# Muon g-2 Detectors

Muon g-2 PGM
2/19/2013

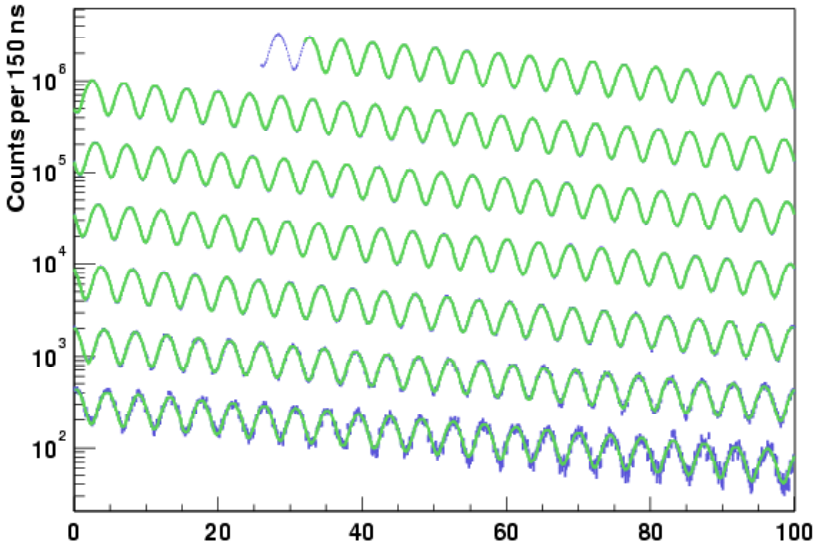
Brendan Casey
Detector L2 Manager

U.S. DEPARTMENT OF ENERGY | Office of Science

# Detector Physics Goals

- The L2 detector branch of the WBS contains all instrumentation required to measure the muon precession frequency
- This includes:
  - Calorimeters to measure positron energy and time
    - This data is fit to extract the precession frequency
  - Tracking and other auxiliary detectors to measure characteristics of the muon beam
    - This data is used to make corrections to the extracted precession frequency and help constrain systematics
  - Readout electronics, data acquisition, and slow controls

# of positrons over threshold versus time




This plot x 40

# Detector Scope

WBS 4 Detectors
Brendan Casey
Fermilab

4.1 Project Management
Brendan Casey
Fermilab

4.2 Calorimeters
David Hertzog
Washington

4.3 Trackers
Brendan Casey
Fermilab

4.4 Back-end electronics
Lawrence Gibbons
Cornell

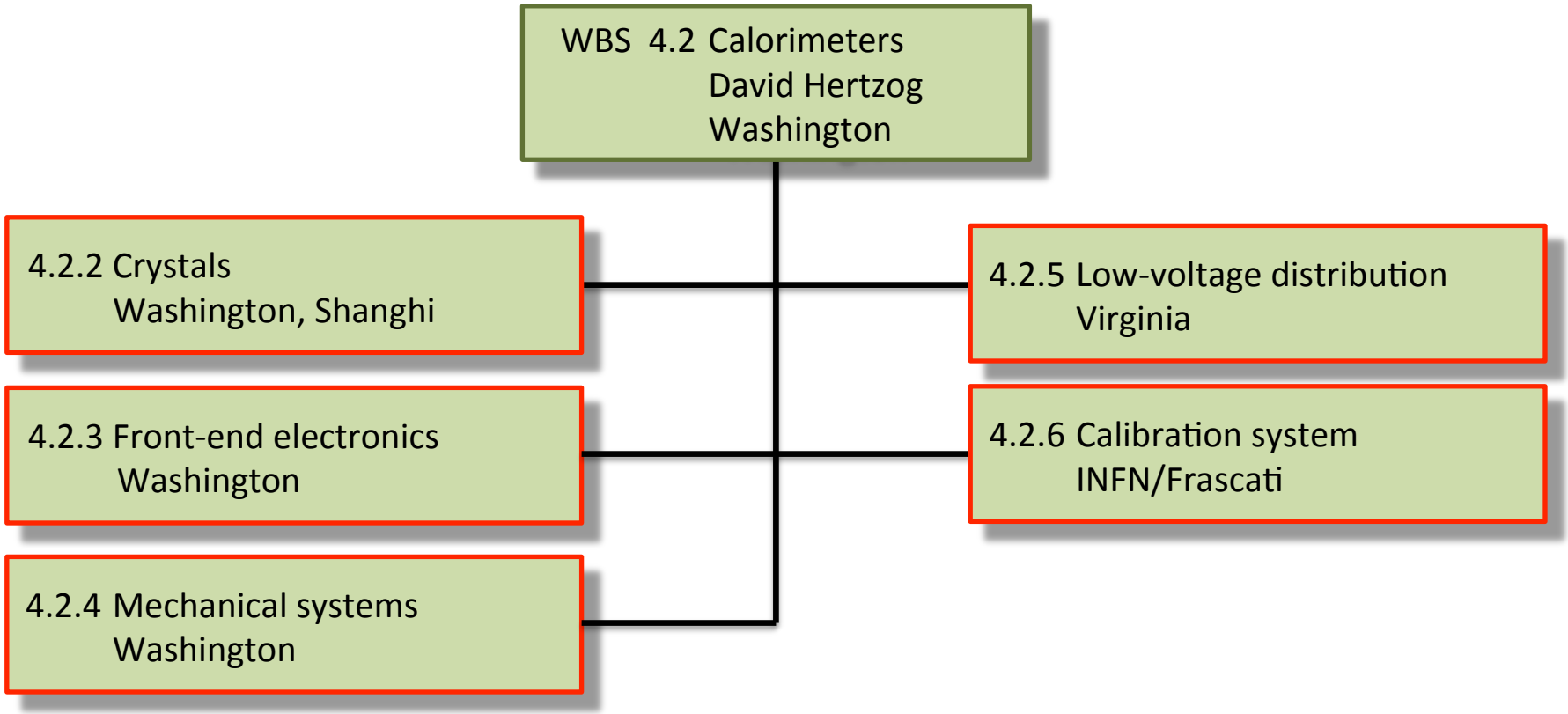
4.6 Auxilliary detectors
Fred Grey
Regis

4.5 Data acquisition
Tim Gorringe
Kentucky

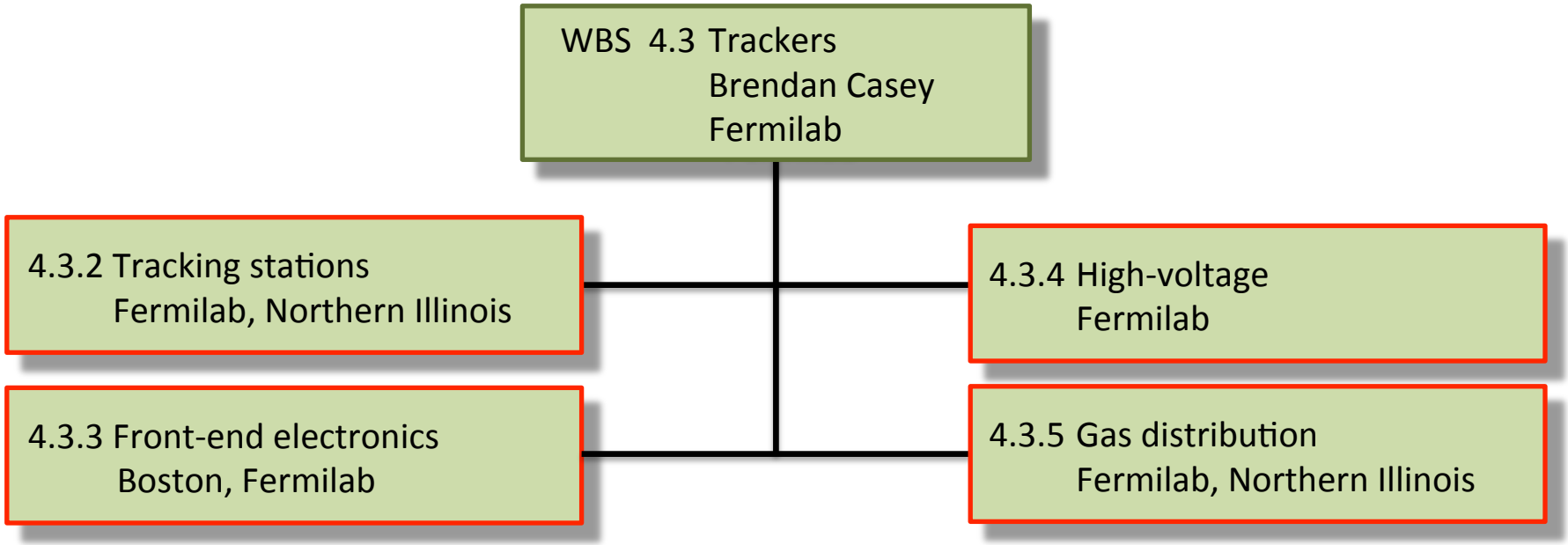
4.7 Slow controls
Peter Winter
Argonne

Plan to fund with NSF MRI

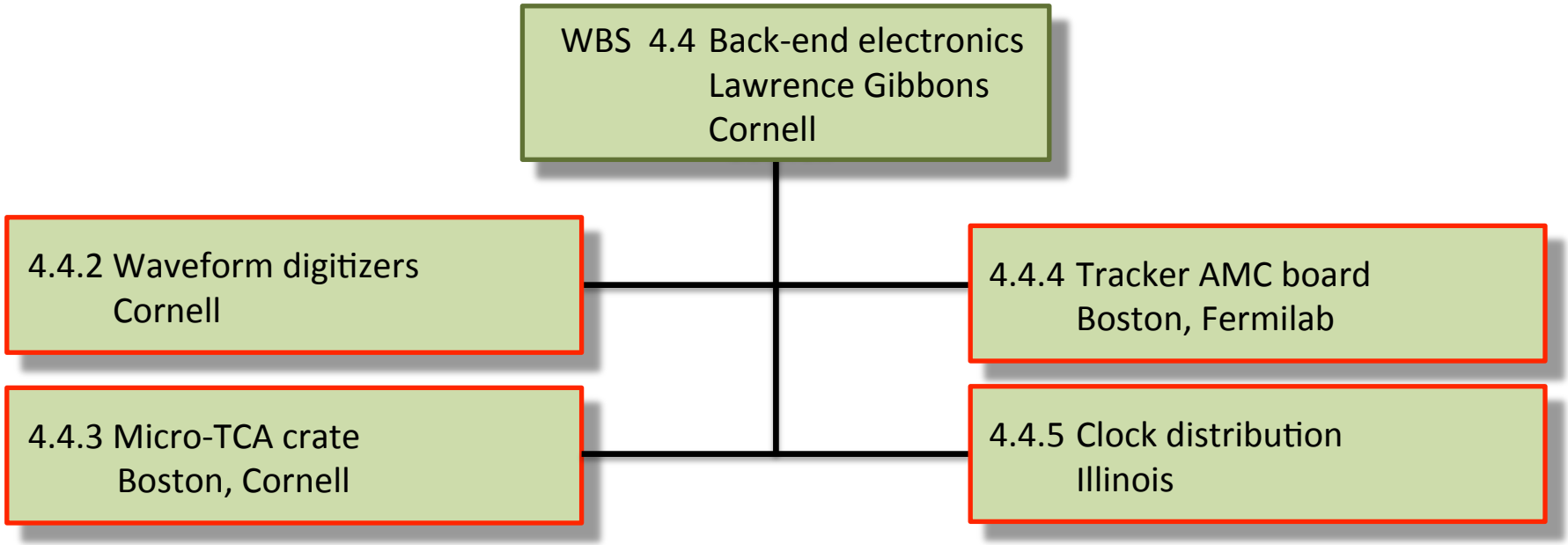
# Calorimeter Scope



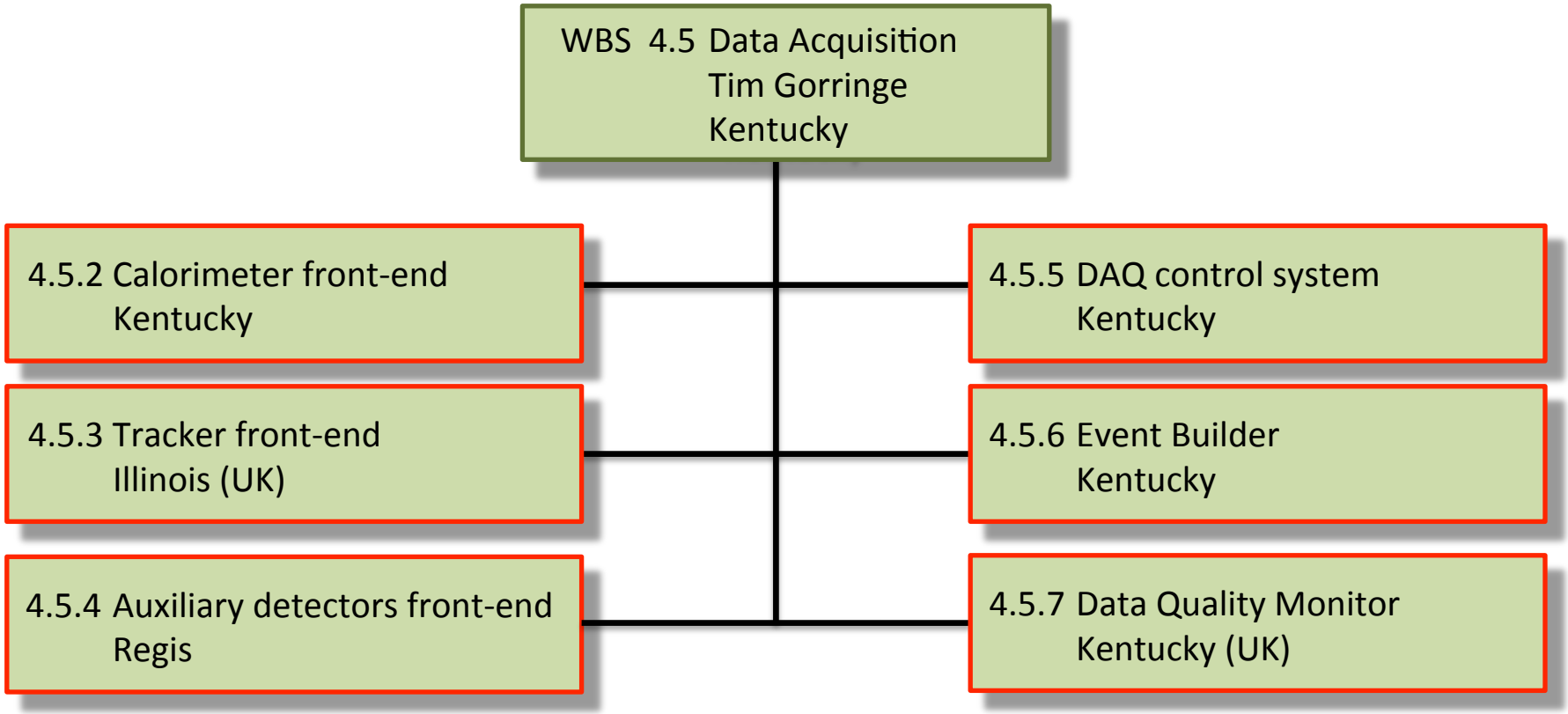
# Tracker Scope



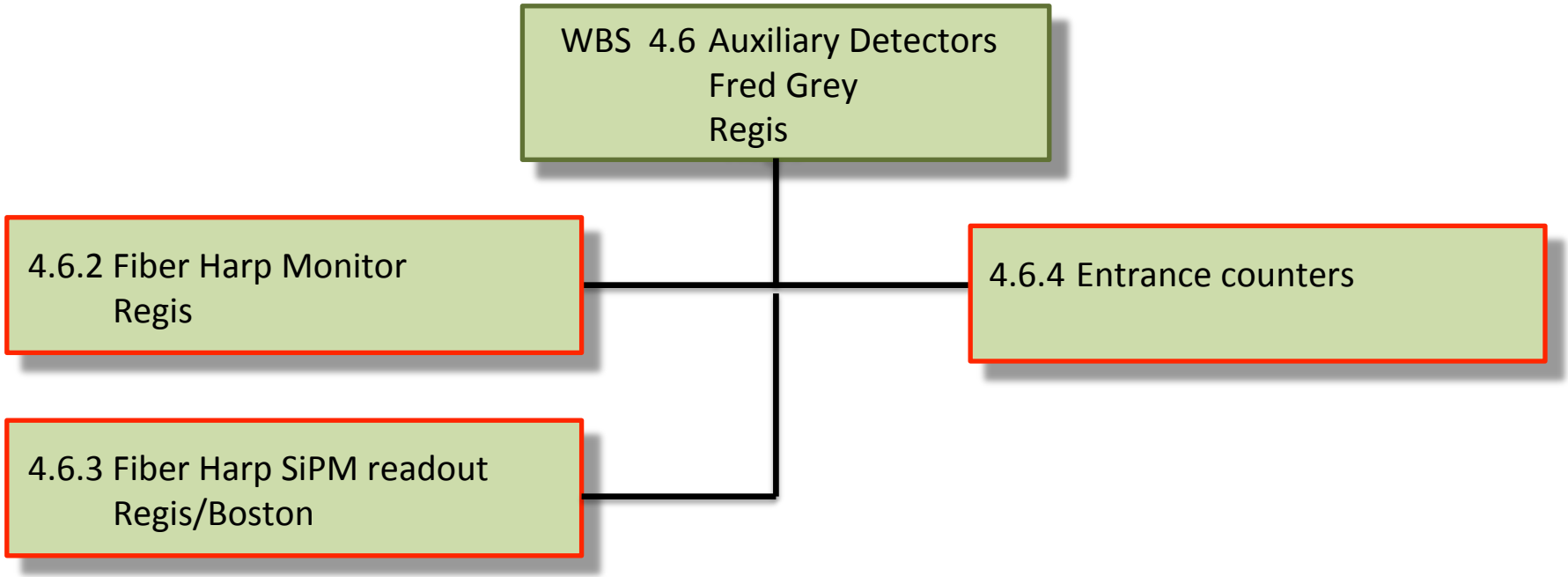
# Back-end electronics Scope



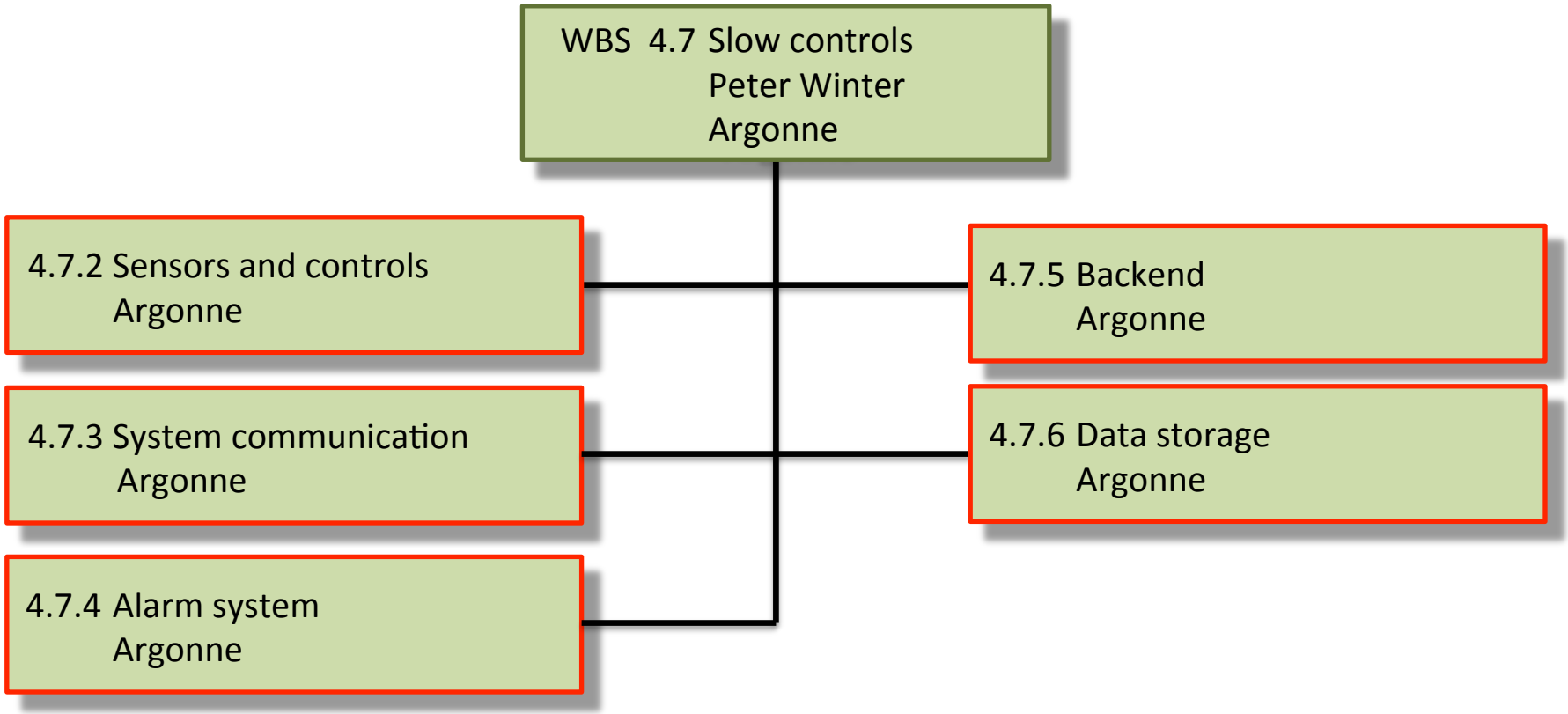
# DAQ Scope


WBS 4.5 Data Acquisition
Tim Gorringe
Kentucky
4.5.2 Calorimeter front-end
Kentucky
4.5.3 Tracker front-end
Illinois (UK)
4.5.4 Auxiliary detectors front-end
Regis
4.5.5 DAQ control system
Kentucky
4.5.6 Event Builder
Kentucky
4.5.7 Data Quality Monitor
Kentucky (UK)

# Auxiliary Detectors Scope



# Slow Controls Scope



# MRI Submitted

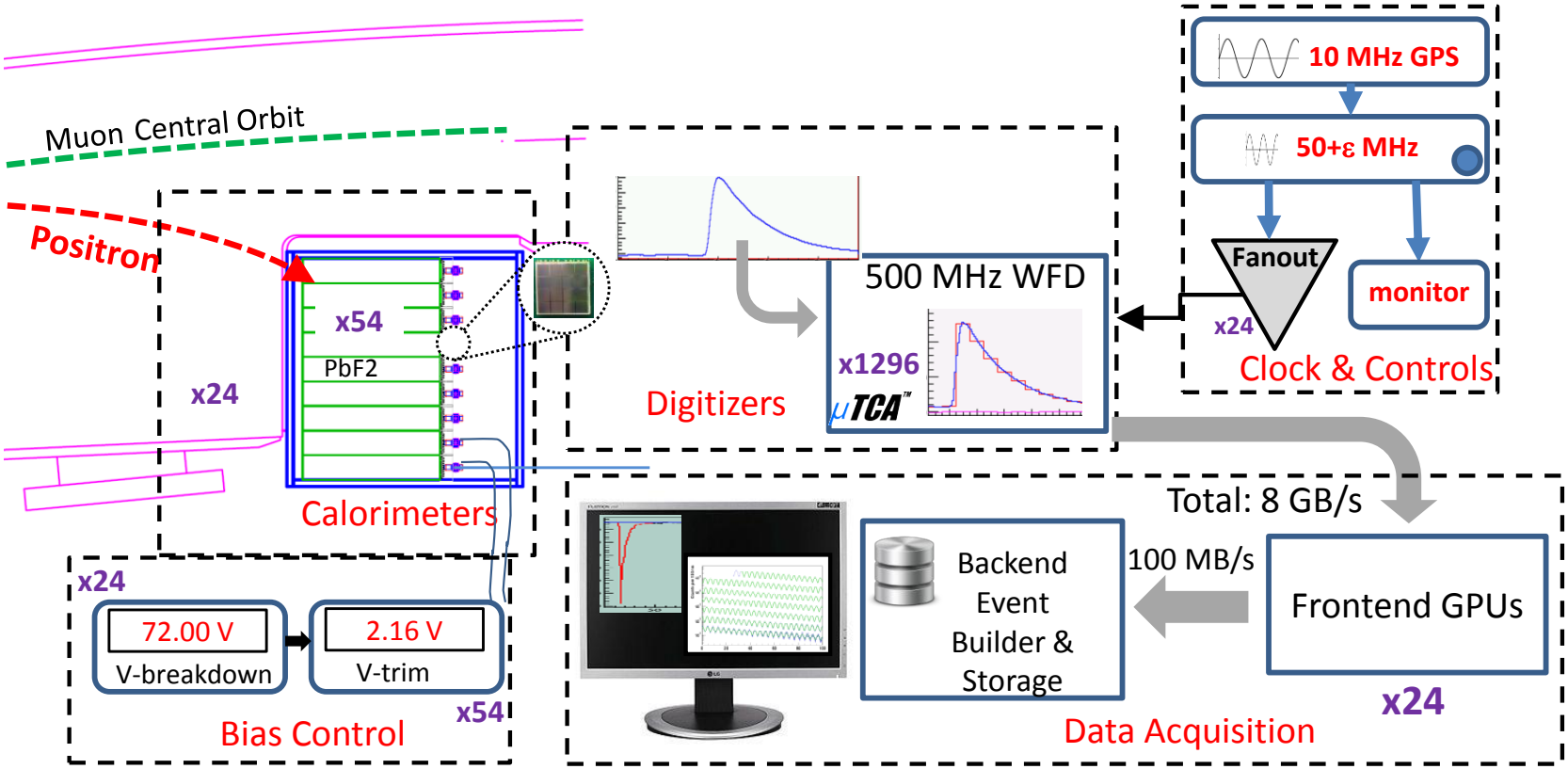
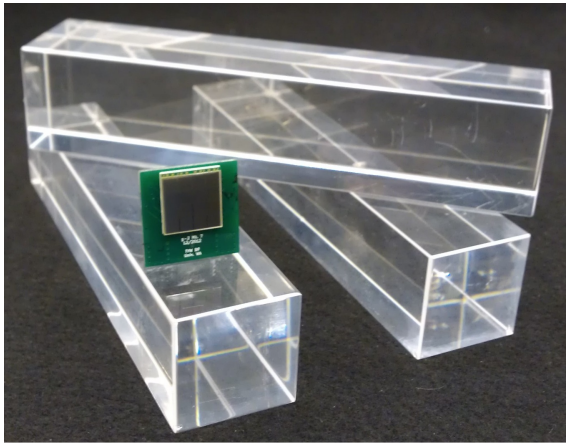



Figure 2: Schematic of the $\omega_a$ instrumentation organized by dedicated systems. The participating institutes have well-defined responsibilities: Calorimeter (Washington, Shanghai), Bias Control (Virginia, JMU), Digitzer (Cornell), Clock & Controls (Illinois), Data Acquisition (Kentucky)

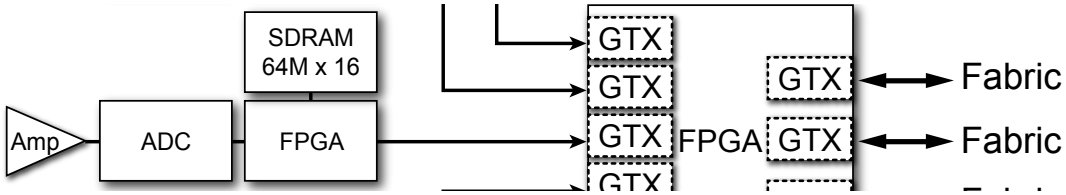
# MRI Contributions

- Tot$3.898 M
  - $2.757 M requested from NSF
  - $1.141 M in-kind contributions



$625 k from collaborating Universities

20% of crystals from Shanghai Jiao Tong University, $248.4 k (270/1350)




All the 12-bit 500 MHz ADCs from Texas Instruments Donation to Cornell negotiated by Lawrence Gibbons, $200k

# CDR progress

| WBS | 1st draft | reviewed | collaboration review | final |
|---|---|---|---|---|
| 4.2 Calorimeters | MRI | | | |
| 4.3 Trackers | In progress | | | |
| 4.4 Backend electronics | MRI | | | |
| 4.5 Data acquisition | MRI | | | |
| 4.6 Auxiliary detectors | In progress | | | |
| 4.7 Slow controls | In progress | | | |

# BoE progress (Calorimeters)

| WBS | responsibility | activities defined | costing | risks listed | reviewed | sign off |
|---|---|---|---|---|---|---|
| 4.2.2 Crystals | D Hertzog | 2nd pass | In progress | | | |
| 4.2.3 Front-end electronics | D Hertzog | 2nd pass | In progress | | | |
| 4.2.4 Mechanical systems | D Hertzog | 2nd pass | In progress | | | |
| 4.2.5 low voltage dist. | D Hertzog | 2nd pass | In progress | | | |
| 4.2.6 Calibration system | G Venanzoni | 1st pass | In progress | | | |

# BoE progress (Trackers)

| WBS | responsibility | activities defined | costing | risks listed | reviewed | sign off |
|---|---|---|---|---|---|---|
| 4.3.2 Tracking stations | B Casey | 2nd pass | In progress | | | |
| 4.3.3 Front-end electronics | B Casey | 2nd pass | In progress | | | |
| 4.3.4 Vacuum mods. | B Casey | 2nd pass | In progress | | | |
| 4.3.5 High voltage | B Casey | 2nd pass | In progress | | | |
| 4.3.6 Gas | B Casey | 2nd pass | In progress | | | |

# BoE progress (BE Electronics)

| WBS | responsibility | activities defined | costing | risks listed | reviewed | sign off |
|---|---|---|---|---|---|---|
| 4.4.2 WFDs | L Gibbons | 2nd pass | In progress | | | |
| 4.4.3 micro-TCA crate | L Gibbons | 2nd pass | In progress | | | |
| 4.4.4 Tracker AMC card | B Casey | 2nd pass | In progress | | | |
| 4.4.5 Clock distribution | K Pitts | 2nd pass | In progress | | | |

# BoE progress (DAQ)

| WBS | responsibility | activities defined | costing | risks listed | reviewed | sign off |
|---|---|---|---|---|---|---|
| 4.5.2 Calo front-end | T Gorringe | 2nd pass | In progress | | | |
| 4.5.3 Tracker front-end | T Gorringe | 2nd pass | In progress | | | |
| 4.5.4 Aux det front-end | T Gorringe | 2nd pass | In progress | | | |
| 4.5.5 DAQ control system | T Gorringe | 2nd pass | In progress | | | |
| 4.5.6 Event builder | T Gorringe | 2nd pass | In progress | | | |
| 4.5.7 Data quality monitor | T Gorringe | 2nd pass | In progress | | | |

# BoE progress (Aux detc)

| WBS | responsibility | activities defined | costing | risks listed | reviewed | sign off |
|---|---|---|---|---|---|---|
| 4.6.2 Fiber harp monitor | F Grey | 2nd pass | In progress | | | |
| 4.6.3 T0 counter | F Grey | 1st pass | In progress | | | |

# BoE progress (Slow controls)

| WBS | responsibility | activities defined | costing | risks listed | reviewed | sign off |
|---|---|---|---|---|---|---|
| 4.7.2 Sensors | P Winter | 1st pass | In progress | | | |
| 4.7.3 Receivers | P Winter | 1st pass | In progress | | | |
| 4.7.4 Data logger | P Winter | 1st pass | In progress | | | |
| 4.7.5 Database | P Winter | 1st pass | In progress | | | |
| 4.7.6 Alarm system | P Winter | 1st pass | In progress | | | |
| 4.7.7 Beam/cryo interface | P Winter | 1st pass | In progress | | | |