BINP-FNAL-SLAC plans for slow ground motion measurements

Snowmass 2001, July 6
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BINP – FNAL – SLAC joint slow motion studies

- Plans to measure slow ground motion in **three geologically different places**:
  - SLAC at the surface (**sandstone**)
  - FNAL at the surface (**glacial till**)
  - Aurora deep tunnel (**dolomite**)

- **Budker INP** is developing **new Hydrostatic Level System (HLS)** for these measurements
  - Hope to overcome commercially available systems
  - Stable electronics and pipes half-filled with water
  - Aim for a system able to resolve $A_D \sim 10^{-8} \, \mu m^2/(m.s)$
BINP-FNAL-SLAC slow motion studies and HLS R&D

- April 2001: test review of the new HLS at SLAC and FNAL
- Requirements are achieved
- Proceed with manufacturing of 3 HLS systems (~30 probes)
- Prepare to start installation of the systems this fall in
  - MI8 line at FNAL over ~500m
  - Sector 10 alignment lab at SLAC over 30m
  - Aurora mine over 30m
- Results ~ mid 2002
Developments of new HLS at Budker INP
HLS with single tube half-filled with water

Single tube HLS is much less sensitive to temperature variation along the system

A.A.Michelson, Astrophysical Journal, volume XXIX, March 1914, Number 2
Shigeru Takeda, et al., KEK Prepr. 94-48
Developments of new HLS at Budker INP
March 2001: tests of new HLS probes

- **March**: tests with two pipes (Air, H$_2$O)
- **April**: tests with one pipe half-filled
Tests of new HLS

- For T=1 hour, noise power is factor 4 less than the HLS system currently used, and some 40 times less for T=2 days.

- For 500m system and T=1 hour, one hopes to resolve \( A = 5 \times 10^{-9} \mu m^2/m/s \).

- New measurements will hopefully shed more light on slow motion properties.

Level difference (a), diffusion (b) and temperature difference (c) of two SAS probes of 2nd iteration of design installed 1m apart (April 2001).