PANDA Controls

Announcements

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EPICS GUIs in CSS

EPICS GUIs in CSS

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Description

This tutorial teaches you how to use CSS (Control System Studio) to write GUIs that communicate with the E[...]
steps, CSS installation and project set up, and we use existing information from the DCS requirements datab[...]

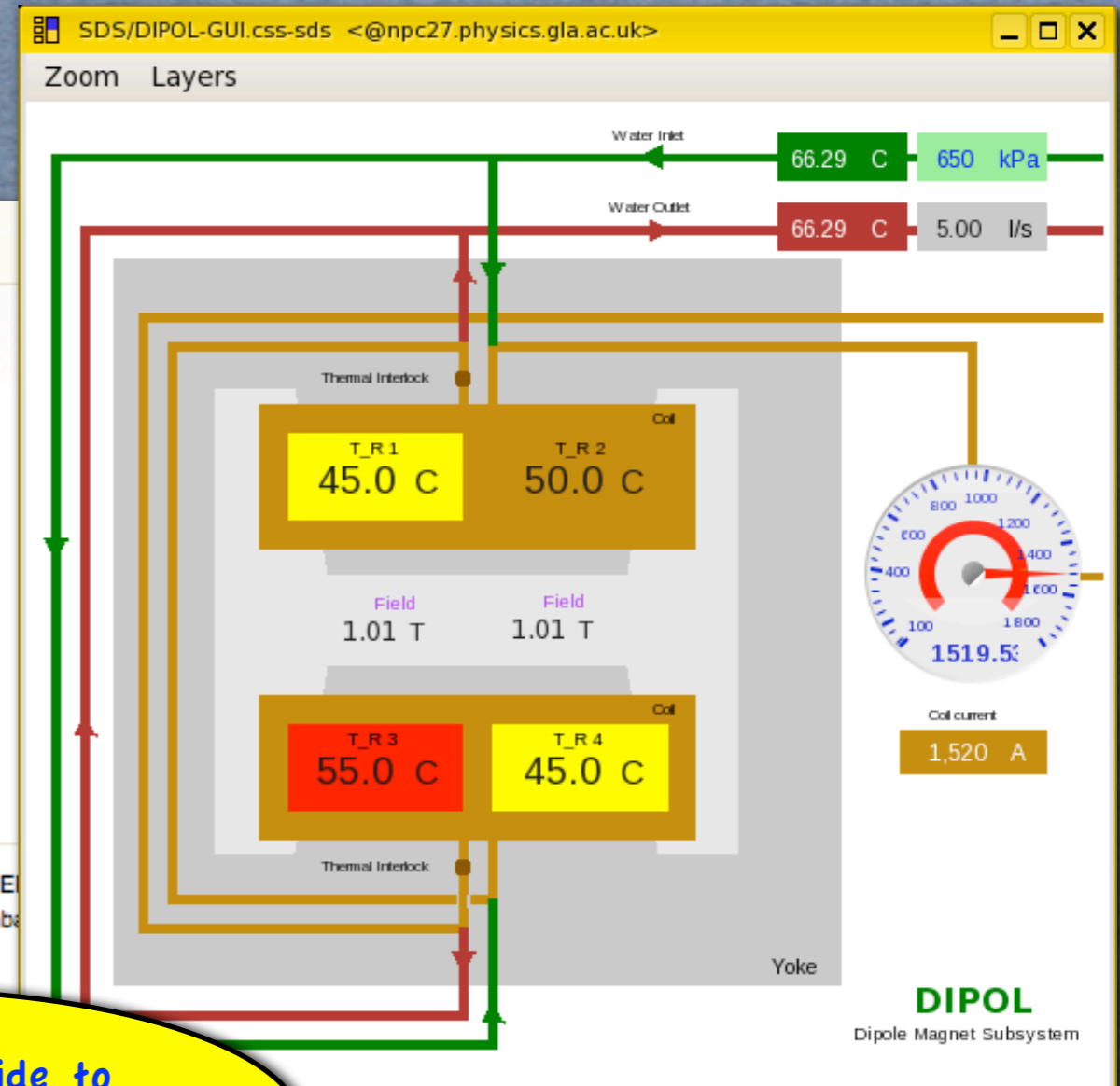## Starting Documentation

Some direct links to resources used herein:

- EPICS (GSI wiki)
- CSS (Control System Studio)
- PANDA DCS wiki | eLog

Installing EPICS

First EPICS base:

- Download source from http://www.aps.anl.gov/epics/download/base/index.php (baseR3.14.11.tar.gz)
- Unpack with `tar -zxvf baseR3.14.11.tar.gz`
- Set `export EPICS_HOST_ARCH=linux-x86_64` (or whatever your architecture actually is)
- Go into `configure/` directory; do `make`
- Go to `../src`; do `make`

SDS/DIPOL-GUI.css-sds <@npc27.physics.gla.ac.uk>

Zoom   Layers

Water Inlet   66.29 C   650 kPa

Water Outlet   66.29 C   5.00 l/s

Thermal Interlock

T_R 1   45.0 C   T_R 2   50.0 C

Field 1.01 T   Field 1.01 T

T_R 3   55.0 C   T_R 4   45.0 C

Thermal Interlock

Coil

Yoke

Coil current   1,520 A

1519.5[...]

DIPOL
Dipole Magnet Subsystem

Step-by-step guide to writing and testing the GUI for your detector subsystem

EPICS/CSS/Root wiki

Main PV Database

ProcessVariables

This is the main table. Some of the fields in this table are standardized, and you might have to edit other tables (Subgroups, Parameters, Types, Units etc.), before the desired options show up in the drop down in Hz (0.016=1/min). Range min and max should be outside Alarm min and max limits, respectively.

+ Table Description | Hints | Show all subgroups | Show all columns | Stats | SQL   Tables: Contacts | Experiments | Hardware | Institutes | Logbook | Parameters | Subgroups | Types | Units

Subgroup	Parameter	Unit	Type	Channels	Update rate	Is monitored	Is controlled	Gen interlock	Description	Contact	Hardware	Action
DIPOL	T_R	°C	Continuous	4	1	yes	no	no	Dipole coil temperature	Guangliang Yang	custom	N/A
DIPOL	P_F	kPa	Continuous	1	1	yes	no	no	Cooling water pressure	Guangliang Yang	unknown	N/A
DIPOL	T_F	°C	Continuous	2	1	yes	no	no	Cooling water temprature	Guangliang Yang	unknown	N/A
DIPOL	H_2O_Flow	l/s	Continuous	1	1	yes	no	no	Cooling water flow	Guangliang Yang	unknown	N/A
DIPOL	I_c	A	Continuous	1	0.1	yes	yes	yes	Dipole coil current	Guangliang Yang	custom	N/A
DIPOL	B	T	Continuous	2	1	yes	no	no	Magnetic field intensity	Dan Protopopescu	custom	N/A
Subgroup	Parameter	Unit	Type	Channels	Update rate	Is monitored	Is controlled	Gen interlock	Description	Contact	Hardware	Action

Find here an autogenerated EPICS records database file for this subsystem: DIPOL.db, and an IOC test script: DIPOL-IOCtest.sh

EPICS database file automatically created

Simple bash test script automatically produced

It doesn't get simpler than this ...

http://panda-controls.gsi.de/DB/interactiveTable.php?name=ProcessVariables

EPICS Test Database

ProcessVariables

This is the main table. Some of the fields in this table are standardized, and you might have to edit other tables (Subgroups, Parameters, Types, Units etc.), before the desired options show up in the drop down in Hz (0.016=1/min). Range min and max should be outside Alarm min and max limits, respectively.

+ Table Description | Hints | Show all subgroups | Show all columns | Stats | SQL   Tables: Contacts | Experiments | Hardware | Institutes | Logbook | Parameters | Subgroups | Types | Units

Subgroup	Parameter	Unit	Type	Channels	Update rate	Is monitored	Is controlled	Gen interlock	Description	Contact	Hardware	Action
									Dipole coil temperature	Guangliang Yang	custom	N/A
									Cooling water pressure	Guangliang Yang	unknown	N/A
									Cooling water temprature	Guangliang Yang	unknown	N/A
									Cooling water flow	Guangliang Yang	unknown	N/A
									Dipole coil current	Guangliang Yang	custom	N/A
									Magnetic field intensity	Dan Protopopescu	custom	N/A
									Description	**Contact**	**Hardware**	**Action**

```
# DIPOL.db: EPICS records generated from the DCS_REQ DB entries on 2-12-2010
# From http://panda-controls.gsi.de/DB/interactiveTable.php?name=ProcessVariables&showonly=5&keephidden=1
# This is an autogenerated draft, doublecheck it before use (and remove this line)!

record(ai, "PANDA:DIPOL:COIL:C1:T_R"){
    field(DESC, "Dipole coil temperature (1)")
    field(EGU,  "C")
    field(PREC, "3")
    field(SCAN, "1 second")
    field(VAL,  "35")
    field(HIHI, "50")
    field(HIGH, "40")
    field(LOLO, "10")
    field(LOW,  "15")
    field(HOPR, "60")
}
record(ai, "PANDA:DIPOL:COIL:C2:T_R"){
    field(DESC, "Dipole coil temperature (2)")
    field(EGU,  "C")
    field(PREC, "3")
    field(SCAN, "1 second")
    field(VAL,  "35")
    field(HIHI, "50")
    field(HIGH, "40")
    field(LOLO, "10")
    field(LOW,  "15")
    field(HOPR, "60")
}
record(ai, "PANDA:DIPOL:COIL:C3:T_R"){
    field(DESC, "Dipole coil temperature (3)")
    field(EGU,  "C")
    field(PREC, "3")
    field(SCAN, "1 second")
    field(VAL,  "35")
    field(HIHI, "50")
    field(HIGH, "40")
    field(LOLO, "10")
    field(LOW,  "15")
    field(HOPR, "60")
}
record(ai, "PANDA:DIPOL:COIL:C4:T_R"){
```

EPICS database file automatically created

Test script

ProcessVariables

This is the main table. Some of the fields in this table are standardize in Hz (0.016=1/min). Range min and max should be outside Alarm m

+ Table Description | Hints | Show all subgroups | Show all colu

Subgroup	Parameter	Unit	Type	Channels	Upd

```
# DIPOL.db: EPICS records generated from the DCS_REQ DB
# From http://panda-controls.gsi.de/DB/interactiveTable.p
# This is an autogenerated draft, doublecheck it before u

record(ai, "PANDA:DIPOL:COIL:C1:T_R"){
    field(DESC, "Dipole coil temperature (1)")
    field(EGU,  "C")
    field(PREC, "3")
    field(SCAN, "1 second")
    field(VAL,  "35")
    field(HIHI, "50")
    field(HIGH, "40")
    field(LOLO, "10")
    field(LOW,  "15")
    field(HOPR, "60")
}
record(ai, "PANDA:DIPOL:COIL:C2:T_R"){
    field(DESC, "Dipole coil temperature (2)")
    field(EGU,  "C")
    field(PREC, "3")
    field(SCAN, "1 second")
    field(VAL,  "35")
    field(HIHI, "50")
    field(HIGH, "40")
    field(LOLO, "10")
    field(LOW,  "15")
    field(HOPR, "60")
}
record(ai, "PANDA:DIPOL:COIL:C3:T_R"){
    field(DESC, "Dipole coil temperature (3)")
    field(EGU,  "C")
    field(PREC, "3")
    field(SCAN, "1 second")
    field(VAL,  "35")
    field(HIHI, "50")
    field(HIGH, "40")
    field(LOLO, "10")
    field(LOW,  "15")
    field(HOPR, "60")
}
record(ai, "PANDA:DIPOL:COIL:C4:T_R"){
```

```bash
#!/bin/bash
#
# DIPOL-IOCtest.sh: IOC Test script generated from the DCS_REQ DB entries on 2-12-2010
# From http://panda-controls.gsi.de/DB/interactiveTable.php?name=ProcessVariables&showonly
# Use this script to test your DIPOL.db EPICS record and GUIs
#    softIoc -s -m user=$USER -d DIPOL.db; ./DIPOL-IOCtest.sh


T=120

for (( c=1; c<=3600; c++ ))
do
   d=`echo "(1 + s(6.28*$c/$T))/2" | bc -l`
   cv=`echo "0+$d*(60-0)" | bc -l`
   echo -n "Setting PANDA:DIPOL:COIL:C1:T_R to "
   caput -t PANDA:DIPOL:COIL:C1:T_R $cv
   cv=`echo "0+$d*(60-0)" | bc -l`
   echo -n "Setting PANDA:DIPOL:COIL:C2:T_R to "
   caput -t PANDA:DIPOL:COIL:C2:T_R $cv
   cv=`echo "0+$d*(60-0)" | bc -l`
   echo -n "Setting PANDA:DIPOL:COIL:C3:T_R to "
   caput -t PANDA:DIPOL:COIL:C3:T_R $cv
   cv=`echo "0+$d*(60-0)" | bc -l`
   echo -n "Setting PANDA:DIPOL:COIL:C4:T_R to "
   caput -t PANDA:DIPOL:COIL:C4:T_R $cv
   cv=`echo "200+$d*(800-200)" | bc -l`
   echo -n "Setting PANDA:DIPOL:COOL:P_F to "
   caput -t PANDA:DIPOL:COOL:P_F $cv
   cv=`echo "10+$d*(85-10)" | bc -l`
   echo -n "Setting PANDA:DIPOL:COOL:C1:T_F to "
   caput -t PANDA:DIPOL:COOL:C1:T_F $cv
   cv=`echo "10+$d*(85-10)" | bc -l`
   echo -n "Setting PANDA:DIPOL:COOL:C2:T_F to "
```

Simple bash test script automatically produced

Root and EPICS

ROOT and EPICS

The PANDA collaboration software is based on ROOT. From a DAQ or Online Analysis point of view it simple example.

- ROOT and EPICS
  - EZCA Package
  - Test macro
  - Communicating with EPICS
  - Error handling

Step-by-step guide

EZCA Package

A simple way to communicate with EPICS from C is provided via the EZCA package. Documentation c

- E-Z (Easy) Channel Access

Both the source code and the primer are attached to this wiki. The EZCA package should be download

```
-bash-3.2$ mkdir $EPICS_BASE/extensions
-bash-3.2$ cd $EPICS_BASE/extensions
-bash-3.2$ tar -zxvf ~/ezca_20070625.tar.gz
-bash-3.2$ mv ezca_20070625 ezca
-bash-3.2$ cd ezca
-bash-3.2$ make
```

then set your LD_LIBRARY_PATH to include the ROOT and EZCA libraries:

```
export LD_LIBRARY_PATH=${LD_LIBRARY_PATH}:$ROOTSYS/lib:$EPICS_B
```
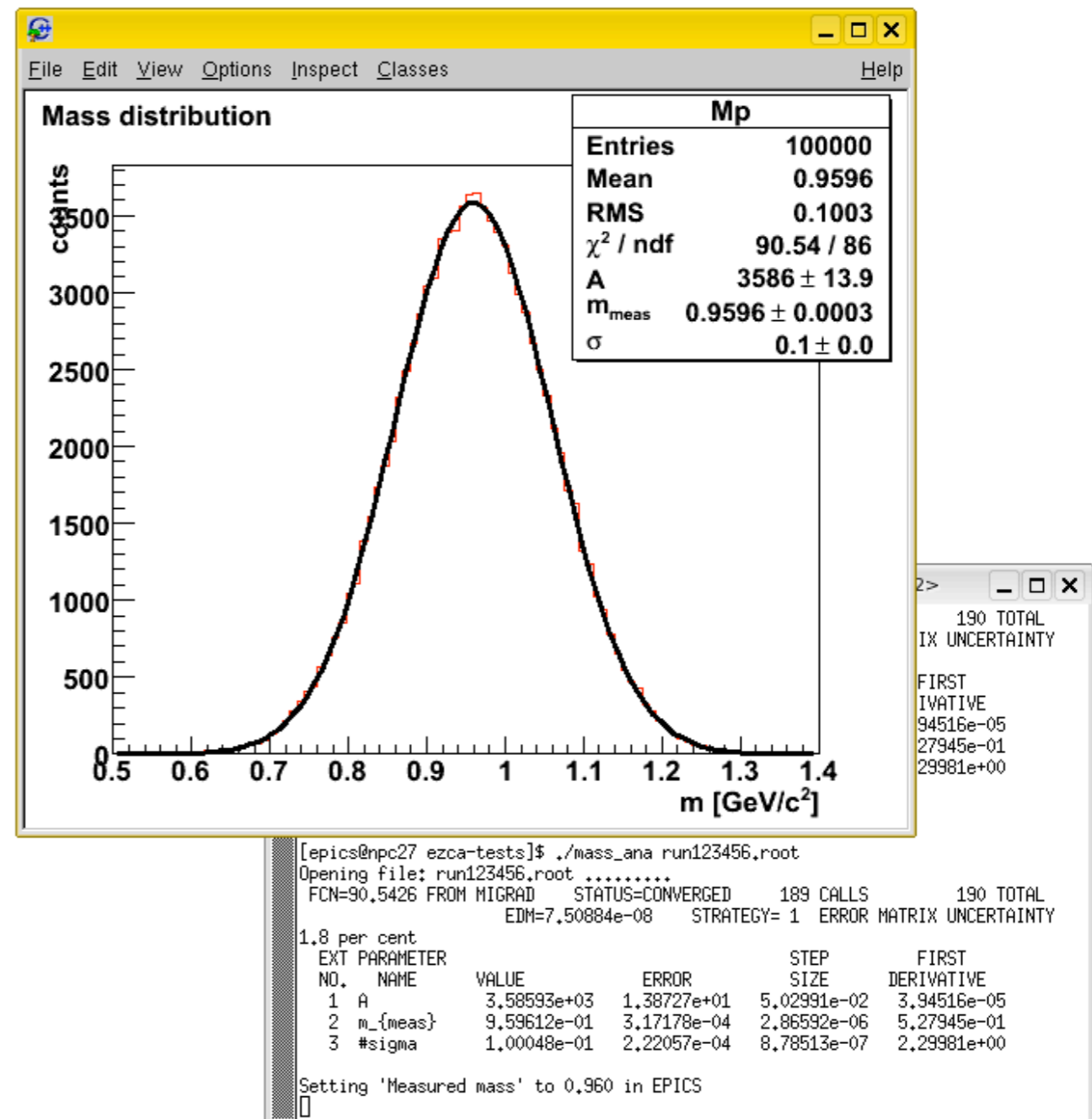
Make sure that $ROOTSYS is defined in your environment; $EPICS_BASE and $EPICS_HOST_

Test macro

This test macro produces a root file, containing a 'particle mass' spectrum, used as input for the next example.

Communicating with EPICS

Here is simple ROOT macro - mass_ana.C - that uses EZCA functions and does the following:

Mass distribution

	Mp
Entries	100000
Mean	0.9596
RMS	0.1003
χ^2 / ndf	90.54 / 86
A	3586 ± 13.9
m_{meas}	0.9596 ± 0.0003
σ	0.1 ± 0.0

```
[epics@npc27 ezca-tests]$ ./mass_ana run123456.root
Opening file: run123456.root .........
 FCN=90.5426 FROM MIGRAD    STATUS=CONVERGED     189 CALLS         190 TOTAL
                    EDM=7.50884e-08    STRATEGY= 1  ERROR MATRIX UNCERTAINTY
1.8 per cent
  EXT PARAMETER                                  STEP       FIRST
  NO.   NAME      VALUE          ERROR          SIZE      DERIVATIVE
   1  A          3.58593e+03   1.38727e+01    5.02991e-02   3.94516e-05
   2  m_{meas}   9.59612e-01   3.17178e-04    2.86592e-06   5.27945e-01
   3  #sigma     1.00048e-01   2.22057e-04    8.78513e-07   2.29981e+00

Setting 'Measured mass' to 0.960 in EPICS
```

I need slow controls for my sub-detector. How do I get that ?

Ok, here is the recipe:

- **publish** your channels/PVs in our DCS database
- **get** the *draft* EPICS.db and test script, set up a test EPICS environment as shown in this wiki; **observe** our PV naming conventions
- **start writing** your GUIs like shown here; review existing examples
- edit the *draft* EPICS.db to do advanced customisation
- **produce** a scheme of monitoring/control interdependencies between your channels
- using this scheme, separate what will be controlled locally (e.g. voltage ramping, some interlocks etc.) and what relates to the Experiment CS
- **implement** local controls via EPICS, a script and/or compiled program
- **get** EPICS **running** with your control hardware like shown in these examples, contact Peter Zumbruch if help is needed
- **document** your hardware in our DCS database and Hardware Wiki
- use our forum to ask for help, tell others what you are doing, find out what others know

Today's programme

Two talks, both by Florian, followed by an open discussion:

- **Florian Feldbauer:** "Status of the EMC Slow Control"
- **Florian Feldbauer:** "Development of ultra thin PT100 sensors"

(Please attach your presentations to our TalksArchive)

Backup slides

from here on

Let's use our tools

You have ideas, work is being done, progress is being made, but the others don't know about it.

Everybody should really:

- review the DCS wikis
- subscribe to the mailing list and forum
- communicate with the other members of the DCS group and update their data in the Requirements DB along the way
- add documentation about prototyped hardware to the DB and the Hardware Wiki
- post ideas on the forum and add a entries to the wiki
- find out what others are doing

Forum

bookmark it, follow it!

Knowledge flow

This is what I would like to see happening:

Idea, successful prototype, innovative solution, requirement → Entry in one of the wikis, or a new, dedicated sub-wiki → Post to Forum or/ and mailing list, to let others know

\+

Entry in the requirements database

Others comment, investigate possible benefits for their subgroup etc.

new ideas
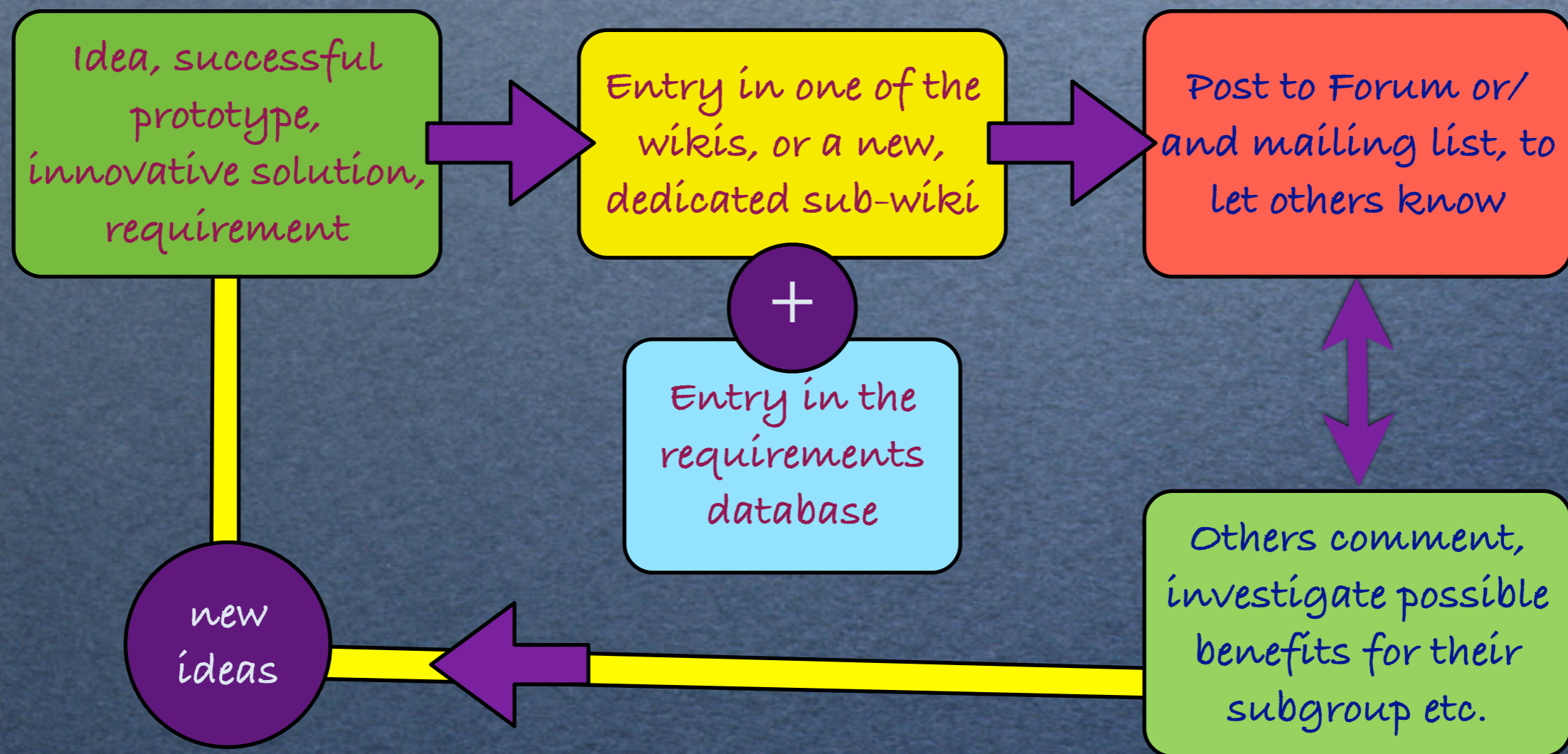
PANDA Experiment Control system