Measuring Beam Size with $\Delta K_1L(\Delta K_2L)$

$$\Delta\nu/\beta = \Delta K_1L = (X_0+dx)(K_2L+\Delta K_2L) - X_0 K_2L = X_0 \Delta K_2L + (K_2L+\Delta K_2L)\, dx$$

Choose "unperturbed" $K_2L = 0\ m^2$!

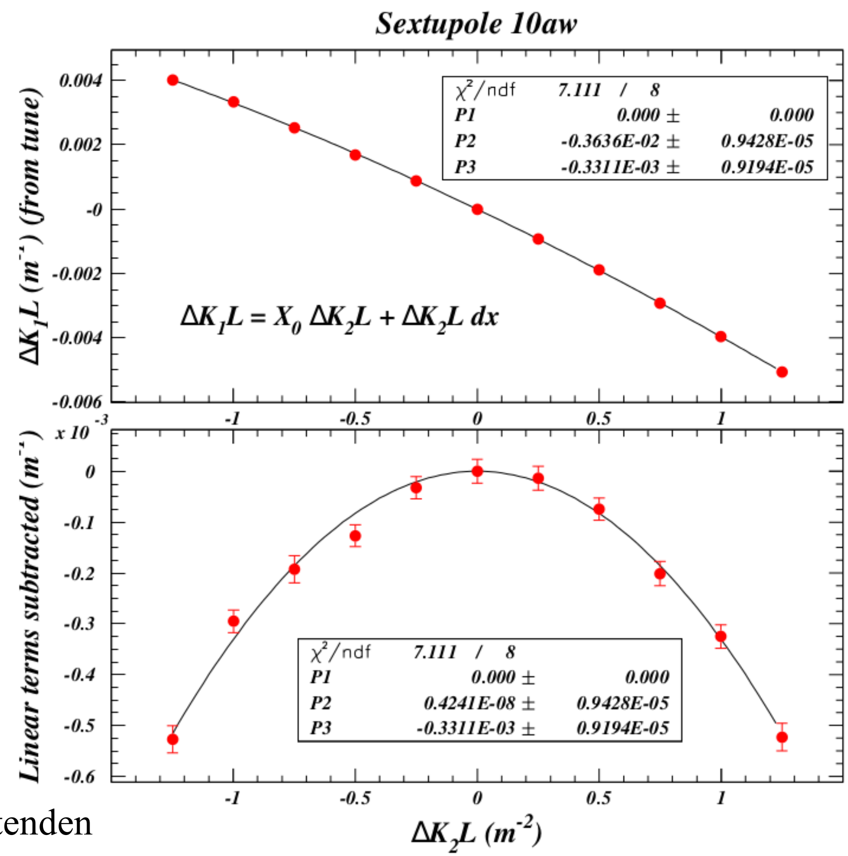
$$\Delta K_1L = X_0 \Delta K_2L + \Delta K_2L\, dx$$

Fit coefficients and errors are now independent

$$\Delta K_1L(\Delta K_2L) = a\, \Delta K_2L + b\, (\Delta K_2L)^2$$

$$a = X_0 = -3.626 \text{ +- } 0.009 \text{ mm } (0.4\%)$$

$$b = dx/\Delta K_2L = -331 \text{ +- } 9\ \mu m/m^{-2}\ (3\%)$$



Jim Crittenden
Georg Group Meeting
29 April 2021

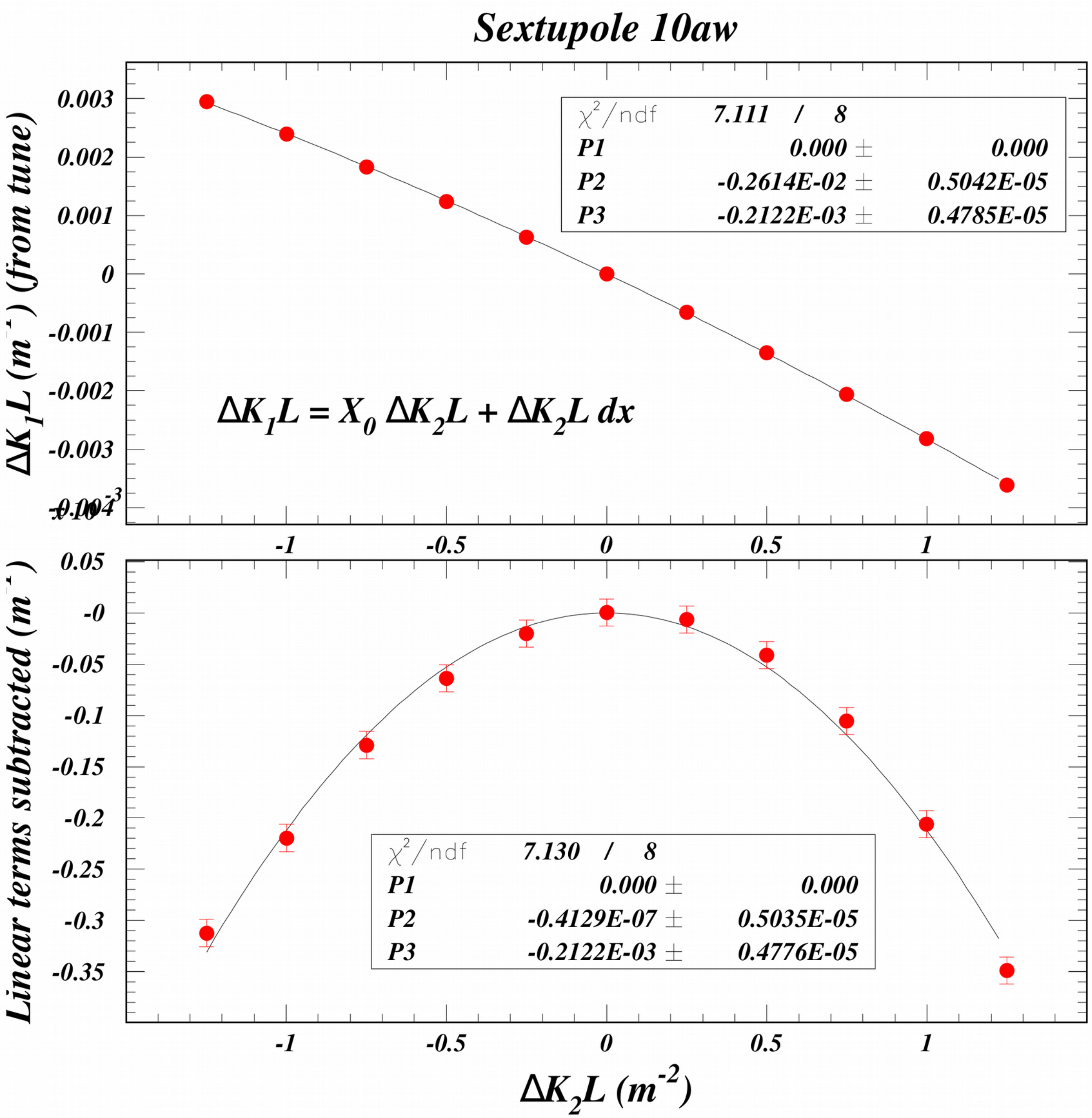
Together with the differential expression for the orbit kick, we obtain

$$\sigma^2 = \frac{4\tan(\pi Q)}{\beta}\frac{\mathrm{d}x}{\mathrm{d}k_2} - \left(\frac{\mathrm{d}k_1}{\mathrm{d}k_2}\right)^2 + (k_2\frac{\mathrm{d}x}{\mathrm{d}k_2})^2\left(1 + \frac{\mathrm{d}k_2}{k_2}\right)$$

Which, for $K_2L = 0\ m^2$, gives

$$\sigma^2 = \frac{4\tan(\pi Q)}{\beta}\frac{\mathrm{d}x}{\mathrm{d}k_2 l} - (X_0)^2 = 2\frac{\mathrm{d}x'}{\mathrm{d}k_2 l} - (X_0)^2$$

But 9.1 +- 0.1 mm ?



$a = X_0 = -2.614$ +- 0.005 mm (0.4%)

$b = dx/\Delta K_2 L = -212$ +- 5 μm/m^{-2} (3%)

7.35 +- 0.09 mm