GlueX Software

Perspectives for JLab Grid Workshop
April 7, 2005

Zisis Papandreou and David Lawrence
(for The GlueX Collaboration)

Overview

- Background
  - LHC & CLAS Experience
  - Sources: DR (Chapter 9), GlueX-doc-438, etc.
- Event rates & CPUs
- Computing Strategy
  - Jefferson Lab Resources
  - Off-site Resources
  - Grid Resources
- Project Milestones

Background

- Study of exotic hybrids
- Data sets: ~3 Pb/year
- CPU intensive: data reduction, MC, PWA
- I/O intensive: may cause bottleneck
- Data Access & Management
- Distributed Collaboration
- Modern, flexible, transparent software tools
  - Leverage existing tools
  - Design appropriate user interfaces

Event Rates

Total photoproduction cross section = 120 μb @ Eγ = 9 GeV				
	σ	Rate (Hz)	Raw (yr^{-1})	Reconstructed
10^7 photons/s	1 μb	12.5	1.25×10^8	1.25×10^7
10^8 photons/s	1 μb	125	1.25×10^9	1.25×10^8

Level 3 Trigger Event Rate= 15 kHz @ 10^8 photons/s

Event size = 5 kb

Level 3 Trigger Data Rate = 15 kHz x 5 kb ≈ 100 Mb/s

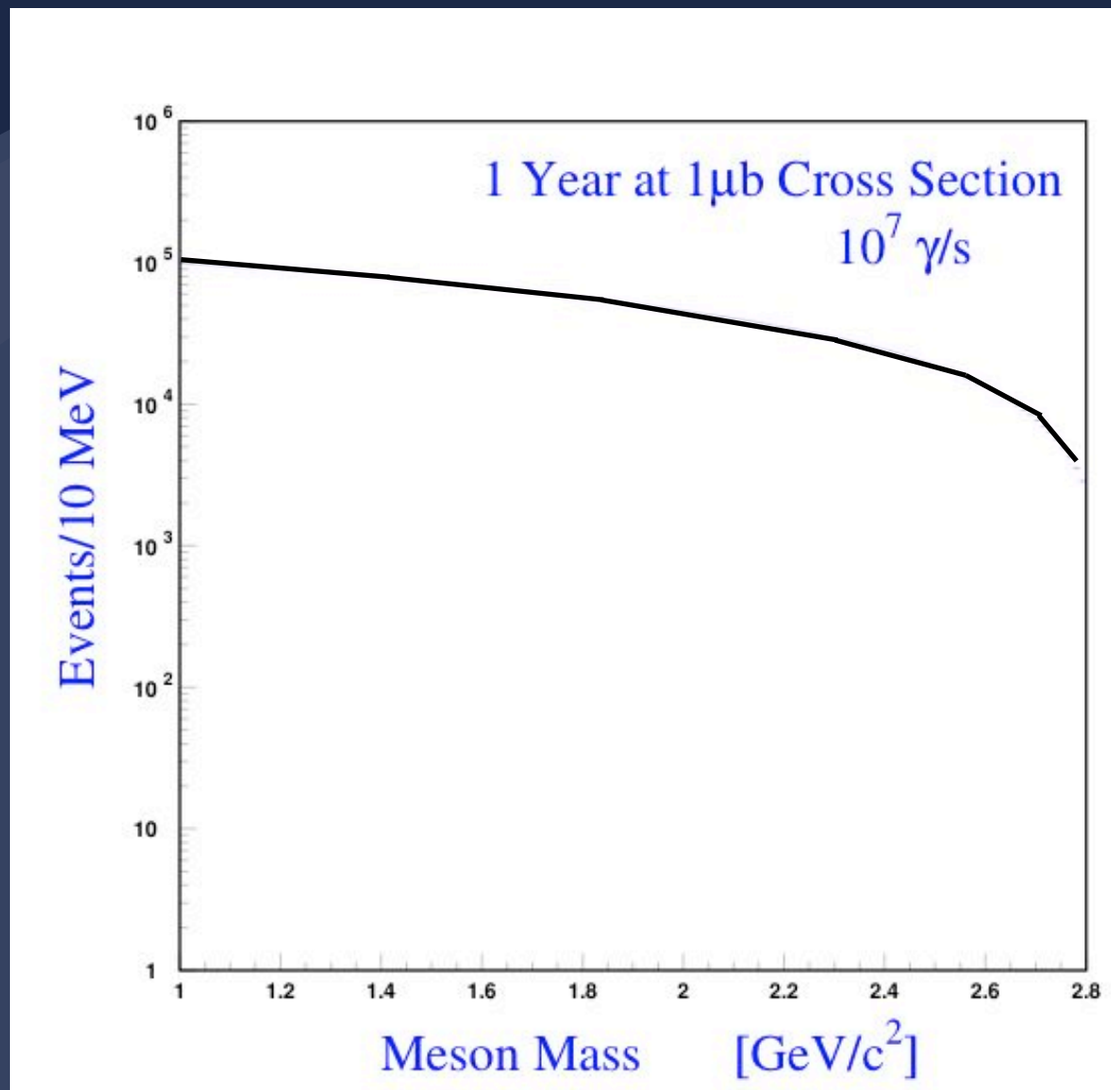
1 year of running = 10^7 seconds

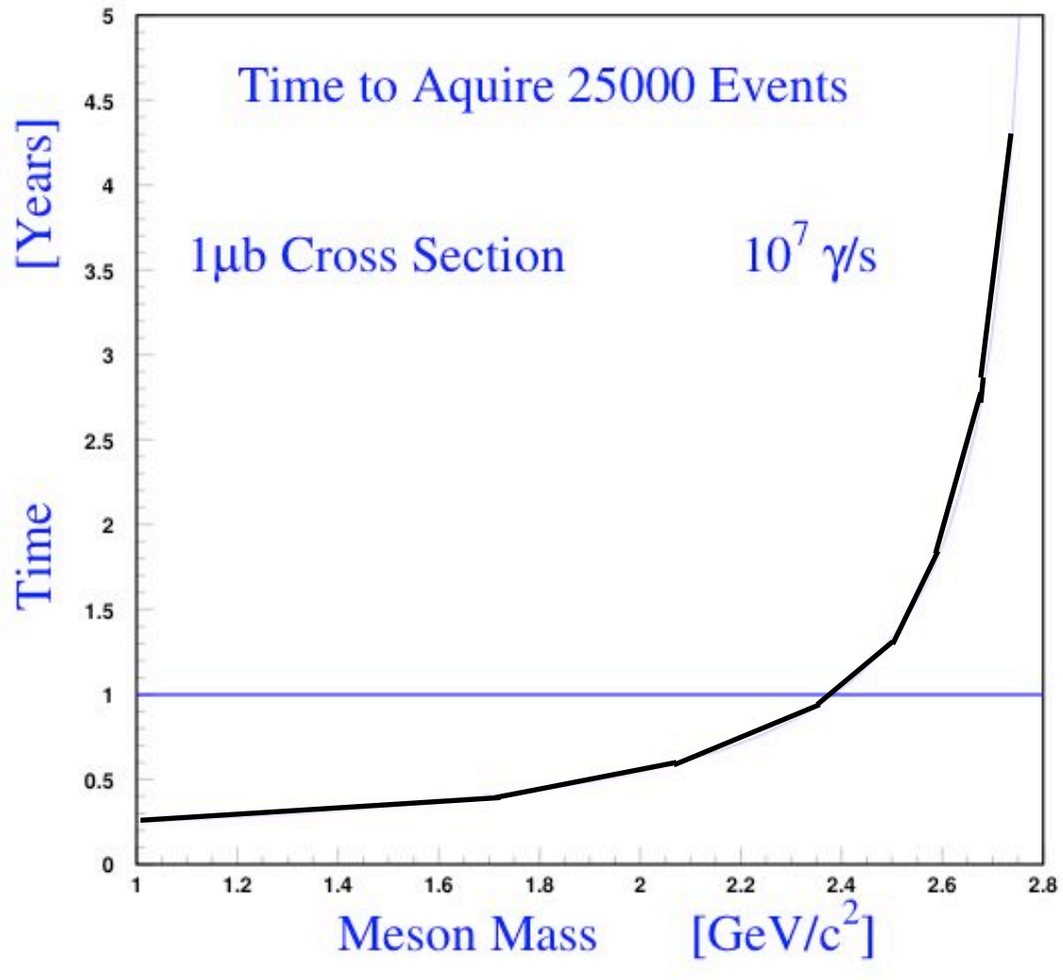
Annual data collected = 15 kHz x 10^7 s x 5 kb ≈ 1 Pb/year

Level 3 Multi-Track Event Reconstruction (2008) → 15 msec → 450 CPUs

MC Event Generation (2008) → 30 msec → 700 CPUs

Rates and Times





Solid Physics in 2 years running on exotic hybrids at 10^7 photons/s

For rare channels, beam rate needs to be $5x10^7$ photons/s

Farms & Clusters

Data Production for Hall-D and the 12 GeV upgrade

Based on a discussion between:

Roy Whitney, Graham Heyes, Andy Kowalski and Elton Smith

In this discussion we make the assumption that the DAQ improvements in CLAS in 2004/2005 bring

Year	Raw /yr	Prod /yr	Sim Raw	Sim Prod	work/Cache			Sim CPU	Raw Prod CPU	Sim Prod CPU
					CLAS	GLUEX	total			
2013	1	1	1	1		1.2	1.2	700	250	250
2012	1	0.5	1	1		0.8	0.8	700	200	250
2011	0.7	0.3	1	1	0.7	0.5	1.2	700	200	250
2010	0.3	0.3	0.5	0.5	0.5	0.3	0.8	350	200	100
2009	0.3	0.3	0.1	0.1	0.28	0.1	0.38	100	200	50
2008	0.3	0.3			0.15		0.15		200	
2007	0.3	0.3			0.12		0.12		150	
2006	0.3	0.3			0.1		0.1		125	
2005	0.2	0.2			0.07		0.07		100	
2004	0.2	0.2			0.04		0.04		100	

Notes:

_ All data numbers are in PB except when otherwise stated.

_ All CPU numbers assume 2008 hardware, i.e. already scaled from present and are a count of CPU's not boxes, quad-CPU boxes count as 4 not 1.

_ In 2005 we have approx. 200 CPUs but the 2008 hardware scaling factor brings this down to 100.

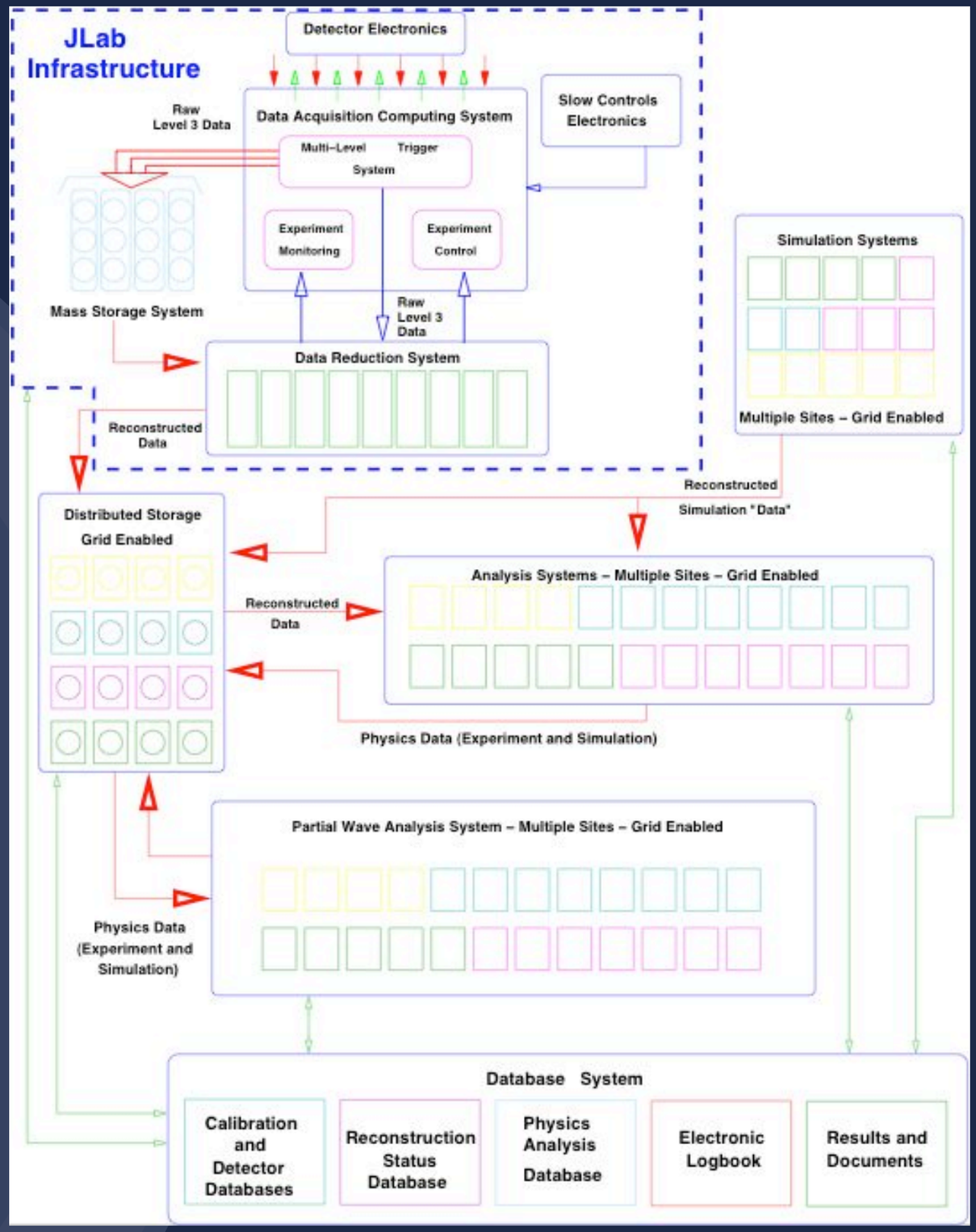
_ After 2011 CLAS may, or may not, be upgraded. If no upgrade occurs then do we assume CLAS generates in 2012 the same as 2011?

After an upgrade to CLAS what is the expected analysis requirement? Some statements are that CLAS generates the same data volume as GLUEX after an upgrade.

_ Current tape technology doubles tape capacity should at least double by 2011 and may double twice.

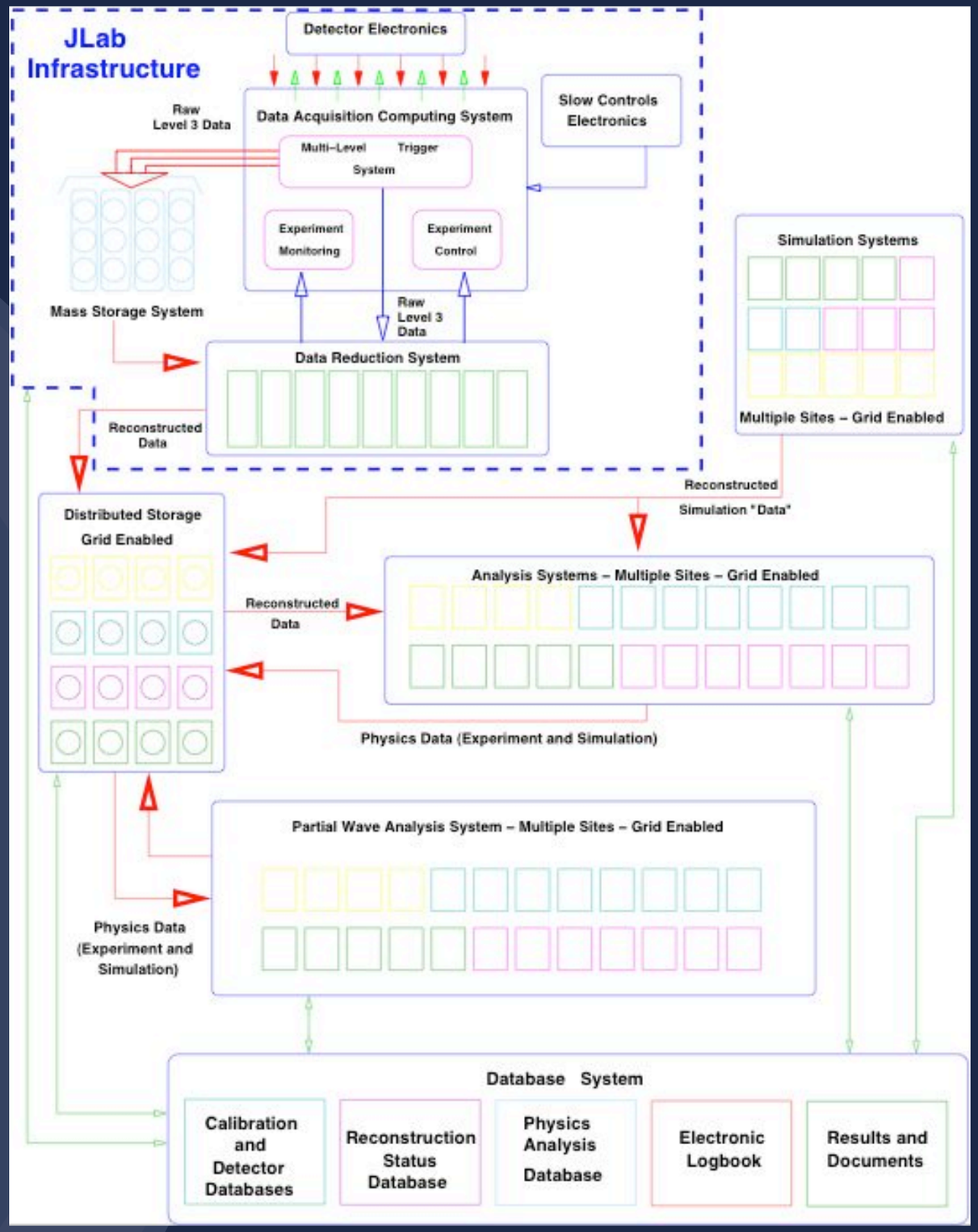
JLab Resources

- DAQ & interface to electronics
  - Raw @ 1 Gb/s ⇒ L3 @ 100 Mb/s
  - Direct data transfer to mass storage
  - Local and remote monitoring & control
  - Interface to data reduction software
- Calibration & Monitoring
  - High availability of (small) raw data set
  - Detector & conditions calibration
  - Run parameters
  - Database design - offsite access
- Data Storage
  - 100 Mb/s into 1 Tb cassettes ⇒ 3-4 drives
  - 1 tape silo (6000 Tb) required
  - Alternative technologies for storage?
- Data Reduction
  - Event reconstruction is CPU intensive
  - L3 data reduction needs 450 CPU-2008
  - Portable code
- High speed network



Off-site Resources

- Distributed Data Storage
  - Storage related to specific activity (~10 Tb)
  - 600 Gb to CMU → 2 days
  - Need OC-24 or OC-48; last mile?
- Physics & Detector Simulations
  - CPU intensive (a few event/sec)
  - Event generation at multiple sites
  - Grid-, Web-based access
- Partial Wave Analysis
  - Multi-parameter function & likelihood fit
  - Visualization tools
  - Portable code
- Record-keeping & Collab. Interface
  - Electronic Logbook / Messaging
  - Communications portal
  - Document Database



Existing Tools

the globus alliance
www.globus.org

GRIDS

Leveraging Existing and Proposed Standards

- SSL/TLS v1 (from OpenSSL) (IETF)
- LDAP v3 (from OpenLDAP) (IETF)
- X.509 Proxy Certificates (IETF)
- GridFTP v1.0 (GGF)
- OGSI v1.0 (GGF)
- And others on the road to standardization:

  WSRF (GGF, OASIS), DAI, WS-Agreement, WSDL 2.0, WSDM, SAML, XACML

12

Pick and Choose

* Secure, reliable access to data, software, people, etc (via browser)
* Leverage what's out there, plan carefully
* Decompose into smaller components if necessary
* Glue together: Application Development & System Integration

- Basic Grid Security Mechanisms
- Certificate Generation Tools (Purse…)
- Certificate Management Tools
- Authorization/Access Control Tools (MyProxy…)
- Monitor and Discovery Tools (CHEF/Sakai)
- Workflow Managers (Pegasus)
- Metaschedulers (Condor, Condor-G)
- Virtual Data - Metadata catalog, Replica Location (Chimera)
- GridFTP
- System Packaging/Distribution (Pacman)

Project Milestones

- ☆Object Oriented Framework
- ☆Data exposed in XML
- ☆Metaschedulers
- ☆Portal
- ☆On the right track

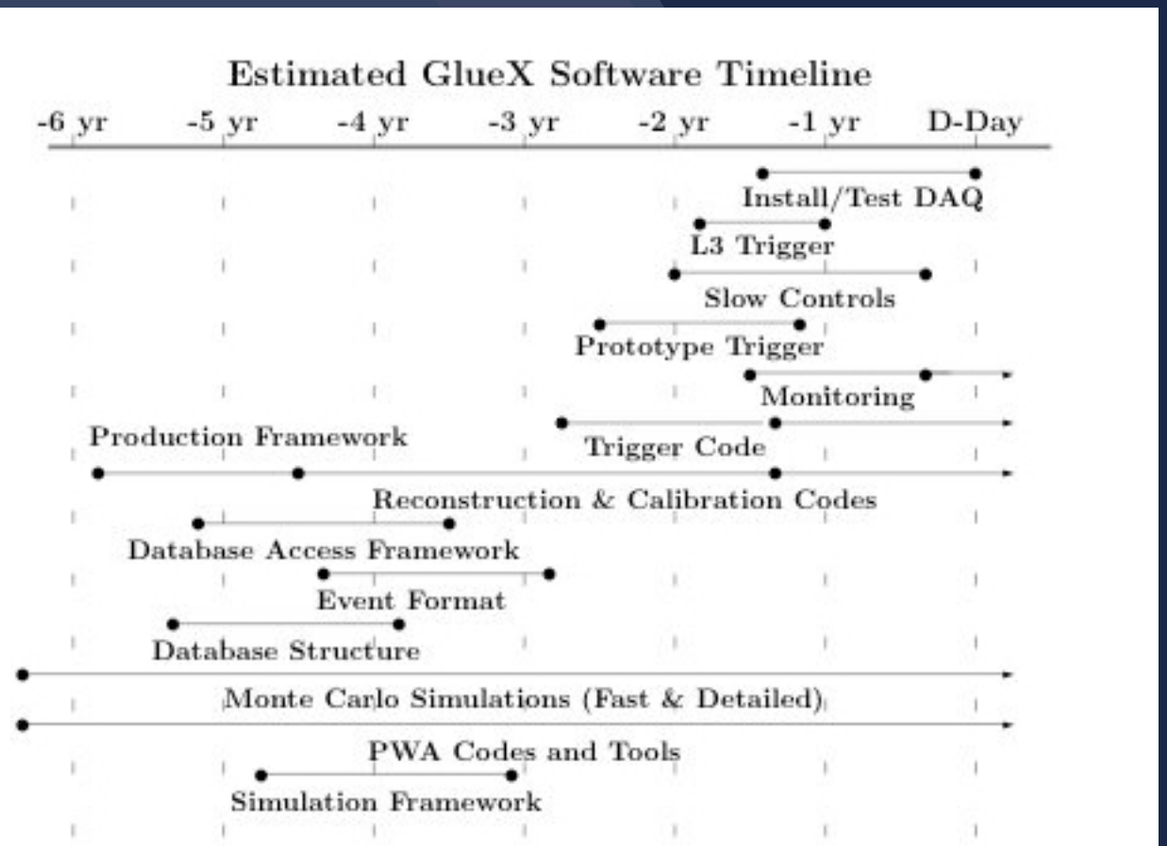


Figure 9.1: Milestones for GlueX computing projects and tasks.