

Design and Status of the SuperKEKB Accelerator Control System

M. Iwasaki (KEK)

for the SuperKEKB accelerator control group

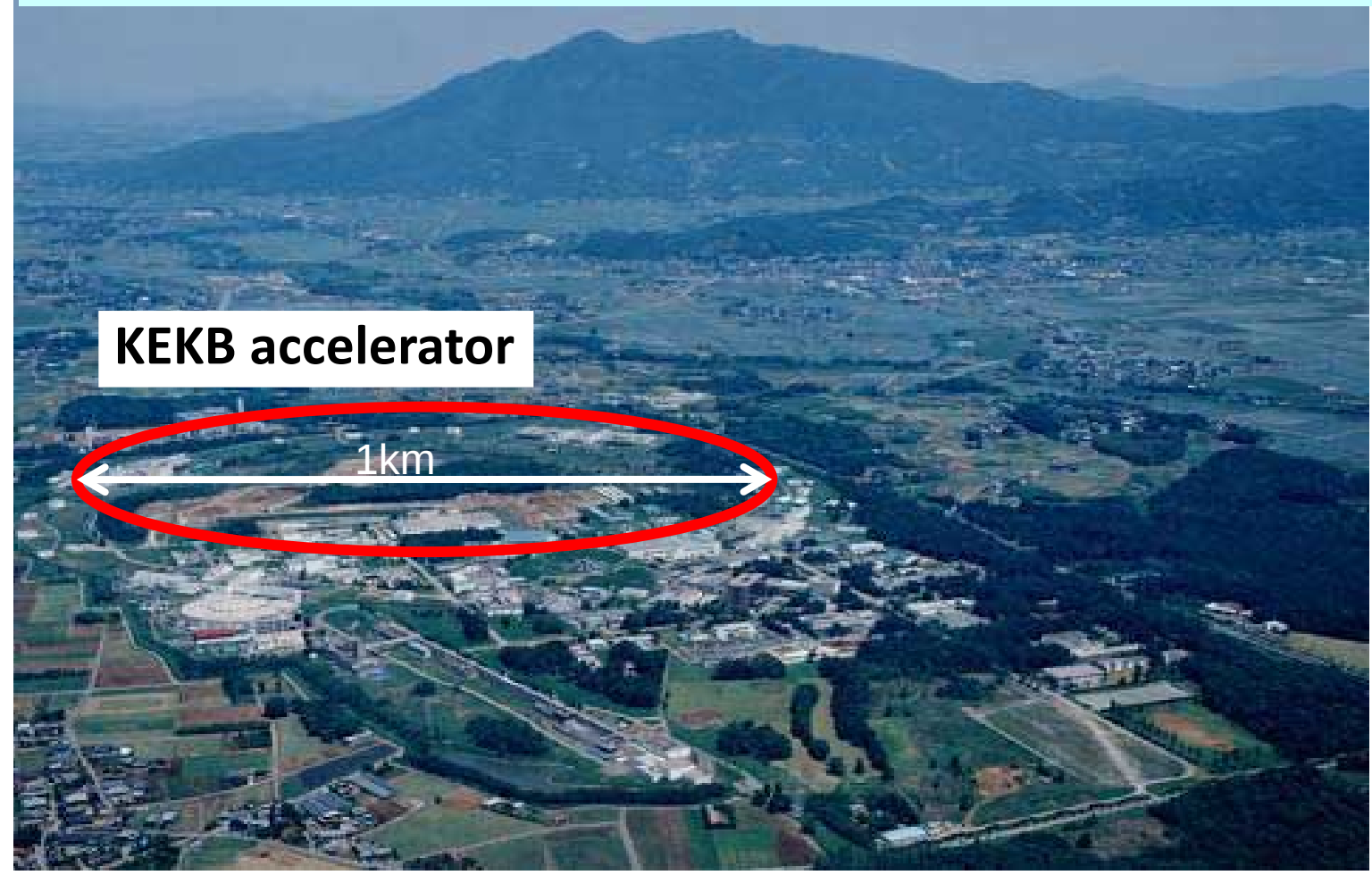


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SuperKEKB → Upgrade of the KEKB B-factory experiment in Japan

KEKB accelerator

1km

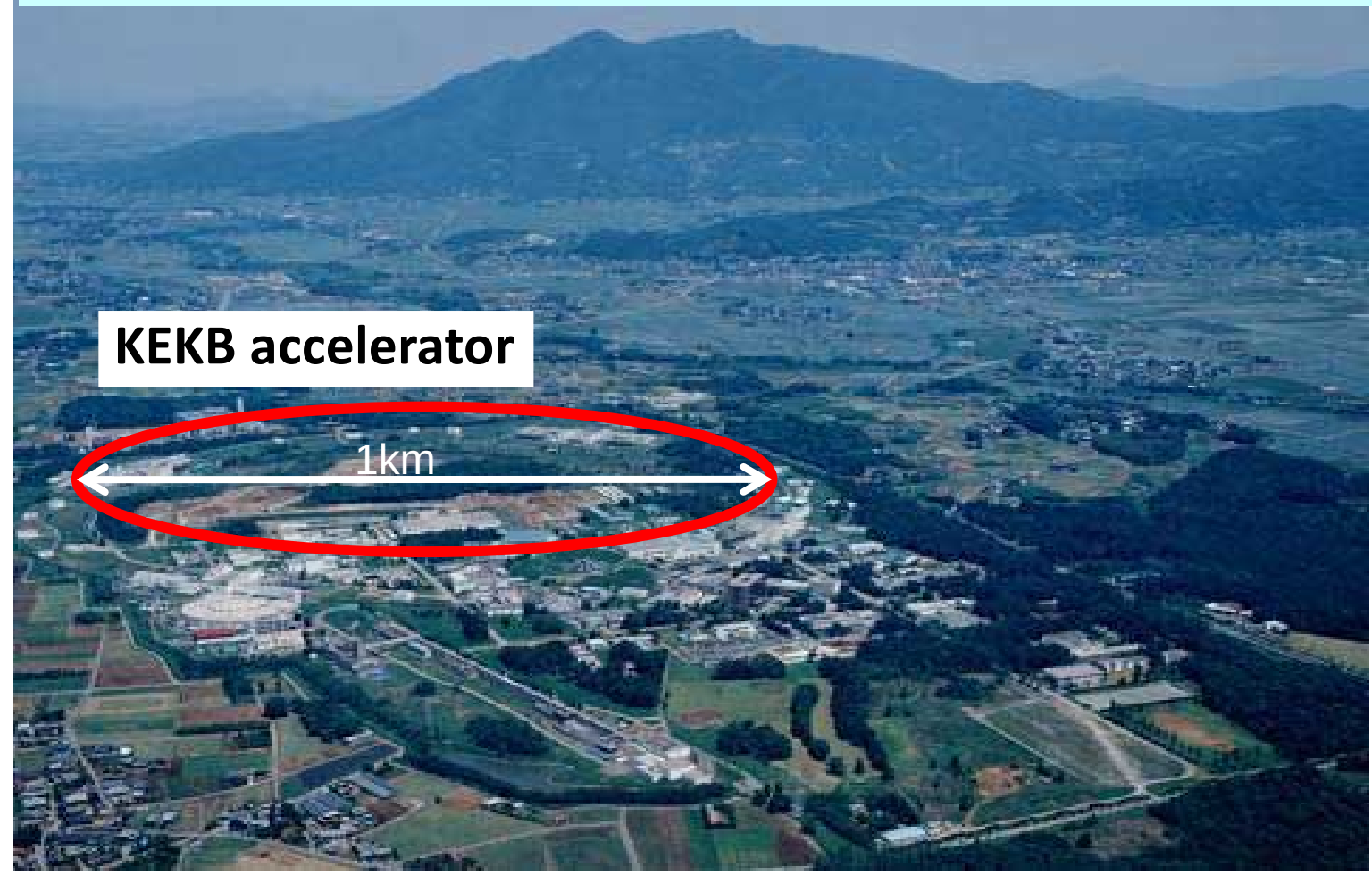


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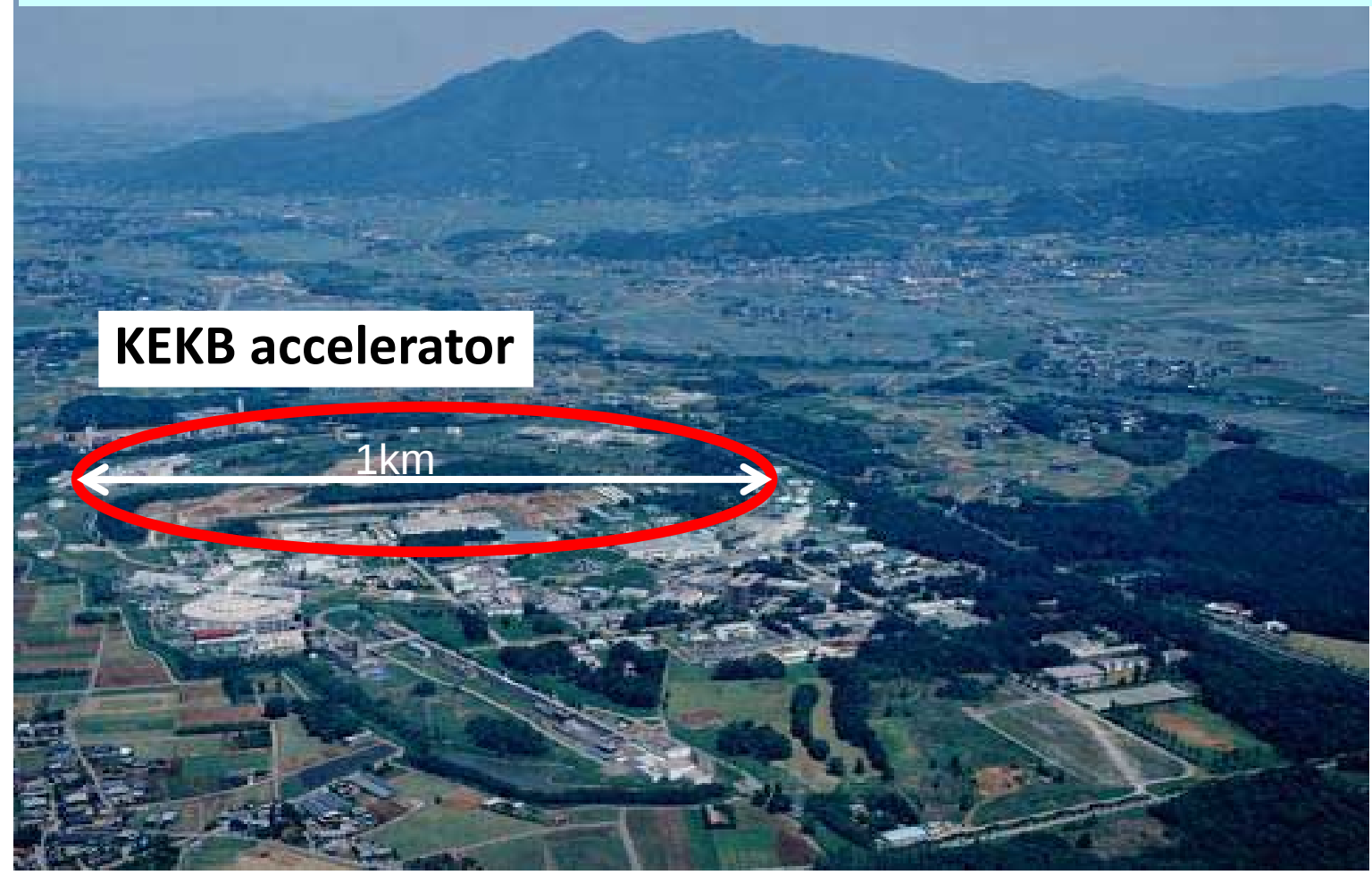


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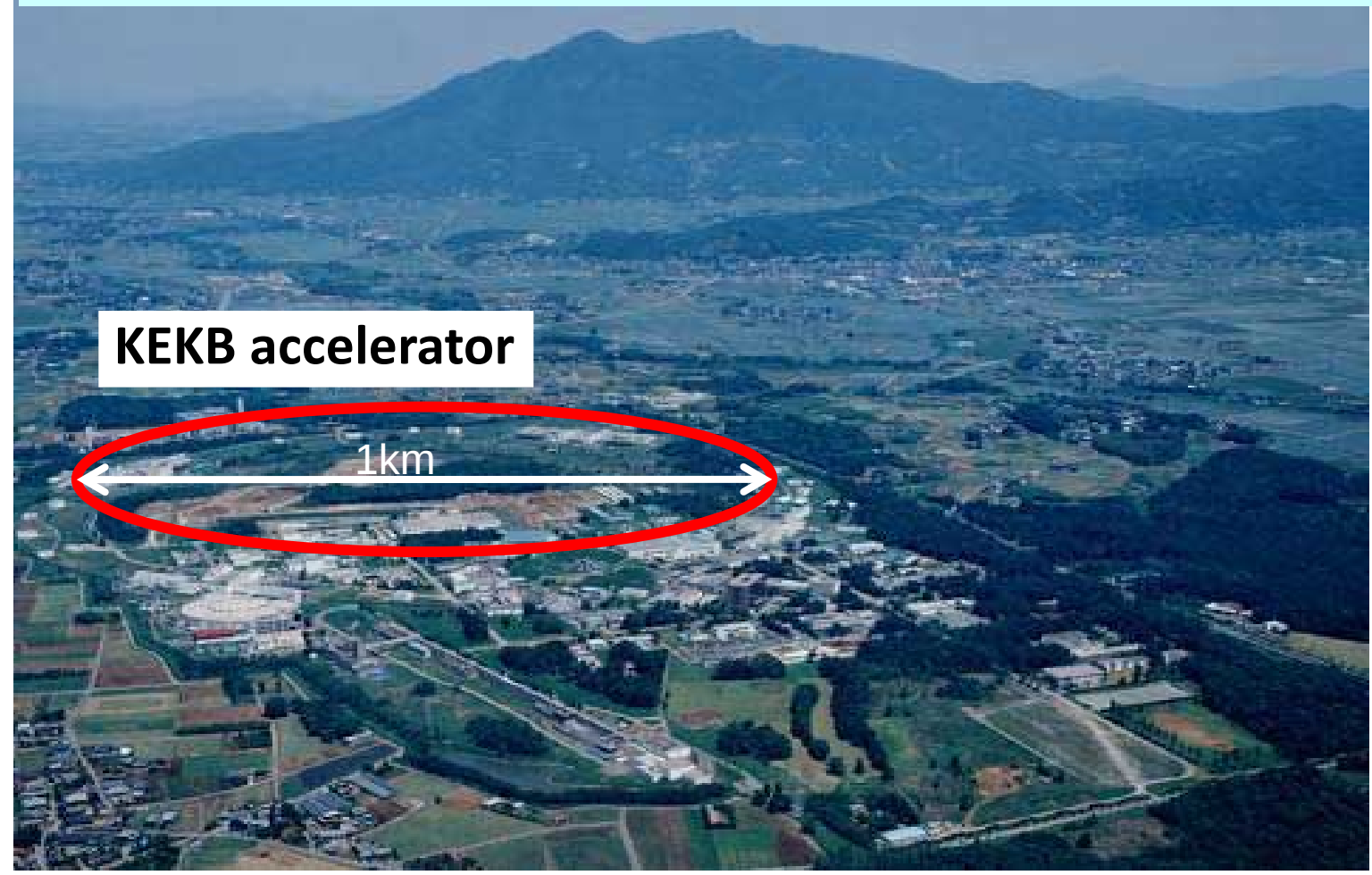
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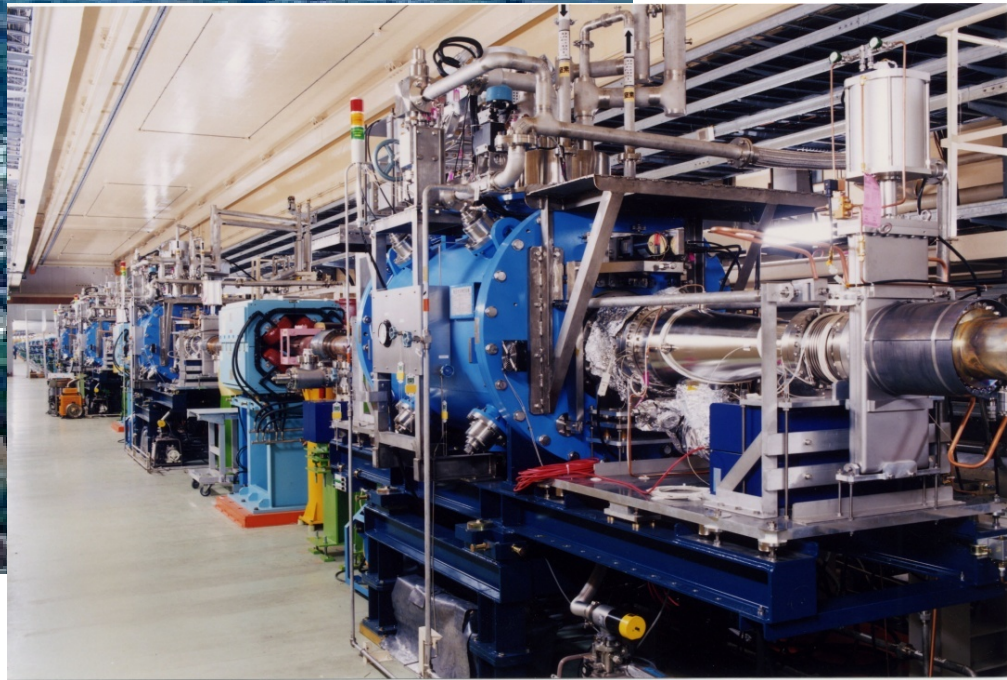


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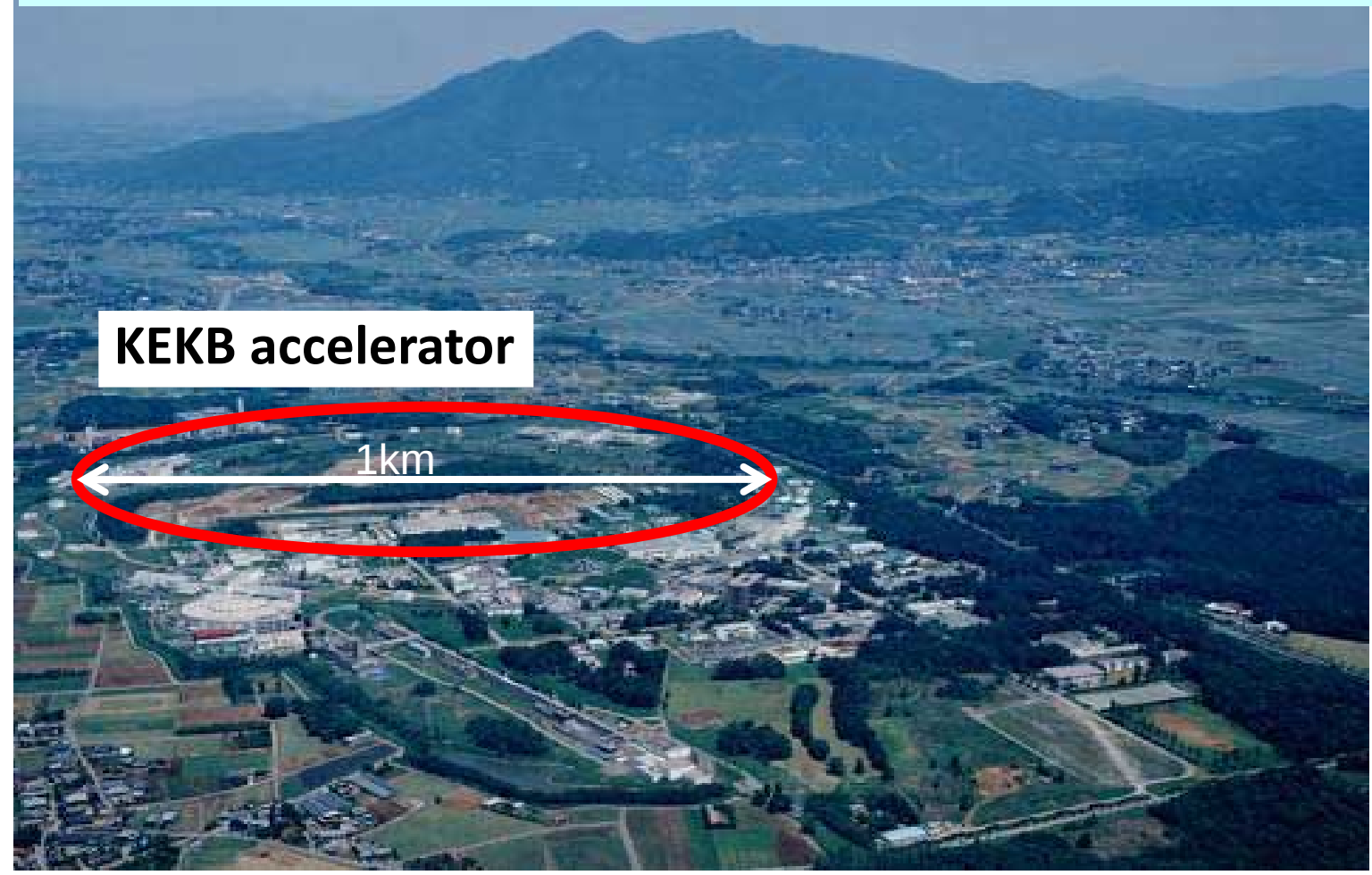


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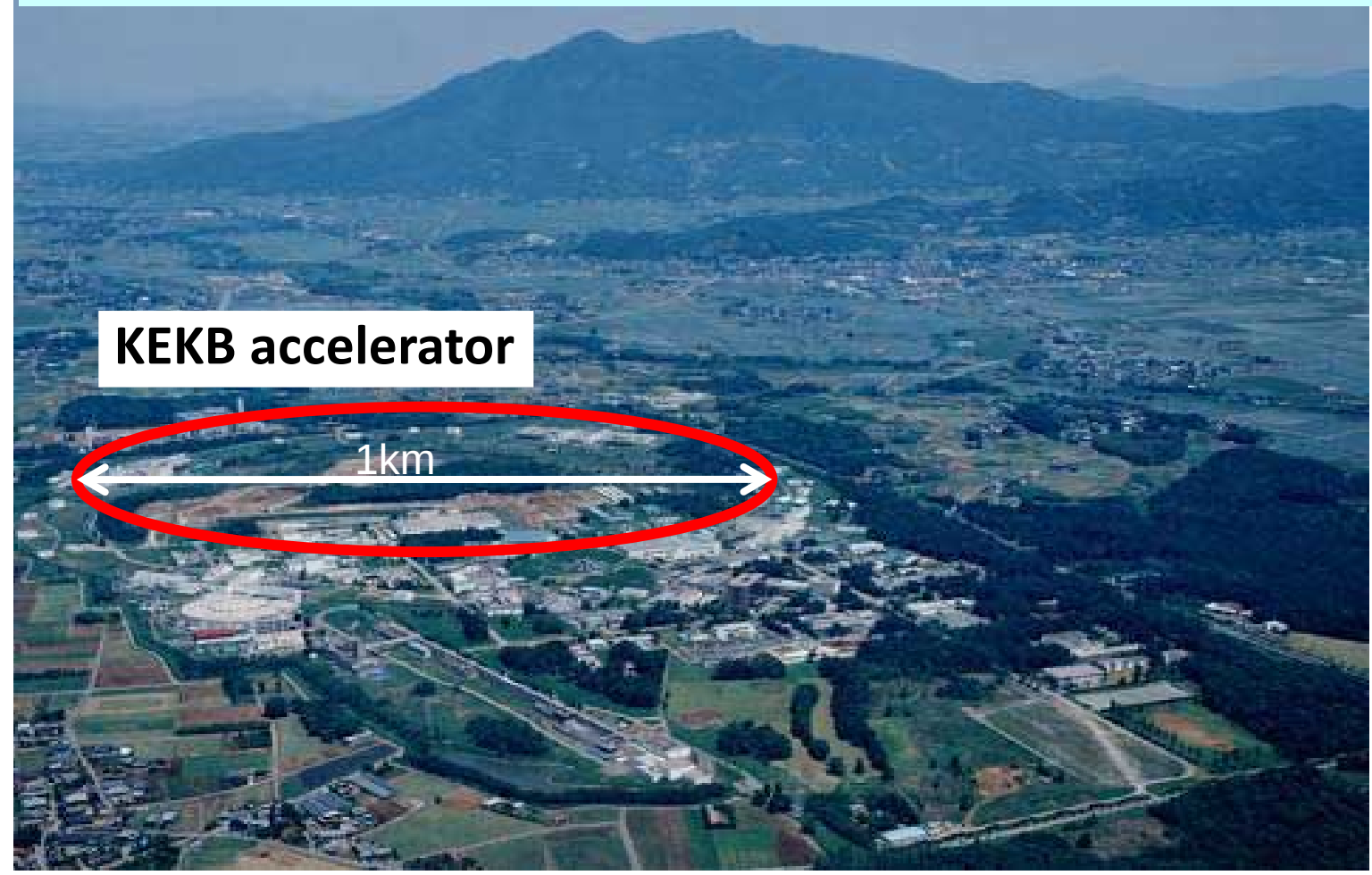


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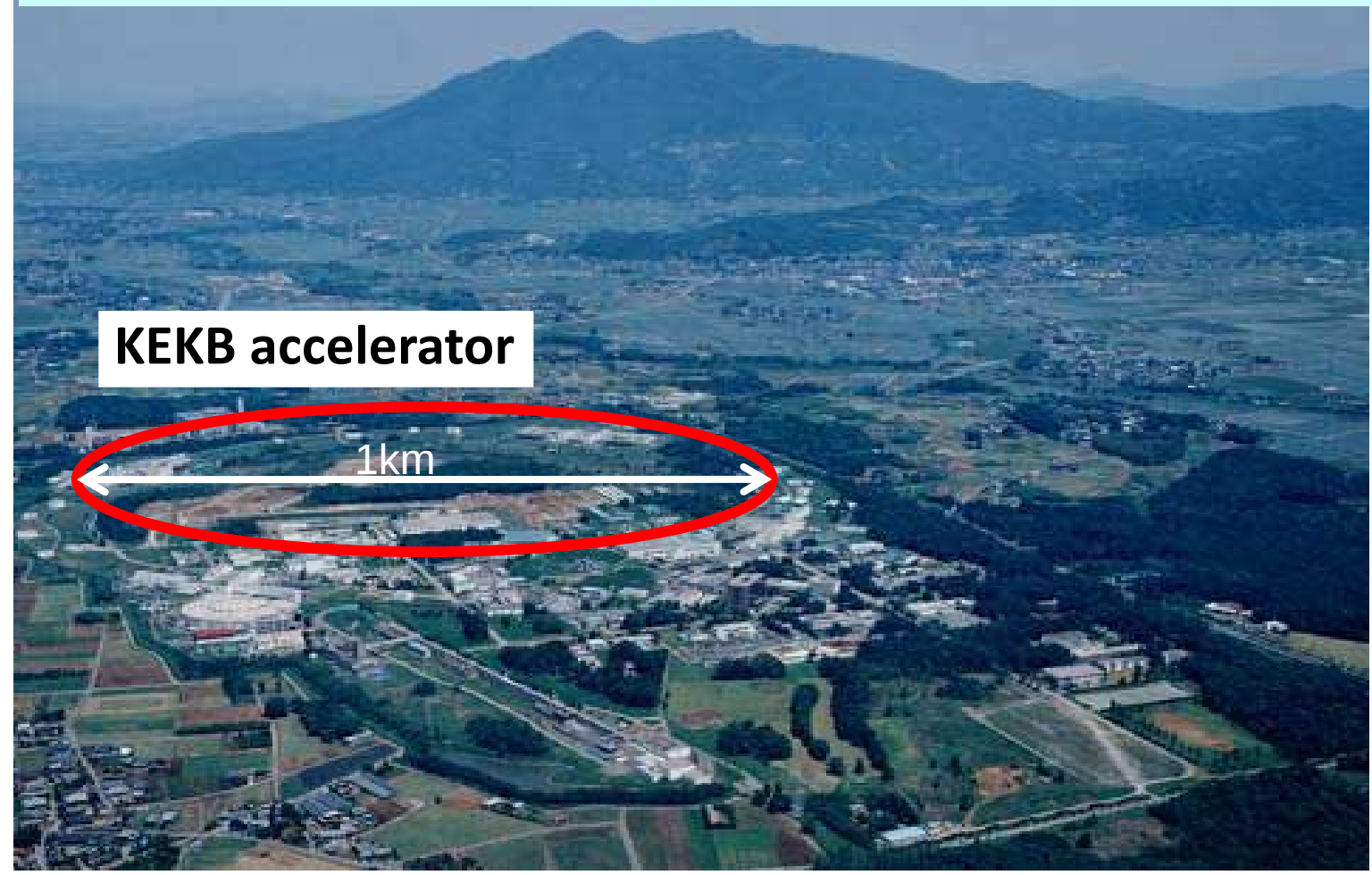


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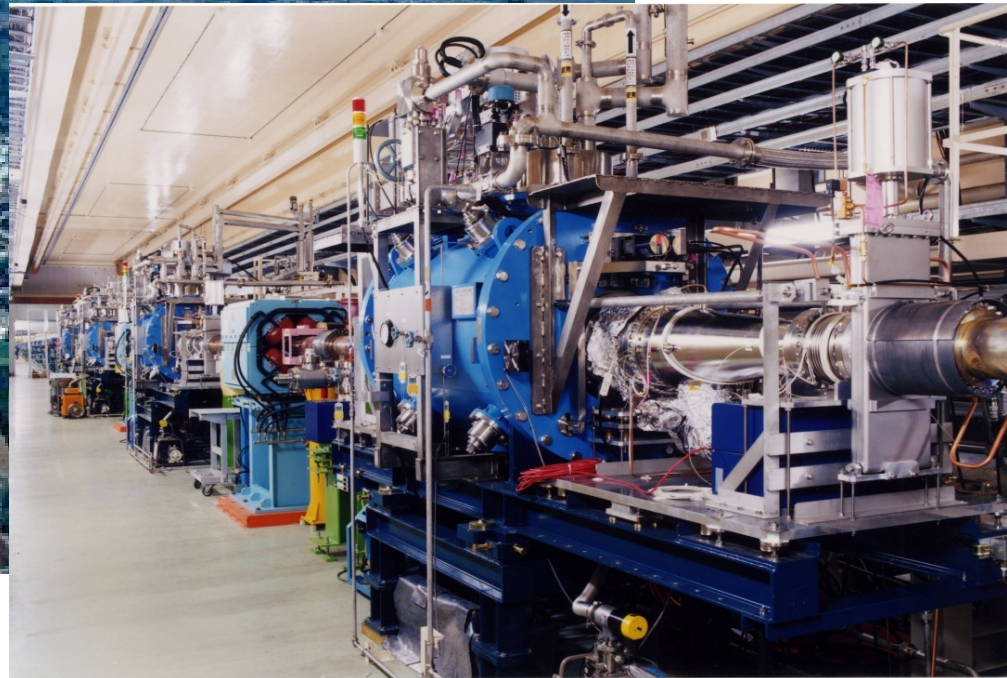


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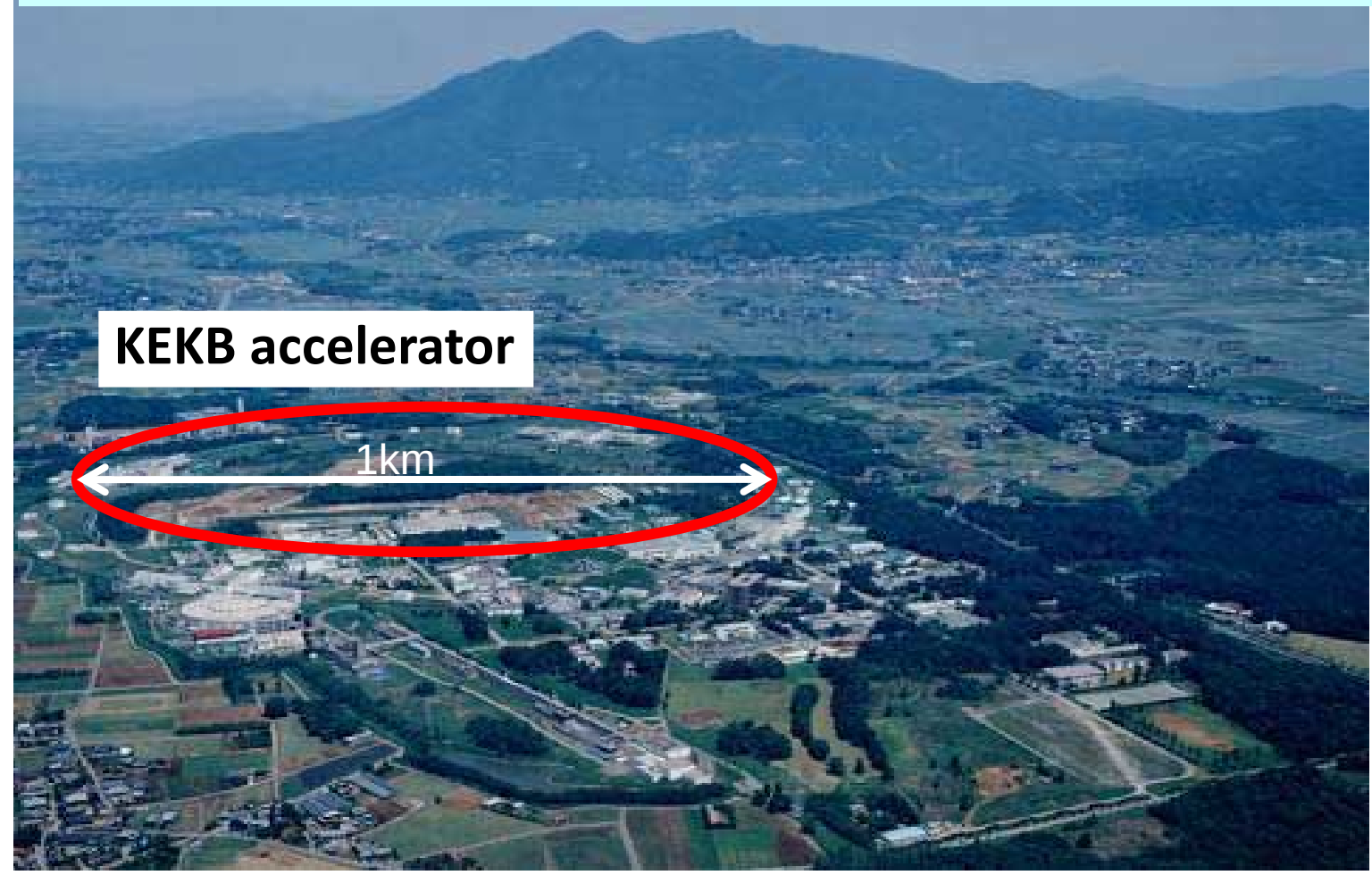


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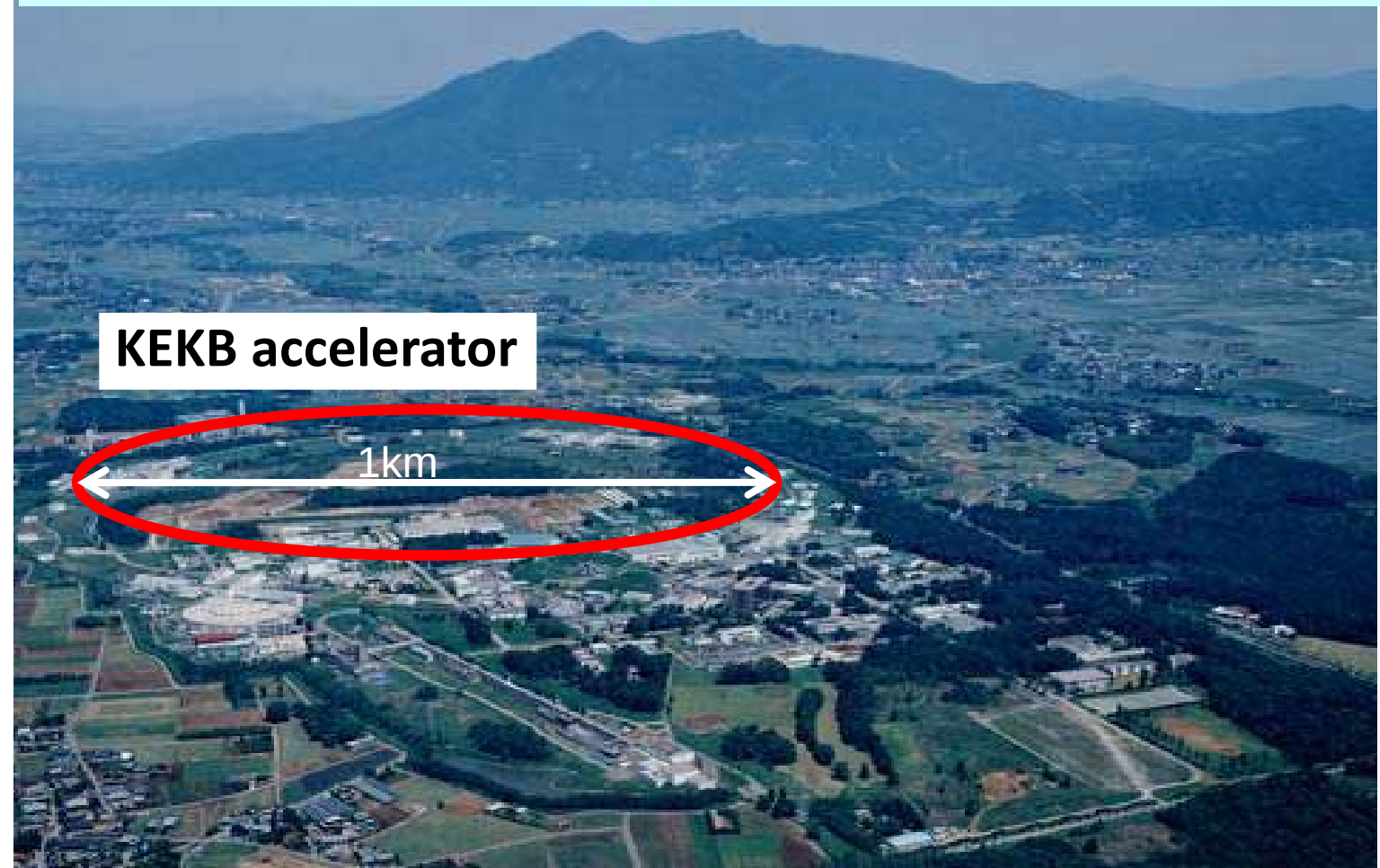


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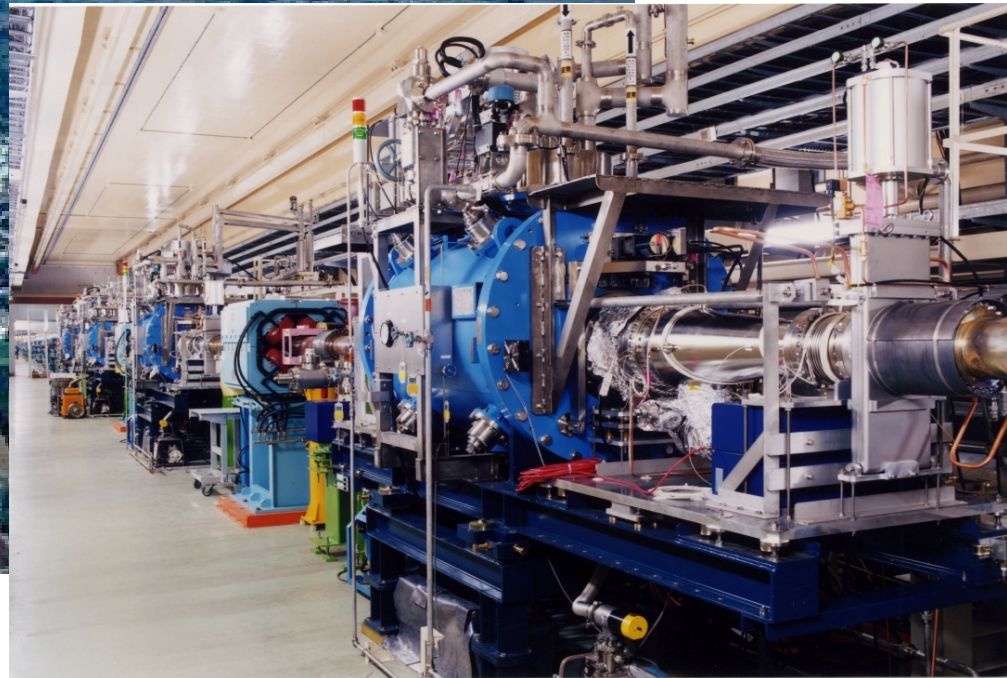


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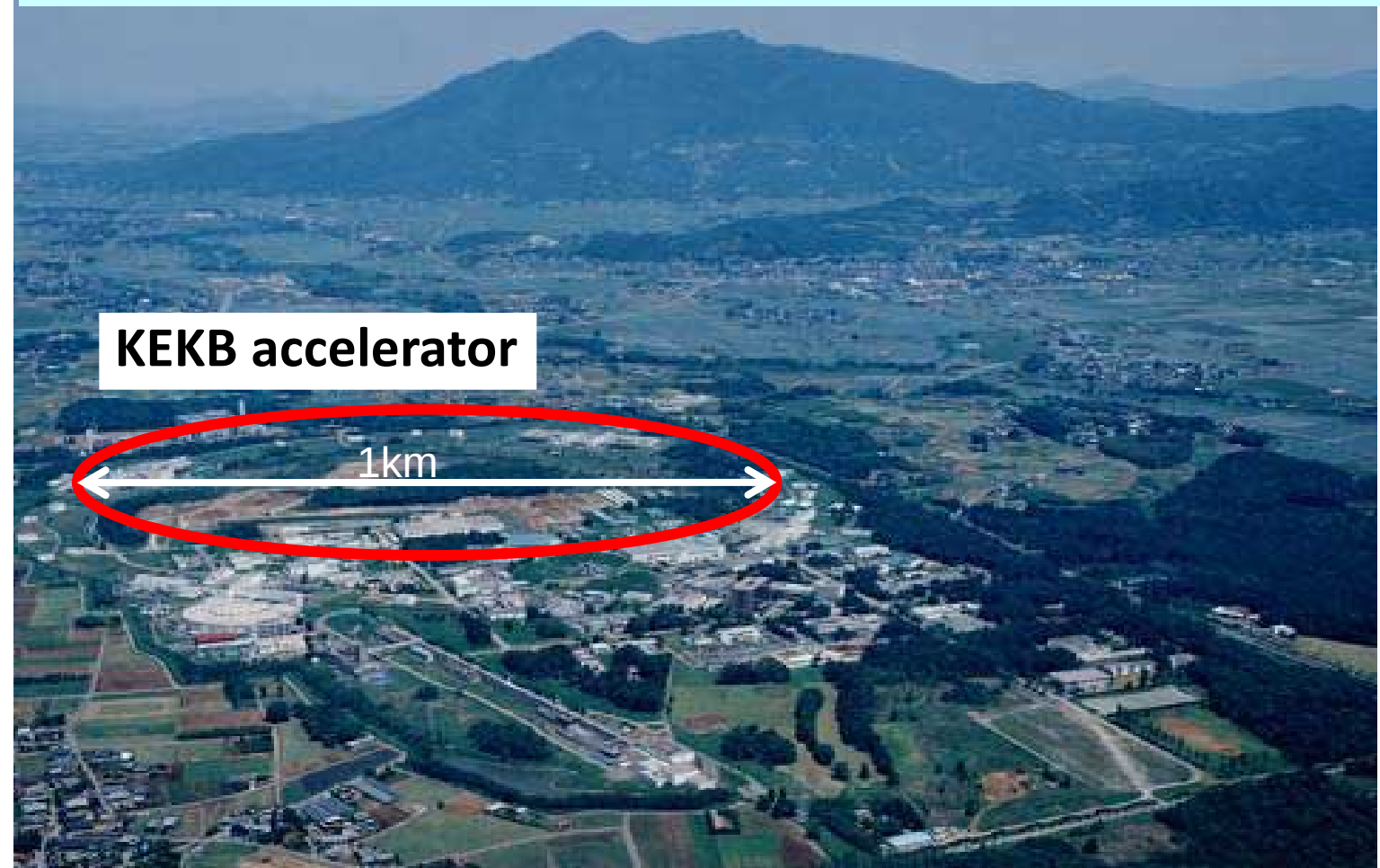


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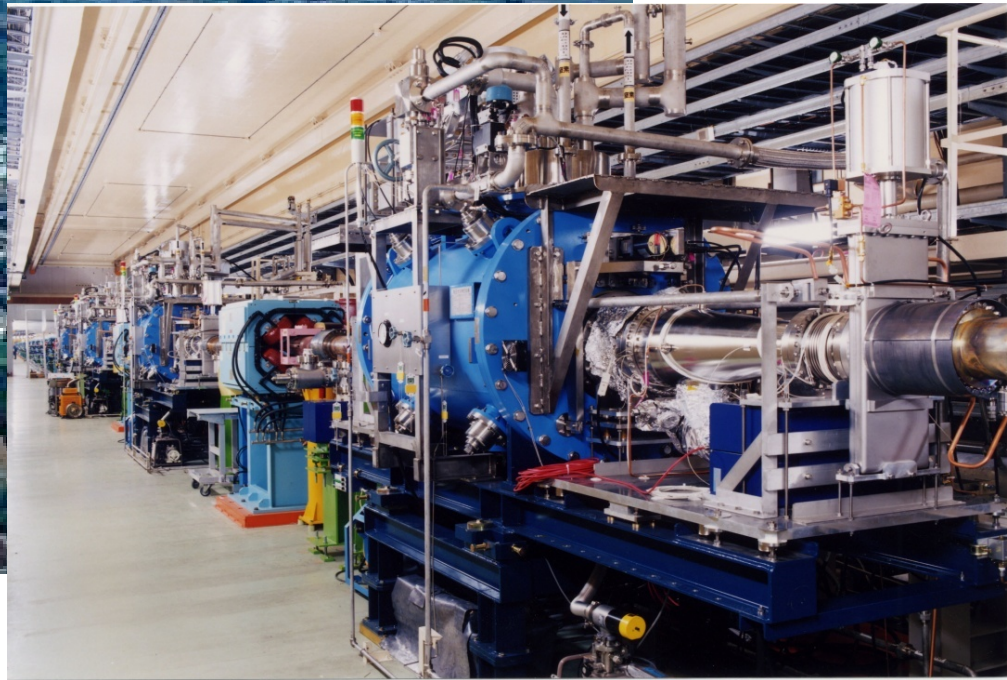


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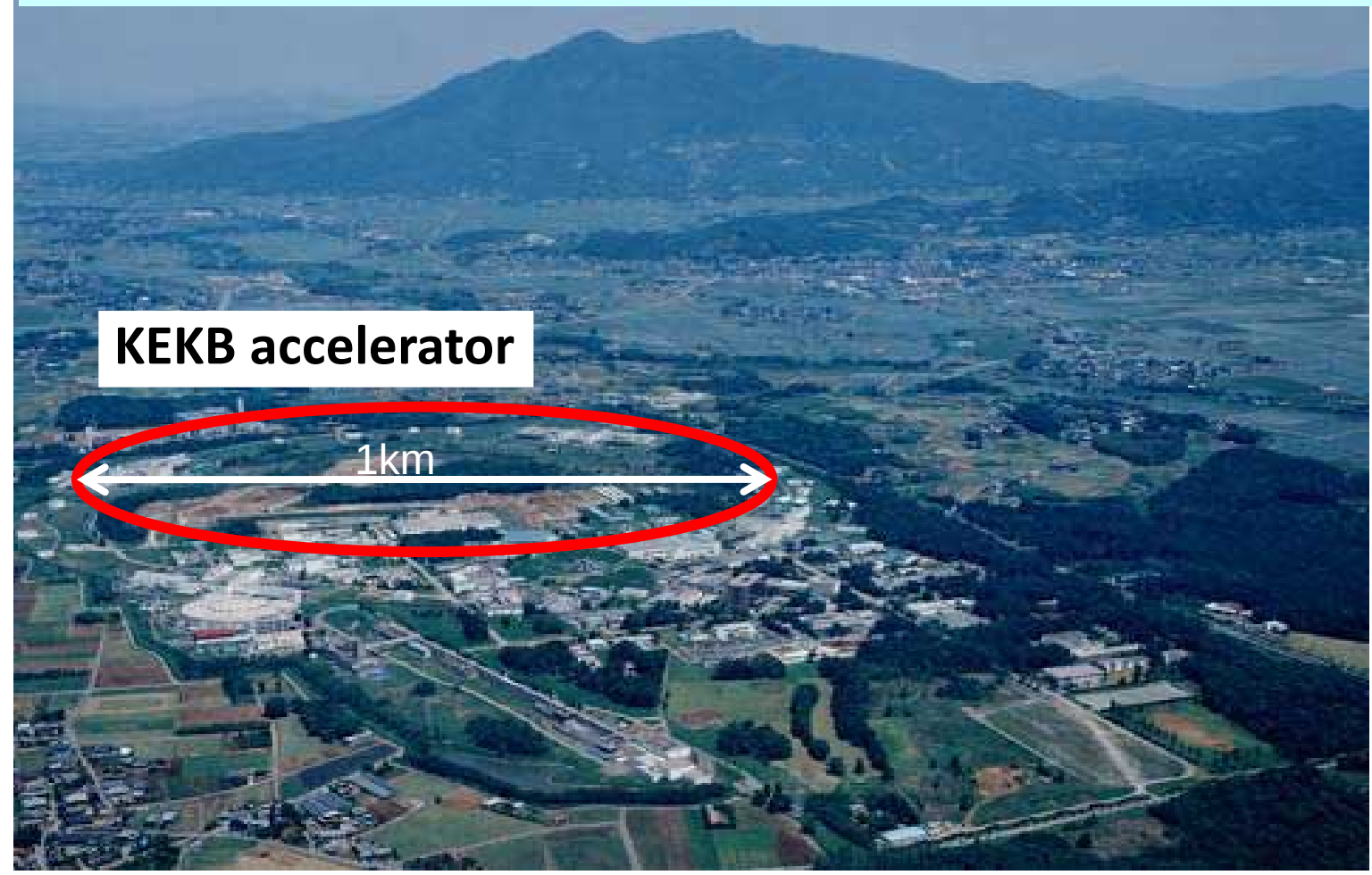


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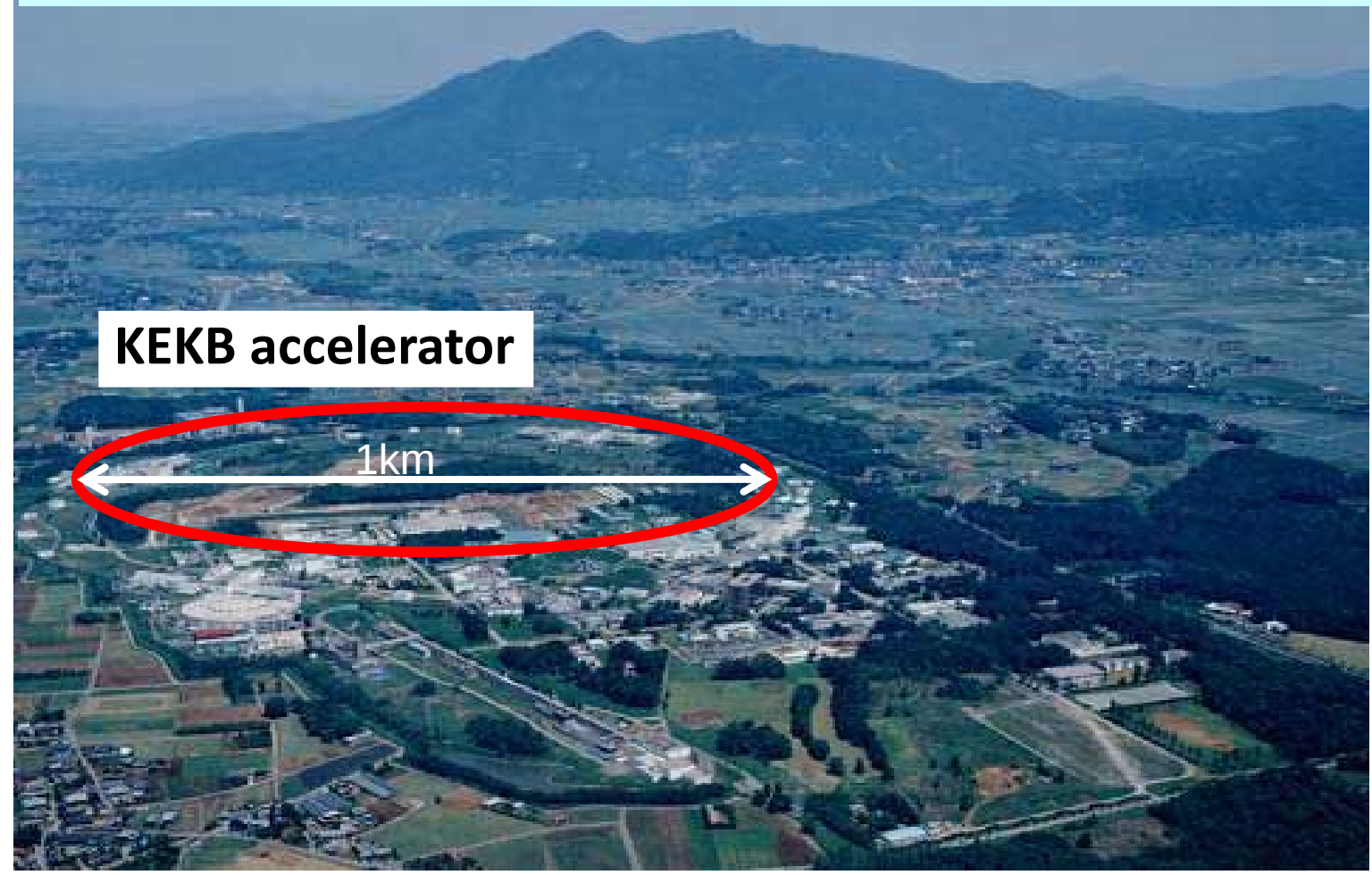


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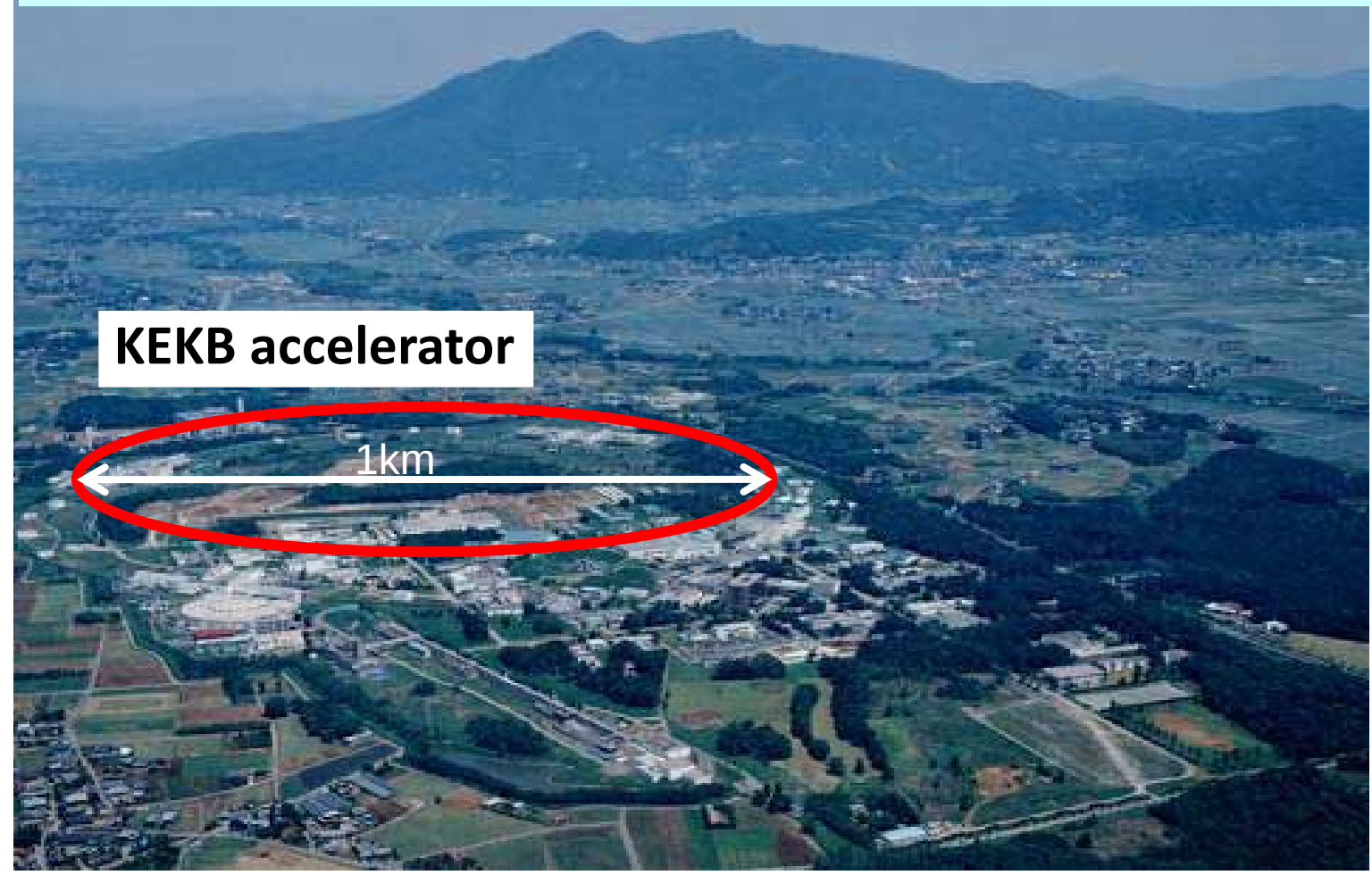


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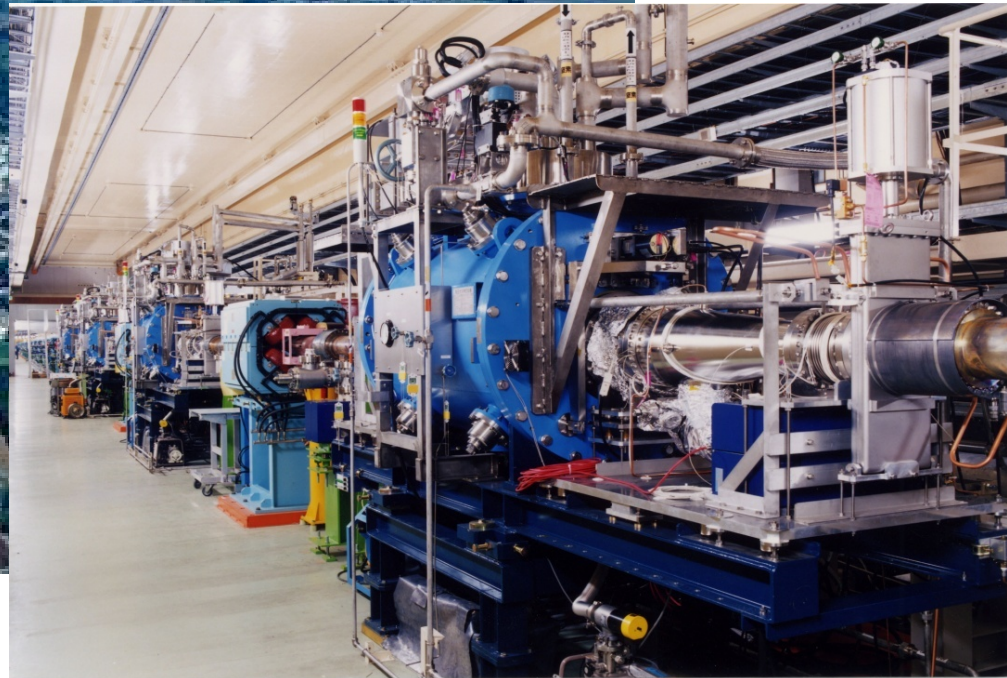


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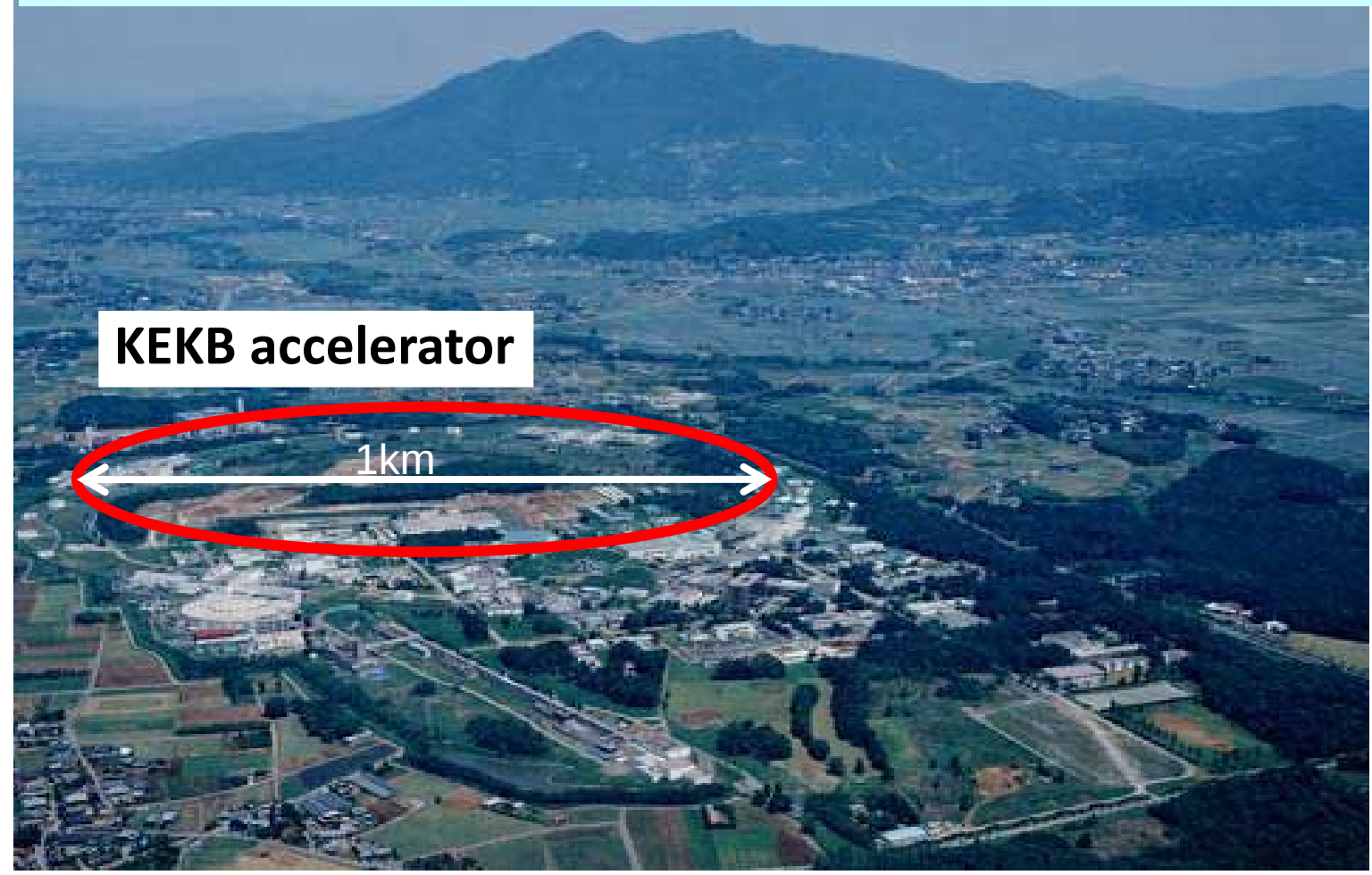


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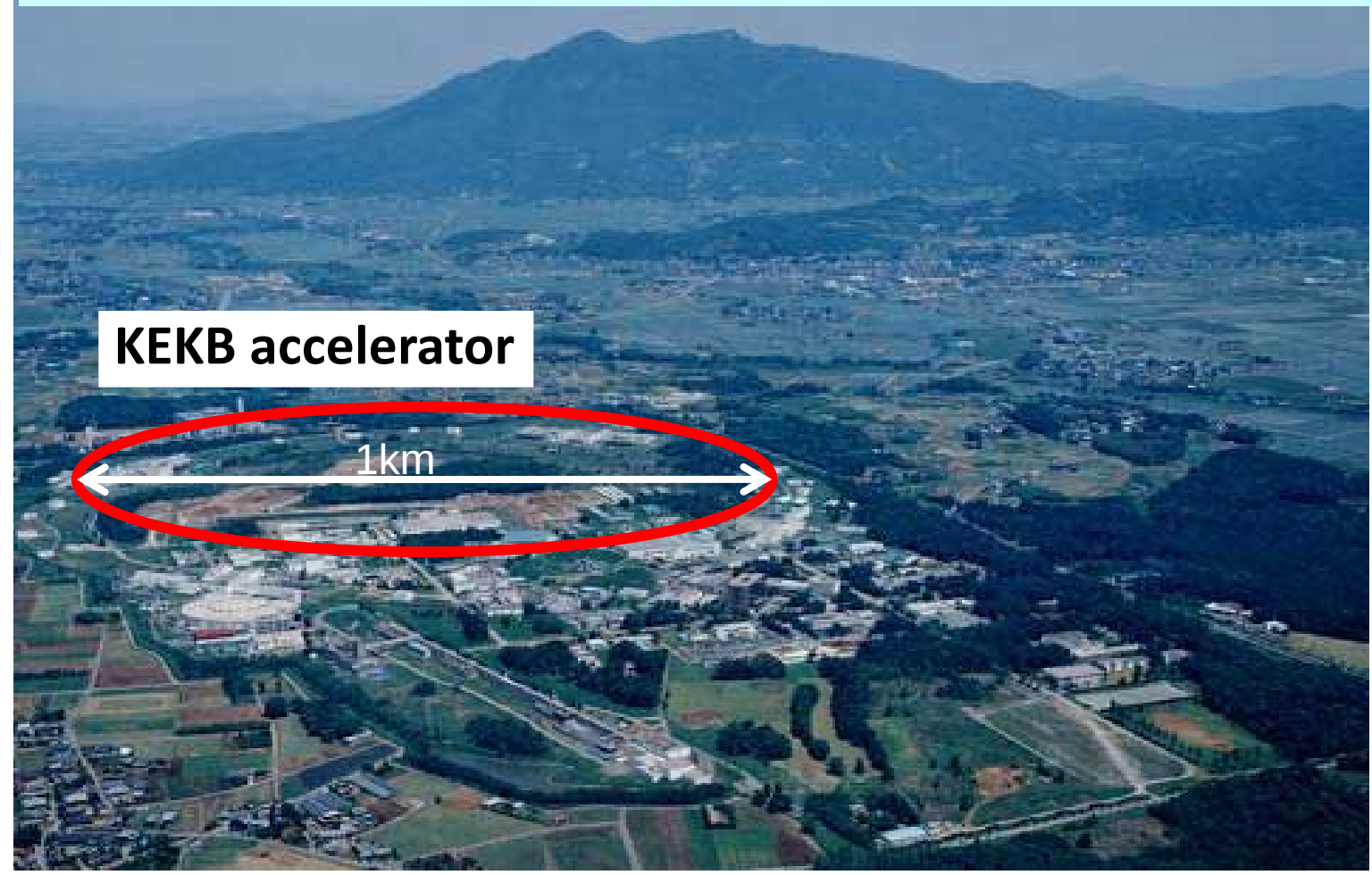


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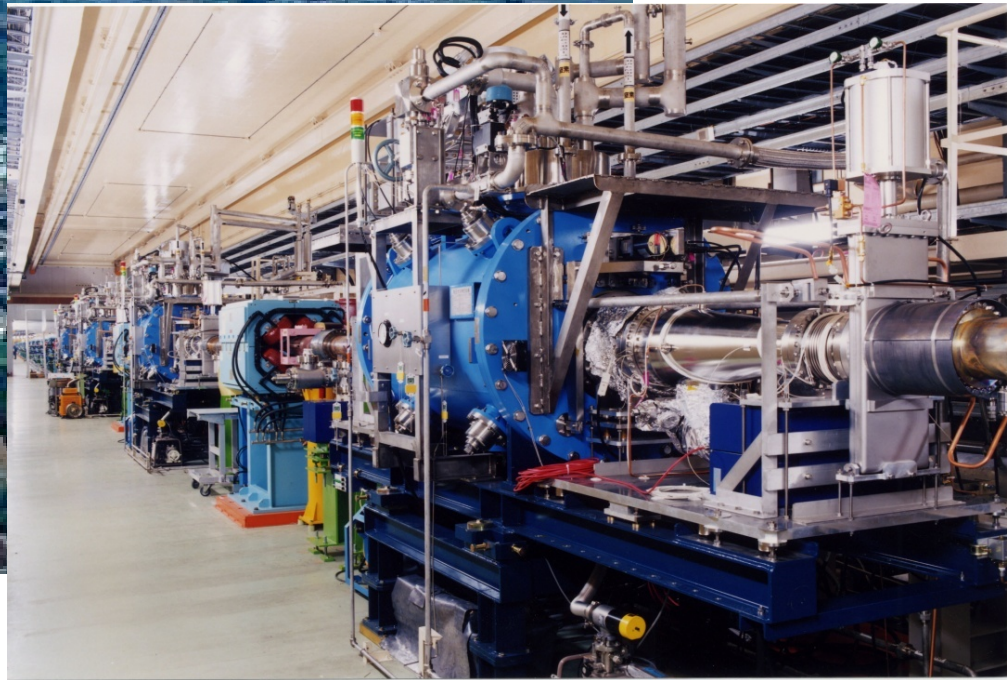


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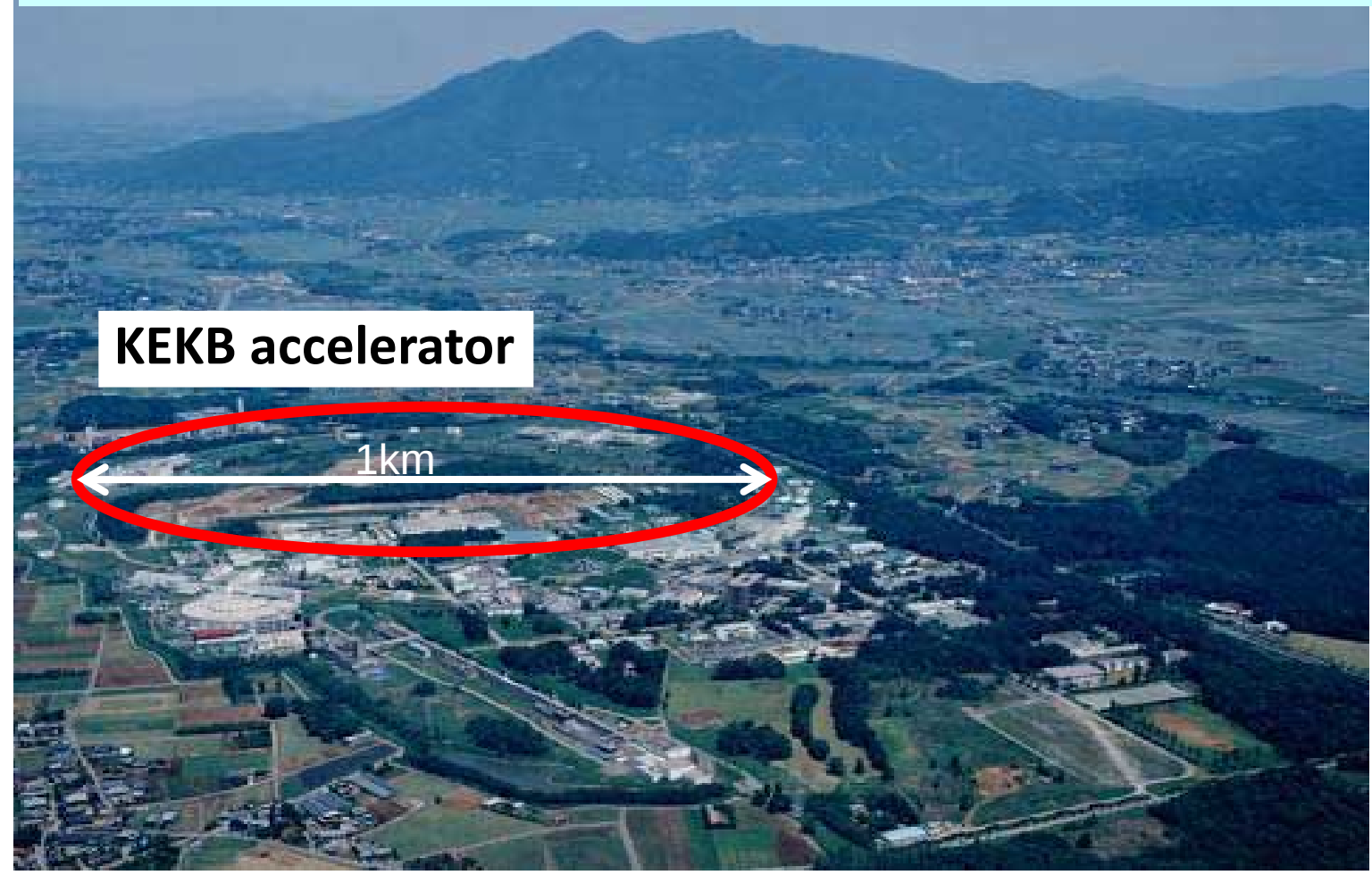


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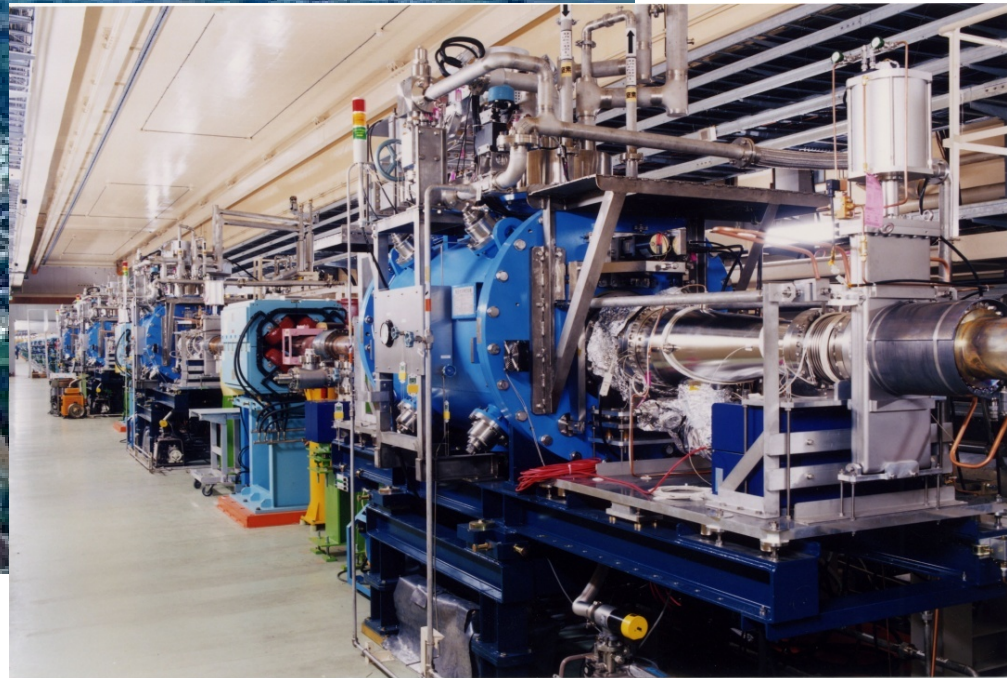


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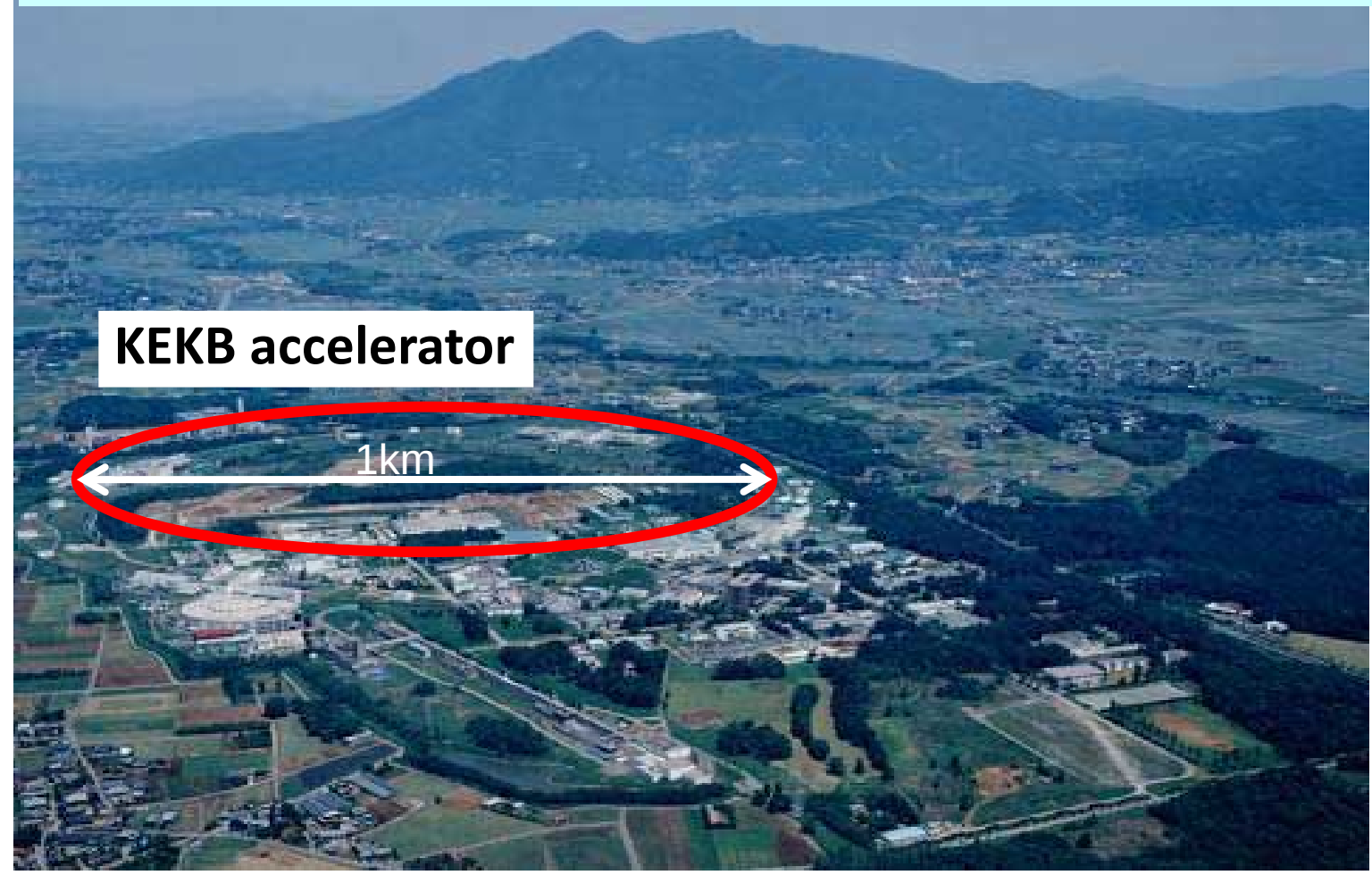


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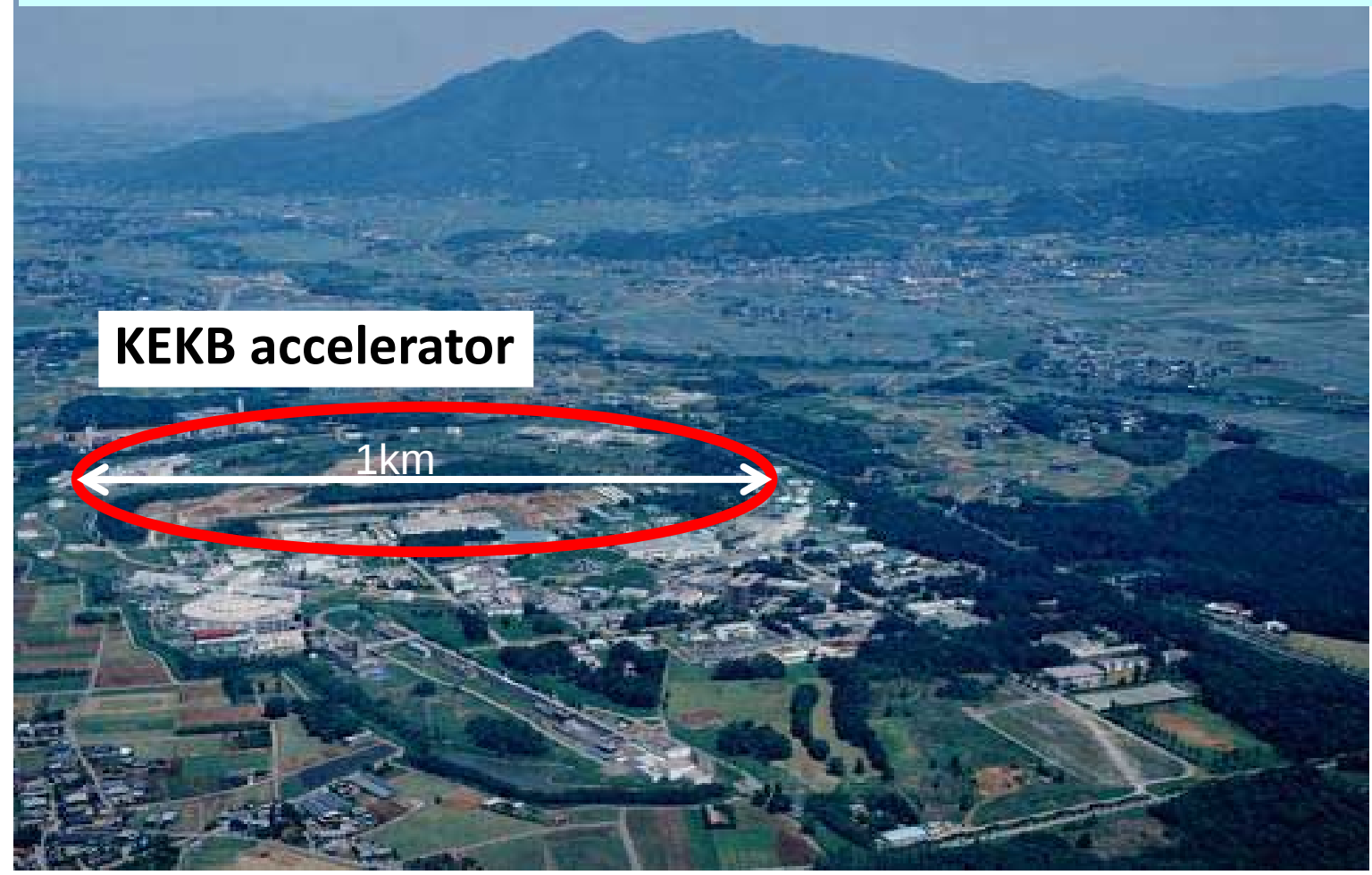


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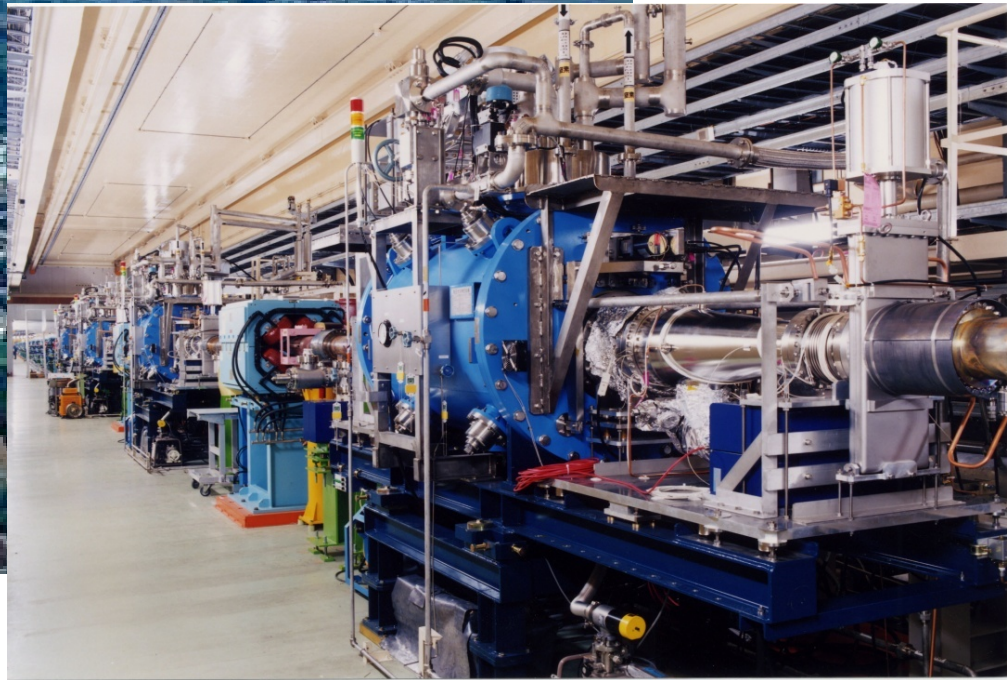


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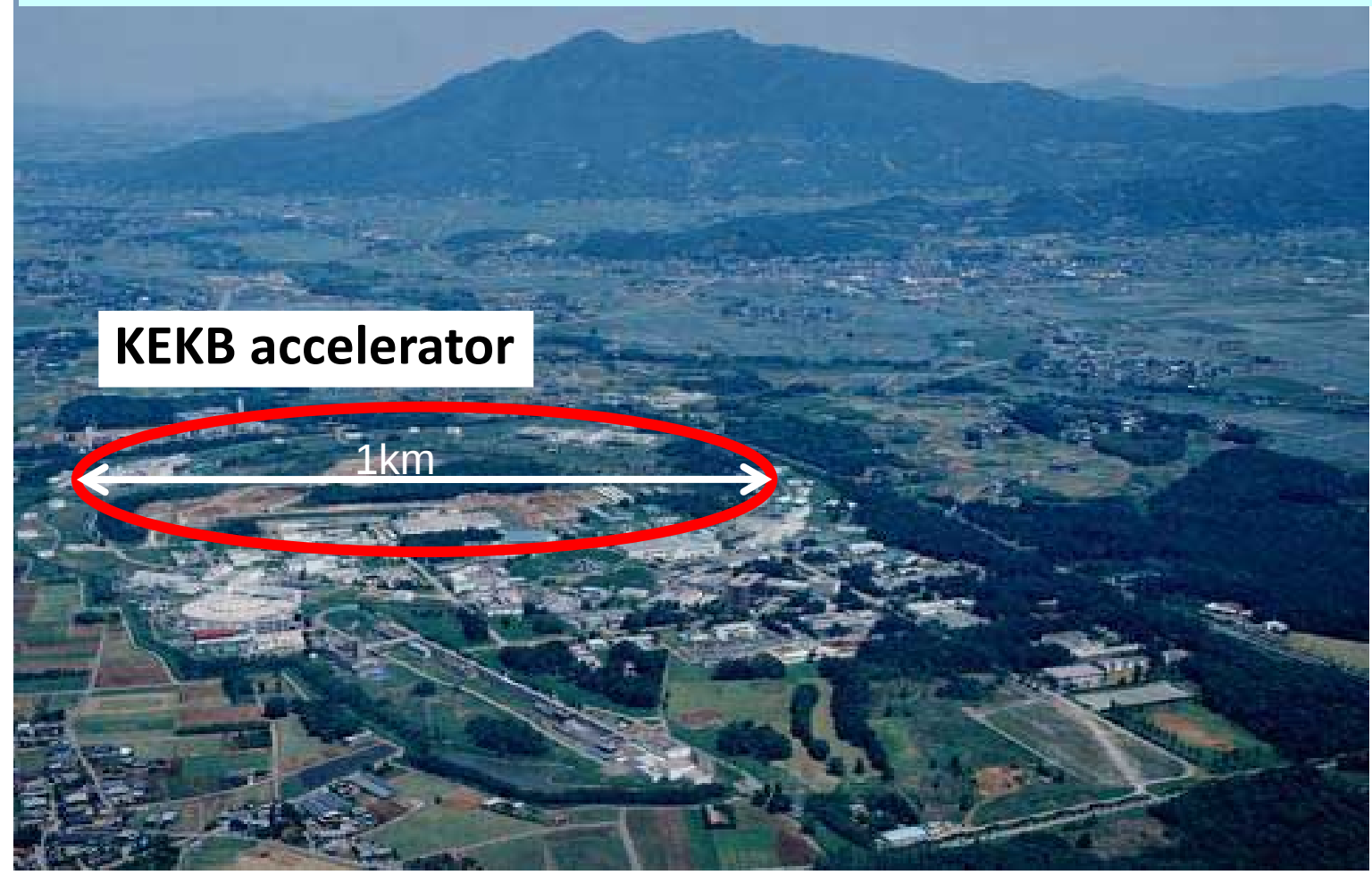


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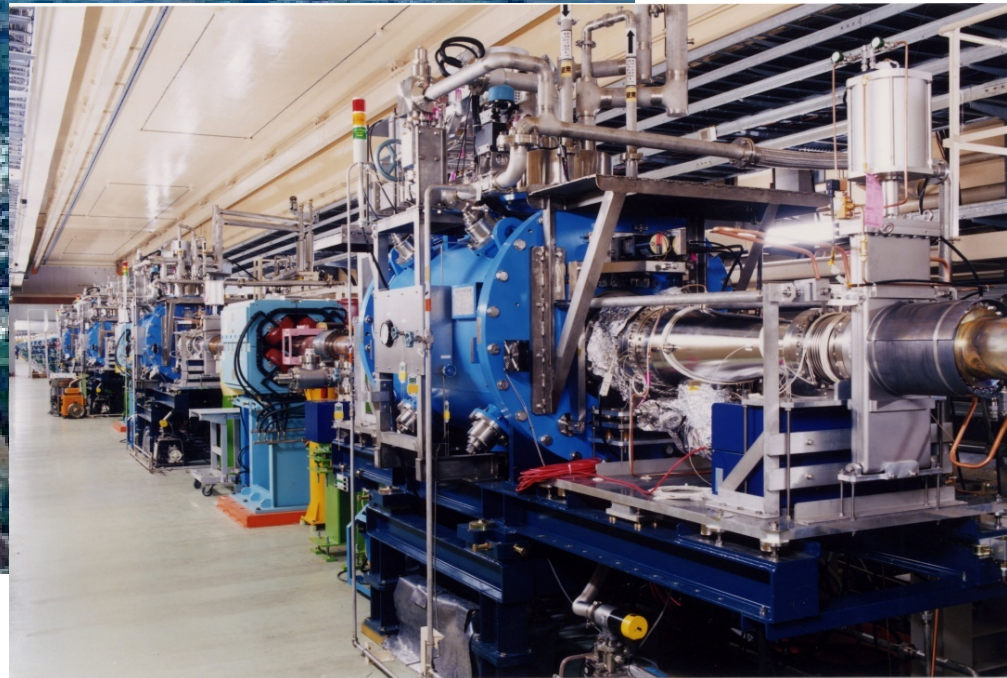


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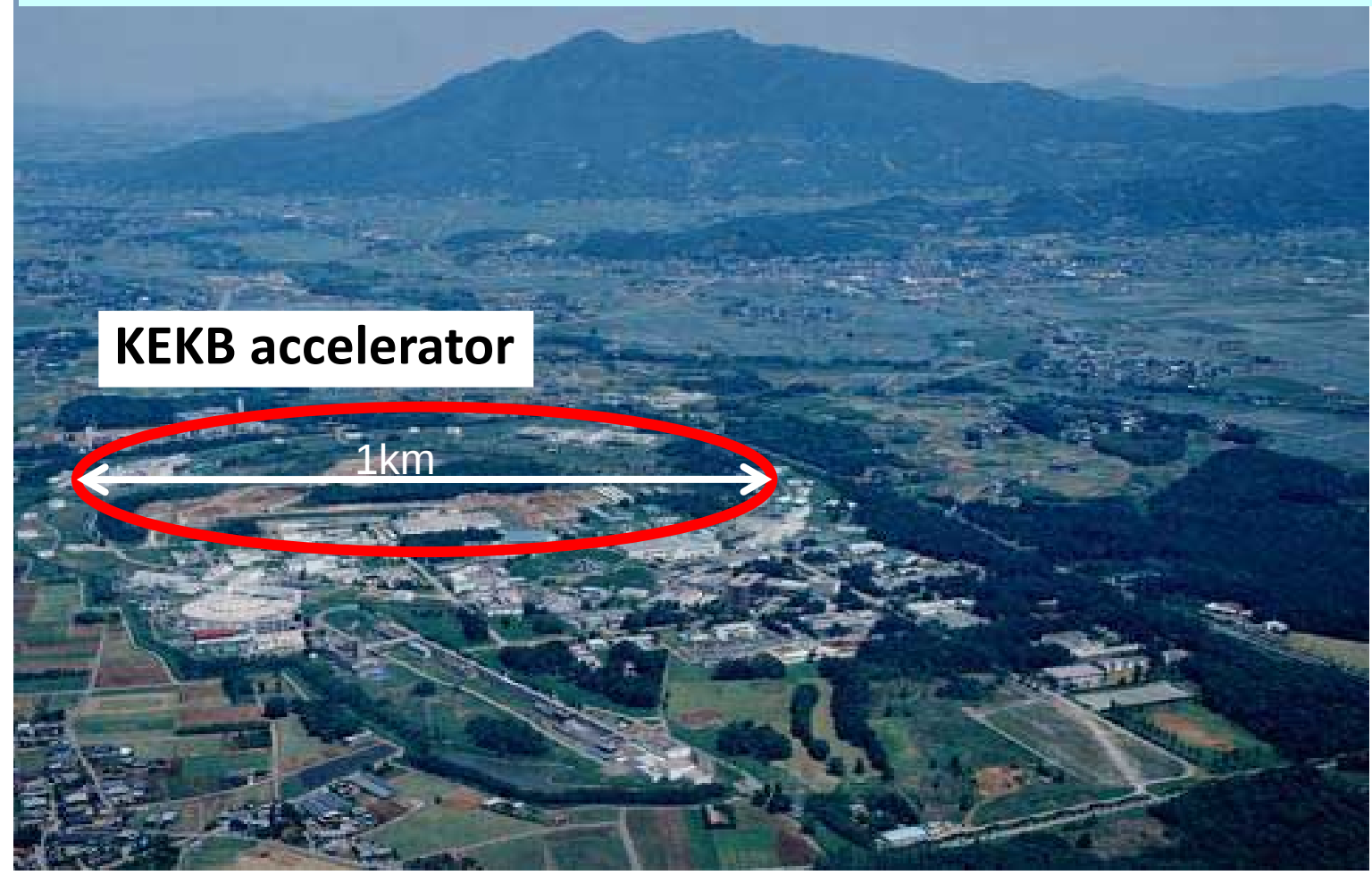


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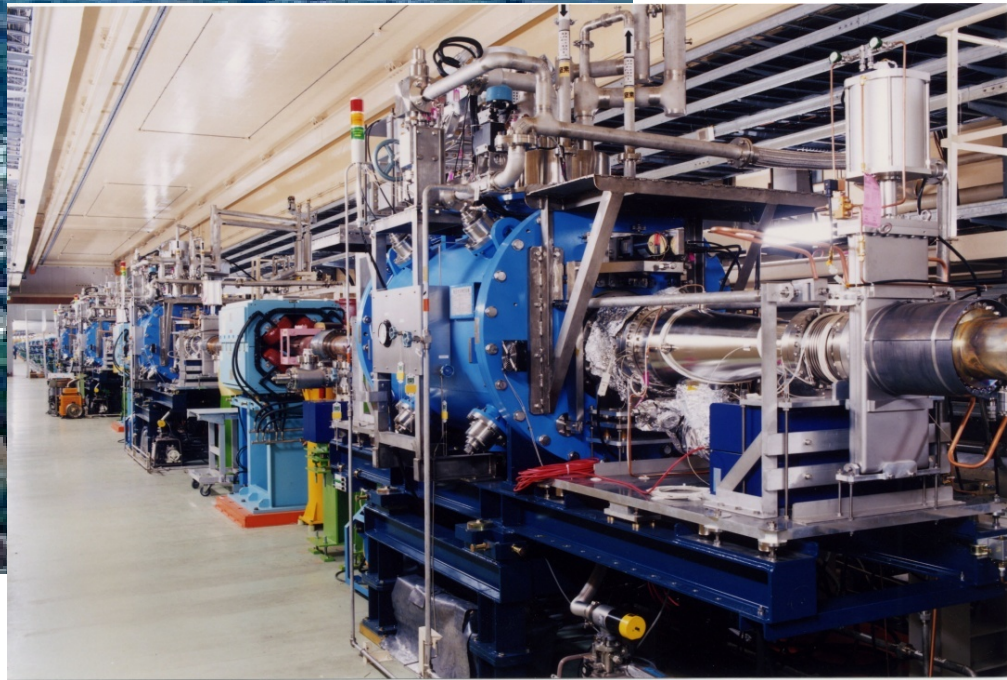
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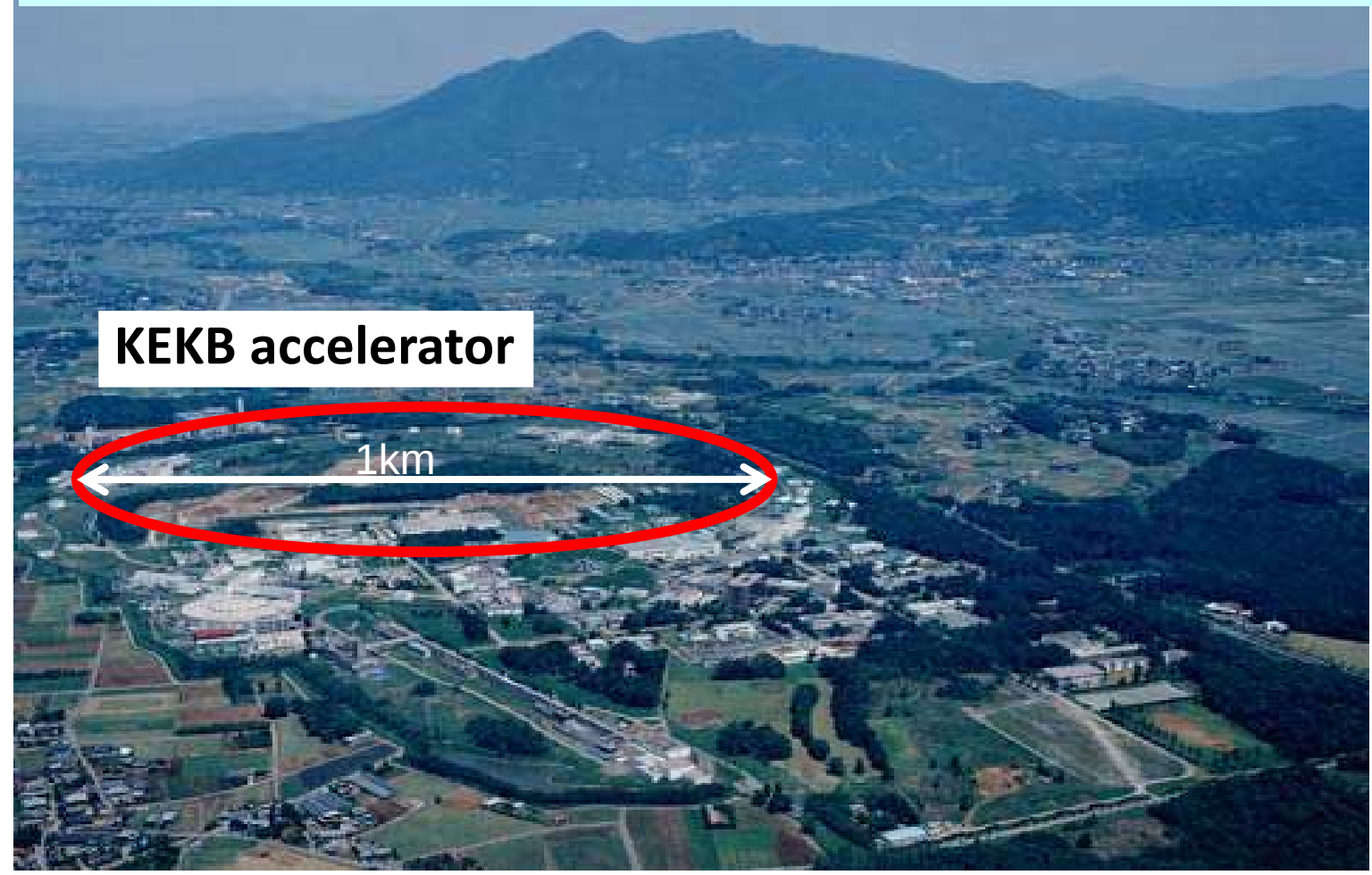


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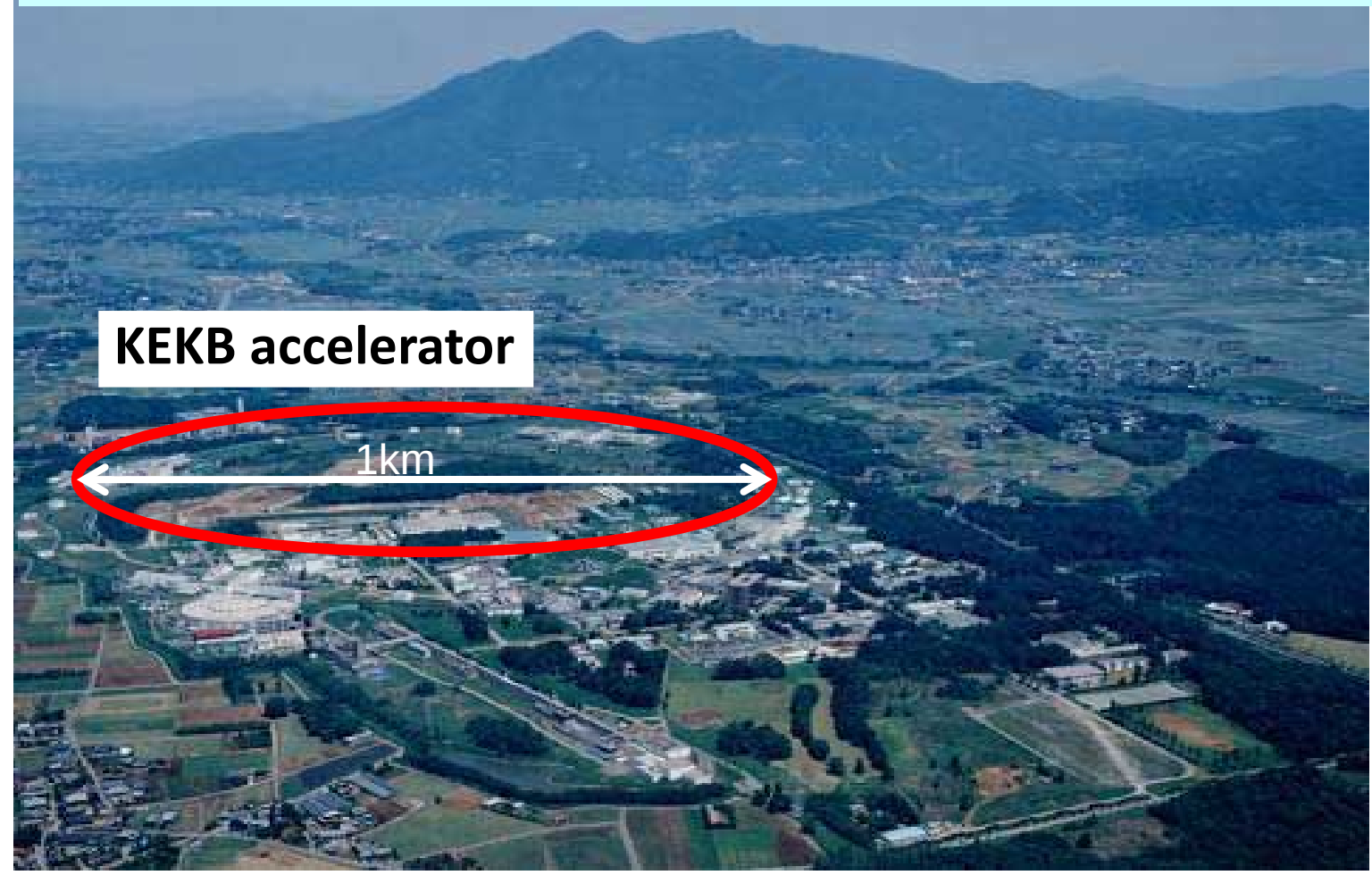


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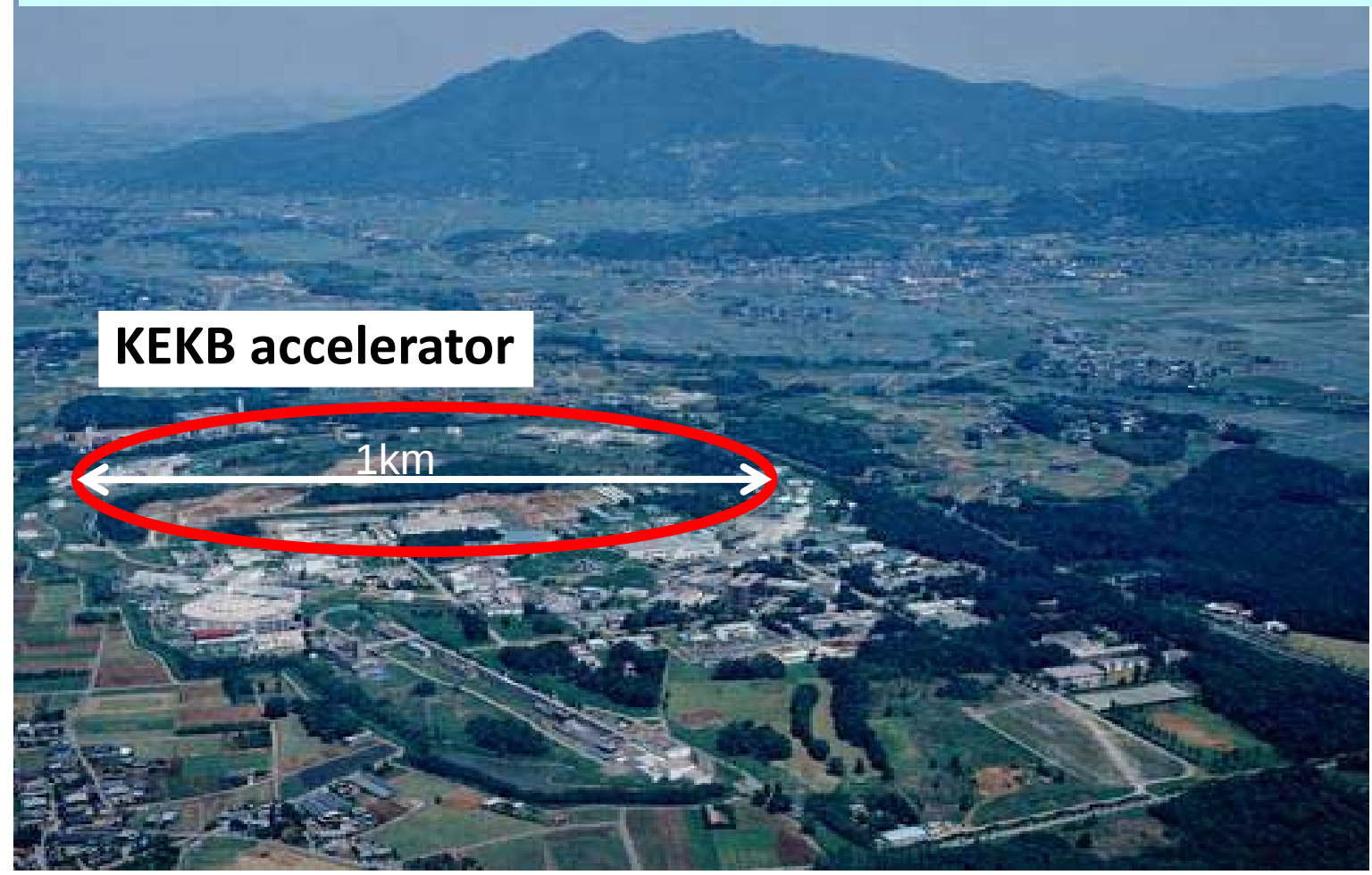


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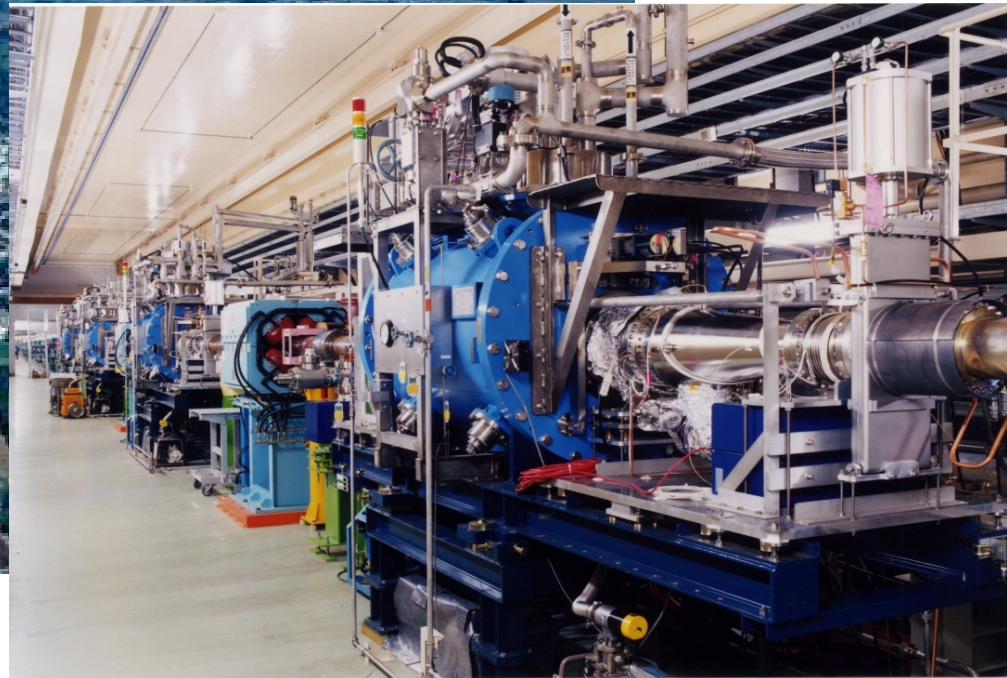


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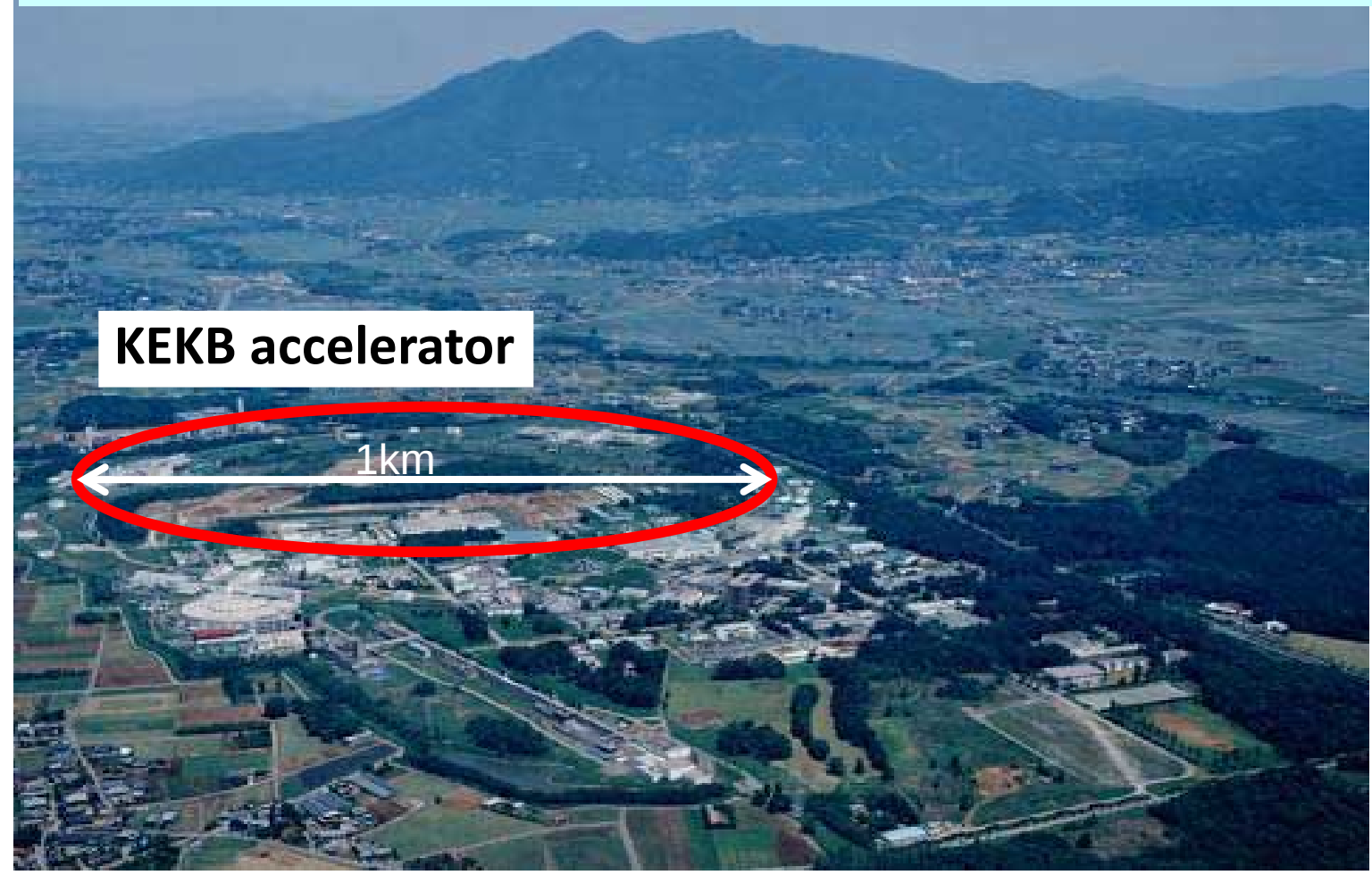


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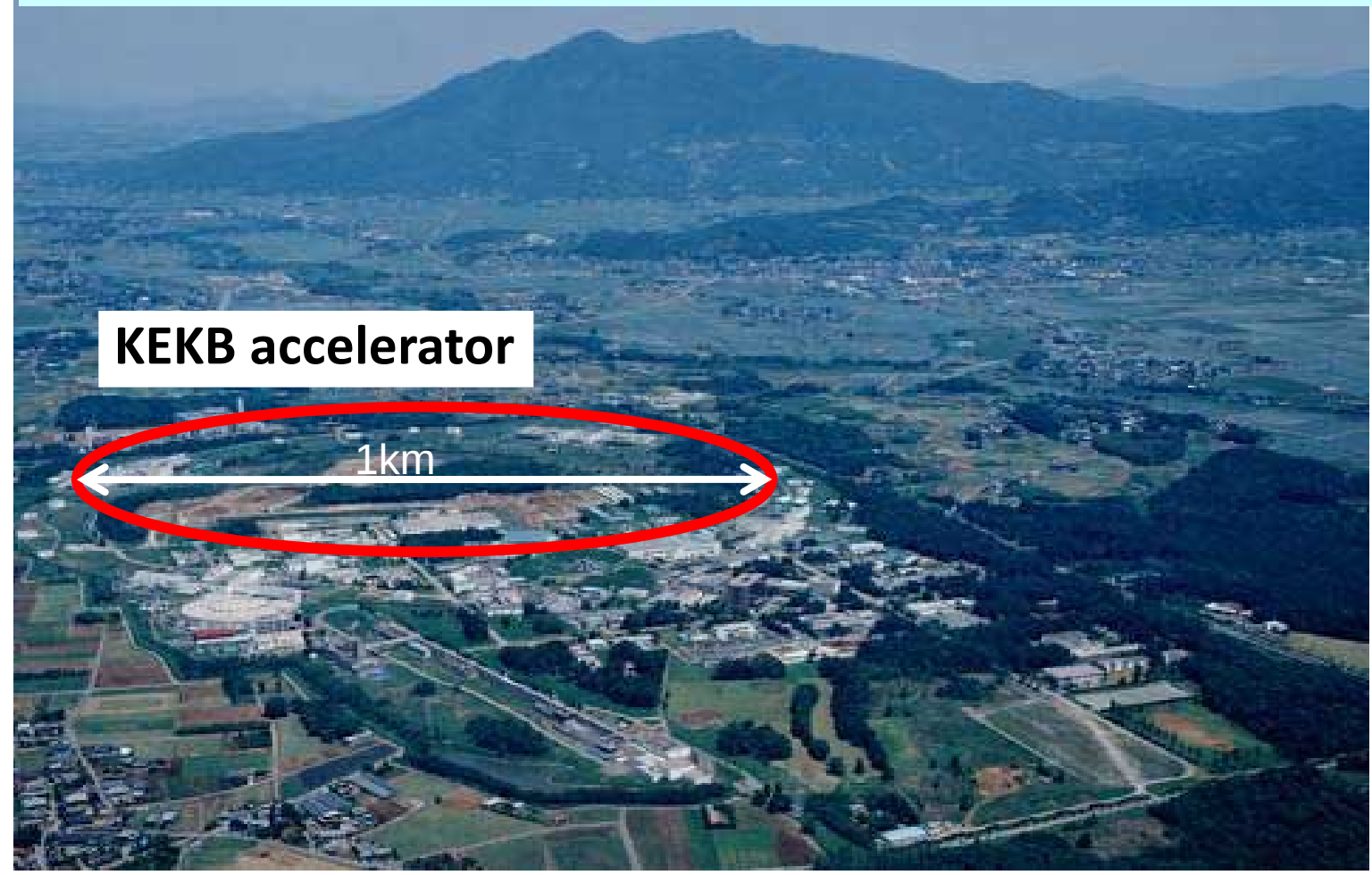


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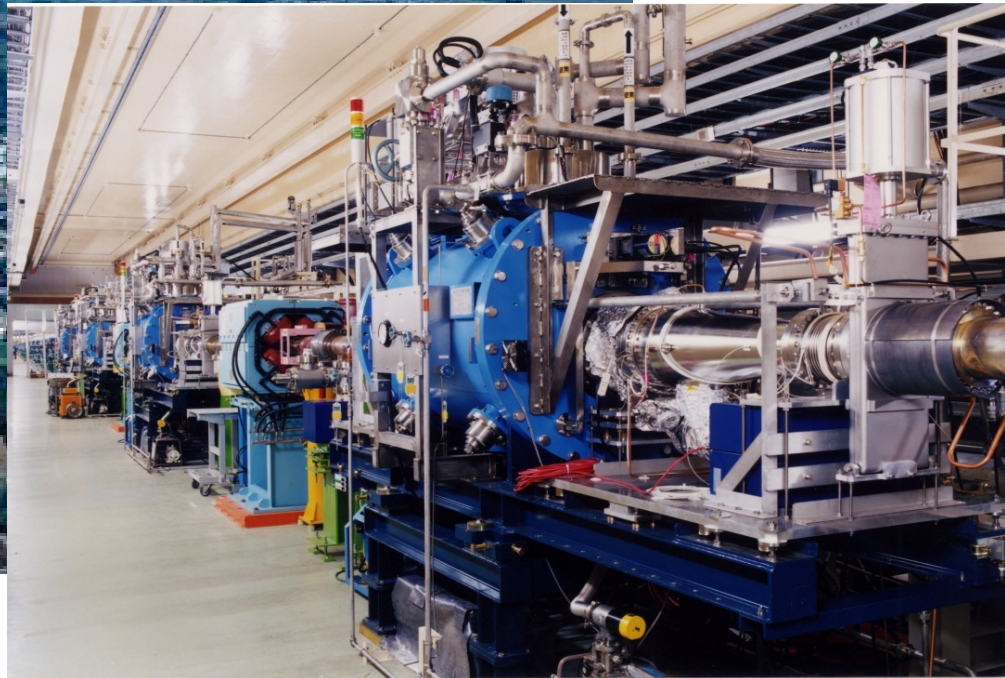


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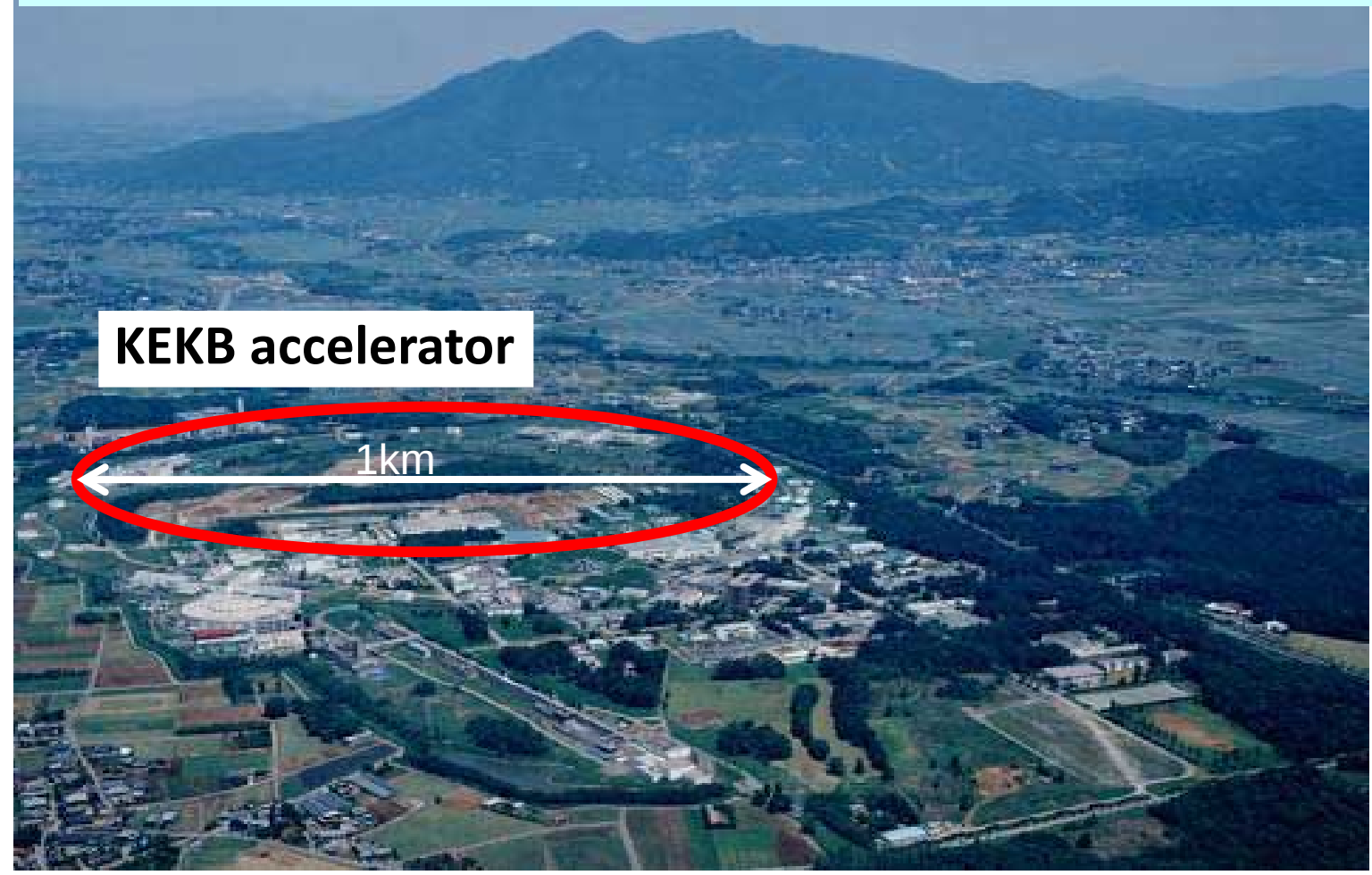


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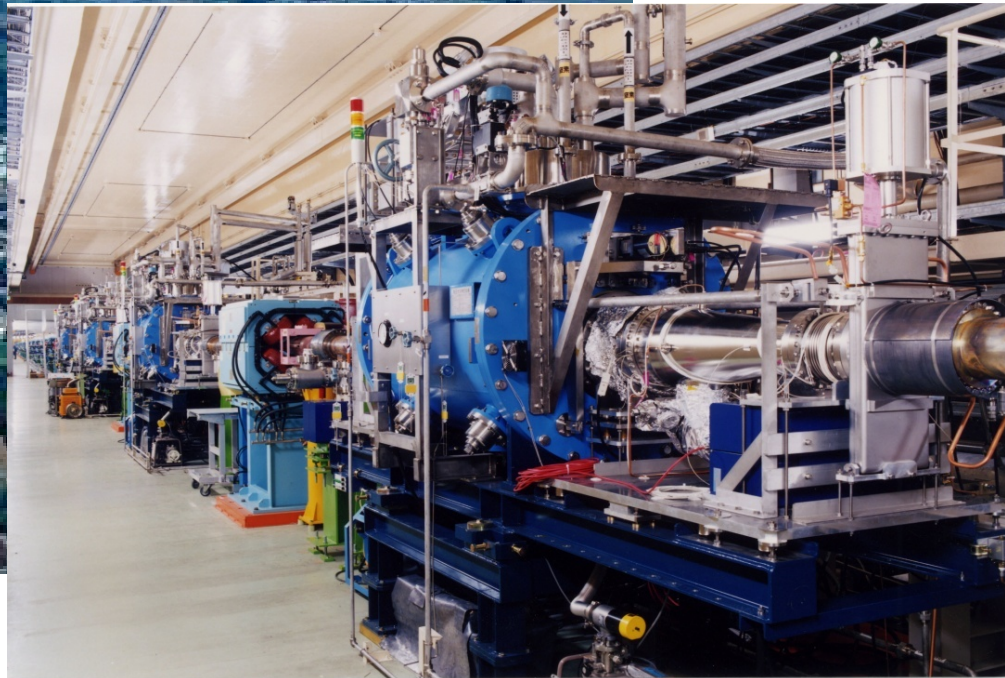


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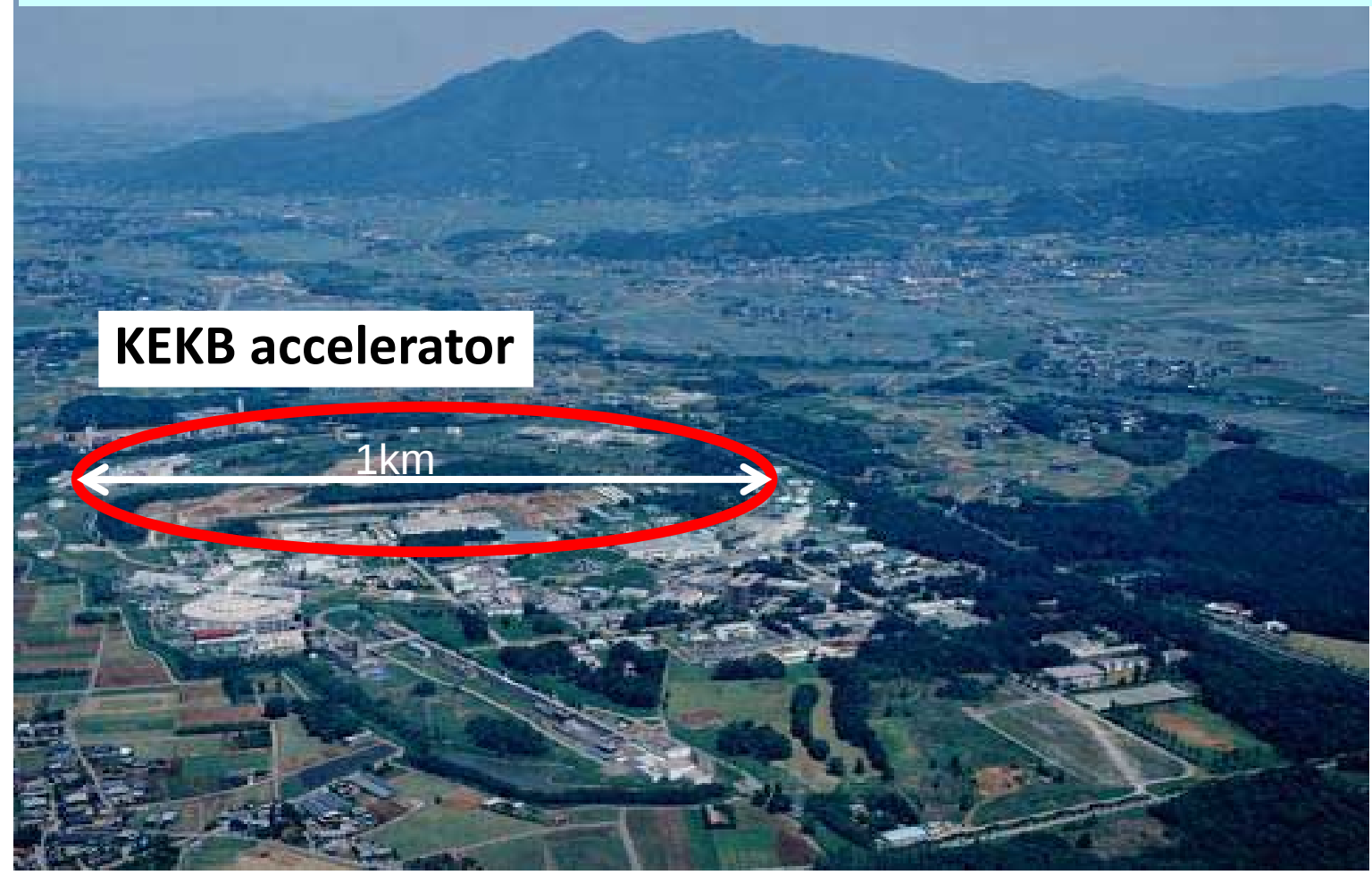


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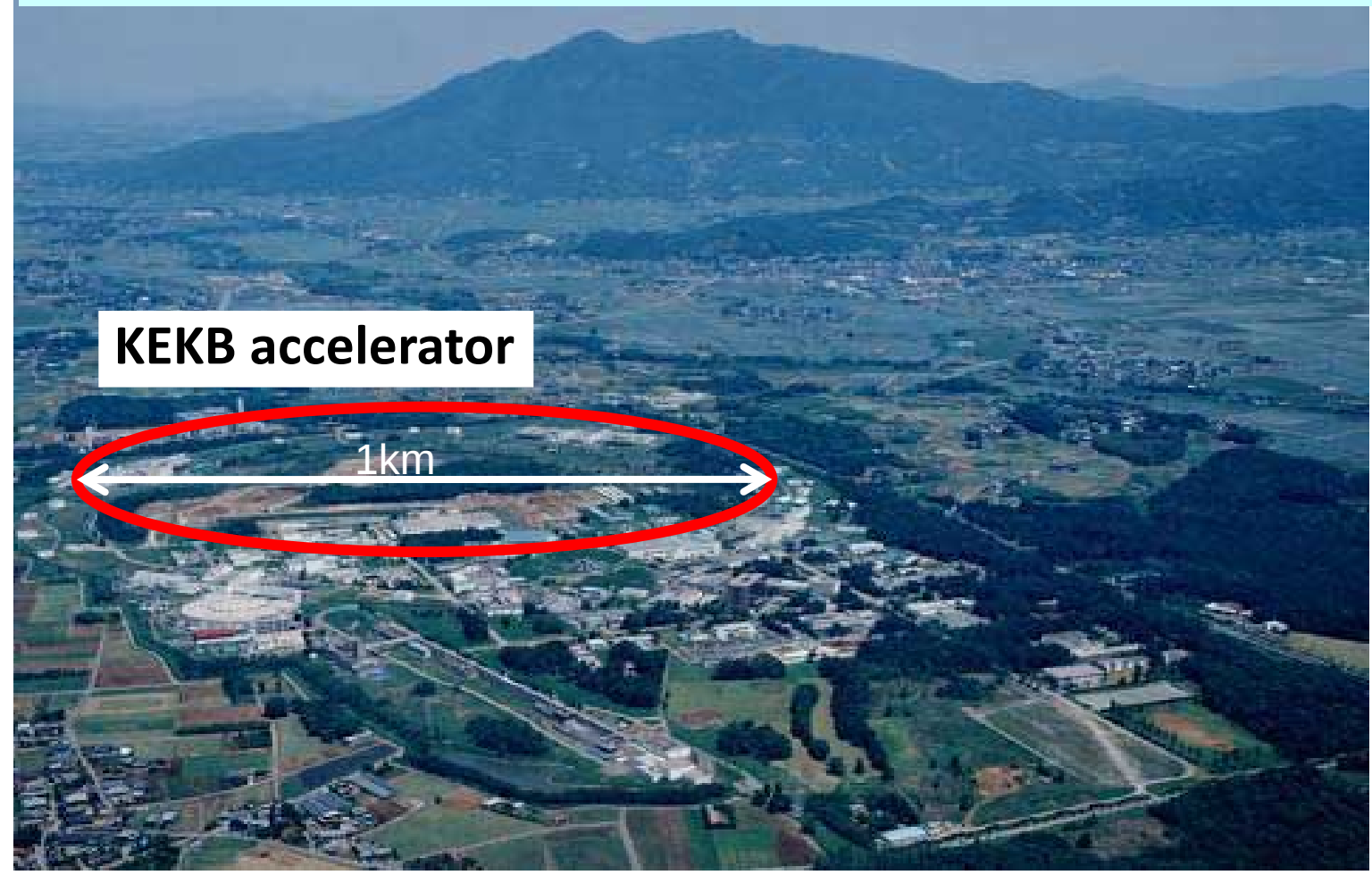


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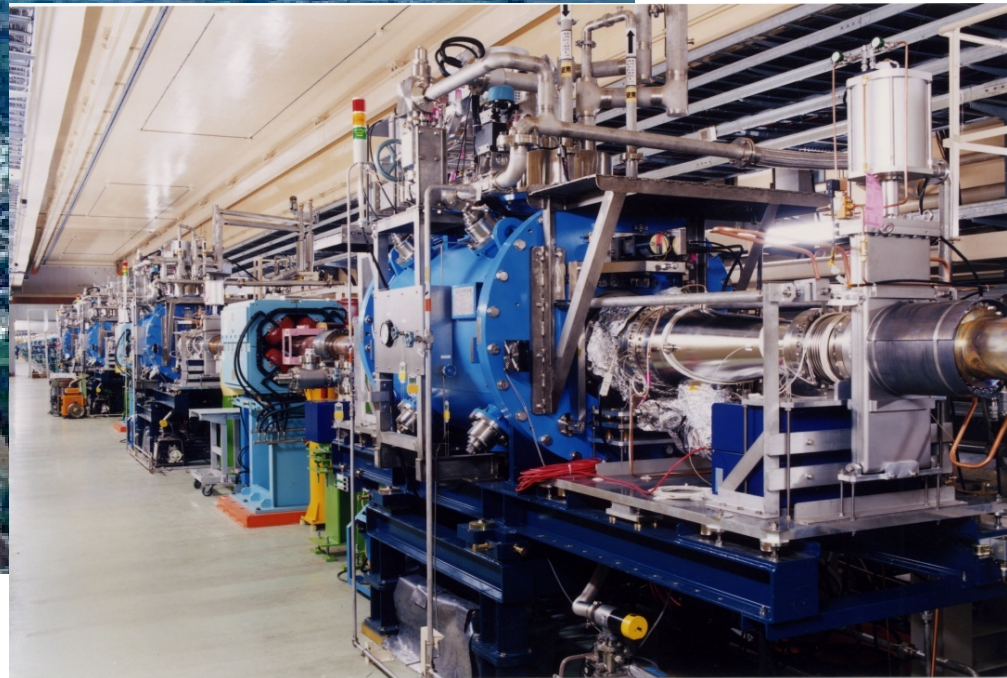


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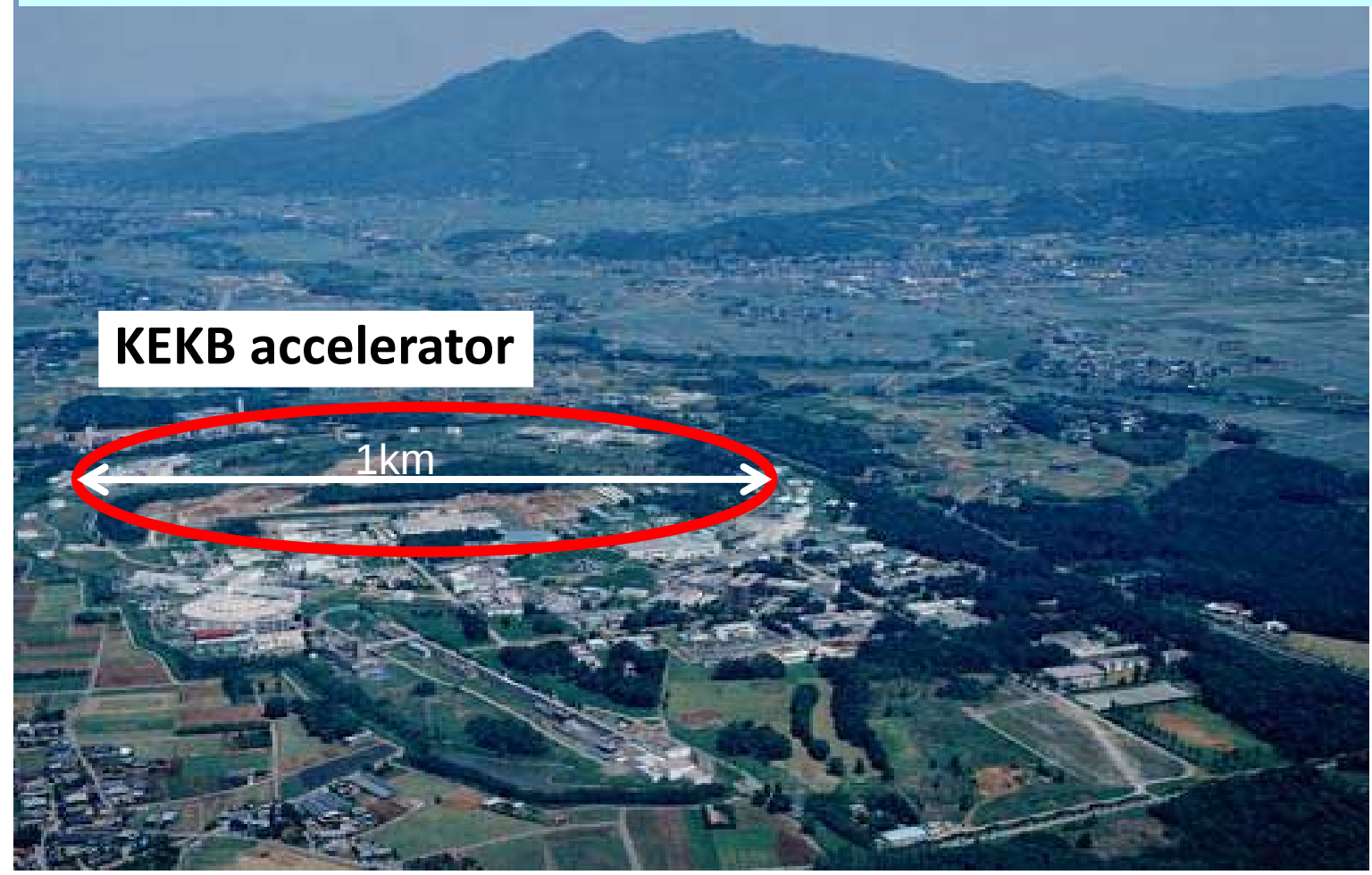


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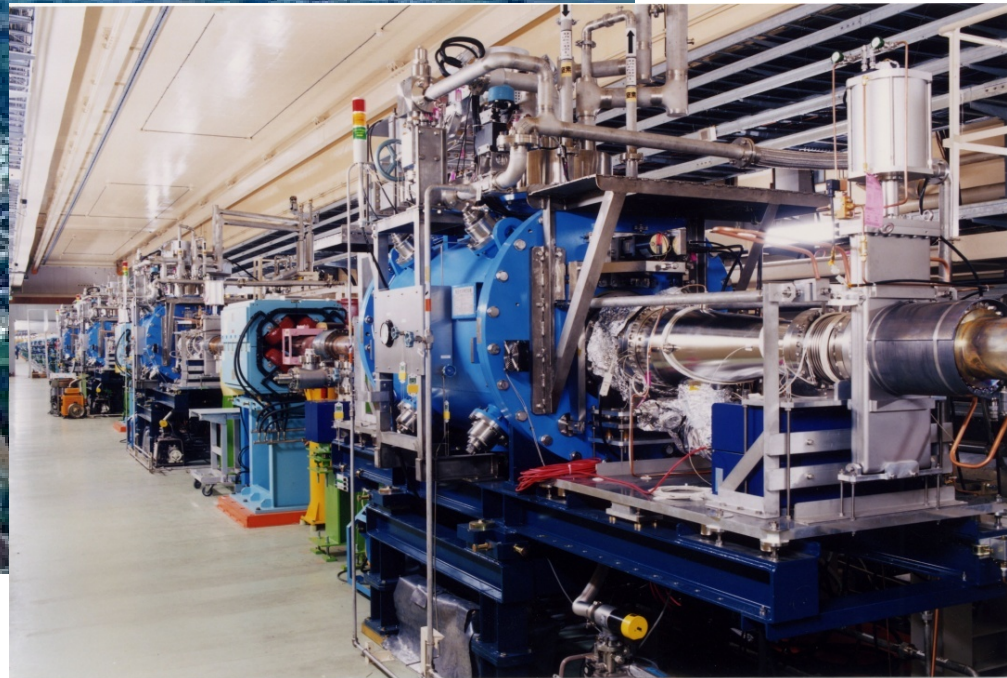


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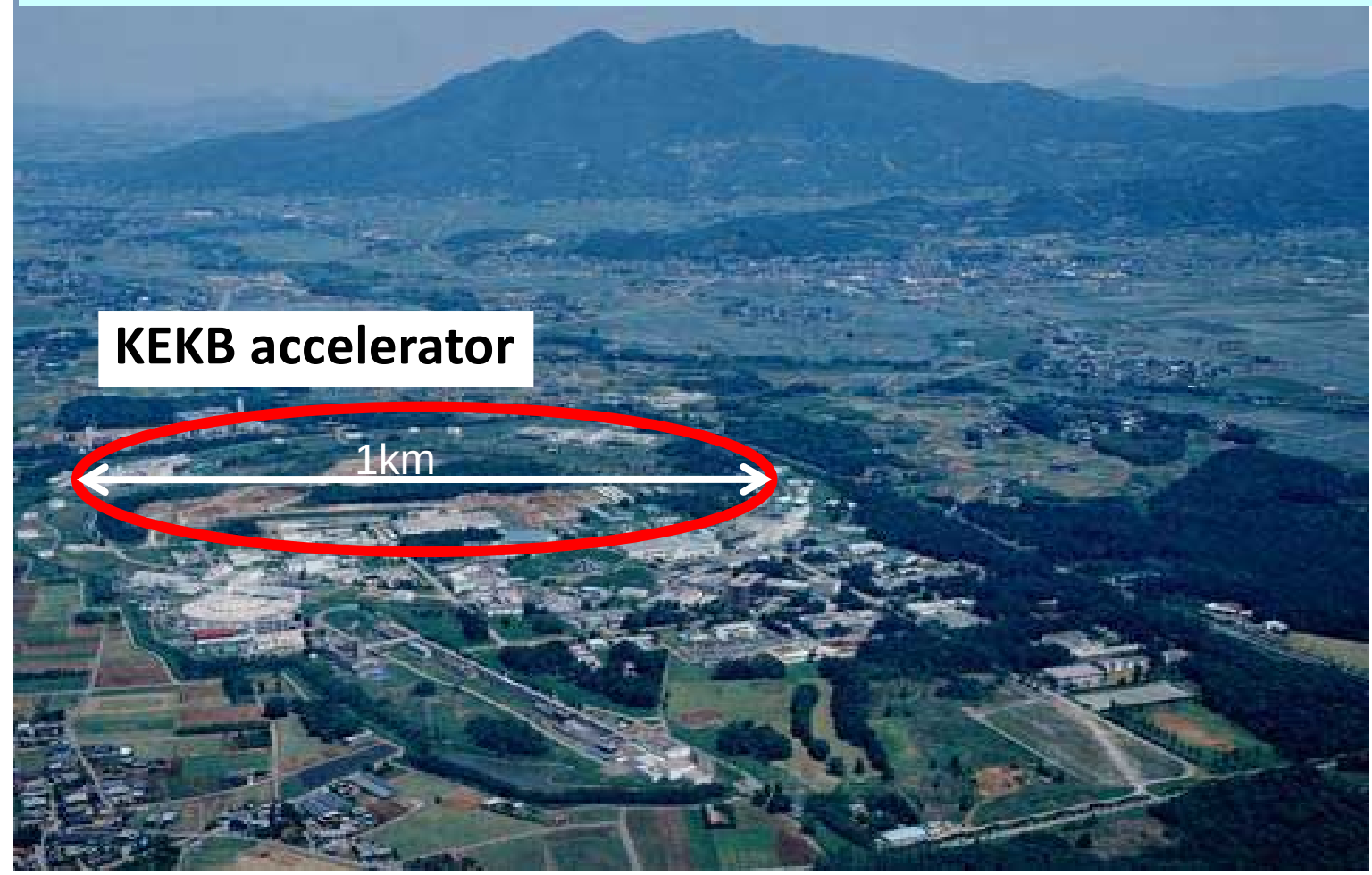


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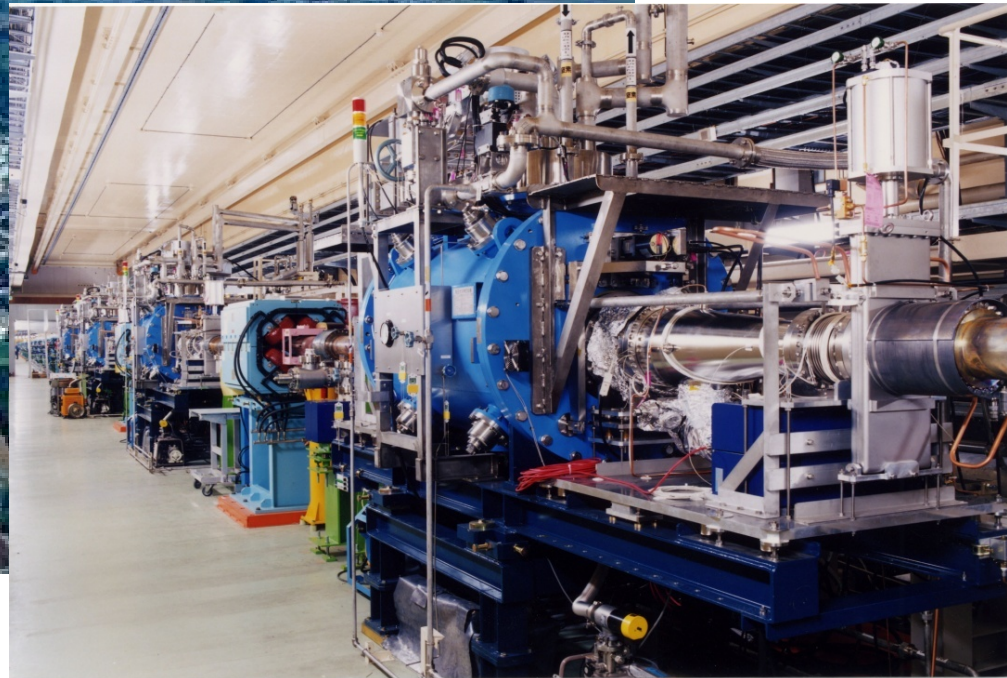


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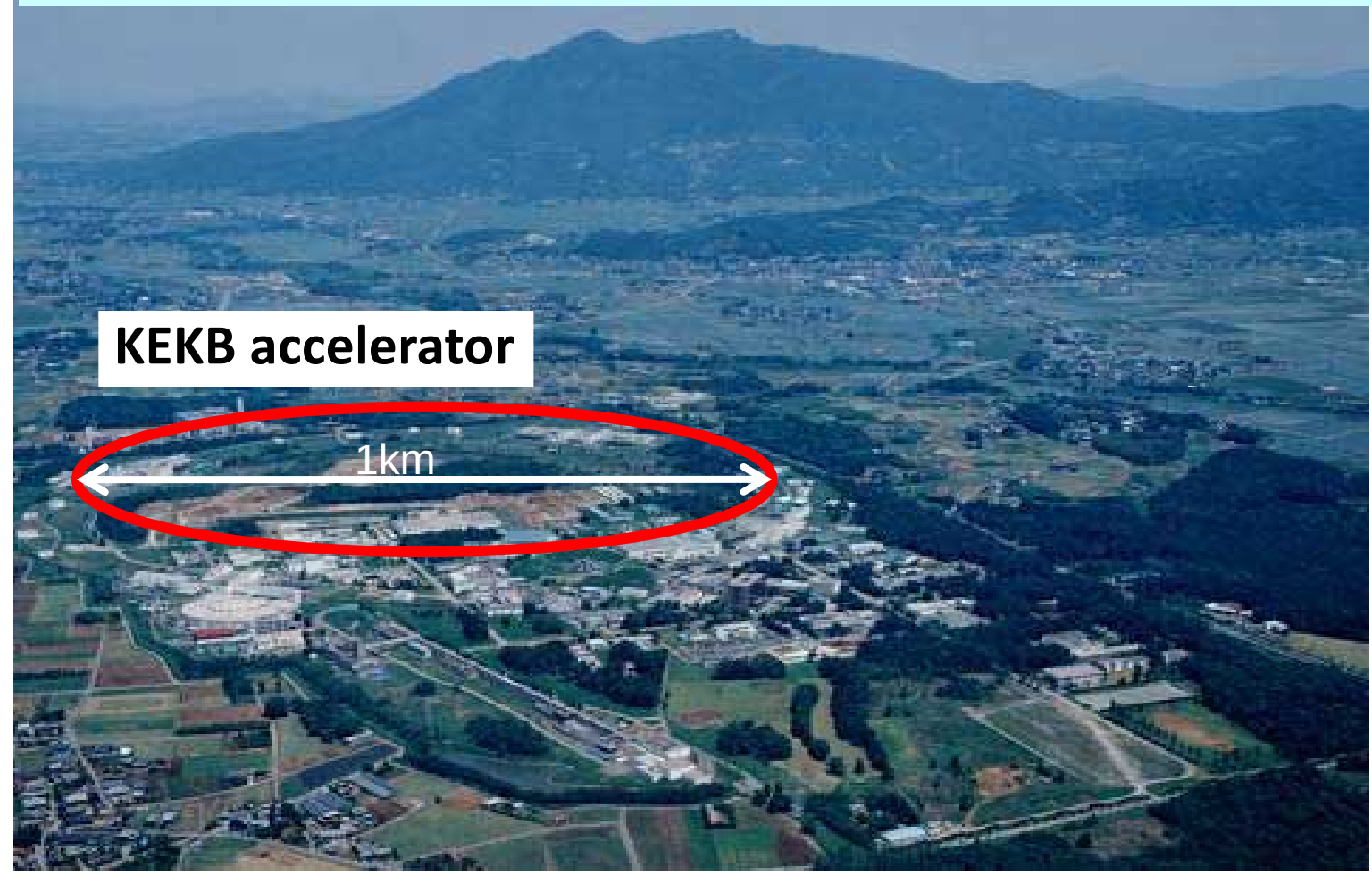


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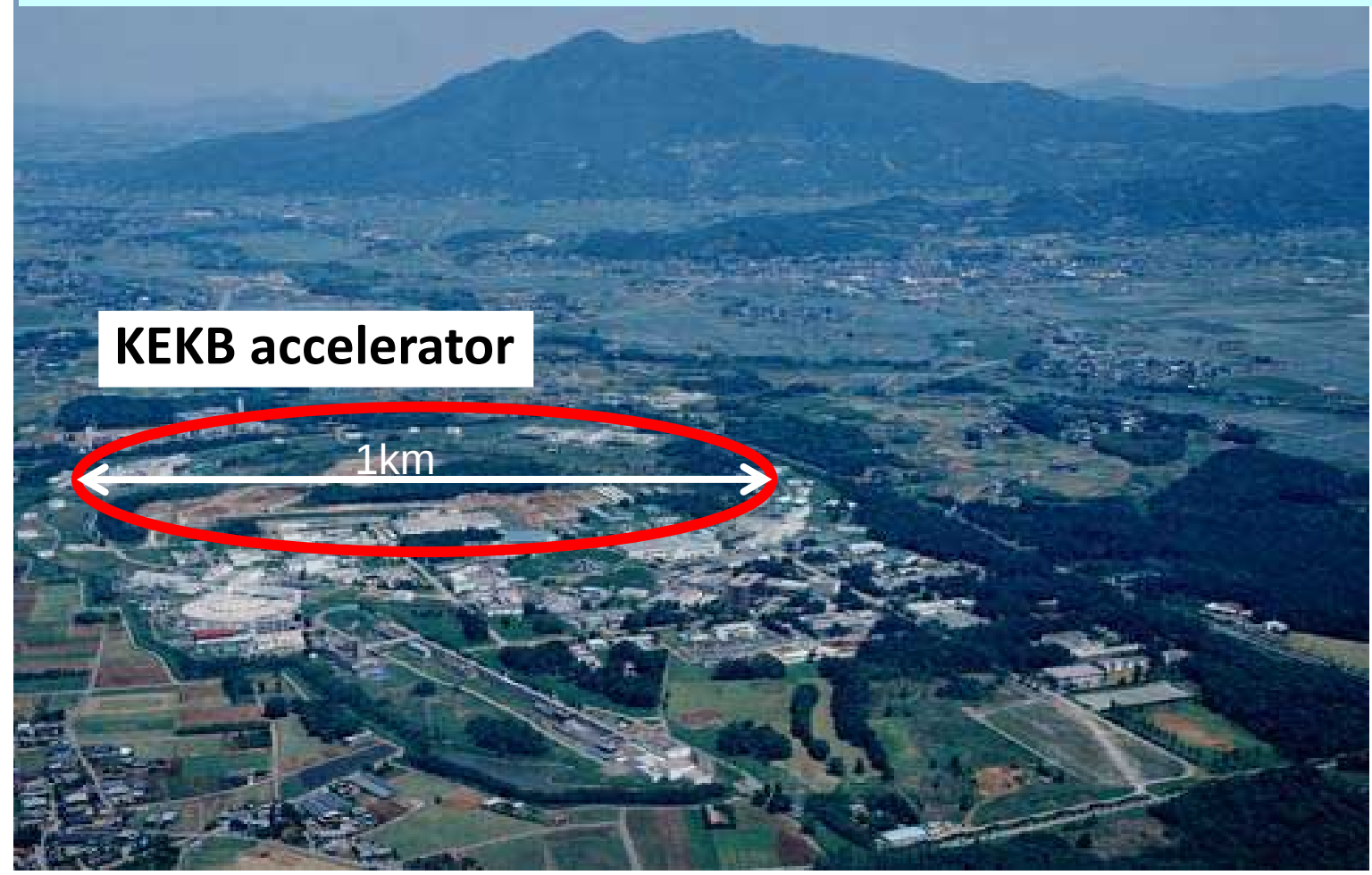
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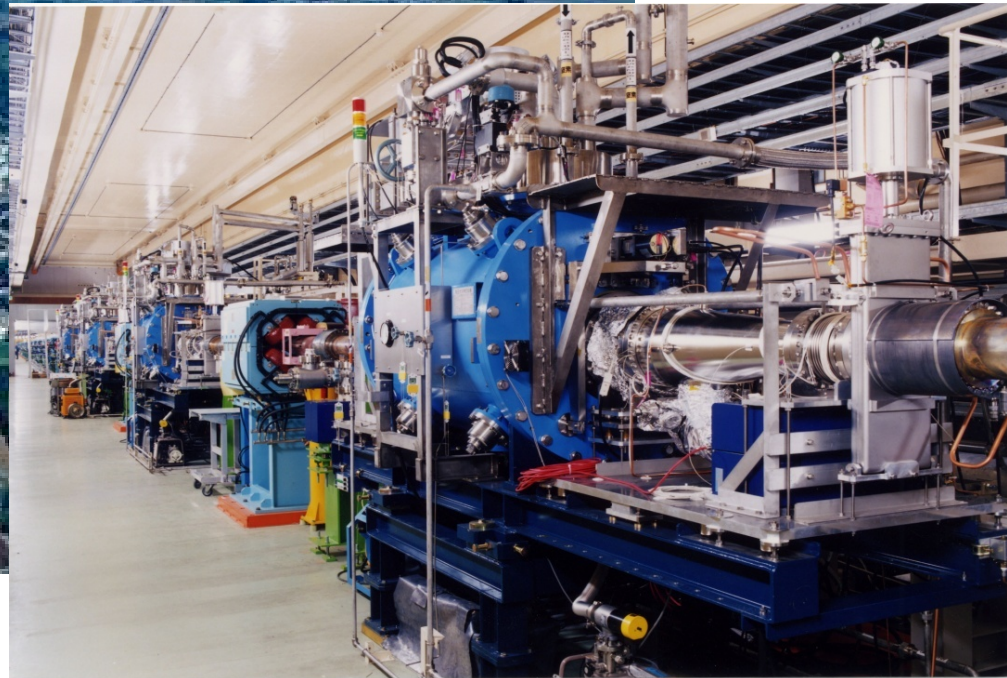


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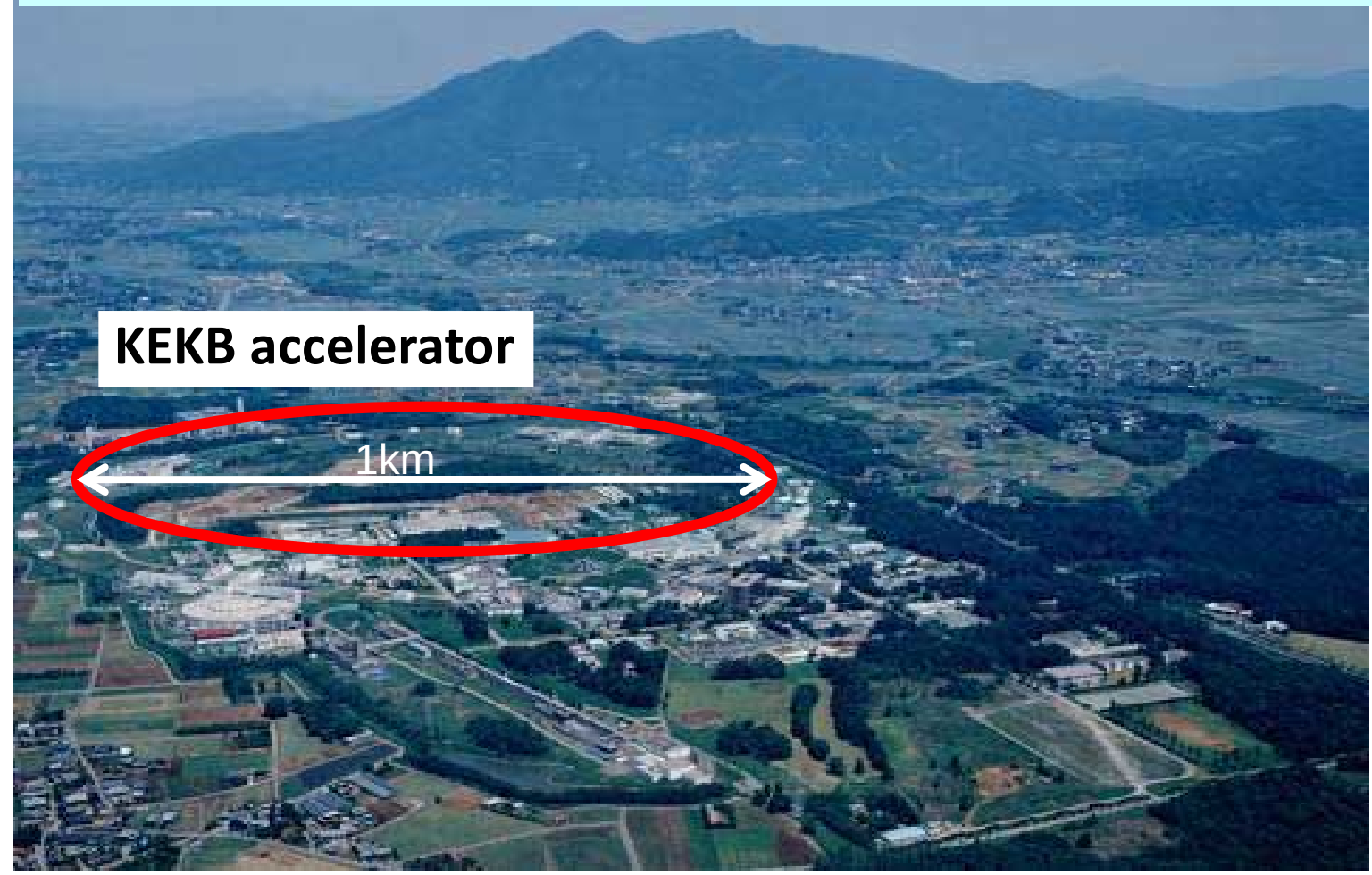


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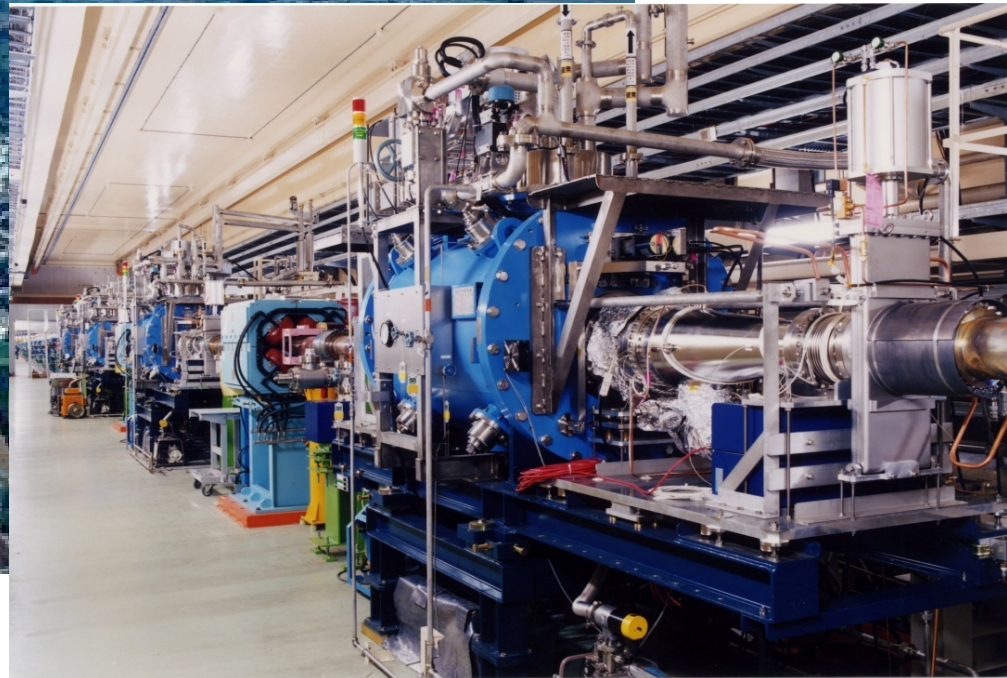


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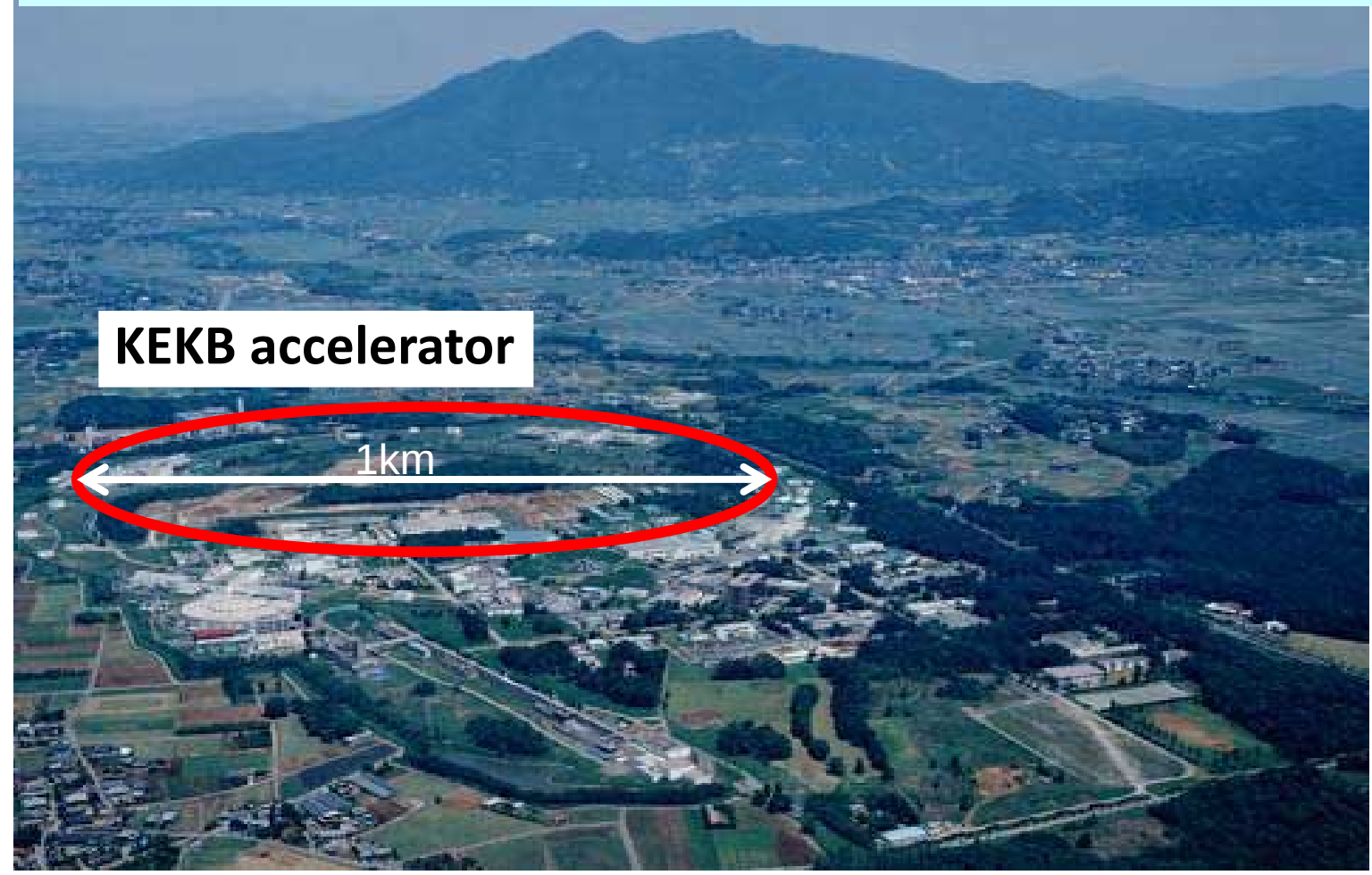


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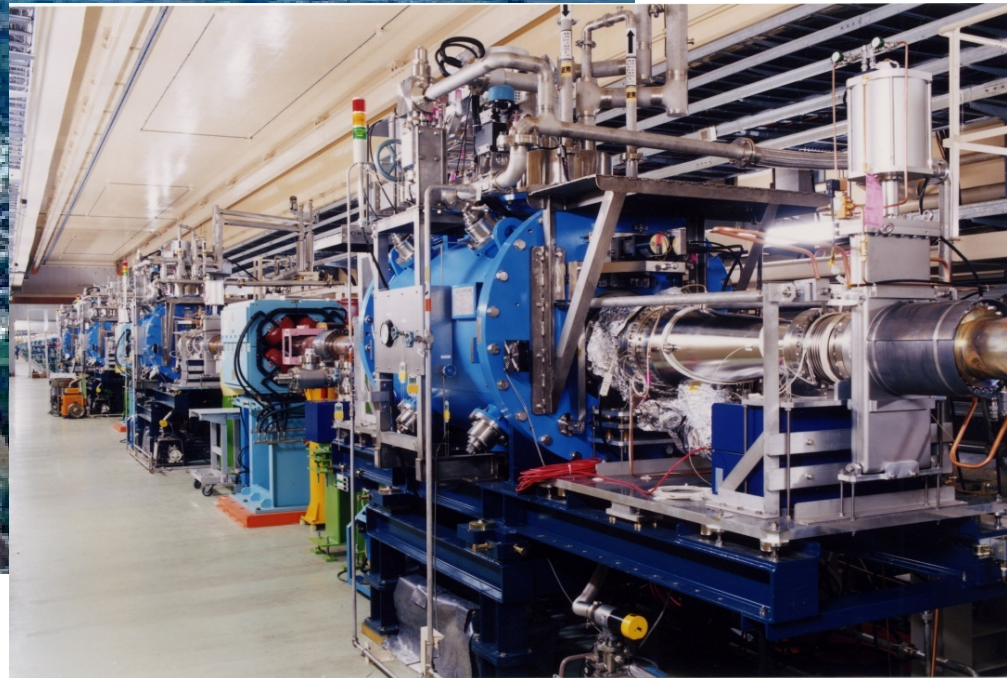


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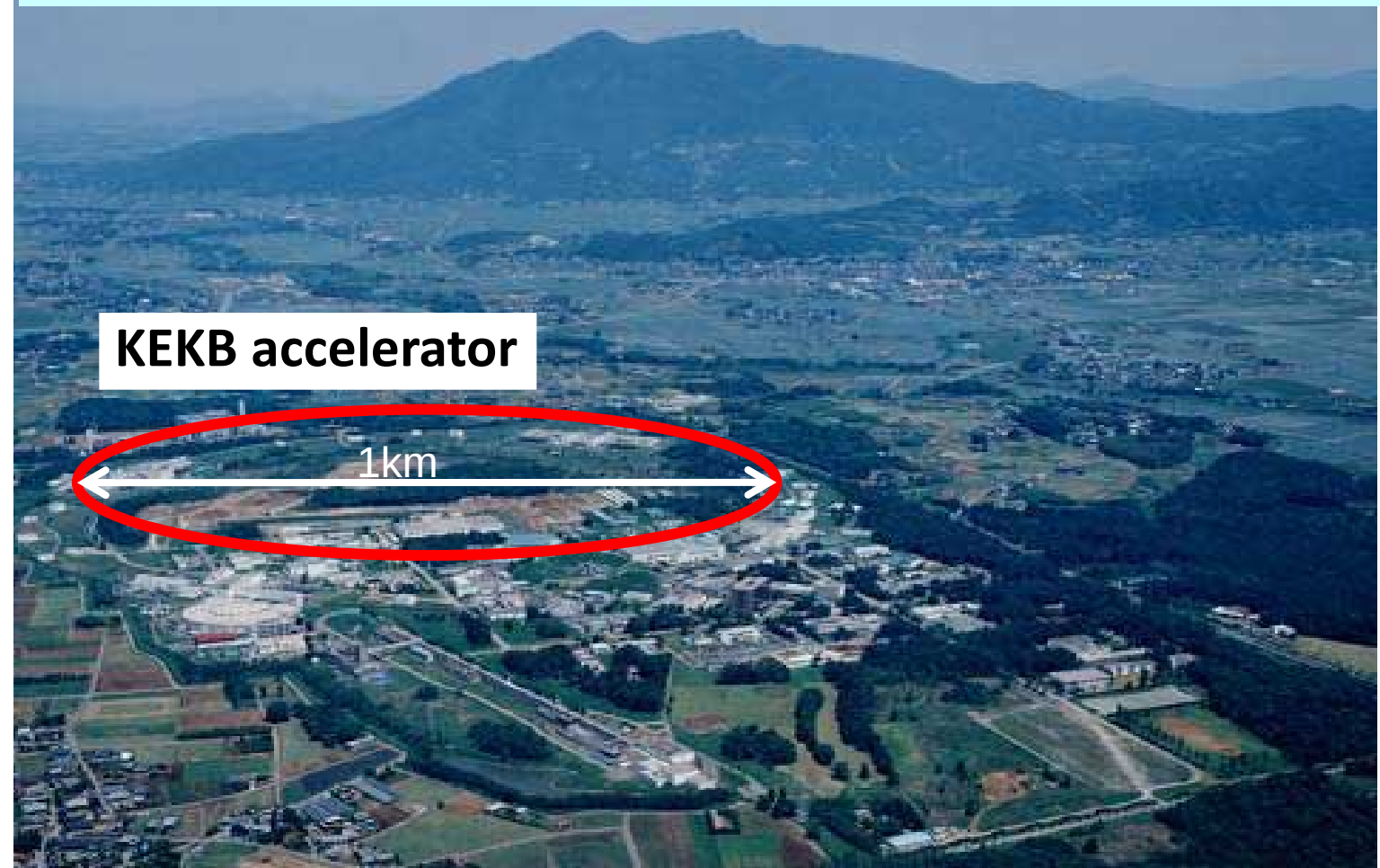


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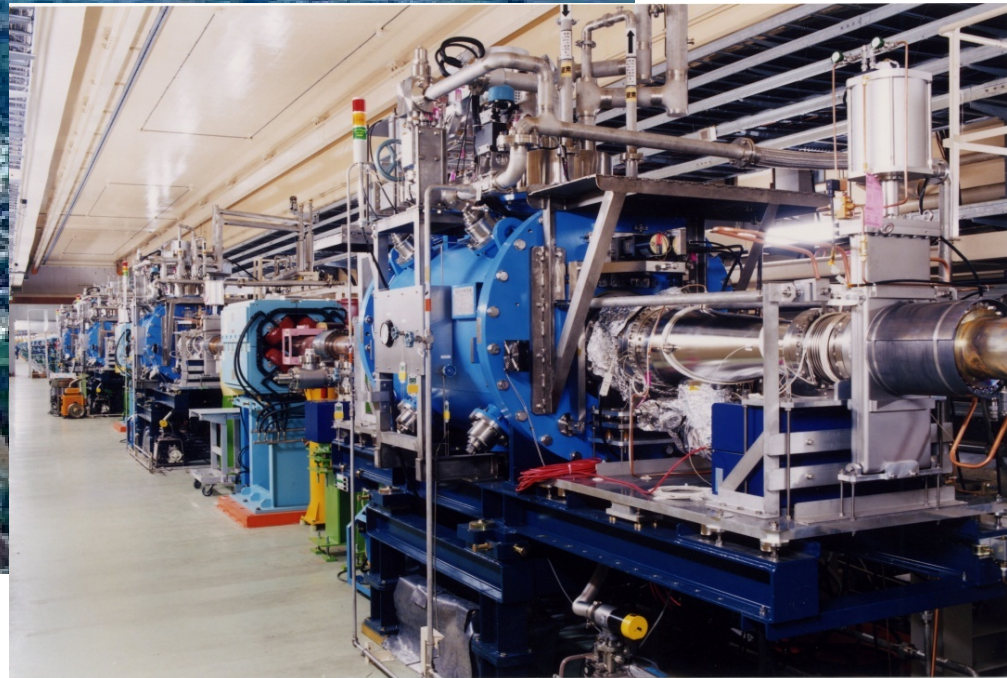


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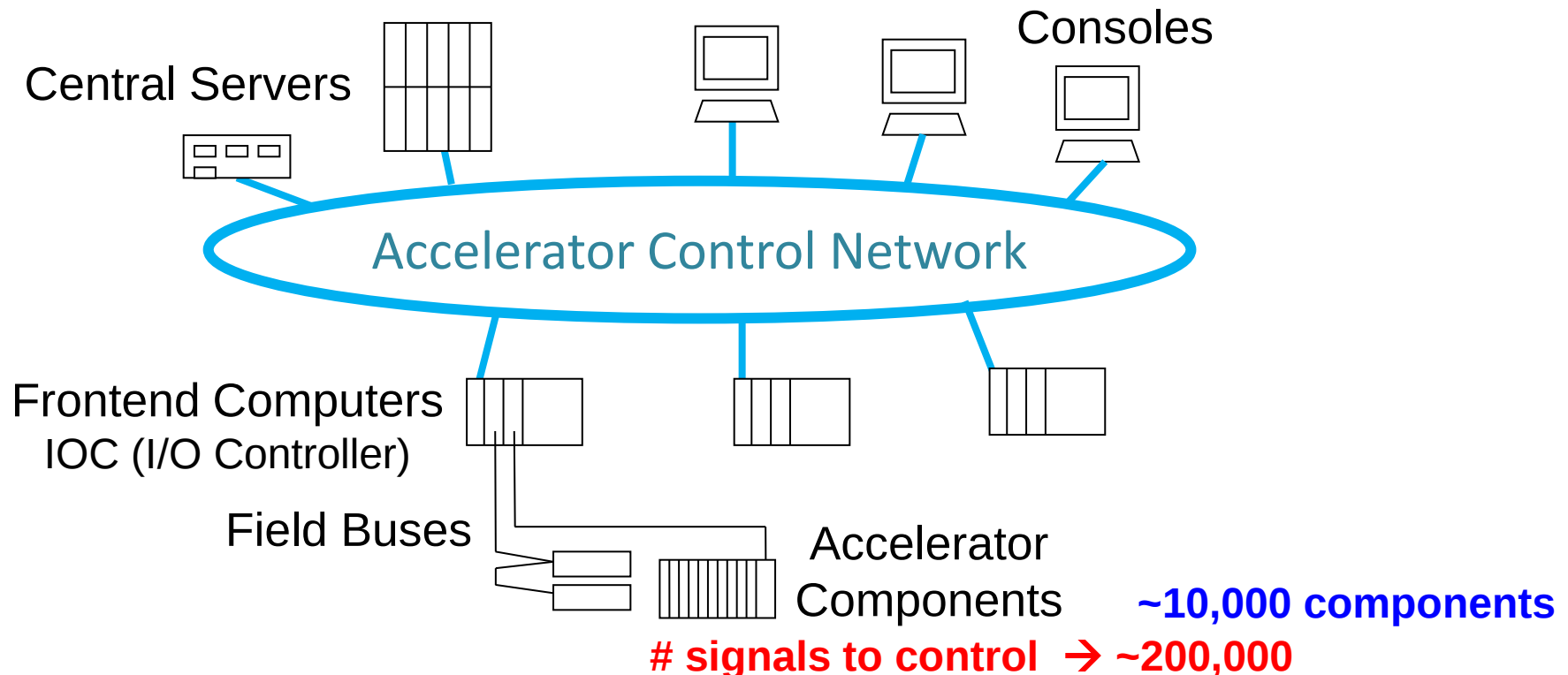
SuperKEKB Control System

- **EPICS is used as the main software to control the accelerator**

2 layer model

- **OPI (Operation Interface)** --- operation programs on central servers
- **IOC (I/O Controller)** --- equipment controls on frontend computers
- **Scripting Languages are used for the operation programs**

SAD Script/Tk Python/Tk Tcl/Tk



IOC (I/O Controller) for SuperKEKB

- VME/VxWorks IOC
- PLC/Linux IOC
 - Yokogawa FAM3 series
 - Linux running on the CPU module(F3RP61)
 - Install EPICS into the CPU module



Control the vacuum system, LLRF, beam collimators, etc.

CPU Module
F3RP61

I/O Modules

J. Odagiri et al., MOCOBAB02

- PC/Linux IOC

Field Buses

Many kinds of fieldbus in SuperKEKB

Ethernet, GP-IB, serial, VXI/MXI (for BPM), ARCNET (for magnet power supply) ...

**We have developed the
magnet power supply interface controller module (PSICM)**

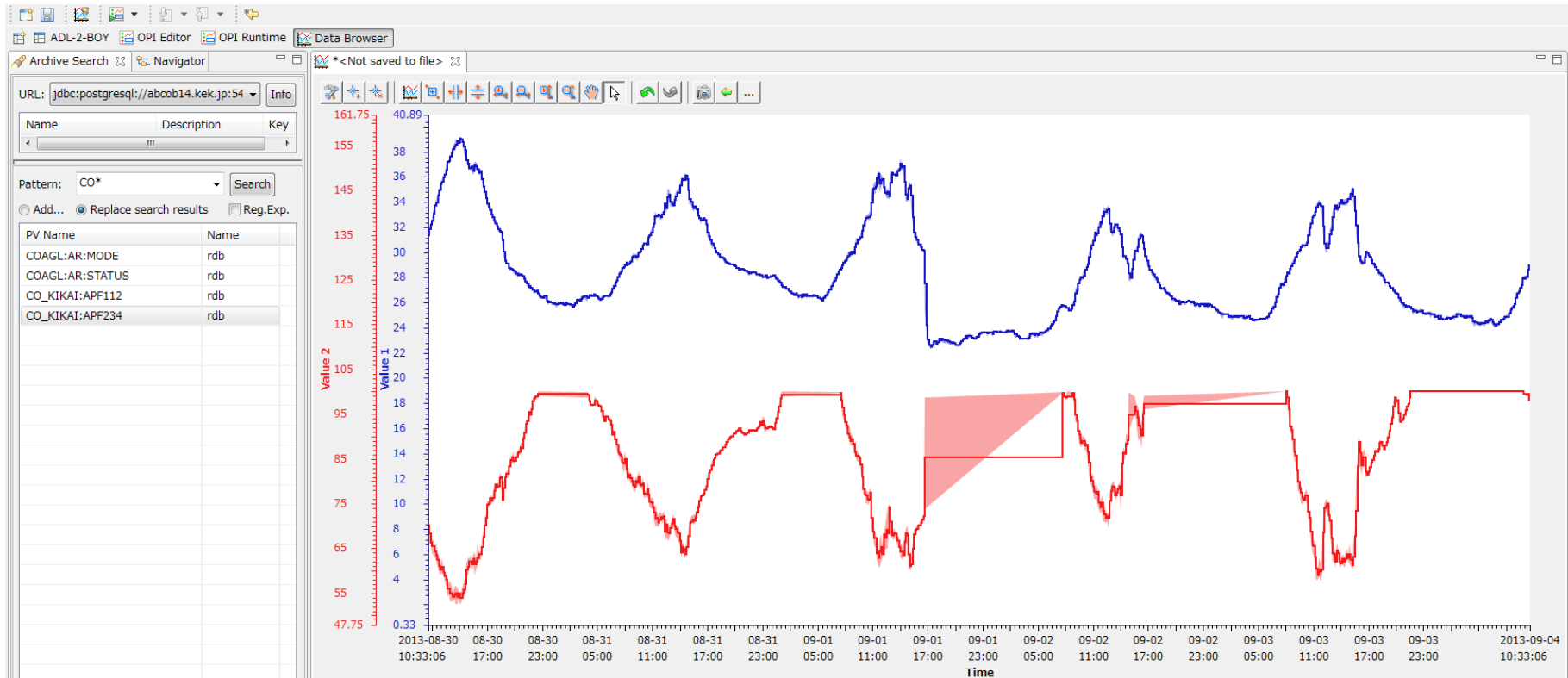
**We upgrade PSICM
for SuperKEKB**

- Faster data transfer rate
- Support 24, 20, 18-bit DAC
- Redundant timing signal input



Data Archiving System

- **KEKBlog** as a primary data archiving system (file based logging system)
- **CSS(Control System Studio)-based Archiver + PostgreSQL**
as the 2nd option data archiving system



CSS installed users PCs can be remotely access to the database
For real-time / historical / trend monitoring

SuperKEKB Control Network System

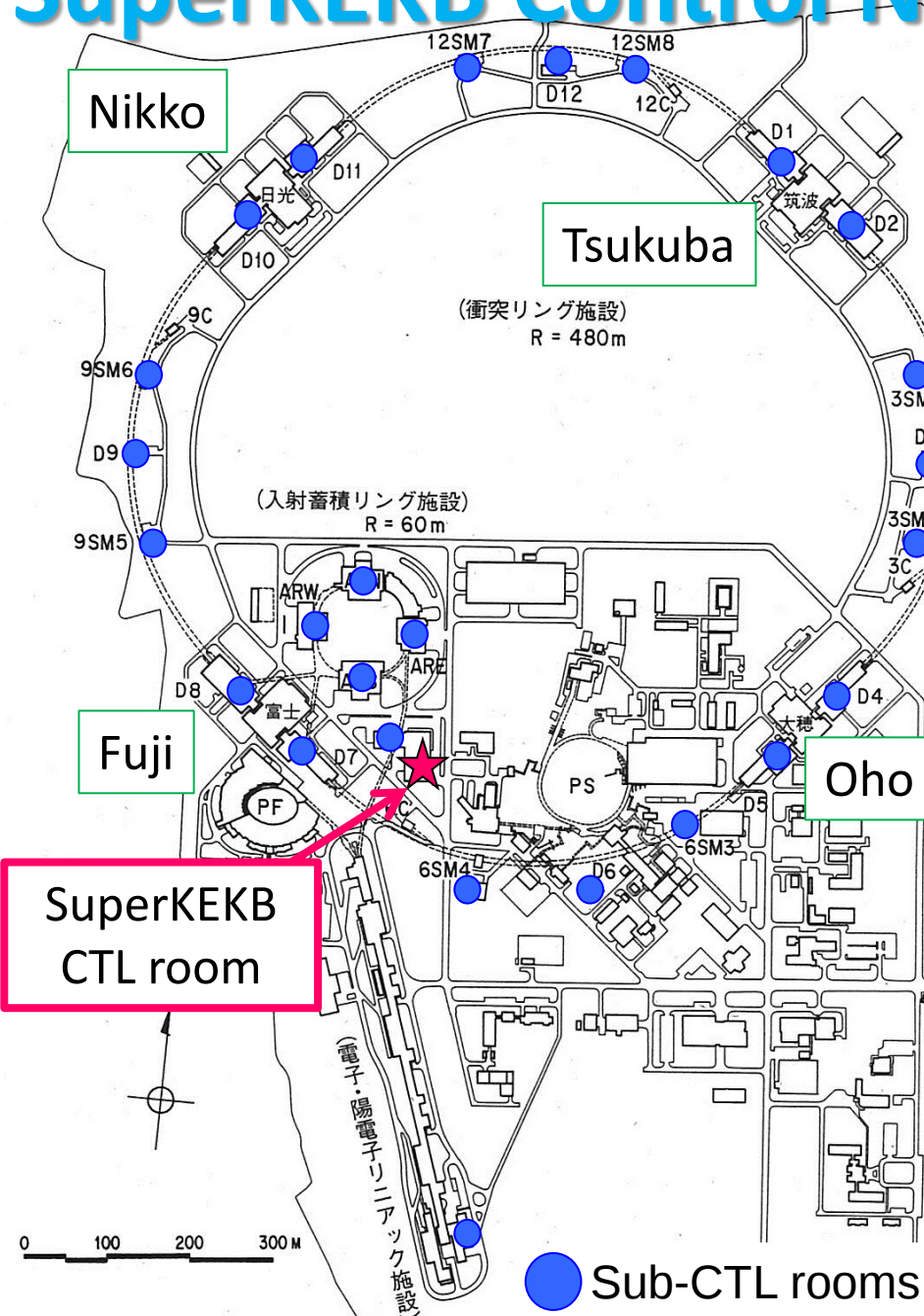
Star network topology

Main network switch is located at the SuperKEKB CTL room

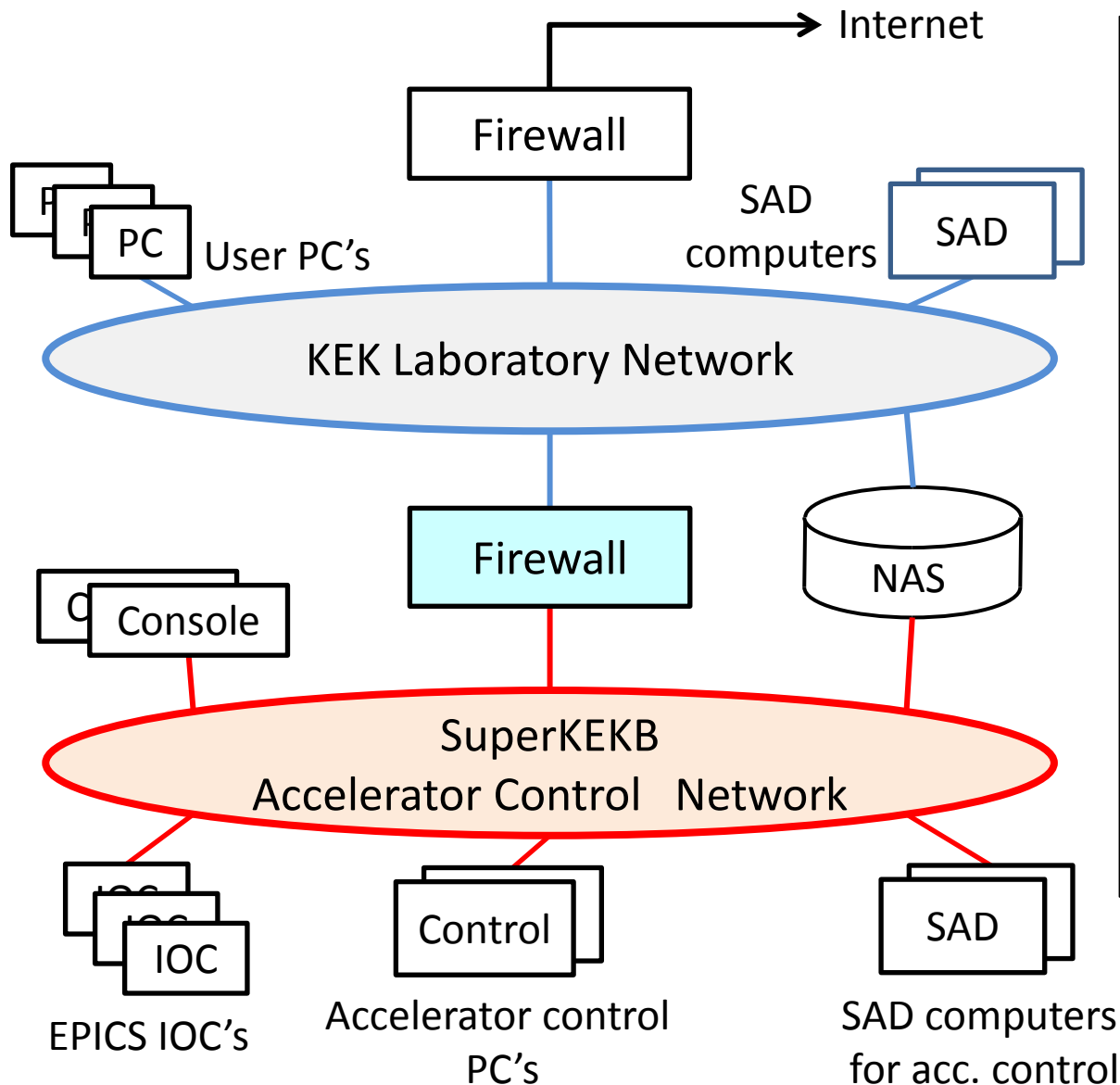
Connecting the SuperKEKB CTL room and 26 sub CTL rooms, where network switches are located.

Upgrade in Progress

- 10GbE/1GbE switches
- Additional optical cables for the redundant network configuration
- New network configuration
- Wireless LAN installation into the whole SuperKEKB accelerator area



New Network Configuration



**New configuration
from this summer**

All computers in the
acc. control network
don't directly connect
to the
KEK laboratory network

→ **Enhance the security**

Wireless LAN system into the beamline

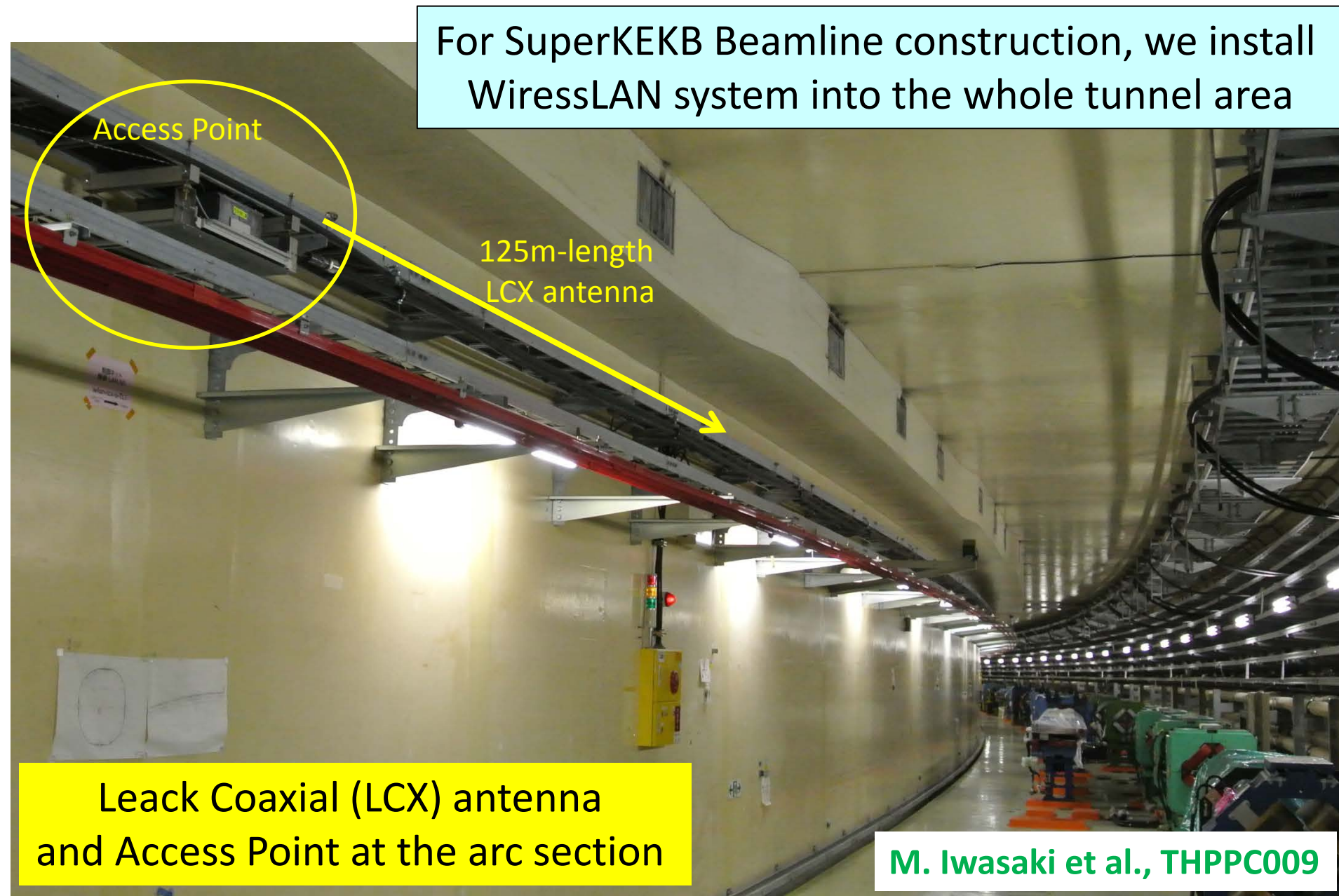
For SuperKEKB Beamline construction, we install WiressLAN system into the whole tunnel area

Access Point

125m-length
LCX antenna

Leack Coaxial (LCX) antenna
and Access Point at the arc section

M. Iwasaki et al., THPPC009

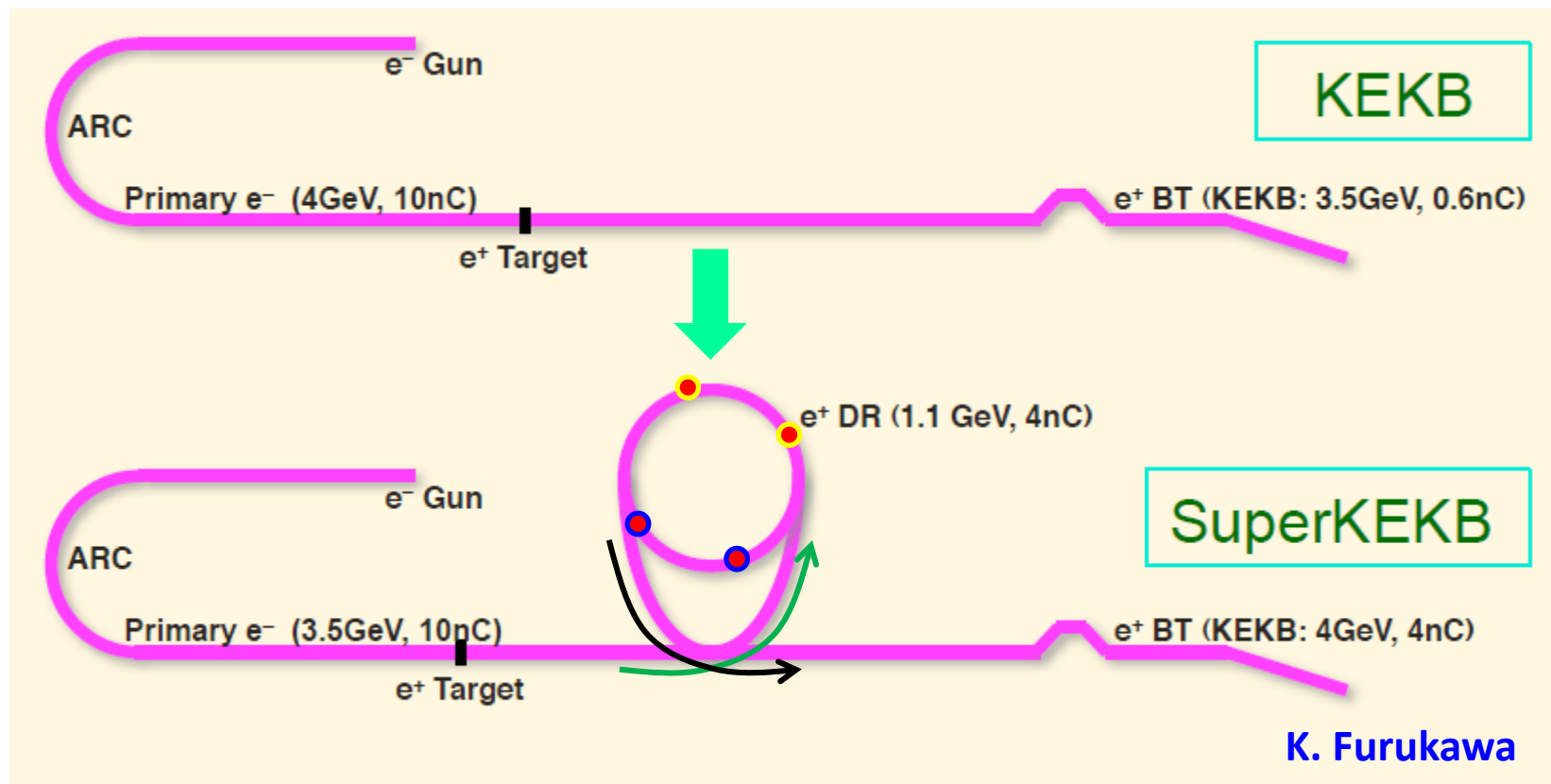


Timing System for positron injection

In SuperKEKB, we construct the positron Damping Ring

→ Positron injection timing scheme become complicated

To account for DR, new timing system for e^+ injection is required

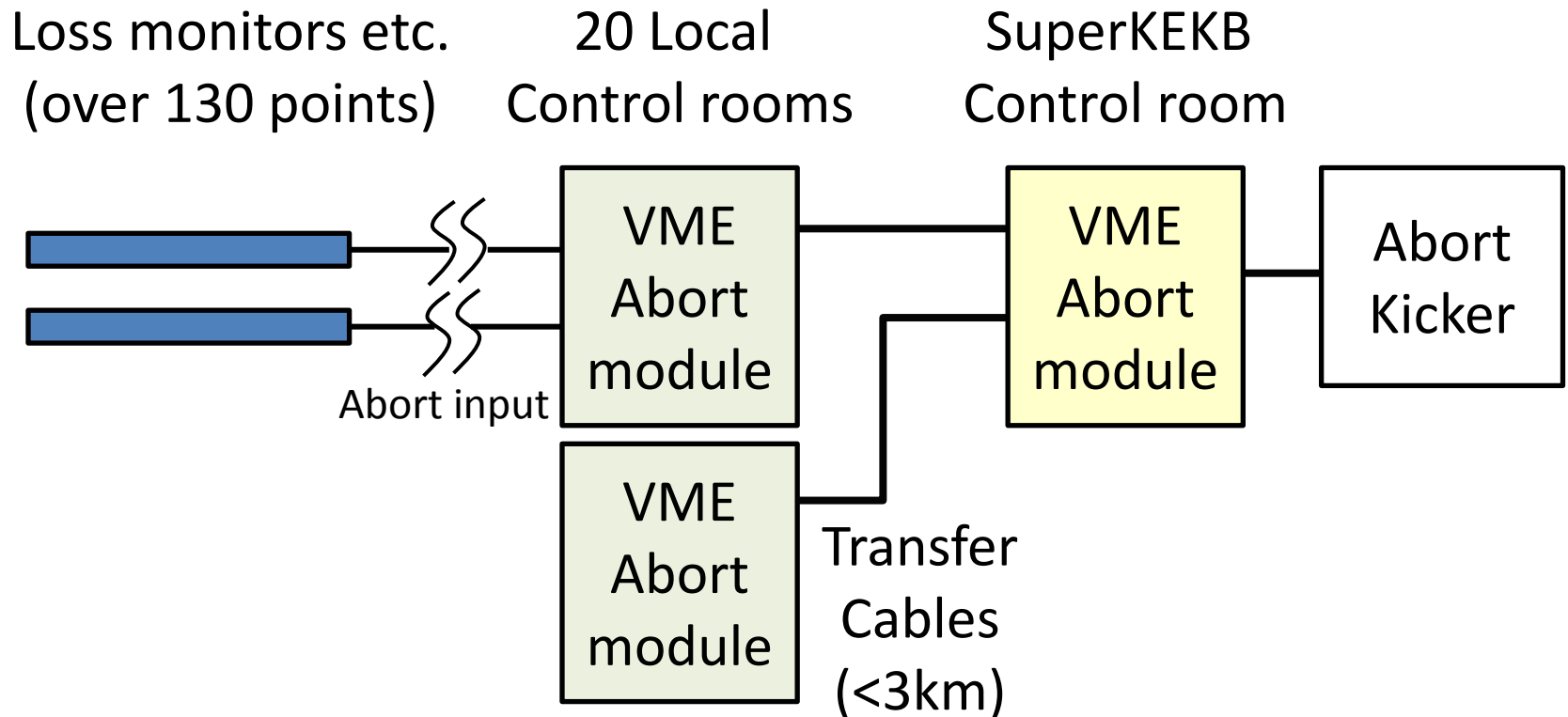


H. Kaji et al., THCOCA04

K.Furukawa et al., FRCOBAB04

Beam Abort System

We have developed the faster response Beam Abort System for SuperKEKB
E/O conversion, optical cable to transfer the signal, remove low-pass filters
→ Response time improved from 100 μ s to 20 μ s



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T. Naito, A. Akiyama

Renovation of the computing room

Before the renovation



Renovation of the computing room



This summer, we removed old server racks, old panel board cabinets, power and signal cables.

Renovation of the computing room

Now under installation of the server racks



Summary

**Upgrade of the accelerator control system
for SuperKEKB is in progress**

Currently preparing for the 1st SuperKEKB operation in 2015 January

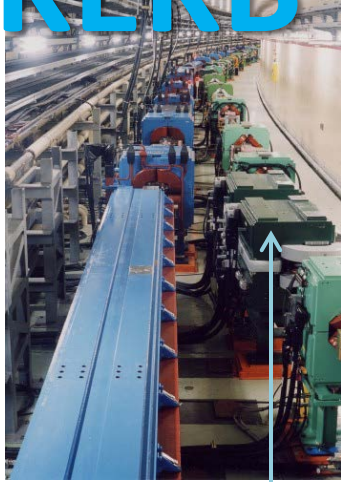
**Please also see the details of the accelerator control system upgrade
in the following presentations/posters**

J. Odagiri et al., MOCOBAB02,
“Integration of PLC with EPICS IOC for SuperKEKB Control System”
T. T. Nakamura et al., TUPPC089,
“Upgrade of the Power Supply Interface Controller Module for SuperKEKB”
H. Kaji et al., THCOCA04,
“Upgrade of Event Timing System at SuperKEKB”
M. Iwasaki et al., THPPC009,
“Design and Status of the SuperKEKB Accelerator Control Network System”
K. Furukawa et al., FRCOBAB04
“Beam Feedback System Challenges at SuperKEKB Injector Linac”

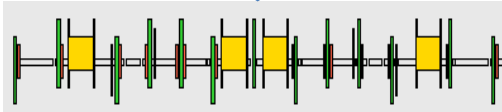
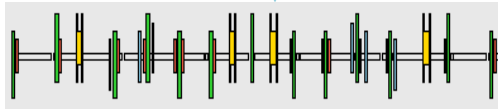
Back Up

KEKB to SuperKEKB

How to upgrade

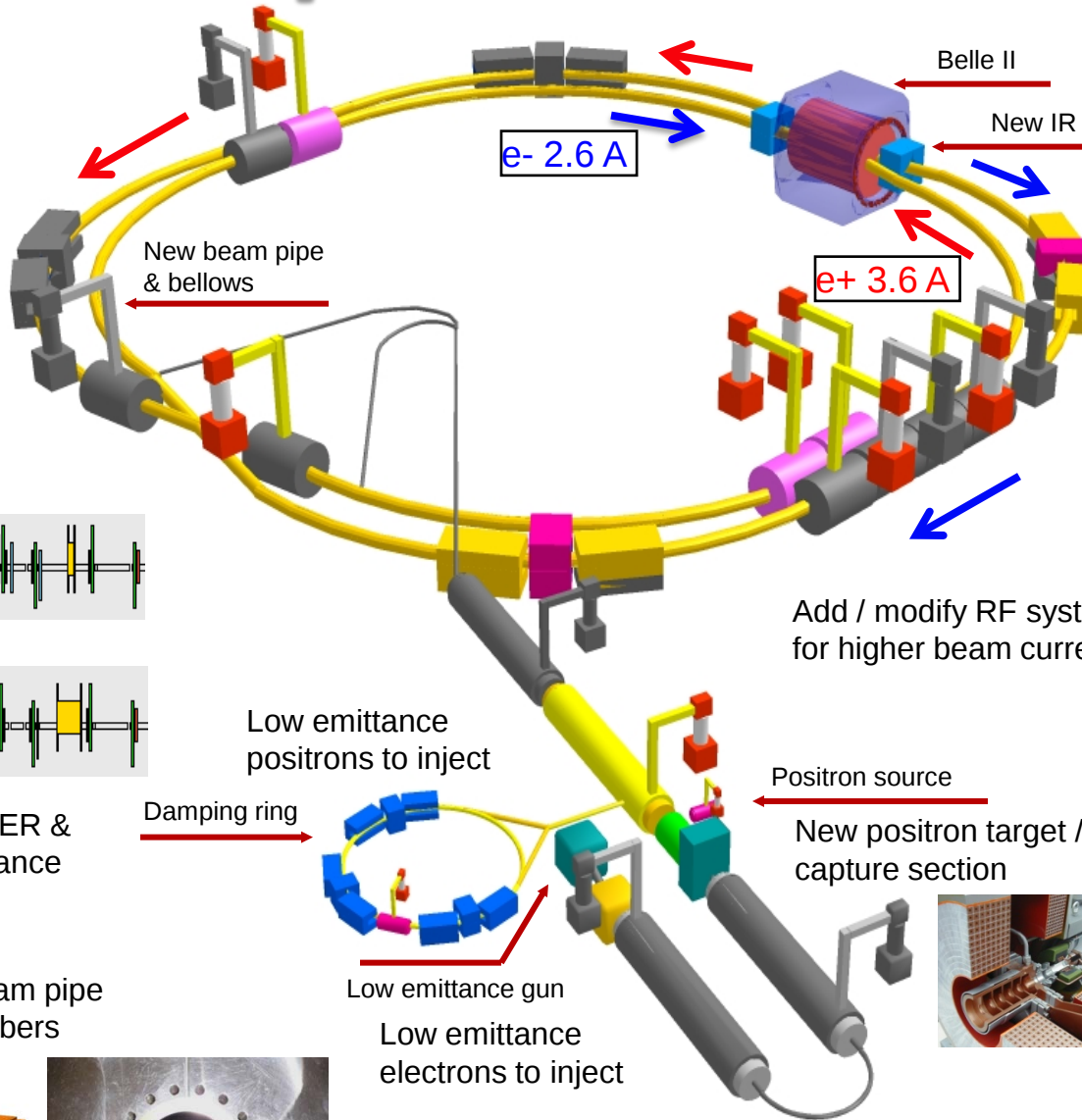
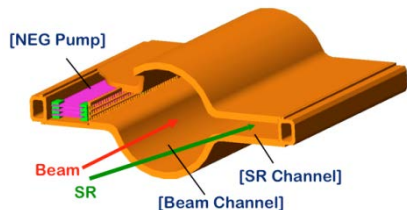


Replace short dipoles with longer ones (LER)

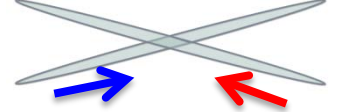


Redesign the lattices of HER & LER to squeeze the emittance

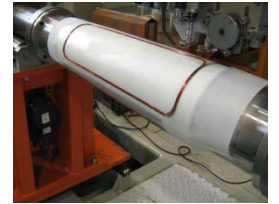
TiN-coated beam pipe with antechambers



Colliding bunches

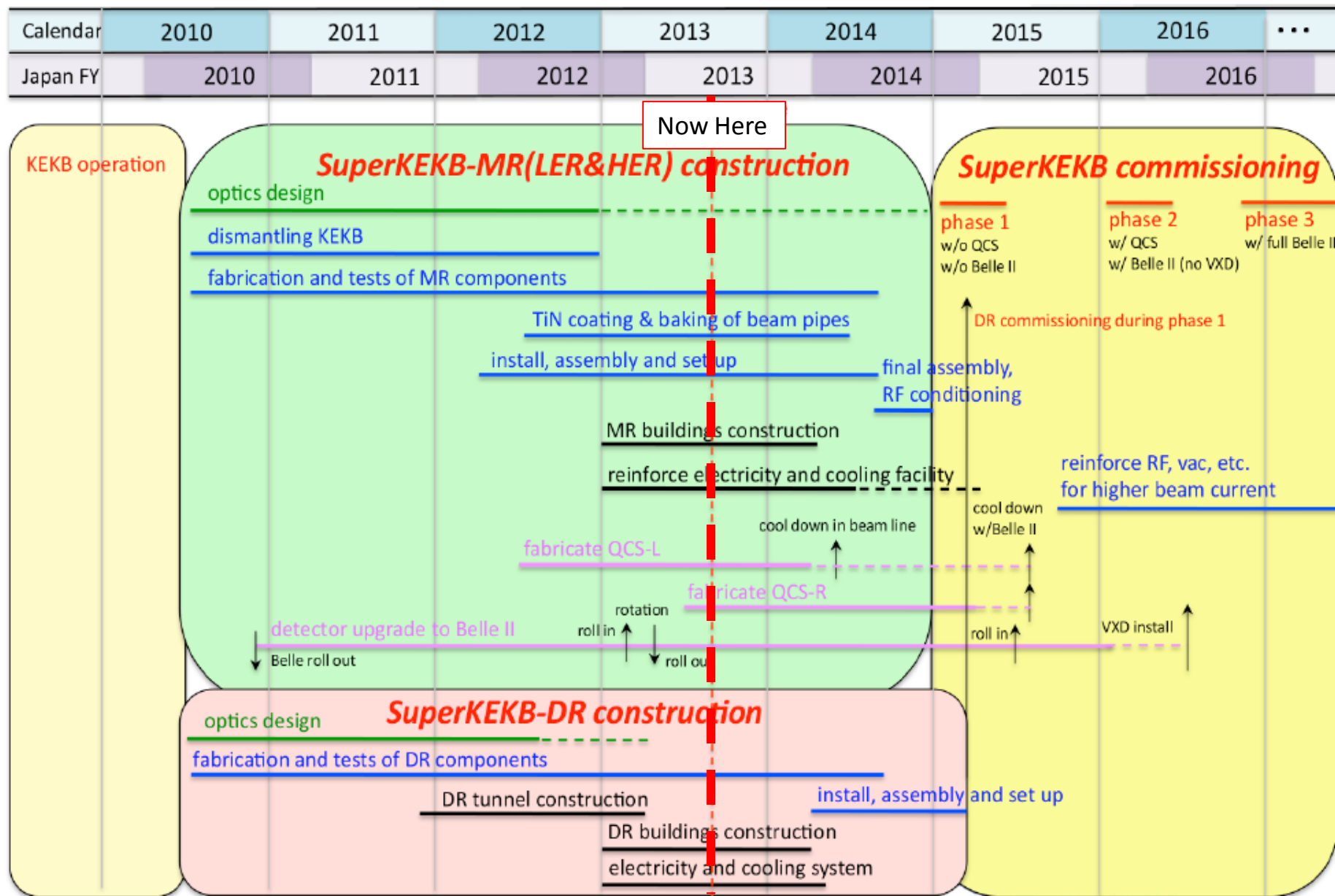


New superconducting / permanent final focusing quads near the IP



To get x40 higher luminosity

SuperKEKB Schedule



Event Timing System at SuperKEKB

The Event Timing System is configured mainly with ...

- VME-EVG-230
- VME-EVR-230RF

Two layers of EVGs are configured at Main Trigger Station.

Local devices along with Linac beam line are controlled by EVRs.

The SINAP modules will be installed at Damping Ring.

