

# ICE SECTION

Elias Métral

In very close  
collaboration (as usual)  
with LIS and LCU

- ◆ **A remarkable year 2012** => Tough year for us!
- ◆ **Personnel**
- ◆ **Main highlight of the year** (as we know already that it will be very difficult in the future to do better)
- ◆ **2<sup>nd</sup> (good) highlight**
- ◆ **Other highlights**
- ◆ **2 workshops organized:** BB2013 and SC2103. Another one on impedance in preparation for Spring 2014
- ◆ **Others**
- ◆ **What next?**

# A REMARKABLE YEAR 2012

- ◆ Doctor honoris causa talk from our DG (Lund University, Sweden, 31/05/2013)



**=> We can all be very proud of the CERN results in 2012 (with the discovery of the Higgs-like boson on July, 4<sup>th</sup>)!**



# PERSONNEL

## ◆ People who joined us

- Benoit Salvant (LD, 01/10/2012) => As foreseen and announced the last time
- Kevin Li (LD, 01/02/2013) => As foreseen and announced the last time
- Carlo Zannini (Fellow, started on 07/01/2013)
- Daria Astapovych (oPAC fellow, 01/02/2013)
- Danilo Banfi (EPFL fellow, 01/11/2012)
- Javier Barranco (EPFL fellow, 01/04/2013)
- Adrian Oeftiger (PHD, 01/06/2013)
- Sergio Rioja Fuentelsaz (Technical student, from 01/10/2012 to 30/09/2013)
- Andrea Passarelli (Technical student, from 01/06/2013 to 31/05/2014)
- Simon White (Toohig fellow from BNL who helped us a lot in 2012 => ~ End of 2013)
- Mauro Migliorati (SASS, 2 × 6 months => 31/07/2013)... **but + 1 year approved**
- Uwe Niedermayer (HL-LHC collaborator from TUD => From 07/04/13 to 05/05/2013)
- Andrea Mostacci (HL-LHC collaborator from La Sapienza => From 10/06/13 to 05/07/2013)
- Joseph Kuczerowski (IC from PS-OP, during LS1)

## ◆ People who left us (or will leave us very soon)

- Hugo Day (end of PHD on 31/01/2013) => Now COFOUND fellow with Mike Barnes
- Jean-Luc Nougaret (IC, 31/05/2013)
- Alexey Burov (LARP LTV, after 25 months => 30/06/2013)
- Vittorio Vaccaro (SASS, after 2 × 6 months => 25/06/2012)

# MANY THANKS VITTORIO!



- |            |           |        |            |        |        |           |        |          |          |        |          |
|------------|-----------|--------|------------|--------|--------|-----------|--------|----------|----------|--------|----------|
| Elias      | Nicolò    | Benoit | Carlo      | Andrea | Serena | Georges   | Chiara | Luca     | Fritz    | Gianni | Giovanni |
| Alexey     |           |        |            |        |        |           |        |          |          |        | Jean-Luc |
| Sandra     |           |        |            |        |        |           |        |          |          |        | Frank    |
| Bruno      |           |        |            |        |        |           |        |          |          |        | Werner   |
| Serena     |           |        |            |        |        |           |        |          |          |        | Hugo     |
| Giovannino |           |        |            |        |        |           |        |          |          |        | Kevin    |
| Almir      |           |        |            |        |        |           |        |          |          |        | Giulia   |
| Claus      |           |        |            |        |        |           |        |          |          |        | Octavio  |
| Eduardo    |           |        |            |        |        |           |        |          |          |        | Bernhard |
| Nicolas    |           |        |            |        |        |           |        |          |          |        | Riccardo |
| Silke      |           |        |            |        |        |           |        |          |          |        | Simone   |
| Mauro      |           |        |            |        |        |           |        |          |          |        | Yannis   |
| Tatiana    |           |        |            |        |        |           |        |          |          |        | Hannes   |
| Eirini     |           |        |            |        |        |           |        |          |          |        | Raymond  |
| Olav       |           |        |            |        |        |           |        |          |          |        | Oliver   |
| Rama       |           |        |            |        |        |           |        |          |          |        | Massimo  |
| Chandra    |           |        |            |        |        |           |        |          |          |        | Delphine |
| Glenn      |           |        |            |        |        |           |        |          |          |        | Alexej   |
| Rogelio    | Gianluigi | Elena  | Alessandro | Vasim  | Cinzia | Christian | Cedric | Vincenzo | Gersende |        |          |





# MAIN HIGHLIGHT OF THE YEAR

- ◆ **Tough year!**
- ◆ **24-01-2013: Birthday of Xavier Buffat and Simon White**

**Xavier decided to make a big snowboard jump for his birthday... congratulations...**







Xavier  
(after the big  
jump...)



Xavier's big jump...



Xavier's trace...

=> Will be really very tough to do better in the future...

## 2<sup>nd</sup> (GOOD) HIGHLIGHT OF THE YEAR



Revenge soon...

SOCCER GAME: OP (6) vs. MD (7) (29/06/12)

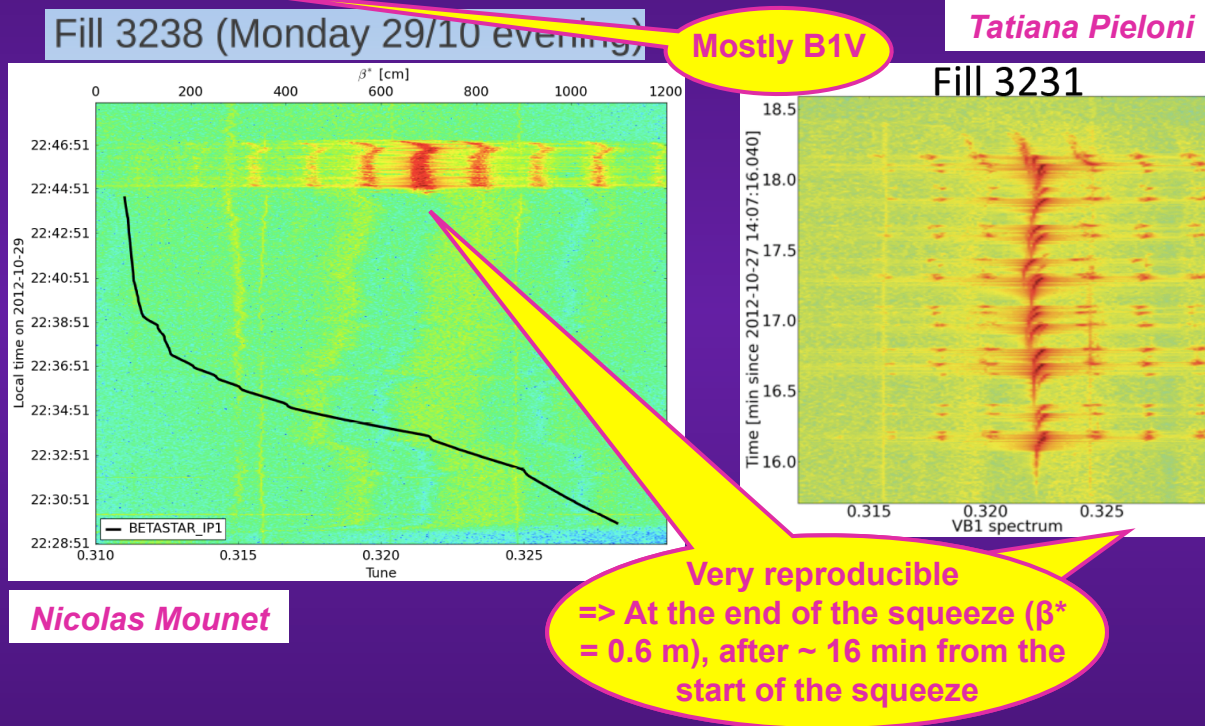


## OTHER HIGHLIGHTS: LHCI and LHC (1/7)

- ◆ **Peak luminosity record: 77% of design luminosity with**
  - 57% of design energy
  - 1/2 number of bunches
- ◆ **Bunch brightness :  $\sim (1.6 / 1.15) \times (3.75 / 2.2) \sim 2.4$  times larger than nominal**
  - $\sim 1.6 \cdot 10^{11}$  p/b  $\Rightarrow$  39% more particles than nominal
  - $\sim 2.2 \mu\text{m}$   $\Rightarrow$  70% smaller transverse emittance (and there was blow-up in the LHC...  $\Rightarrow$  Many thanks to the LHCI!)
- ◆ **Tough year for us because the LHC beam was always at the limit of stability and the beam heated a lot of equipment ( $\sim 10$  cm rms bunch length instead of nominal 7.5)  $\Rightarrow$  But overall, excellent results!**

## OTHER HIGHLIGHTS: LHCI and LHC (2/7)

- ◆ 1 instability remained at the end of the year at the end of the squeeze => Why? Still to be understood...



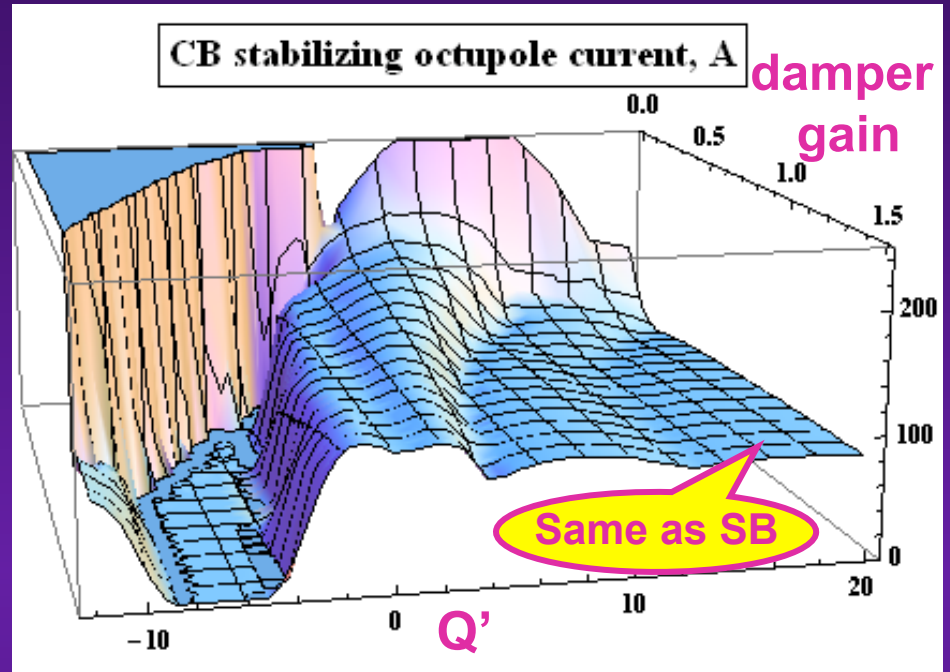
Many meas. with  
Xavier Buffat et  
al.

=> Internal review in September (25-26) of the LHC Performance Limitations during Run I (from collective effects)

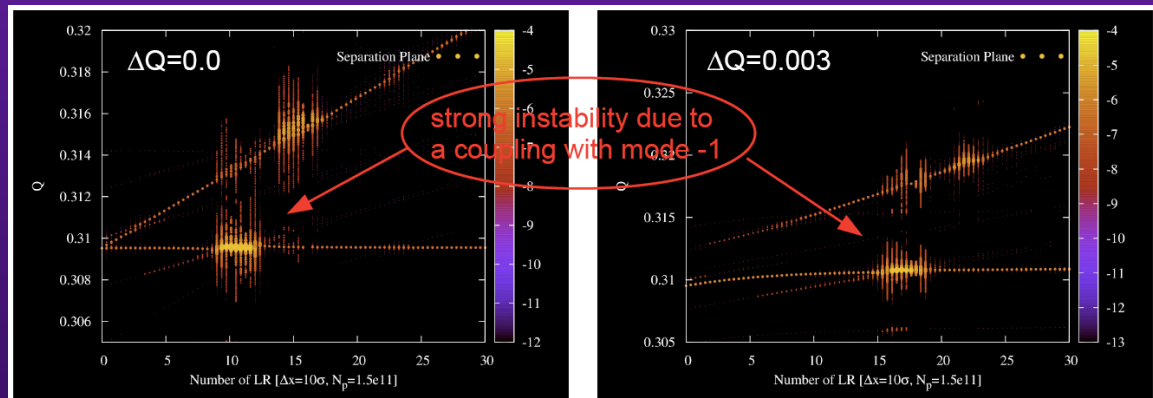


## OTHER HIGHLIGHTS: LHCI and LHC (3/7)

- ◆ **NHTVS code developed by Alexey Burov => ADT helps for HT and very much for TMCI (LHC)**
  - Proposition to use circular modes and flat optics in future

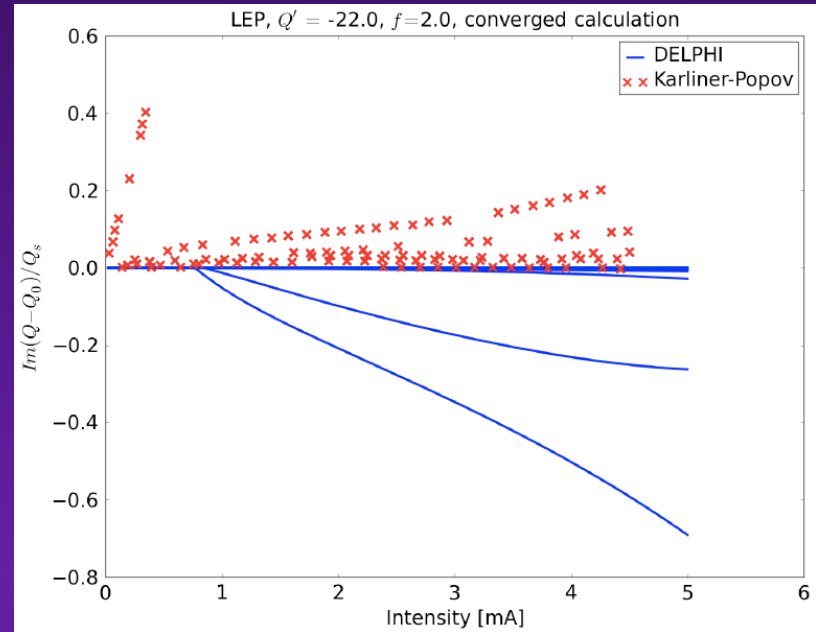


- ◆ **Interplay between impedance and BB developed by Simon White et al.**

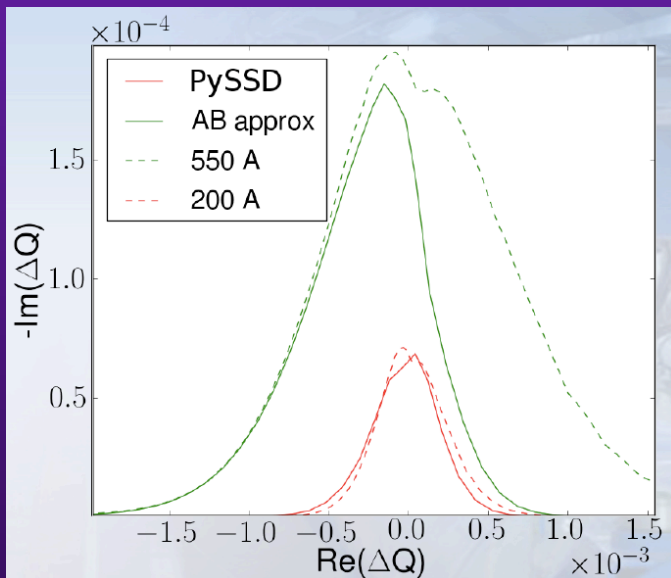


# OTHER HIGHLIGHTS: LHCI and LHC (4/7)

◆ **DELPHI code developed by Nicolas Mounet => ADT does not help for LEP TMCI (Qs much bigger in LEP than LHC?)**

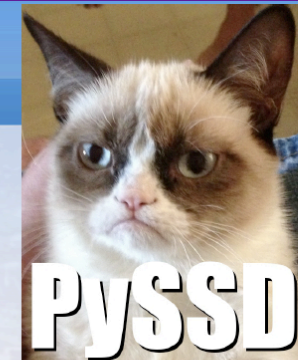


◆ **PYSSD code developed by Xavier Buffat**



## Models :

- Tracking with MAD-X
- Numerical evaluation of the dispersion integral
- (Python Solver for Stability Diagrams)
- Full LHC complexity included but :



# OTHER HIGHLIGHTS: LHCI and LHC (5/7)

- ◆ Many beam-induced RF heating issues => Benoit Salvant's table for the LHC but there are also many impedance studies in the LHCI (Serena Persichelli, Mauro Migliorati et al.)

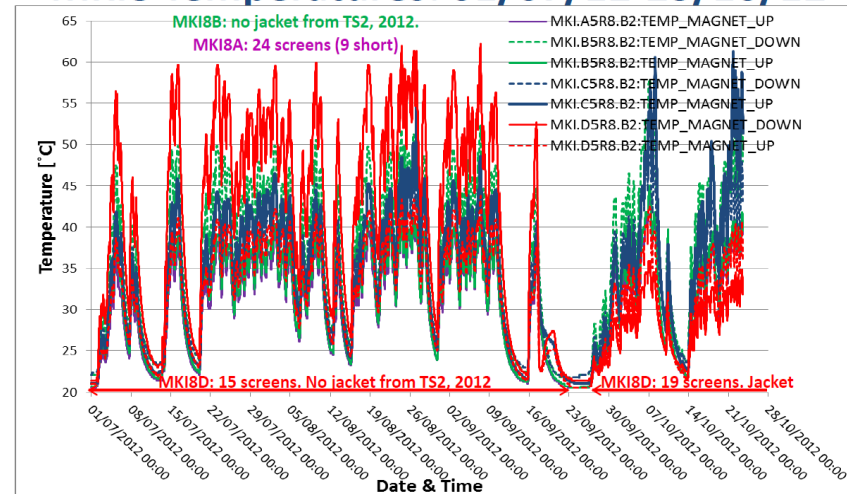
Simulations study of the longitudinal coupled-bunch instability in the PS

=> Great success for the LHC MKI studies and exchange: Hugo Day's PHD study

equipment	Problem	2011	2012	Hopes after LS1
VMTSA	Damage		replaced	removed
TDI	Damage			Beam screen reinforced, and?
MKI	Delay		(+ MKI8C high temperatures)	Beam screen and tank emissivity upgrade
TCP_B6L7_B1	Few dumps		Interlock increased	Cooling system checked
TCTVB	Few dumps		Interlock increased	removed
Beam screen Q6R5	Regulation at the limit		Since TS3, correlation with TOTEM?	Upgrade of the valves + TOTEM check
ALFA	Risk of damage		Due to Intensity increase	New design + cooling
BSRT	Deformation suspected			New design + cooling

## Impedance reduction (MKI8-D)

### MKI8 Temperatures: 01/07/12-23/10/12



MKI8 temperatures pre and post TS3 – The temperature of the MKI8d (15 screen conductors replaced with 19) decreases drastically. **From the warmest magnet to the coolest!**



# OTHER HIGHLIGHTS: LHCI and LHC (6/7)

- ◆ Many MDs in the LHCI => LIU Beam Studies review on 28/08/2012 chaired by Giovanni Rumolo

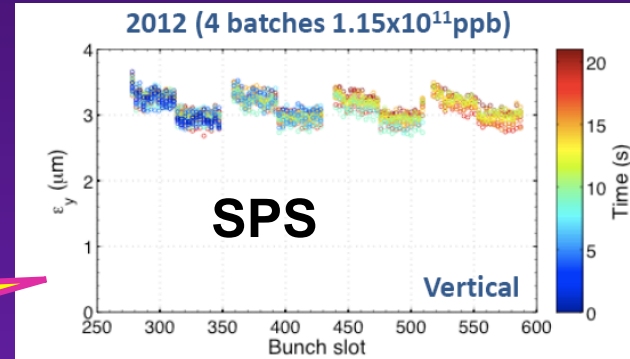
## LIU Beam Studies Review

LHC Injectors Upgrade  
28 August 2012  
CERN  
Europe/Zurich timezone

Tue 28/08

	<p><b>Welcome and introduction</b> <span style="float: right;">Roland GAROBY</span></p> <p><i>BE Auditorium Meyrin, CERN</i> 08:30 - 08:40</p> <p><b>Setting the scene</b> <span style="float: right;">Giovanni RUMOLO</span></p> <p><i>BE Auditorium Meyrin, CERN</i> 08:40 - 09:00</p> <p>09:00 <b>Performance reach of LHC beams</b> <span style="float: right;">Dr. Bettina MIKULEC et al.</span></p> <p><i>BE Auditorium Meyrin, CERN</i> 09:00 - 09:30</p> <p><b>Space charge studies at 160 MeV in the PSB</b> <span style="float: right;">Alexander MOLODOZHENTSEV et al.</span></p> <p><i>BE Auditorium Meyrin, CERN</i> 09:30 - 09:50</p> <p>10:00 <b>RF &amp; transverse feedback aspects</b> <span style="float: right;">Alan James FINDLAY et al.</span></p> <p><i>BE Auditorium Meyrin, CERN</i> 09:50 - 10:10</p> <p><b>Coffee break</b></p> <p><i>BE Auditorium Meyrin, CERN</i> 10:10 - 10:40</p> <p><b>Space charge studies and impact on performance</b> <span style="float: right;">Raymond WASEF et al.</span></p> <p><i>BE Auditorium Meyrin, CERN</i> 10:40 - 11:00</p> <p>11:00 <b>Longitudinal plane</b> <span style="float: right;">Heiko DAMERAU et al.</span></p> <p><i>BE Auditorium Meyrin, CERN</i> 11:00 - 11:30</p> <p><b>Transverse plane</b> <span style="float: right;">Dr. Simone GILARDONI et al.</span></p> <p><i>BE Auditorium Meyrin, CERN</i> 11:30 - 12:00</p> <p>12:00 <b>PS-SPS transfer studies</b> <span style="float: right;">Helga TIMKO et al.</span></p> <p><i>BE Auditorium Meyrin, CERN</i> 12:00 - 12:20</p> <p>Lunch @Restaurant 1</p>
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**Many e-cloud studies: Giovanni Iadarola et al.**



**No emittance growth in 2012 with 4 batches**

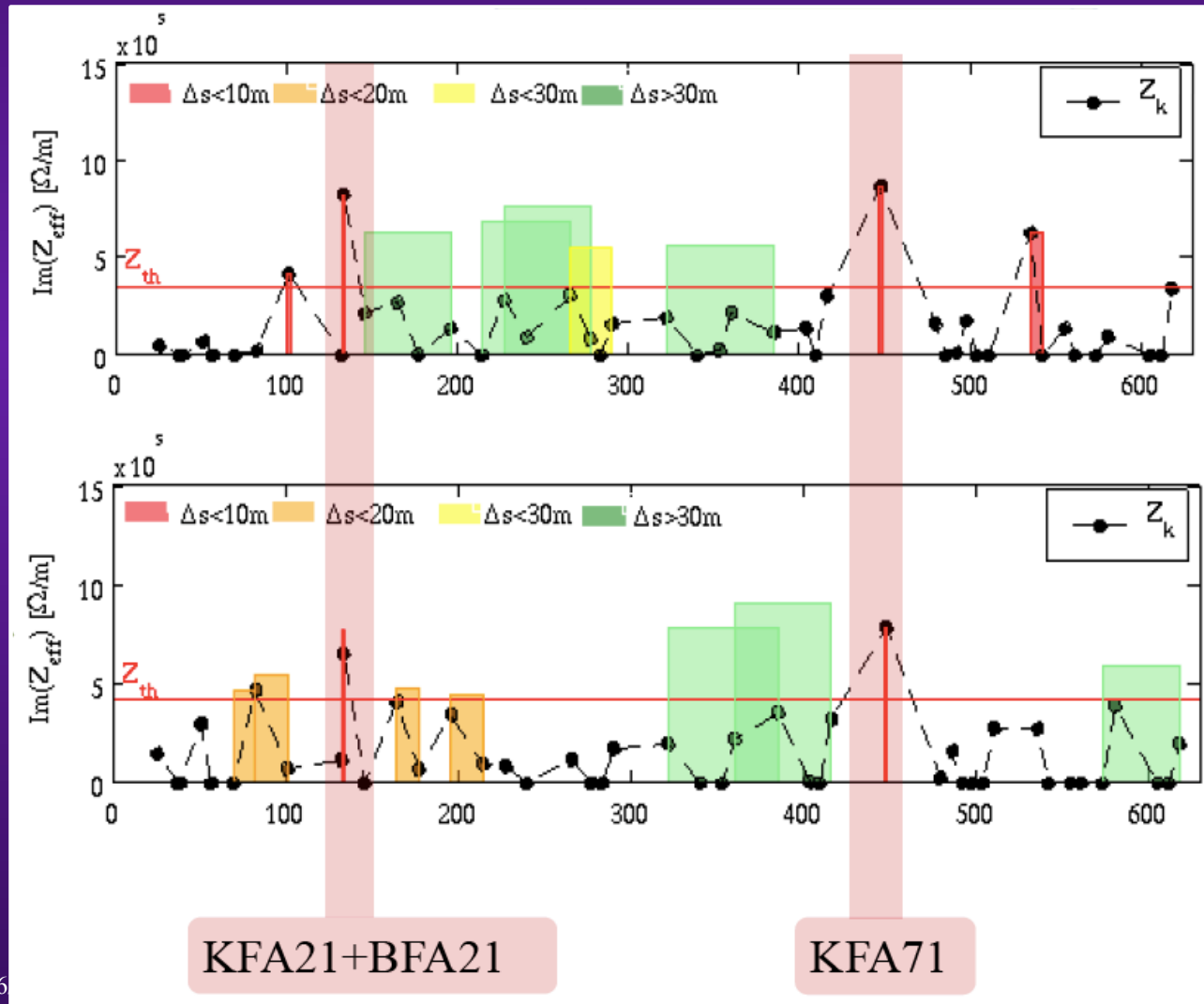
- With low chromaticity in both planes
- Identical behavior of all 4 batches
- No blow-up along bunch train

	<p><b>Glassbox</b> <span style="float: right;">12:20 - 14:00</span></p> <p>14:00 <b>Performance and reach of Q20 optics (wrt Q26)</b> <span style="float: right;">Hannes BARTOSIK et al.</span></p> <p><i>BE Auditorium Meyrin, CERN</i> 14:00 - 14:30</p> <p><b>Electron cloud status @ SPS in 2012</b> <span style="float: right;">Giovanni IADAROLA et al.</span></p> <p><i>BE Auditorium Meyrin, CERN</i> 14:30 - 15:00</p> <p>15:00 <b>Longitudinal stability in the SPS: RF studies</b> <span style="float: right;">Theodoros ARGYROPOULOS et al.</span></p> <p><i>BE Auditorium Meyrin, CERN</i> 15:00 - 15:30</p> <p><b>Coffee break</b></p> <p><i>BE Auditorium Meyrin, CERN</i> 15:30 - 16:00</p> <p>16:00 <b>High Bandwidth Feedback system</b> <span style="float: right;">Wolfgang HOFLE et al.</span></p> <p><i>BE Auditorium Meyrin, CERN</i> 16:00 - 16:30</p> <p><b>Summary (collective)</b></p> <p><i>BE Auditorium Meyrin, CERN</i> 16:30 - 17:30</p>
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# OTHER HIGHLIGHTS: LHCI and LHC (7/7)

- ◆ **Talk at IPAC'13 by Nicolo Biancacci: Beam Coupling Impedance Localization Technique Validation and Measurements in the CERN machines**

=> PS here:



# BB2013 workshop organised by **Werner Herr**

ICFA Mini-Workshop on Beam-Beam Effects in Hadron Colliders (BB2013)

18-22 March 2013  
CERN  
Europe/Zurich timezone

Search

Overview  
Timetable  
Scientific Programme  
Uploading Instructions (abstract etc.)  
List of registrants  
International Organizing Committee  
Local Organizing Committee  
Workshop Circular  
Previous beam-beam workshops  
Instructions for Authors  
Support  
bb.2013@cern.ch

### Scientific Programme

Beam-beam experience in hadron colliders  
Beam-beam effects in hadron colliders

Beam-beam experience in lepton colliders  
Beam-beam effects in lepton colliders

Single Particle Effects I - head-on beam-beam effects  
Incoherent beam-beam effects from head-on collisions with and without crossing angle

Single Particle Effects II - parasitic beam-beam effects  
Incoherent beam-beam effects from parasitic and long range interactions

Beam-beam compensation schemes  
Compensation of head-on and long range beam-beam effects, coherent and incoherent

Strong-strong beam-beam effects  
Strong-strong beam-beam interactions, self-consistent models and coherent effects

Theory and simulations  
Beam-beam models, analytical and simulation models, single particle and multipartic

Operational aspects of beam-beam effects  
Operational considerations for colliders with strong beam-beam effects (PACMAN, mi  
luminosity levelling, ..)

Studies for future Projects  
Studies required for future projects (HL-LHC, LHeC, ..)

Many talks from  
BB team

Detailed studies  
of effects of BB  
on luminosity  
=> **T. Pieloni et  
al.**



# SC2013 workshop organised by Frank Schmidt and Giuliano Franchetti (GSI)

**SPACE CHARGE 2013**

16-19 April 2013  
CERN  
Europe/Zurich timezone

Many talks from SC team

- Overview
- International Advisory Committee
- Timetable
- Scientific Program
- SC-13 Workshop Summary
- List of questions for the participants
- Call for Abstracts
  - View my abstracts
  - Submit a new abstract
- Author index
- Usefull information
  - Registration Form
- List of registrants
- Video Services
- Site & Internet Access for Visitors
- Acomodation
- Transport

**SPACE CHARGE 2013**

	Tuesday 16th	Wednesday 17th	Thursday 18th	Friday 19th
8:30	S. Myers, F. Schmidt, G. Franchetti - Welcome address	F. Trischler (MELBA) "Resonance compensation and lattice modeling for the PSB"	A. Bism (Frankfurt GSI) "High intensity beam dynamics"	J.-L. Vay (LBNL) "Report on the WARP code"
9:30	S. Gilardoni (CERN) "The LHC project and challenges in PSB, PS and SPS"	E. Tardieu (CERN) "Non-linear lattice modeling for small machines in the context of RHAF"	A. Borer (FNAL/LARP) "Space charge and beam transport simulations"	S. Wicks (TECH-X) "Space charge effects in nonlinear transport lattices: mitigation of halo formation"
10:00	G. Rando (CERN) "Overview of the LHC studies"	Y. Alexahin (FNAL) "Computing Equiv. Estimates from Tracking Data"	Y. Korobov (GSI) "Head tail and beam break up instability with strong space charge. Lessons learnt from linear simulations and experiments at CERN and GSI"	J. Kirk (Discussion) "Where we stand and where we want to go"
10:30	C. Pivar (ASTC/STFC) "Modeling of space charge dominated beams"	F. Fark (GSI) "Beam instrumentation achievements for high current beams"	T. Agropoulos (CERN) "Loss of Luminosity during due to resistive impedance in a single and double RF cavity"	J. Kirk (Discussion) "Where we stand and where we want to go"
11:00	Coffee break	Coffee break	Coffee break	Coffee break
11:30	C. Wang (RAL) "Half integer and high intensity limits on the SIS ring"	S. Machida (RAL) "Optimize simulation parameters towards the correct physics"	S. Amemiya (GSI) "Studies of space charge effects during bunch compression in SIS-100"	J. Kirk (Discussion) "Where we stand and where we want to go"
12:00	G. Franchetti (GSI) "PS experiments"	K. Ohmi (KEK) "Space charge effects based on operational data"	J. Qiang (LBNL) "Simulation of high intensity beams"	
12:30	LUNCH	LUNCH	LUNCH	
14:00	C. Gati (CERN) "Distortion of the multi-turn injection into rings with space charge"	J. Hofmann (SNS) "Numerical aspects (schemas, parallelization, 2D beam physics codes with space charge"	B. Corbin (LANL) "Space charge in electron guns"	
14:30	S. Machida (RAL), B. Borch (J-PARC, JAEA) "Beam loss and its mitigation in the J-PARC RCS ring"	L. A. Vaynshteyn (Moss Inc) "Accuracy and performance upgrade of PIC and hybrid space charge solvers"	C. Chen (MIT) "Adiabatic thermal beams in a periodic focusing field"	
15:00	R. G. Pinc (ISIS, STFC) "Studies of image effects and working points on the ISIS ring"	F. Schmidt (CERN), V. Kapin (FNAL) "Proton space charge model in MAD-X with adaptive accuracy and rapid calculation"	P. Nishim (Osaka) "Beam core halo issues"	
15:30	Jiufang Chen (HEP) "Studies on longitudinal dynamics at CNSRCS"	J. Amundson (FNAL) "Certifying the SYNERGIA code for CERN accelerators"	M. Bergami (KEK) "Resonance crossing in linear, beam measurements on space charge resonances in J-PARC line"	
16:00	Coffee break	Coffee break	Coffee break	
16:30	V. Fortel (CERN) "Status of the space charge studies and measurements in the CERN PSB"	F. Schmidt (CERN) "Micro-instability in space charge PIC codes"	J. Hofmann (GSI) "Beam Halo: Coping by Space Charge to High Intensity Beams"	
16:45	R. Willemsen (ISIS, STFC) "Longitudinal Dispersion Studies for ISIS Upgrade"	E. H. Bogge (CERN) "Instrumentation for space charge effects"	M. Fitterer (CERN) "Lattices for Synchrotrons with Strong Direct Space Charge"	
17:00	A. Hirschfelder (CERN) "Identification and compensation of resonances in the CERN Proton Synchrotron"	J. Fritzer (GSI) "Beam Dynamics Simulations Using GPCs"	B. Bartosik (CERN) "Space charge studies in the SPS in view of the LHC injector present performance and future upgrade"	
17:15	R. Wasie (CERN) "Space Charge studies at the CERN PS"	S. Appell (GSI) "Simulation of space charge effects during multi-turn injection with the codes PAREC and PAREC2"	E. Laface (ESS) "Space Charge studies in the ESS Line"	
17:30	WORKING SESSION + DISCUSSION	WORKING SESSION + DISCUSSION	WORKING SESSION + DISCUSSION	
20:30			DINNER	

**SESSIONS**

- Stimulus / Projects
- Modeling / Theory / overview
- Space charge studies
- Machine model (Theory and Instruments)
- Code development
- Mitigation and advanced techniques
- High intensity effects
- Synergies
- Discussion/Outlook



## OTHERS (1/2)

- ◆ **Words of the year:** Instabilities, sign of the octupoles, beam-induced RF heating, very small emittances from the LHCs, ...
- ◆ **Beta-beam report in August as expected => Elena Wildner**
- ◆ **HL-LHC WP2 Task 2.4 and 2.5 – LIU – MDs and MD coordination**
- ◆ **More about LHC injectors in LIS (injectors) section**
- ◆ **Teaching activities => W. Herr, G. Rumolo, T. Pieloni, etc.**
- ◆ **2 prizes for Giovanni Rumolo's students (ICAP'12 prize for best young scientist)**
  - **Carlo Zannini and Eirini Koukovini Platia => Congratulations!**
- ◆ **Congratulations also for recent PHD thesis of Carlo Zannini!**
- ◆ **Good luck to Hugo Day who will soon defend his PHD thesis => Now COFUND fellow with Mike Barnes**
- ◆ **Study of a wide-band feedback for e-cloud instability => Kevin Li**
- ◆ **Impedance studies and measurements => Olav Berrig and JosephK**



## OTHERS (2/2)


=> We have now an impedance lab thanks to Joseph Kuczerowski and Olav Berrig





## WHAT NEXT? (1/5)

- ◆ Get prepared for the re-start => Both in the LHC and LHCIs



We were above the (electron) clouds until now but we have to prepare ourselves well for the restart as the future could be cloudier...

## WHAT NEXT? (2/5)

- ◆ Tomorrow => Talk by Alexey Burov. Everybody welcome!

From Alexey's artistic son

FAITH  
OF  
FUNDAMENTAL  
SCIENCE



History shows that fundamental science is a fruit of a certain faith. How was this faith expressed through centuries and what is its condition now? What is the relation between the scientific faith and scientism? Does physics send a spiritual message to humanity? Does it shed any light on the mystery of our own existence?

Alexey Burov FNAL/CERN-LTV

17:30, June 20th, 2013  
Room C (61-1-009)



ConCERNed  
for Humanity

SCIENTIFIC HUMANITIES



## WHAT NEXT? (3/5)

### ◆ This week-end (22-23/06/2013)

- Thank our collaborators and celebrate all the successes of the year...
- Everybody most welcome on Sunday for hiking

BIENVENUE AU REFUGE NOTRE DAME DES NEIGES PLATEAU DES GLIERES PLAINE DE DRAN



Le Gîte chalet de montagne Notre Dame des Neiges vous accueille en toutes saisons pour toutes vos fêtes, réunions entre amis, fêtes de famille, équipe de randonneurs, marcheurs...

## WHAT NEXT? (4/5)

- ◆ **Re-organization by expertise**
  - Ski
  - Soccer
  - Hiking
  - Tennis, etc.
  - And some other collective effects
- ◆ **Need to cover all the machines (with the same effort)**
  - LHC
  - LHCIs
  - ELENA and other projects
- ◆ **Need a close collaboration between the sections**

## WHAT NEXT? (5/5)

- Nice example with the recent wedding (08/06/13) of Carlo Zannini and Tatiana Rijoff => Congratulations!

Proposition for the name of the baby: **LICE**... but it is maybe not that good...

- Note that 2 people from **ICE** and **LCU** are already married

=> Taking all this into account, new section's name: **HSC = Health and Social Care**

Also called  
**Hadron Synchrotrons Collective effects**

From ICE

From LIS





# MANDATE OF THE HSC SECTION

- ◆ **The Hadron Synchrotron Collective effects (HSC) section provides expertise in the field of impedance computation and optimization, and multi-particle (collective) effects. The section**
  - Is responsible for the studies of the collective effects limiting the performance of the CERN accelerators, including beam coupling impedance, space charge, beam-beam and electron cloud
  - Is responsible, develops and maintains software tools to study the multi-particle beam dynamics
  - Carries out theoretical, simulation and experimental research in the dynamics of high-intensity and/or high-brightness particle beams
  - Defines parameters, strategies and measurement procedures for initial beam commissioning and routine operation of the CERN accelerators (in collaboration with other sections and groups)
  - Provides coordination and support during both commissioning and routine operation of the CERN circular accelerators
  - Hosts the co-ordination of the machine studies of LHC injectors' complex
  - Hosts the co-ordination of the ELENA project
  - Hosts the co-ordination of the studies for a radiobiological facility based on LEIR (BIO-LEIR)
  - Contributes to the study effort for the upgrade of both the LHC and its injector
  - Contributes to R&D activities for CLIC and other future (lepton) projects
  - Provides expertise for educational and outreach activities