# Status of the experiments at K1.8BR

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- 2. Status of CDS
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### J-PARC K1.8BR beamline



By KEK hadron beam line group, March 3, 2009

## **Experimental Programs at K1.8BR**

Experiment	Physics aim	Reaction	Secondary Beam	Production Data Aquisition
E15	Search for K <sup>-</sup> pp kaonic nuclear bound state	<sup>3</sup> He(K <sup>-</sup> , n) K <sup>-</sup> pp K <sup>-</sup> pp -> Λp, etc.	K <sup>-</sup> 1.0 GeV/c	2012?
E17	Precision spectroscopy of Kaonic <sup>3</sup> He atomic 3d->2p X-rays	<sup>3</sup> He(K <sup>-</sup> <sub>stopped</sub> , xC <sup>±</sup> )	K <sup>-</sup> 0.9 GeV/c	2012?
P28(=E15)	Search for K <sup>-</sup> pn kaonic nuclear bound state (Isospin dependence)	<sup>3</sup> He(K⁻,p)K⁻pn K⁻pn -> Λn, etc.	K <sup>-</sup> 1.0 GeV/c	2012?
E31	Investigation of the nature of $\Lambda(1405)$	d(K⁻, n)Λ(1405) Λ(1405)->(Σπ) <sup>0</sup>	K⁻ 1.0 GeV/c	? (stage1)

At K1.8BR,  $K_{bar}$ -N/ $K_{bar}$ -nuclear interactions are studied in various aspects for few-body systems.

### E15: Motivation



Strongly bound Kaon-nuclear systems (Kaonic Nuclei): Formation of Cold (T=0) and Dense ( $\rho$ >5  $\rho_0$ ?) nuclear matter =>

#### **Chiral symmetry restoration**

- \* Kaon condensation
- \* Neutron star

K⁻pp?

The simplest and the most easy

system to be identified?





#### E15:K<sup>-</sup>pn search/Isospin dependence (P28)



E17:Strong-interaction Shift and Width of Kaonic Helium 3





## E17 Setup

Beamline / Beam	K1.8BR / K <sup>-</sup> (p <sub>K</sub> ~0.9 GeV)	+
Target	Liquid <sup>3</sup> He/Liquid <sup>4</sup> He	+
X-ray detector	Silicon Drift Detector (SDD)	
Secondary particle detector	E15 Cylindrical Drift-chamber System (CDS)	+



## Extended goal of E17

#### The (slightly) modified E17 goals



Isotope shift with **negligibly small systematic error**.

## Possible $\Gamma_{\rm 2p}$ measurements using SDDs

- Strong-interaction width seems to be much smaller than SDD resolution
- It is very hard to say a finite width from X-ray measurements with SDDs
- Are there some solution??

The fitted width was

Tatsuno, draft of KEK E570 full paper

$$\Delta\Gamma_{2p} = 6 \pm 5 \text{ (stat)} {}^{+4}_{-5} \text{ (syst) eV.}$$
(8)

An upper limit of the width was determined to be

$$\Gamma_{2p} \le 17 \text{ eV } 95\%$$
 confidence level (9)

where the total error of the width was treated as a

#### K<sup>-3</sup>He case





By Dr. T. Ishiwatari, SMI



By Dr. T. Ishiwatari, SMI

#### Nd 10 micron filter



#### Run35:Kaon/Pion Vertical Profile Study

Reinforced 2.9 kW beam intensity was valuable to measure the vertical profile of K/pi.



## Analysis of CDS (Oct. 2010:Run35 Data)

- We accumulated the data (0.9 GeV/c  $\pi^+$  and K^- @2.9 kW/Pt) for CDS commissioning.
- -> CDS seems working well!





Liq. <sup>4</sup>He transfer /~ 10 hous @E17

#### Beamline devices after the earthquake

Damaged chamber





Detector Uninstallation after D5 removal

#### Magnets

D5 magnet shook strongly, and detached from the holder. The magnet was removed for the repair.

#### Detectors

PDC and the holder were crashed by the displacement of D5. All other beamline detectors were Uninstalled for the realignment of magnets.

All detectors will be installed again immediately after the re-alignment of magnets. Kaon tuning must be considered again, as it is sensitive to small relative displacements of beamline elements.

## CDS Status after the earthquake



• CDC

- Check by test pulse  $\rightarrow$  OK
- Excitation of wire
   at low Voltage → OK
- Leak test of CDC by Ar Gas  $\rightarrow$  OK
- CDH
  - Check the signal using cosmic ray
     → OK

#### No problem is found about CDS until now.

-> we must check CDS in detail. (efficiency ,etc.)

## Target system after the earthquake

□ Liquid 3He target system (not operated at that time)







no serious damage

To be checked with He cooling test

- □ confirmation of 3He gas
- □ tightness of Be cell

After assembly and some cooling tests, 3He target will be ready.

# Situation of Silicon drift detectors

looks no damage, but needs to be checked as soon as possible (repair takes long time)



Operation check of SDDs will be done in this month with a test bench cryostat in J-PARC.



~1m x 1m

For the precise estimation of systematic errors

- □ Long-term measurement (ADC linearity)
- **D** Energy dependence of response function

are to be measured

#### **Beam request**

Next beam time (from Dec.?) will be devoted to beam tunings which can be performed with low beam intensity, ~a few kW.

Reproducibility check for 0.9 GeV/c (E17 : 15 shifts) Range measurement (E17 : 9 shifts) Tuning for 1.0 GeV/c (E15 : 15 shifts)

We intend to perform physics run from Oct. 2012, with ~10 kW beam intensity.

E17 : 12 (<sup>3</sup>He)+ 8 (<sup>4</sup>He) kW week with Pt target E15-phase1 : 30 kW week with Pt target

## Summary

#### **Preparation status / damage by the earthquake**

- ✓ Kaon tuning of K1.8BR was almost done at 0.9 GeV/c, and K<sup>-</sup> beam had been applied for  $(K^-, \Lambda/K^0_s)$  run. But D5 and upper-stream drift chamber were seriously damaged by the earthquake. All beamline detectors were uninstalled once.
- ✓ CDS commissioning had been successfully done, and ready for both E15 and E17. No damage is found until now.
- ✓ <sup>3</sup>He target system had been completed. Neither target system nor SDD has visible damage, and checking operation will be performed in this summer.
- ✓ All E17 detectors will be re-installed promptly after realignment of K1.8/K1.8BR elements, and E17 will be ready again by this December.
- ✓ Modification of the lower-stream area is underway for in-flight experiments.

#### **Beam requests**

#### 2011.12~2012.6

- ✓ 15 shifts reproducibility check of the K1.8BR beamline (E17).
- ✓ 9 shifts for tuning of stop  $K^-$  (E17).
- ✓ 15 shifts for 1.0 GeV/c tuning for in-flight experiments (E15/E31).

#### 2012.10~2013.6

- ✓ 20 kW week E17 production with Pt production target.  $\Gamma_{\rm 2p}$  measurement is now seriously considered.
- ✓ 30 kW week E15 phase1 production with Pt production target.

#### **K1.8BR Beam Line Devices**

