Main Linac Integration Work Packages

High Priority Items in Red

Chris Adolphsen Dec 11, 2007

WP1.1: Quad Package Design

a) Determine the cost/performance optimal quad/bpm aperture considering beam dynamics, cryo heat loads and beam interception issues.

b) Describe likely backgrounds (Halo, SR, MP, dark currents) and the means of dealing with them and minimizing beam interception damage.

c) Based on the linac optics and magnet field requirements (from other WPs), work with magnet experts to design a set of SC quads and correctors.

d) Based on the linac bpm requirements (from other WPs), work with instrumentation experts to design the bpms and signal processing system.

e) Based on above results and the HOM absorber requirements (from other WPs), work with cryomodule group to define layout of the quad package that achieves the required performance.

WP1.2: Quad Package Prototypes

a) Build prototype quads and correctors (combined and separate) to verify quad center stability and basic field requirements can be met

b) Build prototype bpms to verify required resolution and stability in a ‘cleanable’ design

c) Using prototype quads and bpms in a beamline, show that quad shunting will provide a stable, micron-level measure of the quad magnetic center

d) Build prototype HOM absorbers to verify HOM attenuation in bench tests and in beam operation in one or more of the test facilities

WP2: General ML BD

a) Do analytical estimates of the various emittance growth mechanisms in the linac to establish the relative sizes and scalings with energy and lattice strength.

b) Use this info to optimize the linac lattice and identify the critical alignment, resolution and magnetic field requirements.

c) Compare simulations to analytic results - understand any significant deviations and ‘cross-term’ effects.

d) Identify those mechanisms that ultimately limit further emittance reductions and suggest possible mitigations.

WP3: Initial Alignment

a) Develop realistic models of both short and long range spatial misalignments for the beamline components based on the likely methods of installation and global alignment

b) Incorporate these models into the beam simulation programs to determine if the misalignments will cause unacceptable emittance growth after beam-based steering

c) Work with the installation/alignment groups to establish specs for the initial alignment of the components that can be easily interpreted by those who will do this work

WP4: Energy Errors

a) Develop realistic models of how the bunch energy and energy spread may vary from ideal along the linac and along each bunch train.

b) Incorporate these models into the beam simulation programs to determine the allowed energy errors.

c) Work with the LLRF group to translate these errors to specs on their system to regulate the rf gradients and phases in each rf unit.

WP5: Static Tuning

a) Evaluate the various proposed linac alignment methods, including quad shunting, in terms of performance, impact on operation, sensitivity to lattice errors and requirements on beam position resolution, accuracy and offset stability.

b) Briefly describe how the tuning will be done in other parts of the machine

c) Describe how various tuning bumps could be used to further reduce the emittance growth

WP6: Dynamic Tuning

a) Specify acceptable fast and slow quad motion in terms of amplitudes and correlations. For the latter, determine the implications for the ‘static’ tuning system.

b) Specify a fast FB system to stabilize the beam orbits, including the requirements on the magnet response times.

c) Specify methods for measuring the bunch/beam energy profile, matching the quad lattice and regulating the bunch energy at the end of the linacs. Work with Controls and LLRF to have these implemented

d) Specify system and procedures to monitor the bunch/beam emittance including the instrumentation requirements. Work with the Instrumentation group to design bunch size monitors.

WP7: Wakefield and Cavity Topics

a) Compute wake offsets due to FPC/HOM antennae intrusions and propose methods to reduce it

b) Specify short and long range wakefields and cross (x-y) coupling effects

c) Evaluate the effectiveness of the HOM absorber to remove the wake energy before it is absorbed in the 2K cryo system

d) Simulate multi-cavity trapped modes to look for significant wakefield build up

e) Develop cavity distortion model to match first/second band dipole mode properties

f) Analyze dipole mode signals to provide info on cavity properties

g) Evaluate multipacting in power and HOM couplers

See results from these studies at …

Wake Fest 07

Where all of your wake questions will be answered

Well…at least they will be acknowledged

Anyway… the talks will be posted