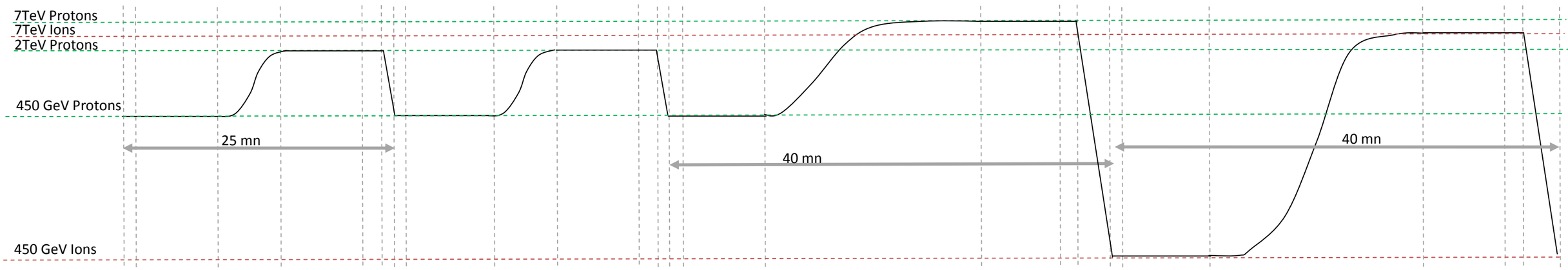
RF RAMPING TESTS

Thursday 21st of November at 9:00 am.



	Typical 2TeV Protons Cycles												Typical 7 Tev Proton Cycle						Typical 7TeV Ions Cycle					
Beam modes	3	6	7	8	13	15	3	6	7	8	13	15	5	6	7	8	13	15	4	6	7	8	13	15
Duration (min)	1	5	13	5	1	0	1	5	13	5	1	0	1	5	28	5	1	0	1	5	28	5	1	0
Total	25 mn						25 mn						40 mn						40 mn					

Procedure:

Time slot	Flat Top Energy	# of cycles during the slot	Particles	INJ mode code	Frequency during setup	Top Frequency	Delta F
9:00 – 10:00	2TeV	2	PROTONS	INJPROBEAM (3)	40.07887834	40.0789607	82Hz
10:00 - 13:00	7TeV	4 or 5	PROTONS	INJPHYSICSBEAM (5)	40.07887834	40.07896474	86Hz
13:00 – 14:00							
14:00 – 15:00	7TeV	1 or 2	PROTONS	INJPHYSICSBEAM (5)	40.07887834	40.07896474	86Hz
15:00 – 17:00	7TeV	3	IONS	INJSETUPBEAM (4)	40.0784187	40.0789628	544Hz

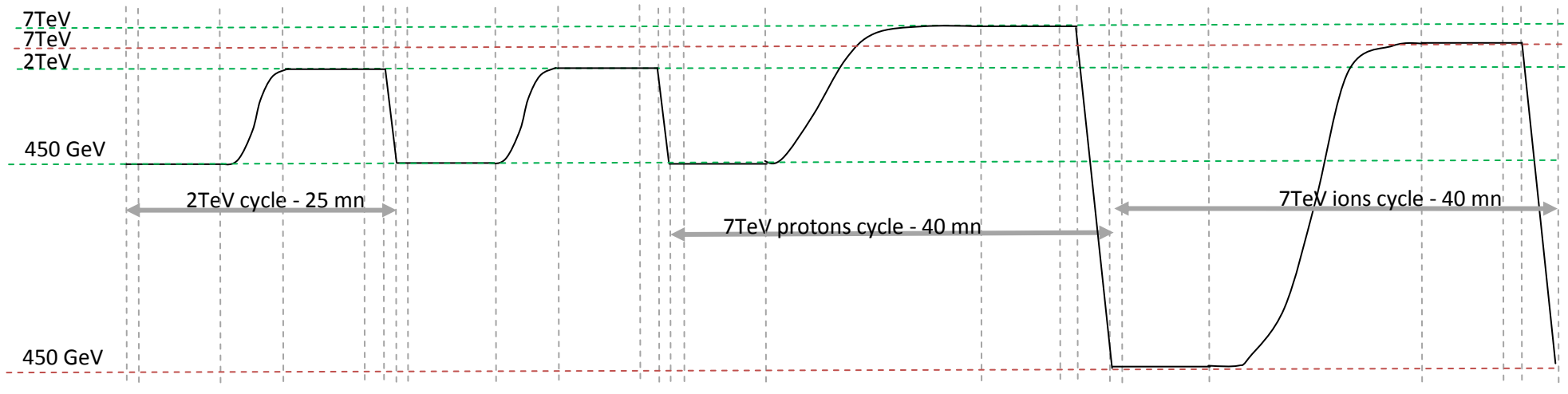
Typical sequence loop

1. Change beam mode to "**INJPROBEAM**" [3] for a 2Tev ramp for protons or "**INJPHYSICSBEAM**" [5] for a 7TeV ramp for protons or "**INJSETUPBEAM**" [4] for a 7TeV with ions .
   Wait 1 min.
2. Change beam mode to « **PRERAMP** » [6]
   Change resident cycle to ramp cycle (ramp to 2 Tev (800s) or 7 Tev (1700s))
   Load ramp setting for frequency program into the FGC
   Wait 5 mins
3. Change beam mode to "**RAMP**"[7]
   Send event HX.SRMP-POW-CT (Start ramp power converters) .
   Ramp is starting
   Wait the end of the ramping
4. Change mode to "**FLATTOP**"[8]
   Wait 5 mins
5. Change beam mode to "**BEAMDUMP**"[13]
   Change resident cycle to the injection cycle (ramp-1Tev_V1@start)
   Load injection settings for frequency program into the FGC
   Wait 1min
6. Change beam mode to "**RECOVERY**"[15]
   Send event HX.SRMP-POW-CT (Start ramp power converters) .
   The frequency goes down to injection settings (takes only a few ms).

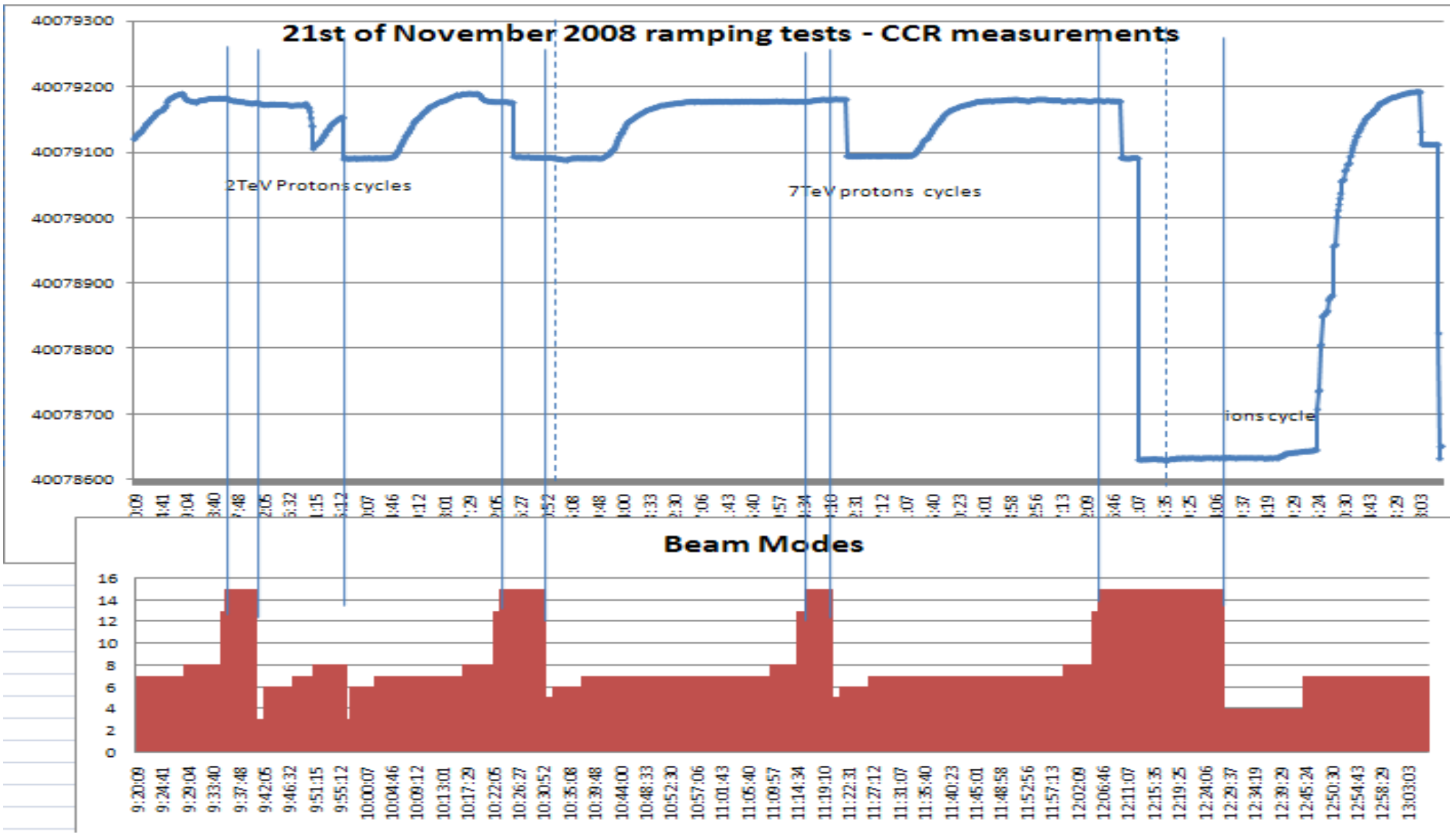
Repeat the procedur

Sequence of the day:

Theory



measurements (measurements made by a frequency meter VME module at the CCR and beam modes logged at ALICE)



beam modes logged by Anton Jusko (Alice), via the RF2TTC

General comments on the day:

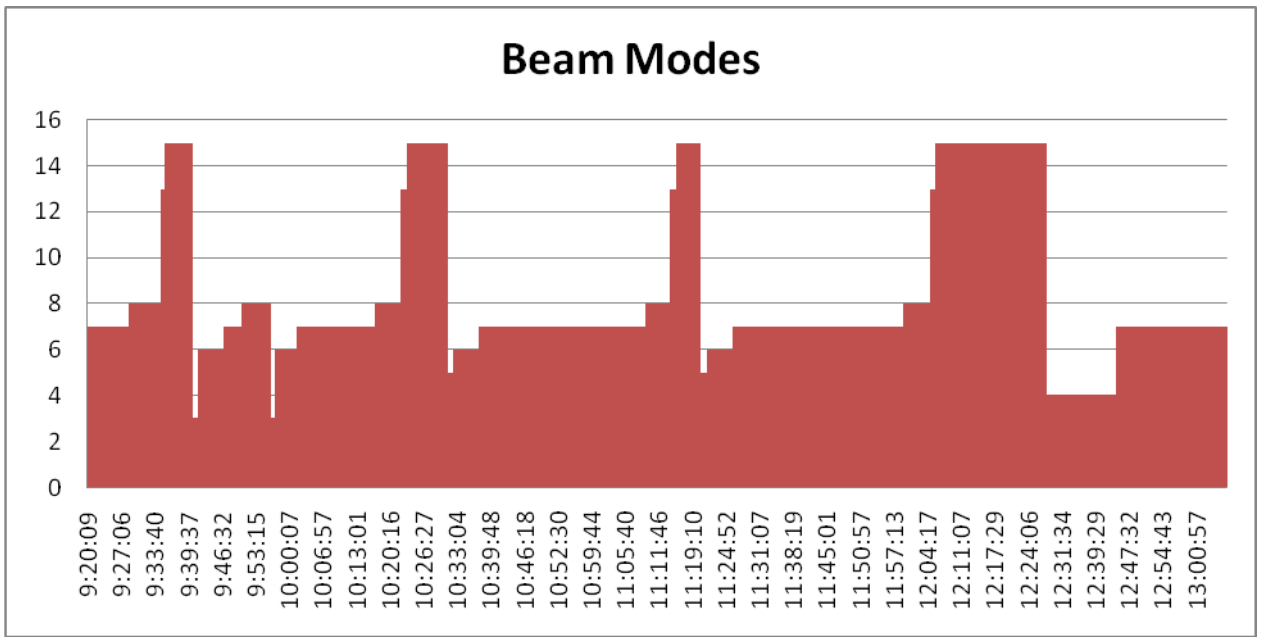
- We did
    - 2.5 cycles of 2TeV protons (between 9:00 and 10:30)
    - 2 cycles of 7TeV protons (between 10:30 and 12:15)
    - 1 cycle of 7TeV ions (between 12:15 and 13:00)
- The second 2TeV cycle began before the end of the first one, which is not representative of real conditions. The 2TeV cycle beginning at 10:00 is more representative. Fluctuations on its flat top are due to manipulation of the frequency meter at the CCR reception point.
- The ramping session stopped at 13:00 as CMS had to shutdown installations
- Initially, CMS and LHCb were supposed to be in global run to check the behavioral of the detectors in real life clock conditions. LHCb had a cooling problem during the previous night which prevented data taking and status monitoring. ATLAS and ALICE were following the frequency and beam modes evolution with on-site electronics. The TTC crate at the CCR was monitoring the frequency, tracking the beam modes and following BCmain output, configured in automatic mode to switch source according to the beam mode.
- The sequences were not fully automated and not coupled with the beam modes at the operation level(changes were done manually), which explains the inconsistency between frequency and beam modes at some points (11:20, 12:15)

- The frequency meter at the CCR has a positive freq offset of about 200Hz: on the previous graph, variations are relevant, but it is not the case of absolute values
- During the first 1.5 hours, hot-plugging of modules on the VME crate explain probably fluctuating frequency values on the flat tops.

Teams feedback and results

ALICE (Anton Jusko)

- Log of the BST signals decoded by the RF2TTC

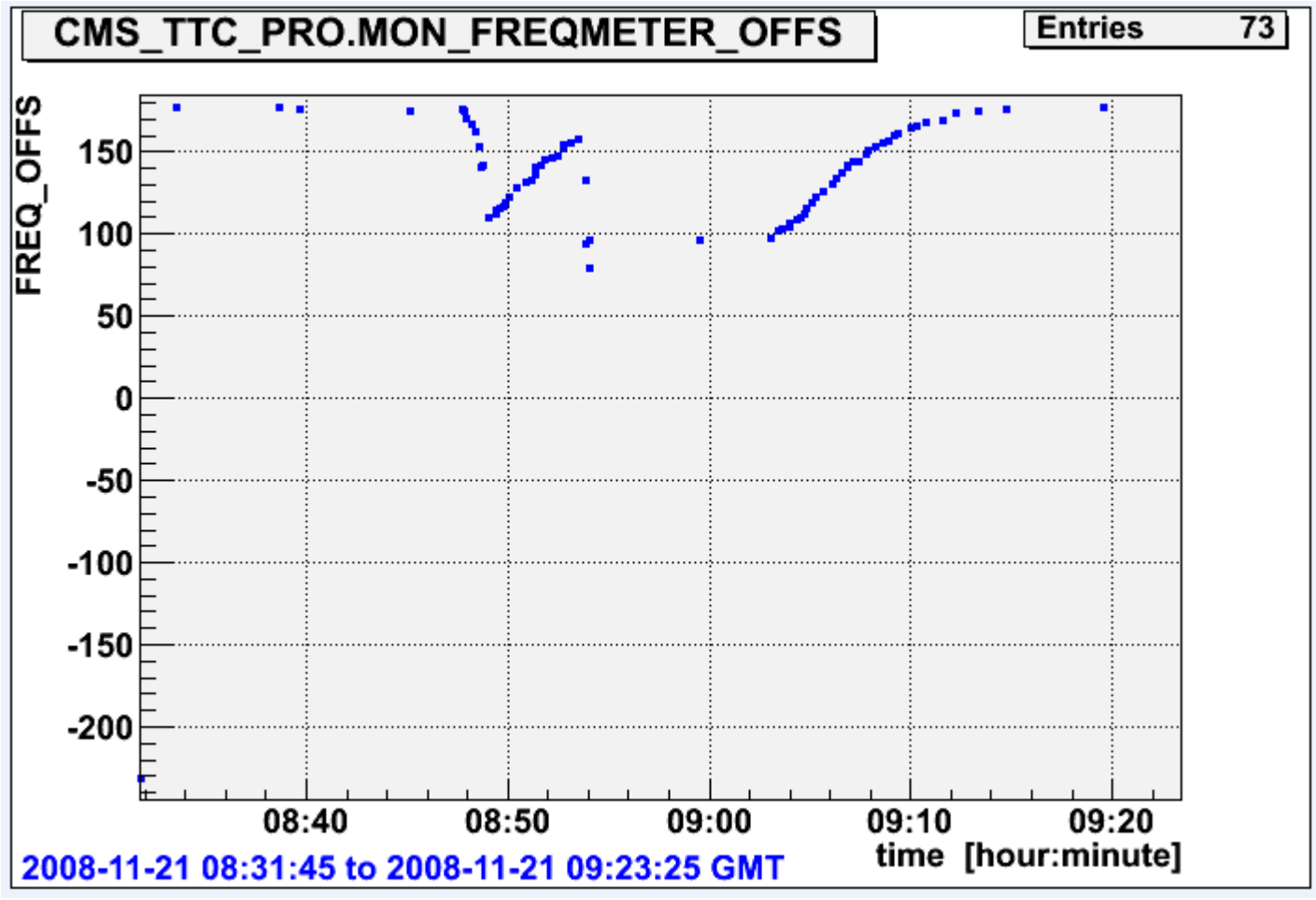


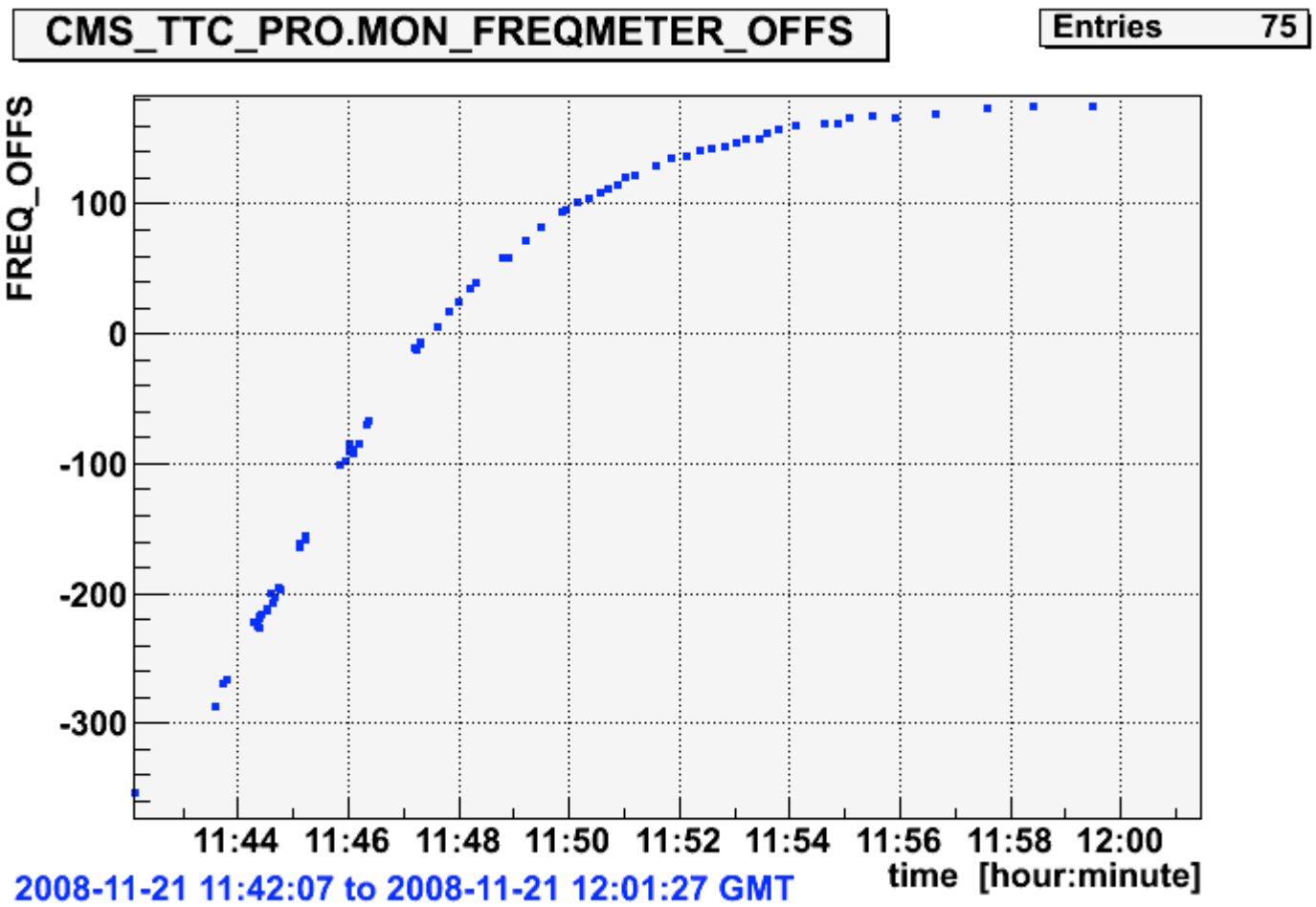
ATLAS (Thilo Pauly)

Note: the phase between bunch clocks changes by steps of 2.5ns (1 period of 400MHz) at the end of some cycles. This will (hopefully) not happen in real conditions. RF team has confirmed that these steps in phase are caused to the fact that the BCs were not resynchronized before cycles. The period between 8:45 and 10:00 is not significant, as a lot of phase and frequency adjustments were made at the RF level. Shorts glitches on the measurements are very likely coming from measurements problems, but this will be checked during the next ramping session.

CMS (Andre Holzner, Jan Troska)

Add 1 hour to the GMT time to be consistent with the other measurements.



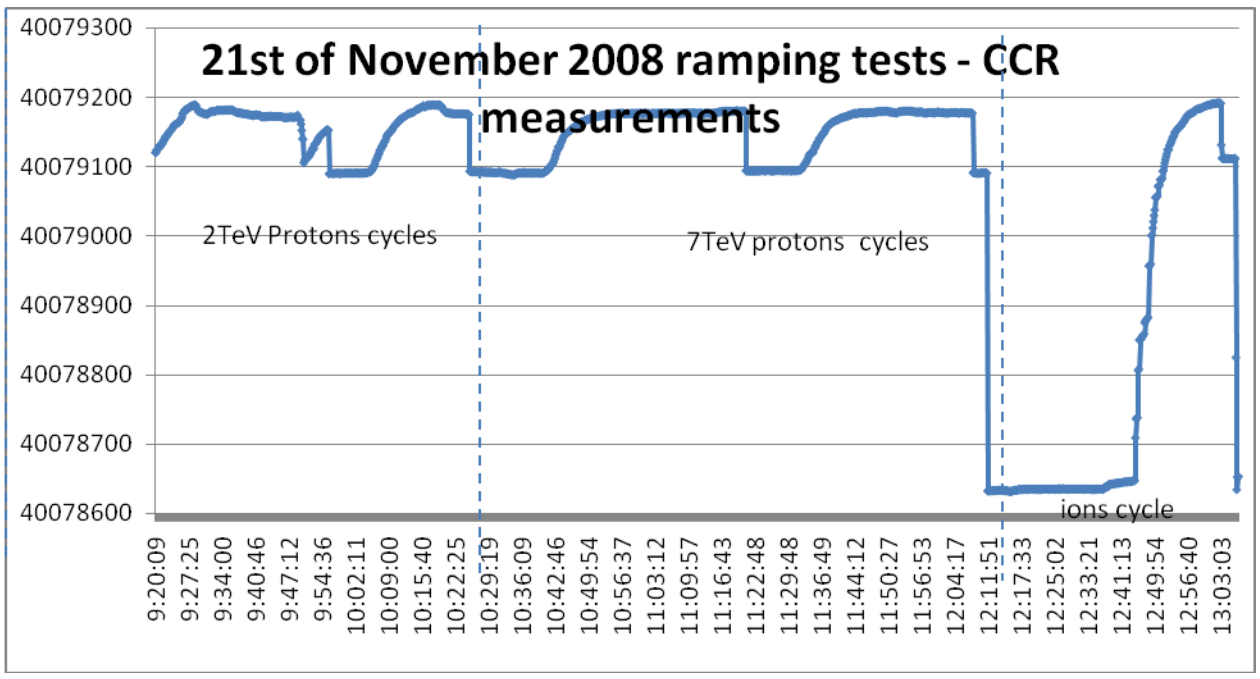


Remark from CMS: CMS survived the proton ramp while taking data, but after a few hundred Hz of change on the ion ramp various sub-systems with QPLLs failed to remain in sync. This has to be understood, as the frequency used during the ion ramp should have stayed within the analog range. The slope of the ramp was, at its maximum, around 250/120= 2.1 Hz/s, well below the QPLL bandwidth. Some tests simulating the ions and protons ramp will be done locally at CMS to check the QPLL locking ability.

LHCb (Federico Alessio, Richard Jacobsson)

- No data

TTC support (Sophie Baron, Piotr Jurga)



The monitoring system was not operational yet at the time the tests were made. We just set up rapidly a frequency measurement system. The new monitoring system will allow tracking the phase, jitter, frequnecies, beam mode, etc.The RF2TTC was working on automatic mode (switching source frequency automatically with BST mode). It was working very well. However, a bug was seen once on the rf2ttc when suddenly the BST mode was not decoded anymore and stayed at the value 15 (beam dump). This firmware problem will be fixed in the spring 2009 firmware upgrade of the rf2ttc.

LHC operation (Delphine Jacquet)

RF Team (Philippe Baudrenghien, Andy Butterworth)

Conclusions

This ramping session was very useful and allowed us to test the full transmission chain of BC and orbit transmission. A few problems have been identified in CMS, in the CCR. Users have now a better knowledge of the behavior of the signals they receive, and, as it was the first time this type of test was done, it was a good opportunity for RF and operation teams to learn more about their systems. A great thanks to everybody!

As LHCb, ALICE and ATLAS were not able to have their detector running during these days, we will try to set up another ramping session in spring 2009.