High-Speed Image Delay Tube

- Motivation
  - Experiments with strangeness at KEK-PS
  - ... and at J-PARC
- High-Speed Image Delay Tube
  - What is it ?
  - Characteristics & Performances expected
- R&D present status
- Next step

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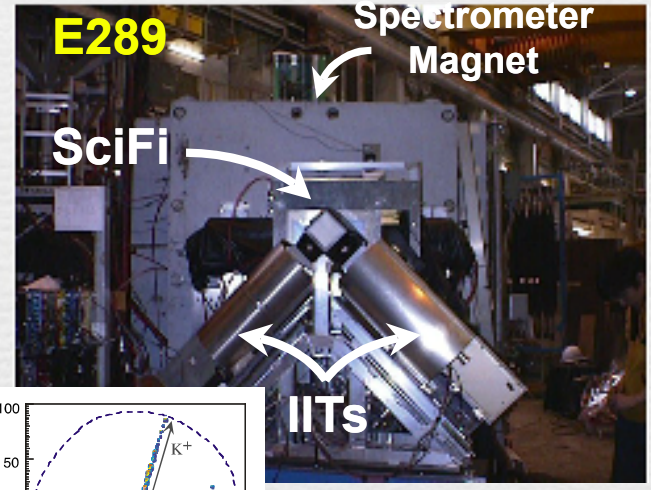
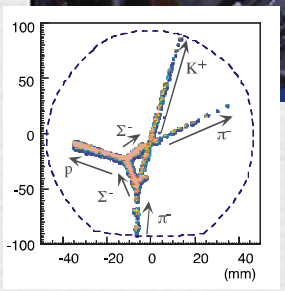
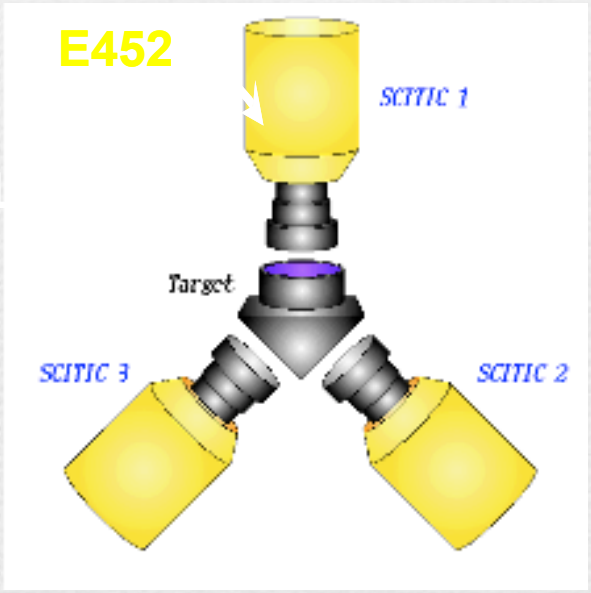
2013.09.12

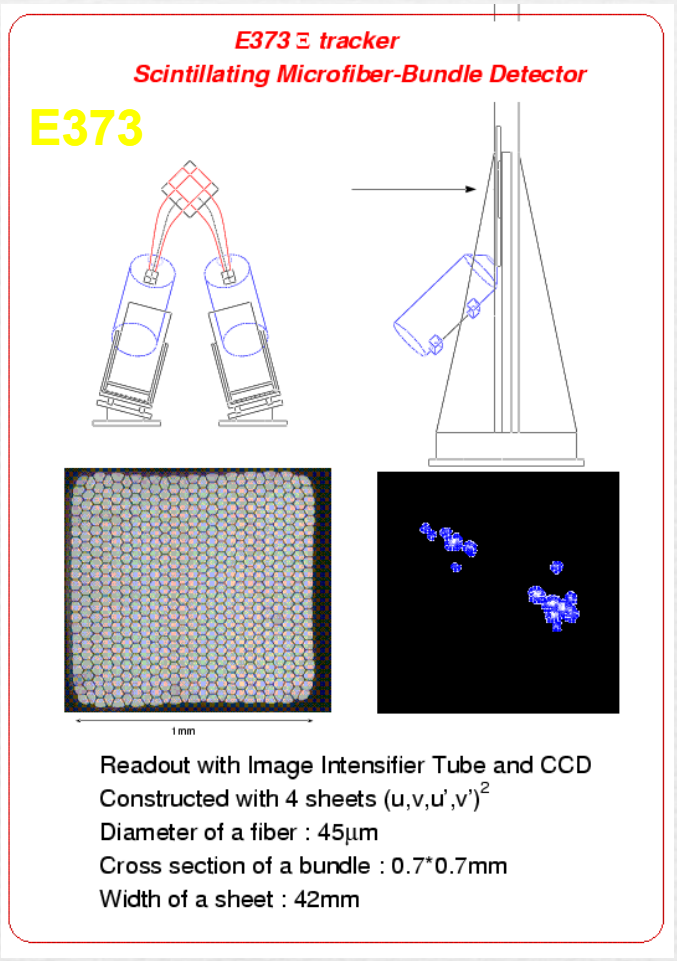
Motivation
- Experiments at KEK-PS -

- reaction/scattering & decay of Strange particles







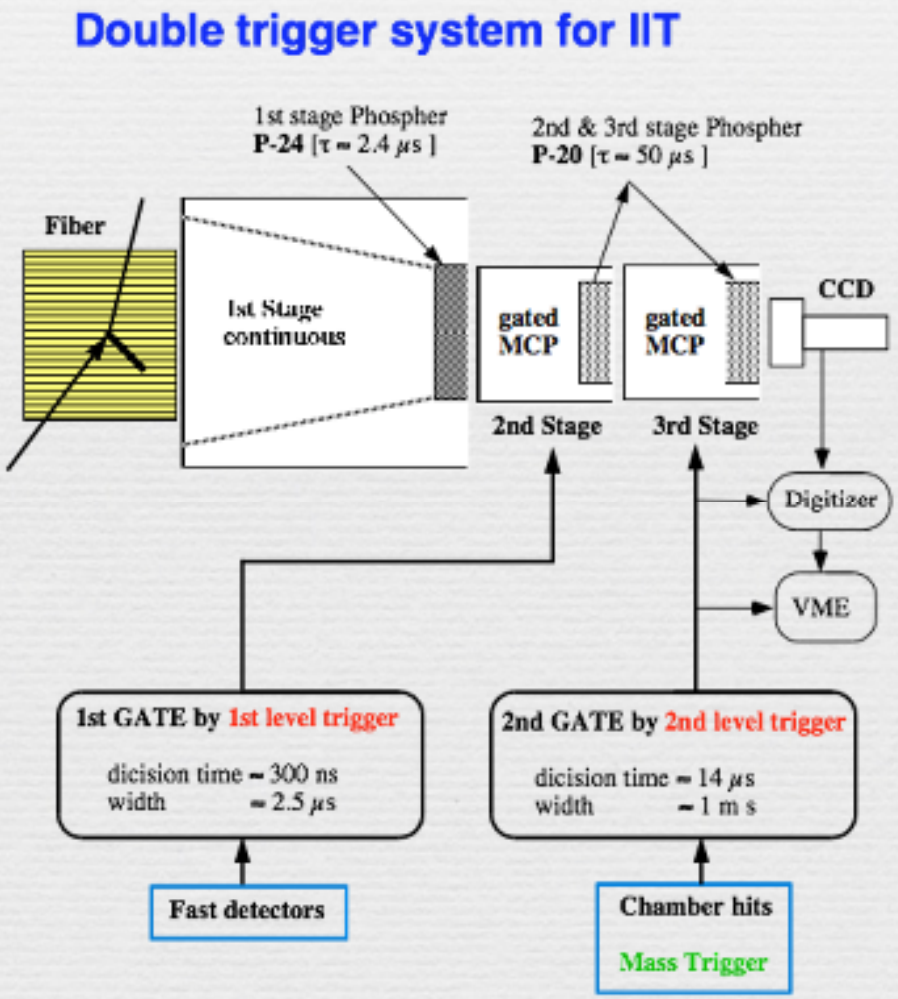


Scintillating Fiber Block (or Liquid Scintillator) with IIT-CCD Camera triggered by Spectrometer system

Motivation
- Experiments at KEK-PS -

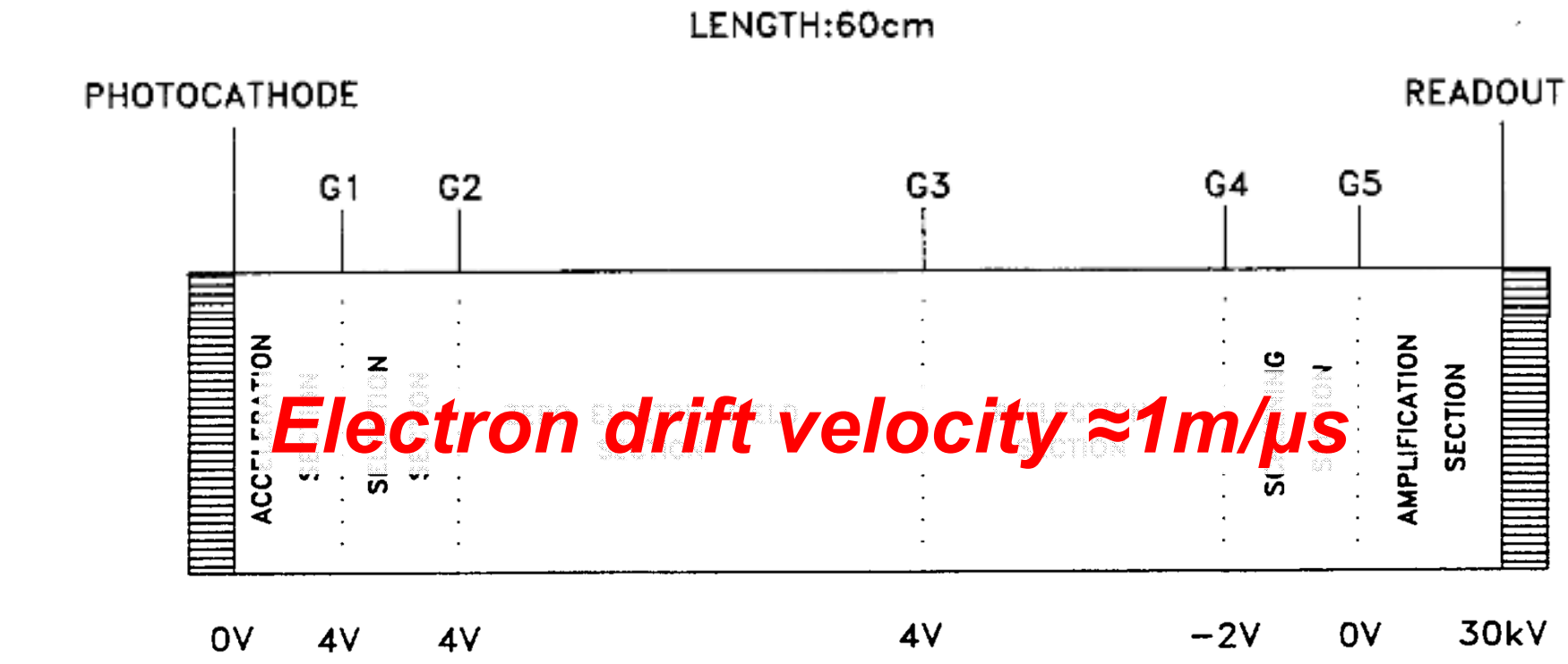
- IIT & Triggers
  - Phosphor Decay Time
    – a few μs
  - Decision Time
    – several hundreds ns
  - CCD image handling
    – several tens ms

Beam rate ≤ 10^5Hz

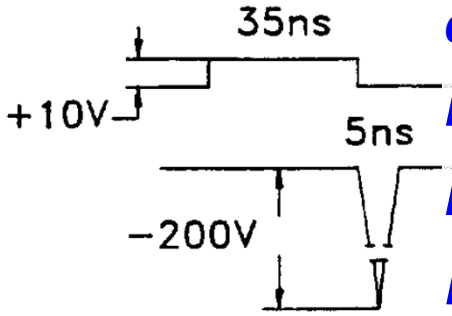


High-Speed Image Delay Tube

- What is it ? -



Electron drift velocity ≈1m/μs



during decision time ...

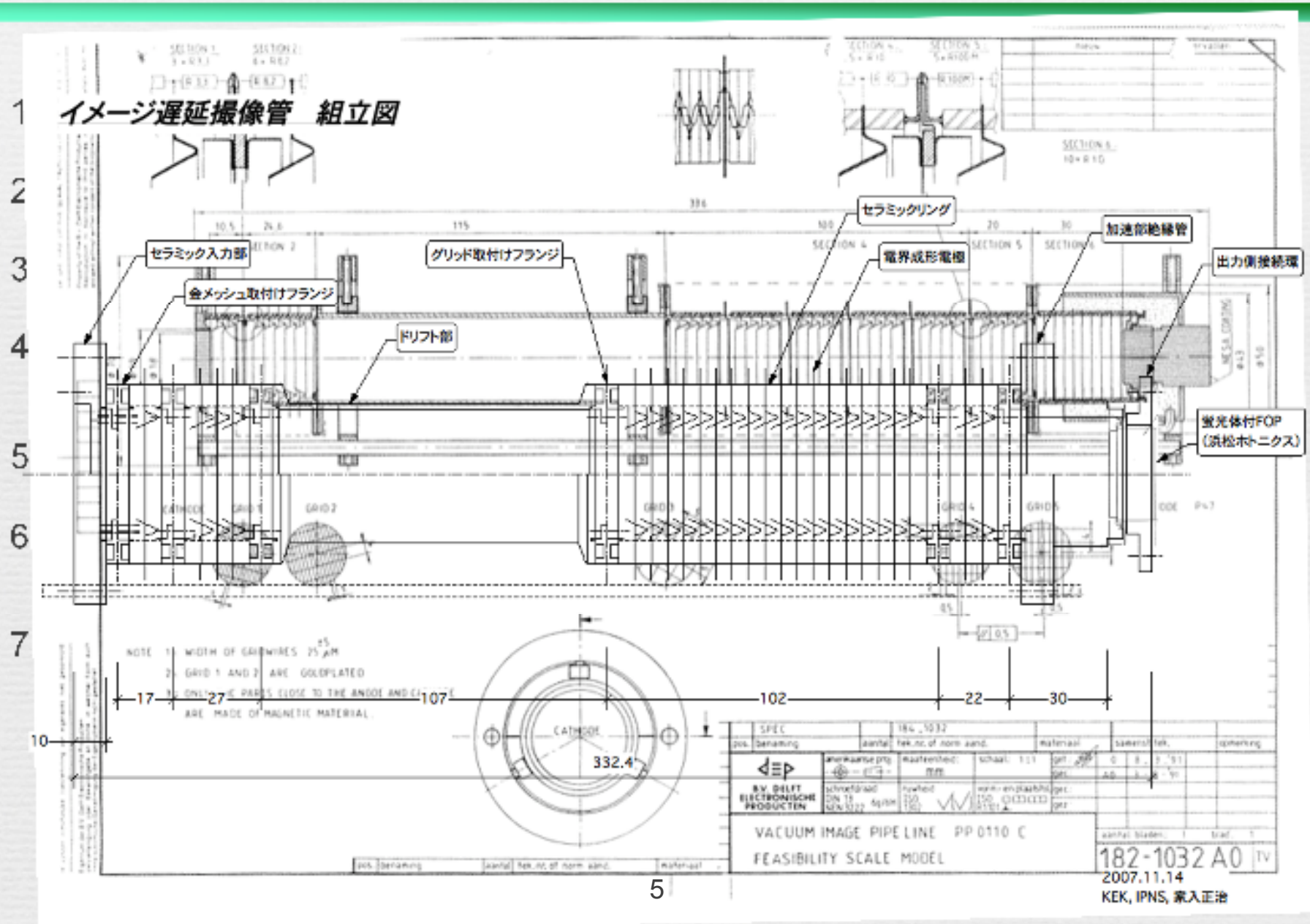
keep data

by using electron drift,

not by phosphor decay time

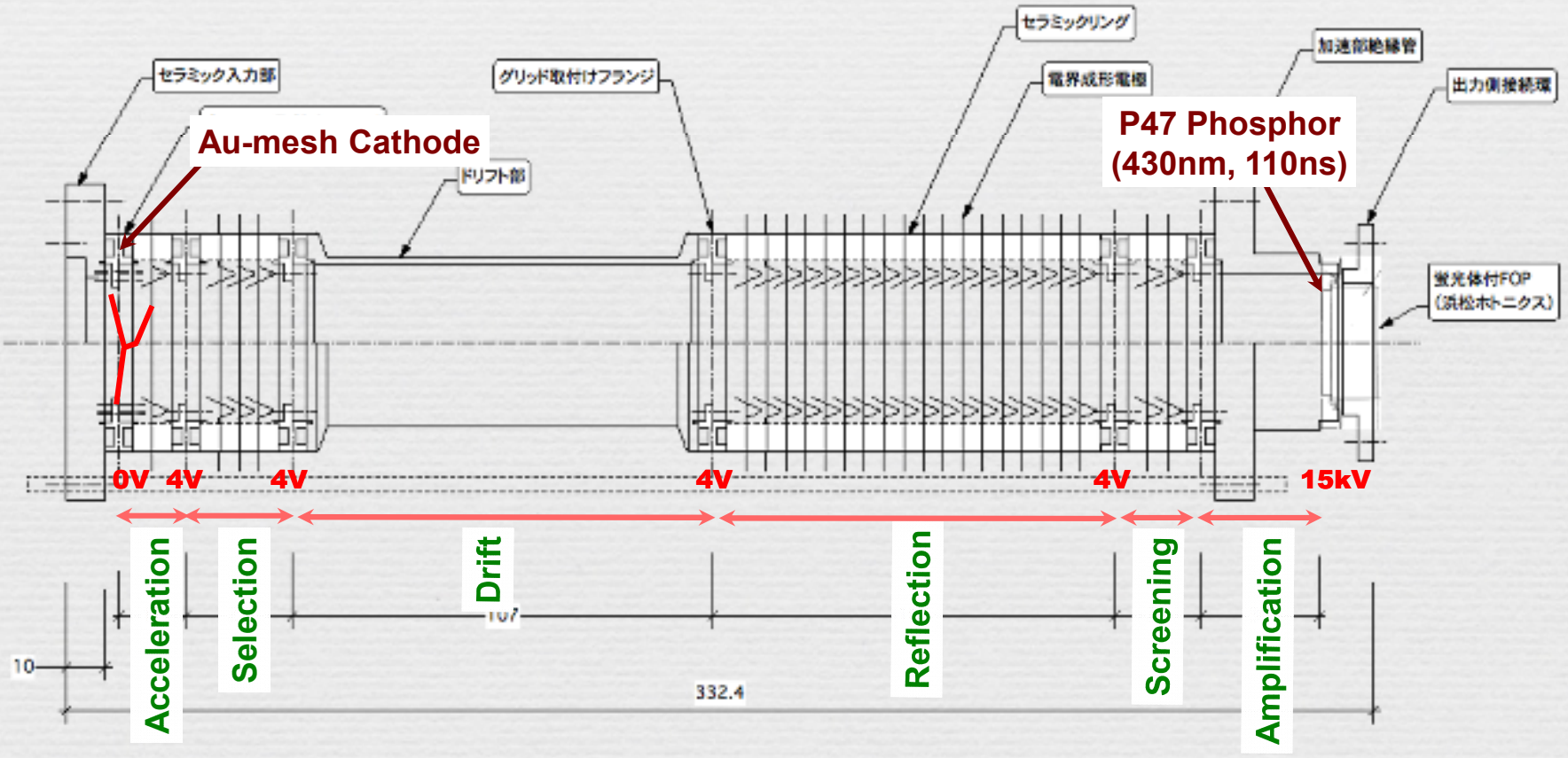
R & D at KEK

- since 2006 -



Operation modes : 1

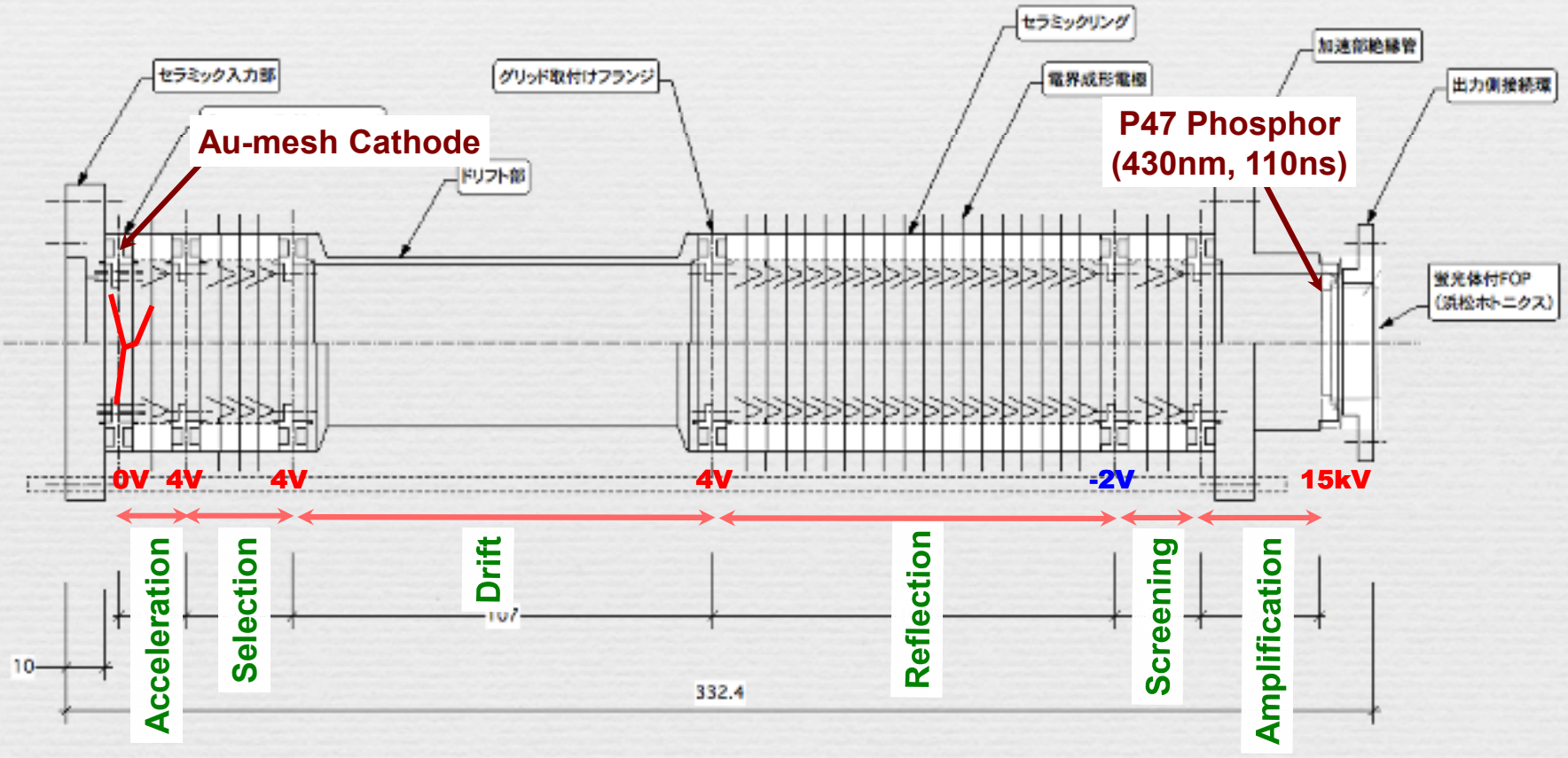
No reflection (continuous)



2007.11.14
KEK, IPNS, 栗入正治

Operation modes : 2

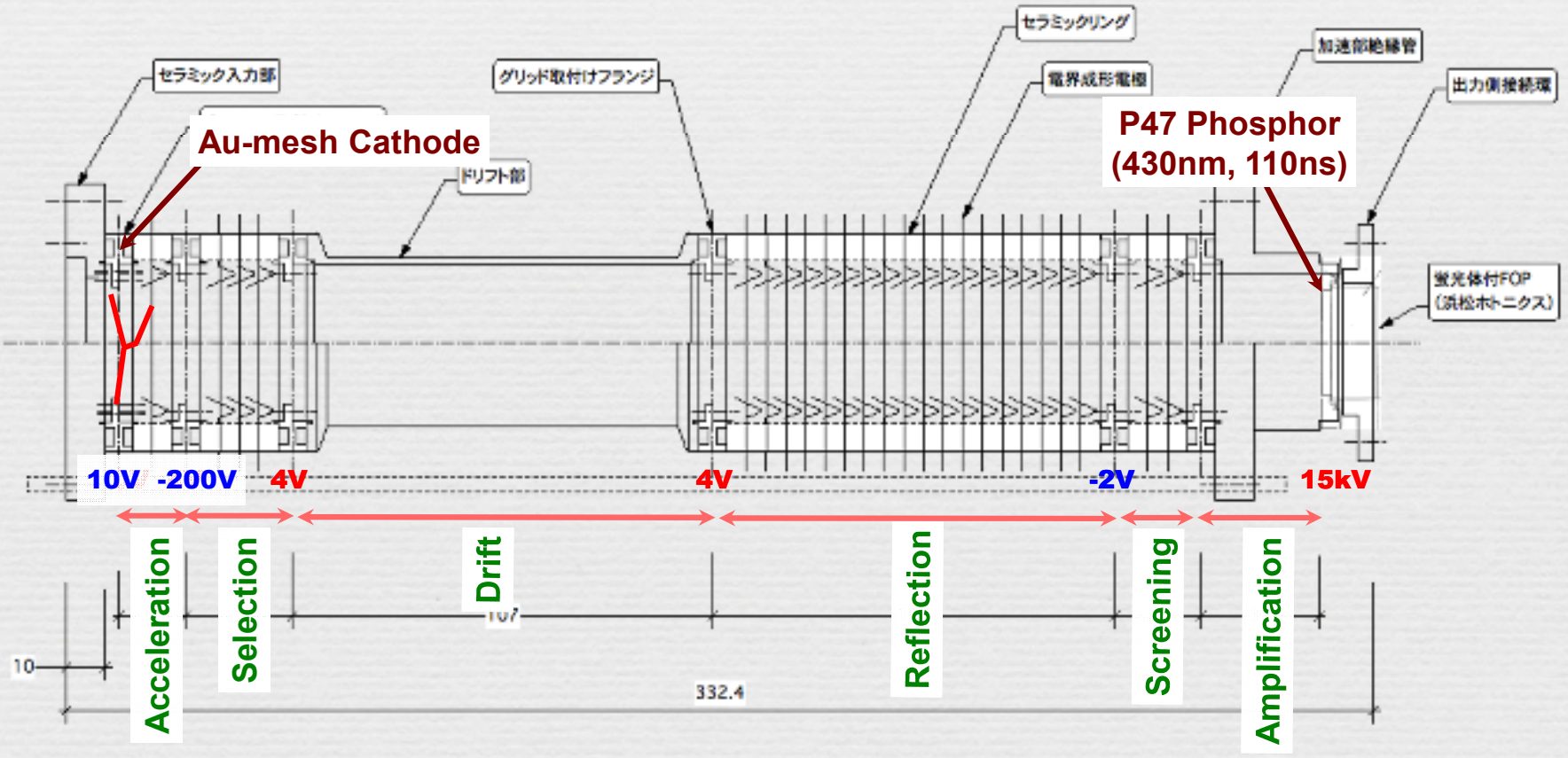
Image Elimination



2007.11.14
KEK, IPNS, 栗入正治

Operation modes : 3

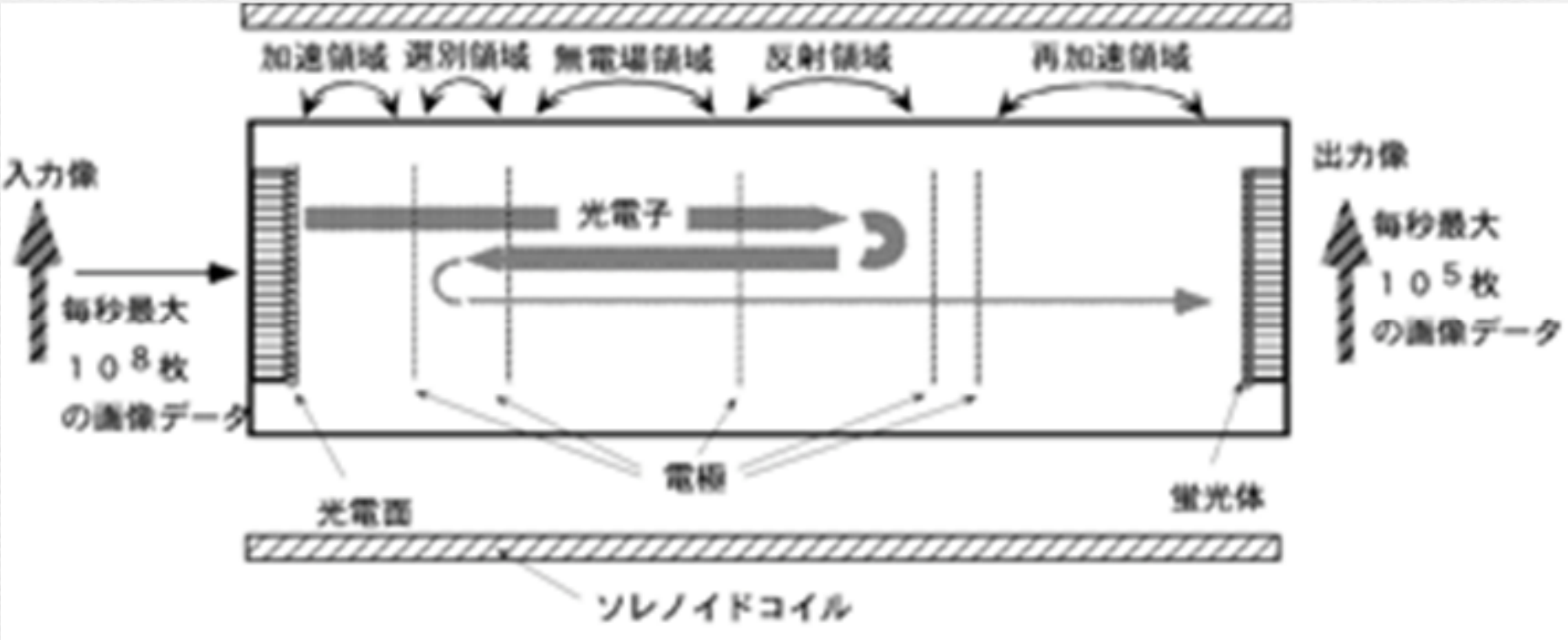
Image Selection



2007.11.14
KEK, IPNS, 素入正治

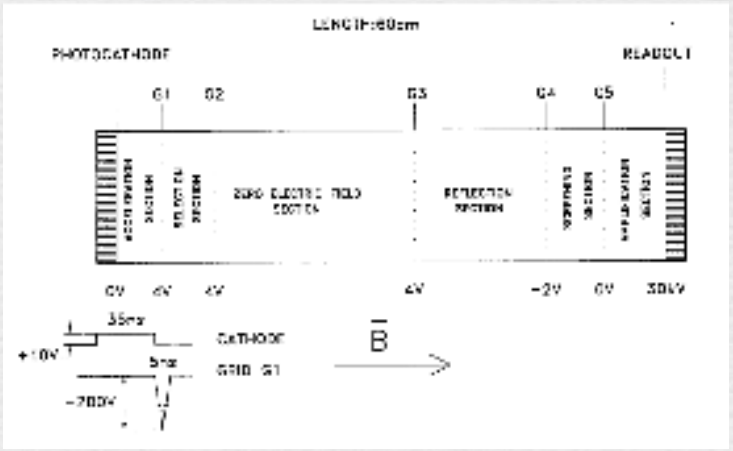
High-Speed Image Delay Tube

- Basic scheme: addendum -



High-Speed Image Delay Tube
- Performance & Characteristic -

- Main features (CERN/LAA-SF91-3)
  - a good detection efficiency
  - a delay capability to wait for the first-level trigger decision
  - a space resolution which is comparable with that of the fibers (≤30μm)
  - an intrinsic time resolution (≈10ns) which minimizes the mixing of successive images
  - gating facilities to select triggered events (data reduction ≈10^{-3})
- At J-PARC
  - 10^{7} $K^{\pm}$/s can be acceptable
  - $10^{8(9)}$ $\pi^{\pm}$/s would be O.K.

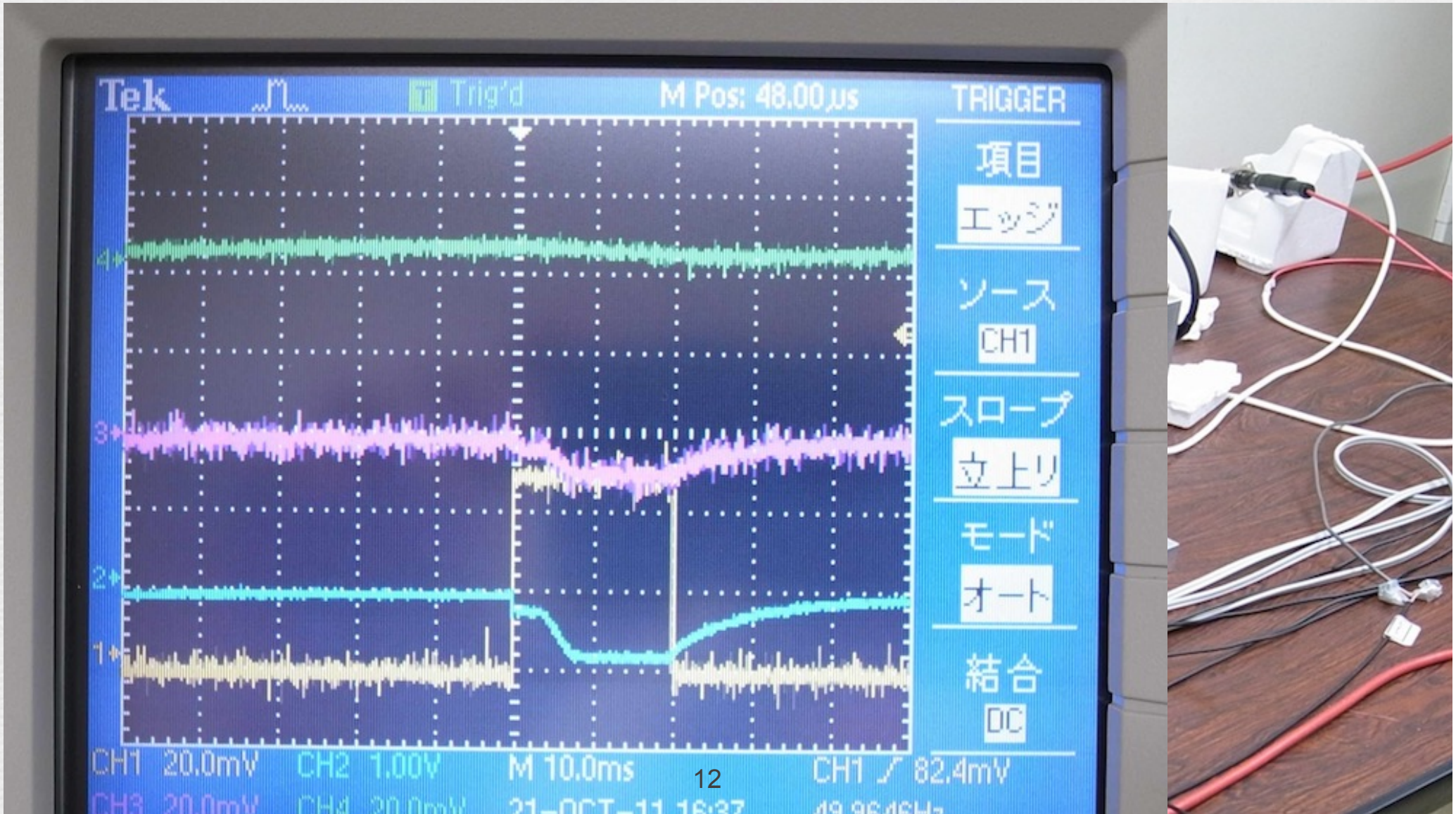


R & D at KEK

- assemble -

R & D at KEK

- Present status -



Signal test ..just started ... ?

Next Step

- Basic performance of reflection & gating
- spatial resolution
- short reflecting pulse power supply : - 200~300V with 5ns width
- Selecting photocathode : Au
- optimization : I/O window size and tube length
- readout device

Summary

- High-Speed Image Delay Tube (made in Japan) will soon be available
  - Delay capability, Intrinsic time resolution of ≈10ns,
    Data reduction ≈10^{-3}, Space resolution of ≤30μm,
    Good efficiency ...
- Next step
  - Fast readout device keeping good space resolution with large area
- Apply to a new experiment
  - Double Strangeness System
  - YN scattering
  - ... think about new application ...