RMS vs. Gaussian fit for Modeling ATF2 IP Beam Size

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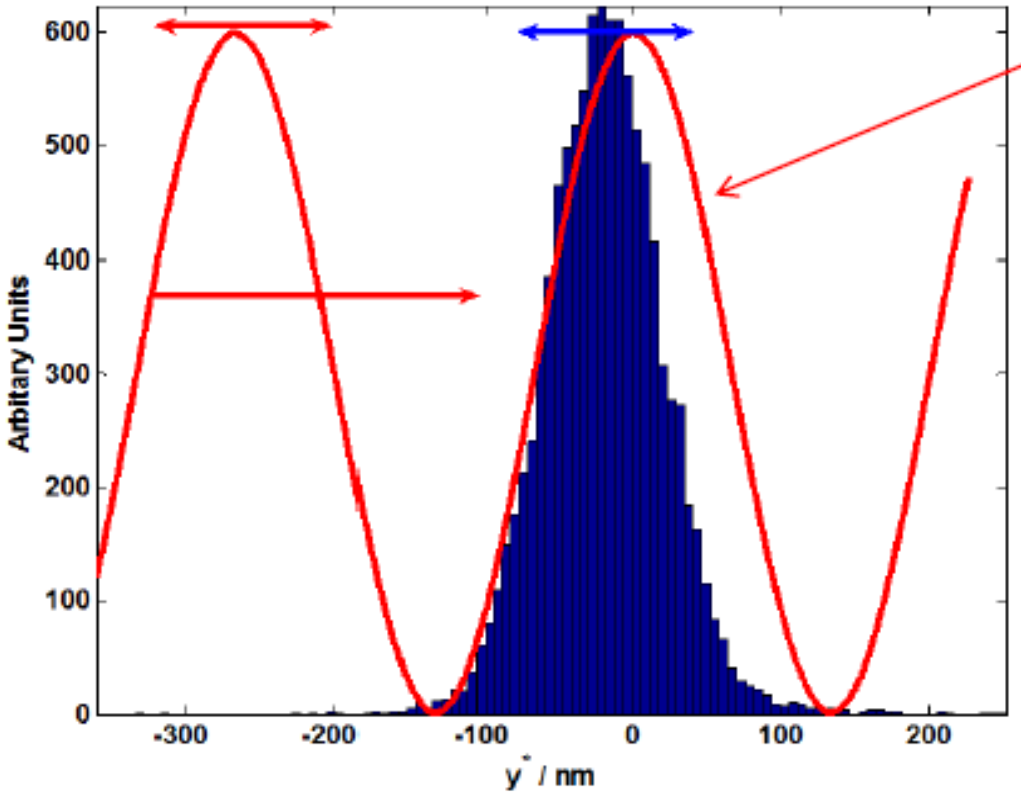
Shintake BSM Simulation



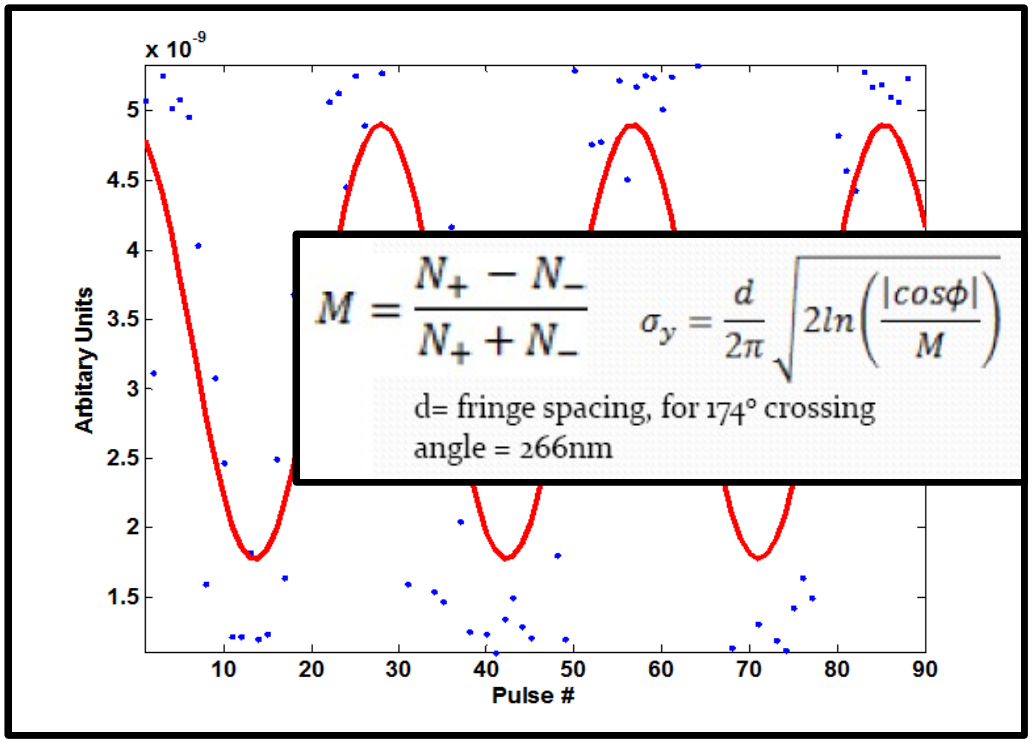
$$< B_x^2 B_y^2 >= B^2(1 + cos2\emptyset cos2k_y y)$$

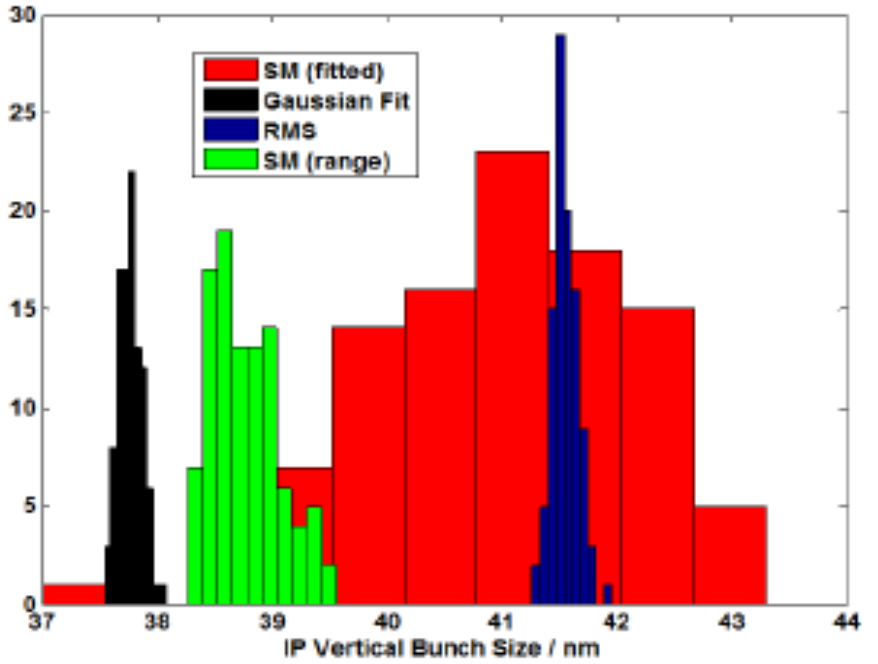
ϕ = Laser beam crossing angle (174°)

$k_y = k\sin\phi$

- Track beam through to IP (10k macro-particles)
- Scan interference pattern past beam +/- 2π over 90 bunches
- Form modulation pattern from overlap integral of beam with interference pattern
- Beam naturally jitters from tracking with simulated jitter sources
- Also simulate laser phase jitter by jittering phase of fringe pattern ~ 10nm

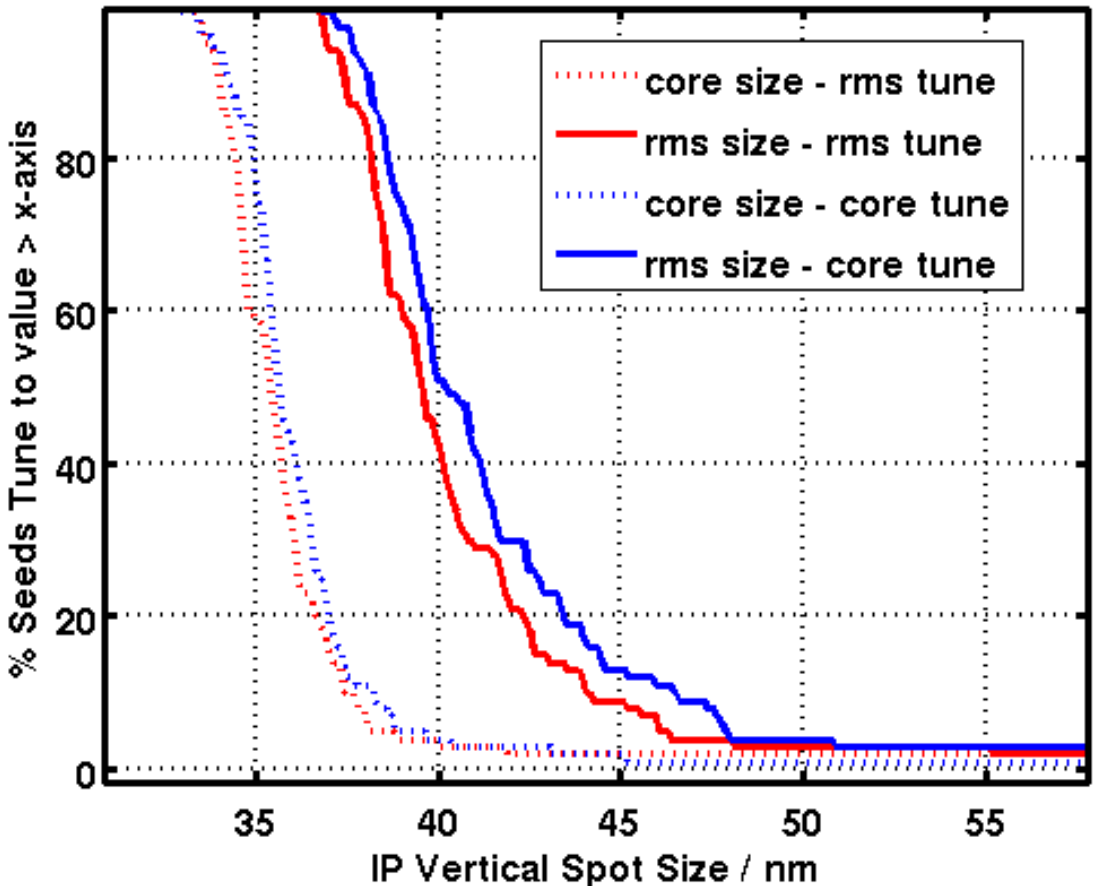
IP Measurement Process





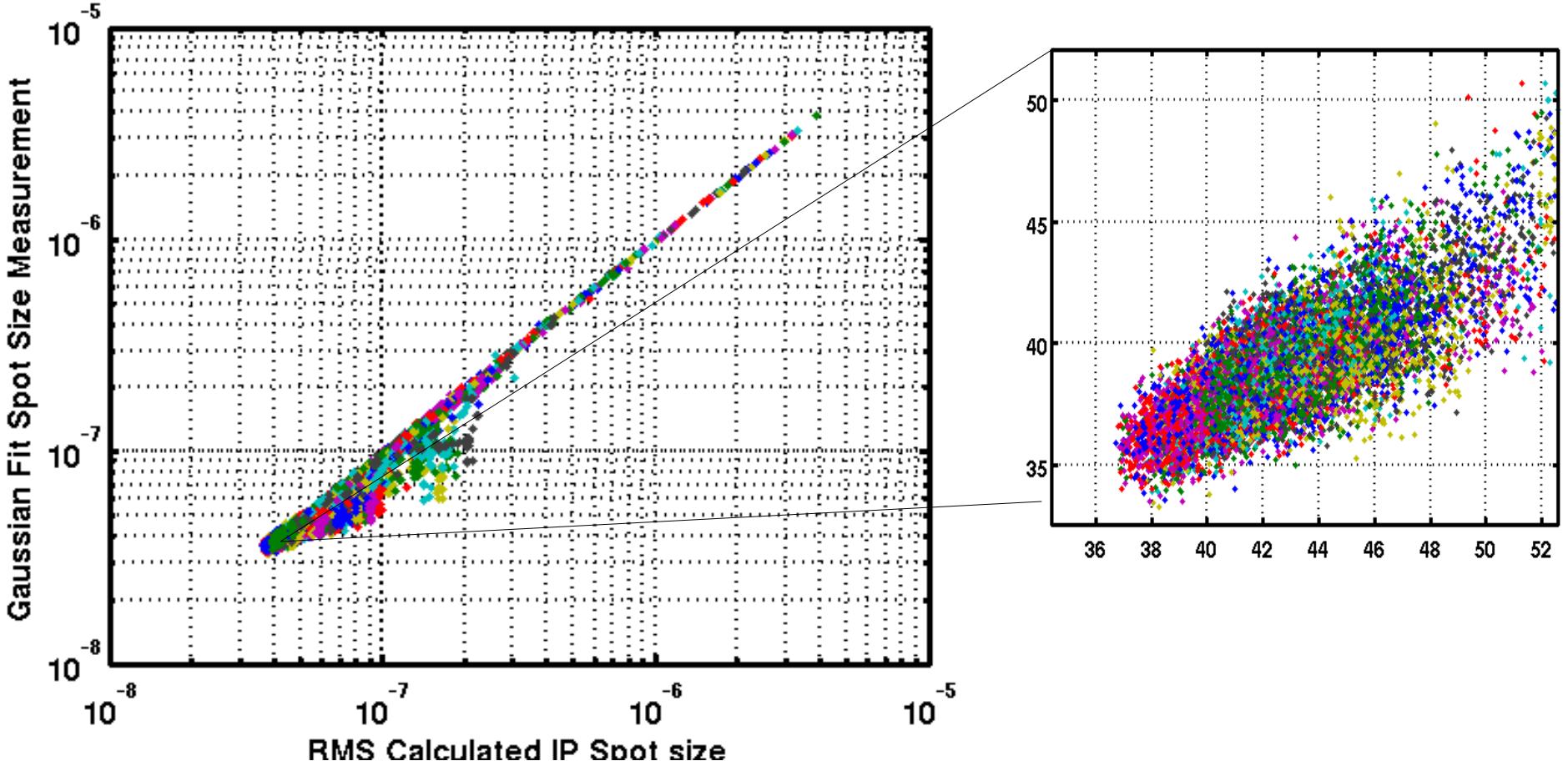
- Can measure (in simulation) the beam size in different ways with different results (at 10% level).
- Shintake monitor measure ~rms value – in simulations, should tune on RMS...
- If fixed relation between RMS and core (fixed shape beam profile), can infer core size maybe (more relevant quantity for ILC)...

Tuning Simulation Results



- Tuning results, performed using rms beamsize as tuning input, or gaussian core.

Measurement Comparison



- 100 seeds, core vs. rms beam size for all tuning steps
- Near target region- seems possible to predict core size ~ +/- 2nm, similar to measurement resolution.