CMS and schools

- Large size of the CMS community (3500 users)
- Geographical spread (5 continents)
- Distributed computing resources (200 institutes) countries)
- Multiple time zones
- Logistics and financial constraints
- Complex software and analysis tools
- Tap physics potential of every user

Meeting the challenge

- Organised effort to support, engage users in analysis
- CMS Physics Support leads this effort
- CMS instituted extensive training program
- 1-day hands-on-sessions (grid, statistical tools, python, events visualisation), Physics Analysis Toolkit(PAT)
- Tutorials – 1-week, Data Analysis Schools – 1-week, By experts from CMS, Collaborative spirit
- LHC Physics Centres Worldwide
  - Fermilab (LPC), DESY (Terascale), CERN (LPC)

Organisation and Training Workflow of PAT training

Planning and Preparation

- Identify responsible – project manager
- Setup registration website
- Announcement hypernews
- Book the rooms (30-40 people)
- Detailed Agenda

Identify help

- Lecturers – give lectures/exercises session
- Tutors – assist participants in exercises
- People who prepare the material (twikis)
- People who will cross check and debug twikis

Training Format

Pre-requisite Exercises

- 2-week time basics – C++, account
- access, access to code, access to data, run grid jobs, python
- Answers submission via web-forms

Morning

- Lectures (recode)
- remote participation allowed (EVO)
- Discussion, Presentation of exercises

Afternoon

- Individual work on exercises in presence of experts,
- Post queries to discussion forum

Feedback

- Results from exercises
discussed
- Feedback on presentation
- Questions handled

Improvement and evolution of training

- 12 PAT tutorials organised in last 3 years based on popular demand, frequency 2-3 times/year
- Pre-requisite exercises were added after feedback and experience (participants come well prepared)
- The PAT training format extended to apply new learned methods to a real physics/analysis case
- PAT format was applied to CMS Data Analysis School (CMSDAS), hands on physics analysis learning
- CMSDAS started in 2012 is an evolution of one-week workshop JTERM – an analysis and software tutorials held at Fermilab (U.S.A.) since 2006
- CMSDAS have been held in U.S.A(Fermilab), Italy (INFN,Pisa) and future ones in Taiwan (NTU) and Brazil (UNESP)
- Trained over 800-1000 CMS users in last 3 years

CMS Data Analysis School Format

Pre-requisite Exercises

- 1-month time
- Four sets of exercises learn basics of - CMS Software, account
- access, access to code & data, run grid jobs, PAT basics, python, ROOT, histogram fitting, CVS code repository,
- Answer submission via web-forms

1-week hands on physics analysis exercises

- Short Exercises
  - (2 days)
  - Roostats, Generators
  - Tracking & vertising,
  - Electrons, Muons, Photons,
  - Jets, b-tagging, particle flow,
  - pile-up, event visualisation

- Long Exercises
  - (2.5 days)
  - New physics with jets, Exotica
  - with displaced vertices, Top-quark pair cross section, higgs
to mass, higgs high mass,
  - SUSY hadronic, SUSY leptonic, Wprime, Zprime

Lectures

- (0.5 days)
- Lectures CMS/LHC physics,
- how to do analysis,
- CMS software, analysis tools,
- big picture of HEP etc.

Feedback

- Final reports from exercises
- Discussion and feedback
- Students feedback
- Assessment at the end of the course

LHC Physics Centers

- CMS - new paradigm – many scientist in CMS not located at host lab (CERN), but face-to-face interaction still remain indispensable. In this scenario, the role and efficacy of a remote regional centre can hardly be overemphasised. Three LHC regional centres have come up in last few years, they are accessible to all CMS institutes (0.5 days)
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- CMSDAS at LPC (2012)

Conclusion

- CMS training program a success model
- Growing stronger and evolving
- PAT and CMSDAS epitomize these efforts
- Motivated team formed around training
- Makes CMS documentation robust
- 800-1000 people trained
- Made impact in engaging collaboration to contribute to physics
- Synergy between training and growth of LHC Physics Centres
- LHC centres act as training hubs, catalyst for physics and mutual exchange of new ideas