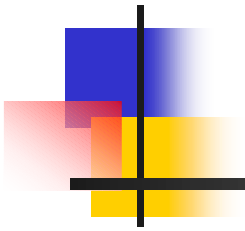


The future of the E391a experiment

G.Y.Lim

IPNS,KEK

質量起源と超対称性物理の研究

筑波大、2003年3月4日

Precise measurement of $Br(K_L \to \pi^0 \nu\nu)$

Direct CP violation ($\Delta s = 1$)

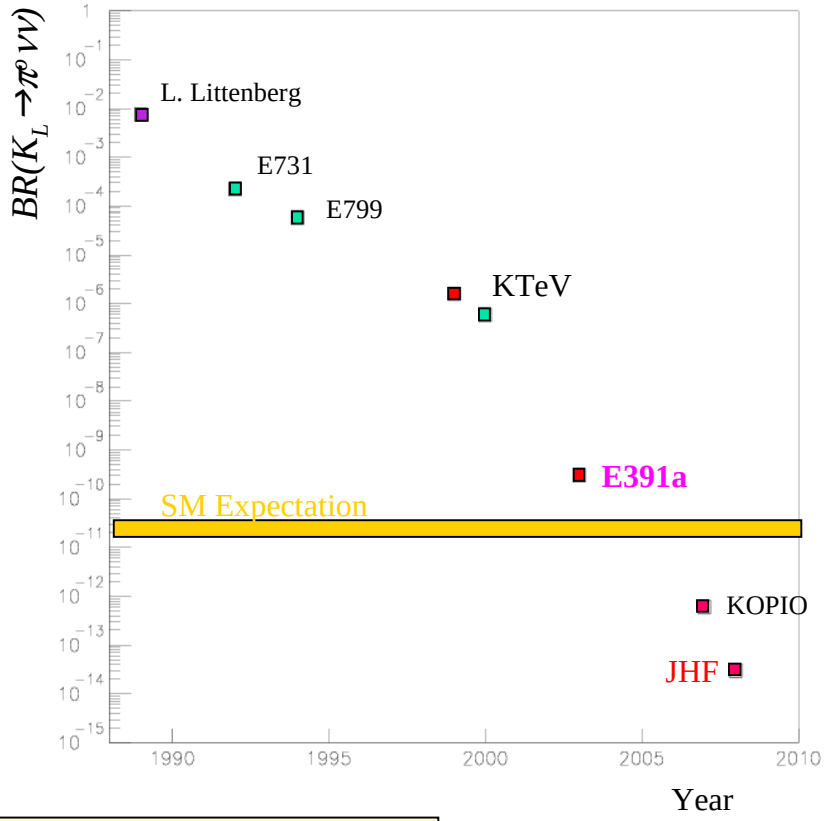
Clean measurement of $Im(V_{td}) \sim \eta$

Kaon unitarity triangle

Clue for the new physics

Goal

- Sensitivity < 10^{-13}
- Standard Model events > 100
- $\Delta\eta/\eta$ < 5 %



Practical test of the methodology by the E391a

For the high sensitivity experiment

Smooth extension (E391a→ JHF)

- High flux of K_L
  - 500 times larger K_L Flux
  - 3 orders higher sensitivity
- Sufficient background rejection
  - Same principle of beamline
  - Minor up-grade of detector
  - Background study at the E391a

	BNL	Fermilab		KEK	
	KOPIO	KTeV-99	KAMI-near	E391A	JHF
Proton energy	24 GeV	800 GeV	120 GeV	12 GeV	50 GeV
Protons/pulse	5×10^{13}	1×10^{13}	3×10^{13}	2×10^{12}	2×10^{14}
Cycle time	3.6 sec	60 sec	2.9 sec	2.5 sec	3.42 sec
Flat-Top	1.6 sec	40 sec	1.0 sec	0.5 sec	0.75 sec
Ext.angle	45°	4.8 mr	24 mr	4°	10°
Beam profile	4mr×125mr	0.22mr×0.22mr	0.6mr×0.6mr	4 mr$^\phi$	2.6 mr$^\phi$
Solid Angle	500 μstr	0.048 μstr	1 μstr	12.6 μstr	5.5 μstr
$Y_{K_L^0}$/p/str	4.8×10^{-3}	4.8×10^{7}	3.7	5.9×10^{-2}	0.96
Av.K_L^0 mom.	0.7 GeV/c	70 GeV/c	10 GeV/c	2 GeV/c	2 GeV/c
Decay region	3.5 m	38 m	34 m	2.7 m	2.7 m
Decay prob.	16 %	2.1 %	10 %	4.3 %	4.3 %
K_L^0/pulse	1.2×10^{8}	2.3×10^{7}	1.1×10^{8}	1.5×10^{6}	1.1×10^{9}
K_L^0-decay/pulse	1.9×10^{7}	4.8×10^{5}	1.1×10^{7}	6.5×10^{4}	4.7×10^{7}
Av.K_L^0-decay/sec	5.3×10^{6}	6×10^{3}	3.8×10^{6}	2.6×10^{4}	1.4×10^{7}
Inst.decay-rate	12 MHz	12 kHz	11 MHz	130 kHz	63 MHz
Acceptance	1.6 %	5 %	7.4 %	8 %	16 %
Run Time	3×10^{7} sec	6×10^{5} sec	3×10^{7} sec	1×10^{7} sec	3×10^{7} sec
Running Eff.	50 %	50 %	50 %	50 %	50 %
Sensitivity	7.8×10^{-13}	1.1×10^{-9}	2.3×10^{-13}	1.0×10^{-10}	3.0×10^{-14}
Events (3×10^{-11})	35 events		130 events		1000 events

T.Inagaki CP Violation in K (1998)

Experiment at the JHF

Construction an extraction line (B-line)

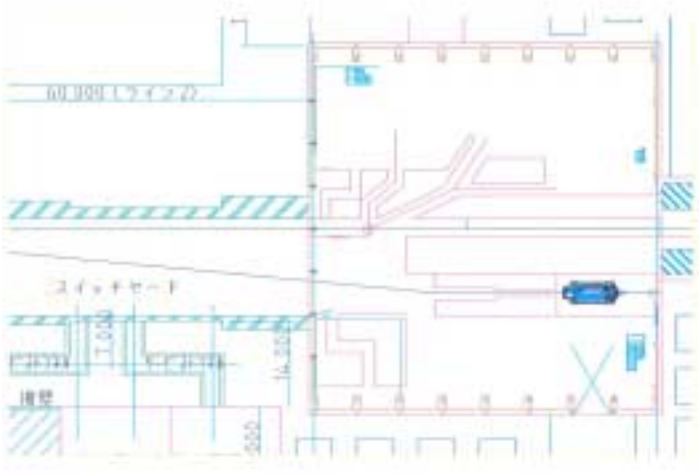
Concentration on K_L production

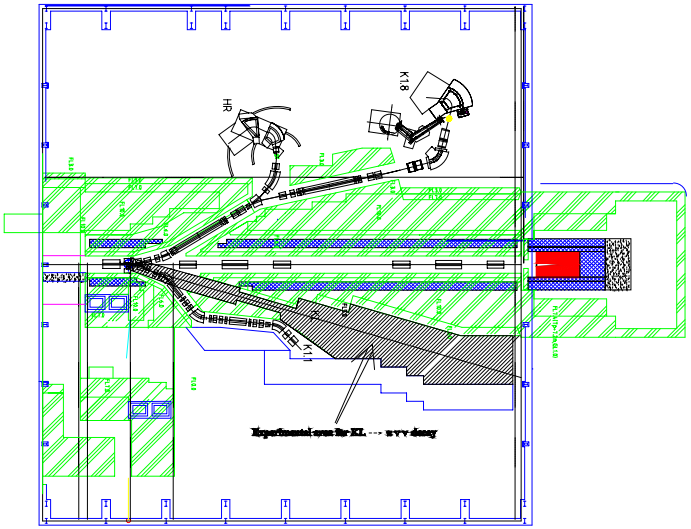
Difficult to become time-zero experiment

- budgetary condition / other programs

Share the target station (A-line)

Prompt starting option





Prompt starting option

- Merit and Demerit
  - We can share the beam
  - Prompt access the SM expectation
  - Clearer understanding the BG
  - Make sure for precise measurement
  - Large angle

    smaller K_L flux
- Condition
  - Proton energy : 30 GeV
  - Proton intensity : $2 \cdot 10^{14}$
  - Production angle : 16^o

- Rough Estimation
  - Proton intensity : 100
  - Production yield : 0.9
  - Beam acceptance : 0.25
  - Beam line optimization : 0.7
  - Longer data taking : 6
  - Repetition time : 1.21

10 SM events for 3 Yr.

Summary

- Smooth extension to the JHF
  - Step-by-step approach to the $K_L \rightarrow \pi^0 \nu\nu$ decay
  - Additional two stages of experiment
- Finally we will measure the Br($K_L \rightarrow \pi^0 \nu\nu$) with accuracy less than 10%
  - Contribute the CPV study
  - Search for new physics effects

- LOI for the JHF locates at

  http://psux1.kek.jp/~e391/documents/paper/loi-jhf.pdf