CHEPREO PHYSICS RESEARCH

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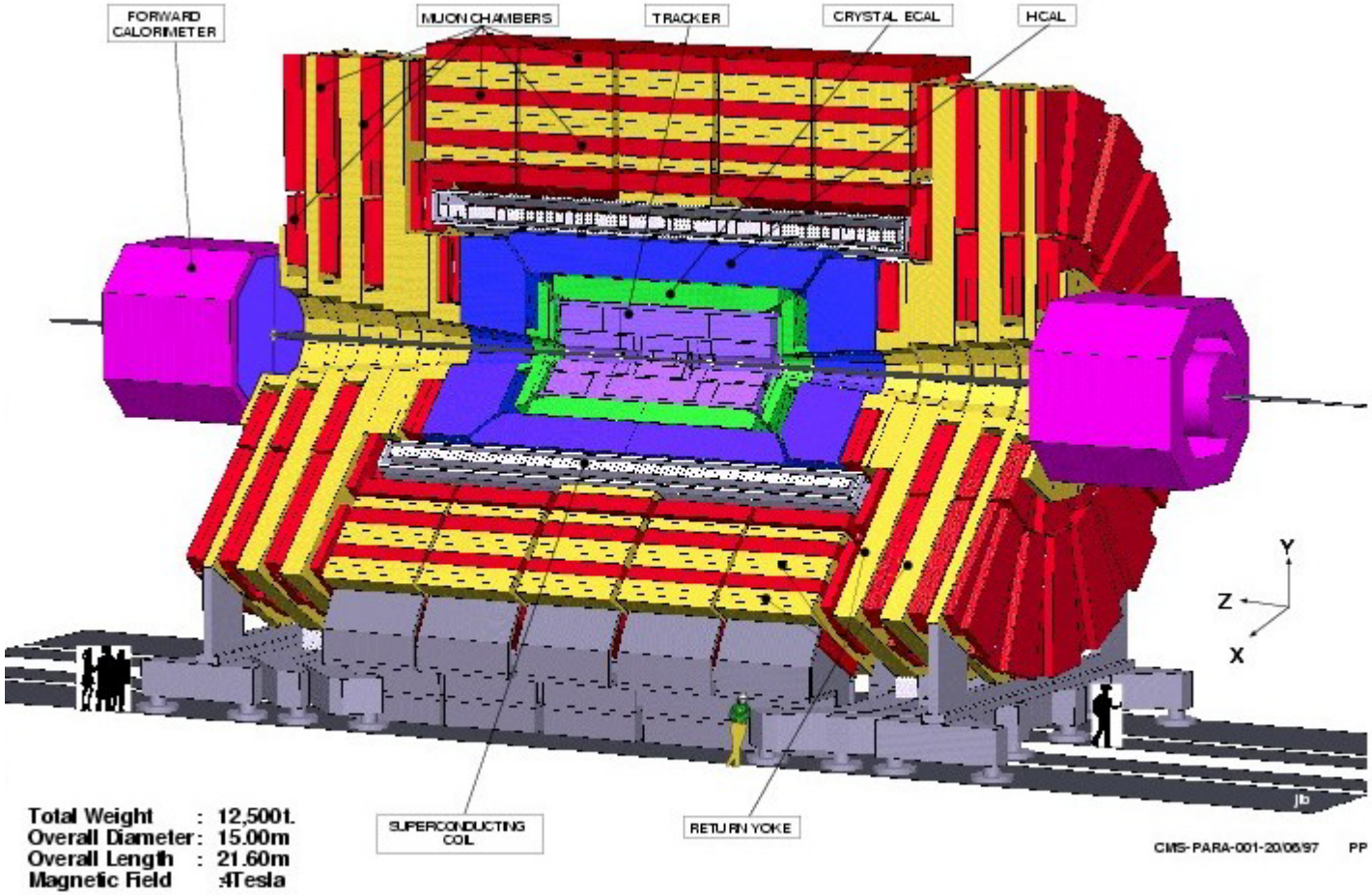
CMS HCAL


FORWARD CALORIMETER
MUON CHAMBERS
TRACKER
CRYSTAL ECAL
HCAL
SUPERCONDUCTING COIL
RETURN YOKE
Y
Z
X
Total Weight : 12,500t.
Overall Diameter: 15.00m
Overall Length : 21.60m
Magnetic Field :4Tesla
CMS-PARA-001-20/06/97 PP

Current Research Activities

- Host of Winter ‘04 HCAL meeting at FIU
- FSU/FIU Grid Monte Carlo, effort started
- HCAL test beam @ CERN, effort ongoing for FIU and FSU
- FSU/FIU laser calibration system, effort ongoing
- HCAL Detector Control Systems coordination (L3 CMS Management, Steve Linn of FIU)

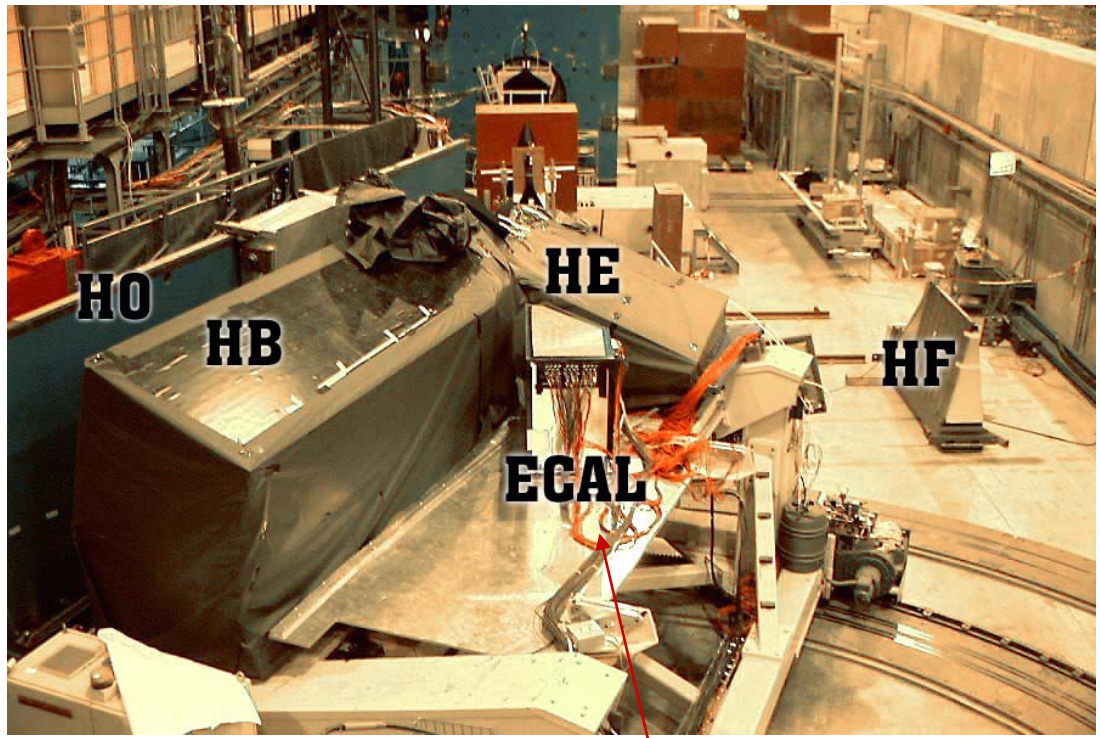
Grid Monte Carlo

- People
  H. Prosper (FSU faculty)
  Y.Gershtein (*new* FSU faculty)
  J. MacDonald (FSU physicist)
  E. Rubio (FIU computer scientist)
- Status
  - RedHat, grid, Rocks, Open AFS, scram, CMS installed at FSU
  - RH, grid, Rocks installed at FIU
  - Limited testing at FSU

- Soon
  - System test on FSU PD cluster (60 nodes)
  - Then FIU/NAP cluster (~25 nodes)
  - Port CMS environment to FIU
  - Production as needed
  - Physics algorithm development

HCAL Testbeam

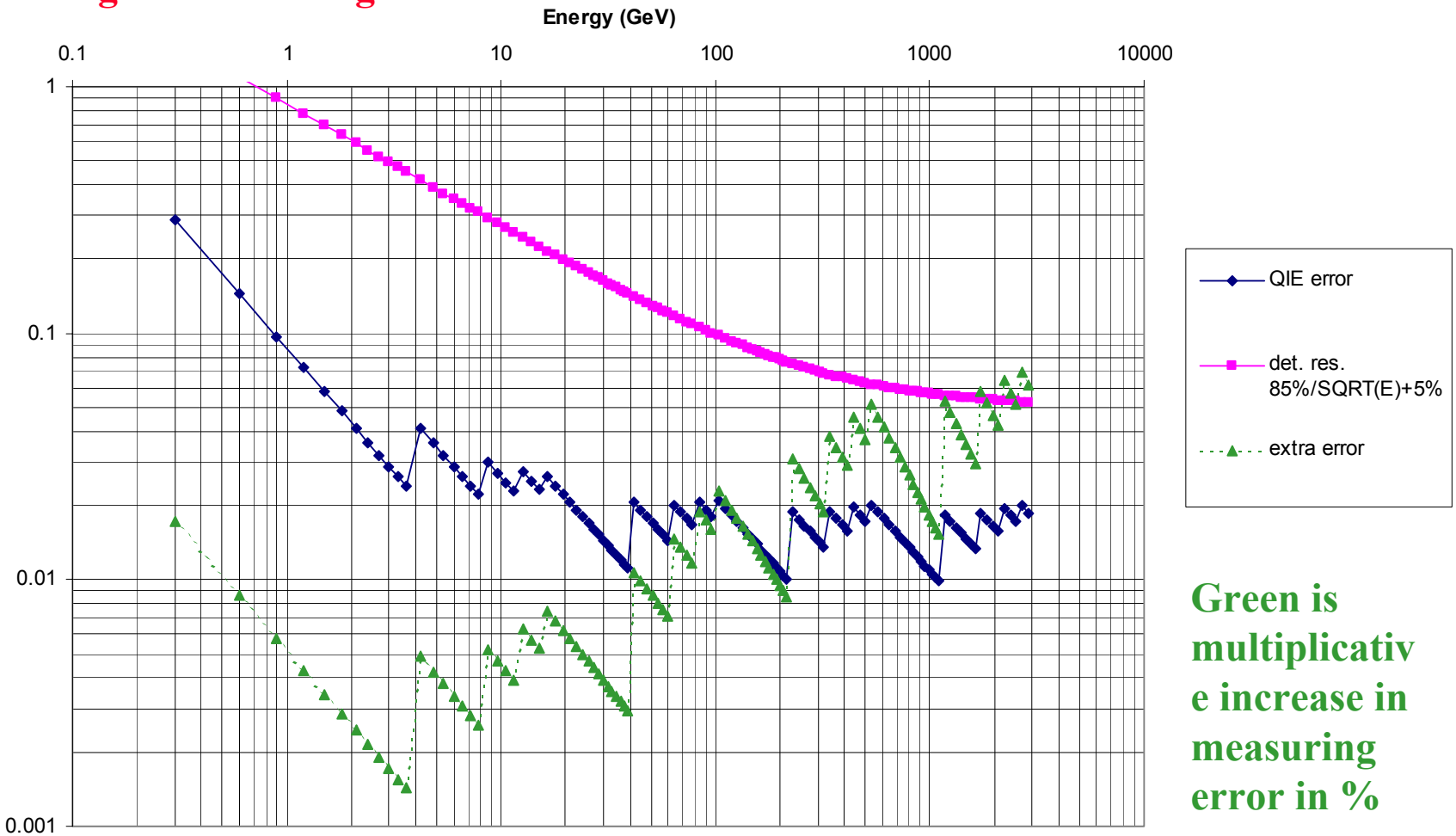
FIU/FSU participation:
- Hardware setup May '04
- Data collection @ CERN Summer '04
- Data analysis @ CERN + Fermilab



- CERN H2 test area
- 5-250 GeV beam
- e,π,μ unseparated
- Table rotates modules into ϕ–η projections
- data logged and networked to FNAL for same-day analysis

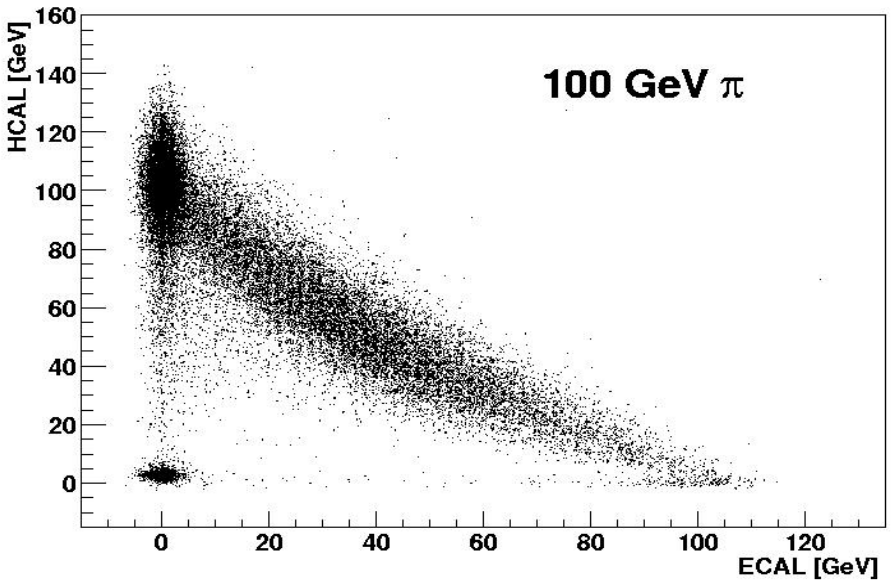
QIE Flash ADC

Implementation of a 4-range splitter and a 5 bit non-linear FADC allows to simplify the design while having minimum effect on the detector resolution.

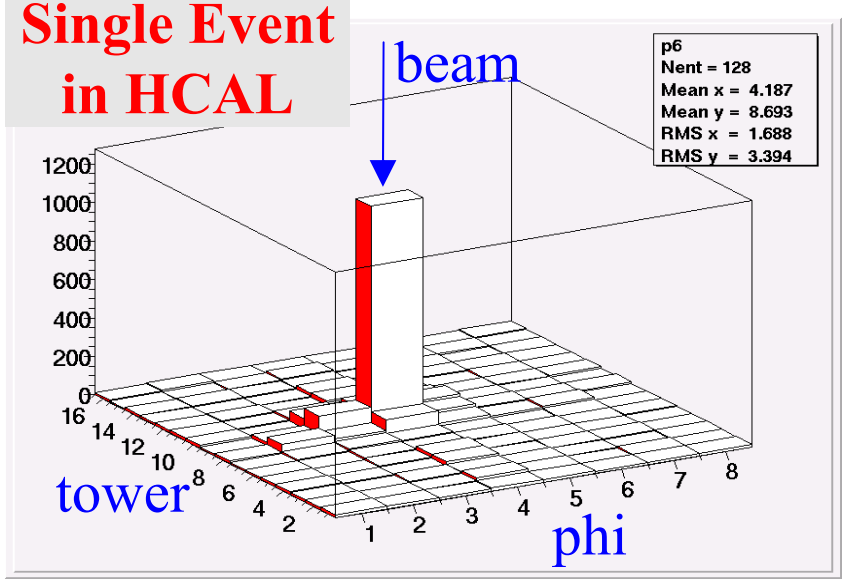


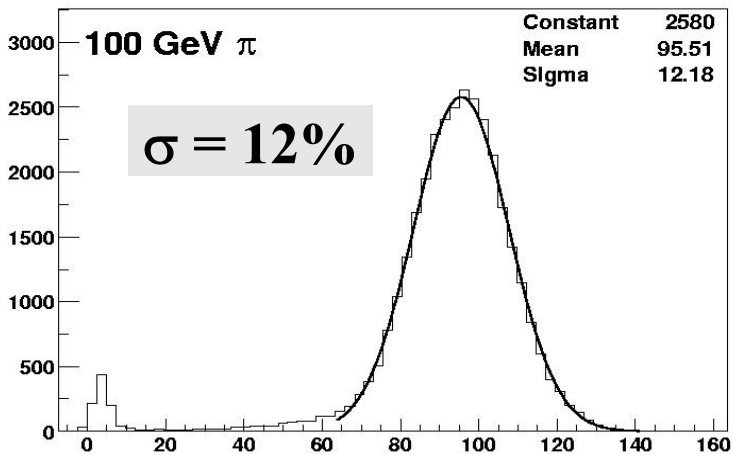
Green is multiplicative increase in measuring error in %

Test Beam Results



Single Event in HCAL





Trigger Tables

Level-1 Trigger at low luminosity ($2\times10^{33}cm^{-2}s^{-1}$)

- **Total Rate: 50 kHz. Factor 3 safety, allocate 16kHz**

Trigger	Threshold (ε=90-95%) (GeV)	Indiv. Rate (kHz)	Cumul rate (kHz)
1e/γ, 2e/γ	29, 17	4.3	4.3
1μ, 2μ	14, 3	3.6	7.9
1τ, 2τ	86, 59	3.2	10.9
1-jet	177	1.0	11.4
3-jets, 4-jets	86, 70	2.0	12.5
Jet * Miss-E_T	88 * 46	2.3	14.3
e * jet	21 * 45	0.8	15.1
Min-bias		0.9	16.0

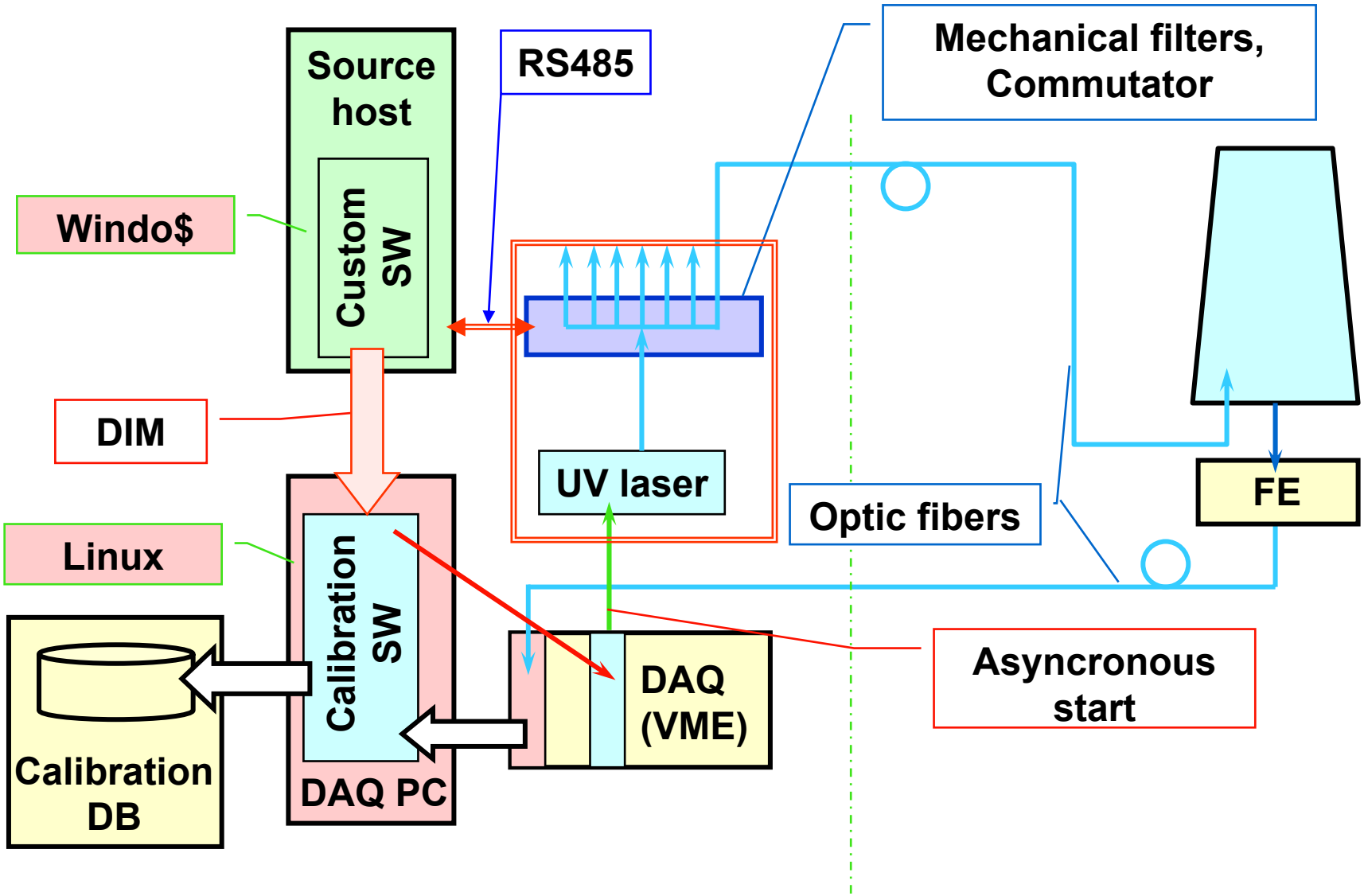
Tables exist for 1/5 and design L. "Discovery" modes covered well. We think we know how to trigger CMS and acquire the Physics.

Laser System of HCAL

Laser System to Calibrate and Monitor

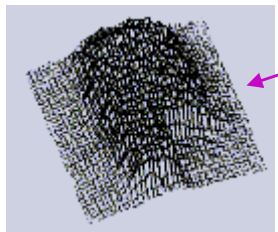
1. Each ADC (QIE) has 8 constants to be determined.
2. Test beam measure response to 250 GeV and laser will extrapolate to 3 TeV energy.
3. Monitor radiation damage to scintillators and photodetectors (HPD)
4. Monitor the Data acquisition chain

Laser Calibration



Laser Calibration

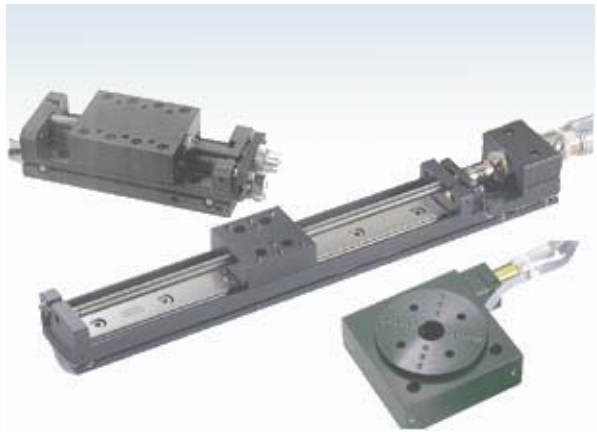
- Inject light into scint. tiles
- Monitor: aging, Rad. damage, photodetectors to 1%
- Timing determination
- Linearity
- Monitoring



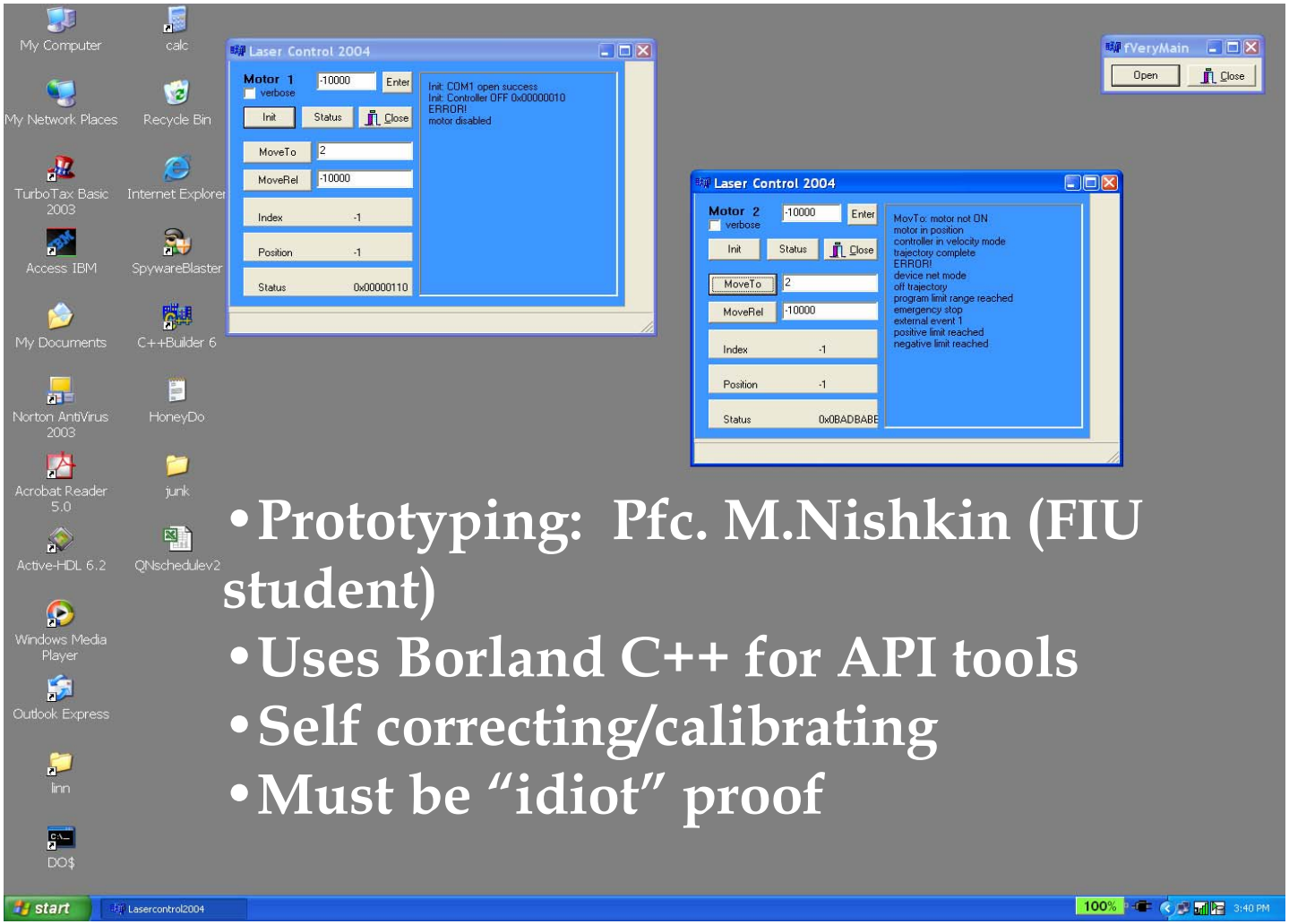
Laser Science 337nm, 300mJ/pulse, σ=4%, 40ns time jitter

Laser Calibration

- New stand-alone system to replace existing prototype
- FSU design and construction (V.Hagopian and K. Johnson)
- FIU supplied components
  - Linear and rotary stages
    - 1μm precision
    - over torque protection
    - IR stops
    - controllers (MicroMini)
  - Interface RS 485 PC serial port
- FIU "driver" software (DIM interface)



Laser Calibration

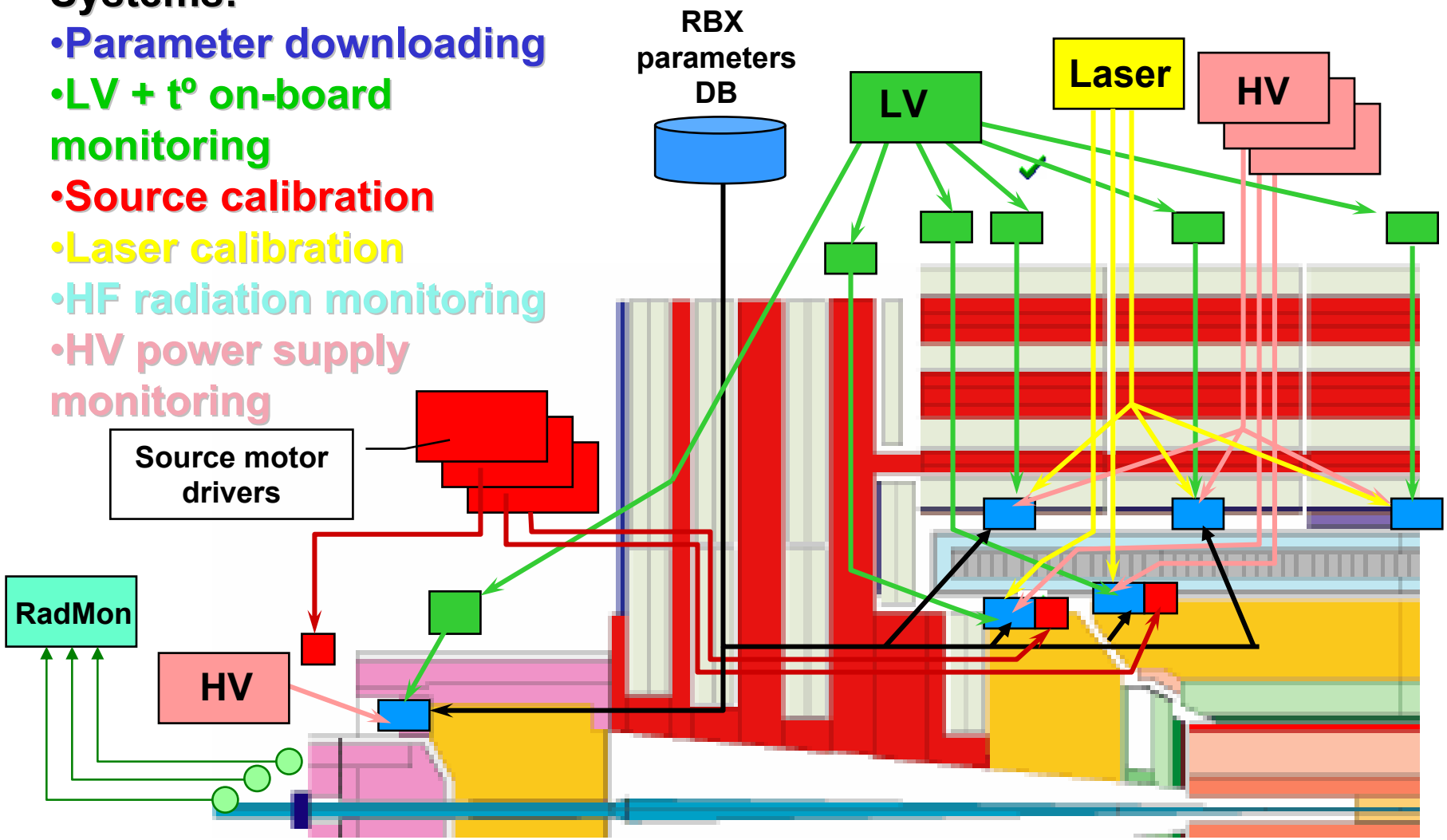


- Prototyping: Pfc. M.Nishkin (FIU student)
  - Uses Borland C++ for API tools
  - Self correcting/calibrating
  - Must be “idiot” proof

DCS Coordination

Systems:

- Parameter downloading
- LV + tº on-board monitoring
- Source calibration
- Laser calibration
- HF radiation monitoring
- HV power supply monitoring



DCS Coordination

Challenges:

- Must be extremely reliable because some components are buried.
- Must operate in a 4 Tesla field.
- Must operate in a high radiation environment for > 10 years
- Coordination of 6 systems:
  - 1/3 hardware
  - 1/3 software
  - 1/3 interfacing (human aspects)

Future Activities

- Monte Carlo production via grid
- Sector test starting Oct ’04
- Torture testing of existing hardware/software (student opportunity)
- DCS final architecture and DAQ interface
- Start development of PVSS layer with laser control as prototype
- Evaluate prototype, plan, implement final system with all DCS components (students can help here)
- Increase GRID effort at FSU. One scientist and one grad student joining the effort in Aug. 04