The Ion Source for the Commissioning of ELENA Ring

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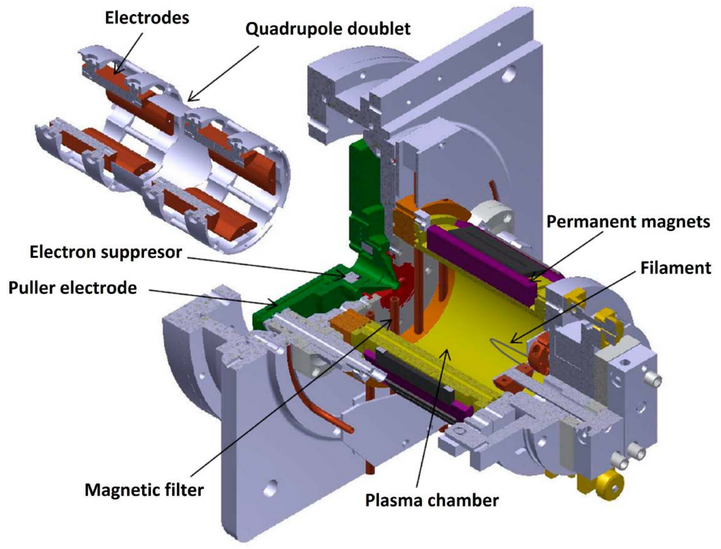
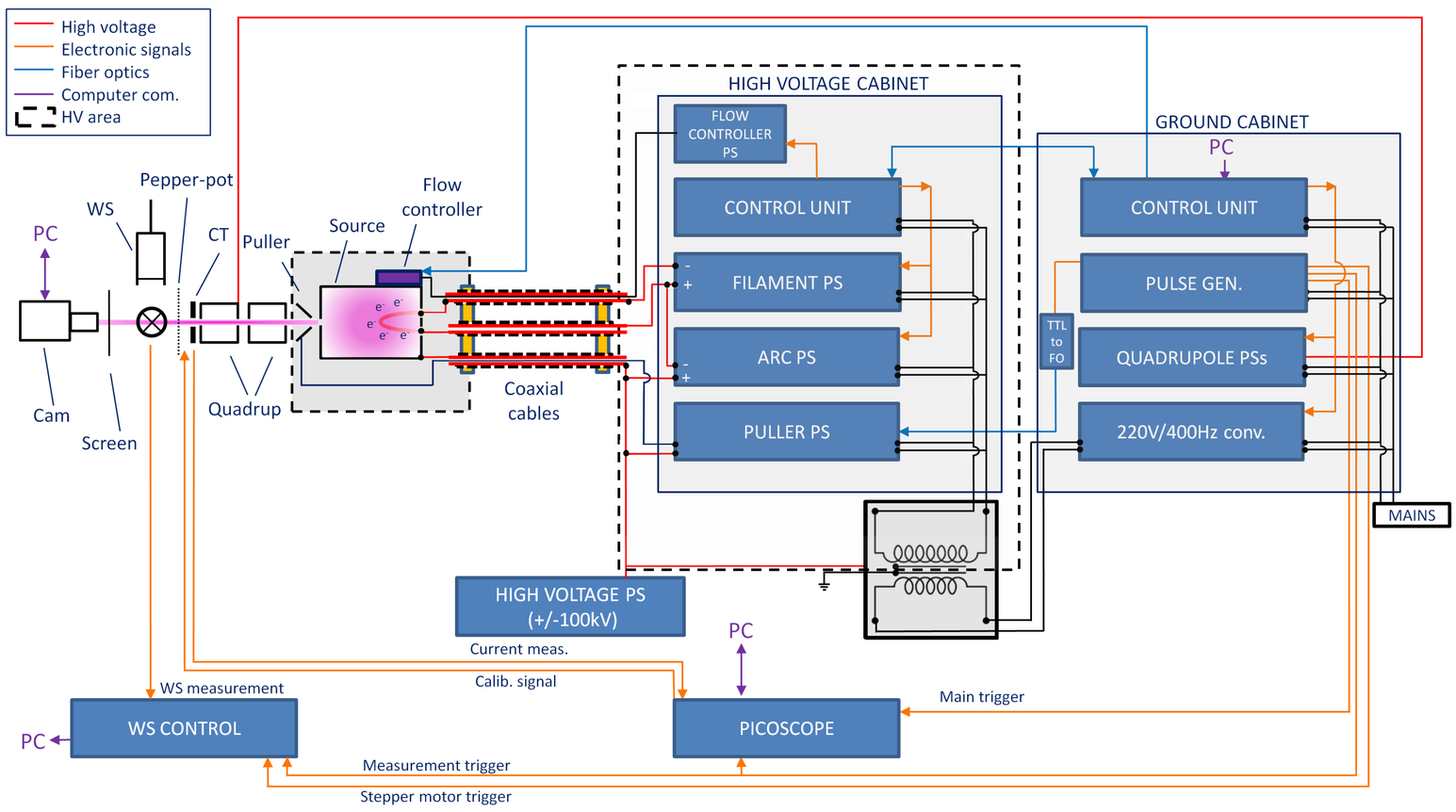
ION SOURCE DESIGN

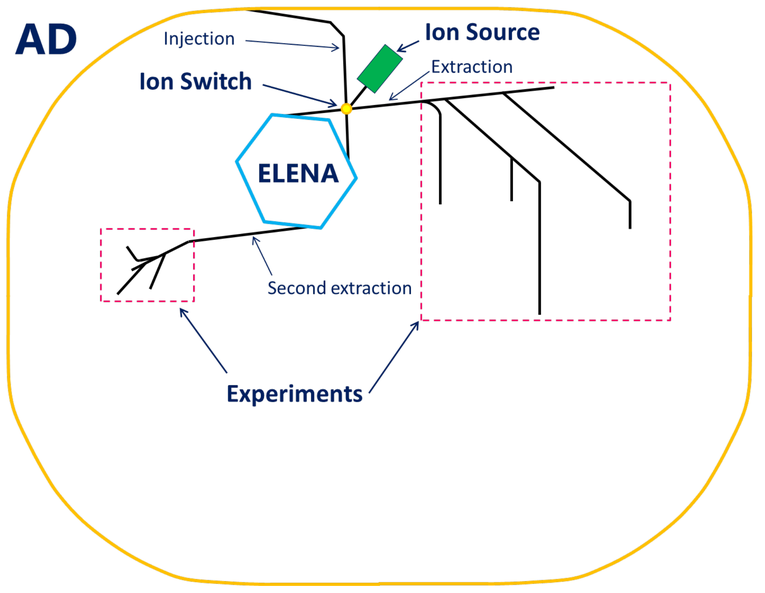
The AD cycle is quite long (100 s) and to do the commissioning of ELENA with antiprotons would require a long shut down for the experiments. For this reason, an Ion Source with dual polarity has been installed for commissioning and start-ups. This ion source produces protons and H- at 100 keV.

Hydrogen plasma is produced in an arc discharge chamber where electrons coming from a tungsten filament tend to reach the plasma chamber walls that are positively biased with respect to the filament. On their way towards the plasma chamber wall, the electrons collide with the hydrogen atoms ionizing them and, thus, igniting the plasma. To keep the electrons and ions far from the plasma chamber walls and to increase the confinement time, ten permanent magnets are arranged around the plasma chamber producing a decapole magnetic cusp field.

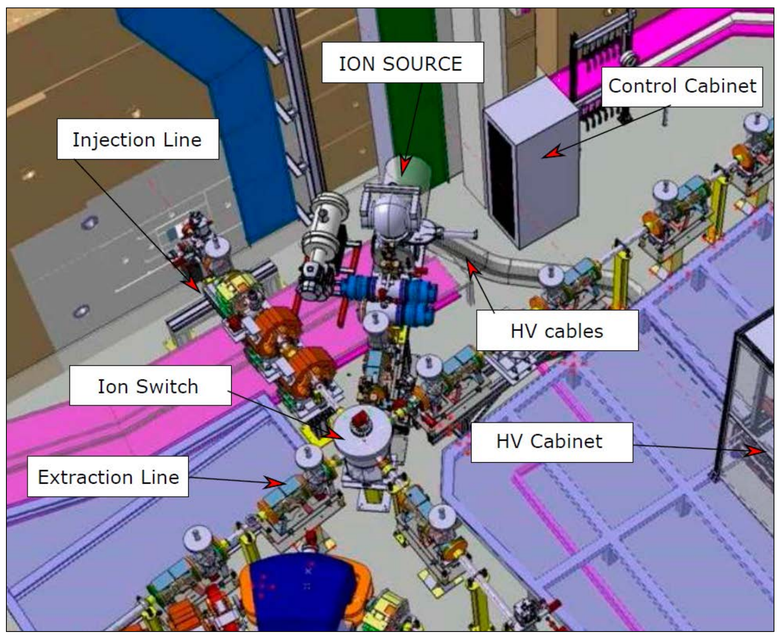




INTEGRATION IN ELENA



An injection line introduces the 5.3 MeV particles coming from the AD into ELENA ring. Two extraction lines are installed to guide the 100 keV antiprotons to the experiments. The H^+/H^- ion source is installed on the space between the injection line and the first extraction line.

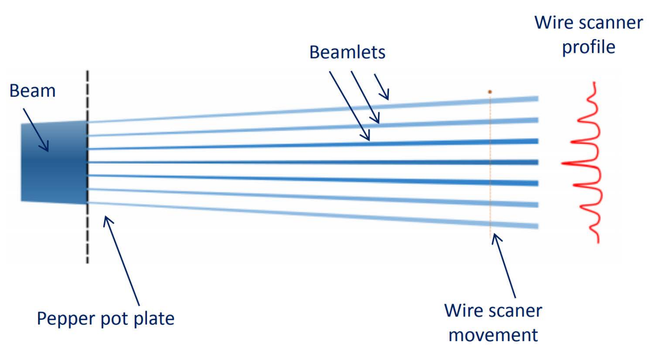


ION SOURCE CHARACTERIZATION

Working parameters

Parameter	100 µA H^-	150 µA H^+
Arc Voltage [V]	75	75
Arc Current [A]	2	3
Filament Current [A]	72.7	73.2
Hydrogen flow [sccm]	1.6	0.6
Extraction Voltage [kV]	3.2	-2
Suppression Voltage [kV]	-0.15	0,23

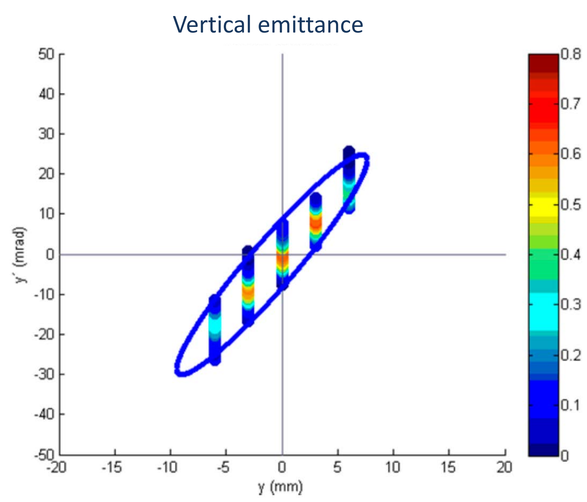
Beam profile from Wire Scanner



Beam emittance

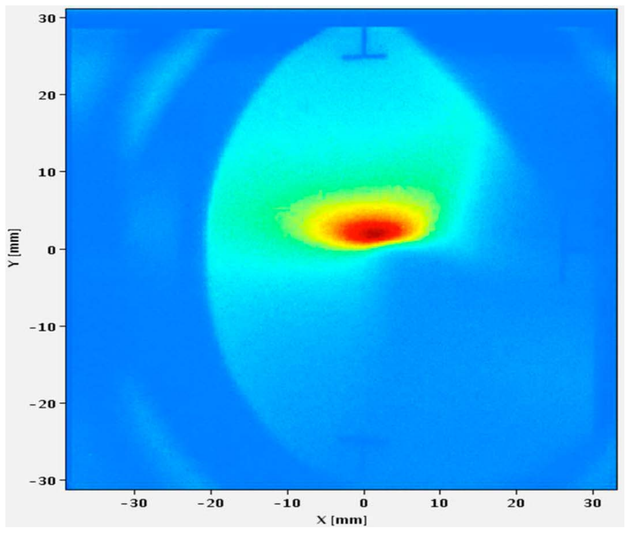
Knowing the distribution of the pepper-pot holes and the distance between the pepper-pot and the wire scanners (138 mm for the vertical scan and 139 mm for the horizontal one) it is possible to calculate the angular deviation of each beamlet.

In the studied working parameter range, the values of the normalized emittance are always below ***1.2 mm mrad*** for both H^+ and H^-



FIRST H^- BEAM INSIDE ELENA

During November 2016 the first H^- was injected in ELENA and observed during some microseconds. The beam profile was measured in one of the luminescent screen monitors (BTV) present on the ring.



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[1] https://home.cern/about/accelerators/antiproton-decelerator.
[2] V. C. [Ed], \Extra low energy antiproton (ELENA) ring and its transfer lines," Technical Report (CERN, 2014).
[3] R. Gebel, O. Felden, R. Maier, S. Mey, A. Sidorov, and D. Prasuhn, in Proceedings of IPAC 2015 (Richmond, USA, 2015).
[4] G. Tranquille, in Proceedings of IBIC 2013 (2013).