

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 4 march 2020 and concerned the status of the GEMROC ancillary modules development.

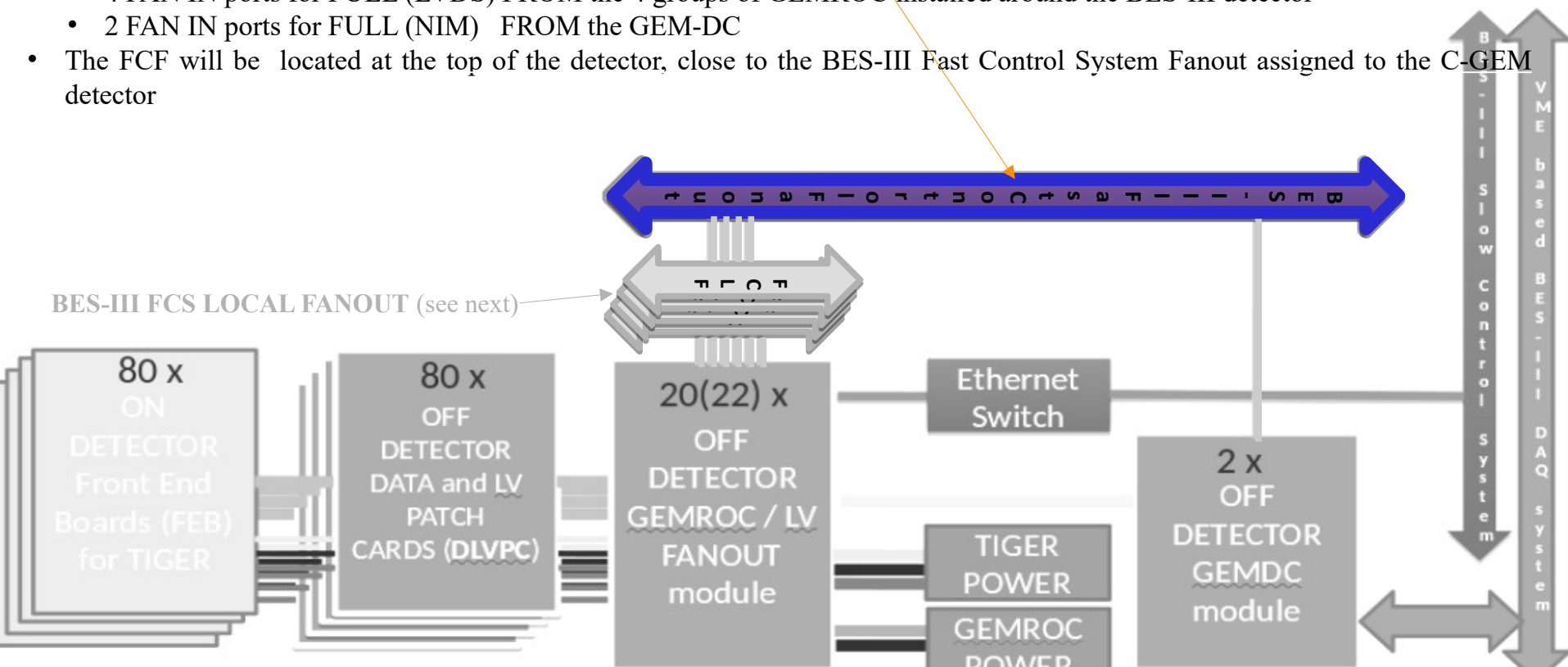
Summary of this report:

- development of the Modular FCS FANOUT system: overview
 - **GEMROC-based FCS SYSTEM FANOUT**
 - **Modular FCS Local FANOUT**
- development of the Modular FCS FANOUT system: status
- outlook

- **development of the modular Fast Control Signals (FCS) FANOUT system**

GEMROC BES-III FC system FANOUT (FCF)

- The BES-III Fast Control System Fanout (FCF) is a modified GEMROC module which connects to the CLK, L1, L1_CHK, FULL signals from the BES-III Fast Control System Fanout. If it is made programmable it can also generate simulated Fast Control signals
- The FCF will have:
 - 4 FAN OUT ports for CLK, L1, L1_CHK (LVDS) TO the 4 groups of GEMROC installed around the BES-III detector:
 - North East, South East, North West, South West
 - 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
- The FCF will be located at the top of the detector, close to the BES-III Fast Control System Fanout assigned to the C-GEM detector

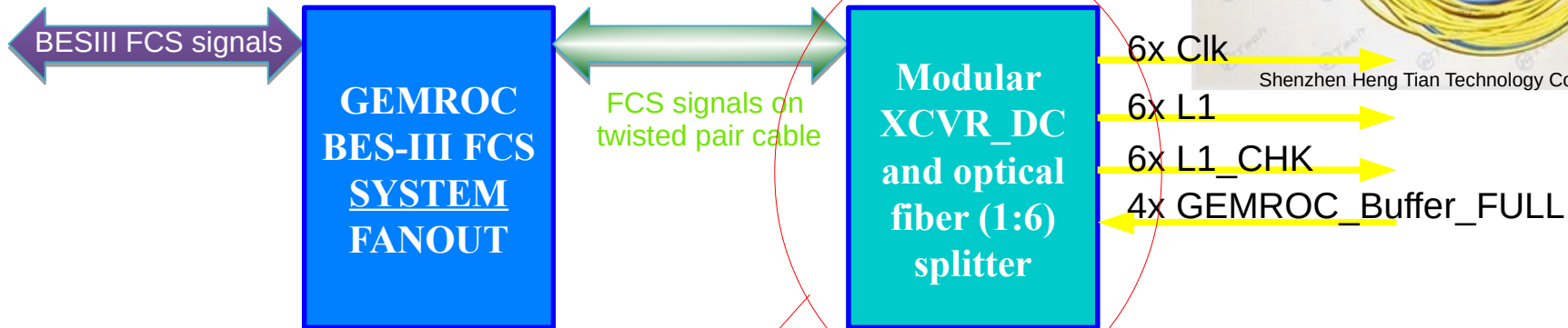


• development of the modular Fast Control Signals (FCS) FANOUT system

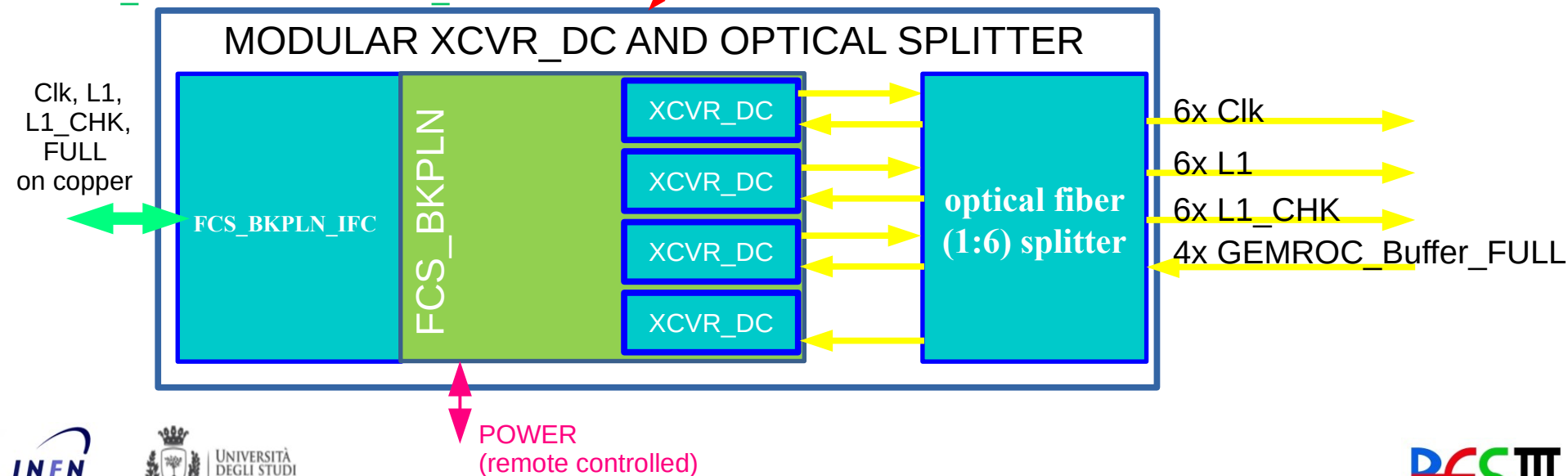
GEMROC-based FCS SYSTEM FANOUT

QUANTITY NEEDED:

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



Status:
FCS_BKPLN and XCVR_DC delivered



development of the modular Fast Control Signals (FCS) FANOUT system

GEMROC-based FCS SYSTEM FANOUT status

QUANTITY BUILT AND TESTED (A.C.R.):

- **2 GEMROC BES-III FCS SYSTEM Fanout modules (~ 2/3 DONE):**
 - **1** in operation at BES-III (needs HW-FW upgrade)
 - **1** in operation at the planar GEM test setup in Ferrara (with latest HW-FW upgrade)
- **1 Modular XCVR Fanout (~ 1/3 DONE):**

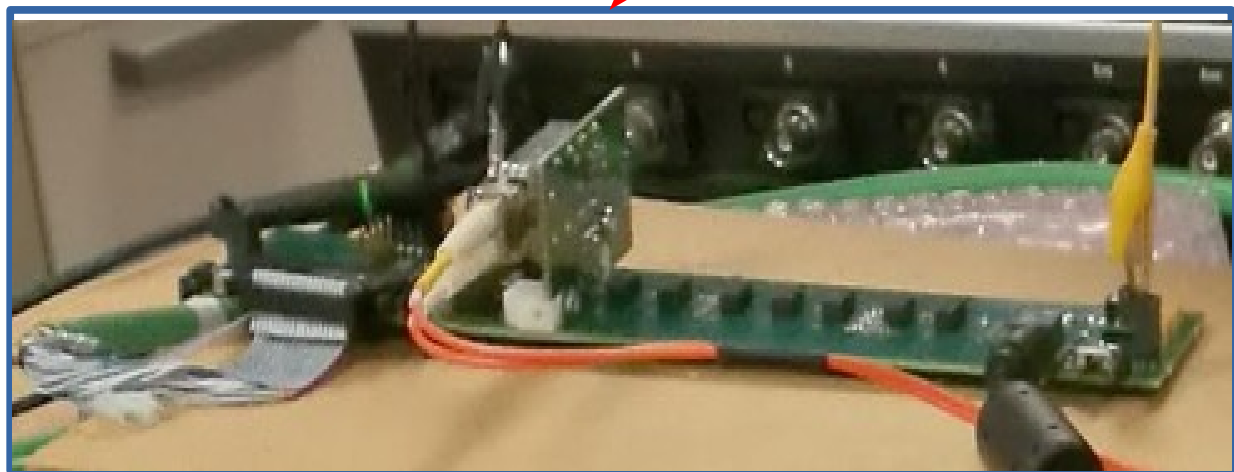


BESIII FCS signals



FCS signals on twisted pair cable

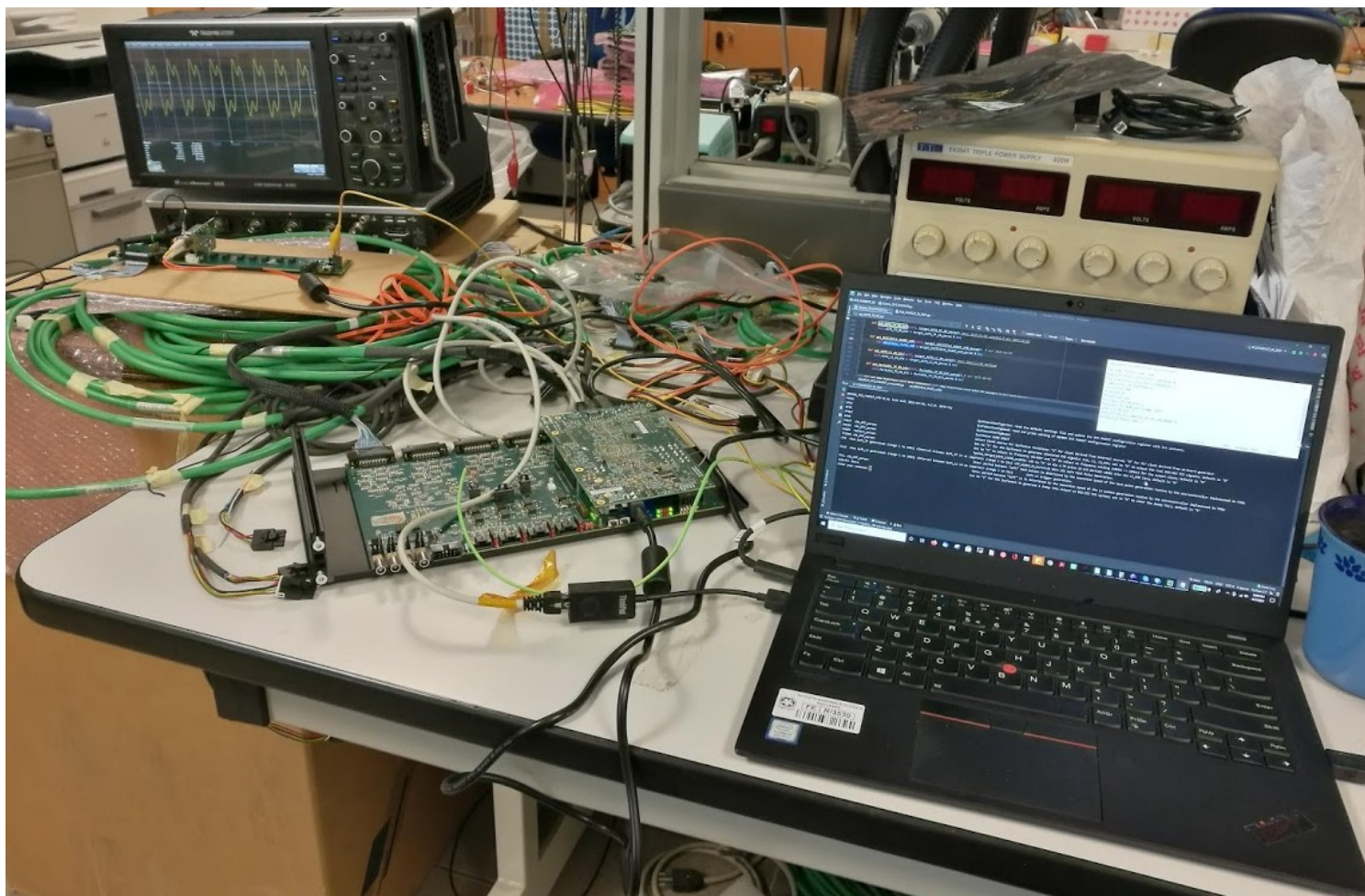
Modular XCVR_DC and optical fiber (1:6) splitter



- **development of the modular Fast Control Signals (FCS) FANOUT system**

GEMROC-based FCS SYSTEM FANOUT UPGRADE (A.C.R.)

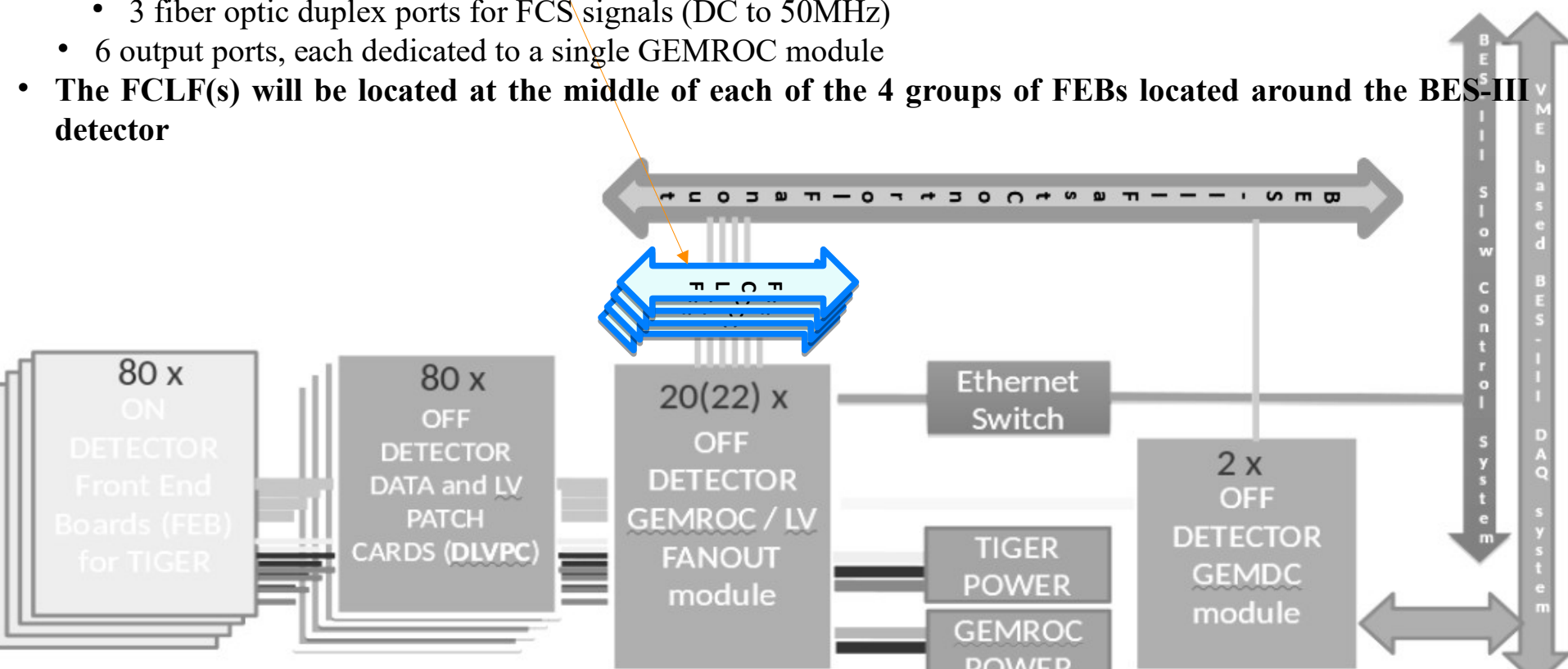
- HW: improved termination accuracy and signal integrity by small interventions on PCB
- FW: introduced more flexibility in the setting of emulated clock and generation of diagnostic signals
- SW: Python script for the GEMROC-based FCS_SYSTEM_FANOUT module updated
- Optical transceivers for FCS signals tested



• development of the modular Fast Control Signals (FCS) FANOUT system

Modular FCS Local FANOUT

- **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 SYSTEM FANOUT.**
- **Four (+ spares) FCLF are needed**
- The FCLF will have:
 - 2 alternatives for the connection to the GEMROC-based FCS SYSTEM 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**



- development of the modular Fast Control Signals (FCS) FANOUT system

Modular FCS Local FANOUT

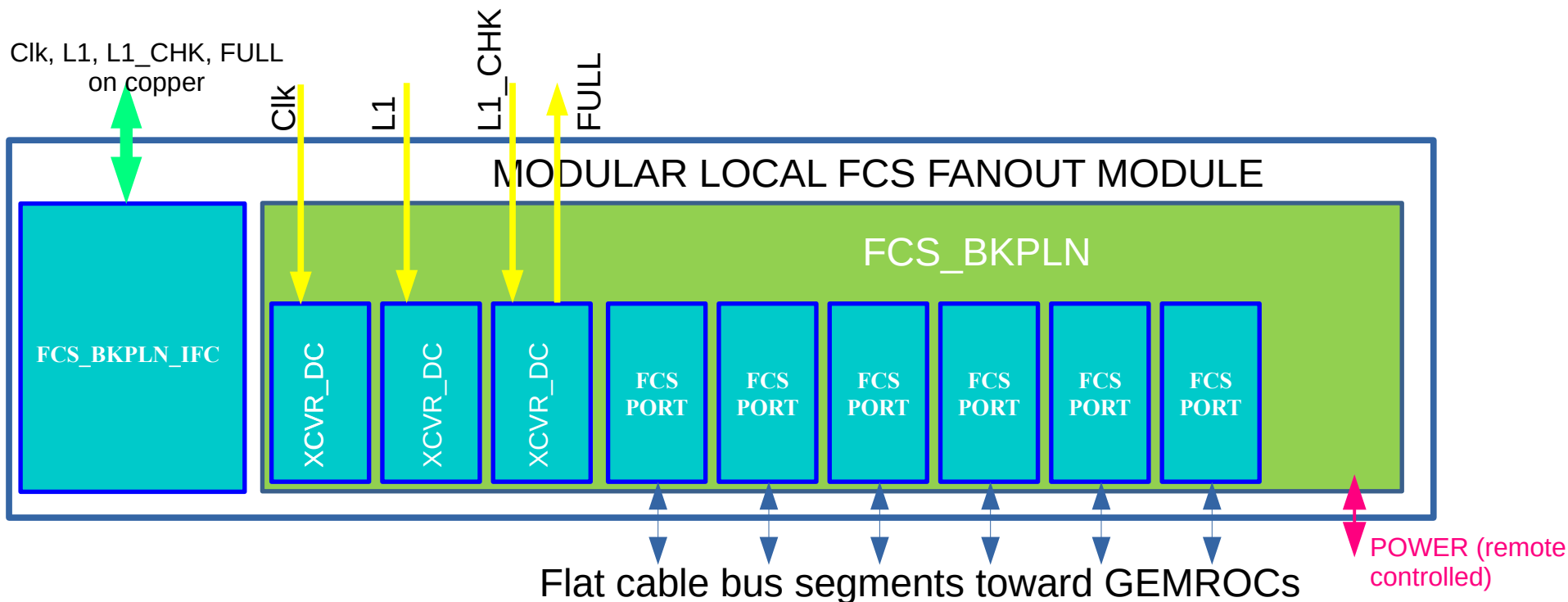
QUANTITY NEEDED:

- 6 pieces:
 - 4 in operation at BES-III
 - 1 for prompt backup at BES-III
 - 1 used for firmware debugging / development

Status:

All needed mosaic tiles have been delivered:

FCS_BKPLN_IFC,
FCS_BKPLN,
FCS_PORT,
XCVR_DC



- development of the modular Fast Control Signals (FCS) FANOUT system

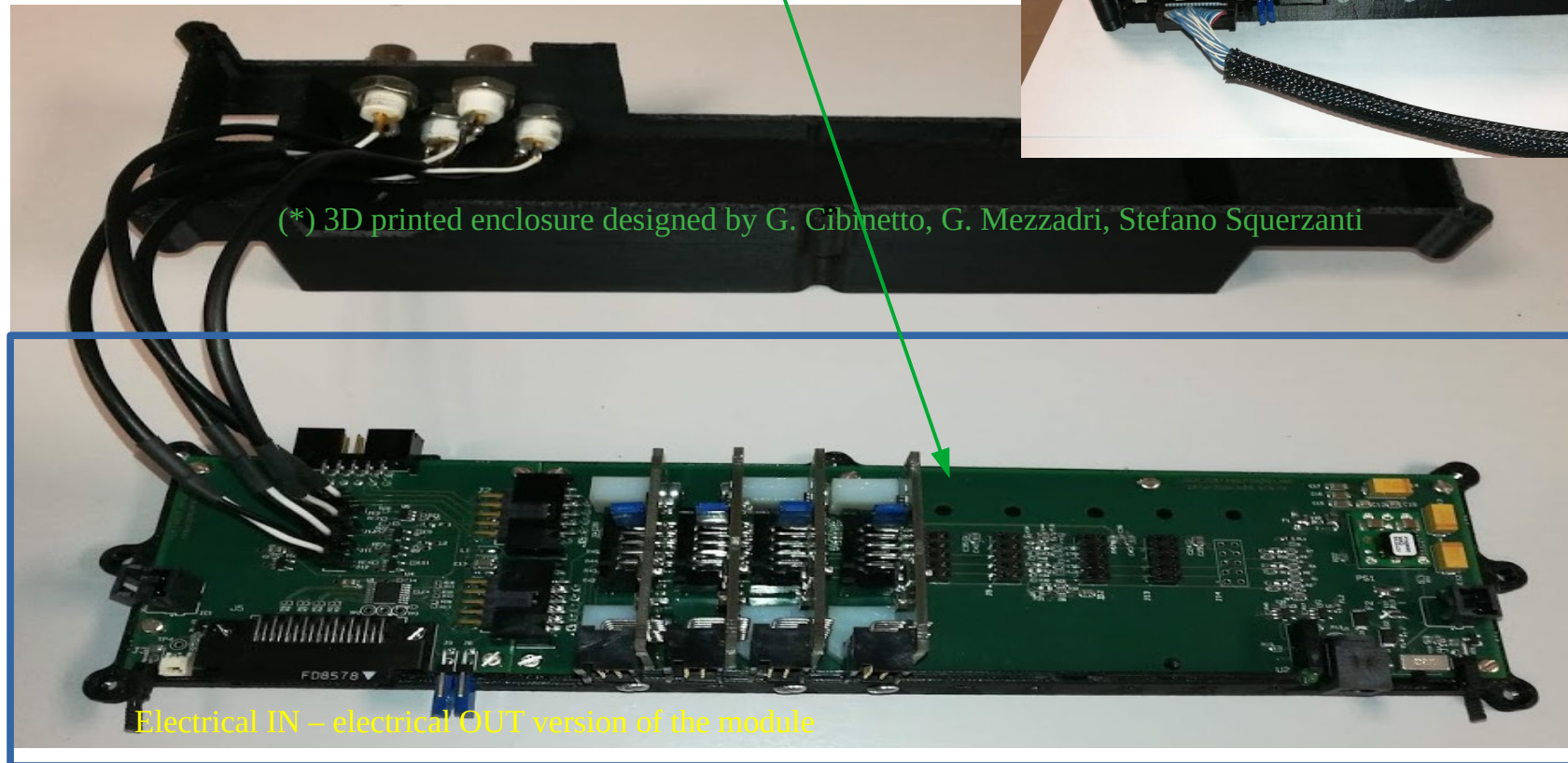
Modular FCS Local FANOUT

QUANTITY BUILT AND TESTED (~1/6 DONE) (A.C.R.):

- 2 Local Fanout modules:
 - 1 in operation at the planar GEM test setup in Ferrara electrically connected to the GEMROC-based SYSTEM FANOUT
 - 1 built and packaged (*) as a stand alone system:



(*) 3D printed enclosure designed by G. Gibinetto, G. Mezzadri, Stefano Squerzanti



Electrical IN – electrical OUT version of the module

- **FCS FANOUT System TODO list:**

- replicate a GEMROC SYSTEM FANOUT (~ 2 days)
- assemble all FCS FANOUT modular components into the CMS(*) 3D printed enclosures identical to (~ 4 weeks, to be started soon)

(*) Cibinetto, Mezzadri, Squerzanti