Gravity Group Summary

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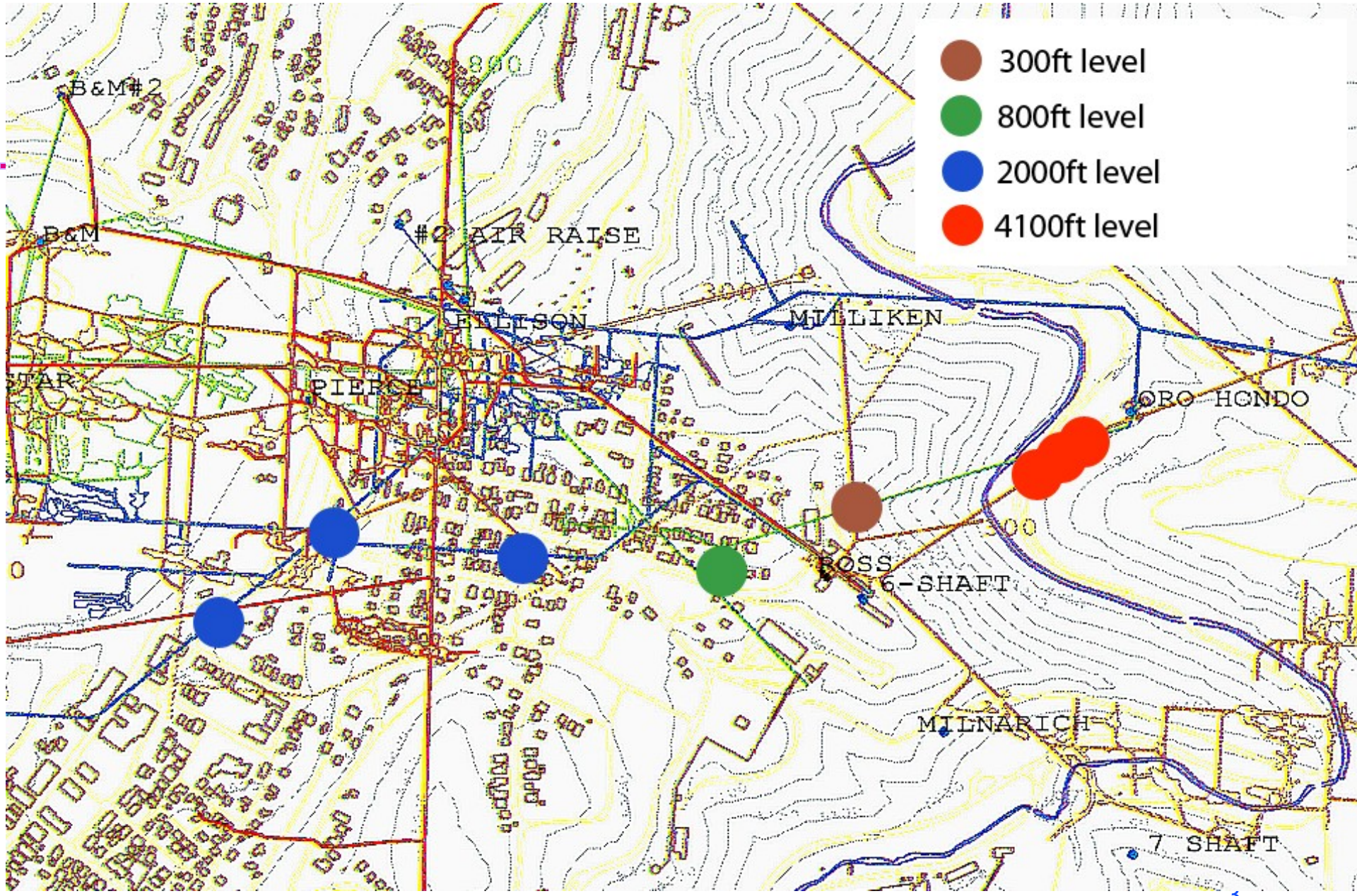
DUSEL Workshop, Lead, SD

10/03/09

Locations, Needs etc

- Not part of the S4/S5 process...
- Immediate plans (next year or so):
  - » Expand seismic array in the “orthogonal” direction, preferably near 2000 and 4100 levels (~2 stations, maybe more).


300ft level
800ft level
2000ft level
4100ft level
B&M#2
B&M
#2 AIR RAISE
ELLISON
MILLIKEN
PIERCE
ORO HONDO
ROSS
6-SHAFT
MILNARICH
7 SHAFT

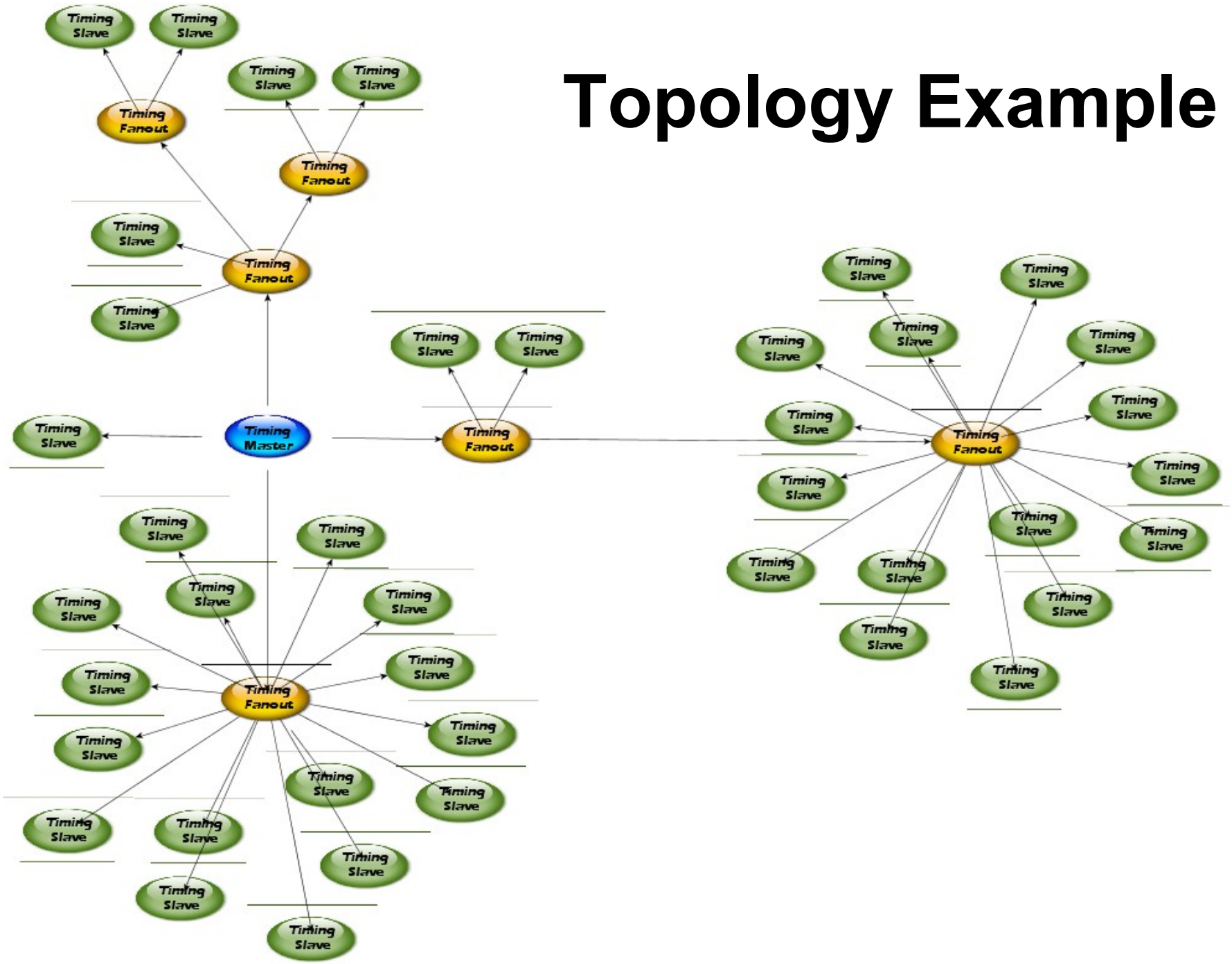
Locations, Needs etc

- Not part of the S4/S5 process, but these are our plans.
- Immediate plans (next year or so):
  - » Expand seismic array in the “orthogonal” direction, preferably near 2000 and 4100 levels (~2 stations, maybe more).
  - » Initiate R&D effort for the optical strainmeter:
    - – Find an appropriate location.
    - – Design vacuum chamber.
    - – R&D mounting of mirrors on the cavern wall (may require drilling etc).
  - » Continue other R&D efforts:
    - – Tilt-meter.
    - – Test new seismometer technologies.
    - – Use existing station at 4100 level.
  - » Install AdvLIGO timing distribution system.

Timing Distribution System

- Developed by S. Marka's group, Columbia University, for purposes of Advanced LIGO.
- Star-like topology:
  - » Master, fan-out, and slave modules, connected with fiber links.
  - » 15 ns resolution or better.
  - » Arbitrary timing signals (1PPS ramps, sine waves etc).
  - » Synchronization to GPS or atomic clocks.
  - » Expandable hardware, multi-level diagnostics...
- Plan to install first modules this winter.

Topology Example



Longer Term...

- DUGL proposal submitted to NSF.
- Proposed 3-year effort:
  - » Further development of the seismometer array.
  - » Installation of the optical strainmeter.
  - » Torsion balance experiments (measurements of gravity gradients and rotational normal modes, equivalence principle tests).
- Very long term:
  - » DUGL proposal will inform the design of an underground gravitational wave detector, and it will be a cornerstone of a future proposal to build such a detector.
- Contact: Vuk Mandic, University of Minnesota
  - » mandic @ physics.umn.edu

Atom Interferometry

- Had a very interesting discussion with members of the atom-interferometry community (Mark Kasevich, Holger Mueller, Philippe Bouyer, Andre Petukhov).
- Technology currently used to develop seismometers, gravimeters and gravity gradiometers.
  - » Potential to improve over the existing technologies.
  - » Could also be of importance for studying the gravity gradient noise due to seismic motion (verifying gravity gradient noise models).
- Possibility of operating the AI instruments along-side the traditional seismometers at DUGL stations.
- Long term: gravitational wave search.
- Look forward to collaborating more in the future...


300ft Station
POLYISOCYANURATE INSULATION
FIRST AID KIT


2000ft Station


DELL
DOW