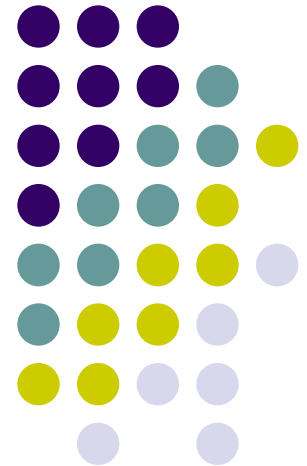


# TINE Control System Overview and Status

P. Bartkiewicz, P. Duval, S. Herb, H. Wu (DESY/ Hamburg)

and

S. Weisse (DESY/ Zeuthen)





# TINE: A Quick Tour

- Three-fold Integrated Networking Environment  
(->Keep your eye on the word “*Integrated*”)
- Mature Control System
  - CERN Isolde Spin-off (~1991)
  - All the usual central services :
    - Archive, Alarm, Naming, Security, Logging, etc.
- Small Footprint
  - TINE Kernel written in C (just like your Operating System) or Java
  - Berkeley Sockets (NO SunRPC, CORBA, or other 3<sup>rd</sup> Party dependencies !)
  - Either Single-threaded or Multi-threaded mode
- Easy to Install
- High Performance
- Plug and Play
- Scalable to very large machines !

# Large machines @ DESY



# Smaller machines ....



# Control Systems101

Control Systems (one way or another) have to deal with ...



- **Distributed** end points and processes
- **Data Acquisition** (front end hardware)
- **Real-time** needs (where necessary)
- **Process control** (automation, feedback)
- **Central Services** (Archive, Alarm, Name Resolution, ...)
- **Security** (who's allowed to do what from where?)
- **States** (Finite State Machines, sequencing, automation...)
- **Time synchronization** (time stamps, cycle ids, etc.)
- **Databases** (configuration, machine data, post-mortem data, ...)
- **Statistics** (control system itself, operation, ...)
- **Logging** (central, local, application, ...)
- **Data transport** (data flow, *control system protocol*, scalability)



# Data Flow Memes : 0<sup>th</sup> Order

Transaction-based Client-Server

- Transaction-based Client-Server
  - Client asks, server responds
  - KISS (no management tables) !
  - Suitable for *small* systems
  - Server Load:

Keep It Simple, Stupid !

Threads ?

Multi-Core ?

$$L_S \sim N_C \times N_T \times L_D \times U_T$$

$L_S$  = Load on Server/sec (CPU cycles spent)

$N_C$  = Ave. num clients

$N_T$  = Ave num transactions / client

$L_D$  = Ave Load handling a dispatch

$U_T$  = Ave update rate



# Data Flow Memes : 0<sup>th</sup> Order

Transaction-based Client-Server

- Network Load:

$$L_N \sim N_C \times N_T \times P_T \times U_T \times 2$$

Threads ?

Multi-Core ?

$L_N$  = Load on Network (bytes/sec)

$N_C$  = Ave. num clients

$N_T$  = Ave num transactions / client

$P_T$  = Ave Transaction Payload

$U_T$  = Ave update rate

2 = outgoing + incoming payloads ~equal

- Increase Scalability => Reduce the Load

Reduce any of these factors !



# Data Flow Memes : 1<sup>st</sup> Order

Contract-based Publish-Subscribe

- Contract-based Publish-Subscribe
  - Kiss **KISS** goodbye !
    - Contract and connection management
    - Transaction => managed contract + table of clients
    - Larger systems
    - Server Load :

$N_C$  (Number of Clients)  
no longer a factor !

$$L_S \sim N_T \times L_D \times U_T$$

$L_S$  = Load on Server/sec

$N_T$  = Ave num transactions / client

$L_D$  = Ave Load handling a dispatch

$U_T$  = Ave update rate





# Data Flow Memes : 1<sup>st</sup> Order

Contract-based Publish-Subscribe

- Network Load:
  - Similar, but:
    - Factor 2 gone!
    - Can use '*Send on Change*' to reduce  $U_T$
    - Can use *multicast* to reduce  $N_C$

$$L_N \sim N_C \times N_T \times P_T \times U_T$$

$L_N$  = Load on Network (bytes/sec)

$N_C$  = Ave. num clients

$N_T$  = Ave num transactions / client

$P_T$  = Ave Transaction Payload

$U_T$  = Ave update rate

- Great Benefit to Scalability!
  - BUT: API can still allow inefficiency !
  - AND: Who is doing the programming ?

# Data Flow Memes : 2<sup>nd</sup> Order



## Contract-Coercion

- Analyze the transaction request
  - Map to an existing contract if possible
  - Anticipate future requests and renegotiate the contract with the client
    - e.g. “if he’s asking for BPM#1, then he’ll probably want BPM#2 as well”
  - Guide synchronous and asynchronous acquisitions
    - Don’t monitor ‘static data’
    - Don’t synchronously poll monitorable data.
    - Trap ‘foolish’ update intervals
  - KISS is a distant memory
- Briefly review 3 Control System Architecture Models ...

# Control System Models

(a review)



- Model I: Database Model
  - **EPICS**, **VISTA** (i.e. VSystem not the OS)
  - Control system data are *elements in a database*.
  - Transfer *Process Variables*
    - pvData have names
    - Actions are 'get', 'set', 'monitor'
  - BUT: Some things aren't variables at all !
    - e.g. command and calls

# Control System Models

(a review)



- Model II: Device Server Model

- TANGO, DOOCS, ACS, STARS\*, TINE\*
- Elements are controllable objects managed by a device server.
- Instance of such an object is a *device*, with a hierarchical name.
- Actions pertaining to a device given by its *properties* !
  - i.e. *get*, *set*, *monitor*, *call* some *property* OR *command*
- BUT: some things aren't devices !
  - e.g. "\*" is NOT a device.
- AND: some services are *Property-orientated* !

# Control System Models (a review)



- Model III: Property Server Model
  - STARS\*, TINE\* (maybe ACS?)
  - Elements are *services* with *properties* (or methods)
  - Same basic hierarchy as Device Server Model
  - Properties have Keywords
    - (instead of Devices having Properties)
  - e.g. Middle layer services
    - Name Server
    - Central Alarm Server
    - Central Archive Server
    - CDI Server
    - etc.
  - BUT: Not everything divides cleanly into *Device Server* or *Property Server*!



# TINE Data Types

- Primitives (byte, short, int\*, long\*, float, double, char\*)
- Fixed-length Strings (“NAME16”, “NAME32”, “NAME64”, ...)
- Doublets (FLTINT, “INTINT”, “DBLDBL”, “NAME32INT”, ...)
- Triplets (“FLTINTINT”, “NAME16FLTINT”, ...)
- Quadruplets (“FLTINTINTINT”, “INTINTINTINT”, ...)
- Specials (“USTRING”, “UNAME”, “SPECTRUM”, “IMAGE”, “HISTORY”, ...)
- Bitfields :
  - CF\_BITFIELD8, CF\_BITFIELD16, CF\_BITFIELD32, CF\_BITFIELD64
    - Data type: DBITFIELD
    - Bitfield Registry
- **User-defined “Tagged Structures” !!!**
  - Structure registered at both ends (client, server)
    - Client can ‘discover’ structure fields !

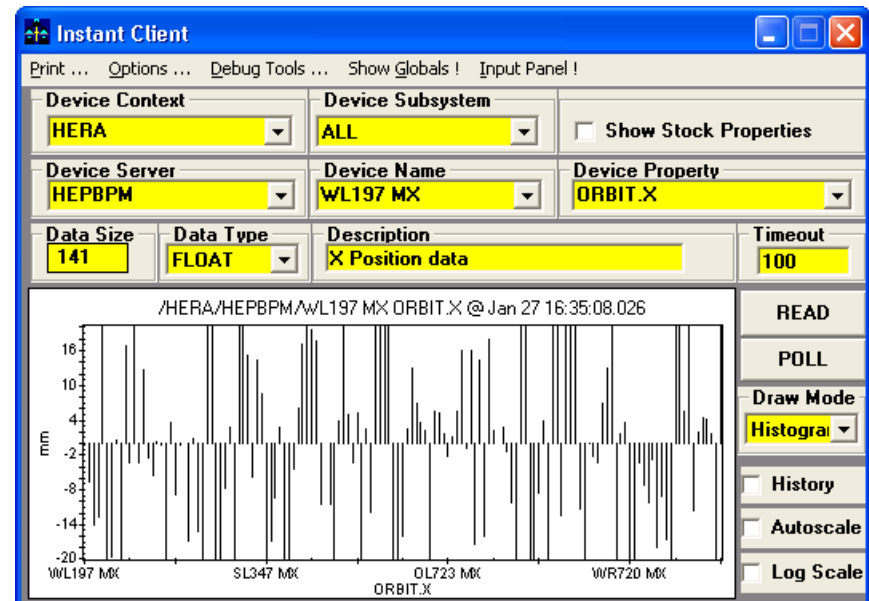


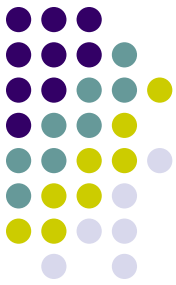
# TINE Naming Convention

- Hierarchical
- Device is specified by :
  - **Device Context** (*Facility* in DOOCS, *Domain* in TANGO)
  - **Device Server** (or **Group**) (*Device* in DOOCS, *Family* in TANGO)
  - **Device Name** (*Location* in DOOCS, *Member* in TANGO)
- Data endpoint is specified by:
  - **Property** (*Property* in DOOCS, *Attribute/Command* in TANGO)
    - Are really 'methods' or 'calls'

Engineer's View or Machine Physicist's View

Note: **Device Subsystem** is not part of the name space, but is a browseable element!





# TINE Address Redirection

## Device Redirection

The screenshot shows the Instant Client interface with the following settings:

- Device Context: TTF
- Device Subsystem: ALL
- Device Server: QUAD
- Device Name: Q9ACC3
- Device Property: BITS2AMPS
- Data Size: 1
- Data Type: FLOAT
- Timeout: 100

The main window displays the command: `/TTF/QUAD/Q9ACC3 BITS2AMPS @Jan 27 12:28:54.013` and the response: `( 0 ) 3.662221E-03`.

A dialog box titled "Front End Information for : TTF/QUAD" is open, showing the following details:

- Device Server : QUAD -> TTMAG1-19
- Local equipment module name : QUAD -> TCPDAT
- Front End Computer (FEC) name: TTFMAG1 -> TTMAG1-19
- Property : BITS2AMPS -> BITS2AMPS
- IP Address: 131.169.147.189
- IPX Address: 000000000000[00000000]
- Port Offset: 0
- Host Computer: accsottfmag2.desy.de

An arrow points from a yellow callout box to the dialog box.

Some registered devices are not handled directly by "QUAD" !

Wildcard calls (e.g. /TTF/QUAD/\*/BITS2AMPS) still work !

PH Property Redirection (e.g. "Orbit.X.ARCH" -> central archive server)



# TINE ENS: Plug and Play



I want to be known  
to the system as  
“BPM.P” in the  
context “HERA”



Does BPM.P already exist for HERA?

-> **Yes** : Is same address as already  
registered?

-> **Yes: Accept** and increment reboot count

-> **No**:

Is the currently listed BPM.P for HERA  
running ?

**Yes : Refuse** and send “in-use” message

**No : Accept** and update database

-> **No : Accept** and update database

Equipment Name Server (ENS)

- Forward accepted requests to secondary name servers

# Plug and Play (joining a group)



I want to be known to the system as “**ERF.WL**” in the context “**HERA**” and join the group “**EHF**”

- ERF.WL registers with ENS as before
- ERF.WL registers group EHF with GENS  
Does group EHF exist ?

**Yes:**

Is ERF.WL a member?

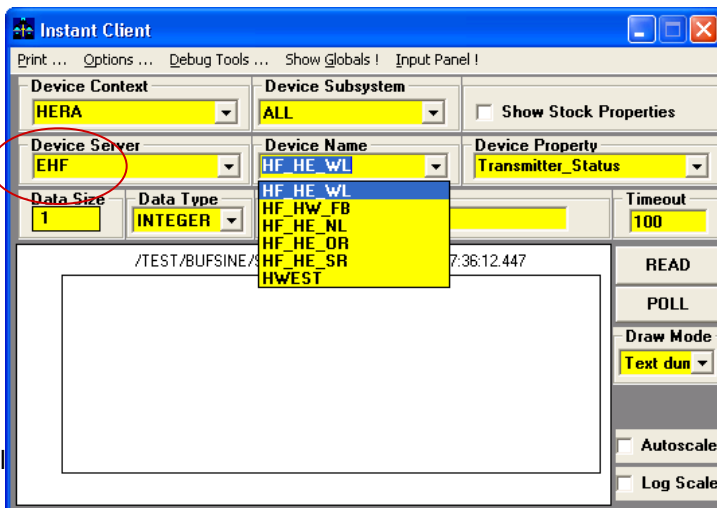
**Yes:** Update device list if different

**No:** join group

**No:**

Create Group and register Group as Server in Context HERA with the ENS

- Clients see a “Server” called “EHF”
- Selected Device is redirected to the appropriate physical server.



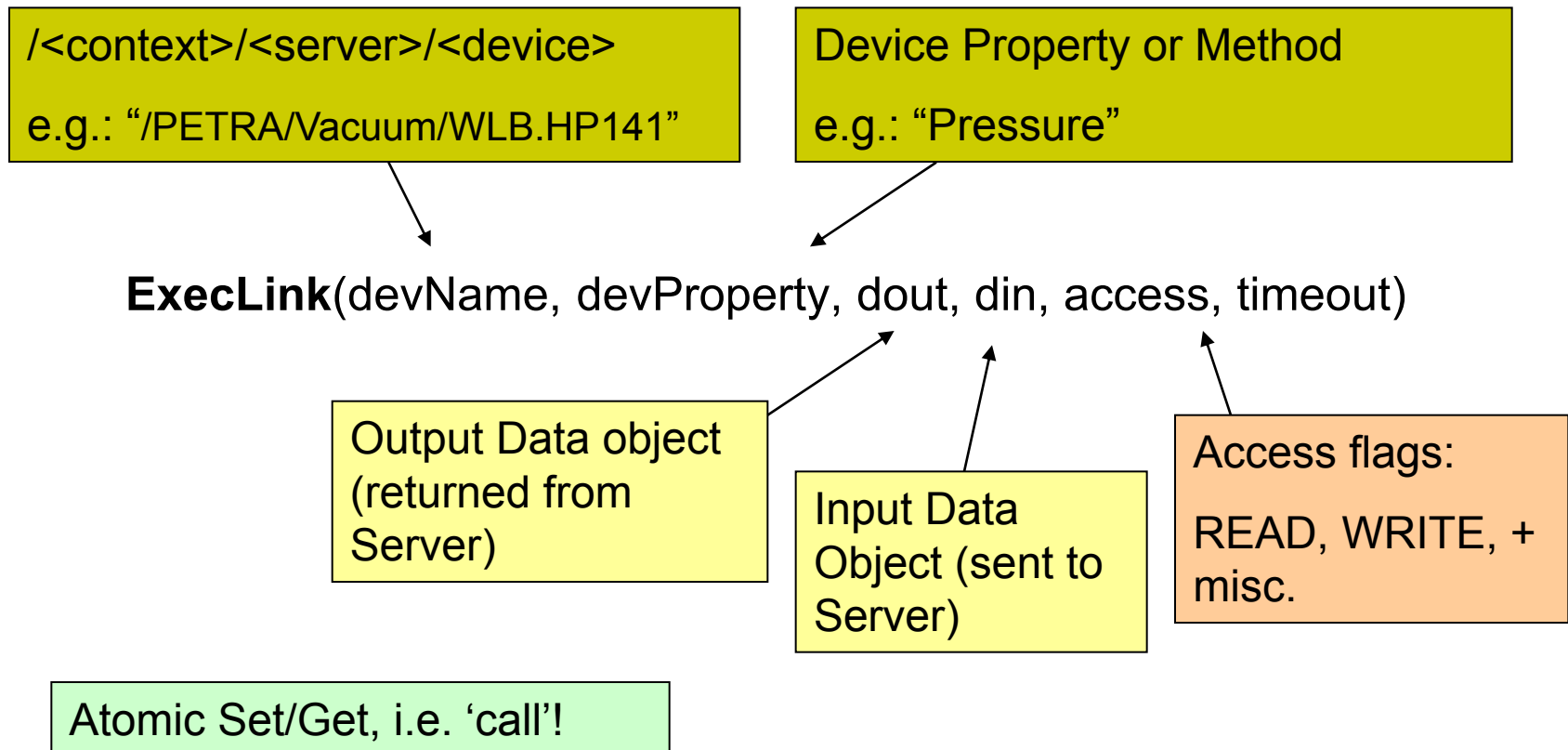


# TINE Client API ...

- Fundamental API is :
  - Link based and Not Channel based !
  - Narrow Interface
  - **NOT** 'get', 'set', and 'monitor' !!!
  - Think of 'calls' a la RPC or RMI ...
  - Synchronous data acquisition
  - Asynchronous data acquisition
    - Callbacks, events

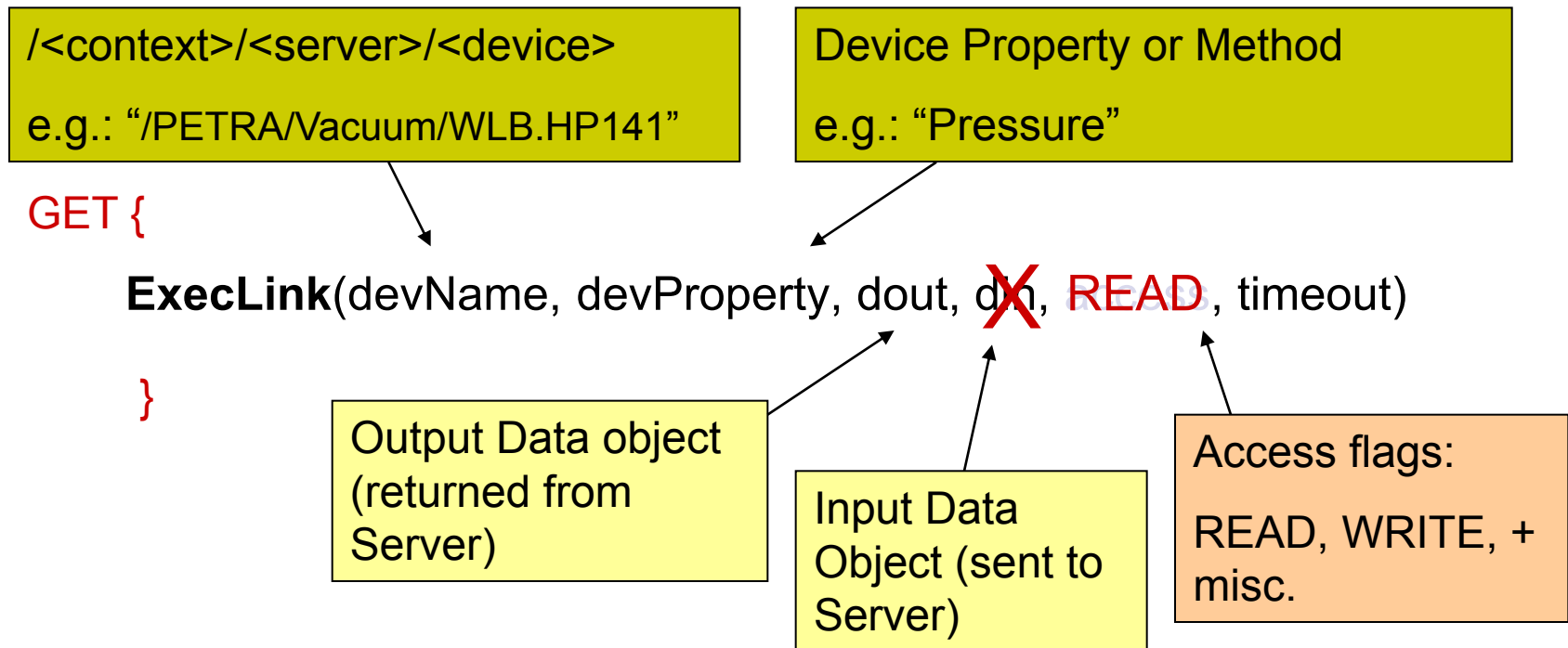
# Client API: Synchronous Calls

(schematic API ...)



# Client API: Synchronous Calls

(schematic API ...)





# Client API: Synchronous Calls

e.g. A call to the orbit correction server:

din = tagged struct with optics, current orbit, beam parameters;

dout = tagged struct with new optics, projected corrected orbit;

**ExecLink**("/SERVICE/ORBCOR", "EFFCOR", dout, din, READ, 1000)

e.g. "Command" Properties: "RESET", "INIT", "START", ...

**ExecLink**("/HERA/Transfer/P", "STOP", NULL, NULL, WRITE, 1000)

# Client API: Asynchronous Calls

(schematic API ...)



Analogous to synchronous parameters ...



**AttachLink**(devName, devProperty, dout, din, access, pollrate,  
void (\*callback)(int,int), callbackID, mode)

Callback with callback id  
and status code ...



DATACHANGE  
TIMER  
**SINGLE**  
**EVENT** (scheduled)  
NETWORK  
GROUPED  
WAIT  
+ ...

# TINE API

## (Application Programmer's Interface)



- C, C++
- VB
- ActiveX
- Java
- C#, VB.NET
- Command line scripts
- Python, Perl Bindings
- Plus ...



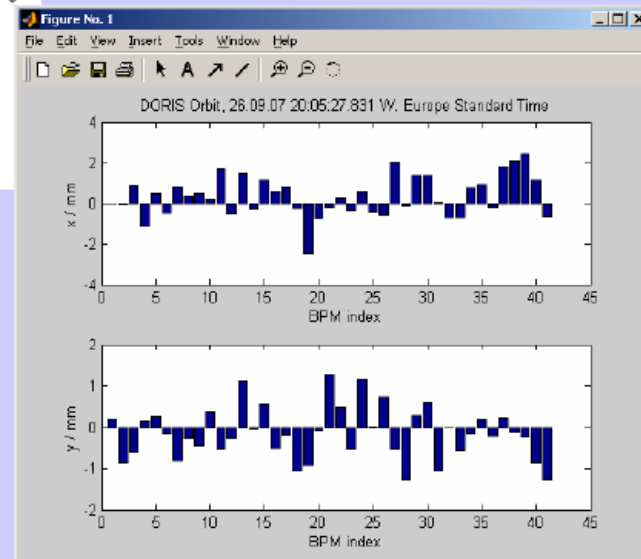


# TINE and MatLab ...

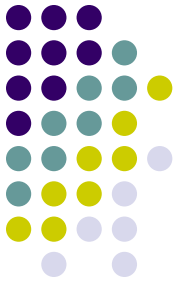
## Example: DORIS Orbit

Simple script ("M-file") to read and plot the DORIS orbit

```
val = tineread('/DORIS/DOORBIT/#0 [ORBIT]');  
  
figure(1)  
subplot(2,1,1)  
bar(1:41, val.ORBITE(2:42))  
xlabel('BPM index')  
ylabel('x / mm')  
title(['DORIS Orbit, ' val.timestamp])  
subplot(2,1,2)  
bar(1:41, val.ORBITE(44:84))  
xlabel('BPM index')  
ylabel('y / mm')
```



# TINE and LabView ...



HelpOnTinePolymorphicVIs.vi Block Diagram \*

File Edit View Project Operate Tools Window Help

13pt Application Font

There are only 4 Library's  
Client Get & Client Put  
Server Pull & Server Push

You should mostly use the Top- Level VI's: `lvTine_xxxx_AnyType.vi`

`lvTineClnGetAnyType.vi`   `lvTineClnPutAnyData.vi`   `PullAnyData.vi`   `PushAnyData.vi`

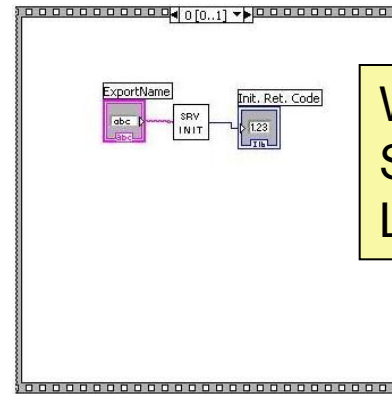
You'll then get an instance of one of the VI's above, which will morf according to the pin connections.

CLN GET STR	CLN GET [STR]	CLN PUT STR	CLN PUT [STR]	SRV PULL String	SRV PUSH String
CLN GET SHORT	CLN GET [SHORT]	CLN PUT SHORT	CLN PUT [SHORT]	SRV PULL SHORT I16	SRV PUSH SHORT I16
CLN GET SHORT I32	CLN GET [SHORT I32]	CLN PUT SHORT I32	CLN PUT [SHORT I32]	SRV PULL SHORT I32	SRV PUSH SHORT I32
CLN GET LONG	CLN GET [LONG]	CLN PUT LONG	CLN PUT [LONG]	SRV PULL LONG I32	SRV PUSH LONG I32
CLN GET LONG I64	CLN GET [LONG I64]	CLN PUT LONG I64	CLN PUT [LONG I64]	SRV PULL LONG I64	SRV PUSH LONG I64
CLN GET SINGLE	CLN GET [SINGLE]	CLN PUT SGL	CLN PUT [SGL]	SRV PULL SINGLE	SRV PUSH [SGL]
CLN GET DBL	CLN GET [DBL]	CLN PUT DBL	CLN PUT [DBL]	SRV PULL DBL	SRV PUSH [DBL]

**Example:**

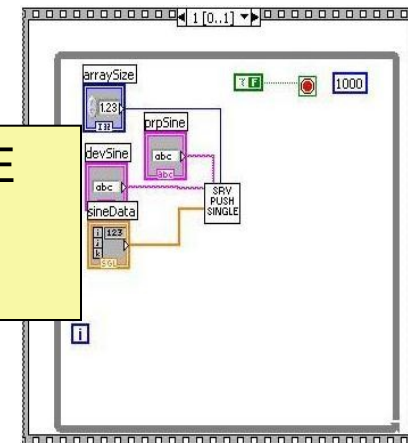
Here you should simply edit the constant "Representation" ==>>> . Thus change to I16; I32; SGL or DBL. You'll then see how the VIs change.

It's also possible to convert to String. However, note that there are currently no String- Arrays available. Hence the corresponding sub VIs are indeterminant.

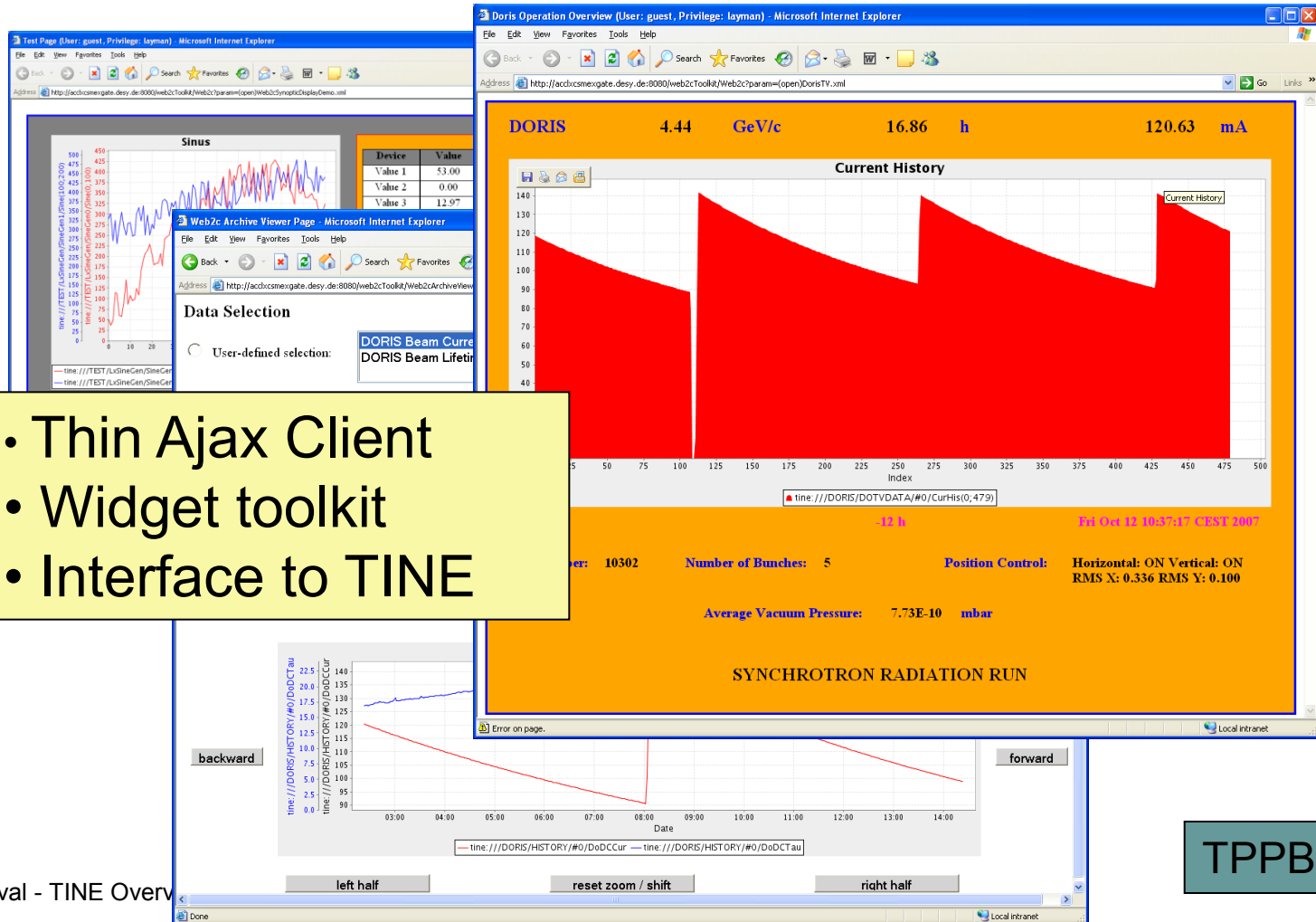
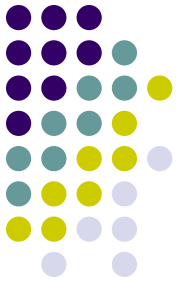


Write TINE Servers in LabView !

Write TINE Clients in LabView !



# TINE and Web Tools (Web2C: Web-based Controls Client)



- Thin Ajax Client
- Widget toolkit
- Interface to TINE



# TINE Device Layer

- “Do it yourself” + your hardware API
  - Use those Windows drivers your hardware comes with!
  - You’ve already got a stand-alone system: how do you connect it to the control system?
- EPICS IOCs (asyn drivers) + Epics2Tine
- LabView VIs + TINE LabView
- DOOCS + DOOCS API
  
- **CDI** (Common Device Interface) !!!
  - Bus plugs for CANOpen, SEDAC, RS232, SiemensPLC, TwinCatADS, Libera, ... (asyn?)
- **TICOM** (TINE CanOpen Manager)

# TINE Archive System

(lickity split data retrieval !)

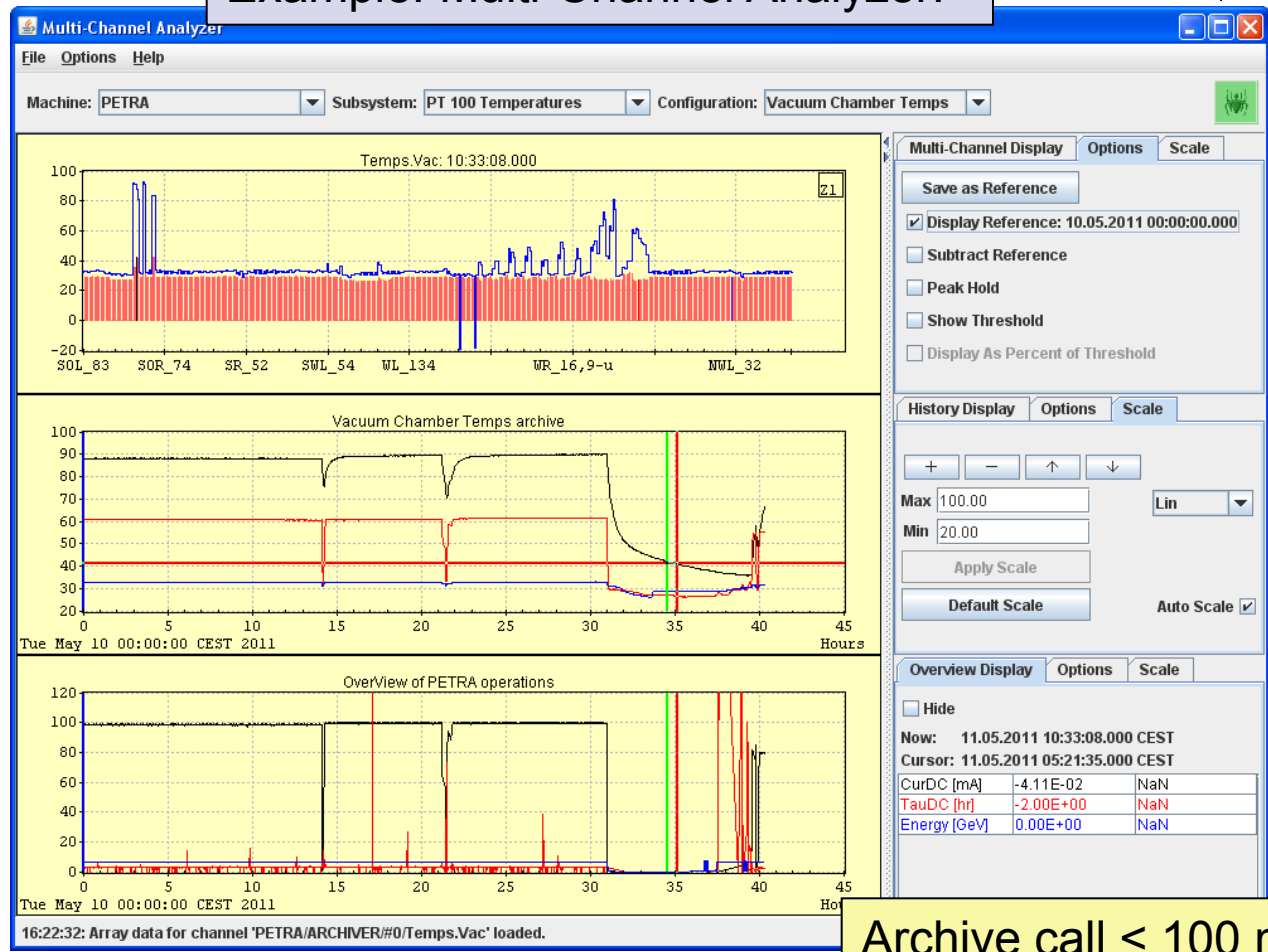


Example: Multi-Channel Analyzer:

All temperatures as "snapshot" (vs. selected reference)

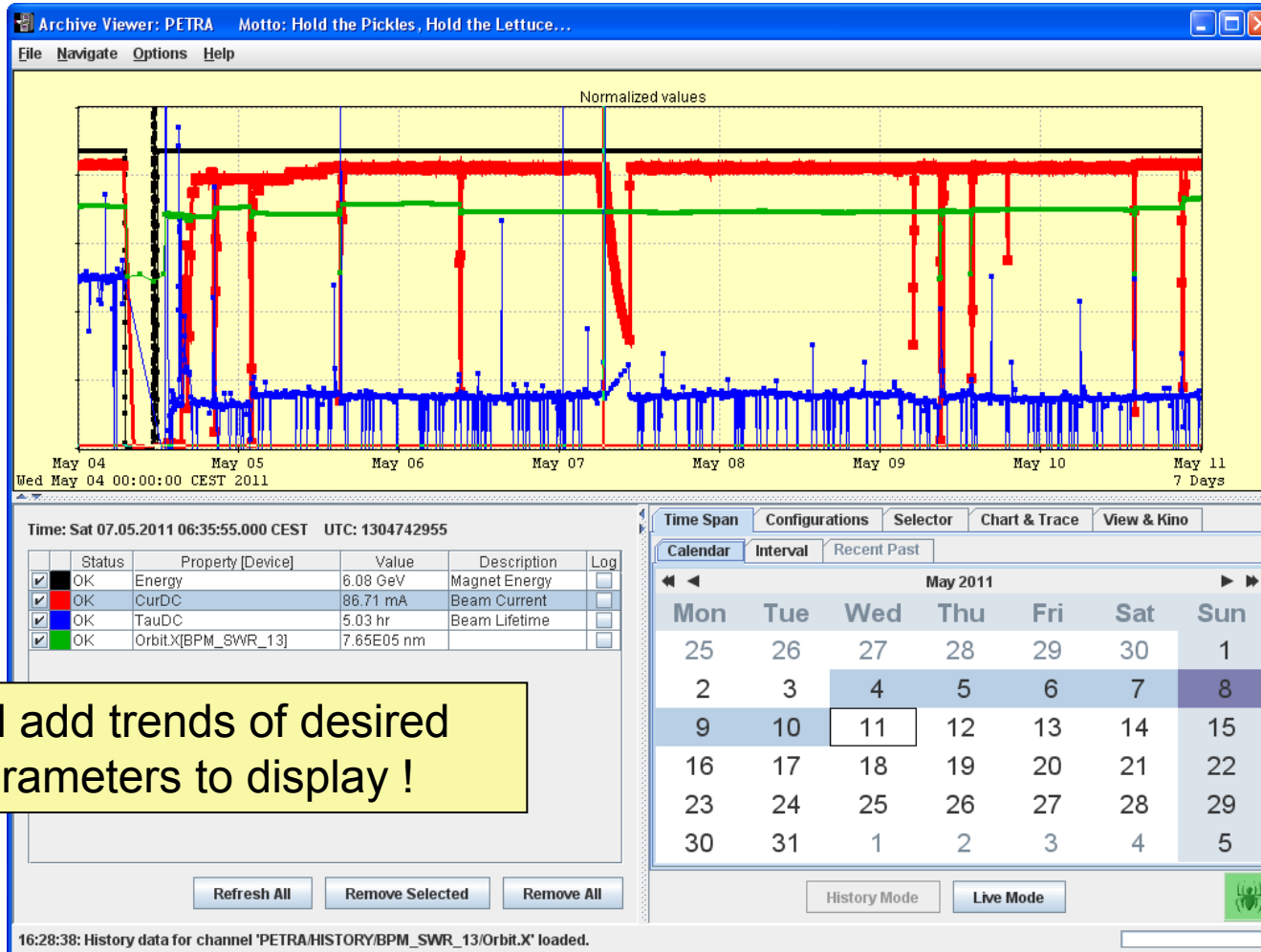
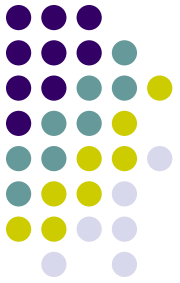
Histories of selected sensors:

Histories of machine operation parameters:



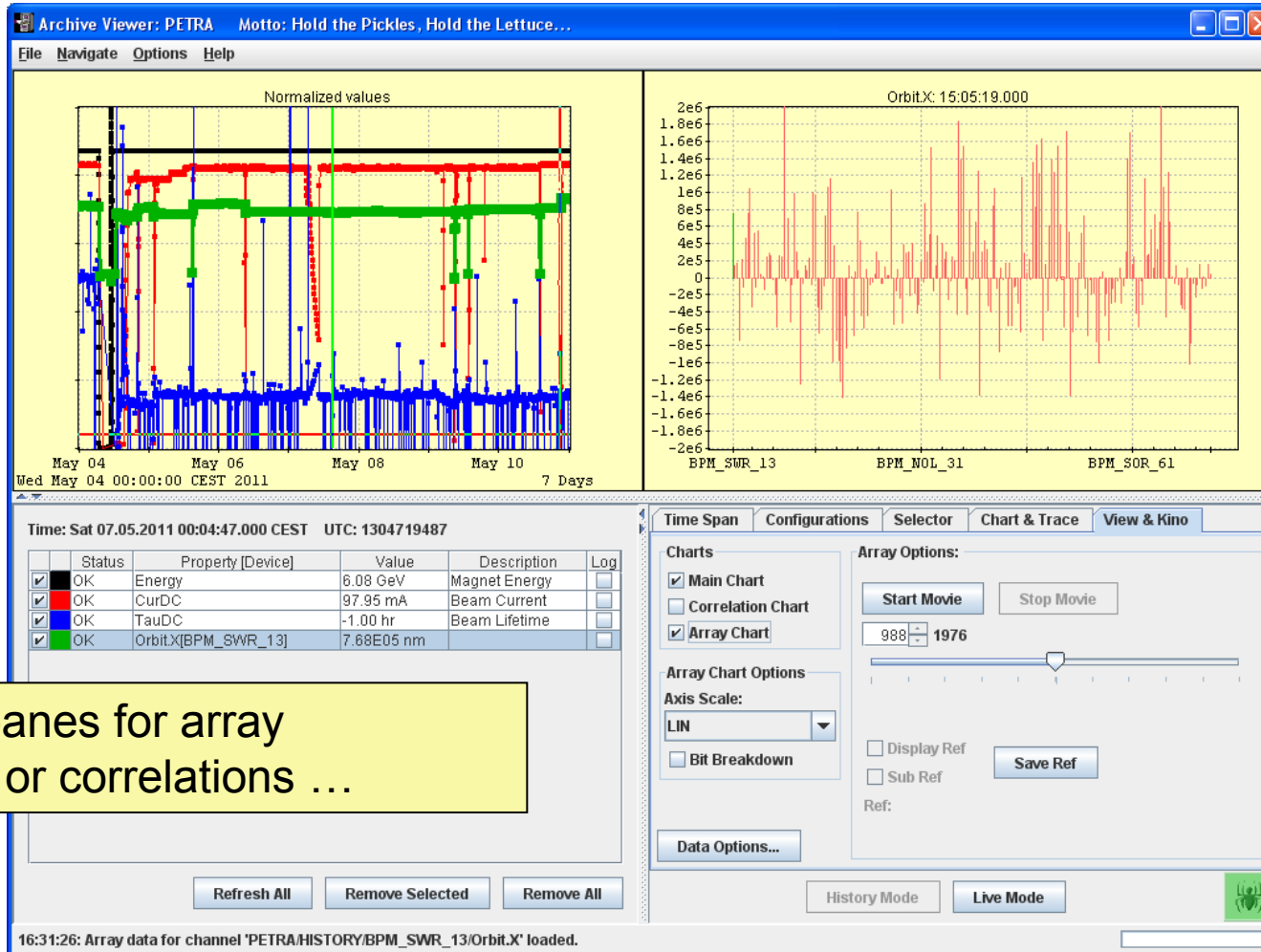
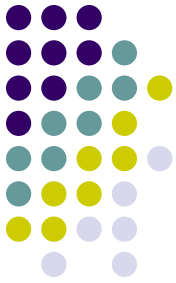
Archive call < 100 msec

# TINE Archive System



Browse and add trends of desired machine parameters to display !

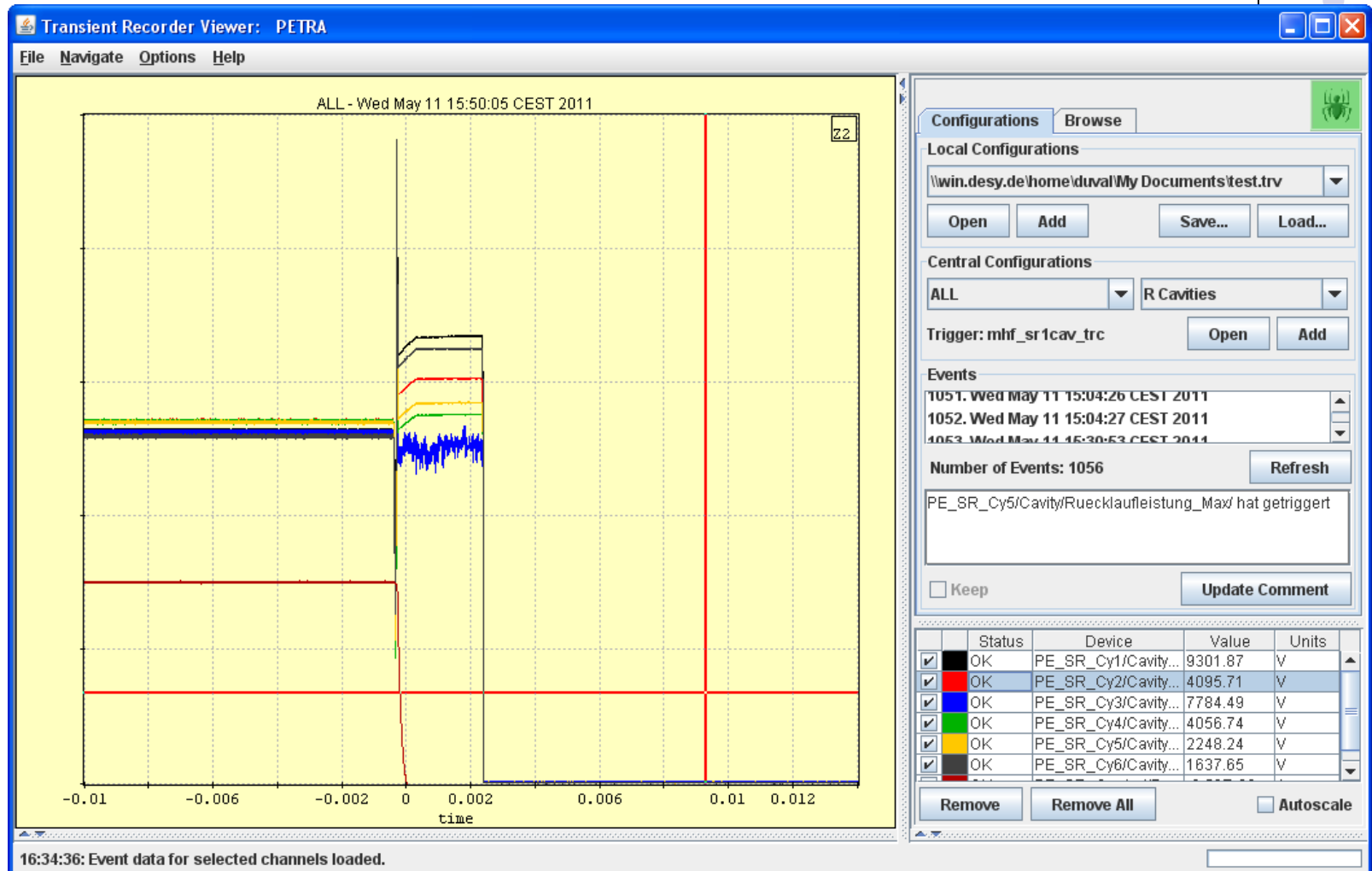
# TINE Archive System



Add other panes for array 'snapshots' or correlations ...

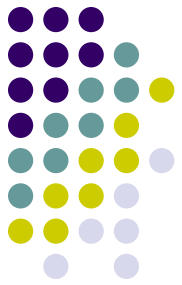
# TINE Archive System

(post-mortem and events ...)





# TINE Alarm System



## Compact Overview

Alarm Viewer: REGAE

File View Options Navigate Help

Context: REGAE

Fatal	Error	Warning	Alarm Display
0	0	6	<input checked="" type="radio"/> Live <input type="radio"/> Archive

Wed May 11 16:40:12 Warning Severity >= 0 Selected/Total No. of Alarms: 6/6 Active Alarms Only

Magnets	0 0 0	Beam Dump	0 0 0	System	0 0 0
Ref. Magnets	0 0 0	Feedback	0 0 0	Hardware	0 0 0
RF	0 0 0	Timing	0 0 0	Services	0 0 0
Vacuum	0 0 6	Diagnostics	0 0 0	Alarm Server	0 0 0
Kicker/Septum	0 0 0	Collimators	0 0 0	Archive Server	0 0 0
Transfer	0 0 0			Infrastructure	0 0 0

16:40:11: Alarms loaded.

# TINE Alarm System



Detailed view:

Alarm Viewer: REGAE

File View Options Navigate Help

Context: REGAE

Fatal	Error	Warning
0	0	0

Wed May 11 16:40:12 Warning Severity >= 0 Selected/Total No. of Alarms: 6/6

Magnets	0 0 0	Beam Dump
Ref. Magnets	0 0 0	Feedback
RF	0 0 0	Timing
● Vacuum	0 0 6	Diagnostics
Kicker/Septum	0 0 0	Collimators
Transfer	0 0 0	

System	Device Name	Message	Sev	Al
Vacuum	SEK.GUN	Device error	8	Heartbea
Vacuum	SEK.DDC	Device error	8	Heartbea
Vacuum	SEK.BC	Device error	8	Heartbea
Vacuum	SEK.DISP	Device error	8	Heartbea
Vacuum	SEK.HF	Device error	8	Heartbea
Vacuum	SEK.KLY	Device error	8	Heartbea

16:40:11: Alarms loaded.

Alarm Details: Vacuum: VAC.ION\_PUMP/SEK.GUN

Property	Value
Alarm System	Vacuum
Device Server	VAC.ION_PUMP
Alarm Device	SEK.GUN
Device Text	VAC.ION_PUMP
FEC Name	lo83a999d4.1f8
Host Address	131.169.153.212
HostName	acclxrgs03b.desy.de
Location	bldg 23 rm U02 K3 (2)
Alarm Text	Device error
Severity	8
Alarm Data Text	
Alarm Tag	Device error
URL	
Code	1012
Format	4
Dimension	64
Mask	255

Alarm Descriptor	Alarm Time	Duration
Heartbeat	16:39:04.625 - May 11 CE...	40.0 min
Heartbeat	16:19:03.675 - May 11 CE...	20.0 min
New	15:59:02.645 - May 11 CE...	20.0 min
New Terminated	15:59:02.000 - May 11 CE...	2.4 min
Heartbeat Terminated	15:56:32.000 - May 11 CE...	1.7 hr
Heartbeat	15:29:31.013 - May 11 CE...	1.3 hr

Alarm Data:  
Mittlerer Druck ueber Schwelle

Close



# TINE Alarm System

Add the alarm are archived !

Alarm Viewer: REGAE

File View Options Navigate Help

Context: REGAE

Fatal	Error	Warning	Alarm Display
0	0	670	<input type="radio"/> Live <input checked="" type="radio"/> Archive

Wed May ... Warning Severity >= 0 Selected/Total No. of Alarms: 670/670 Active Ala

Magnets	0 0 0	Beam Dump	0 0 0	System	0 0 200
Ref. Magnets	0 0 0	Feedback	0 0 0	Hardware	0 0 70
RF	0 0 200	Timing	0 0 0	Services	0 0 0
Vacuum	0 0 200	Diagnostics	0 0 0	Alarm Server	0 0 0
Kicker/Septum	0 0 0	Collimators	0 0 0	Archive Server	0 0 0
Transfer	0 0 0			Infrastructure	0 0 0

Hardware, Fatal: 0, Error: 0, Warning: 70

Calendar Interval Recent Past

May 2011

Mon	Tue	Wed	Thu	Fri	Sat	Sun
25	26	27	28	29	30	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
		1	2	3	4	5

Alarm Count

The number of alarms with Severity >= 0

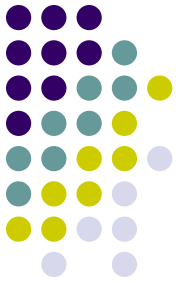
670

System	Device Name	Message	Sev	Alarm Descriptor	Alarm Time	Duration
Hardware	SysStateRead	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	SysExtCommAccessLevel	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	SysTrigPrfSet	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	SysTrigPlswthSet	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	SysTrigPrfHlim	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	PtFIIPsVoltRead	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	PtFIIPsCurrRead	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	PtDiagCtRead	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	PtDiagCvdRead	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	PtDiagCtScanRead	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec

16:44:26: Alarms loaded.

# TINE Alarm System

## (alarm analysis)



Alarm Viewer: REGAE

File View Options Navigate Help

Context: REGAE

Fatal	Error	Warning	Alarm Display
0	0	670	<input type="radio"/> Live <input checked="" type="radio"/> Archive

Wed May ... Warning Severity >= 0 Selected/Total No. of Alarms: 670/670 Active Ala

Magnets	0 0 0	Beam Dump	0 0 0	System	0 0 200
Ref. Magnets	0 0 0	Feedback	0 0 0	● Ha	
RF	0 0 200	Timing	0 0 0	Se	
Vacuum	0 0 200	Diagnostics	0 0 0	Ala	
Kicker/Septum	0 0 0	Collimators	0 0 0	Ar	
Transfer	0 0 0			Infrastructure	0 0 0

Calendar Interval Recent Past

May 2011

Mon	Tue	Wed	Thu	Fri	Sat	Sun
25	26	27	28	29	30	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

Analysis of Alarms for This Subsystem

Toggle System Selection

Reset Selection

Suspend

The number of alarms with Severity >= 0

670

System	Device Name	Message	Sev	Alarm Descriptor	Alarm Time	Duration
Hardware	SysStateRead	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	SysExtCommAccessLevel	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	SysTrigPrfSet	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	SysTrigPlswthSet	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	SysTrigPrfHlim	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	PtFilPsVoltRead	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	PtFilPsCurrRead	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	PtDiagCIRead	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	PtDiagCvdRead	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec
Hardware	PtDiagCTIScanRead	Hardware error	8	Terminated	16:10:35.420 - May 11 C...	8 sec

16:44:26: Alarms loaded.

# TINE Alarm System

## (alarm analysis)



Alarm Analysis

Order By:

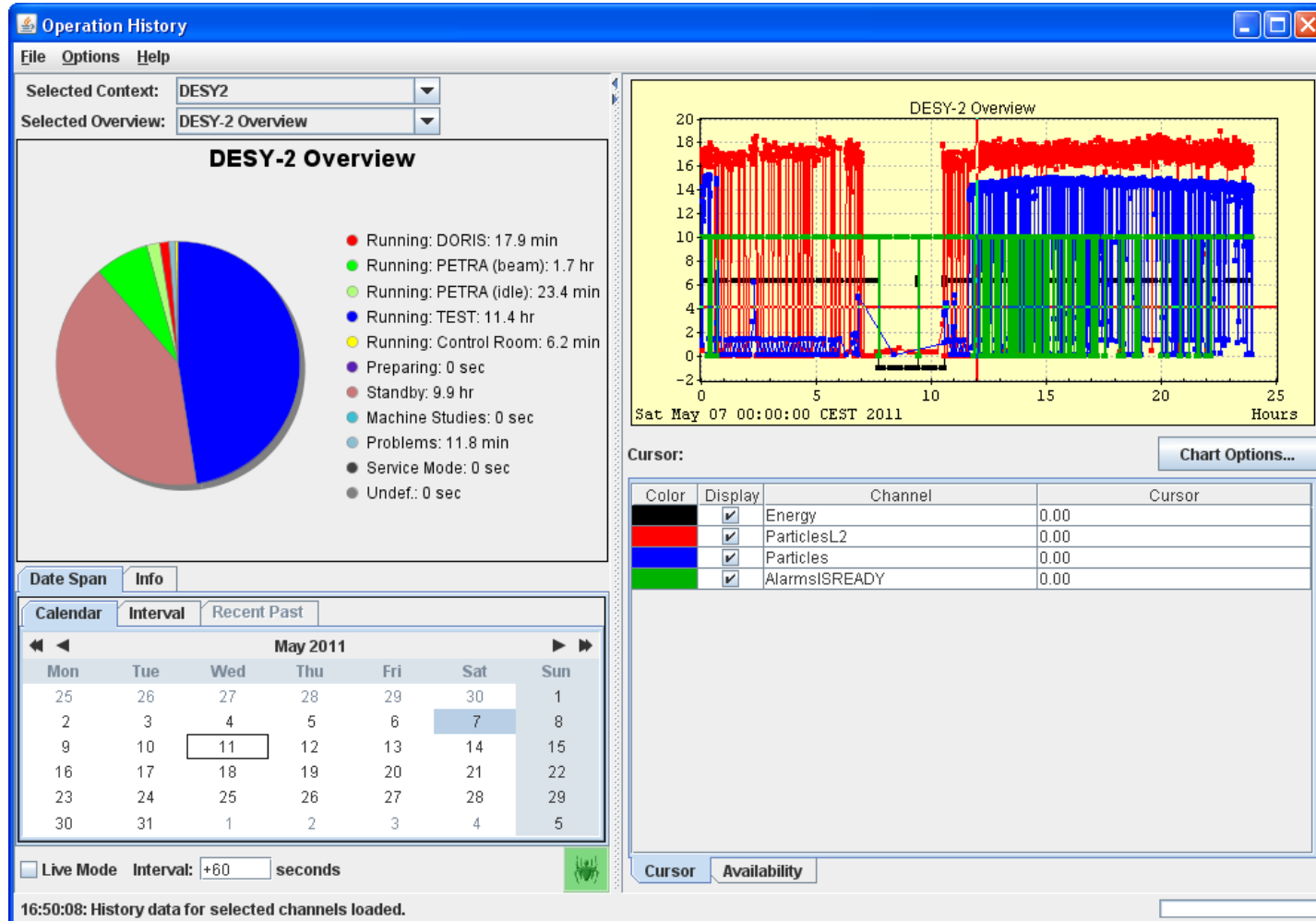
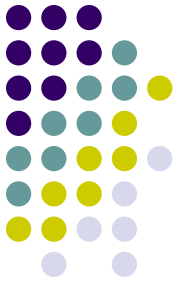
Device  Server  Code  Severity

#	Device	Server	Code	Sever..	Tag	Al. Data	Al. Data Text	Descriptor	St. Time	Duration
0	HvPs_1_CurrRe...	RF.RgModulator...	34	8	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
1	HvPs_1_HvHour...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
2	HvPs_1_StandB...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
3	HvPs_1_TrigHou...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
4	HvPs_1_VoltRead	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
5	HvPsVoltSet	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
6	PtDiagCtRead	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
7	PtDiagCtScanDe...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
8	PtDiagCtScanInc	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
9	PtDiagCtScanRe...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
10	PtDiagCtScanSt...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
11	PtDiagCvdRead	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
12	PtDiagCvdScan...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
13	PtDiagCvdScanInc	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
14	PtDiagCvdScan...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
15	PtDiagCvdScanS...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
16	PtDiagPlswthFw...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
17	PtDiagPlswthRe...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
18	PtDiagPowRead	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
19	PtDiagPrfRead	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
20	PtFilPsCurrRead	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
21	PtFilPsVoltRead	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
22	RfMagPs1CurrR...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
23	RfMagPs1VoltRe...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
24	RfMagPs2CurrR...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
25	RfMagPs2VoltRe...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
26	RfMagPs3CurrR...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
27	RfMagPs3VoltRe...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
28	RfMagPs4CurrR...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
29	RfMagPs4VoltRe...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
30	SysExtCommAcc...	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
31	SysStateRead	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
32	SysTrigPlswthSet	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (28)	hardware device descri...	Terminated	16:10:27...	8 sec
33	SysTrigPrfHlim	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec
34	SysTrigPrfSet	- -	- -	- -	Hardware error	SCANDINOVA-line1 : SCANDINOVA 0 0 0 0 (32)	hardware device descri...	Terminated	16:10:27...	8 sec

Refresh Save Close

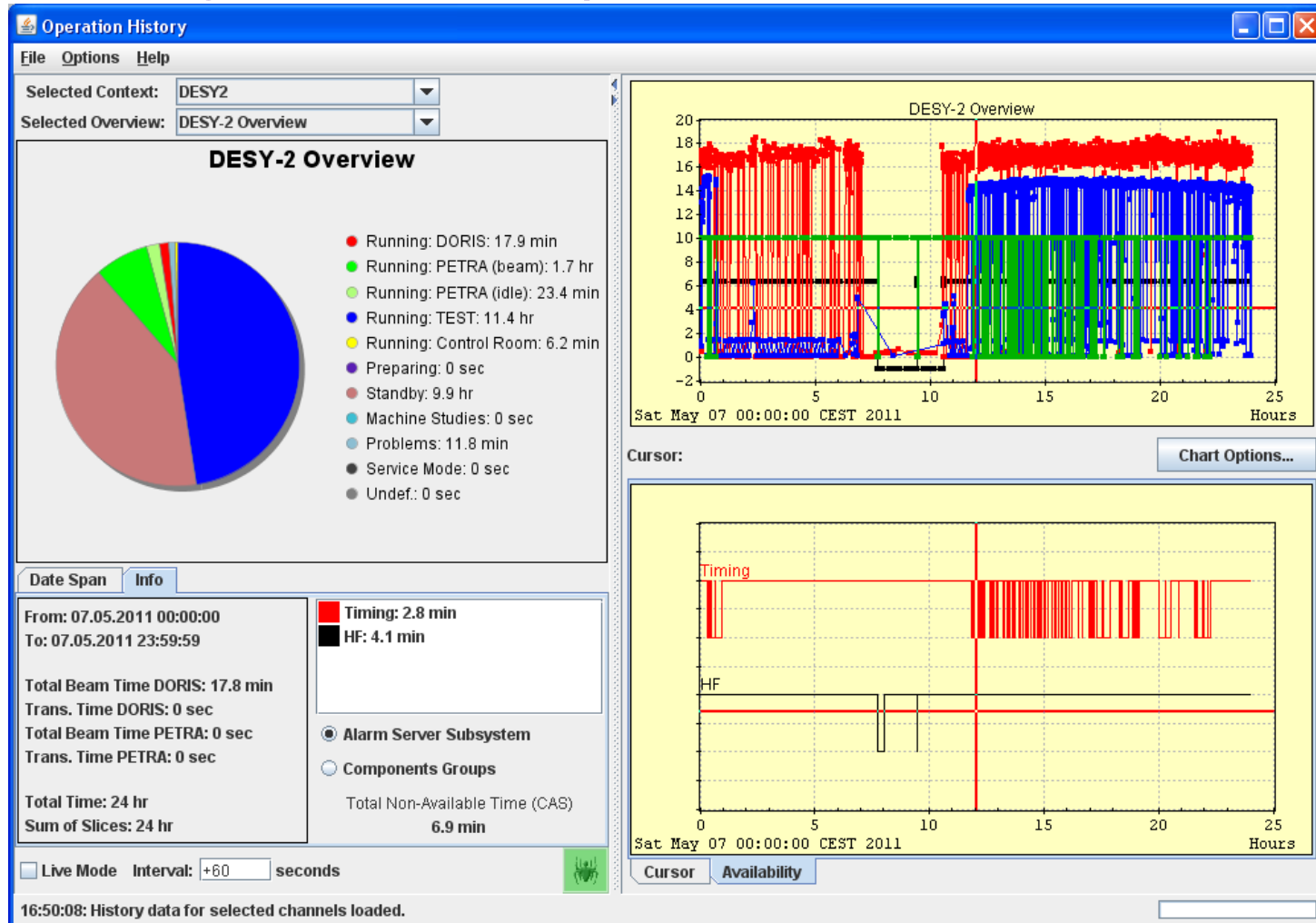
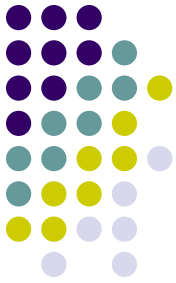
# Operations + Availability

## (typical day at DESY2 ...)

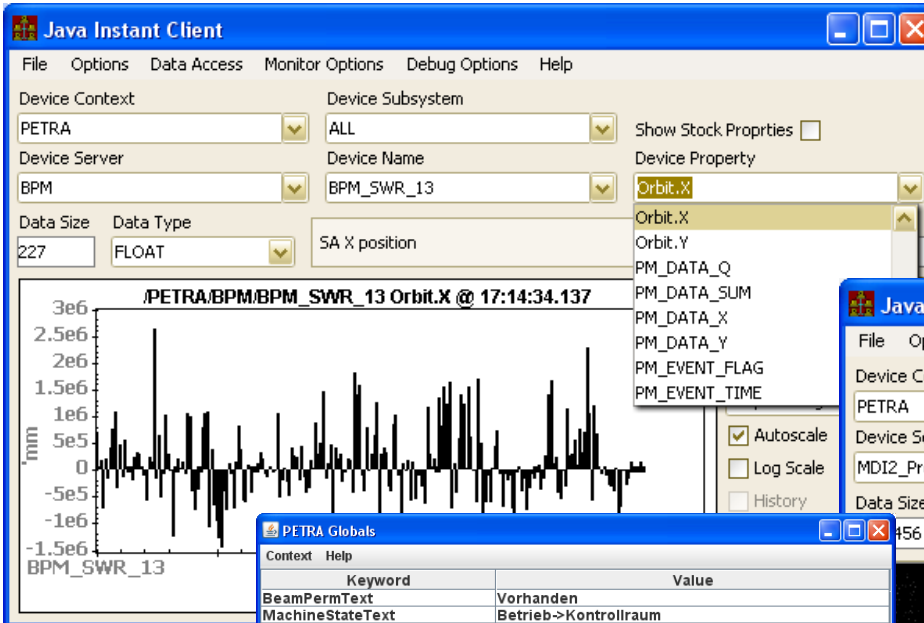


# Operations + Availability

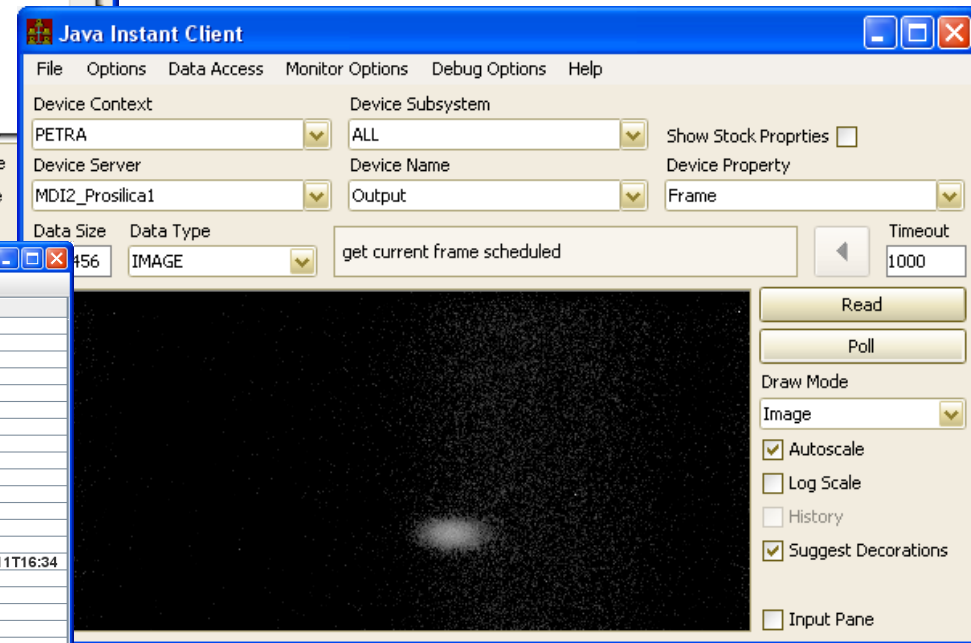
(typical day at DESY2 ...)



# TINE generic tools ....



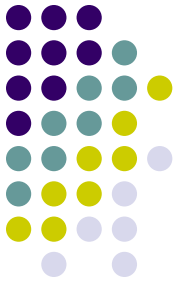
The "Instant Client" control system browser ....



TINE 'Globals Viewer'



# TINE Front End Management



**FEC Remote Control Panel**

File View Tools Help

ALARMSTATE	Mag.Group.Main-N...	PE_SR_Cy1	PET3ID11.CDI
ALMSTATE	Mag.Group.Main-N...	PE_SR_Cy2	PET3ID12.CDI
ARCHIVER	Mag.Group.Main-E...	PE_SR_Cy3	PET3ID13.CDI
BkrScopes	Mag.Group.Main-E...	PE_SR_Cy4	PET3ID14.CDI
BLM	Mag.Group.Main-E...	PE_SR_Cy5	PETRASTATE
BLM_SedL	Mag.Group.Main-E...	PE_SR_Cy6	PEVAC-W.CDI
BMS_FEC	Mag.Group.Main-E...	PE_SR_Kly1	PEVAC-SO.CDI
BPM	Mag.Group.Corr-W	PE_SR_Kly2	PEVAC-SR.CDI
Bunche_EWeg	Mag.Group.Corr-TA	PE_SR_Mod1	PEVAC-SW.CDI
BunchScope	Mag.Group.Corr-SL	PE_SR_Mod2	PEVAC-O.CDI
BunchScope.Data	Mag.Group.Corr-SO	PE_SR_TRANSMI...	PEVAC-NO.CDI
BunchScope.Control	Mag.Group.Corr-SW	PE_SR_TRNSM_L...	PEVAC-NR.CDI
BunchScope.Atten...	Mag.Group.Corr-NL	PEALARMSTATE	PEVAC-NW.CDI
CANalyzer	Mag.Group.Corr-NO	PeBeam	PiConditions
CAS	Mag.Group.Corr-NW	PeBeamLH	PiControls
CAS.ARCHIVE	Mag.Group.Corr-EXL	PeCanEwC1	PiCoPy
Cms.MagnetPs	Mag.Group.Corr-E...	PeCanEwC2	PiDisplayDeviceSt...
Cms.PsGroup	Mag.Group.Corr-E...	PeCanEwM1	PiKeyBoxes

Ping all Active: 301 of 311 (17:22:13)

Device context: PETRA

Selected Subsystems:

<input checked="" type="checkbox"/> SER	<input checked="" type="checkbox"/> DIAG	<input checked="" type="checkbox"/> HIST	<input checked="" type="checkbox"/> RF
<input checked="" type="checkbox"/> VAC	<input checked="" type="checkbox"/> TIM	<input checked="" type="checkbox"/> PINTLK	<input checked="" type="checkbox"/> MAG
<input checked="" type="checkbox"/> TRANS	<input checked="" type="checkbox"/> INJ	<input checked="" type="checkbox"/> MEX	<input checked="" type="checkbox"/> INSTR
<input checked="" type="checkbox"/> EXP	<input checked="" type="checkbox"/> VIDEO	<input type="checkbox"/> TEST	

OS Color Code: Dos Unix VxWorks VMS Win16 Win32 Java  
FEC Importance: ALL

17:22:32: Normal

Front End	OS	Address
PEMAGCMS	UNIX	131.169.151.41
Host Computer	Responsible	Location
accclxpemagorbs.desy.de	S.Herb	ldg 30 rm 103 CSR-8 (3)
Device servers	Description	
Cms.PsGroup	PE Central Magnet Server	

Ping Control Restart

Activity	Contracts	Clients	Alarms	Log File	Stats
Server					PEMAGCMS
Local Time					Wed May 11 17:22:43
Start Time					Tue May 10 22:52:03
Sys Poll Rate					50
Nr bkg tasks					0
[SRV] Nr total contracts					53
[SRV] Nr total clients					14
[SRV] PETRA/Cms.PsGroup contracts					35
[SRV] PETRA/Cms.PsGroup clients					4
[SRV] Nr UDP packets received					5906370
[SRV] Nr TCP packets received					0

FEC: "Front End Controller"



# TINE Front End Management

- The 'attachfec' utility
  - On local host: attachfec <FECNAME>
  - From remote client: attachfec "/Context/Server"

The screenshot shows a window titled "/DORIS/Idc.Main Activity" with a menu bar (Help, clients, contracts, connections, stats, modules, time, version, security) and a "Screen Buffer Size" of 1000 lines. The main area displays a list of contracts with their parameters and values.

Contract	Parameter	Value
	131.169.5.80:8050	UDP 1
	131.169.119.66:8051	UDP 4
	131.169.152.168:8054	UDP 1
	131.169.119.61:8055	UDP 1
	131.169.119.61:8057	UDP 1
	131.169.119.61:8061	UDP 2
	131.169.121.111:8054	UDP 1
	131.169.152.188:8052	UDP 8

Contract	Parameter	Value
CONTRACT	POLL	TO
[0]	IDCEQM SRVLASTACCESS <#0>	(1 elements) 30000 msecDOSPYFEC
[1]	IDCEQM Strom <#0>	(1 elements) 1000 msec DOARCALM.4
[2]	IDCEQM TauFast <Buffer-0>	(1 elements) 1000 msec BREDE
[3]	IDCEQM Tau <#0>	(1 elements) 1000 msec DOARCALM.4
[4]	IDCEQM Tau <Buffer-0>	(1 elements) 1000 msec PETRACON
		WEBADMIN
		SYSTEM
[5]	IDCEQM Strom <#1>	(1 elements) 1000 msec DOMARCHX
[6]	IDCEQM Loss <#1>	(1 elements) 1000 msec DOMARCHX
[7]	IDCEQM Tau <#1>	(1 elements) 1000 msec DOMARCHX
[8]	IDCEQM TauArray <#0>	(5 elements) 1000 msec DOARCALM.4
		DOMARCHX
[9]	IDCEQM SRVSTARTTIME <>	(1 elements) 1000 msec DOI0cspare.0
[10]	IDCEQM TauFast <#0>	(1 elements) 1000 msec DOARCALM.4
[11]	IDCEQM Loss <#0>	(1 elements) 1000 msec DOARCALM.4
[12]	IDCEQM NPointsHist <#0>	(5 elements) 1000 msec DOARCALM.4
[13]	IDCEQM Chi2 <#0>	(5 elements) 1000 msec DOARCALM.4
[14]	IDCEQM Chi <#0>	(5 elements) 1000 msec DOARCALM.4
[17]	IDCEQM SRVSTATS <>	(10 elements) 5000 msec DOFECSTATS
[18]	IDCEQM NALARMS <*>	(6 elements) 500 msec DOCASFEC
[19]	IDCEQM ACTIVITY <#0>	(68 elements) 30000 msecDOSPYFEC
[21]	IDCEQM Charge <Buffer-0>	(1 elements) 1000 msec DORISCON

e.g.  
'attachfec /DORIS/Idc.Main':

# TINE Clients : Rich Clients (java)



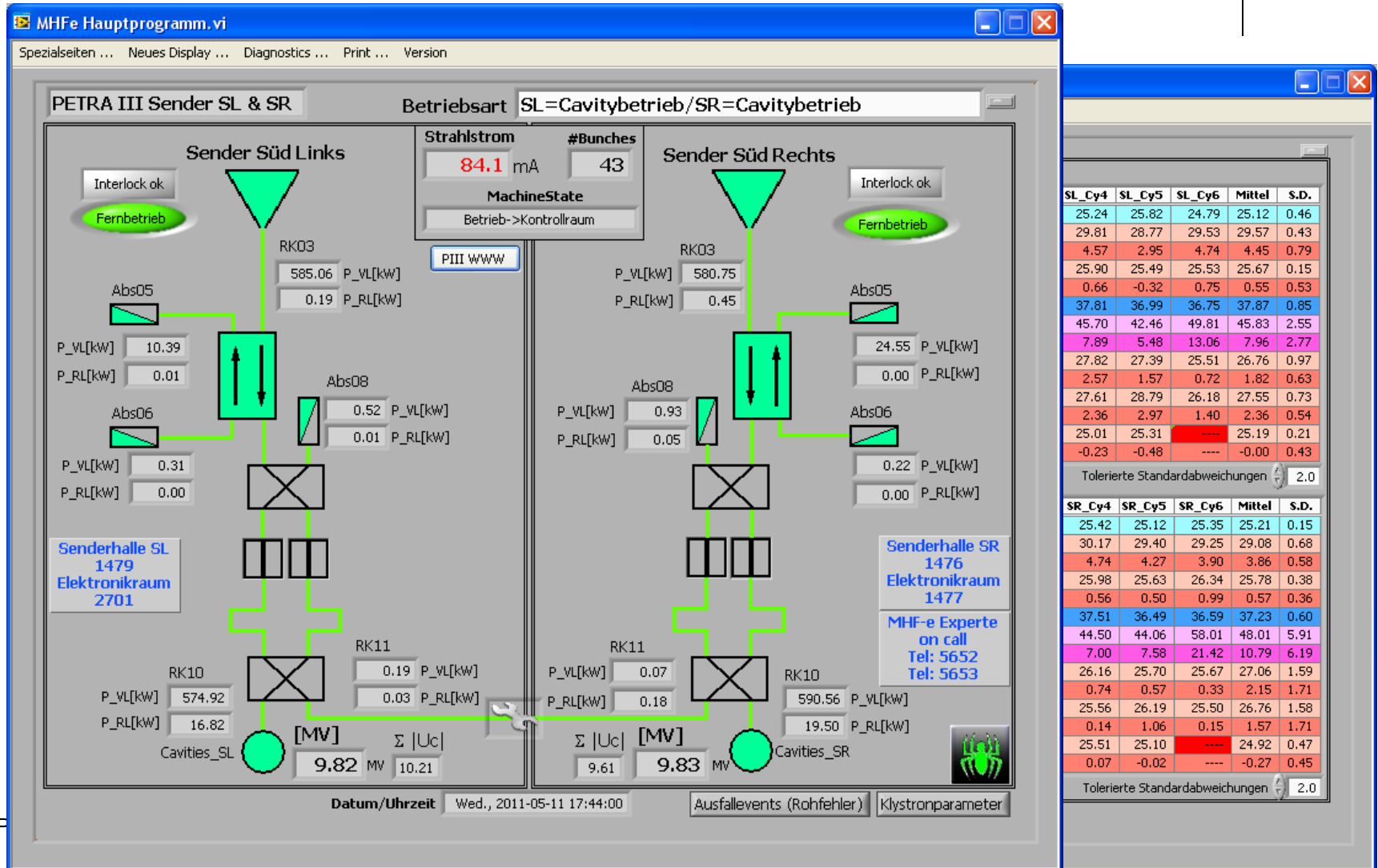
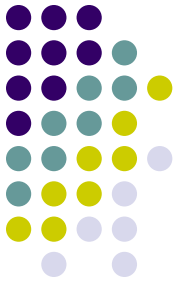
The screenshot displays the TINE control interface with several key components:

- LINAC 2 Operating Panel:** Shows operational parameters:
  - Teststrahl: T22 EIN
  - Positionen: Betrieb->Teststrahl
  - Energy: 449.6 MeV
  - Current: 35.72 mA
  - Particle Count:  $21.20 \cdot 10^9$  Teilchen
- PETRA Panel:** Displays a Schirmmonitor and Monochromator. It includes X and Z analysis data:
 

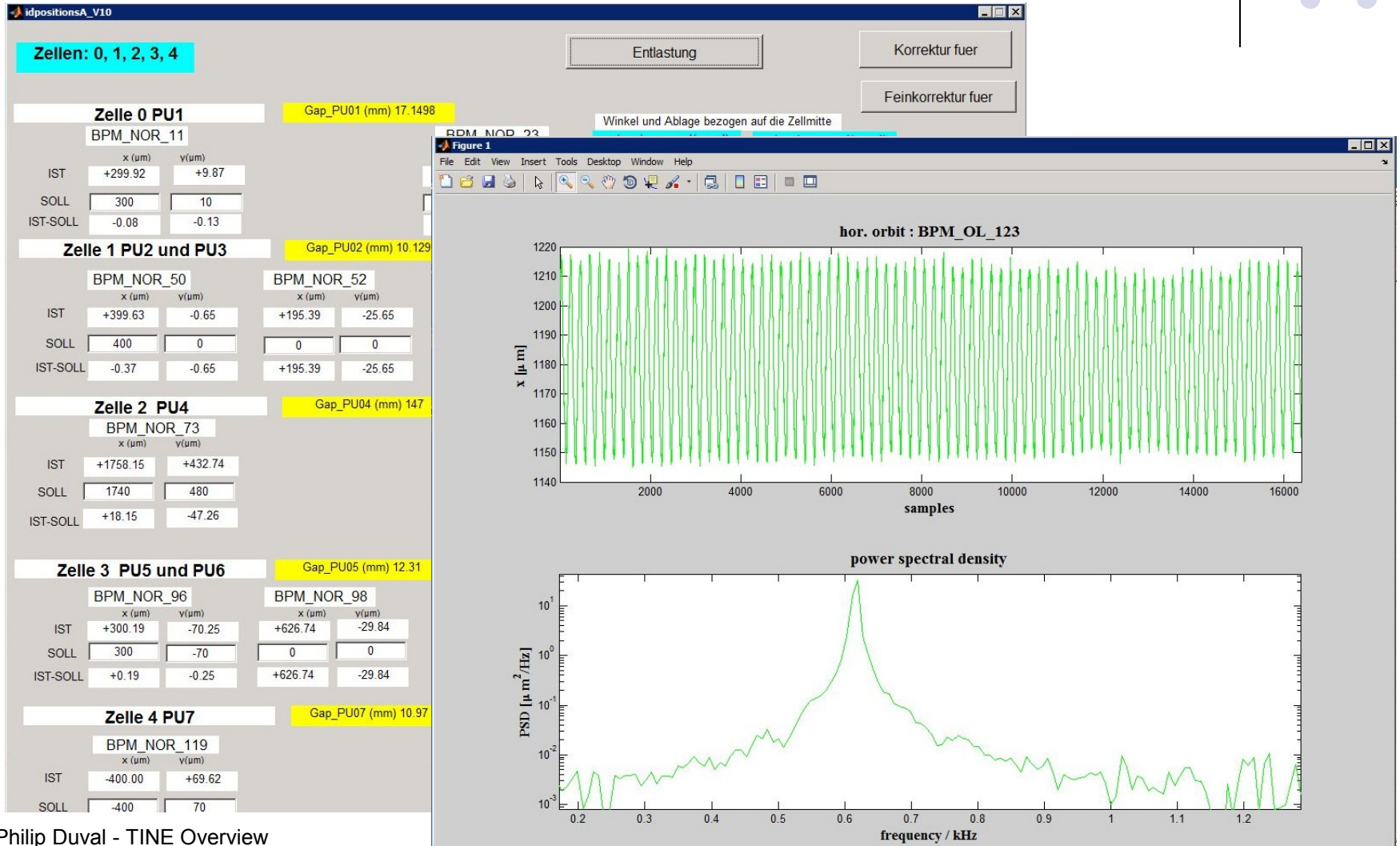
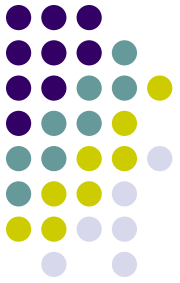
Parameter	X Analysis	Z Analysis
Amplitude	6269	7609
Position	1.14 mm	-1.09 mm
Sigma	46.99 $\mu$ m	37.66 $\mu$ m
Emittance	1.16 nm rad	41 pm rad
- DTLU Panel:** Shows a schematic of the DTLU (Drift Tube Linac) and a table of device parameters:
 

Device name	Device position [m]	Device length [m]	Magnet current [A]	Ist minus Soll [A]	Temperature [C]
QA4_OL_107	1333.084	0.476	101.338	-0.000	34.26
- Other Panels:**
  - Horizontal orbit plot:** Shows a plot of horizontal orbit [mm] vs BPM positions (BPM\_OL\_106, BPM\_OL\_98, BPM\_OL\_88).
  - Waveform plot:** Shows a pulse waveform with a peak at approximately  $1.05e-7$  s.
  - INAC 2 Panel:** Shows a large green display of 9.568 h and a pulse train plot.
  - Summary Panel:** Shows accumulated charge: 597.780 C and energy: 6.084 GeV.

# TINE Clients: Rich Clients (LabView)



# TINE Clients: Rich Clients (MatLab)



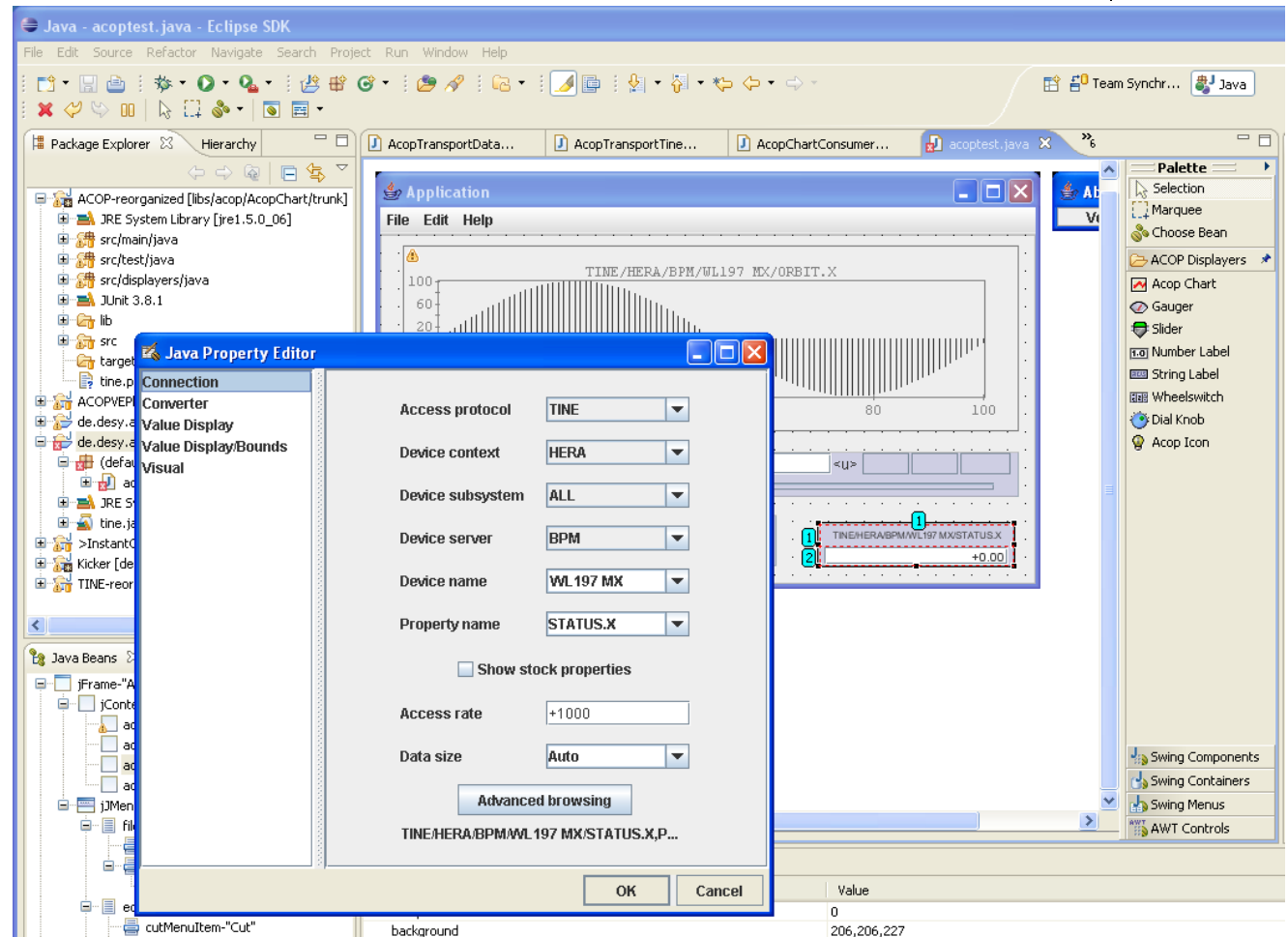
# TINE and Java ACOP (for rich clients)



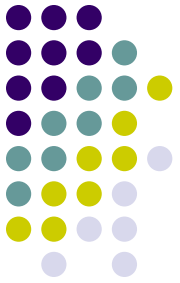
No Frameworks !

Use Eclipse,  
NetBeans, or  
whatever ...

Browse  
Control system  
at **design-time**  
with property  
panels or  
*customizer* ...



# TINE and Java ACOP + COMA (for simple clients)

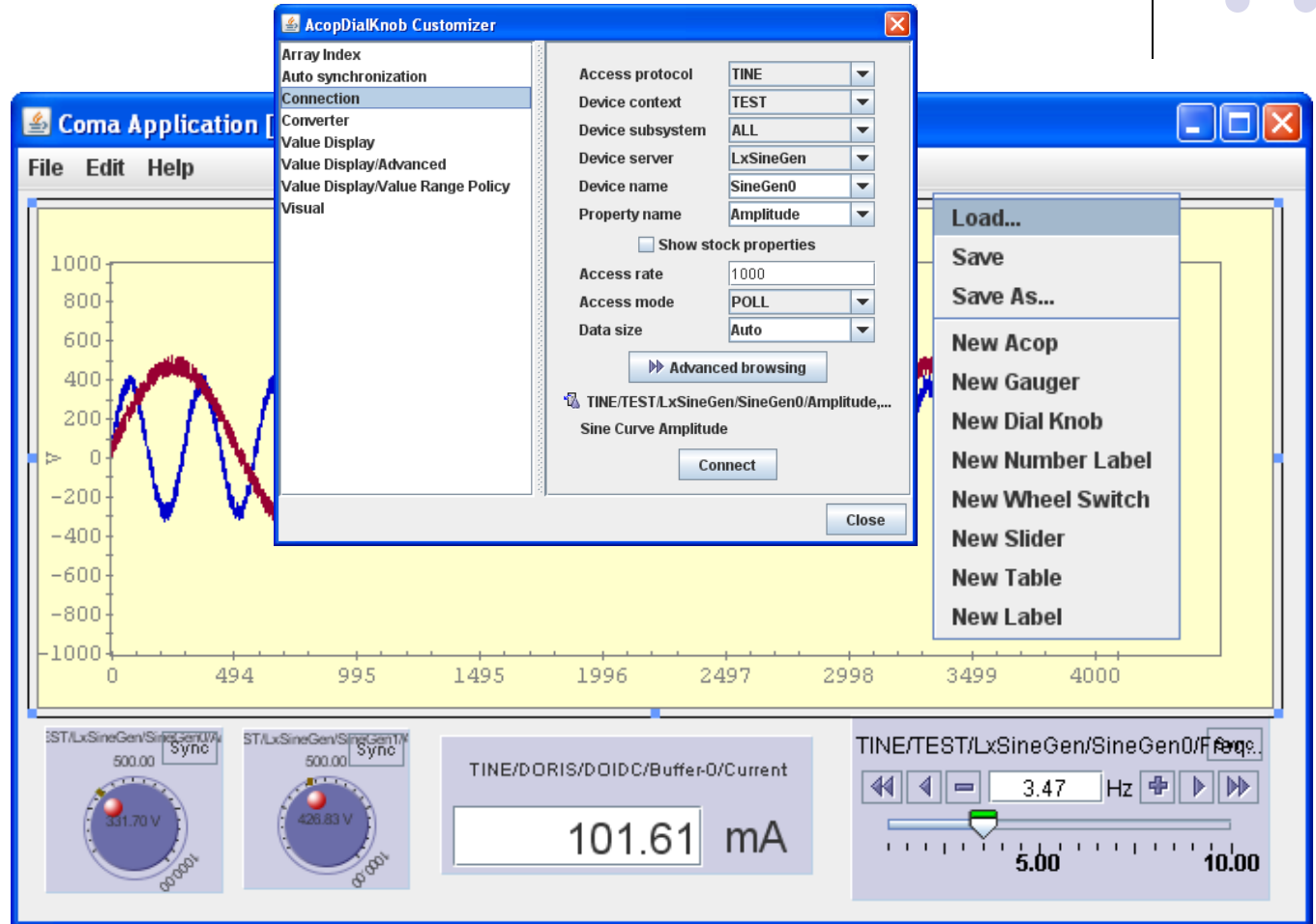


No Frameworks !

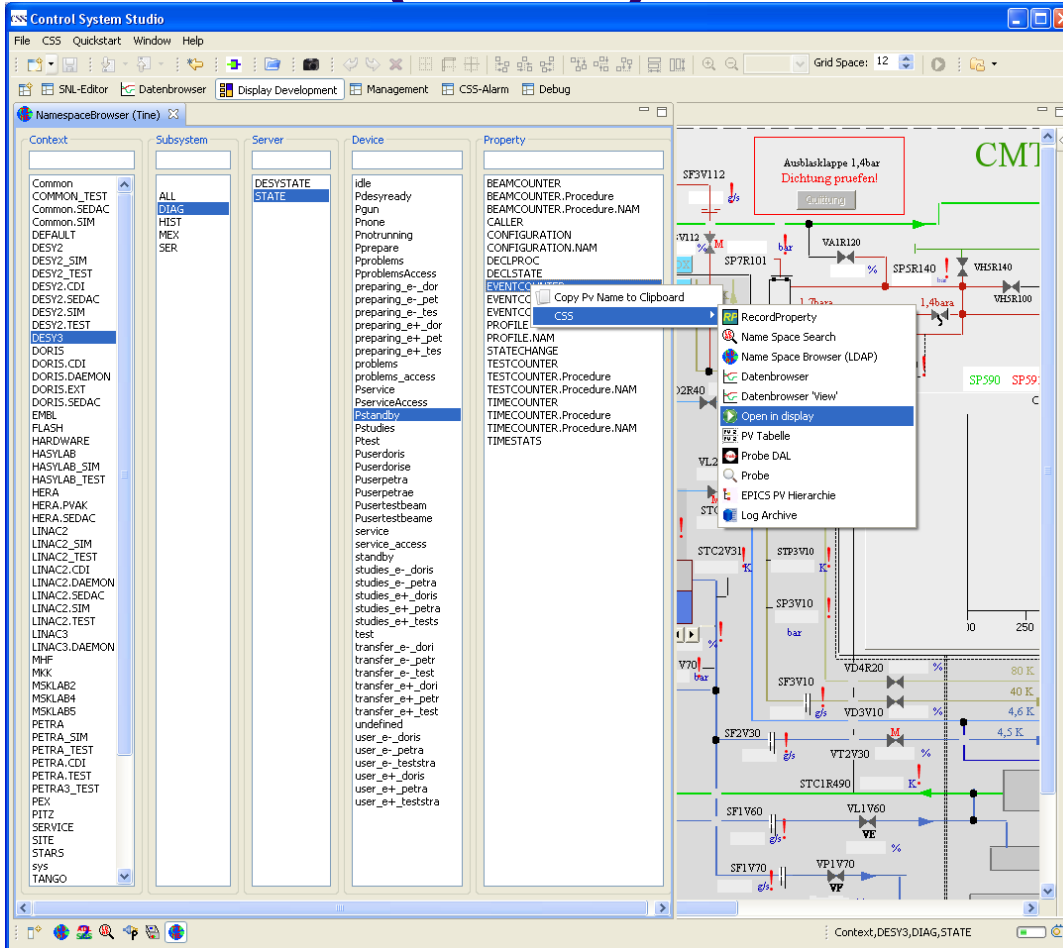
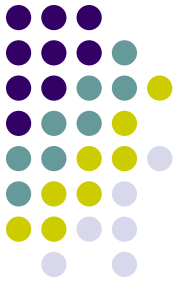
Lightweight!

Just start a coma application (e.g. an empty coma application)

Browse  
Control system  
at **run-time**  
with  
*customizer* ...



# TINE and Control System Studio (CSS)



Namespace Browser (TINE)

Call up:

- Display
- PV-Table
- .....

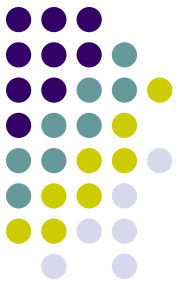
Drag and Drop

- Into PV-Table
- Into Display (edit mode)

No DAL support for PV-Table - yet



# TINE and jddd



The screenshot shows the jdddEditor Version 1.0 interface. The main window is titled "GunSection.xml" and contains a diagram of a "Gun Section" with a "Diag" tab. The diagram includes components like "Sol Mover", "Laser", "Klystron 3", "Klystron 2", and "ADD1". A "Laser On" checkbox is checked. The interface is divided into three main panels:

- Component Inspector:** Located on the left, it shows a tree view of components including "IncludeComponent", "IF7", "IF6", "Icon 1", "CheckBox1", "Label1", "IF5", "IF4", "Button6", "Button1", "Button5", "Button4", "Line5", "Button3", "Button2", "Line2", and "IF3".
- Component Palette:** Located on the right, it lists categories: "Pane Components", "Static Components", "Dynamic Components", "Logic Components", and "Plot Components".
- Component Properties:** Located at the bottom right, it shows the properties for "IncludeComponent7".

Property	Value
name	IncludeComponent7
adr	
xmlFile	/home/etkes/opm_co...
borderType	No Border
toolTipText	
layer	NONE
scale	<input checked="" type="checkbox"/>
bounds	[188, 114, 13, 68]

# TINE Video (Multicasting + Scheduling)



.5 Mbyte Video  
Frames @ 10 Hz  
multicast (100 Mb  
ethernet). (also runs  
fine @ 20 Hz)

Uses the **NETWORK**  
switch => **as many**  
**clients as you want!**

Server calls the  
**Scheduler** when a  
new frame is  
grabbed => **as real-**  
**time as it gets !!!**

DESY-2/PITZ Schirm & Video: One-Stop-Shopping!

Printing Options Beam Steering Info Reference Files Particle Type Old Program

11:46:03  
IPIA: 3.02

Pia L-Weg DESY-II E-Weg R-Weg

Halt Once

REIN

Ist: REIN

RAUS

Alle RAUS

Rein damit! Select a Schirm...

rein	SML 20
rein	SML 53
rein	OTR 85 only for Tests!
rein	SML 92 hinter Blende
rein	SML 100
rein	SML 114
rein	SML 125 hinter DESY-3
rein	FM 48SG Inj Septum

Ref:  
X: ? Vid+Trg  Cursors ROI  Projections Subtract-Bgd

Y: ? Current Staus: Posit Pos-File2-3

Beam Steering Knobs at Screen SML\_114

B↑ ML 95 B↓

← →

↑ B↑ SVL 85

↓ B↓

Just a Test Comment

Ref File: 2007-01-10 16:16:36



# TINE Platforms ...

- DOS
- Win16, Win32 (9x, NT, 2K, XP, ...), Win64 ?
- Win CE
- Unix (Solaris, HP, OSF, SGI, Ultrix, ...)
- Linux, FreeBSD (32 bit, 64 bit)
- ELINOS
- MAC OS X
- VxWorks
- VMS (Vax, Alpha)
- LynxOS
- NIOS (plugs, single-threaded LWIP, ...)
- Java, Mono, (.NET)



# TINE and Connectivity to other systems

- Already embedded in DOOCS
- Epics2Tine runs on any EPICS ioc
- Connect to STARS/COACK via STARS bridge
- Tango2Tine



TANGO2TINE example MD2  
Goniometer

# TINE : Where to get it ...



- <http://tine.desy.de>
  - Visit the *download* section and chose your platform.
  - Use setup tools available.
  - Installation takes a few minutes
  - Don't expect too many miracles (you might have to read a README.txt or two).
- Email to [tine@desy.de](mailto:tine@desy.de)

**TINE (Three-fold Integrated Networking Environment)**

Note: Remember: *This Is Not Epics!*  
But you can run [EPICS](#) iocs on TINE using Epics2Time.  
TINE is embedded in [DOOCS](#), so you can also run DOOCS clients and servers using TINE.  
TINE can also be used in a [STARS](#) system and via a STARS-bridge in a [COACK](#) system.  
But you might want to go native ...

General	APIs	Services	Examples & Tutorials	Recipes
<a href="#">Bird's Eye View</a>	<a href="#">C API</a>	<a href="#">Alarm System</a>	<a href="#">Getting Started</a>	<a href="#">DOS</a>
<a href="#">Overview</a>	<a href="#">Visual Basic API</a>	<a href="#">Archive System</a>	<a href="#">TINE Server Wizard</a>	<a href="#">UNIX</a>
<a href="#">Features</a>	<a href="#">Java API</a>	<a href="#">Post Mortem System</a>	<a href="#">Console Server (C)</a>	<a href="#">VxWorks</a>
<a href="#">Configuration</a>	<a href="#">Java API (ACOP)</a>	<a href="#">State Server</a>	<a href="#">Console Client (C)</a>	<a href="#">VMS</a>
<a href="#">Data Types</a>	<a href="#">Buffered API</a>	<a href="#">Dialog Server</a>	<a href="#">GUI Server (VB)</a>	<a href="#">Win16</a>
<a href="#">Transfer Modes</a>	<a href="#">LabView API</a>	<a href="#">Name Server</a>	<a href="#">GUI Client (VB)</a>	<a href="#">Win32</a>
<a href="#">Access Flags</a>	<a href="#">MatLab API</a>	<a href="#">Remote Services</a>	<a href="#">Console Client (Java)</a>	<a href="#">Workshop Tutorial (Buffered Server)</a>
<a href="#">Arww Types</a>		<a href="#">Network Globals</a>	<a href="#">GUI Client (Java)</a>	<a href="#">Workshop Tutorial (Standard Server)</a>
<a href="#">Time Stamps</a>		<a href="#">Time Synchronization</a>	<a href="#">Console Server (Java)</a>	<a href="#">W (C)</a>
<a href="#">Naming Conventions</a>		<a href="#">Security</a>	<a href="#">Trouble Shooting</a>	<a href="#">C</a>
<a href="#">Data Flow Tips</a>		<a href="#">Netmex</a>		
		<a href="#">Command Line</a>		

TINE is fully supported by [ACOP](#), [Abeans](#), [JoMint](#), and will be supported by [Control System Studio](#).

You may want to have a look at the release note for versions [3.20](#), [3.30](#) or [3.31](#) or take a quick look at a [Bird's Eye View](#)

Download TINE [Download page](#)

