

# Design and Status of the SuperKEKB Accelerator Control System

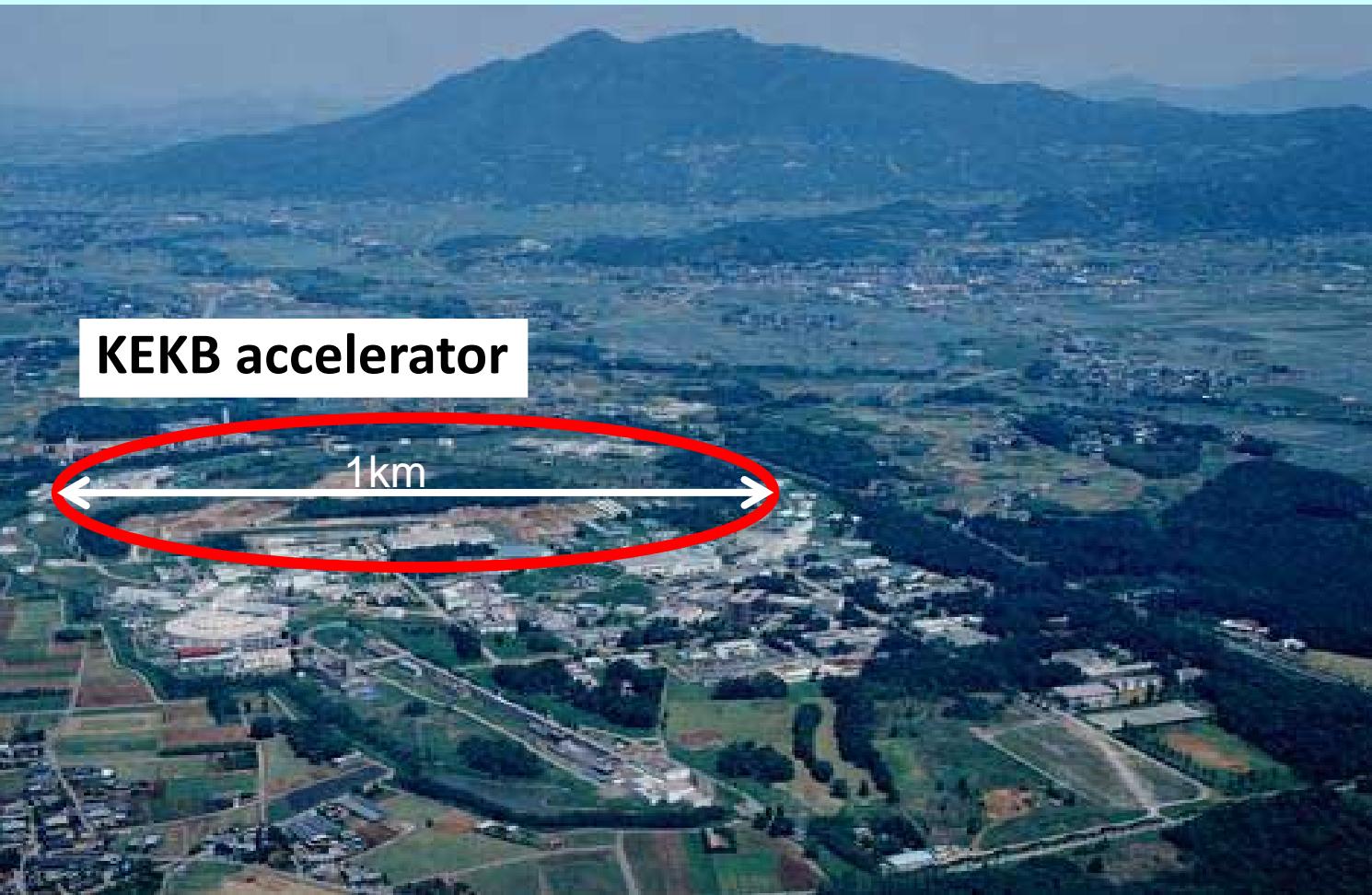
*M. Iwasaki (KEK)*

*for the SuperKEKB accelerator control group*



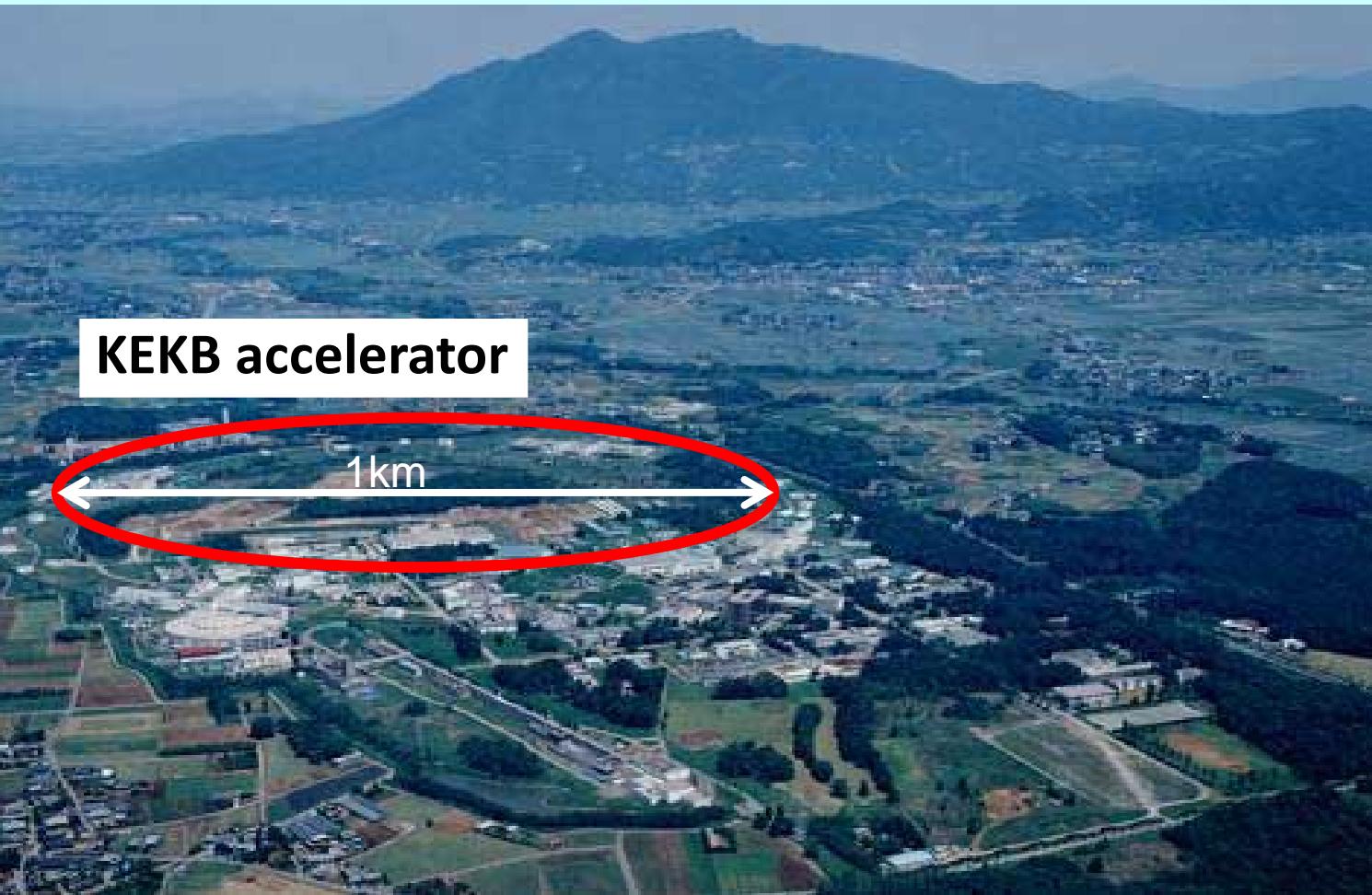
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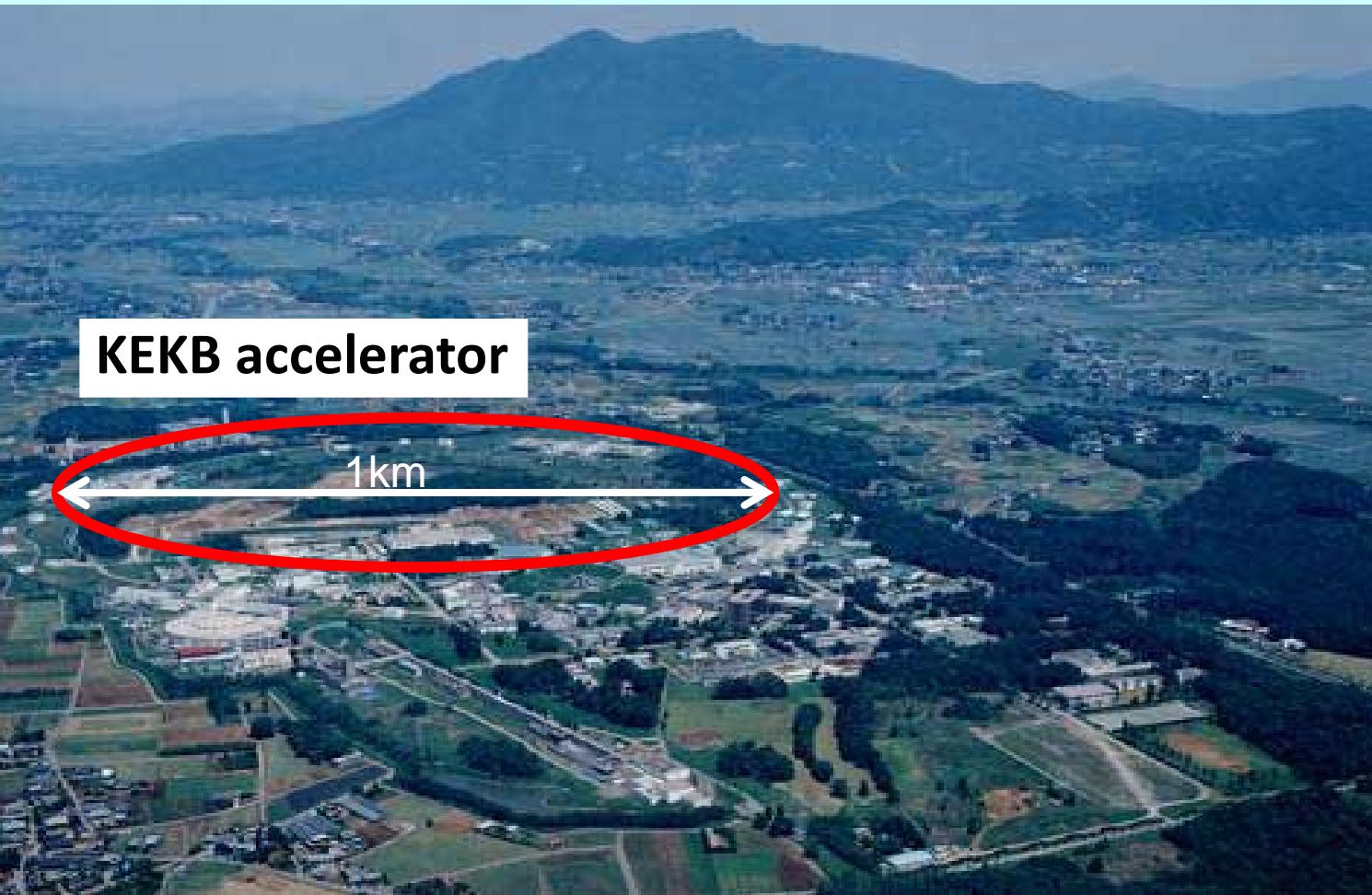
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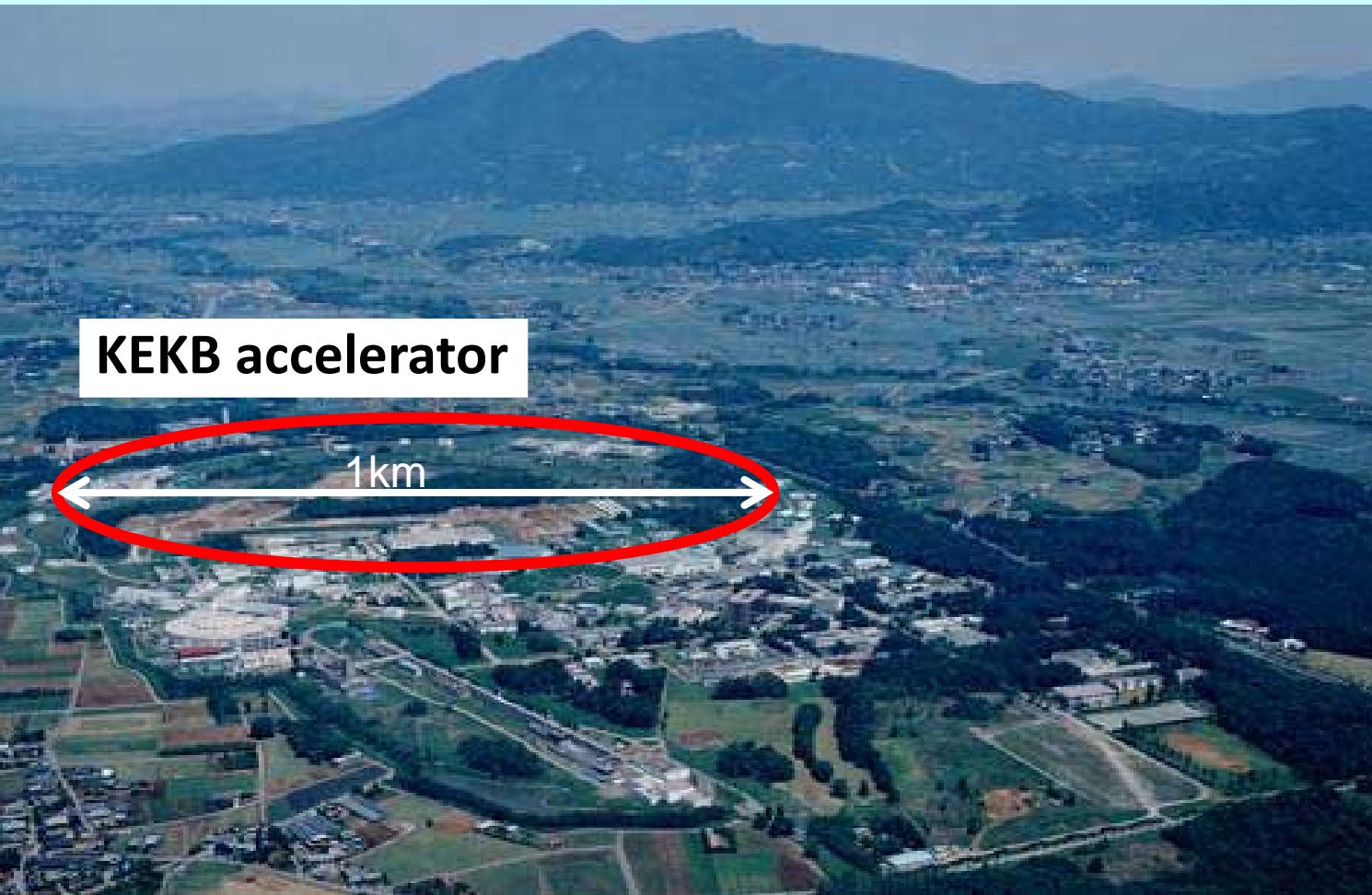
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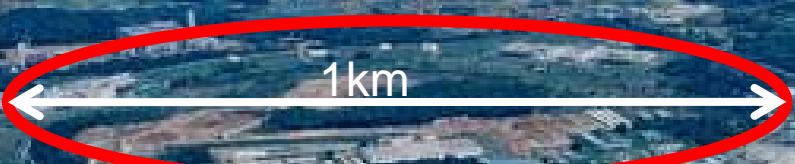


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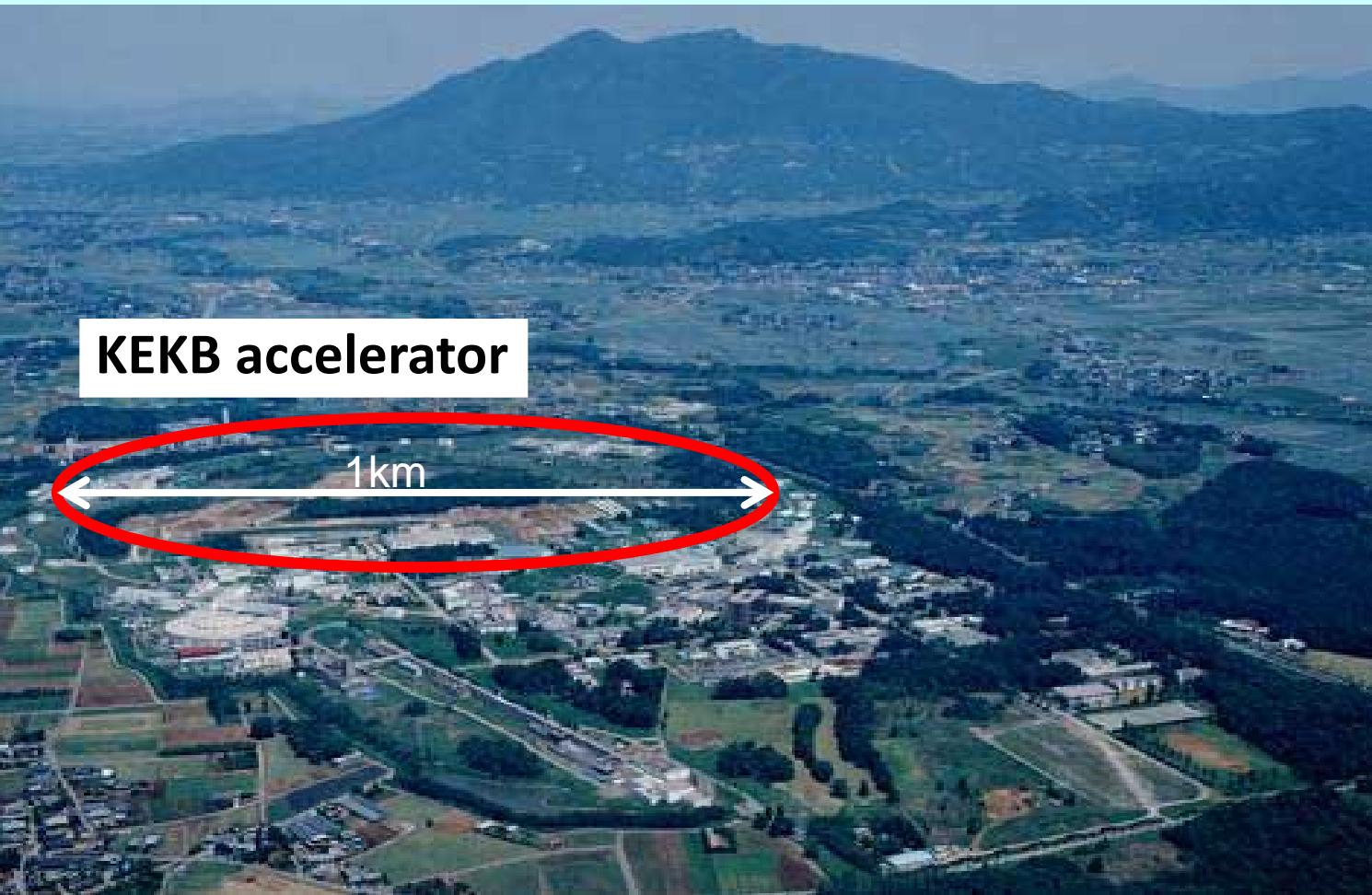


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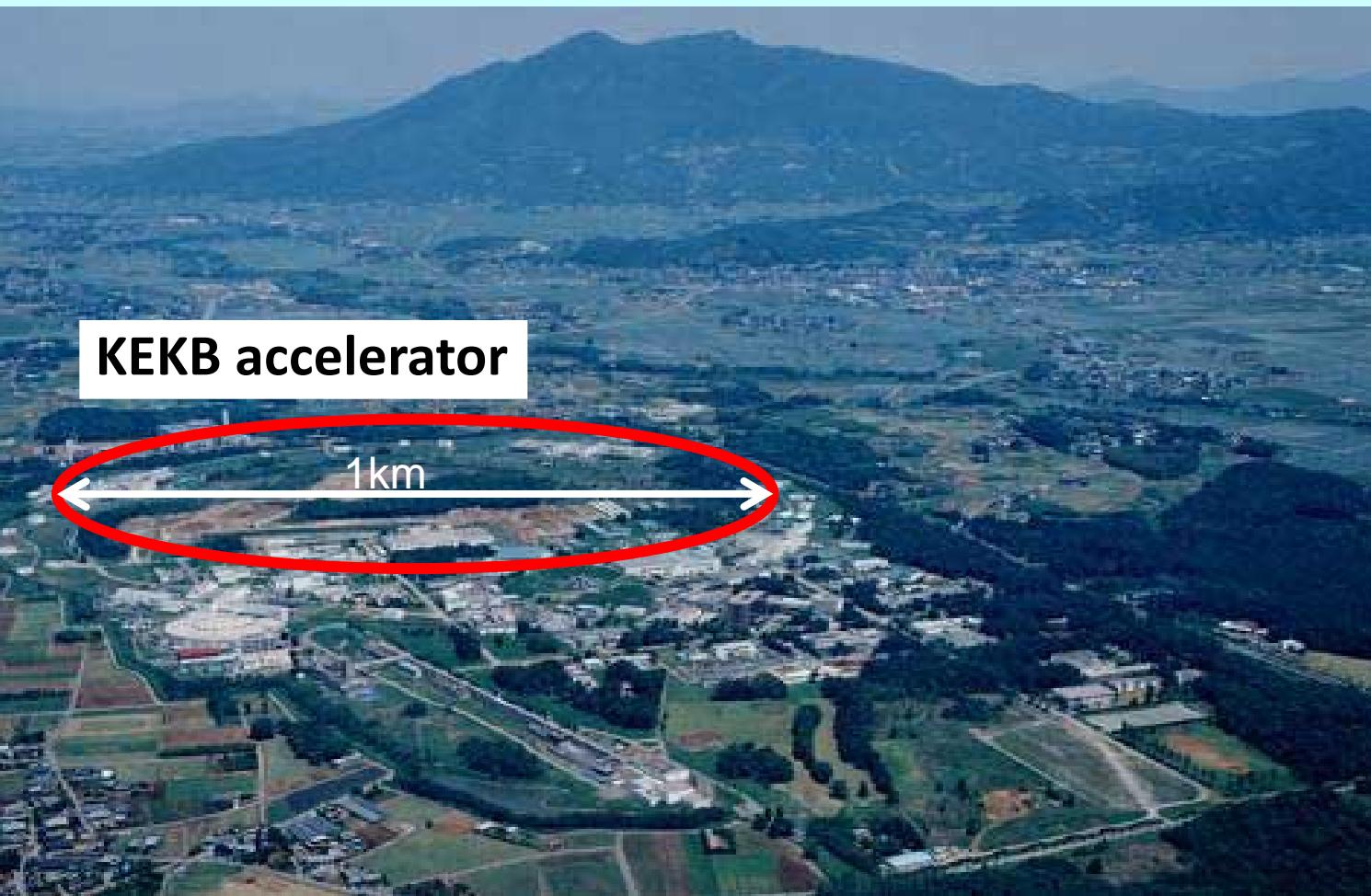
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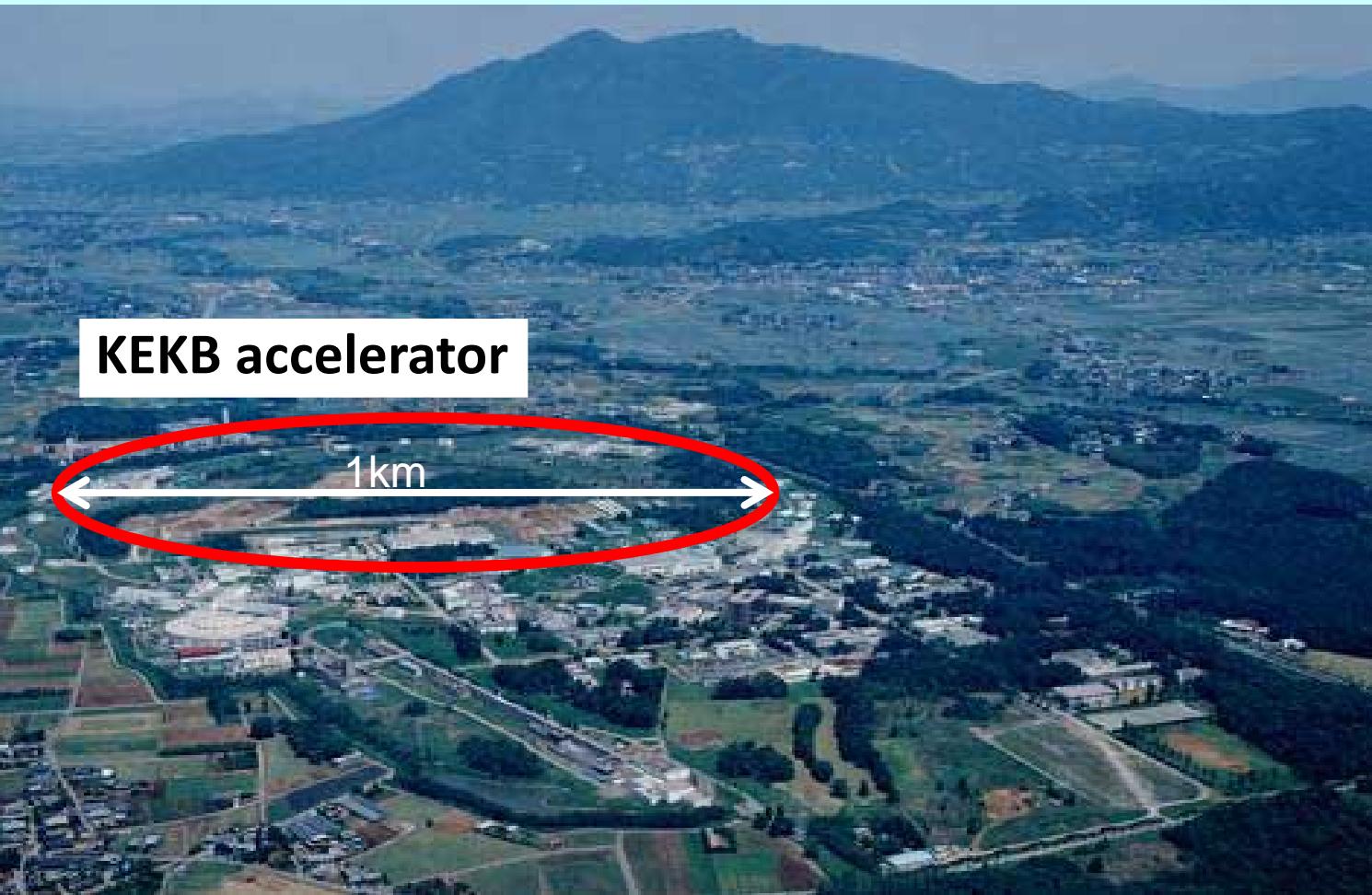
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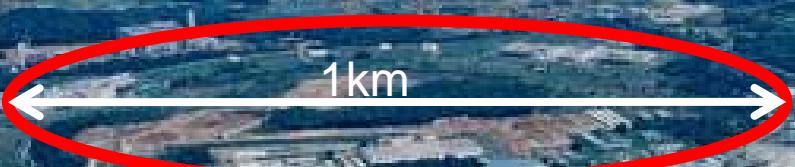


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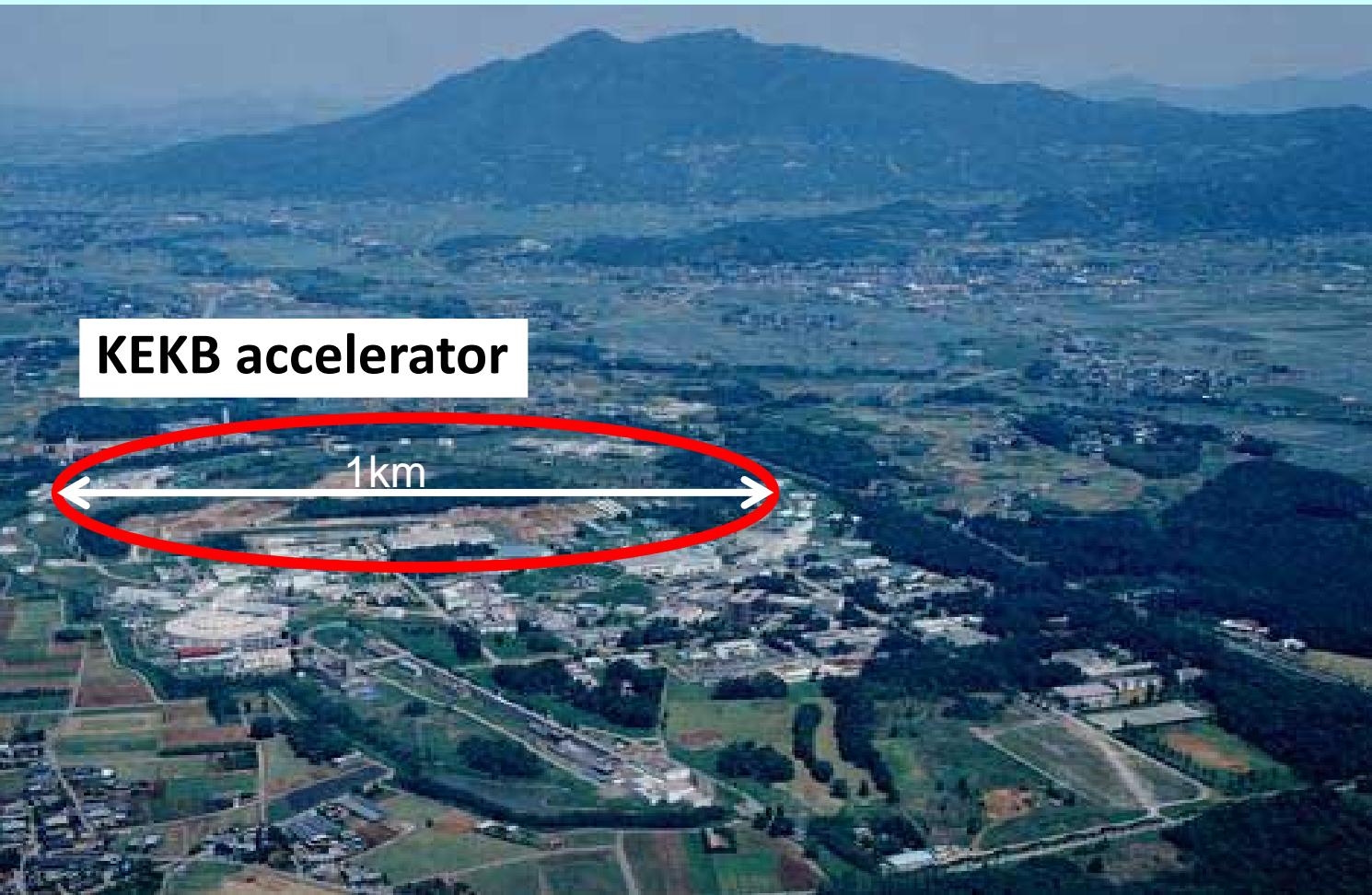


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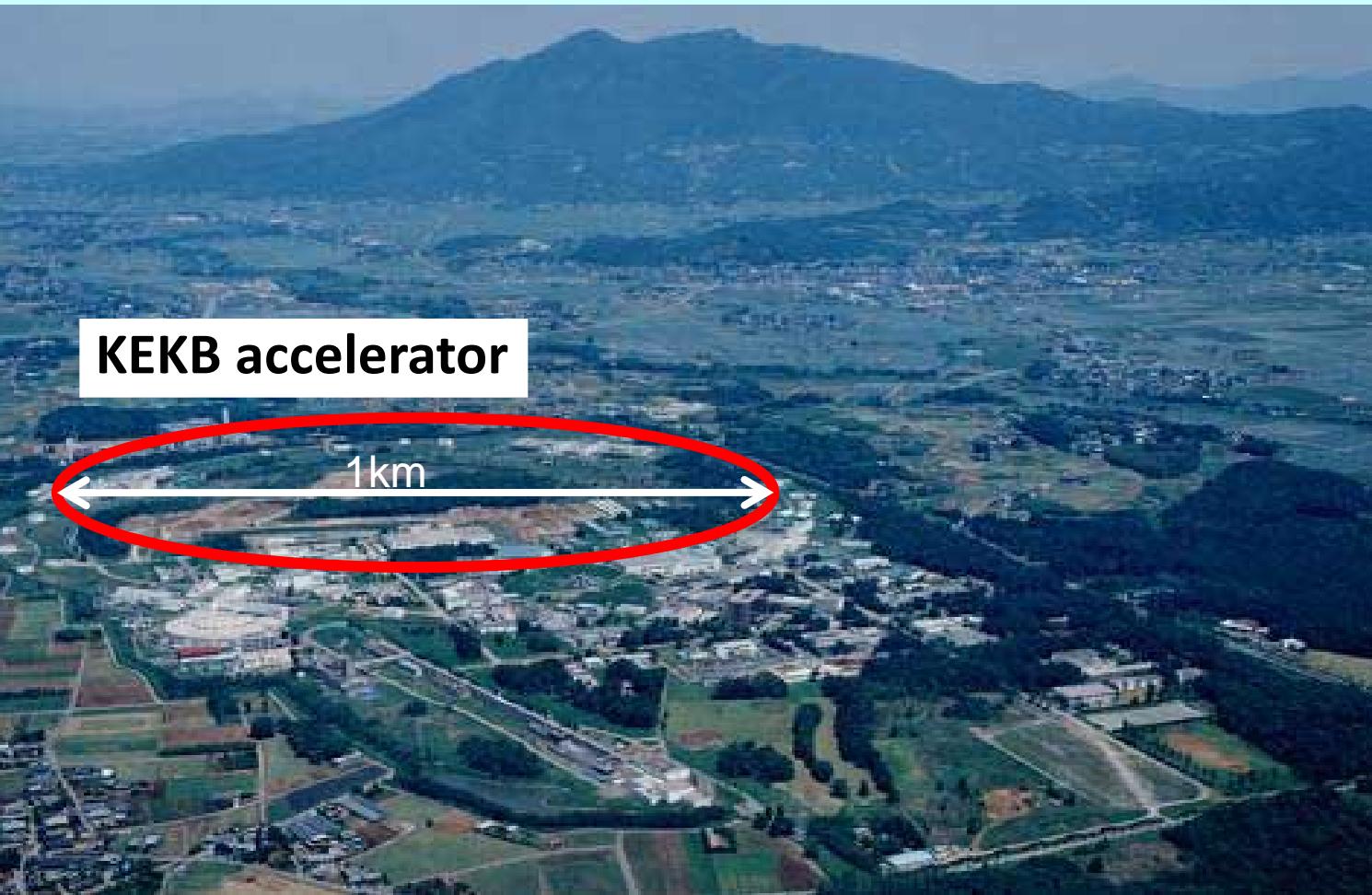
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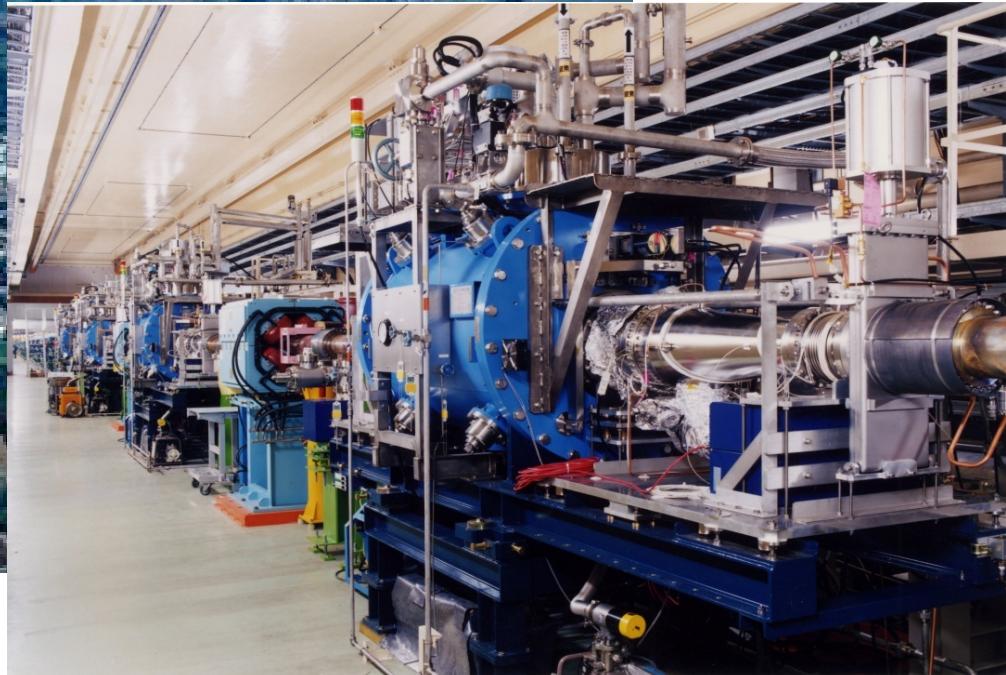
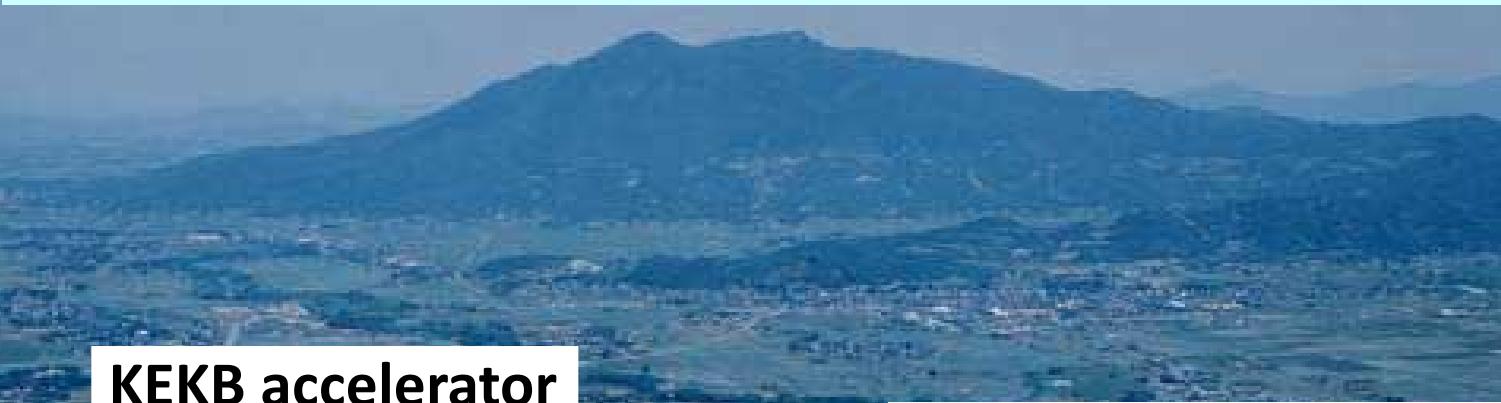
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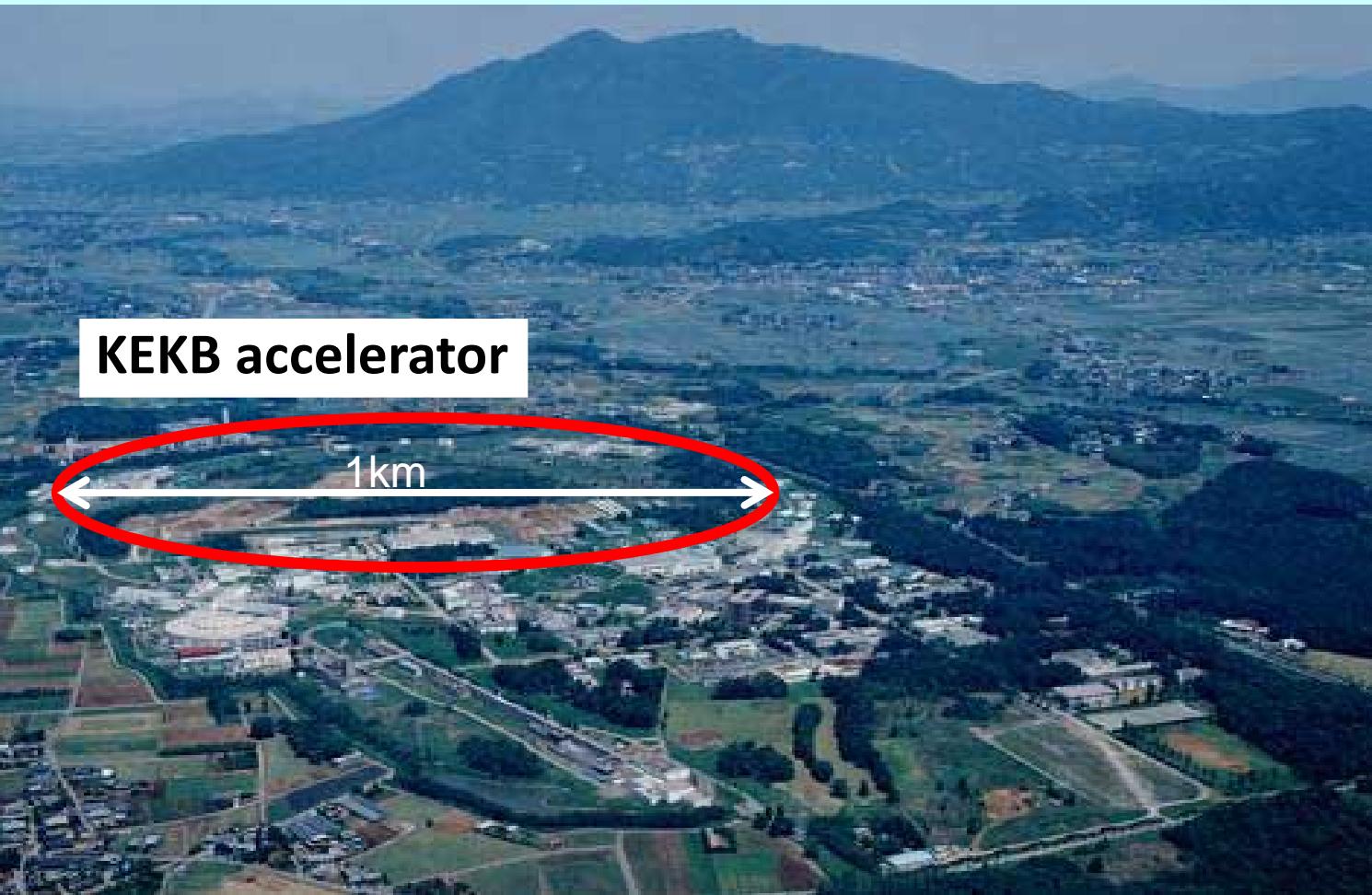
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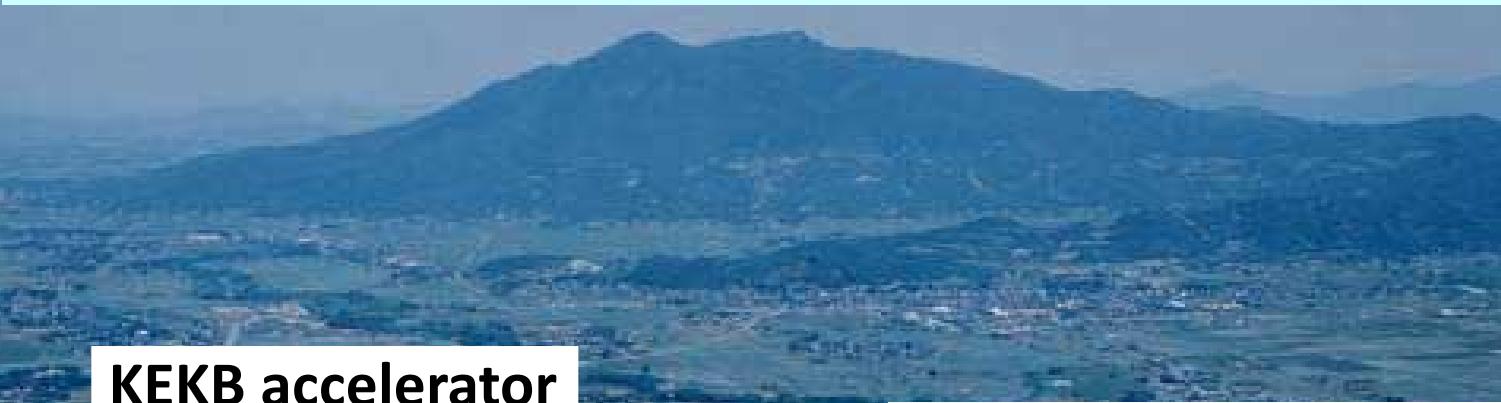
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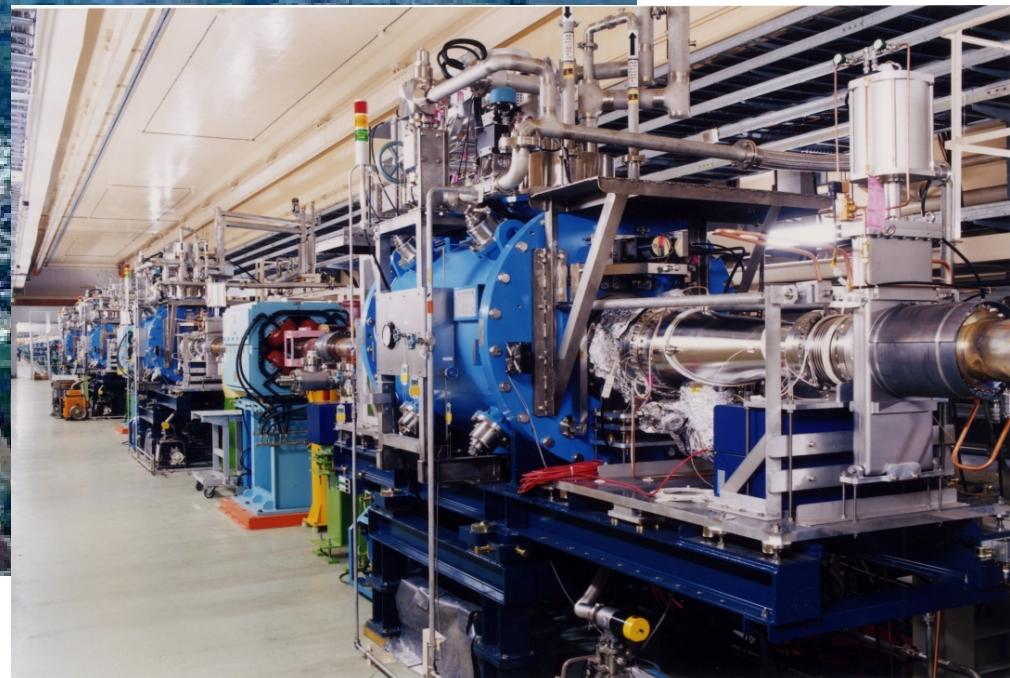
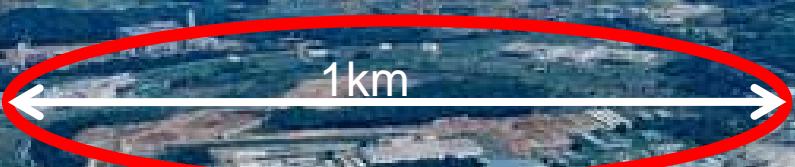


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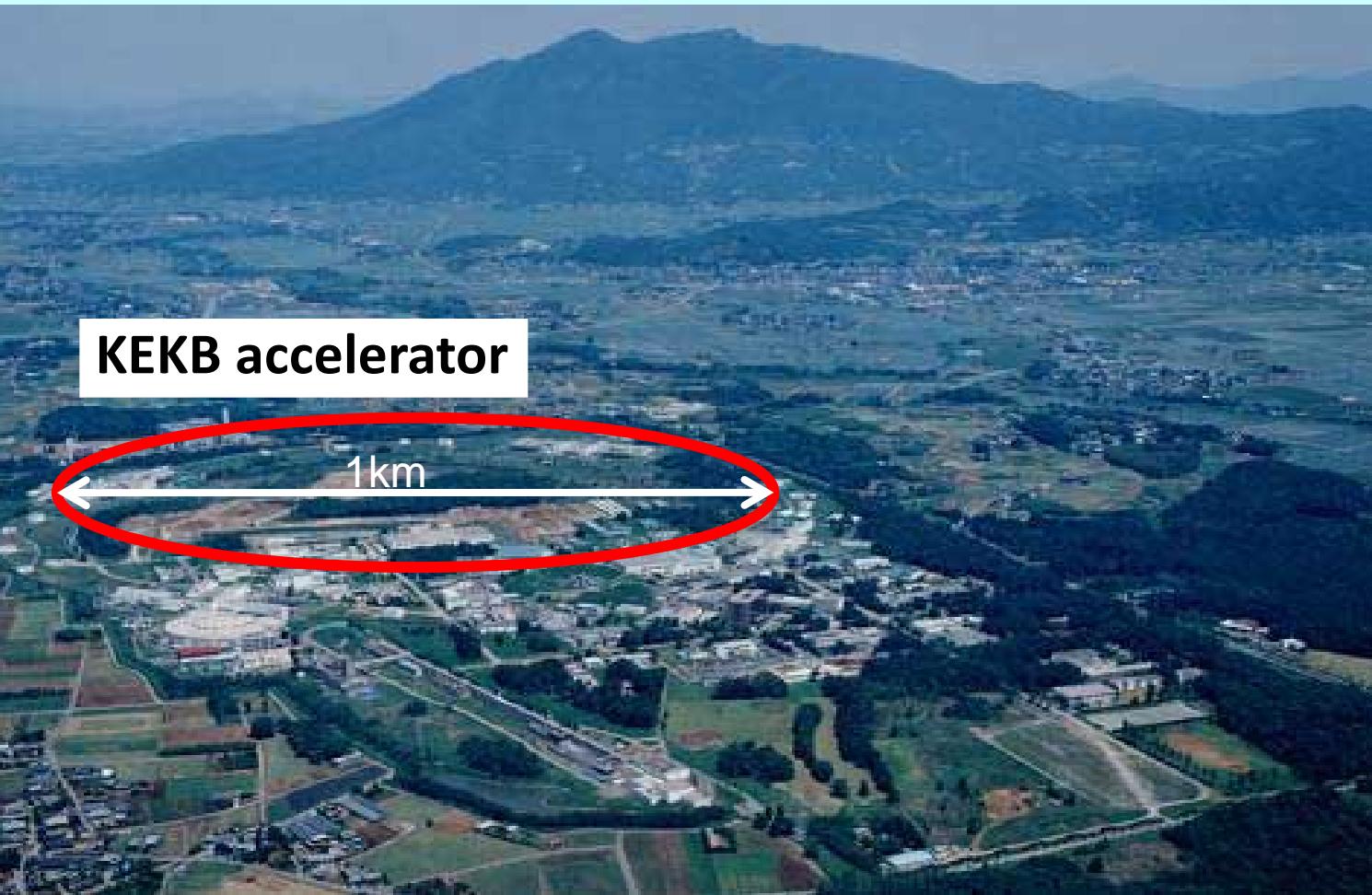
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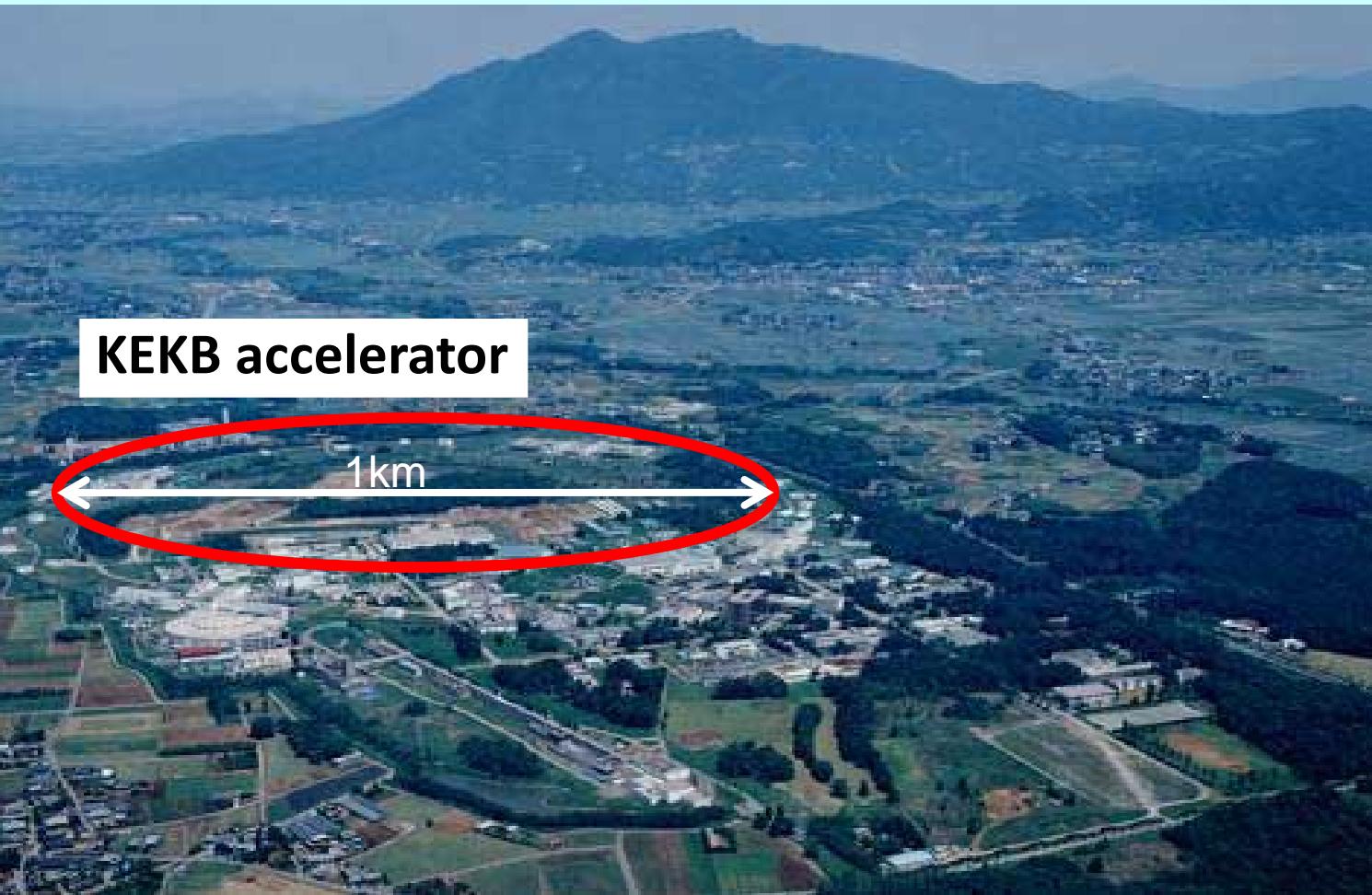
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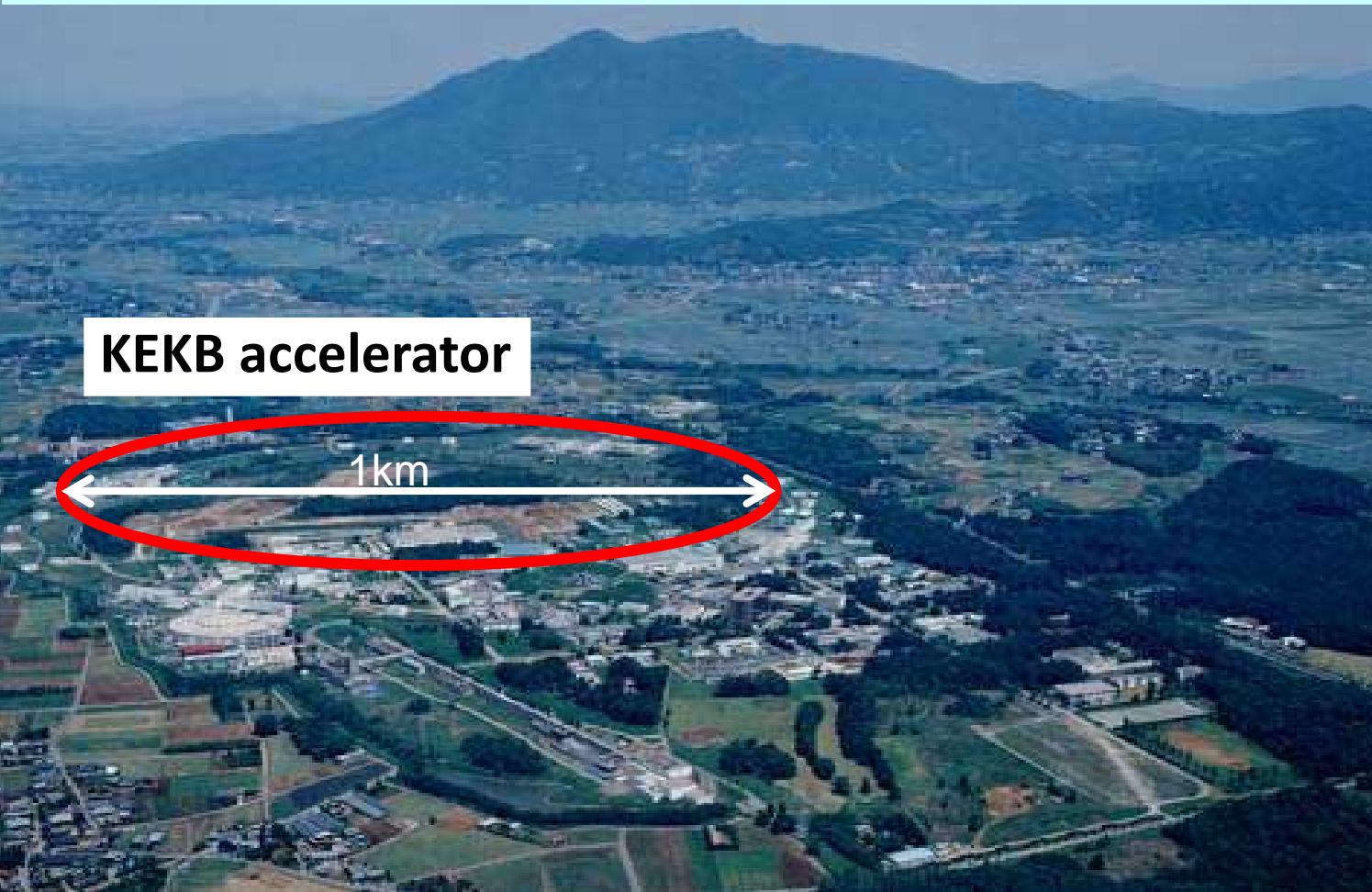
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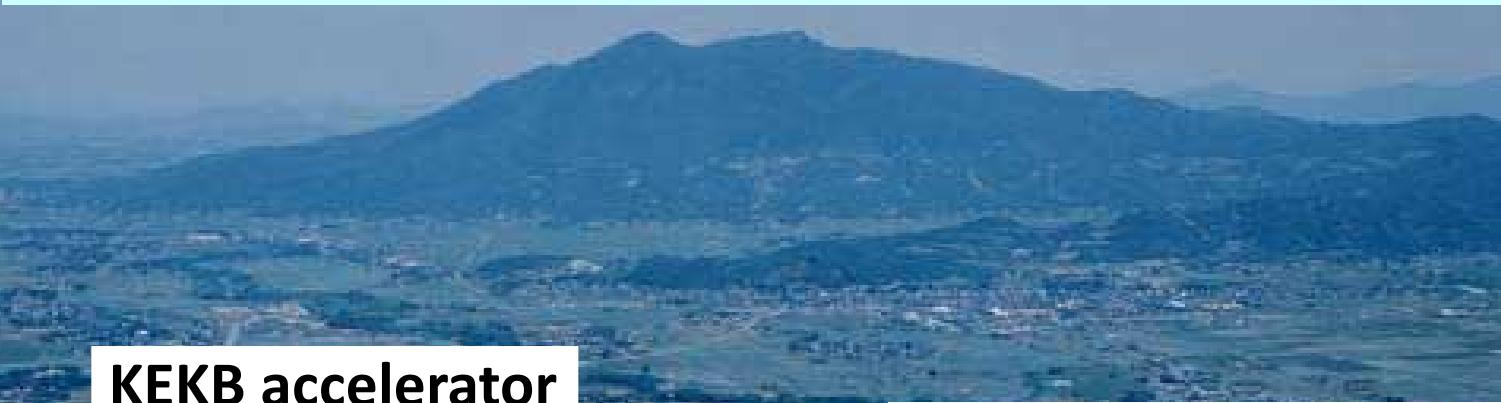
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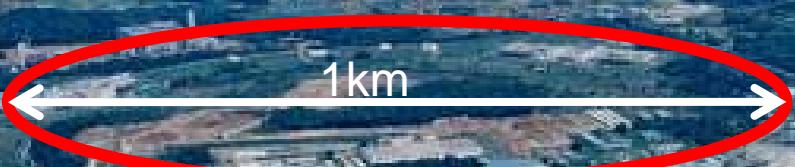


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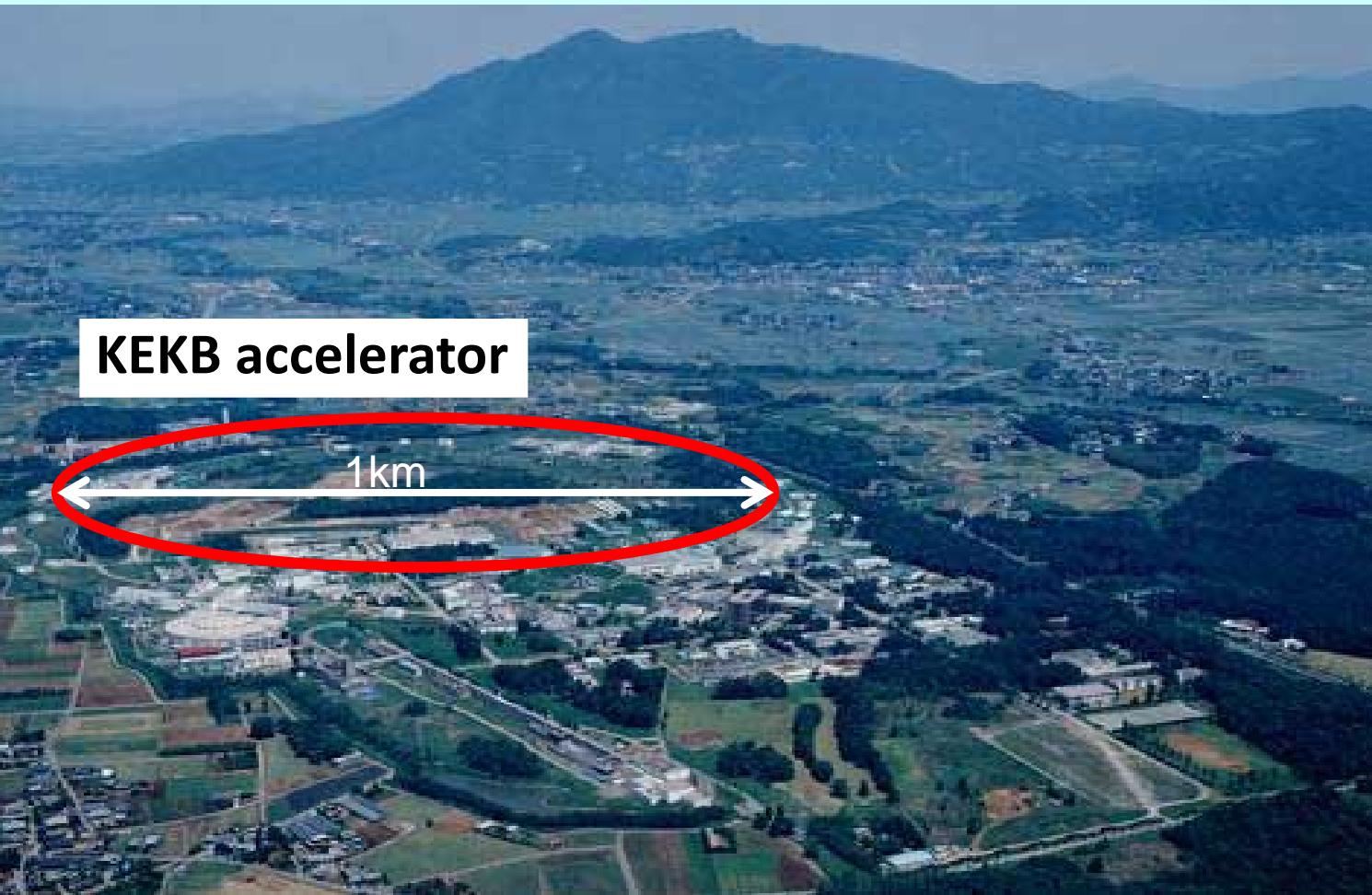


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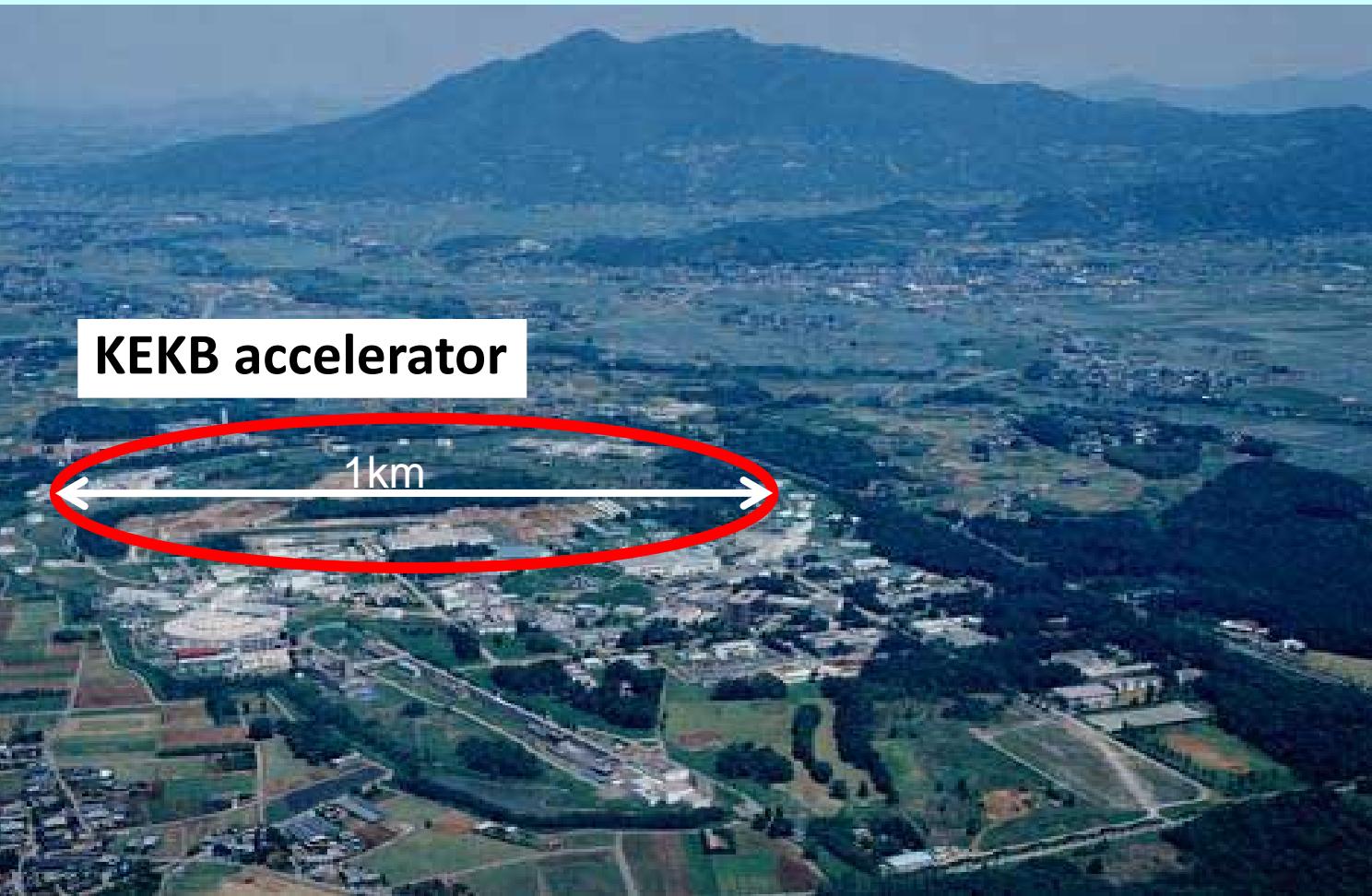
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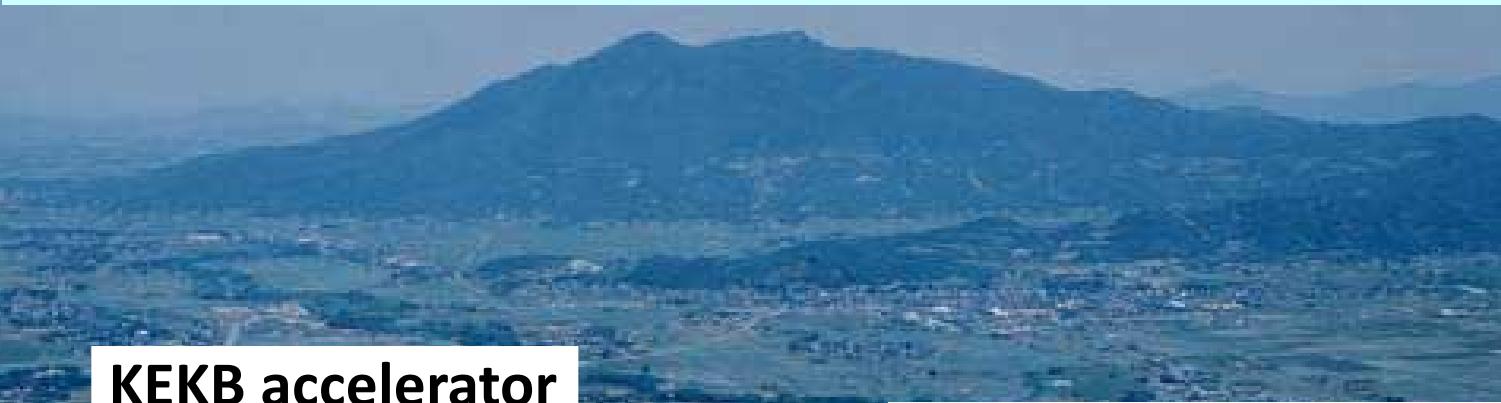
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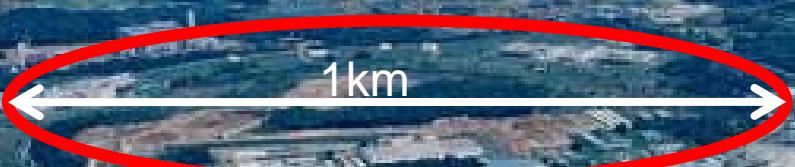


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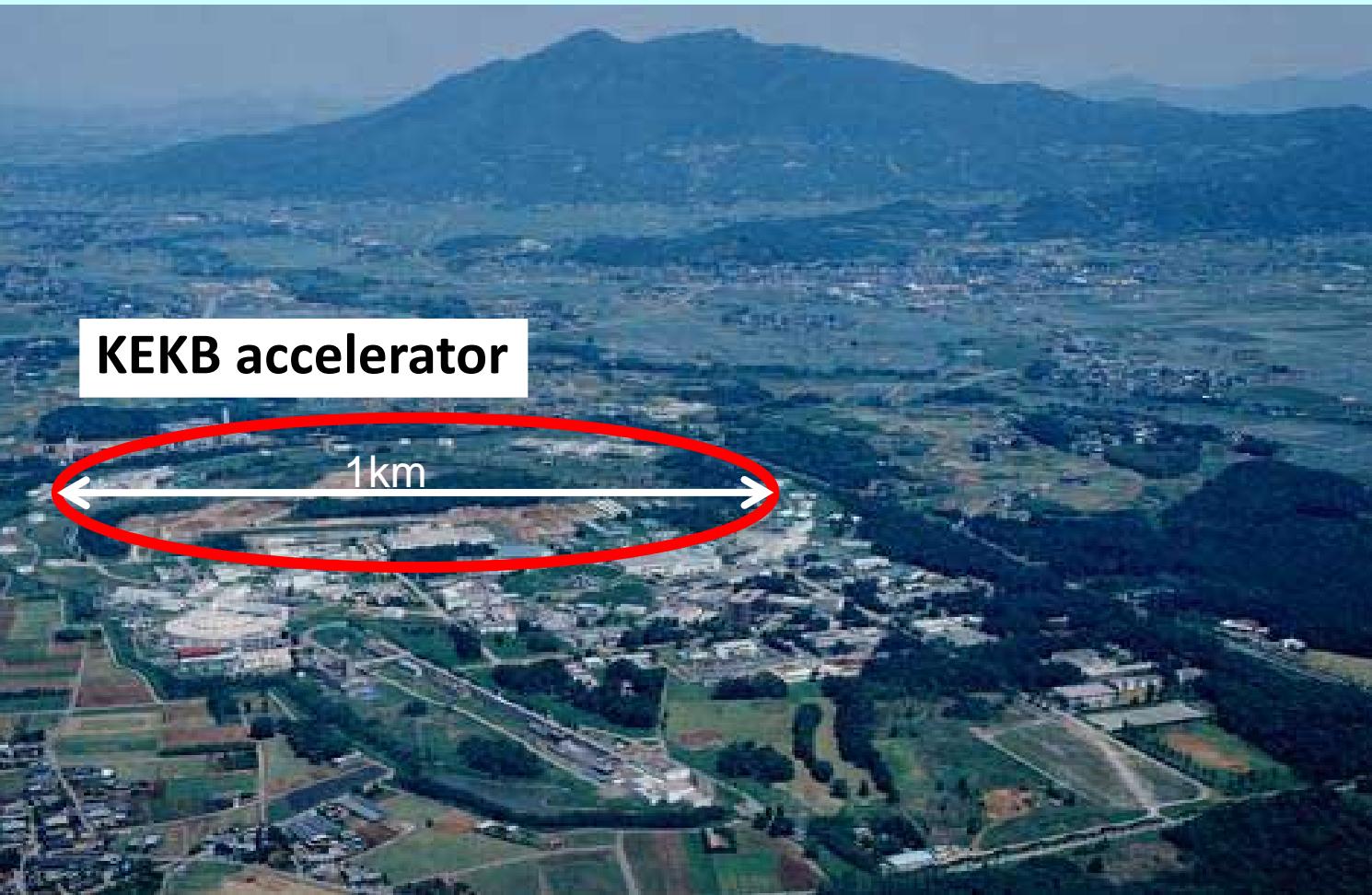


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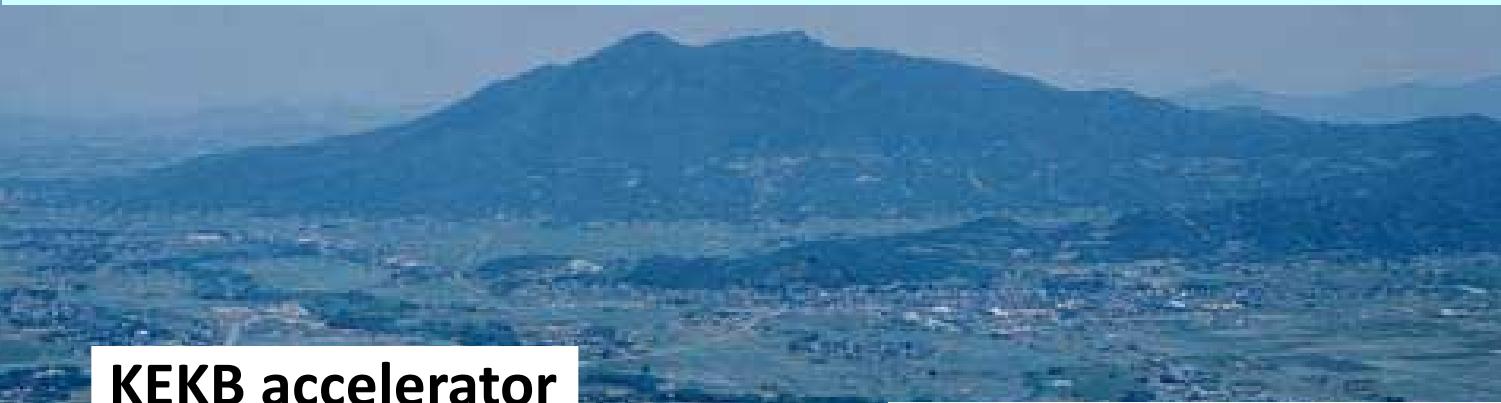
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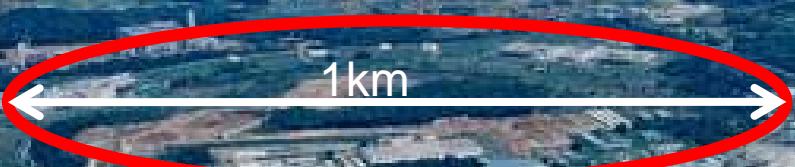


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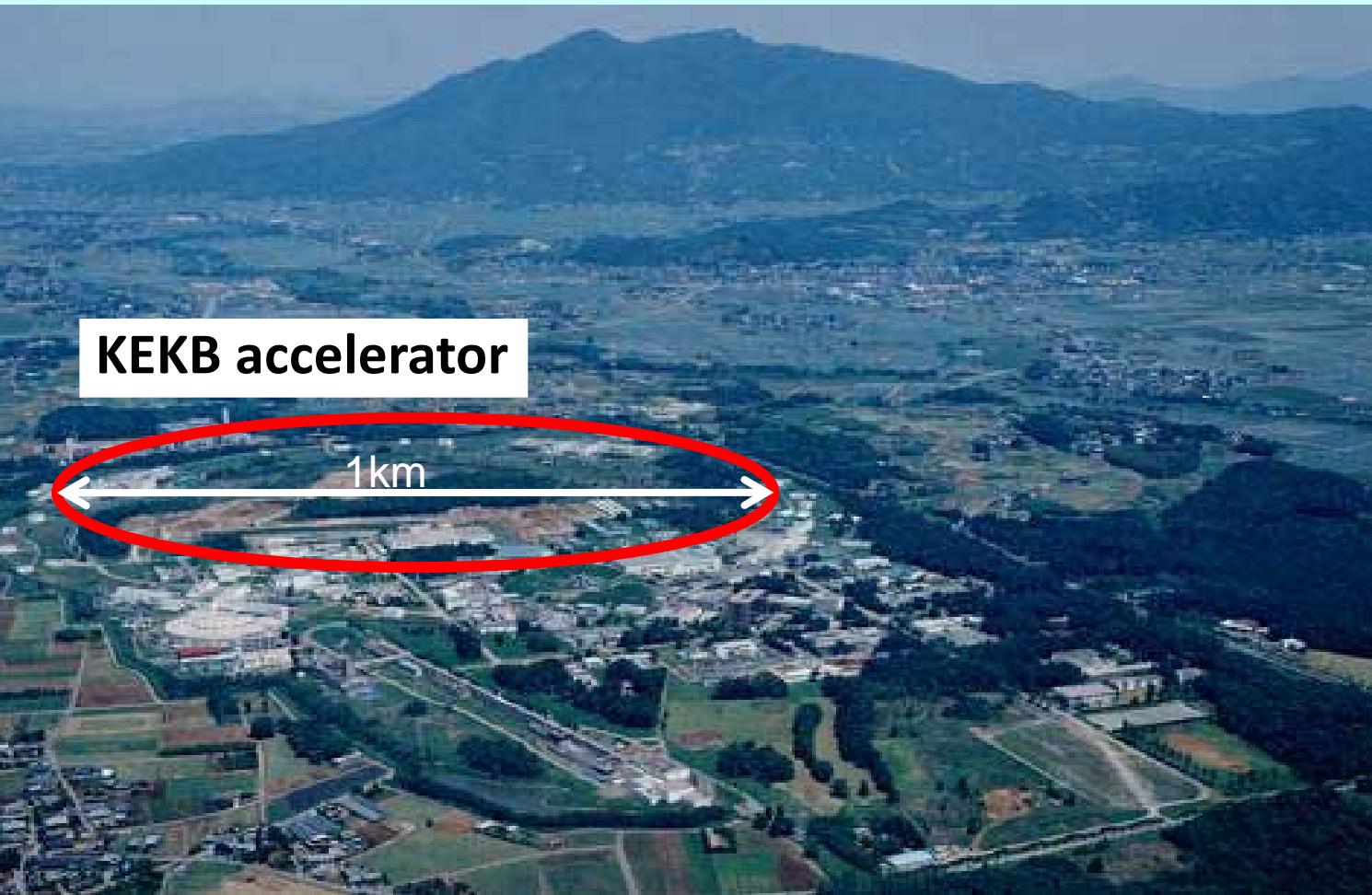
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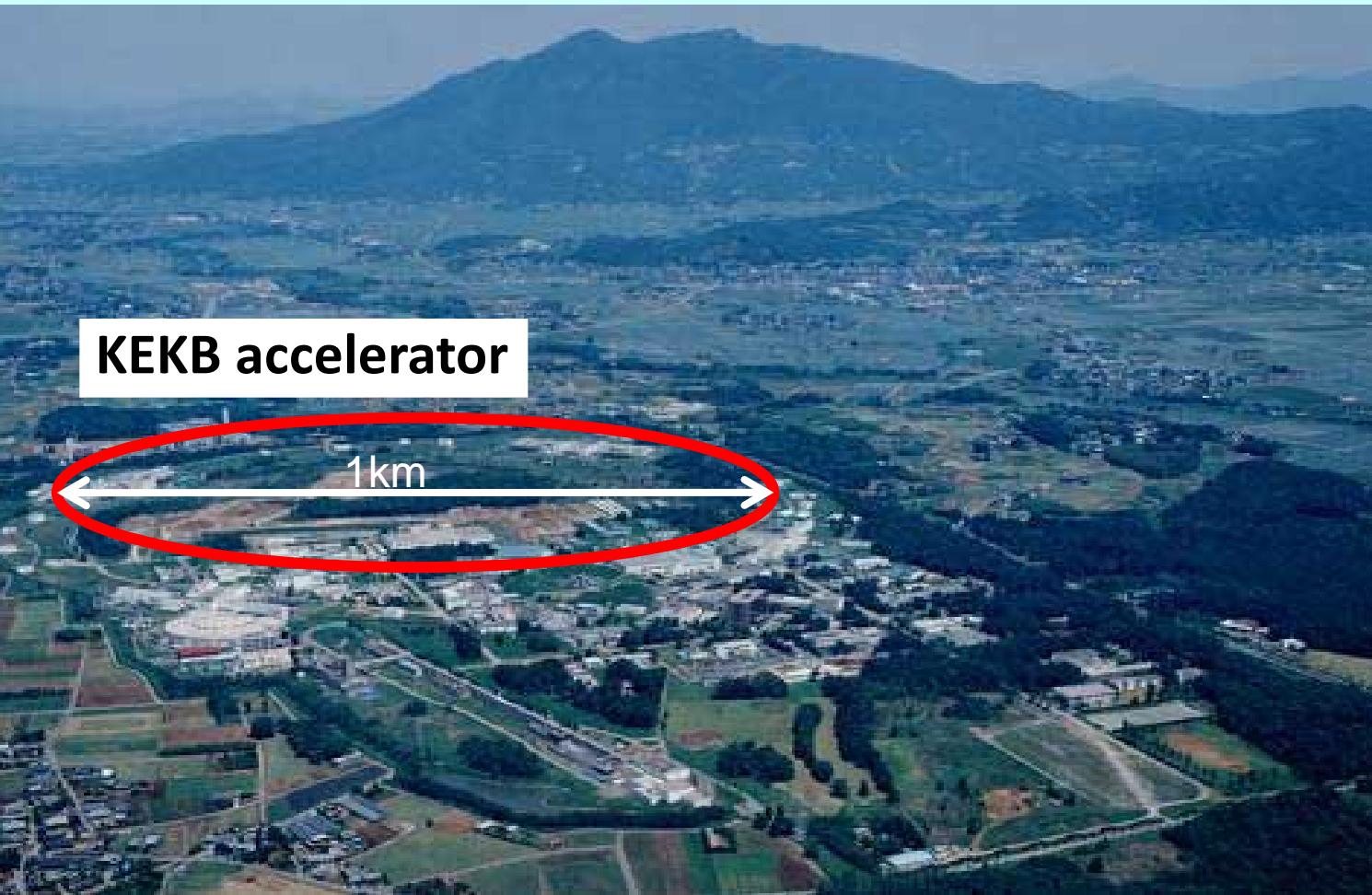
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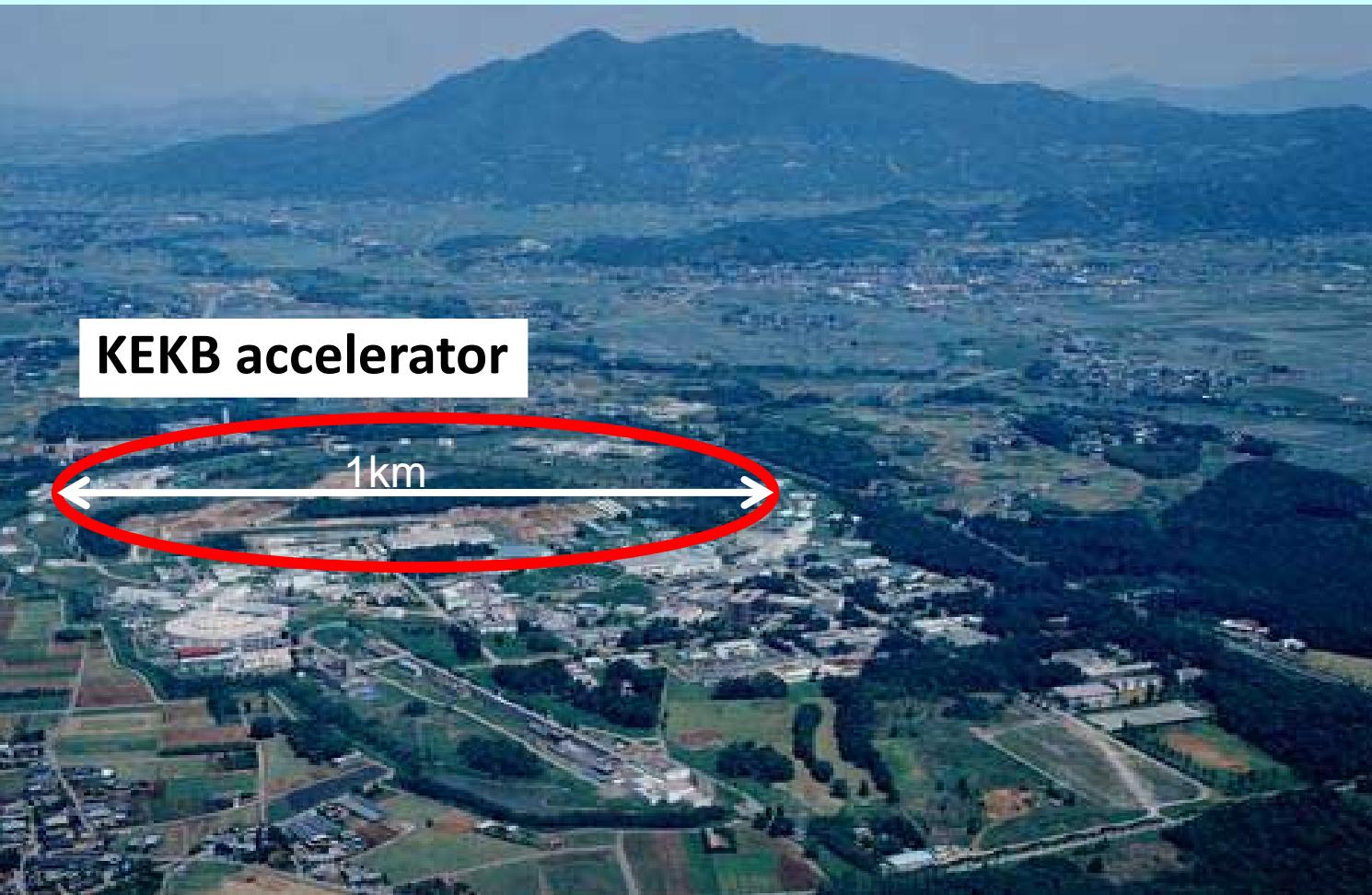
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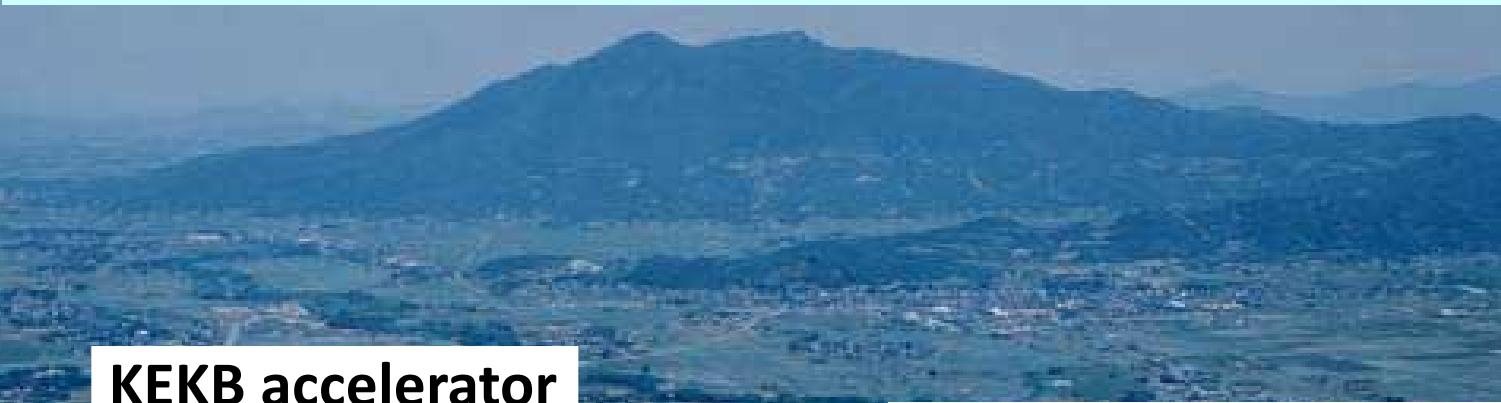
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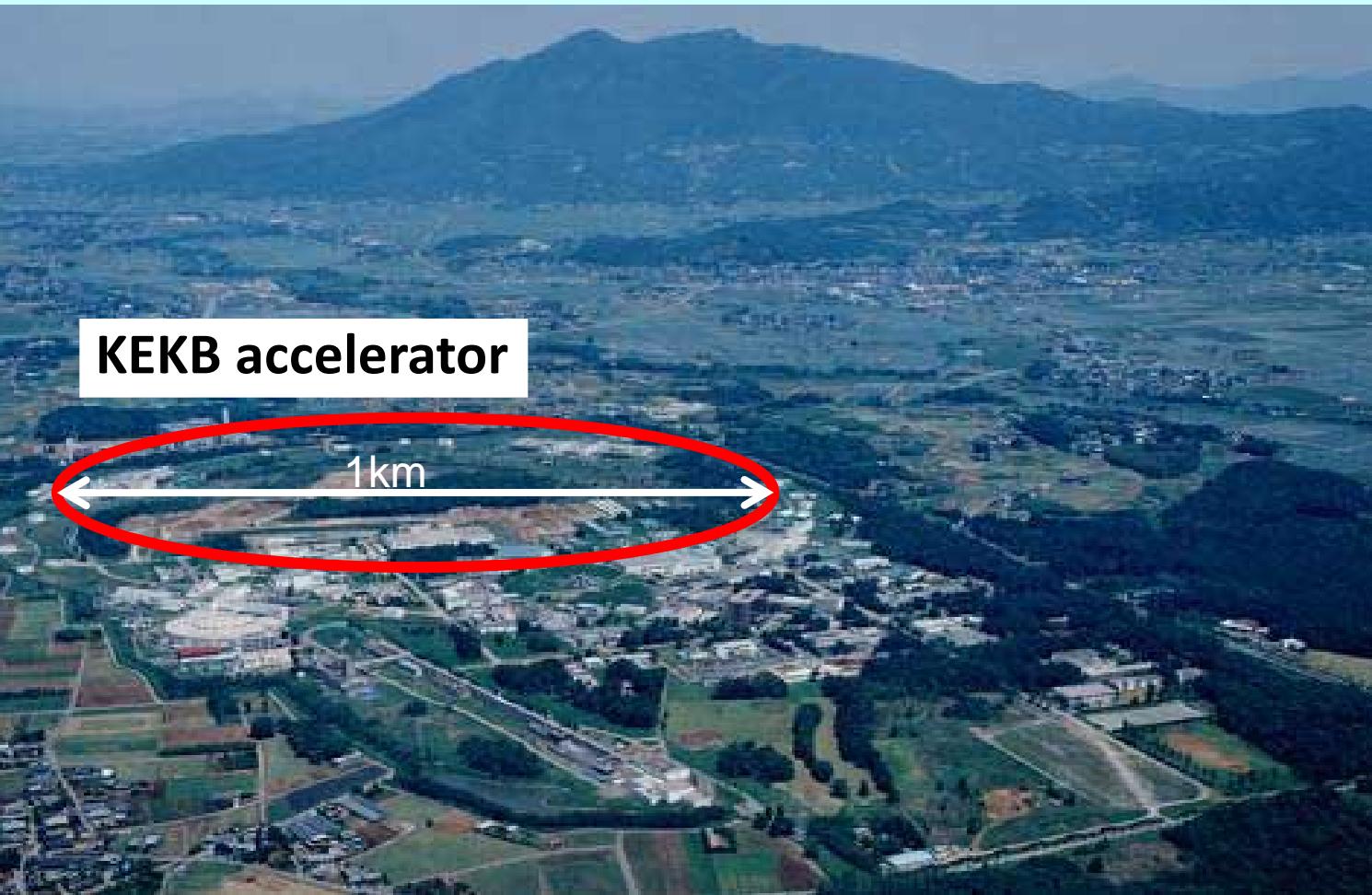
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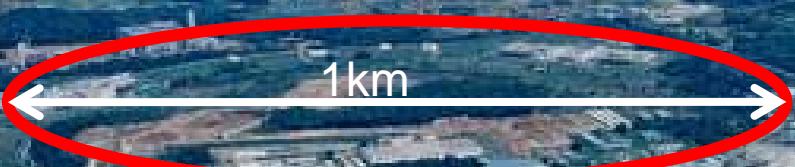


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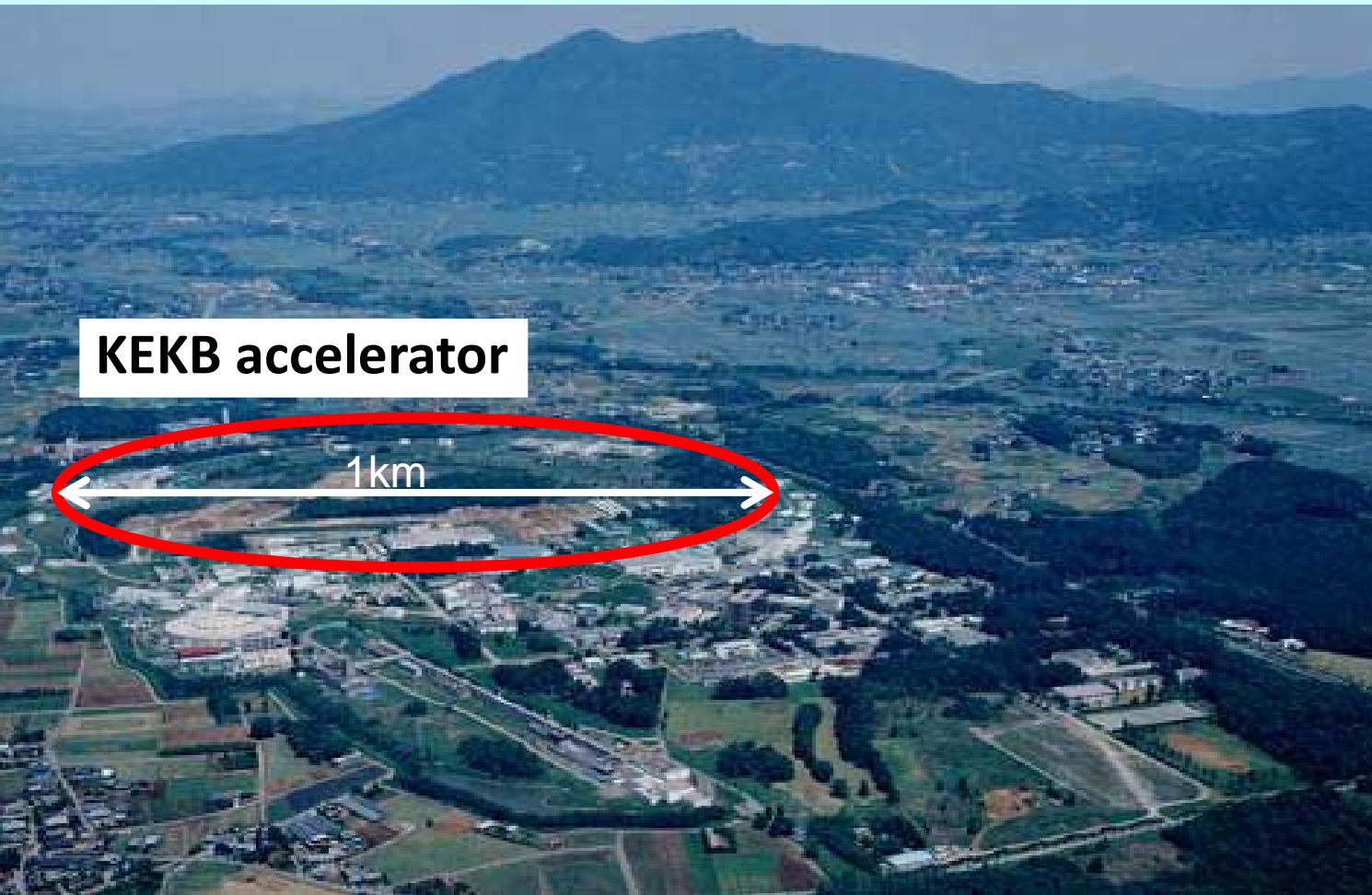
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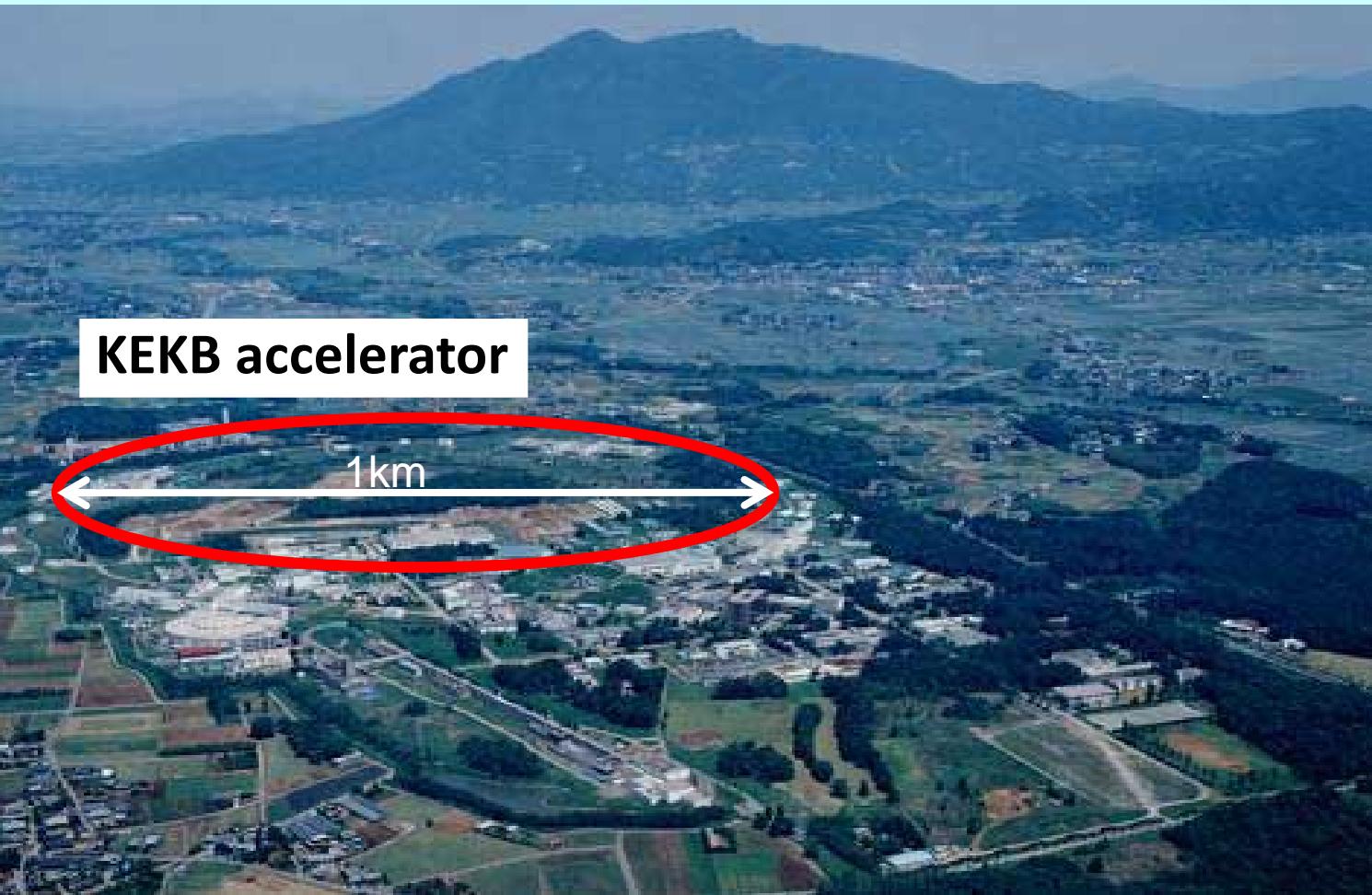
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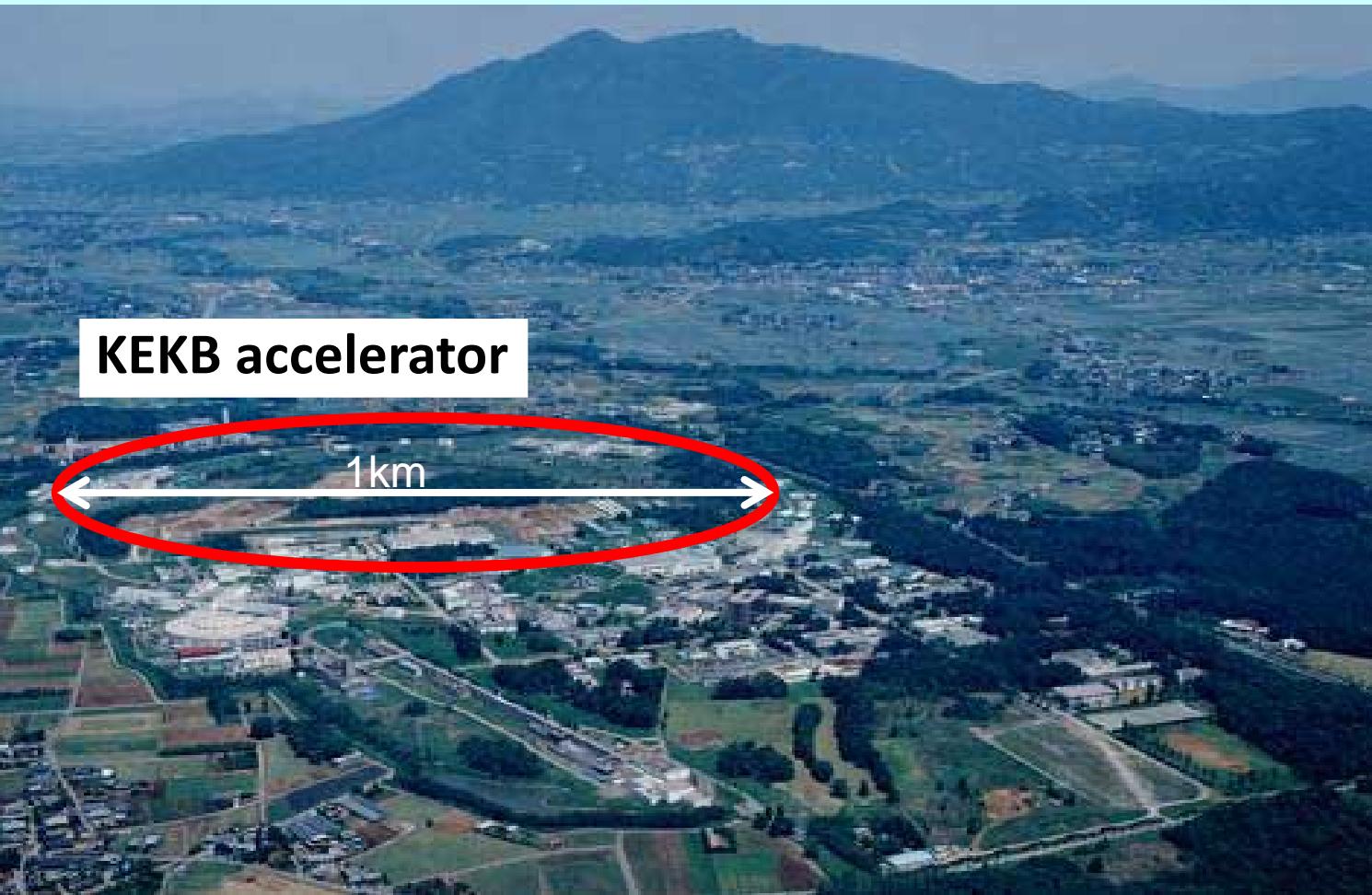
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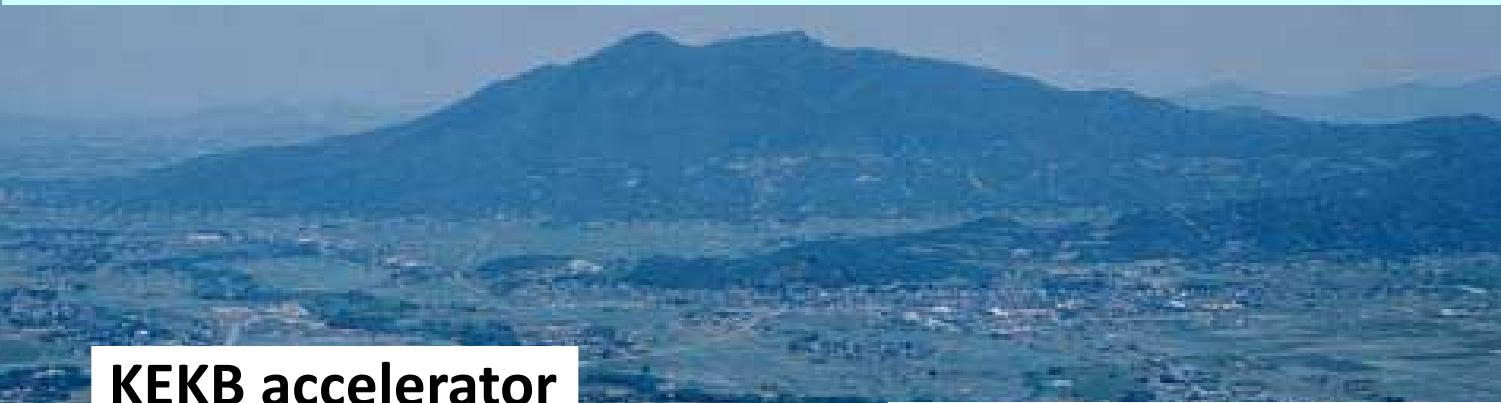
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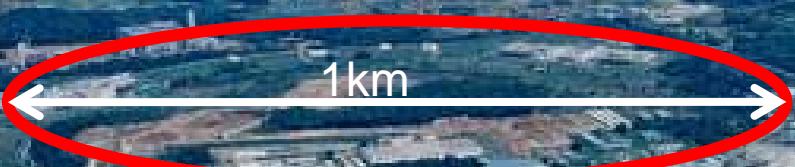


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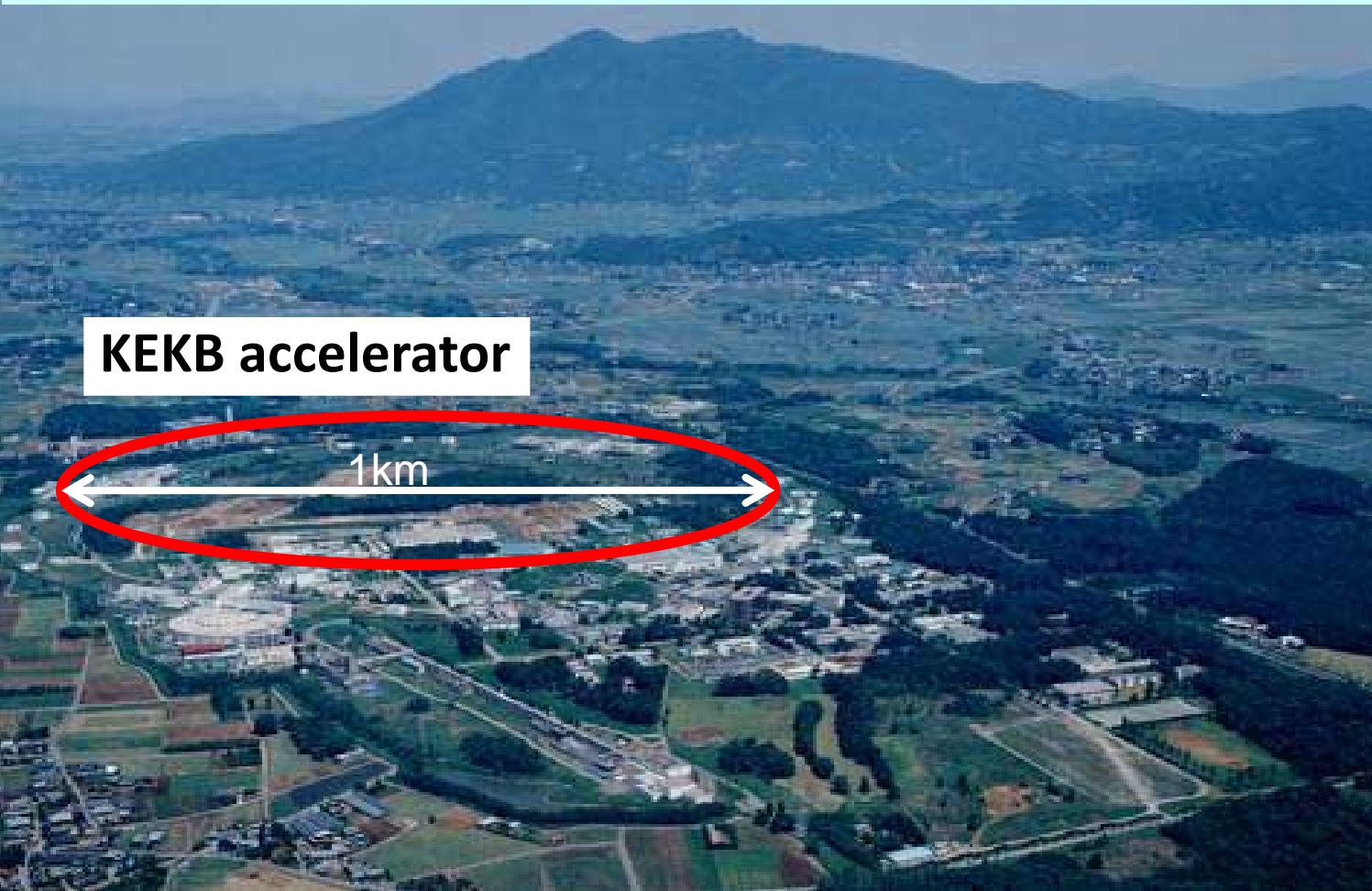


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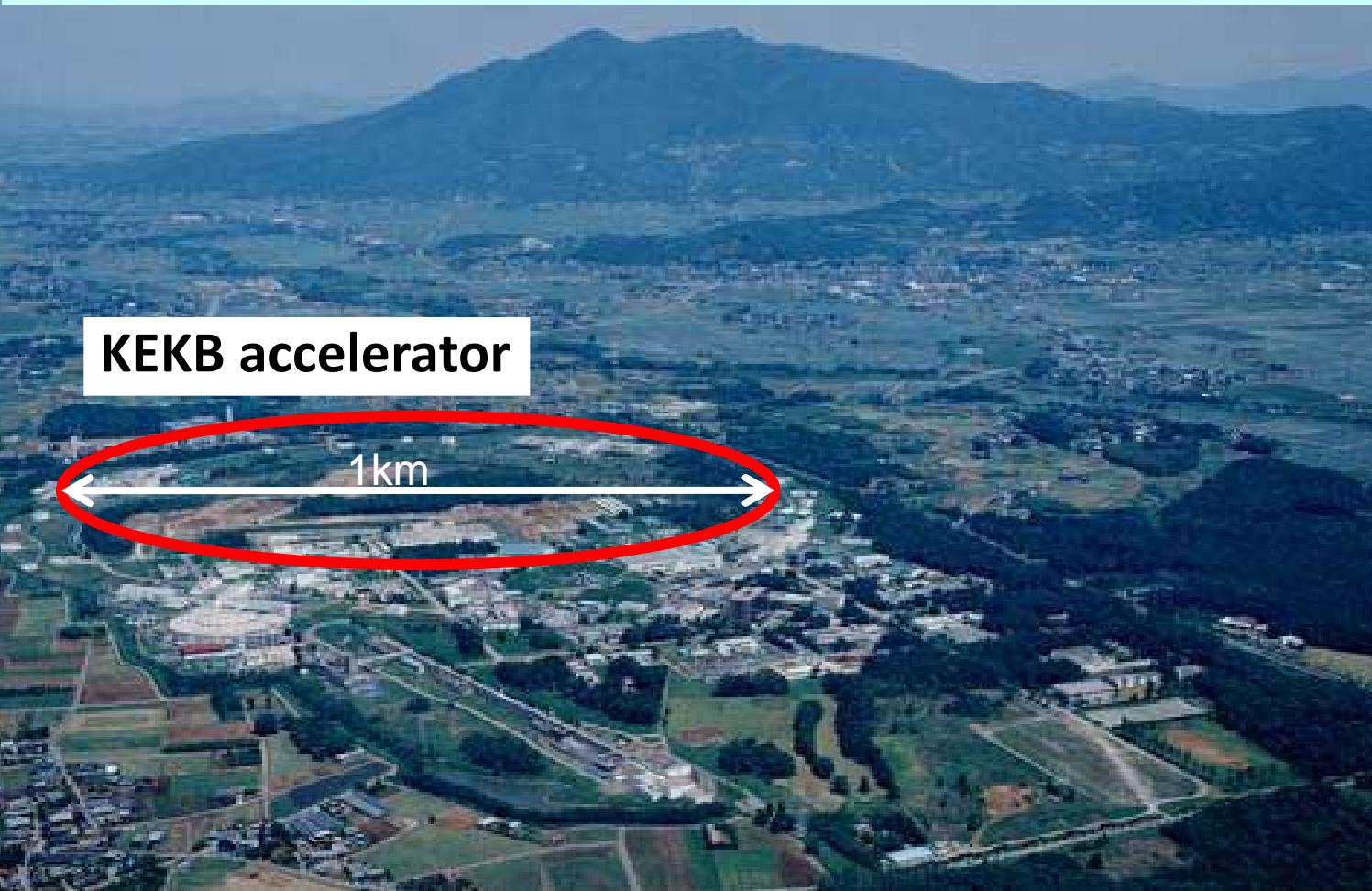
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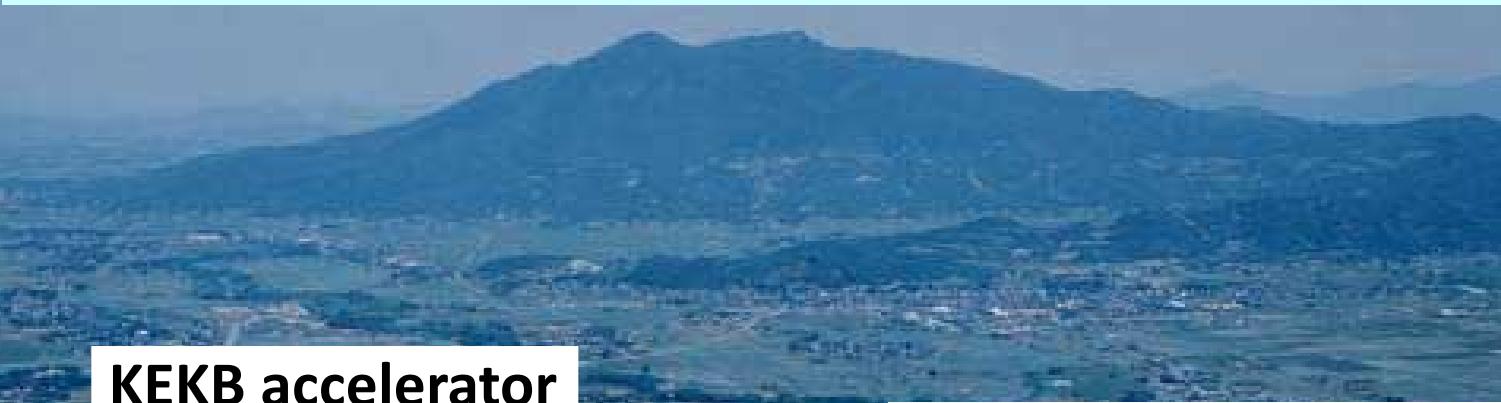
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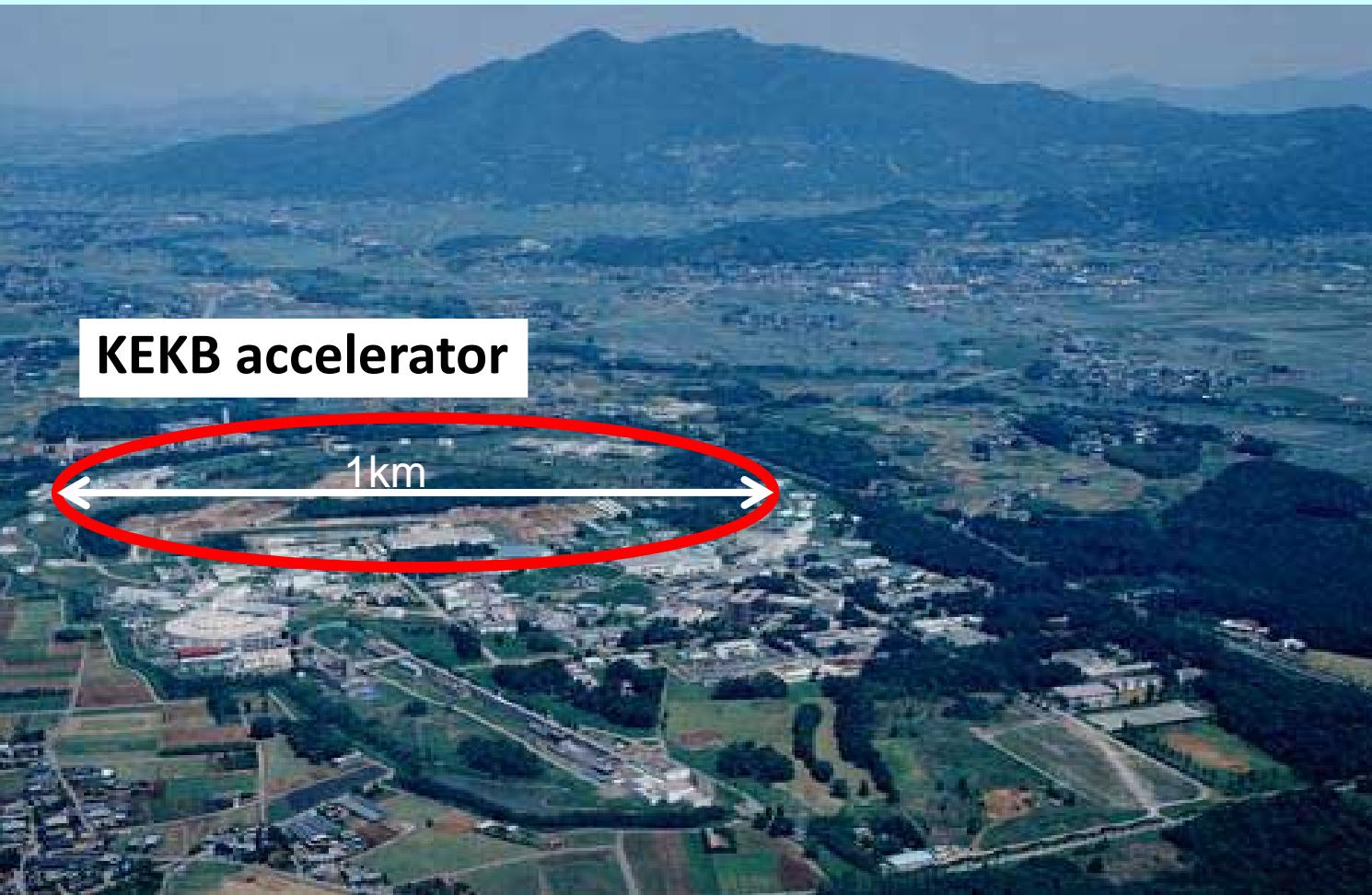
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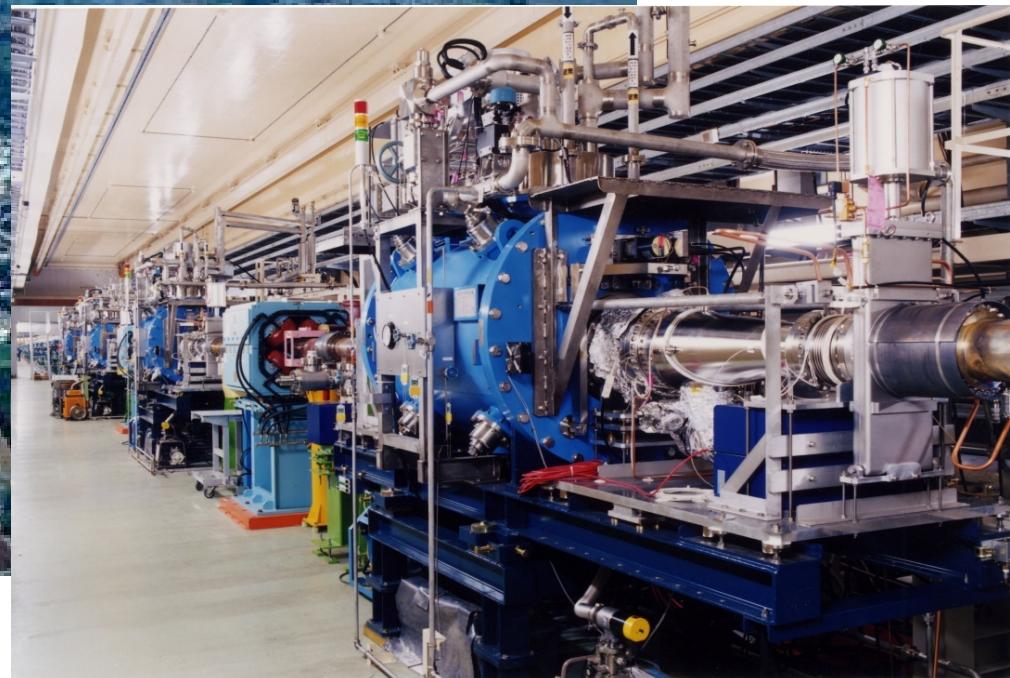
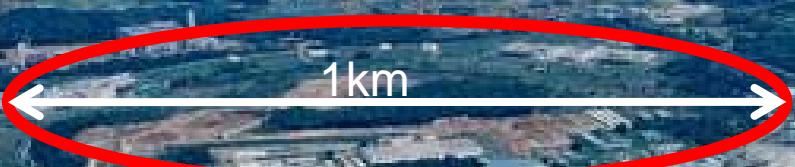


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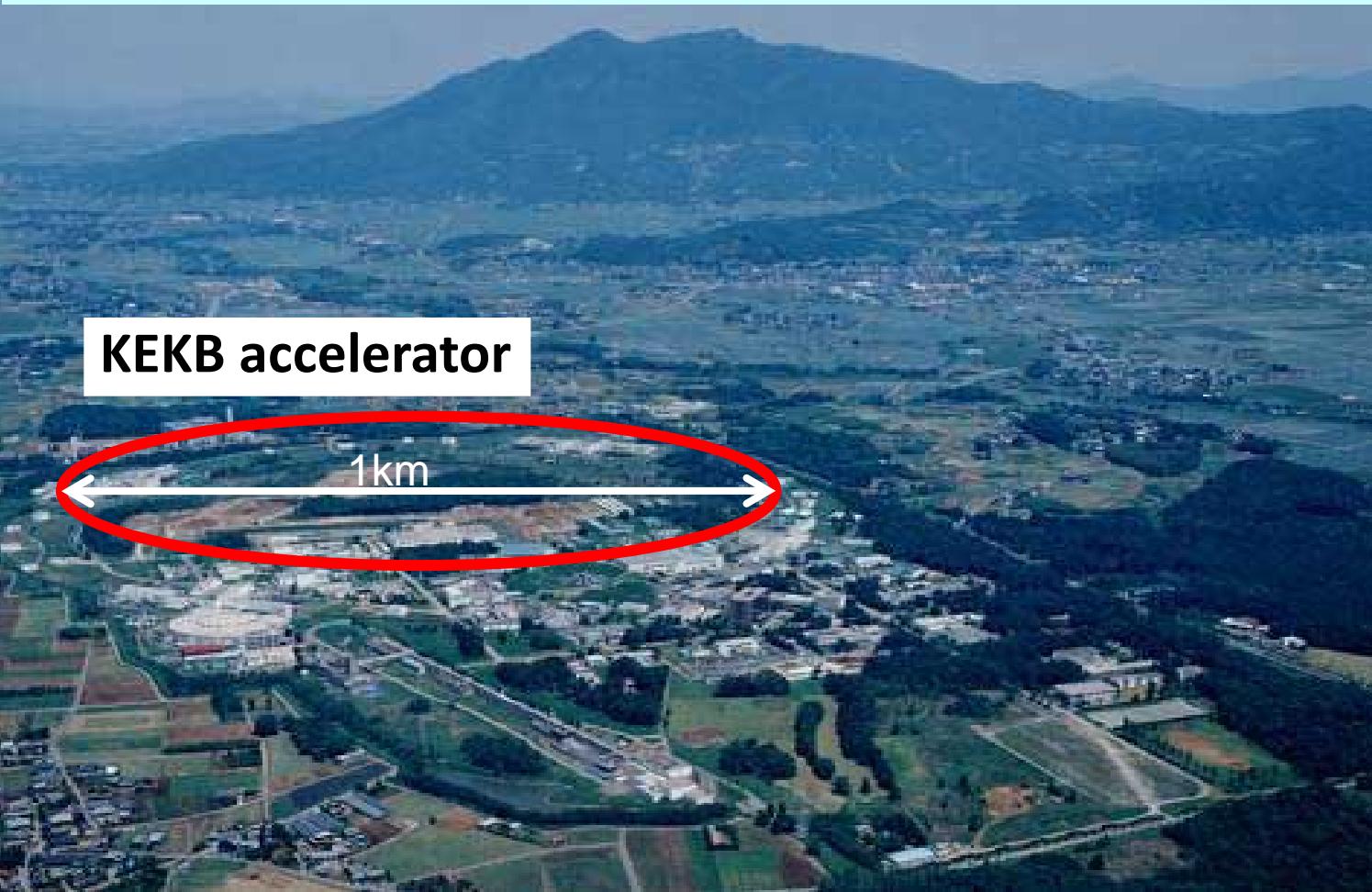
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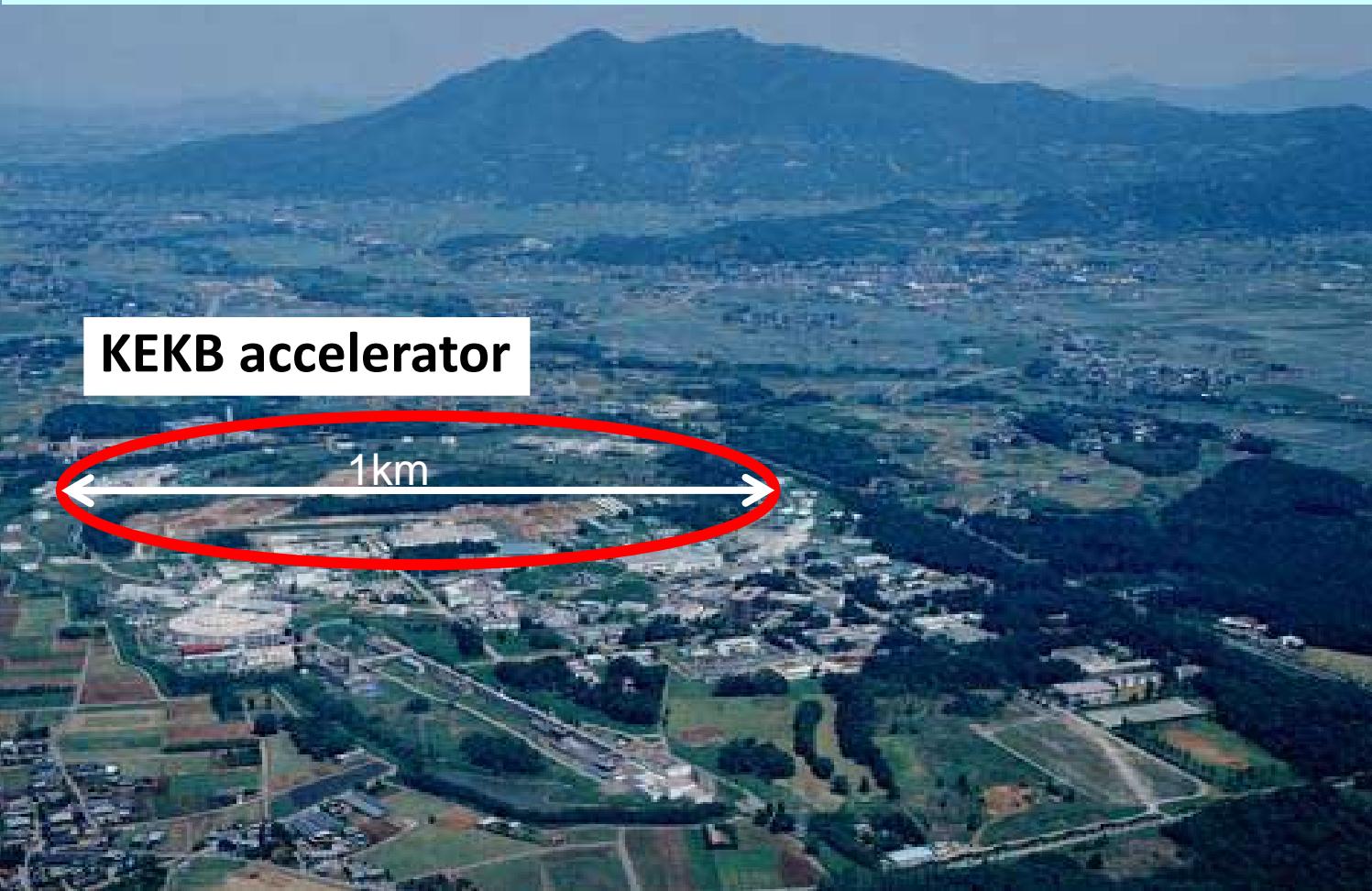
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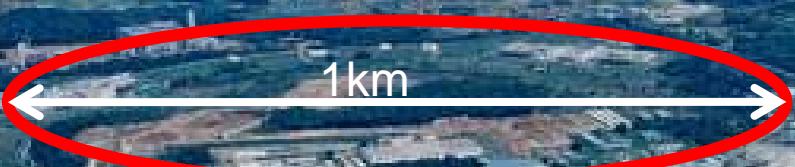


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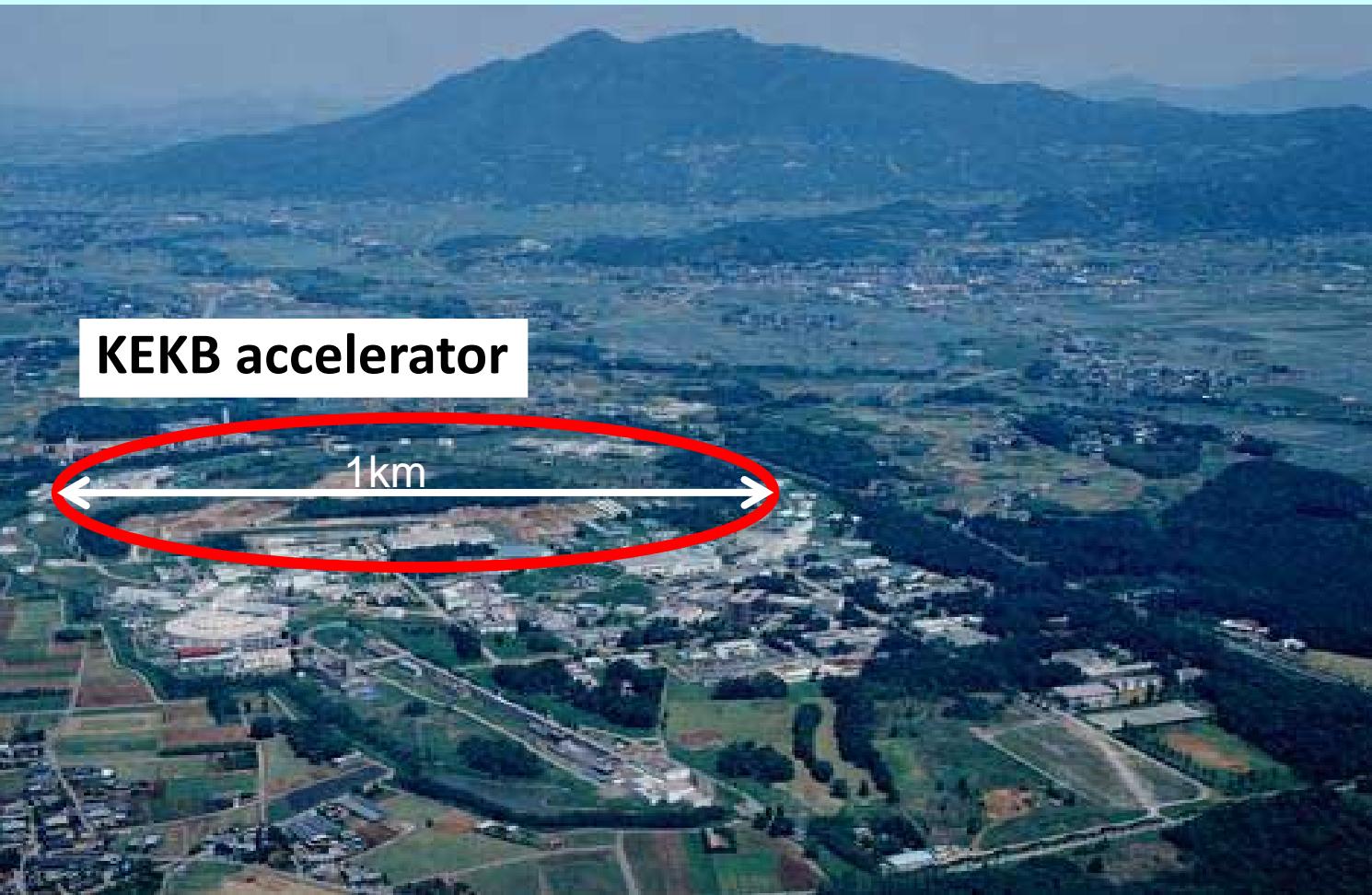


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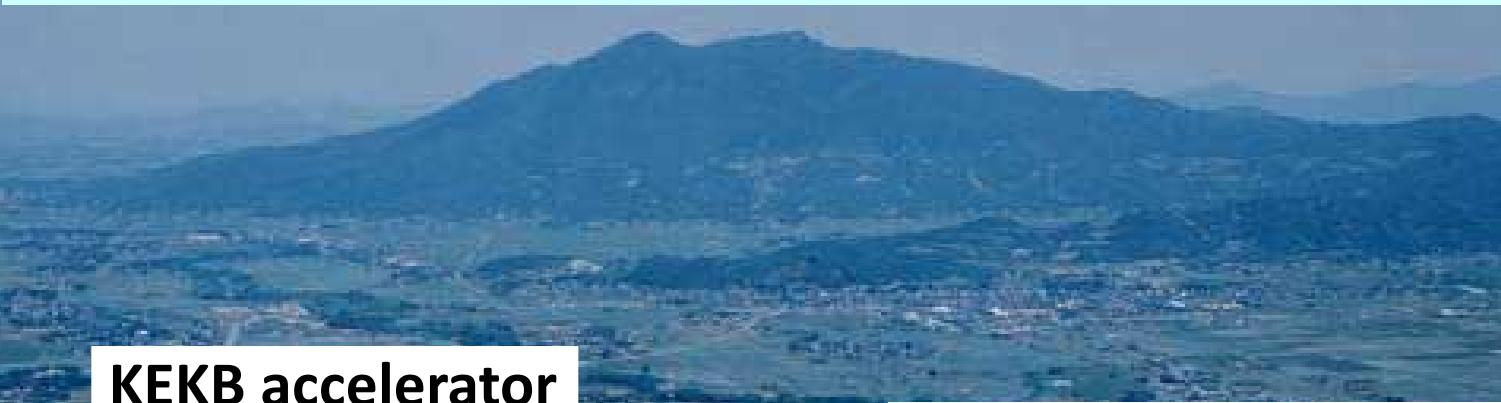
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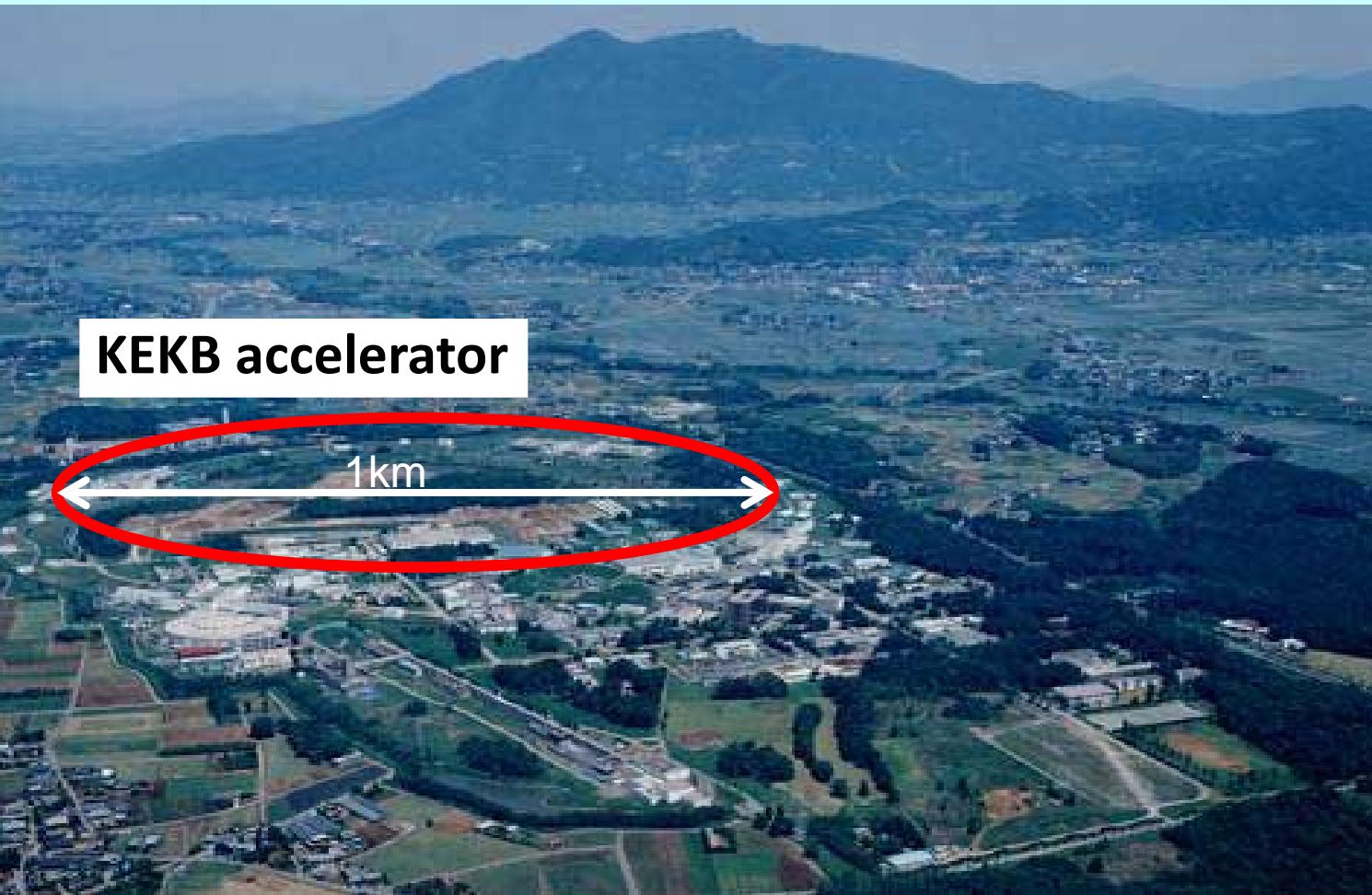
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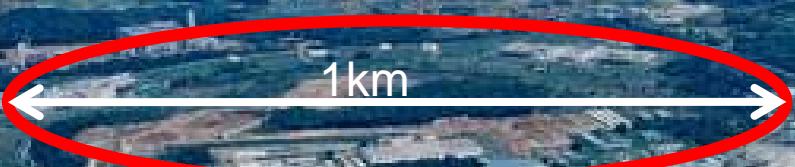


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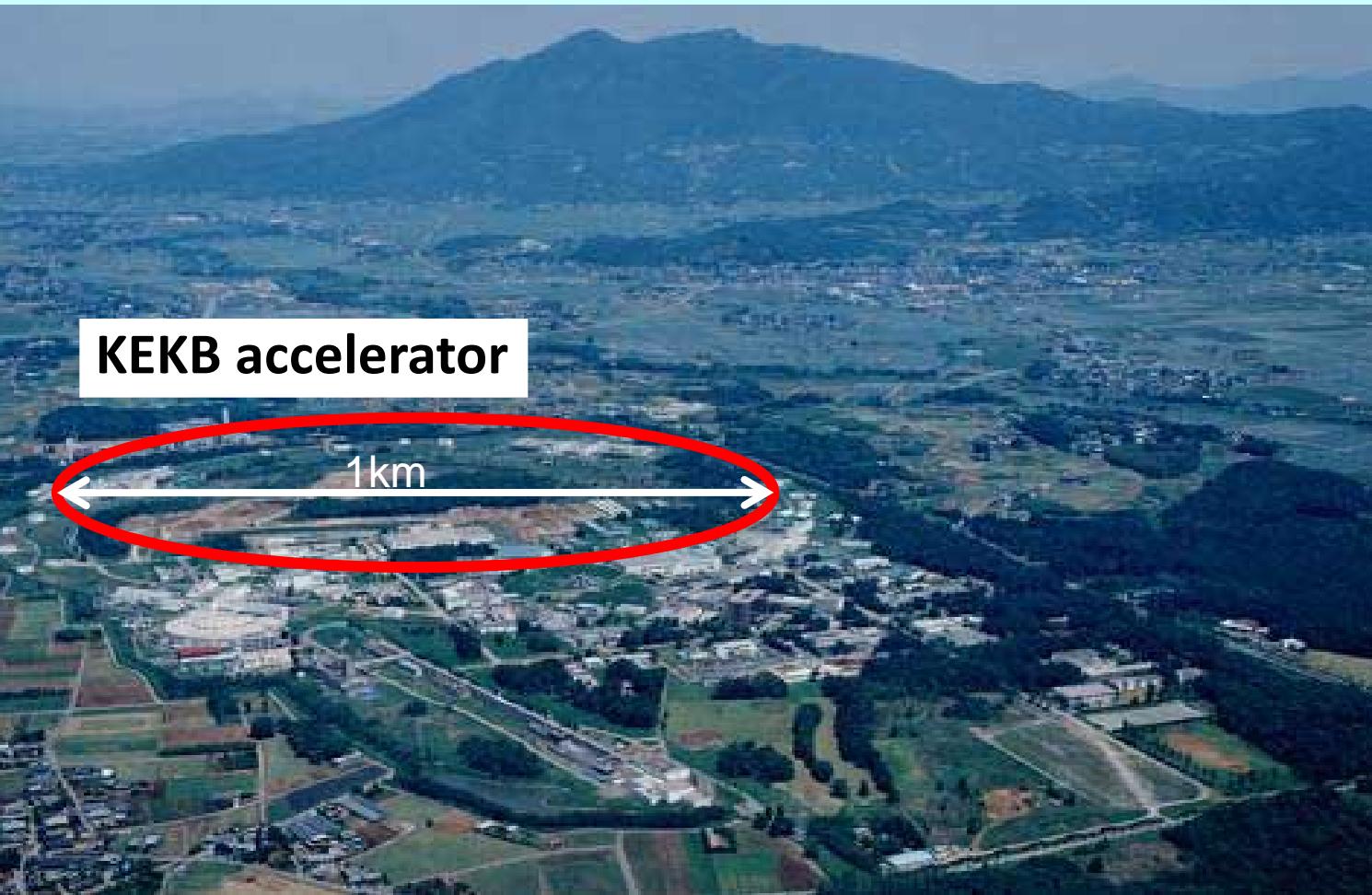
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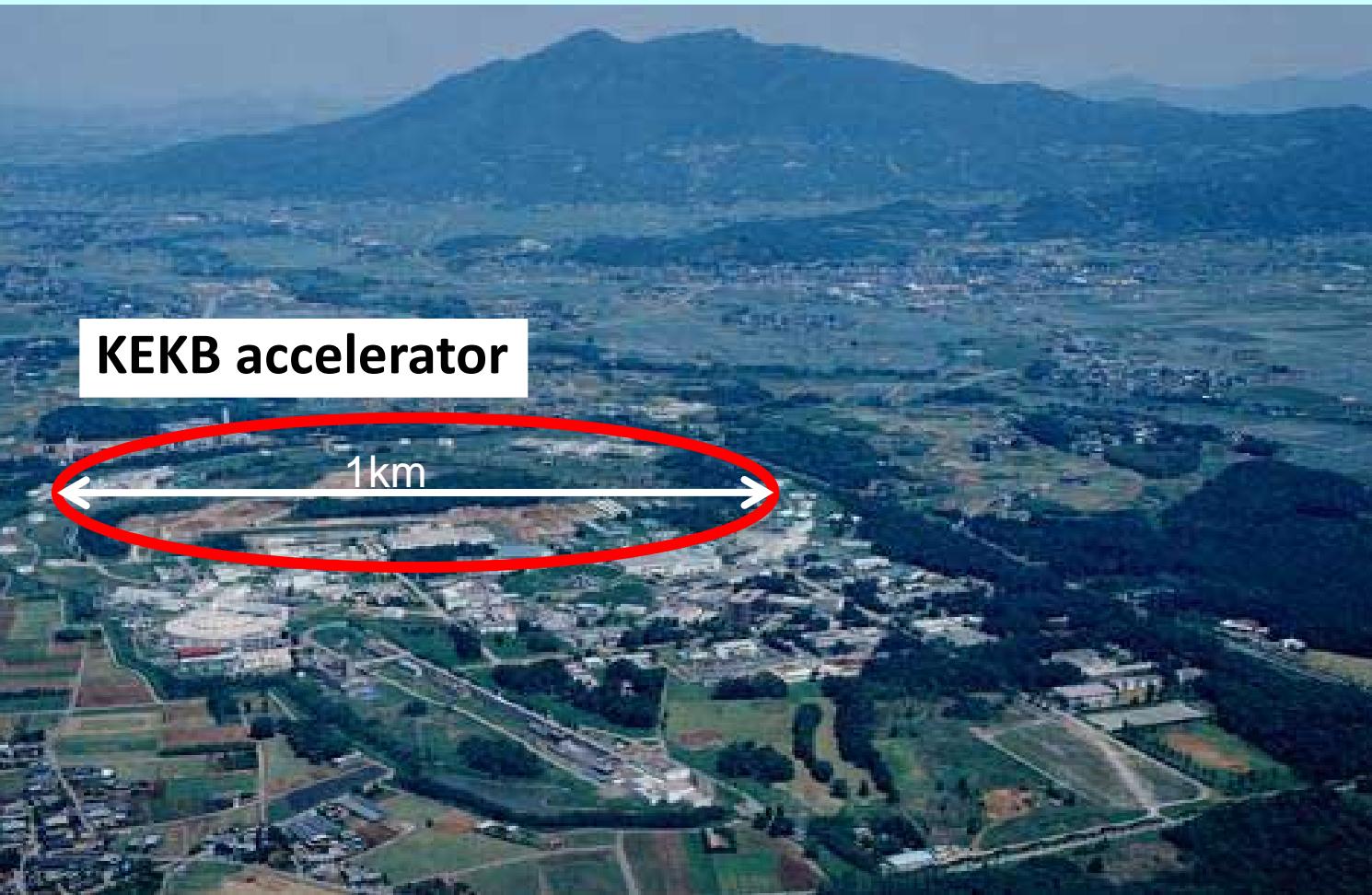
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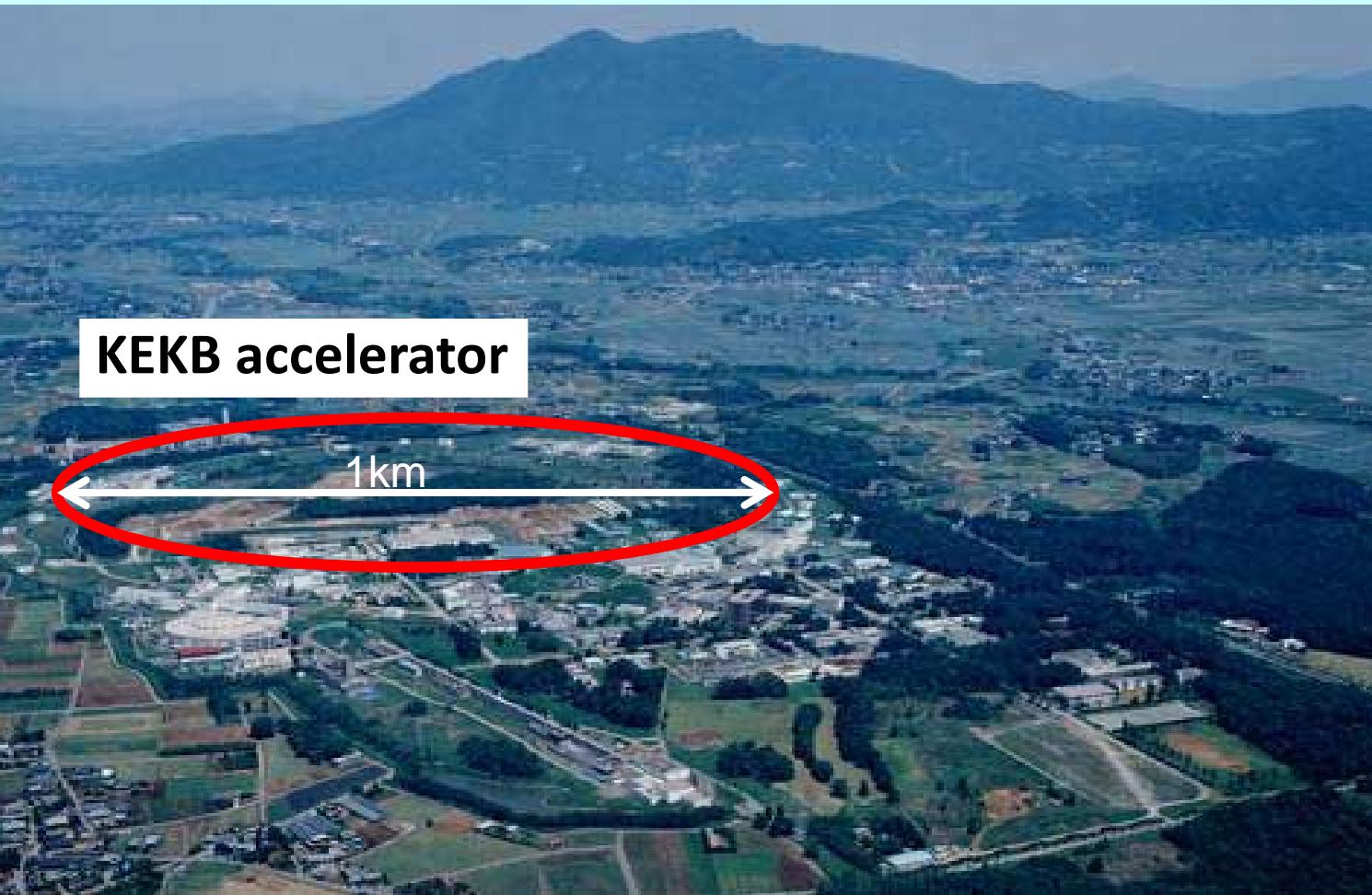
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1km



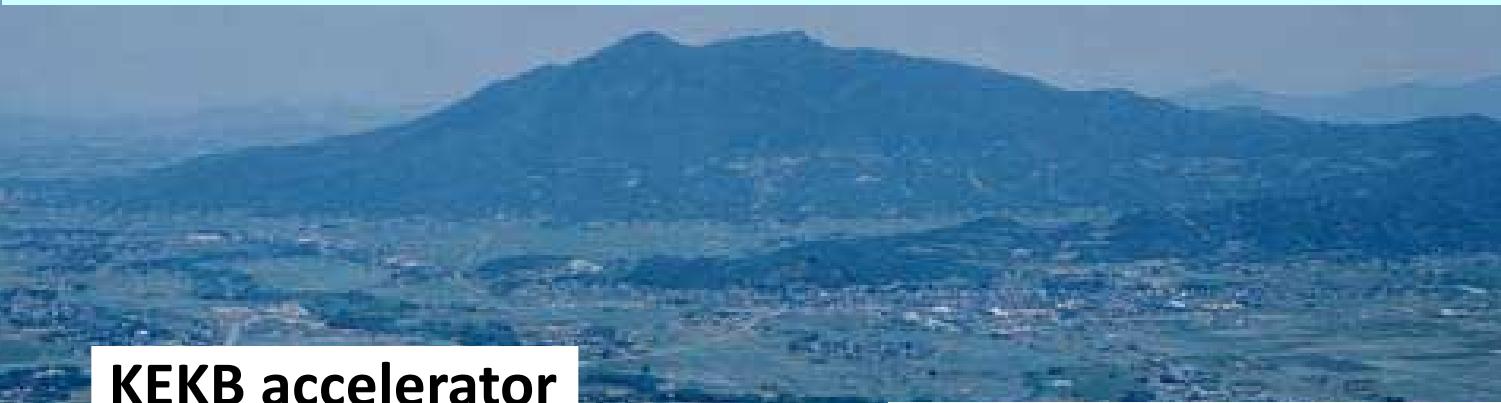
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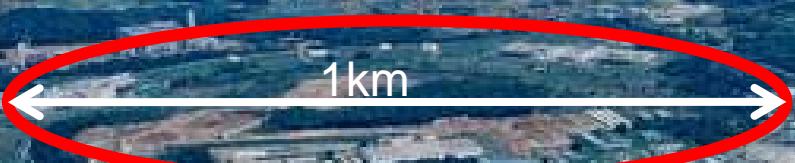


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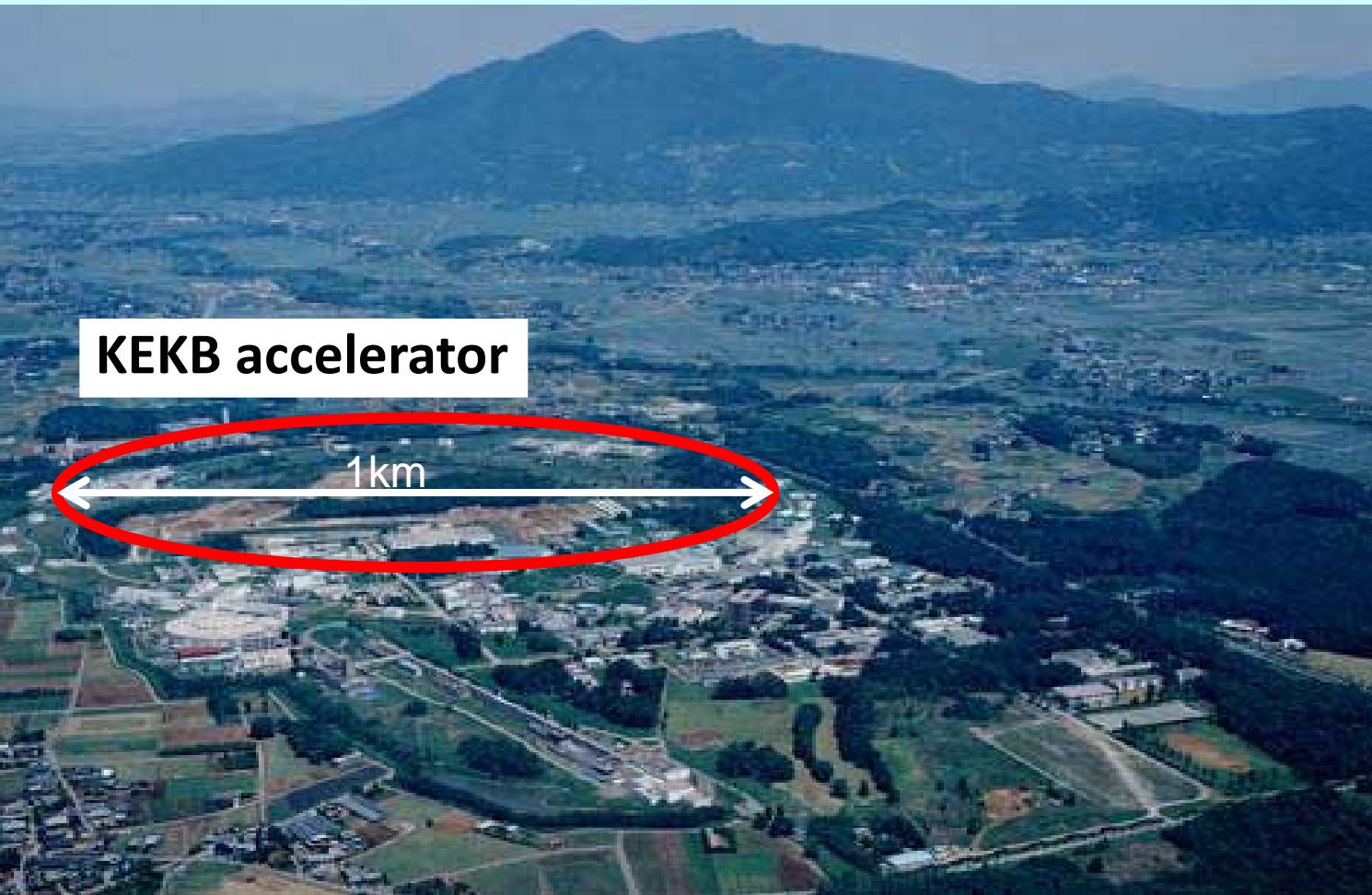
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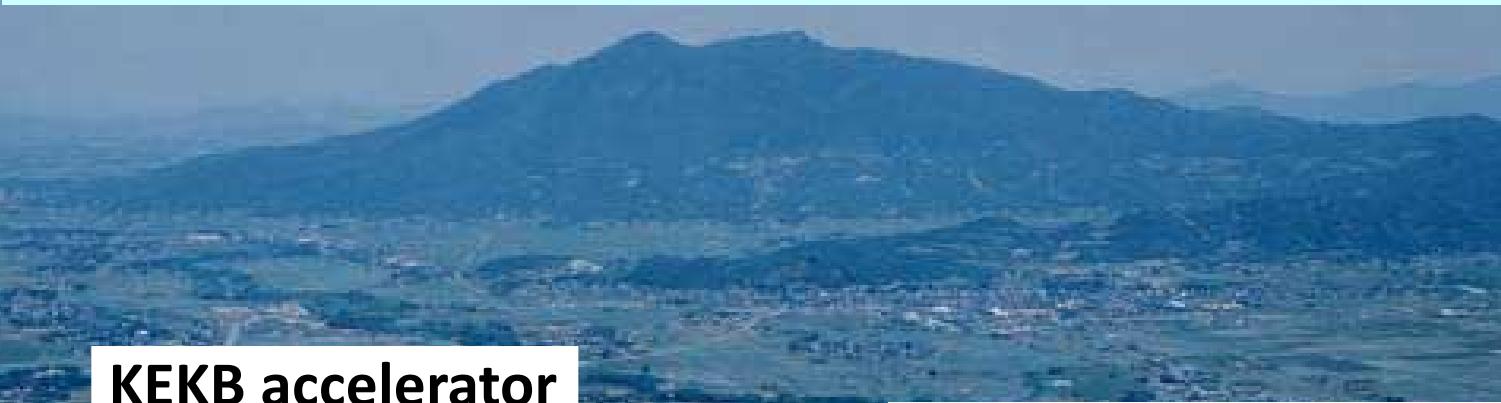
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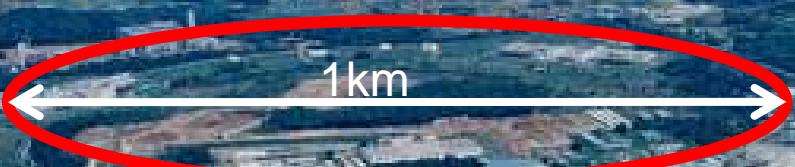


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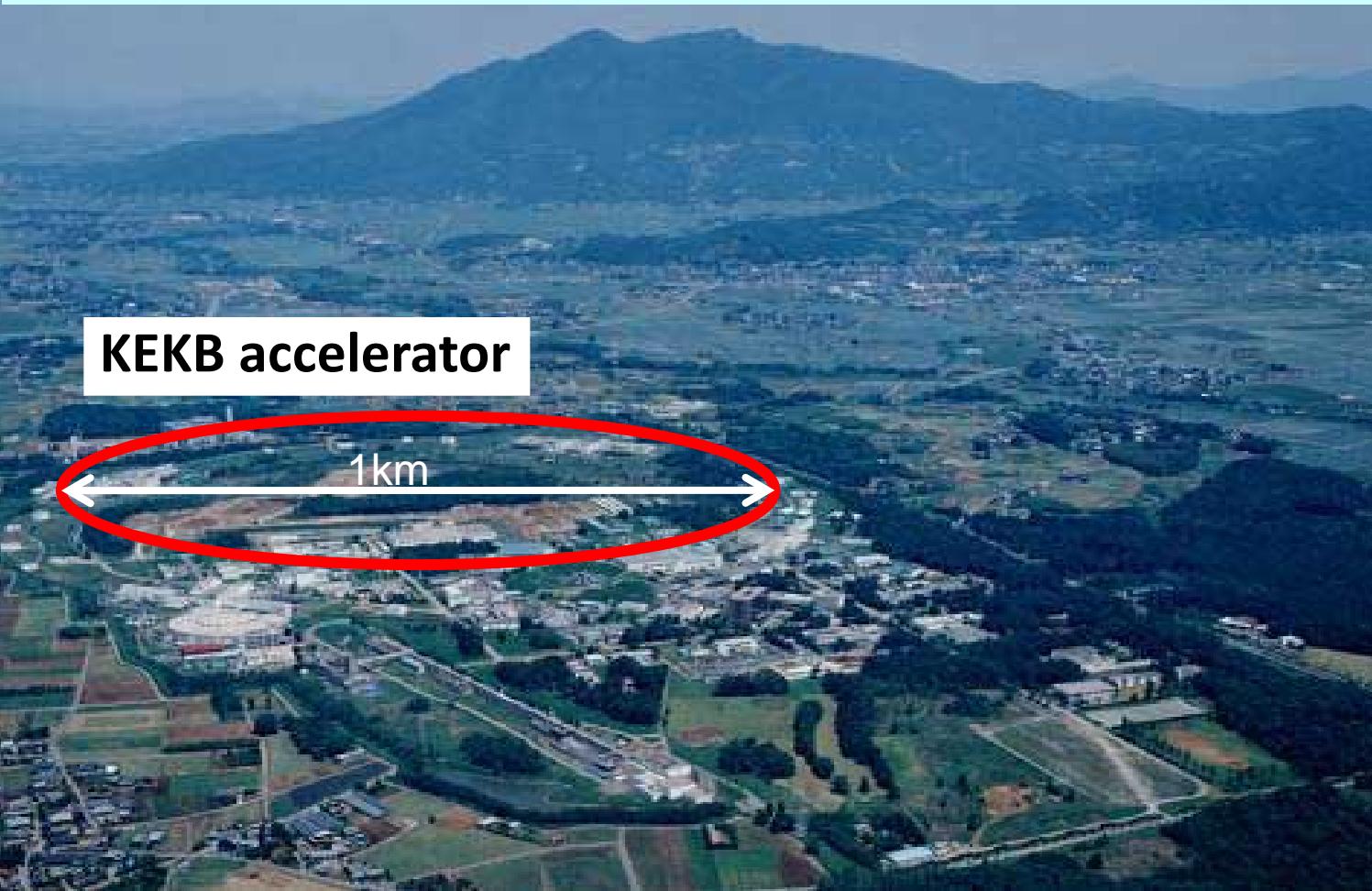
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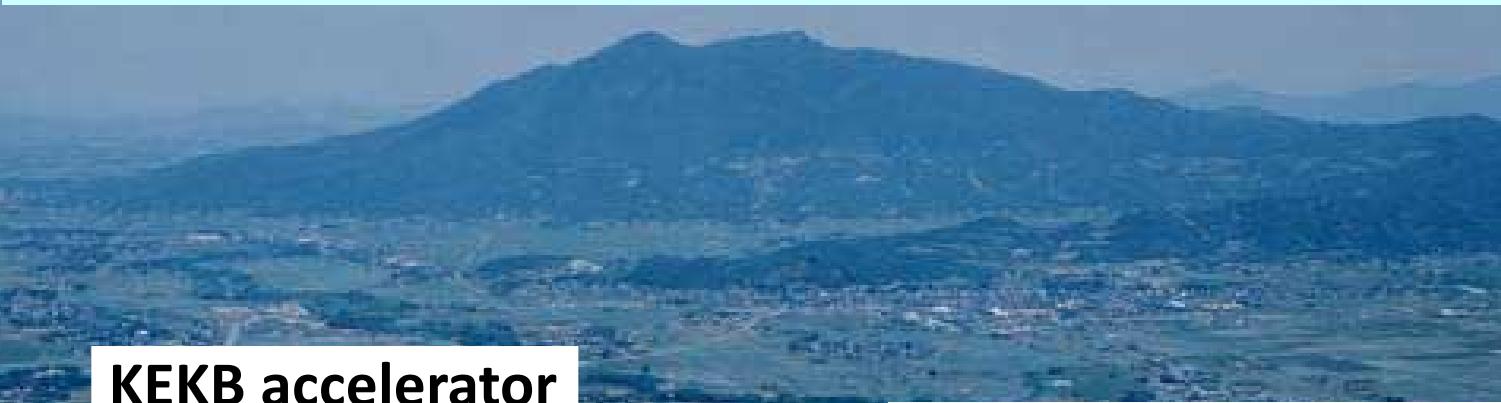
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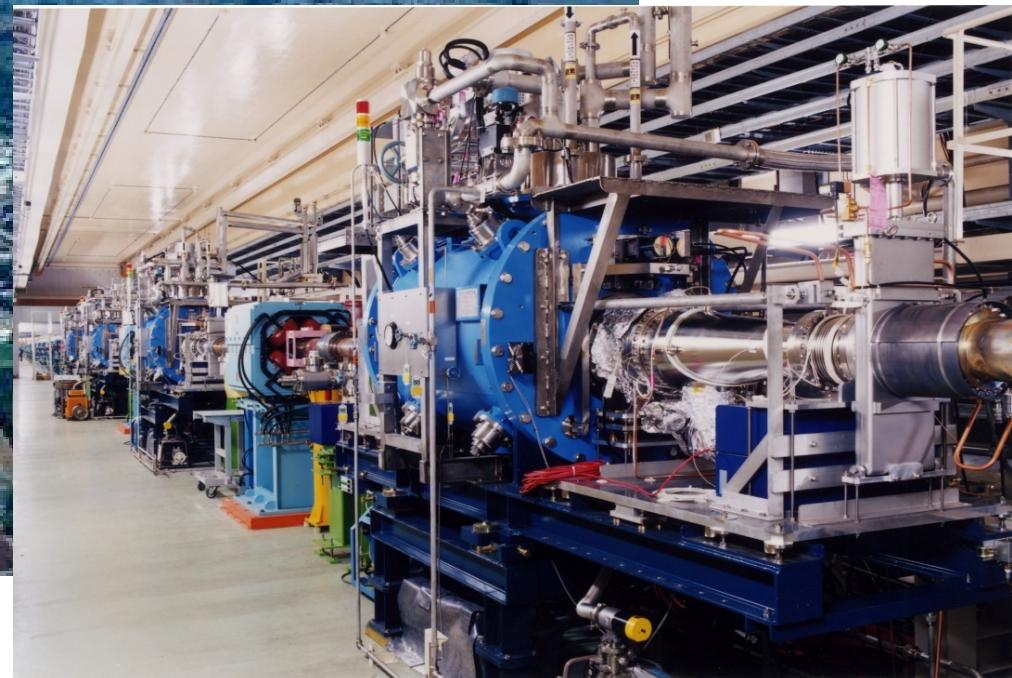
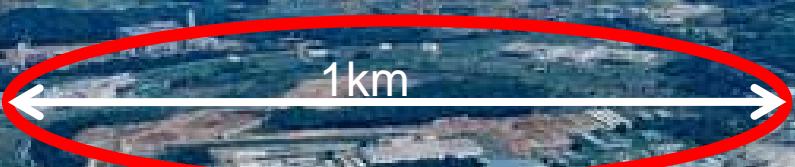


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# KEKB to SuperKEKB

- KEKB operation finished in 2010 June.
- SuperKEKB operation will start from 2015 Jan.

**Currently under construction**



# KEKB to SuperKEKB

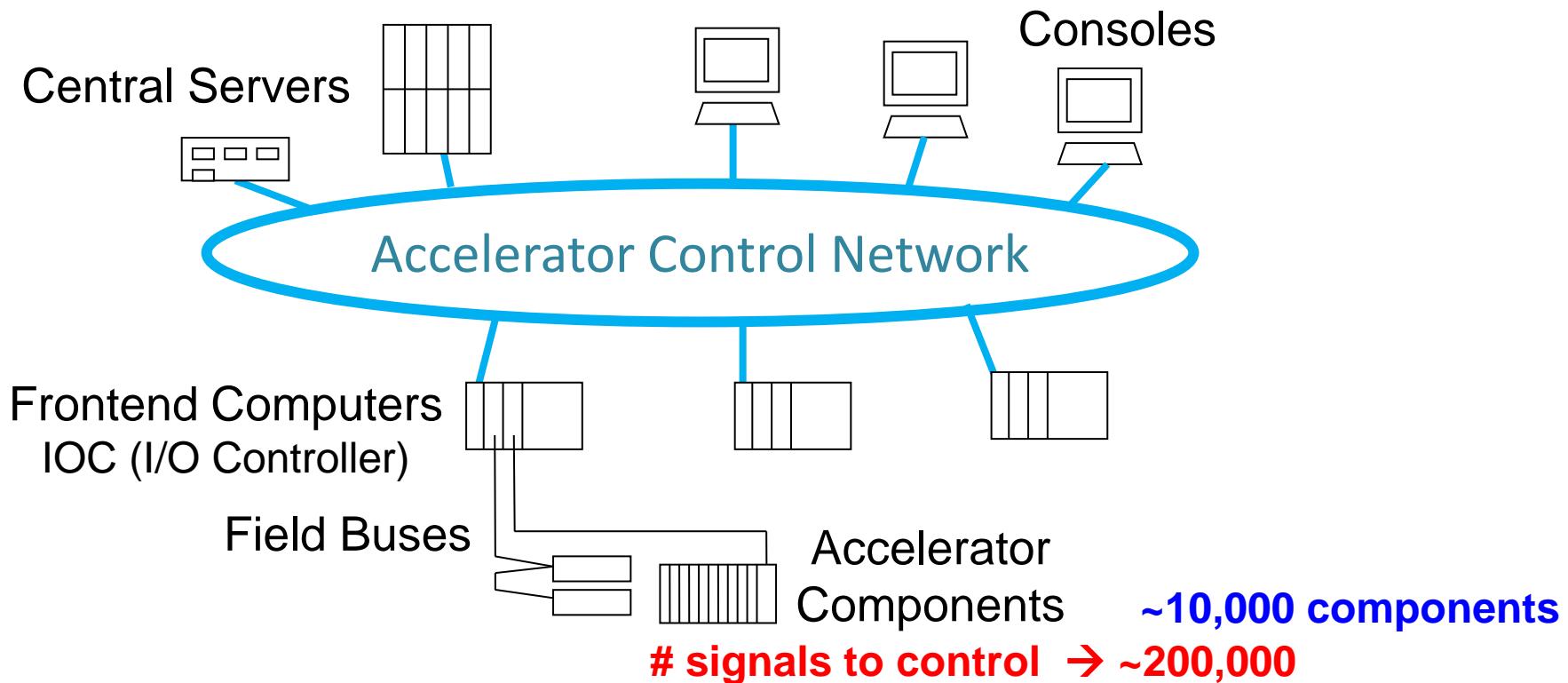
- KEKB operation finished in 2010 June.
- SuperKEKB operation will start from 2015 Jan.

**Currently under construction**



# 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)

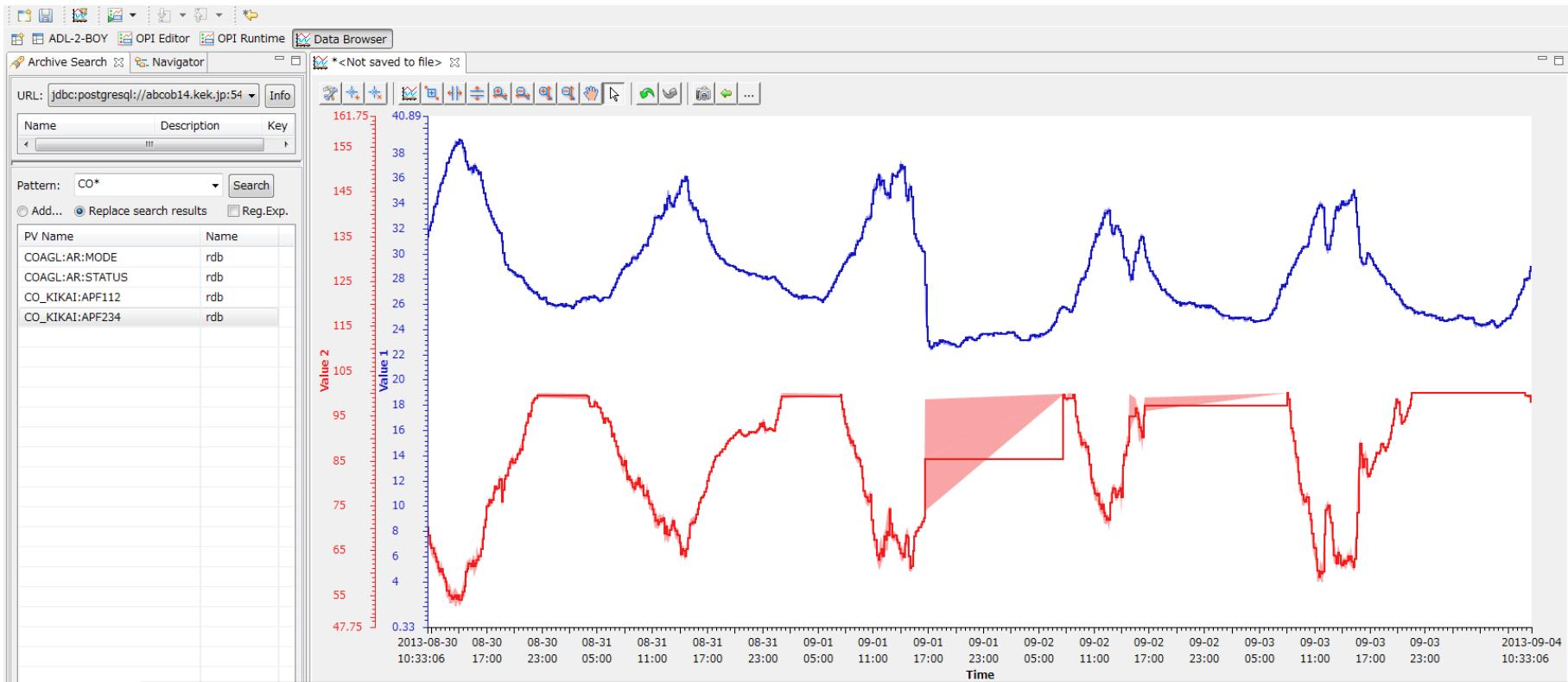
We upgrade PSICM  
for SuperKEKB

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



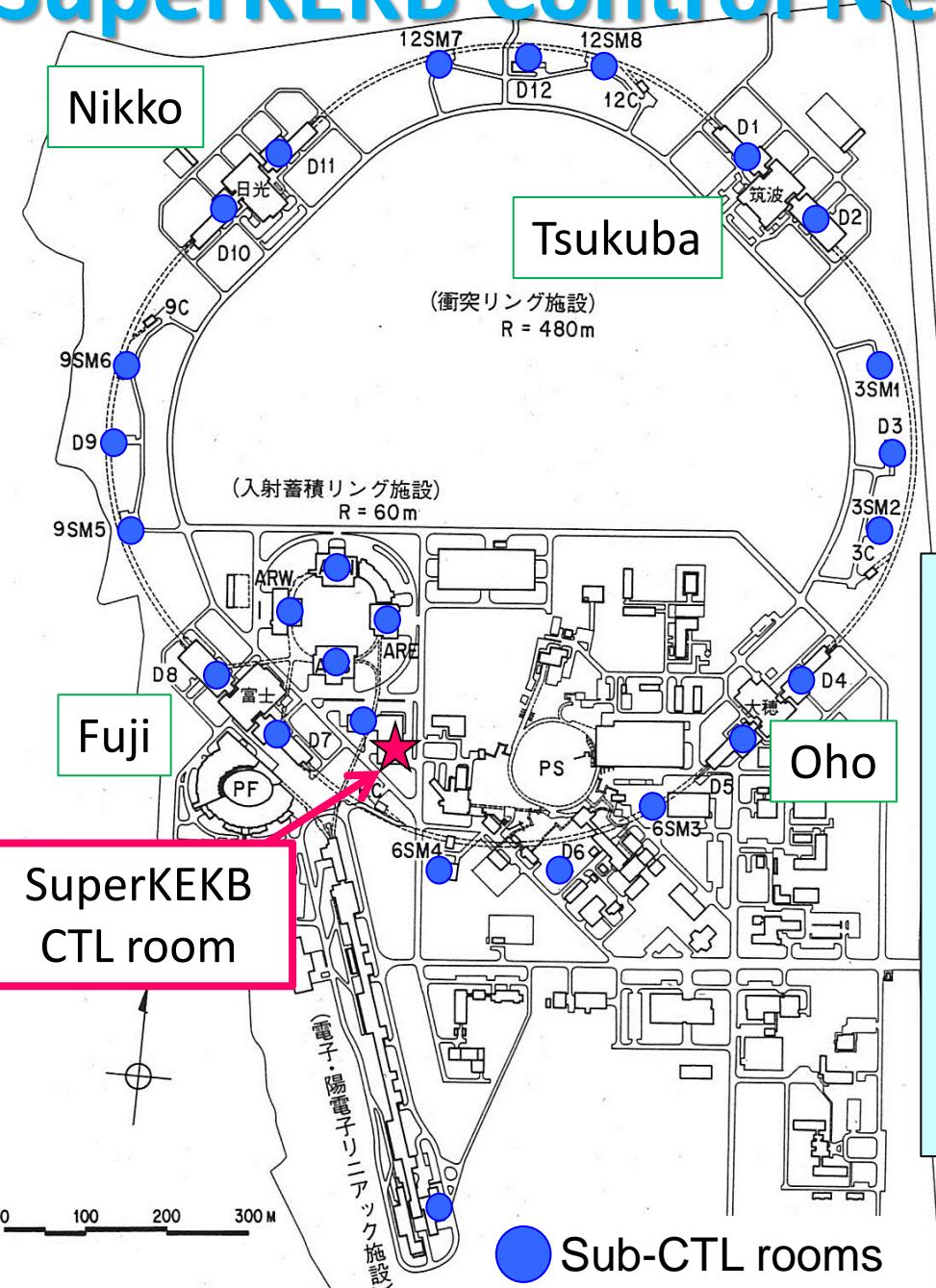
# Data Archiving System

- KEKBLog as a primary data archiving system (file based logging system)
- CSS(Control System Studio)-based Archiver + PostgreSQL as the 2<sup>nd</sup> 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

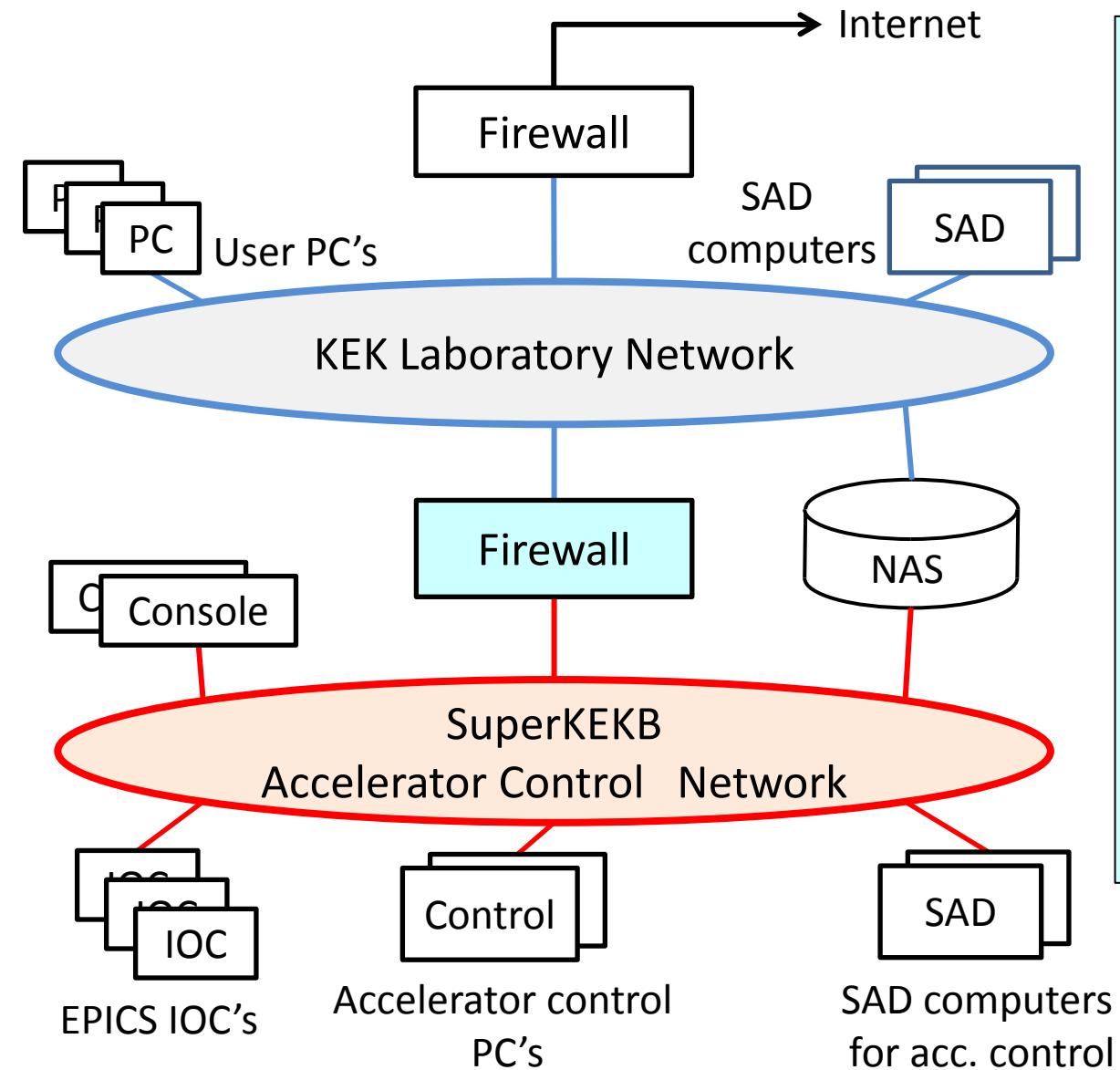
Main network switch is located at the SuperKEKB CTL room

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



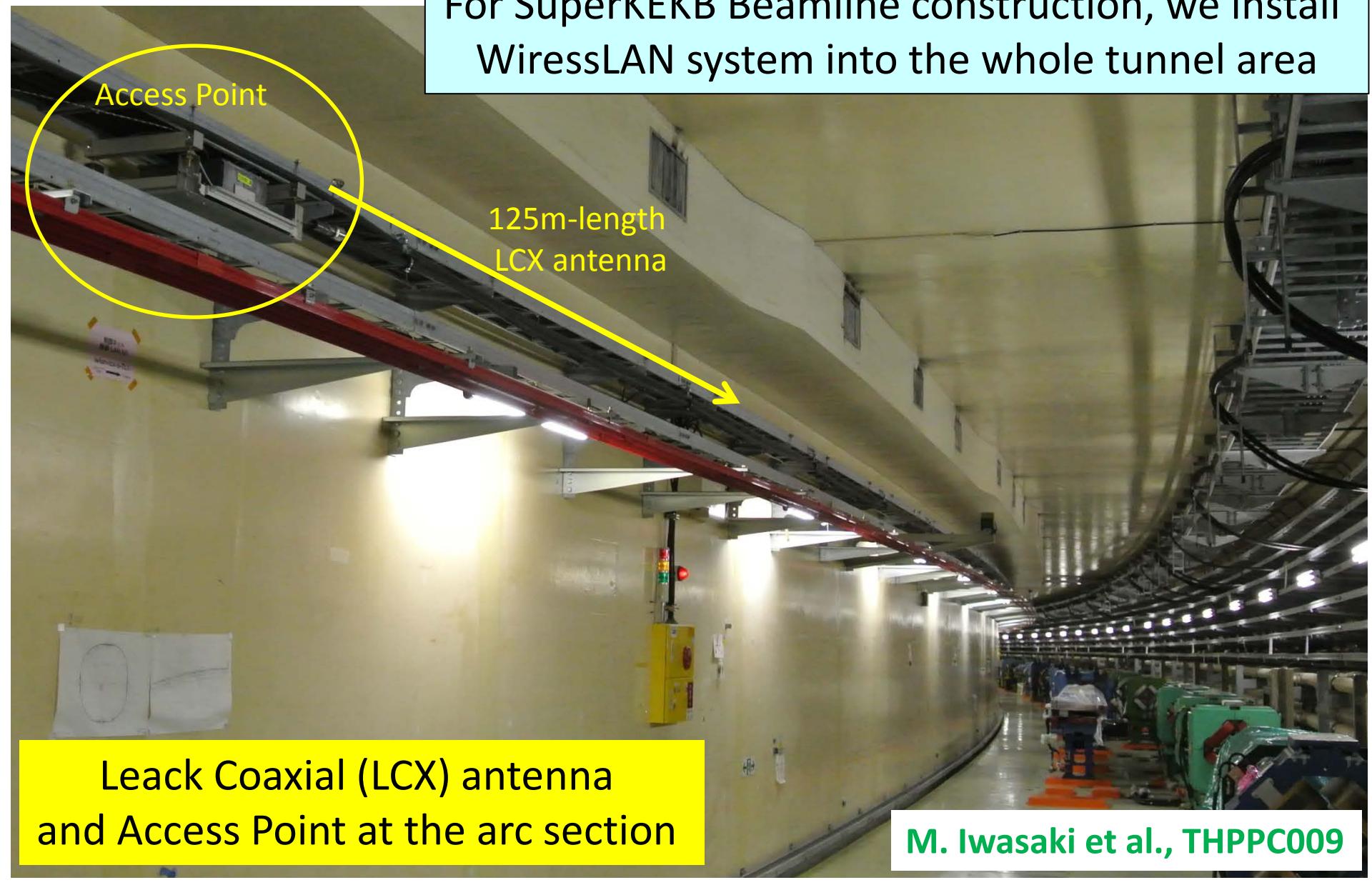
**New configuration  
from this summer**

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



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

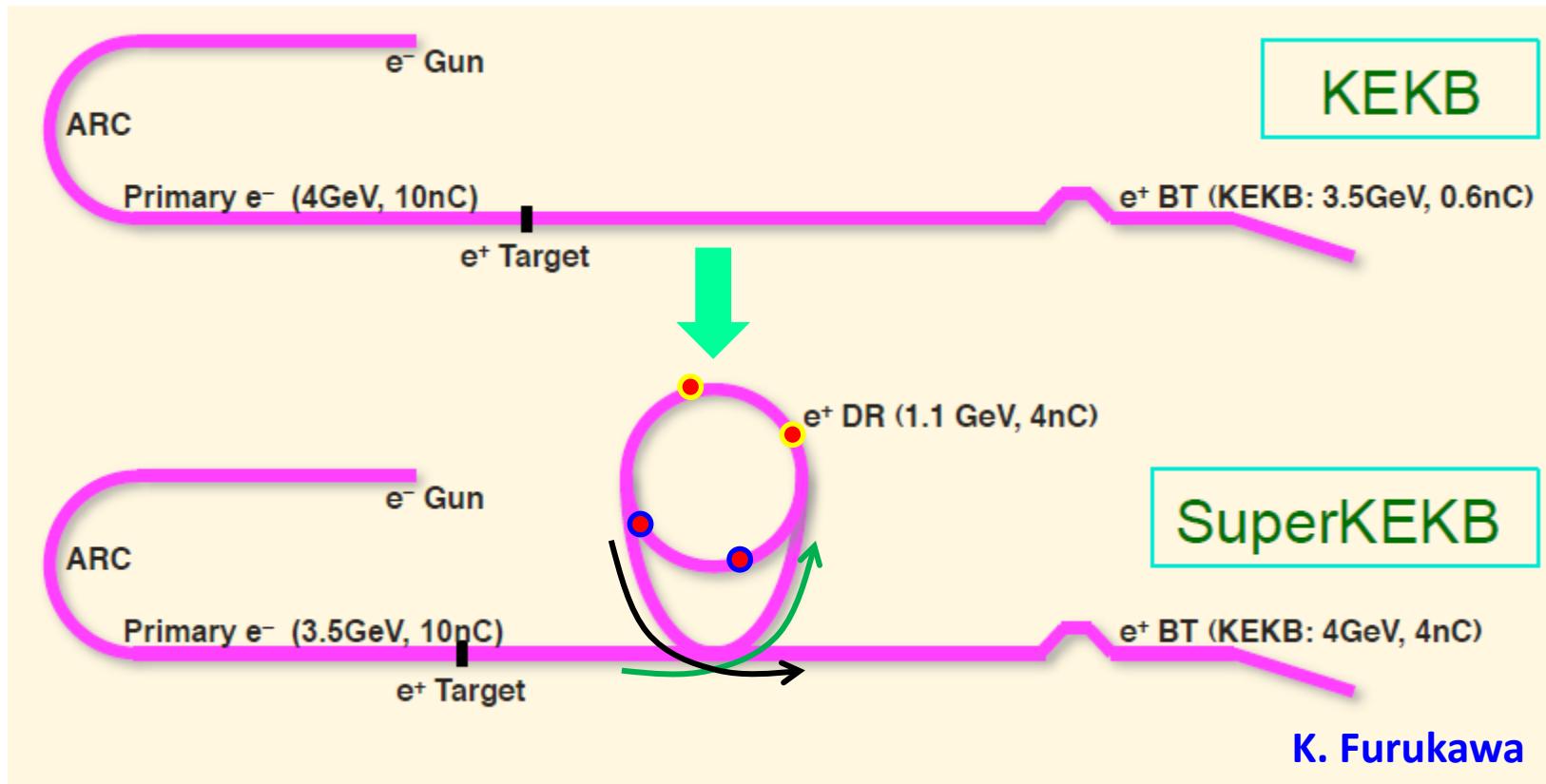
M. Iwasaki et al., THPPC009

# 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



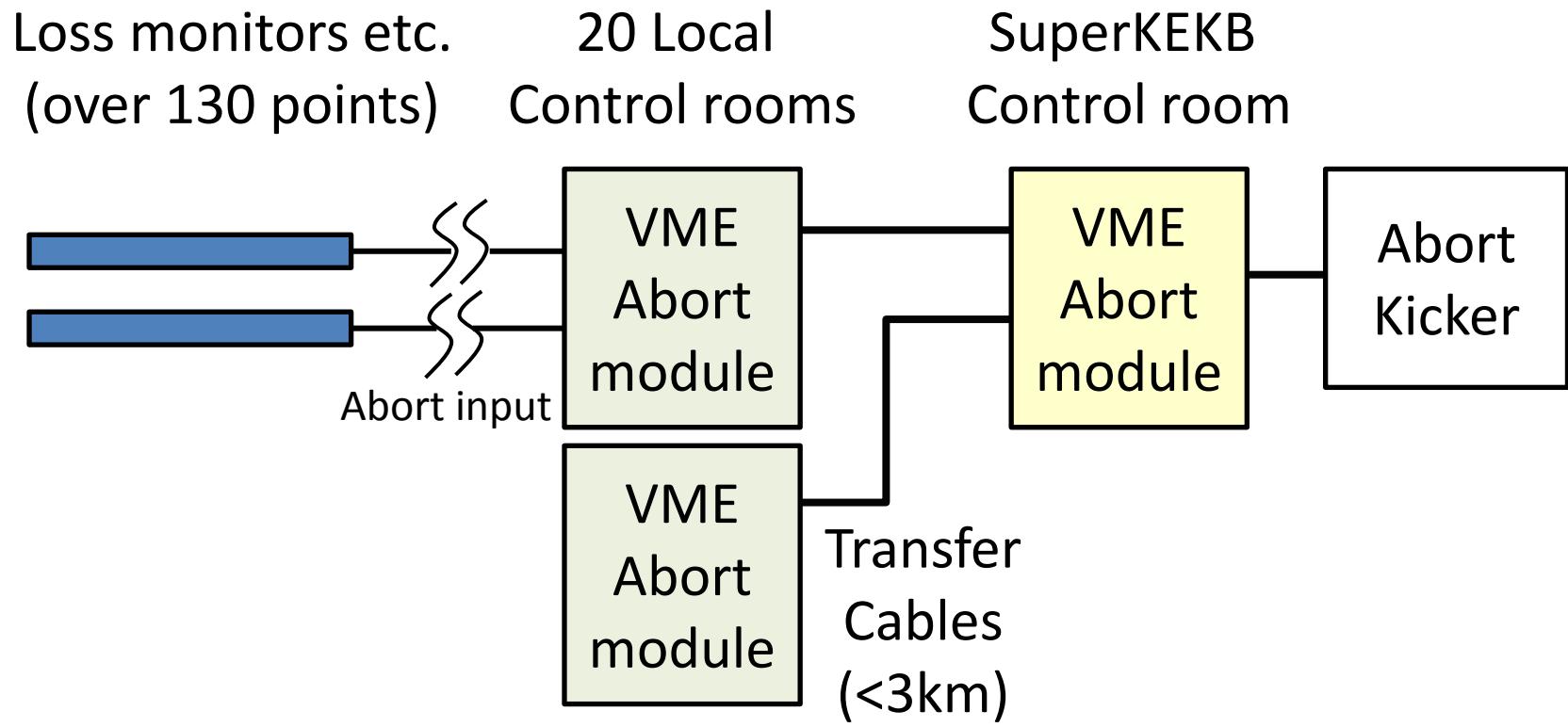
K. Furukawa

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  $100\mu\text{s}$  to  $20\mu\text{s}$



.....

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 1<sup>st</sup> 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”

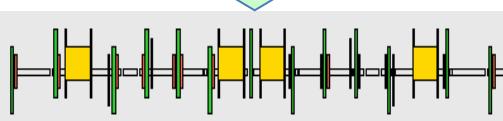
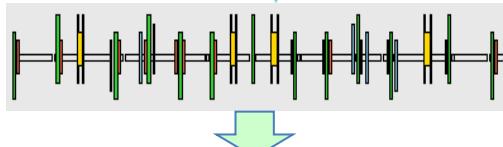
# Back Up

# KEKB to SuperKEKB

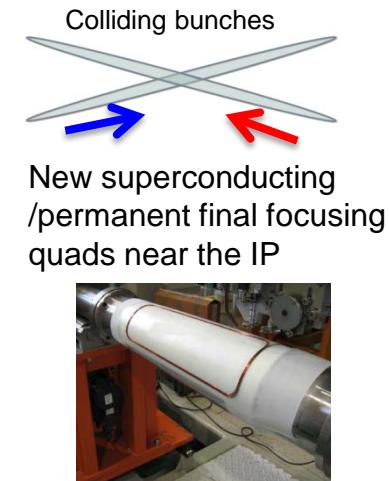
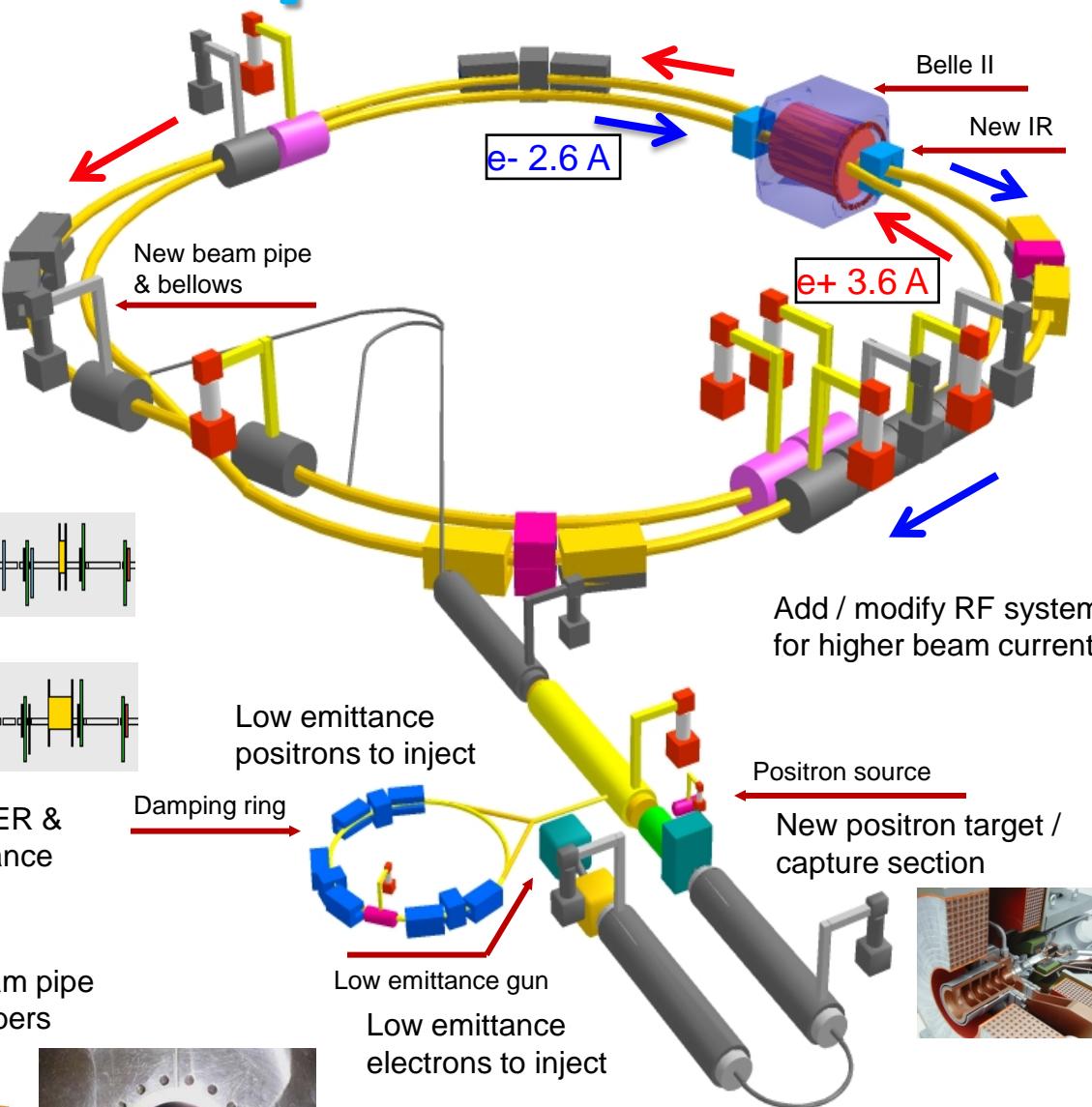
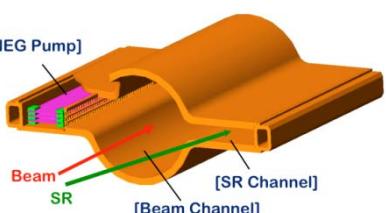
## How to upgrade



Replace short dipoles with longer ones (LER)

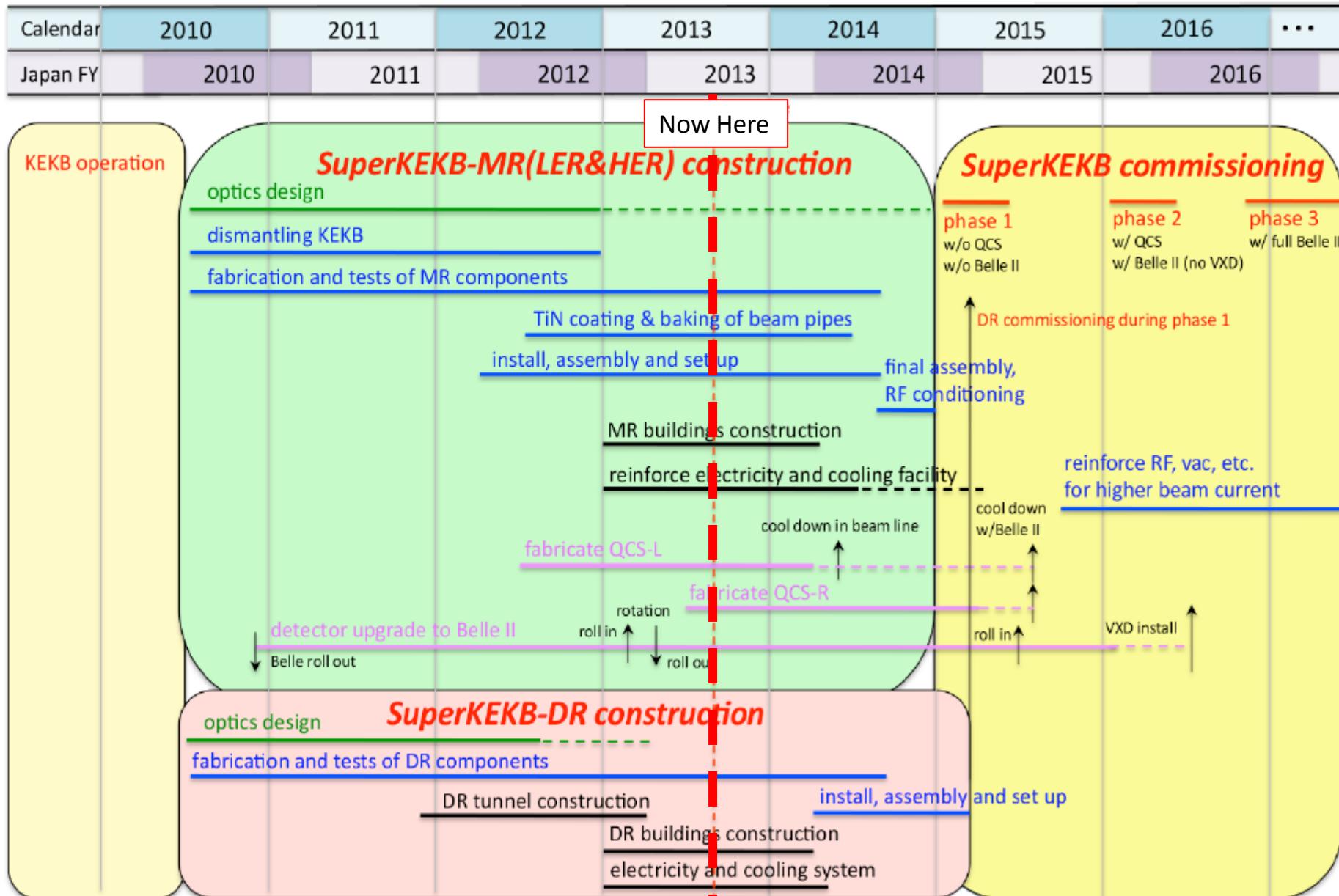


Redesign the lattices of HER & LER to squeeze the emittance



*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.

