



Muon PRS : status report

- Outcome from Muon PRS-Workshops
- Software status, preparation for detector commissioning & “cosmic challenge” in CMS magnet test
- Physics TDR preparation



Muon Detector/PRS Physics TDR Workshops

- **EMU-PRS workshop during CSC meeting at FNAL:
Friday 29 October:**
 - ◆ **Agenda:** <http://agenda.cern.ch/fullAgenda.php?ida=a044612>
 - ◆ **Summary talk given during CPT week:**
<http://agenda.cern.ch/fullAgenda.php?ida=a044532>

- **BMU-PRS workshop in Torino: 16-17 November**
 - ◆ **Agenda:** <http://agenda.cern.ch/fullAgenda.php?ida=a044912>
 - ◆ **Brief summary included in this talk**

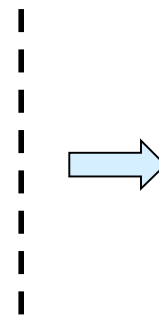
- **Joint workshop: Cern 5-6 December**
Agenda: <http://agenda.cern.ch/fullAgenda.php?ida=a045395>



PRS mu workshops

Both **EMU/BMU workshops** tried to address:

- Detector commissioning aspects
- Preparation of magnet test
- Startup procedures/synchronization
- Calibration , alignment issues



Important inputs
also to 1st volume
of Physics TDR

- Preparation of PTDR, physics analyses on benchmark channels

Joint workshop at Cern:

- More focused on PTDR
- Review Common issues...



EMU-PRS workshop Agenda

Friday 29 October 2004

<http://agenda.cern.ch/fullAgenda.php?ida=a044612>

STATUS AND OVERVIEW (09:00->09:30) Chairperson: [Loveless, R.](#)

09:00 STATUS AND OVERVIEW (20') ([transparencies](#)) [Loveless, R.](#)
(Wisconsin)

PRS Workshop (09:30->14:30) Chairperson: [Acosta, D.](#)

09:30 Overview of Physics TDR Goals (30') [Acosta, D.](#)
(Florida)

10:00 Plans of the Muon LPC Group (15') ([transparencies](#)) [James, E.](#)
(Fermilab)

10:15 Calibration Procedures and Plans (15') ([proceedings](#)) [Durkin, S.](#)
(Ohio State)

10:30 Synchronization Procedures and Plans (15') ([transparencies](#)) [Hauser, J.](#)
(UCLA)

11:15 Alignment Plans (15') ([transparencies](#)) [Hohlmann, M.](#)
(Florida Tech)

11:30 Data Quality Monitoring Plans (15') [Korytov, A.](#)
(Florida)

11:45 Cosmic Muon Reconstruction and Future Plans (15') ([transparencies](#)) [Barberis, E.](#)
(Northeastern)

12:00 Status of Muon Simulation and Reconstruction Software (15') ([transparencies](#)) [Cox, T.](#)
(UC Davis)

13:30 Muon Reconstruction, Identification and HLT (15') [Neumeister, N.](#)
(Vienna)

13:45 TeV Muon Reconstruction, Fast Simulation and High-Mass Muon-Pair Studies (15') ([transparencies](#)) [Bourilkov, D.](#)
(Florida)

14:00 SUSY and Radiative Tail in $Z \rightarrow \mu^+\mu^-$ (15') [Tripathi, M.](#)
(UC Davis)

TEST BEAM (14:30->16:00) Chairperson: [Padley, P.](#)



BMU-PRS workshop

<http://newton.ph.unito.it/muon-prs/>

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Muon - PRS workshop on detector commissioning & startup and Physics TDR preparation
 16-17 of November 2004 Torino

Agenda & slides on CDS



General Topics for PTDR

- **Muon detector data (readout)**
- **Synchronization, calibration and alignment**
- **Commissioning at SX5 and start-up scenarios**
- **Trigger**
- **Simulation**
- **Reconstruction**
- **Benchmark physics analyses**

- ◆ **Joint workshop during this CMS week:**
 - **Reports from groups planning to contribute to PTDR and who were not able to report at the first two workshops**
 - **Summarize the status and workplan for PTDR activities**
 - **Usual status reports on Muon PRS activities**



Workshops outcome

- **First overviews of det. commissioning and needs for Magnet test (cosmic challenge test)**

- **E.Conti (BMU)**

Summarizing contributions at MB workshop on:

- **Commissioning of DT (slices by *A.Benvenuti*)**
- **Schedule & plans for *magnet test* (*F.Gasparini*)**
- **DTs and cosmic-rays (*A.Meneguzzo*)**
- **Status of hardware (local mode; global mode) DCS/DAQ (*M.Passaseo, S.Ventura*)**

- **F.Guerts (EMU)**

(also reporting experience from EMU slice test)

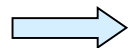


Cosmic challenge: Goals for DT

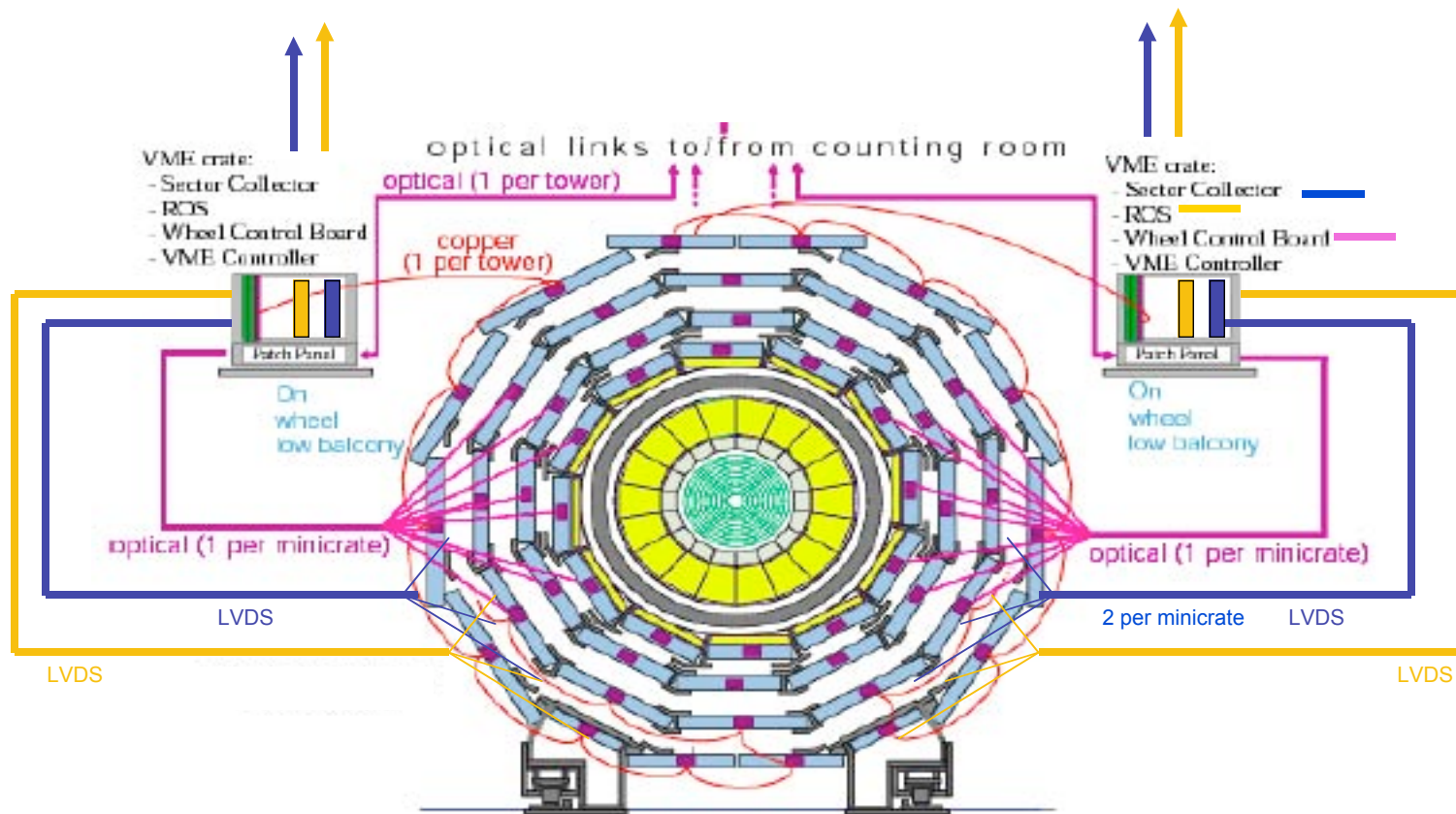
- **check cabling and signal distribution**
- **study DT performance under real CMS magnetic field (expecially MB1 in YB+2):**
 - ◆ **drift velocity**
 - ◆ **resolution**
 - ◆ **trigger efficiency**
- **understand how to synchronize a sector without external counters (but cosmics are not bunched)**
- **give a trigger to CMS**

Above all: test of integration (DAQ, DCS, trigger) within CMS system

Status of hardware and software needed was reviewed e.g. DCS & DAQ



DT DAQ & DCS Layout

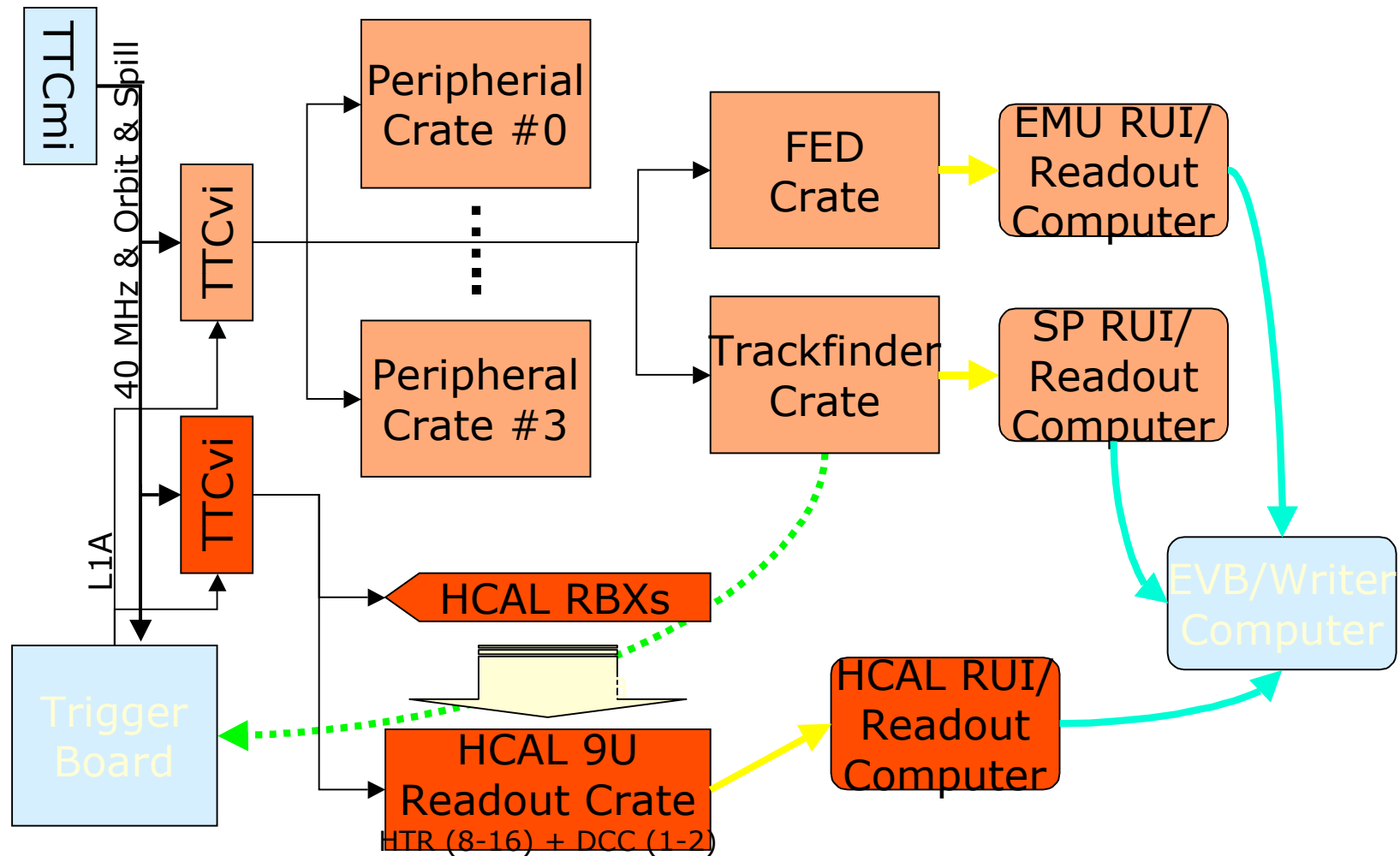


Three main data backbones: DCS, TDC Data, Trigger



HCAL+EMU: TTC and DAQ Set-Up

Integration experience from EMU slice test:

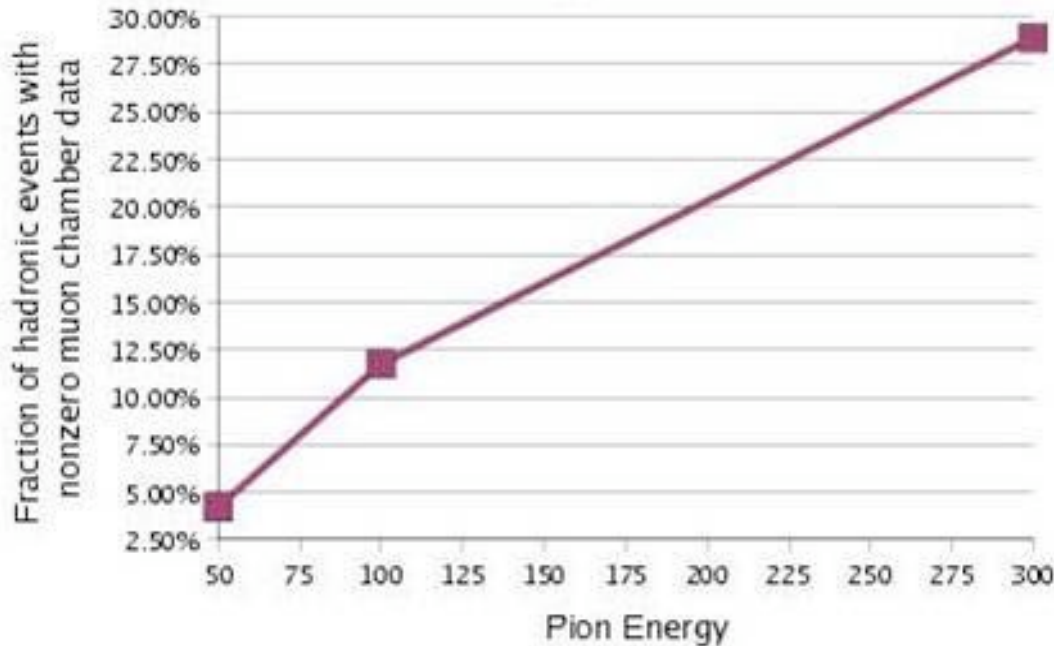




First punch-through results

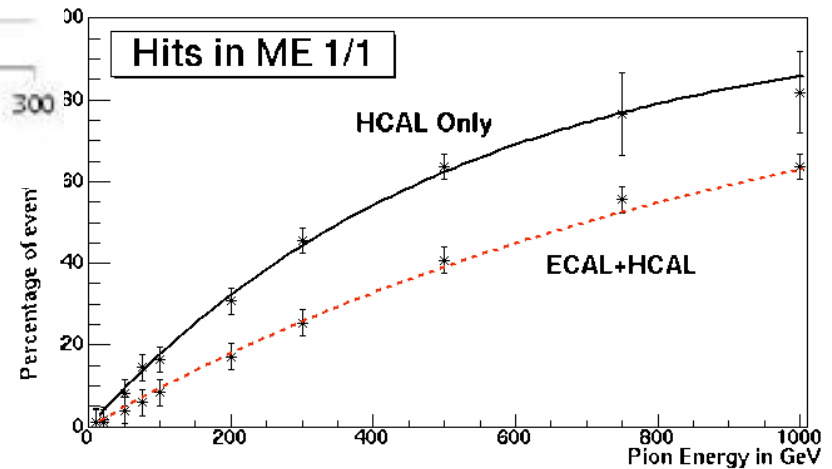
from Jeremy Mans

Punchthrough Rate



Results based on occupancy in pion data runs

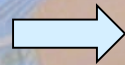
GEANT4 Monte Carlo expectation without mechanical dead material.





EMU Slice Test at SX5

- **Transition from Test Beam configurations to actual CMS set-up**
 - ◆ No more EMU Beam Tests
 - ◆ Move from individual component testing to a full system
 - ◆ use final electronics if available, otherwise revert to Test Beam equipment
- **Goal is to “configure and read out 18 chambers in various configurations, and self-triggering on cosmics”**



First plans to achieve this were reported



Outcome on “PTDR items”

■ **Readout:**

- ◆ Documentation on data formats exist
- ◆ Need to update digi representations to match current DDU data formats
(basically already used in DT “TBeam ORCA”)

■ **Geometry**

- final reconstruction geometry OK;
 - necessary changes in L1 simulator & DT reco ongoing
- ◆ Do we have reconstruction geometry tied with simulation and magnetic field geometries (e.g. passive material in reconstruction geometry) ?



Outcome on “PTDR items”

- **Simulation studies with OSCAR (G4)**
 - ◆ Validates the simulation framework, upon which much of the PTDR rests
 - ◆ Requires beam test simulation fully operational
 - tools for comparison with test beam data available
 - ◆ CSC: Should include possibility to reconstruct raw data in ORCA
 - **Test our algorithms**
 - ◆ Tuning FAMOS only makes sense if full simulation is correct!
- **Neutron background simulation**
 - ◆ We know this background will be present, but so far have not enabled it in ANY physics studies so far (incl. DAQ TDR)
 - **Would be a shame to ignore in Physics TDR as well**
 - ◆ Requires finalizing current ORCA implementation
 - ◆ Should cross-check against flux calculations of M.Huhtinen
 - ◆ Should update with improved simulation (Geant-4) and latest shielding designs
 - **New study initiated by Thai student + P.Arce + T.Cox**



Outcome on “PTDR items”

- Digitization

- modification needed in DT to handle timing in cosmic simulation

- L1 trigger simulation

- significant DT and CSC improvements reported;
- DT/RPC: need to become compliant with final geometry
- RPC: new PACT algo still under development;
not available in ORCA yet
**(tighter collaboration between trigger and det. people
needed; whorkshop was the occasion to (re)start it)**



Synchronization, Alignment, Calibration

■ Synchronization

- ◆ Detailed procedures presented for DT/RPC/CSC
- ◆ Need more automated procedures developed for CSC
- ◆ In particular, how to automate the timing-in of >1000 chambers? How do time constants differ for cosmic running, single beam (or halo), and collisions?

■ Alignment

Reports on hardware data, software tools in ORCA, misalignment effects at HLT & physics analysis level

■ Calibration

- ◆ Understood at hardware level, but must implement mechanisms to use calibration data in HLT and reconstruction

- All three areas need implementation into a “conditions DB”



Workshop Outcome on “PTDR items”

High-Level Trigger

We should recalculate our efficiencies and rates using latest ORCA8 release used for full analyses

Reconstruction

- improved in ORCA_8_6
- still issues in multi-muon events and high energy region
(work in progress from Dubna, UCLA, Padova:
latest ORCA_8_7 for DST production)
- comparison with test beam data needed
- developments for usage of calib.dbase needed

Interface to databases (configuration, calibration,...), proposal/developments of schema

- first ideas shown for DT / RPC /CSC systems...
- link/connection between detector and
dbase-CCS experts established



Outcome on “PTDR items”

Cosmic muons simulation

- exists
- beam halo sim. under development

Physics Analyses on “benchmark channels”:

- status plans for $H \rightarrow 2\gamma 2\gamma$, 4γ , $Z \rightarrow \gamma \gamma > 2\gamma$
- impact of miscalibration, misalignments firstly discussed; need to refine definition of realistic scenarios
- discussed on how organize/share work on various aspects (exp. Systematics, background measurement/computation, theor. uncertainties...)



Full Analyses

- **Aim of workshop was to coordinate activities**
 - ◆ Identify areas of work and find people to work on them
- **Rather than having N identical analyses at the same level of detail, we ought to strive toward “one” analysis which is a factor N better than can be done by one person or group**
- **Try to identify common areas between analyses**
 - ◆ Muon reconstruction, isolation, background generation...
- **Emphasis should be on testing and *improving* upon our simulation and reconstruction tools and our detector operation methods.**
 - ◆ i.e. Don't just focus on the “final result” of a physics channel. Actively contribute to the testing and development of our muon reconstruction tools



Systematic Uncertainties in Full Analyses

- **Must identify and address the most important ones, which will depend on analysis:**
 - ◆ **Misalignment & miscalibration: may impact Z' study more than Higgs studies**
 - **Softer muons affected mostly by multiple scattering**
 - ◆ **Backgrounds: Z' has fewer potential background processes than Higgs studies, and less sensitive to normalization(?)**

- **Significance estimator: High priority to define ones that include systematic uncertainty to guide selection optimization**
 - ◆ **Will help in prioritizing work plan to separate those studies with potentially large impact on result, from those affecting only the 3rd decimal place**
 - **We won't have the manpower to study every possible background, and to tune every possible reconstruction tool on the timescale of the PTDR**
 - ◆ **Estimator could be a simple approximation for selection optimization studies (vs. complete robust one for final results)**
 - **So timescale to define one should be quick**



Full Analyses: job sharing

H -> 4☐: Madrid & UFL groups
recent updates from A.Drodetski, P. Arce
(misalign/mis calib. Effects), status & plans
(Darin)

H->WW-> 2☐ : Padova
status presented by M. Zanetti



**Only 1 group here;
Would be nice
To have a 2nd
(job sharing,
x-checks...: highly
desirable for PTDR)**

Z' -> 2☐ UCLA, DUBNA, UFL

status reports & plans presented by
S.Valuev (UCLA), I. Belotelov (JINR)