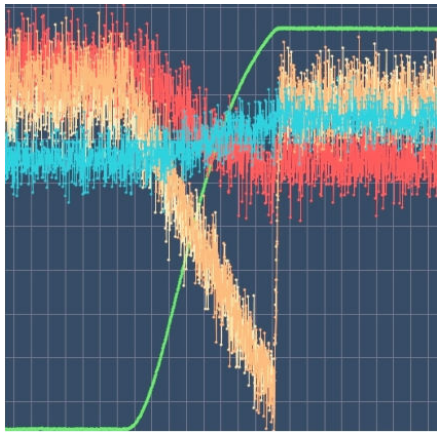

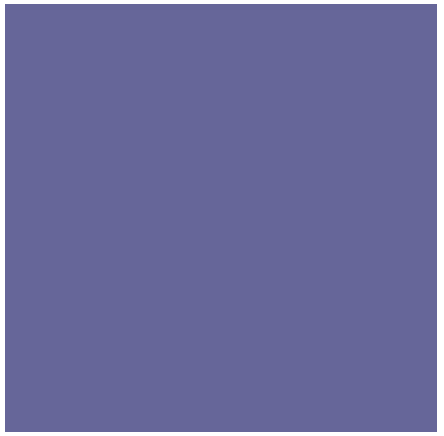

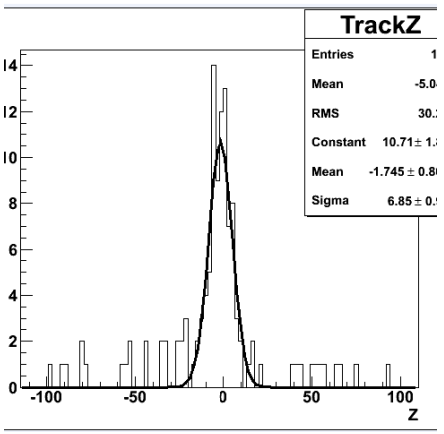
TrackZ
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Z

Cogging & co

AGENDA

- A. from 2009:
  - A.1. Feedback from RF point of view
    - A.1.a. Summary of RF phase jumps & explanation
    - A.1.b. Vertex position shift versus RF events
    - A.1.c. Which parameters could impact vertex position?
    - A.1.d. Phase during ramp
    - A.1.e. Clock quality and stability in Nov & December at the CCR (jitter, jumps…)
    - A.1.f. Conclusion: what should we expect as 'normal' variations of bunches & beam spot from RF point of view? What are the final values of RF BC for beam capture?
  - A.2. Feedback from experiments
    - A.2.a. consistency of BPTX deltaT versus Vertex? Resolution of BPTX measurements after calibration?
    - A.2.b. How do experiments deal for deltaT with multibunching?
    - A.2.c. Which shift in beam spot position can experiments tolerate without requiring rephasing?

- B. for 2010:
  - B.1. External clock handshake? Except during SETUP (and before IMMINENT), when may resynchro happen?
  - B.2. No synchronised Bcref for 2010 – check the agreement from experiments
  - B.3. Rephasing procedure for 2010:
    - B.3.a. Will we use the BPTX to check the alignment? Should/could the data be published? Which format?
    - B.3.b. Will the RF implement this automatic rephasing tool?
    - B.3.c. If the phase is 'wrong', what should be the procedure? (experts won't be there night and day on a long term basis)
    - B.3.d. If rephasing is done, could it be during 'stable beam'? If yes, will the feedback be given by vertex reconstruction? How fast is it (versus luminosity)?
  - B.4. RF Piquet
    - B.4.a. Procedure for experiments to follow before calling the Piquet service. Is it through CCC?
    - B.4.b. Requirements of registers publication on DIP for RF-Rx configuration check
  - B.5. Fibre maintenance:
    - B.5.a. agreement with EN-EL
  - B.6. Drift versus temperature of transmitted RF signals

Aim of todays meeting

- Understand the BPTX and Vertex results of 2009 in relation with RF events.
- What is the acceptable range (both from RF and experiments) of Vertex and BPTX variations without requiring a warning and/or a rephasing.
- Define a procedure for 2010 runs (phase alignment, piquet service, system monitoring).

2009 – BUNCHES & CLOCKS VARIATIONS

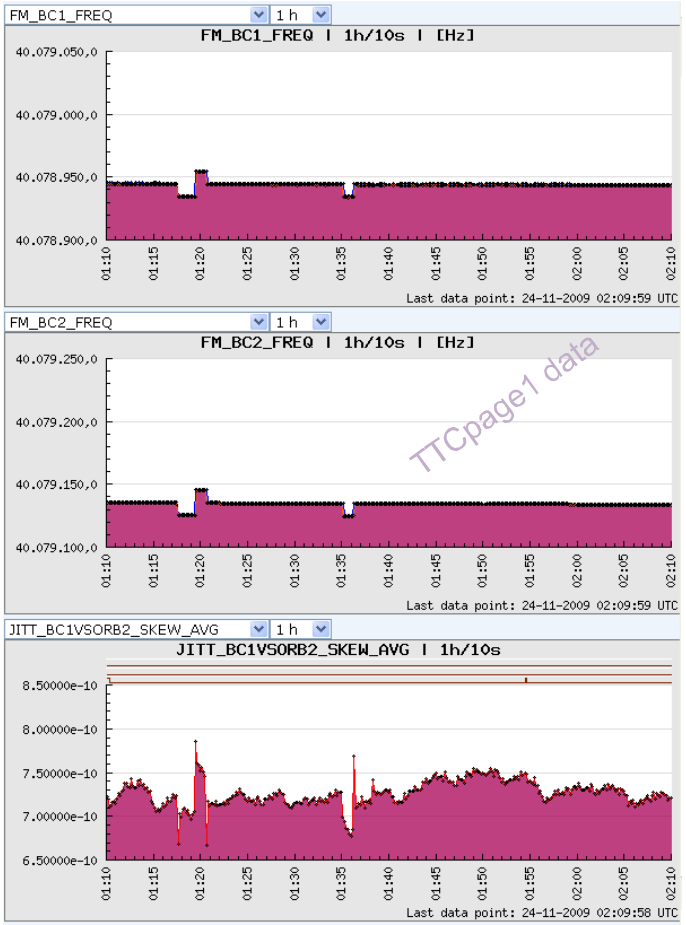
Measurements and data analysed from the RF point of view

Outline

- Summary of RF phase jumps & explanation
- Vertex position shift versus RF events
- Which parameters could impact vertex position?
- Phase during ramp
- Clock quality and stability in Nov & December at the CCR (jitter, jumps…)
- Conclusion:
  - what should we expect as 'normal' variations of bunches & beam spot from RF point of view?
  - What are the final values of RF BC frequencies after adjustment of beam capture?

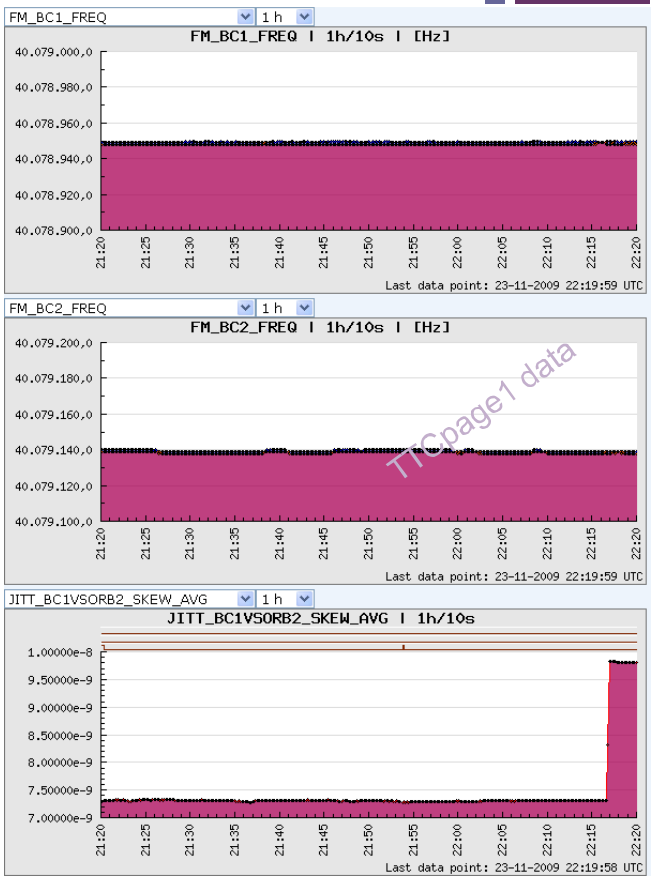
Phase Jumps zoo [1/4]

- Summarized in week1 report
- Several actions have been understood to cause phase jumps:
- **Trims (chromaticity tests, dispersion):** 'brutal' change of frequency by +-50Hz or +-100Hz.
  - Generated a brief unlock of the synchro loop. The VCXO in the loop relocked almost instantaneously, but the phase slipped by a few buckets, generating a dephasing of the 2 beams (and a displacement of the collision point)
  - Action: the frequency rate applied during the TRIMS has been reduced to 200Hz/s @ 400MHz (ie 20Hz/s for the experiments) to avoid an un-lock of the synchro loop.



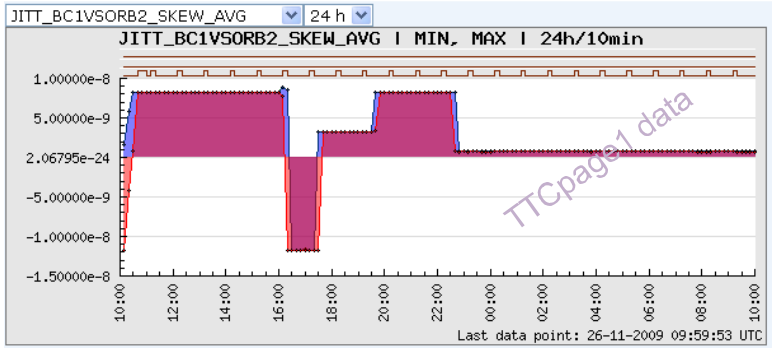
Phase Jumps zoo [2/4]

- **Injection with RF OFF (frequently used for Inj&Dump):**
  - This was creating a phase error on the synchro loop which was, as well, unlocking the VCXO and generating a phase jump.
  - The problem has been solved and should not happen anymore.



Phase Jumps zoo [3/4]

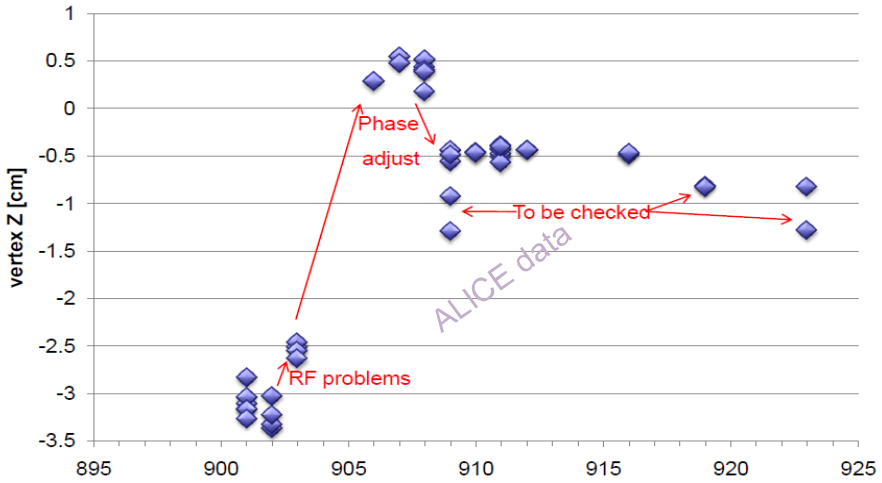
- **Master Frev 40MHz not resynchronized during beam control resynchro:**
  - At each injection, the phase of the 40MHz could be in each of the 10 positions of the 2.5ns bucket. This created a random phase offset that the synchro loop was trying to correct. It resulted in the displacement of the bucket by + or – one or several buckets. **The resynch of these 40MHz have now been integrated in the sequencer. However, as soon as the sequencer is not used to reset the RF, this has to be carefully checked.**
  - This means that the parameters obtained for the capture during the first week-end had to be re-adjusted Sunday 29.

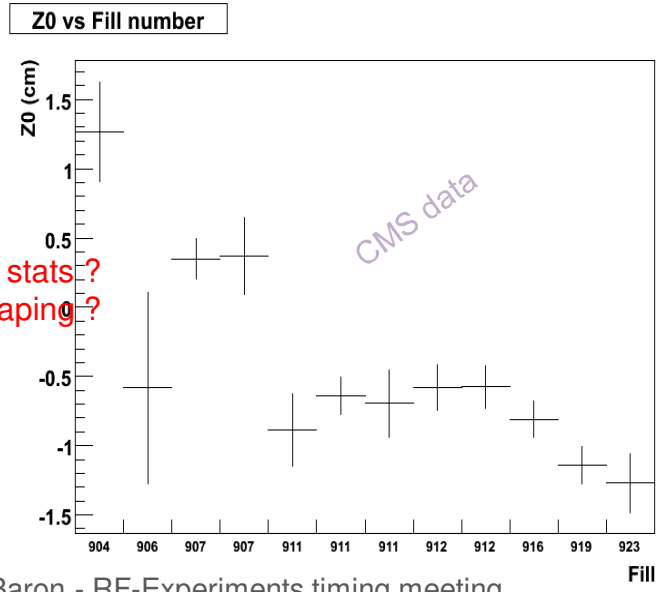


Phase Jumps zoo [4/4]

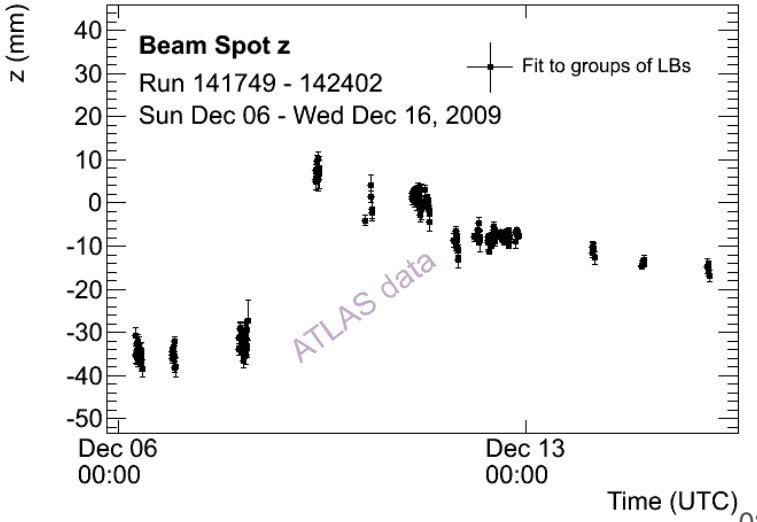
- **Miscellanea:**
- Reset of the FGC: human mistake
- The phase accumulator of the 2 DDS may not have been reset before first injection (could have add an error of 0 to 1ns). The reset has been done now, and this should not be required anymore.

Vertex Position History

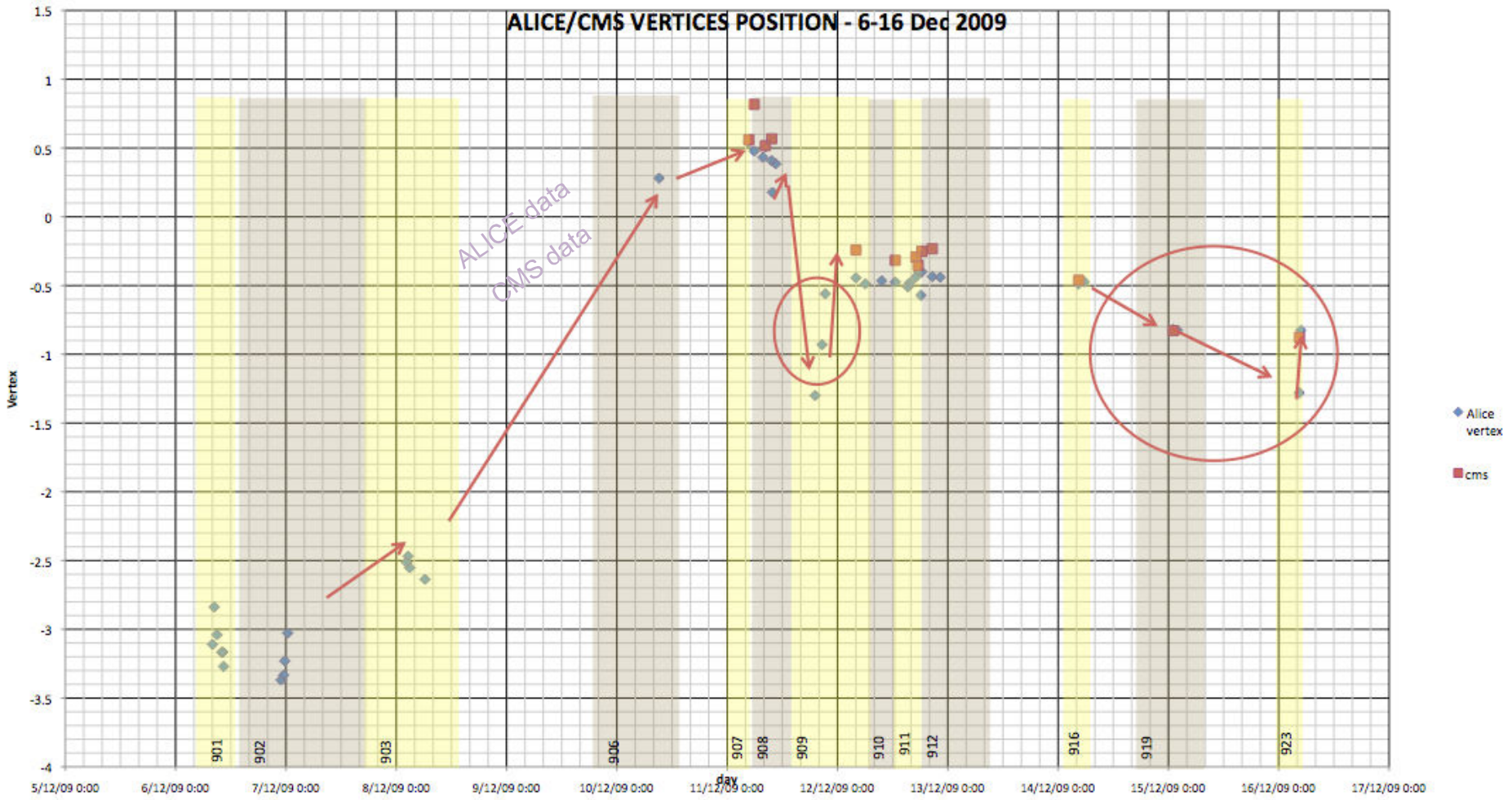




low stats ?
beam scraping ?

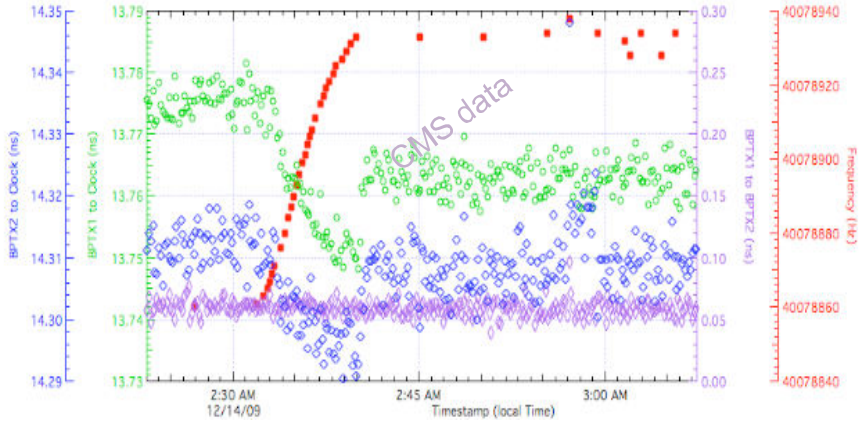


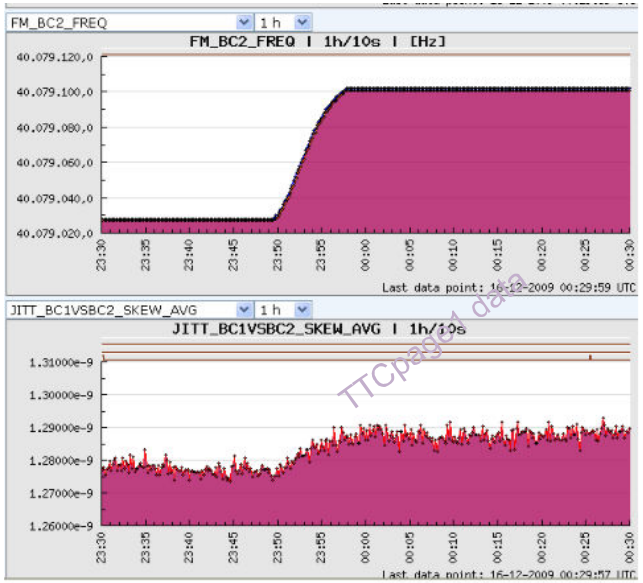
Vertex Position History

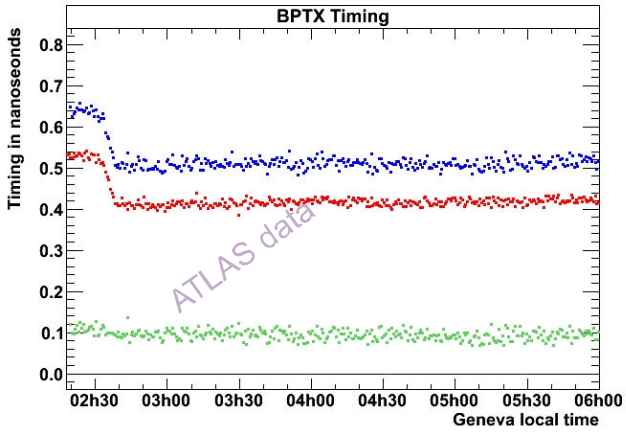


Link to Timber check

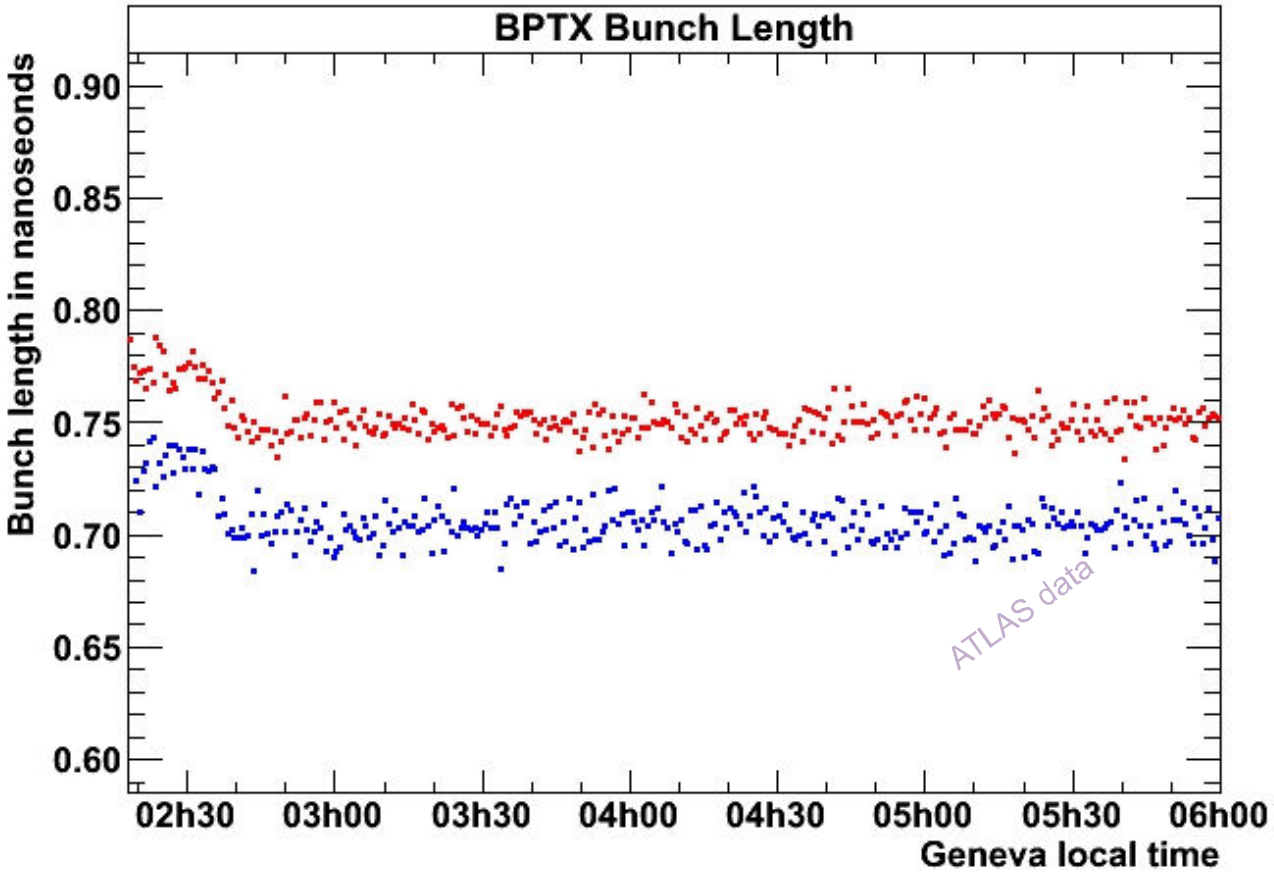
Phase during ramp





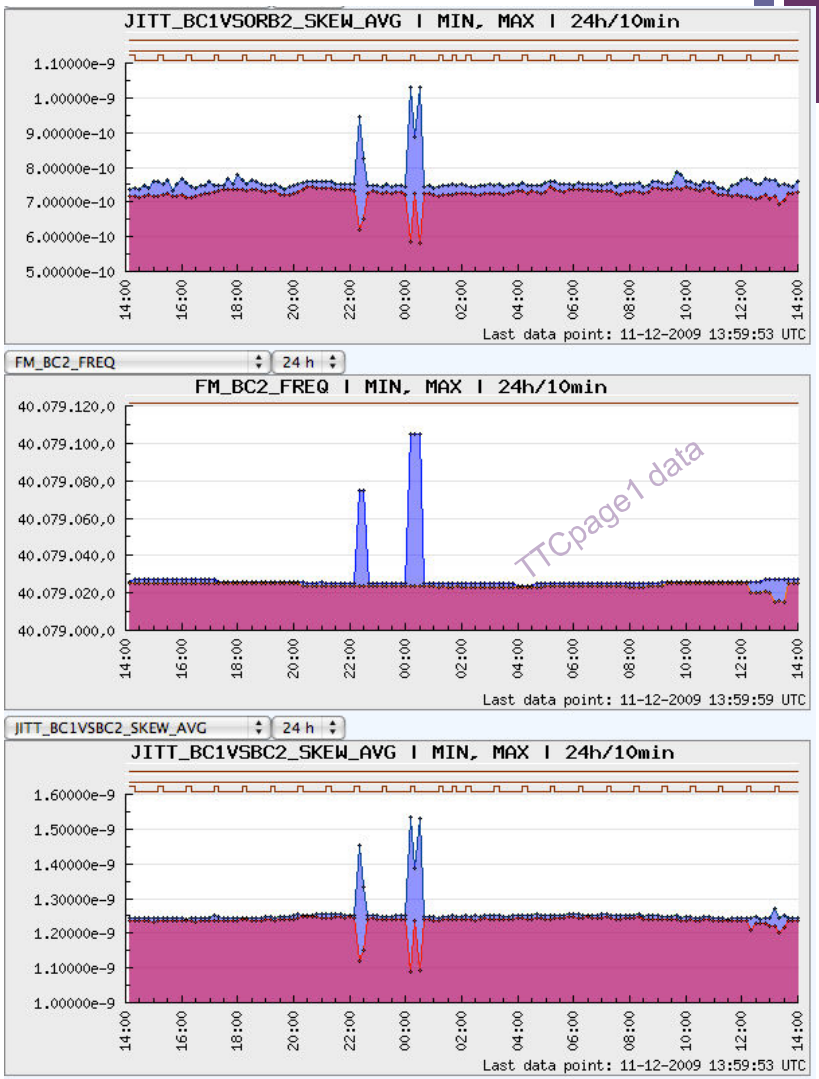


Use of BPTX to measure bunch length? (ramp 14/12 – 2:00)

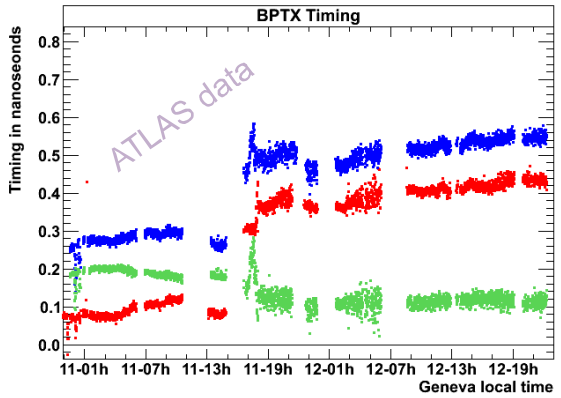


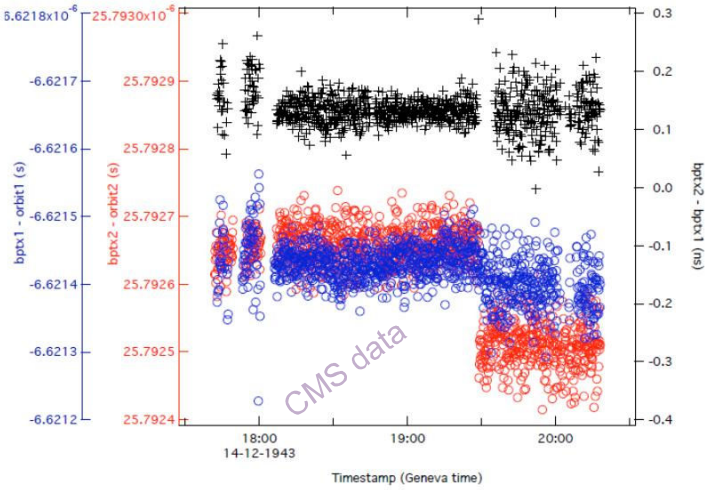
Clock quality and stability

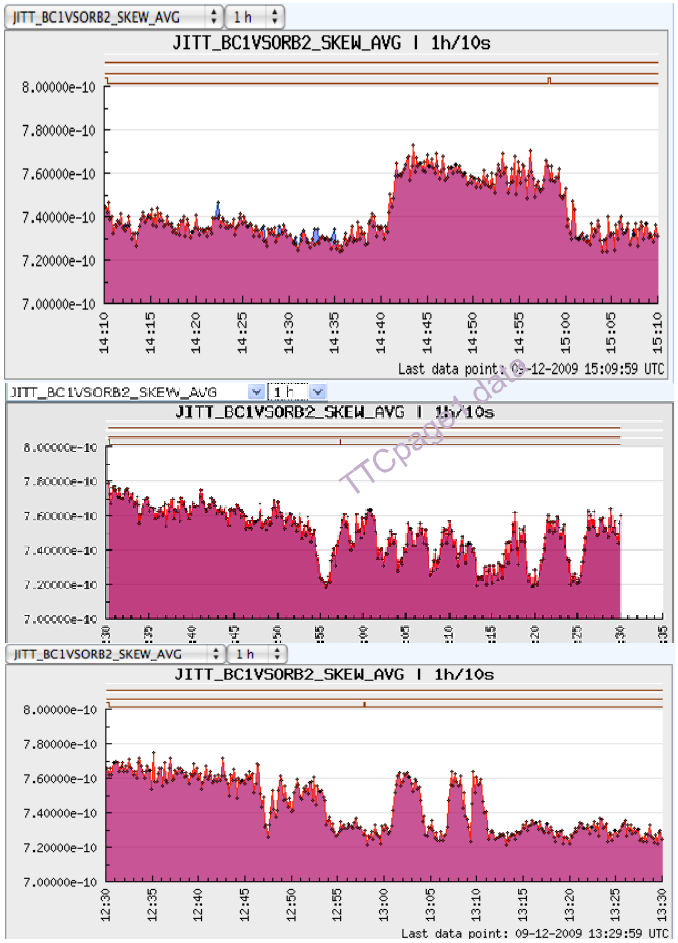
- Measured on the RF_Rx outputs in the CCR
- During normal conditions
  - BC1 vs BC2:
    - Sdev <16ps rms
    - Pkpk <170ps
  - BC Cy2Cy:
    - Sdev <17ps rms
    - Pkpk <200ps
  - Orb period jitter:
    - Sdev <30ps rms
    - Pkpk <170ps
    - Much less statistics
- Trims effects:
  - 300ps pkpk more



Bunch & BC phase jumps – should we care?

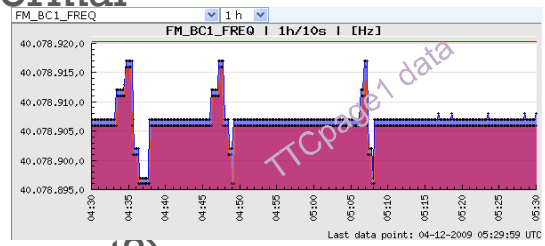






What are the normal variations expected by RF?

- Delta_T / Delta_z_IP?
  - Jitter
  - Slow drift
  - Above which value is this drift not considered as 'normal'
- Frequencies during adjust, trims.
  - Max 200Hz/s (20Hz/s for the experiments)
  - Max amplitude? (500Hz@400MHz, 50Hz for experimenst?)
- Are the nominal frequencies fixed?
  - Are the capture parameters fixed?



2009 – BPTX and Vertex post-mortem

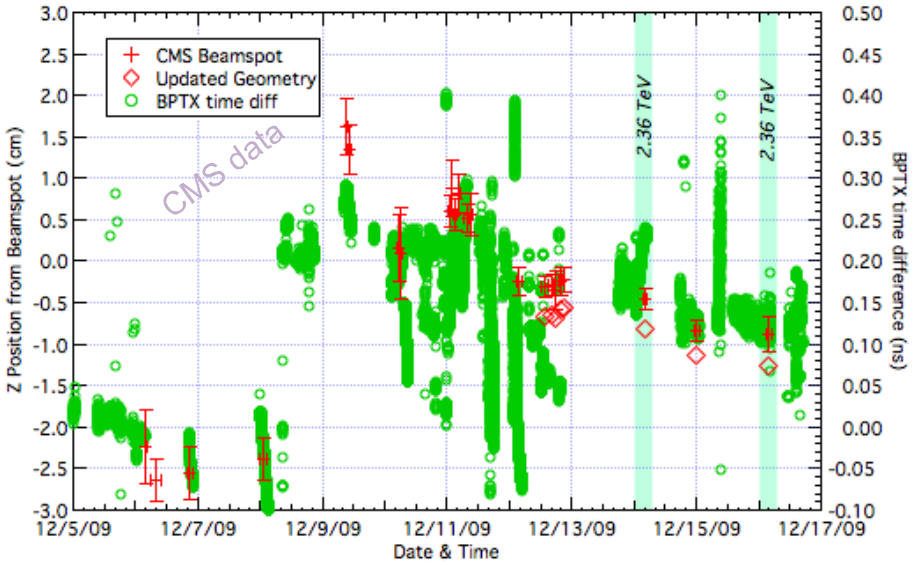
Measurements from the experiments point of view

Outline

- BPTXs:
  - Consistency of BPTX deltaT versus Vertex?
  - Resolution of BPTX measurements after calibration?
  - How do experiments deal for deltaT with multibunching?
- VERTEX
  - Which shift in beam spot position can experiments tolerate without requiring rephasing?
  - Publication?
  - Is there an impact of RF BC variations on the vertex reconstruction?

BPTX feedback

- BPTX consistency versus Vertex?
  - CMS data:



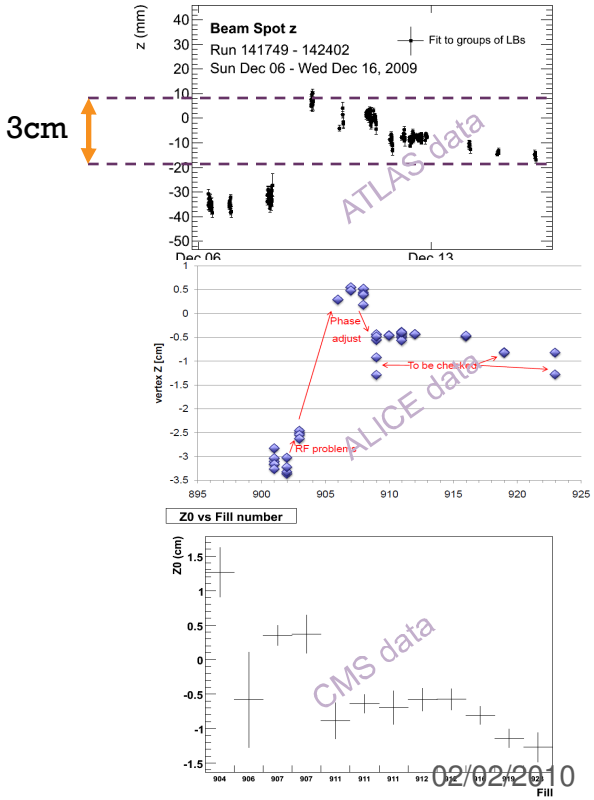
- BPTX resolution after calibration?

BPTX with multibunching?

- Use CirculatingBunchConfig , IntensityPerBunch?
- Paired bunches?

Vertex position

- Published during stable beams? Which rate?
- Impact of BC variation on Vertex position calculation?
- Acceptable shift versus IP ?
  - Between runs?
  - Within a run?



Procedures for 2010 runs

Handshake,

BCref,

Alignment procedure,

Piquet,

Monitoring & Post mortem

Ext BC Handshake

- External clock handshake? Except during SETUP (and before IMMINENT), when may resynchro happen?
  - Synchro should only happen during SETUP: http://lhc-data-exchange.web.cern.ch/lhc-data-exchange/ (P. Baudrenghien's talk, sept 2008, LEADE 47th)
  - Handshake procedure defined here: http://indico.cern.ch/materialDisplay.py?materialId=minutes&confId=67796
  - Comments from Richard: After the IMMINENT is realised, an ABORT of the handshake could lead back to a resynchro…Only the change of beam mode is a garanty that the RF will not be resynchronised.
  - This is only true if the sequencer is used on a linear basis. If not, a resync may happen out of the SETUP mode.
  - Questions:
    - should the experiments publish their 'sensitivity to RF synchro' in case of a wild resync, or do we stick on the existing agreement?
    - What do we do in case of an ABORT?

BCref

- No synchronised Bcref for 2010 – check the agreement from experiments :

- Same agreement as during November 09 Timing Meeting: http://indico.cern.ch/getFile.py/access?resId=0&materialId=minutes&confId=74019
  - ***Do experiments confirm that they will run on BC1 and BC2 during runs until the BCref is commissioned?***
  - Still, as stated during previous meeting, Bcref value is important to help centering QPLLs in experiments:
    - "The BCref as defined above is useful for experiments to ease the reset procedure of QPLLs (have a reference Bunch Clock to which the QPLLs could lock after a reset and thus center their analog locking range to the right frequency) despite the fact that it will not be synchronous with other clocks. ***Hence, the RF group will keep BCref ON and up-to-date to top frequency as much as possible, even if it is not related to beam for the moment." (minutes of Nov meeting). Could RF guaranty that for 2010?***

Rephasing Procedure for 2010?

- Will we use the BPTX to check the alignment?
  - Should/could the data be published on DIP?
  - Which format, which rate?
  - Normalise results to compare BPIM to Scopes outputs
  - Bunch length?
- If the phase is wrong*, what should be the procedure?
  - What/Who is responsible for detecting it,
  - And how should it/he warn the OP or the RF?
  - Experts won't be there night and day on a long term basis

* Previously defined

Rephasing Procedure for 2010?

- Will the RF implement the (semi)-automatic rephasing tool?
  - When will the rephasing be applied – start of coast?
  - Systematic or on 'request'?
  - When is it foreseen to be implemented?
- If rephasing is done, could it be during 'stable beam'? If yes, will the feedback be given by vertex reconstruction? How fast is it (versus luminosity)?
- Cogging blog? Do we keep it? (130 messages exchanged in 1 month)

* Previously defined

Setting up RF Piquet

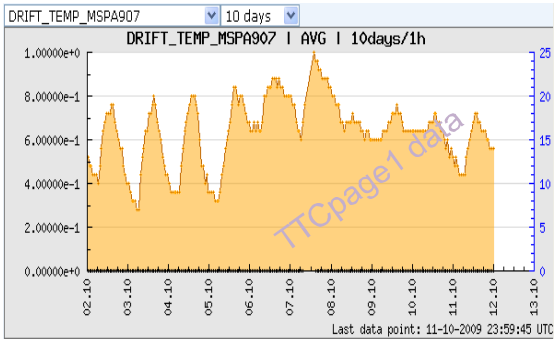
- RF Piquet
  - Procedure for experiments to follow before calling the Piquet service. Is it through CCC?
  - Procedure for the RF piquet to come to experiments if they have been called
  - Requirements of registers publication on DIP for RF-Rx configuration check

Fibre and monitoring

- Fibre maintenance:
  - Collaboration with EN-EL
  - TTC & RF is the opportunity for them to define an intervention procedure (on-going)
    - Identify their contacts (fibre users and/or piquet members)
    - Participate in the writing of the procedure for experiments and piquet before asking for an intervention (in particular for what concerns the fibre cleaning)
    - Prepare a way (d^3 « Document De Depannage ») to ask for an intervention:
      - Who to call, how do they identify the fibre to check?

Fibre and monitoring

- TTCpage1 : https://ttcpage1.web.cern.ch/ttcpage1/war/TTCpage1.html
  - running since day 1
  - Beam modes, Frequencies (soon GPS based), QPLL status, RFRx and RFTx, signals jitter and phase
  - Cross check your system with the CCR and the other experiments
  - Log of all the data on cerndb1 available on GPN
    - 1s or 10s sampling
    - ALL the qpll unlocks are logged



- Drift versus temperature of RF signals over optical fibres
  - Monitoring system does exist on the TTCpage1
  - An orbit signal is sent from CCR over a fibre to ATLAS and back to CCR. Its phase is measured and plotted (infrastructure is there, but fibre connector pb)
  - Time scale of 24h, 10days, 1 month, 4 months and 1 year
  - Problem of reliability of RAMSES publication via DIP for external temperature

Wrap-up