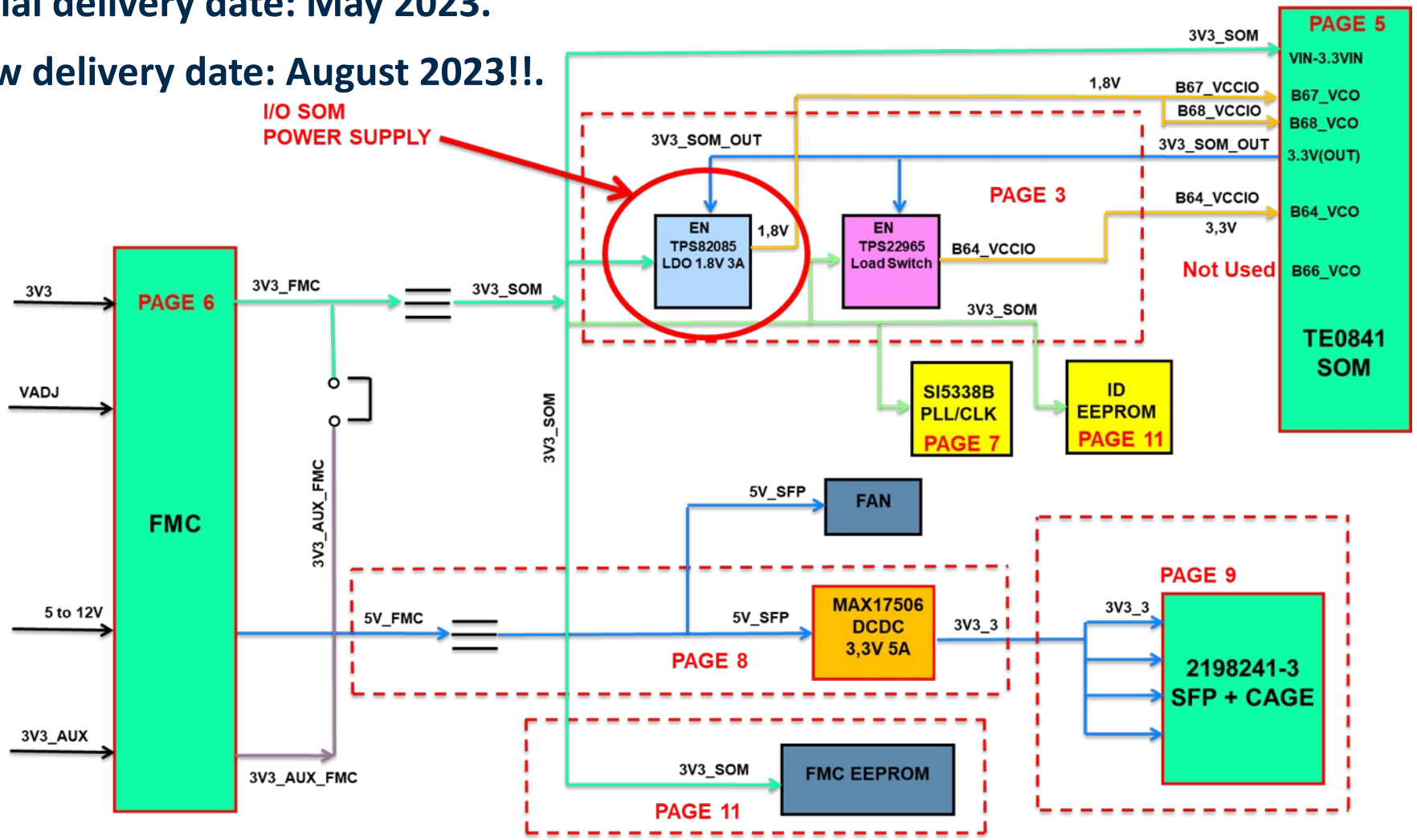
STARE characteristics




PAGE 2
3V3_EXT1
3V3_FMC
3V3_EXT1
3V3_SOM
1,8V
B67_VCCIO
B68_VCCIO
3V3_SOM_OUT
PAGE 5
VIN-3.3VIN
B67_VCO
B68_VCO
3.3V(OUT)
B64_VCO
B66_VCO
TE0841 SOM
PAGE 3
EN TPS82085 LDO 1.8V 3A
EN TPS22965 Load Switch
B64_VCCIO
3,3V
Not Used
3V3
VADJ
PAGE 6
FMC
5 to 12V
3V3_AUX
3V3_AUX_FMC
SI5338B PLL/CLK
PAGE 7
ID EEPROM
PAGE 11
5V_SFP
FAN
5V_FMC
5V_EXT
PAGE 8
MAX17506 DCDC 3,3V 5A
3V3_3
PAGE 9
2198241-3 SFP + CAGE
FMC EEPROM

Initial delivery date: May 2023.

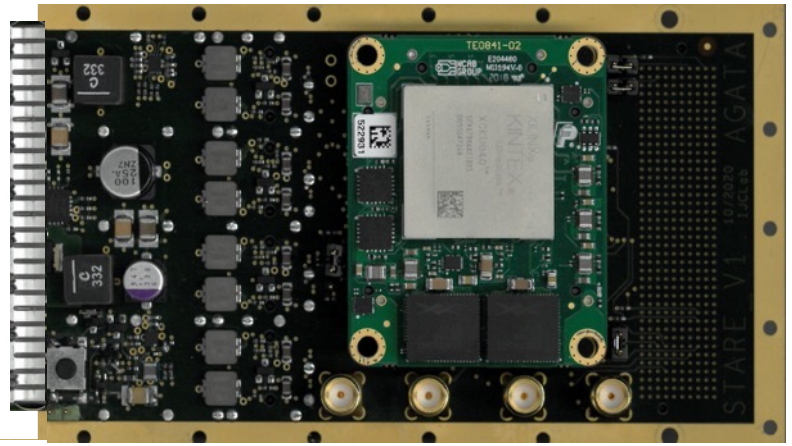
New delivery date: August 2023!!.



STARE Production

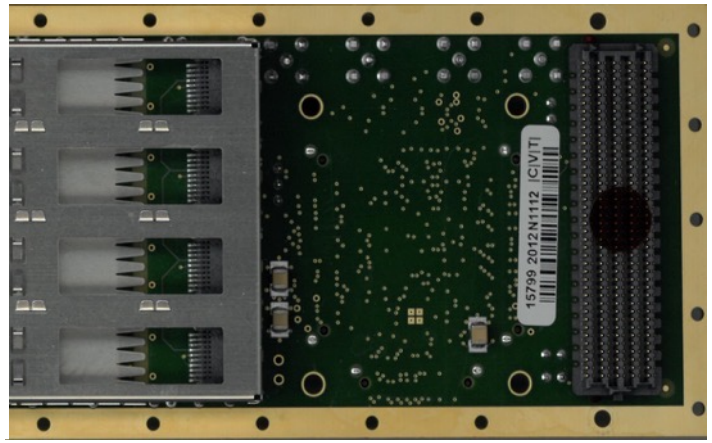
- New I/O SOM Power supply designed, PCB modified & ready to manufacture.
- Difficulties in purchasing Components: All components in stock.
- Ready to produce Pre-production (10 STARE V2): Delivery : Jan 2023.
- Production Feb 2023 to April 2023. Delivery: May 2023.

Top side



Artist View

Bottom side

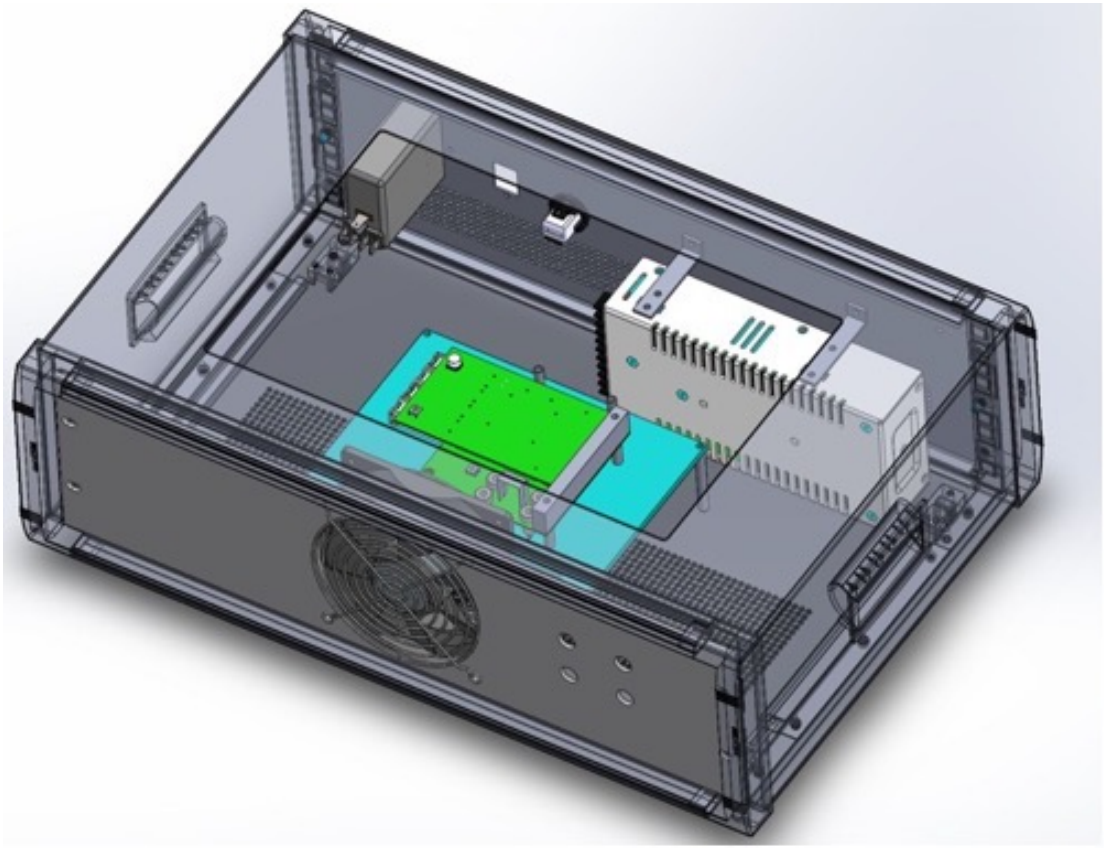


Production Tests Bench

- Final Year Project for Mathieu
- Dedicated for manufacturer : STARE V2 Production tests before delivery and also for the maintenance in the future.
- Covers more than 95 % of the components soldering reliability. All STARE interconnections will be tested.
  - EEPROM, Clock manager, Optical fiber, LVDS, Aurora, IPbus, Power Supply
- 2 Testbenches to be produced : 1 in the lab and 1 for the maintenance and production test @ the manufacturer.
- 1 is ready and functional, 1 is in production.

Production Tests Bench

From mechanical design → Real Test bench



Production Tests Bench

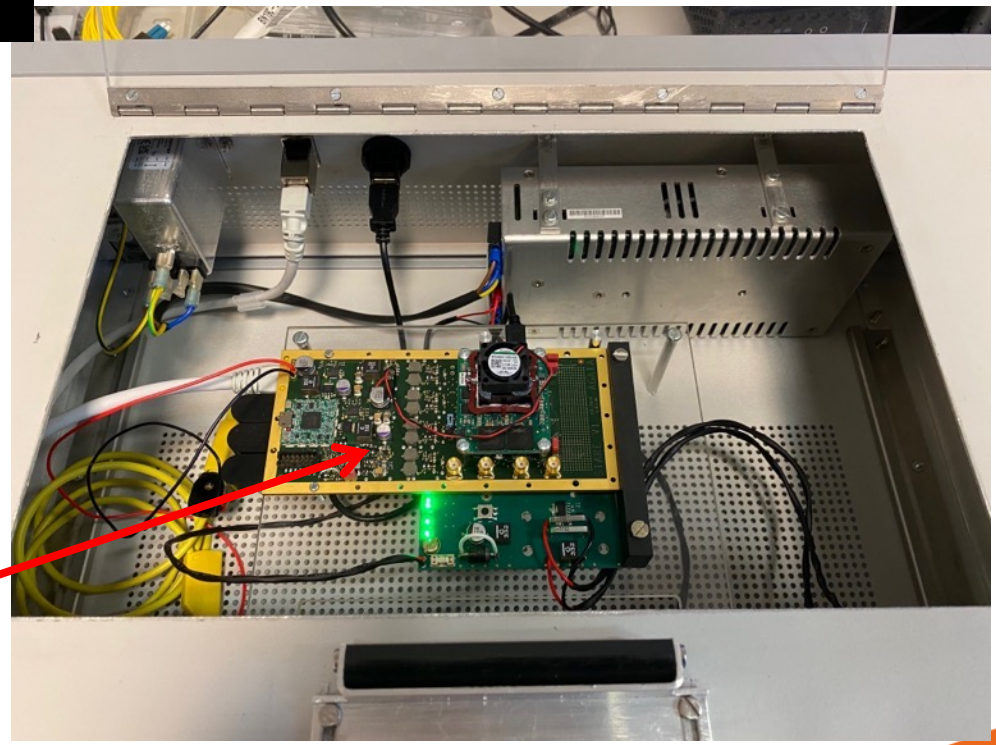
```
(Cmd) start_test_clock
clock0 :   156252409
clock1 :   156252409
clock2 :   156252408
clock3 :   156252410
clock4 :   600008597
clock5 :   156252238
clock6 :   156252238
clock7 :   600008592
clock8 :   99999998
```

```
(Cmd) start_test_loopback
error:  0
loopback_out:  1347393
loopback_in:  7897536
data_check:  561300
(Cmd) start_test_loopback
error:  0
loopback_out:  3710645
loopback_in:  27373
data_check:  8312302
```

```
(Cmd) start_test_eeprom 0
write eeprom in progress for 51 sec ...
address:  255
data:  255
test_eeprom OK
```

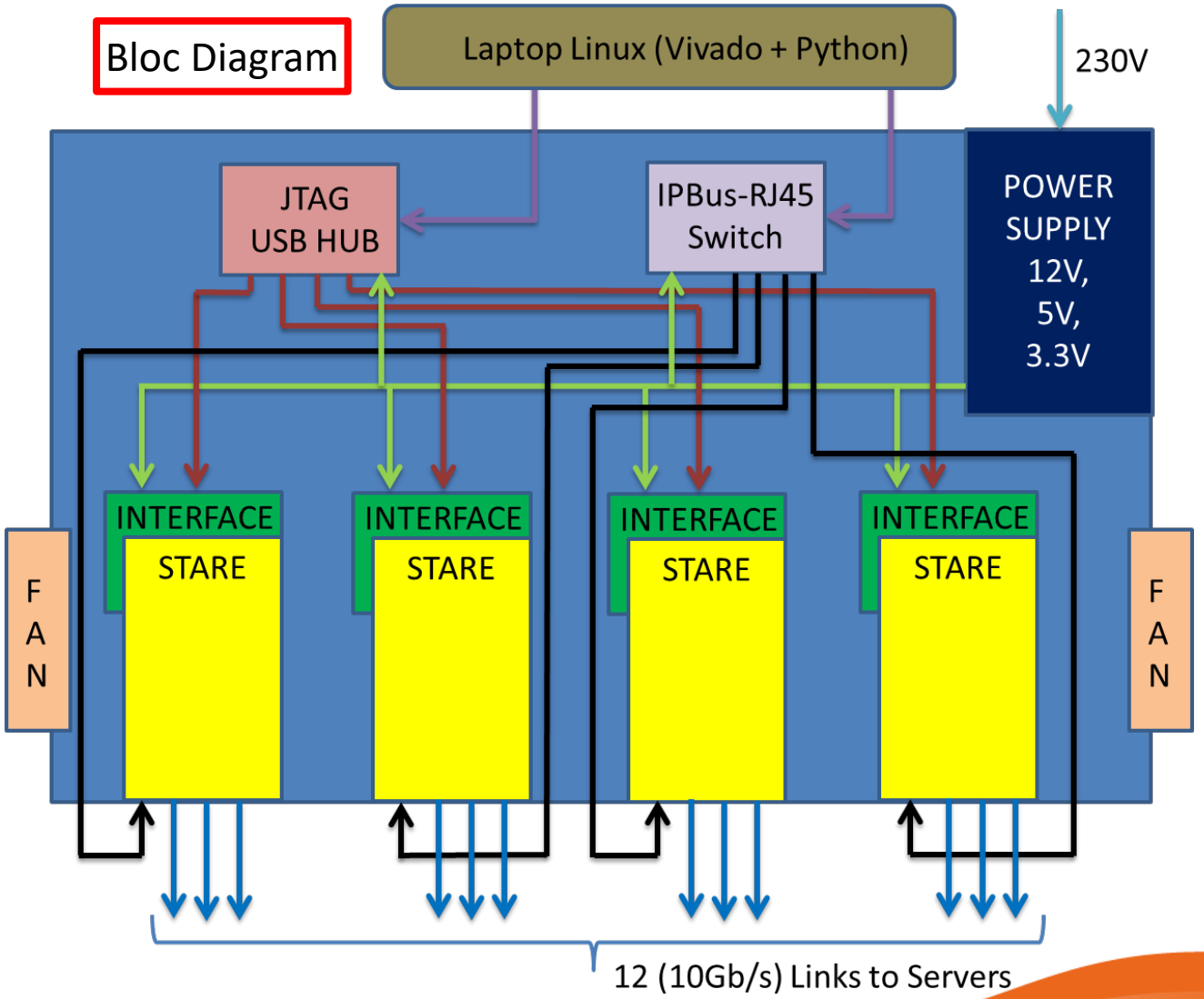
Front panel

STARE under tests

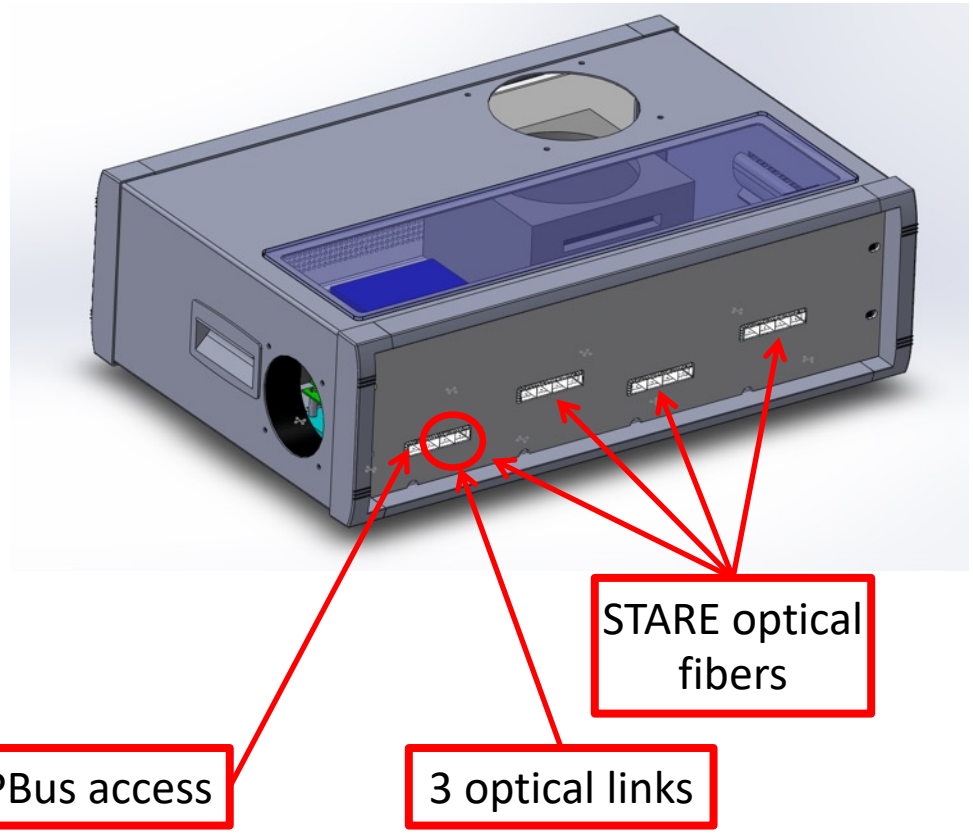


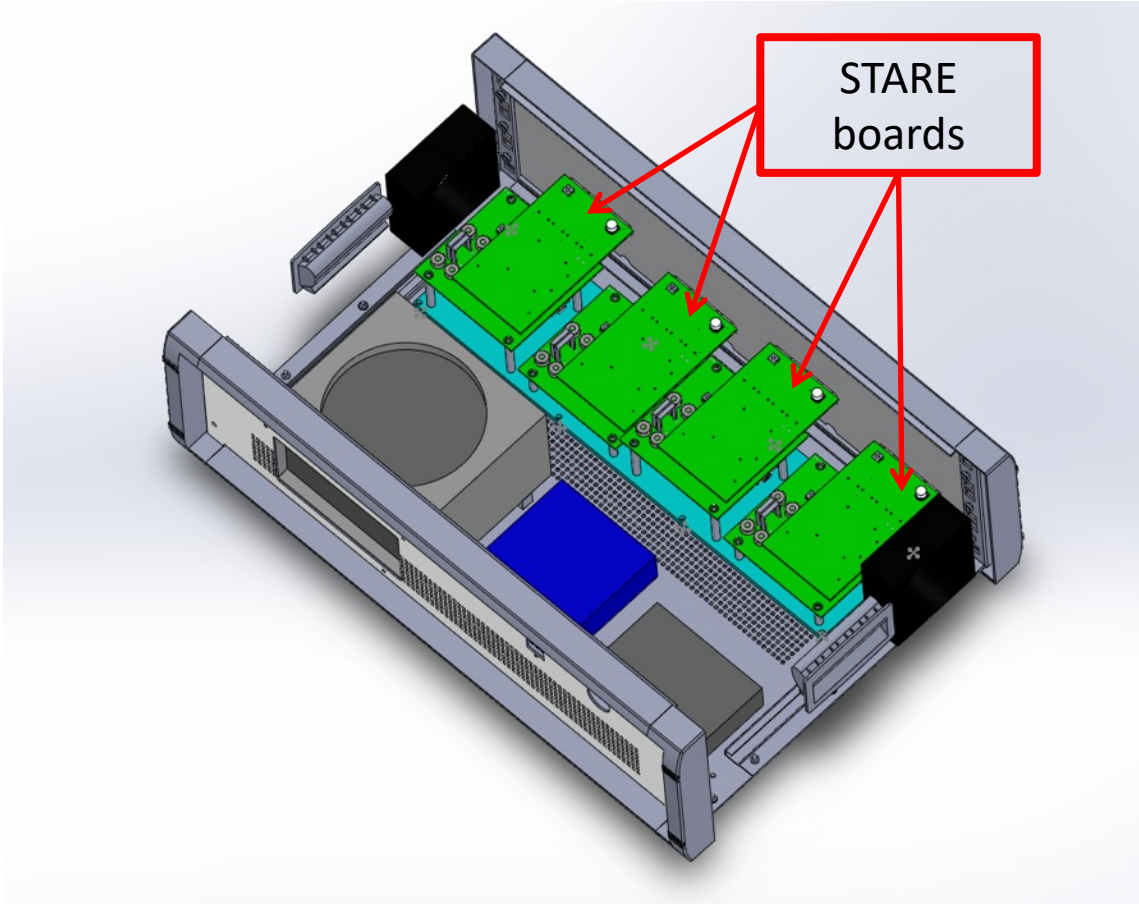
12 Readout Links Bench

- Designed to simulate actual and future 10 Ge crystals transferring up to 10 Gbps each or 4 Ge crystals transferring up to 30 Gbps each.
- 4 STARE V2 running: 12 optical links available (10 Gb/s each) for tests servers capabilities and server configurations for 10 Gbps receivers.
- RUDP tests on multiple crystals. Check for Packets loss statistics and qualify RUDP utility for the project.
- Back pressure program tests and qualification.
- High transfer rate demonstrator
- JTAG control for programming FPGAs.
- IPBus access for slow control actions.



- CAD views : ready to manufacture, delivery Feb 2023

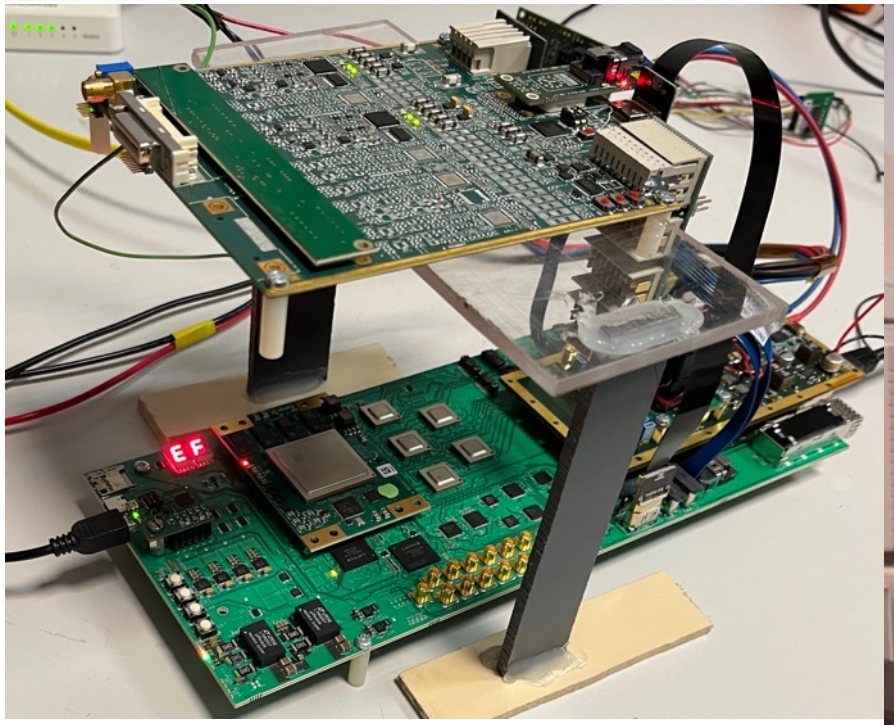




Orsay Test Benchs

3 Test benches in Orsay :

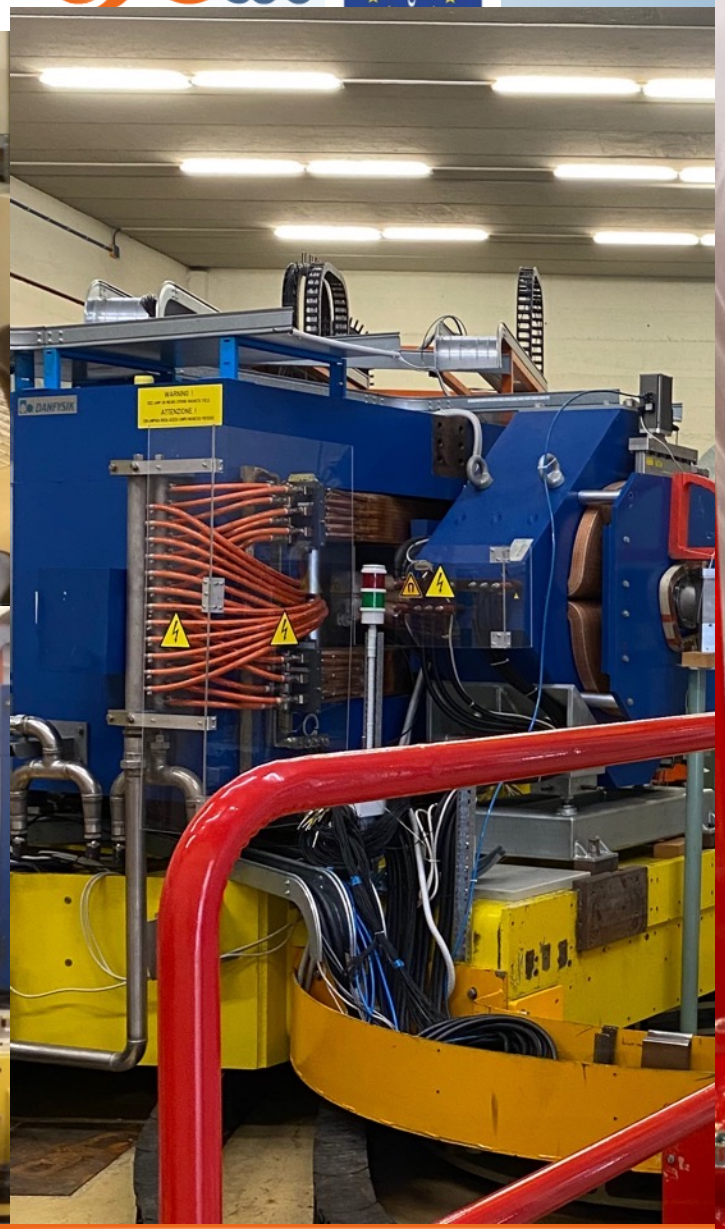
- 1 standalone in 102 building for Monique
- 1 standalone in AP1 104 building
- 1 with CAP board in AP1 104



CEM @ LNL 2021 and 2022

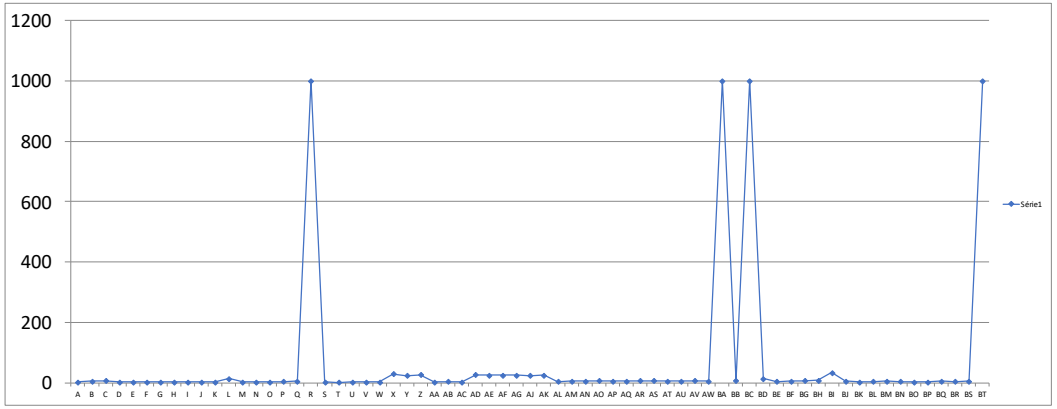
EMC @ LNL

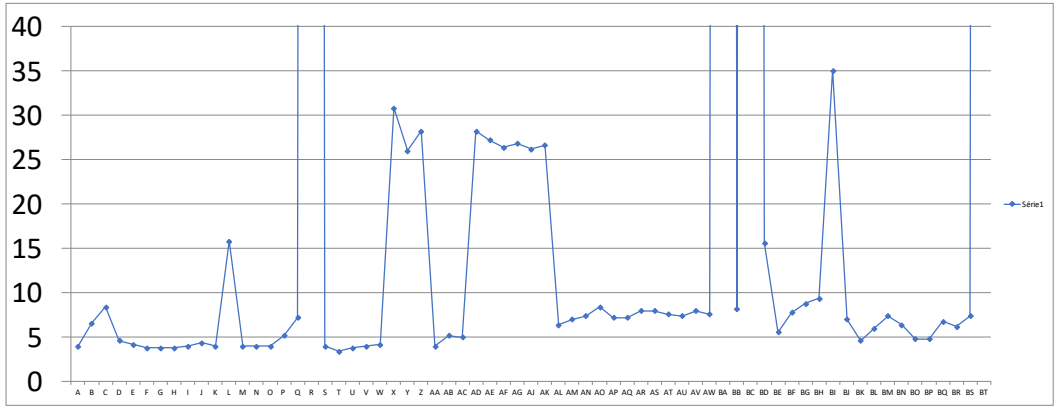
- Signal integrity is extremley important in AGATA (Energy resolution)
- At least 2 EMC qualifications for each phase
- Tests of all the mechanical and electrical connections
- 3 Visits @LNL . July 2021, November 2021 and April 2022.
- More 150 test points per test
- 3 types of tests (4Wire resistance, Direct and indirect injection).
- First visit in July gave successful results.



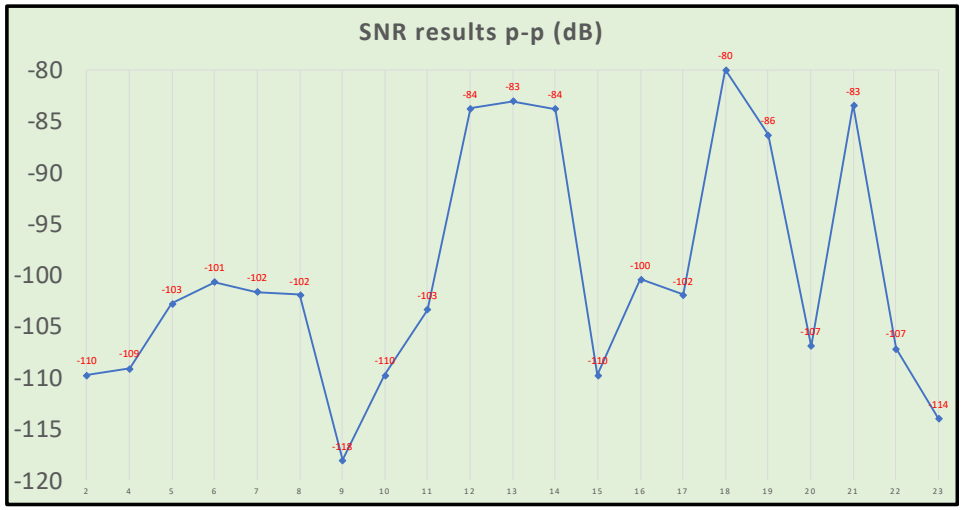
EMC @ LNL in July 2021

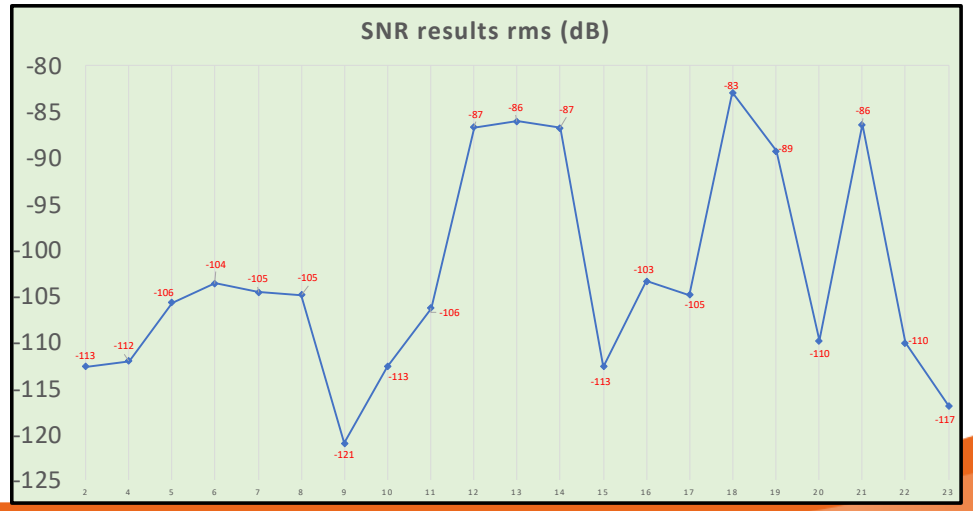
4 wire resistance measurements (mOhms)



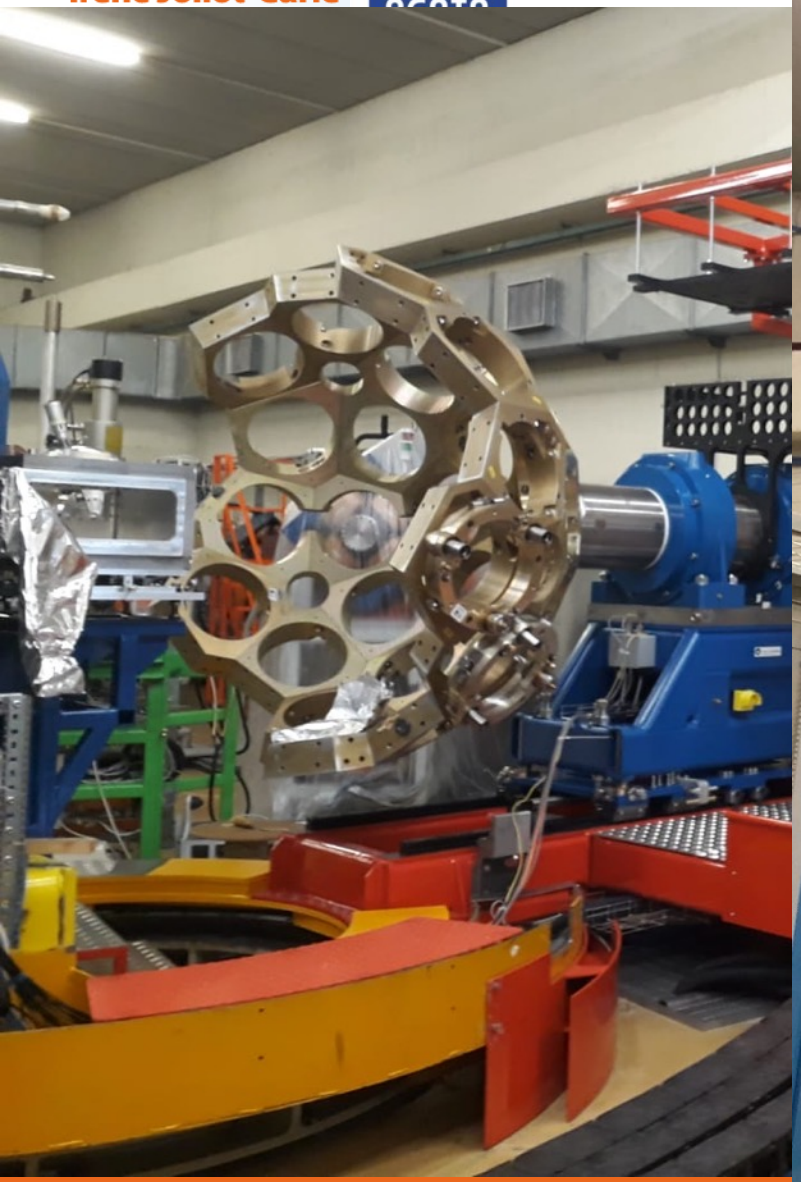


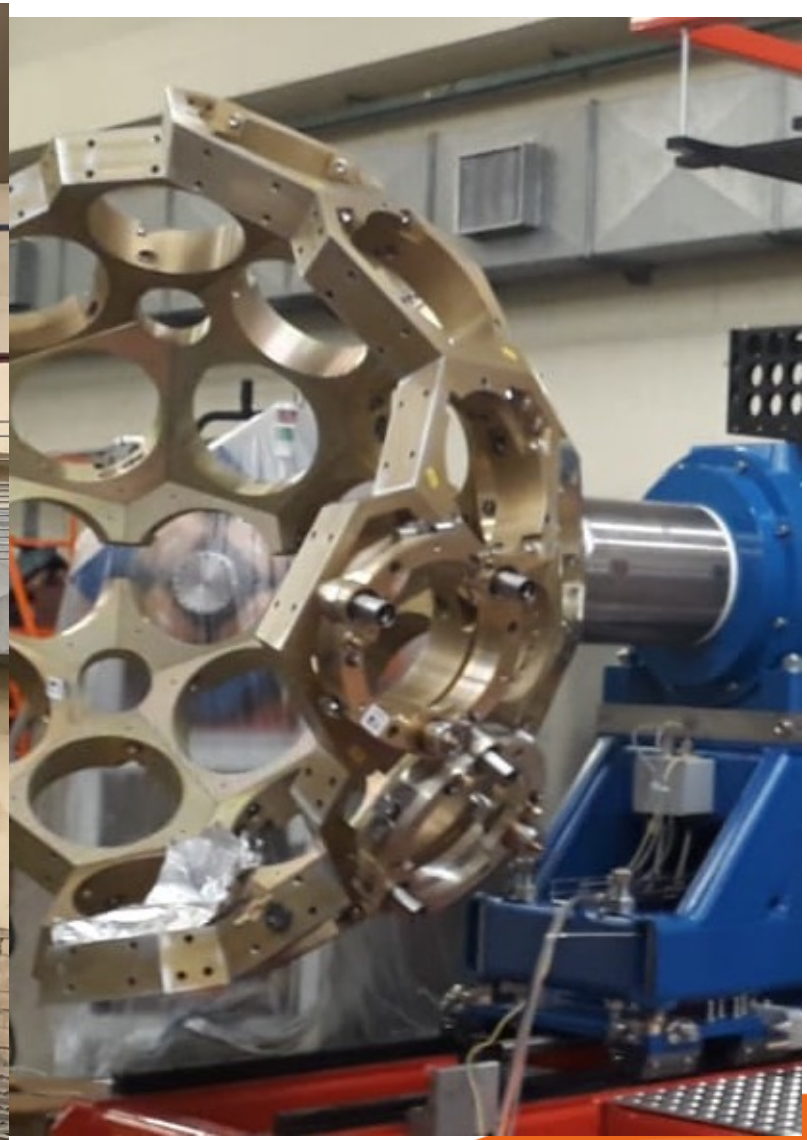
Direct injection to the ground using 4 kV pulser



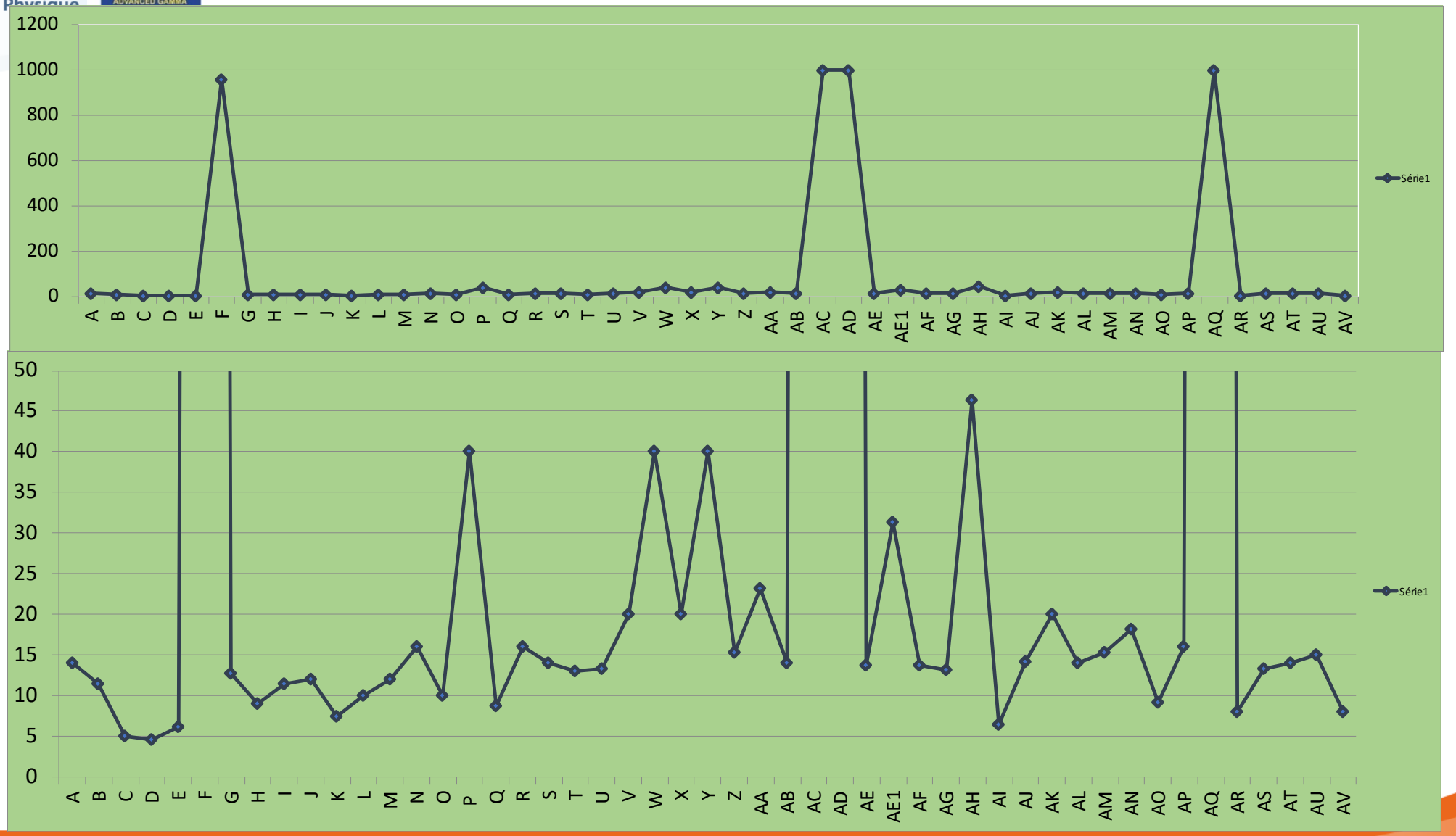


EMC @ LNL November 2021



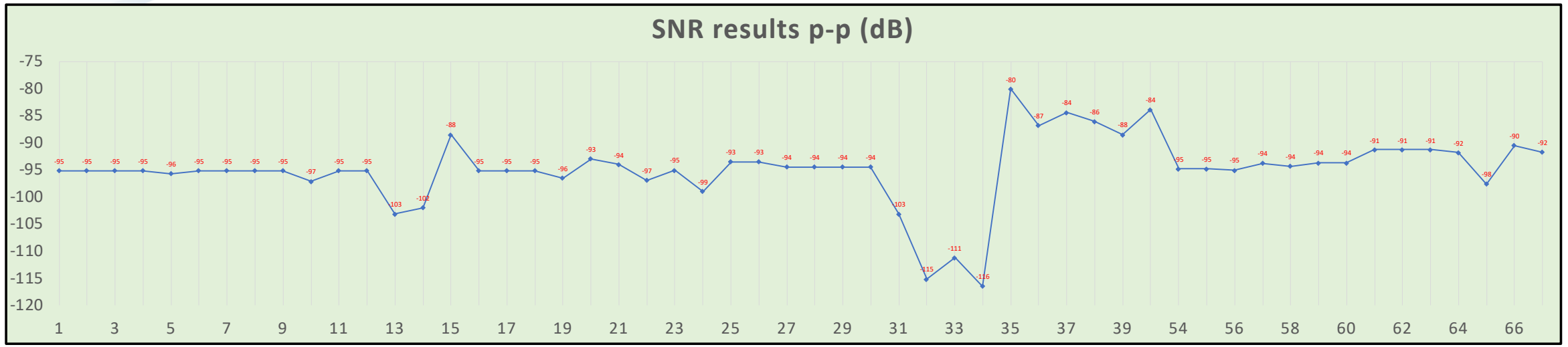


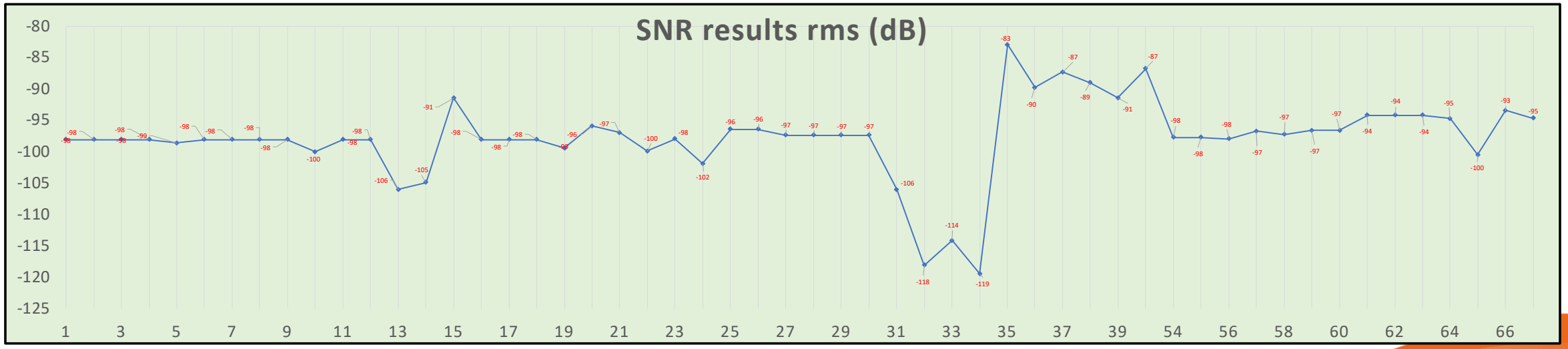
4 wire resistance measurements (mOhms)



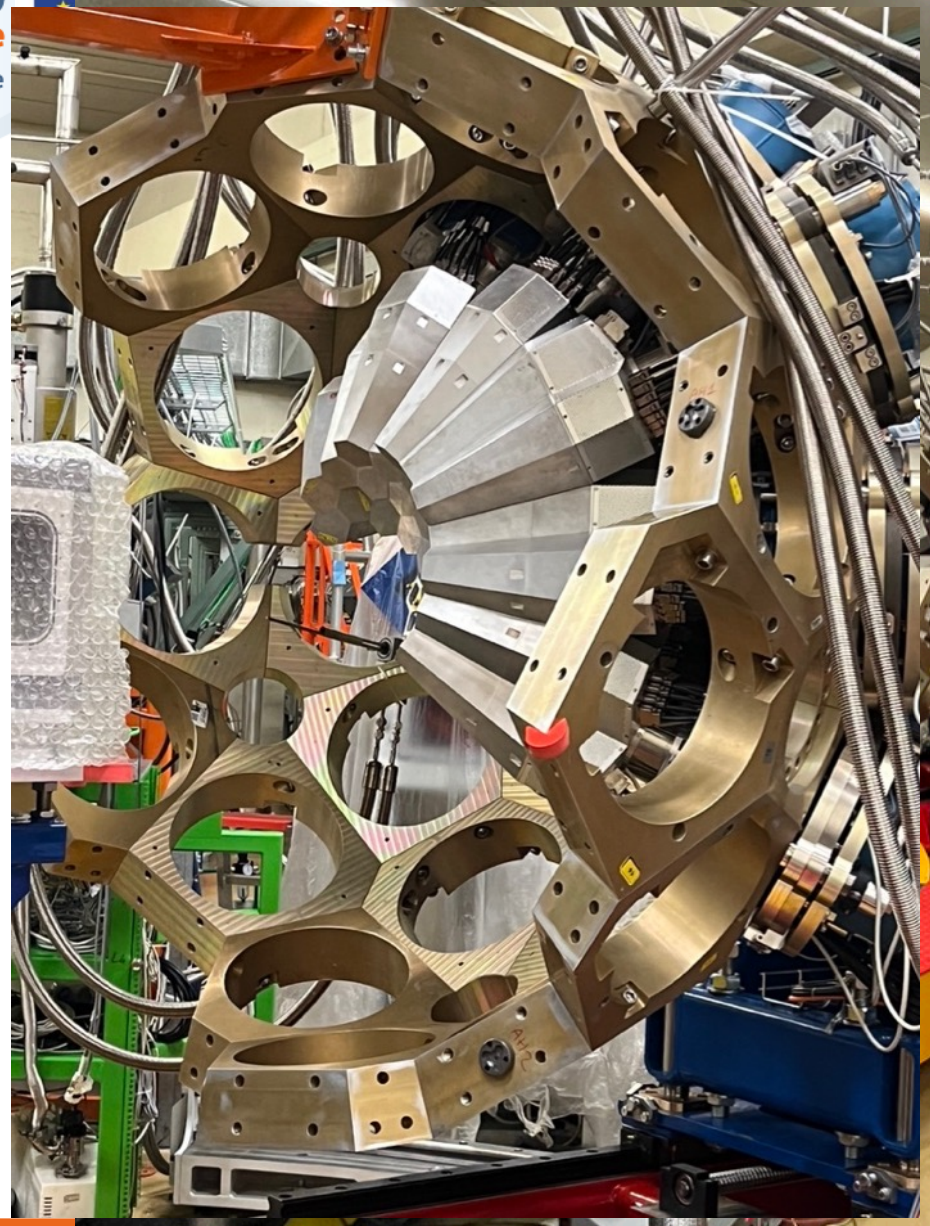
EMC @ LNL November 2021

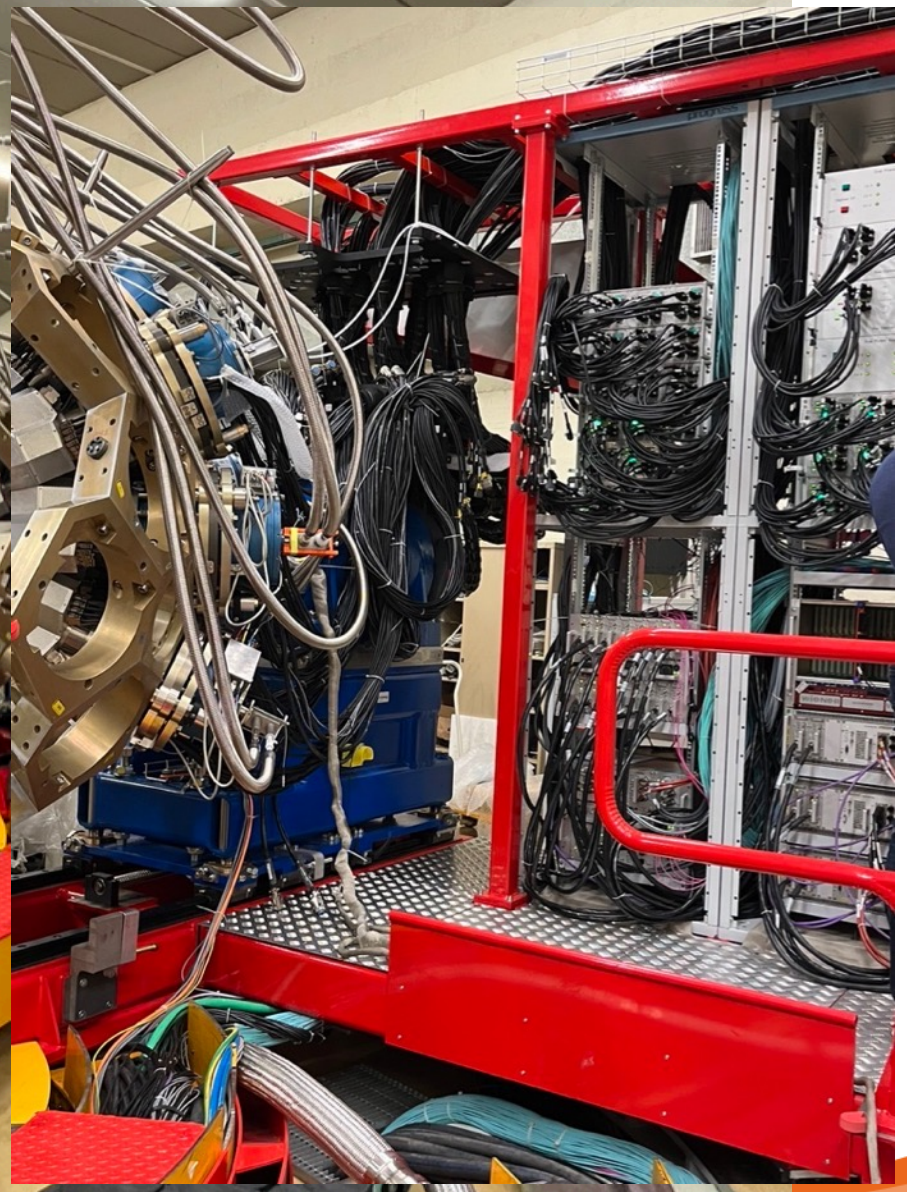
Direct injection to the ground using 4 kV pulser

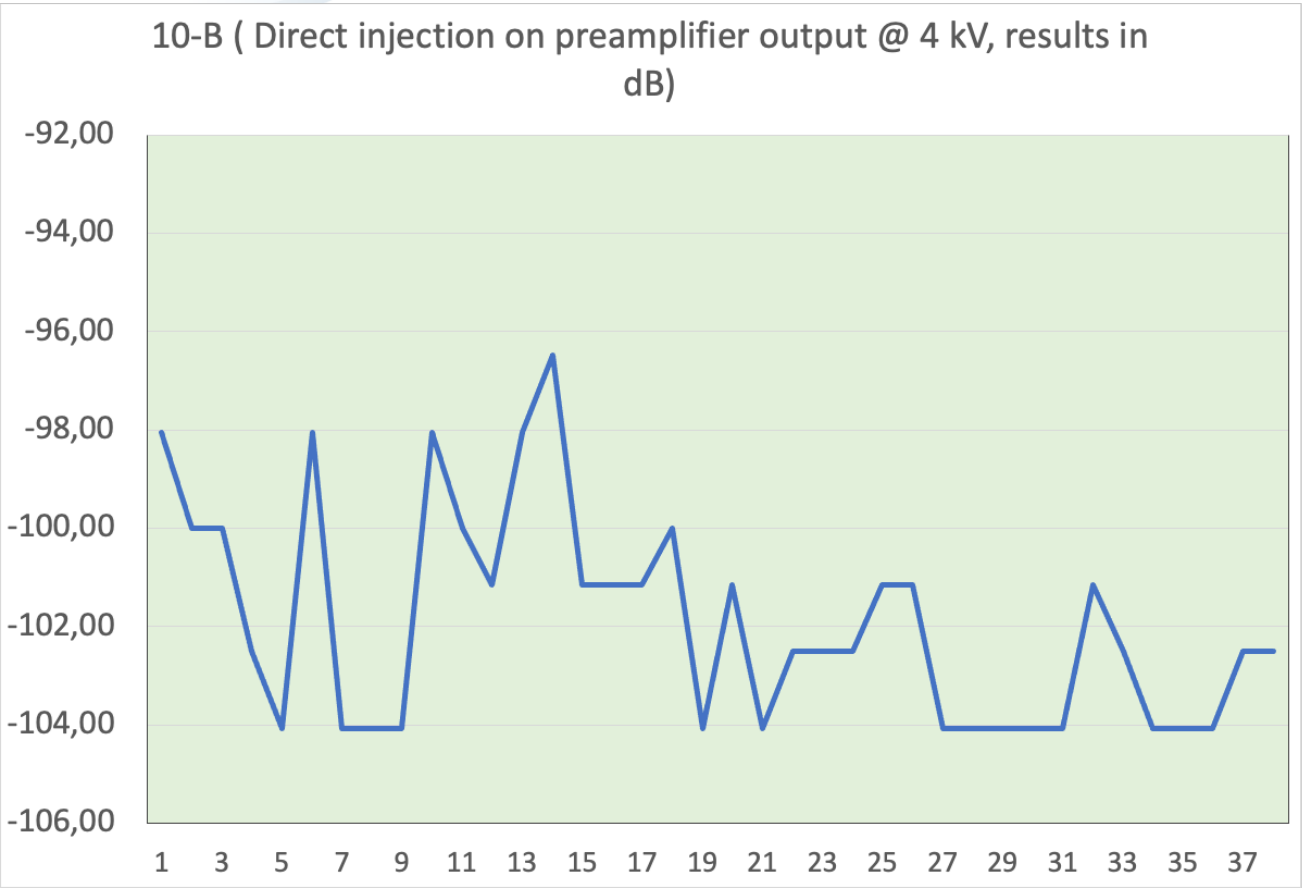


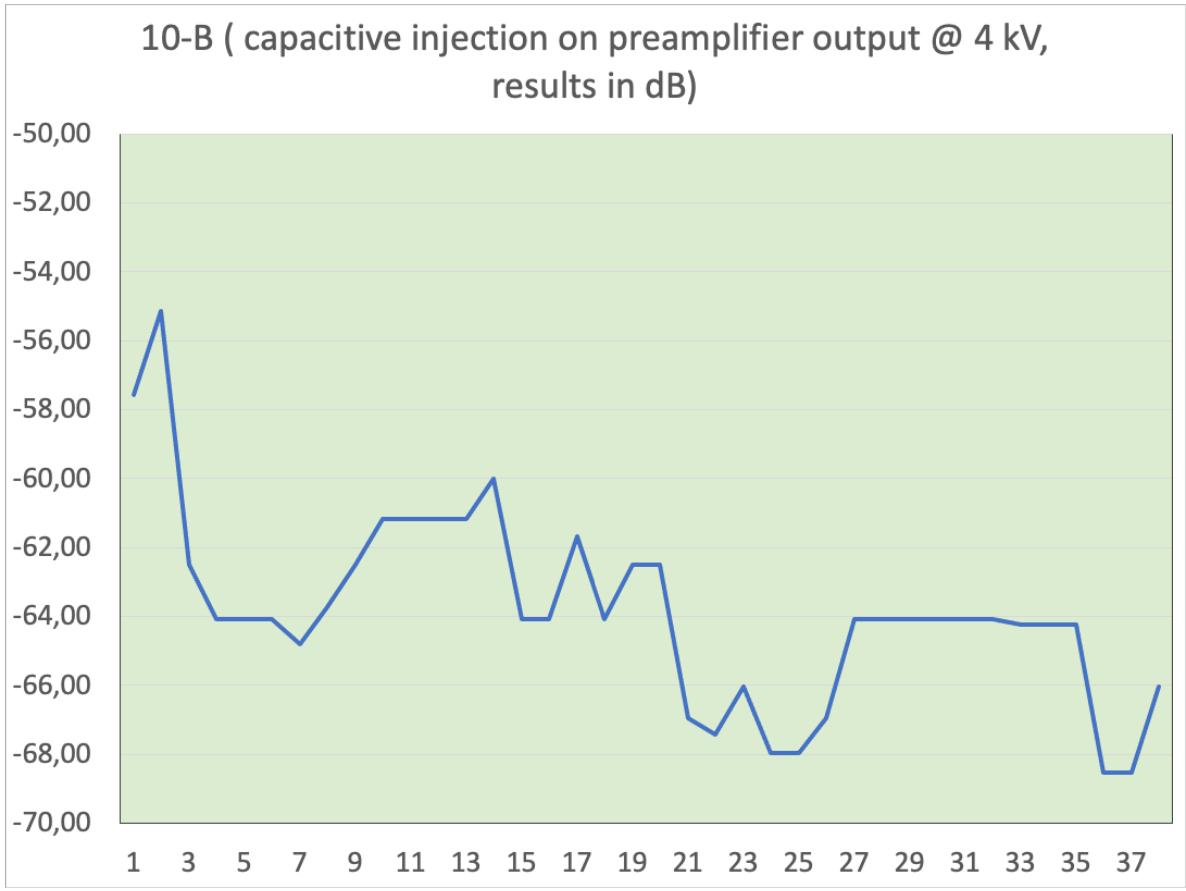


EMC @ LNL April 2022



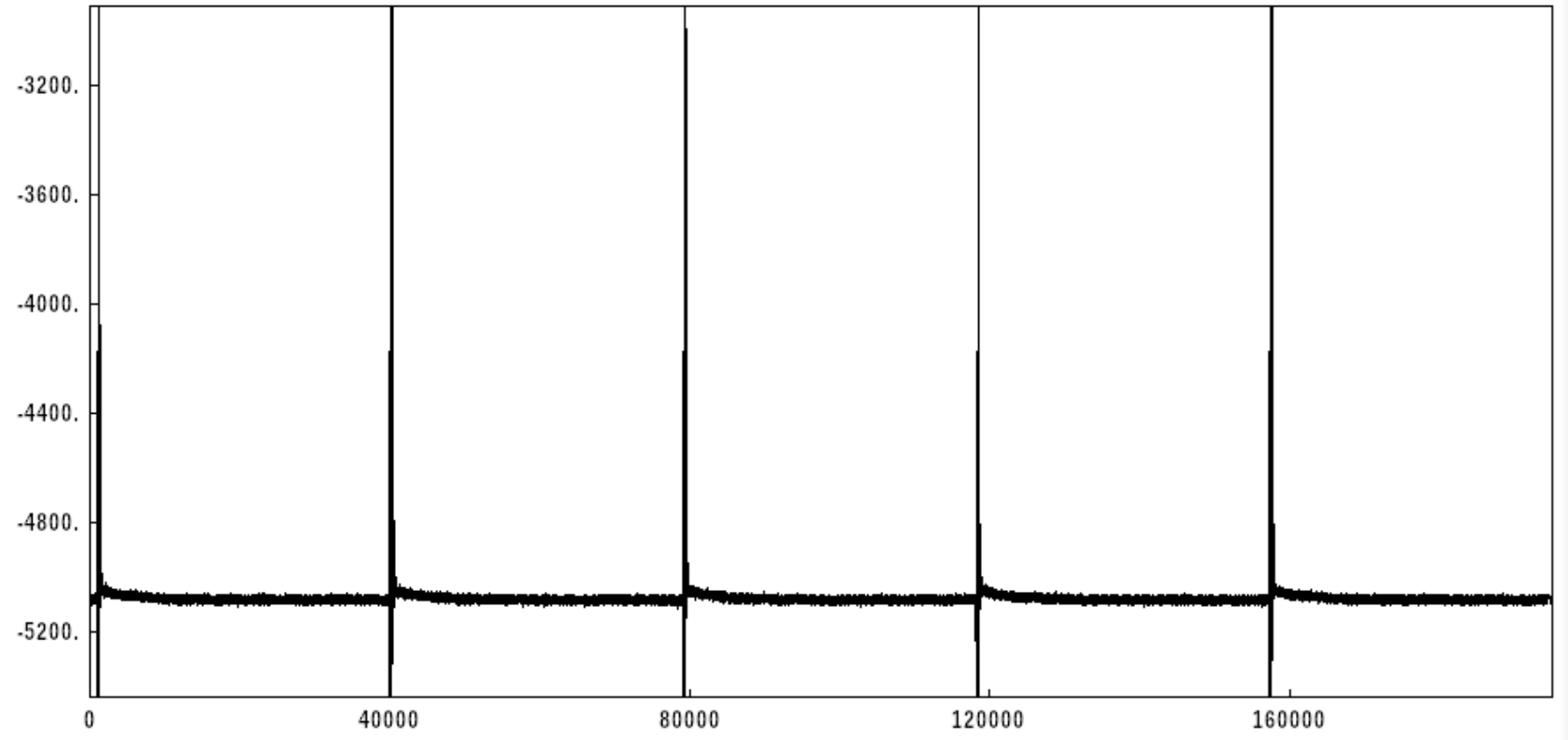



10-B (Direct injection on preamplifier output @ 4 kV, results in dB)
-92,00
-94,00
-96,00
-98,00
-100,00
-102,00
-104,00
-106,00
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37

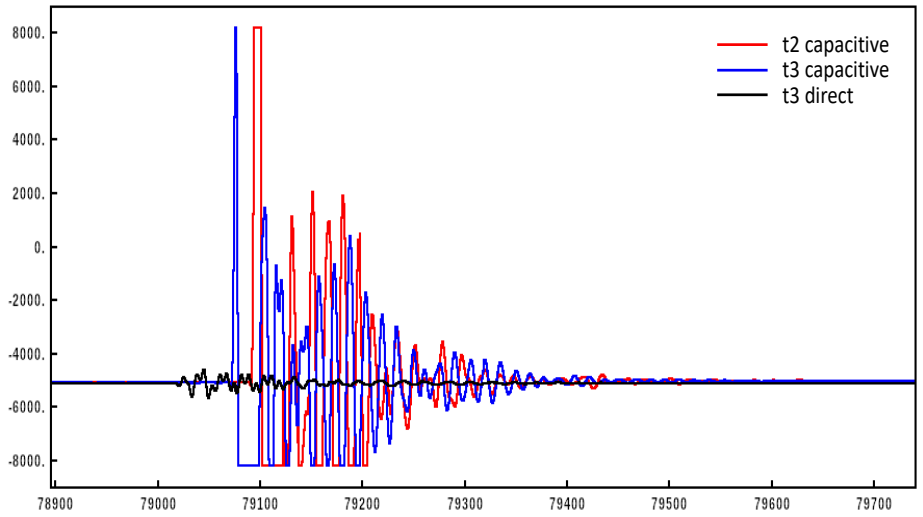

10-B (capacitive injection on preamplifier output @ 4 kV, results in dB)
-50,00
-52,00
-54,00
-56,00
-58,00
-60,00
-62,00
-64,00
-66,00
-68,00
-70,00
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37

Detector 01A traces

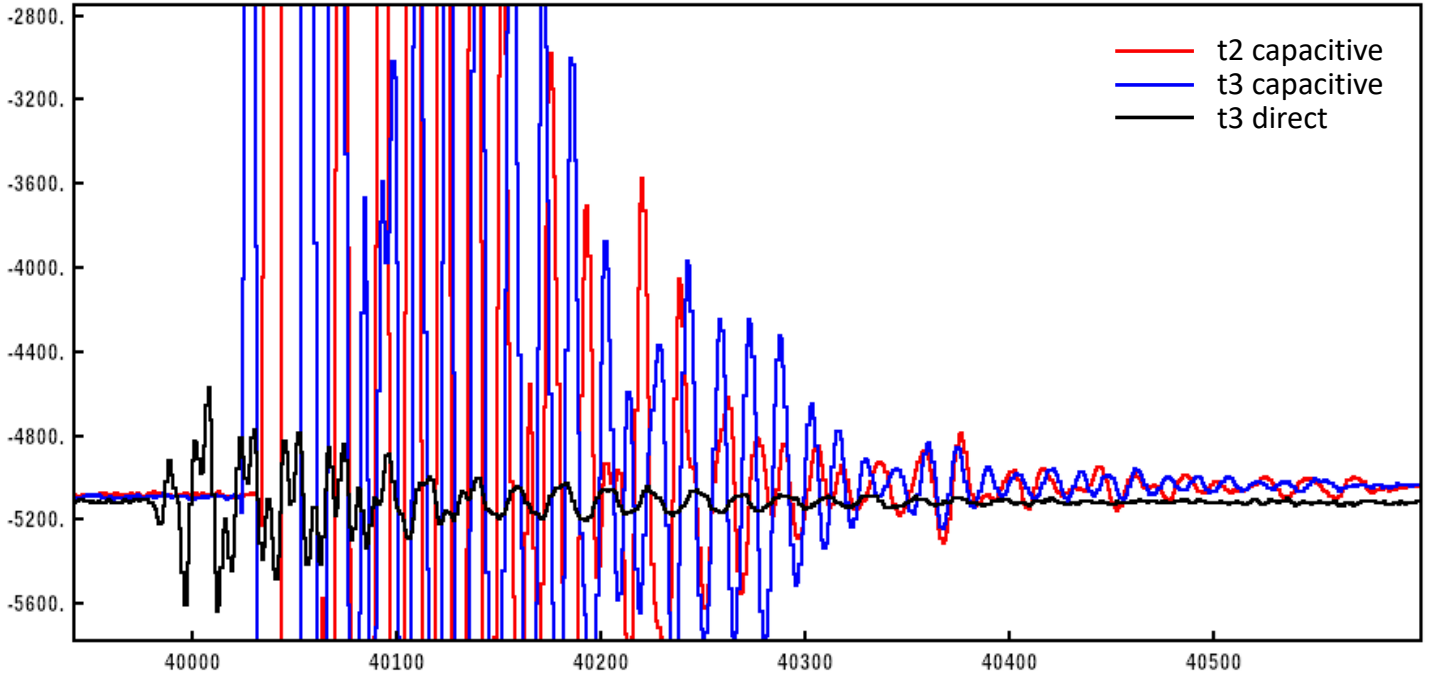
Capacitive injection noise effect



Detector 01A traces

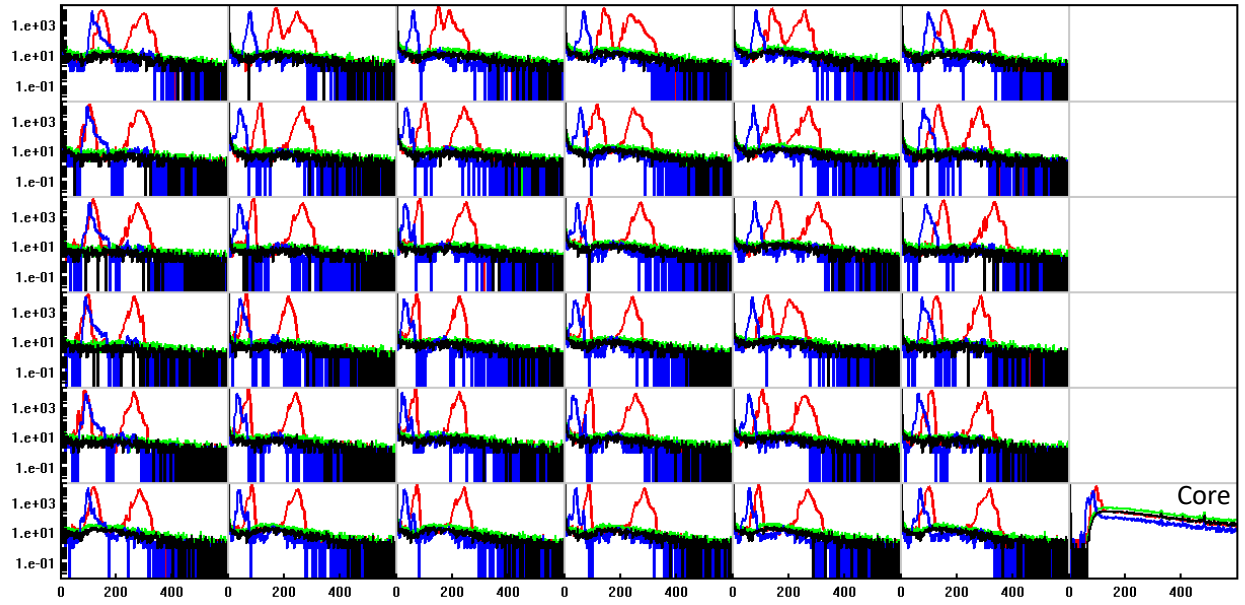


Detector 01A traces



Detector 01A energy spectra

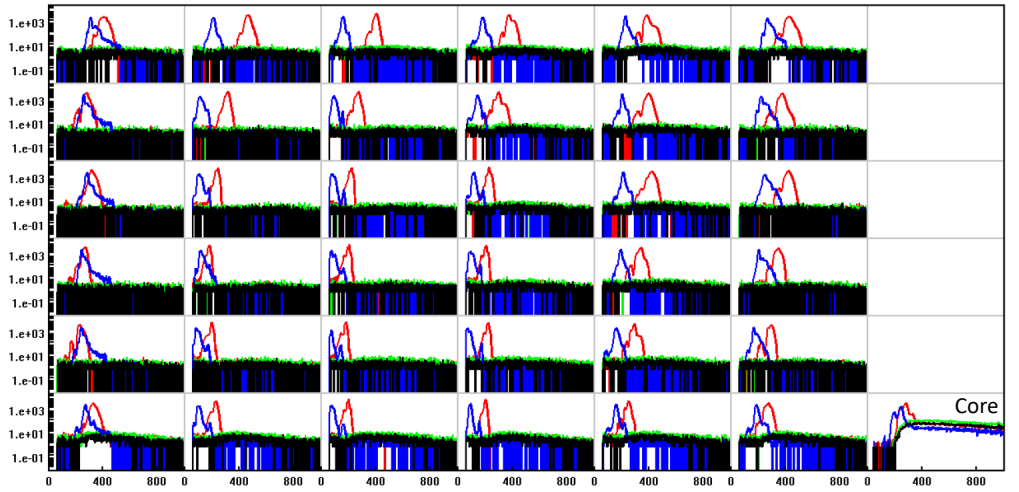
t1 without noise
t2 capacitive
t3 capacitive
t3 direct



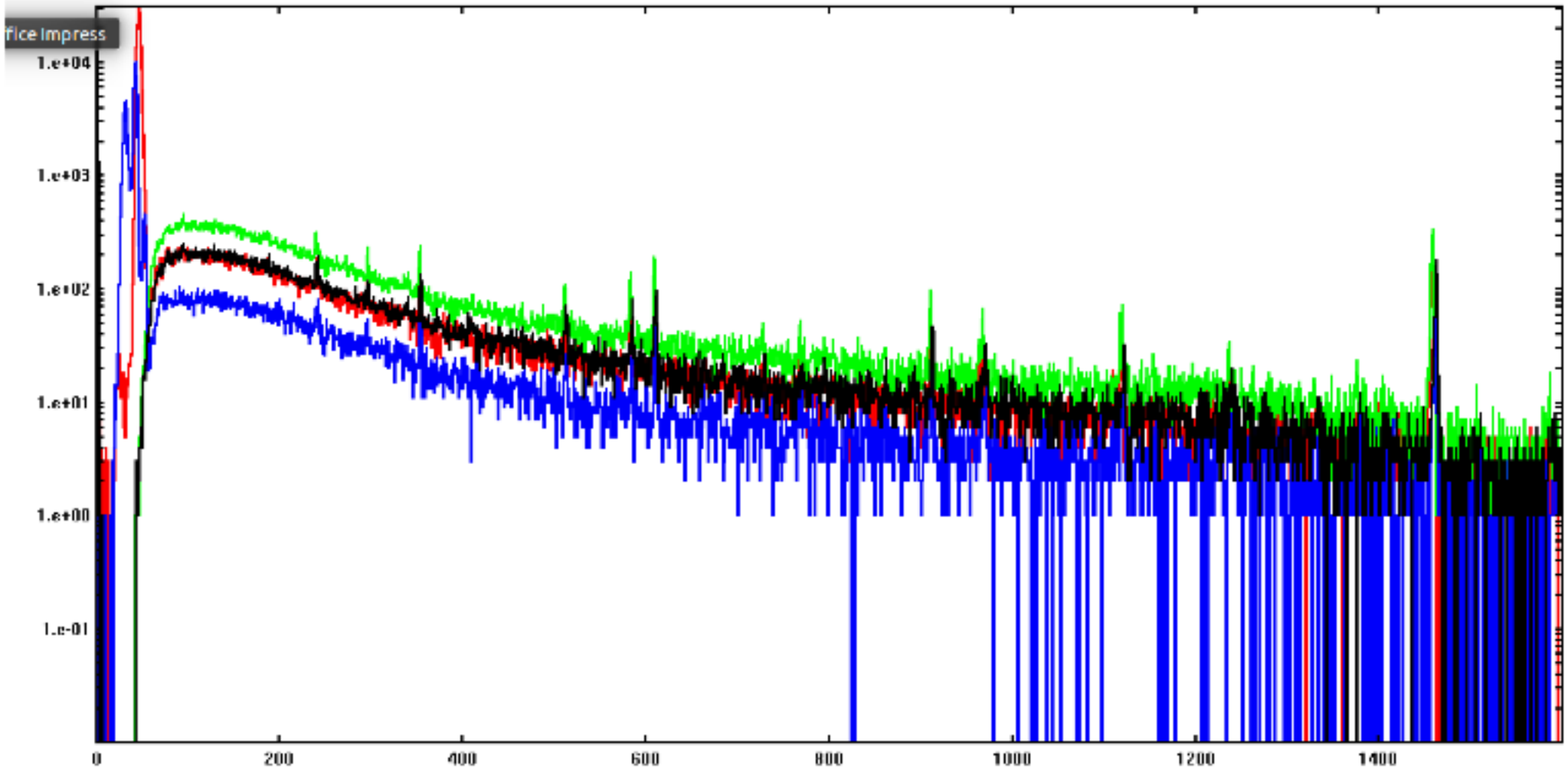
Amplitud energy spectra

Detector 01A energy spectra

t1 without noise
t2 capacitive
t3 capacitive
t3 direct



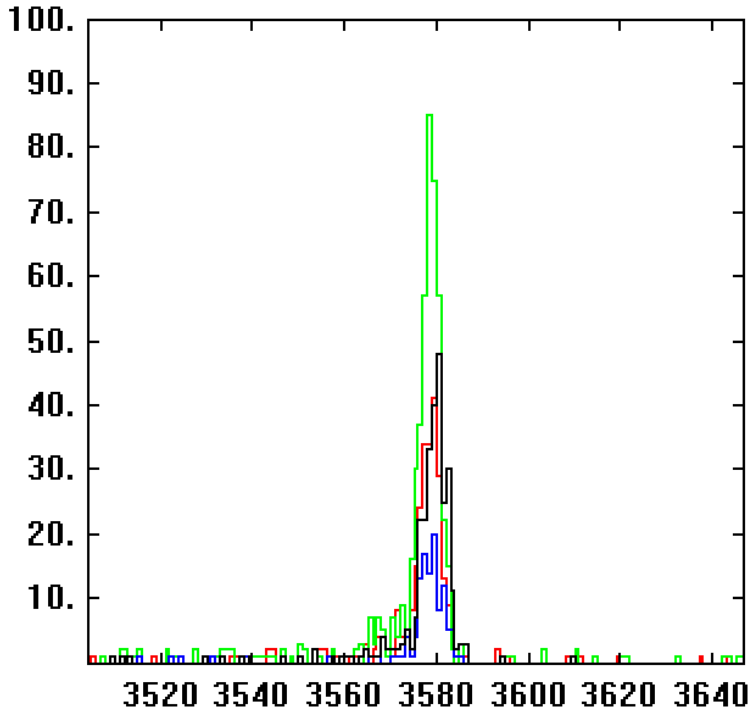
Calibrated energy spectra


fice Impress
1.e+04
1.e+03
1.e+02
1.e+01
1.e+00
1.e-01
0
200
400
600
800
1000
1200
1400

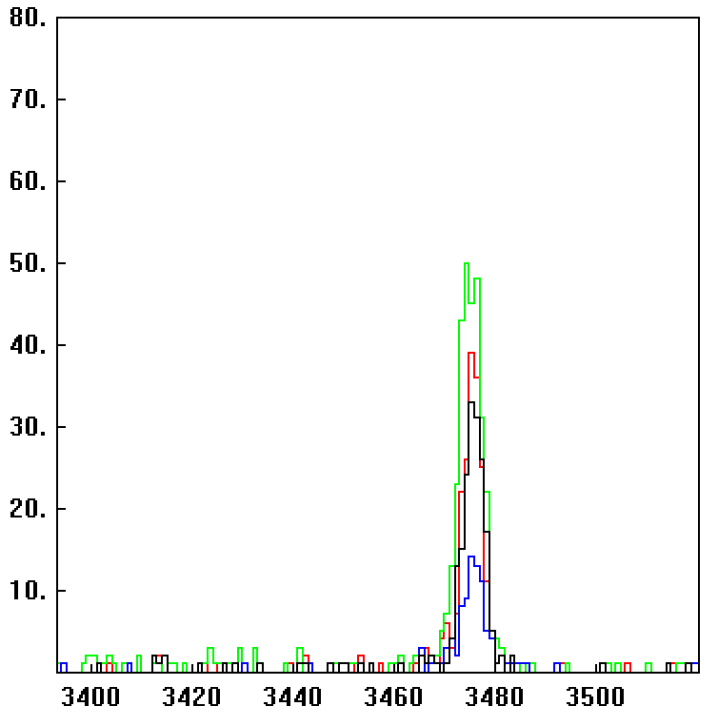
Core energy spectra

t1 without noise
t2 capacitive
t3 capacitive
t4 direct

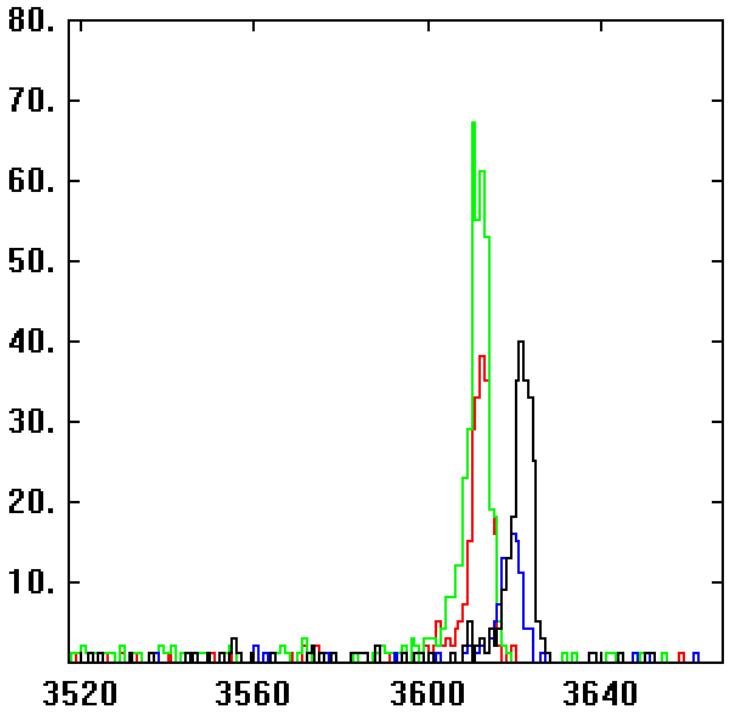
01A



01B



01C



Amplitud energy spectra

Merci