Parity DAQ and Data Analysis

Bryan Moffit

The College of WILLIAM & MARY

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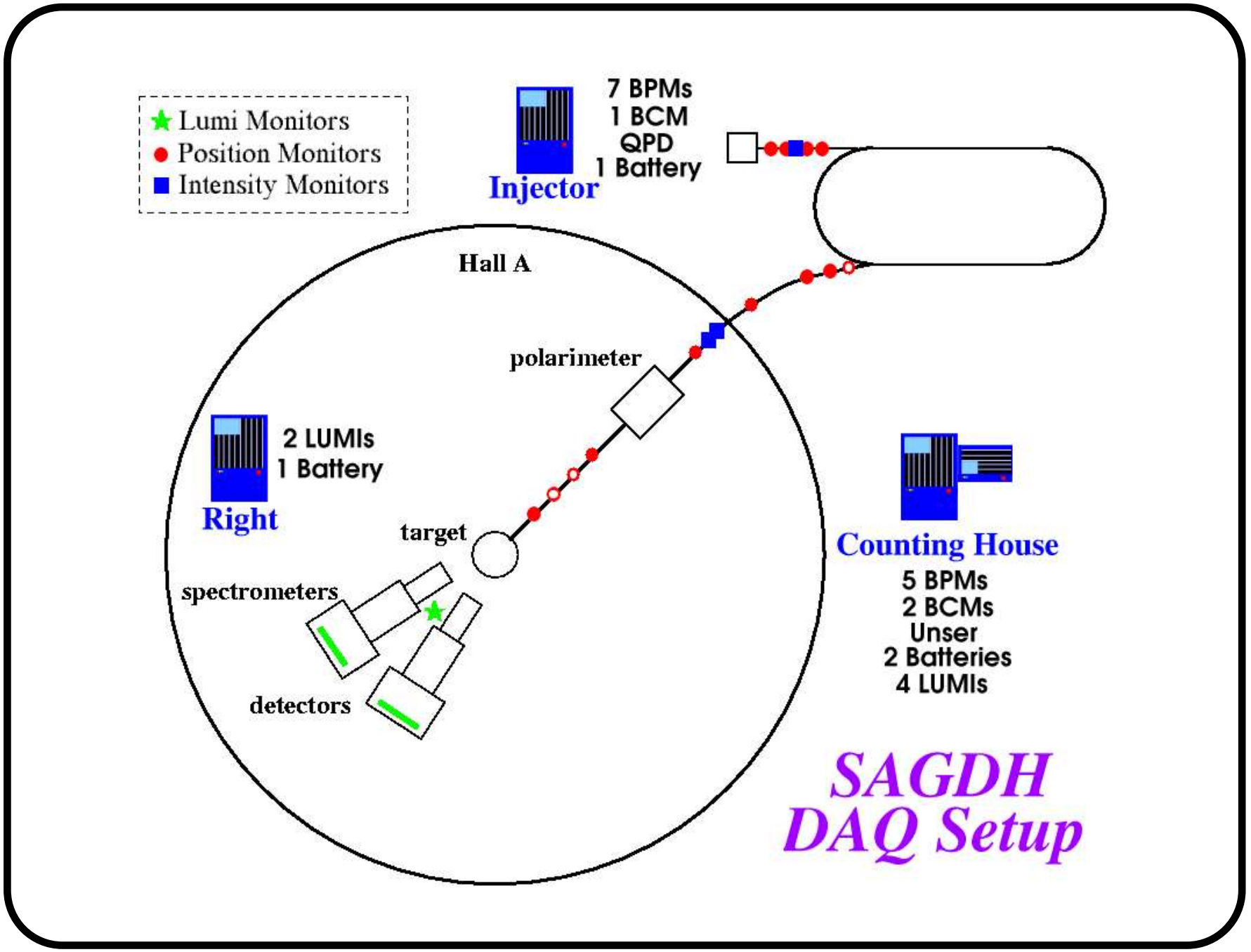
HAPPEX DAQ - Components

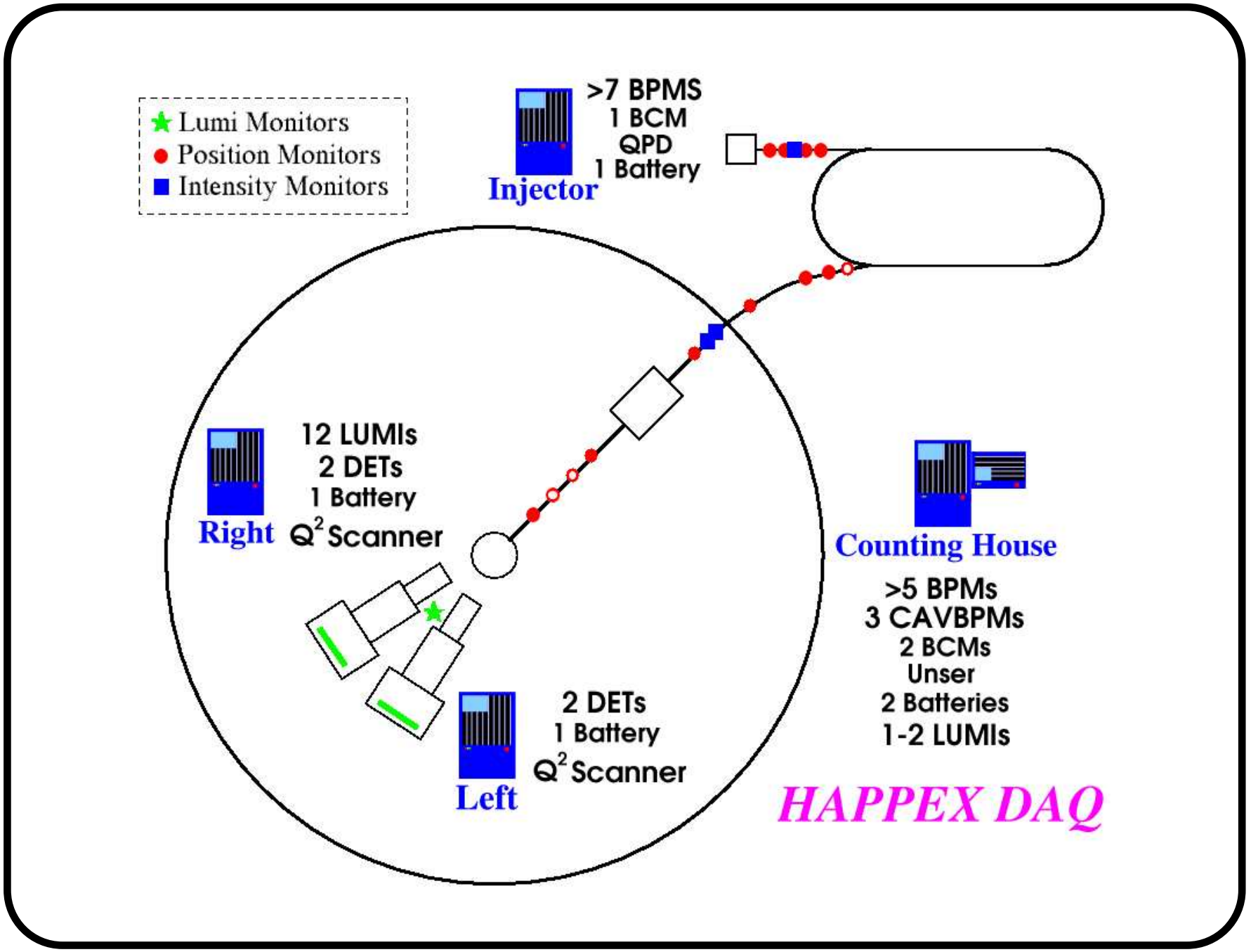
Hardware	*Software*
MVME5100 CPU	
JLab Trigger Supervisor	
JLab Trigger Interface *(TIR)*	CODA v2.2
HAPPEX Timing Board	Parity Analyzer *(PAN)*
Harvard-Princeton ADCs	Regression/Dithering Analysis *(REDANA)*
SIS3801 Scalers	
V-to-F Converters	


Lumi Monitors
Position Monitors
Intensity Monitors
7 BPMs
1 BCM
QPD
1 Battery
Injector
Hall A
polarimeter
2 LUMIs
1 Battery
Right
target
spectrometers
detectors
Counting House
5 BPMs
2 BCMs
Unser
2 Batteries
4 LUMIs
SAGDH
DAQ Setup

Accomplishments since December

- Counting House DAQ provided A_Q Feedback for Spin-Duality and SAGDH
- Injector DAQ run alone to tune Polarized Source
- Four ADCs (out of 10) from UMass, recovered and confi gured
- Right Spectrometer Crate installed
- Three-Crate-DAQ run with Trigger Supervisor
- Commissioning of two small angle LUMIs
- More BPMs readout in Injector
- Start & End of Run EPICS Variables (HALOG) stored in MySQL Database

Issues..	Solutions??
Helicity Mismatch with TS	Changed Readout Order, Use Flex I/Os
Large A_Q Width	Increased Beam Current
Right Spectrometer Crate Crash	Remote Switch in Counting House?
Run Numbers stopped incrementing	Upgrade to CODA 2.2.1?
Two ADCs lost DACnoise	Replace DACnoise Chips?
Large Lumi Signal Noise	Better Shielding/Grounding?


Lumi Monitors
Position Monitors
Intensity Monitors
>7 BPMS
1 BCM
QPD
1 Battery
Injector
12 LUMIs
2 DETs
1 Battery
Q² Scanner
Right
Counting House
>5 BPMs
3 CAVBPMs
2 BCMs
Unser
2 Batteries
1-2 LUMIs
2 DETs
1 Battery
Q² Scanner
Left
HAPPEX DAQ

Ongoing and Planned DAQ Work

- Recover and confi gure more ADCs from UMass
- Commission more small angle LUMIs
- Commission Cavity Monitors
- Readout more BPMs in Injector and High Energy Region
- Store PAN Database in MySQL
- EPICS Server for HAPPEX Variables
- Install Left Spectrometer Crate

Parity Data Analysis

Primary Workhorse: Parity Analyzer (PAN)

- Authors: R. Holmes, R. Michaels, B. Moffit, K. Paschke, R. Suleiman, A. Vacheret
- C++ Classes (Data Structures and Methods)
- Utilizes CERN ROOT Libraries (v3.03 and greater)
- Three applications:
  - ⋆ pan - Standard Analysis
  - ⋆ panFFB - Provides Feedback to Polarized Source
  - ⋆ panam - Online Monitor
- Suitable for Online and Offline Analysis
- Produces two outputs: .root and .res
- Developed & Supported by Red Hat 7.2 and greater, Debian 3.0

Secondary Applications:

- Many Perl and Shell Scripts, ROOT Macros
  - ⋆ Organize and compile statistics from .res fi les and HALOG entries
  - ⋆ Generates histograms for Online/Offline analysis
- Regression-Dithering Analysis (REDANA)
  - ⋆ Uses PAN .root and .res fi les as input
  - ⋆ Two outputs: .root and .res fi les

Progress since December

- Blinding of Helicity Correlated Asymmetries (TaBlind)

  HAPPEX:

$$A_{hidden} = A_{sign} * \{(A_{true} * A_{sign} - A_{mean}) * \mathrm{BlindSign} + \mathrm{BlindOffset} * A_{offscale} + A_{mean}\}$$

  E158:

$$A_{hidden} = A_{true} + \mathrm{BlindOffset} * A_{offscale} + A_{mean}$$

A_{sign}	Slow helicity reversal sign
A_{mean}	Supplied Constant, typically expected mean when A$_{sign} = +1$
$A_{offscale}$	Supplied Constant, typically expected error
BlindSign	From Blinding Algorithm (-1 or $+1$) (E158: $+1$)
BlindOffset	From Blinding Algorithm [-1,$+1$]

BlindOffset not applied to Beam Parameters

Progress continued...

- New Data Decoding Scheme
  - ⋆ Multi-crate confi guration - binds devices to specifi c crates
  - ⋆ Primitive devices (scalers, ADCs) tied to Derived Devices (BPMs, LUMIs)
- Feedback Analysis Class (TaFeedbackAna)
  - ⋆ Provides Methods for Source Feedback

    Send Measurement (A_Q, Δx)

    Send computed change of source voltage (IA Cell Setpoint)

Progress continued...

- Other notable changes
  - Creation of TaStandardAna and TaDebugAna
  - New database options (**timestamp, curmon, randomheli**)
  - User-defi ned Database handling of BPM rotations
  - Startup Cut for invalid scaler data
  - Perl scripts/modules for .res fi le manipulation
- Regression and Dithering - Still mainly in development phase
  - ⋆ Dithering
    - ∗ Methods written to read PAN .root fi les and calculate slopes
  - ⋆ Regression
    - ∗ Matrix Method written. Agrees with Linear Method.

Future/Planned Analysis work

- Statistics on Four Peak Structure on PAN output
- Feedback cut - remove events between changes in source setpoints
- Pan Online Monitor
  - Optimize by combining related histograms
  - Develop an ET Application that is a Client And Server
  - Develop a method to keep PANAM running between CODA Runs
- Regression and Dithering
  - Implementation of output to .res fi les
  - Considerable attention to Error Analysis

Conclusions

HAPPEX DAQ

- Overview of DAQ Components
- Progress since last December
- Problems/Issues that arose
- Plan for future work

Parity Analysis

- Brief Introduction to Software
- Progress since last December
- Plans for future work