

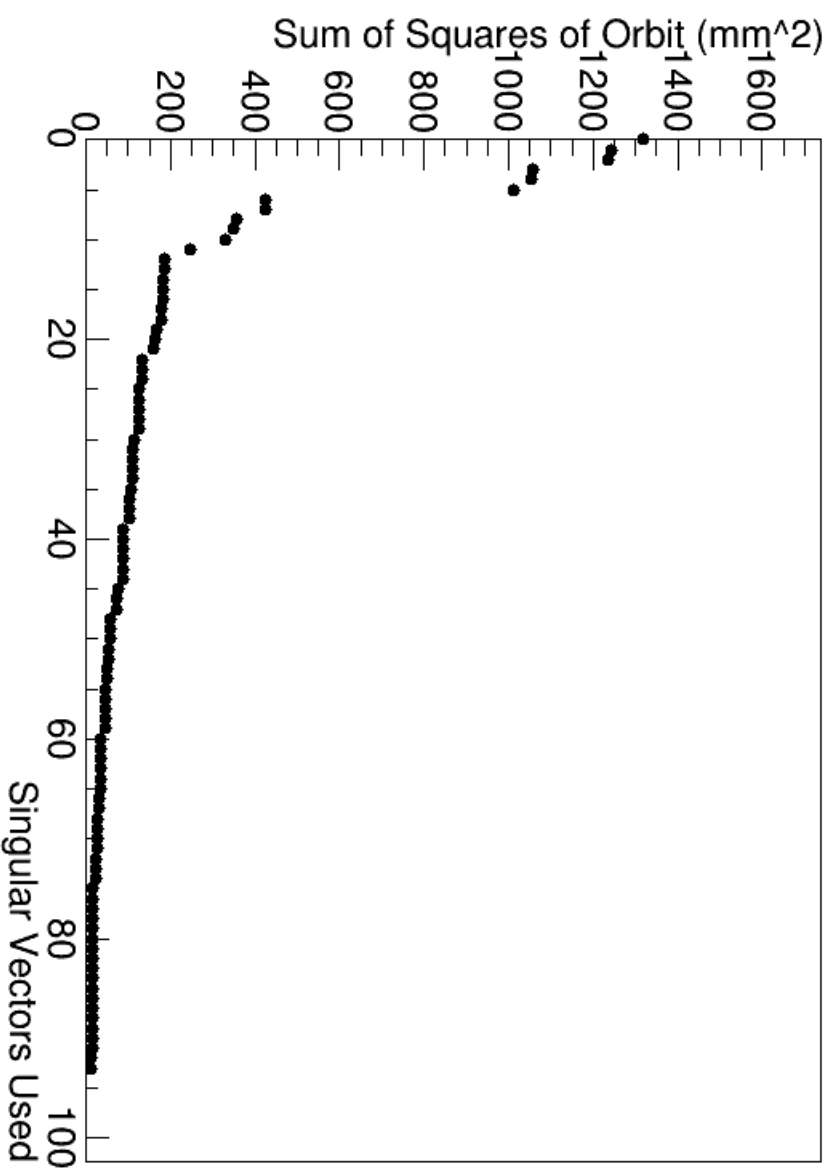
Sloppy Models Updates

- Synchrotron orbit knobs

Synch Orbit Knobs

- Derived from Hessian of sum of squares of vertical and horizontal orbit at synch BPMs with respect to synch steerings

Results of Tuning on 1000 Lattices



Questions

- Separation of horizontal and vertical steerings
- Odd jumps in the tuning curve – may be from the sorts of misalignments I was able to include?
- Utility in actually improving synch beam?

OSC Updates

- Helical undulator focusing
- Backup: 3rd Harmonic exists off-axis, where e^- is

Helical Undulator Focusing

- Compare my analytic formulas to results from Vardan's code
- Undulator has period of 32.5 cm, length of 1.3m, peak field of 0.15 T

1st Order Forces

(Averaged over One Period)
(July 10, 2018 Presentation)

- $x'' = -e^2 B_0^2 / (\bar{v}^2 \gamma^2 m^2 k) \Delta y'$
- $e^2 B_0^2 / (2 \bar{v}^2 \gamma^2 m^2) (\Delta x' z + \Delta x_0)$

- $y'' = e^2 B_0^2 / (\bar{v}^2 \gamma^2 m^2 k) \Delta x'$
- $e^2 B_0^2 / (2 \bar{v}^2 \gamma^2 m^2) (\Delta y' z + \Delta y_0)$

- I make the assumption that z changes slowly
relative to $\sin(kz)/k$

- $\langle (\Delta y' z + \Delta y_0) \rangle$ is Δy at the center of the undulator

Transverse Focusing

- Theory predicts focusing (shift in x' divided by initial x offset) of $-1.31 \times 10^{-9} / \mu\text{m}$
- Results from scanning in Vardan's code from -1mm to 1mm are $-1.27 \times 10^{-9} / \mu\text{m}$
- Holds in both transverse planes

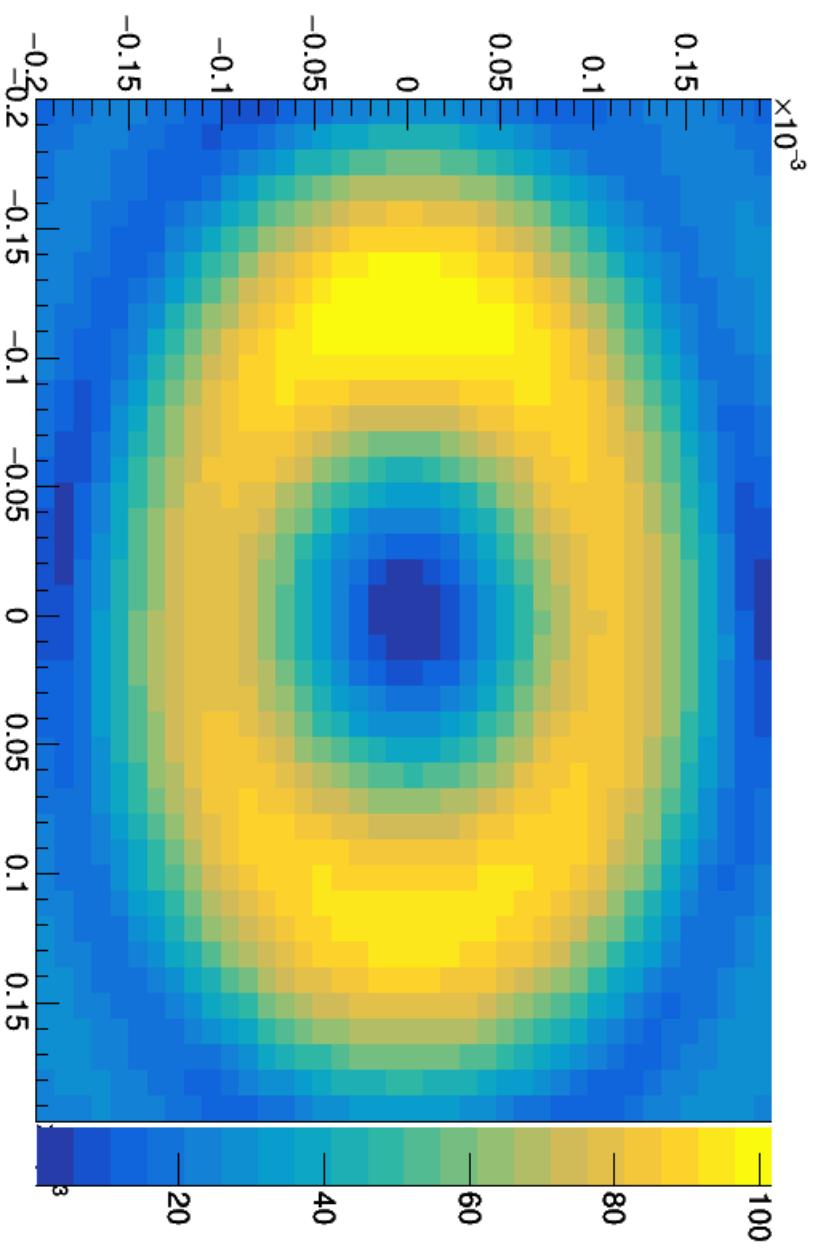
Transverse Coupling

- Theory predicts $\Delta y'_{fin}/\Delta x'_{init}$ and $\Delta x'_{fin}/\Delta y'_{init}$ to have opposite signs and magnitude 1.4×10^{-4}
- Results from scanning in Vardan's code from -10 μ rad to 10 μ rad are -4.4×10^{-4} for $\Delta x'_{fin}/\Delta y'_{init}$ and -1.6×10^{-4} for $\Delta y'_{fin}/\Delta x'_{init}$
- Will investigate source of discrepancy

Backup

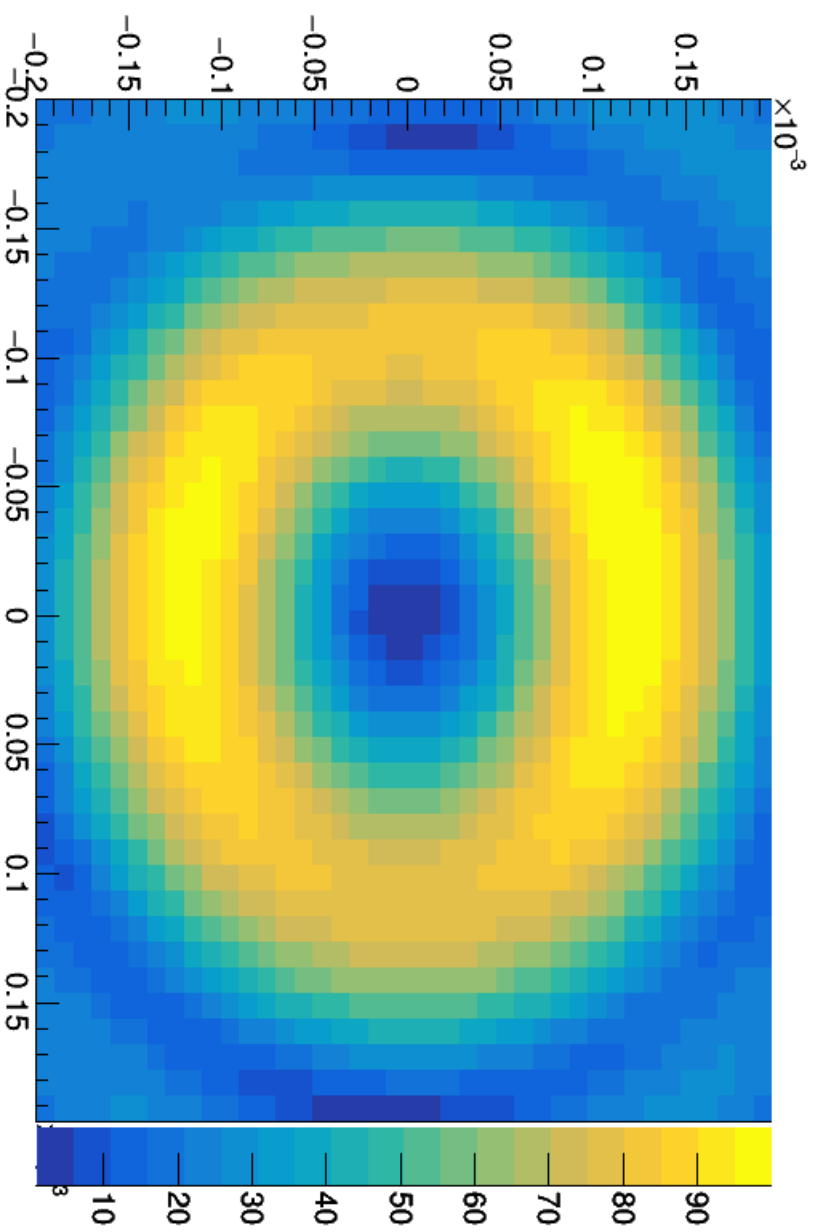
- Location of 3rd Harmonic (K=5.12, period = 22.5 cm, 6 periods, 6 m between pickup and lens and between lens and kicker undulator, helical undulators)
- Plots from scans of Vardan's code – unfortunately, axes are messed-up...

3rd Harmonic Amplitude Horizontal Field



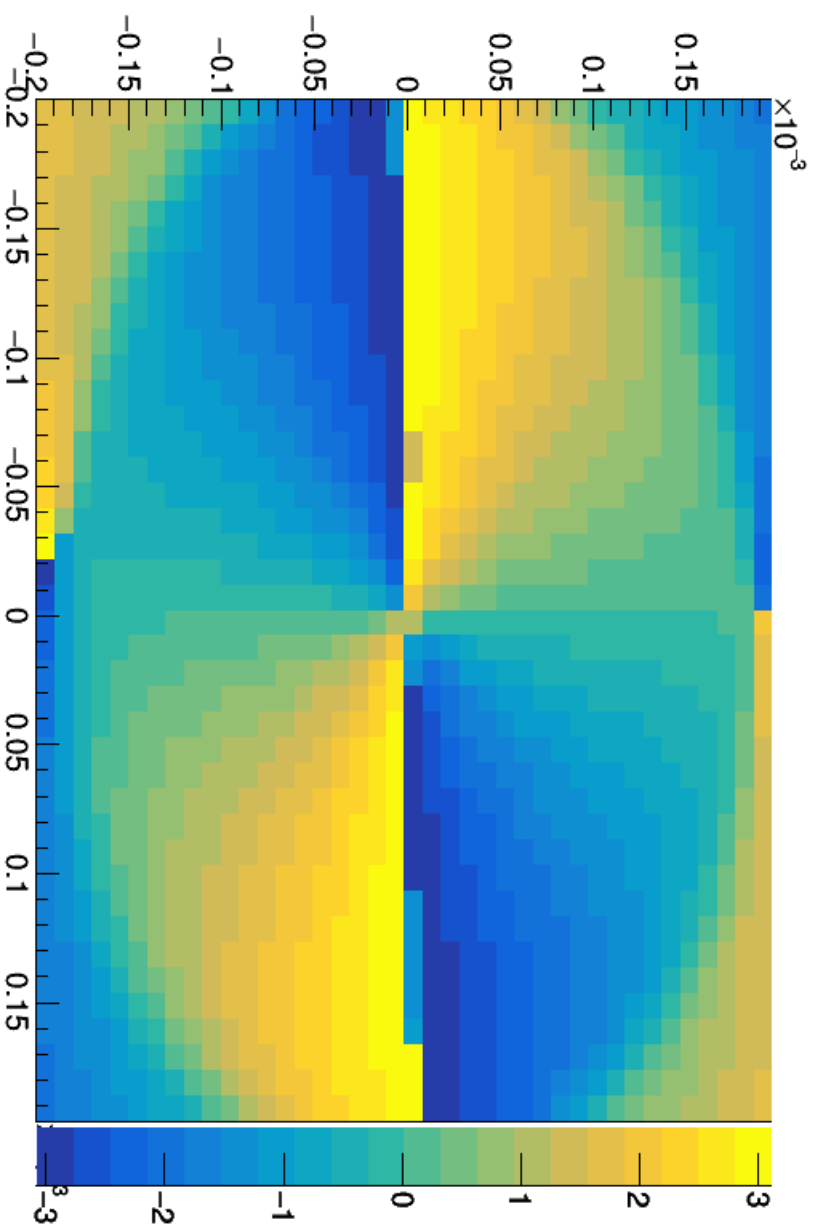
Spatial scales in mm, color in V/m

3rd Harmonic Amplitude Vertical Field



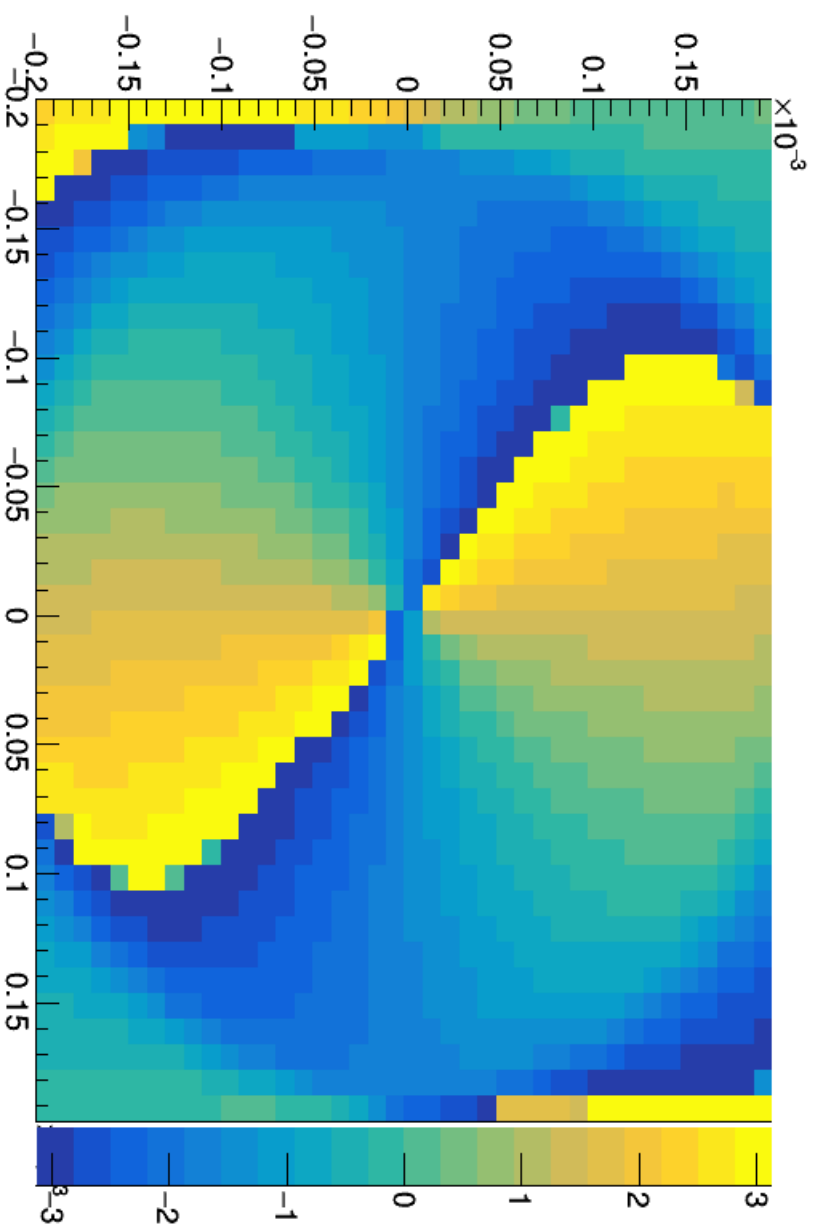
Spatial scales in mm, color in V/m

3rd Harmonic Phase Horizontal Field



Spatial scales in mm, color in radians

3rd Harmonic Phase Vertical Field

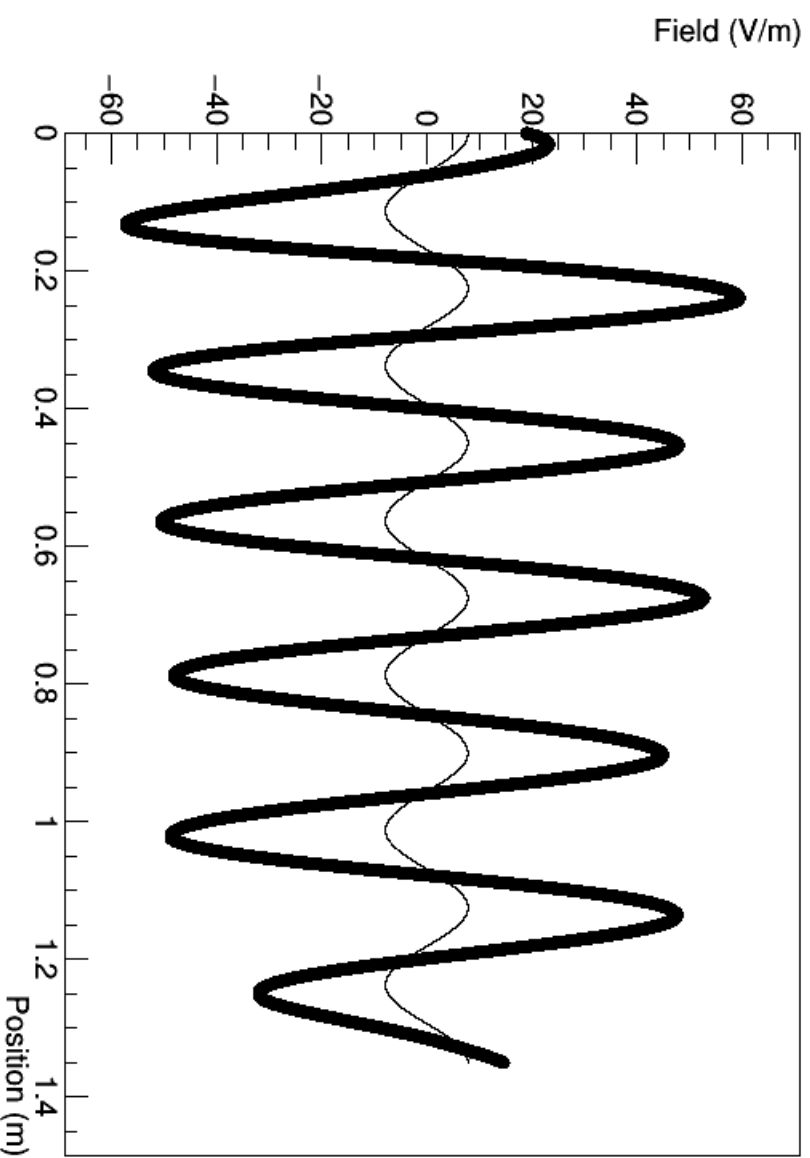


Spatial scales in mm, color in radians

Electric field and e- Velocity

1st Harmonic

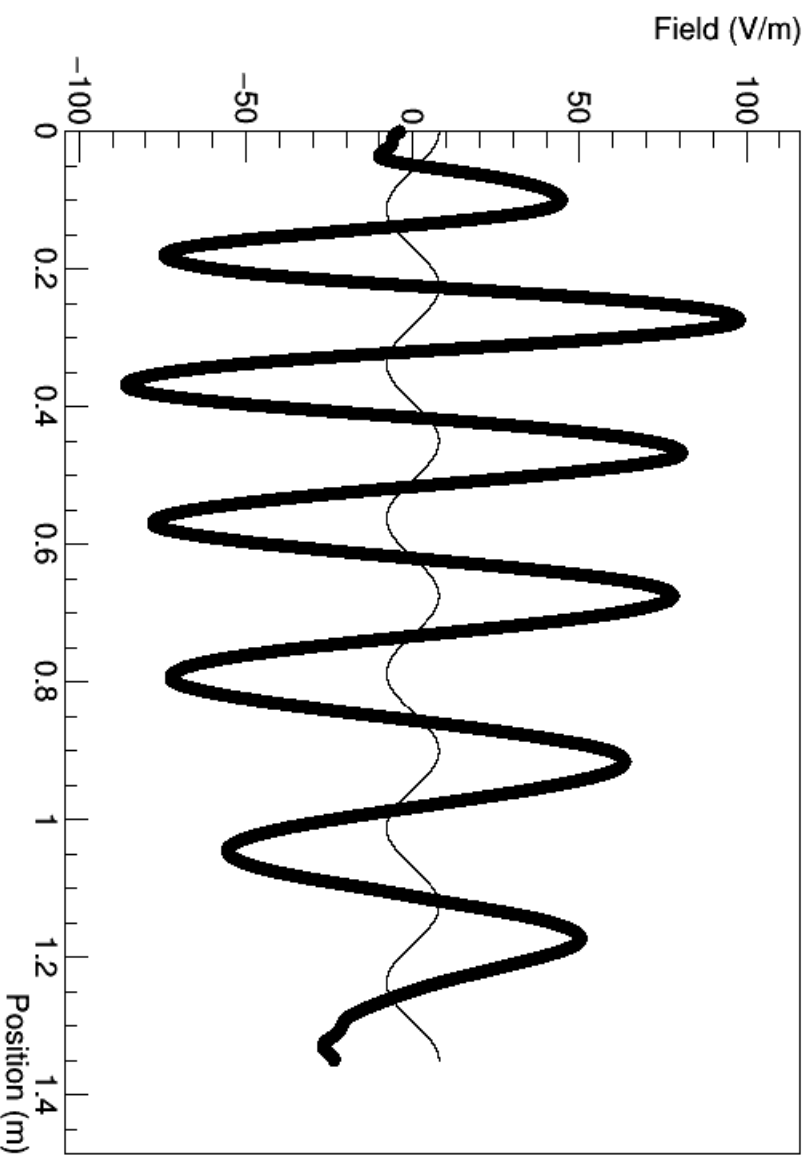
Energy Transfer 160 meV



Electric field and e- Velocity

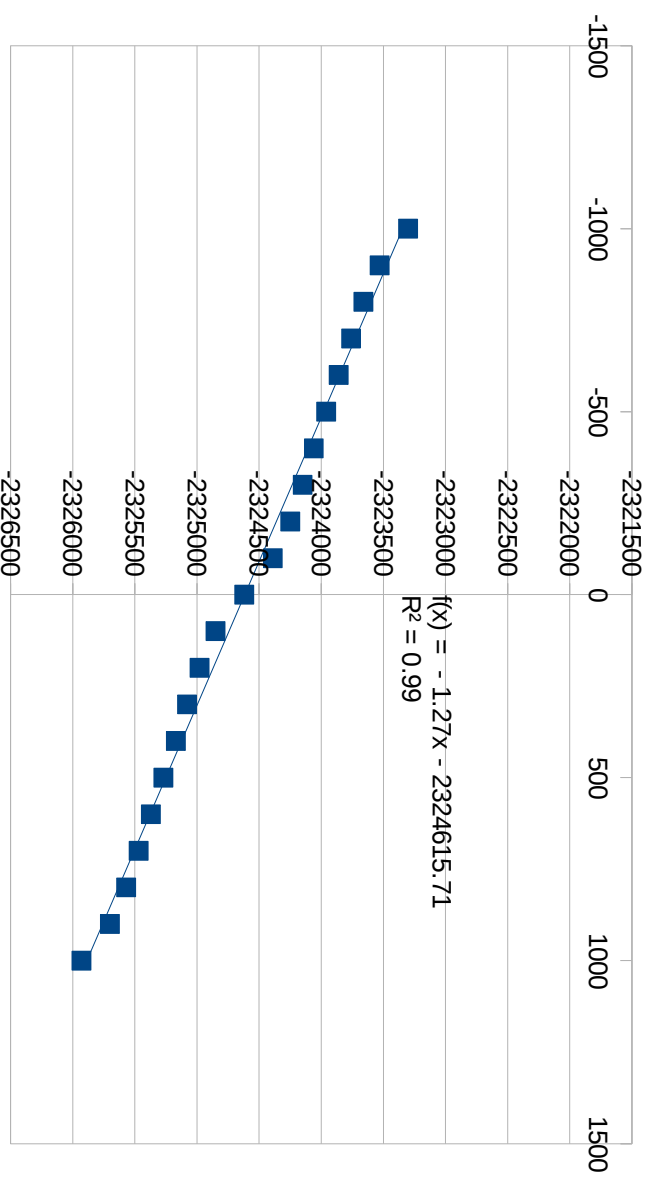
3rd Harmonic

Energy Transfer 120 meV



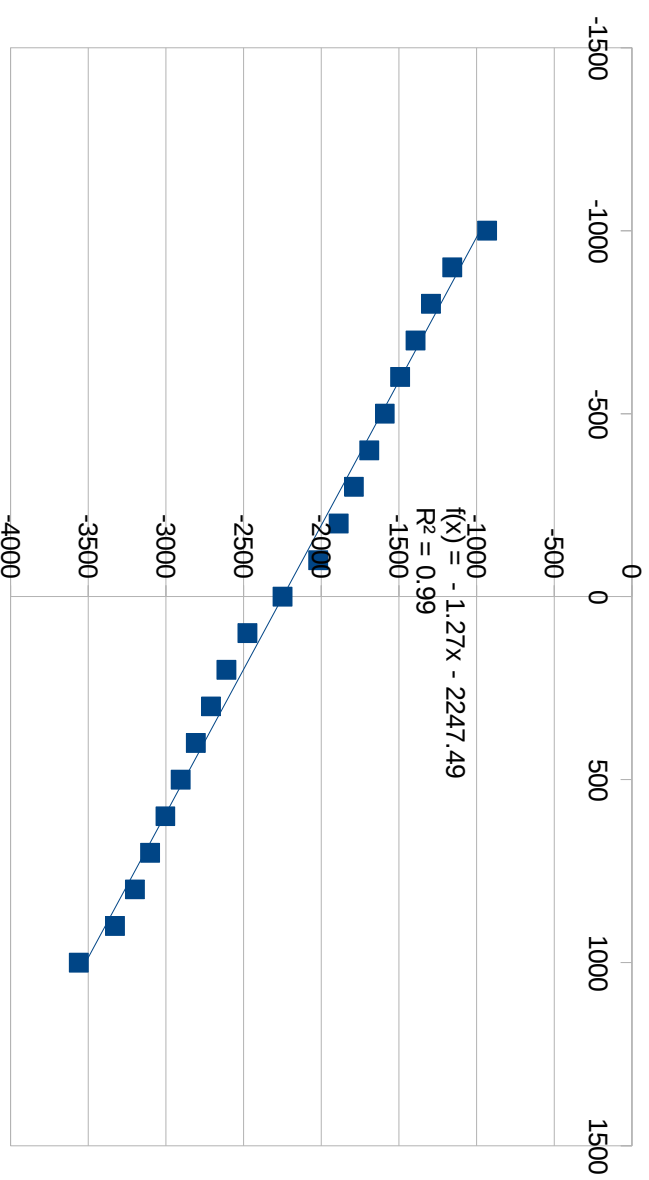
$$X'_{fin} / X'_{init}$$

Horizontal axis is X in microns, vertical is X' in nrad



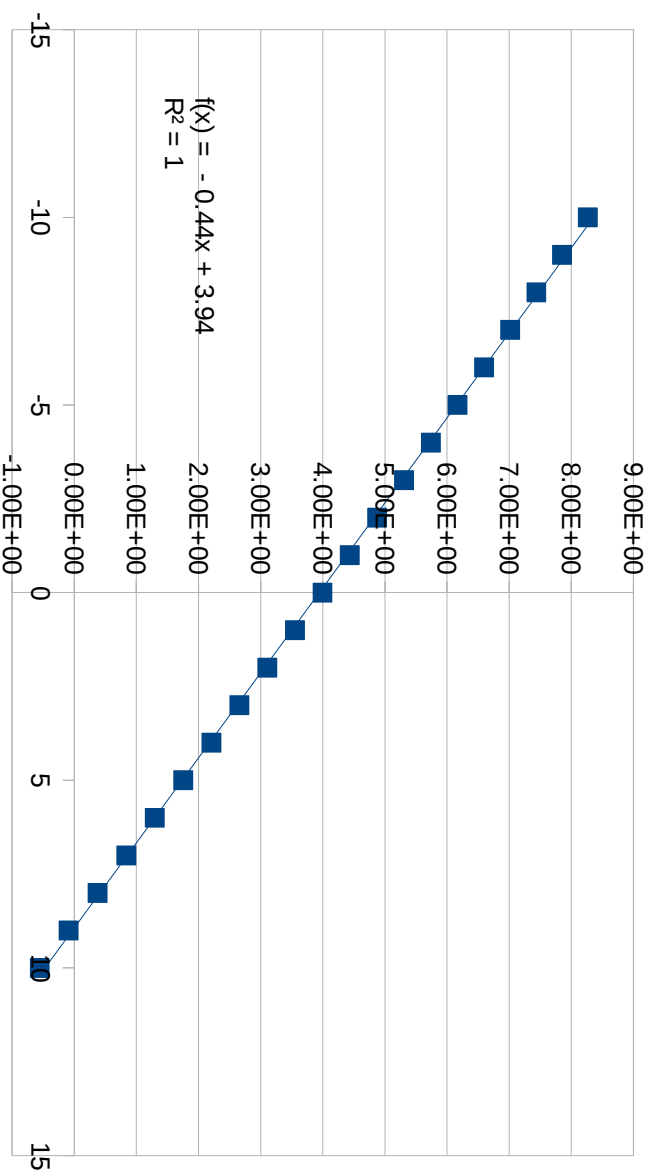
$$y'_{\text{fin}} / y_{\text{init}}$$

Horizontal axis is y in microns, vertical is y' in nrad



$$X'_{\text{fin}} / Y'_{\text{init}}$$

Horizontal axis is y' in μrad , vertical is x' in mrad



$$y'_{\text{fin}} / x'_{\text{init}}$$

Horizontal axis is x' in μrad , vertical is y' in mrad

