KURRI Simulation Benchmarking
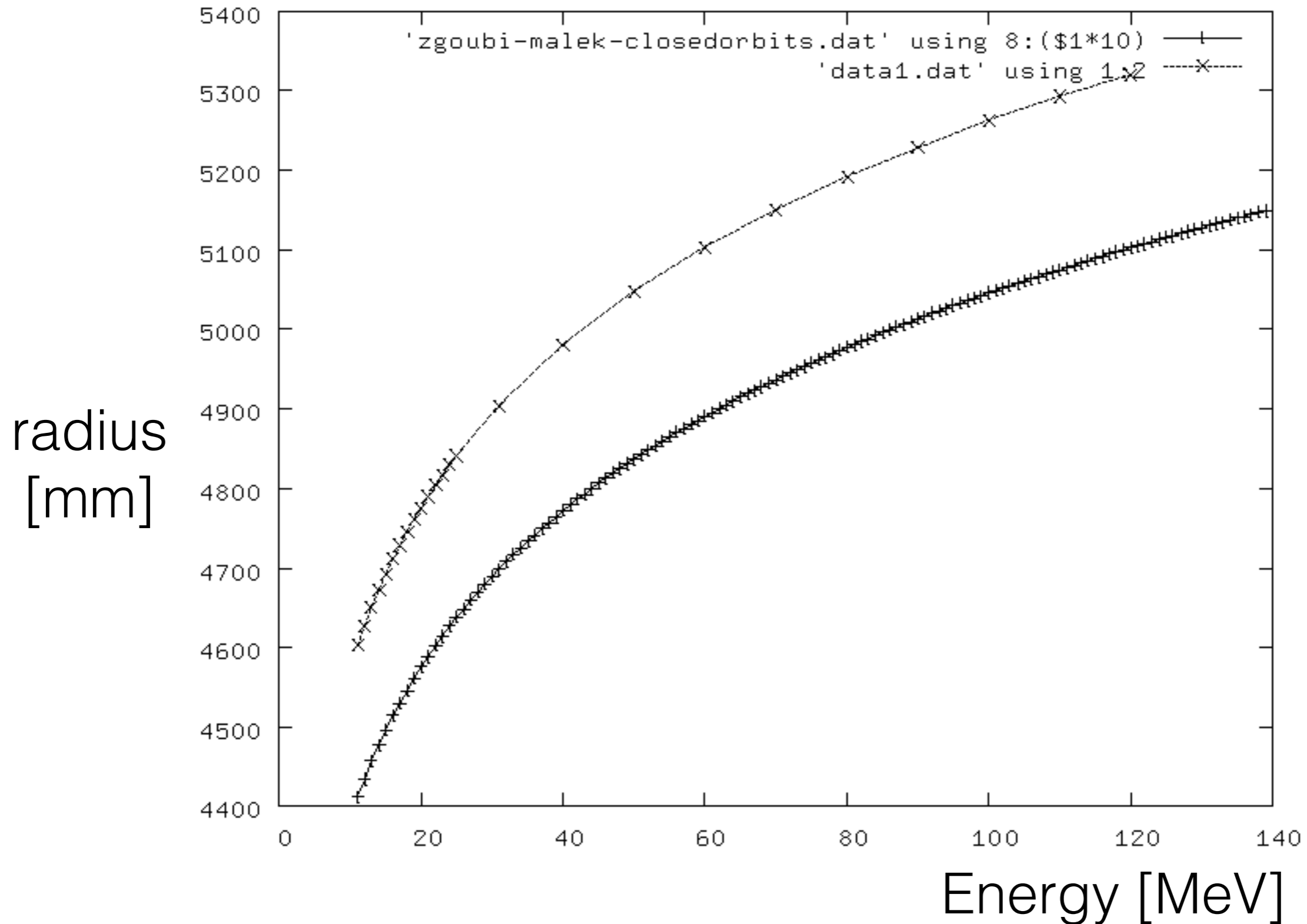
Progress with OPAL

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Setup

- Using OPAL version 1.3.2 binaries available from AMAS website

- Using Chris Rogers' field map: "tosca_map_f810_d1020_massaged.table" updated to correct geometry (not get on github)

- Most of the setup work was done by Chris (thanks!)
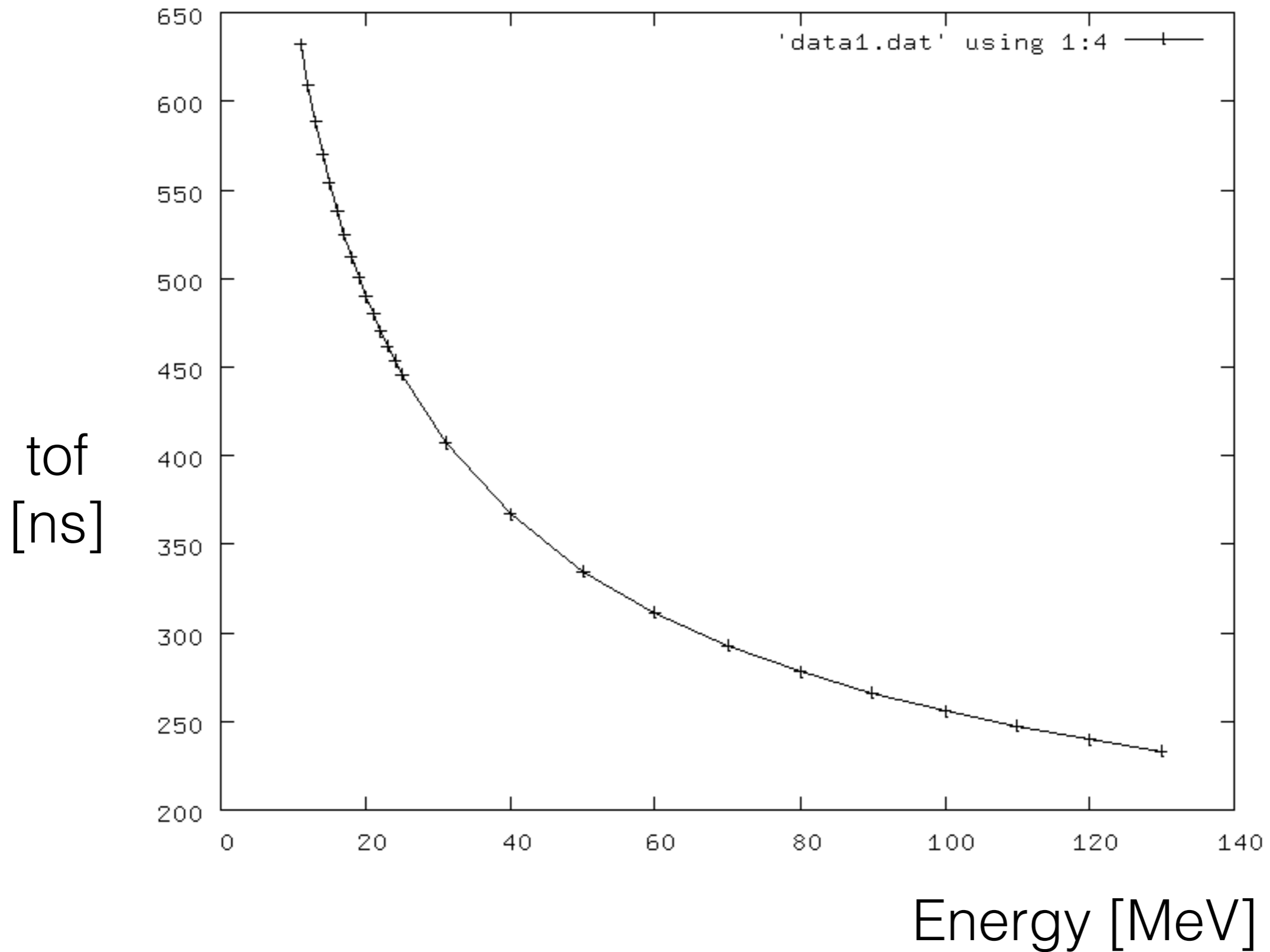
Benchmarking aims

- single particle dynamics:

  - closed orbit positions

  - time of flight with energy

  - betatron tunes with energy

  - accelerated orbits

- multi-particle dynamics:

  - tracking emittance growth with space charge

OPAL configuration

r_init=4430.;

patch_offset: LOCAL_CARTESIAN_OFFSET, end_position_x=0.0813615, end_position_y=0., end_normal_x=1., end_normal_y=1.8366e-05;

triplet: SBEND3D, FMAPFN="fieldmaps/TOSCA_cyli13_massaged_4.H", LENGTH_UNITS=10., FIELD_UNITS=1e-3, POLYNOMIAL_ORDER=poly_order, SMOOTHING_ORDER=smooth_order;

ringdef: RINGDEFINITION, HARMONIC_NUMBER=1, LATTICE_RINIT=r_init,
        LATTICE_PHIINIT=0.0, LATTICE_THETAINIT=0.0, BEAM_PHIINIT=0.,
        BEAM_PRINIT=0.0, BEAM_RINIT=r0, SYMMETRY=1.0, RFFREQ=frequency,
        IS_CLOSED=true;

l1: Line = (ringdef, probe1, triplet, triplet, triplet, triplet, triplet, triplet, triplet, triplet, triplet, triplet, triplet, triplet);

Single particle closed orbits

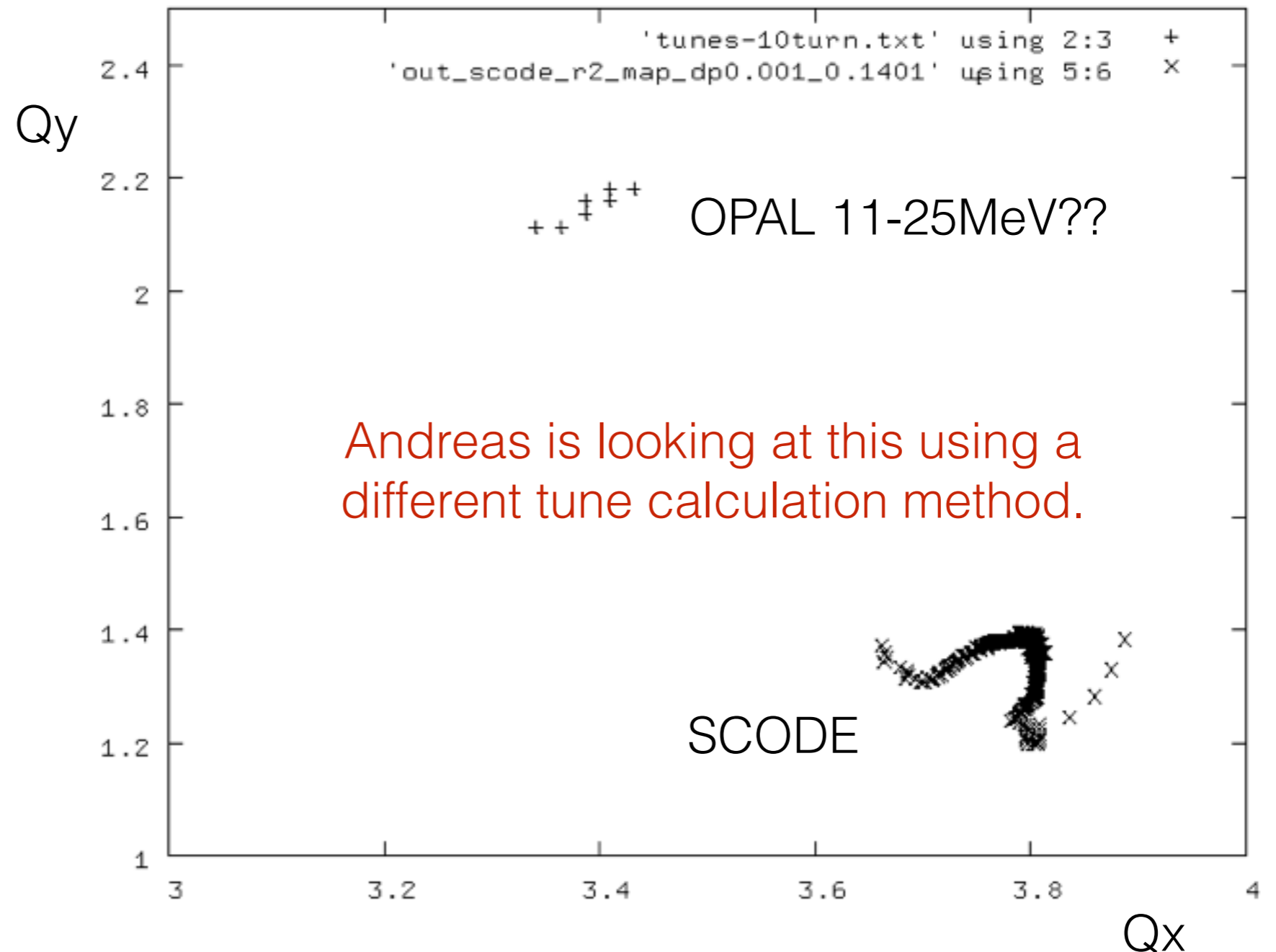- Iterative method with tolerance to find CO
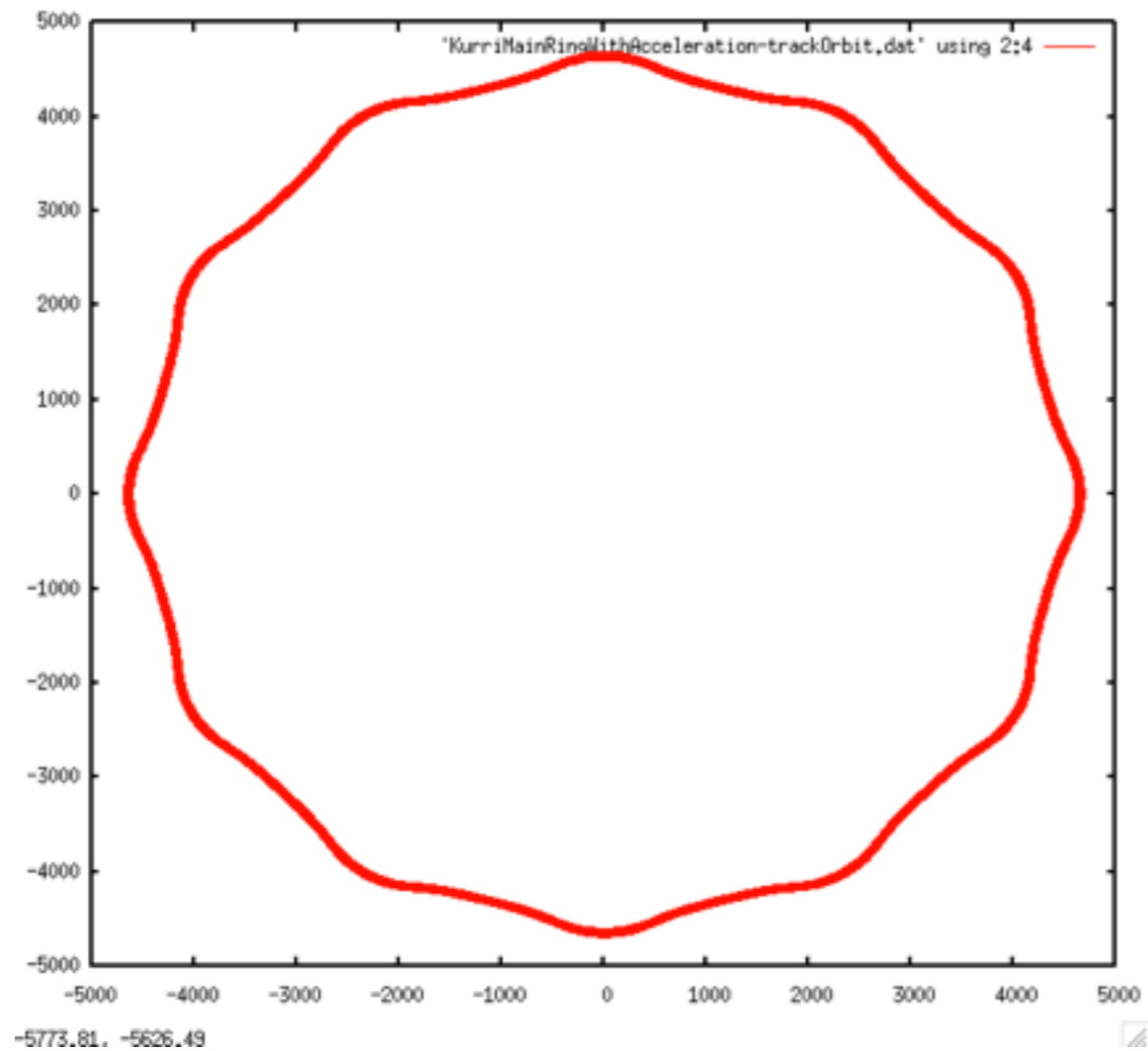
Revolution times

Betatron tunes

- Uses FFT method with 2 particles

- Note: Very sensitive to parameter 'BFREQ' which defines the tracking time step and tells OPAL how many steps it expects per 'turn'. (This is a bit clunky…)

Single particle orbits - OLD

Just did a simple run of Chris' file for 100 turns with acceleration
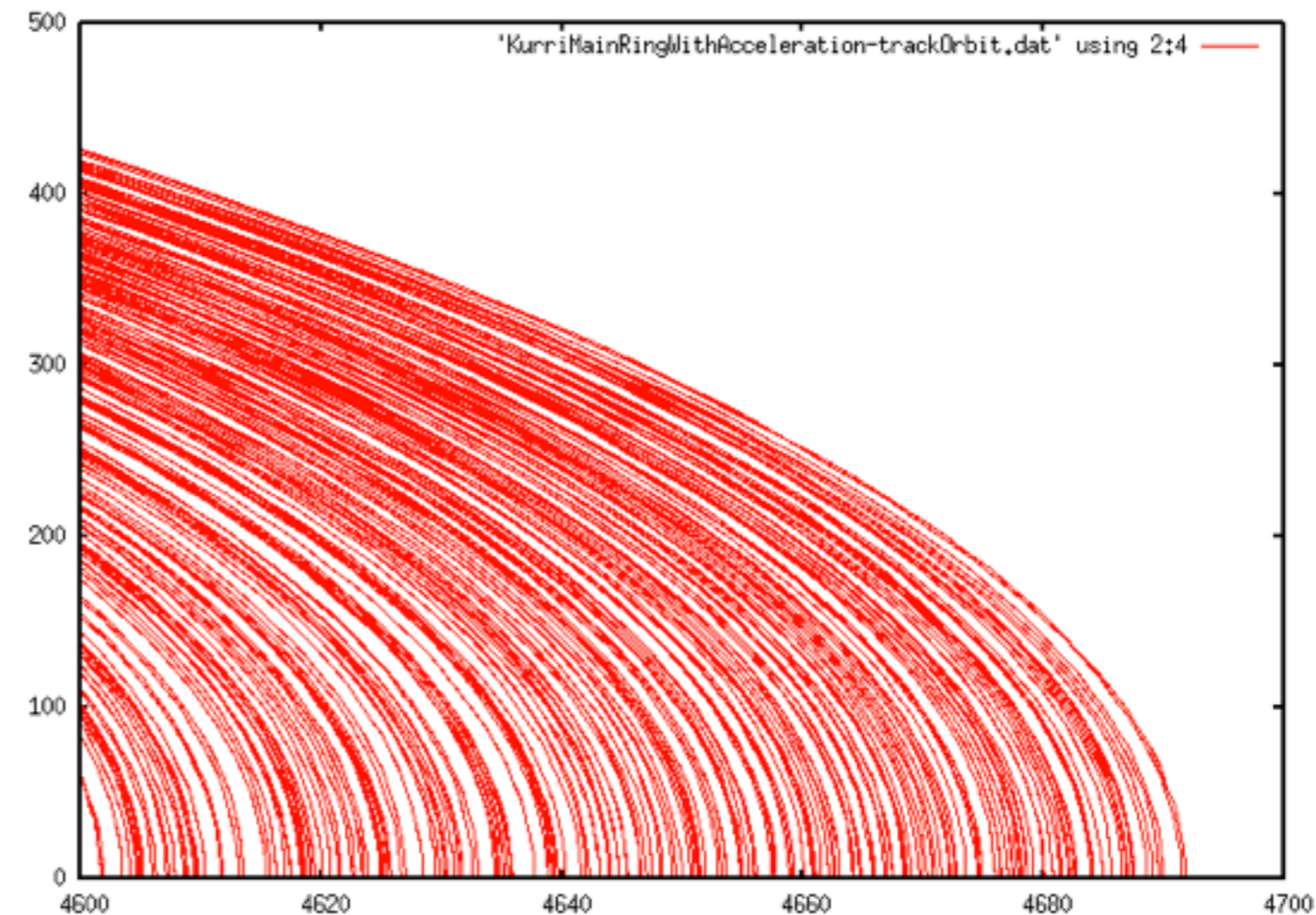10mm step size

Full ring, 100 turns
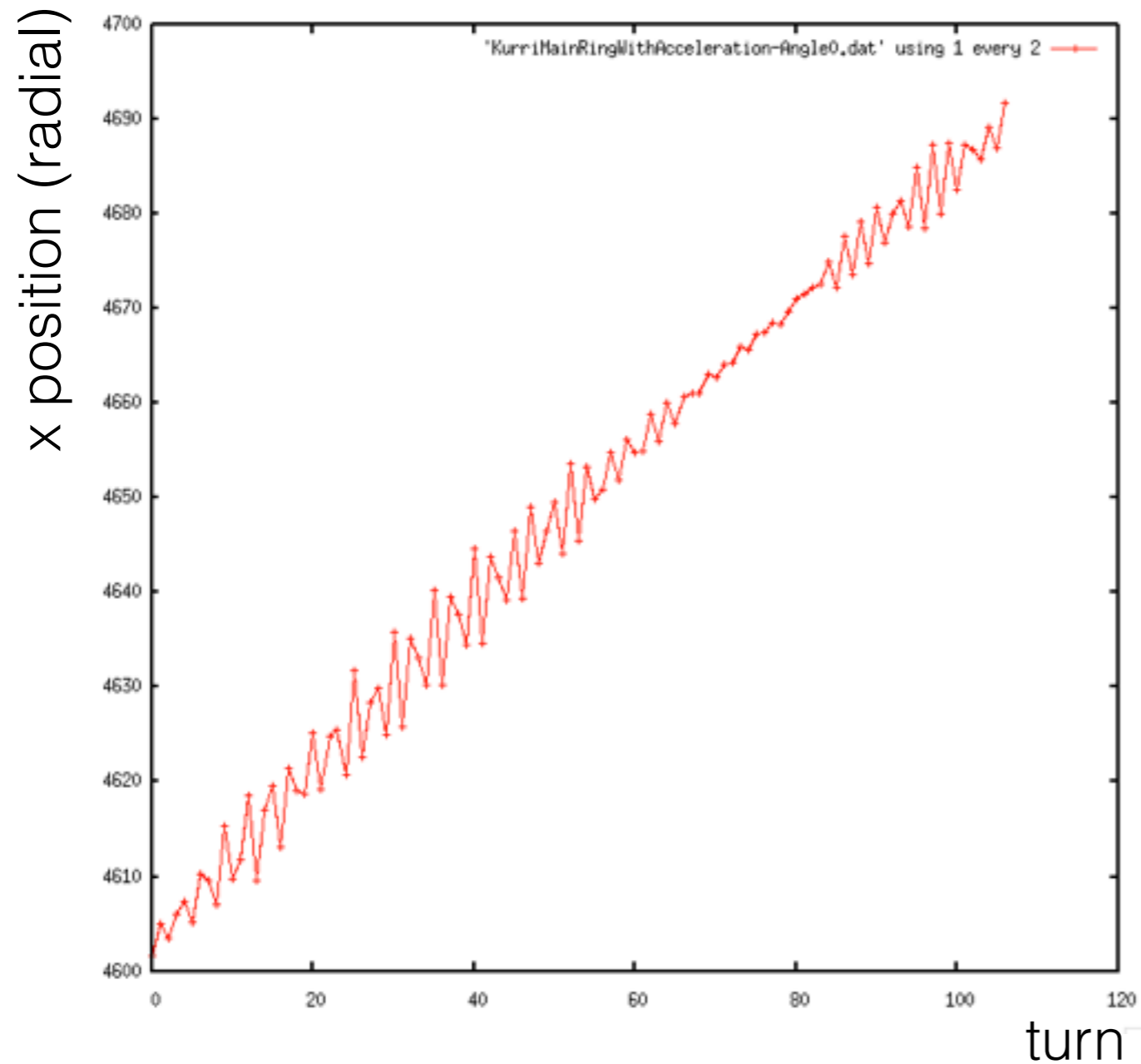
[4600:4700][0:500]

Note that turns don't appear evenly spaced with acceleration

Single particle orbits

- 'Angle0' file - 0 azimuth turn by turn phase space data