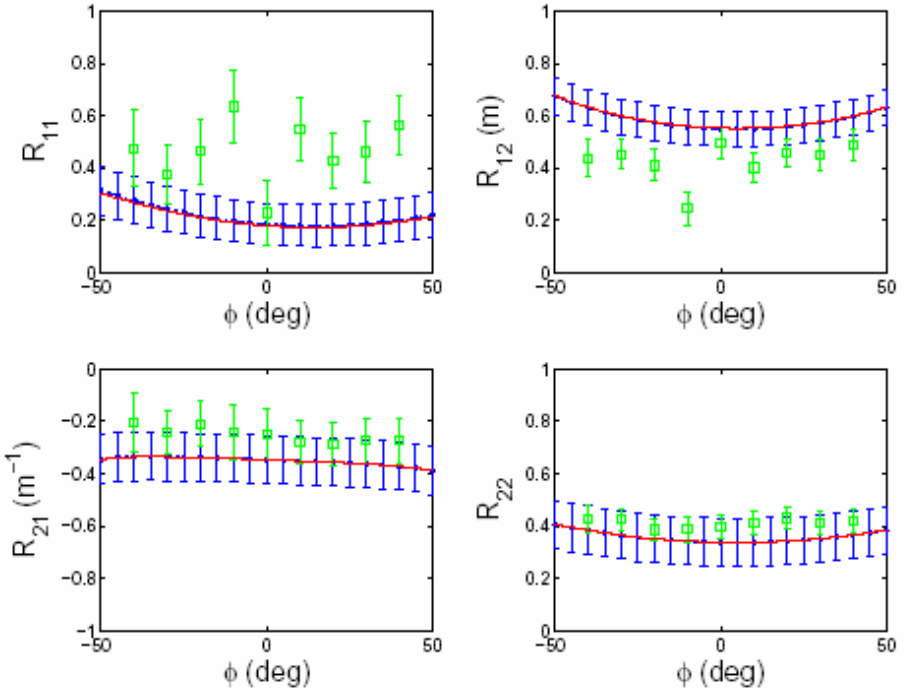
9-cell T-matrix

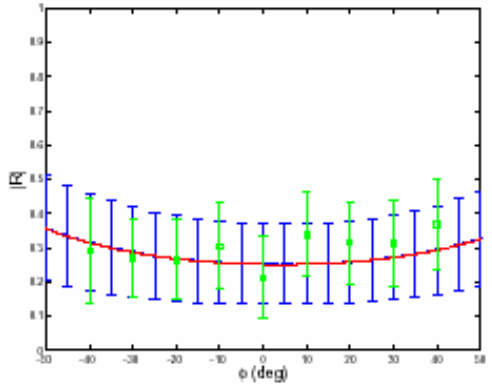
? Discrepancies with simple cylindrical-symmetric models

? Still not understood, last summer; analysis redone (w M. Ripert) including non linearity in the BPM

? Wanted to first do a beam-based alignment of the beam in the cavity using HOM power, but there is no HOM signal on the pick-up (finding by Tim Koeth)…

? On the simulations side, 3D model of the DESY/Saclay type couplers have been included in Astra (Spring 2005) but not yet applied to A0 data





Flat beam

? **Done for now(?)** : developed procedures, and reproducibly achieve high emittance ratio
=> emittance ratio=100

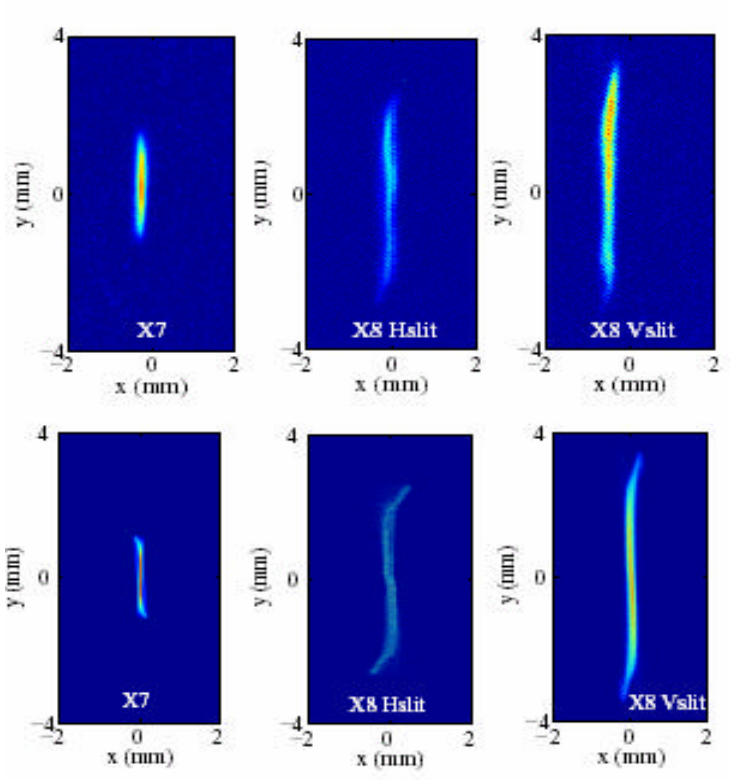
? Installed single slit and did simulation studies of the meas. (BeamDocs)

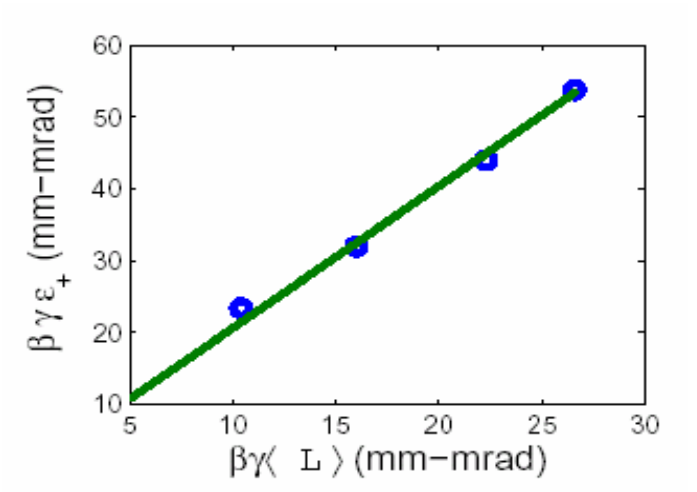
? Not able to measure the smallest emittance (resolution and spurious dispersion),

? Smallest measured emittance is two time lower than the thermal emittance (measure 0.4 mm-mrad at 0.5 nC)

? Experimentally measured: $e_+ = 2\ell$

? 1st draft of PRL done





Longitudinal space charge studies

? 1st experiment/observation done in Dec. 2003

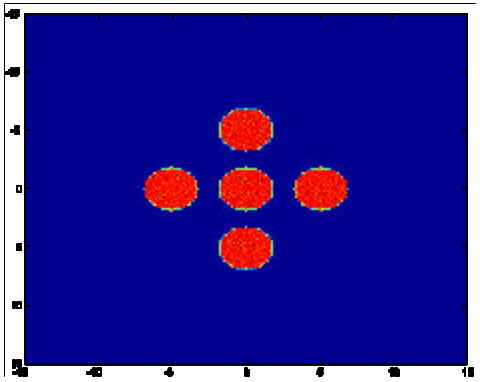
? Should retake data together with monitoring laser (single shot auto-correlator)

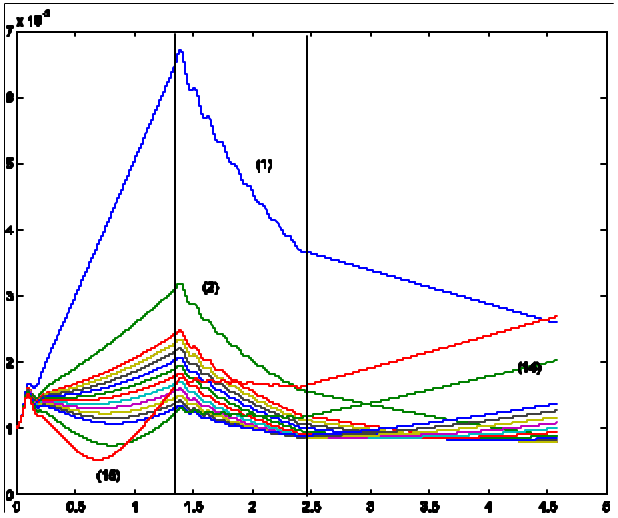
? We could also study possible interplay between longitudinal and transverse density (using imaging system to “modulate” the transverse laser distribution will results in energy modulation”

Application of the imaging system (1)

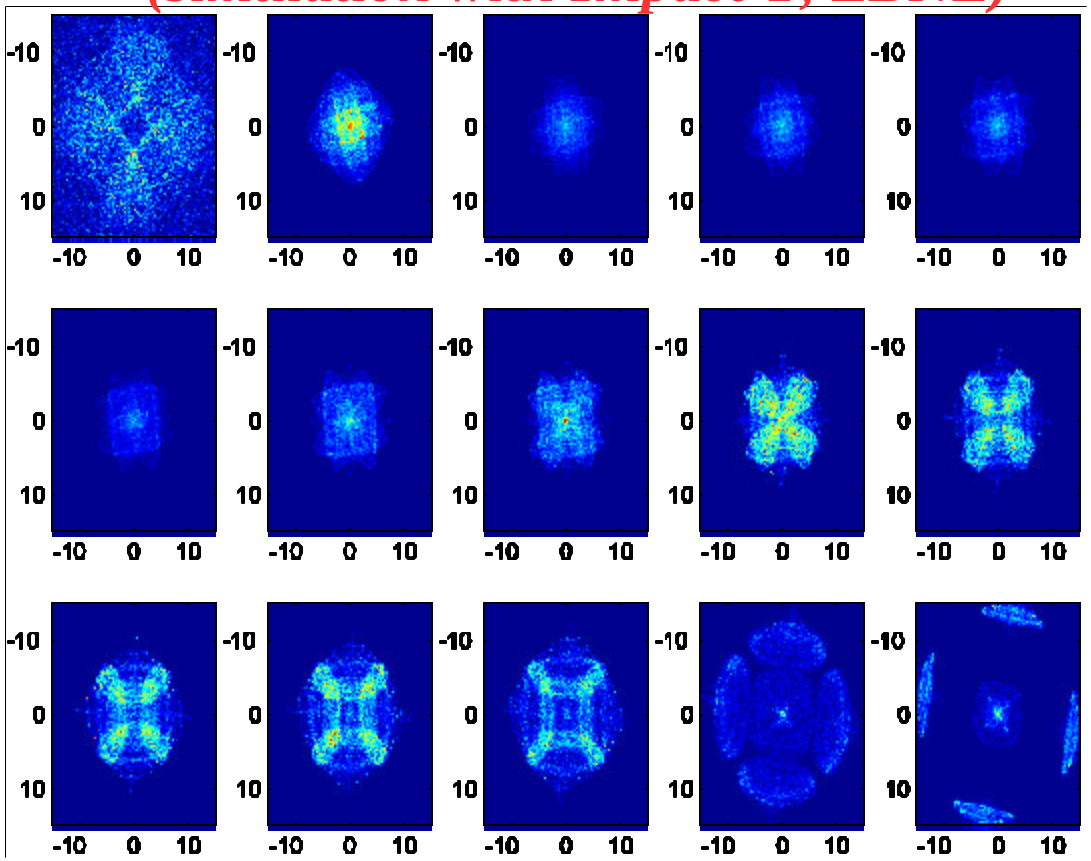
? “5 beamlets”, initially thought as adaptation of Reiser’s 5-beamlets experiment to photo-injector,

? to date 5-beamlets “only” offer a way to quantitatively benchmark 3D space charge algorithm,





(simulation with Impact-T, LBNL)



Application of the imaging system (2)

? First version use a Al-mask machined in Rochester workshop

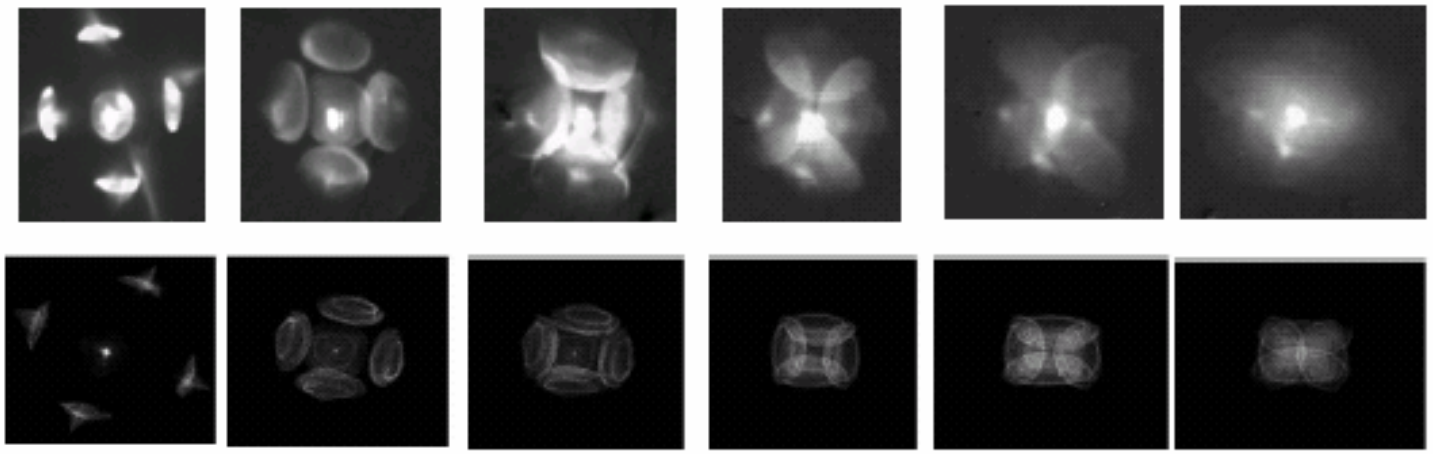


Fig. 4. Comparison of results from experiment (up row) and simulation (low row). The currents on primary solenoid are, from left to right, 237 A, 209 A, 199 A, 188 A, 182 A, and 173 A (the images are not to scale)

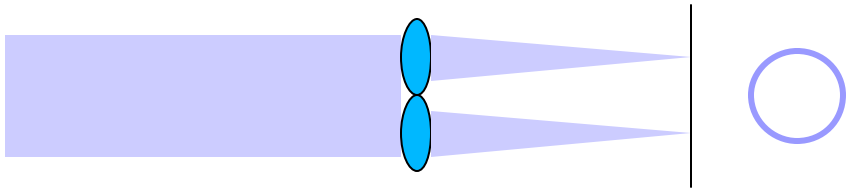
? Should use UV mask, with given modulation (in intensity and period)

? Could study how the “granularity” is smoothed as the beam propagate, both in space (viewer) and divergence (slits)

? Could also measured emittance (but this has been done at ATF/BNL)

Application of the imaging system (3)

? Generation of ultra-low energy spread beam (intrinsic energy spread comes from r-dependence of E_z-field)



? Cylindrical lens, could be used to produce a line focus on the cathode, that is a ribbon beam (not studied yet)

EO sampling experiment

? NIU, is about to procure a Ti:Saphire laser (~20 fs) + ICCD

? Phase 1 (at NIU): couple laser to fiber, study polarization preservation, compression, and chirping, develop control system (with Jianliang)

? Phase 2 (at A0?): install laser at A0, do single shot experiment (use frequency chirp first?) in a six-way cross

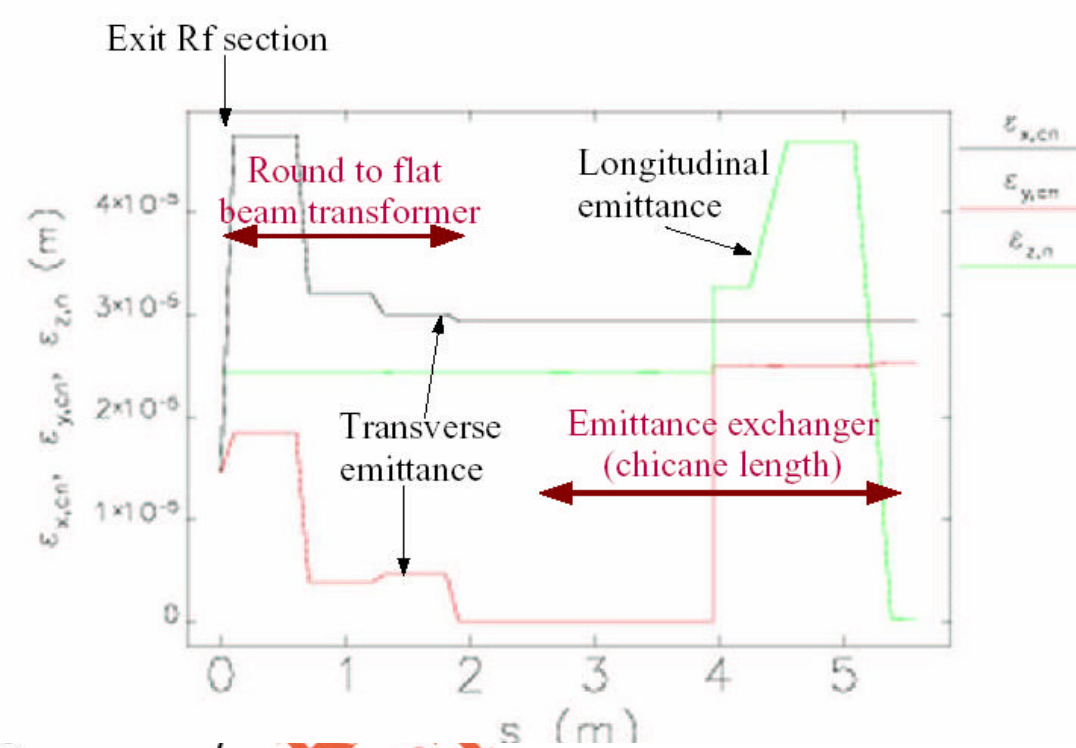
? Phase 3: Design a better interation region, measure bunch length

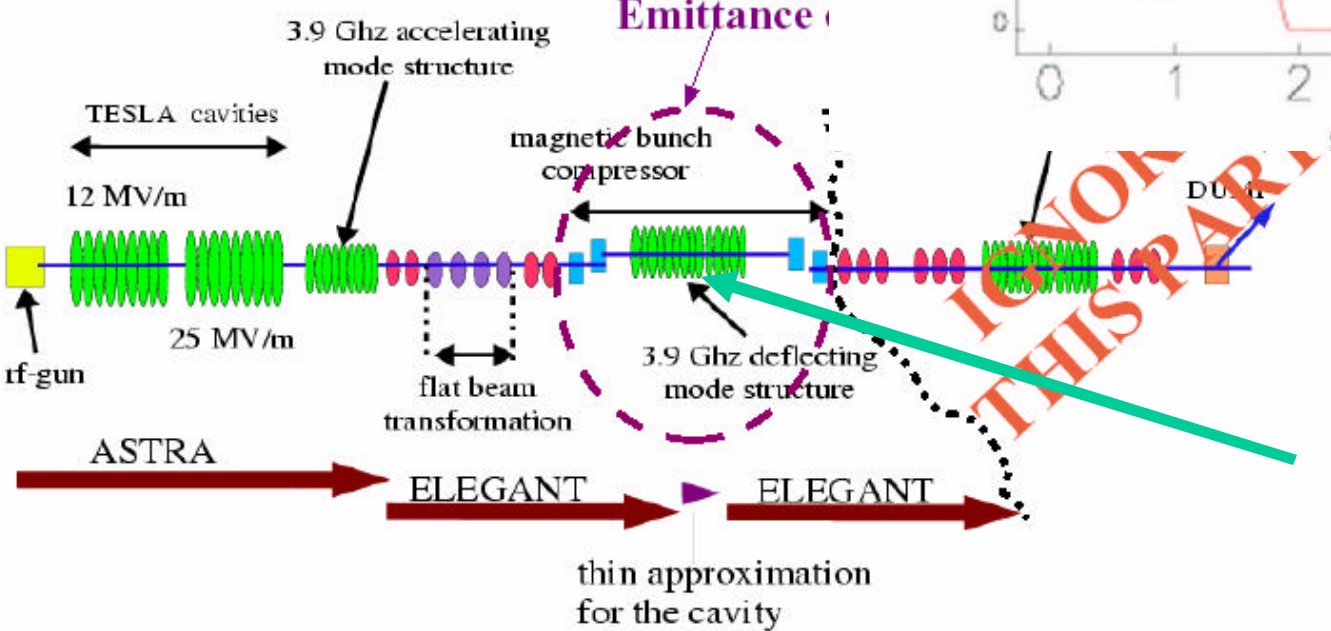
? Phase 4: do time dependent transverse spot size measurement

Flat beam and longitudinal-to-transverse emittance exchnage

? Combine flat beam with transverse-to-longitudinal emittance exchange (prop. in Dec 2003…)

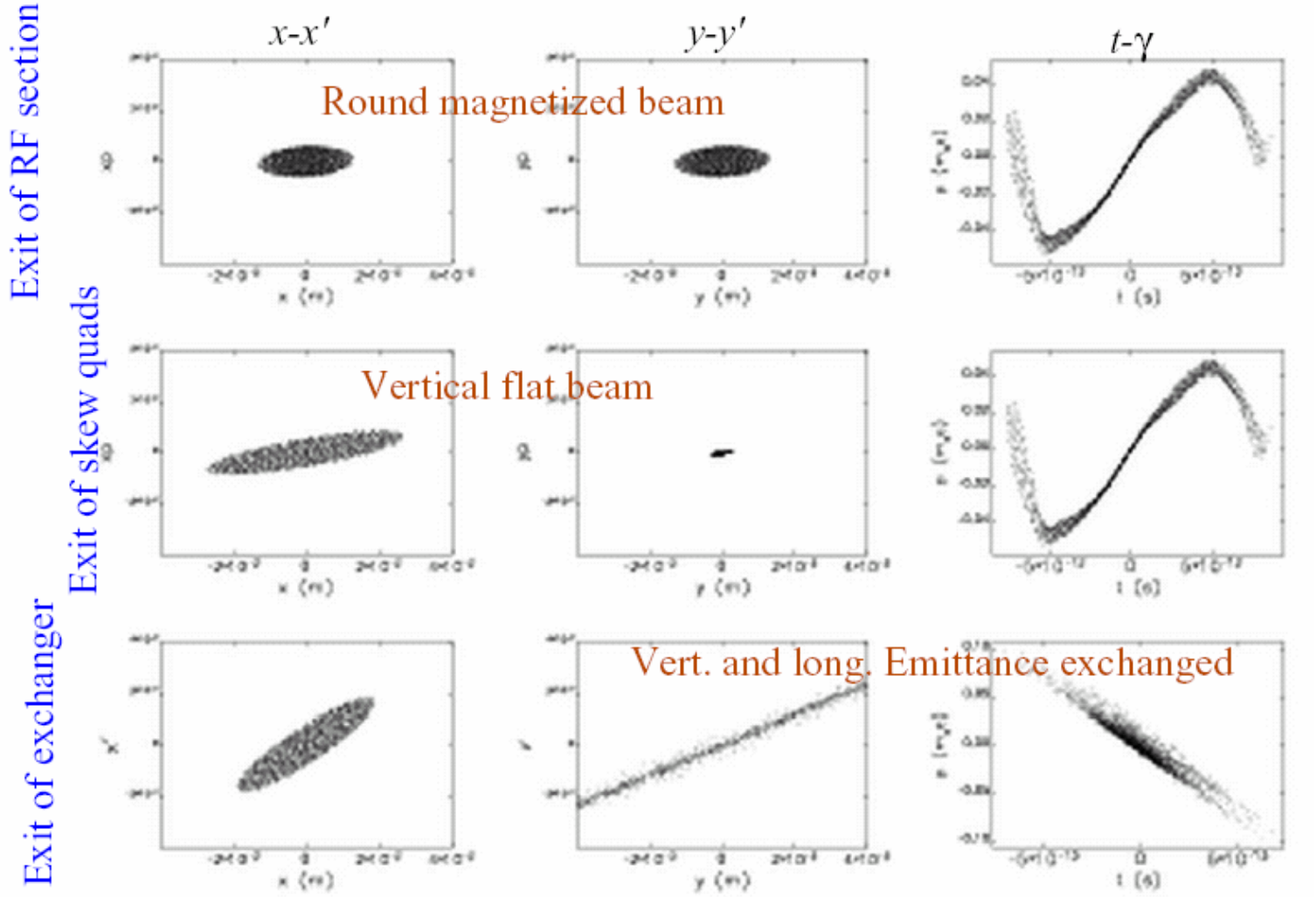
? Proof-of-principle possible at A0 (at 40 MeV)





Do not need high voltage ~ few kV

Flat beam and longitudinal-to-transverse emittance exchnage



It has application to FELs

? Application to LCLS (Emma, Huang, Kim and Piot), to enhance gain in single-pass FEL's (paper in preparation)

? Low charge operation, make ultra-low transverse emittance (~0.1 mm-mrad) and larger longitudinal emittance (10 mm-mrad).

? Larger longitudinal emittance good to avoid LSC, CSR as long as the energy spread is low enough for the FEL performance,

? Smaller transverse emittance good for the gain

? Can reduce the undulator length…