Status of Asian test beam facilities

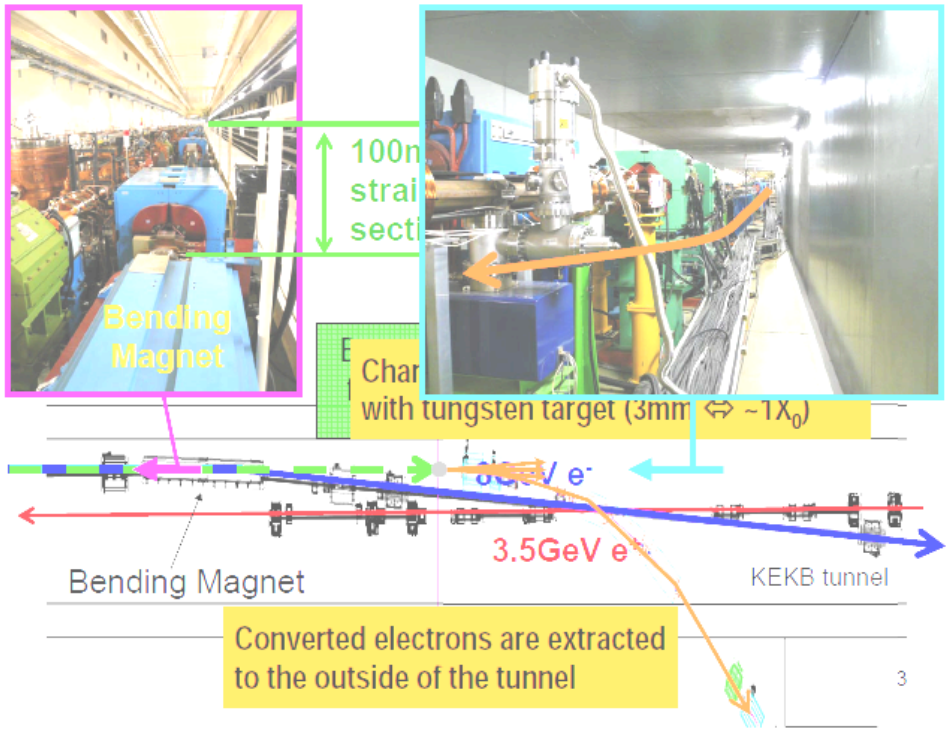
ALCPG Workshop

30 September 2009

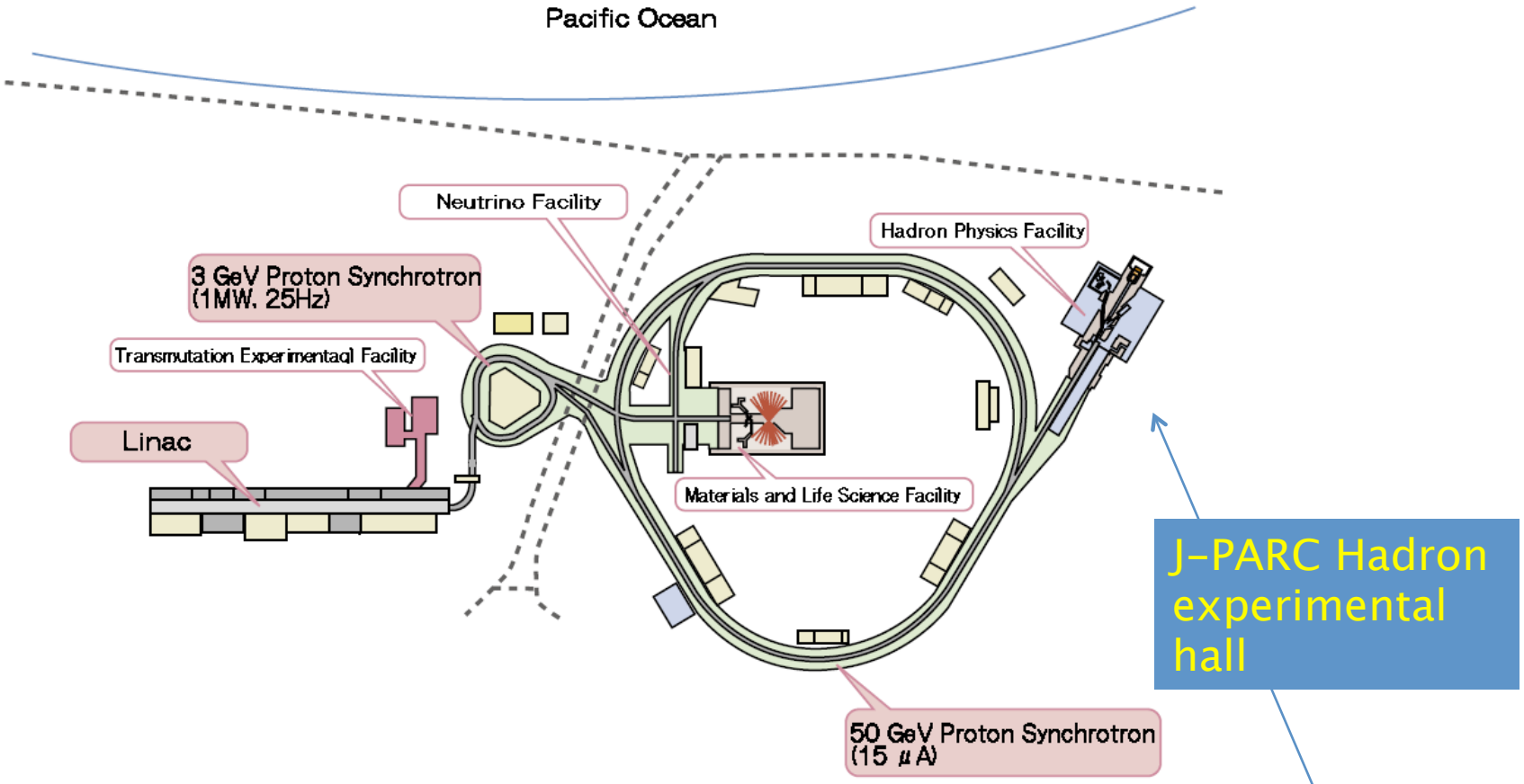
K. Kotera (Shinshu-U)

KEK FTBL

- Operation started in September 2007.
  - Electron with momentum 0.4~3.4 GeV/c
  - Rate ~20Hz
- Many test beam experiments have been performed:
  - ILC: Scintillator study for ScECAL
  - Belle: SVD, RICH, TOP detectors
  - T2K , KASKA, ATLAS, Phenix, and so on
- Shutdown at the end of 2009 for the KEKB upgrade , at least 3 years.
- Future re-operation yet to be decided.

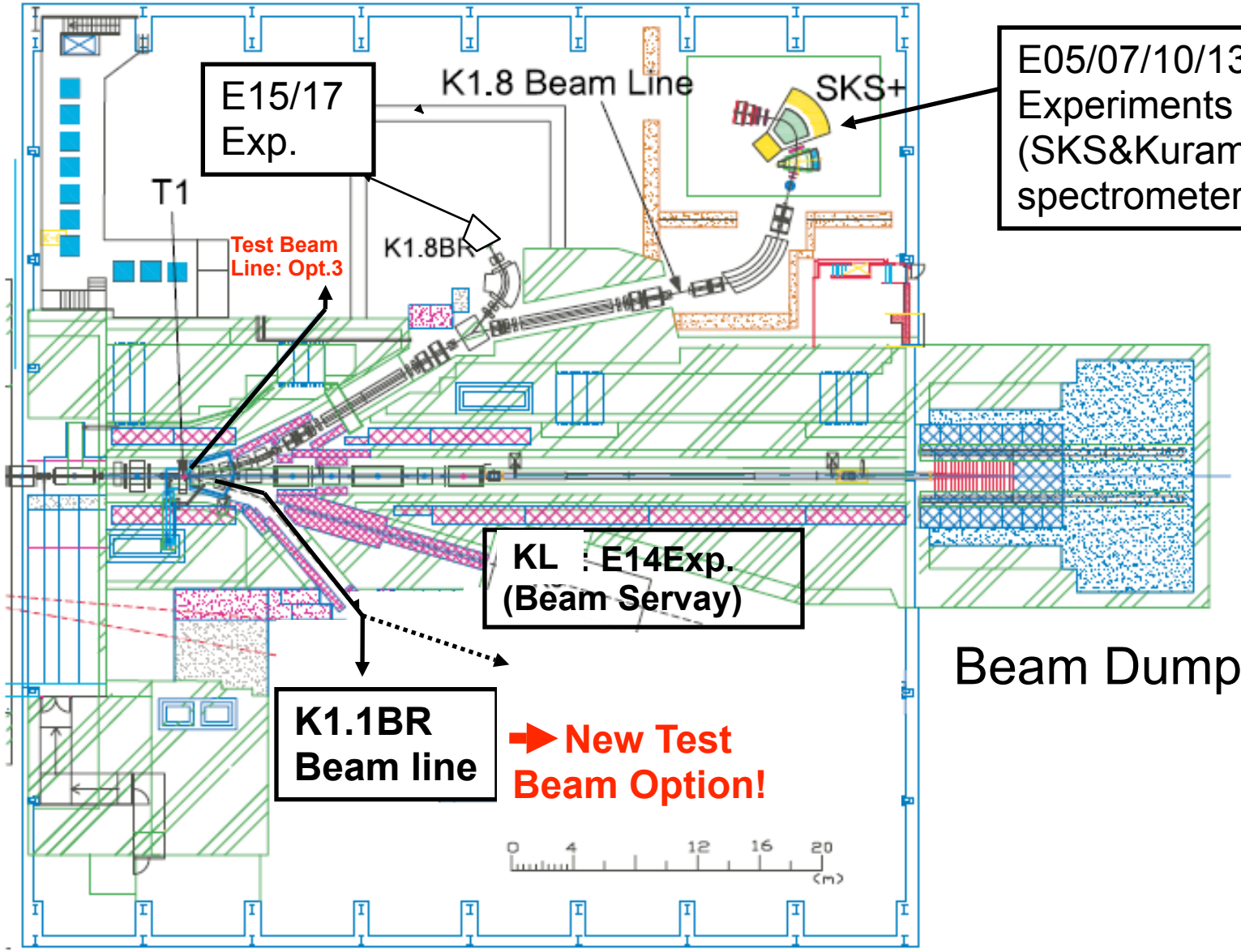


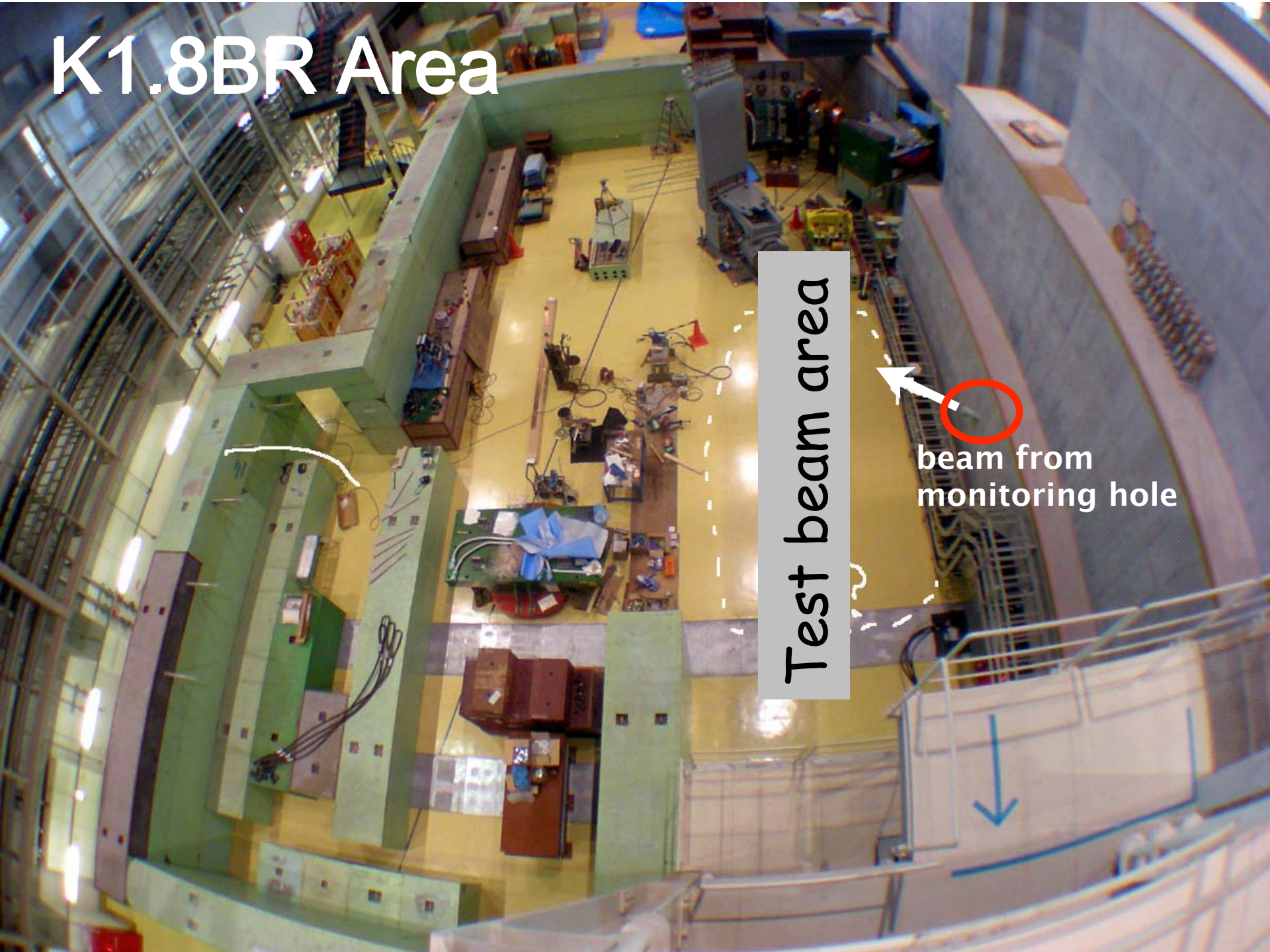
Test Beam at J-PARC



- There are two plans of test beam lines in Hadron experimental hall.
  1. **Using target monitor hole of K1.8 beam**
  2. **K1.1BR line until main experiment will begin**

Hadron Experimental Hall in mid 2010

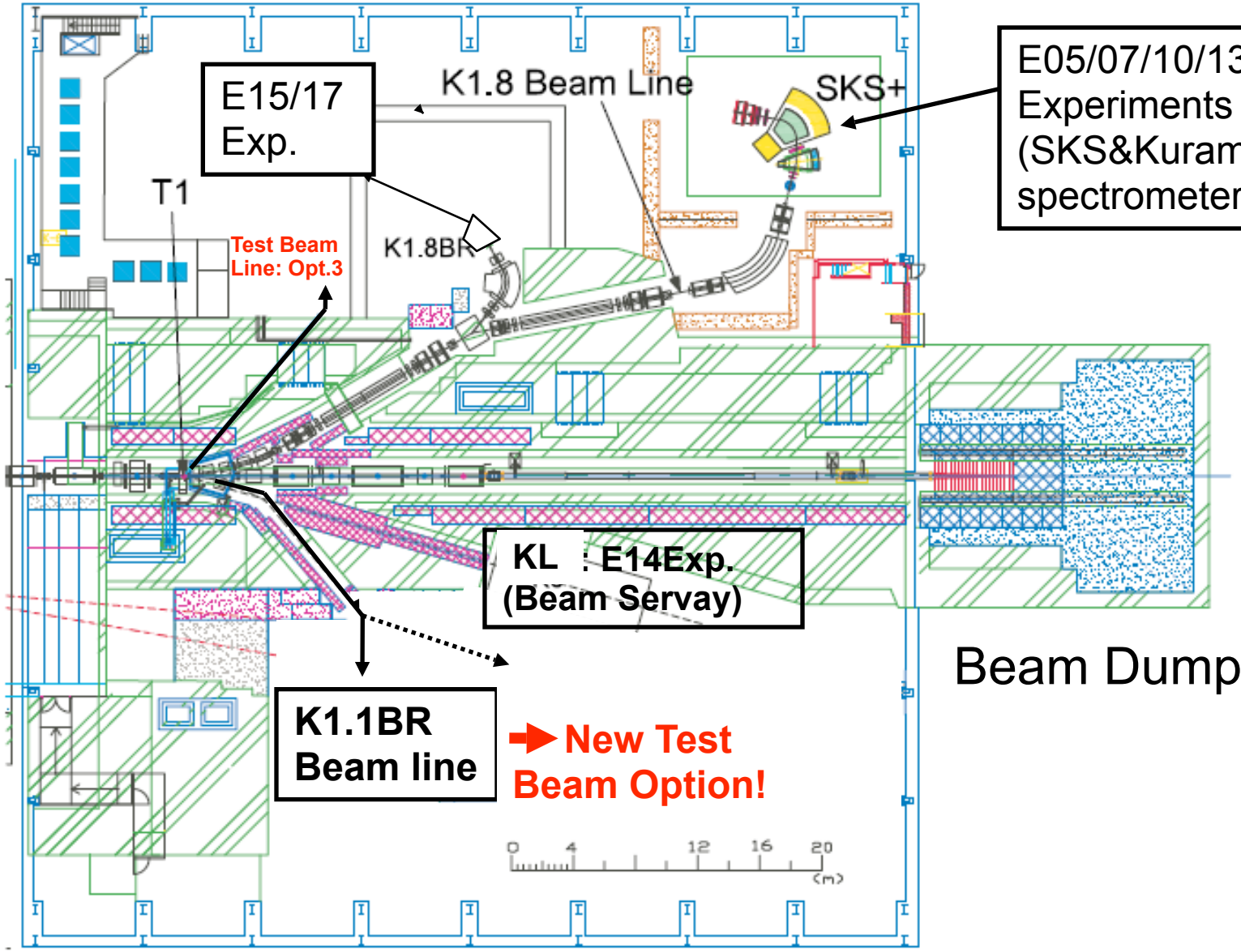



K1.8BR Area
Test beam area
beam from
monitoring hole

Test Beam using the Monitor Hole Possible Problems

- 0.5~1.5 GeV/c beam will be available.
- Beam Line (Hole) will be ready in the mid Japan Fiscal Y 2010.
- Yield will be reasonable at ~100kW (goal).
  but it has not been achieved yet(~5kW)
  → 2nd plan (K1.1BR)

Hadron Experimental Hall in mid 2010



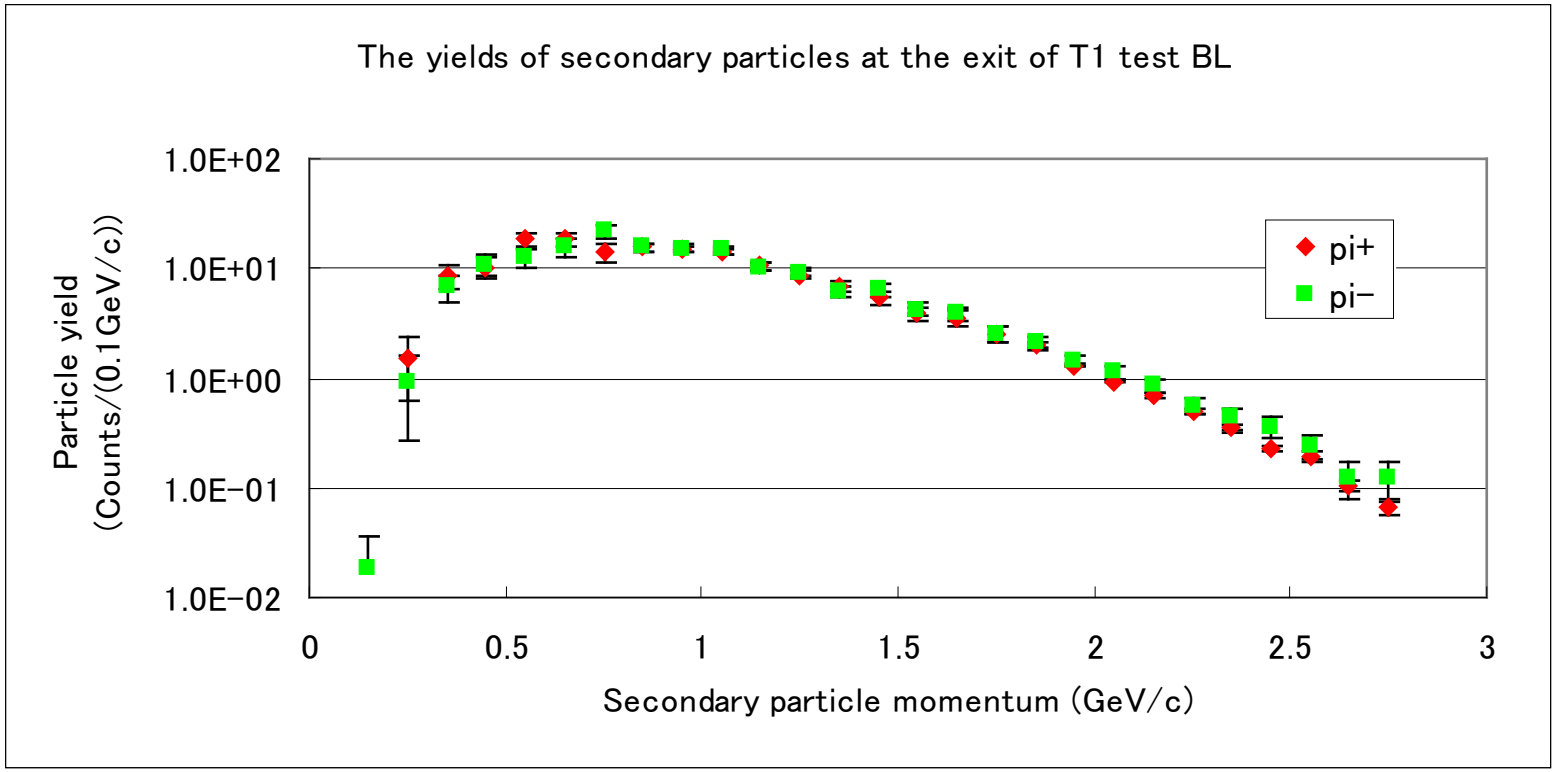
Test Beam using K1.1BR New Option

- 0.5~1.1 GeV/c beam will be available.
- Yield will be more than enough even at ~1kW beam.
- Beam Line will be ready in the mid JFY2010.
- Beam Line construction Budget has already been approved by the Government.
- Operation as a Teat Beam will be terminated if the main Experiment beam is ready at K1.1BR.

→ Possible Problem! However the main experiment requires ~100kW beam. Then the test beam line using the target monitor hole will be able to provide sufficient intensity!

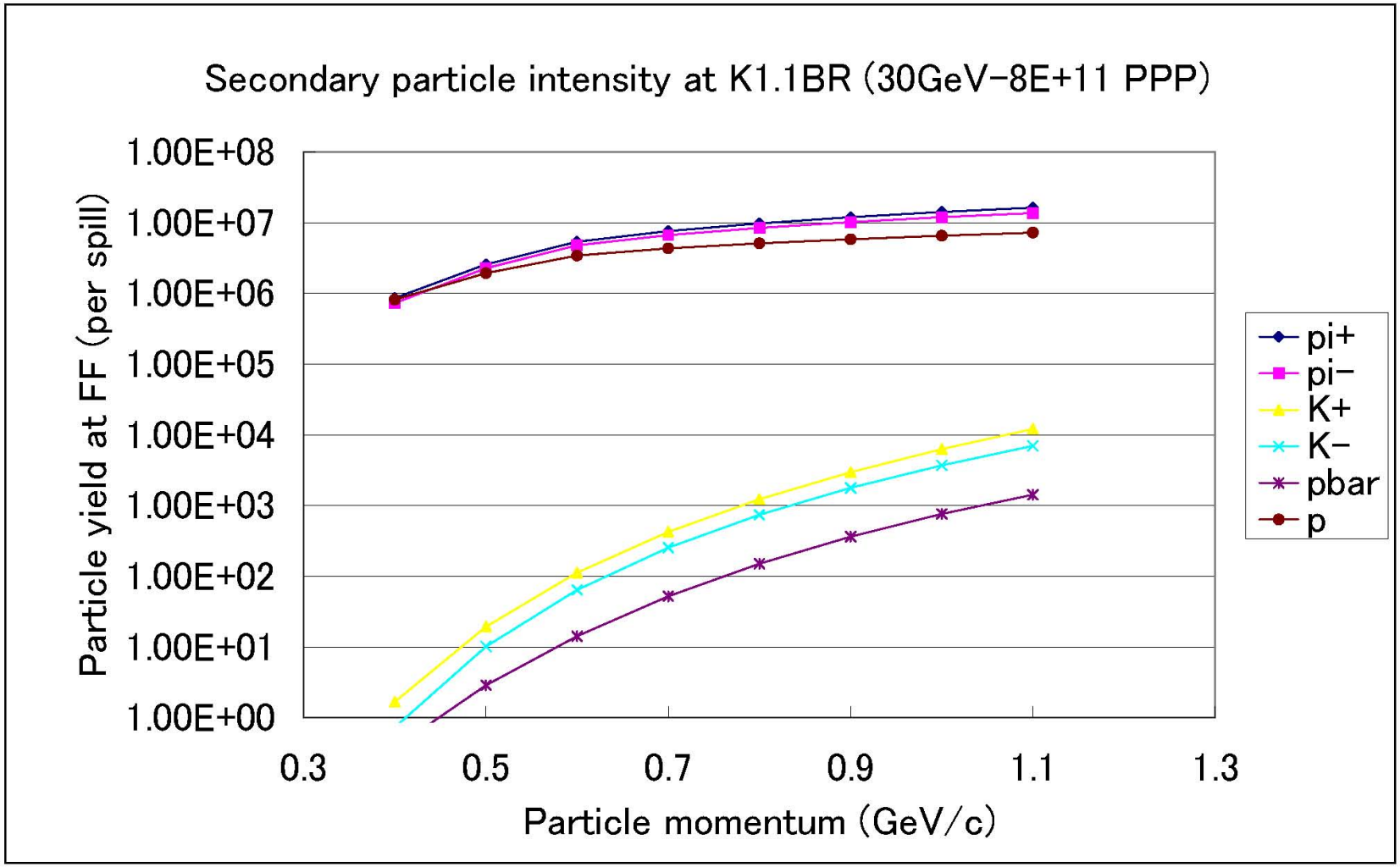
- PAC endorsed to use K1.1BR as a test beam (PAC June 2009).

Yield calculation based on SW Formula

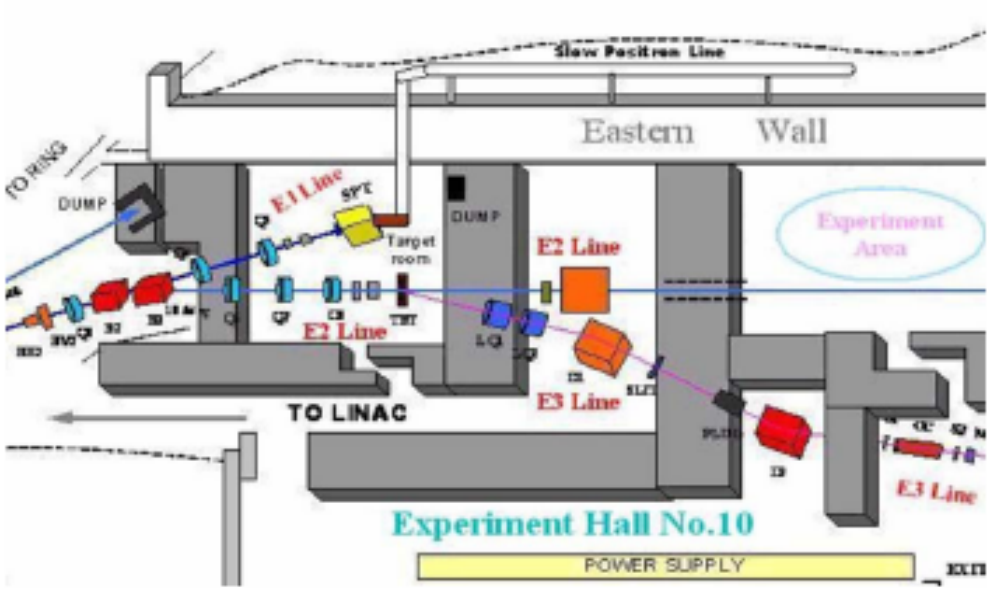


- Yield Calculation: Sanford-Wang Formula
  - Primary Beam Energy: 30GeV
  - Primary Beam Intensity: 8.0E+11 ppp (1.2kW)
  - Target: Beryllium (Ni: Yield ~ A)
  - Extraction Angle: 50°
  - Solid Angle: 0.043 msr
- Simulation Code: MARS15

Particle yields at K1.1BR tuned as a test beam line.

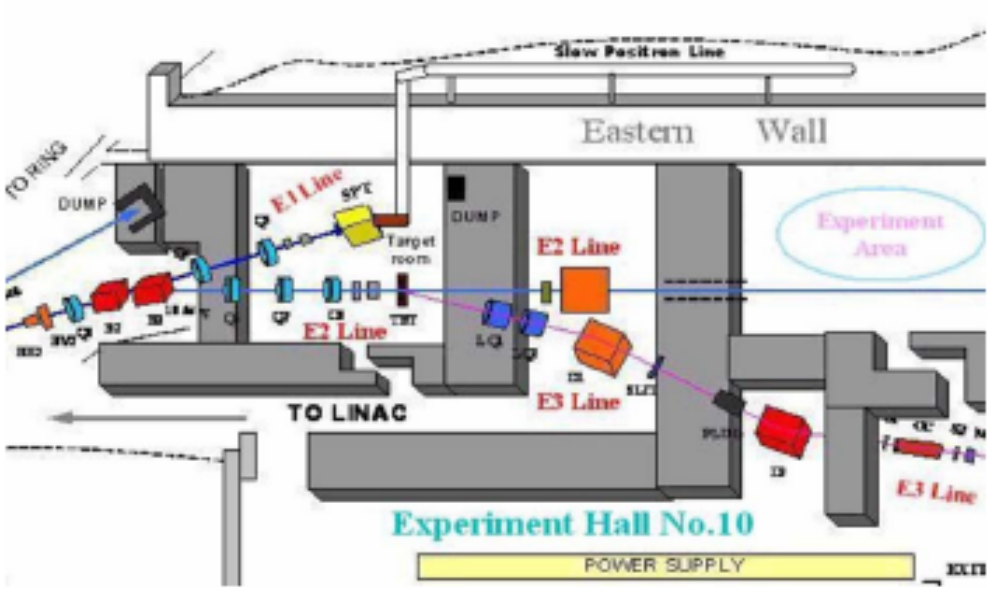


30% Loss Target at T1



IHEP Beijing
(Li Jiacai)

- **Beijing Test Beam Facility (BTF) provides**
  - Primary electrons, 1.1-1.5GeV/c E1&E2)
  - Secondary e, π, p, 0.4 - 1.2 GeV/c (E3)
  - E3 area is equipped with Cherenkov, TOF, MWPC.
- **Last season (437hours) ended on 28th, March 2008.**
  - Test of low energy X-ray telescope for the HXMT project (all-sky Hard X-ray survey).
  - Test of MRPC (Multi-gap resistive plate chamber) for STAR experiment
  - Test of CVD diamond film detector to measure irradiate flux and dose rate for BEPCII & III.
- **Long shutdown 2008-2010 for upgrade**
  - Improve beam optics, beam monitors and alignment scheme
  - Equip "TPC+GEM" detector in the spectrometer for double particle ID and momentum resolution of 0.5%
  - Equip pulse dose measuring instruments in irradiation area.



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Shutdown 2008-2010

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28th, March 2008.

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ve plate chamber) for STAR experiment

detector to measure irradiate flux and dose rate for BEPCII & III.

IHEP Protovino (Alexander Vasiliev)

- 8 beam channels at the 70-GeV proton accelerator at IHEP. The best one is channel 2, where we can use
  - Electrons from 1.5 GeV up to 19 GeV.
  - Pions of up to 34 GeV, and Protons up to 50 GeV.
  - Momentum spread is large, but beam momentum can be measured with 0.1% accuracy with a magnet and 14 drift chambers.
- Last upgrade of our test beam facility was in building and commissioning of 4 planes of fiber hodoscopes with a cell less than one mm.
- Our plan is to use intensively this beam line for many needed tests for experiment PANDA at FAIR in Darmstadt where we are responsible for
  1) design and production of barrel calorimeter consisting of 11,360 lead tungstate crystals,
  2) design and production of fine-segmented forward shashlyk calorimeter for about 1500 electronic channels,
  3) design and production of 8 silicon discs of the forward microstrip vertex detector.

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No change since LCWS08

Summary

Laboratory	Energy range (GeV)	Part. type	# of beam lines	Rate (Hz)	$\Delta p/p$	Availability and plans
KEK FTBL	0.4 - 3.4	e	1	20	1 %	Shut down Dec2009
J-PARC	0.5 – 1.1	π, p	1		broad	Start mid2010
IHEP Beijing	1.1 – 1.5 (primary) 0.4 – 1.2 (secondary)	e π	2 1	25 1.5	< 1 % 1%	Shutdown 2008 - 2010
IHEP Protovino	1.5 – 1.9 Up to 34 Up to 50	e, π, P	8	160 ~ 1000	broad can be measured w/ 0.1 % accuracy	Two months periods per year (one and one)

Backup

contact persons

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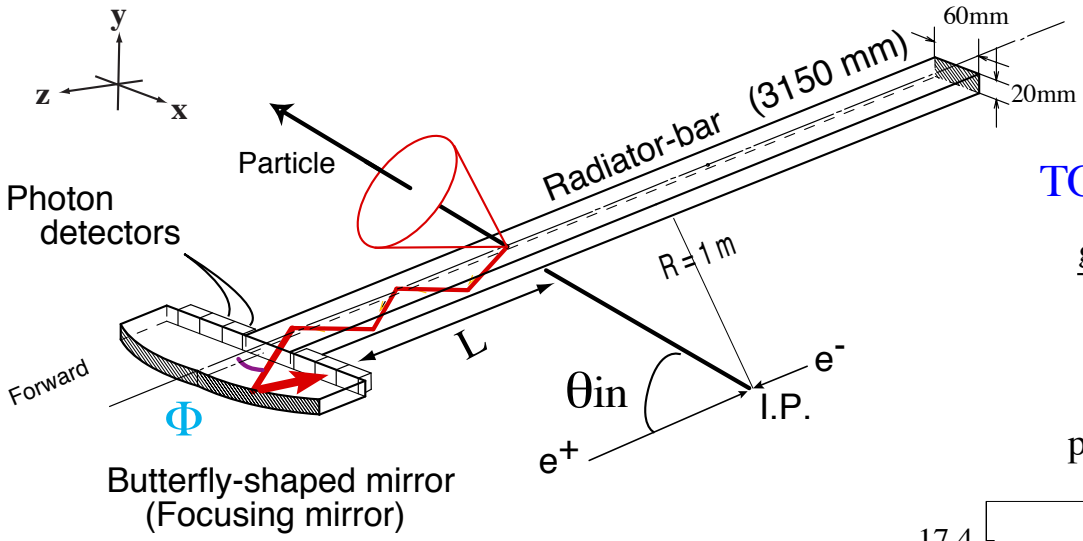
Test Beam using the Monitor Hole Possible Problems

- 0.5~1.5 GeV/c beam will be available.
- Yield will be reasonable at ~100kW era.

→ In the case of the beam intensity of ~5kW???

- Beam Line (Hole) will be ready in the mid JFY2010.
- Some extra cost (~0.5M$) will be necessary to prepare the test beam at the hole with putting a small dipole magnet etc.

Principle



Time Of Propagation

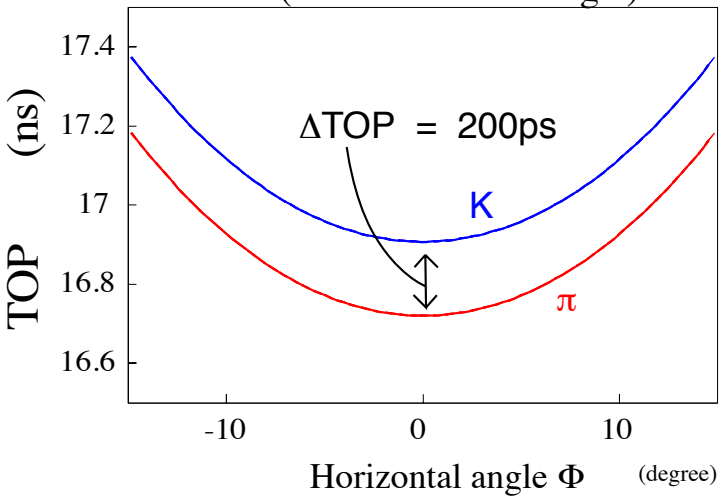
$$TOP(\theta_c,\Phi) = \left(\frac{L}{v_g(\lambda)}\right) \times \frac{1}{q_z(\theta_c,\Phi)}$$

group light velocity

Horizontal angle

q_z ; z component unit vector

p=3GeV/c, L=2m, θin=90.
(normal incident angle)



π/Kの時間差

TOP : $\theta_c^{\pi} > \theta_c^{K}$ → $TOP^{\pi} < TOP^{K}$

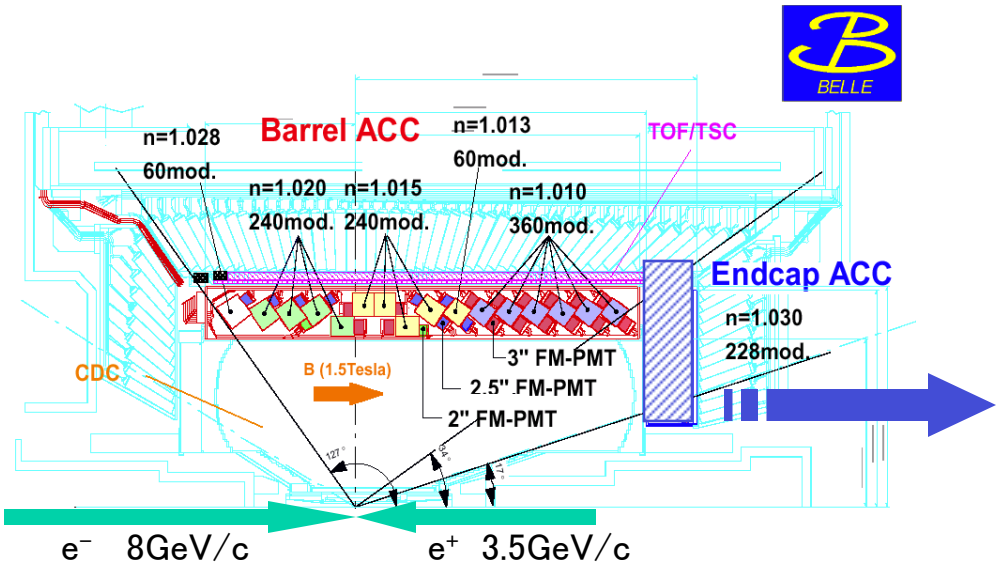
TOF : $\beta^{\pi} > \beta^{K}$ → $TOF^{\pi} < TOF^{K}$

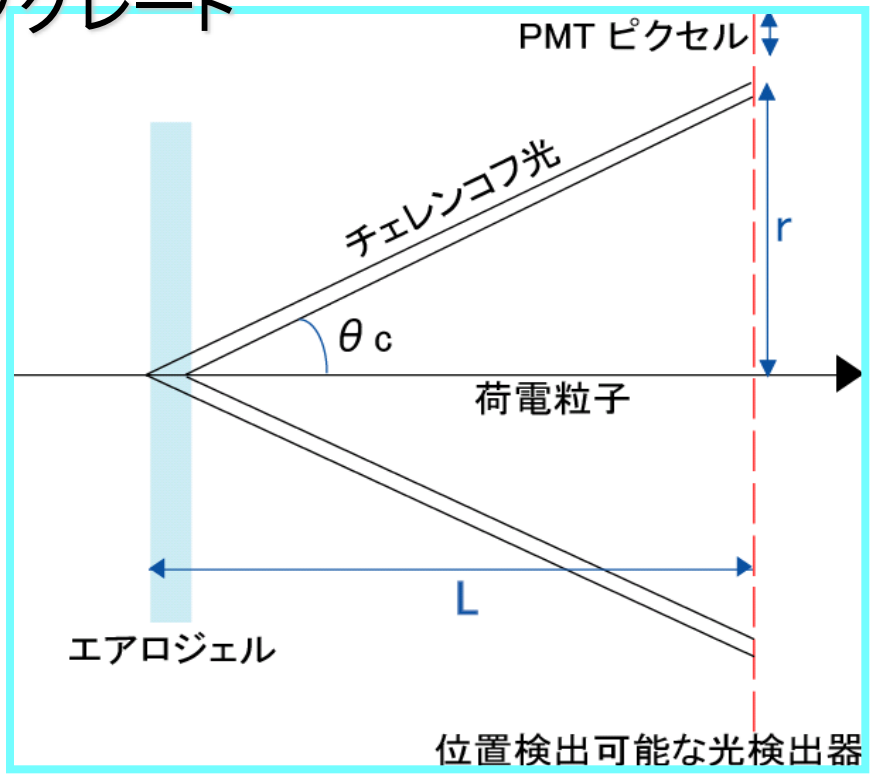
→ ΔTime = ΔTOP + ΔTOF

(200ps = 160 ps + 40 ps)

エアロジェルを用いた近接型リングイメージングチェレンコフカウンター

開発目的：Belle粒子識別装置のアップグレード





π/K中間子の識別可能な運動量

- 現在の閾値型ACC・・・ 0.8～2GeV/c
- RICH・・・0.8～4GeV/cまで可能！

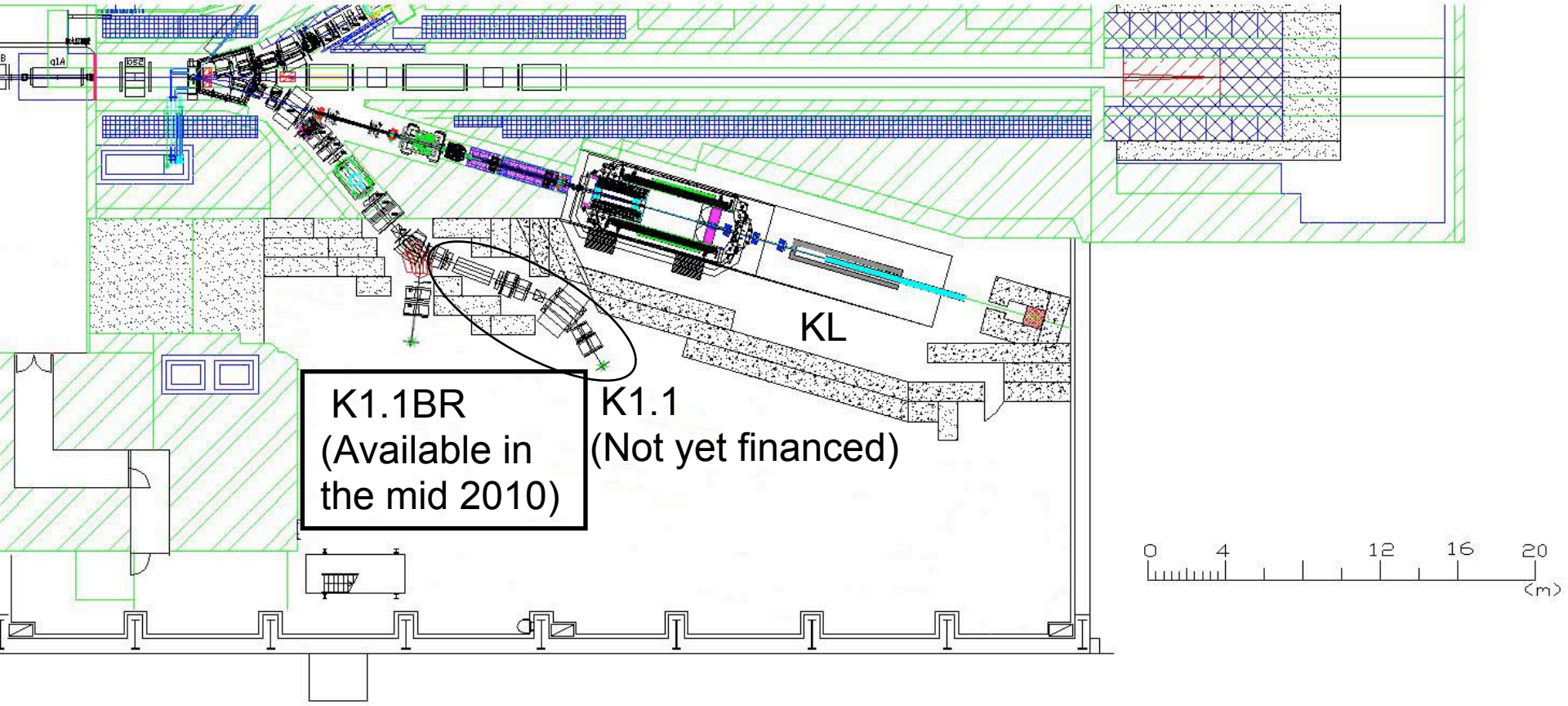
エンドキャップ部(奥行き28cm)
→ミラーを用いない近接型RICH

チェレンコフ角の差から粒子識別

$$\theta_{c\pi} - \theta_{cK} \cong 23mrad$$

角度分解能が重要!

Beam line plan at southern area



Beam Line Layout in the mid 2010 at the Phase-1 Construction of Hadron Experimental Hall