Configuration and detailed schedule for the proton reference run

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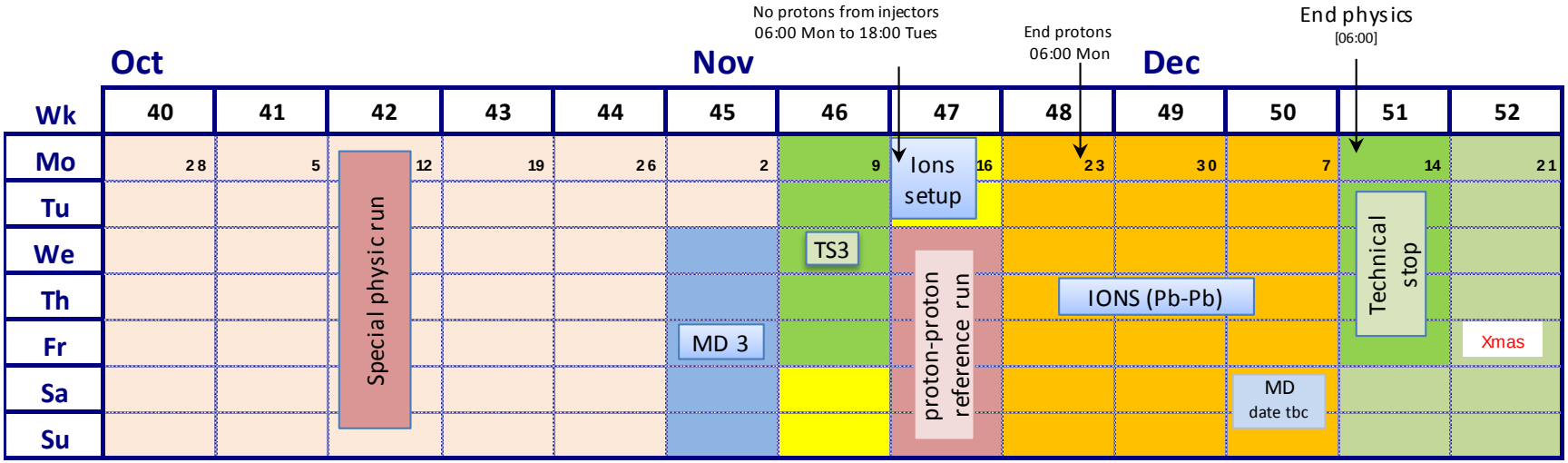
Introduction

- The pp reference (for ions) run must be made at **2.51 TeV** to match the 6.37 TeV ion run
- The experiments would like to accumulate 20-40 pb^{-1} in the little available time (the first week of ions, between Tuesday evening and the end of the week)
  - **Many bunches** – using the 25 ns beam seems the logical choice, number of bunches ~1600 not to over-stress cryo
  - **Squeeze** – combined Ramp&Squeeze worked smoothly in MD1 we propose to use it and squeeze by a factor 2 (if β^* is not too low, optics correction should not be an issue)

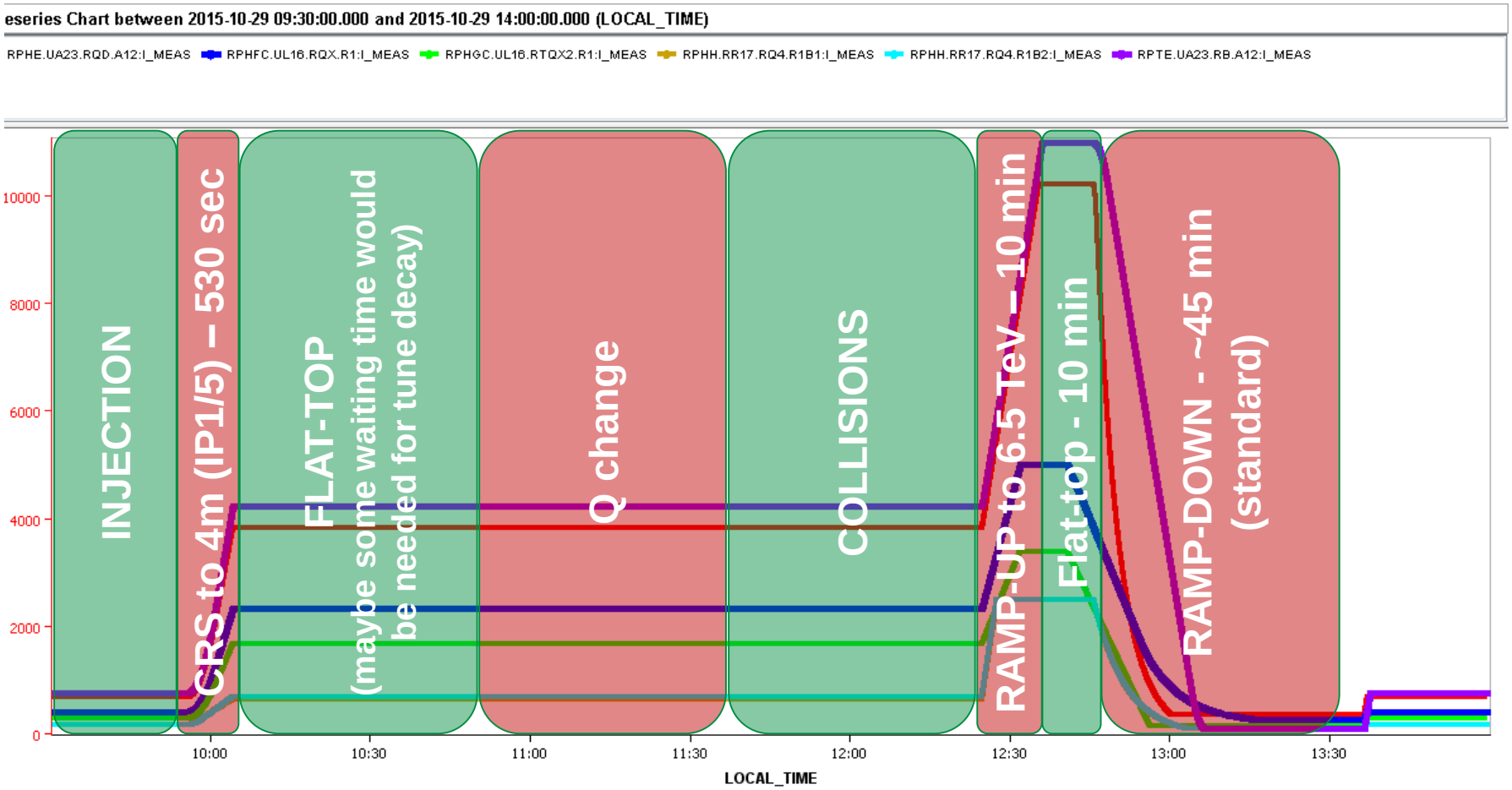


Needs

- All **settings** to be defined - PC, RF, ADT, COLL:
  - **Combined Ramp&Squeeze** (squeeze between 1 TeV and 2.45 TeV)
  - **Spool ramp** (no RCS.A78B2), with dedicated b3 decay compensation at flat-top (linear scaling used, as guess)
  - **Tune change & Collisions** beam processes
  - **Ramp-down** (dedicated to ensure magnetic compensation of dynamic effects, thus avoiding re-calibration of FiDel)
  - Truncated **copy of corrections** for the whole cycle
- Dedicated **sequence**

Matched Pt	Time (s)	IR1/5	IR2	IR8	Name	Energy
1	0	11.00	10.00	10.00	R2015a_A11mC11mA10mL10m_INJ	450
2	60	11.00	10.00	10.00	R2015a_A11mC11mA10mL10m_INJ	500
3	120	11.00	10.00	10.00	R2015a_A11mC11mA10mL10m_INJ	600
4	200	11.00	10.00	10.00	R2015a_A11mC11mA10mL10m_INJ	1000
5	290	**9.00**	10.00	**9.00**	R2015a_A900C900A10m_0.00950L900_0.00934	1200
6	380	**7.00**	10.00	**8.00**	R2015a_A700C700A10m_0.00950L800_0.00919	1300
7	500	**4.00**	10.00	**7.00**	R2015a_A400C400A10m_0.00950L700_0.00906	2450
8	530	**4.00**	**10.00**	**7.00**	R2015a_A400C400A10m_0.00950L700_0.00906	2510

2.51 TeV cycle

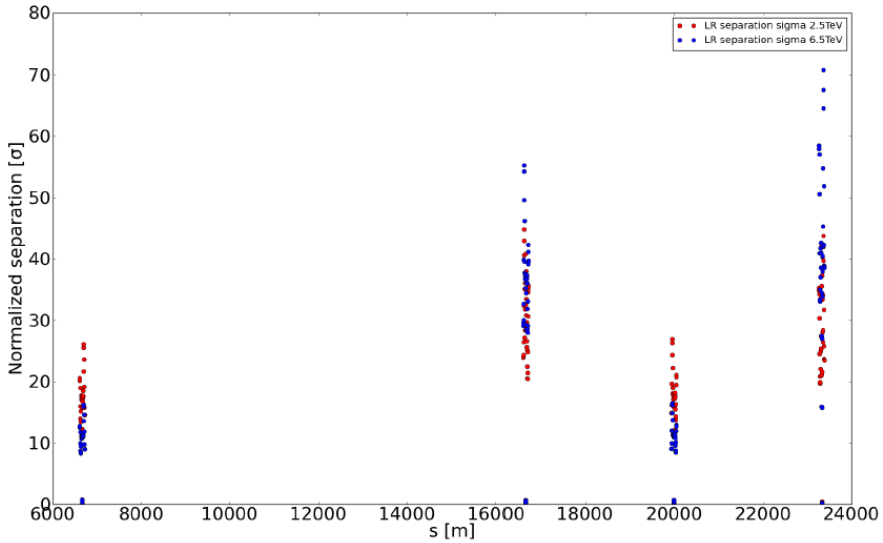


Length of cycle phases does not reflect reality

(logged data from first commissioning phase)

Parameters

Long Range separations in collision



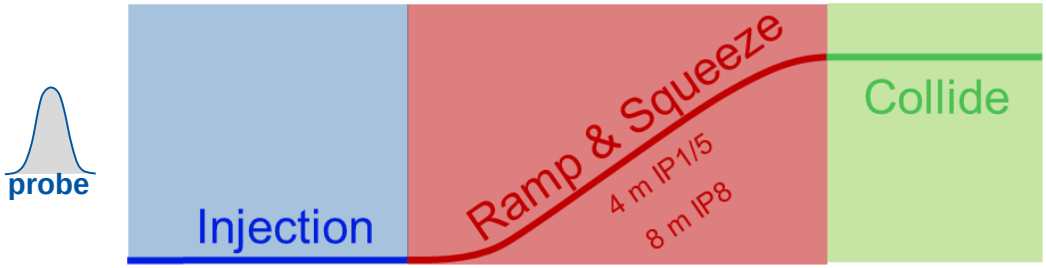
Courtesy of T.Pieloni

At IP1&5 separations are larger than in normal operation and these two Ips are the main contributors

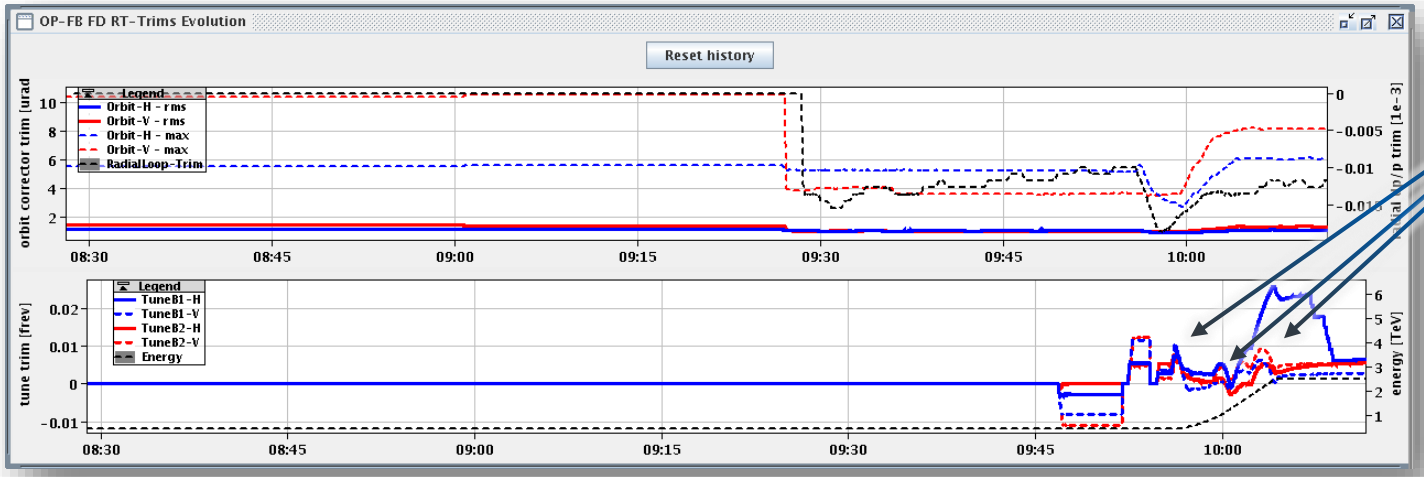
IP2 & 8 have reduced separations all above 20 σ

Parameter	Value
Separation	**2 mm** (all IPs)
Crossing angle	**170 urad** (1/2 Xing, all IPs) If aperture needed, it can be reduced to **140 urad** (in IR1 and IR5)

Commissioning with pilot

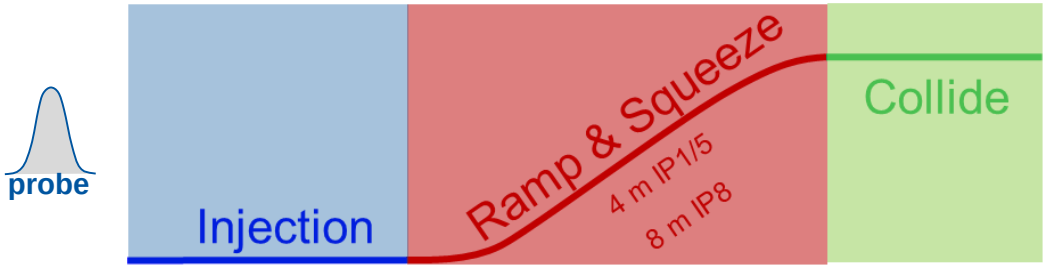


- **Injected 1 pilot/beam**
- Ramped&Squeezed:
  - Few **setting mismatches** found and fixed
  - Typical **Q variations** between matched points (large (~2x10^{-2}) for QHB1 between 9 m and 4 m, already observed during CRS MD)



Typical signature of optics change

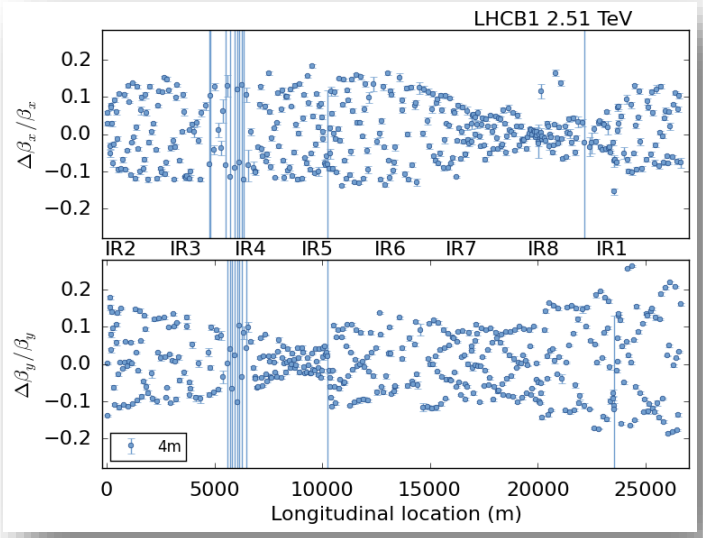
Commissioning with pilot…continued



- **Coupling** measured and corrected
- **Q‘** measured (~1.5 unit not-compensated decay observed)
- **Orbit** cleaning done
- **Optics** measured
- **Q change** done
- Beams brought to **collisions**
- **Q’** measured (nothing abnormal observed)
- **Ramp-down** tested
- **Q’ decay @injection** (after special ramp-down) checked - well compensated (powering history dependency excluded from the model)

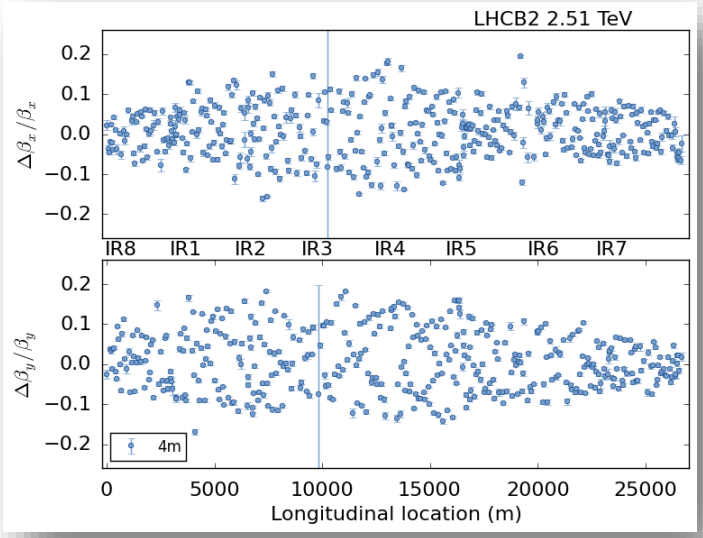
Orbit, Q, Q’ and coupling fed-forwarded offline

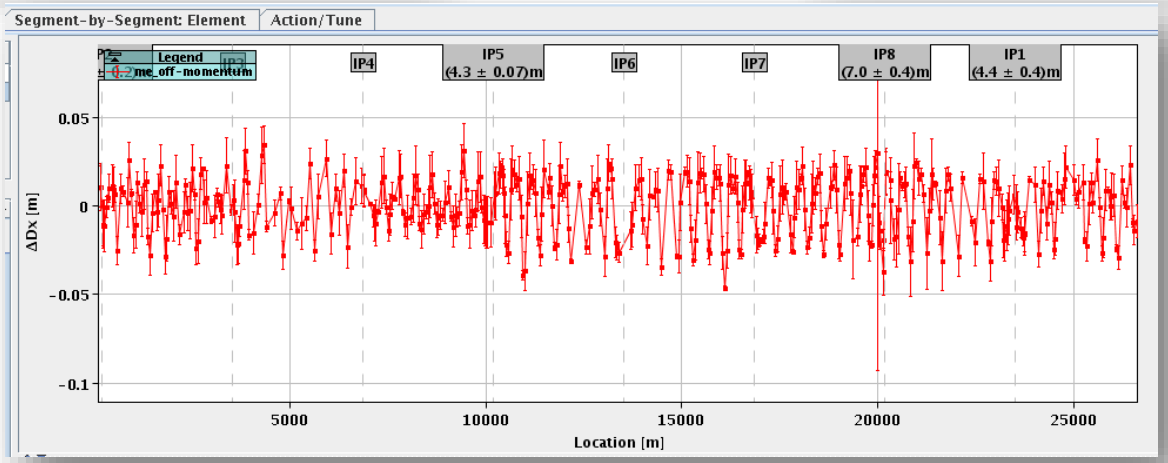
Optics @4m (2.51 TeV)



β-beating below 20%

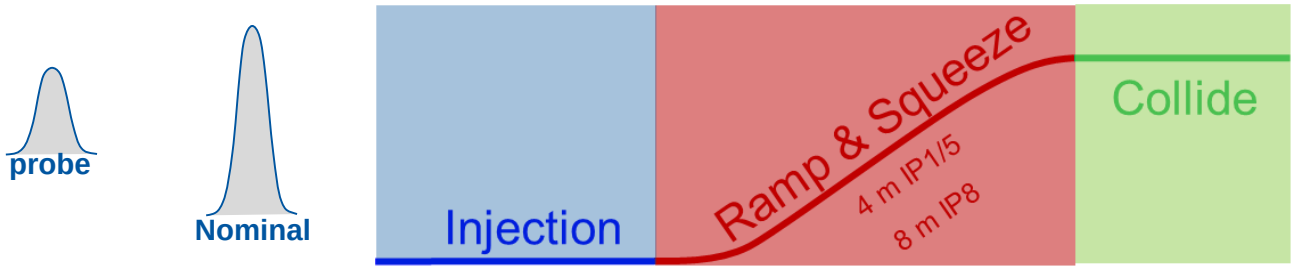
Corrections calculated and available if requested





Courtesy of the optics team

Remaining commissioning breakdown



Nominal cycle

- Cycle with nominal bunches
- Orbit cleaning
- Q & Q' decay (re)meas @FT
- Collimators alignment:
  - @FT:
    - TCTs alignment
    - IP7 and IP6 check
  - @COLL:TCT alignment

Probe cycle (if time left)

- High Q' settings meas all along the cycle

Loss Maps

	@FT	@Coll
Betatron (H&V)	Y	Y
Off-p (+&-)	Y	Y
Asyncronous dump	Y	Y

Intensity ramp-up

(1 fill/step), proposal:

- 50 bunches
- 500 bunches
- 1600 bunches

Tentative planning

SHIFT	Cycle n#	ACTIVITY	TIME REQUIRED
Sometimes in the week-end (Sat N / Sun M)	1/2	**COLL alignment** @FT & @COLL	6 hours
		If time left, cycle with pilot for high **Q' settings check**	2 hours
Tuesday N (switch back to p around 6pm)	3	**All LMs @COLL** + Ramp-down	8 hours
Wednesday M	4	**All LMs @FT** + Ramp-down	8 hours
Wednesday A	5	**Physics fill** with 50 bunches	5 hours
Wednesday N	6	**Physics fill** with 500 bunches	8 hours
Thursday to Sunday	8…	**Physics fill** with ~1600 bunches	

Each LM fill has one entire shift allocated to account for contingencies

Conclusions

- **First part of the 2.51 TeV commissioning is done, nothing unexpected found**
- **1 cycle with nominal bunches is needed to complete commissioning and align collimators + 2 cycles for loss maps**
- **About 3 cycles needed for intensity ramp-up**
- **Unless objections from the experiments 25 ns would be preferred over 50 ns (well established operational conditions)**