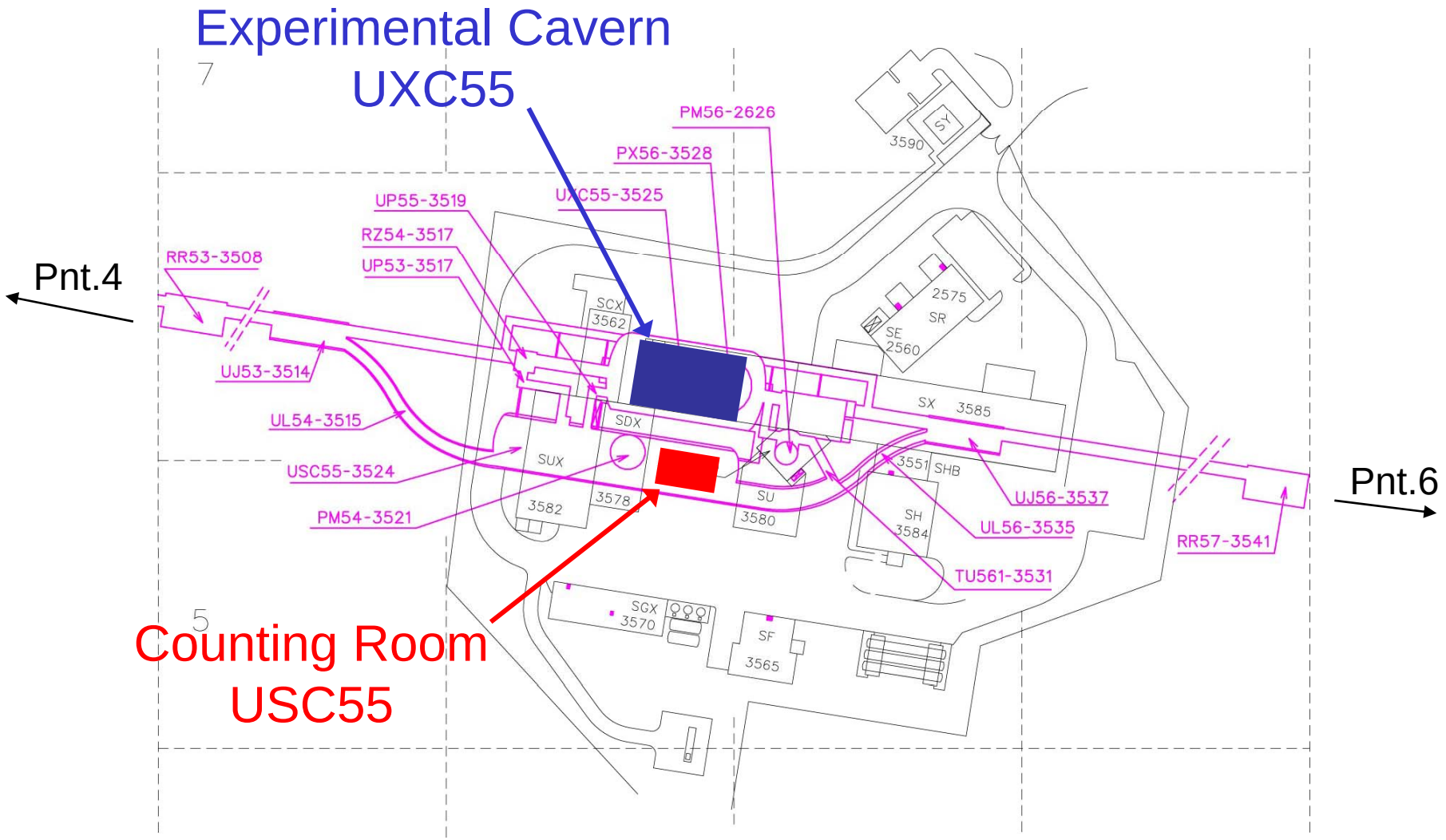
CMS - LHC Interfaces Overview and Status

- Hardware Systems
  - TTC
  - BST
  - GMT
  - Beam Interlock System
  - BPTX
- Software Systems
  - DIP Data
  - Software interlocks

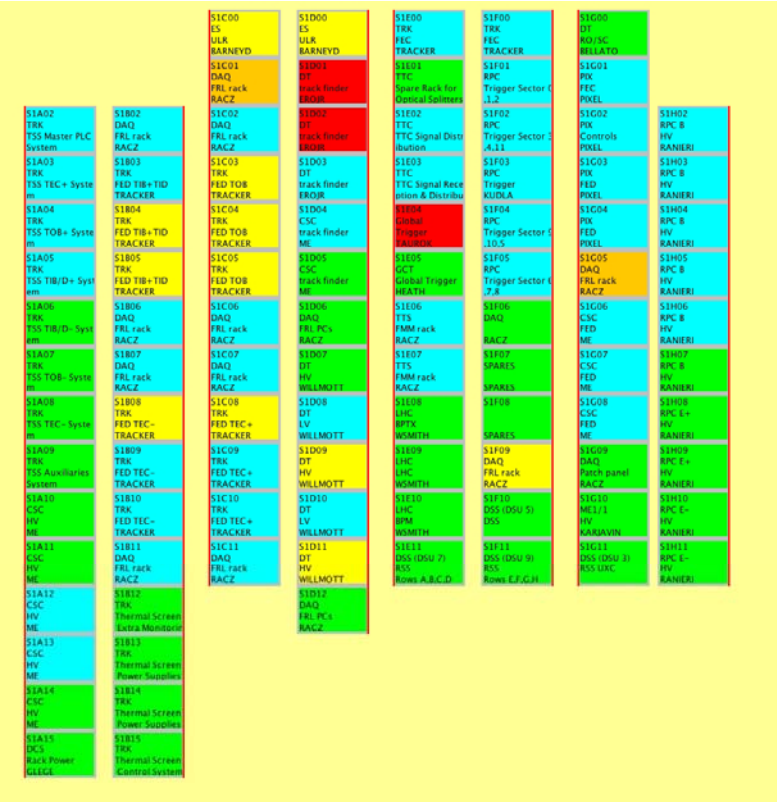
jan.troska@cern.ch

Finding your way around LHC Point 5



CMS Underground Counting Room

S1 - Lower floor



S2 - Upper floor

USC55 - 3524

TTC Signals - CMS use

- RF2TTC-based system to be installed in Rack S1E03
- Distribution to Detector via modules in Racks S1E02 & S1E03
- Successful initial testing of RF2TTC protoypes, get modules back again for two weeks to finish s/w interface to CMS systems
- Ready for interconnection test with SR4 as soon as production hardware becomes available
  - PH/ESS estimate is May.
  - Also need estimate for Signal Generation in SR4

J. Troska

TTC Signals - Cabling Status

- Cable path defined
  - SR4 - LHC Tunnel - UJ56 - USC55
  - Long distance fibres installed
  - Missing patch connections at above locations
    - TS/EL/OF in process of scheduling this operation
- Signals required by CMS:
  - LHC beam start -3 months

BST Signals - CMS use

- BST Signals are used in CMS by the Trigger Controllers to time-stamp event fragments
  - Global Trigger (GT) x1 (choose beam 1 or 2 manually)
  - Local Trigger Controllers (LTC) x9 (choose beam 1 or 2 manually)
- Beam information is decoded and added to Online DB
  - BOBR in RF2TTC crate x1 (both beams)
- Beam information is required for the functioning of the Beam Condition Monitor (BCM) system
  - BOBR module x2 (S1, S4) (both beams)
- Will house optical splitters at reception point in S1E03
  - Route signals to destinations within CMS
- Ready to receive BST signals today
  - Trigger controllers already installed in USC55

J. Troska

BST Signals - Cabling Status

- Same Status as TTC
  - Long Cable runs mostly exist
    - Apart from a run between CCC and CCC-Telecom racks
  - Patching missing
- Signal generation equipment in place and operational in CCC
- Signals required by CMS:
  - LHC beam start -3 months

GMT Signals - CMS use

- Time-references and Triggers used by CMS Beam Conditions Monitor (BCM)
  - Clone of LHC Beam Loss Monitor (BLM) system
  - Crate-based system contains 1x CTRV
  - Located in S1 and S4.
- Single PCI receiver for telegram monitoring
  - Data to be stored in CMS Online DB
  - Housed in a PC Inside DCS rack thus on UPS

J. Troska / R. Hall-Wilton

GMT Signals - Cabling Status

- GMT cable arrives in S1E08
  - Installation complete
  - Patch panel to be defined
- Cabling within USC55 still TBD in discussion with AB/CO
  - Cables will be installed by CMS to AB/CO requirements

Beam Interlocks in CMS

- CMS Experiment CIBU driven by CMS Beam Condition Monitor
  - LHC-BLM standard system
  - CMS use was approved by AB/BI technical board
- CMS Magnet Control system maintains a CIBU in its design for future use
- Totem has no experiment CIBU any more
  - Roman pot motor control only

A. Macpherson / W. Snoeys

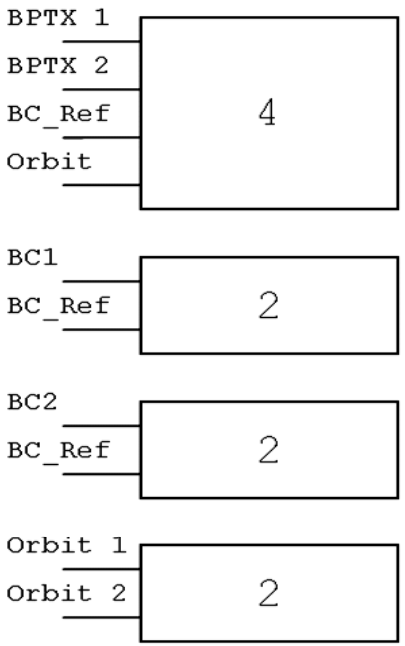
BIS - Cabling Status

- Interlock cables arrive in S1E08
  - Installed
  - Patch panel to be defined/installed
- CMS would be ready for testing in USC55
  - May/June

BPTX use in CMS

- CMS has adopted an Oscilloscope-based readout scheme
- SPS test beam targeted in June/July to validate readout and cable couplings

- Direct BPTX measurements:
  - Phase between each bunch and clock
  - Position of the bunch train with respect to orbit marker
- Offline Calculations:
  - Filling scheme of the bunch train
  - Individual bunch length
  - Bunch intensity and amplitude of BPTX signals
  - Location of interaction region
  - Fraction of current in the abort gap
  - Fraction of current migrated into adjacent RF buckets
  - Bunch shape



T. Aumeyr

BPTX Signal - Cabling Status

- Cables installed
  - Termination to be done
- CMS is in process of designing patch panel for S1E08
  - Some concern about noise implications of the ground loop established between USC55, the two BPTX and the LHC machine
- Hardware signals required not later than 3 months before first beam

Powering of Machine I/f equipment

- CMS Detector requires that if LHC is running then the CMS Protection System (BCM) must be operational to ensure safety of the Detector Systems
  - Exact UPS/Diesel configuration remains to be defined
- Is there other equipment that the Machine requires to remain operational in the case of a loss of general power at CMS?

DIP Data Publishing in CMS

- Online Systems use CMS XDAQ s/w framework to send Data to CMS Central DCS System (PVSS-based)
- Data are simultaneously written into CMS Online Database and datapoint is published via DIP
  - Machine physically connected to both CMS private network and CERN GPN
- Data to be published as per Data exchange document
  - EDMS HC-DE-ES-0001
- Server is installed in USC55, not yet publishing anything

F. Glege / M. Chamizo-Llatas / D. Stickland

DIP Data use in CMS

- Central CMS DCS server will subscribe to relevant data
- Data will be stored in CMS Online DB
- Could test this anytime data becomes available

F. Glege

Software Interlocks

- All software interlocks
  - Ready for Injection
  - Handshaking for changing machine modes
- Will again be handled by CMS Central DCS
  - Will define a state machine for CMS, taking subsystem status into account.
    - Initially state changes will require CMS Control Room intervention
      - Could eventually be automated
    - Machine modes must be a reliable indicator of machine state
  - Timescale for implementation
    - May 2007
  - Ready for testing with LHC CR
    - TBC in discussion with LHC OPs - June 2007?

F. Glege

DIP Issues

- Server Denial of Service
  - Easy to saturate single entry point with large number of Clients
  - Thus will limit (using network routing tables) access to CMS DIP Server to necessary consumers
    - LHC
    - Other experiments? Single machine each in this case.
- Should DIP communications be moved from GPN to TN?
  - DIP transfer must be ensured at all times
- Namespace definition
  - Agree on scheme proposed by D. Swoboda in LEADE

Summary

- Hardware interfaces now finalised
- Hardware signals required by CMS 3 months before beam in the LHC
  - Making reasonable progress on installation, but must not be forgotten!

- Software framework for Data communication now defined
- CMS Internal discussions ongoing regarding the generation of the data quantities
- Testing can start as soon as (Dummy) Data are available
  - Contact persons on LHC side for
    - DIP data availability?
    - S/W handshaking for interlocks and machine mode changes?