Introduction to the North and East Areas and CNGS

Outline

- Review of the start-up and operation in 2006
  - Highlights - Statistics
- What went wrong and how to make it better
  - Critical look at this year's changes
- Can we run the complex in 2007 and beyond in the way we do it today?
  - My nightmares

Ilias Efthymiopoulos – AB/ATB-EA
ATC/ABOC Days – Session #6
January 2007

The CERN Secondary Beam Line Complex

SPS North Area

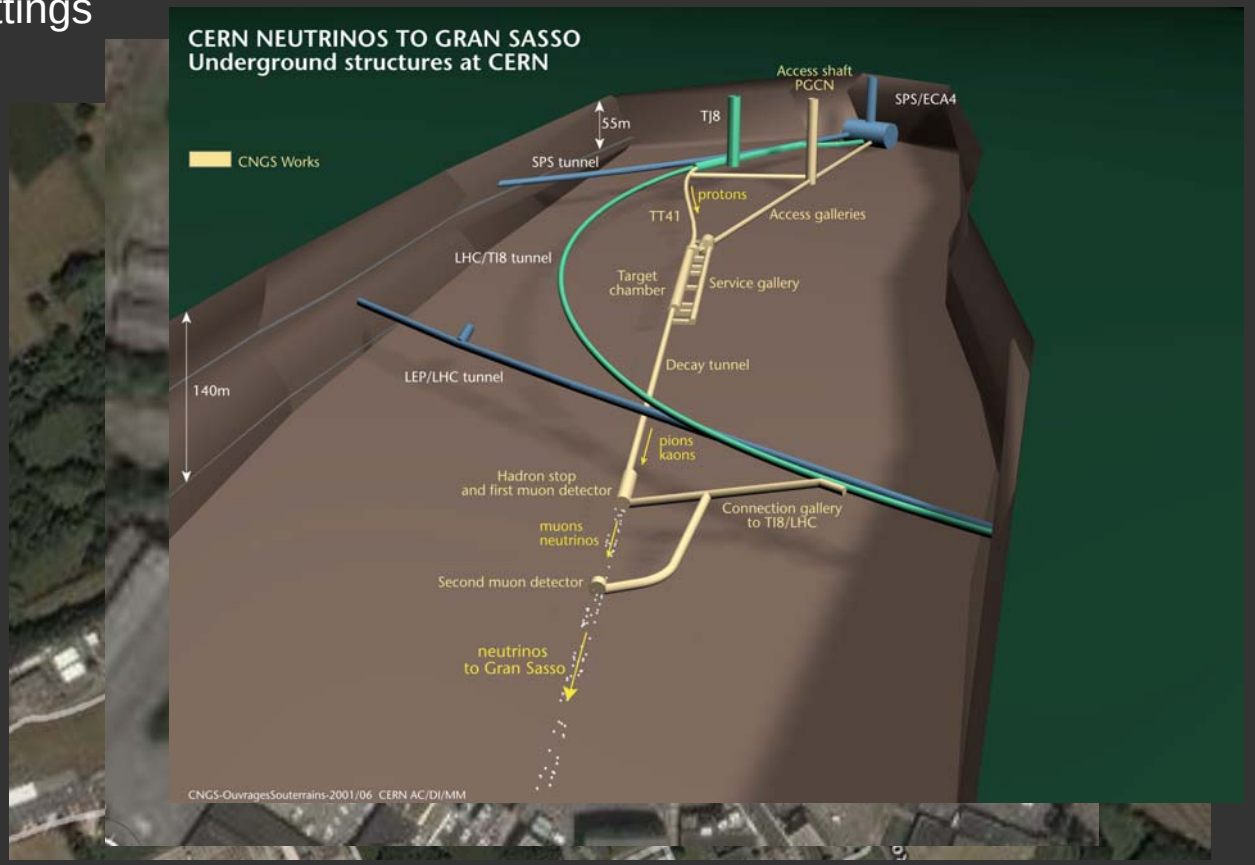
- Three experimental halls : **EHN1**, **EHN2**, **ECN3** , **5** service buildings
- **7** beam lines ; ~**1000** equipment installed ; total length **5.8 Km**
- ~**2000** users / year performing experiments and tests ; frequent changes of beam configuration and settings

PS East Area

- **5** beam lines ; ~**50** equipment installed ; total length **200m**
- ~**300** users / year performing experiments and tests

CNGS

- **1** beam line ; ~**50** equipment installed ; total length **1(+730)Km**
- LNGS experiment



2006 startup

SPS North Area

- Started up with a brand new control system
  - CAMAC and NIM replaced by VME and PLC for BI equipment
  - NODAL software replaced (almost) by CESAR
- Commissioning was done in three steps
  - **Dry Run 1**: November 2005 – {H2, H4} beam lines
  - **Dry Run 2**: March 2006 – whole North Area
  - new **Commissioning with beam**: 3 days at startup – whole North Area
- The additional delay due to the PS problem allowed completing on time the installation for the beam lines and users
  - ATB-EA staff was heavily occupied in the CNGS installation during the 2005 shutdown
  - NA activities started late, after the CNGS installation was completed

The effort paid off - Congratulations and thanks to all colleagues involved.

No significant time lost for beam line setup → **Happy Users !!!**

… 2006 startup

PS East Area

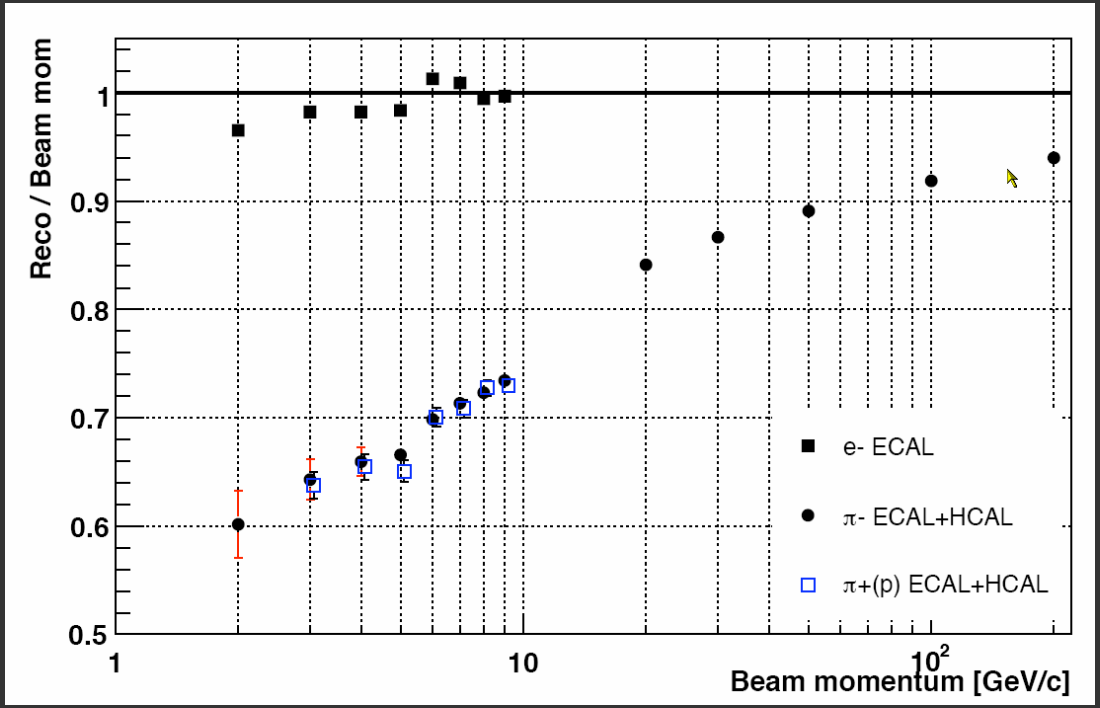
- Several (5) magnets replaced during the shutdown
- Unfortunately the startup and operations were dominated by the F61S.BHZ01 magnet problems
  - → see talk by W.Kalbreier
- For the rest, smooth startup and operations throughout the year

CNGS

- Installation completed on schedule
- Commissioning went quite smoothly
  - Dry runs again paid off!
- October's high intensity run was abruptly aborted due to the leak in the cooling circuit of the reflector
  - → see talk by E.Gschwendtner

Operations in 2006 - Highlights

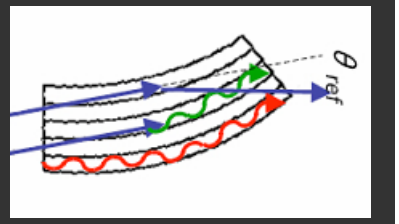
- The Very Low Energy beam of H2 was fully exploited by **CMS**
  - Beam tunes for calorimeter calibration from **1÷350 GeV/c**



- Successful test for **LHCb-VELO** in H8
  - Validation of final detector module before installation

Operations in 2006 - … Highlights

- Exciting results from the bend **crystal test in H8**
  - Volume reflection with high efficiency at high energies verified
  - Although the full potential of the beam was not exploited

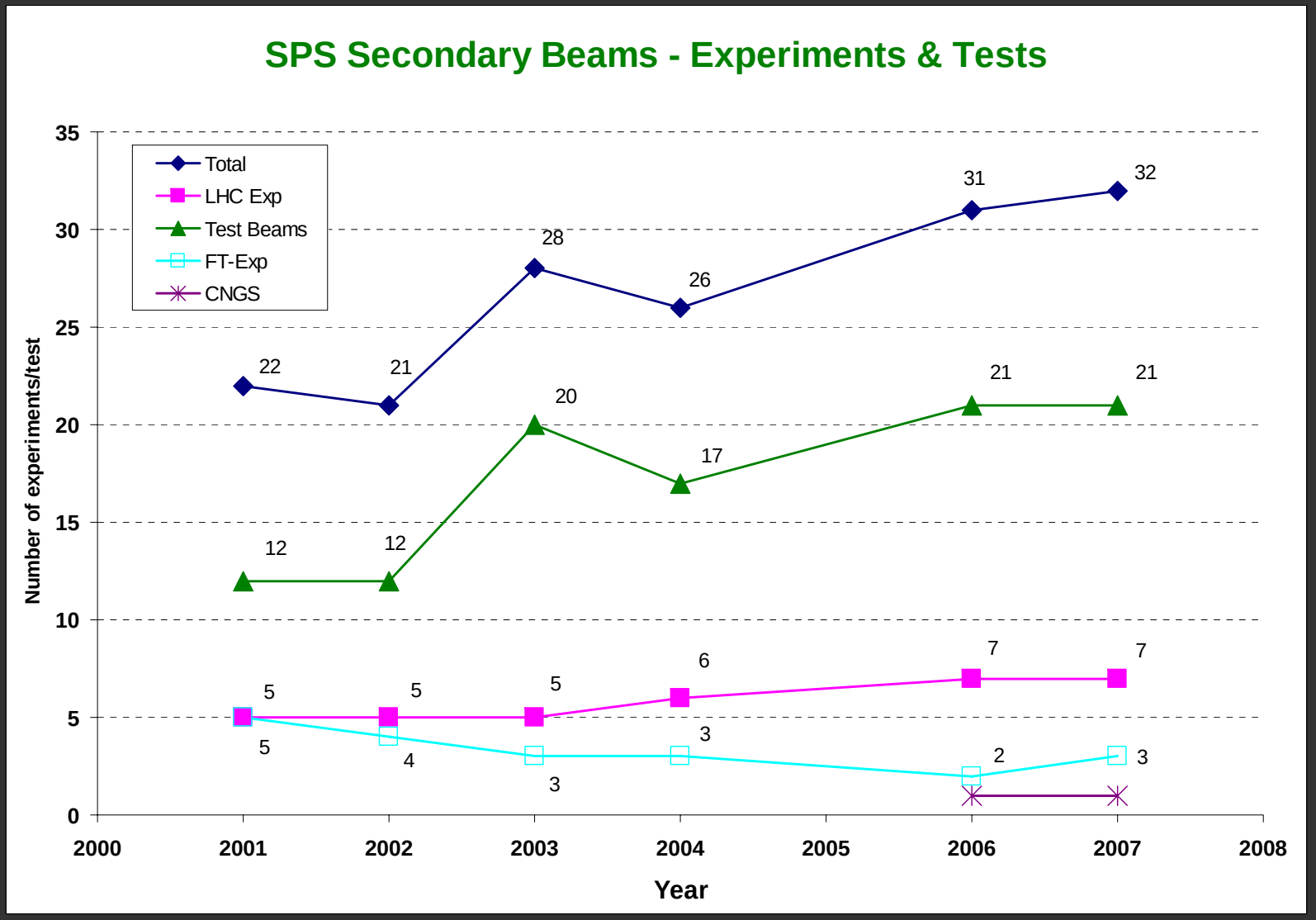


- Impressive work and results for the **ILC detector R&D teams**
  - Newcomers to CERN; decision pending for long term usage of the test beams at CERN (competition with FermiLab…)

- Modifications done in TCC2 and M2 line during the 2005 shutdown allowed to increase the beam intensity for **COMPASS** by 15% → **1.40×10^{13} protons/extraction on T6 (16.8 sec sc)**

- **CLOUD** completed successfully the first commissioning run in T11 line

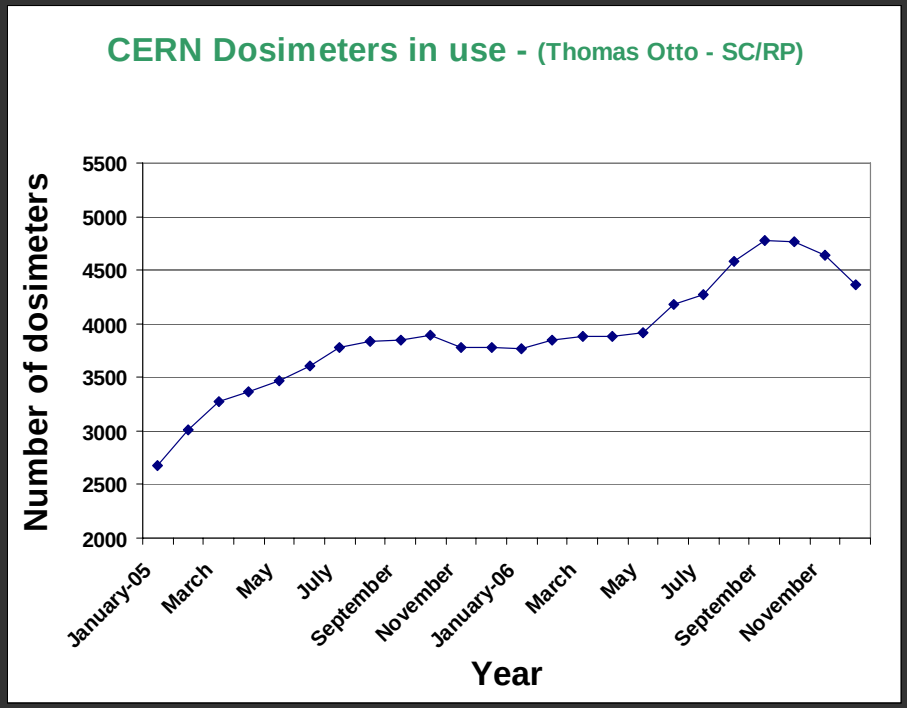
Operations in 2006 - Statistics



Operations in 2006 - … Statistics

- Clear increase in the number of users with the beam startup in 2006

- These users represent a large and active community doing, besides FT experiments, R&D for future accelerators, detectors, TT projects, astroparticle projects, ..

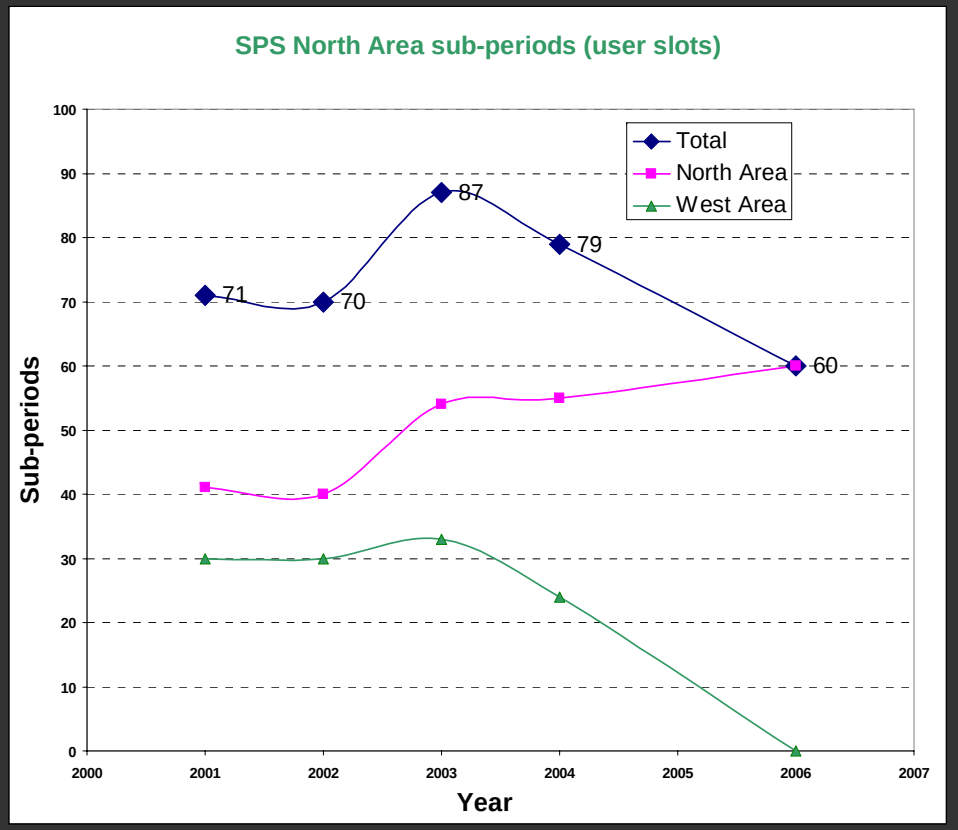


- It is expected that the activities will continue at same level in the coming years

  → see talk by SPS Coordinator [C.Rembser]

Operations in 2006 - … Statistics

- Most of the small experiments are scheduled in weekly slots
- Try to satisfy more requests
  - WA not available anymore…
  - Budget constraints (travel,…) for the users limit their stay at CERN
- Fully exploit the possibilities in the exp. halls
  - multiple exp. areas per beam line
  - parasitic users

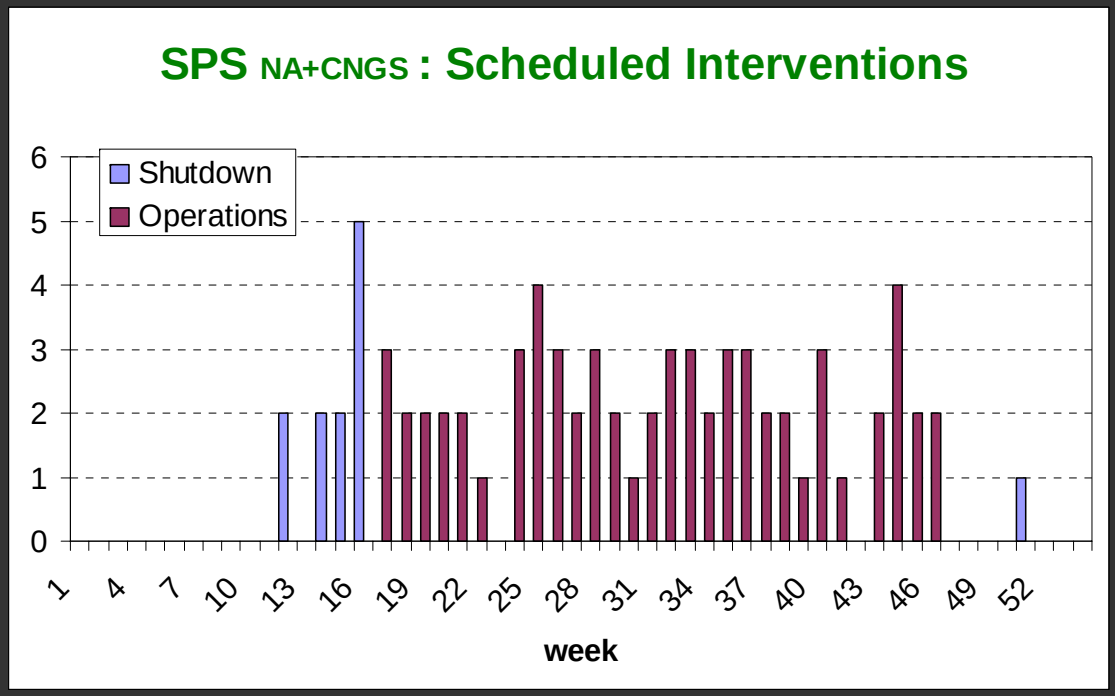


Operations in 2006 - … Statistics

Impact for AB(EA) :

- Frequent changes to the beam lines
  - Hardware modifications
    - Magnets, vacuum, dumps, access system, etc.
  - Installation/de-installation of experiments
- Large number of configurations - ~50 beam tunes per beam line!
- Constant load to operators and EA staff to service the users
- Sensitivity to failures and machine down time
  - additional load to the SPS coordinator to find replacement slots for unlucky users
    - works within limits with good will and collaborative spirit

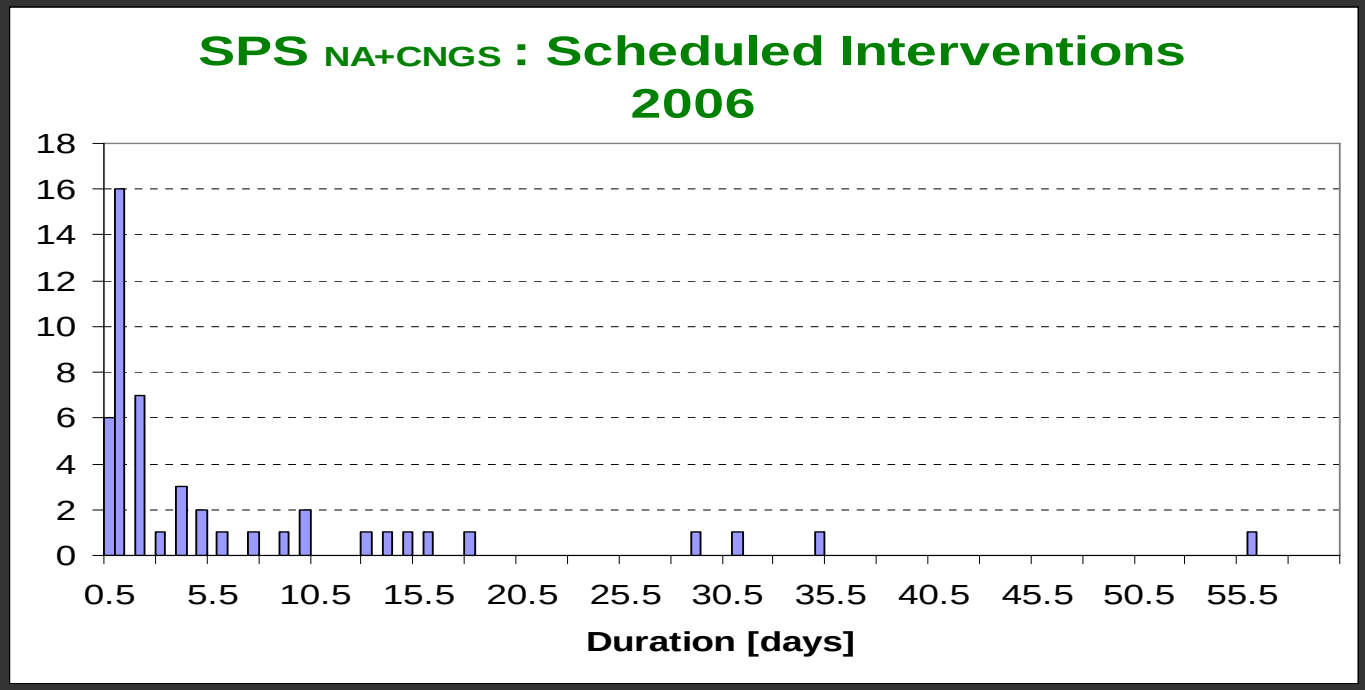
Operations in 2006 - …Statistics



- **~2 scheduled interventions** per week during operations
  - small daily jobs not included
- Work typically done by:
  - **AB**: ATB-EA, BI-EA , **AT**: MEL, **TS**: CSE, SU and transport

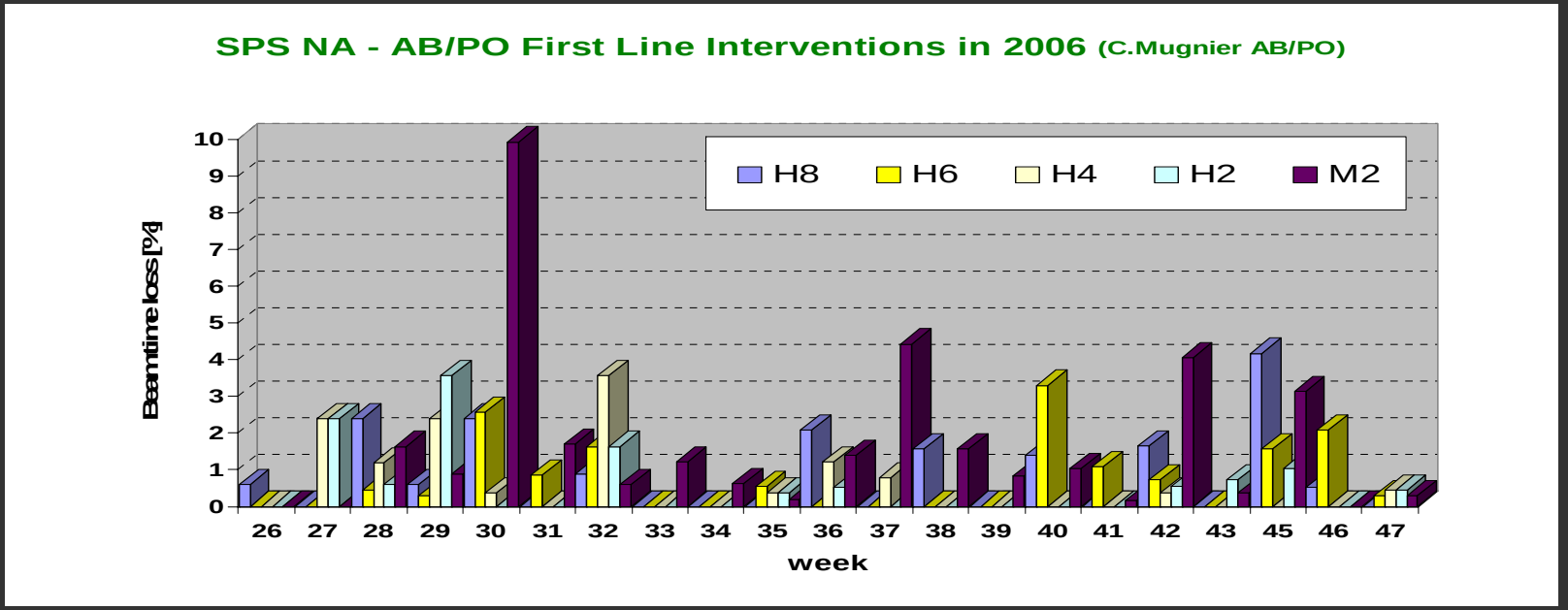
Note: PO first line interventions are not included

Operations in 2006 - …Statistics



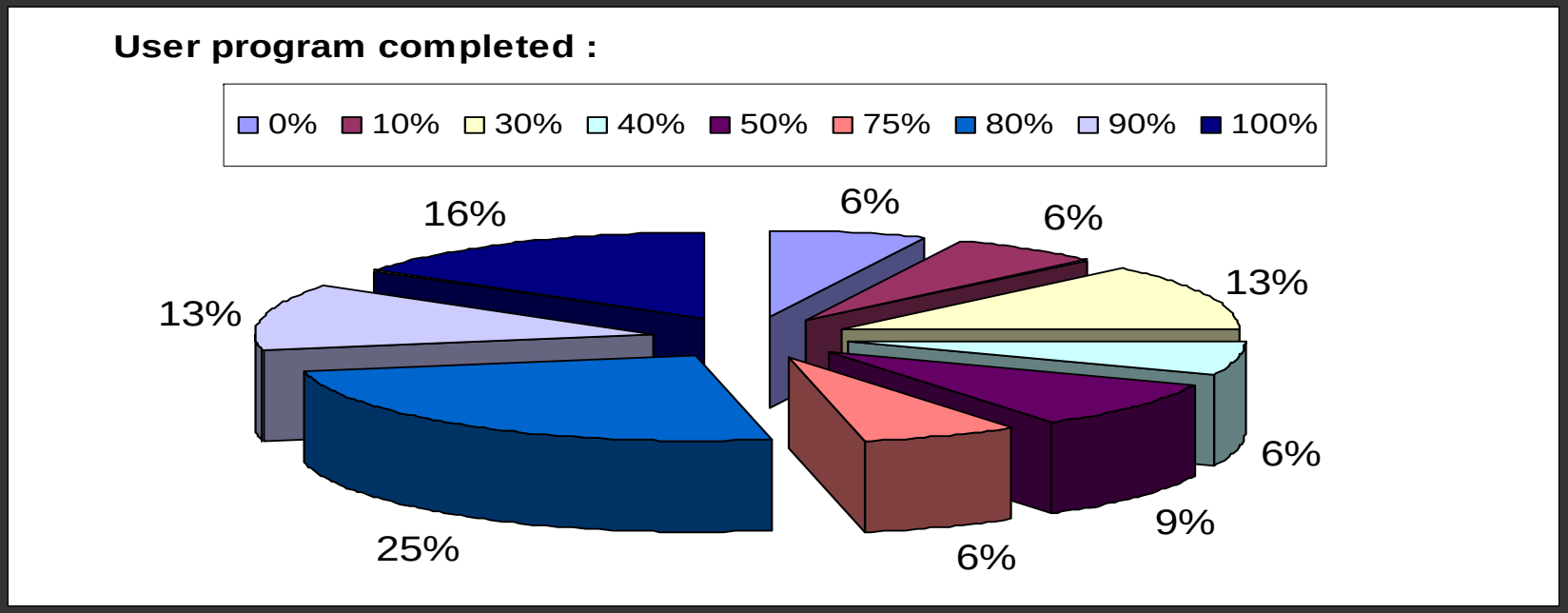
- Majority of interventions during the Wednesday MD times
- Preparation time is quite important but not taken into account – difficult to quantify
  - Preparatory work starts sometimes a year before !!!
- Service to users is done on a **“best effort”** basis

Operations in 2006 - ...Statistics



- Difficult to estimate the down time for the test beams
  - Last in the chain - cumulate the errors from all the accelerators
- EA proper down time
  - Power supplies : <4% / week
  - Beam instrumentation: ???
  - Beam steering is where most of the time is lost
    - but should it be considered as time lost ??

Operations in 2006 - …Statistics



My own scaling for "'user happiness"

- ~**70%** of the users manage to do >50% of their original program
  - PhD studies depend on test beam data
- Very rare cases when people go back with zero data on tape !!!
  - However it did happened in 2006 for PS South Branch + some NA users
- R&Ds are continuous efforts
  - November to April is not that far away → come back next year

What went wrong and how to make it better.

Critical look at this year's changes

- BI hardware renovation
  - ☺ really an excellent job - basically no failures during the year
  - ☺ not all fully debugged but nothing blocking operations
  - 😐 not all equipment commissioned → in 2007 ??
  - ☹ tuning of detectors (scintillators) not always correct
    - ☹ more effort during startup – check-out lists ???

- Power supply controls renovation
  - ☺ the breakthrough for the year
  - ☺ after some initial debugging / tuning everything worked beautifully
  - 😐 handling of messages / alarms needs some improvement
  - ☹ learn to live with some new "features" of the system – i.e. hunting…

    → see talk by Y. Gaillard

What went wrong and how to make it better.

…Critical look at this year's changes

- Control software renovation - CESAR
  - ☺ again an excellent job – a big "plus" for the operations and users
  - ☺ software deployment and support very good
    - ☺ only two freeze-outs of the system during the year
  - 😐 some debugging and cleanup is needed – continuous process
  - 😐 introduction of new equipment in 2007 ??

  - 👍 The next step is to enhance the functionality in CESAR to help operations
    - 👍 Settings management
    - 👍 Logging and information

  → see talk by V.Baggiolini

What went wrong and how to make it better.

Short / Long term actions

- Non renovated beam instrumentation hardware
  - ☹ Critical equipment like collimators still with old hardware – SLEquip bus
  - ☹ Main source of problems during operations
    - 😐 Had to go back to NODAL to save the situation and give beam to users
    - ☺ Patch in CESAR towards the end of the run saved the situation

- Renovation of PS East Area
  - Start with minimal program (counters) in 2007 – only BI work
  - Should be completed with controls and extended to all equipment in 2008 ?

Doing the strictly necessary work for HW and SW we can probably survive in 2007.

However, any effort to ease operations will worth it, given the additional load with the LHC in 2007 and beyond

What went wrong and how to make it better.

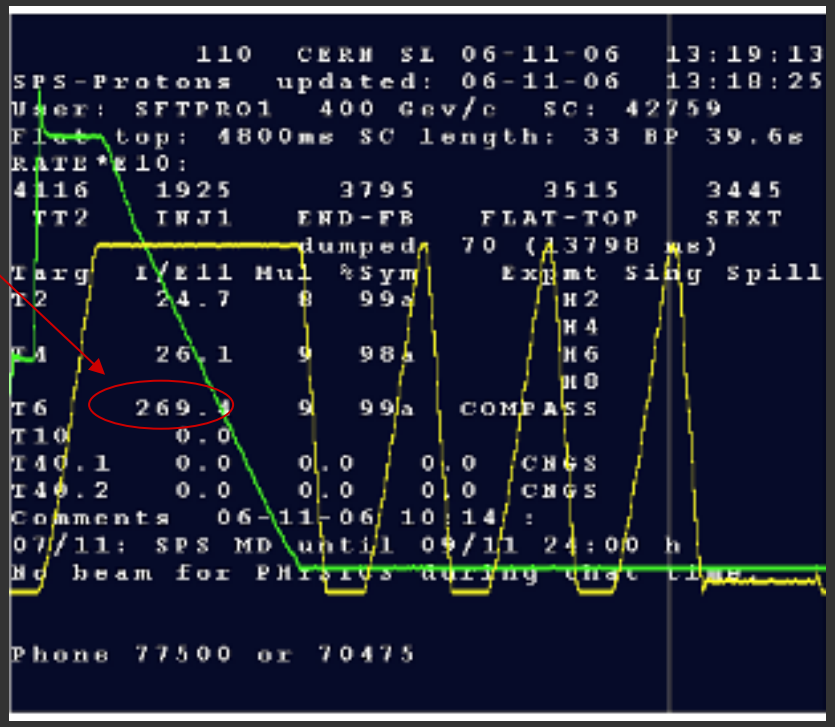
Further improvements for 2007

- Introduce **Beam Development (BD) slots** for the beam lines
  - two slots × 8h per beam line – spread out during the run
- **Safety matters**
  1. Access control to EHN1
     - Card readers to all doors + barriers to the access ramps
     - Avoid long stays above the M2 line where radiation levels are at the limit
  2. Clean-up of big experimental halls
     - Gradually all the LHC material (machine+exp.) is taken away
     - Define proper locations for storage of remaining material
       - improve safety conditions mainly for transport teams
     - Recurrent problem is the clean-up of the areas & barracks after the experiments are completed – i.e. NA60
  3. Safety inspections for new experiments
     - Consensus with PH/DSO to simplify and make more efficient the whole process

What went wrong and how to make it better.

… Further improvements for 2007

- **New (long) flat-top**
  - New super cycle of 39.6s with 9.6 FT was successfully tested
  - No problems with the magnets observed
  - Record intensities:
    - 2.7×10^{13} ppp on T6
    - 4.3×10^{8} μ to COMPASS
  - Will most likely be the running scheme for 2007, compatible with CNGS operation



2007 and beyond ?

My nightmares …

- Hardware + controls renovation of key equipment
- Consolidation program
  - Present budget limitations basically exclude any work for the areas
  - Presently not a serious issue, but things are getting rather old
    - buildings, power supplies, equipment, …
- Operations
  - Coexistence with LHC operations
- Projected manpower
  - The areas are serviced by very motivated teams from various groups
  - We are doing an excellent job in the shadow of LHC, but also for LHC !!!
    - Users leave with a very high opinion for CERN
  - In few years several of those teams will be drastically reduced due to retirements … but the user requests keep increasing !!!

Summary

- Starting in 2006 the beam lines entered in a new era with the renovated BI hardware and the new control software
- The excellent work of many people made the startup and operations rather smooth
- It is a good step forward, although needs to be completed with the remaining equipment and extended to the PS East Area
- No major problems during the 2006 run for the NA
  - All concentrated in the PS East Area and CNGS !!!
- A full program for 2007 is ahead, with :
  - COMPASS preparing for a new run with hardons / muons
  - the repaired CNGS ready for high intensity beams
  - our usual test beam friends, and….
  - it will be our first year in the LHC era !!!