SUMMARY OF ORBIT/ESME COMPARISONS

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- Detailed comparisons made between the programs using identical particle distributions (which were created in esme)
- General agreement on many aspects of operation, including tracking, RF voltage ramp-up and space charge
- Orbit uses first order approximation, esme uses precise calculation, for delta_p for a particle given delta_E (I have fixed this in some locations in code, could do the rest.)
- Esme allows power series expansion of orbit length as function of delta_p/p, while orbit stops at first order. Noted that orbit will be inadequate at transition crossing given this. (I am in the process of adding this.)
- Esme has special code for dealing with the effect, under periodic boundary conditions, of a particle leaving one side of a bucket and appearing on the other side. Such a particle has its own harmonic number – one greater or less that the norm – for the turn on which this occurs. This affects few particles, but significantly changes those it does affect. (I have changed orbit to deal with this effect.)
- In space charge calculations esme corrects the 'geometry factor' to account for adiabatic damping changing the effective beam radius during acceleration. It similarly rolls off the space charge voltage at very high multiples of RF frequency. Orbit does neither. (These effects could be added to orbit.)
- Orbit has a peculiarity of tracking particles through a full turn at both an RF node and a space charge node. When both are present the results are not at all as desired. (Can be fixed in the script once it is realized what is happening.)
- Esme allows any reasonable table of impedances as functions of frequency. Orbit limits the table's frequencies to being harmonics of the RF. In practice this means that wall impedance and acceleration cannot be used together. (Suggestion would be to copy esme code into orbit, translating to C++ in the process.)

A REMINDER – OF WHAT EXISTS IN ESME FOR BOOSTER INJECTION

- Take Linac microbunches, for which must be specified longitudinal emittance and phase space tilt
- Propagate through transfer line, including debunching cavity if desired
- Dump into a ring
- Execute multiturn injection with successive turn phase slip as desired
- Capture in ring RF, with acceleration active
- All the above with space charge and wall impedance