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Proposal No.: S1.03-8314

Identification and Significance of Innovation:

The NASA's GeoSTAR satellite will carry aboard a microwave sounder employing an array of 375 microwave receivers. The IF signal is quantized at 1GHz with 2-bit accuracy, resulting in 700Gb/s data. Cross-correlation is employed to process the data. Pacific Microchip Corp. is designing an ASIC that includes a cross-correlation unit with interfaces for the GeoSTAR's receivers. The ASIC will have greatly reduced power consumption compared to that of the FPGA-based or classic ASIC-based implementations. This ASIC must be designed and integrated with already existing system components of the GeoSTAR instrument. The ASIC includes cross-correlation cells based on novel architecture. The 45nm SOI CMOS technology selected for the ASIC's fabrication will increase its tolerance to the total ionizing dose and reduce the probability of radiation-induced latch-up. The design of the ASIC will follow design for testability methods, which will simplify characterization and testing of the fabricated ASIC, reduce risk and lower the cost of the product.

Estimated TRL is 2 (end of Phase I), 5 (end of Phase II).

Technical Objectives :

1) To make the final selection of a commercial technology for the ASIC's implementation. 2) To design the architecture of the main functional blocks and to present a diagram showing how the proposed architecture can meet the requirements. 3) To prove the feasibility of the proposed block level implementation 4) To design the critical circuits required to demonstrate the implementation feasibility. 5) was to simulate/verify and to provide the results proving the feasibility of the circuit level implementation. 6) To summarize the completed work, to reach a conclusion on the feasibility of the ASIC's implementation and to provide a technical report.

Work Plan:

- Block level design
- Circuit level design and verification
- Design validation based on simulations
- Project report



Layout Floorplan of the Cross-Correlator ASIC

NASA and Non-NASA Applications:

- GeoSTAR microwave sounder
- Space born interferometer instruments
- Radio Telescopes
- Correlation arrays used in medicine for neural implants
- Image sensor signal processing for medical, military, space and homeland security purposes
- Future sensor networks

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