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SNS Neutron Data

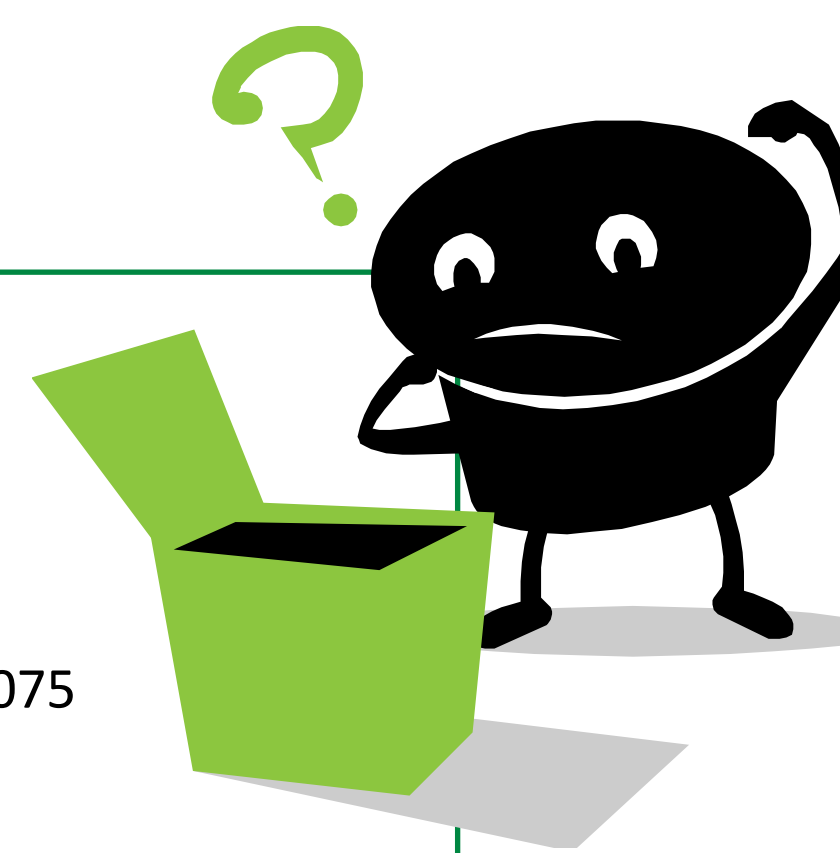
Zero to 10 million events per second:

- Pixel ID
 - Where was the detector hit by a neutron?
- Time of flight
 - When was the detector hit by a neutron?

.. plus beam pulse proton charge & time stamp
.. plus maybe additional detector internals (raw ADC counts, ...)

EPICS "V4"

- pvData – Structured Data
 - Java, C++
 - Normative Types: Structs w/ time, alarm, ..
- pvAccess – Network protocol
 - Similar to CA
 - Search via UDP 5076, connect by default on TCP 5075
 - Server decides on byte order
 - Partial transfers, whatever client requests
 - Clever 'size': 1 byte if <255, ...
 - Protocol freeze in Oct. 2014



SNS events as pvData

```
Structure
// Time stamp for all;
// eventID in .userTag
time_t timeStamp

NTScalar protonCharge
double value

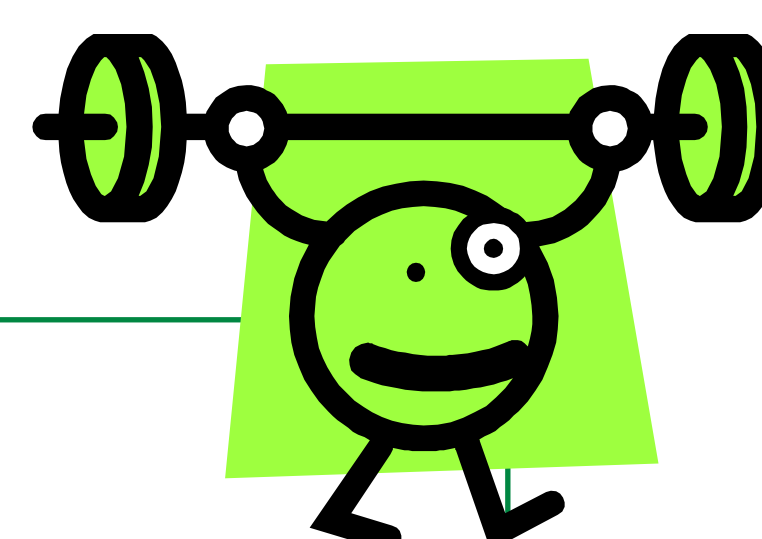
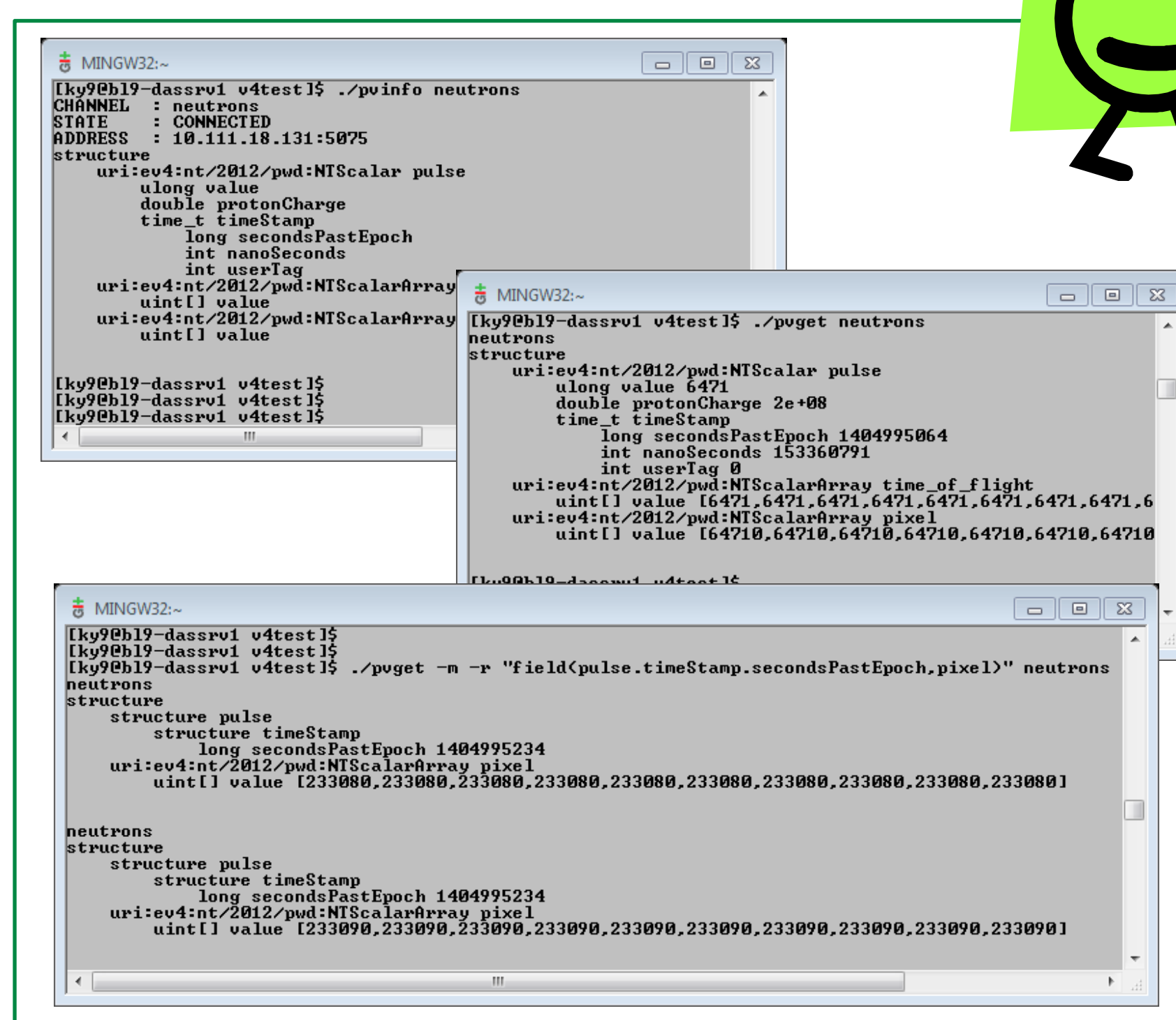
NTScalarArray time_of_flight
uint[] value

NTScalarArray pixel
uint[] value

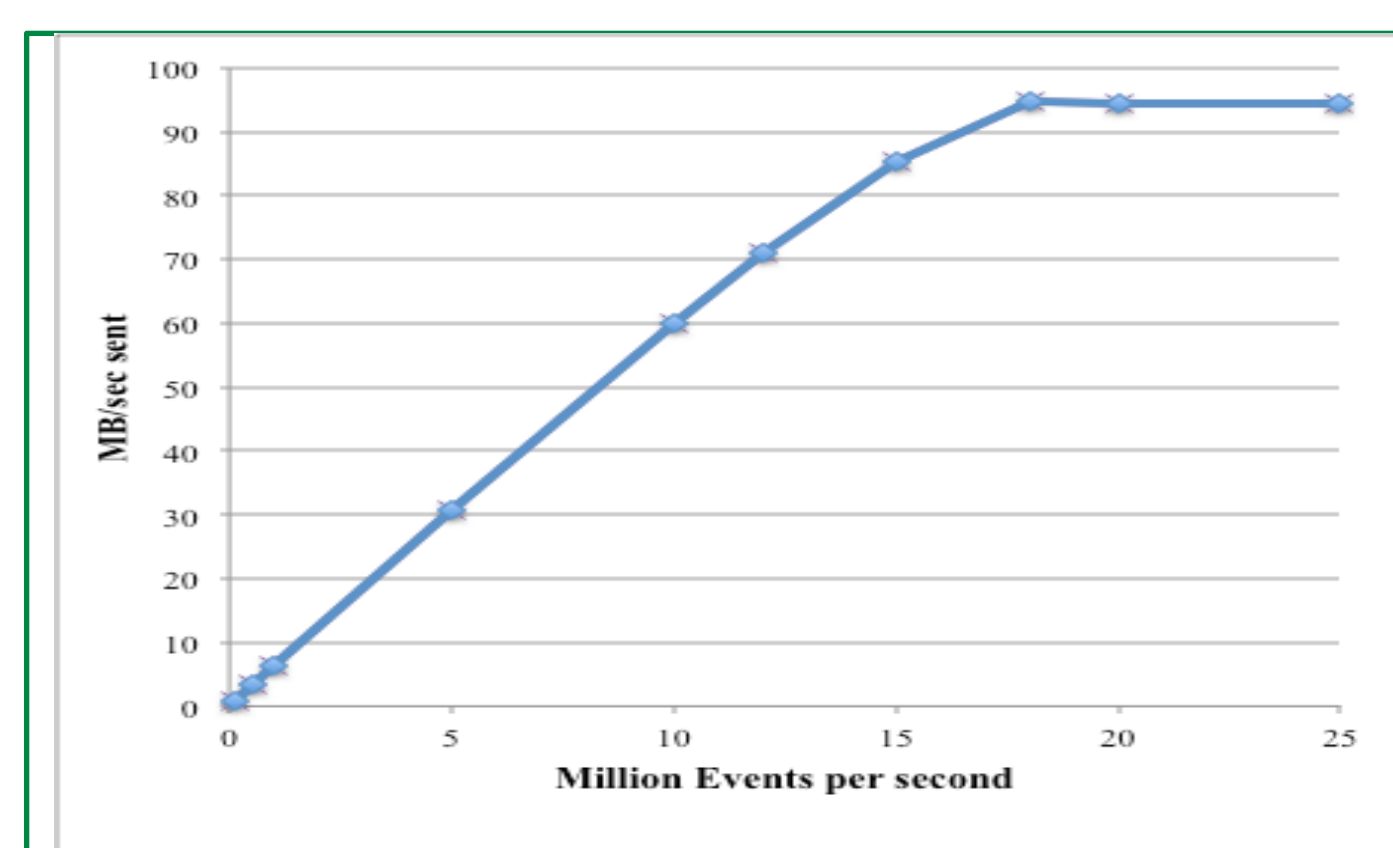
NTScalarArray position_x
uint[] value
.. a few more optional elements
```

Could also arrange as array-of { t.o.f., pixel}, but above structure allows flexible subscription: XY histogram to subscribe to just 'pixel' updates, while t.o.f. histogram can receive only the 'time_of_flight' changes, optimizing network usage.

Generic V4 Tools

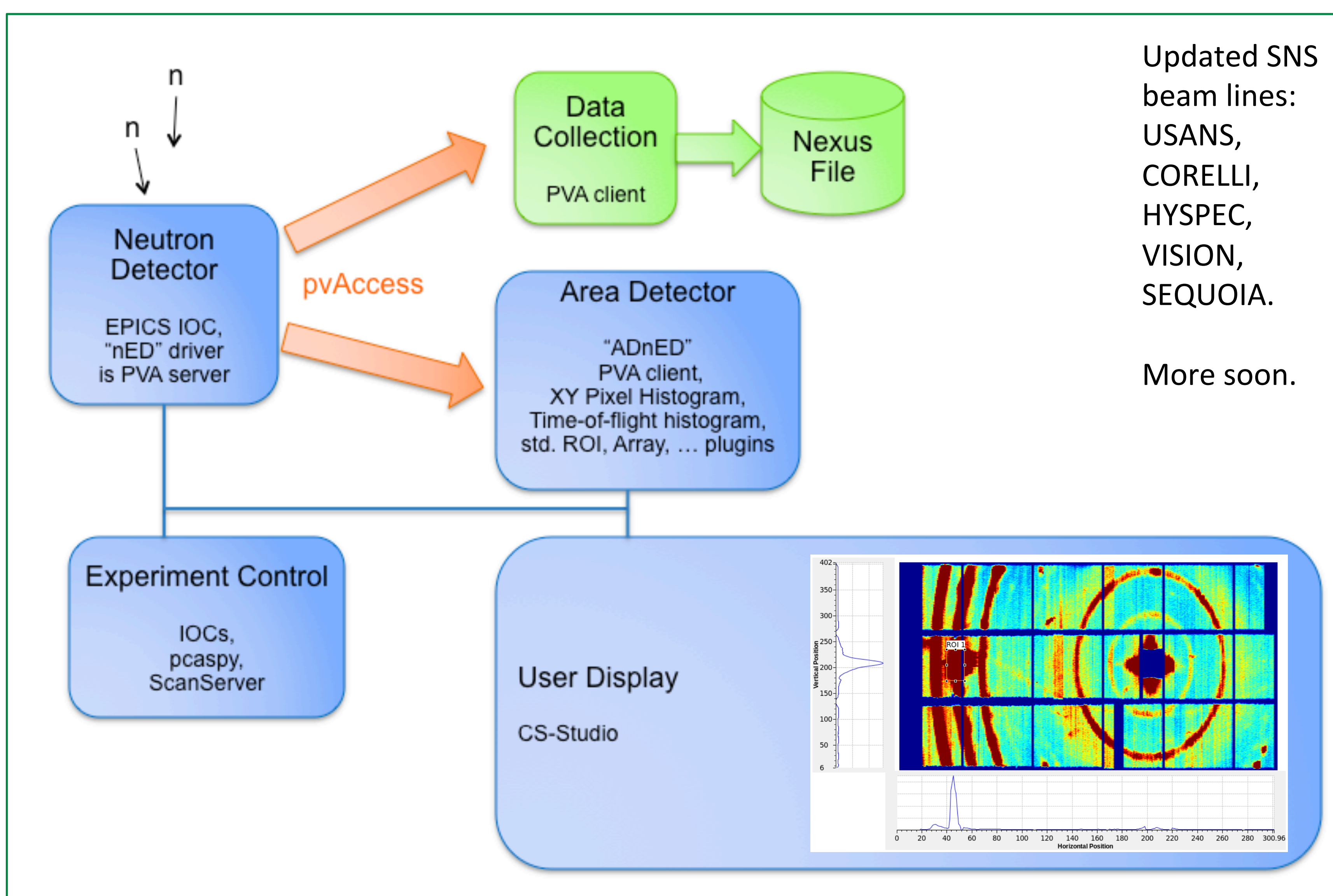


pvAccess



1GigE network:
Up to 150k events at 100Hz,
i.e. 15 Million events per second,
before network saturation
10GigE network:
100 M evt/sec before CPU saturation

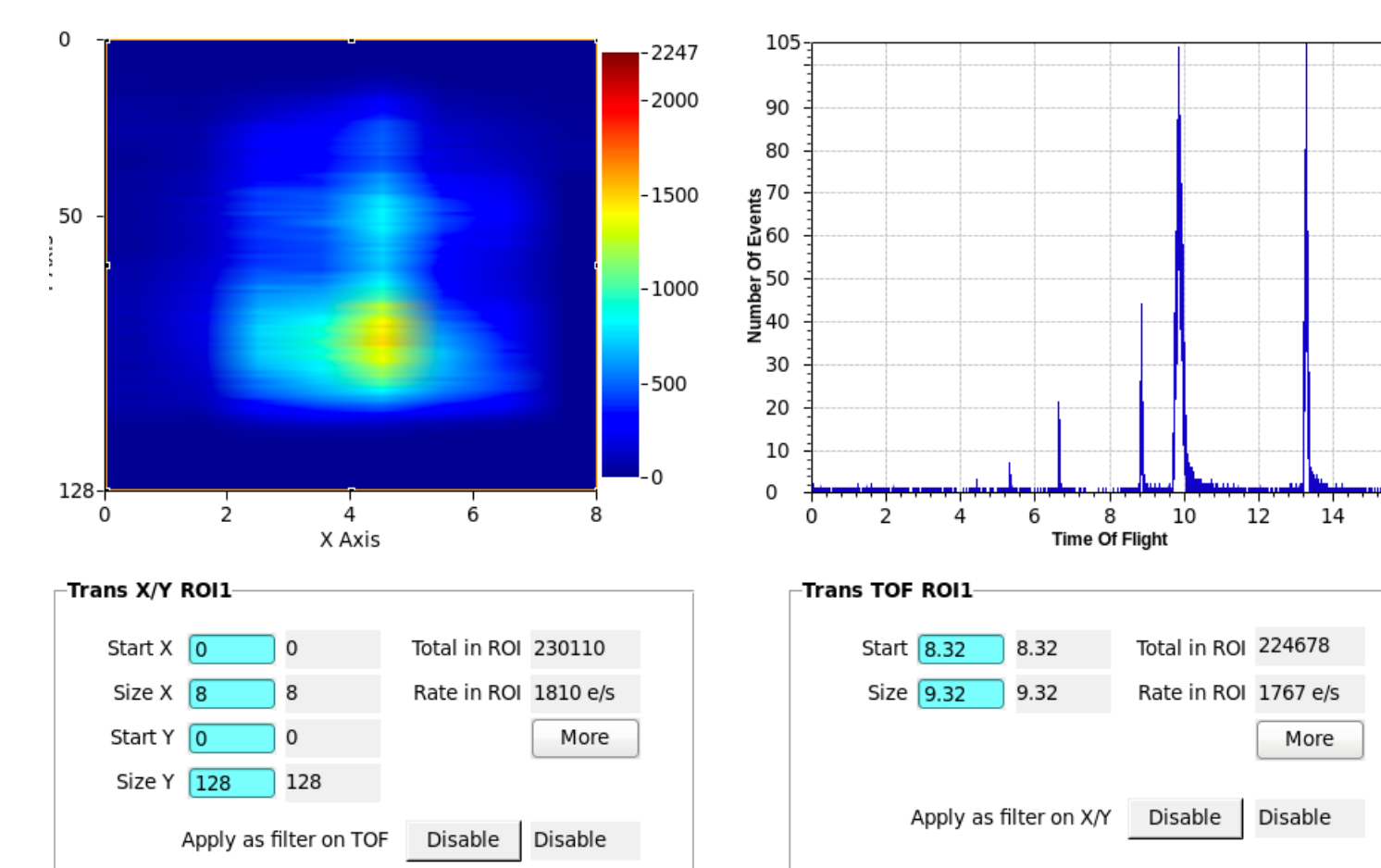
Operational on SNS Beam Lines



Summary

Control System Software update of SNS beam lines to EPICS successfully uses V4 to transfer neutron events from detectors to first processing stages

- pvData easily wraps the SNS neutron event information
- pvAccess meets our performance needs
- Overall stability exceeded our expectations for a first production deployment of this new technology



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