SRW Updates

- Power at lens surface
- Off-axis beam in kicker (now with kick calculated based on spatial overlap of field and electron)
- 2-micron light

Power Delivered to Lens

- For helical undulator, K=5.12, 16 mm/side square lens, average power to lens is 17 mW for 0.1 mA, 1 GeV beam (from Lienard-Wiechert code)

- Equation from x-ray data booklet:

  $P[kW]=0.633\ E^2[GeV]B^2[T]L[m]I[A]$ – double this since helical undulator has magnetic field always on

  Get power of 14 mW

- Thermal stresses occur at few mJ/cm^2 (aluminum and beryllium numbers) at 120 Hz rep rate, leading to power of 720 mW

  unsure of applicability of comparison due to large difference in rep rates...

  https://aip.scitation.org/doi/10.1063/1.1590747

- Temperature dependence of index of refraction is generally small – $dn/dT \sim 10^{-6}$/K

Power Delivered to Lens (cont.)

- Each of our pulses delivers ~40 nJ
- Damage thresholds ~0.1 J/cm^2 https://aip.scitation.org/doi/10.1063/1.2734366
- Not always perfect comparison based on different wavelengths and pulse lengths, but don't feel too concerned

Off-axis Beam in Kicker

- For K=5.12 case, simulate beam off-axis by 100 microns in x, 50 microns in y

- Energy transfer of 187 meV

  (had 225 meV in on-axis case – 17% reduction)

2 Micron Radiation
(1 GeV beam, helical undulator)

	Peak Field (V/m)	Energy Transfer (meV)
4 0.45 m periods K = 5.75 16 x 16 mm square lens	9 (SRW) 9 (LW)	47 (SRW) 50 (LW)
6 0.3 m periods K = 7.08 16 x 16 mm square lens	10 (SRW) 10 (LW)	58 (SRW) 65 (LW)
8 0.225 m periods K = 8.19 16 x 16 mm square lens	10 (SRW) 10 (LW)	67 (SRW) 75 (LW)
8 0.225 m periods K = 8.19 4 x 4 cm square lens	13 (SRW) 18 (LW)	97 (SRW) 131 (LW)

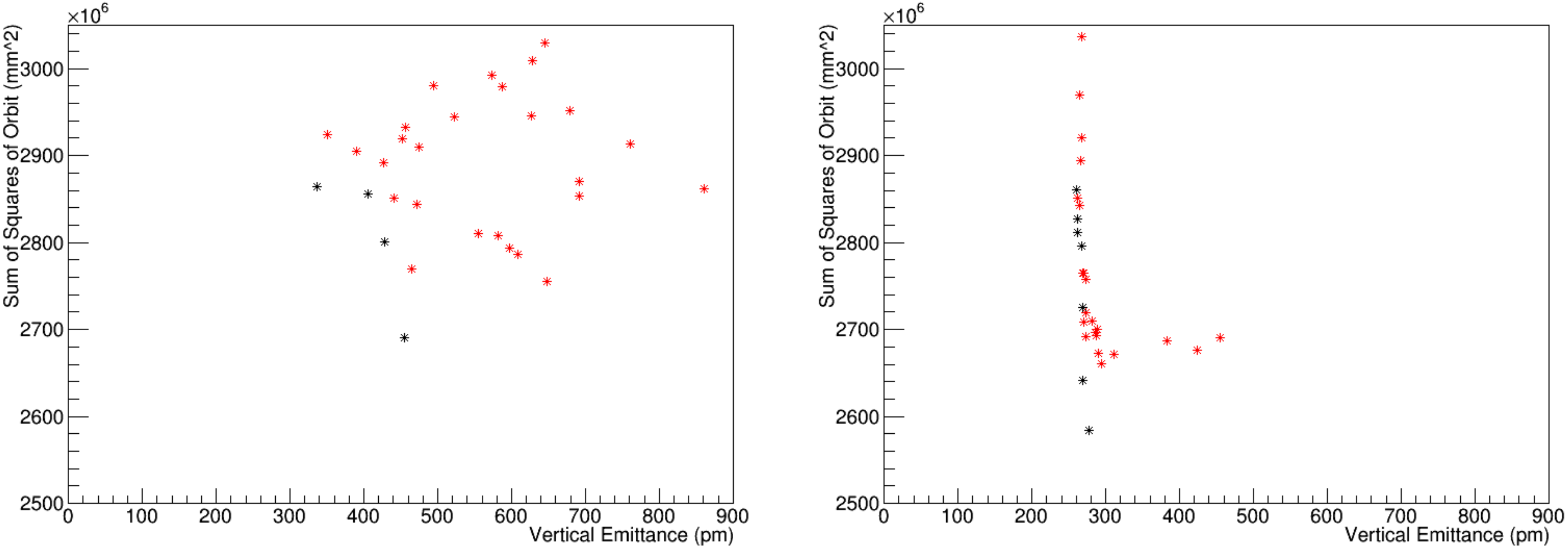
SRW takes into account that the spatial overlap of the radiation and e- beam

Planar undulators explored in backup slides

Sloppy Models Update

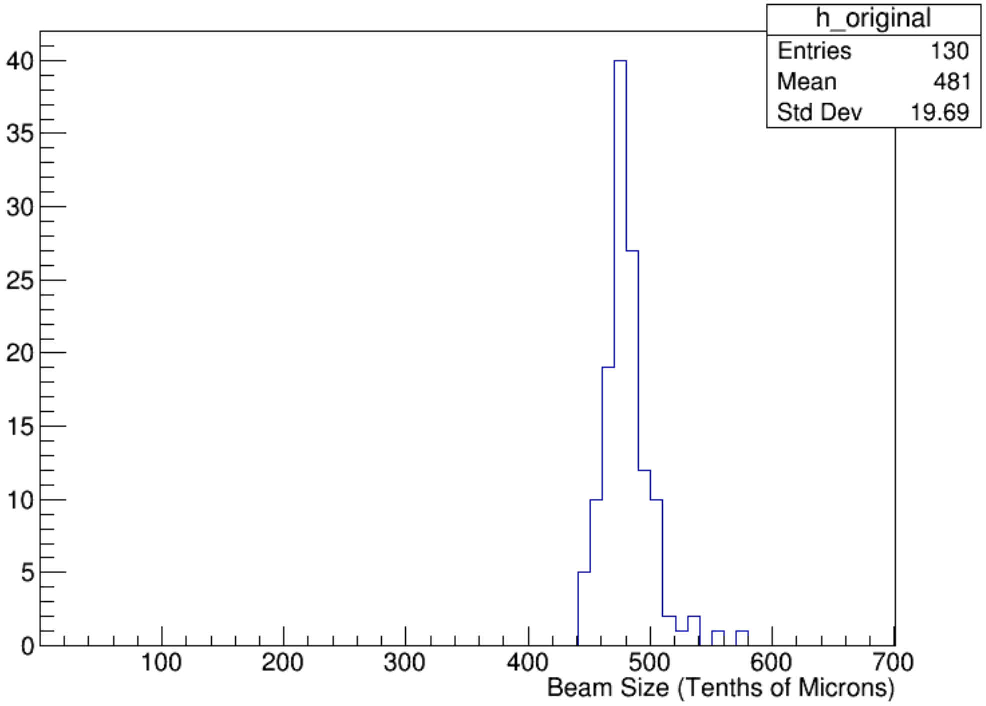
- Results from last week
- Notes on orthogonality

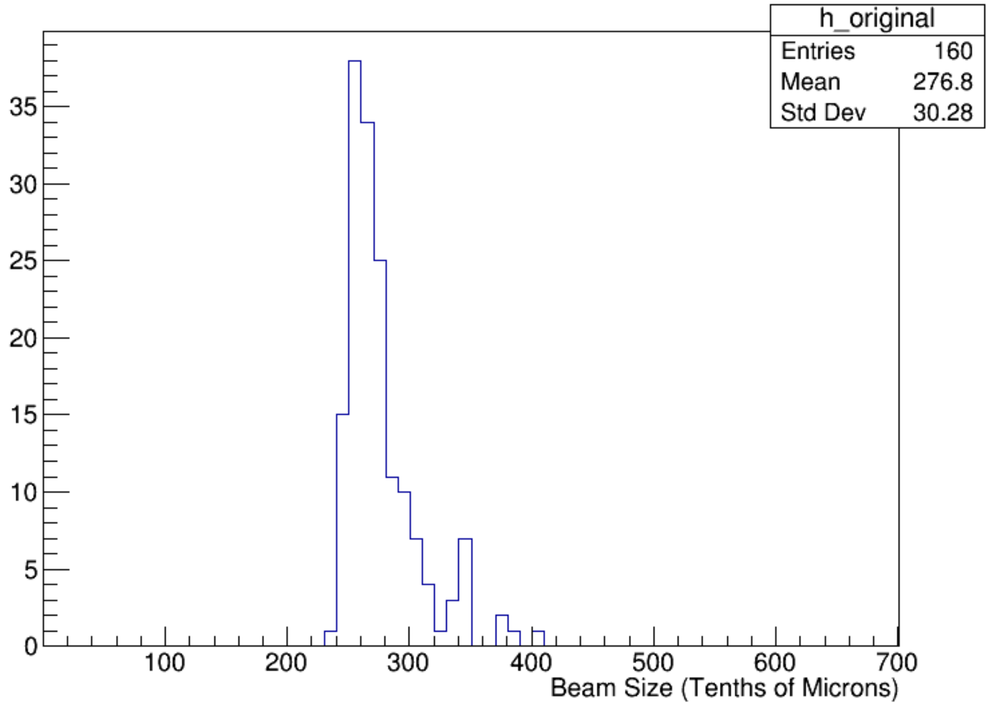
Genetic Algorithm Population



Distribution of individuals in generations 1 (left) and 17(right)

Selected Individuals





Distribution of beam size measurements for starting individual (left) and one in final generation (right)

What we Learned

- Asymmetry of vbsm peaks is not a useful diagnostic (see backup slides)
- High-side tail appears more prominent at smaller beam sizes
- Fast kickers in east are not our issue
- Need to use a wider range of allowed values for the knobs – fixed
- Need to re-evaluate the pareto front – fixed
- Need to remember LIBERA masks
- Some magnet hysteresis when re-zeroing the knobs

Notes on Orthogonality

- If make beam-size Hessian with different misalignments, only first 6 knobs consistent – if try to minimize with 8 knobs and repeat minimization, occasional non-orthogonality arises (001960269 misalignments)
- Tried to fix this with knobs to fix local dispersion and coupling, but only somewhat helpful – does better on lattice 001960269, but no clear preference overall

Backup Slides

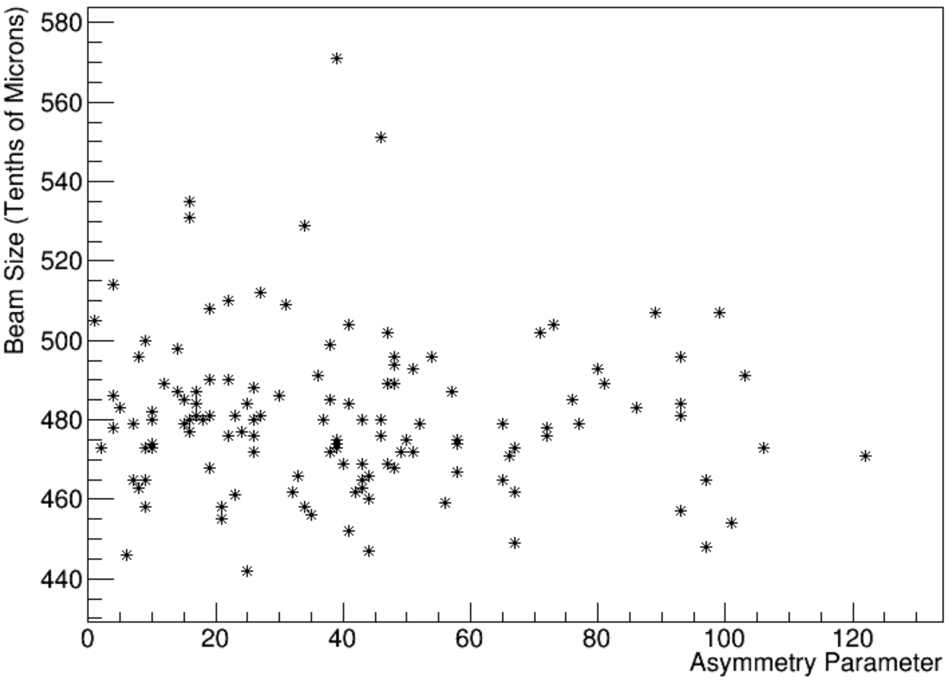
2 Micron Radiation
(1 GeV beam, planar undulator)

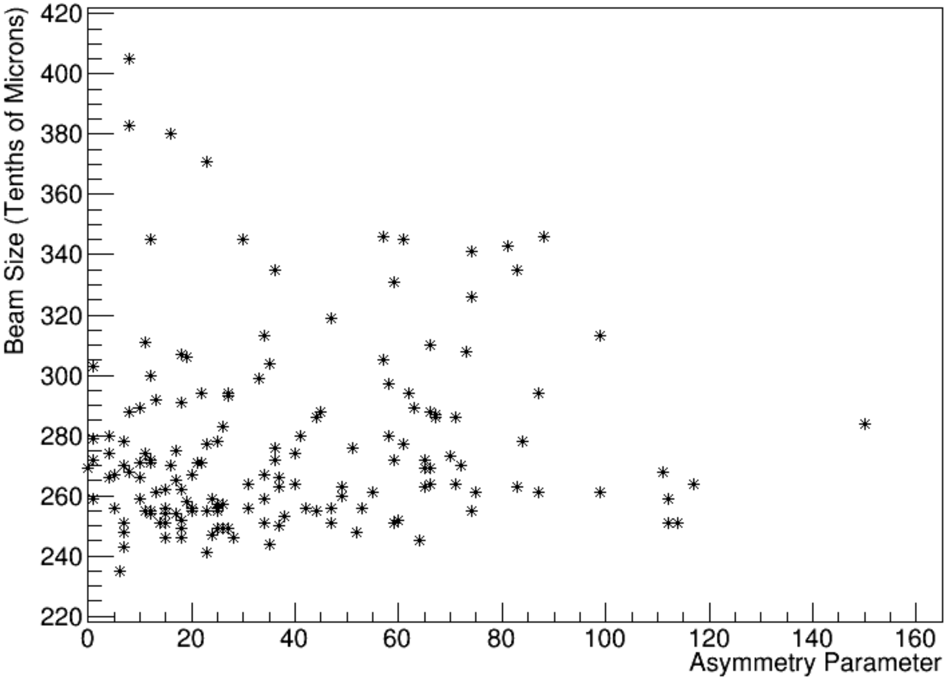
	Peak Field (V/m)	Energy Transfer (meV)
6 0.3 m periods K = 10.0 4 x 4 cm square lens	16 (SRW) 17 (LW)	47 (SRW) 56 (LW)
8 0.225 m periods K = 11.58 4 x 4 cm square lens	18 (SRW) 19 (LW)	53 (SRW) 70 (LW)

SRW takes into account that the spatial overlap of the radiation and e- beam

Both include the phase-slippage between radiation and electrons

Selected Individuals, Asymmetry





Dependence of beam size on asymmetry for starting individual (left) and one in final generation (right)