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PIBHI 2025 workshop: open mind discussions on ECR ion sources

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This article summarizes the discussions during the PIBHI 2025 workshop highlighting the most crucial points emerged. The workshop's main purpose was to stimulate debate among participants on various topics of interest to the community in dedicated round tables.

The discussions covered several key arguments with a huge impact on daily ECRIS operations and in perspective on the development of the new generation sources. In fact, an adequate understanding of the fundamental processes may provide crucial information for optimizations facilitating the production and transport of stable high-intensity ion beams.

Plasma studies, factors contributing to the emittances measured and solutions that can be envisioned for transporting such intense beams were discussed in depth. It is traditionally thought that the magnetic field is the dominating contribution while recent works show that the extraction design has a huge impact on the source. Moreover: availability, reproducibility and stability of HCI beams for various elements up to uranium are required from several facilities worldwide. Requests are usually accompanied by an increasing value of beam intensity creating serious beam quality problems of match with downstream accelerator. Only an appropriate plasma and beam diagnostics would permit the correlation between beam and plasma parameters optimizing the operating conditions for each specific experimental context.

Finally, the discussion moved to the challenges for the development of new generation ECRIS. Two factors look to be the most critical: the magnetic system and a new coupling scheme.

The magnetic system of future ECRIS envisages the need to operate daily and reliably with high magnetic fields. Limiting factors, technologies, and new magnet solutions are analyzed. The development of new coupling schemes for high-frequency ECRIS belongs to a launching-dominated scenario instead of the classical modal-dominated scenario of second-generation ECRIS.

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