FERMILAB-POSTER-25-0022-ETD

MAGIS-100 Experiment in 100m Shaft

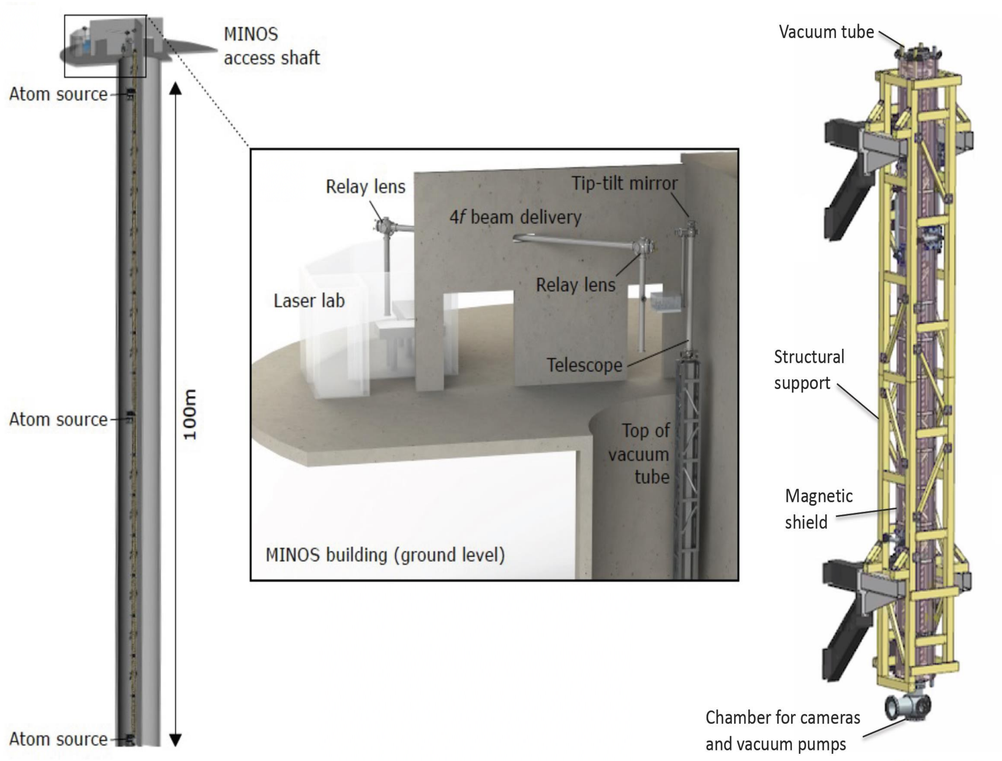
Matter-wave Atomic Gradiometer Interferometric Sensor

website

paper

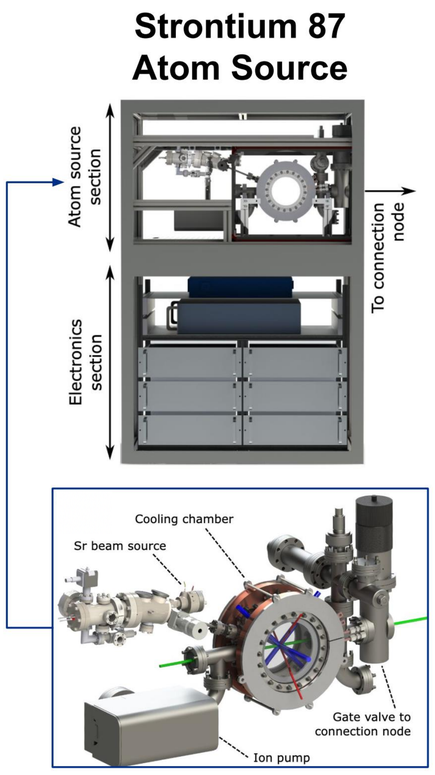
Complex sub-systems comprise this experiment

- 3x strontium atom sources at top, middle, and bottom of shaft
- Interferometry laser system (see other poster for details)
- 17x modular sections with support frames, vacuum, magnetic, and optical system components
- Vacuum system to reach ultra-high vacuum (UHV) down to -11 Torr
  - 6” diameter stainless steel vacuum tube
  - UHV pumps, gauges, and controls
  - Heating system with controls and temperature sensors to reach 150C
- Magnetic field system
  - Bias field coils to create optimal field
  - Octagonal mu metal shield to block external interference
- Imaging and distributed camera system
- Retroreflection mirror system at bottom of shaft to reflect laser light back up the shaft with minimal scattering
- Platforms to provide safe personnel access



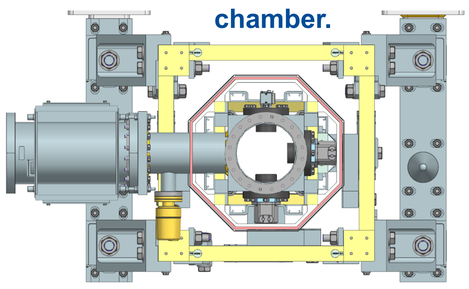
MAGIS-100 is a blend of accelerator and detector technology and requires technical excellence which Fermilab has:

- Civil, mechanical, and vacuum engineering
- Lasers and interlocks
- Controls and networking
- Safety systems
- Assembly and installation of large yet delicate scientific instruments
- Data collection, storage, scientific computing and data analysis
- Existing shaft and laboratory infrastructure

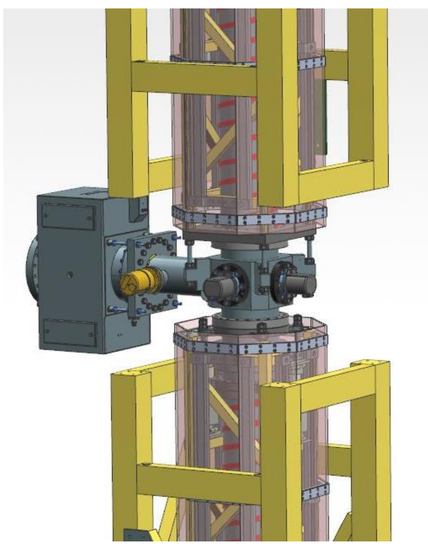


Above: Atom source details.

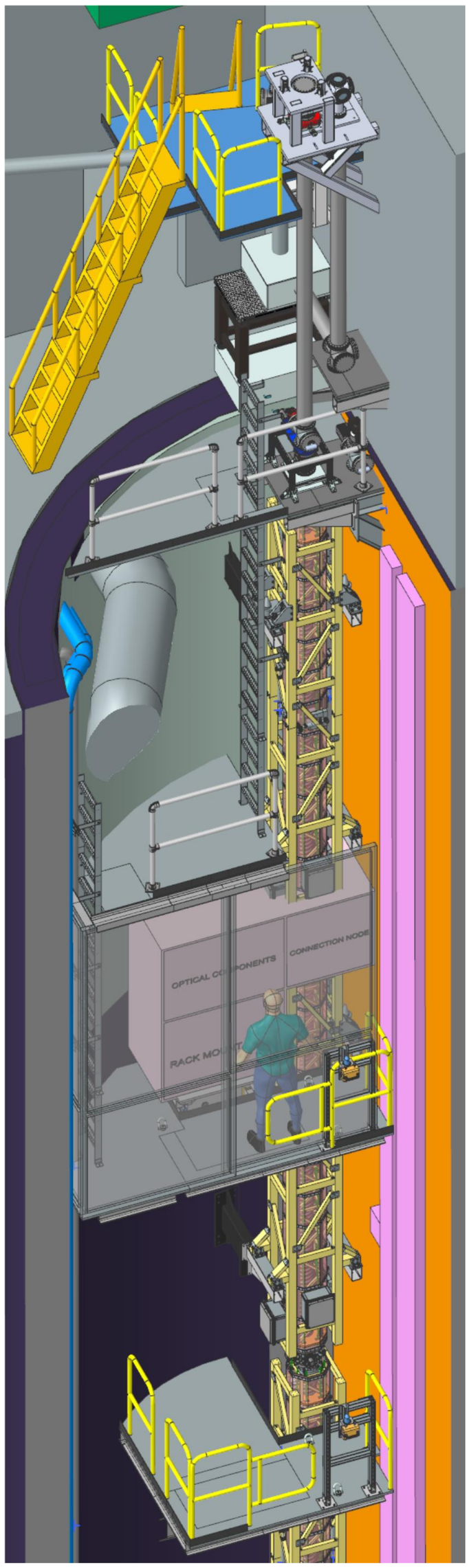
Below: Cross-section view of a modular section connection chamber.



Below: Vacuum pumps and viewports with cameras will be placed between tube sections.



Conceptual access plans for top of experiment



Right: Upper shaft area, with experiment installed on Northern corner of shaft and conceptual view of access platforms. Railing around curved wall of shaft at ground level is omitted for clarity.

Fermi National Accelerator Laboratory

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