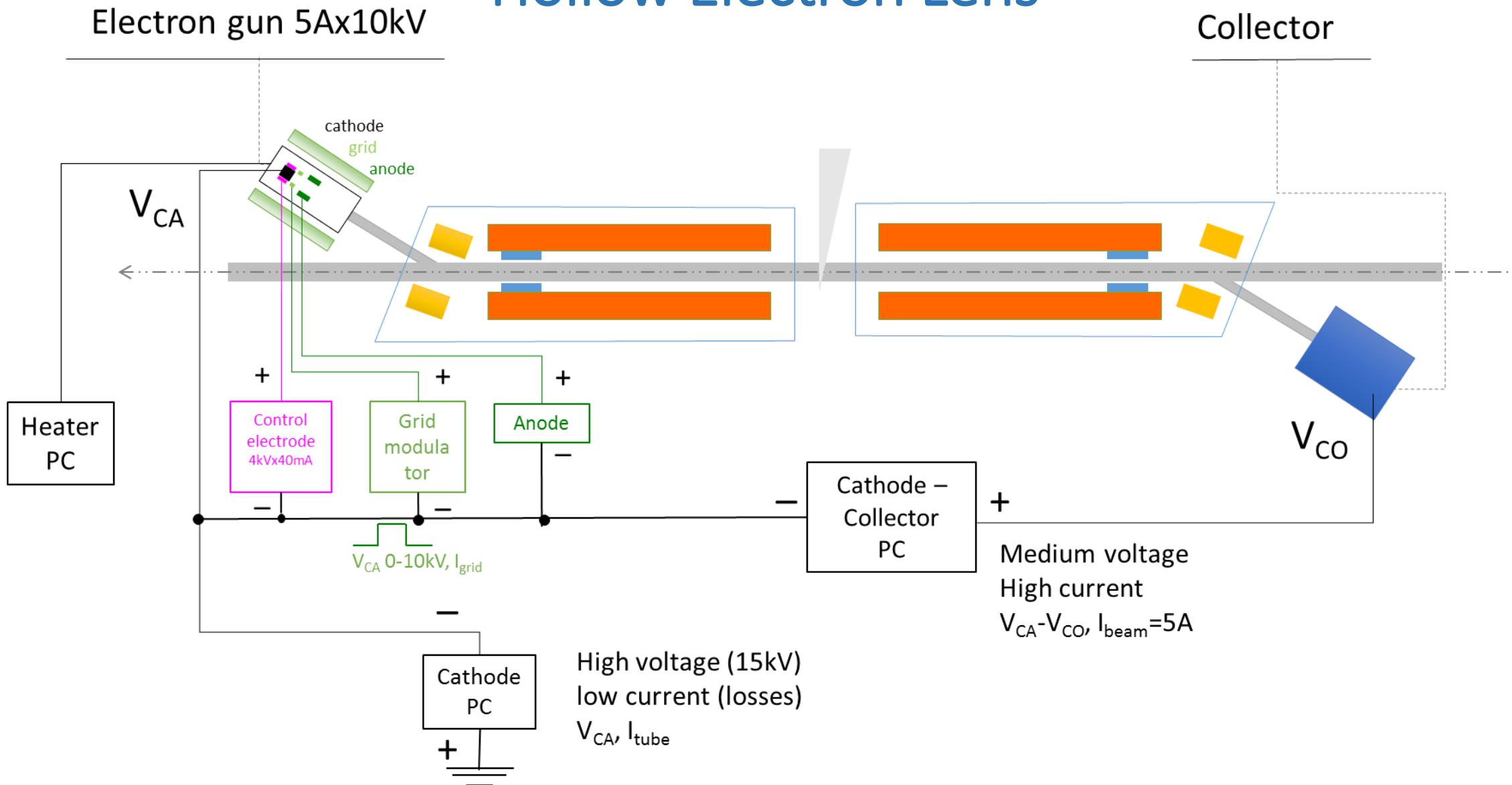


HEL modulation and instrumentation

A. Rossi and R. Veness, G. Schneider, T. Dodington, S. Sadovich, L. Soby, B. Goddard

Hollow Electron Lens



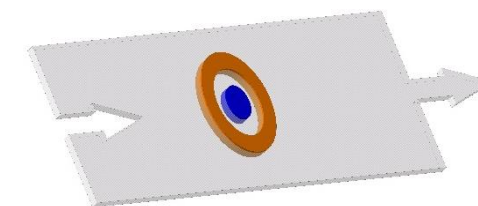
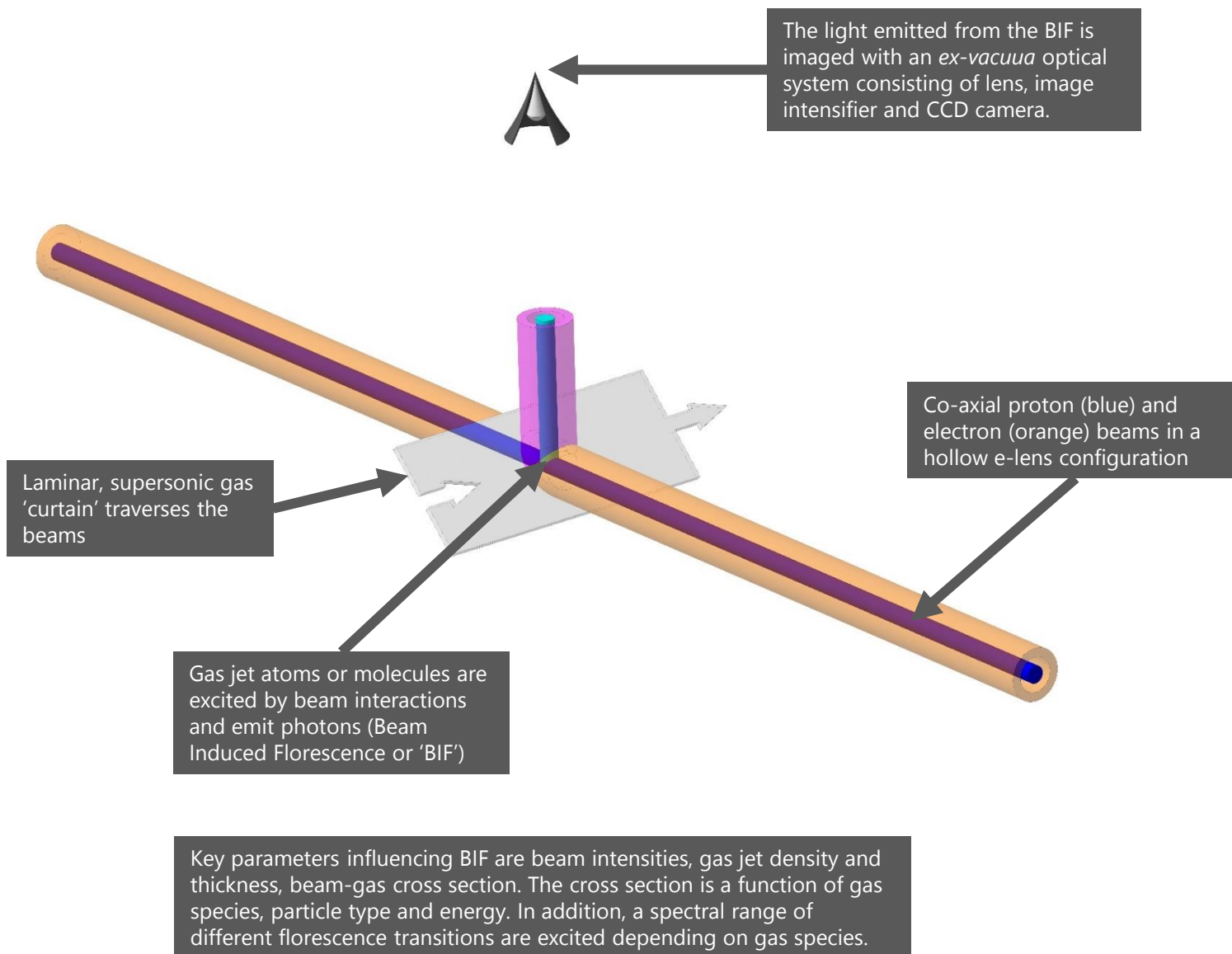
Modulator

Parameter	Unit	Value
Electron beam current	A	5.0
Maximum modulation voltage	kV	10.0
Minimum modulation voltage	kV	0.625
Modulation voltage steps	kV	0.625
Flat-top stability	kV	±0.1
Voltage rise time (10-90%)	ns	≤200*
Repetition rate	kHz	33
Flat-top pulse length	us	tbd

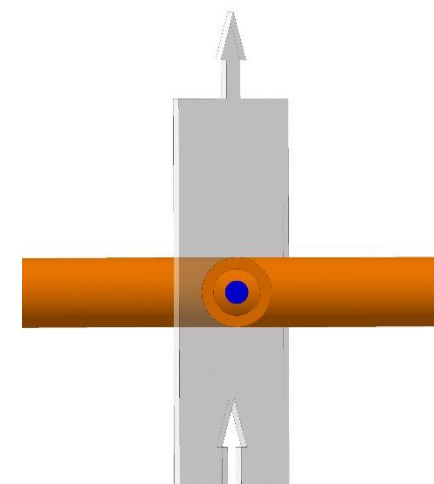
*NOTE: at RHIC modulation 10-90% in 50ns for 15kV

Compatibility with LHC control system must be ensured, specs will be given.

Beam-Gas Curtain: Principles

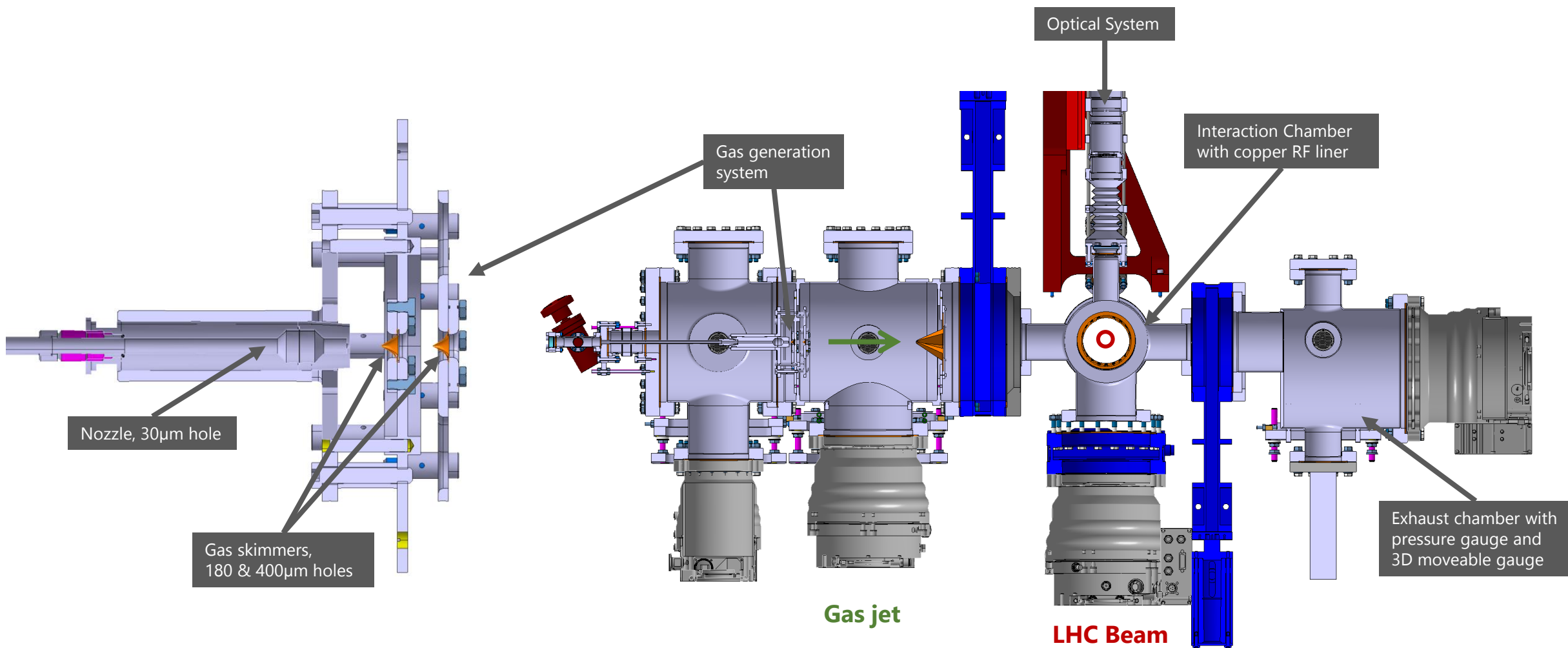


Elliptical image of two beams on the 'virtual screen'

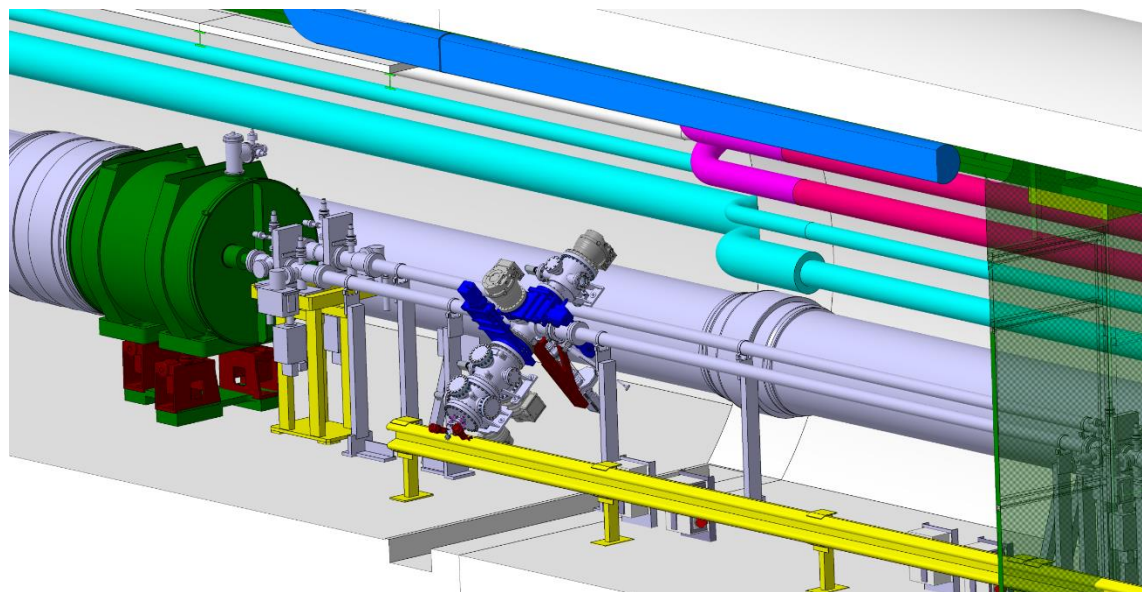


True 2D beam image seen by the camera when viewed at 90° to the beam axis

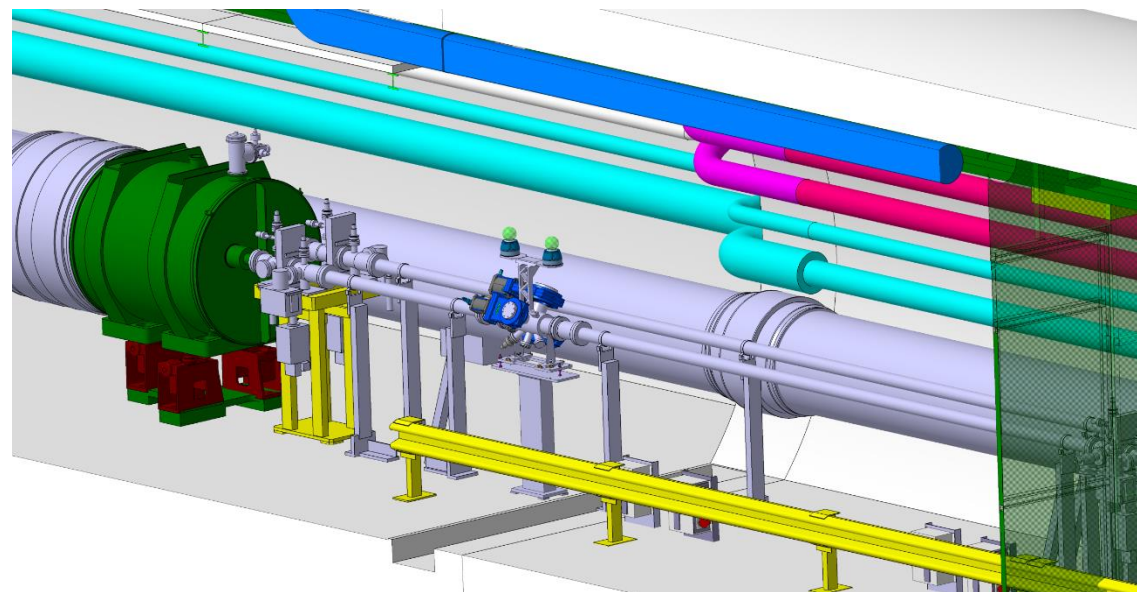
Beam-Gas Curtain: Sectors



Beam-Gas Curtain: LHC Integration



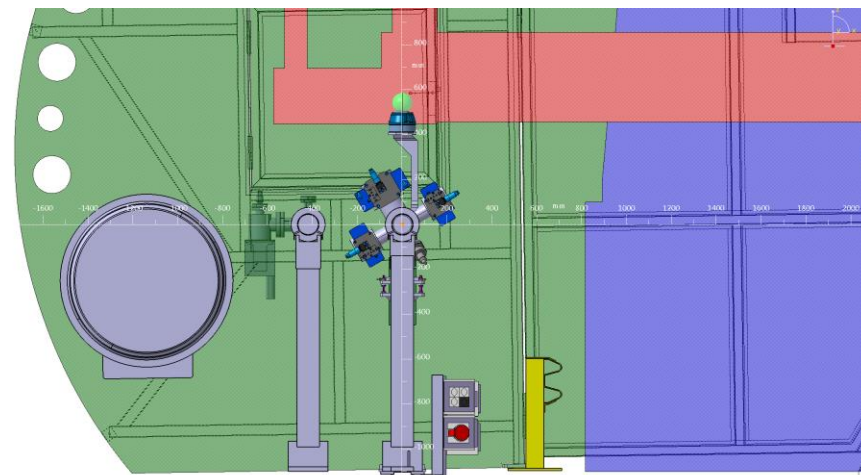
BGC Lab Prototype in the LHC



Stage 1 BGC Installation on LHC.

Important considerations:

- Space availability
- Alignment of nozzle and skimmers
- Vacuum and pumping on the LHC (magnetic field present)
- Impedance, solved with copper liner
- Reduction of synchrotron light
- Calibration and operation of the optical system



Space availability in LHC LSS4

BPM

- Has to work both for electron and proton beam
- Electrons measured in absence of protons and during set-up
- Use same rise/decay of modulator for current variation
- Electronics to be worked out
- Integrated in vacuum chamber
- Buttons or strip-line, still under study

- References for Beam Gas Curtain (or Jet) monitor:
- H. Zhang et al, [DEVELOPMENT OF A SUPERSONIC GAS JET BEAM PROFILE MONITOR, IBIC2015](#)
- V. Tzoganis et al, [EXPERIMENTAL RESULTS OF A GAS JET BASED BEAM PROFILE MONITOR, IPAC14](#)
- V. Tzoganis et al, Design and first operation of a supersonic gas jet based beam profile monitor,
[Phys. Rev. Accel. Beams 20, 062801](#), 12 June 2017

Hollow Electron Lens

