

# PRELIMINARY MD PLANNING FOR 2010

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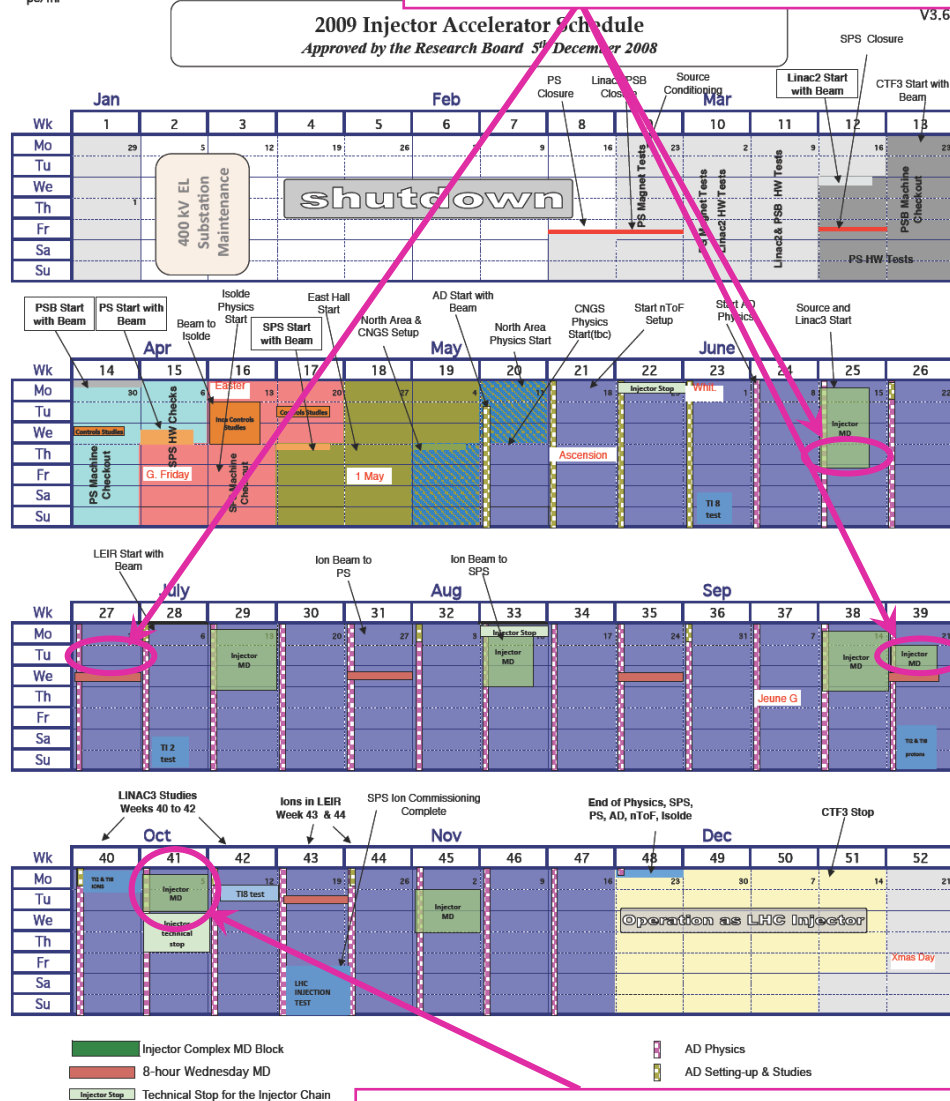
## REMINDER: 2009 vs. 2008

- ◆ **Conclusion of the talk at the APC held on 10/10/08 (Preliminary MD planning for 2009):** “The problem in the SPS is that one cannot easily add/change a cycle in the supercycle => Shouldn't we improve that (during MDs?) to be able to be as flexible as the PS&PSB and therefore perform most of the MDs in // to physics?”
- ◆ **This is no longer the case and the SPS “ppm-ization” enabled us to**
  - Deliver much more protons to CNGS this year
  - Make a lot of // MDs with fast supercycle changes
- ◆ **However, many MDs cannot be done in // such as for instance the ones requiring a COAST (LHC collimators, UA9, BBLR etc.) => Dedicated time still needed**

# 2010 INJECTOR ACCELERATOR SCHEDULE vs. 2009

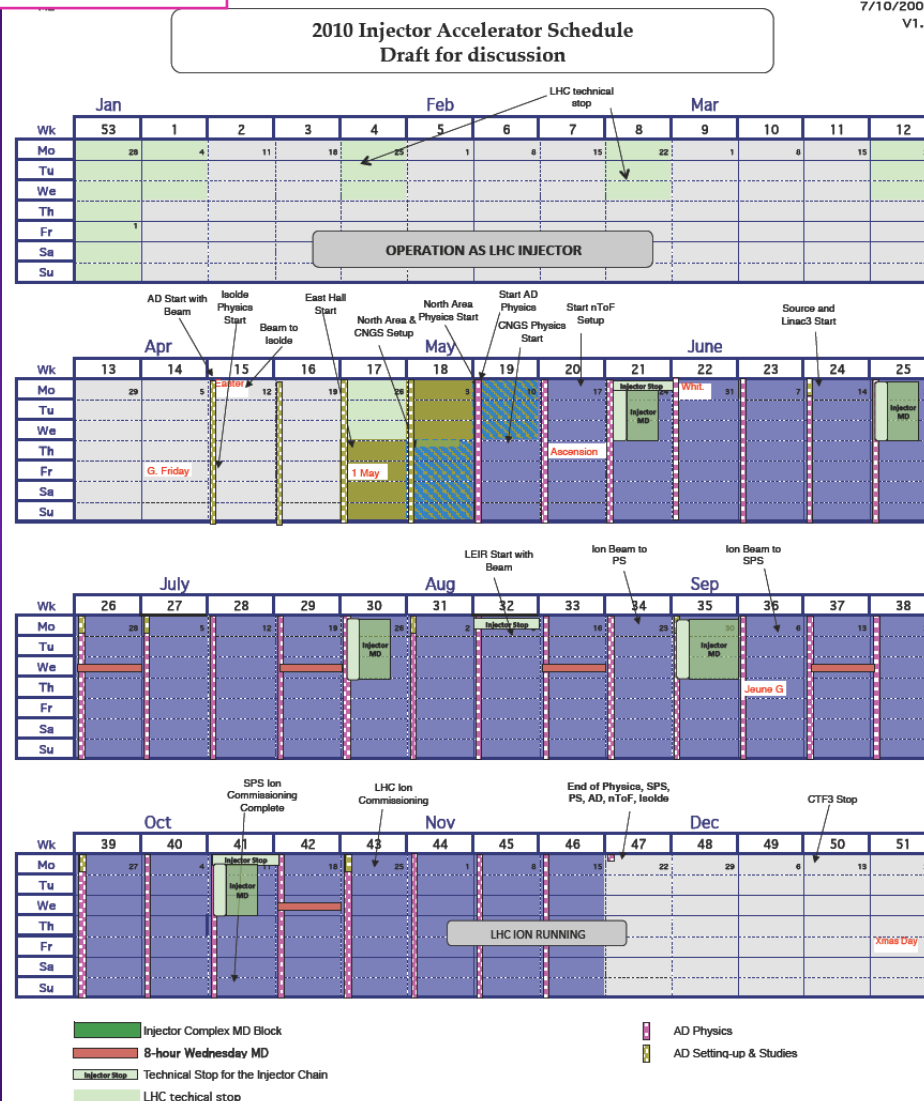
3 days (24 h) added for UA9 and ions

pc/ml



1 block cancelled (due to a problem with PS injection septum 42)

7/10/2009  
V1.1



## 2 REQUESTS FROM M. FERRO LUZZI

- ◆ See MD report of 09/10/09 => [https://ab-mgt-md-users.web.cern.ch/ab-mgt-md-users/2009/StatusOfMDs/StatusOfTheMachineStudies\\_09-10-09.pdf](https://ab-mgt-md-users.web.cern.ch/ab-mgt-md-users/2009/StatusOfMDs/StatusOfTheMachineStudies_09-10-09.pdf)
- Selection of the phases
- Replace a usual train by a particular train (for the LHC filling) and in particular a train of bunches spaced by  $\geq 100$  ns => MDs to be performed in the PS. Can we start them before the end of this year?

# OTHER REQUESTS KNOWN AS OF TODAY (1/10)

## ◆ LINAC3

- ?

## ◆ LEIR

- ?

## ◆ LINAC2

- **Installation and testing of an Multi-Slit Emittance Measurement, for Linac4 (R. Scrivens)**
  - Collaboration with John Adams - University of Oxford. This is very preliminary, as the study of the feasibility of the device is not yet made)
  - Installation of a emittance measurement inside the present LTE, separate measurement line
  - Installation would take place in a technical stop after summer 2010 (that may have to be slightly extended)
  - Measurements would then take place over a couple of weeks using  $\sim 1 / 12$  of the beam cycles in Linac2
  - Measurements would be in // to operation or other MDs

## OTHER REQUESTS KNOWN AS OF TODAY (2/10)

### ◆ PSB (from the PSB supervisors)

#### ■ General:

- LHC25 maximum intensity in single batch transfer (with PS)
- Test and deploy digital beam control on single ring (//)
- Continue debugging wire scanners (//)
- RF limitations for high intensity (//)
- Transverse emittance blow up studies (//)
- Evaluate automatic injection steering with YASP

#### ■ On 160/50 MeV flat cycles (all //, but need dedicated cycles):

- Measure emittance growth for space charge studies at 160 MeV
- Continue measurements of resonance lines at 160 MeV and compare to 50 MeV (need to set up flat 50 MeV cycle)
- Try to use sextupoles to control chromaticity and octupoles to compensate space charge

# OTHER REQUESTS KNOWN AS OF TODAY (3/10)

## ◆ PS

- **RF MDs (H. Damerau):** No detailed list of requests yet. Our main subjects during next year's run will be:
  - High intensity studies with the various LHC-type beams: intensity limitations, coupled bunch instabilities, transient beam loading along the batch, etc.
  - Tests with a new implementation of the 1-turn delay FB (presently used for AD only; the new system will be applicable to other high intensity beams)
  - Ideally the total time allocated to RF related MDs in the PS should be of the same order as during this year's run
- **Test the new electronic core of the PS transverse feedback (F. Blas):**
  - After previous tests with electronic circuits partially adapted to the requirements, test of the PS TFB system in its fully operational version
  - Conditions:  $5 \times 4$  h in //, low intensity, h=8 beam for a first session. The following sessions would test the system on all the high intensity beams

# OTHER REQUESTS KNOWN AS OF TODAY (4/10)

## ◆ PS

- **Optimize the beam parameters of the 5 BP long LHC super-cycle and 2 BP SFTPRO like cycle in case of failure of the rotating machine (Y. Papaphilippou):**
  - In 2009, the two cycles were set-up. For the LHC type beam we managed to deliver almost 50% of the nominal intensity. Working point optimisation is needed for the full intensity
  - The SFTPRO/CNGS type cycle the magnetic cycle has to be prolonged to reduce the Bdot. The magnetic cycle is set up but measurements are needed for optimisation (transverse and longitudinal)
  - Conditions: **1 × 8 h in // + 1 × 8 h in dedicated.** For the LHC type, special SC with 14 BP and only one long LHC 5BP cycle. Physics (or other beams cannot be guaranteed (rms current)). For the other beam, any cycle is good, with 2 BP space for this cycle
  - Preferred period: **End of May**



# OTHER REQUESTS KNOWN AS OF TODAY (5/10)

## ◆ SPS

### ■ Long-range beam-beam studies for the LHC using the SPS wires for beam excitation and compensation experiments (F. Zimmermann):

- During 2009, we reproduced in the MDs dedicated to the long-range beam-beam studies, the equivalent long-range beam-beam excitation of one LHC interaction region at LHC nominal current. In the excitation experiment, we observed a significant reduction of the beam lifetime while, in the compensation experiment, we almost recovered the beam lifetime of the unperturbed machine. Due to the longer observation period, it appeared evident that the experiments performed with a beam in **coast** carry more information than similar experiments done in pulsed mode. Nevertheless, due to lack of time only the nominal LHC tunes were explored (with coasting beam). We think it is worth to investigate with a similar approach several working points to observe in the different conditions the steady state losses of the beam in excitation and compensation mode
- Conditions: **3 × 8 h in coast, between 55 and 120 GeV/c** (the lower the better if the beam lifetime of the unperturbed machine is good, i.e., >1 h, ideally one MD at 55 GeV/c and another at 120 GeV/c). The beam structure required is 4 bunches of  $\sim 10^{11}$  p/b. Transverse emittance BU needed if 120 GeV/c used

# OTHER REQUESTS KNOWN AS OF TODAY (6/10)

## ◆ SPS

- **UA9 (CRYSTAL) in the SPS ring, with protons or ions (W. Scandale):** 2 shifts (16 h) per MD dedicated period => Same as this year
- **Transverse coupled-bunch instabilities in the SPS (N. Mounet)** => 2 shifts in dedicated with LHC beams (25, 50 and 75 ns)
- **Single-bunch instability studies (W. Hofle):** Continue our studies for a wide band feedback system in the SPS meant to cure single bunch transverse instabilities. This includes TMCI and e-cloud. For this we would like beam time with a longer flat bottom, grouped in three blocks with ~10 s flat bottom and the possibility of injecting single bunches and multiple LHC batches up to nominal intensity. The long flat bottom is required to do beam response measurements, acceleration would not be needed. I would suggest 3 x 8 h, and prefer to use the MD blocks in week 21, 30 and 35. Half the eight hours should be with single bunch and half with multiple bunches (25 ns spacing). It might also be useful to do a test this year in the shadow of commissioning LHC if a flat bottom of 26 GeV could be prepared while not filling LHC with a single bunch from the PS

# OTHER REQUESTS KNOWN AS OF TODAY (7/10)

## ◆ SPS

### ■ Commissioning of the new SPS BPCE Interlock system (T. Baer):

- MDs, tests and simulations in 2009 underlined and helped understanding the vulnerability of the SPS to fast equipment failures. Currently, final works concerning the BPCE hardware and the software implementation are going on. In early 2010 the system needs to be tested and commissioned
- Conditions:  $3 \times 10 \text{ h in //}$ , as early as possible to protect the SPS against its vulnerability to fast failures as fast as possible. The MDs are preferably in intervals of 1-2 weeks

### ■ Further setting up studies of TPSG (B. Goddard):

- Complete studies started in 2009 to verify protection of extraction septa in LSS6 for high intensity LHC beam
- Conditions:  $2 \times 8 \text{ h in //}$ , LHC pilot/probe single bunch 450 GeV extracted to TT60 TED

# OTHER REQUESTS KNOWN AS OF TODAY (8/10)

## ◆ SPS

- 1) setup tests with the new “phase 2” LHC collimator in the SPS (in-jaw buttons) and 2) fast collimator controls setup tests (R. Assmann):
  - 3 x 8h in coast at 270 GeV/c, with different intensities (up to full LHC batch)
  - 1 x 8h reserve time in case of problems or important observations
- Beam instability in a double RF system (E. Chapochnikova):
  - Studies of limitations of a double RF system when used as a Landau system for beam stabilisation. Important both for SPS operation and LHC upgrade
  - 3 x 8h dedicated (LHC nominal cycle), variable beam intensity and constant longitudinal parameters, 1 and 4 bunches
- Ecloud studies (E. Chapochnikova):
  - Long-term behaviour of the coated MBB magnets and studies of new coatings
  - 6 x 8h dedicated with nominal intensity LHC beam

# OTHER REQUESTS KNOWN AS OF TODAY (9/10)

## ◆ SPS

### ■ I-LHC (T. Bohl):

- Part I
  - 4 days of // 1-injection cycle (08-18H) MD per week during the six weeks of commissioning of I-LHC in 2010
  - +
  - 3 dedicated MDs with the full 4-injection I-LHC cycle of about 10h each, spaced by about 2 weeks during the six weeks of commissioning. It might be that toward the end of the commissioning period we would like to have the // 1-injection cycle be replaced by a // 4-injection cycle
- Part II
  - 2 dedicated MDs with the 13-injection I-LHC cycle and nominal beam during the LHC run with the early beam (each about 10h)

# OTHER REQUESTS KNOWN AS OF TODAY (10/10)

## ◆ SPS

### ■ BI studies (R. Steinhagen):

- It seems that most of our MD programme in 2010 will be either determined by the ongoing LHC commissioning, or **most likely done in // or conjunction with other already scheduled MDs (collimators etc.), or // to regular machine operation**
- What concerns our BI-QP specific programme: we have certainly some items to be verified but at this point (especially in view of the LHC commissioning) the amount of time or type of MD we need it is hard to be estimated => Get few hours every now and then

## CONCLUSION (1/2)

### ◆ The SPS is much more flexible

- Can be used for many // MDs
- Concerning the dedicated MDs, some time in the setting-up could be gain:
  - In the interventions to block (and then de-block) the fast vacuum valves in injection and extraction areas
  - Programming some procedures to switch from physics to MDs (putting some equip. OFF, retracting girders etc.)
  - (Discussion with StephaneCC): One should be able to work on the Sequence Editor without reservation and then use the Sequence Manager to send. But at the moment it seems not to be the case and we lose time... We could then create and save several sequences which we would then have only to be loaded whenever we want
  - Nobody should touch anything during UA9 MDs!!! Spikes observed on LHC BLM during working hours...

## CONCLUSION (2/2)

- ◆ More MD blocks (~ 2) will be needed that the ones foreseen at the moment in the 2010 “Draft for discussion” injectors schedule
- ◆ Recommendation from the MSWG to work in the PS (asap?) on the creation of a train of LHC bunches spaced by  $\geq 100$  ns (Massi’s request)?

### READINESS OF AND PLANS FOR INJECTORS FOR 2009 (6/7)

- ✧ Answers (after discussions with PS RF experts, H. Damerau and S. Hancock):
  - ✓ It is OK with 2 bunches spaced by 1050 ns. Already done and it is just a matter of supercycle (LHCINDIV with only 2 PSB rings)
  - ✓ It should be OK with 12 bunches spaced by 150 ns, but needs some work and cannot be done this year as the MD program is already full (but no major problem is anticipated there). The idea would be to inject 6 bunches from PSB on h7, then do a rebucketing from h7 to h14 at low energy (instead of triple splitting), accelerate on h14 and then do only 1 splitting a top energy to end up with 12 bunches. Therefore, it is very similar to 75 ns beam which is also accelerated on h14
  - ✓ With 6 bunches spaced by 300 ns, it should not be much work compared to 12 bunches, but there might be a certain intensity limit which still has to be found experimentally
  - ✓ However this cannot be done in 2009 as the MD program is full and it is scheduled for 2010. Furthermore, these beams will profit from all the MDs scheduled this year, in particular with the 1-batch injection in the PS