# Implementation of a GUI for the MPS

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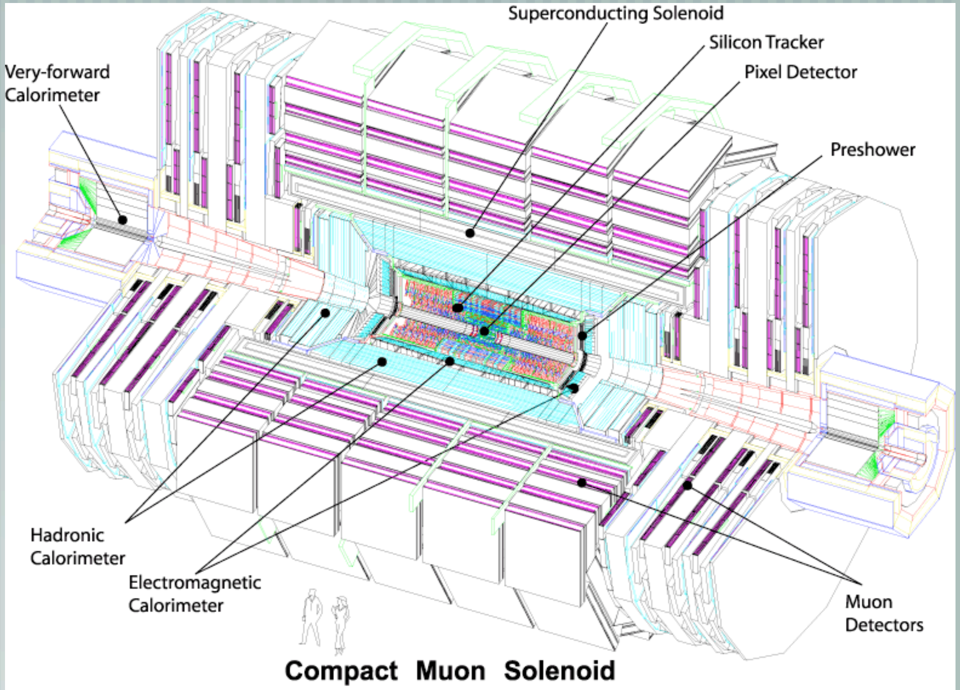
# CMS tracker

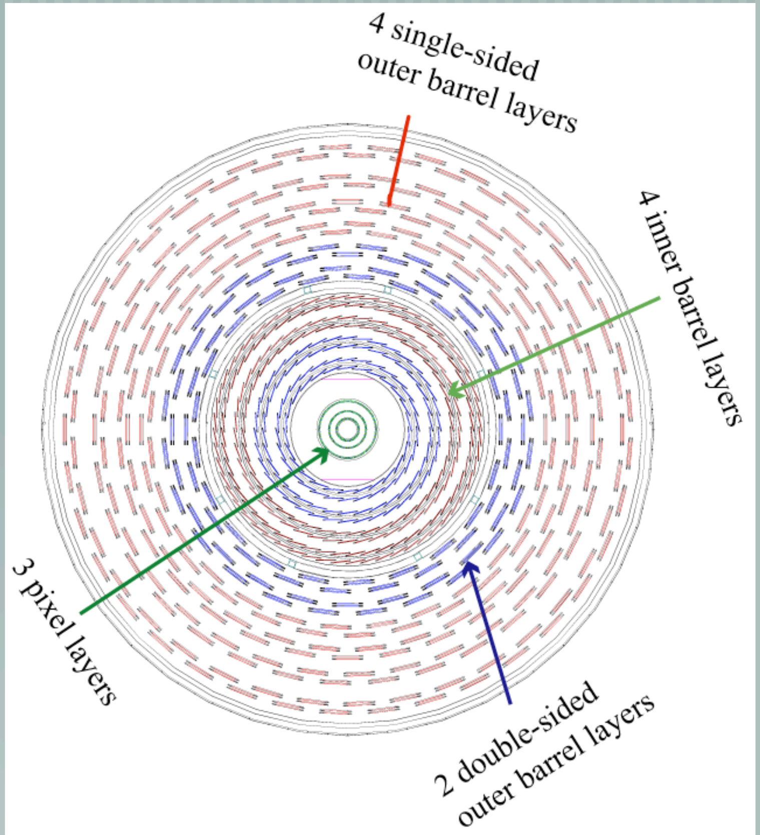
- The tracker is the device responsible for reconstructing the trajectories merging from the pp collisions.
- CMS tracker is the largest silicon detector ever built.
- A major requirement has been to achieve at least a 10% accuracy in the determination of the transversal momentum.

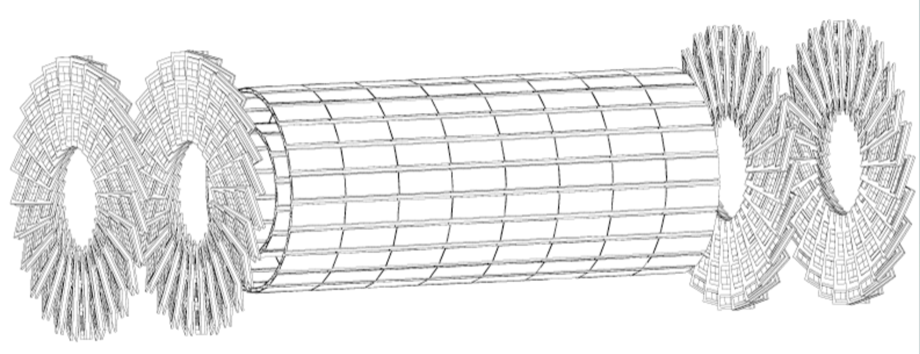


# Tracker layout

- The tracker system consists of a series of concentric cylindrical detectors located inside a solenoid magnet that create an axial magnetic field.
- The detectors form a cylinder by assembling a set of rectangular sub-assemblies with the right orientation.
- The layout comprise 25,000 silicon sensors having a composite surface of 210 $m^2$. The diameter is 2.4 m and the length is 5.4 m.

Layout for the silicon strip detector which is composed by several sub-detectors, namely the tracker inner barrel, tracker outer barrel, tracker inner disks and tracker endcaps.


4 single-sided outer barrel layers
4 inner barrel layers
3 pixel layers
2 double-sided outer barrel layers



The pixel detector is composed by two barrel layers, it is located surrounding the immediate vicinity of the interaction region.

# Why a silicon detector?

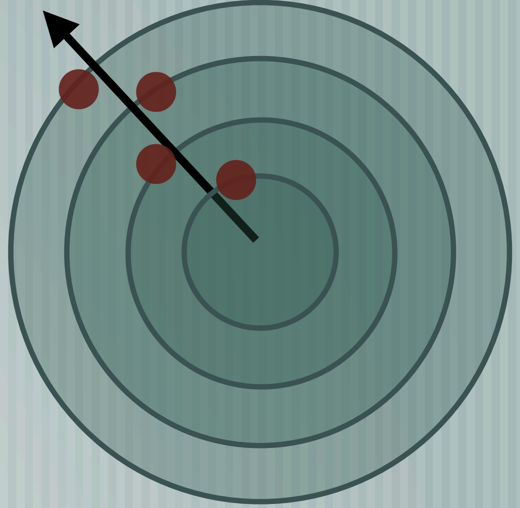
- Gas detectors are intrinsically limited in position reconstruction due to diffusion.
- Heavy flavor hadrons will be produced in QCD processes in LHC. High resolution required.
- This can be achieved by a silicon detector.

# Tracker must be aligned!

- We need to know with high precision the position of every single element of the tracker.
- This is impossible to achieve at this level of precision by mechanical (or optical) means.
- Track based alignment has been used successfully in the past.

# Track based alignment

- Track based alignment is based on the chi squared minimization principle of residuals.
- For CMS this is a complicated issue as it implies around O(100, 000) parameters.
- In the CMS tracker one usual track consists of 20 measurements, a helix track can be determined from only five parameters .



# Algorithms

- The first one is the Hits and Impact method which minimizes a chi squared function constructed from the track hit-residuals on the sensor, it is an iterative and computationally light method.
- The Kalman filter algorithm is another iterative method that avoids large matrix inversion and can use prior information, in this method the speed of convergence depends on the layer.

# The Millepede algorithm

- Millepede is a linear least-squares algorithm.
- Designed for certain problems where parameters can be separated into global and local.

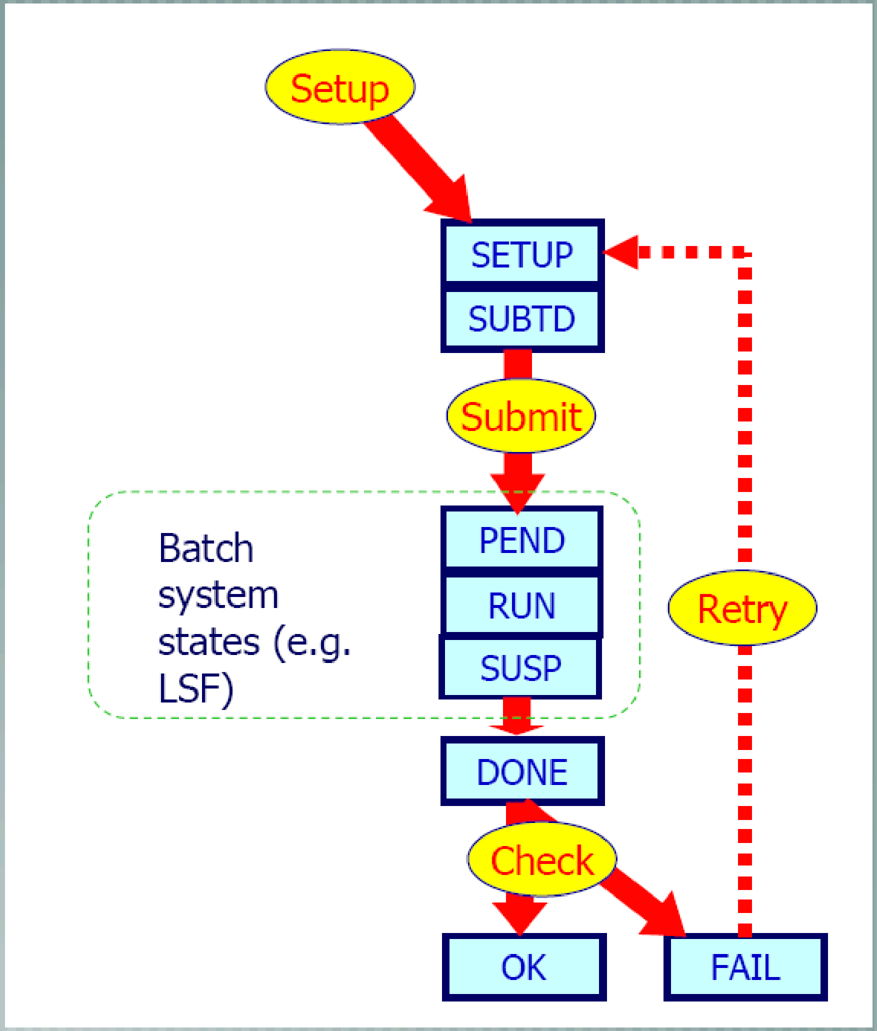
# Data sample sources

- High $p_t$ muons from W,Z decays.
- Cosmic muons.
- Beam halo muons.
- Muons from J/Psi and b hadron decays.
- Isolated tracks from QCD events.

# Millipede Production System

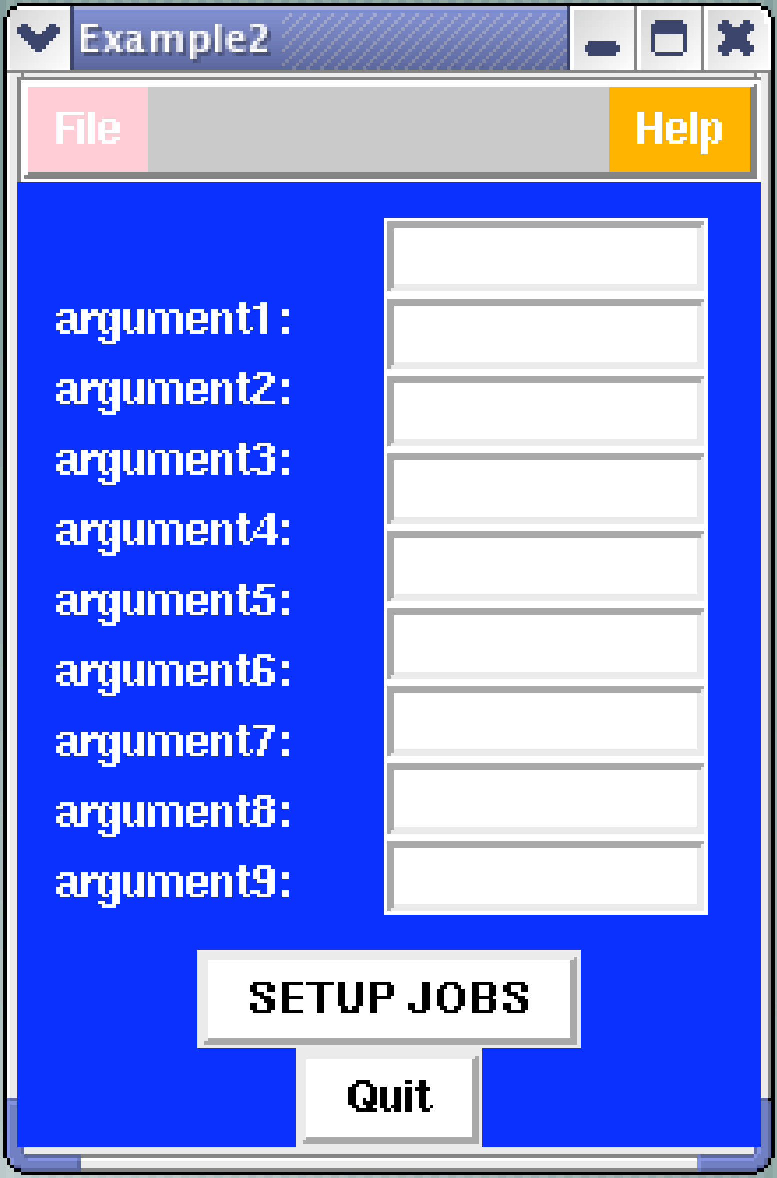
- The Millepede production system (MPS) is a set of Perl scripts.
- It can be used to run a large number of Mille jobs, to fetch the output.
- Output can be feed it into the pede program.

# MPS Workflow



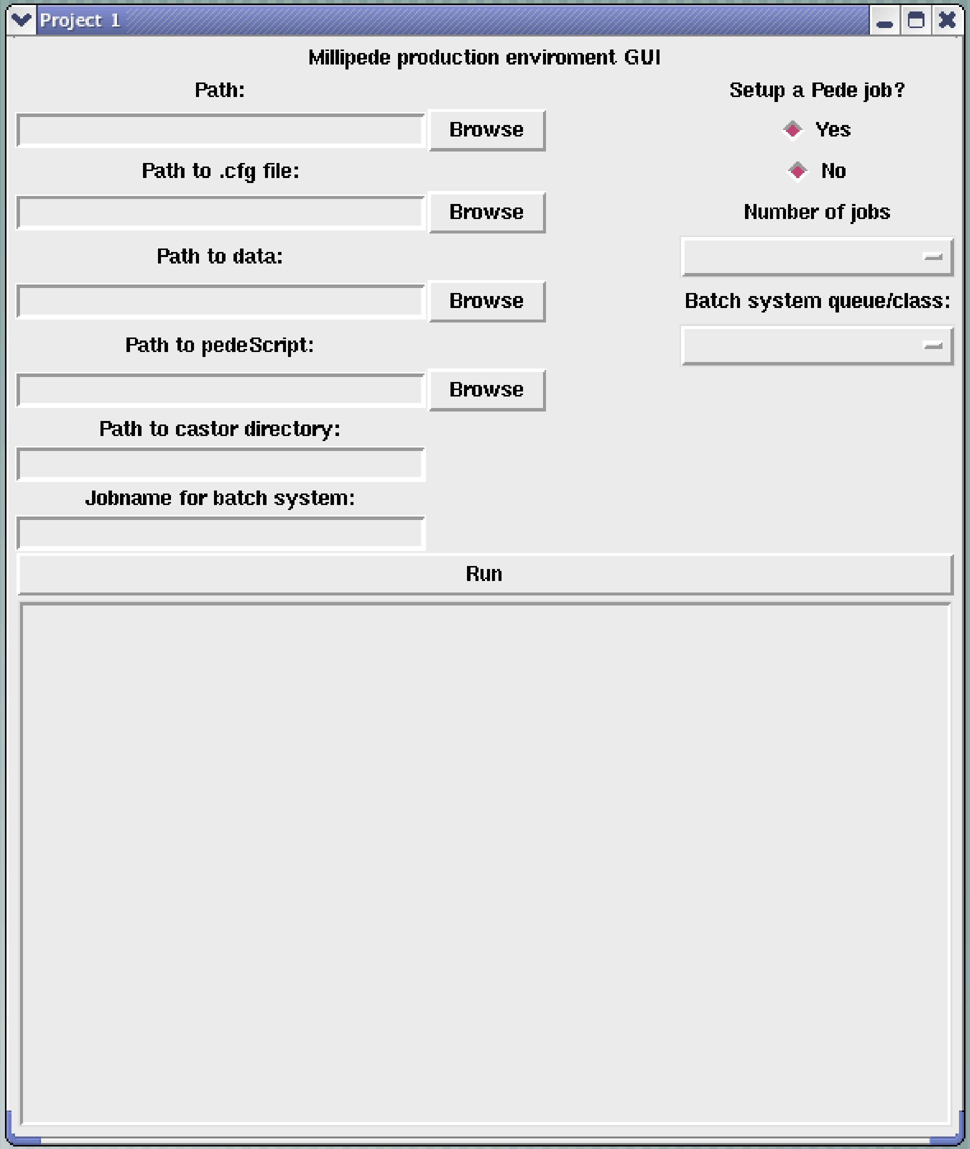
# GUI Development

First GUI implement for mps_setup.



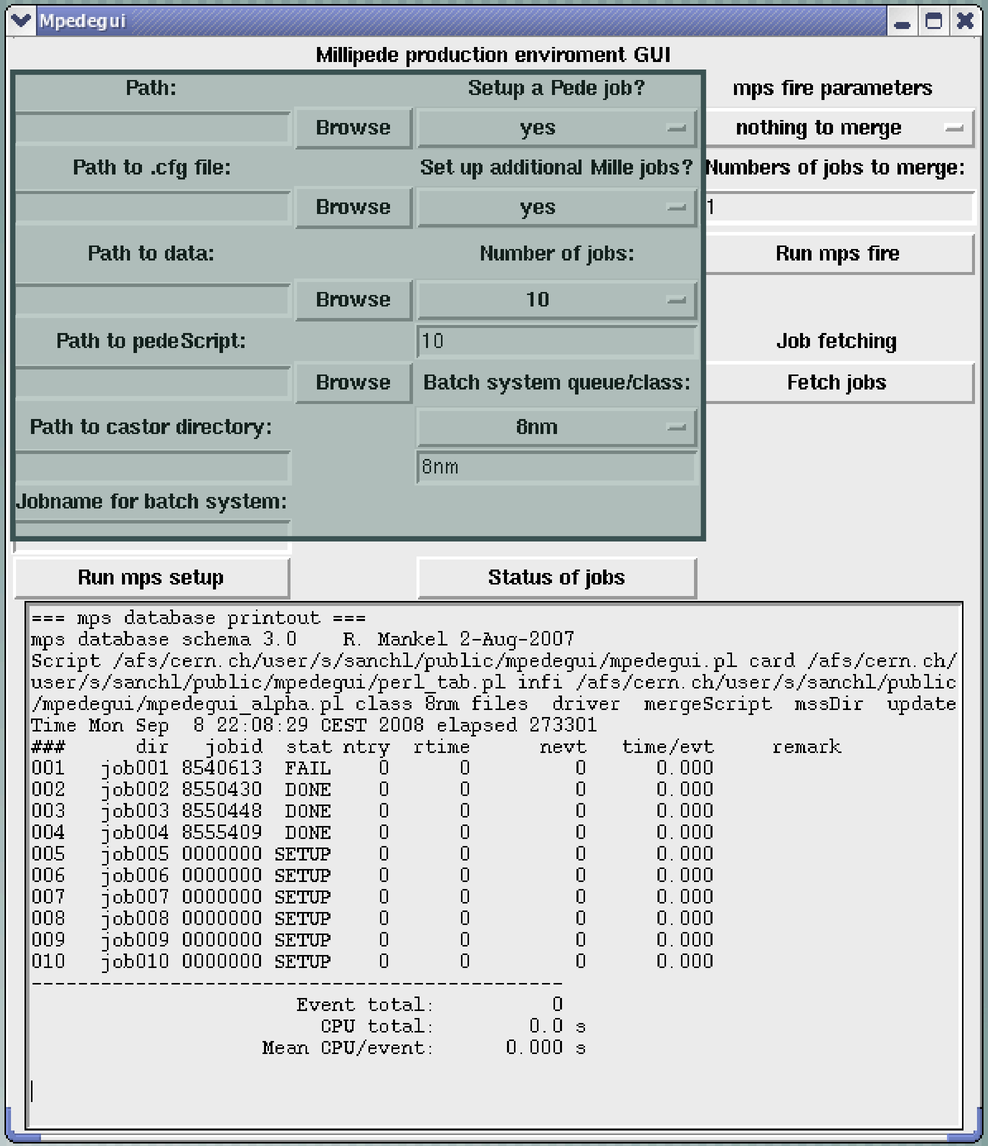
# GUI Development

## GUI skeleton produced by ZooZ



# GUI Development

MPS Setup Input (configuration files, input files, castor directory, system class, number of jobs.



Path:

Path to .cfg file:

Path to data:

Path to pedeScript:

Path to castor directory:

Jobname for batch system:

Setup a Pede job? yes

Set up additional Mille jobs? yes

Number of jobs: 10

10

Batch system queue/class: 8nm

8nm

mps fire parameters

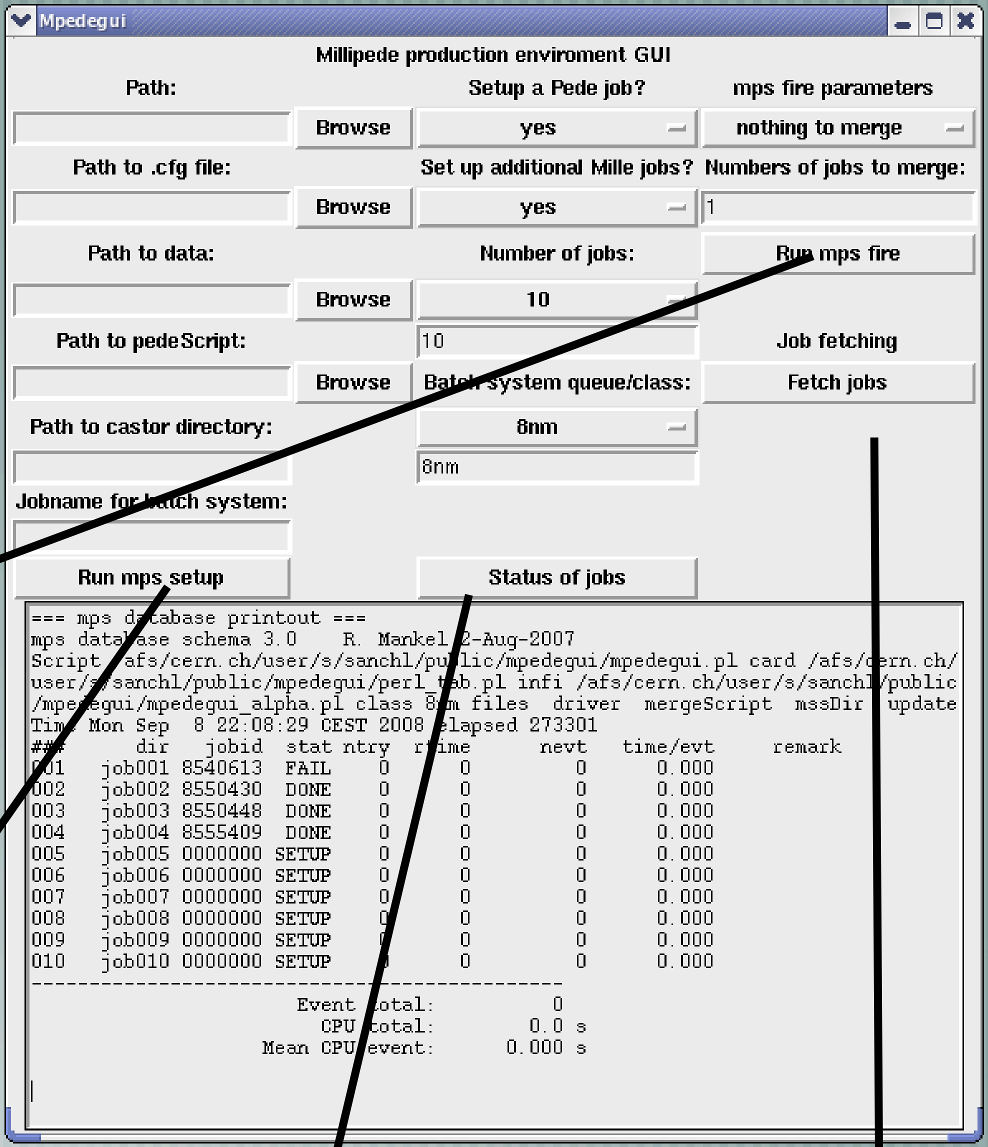
nothing to merge

Numbers of jobs to merge: 1

Job fetching

```
=== mps database printout ===
mps database schema 3.0    R. Mankel 2-Aug-2007
Script /afs/cern.ch/user/s/sanchl/public/mpedegui/mpedegui.pl card /afs/cern.ch/
user/s/sanchl/public/mpedegui/perl_tab.pl infi /afs/cern.ch/user/s/sanchl/public
/mpedegui/mpedegui_alpha.pl class 8nm files  driver  mergeScript  mssDir  update
Time Mon Sep  8 22:08:29 CEST 2008 elapsed 273301
###      dir    jobid  stat ntry  rtime       nevt   time/evt      remark
001   job001 8540613  FAIL    0      0          0      0.000
002   job002 8550430  DONE    0      0          0      0.000
003   job003 8550448  DONE    0      0          0      0.000
004   job004 8555409  DONE    0      0          0      0.000
005   job005 0000000 SETUP    0      0          0      0.000
006   job006 0000000 SETUP    0      0          0      0.000
007   job007 0000000 SETUP    0      0          0      0.000
008   job008 0000000 SETUP    0      0          0      0.000
009   job009 0000000 SETUP    0      0          0      0.000
010   job010 0000000 SETUP    0      0          0      0.000
----------------------------------------------
                      Event total:          0
                        CPU total:        0.0 s
                  Mean CPU/event:      0.000 s
```

# GUI
# elopment



Millipede production enviroment GUI

Path: [Browse]

Path to .cfg file: [Browse]

Path to data: [Browse]

Path to pedeScript: [Browse]

Path to castor directory:

Jobname for batch system:

Run mps setup

Setup a Pede job? yes

Set up additional Mille jobs? yes

Number of jobs: 10

10

Batch system queue/class: 8nm

8nm

Status of jobs

mps fire parameters: nothing to merge

Numbers of jobs to merge: 1

Run mps fire

Job fetching

Fetch jobs

```
=== mps database printout ===
mps database schema 3.0    R. Mankel 2-Aug-2007
Script /afs/cern.ch/user/s/sanchl/public/mpedegui/mpedegui.pl card /afs/cern.ch/
user/s/sanchl/public/mpedegui/perl_tab.pl infi /afs/cern.ch/user/s/sanchl/public
/mpedegui/mpedegui_alpha.pl class 8nm files  driver  mergeScript  mssDir  update
Time Mon Sep  8 22:08:29 CEST 2008 elapsed 273301
###       dir    jobid  stat ntry  rtime       nevt   time/evt      remark
001   job001 8540613  FAIL    0      0          0      0.000
002   job002 8550430  DONE    0      0          0      0.000
003   job003 8550448  DONE    0      0          0      0.000
004   job004 8555409  DONE    0      0          0      0.000
005   job005 0000000 SETUP    0      0          0      0.000
006   job006 0000000 SETUP    0      0          0      0.000
007   job007 0000000 SETUP    0      0          0      0.000
008   job008 0000000 SETUP    0      0          0      0.000
009   job009 0000000 SETUP    0      0          0      0.000
010   job010 0000000 SETUP    0      0          0      0.000
----------------------------------------------------
                       Event total:          0
                         CPU total:        0.0 s
                    Mean CPU/event:      0.000 s
```

mps_fire

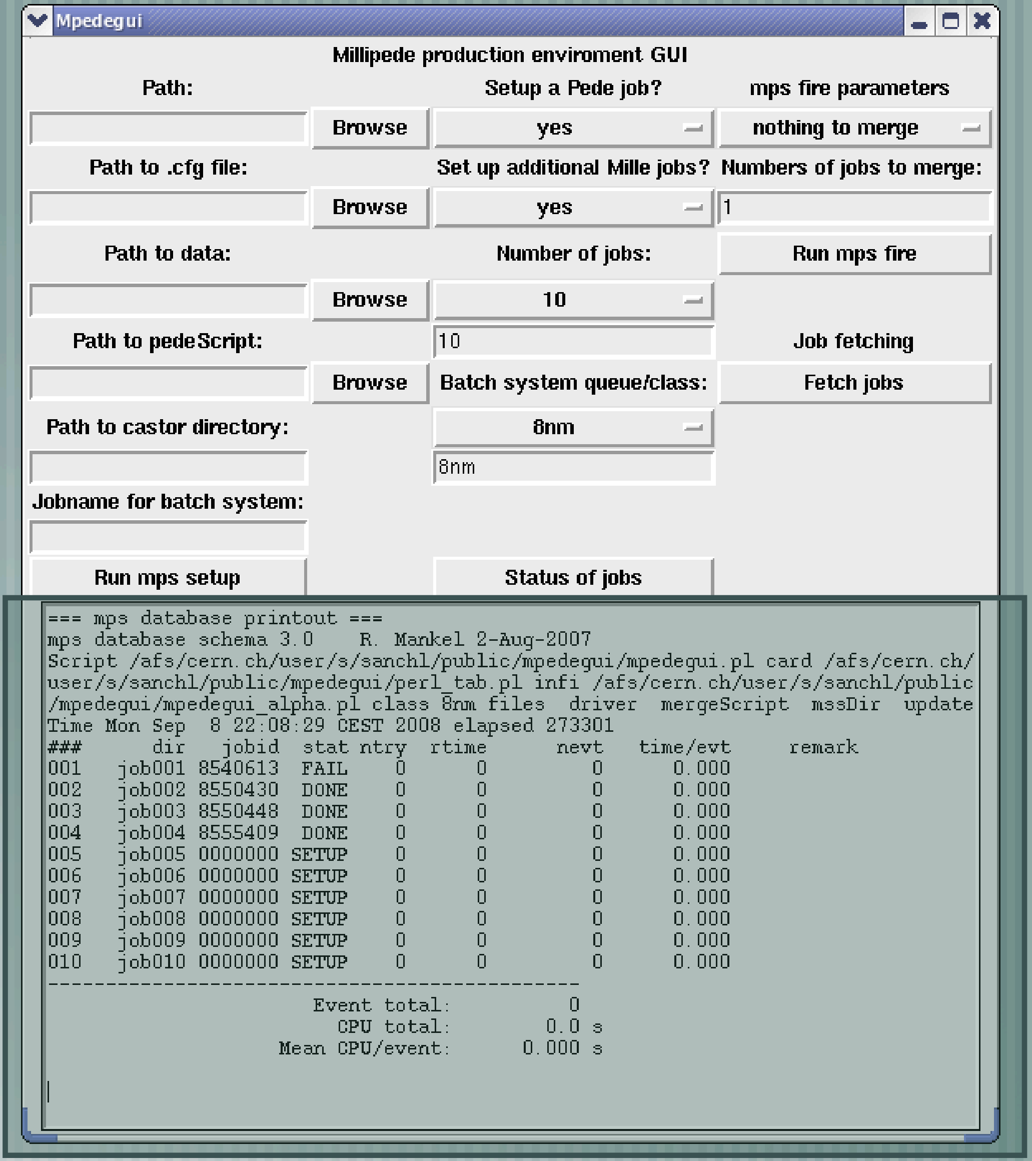
mps_setup

mps_status

mps_fetch

# GUI Development

Output read-only window. The output of all commands is displayed to the user as soon as the command is executed.



Setup a Pede job? yes

Set up additional Mille jobs? yes

Number of jobs: 10

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Batch system queue/class: 8nm

8nm

mps fire parameters: nothing to merge

Numbers of jobs to merge: 1

```
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Script /afs/cern.ch/user/s/sanchl/public/mpedegui/mpedegui.pl card /afs/cern.ch/
user/s/sanchl/public/mpedegui/perl_tab.pl infi /afs/cern.ch/user/s/sanchl/public
/mpedegui/mpedegui_alpha.pl class 8nm files  driver  mergeScript  mssDir  update
Time Mon Sep  8 22:08:29 CEST 2008 elapsed 273301
###      dir    jobid  stat ntry  rtime      nevt   time/evt     remark
001   job001 8540613  FAIL    0       0         0      0.000
002   job002 8550430  DONE    0       0         0      0.000
003   job003 8550448  DONE    0       0         0      0.000
004   job004 8555409  DONE    0       0         0      0.000
005   job005 0000000 SETUP    0       0         0      0.000
006   job006 0000000 SETUP    0       0         0      0.000
007   job007 0000000 SETUP    0       0         0      0.000
008   job008 0000000 SETUP    0       0         0      0.000
009   job009 0000000 SETUP    0       0         0      0.000
010   job010 0000000 SETUP    0       0         0      0.000
----------------------------------------------
                       Event total:           0
                         CPU total:         0.0 s
                    Mean CPU/event:       0.000 s
```

# Conclusions

- We have a functional GUI for the basic MPS workflow control.
- Further development required to add the remaining scripts.
- The GUI still needs some “beautification”.