Status report on J-PARC E19 (1)

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for the K1.8 Collaboration

outline

- Introduction
- J-PARC E19 experiment

  + goal of beam time 2010
- detector setup
- beam structure
- summary

introduction

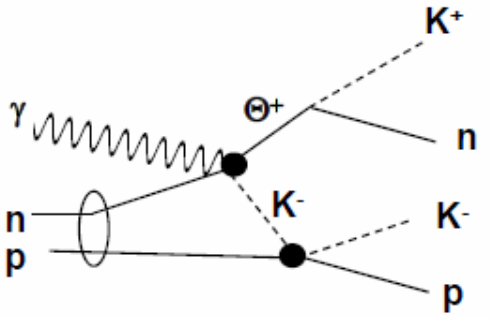
- Θ^+ S=+1 baryon, $uudd\bar{s}$
- multiquark system : test the QCD

what we know:
the narrow width (< 1 MeV)
What mechanism suppresses the decay of Θ^+?
effective forces between quarks

$\gamma n \to K^- \Theta^+$

CLAS-d $\gamma d \to p K^- K^+ n$ < 0.3nb
(< 3nb for $\gamma n \to K^- \Theta^+$)
LEPS $\gamma C \to K^- K^+ (n)$ 4.6σ
$\gamma d \to p K^- K^+ n$ 5.1σ

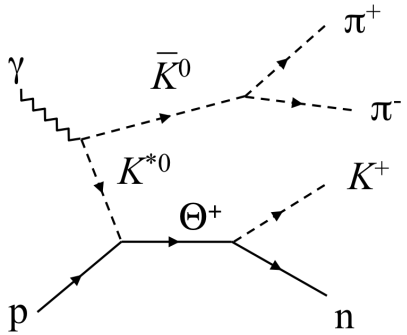
angle dependent?



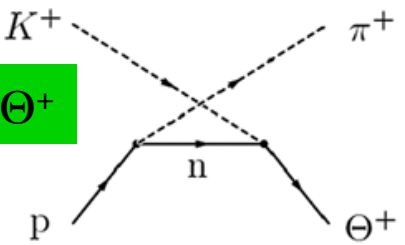
$K^* p \to \Theta^+$

CLAS-p $\gamma p \to K^0 K^+ n$ < 0.8nb
KEK E559 $K^+ p \to \pi^+ \Theta^+$ < 3.5μb/sr

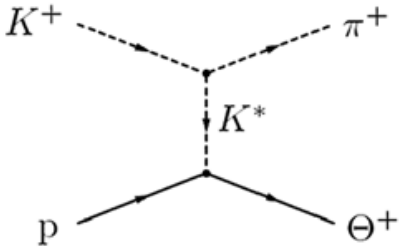
gNK*Θ ~ 0



$K^+ p \to \pi^+ \Theta^+$



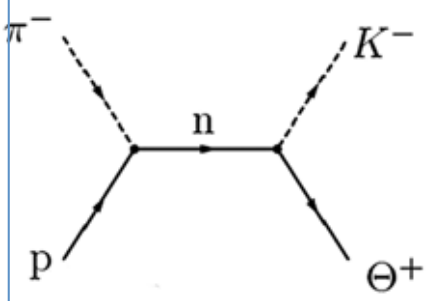
u-channel



t-channel

s-channel via N*

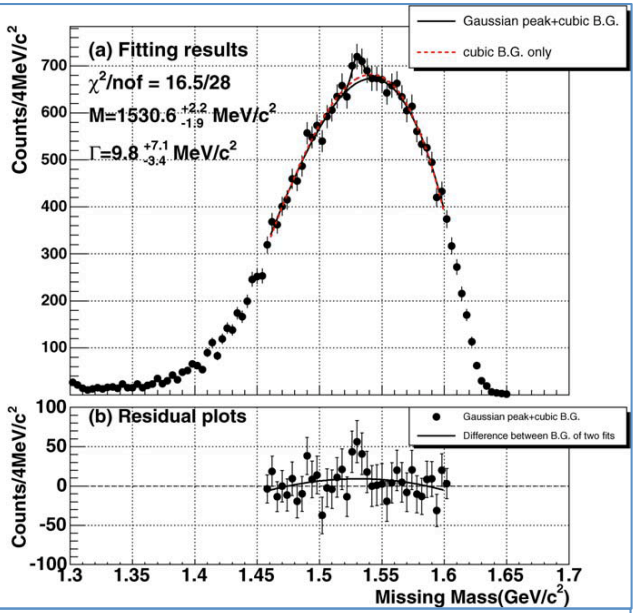
$\pi^- p \rightarrow K^- \Theta^+$



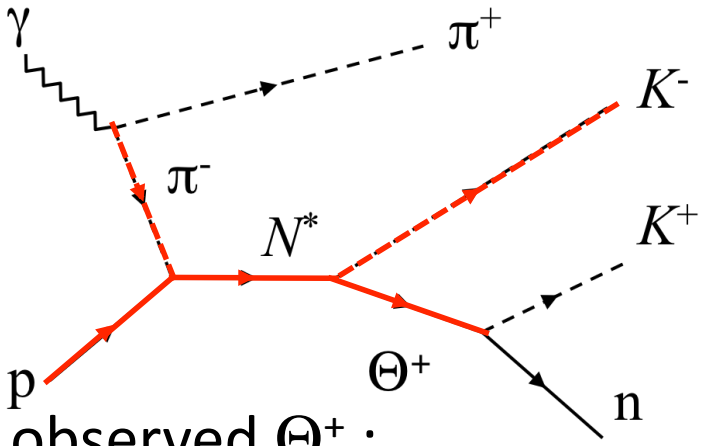
s-channel

π^- 1.92 GeV/c , CH_2 data
a bump was observed
at M =1530.8MeV/c^2
but : S/N = 2.5σ
upper limit : σ_{tot} = 3.9μb

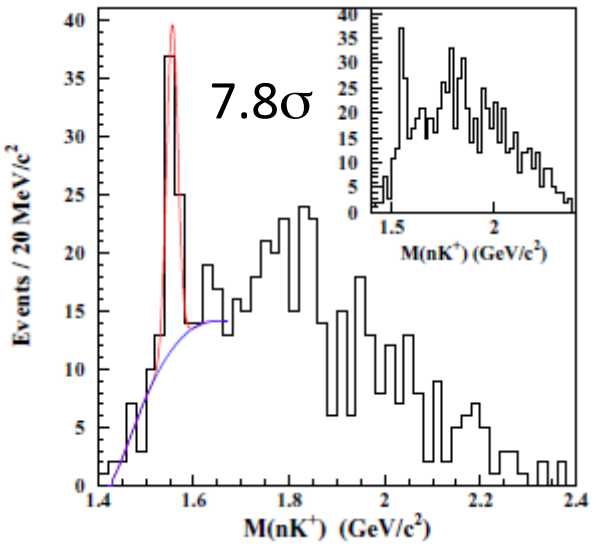
K. Miwa et al., PLB 635, 72



$\gamma p \rightarrow \pi^+ K^- K^+ (n)$



CLAS observed Θ^+ :
$\gamma p \rightarrow \pi^+ K^- K^+ n$ reaction.

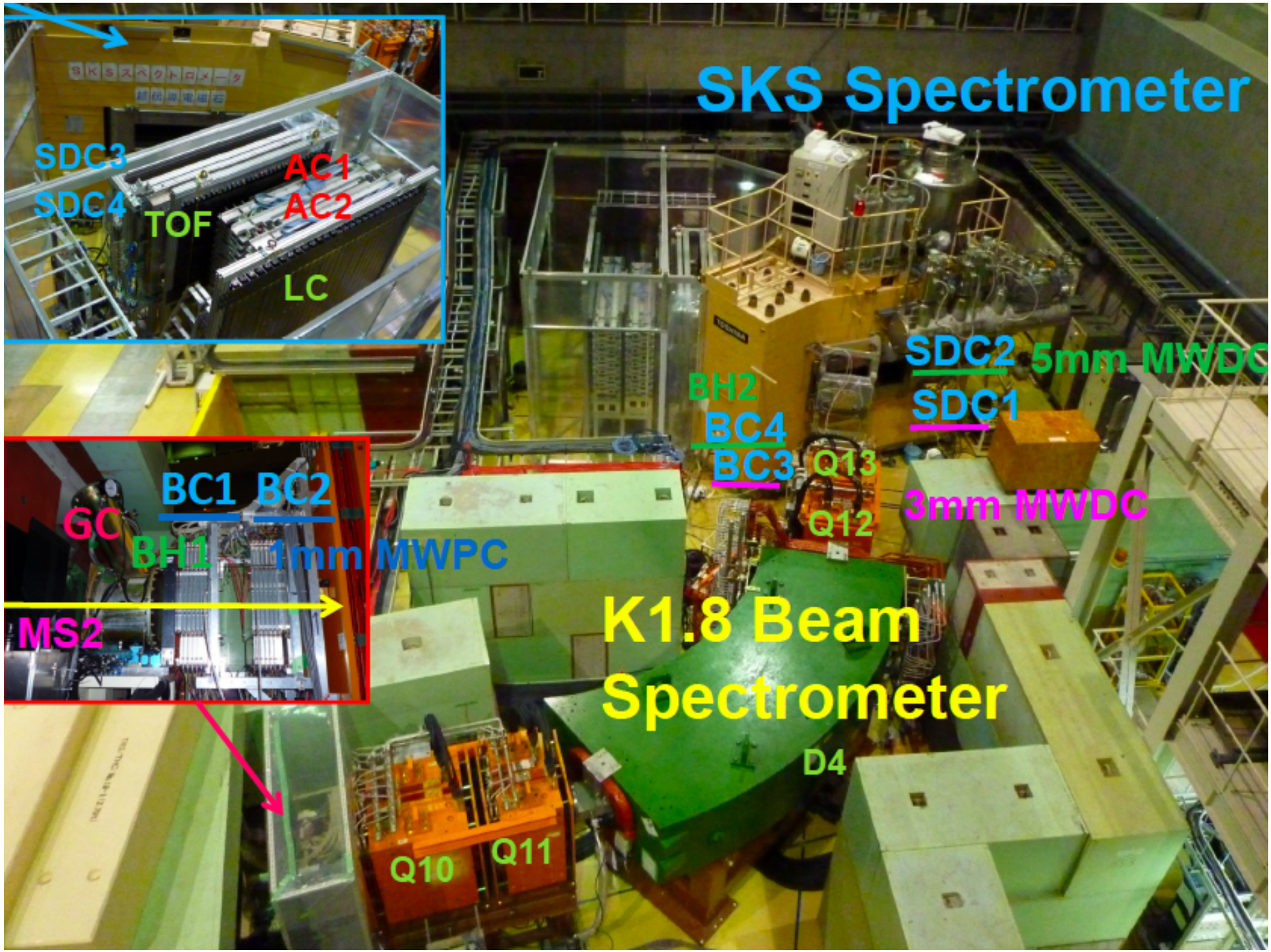


V.Kubarovsky *et.al.*, PRL92 032001

J-PARC E19

- Goal : confirm Θ^+ existence with high statistics
  - $\pi^- p \rightarrow K^- X$: with K1.8 BS & SKS → 2.5 MeV(FWHM)
  - momentum dependence of cross section
    - p_{beam} = 1.87, 1.92, 1.97 GeV/c
  - beam time : 160 hours, $10^7\pi$/4sec (original)
  - yield: 10^4 Θ^+ for each momentum
    100 times larger than KEK E522
  - sensitivity : 75nb/sr for Γ<2 MeV

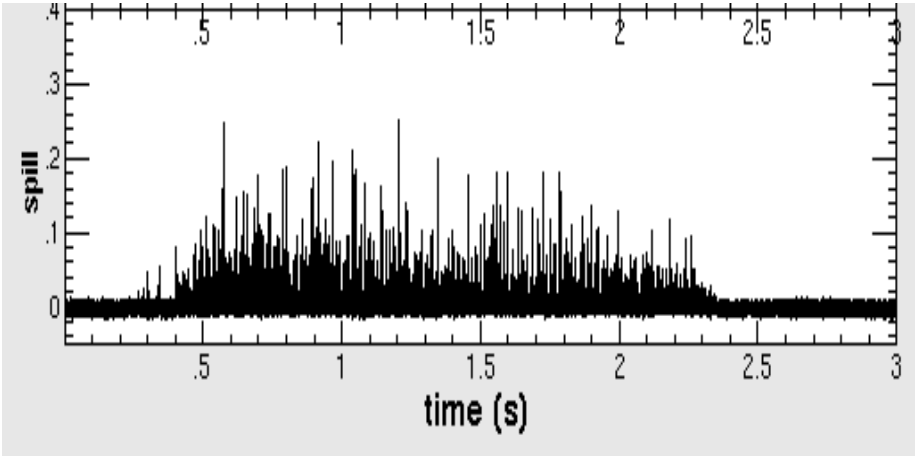
- Oct. – Nov. 2010:
  confirm Θ^+ existence with 10σ at p_{beam} = 1.92 GeV/c
  - beam time
    request : ~ 150 hours, $10^6\pi$/6sec for Θ^+ production
    assigned: ~ 270 hours (including beam tuning, calibration run, …)

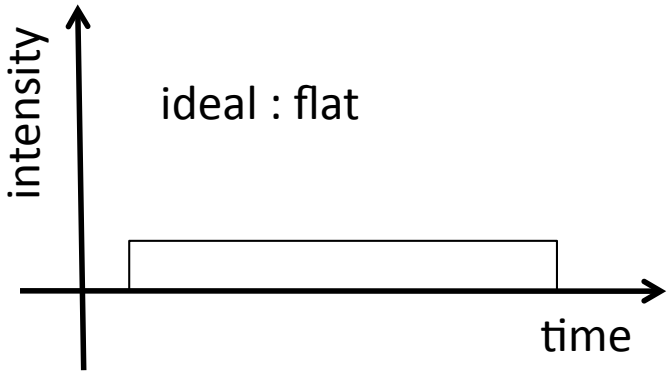

SKS Spectrometer
SDC3
SDC4
TOF
AC1
AC2
LC
SDC2
5mm MWDC
SDC1
BH2
BC4
BC3
Q13
Q12
3mm MWDC
BC1
BC2
GC
BH1
1mm MWPC
MS2
K1.8 Beam
Spectrometer
D4
Q10
Q11

beam spill structure problem

- instantaneous beam rate limits the acceptable beam particles per spill.
- duty factor cf. KEK-PS ~ 80%
  - Feb. 2010 ~ 8% → 750kπ/spill
  - Oct. 2010 ~ 12%
  - Nov. 2010 ~ 16% → 1Mπ/spill

repairing MWPC





summary

- J-PARC E19 aims to confirm Θ^+ existence with high statistics. (x100 of KEK-E5222)
- goal of 2010 beam time
  - x10 statistics of KEK-E522 for p_{beam} = 1.92 GeV/c
- beam structure : gradually improving
- details of analysis → next speaker