Wire Scanner Assessment of Transverse Beam Size in the Fermilab Side-Coupled Linac
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Overview of the Fermilab Side-Coupled Linac
The Fermilab Side-Coupled Linac (SCL) contains 12 wire scanners (WSs) to assess transverse beam characteristics.

Ongoing initiatives seek a more physics-based approach to day-to-day operation of the Fermilab Linac. This goal will be realized with support from data gathered from the WSs, prompting our presented investigation into the state and capabilities of the WSs & their data.

X-Y Coupling Analysis & Wire Scanner Data
Wire scanner data consists of intensity in the wire vs. calibrated position of the wire. A Gaussian fit extracts σ, beam size.

The “U” wire assesses X-Y coupling. X, Y, and U data are fit to a rotatable ellipse. Results of this analysis show unexpected levels of coupling & non-physical beam sizes.

Wire Speed & Data Quality
In 2024, we introduced a new, faster method of collecting WS data at a constant speed, facilitate more complex studies with the WSs. Data quality between methods is comparable.

Scan time decreased from 10-15 min ("steps") to 1.25 min ("fast") at 5 Hz.

References

Wire Scanner Layout
The wire scanners contain three electrically-isolated wires, mounted at different angles to assess the “X”, “Y”, and 45° (called “U”) directions [2]. The wires share a frame which is moved transversely across beam to record current in the wire.

Wire Biasing Study
To investigate whether secondary electron emissions from the wire are the cause of the X-Y coupling, we biased the "U" wire between -80 and 100 V and recorded the current in the "X" and "Y" wires. No significant changes are observed in response to bias voltage.