ced and swimmer updates

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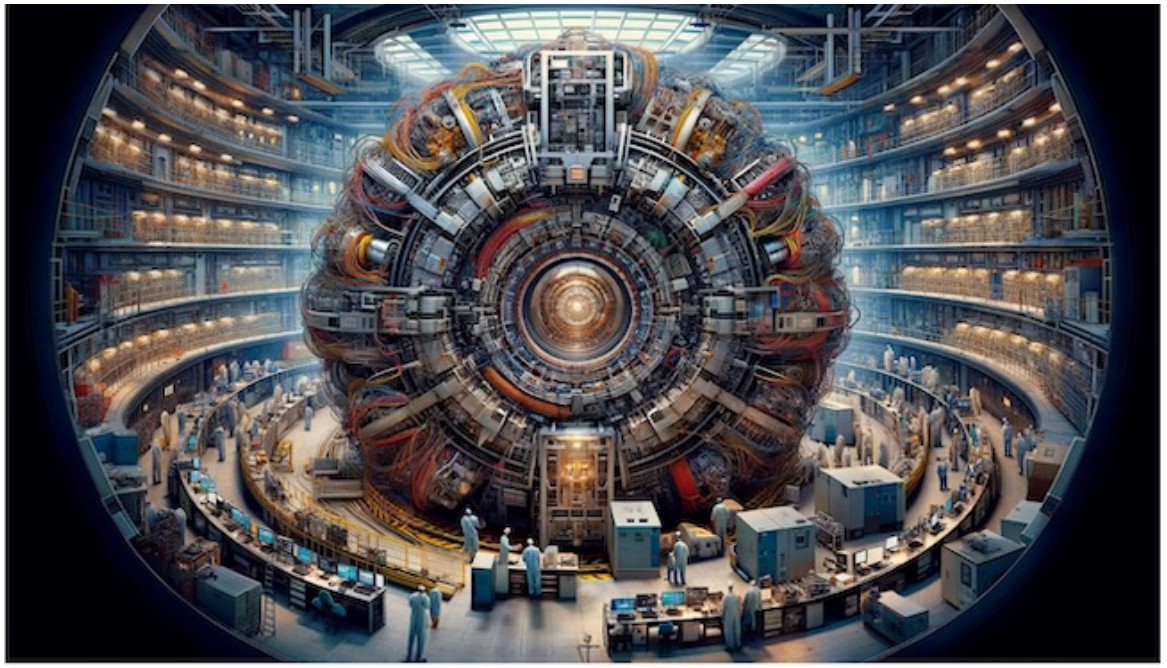


CLAS12 as rendered by ChatGPT

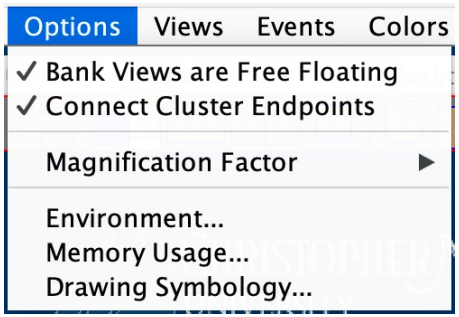
ced (the **c**LAS12 **e**VENT **d**ISPLAY)

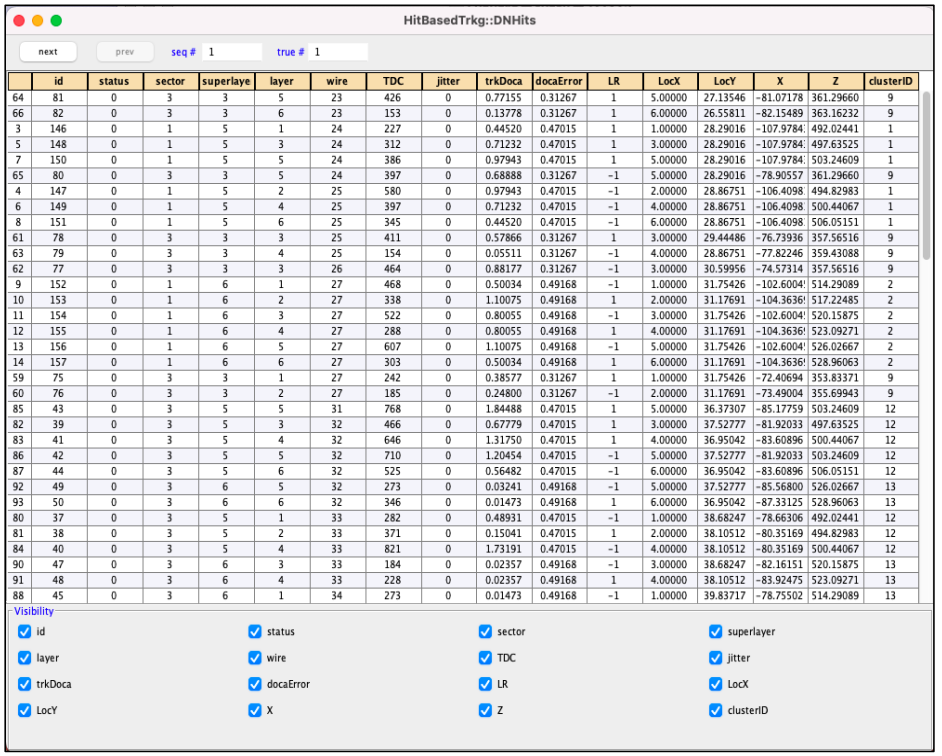
- Is in version and minor update 1.6.X (currently X = 2)

- Available here: https://userweb.jlab.org/~heddle/ced/builds/

What's new?

- Incompatible requests (e.g.) to make bank views free-floating or tied to the ced desktop were resolved by making them user options
- As per a user request, the bank views are now sortable
- Dealing with "go to true event number" (as opposed to sequential event number) is faster
- We continue to add to the relatively new "highlighting" feature.





	id	status	sector	superlaye	layer	wire	TDC	jitter	trkDoca	docaError	LR	LocX	LocY	X	Z	clusterID
64	81	0	3	3	5	23	426	0	0.77155	0.31267	1	5.00000	27.13546	-81.07178	361.29660	9
66	82	0	3	3	6	23	153	0	0.13778	0.31267	1	6.00000	26.55811	-82.15489	363.16232	9
3	146	0	1	5	1	24	227	0	0.44520	0.47015	1	1.00000	28.29016	-107.9784	492.02441	1
5	148	0	1	5	3	24	312	0	0.71232	0.47015	1	3.00000	28.29016	-107.9784	497.63525	1
7	150	0	1	5	5	24	386	0	0.97943	0.47015	1	5.00000	28.29016	-107.9784	503.24609	1
65	80	0	3	3	5	24	397	0	0.68888	0.31267	-1	5.00000	28.29016	-78.90557	361.29660	9
4	147	0	1	5	2	25	580	0	0.97943	0.47015	-1	2.00000	28.86751	-106.4098	494.82983	1
6	149	0	1	5	4	25	397	0	0.71232	0.47015	-1	4.00000	28.86751	-106.4098	500.44067	1
8	151	0	1	5	6	25	345	0	0.44520	0.47015	-1	6.00000	28.86751	-106.4098	506.05151	1
61	78	0	3	3	3	25	411	0	0.57866	0.31267	1	3.00000	29.44486	-76.73936	357.56516	9
63	79	0	3	3	4	25	154	0	0.05511	0.31267	-1	4.00000	28.86751	-77.82246	359.43088	9
62	77	0	3	3	3	26	464	0	0.88177	0.31267	-1	3.00000	30.59956	-74.57314	357.56516	9
9	152	0	1	6	1	27	468	0	0.50034	0.49168	-1	1.00000	31.75426	-102.6004	514.29089	2
10	153	0	1	6	2	27	338	0	1.10075	0.49168	1	2.00000	31.17691	-104.3636	517.22485	2
11	154	0	1	6	3	27	522	0	0.80055	0.49168	-1	3.00000	31.75426	-102.6004	520.15875	2
12	155	0	1	6	4	27	288	0	0.80055	0.49168	1	4.00000	31.17691	-104.3636	523.09271	2
13	156	0	1	6	5	27	607	0	1.10075	0.49168	-1	5.00000	31.75426	-102.6004	526.02667	2
14	157	0	1	6	6	27	303	0	0.50034	0.49168	1	6.00000	31.17691	-104.3636	528.96063	2
59	75	0	3	3	1	27	242	0	0.38577	0.31267	1	1.00000	31.75426	-72.40694	353.83371	9
60	76	0	3	3	2	27	185	0	0.24800	0.31267	-1	2.00000	31.17691	-73.49004	355.69943	9
85	43	0	3	5	5	31	768	0	1.84488	0.47015	1	5.00000	36.37307	-85.17759	503.24609	12
82	39	0	3	5	3	32	466	0	0.67779	0.47015	1	3.00000	37.52777	-81.92033	497.63525	12
83	41	0	3	5	4	32	646	0	1.31750	0.47015	1	4.00000	36.95042	-83.60896	500.44067	12
86	42	0	3	5	5	32	710	0	1.20454	0.47015	-1	5.00000	37.52777	-81.92033	503.24609	12
87	44	0	3	5	6	32	525	0	0.56482	0.47015	-1	6.00000	36.95042	-83.60896	506.05151	12
92	49	0	3	6	5	32	273	0	0.03241	0.49168	-1	5.00000	37.52777	-85.56800	526.02667	13
93	50	0	3	6	6	32	346	0	0.01473	0.49168	1	6.00000	36.95042	-87.33125	528.96063	13
80	37	0	3	5	1	33	282	0	0.48931	0.47015	-1	1.00000	38.68247	-78.66306	492.02441	12
81	38	0	3	5	2	33	371	0	0.15041	0.47015	1	2.00000	38.10512	-80.35169	494.82983	12
84	40	0	3	5	4	33	821	0	1.73191	0.47015	-1	4.00000	38.10512	-80.35169	500.44067	12
90	47	0	3	6	3	33	184	0	0.02357	0.49168	-1	3.00000	38.68247	-82.16151	520.15875	13
91	48	0	3	6	4	33	228	0	0.02357	0.49168	1	4.00000	38.10512	-83.92475	523.09271	13
88	45	0	3	6	1	34	273	0	0.01473	0.49168	-1	1.00000	39.83717	-78.75502	514.29089	13

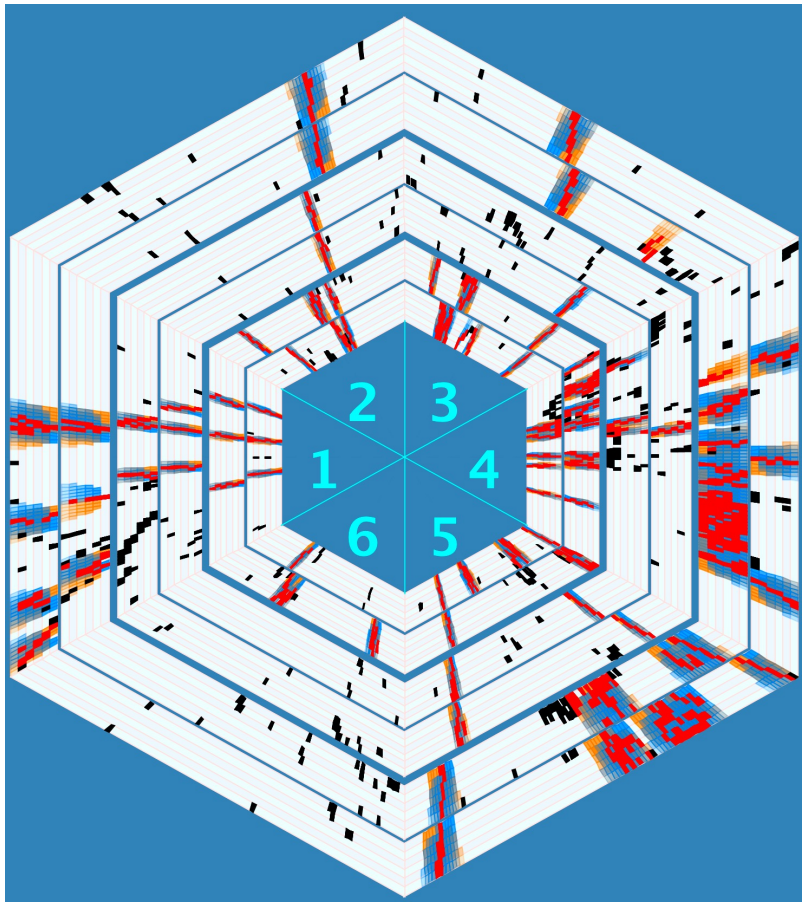
What's new (under the hood)

- A bit snappier event-to-event because of a new threading model. Swims were removed from the GUI thread.*
- Uses the new swim package, CLAS12Swim (next topic) for its trajectories*
- ced had a data model that predated HIPO. It was from the days when it was evio or nothing. It now has a completely new data model.

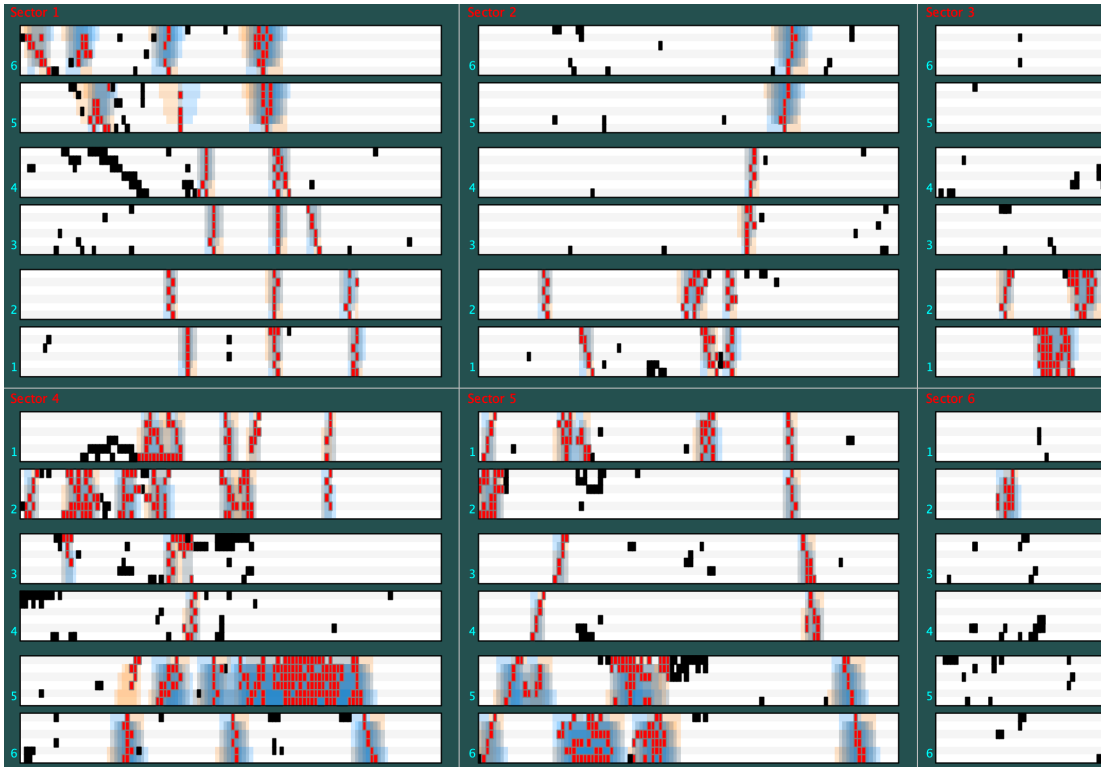
*Swimming in the GUI thread was more or less an unpardonable sin.

New “All DC” view (old one still there)

New



Old



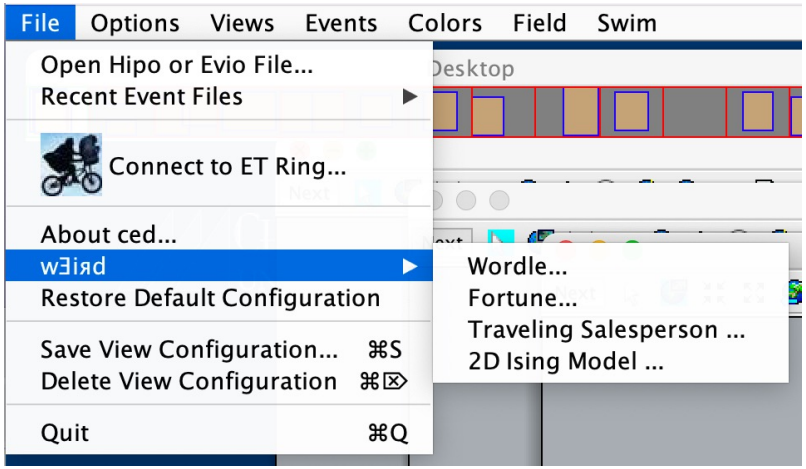
Call for requests

- We are always willing to entertain new requests for the display. New views of detectors, new detectors, new features, improved usability, etc.

- Send them (and bug reports) to heddle@jlab.org

If you are bored on shift comparing histograms

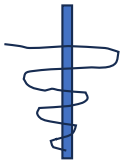
New choice on the **wƎiʁd** menu*



*Just last week the *New York Times* said it would "go after" unlicensed wordle implementations. Please don't rat me out.

Swimmer Updates

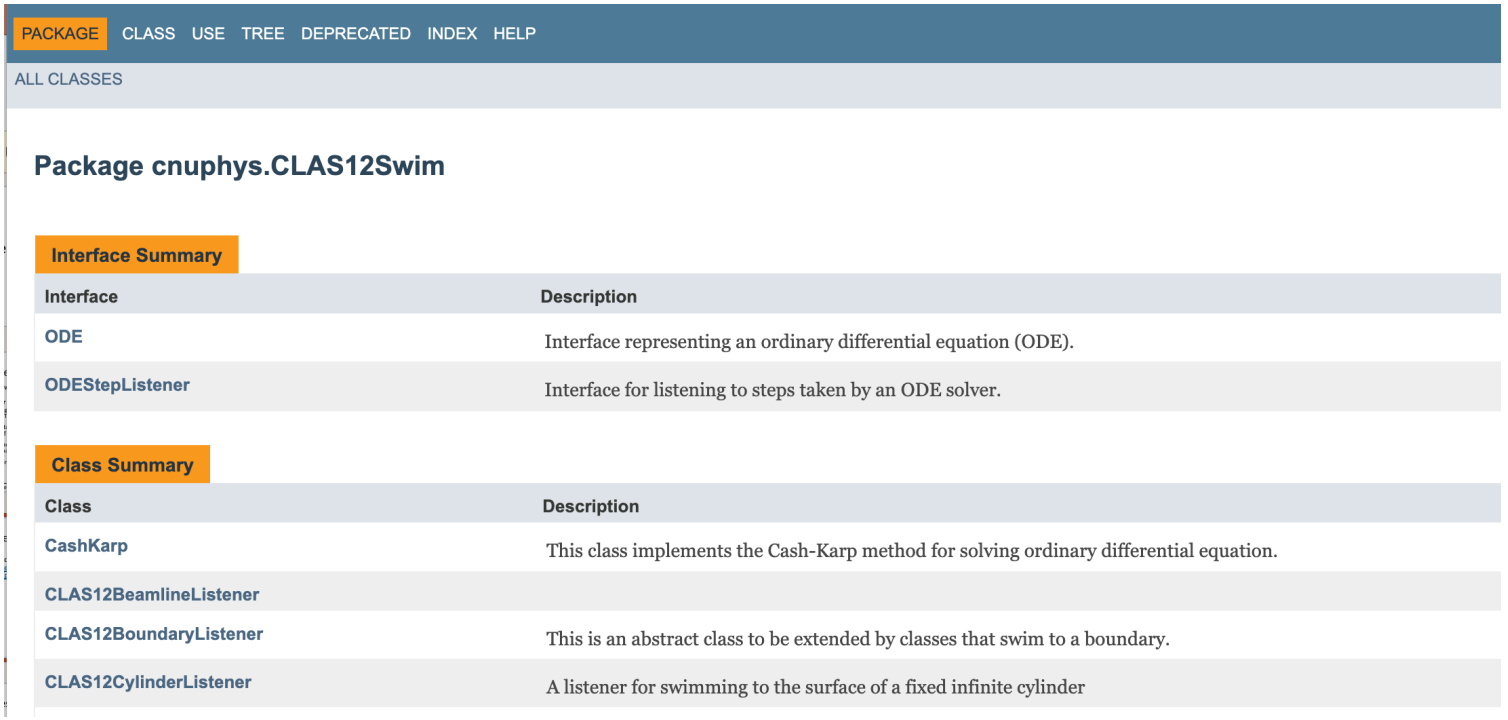
- Entirely new swimming package (prefix **CLAS12Swimmer**)
- Motivation for new package
  - Extant package has bad genes. It was originally developed merely so that ced could display trajectories. There was no pressing need to optimize speed, swim to a target, or have a uniform API.
  - The base distance unit for the extant swimmer was *meters*, while the reconstruction wanted *cm*. The result was a bazillion factors of 100 in the recon code base.
  - After it was adopted for reconstruction specialized targeted swims were added in a haphazard manner. Targeted swims had an inefficient “end game”.
  - The first attempt to remedy this, called the “new swimmer” was an epic FAIL.*



*We agonized over whether the latest package should be called “CLAS2Swimmer” or “NewNewSwimmer”

Documentation

There is comprehensive JAVAdoc API documentation at https://userweb.jlab.org/~heddle/docs/clas12SwimDoc/cnuphys/CLAS12Swim/package-summary.html



PACKAGE CLASS USE TREE DEPRECATED INDEX HELP

ALL CLASSES

Package cnuphys.CLAS12Swim

Interface Summary

Interface	Description
ODE	Interface representing an ordinary differential equation (ODE).
ODEStepListener	Interface for listening to steps taken by an ODE solver.

Class Summary

Class	Description
CashKarp	This class implements the Cash-Karp method for solving ordinary differential equation.
CLAS12BeamlineListener	
CLAS12BoundaryListener	This is an abstract class to be extended by classes that swim to a boundary.
CLAS12CylinderListener	A listener for swimming to the surface of a fixed infinite cylinder

Swimmer Thread Safety

Swimmer was always “trivially” thread safe. (Each thread had its own swimmer). CLAS12Swimmer is *truly* thread safe.

Test: 1000 random swims to fixed Z. #Threads = 12 = #cores

Threading	Rel. Time
Single Threaded (for loop)	3.0
Multithreaded, private swimmer and magnetic probe	1.06
Multithreaded, shared swimmer and magnetic probe	1.0

Time and accuracy* Testing

- CLAS12Swimmer is faster and (related) takes fewer adaptive steps
- It terminates closer to the target

Swim	T_{old}/T_{CLAS12}	Δ_{old}	Δ_{CLAS12}	NS_{old}	NS_{CLAS12}
Base	1.1	N/A	N/A	51	39
Rho	1.8	5.73×10^{-4}	3.5×10^{-4}	119	49
Plane	1.5	7.1×10^{-4}	3.9×10^{-4}	25	20
Z	1.9	5.8×10^{-4}	3.1×10^{-4}	129	52
Cylinder	1.6	2.0×10^{-3}	1.3×10^{-3}	23	17
Sphere	76	2.0×10^{-2}	1.5×10^{-2}	3514	34
SectorZ	2.9	2.7×10^{-3}	3.2×10^{-4}	157	58

Note: the old sphere swimmer was a fixed step size swim.

Preliminary testing **in reconstruction** shows about a 20% overall speed increase. (At least that's the last I heard)

*To be fair, **accuracy** used here means how close we get to the target, say the intersection with a plane. But a lousy swim could end up right at the target yet in the wrong place. In terms of the *actual* accuracy– that was tested elsewhere.

Conclusion

- Both ced and the swimmer continue as active and (I hope) useful projects
- The CLAS12Swimmer needs further vetting
- Again, please make suggestions on how ced can be more useful
- Next we will take a fresh look at the magnetic field package, hunting for speedups