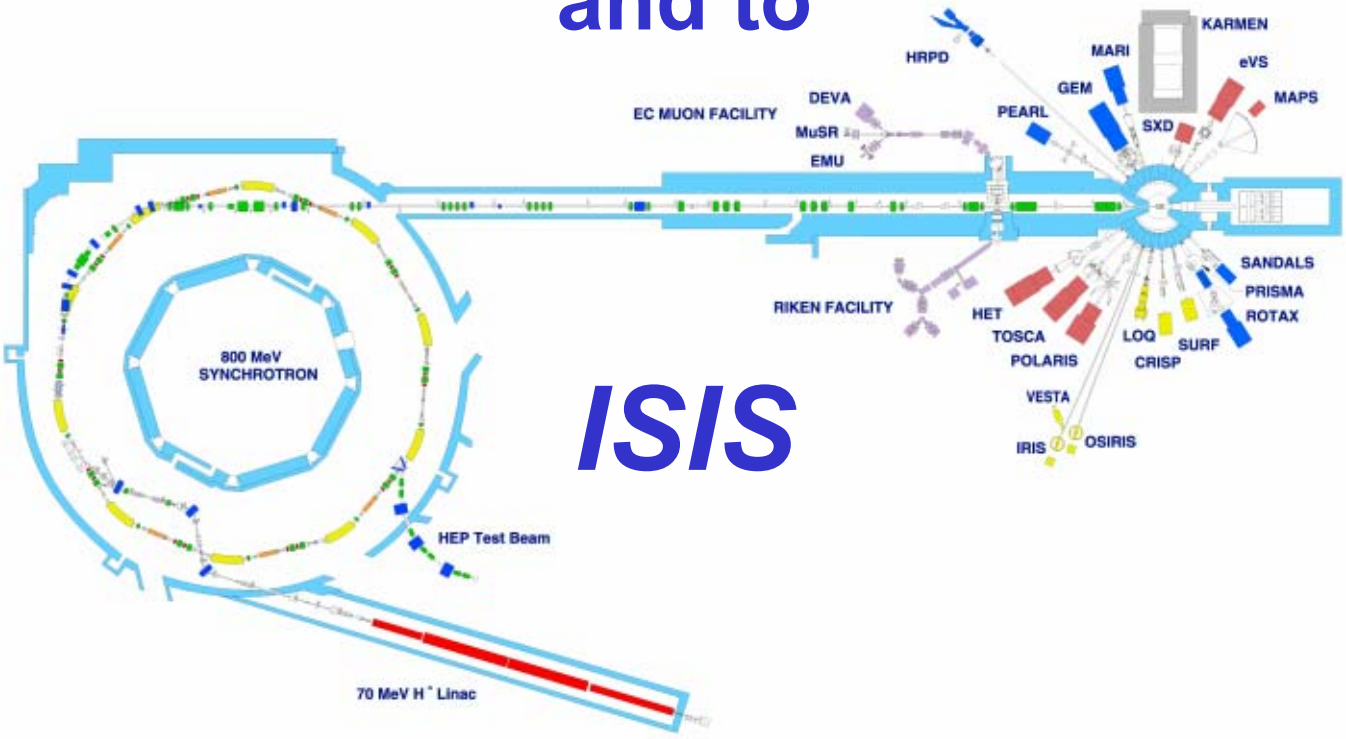
An Introduction to the

Rutherford Appleton Laboratory

and to



ISIS

Philip King

ISIS Muon Training Course

21 February 2005

ISIS

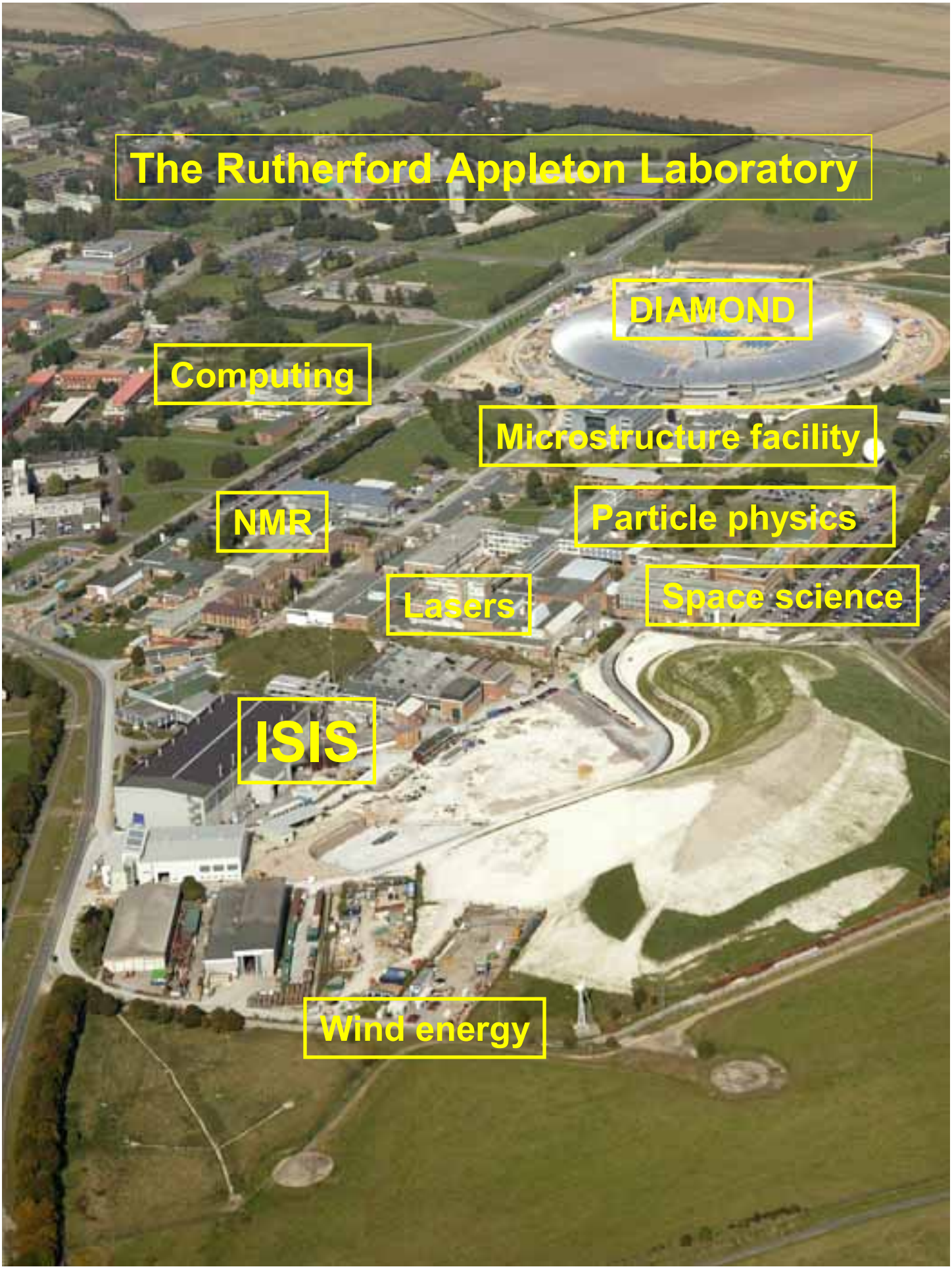
ï A brief introduction to the CCLRC and to RAL

ï ISIS - a few facts and figures

ï ISIS - making neutrons and muons

ï ISIS and RAL - the future

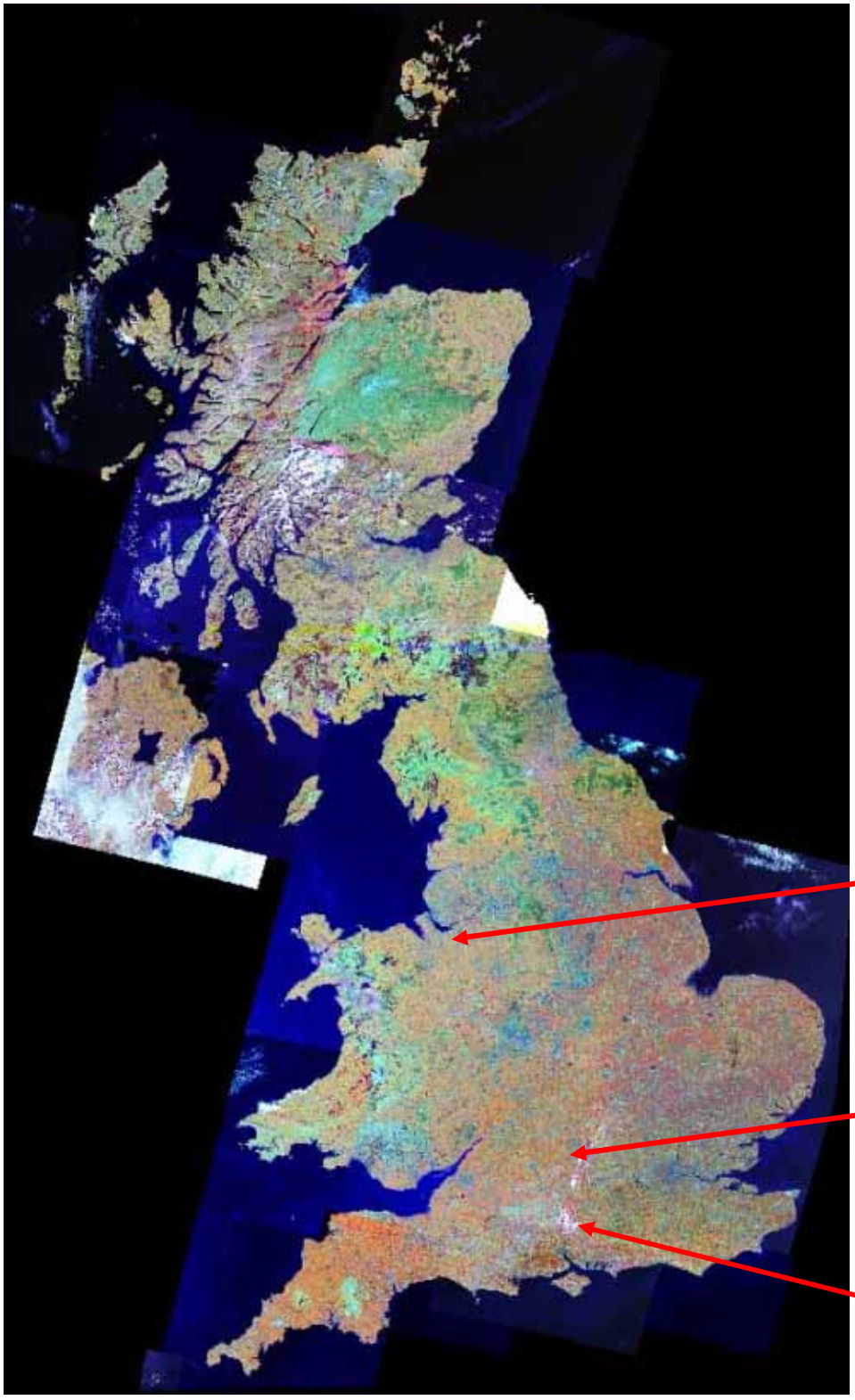
ISIS


The Rutherford Appleton Laboratory
DIAMOND
Computing
Microstructure facility
NMR
Particle physics
Lasers
Space science
ISIS
Wind energy

ï The Rutherford Appleton Laboratory is part of CCLRC (the Council for the Central laboratory of the Research Councils)

ï CCLRC owns and runs the Rutherford Appleton Lab, the Daresbury Lab, and the Chilbolton Observatory

ï Between them these laboratories CCLRC provides access to facilities and expertise across a wide range of science areas


Daresbury
Laboratory
Rutherford
Appleton
Laboratory
Chilbolton
Facility

ISIS


ISIS . . .
. . . the worldís most intense pulsed neutron and muon source

ISIS

A large experimental facility . .

ï Attracts **1600 visiting researchers** per year
ï . . . from over **30 countries**
ï Delivers some **600 experiments** per year
ï . . . in a wide variety of scientific areas:

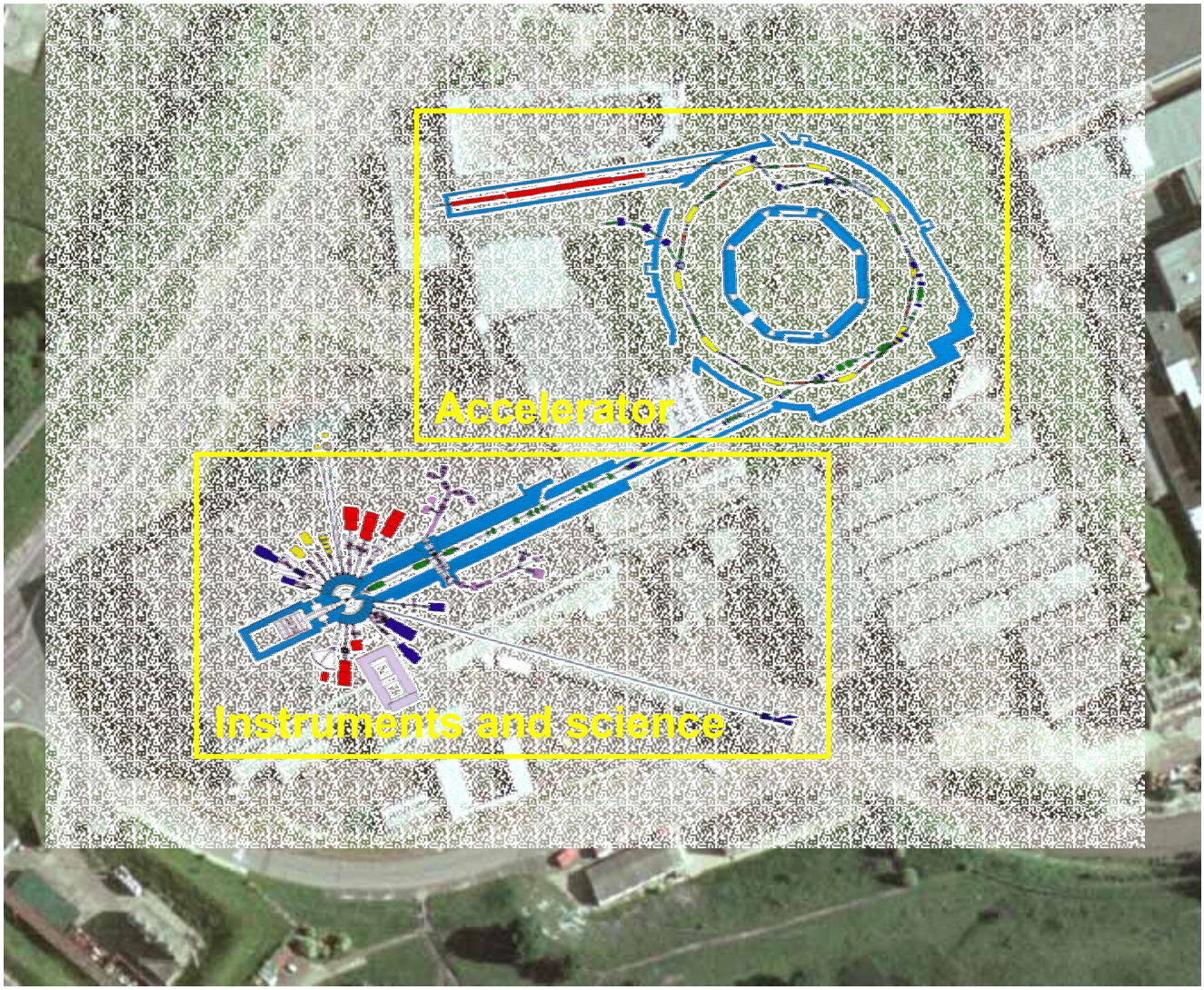
physics, chemistry, earth science,
materials science, engineering,
pharmaceutical science, biological science

ï Employs around **260 staff**
ï Uses **£1.5M** of electricity per year

ï . . . Uses neutrons and muons to study atomic-level structure and dynamics

ISIS

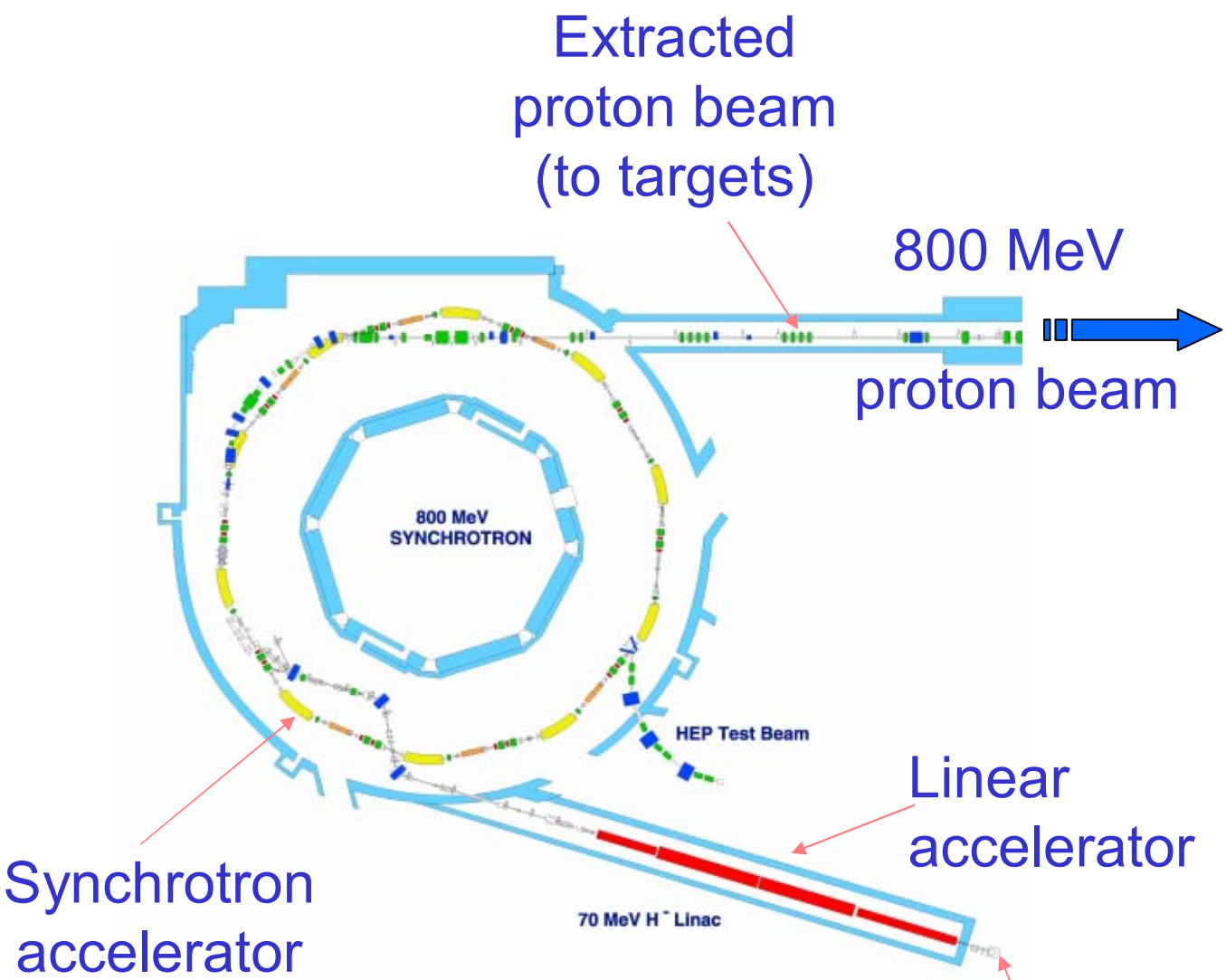
ISIS



ISIS

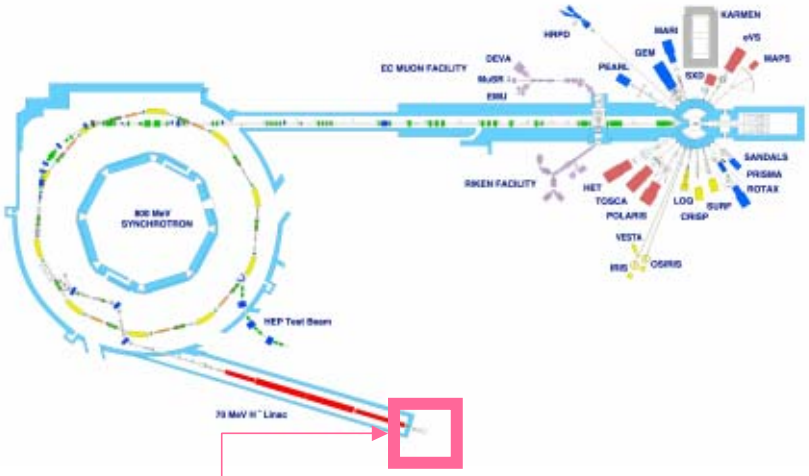
The ISIS accelerators

Neutrons and muons produced from an 800 MeV proton beam.



ISIS

The ISIS accelerators

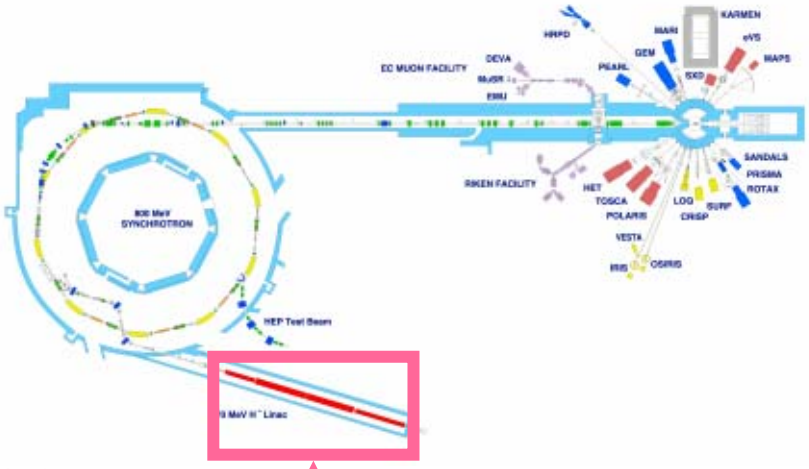


The beginning - the *Ion Source*

Produces H^- ions and accelerates them to 665 keV.

ISIS

The ISIS accelerators

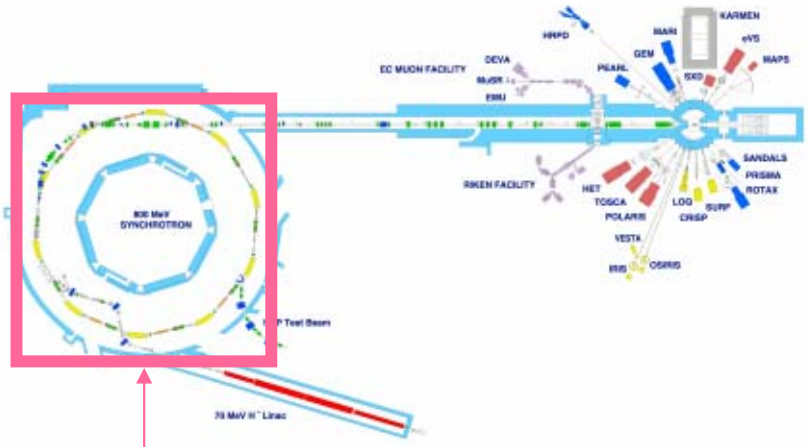


The middle - the
Linear Accelerator

Accelerates the H^- ions to 70 MeV.

ISIS

The ISIS accelerators

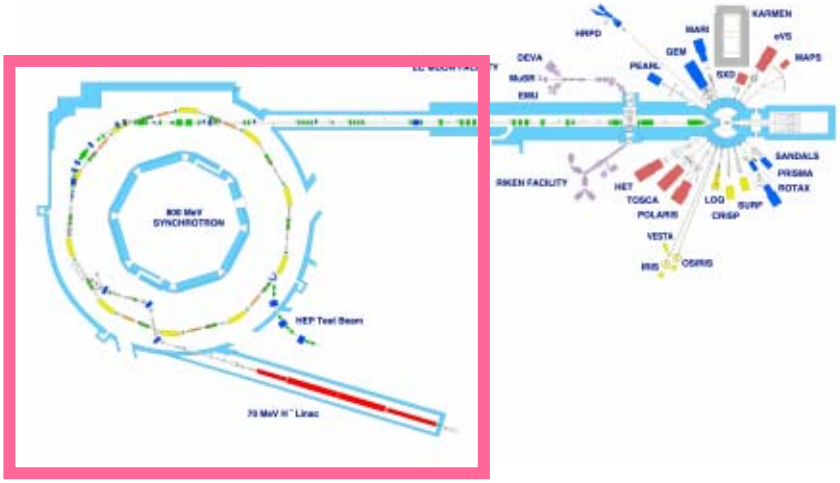


The final stage - the *Synchrotron Accelerator*

Electrons stripped from the H^- ions.
Resulting protons are accelerated
to 800 MeV, and split into two bunches

ISIS

The ISIS accelerators



ISIS accelerates over a thousand million million protons per second.

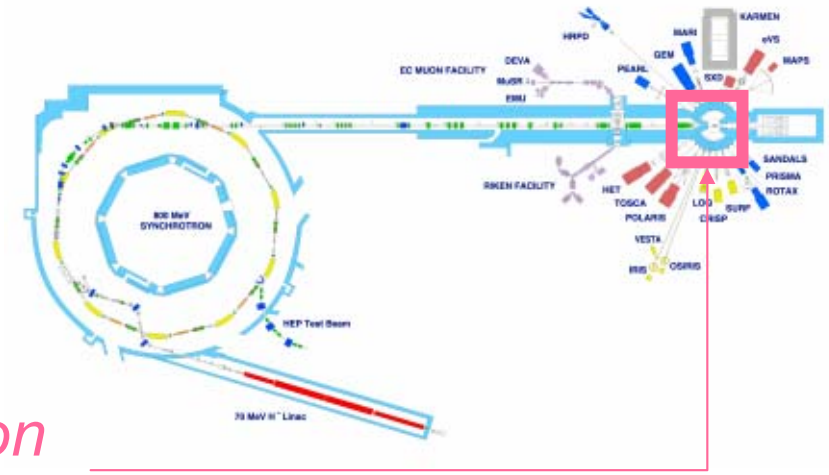
Each proton travels around the accelerator many thousands of times.

The accelerator is 50 m in diameter (157m circumference). At final speed, it takes a proton 1/2 millionth of a second to go round.

The whole acceleration process happens 50 times every second - ISIS is a pulsed source.

ISIS

Making neutrons

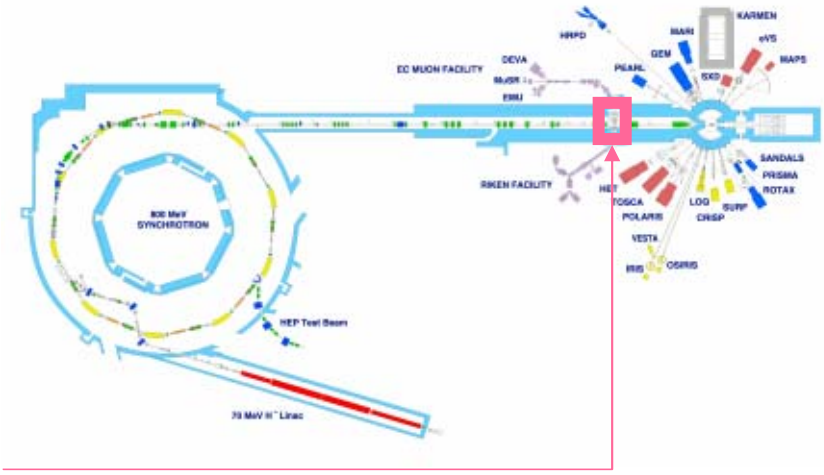


The *Neutron Target*

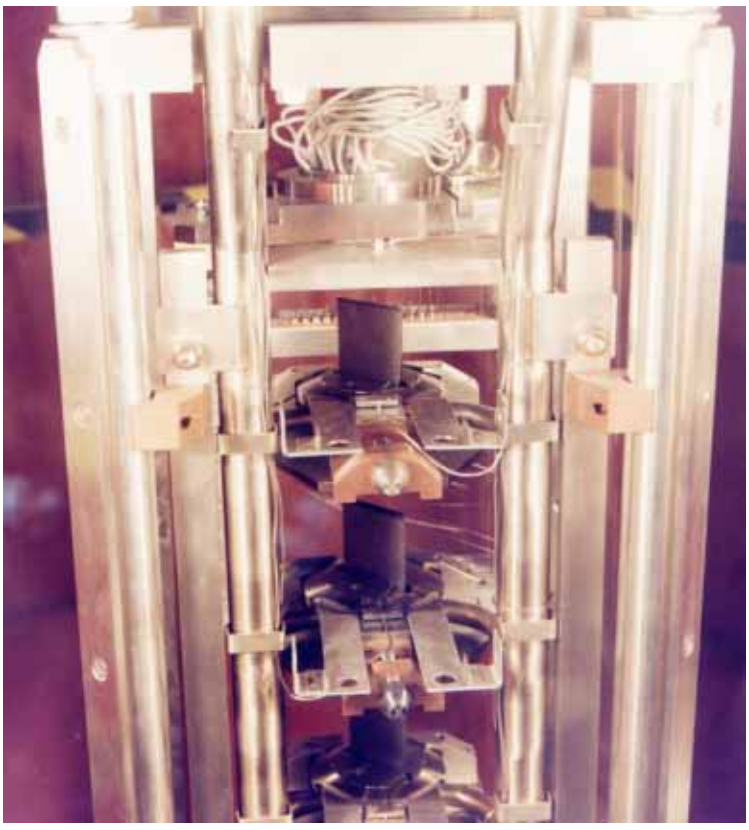
Tantalum target
Neutrons produced by ëspallationí
Heat dissipation is 135 kW

ISIS

Making muons

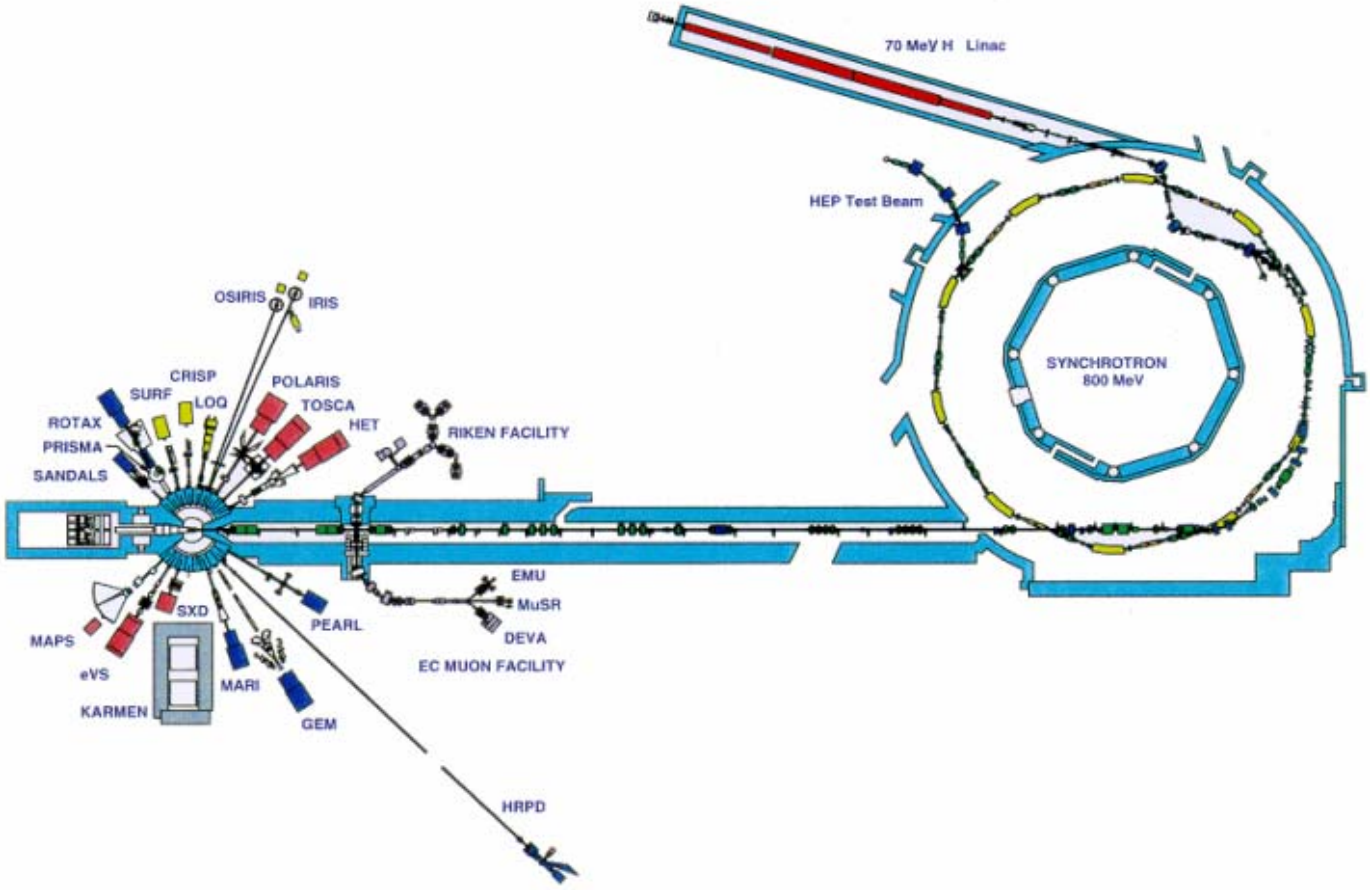


The *Muon Target*



Carbon target, 10 mm thick
Takes 2-3% of the proton beam

ISIS


70 MeV H Linac
HEP Test Beam
SYNCHROTRON
800 MeV
OSIRIS
IRIS
CRISP
SURF
LOQ
POLARIS
TOSCA
HET
ROTAX
PRISMA
SANDALS
RIKEN FACILITY
EMU
MuSR
DEVA
EC MUON FACILITY
SXD
PEARL
MAPS
eVS
KARMEN
MARI
GEM
HRPD

ISIS

ISIS running

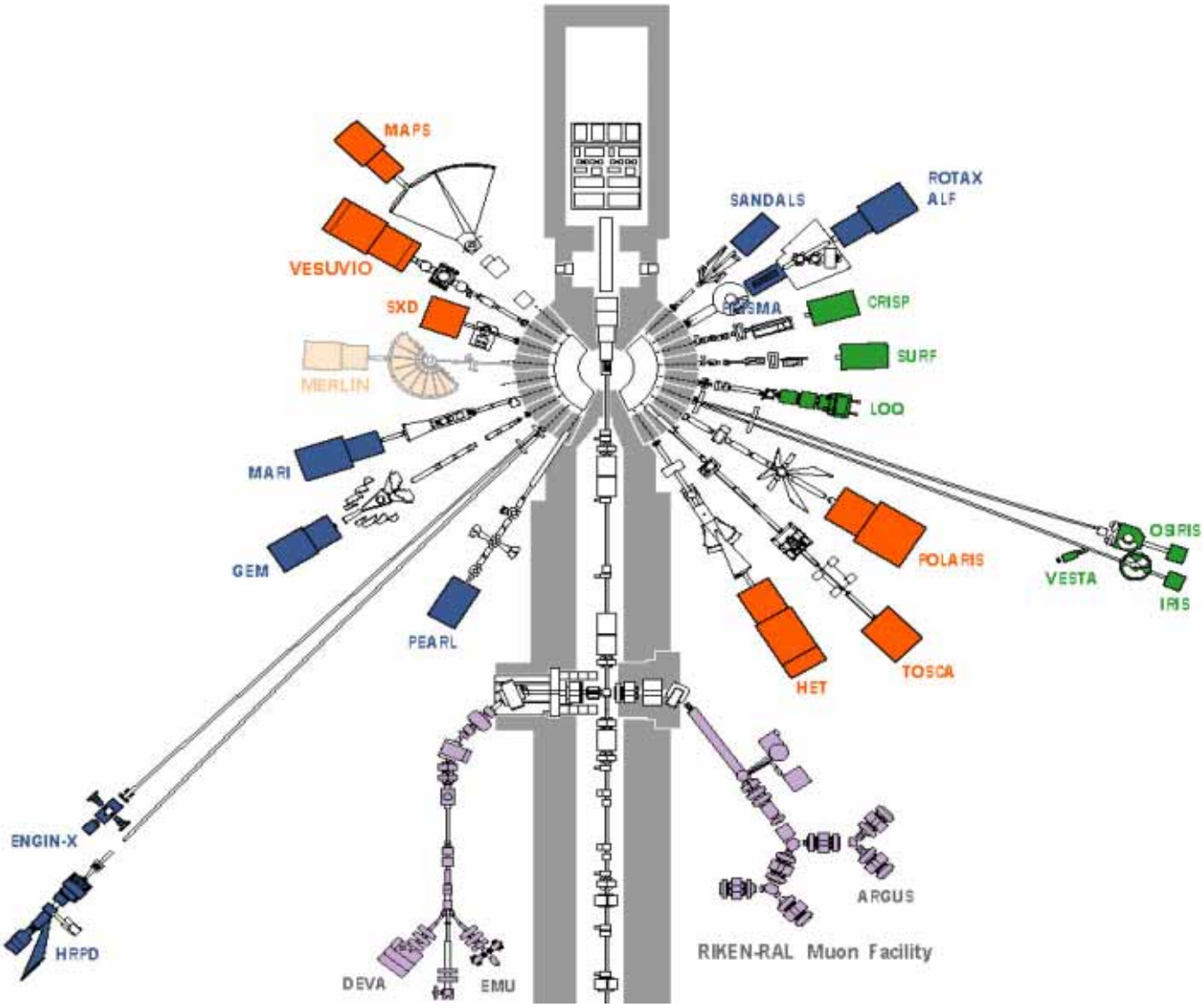
ISIS runs for ~180 days per year.

During run periods (‘cycles’) the facility operates 24 hours per day, 7 days per week.

The accelerator is controlled from the ISIS Main Control Room, which is permanently staffed, day and night, by a team of three during periods when ISIS is running.

ISIS

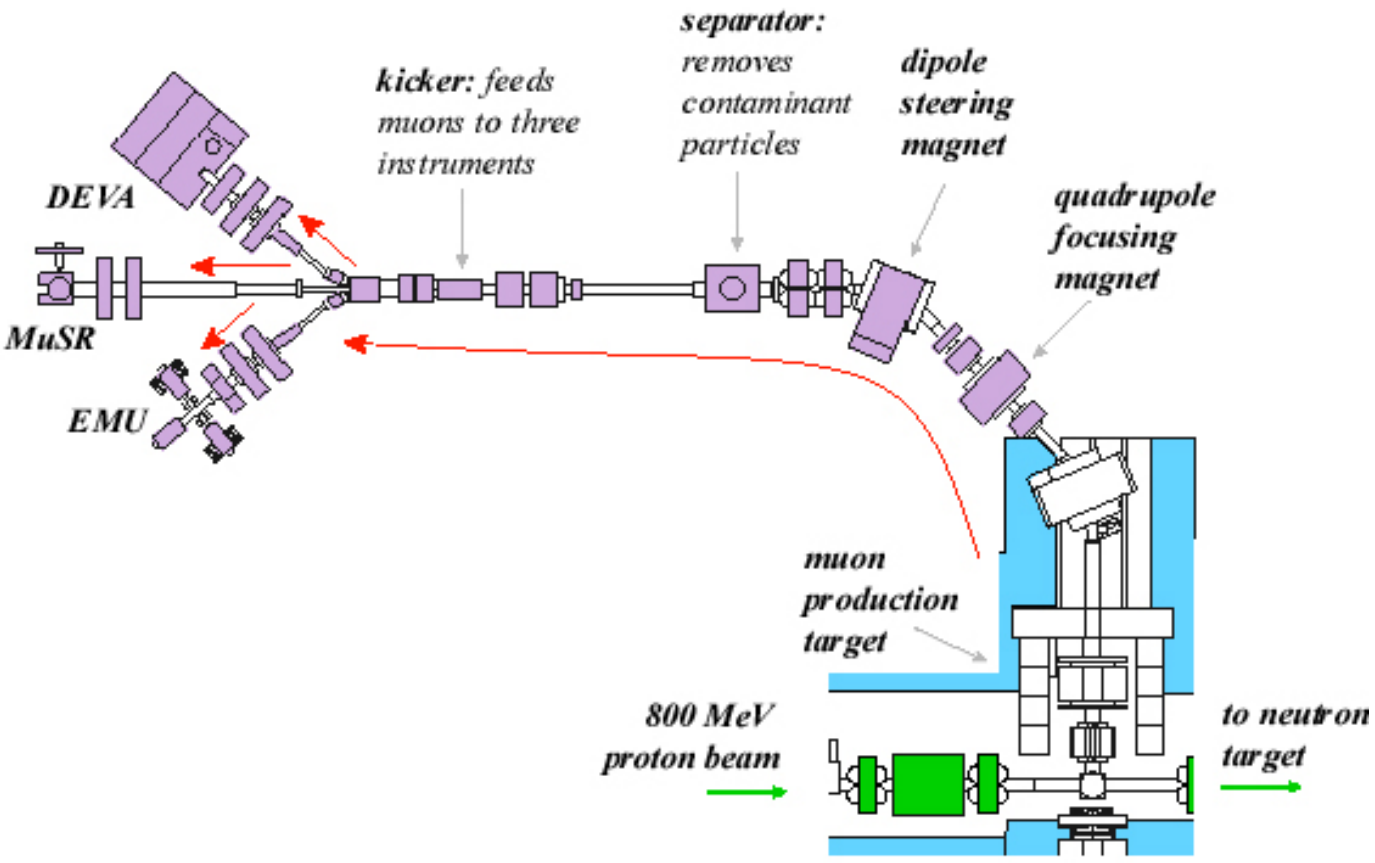
ISIS Instruments



The ISIS neutron and muon instruments

ISIS

ISIS Instruments

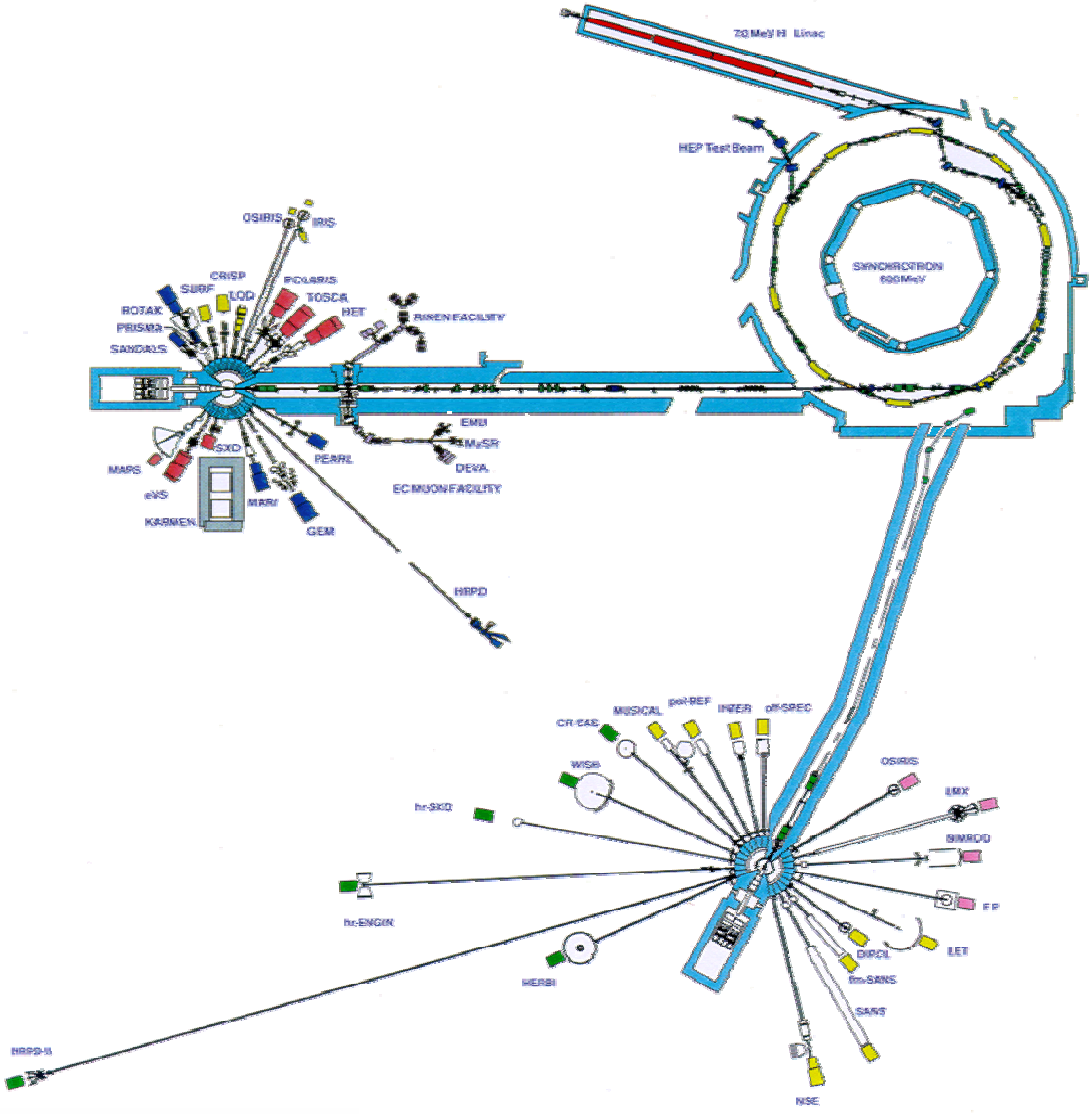


The ISIS neutron and muon instruments

ISIS

ISIS - The Future

A new neutron target station, optimised for lower power, and longer wavelength neutrons.



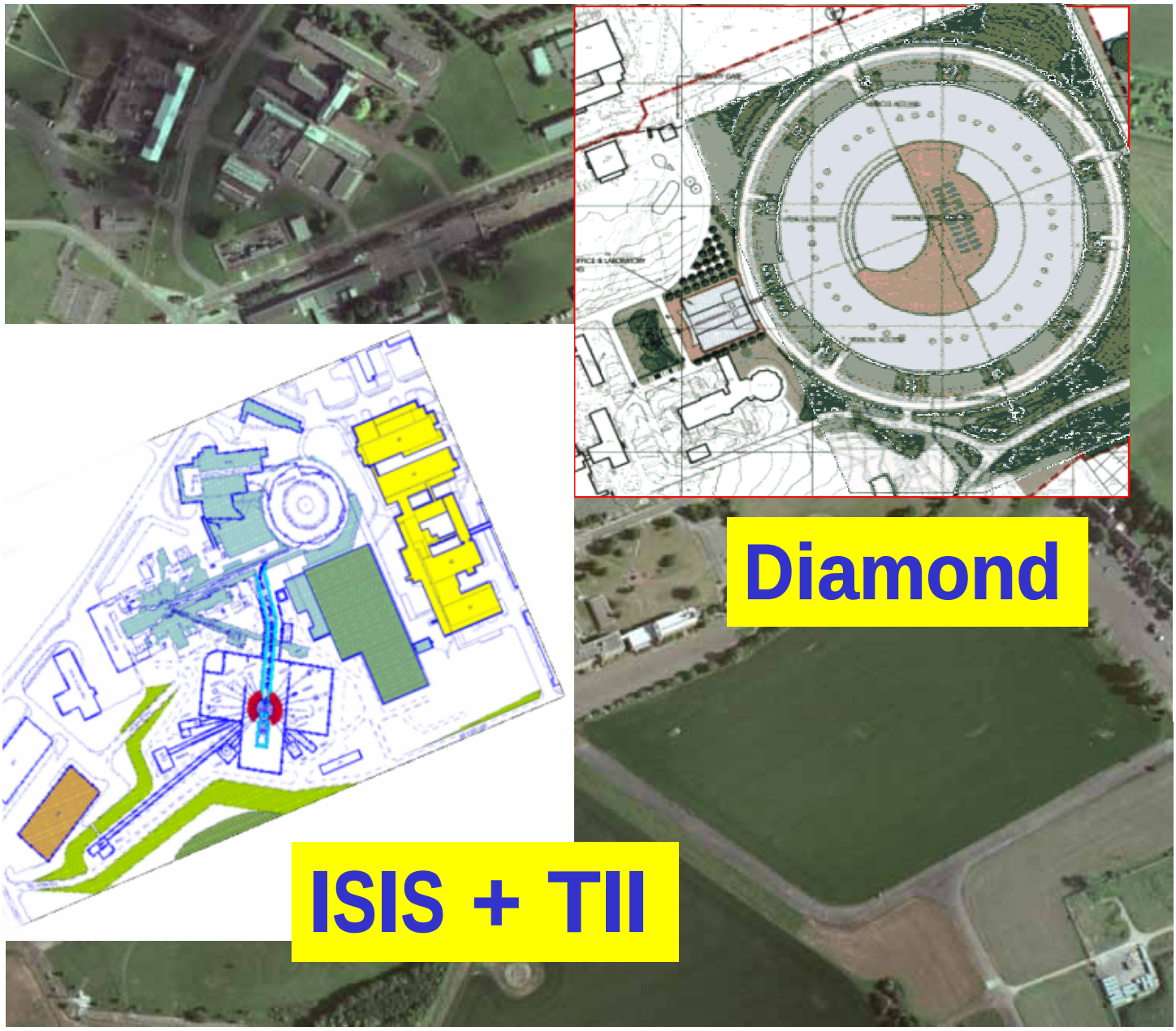
TS2 ISIS
second target station project

ISIS

Jan 2005 Start building construction
Jan 2007 Completion of Target Station
Oct 2007 Proton beam to target
Sept 2008 Start experimental programme

ISIS

RAL - The Future



ISIS