**Questions and Remarks**

**Nicolo Bianccaci:**Transverse Impedance (S.05)

**1)** Jeff E asks if large orbit displacements should have an impact on transverse impedance. Nicolo and Valeri L agreed that it should have an impact. Jeff E suggested since the impedances appeared mostly distributed that, it might be interesting to organize the impedances by orbit displacement rather than s-dependence.

**2)** Valeri L comments that the signs of the measured global impedance effects are correct – positive for horizontal and negative for vertical.

**3)** Nicolo showed some plots of the change in phase advance with intensity. Valeri questioned whether the plots should always trend in the same direction or whether the sign could change. After some back-and-forth Nicolo and Yuri explained that measurement errors could cause this without invalidating the overall results and that it could also be caused by local sources of impedance.

**Alexey Burov:**Convective Instability (S.01)

**4)** Alexey makes the statement that the instability occurs in each bunch independently, since there is no pattern in the onset or amplitude of the instability across the batch. Tan remarks that it can be difficult to discerning this kind of pattern by eye, and that a Fourier series would really prove there is not pattern.

**5)** Frank asks if there is any correlation between the onset of the maximum amplitude of the instability, and the time of the maximum amplitude. Alexey says he examined that and there is no clear correlation.

**6)** Tan asks about what the oscillation amplitude shown in Alexey’s talk really indicates. Valeri L and Alexey explain it is diff-signal divided by sum-signal, with the orbit offset properly subtracted.

**7)** Alexey’s talk shows a 5-fold increase in oscillation amplitude with a 30% increase in charge, and a 1/7-fold decrease for nominal chromaticity. Jeff E remarks that if the same exponential dependence of the oscillation amplitude held for the nominal chromaticity as the zero-chromaticity data, that would predict serious losses at about 18-turns for nominal chromaticity. We in fact observed serious losses at transition starting at 18-turns, but we do not know if it is convective instability because we did not measure the intrabunch motion.

**8)** Tan asks why the instability occurs at transition. Alexey explains that it is not just that the bunch-length is shortened, but more importantly, the synchrotron motion is slow. The hundred turn window or so around transition is within what Alexey and Valeri L call the adiabatic time. The adiabatic time can be approximately understood as the time for one-half synchrotron oscillation around transition.

**9)** Tan asks why the instability occurs in the vertical before the horizontal. Alexey explains that the high-frequency impedance is about a factor of two stronger in the vertical compared to the horizontal.

**Frank Schmidt:** Power Supply Ripple (S.02)

**10)** Tan points out that the 2D tunescan plots had a minor labeling error which has subsequently been fixed.

**11)** Tan asked Frank to reiterate the outstanding aspects of the study. Frank indicates that the IPM data was collected but not examined yet. Frank also indicates that his transmission model predicts that the magnets should especially be susceptible to high frequencies – up to about 10 kHz, and that the power supplies should be measured in this frequency band.

**12)** Howie asks Valeri L if any indication of dipole power-supply ripple was seen in the transverse pickup data. Valeri L indicates he is very confident that there is not any significant beam motion at these frequencies. Jeff E clarifies that there is not any significant tune modulation observed either, but that we’d expect to see it more easily in the orbit.

**13)** Howie asks why a gamma-T jump is not used in the Booster. Tan explains there is not the available space for it. Valeri L indicates that the dispersive effect on the beam is too severe to be beneficial. Jeff E mentions the idea of upgrading the power-supply for the quadrupole to ramp through transition more quickly and Tan agrees that would be an option.

**Vladimir Kornilov:** Elegant Simulation (S.09)

**14)** Vladimir K tunescan simulations show losses dominated by integer resonance rather than half-integer resonance. The losses are associated with the change in beam orbit with the tunescan. Tan asks if that means the beam would be scraping the aperture, which doesn’t match the distributed loss pattern in measurement. Vladimir K clarifies that the losses are gradual, so therefore he expects the orbit displacement means that particles are moved outside the dynamic aperture and consequently there would be distributed losses.

**15)** The orbit in the Vladimir K’s Elegant simulation does not appear to match the measured orbit. Jeff E explains that he had some difficulty getting the orbit to match between the MAD-X model and the Elegant model. Tan and Kiyomi said the orbit correctors are usually not used in the MAD-X model. Valeri L said the best procedure was to match the dipole correctors to the measured beam orbit.

**16)** Jeff E remarks since we do see an orbit change during the actual tunescan measurement, and this effect should be compensated in order to properly understand the resonances.

**17)** Vladimir K asked for the 2D tunescan loss data and Jeff E said he would provide that.

**18)** Jeff E remarked that the 11 mm mrad used by Vladimir K, and that he should try 7 to see if the results change. Kiyomi said that 7 was what she expected from the linac, but not necessarily what the emittance would be after capture. Hannes commented that this early emittance growth was not well measured, and Kiyomi mentioned this is what the IPMs showed. It was agreed that the IPMs need to be calibrated for this to be verified. Vladimir K indicated that from the simulations he conducted, he would not expect this to have any significant impact.

**Group Discussion**

**19)** The purpose of the discussion was to establish a plan for continuing studies over the next year. There are parasitic studies for the next year, a couple of hours of dedicated beam time each month, and the likelihood of another dedicated study event next spring/summer. Tan asserted we should settle on about three study topics, to keep the workload on Booster experts manageable and to make more better progress on each study. A follow-up document will be circulated to organize the next phase of Booster studies.

**20)** Tan emphasized that publications are valuable in the case that he makes to management for funding and support for the studies. This includes not only peer-review publications, but also conference papers and technical notes.