TPC electronics cooling design status

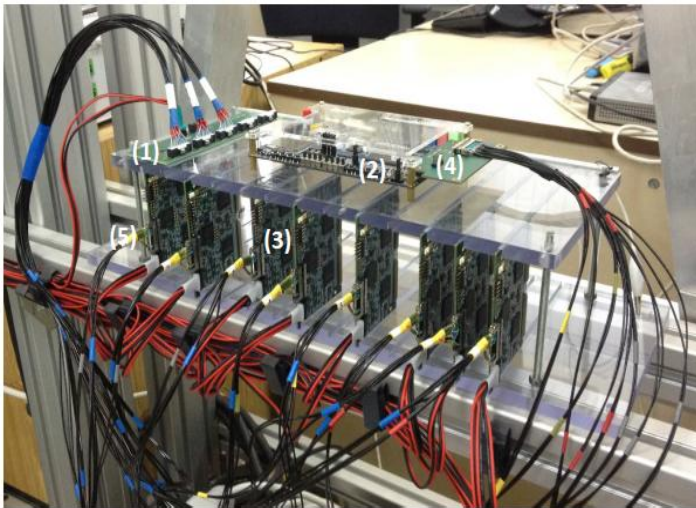
Prezented by V.Chepurnov

TPC electronics design

SAMPA chips (4500 pc): delivered

Pilot system – 512 ch

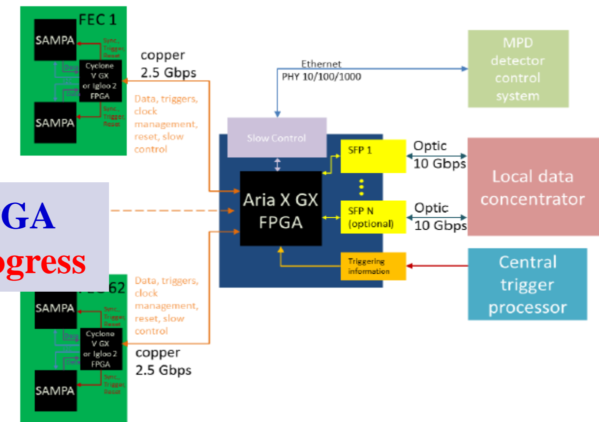
Eight cards pilot system



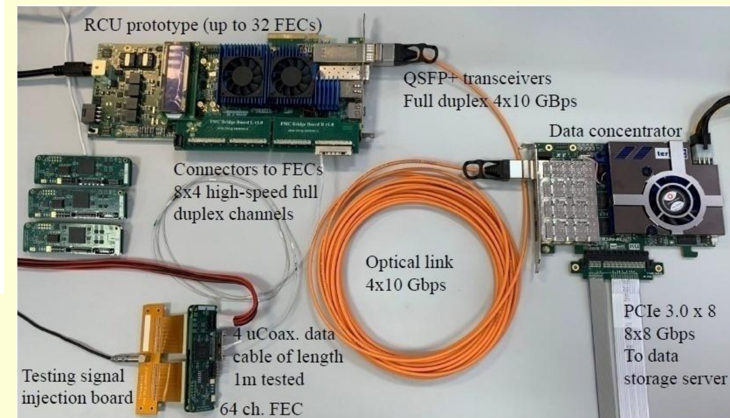
1) Trigger, clock, reset distr. board .
2) System controller.
3) 64-ch SAMPA- FEC.
4) HSSI (up to 2.5 GBps; up to 8 FECs).
5)Data/conf. full duplex HSSI port; clock 40 MHz, trigger, reset.

Status: tested

Block diagram of one chamber readout

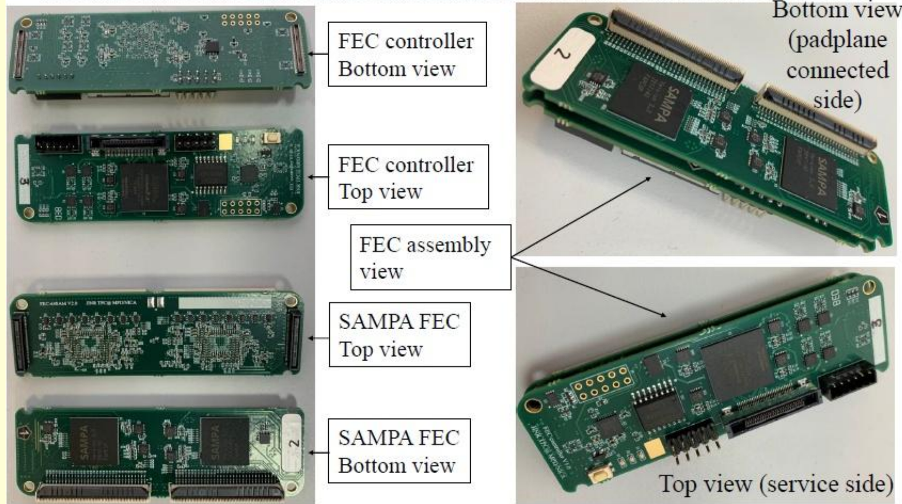


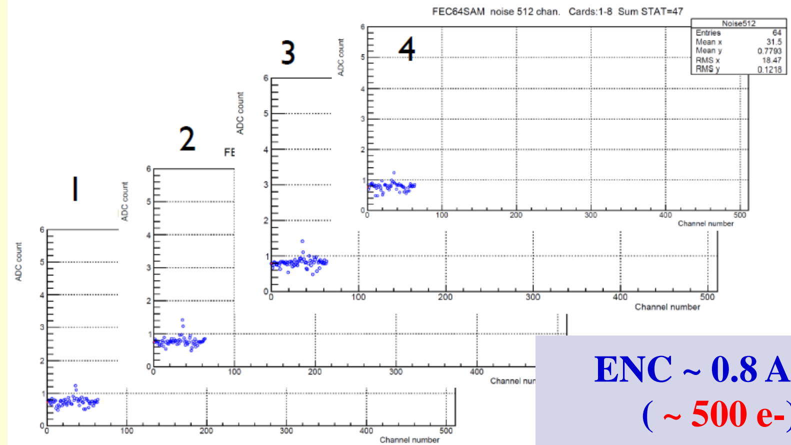
tests with FPGA Aria X – in progress



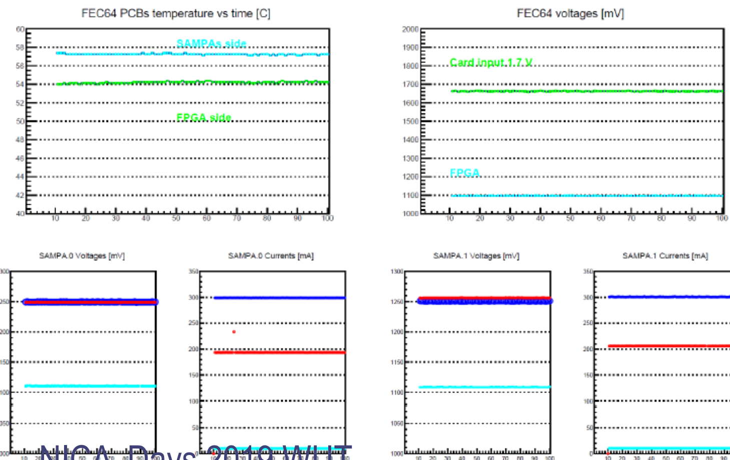
Pilot readout system for few ROCs – proposal

TPC electronics: FE cards



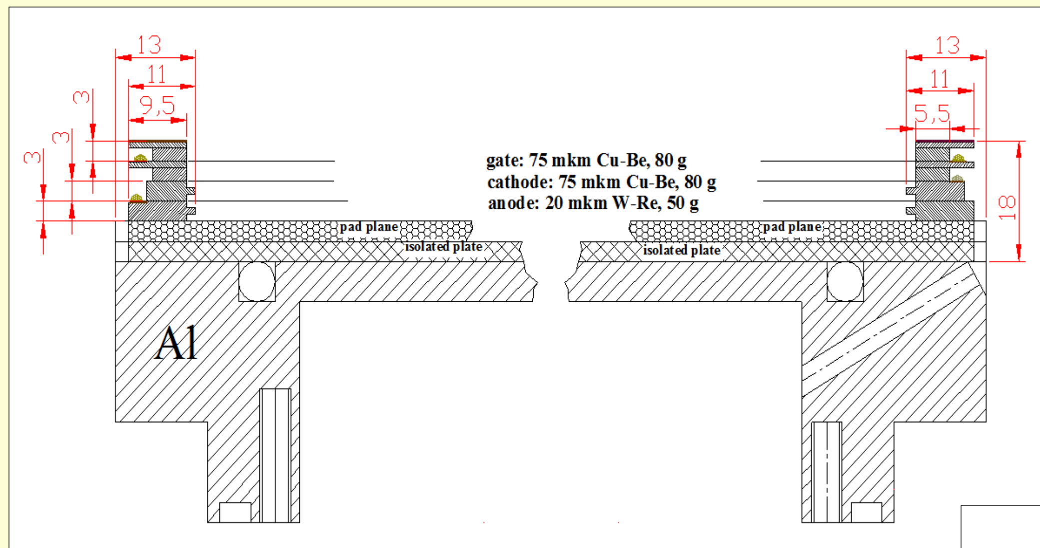


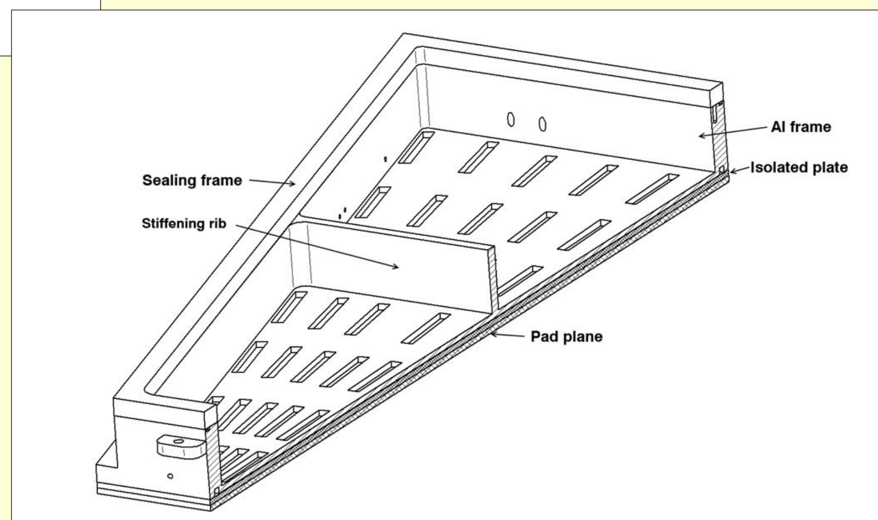
ENC ~ 0.8 ADC
(~ 500 e-)



T SAMPA = 57 degree
T FPGA = 54 degree
Board LV: 1.7V & 1.1V
SAMPA (2 pc): P=2W
FPGA: P=2W

ROC chamber

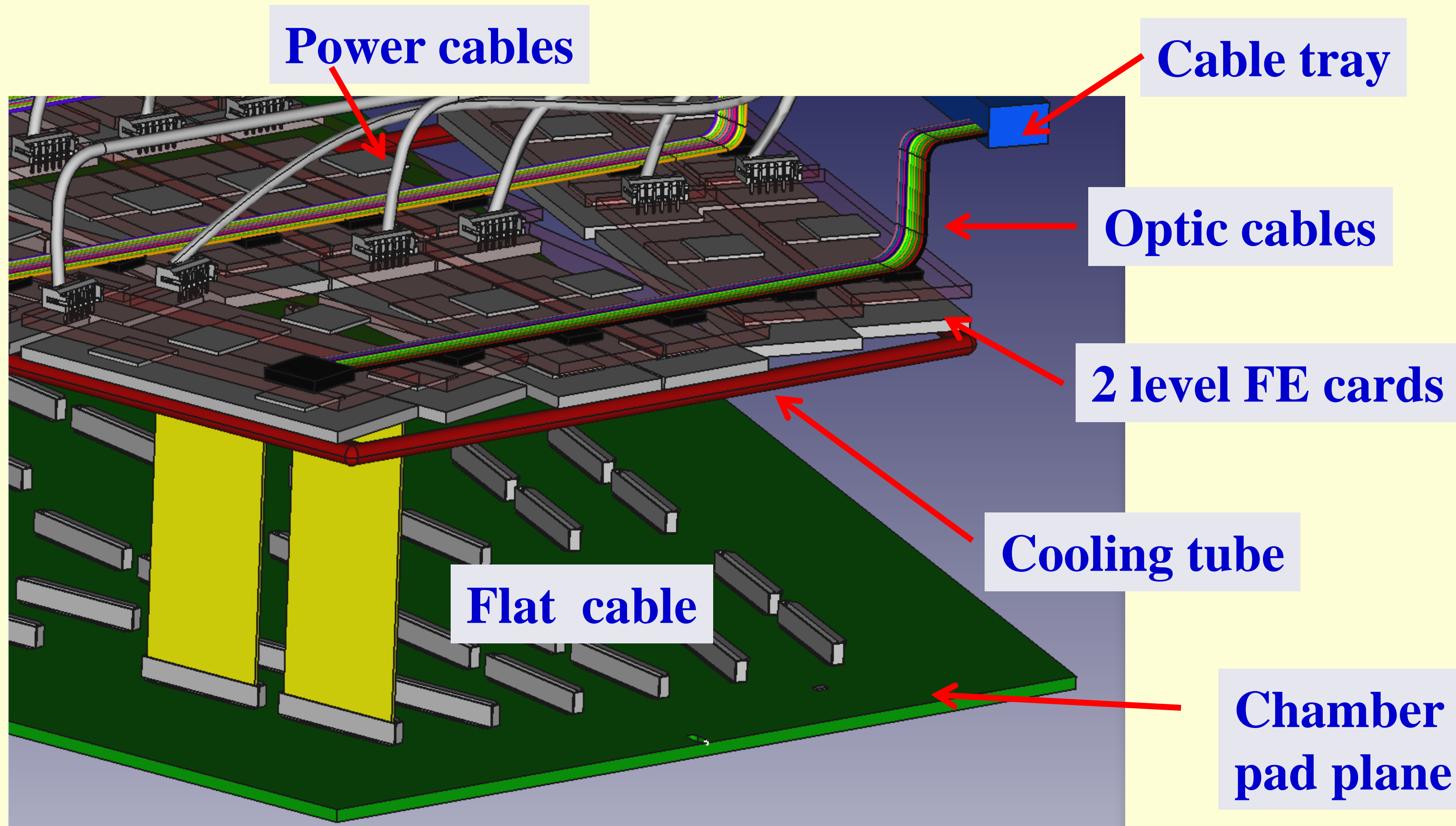




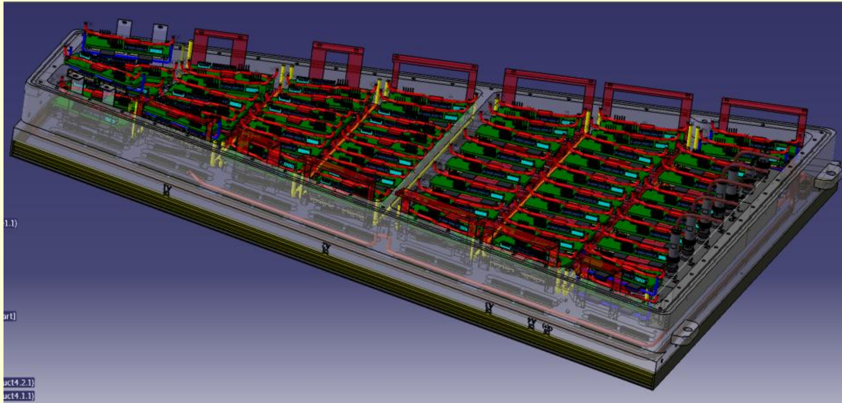
Requirements:

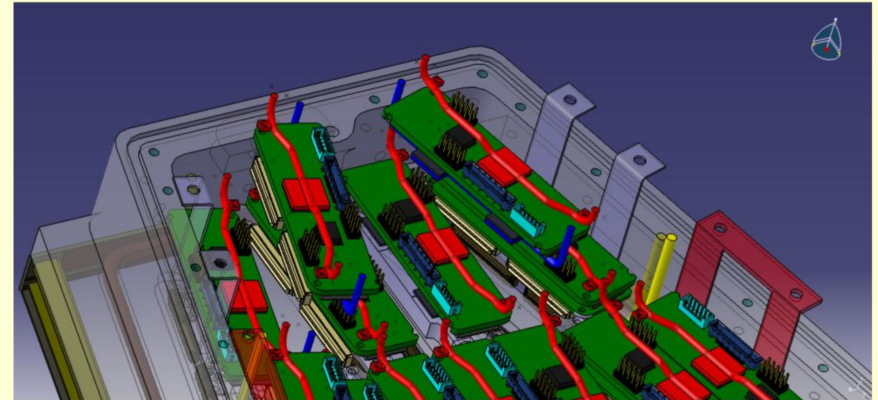
- for minimization TPC end cap radiation length:
  - FE boards must be fixed parallel to ROC chamber surface;
  - material for cooling plate – aluminum instead Cu;
- TPC gas mixture temperature must be very stable: T=(To+/-0.25) degree;
- length of flat cable “pad plane – FE card” must be minimal;
- total electrical power FE electronics – about 10 kW. FE cards consumption is about 2x1W (SAMPA) + 2W (FPGA);
- FE cooling radiators must be with max efficiency (to prevent pad plane hitting);
- easy FE installation and reparation;
- easy access to connectors on board with FPGA.

ROC chamber + electronics integration: conceptual design



TPC electronics: FE cards integration and cooling (option 3)

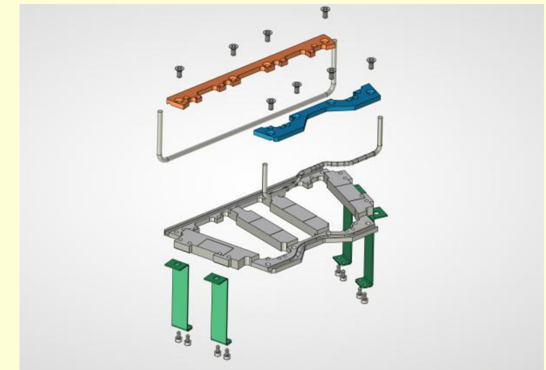


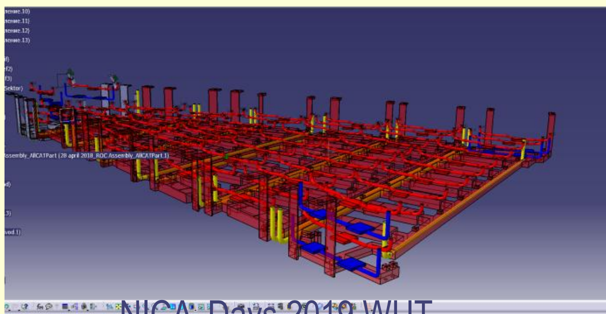


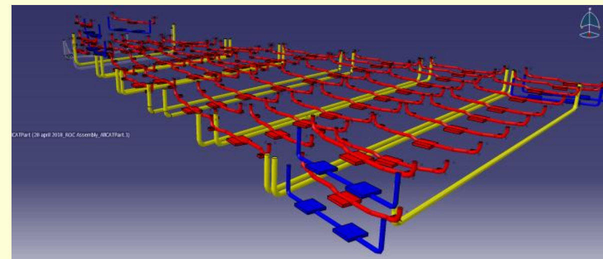
Many radiators (8pc):

SAMPAs - cooling by radiator

FPGA – cooling by pad with tube

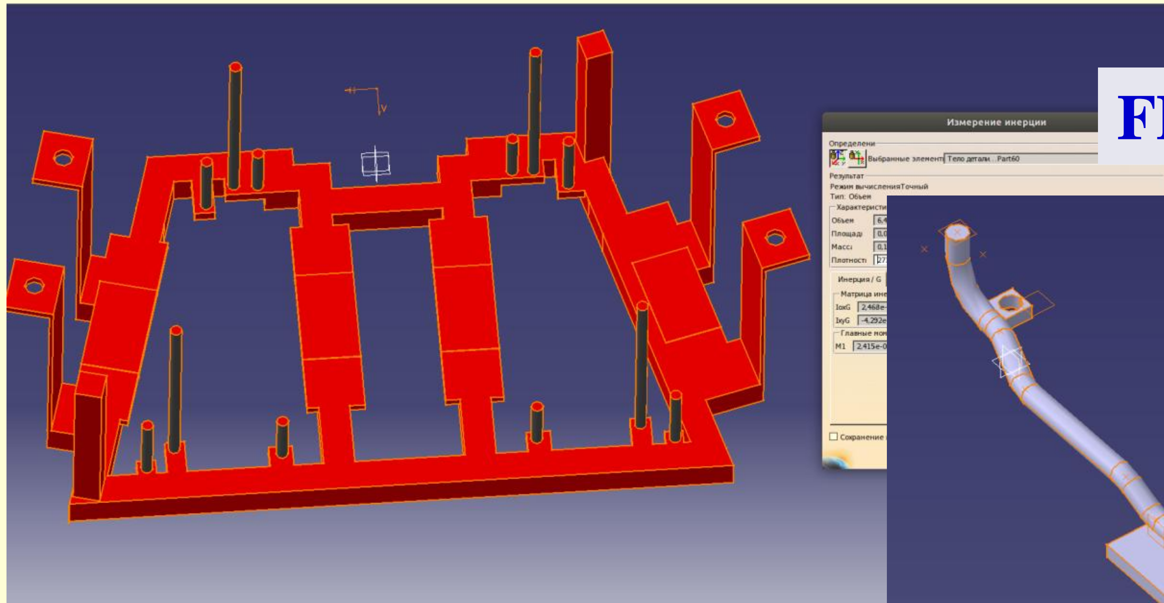




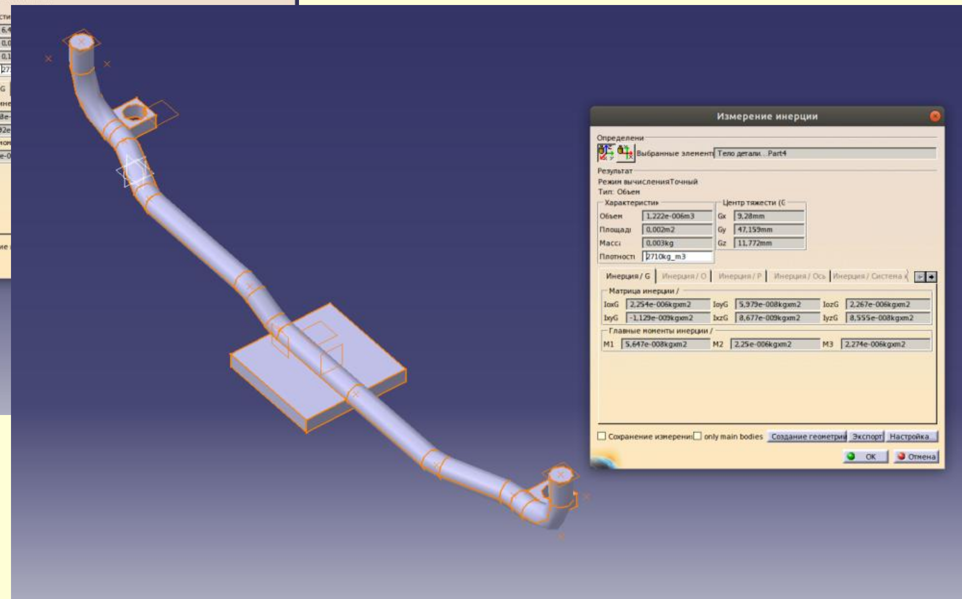


TPC electronics: FE cards integration and cooling (option 3)

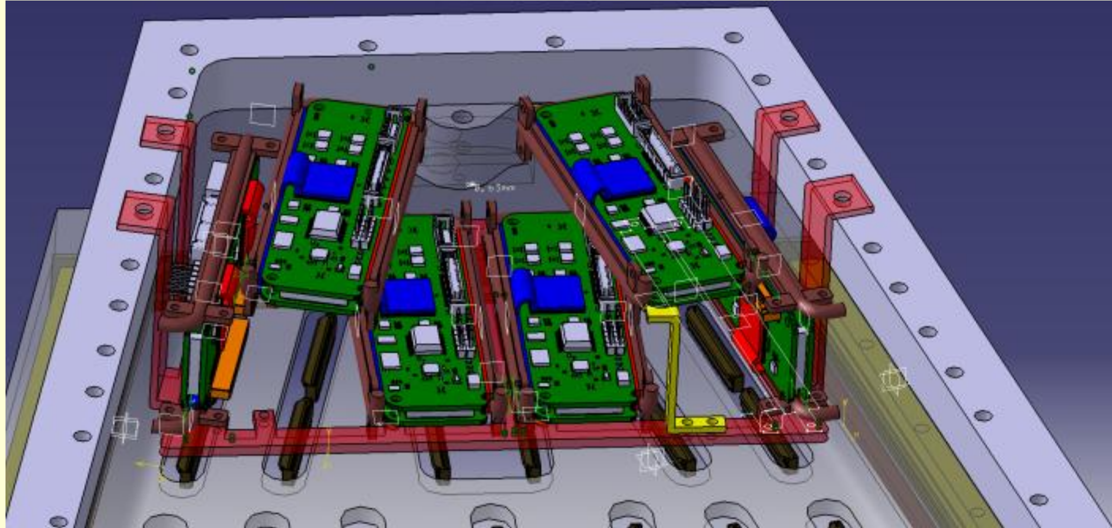
SAMPA cooling radiator

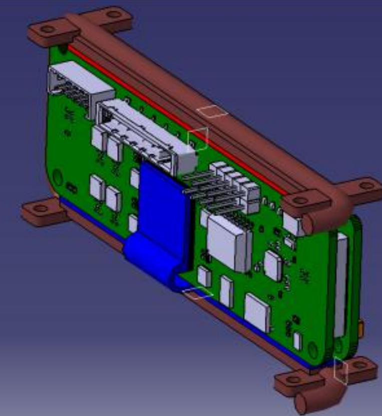


FPGA cooling radiator



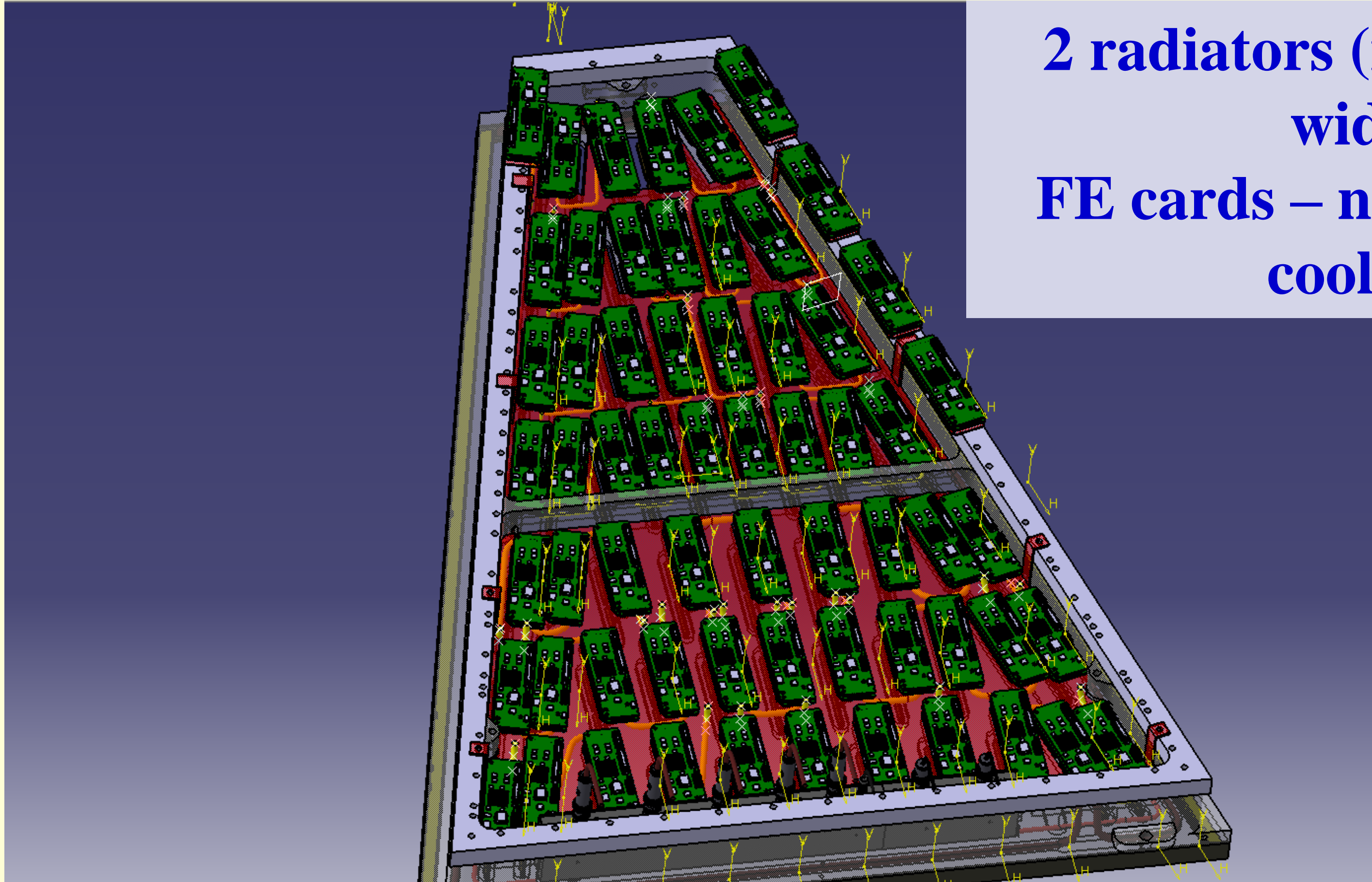
TPC electronics: FE cards integration and cooling (option 2)





Both FE cards cooling by tube

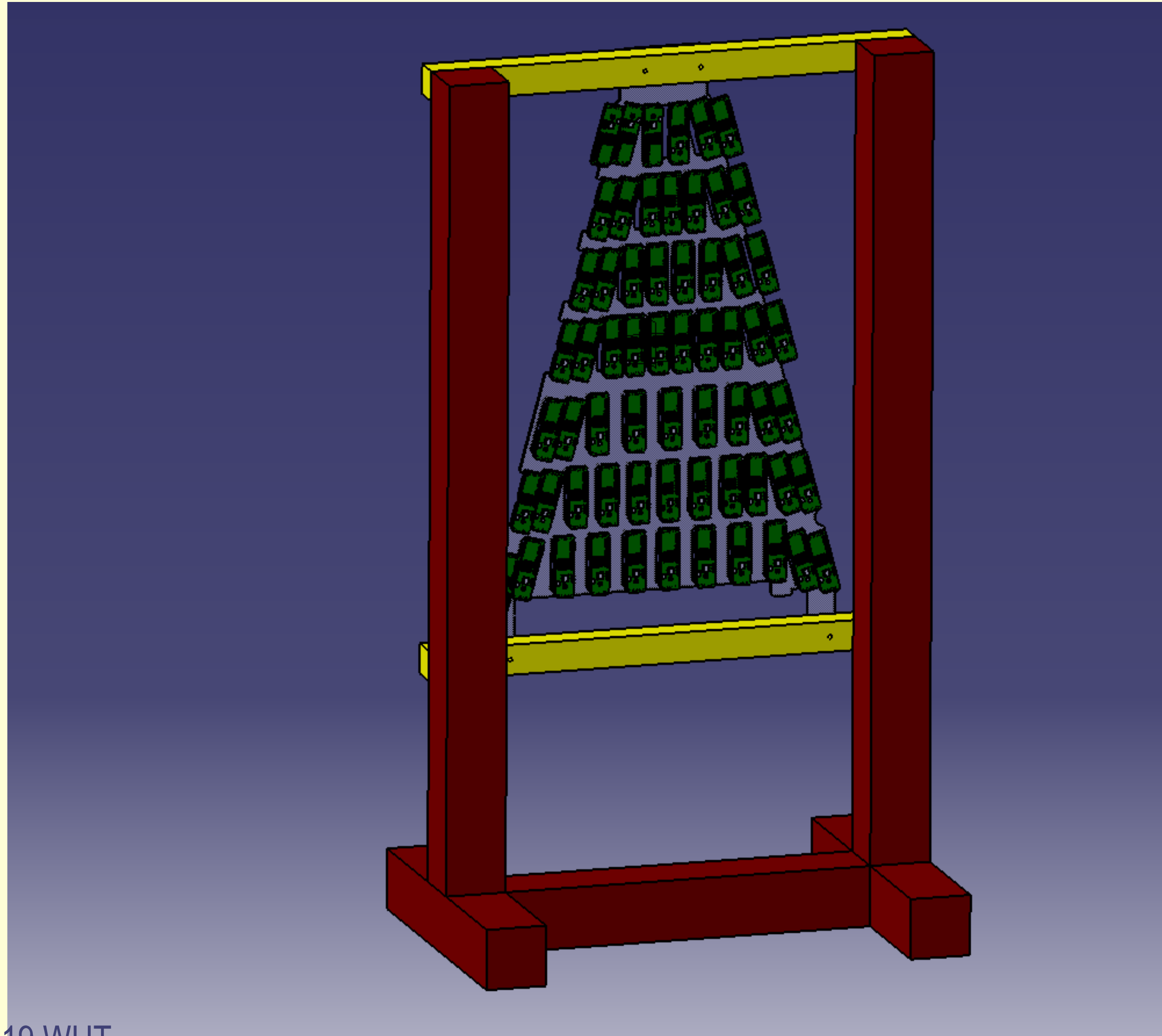
TPC electronics: FE cards integration and cooling (base line option)



2 radiators (narrow and wide)
FE cards – no individual cooling

Status: in progress

Test set up for testing FE boards with ROC chanber



TPC electronics: power cables

Conclusion

1) According to requirements 3 options of FE cards cooling were designed;

2) Tests with prototype (option №3) shown, that construction is very complicated and not useful for mass-production;

3) Design with cooling tube around each 2 boards is ok but the number of tube connections to 2 water manifolds (N=124) is un acceptable;

4) Base line option with common radiator for narrow and wide ROC chamber parts seems will be ok. Prototype ordered and will be tested.

Thank You!