

# LHC Injectors Upgrade





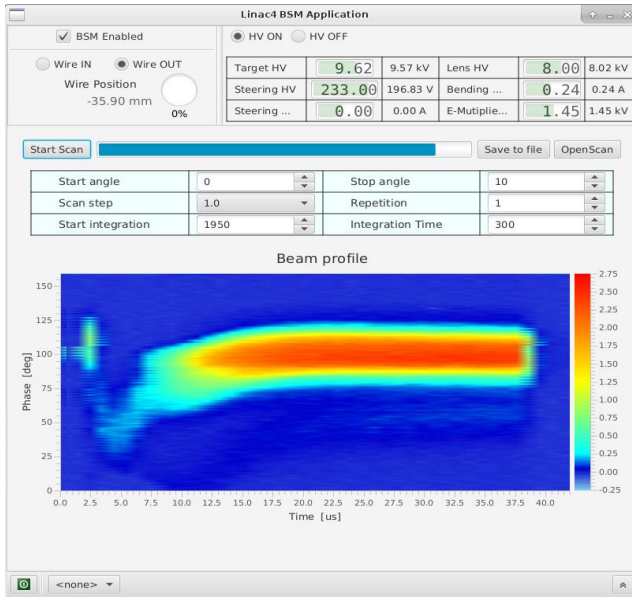
## LHC Injectors Upgrade



# PSB and Linac 4 Applications Development during LS2



# Longitudinal Emittance Application

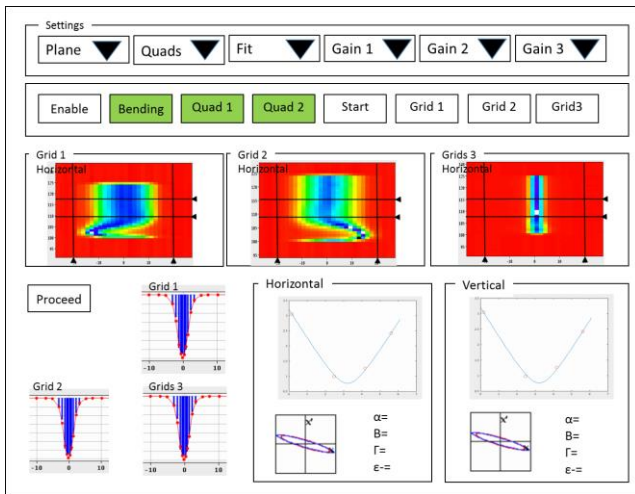


Operational BSM application

- BSM operational application available. Used to measure bunch shape.
- Energy spread will be computed with a new offline application.
- Operational application will be used to take the measurements, varying amplitude of debuncher for BSM2 and another cavity for BSM1.
- **BE/ABP should provide the reconstruction algorithm.**
- **Ready June 2019. (Y. Wu – 2 Months)**



# Transverse Emittance Application

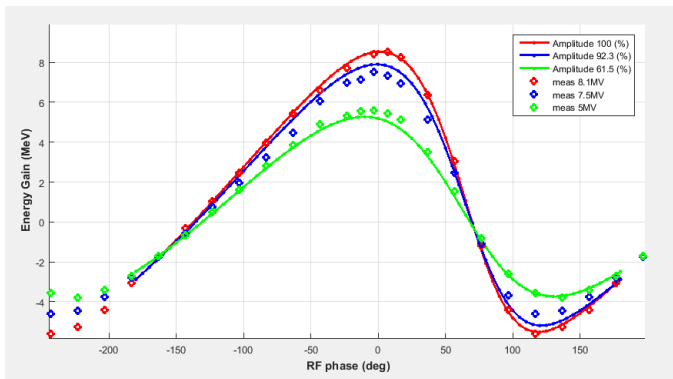


Sketch of future application

- Emittance measurement with 4 grids/WS in L4Z and 3 in LBE.
- Reconstruction algorithm with drifts.
- Fully automatic with grids.
- Semi-automatic with wire scanners (Each measurement started individually).
- Available this autumn for L4Z with wire scanners.
- June 2019 for LBE with grids and WS. (T. Bukovics / JF Comblin – 3 Months)

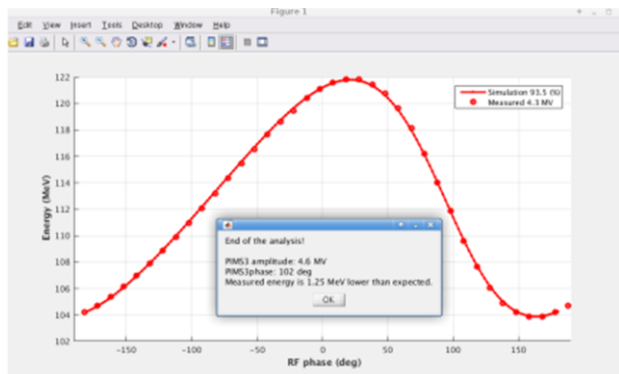


# Energy Measurement With Beam Loading



Energy gain from beam loading vs phase

- Fast method to tune the LN4 RF cavities.
- Script (python) to scan the phase and calculate the energy from beam loading written by ABP
- Offline analysis to fit data and find phase.
- Automated procedure with an application will be developed.
- Ready June 2019. (A. Akroh – 1 Month)





# Time of Flight



TOF Application

- More precise method to tune the RF cavities.
- Available and commissioned.
- Automation with simulation plots will be implemented during LS2 to speed up the measurements.
- Ready June 2019. (A. Akroh – 1 Month)



# Cruise Control

Cruise Control v2.0.7 on LN4.USER.MD1 (on cwo-ccc-b11c)

BCT	RING 4	RING 3	RING 2	RING 1	CURRENT
L4L.BCT.1213	0.91 E10	1.23 E10	0.23 E10	-0.54 E10	0.02 n
L4L.BCT.3113	3.29 E10	2.79 E10	1.57 E10	0.98 E10	0.07 n
L4L.BCT.4013	-0.29 E10	-0.06 E10	0.37 E10	0.51 E10	0.00 n
L4C.BCT.0117	-0.06 E10	-0.02 E10	0.33 E10	0.53 E10	0.01 n
L4P.BCT.0117	-0.06 E10	-0.06 E10	0.08 E10	0.22 E10	0.00 n
L4T.BCT.0107	0.08 E10	0.17 E10	0.11 E10	0.11 E10	0.00 n
L4Z.BCT.0273	-0.01 E10	0.03 E10	0.79 E10	1.14 E10	0.02 n
L4T.BCT.0673	0.05 E10	0.24 E10	0.00 E10	0.10 E10	0.00 n
L4T.BCT.1043	-0.13 E10	-0.12 E10	-0.15 E10	0.13 E10	-0.00 n

Control parameters:

- # turns [us]: 50
- Chopper OFF [ns]: 150000
- Chopper ON [ns]: 275
- WDOG L4L: 0/20
- WDOG DUMP: 0/20
- WDOG L4T: 20/20
- HEAD: 274000000
- TAIL: 0
- init: 274900000, 274850000, 275648000, 277090000

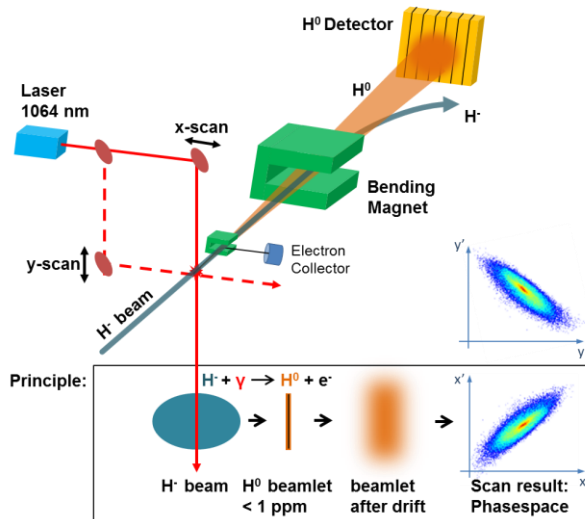
cpsop

Cruise Control Application

- Used to control injection, intensity and chopping away of beam head. Display transmission.
- Ready and commissioned.
- More complex chopping patterns to be added + PSB injection specific controls.
- Specs for longitudinal painting needed (BE/RF).
- Ready end of LS2 (A. Akroh – 2 Months)



# Laser Emittance Measurement



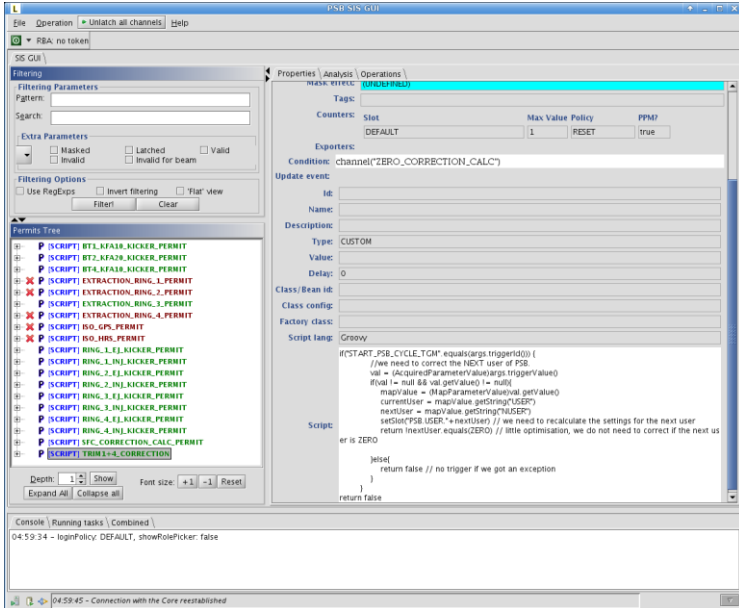
Thomas Hofmann

- System developed (outside OP) with Labview.
- Tests planned end of 2018 with specialist application.
- Awaiting test results to write specifications for operational application (OP & BI).
- Ready end of LS2, if FESA class available. (V. Barbet – 1.5 Months)





# Software Interlock System



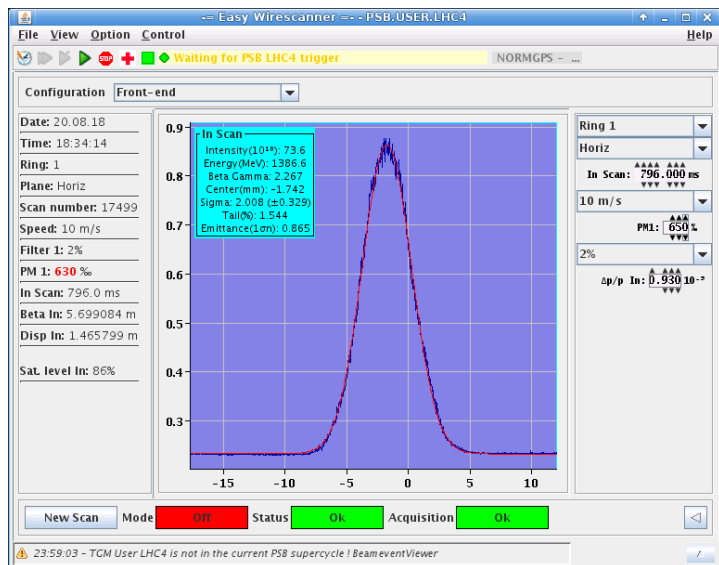
PSB SIS GUI

- No new system developed.
- List of tasks well defined.
- Update of current scripts (PSB + LN4)
- New ones needed:
  - Source oven temperature monitoring.
  - H0/H- monitoring to detect stripping foil breakage.
- Linac 4 scripts needed for June 2019.
- PSB script end of LS2. (T. Bukovics / M. Gabriel – 2 Months)



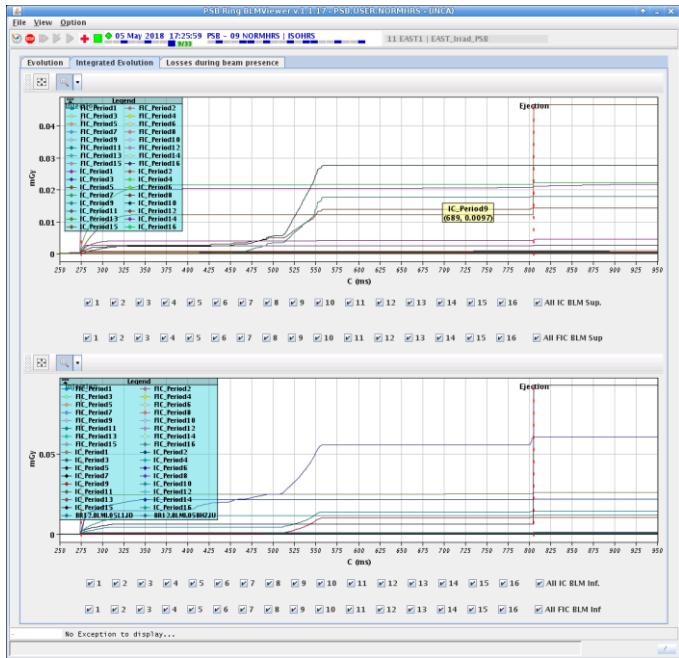


# New wire scanners



Actual PSB+PS WS app.

- Same application for PSB and PS.
- Current application to maintain.
- Same functionality +
  - Bunch-by-bunch capability.
  - Better integration of Logging.
- Automatic measurements for LHC beam quality tracking.
- Deconvolution with Tomoscope.
- Available end of LS2. (JF Comblin – 1.5 Months)



Actual PSB BLM application

- Update of the PSB BLM fix display, ejection/recombination survey and ring applications.
- New application for Linac 4 and PSB injection BLMs.
- Update of the working-set.
- Ready end of LS2. (Y. Wu – 2 Months)



# Matching Monitor in Ring3

- Standard grid.
- Used for matching and emittance measurement in complement of the LBE line.
- New application re-using part of Linac 4 Semgrid application and matching libraries.
- Available end of LS2. (JF Comblin – 0.5 Month)

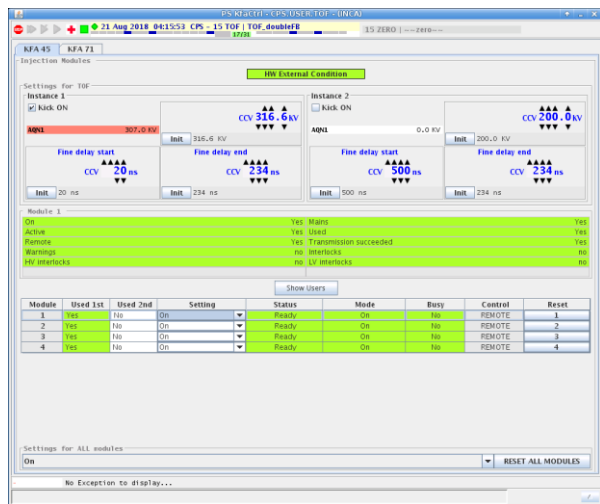


# H0/H- monitor

- Display of H0/H- signal for the 4 rings over a variable period of time.
- Display thresholds for degraded performance and stripping foil failure.
- Useful for:
  - Injection set-up.
  - Monitor stripping efficiency.
  - Detect foil degradation or failure.
- Available end of LS2. (T. Bukovics – 1 Month)



# New extraction kicker control

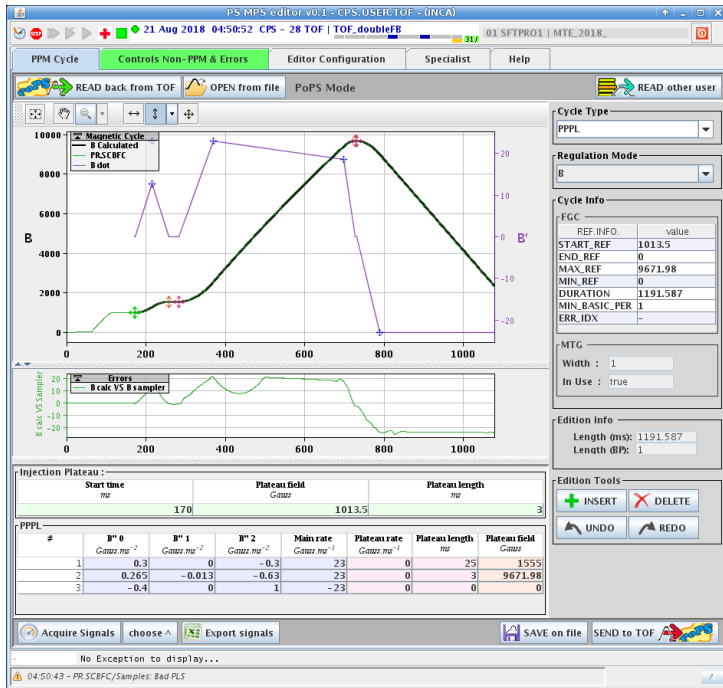


PS KFA45 Control

- Same renovation as the one made for the PS.
- Application needed because knobs can't be used.
- PS application re-used or taken as model.
- Available end of LS2. (A. Akroh – 0.5 Month)



# POPS-B + Tune Control



PS MPS Editor

- Control of current MPS to be maintained.
- New POPS-B tested in December.
- Study feasibility of using LSA + makerules.
- Or new application to be written with PS MPS Editor as model.
- Available end of LS2. (V. Barbet / JF Comblin / JM Nonglaton – 2 + 3 Months)

# Miscellaneous

- Review and update of logging for Linac4, PSB and transfer lines. (Y. Wu – 1 Months)
- YASP reconfiguration. (JF Comblin – 0.5 Month)
- Requests from Settings Management WG during Workshop in October. (JF Comblin / A. Akroh)
- Knobs and working-set configuration. (JF Comblin / A. Akroh)
- Update of all existing applications. (All – 4 x 1 Month)
  
- End of LS2.





# Summary

Application	Delivery Date	Responsible	Estimated Time
LN4 Longitudinal Emittance	June 2019	Y. Wu	2 Months
LN4 Transverse Emittance.	June 2019	T. Bukovics / JF Comblin	3 Months
Time of Flight	June 2019	A. Akroh	1 Month
Energy Meas. with Beam Loading	June 2019	A. Akroh	1 Month
Cruise Control	End of LS2	A. Akroh	2 Months
Laser Emittance Measurement	End of LS2	V. Barbet	1.5 Months
S.I.S.	June 2019 for LN4, End of LS2 for PSB	T. Bukovics / M. Gabriel	2 Months
Wire Scanner Application	End of LS2	JF Comblin	1.5 Month
BLMs	End of LS2	Y. Wu	2.5 Months
Matching Monitor	End of LS2	JF Comblin	0.5 Month
H0/H- Monitor	End of LS2	T. Bukovics	1 Month
Extraction Kickers Control	End of LS2	A. Akroh	0.5 Month
POPS-B Control	End of LS2	V. Barbet / JF Comblin / JM Nonglaton	2 Months
Tune Control	End of LS2	V. Barbet / JF Comblin / JM Nonglaton	3 Months
YASP Configuration	End of LS2	JF Comblin	0.5 Month
Review and Update of Logging	End of LS2	Y. Wu	1 Month
Misc. (Update of app., knobs, W-Sets)	End of LS2	Y. Wu / A. Akroh / JF Comblin / V. Barbet	4 x 1 Month
<b>Total</b>		<b>5 programmers (3 experimented + 2 novices)</b>	<b>~ 2.5 FTE</b>



## Work to complete before LS2

- Longitudinal painting – specifications. (RF)
- Transverse painting – specifications. (ABP)
- POPS-B control – feasibility of using LSA + make rules. (OP+EPC)
- Tune control – feasibility of using LSA + make rules. (OP)
- Energy spread – reconstruction algorithm. (Lin4 sup.)
- Laser Emittance Meas. – operational procedure + doc. (BI)
- Writing missing application specifications. (JF Comblin).