The success of high brightness photoinjectors as drivers of SASE FEL experiments has raised again the interest in the beam dynamics associated with intense, quasi-laminar, space charge dominated electron beams: the relevant phenomena observed in such a regime of beam physics are presented and discussed in this talk. Most of the emphasis is focused on the analysis of the so called emittance correction technique, which is applied in the operation of RF guns in order to enhance the performances of these devices in terms of the attainable beam brightness, i. e. minimising the beam emittance in high peak current beams. An introduction of this process is presented, based on an envelope equation approach, which leads to the concept of invariant envelope. The implications of such a concept are discussed and specific examples related to the SPARC high brightness photoinjector project (INFN) and SPARXINO 1 GeV linac design are reported.