
BeamCal Front-End Electronics

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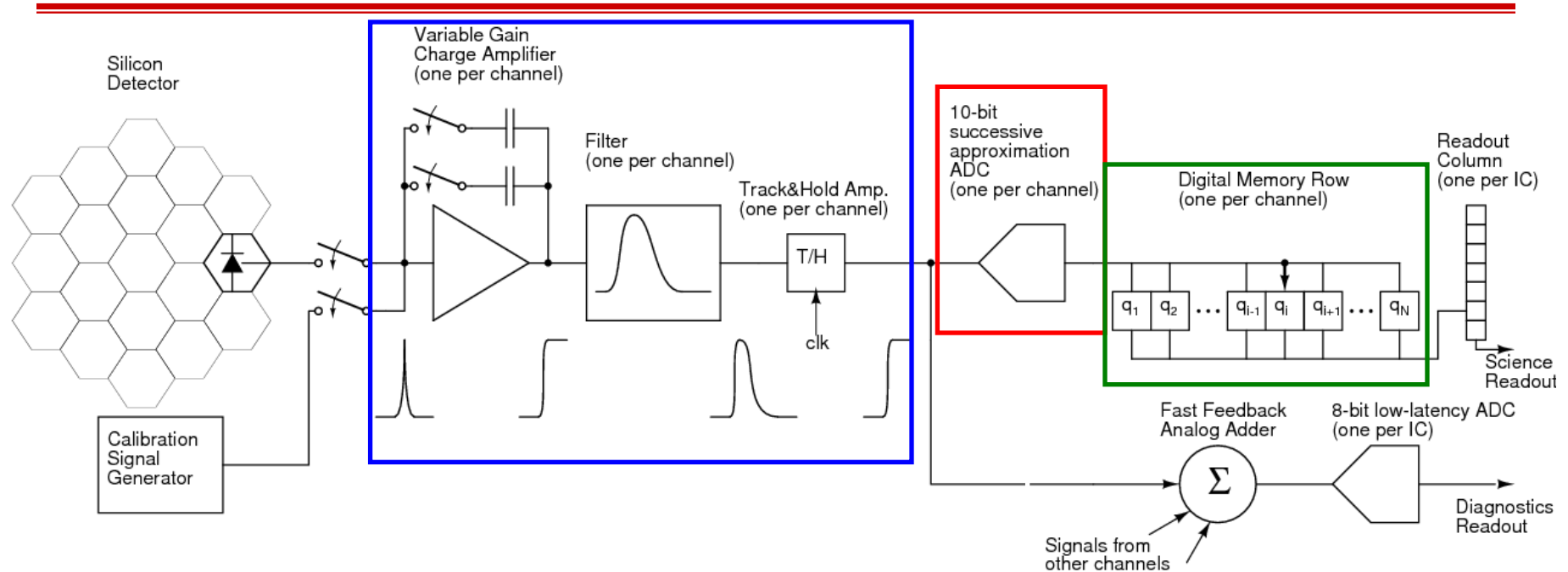
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BeamCal Specifications

- * High input rate (3.25 MHz)
- * High occupancy (100%)
- * Large input signals ($\sim 40\text{pC}$)
- * Large input capacitance ($\sim 40\text{pF}$ detector + wires)
- * High resolution (10 bits)
- * Dual gain (50x) for different modes of operation: science and detector calibration
- * Low latency ($\sim 1\mu\text{s}$) output for beam diagnostics
- * High radiation (1Mrad total dose)
- * Integrated circuit in design at SLAC

Simplified Block Diagram

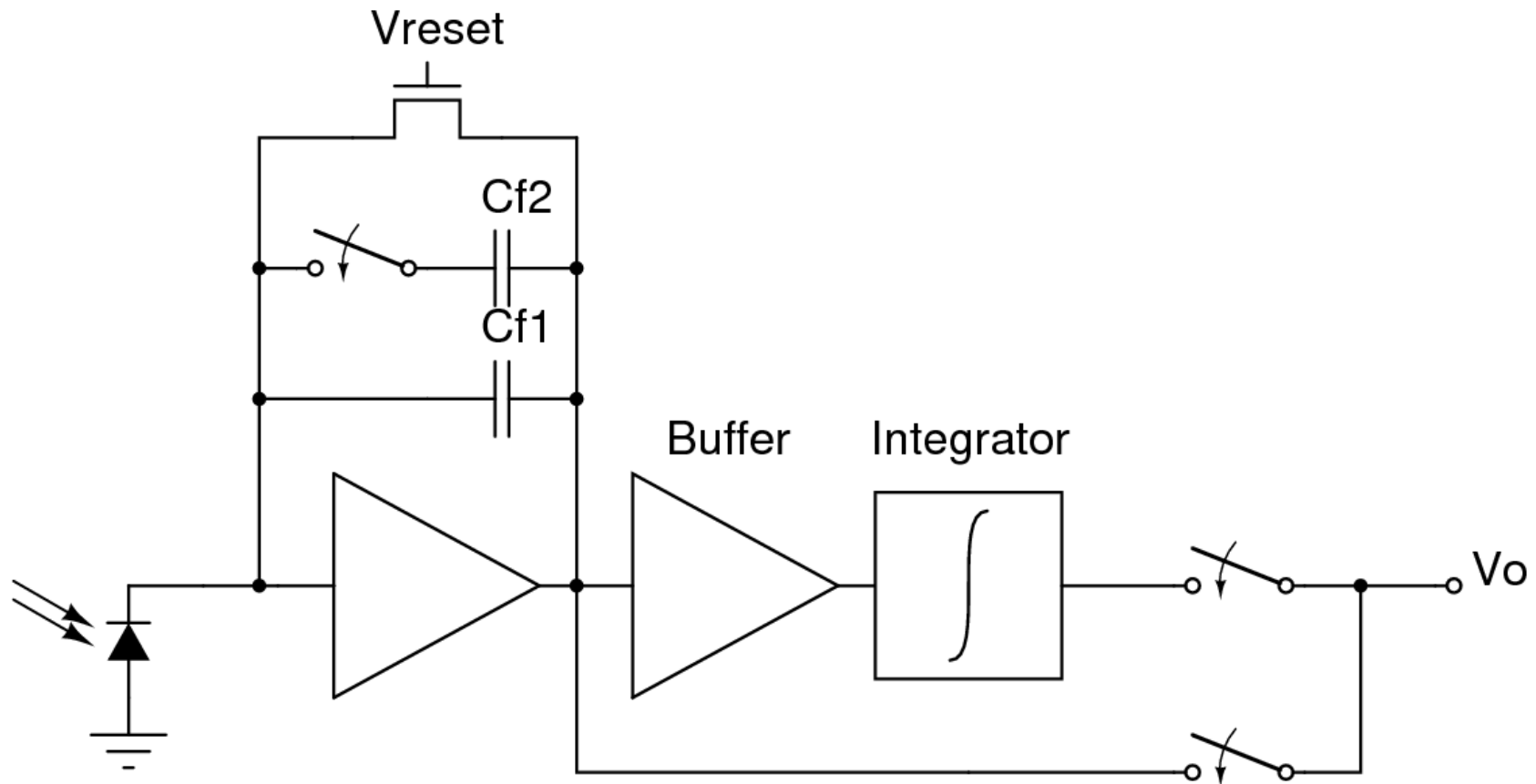


- * Dual-gain front-end electronics: charge amplifier, pulse shaper and T/H circuit
- * Successive approximation ADC, one per channel
- * Digital memory, 2820 (10-bits + parity) words per channel
- * Analog addition of 32 channel outputs for fast feedback; low latency ADC

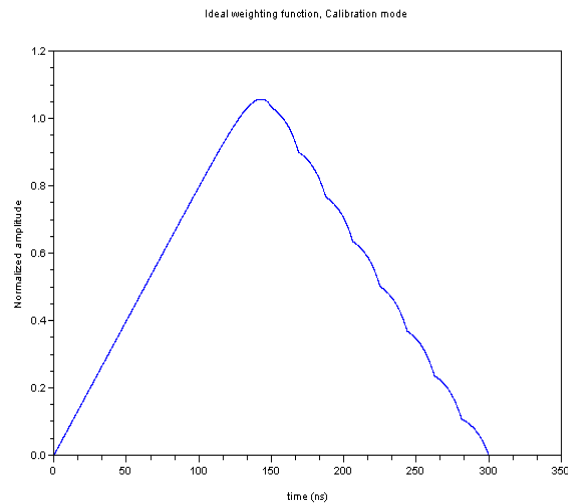
Low Noise Design Considerations

- * High occupancy: gated system to prevent signal pileup
- * Only 308 ns per beam crossing: noise is dominated by charge amplifier voltage noise
- * Careful design of weighting function is necessary (time-variant filter) in calibration mode: limit its slopes
- * In calibration operation, a switched-capacitor integrator is used to limit the weighting function slope
- * In science operation, no additional filter is used (good linearity)
- * In both modes of operation, a slow reset technique is implemented using switched-capacitor circuits

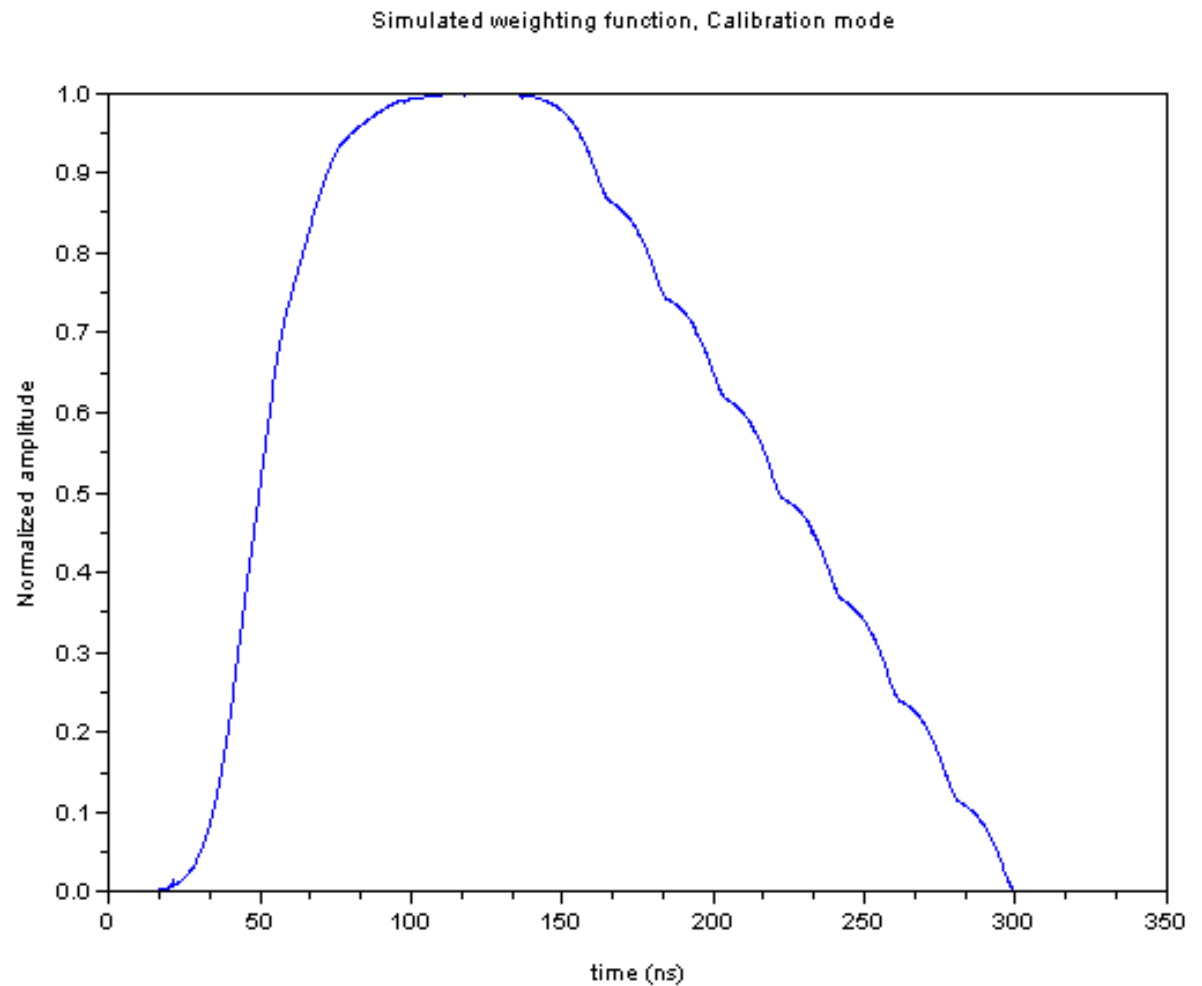
Front End Block Diagram



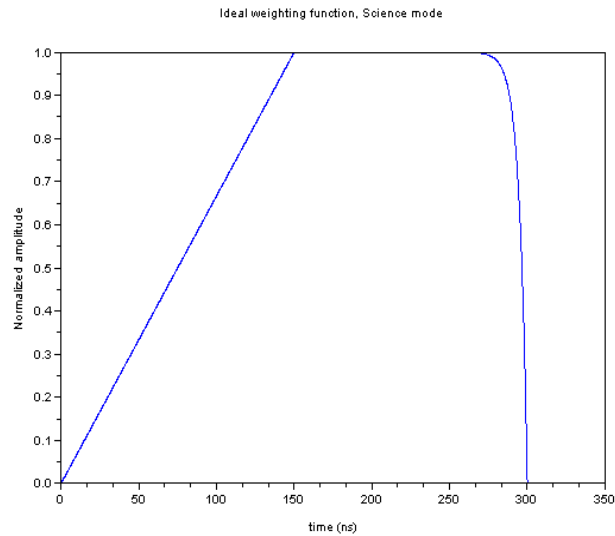
Front End Simulation Results: Weighting Function, Calibration Mode



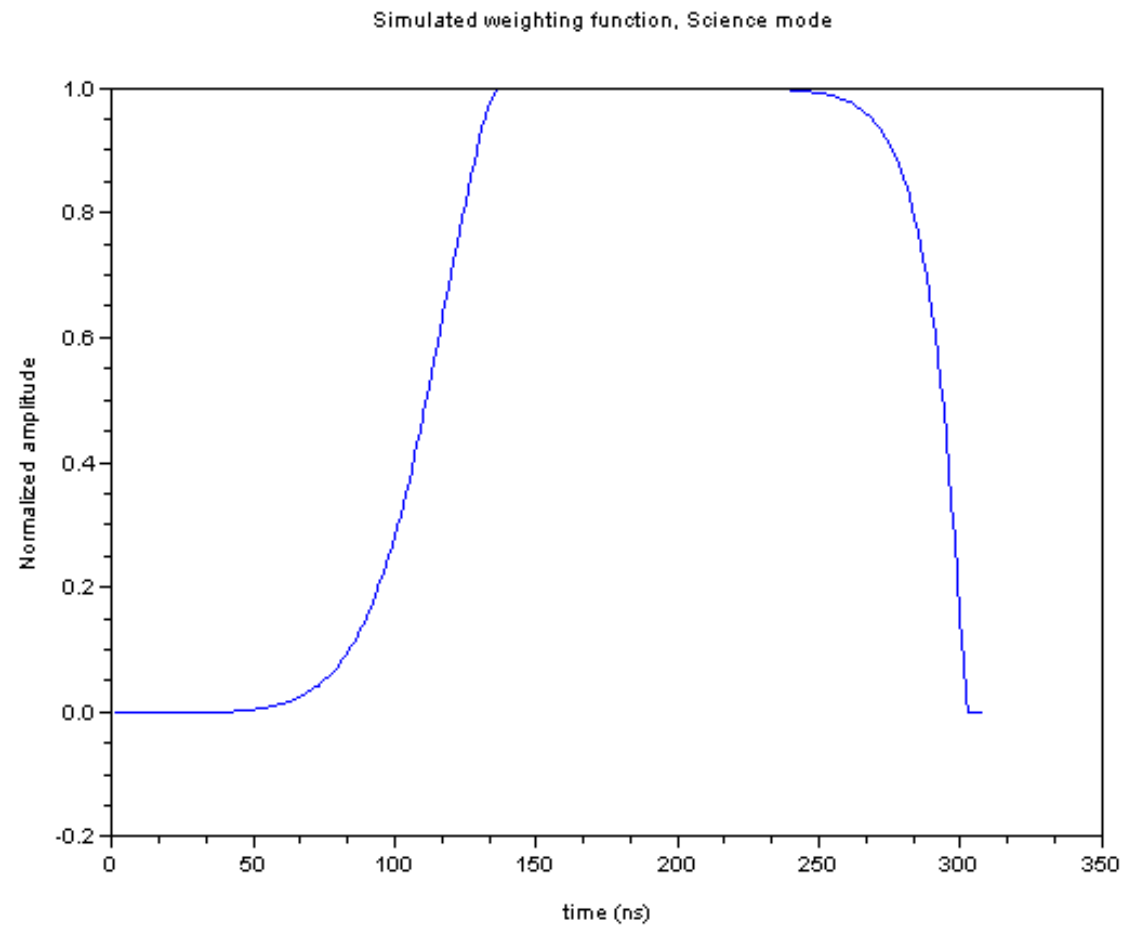
Ideal



Front End Simulation Results: Weighting Function, Science Mode



Ideal



People

- * Angel Abusleme (Ph.D. student)
- * Professor Martin Breidenbach (SLAC)
- * Dr. Angelo Dragone (SLAC)
- * Dr. Dietrich Freytag (SLAC)
- * Dr. Gunther Haller (SLAC)
- * Professor Bruce Wooley (Stanford U.)