




BGC Collaboration

Looking back and looking forward

Ray VENESS

A few highlights since GSI

- GSI Meeting: 19-20 March 2018
 - Still working with the 'old' electron gun on the v1 set-up at Cockcroft
 - LHC set-up was still being installed
- IPAC paper: May 2018

Re: Our first baby was born	Raymond Veness	Fri 27/04/2018 10:16	11 KB	<input type="checkbox"/>	<input type="right-triangle"/>
 Our first baby was born	hao.zhang@cockcroft.ac.uk	Thu 26/04/2018 23:14	51 KB	<input type="checkbox"/>	<input type="right-triangle"/>
 IPAC paper	hao.zhang@cockcroft.ac.uk	Thu 26/04/2018 23:03	607 KB	<input type="checkbox"/>	<input type="right-triangle"/>
 Minutes GSI v01 - DV	Raymond Veness	Fri 13/04/2018 09:50	1 MB	<input type="checkbox"/>	<input type="right-triangle"/>

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A SUPERSONIC GAS JET-BASED BEAM PROFILE MONITOR USING FLUORESCENCE FOR HL-LHC

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DEVELOPMENT OF A BEAM-GAS CURTAIN PROFILE MONITOR FOR THE HIGH LUMINOSITY UPGRADE OF THE LHC

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- IBIC paper: September 2018
 - Comparison of working gases (Neon, Argon)
 - Simulation path: High pressure → low pressure → beam interaction → signal acquisition, with an integration time acceptable for an instrument
- HL-LHC annual meeting: October 2018
 - Three presentations on the BGC work
 - Interesting preliminary discussions with the BGV team on gas jets



Local powering of corrector package the IT	The beam gas curtain as an in... <i>Raymond Veness</i>	Vacuum experience from SPS-DQW & ... <i>Diogo Murteira</i>
Disconnectors within HL-LHC p... <i>Samer Yammine</i>	Beam gas interactions and ... <i>Stefano Mazzoni</i>	Thermal studies & measurements fo SPS-DQW <i>Diogo Murteira</i>
General considerations fo... <i>Hugues Thiesen</i>	Beam gas curtain experimental progr... <i>Hao Zhang</i>	BA6 installation & consolidatio... <i>Giovanna Vandoni</i>
CLIQ and k-modulation feed-throughs <i>Lloyd Ralph Williams</i>	Status of the beam gas vertex profile monitor development for HL-LHC <i>Robert Kieffer</i>	

ECR Under Approval

Installation of a Beam Gas Curtain (BGC) Demonstrator Instrument – Stage 1

HL-LHC

G. Schneider BE-BI & al

EDMS:

LHC-BGC-EC-0002

Version 0.1 → 2018-10-17

A “Beam Gas Curtain” instrument is under development in the framework of HL-LHC WP13. Its ultimate function is to work as an overlap monitor between the electron beam of the Hollow Electron Lens (HEL) and the LHC proton beam.

It is proposed to install a BGC demonstrator to validate its operation with 7 TeV protons and gain operational experience. The instrument is under development and a staged approach for the installation is foreseen. This ECR focuses on stage 1.

This activity is within the scope of HL-LHC (WP13).

ECR Under Approval

Installation of a Beam Gas Curtain (BGC) Demonstrator Instrument – Stage 1

HL-LHC

The staged approach was presented to the 37th HL-LHC TCC and endorsed by the WP13 meeting.

The 50th HL-LHC TCC meeting endorsed the installation of the gas jet monitor prototype in LHC during LS2.

Stage 1

It focuses only on

- infrastructure installation (cables for next step, racks)
- installation of an RF-shielded vacuum chamber with its all-metal gate valves and the additional sector valve. The vacuum sector Beam 1 B5L4.B will be split.

No gas will be injected.

It will allow for an installation of further sections of the BGC without opening or intervening on the beam vacuum.

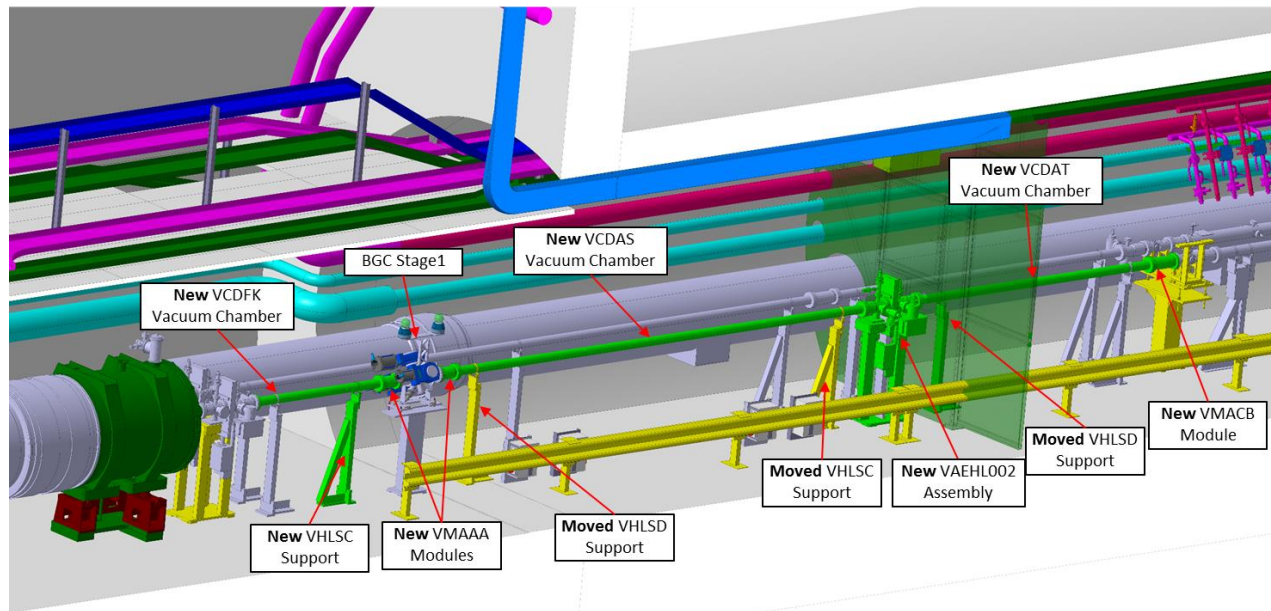
Stage 2

The installation of the instrument and associated vacuum equipment (to be described in a second ECR).

ECR Under Approval

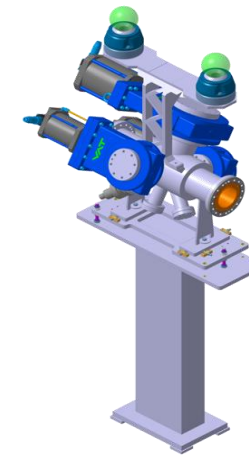
Installation of a Beam Gas Curtain (BGC) Demonstrator Instrument – Stage 1

HL-LHC



*In green: new vacuum components
In yellow: displaced components.*

New Layout in VACSEC.C5L4.B and VACSEC.B5L4.B



BGC vacuum chamber on support with gate valves and geometers targets

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Installation of a Beam Gas Curtain (BGC) Demonstrator Instrument – Stage 1

HL-LHC

Seen by **Giovannozzi Massimo 2018-10-08**

No impact on machine aperture.

Seen by **PAGE Eric 2018-10-09**

A new version with correct tables and reference to TE-VSC vacuum layout EDMS document has been discussed with Gerhard Schneider.

Seen by **FUCHS Jean-Frederic 2018-11-02**

Accepted with warning by **MUTTONI Yvon 2018-10-16**

The drawing should be released

Accepted by **JONES Rhodri 2018-10-09**

Accepted by **ROSSI Lucio 2018-10-10**

OK. Of course the comments have to be taken into account.

Accepted by **GAIGNANT Christelle 2018-10-16**

Please make reference to the BGC Safety assessment : [EDMS 1936384](#)

Accepted by **ADORISIO Cristina 2018-10-04**

Accepted by **GIRARDOT Gael 2018-10-05**

The DIC and DIR mentioned are received and in treatment

ECR Under Approval

Installation of a Beam Gas Curtain (BGC) Demonstrator Instrument – Stage 1

HL-LHC

Accepted by SALVANT Benoit 2018-11-06

Comment from Impedance WG:

The BGC design was discussed well in advance with the impedance WG and allowed implementing a screening liner that significantly reduces the impedance contribution of the BGC. Thank you!

As mentioned in the minutes of IWG meeting #17 (<https://indico.cern.ch/event/702251/>) that recommended approval of the BGC installation, the usual validation RF measurements should be planned.

On the other hand, concerning the new valve, as mentioned already for ECR LHC-V-EC-0016, adding a valve with 100 mm diameter in a location with 80 mm pipe requires a VAEHL module that creates a cavity, since 80 mm valves are not yet available. It was checked with the ECR authors that the valve cannot be pushed 3 m downstream to match an existing valve diameter (63 mm).

The recommendation from the impedance WG is therefore - as for LHC-V-EC-0016 that these VAEHL modules are considered for replacement (1) when 80 mm valves are available and (2) if impedance needs to be further reduced in the HL-LHC era.

Please add this comment to the impedance part of section 6.3.

Accepted by SCHNEIDER Gerhard 2018-11-06

All comments are taken into account in the final version of this document.

Asking for approval

Actions from the GSI collaboration meeting

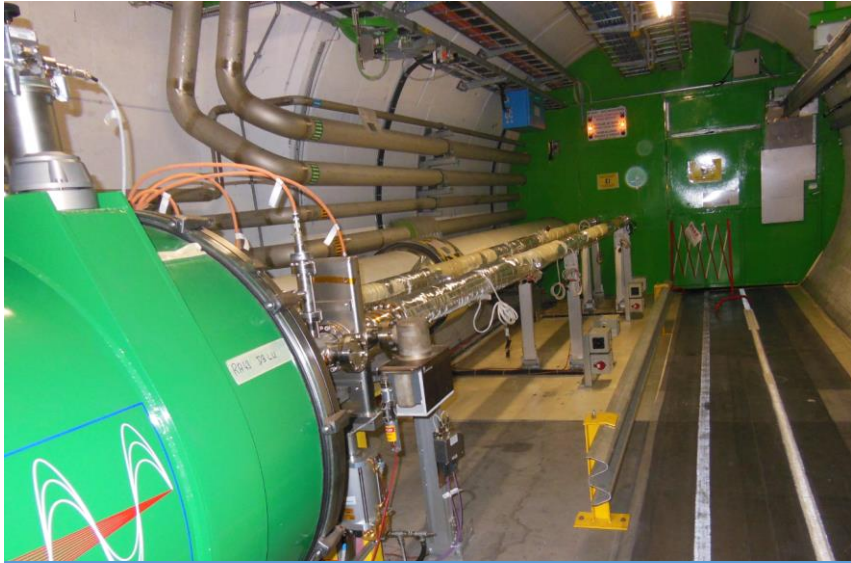
15 lively video meetings since the GSI meeting...!

ACTIONS		
Publications - Organise and prepare for peer-review journals.	General	To do
Look at optimistic proton count rate and limiting factors.	Serban	Done
Investigate adding up several pixels to produce a significantly smoother image.	Hao	Done
Would the BGC be able to measure the HEL diocotron instabilities?	TBC	To do
Experiments		
Check extrapolations of the cross-sections with the new e-gun	Cockcroft	Done
Which nozzle will be used, how to align on the available equipment?	Hao, Cockcroft	Done
Redo the tests to calibrate the gas jet vs the residual gas pressure	Hao, Cockcroft	Done
Confirm the Faraday Cup will be used as a dump for the e-gun on v2 set-up	Hao, Cockcroft	Done
Investigate adding a 4 th exhaust skimmer / barrier for the v2 set-up	Cockcroft	In progress
Make a detailed comparison between Ne, N2 and Ar. Ensure measurement of the e-gun with a Faraday Cup to verify intensity.	Serban & Cockcroft	In progress
Restart tests on different blackening coatings, vacuum and reflectivity.	Gerhard	Done
Measure the surface finish of the CERN nozzle	Tom	Done
Investigate moving the exhaust pump further away. If successful, could this be done experimentally on the v2 set-up?	Marton	Done
Measure the reflectivity of all surface coatings that are UHV compatible	Serban / CERN	Done
Consider using Argon with 476nm line in the LHC	Stefano	Done

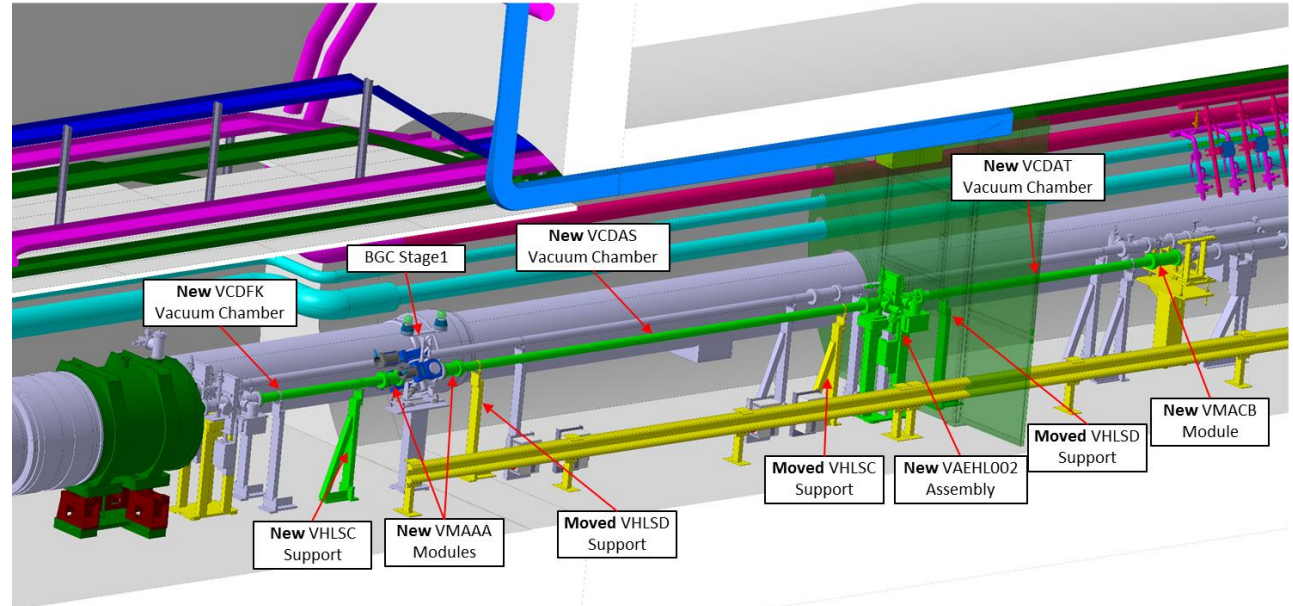
Actions - II

Design		
Search for most suitable intensifier/camera with about 20% efficiency for Ne	Serban	Done
Which decisions must be taken by October 2018. Make a timeline.	Gerhard	Done
Investigate rotation of v3 design to avoid optical system at the bottom.	Tom	?
Interfaces		
Investigate the magnetic fields from the SC magnet at the position of camera	Adriana	?
200mm allocated for BGC between cryostats. Optimise this with Antti, including bellows and fixed points.	Adriana	?
Write down operational scenarios for feedback into vacuum design.	Gerhard	Done
Define the parameters of the e-lens test stand, which the BGC should test.	General	In progress
Send Serban a radiation map for the region of the e-lens	Adriana	?
Simulations		
Should we consider using gas jet clusters?	Hao	Done
Provide Przemek with publications on analysis of the gas nozzle.	Carsten, CI	Done
Investigate the difference between a perfect gas model with no interaction between molecules and a viscous model from a FE simulation.	Przemek	Done
Further investigate exhaust skimmer / barrier on gas exit side.	Marton	Done
Look at tilting the exhaust pump, feasibility of gas mirror for end pumping at an angle.	Marton	Done
Use the code from GSI for IPMs to see the effect on beams.	Amir? CI	?
Further optimisation of the skimmers and the nozzle set-up		In progress
Accumulation of electrons from the gas jet. Adding low energy electrons.	Russian team?	In progress
Investigate the accumulation of electrons and ions in the interaction chamber from the e-lens.	Adriana	In progress

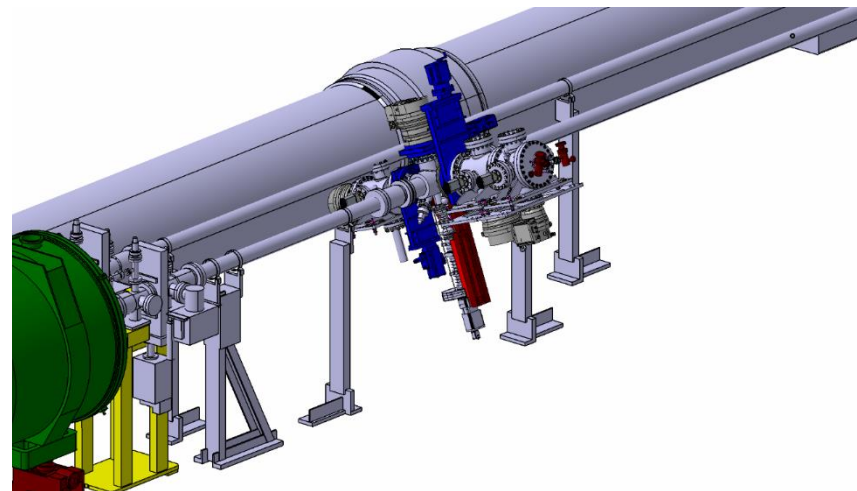
Looking forward



Today



Spring 2020



Summer 2020 (is the target)

Objectives for this workshop

- **BGC Instrument and Science**

- Summarise the know-how gained at Cockcroft, GSI and with the LHC fluorescence experiment.
 - Identify the open issues with this knowledge gained with the aim of an operational instrument in LS2.
 - Agree on an experimental programme on the Cockcroft 2 test bench (v2) for 2019
- Gas type: Neon is baseline. Summarise reasons for that choice. What were the impacts if change to Nitrogen or Argon.
- Evaluate realistic goals for the performance concerning precision and resolution
- Arguments to keep and modify the fluorescence test set-up for Run 3

- **Project management**

- Identify all requirements for a fully working demonstrator instrument in the LHC tunnel by March 2020 (v3)
 - Identify “must have” items for installation in LS2,
- Review the administration progress (Planning, ECRs complete and in progress, Infrastructure requests, project funding, responsibility and boundaries)
- Up-date on the status, requirements and compatibility with the HEL of the LS3 BGC (v4)
 - Review the status and compatibility with the HEL of the LS3 BGC (v4)