

NICA Days 2019 20-26 Oct. 2019

TPC electronics cooling design status

Prezented by V.Chepurnov

NICA Days 2019 WUT, Warsaw

TPC electronics design

SAMPA chips (4500 pc): delivered

Block diagram of one chamber readout

copper Ethernet Pilot system – 512 ch 2.5 Gbi PHY 10/100/100 10 Gbps Eight cards pilot system Aria X GX tests with FPGA Optic 10 Gbps FPGA Aria X – in progress 1) Trigger, clock, reset distr. board . copper 2.5 Gbps 2) System controller. 3) 64-ch SAMPA- FEC. 4) HSSI (up to 2.5 GBps; up to 8 FECs). RCU prototype (up to 32 FECs) 5)Data/conf. full duplex HSSI port; 30 clock 40 MHz, trigger, reset. **QSFP+** transceivers Full duplex 4x10 GBps Data concentrato Connectors to FECs 8x4 high-speed full duplex channels Optical link 4x10 Gbps PCIe 3.0 x 8 **Status: tested** uCoax. data 8x8 Gbps cable of length To data Testing signal 1m tested storage server injection board 4 ch FEC NICA Ways 2019 hepurnov, TPC electronics **Pilot readout system for few ROCs – proposal** Warsaw cooling status, JINR, Dubna

TPC electronics: FE cards



FEC slow control data



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



24-Oct-19 S.Movchan MPD/NICA TPC status IVth MPD Collab meeting, Warsaw, October 21-25 2019

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.



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



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



Both FE cards cooling by tube

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



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Status: in progress

Test set up for testing FE boards with ROC chanber





TPC electronics: power cables



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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!

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