

MTE Commissioning status

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in collaboration with
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Thanks to P. Freyermuth, H. Genoud, Y. Riva AB-OP
and OP crews

Commissioning phases

Goal: provide the CNGS/SFTPRO beams with MTE by the half of the run

Phase I

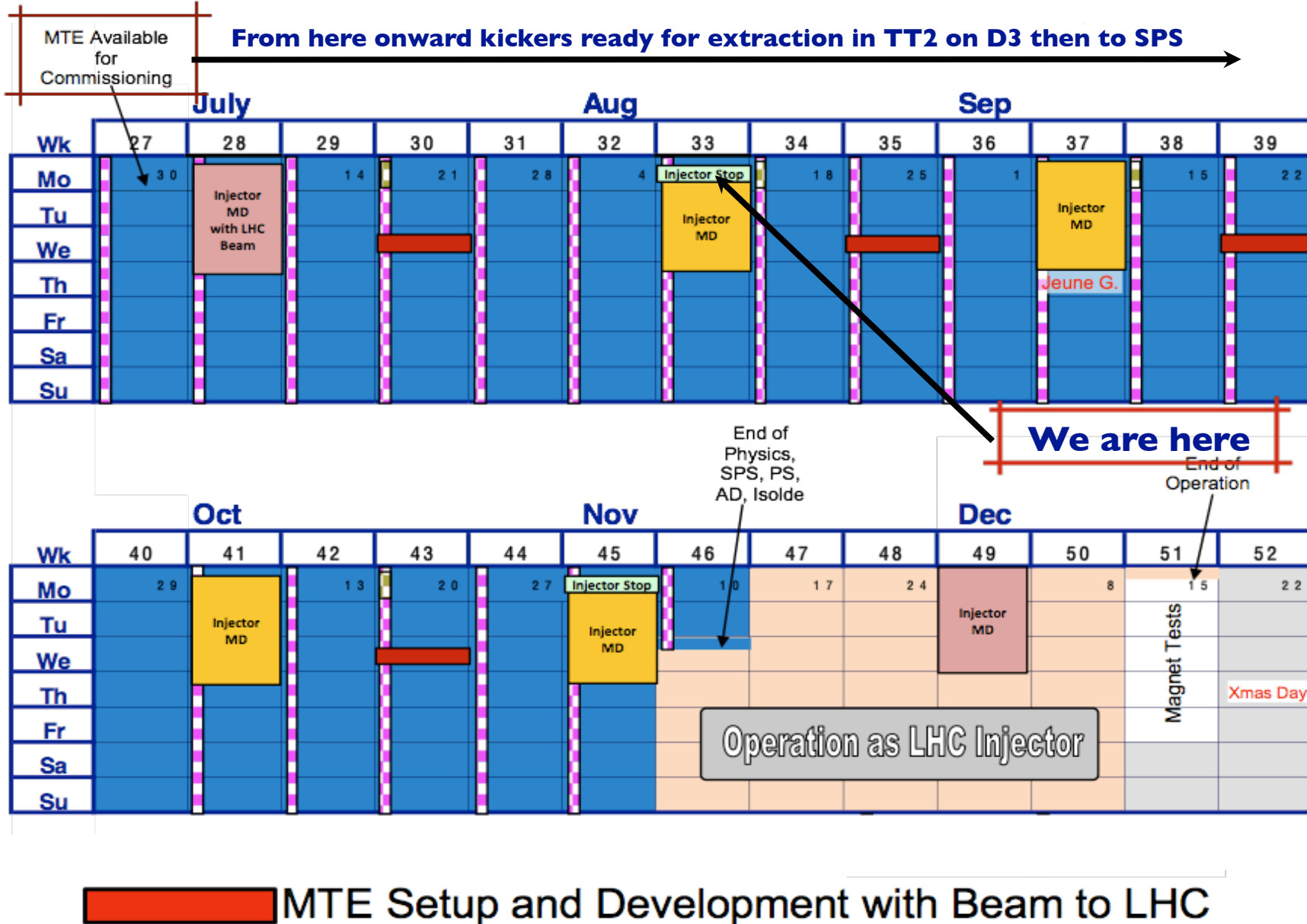
1. Beams preparation \Rightarrow 2 USERS \Rightarrow PSB(h1-h2), PS(2 bp for studies, 1 bp for extraction)
2. Measurement of nonlinear chromaticity to establish working point for capture
 \Rightarrow Working Point (Q_x, Q_y, X_{ix}, X_{iy} but also X_{ix}')
3. Re-establish capture \Rightarrow islands formation and capture optimisation \Rightarrow 2 bp \Rightarrow prepare 1 bp
4. Tests of CT extraction with bunched beam
5. Preparation of the extraction elements
 \Rightarrow Kickers with no beam on ZERO Cycle
 \Rightarrow Optimisation/Calibration of the new bump 16

Phase 2

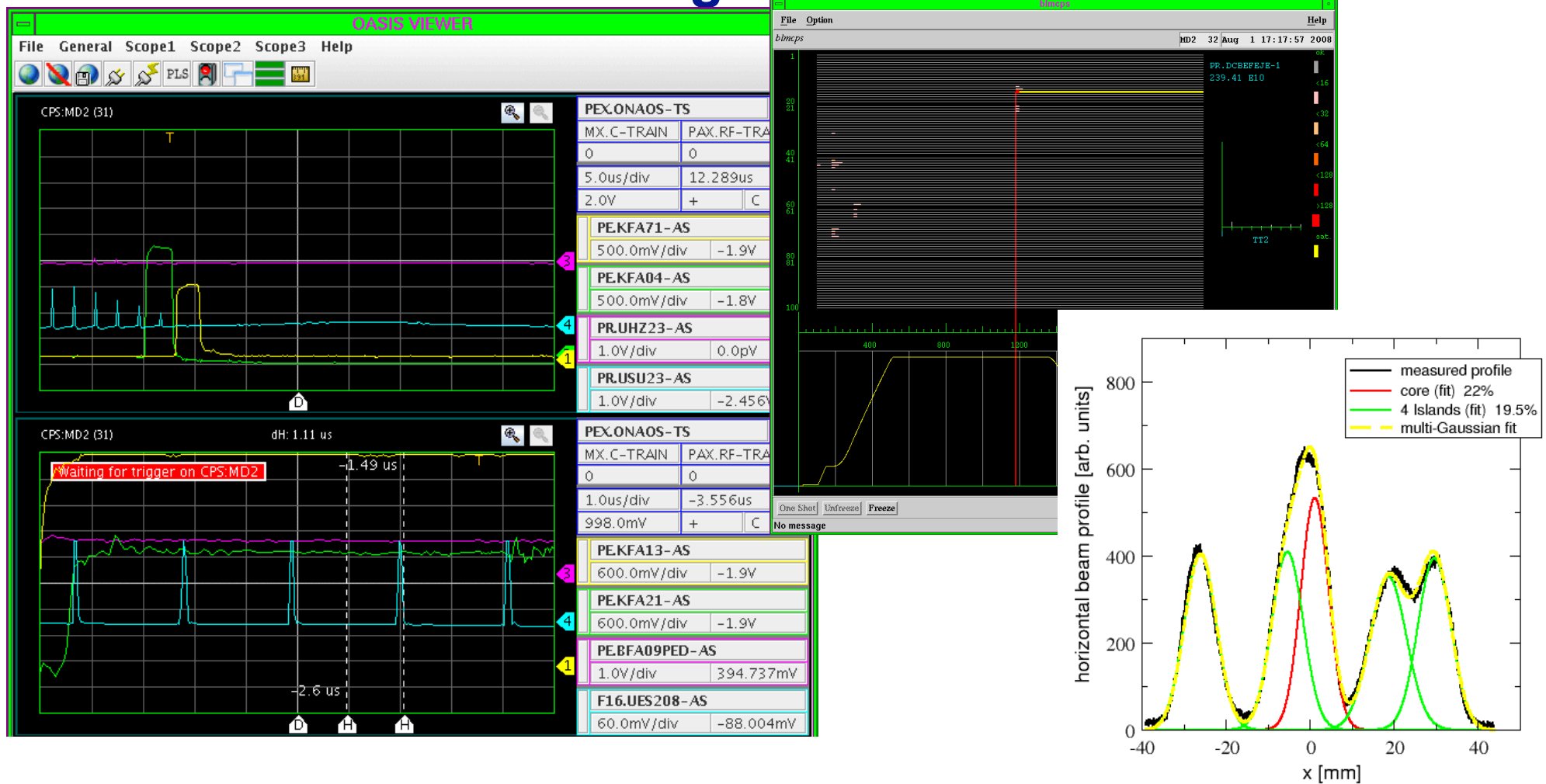
6. Preparation of nominal extraction with moderate intensity for CNGS-SFTPRO operation \Rightarrow 1 bp
7. Optics study and matching PS-TT2-SPS
8. CNGS-SFTPRO with MTE extraction
9. make a party ...

From APC- 29/02/08

MTE commissioning - Schedule 2nd part



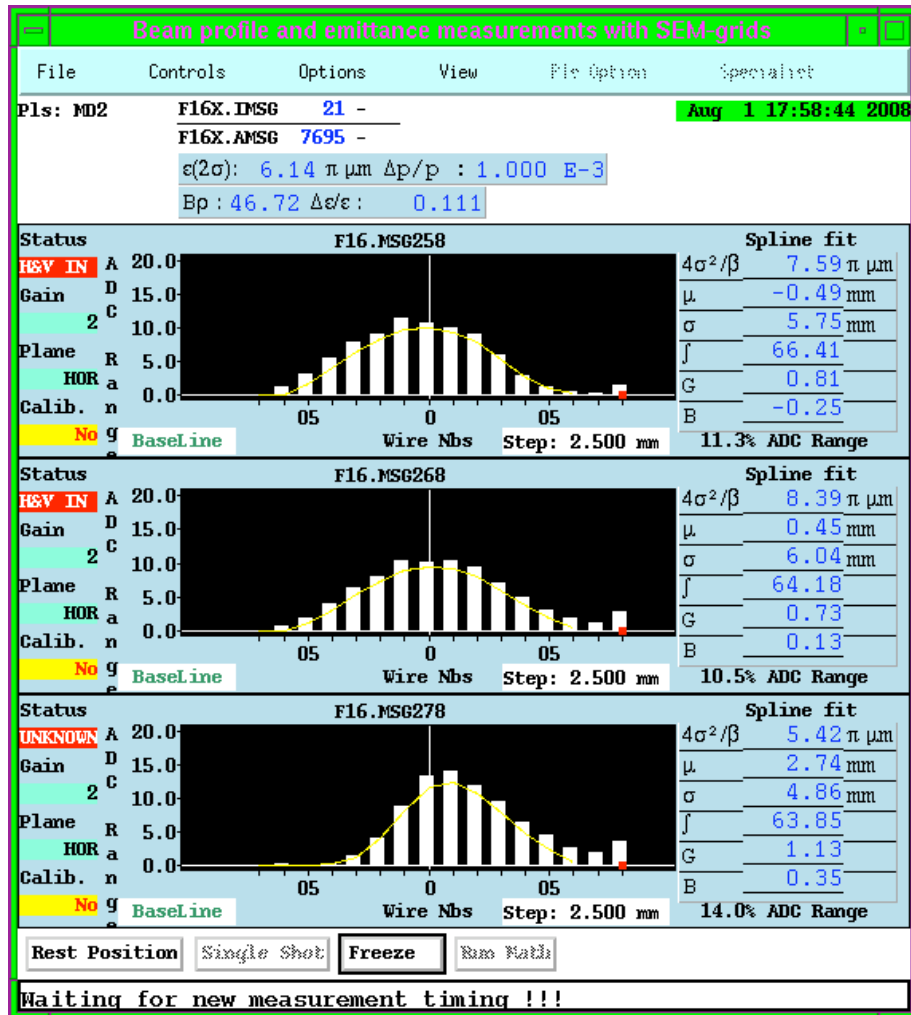
First: good news



1. 18%-19% loss less capture per islands regularly done
2. Extraction on 5 turns in TT2 done

http://webh06.cern.ch/ab-project-mte/news_2008.htm

Islands in TT2

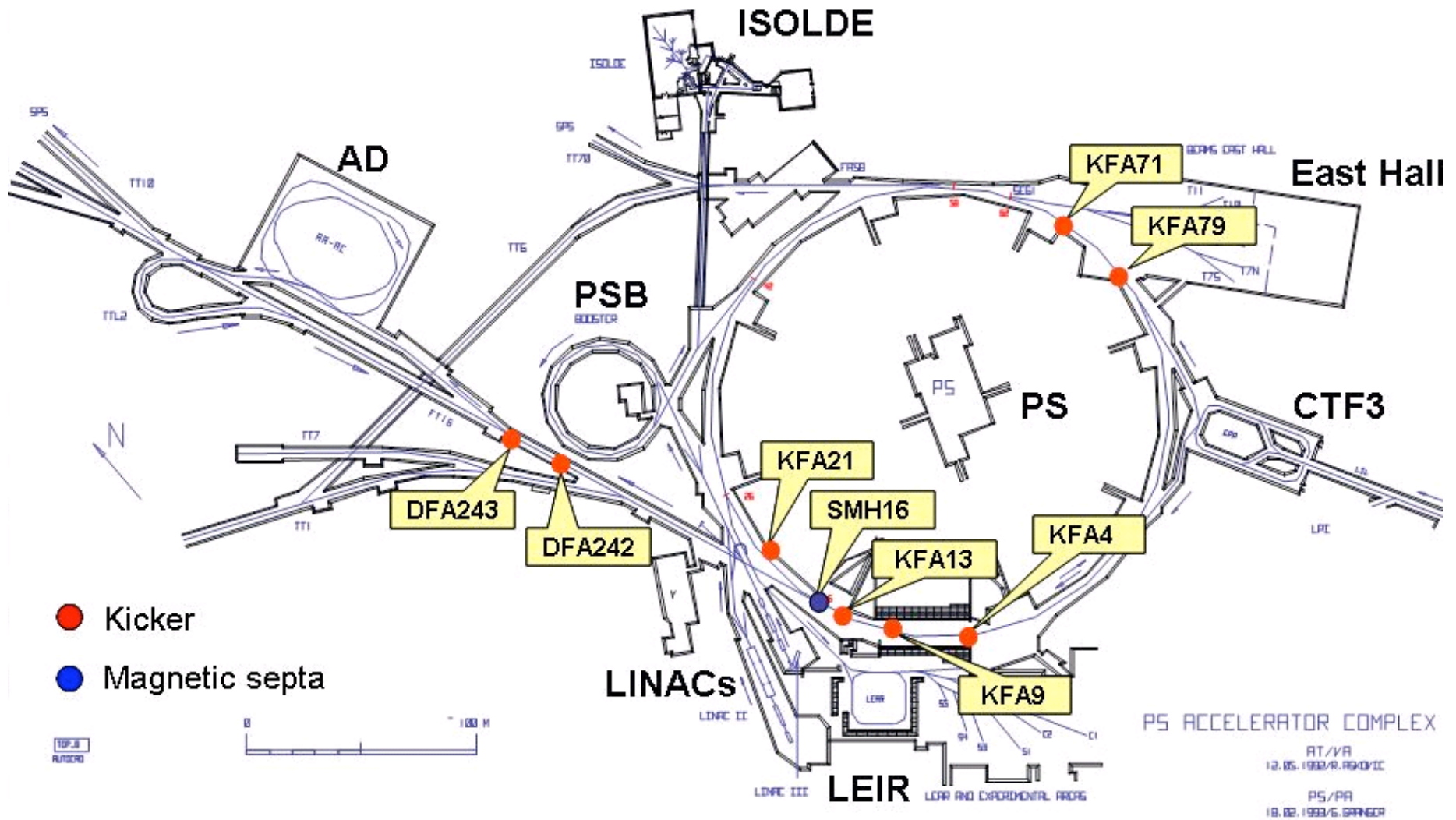


Islands in TT2 without the central core to better distinguish the islands.

Large profiles also due to optics still not matched.

KICKER status

Kickers available since the last 2 weeks. Teething problems with the thyristors, it should have been solved last Friday. Kicker calibration done. Kick strength corresponding to design values



Summary of activities

Activity	bp	Beam@PSB	Tot. Int.	Bnchs	Exp. Status	Eventual issues	Comments
References of pencil beam	2	Pencil	1.00E+12	2	ongoing	time available	
Non-linear chrom nominal working point	2	Pencil	1.00E+12	2	Done	Slow radial loop, 50 ms to go to 20 mm	Done with no low energy quad +-20 mm max
Check OMT XMT by Q' meas	2	Pencil	1.00E+12	2	Done	OMT with wrong polarity, one too weak	With no low energy quad, r= +-20 mm max. +100 A, +50 A OMT, 250 XMT
OMT XMT Q' meas	2	Pencil	1.00E+12	2	ongoing	OMT with wrong polarity, one too weak	With no low energy quad, r= +-20 mm max. +100 A, +50 A OMT, 250 XMT
Bump16 detuning	2	Pencil	1.00E+12	2	Done	Oasis not available to check synchronism	none
Bump16 detuning compensation	2	Pencil	1.00E+12	2	Done	Low energy quad large with time spread	Low quads max dI/dt about 2A/ms
Matrix of low energy quadrupoles	2	Pencil	1.00E+12	2	Done	Some of the quad. Not pulsing correctly	Scan with 0 +-1 A +-2 A. Done twice because of pb low energy quads.
Capture pencil	2	Pencil	1.00E+12	2	Done	none	
References of large emittance beam	2	TOF	3.00E+12	1	ongoing		bad vertical profile, longitudinal to check
Capture TOF	2	TOF	3.00E+12	1	Done	losses at c800. No program for W.P.	
Capture TOF optimisation	2	TOF	3.00E+12	1	ongoing	No program for W.P.. No CODD	
Slow Bump16 calibration	2	Pencil	1.00E+12	2	done	CODD not working. No bump18	
Fast bump calibration	2	Pencil	1.00E+12	2	done	KICKER ready in July	
1 basic period preparation	1	h1-h2		1--8	ongoing	Archives at PSB, risk lose pencil. No W.P.	Cycle preparation with low intensity CNGS or SFTPRO. h8-h16-h420?
1 basic period capture	1	h1-h2		1--8	not done		
1 basic period extraction study, no capture	1	Pencil	1.00E+12	2	not done		Injection of h1 pencil on h2 prepared cycle?
Capture - extraction	1	CNGS		1--8	not done		
TT2-TT10 optics study	1	Pencil	1.00E+12	2	not done		First TT2, then TT10. ERDs not yet used this year
Injection in SPS	1	CNGS		1--8	not done		

Done
Ongoing
Critical
To be done

Not Done means not done yet because scheduled later in the commissioning

Eventual issues during the commissioning

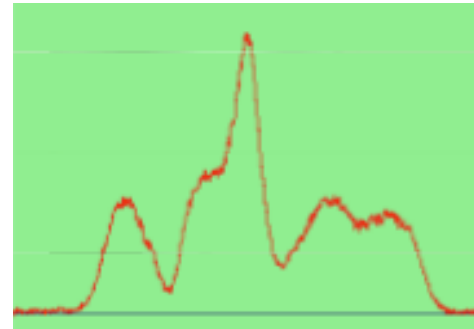
- **Working point has to be precisely tuned**, both for the tune variation vs time for the capture, as for the non-linear chromaticity:
 - **5 current matrices needed**
 - program to control the working point
- **Particular care to the longitudinal structure:**
 - degraded longitudinal structure can spoil the capture (coupling longitudinal plane with transverse plane via chromaticity)
- **Noise on the power converters** can spoil completely the capture
- **Availability of the Fast-Wire Scanners**, only instrument to monitor the capture process
- **Noise on the PS main power supply**

$$\frac{\Delta Q}{Q} = \xi \frac{\delta p}{p}$$

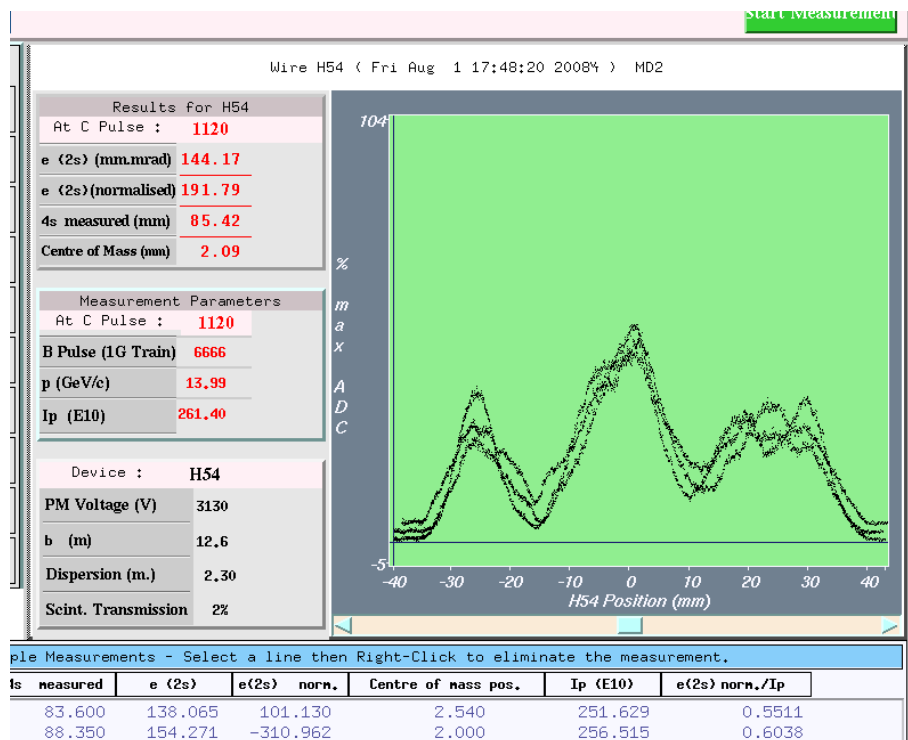
PFW, F8L, MTE-XCT, MTE-OCT, Low-energy quadrupoles should be stable all along the capture process ~ 100 ms (Similar to slow extraction issue during 2007 run)

An eventual noise can destroy completely the island structure

Normal capture



Observed instability on the capture



Instability observed during capture on the 2bp.
Looks much better on the 1 bp.
Losses at extraction comes from particles between the islands.

Possible sources:

Longitudinal structure:

first check done, Hereward dumping found not correctly set.

Non-linear elements PS: nothing found
PFW+F8L: to be checked this week

1 bp preparation

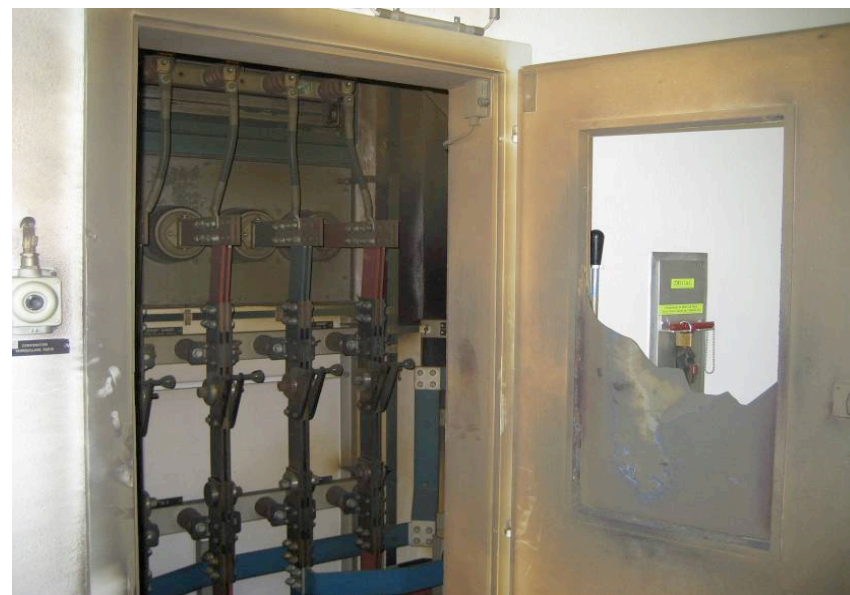
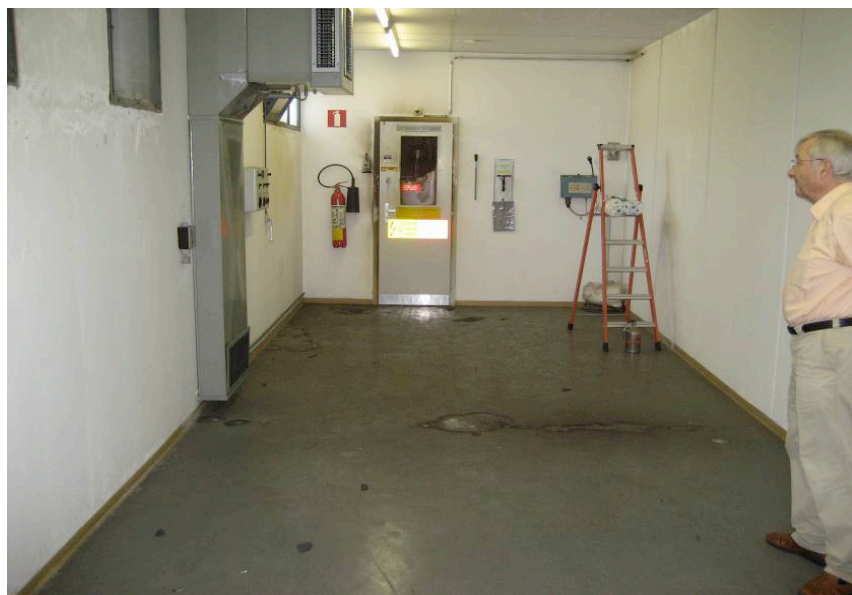
- Preparation of the operational 1bp – CNGS/SFTPRO like ongoing:
 - Capture with the same efficiency as the 2bp already achieved.
 - **Extraction set but to be tuned. Not possible last week due to instability of the kickers.**
 - **Extraction tests this week.**
- Longitudinal plane preparation:
 - Unfortunately due to the different delays in the run, priority of RF colleagues are overlapping.
So far only normal h8 not synchronised with large $dp/p \sim 2e10^{-3}$
 - MD on bunched CT extraction was cancelled due to PSB instability and OASIS problems. The CT extraction spill, for the unbunched case, could be properly tuned thanks to the bunched beam tuning. This reduced significantly the losses in the SPS.

Conclusion and short term program

- **MTE commissioning results:**
 - 19% stable loss-less capture achieved regularly.
 - **Extraction done on five turn “a la MTE” on 2 bp cycle**
- **Program for next weeks (short term):**
 - **Extraction on 1bp cycle**
 - **TT2 study**
 - **TT10-SPS matching/injection (to be discussed with SPS-Elias to schedule it)**
 - **Bunched CT extraction**
- **Main issues encountered so far, none of them MTE-specific but common to normal operation:**
 - **CODD availability**
 - **Application for working-point control still in development**
 - **PS and PSB down time**
 - **Control system**

Fire on 358 – 26/07/08

- 22H43: CCC did three re-start of the MPS before a fire alarm arrived in bat 358
- Fireman broke “arret d’urgence” which stopped the rotating machine
- The smoke came from the little room “sectionneur aimant” which is in “batiment filtre”
- Hopefully no fire turned on, only smoke



29-07-2008

JP. BURNET

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Spark gap on DC output circuit

- One bus bars is connected to the top coils of the PS magnets
- The others one is connected to the bottom coils of the PS magnets
- Each circuit is powered by a thyristor rectifier “Station B – Station C”
- A spark gap was placed between the + and – of each circuit
- In case of overvoltage, the spark gap turns on to protect the magnet (short-circuit of the DC output)
- The spark gap is a 10 kV spark gap

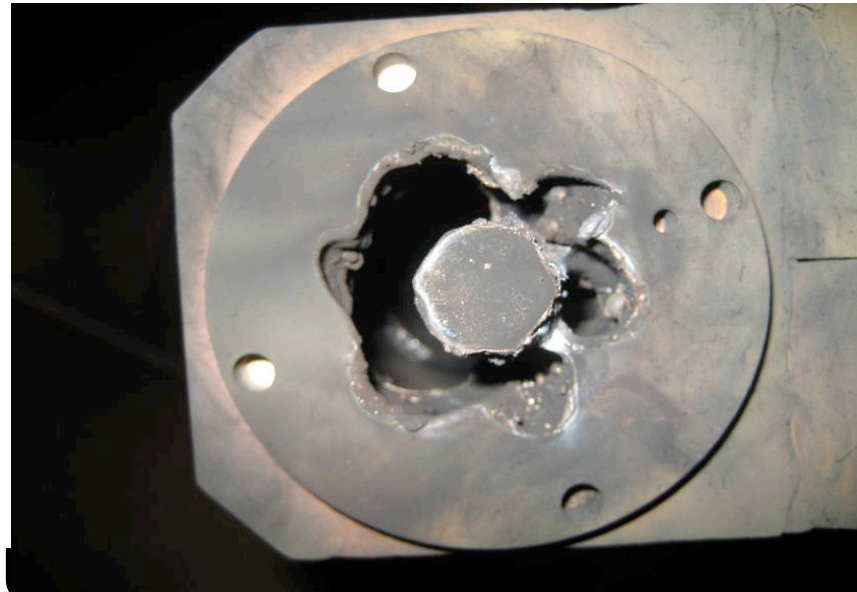
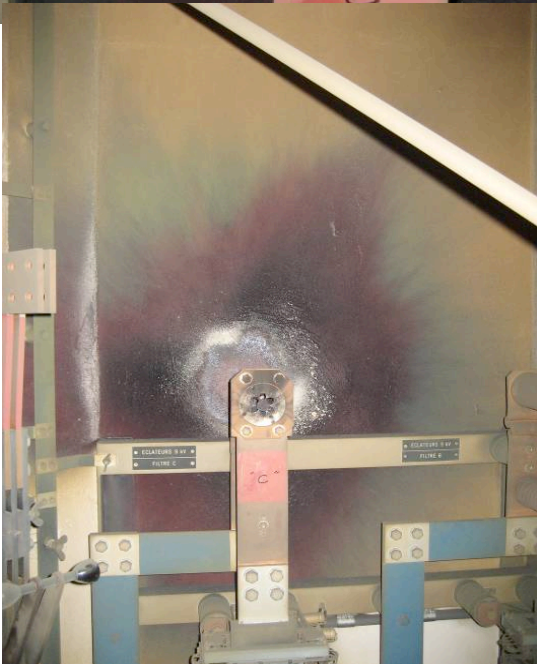


Busbar aimant



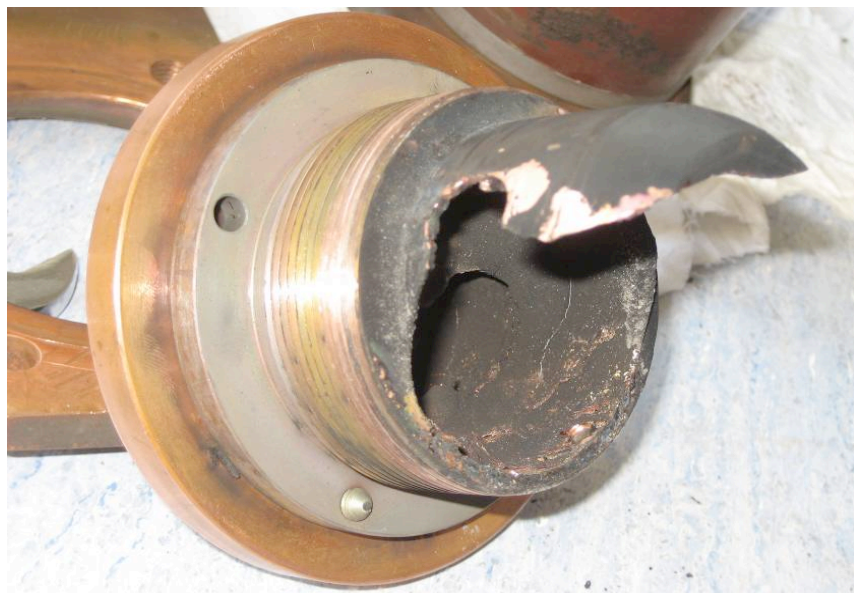
Spark gap

Spark gap ignition



JP. B...

Spark gap ignition



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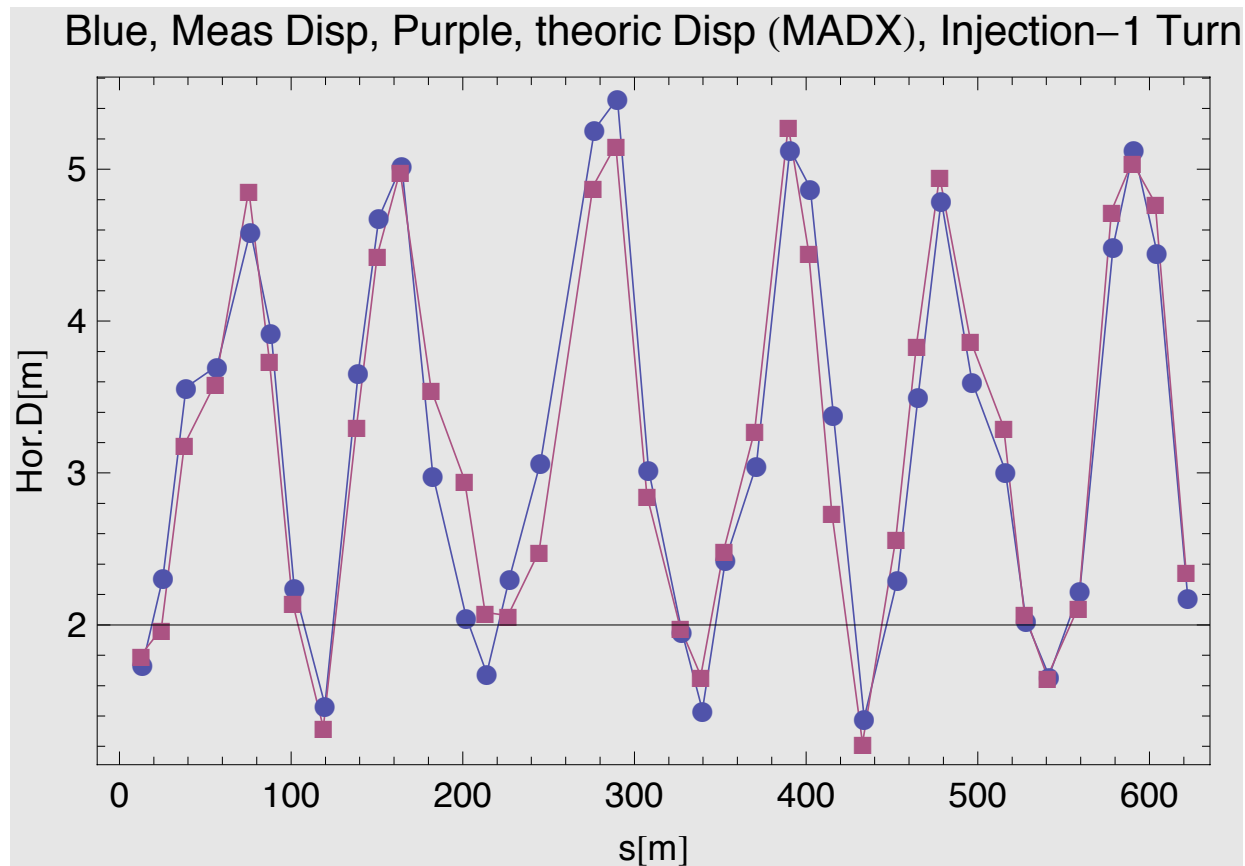
Fire last Friday

Oil leak due to failed bearing on the shaft of the main ventilation fan



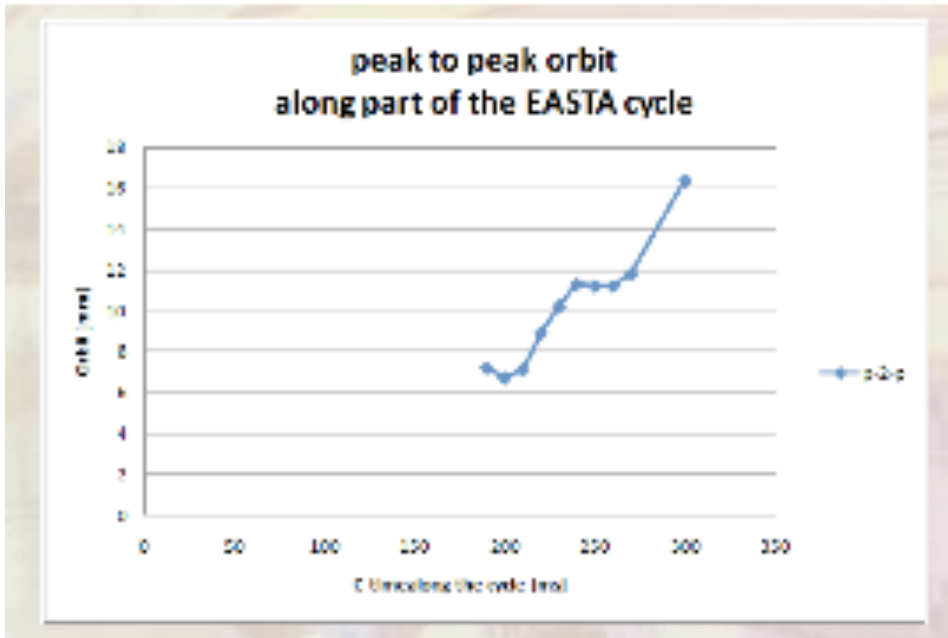
About the codd and dispersion discussion...

Preliminary from Sandra: dispersion measured at 1st turn agrees well with the MADX computed one.

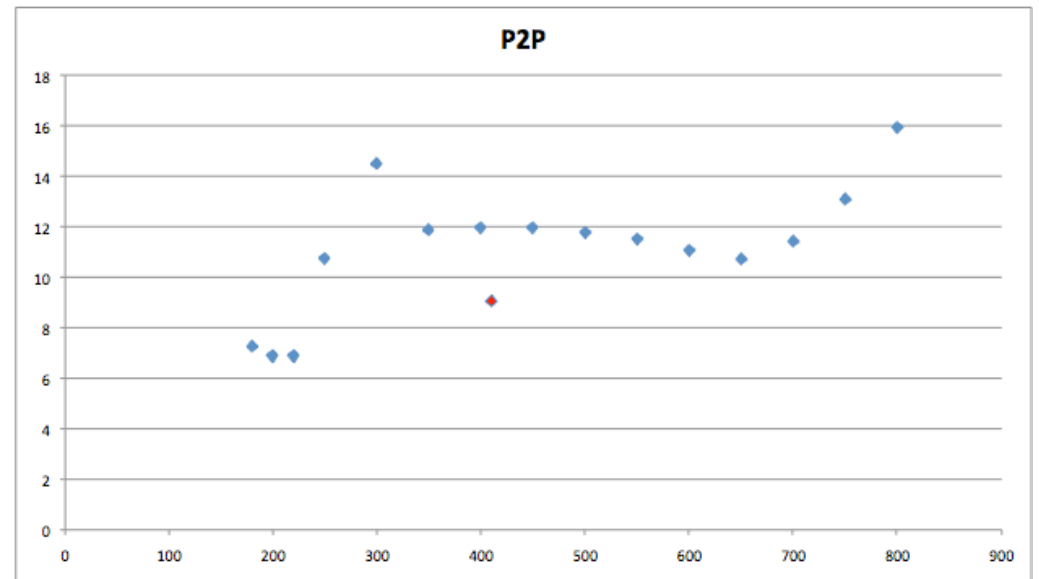


CODD status ...

For Rende – APC 4/07/08



Horizontal orbit compatible with the orbit measured before the changing of MU25.

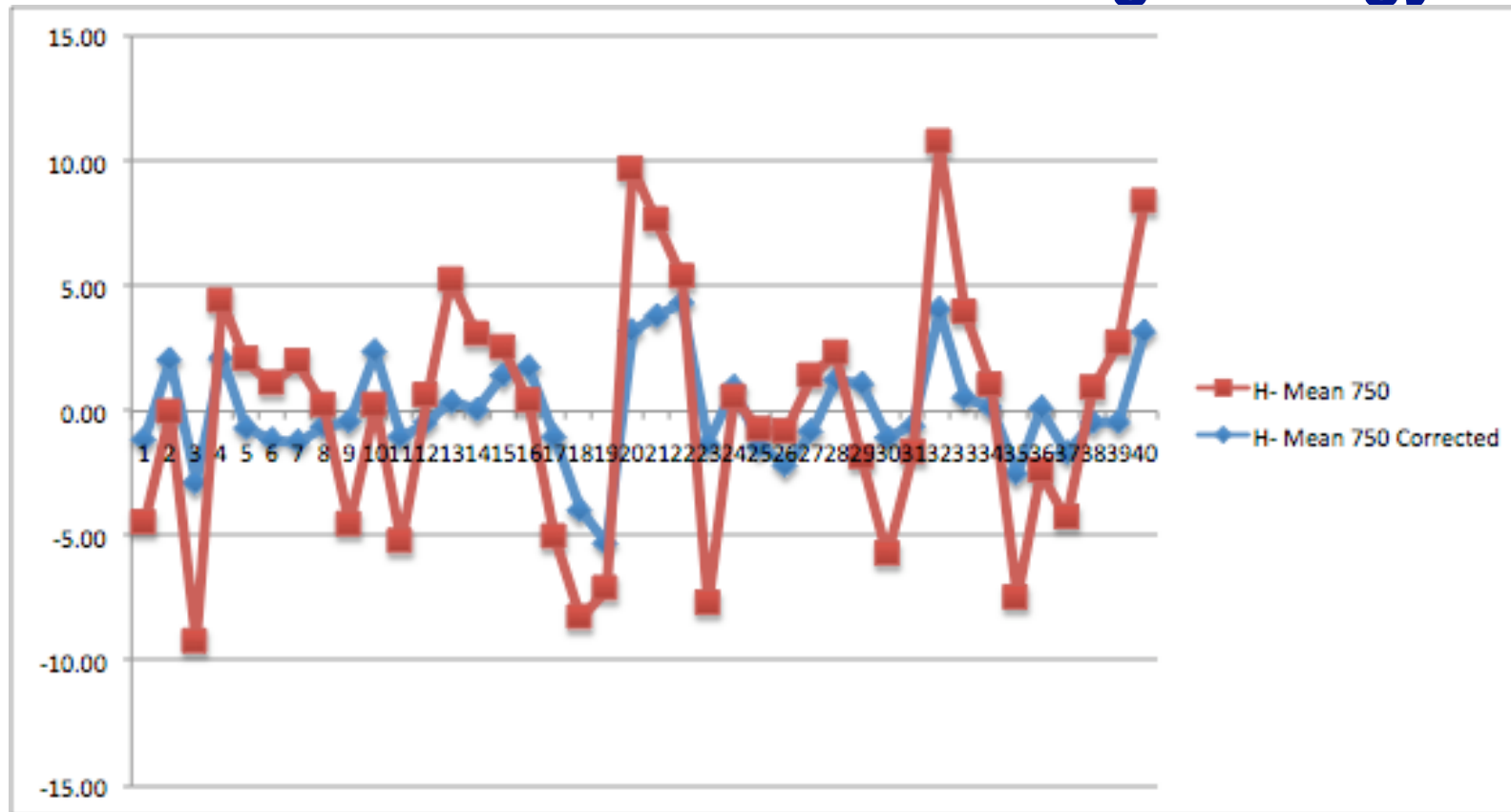


Low energy: good orbit, probably correction for magnet errors like bad alignments.

Acceleration: dynamical magnetic errors corrected less efficiently.

High energy: magnet saturation corrected with DHZ15-60

Correction with DHZ15-60 for high energy



Data for correcting the orbit at 10 GeV are available but PSSs decided not to do the correction since all the problems encountered so far with the PS.

No time to compute the magnets yet. Anyhow the factor limiting the intensity is the beam loading on cavity 36 causing large losses independent on the aperture. Limit for the CNGS is 2.82×10^{13} ppp. (I am not going to discuss it, people are working on it)

Correctors vs energy

Before changing MU25.

c Time	DHZ Cor.1	DHZ Cor.2
c210	25	91
c230	25	61
c250	25	61
c270	25	43
c290	25	43
c310	25	1
c330	25	43
c350	25	1
c370	17	43
c390	17	93
c410	17	93
c430	9	93
c450	9	35
c470	9	35
c490	9	25
c510	9	35
c530	17	35
c550	9	1
c570	9	25
c590	25	1
c610	25	9
c630	25	1
c650	25	9
c670	25	9
c690	25	9
c710	25	9
c730	25	9
c750	25	41
c770	25	41
c790	25	41
c810	25	41
c830	25	57
c850	25	57

After changing MU25.

Time	Correctors	Correctors	Correctors
180	15	75	43
200	25	75	91
220	25	63	47
250	17	35	25
400	9	43	25
450	9	63	25
500	9	73	25
550	9	81	25
600	9	57	41
650	17	57	41
700	25	57	15

MU25 still present in the corrector list.