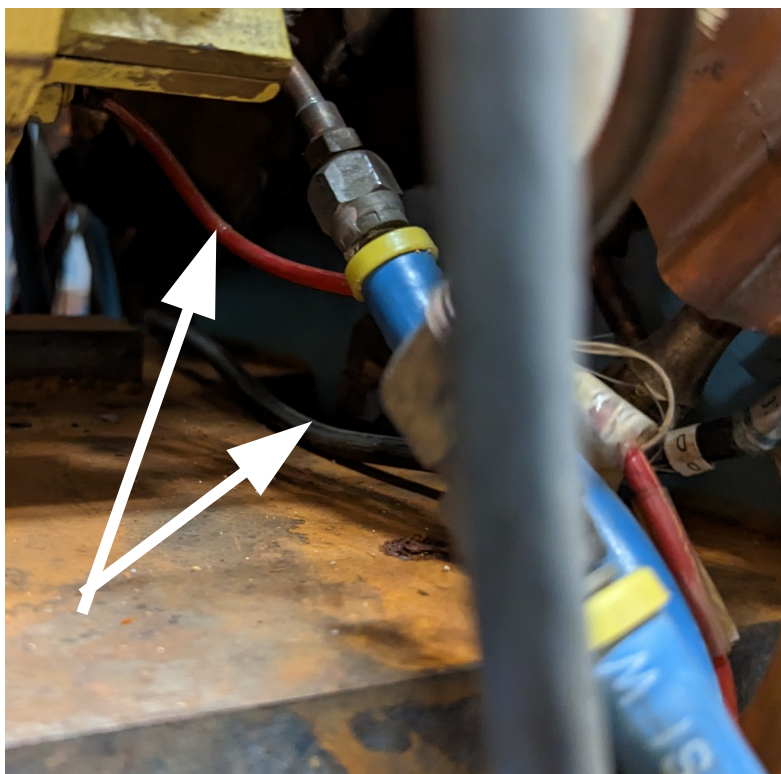




Sources of Systematic Error in the Measurement of Beam size Using Sextupole Magnets

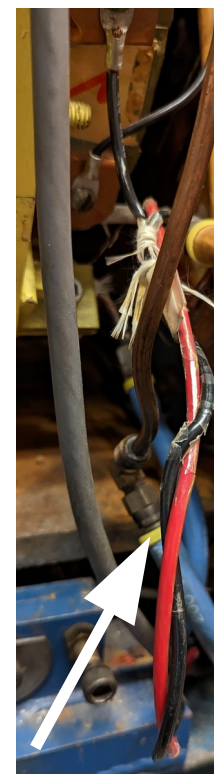
1. Stray Fields



Experiment at S34E

← Before

After →



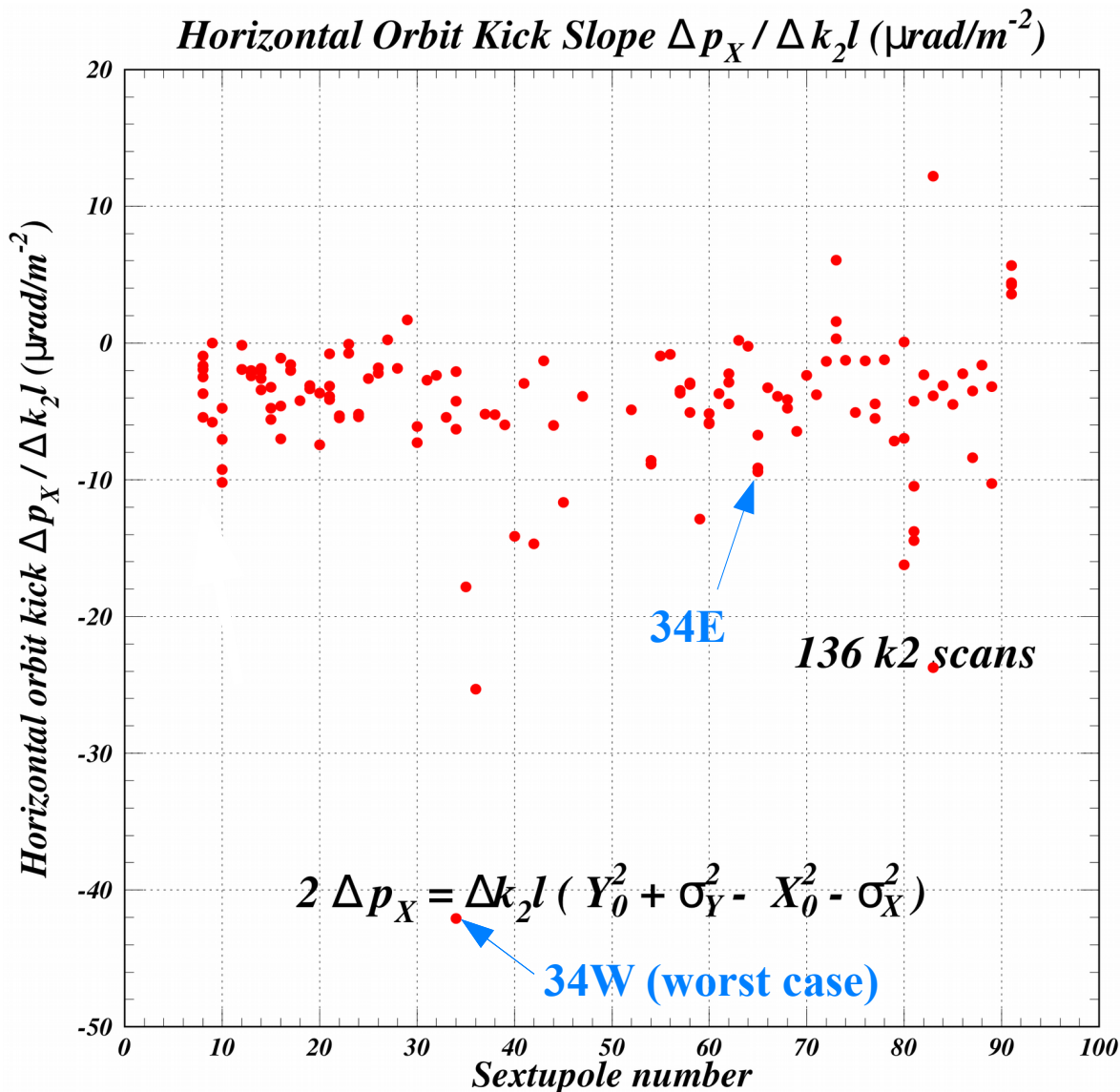
Jim Crittenden

CESR Accelerator Group

29 March 2023



The Problem



A horizontal beam size of 1 mm results in a linear dependence of the horizontal orbit kick on the sextupole strength of 1 microradian / m^{-2} .

The values shown here give beam size estimates of 1-5 mm, much greater than the known beam size.

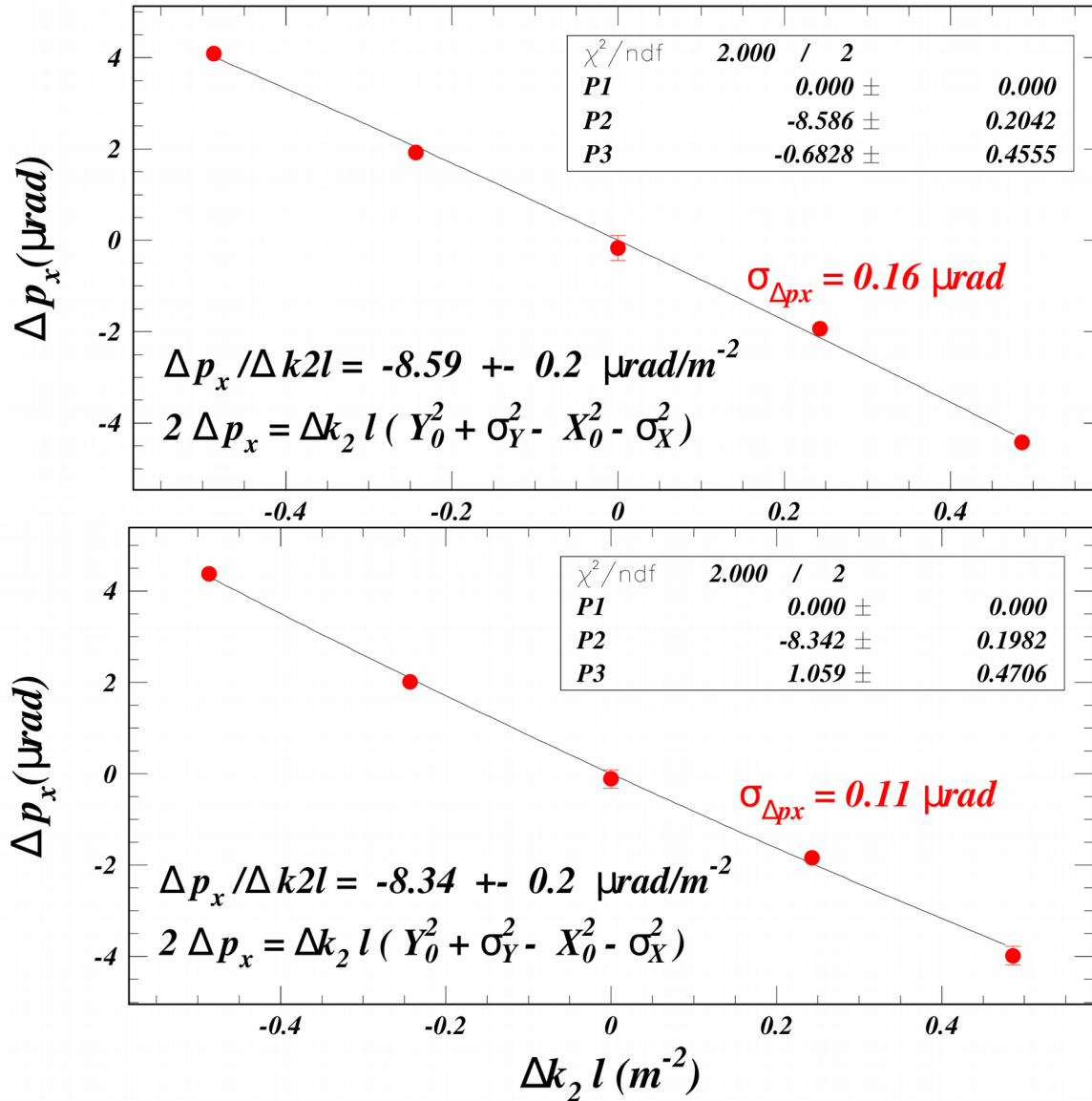
The statistical errors in this slope are about 0.1-0.2 microradian / m^{-2} .

A 1-microradian kick is given by a magnetic field value of 0.8 G integrated over the length of the sextupole.

Could such a field be caused by a loop in the power leads?



Horizontal kick slope – before –



30 May 2021

First measurement

$-8.59 \pm 0.20 \text{ microradians / m}^{-2}$

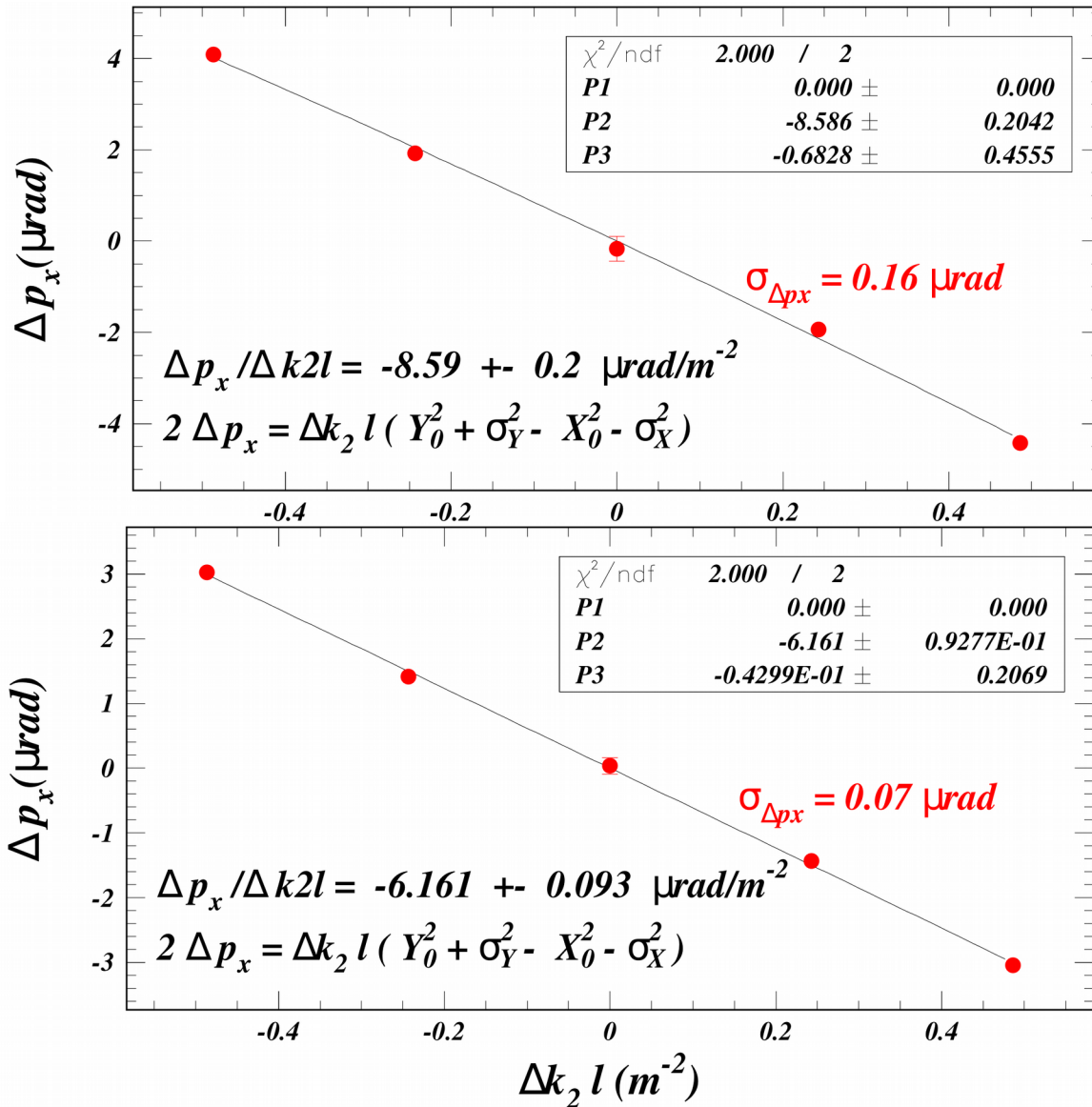
30 May 2021

Second measurement

$-8.34 \pm 0.20 \text{ microradians / m}^{-2}$



Horizontal kick slope – before and after –



30 May 2021

First measurement

-8.59 ± 0.20 microradians / m^{-2}

7 March 2023

-6.161 ± 0.093 microradians / m^{-2}

The effect is greater than our goal for beam size measurement, but smaller than the effect we need to explain the large negative values.