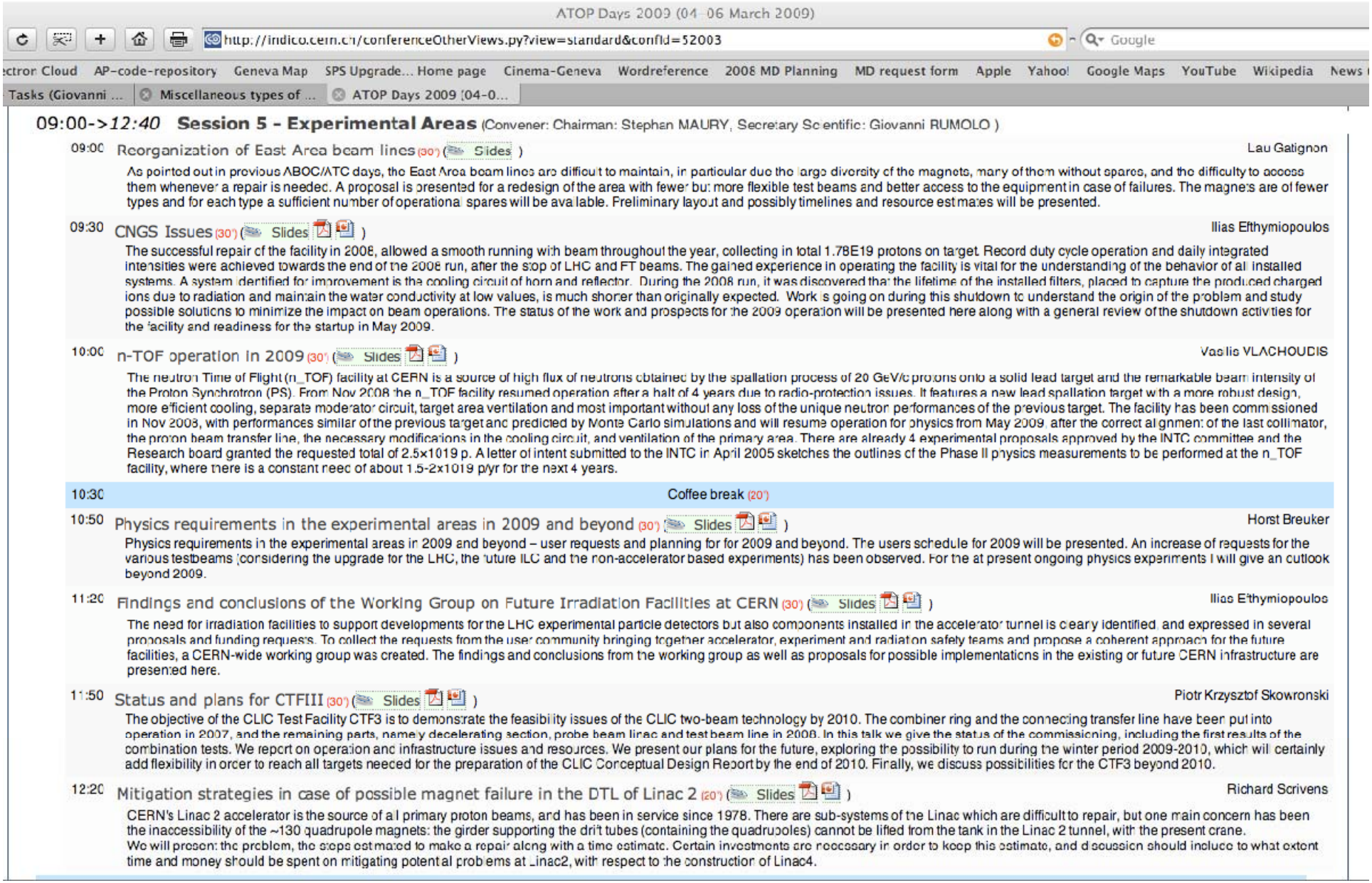
Session 5, Experimental areas

Summary prepared by
S. Maury and G. Rumolo

from the ATOP Days, 4-6 March, 2009

SCHEDULE


ATOP Days 2009 (04–06 March 2009)
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ATOP Days 2009 (04-0...
09:00->12:40 Session 5 - Experimental Areas (Convener: Chairman: Stephan MAURY, Secretary Scientific: Giovanni RUMOLO)
09:00 Reorganization of East Area beam lines (30') (Slides)
Lau Gatignon
As pointed out in previous ABOC/ATC days, the East Area beam lines are difficult to maintain, in particular due the large diversity of the magnets, many of them without spares, and the difficulty to access them whenever a repair is needed. A proposal is presented for a redesign of the area with fewer but more flexible test beams and better access to the equipment in case of failures. The magnets are of fewer types and for each type a sufficient number of operational spares will be available. Preliminary layout and possibly timelines and resource estimates will be presented.
09:30 CNGS Issues (30') (Slides)
Ilias Efthymiopoulos
The successful repair of the facility in 2008, allowed a smooth running with beam throughout the year, collecting in total 1.78E19 protons on target. Record duty cycle operation and daily integrated intensities were achieved towards the end of the 2008 run, after the stop of LHC and FT beams. The gained experience in operating the facility is vital for the understanding of the behavior of all installed systems. A system identified for improvement is the cooling circuit of horn and reflector. During the 2008 run, it was discovered that the lifetime of the installed filters, placed to capture the produced charged ions due to radiation and maintain the water conductivity at low values, is much shorter than originally expected. Work is going on during this shutdown to understand the origin of the problem and study possible solutions to minimize the impact on beam operations. The status of the work and prospects for the 2009 operation will be presented here along with a general review of the shutdown activities for the facility and readiness for the startup in May 2009.
10:00 n-TOF operation in 2009 (30') (Slides)
Vasilis VLACHOUDIS
The neutron Time of Flight (n_TOF) facility at CERN is a source of high flux of neutrons obtained by the spallation process of 20 GeV/c protons onto a solid lead target and the remarkable beam intensity of the Proton Synchrotron (PS). From Nov 2008 the n_TOF facility resumed operation after a halt of 4 years due to radio-protection issues. It features a new lead spallation target with a more robust design, more efficient cooling, separate moderator circuit, target area ventilation and most important without any loss of the unique neutron performances of the previous target. The facility has been commissioned in Nov 2008, with performances similar of the previous target and predicted by Monte Carlo simulations and will resume operation for physics from May 2009, after the correct alignment of the last collimator, the proton beam transfer line, the necessary modifications in the cooling circuit, and ventilation of the primary area. There are already 4 experimental proposals approved by the INTC committee and the Research board granted the requested total of 2.5x1019 p. A letter of intent submitted to the INTC in April 2005 sketches the outlines of the Phase II physics measurements to be performed at the n_TOF facility, where there is a constant need of about 1.5-2x1019 p/yr for the next 4 years.
10:30 Coffee break (20')
10:50 Physics requirements in the experimental areas in 2009 and beyond (30') (Slides)
Horst Breuker
Physics requirements in the experimental areas in 2009 and beyond – user requests and planning for for 2009 and beyond. The users schedule for 2009 will be presented. An increase of requests for the various testbeams (considering the upgrade for the LHC, the future ILC and the non-accelerator based experiments) has been observed. For the at present ongoing physics experiments I will give an outlook beyond 2009.
11:20 Findings and conclusions of the Working Group on Future Irradiation Facilities at CERN (30') (Slides)
Ilias Efthymiopoulos
The need for irradiation facilities to support developments for the LHC experimental particle detectors but also components installed in the accelerator tunnel is clearly identified, and expressed in several proposals and funding requests. To collect the requests from the user community bringing together accelerator, experiment and radiation safety teams and propose a coherent approach for the future facilities, a CERN-wide working group was created. The findings and conclusions from the working group as well as proposals for possible implementations in the existing or future CERN infrastructure are presented here.
11:50 Status and plans for CTFIII (30') (Slides)
Piotr Krzysztof Skowronski
The objective of the CLIC Test Facility CTF3 is to demonstrate the feasibility issues of the CLIC two-beam technology by 2010. The combiner ring and the connecting transfer line have been put into operation in 2007, and the remaining parts, namely decelerating section, probe beam linac and test beam line in 2008. In this talk we give the status of the commissioning, including the first results of the combination tests. We report on operation and infrastructure issues and resources. We present our plans for the future, exploring the possibility to run during the winter period 2009-2010, which will certainly add flexibility in order to reach all targets needed for the preparation of the CLIC Conceptual Design Report by the end of 2010. Finally, we discuss possibilities for the CTF3 beyond 2010.
12:20 Mitigation strategies in case of possible magnet failure in the DTL of Linac 2 (20') (Slides)
Richard Scrivens
CERN's Linac 2 accelerator is the source of all primary proton beams, and has been in service since 1978. There are sub-systems of the Linac which are difficult to repair, but one main concern has been the inaccessibility of the ~130 quadrupole magnets: the girder supporting the drift tubes (containing the quadrupoles) cannot be lifted from the tank in the Linac 2 tunnel, with the present crane.
We will present the problem, the steps estimated to make a repair along with a time estimate. Certain investments are necessary in order to keep this estimate, and discussion should include to what extent time and money should be spent on mitigating potential problems at Linac2, with respect to the construction of Linac4.

Reorganization of East Areas beam lines

Lau Gatignon

- At the ABOC/ATC Days in 2007 showed that a global review was needed, as the number of requests for use is increasing…
  Guidelines for the reorganization:
  - Use fewer types of reliable magnets with spares:
    ⇒List of available magnets compiled by the TE/MCS team.
  - Optics of the lines for primary and secondary beams ready.
  - Reduce roof shielding areas to ease access to equipment
  - Keep radiation restricted to upstream areas as much as possible
  - No splitter (switch or wobbling schemes, instead)
  - Respect user requirements…

- Works (10-12 months) could be synchronized with CLOUD relocation from T11 to "T9b", in 2011 at the earliest and, part of them, compatible with the DIRAC running

Reorganization of East Areas beam lines: Recommendations

- **Upgrade of controls** (remote readout/control of collimators, access and vacuum state, applications for instrumentation,…)

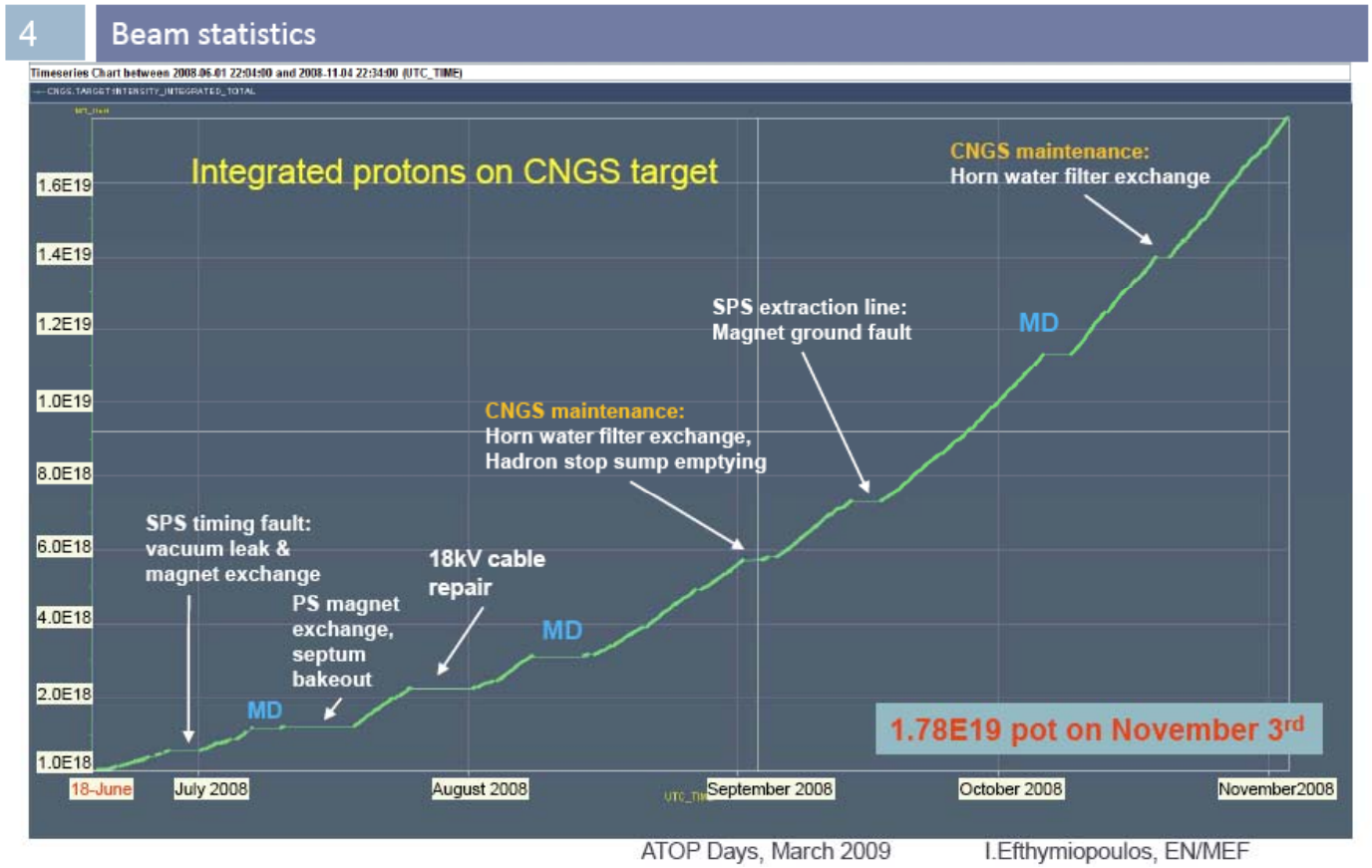
- **Prepare the Project**

1. Make use of existing material with proper reshuffling
2. RP simulations
3. Finalize the layout & engineering aspects
4. Detailed cost & resources estimates

CNGS issues

Ilias Efthymiopoulos

- 2008 run was smooth and successful, with an integrated efficiency of ~61% (~1700 neutrino events @OPERA)



CNGS issues

- Detector broke down after 1.2 x 10^{18} pot (no spare available, and access not easy due to high radiation)
- High duty-cycle operation at the end of the run has shown:
  1. Increased temperature at the first He-tank window
  2. Short lifetime of the horn cooling circuit filters due to radiation
- Repair of ventilation unit in TCV4 (leak in the heat-exchanger, no system to detect small water leaks, more cameras will be installed)
- Lifetime of filters:
  1. Use 2 filters in parallel with 50l capacity, instead of single 40l filter (one exchange per year would be sufficient)
  2. New optimized filter container design
- Evacuation and handling of the sump waters (temporarily stored in BB4 before elimination).
- A problem appeared in the motorization of the target rotation (under investigation)

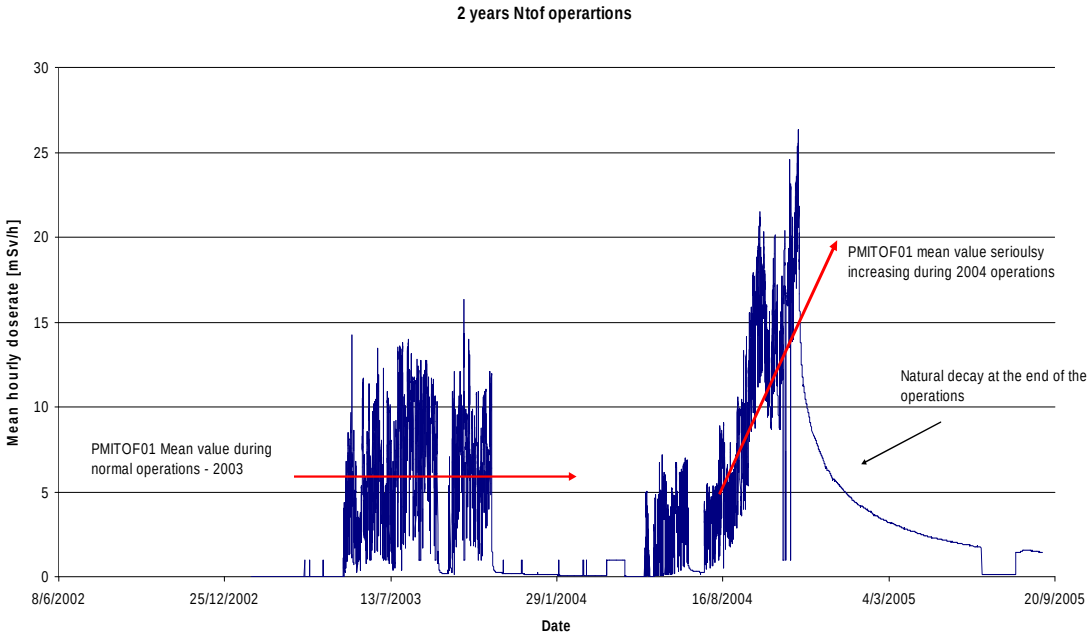
CNGS issues: Recommendations

- More studies on the poor filter lifetime.
- Make a complete study (RP and environment) of an evaporator for CNGS water or look for alternative solutions

n-TOF operation: history

Vasilis Vlachoudis

- n-TOF is a high intensity beam for the PSB/PS ($7x10^{12}$ ppb to be extracted from the PS at 20 GeV/c)
- First time commissioned in 2001-2002, and running experiments through 2002-2004
- Activation level seriously increased during 2004 operation



n-TOF towards 2009

- Target was removed, inspected and studied
- Decision for a new target was made in March 2008, target subsequently built

1. Short commissioning in 2008 was made with RP authorization 300 high intensity pulses on target (with reduced cooling and no ventilation)
2. Obtained neutron flux as simulated

- This shutdown the FTN line has been re-aligned and new cooling and ventilation system will be installed.
- Commissioning of new target planned to start in 05.2009
- Rich physics program to be done with n-TOF requesting 2×10^{19} pot/year

n-TOF Recommendations

- Follow-up radiation related issues (ventilation, alignment,…)

- Optimize sharing of PS cycles between n-TOF and the other users to match the request

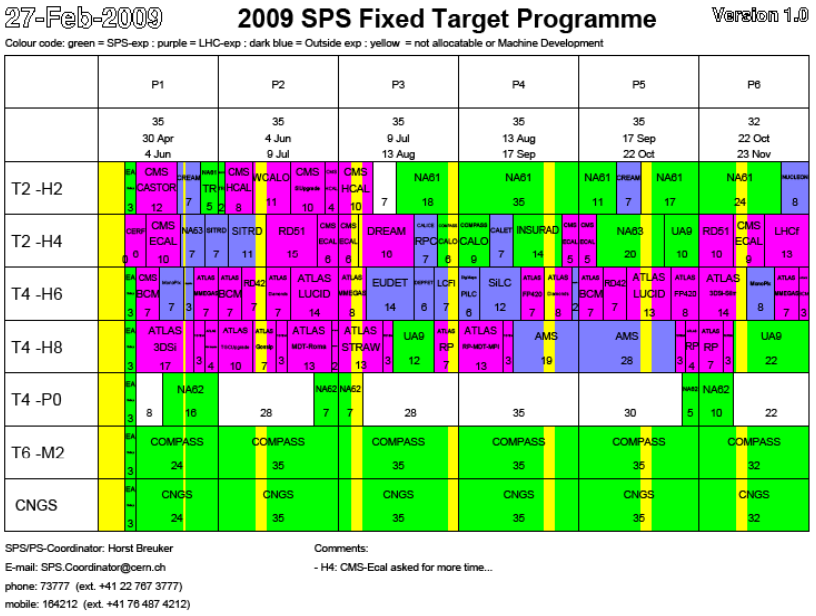
Physics requirements in the experimental areas in 2009

Horst Breuker

- 2009 PS fixed target program:
  - DIRAC (T8), CLOUD (T11), nTOF
  - ATRAP, ASACUSA, ACE, ALPHA
  - Test beams for irradiation (T7), other user groups (T9, T10)

- 2009 SPS fixed target program:
  - COMPASS, NA61, NA62, NA63, CNGS (OPERA, ICARUS)
  - Test beams for 33 user group

- Packed schedules



Physics requirements in the experimental areas beyond 2009

- CLOUD will run till 2014 (>2 years Mk2 and >2years Mk3)
- n-TOF will continue running for the users (see previous talk)
- AD program until 2017
  - May continue with PS2
- COMPASS will run till 2014
- NA61, NA62, NA63 till 2012 and maybe beyond
- OPERA & ICARUS (CNGS) till 2014 delivering nominal beam
- Durations above are pending on the approval by the RB, more to be learnt at the May 11/13 Workshop "New Opportunities in the Physics Landscape at CERN"

Physics requirements in the experimental areas beyond 2009: Recommendation

- Suggestion to improve the clarity of the procedure from scientific recommendation to final approval: A **technical committee** could give technical, safety and cost related comments, useful to the research board to accept or refuse a specific proposal (could be mandated by IEFC ?)

Irradiation facilities at CERN

Ilias Efthymiopoulos

- Irradiation facilities are used for testing, developing prototypes, calibration of components (RADMON, RAMSES,…)
- PS East Area: parasitic to Dirac, Protons and mixed field irradiations, mainly used by detector community
- SPS
  - CERN Reference Facility (North Area), secondary beam 120 GeV/c hadrons, test/calibration of detectors
  - Gamma Irradiation Facility (West Area), 740 GBq Cs^{137} source, irradiation over large surfaces, test of muon detectors
  - CNIRAD, exposure of LHC electronics to mixed high-energy radiation fields, parasitic to CNGS
  - Plus other ad-hoc tests (TCC2,TT40) now stopped.
- These facilities produce knowledge but unfortunately also radioactive waste!

Mandate of the Working Group on future irradiation facilities at CERN

- CERN-wide working group, combining expertise from several divisions/groups
- It was asked to
  - Collect requirements for future irradiation facilities at CERN, taking into account availability of facilities outside CERN
  - Produce a report on the findings and recommendations for facilities to build
- Web-based questionnaire launched to a very wide community (134 replies from experiments and accelerators)
  - Details in : http://cern.ch/irradiation-facilities

Considerations on the future irradiation facilities at CERN

- Proposal to construct/maintain 4 facilities:

1. HIRADMAT (high energy and high density proton irradiation),
2. GIF++ (gamma irradiation and with beam),
3. CERF++ (mixed field irradiation),
4. East Area of PS for future moves to SPL/PS2,
5. Heavy ion irradiation facility needed but can be in one of above

- Why use CERN? Because other facilities in the member states are often insufficient and their availability for science is decreasing. CERN has unique beam LHC type.

Considerations on the future irradiation facilities at CERN: Recommendations

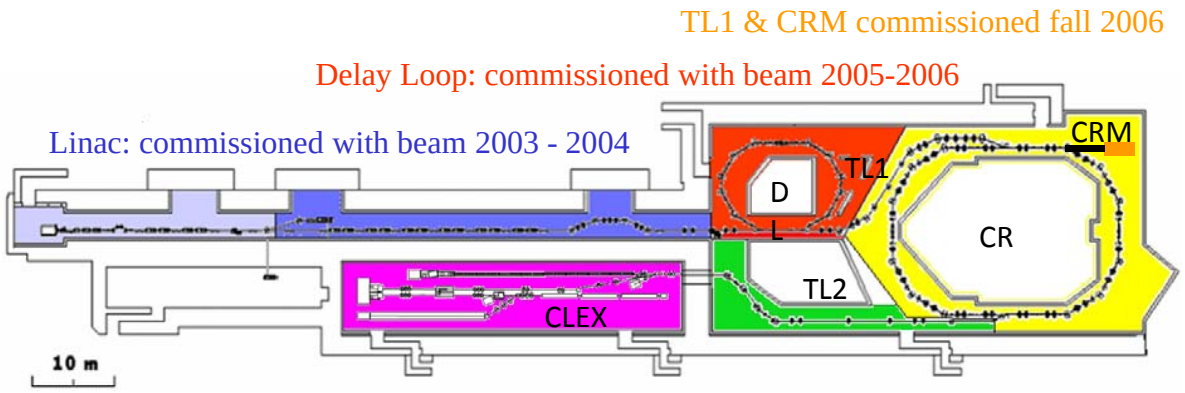
- Endorsement from management needed. Funding from White Paper and EU/FP7 projects exists, does not cover everything.

- It is strongly recommended that the problems of dismantling and radiation wastes of these facilities be included in the design phase.

CTF3 operation in 2008

Piotr Skowronski

- CTF3 is a test facility for CLIC studies. E.g.
  - ✓ Provide the RF power to test the CLIC accelerating structures and components
  - ✓ Electron beam pulse compression and frequency multiplication using RF deflectors
  - ✓ Safe and stable beam deceleration and power extraction
- 2008 run had two short shut-downs to install TL2, CLEX, PETS and CALIFES
- Achievements:
  - ✓ CR stable operation
  - ✓ RF power extracted PETS to TBTS
  - ✓ TL2, TBTS, early commissioning



CTF3 operation in 2008

- Main issues during operation:
  - Many front-ends are at the limit of their capability
    - According to CO no HW available at the moment. CO plans to distribute some tasks from these front-ends to other ones as a temporary solution
  - Problems with the control of the BPMs provided by LAPP
  - OASIS viewer problems (signals not connected, etc.)
  - Timing problems due to malfunctioning TG8 cards (upgrade to new cards foreseen)
  - Beam instability in the CR caused by the rf deflectors: New re-design deflectors fixed the problem.
  - Water temperature stability was an issue: Readjustment of the system solved the problem.
  - Injection and extraction losses in the CR led to alarm levels, extension of two exit chicanes was needed

Plan for CTF3

- CTF3 relies on the help of many organizations outside CERN
- Rich experimental program for 2009
  - Short shutdown 2009-2010 (10 weeks)
- Program for 2010 already decided, and beyond…
  - Running beyond 2010 relies on FP7 framework accepted already by CERN
  - Use CTF3 as an X-band testing plant in future
  - CTF3 used to condition CLIC structures before sending them into the tunnel
  - ….

CTF3: Recommendations

- Higher priority is desirable to put the controls on stable operational level. If CTF3 has to serve as a test-bed for controls, it should be made sure that it is given high priority or to be able to swap to the previous system.

- Lack of manpower inside CERN (experts are leaving), it is recommended to plan a reshuffle of the existing CLIC resources to extend the expertise on CTF3 and/or give support with qualified OP help on constant duration.

Failure scenario of DT quadrupoles in Linac2

Richard Scrivens

Belonging to session II, but postponed to Friday for the availability of the speaker

- They are pulsed with >300A~700V every pulse. ~500 Mpulses to date.
- No maintenance of the circuits ever done
- Insulation tests (of coils and cables) never done at CERN: they proved to weaken the insulation in DESY
- Vacuum leak in one drift tube: fixed with a differential pumping, assumed to be general fix for this type of problems.
- Operation without a quadrupole has been simulated for one failed quadrupole per tank: Result is emittance growth, worst case for the quadrupole in Tank 1
- Recabling, recommissioning and setting up the Booster for the larger emittance beams could take several weeks.

Failure scenario of DT quadrupoles in Linac2

- Linac2 will be injector for 5 more years: if a DT quadrupole fails, it almost certainly has to be repaired
- A list of potential areas for investigation to make the repair exists, but it needs more detailed study, preparation, time to validate and produce tooling
- N.B. Failure rate in Linac2 is about 1.5%, mainly due to power cuts, water switching off, more seldom RF. There is no real reason to suspect that a quad failure should occur in the next 5 years…

DT quadrupoles in Linac2: Recommendation

- A preliminary list of studies for a repair has been compiled:
  - List has to be prioritized and resources evaluated to carry out the items with higher priority

SUMMARY of the recommendations

- **East area re-organization:**
  - upgrade of controls/instrumentation needed
  - prepare the project based on existing list of magnets
- **CNGS:**
  - more studies on filter lifetime needed
  - feasibility study of a solution (evaporator?) for radioactive waters
- **n-TOF:**
  - keep an eye on radiation issues
  - optimize cycle sharing with other users
- **Irradiation facilities:**
  - clarify funding
  - dismantling should be included in the design phase

SUMMARY of the recommendations

- **CTF3:**
  - ask for priority if test-bed for controls
  - lack of manpower
- **Strategies in case of failure of the DT quadrupoles in Linac2:**
  - preliminary list of actions compiled, needs to be prioritized and resources have to be evaluated