CoToGAN 2003

3rd International Workshop on

COmmunication TOols for a Global Accelerator Network

October, 28-31, 2003 / *Jolly Hotel* / Trieste, Italy

Workshop Summary

Fulvia Pilat, BNL

November 14, 2003

ELETTRA

ELETTRA

Accelerator Characteristics & Developments of Note

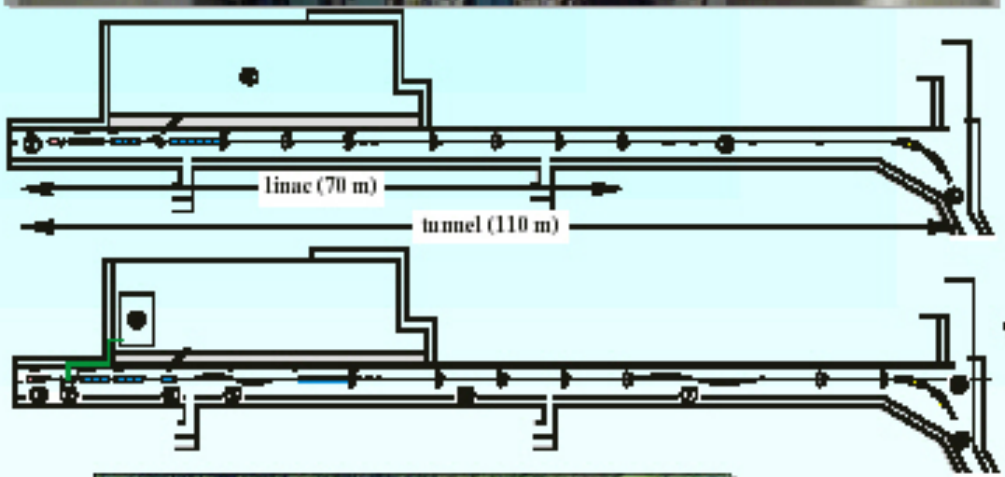
- Linac: 1.2 GeV
- Storage Ring: 0.7 to 2.4 GeV operation
- Photon Sources - bending magnets, wigglers and undulators (IR to soft X-Rays)

- European SR-FEL: 189 nm

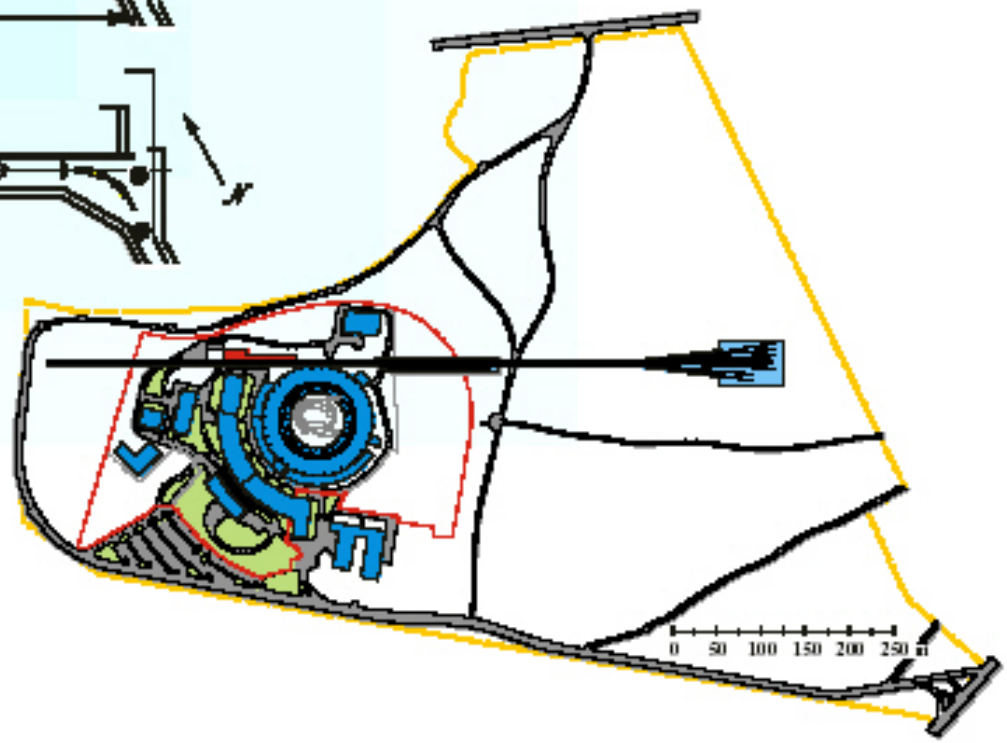
- Construction of Full Energy Injector (pre-injector & Booster)

- Development of Linac based FEL

FERMI@ELETTRA - Linac based FEL



Three "Beam Lines"
100-40 nm
40-10 nm
10-1.2 nm



C.J.Bocchetta

	Introductory Session
9:15	**Summary of Previous remote Operations Workshops & REAP Working Group** *David Rice (Cornell, US)*
9:45	**The proposed GANMVL Tool** *Simone Richter (GSI, DE)*
10:15	**Planned operations of SNS** *Willem Blokland (SNS, US)*
11:00	Coffee break
	Introductory Session
11:15	**Planned operation of LHC: contributions from collaborating institutes** *Mike Lamont (CERN, CH)*
11:45	**Present state of remote diagnostics in CERN accelerators** *Uli Raich (CERN, CH)*
12:15	**Recent Activities at to Support remote Development and Access to TTF** *Kay Rehlich (DESY, DE)*
13:00	Lunch
	Introductory Session
14:00	**Prospects of Desktop Video Conferencing** *Martin Einhoff (IGD, DE)*
14:30	**Psychological and Sociological Aspects of Remote Co-operation** *Christian Liebig (University of Mannheim, DE)*
15:00	**The evolution of Elettra Virtual Collaboratory** *Roberto Pugliese (Elettra, IT)*

Working group 1

Accelerator Experiments with Remote Participation

Remote accelerator control is a too simplistic approach to describe GAN activities. Accelerator operation has several aspects, notably task related to routine machine operation and tasks related to machine improvements and machine experiments. Working Group 1 will develop concrete scenarios and hopefully even concrete proposals for the year 2004, which demonstrate that dedicated machine experiments are good candidates for first applications of the GAN technology. These scenarios and proposals have to be well founded and realistic enough to even convince careful people in top management positions about the usefulness of this approach.

Dr. SCHMICKLER Hermann

Working group 2

Controls, Networking and Accelerator Hardware Issues relevant for Remote Operations

Working Group 2 will be dedicated to discussions on all the controls, networking and accelerator hardware issues which are relevant to remote operations. In particular we will try to find answers to the following questions:

- Is GAN tightly related to the next linear accelerator, or can GAN also be adopted to other multi national projects (i.e. the X-FEL)? - We are often discussing the operation of a GAN machine - I would also be interested in the approach to get there: - How can we establish collaborations? -
- Which tools are necessary? - Project Management - Source control - Quality Management - Asset Management - Knowletge Management
Hardware Issues: - Do we need redundancy? - Processors - Network - I/O - Local diagnostic features - Remote Management Boards
Besides all this we will discuss also issues related to: - Diagnostics -
- Standards to follow - Network requirements - Access control - Remote access to local LAN's - VPN and the latest WORM attacks - GRID - Laboratory Regulations

Dr. Clausen Matthias

Working group 3

Telepresence: Technical, Sociological and Operational Aspects

Working Group 3 will be dedicated to technical, sociological and operational aspects of telepresence, i.e., the operation of a certain system at distance, in the context of scientific experiments. The topics that will be discussed include: - What are the most important shortcomings of remote interactions via communication technology, and which technical systems need to be improved to mitigate these shortcomings - What is the experience with remote interaction using phone and videoconference, - Where are the main difficulties and what can be done technically or organisationally to advance the state of the art - Experience with and characteristics of current & developing videoconferencing and teleoperation systems - What is the impact of network safety consideration for telepresence purposes - What is the impact of advanced technologies like immersive virtual reality or augmented reality in remote operations.

Prof. Chittaro Luca

GAN/RemOp Reports & Workshops

➢ Two ICFA commissioned reports and 2-1/2 workshops on GAN and Remote Operations:

- 3/00 - 12/01 **ICFA Reports** –
  1) General considerations of implementing a GAN,
  2) Technical considerations – design & cost

  www.fnal.gov/directorate/icfa/icfa_tforce_reports.html
- **Workshops** –

  3/02 (Cornell) Enabling the GAN

  www.lns.cornell.edu/ganwkshp

  8/02 (Berkeley) Collaboration Tools for the GAN

  www-itg.lbl.gov/Collaboratories/GANMtg

  9/02 (BNL/Shelter Is.) Remote Operations Workshop

  www.agsrhichome.bnl.gov/RemOp/

David Rice

REAP Working Group

- The Remote Experiments in Accelerator Physics working group was approved by ICFA to function under the Beam Dynamics Panel in February, 2003.
- Mission Statement:

  To promote collaborative accelerator physics experiments carried out using the evolving techniques of remote operation. It is intended that web based communication and collaborative decision making will be an important part of the effort.
- 23 initial members from (primarily HEP) accelerators worldwide. Primary responsibility is to function as liaison between lab and working group.

David Rice

REAP WG Activities

- **Web page** to disseminate information
  - www.lepp.cornell.edu/icfa/reap/
- **Database of Remote Ops/ AP experiments**
  - F. Pilat - www.c-ad.bnl.gov/RemExp/default.asp
- Support of **workshops** on Remote Operations
- **Reporting of activities** in BDP newsletter
- Development / promoting of **webcast seminars** for accelerator physics
  - Accessible Webcast Seminars (under devel. at Cornell)
  - VRVS

David Rice

MVL - Multipurpose Virtual Laboratory

Simone Richter

Design and build a collaborative tool for

- Far Remote **Observation** and/or
- Far Remote **Control**

of accelerator components or experiments at accelerators

- With combined high quality audio and video and
- File and information sharing
- All within one tool

MVL

Simone Richter

Combine already or almost available technology and elements of far remote controls into ONE collaboration tool:

- Provide a versatile set up which is easy to transport, easy to install and set up
- Accelerator controls and Virtual instruments
- Document sharing
- Video Conferencing
- Secure and deterministic network connections

MVL
Server

Network

Video

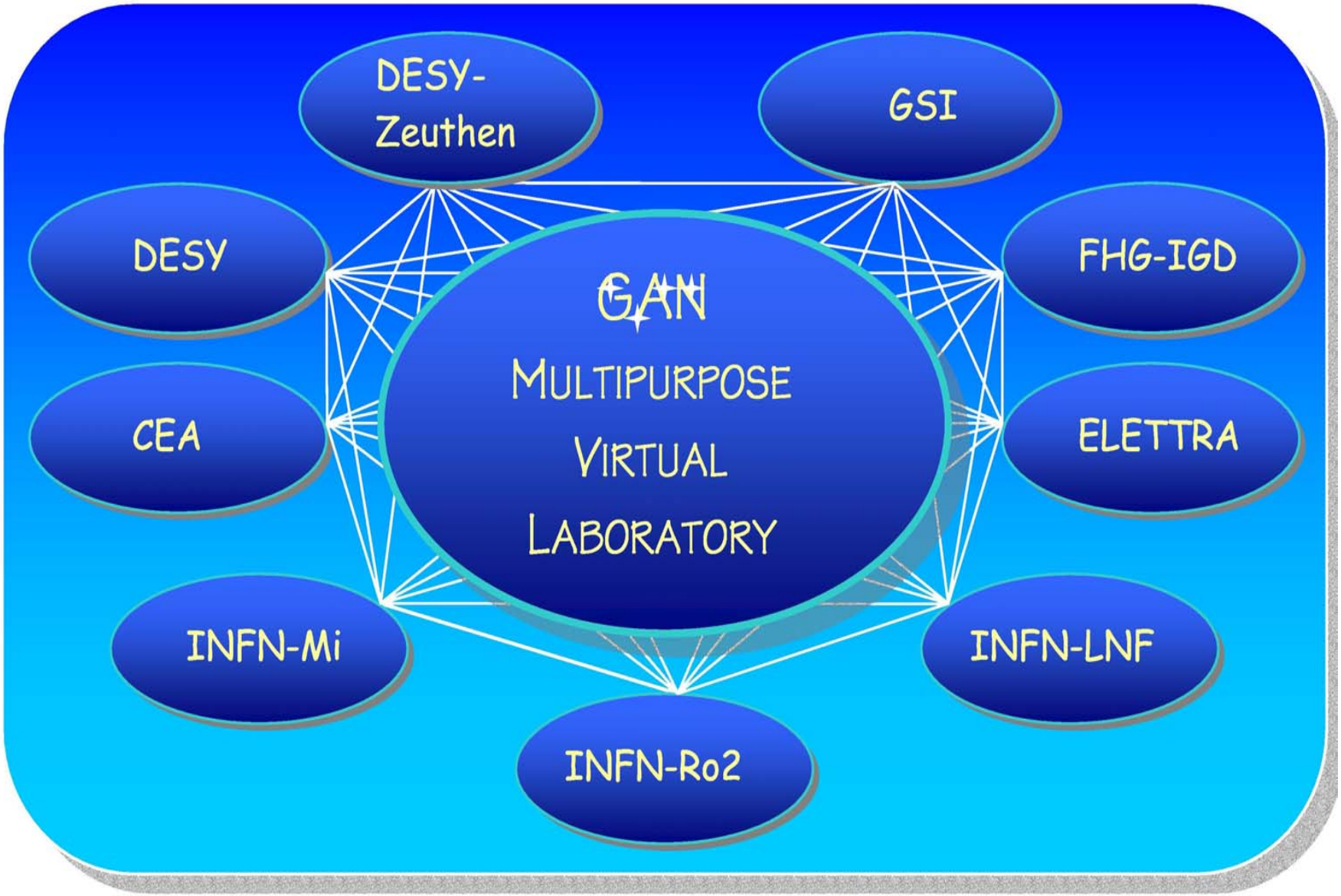
Audio

Accel.
Controls

Support of
equipment

MVL
Client

Institutions cooperating in the MVL collaboration



Activities supported by MVL

Simone Richter

- operation of accelerators with far remote access to the accelerator controls and close contact to the local operation crew
- commissioning of accelerator components with far remote access and support of communication between local and remote crew
- trouble shooting and repair on accelerator components with involvement of off-site experts
- measurements in a laboratory environment
- support for technical discussions, collaboration meetings

MVL Milestones and Deliverables

Simone Richter

- **After 6 months:**
  - Users Needs and Technical Requirements Defined
- **After 13 months:**
  - System Design Ready (Specification of the technical platform, components and application prototypes)
- **After 18 months:**
  - First Prototype finished
- **After 24 months:**
  - **FINAL Design review**
- **After 36 months:**
  - Pilots ready, Installation, **Test of complete MVL**
- **After 48 months:**
  - Evaluation Report

MVL Outlook

Simone Richter

MVL project turned down for 2004 ESGARD/CARE funding
(2 project out of 4 funded in the same 'basket')
Project to be re-submitted in march 2004 for 2005 funding

KEEP ON GOING!!!!!!

- Prepare a new Proposal within 6th European Framework – Design Studies
- Find possible Industrial Partners
- Find (new and better???) arguments

Remote Communications at the SNS Divisions

Videoconferencing

- Equipment at all labs
- Share desktops
- Not always smoothly
- Feels like presentation, an not informal get-together

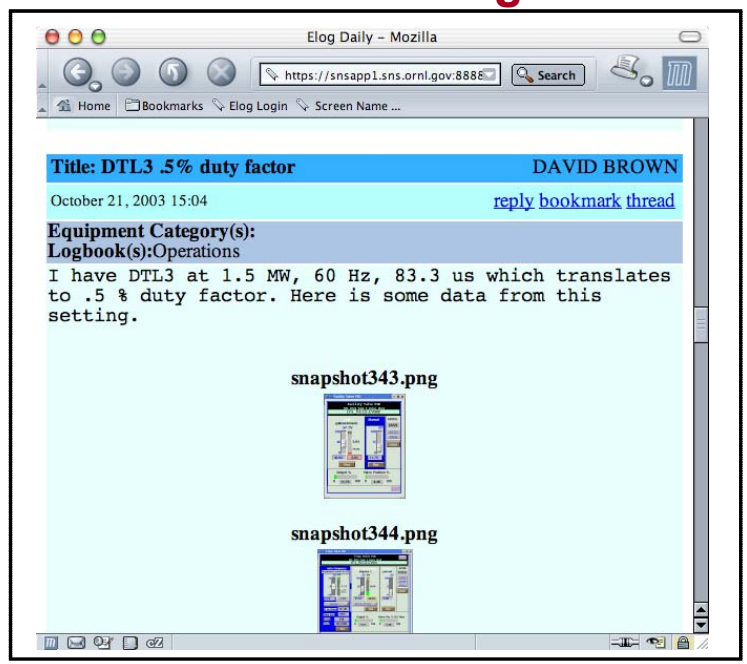
Divisions

- Experimental Facilities
  - Instruments: data-sharing
- Conventional Facilities
  - Problem solving with Tullahoma, TN, contractor
- Accelerator Systems
  - Physics
  - Controls
  - Diagnostics

Remote Institute Access Procedure

- Call control room
- Activate VPN access
- Get data, do allowed settings
- Document in Elog
- Deactivate VPN access

Electronic Log



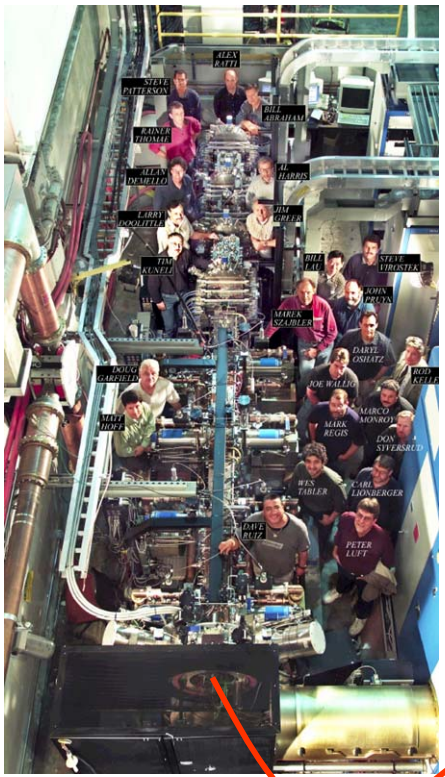
Willem Blokland

ASD/Physics Remote Access

Willem Blokland

- Java applications for the high-level control and data representation using the XAL framework accessing EPICS PVs
- Remote control room at SNS while front-end commissioned at LBNL for testing
  - EPICS gateway server used at LBNL
  - Read/write access granted to ORNL Control room CPU IP address
- Remote control room at LANL for diagnosing
  - Monitoring progress on DTL conditioning and RCCS (resonant cavity control system for water flow)
  - EPICS gateway server
  - Read access only (operators can give write access to any IP address)
- Planned Remote Access at JLab for SRF commissioning
  - EPICS gateway serve

Remote Testing of Applications



Front End
at LBNL

Test control room
at ORNL

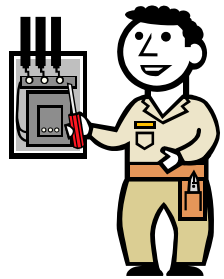
- Remote testing of high level applications from ORNL on the Front End System at LBNL

Willem Blokland

Experience with remote contributed hardware

The Diagnostics Group receives instruments from partner labs and also designs and develops locally

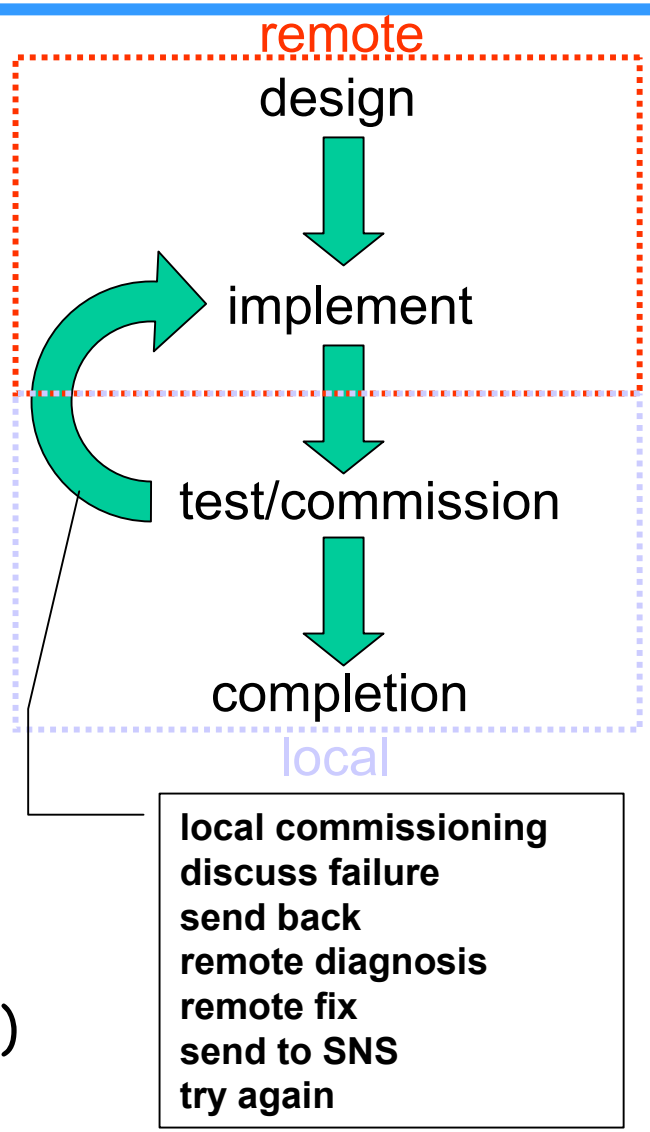
- Handoff criteria
  - It's shipped, it's yours (commercial)
    - Cheaper but very difficult road to success
  - Design expert installs and commissions
    - Expensive? but much easier road to success



- Collaboration setup
  - Remote person works for partner lab and gets SNS task
    - Different priorities, local priority likely to overrule
  - Remote person only works for SNS
    - Same priorities, time limited involvement

Experience with remote contributed hardware

- 99% finished can be 100% failure, especially when remote
  - Different operating environment
  - Match visit with beam time
  - Designers not present to analyze in actual conditions (send back instrument)
  - Debugging normally done in the background now is shown in the foreground
  - No personal contact of design team with install/operation team
  - Budget constraints
  - If developed locally, the last 1% (50%) are easier to complete



Summary- SNS

Willem Blokland

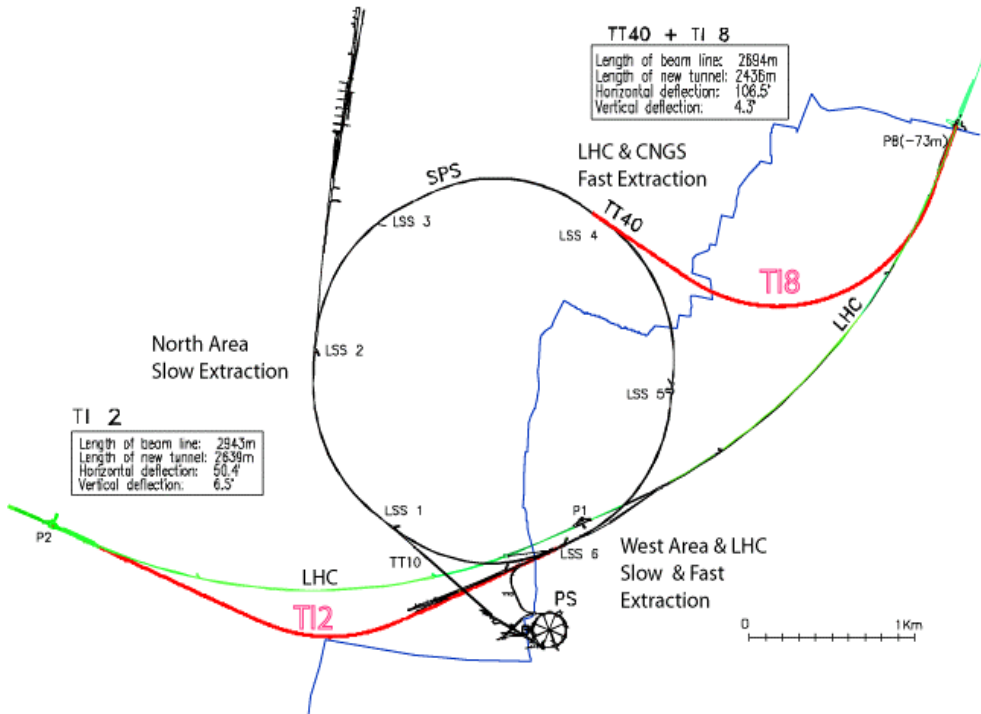
- Remote contributed hardware is challenging but also exciting
- Video conferencing is not equal to being there
- Remote access is needed when having remote contributed hardware

- No remote access planned for SNS accelerator operations after commissioning
- Remote control and data sharing planned for experiments

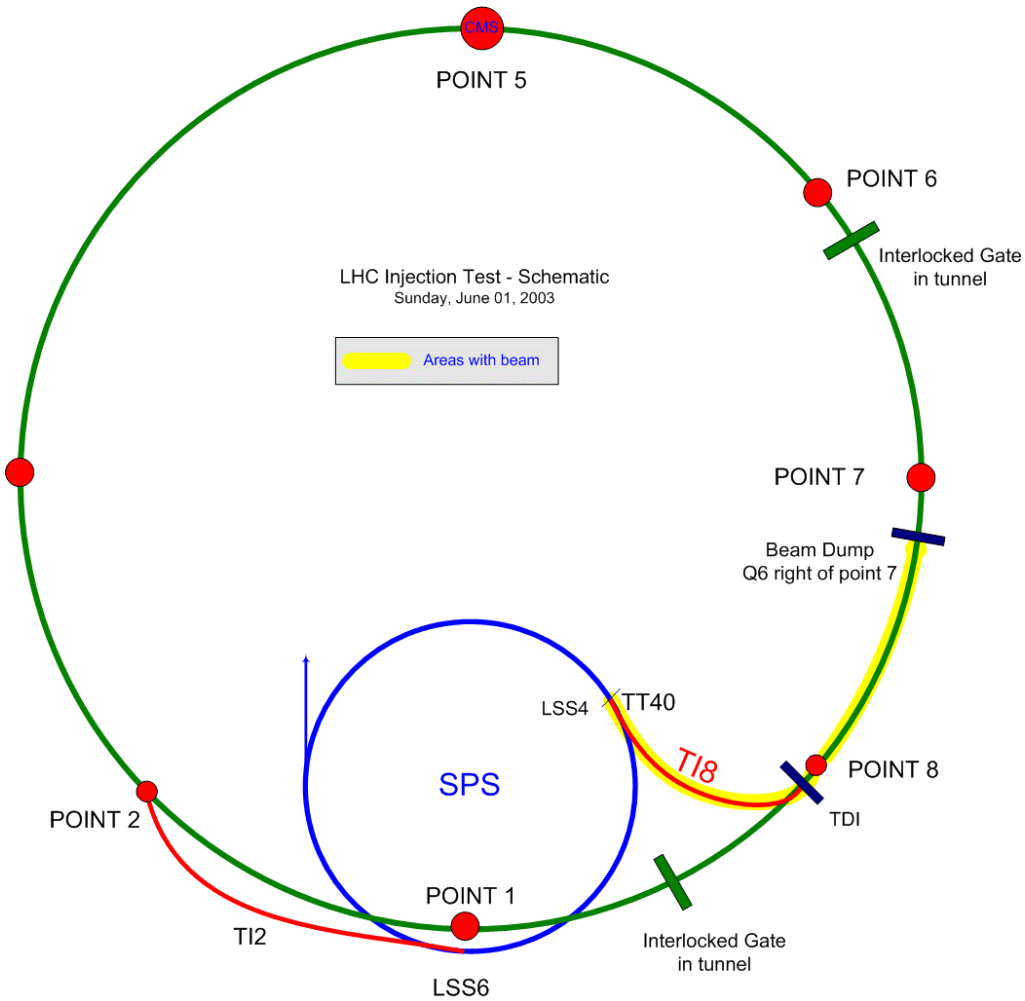
LHC - Upcoming Beam Tests

Mike Lamont

- TT40 extraction
  - 2 x 24 hours, September/October 2003
- TI8
  - 4 x 24 hours, September 2004
- LHC Injection test
  - 2 weeks, May 2006
- TI2 commissioning
  - April 2007
- LHC commissioning
  - April onwards 2007



Injection test in 2006



Mike Lamont

RECENTLY APPROVED

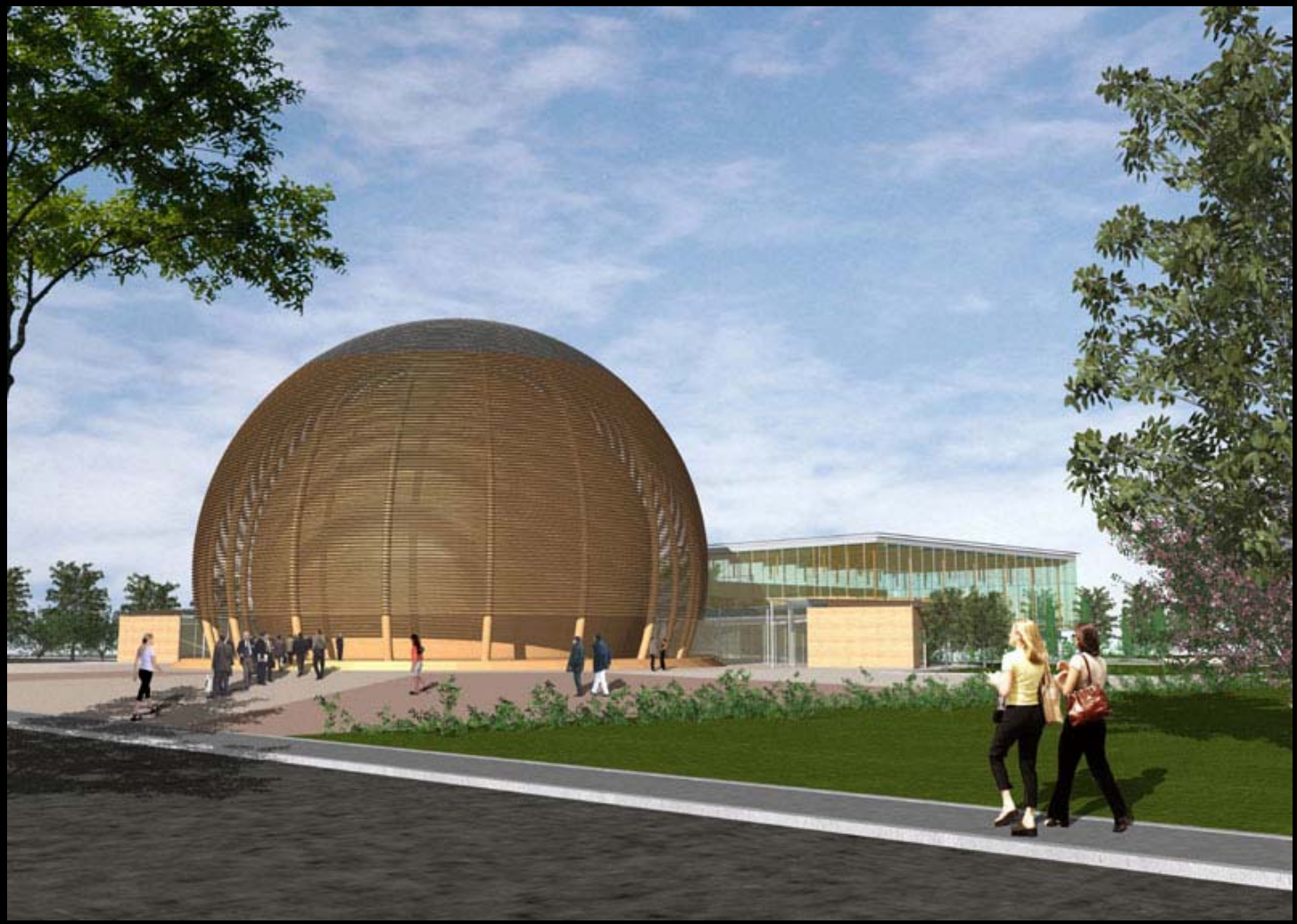
3.3 km of the LHC including one experiment insertion and a full arc

About 30 cells with a phase advance of ~ 3000 degrees total.

Control room(s)

- Start **2006** CERN is planning to move all accelerator operations into a single control room.
- For the LHC will include:
  - **Beam based operations**
    - Machine protection etc.
  - **Technical services**
    - Cooling, ventilation, electricity etc.
  - **Cryogenics**
    - Industrial CS
    - Dedicated operators
  - **Hardware commissioning**
    - Cryogenics, QPS, powering. Vacuum, post-mortem, interlocks
    - "Mobile" field control rooms foreseen.

Globe of Innovation (Unified Control Room)



Remote operations

Mike Lamont

- We do 27 km already…
  - Given a laptop you should be able to control the LHC from anywhere
- However: Clearly don't foresee full remote operations
  - No motivation for the risks
  - No motivation to accept the inevitable overhead.
- Well-controlled, limited access for manipulation possible.
- Concerns:
  - Security/ID/Reservation/Exclusivity
  - Parallel operation
  - Remote Mistakes!
- With the GCC some provision for video link-ups are being foreseen
- Remote equipment diagnostics:
  - Web based access already in use, see following talk..

Remote… what?

Mike Lamont

- Hardware Commissioning
  - Not obvious, even the HWC guys are going to park themselves in the tunnel to be close to their equipment… lot of teams involved.
- Beam commissioning
  - Not obvious, a lot of problems to deal with…
- Machine development
  - is clearly an option with limited access to beam manipulations
- Controls
  - Remote development & subsequent use?
  - Certain sub-systems open to analysis
- Operational scenarios
  - Involving standard, well-defined, limited beam manipulation
- Understanding
  - Post-run analysis, brainstorming etc.

LHC - Remote?

Mike Lamont

- Hardware Commissioning
- Beam commissioning

} **NO**

- Machine Studies
- Controls
- Operational scenarios
- Understanding

} **SURELY**

Conclusions

Mike Lamont

- However GAN like facilities could be available:
  - **Video**
  - **Remote access to data, displays, RT info,**
  - **Limited manipulations back by appropriate security**
- Scope for "remote" collaboration
  - **Machine studies**
- LHC is a big, complex beast:
  - **Full remote operations is not envisaged**
  - Instrumentation & their use in specific beam-based operation scenarios
  - Controls sub-systems
  - Raking over the coals: problem solving, brainstorming, post-run analysis

This is not a top priority at CERN at the moment (understandably) but the opportunity and support is there.

Clear political motivation that something is done.

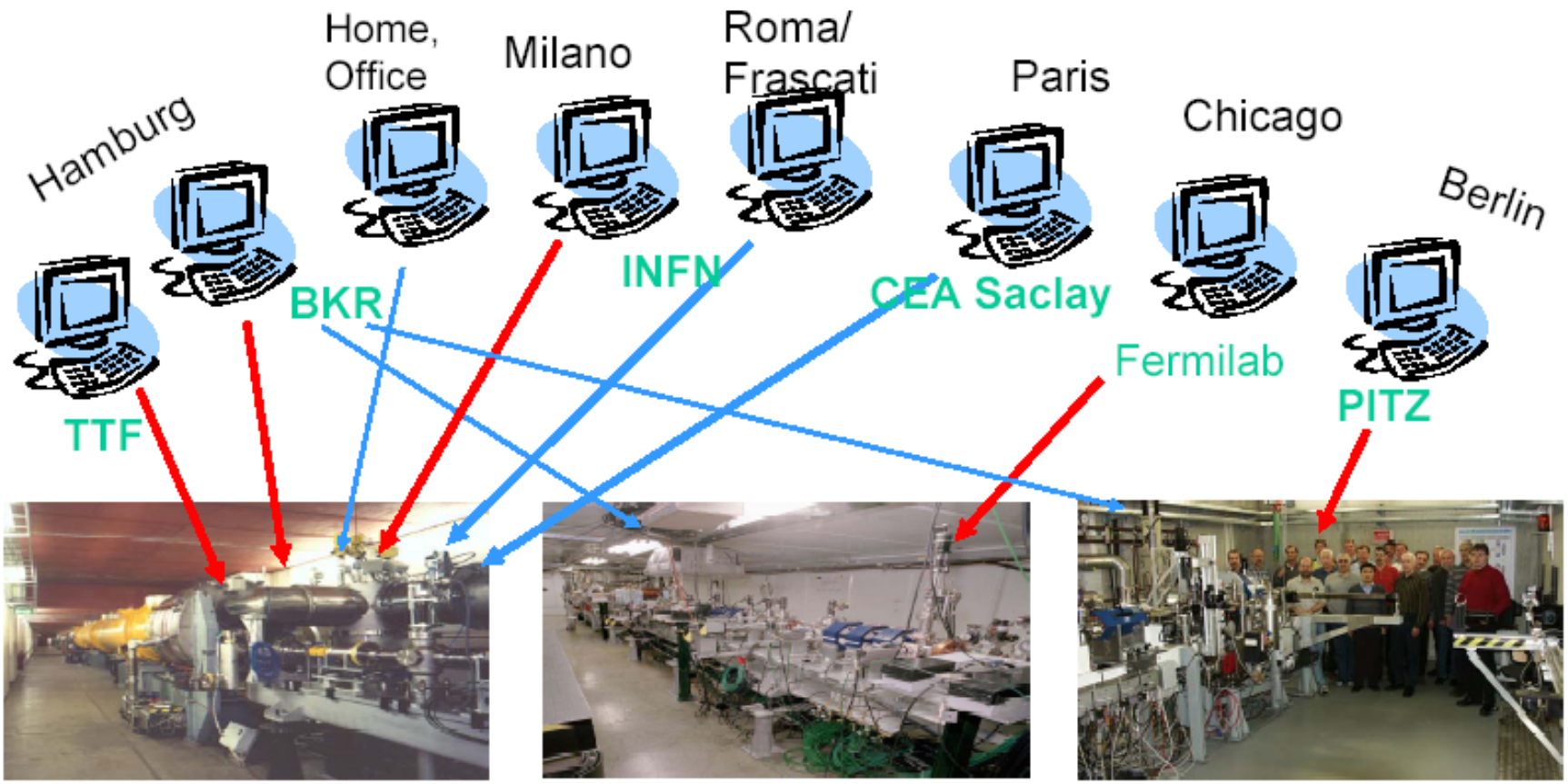
Status @ TTF

Kai Rehlich

- Remote shifts / Remote Maintenance
  - Maintenance since 1996
  - Remote shifts since 2001
  - Control system provides 'all' data to remote sites
  - Audio/Video connection
  - eLogBook
- Cavity DataBase
  - All measurement results are on the Web
  - ORACLE tools

Remote Operation and Maintenance

Kai Rehlich



Next Step @ TTF2

Kai Rehlich

- Collaborative Development: the DAQ Project
  - Collaboration is founded in relationships NOT in technologies
  - Learn to create and maintain a virtual team
  - Building trust between different cultures
  - Evaluate different tools by using them
  - Improve the tools or try better solutions
  - Understand which tool helps best for a task

Collaborative Design

Kai Rehlich

- VRVS video conferencing tool
  (all platforms, cheap, multipoint ..)
- VNC desktop sharing
  (edit a common file, show transparencies ..)
- All documents are on the Web (distributed)
  - .eLogBook (Hamburg)
  - .Wiki (Cornell)
- CVS common code repository
- Doxygen Software documentation
- Mailing list

e-Logbook

- TTF eLogBook — Kai Rehlich
  - Used for local and remote shifts since 2001
  - Used to upload documents (PDF, PS, GIF, JPEG ..)
- ~30 eLogBooks installed
  - DESY, SLAC, INFN, ESRF
- Based on Web technologies
  - XML to store meta info
  - JAVA Servlets, JavaServerPages, XSL ...
  - Apache and Tomcat Web server

Wiki

Kai Rehlich

- A set of pages of information that are free for anyone to edit --> Self-Organizing System
- Flexible, powerful and easy to use Web-based collaboration platform (calendar plug-in ..)
- WikiWiki principle 1995 introduced by W. Cunningham: gains increasing popularity
- The system creates cross-reference hyperlinks between pages automatically
- Easy formatting rules, no WYSIWG
- TWiki **http://twiki.or** (GPL license), PERL based
- Server in Cornell

What is a Collaboratory?

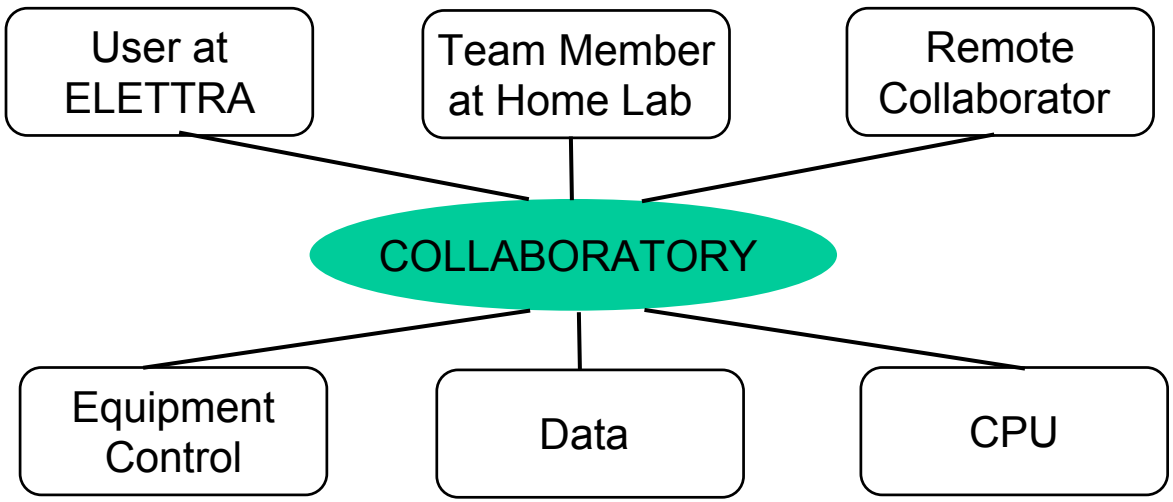
Roberto Pugliese

- The term *"collaboratory"* was coined by William Wulf by merging the words *collaboration* and *laboratory*, and defined as "... Center without walls, in which researchers can perform their research without regard to geographical location - interacting with colleagues, accessing instrumentation, sharing data and computational resource, and accessing information in digital libraries".

What is the Elettra Virtual Collaboratory (EVC)?

Roberto Pugliese

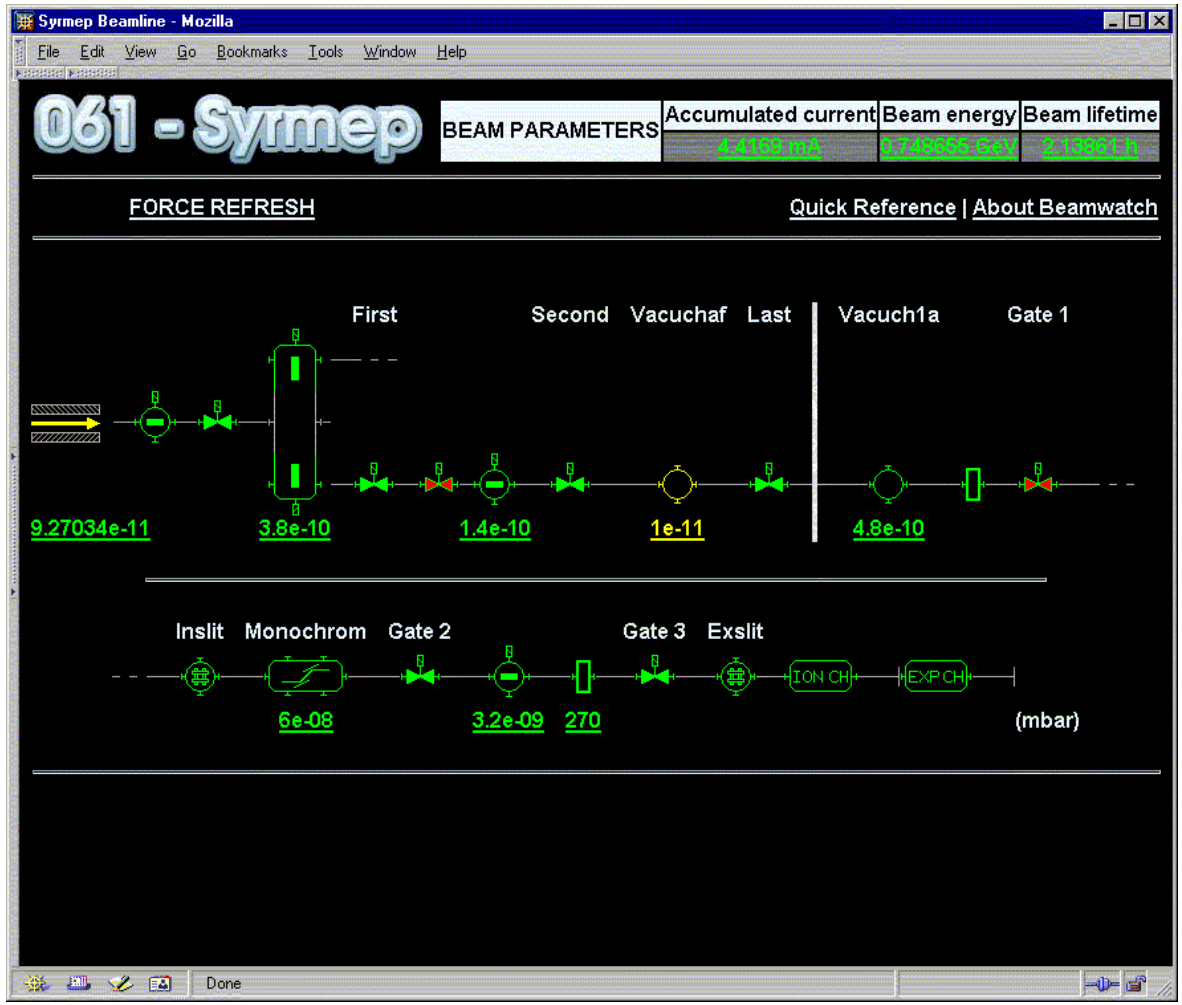
- EVC is an example of virtual laboratory, a system which allows a team of researchers distributed anywhere in the world to perform a complete experiment on the equipped beamlines and experimental stations of Elettra.



Collaboration Tools: Remote Beamline Control and Supervision

Roberto Pugliese

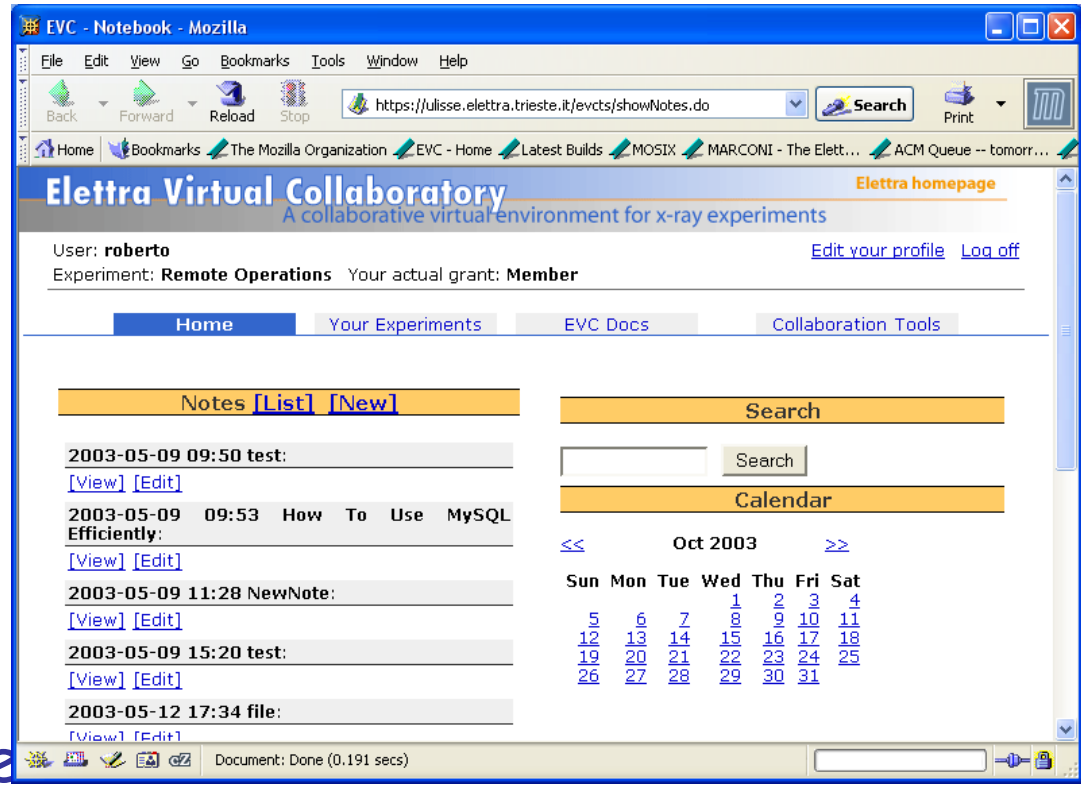
- Beam-watch presents a synoptic view of the beamlines
- Authorized people can thus operate remotely on the beamline instrumentation



Collaboration Tools: Electronic Notebook

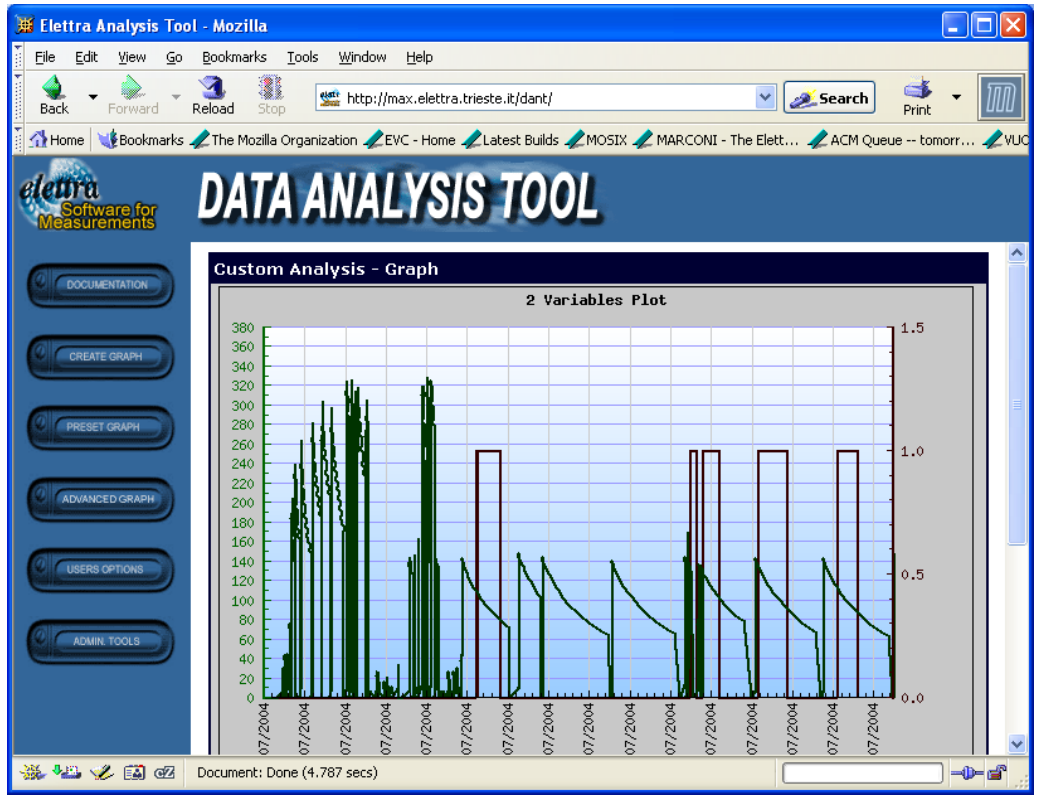
Roberto Pugliese

- Web application which substitutes the Beamline LogBook registering meaningful beamline events using a wiki-weblog methaphor
- Events can be entered manually or automatically by a program
- Texts and images are automatically indexed and hence easily searchable and browsable



Collaboration tools: Advanced LogAnalizer

Roberto Pugliese



- Advanced LogAnalizer is a web application which allows to select variables from the logfiles produced by different control and supervision systems, and to plot them in a user specified temporal interval

- Advanced LogAnalizer is technically a data webhouse, modular both considering the data loading and the data visualisation (Visual Data-Mining)

EVC status and future developments

Roberto Pugliese

- We are now refactoring EVC using *GRID technologies* to face the new challenges rapresented by complex problems like "High-Throughput" Protein Crystallography and Remote Operations of Large Experimental Physics plants (e.g. Accelerators).
- These complex problems involve in fact coordinating and sharing computing, application, data, storage, or network resources across dynamic and geographically dispersed organizations.

COTOGAN2003

Summary of Working group 1:

Beam Studies and Beam Experiments

Prototyping for GAN?

H.Schmickler, CERN AB-BDI

Non exhaustive list of GAN activities

Hermann Schmickler

- Steering and quality control of experimental beam lines (secondary and tertiary beams): widely used
- Remote maintenance, diagnostics and small problem fixing of "delivered" hardware. Example: SACLAY, Superconducting RFQ for TTF, PEP: Rf maintenance.
  This is the field SNS and LHC will have a large need.
- Full remote operation of accelerator complex.
  Good success at TTF = R&D machine, no big risk of machine destruction. Nothing of this kind presently wanted for SNS or LHC.
- Remote machine experiments. Wish list from Shelter island workshop, mostly not yet done, because of low priority during operation of the complex. Ad hoc positive implementations: example: CERN head-tail monitor installed at RHIC with remote read-out to CERN.
  Further examples will integrate better accelerator physicists into the GAN activity. Those are the people, who are in general very close to the decision takers.

Specifications for remote machine experiments

Hermann Schmickler

- Should be one of the easy GAN jobs:
  Collaboration of people, who know each other from conferences etc (accelerator physicists)
- Is based on working equipment
- Needs audio-video communication for agreement of the experiment procedure and for preliminary discussion of the results.
- Needs shared machine consoles to launch application programs and data retrieval.

RHIC Beam Ex 2004

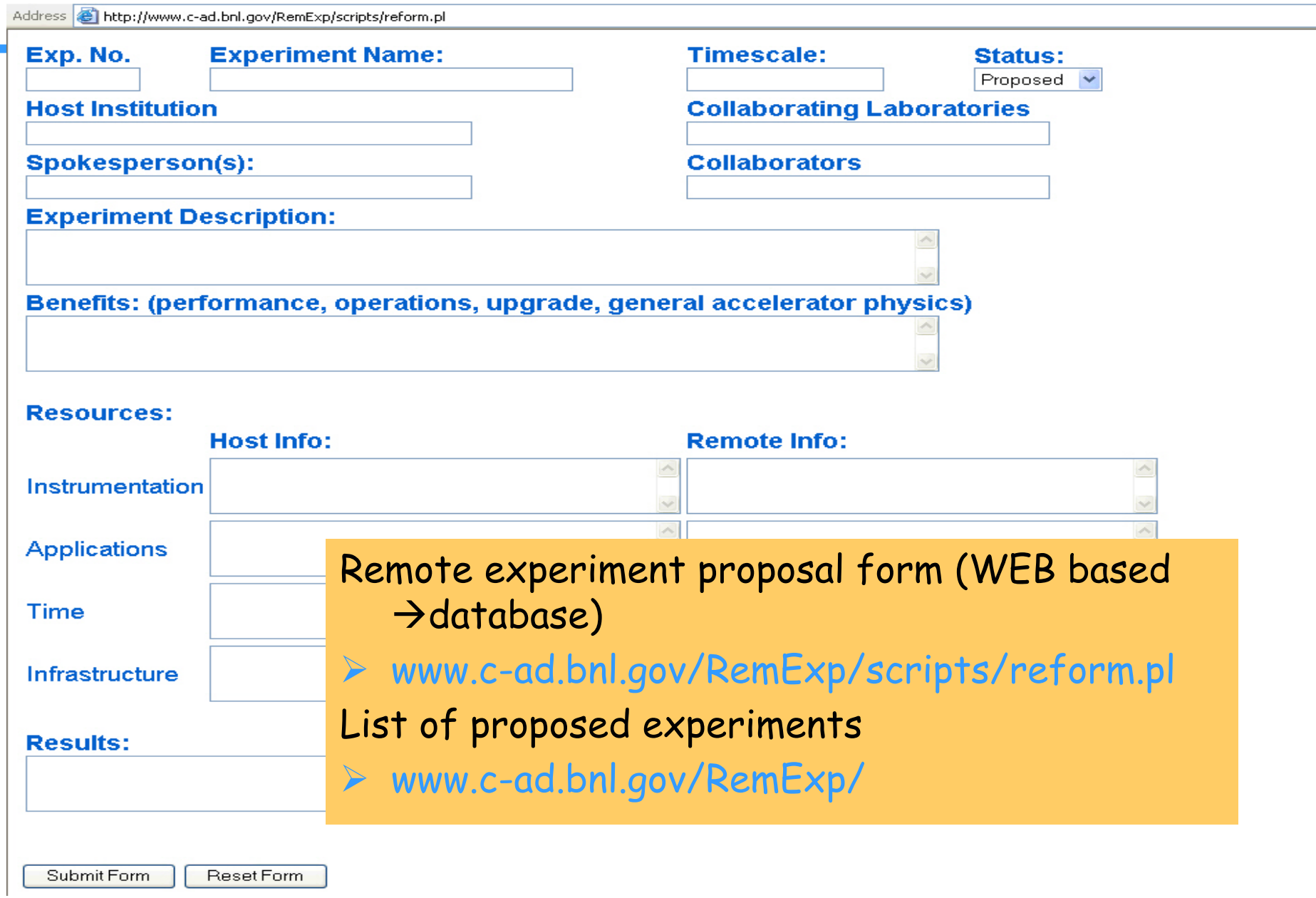
- **AEAC** meeting in ~mid december (+ possibly follow-up in ~march). Missing written results to be submitted prior to that.
- **Program** & coordinators similar to last year (with appropriate additions and inclusion of new arrivals)
- Continuation **external collaborations**
- Start of **Remote Operation Experiments**

  parasitic" to experiments already in the program

  identify collaborating institutions/individuals

  CERN, FNAL existing collaborators a good start

Submission form (as on web)



Remote experiment proposal form (WEB based →database)

- www.c-ad.bnl.gov/RemExp/scripts/reform.pl

List of proposed experiments

- www.c-ad.bnl.gov/RemExp/

Technological shortcomings

Hermann Schmickler

- Impressive flood of more or less adequate informatics tools; tools developed by industry for applications with different objectives
- Important security issues not solved
- Apparent lack of technical coordination
- Positive exception:
  - proposed GAN-MVL = proposed and presently refused EU project for ONE appropriate integrated tool
  but:
  - very long lead time of MVL (3…4 years)
  - very ambitious and probably overkill specifications (fully immersed 3D audio and 3D video)
  - does not integrate all interested communities, in particular the main American institutes
- Remote machine experiments can not wait for a common solution and they will happen with whatever technical implementation.

Personal conclusion

Hermann Schmickler

- The Cotogan2003 community feels that more specific remote machine experiments are not needed to support the general acceptance of the GAN approach. But nevertheless remote machine experiments are a good occasion to integrate the present big labs with running production machines into the GAN effort.
- Get minimum equipment for remote machine experiments at RHIC and CERN now
- We should encourage this to happen also at different places and make the results widely known. Topical workshops on beam instrumentation, RF systems, Power converters like BIW2004, DIPAC2005 could focus on this aspect.
  - Letter to program committees!

Personal conclusions

Fulvia Pilat

- "where there's a need, there's a way" ..if not gan-desperation, a **need** for remote access/ops must be there: SNS, TTF, collaboratories (SL sources)
- **SNS and LHC** (next big projects on line): **NO** to remote commissioning and operations, but **YES** to remote diagnostics, experiments
- Test of **remote beam experiments**, initially parasitic to local activities and with ad-hoc tools. Initially RHIC-CERN, but encourage other institutions. Issues: security, control room access, local priorities