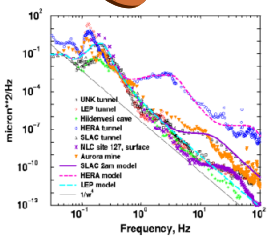
Warm LC Stability Requirements Easily Met at Many Sites Worldwide

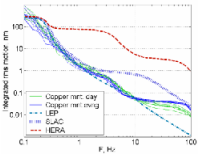


More than 15 Years Studying Ground Motion Amplitudes and Correlations

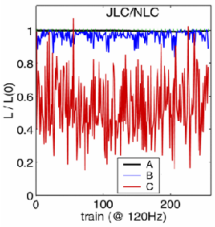
DESY and SLAC Preparing for Measurements at California Site

Ground Motion Measured at Aurora Mine Near Fermilab

KEK, SLAC and FNAL Visit a Possible Site in Japan



California Sites Nearly as Quiet as LEP, even Quieter than X-band Goal



Luminosity Degraded only for Sites with Large Cultural Noise, Urban Location and Poor Geology

Multiple Paths to Stable Interaction Point

Paths to stable collisions:

- Quiet site and well engineered detector
- Active stabilization
- Inter-train feedback backed up by fast intra-train

Active stabilization of Final Doublet

- Optimized for realistic location in detector field
- Standalone tests @ SLAC, KEK and CERN

Multiple viable sensor technologies

- Nonmagnetic inertial sensors - commercial and SLAC
- Optical anchor (UBC)

Fast feedback tests - FONT (UK at SLAC) and FEATHER (KEK) (latency < 60ns)

IP collision stability ensured by overlapping solutions

Beamline Vibration Minimized

Utility tunnel:

- Vibration sources identified, feasibility of remediation demonstrated

Linac components:

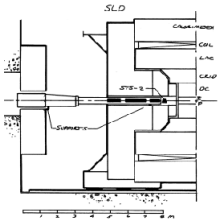
- Structure vibration due to cooling water - loose tolerances, easily met
- Quad vibration - tight tolerances ~10nm, decoupled from structures
- Quad support stability demonstrated at FFTB
- X-band girders designed to minimize vibration

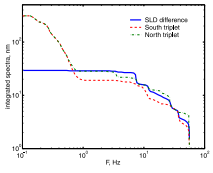
Beam Delivery System and Damping Ring components:

- Final Doublet - nm tolerances; others similar to Linac
- DR: tolerances looser than linac, similar to 3rd generation light sources

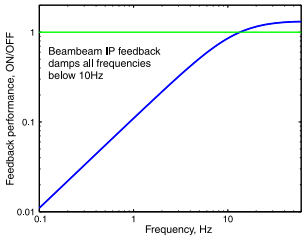
Accessibility of quads for X-band LC facilitates future remediation if needed

Overall approach to site and noise specifications based on LIGO experience

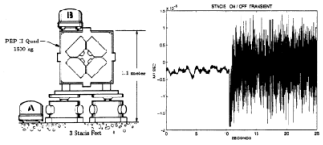




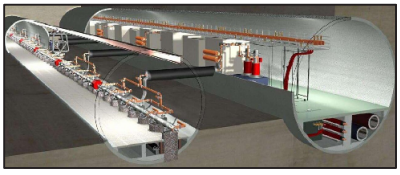
SLD Triplet Relative Motion only 30nm, Without Engineering for Stability



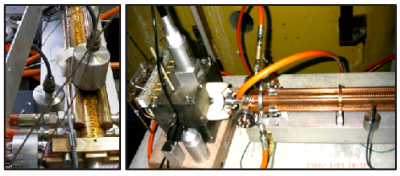
120 Hz Pulse-to-pulse IP Feedback Stabilizes Collisions, Backed up by Fast Intra-train Feedback



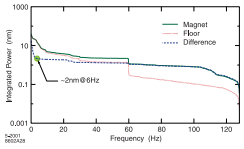
1996 nm-level Active Stabilization Demo with Commercial Equipment.Current R&D Aimed at Solution Compatible with Location in Detector Magnetic Field



Separate Supports Tie Vibration Sensitive Quads to Floor



Structure Vibration Due to Cooling Water Does Not Couple to Quad



Only 2nm Extra Motion Measured on Water-cooled FFTB Quad on Movers