

Hybrid Target R&D at KEK-LINAC

T.Takahashi

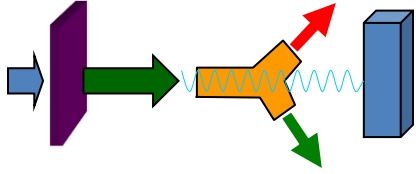
Hiroshima University

25 Septemer 2012

LCWS2012, Arlington, TX

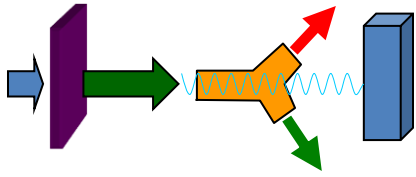
Collaborators:

V. Strakhovenko O. Dadoun, R. Chehab, A.Variola, L. Rinolfi, O. Dadoun, T.Kamitani, T.Suwada, T.Omori, J.Urakawa, K.Furukawa, K.Umemori, M.Satoh, T.Sugimura, S.Kawada, T.Akagi, Y. Uesugi



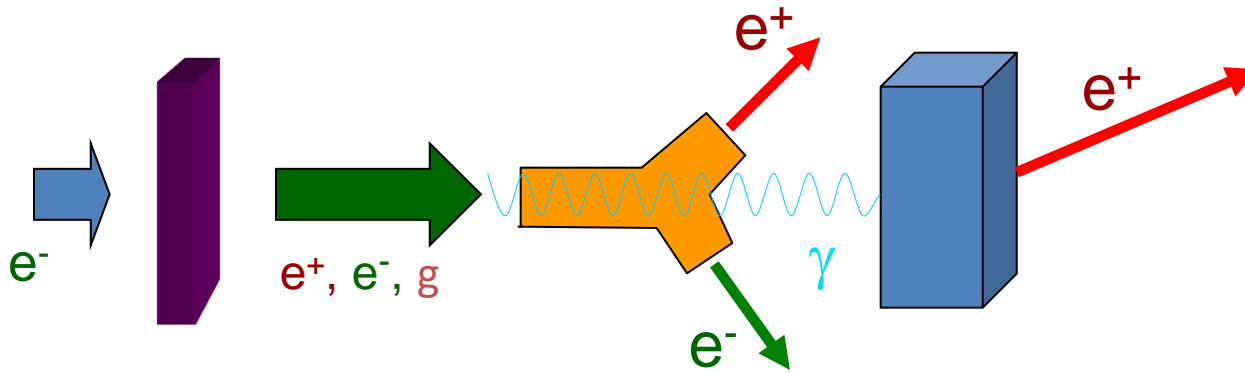
Contents

- Status of previous experiments
- Temperature measurement 2012 January
- Prospects

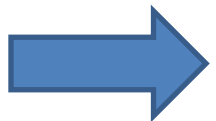


Hybrid target for positron source

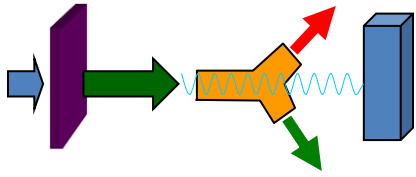
- A way to reduce thermal load in positron targets
 - proposed by Chehab, Variola, Strakhovenko



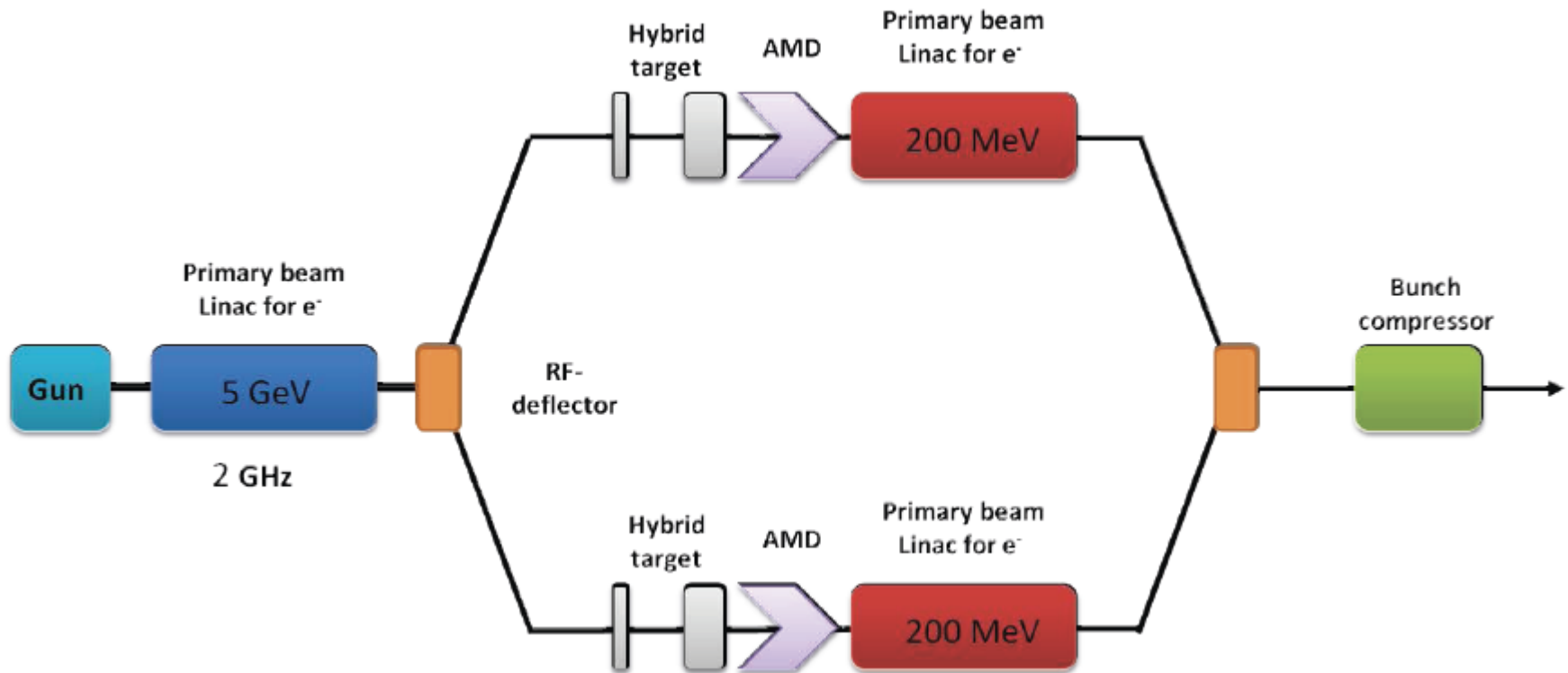
- -> Experimental study to
 - accumulate data on e^+ yields, heat deposit,,,

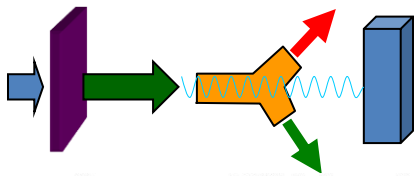


Feasibility as a positron source for LCs



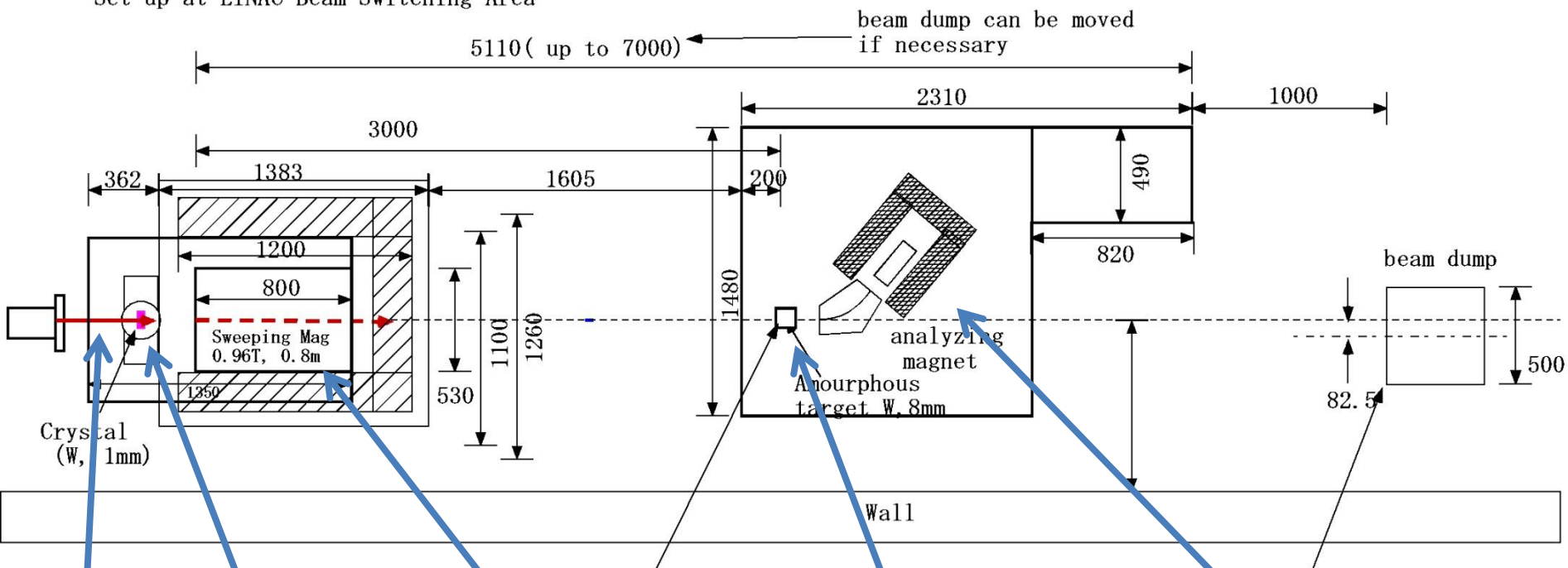
hybrid souce for CLIC





Setup

Set up at LINAC Beam Switching Area



beam dump can be moved if necessary

5110 (up to 7000)

3000

2310

1000

362

1383

1605

200

490

1200

800

820

Sweeping Mag
0.96T, 0.8m

analyzing magnet
Amorphous target W, 8mm

beam dump

Crystal
(W, 1mm)

1100
1260
530

82.5

500

Wall

8GeV e-

1mm
W crystal

Sweeping Magnet
0.96T 0.75m

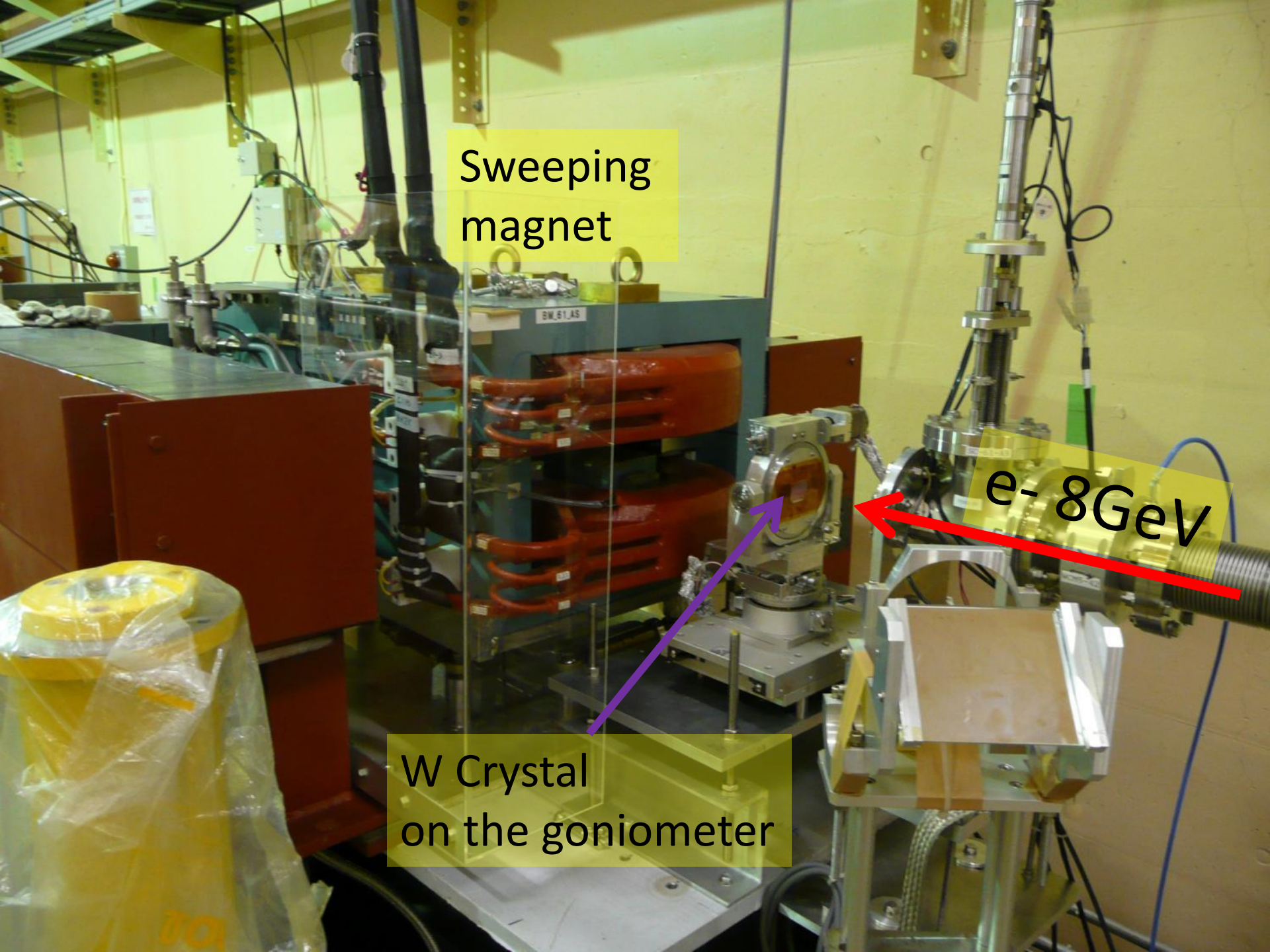
amorphous W
8 mm
18 mm

Analyzing magnet
5 ~ 30MeV

Sweeping magnet

e^- 8GeV

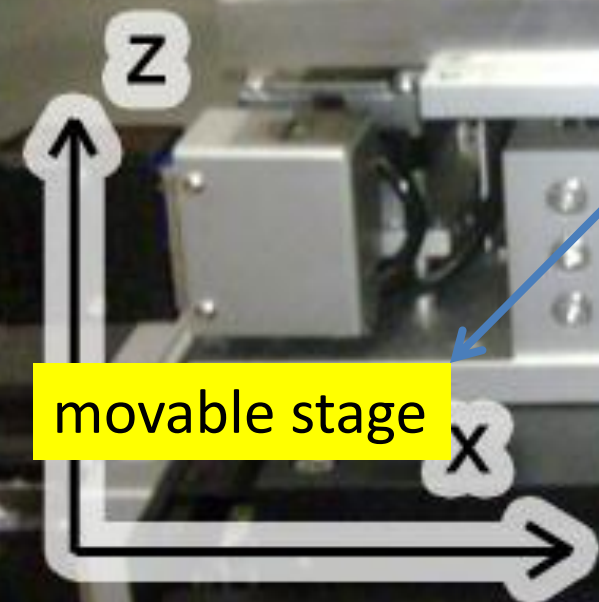
W Crystal
on the goniometer



1.75mm 3.5mm 5.25mm 8mm 18mm

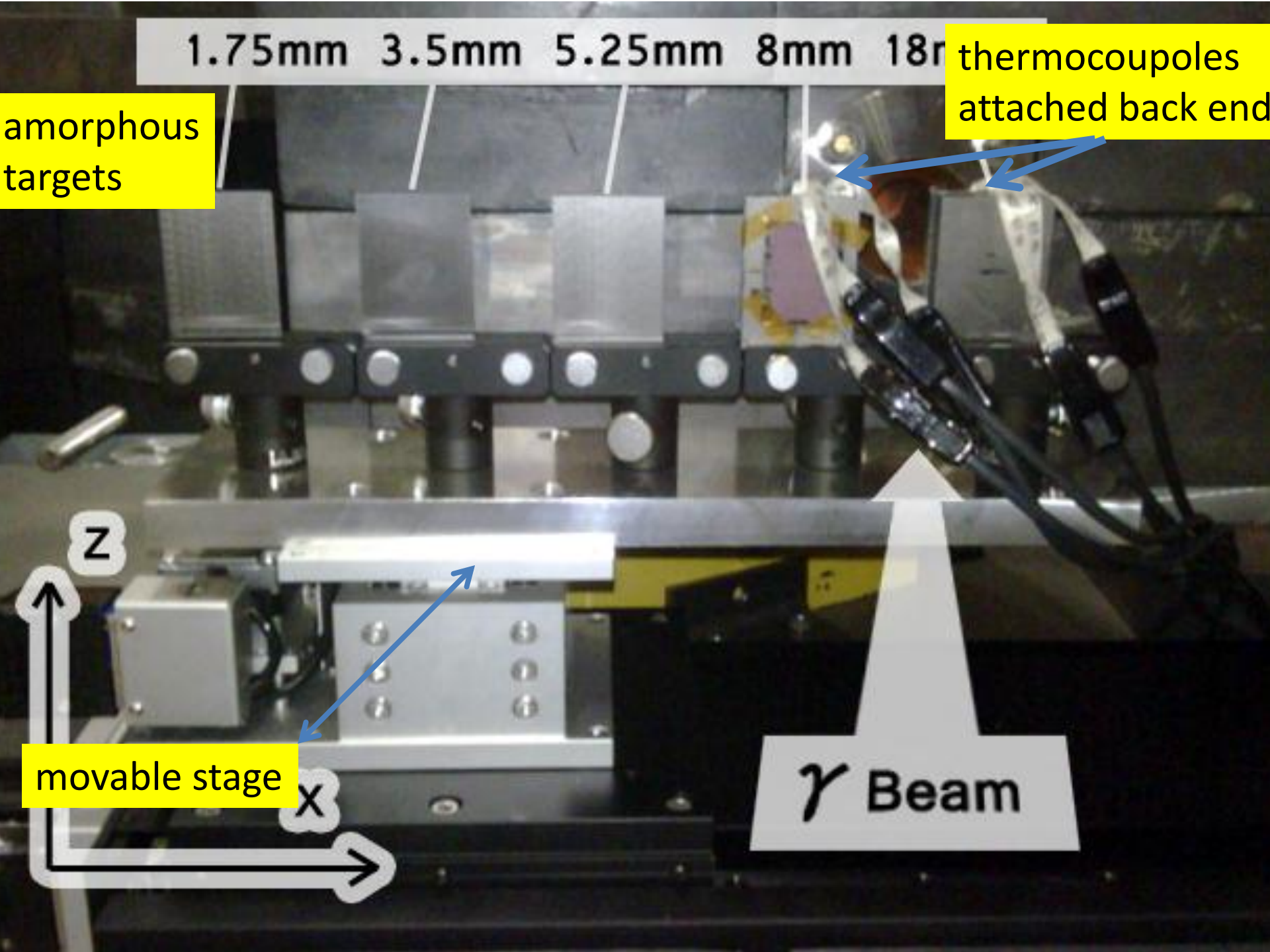
amorphous targets

thermocouples attached back end

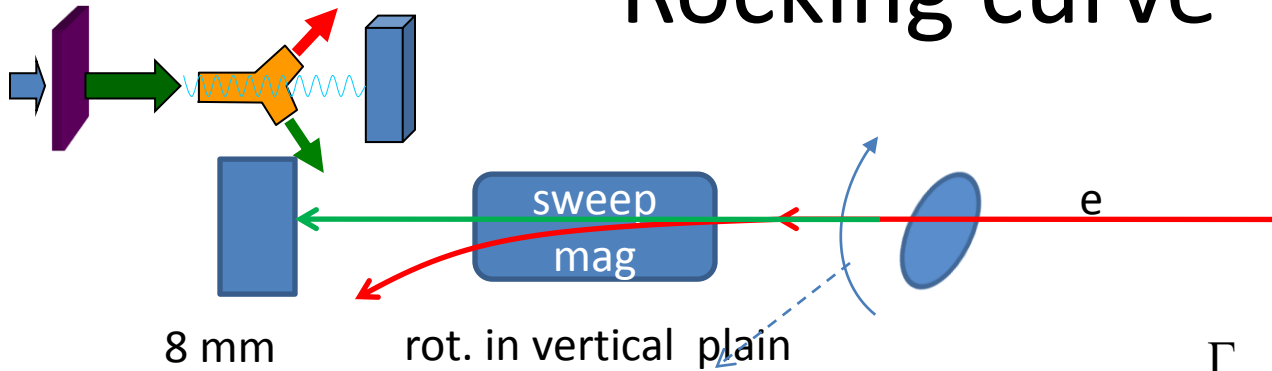


movable stage

γ Beam



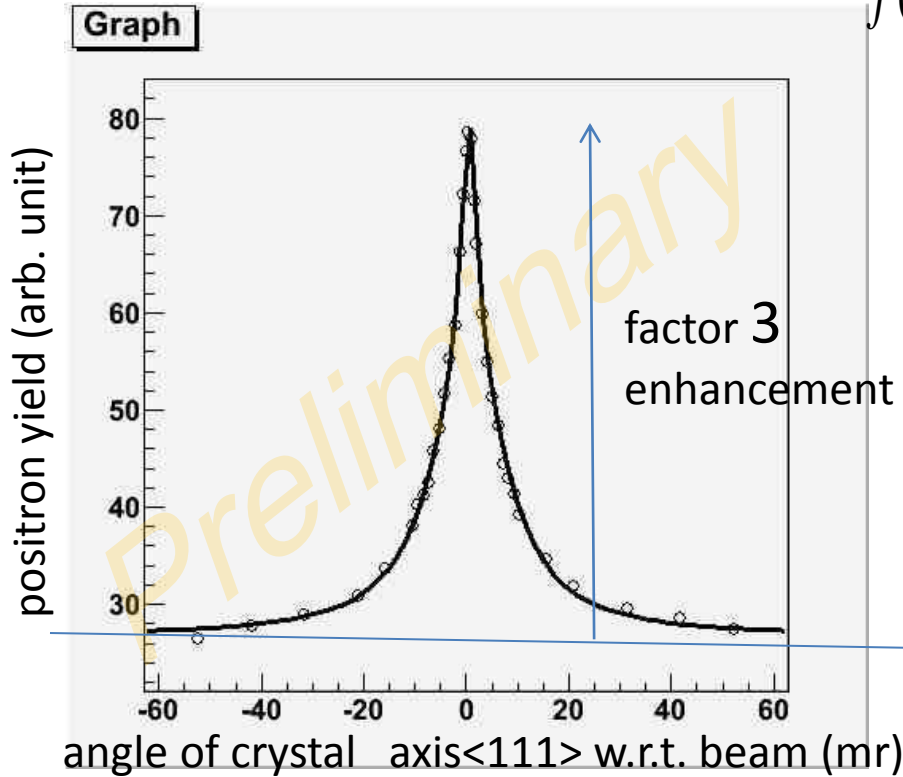
Rocking curve



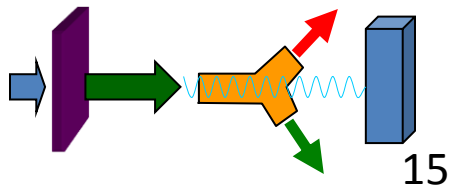
$$f(\theta) = A \frac{\Gamma_1}{(\theta - \langle \theta \rangle)^2 + \Gamma_1^2} + B \frac{\Gamma_2}{(\theta - \langle \theta \rangle)^2 + \Gamma_2^2} + Const$$

$$\Gamma_1 = 3.4 \pm 0.1$$

$$\Gamma_2 = 17.7 \pm 0.4$$

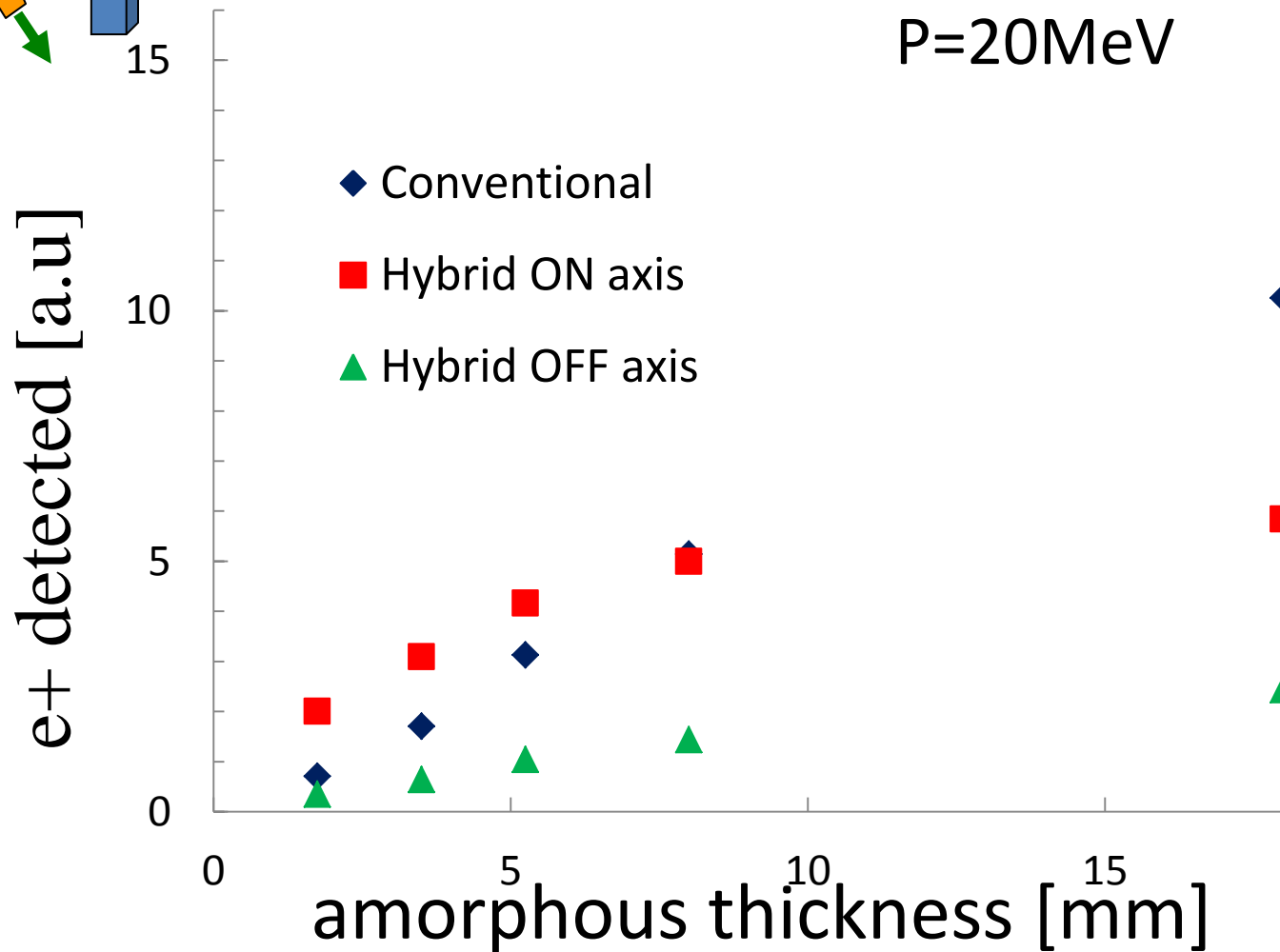


same for horizontal rotation

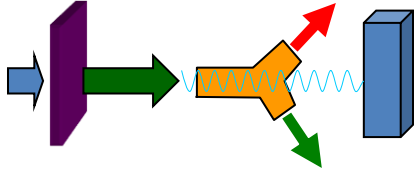


e+ yield

P=20MeV

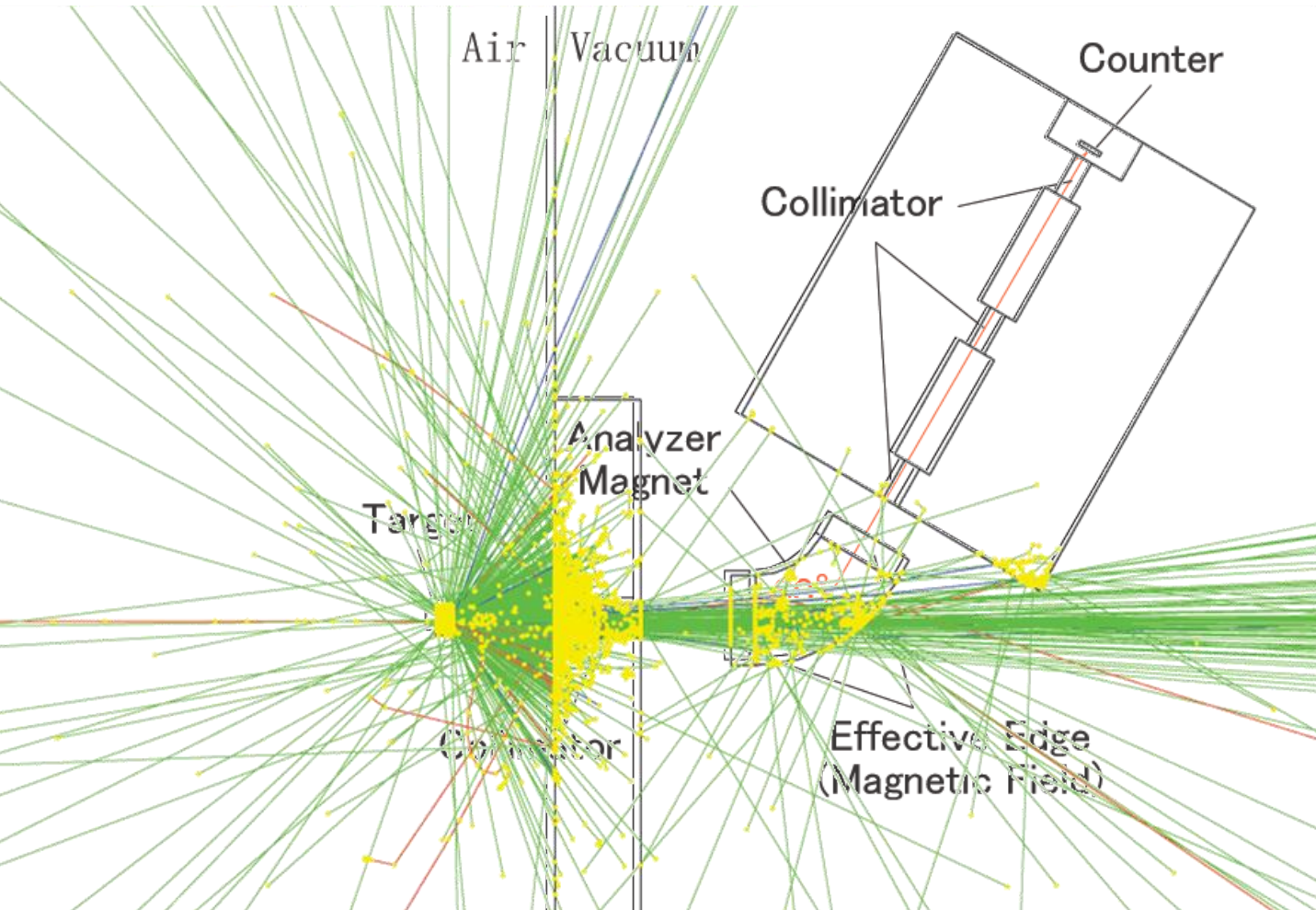


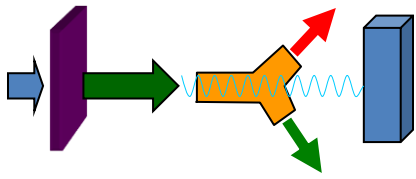
Need simulation for analyzing the magnet collimator , detector to evaluate e+ yeilds



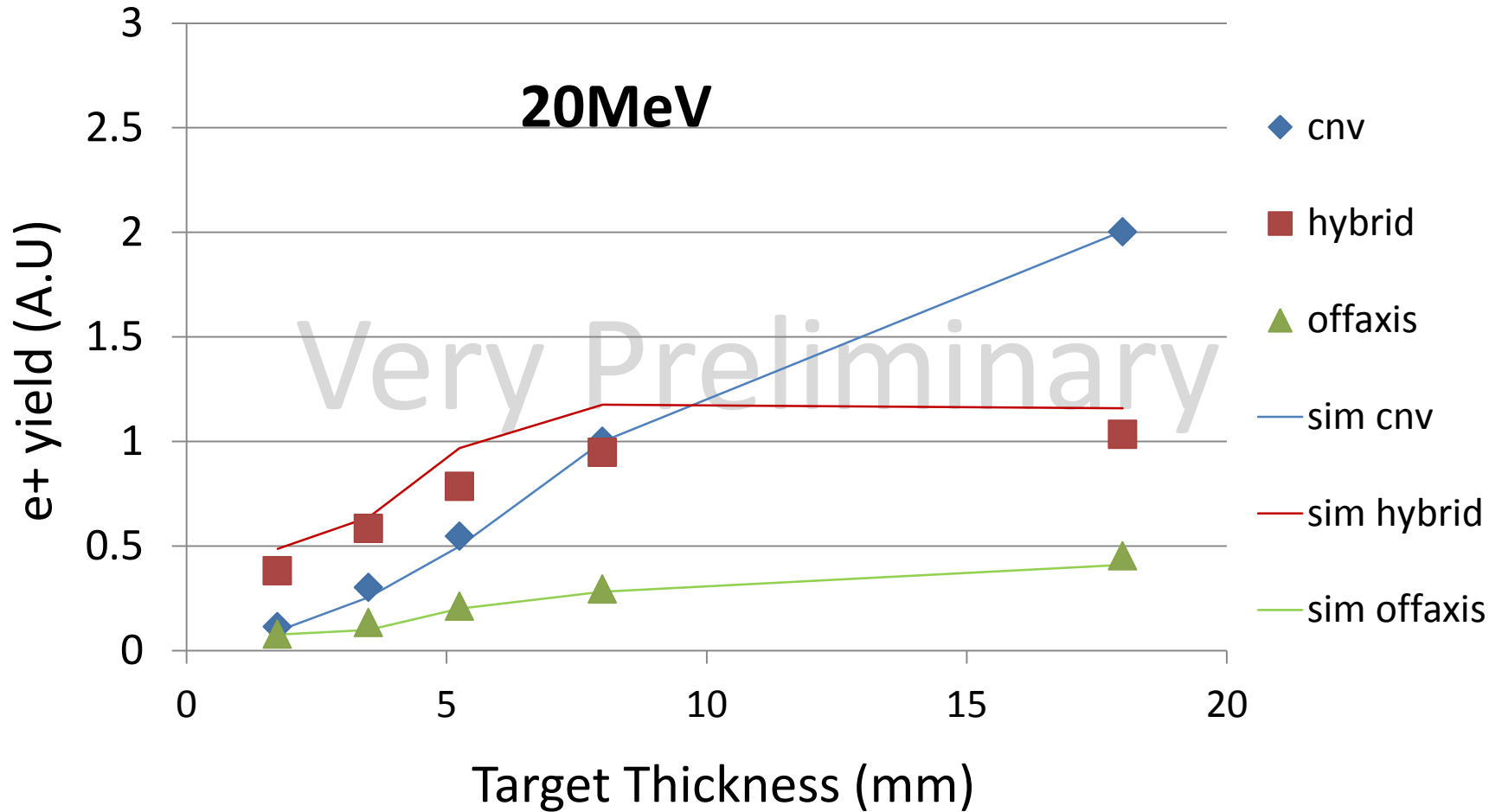
Detector acceptance

- Simulation of the is in progress by Y.Uesugi

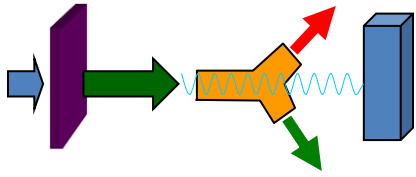




simulation in progress



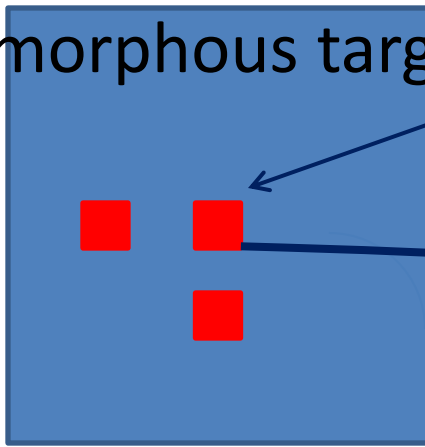
low acceptance $0.0005e^+/e^-$ takes time for simulation



Temperature measurement w/ thermocouples

back plane of

amorphous target

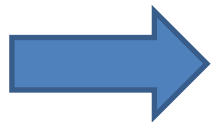


thermocouple

approximately 1mm x 1mm

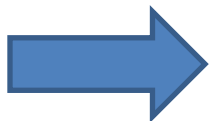
to fast data logger
read temperature
each 10ms

temperature at equilibrium

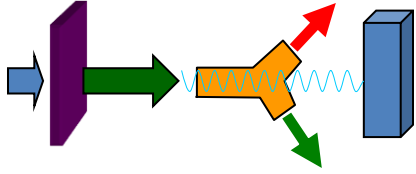


total energy deposit

bunch by bunch temperature variation

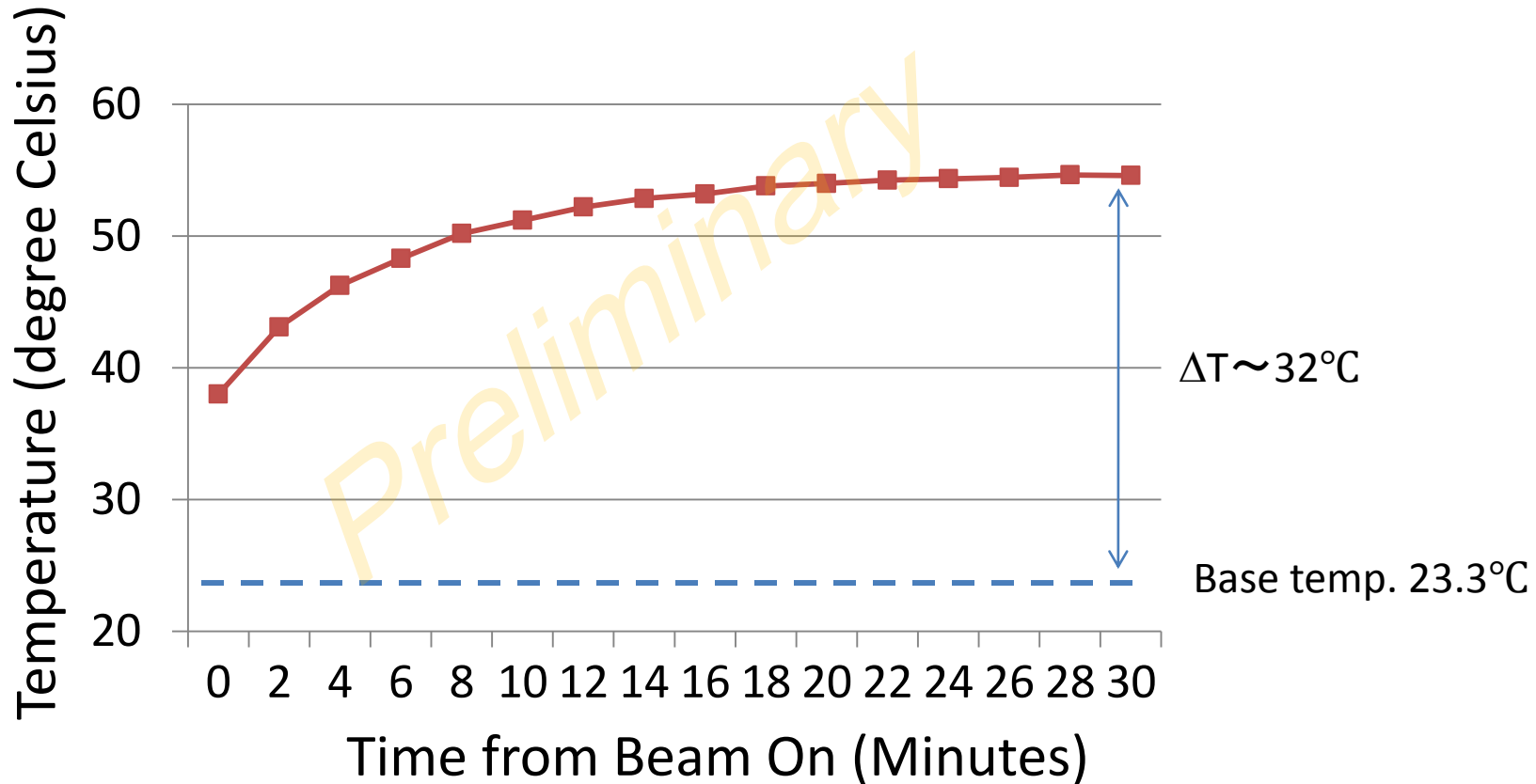


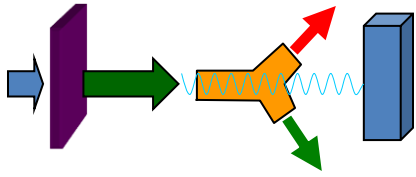
PEDD information by thermocouple



Example of Temperature Measurement

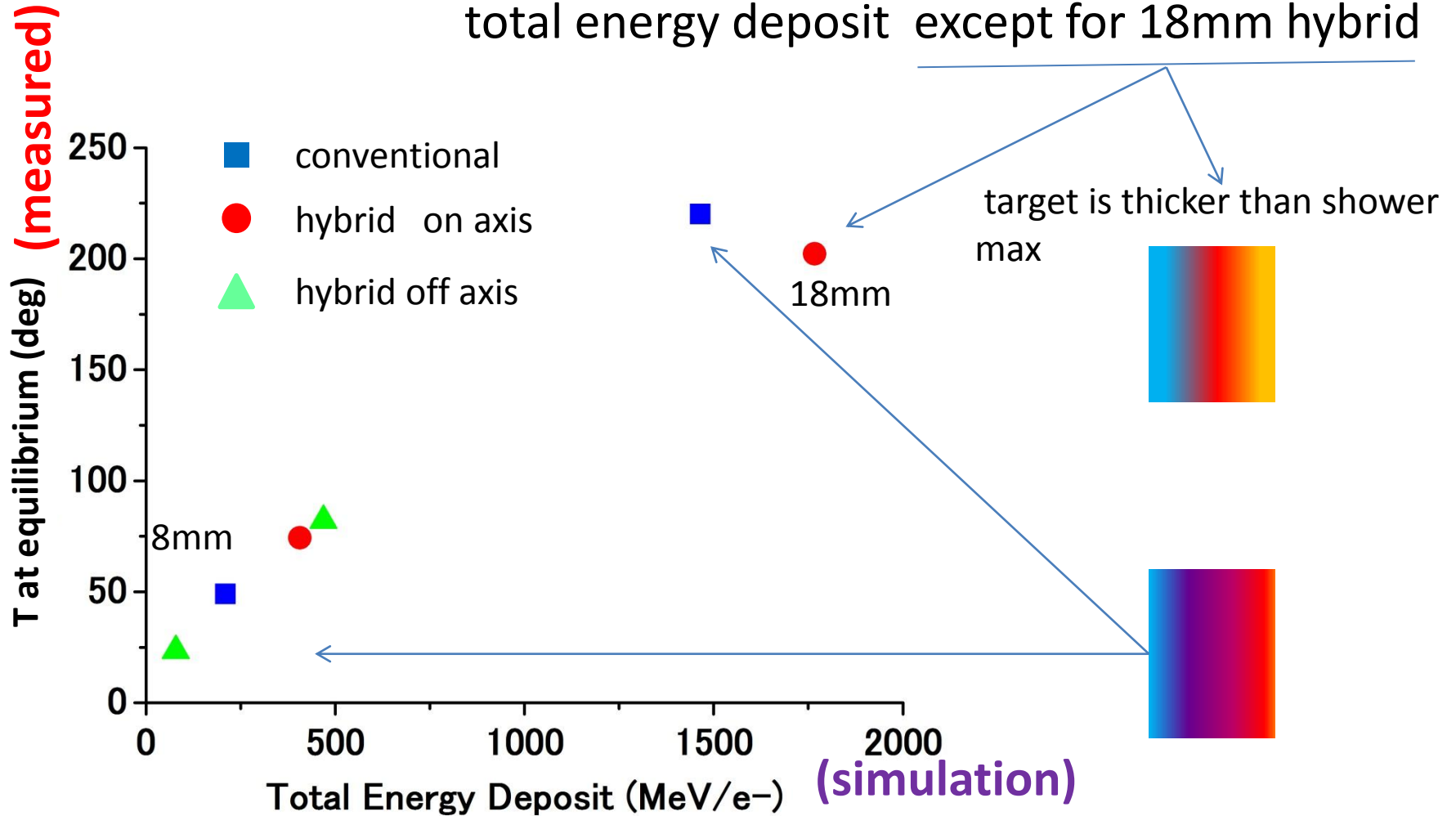
Temperature of the 8mm amorphous target for the hybrid case

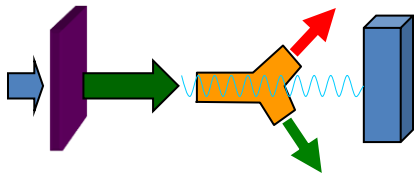




T vs total energy deposit

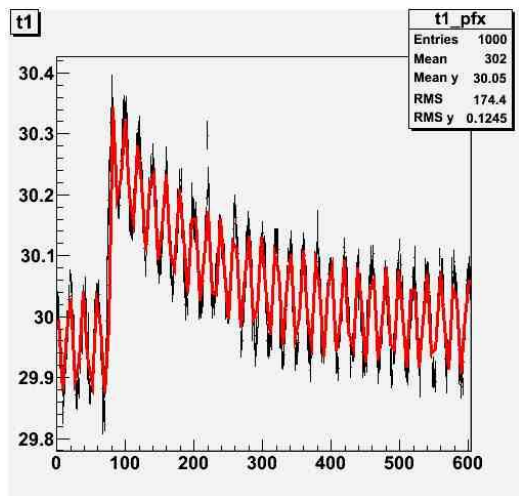
T at equilibrium has information for total energy deposit except for 18mm hybrid



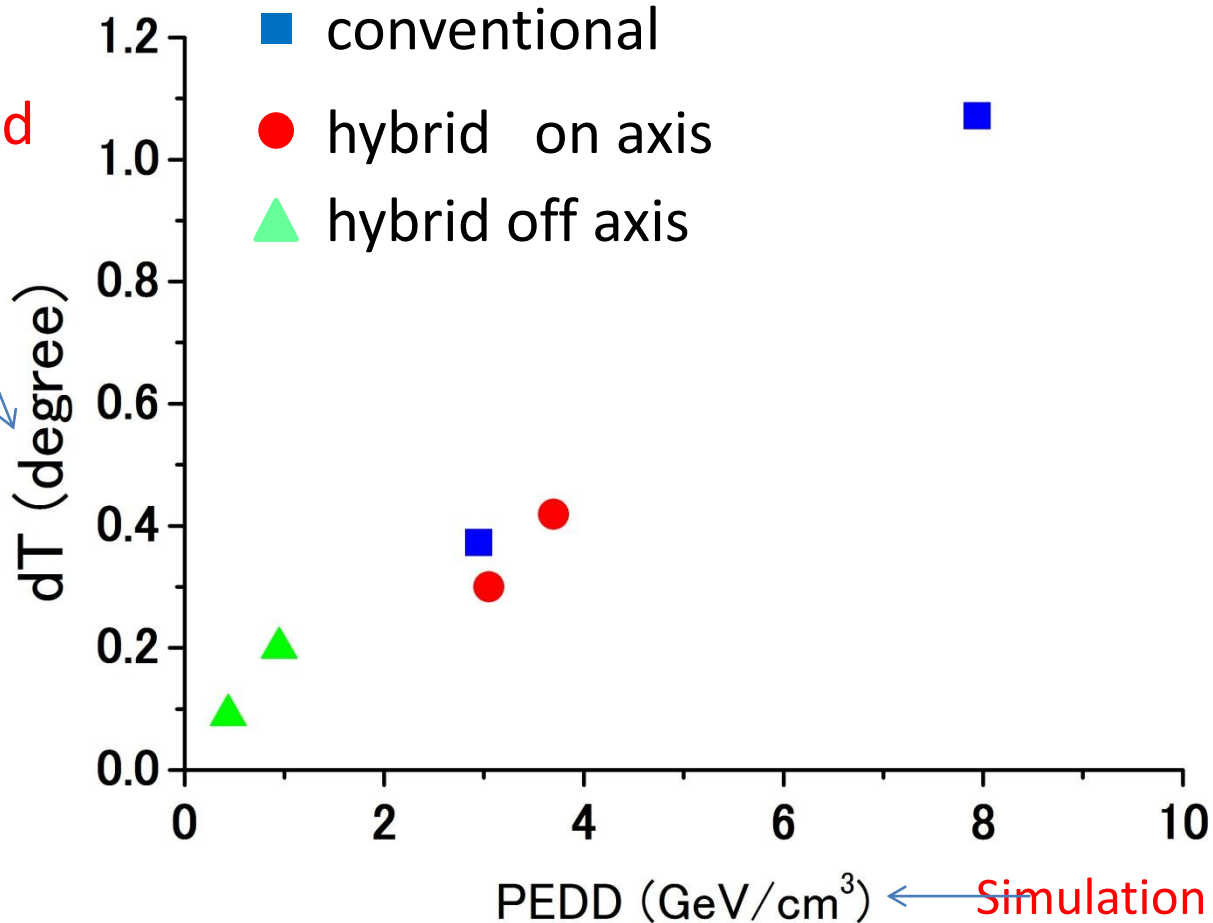


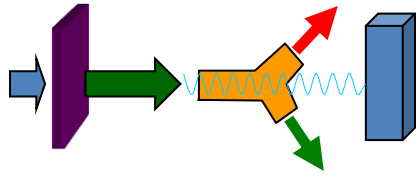
bunch by bunch temp.

- dT provides a measure of PEDD

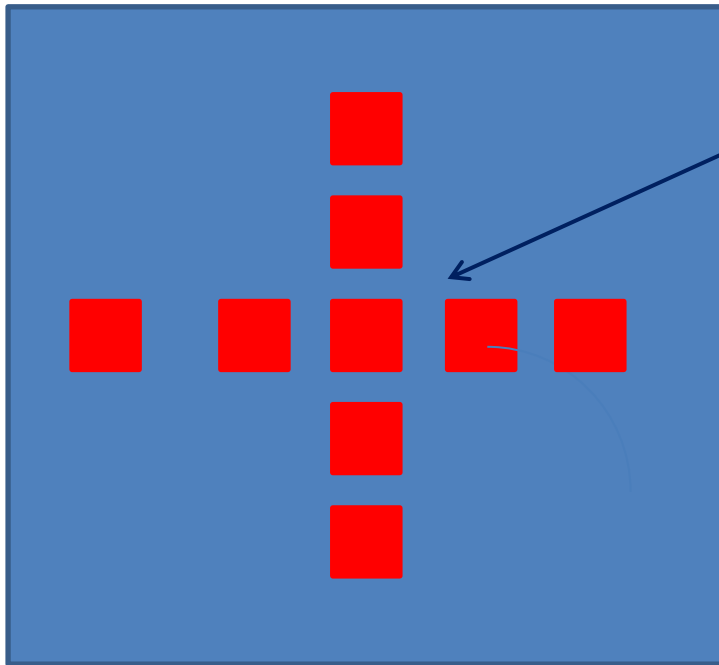


Measured





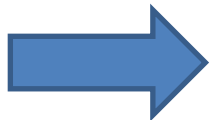
Making thermo couple array



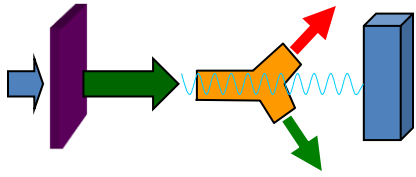
thermocouples



temperature distribution of amorphous target
bunch by bunch bases

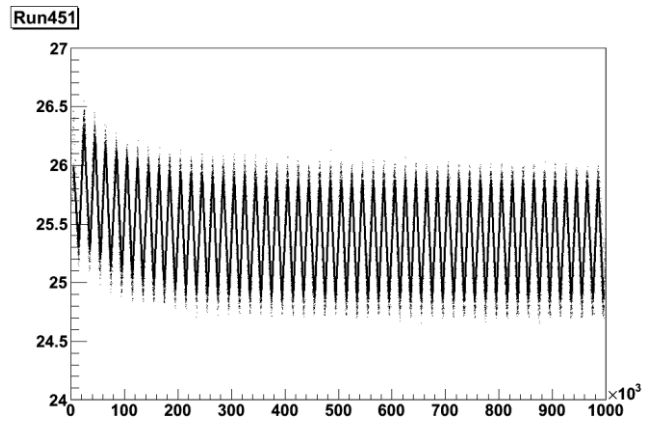
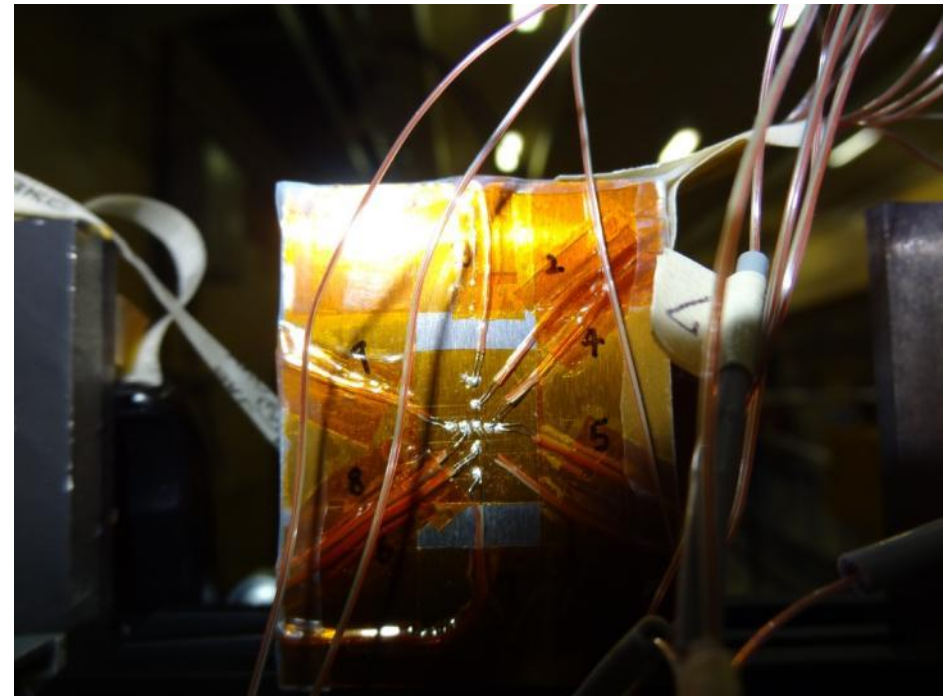
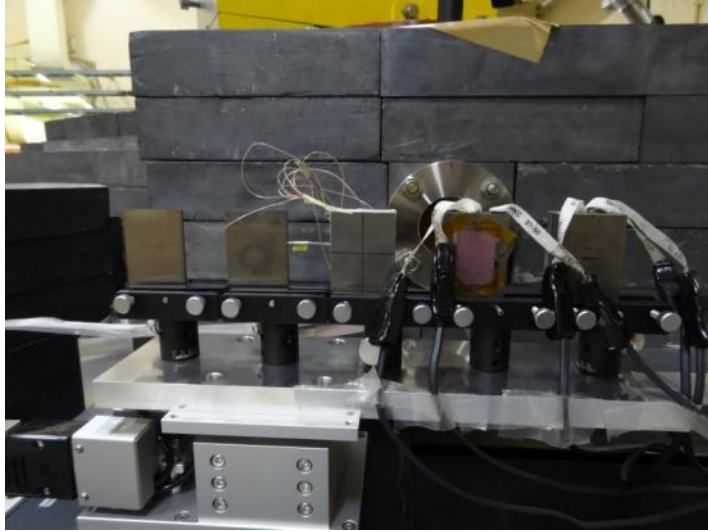


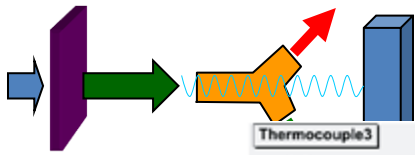
design in progress at Hiroshima



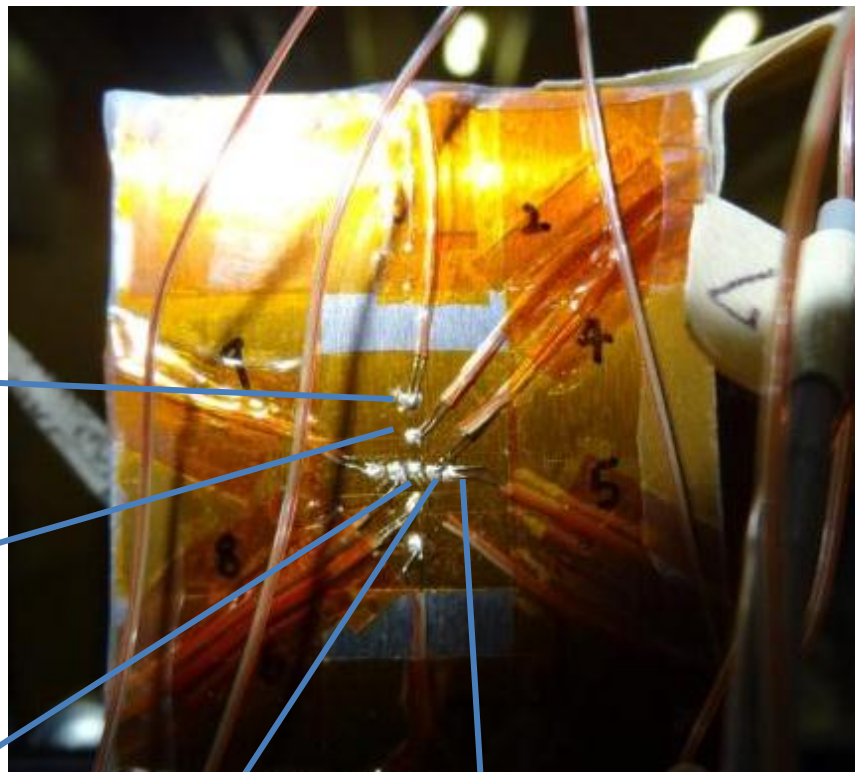
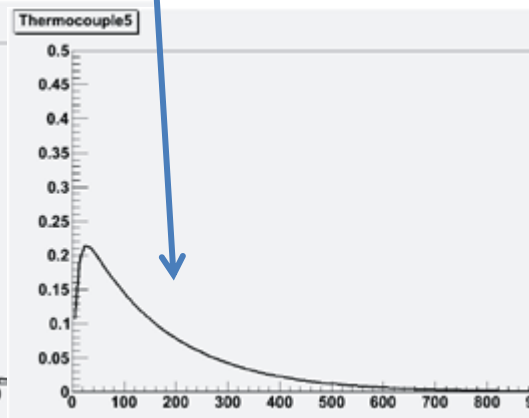
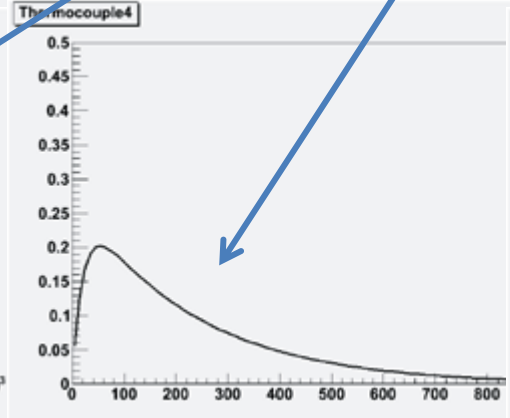
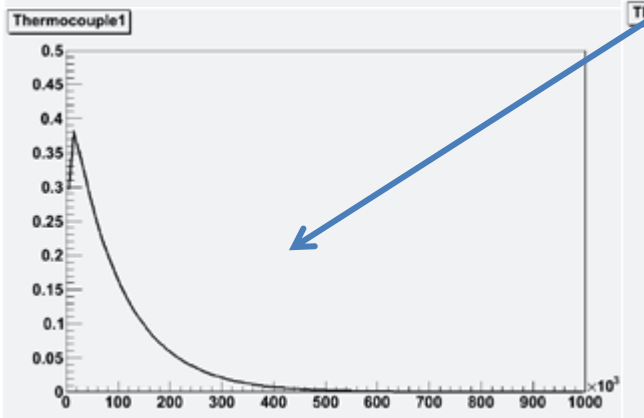
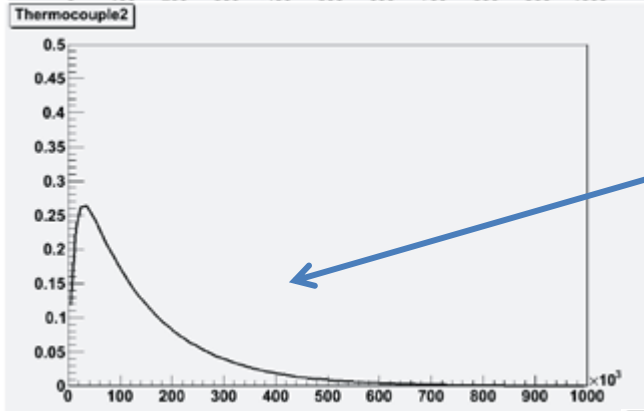
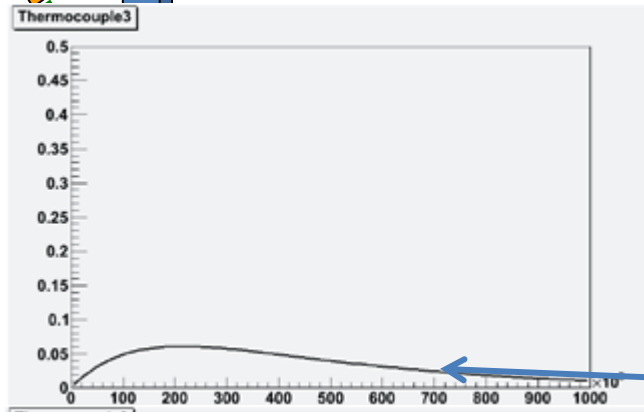
temperature measurement

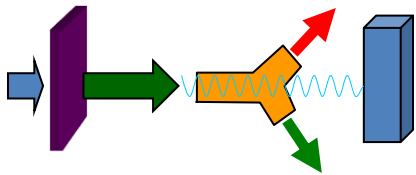
January 2012





temperature measurement

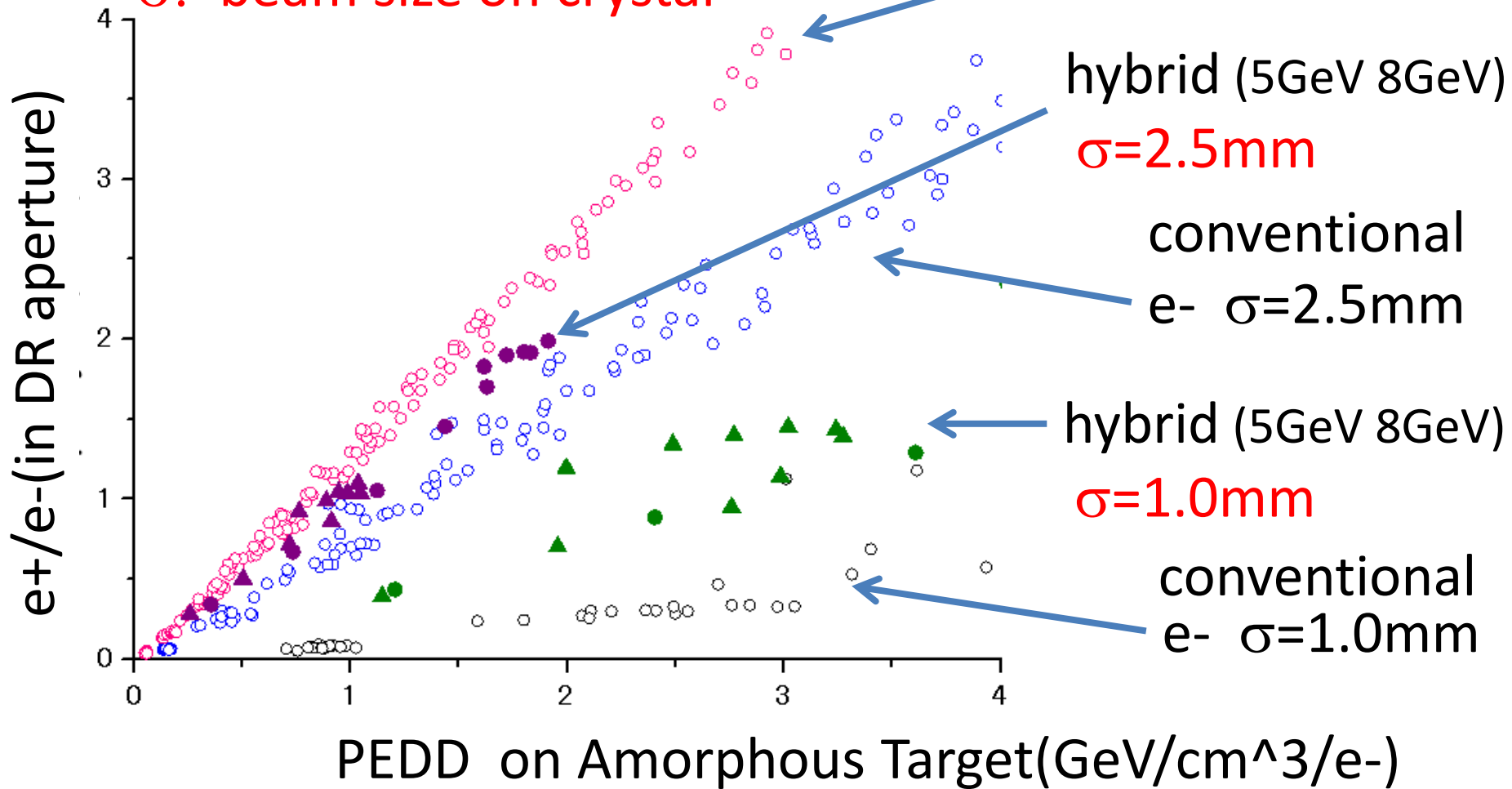


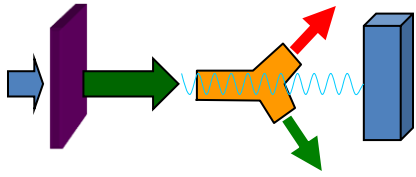


e+ yields v.s. PEDD $\sim G4 \sim$

σ : beam size on amorphous

σ : beam size on crystal





e+ yields v.s. PEDD ~G4~

σ : beam size on amorphous

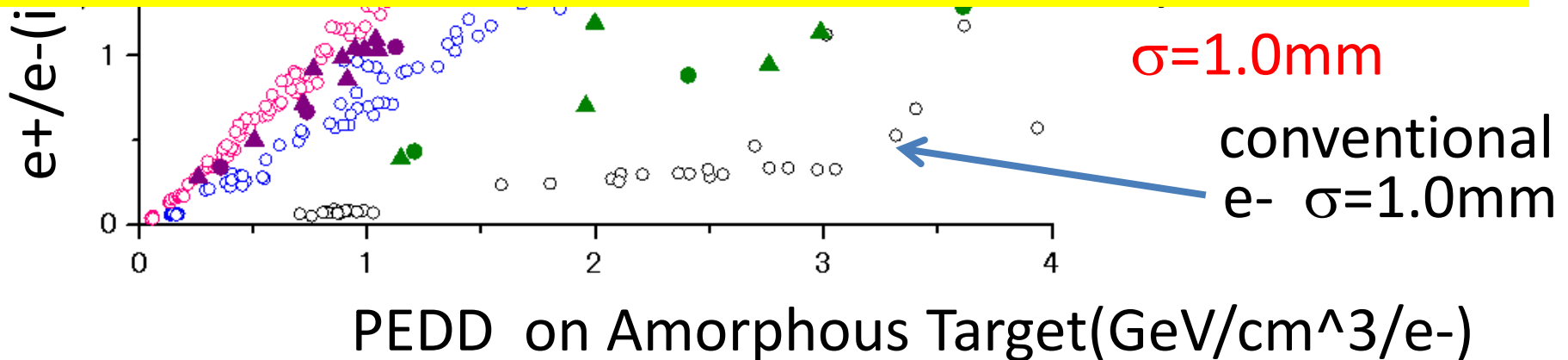
σ : beam size on crystal

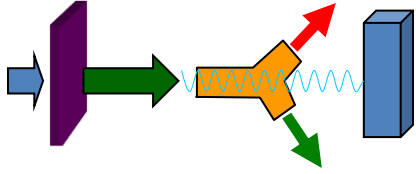
conventional
e- $\sigma=4.0\text{mm}$



Making this plot is a purpose of this experiment,
but if it is the case;

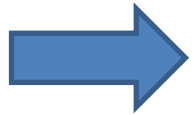
A hybrid works, why not a conventional
(but worthwhile studying better crystals)





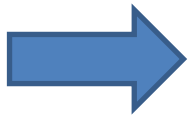
summary

- Systematic data for hybrid target R&D
 - yield from various target thickness, momentum



G4 Simulation in progress

- energy deposit/temperature
 - Thermocouple array works
 - in progress. G4 simulation is ready.
 - Systematic data in next experiments
- (but we need to wait for full recovery of KEKB LINAC)



experimental site KEKB LINAC

Switch yard



8GeV e-
~nc/bunch
upto 25Hz single bunch

After the earthquake:
beam recovered to 3GeV
8 GeV operation expected later half of 2012