

# Remote Programming of Igloo2

A. Campbell, F. Costanza

# Introduction

- Remote programming of Igloo2 FPGA on front-end QIE cards is fundamental for a successful operation of the HE and HB front-end electronics.
- ngFEC is the main module that will allow this functionality, helped by the ngCCM server sw
- Stephen Goadhouse was already able to successfully program Igloo2 remotely using a GLIBv2 board and a the GLIBtool.
- Özgür Sahin had already ported this to ngFEC on GLIBv3 (not fully tested before)

# Test stand @ DESY

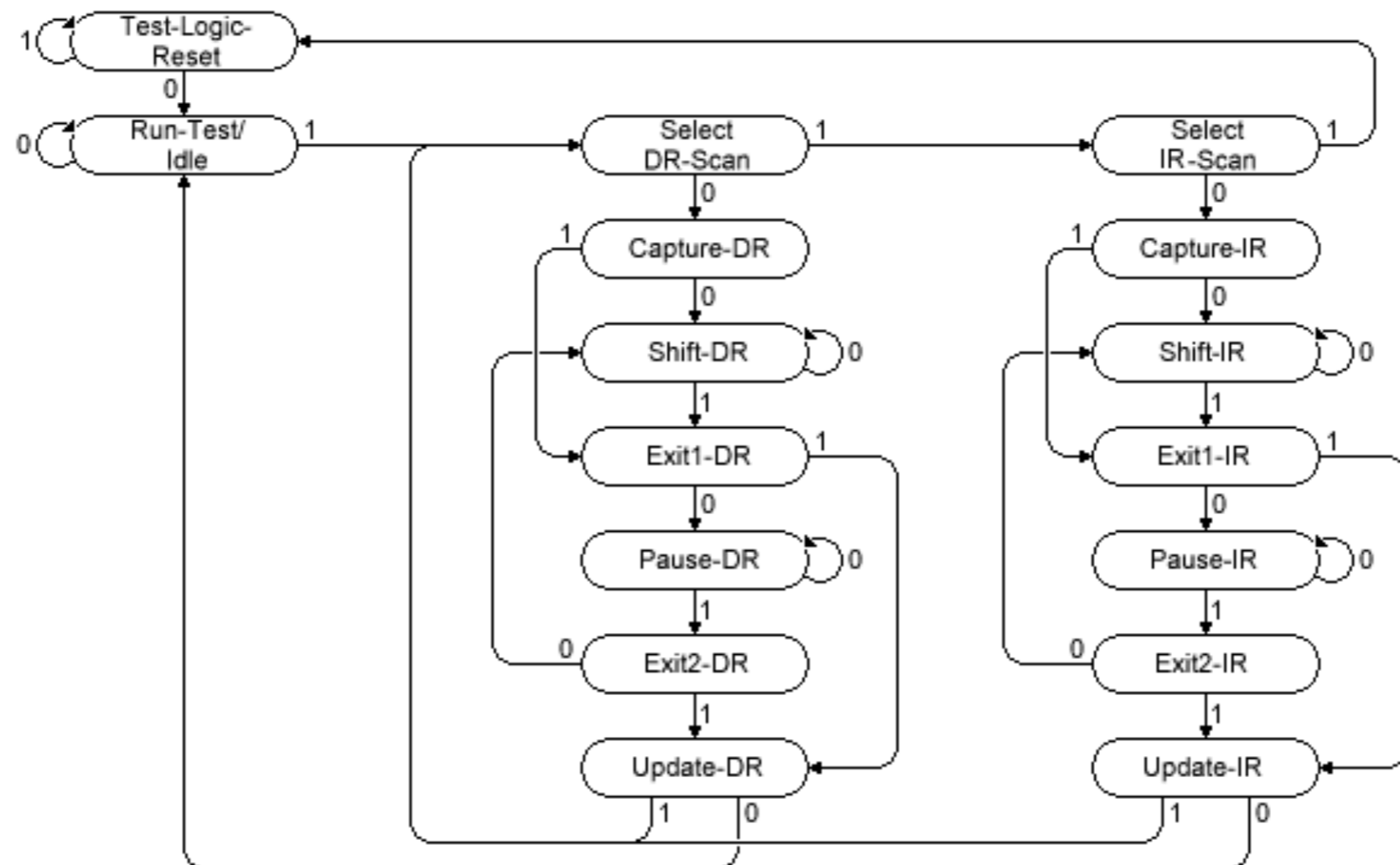
- QIE board: HF pre-production board
- ngCCM: HF prototype board  
glue Logic FPGAs were updated to the latest official fw version as described in:  
<https://twiki.cern.ch/twiki/bin/view/CMS/HCAL/NgCCMHFProd>
- We start implementing the remote programming in HF and then we port it to the ngFEC HE fw

# Programming via JTAG

- What is JTAG?  
JTAG is an IEEE standard (1149.1) developed in the 1980s to solve electronic boards manufacturing issues.  
Nowadays it finds more use as programming, debug and probing port.
- JTAG consists of four logic signal, named TDI, TDO, TMS and TCK.  
TCK is the JTAG clock signal.  
TMS is the signal that changes the state of the JTAG finite state machine (FSM) controller.  
TDI and TDO are input and output data lines that make a chain between the controller and the device under test.

# Test Access Port (TAP) Controller

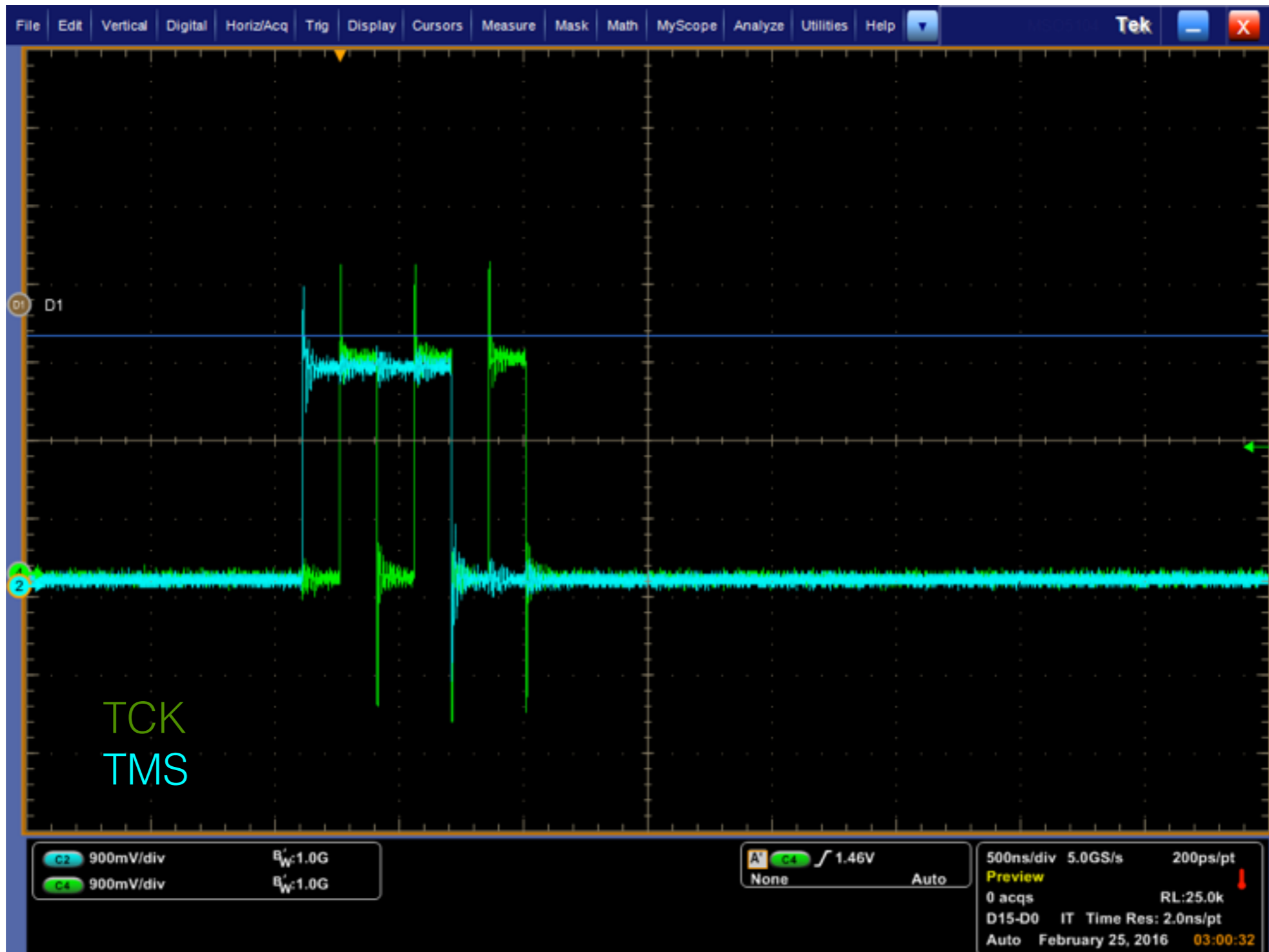
- This is the core of the JTAG logic. Implemented by Stephen and already extensively tested with GLIBv2



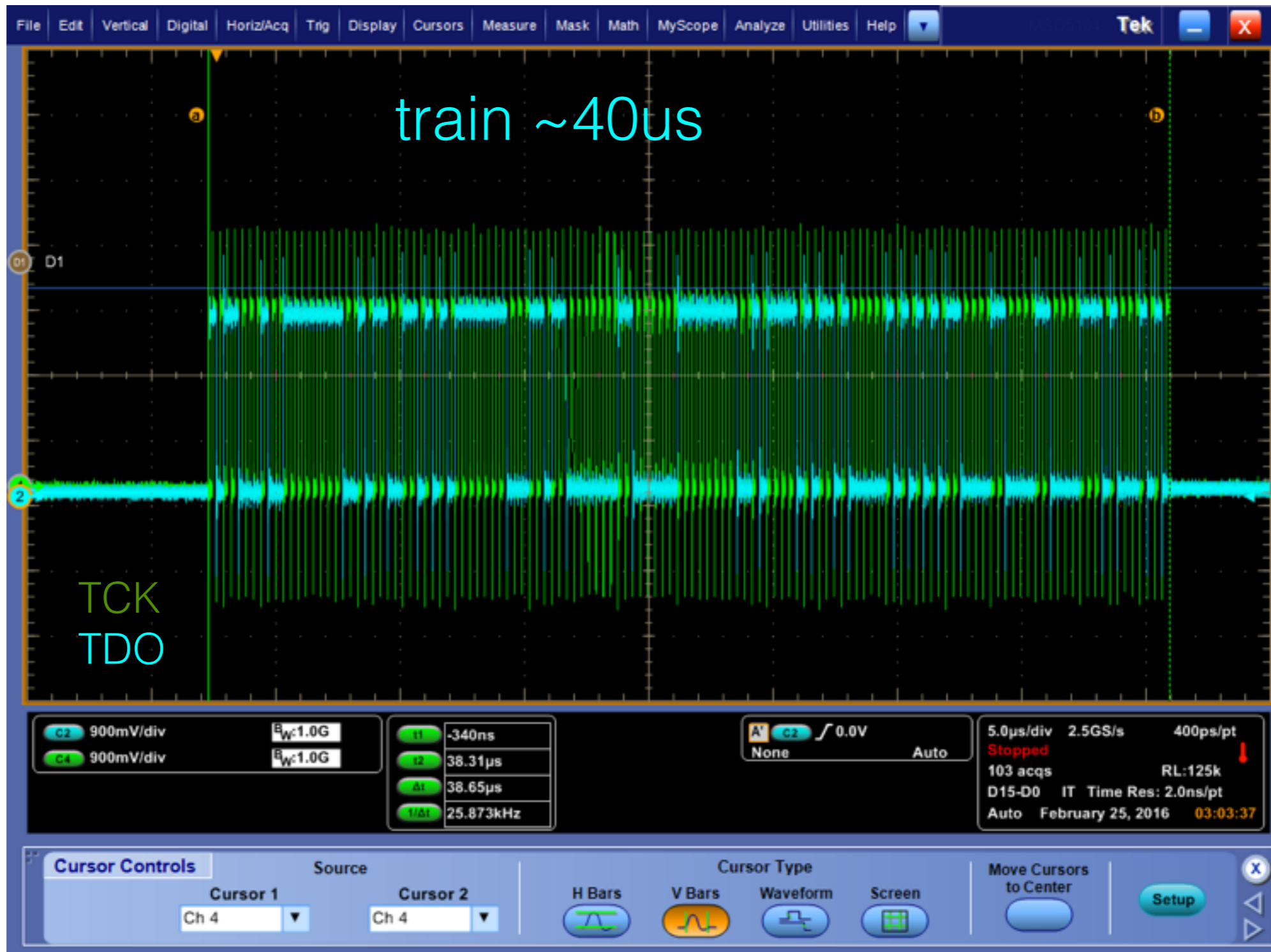
# Porting GLIBv2 fw to FC7

- No major problem. Also thanks to Stephen support.
- ngCCM server had to fix jtag\_sel registers used to select the correct FPGA that has to be programmed.
- Other ngCCM small fix were needed to improve performances (first version would have taken ~month to complete a single Igloo2 FPGA program).
- How to use it (from an ngCCM client):  
`jtag _STAPLE_FILE_ HF$CRATE-$SLOT DEVICE_INFO/VERIFY/  
PROGRAM`

# Check JTAG lines

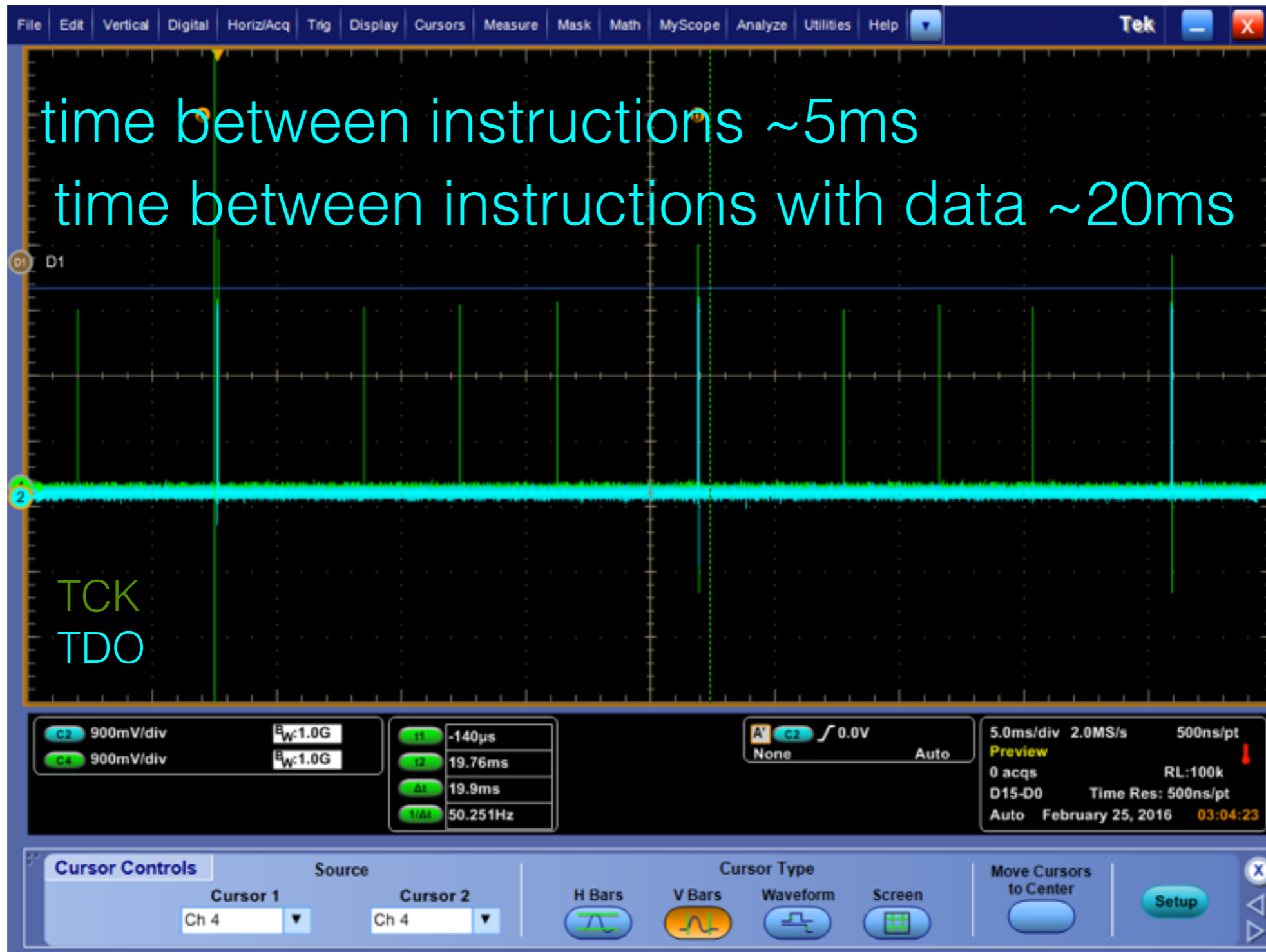


# Check JTAG lines





# Check JTAG lines



# Performance

- Remote programming a single Igloo2 FPGA requires ~1h.
- Programming through direct connection of JTAG programmer takes ~5min.
- Difference due to JTAG instructions sent in small single packages through TCP and UDP.
- Smarter fw/sw can speed up the programming procedure minimizing the number of sent packages.

# Plan

- Implement JTAG programming in HE ngFEC fw (small differences in GBT word scheme due to different redundancy scheme wrt HF)
- ngCCM server sw for HE is ready
- HE test not possible at DESY.
- Can Alan and I use the test stand in Bld. 28 one day next week?

# Summary

- Stephen's GLIBv2 fw for remote programming of Igloo2 FPGAs was successfully ported to ngFEC FC7.
- ngCCM server software was debugged and improved
- Remote programming of HF Igloo2 FPGAs is working and has been tested at DESY
- Bit file can be found here:  
[https://twiki.cern.ch/twiki/pub/CMS/HCALngFEC/fc7\\_ngFEC\\_HF\\_22\\_02\\_16.bit](https://twiki.cern.ch/twiki/pub/CMS/HCALngFEC/fc7_ngFEC_HF_22_02_16.bit)
- A first version of the HE fw is expected by the end of the week.