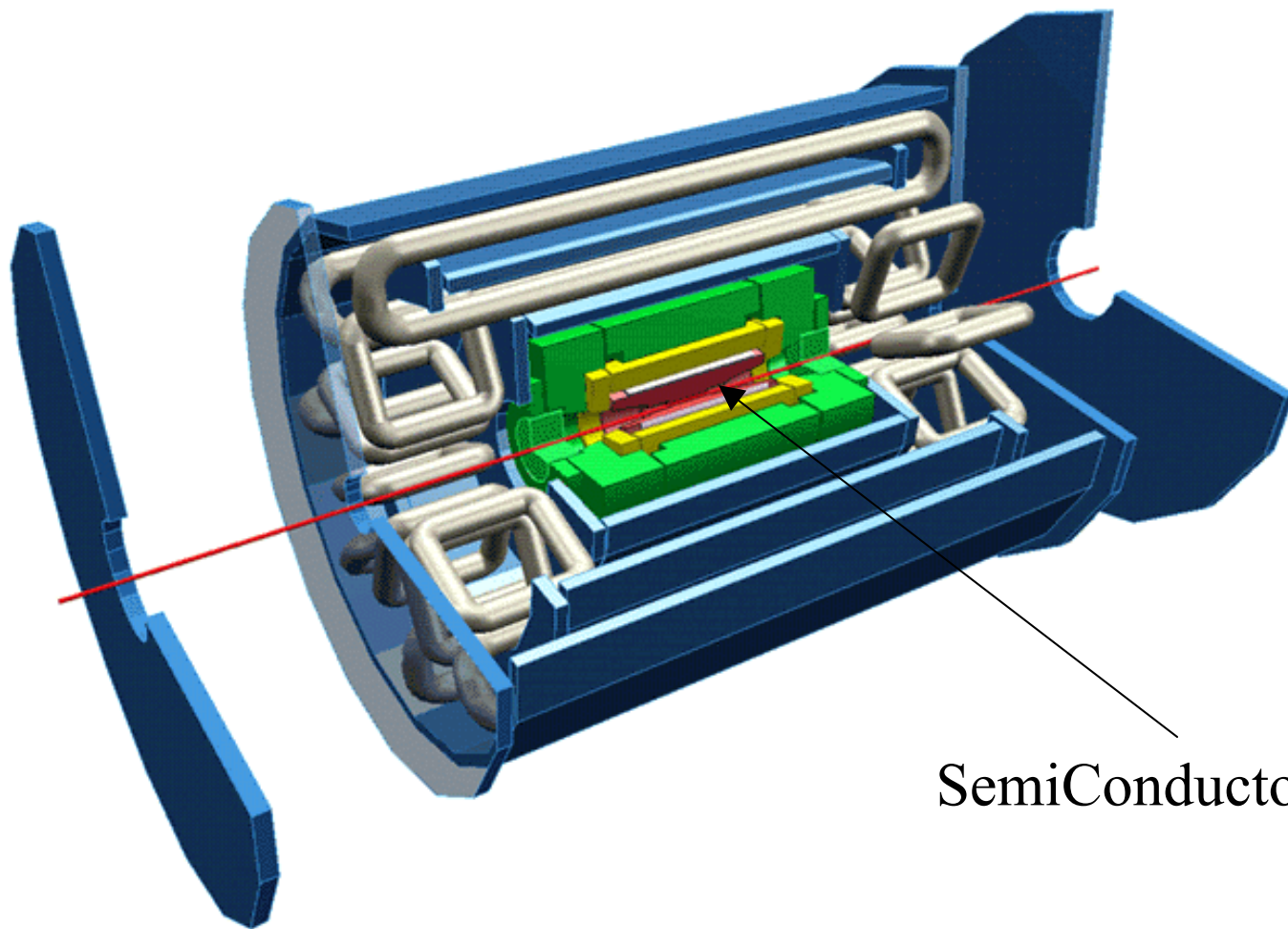


# DAQ for ATLAS SCT macro-assembly

Bruce Gallop

University of Birmingham/RAL

# ATLAS

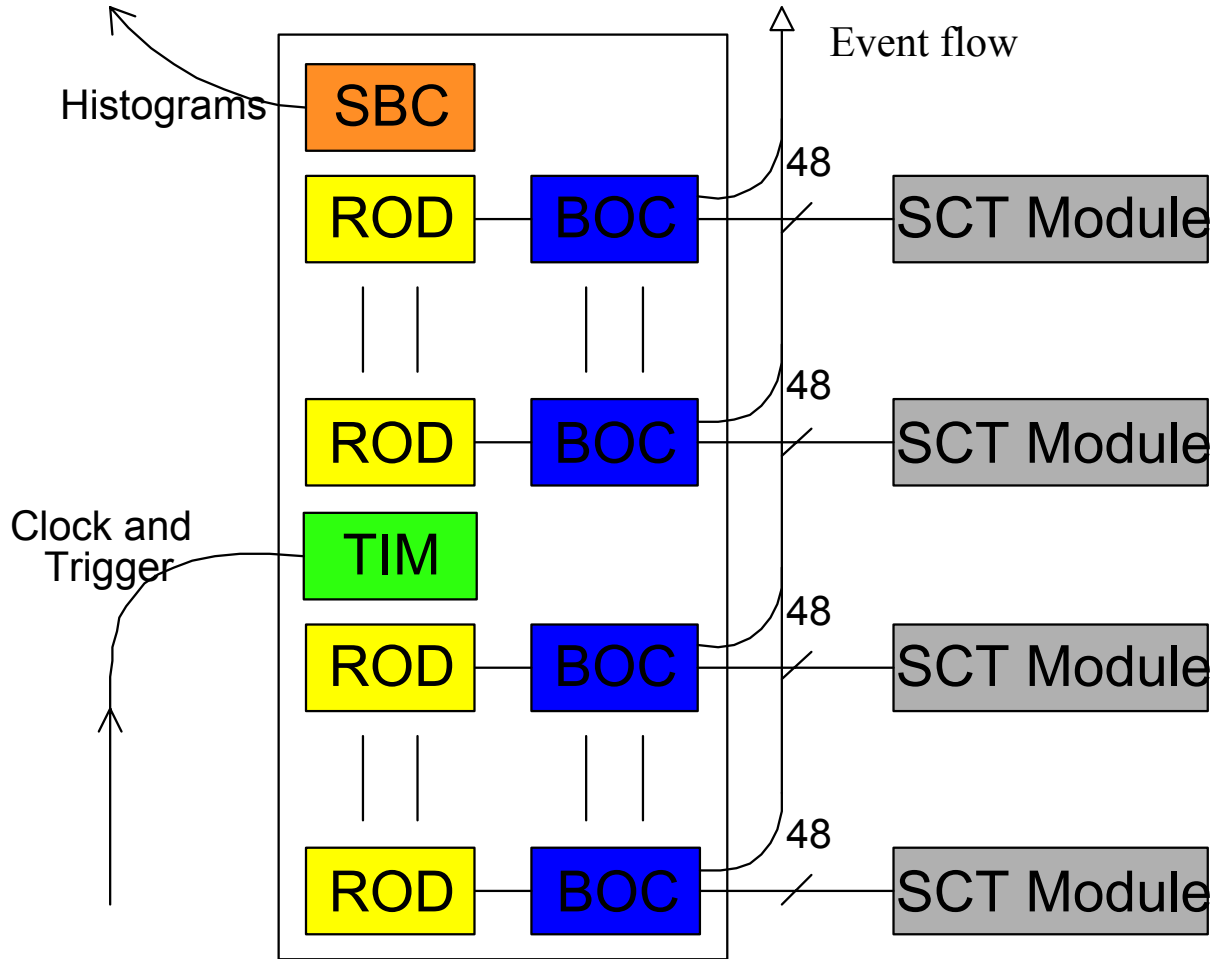


SemiConductor Tracker

# SCT Barrel

- 4 Barrels with a total of 2112 modules
  - Each module has 1536 binary strips
- Modules will be assembled onto the barrels at Oxford
  - Up to 672 modules on one barrel
- The barrels will be inserted into each other at CERN

# DAQ Hardware



ROD – Read Out Device

BOC – Back of Crate Card

SBC – Single Board Computer

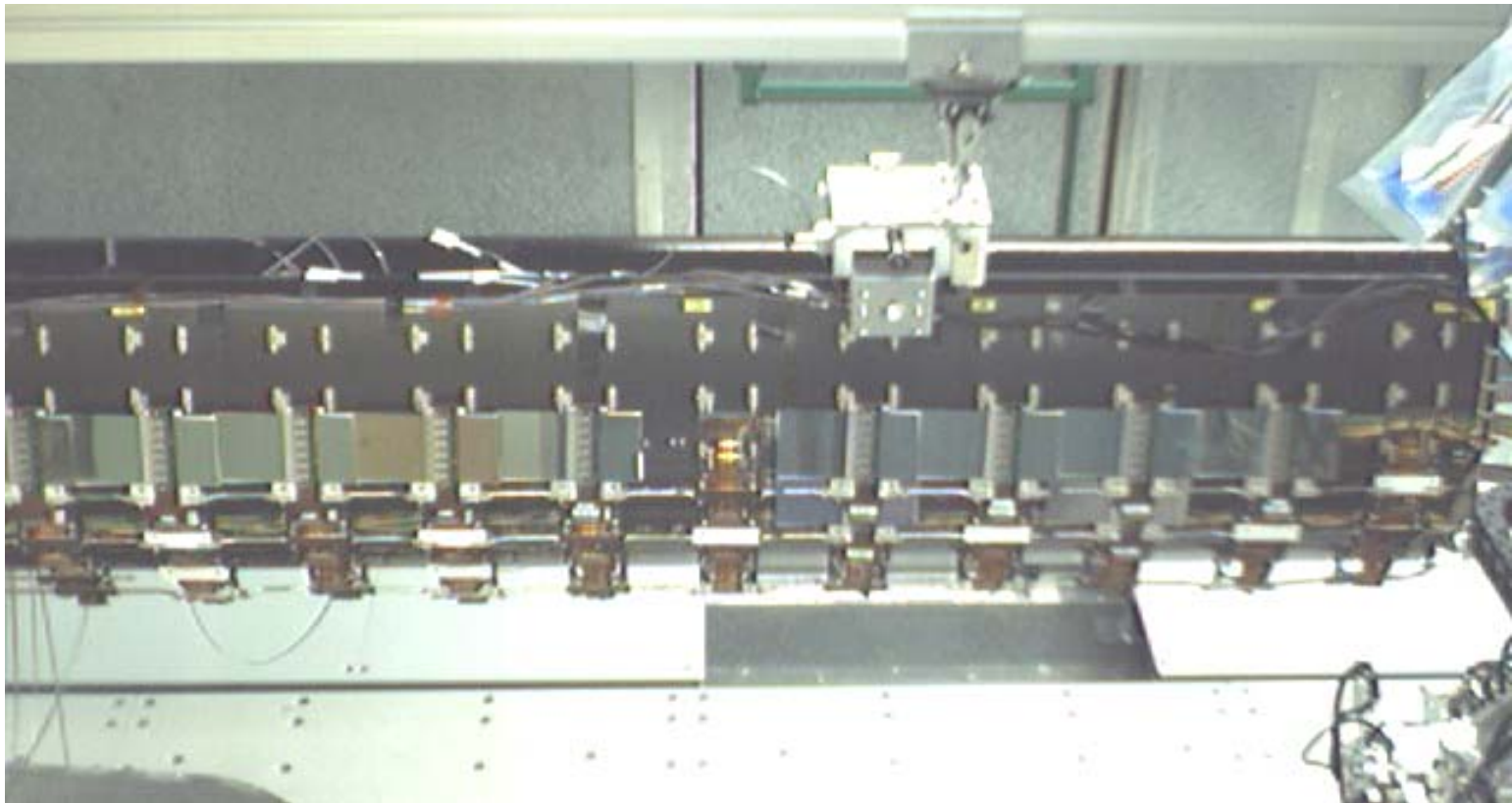
TIM – Timing Module

# Oxford testing

- While at Oxford the modules need testing
  - Comparison with production results
  - Base point for inner detector tests
- This will make use of the DAQ hardware designed for use in ATLAS for the first time
- Integration of the DAQ system software is done at Oxford where more modules can be used
  - Cooling system in place for macro-assembly

# Development at Oxford

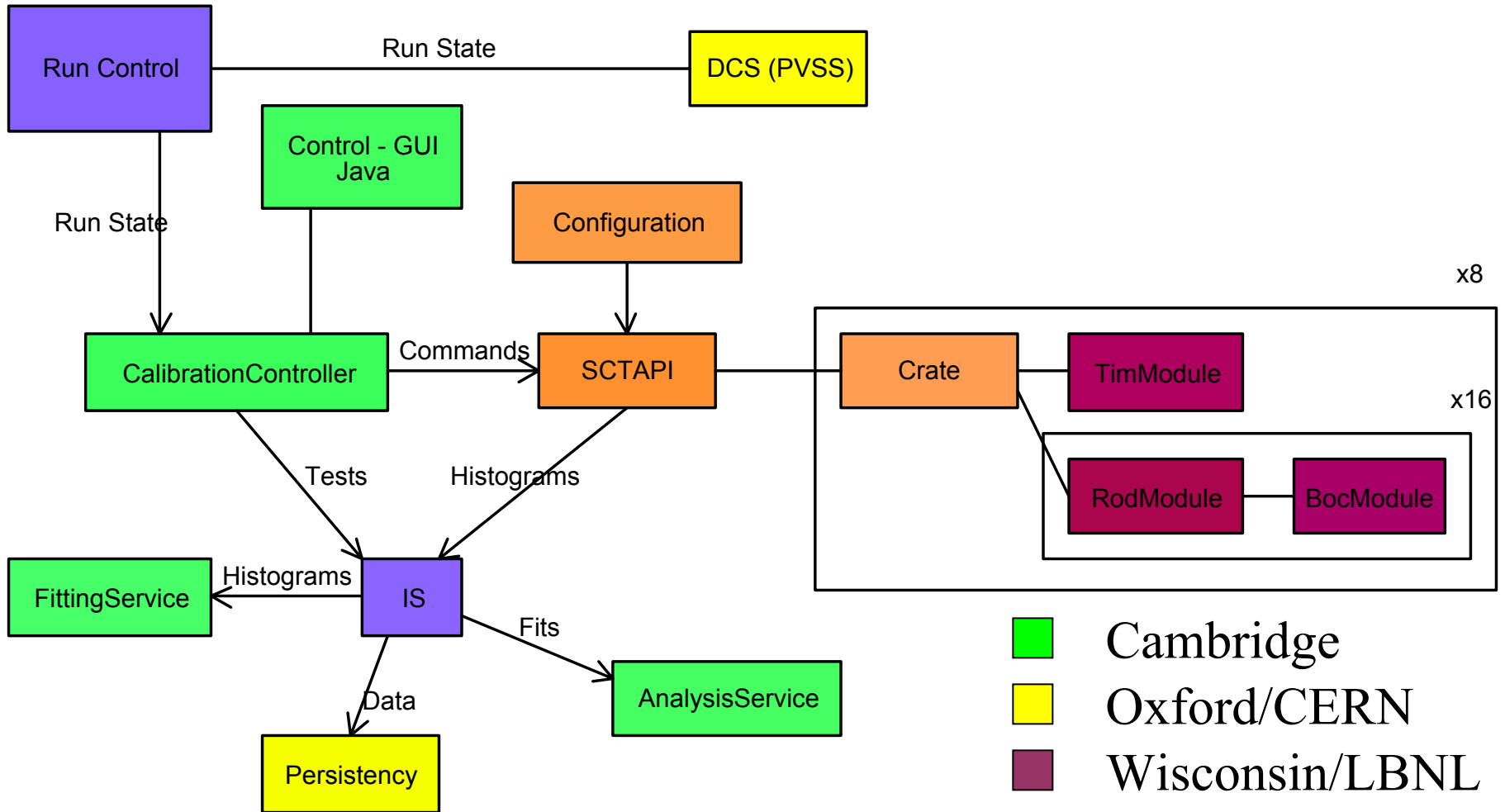
- Barrel sector with up to 12 modules on 3 harnesses



# SCTAPI software

- Configure modules with calibration constants
- Monitor and coordinate histogramming on up to 16 RODs in a crate
- “Probe” feature checks status of module before running scan
- Allow histogramming of events while scanning over different variables

# Software Overview



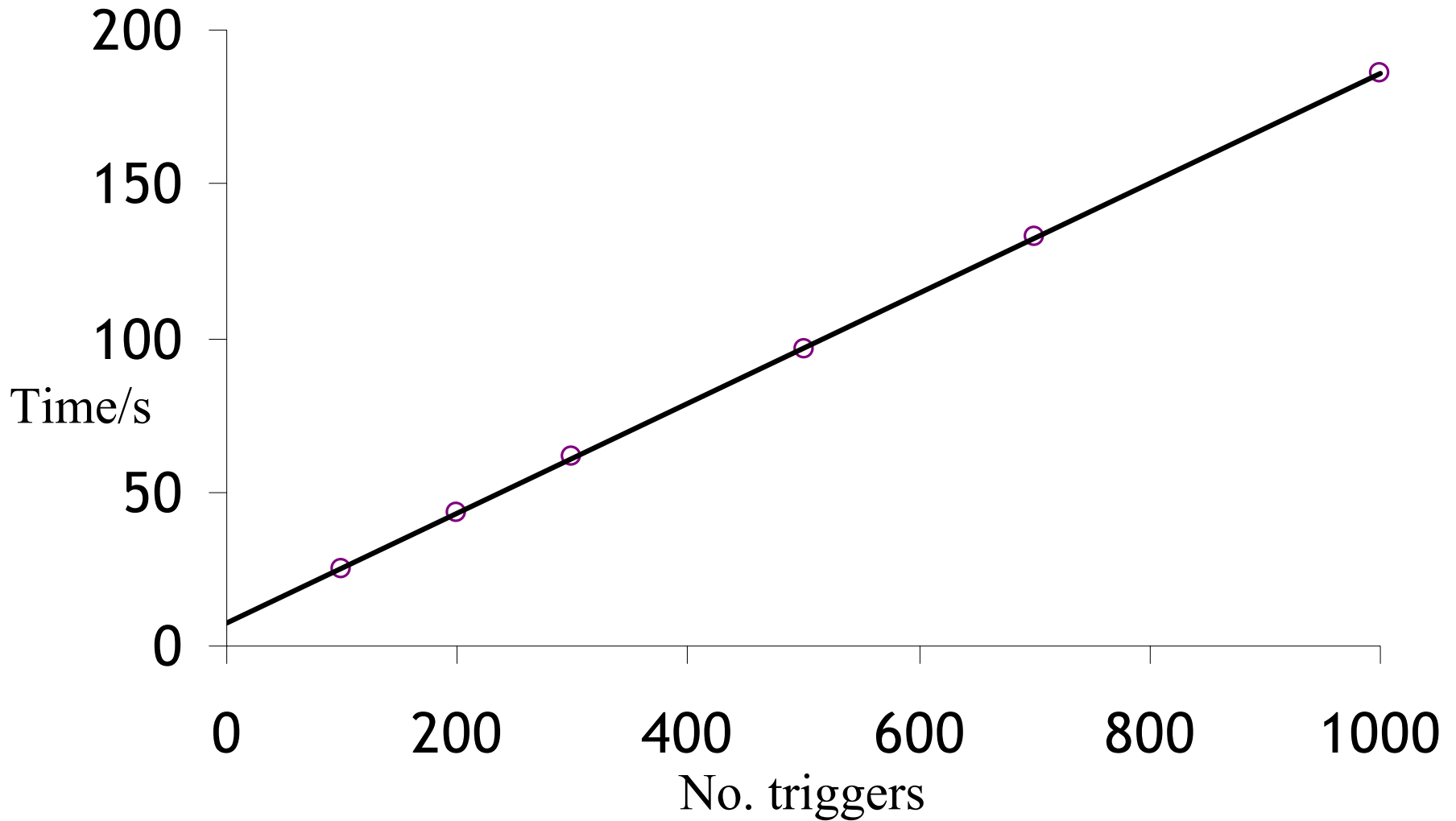
- Cambridge
- Oxford/CERN
- Wisconsin/LBNL
- Birmingham/RAL
- ATLAS online



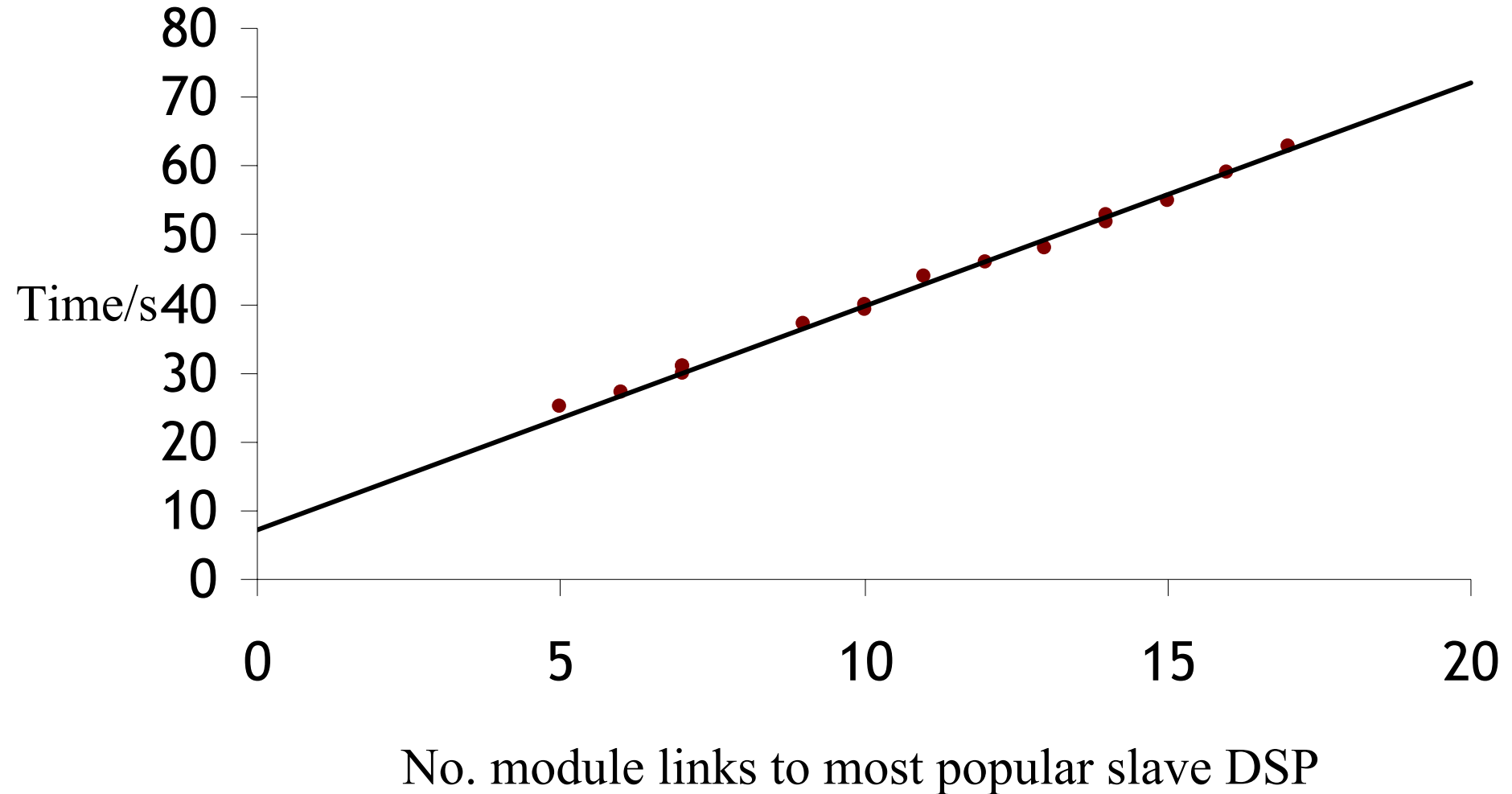
# Scalability

- Theoretical maximum speed for all modules is 1/12 of single module
- 4 DSPs on each ROD carry out histogramming on 12 modules each
- Check scalability

# Affect of increased trigger count



# Increased number of modules



# Analysis software

- Interprets fits of the histograms to calibrate the modules
- Need check of module quality against production tests
- System developed for automatic comparison of analyses with production DAQ software
  - This has been used to test the software under the load of a virtual barrel 3
  - Comparisons have been made with the results of over 120 production modules with negligible differences

# Full Barrel 3 configured (virtually)

System Display Tests Options Tools Help Preferences

### Display

Parameters  
Module Group

---

Options  
Add to Group 1  
Add to Group 2

---

Views  
Barrel 3  
Barrel 4  
Barrel 5  
Barrel 6  
EndCap 1a  
EndCap 2a  
EndCap 3a  
EndCap 4a  
EndCap 5a  
EndCap 6a  
EndCap 7a  
EndCap 8a  
EndCap 9a  
EndCap 1c  
EndCap 2c  
EndCap 3c  
EndCap 4c  
EndCap 5c  
EndCap 6c  
EndCap 7c  
EndCap 8c  
EndCap 9c

### Module Group Selection

Module Counts : 384 0  
Barrel 3 22220330200169 (0,4,8,-1,-1) MUR: 33 Positior: 3

### Scan Status

CalibrationController Status : LOADED  
Current Test :  
Current Sequence :  
Current Scan Index : 0  
Scan Progress :

### Display Colour Scale

None Group 1 Group 2

Scale: Selected module grouping

### Data

Group 1 modules : 384

Serial No	Row	Posn	MUR
20220330200015	0	-1	0
20220330200017	0	-2	0
20220330200018	0	-3	0
20220330200019	0	-4	0
20220330200020	0	-5	0
20220330200024	0	-6	0
20220330200025	0	1	1
20220330200028	0	2	1
20220330200054	0	3	1
20220330200056	0	4	1
20220330200061	0	5	1
20220330200070	0	6	1
20220330200075	1	-1	2
20220330200079	1	-2	2
20220330200089	1	-3	2
...	...	...	...

Group 2 modules : 0

Serial No	Row	Posn	MUR
-----------	-----	------	-----

# DCS (Detector Control System)

- This controls the power supplies and other electrical connections to the modules
- Need agreement between the DAQ and DCS for redundant clock selection
- Control and monitoring of DCS system from the DAQ GUI

# Real modules with DCS readout

System Display Tests Options Tools Help

Preferences

Display

Parameters

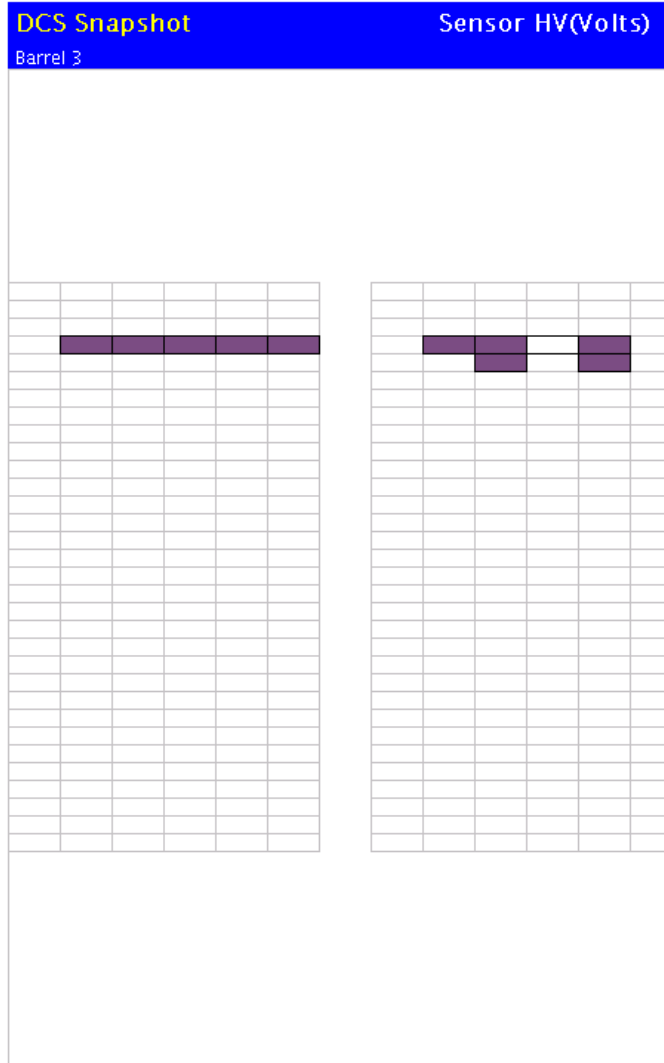
- Sensor HV(Volts)
- Sensor Current(uA)
- Hybrid T0(degC)
- Hybrid T1(degC)
- Chip VCC (Volts)
- Chip ICC (mA)
- Chip VDD (Volts)
- Chip IDD (mA)

Options

- Selected Test
- SCTDAQ Reference
- Current Conditions

Views

- Barrel 3
- Barrel 4
- Barrel 5
- Barrel 6
- EndCap 1a
- EndCap 2a
- EndCap 3a
- EndCap 4a
- EndCap 5a
- EndCap 6a
- EndCap 7a
- EndCap 8a
- EndCap 9a
- EndCap 1c
- EndCap 2c
- EndCap 3c
- EndCap 4c
- EndCap 5c
- EndCap 6c
- EndCap 7c
- EndCap 8c
- EndCap 9c



Scan Status

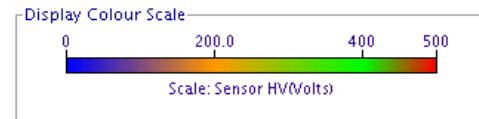
CalibrationController Status : **LOADED**

Current Test :

Current Sequence :

Current Scan Index : 0

Scan Progress :



Data

Number of Tests : 0

Test	Status	Run	Scan	#Scans

Chip VDD (Volts) Results : 0

Serial No	Chip VDD (Volts)

# Conclusion

- DAQ system mostly ready for macro-assembly
- Some optimisations
  - Reduce histogram overheads
- Some higher-level integration still to be done
  - More testing with more than one ROD
- Usability improvements
  - System in use at CERN, currently getting feedback