EPICS V4 for SNS Neutron Data

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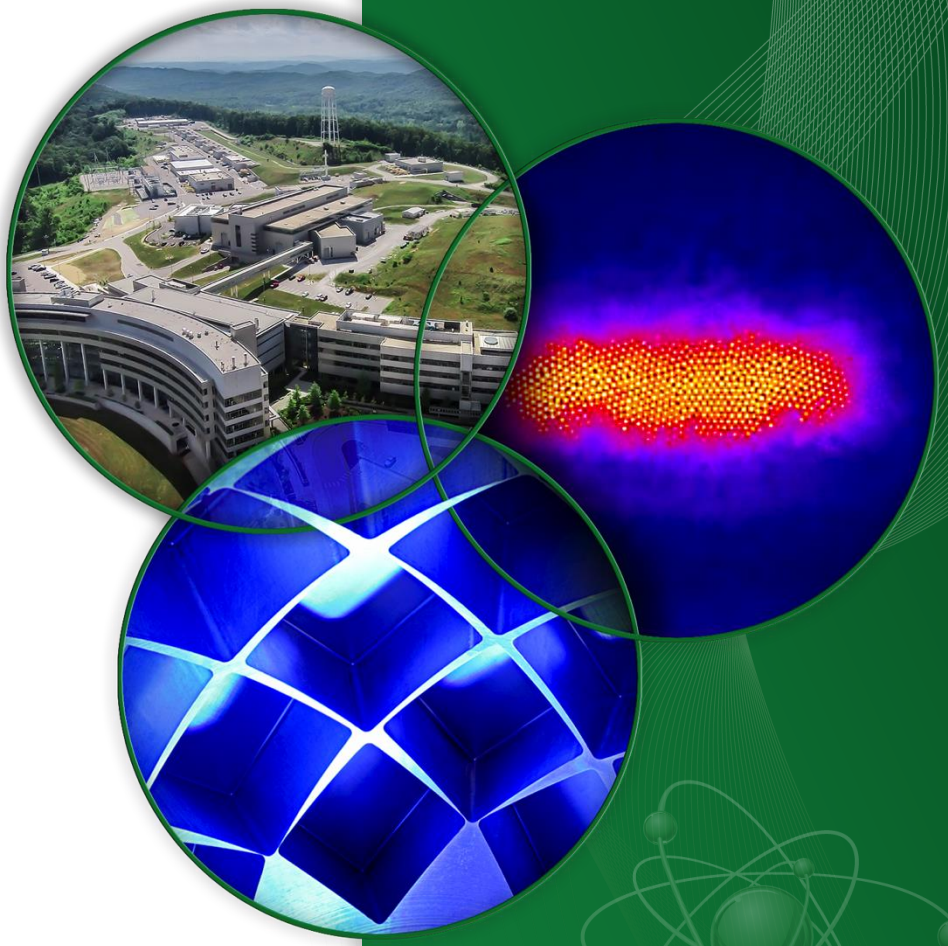
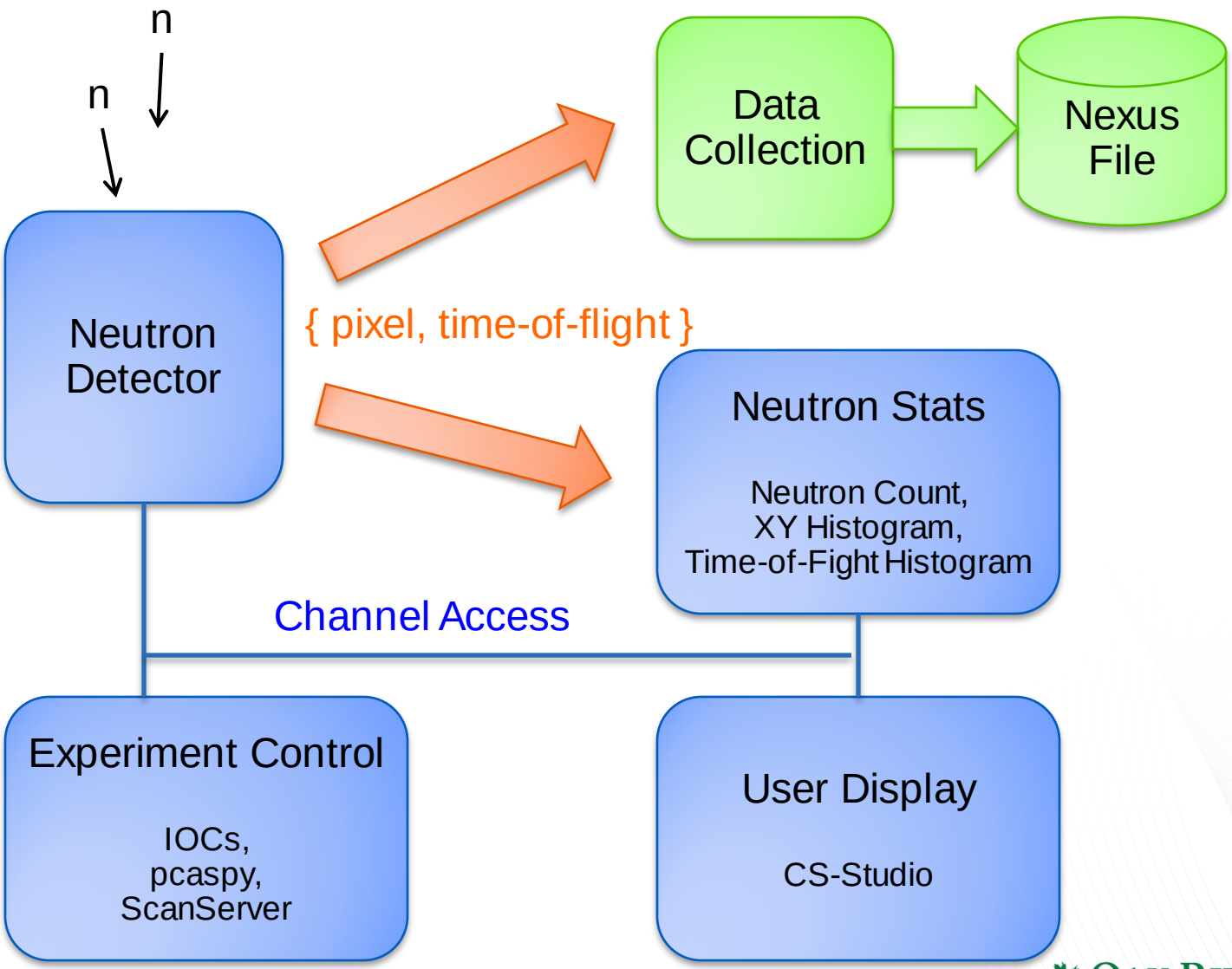
Oct. 2014



Basic Idea: V4 for Raw Neutron Data



"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, …

Active development, protocol freeze in Oct. 2014

Orig. SNS neutron network protocol	V4 pvData, pvAccess
'events' via UDP broadcast to any number of listeners	'monitors' via TCP to 2-3 listeners
Protocol documented in code	Protocol documented in specification
Custom MS Visual C++ code took years to get stable	Java, portable C++, python code with wider developer and user base
No 'debug' tools	pvinfo, pvget, CSS Probe, …
Clients receive neutron events	Clients can see last (=stale) value, then new events
Can put anything into network package	Need to fit into pvData

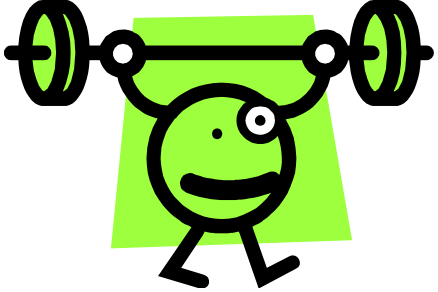
SNS Neutron Data

```
uint64   eventID
uint64   pulseID      // timeStamp
double   protonCharge
struct
{
    uint32 time_of_flight
    uint32 pixel
}       events[]
```

SNS Neutron Data 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
```

What you get for free



MINGW32:~

```
[ky9@bl9-dassrv1 v4test]$ ./pvinfo neutrons
CHANNEL   : neutrons
STATE     : CONNECTED
ADDRESS   : 10.111.18.131:5075
structure
    uri:ev4:nt/2012/pwd:NTScalar pulse
        ulong value
        double protonCharge
        time_t timeStamp
            long secondsPastEpoch
            int nanoSeconds
            int userTag
    uri:ev4:nt/2012/pwd:NTScalarArray time_of_fligh
        uint[] value
    uri:ev4:nt/2012/pwd:NTScalarArray pixel
        uint[] value


[ky9@bl9-dassrv1 v4test]$
[ky9@bl9-dassrv1 v4test]$
[ky9@bl9-dassrv1 v4test]$
```

MINGW32:~

```
[ky9@bl9-dassrv1 v4test]$ ./pvget neutrons
neutrons
structure
    uri:ev4:nt/2012/pwd:NTScalar pulse
        ulong value 6471
        double protonCharge 2e+08
        time_t timeStamp
            long secondsPastEpoch 1404995064
            int nanoSeconds 153360791
            int userTag 0
    uri:ev4:nt/2012/pwd:NTScalarArray time_of_flight
        uint[] value [6471,6471,6471,6471,6471,6471,6471,6471,6
    uri:ev4:nt/2012/pwd:NTScalarArray pixel
        uint[] value [64710,64710,64710,64710,64710,64710,64710


[ky9@bl9-dassrv1 v4test]$
```

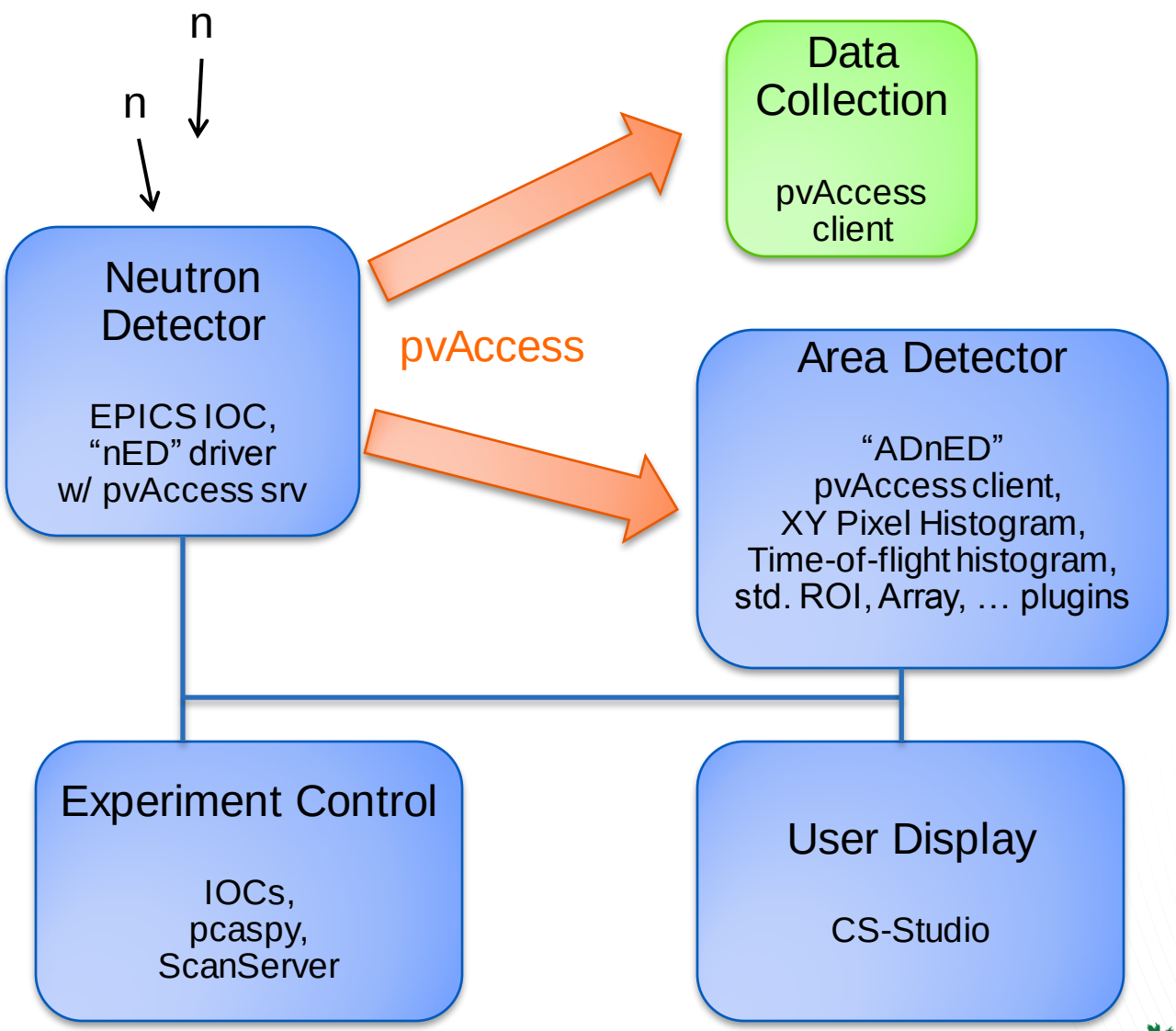
MINGW32:~

```
[ky9@bl9-dassrv1 v4test]$
[ky9@bl9-dassrv1 v4test]$
[ky9@bl9-dassrv1 v4test]$ ./pvget -m -r "field(pulse.timeStamp.secondsPastEpoch,pixel)" neutrons
neutrons
structure
    structure pulse
        structure timeStamp
            long secondsPastEpoch 1404995234
    uri:ev4:nt/2012/pwd:NTScalarArray pixel
        uint[] value [233080,233080,233080,233080,233080,233080,233080,233080,233080,233080]


neutrons
structure
    structure pulse
        structure timeStamp
            long secondsPastEpoch 1404995234
    uri:ev4:nt/2012/pwd:NTScalarArray pixel
        uint[] value [233090,233090,233090,233090,233090,233090,233090,233090,233090,233090]
```

Tests

- Server that generates fake neutron events
  - Similar to pvDatabaseCPP example
  - Can run standalone or in V3 IOC
- "pvget –m" for initial tests
  - Hit CPU limit because of string formatting
- Custom client
  - Tests for missing 'event ID'
- Results:
  - Saturating 1GB network around 15M SNS events/sec
    - 100 updates/sec, each with 150000 events
    - 1 'event' ⇔ T.o.F + pixel ⇔ 8 bytes, and indeed about 8 b/evt on network!!
  - On 10GB network 100M SNS events/sec w/o problems
    - Limit was CPU load, not network
  - Required for SNS: 10M events/sec?

Plan



Looking Good!

- Can package data in flexible ways
- Already have network tools to inspect, monitor
- Performance is good
- Community of developers and users

  Thanks to Matej Sekoranja, Marty Kraimer, David Hickin for fast bug fixes and help