

# Off-line Analysis goes On-line!

Controls ain't just Buttons,  
Flashing Lights and Sliders

**Customer's !!!**

A ~~User's~~ Perspective

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Group-MIN (Machine-Injection: NOT the controls group!)

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# Customer

Who IS this ~~"User"~~ (me) ?

- USER: Physicist, member of the "part-time" shift crew at DESY (no "Professional" Operations Crew). The machine is a running experiment....
- MODIFIER: Does "part-time" programming for DESY accelerator controls.

# A Day on the Job

- Lots of button-pushing, watching flashing lights and tweaking scroll bars
- More Interesting and More Fun and More of a CHALLENGE for the Control-System:

## **Use of Diagnostics-Data in Operations**

“Data” includes Vacuum, Beam Position, Losses,....

## **Analysis + Interpretation ⇒ Decision-Making**

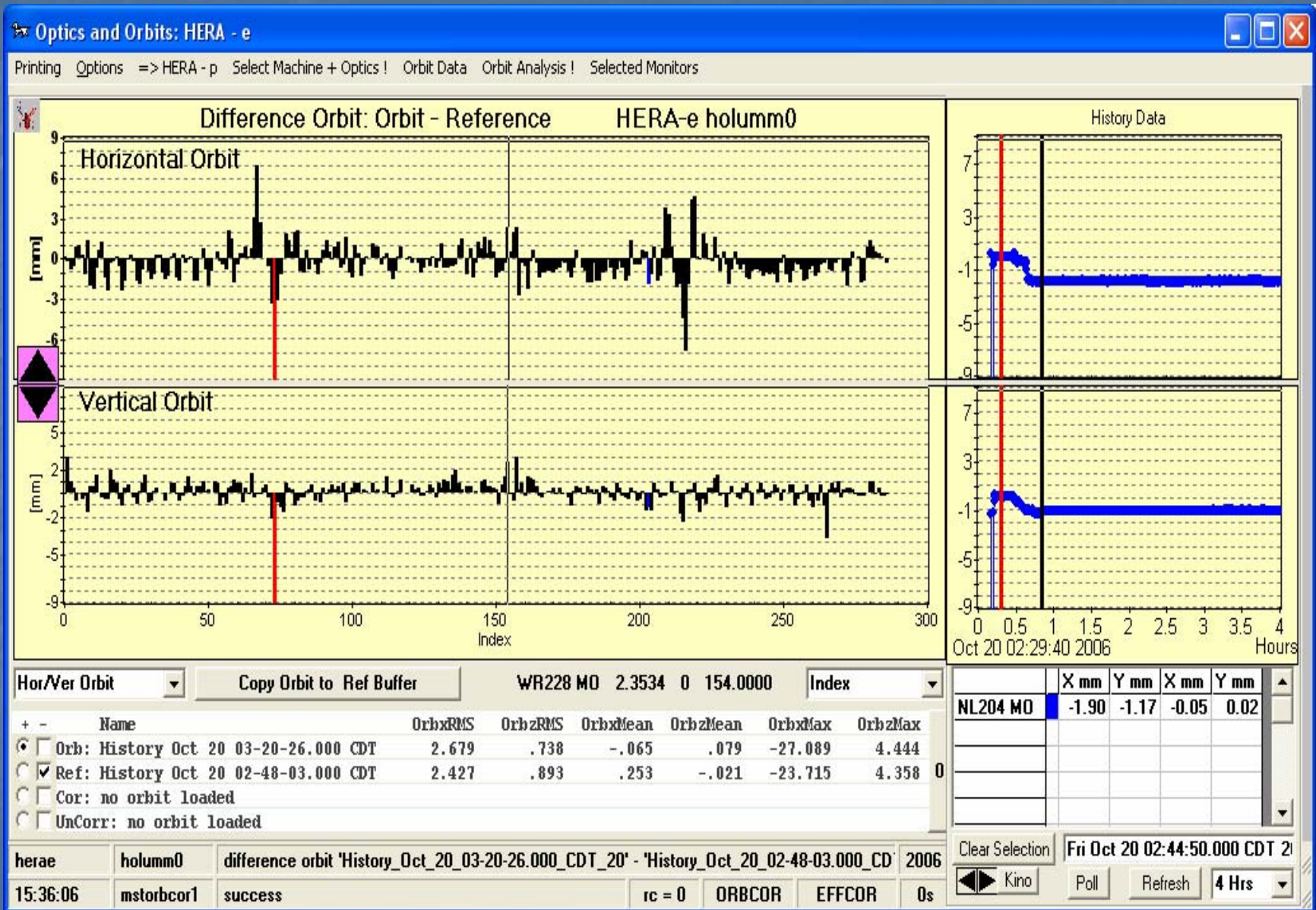
Cannot always be done in software (front-end or a “middle-layer”) with a simple answer sent up to the consoles



# A Few Examples

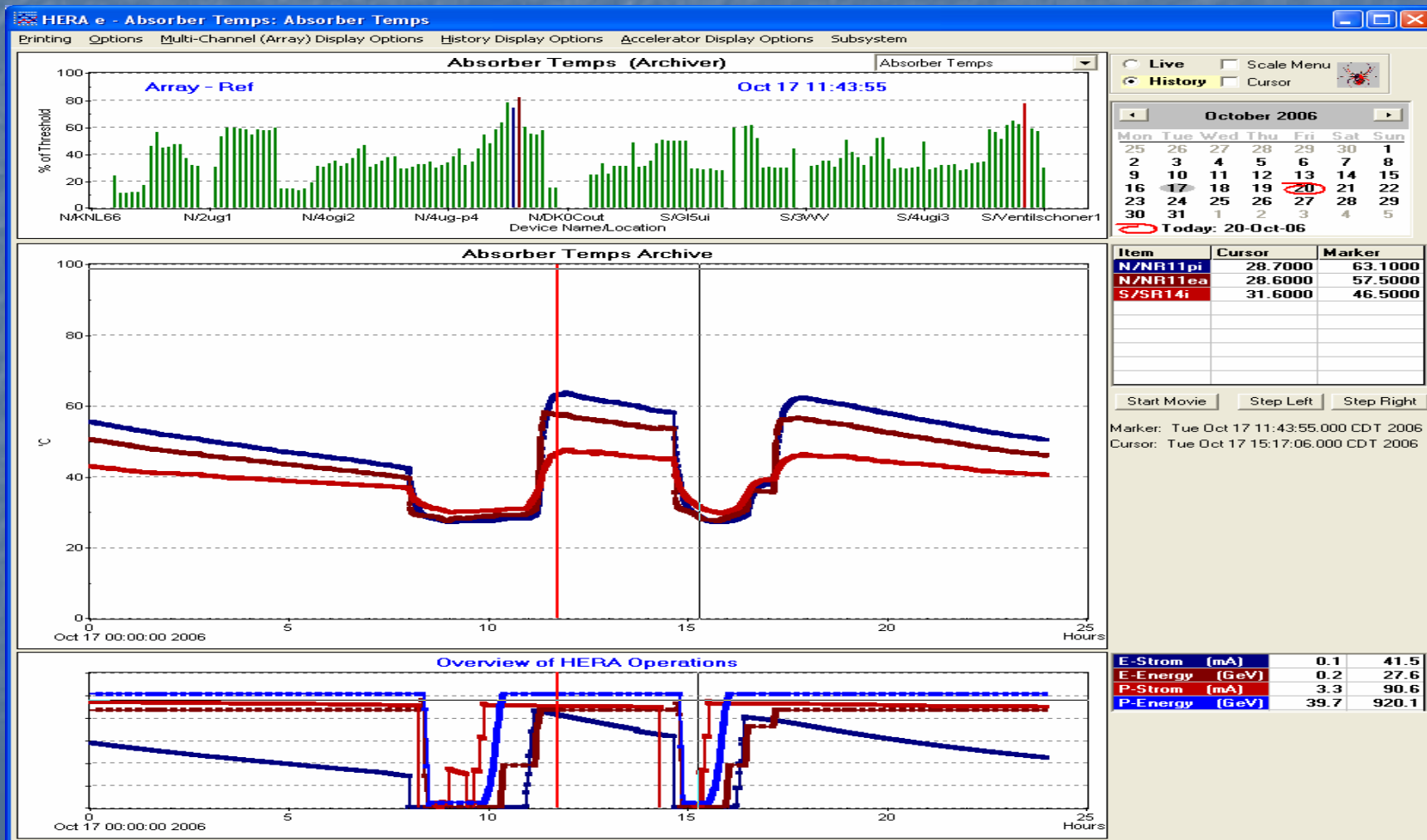
- Beam Position Monitors
- Temperature Alarms
- Proton Losses

# One Stop Shopping! Orbits, Differences, Correction, ...



Synchrotron light warms up the vacuum chamber during HERA electron ramp. Monitor 200 Temperatures and possibly make orbit corrections to reduce Temps. Need to display Temps, Diff. to REF, scaled to DUMP-THRESHOLD, Histories,....

Here, the MCA-Archive Reader (used normally in live-data mode); these scaling solutions also used for the General Archive Reader.





# Proton Loss Alarms

- Not Untypical problem at HERA 920 GeV proton ring: Intense beam losses have triggered a beam-dump to protect the cold magnets. No technical system tripped.... What was the cause of the beam losses?
- Need to analyze the time structure and distribution around the ring... finding the cause may save another beam loss...
- 300 Monitors! Tedious to do by hand...

Suggestion from Phil: if YOU know what you'd like to see, then try programming it yourself! Here is one of my first efforts:

**Archive Alarm Analysis**

Print 3-D Chart Error List Help!?

### Which BLMs Triggered The Alarm?

Search/Test Criteria

Start Search

**BLMs Found**  
31

Search/Test Criteria

**Start+Stop Bins:** Before Dump  After Dump

**Threshold:** Ratio of Test to ALRM Threshold

Archive: 16-Oct-2006 16:50:30 164 GeV

BLM	ALRM	-4	-3	-2	-1	Dump?	1
WR628	2048	0	4	8	30	4654	18
WR439	2048	0	3	7	10	2171	7
WL23	4096	1683	1664	2838	5630	6340	1649
WL43	4096	0	0	110	3551	8641	2439
WL58	4096	6	22	71	179	6347	9511
WL123	4096	65	153	354	1162	4525	826
WL166	256	1	0	1	417	158	0
WL195	256	0	0	1	354	1	0
WL250	256	1	1	3	32	579	0
SR065	4096	14	39	102	247	6741	1698
SR061	4096	82	379	888	2240	7591	3389
SR048	4096	176	347	840	6874	1766	242
SR036	4096	383	855	1953	6725	3014	354
SL015-1	4096	3	15	34	130	4975	511
SL015-2	4096	14	57	189	519	6833	370
SL021	4096	8	25	82	244	4733	874
SL036	4096	27	89	194	797	6450	486
SL048	4096	4	18	43	658	4548	132
NR048	4096	10	29	102	4512	231	29
NL015	4096	2213	4301	7080	10429	4376	1074
NL021	4096	40	93	220	657	7854	1589
NL036	4096	40	96	267	1220	6284	518
NL048	4096	14	21	72	943	5519	936
NL062	4096	1870	3987	6956	9739	7345	4244
NL116	2048	8	30	104	326	6516	163
NL146	2048	4	19	49	148	8070	57
NL173	2048	0	3	16	51	6079	18
NL251	2048	0	1	3	9	2803	1111
NL394	2048	2	8	18	4256	392	1
NL486	2048	0	4	16	140	4264	8
NL674	2048	1	2	6	38	3636	7

Select TIME-WINDOW and THRESHOLD, and monitors are searched through, collected.

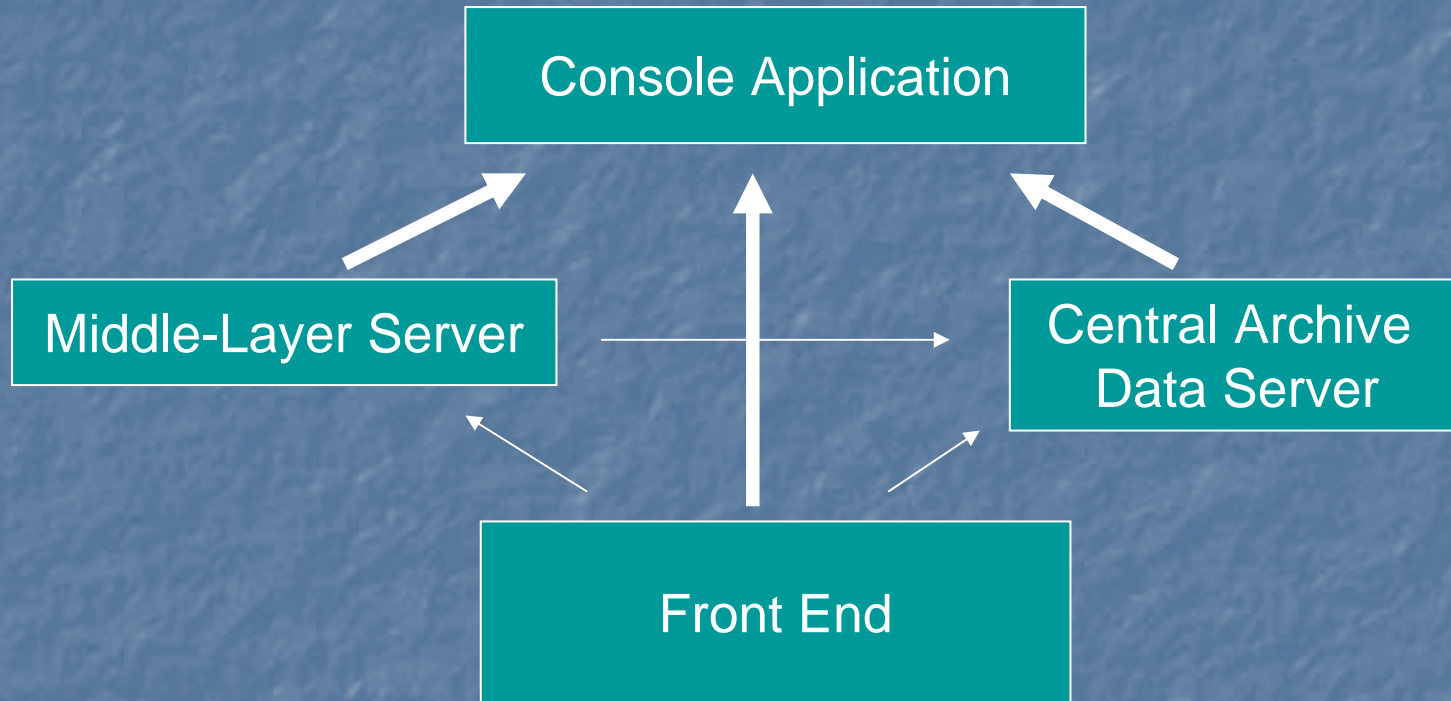
The program starts with the “Standard Settings” for these parameters, but they can be changed to answer special questions in non-standard cases.

We use similar sorting/display choices for interlock data / status-info: what subset of the data does the ~~user~~ want to see?

**Customer**



# Data Flow for a “Typical” Application



Possible sources of the “same” data:

Live Data: Front-End, Middle-Layer (analysis can be done in both)

History Data: **Local-Archives:** Front-End, Middle Layer; **Central Archive**

## What I (a part-timer) Need from the Controls Group:

- The Data: the “Raw Materials” for analysis  
Live and Archived Data (Local, Central)
- An easy language to write the console application
  - Use-able by a “part-time” programmer
  - Collect the data over the net
  - Analyze
  - Produce a graphical display, which is user-friendly (not just for experts (or myself))

These are General requirements for control applications...

# My Tool-Kit (provided by the controls group)

- TINE
- Visual-Basic
- Local-Histories, Central Archiving

Ingredients used to produce "flexible" / "complicated" Apps for General Archive Data, Vacuum, BPMs, Loss Monitors, Screen Monitors, Power Supply Data.....

The time spent on ACOP by the controls group was well spent!!! Simplifies tremendously both acquiring complex data and displaying/integrating it easily.

I'm (reasonably) Happy with the Experience, and can't imagine the controls system without such flexible tools.



# New Developments/Perspectives in Controls?

Things which I seem to have understood, about what controls-people are thinking about....

## 1. Quick and Easy Client Applications

Drag 'n' Drop / Cut 'n' Paste Clients:

“browsing” the control system, selecting “elements” and “pasting” them together (in a displayer) to get a client application

– no fuss, no muss

- Sounds good for **testing**, but also sounds **academic**....
- VERY FEW clients we use are simply “cut-and-paste”!  
One App per sub-system, one **DISPLAY** per sub-system:  
well thought out, with MUCH more functionality
- You need a “sophisticated” program to take complicated data and make an easy/user-friendly client application!!!!  
Reminder: BPM Console App: Orbits, Differences, Corrections : One-Stop-Shopping
- Not of much use for operations at DESY!!

## 2. Expert Programs

- Extra-Complicated, not needed “often”, “only” by “experts”
- Software Group: “not part of the control system”
  - I’ve also heard this for “data analysis” programs
- More time-consuming to write and to support:
  - Dialogue between software and hardware people
  - Requirements change more often / are harder to define

Applications required for operations

Applications USEFUL for operations,  
problem solving,

Applications ONLY NEEDED by experts  
to set-up / debug subsystem

Three NON-DISTINCT  
classes of applications

# Expert-Software...

- Often VERY DIFFICULT to cleanly separate between what is useful for the “Operations Crew” to solve problems and what is ONLY NECESSARY for experts
- Time can / is / has-been wasted when “operations” software doesn’t include enough functionality to get-to-the-bottom of a problem
- Efficiency will be higher when MORE functionality rather than LESS is implemented in console apps, and it conceived of as an integral part of the control system



# Summary: The Importance of the Presentation Layer

1. You can have super-duper hardware, gorgeous servers, but if the PRESENTATION LAYER is suffering, then efficiency is immediately affected
2. It's not **Down Time** of the MACHINE but **Dead Time** of the Operators!
3. The Importance of Clean/User-Friendly/... software for time/operations-efficiency cannot be stressed enough
4. A Complex Accelerator produces Complex Data and "user-friendly" apps require sophisticated software
  1. I don't need "Drag-'n'-Drop" Console Apps (*one-stop-shopping!*)
  2. When a problem occurs, I hope that the software I use is well structured/thought-out/part of the software used by the experts **and written by a caring PROFESSIONAL**