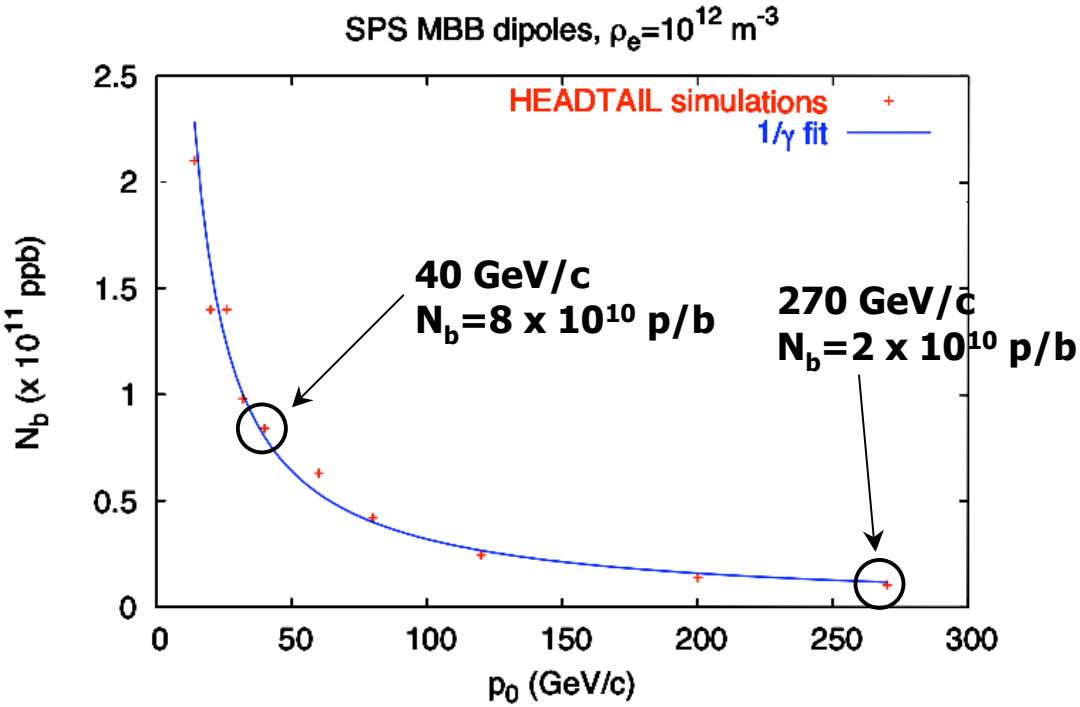
Dependence of the E-Cloud Instability threshold on energy: update on code-code benchmark

G. Rumolo, in SPSU-PAF Study Team (01/06/2007)

- Recall HEADTAIL results
- Simulations performed with Ohmi's code PEHTS:
  - Trend seemed to be confirmed, but thresholds disagreed by a factor ~10
  - Revise simulation parameters: new results

⇒ Thanks to: H. Jin, K. Ohmi

Model with uniform E-cloud
Overview on the instability thresholds

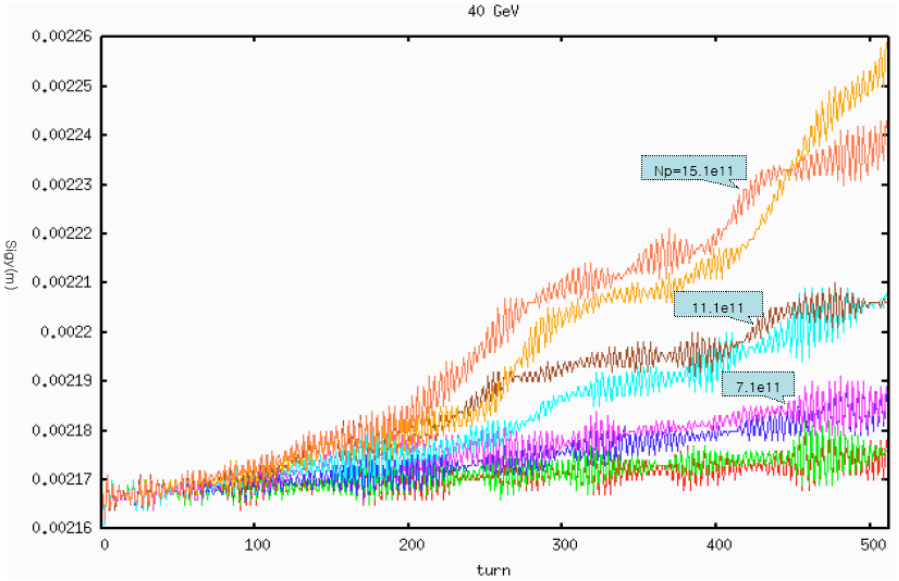


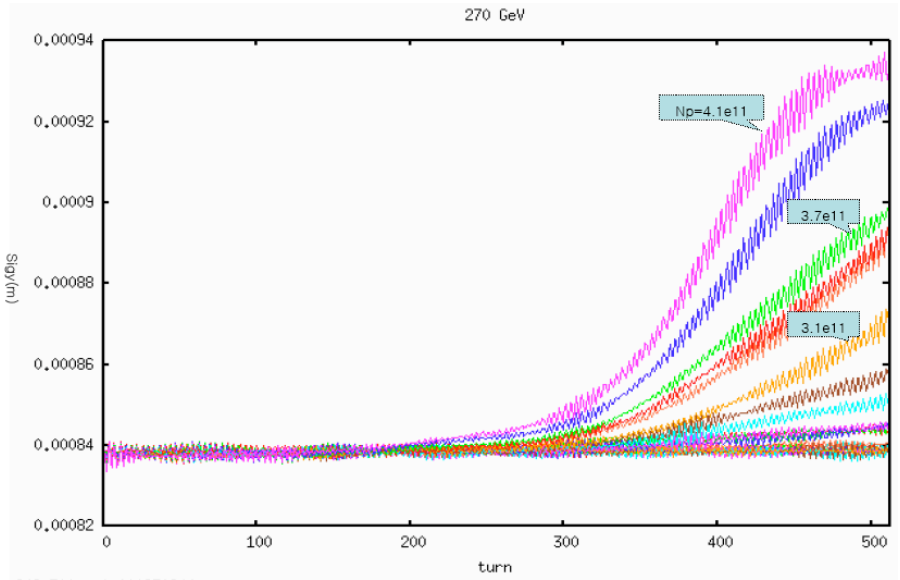
Instability thresholds as:

- Bunch intensity when the e-cloud density is fixed → **decreases with energy!**

- Benchmark with **Ohmi's code PEHTS**

⇒ Here we were standing two months ago:

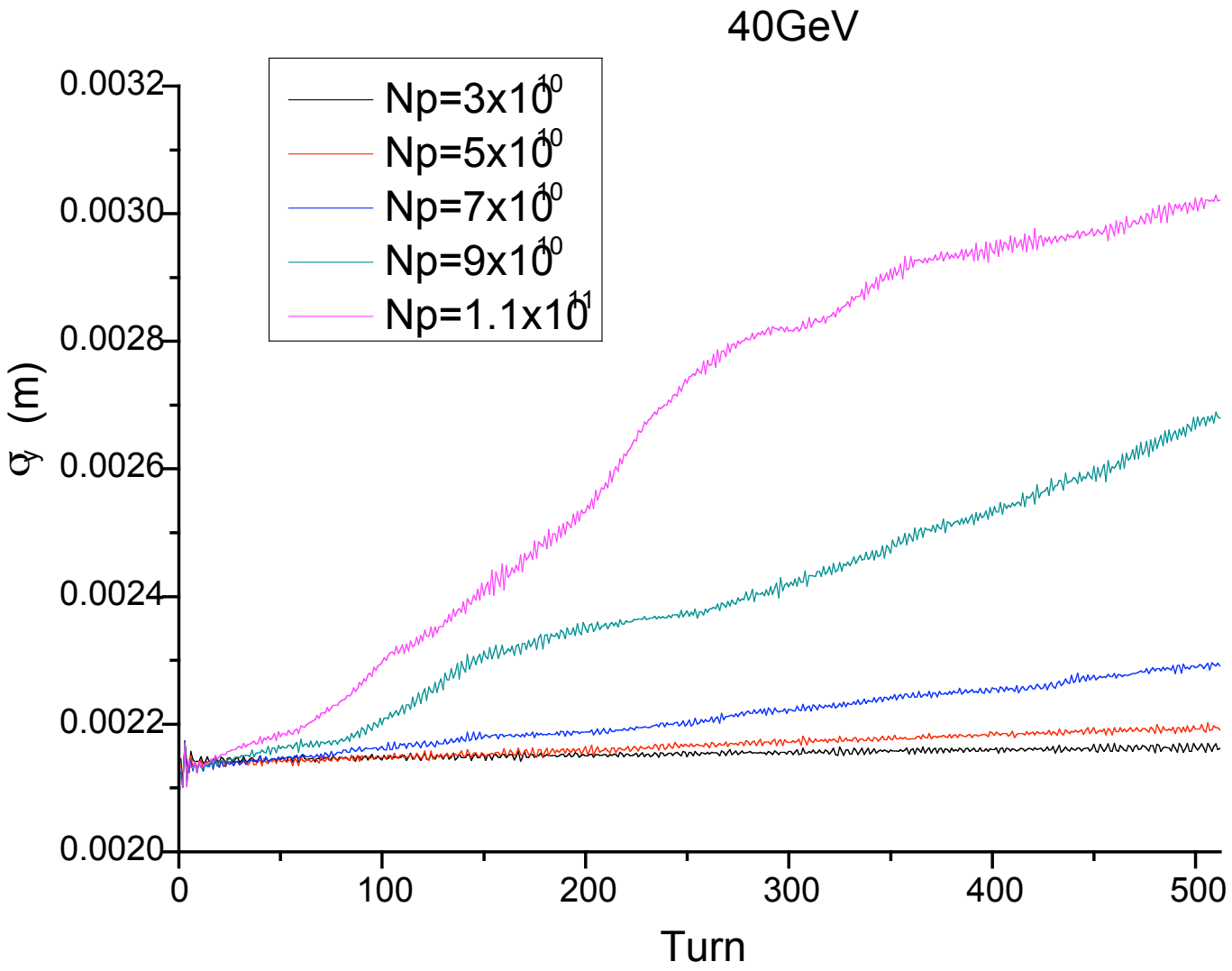




- The bunch at 270 GeV/c is more unstable than the bunch at 40 GeV/c
- Thresholds estimated from the figures:
  - 40 GeV/c → 7 x 10^{11}
  - 270 GeV → 2 x 10^{11}
- HEADTAIL predicts thresholds about a factor 10 lower.
- Investigate reasons for discrepancy.

- Subsequent email exchange with **Ohmi's student, H. Jin,** proved that some parameters had been somehow wrongly passed
  - They assumed the synchrotron tune to be the same at both energies (different from what it should be in either case).
  - They set chromaticity to ~3 units in Q' in both planes
  - Longitudinal emittance was not the same in the two cases
- After several iterations, we have finally converged on the most critical ingredients of the analysis:
  - Bunch length, longitudinal emittance and transverse normalized emittance are conserved
  - Synchrotron tunes are such that the bunch is matched at both energies
- Some minor differences might still lie in: **the last cross-check is underway**
  - They use linearized synchrotron motion
  - I use 10 beam-ecloud interactions/turn
  - My ecloud is $30\sigma_x$ x $10\sigma_y$

→ NEW RESULTS, **N_b=7 x 10^{10} @ 40 GeV/c**



→ NEW RESULTS, **N_b=2 x 10^{10} @ 270 GeV/c**