

# SNOWMASS 2001



the future of particle physics

## *Working Group on Environmental Control*

**BINP-FNAL-SLAC plans for slow  
ground motion measurements**

Snowmass 2001, July 6

Andrei Seryi

SLAC



# BI NP – FNAL – SLAC joint slow motion studies

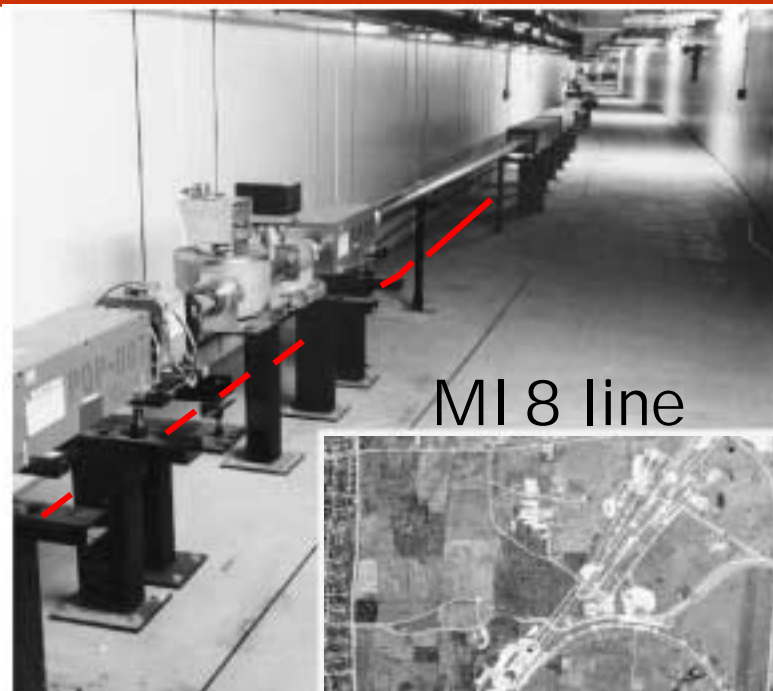


- Plans to measure slow ground motion in **three geologically different places**:
  - SLAC at the surface (**sandstone**)
  - FNAL at the surface (**glacial till**)
  - Aurora deep tunnel (**dolomite**)
- **Budker INP** is developing new **Hydrostatic Level System (HLS)** for these measurements
  - Hope to overcome commercially available systems
  - Stable electronics and pipes half-filled with water
  - Aim for a system able to resolve  $A_D \sim 10^{-8} \mu\text{m}^2/(\text{m}\cdot\text{s})$

# 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



MI 8 line

- MI 8 line at FNAL over ~500m
- Sector 10 alignment lab at SLAC over 30m
- Aurora mine over 30m



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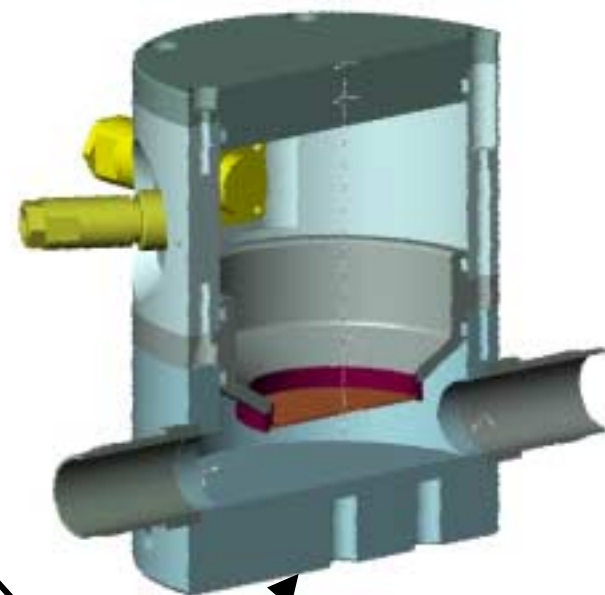
**Results ~ mid 2002**

# Developments of new HLS at Budker INP

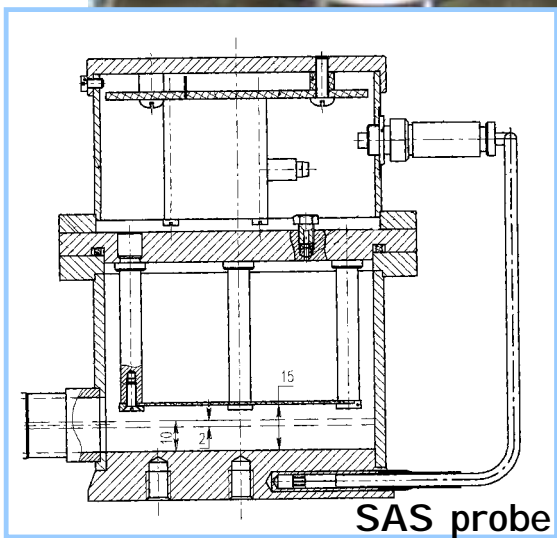
## *HLS with single tube half-filled with water*



Probe's vessel



Single tube version



SAS probe

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

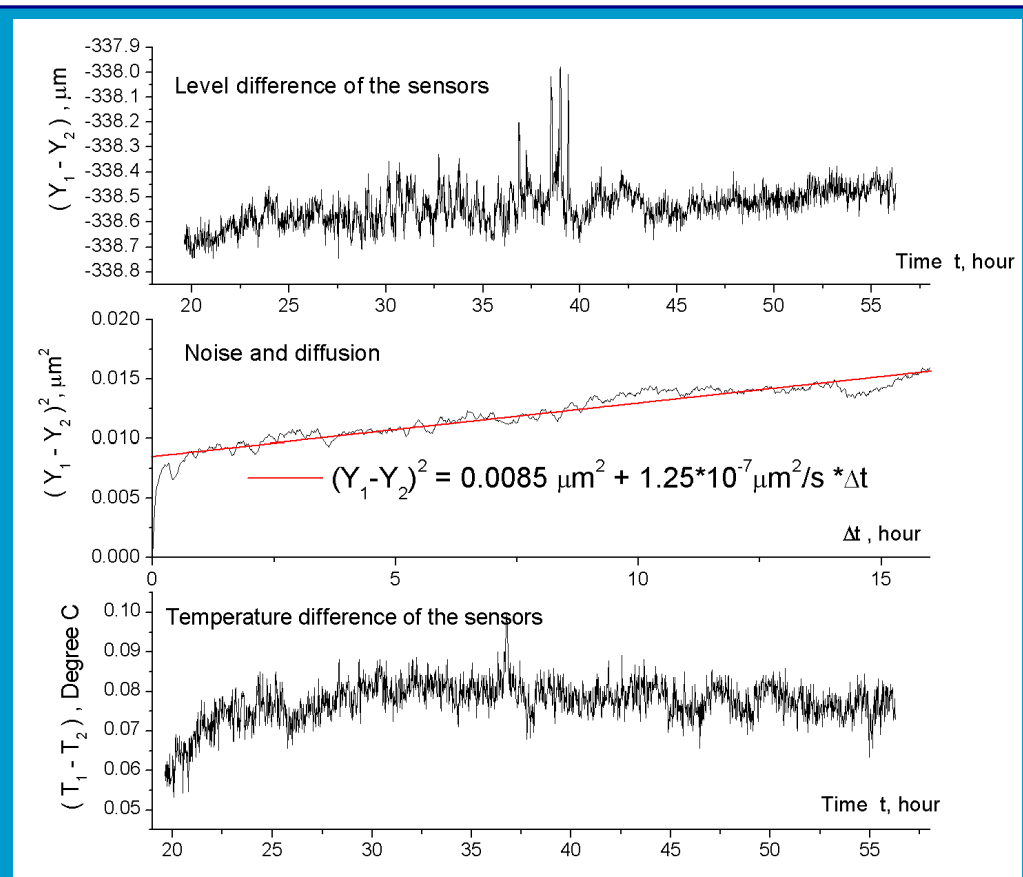


- **March:** tests with two pipes (Air, H<sub>2</sub>O)
- **April:** tests with one pipe **half-filled**

# 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 hope to resolve  $A= 5 \cdot 10^{-9} \mu\text{m}^2/\text{m}/\text{s}$
- 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 2<sup>nd</sup> iteration of design installed 1m apart (April 2001).