JHFNP01@KEK
ν WG on Dec.11,2001

Beam

Takashi Kobayashi
IPNS, KEK

Contents

- Neutrino beam
  (request for facility)
- Neutrino facility
  - Overview
  - Recent status
  - Schedule

  (introduction for following talks)

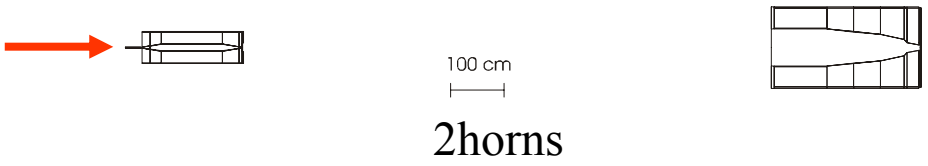
Neutrino beams and strategy in LOI

hep-ex/0106019(June 2001)

- Three types of beams
- WBB: first ~1year for Δm^2 rough determination
- NBB or OAB: Precision/high sens. measurement of disapp./app. at osc. max.
- NBB: neutrino interaction in near site
- Decay pipe: 80m from target

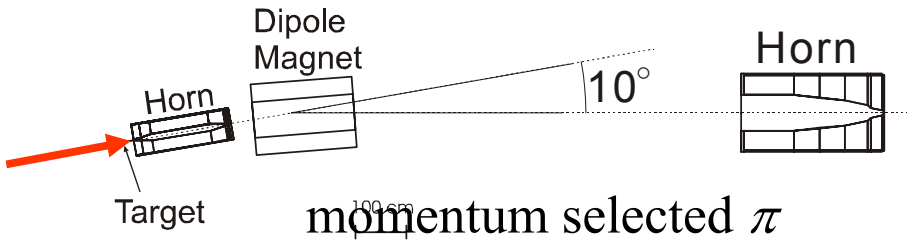
Three Beams

Wide Band Beam



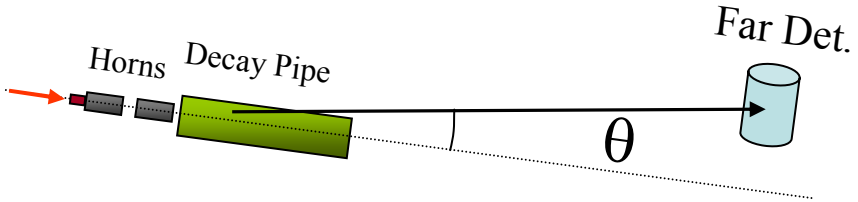
- Intense
- Wide sensitivity in Δm^2
- BG from HE tail
- Syst. err from spectrum extrapolation

Narrow Band Beam



- Less HE tail
- Less sys err from spectrum "counting experiment"
- Easy to tune E_ν

Off Axis Beam



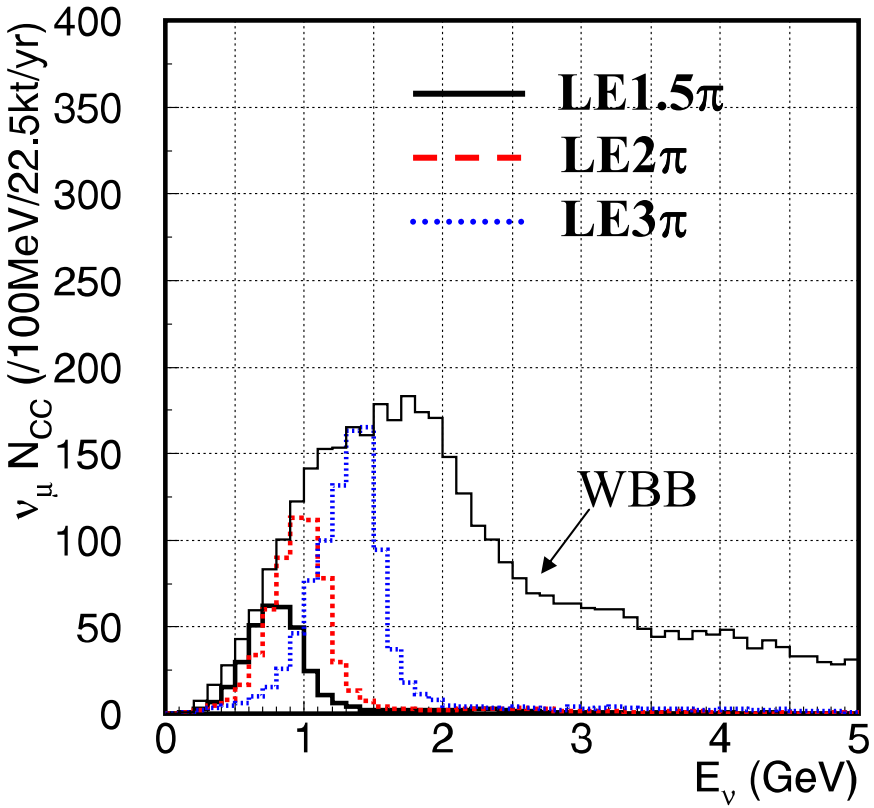
- High int. narrow band beam
- More HE tail than NBB
- Hard to tune E_ν

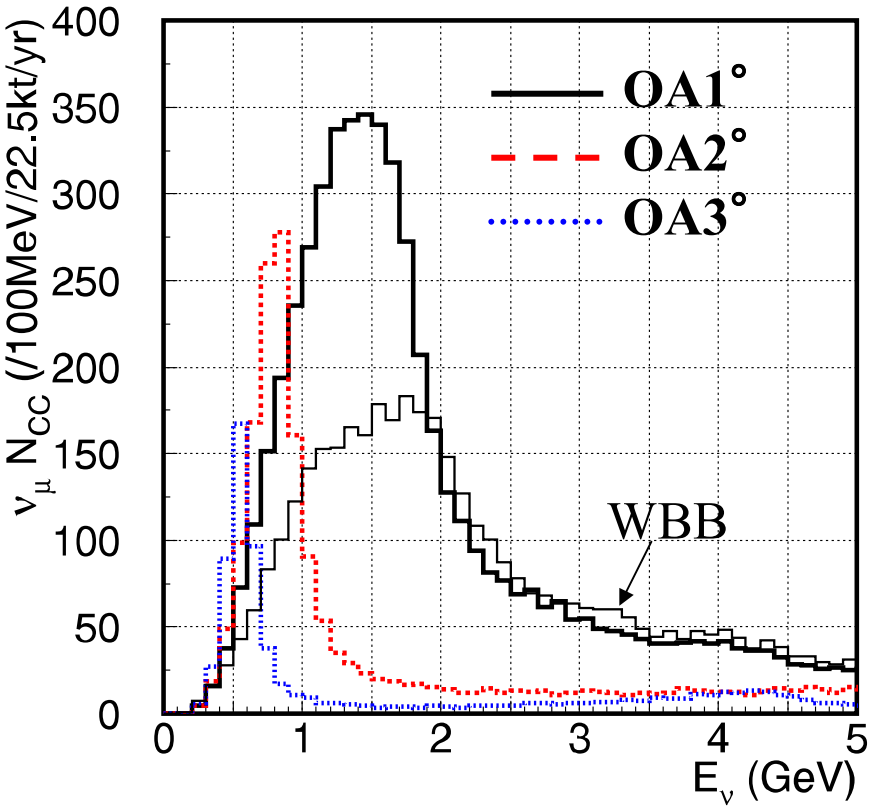
Current beam/strategy

- Discard WBB option → smaller decay pipe
- Only OAB for long term LBL measurement
  - Factor 2~3 higher flux than NBB
- Decay pipe : 80m → 130m for higher flux
  - ~40% increase in peak flux
- Adjustable OAB angle **X**$\pm$**0.5**deg.
  - **X** still to be decided later for max. sensitivity
  - Deadline: ~1year
- NBB only for ν int. study at near site
- Shoot SK and possible HK site (10km=2deg apart) w/ the same beam line

Request for facility

of CC events of various beams





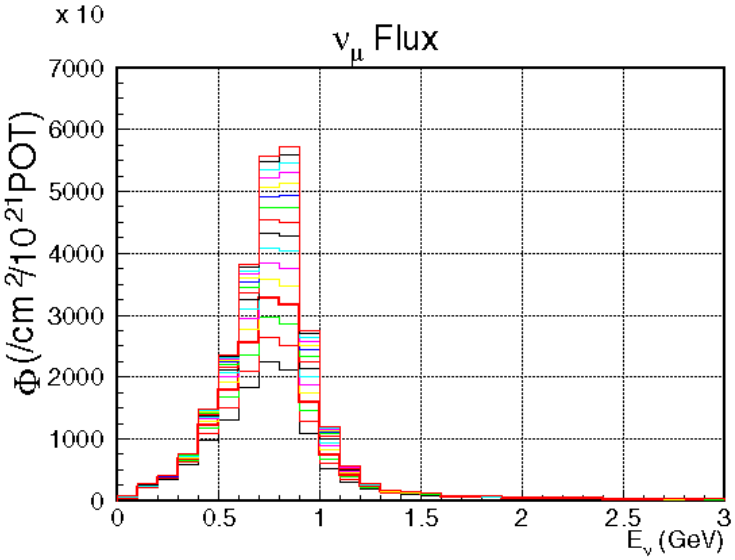
WBB:**5200** CC int./22.5kt/yr

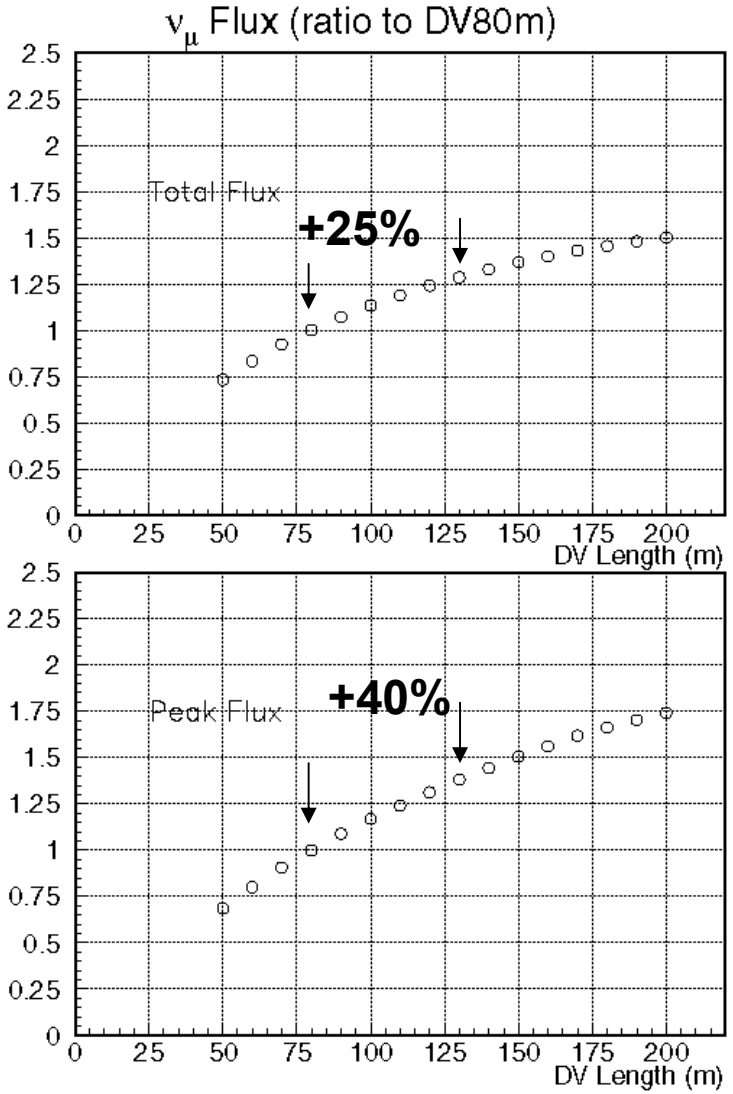
NBB: **620** CC int./22.5kt/yr (2GeV/c π tune)

OAB: **2200** CC int./22.5kt/yr (2degree)

Peak energy can be tuned by changing mag. field(NBB) or angle(OAB)

Decay pipe len 80m→130m





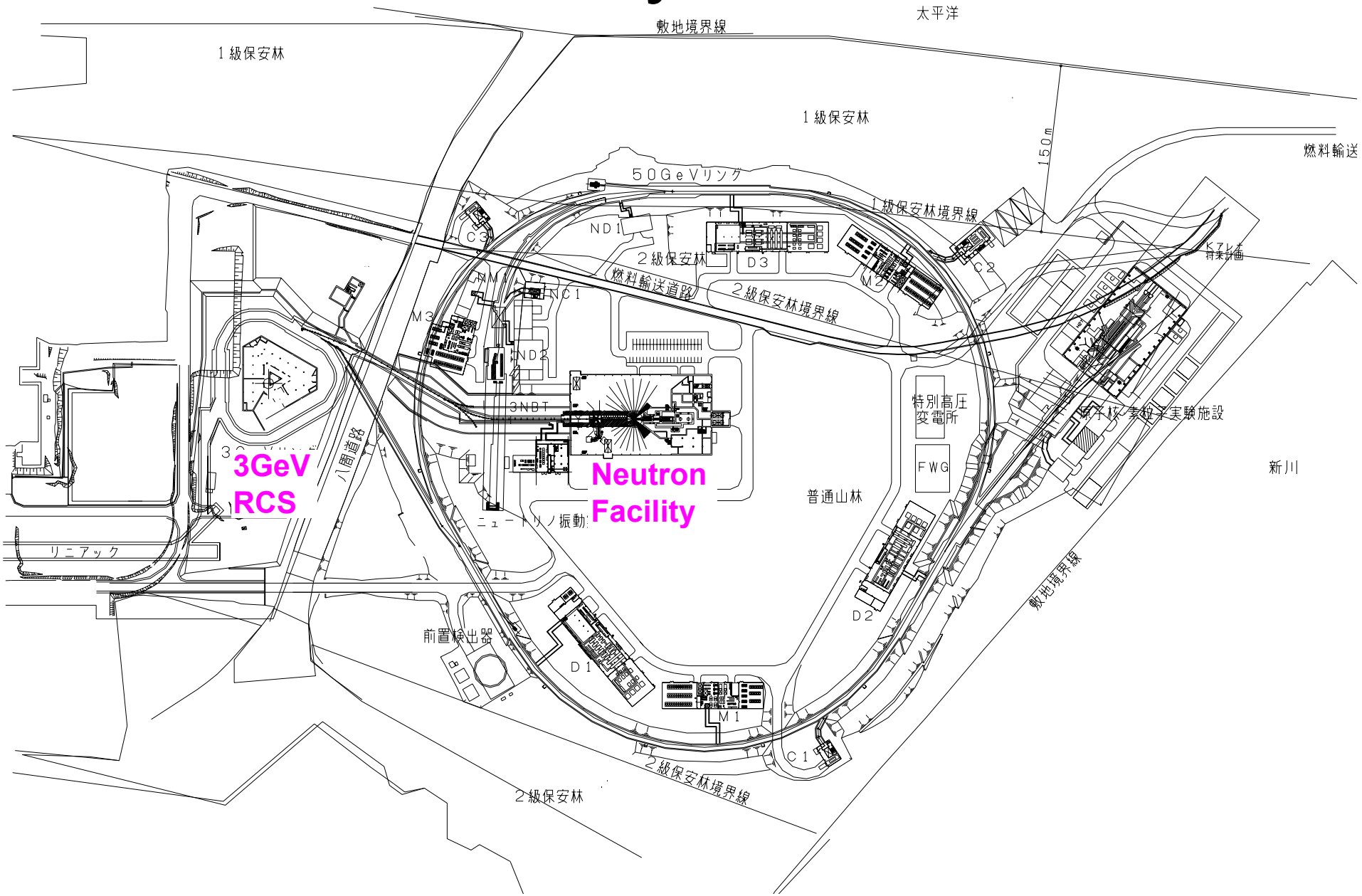
40% increase in peak flux

Neutrino Facility

All drawings are preliminary

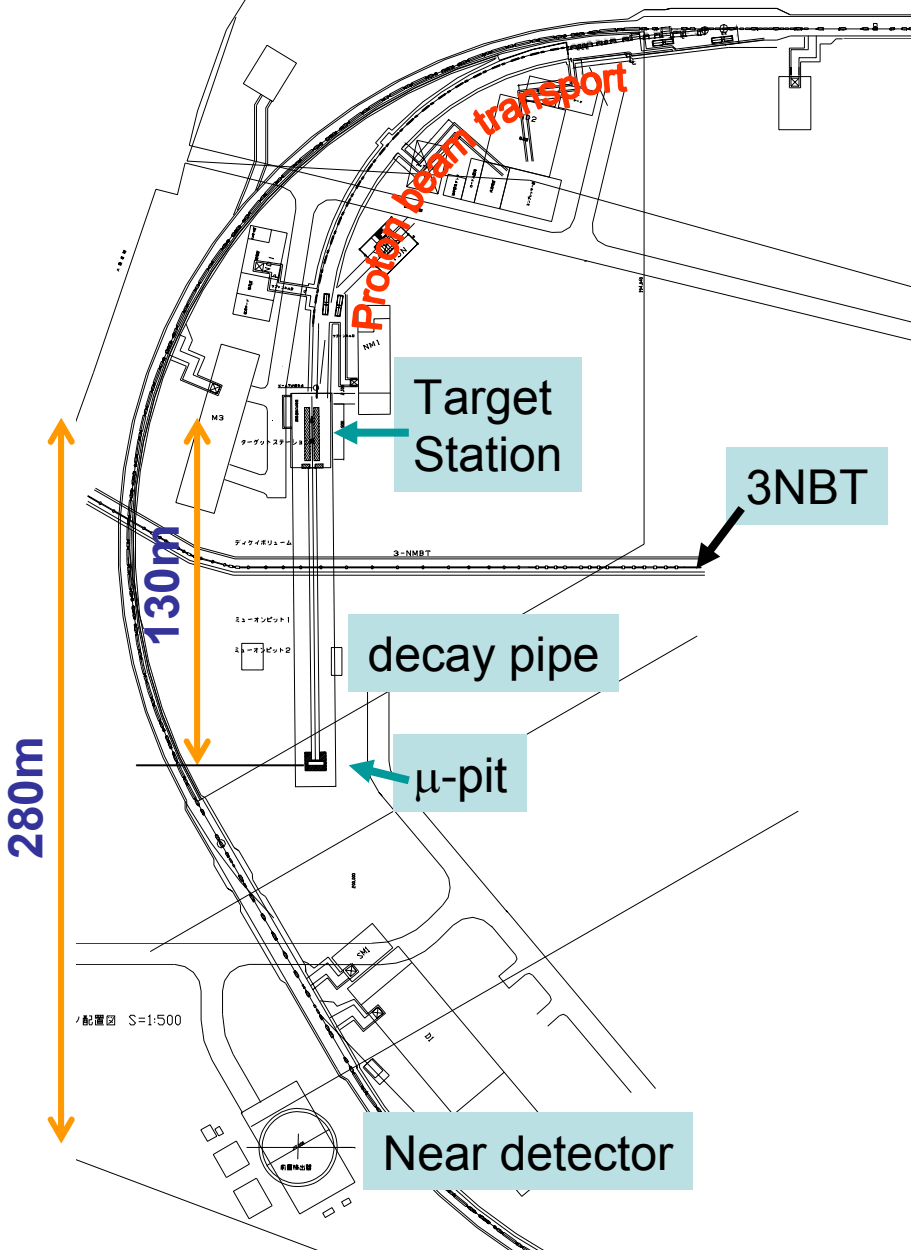
Recent changes have not been reflected in the drawings yet

Layout


敷地境界線
太平洋
1級保安林
1級保安林
燃料輸送
150m
50GeVリング
1級保安林境界線
ND1
C3
2級保安林
D3
C2
M2
燃料輸送道路
2級保安林境界線
NC1
M3
ND2
3NBT
特別高圧
変電所
FWG
3GeV
RCS
八間道路
Neutron
Facility
普通山林
ニュートリノ振動
リニアック
前置検出器
D1
D2
M1
C1
2級保安林境界線
敷地境界線
2級保安林
新川

Overview of neutrino facility

- Beam line tunnel
- Proton beam transport
  - Preparation section
  - Arc section (Super cond.)
  - Final focusing
- Target/Horn system
  - NBB/OAB changeable
- Decay pipe
  - Cross w/ 3NBT
  - Target-Dump: 130m
  - “Trapezoid” shape
- Pit for muon monitor
- Beam dump
- Near detector
  - @280m in JAERI site
  - @~2km



Specification

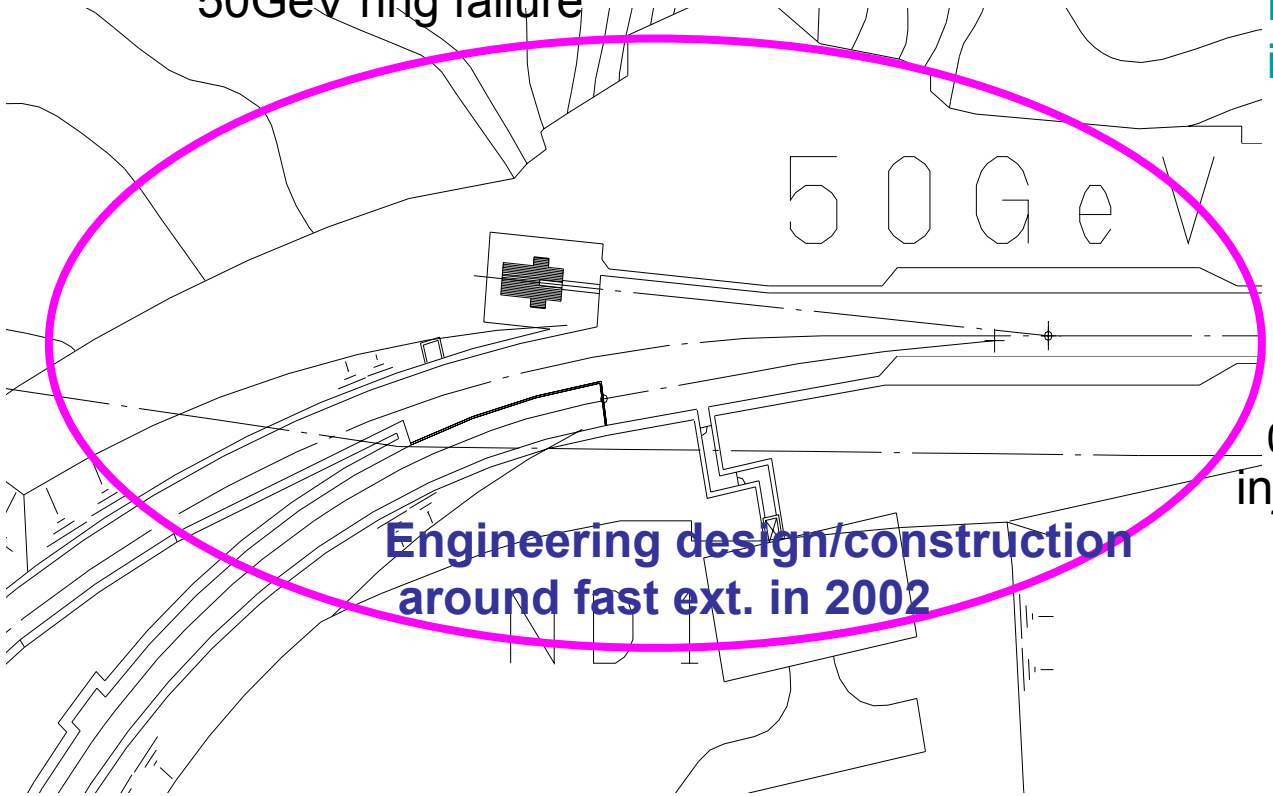
Beam kinetic energy		50GeV
Protons/pulse		3.3×10^{14}
Beam current		15μA
Beam power		750kW
Extraction		Single turn fast extraction
Micro structure		8bunches/9 RF buckets
Bunch spacing		598ns
Spill width		~5μs
Cycle		~3.64sec
Rep rate		0.275Hz
Proton beam emittance		6.1πmm.mrad
Physical acceptance		60πmm.mrad
Beam loss(proton transport)		1W/m
Curvature of arc		110m
Decay pipe length (target-dump)		130m
Distance to near detectors		280m/~2km
Distance to SK		~295km
Target-SK beam decline		-1.25deg

Recent progress

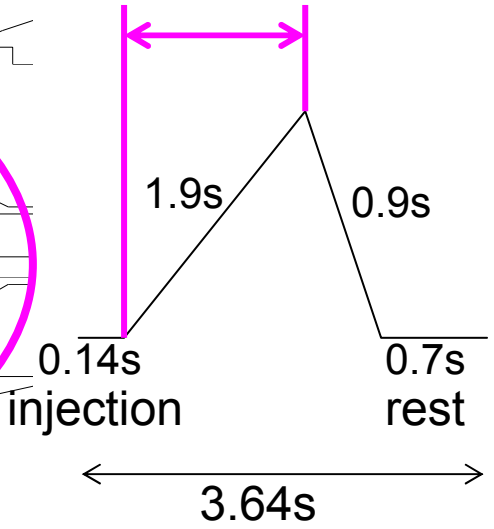
- Neutrino facility construction group **OFFICIALLY** formed in KEK (Apr.2001)
- 50GeV beam abort still to be settled
- Primary proton beam optics almost fixed → Ichikawa's talk
- Design of norm. cond. mags started (Kusano)
  - Preparation section/Final focusing
- Design of super conducing magnets → Nakamoto's talk
- Conceptual design of low T facility done.
- Optimization of target/horn system started → Hayato/Ichikawa's talk
- Radiation shielding design → Oyama's talk
- Decay pipe
  - decide to fill He
  - heat dissipation simulated→ hayato's talk
  - Common decay pipe design for SK and HK
  - Started design w/ company
- Long baseline GPS survey finished → Noumi's talk
- Plan to include 2km detector in the same budget request
- Aiming to submit budget request in 2002
  - ➔ get answer by the end of 2002.

Beam (50GeV) abort (fast)

For ν line failure
50GeV ring failure



No where to abort
if ν line fails



Position/scheme of beam abort not settled yet.

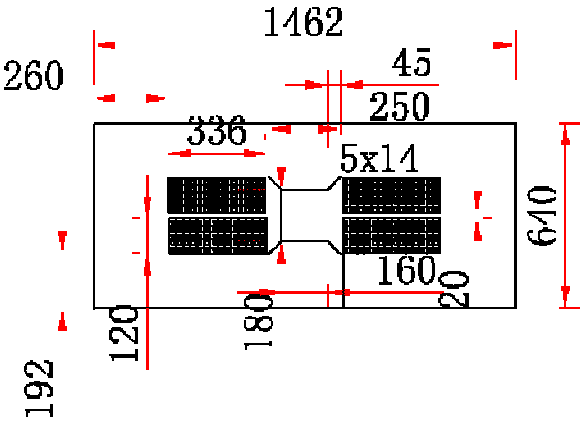
This may give significant modification on ν facility design depending on solution

Urgent task

Design of normal conducting magnets

Magnets for preparation section

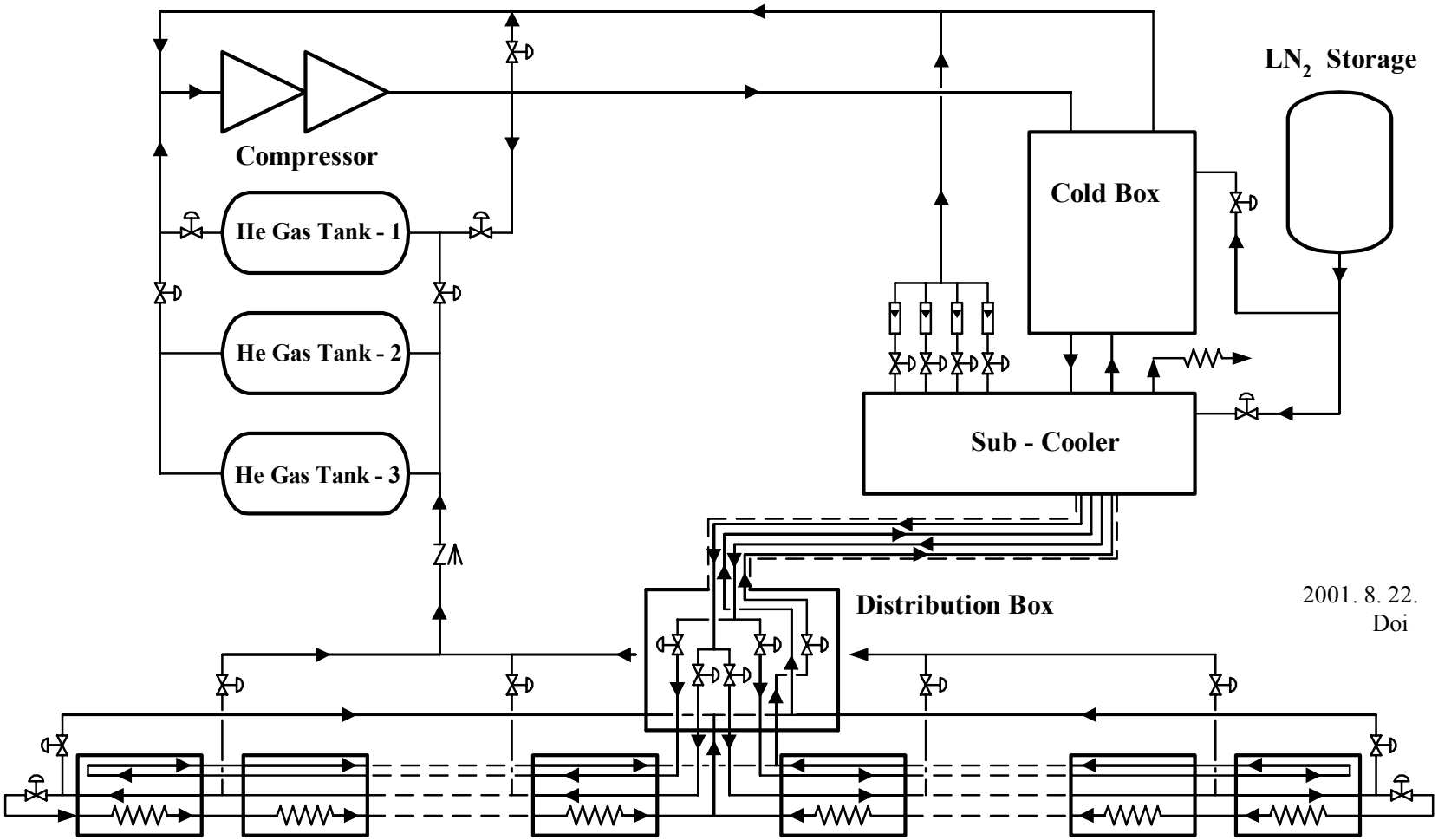
PD1MIC(3.2D3.660)



Summery					
	Dipole		Steering		
Name	PD1MIC	PD2	PH1&PH2MIC	PV1&PH3	PV2
Field[T]	2	2	2	2	2
Gap(V)[mm]	139	126	44 & 54	104 & 95	47
Gap(V)[mm]	180	160	100	150	100
Gap(H)[mm]	120	101	108 & 145	70 & 41	79
Gap(H)[mm]	160(250)	160	200(300)	150(300)	100(200)
Len[mm]	3000	3000	1000	1000	1000
I[A]	2500	2500	2000	2000	2000
Turn	140	128	96	144	100
Voltage[V]	220	140	70	100	70
Power[kW]	450	350	140	200	140
Width[mm]	1500	1300	1400	1100	1000
Height[mm]	700	500	500	500	500
Length[mm]	3600	3400	1600	1400	1500
Weight[ton]	26	16	10	7	4
	Guadrupole				
Name	PQ1MIC	PQ2A&BMIC	PQ3A&B	PQ4A&B&5	Total power[kW]
Field[T]	1	1	1	1	
Gap(V)[mm]	200	200	200	150	
Gap(V)[mm]	200	200	200	150	
Gap(H)[mm]					
Gap(H)[mm]					
Len[mm]	3000	2000	2000	2000	
Current[A]	2500	2500	2500	2000	
Turn	144	144	160	160	
Voltage[V]	220	100	100	60	
Power[kW]	550	250	250	120	2450
Width[mm]	1280	1280	1280	1200	
Height[mm]	1280	1280	1280	1200	
Length[mm]	3500	2500	2500	2500	
Weight[ton]	25	16	16	16	

E.Kusano

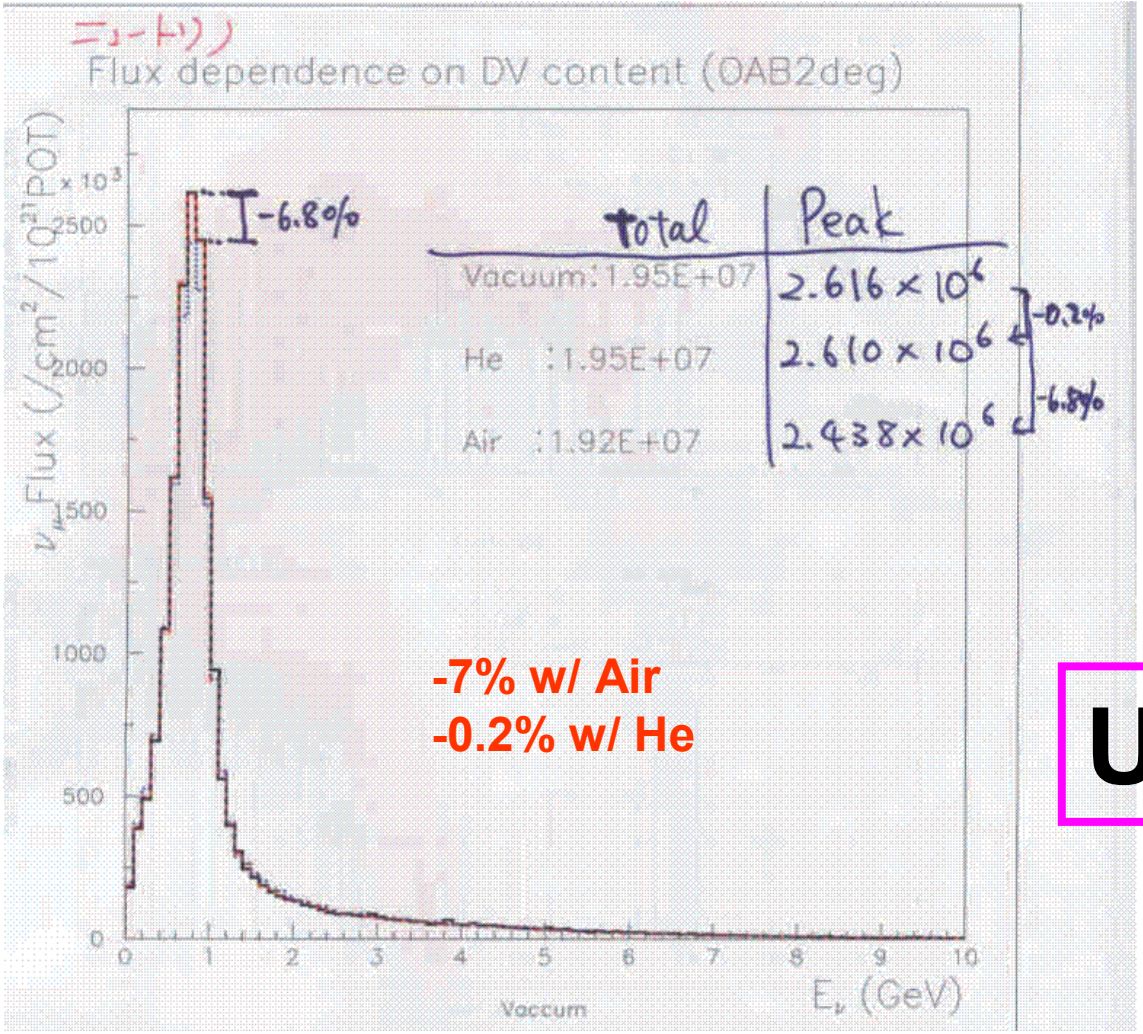
Low T facility



A candidate design

Y.Doi

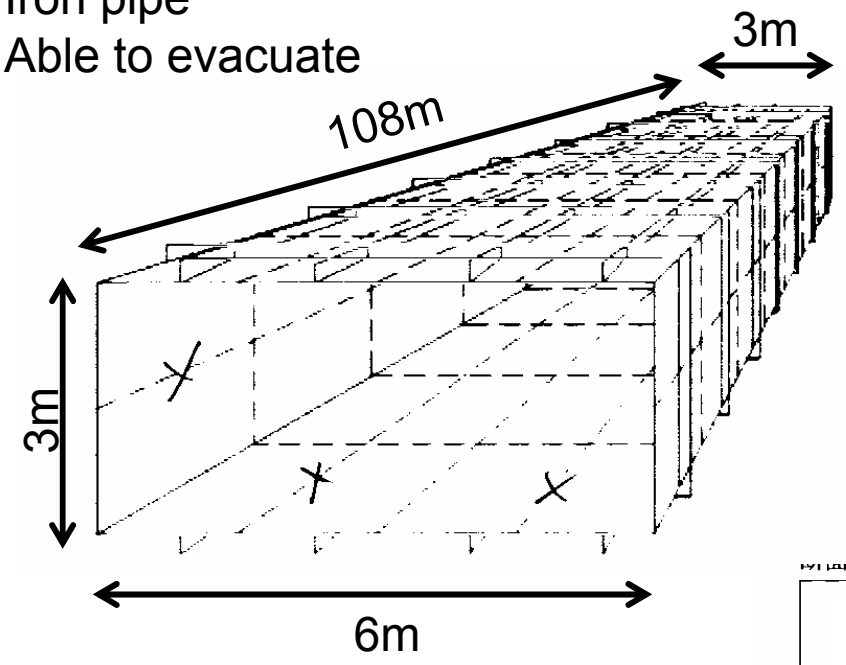
Gas in decay volume



Use Helium

Conceptual design of decay pipe

Iron pipe
Able to evacuate



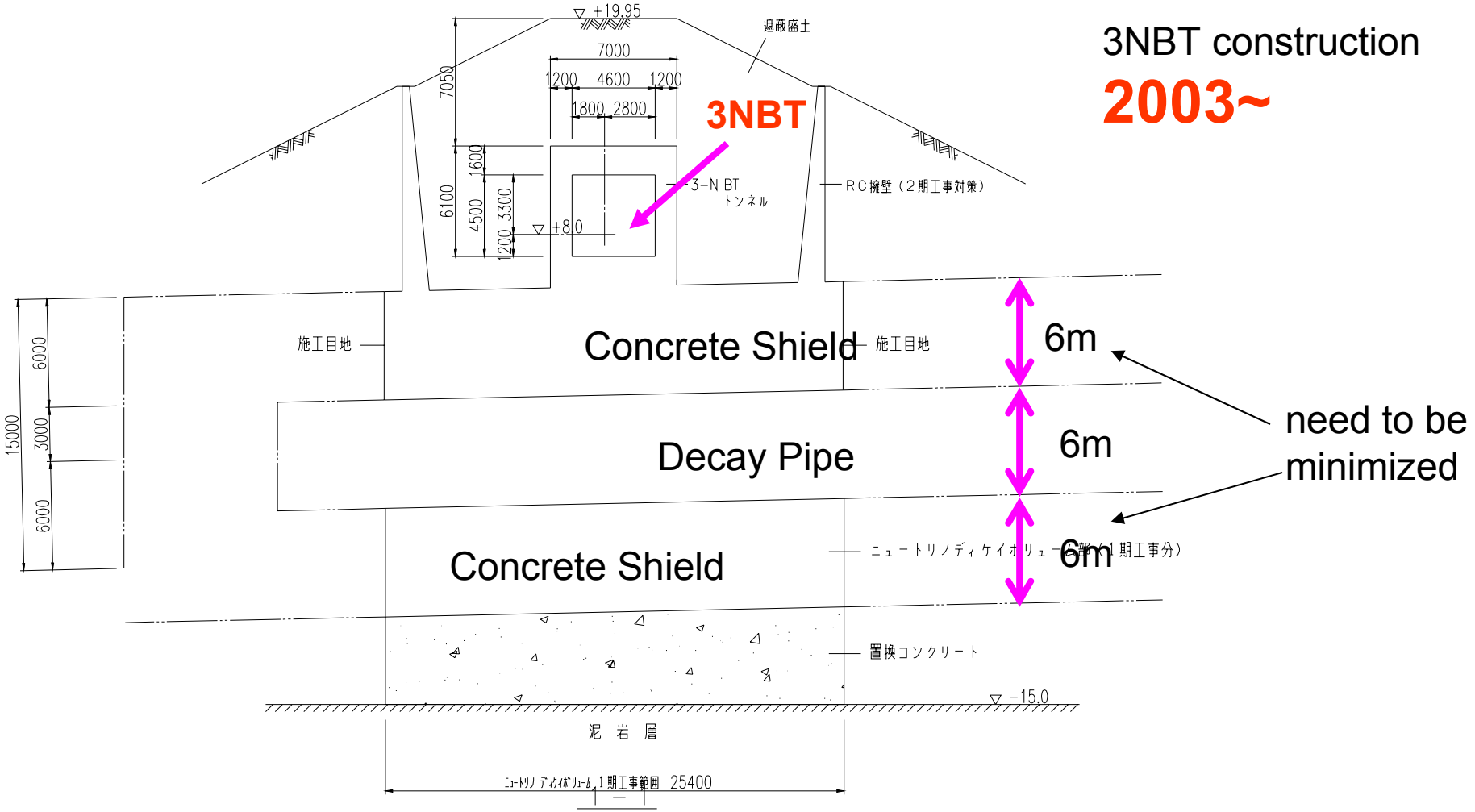
Have to build in 2002
at least the part beneath 3NBT

Trapezoid pipe is best
Cooling scheme to be developed.

Comparison of pipe shape

Shape	Cost	工場製作 施工性	現地施工 作業性	Total
丸 ○	1．2	×	△	△
楕円（上面，下面は平板） ⬭	1．3	△	△	×
四角 □	1．0	○	○	○

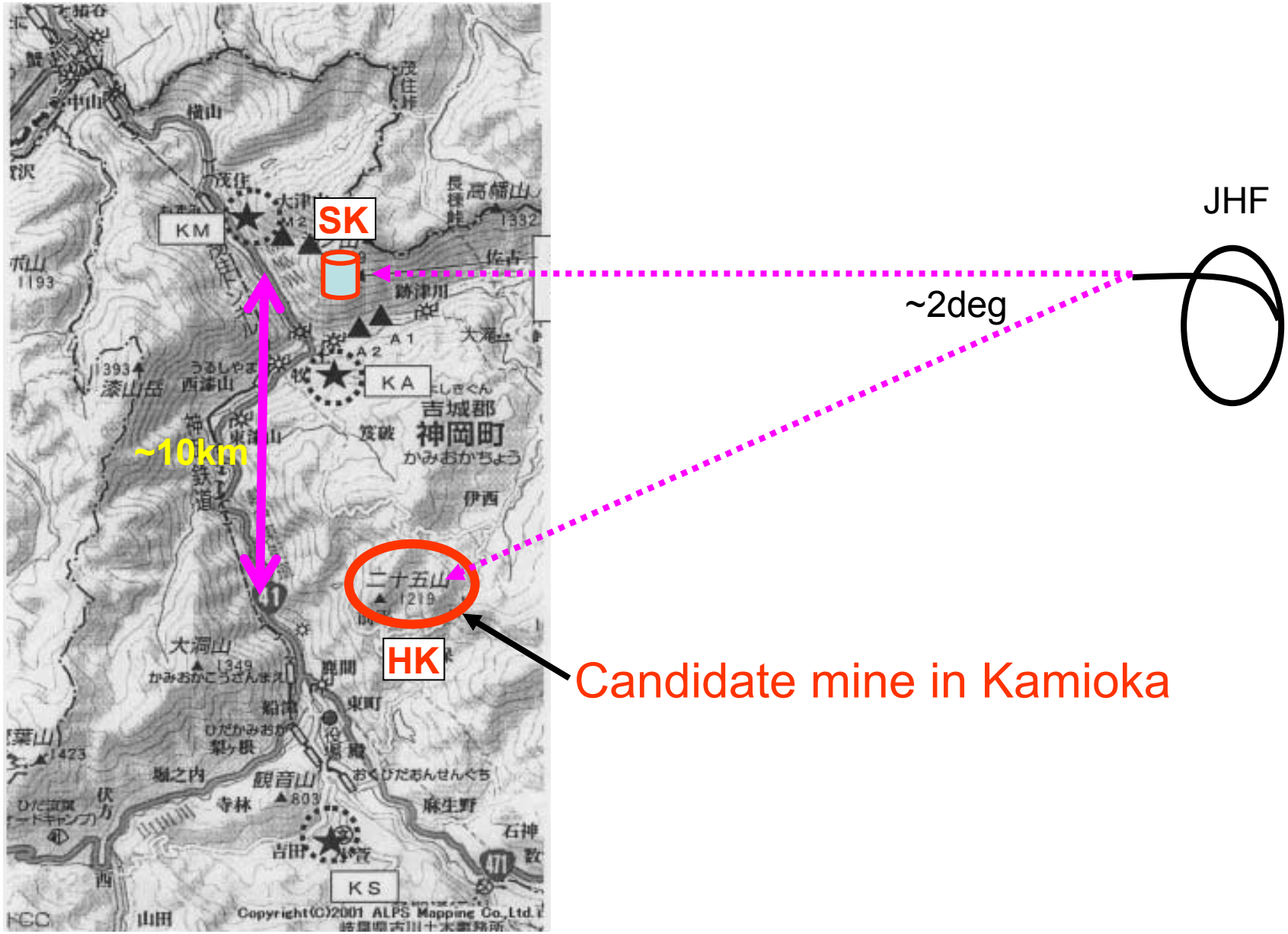
Decay pipe (3NBT cross)



3NBT construction

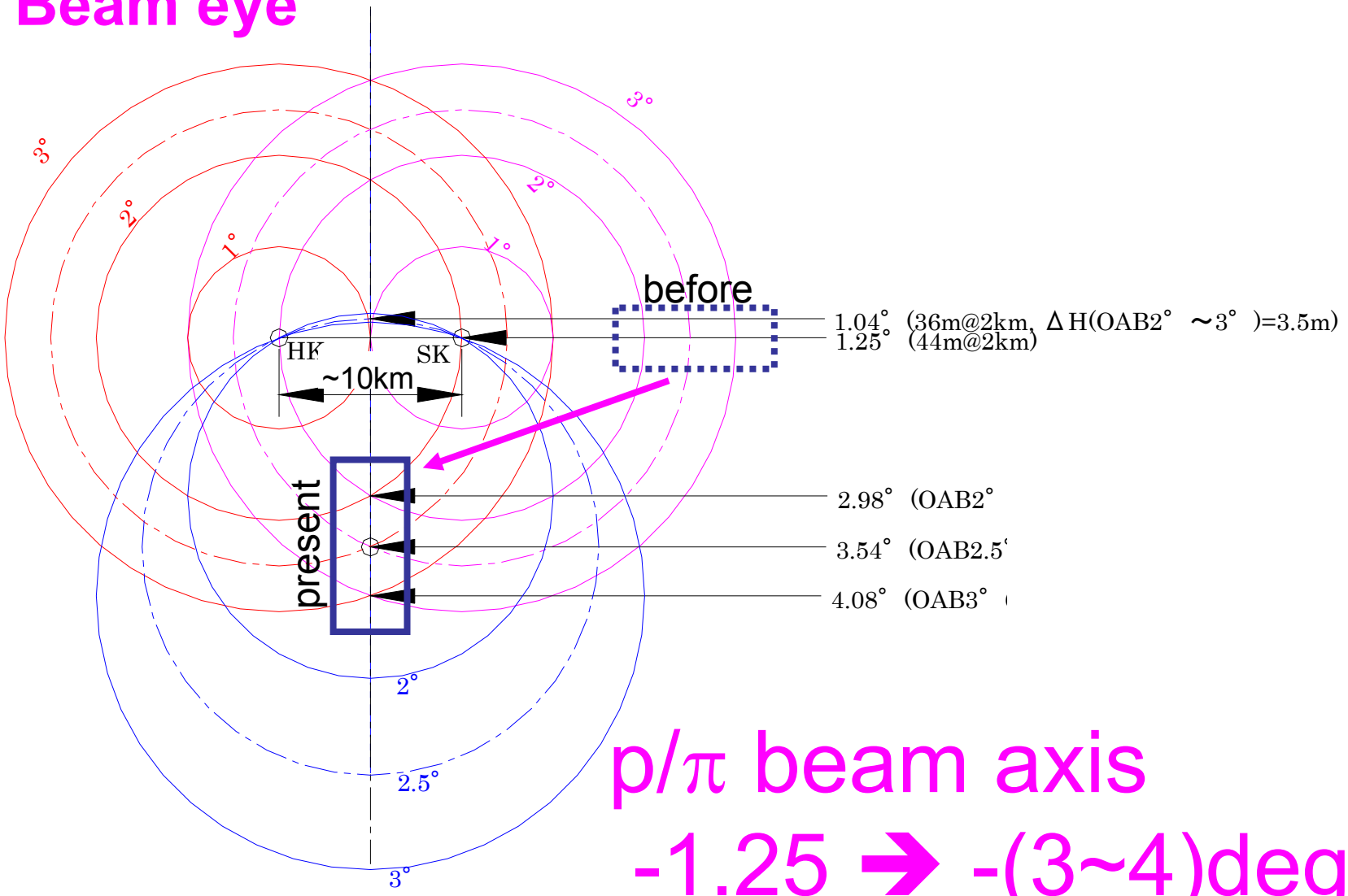
2003~

SK and Possible HK site



Common decay pipe for SK/HK

Beam eye

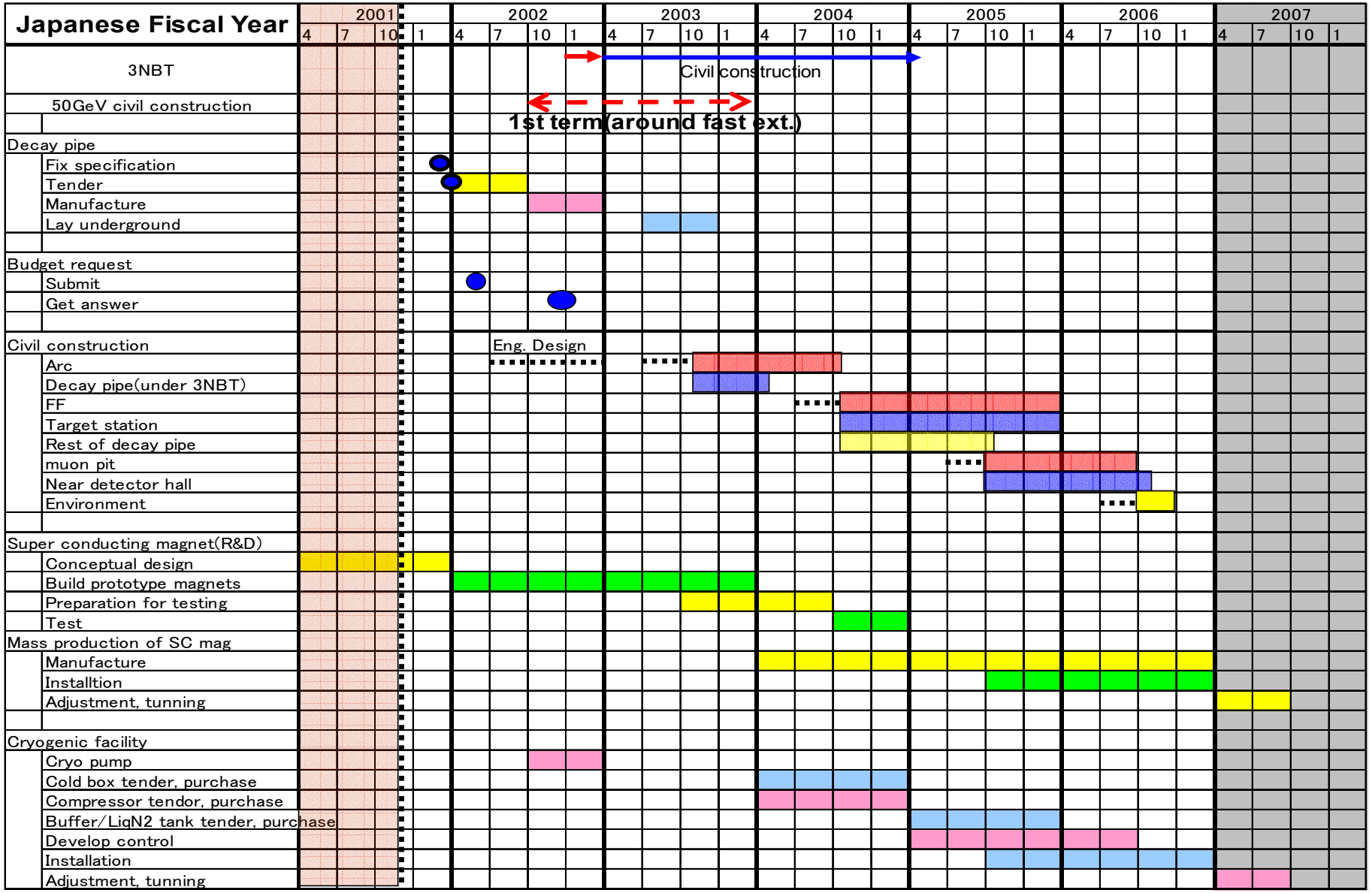


p/π beam axis

-1.25 ➔ -(3~4)deg

Ichikawa

Mile stones/Schedule(Summary)



Not all items listed. We aim to complete construction by the end of JFY2006