cosylab
CONTROL SYSTEM LABORATORY

Contracting Turn Key Systems with EPICS

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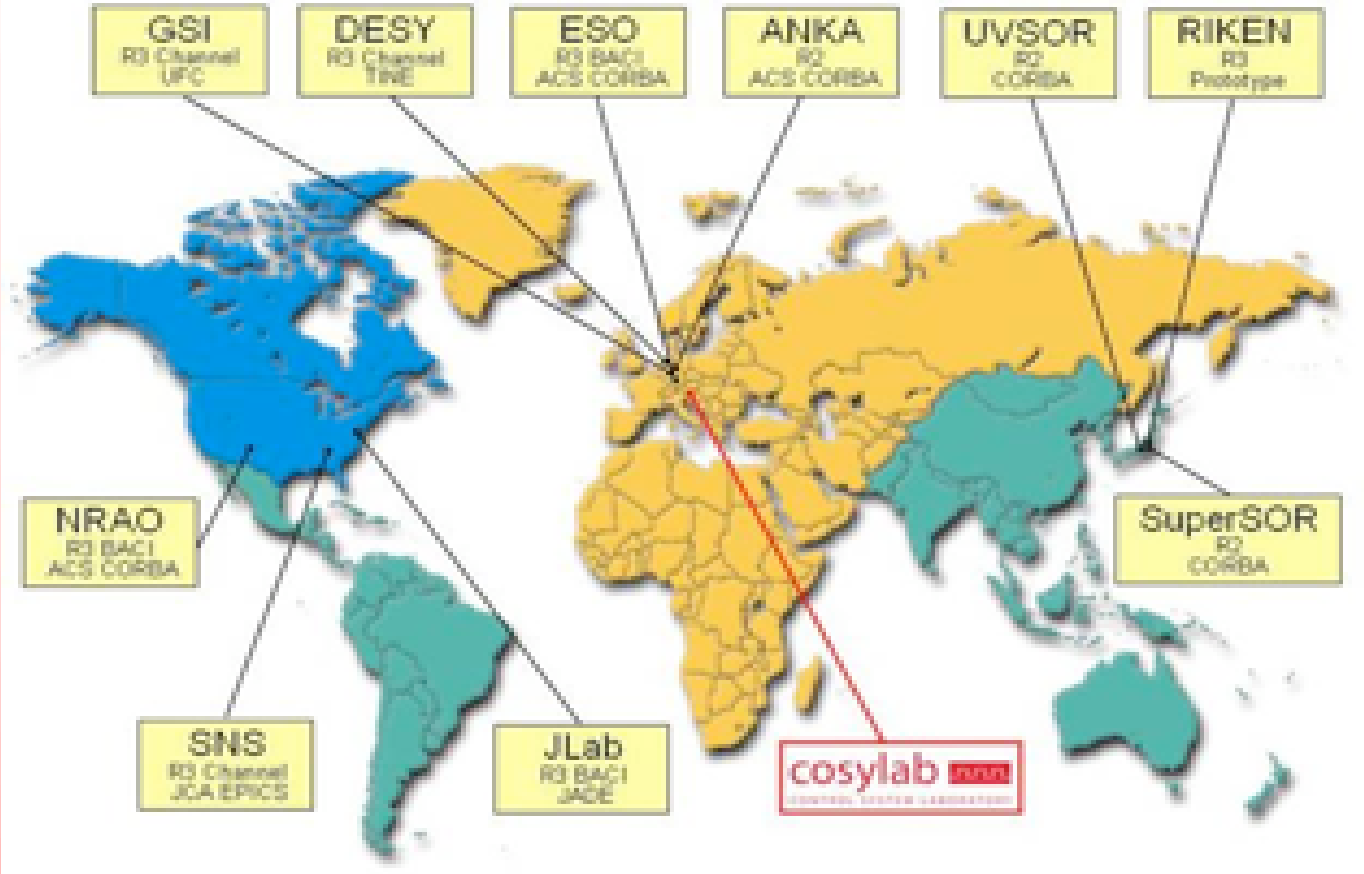
Contracting Turn Key Systems with EPICS

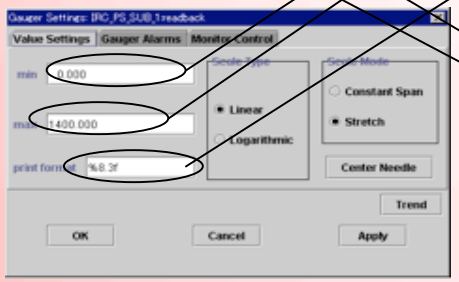
- What is Cosylab
- Standards and EPICS
- Two sample turnkey systems
  - Cosylab is subcontractor for CS
- Technical issues
- Organizational issues

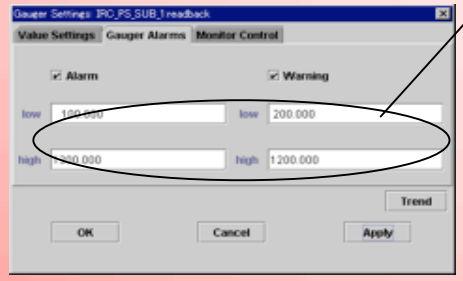
Cosylab

- 1997-2000 ANKA CS: “cheap”
  - PC, commercial fieldbus, own I/O
- 2001 students finish, start company
  - Professional: work to spec/wishes + documentation
  - CS development and integration
- Development more fun, but difficult to sell
  - VDCT, CAJ, Abeans, ACS (CORBA for astronomers)
- 2004 10 employees, 10 external, 15 students
  - Add: GIS, Telecom, Automotive electronics

Cosylab Abeans Customer Base








```
//  description of read-only double channel
  struct  RODoubleDesc {
     double     graphMin;   // minimal value on graph
     double     graphMax;   // maximal value on graph
     double     warningMin; // below this warning color is enabled
     double     warningMax; // above this warning color is enabled
     double     alarmMin;   // below this alarm color is enabled
     double     alarmMax;   // above this alarm color is enabled
     string     unit;       // units
     string     format;     // format of value
     string     description;// description of value
     double     minStep;    // minimal possible change in value
  };

  //  description of read-only double channel
  struct  RWDoubleDesc {
     double     minValue;   // minimal allowed value
     double     maxValue;   // maximal allowed value
     double     graphMin;   // minimal value on graph
     double     graphMax;   // maximal value on graph
     string     unit;       // units
     string     format;     // format of value
     string     description;// description of value
     double     minStep;    // minimal possible change in value
  };

  /* Possible conditions of a physical device or its state.
  The names correspond to colours of typical LEDs.
  GREY corresponds to the LED being off. */
  enum Condition {
     RED,
     YELLOW,
     GREEN,
     GREY
  };
  typedef sequence <Condition> ConditionSeq;

  typedef sequence <string> stringSeq;

  //  description of read-only status (pattern) channel
  struct  ROPatternDesc {
     string         description;    // description of the status channel
     stringSeq      bitDescription; // string description for each single bit in status
     ConditionSeq   whenSet;       // describes wich color has status bit when it is 1
     ConditionSeq   whenCleared;       // describes wich color has status bit when it is 0
  };

  /*----------------------*/
  /* Power Supply Interface */
  /*----------------------*/
  interface   PowerSupply : Device {
     // sets new setting on server
     long setCurrent(in double dCurrent);
     // reads teh setting on server
     long getCurrent(out double dCurrent);
     // returns description for current channel
     readonly attribute RWDoubleDesc currentDesc;

     short      retPutOn();
     short      retPutOff();
     short      retPutReset();

     // Returns read-only status of device. Each bit has special meaning, which is described in description part
     long getStatus(out long status);
     // Returns description of the status.
     readonly attribute ROPatternDesc statusDesc;

     // Returns current readback measurement.
     long getReadback(out double ampVal);
     // Returns structure with description of read-only current readback.
     readonly attribute RODoubleDesc readbackDesc;

  };
```

Outsourcing, Turnkey and Standards

- In-house systems are proprietary and not open
  - Doesn't matter if free or with source code
- Difficult to outsource: extensive learning time
- Impossible to buy turn-key: who is responsible for bugs?
  - Example ANKA: turnkey booster, but without CS
- Lessons from human history: need standards

EPICS as Standard (1/2)

[whether EPICS is a de-facto standard is left as an exercise to the reader]

- Is sufficiently stable and known that labs can expect equipment vendors to know and support it
- Has sufficient "market share" that it is worthwhile for equipment vendors to consider
- Has cases of excellent documentation and courses so that anybody can learn it
  - Fortunately for Cosylab, EPICS is still not easy ☺

EPICS as Standard (2/2)

- International tenders for equipment require EPICS, such as:
  - Australian Synchrotron Project (ASP)
    - Turnkey injector (linac+booster synchrotron) with control system (not necessarily EPICS) that integrates into ASP EPICS system
  - Diamond Light Source (DLS)
    - EPICS required, DLS even free issues hardware and developing environment to ensure compatibility
- Clarifications
  - ASP linac and RF including EPICS subcontracted to Accel and PPT, Cosylab makes only booster CS

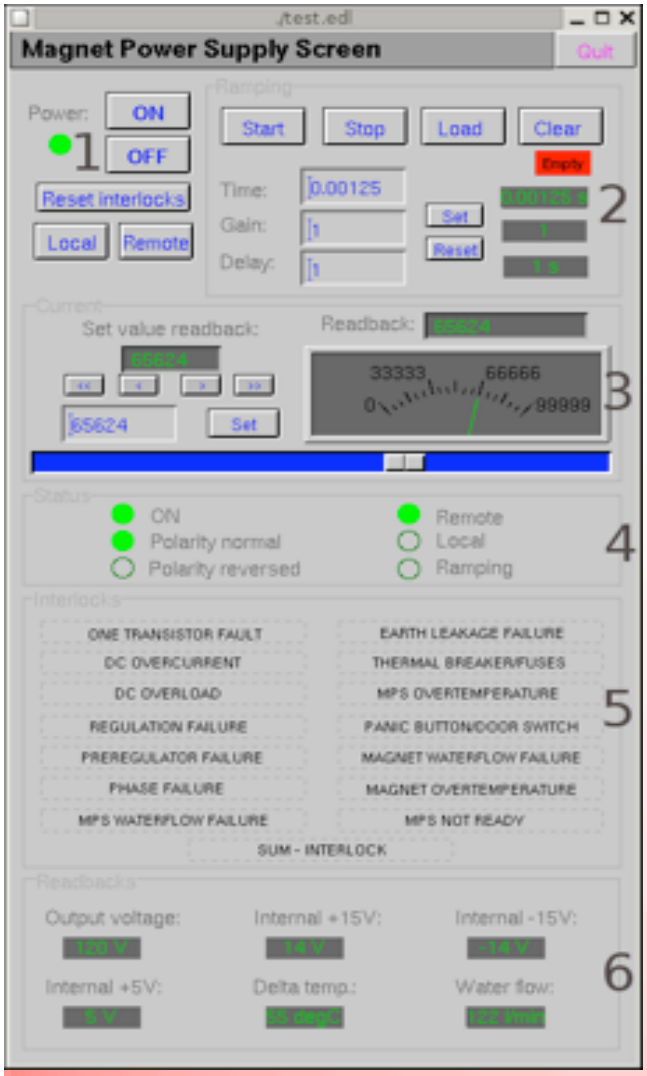
Particularities of the Control System Subcontract

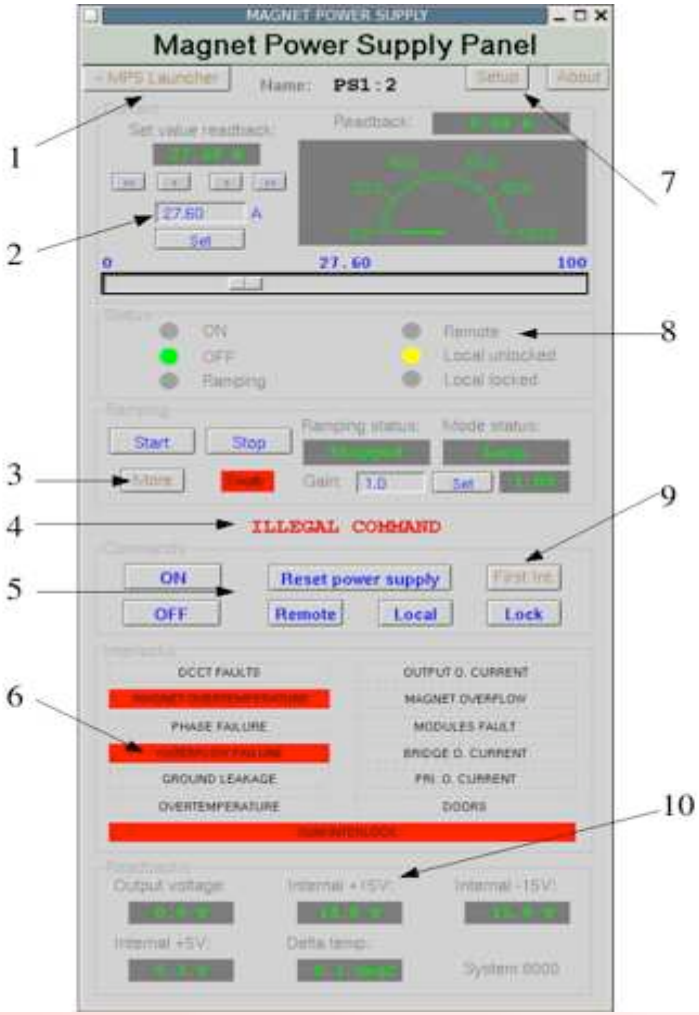
- Fixed price contract
  - Time management is a big problem:
    - we have to sell our time but not oversell
    - If project is delayed for any reason, we can't just get a new project to fill the hole => we lose money!
  - Commissioning included in price, additional help is extra
- Contractor (our client) wants to control communication with the lab (end user)
  - Understandable, but slows down progress
  - Good direct relations with end user are essential
    - Cosylab is lucky that it comes from the community

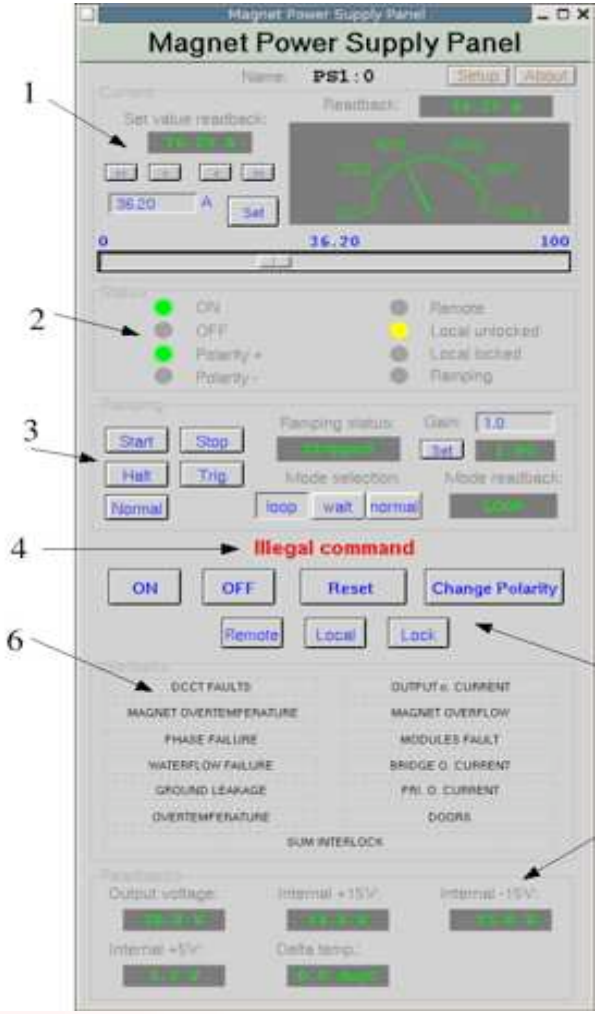
Status of ASP Booster and DLS Diffraction Beamlines

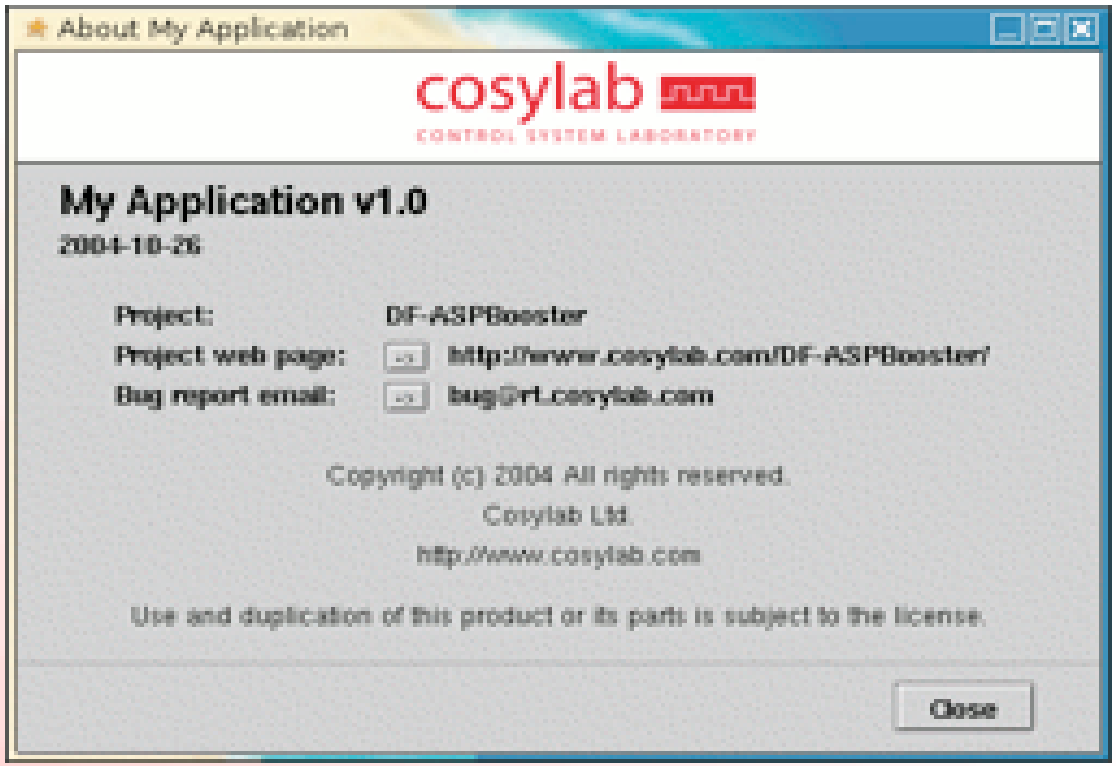
- Slideshow.....


OFF
OFF
OFF
OFF


./test.edl
Magnet Power Supply Screen
Quit
Power:
ON
OFF
Reset interlocks
Local
Remote
Ramping
Start
Stop
Load
Clear
Empty
Time:
Gain:
Delay:
Set
Reset
Current
Set value readback:
Readback:
Status
ON
OFF
Polarity normal
Polarity reversed
Remote
Local
Ramping
Interlocks
ONE TRANSISTOR FAULT
EARTH LEAKAGE FAILURE
DC OVERCURRENT
THERMAL BREAKER/FUSES
DC OVERLOAD
MPS OVERTEMPERATURE
REGULATION FAILURE
PANIC BUTTON/DOOR SWITCH
PREREGULATOR FAILURE
MAGNET WATERFLOW FAILURE
PHASE FAILURE
MAGNET OVERTEMPERATURE
MPS WATERFLOW FAILURE
MPS NOT READY
SUM - INTERLOCK
Readbacks
Output voltage:
Internal +15V:
Internal -15V:
Internal +5V:
Delta temp.:
Water flow:
1
2
3
4
5
6


MAGNET POWER SUPPLY
Magnet Power Supply Panel
MPS Launcher
Name:
PS1 : 2
Setup
About
Set value readback:
Readback:
27.60
A
Set
0
27.60
100
ON
OFF
Ramping
Remote
Local unlocked
Local locked
Start
Stop
Ramping status:
Mode status:
More
Gain:
1.0
ILLEGAL COMMAND
ON
OFF
Reset power supply
Remote
Local
Lock
DCCT FAULTS
MAGNET OVERFLOW
PHASE FAILURE
MODULES FAULT
BRIDGE O. CURRENT
GROUND LEAKAGE
PRI. O. CURRENT
OVERTEMPERATURE
DOORS
Output voltage:
Internal +15V:
Internal -15V:
Internal +5V:
Delta temp.:
System 0000
1
2
3
4
5
6
7
8
9
10


Magnet Power Supply Panel
Name:
PS1 : 0
Setup
About
Set value readback:
Readback:
36.20
A
Set
0
36.20
100
ON
OFF
Polarity +
Polarity -
Remote
Local unlocked
Local locked
Ramping
Start
Stop
Halt
Trig
Normal
Ramping status:
Gain:
1.0
Mode selection:
Mode readback:
loop
wait
normal
Illegal command
ON
OFF
Reset
Change Polarity
Remote
Local
Lock
DCCT FAULTS
MAGNET OVERTEMPERATURE
PHASE FAILURE
WATERFLOW FAILURE
GROUND LEAKAGE
OVERTEMPERATURE
MAGNET OVERFLOW
MODULES FAULT
BRIDGE O. CURRENT
PRI. O. CURRENT
DOORS
SUM INTERLOCK
Output voltage:
Internal +15V:
Internal -15V:
Internal +5V:
Delta temp.:
1
2
3
4
6


About My Application
cosylab
CONTROL SYSTEM LABORATORY
My Application v1.0
2004-10-26
Project: DF-ASPBooster
Project web page: http://www.cosylab.com/DF-ASPBooster/
Bug report email: bug@rt.cosylab.com
Copyright (c) 2004 All rights reserved.
Cosylab Ltd.
http://www.cosylab.com
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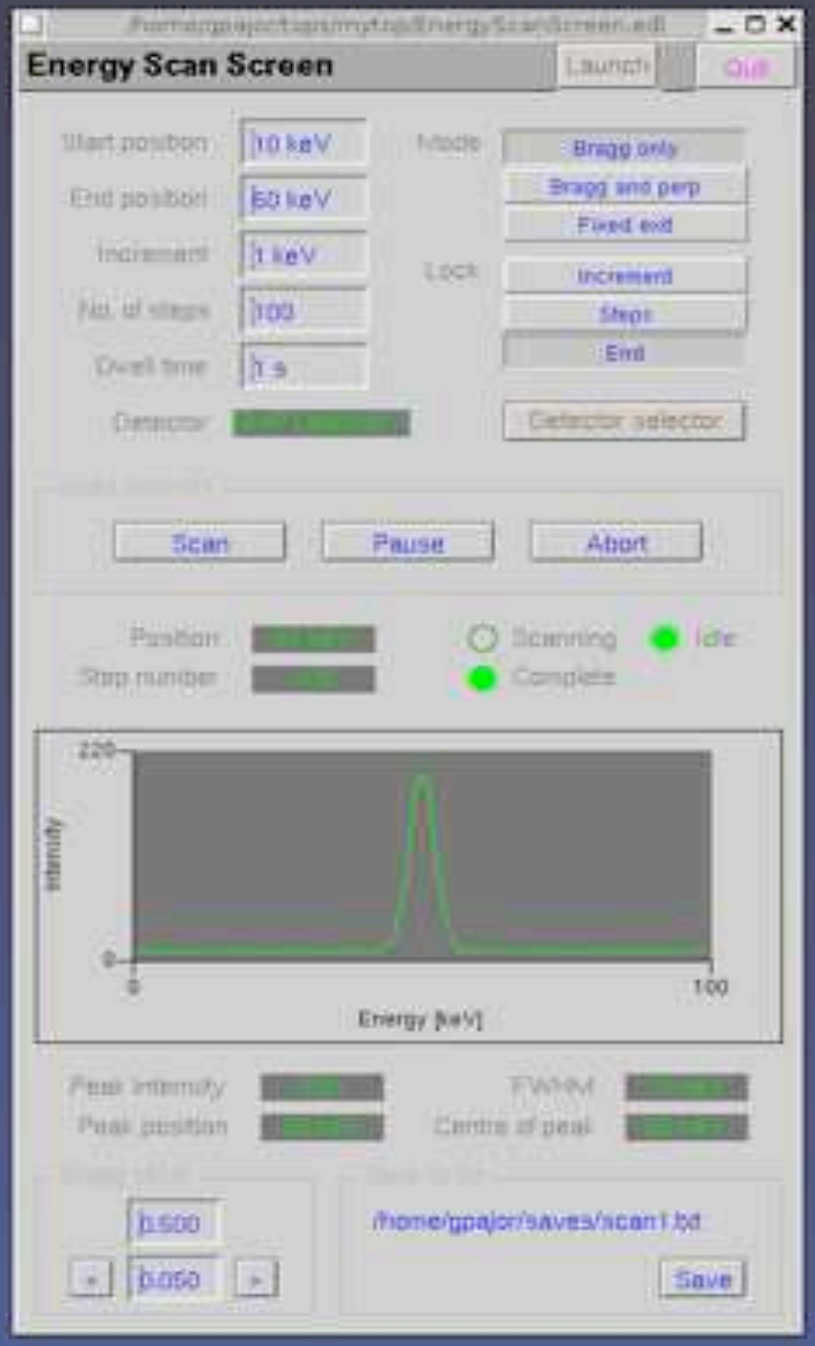
Close


Energy Scan Screen
Launch
Quit
Start position
10 keV
End position
60 keV
Increment
1 keV
No. of steps
100
Dwell time
1 s
Detector
Mode
Bragg only
Bragg and perp
Fixed exit
Lock
Increment
Steps
End
Detector selector
Scan
Pause
Abort
Position
Step number
Scanning
Idle
Complete
220
Intensity
0
100
Energy [keV]
Peak intensity
Peak position
FWHM
Centre of peak
0.500
0.050
/home/gpajor/saves/scan1.txt
Save


OXFORD
INSTRUMENTS
MAINS DISTRIBUTION

Technical Issues

- EPICS community support much better than commercial
  - asynDriver (in particular Marty and Eric)
  - PLC S7 driver (Dirk) – paid by PPT (on Danfysik contract)
  - DG535 (delay generator) device support (Marty)
  - autoSaveRestore (Tim Mooney) for bumpless reboot
  - caSR (John Winans, ?) channel access save/restore (snapshot)
  - stream device (Dirk), given to us by DLS
  - motor record, transform record, sscan record, waveAnl record (Synapps package, APS beamlines)
- Lots of commercial devices with serial/GPIB interfaces
  - Use our microIOC (embedded PC box with EPICS - see presentation on Friday) to integrated and decouple from the rest.

Organizational Issues

- Need each type of equipment at our premises
  - Soft records -> protocol simulator -> 1 device connected
- Prefer to work at home
  - Early visit to build trust in our competences
  - Install at "factory" on all devices, first acceptance
  - Participate in commissioning on site, final acceptance
- Diplomacy is important
  - How to be committed, but still get paid for all the extra work?
  - Refering to specs and contract just doesn't work
  - Sometimes need to negotiate between contractor and end user
- We usually deliver more than internal people, just because we know that we get only paid at the end!

Conclusions

- Will equipment vendors provide EPICS inside? yes
  - Will they still need integrators like Cosylab? Yes (I hope)
- Will EPICS become a monopoly? No
  - But labs will have to decide on some standard, else they will pay a higher price
- Labs can accelerate this development by requesting EPICS for each piece of equipment!
  - Everyone will profit (wink, wink ☺)