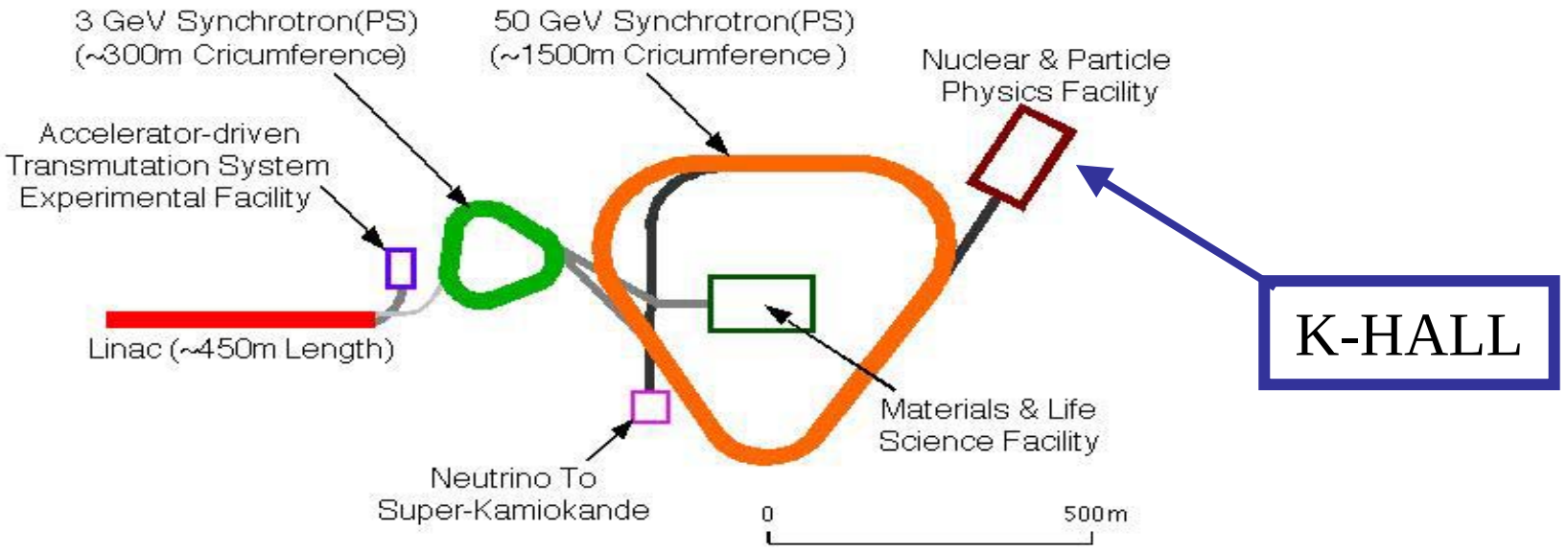
OUTLINE of the K-HALL

K.H. Tanaka for NP Facility Construction Team

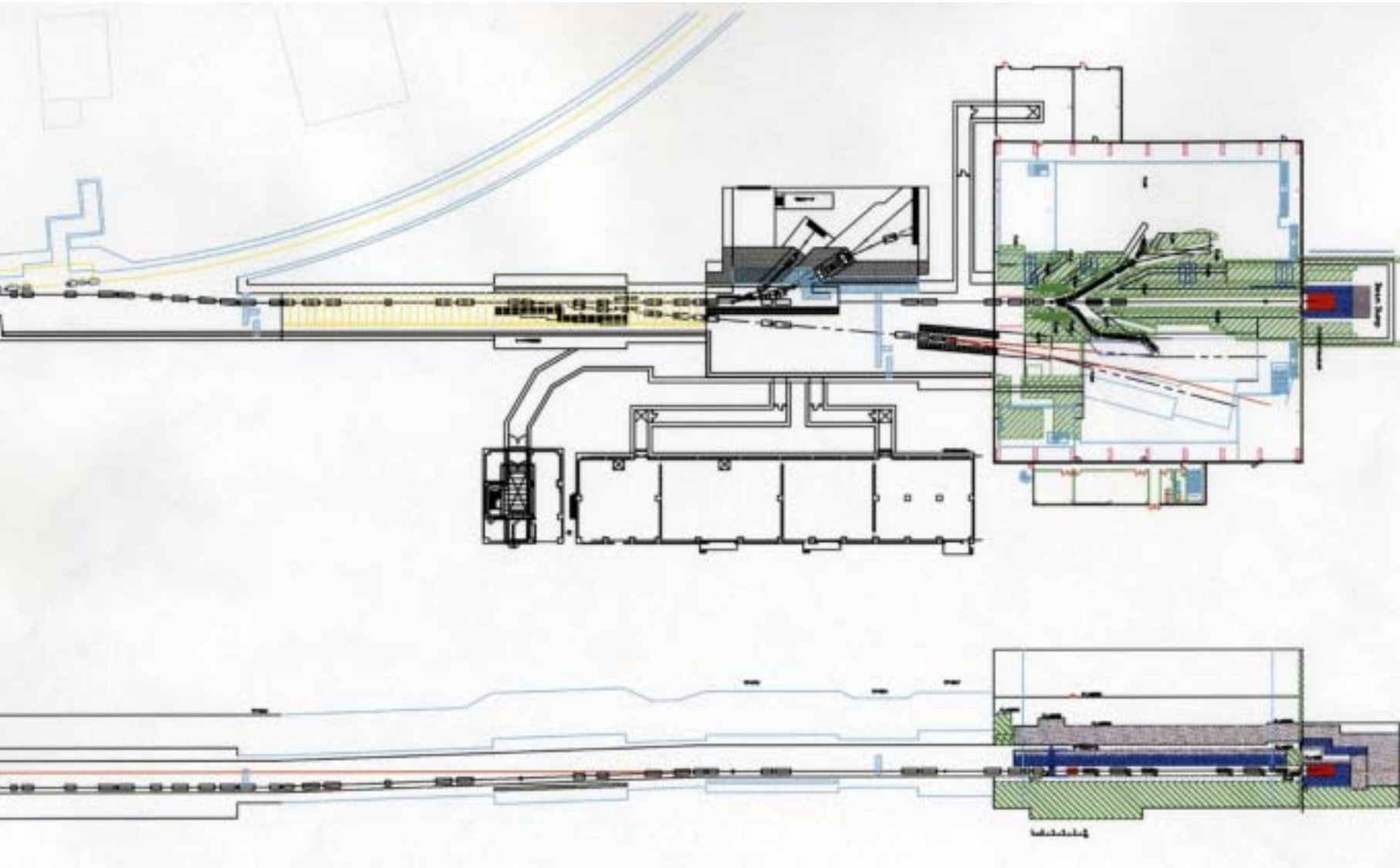


High Intensity Proton Accelerator Project

Experimental Hall for 50GeV-15 μA Slow Beam

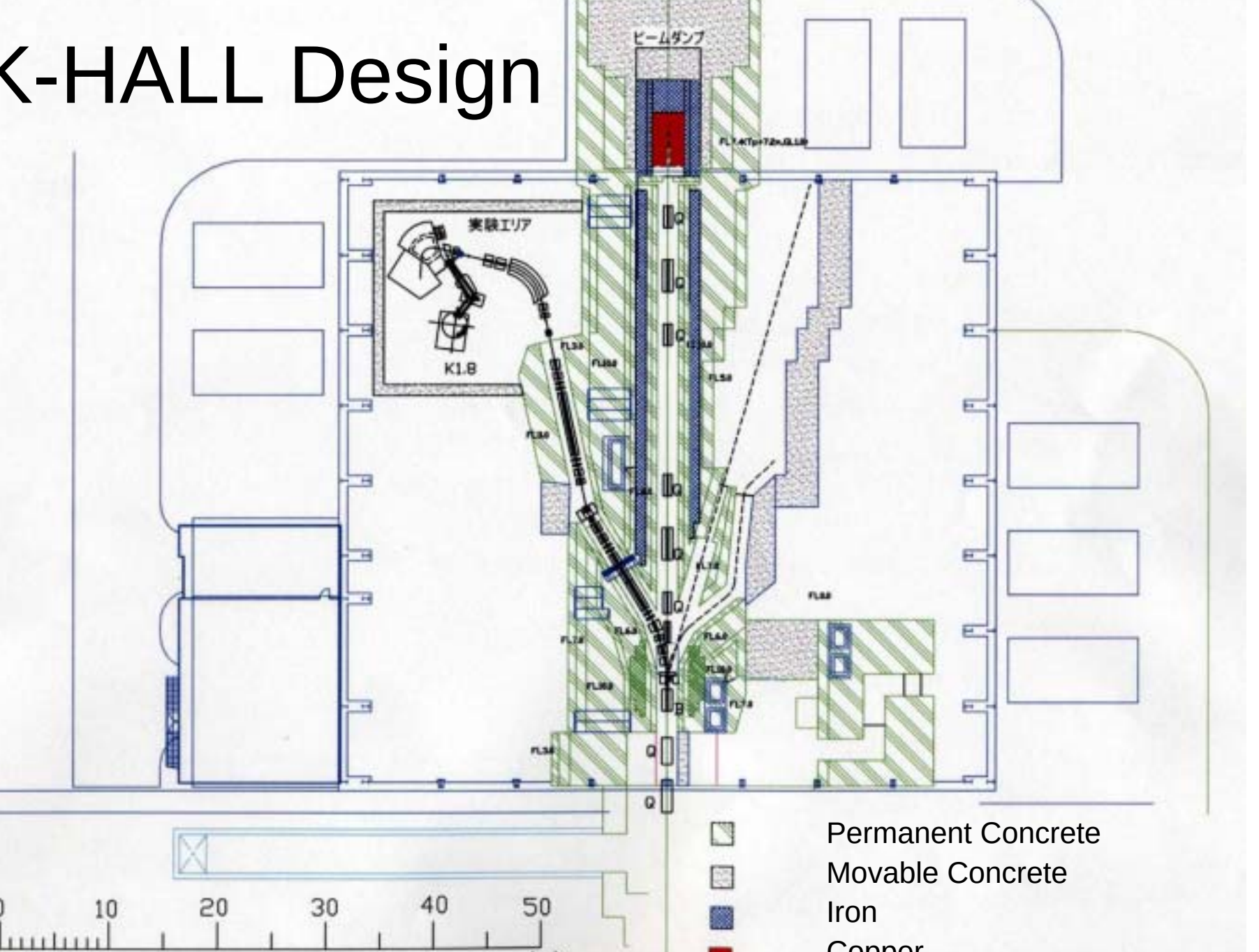
The First (Only One?) KAON FACTORY in the World

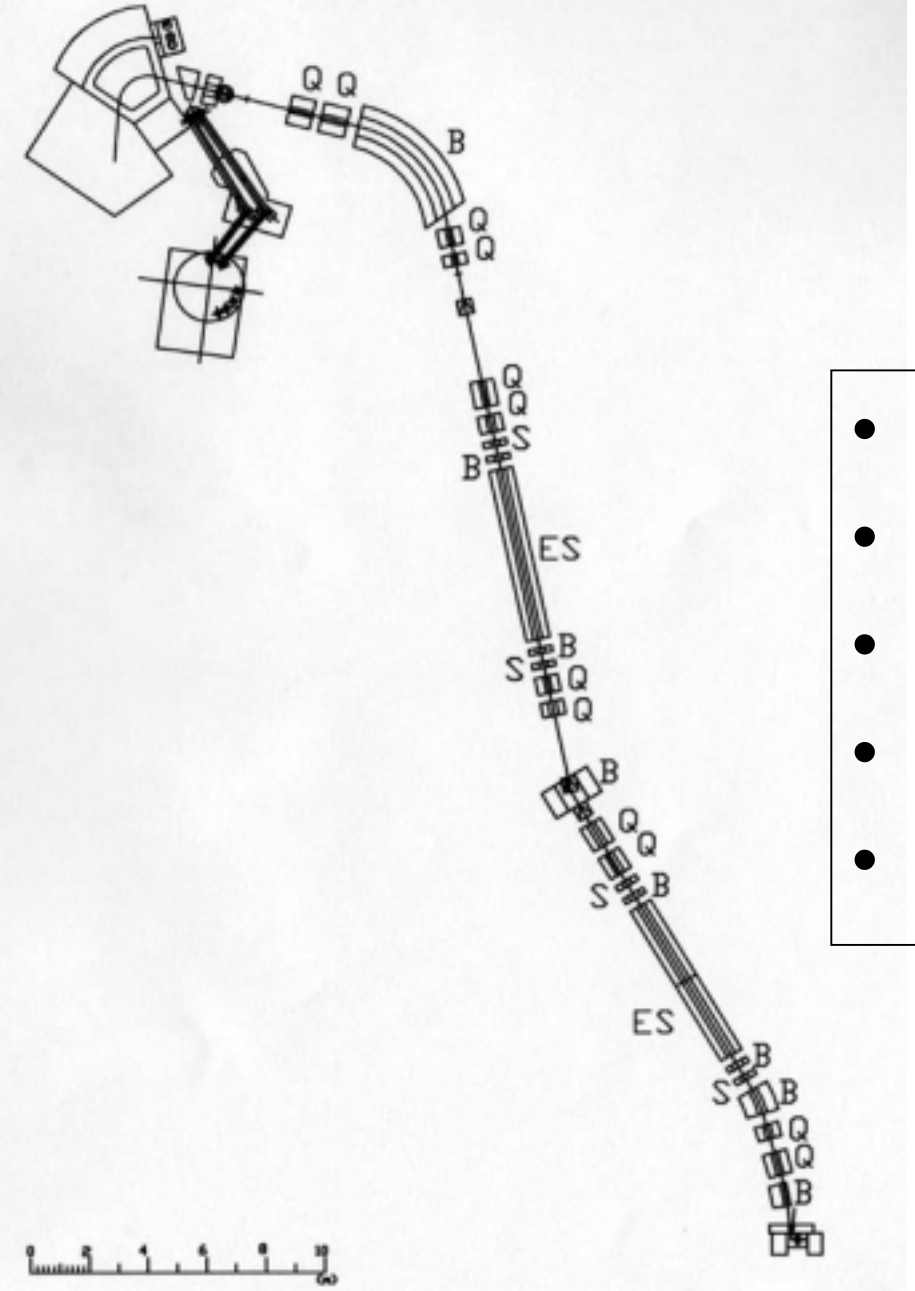
SY and K-HALL



Elevation: 2.9m/80m

K-HALL Design





K1.8 Separated Kaon Beamline

- Double Stage
- 42m - 44m
- 4.5msr.% – 4.7msr.%
- 60M – 70M K^- (1.8GeV/c)
- K/π > 1

Technical Issue

Problem is:

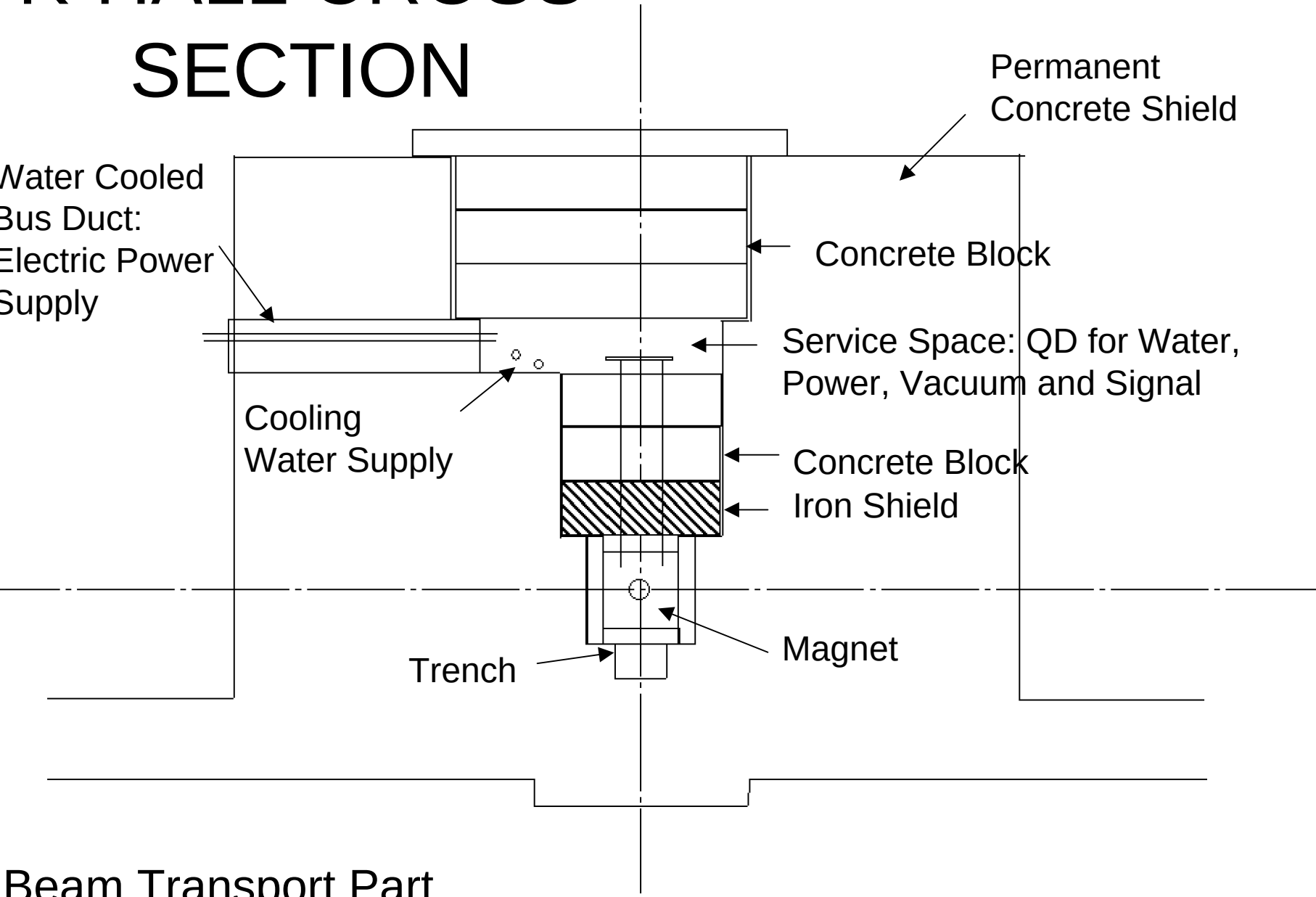
- JHF (50GeV) PS: More than 100 times Higher Beam Power than KEK (12GeV) PS.
  - More than 100 times Higher Radiation Dose.
  - More than 100 times Larger Heat Deposit.

How to Handle MW-Class Beam?

For the Stable Operation

- Tight/Enormous Radiation Shield.
- Radiation/Heat Resistant Beam Line Elements.
- Facility Design Oriented for the Maintenance.
  - Quick disconnect Devices

K-HALL CROSS SECTION



Beam Transport Part

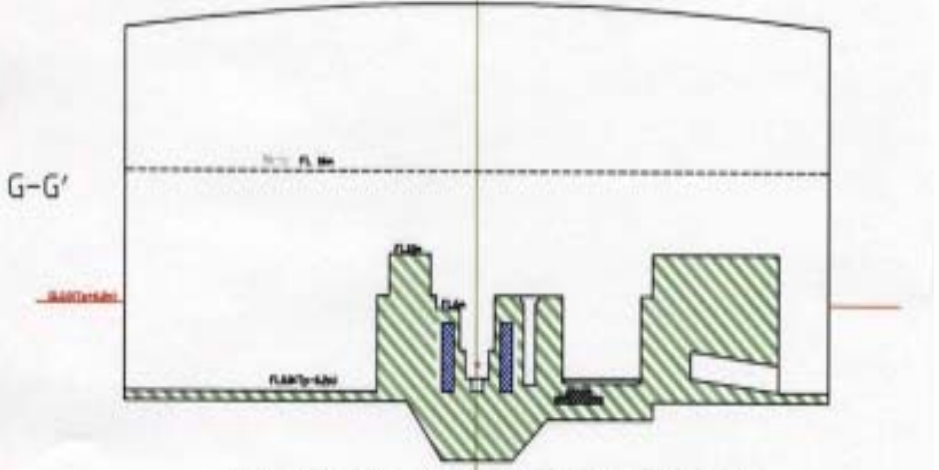


図10 原子核素粒子実験ホール断面図(G-G'断面)

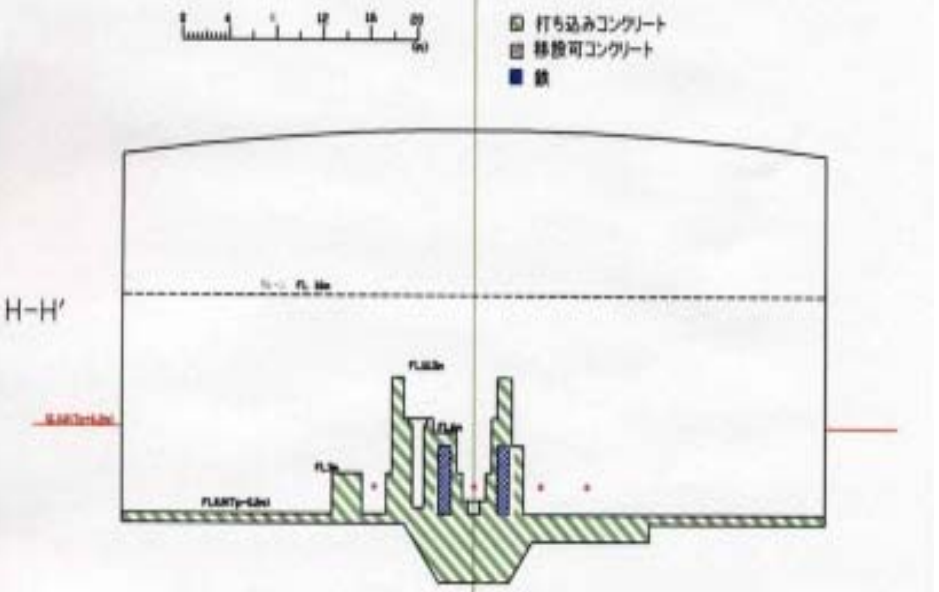
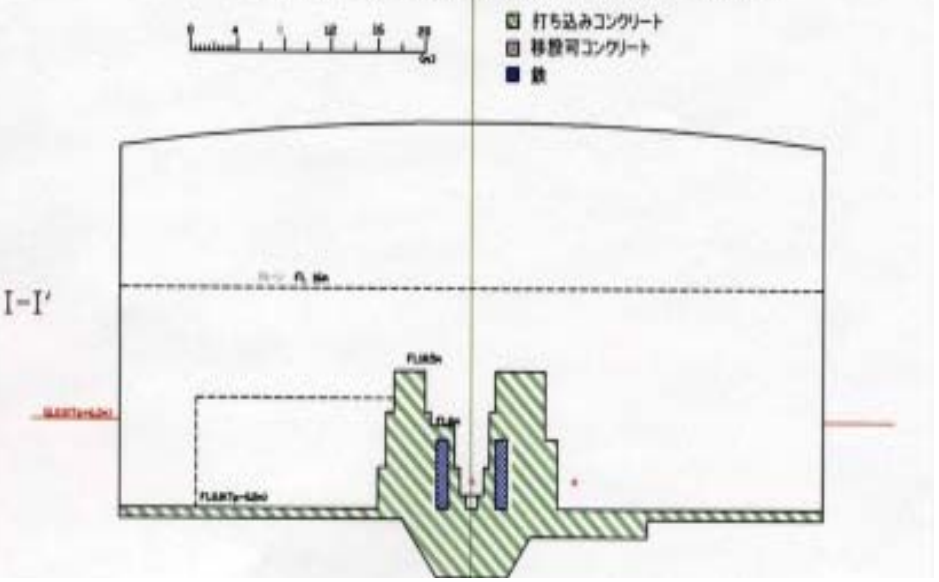


図11 原子核素粒子実験ホール断面図(H-H'断面)



K-HALL Cross Sections

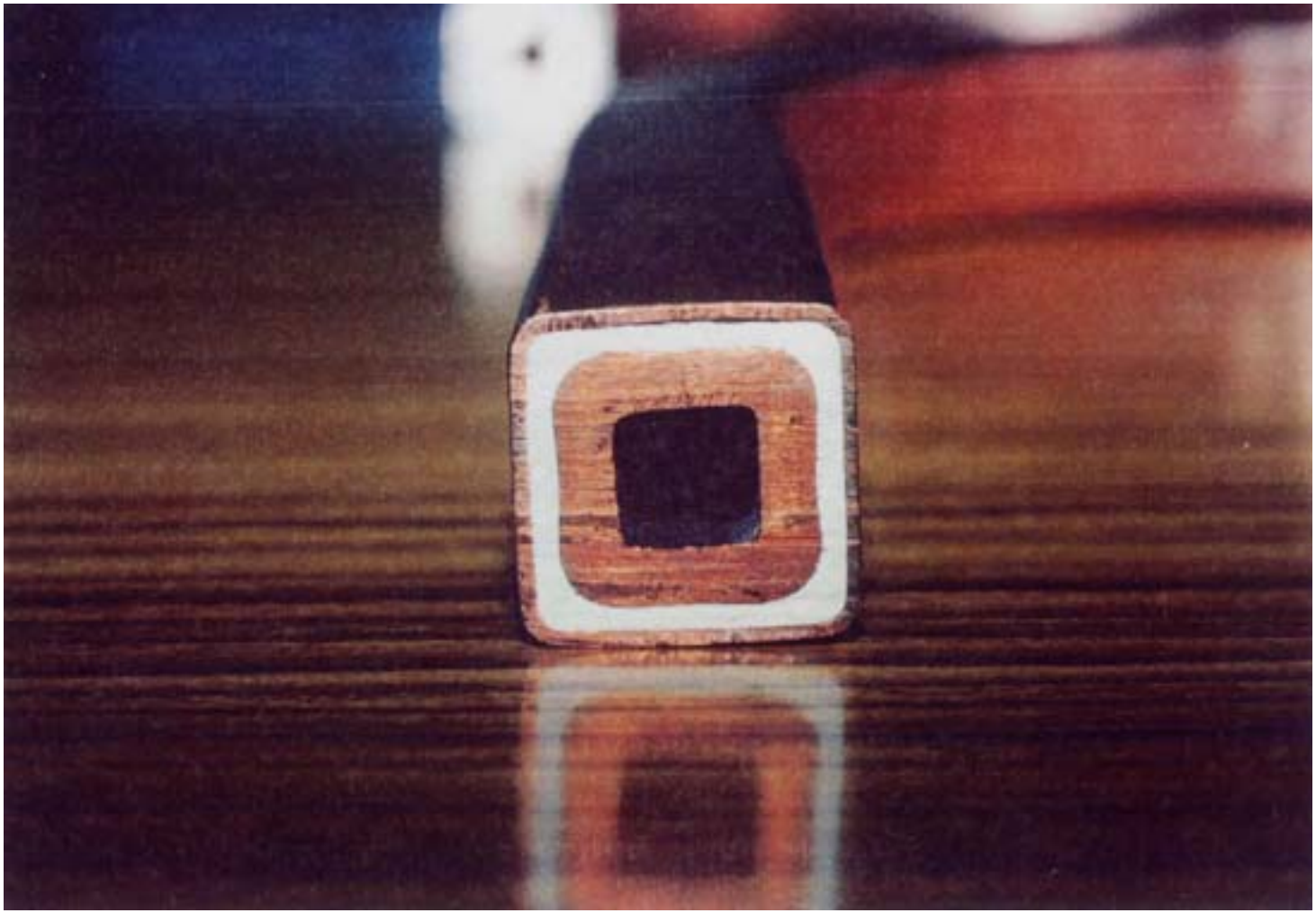
Radiation/Heat Resistant Beam line Elements

- High Radiation Resistance
- High Heat Resistance

Natural Solution: Remove Organic Materials from the Beam Line.

Rubber, Plastic, Oil, Paint, and Semiconductors, etc. etc.

2500A Class Mineral Insulation Cable



MI Cable: Completely Inorganic High Power Cable!

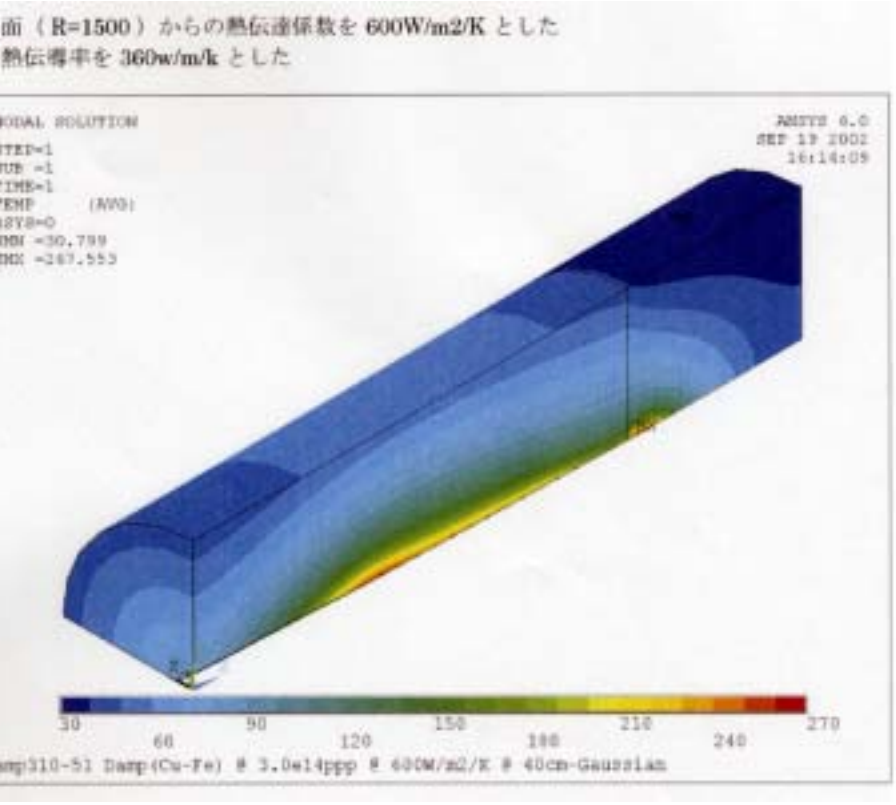
Magnet Coil Winding by 60m 2500A HC-MIC

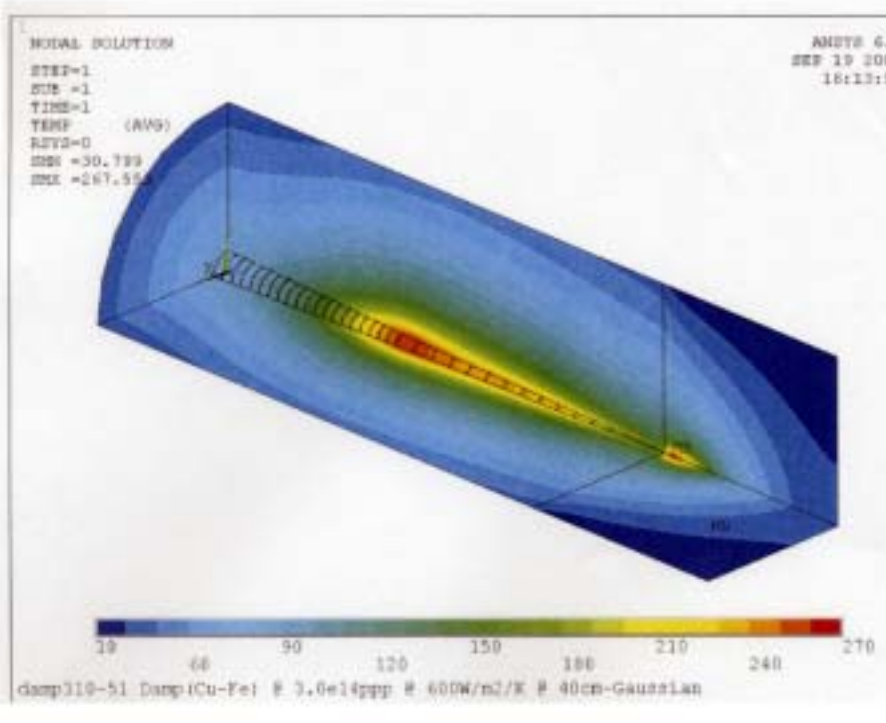
High-Pot. leak test

Coil Winding!

The first coil of 60m-2500A HC-MIC

Heat Up of Beam Dump by 750kW Beam



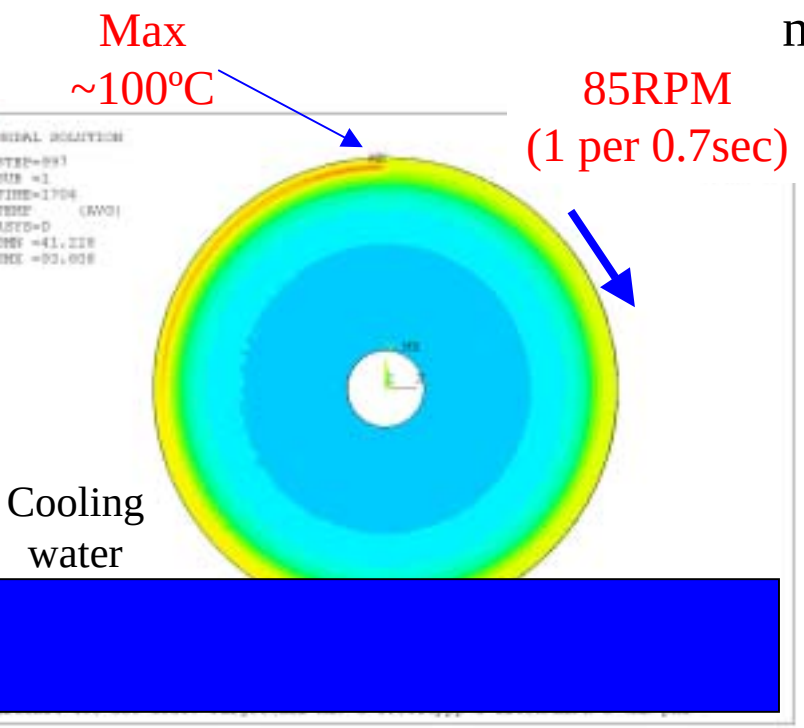


- Without Water Cooling: Copper melts
- With Water Cooling: Copper Temp. go down to 300 ℃

Production target (T1)

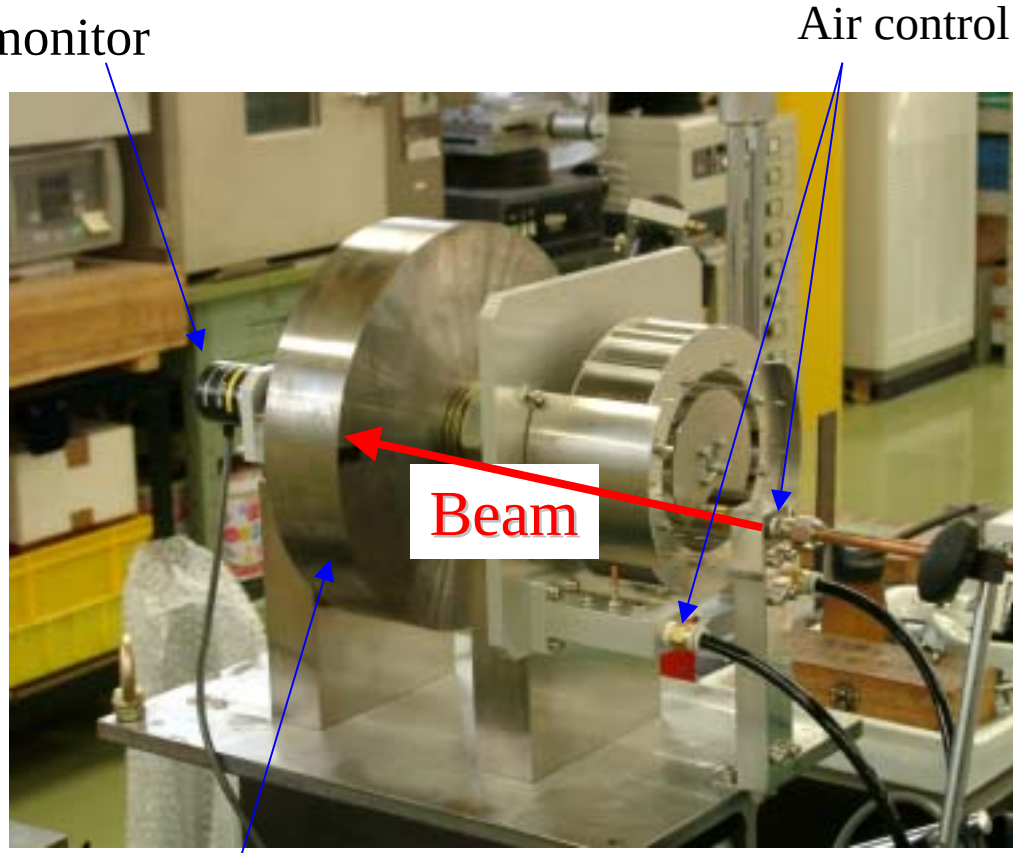
Rotating target and water cooling

Thermal evolution by ANSYS (M. Minakawa)



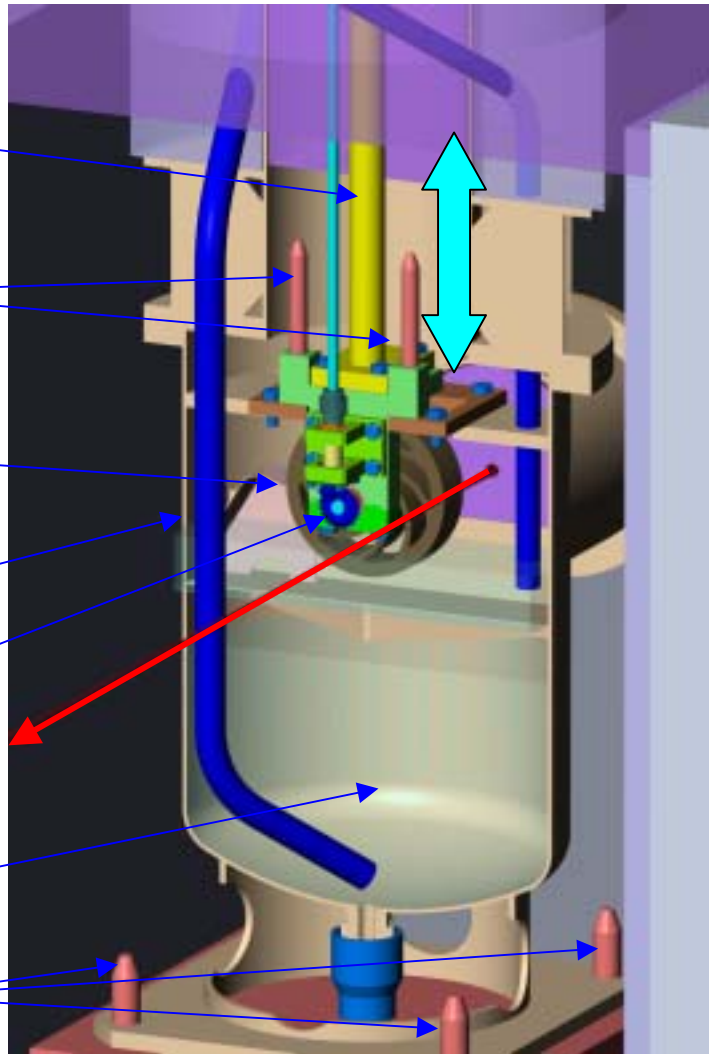
ϕ50cm x 6cm^{t} , Ni200

T1 prototype (Y. Yamanoi)

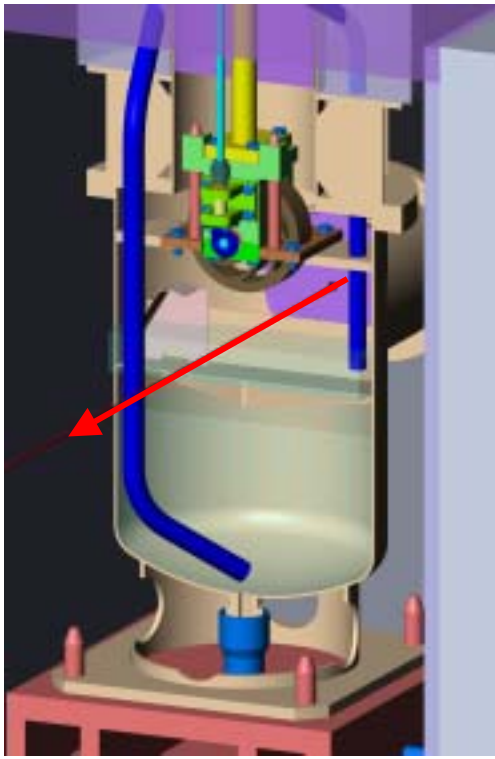


Production target (T1)

Schematic view of the T1 target

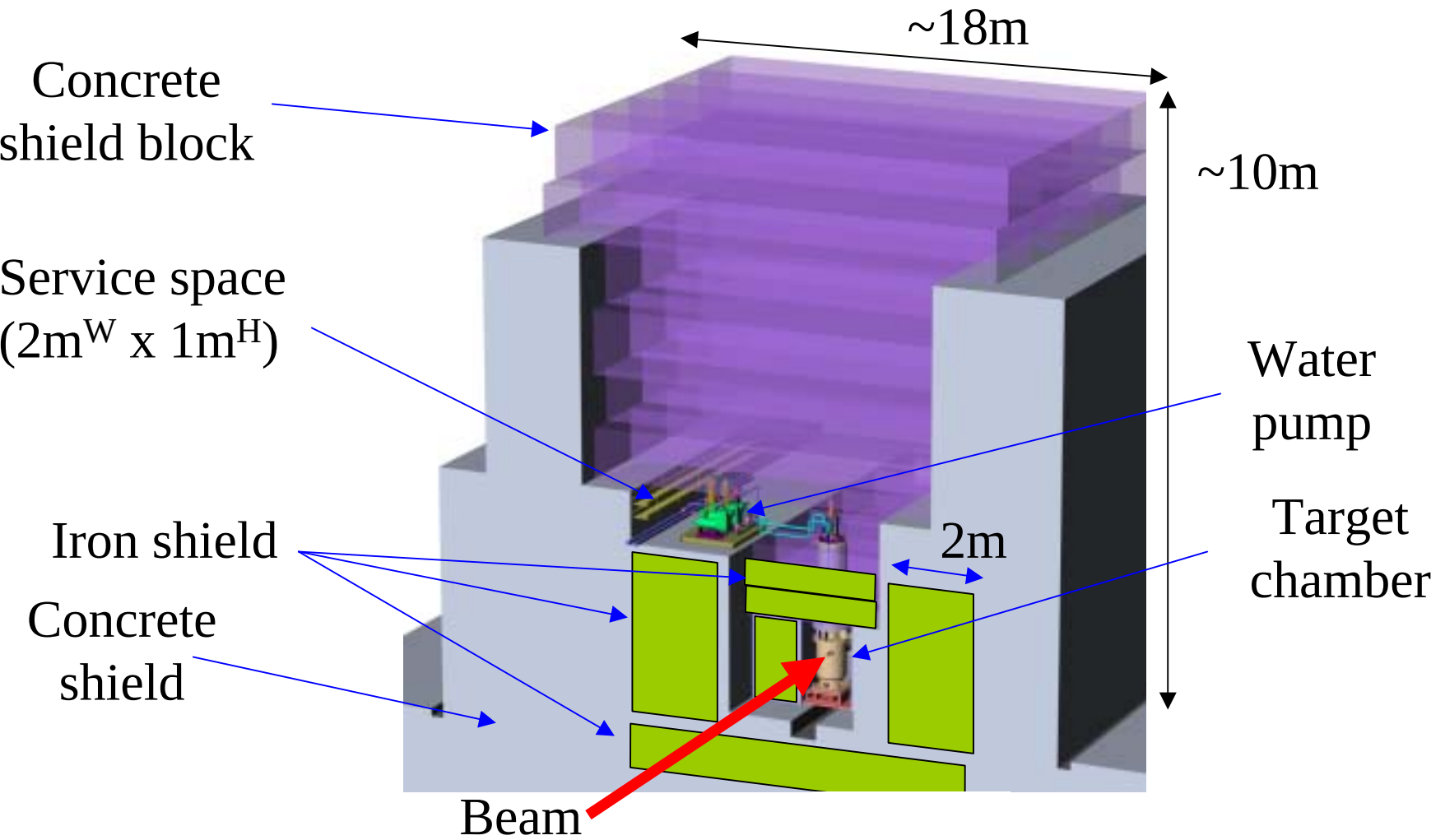


Target off



Production target (T1)

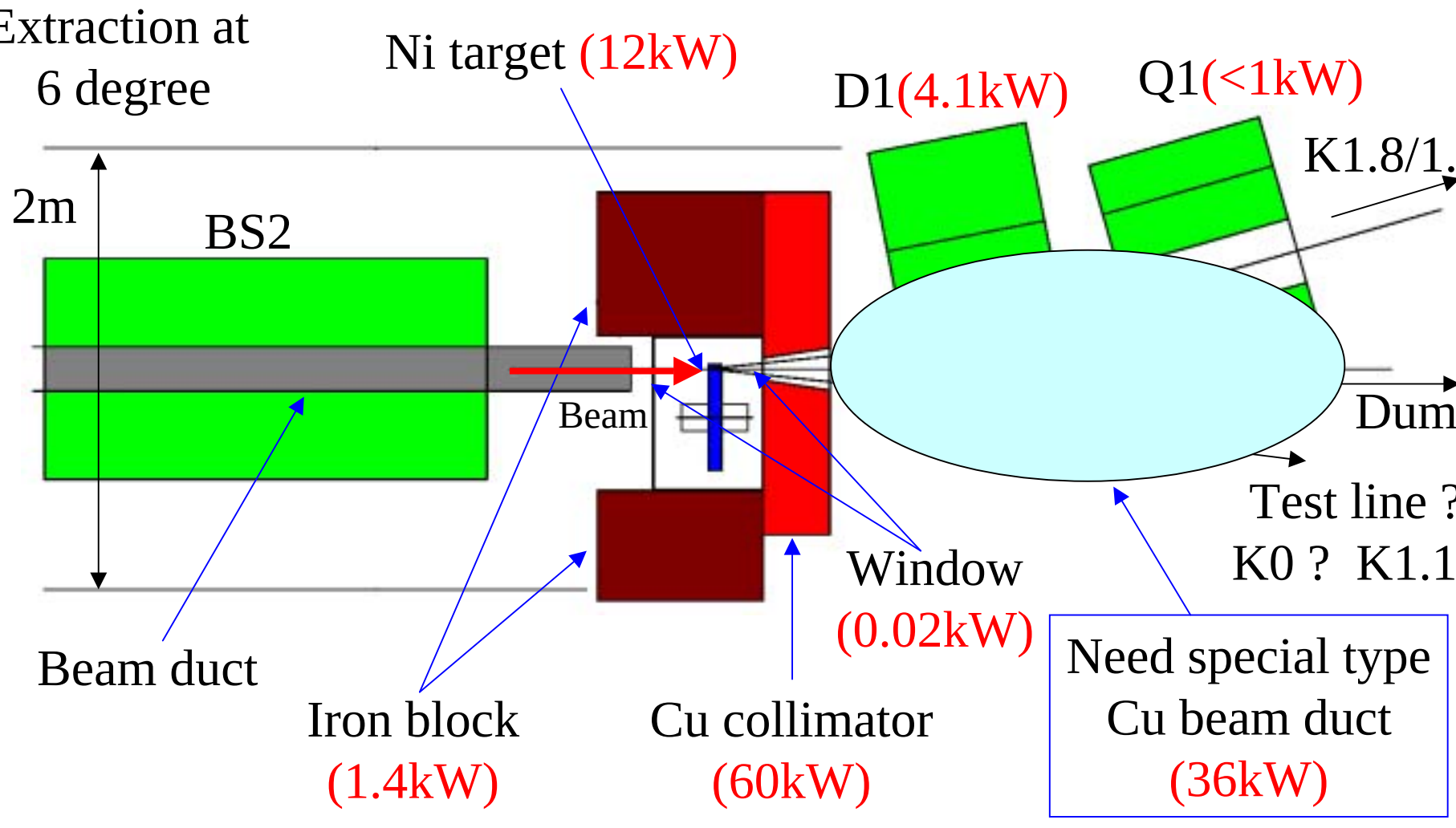
Schematic view of the whole system



The whole system will be tested by the T1 mock-up.

Collimator and Beam Duct

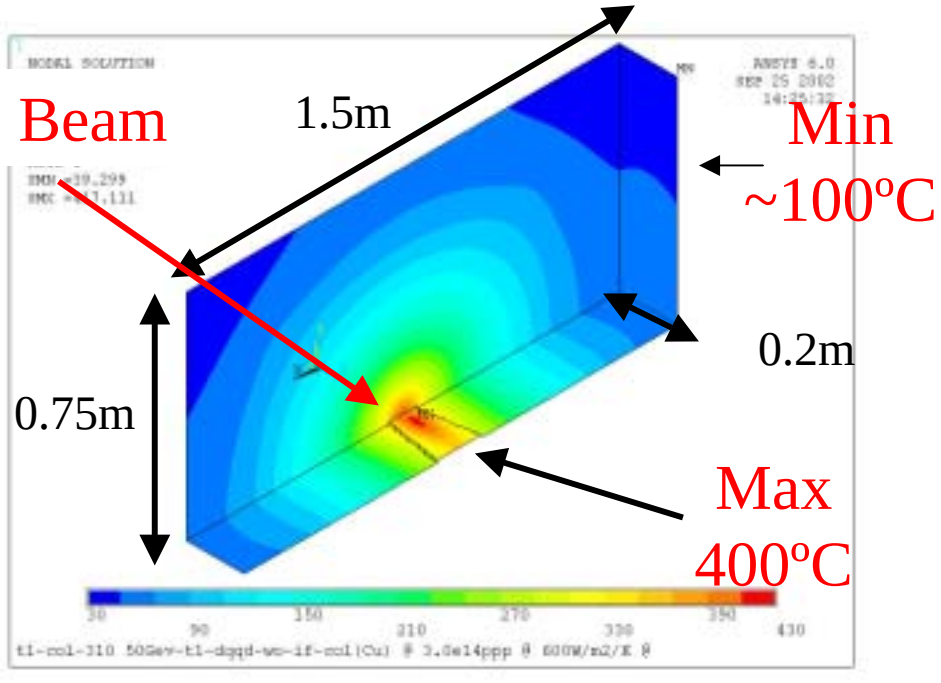
Schematic view of the T1 target area



Collimator

Thermal evolution by MARS+ANSYS ***(H. Takahashi & M. Minakawa***

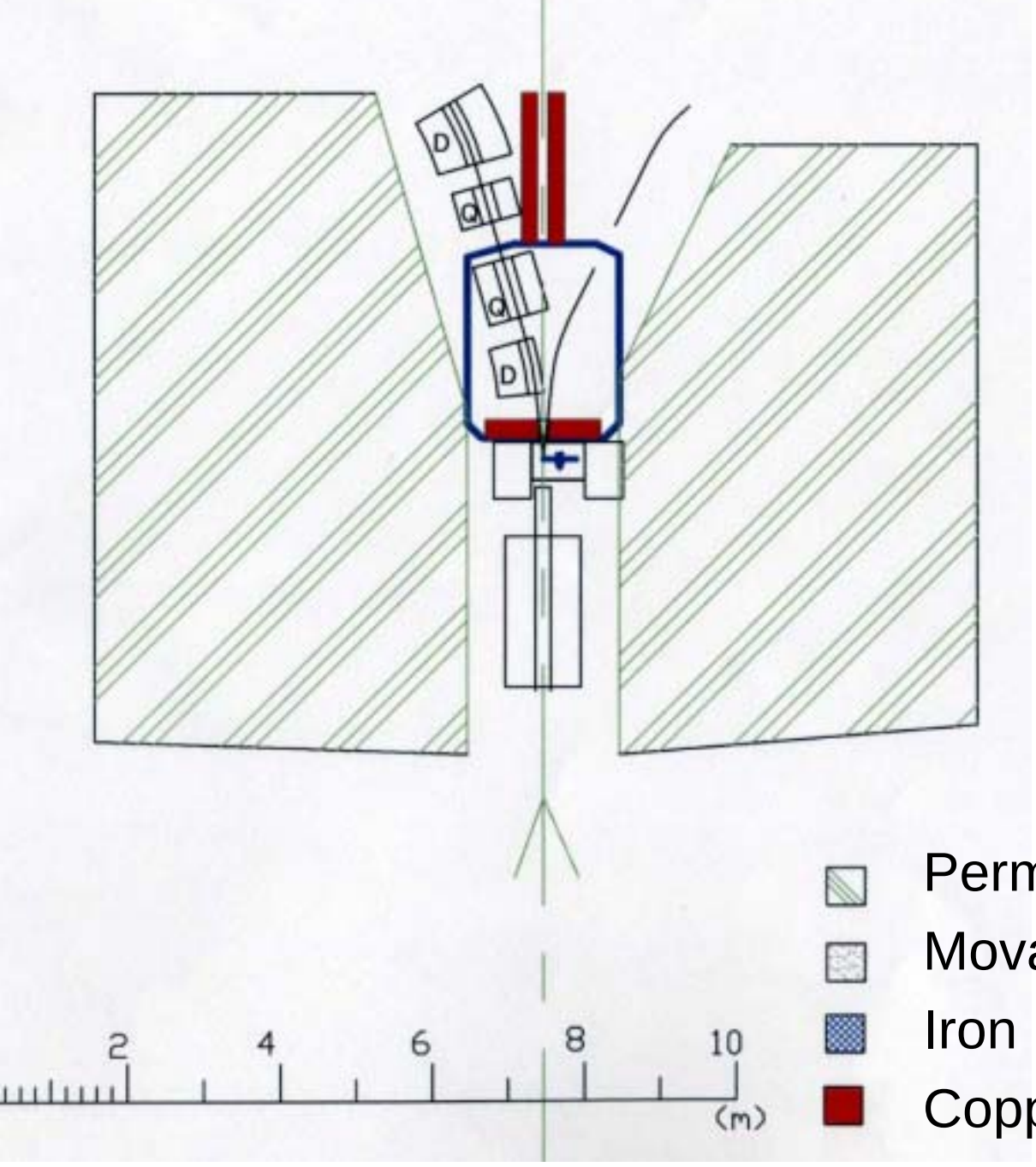
Cu collimator ($1.5m^H$ x $1.5m^W$ x $0.2m^T$)



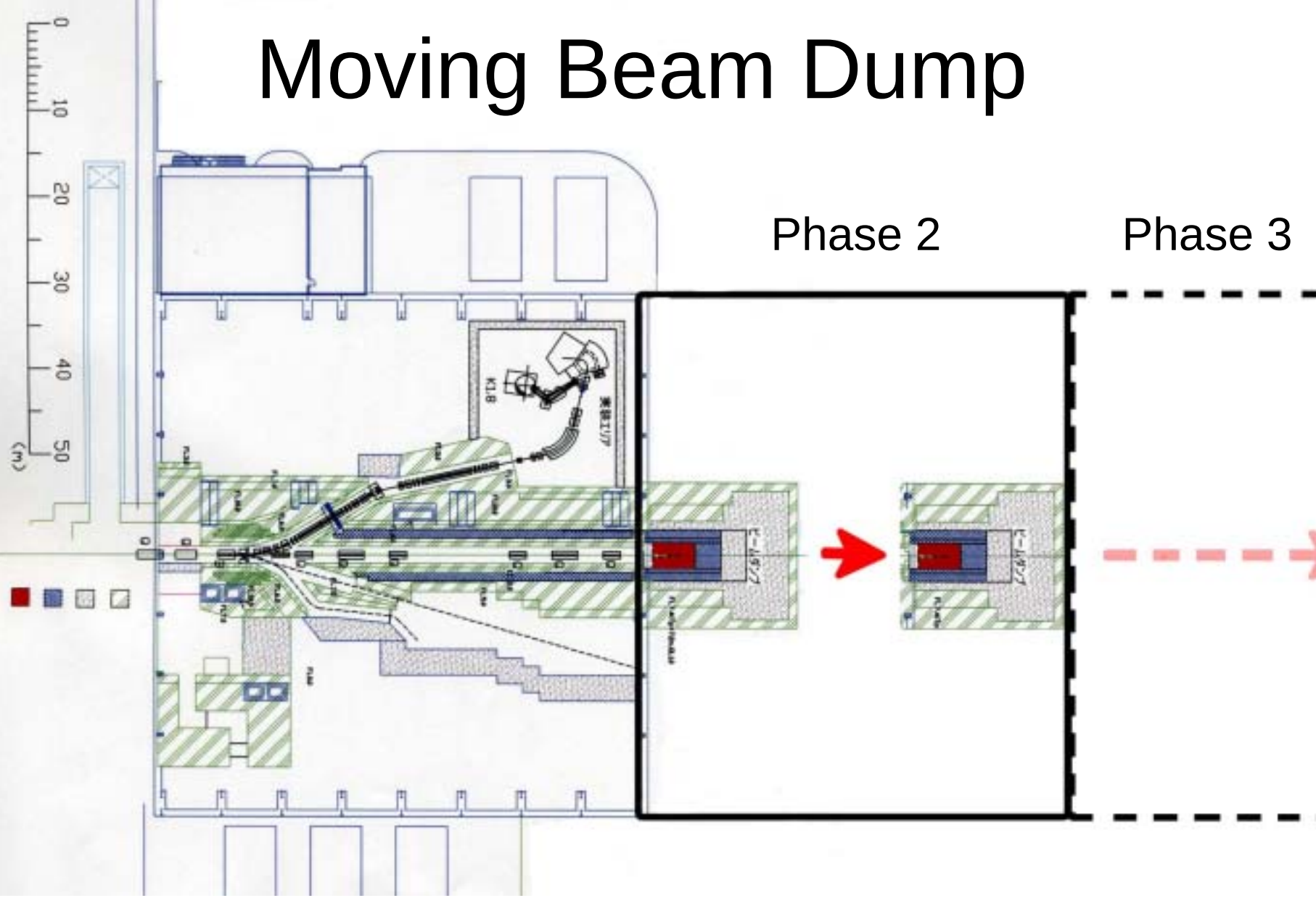
- Aperture size
  - H=±10 cm (16cm)
  - V=±0.8cm (0.8cm)
- Acceptance
  - x=±50mrad
  - y=±10mrad
- 30cm away from T1

To be optimized

T1 Collimato
Configuration



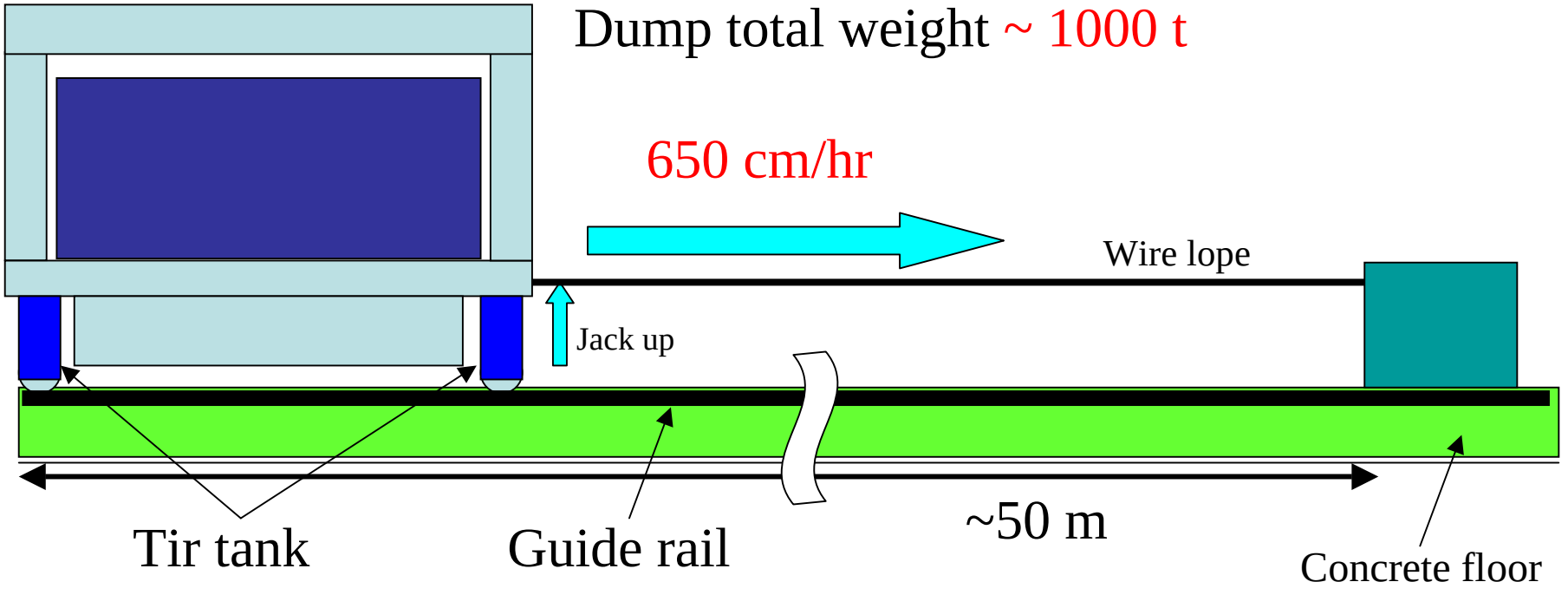
Moving Beam Dump



Beam dump must be moved for the future extension!

K-HALL Beam Dump

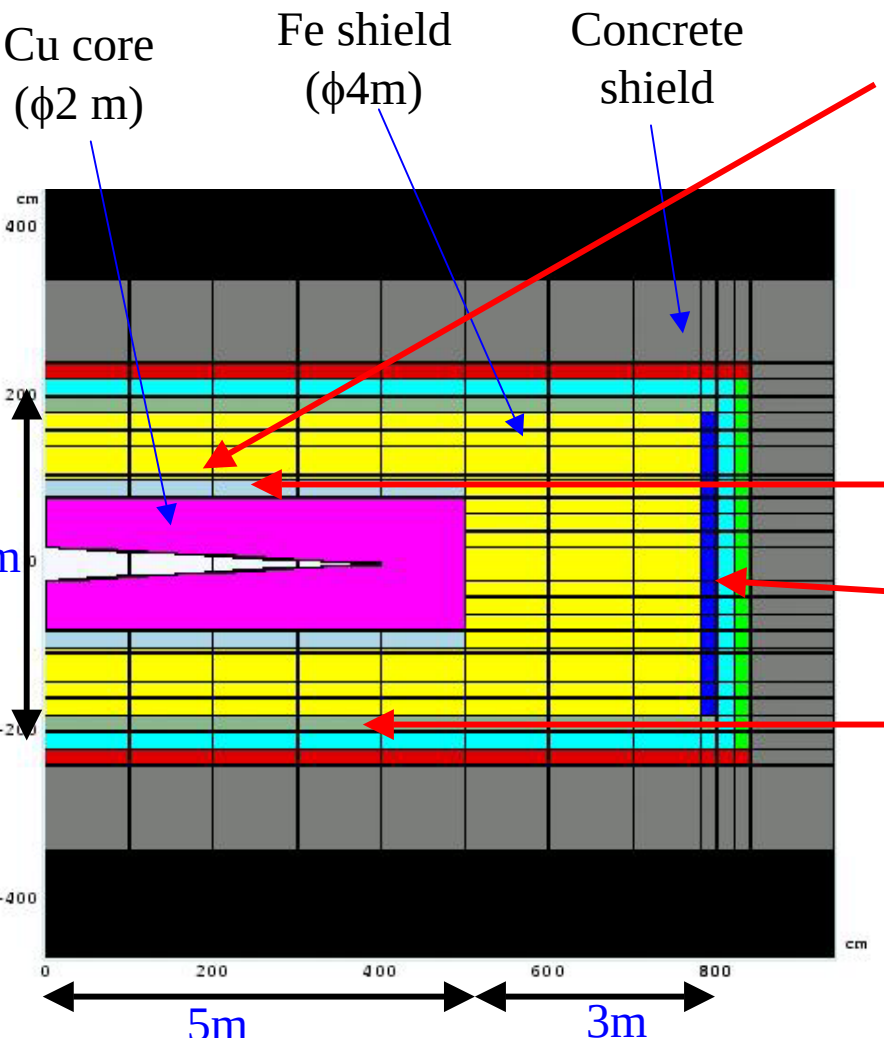
How to move it safely



- Need to be balanced carefully
- Guarantee flatness of the floor

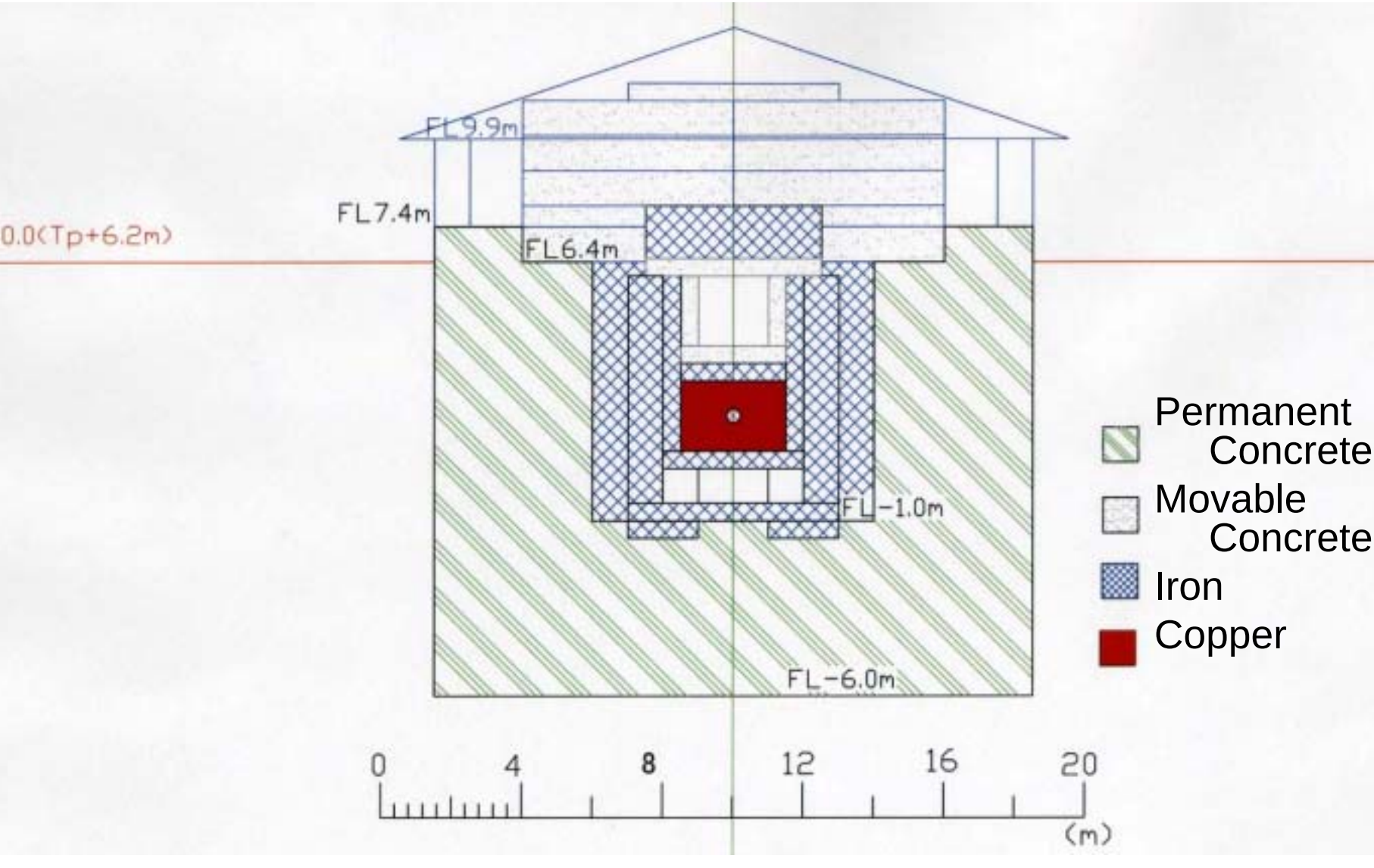
K-HALL Beam Dump

Radiation protection (preliminary)

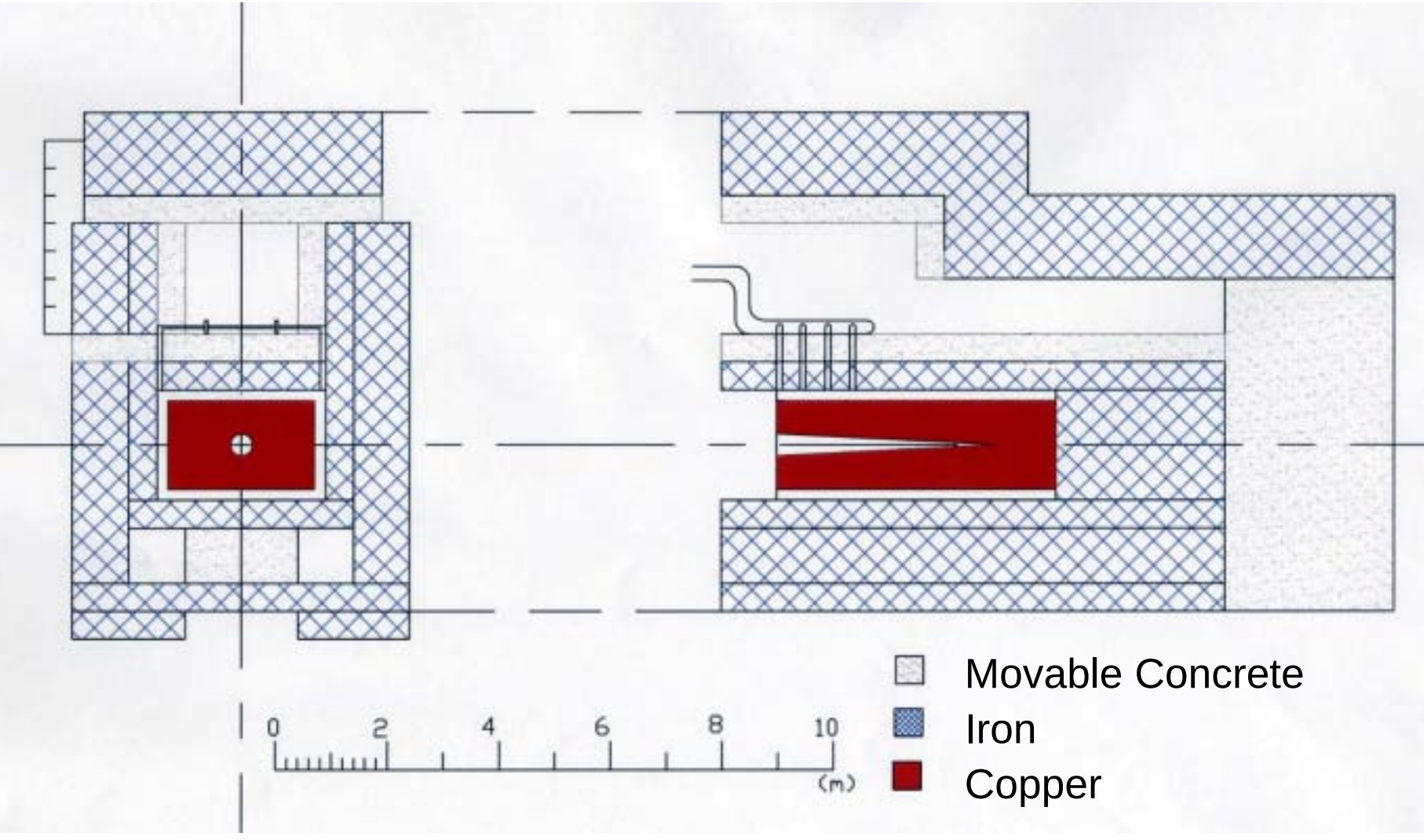


- ^{3}H ($T_{1/2}$=12.3 year) production at the surface of Cu core
  - ~100 Bq/cc/1 month for 11 m^3 Volume (Notice: 20 cm thick cooling water)
- Residual dose rate at contact after 1 year irradiation and 0.5 year cooling (KEK safety limit: 500 μSv / day)
  - 90 mSv/12 hr (averaged) at Cu surface (R=0.8-1.0m)
  - 0.12 μSv/12 hr (averaged) at Fe end (Z=7.8-8.0m)
  - 320 μSv/12 hr (averaged) at Fe surface (R=1.8-2.0m)

Beam Dump Housing



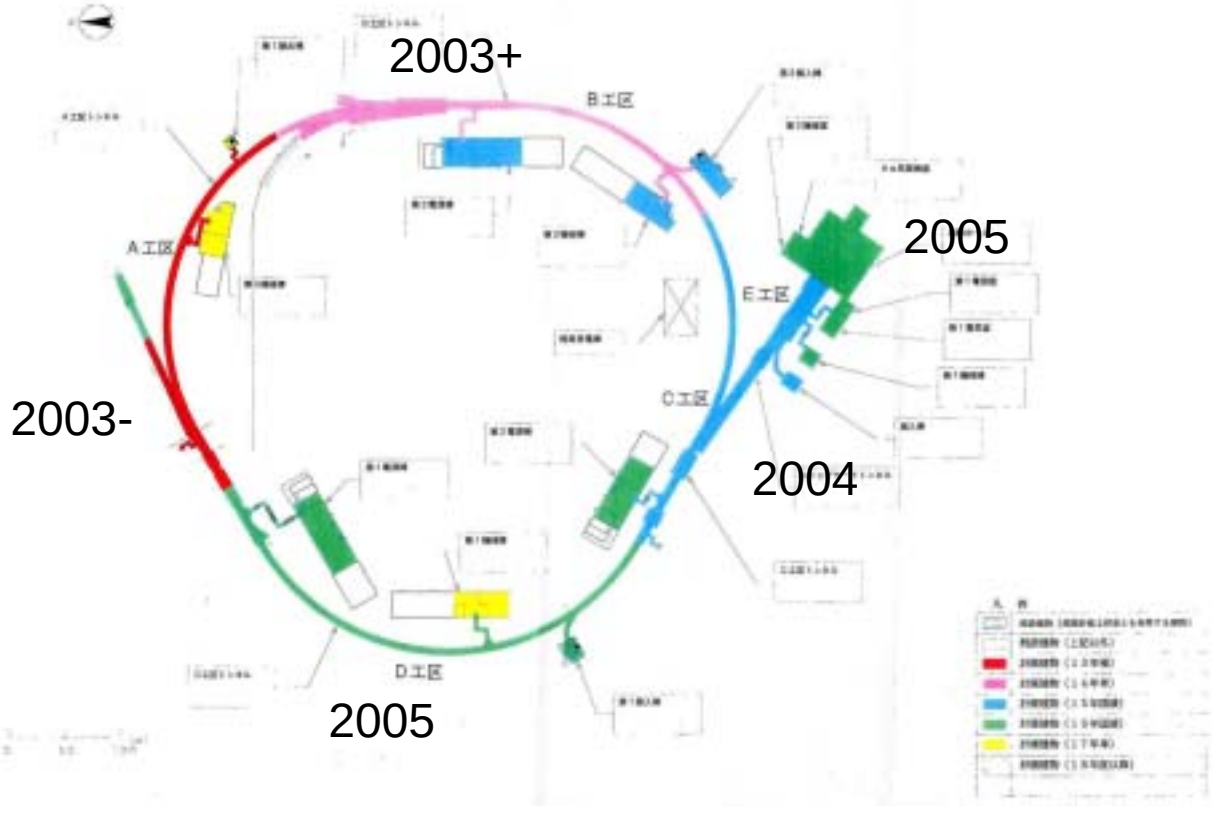
Cooling of Beam-Dump Core



STATUS

- Tight/Enormous Radiation Shield.
  - Design Completed
- Radiation Resistant Parts/System.
  - Almost Ready.
- Heat Resistant Parts/System.
  - Final Stage of Design/R&D.
- Remote Handling System/Maintenance Scenario.
  - Final Stage of Design/R&D.

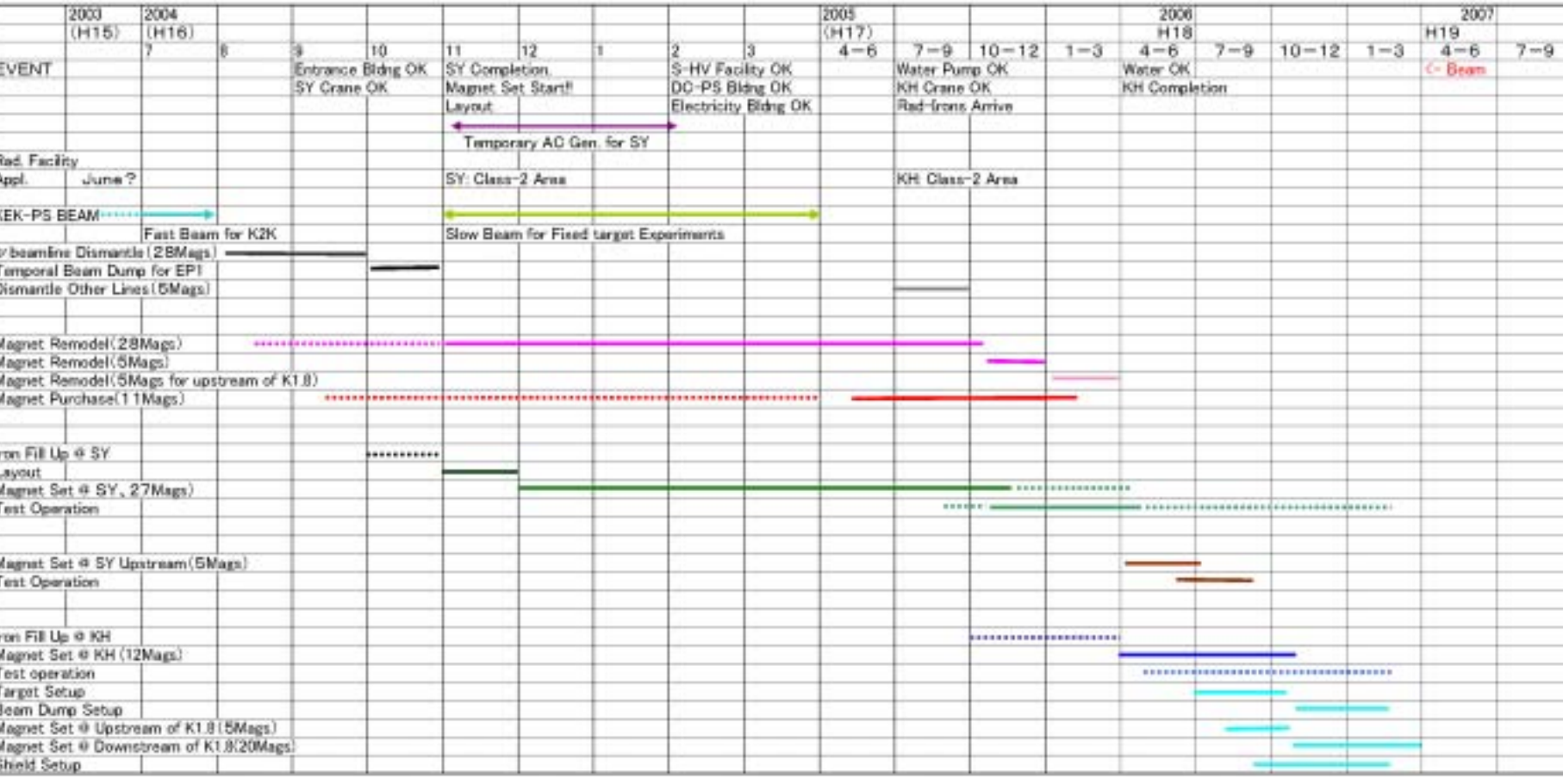
Construction Schedule at Tokai



Magnet Installation in SY is Scheduled in 2004+

Magnet Installation in KH is scheduled in 2006-

Magnet Transfer Schedule



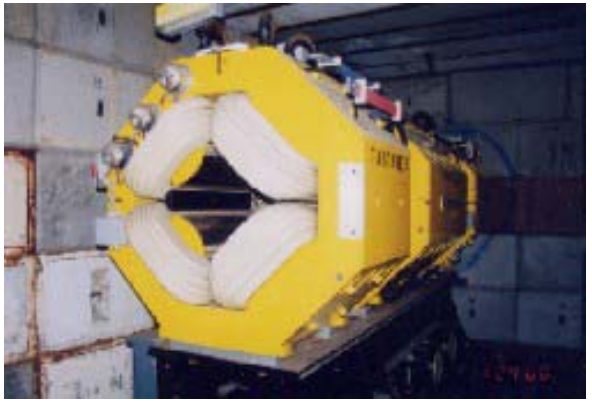
Problem：Can K2K be Finished in the summer 2004?

Magnet Collection Project

- The budget situation of the J-PARC/JHF is NOT very good.
- Let us construct the JHF as an international facility/collaboration!
- Let us collect USED magnets from all through the world!!!!
  - Magnets for secondary lines
    - Dipoles
      - Gap: 12 - 20cm
      - Width: 30 - 40 cm
      - Length: ~1 m or longer
      - B: ~2T
    - Spectrometers
- Contribution from SLAC, CERN, CEA(Saturne), Tsukuba U, and LANL, BNL……

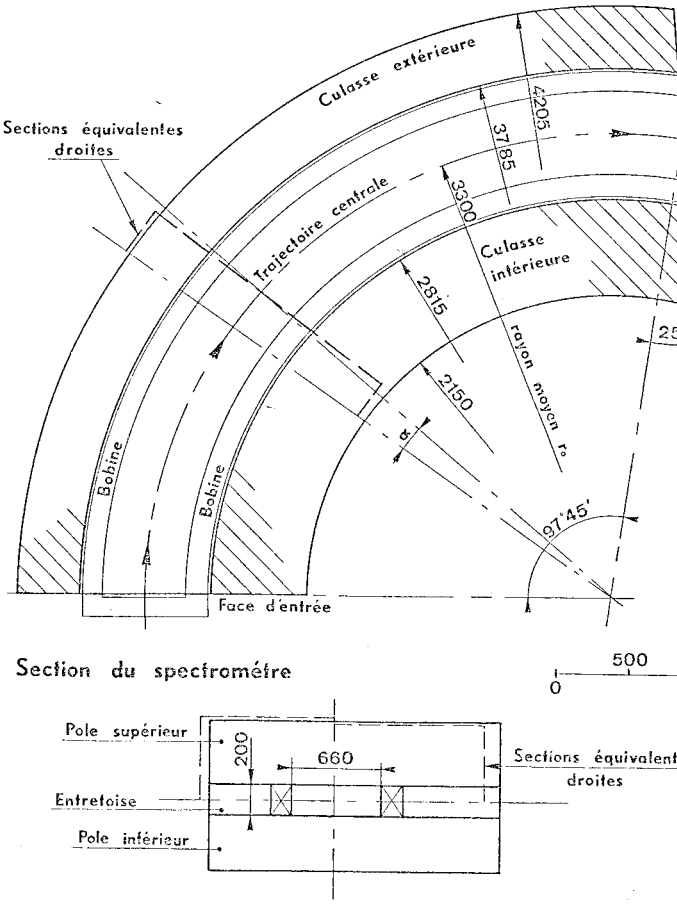
•Quadrupoles
- –Bore: 20 – 30 cm
- –Length: ~1 m
- –B: ~1 Tesla at pole

Magnet Collection Project from Saturne near Paris



- 2 Spectrometer Systems (SPES-I,II)
- 40 Q-Mags, 30cm Φ 0.8-1.6mL, 1T@pole
- 12 D-Mags, 15-20cm Gap, 1-2mL, 2T

SPES-I arrived at KEK from SATURNE



SPES-I(A23) Magnets

Magnet Collection project from CERN, SLAC, Tsukuba

Antiproton Accumulator Ring from CERN

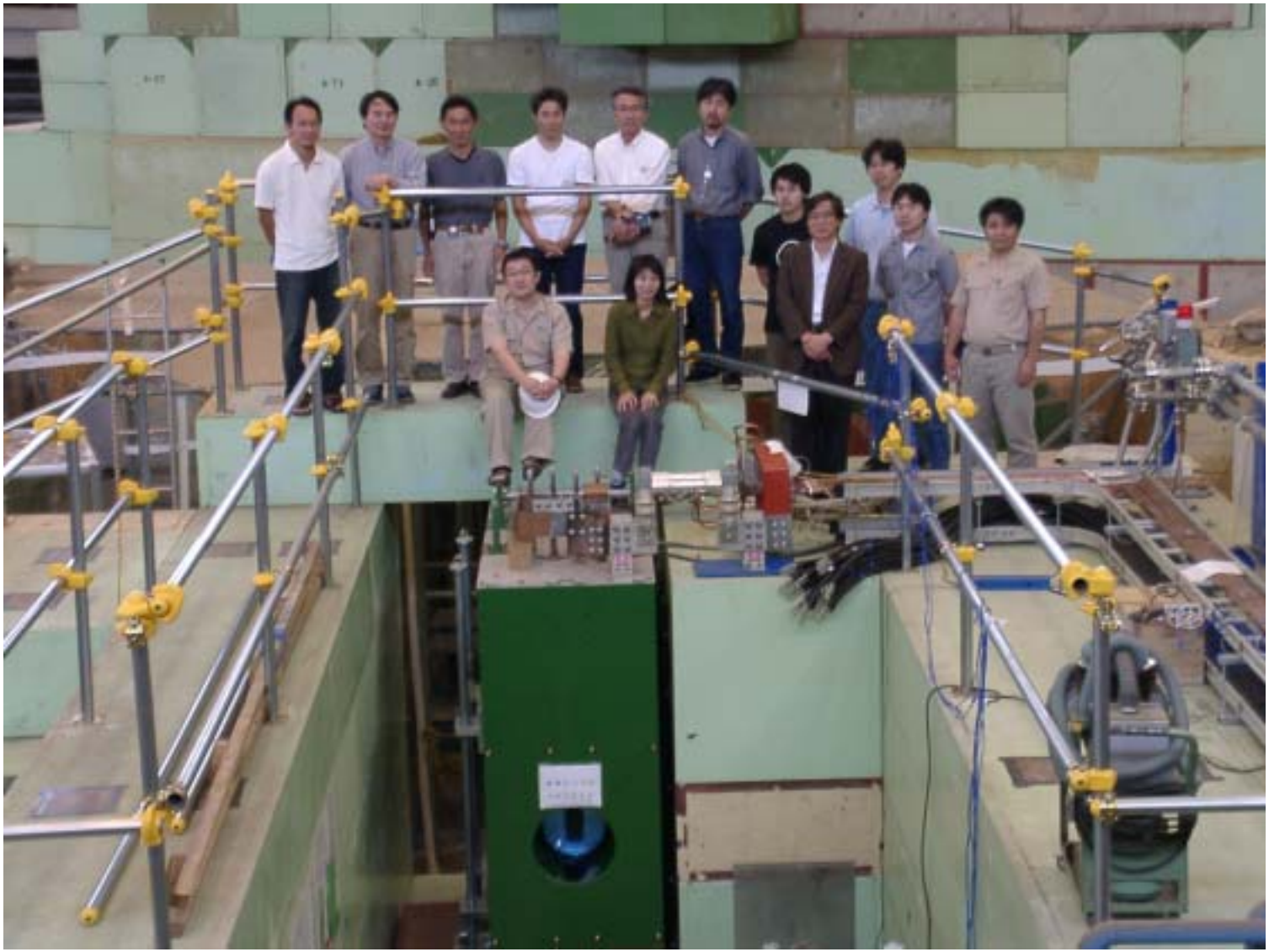
Fixed Target Facility Magnets from SLAC

Medical Facility Magnets from Tsukuba U.

Radioactive Iron from DURATEC

- 1$/10t
- 100$/1t including transport fee.
- 1/10 of Normal Iron
- Max. 2mR at Surface.
- Less than 2nCi/gr (74Bq/gr)
- Nuclear Wastes?
- Scheduling?
- Possible in Japan?

Design & Construction of K-HALL



Hadron Beam-Line Subgroup is Responsible