

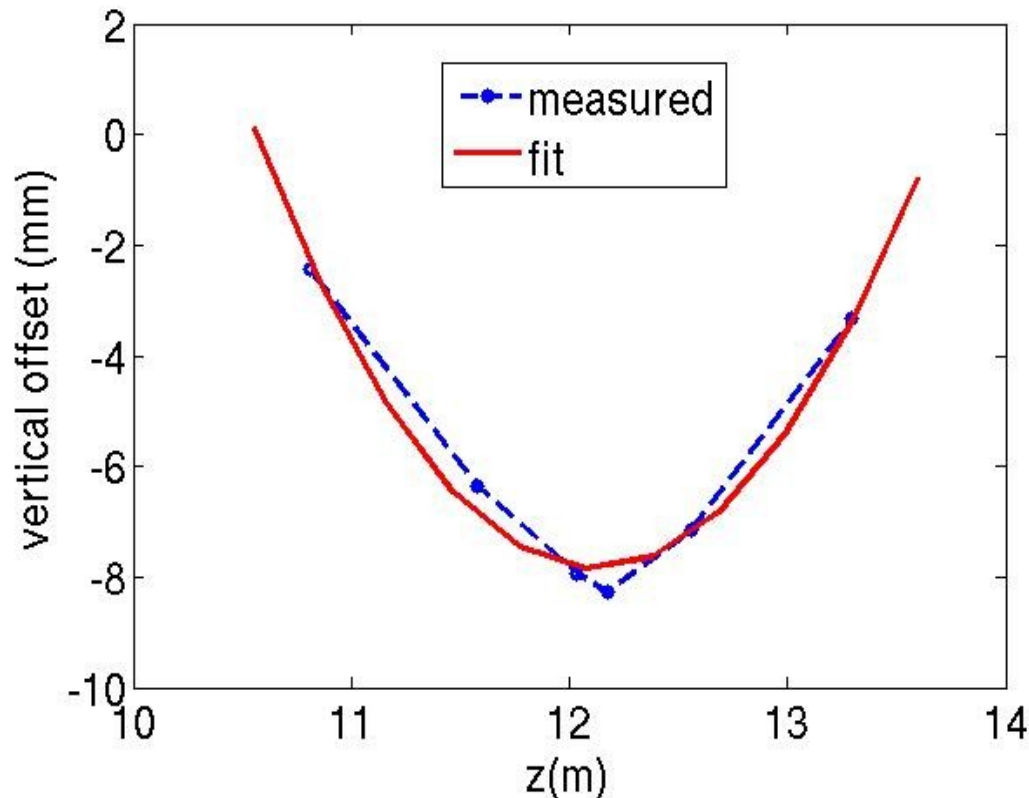
# Optimization of Beam Trajectory to Minimize Transverse Wake Field Effect (ASTRA simulations)

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# Survey of the L2:AS1: Large Vertical Offsets Along the 10ft-Long Structure

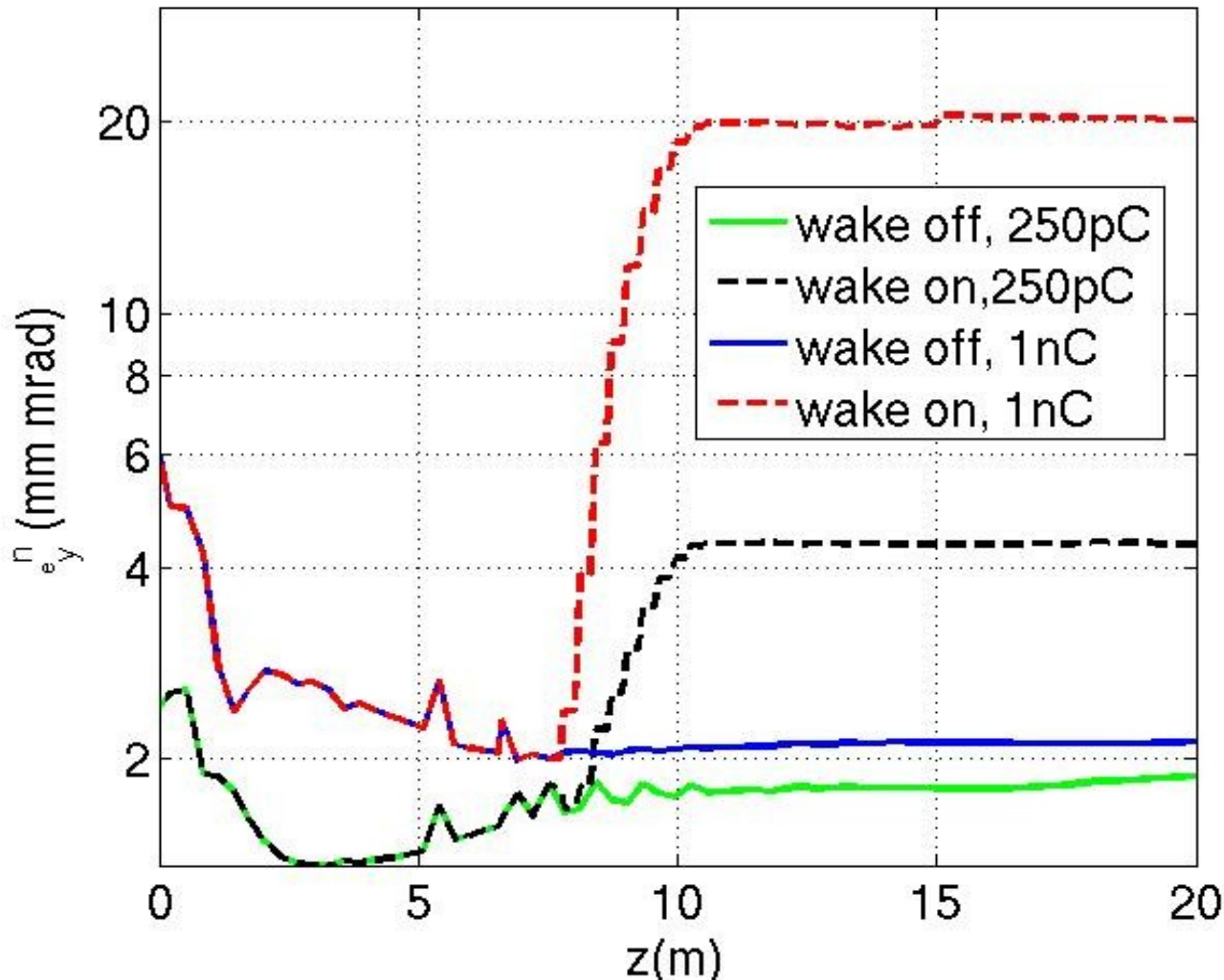


## Implementation in ASTRA

- Divide the 10-ft structure into 10 sections;
- Assign each section a y-offset using the fitted curve;
- Scale the wake field strength by a factor of 0.1 from the whole structure wake field map;
- Can be done but not included at this time: x-offset, divide each structure into more sections, adding L2:AS2 offsets etc.

Z-axis used the survey data values. Survey Group measurement data can be retrieved from ICMS under [APS\\_1435365](#) .

# Effect on Vertical Emittance from the Transverse Wake from Misaligned L2:AS1



Vertical Emittance:

1nC: 2.1mm mrad  
==>20.0 mm mrad

250pC: 1.9 mm mrad  
==>4.4 mm mrad

# Steering Magnets to Match Beam Trajectory to Structure Curve

- From Michael's ELEGANT files, steering magnet locations are extracted. Five vertical Steerers are used to tune the trajectory.

Vertical Steering Magnet Name	Longitudinal location in ASTRA (m)
L1:SC1	5.059
L1:SC4	7.008
L2:SC2	10.740
L2:SC3	14.753
L2:SC4	18.956

- GeneticOptimizer is used to minimize vertical emittance at the end Of L2 (entrance to the chicane).

# Genetic Optimizer Input File: Vary Five Steering Magnet Strength while Minimizing Y-Emittance

The screenshot shows the **sddsEditNew** application window. The menu bar includes **File**, **Edit**, **Search**, **Edit\_Command**, **Info**, and **Help**. The status bar at the top indicates "5 columns with 5 rows in page 1" and "13:19:39 File is open." Below this, a message states: "For usage information, please refer to 'Guidelines' in the 'Info' sub menu." The main editing area shows "Now editing: **steer.sdds**". The **Parameters** section is active, displaying a list of parameters and their values: **PauseAfterChange** (0.0), **nTotalJobs** (1000), **nParents** (6), **childMultiplier** (3), **sleepTime** (4.0), and **postProcessingScript** (measureScript). The **Columns** section is also visible, showing a table with 6 columns: **Rows\Col's**, **parameterName**, **lowerLimit**, **upperLimit**, **errorLevel**, and **initialValue**. The table contains 5 rows of data for parameters DS1 through DS5. The **Columns** section also includes a toolbar with buttons for **Copy**, **Paste**, **Cut**, **Undo**, **<-**, **->**, **<<-**, **->>**, **Down**, **Up**, **PgDown**, **PgUp**, **Home**, and **End**.

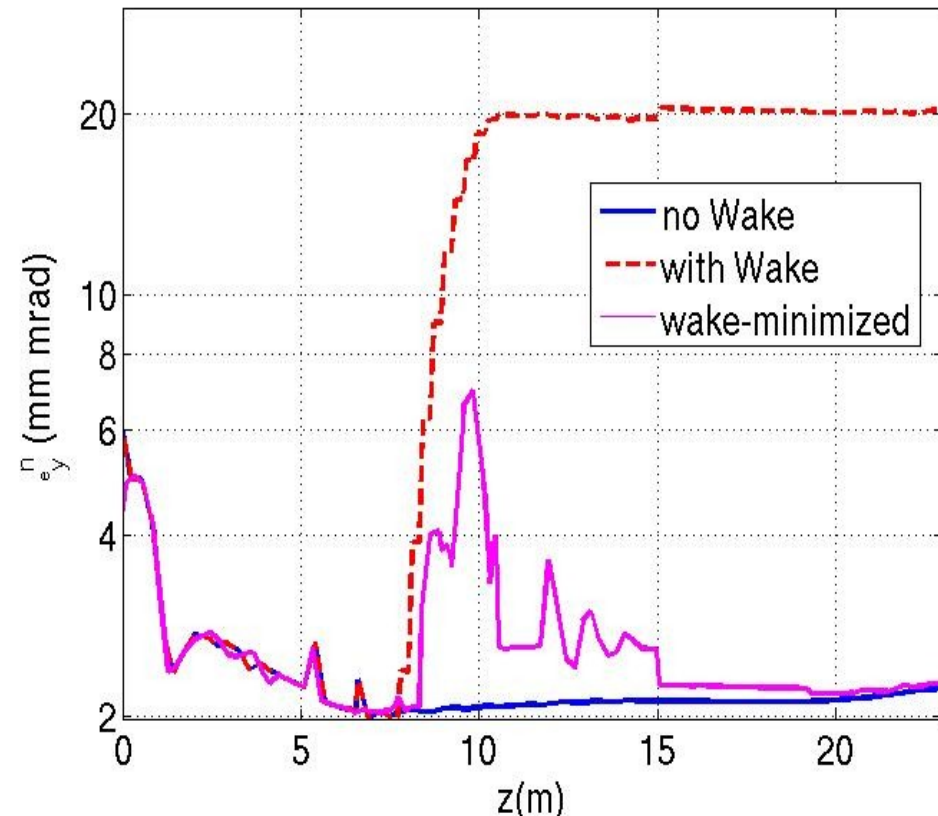
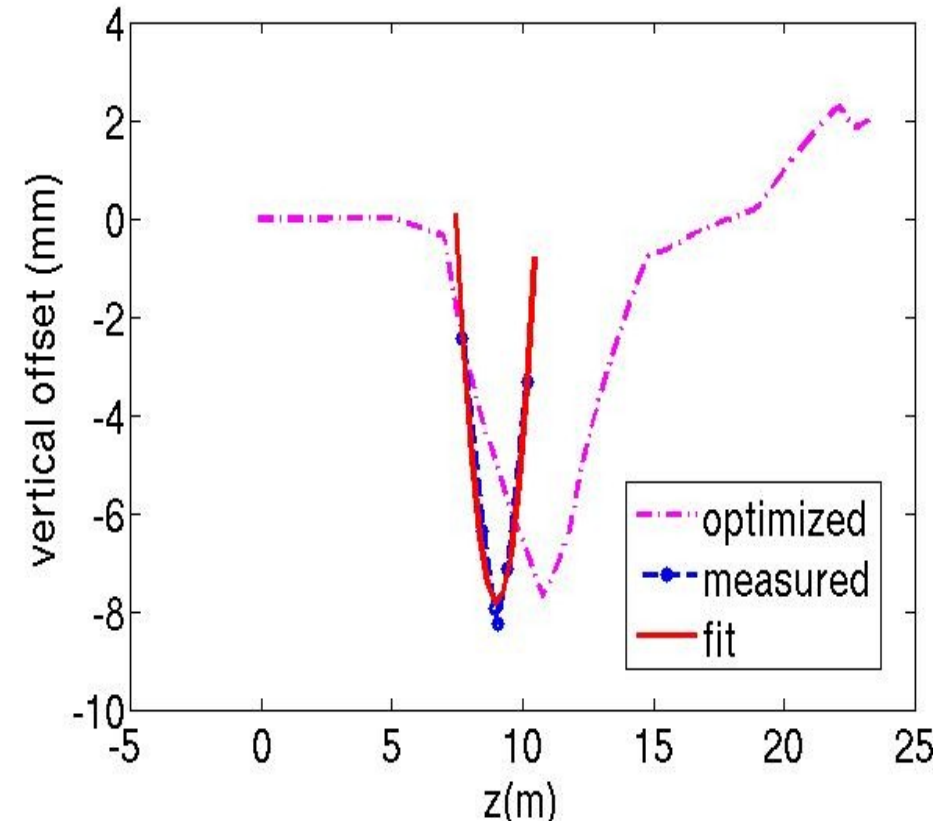
Parameters

PauseAfterChange	0.0
nTotalJobs	1000
nParents	6
childMultiplier	3
sleepTime	4.0
postProcessingScript	measureScript

Columns

Rows\Col's	parameterName	lowerLimit	upperLimit	errorLevel	initialValue
1	DS1	-0.02	0.02	0.002	-0.01
2	DS2	-0.02	0.02	0.002	0.01
3	DS3	-0.02	0.02	0.002	-0.01
4	DS4	-0.02	0.02	0.002	0.01
5	DS5	-0.02	0.02	0.002	-0.01

# Optimization of Beam Trajectory to Minimize Vertical Wake Field Effects on Beam Emittance



GeneticOptimizer runs used 1k particles, 3D space charge on, from photocathode to the entrance of the chicane. Then best steering settings is used to run ASTRA simulation using 50K particles. Z-axis used simulation coordinates (which has an offset in  $z$  compared with survey data).

Thanks to Bob Soliday for his assistance during our optimizer setup on the cluster.