

# Status of BSM Gamma Detector

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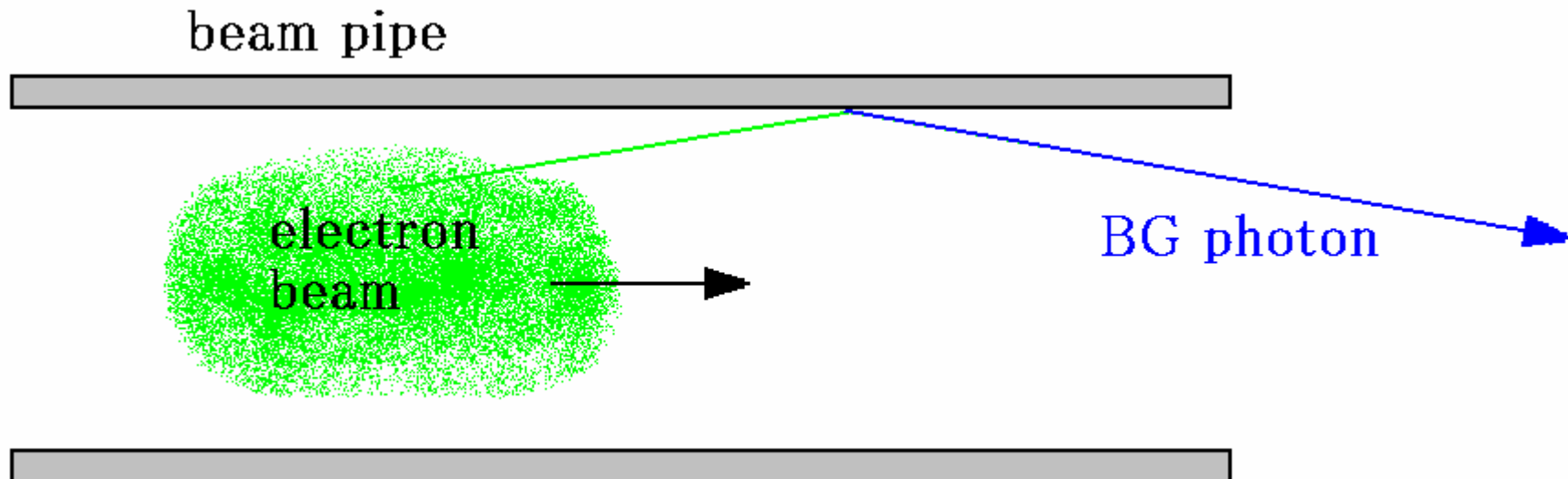
# Overview

# Goals

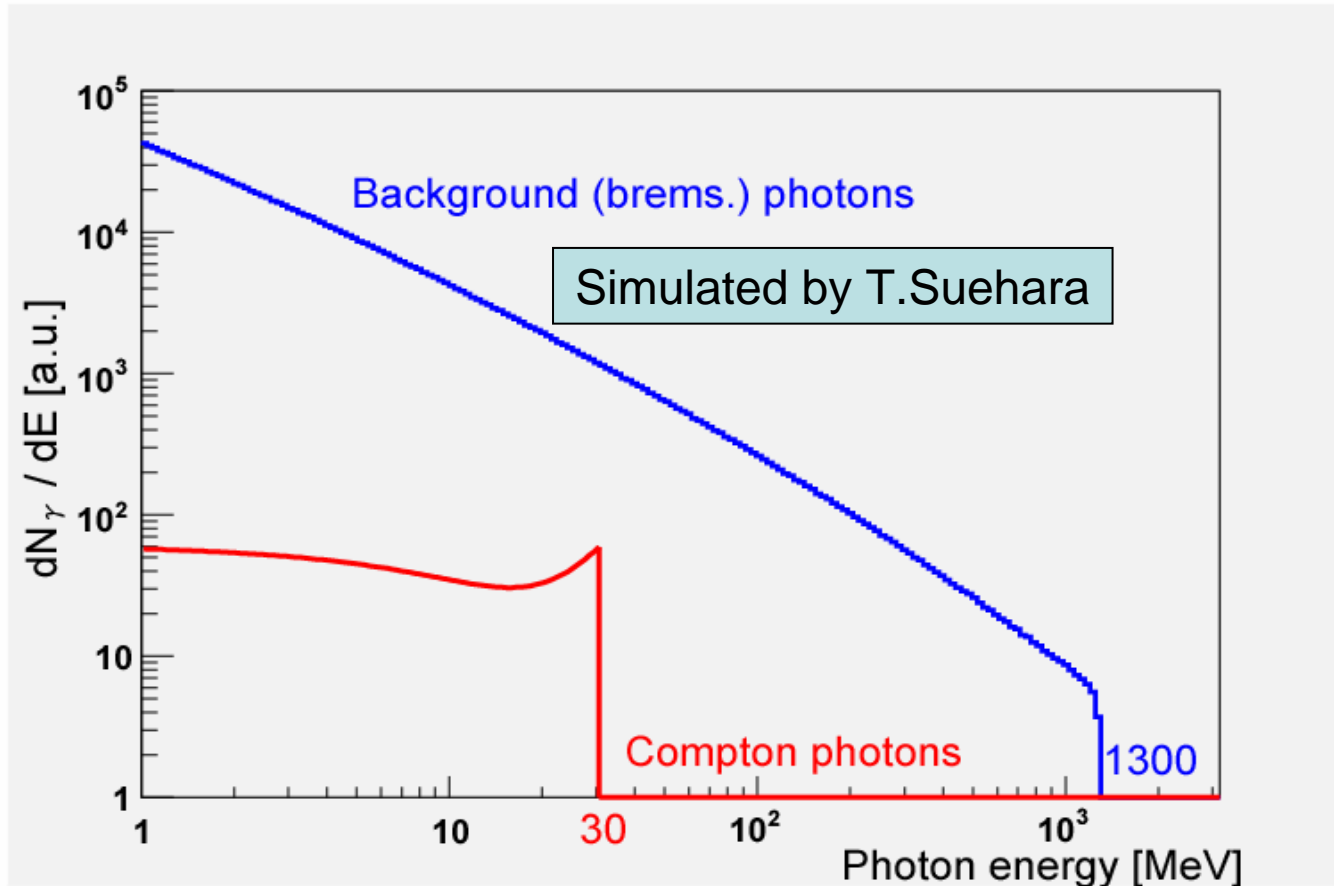
- Detect the amount of gamma-ray from Shintake-monitor(BSM) precisely
- Develop background resistive detector

# Major background source

- Beam halo scattering with beam pipe
  - High energy ( $\leq$  beam energy: 1.3GeV)
  - High rate ?
  - Spatial distribution is not understood well

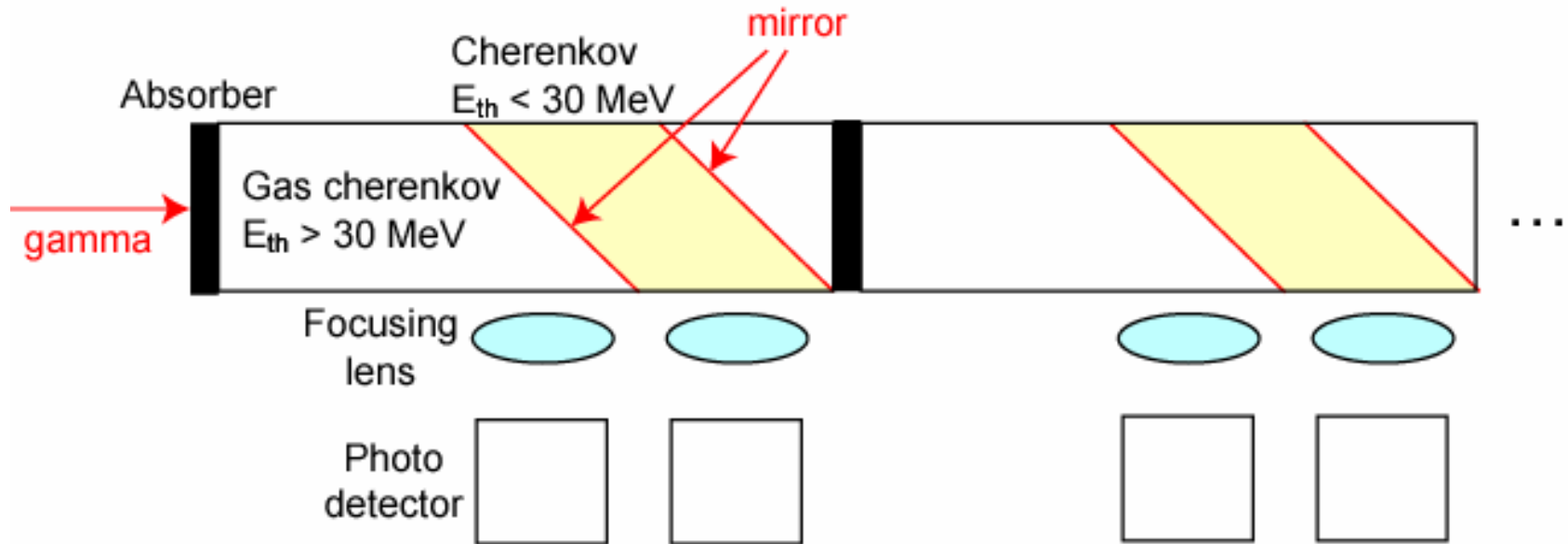


# Photon energy distribution



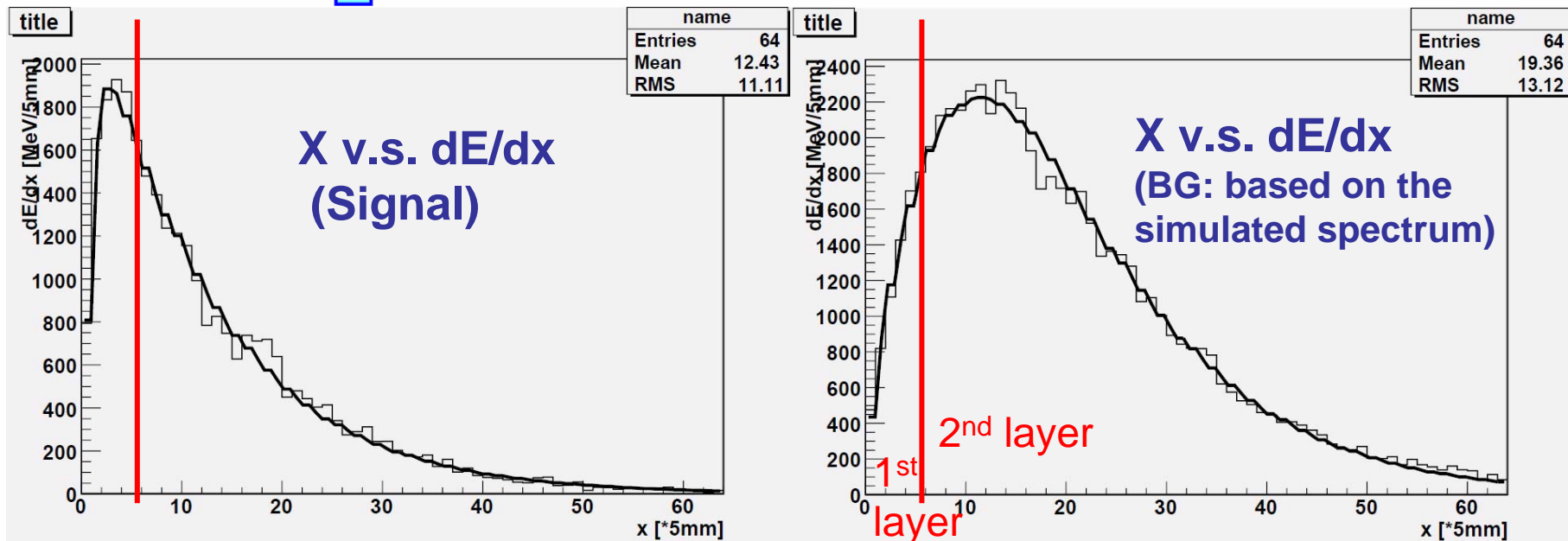
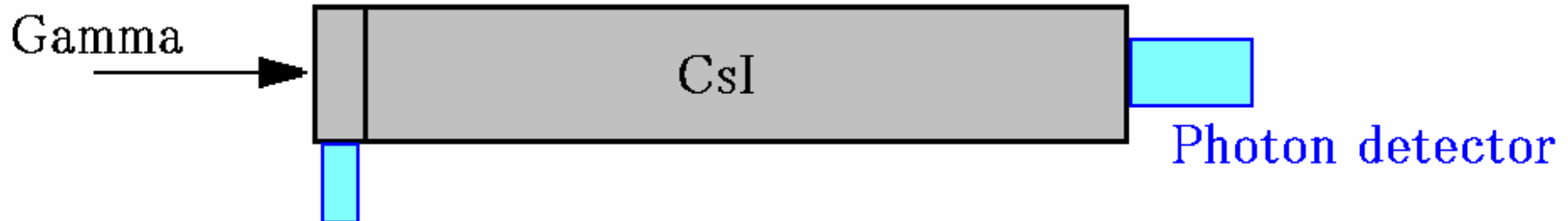
- Maximum energy of BG photons is 40 times higher than that of Compton photons !!

# Detector idea (1)



- Multi material Cherenkov detector
    - Needs space (~2m)
    - Small number of emitted photons
- **not realistic !!**

# Detector idea (2)

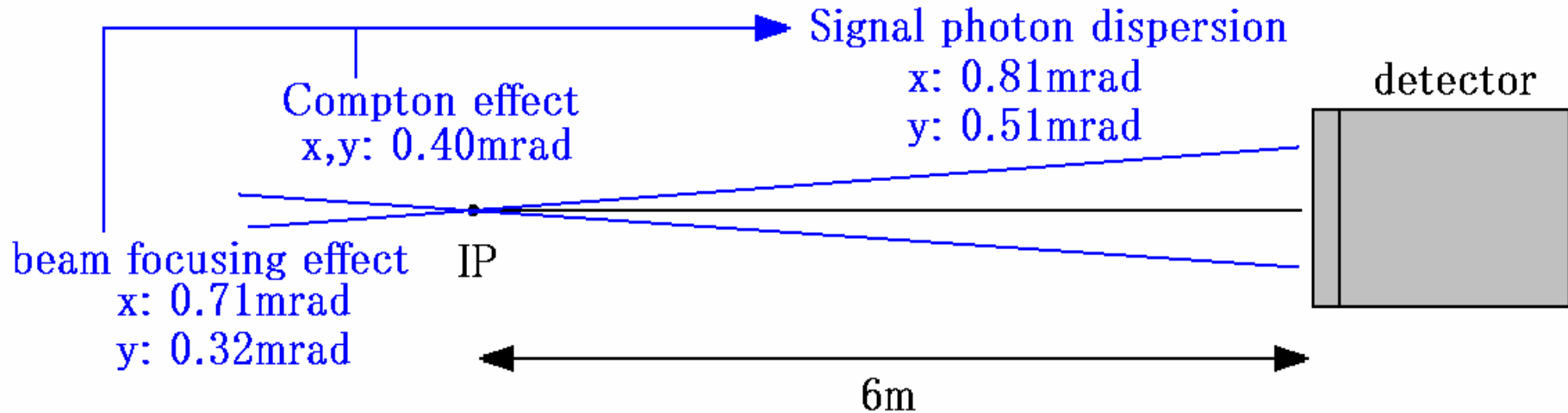


- Two layer Scintillator(CsI)
- Signal/BG mainly deposits energy in 1<sup>st</sup>/2<sup>nd</sup> layer

# Simulation study



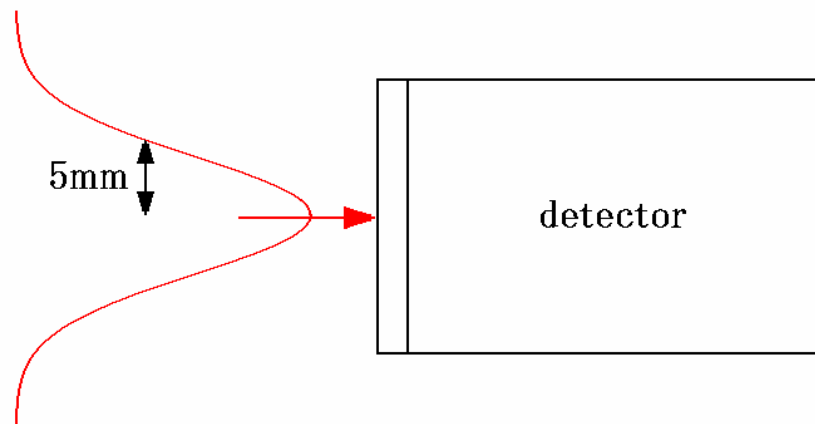
# Conditions of simulation (1)



- Based on the actual geometry of ATF2
- Condition of Signal photons:
  - Emitted angular distributions are due to combined effects of
    - Beam focusing
    - Compton scattering

# Conditions of simulation (2)

- Condition of BG photons:
  - Spatial distribution is not understood well
    - **Assuming ...**
      - Gaussian distribution in x and y
      - Mean of distribution is at the center of the detector surface
      - Standard deviation is 5mm



# Detector geometry

- Detector geometry

- 1<sup>st</sup> layer :

- CsI  $2a \times a \times 2 \text{ cm}^3$

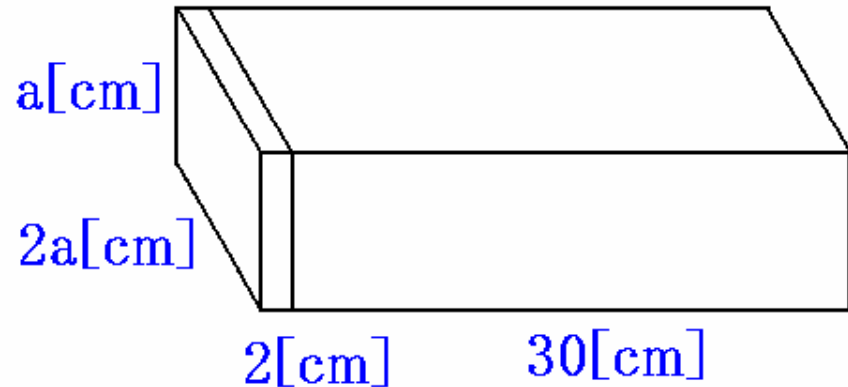
- 2<sup>nd</sup> layer :

- CsI  $2a \times a \times 30 \text{ cm}^3$

(  $a=1, 2, 3, 4, 5, 7, 10$  )

- cf. radiation length of CsI: 1.85cm

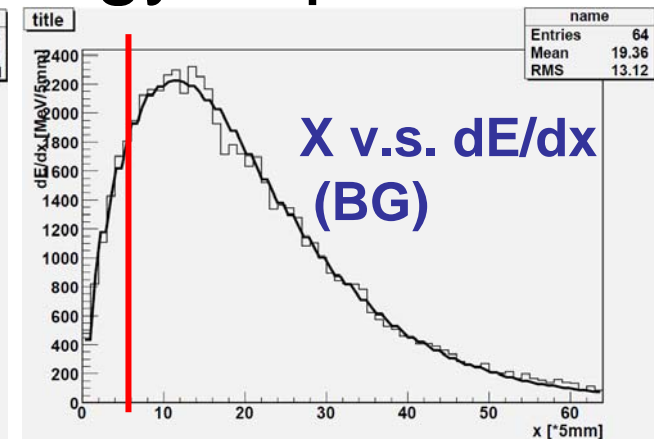
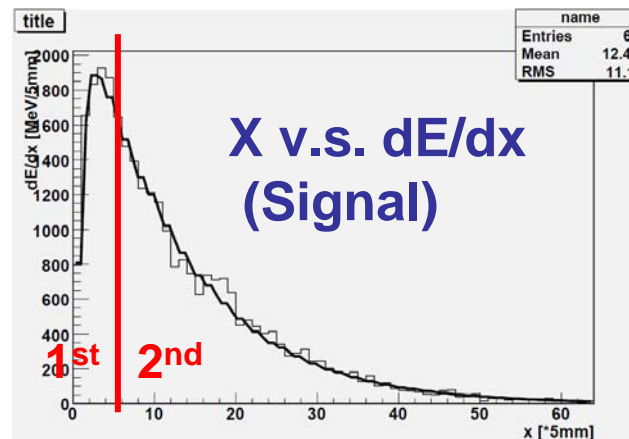
- 30cm = 16.2 radiation length :enough long



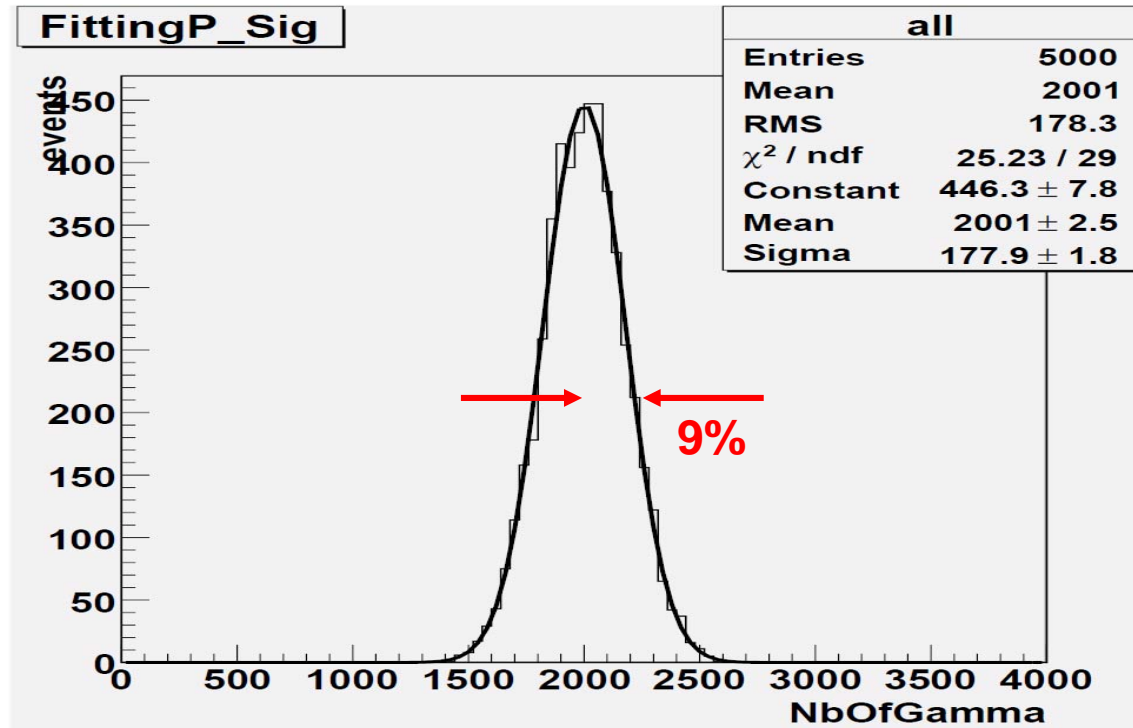
# Analysis methods

- Assume that a bunch contains 2000 Signal photons & 1000 BG photons
- Get number of Signal photons ( $N_s$ ) from total energy deposit of the bunch  
( compare  $N_s$  with 2000 later !! )  
by using the difference of energy deposit

patterns  
in Signal  
and BG

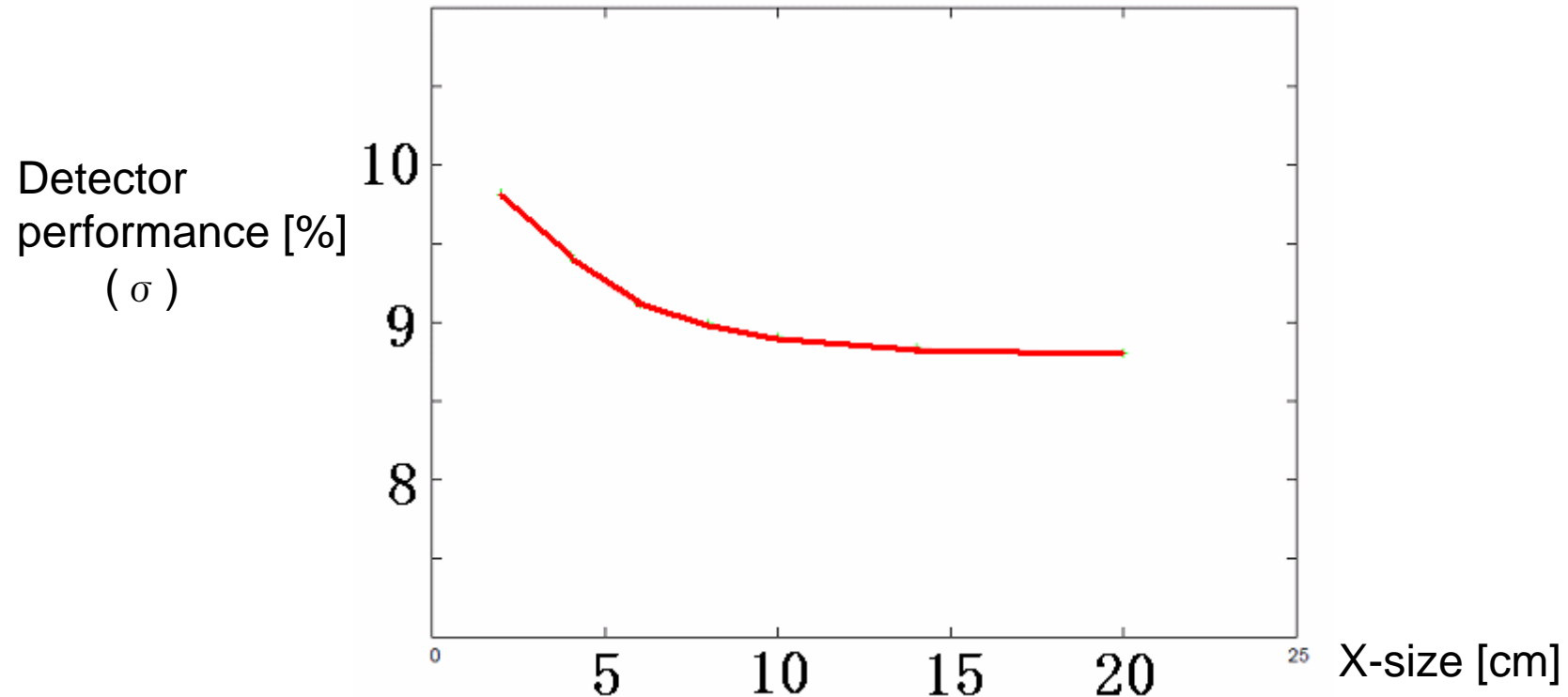


# Result (1)



- Check the fluctuation of  $N_s$ ;  
it shows performance of the detector  
→ The amount of Signal photons can be measured with 9% error ( $\sigma \sim 9\%$ )

# Result (2)

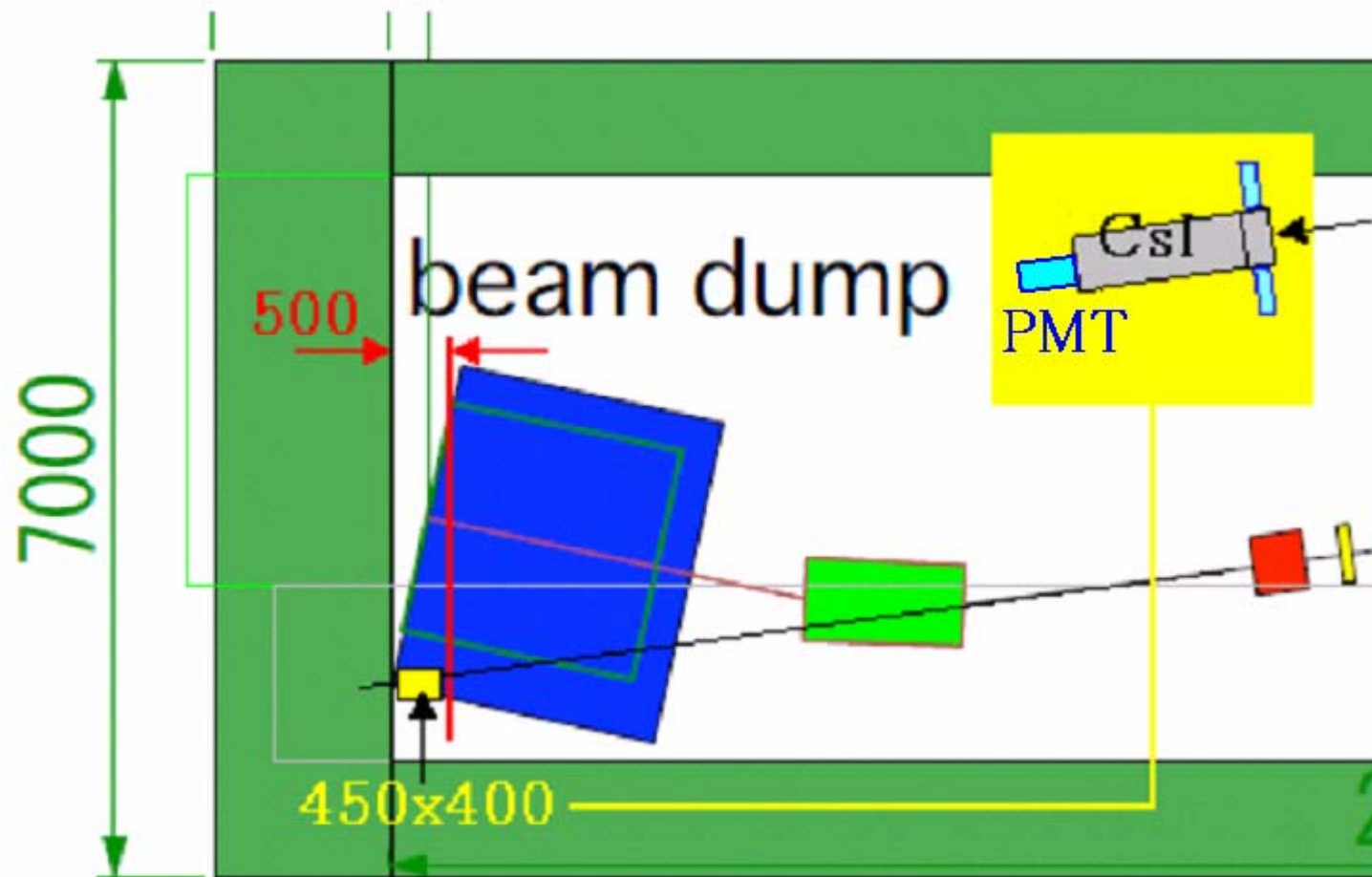


- Need 10x5x30 cm<sup>3</sup> or more larger CsI scintillator
- Total length of detector (scintillator + PMT) is about 50cm

# Plans and summary

# Detector layout plan

- Remove a part of beam dump or shift the dump ?





# Future prospects

- In next year
  - ~Mar. Prototype making
  - ~Jun. Prototype test (with cosmic ray, beam, ...)
  - ~Sep. Detector making
  - ~Nov. Detector test

# Summary

- The idea of detector is two layer CsI
- The amount of Signal photons can be measured with 9% error (if  $S/N = 2$ )
- The performance of detector largely depends on the amount of BG photons
- Features of BG photons are not understood well
- More and more BG study is necessary