TAMA300 Overview

- Interferometric gravitational wave detector TAMA300
  - Fabry-Perot Michelson interferometer with arm length of 300m

  **Site:** National Astronomical Observatory of Japan (Tokyo, Mitaka)

  **Laser Source:** 10W injection-locked LD-pumped Nd:YAG laser

  **Mode Cleaner:** 10m-length ring-type cavity

  **Main Interferometer:**
  - Michelson interferometer with Fabry-Perot arms of 300-m baseline length
  - Designed for power recycling with gain of 10

**Purpose of the project**

- To establish techniques needed for a future kilometer-class interferometer
- To detect possible events in galaxies nearby

**Designed sensitivity** \( \sim h_{\text{RMS}} = 3 \times 10^{-21} \)
Bird's view of the site
Vacuum duct of 300m length
Progress of TAMA300

- **1995** Project started
- **1996** Facilities construction completed
- **1997** Vacuum system completed
- **1999/8** Data Taking 1 (engineering run) 10 hours
- **1999/9** Data Taking 2 (first data run) 30 hours
- **2000/4** Data Taking 3 16 hours

Diagram:

- Mode Cleaner 97/4 - 97/12
- Mode Cleaner + 10W Laser 98/1 - 99/1
- 10m Mode Cleaner
- 10W Laser
- 300m FP cavity
- 1999/8 Data Taking 1
- 1999/9 Data Taking 2 (first data run)
- 2000/4 Data Taking 3

**Key Nodes:**

- **Rcombine I** 98/5 - 99/1
- **Rcombine II** 99/2 - 00/6
- **One Arm** 97/8 - 98/4
Current Status of TAMA300

- **Data Taking (99/8, 9)**
  - **Data Taking 1**: 1999/8/6~8/7 (1 night)
  - **Data Taking 2**: 1999/9/17~20 (3 night)

  \[
  1 \times 10^{-17} \text{ m/Hz}^{1/2} \Rightarrow 3 \times 10^{-20}/\text{Hz}^{1/2}
  \]

  - Longest lock stretch: 7h43m  Total: 30 hours
Current status of TAMA300

- Improvement of the sensitivity

![Graph showing strain noise and displacement noise over frequency]

Best sensitivity

\[ 4 \times 10^{-18} \text{ m/Hz}^{1/2} \quad \rightarrow \quad h = 1 \times 10^{-20} \text{ /Hz}^{1/2} \]
Identified noise sources

- Sensitivity-limiting-noises
  Present noise sources are identified
  In the observation band:
  Alignment control noise & Noise from Michelson part

Displacement noise level of TAMA300 (March 16, 2000)