

Computing the edge safety factor $q(a)$

Definition:

$$q(r) = \frac{rB_t}{R_0 B_p(r)}.$$

Using Ampère's law at the plasma edge:

$$B_p(a) = \frac{\mu_0 I_p}{2\pi a}.$$

Insert into the definition:

$$q(a) = \frac{2\pi a^2 B_t}{\mu_0 R_0 I_p}.$$

For GOLEM (fixed geometry):

$$K_{\text{geom}} = \frac{2\pi a^2}{\mu_0 R_0}$$

$$q(a) = K_{\text{geom}} \frac{B_t}{I_p}.$$

Thus: measuring $I_p(t)$ and knowing B_t is fully sufficient to compute $q(a)$ for any discharge on GOLEM.