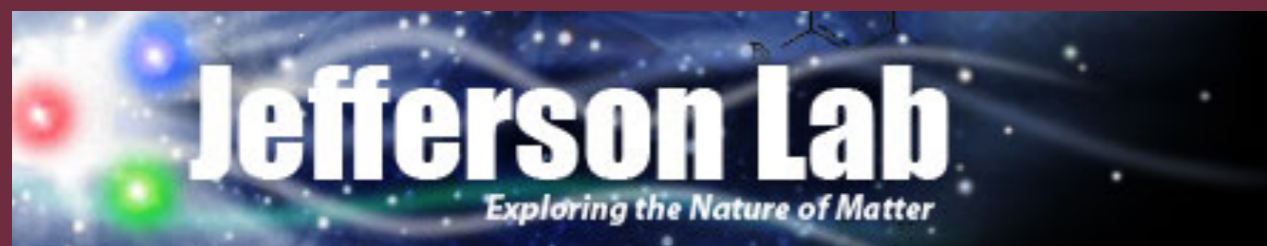
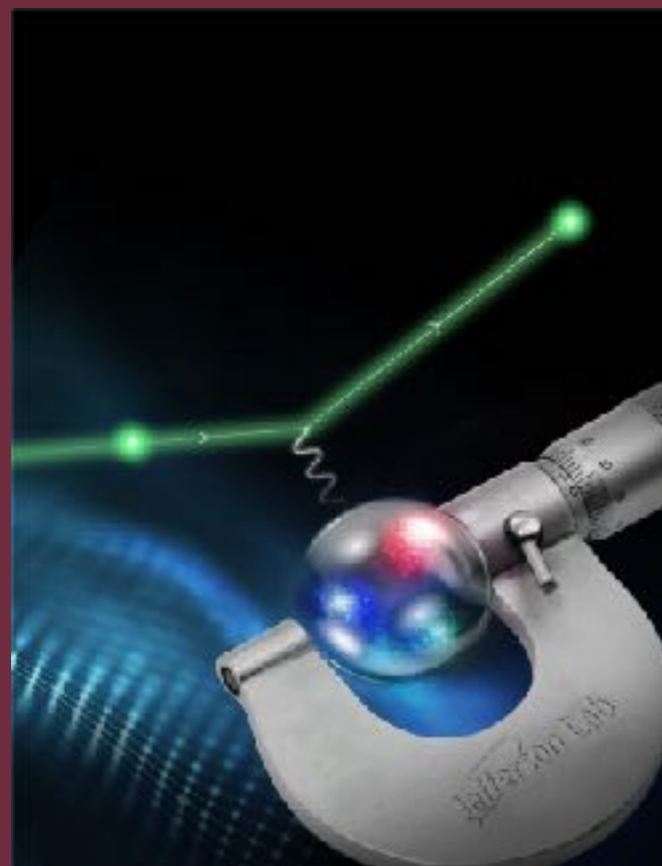


The PRad-II Flash ADC-based Upgraded DAQ.

Dipangkar Dutta



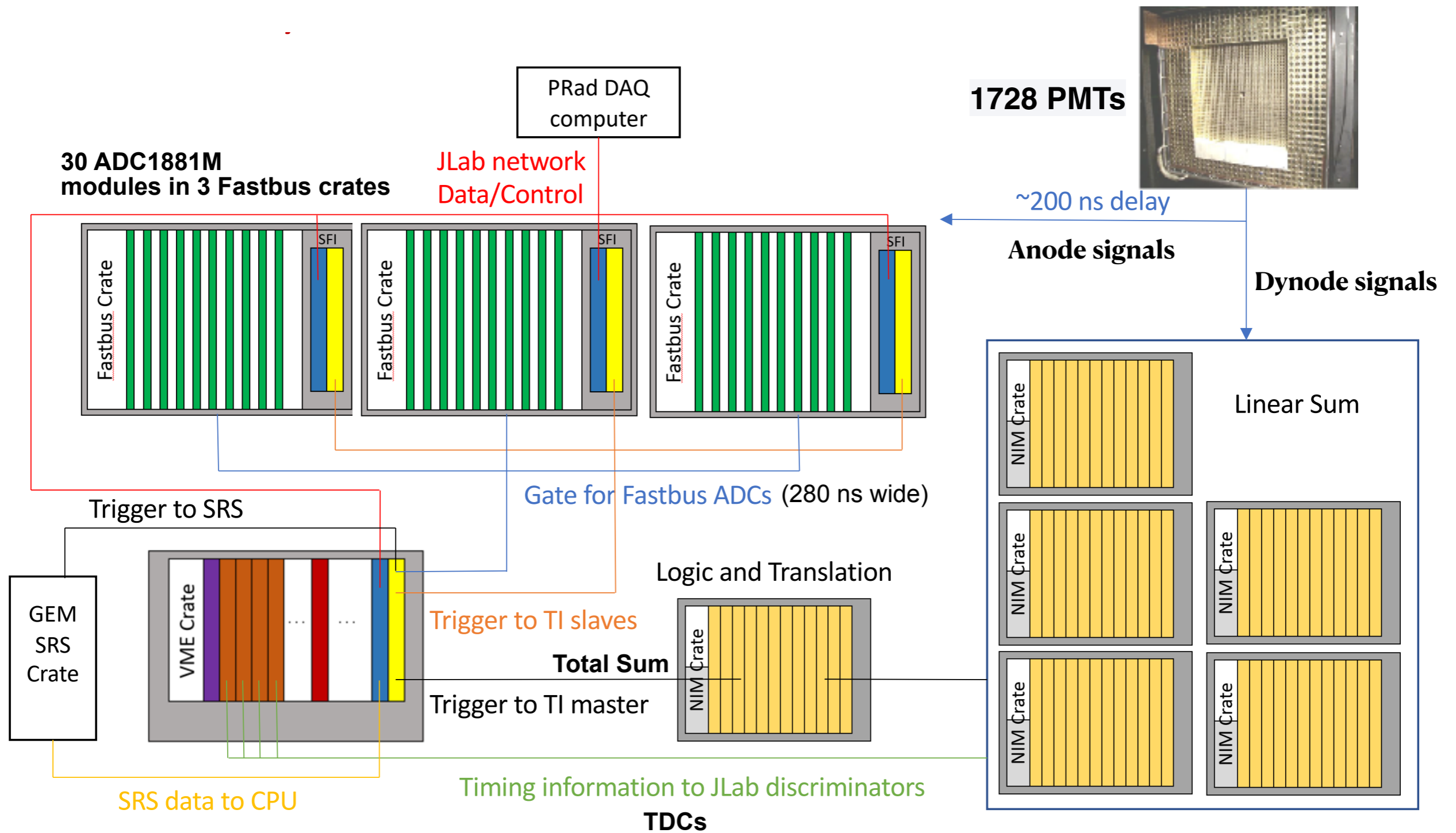
for the
PRad collaboration



PRad-II Technical Review

March 12, 2021

PRad used a FASTBUS-based DAQ



A FASTBUS-based DAQ with custom summing modules and TDCs
DAQ rate ~ 4 kHz & 80-90% live-time during production.

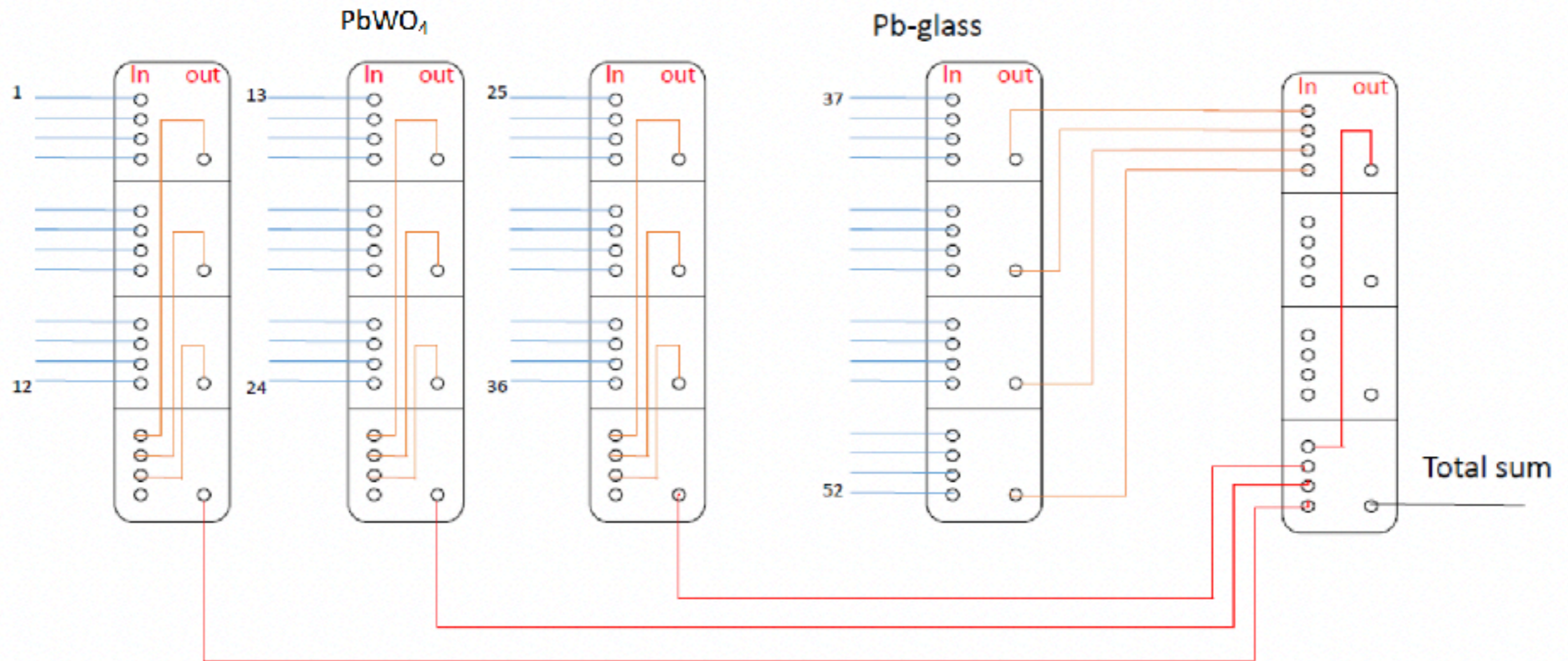
Image courtesy of Chao Peng

PRad used custom summing modules

Dynode signals from all PMTs summed by 52 UVA120A custom linear summing modules

1 copy of output digitized using 52 CAEN v1990 TDC modules

2nd copy summed using NIM Fan-In modules to produce the Total Sum Trigger

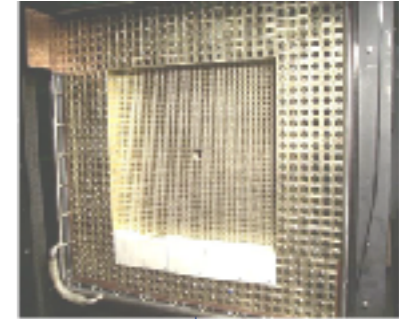
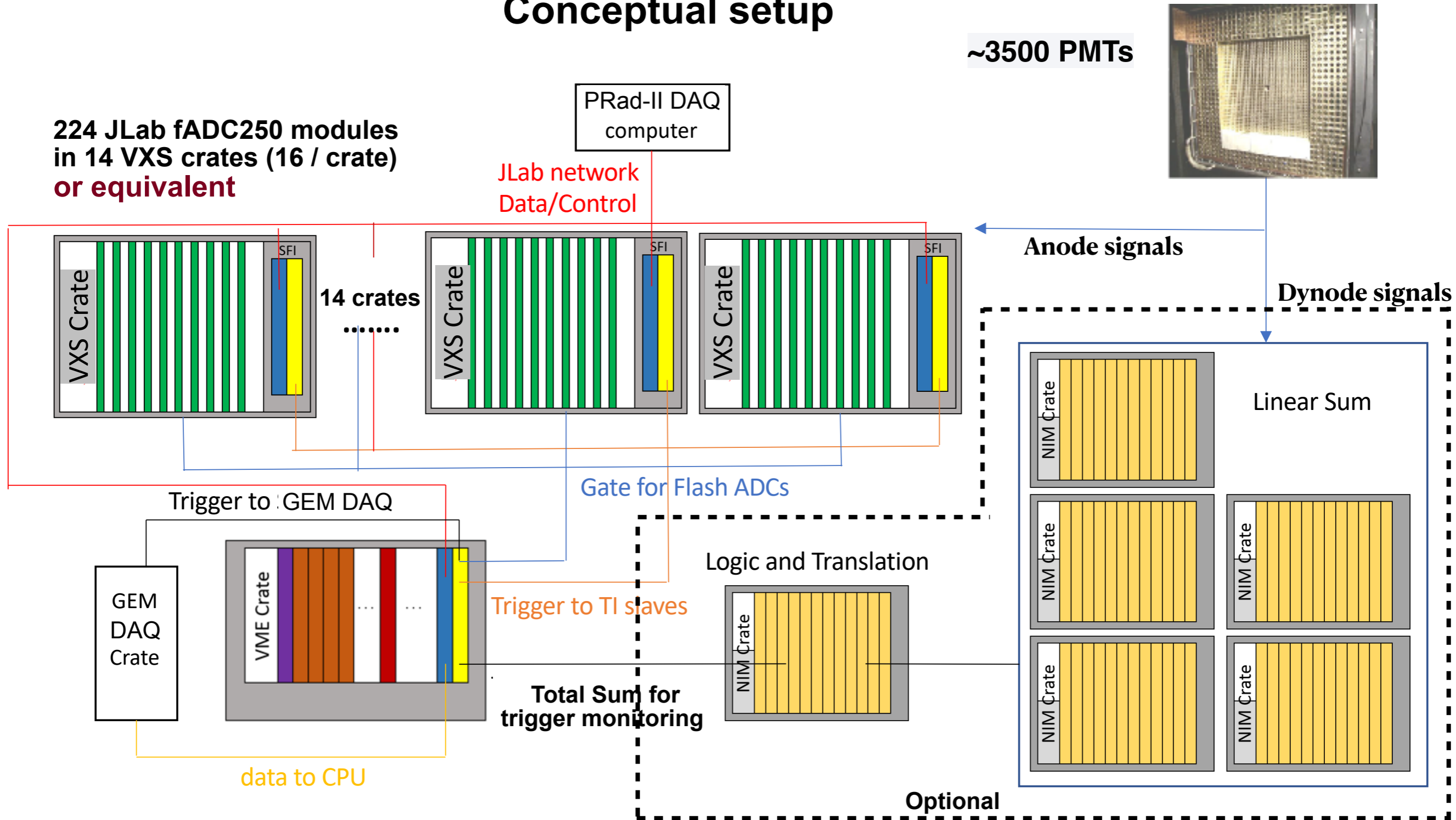


A FASTBUS-based DAQ with custom summing modules and TDCs
DAQ rate ~ 4 kHz

Image courtesy of Chao Peng

PRad-II will upgrade to a FADC-based DAQ

Conceptual setup



Modern flash ADC-based pipelined DAQ with robust trigger efficiency monitoring

Image courtesy of Chao Peng

There are several key advantages to the FADC-based DAQ

Advantages of a modern flash ADC-based pipelined DAQ



Eliminates the need for 100s of meters of delay cables

Better gain and pedestal stability and monitoring

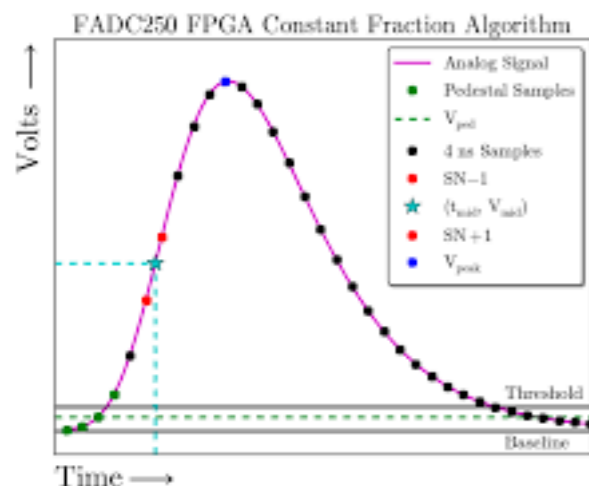
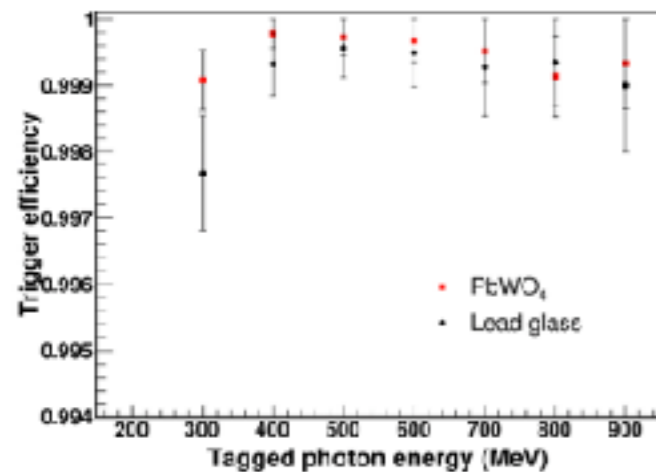
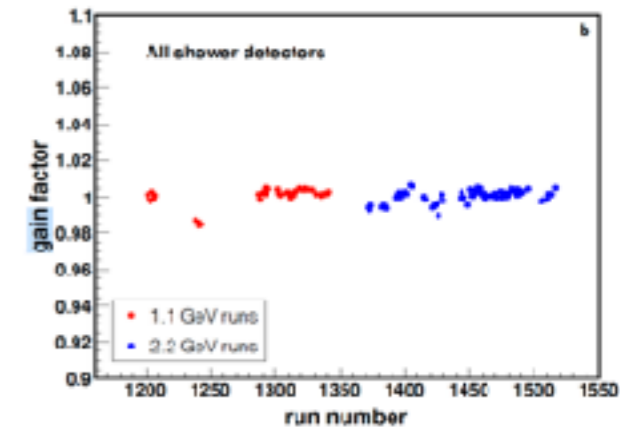
Essentially dead time free

Improved rejection of accidentals

Improved trigger efficiency with continuous monitoring

Provides timing information for each crystal with better than 1.5 ns resolution, needed for the veto scintillators enabling access to the lowest Q^2 in e-p scattering experiments.

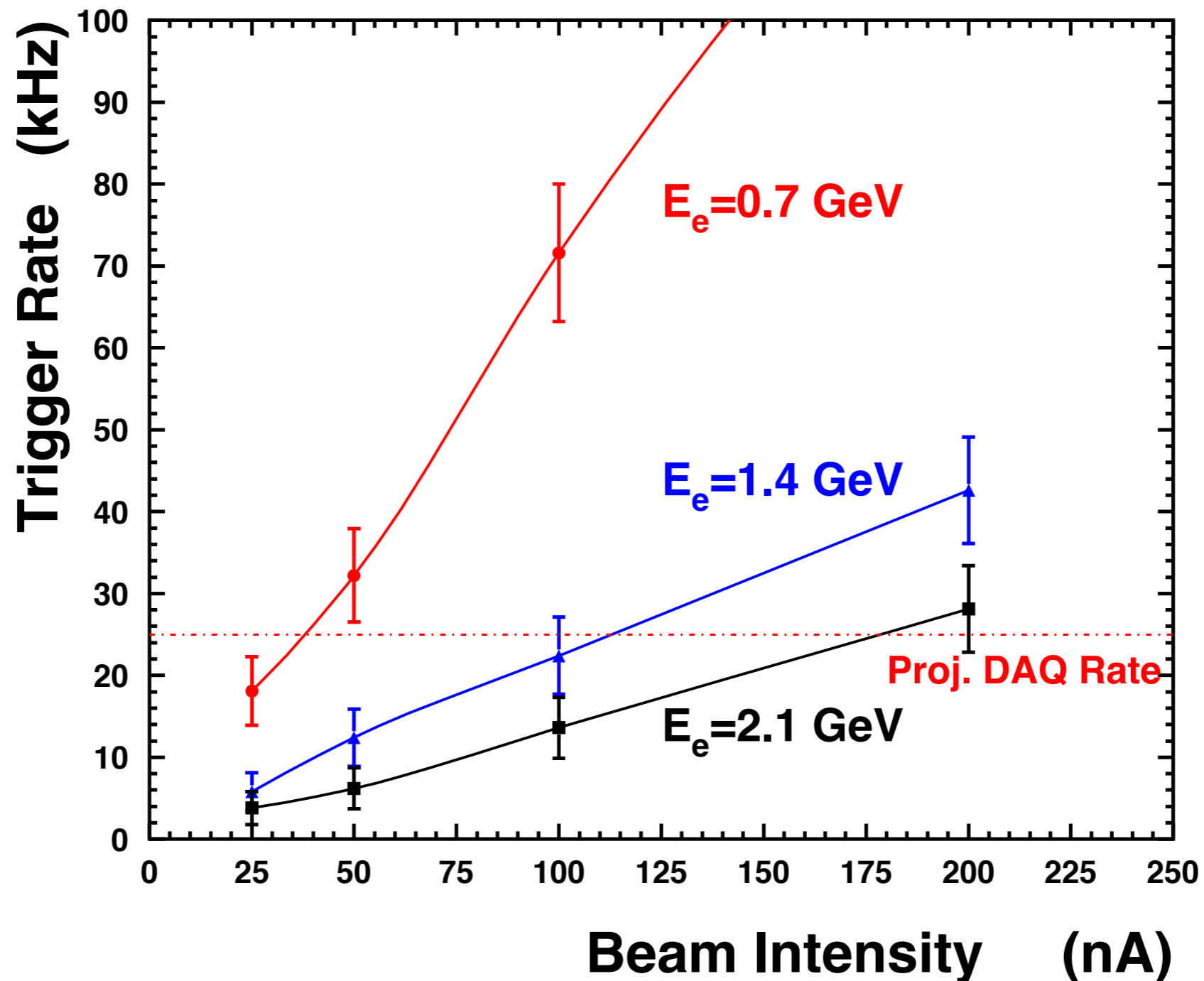
7 fold improvement in DAQ rate



Images courtesy of Weizhi Xiong

The upgraded DAQ enables 7-fold improved rate

Critical for the factor of ~ 4 reduction in the statistical uncertainty of PRad-II



DAQ Hardware related resources were requested in the NSF pre-proposal

| Qty | Description | cost | | Notes |
|-----|-------------|----------|-----------|---|
| 1 | VXS crate | \$16,000 | \$16,000 | Includes high current supply and high RPM fans |
| 16 | FADC250 | \$6,000 | \$96,000 | 16 boards per crate (256 channel total) Lemo inputs |
| 1 | SD | \$2,000 | \$2,000 | Signal distribution board |
| 1 | VTP | \$9,000 | \$9,000 | Trigger processor |
| 1 | TI | \$1,500 | \$1,500 | Trigger interface |
| 1 | CPU | \$5,500 | \$5,500 | Linux readout controller |
| | | Total: | \$130,000 | |

14 crates + 1 spare : $\$130,000 \times 15 = \1.95 Million