An Incremental Solenoid Based FEL Beam Conditioner (*preliminary results*)

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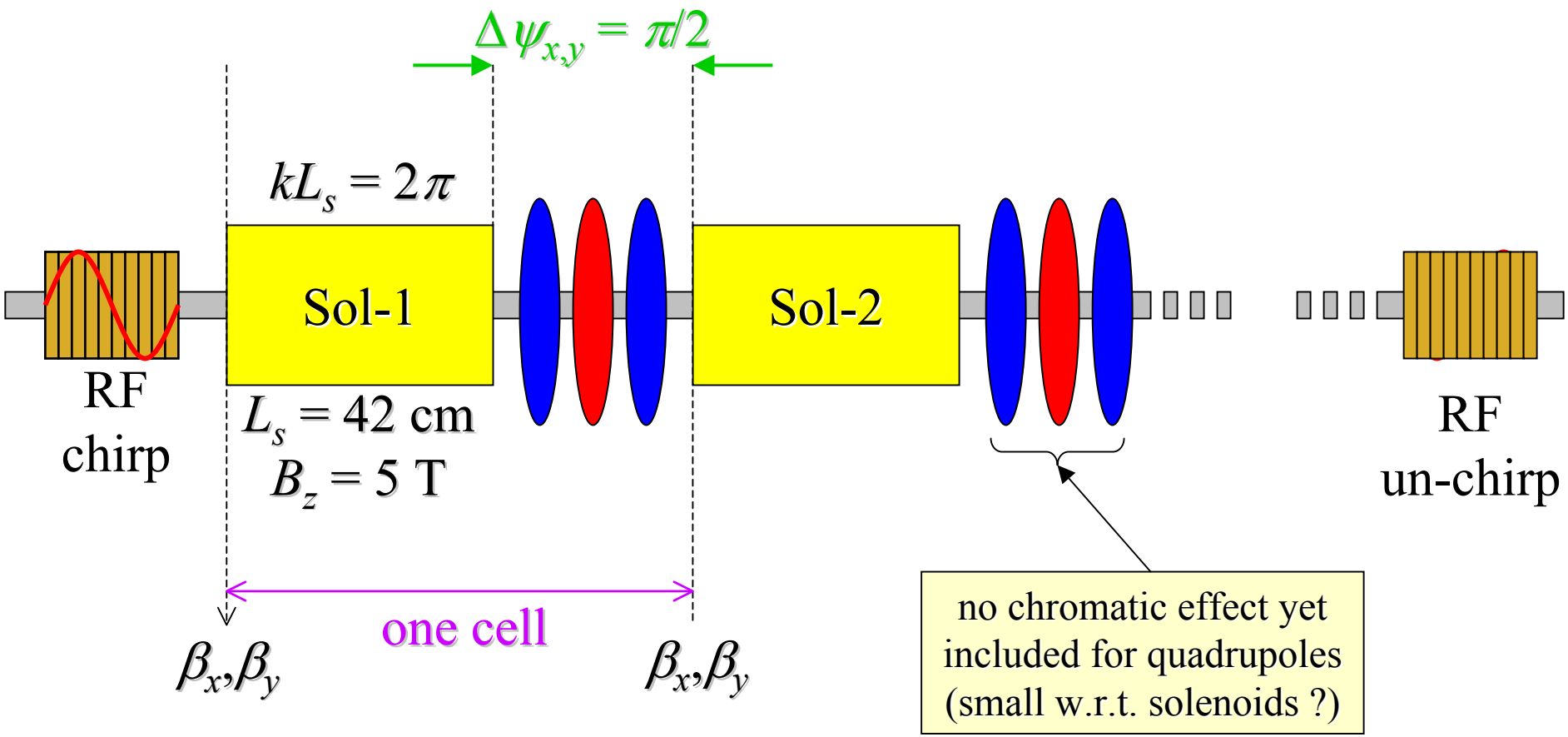
Thanks to Andy Wolski / Sessler *et al.*

Incremental Phase-Stepped Solenoid Conditioner



Solenoid Conditioner Parameters

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Ei      = 0.100;        % initial electron energy [GeV]
Bz      = 50.0;         % solenoid field [kG]
nrot    = 1.0;          % number of beam rotations in each solenoid (sets length of solenoids)
N       = 5000;         % N-macro-particles
sigZ0   = 1.0E-3;       % rms initial bunch length [m]
sigE0   = 0.45E-2;      % rms initial correlated E-spread [ ]
sigEu0  = 1E-6;         % rms uncorrelated E-spread [ ]
corsign = +1;           % E-z correlation sign (=1, -1, or 0) [-1 is head at high-E]
betax0  = 10;           % initial X beta at 1st solenoid entrance [m]
betay0  = 10;           % initial Y beta at 1st solenoid entrance [m]
alphax0 = 0;            % initial X alpha at 1st solenoid entrance [ ]
alphay0 = 0;            % initial Y alpha at 1st solenoid entrance [ ]
emitxN0 = 1E-6;         % initial X norm.emittance at 1st solenoid entrance [m-rad]
emityN0 = 1E-6;         % initial Y norm.emittance at 1st solenoid entrance [m-rad]
psi     = 90*pi/180;    % X and Y phase adv. between each solenoid
Ncells  = 38;           % number of cells (= number of solenoids)
Lc      = 0.5;          % length of phase advancer section [m] (used to estimate sys. length)
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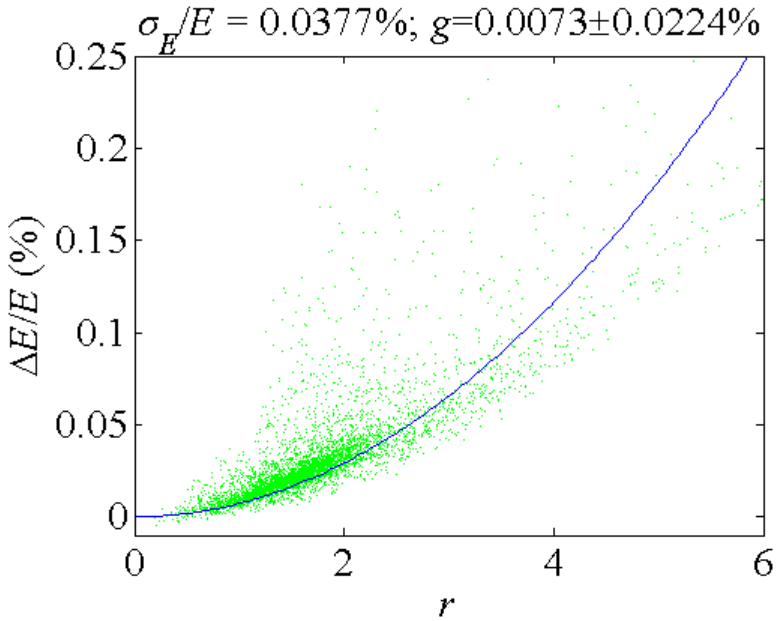
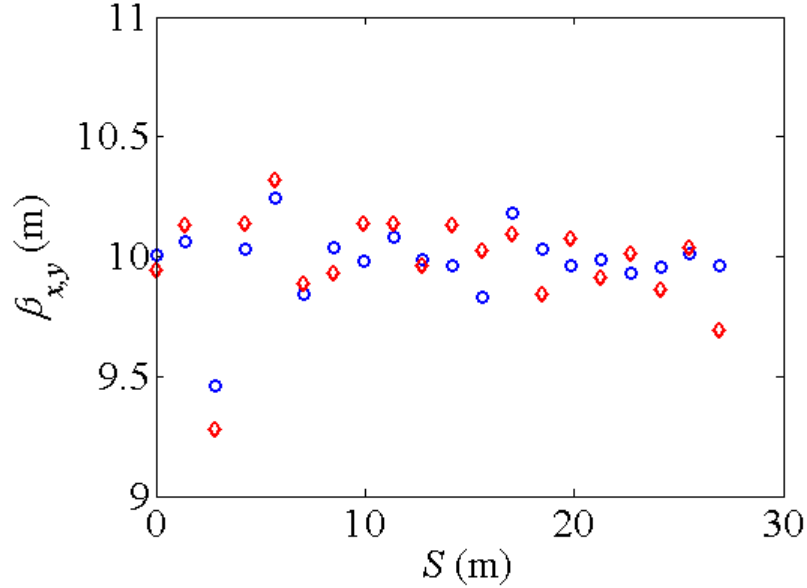
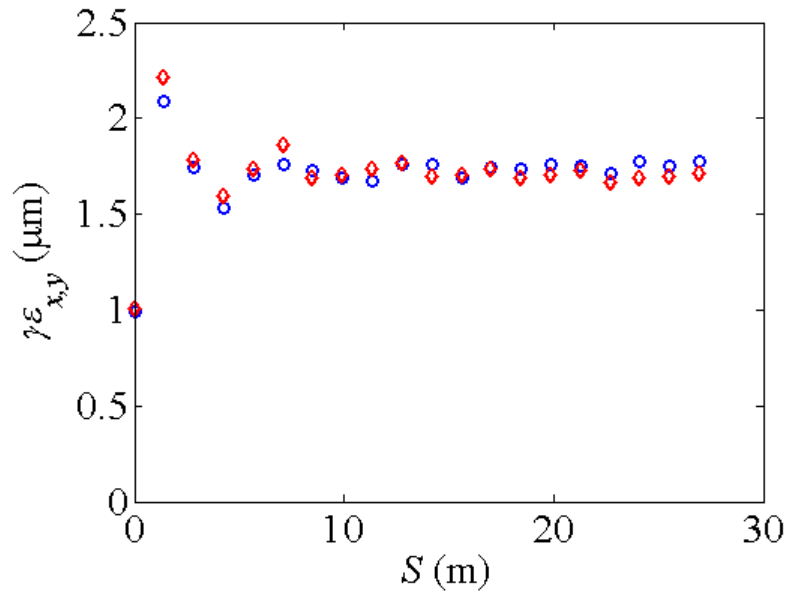
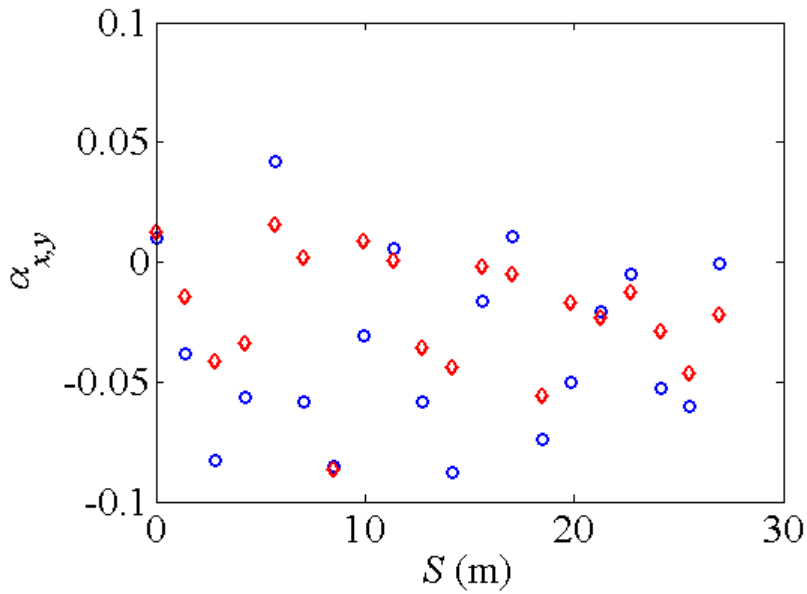
30-m long conditioner with $\beta_{x,y}$ = 10 m, 38 cells

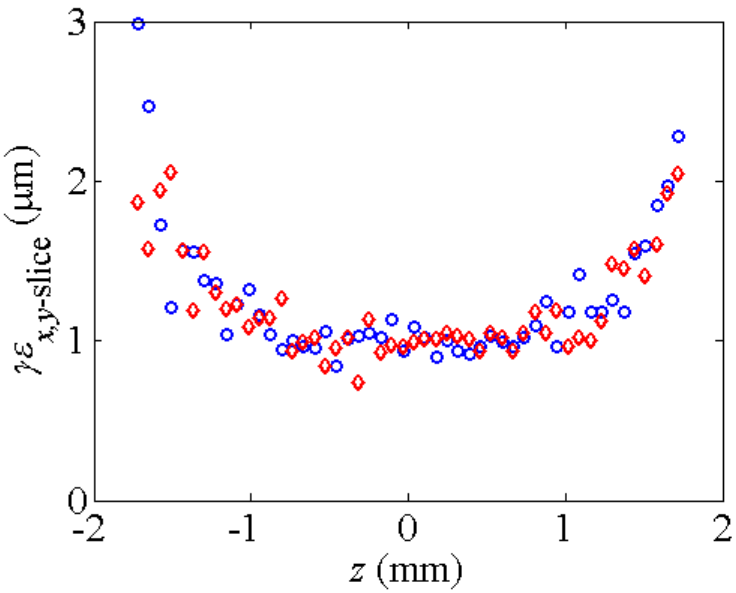


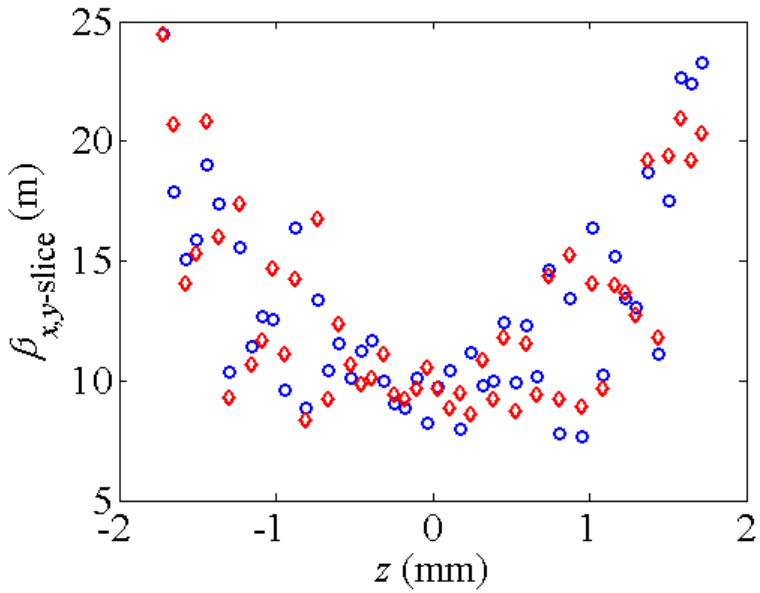


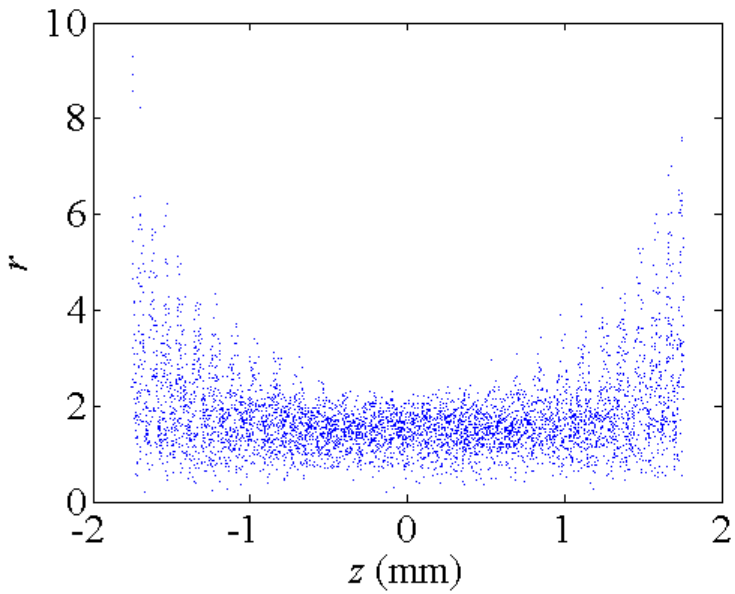


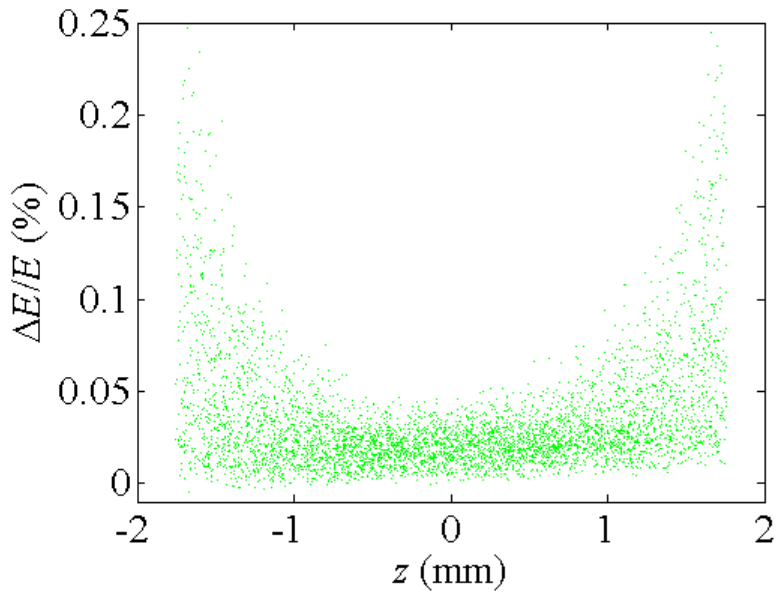


Slice emittance, beta functions, *r*, and energy spread at system end

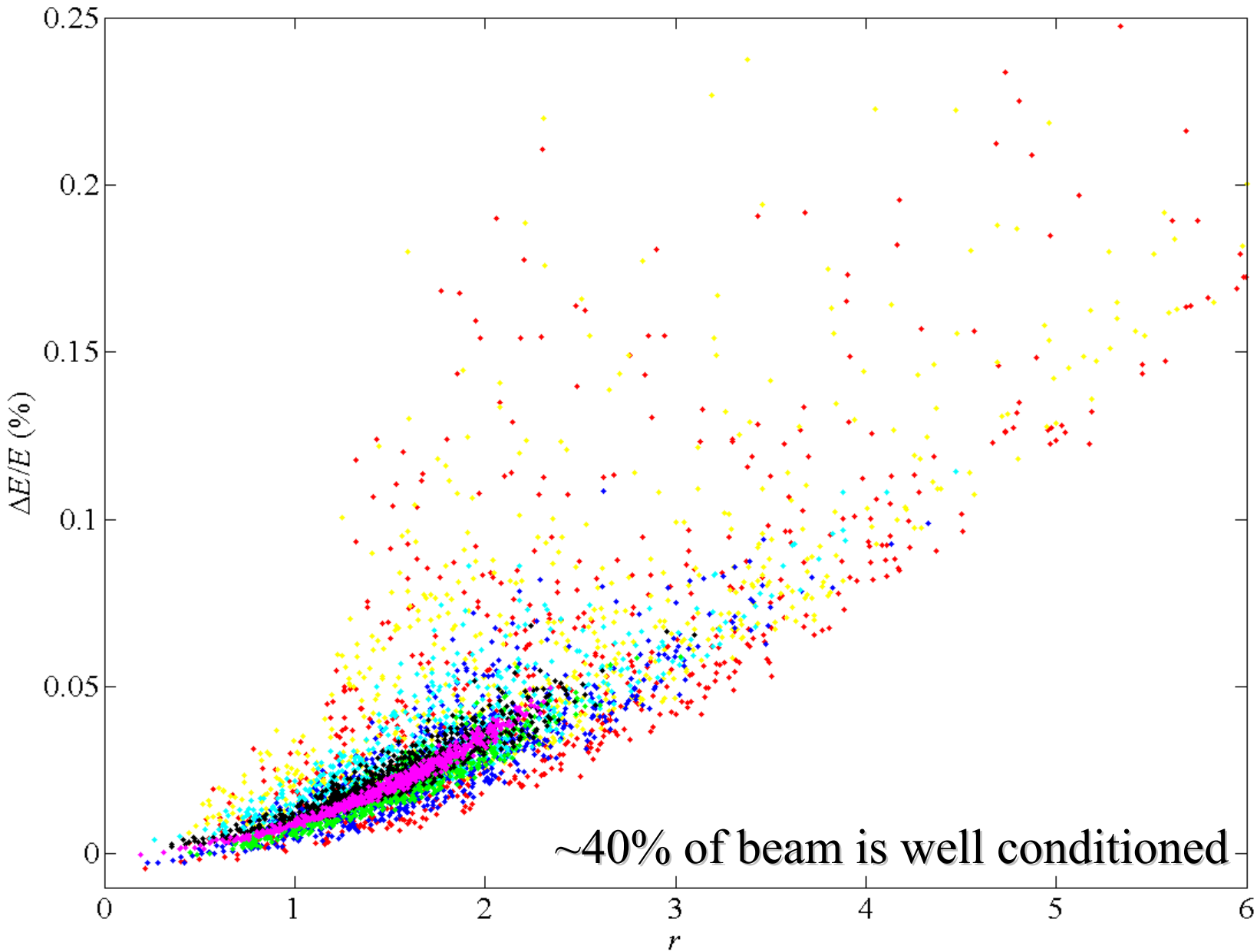




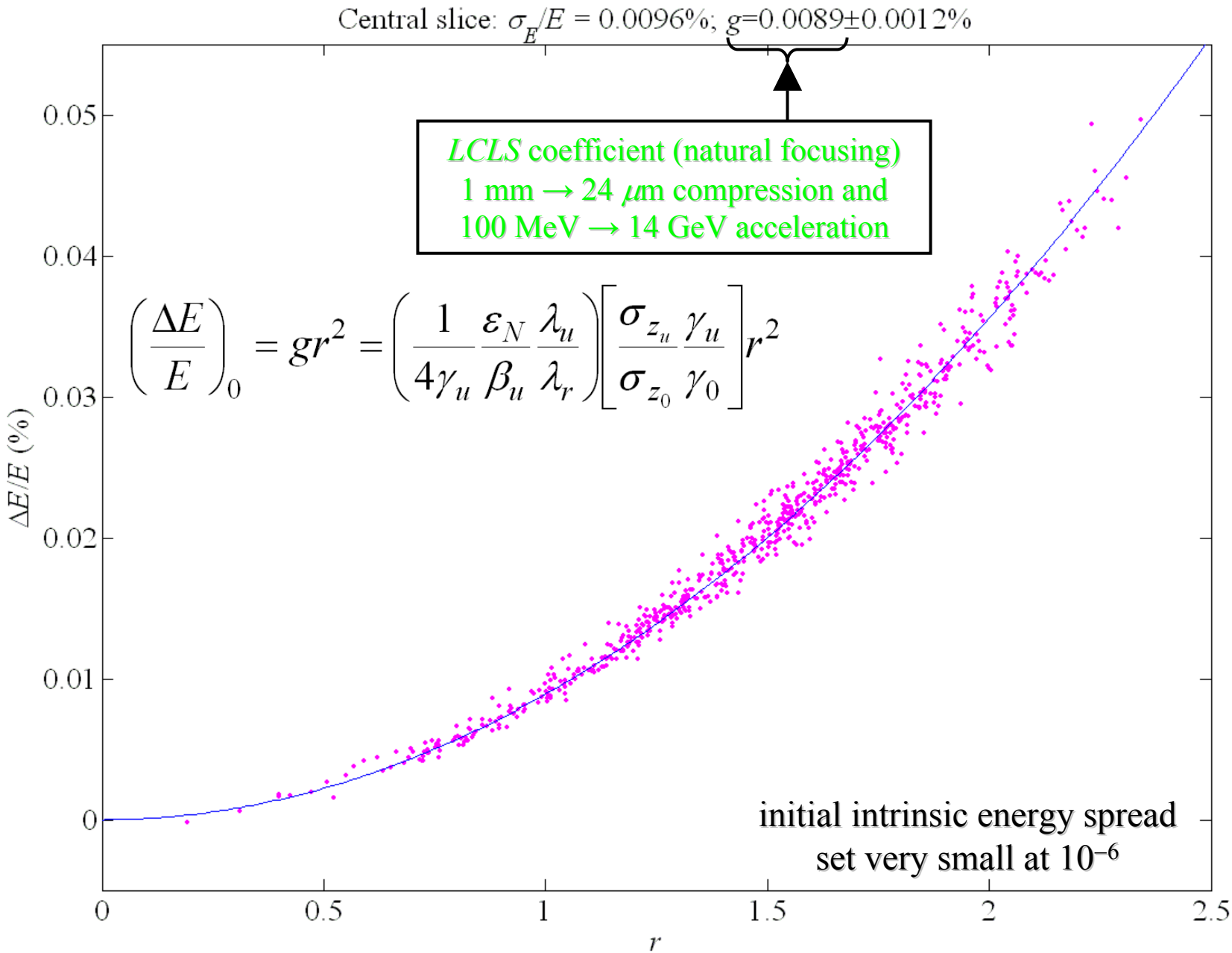




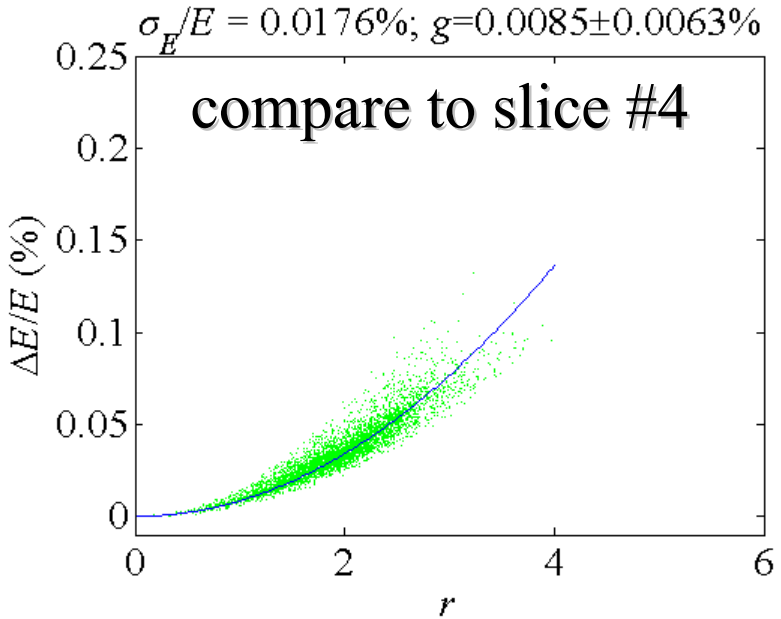
Conditioning of each of 7 time slices (–3 –2 –1 0 +1 +2 +3)

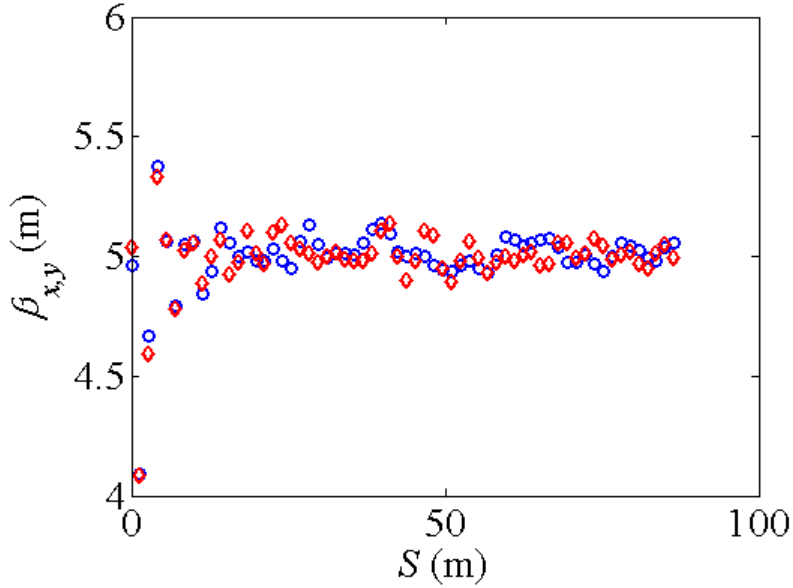


Conditioning of central slice (15% of beam)

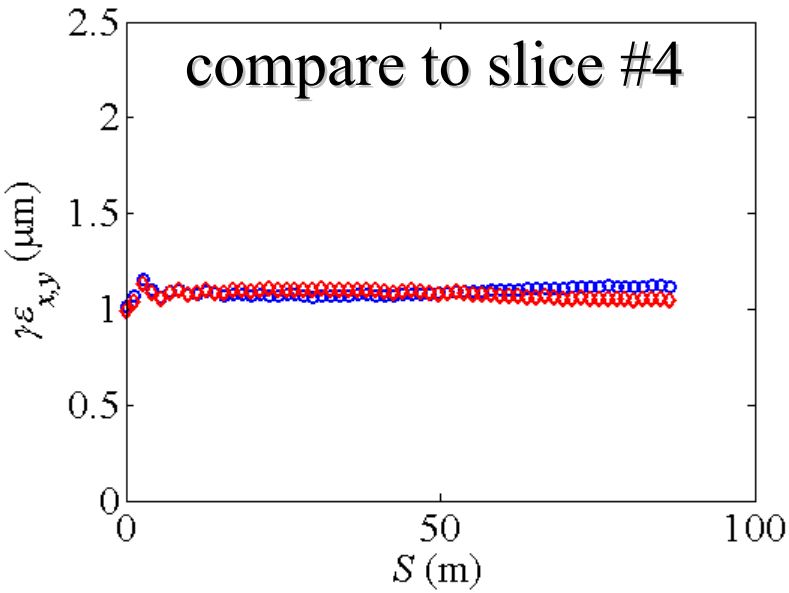


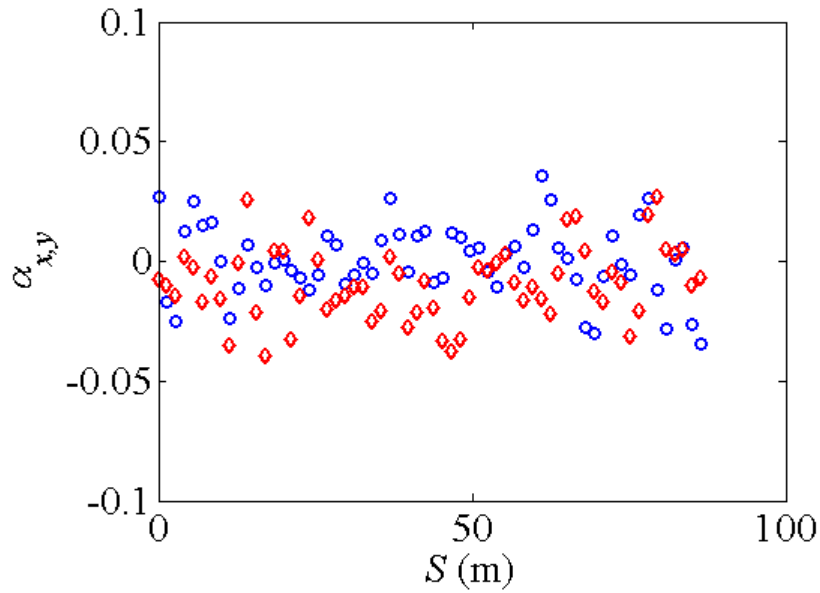
80-m long conditioner with $\beta_{x,y}$ = 5 m, 122 cells





NOW LOOK AT LONGER, GENTLER CONDITIONER





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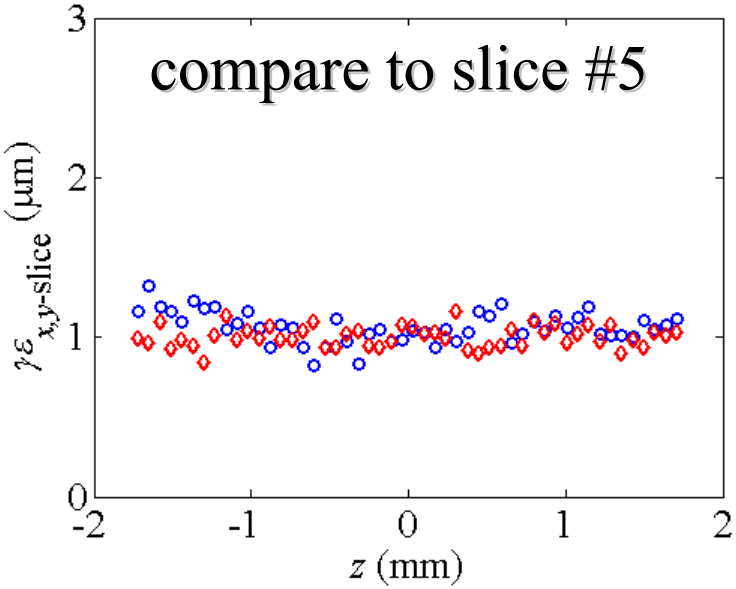

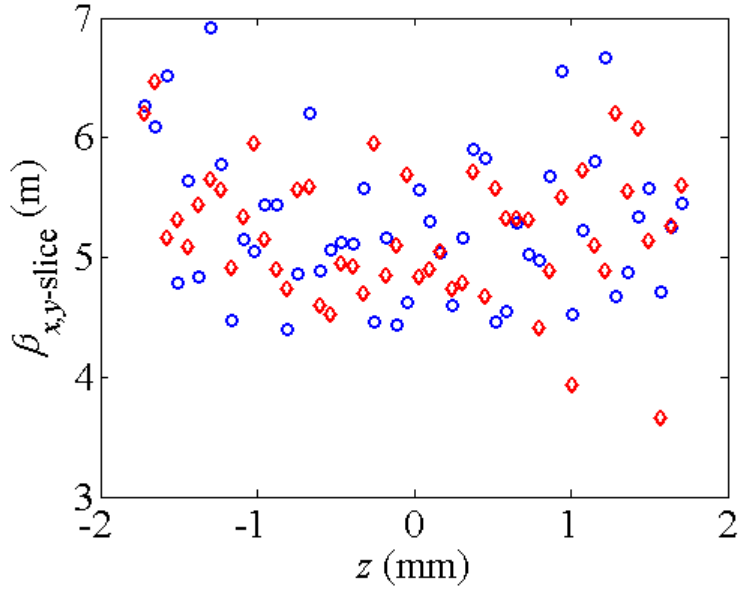

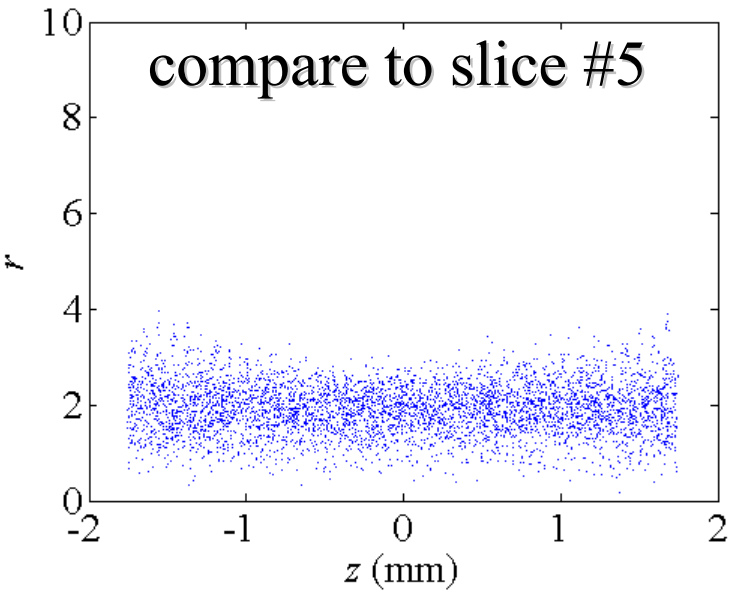

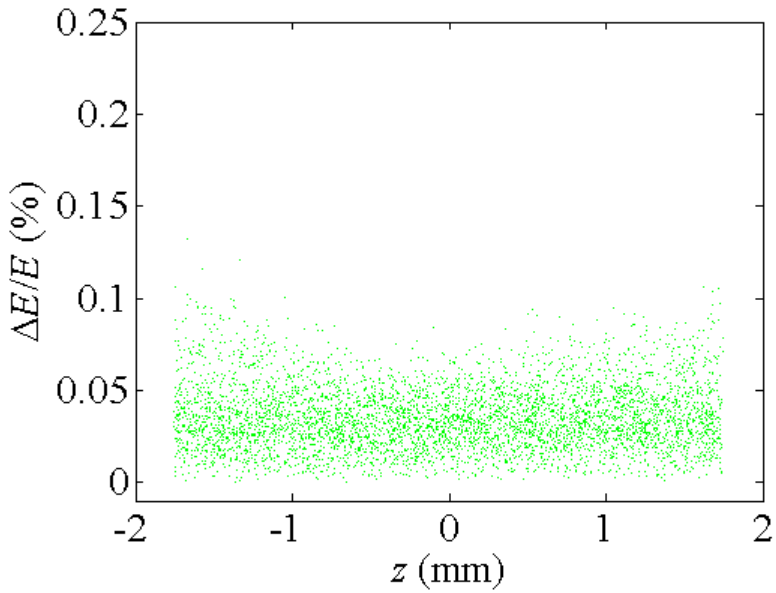

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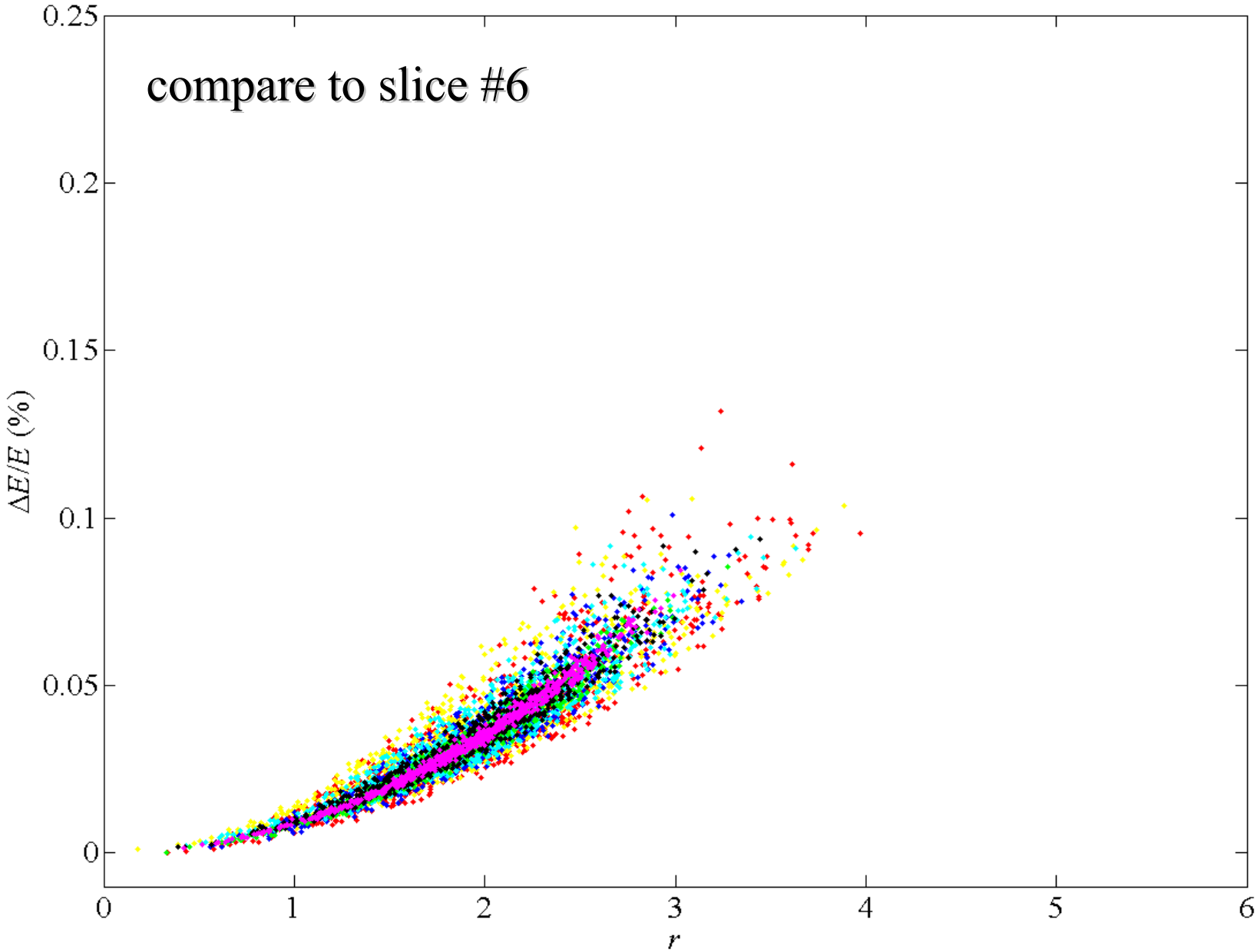

Conditioning of central slice (15% of beam)