ATLAS Remote Monitoring System Framework

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08/14/08

Context of My Project

- My project is to extend the remote monitoring capabilities of the ATLAS experiment, a particle physics experiment at the Large Hadron Collider at CERN

  - ATLAS Goal: to search for new discoveries in proton collisions

  - ATLAS involvement and scope: 37 countries, 169 universities and institutions, 700 students and 2500 physicists total

  - ATLAS challenges relevant to my project: collaboration among experts and presentation of ATLAS to the general public

Challenges Addressed by My Project

- ATLAS requires extensive collaboration from experts
  - Thousands of physicists live in different time zones
  - Expertise and data processing power are globally distributed
  - Analysis work is done at sites other than CERN

- ATLAS needs an outreach component
  - Outreaches to high school students and college undergraduates to increase their interests in high energy physics
  - Presents to funding sources on the use of budget

Thus, a remote monitoring system framework is needed to access the state of the experiment and ongoing analysis to satisfy both of the needs above

Project Goals

- To develop a framework for a remote monitoring system that can facilitate the work of experts at distance and present ATLAS to the general public
  - Framework components should include the abilities to access the following :
    - Control room desktops: to provide experts real-time information on the status of the detector and data quality
    - Event displays: to view collision topologies and reconstructed particle tracks
    - Tier-2 centers status: to show the status of each site's operation(Ann Arbor is the case study here)
    - Archived multimedia, such as CERN videos and Indico events: to keep people aware of the progress being made

A Key Project Component: ATLAS TV

- ATLAS TV: designed to communicate ATLAS collaboration information, including audio, video, and text, via video displays and Internet based on a commercial software system Scala
  - Scala software system has the following components:
    - Designer: to design channel contents by using a combination of Scala scripts(for the layout of the channel and the order of contents) and Python scripts(for fetching non-local contents); standalone; publish scripts to the content manager for players to play
    - Player: to play TV channel contents on displays; communicate with the content manager
    - Content Manager: to organize the schedules of TV contents on players; based on a server and capable of controlling several players

  - Recommended hardware:
    - Displays: 1920x1080(resolution)x32 bits per pixel
    - Driving CPU for displays: Intel P4-600 and XP 32-bit
    - Server: RAID 1, 5 with 80 GB; Windows 2003 Server Wed Edition; Intel P4; 512 MB RAM
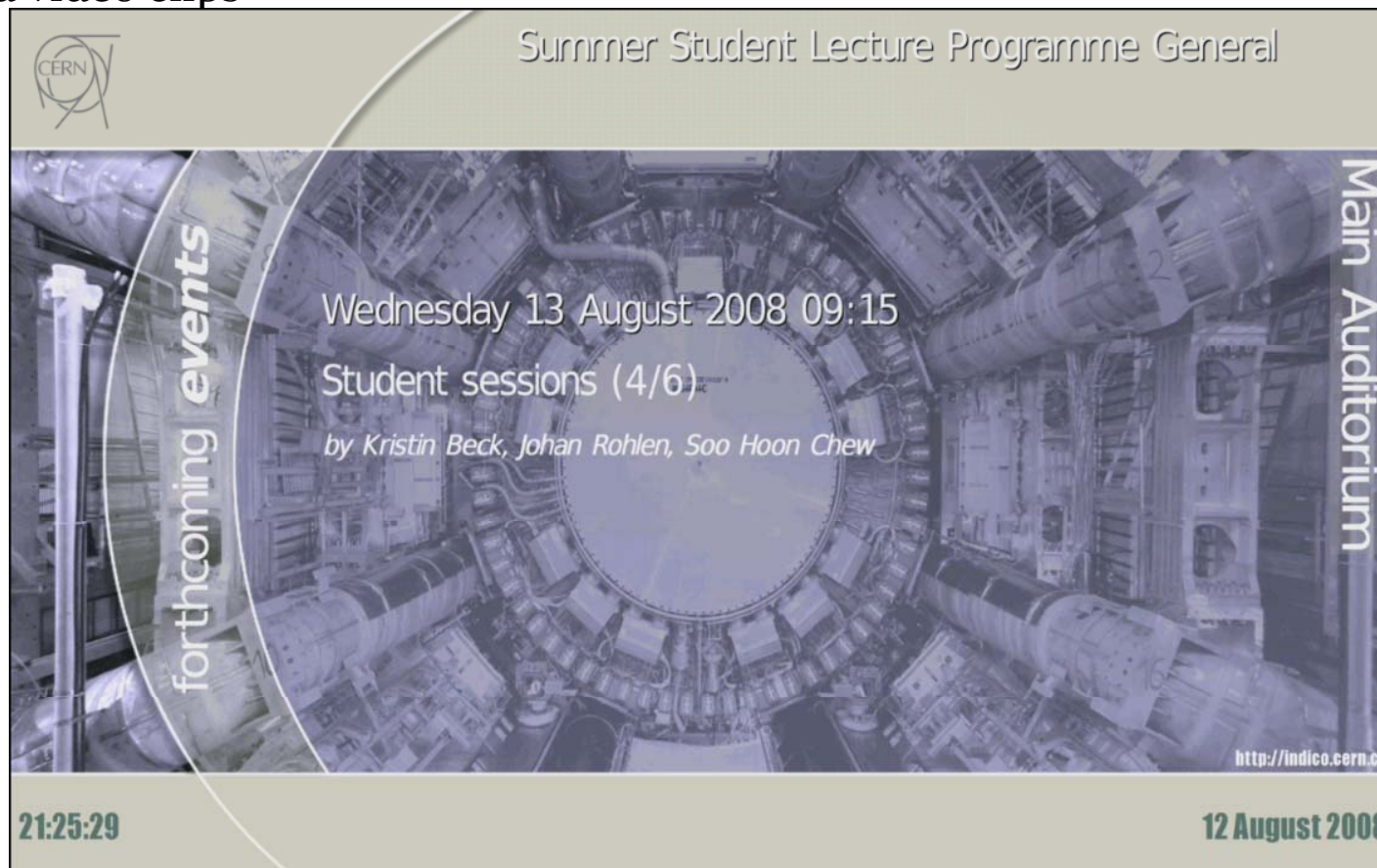
How to Set up an ATLAS TV

An example in Ann Arbor
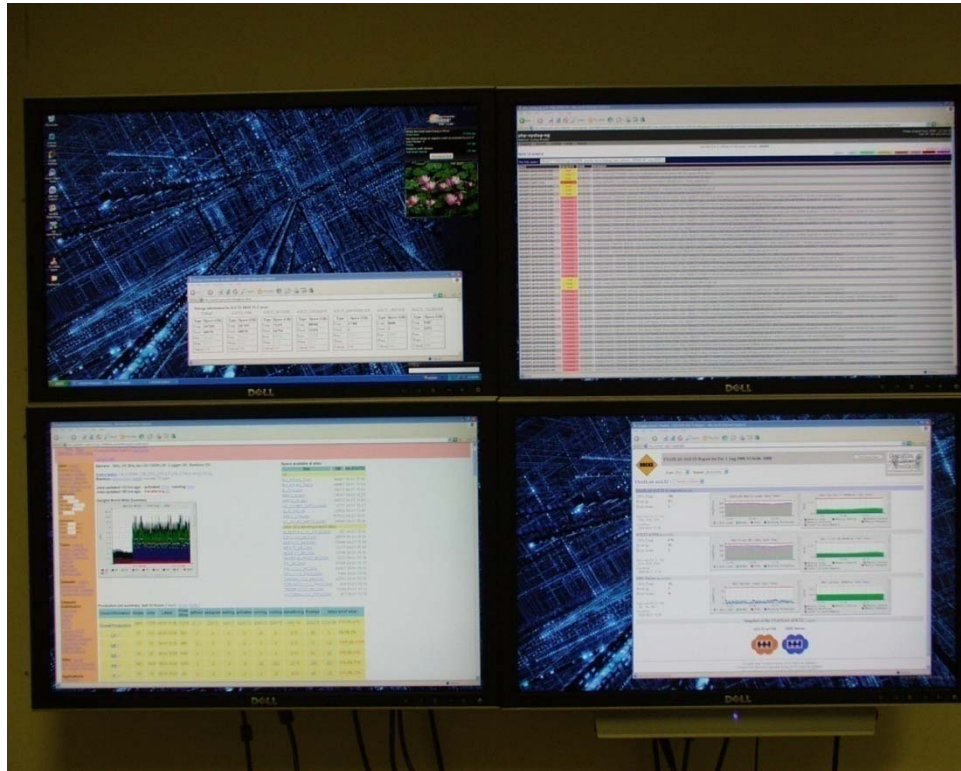
- Licenses Ordering
  - Designer license(a USB physical key)
  - Player license(one per CPU that can drive several displays)
- Set up a server for the content manager to reside on
  - Ann Arbor example: A dedicated server in CERN IT department http://pcuds93.cern.ch:8080/ContentManager/Login.do
- Set up displays and their driving CPUs
  - Ann Arbor example: Dell Precision Workstation T3400 375W (32bit) with wall mounted displays(picture to the right)
- Scripts to deliver contents

ATLAS TV's Capabilities in Assessing Framework Components

It can be readily used for conveying multimedia information, such as text and video clips

Indico events on CERN summer student presentations broadcast
in an ATLAS TV channel content

A video clip (wmv) of a director general's talk from CERN media server broadcast in ATLAS TV channel content

Another Key Project Component: NX Technology

- NoMachine NX: a desktop virtualization tool to gain access to ATLAS control room desktops. A mirror machine to the control room desktops has NX server, and end users utilize NX clients to connect. It has viewing functionalities, no control functionalities.
  - Mirror machine(a virtual control room desktop)
    - Located on CERN General Purpose Network(GPN)
    - To mirror off the desktop in the control room on Point 1 network for various security considerations; outsiders will only see the mirror machine on CERN network
    - Restricted access to AFS accounts added by TDAQ SysAdmins
  - NX server on the mirror machine
    - Resides on the mirror machine
    - Deploys X11 desktops securely over the web
    - Flexible file access with clients
  - NX clients used by end users
    - Opens an X window
    - SSH to tunnel information from the server

# Connection to the Mirror Machine using NX Technology

Point 1

Mirror Machine

CERN GPN

Scary Outside World
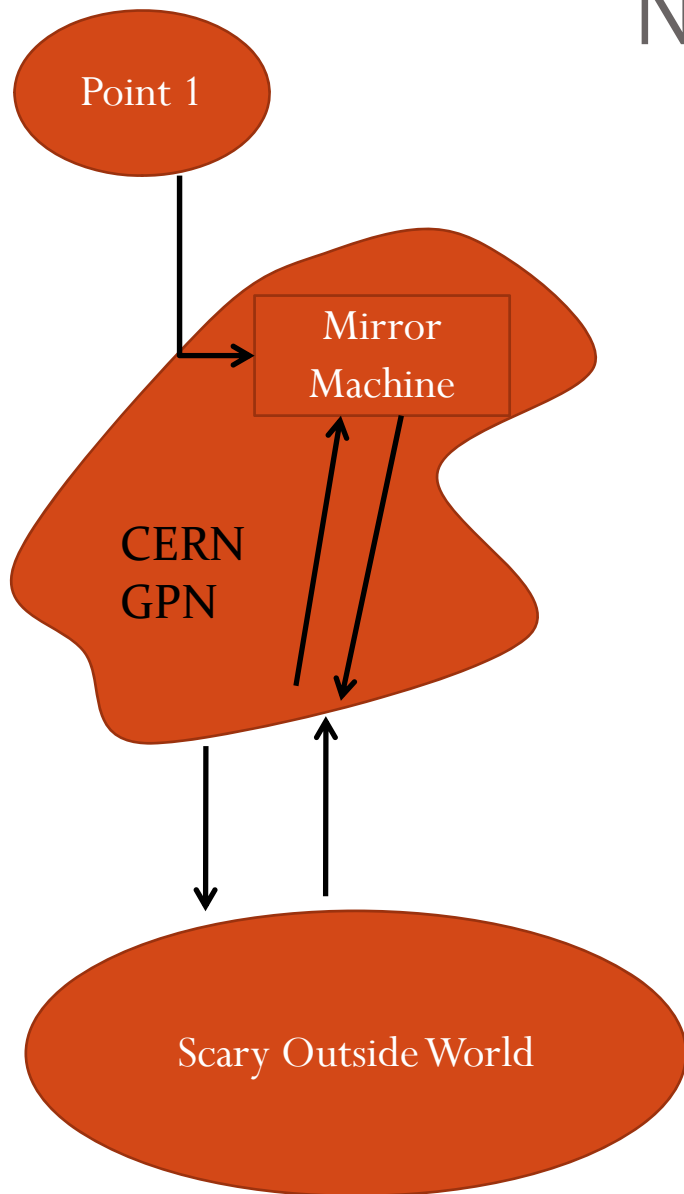
- Forward a local port to a port on GPN through the gateway

  ssh –L 8000:localhost:8001 cbliu@lxplus.cern.ch

- Forward the GPN port to port 22 on the mirror machine

  ssh –L 8001:localhost:22 pc-tdq-mon-gpn-03.cern.ch

- Start NX client using AFS account

- Start TDAQ Panel(Spy IGUI) using muon specific config files on the mirror machine

  Setup: /data/ATLAS/scripts/setup.sh
  Part Name: ATLAS
  Database file: /data/ATLAS/database/ATLAS.data.xml
  MRS Filter: *TIL*|*Til*
  OHP Opt: -c /data/ATLAS/Muon/MDT.ohpconf.data.xml
  OMD Opt: /data/ATLAS/config/omd-EFi.xml
  TriP Opt: -c /data/ATLAS/config/TriP.xml

NX Technology's Capabilities in Assessing Framework Components

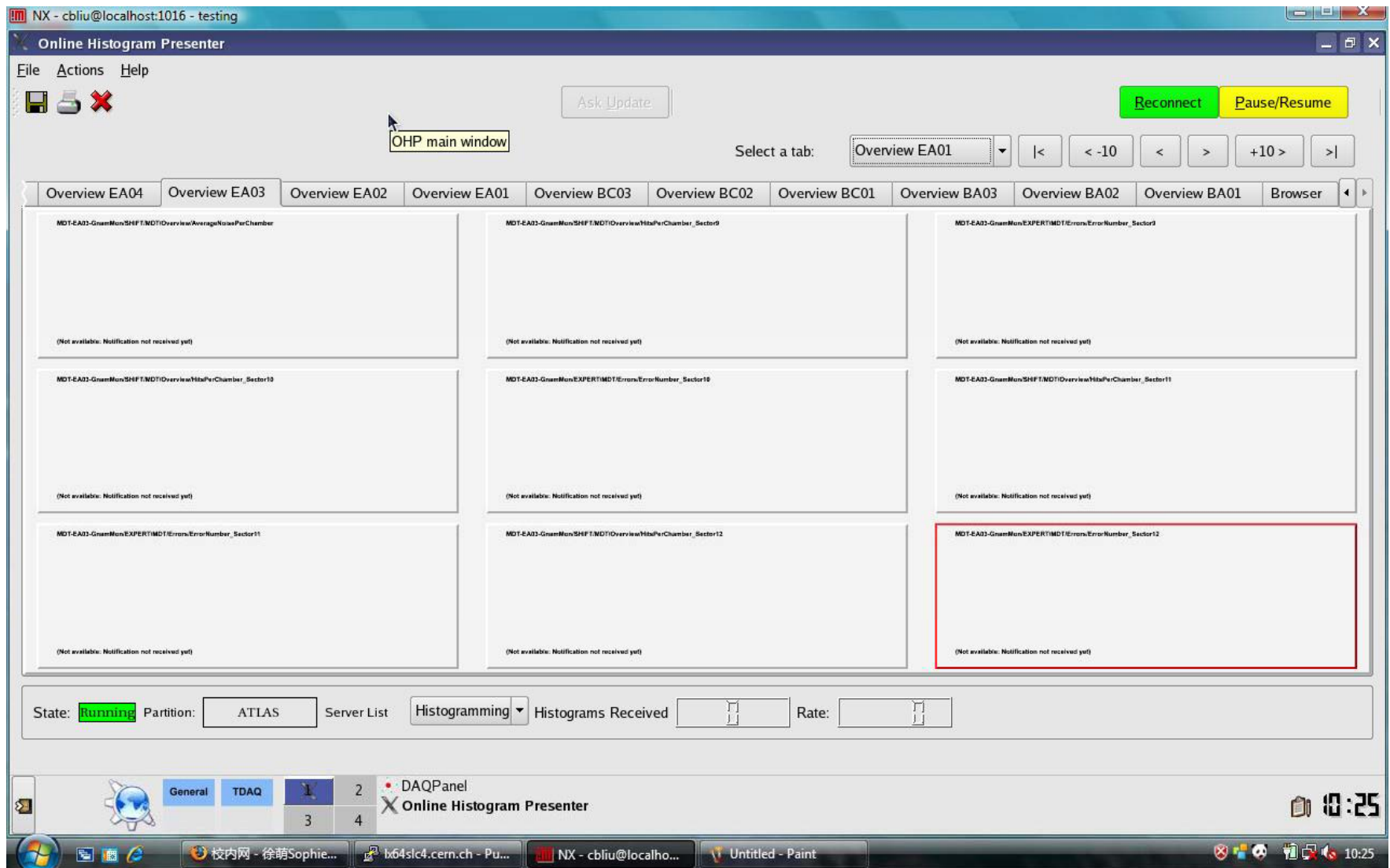It delivers control room information in real time
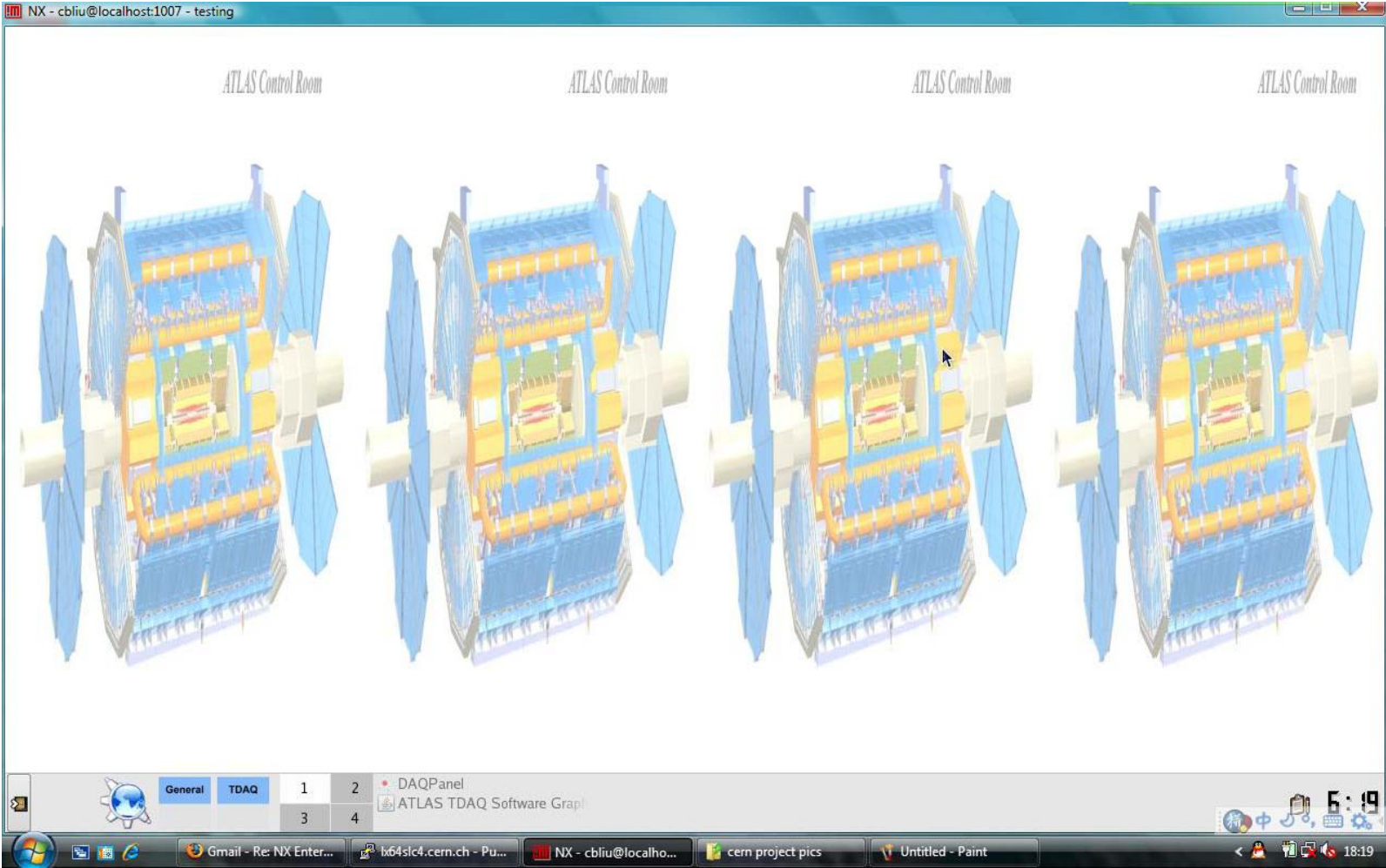
Control room desktop view
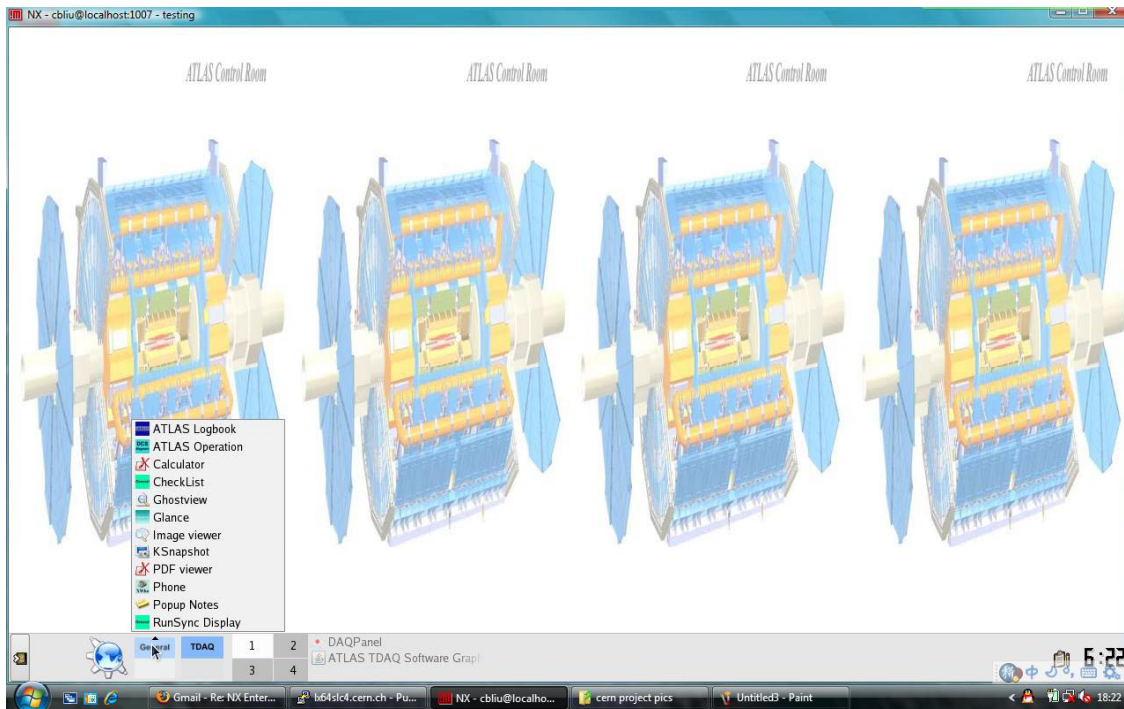
Functionalities
from the
"General" and
"TDAQ" tabs
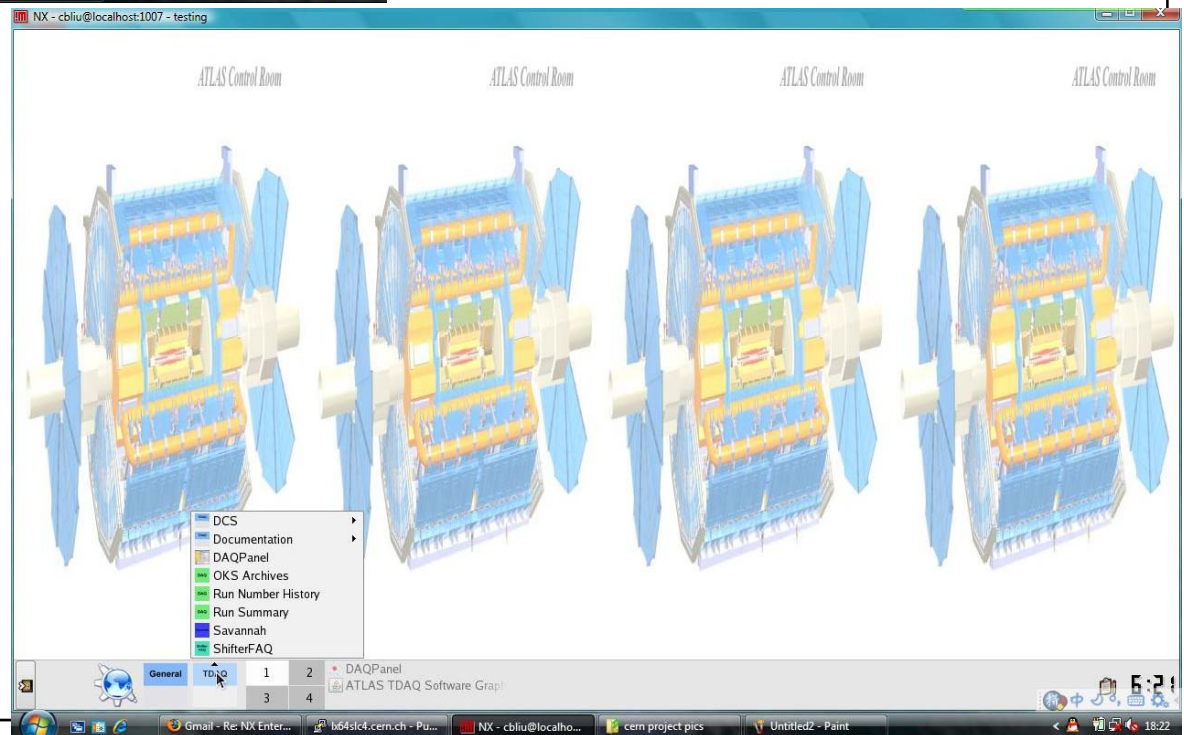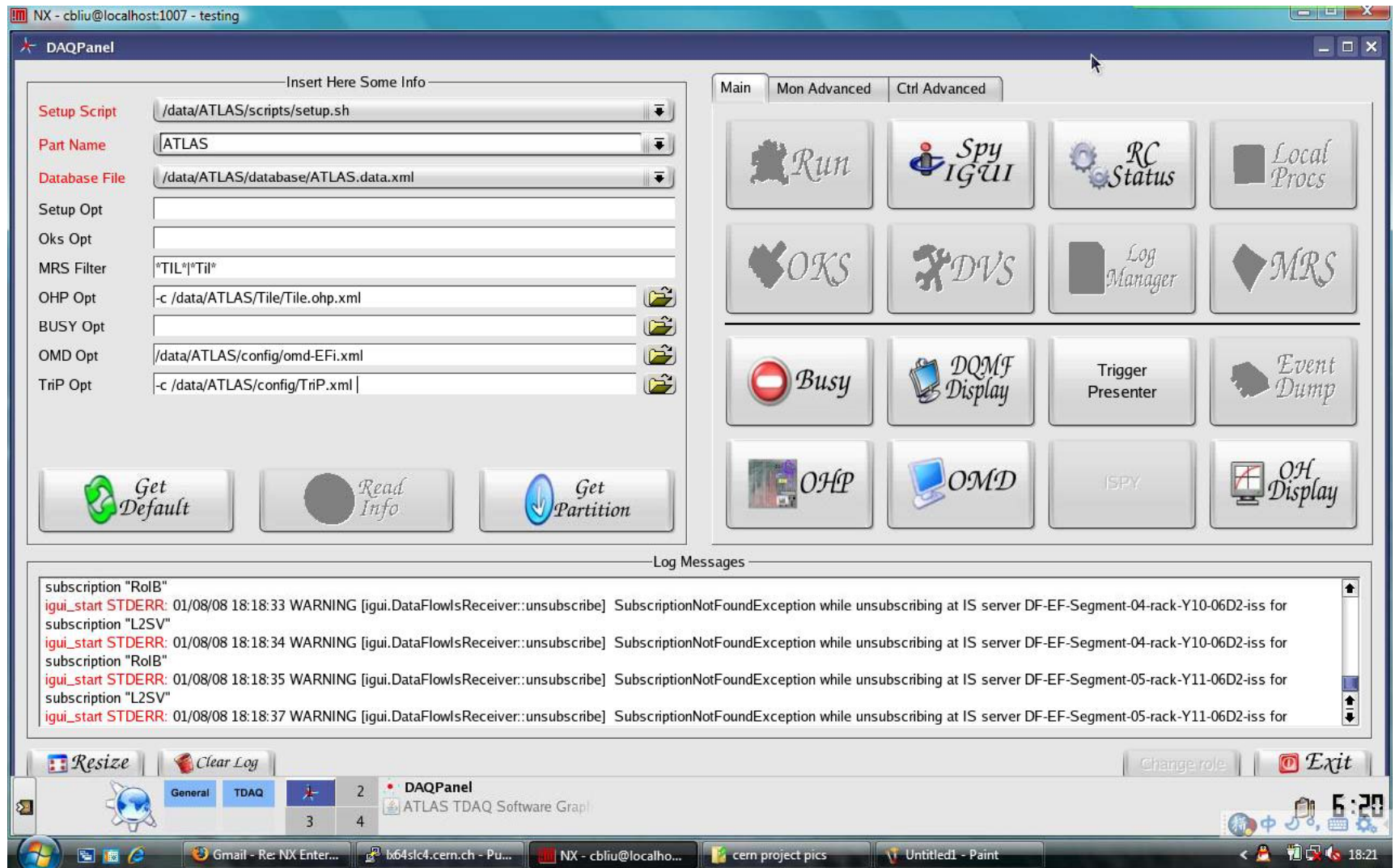
TDAQ panel for shifters
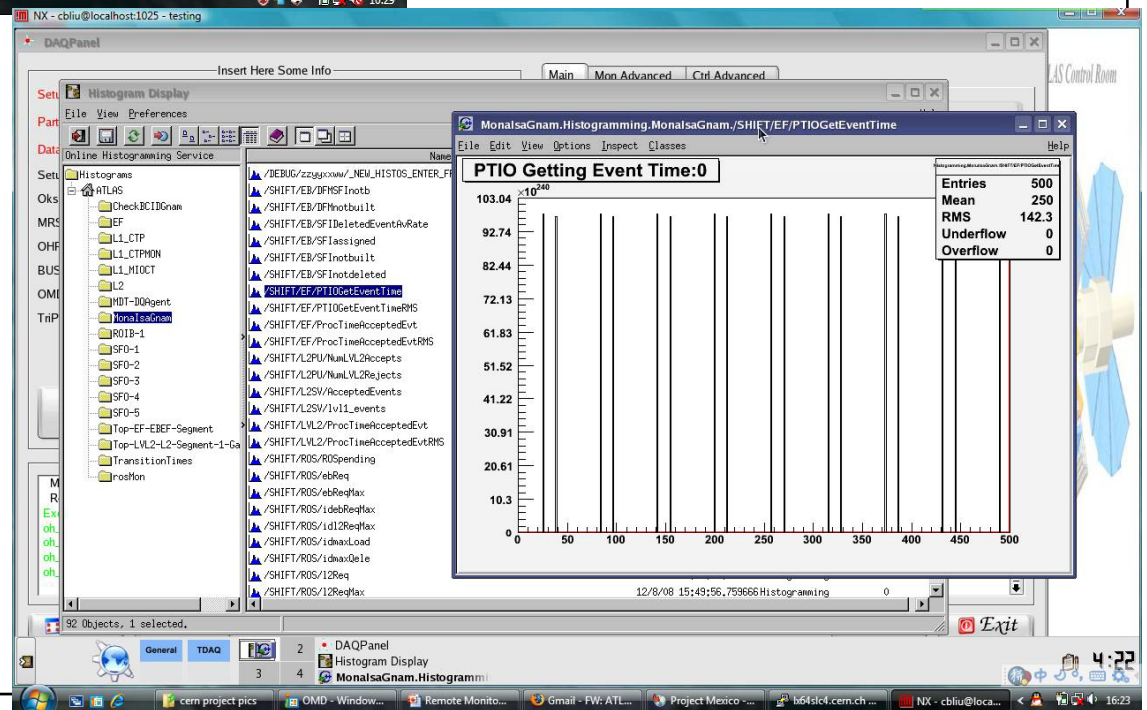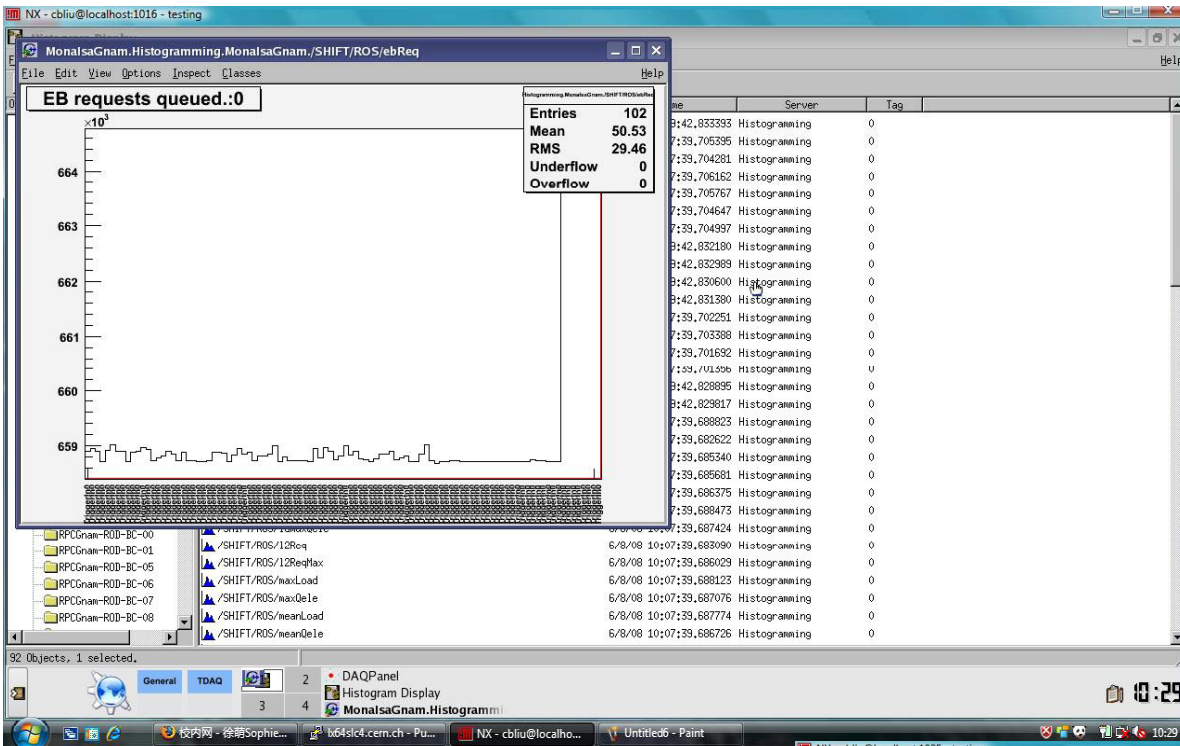
Muon data quality online histogram presenter

Examples of histograms that can be seen

ATLAS system
status display

Current Status and Future Plans

- Licenses for Scala designers and players have been ordered by the Outreach committee and Michigan

- Scala scripts are being developed and tested for different users needing different TV channel contents

- Evaluation between NX technology and Sun Secure Desktop is underway to determine which technology to commit to

- Remote monitoring systems are being developed at several US sites

- To develop scripts to show web lectures recorded by Michigan team

- Policies for remote shifters using the mirror machine is being formed

- To outreach to high schools using ATLAS TV

Current Status on the Michigan Remote Monitoring System

Michigan developers with the system: 4 displays
with one driving CPU
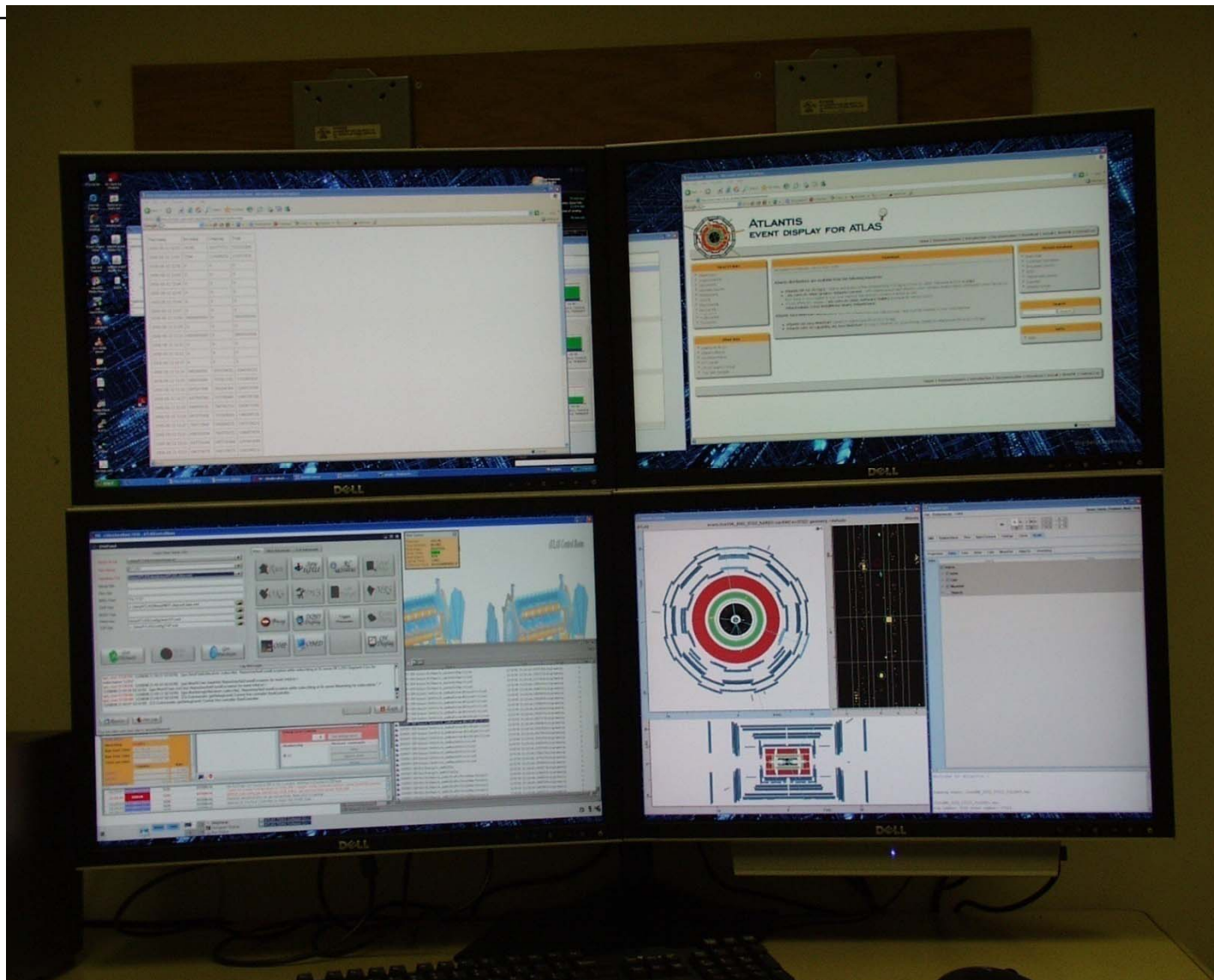
Contents that are being shown:
Upper left: Michigan Tier-2 center dCache information
Lower left: Control room desktop using NX
Lower right: Event display using Atlantis, ATLAS event display software

Our Vision of a Remote Monitoring System

- There will be an open space equipped with multiple monitors and a working desk. The displays driven and controlled by a CPU will show different contents tailored to people of different interests and levels. For example, experts can discuss future plans by viewing the current status of the experiment; while, high school students can expand their horizons in seeing the even displays of ATLAS.

  At the host site, modules can be designed to meet their needs ranging from taking remote shifts for ATLAS to presenting to high school students. In general, this framework with ATLAS TV and NX technology should serve to improve the collaboration among physicists and to reach out to the general public.
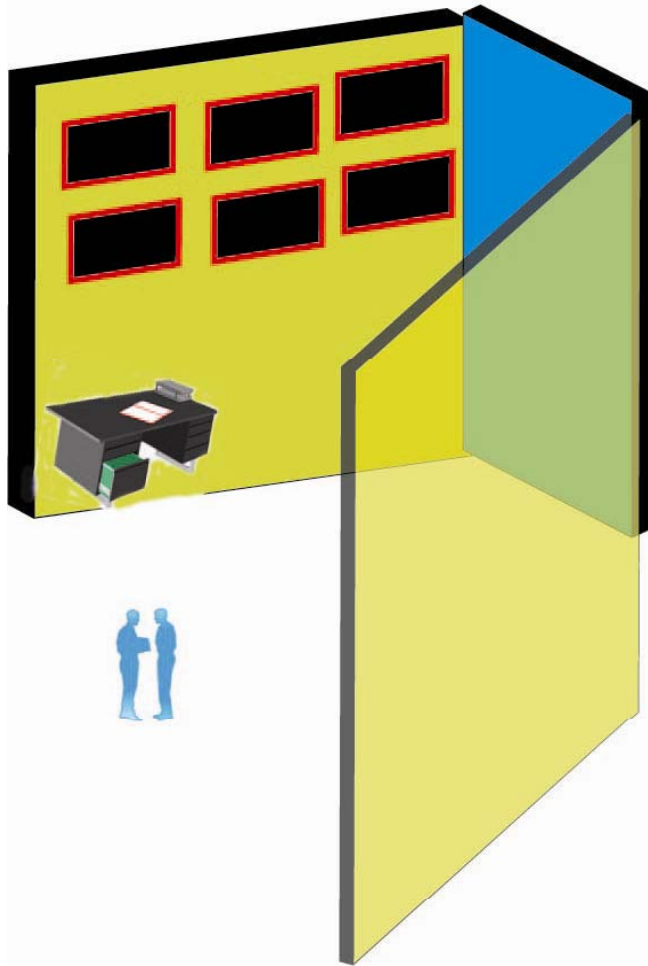
A visionary remote monitoring room made by using Adobe Illustrator

Summary

- The components of this framework are able to facilitate the work of experts at distance by letting them get access to the current information about the experiment using the many viewing functionalities by NX; in addition, the components can broadcast videos, pictures, and text for outreach purpose using ATLAS TV concept

- I have researched efforts underway on remote monitoring system, including these within CMS

- I have worked with Eric Feng and Jonas Strandberg to make the muon data quality histogram online presenter available

- I have worked with Tiina Wickstroem and Jeremy Herr to test the Scala software and scripts and to develop other scripts

- I have worked with Shawn McKee to setup the displays and the contents in Ann Arbor

- I have worked with Homer Neal to develop a vision and model of a remote monitoring system framework, which can be deployed by experts and the public

Cultural Experiences
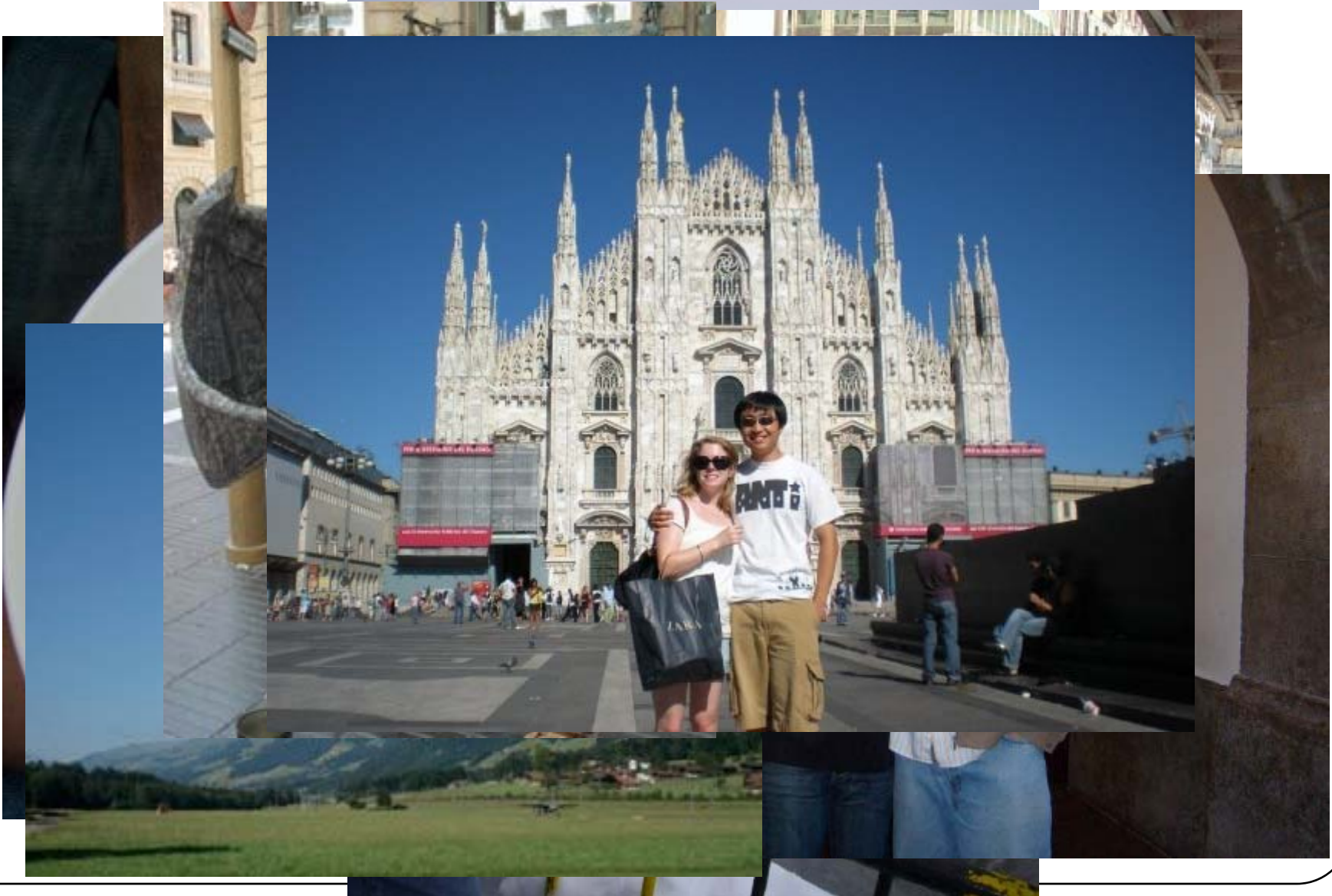
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- www.scala.com
  - Scala information
- https://twiki.cern.ch/twiki/bin/view/Atlas/TileRemoteMonitoring
  - Setting up NX for TileCal

Acknowledgements

- ATLAS Monitoring Working Group
- ATLAS Outreach Committee
- CERN IT Department
- CMS Remote Operation Group
- Michigan group, Michigan State group, and UTA group
- REU group
- NSF, Ford Motor Company and CERN

- Dr. Myron Campell
- Dr. Jean Krisch
- Dr. Steve Goldfarb
- Dr. Shawn McKee
- Mr. Jeremy Herr
- Dr. Homer A. Neal

Thank you

- Any questions?