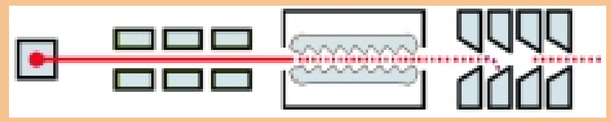
A Non-Destructive Emittance Instrument for High Brilliance H^{--} Ion Beams *



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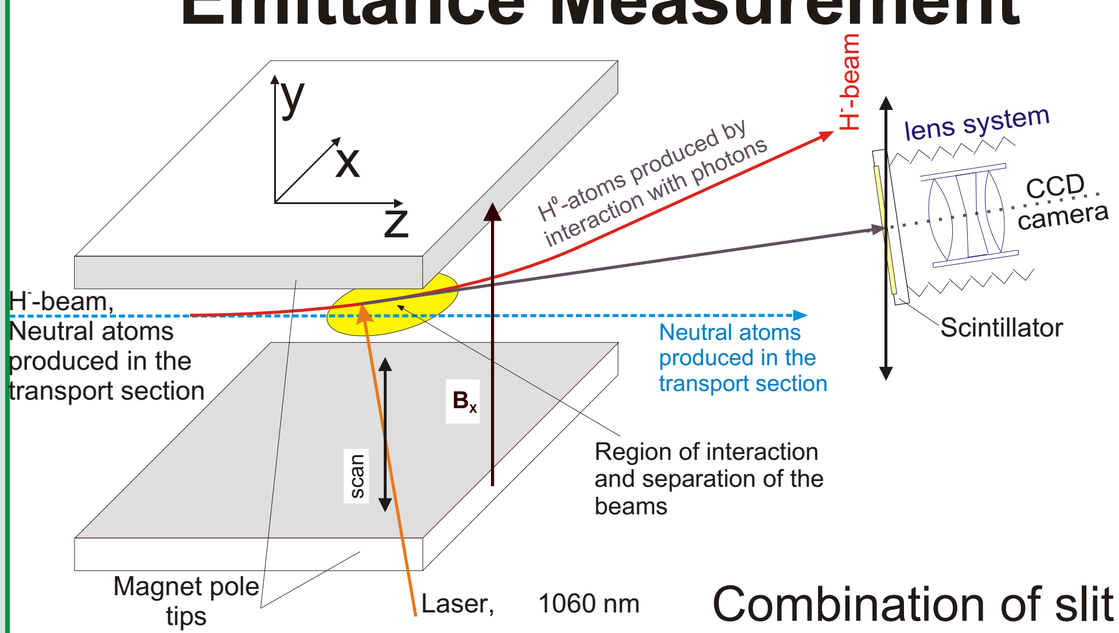
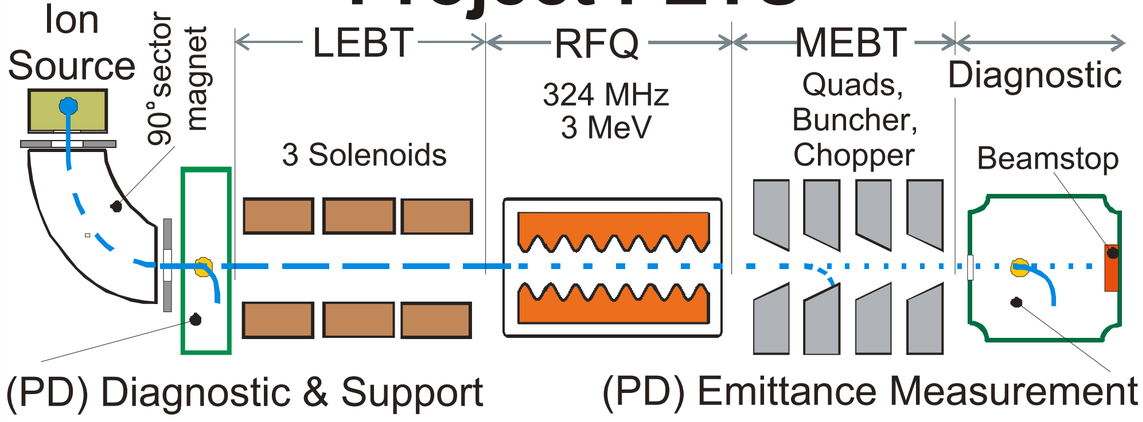
Non--Destructive Transverse Emittance Measurement



Combination of slit and point emittance principle gives unique coupling information of both transverse planes.

The Front End Test Stand Project FETS



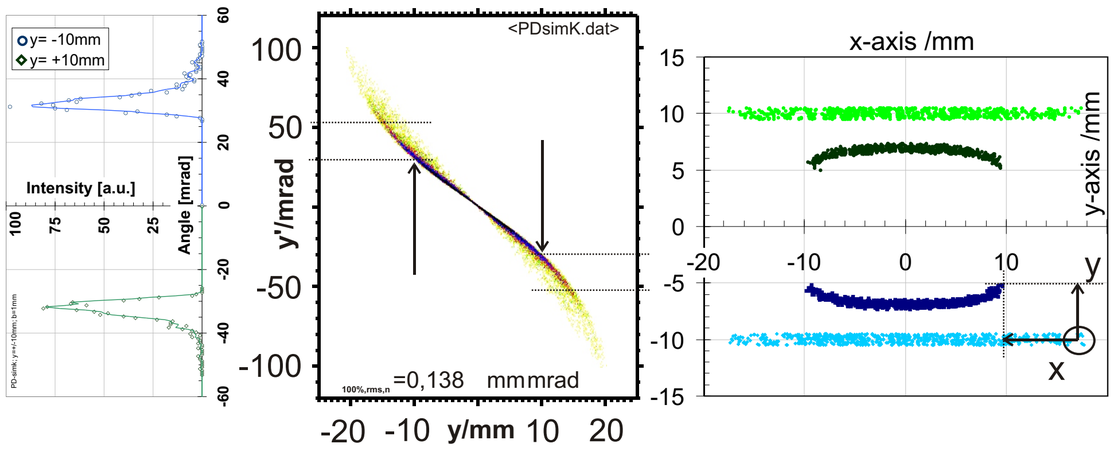
Reasons for non destructive beam diagnostics:

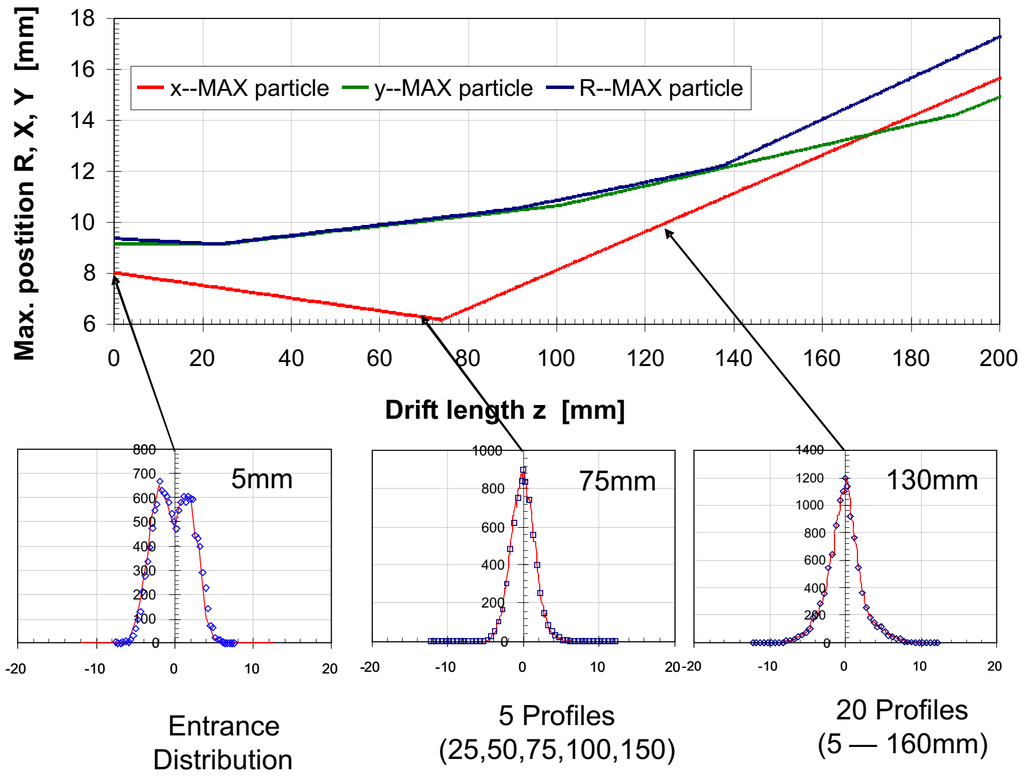
a) high beam power, i.e. technical problems
b) no mechanical parts inside the beam
c) possible to get more info about phase space

Introduction

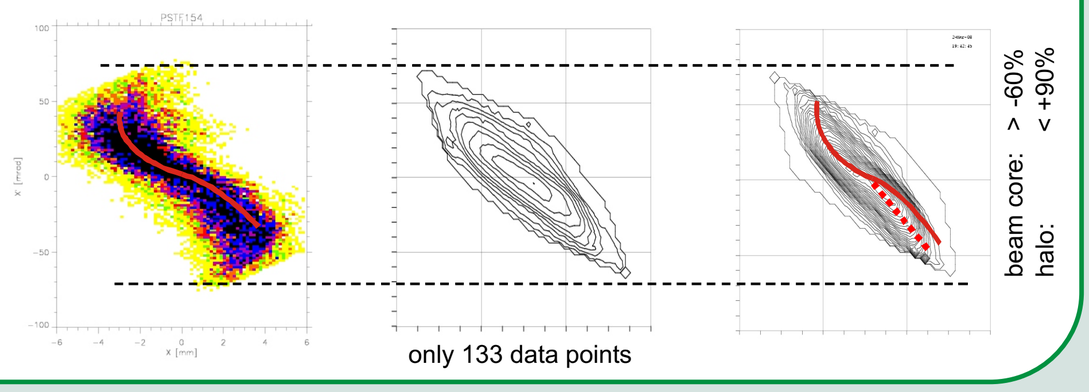
A crucial point for future **H**igh **P**ower **P**roton **A**pplications (**HPPA**) is diagnostics to determine a full set of beam parameters like (transverse) emittance and beam profiles. To overcome problems feeding mechanical parts into the beam, the **P**hoto-**D**etachment (**PD**) process can be used for H- ions. There laser light with appropriate wave length detaches the outer weakly bonded electron. The produced electrons respectively neutrals can than be separated by a magnetic field from the rest of the ion beam without any further disturbing of the ion beam. The poster gives an overview of a transverse emittance instrument intended to use at a 3MeV, 50....60mA H- ion beam:

Above are shown the basic principle and a layout of the beam line. **Below**, on the upper left side, are shown simulations about the transfer function which also has been proven at a downscaled experiment at Frankfurt University, IAP. Because of technical problems applying this concept to both transverse planes it is also possible to move the angle detector in order to profit by the shown coupling. For the emittance reconstruction of the missing plane was chosen an image reconstruction method called Maximum Entropy (MaxEnt). For first tests a code written in Los Alamos (see References) was used.





Maximum Entropy means (MaxEnt) means,
It yields a test object (xx' emittance) with the lowest information content consistent with the available data, i.e. an infinite number of beam profile measurements (projection views) with sufficient "phase advance".



U.Rohrer "Introduction of 2—dimensional beam tomography for monitoring transverse beam emittance at SIN", PSI Ann. Rep. 1982, NL 5—6
G.N.Minerbo, "MENT: A maximum entropy algorithm for reconstructing a source from projection data", Computer Graphics and Image Processing 10 (1979), p. 48—68