

Design of a Low-Cost High Speed Data Capture Card for the Hubble Sphere Hydrogen Survey


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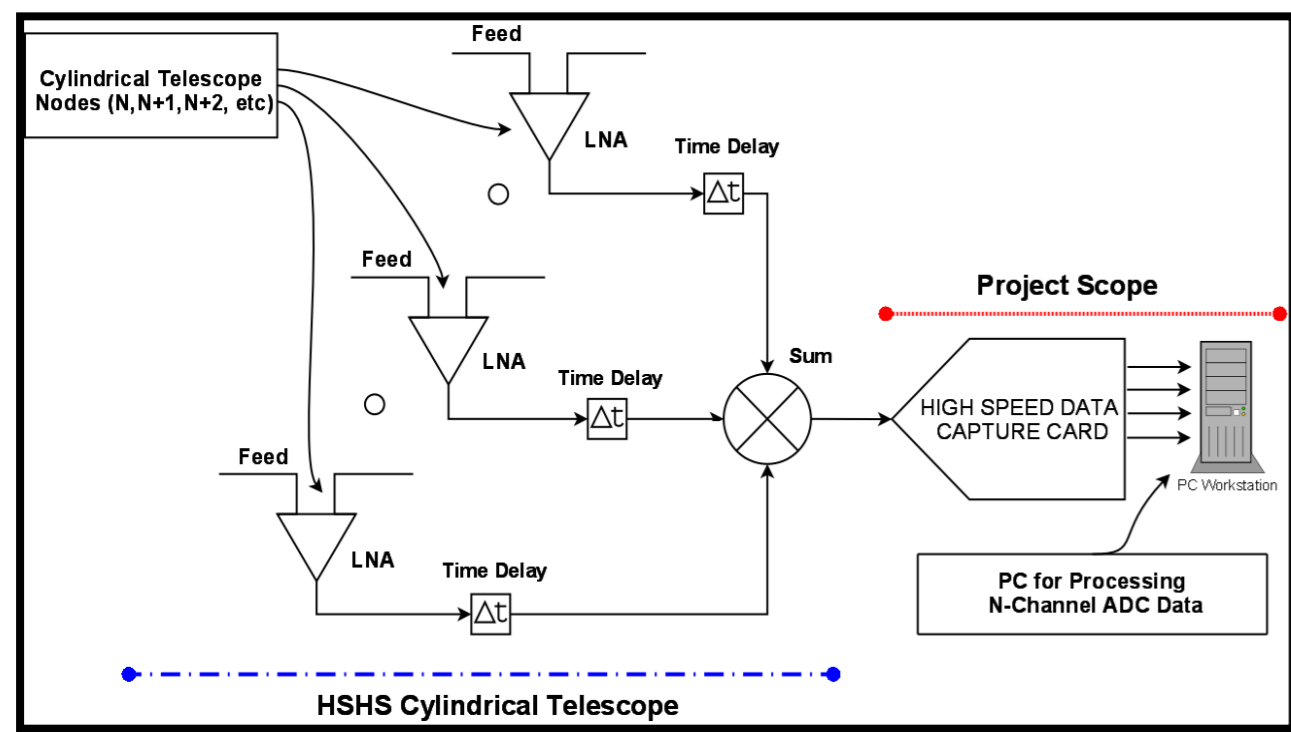
THE HUBBLE SPHERE HYDROGEN SURVEY?

- All sky red shift survey using hydrogen 21cm emissions
- 3-Dimension mapping of the bulk 'Hubble Sphere'
- Allow insight into the evolution of 'Dark Energy'




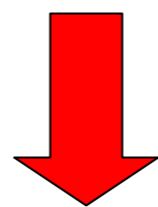

SYSTEM TOPOLOGY

- Cylindrical reflectors
- Low noise HEMT amplifiers
- High Speed Analogue-to-Digital Converter (ADC)

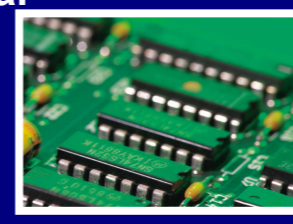

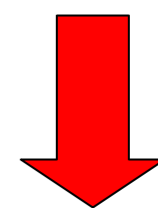
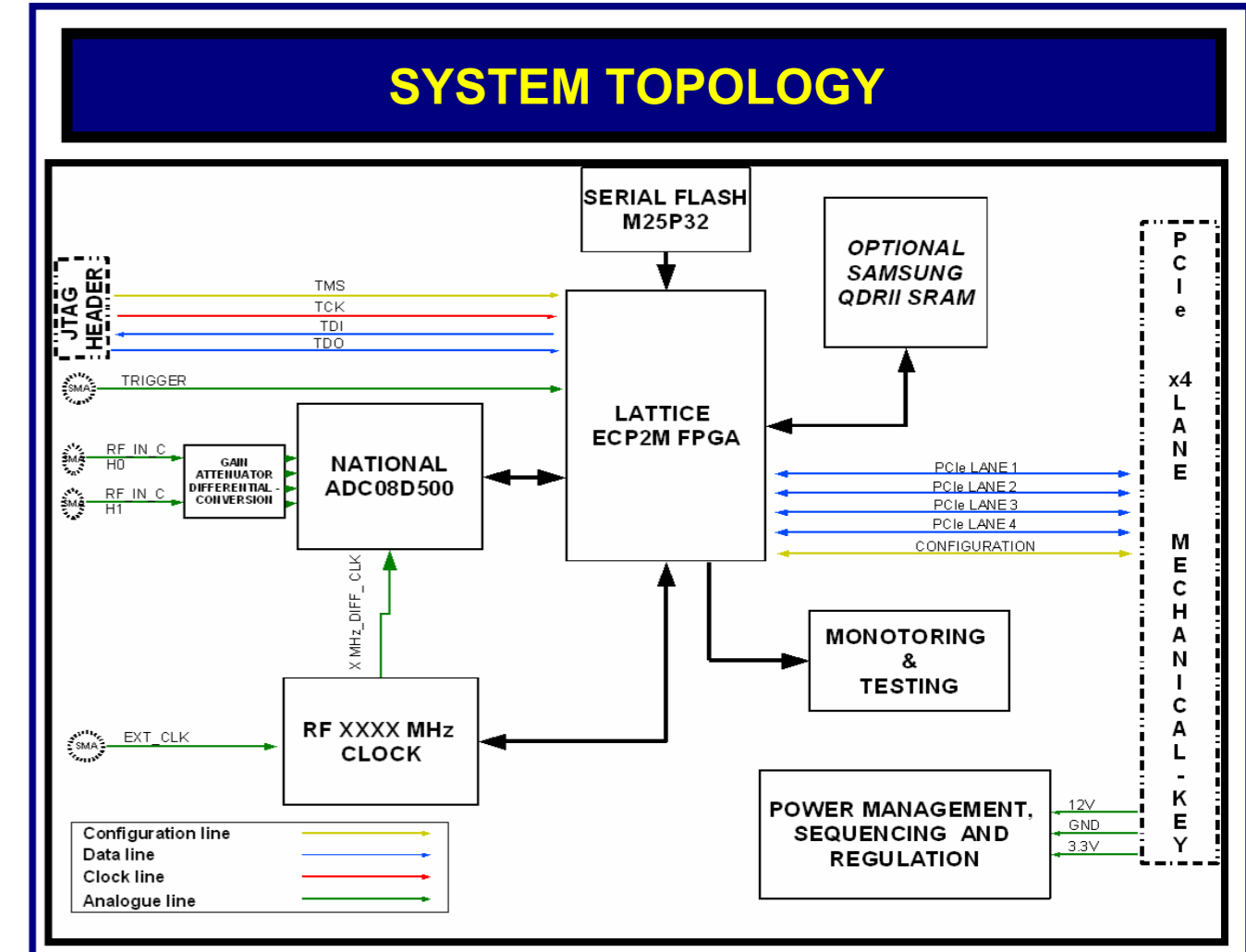
USER REQUIREMENT

- Dual input channel digitization
- Instantaneous sampling bandwidth of 200MHz
- Output interface capable of data rates = 1GB/s
- Frequency Range 500-1500MHz
- Low-cost design

PROJECT OBJECTIVES

- Conduct a user requirement and functional analysis of the proposed hardware
- Discuss problems and design choices
- Capture Schematics and research principles of PCB Layout
- Export Schematics for Layout and Route
- Write firmware to test the hardware and interface the Card to a standard Desktop PC to obtain sampled data
- Process the data using Digital Signal Processing Techniques in *MatLab/Octave*

KEY REFERENCES

- THE HUBBLE SPHERE HYDROGEN SURVEY- Jeffrey B. Peterson et al. Department of Physics, Carnegie Mellon University
- PCI-EXPRESS Specifications - www.pcisig.com
- Mentor Graphics EDA (DxDesigner, Hyperlynx and PADS Layout/Routing - www.mentor.com
- Dual 500MSPS 8-bit ADC - www.national.com/pf/DC/ADC08D500.html
- Lattice Semiconductor ECP2M FPGAs - www.latticesemi.com
- CASPER - <http://seti.berkeley.edu/casper>
- KAT/SKA - www.ska.ac.za

