EASY to OBTAIN 10^{33} at DAΦNE2?

(scalings from DAΦNE)

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Factors to Improve Peak Luminosity at DAΦNE2

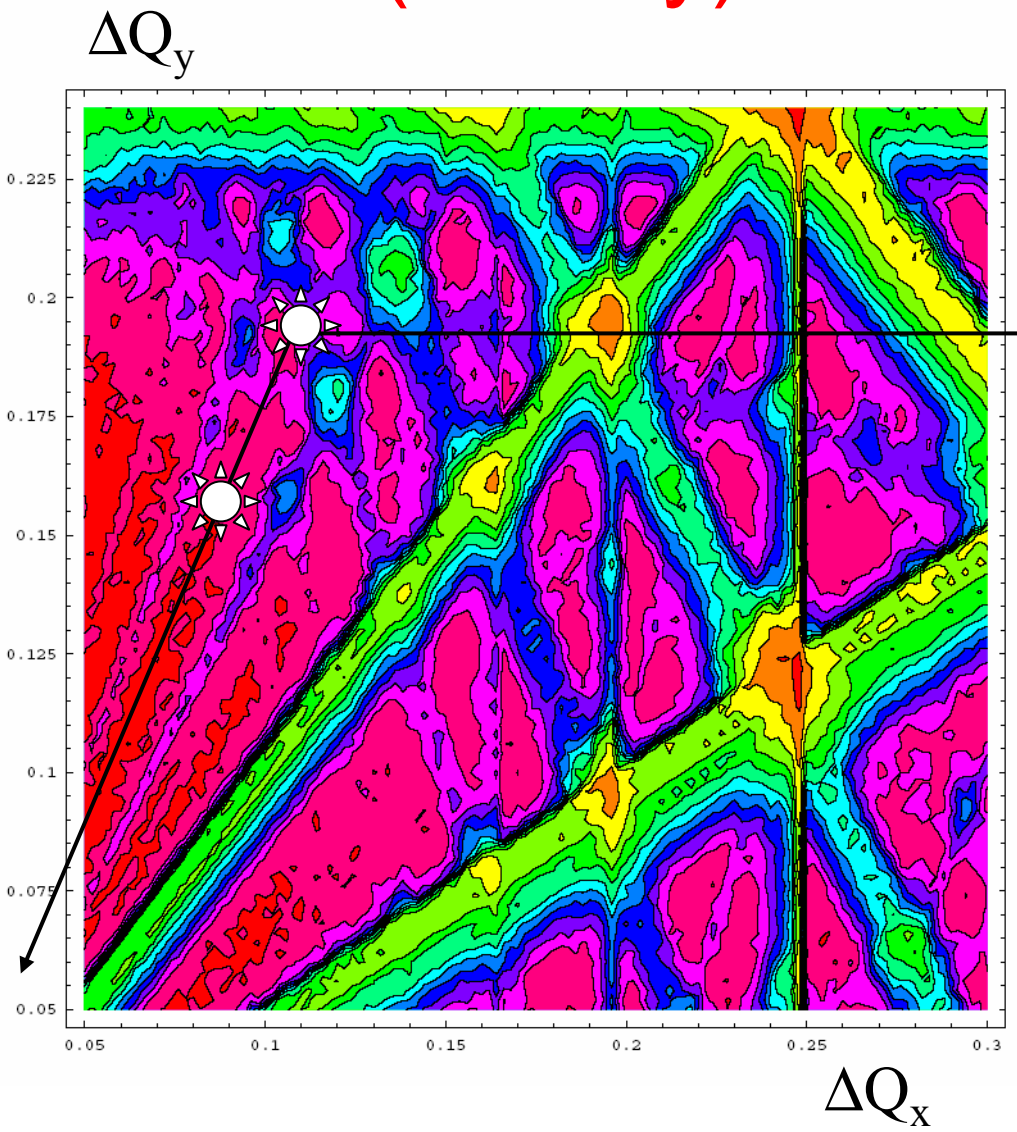
1. Higher Number of Bunches (160/120 = 1.33)
2. Stronger Radiation Damping ($2^{1/3}$ = 1.26, *to be proved*)
3. Shorter Bunches (factor of 2, *only if βx and βy scales proportionally to the bunch length*)

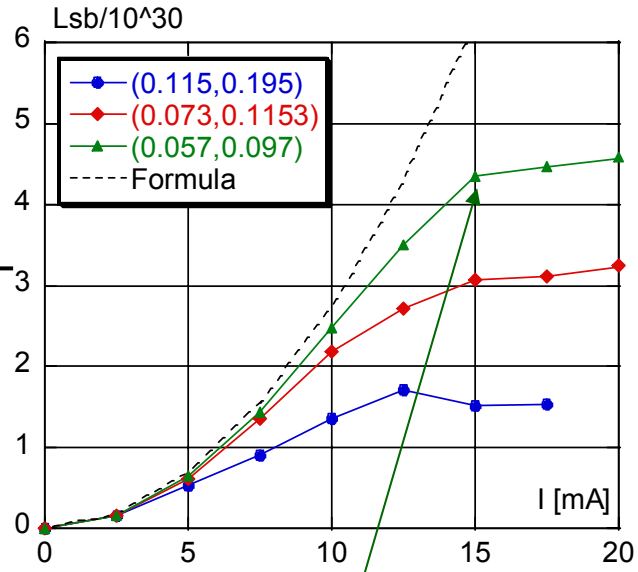
Total = 1.33 x 1.26 x 2.00 = 3.35

WORST SCENARIO

$$1.53 \cdot 10^{32} \text{ x } 3.35 = 5.12 \cdot 10^{32}$$

Best (Theory) Luminosity per Bunch





4×10^{30}

BEST SCENARIO
(too optimistic…)

$$4.0 \cdot 10^{30} \times 145 \times 1.26 \times 2 = 1.46 \cdot 10^{33}$$

(110/120)x160

$2^{1/3}$

$\sigma_z/2$

PROBLEMS (Beam Dynamics)

- Does damping help much? If not → /1.26 = 1.16×10^{33}
- Short bunches 7-9 mm long are needed without lengthening and microwave instability → High Qs
- Is it possible to obtains tune shifts of the order of 0.04-0.05 with the high Qs? → so far the answer is NO
- Does a sufficient dynamic aperture exist for good beam-beam working points (if found)?

VEPP-2M Experience with SC Wiggler

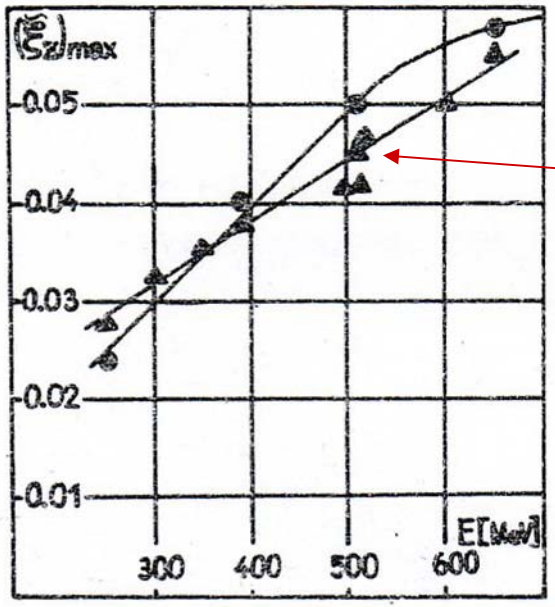


Fig. 2. Experimental dependences of the space charge parameter on the VEPP-2M energy in the maximum luminosity regime: ▲ — the wiggler is on; ● — the wiggler is off.

No tune shift gain at 510 MeV

Factor of 3 luminosity improvement only due to higher horizontal emittance

References

1. *Nikitin S. A., "e+e-Factories'99", Tsukuba 1999.*
2. *Shatunov et al., ICFA Workshop, Novosibirsk 1989*

SO FAR……

The best result found (for the moment) is 7.5×10^{32} at the working point (0.12, 0.06)

However, the working point is situated at the principal sextupole resonance $Q_x = 2\,Q_y$

Lifetime → 0? Coupling?

Ways to Proceed Studies

- Lower RF voltage, Negative momentum compaction factor → Short bunches at lower Qs
  (see DAΦNE gradual upgrade approach)
- Higher Emittance → feasible if:
  - There is enough separation at the first PC
  - Higher current per bunch (and beam) is provided
- Crab-Crossing
- Other Proposals?

Forsing Parameters…

1) V_{RF} => 400 kV
2) Qs = > 0.025
3) Coupling => 0.3%
4) β_x => 8 mm
5) Crab-crossing
6) ε_x => 0.45 mm$_x$mrad

L = > $9x10^{32}$

at (0.11, 0.06) with blow up

Dynamic Aperture?

Coupling?

Next step $\alpha_c < 0$?