Experimental Facilities at the J-PARC 50-GeV PS

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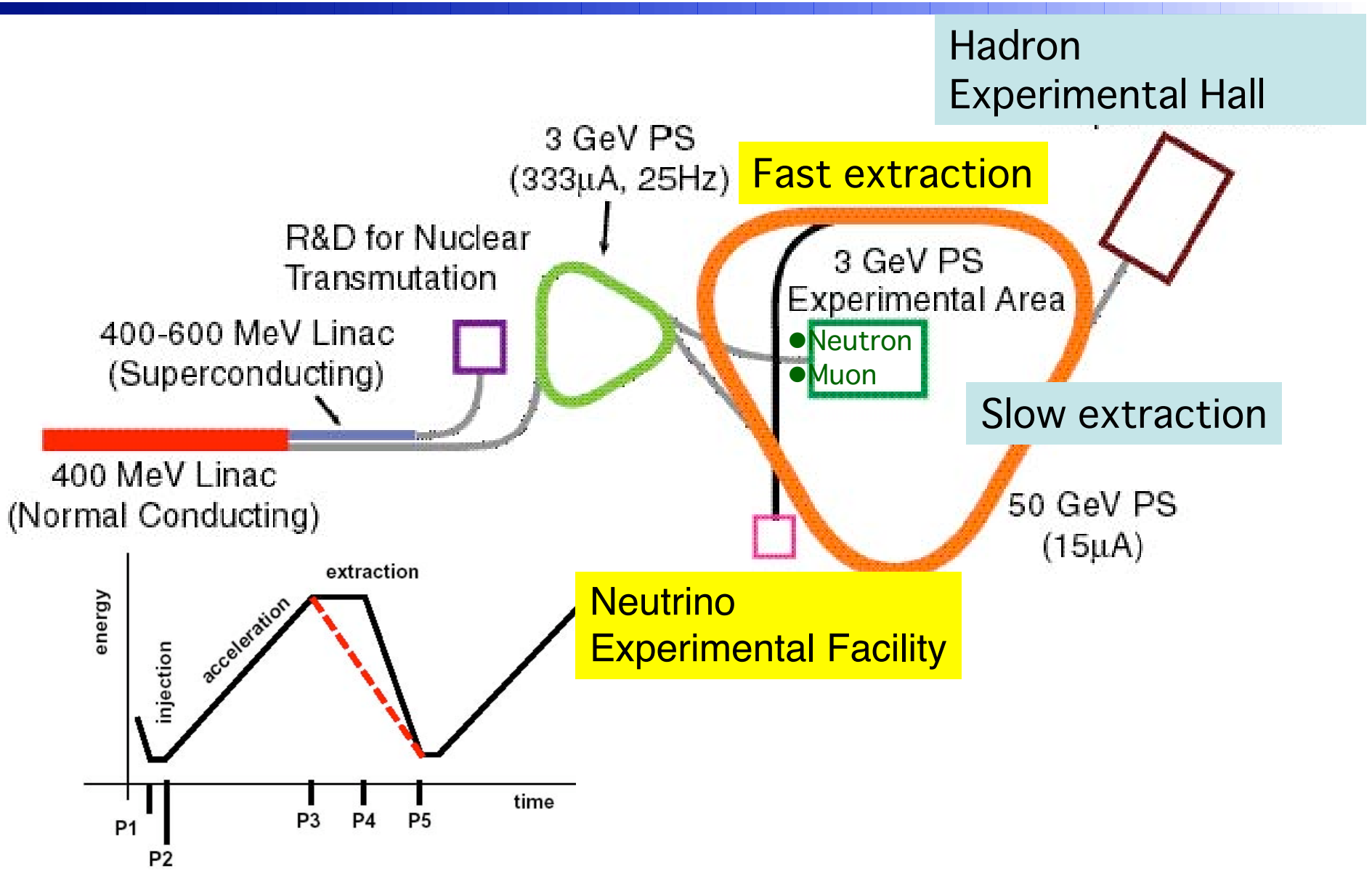
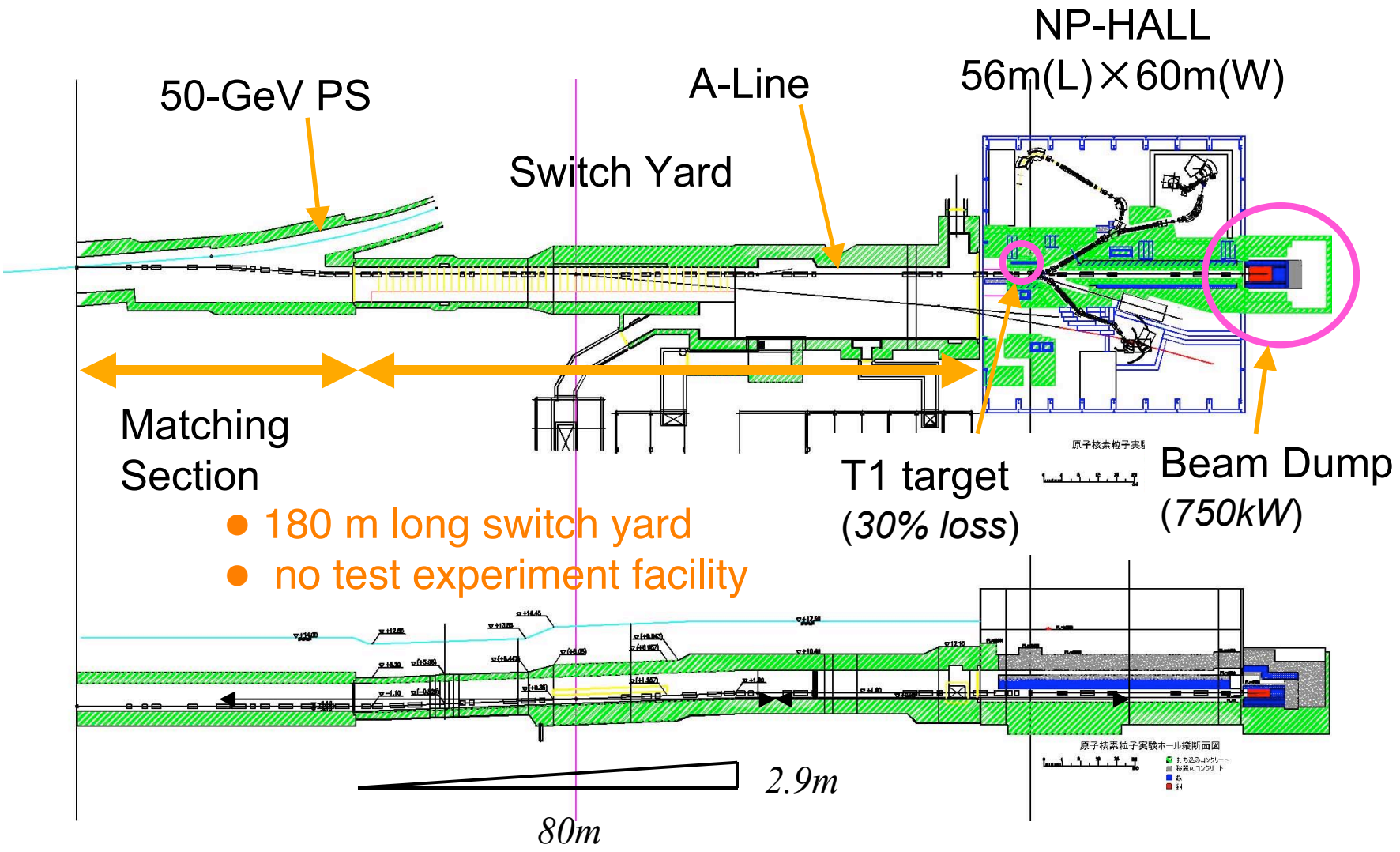
1. Nuclear and particle physics facilities
2. Construction schedule
3. Shift from the 12-GeV PS
4. Development of beamline elements
5. Physics program and secondary lines

50-GeV PS facilities



Hadron Experimental facility (Phase 1)



- 180 m long switch yard
- no test experiment facility

Slow-extraction beam

E(GeV)	Harm.#	Bunch	Period (s)	*I* (μA)	*P* (kW)	Spill(s)	*D.F.*	E_{lin}(MeV)
30*	9	8	3.53	9	270	> 0.7	> 20 %	181
30*	18	15	4.08	14.4	432	> 0.7	> 17 %	181
<for comparison>								
30	9	8	3.53	15	450	> 0.7	> 20 %	400
40	9	8	3.53	15	600	0.7	20 %	400
50	9	8	3.53	15	750	0.7	20 %	400

* The ratio of per bunch intensity between 181 MeV and 400 MeV of 0.6 is assumed.

- Beam energy is limited to 30 GeV due to electricity and cooling water capacities in Phase 1

Experimental Hall (Phase 1)

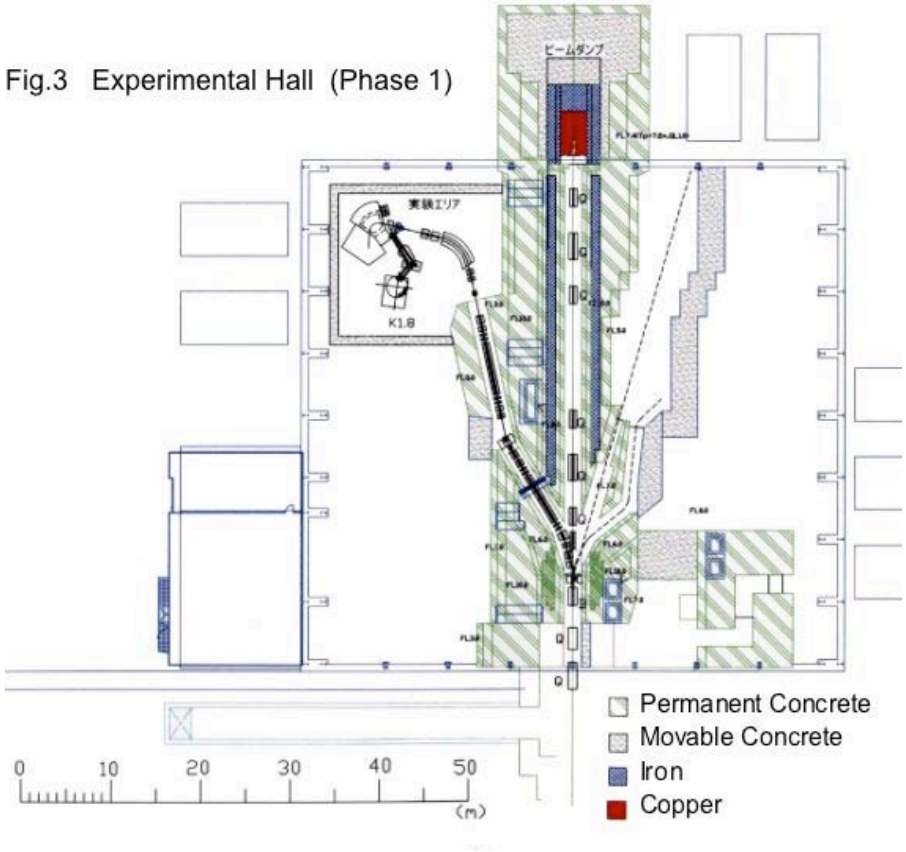
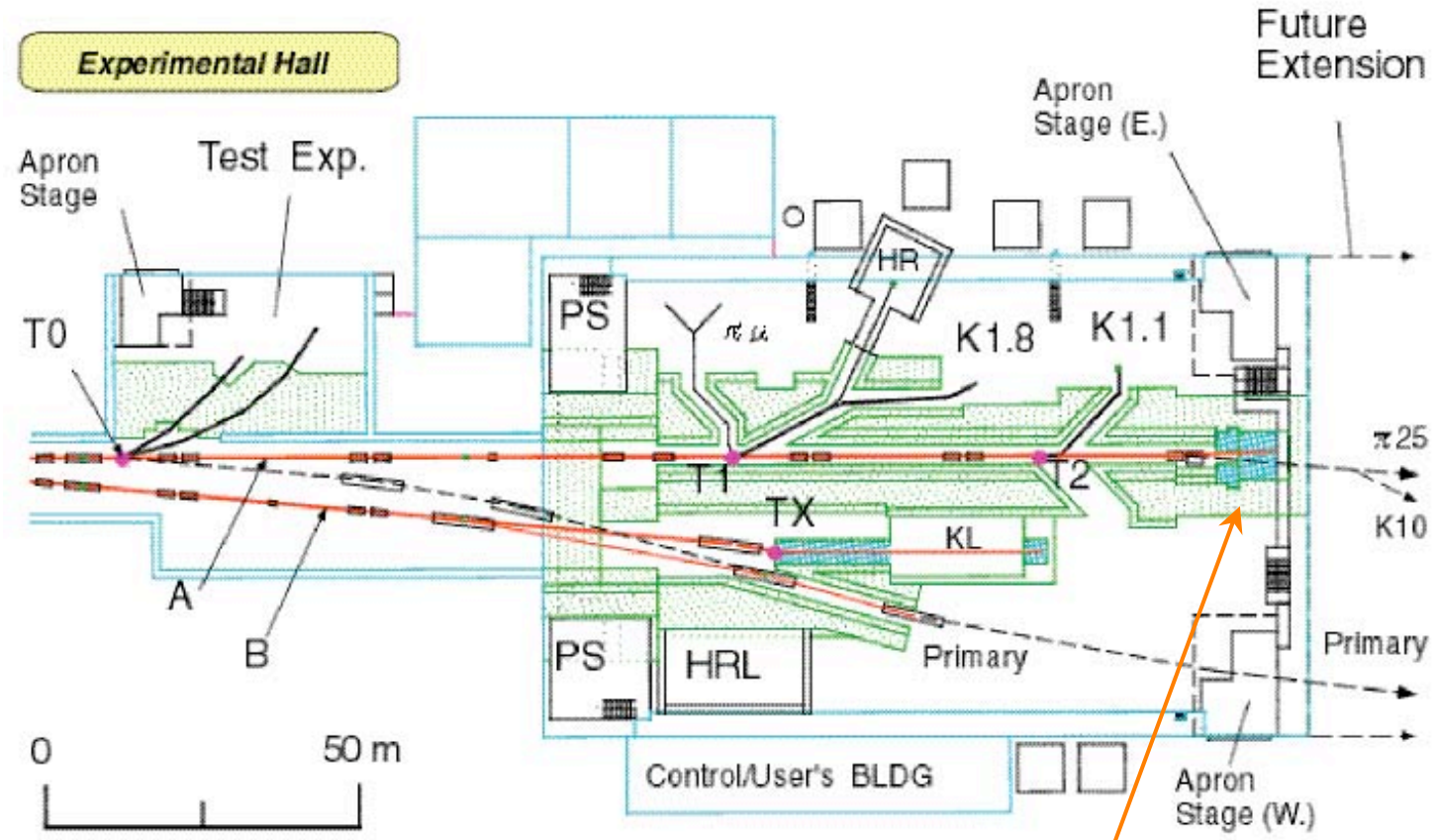


Fig.3 Experimental Hall (Phase 1)

- Hall size : 60m (W) x 56 m (L)
- Floor level : -6.4 m from ground level
- Beam height : 2.0 m above floor

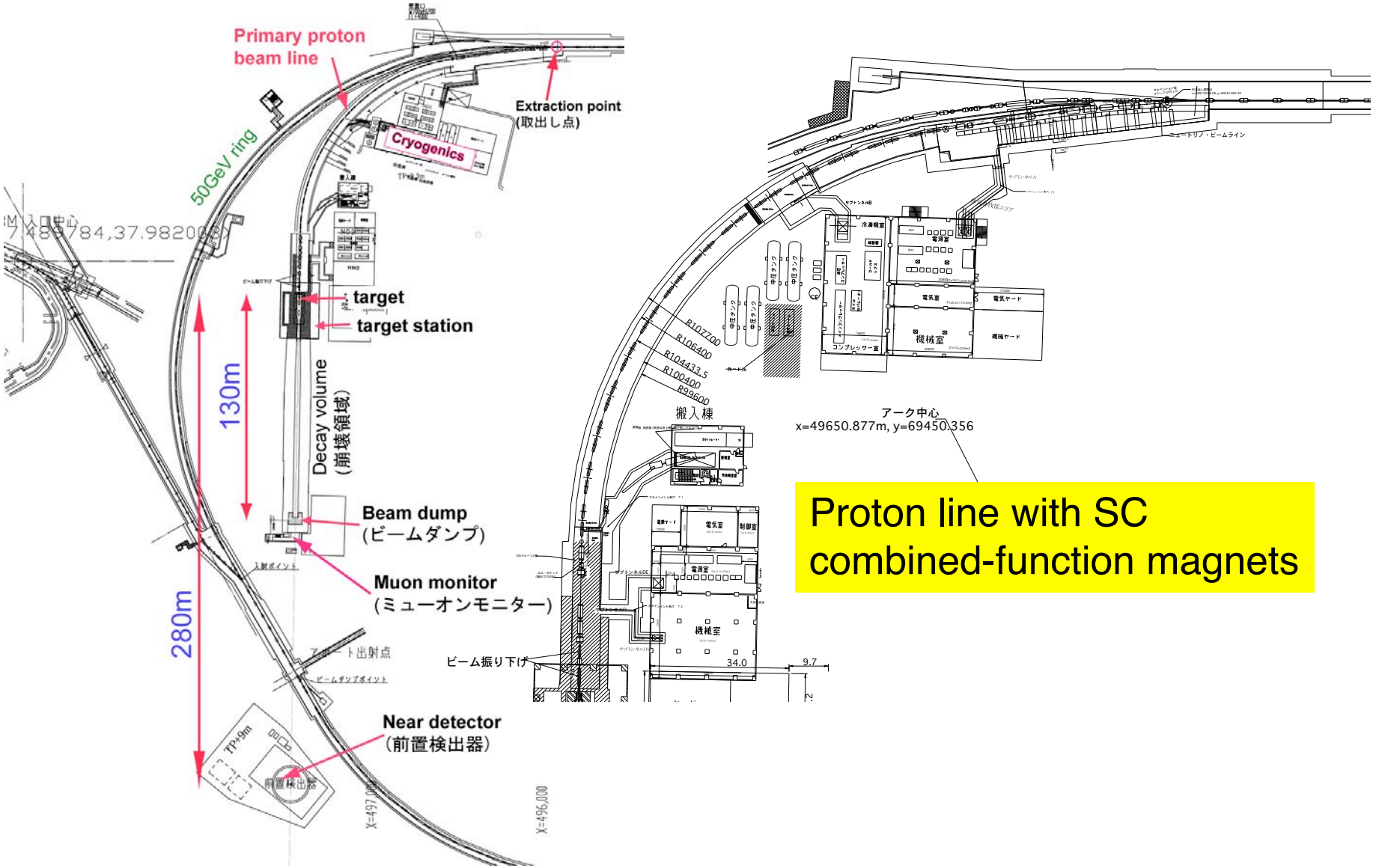
- Primary line : A- line (straight line)
- T1 target : rotating Ni disks water-cooled
- T1 length : 30 % beam loss equiv.
- T1 heat load: 9.3 kW
- Beam dump: Cu blocks with tapered beam inlet
- Dump power: 750 kW maximum

Phase-2 Hall



- Hall size = 60m (W) x 100 m (L)
- More than 2 target stations
- Test beam facility
- Beam dump will be rolled down

Neutrino facility



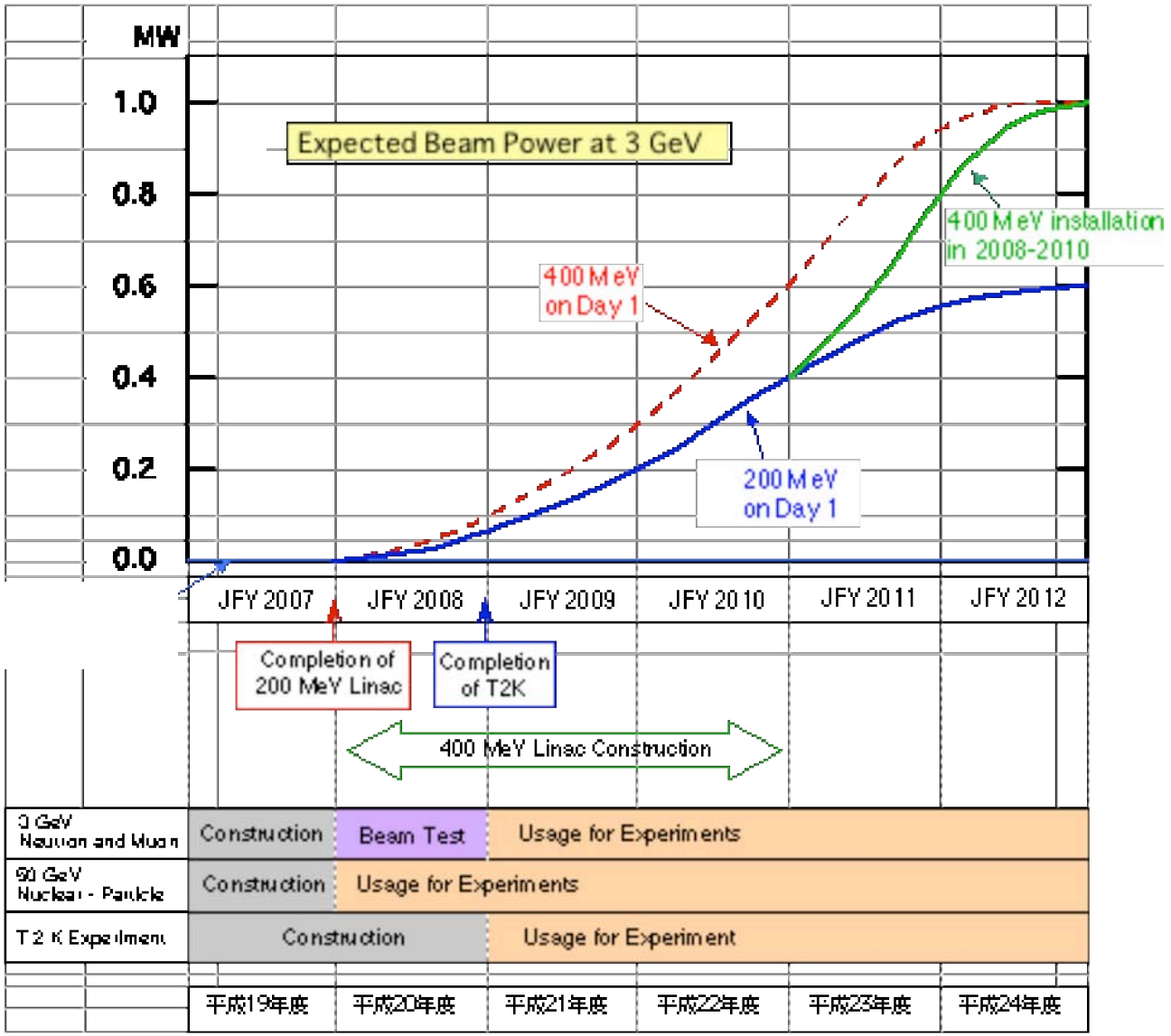
Fast-extraction beam

E (GeV)	Harm.#	Bunch	Period (s)	I(μA)	P (kW)	E_{lin}(MeV)
40*	9	8	3.53	9	360	181
40*	18	15	3.38	17.4	700	181
<for comparison>						
40	9	8	3.53	15	600	400
50	9	8	3.53	15	750	400

* The ratio of per bunch intensity between 181 MeV and 400 MeV of 0.6 is assumed.

- Beam energy is limited to 40 GeV due to the lack of a flywheel.

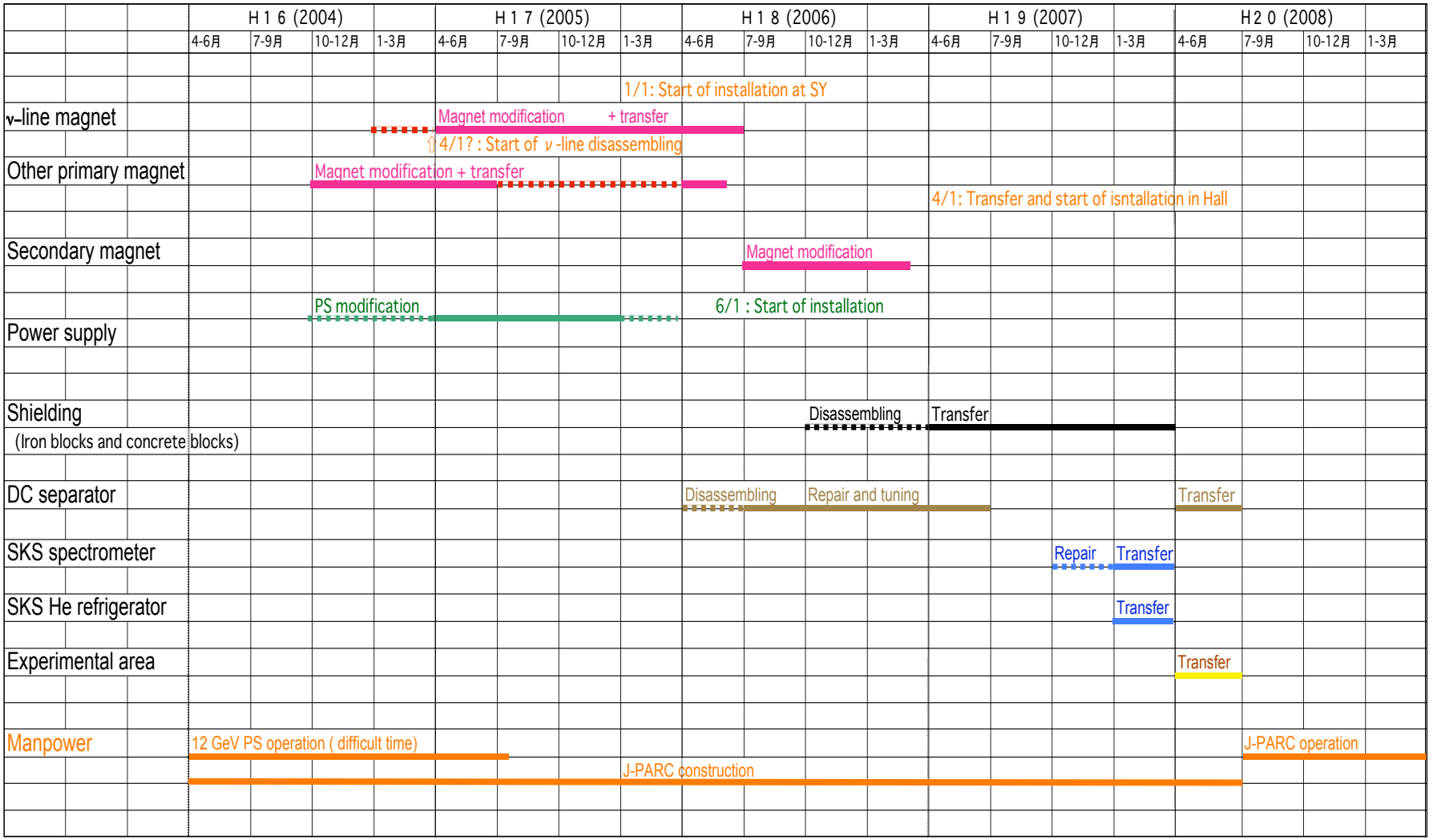
Expected Beam Power



Equipment transferred from 12-GeV PS

Item	Quantity	From	To
Bending magnet	18	ν line *etc*.	hadron SY primary line
Quadrupoles	21	ν line *etc*.	hadron SY primary line
Magnet power supply	>69	E-, and N-Hall	hadron hall and neutrino
Secondary magnets	27	K6, K5 *etc*.	K1.8, K1.1 in hadron hall
Iron shielding blocks	5,000 t	E-, and N-Hall	hadron hall, neutrino line
Concrete blocks	12,000 t	E-, and N-Hall	hadron hall, neutrino line
DC separator	2	K5 and K6	K1.1 in hadron hall
Horn power supply	1	ν line	ν line

Transfer of 12-GeV equipment



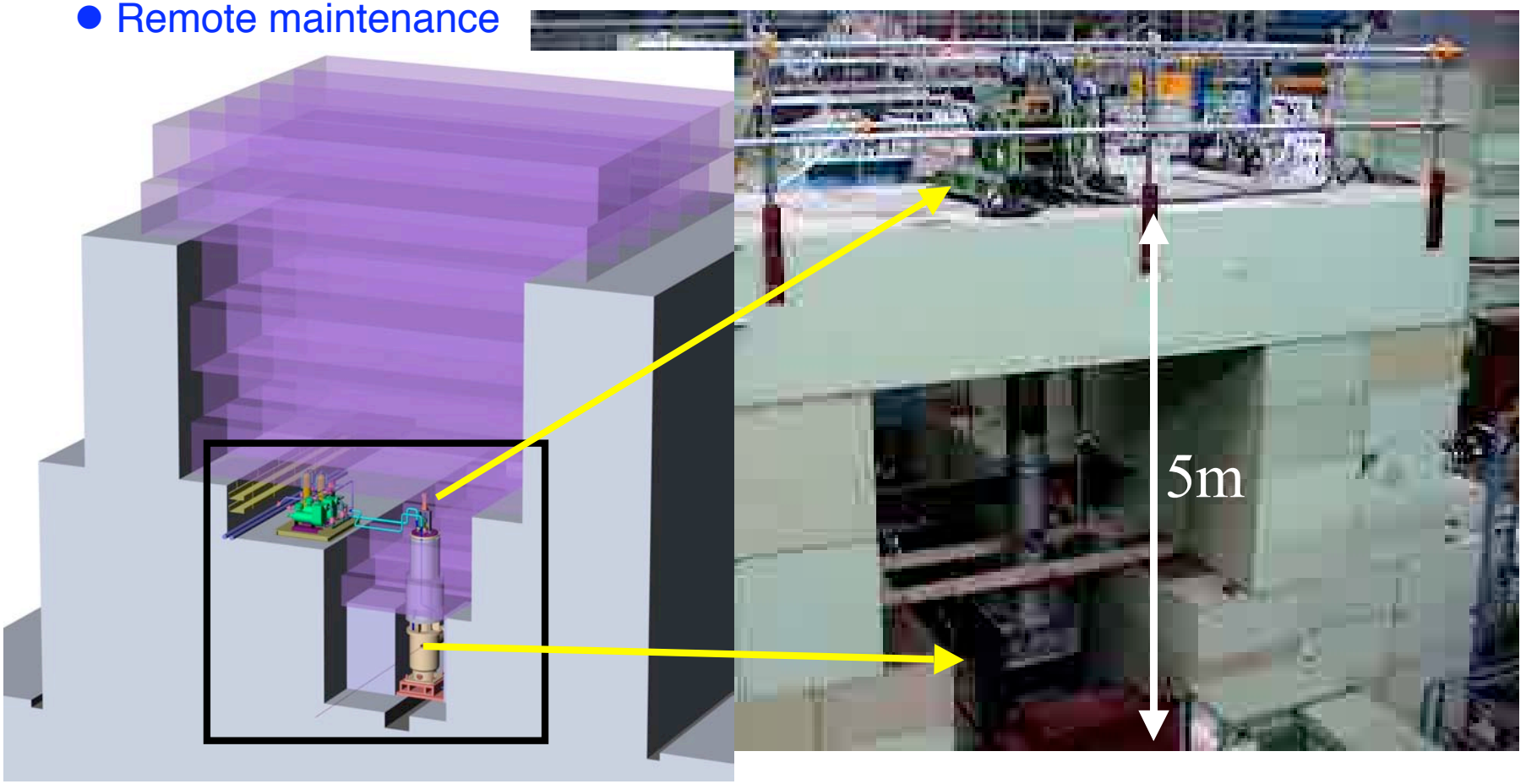
R&D in the facility construction group

Item	Method	R&D
T1 target	rotating disks	• drive mechanism • water cooling characteristics • maintenance process
ν target	graphite rod	• cooling characteristics • thermal shock • irradiation effects
A-line beam dump	Cu block	• water-cooling characteristics • attachment of cooling channel
ν horn	Al 3 horn system	• welding of Al, *etc*.
Rad-hard magnet	inorganic magnet	• MIC conductor with high capacity • water cooling peripherals
ν line arc magnet	combined-function SCM	• windings, color, *etc*. • cryostat
Beam monitor	SSEM	• prototype
	RGBPM	• prototype
	Loss monitor	• prototype
Junctions	quick disconnect system	• water, power, vacuum, crane-hook
Power feedthrough	inorganic bus-bar	• insulation, thermal stress

Test of T1 target prototype

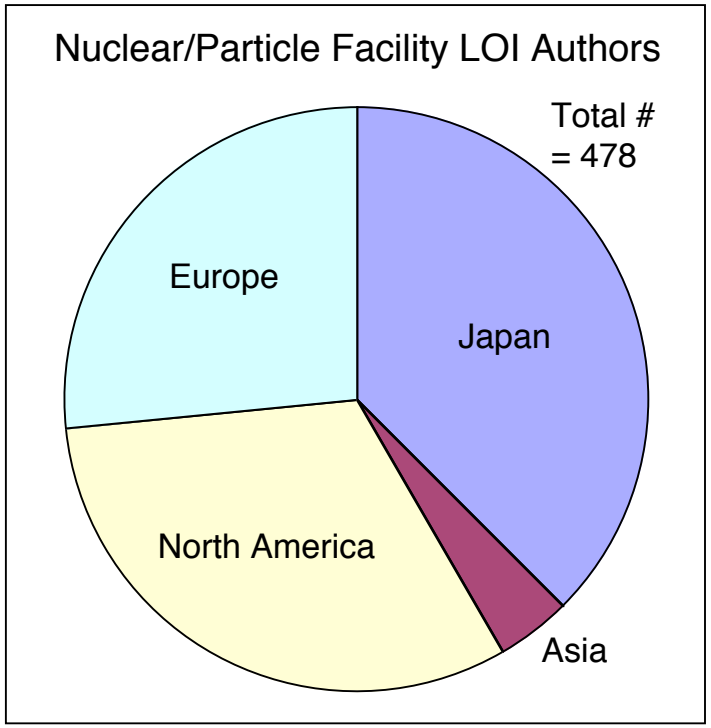
- Water cooling
- Rotating Ni disks
- Remote maintenance

East Hall mock-up



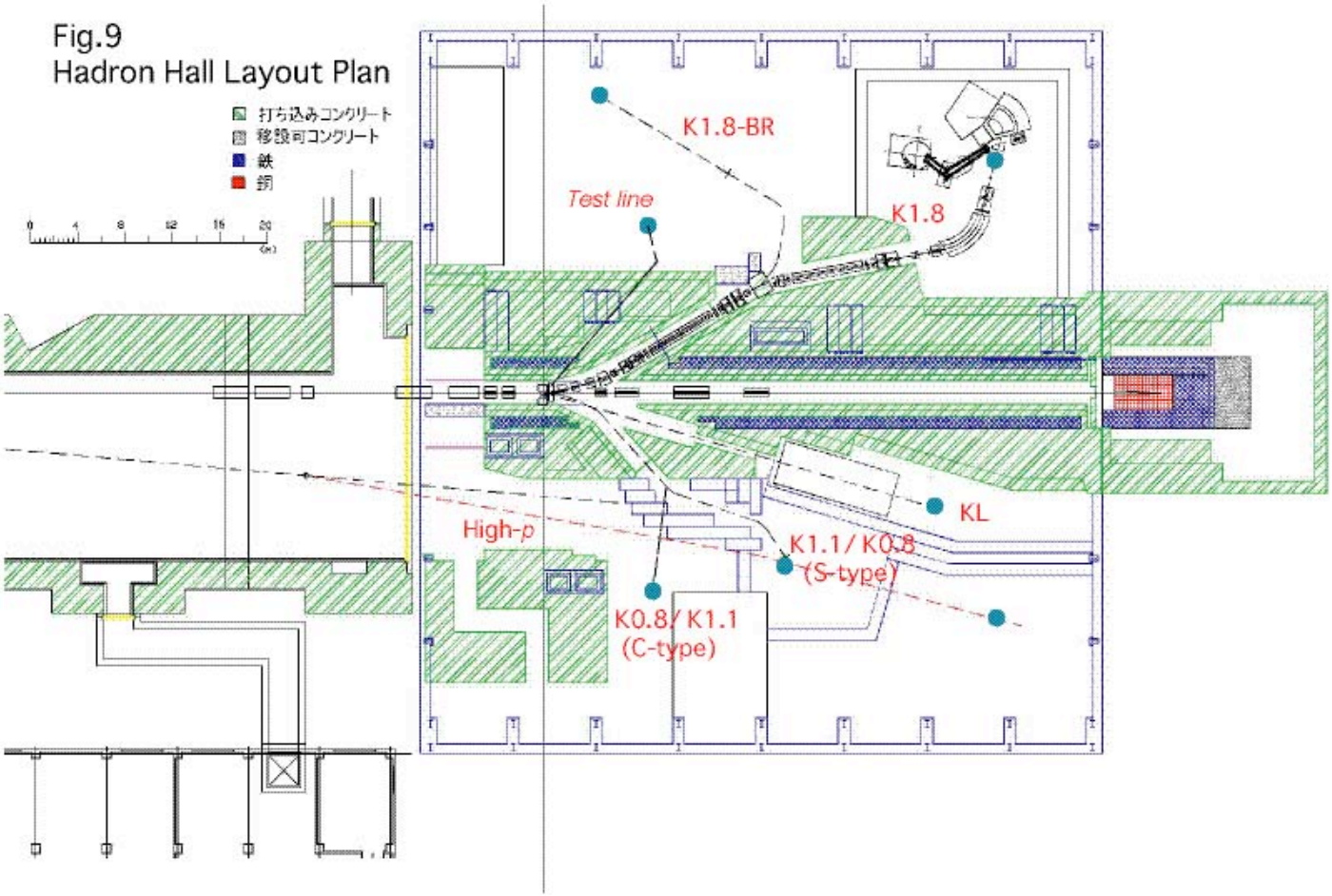
Letters of Intent

- Announce of LoI call : July 2002
- Thirty LoI's were submitted by early 2003
  - Strangeness nuclear physics : 6
  - Hadron physics : 7
  - Kaon decay : 5
  - Neutrino oscillation : 1
  - Muon decay : 3
  - Facility : 8
- NPFC Committee meetings:
  - March 22, 2003
  - June 26-28, 2003
  - February 16, 2004
- Review by June 2003 meeting
  - Day-1 experiments : 2 + test line
  - Phase1 experiment : 16



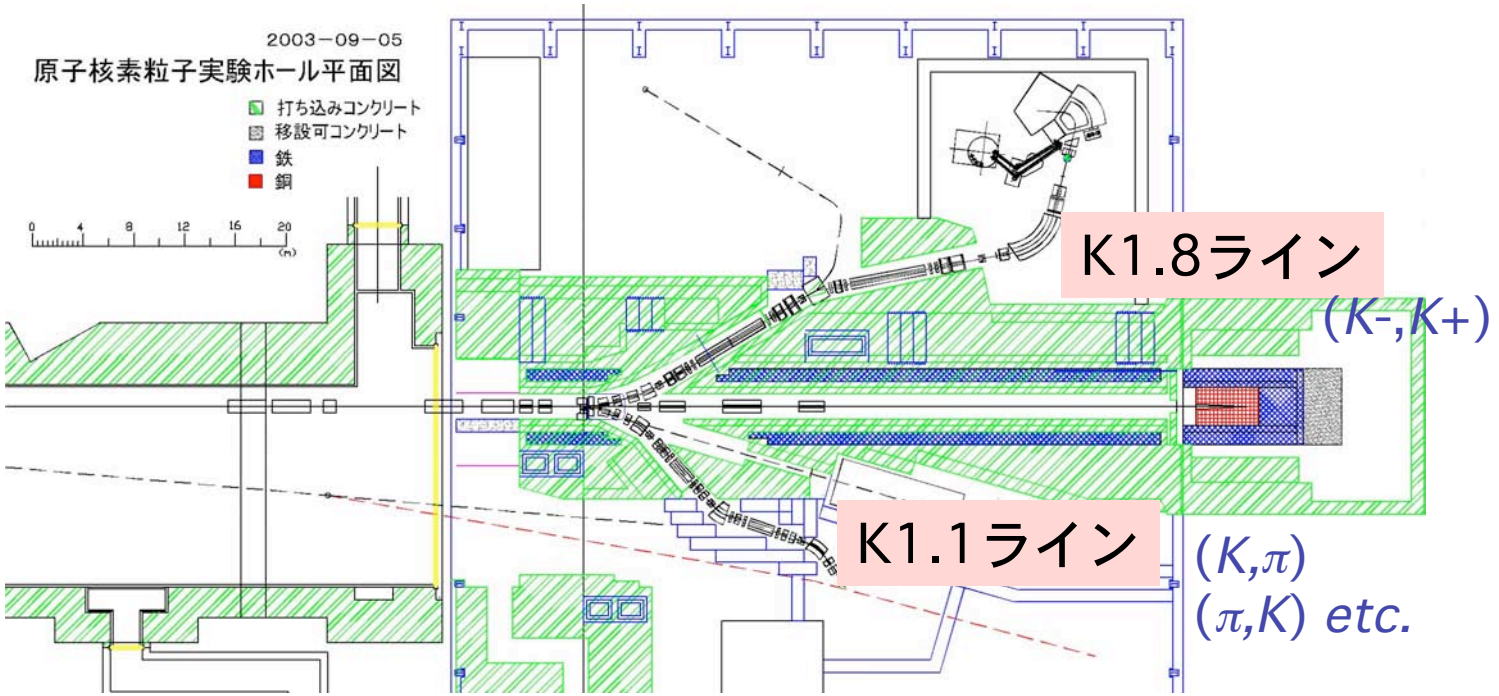
- Call for full proposals:
  sometime this year
- Formation of PAC:
  sometime next year ?

Possible secondary lines in Phase 1



- Plan made by the beamline working group
- Presented to 3rd NPFC in Feb.2004

Strangeness nuclear physics

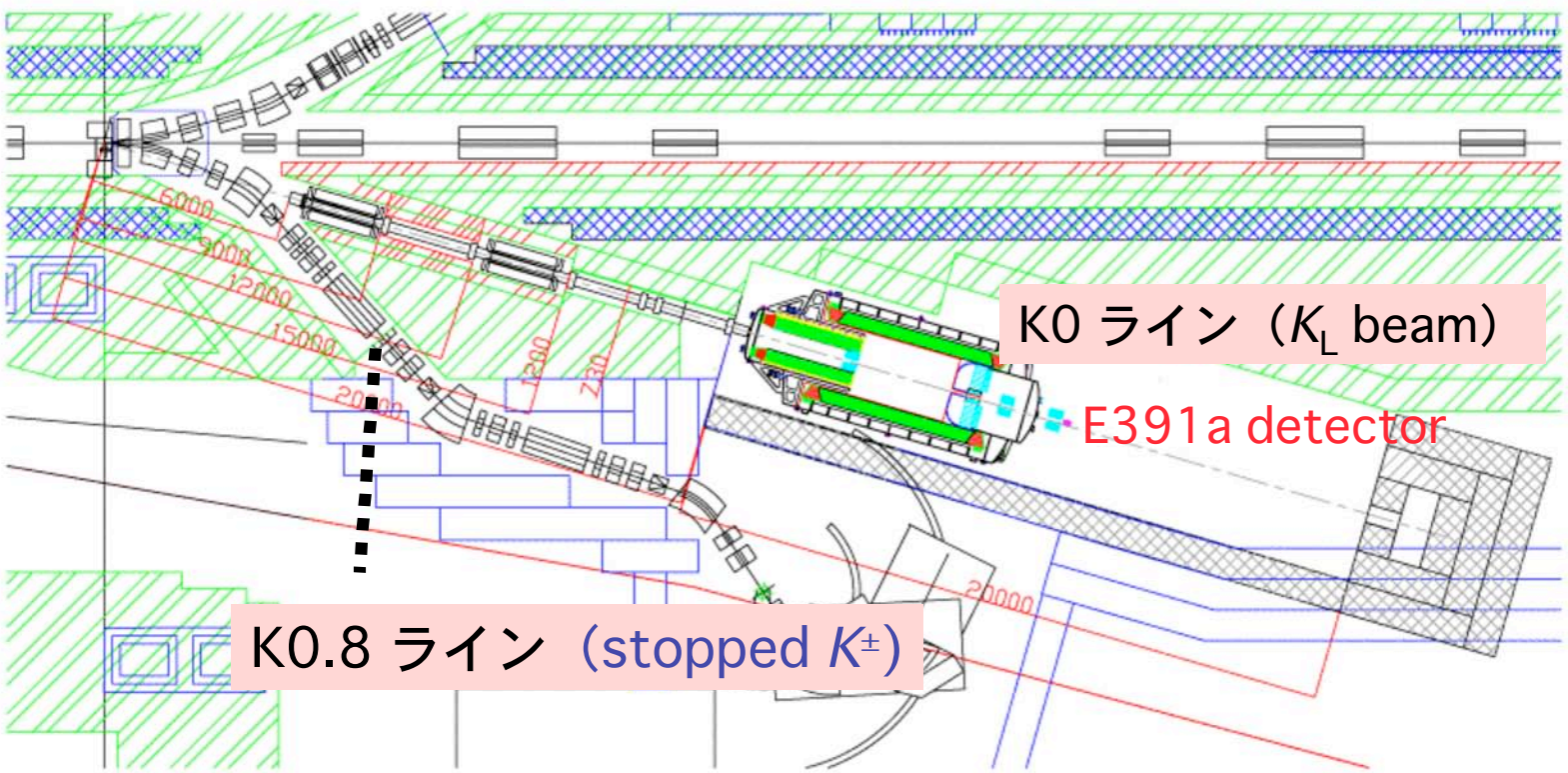


L06: New Generation Spectroscopy of Hadron Many-Body Systems with Strageness S=-2 and -1
L07: Hyperon-Proton Scattering Experiments at the 50-GeV PS
L08: High-Resolution Reaction Spectroscopy of S=-1 Hypernuclei
L09: Neutron-rich Λ hypernuclei by the double-charge exchange reaction
L10: Study of Dense K Nuclear Systems K Nuclear Systems
L21: Precise Measurement of the Nonmesonic Weak Decay of A =4, 5 Λ Hypernuclei

K1.8 and K1.1 lines

	K1.8	K1.1
Length	45.7 m	25.8 m
Maximum momentum	2.0 GeV/c	1.1 GeV/c
Acceptance	2.9 msr %	4.4 msr %
	@MS1=±2mm,	@MS1= ±1mm,
	MS2=±2mm	MS2= ±1mm
K^- Intensity		
50GeV, 15μAp	13 $\times 10^6$ /spill @ 1.8 GeV/c,	12 $\times 10^6$ /spill @ 1.1 GeV/c,
30GeV, 9μAp	3.1$\times 10^6$ /spill @ 1.8 GeV/c,	2.9 $\times 10^6$ /spill @ 1.1 GeV/c,
Separation	double stage	double stage
K^-/π^-	>> 1	1.7
Momentum resolution	0.03% in σ	
Request	10^6 - 10^7 /sec K^- (LoI-10)	10^6 - 10^7 /sec K^- (LoI-06,10)

Kaon decay physics

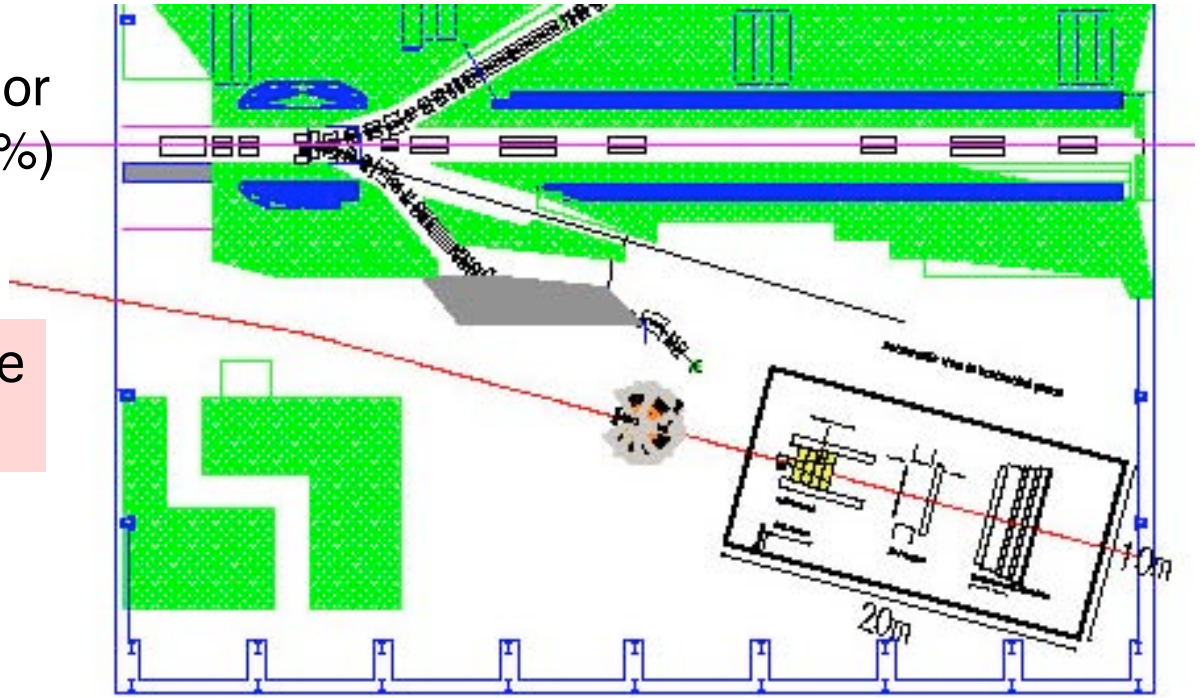


LoI-04 Study of the Rare Decay $K^+ \to \pi^+ \nu\nu$ with Stopped Kaon Beam at J-PARC
LoI-05 Measurement of the $K^0_L \to \pi^0 \nu\nu$ Branching Ratio
LoI-16 Study the Kaon Decay physics at JHF
LoI-19 Search for Tviolation in K^+ decays
LoI-20 Precise Measurement of the $K^+ \to \pi^0 e^+ \nu$ (K_{e3}) Branching Ratio

High momentum beam physics

- Beam stealer or
- Thin target (2%) at SM1

Primary C-line
High-*p* beam



LoI-01: Measurements of the spin rotation parameters *A* and *R* in the resonance region of πN elastic scattering
LoI-11: Electron pair spectrometer at the JHF 50 GeV PS to explore the chiral symmetry in QCD
LoI-13: Hadron Spectroscopy at J-PARC
LoI-15: Physics of High Mass Dimuon Production at the 50GeV Proton Synchrotron
LoI-18: Energy Dependence of Intermediate Mass Fragment Angular Distribution
LoI-23: Lefetime Measurement of $\pi^+\pi^-$and $\pi^{\pm}K^{\pm}$ atoms to test low energy QCD

Transferred spectrometers

Spectrometer	Experiments	Proposal (LoI)
SKS*	hyper-nuclear spectroscopy	L06, L09, L10, L21
Toroidal	kaon decay with stoppoed K	L16, (L19), L20
E391a	$K_L \rightarrow \pi^0\nu\nu$ rare decay	L05
SPES-II	hyper-nuclear spectroscopy *etc.*	
KURAMA	hyperon scattering	L07

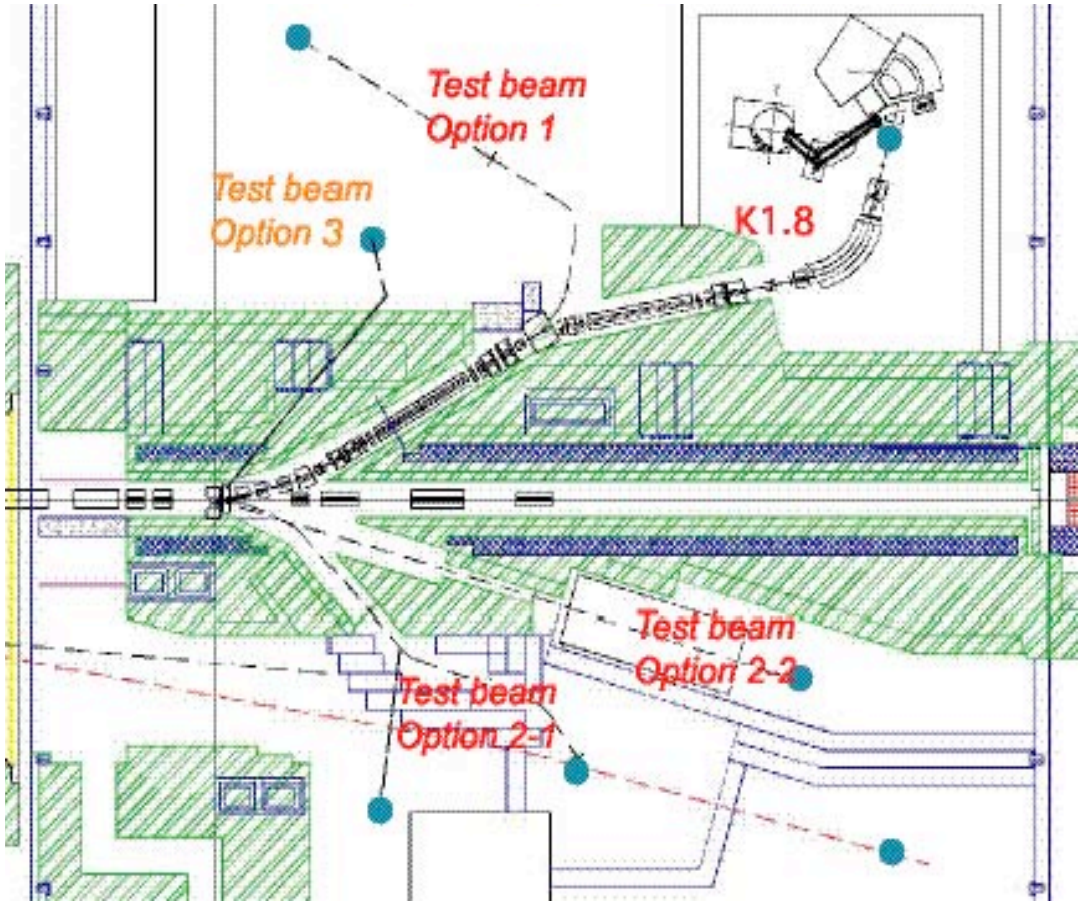
* SKS spectrometer is for Day-1 experiments.

Test beam request

LoI-02: Test beam facilities at J-PARC;
Request by High Energy Physics Committee

	Must/ Indispensable	Should/ required	desired	Preferred/ optional
momentum	0.5~2GeV/c easy tunable	Up to 10GeV/c		
mom. bite	Less than 1%		Analyzing magnet	
Intensity [/sec]	Electrons: 1~10 Inclusive: 1~100 Easily tunable		Up to ~100 Up to ~1000	
Particle species	Unseparated e, mu, pi, K, p, p-bar		DC separator	e-enriched tertiary
Time structure	Flat-top			Chopper

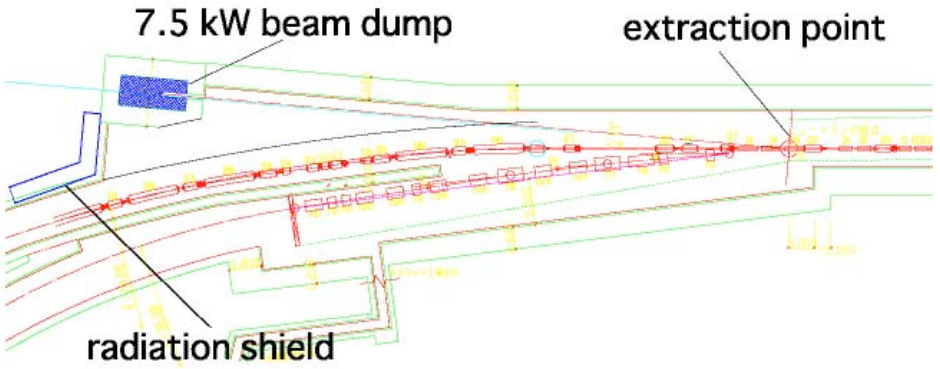
Test beam options



- Option-3 : 230 π^-/s of 2 GeV/*c* through a 3cmϕ hole at 30 GeV x 9μA
- Realistic proposal will be made by fall this year
- No budgetary measures at the moment

Preparation for future extension

Phase 1
Extension port with concrete shielding to avoid soil activation



Future plan
- Muon source (PRISM)
- Anti-proton facility

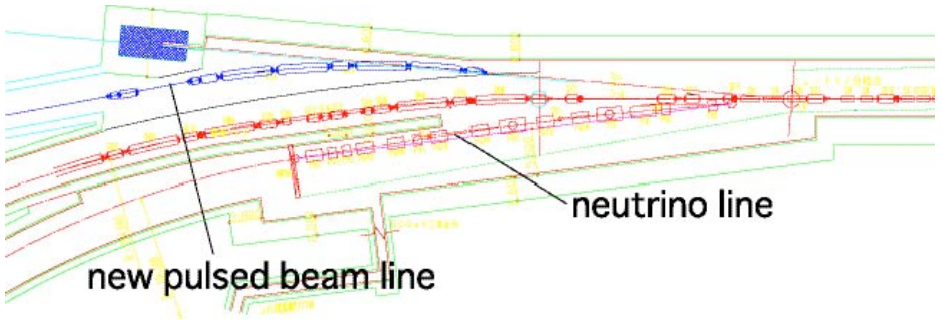


Table 20 High-brightness muon beam facility (PRISM)

Proton beam	100-1000 Hz extraction from 90 bunch operation
Muon monochromatization	phase rotation by FFAG synchrotron
Muon beam intensity	10^{11}-10^{12} /s for 10^{14} protons /s
Beam energy	20 MeV (68 MeV/c)
Energy spread	+/- (0.5 ~ 1.0) MeV

Summary remarks

- The construction of J-PARC 50-GeV experimental facilities is going on aiming for the completion in 2007 and 2008 for the hadron hall and neutrino facility, respectively.

- We would like that the activity of the hadron beam science shifts from the 12-GeV PS to J-PARC as soon as possible in view of its two-orders of magnitude higher potentiality.

- We are going to move nearly all valuable resources at the 12-GeV PS such as beamline magnets and radiation shielding. Therefore, the schedule coordination between the 12-GeV operation and the 50-GeV facility construction is extremely important.

- To start the experimental program at J-PARC, an operation scheme including experiment funding has to be settled as soon as possible. Also, the transfer of the 12-GeV PS equipment has to be funded by some means.