

# Use of the TINE Archiving Tools at PITZ

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Travelling Salesman, or Missionary?

# Control-System Archiving Basics

Data Storage: Who, what and where?

Data Browsing: where to click to find 'em?

Data Display (Basics):

Data Display (Advanced):

I'll try to illustrate these ideas with use-cases... to help you compare these tools with the one you are using, to help you see solutions to your "archiving problems"

# Data Storage: Who?

**A Fundamental Right of the Uses of the Control System:**

The **Controls Group** stores EVERYTHING you need!

You are allowed to write your own clients to collect data, but... do  
want to?

# Data Storage: What?

Store everything as often as you might need it, within reason....  
Lieber zu viel als zu wenig...

If it was worth the time and money to build it, it is worth the disk space to store it's status.

I'm not an expert here: DOOCS Local-Histories have limitations in format types and the Idea of the "FLASH DAQ" is to store really truly everything in "one place"

The TINE Archiving is oriented on filtering, and a selection of tools are available to store data with different "strategies" so the choice/requirements for "how much data" influences the choice of tool to use.

Not just "floating points numbers": text, bits, images, ....

# Data Storage: Where?

## **Central** and/or **Local**?

Central: “Middle Layer” collects and stores data “centrally”

Permanent, backed-up, fast, .....

Local: Front-End server stores the data “itself”

In memory or on disk, flexible, quantity limited by disk space

Data from both sources can be displayed in the same application!

Vacuum, Pandora, PETRA Diagnostics...

**Events:** Collect data which belong “together”

Trip of an RF Station,

Documentation of accelerator Status

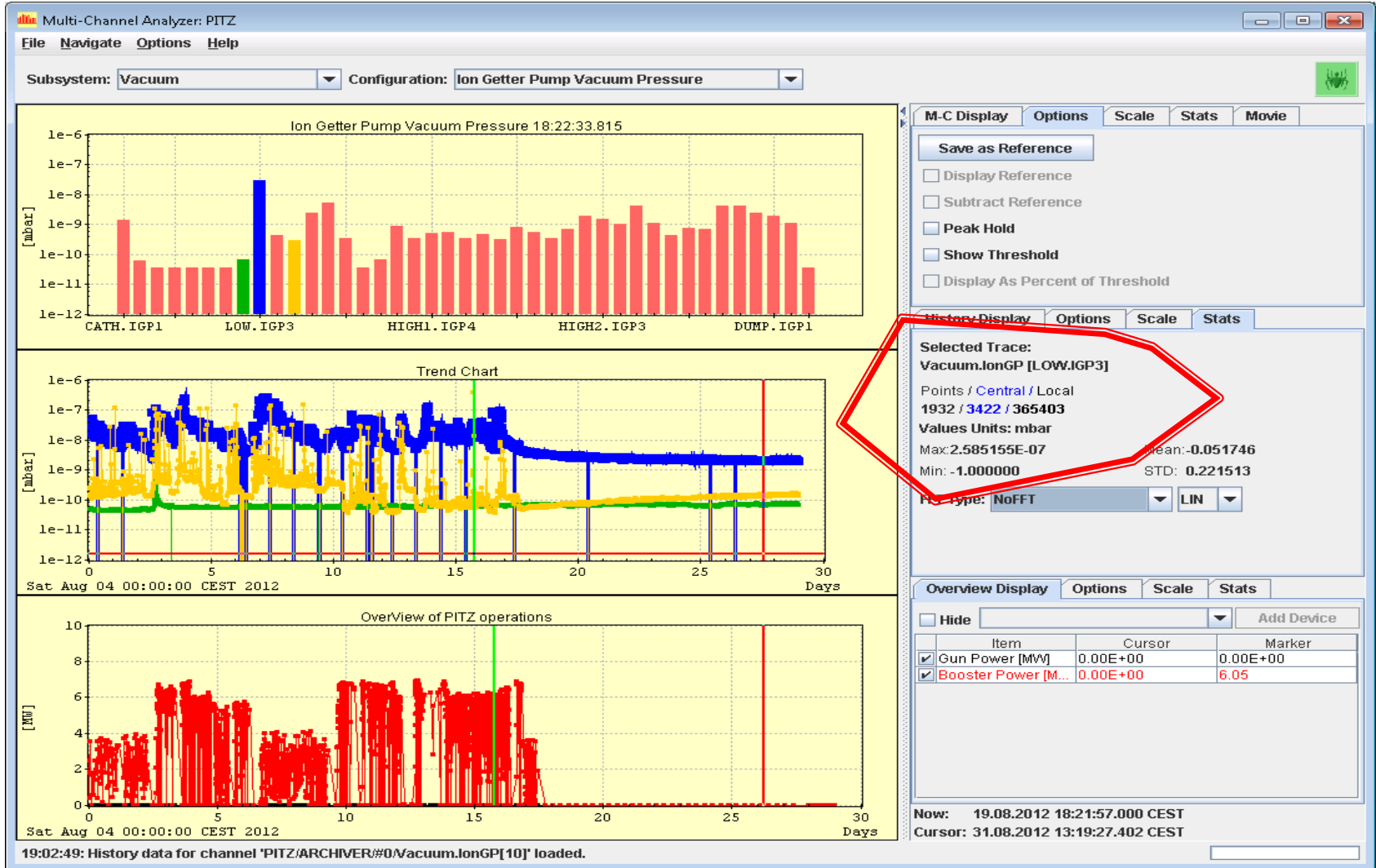
**Alarm System:**

Optimization: Store the same data with different tools?!

# Central and Local Data Storage: Vacuum Data

Vacuum Data: 3422 points in central storage, 365k points in local storage.

Plot shows only 1932 points from central. Note: Both data sources are “available” in this App!

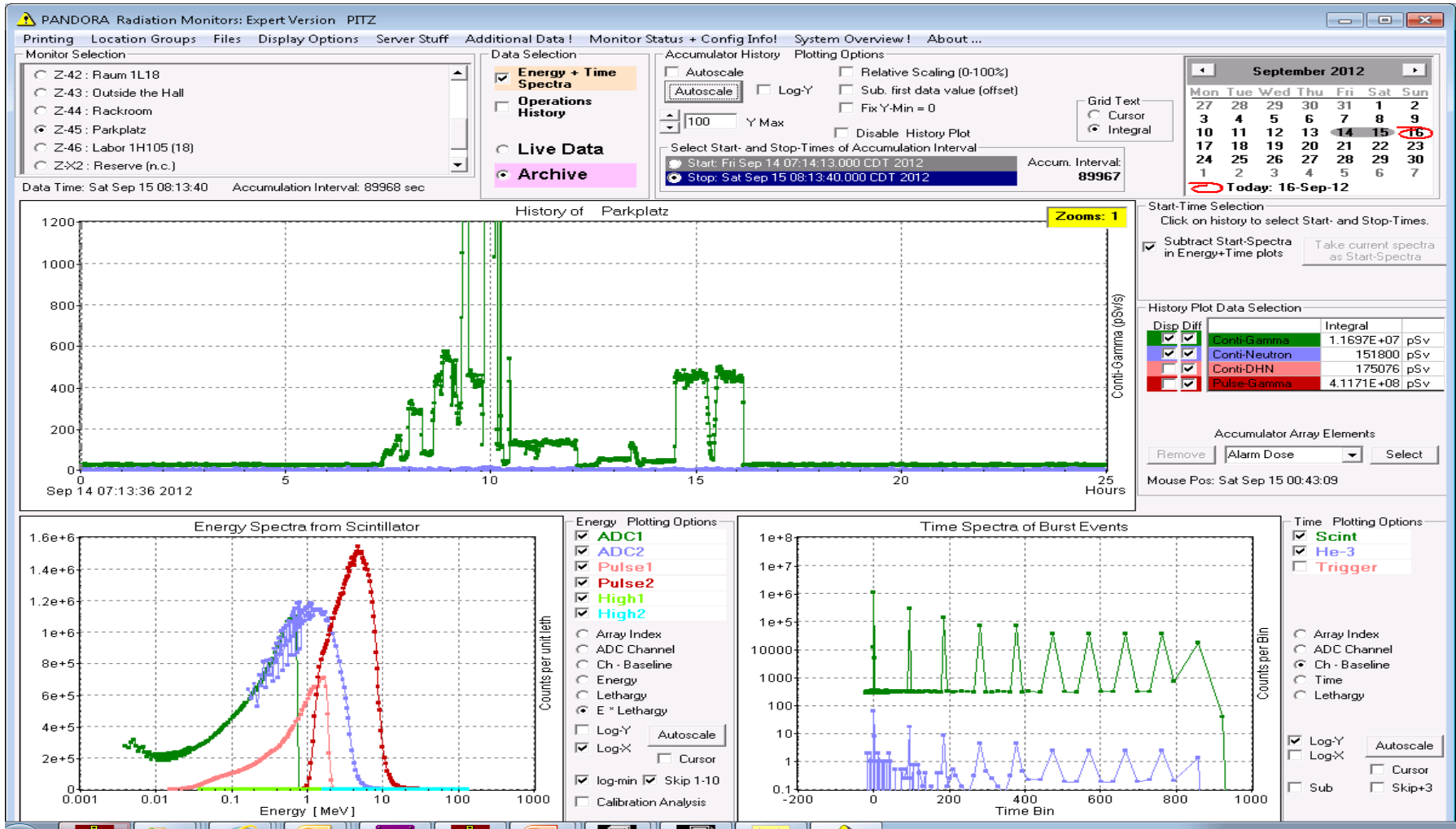


# Central and Local Data Storage: Pandora Radiation Monitors

Pandoras: "Machine Critical" parameters (dose rates, etc) are stored centrally.

Complete data sets for analysis [Energy and time spectra] are stored locally: >~100 GBytes.

The last few months is kept; important time periods can be saved.



# Central and Local Archiving: Diagnostics Monitoring, debugging, etc.

The “official” PETRA3 bunch currents measured with the LeCroy scope are stored centrally. Extra data for testing new calculations and for monitoring are only stored locally.

View all data with the same Application! “Point” the viewer to your local-history source!

Archive Viewer: PETRA Motto: Hold the Pickles, Hold the Lettuce...

File Navigate Options Help

Data Options...  
 Use Absolute X Scale  
Number of History Points...  
 Plot Bit Channels At Zero  
 Central Archive  
 Subsystem Browsing  
 Local History Browsing  
 Warn About Log Channels  
 Debug Chart

Time Span Configurations Selector Chart & Trace View & Movie

Status	Property [Device]	Value	Description	Log
<input checked="" type="checkbox"/> OK	I.Sum [Bunch-1]	79.72 mA	Bunch Current Sum	<input type="checkbox"/>
<input checked="" type="checkbox"/> OK	I.Sum.1Turn [Bunch-1]	79.78 mA	Bunch Current Sum (...)	<input type="checkbox"/>
<input checked="" type="checkbox"/> OK	IDC.Cur.OR08 [Bunch-1]	79.61 mA	DC Current	<input type="checkbox"/>
<input checked="" type="checkbox"/> OK	V.Max [Bunch-1]	5.32 V	Maximum Voltage in ...	<input type="checkbox"/>
<input checked="" type="checkbox"/> OK	VerScale [Bunch-1]	0.88 V	Scope V-Scale	<input type="checkbox"/>
<input checked="" type="checkbox"/> OK	Index.Peak [Bunch-1]	42.00	Array Index of Peak	<input type="checkbox"/>

Time: Sat 15.09.2012 02:06:32.800 CEST UTC: 1347667592

Contexts: PETRA  
Server: BunchScope.Data  
Device Name: Bunch-1  
Selected Bit: ALL  
Buttons: Add Selected, Add All, Add To History  
History Mode, Live Mode

19:14:37: History data for channel 'PETRA/BunchScope.Data/Bunch-1/Index.Peak' loaded.



# Locating the Data: Data Browsing

DOOCS: locate a parameter in a display and click to open its history

With a Central Storage, you need to browse through all the names of all the properties (how many individual channels In PITZ? )

To help speed up the search:

**(1) Collect and store as “Multi-Channel” Arrays** (array of devices with the same property)

**(2) Need new names!** (think of this as an opportunity!)

For example, the Property “P” from ion getter pumps, and the property “P” from TPGs!

Pressure.IonGP, Pressure.TPG (why did I use “Vacuum.TPG”?)

Are the names “descriptive” and “clear”?

Booster Water Temperature: TF348 In the DDD display, you might find “Gehause” ...

Currently the PITZ archive has 107 keywords....

**(3) Collect properties in “Subsystems”** to “cut to the chase”

All, Vacuum, Laser, Klystrons, RF, .... as many as you would like...

**(4) Events:** browse through an Event-List and select the property...

# Browsing Multi-Channel Arrays

Subsystem **RF** → Property **RF.Power** → Device **Booster**

The data is stored as an array – select a time, get the values of all elements of the array

The screenshot displays the Archive Viewer software interface. The top-left pane shows a time-series plot of RF power for various channels from 17:09 to 19:09. The top-right pane shows a bar chart titled 'RF.Power 18:23:02.000' with values for Gun.Sum, Gun.Ref, Booster, and Booster.Probe1. The bottom-left pane is a table of RF power data. The bottom-right pane shows the configuration for the 'Booster' device, with a list of RF power properties. A blue arrow points to the 'Live Mode' button, and the text 'Thanks, Igor!' is written below it.

Status	Property [Device]	Value	Description	Log
<input type="checkbox"/>	OK RF.Power [Gun.Sum]	0.00 MW	RF Powers	<input type="checkbox"/>
<input type="checkbox"/>	OK RF.Power [Gun.For]	0.00 MW	RF Powers	<input type="checkbox"/>
<input type="checkbox"/>	OK RF.Power [Gun.Ref]	0.00 MW	RF Powers	<input type="checkbox"/>
<input type="checkbox"/>	OK RF.Power [Coupler10MW]	0.00 MW	RF Powers	<input type="checkbox"/>
<input type="checkbox"/>	OK RF.Power [Coupler10MW.For]	0.00 MW	RF Powers	<input type="checkbox"/>
<input type="checkbox"/>	OK RF.Power [Coupler10MW.Ref]	0.00 MW	RF Powers	<input type="checkbox"/>
<input checked="" type="checkbox"/>	OK RF.Power [Booster]	6.66 MW	RF Powers	<input type="checkbox"/>
<input checked="" type="checkbox"/>	OK RF.Power [Booster.For]	6.97 MW	RF Powers	<input type="checkbox"/>
<input checked="" type="checkbox"/>	OK RF.Power [Booster.Ref]	0.31 MW	RF Powers	<input type="checkbox"/>
<input checked="" type="checkbox"/>	OK RF.Power [Booster.Probe1]	3.83 MW	RF Powers	<input type="checkbox"/>

Time Span Configurations Selector Chart & Trace View & Movie

Subsystem: RF

RF.Powers

Device Name: Booster

Gun.Ref  
Coupler10MW  
Coupler10MW.For  
Coupler10MW.Ref  
Booster  
Booster.For  
Booster.Ref  
Booster.Probe1

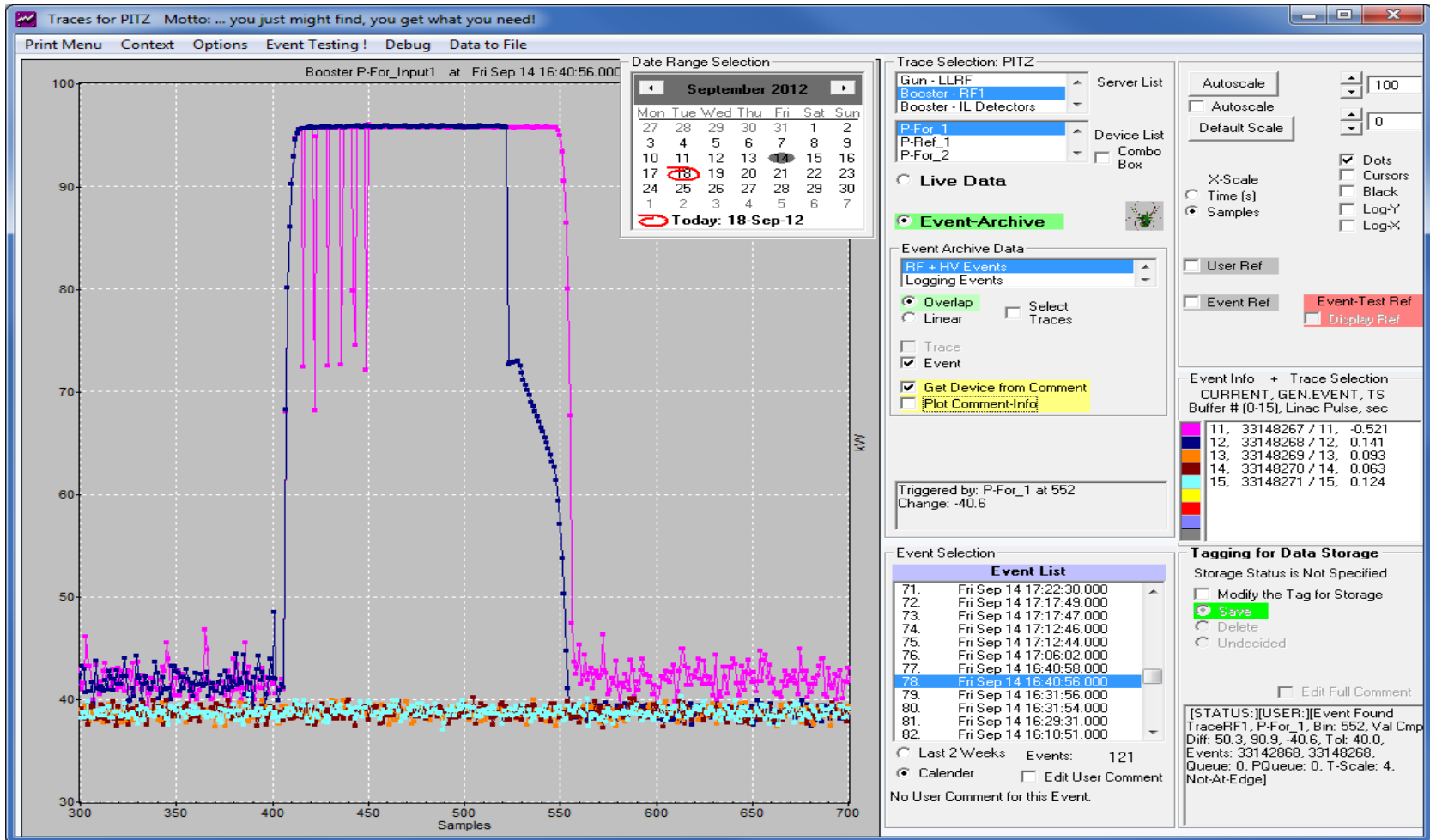
Refresh All Remove Selected Remove All

15:33:31: Array data for channel 'PITZ/HISTORY/Booster/RF.Power' loaded.

Thanks, Igor!

# Browsing Events

Looking for “events”: 121 RF Events on September 14



# Browsing Events: Alarms

Live alarms in “FIFO” Display (“now” is at the top)  
(red entries: “not cleared”)

Archive display with subsystems

Alarm Message Viewer: LINAC2/L2-Protokoll

File Options Help

Last: 18.09.2012-16:00:17 Active/All: 1/285

Generated	Device	Message	Code	Cleared
18.09.2012-16:00:17 CEST	Sec12/Wavg2 GP55	GP Schwelle fuer HF Interlock	657	
18.09.2012-15:57:33 CEST	Modulator11	Pulsdauerfehler Klystron	517	18.09.2012-15:57:37 CEST
18.09.2012-15:35:08 CEST	Modulator08	Pulsdauerfehler Klystron	517	18.09.2012-15:35:12 CEST
18.09.2012-14:51:58 CEST	Modulator08	Pulsdauerfehler Klystron	517	18.09.2012-14:52:01 CEST
18.09.2012-14:28:21 CEST	Sec12/Wavg2 GP55	GP Schwelle fuer HF Interlock	657	18.09.2012-14:29:17 CEST
18.09.2012-12:24:14 CEST	Modulator03	Pulsdauerfehler Klystron	517	18.09.2012-12:24:18 CEST
18.09.2012-12:24:09 CEST	Modulator03	Pulsdauerfehler Klystron	517	18.09.2012-12:24:13 CEST
18.09.2012-12:24:05 CEST	Modulator03	Shunt Diode (Fehlanpassung)	698	18.09.2012-12:28:28 CEST
18.09.2012-12:23:32 CEST	Sec3/Wavg2 GP16	Getterpumpe aus	656	18.09.2012-12:23:55 CEST
18.09.2012-12:23:32 CEST	Sec3/Wavg2 GP16	GP Schwelle fuer HF Interlock	657	18.09.2012-12:24:38 CEST
18.09.2012-12:21:42 CEST	Modulator03	Pulsdauerfehler Klystron	517	18.09.2012-12:21:46 CEST
18.09.2012-12:21:39 CEST	Modulator03	Shunt Diode (Fehlanpassung)	698	18.09.2012-12:23:57 CEST
18.09.2012-12:21:37 CEST	Modulator03	Pulsdauerfehler Klystron	517	18.09.2012-12:21:41 CEST
18.09.2012-12:21:28 CEST	Modulator03	Shunt Diode (Fehlanpassung)	698	18.09.2012-12:21:38 CEST
		Pulsdauerfehler Klystron	517	18.09.2012-12:21:31 CEST
		Shunt Diode (Fehlanpassung)	698	18.09.2012-12:20:04 CEST
		HV wurde auto. eingeschaltet.	520	18.09.2012-12:20:04 CEST
		GP Schwelle fuer HF Interlock	657	18.09.2012-12:20:23 CEST
		Pulsdauerfehler Klystron	517	18.09.2012-12:17:08 CEST
		Shunt Diode (Fehlanpassung)	698	18.09.2012-12:19:43 CEST
		Pulsdauerfehler Klystron	517	18.09.2012-12:17:03 CEST
		Shunt Diode (Fehlanpassung)	698	18.09.2012-12:16:55 CEST
		Shunt Diode (Fehlanpassung)	698	18.09.2012-12:16:49 CEST
		Shunt Diode (Fehlanpassung)	698	18.09.2012-12:16:44 CEST
		Pulsdauerfehler Klystron	517	18.09.2012-12:16:41 CEST
		Getterpumpe aus	656	18.09.2012-12:13:05 CEST
		GP Schwelle fuer HF Interlock	657	18.09.2012-12:13:47 CEST
		Getterpumpe aus	656	18.09.2012-12:10:31 CEST
		GP Schwelle fuer HF Interlock	657	18.09.2012-12:11:31 CEST

Alarm Viewer: LINAC2

File View Options Navigate Help

Context: LINAC2

Fatal	Error	Warning	Alarm Display		
1	1	1	<input checked="" type="radio"/> Live	<input type="radio"/> Archive	

Tue Sep 18 16:02:38 Warning Severity >= 0 Selected/Total No. of Alarms: 3/3 Active Alarms Only (14 Disabled)

System	Device Name	Message	Sev	Alarm Descriptor	Alarm Time	Duration
Vakuum	Sec12/Wavg2 GP55	GP Schwelle fuer HF Interlock	15	Oscillating	16:02:32.534 - Sep 18 C...	3 sec
L2-Protokoll	Sec12/Wavg2 GP55	GP Schwelle fuer HF Interlock	9	Oscillating	16:02:32.534 - Sep 18 C...	3 sec
Magnete	QL10	PS IST-SOLL WARNUNG	4	Oscillating Data Changed	16:02:10.153 - Sep 18 C...	2.1 hr

16:02:38: Alarms loaded.

# Browsing Events: Alarm Archive

Alarm Viewer: LINAC2

File View Options Navigate Help

**Context: LINAC2**

Fatal	Error	Warning	Alarm Display	
<b>375</b>	<b>318</b>	<b>252</b>		<input type="radio"/> Live <input checked="" type="radio"/> Archive

Tue Sep... Warning Severity >= 0 Selected/Total No. of Alarms: 945/945 Active Al:

Magnete	1 0 0 200	Kicker-Septa	0 0 0	Kontrollen	0 0 42
H.Korrekt.Mag.	0 0 0	Chopper	0 0 4	Front-End	0 0 0
V.Korrekt.Mag.	0 0 0	Timing	0 126 0	Diagnose	0 0 2
Steerer	0 0 0	Temperaturen	0 0 0	L2-Protokoll	187 62 4
PIA-HF	0 0 0	Piloth.-Was...	12 149 0 0	Interlock	0 0 0
L2-HF	1 39 58 0	Vakuum	0 0 0	Schirmmonitore	0 72 0

Calendar Interval Recent Past

August 2012

Mon	Tue	Wed	Thu	Fri	Sat	Sun
30	31	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2
3	4	5	6	7	8	9

Alarm Count

The number of alarms with Severity >= 0

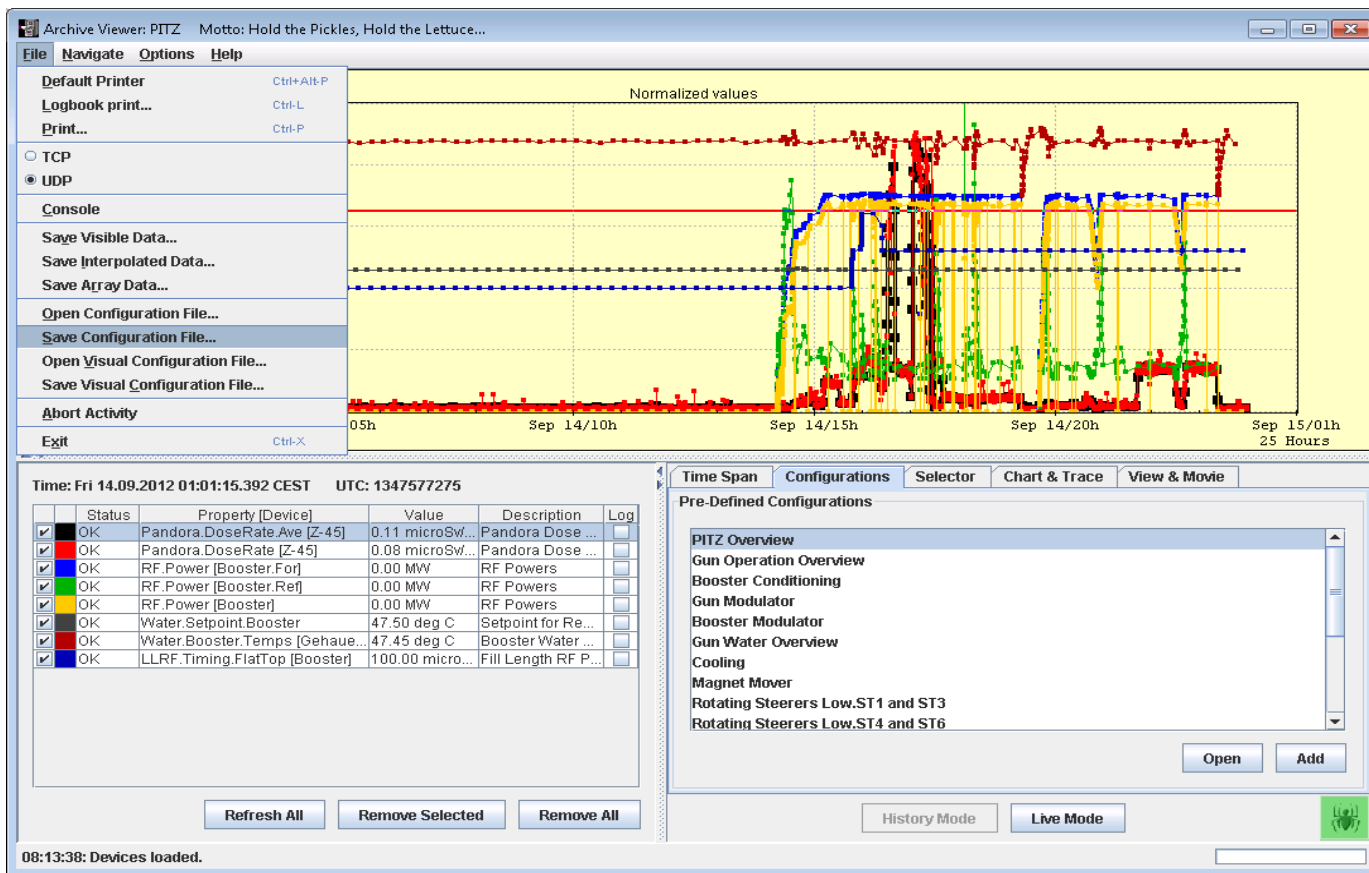
945

System	Device Name	Message	Sev	Alarm Descriptor	Alarm Time	Duration
L2-HF	Modulator06	HVPS Overload	15	Terminated	20:47:07.000 - Aug 16 C...	49 sec
L2-HF	Modulator06	HVPS Overload	15	New	20:46:17.984 - Aug 16 C...	49 sec
L2-HF	Modulator02	Shunt Diode (Fehlanpassung)	15	Terminated	20:41:16.000 - Aug 16 C...	3 sec
L2-HF	Modulator02	Pulsdauerfehler Klystron	12	Terminated	20:41:15.000 - Aug 16 C...	3 sec
L2-HF	Modulator02	Shunt Diode (Fehlanpassung)	15	New	20:41:12.960 - Aug 16 C...	3 sec
L2-HF	Modulator02	Pulsdauerfehler Klystron	12	New	20:41:11.960 - Aug 16 C...	3 sec
L2-HF	Modulator02	Shunt Diode (Fehlanpassung)	15	Terminated	20:17:10.000 - Aug 16 C...	2 sec
L2-HF	Modulator02	Pulsdauerfehler Klystron	12	Terminated	20:17:09.000 - Aug 16 C...	2 sec
L2-HF	Modulator02	Shunt Diode (Fehlanpassung)	15	New	20:17:07.849 - Aug 16 C...	2 sec
L2-HF	Modulator02	Pulsdauerfehler Klystron	12	New	20:17:06.849 - Aug 16 C...	2 sec
L2-HF	Modulator01	Shunt Diode (Fehlanpassung)	15	Terminated	19:18:46.000 - Aug 16 C...	5 sec

15:24:37: Alarms loaded.

# Re-Browsing: Configurations!

You have found interesting channels, and would like to view them periodically?  
Without having to search for them again? Save the selection in a Configuration!



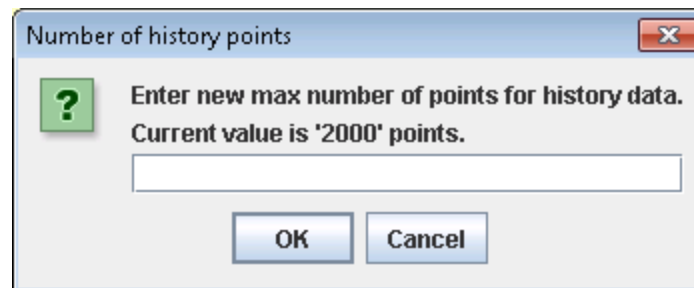
# Data Retrieval

**On-line:** quick viewing using General-Purpose Applications, or write your own (in Matlab ...)

**Off-line:** Use your own analysis programs. Use the general purpose Application to find the data you want, then store the data to file

(Take a peek at the menu on the previous slide...)

Note that the data in the viewer may not be ALL the data archived (see vacuum slide). You can increase the maximum data-size collected by the Viewer:



# Saving Data from the Application to a File

Save Visible data: Save the (Time Stamp, Data) for each data point of each property  
(The properties are archived asynchronously)

	A	B	C	D	E	F	G	H
1	TimeStamp	TimeText	RF.Power/Booster (MW)	TimeStamp	TimeText	RF.Power/Booster.For (MW)	TimeStar	TimeT
2	1347629741	14.09.2012 15:35:41.000	6.607311249	1347629741	14.09.2012 15:35:41.000	6.973038673	1.35E+09	14.09..
3	1347629804	14.09.2012 15:36:44.000	6.602902889	1347629804	14.09.2012 15:36:44.000	6.962097168	1.35E+09	14.09..
4	1347629805	14.09.2012 15:36:45.000	0	1347629805	14.09.2012 15:36:45.000	0	1.35E+09	14.09..
5	1347629806	14.09.2012 15:36:46.000	0	1347629806	14.09.2012 15:36:46.000	0	1.35E+09	14.09..
6	1347629807	14.09.2012 15:36:47.000	6.707049847	1347629807	14.09.2012 15:36:47.000	6.935323715	1.35E+09	14.09..
7	1347629842	14.09.2012 15:37:22.000	6.63373518	1347629842	14.09.2012 15:37:22.000	6.962427139	1.35E+09	14.09..
8	1347630268	14.09.2012 15:44:28.000	6.657970428	1347630268	14.09.2012 15:44:28.000	6.959226131	1.35E+09	14.09..
9	1347630269	14.09.2012 15:44:29.000	0	1347630269	14.09.2012 15:44:29.000	0	1.35E+09	14.09..

Save Interpolated Data: One file with Timestamp, Data1, Data2, Data3, ..  
The time stamps of all data collected; and the values of each property interpolated

	A	B	C	D	E	F	G	H	I
1	TimeStamp	TimeText	RF.Power/Booster (MW)	RF.Power/Boost	RF.Power/B	LLRF.Amplit	LLRF.Timing.Fla	Vacuum.IonGP/BC	Vacuum.I
2	1347629639	14.09.2012 15:33:58.615	6.614475533	6.990820356	0.37634469	65	99.96790146	7.14E-11	1.26E-09
3	1347629645	14.09.2012 15:34:04.637	6.61405415	6.989774487	0.37572023	65	99.97522749	8.05E-11	1.05E-09
4	1347629655	14.09.2012 15:34:14.683	6.613351191	6.988029752	0.37467848	65	99.98744891	7.58E-11	1.05E-09
5	1347629662	14.09.2012 15:34:21.610	6.612866482	6.986826707	0.37396017	65	99.99587591	7.14E-11	1.26E-09
6	1347629665	14.09.2012 15:34:25.000	6.61262927	6.98623795	0.37360864	65	100	6.91E-11	1.22E-09
7	1347629667	14.09.2012 15:34:27.000	6.612489322	6.9858906	0.37340124	65	100.0024331	6.77E-11	1.20E-09
8	1347629668	14.09.2012 15:34:27.647	6.612444049	6.985778233	0.37333415	65	100.0032202	6.73E-11	1.19E-09
9	1347629676	14.09.2012 15:34:35.619	6.611886216	6.984393698	0.37250747	65	100.0129185	6.73E-11	1.26E-09



# Display: Advanced

Doing “off-line” analysis “on-line”

(use general purpose applications to answer your questions...)

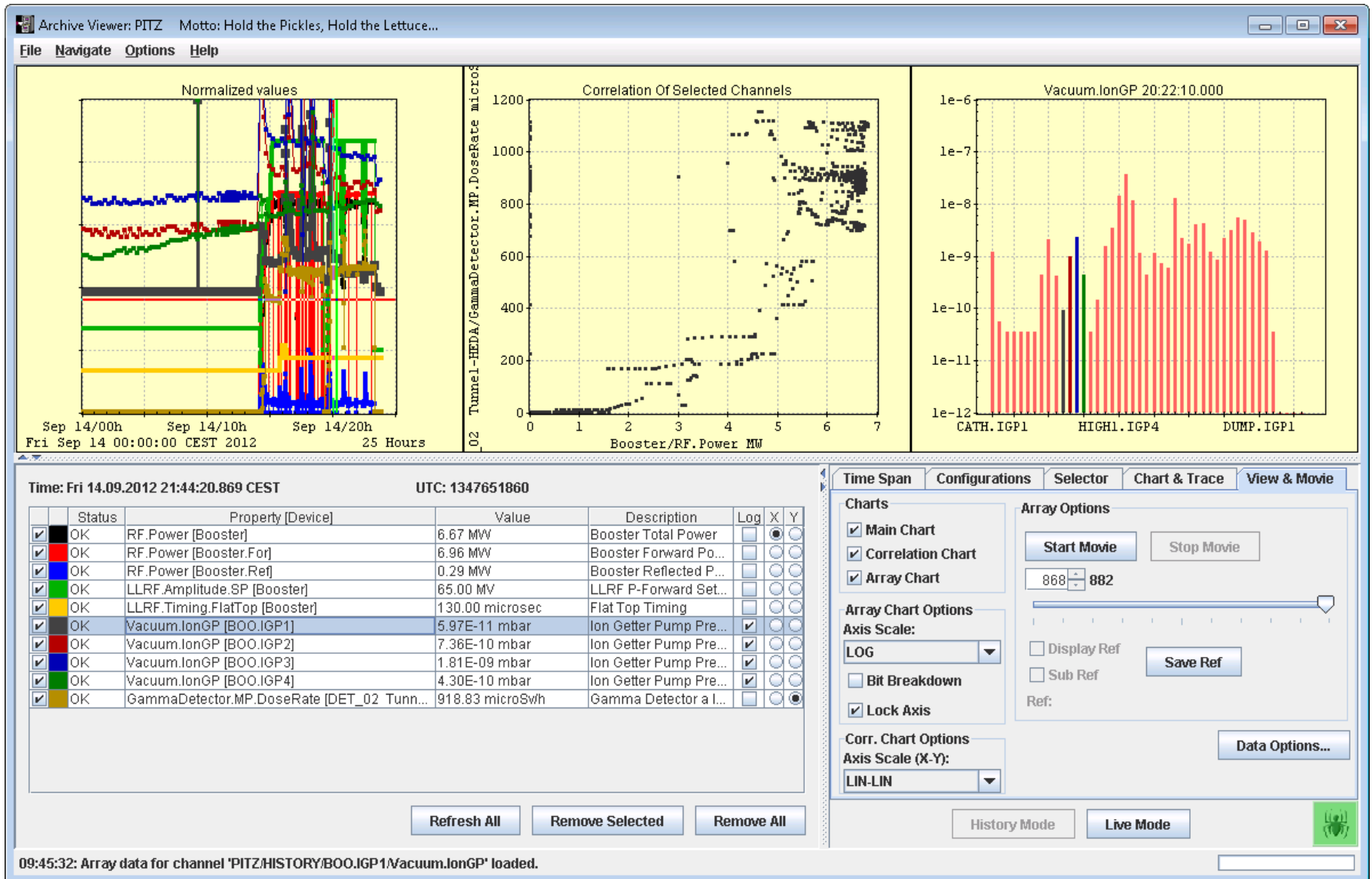
Display an array?

Multi-Channel (Vacuum readings) MCA Viewer

“pulse” (rf ) Scope Trace Viewer

“Movies”, Correlations, Annotations, ....

# Main-, Correlation- and Array-Plots



# Histories of Apples and Oranges

