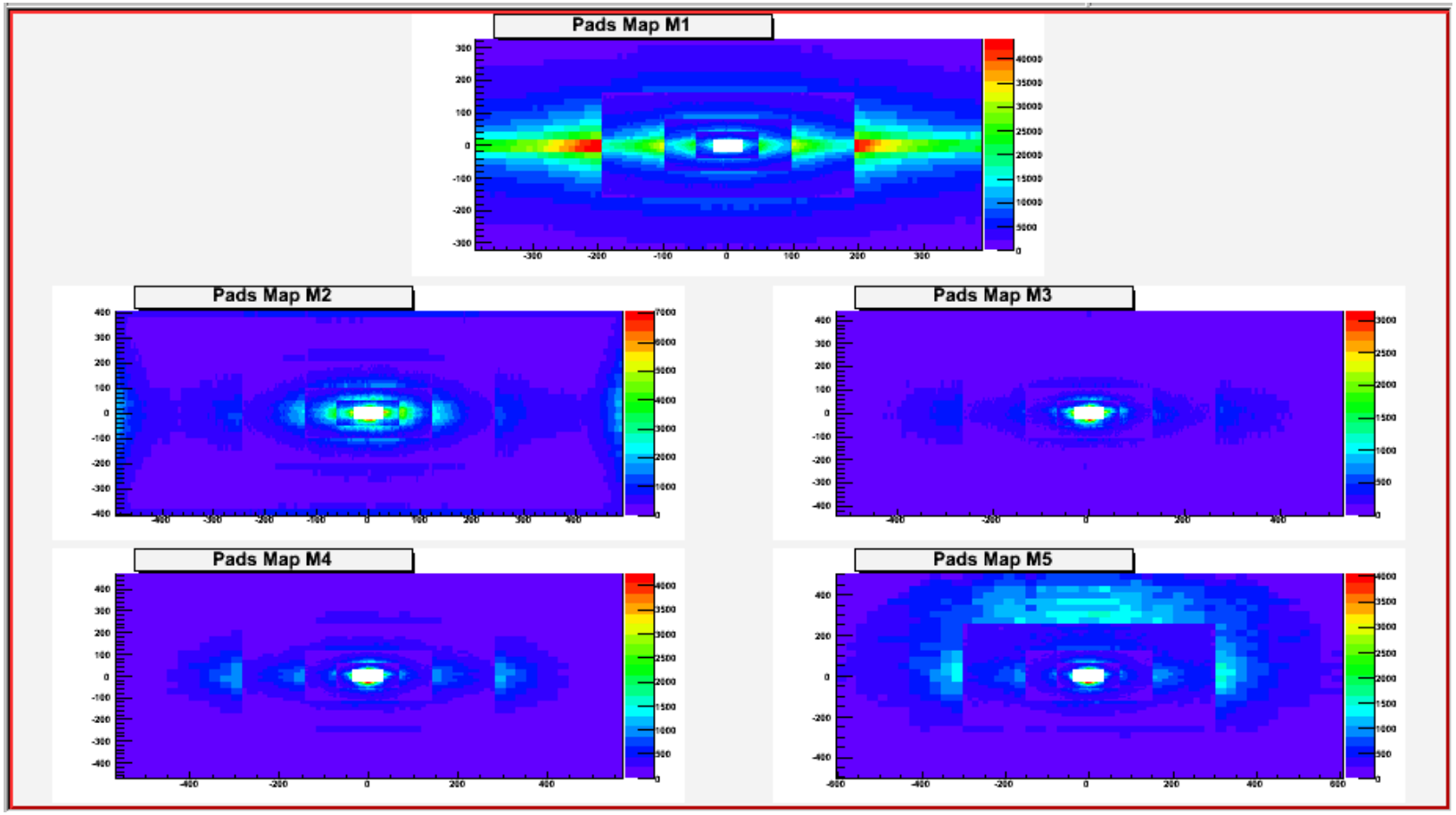
Status of Muonitoring tools

G. Graziani Oct 7 2009
LHCb Software Week



Overview

Muon DQ is mostly based on standalone Online Monitoring

- most calibrations are hardware based (thresholds, timing)
- typical problems require immediate action (trigger efficiency affected):
  - HV trips
  - chamber/readout inefficiency
  - time misalignment

However, we also need some monitoring during reconstruction:

- space alignment
  (expected to change only after detector opening)
- MuonID performances
  (expected to be stable)
- efficiency monitor
  (use tracking + large statistics)

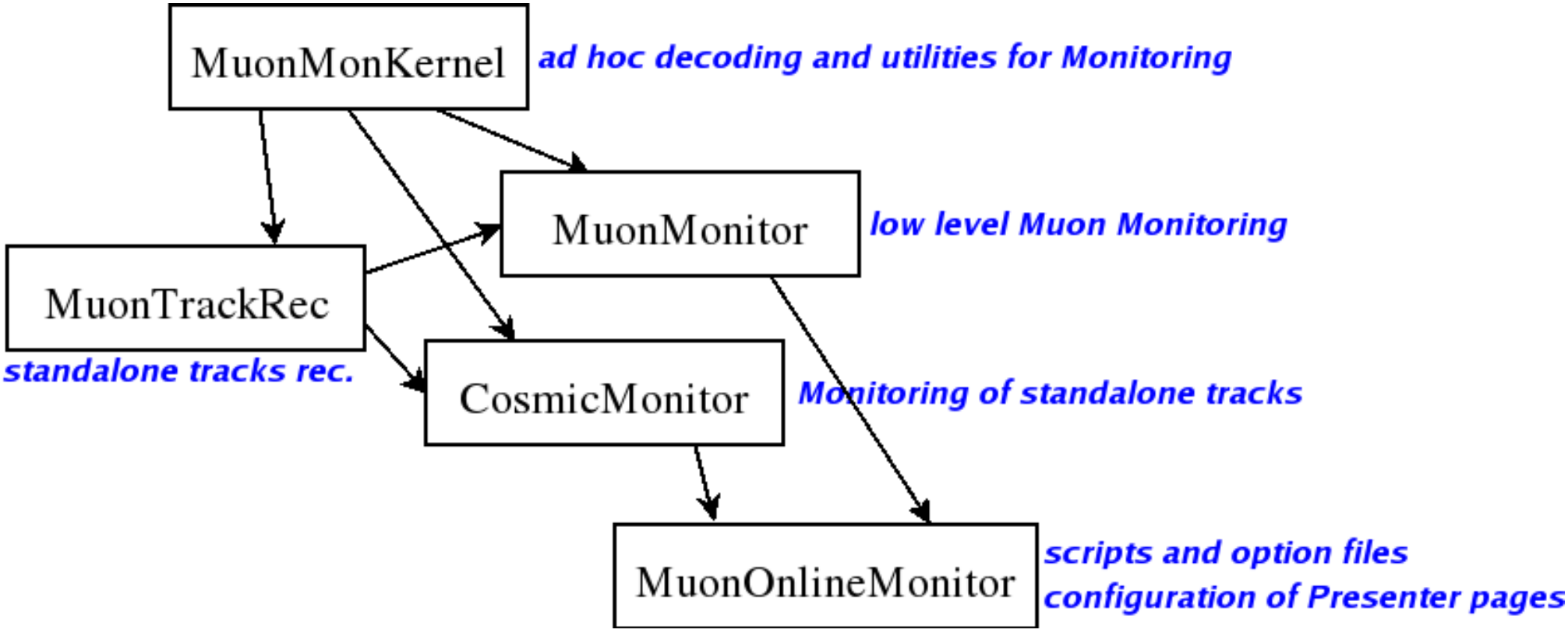
Online Monitoring

(G.Passaleva, G.G.)

- **Low level monitoring:**
  - occupancy and time spectra by different hardware components (Tell1s, ODEs, chambers, regions, quadrants)
- **Standalone track reconstruction:**
  - checks of internal space and time alignment
  - limited by CPU (single process) to $\sim$ 10 Hz of rec. tracks
    $\Longrightarrow$detect 1 ns time misalignment of a FEB or 1 mm displacement of an half–station in a few hours

Software for Online Monitoring

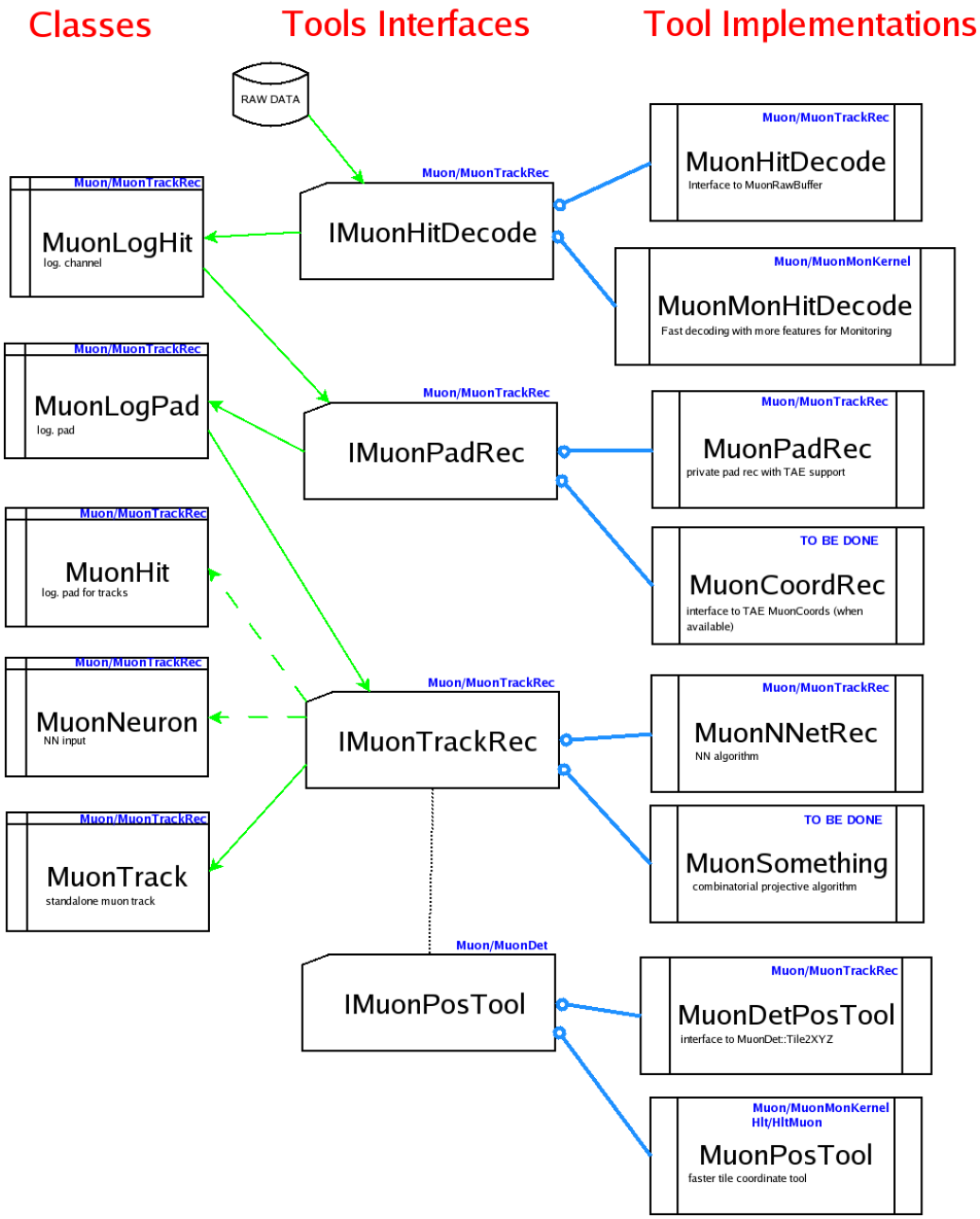
All packages in cvs under Muon/



The Muon/MuonTrackRec package

(replaces Muon/MuonNNet) provides standalone muon track reconstruction:

- can use optimized tools for monitoring or the normal muon decoding/rec. offline tools (for use within Panoramix or Brunel)
- 2 rec. algorithms:
  - Neural Network optimized for cosmics
  - Combinatorial algorithm (à la HLT) for projective tracks



Monitoring in Brunel

Algorithms for Brunel monitoring sequence:

- **MuonPIDChecker** (E. Polycarpo, M. Gandelman)
  generic checks on pattern recognition

- MuonID performance monitoring inside DaVinciMonitors
  MuID2BodyPlot (A. Sarti)

- New package Muon/MuonTrackMonitor to be released:
  MuonAlignmentMonitor (A. Petrella, S. Vecchi)
  MuonEfficiencyMonitor (P. Desimone)

MuonID performance Monitoring

(A. Sarti et al.)

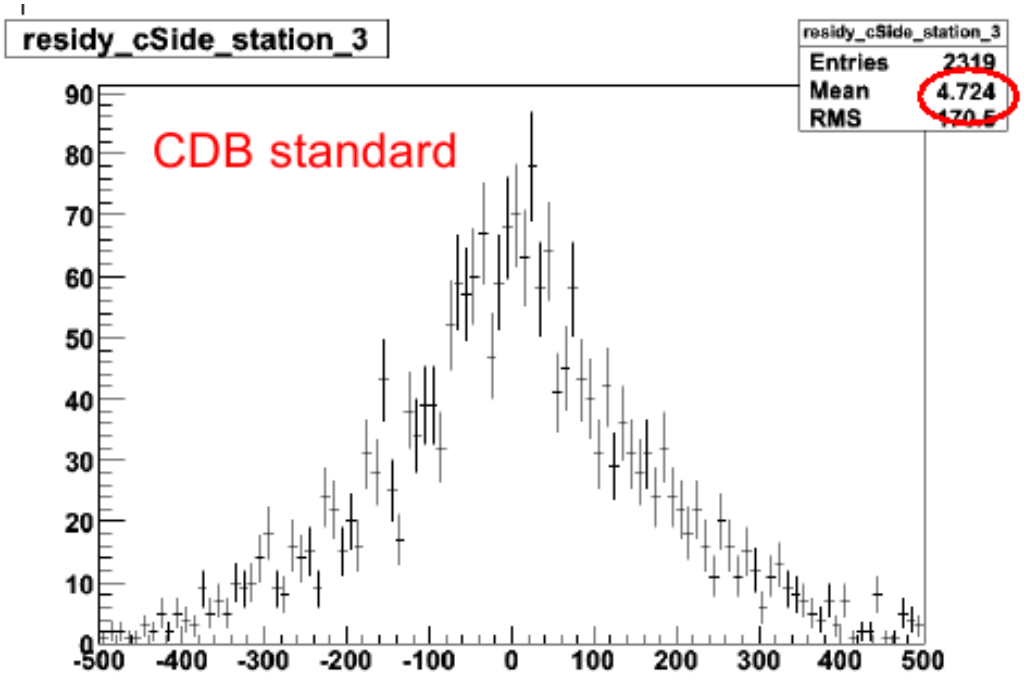
- MuonID calibration and monitoring performed using
  - $J/\psi \to \mu\mu$ (prompt or detached, selection depending on luminosity)
    for efficiency (tag and probe method)
  - $\Lambda \to \pi p$ for MisID
- Accurate calibrations (FOI and DLL) will be performed after stripping
  (needs $\sim$ 50k of selected tracks per region $\simeq$3 days@10^{31})
- first calibration and monitoring obtained from histograms produced in DaVinciMonitors
  - expect to measure MuonID eff. with 2% accuracy and misID for pions and protons with 0.1% accuracy, with $\sim$15'@10^{31}
  - check stability of FOI and DLL curves

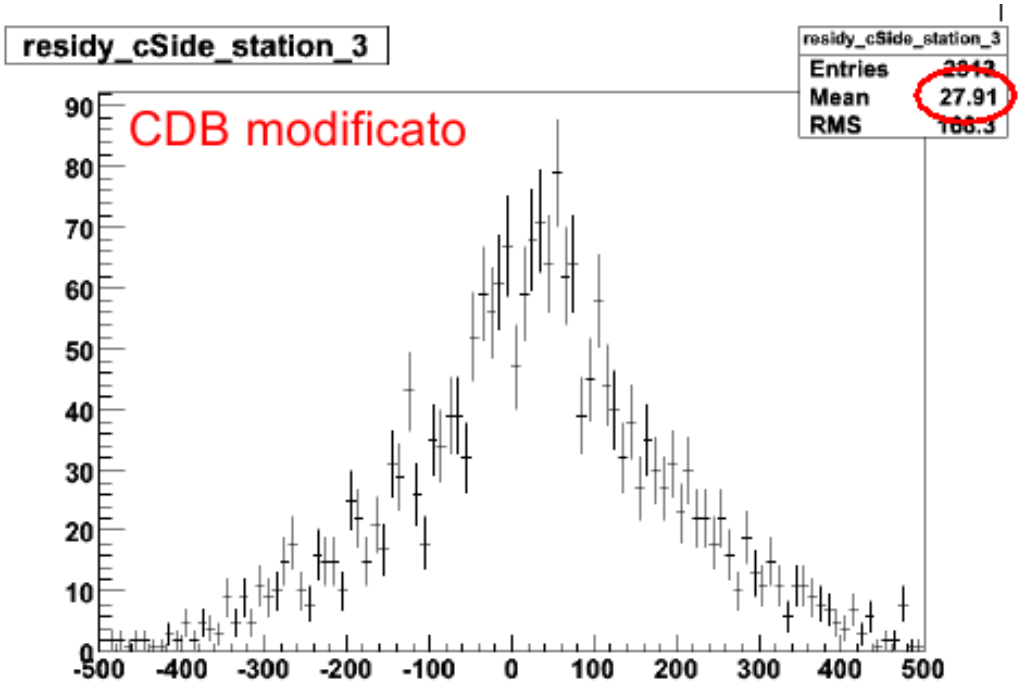
Alignment monitoring

(A. Petrella and S. Vecchi)

- Full alignment procedure will be performed at regular intervals or when needed offline
- a faster algorithm to monitor alignment has been implemented:
  - using objects from MuonID (long tracks + associated muon hits)
  - checks the overall tracker/muon alignment by plotting the residual between extrapolated long tracks and muon segment
  - checks the absolute position of each half station
  - results accurate within a few mm

Test: misalign one half station by 30 mm



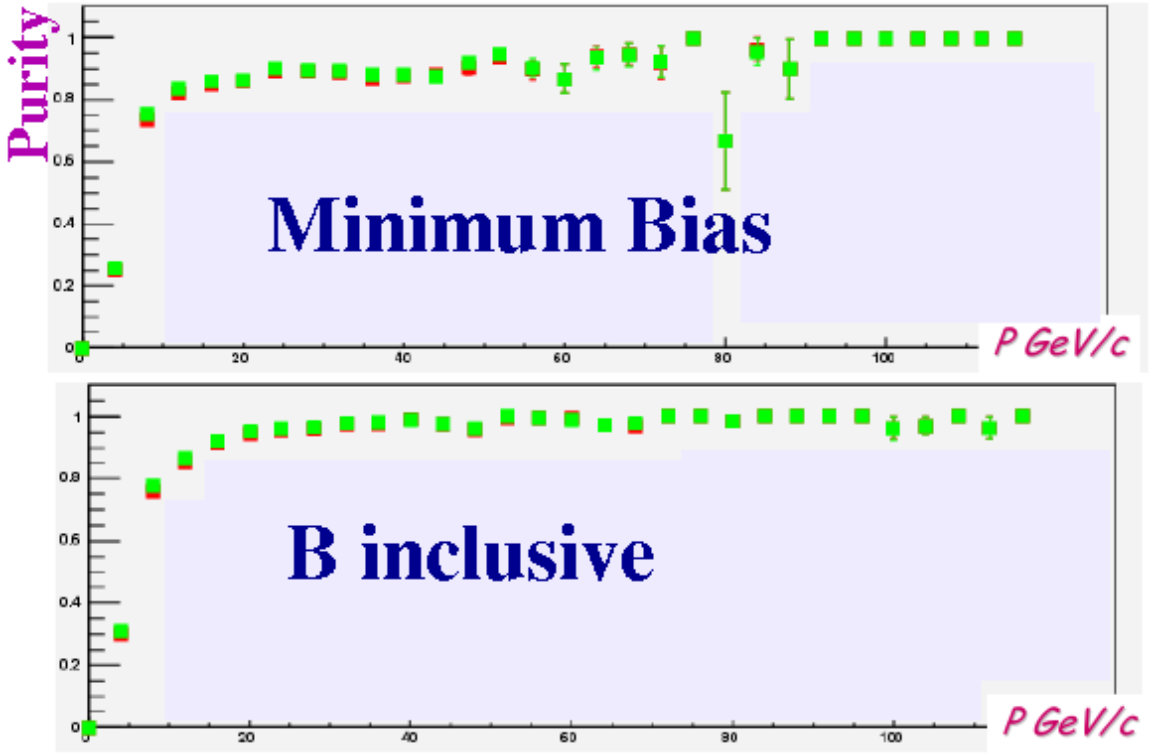


statistics used: 720k min. bias events

Efficiency Monitor

(P. DeSimone)

- can use the new MuonID loose selection (requiring at least 3/4 hits in M2–M5), excluding the triggering muon
- + cuts to enforce sample purity (track χ^2, isolation cut, mip signal in calo)



- expect ~ 0.3 selected track/minimum bias event
  $\Longrightarrow$can measure efficiency with >100 tracks/chamber with 400k min. bias events
- to be released in a week or so

Conclusions

- Muon Online Monitoring on raw data in mature state
- standalone muon track reconstruction tools available also for offline use
- Monitoring algorithms for Brunel almost completed. Plan:
  - include MuonTrackMonitor package in the next Brunel release
  - prepare standard Presenter pages