



Budker Institute of Nuclear Physics, Novosibirsk  
The VEPP-4 lab, <http://v4.inp.nsk.su>

# THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

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# THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

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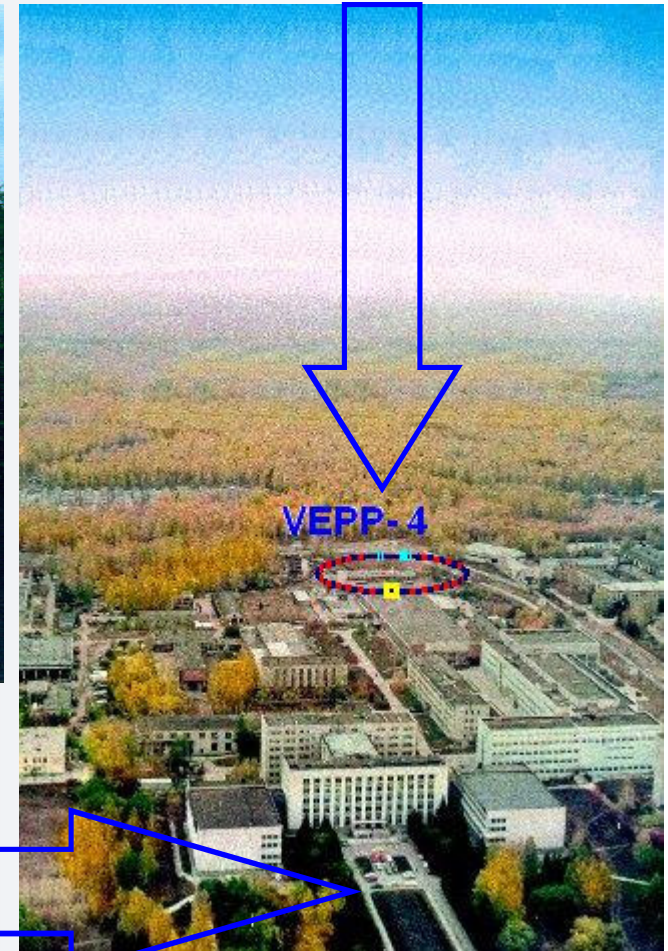


THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

## The VEPP-4 Accelerating Storage Complex



The complex is located at the Budker  
Institute of Nuclear Physics



7-th International Workshop PC a PAC, Ljubljana, 19-23 October 2008



# The VEPP-4 Accelerating-Storage Complex

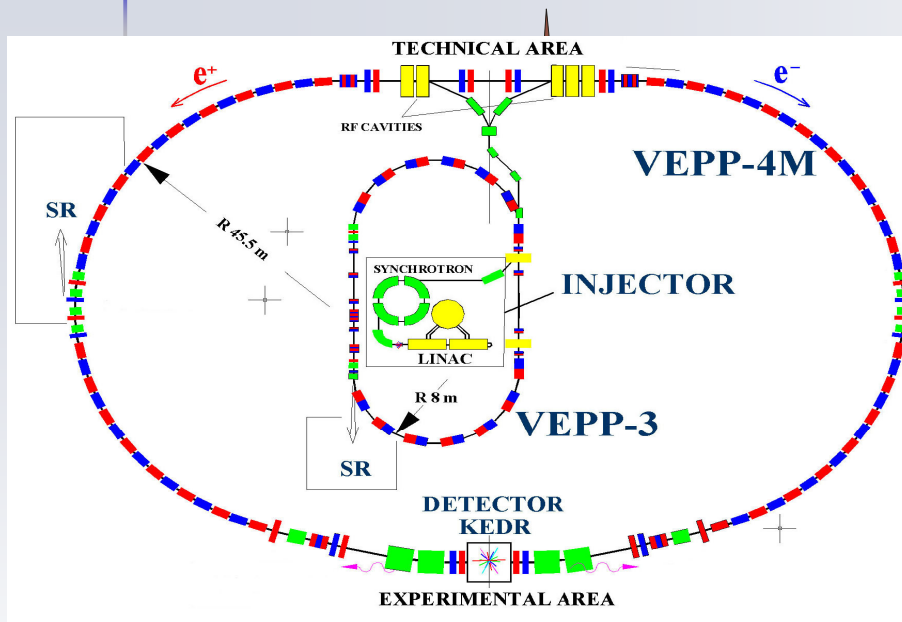


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## THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

### The VEPP-4 Accelerating-Storage Complex



Now the VEPP-4 Electron-Positron Collider operates for high-energy physics experiments in the 1.5-2.0 GeV energy range.

The most important of the VEPP-4 experiments are:

- precise measurement of tau-lepton and psi-mesons masses,
- study of psi-mesons and c-quarks physics.

Totally about three thousands parameters are stored to the database.

- Injection Complex
- VEPP-3 Storage Ring
- VEPP-4 Electron-Positron Collider

This report describes VEPP-4 database structure and the method of data collecting.



## THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

### Groups of Parameters

VEPP-4 parameters can be divided into the following groups.

- **Status Parameters**
- **Beam Diagnostic Parameters**
- **Power Supply Parameters**
- **Temperature Measurements**
- **Cooling System Parameters**



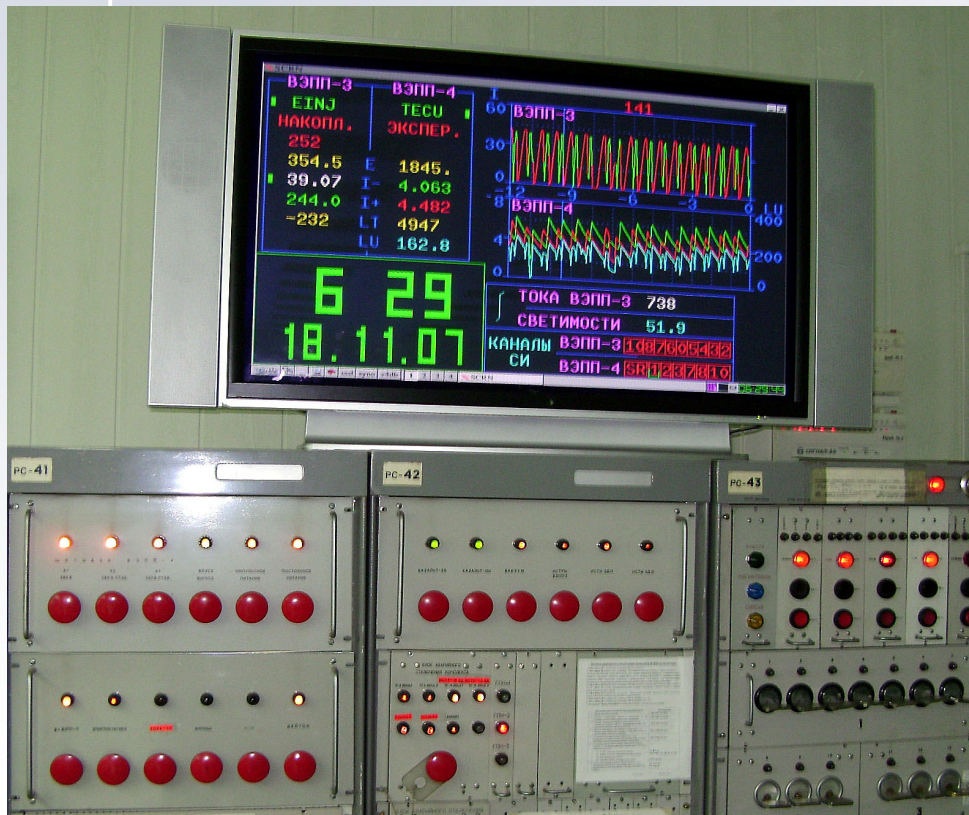
# THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

## Groups of Parameters

### Status Parameters

Beam Diagnostic Parameters  
Power Supply Parameters  
Temperature Measurements  
Cooling System Parameters

- **Status Parameters** are the most important information about all parts of VEPP-4 Control System.



About 200 parameters are recorded each second to the database: facilities operation modes, beam currents, set energy, luminosity, average vacuum values, temperatures of the most important points, the values of magnetic fields of some important magnets, etc.

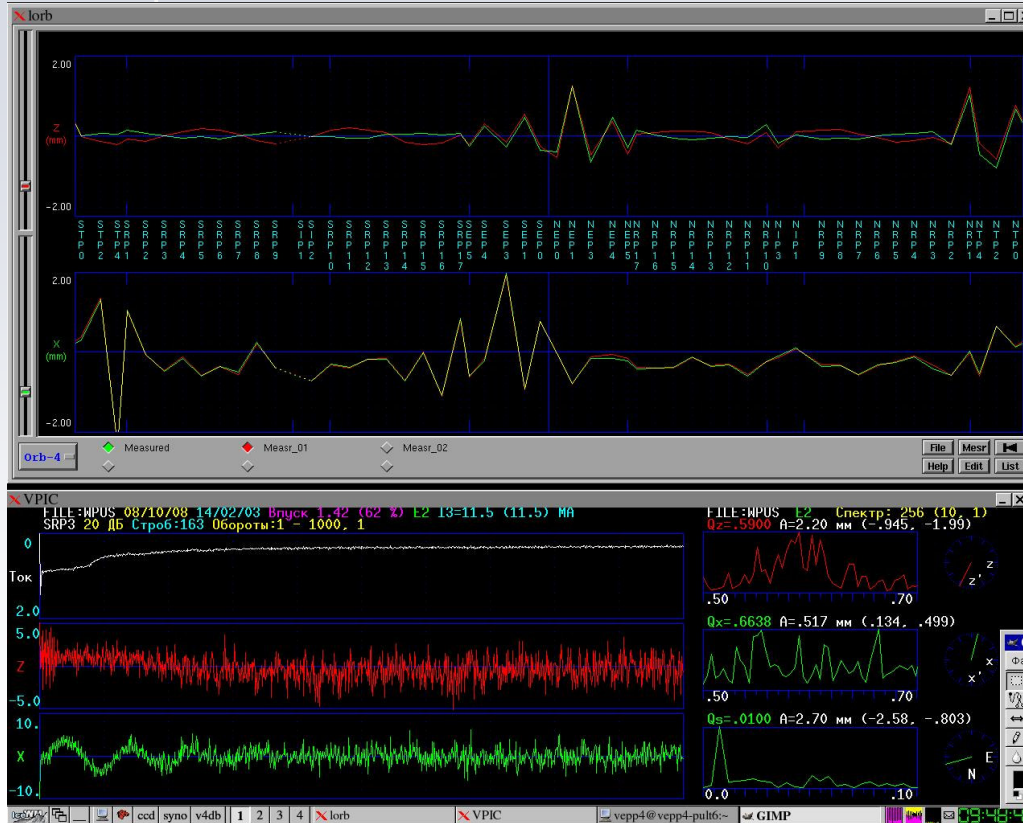


# THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

## Groups of Parameters

Status Parameters  
Beam Diagnostic parameters  
Power Supply Parameters  
Temperature Measurements  
Cooling System Parameters

- **Beam Diagnostic Parameters.** This group consists of four parts.



- Beam Orbit of the VEPP-3 Storage Ring
- Beam Orbit of the VEPP-4 Collider
- Luminosity of VEPP-4
- Beam Dimensions of VEPP-4

This figure shows position of an orbit of VEPP-3 bunch.



## THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

### Groups of Parameters

Status Parameters

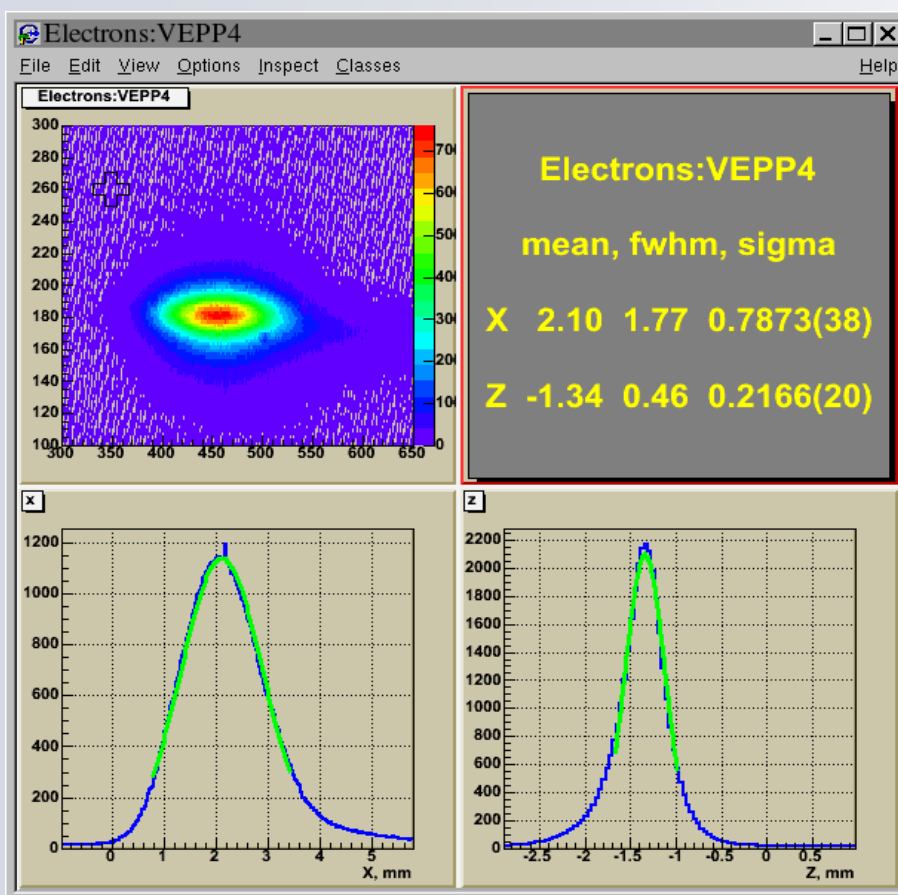
Beam Diagnostic Parameters

Power Supply Parameters

Temperature Measurements

Cooling System Parameters

#### • Beam Diagnostic Parameters



- Beam Orbit of the VEPP-3 Storage Ring,
- Beam Orbit of the VEPP-4 Collider,
- Luminosity of VEPP-4,
- Beam Dimensions of VEPP-4

The stored measurements of the VEPP-4 beam orbits with the measurements of the magnetic fields allow us to reconstruct the beam energy value between the calibration procedures.

The figure shows VEPP4 electron beam dimensions, density distribution on hor & vert coordinates.



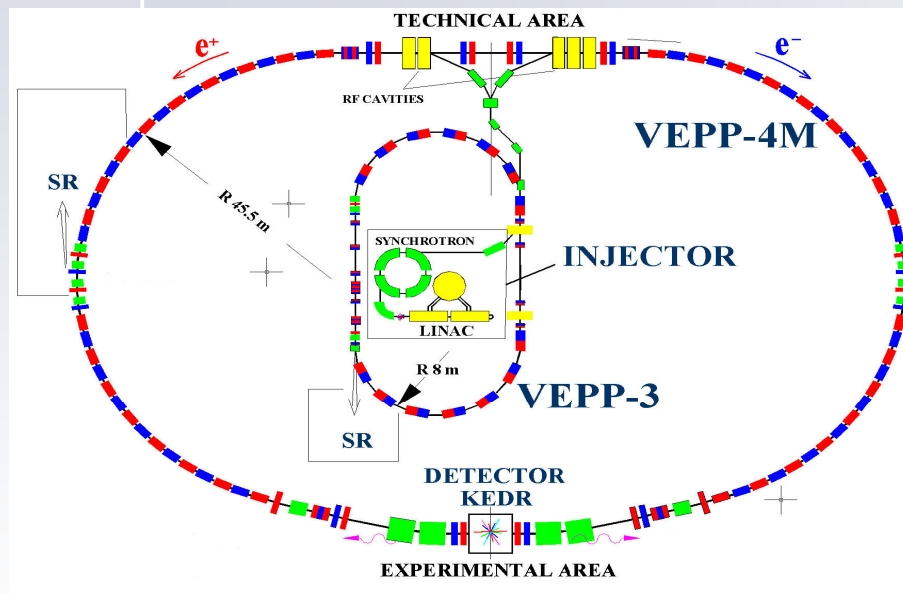
## THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

### Groups of Parameters

Status Parameters  
Beam Diagnostic Parameters  
**Power Supply Parameters**  
Temperature Measurements  
Cooling System Parameters

- **Power Supply Parameters.** There are four parts in this group:

- Injector,
- VEPP-3,
- Transport Channel from VEPP-3 to VEPP-4
- VEPP-4



These parts include a full set of the facility Power Supplies parameters: totally about 1000 parameters. This group of parameters allows checking of power supplies operation stability. These parameters also are taken into account in the beam energy value reconstruction.



## THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

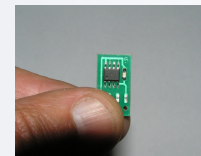
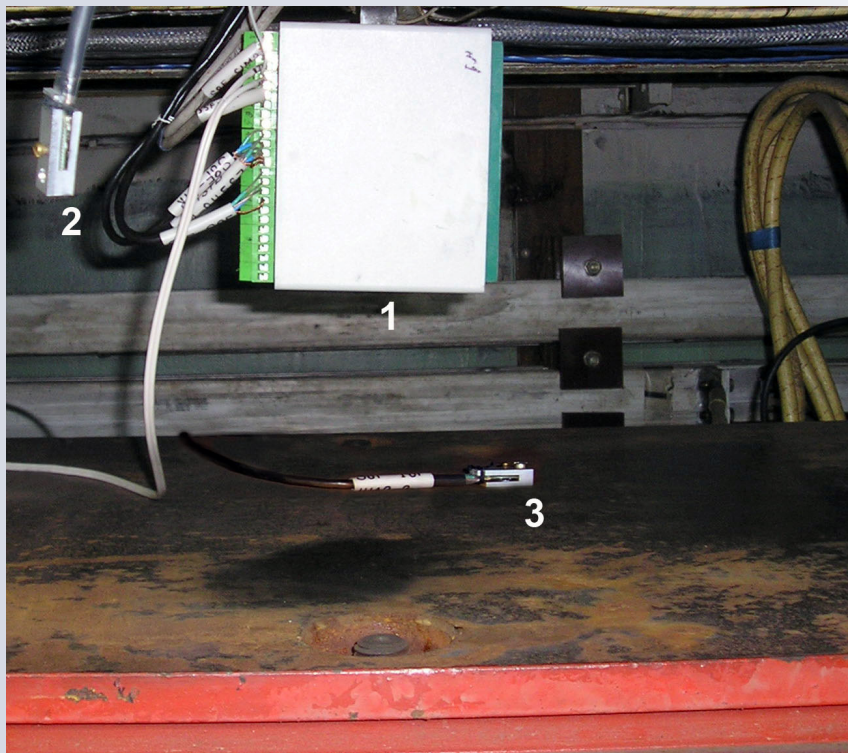
### Groups of Parameters

Status Parameters  
Beam Diagnostic Parameters  
Power Supply Parameters

### Temperature Measurements

Cooling System Parameters

#### •Temperature Measurements



The temperature measurements are performed in order to protect the devices and equipment from the overheating. Almost 500 temperature sensors are distributed at the VEPP-4. The temperature measurements also are used for the beam energy reconstruction. For this purpose a lot of temperature sensors are mounted on the magnets yokes, on the tunnel walls, and in the all collider areas for air temperature measurements.



## THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

### Groups of Parameters

Status Parameters  
Beam Diagnostic Parameters  
Power Supply Parameters  
Temperature Measurements

### Cooling System Parameters

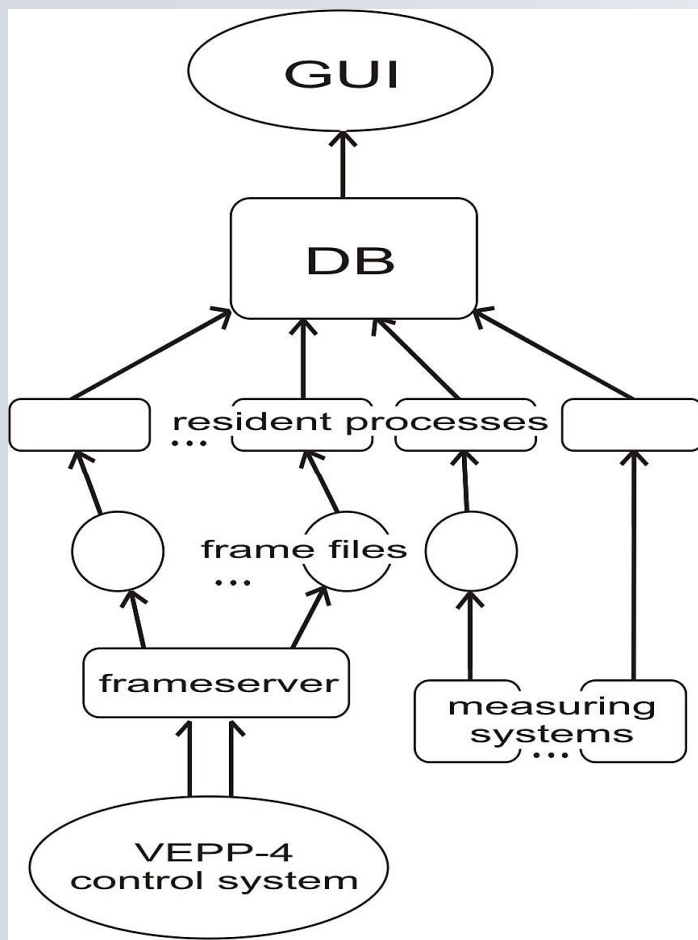


The Cooling System parameters include information about distillate cooling equipment. This equipment provides distillate temperature stabilization during the all facility operations. It is not easy task, because the power consumptions of the VEPP-3 storage ring in the mode of the beam accumulation almost twenty fife times less than in the mode of the beam extraction to the VEPP-4 collider.



## THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

### Data Collection



The **VEPP-4 control system** includes several control computers which send the data packets to the special frameserver program.

The **frameserver** puts the data into the text files (**frame files**).

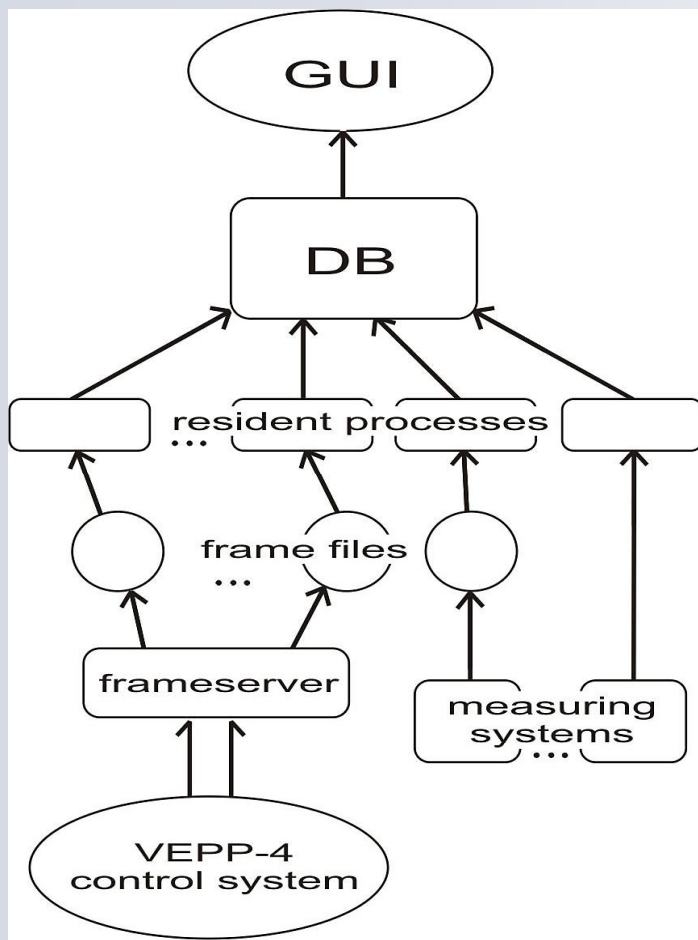
There are about twenty text files which include the description about VEPP-4 groups of parameters.

Also there are several measurement programs running in PCs which measure the beam parameters of VEPP-4 and put data into the **frame files**.



# THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

## Data Collection



There is a corresponding name configuration file for the each frame file.

These name configuration files are renewed if the data structure is changed in the case of addition or dropping of control or measurement parameters in the VEPP-4 control system.

There are twelve resident processes which check if the frame files renewed or not.

In the case of renewing of the data file the corresponding process sends the data to the postgresSQL server. The postgresSQL server puts the data to the corresponding table of the database.

In the case of a new parameter in the name configuration file the corresponding process sends to database server the request to renew the data table: to add new attribute.



## THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

### The Database Structure

- Description Tables of the Parameter's Groups
- Stored Tables



# THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

## The Database Structure

Description of the Tables Parameter's Groups  
Data Tables

### • Description Tables of the Parameter's Groups

```
v4parameters=> \d stap_config
               Table "public.stap_config"
  Attribute    |          Type          |
-----+-----+-----+
 param_name    | character varying(32)  |
 writer        | character varying(16)  |
 group_id      | integer                |
 param_id      | integer                |
 param_type    | character varying(16)  |
 divider       | double precision       |
 units         | character varying(32)  |
 event_date_time | timestamp without time zone |
 status        | boolean                |
```

The structure of configuration table for group named Status Parameters.

There is the main configuration table, which includes information about every data table, the name of the VEPP-4 control system server which is the data source, corresponding data collecting process and frame file.

Each data table has corresponding configuration table which includes next fields: parameter names, dividing factors and physical units for the values presentation, etc.



## THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

# The Database Structure

Description of the Parameter's Groups  
Data Tables

- **Data Tables** contain the measured parameters.

```
v4parameters=> \d nmr
```

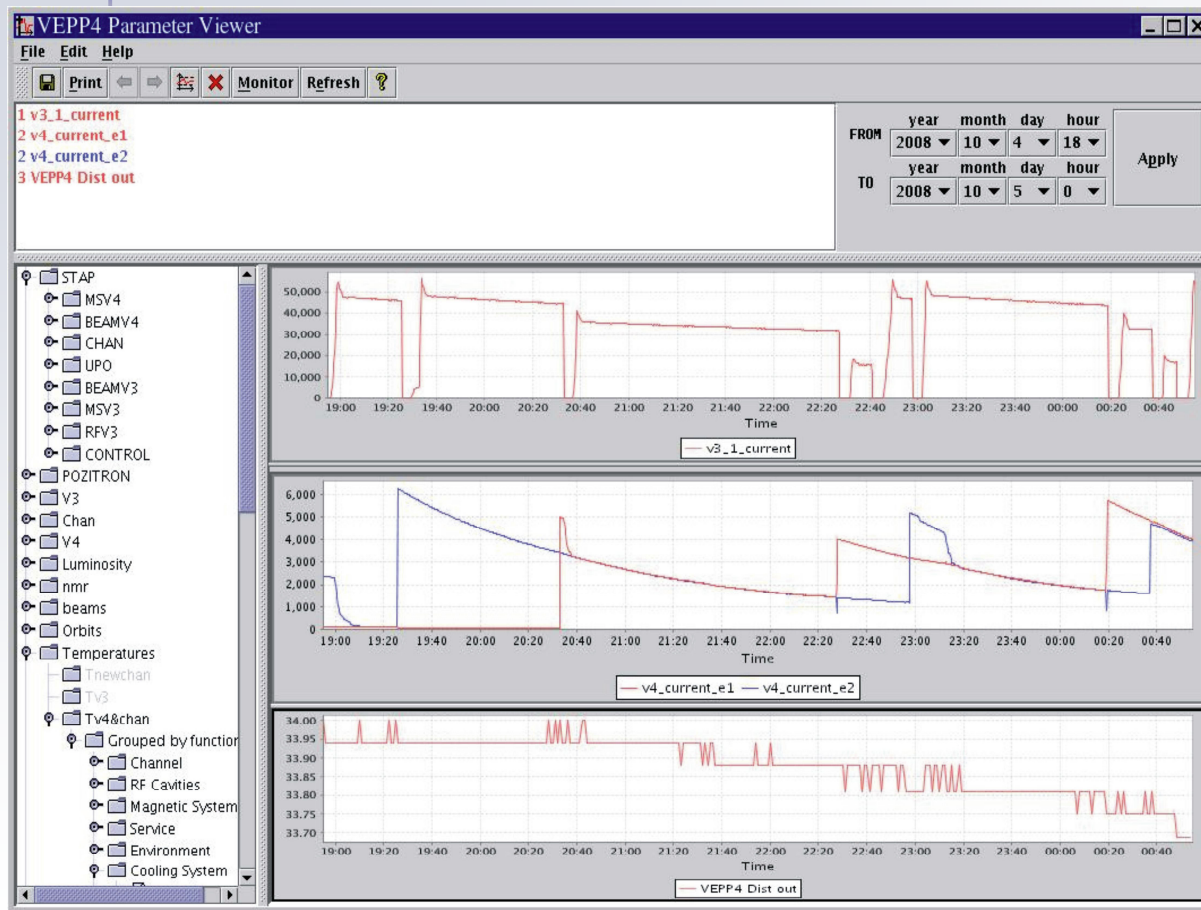
Table "public.nmr"	
Attribute	Type
date_time	timestamp without time zone
H	double precision
NEM	double precision
SEM	double precision
SIM	double precision
EM3	double precision
VEPP3	double precision
KEDR2	double precision

This is structure of short data table  
with magnetic field's measurements.



# THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

## The Graphical Interface

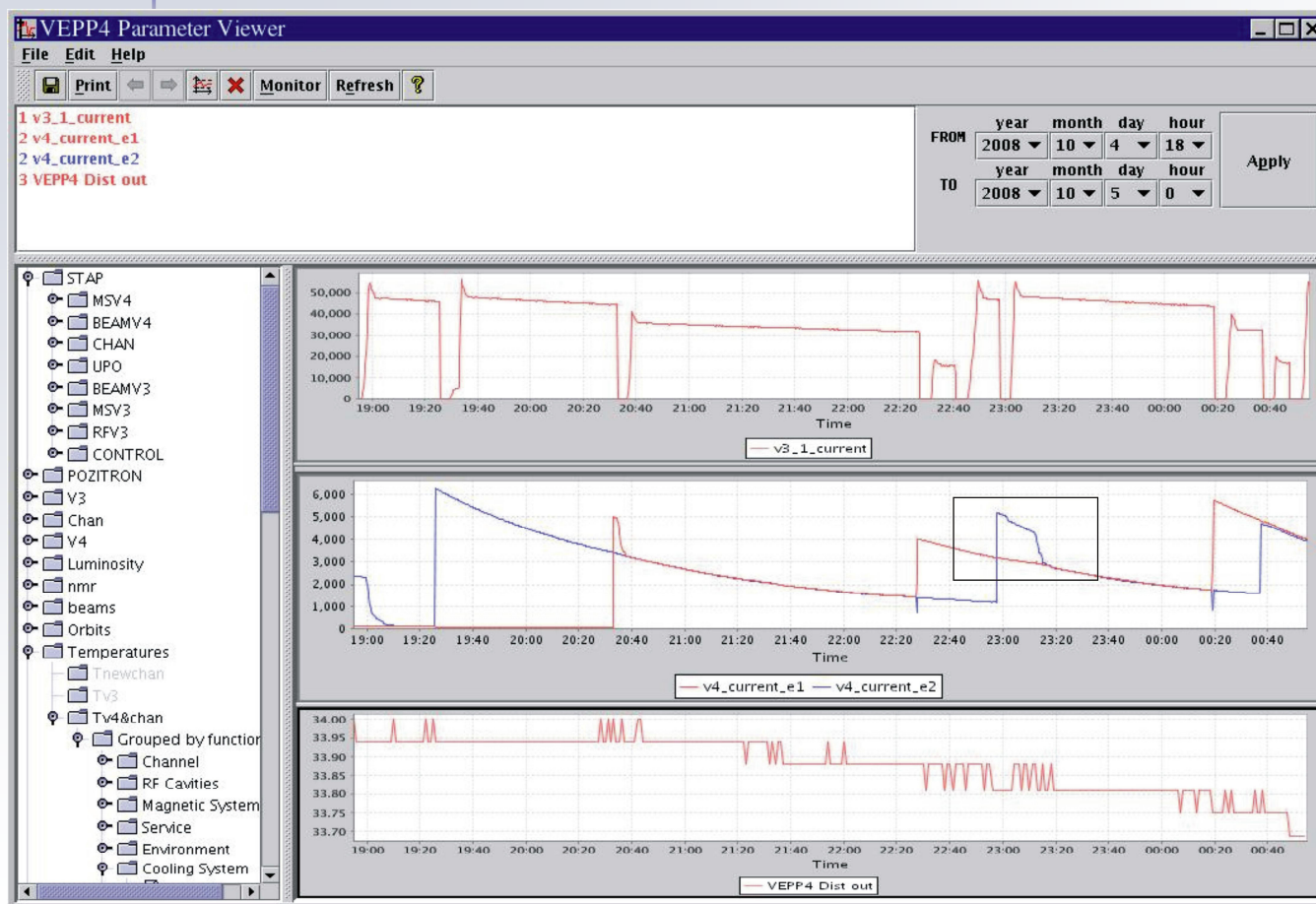


The handy graphical interface is developed for user's access to the parameters stored in the database. It provides observation of the stored data in graphical or textual form and monitoring of the parameter values. The interface allows us to observe any collection of parameters in a single or in different diagrams (in sub-windows) for any period of time. The interface provides the parameter's observation with varying time and amplitude resolution.



# THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

## The Graphical Interface

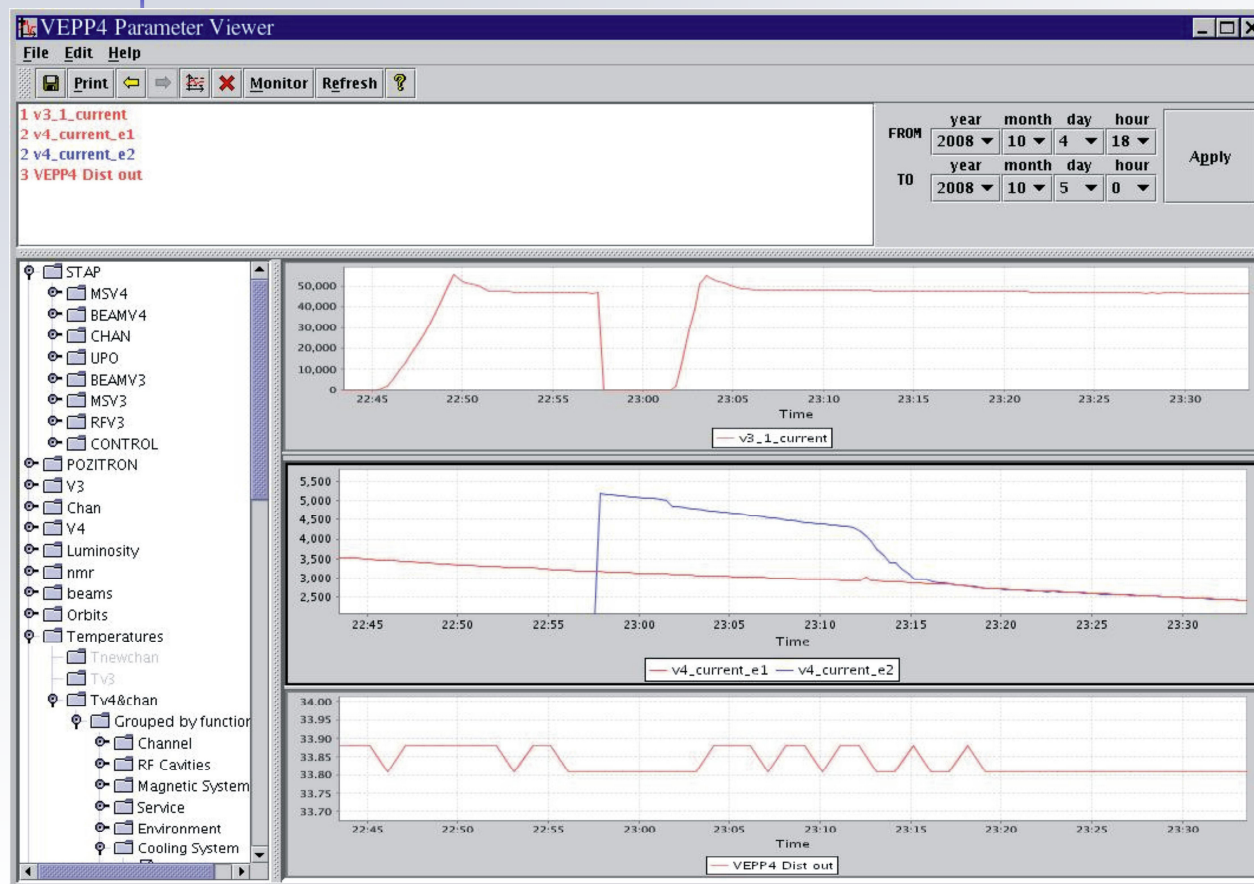


The user can select any square region of any diagram ...



# THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

## The Graphical Interface

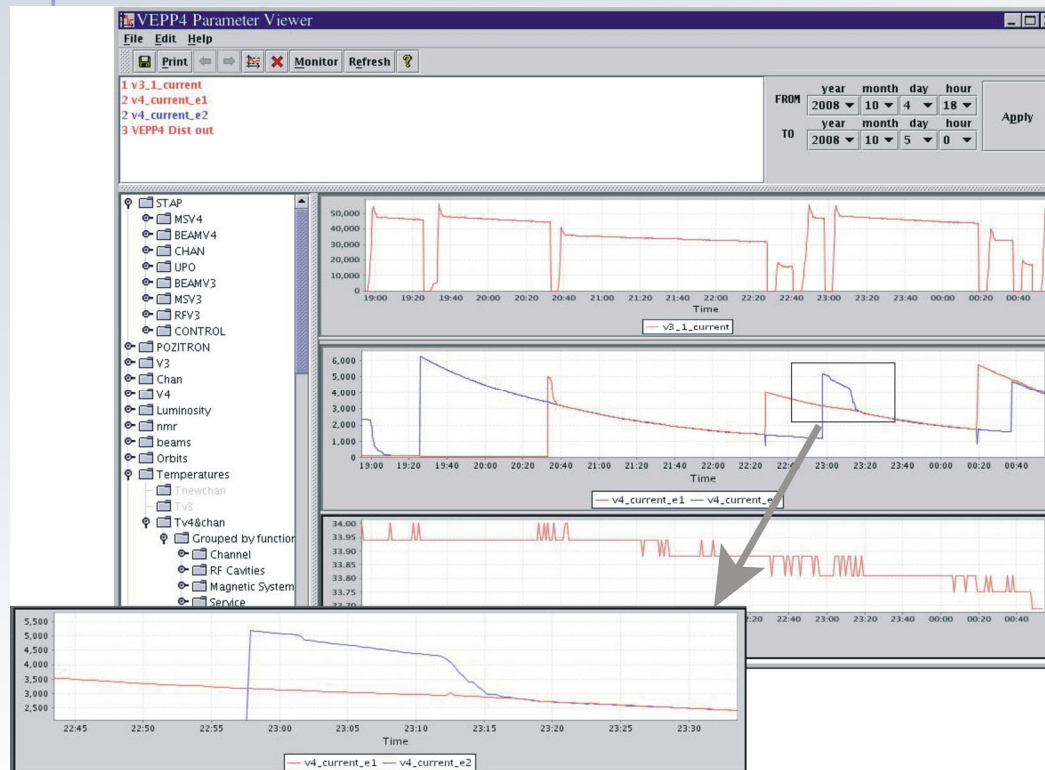


... and extend it.  
At the same time  
the other  
diagrams  
automatically change  
the scale.



# THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

## The Graphical Interface



The application is developed using client-server technique. That provides easy following to the database development.



The VEPP-4M Collider Operation in the Experiment of  
Precise Tau-lepton Mass Measurement



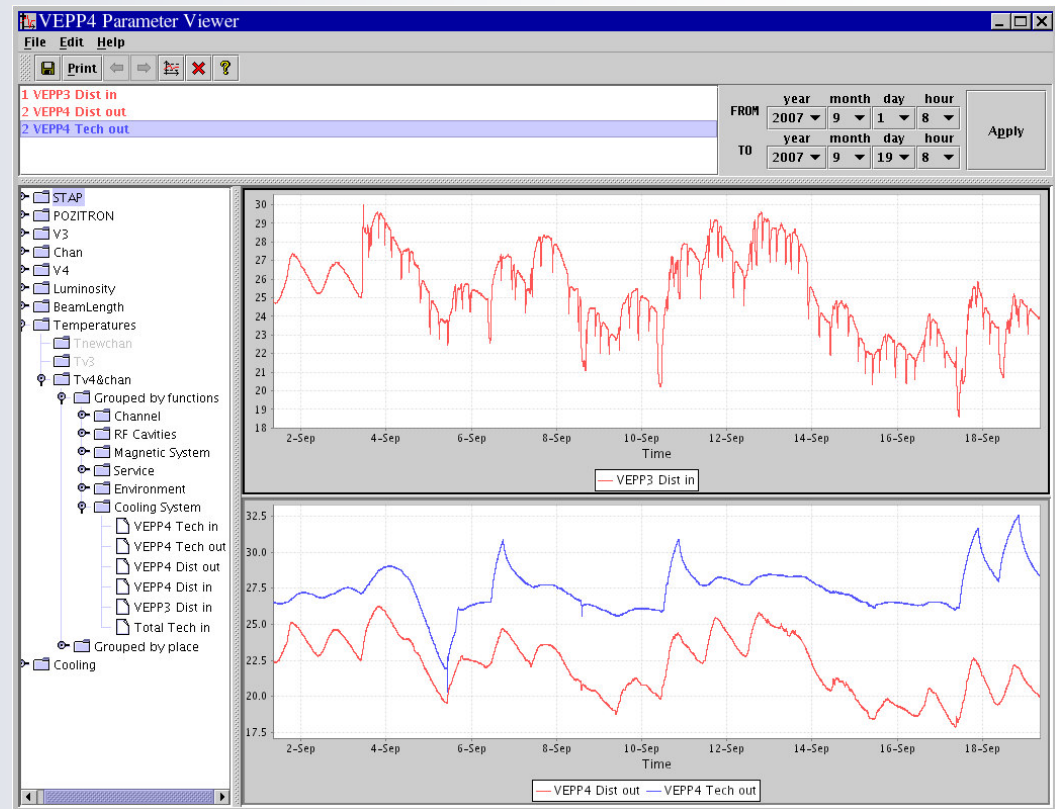
# Monitoring Parameters...



## THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

# Conclusion

- PostgreSQL database
- near 3000 parameters of beams and accelerators
- 1-second samples are available during last 24 hours
- 30-second samples are stored for 1 year
- older data are available from an archive storage
- GUI



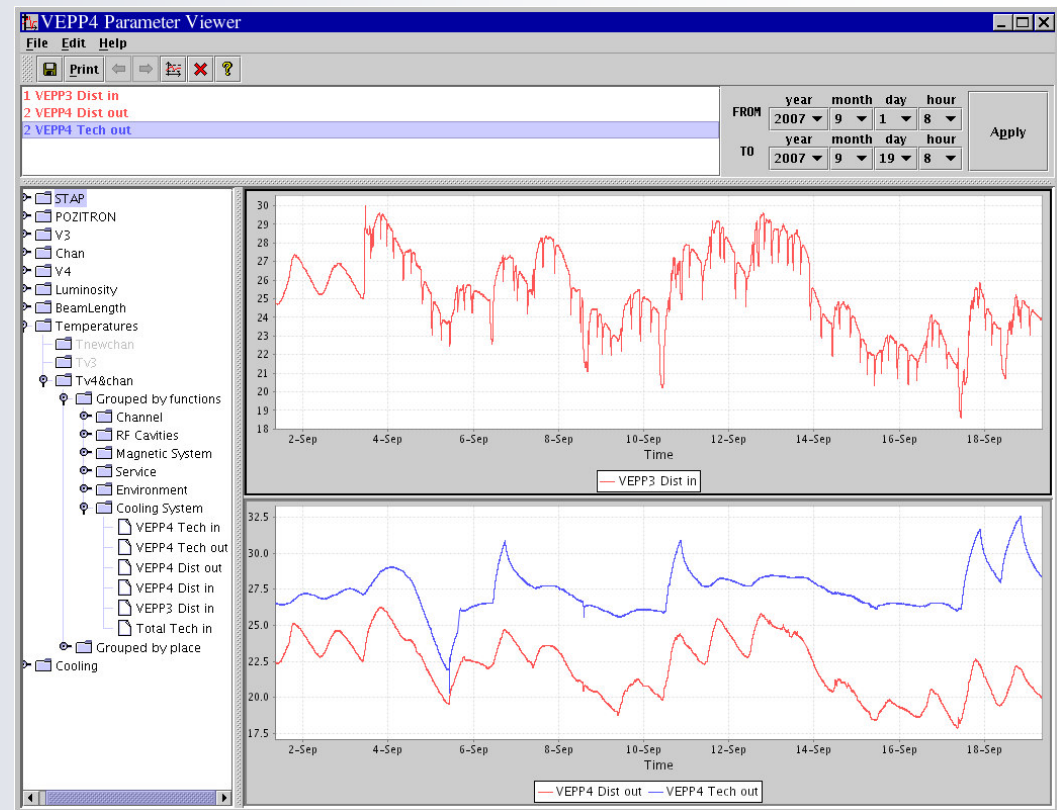


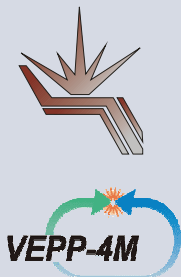
# THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

## Conclusion

Main achievements are:

- PostgreSQL database
- near 3000 parameters of beams and accelerators
- 1-second samples are available during last 24 hours
- 30-second samples are stored for 1 year
- older data are available from an archive storage
- GUI

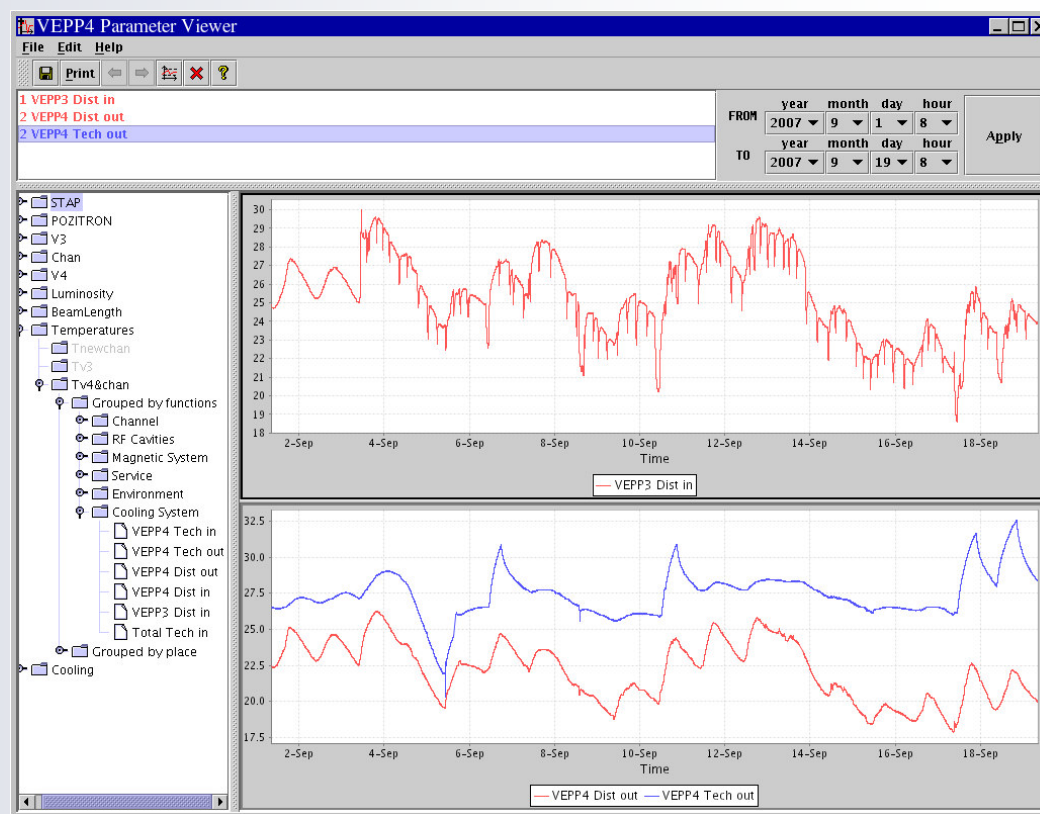




## THE DATABASE OF THE VEPP-4 ACCELERATING FACILITY PARAMETERS

# Conclusion

The database and graphical interface are used since 2006/2007 operating season. The database is used for the beam energy value calculations during the experiments on high precision tau-lepton and psi-mesons masses measurements. Also the database provides new possibilities in automation and visualization in machine operations.



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THANK YOU FOR YOUR ATTENTION!