

Transition Crossing Experiments

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What do we need to know to improve transition crossing?

- **Measure** nonlinear momentum compaction factor α_1 , defined as (J. Wei)

$$\frac{L}{L_s} = 1 + \frac{\delta}{\gamma_t^2} (1 + \alpha_1 \delta).$$

Method:

Measure f_s vs. **radial loop** close to transition energy

Time estimate:

1 hour, but stopping the ramp close to γ_t may require more time

Alternatively, it might be possible to determine α_1 by **tomographic phase-space reconstruction**.

Benefits for machine operation:

- Improve RF matching during the jump
- Understand possible difference between BLUE and YELLOW

Note:

At $\beta^* = 3$ m, we get $\alpha_1 = -3/2$, and therefore

$$\begin{aligned}\eta &= \eta_0 + \eta_1 \delta \\ &= \left(\frac{1}{\gamma_t^2} - \frac{1}{\gamma^2} \right) + \frac{2}{\gamma^2} \left(\alpha_1 + \frac{3\beta^2}{2} \right) \delta \\ &= \eta_0.\end{aligned}$$

- Measure longitudinal **emittance vs. jump amplitude and jump speed**

Time estimate:

Parasitical study

Benefit:

Find optimized set of parameters

- Optimize quad and RF jump timing

Time estimate:

Parasitical study

Benefit:

Find optimum parameters