ced$_{12}$

Seeing Tracks Through Thick and Thin[†]

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[†] As in *thick* and *thin* clients

Outline

1. Introduction
2. Thick & Thin
3. Architecture
4. Features
5. Availability & Plans

1. Introduction

- *ced*$_{12}$ = cLAS eVENT dISPLAY (for 12 GeV)
- It is an *event* display, not a *detector* display
  - Primary role is *not* to visualize the detector.
  - Primary roles: Help *debug* and *diagnose* the detector (online) and to assist in analysis (offline).
  - Unfaithful (to the geometry) displays are often more useful that faithful displays. Especially when there is a lot of “air.”
  - 2D often more useful than 3D.

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2. Thick and Thin

- Thick: Traditional, full-featured Desktop Application
- Thin: **Same** full-featured Web 2.0 application delivered in a browser[†]
- We will deliver both, using (approximately) the same code base

[†] With, perhaps, some minor security related annoyances, such as no access to local file system—e.g., *ced*$_{12}$ will not be able to upload your *Quicken* files to the CLAS calibration database. Honest.

Web 1.0 v. Web 2.0

- **Web 1.0**
  - Web delivers documents
  - Web apps are stateless
  - HTML based; browser *renders*
- **Web 2.0**[†]
  - Web delivers Rich Internet Applications (RIAs)
  - Applications maintain state
  - Data centric; browser *contains and delivers*

Rich Internet Applications

1. Browser ***delivers*** virtual machine and ***provides*** real estate.
2. Compiled application runs in vendor VM.
3. VM, not browser, renders.
4. Browser's primary role has changed! It is a VM container.

[†] Web 2.0 is here *now*. Sometimes it provides dramatic new interfaces. Sometimes, as in the case of *NetFlix*, it takes a decent site and redoes it in a way that produces a much more appealing desktop-like response and experience.

RIA Technologies

- Adobe FLEX (2004) FLASH player is VM. **~97 percent penetration across all platforms**.[1]
- Microsoft Silverlight (2007) So far, little penetration.[666]
- SUN JavaFX (too late—little chance to succeed.)
- HTML 5 (Interesting—essentially dumps the VM responsibilities onto the browser developers.) [3]

[1] The best reason for adopting FLEX; ~nobody will have to download anything.

[666] But yes, I agree, that is one hard-to-ignore 800lb gorilla.

[3] Spec to reach the W3C Candidate Recommendation stage 2012, and W3C Recommendation in the year **2022** or later! Many parts of the spec are stable and may be implemented early. (Source: *wikipedia*)

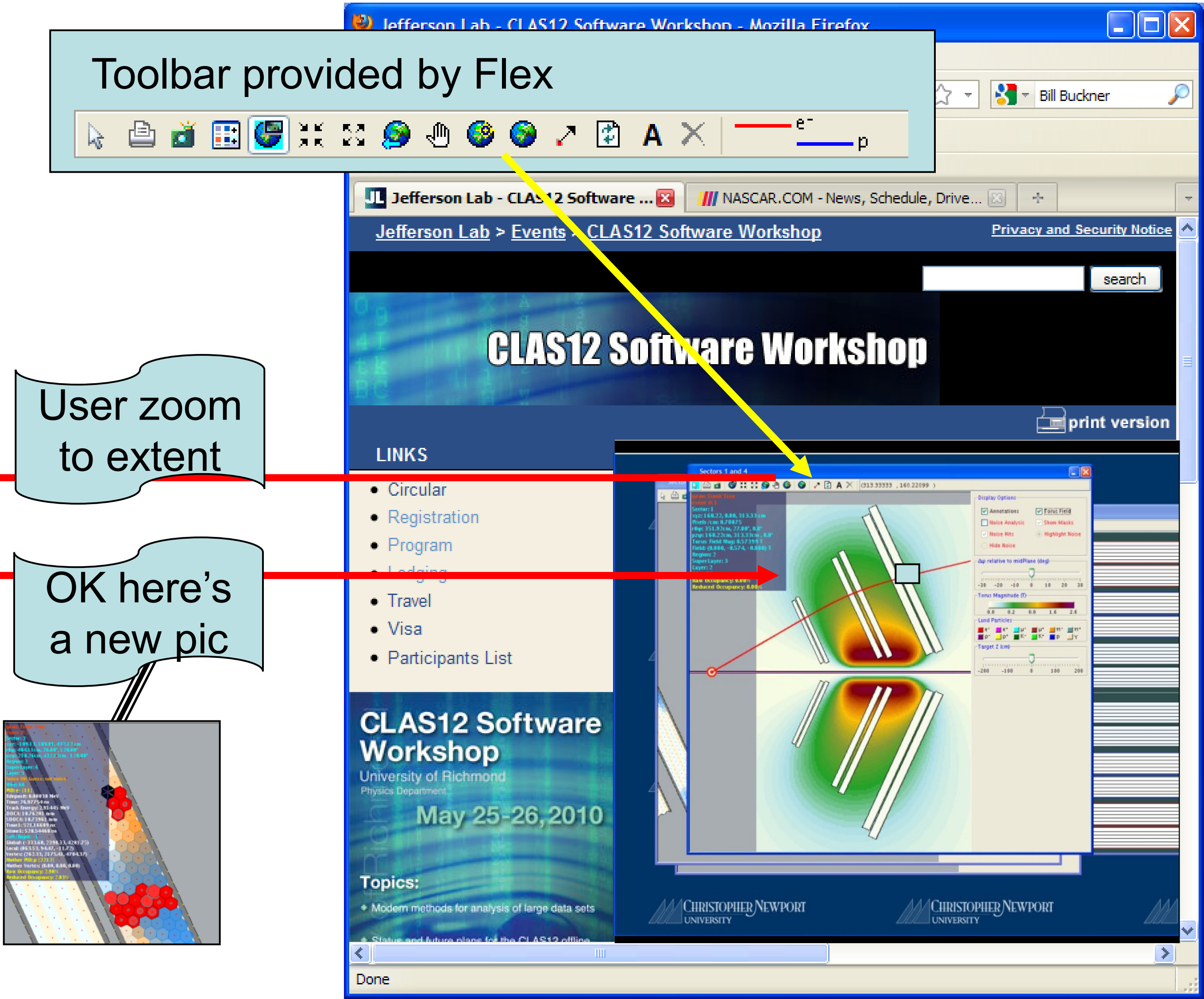
Google Maps Paradigm

Client tools overlaying server provided image

SOA Container (See talk by Vardan Gyurjyan)

Headless event display

Other Service



Toolbar provided by Flex

User zoom to extent

OK here's a new pic

Jefferson Lab - CLAS12 Software Workshop - Mozilla Firefox

Bill Buckner

Jefferson Lab - CLAS12 Software ...

NASCAR.COM - News, Schedule, Drive...

Jefferson Lab > Events > CLAS12 Software Workshop

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- Circular
- Registration
- Program
- Lodging
- Travel
- Visa
- Participants List

CLAS12 Software Workshop

University of Richmond

Physics Department

May 25-26, 2010

Topics:

- Modern methods for analysis of large data sets
- Status and future plans for the CLAS12 offline

Done

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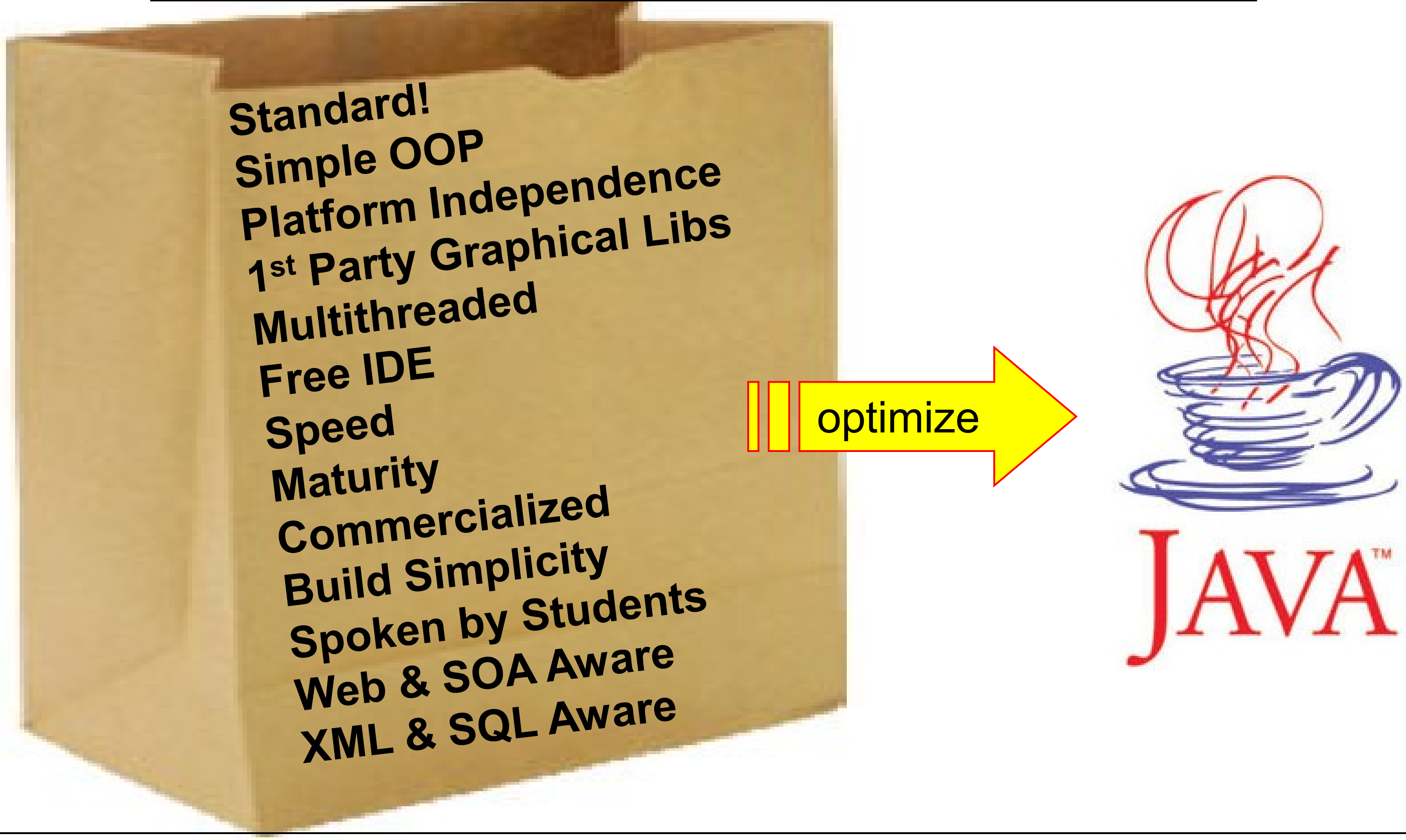
3. Architecture

CLAS 6 (and 12?) Software Motto:

“Standard is Better than Better” †



- Standard!
- Simple OOP
- Platform Independence
- 1st Party Graphical Libs
- Multithreaded
- Free IDE
- Speed
- Maturity
- Commercialized
- Build Simplicity
- Spoken by Students
- Web & SOA Aware
- XML & SQL Aware

† If you were to say: “in *practice* it appears that the CLAS 6 motto was: ***Complicated** is Better than Better*,” I, for one, could not say that you were being uncharitable.

Two Plus One Libraries

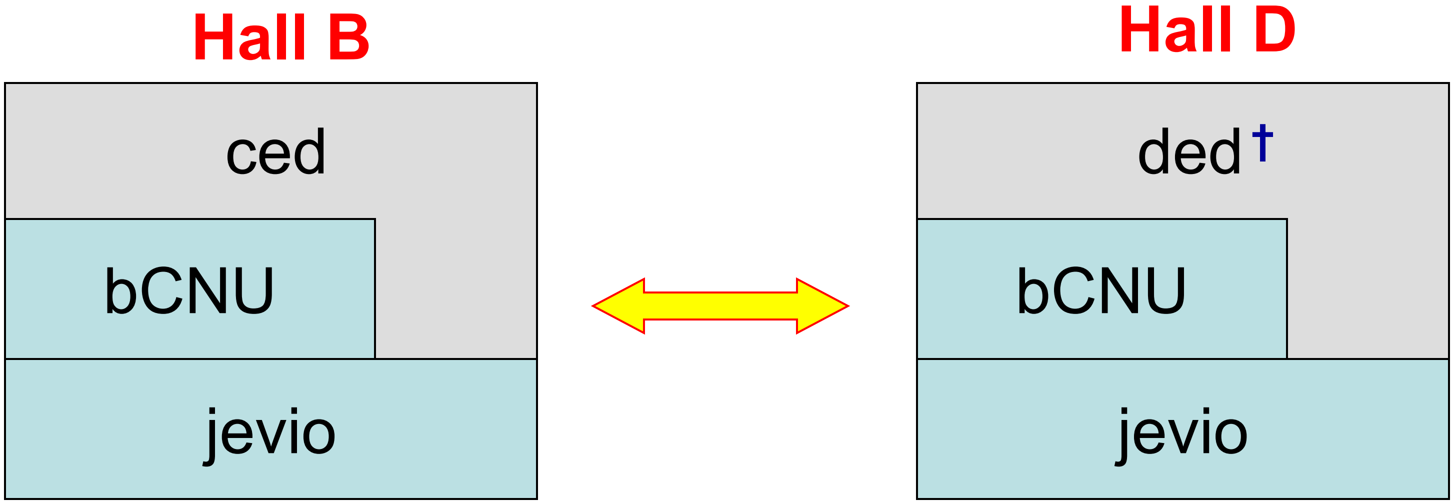
Library	***Purpose***	***Comments***
jevio	JAVA I/O for JLab CODA evio format	Developed by CLAS software group—adopted and taken-over by JLAB DAQ group for JLAB site-wide use.
bCNU[1]	Multiple Document Interface (MDI) Framework	CLAS SWG JAVA Swing-based graphical package. *bCNU* provides framework and base classes, but knows nothing about any specific detector.
jogl[2]	JAVA bindings to OpenGL (3D)	One of two well-known free 3D solutions for JAVA. Requires platform specific jars and shared libraries.

On this platform we are building Hall B and Hall D event displays

[1] bCNU, i.e., "be seein' you!" (unless that is too cheesy, in which case it stands for Hall **b** and **CNU** collaboration. Your call.)

[2] This is the "plus one." It differs from the other two in that a) we didn't develop it and, more importantly, b) it is quasi-platform dependent.

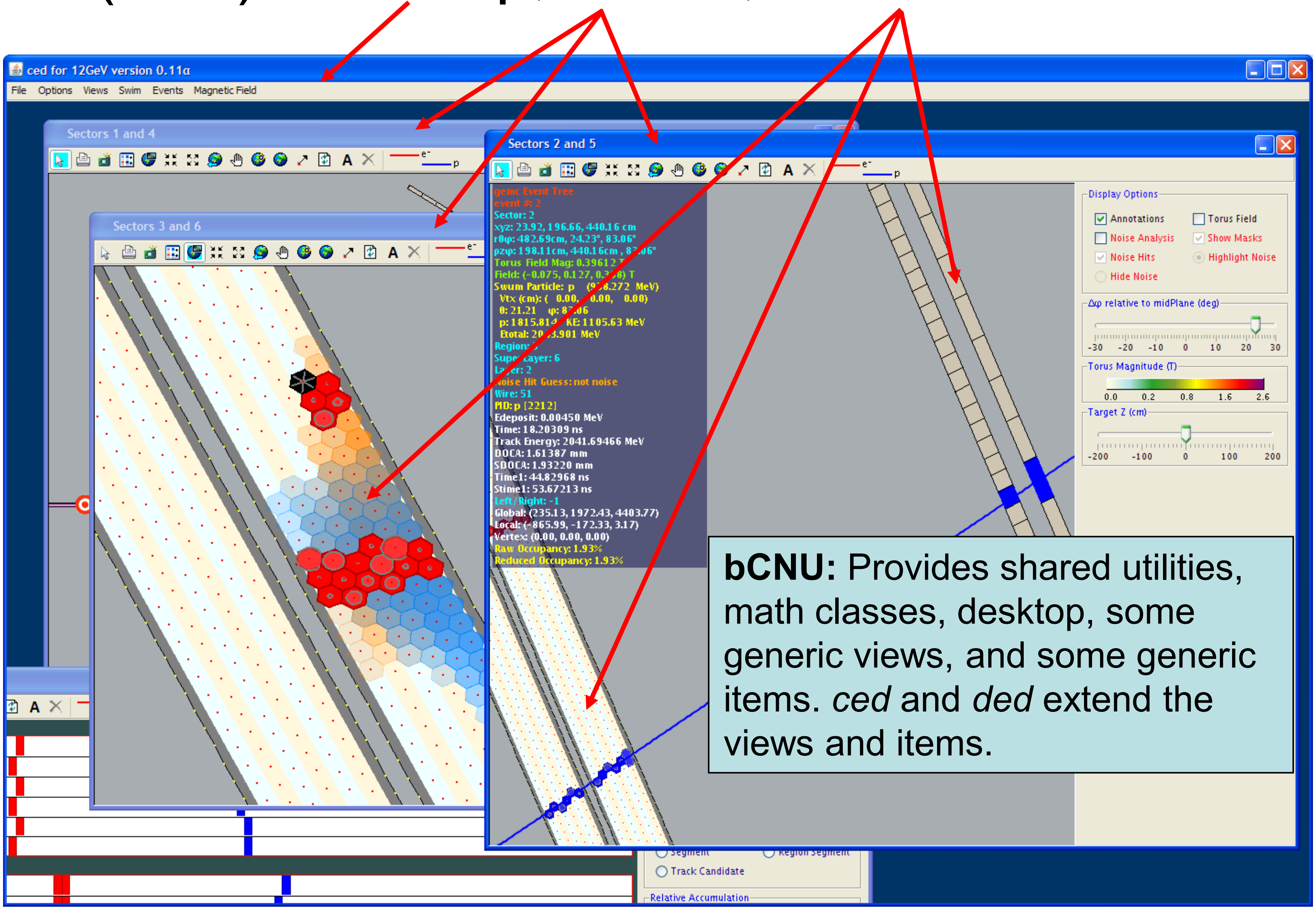
Shared Hall B/D Code Base



Goal: common (or potentially common) features developed in *bCNU* (or migrated to *bCNU*) with the intent that the *ced*/*ded* code base < ¼ the size of the *bCNU* code base.

[†] *ded* (pronounced "*dee-e-dee*") is the Hall D event display. This naming convention is bloody awful, since you would then think *ced* is the Hall C event display, and that *ced* should really be *bed*. But there it is.

Multiple Document Interface (MDI): Desktop, Views, & Items



gemc Event Tree
event #: 2
Sector: 2
xyz: 23.92, 196.66, 440.16 cm
rθφ: 482.69cm, 24.23°, 83.06°
ρzφ: 198.11cm, 440.16cm , 83.06°
Torus Field Mag: 0.39612 T
Field: (-0.075, 0.127, 0.368) T
Swum Particle: p (938.272 MeV)
Vtx (cm): (0.00, 0.00, 0.00)
θ: 21.21 φ: 83.06
p: 1815.814 KE: 1105.63 MeV
Etotal: 2043.901 MeV
Region: 3
Super Layer: 6
Layer: 2
Noise Hit Guess: not noise
Wire: 51
PID: p [2212]
Edeposit: 0.00450 MeV
Time: 18.20309 ns
Track Energy: 2041.69466 MeV
DOCA: 1.61387 mm
SDOCA: 1.93220 mm
Time1: 44.82968 ns
Stime1: 53.67213 ns
Left/Right: -1
Global: (235.13, 1972.43, 4403.77)
Local: (-865.99, -172.33, 3.17)
Vertex: (0.00, 0.00, 0.00)
Raw Occupancy: 1.93%
Reduced Occupancy: 1.93%

Display Options
☑ Annotations ☐ Torus Field
☐ Noise Analysis ☑ Show Masks
☑ Noise Hits ● Highlight Noise
○ Hide Noise

Δφ relative to midPlane (deg)
-30 -20 -10 0 10 20 30

Torus Magnitude (T)
0.0 0.2 0.8 1.6 2.6

Target Z (cm)
-200 -100 0 100 200

bCNU: Provides shared utilities, math classes, desktop, some generic views, and some generic items. *ced* and *ded* extend the views and items.

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4. Features (Current *ced* Views)

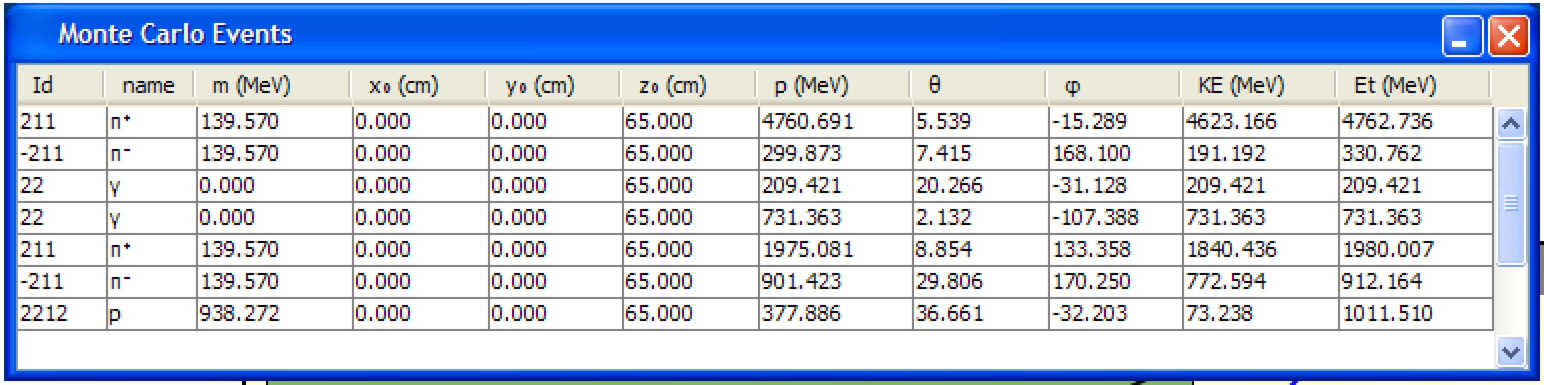
View	***Comment***
All DC	All the drift chambers—approximate geometry
Sector	Split sectors 1/4, 2/5, 3/6. Faithful geometry. Currently DC and OTOF.
Monte Carlo	Table of "event generator" records (if any present) showing what tracks were generated
Event	Drag 'n drop, expandable tree-view of the event so that banks can be examined quickly **(bCNU)**
Noise	A view with fake data used for testing/explaining the noise detection algorithm.
Log	Info/Warning/Error messages for debugging **(bCNU)**
Socket	Establish and manage evio over a socket **(bCNU)**
XML	Drag 'n drop, tree-view of any XML file **(bCNU)**

Some Selected Features

Feature	***Comment***
Zoom, pan, etc	Expected features for view manipulation **(bCNU)**
Snap shot	High quality `.png` image of active area **(bCNU)**
Heads-up	Mouse-over information displayed on a semi-transparent heads-up display (to preserve real estate) **(bCNU)**
Moving target	Trivial: target z-location can be changed
Magnetic Field	Uses same field as GEMC
Accumulate	Accumulation mode for looking for hot spots/dead zones
Swim	Runge-Kutta 4th order for swimming particles **(bCNU)**
Noise	Improved display of results of noise detection
Clusters/ segments/ candidates	Highlight clusters, segments, track candidates, etc. from the *socrat* family of track-finders (or any track-finder that stores results in same banks)
Auto rotate	Rotate to initial ϕ of track to see if it lines up with DOCAs

Some Snapshots

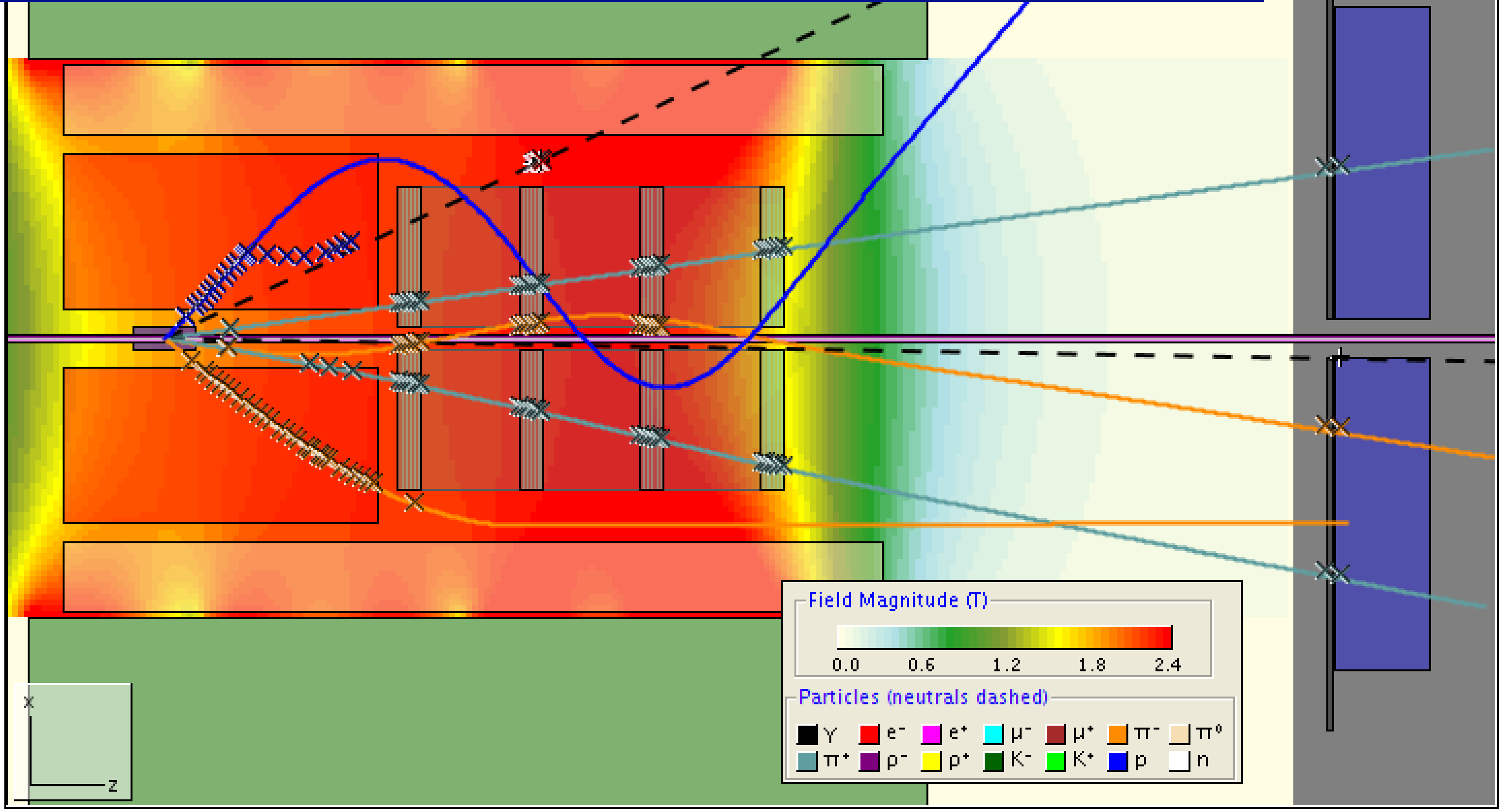
Monte Carlo View



Monte Carlo Events

Id	name	m (MeV)	x_0 (cm)	y_0 (cm)	z_0 (cm)	p (MeV)	θ	φ	KE (MeV)	Et (MeV)
211	π^+	139.570	0.000	0.000	65.000	4760.691	5.539	-15.289	4623.166	4762.736
-211	π^-	139.570	0.000	0.000	65.000	299.873	7.415	168.100	191.192	330.762
22	γ	0.000	0.000	0.000	65.000	209.421	20.266	-31.128	209.421	209.421
22	γ	0.000	0.000	0.000	65.000	731.363	2.132	-107.388	731.363	731.363
211	π^+	139.570	0.000	0.000	65.000	1975.081	8.854	133.358	1840.436	1980.007
-211	π^-	139.570	0.000	0.000	65.000	901.423	29.806	170.250	772.594	912.164
2212	p	938.272	0.000	0.000	65.000	377.886	36.661	-32.203	73.238	1011.510

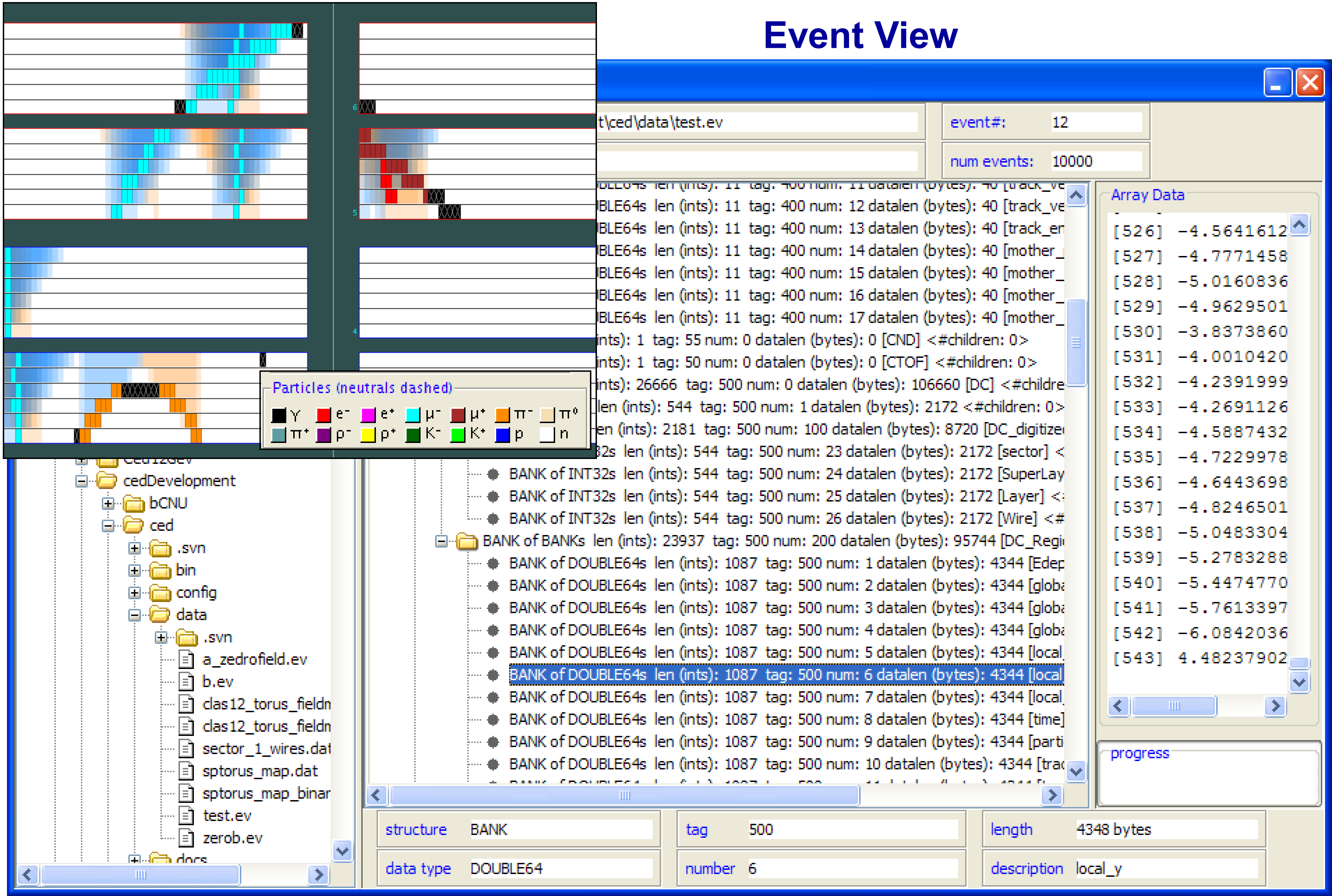
Hall D view using same *bCNU* framework



More Snapshots

Noise Analysis

Event View



t\ced\data\test.ev

event#: 12

num events: 10000

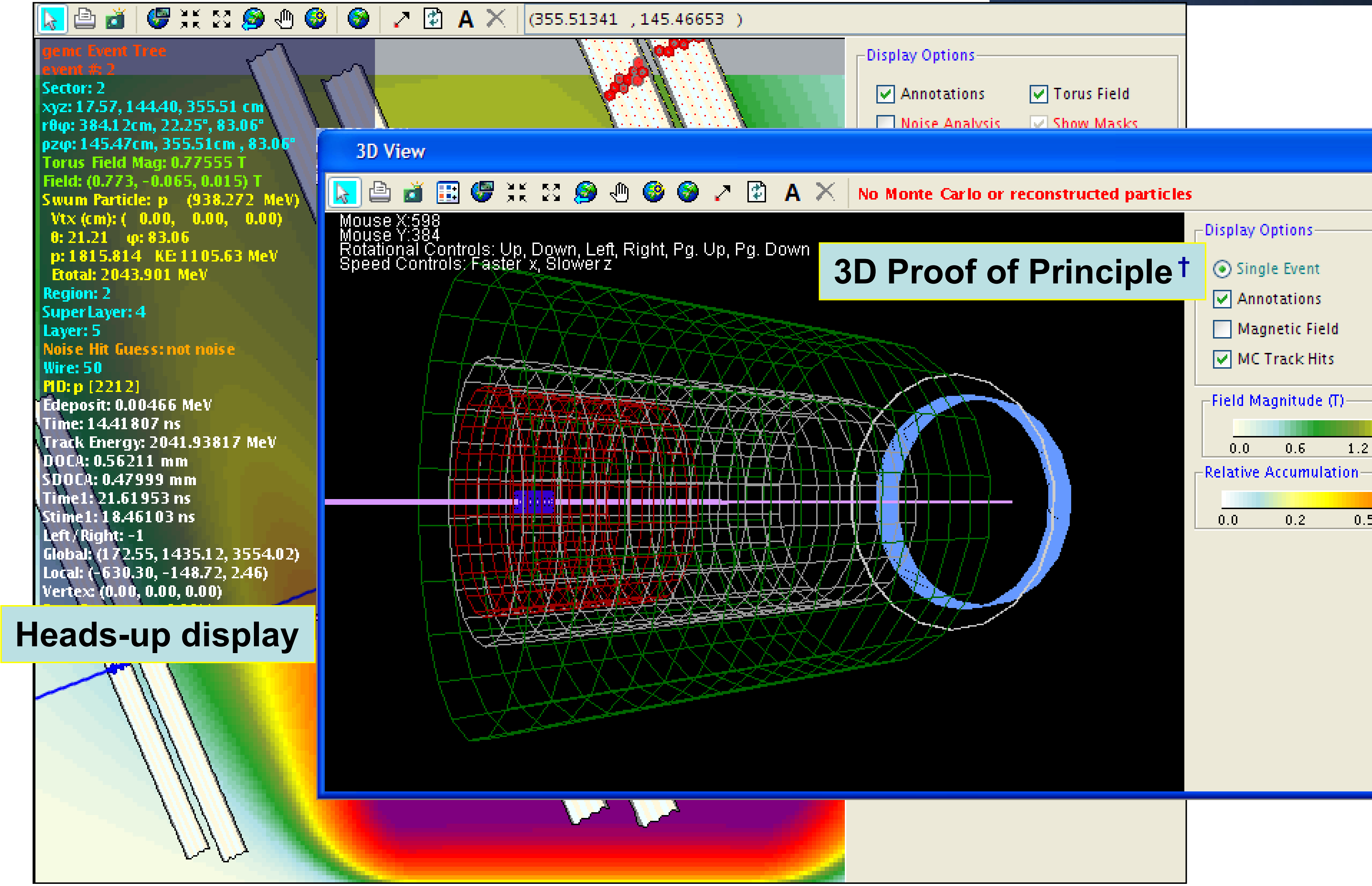
```
BLE64s  len (ints): 11  tag: 400 num: 11 datalen (bytes): 40 [track_ve
BLE64s  len (ints): 11  tag: 400 num: 12 datalen (bytes): 40 [track_ve
BLE64s  len (ints): 11  tag: 400 num: 13 datalen (bytes): 40 [track_en
BLE64s  len (ints): 11  tag: 400 num: 14 datalen (bytes): 40 [mother_
BLE64s  len (ints): 11  tag: 400 num: 15 datalen (bytes): 40 [mother_
BLE64s  len (ints): 11  tag: 400 num: 16 datalen (bytes): 40 [mother_
BLE64s  len (ints): 11  tag: 400 num: 17 datalen (bytes): 40 [mother_
ints): 1  tag: 55 num: 0 datalen (bytes): 0 [CND] <#children: 0>
ints): 1  tag: 50 num: 0 datalen (bytes): 0 [CTOF] <#children: 0>
ints): 26666  tag: 500 num: 0 datalen (bytes): 106660 [DC] <#childre
len (ints): 544  tag: 500 num: 1 datalen (bytes): 2172 <#children: 0>
en (ints): 2181  tag: 500 num: 100 datalen (bytes): 8720 [DC_digitize
32s  len (ints): 544  tag: 500 num: 23 datalen (bytes): 2172 [sector] <
    ● BANK of INT32s  len (ints): 544  tag: 500 num: 24 datalen (bytes): 2172 [SuperLay
    ● BANK of INT32s  len (ints): 544  tag: 500 num: 25 datalen (bytes): 2172 [Layer] <
    ● BANK of INT32s  len (ints): 544  tag: 500 num: 26 datalen (bytes): 2172 [Wire] <#
⊟ BANK of BANKs  len (ints): 23937  tag: 500 num: 200 datalen (bytes): 95744 [DC_Regi
    ● BANK of DOUBLE64s  len (ints): 1087  tag: 500 num: 1 datalen (bytes): 4344 [Edep
    ● BANK of DOUBLE64s  len (ints): 1087  tag: 500 num: 2 datalen (bytes): 4344 [globa
    ● BANK of DOUBLE64s  len (ints): 1087  tag: 500 num: 3 datalen (bytes): 4344 [globa
    ● BANK of DOUBLE64s  len (ints): 1087  tag: 500 num: 4 datalen (bytes): 4344 [globa
    ● BANK of DOUBLE64s  len (ints): 1087  tag: 500 num: 5 datalen (bytes): 4344 [local
    ● BANK of DOUBLE64s  len (ints): 1087  tag: 500 num: 6 datalen (bytes): 4344 [local
    ● BANK of DOUBLE64s  len (ints): 1087  tag: 500 num: 7 datalen (bytes): 4344 [local
    ● BANK of DOUBLE64s  len (ints): 1087  tag: 500 num: 8 datalen (bytes): 4344 [time]
    ● BANK of DOUBLE64s  len (ints): 1087  tag: 500 num: 9 datalen (bytes): 4344 [parti
    ● BANK of DOUBLE64s  len (ints): 1087  tag: 500 num: 10 datalen (bytes): 4344 [trac
```

```
⊞ ced12dev
⊟ cedDevelopment
    ⊞ bCNU
    ⊟ ced
        ⊞ .svn
        ⊞ bin
        ⊞ config
        ⊟ data
            ⊞ .svn
            a_zedrofield.ev
            b.ev
            clas12_torus_fieldn
            clas12_torus_fieldn
            sector_1_wires.dat
            sptorus_map.dat
            sptorus_map_binar
            test.ev
            zerob.ev
        ⊞ docs
```

Array Data

```
[526] -4.5641612
[527] -4.7771458
[528] -5.0160836
[529] -4.9629501
[530] -3.8373860
[531] -4.0010420
[532] -4.2391999
[533] -4.2691126
[534] -4.5887432
[535] -4.7229978
[536] -4.6443698
[537] -4.8246501
[538] -5.0483304
[539] -5.2783288
[540] -5.4474770
[541] -5.7613397
[542] -6.0842036
[543] 4.48237902
```

structure	BANK	tag	500	length	4348 bytes
data type	DOUBLE64	number	6	description	local_y



(355.51341 , 145.46653)

```
gemc Event Tree
event #: 2
Sector: 2
xyz: 17.57, 144.40, 355.51 cm
rθφ: 384.12cm, 22.25°, 83.06°
ρzφ: 145.47cm, 355.51cm , 83.06°
Torus Field Mag: 0.77555 T
Field: (0.773, -0.065, 0.015) T
Swum Particle: p   (938.272  MeV)
  Vtx (cm): (   0.00,    0.00,    0.00)
  θ: 21.21    φ: 83.06
  p: 1815.814   KE: 1105.63 MeV
  Etotal: 2043.901 MeV
Region: 2
Super Layer: 4
Layer: 5
Noise Hit Guess: not noise
Wire: 50
PID: p [2212]
Edeposit: 0.00466 MeV
Time: 14.41807 ns
Track Energy: 2041.93817 MeV
DOCA: 0.56211 mm
SDOCA: 0.47999 mm
Time1: 21.61953 ns
Stime1: 18.46103 ns
Left / Right: -1
Global: (172.55, 1435.12, 3554.02)
Local: (-630.30, -148.72, 2.46)
Vertex: (0.00, 0.00, 0.00)
```

Display Options

☑ Annotations ☑ Torus Field

☐ Noise Analysis ☑ Show Masks

3D View

No Monte Carlo or reconstructed particles

```
Mouse X:598
Mouse Y:384
Rotational Controls: Up, Down, Left, Right, Pg. Up, Pg. Down
Speed Controls: Faster x, Slower z
```

Display Options

● Single Event

☑ Annotations

☐ Magnetic Field

☑ MC Track Hits

3D Proof of Principle[†]

Heads-up display

[†] For those who know about such things, the “lightweight *v.* heavyweight” issue is not a problem.

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5. Availability: Obtaining *ced*[†]

`svn scheckout` [URL]   Where [URL] is:

https://clas12svn.jlab.org/repos/trunk/clas12/cedExport

→ *cedExport*, with *ced.sh* for launching on linux, unix or Mac OS X. And *ced.bat* for launching on the other 95% of all computers. **There is no build procedure**--such is the beauty of JAVA.

From then on, use **`svn update`** → the latest.

On linux, launch the script via: `bash ced.sh`

[†] You need a JLab CUE account.
<rant> Forgot your password? Look on the little piece of paper in your desk! Since we all have multiple accounts, all with out-of-phase über-unbreakable mandatory password shelf lives, we (well, not me) have resorted to writing them down. Everything is *much* more secure! **</rant>**

Last Slide: Development Plans

Feature	***Comment***	***Status***	***LoE (months)***
Use SOA deployed @ CNU	CNU purchased two servers (Feb, 2010)	Started	Continuous
More geometries	Infrastructure ready	Started	As geometries become available
Image Service	Headless *ced*$_{12}$ produces images upon demand	Not started	2
Web 2.0 (RIA) version	Fully functional web version	Started	18
3D Views	jogl support added to bCNU	Started	6
2D Views	Calorimeter, etc.	Started	3
Simple inter-process comm.	Non-firewall penetrating event passing (bare sockets and cMsg)	Completed	3