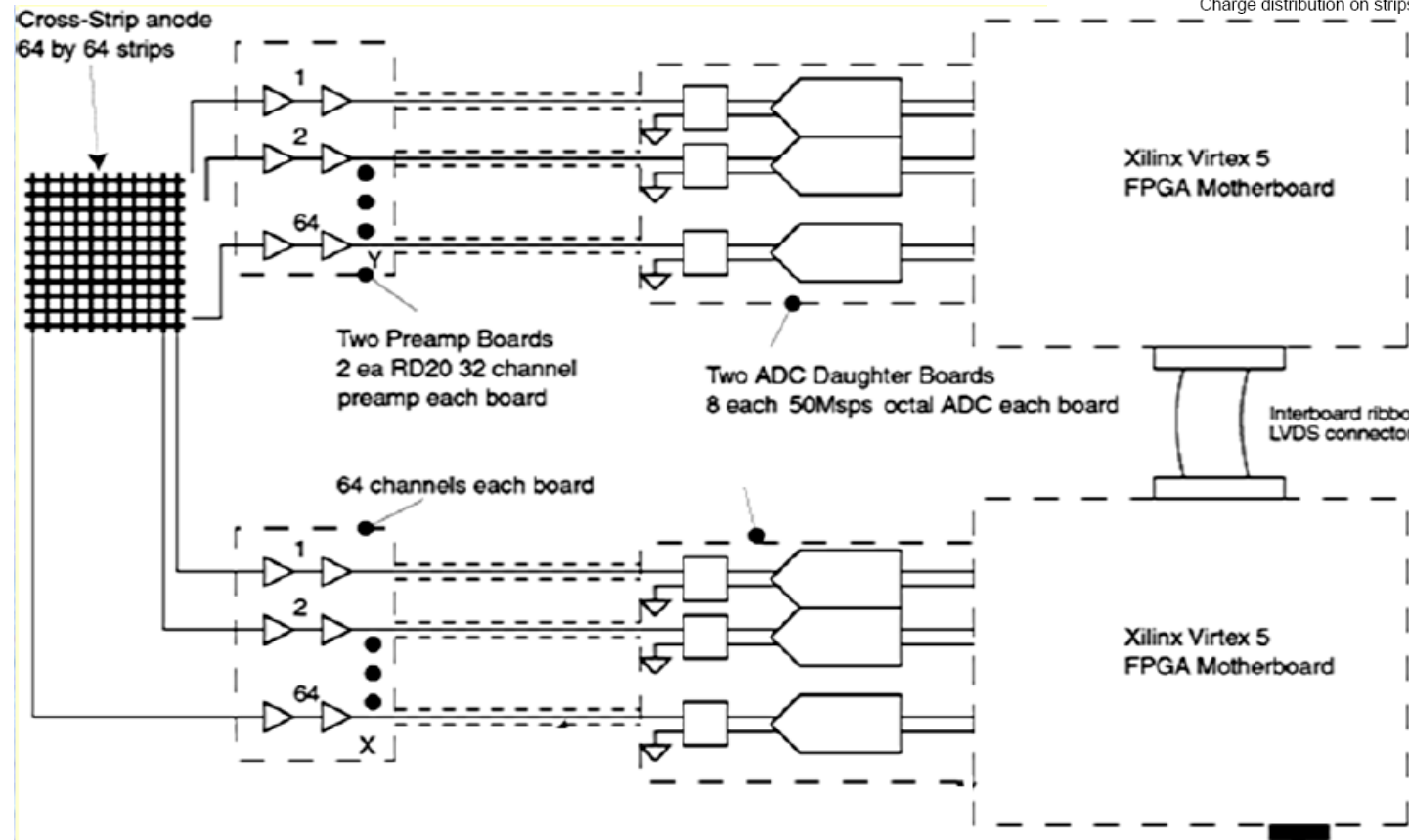
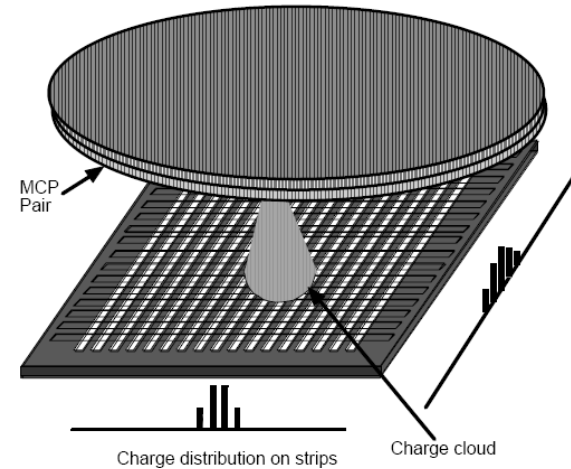
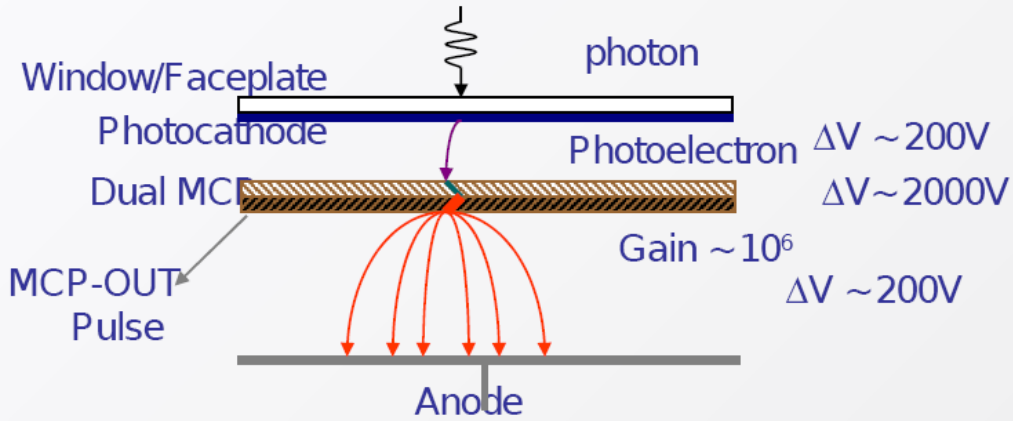


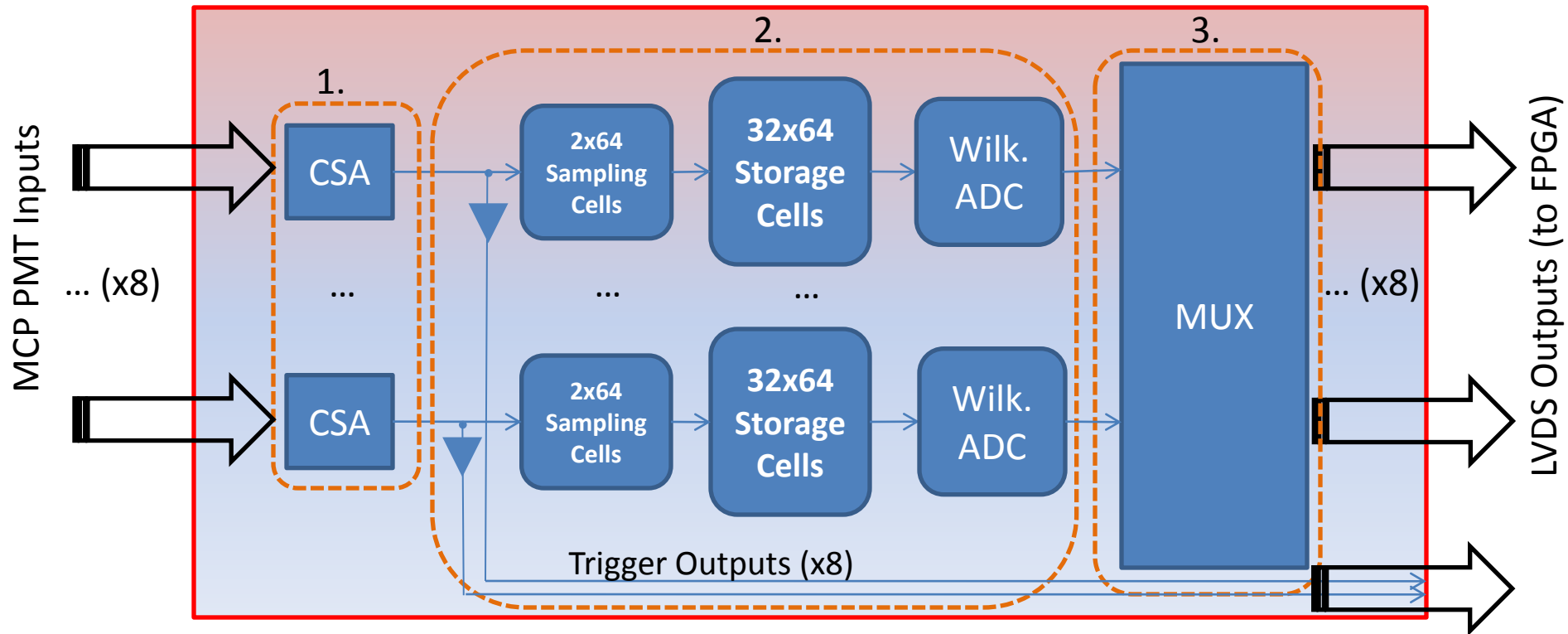
# Cross Strip Micro-Channel Plate Readout



## Performance

- Spatial resolutions <  $7 \mu m$  FWHM
- Time resolution  $\sim 1$  ns FWHM
- Dead time @ 2 MHz  $\sim 16\%$
- Reduced resolution @ MHz rates (due to pile-up from the amplifiers)

# Gigasample Recorder of Analog waveforms from a Photodetector (GRAPH) ASIC

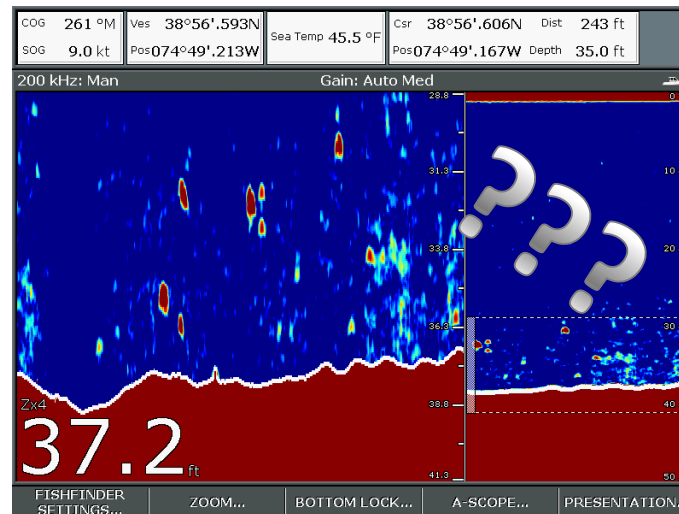


The full GRAPH block diagram is represented above, and has 3 primary challenges:

1. Charge sensitive amplifier (CSA) performance
  - Reduce pile-up with a faster amplifier.
  - Maintain low noise.
2. Noise and dynamic range of the sampling/digitization
  - Increase sampling rate from 50 MHz to ~GHz.
  - Large dynamic range to allow detection of signal on many strips.
3. Fast throughput to the FPGA
  - Onboard triggering & MUX for data reduction during transfer/readout

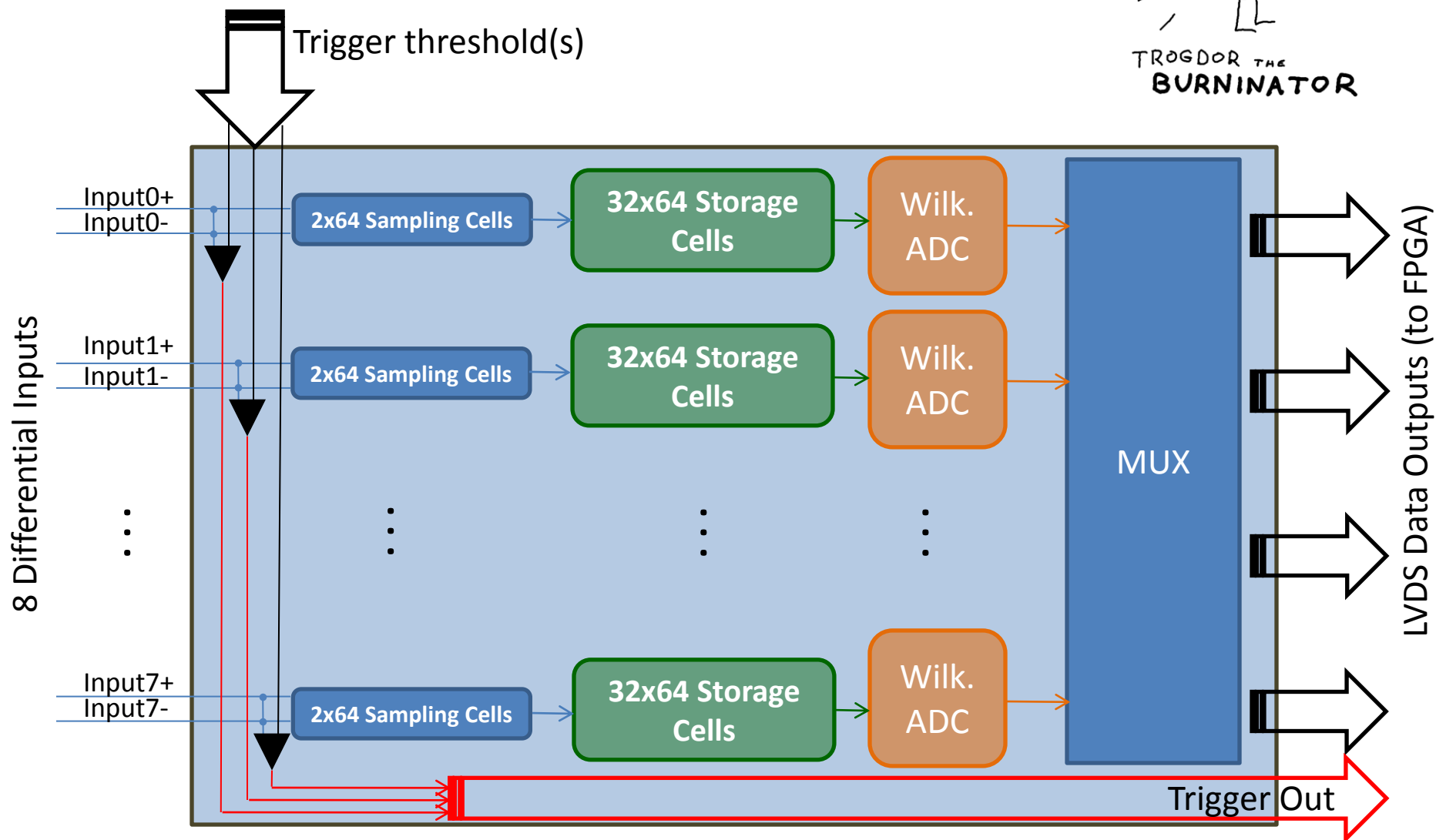
# An aside on naming...

- Original name: Sampler Optimized for Noise and Range (SONAR)
  - I guess this is okay... but the ASIC really has nothing to do with sonar, which could be confusing.



- New acronym that doesn't mislead.
  - (Though it does betray that I'm a nerd.)

# TTrigger-Onboard Gigahertz Digitizer Optimized for Range (TROGDOR)



# TROGDOR Specifications

Parameter	Value	Comments
Input channels	8	Differential
Sampling cells per channel	128	2 rows of 64 cells
Storage cells per channel	2048	32 rows of 64 cells
Sampling rate	~1 Gsa/s	
Dynamic range	~10 bits	Effective(?)
Buffer depth	~2 $\mu$ s	@ 1 GSa/s
Throughput	~4 MHz	w/ ~0 dead time
Trigger outputs to FPGA	8(?)	LVDS? Individual trigger thresholds? Prototype 1 or 2 channels only?
Data outputs to FPGA	4(?)	LVDS

# Important questions...

- Independent Wilkinson ADCs for each channel?
- Triggering
  - How many trigger lines? One to prototype, or all channels?
  - Thresholds set externally or onboard?
- Output multiplexing – 4 channels out?

## Simulations Needed

- Input coupling & analog bandwidth
  - Input expected from CSAs?
- Triggering
- Sampling speed
- Sampling transfer to storage array
- Wilkinson performance
  - Linearity
  - Digitization time
- Output multiplexing