Neutral Beam from A-line (Based on KEK-E391a)

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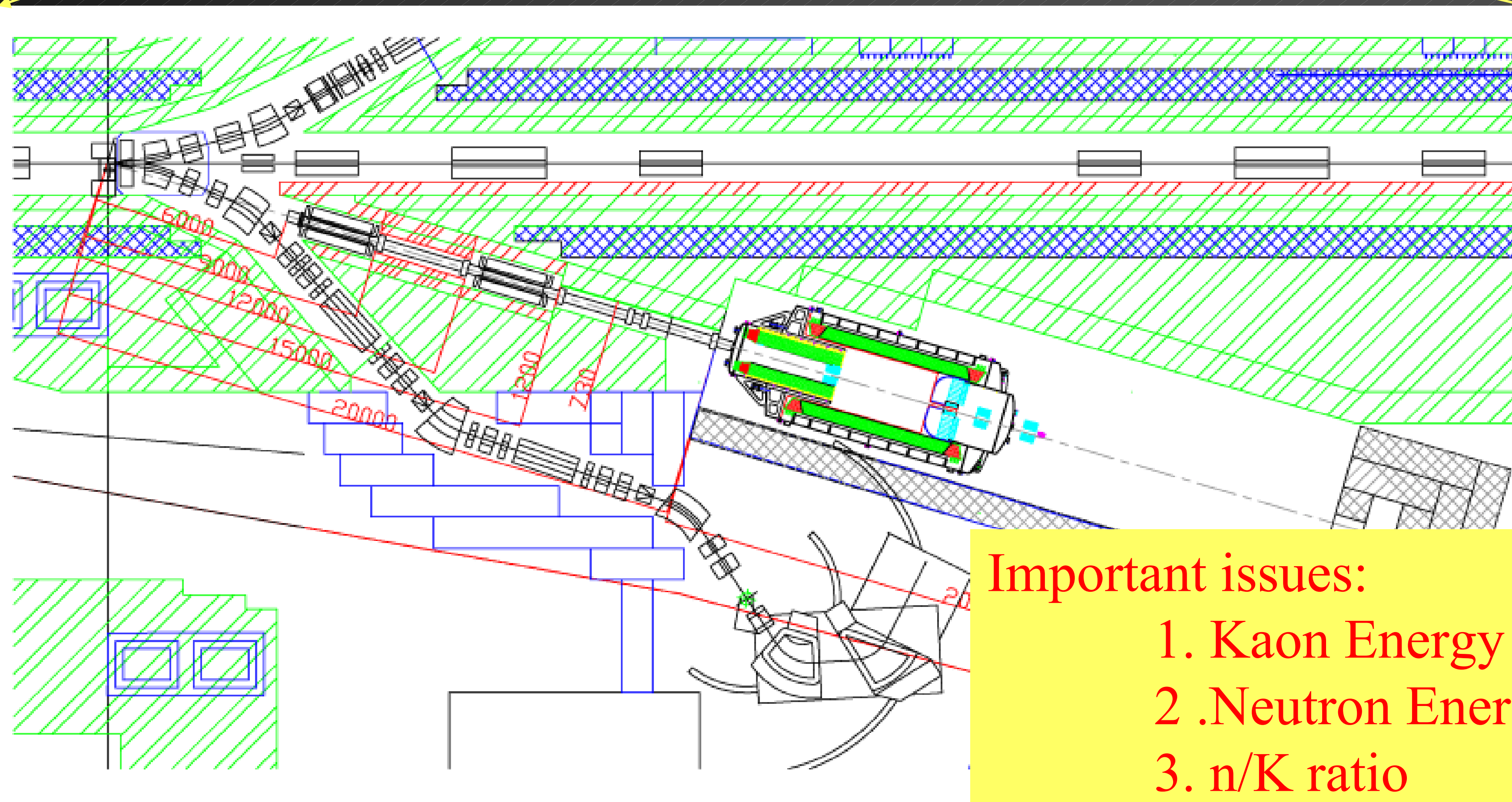
A line



Important issues:

1. Kaon Energy
2. .Neutron Energy
3. n/K ratio

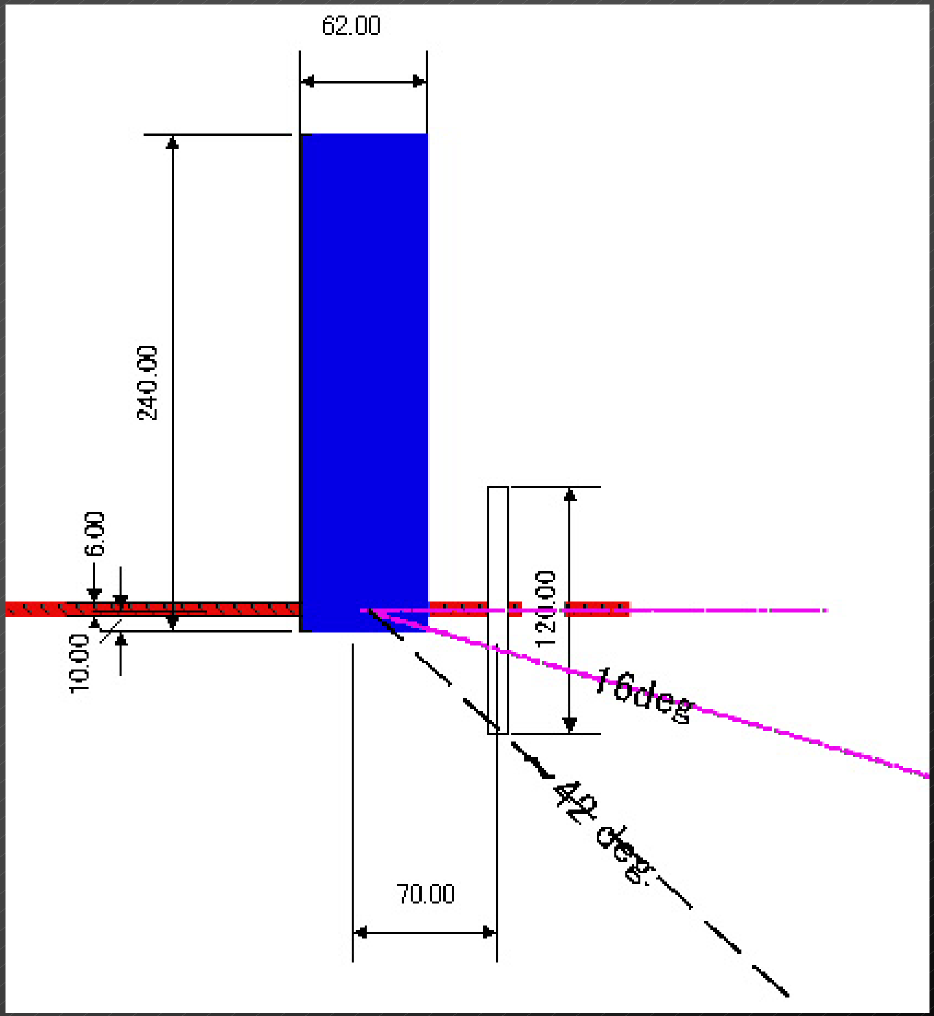
M.C. study ~setup~

Conditions :

54-mm thick Ni
Incident E 30 GeV

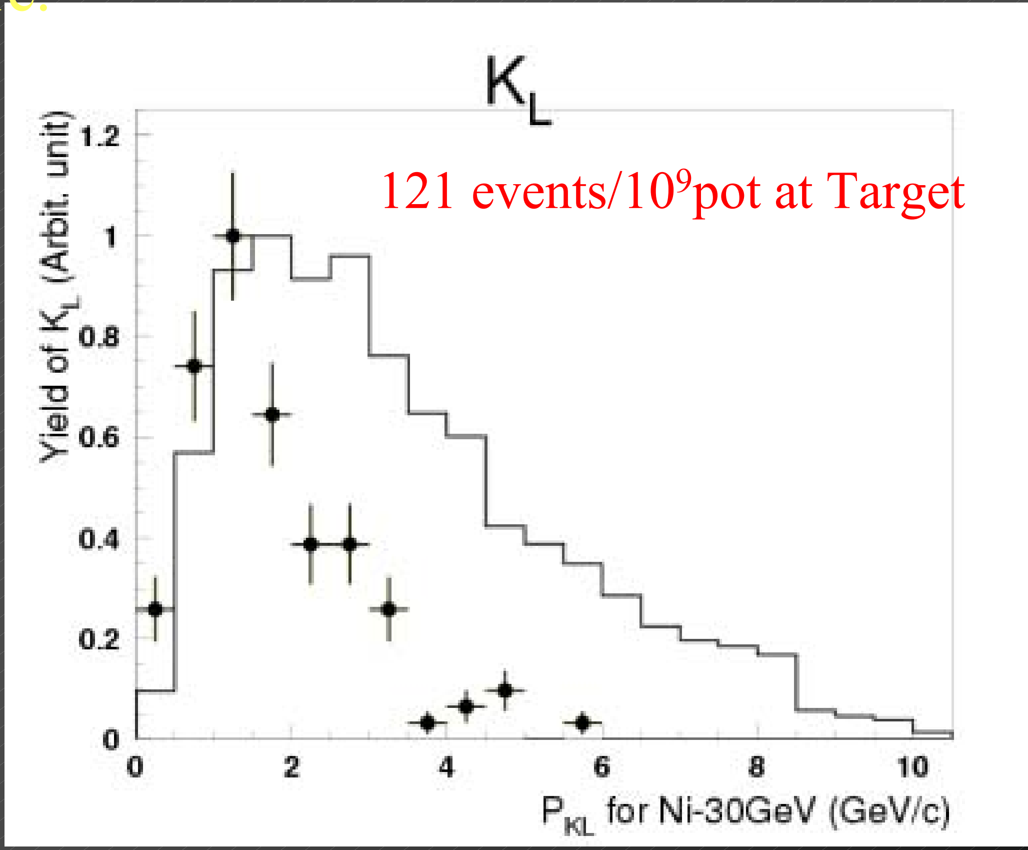
M.C. code : GEANT3
+ G-FLUKA

<u>10^9 proton-on-target</u>
En > 1 GeV
E_γ > 0.5 GeV



M.C. study ~Energy Spectra~

Selection: Tentative beam aperture.
(6.8cm in diameter at 27m from the T1.)



Circle+err-bar: Ni 30GeV

Solid line : E391a
(12 GeV 4°)

<u>Softer beam for A-line.</u>

3 - 4 x 10^7 K_L's / 3×10^{14} pot for Ni 30GeV

Higher K Energy
→Higher γ Energy
→Better efficiency

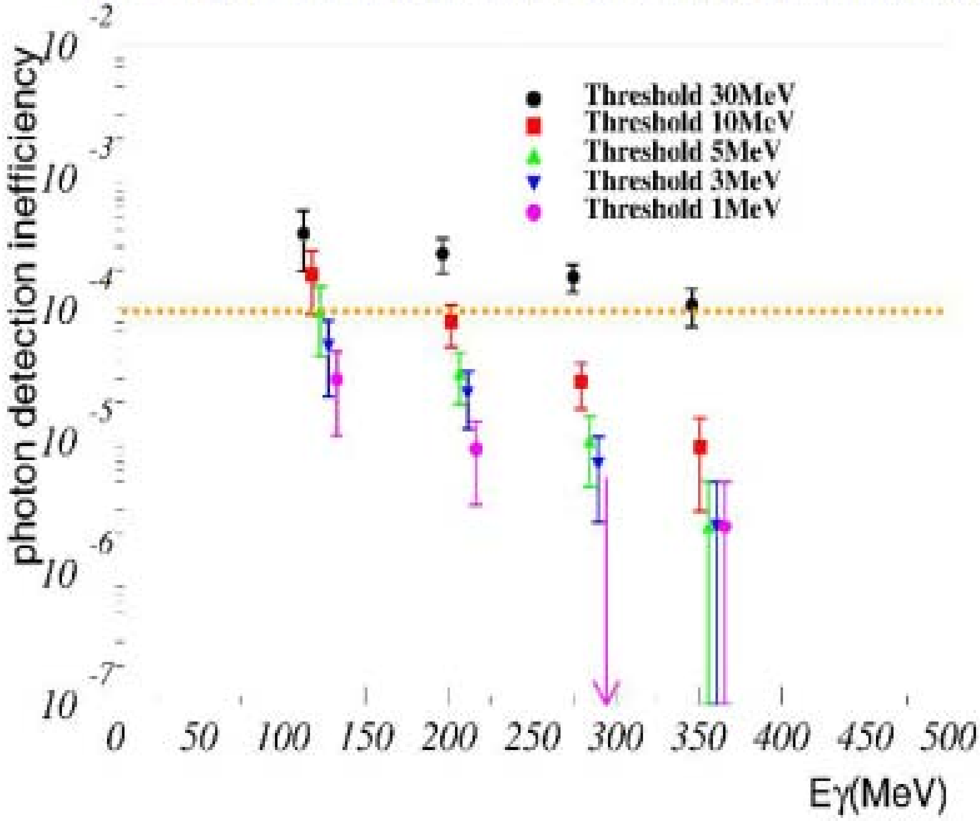
Lower K Energy
→Lower γ Energy
→Worse efficiency

To keep efficiency, lower threshold is necessary.

2004/8/5

Introduction
～Calorimeterの光子不感率(ES171)～

Inefficiencies for CsI calorimeter due to photonuclear interaction (Preliminary).



Background ↓
→ Inefficiency ↓
→ require low threshold 1MeV!!!

Kaon Energy

	γ -detection efficiency	Energy/ Position(angle)/ Timing Resolution	Signal/ KL-related-B.G.
Higher E_K	○	○	○
Lower E_K (A-Line)	△ (lower threshold can compensate, but it fight with rate.)	△ ? (it might compensate by Better detector?)	△

Counting Rate …

Budget (detector, beamline)…

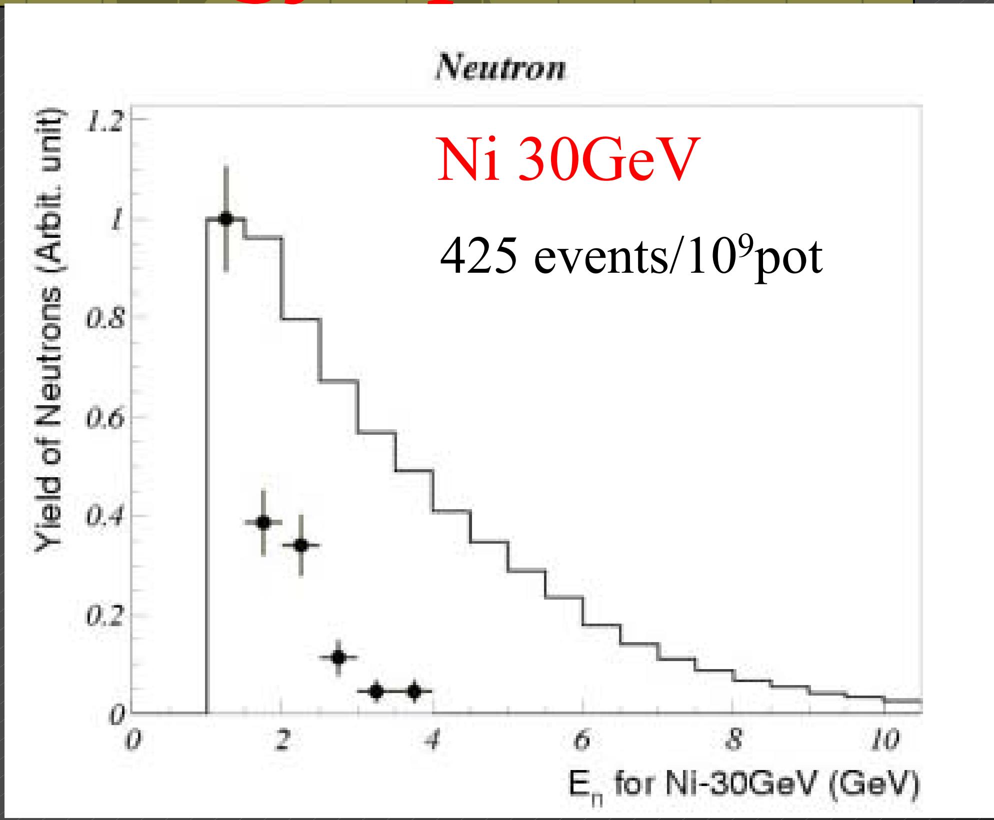
M.C. study ~Energy Spectra~

Neutron

Circle with error : A-line
Solid line : E391

Neutron : Soft

~1.3 x 10^8 n's/3x10^{14}pot
(En>1GeV)



n/K_L ratio ~ 3.5 (En>1GeV and E_K all)
~ 14 (En > 0.1 GeV and E_K all)

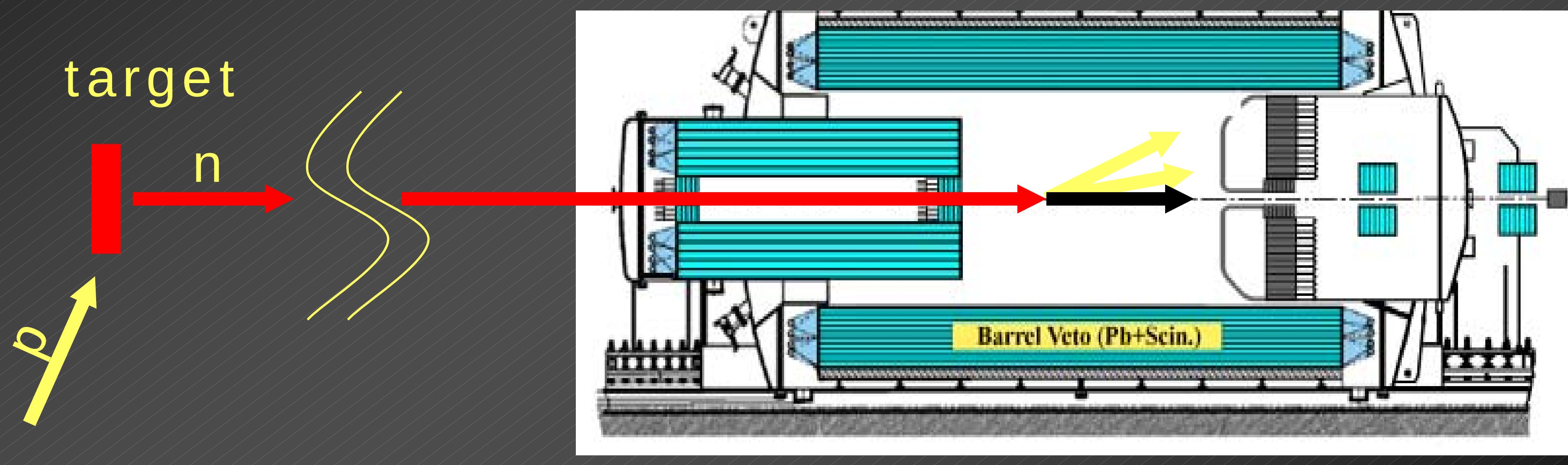
c.f. n/K_L ~60@E391

Neutron-related Background

- $n+n \rightarrow n+n+\pi^0$ at Core
- $n+n \rightarrow n+n+\pi^0$ at Halo
- As a source of accidental coincidence.

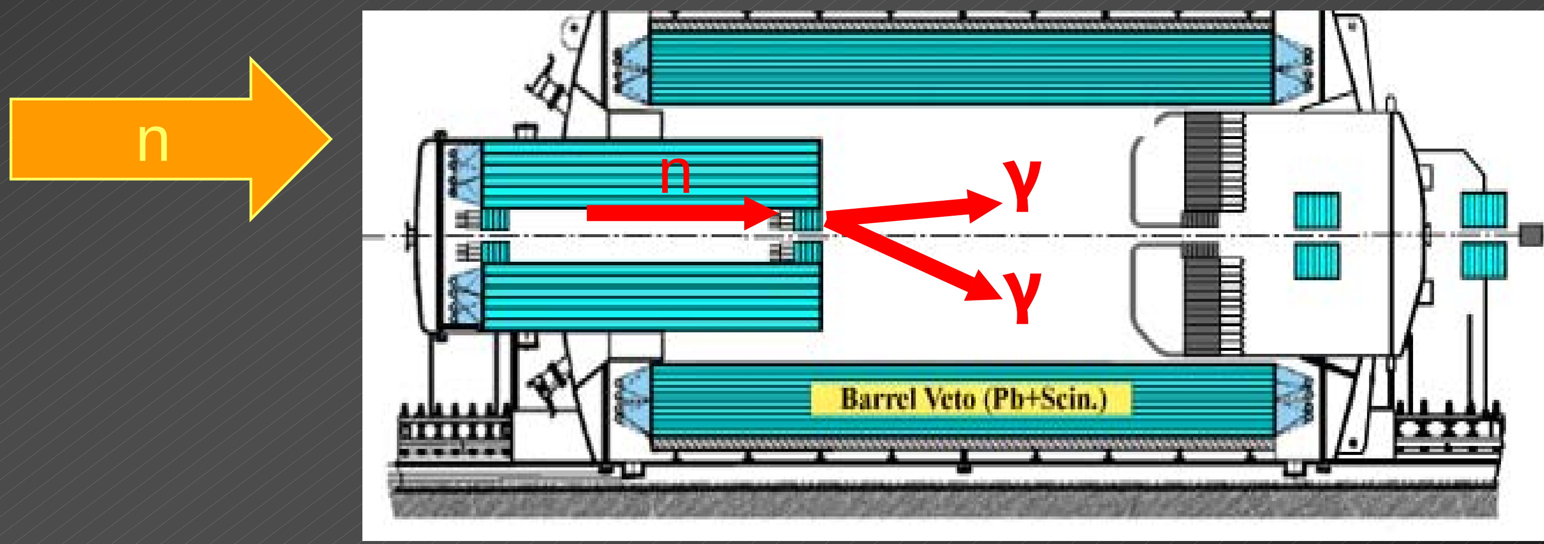
π production by neutron with residual gas

$$n + n \rightarrow n + n + \pi^0 \ldots$$



π production by neutron with detectors

$$n + A \rightarrow \pi^0 + X$$



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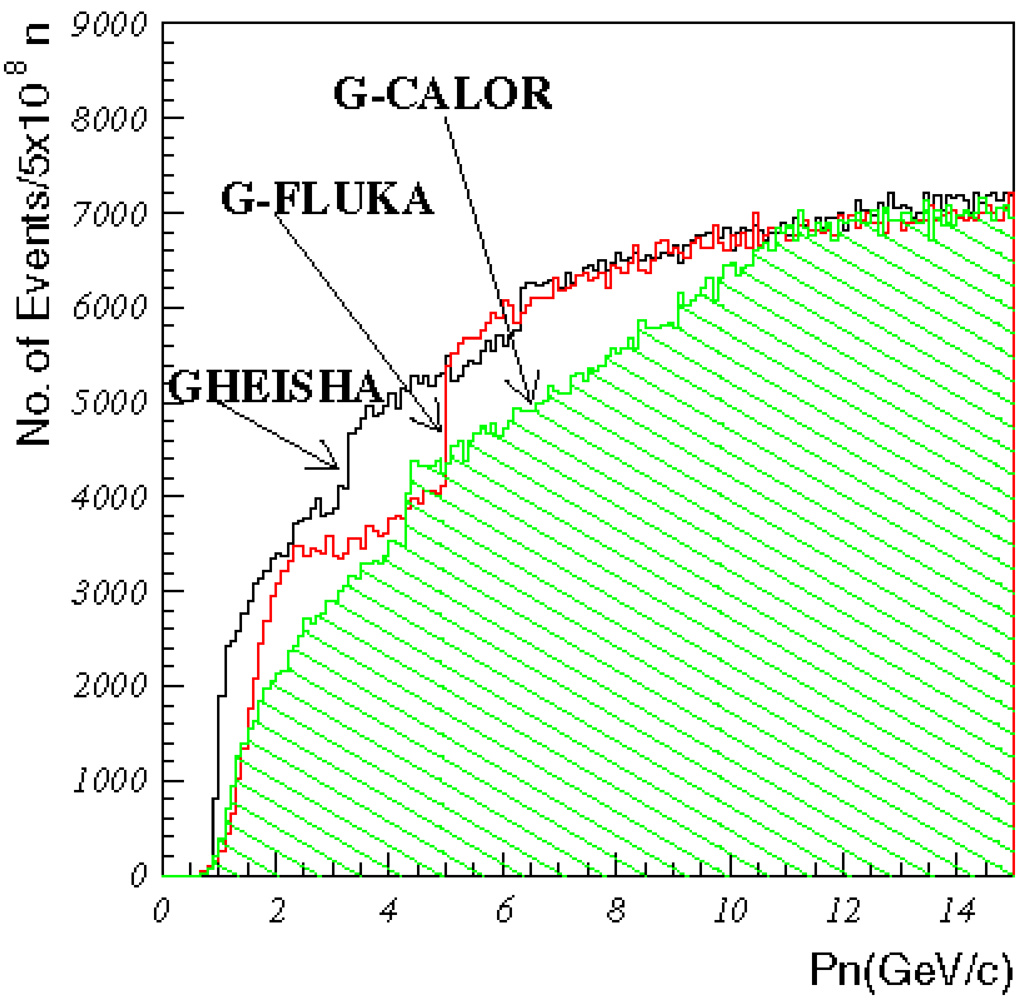
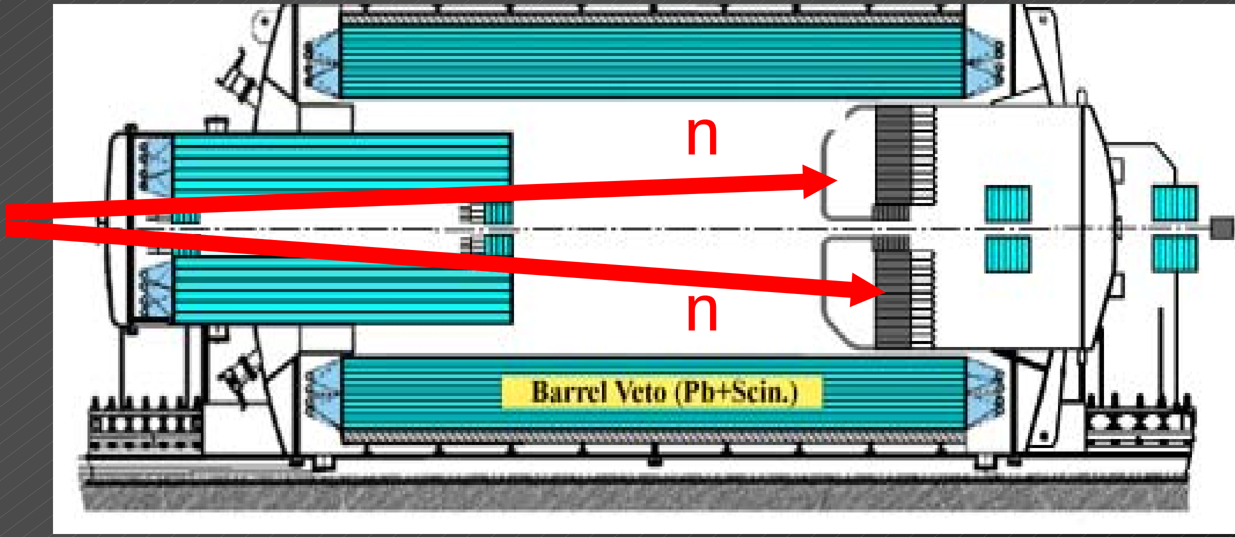
π production rate vs Pn



Accidental Coincidence with halo particles

Even if time window for CsI can open during as short as 1 nsec, 0.1 events B.G. will appear even in the E391a.



Neutron-related Background

- n+n→n+n+π^0 at Core / Halo, or accidental
- → Lower energy is better from B.G. view
- → n/K ratio : Lower is better.
- → Lowest Halo beamline is needed.

Comments for beam-related B.G.'s

n/K ratio : 60 → 14? (En>0.1 and E_K all)

Energy spectrum of n's → Soft

→Signal/B.G is better if same beam condition.

Energy spectrum of KL's → Soft

→ worse of Signal/K_L-B.G. if same detector.

→ Need to improve detector to keep S/N.

Λ : energy is softer + longer beamline (20m ←10m)

- Accidental Coincidence by halos: ← Rate
  - → Add shield or thick veto counter at last collimator.

Some thoughts…

If the **E391a** will show … (Assuming S/B.G. ~ order of 0.1 ~ 10)

Case 1)

KL-related B.G. is reasonably small.

Neutron-related B.G. is dominated.

→ <u>A-line option will be worked.</u>

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Case 2)

KL-related B.G. is dominated or too big.

(Neutron-related B.G. can be handled.)

→ <u>A-line option is hard to use.</u>

(except for new methods to suppress B.G. or

new excellent detector will be succeeded to develop)

→ <u>Go to B-line.</u>

M.C. study ~Energy Spectra~