

User Requirements for the PETRA3 Control System at DESY

M. Bieler, A. Brinkmann, U. Zobjack, DESY
PCaPAC 2006, Jefferson Lab, Oct. 26, 2006

- Introduction
- Good and bad Examples
- Conclusion



Introduction

The user requirements shown in this talk were gathered from the operations group at DESY.

Good and bad examples shown here are from the DESY control room.

Not all (bad) examples shown here are still in use at DESY.

Most of the rules proposed here can probably be found in any software style guide (but who reads them?).

Colors

About 9% of the male population can not distinguish between red and green.

To them a rainbow looks like this:

Therefore, color-coded information should always be accompanied by text.



● Feedback off

How many Buttons per Square Inch?

“All in One” style:

Too much information and too many functions in one application.

Hard to find what you are looking for.

The screenshot displays the HERA control software interface, titled "HERA - 208 MHz - 52 MHz - PROTONEN - Sender". The interface is divided into several sections:

- 52 MHz Sender:** This section includes a table for system selection, a status table, and control buttons. The status table shows parameters for System A and System B.
- 208 MHz Sender:** This section includes a date and time display, a table for system selection (Systems A, B, C, D), a status table, and control buttons. The status table shows parameters for each system.
- Left Panel:** Contains various control buttons such as "Inj. Beding. 10", "Inj. Beding. 60", "Ramp Automatic", "Autom Spg EIN", "Autom Spg AUS", "Autom Phase EIN", "Autom Phase AUS", "Automatik Spg Phase", and "Ramp-Tabelle".
- Right Panel:** Contains buttons for "Energie : 920 GeV", "I_beam : 99,88 mA", "Cavity Phasen", "Lock Tuner", "PHF Info's", and "TRC".

Anwahl A+B	Svstem A	Svstem B
Status	RF Ein	RF Ein
Steuerung	Remote	Remote
Ucav soll / kV	90,	90,
Ucav gemess./kV	88,9	75,1
Pha soll / Grd	17,	13,
Pha gemess./Grd	-1,2	-3,4

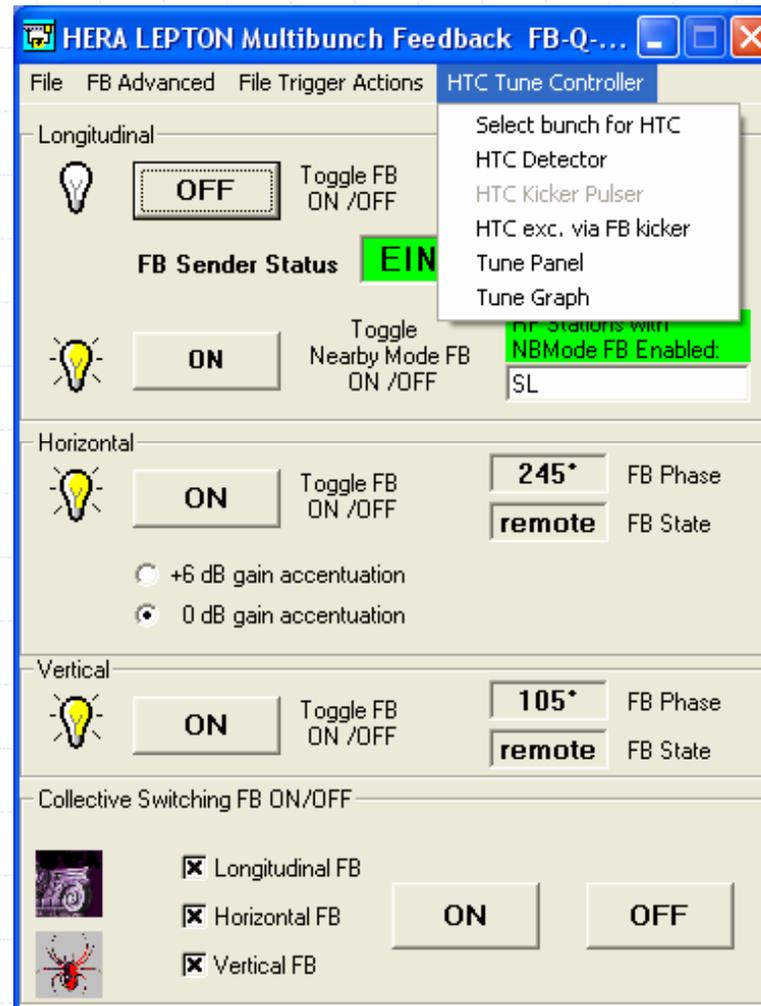
Anwahl A...D	Svstem A	Svstem B	Svstem C	Svstem D
Status	RF Ein	RF Ein	RF Ein	RF Ein
Tuner	34.3 locked	26.7 locked	36.4 locked	36.3 locked
Ucav soll / kV	229,1	229,1	229,1	40,
Ucav gemess./kV	226,1	223,2	228,6	40,5
Pha soll / Grd	0,3	0,4	1,	180
Pha gemess./Grd	-2,4	-2,9	-0,6	-189,4

How many Buttons per Square Inch?

Pull down menus:

Hard to find what you are looking for.

Searching by trial and error takes time.



How many Buttons per Square Inch?

A good tradeoff:

Information separated in groups, all details visible in every group.

Transfer - e/p-Synchronization

Electrons: 27.6476 GeV, 21.1242 mA
Protons: 920.0861 GeV, 99.6759 mA
09.10.2006 13:42:30
Mode: Normal, Expert

TRANSFER ELEKTRONEN | TRANSFER PROTONEN | e/p - SYNC. | FREQUENZ OFFSET

Phase Loop 2: EIN
Petra/Hera Sync.: AUS

FKorr: 360
Differenz (bez. auf 500 MHz): -0.1 Hz

Frequenz e: 499667932.1
Frequenz p: 208194971.7

Frequenz Offset e: 198 Hz

SET OFFSET | STOP | INJEKTION

Expert's Menu

Buttons for experts are

- dangerous and confusing during normal operation
- necessary for troubleshooting.

Expert's menu should be hidden during normal operation, but easy to access in case of trouble.

The screenshot shows the 'Transfer - e/p-Synchronization' control panel in Normal mode. The top status bar displays 'Electrons' (27,6476 GeV, 18,4353 mA) and 'Protons' (920,0861 GeV, 98,2120 mA) on the left, and the date '09.10.2006' and time '15:28:32' on the right. The 'Mode' is set to 'Normal'. The main control area has tabs for 'TRANSFER ELEKTRONEN', 'TRANSFER PROTONEN', 'e/p-SYNC.', and 'FREQUENZ OFFSET'. The 'TRANSFER PROTONEN' tab is active, showing parameters for Hera (208194971.7 Hz, 52048742.9 Hz) and Petra (51644750.0 Hz). The 'FKorrP' is 333.2 Hz. The 'Injektions Phase' is 119 Grd. The 'Synchron.' status is 'AUS'. Below this is a 'Phase Loop' section with two rows: '1' (EIN | AUS | AUS) and '2' (EIN | AUS | EIN). At the bottom, there is a 'Transfer' section with 'Chrom.AUS' (EIN | AUS) and 'Transfer' (1 | 2 | 3) buttons. A 'START' button is present. A red banner at the bottom reads 'Experimente Veto' and 'nicht Inj. Energy'.

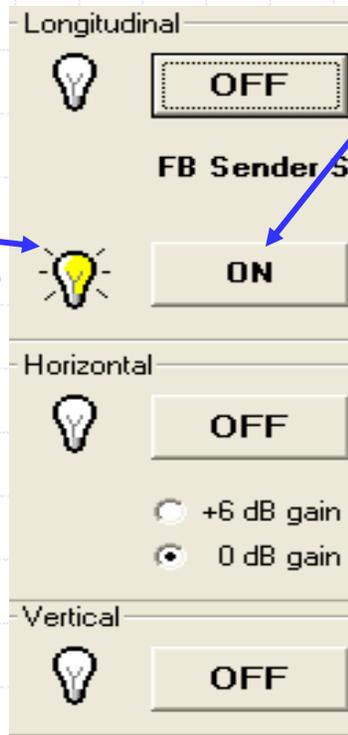
The screenshot shows the 'Transfer - e/p-Synchronization' control panel in Expert mode. The top status bar displays 'Electrons' (27,6476 GeV, 18,4315 mA) and 'Protons' (920,0861 GeV, 98,2167 mA) on the left, and the date '09.10.2006' and time '15:28:43' on the right. The 'Mode' is set to 'Expert'. The main control area has tabs for 'TRANSFER ELEKTRONEN', 'TRANSFER PROTONEN', 'e/p-SYNC.', and 'FREQUENZ OFFSET'. The 'TRANSFER PROTONEN' tab is active, showing parameters for Hera (208194971.7 Hz, 52048742.9 Hz) and Petra (51644750.0 Hz). The 'FKorrP' is 333.2 Hz. The 'Injektions Phase' is 119 Grd. The 'Synchron.' status is 'AUS'. Below this is a 'Phase Loop' section with two rows: '1' (EIN | AUS | AUS) and '2' (EIN | AUS | EIN). At the bottom, there is a 'Transfer' section with 'Chrom.AUS' (EIN | AUS) and 'Transfer' (1 | 2 | 3) buttons. A 'START' button is present. A red banner at the bottom reads 'Experimente Veto' and 'nicht Inj. Energy'.

Labeling of Buttons

The label on a button should always show its function, not the status of the device attached to it.

Additional information about the status of the device is welcome, but should be separated from the button.

Good:
Additional status
information



Bad:

The button shows the status,
not it's function



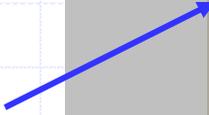
Good:

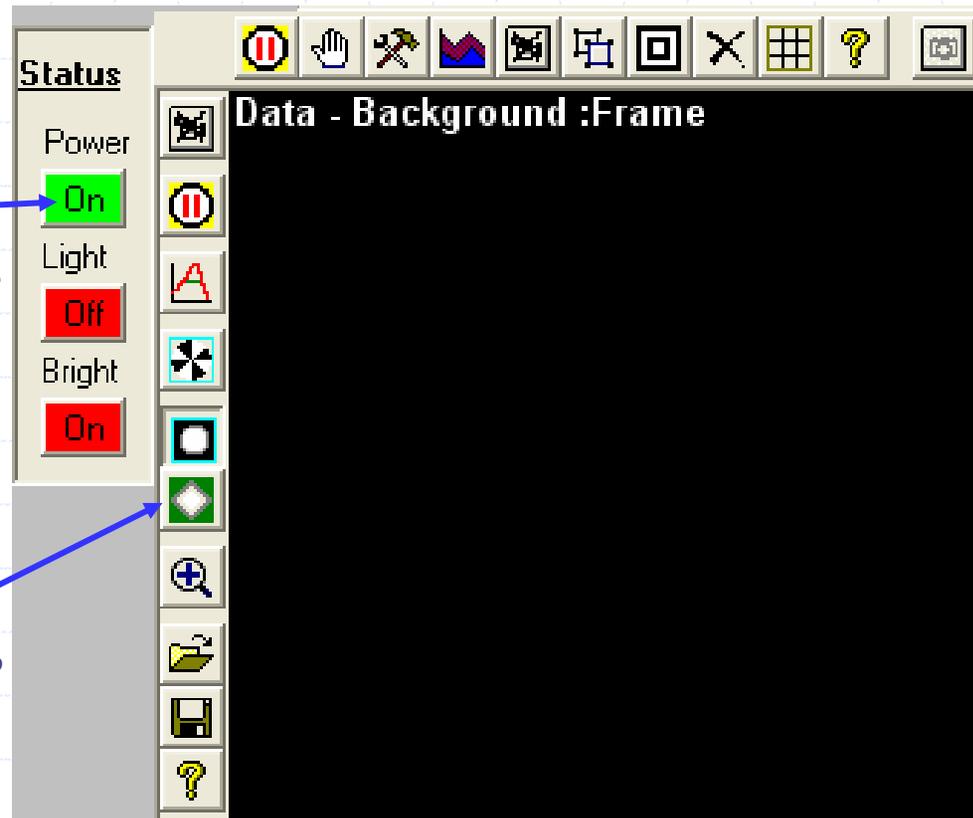
Two buttons for two actions,
additional status information

Symbols

Symbols on buttons or sliders should only be used, if their meaning is well defined.

Bad:  The button shows the status, not its function

Who wants to guess, what this button does? 



(Copied from an expert's menu)

'OLD' Button

If parameters are frequently used for (mostly fruitless) optimization, an 'OLD' button is very useful. It sets this parameter back to the value it had when the application was started.

Example:
Amplitude of
injection
elements:

The screenshot shows the 'e-Injektion/Ej' control interface. At the top, there are status indicators for 'Halle West' and various injection elements (Ki1, Septum A, Septum B, Ki2, Ki3, Ki4, Ki1 Opt, Ki2 Opt). Below this is a table titled 'Kicker/Septum Sollwerte' (Injection/Septum Setpoints) with columns for 'Devname', 'Status', 'Ist-Wert [A]', 'Ziel', 'Min', 'Max', 'Ist-Wert->Old', and 'HV'. Each row represents a different injection element and includes a slider for setting the value and an 'Old' button to reset it to the initial value.

Devname	Status	Ist-Wert [A]	Ziel	Min	Max	Ist-Wert->Old	HV
Kicker 1-4 gemeinsam						Old	
KI 1 EL	EIN	3,011 KV		0	4,5	Old	<input checked="" type="radio"/> Ein <input type="radio"/> Aus
KI 2 EL	EIN	0,000 KV		0	4,5	Old	<input checked="" type="radio"/> Ein <input type="radio"/> Aus
KI 3 EL	EIN	0,410 KV		0	4,5	Old	<input checked="" type="radio"/> Ein <input type="radio"/> Aus
KI 4 EL	EIN	3,011 KV		0	4,5	Old	<input checked="" type="radio"/> Ein <input type="radio"/> Aus
KI 1 OPT	EIN	23,346 KV		0	25	Old	<input checked="" type="radio"/> Ein <input type="radio"/> Aus
KI 2 OPT	AUS	0,000 KV		0	25	Old	<input type="radio"/> Ein <input checked="" type="radio"/> AUS
SEPT A EL	EIN	8,299 KA		0	12	Old	
SEPT B EL	EIN	4,960 KA		0	6	Old	

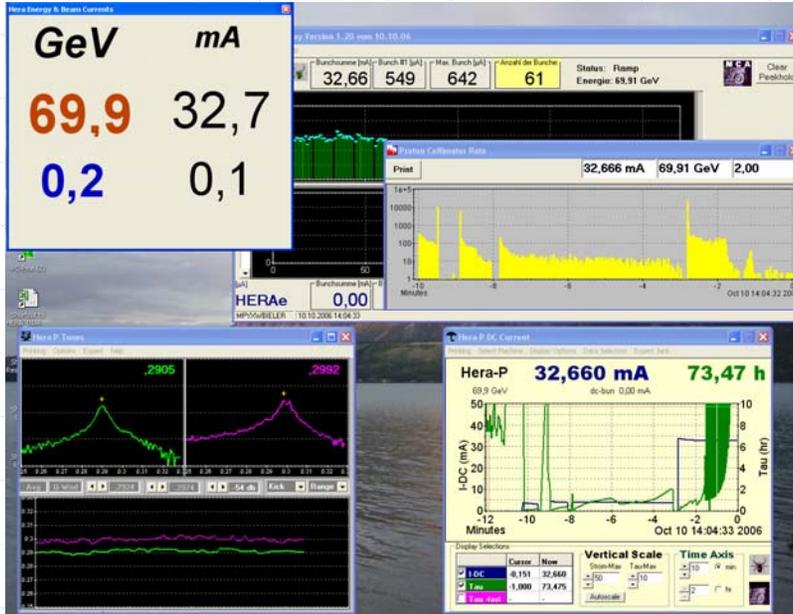
Kicker/Septum Sollwerte 09.10.2006 16:38:12

Size

With many applications running on one screen, the size of each application becomes a problem.

Each application should be scalable according to the users needs.

Scaleable fonts would be ideal.



Size

Some applications can be of small size in normal operation, but should offer more information in case of a fault or for special purposes.

Less

The screenshot shows the 'SEXTUPOLE CORRECTION' software interface. It features several panels:

- Correction Panel:** Displays start, current, and final values for ABB and Zanon. The 'Type of correction' is currently 'OFF'.
- Motor control Panel:** Shows 'MOTOR OFF' and buttons for 'Motor ON' and 'Motor OFF'.
- Raw values Panel:** Shows Dec and Hex values for ABB, Zanon, and Status.
- Status Panel:** Shows 'motor and correction status: 344' and a list of status indicators.

ABB	Zanon
start: 9960	start: 9530
current: ERROR	current: ERROR
final: 8280	final: 7790

ABB	Zanon	Status
Dec: -32768	Dec: -32768	Dec: -21659
Hex: FFFF8000	Hex: FFFF8000	Hex: FFFFAB65

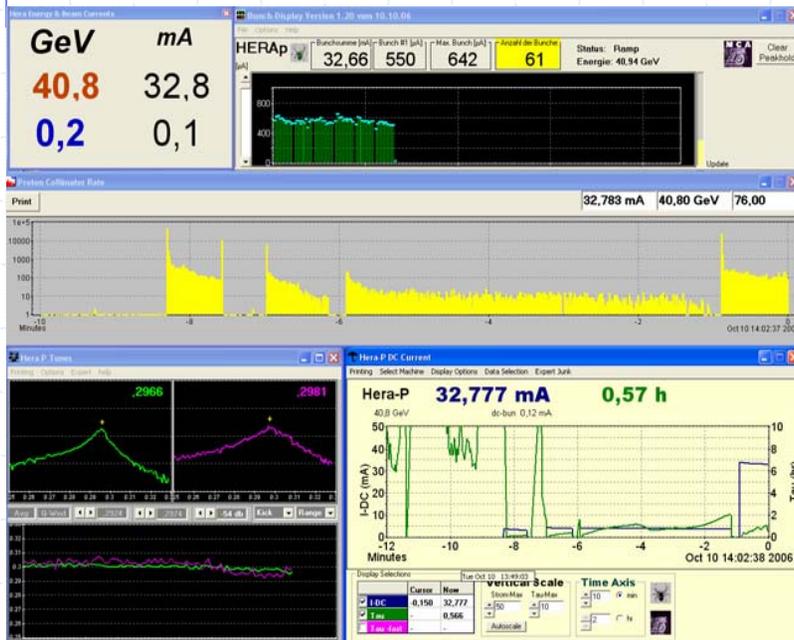
ABB	Zanon
start: 9960	start: 9530
current: ERROR	current: ERROR
final: 8280	final: 7790

ABB	Zanon	Status
Dec: -32768	Dec: -32768	Dec: -21659
Hex: FFFF8000	Hex: FFFF8000	Hex: FFFFAB65

'Look and Feel'

Often used applications should have individual 'Looks', so that the operator can distinguish between them without reading the fine print.

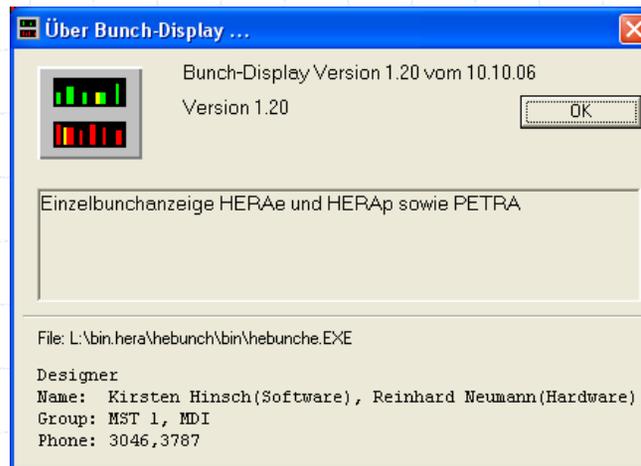
Rarely used applications (e.g. archives) should have the same 'Look and Feel' for easy use.



'About...'

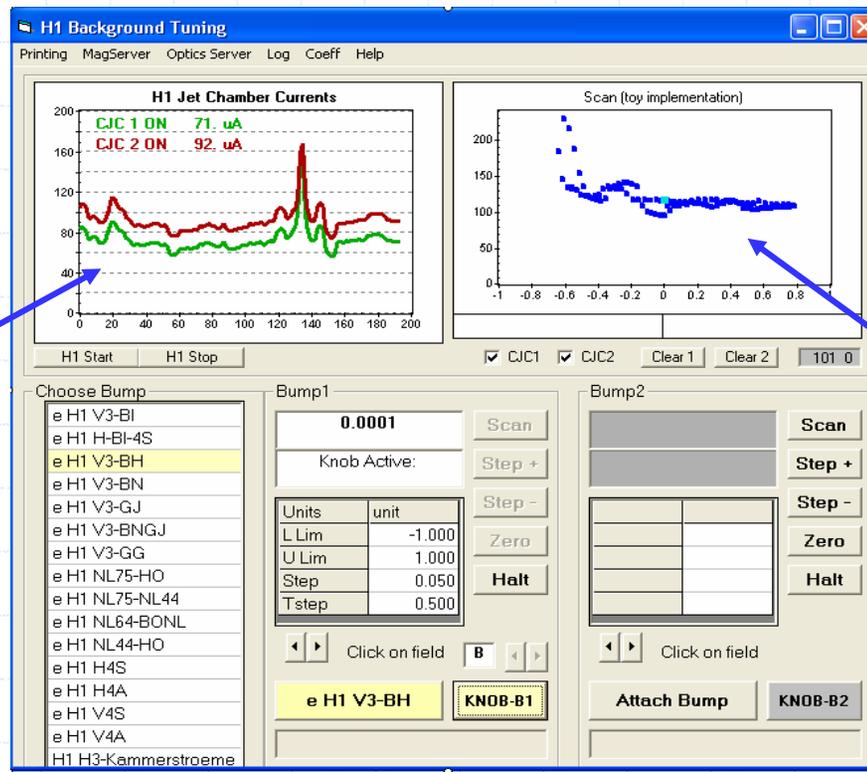
Every application should offer information about

- the software version number
- the date of the last change
- locations of the involved computers
- name and phone number of the author
- name and phone number of the people responsible for the hardware driven by this application (e.g. vacuum valves)



Optimization Plot

When a parameter like experimental background is optimized, it is useful to see a plot showing the figure of merit (experimental background) versus the tuning parameter (orbit bump amplitude).

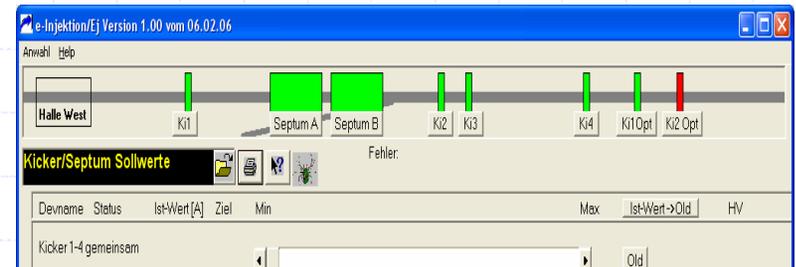
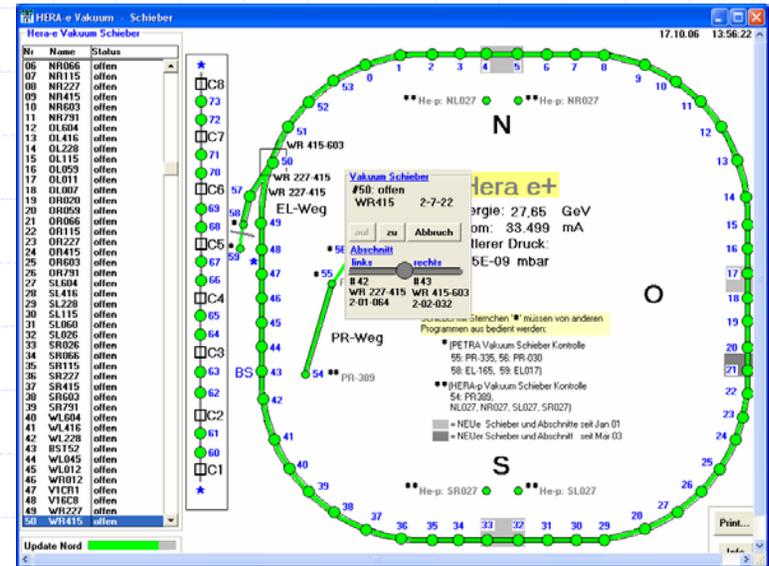
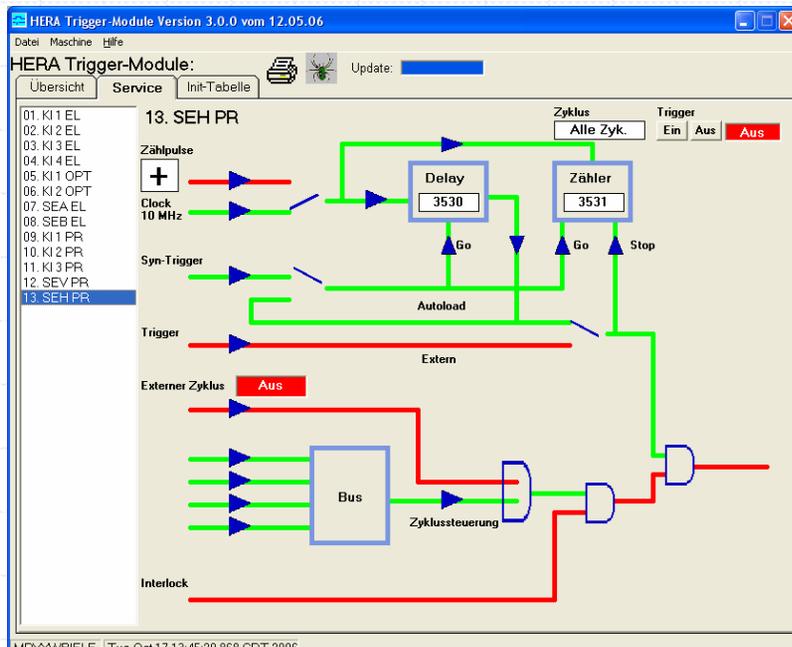


Background
vs. time

Background
vs. bump
amplitude

Simplified Drawings

For some applications a simplified drawing of the components involved can be helpful for the occasional user.



Knobs vs. Sliders

Wherever fine tuning is required (luminosity, background,...), big round knobs are better than sliders. Turning a knob fast for three turns and then slowly for another 1/10 of a turn is easier than doing the same job with a slider.

Different applications can be attached to the same knob, a short text at the knob shows the actual function of the knob.

A counter at the knob keeps track of the changes applied.



The screenshot shows the 'e Inj' software interface. It features a menu bar with 'Printing', 'Optics', 'Servers', 'Log', 'Orbits', and 'Coeffs'. Below the menu is a control panel with buttons for 'Attach', 'Bump Optics', 'Update', and 'Hera Optics'. The main area contains two tables of magnet data and four 'Release Fails' indicators.

Magnet	Soll	Delta I
WR239 CH	.042	.000
WR262 CH	.009	.000
WR309 CH	.054	.000
WR333 CH	-.045	.000

Magnet	Soll	Delta I
WR250 CV	.000	.000
WR274 CV	.000	.000
WR297 CV	.000	.000
WR321 CV	.000	.000

Release Fails: 0,000 mm (H Pos), 0,000 mrad (H Slope), 0,000 mm (V Pos), 0,000 mrad (V Slope)



Archives

All parameters should be archived at an individual rate. The archive reader should plot them on the same time scale.

See next talk by Mark Lomperski.

Miscellaneous Problems

- If an operation takes time (e.g. heating up a thyatron), show the timer on the screen!
- Error messages should be as specific as possible ('Error 41' does not really help to cure the problem).
- Avoid cryptic abbreviations!
- Use always the same word for the same function (End, Stop, Exit, Close, Back,...).
- Every application should be available on every console.
- No application should require a different console type.

Conclusions

- The operators don't care if it is Visual Basic, Java or something, they want good application software.
- Always ask the operators what they need and how they need it.
- The best control room applications are those made by operators.
- Let the controls group do part time shift work!