

PRESENTATION:

Pulsed Neutron Tool **Firmware Development**

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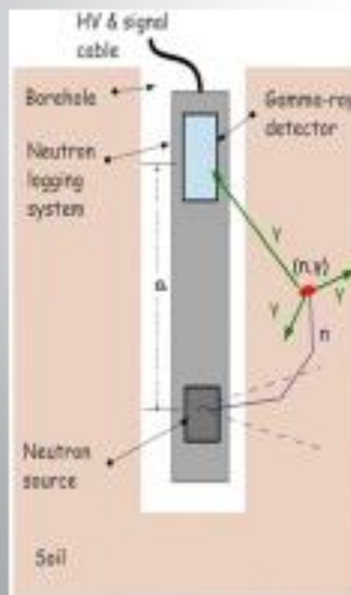
PROJECT

➤ Both projects related to the Pulsed Neutron Tool or PNT

1. Firmware related to the detector section of the PNT
2. Firmware related to the telemetry section of the PNT



PULSED NEUTRON TOOL



Working Principle

- PNG emit neutron bursts into formation at fixed time intervals
- Emitted neutrons interact with formations and generate gamma ray
- Detectors measure gamma ray decay time



C&J PNT Layout

Project 1: Generator and detector synchronization verification



- Measurement need to be synchronized with neutron firing
- Reliable synchronization is vital for accurate measurement
- Final result is the accumulative measurement of 1 sec
- Each measurement should be time aligned for final result to be accurate

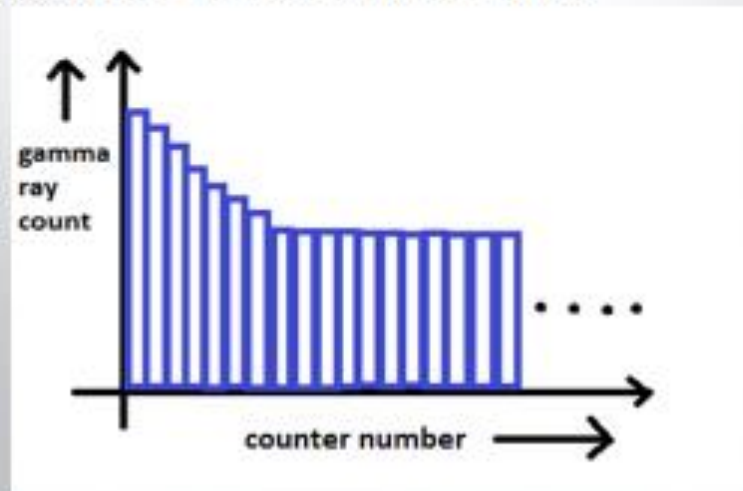


METHOD: Signal Generation

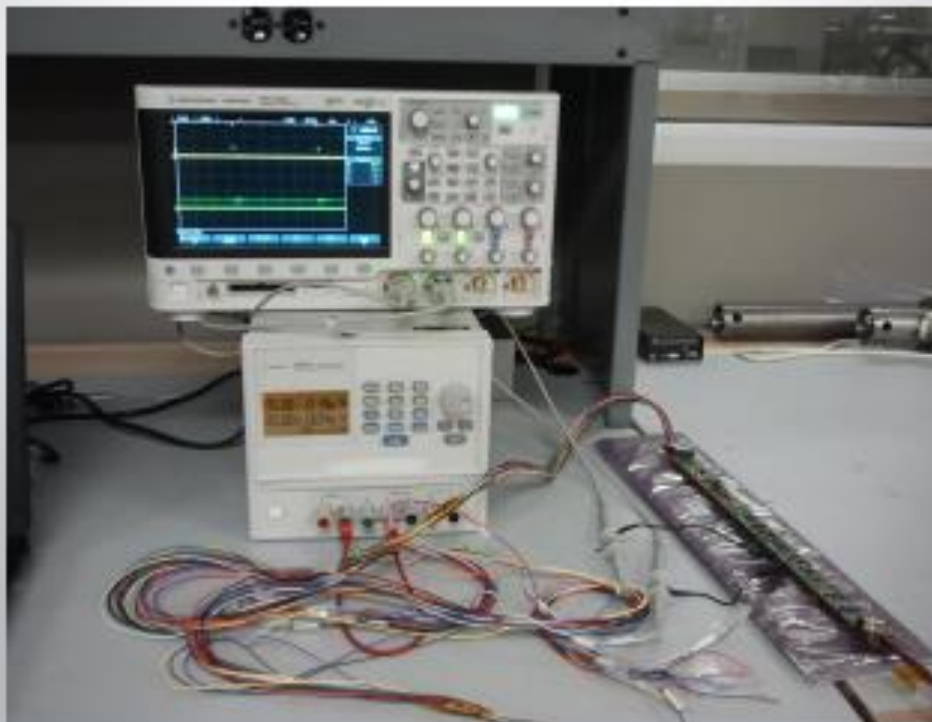


EXPECTED RESULT

- Detector section measures time decay by using time-gated counters
- Have provision to rotate time bins

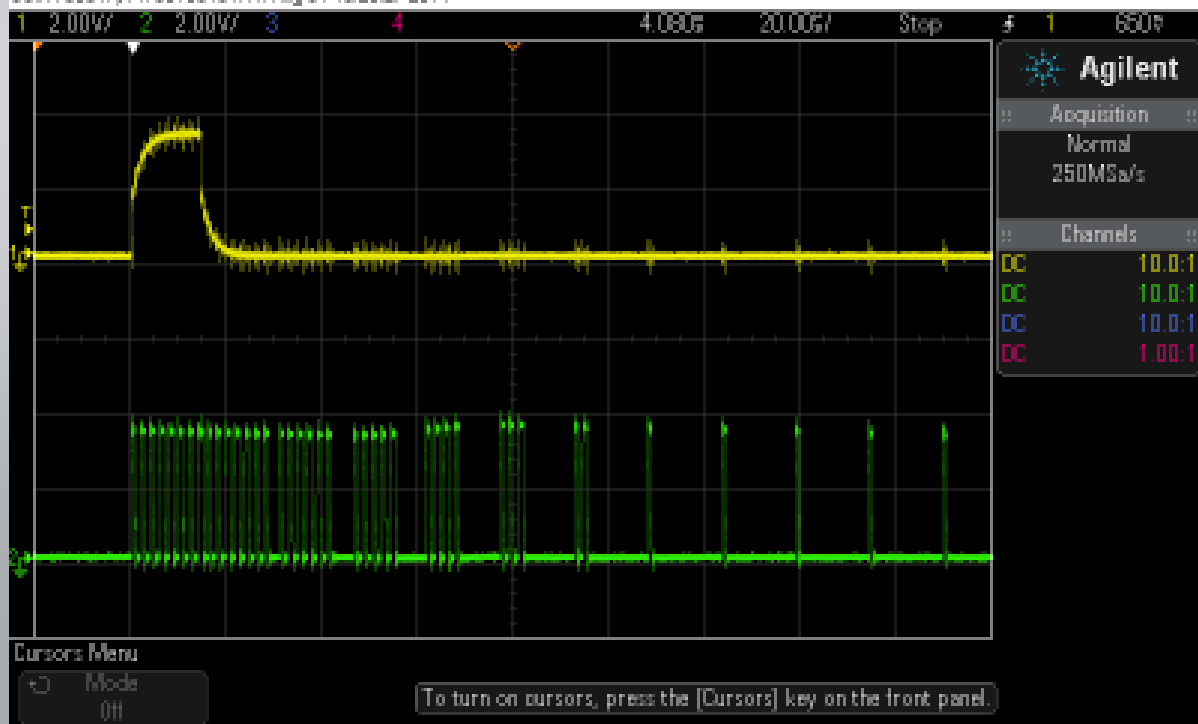


SET UP

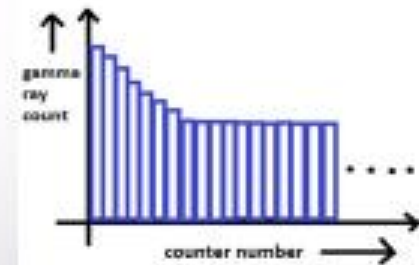
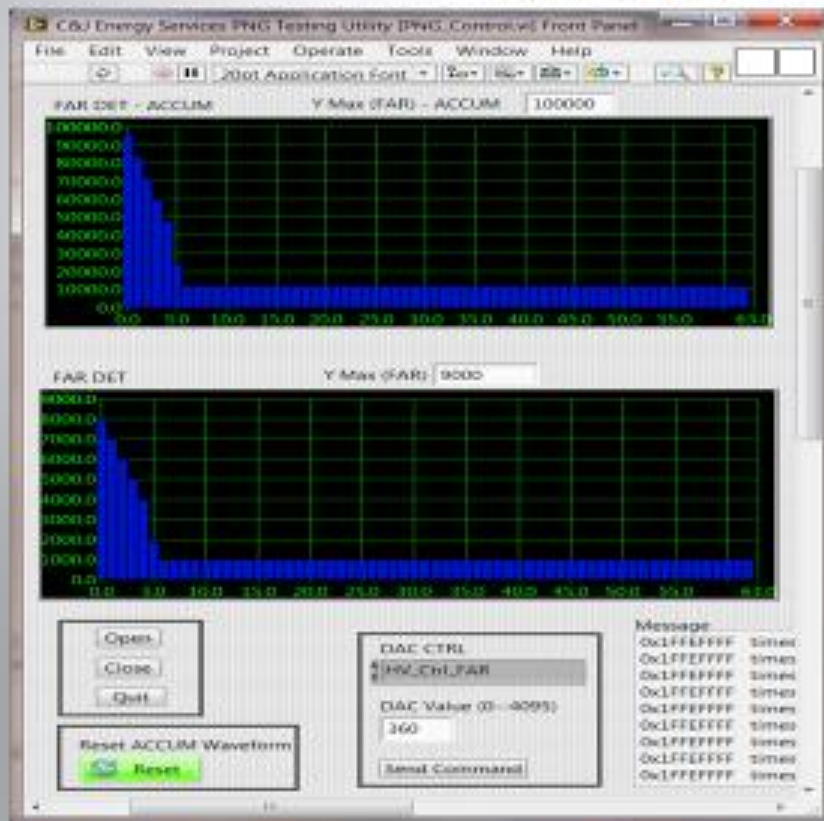


RESULTS

DSO-X 3034A, MY53100181: Fri Aug 01 13:26:27 2014

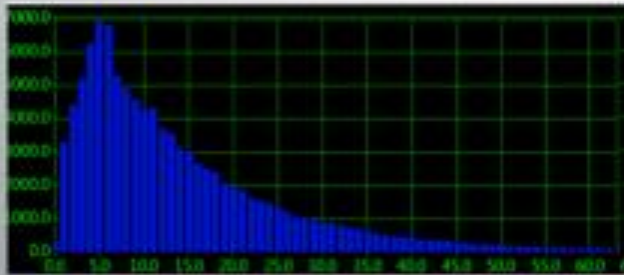


RESULTS

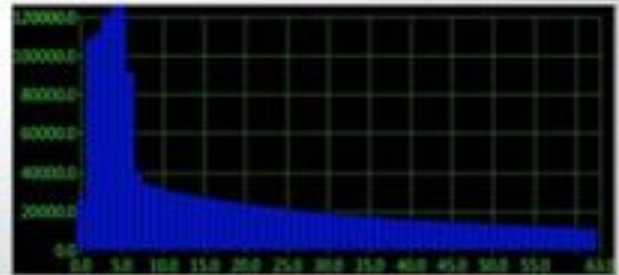


Project 1: Conclusions

- This project was finished in 2 weeks
- It was used for the PNT prototype tool verification and was helpful for trouble-shooting



Real measurement with DD tube at
C&J radiation lab
(Water tank shielding)



Real measurement with DT tube at
Thermo Fisher lab
(Solid concrete blocks shielding)



Project 2 : Making PNT compatible with Probe© tools

- C&J uses Probe tools
- PNT may be used with Probe tools in the same tool string
- Thus, PNT should follow Probe's communication protocols



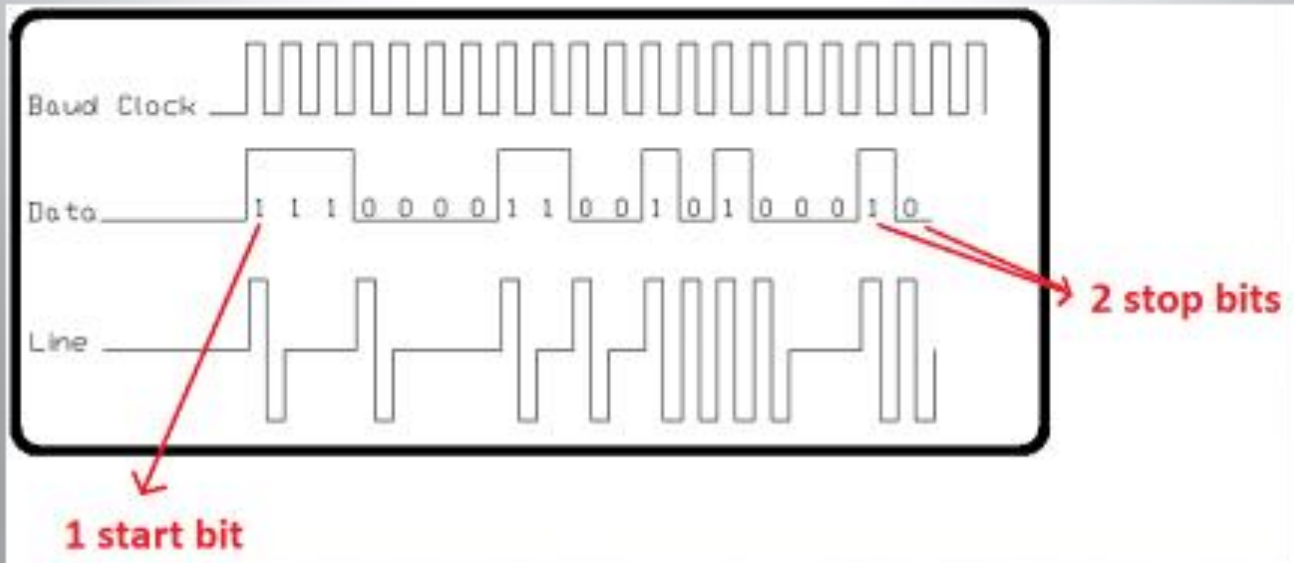
Probe's Telemetry Protocol

- Tools connected in series on the wireline
- Data driven from bottom up
- Each tool acts a repeater
- Adds it own data and sends it back up
- Message protocol implemented via a subroutine in controller



Probe's PTX Telemetry Scheme

- Standard data rate is 20kbps
- Any data transition converted to a pulse couplet

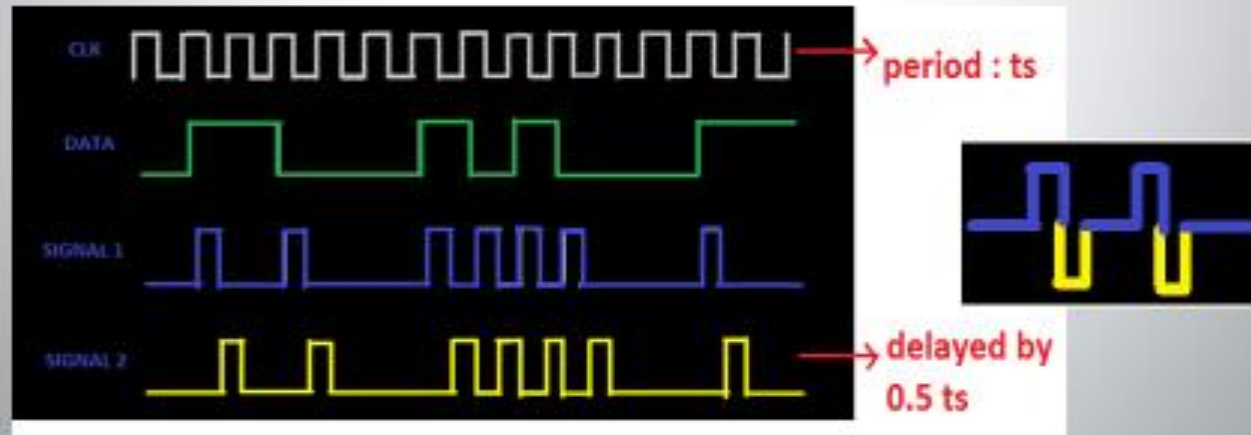


METHOD

- Data sent from controller to FPGA via SPI bus
- FPGA detects data transition and generate two version of transition signals corresponding to input data
- The two signals are used to drive the NMOS and PMOS (switches) to generate the pulse couplet

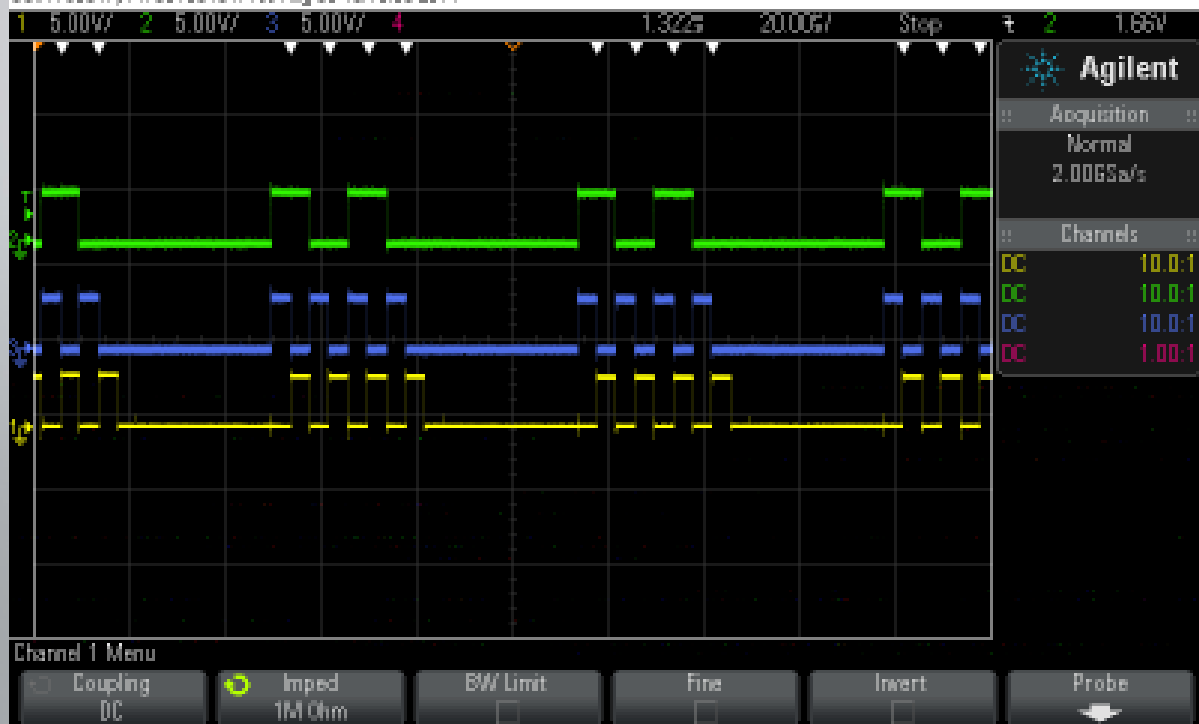


METHOD



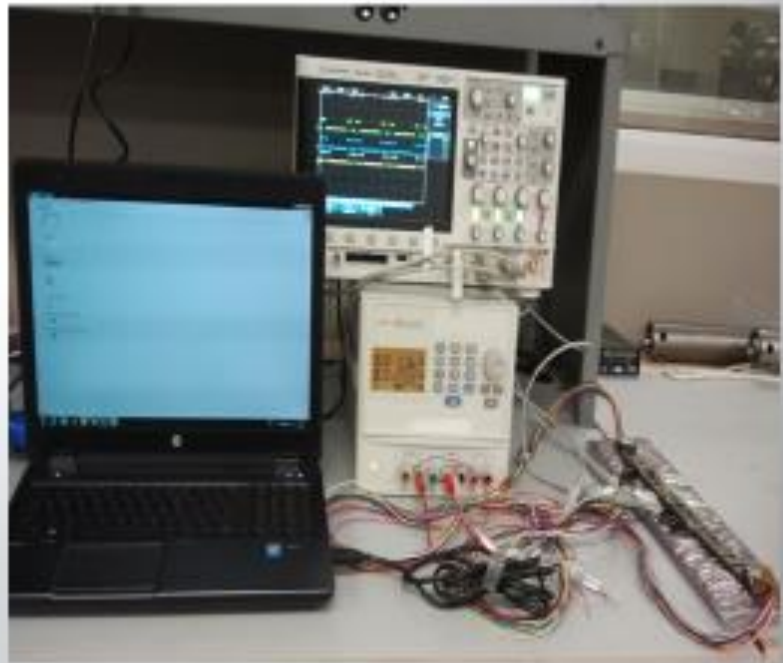
RESULTS

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SET UP

- Use LabVIEW to send test data over UART to DPC
- DPC generates encoded data
- Use oscilloscope to check encoded data output



Project 2: Conclusion

- Have been working on this project for 4 weeks
- Finished most part of data encoding in FPGA
- Finished wrapper subroutine in controller
- Next step will be adding start and stop bits and test with driver circuit



Thank You!

Mentors: Dalong Zhang, Dong Liu, Xin Geng

HR: Michelle Sherman

Product Line Manager: Bulent Finci

C & J Family and Audiences

