Minutes Meeting regarding Power Converters for CR+TCR1 Magnets			
Date and time:20-24May2019 Meeting site: GSI/FAIR Darmstadt			
Att.: D. Senkov (BINP), H. Schwarz, O. Dolinskiy, T. Ziglasch, K.H. Trumm, H. Welker, A. Döring, D. Rodomonti, R. Bär, M. Thieme & T. Mohite	Distribution: to all attendants & I. Koop, D. Schwartz, O. Gorda, A. Wiest, A. Stafiniak		
Agenda item	**type ***	**Action**	**due date**
Action			
I. Power Converter, PC, Design/Prototyping @BINP			
1. There are no changes in the CR- magnet parameters except in quadrupole magnets. But, this change has no influence on the design of the PCs	I		
2. For dipole PC, so far, air cooling is planned for the thyristors, inductors and transformer. Three rooms in CR building are dedicated for the dipole PC.	I		
3. TCR1 dipole PC is similar to the CR quadrupole PC.	I		
4. For quadrupole, sextupole and octupole PCs, a standard 300A /500A IGBT switches based PC sections will be used (in different numbers, as per the requirement). Only, the dc link voltage for each PC type will be different.	I		
5. At present, at BINP, PC section prototyping is underway. Many issues like EMI, grounding, safety etc. are yet to be addressed and tested. After a successful testing, the section will be adapted for the CR PCs.	I		
6. Unlike to most of the machines in FAIR in case of CR, due to low radiation level (as per O. Dolinskii), there is no need to split the water cooled cables in two different sections.	D		
II. CR PC Controls			
1. For the ADC/DAC module of the ACU of the dipole PC it's agreed to use 18 bit ADC and 16 bit DAC cards.	D		
2. A temperature control (acclimatized) cabinet for DCCT electronics is needed only for the dipole PC.	D		
3. Redundancy of DCCT in CR Dipole PC: Due to low beam intensity, the redundancy (machine safety) of current measurements (DCCT/ADC) is not required. Therefore, a standard solution with one DCCT and one ADC is used in temperature stabilised rack at 23°C	D?		
4. Precision issue quadrupole PC in TCR1: The TCR quadrupole (the same construction like CR) does not require the same stability and precision. Therefore, the DCCT/ ADC is defined as ΔI/Inom = +/- 100ppm p-p; long term stability 500ppm rms (the solution where DCCT and ADC is installed in ACU crate)	D?		
5. Controls for the PCs for the quadrupole magnets are proposed to be similar to the controls for the PCs for the magnets in CBM. But, due to the slower data rate (than the expected of 20 kHz), this solution is not feasible.	D		

New proposal for quadrupole PC controls is a combination of PWM card from BINP (a modified one with USI interface) and ICM from GSI. The FPGA in current BINP PWM card will be adapted by D. Senkov to include the GSI USI slave module. The USI slave module implementation will be supported by the ACU team, GSI. Also, one ACU (along with an ICM module) will be transported to BINP (probably for 1-2 years) for testing purpose as will be asked by D. Senkov.	A		
6. Standard version of the ACU will be used for the controls of the PCs for the sextupole magnets.	D		
7. PCs for the steerers and the octupole magnets are proposed to be total 4 or 8 in a cabinet. The proposal from BINP is to use a combination of SCU and ADC/DAC cards (both, provided by the controls department) instead of ACU for the controls of these PCs. Its feasibility could be confirmed with R. Bär and M. Thieme from GSI. No particular issues are foreseen in this direction, because GSI has already adopted such solution for the PCs in CRY-Ring.	D/ A		
8. Controls for CR septum PCs has also been discussed with R. Bär and M. Thieme. The proposal is to adapt the similar SCU solution as for the Power supplies for the kicker magnets in CR. For further information regarding these SCU solutions, the contact person from GSI is Alexander Bauer. The relevant documents/ details for these PCs like detailed specs, the design plan, required number of control units etc. will be delivered to GSI by D. Senkov.	D/ A		
III. Personal Safety System, PSS @CR			
1. Like all other machines in FAIR, CR also supposed to be equipped with an additional protection/ mechanism for PSS. Therefore, it is proposed to switch off any two quadrupole PCs (for redundancy) in the ring.	D/ A		
2. An example from the PSS for HEBT has been discussed. BINP have agreed to adapt this solution.	D/ A		
IV. PC Requirements			
Most of the PC requirements are already mentioned in the reference documents. Apart from that, as per the experience on FAIR PCs, various requirements for the CR PCs (from the electrical, mechanical, infrastructure, documentation, transportation & storage and periodic review perspectives) have been discussed. Through some examples the requirements for the, 1. PC front door components (like name plate, label, different switches etc.). 2. Grounding arrangements considering safety as well as EMI concepts (as per the European EMC directives) 3. Monitoring of various output signals 4. Installation of various monitoring sockets to collect the information regarding magnet cooling, beam interlock and PSS 5. Copper busbars connection keeping in view the requirement of changing magnet polarity. 6. Co-axial cable fixation 7. Cooling circuit arrangement	I/ A/ D		

8. E-plan software for electrical schematics and 9. Documentation have been presented and BINP agreed to adapt the same. 10. Specific instructions regarding DCCT head mounting will be provided timely as per the DCCT type. 11. Half part of the six pin socket, SV6 (for magnet water/ temperature interlock) will be installed on the magnet 12. Preferred flow meter type has been proposed, if required, further details can be provided In addition, for any further clarifications/information in this regard BINP will contact to GSI/FAIR.			
V. Open Points (Further Clarifications Required):			
Following points need further clarification: 1. After assembling and testing the PCs at BINP, all heavy components like the PC sections, transformer etc., will be disassembled before transporting to FAIR. Later, the PCs will be reassembled before transporting to the CR building. This concept as well as the reassembling site (still to find out the possibility outside GSI/FAIR) is yet to be finalized. 2. In principle, GSI supposed to deliver total number of DCCTs and ACUs required for the CR PCs to BINP. But, BINP proposes to GSI to deliver only few samples of these components to BINP, Russia and rest to the CR-PC-reassembling site. The contact person in this regard is Artem Kremnov (BINP). 3. FPGA programming for the USI in ACU needs a personal training. In this regard, D. Senkov will schedule the visit after consulting with A. Döring. 4. To witness the SCU functioning for the PCs in CRY-Ring, D. Senkov may visit during the beam time in September 2019. 5. BINP agreed to a periodic status review regarding progress in PCs in CR, through status reports (at present quarterly), video conferences and personal visits. The frequency of these reviews/meetings/visits is yet to be fixed. 6. Procedure for CE certificate has to be discussed in detail.	A A A A A		

* types: A = action, D = decision, I = information