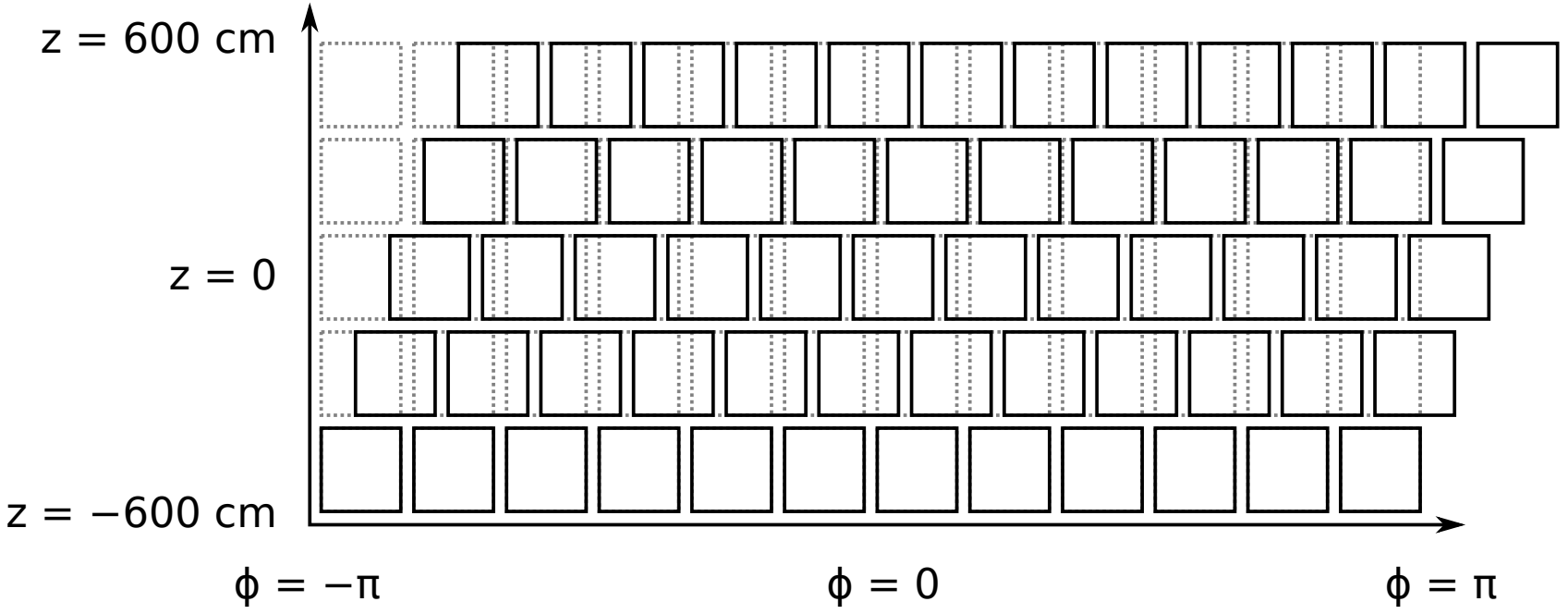
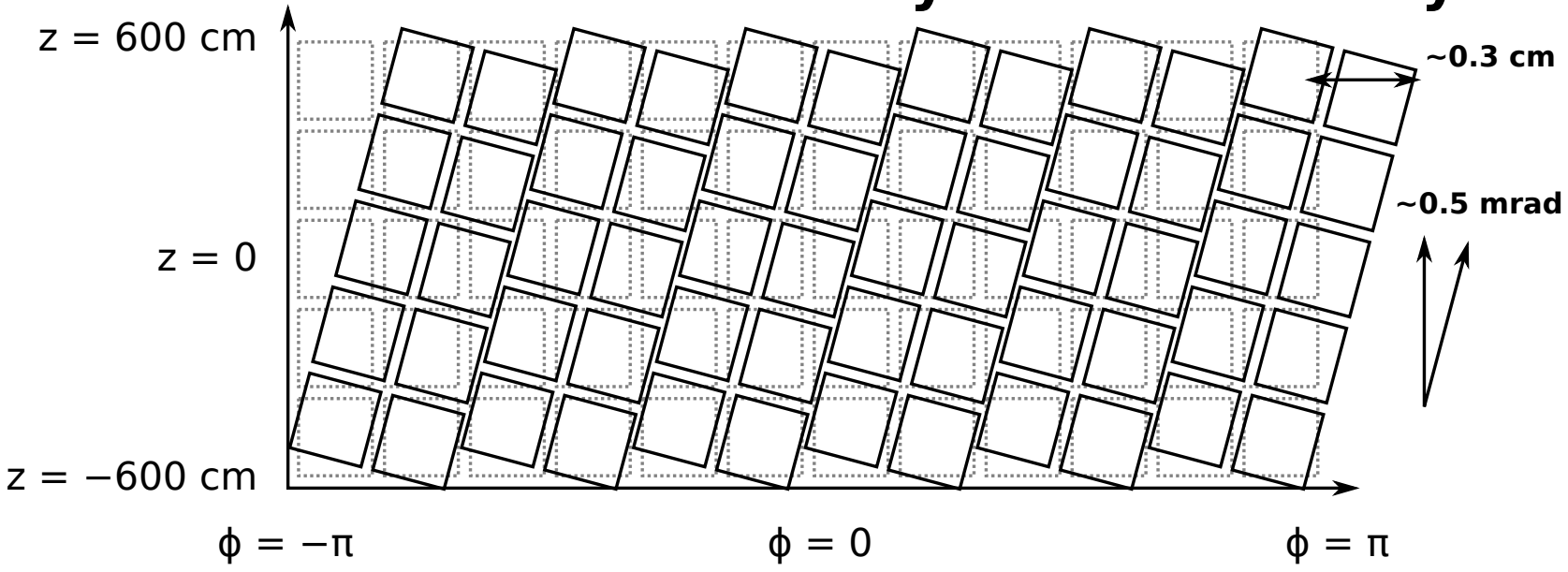
Geometry Models

wheel-to-wheel rotation:
ruled out by global and local tracks



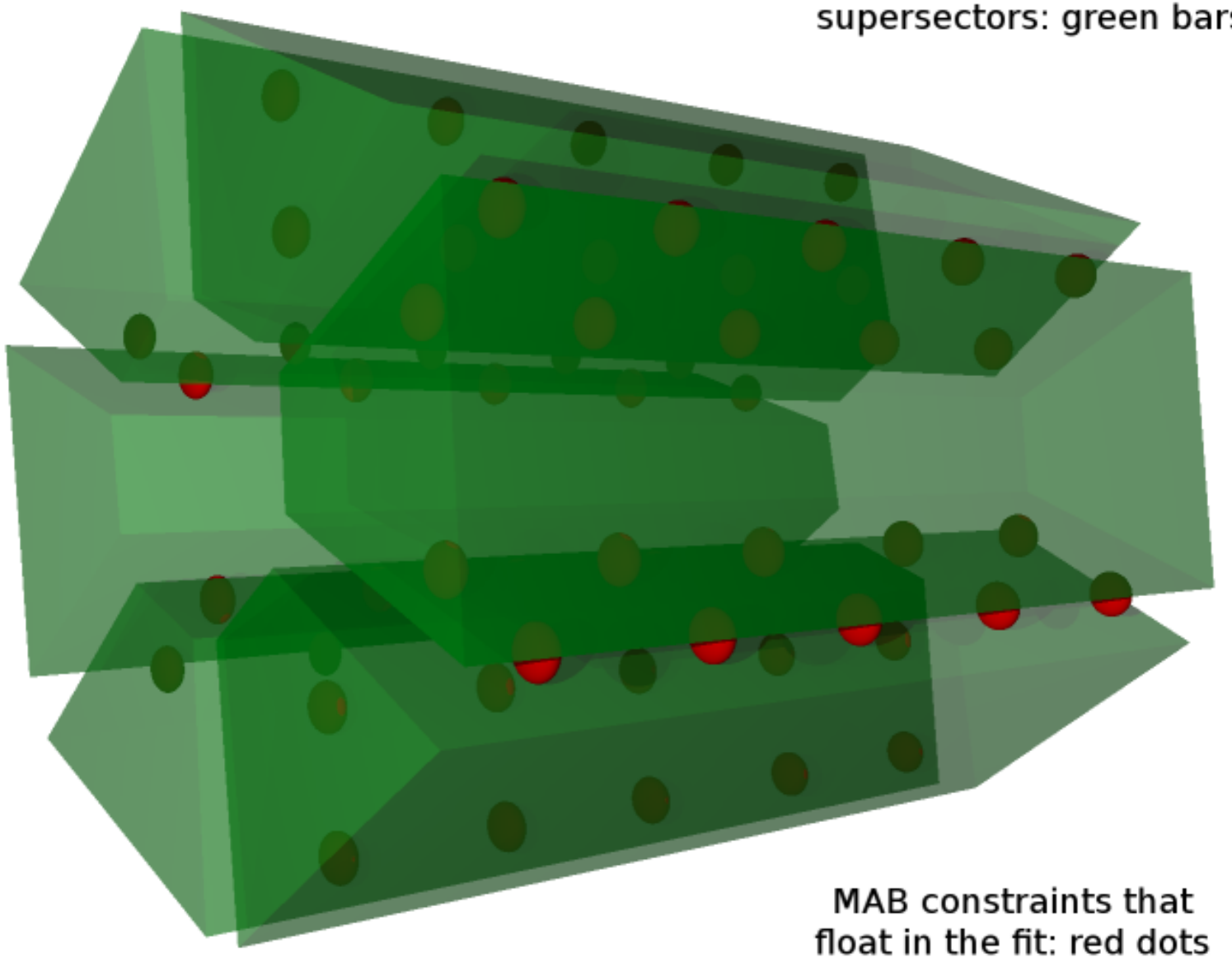
supersector rotation: plausible from tracks, but contradicted by link+AR survey



- It would be interesting to know what the inclinometers and transfer lines have to say about this, since they would provide data which are independent of the link+AR *and* tracks
- As it stands, it's enough of a problem that link+AR and tracks disagree, and that's why we want to investigate more deeply

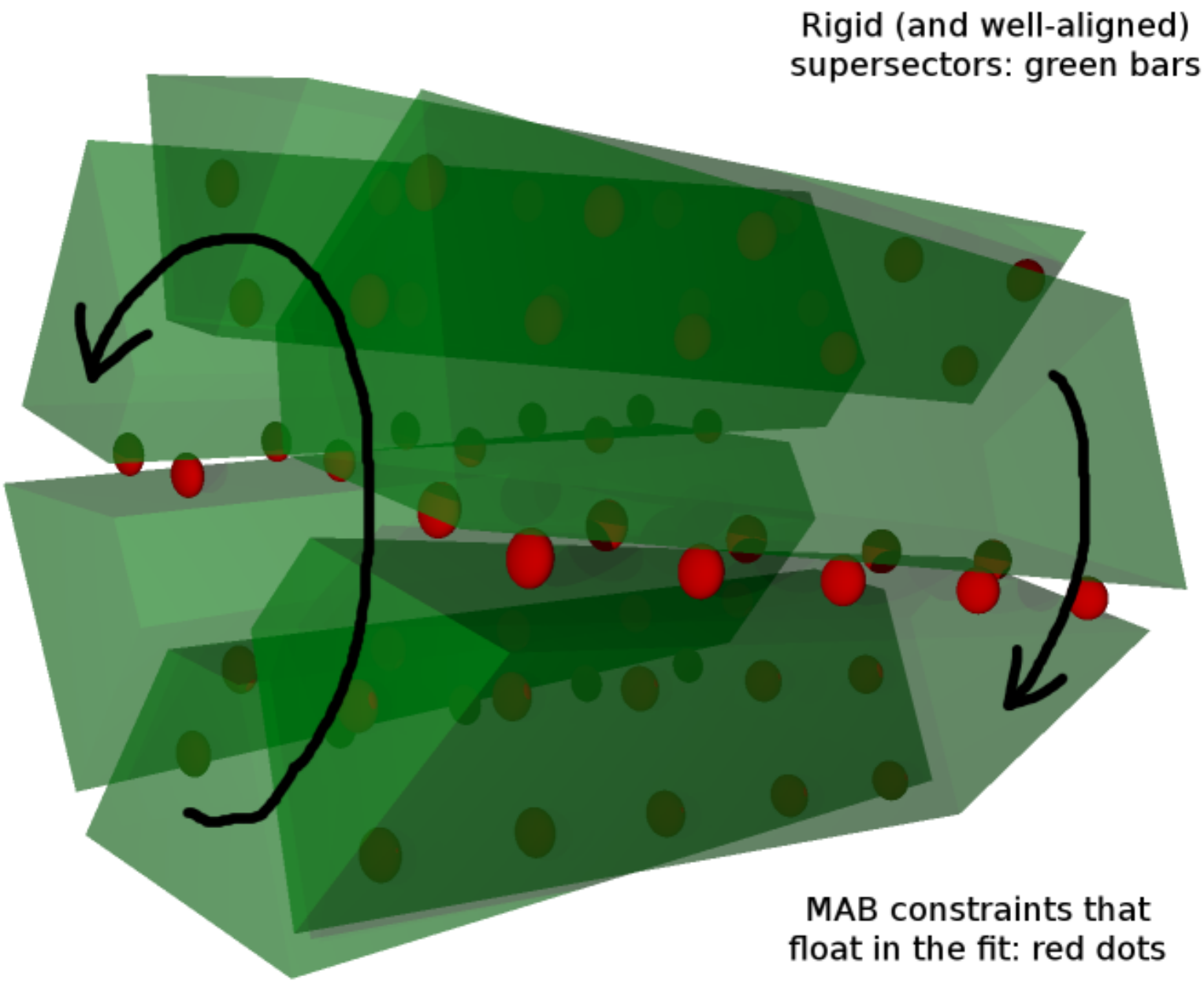
Supersector rotation model: 3D

Rigid (and well-aligned) supersectors: green bars

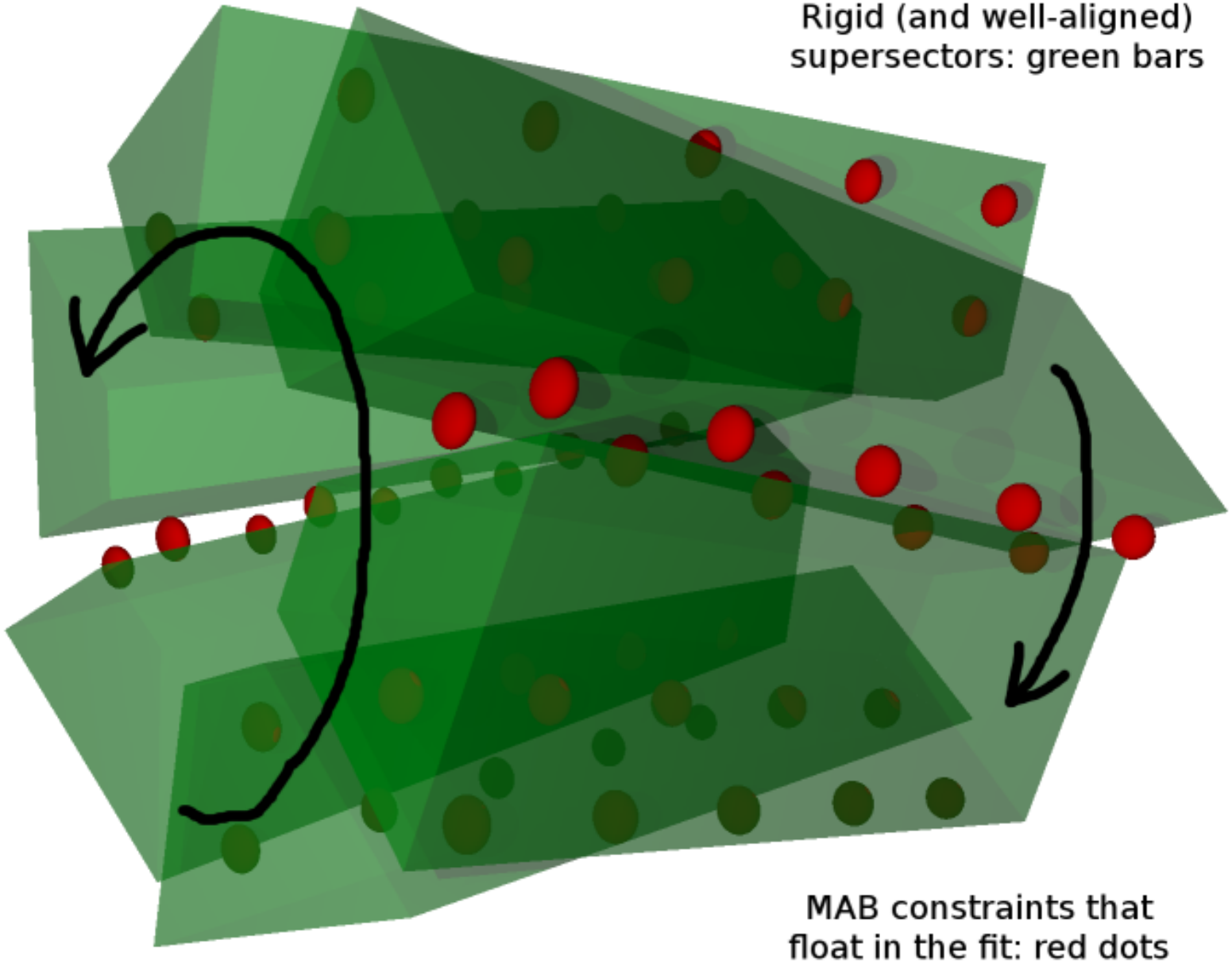


MAB constraints that float in the fit: red dots

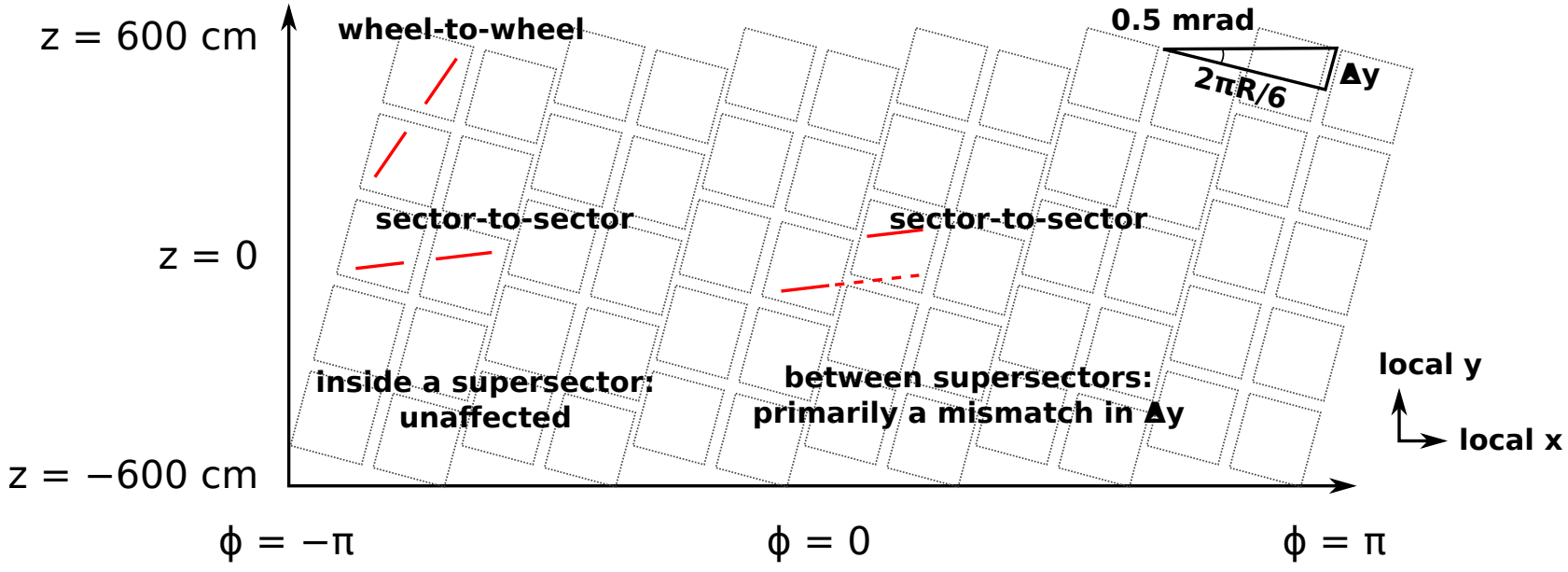
Supersector rotation model: 3D



Supersector rotation model: 3D

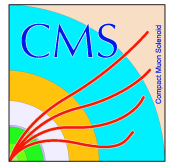


Local segment extrapolations



- Should be a constant offset for all wheels, for all 6 supersector boundaries: $\Delta y = \dfrac{2\pi R}{6} \tan 0.0005 = 2.6$ mm at $R = 5$ m
- "Map plot" style plot of Δy vs. ϕ with a multiple of 12 bins (preferably 48 or more) would show discontinuities between supersectors and linear slopes between them. . . or not, if the model isn't true

Measurements that could help



- A "supersector rotation" of 0.5 mrad would have the following consequences for barrel hardware measurements between neighboring supersectors:

$$\Delta\phi = 0, \qquad \Delta R = \left(Z_{\text{pos}}\right) \tan 0.0005, \qquad \Delta z = \left(\frac{2\pi R_{\text{pos}}}{6}\right) \tan 0.0005$$

  - ϕ and $r\phi$ measurements are *completely* insensitive to it
  - the sensitivity of radial measurements are proportional to Z_{pos}, the distance of the sensor from the symmetry plane of CMS
  - the sensitivity of Δz measurements are proportional to R_{pos}, the distance of the sensor from the beamline

- I've created a mathematical model to verify the above and to search for auxiliary rotations or translations of the supersectors that can absorb a "supersector rotation," thus providing for a weak mode. There aren't any: this is a straight-forward measurment. If the barrel's inter-supersector measurements are sensitive to ΔR or Δz at the level of $\mathcal{O}(1\text{ mm})$, then it can rule out the effect.