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# Software for data acquisition and instrument control Sonix+

# Sonix history

The Sonix package is the main instrument control software at the IBR-2 reactor.  
Sonix – **S**oftware for **N**eutron **I**nstrument on **X**11 base

<i>Version</i>	<i>Period</i>	<i>Hw platform</i>	<i>Soft platform</i>	<i>GUI</i>
<b>Sonix</b>	1995-2004	VME	OS-9	X window
<b>Sonix+</b>	2004 -	PC	Windows (XP, 7)	MFC, PyQt

Now ~20 installations at FLNP and at other centers.



# Sonix+ concept and main features

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## *Comparison with other systems*

### □ *Similar features:*

- Modular hierarchical structure with a unified inter module communication protocol;
- Database for communication and parameter access;
- Configuring all modules in a common file;
- Scripting programming languages (Python, etc.) to describe a measurement procedure.

### □ *Essential differences:*

- Mostly local system;
- Windows OS as a platform;
- The universal GUI approach for all instruments.

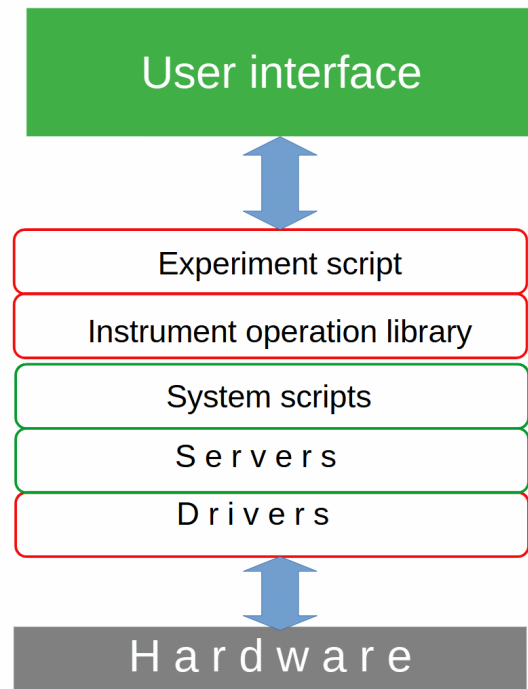
# Sonix+. Varman

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- ❑ Varman – is «VARIable MANager»
- ❑ Original design - OS-9 - IRI Delft, Netherlands (1997).
- ❑ Redesign for Windows – FLNP, JINR (2003)
  
- ❑ Main features:
  - Local parameter storage with fast access;
  - Used for inter-module communication;
  - At every moment contains full information about the current state of the measurement (with the exception of spectra) and descriptions how parameters are structured;
  - Snapshot of Varman database is used in Sonix internal data format.

# Sonix+ structure

## Structure levels



- User interface (MFC & PyQt)
- Instrument library (Python)
- System scripts (Python)
- Control modules ("devices")
  - Servers (DAQ, Script interpreter, etc.) (C++)
  - Drivers (C++)
  
- To install the Sonix+ at a new instrument:
  - Select a set of drivers;
  - Compose configuration file;
  - Prepare instrument operation library.

# Sonix+ data format

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Data reduction & analysis program is responsibility of the User:

- No common data format for IBR-2 instruments
  - Histograms output data with few exceptions
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Universal approach needs *common* data format

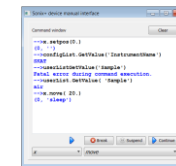
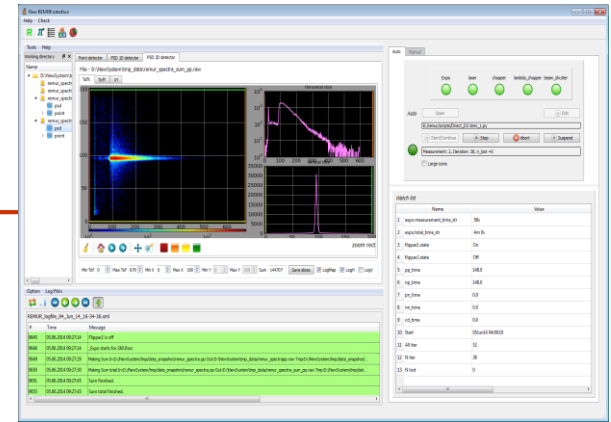
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Sonix "internal" format:

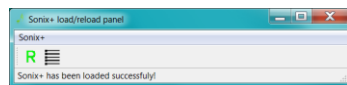
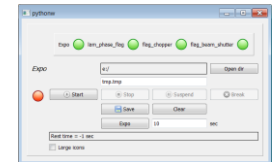
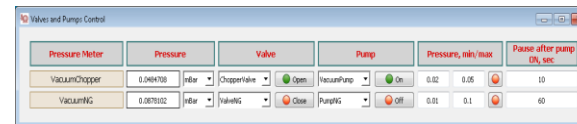
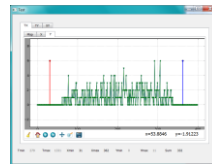
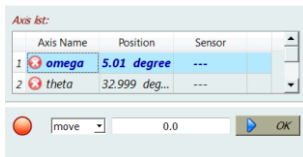
- binary histograms
- Varman snapshot
- event data files if any.

# User interfaces

- ❑ GUI (2 types), Web Sonix, command line
- ❑ GUI main features (4 main needs):
  - to watch *current state* of the instrument,
  - to watch the *measurement history* (log file),
  - *spectra visualization*,
  - and to *control the measurement process*.
- ❑ Universal GUI – single composed window (GUMTREE idea)
- ❑ Additional widgets for manual control some urgent devices & actions



Detectors:	
	Value
1	100
2	101
3	102
4	103
5	104
6	105
7	106
8	107
9	108
10	109
11	110
12	111
13	112
14	113
15	114
16	115
17	116
18	117
19	118
20	119
21	120



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# Universal GUI layout

The screenshot displays the Sonix+ software interface with four key components highlighted by red letters:

- A (SpectraViewer):** A file explorer window showing a directory structure with files like 'ContrVar2019May\_40\_000\_0' and 'ContrVar2019May\_40\_002\_0'. Below it is a plot area with a 2D histogram and a 1D spectrum plot.
- B (LogViewer):** A log window titled 'GRAINS\_logfile\_20190322\_112604.xml' showing a list of log entries with timestamps and messages.
- C (Script interpreter):** A control panel with buttons for 'Expo', 'beam\_shutter', and 'chopper', along with 'Start/Continue', 'Stop', 'Abort', and 'Suspend' buttons.
- D (Varman params WatchList):** A table listing various parameters and their current values.

#	Time	Message
116841	20.05.2019 08:20:23	Sum = 2351 (d:/NewSystem/tmp_data/pp_83.raw); thr = 0
116842	20.05.2019 08:20:23	Start files summing...
116847	20.05.2019 08:20:29	End of files summing.
116848	20.05.2019 08:20:29	UpdateDT 110.0 0.0 0.0 0.0 0.0

Name	Value
1 expo.measurement_time_str	8m 44s
2 expo.total_time_str	10m 8s
3 pp_time	110.0
4 np_time	0.0
5 pn_time	0.0
6 nn_time	0.0
7 cd_time	0.0
8 Start	720.0
9 All iter	0.0
10 Cadm_shutter.position	101.04

A – SpectraViewer, B – LogViewer, C – Script interpreter, D – Varman params WatchList



# Data visualization – SpectraViewer

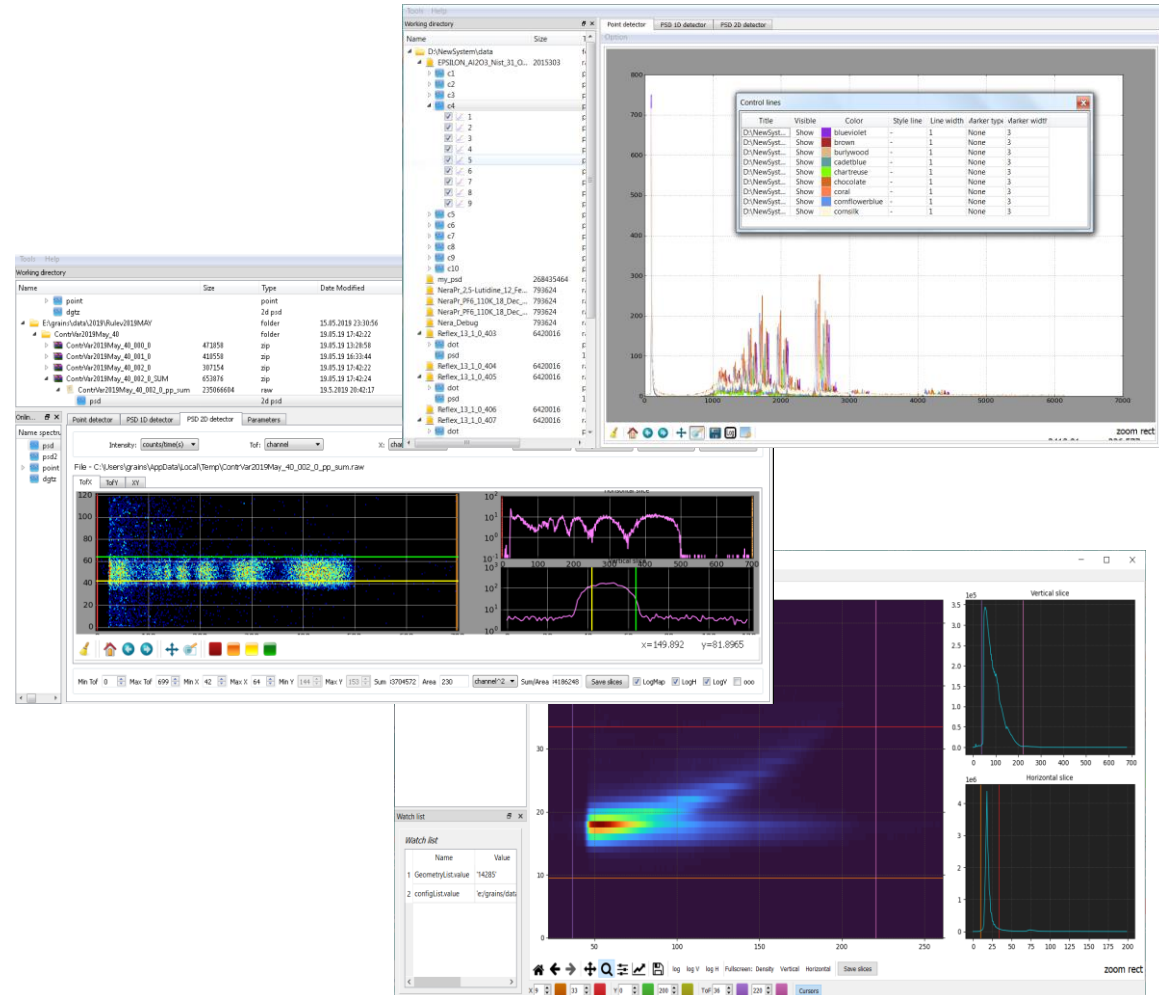


The *SpectraViewer* is designed to visualize online & offline data in Sonix+ format:

- mono detectors,
- 1D PSD,
- 2D PSD.

Implementation:

- Matplotlib
- PyQt5

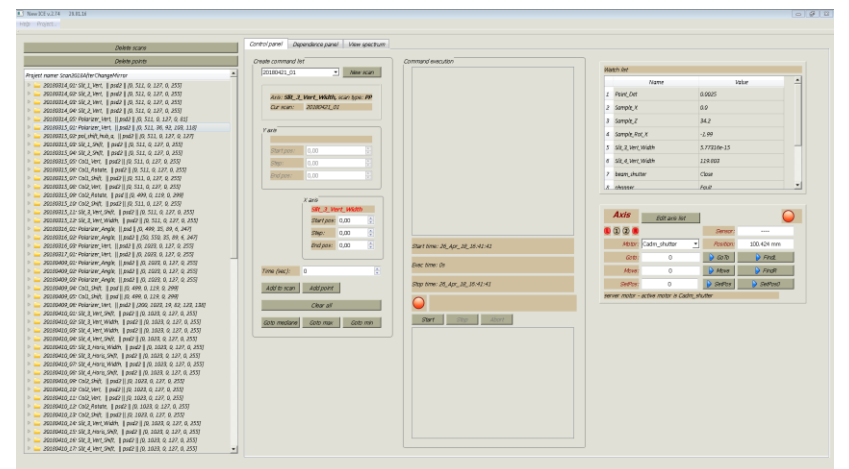
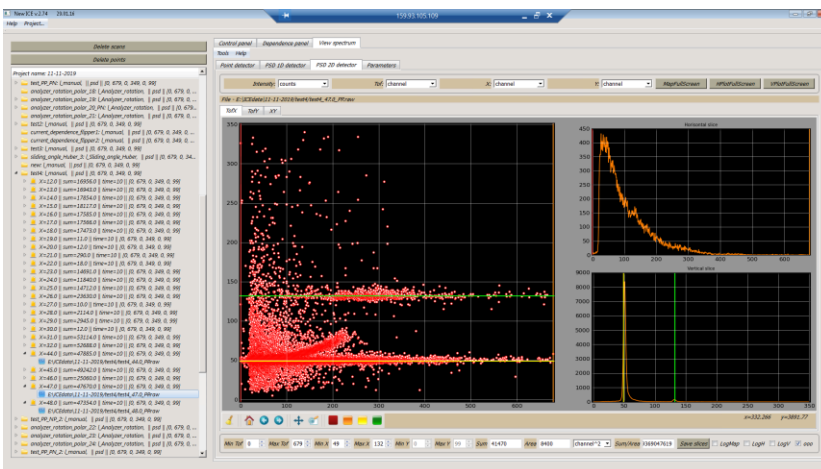
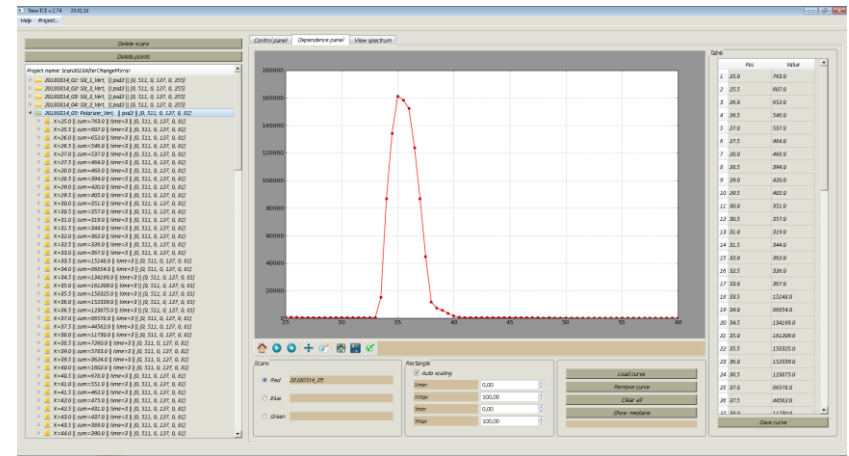


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# ICE - reflectometers calibration



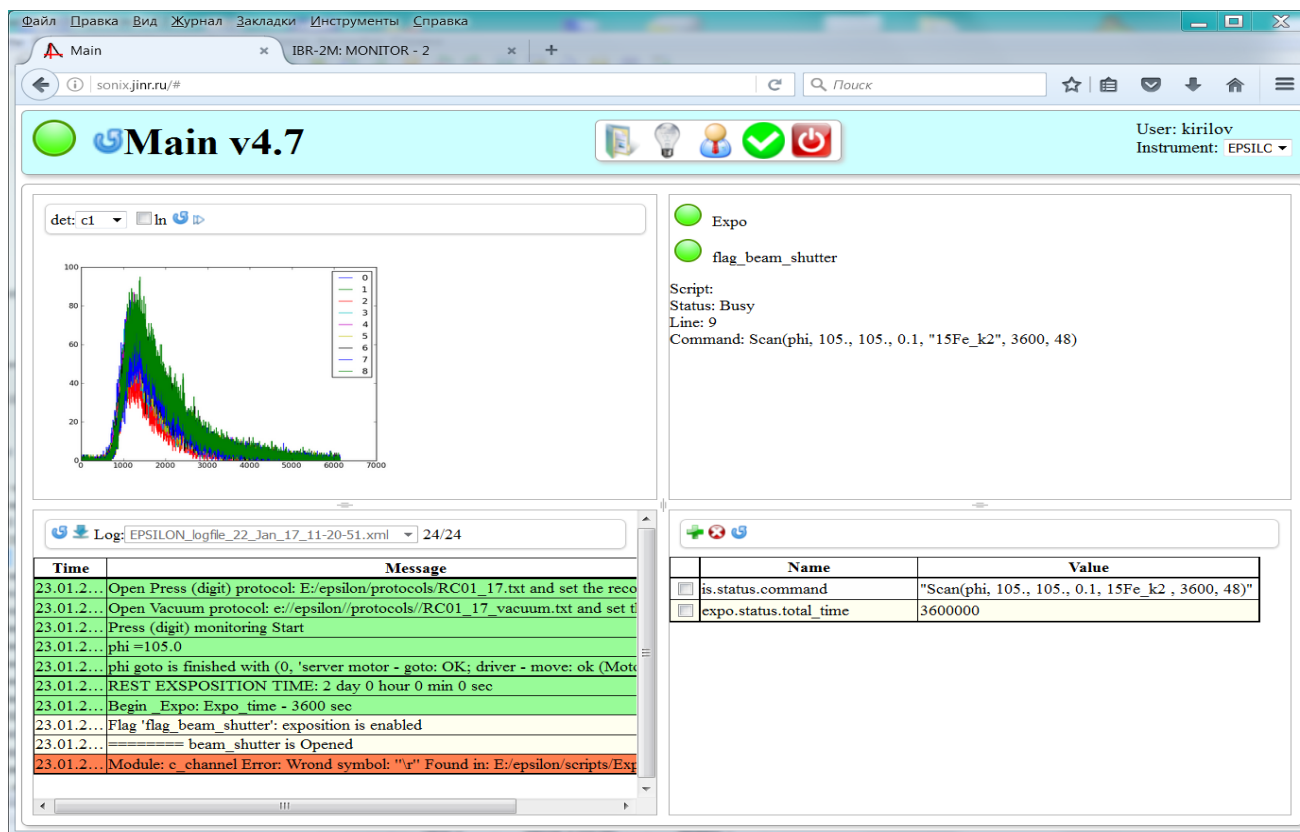
- Create projects & scans
- Setting scan parameters (type, axis, detector, range)
- Automatic and manual scan control
- Results analyses & visualization
- Spectra visualization



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# WebSonix. *Remote measurement supervision*

- ❑ Remote measurement monitoring
- ❑ Reference manual (wiki)



- ❑ Configurable
- ❑ Site pages correspond to the main *GUI*
- ❑ On-line visualization data from point detectors

# Journal system & Repository

*The Journal system* - automatic registration of measurements in a specialized database.

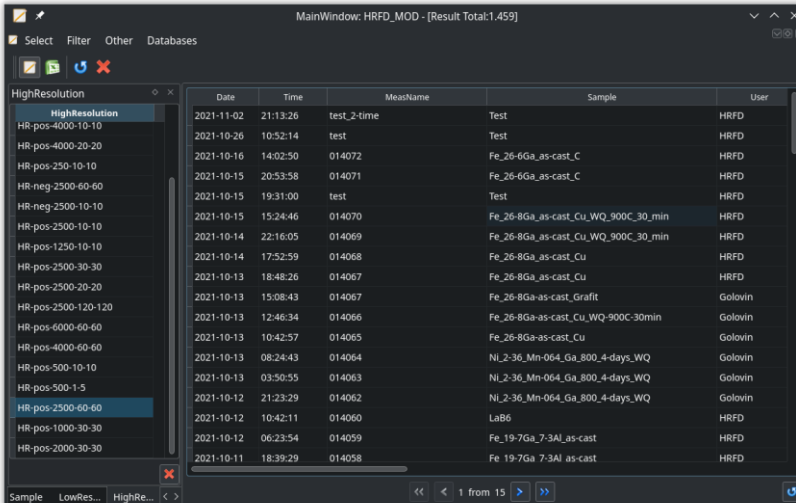
Provides:

- *getting information* about each measurement made at the instrument;
- *search* by measurement *parameters* in the database;
- searching of the *measurement data* in a file storage.

The *Central repository*

- *55TB in 24 disks (RAID6 array)*
- *6 instruments connected*
- *23TB are filled*
- *Mostly (22TB) are occupied by the HRFD the event-mode data*

## The Journal GUI



The screenshot shows a software window titled "MainWindow: HRFD\_MOD - [Result Total:1,459]". It features a table with columns for Date, Time, MessName, Test, Sample, and User. A sidebar on the left lists various measurement configurations under "HighResolution".

	Date	Time	MessName	Test	Sample	User
HR-pos-4000-10-10	2021-11-02	21:13:26	test_2-time	Test		HRFD
HR-pos-4000-20-20	2021-10-26	10:52:14	test	Test		HRFD
HR-pos-250-10-10	2021-10-16	14:02:50	014072	Fe_26-6Ga_as-cast_C		HRFD
HR-neg-2500-60-60	2021-10-15	20:53:58	014071	Fe_26-6Ga_as-cast_C		HRFD
HR-pos-2500-10-10	2021-10-15	19:31:00	test	Test		HRFD
HR-pos-2500-10-10	2021-10-15	15:24:46	014070	Fe_26-8Ga_as-cast_Cu_WQ_900C_30_min		HRFD
HR-pos-1250-10-10	2021-10-14	22:16:05	014069	Fe_26-8Ga_as-cast_Cu_WQ_900C_30_min		HRFD
HR-pos-2500-30-30	2021-10-14	17:52:59	014068	Fe_26-8Ga_as-cast_Cu		HRFD
HR-pos-2500-20-20	2021-10-13	18:48:26	014067	Fe_26-8Ga_as-cast_Cu		HRFD
HR-pos-2500-120-120	2021-10-13	15:08:43	014067	Fe_26-8Ga-as-cast_Grafit		Golovin
HR-pos-6000-60-60	2021-10-13	12:46:34	014066	Fe_26-8Ga-as-cast_Cu_WQ-900C-30min		Golovin
HR-pos-4000-60-60	2021-10-13	10:42:57	014065	Fe_26-8Ga-as-cast_Cu		Golovin
HR-pos-500-10-10	2021-10-13	08:24:43	014064	Ni_2-36_Mn-064_Ga_800_4-days_WQ		Golovin
HR-pos-500-1-5	2021-10-13	03:50:55	014063	Ni_2-36_Mn-064_Ga_800_4-days_WQ		Golovin
HR-pos-2500-60-60	2021-10-12	21:23:29	014062	Ni_2-36_Mn-064_Ga_800_4-days_WQ		Golovin
HR-pos-1000-30-30	2021-10-12	10:42:11	014060	LaB6		HRFD
HR-pos-2000-30-30	2021-10-12	06:23:54	014059	Fe_19-7Ga_7-3AJ_as-cast		HRFD
	2021-10-11	18:39:29	014058	Fe_19-7Ga_7-3AJ_as-cast		HRFD

# Conclusion

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- ▣ At the moment Sonix + is adequate to meet existing requirements.
- ▣ Installation of new wide aperture detectors + rejection of histograms in favor of event mode data → new situation.
- ▣ Perhaps, it's a right time to have a look at projects of data reduction and analysis frameworks like Mantid, in which many capabilities for data processing and visualization for histograms and event mode data are implemented already.

## Reference

[Sonix+] <https://sonix-wiki.jinr.ru/doku.php?id=en:index>

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Thank you for your attention.