

# HCAL Phase 1

FNAL CMS SLHC Upgrade Workshop

October 28, 2009

# System Parts

- Focus on HB/HE (but has application for HF)
- Goal is to not fail to be able to do physics with HCAL at SLHC
- Front-end
  - SiPMs and new QIE to accommodate but keep as much of the current infrastructure/services as possible
    - Increased data bandwidth necessary for longitudinal segmentation (and TDC-like measurements)
- Back-end
  - Complete redesign, abandoning VME in favor of uTCA
    - Accommodate increased FE bandwidth requirement
    - Increased flexibility for L1A triggering, ZSP/Selective Readout
- FE/BE communication
  - Transition from wires to fiber
  - Increased bandwidth
  - Increased redundancy

# *“Are the upgrades required to cope with higher peak/integrated luminosity”*

- Radiation levels in phase 1 for HE
  - Will kill some inner layers.
  - Current HCAL has analog summing over all tower depths
  - Longitudinal segmentation will allow recover via reweighting
    - Can also improve resolution for measuring hadronic energy (50%? Maybe more, under study)
- HPDs carry some risk for >10 years operation
  - High voltage devices, subject to discharge and ion feedback
    - SiPMs are from heaven if we can make them work!
- Multiple interactions will reduce ability to do physics
  - Current HCAL:
    - Low pt electron isolation will suffer and ability to do timing of energy deposits will go away
  - New scheme will recover this.
- Many of the systematics for high PT rare processes will be able to take advantage of having handles on backgrounds from non-bx-related sources

# *“Would we get benefits by introducing some of the upgrades”*

- Back-End
  - Since our plan is radical in the back-end we will commission incrementally, maintaining legacy
  - Heavy dependence on 904 but not naïve enough to think that will be enough
- Front-end
  - All or nothing replacement of the guts of the RBX

# *“Are there some upgrades which we would be better off delaying?”*

- We rely heavily on testbeam schedules, quantizes milestones
  - R&D is already under way.
- Front-end vs Back-end
  - FE R&D will necessarily bring up technological unknowns.
  - BE will be “easier” but much more details
- FE and BE go hand in hand. Cannot really do one without the other
  - Commissioning by 2014? Not going to be easy
- I think we should push ahead

# Schedule Driver

- Obvious delay in SLHC Phase 1....but
  - Summer testbeams quantize milestones
- Focus during this meeting on current year milestones
  - Get ready for Summer 2010 testbeam
  - USCMS FY10 R&D deliverables