Motion control status in ALBA

Exchange on Motion Control in Synchrotron Radiation Facilities

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Outline

- Hardware numbers
- Alba approach
- Motor controller configuration management system
- Integration in the Sardana control system
- Conclusions

Motion numbers at ALBA

The main actuator at ALBA is the 2 phase stepper:

~500 axis distributed in 7 beamlines
~50 axis in 8 front ends
~50 axis in the accelerators

Around 50% of them have an associated encoder (incremental or ssi) and work in position closed loop

All driven with IcePAP controller

Apart from steppers, a handful of brushless DC motors driven with PMAC or ETEL controllers in specific equipment and few piezo actuators (Jena or PI controllers)

Approach

Single controller solution. IcePAP

Simplifies:

- Software interface
- Axis configuration and operation
- Hardware axis synchronization
- Hardware maintenance and spare management
- Cabling

Equipment manufacturers are provided with guidelines during design stages

We haven’t found problems with equipment manufacturers failing to supply compatible hardware

Integration in complex setups

Apart from all the features mentioned in the previous presentation and standard in most controllers, these other features were very practical when integrating the motor controller in different setups:

- Easy forward of position information by means of encoder-like signals:
- To counter or other acquisition cards for continuous scans
- To external amplifiers (for non-standard motors)

- Easy interaction with PSS or other safety systems with “per axis” or “per rack” input disable signals

- Accepts external encoder-like signals as position source (slave mode): external boards can generate trajectories if the application demands it (RF cavities plungers)

- Immediate control of brakes and other subsystems through front panel available digital outputs that can be assigned to internal states (moving, stopped, acceleration, constant speed,…)

System configuration: IcepapCMS

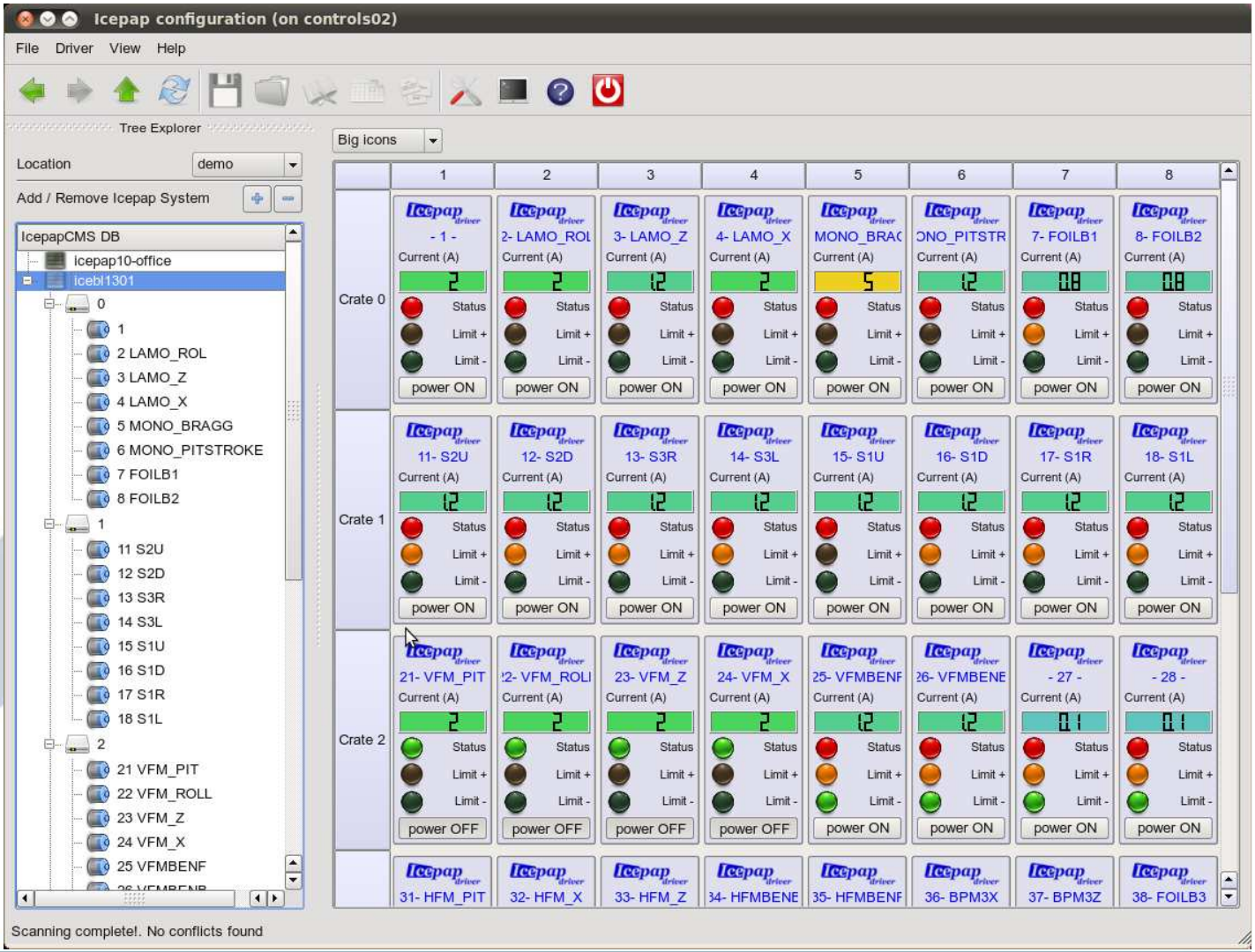
A tool for managing axis configurations

Configurations stored in a DB

Whole system view

Browse by name

Current / Power / Limits at a glance



IcepapCMS (ii) - preferences

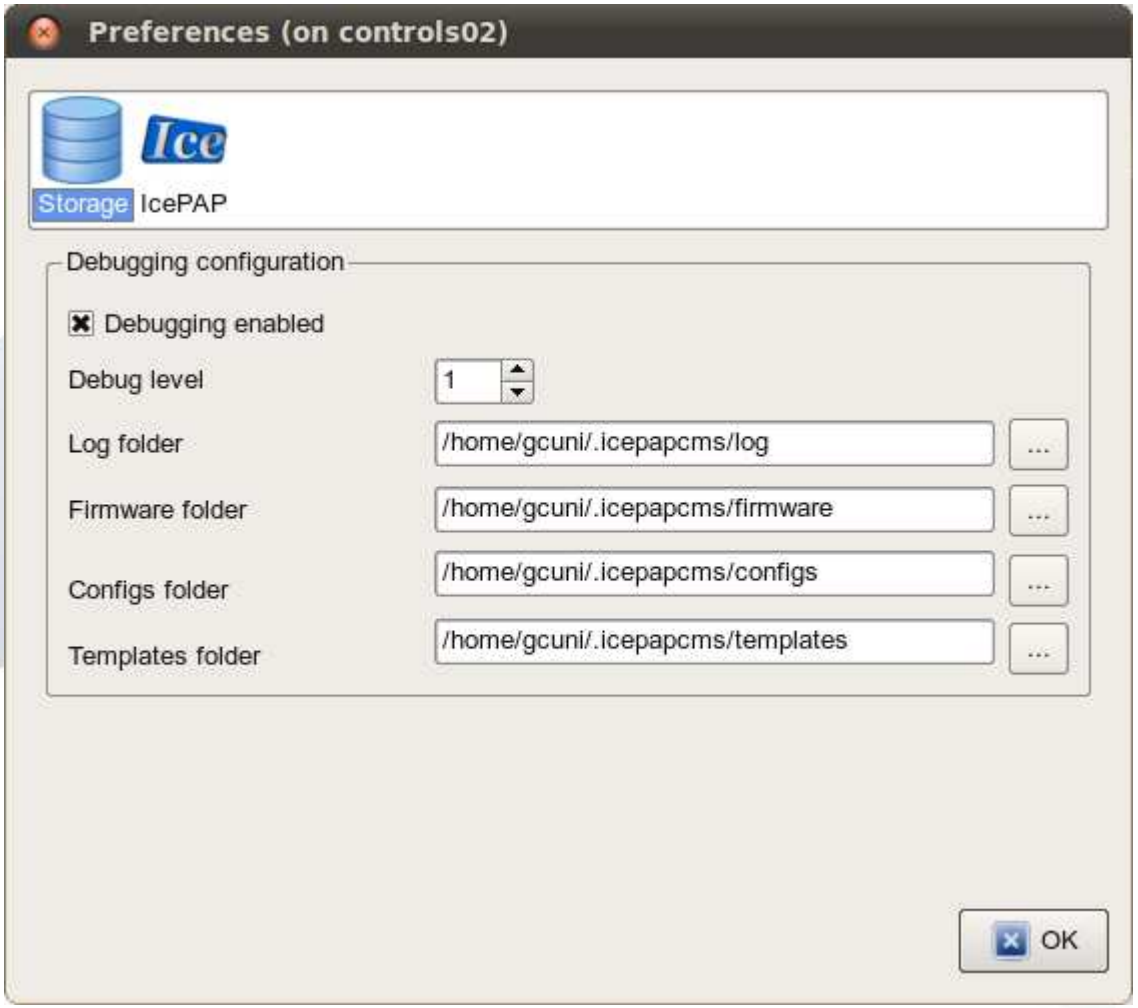
DB Storage and user folders preferences

Storage:

-) Sqlite
-) MySql
-) Postgres

IcePAP preferences:

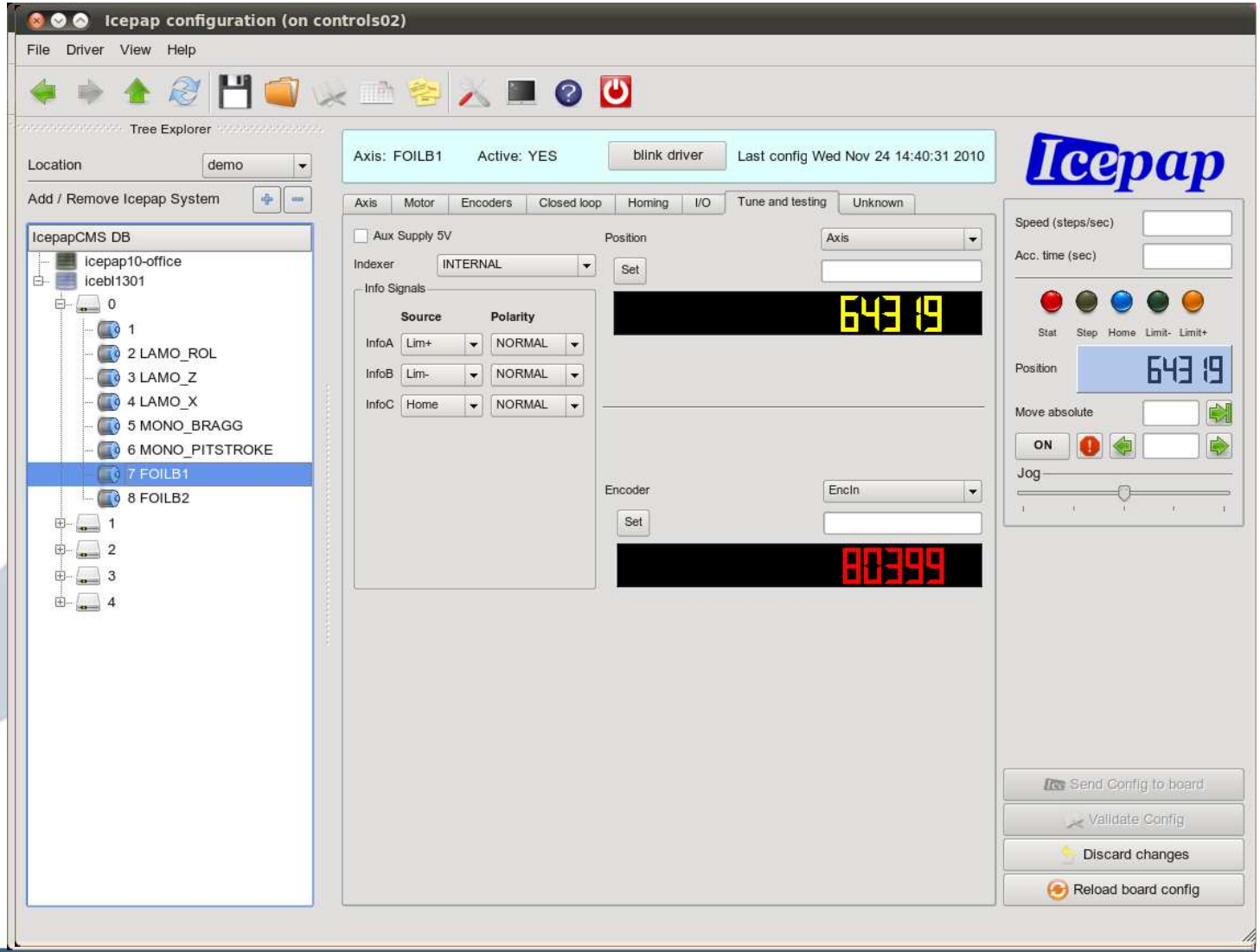
-) Log folder
-) Firmware folder
-) Configs folder
-) Templates folder



IcepapCMS (iii) - config

IcepapCMS configuration tabs

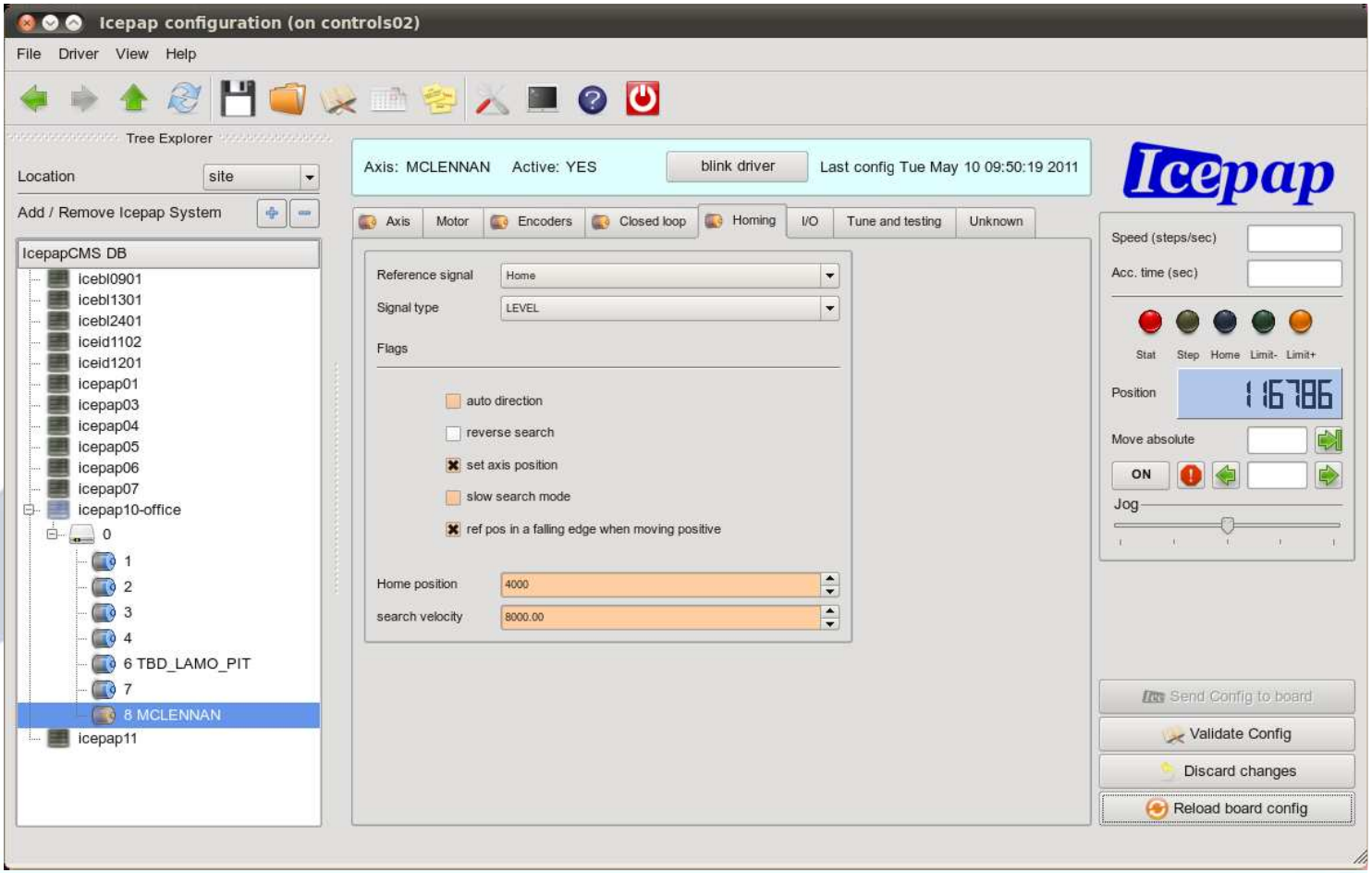
- Axis
- Motor
- Encoders
- Closed Loop
- Homing
- I/O
- Tune&Testing



IcepapCMS (iv) - history

Retrieve historical values

- Calendar view
- Highlighted changes
- Database mismatch



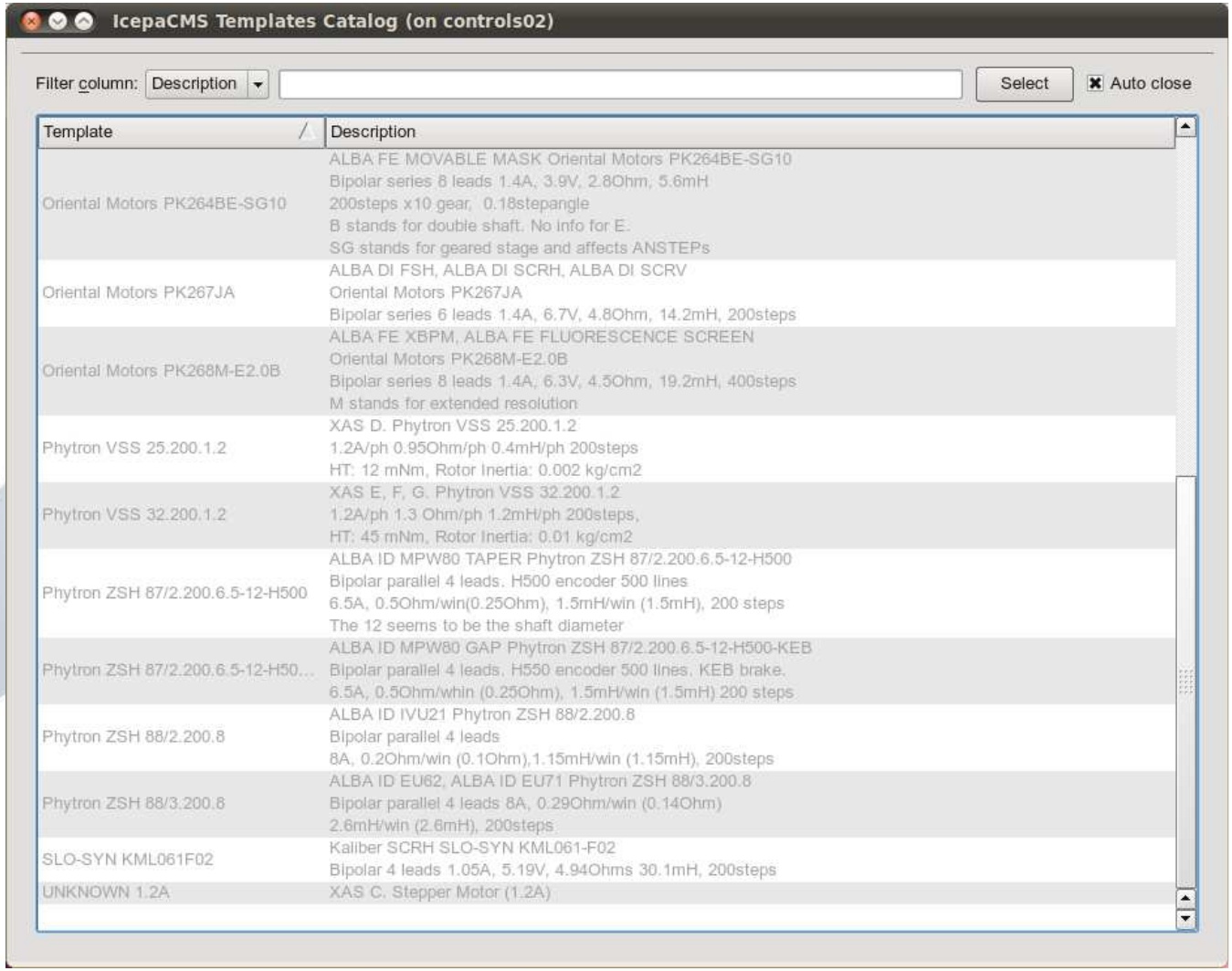
IcepapCMS (v) - templates

Template management (first draft)

Browse template

Filter by motor name or description

Apply all config values



IcepapCMS (vi) - interaction

Console within IcepapCMS

Icepap Console (on controls02)

Icepap host: icepap10-office — Connect — Disconnect

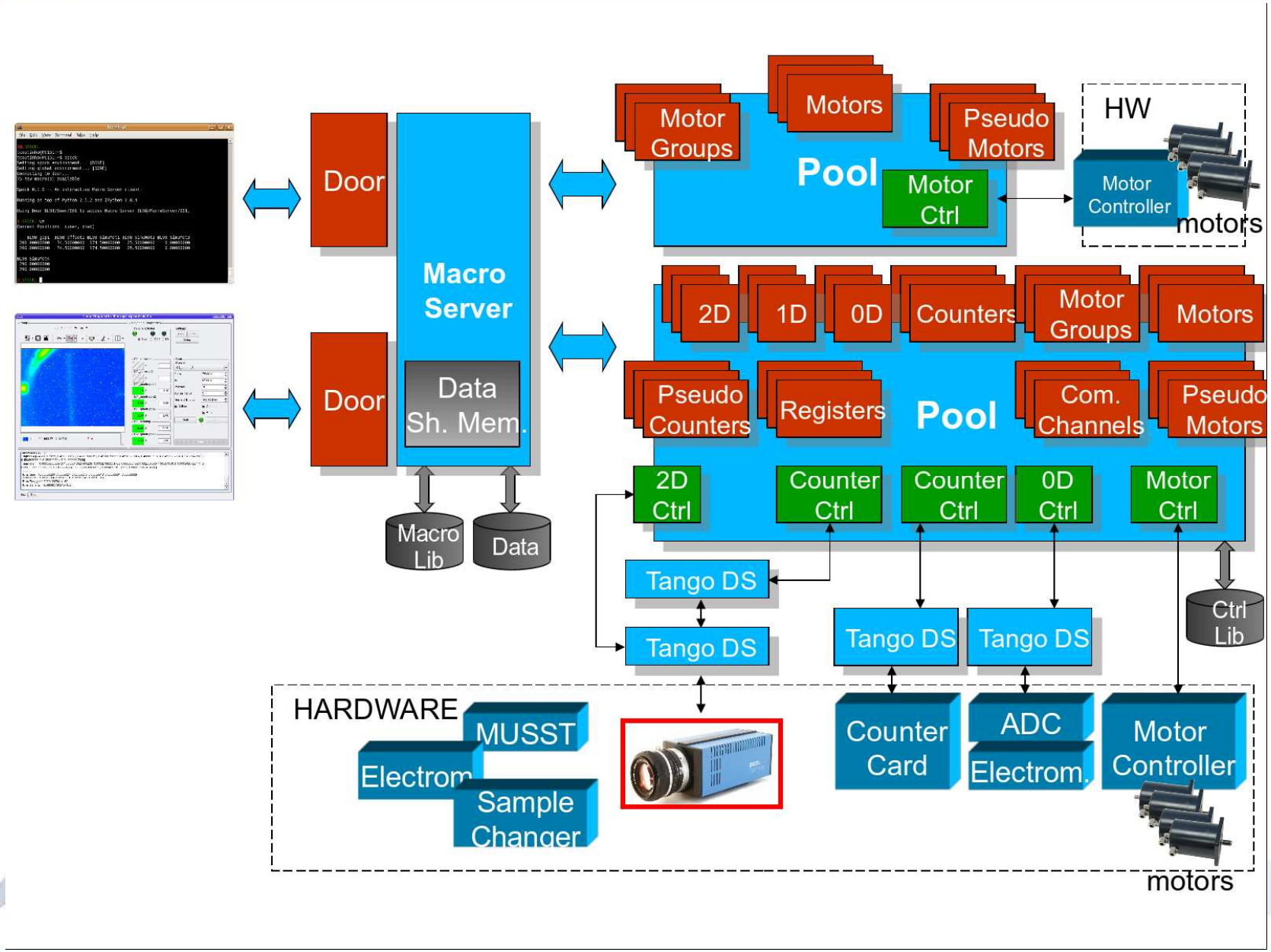
```
Connected to Icepap :  icepap10-office
icepap10-office > ?sysstat
?SYSSTAT 0x0001
icepap10-office > ?sysstat 0
?SYSSTAT 0xEF 0xEF
icepap10-office > 0:?ver info
0:?VER $
SYSTEM      : 1.101 : Mon Apr 11 11:29:10 2011
  CONTROLLER:  1.101
    DSP    : 2.86 : Wed Apr  6 19:31:48 2011
    FPGA   : 0.03 : Tue Jun 19 16:54:00 2007
    PCB    : 0.07
    MCPU0  : 0.20
    MCPU1  : 0.20
    MCPU2  : 1.125
  DRIVER    : 1.101
$
icepap10-office > #1:power on
1:POWER OK
icepap10-office > #1:move 1000
1:MOVE OK
icepap10-office > 1:?pos
1:?POS 1000
icepap10-office > 1:?vstatus
1:?VSTATUS $
0x00B00203
  .......3 - PRESENCE =  3: Board is alive
  .......C -     MODE =  0: Board mode is OPER
  .....2.. -    READY =  1: Board is READY
  ..8..... -  POWERON =  1: Motor power is ON
  ......7. -  DISABLE =  0: Motor power is NOT DISABLED
  .....18. -  INDEXER =  0: Indexer source is INTERNAL
  .....4.. -   MOVING =  0: Motor is not moving
  ...3C... - STOPCODE =  0: No abnormal stop condition
  .....8.. - SETTLING =  0: Closed loop is idle
  ....1... - OUTOFWIN =  0: Axis is in target window
  ...4.... - LIMITPOS =  0: Limit+ signal is not active
  ...8.... - LIMITNEG =  0: Limit- signal is not active
  ..1..... -  HSIGNAL =  1: Home signal is HIGH
  ....2... -  WARNING =  0: Warning flag is off
  ..2..... -  5VPOWER =  1: Aux 5V power supply is ON
  ..4..... -  VERSERR =  0: Firmware versions are consistent
  FF...... -     INFO =  0: Info value is 0
$
icepap10-office >
```

ipython profile

gcuni@controls02:~/svn/IcepapCMS

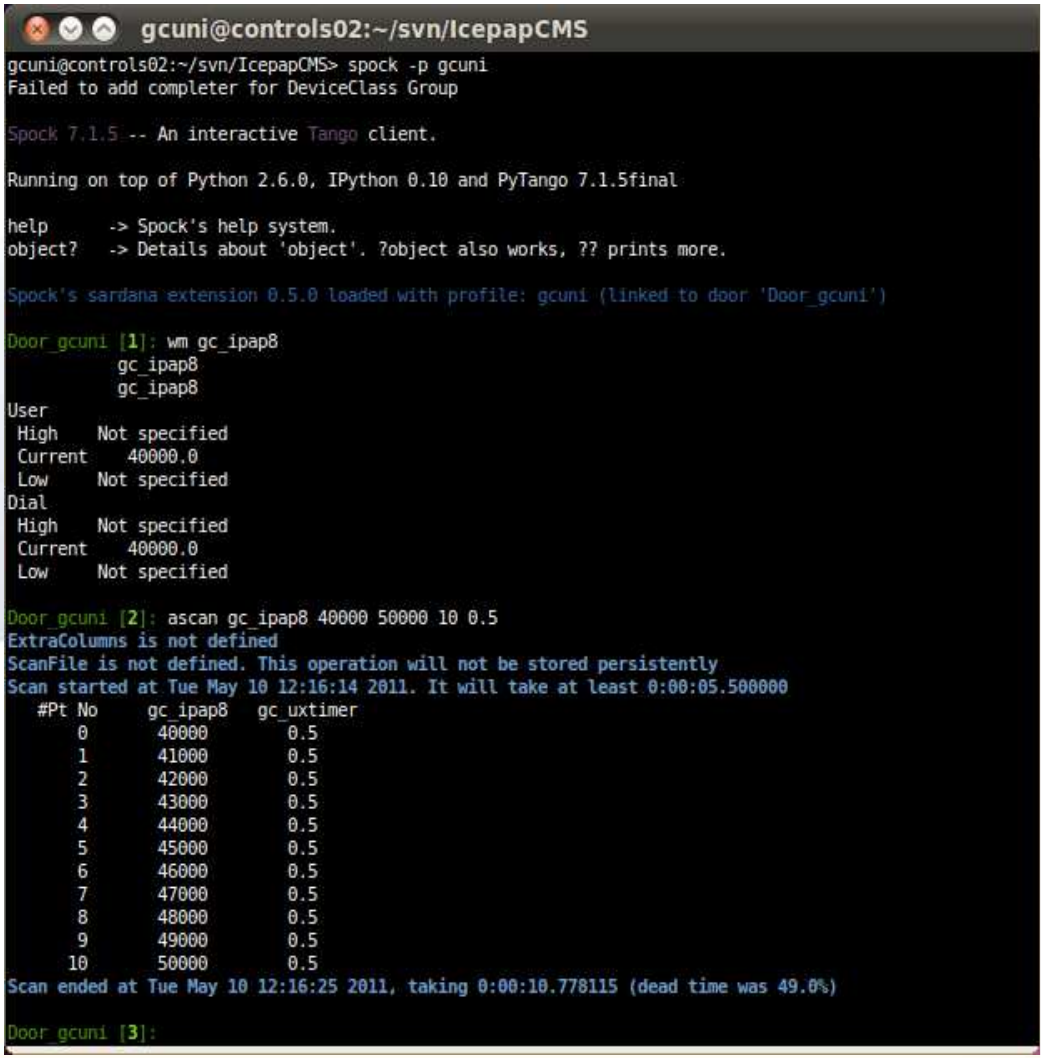
```
igcuni@controls02:~/svn/IcepapCMS> ipython -p ipapconsole
Python 2.6 (r26:66714, Feb  3 2009, 20:49:49)
Type "copyright", "credits" or "license" for more information.

IPython 0.10 -- An enhanced Interactive Python.
?         -> Introduction and overview of IPython's features.
%quickref -> Quick reference.
help      -> Python's own help system.
object?   -> Details about 'object'. ?object also works, ?? prints more.

IPython profile: ipapconsole

In [1]: %connect icepap10-office

In [2]: wr 1:?power
-> 1:?POWER
1:?POWER ON

In [3]: wr ?pos 1 2
-> ?POS 1 2
?POS 1000 0

In [4]: [_ip.magic('wro %d:?status' % axis) for axis in [1,2,3,4,6,7,8]]
-> 1:?STATUS
-> 2:?STATUS
-> 3:?STATUS
-> 4:?STATUS
-> 6:?STATUS
-> 7:?STATUS
-> 8:?STATUS
Out[4]:
['1:?STATUS 0x00B00203',
 '2:?STATUS 0x00B00203',
 '3:?STATUS 0x00300003',
 '4:?STATUS 0x00300003',
 '6:?STATUS 0x003C0063',
 '7:?STATUS 0x00300173',
 '8:?STATUS 0x00B91203']

In [5]: %listversions
Out[5]:
{0: '0:?VER  1.101',
 1: '1:?VER  1.101',
 2: '2:?VER  1.101',
 3: '3:?VER  1.101',
 4: '4:?VER  1.101',
 6: '6:?VER  1.101',
 7: '7:?VER  1.101',
 8: '8:?VER  1.101'}

In [6]:
```

Sardana (i) - architecture



Sardana (ii) - tools

- Using a common tango interface, we can provide standard tools to operate any kind of motor.
- QtWidgets
- Standard scans
- Equipment-specific macros like homing



Sardana (iii) - controllers

Specific motor controllers (software)

- Icepap (eth)
- Pmac (eth)
- PI-E516 piezo (serial/gpib)
- Tango Attribute with threshold (e.g. DAC)

They provide same Tango interface:

Position, Limit_switches, Abort()…

Plus any particular dynamic attribute:

Icepap: StopCode, EncoderPosition…

Pmac: PhasingSearchError, IntegrationMode…

Conclusions

- Though it might look restrictive, a single controller approach simplifies our daily logistics and operation
- Firmware modification to add extra features possibility is a plus
- A single hardware access point to all the axis simplifies the task of higher software layers
- Centralized configuration management helped us a lot during the installation phase

Thank you for your attention.

Questions?