from  to 

Future Kaon Program at KEK/J-PARC

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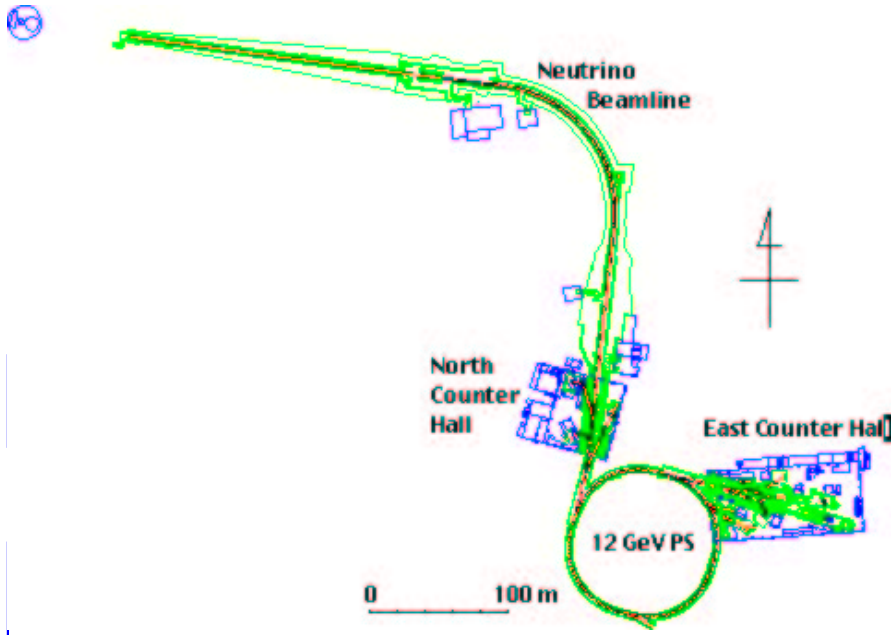
9 June 2004 DAΦNE2004: Physics at Meson Factories

Outline [in the next 17 slides, 12 minutes]

- current program at KEK-PS (by 2005 ?)
  - E246: T-violating in $K_{\mu 3}$
    [by C. Rangacharyulu, June 7]
  - E470: Measurement of Direct Photon Emission in $K_{\pi 2\gamma}$
    [by S. Shimizu, June 8]
  - E391a: CP-violating decay $\mathrm{K}_L^0 \longrightarrow \pi^0 \nu\bar{\nu}$
- future program at J-PARC new 50GeV-PS (from 2009 ?)
  - Accelerators
  - Letters of Intent for J-PARC kaon experiments
  - Beamline Layout plan

12GeV KEK-PS in the New Millennium

- Experiments started in 1977.

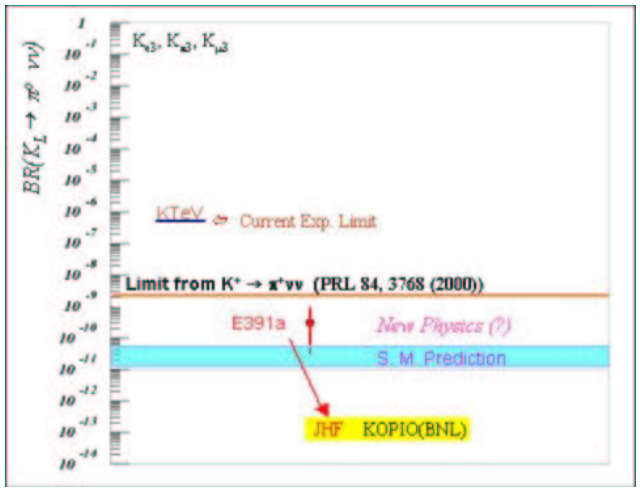


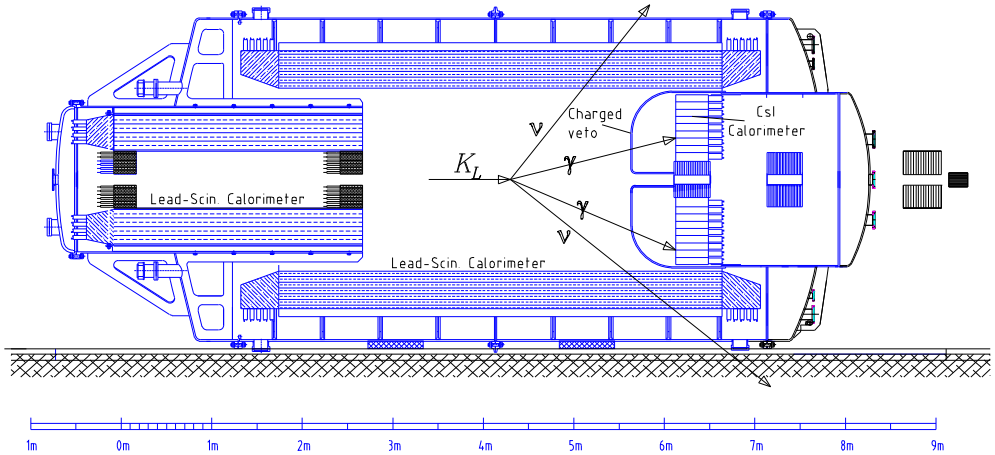
	Fast Ext to ν Beamline	Slow Ext to East Hall / North Hall	
protons per pulse	6.5	2.5	$\times 10^{12}$
beam spill	1.1 micro	2.0	sec
cycle	every 2.2	every 4.0	sec
operation in a year	6	2∼4	months

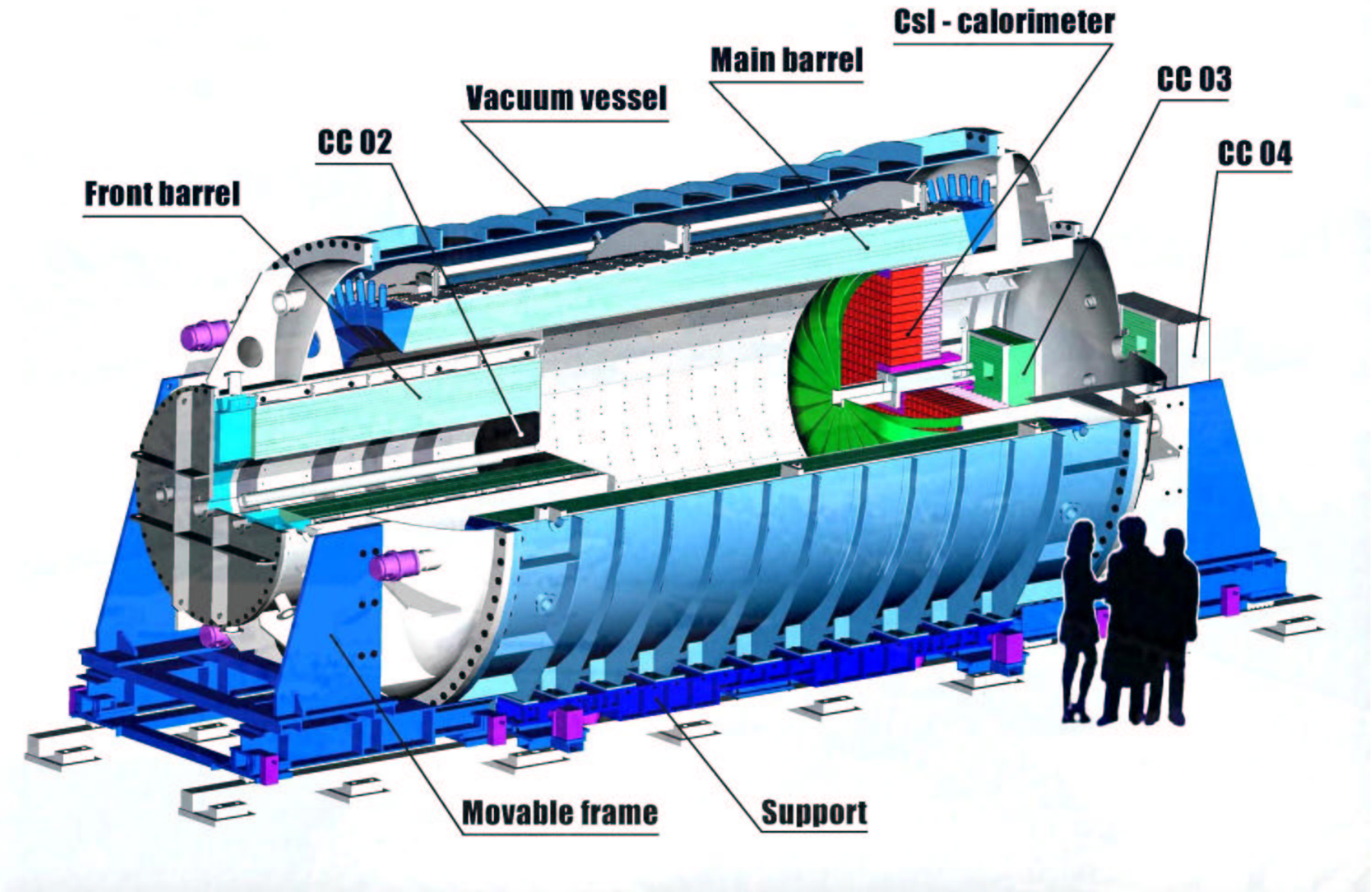
E391a http://www-ps.kek.jp/e391/ at E-Hall

the first experiment dedicated to $\mathbf{K_L^0 \to \pi^0 \nu \bar{\nu}}$

- Japan: KEK, Saga, Yamagata, RCNP, Osaka, NDA, Kyoto
- Russia: JINR
- USA: Chicago
- Taiwan: TNU
- Korea: Pusan

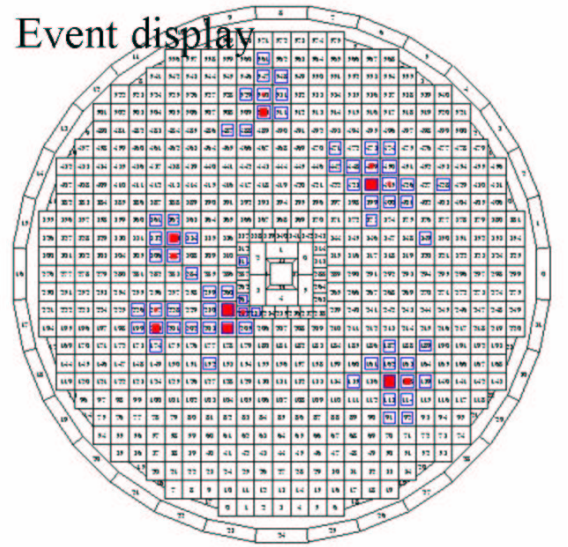


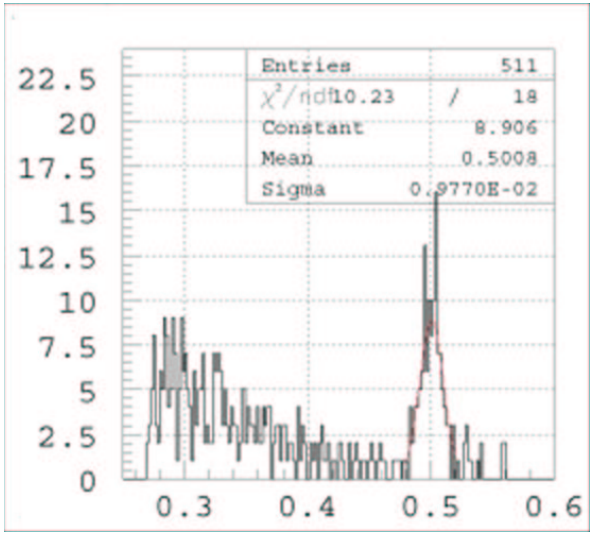



CsI - calorimeter
Main barrel
CC 03
Vacuum vessel
CC 02
CC 04
Front barrel
Movable frame
Support

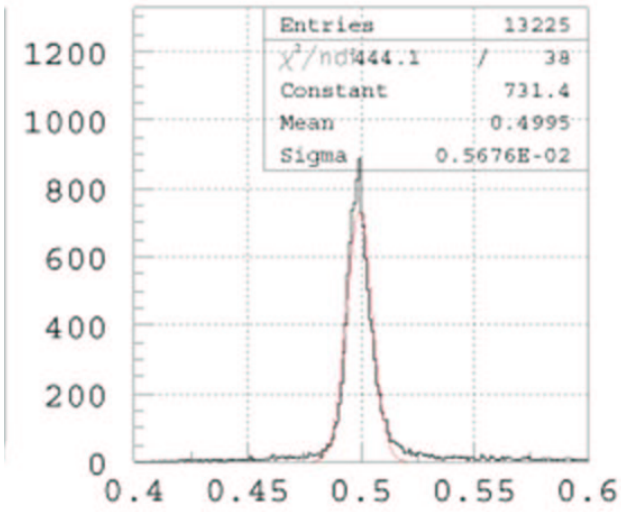
E391a Data Taking (from 18 Feb 2004)

		E391a
Ev size	Bytes	6K
		ADCs
Tr rate	Hz	500
Data flow	B/spill	6M
	B/Day	120G





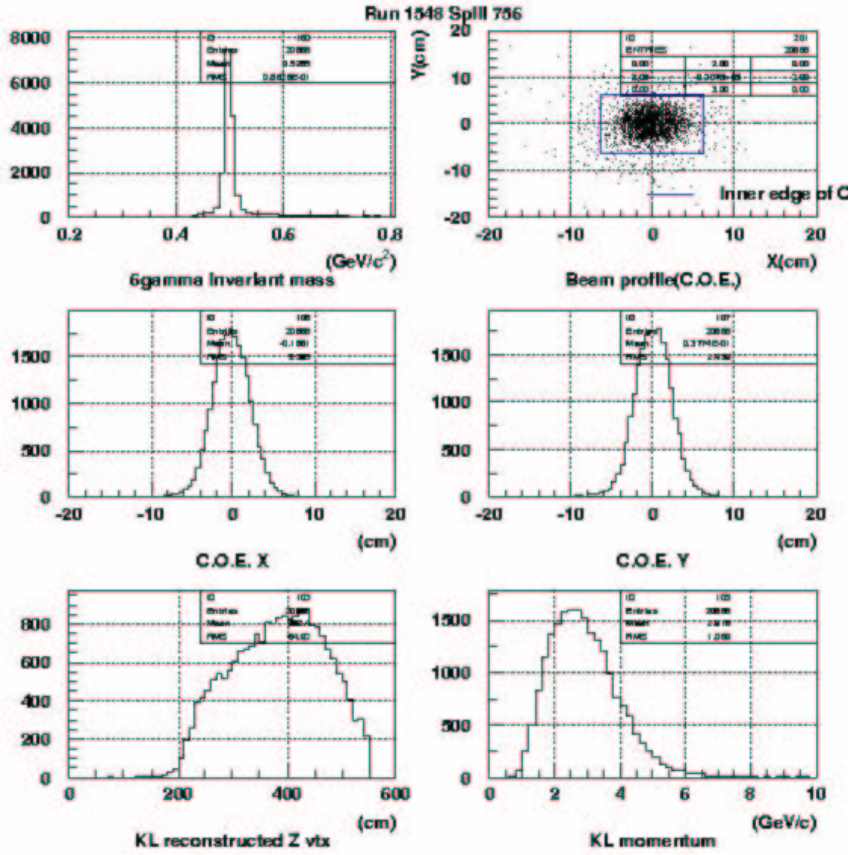
$K^0_L \to \pi^0\pi^0$



$K^0_L \to \pi^0\pi^0\pi^0$

E391a Run-1 (by the end of June 2004): status and prospects

- stable data taking
  - $N_{CLS} \geq 2$ w/vetoes : manageable Trigger rate
  - DAQ Live Time 75%
- Online accidental loss: 10%:
  - clean neutral beam
  - "pencil" concept: okay
- S.E.S (ratio to $K^0_L \to \pi^0\pi^0\pi^0$): $\sim 4 \times 10^{-10}$ w/o very tight PV
  - break the KTeV upper limit
  - below the Grossman-Nir limit 1.4×10^{-9} from $K^+ \to \pi^+\nu\bar{\nu}$
  - reachable to NewPhysics ? 3.1×10^{-10}, PRL 92(2004)101804

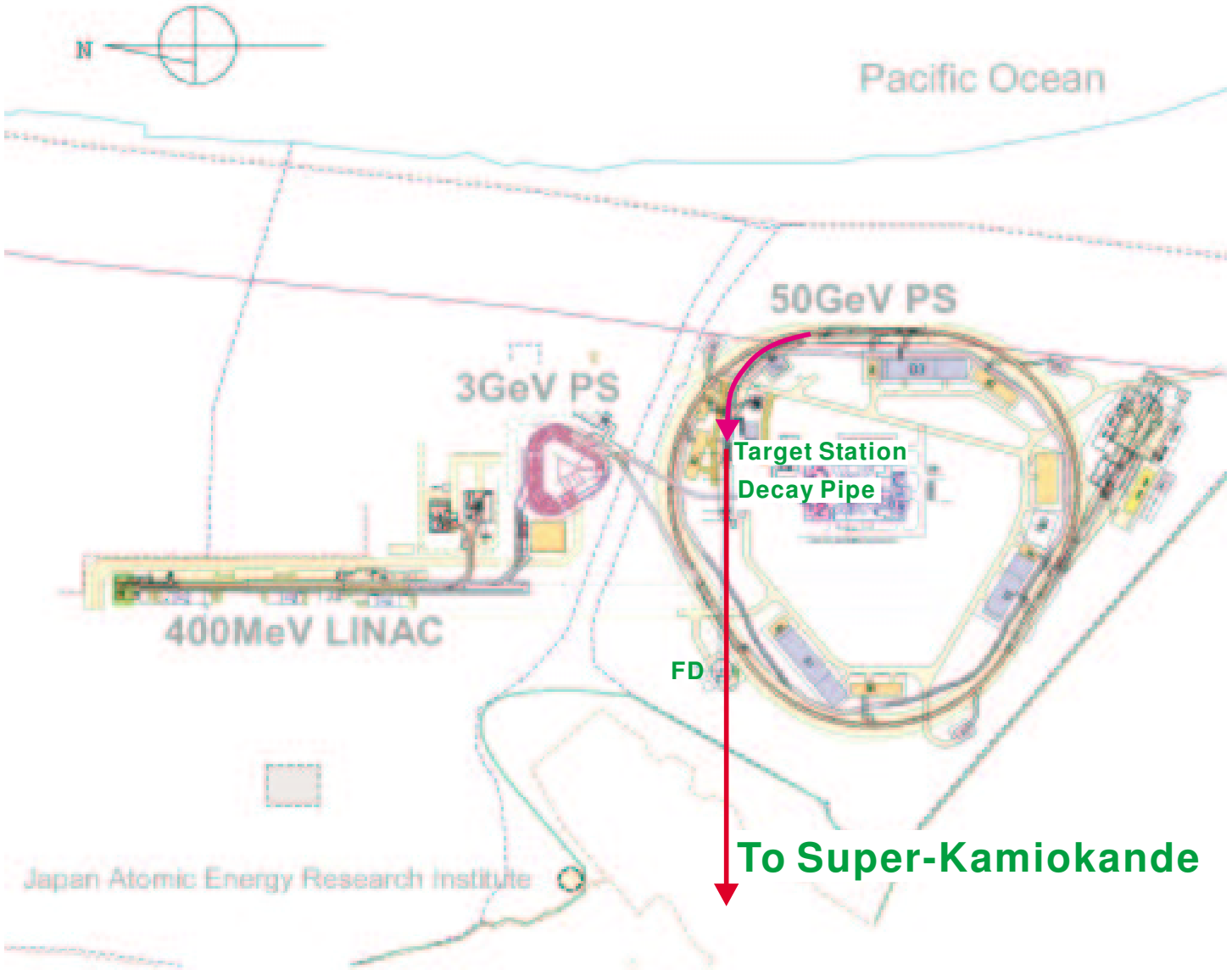


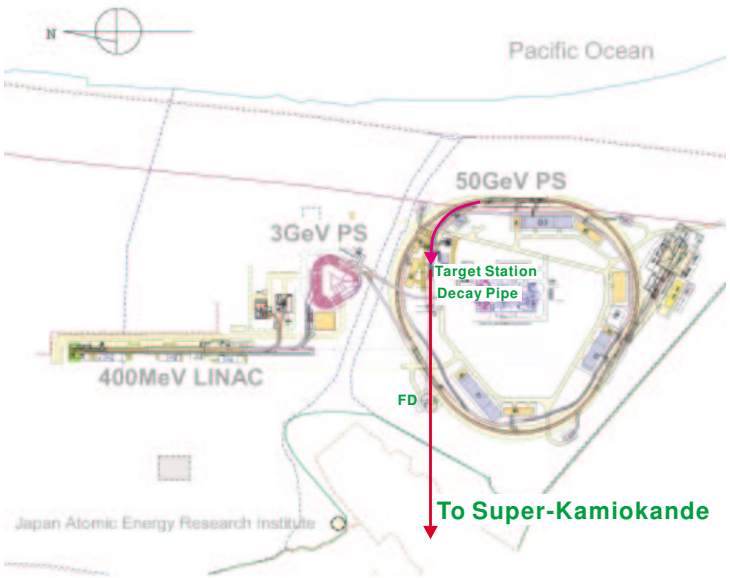
Schedule from KEK-PS to J-PARC

JFY	month	KEKPS	J-PARC
2001			construction start
2004	∼ Jun 04	Slow Ext for E391a	
	Sep 04		
	∼ Mar 05	Fast Ext for K2K	
2005	Apr 05		
	∼ Jun 05	Slow Ext ??	
2008			construction finish

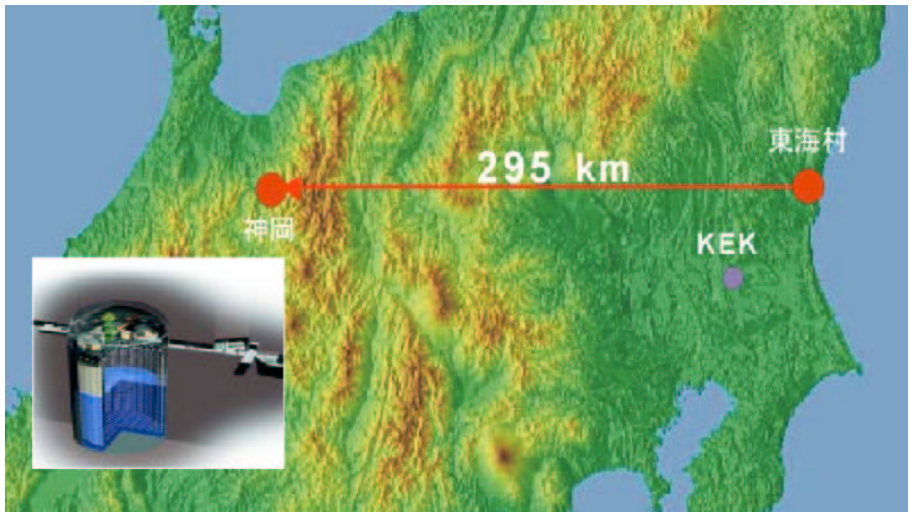
Japan Proton Accelerator Research Complex:

JAERI and KEK Joint Project

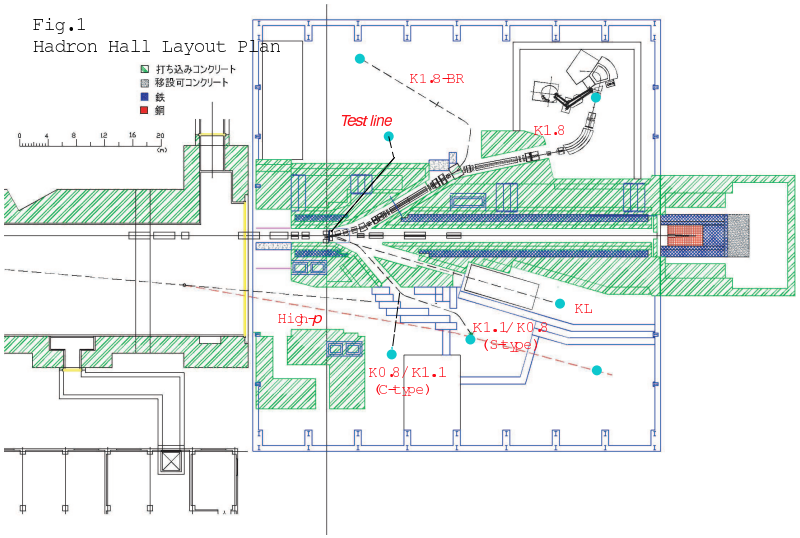




Fast Extraction

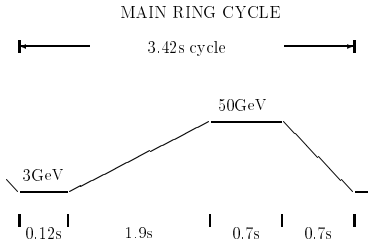


Slow Extraction



* Right photos were taken by TKK on 9 April 2004 at the J-PARC site

J-PARC 50GeV-PS operation (Slow Ext)



	KEK-PS	AGS	J-PARC Phase-1	J-PARC mod	
proton energy	12	24	30	30	GeV
protons per pulse	2.5	65	200	100	10^{12}/spill
cycle	4.0	6.4	3.42	4.42	sec
average current	0.1	1.63	9.5	3.6	μA
beam spill	2.0	4.1	0.7	1.7	sec
duty factor	0.50	0.64	0.20	0.39	
instantaneous rate	1.3	16	286	59	10^{12}/sec

Nuclear and Particle Physics Experiments at J-PARC

2002	Jul	Call for LoI's
2003	Jan	30 LoI's were submitted.
		http://www-ps.kek.jp/jhf-np/LOIlist/LOIlist.html

five LoI's for J-PARC kaon experiments

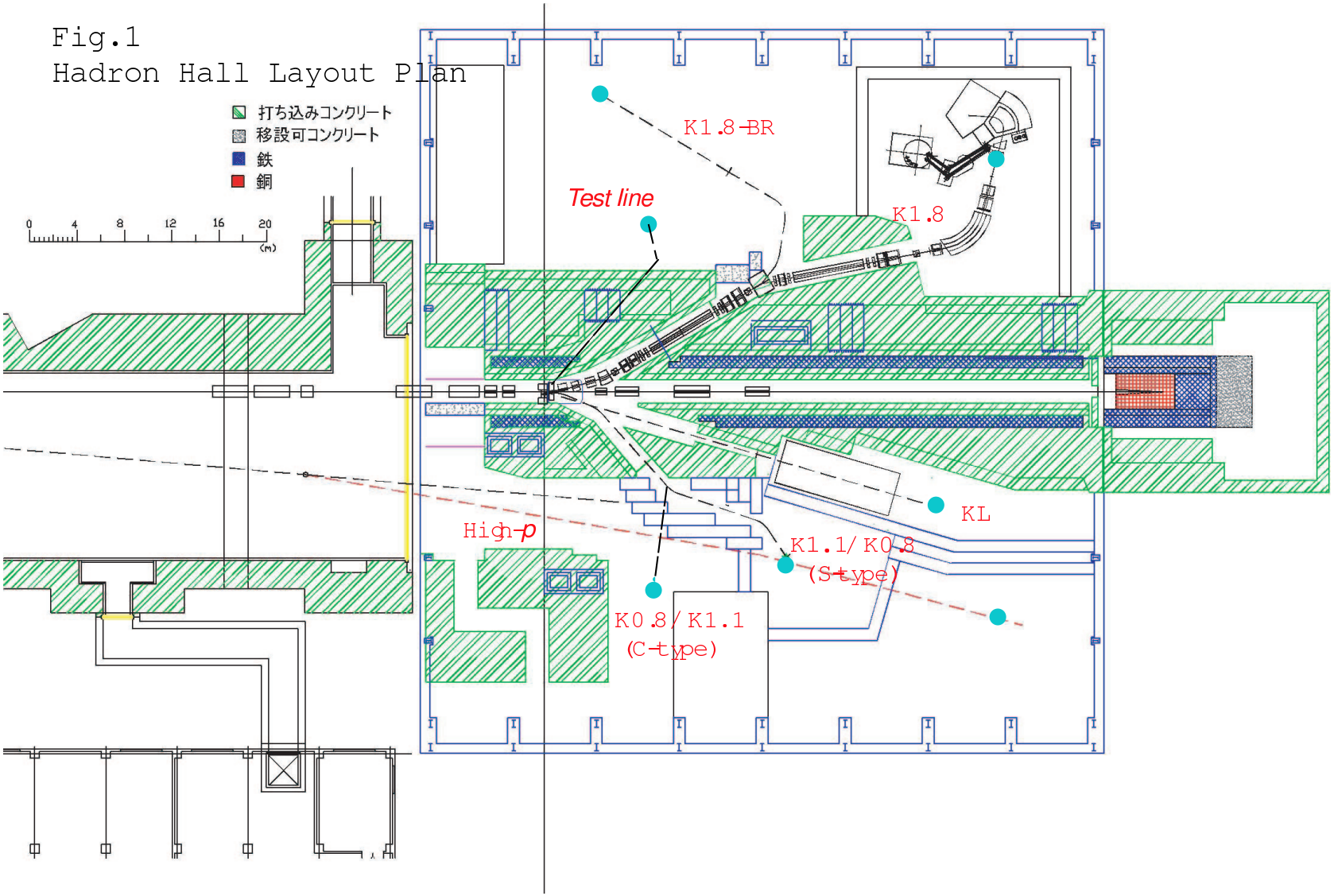
- K_L neutral beamline
  - L-05: $\mathrm{K}_L^0 \to \pi^0\nu\bar{\nu}$ [T.Inagaki(KEK)]
    $\Longleftarrow$ KEK-E391a
- K^+ beamline of low-momentum $(0.6 - 0.8\mathrm{GeV}/c)$
  - L-04: $\mathrm{K}^+ \to \pi^+\nu\bar{\nu}$ [T.Komatsubara(KEK)]
    $\Longleftarrow$ BNL-E949/E787
  - L-19: T-violation in K^+ decays [J.Imazato(KEK)/Yu.Kudenko(INR)]
    $\Longleftarrow$ KEK-E246
  - L-16: medium-rare K^+ decays [C.Rangacharyulu(Saskatchewan)]
    $\Longleftarrow$ KEK-E470
  - L-20: K_{e3} branching ratio [S.Shimizu(Osaka)]
    $\Longleftarrow$ KEK-E470/E246

Nuclear and Particle Physics Experiments at J-PARC

2002	Jul	Call for LoI's
2003	Jan	30 LoI's were submitted.
		http://www-ps.kek.jp/jhf-np/LOIlist/LOIlist.html
	Mar	Facility Committee (NPFC) was organized as a "pre-PAC".
		assessment:
		- Day-1 experiments
		- Phase-1 experiments (including kaon experiments)
2004	Feb	Report on the Beamline Layout plan of the Hadron Exp Hall
		http://www-ps.kek.jp/jhf-np/Layout/Layout.html

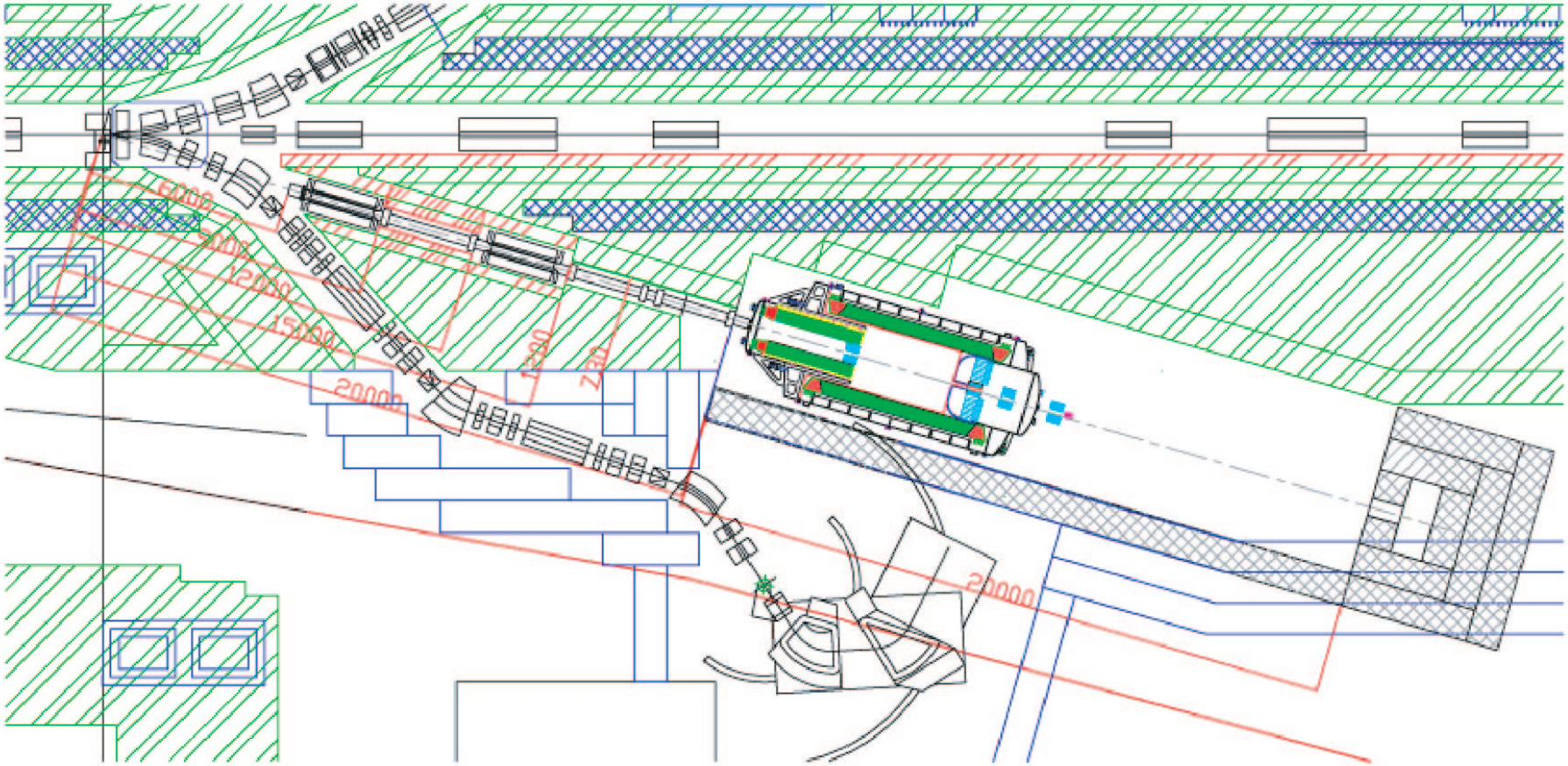
Hadron Hall Layout Plan

Fig.1
Hadron Hall Layout Plan



KL line at 16deg and K1.1 line(S-type)

Fig.2 Layout of K1.1 (S-type) and KL lines



NP Experiments at J-PARC: near-term schedule

2004	Aug	NP04 International Workshop @Tokai
	autumn ??	Call for full-Proposals
2005	summer ??	deadline of the Day-1 Proposals
2008		J-PARC first beam ??
2009		Day-1 experiments start ??

Summary : from  to 

- current program at KEK-PS
  - E246/E470
  - E391a $\mathbf{K_L^0 \to \pi^0 \nu \bar{\nu}}$:
    amazing start-up; would reach $\boldsymbol{O(10^{-10})}$
    The concept of "pencil" beamline worked,
    and is promising in the future.
- future strong program at J-PARC new 50GeV-PS
  - Beamline Layout plan has been prepared,
  - We proceed to prepare a full-Proposal of
    "Kaon Physics at J-PARC"


NP04
The 3rd International Workshop on Nuclear and Particle Physics at J-PARC
Organizing Institutes: High Energy Accelerator Research Organization (KEK)
Japan Atomic Energy Research Institute (JAERI)
Strangeness Nuclear Physics Experiments
Nuclear/ Hadron Physics Experiments
Neutrino Experiments
Kaon Rare Decay Experiments
Muon Rare Decay Experiments
Physics with Low-Energy Anti-Protons
Aug. 2-4, 2004 at Tokai, Ibaraki, Japan
Aug. 24-26, 2004 at KEK (Neutrino session)
http://j-parc.jp/NP04
Photo: J-PARC site taken in Feb. 2004
Contact:
toshiyuki.takahashi@kek.jp
takashi.kobayashi@kek.jp (Neutrino)
Local organizing committee
S.Nagamiya (KEK/JAERI; Chairperson)
K.Imai (Kyoto)
J.Imazato (KEK)
T.Kobayashi (KEK)
T.Komatsubara (KEK)
T.Nagae (KEK)
K.Nishikawa (Kyoto)
S.Sawada (KEK)
T.Takahashi (KEK; Scientific secretary)
M.Takasaki (KEK)
T.Yamanaka (Osaka)

Backup Slides

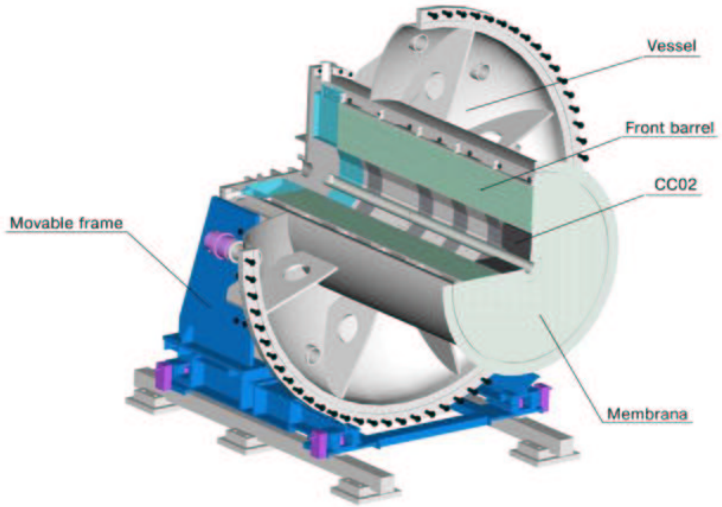


Fig.2

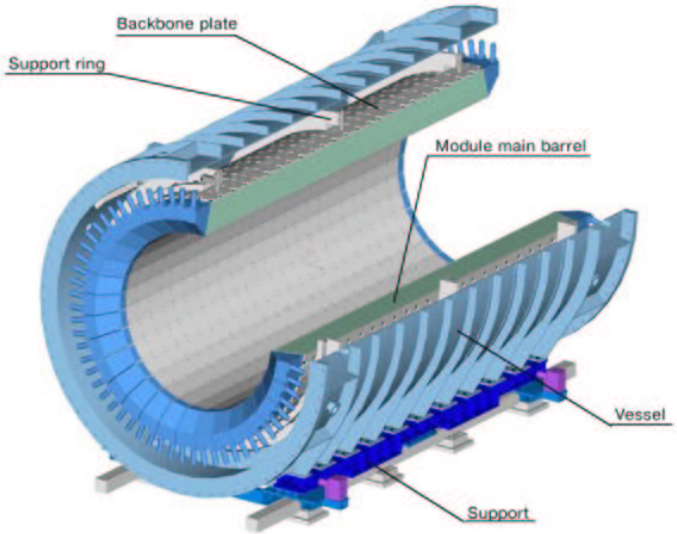


Fig.3

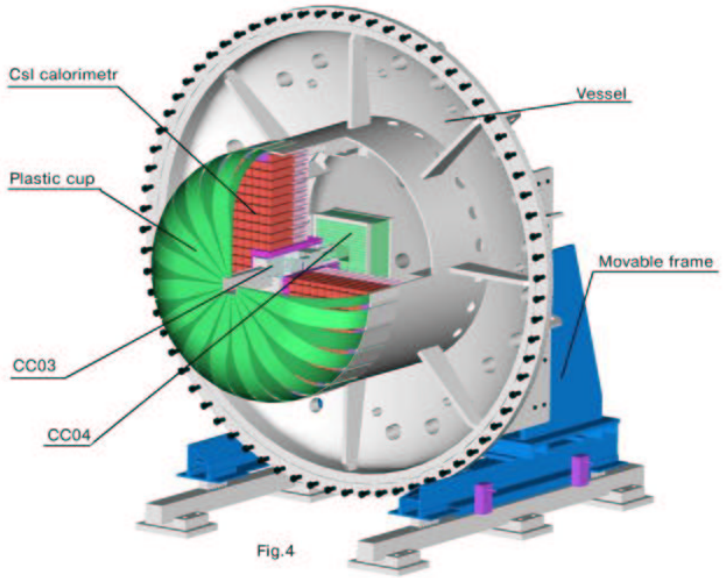
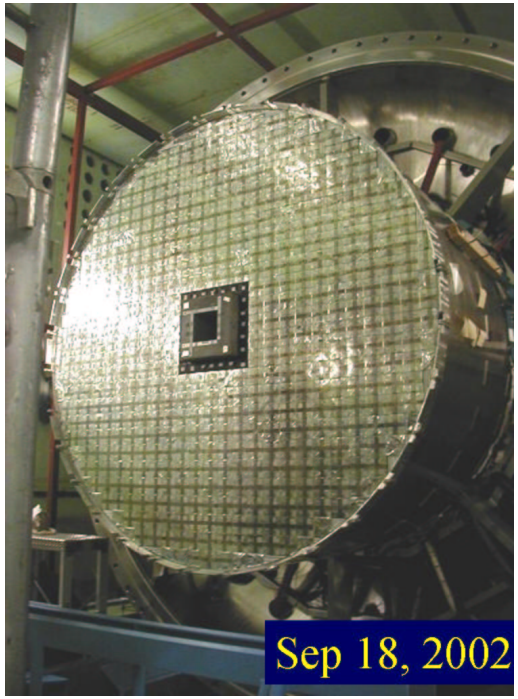
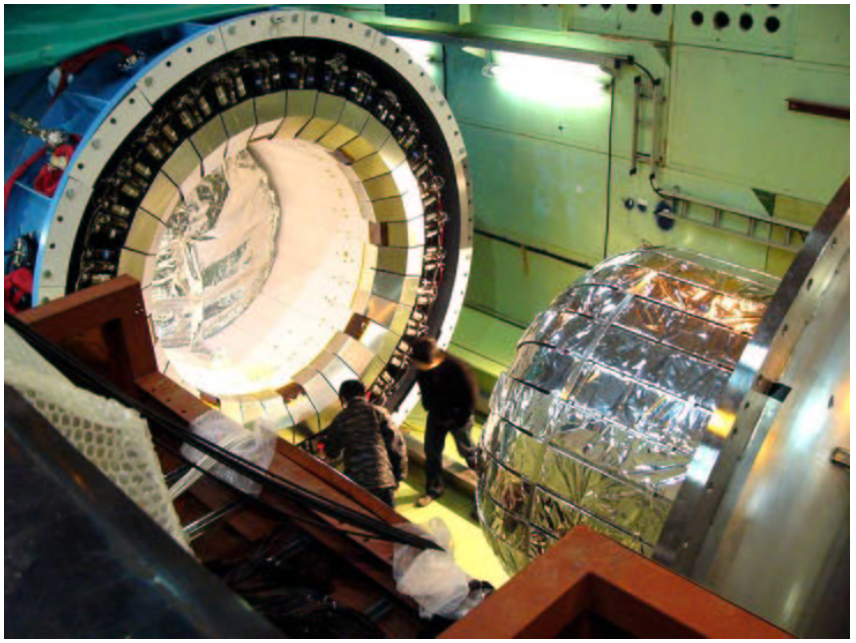
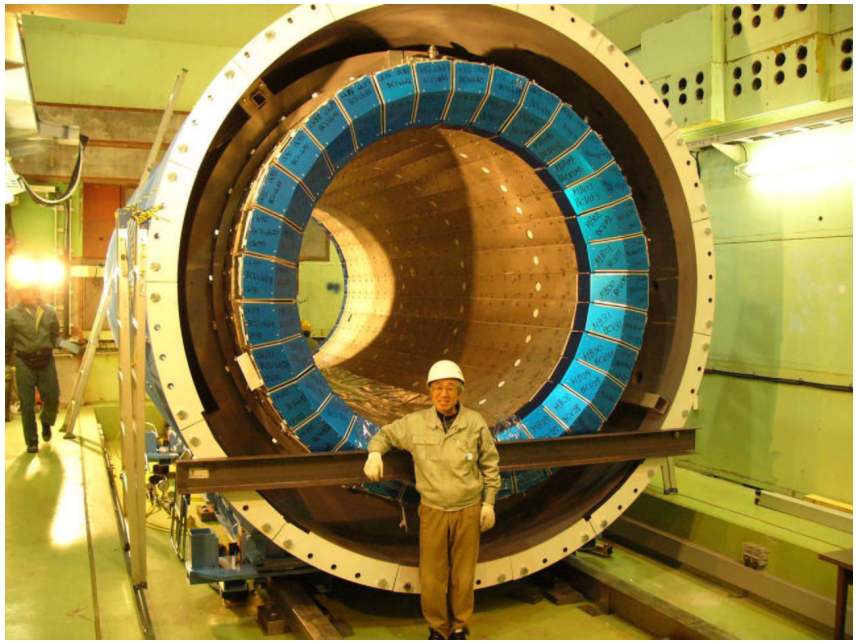


Fig.4


Sep 18, 2002

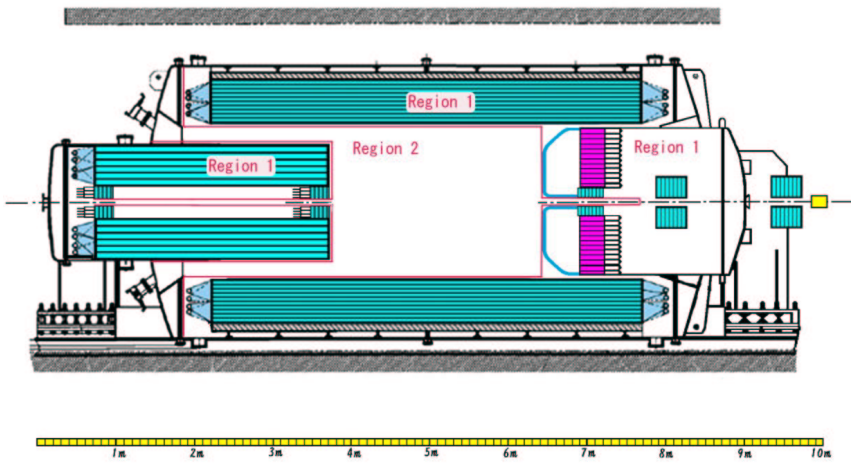


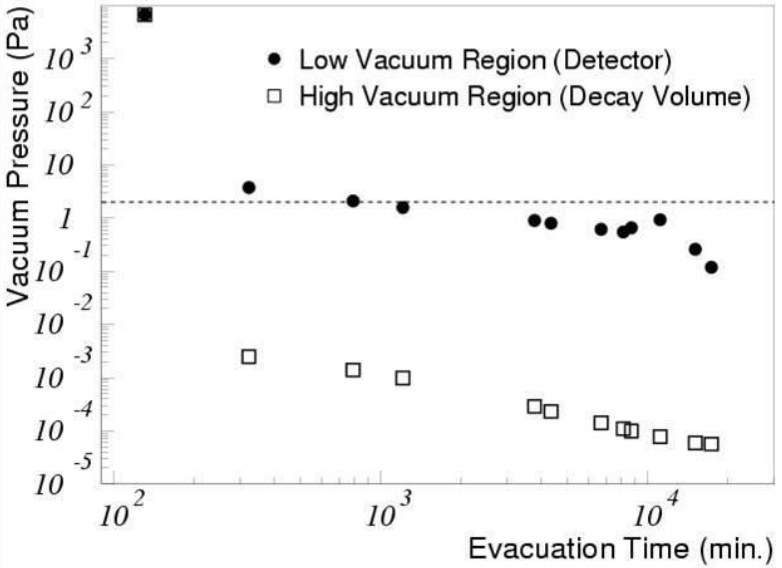



Jan/21/2004

"Differential pumping" for high vacuum (π^0 by neutrons)

- backgound <0.1
- Goal: 10^{-5} Pa
  (10^{-4} Pa for E391a)
- thin "membrane"
  to separate into
  1. low vacuum: < 0.1 Pa
  2. high vacuum:
     1.21×10^{-5} Pa achieved





K0.8/K1.1 line(C-type) and high-memontum line

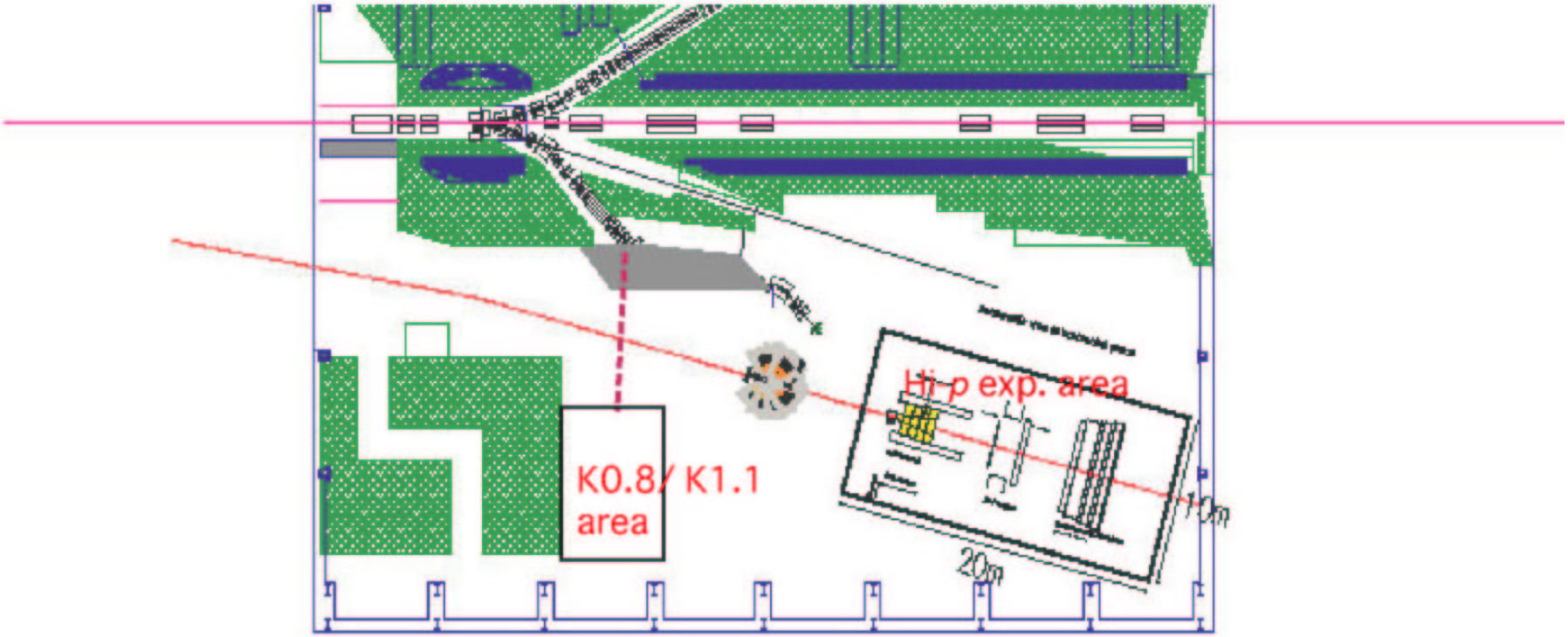


Fig.3 High momentum line and beam crossing scheme