MD3317: Alternative techniques to measure amplitude dependent closest tune approach

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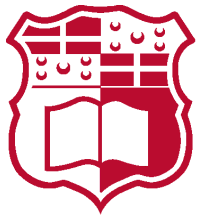
on behalf of the OMC team



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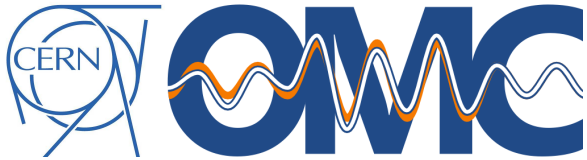
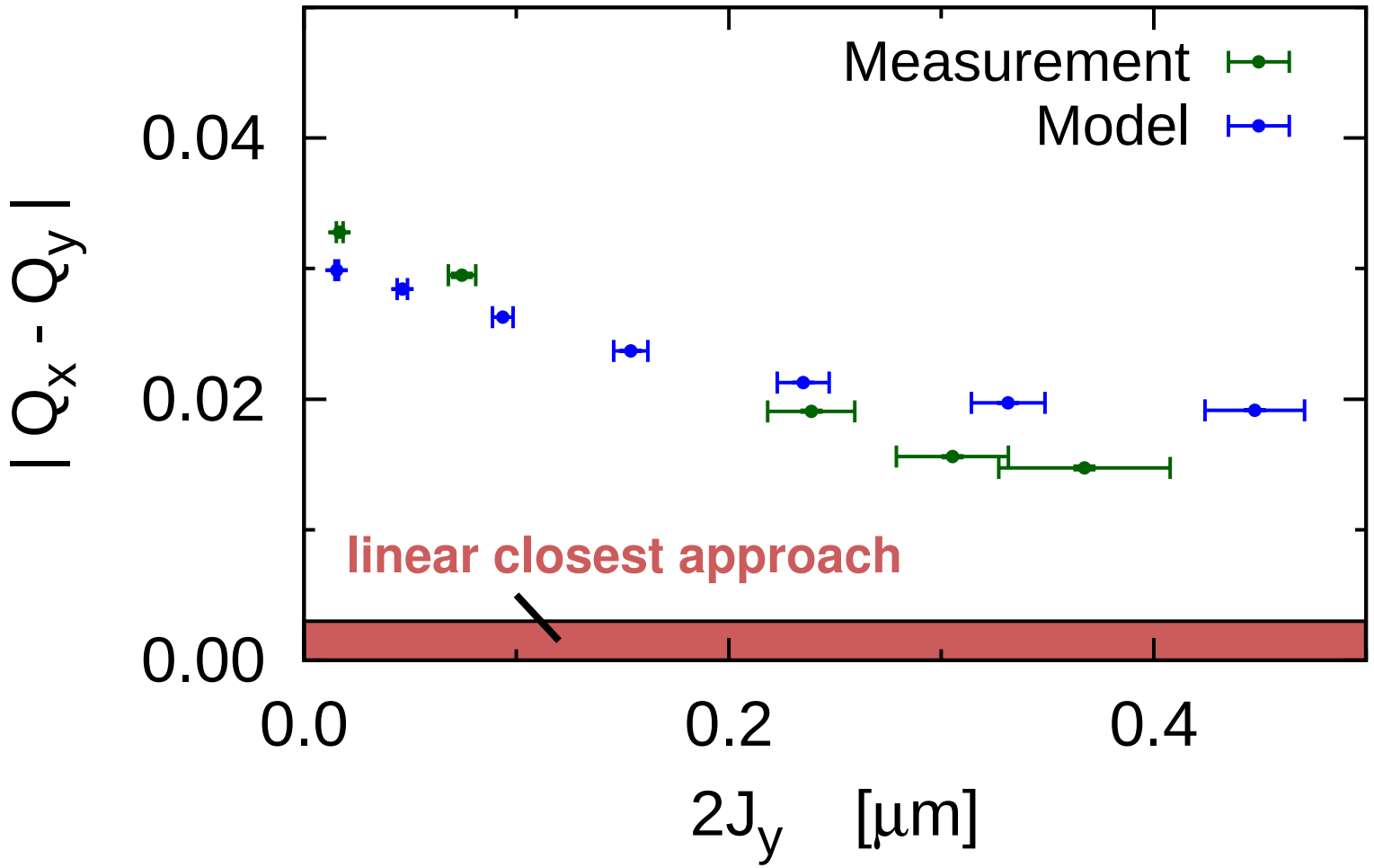


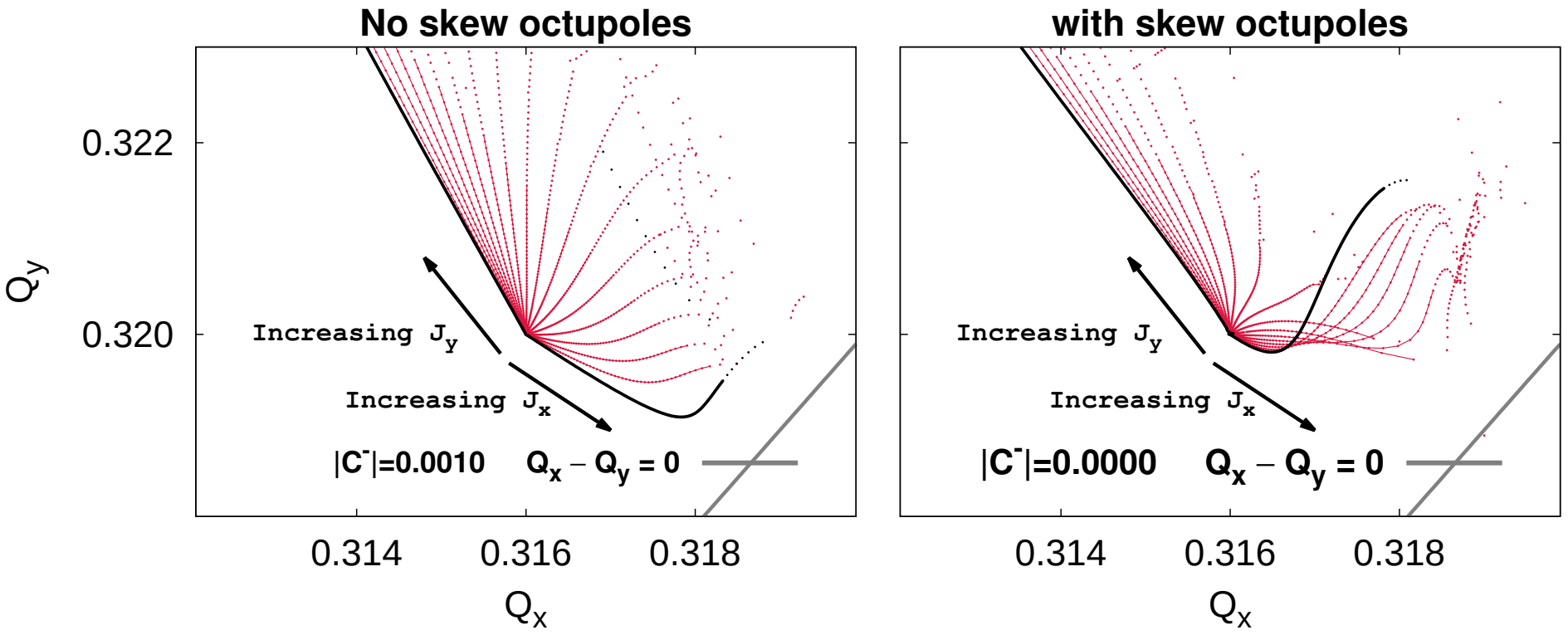
2012: observe saturation of Q-split vs J far above linear ΔQ_{min}

$\longrightarrow$ Interpret as an Amplitude Dependent Closest Tune Approach



Generated by $(a_2 + b_4)$ and $(a_4 + b_4)$

$\longrightarrow$ **Potential for large distortion of tune-footprint**



So far (MD in 2012/2016/2017) studied via saturation of tune-split during amplitude detuning measurements

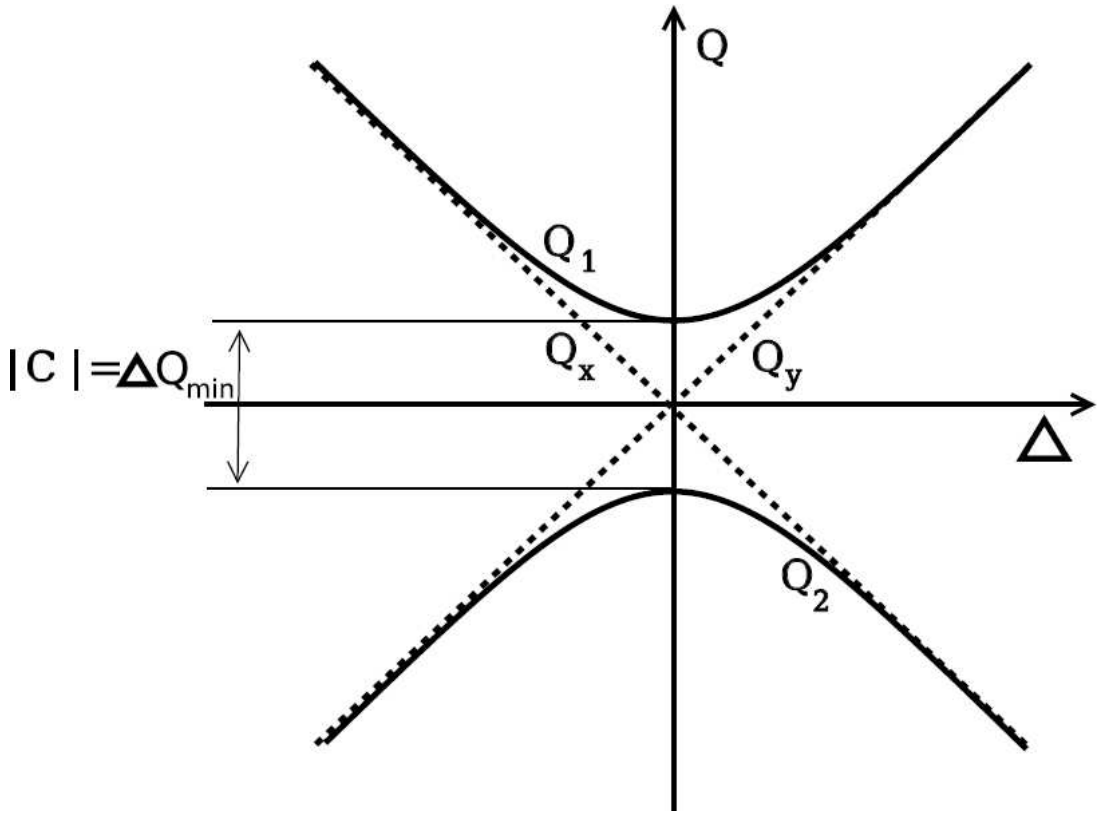
- **Directly observing effect of ADECTA on side of Q-footprint approaching the coupling resonance**

Some limitations from detuning-based measurement:

- **Can't test mechanisms in absence of octupoles**
- **Can only test mechanism with $J_{x,y}$ driving beams towards the coupling resonance**
- **Needs repeated kicks with MKA so impossible at top energy**

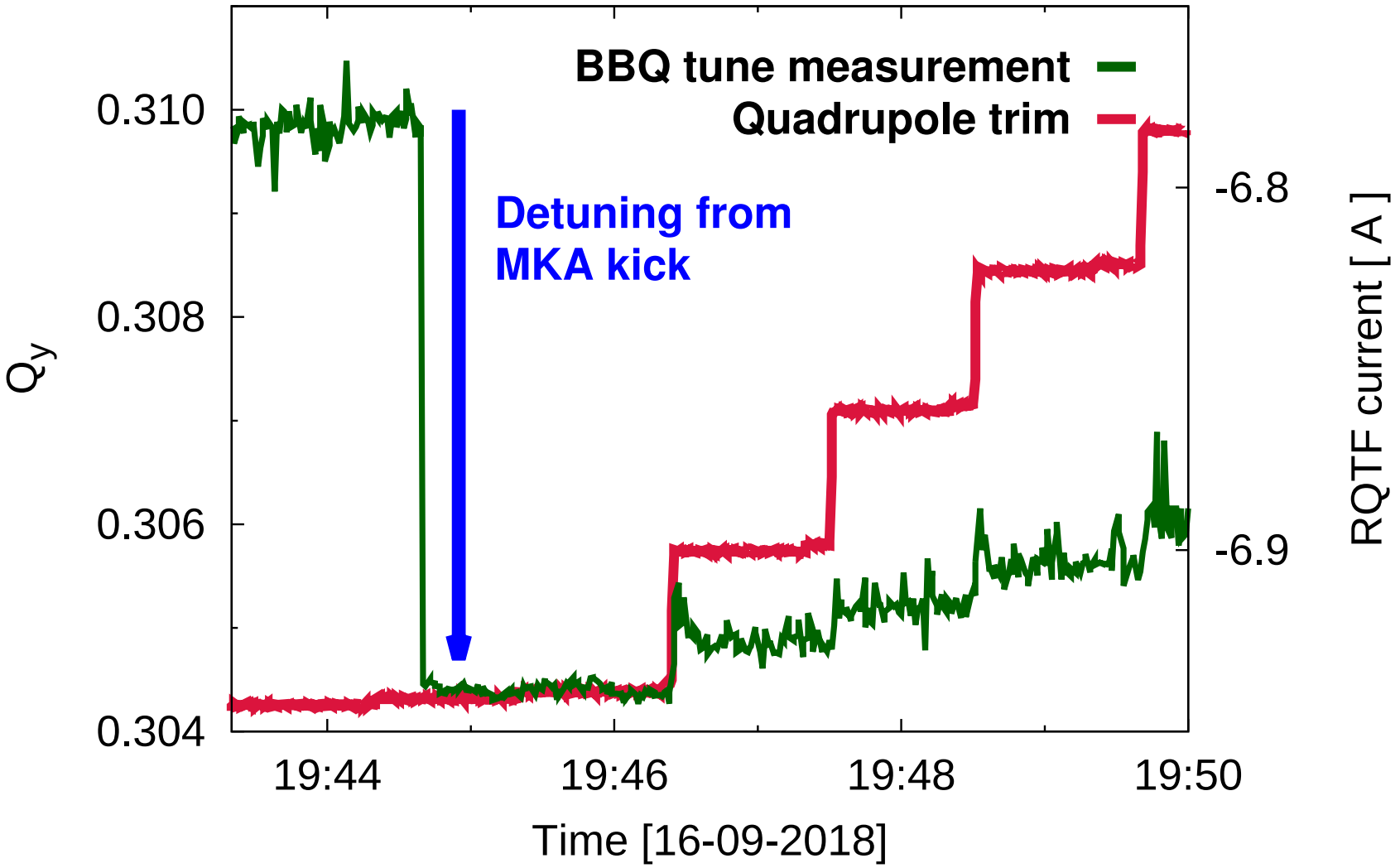
Need additional methods to measure ADECTA

Classical linear coupling measurement measures ΔQ_{min} by using quad trim to try and force tunes to the $Q_x - Q_y$ resonance

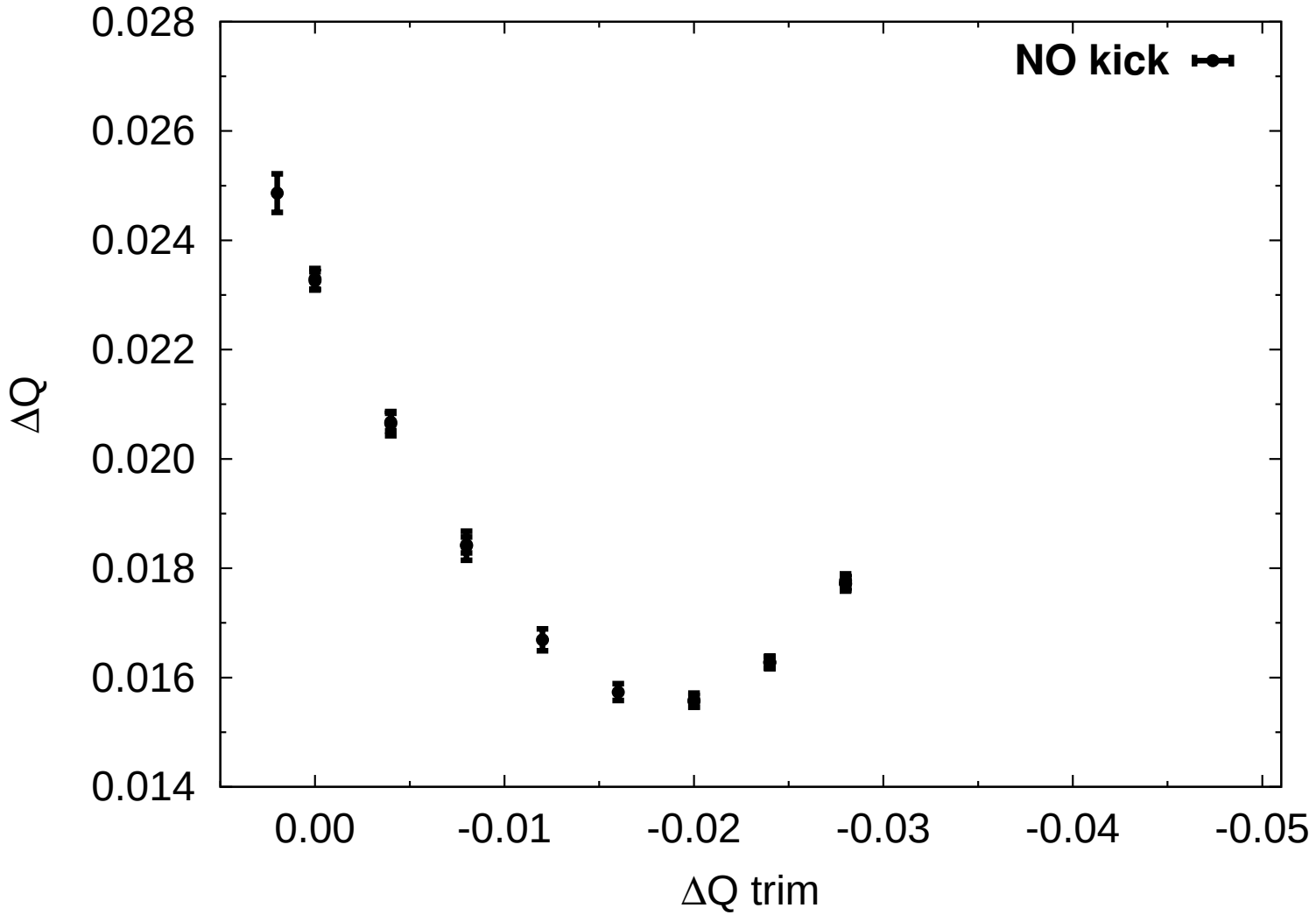


Try classical ΔQ_{min} measurement, but having first kicked beams with MKA (closest approach of a phase space doughnut)

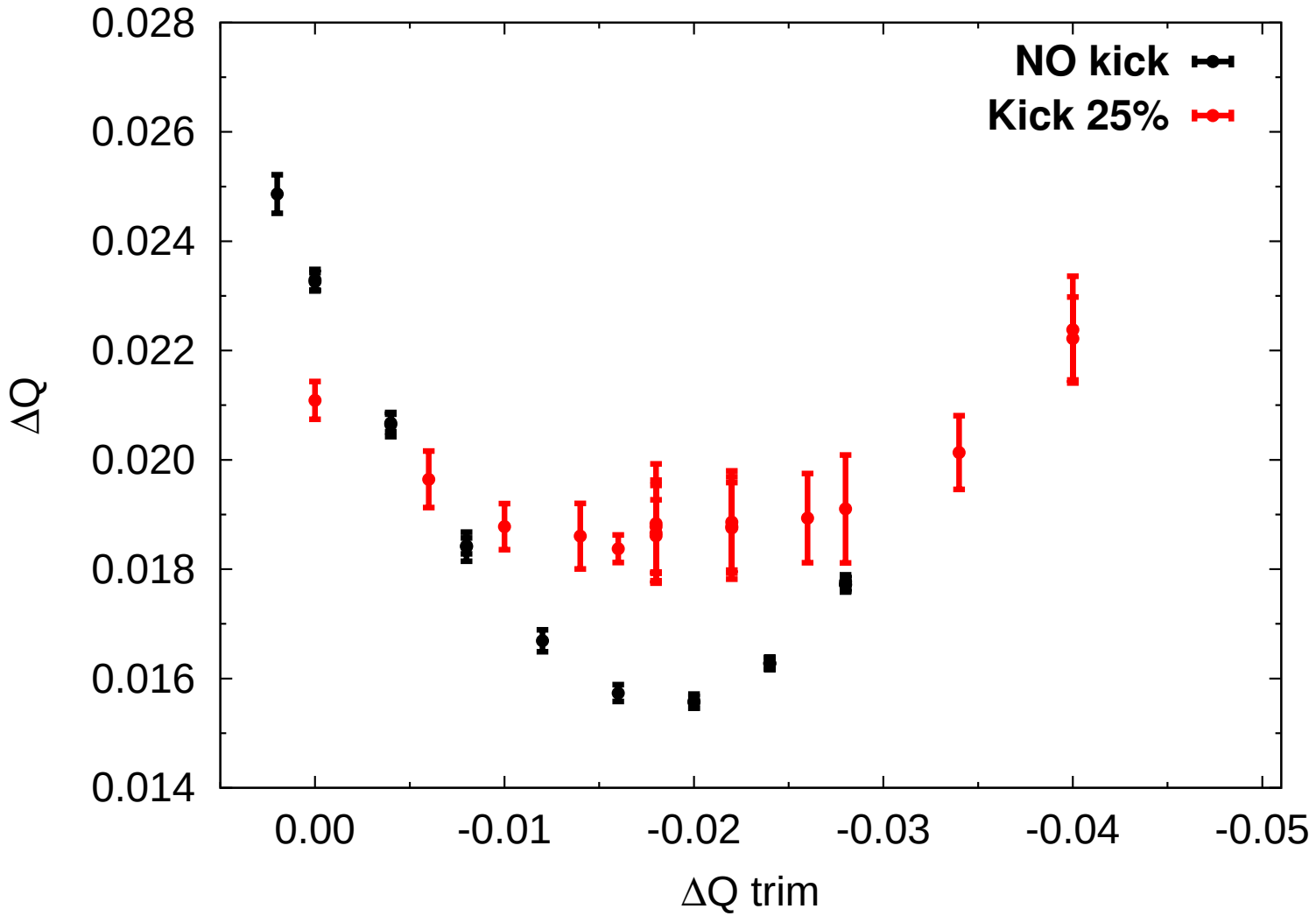
Can observe amplitude detuning and tune scan of kicked beam in BBQ data



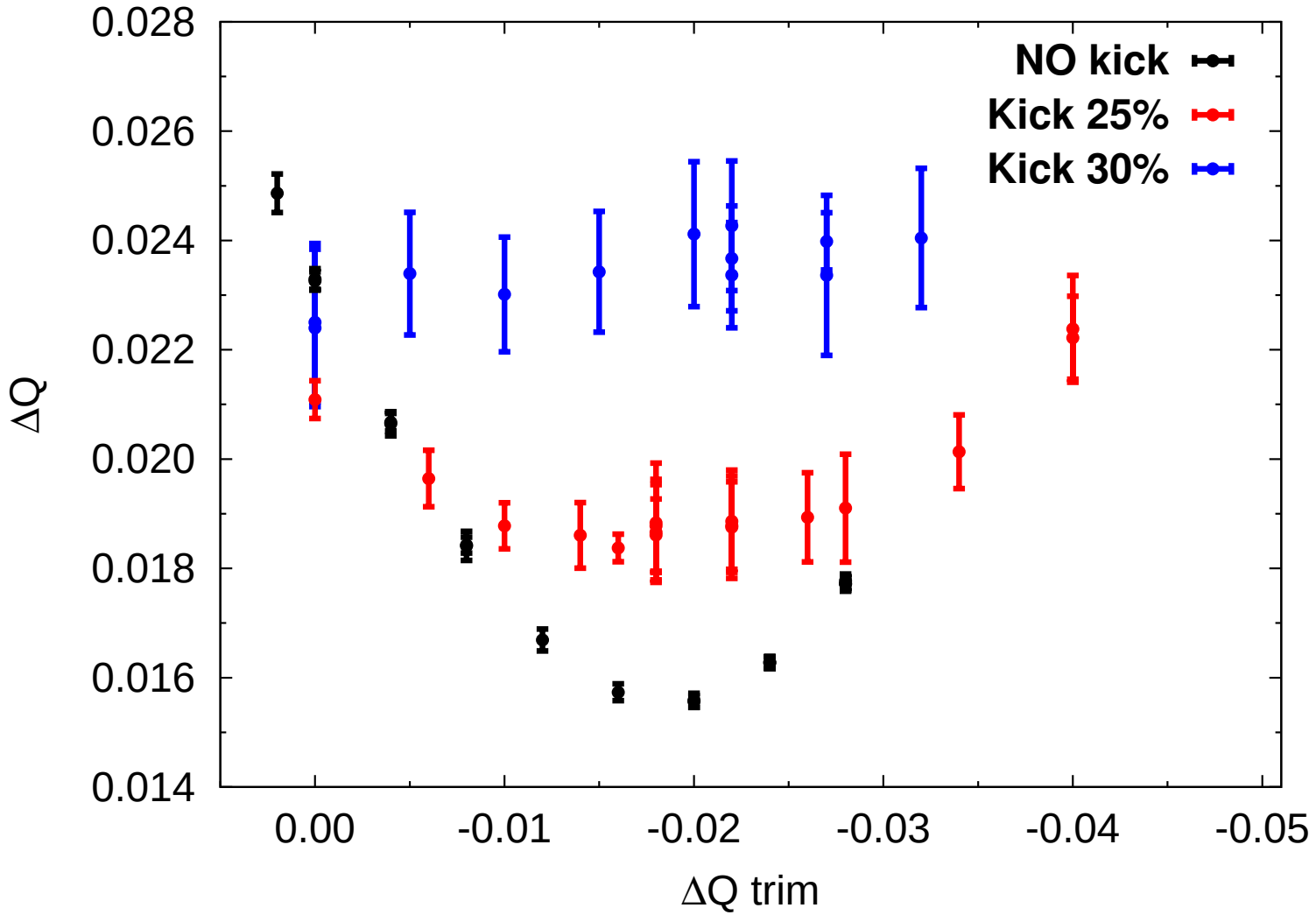
Trim QH_TRIM and QV_TRIM knobs to try and force tunes to same value



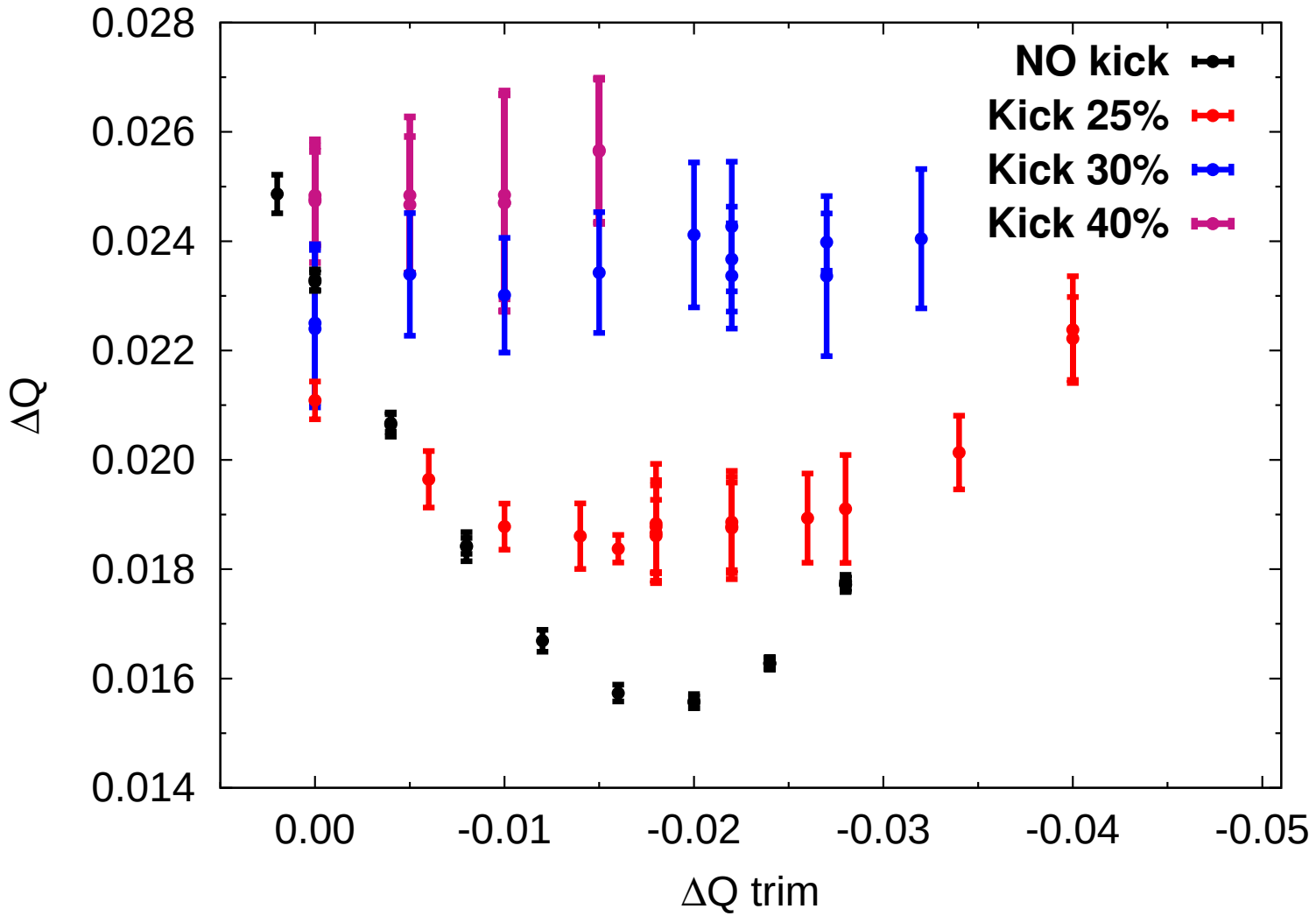
With diagonal kick of 25% MKA powering see increased closest approach



Beams are fully coupled above 30% MKA kick

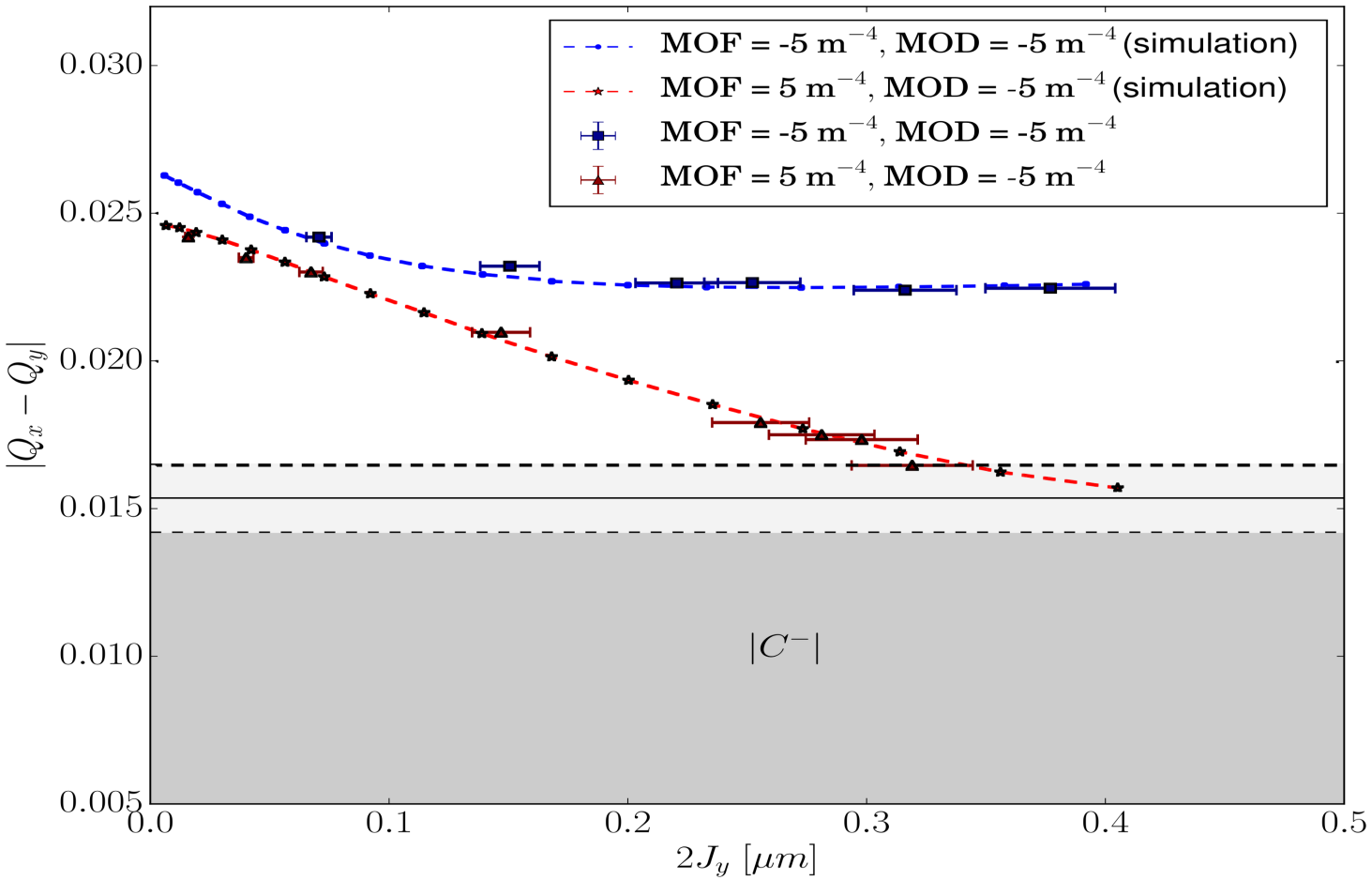


Amplitude dependence of closest tune approach observed for diagonal kicks



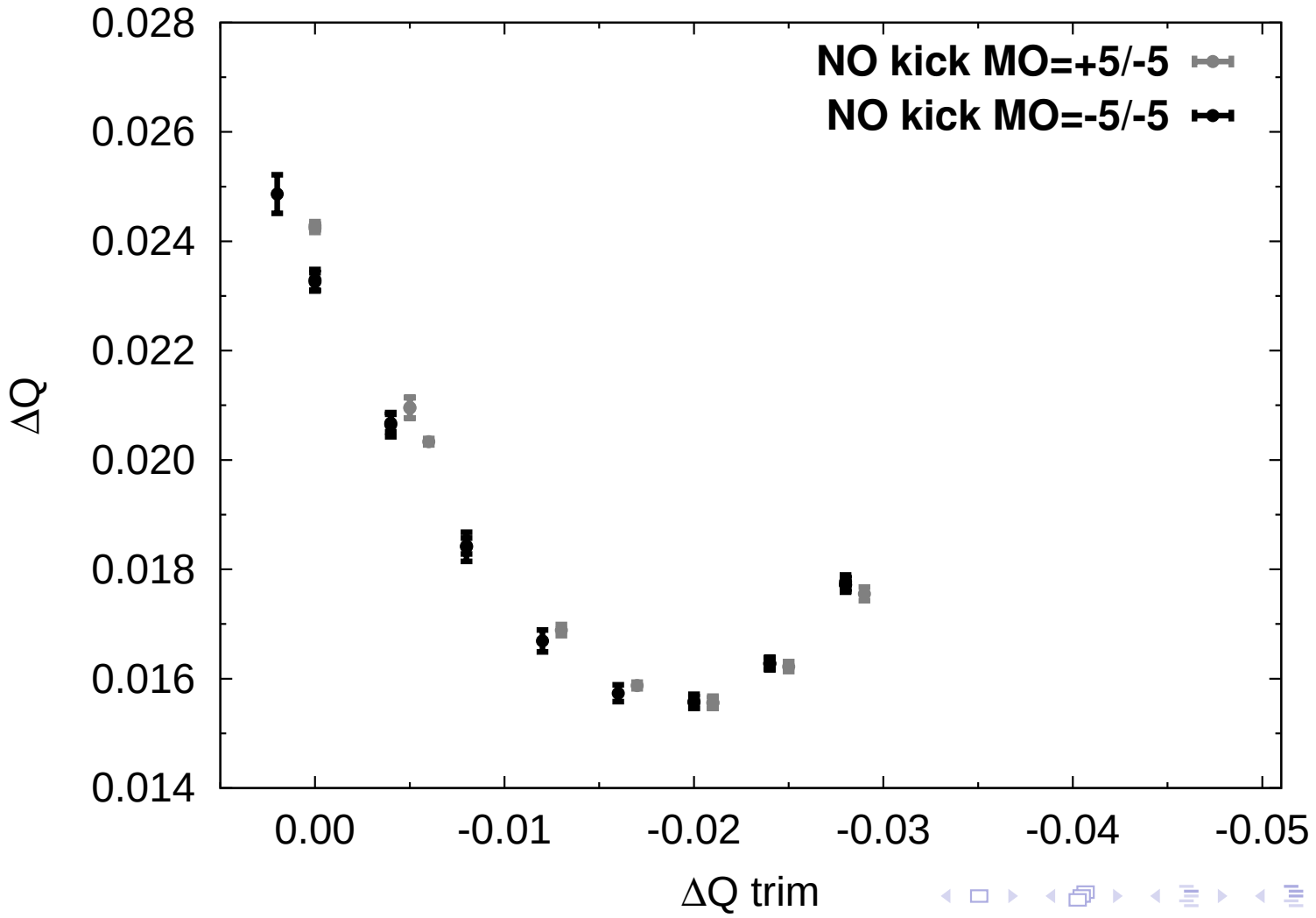
Powering MO with opposite strength should suppress ADECTA

→ **Observed in 2016 MD via saturation of amplitude detuning**



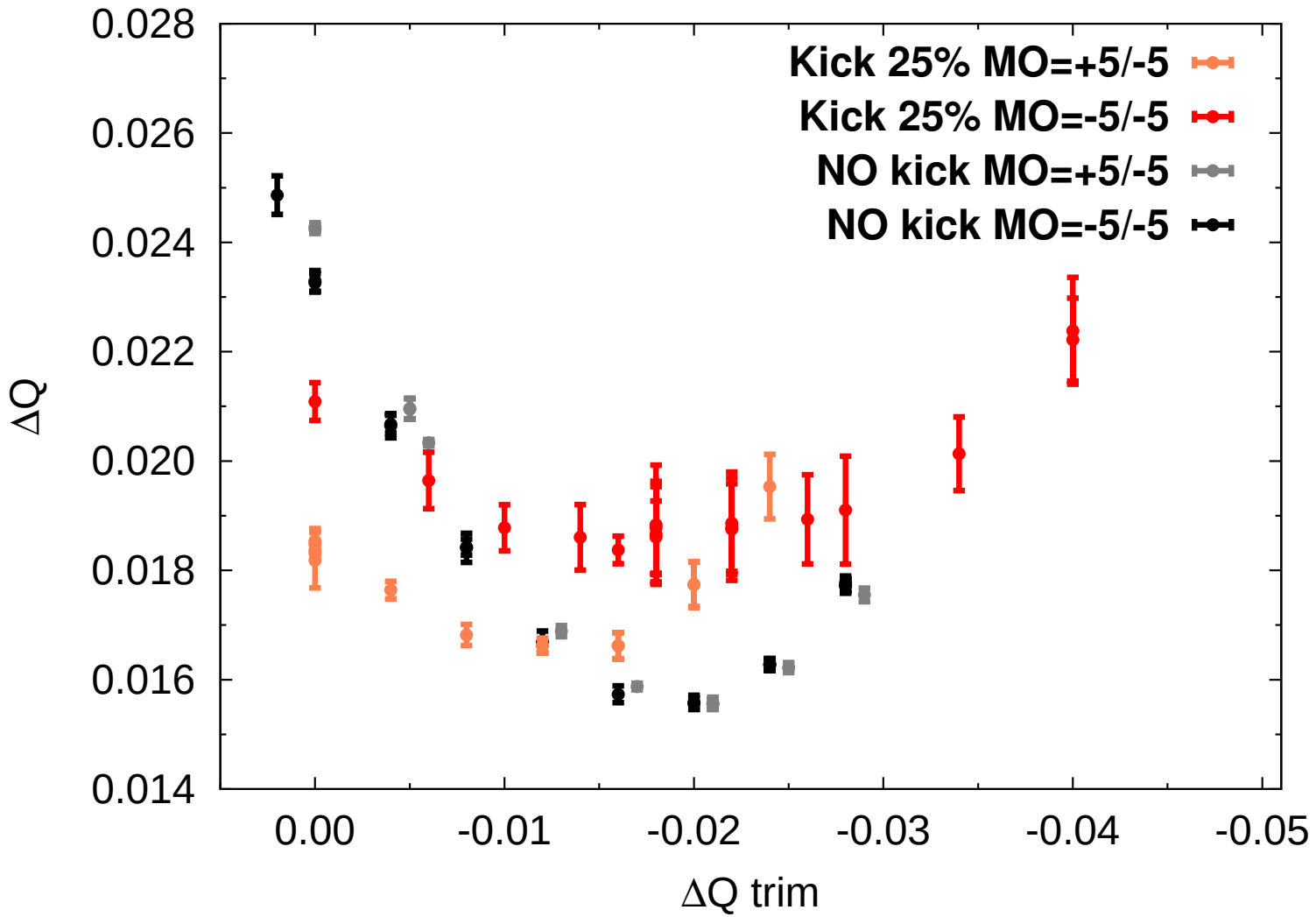
Powering MOF/D with opposite strength should suppress ADECTA

→ **Checked that linear closest approach unchanged for new MO settings**



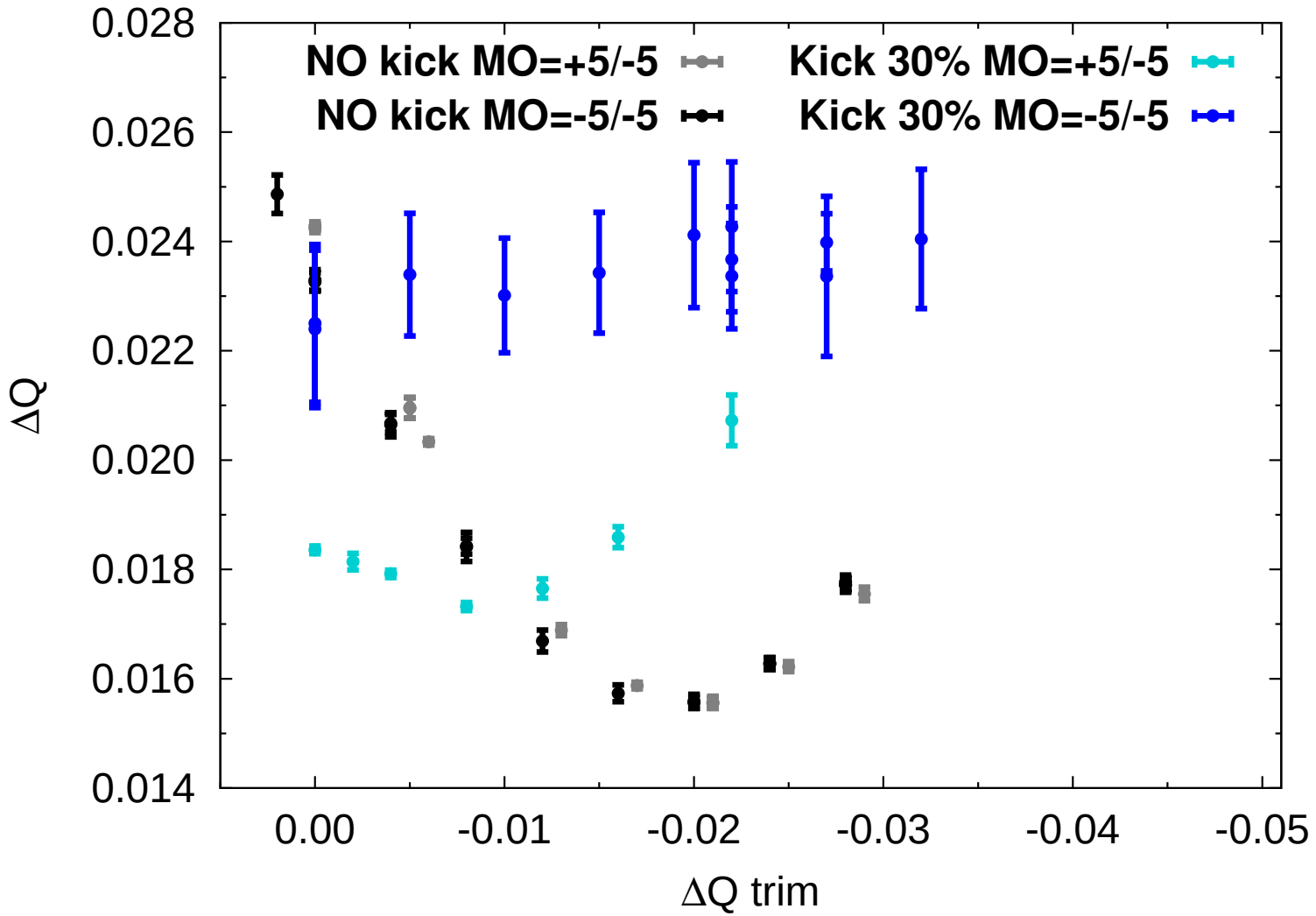
Powering MO with opposite strength should suppress ADECTA

→ ADECTA significantly reduced with opposite MOF/D polarity



Powering MO with opposite strength should suppress ADECTA

$\longrightarrow$ ADECTA significantly reduced with opposite MOF/D polarity



Very happy with outcome of MD:

- Demonstrated alternative method to measure ADECTA
- Observed explicit amplitude dependence for first time
- Replicated observation of suppression via MO powering with new observable