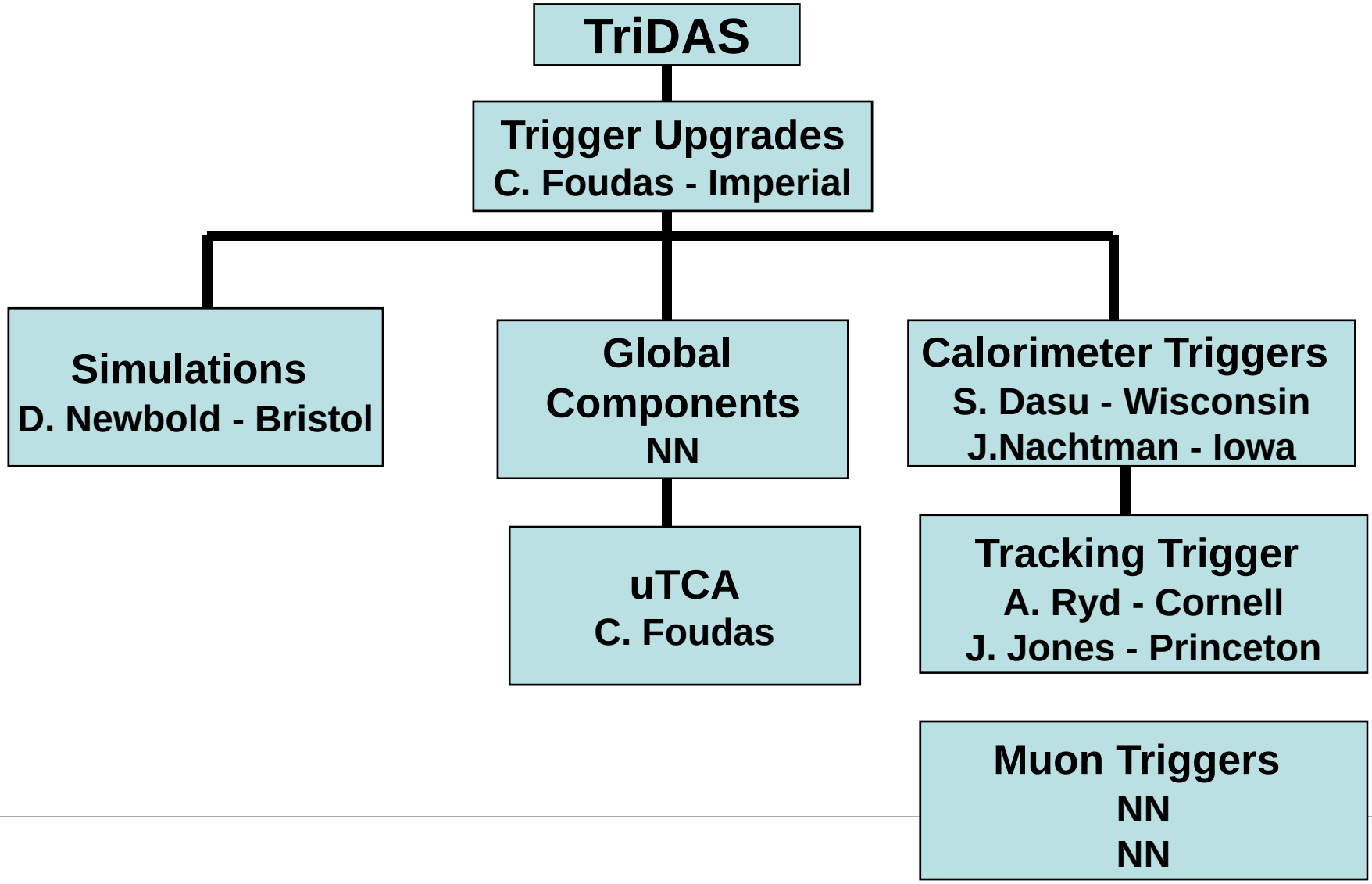
Trigger Introduction

- **Status of the CMS Trigger Upgrade Activities:**
  - uTCA and Optical Link upgrades
  - Simulations of new calorimeter trigger algorithms
- **Goals for the trigger WG which meets this afternoon:**
  - Organize a comprehensive study which will evaluate the physics benefits from upgrading the current system for Phase-I
  - Review the progress on hardware developments (uTCA) and make plans for future designs.
  - Discuss and form a plan for introducing a uTCA system already during LHC to gain experience and confidence.
  - Make the first roadmap for commissioning the new system.

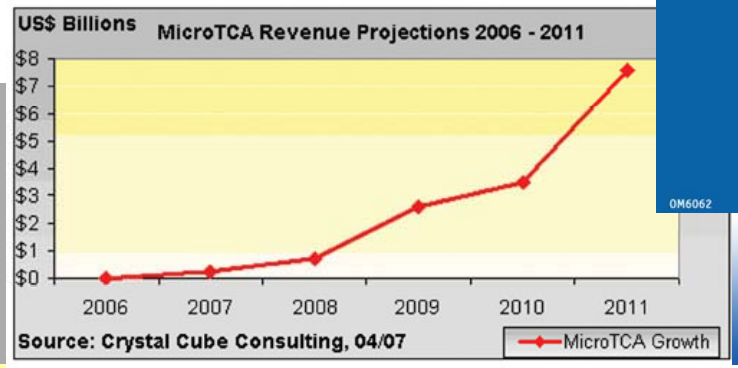
Progress since May 08

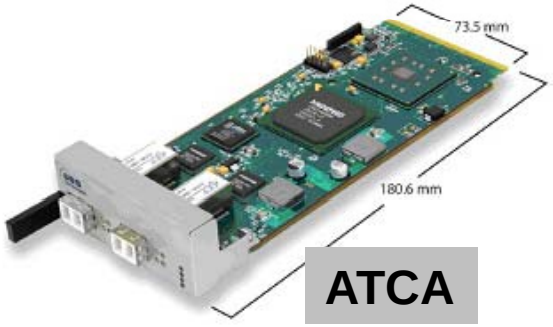
- Starting after the May 08 workshop a number of groups were formed within the Trigger Upgrade Group focusing on the following topics:
  - **Simulation studies for Phase-I triggers (Calorimeter/Muon). The studies done so far refer to improvements in:**
    - Tau Triggers (Texas A&M, Wisconsin)
    - Electron and Jet Triggers plus general clustering algorithms (Wisconsin)
  - **Simulation studies for Tracking Triggers.**
    - Track Trigger group and Simulation group have:
      - used the Stacked Tracker model developed by the Tracker Upgrades group.
      - started developing the trigger software framework (TPG) which is the starting point for trigger studies.
  - **uTCA demonstrator hardware.**
    - A number of uTCA devices are at various stages of development:
      - HCAL prototype card (J. Manns, Minnesota)
      - GCT Matrix System (CERN, Imperial, LANL, Princeton)
      - uTCA TTC/SLINK64 Card (Wisconsin)

Trigger Upgrades Organization

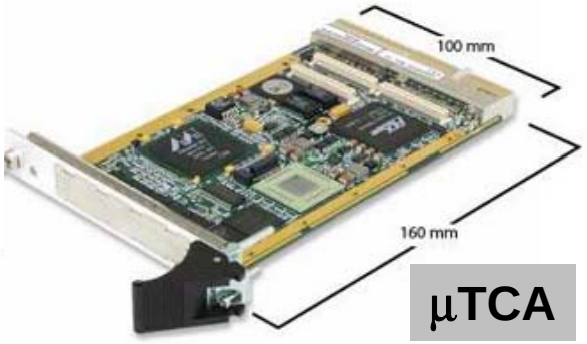


uTCA Systems for SLHC Phase-I Triggering

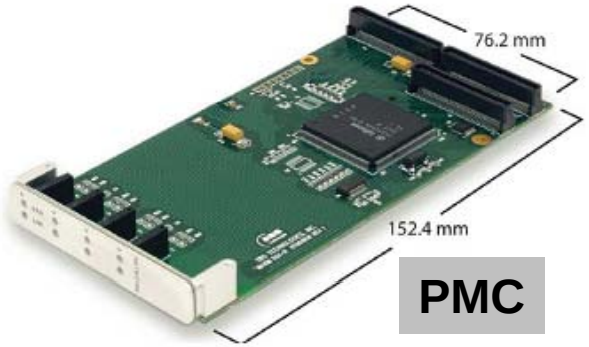




ATCA



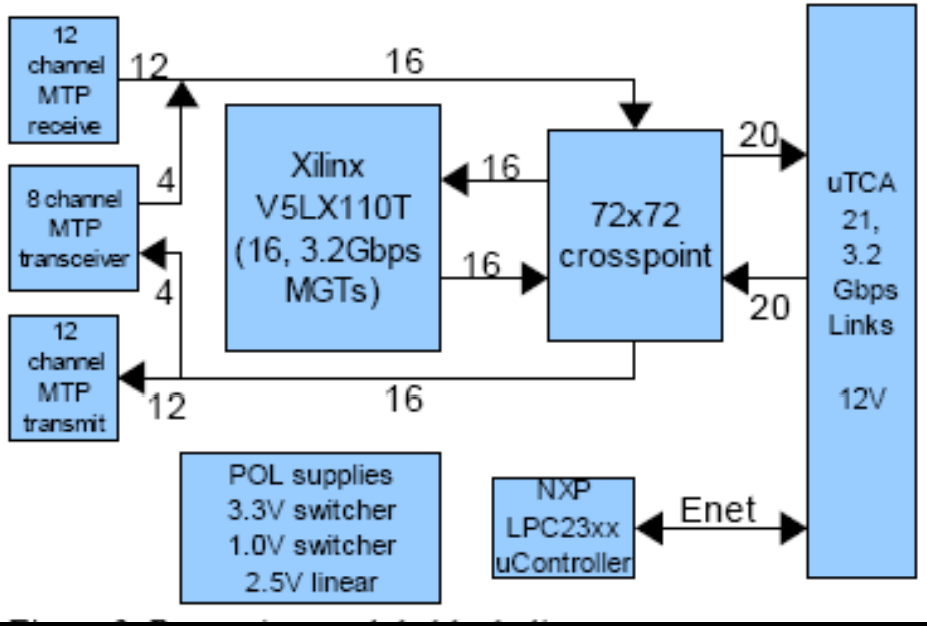
µTCA



PMC

- The µTCA system under development for the GCT Muon/Quit Bits.
- Changes for Lvl-1 Trigger in SLHC Phase-I
- uTCA developments within CMS

The uTCA Standard for Triggering



We are about to start to develop a uTCA system utilizing 3.2 GBps links which will consists of:

a) **A main uTCA processing card.**
b) **A custom backplane.**

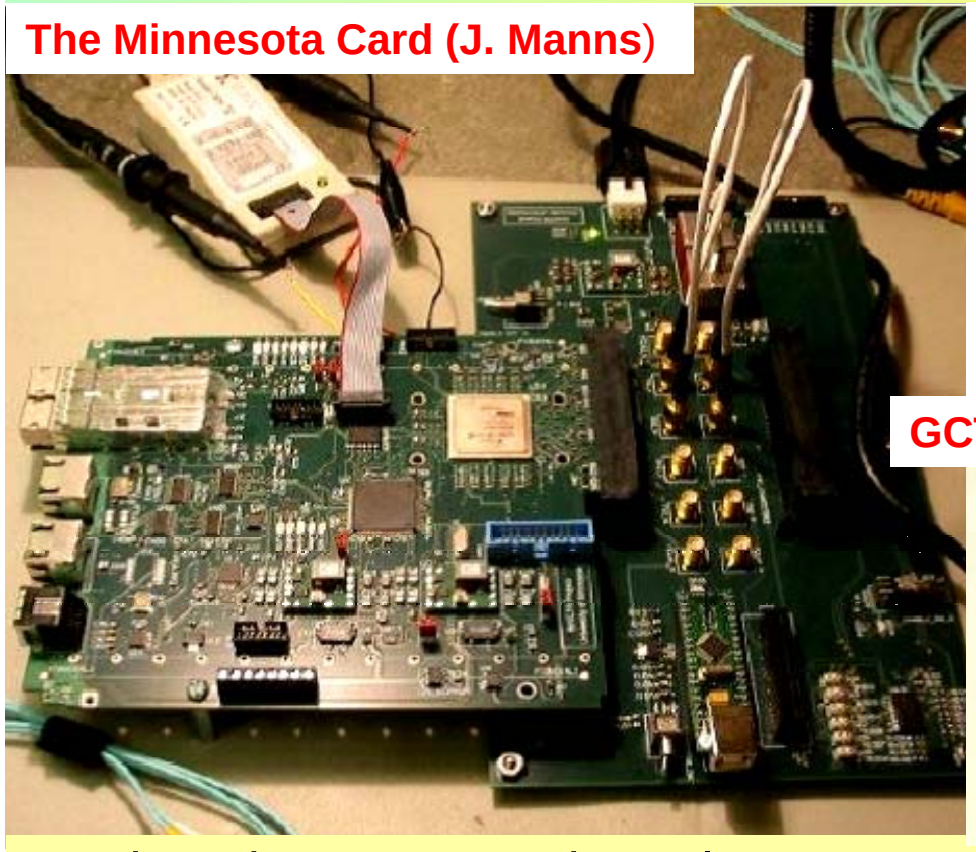
- **A standard trigger platform based on the uTCA telecom Standard.**
- **This platform will be designed to accept data from different detectors and support a Lv1 tracking trigger.**
- **We wish to investigate the question whether this platform can replace all Lv1 trigger off detector electronics and become a CMS-wide standard.**
- **This would reduce significantly manpower and R&D costs**

Phase-I Issues

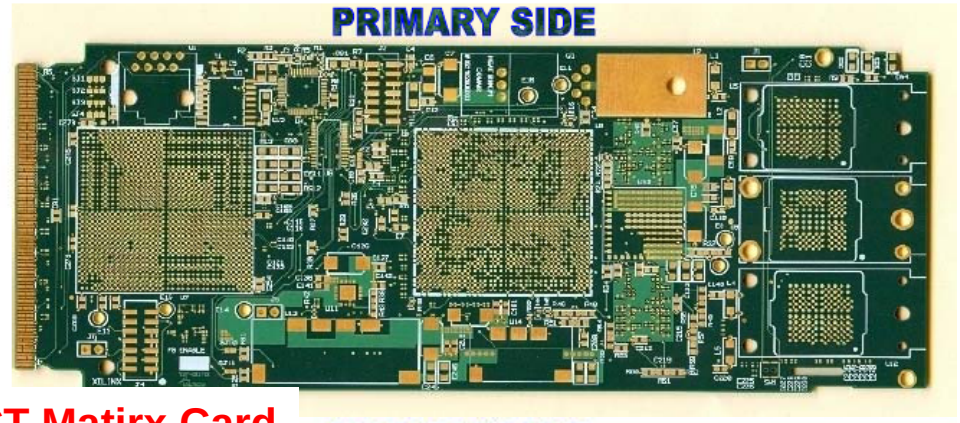
- **The entire Calorimeter Trigger electronics will change for Phase-I and the new platform will be based in uTCA. There are several reason for this:**
  - Increase the trigger granularity and base all the algorithms on trigger towers rather than 4x4 trigger tower regions. This will benefit:
    - Tau triggers
    - Central Jet triggers in terms of rapidity and phi resolution
    - Forward trigger
  - HCAL electronics will change regardless. This will trigger upgrades in:
    - Trigger (RCT,GCT,GT)
    - ECAL SLB will need to be optical
- **The question is how do you bring the new system (and remove the old one) in a safe and smooth way. This will be discussed today.**
- **Groups actively contributing: Imperial, Maryland, Minnesota, Princeton, Texas A&M, Wisconsin. Several others have expressed interest.**

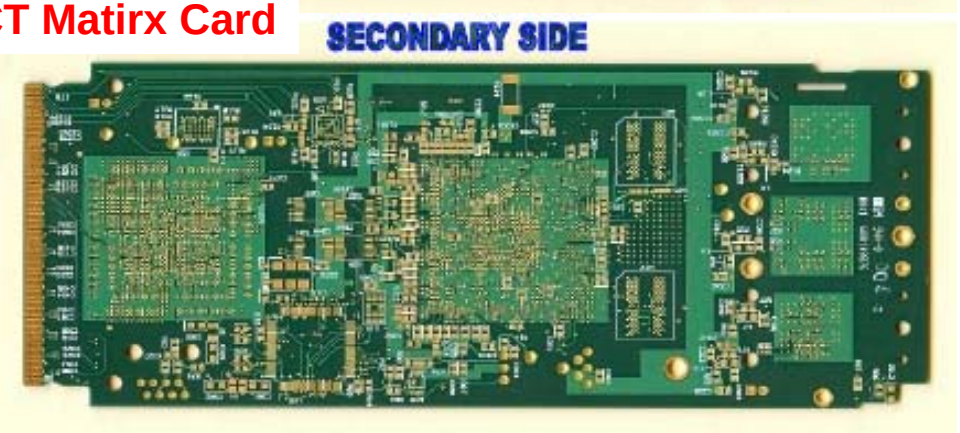
μTCA Cards already in CMS

The Minnesota Card (J. Manns)



GCT Matirx Card

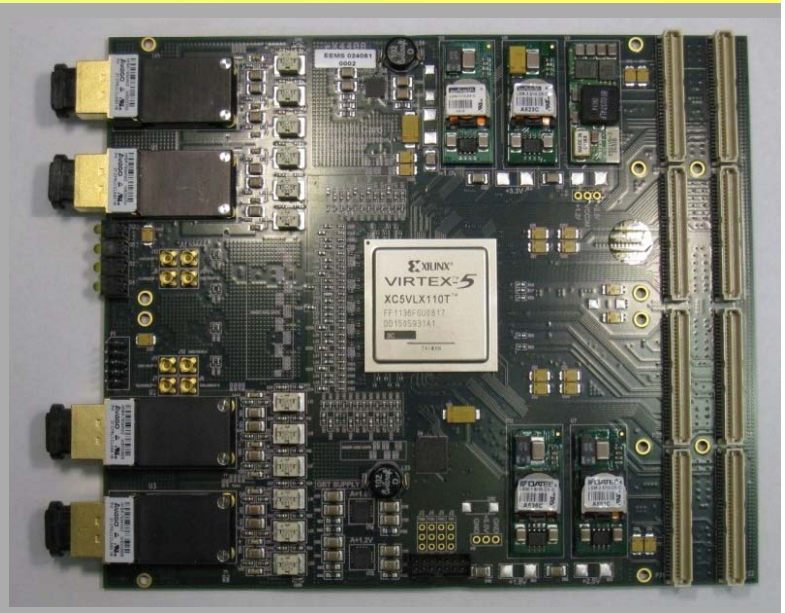


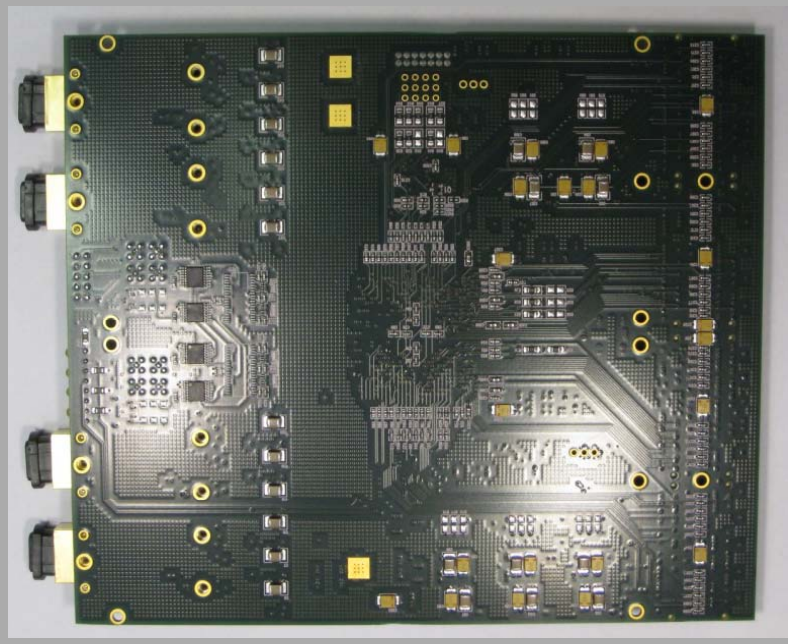


- The Minnesota Card: Evaluate uTCA and Multi GBps optical link technology and then use it for HCAL and CaloTrigger Upgrades.
- The GCT Matrix Card +Backplane: Full blown system for triggering; Hope to use LHC data to demonstrate sophisticated algorithm performance.
- Under development: **μTCA** card with S-link and TTC interface (Wisconsin)
  Optical interface between GT-GCT (Imperial Vienna)

Opto-GTI: GCT-to-GT Optical Links

- **The Interface between GCT and GT is changing from InfiniBand to Optical.**
- **The Links are compatible with those used by GCT and the GCT uTCA Matrix system.**
- **This change will be introduced before the LHC data taking to:**
  - **Improve link reliability**
  - **Double the GCT-to-GT bandwidth.**
- **This also means that the new GCT uTCA crate can communicate directly with GT.**





Plan for this afternoon

- **Calorimeter Trigger Studies:**
  - New Results from the Texas and Wisconsin Groups
  - Plan to complete the various studies by early spring 08
- **uTCA hardware demonstrators:**
  - Status of the various uTCA devices.
  - Preliminary results on Cal. Trigg. Algorithms on Xilinx V5 FPGAs.
  - Sketch plans for future designs and collaborative efforts.
- **uTCA upgrades during LHC data taking:**
  - Make a plan for introducing the first uTCA crates duing LHC data taking without disrupting data taking.
- **Testing and Commissioning of a new uTCA-based trigger system from CMS:**
  - Involves detailed testing of the new system in an integration facility
- **Road map for Phase-I Upgrades:**
  - Device a design and plan that also can accept tracking trigger TPGs.

END

Looking forward to a productive workshop…