

LHC Injectors Upgrade





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SPS Transverse Oscillation Systems

Thanks to M. Gasior and R. Steinhagen

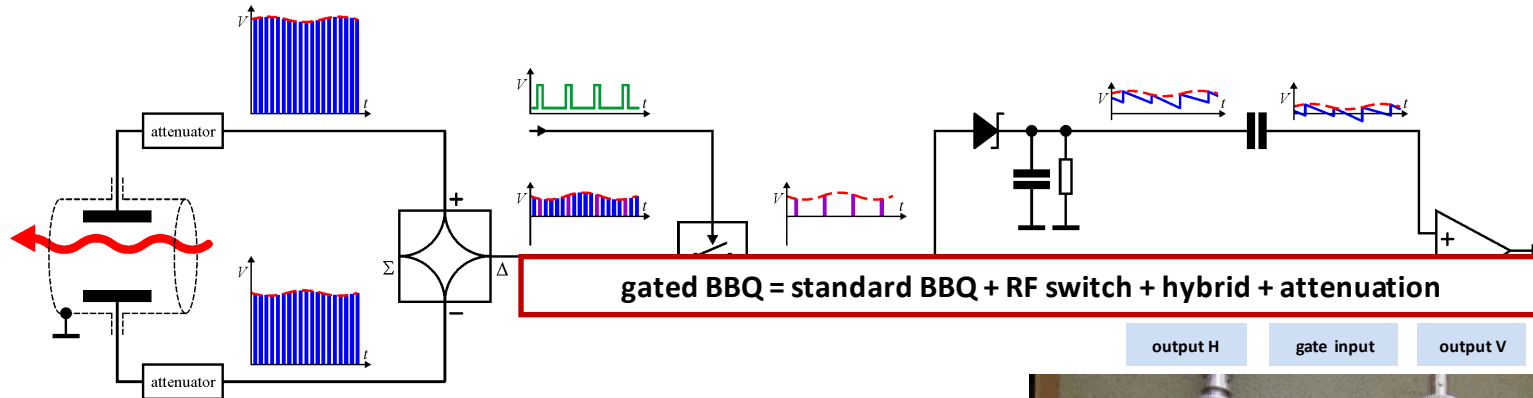


Specifications

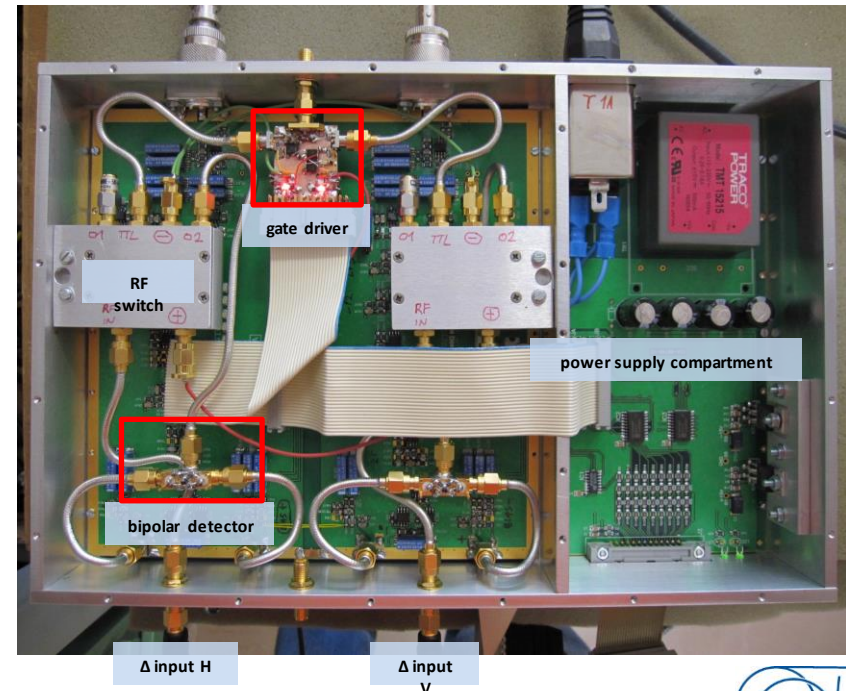
- Tune Measurements (BA2)
 - **Operational standard BBQ system** (not changed) (BA2)
pick-up BPCN209 with optional chirp excitation with DAC signals sent to the transverse damper
 - **Operational "kicked BBQ" system** (BOSC replacement becomes operational):
pick-up BPCR208 and kick excitation synchronised to BBQ acquisition
 - **Operational gated BBQ** (new request):
pick-up BPCN2014.1, Timing from BA2, optional chirp excitation with DAC signals sent to the transverse damper
 - BPCR2014.2 reserved for development (electrode signals can come to BA2, no change)



Proposed Technology



- Not 'bunch by bunch'
 - Gate length from 25ns
- Up to half-revolution period





Status of Development

- On-going - Similar electronic design to LHC system
- Using SPS BST for triggering
- Software required to exploit full functionality of nominal and Gated BBQ – missing GUI's (bunch selection and bunch scans display ...)



Installation and Commissioning Plan

- Cable and pick-up Infrastructures are in place
- Installation of new electronic foreseen by Mid 2014
- Commissioning time to set-up the triggering capabilities and optimise the sensitivity of the device (by how much shall we excite to get reliable signals)

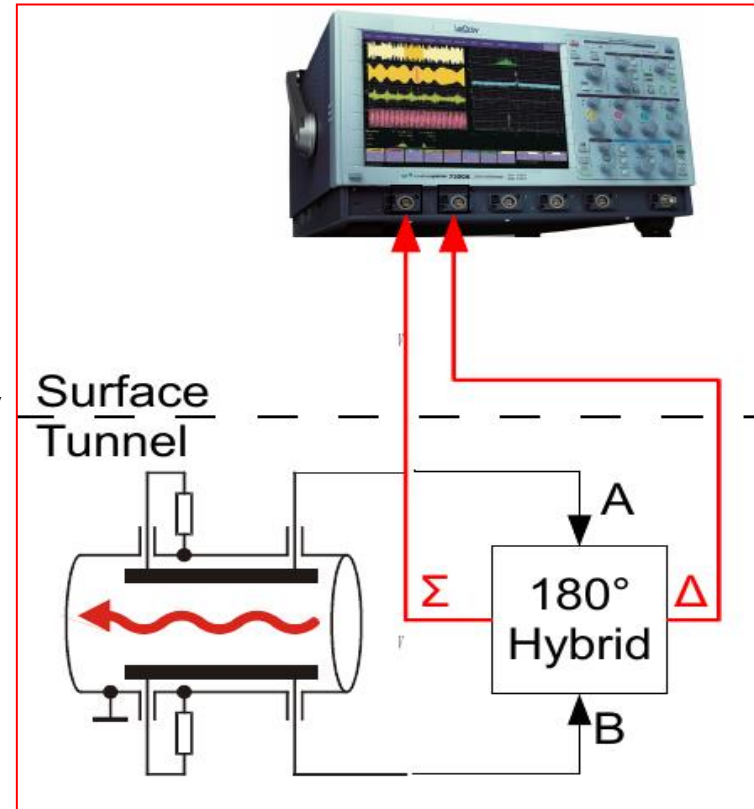


Specifications

- Upgrade of Head-tail Measurements
Higher bandwidth – More sensitivity

- Pick-up (RF versus Optical)
- Analog front-end
 - Time- wide band RF hybrid
 - Frequency: Multiband

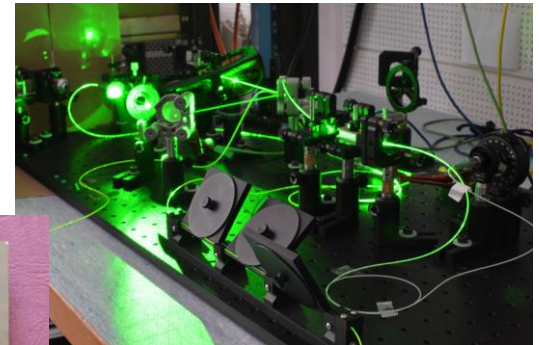
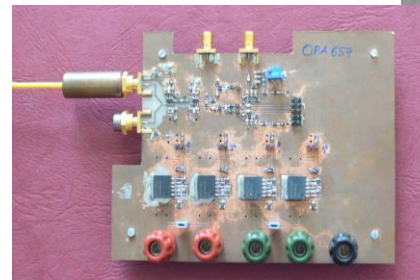
Instability Monitor for improved sensitivity and triggering
- Cable versus Fiber
- Oscilloscope / Digitizers
 - More memory to extend the recording time
 - Windows ... 'no More'





Proposed Technology

- Upgrade the oscilloscopes with fast digitizers providing higher bandwidth and sampling rate, FPGA computing capabilities and extended memory
 - 4 (2,1) channels @ 4 (6.5, 13) GHz
 - 16 (32) GB sampling buffer (1.6s of beam data)
 - Online FPGA processing: data reduction, FFT, ...
 - *Linux driver*
 - Upgrade of the strip-line pick-up by E-O pick-up and laser-based system
 - New pick-up with EO crystal and laser system
 - Optical fiber transmission
 - Metal-Semiconductor-Metal
- Photo detectors





Status of Development

- Price enquiry launched in last August for fast digitizers
 - Has triggered quite some interests from the main oscilloscope manufacturers
 - Offers expected by end of October
 - Delivery by Mid/End of 2014
- MIM trigger currently developed for LHC (2015-2016)
- E-O crystal pick-up and laser-based system
 - Developed a test set-up using fibre laser system
 - First iteration for mechanical design of an E-O button pick-up



Installation and Commissioning Plan

- **Implementation of new fast digitizers for end 2014**
- Mechanical design of E-O pick-up 2014 – Installation of prototype in 2015 – Space reservation (ECR) exists already
- SPS Prototype of laser system with MSM photo detector by 2015
- Radiation hardness test in 2015 and design optimization 2016
- **To be discussed and agreed on ...**
 - EO pick-up commissioned and operational by 2017
 - MIM trigger in 2016



Budgetary Requirements

- Budget as foreseen
 - Covering the gated tune and HT fast digitizers

LIU-SPS	Budget Code	Section	Description	Type	2013	2014	2015	2016	2017	2018	TOTAL LIU
Gating of BBQ	64043	QP	LIU-SPS Transverse Diagnostics Upgrades	LIU	20	20					40
Upgrade HeadTail					150	50				200	
Upgrade HeadTail					0	200				200	

- E-O pick-up development
 - Budget for R&D cofinanced between LIU and HL-LHC but would need additional resources: a Ph. D student and add. hardware for SPS installation
- Possibly MIM triggering system
 - Electronic and cabling required

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E-O pick-up	64043	QP	LIU-SPS Transverse Diagnostics Upgrades	LIU		40	80	80			200
Multi-band instability monitor - Trigger				LIU		50	50			100	





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THANK YOU FOR YOUR ATTENTION!

