Commissioning BLAST With ROOT

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Introduction

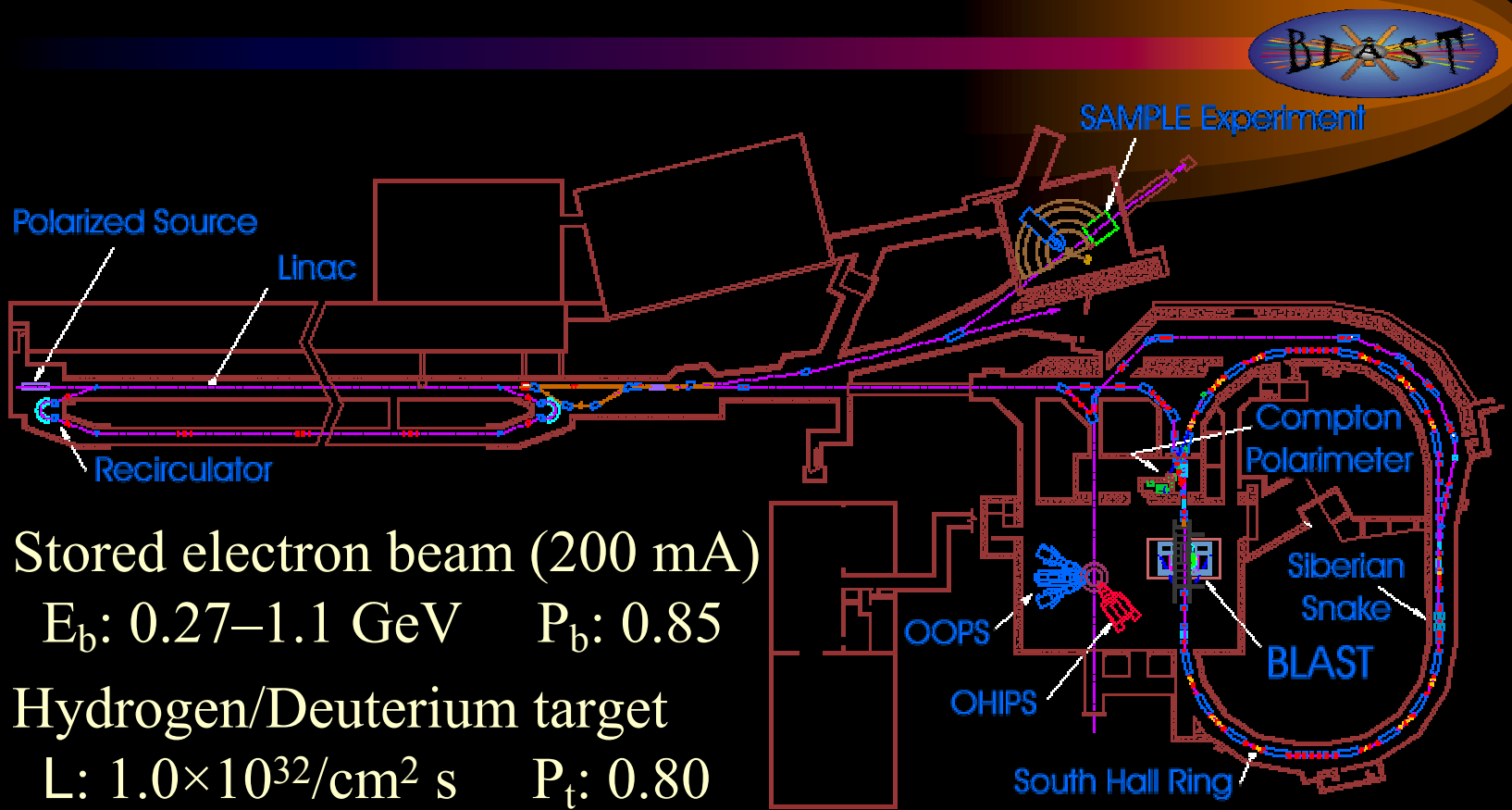
- Overview of BLAST
- ROOT based software
- Commissioning phase
- ROOT as a teaching tool
- Wish list

W.H. Bates Accelerator Facility

BLAST Collaboration

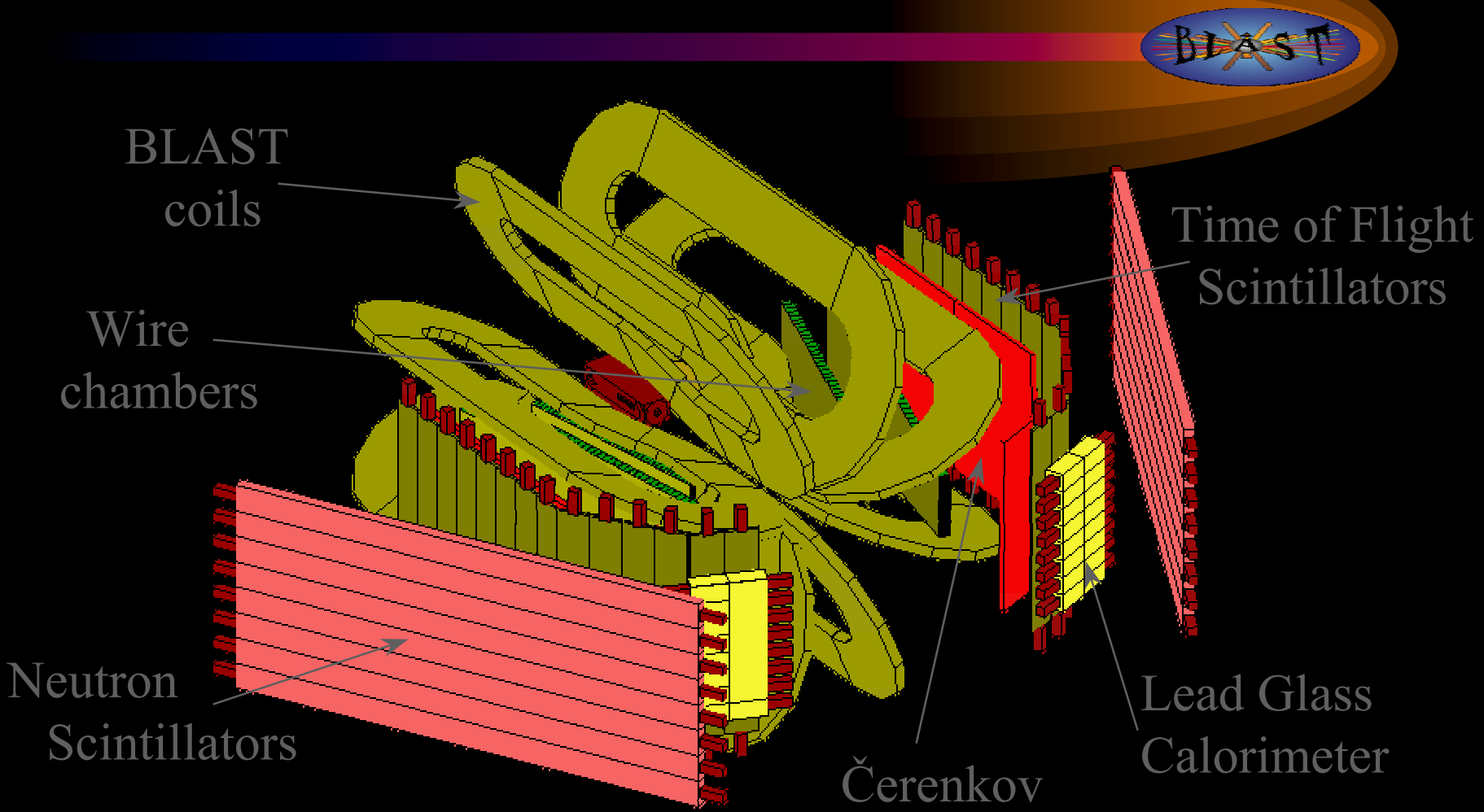
- 20 faculty
- 10 research staff
- 15 grad students
- 10 undergrads
- limited resources for software development

Polarized Beam and Target



- Stored electron beam (200 mA)
  E_b: 0.27–1.1 GeV P_b: 0.85
- Hydrogen/Deuterium target
  L: $1.0\times10^{32}/cm^2$ s P_t: 0.80
- Helium target
  L: $1.2\times10^{33}/cm^2$ s P_t: 0.50

The BLAST Detector



ROOT Based Software

- Slow controls and interfaces
- Event generators
- Reconstruction library
- Single event display
- ROOT classes:
  - Tree, Hist, Matrix, Random, Minuit
  - GUI, Sockets, MySQL

Control Software

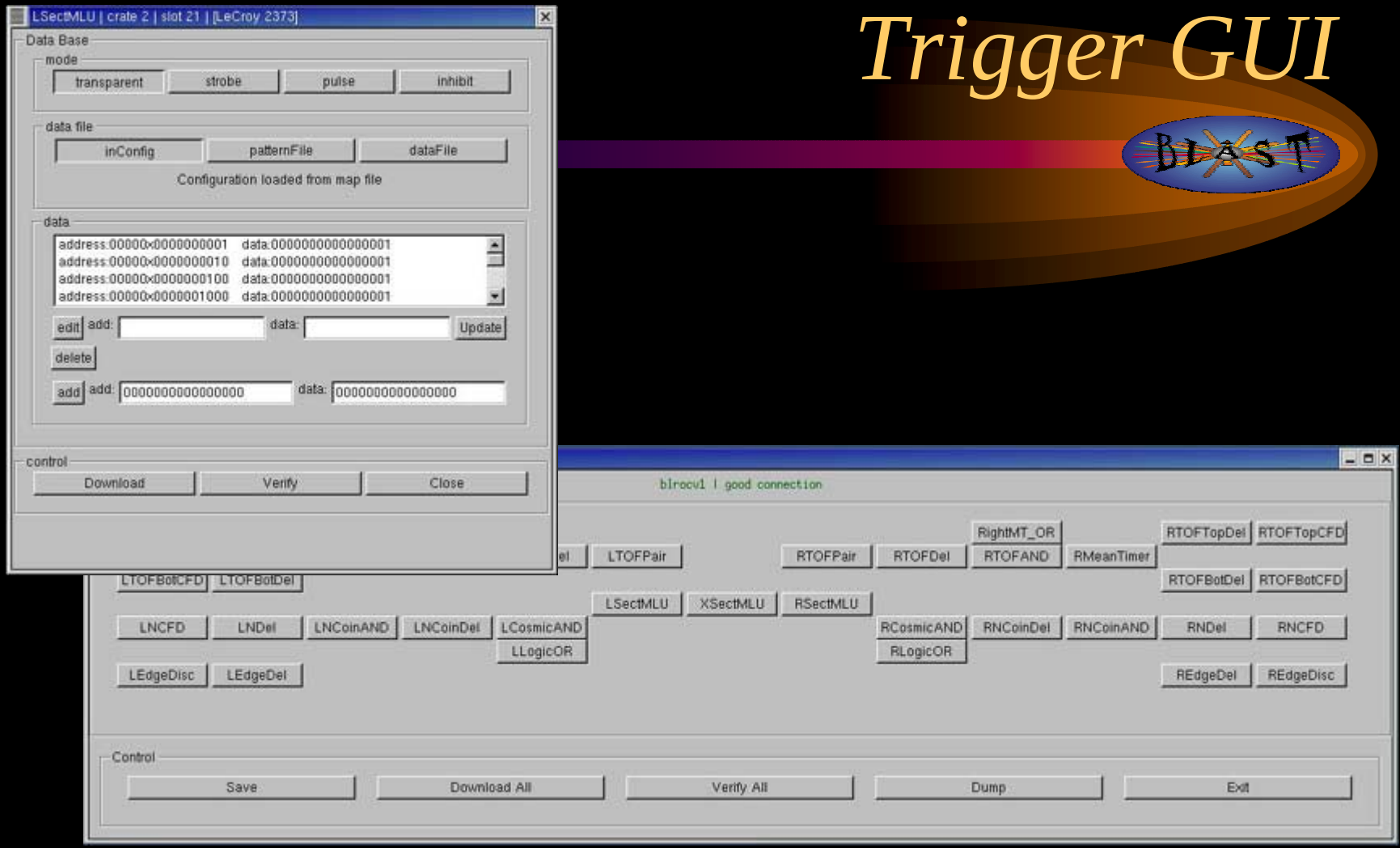
Software

- Trigger control
  - Also used at JLab
- HV controls
  - MySQL interface
- CODA interface
  - Run control
  - EPICS interface
  - Scalers (VME)

Experience

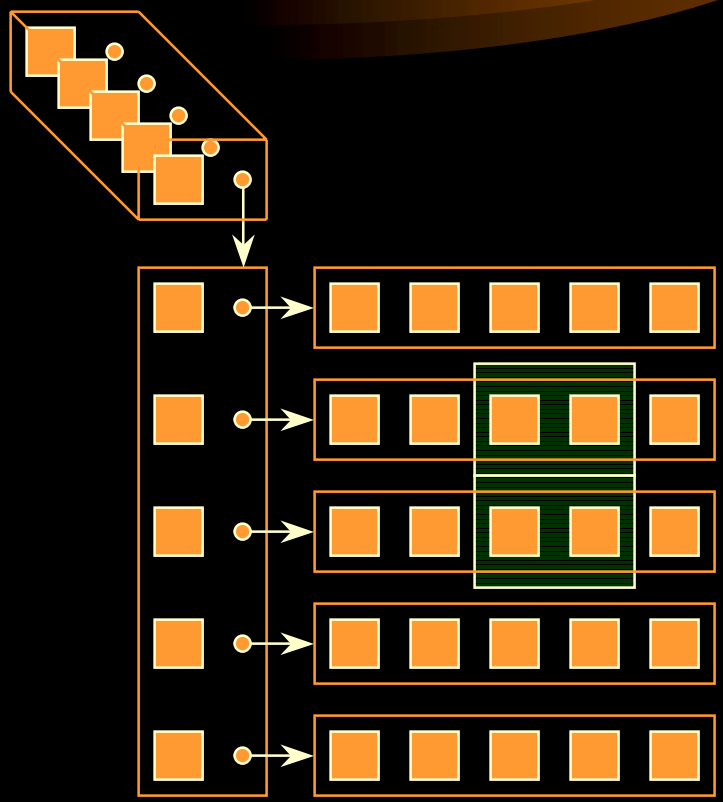
- MySQL, Sockets, Threads, GUI all in one package
  - Convenient
  - GUI documentation
- C++ framework ideal for interfacing
  - no starting over

Trigger GUI


LSectMLU | crate 2 | slot 21 | [LeCroy 2373]
Data Base
mode
transparent
strobe
pulse
inhibit
data file
inConfig
patternFile
dataFile
Configuration loaded from map file
data
address:00000x0000000001 data:0000000000000001
address:00000x0000000010 data:0000000000000001
address:00000x0000000100 data:0000000000000001
address:00000x0000001000 data:0000000000000001
edit
add:
data:
Update
delete
add
add:
0000000000000000
data:
0000000000000000
control
Download
Verify
Close
blrocv1 | good connection
RightMT_OR
RTOFTopDel
RTOFTopCFD
LTOFPair
RTOFPair
RTOFDel
RTOFAND
RMeanTimer
LTOFBotCFD
LTOFBotDel
RTOFBotDel
RTOFBotCFD
LSectMLU
XSectMLU
RSectMLU
LNCFD
LNDel
LNCoinAND
LNCoinDel
LCosmicAND
LLogicOR
RCosmicAND
RLogicOR
RNCoinDel
RNCoinAND
RNDel
RNCFD
LEdgeDisc
LEdgeDel
REdgeDel
REdgeDisc
Control
Save
Download All
Verify All
Dump
Exit

Event Generators

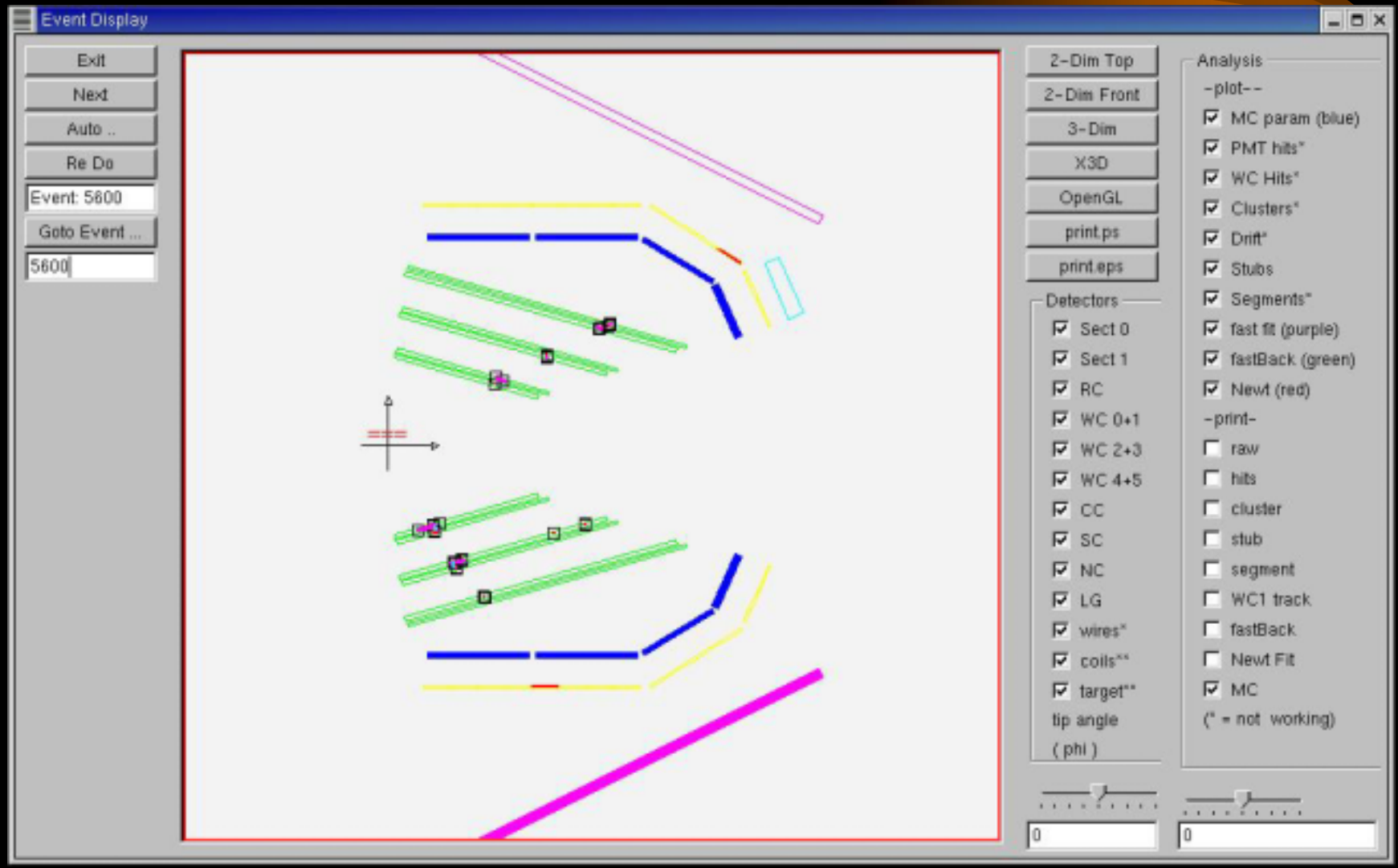
- Hydrogen elastic
- Deuterium elastic, photo-disintegration
- Quasi-elastic
- Multidimensional P.D.F. generator
  - Recursive linking of cumulative sum arrays
  - Allows mixture of variable types



Reconstruction Library

- Geometries and Magnetic Field
- CODA data stream read/write
- Reconstruction
  - Linking
  - Track Fitting
  - Particle ID
- Data Summary Tape

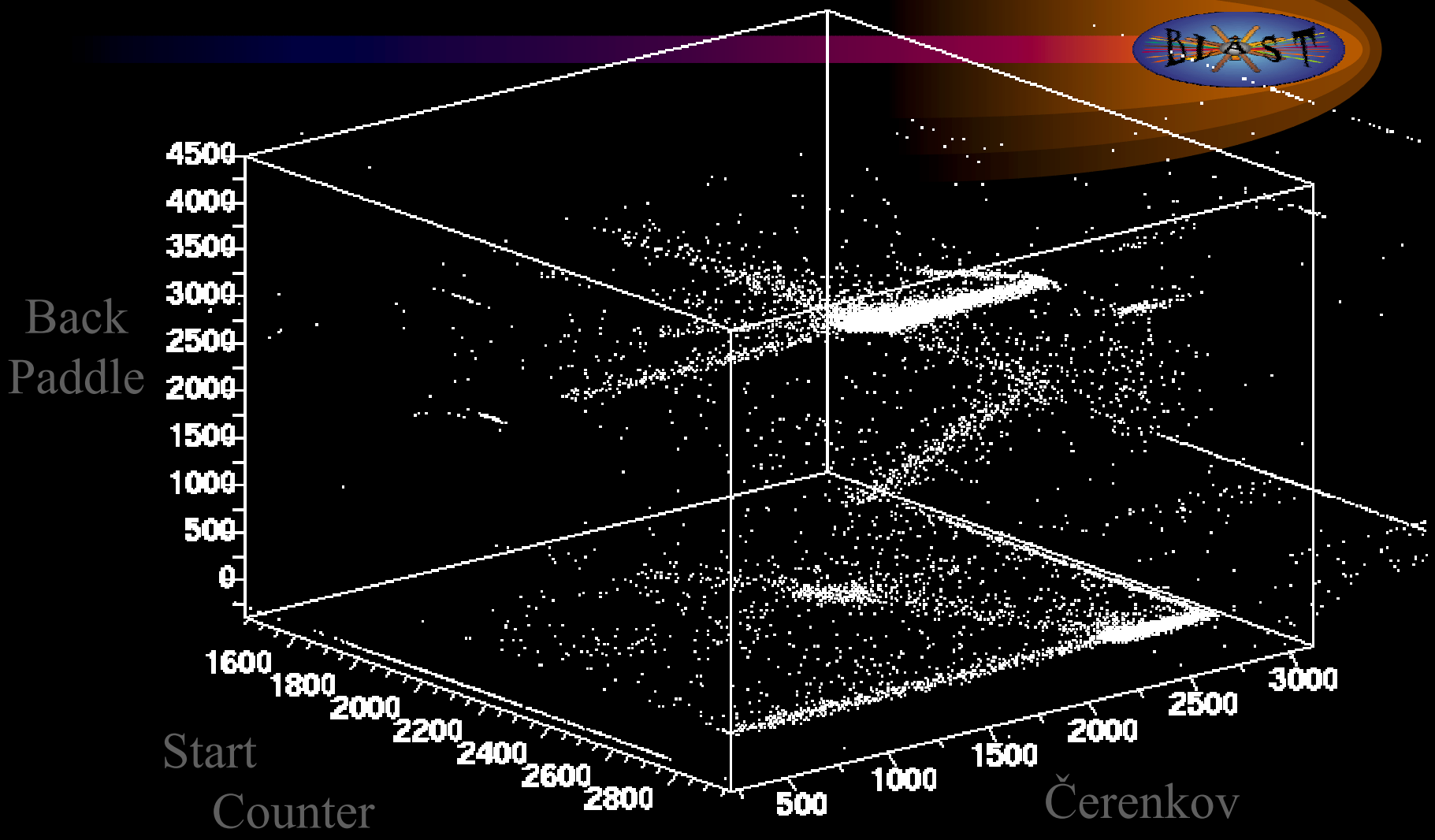
Single Event Display



Commissioning Analysis

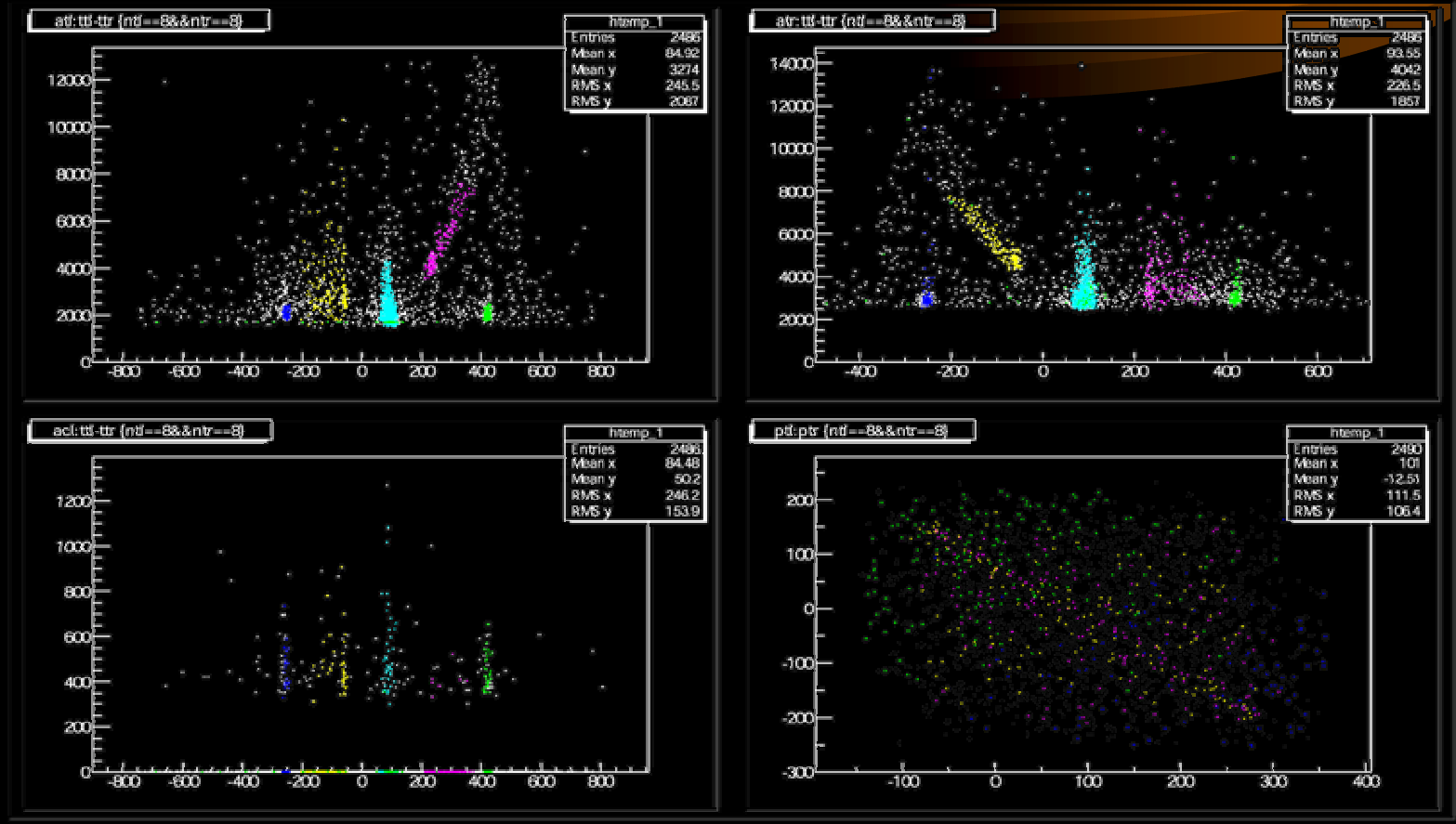
- BLAST began commissioning June/02
- ROOT is ideal for this transient phase
  - TreeViewer user interface
  - 3-d histograms for debugging timing issues
  - Use of colors and graphical cuts
  - Easy to share and modify macros

Timing Histogram Example



TCutG with Colors

study of hits on left#8, right#8



Utility Script: `init.C`

- Simple macro to provide
  - Parsing options and setup of TChains
  - Multiple curves on same histogram
  - Add sub-datasets using TCutG
- Common command line interface to scripts
  - gApplication->Argv()
- Specify cuts by variable name
  - gROOT->ProcessLine()

Pedagogical ROOT

PROS

- Recruitment: C++ !
- ROOT: C++ example
  - Open source
  - Complex classes
- Easy experimentation
- Rapid development
- Single language

CONS

- Learning curve
- Hard to trace multiply inherited methods
- Punctuation-intensive command syntax
- Can’t test some complex constructs

Polishing ROOT

- Command completion
  - Pointer chains
  - Replay history blocks
  - Wildcard completion
  - GUI events to history
  - Auto-cast TObject
  - Emacs root-mode, Calc
  - Return value: objects
- Extra documentation
- Undo option
- Segfault debugging
- Stricter C++ support
  - Pointer handling
  - Overloading
- STL enhancement