BES-III off-detector readout electronics for the GEM detector: GEMROC update: spare and ancillary resources development

> The CGEM off-detector collaboration (INFN/University FE, INFN LNF, Uppsala University)





The latest previous update on the GEMROC modules and auxiliary resources was given at the BES-III Italia (virtual) meeting on 9 June 2020. These presentations covered respectively the status of the GEMROC ancillary modules development.

Summary of this report:

- reminder
- GEMROC spare components and modules
- Ancillary modules development: Fast Control Signals (FCS) FANOUT
  - GEMROC-based FCS <u>SYSTEM</u> FANOUT
  - Modular FCS <u>Local</u> FANOUT
- outlook





#### • reminder: off-detector readout for CGEM detector

DI FERRARA



#### **GEMROC** spare components and modules

SPARES NEEDED for 4 more GEMROC modules to be built in 2019 / 2020 to have a safe supply of spares even when using **22** GEMROC instead of the minimum 20:

- Ordered and received (Dec 2019): 20 spare DLVPC cards
- Ordered and received (Dec 2019): 7 pieces of ArriaV GX FPGA development kit:
  - 3 (so far) to replace the ones with failing JTAG port
  - 4 additional spares
- Ordered and received (Dec 2019): 10 pieces of TEKO DS3470 enclosures all module enclosures machined by mid July 2020 (Michele Cavallina, INFN-FE mechanical shop)
- Ordered and received (21 May 2020): 6 pieces of GEMROC IFC cards
  - all spare GEMROC\_IFC\_CARD\_2020 cards passed the acceptance test by mid June 2020 (A.C.R.)
  - all spare GEMROC IFC CARD 2020 cards have been upgraded and successfully tested after installation of the "Clock Booster Patch Cards" by mid July 2020 (A.C.R.)

details of test procedures have already been given at the previous workshop (23 June 2020)



' montate sulla GEMROCIEC CARD



o Cotta Ramusino, 15 Giugno 2020



• Ancillary modules development: Fast Control Signals (FCS) FANOUT

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BES-III Italia, 6 november 2020, A. Cotta Ramusino, INFN-FE

# Ancillary modules development: Fast Control Signals (FCS) FANOUT GEMROC-based FCS <u>SYSTEM</u> FANOUT

- The BES-III FCS System Fanout is a modified GEMROC module which connects to the CLK, L1, L1\_CHK, FULL signals from the BES-III FCS Fanout card.
- The FCF will have:
  - 4 FAN OUT ports for CLK, L1, L1\_CHK (LVDS) TO the 4 groups (NE,SE,NW,SW) of GEMROC modules installed around the BES-III detector:
  - 2 FAN OUT ports for CLK, L1, L1\_CHK (NIM) TO the 2 GEM-DC
  - 4 FAN IN ports for FULL (LVDS) FROM the 4 groups of GEMROC installed around the BES-III detector
  - 2 FAN IN ports for FULL (NIM) FROM the GEM-DC
  - programmability via Ethernet
  - generation of simulated Fast Control signals for stand alone CGEM detector testing
  - The FCF will be located at the top of the detector, close to the BES-III BES-III FCS Fanout card assigned to the C-GEM detector



• Ancillary modules development: Fast Control Signals (FCS) FANOUT GEMROC-based FCS <u>SYSTEM</u> FANOUT

### **QUANTITY NEEDED:**

- 3 pieces of **BES-III FCS** <u>SYSTEM</u> Fanout:
  - 1 in operation at BES-III
  - 1 for prompt backup at BES-III
  - 1 used for firmware debugging / development

#### Status:

- prototyping and testing of XCVR\_DC modules FINISHED
- production for modular XCVR\_DC-based fanout in progress
- manufactured modular XCVR\_DC based expected by mid November 2020







#### • Ancillary modules development: prototype of XCVR\_DC module: acceptance test passed GEMROC-based FCS <u>SYSTEM</u> FANOUT



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- The FCS LOCAL Fanout (FCLF) are a LOW COST, non programmable, fanout modules which connects to the CLK, L1, L1 CHK, FULL ports of the GEMROC-based FCS <u>SYSTEM</u> FANOUT.
- Four (+ spares)  $\overline{F}CLF$  are needed
- The FCLF will have:
  - 2 alternatives for the connection to the GEMROC-based FCS <u>SYSTEM</u> FANOUT:
    - 1 "copper" port for LVDS signals carried by a 17- twisted pair, shielded cable ("green cable"), with auxiliary BNC ports for stand-alone operation
    - 3 fiber optic duplex ports for FCS signals (DC to 50MHz)
  - 6 output ports, each dedicated to a single GEMROC module
- The FCLF(s) will be located at the middle of each of the 4 groups of FEBs located around the BES-III detector



## **QUANTITY NEEDED:**

- 6 pieces:
  - 4 in operation at BES-III
  - 1 for prompt backup at BES-III
  - 1 used for firmware debugging / development
- Status:
  - prototyping and testing (A.C.R.) of XCVR FINISHED
  - prototyping and testing (A.C.R.) of FCS\_PORT FINISHED
  - prototyping and testing (A.C.R.) of FCS\_BKPLN\_IFC FINISHED
  - manufactured modular XCVR\_DC based expected by mid November 2020



The Modular FCLF will have:

- option a) FCS\_BKPLN\_IFC: 1 "copper" port for LVDS signals carried by a 17- twisted pair, shielded cable ("green cable"), with auxiliary BNC ports for stand-alone operation
- option b) XCVR\_DC: 3 fiber optic duplex (3 in, 1 out) ports for FCS signals (DC to 50MHz)
- 6 output ports ("FCS\_FC\_PORT") for point to point connection to the GEMROC





- outlook
  - Spare GEMROC module and ancillary modules status:
    - Clock Buffer Patch Card (CBPC) (60 pcs) have been delivered (to be installed and tested)
    - Spare DLVPC (20 pcs) have been delivered
    - Spare GEMROC\_IFC\_CARDs have been received; assembling of GEMROC <u>modules</u> (6 pcs) will start as soon as FCS FANOUT production is started

### • TODO:

- GEMROC FPGA's has issues which are not preventing data taking <u>thanks to the software patches</u> <u>provided by the on-line team!</u> Firmware v10 under development (slowly; effort is more on the hardware at the moment)
- Install Clock Buffer Patch Card (CBPC) patch cards on GEMROC modules (at IHEP as soon as possible)
- finalize design of racks for the installation of GEMROC modules and cables in the BES-III hall



