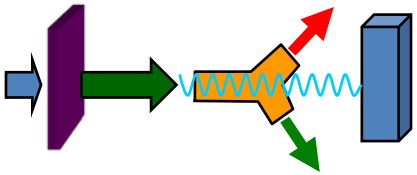


Status of the experiment at KEKB for the hybrid targets

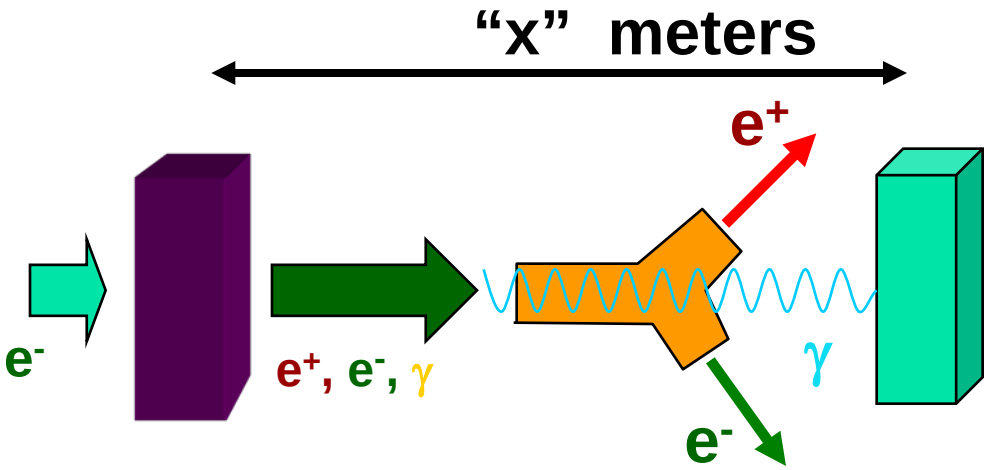
T.Takahashi

Hiroshima University

15 October 2009

POSITRON SOURCES USING CHANNELING FOR ILC & CLIC

- **THE BASIC SCHEME FOR ILC & CLIC**



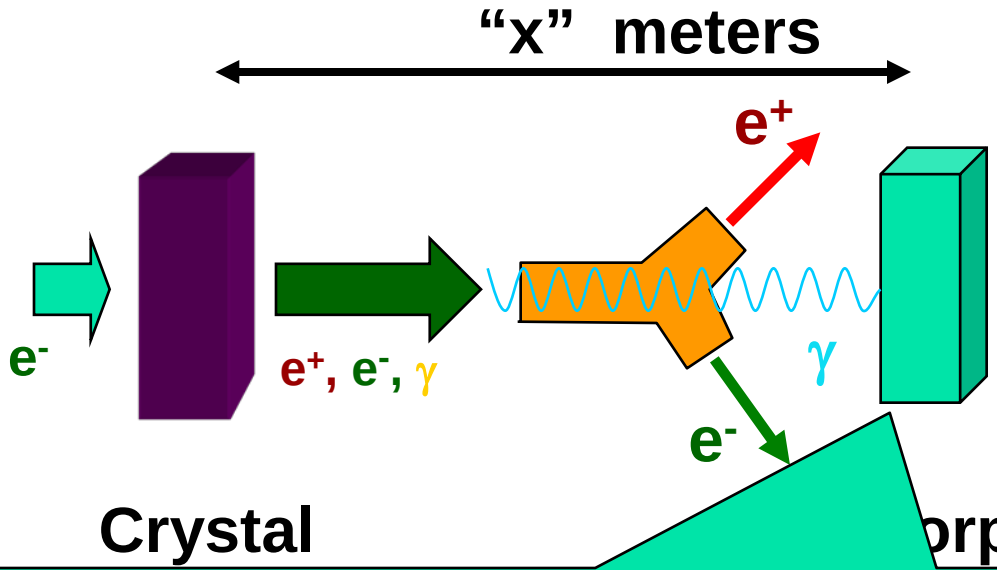
Crystal
Radiator

Amorphous
Converter

Only the photons are impinging on the converter: that limits the energy deposition in the amorphous target. The yield is less than if the particles coming from the crystal were also impinging on the amorphous target

POSITRON SOURCES USING CHANNELING FOR ILC & CLIC

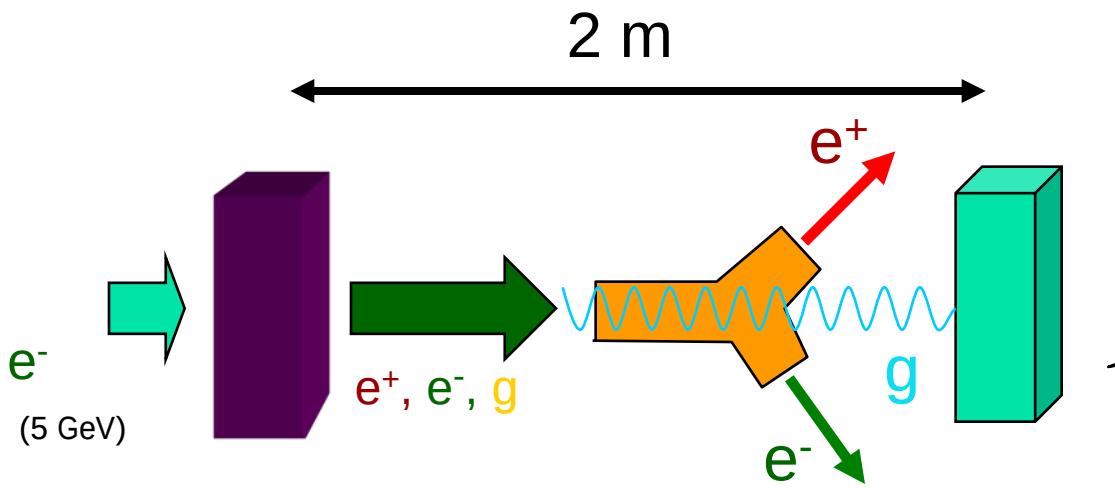
- THE BASIC SCHEME FOR ILC & CLIC



Only photons are on amorphous target --> reduction of energy deposit on the target

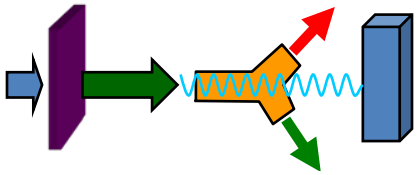
POSITRON SOURCES USING CHANNELING FOR ILC & CLIC

- **PROPOSED POSITRON TARGET FOR CLIC**



PEDD can be well below damage threshold for CLIC

With an incident beam of 2.34 10^{12} e-/pulse, we expect 2.1 10^{12} e+/pulse at 270 MeV (pulse of 156 ns)
Or 6.7 10^{9} e+/bunch



300Hz generation for ILC

Advanced Conventional e+ Source for ILC

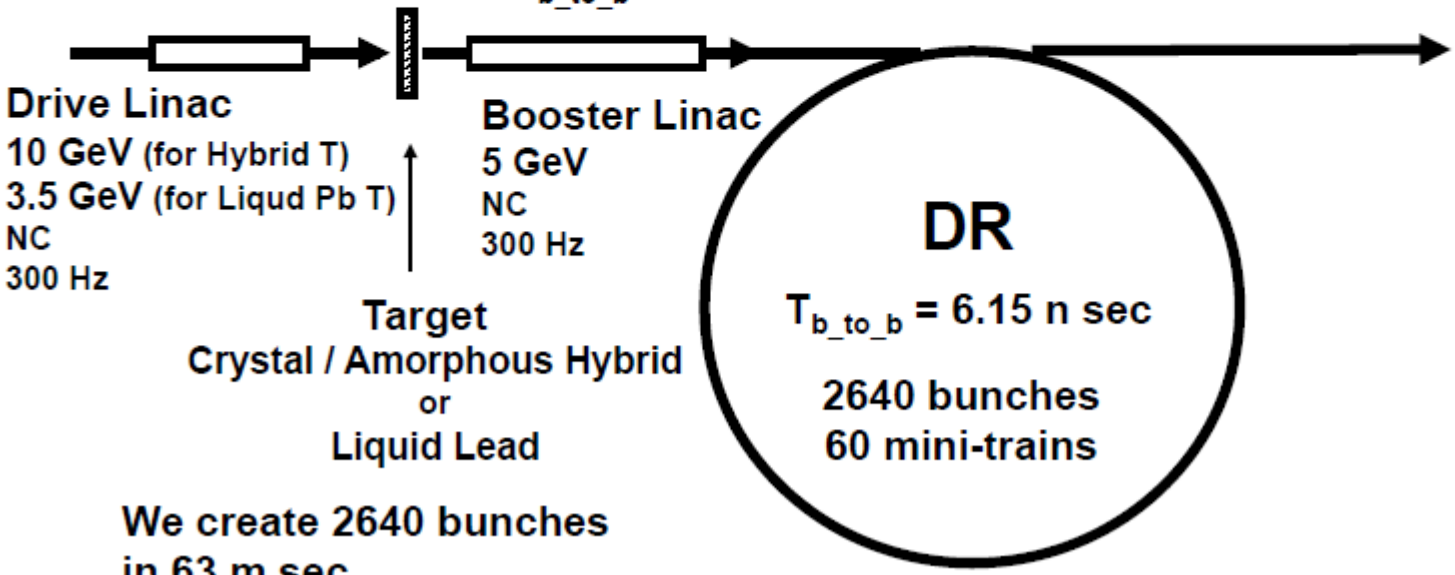
Crystal/Amorphous Hybrid Target or Liquid Lead Target
Normal Conducting Drive and Booster Linacs in 300 Hz operation

e+ creation

20 triplets, rep. = 300 Hz
- triplet = 3 mini-trains with gaps
- 44 bunches/mini-train, $T_{b\_to\_b}$ = 6.15 n sec

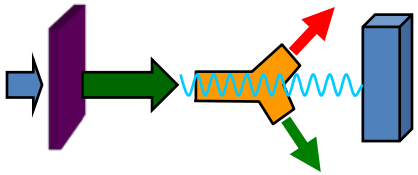
go to main linac

2640 bunches/train, rep. = 5 Hz
- $T_{b\_to\_b}$ = 369 n sec



We create 2640 bunches in 63 m sec

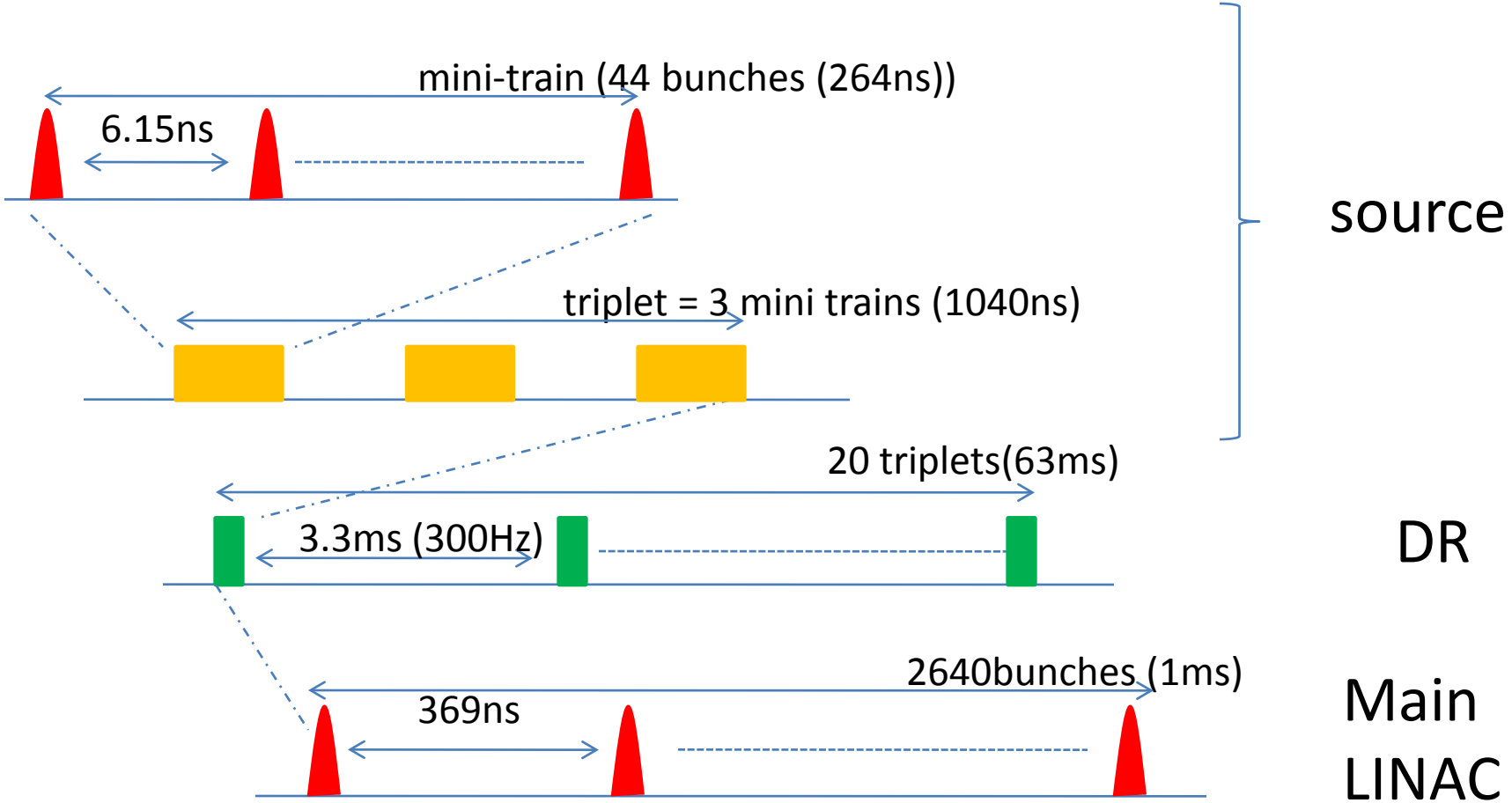
Time remaining for damping = 137 m sec

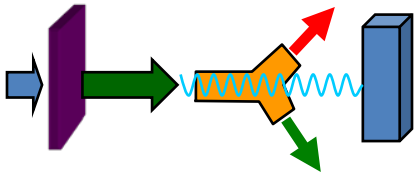


300Hz generation for ILC

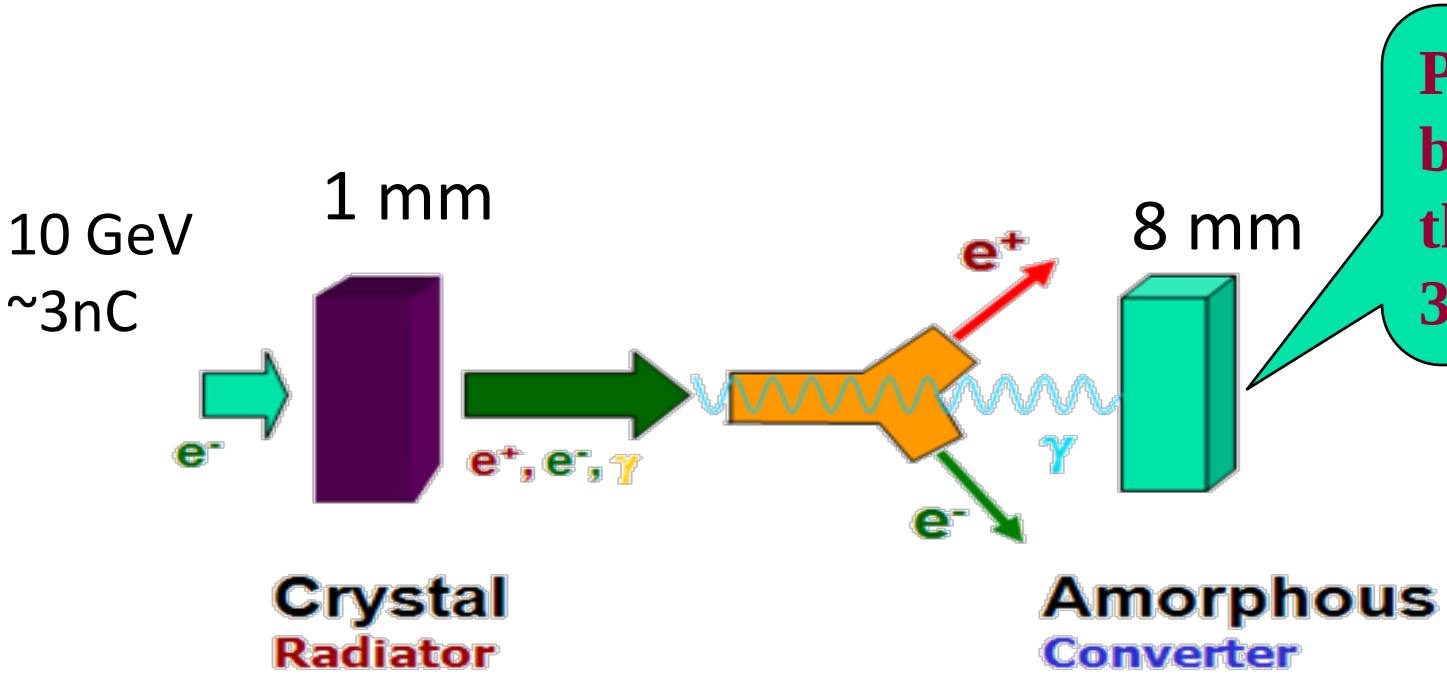
Bunch structure

in the main linac(3000 in 1ms) ≠ at the source



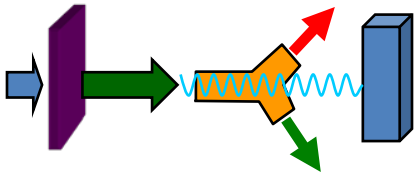


Hybrid Target for ILC



PEDD can be below damage threshold w/ 300Hz scheme

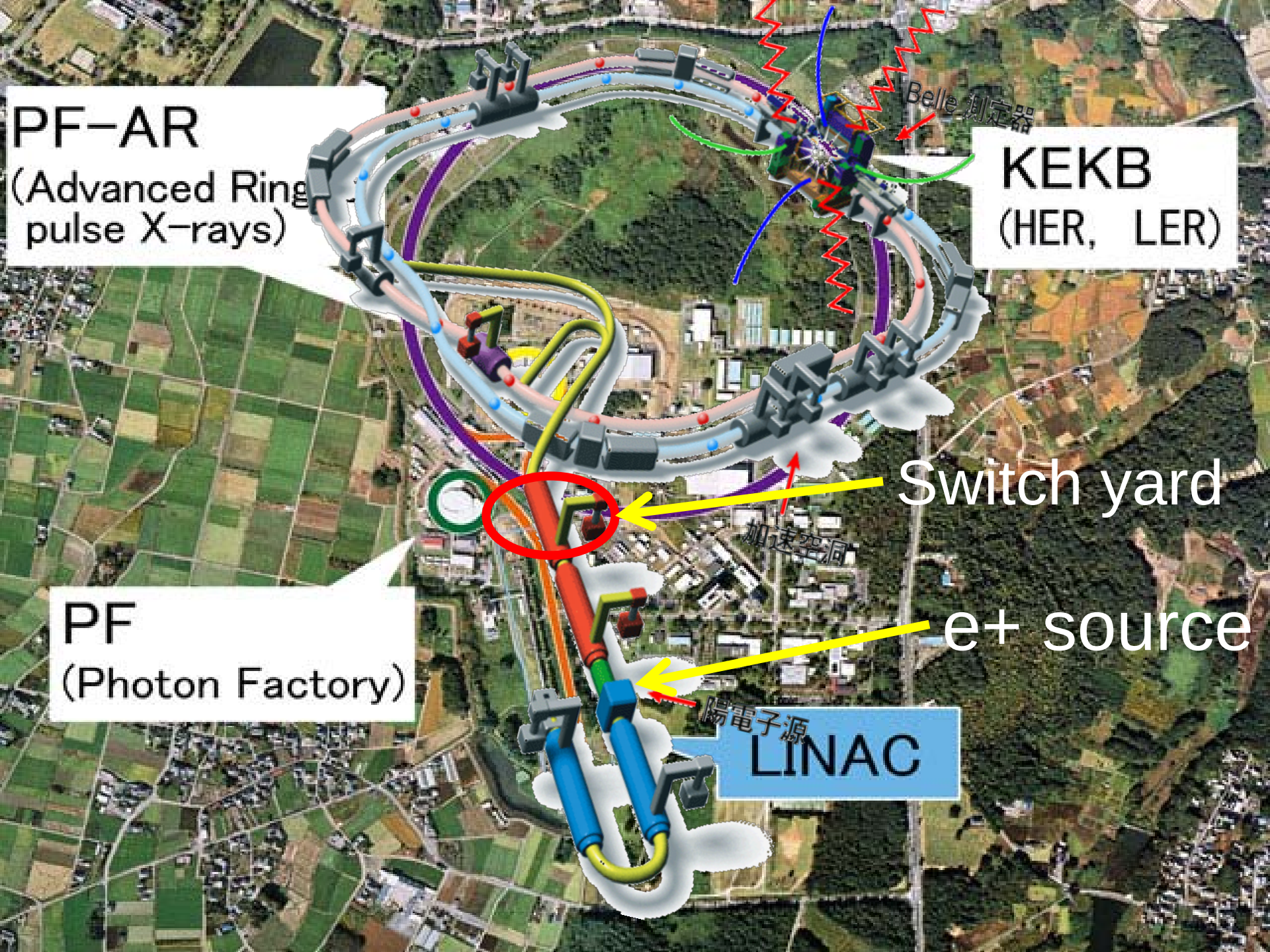
Chehab Posipol2008



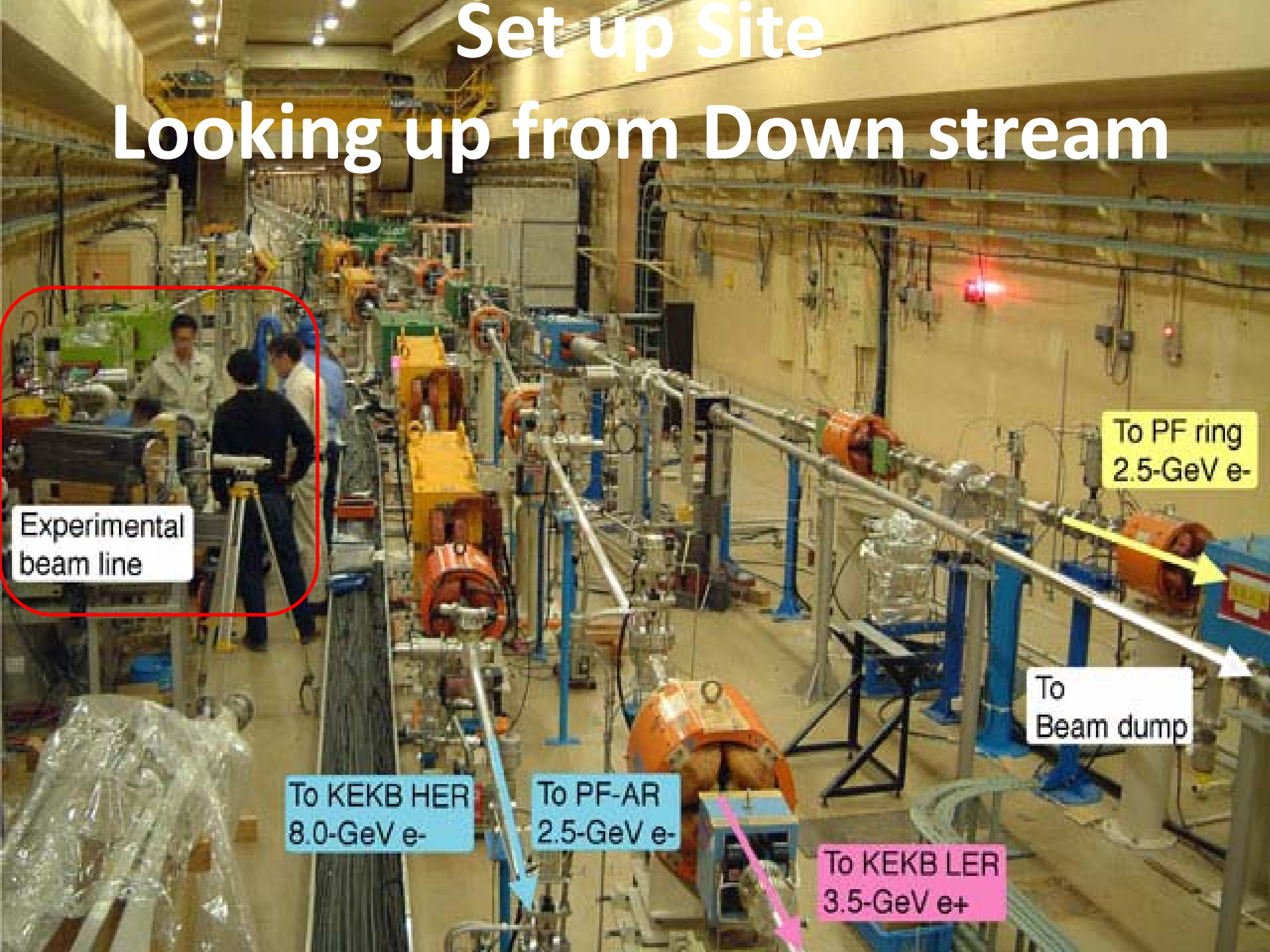
Testing Hybrid Target at KEKB LINAC

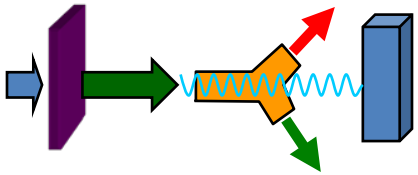
- KEKB LINAC
  - E(beam) : 8GeV
  - Bunch Charge: ~nC
  - Repetition : up to 50Hz (may limited by radiation safety)

Good place for the test
(except for muti-bunch operation)


PF-AR
(Advanced Ring
pulse X-rays)
KEKB
(HER, LER)
Belle 測定器
Switch yard
加速器棟
e+ source
PF
(Photon Factory)
陽電子源
LINAC

Set up Site
Looking up from Down stream





Plan at KEKB LINAC

JFY2009

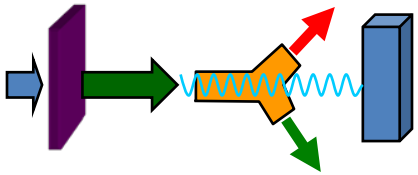
1 To Demonstrate

- **positron yield with the hybrid system**
- **heat reduction by hybrid target**

w/ a real beam (angular divergence, alignment) and crystal (mosicity),,,

JFY2010~

2. **Detail investigation toward the positron source**
   - **momentum distribution,**
   - **angular distribution of e+**

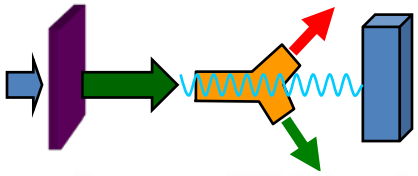


Status and Preliminary results of first beam test

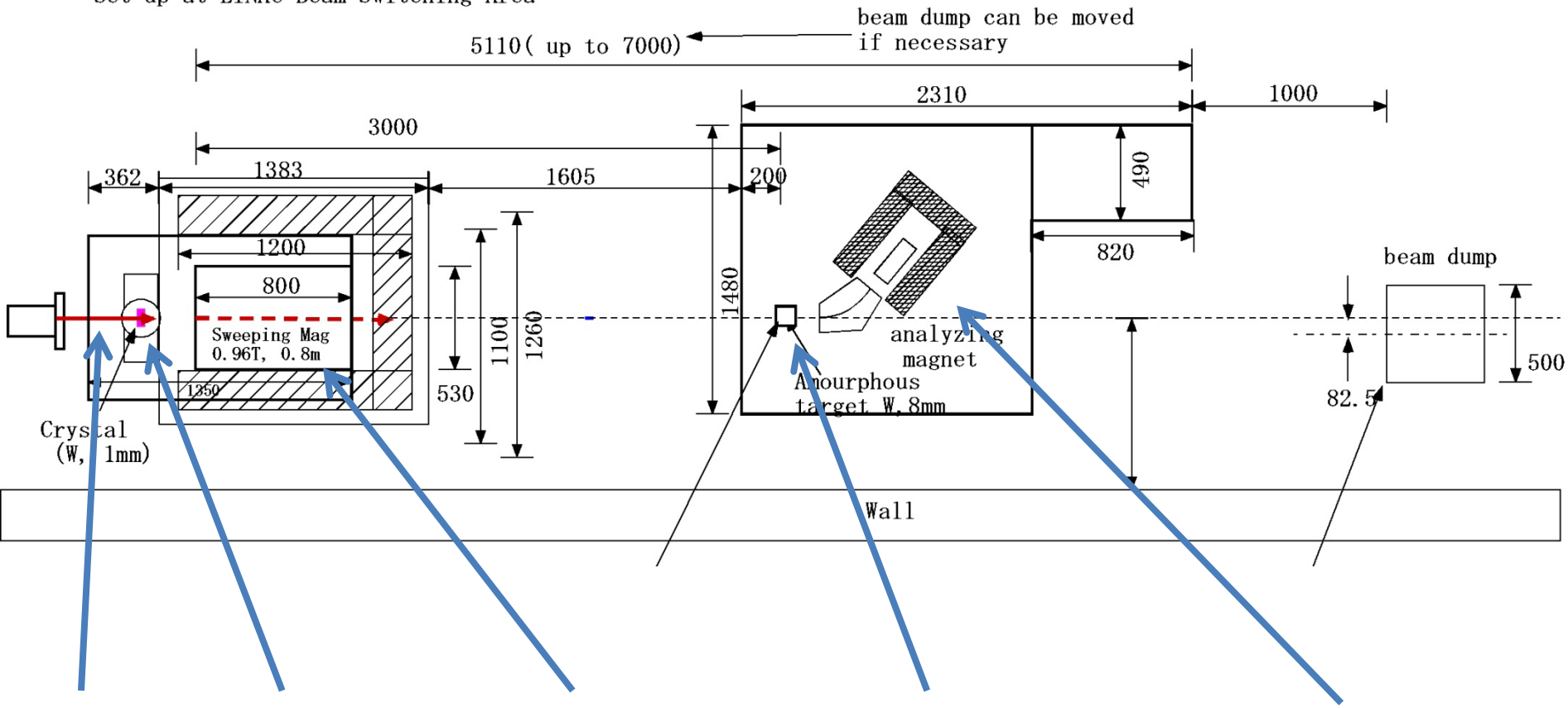
September 21 – 23 2009

All results shown in the following slides are preliminary

Setup



Set up at LINAC Beam Switching Area



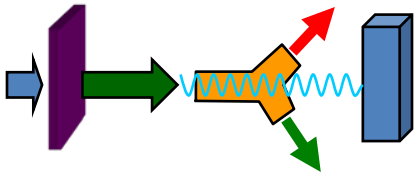
8GeV e-

1mm
W crystal

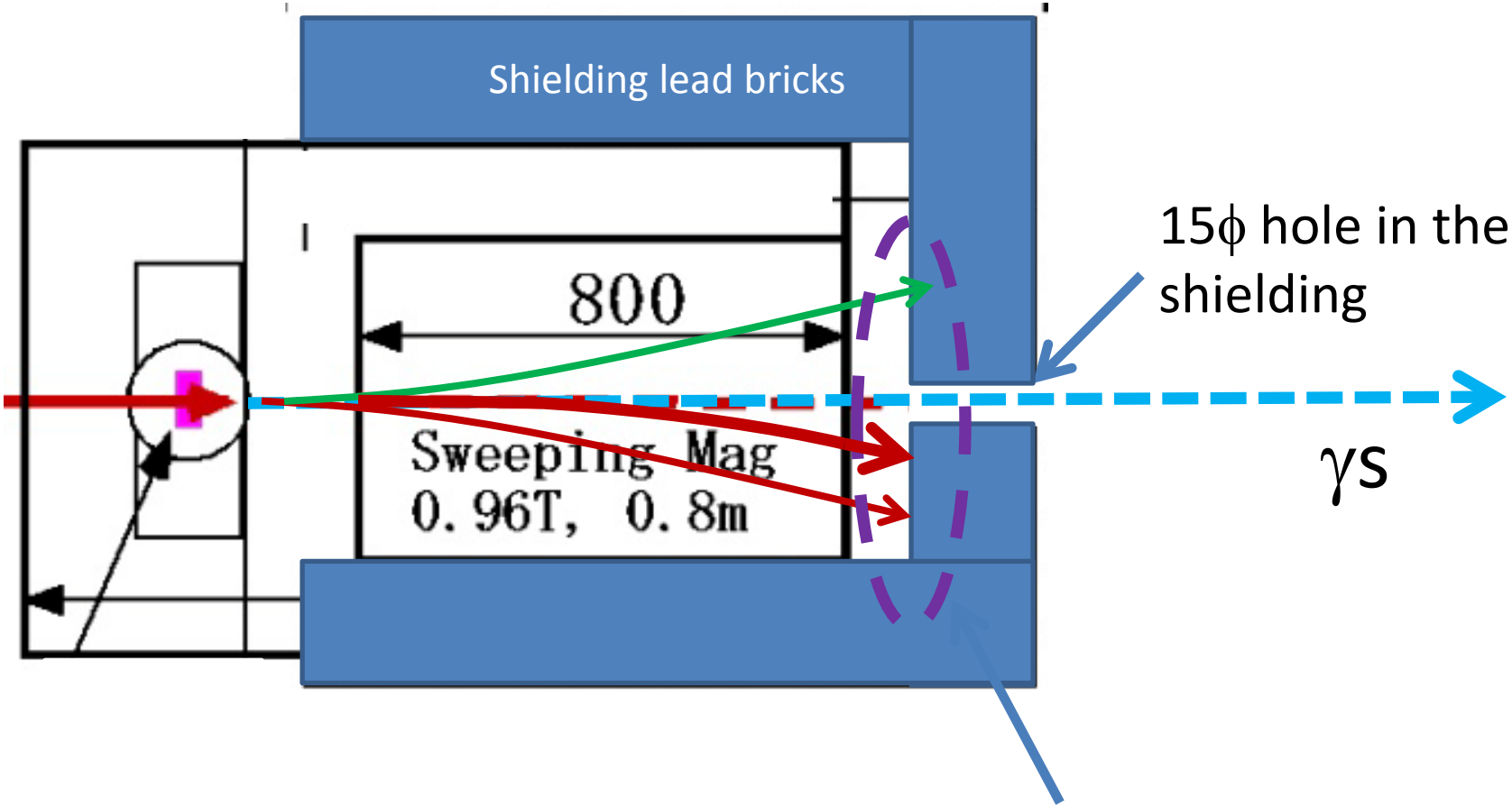
Sweeping Magnet
0.96T 0.75m

amorphous W
0.4 mm
8 mm

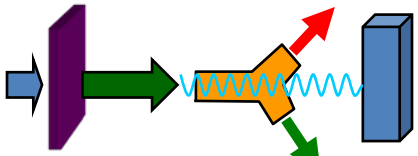
Analyzing magnet
5 ~ 20MeV



Around the magnet



Data Acquisition



Counting room

Beam Area

ADC

e+ detector

e+

PM

Beam current

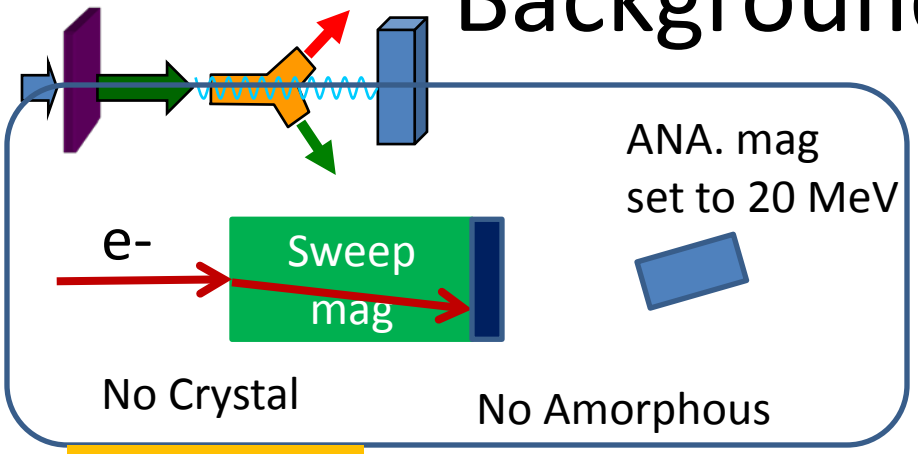
Gate

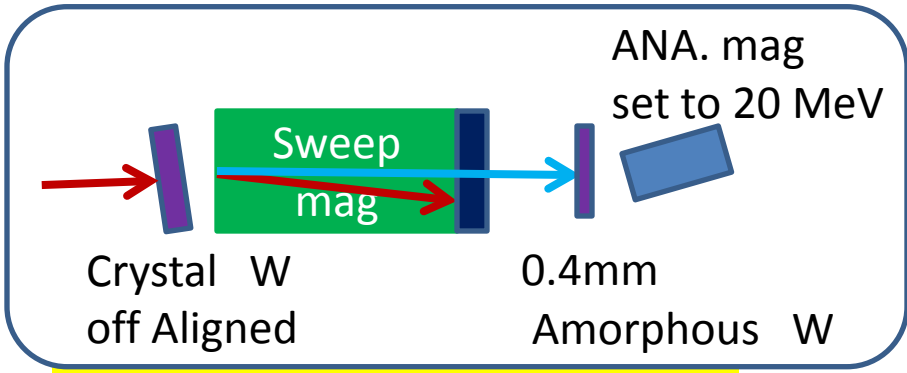
motor Controller

e-

Goniometers to
Align Crystal

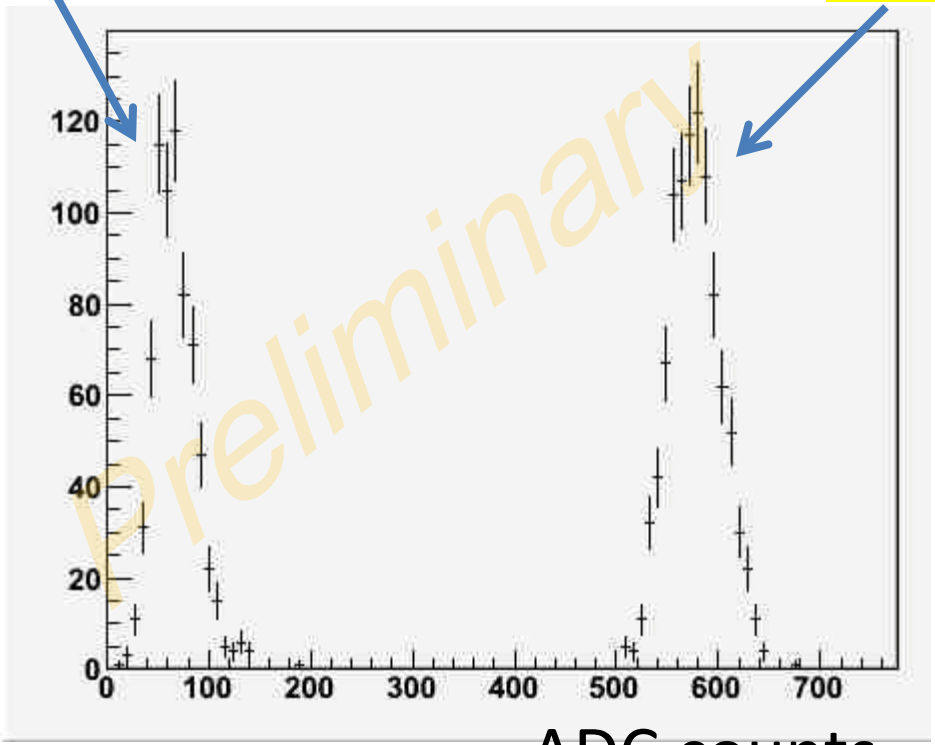
Background conditions





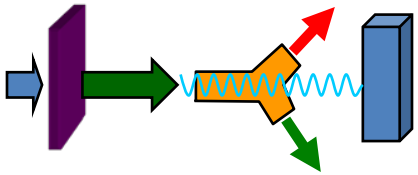
background

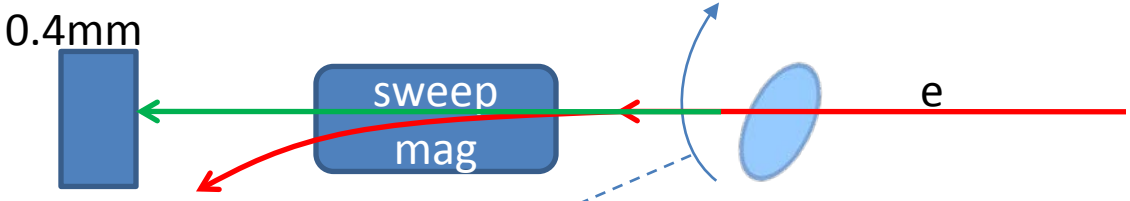
e+ of the least yield condition

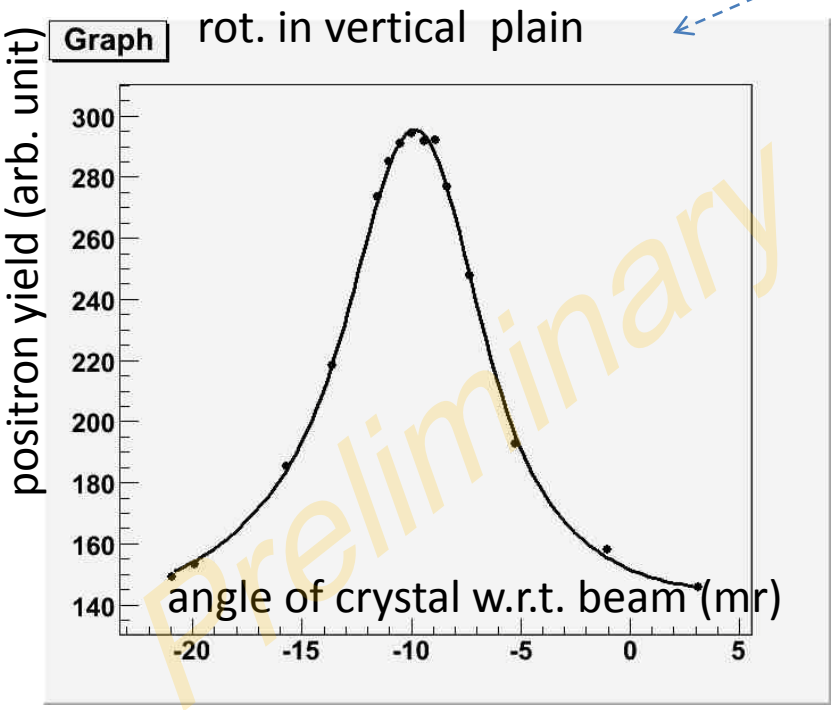


Signal is well separated from background even with thin converter

Rocking curve







$$f(\theta) = Ae^{-\frac{(\theta-\langle\theta\rangle)^2}{2\sigma_1^2}} + Be^{-\frac{(\theta-\langle\theta\rangle)^2}{2\sigma_2^2}} + Const$$

$$\sigma_1 = 2.27 \pm 0.06$$

$$\sigma_2 = 4.86 \pm 0.2$$

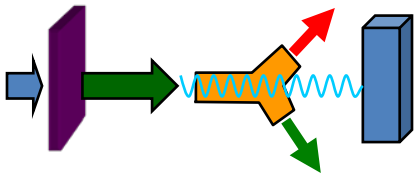
$$const = 144.4 \pm 1.1$$

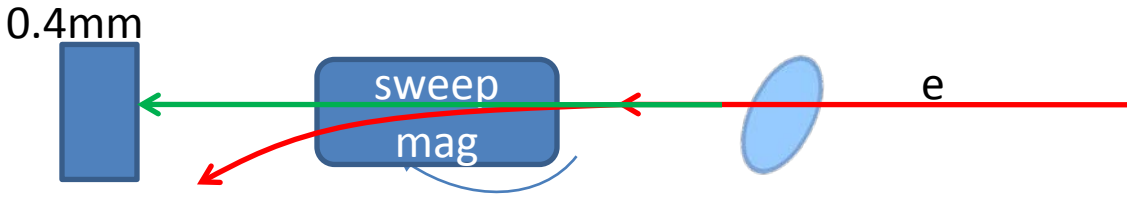
Well fitted by two Gaussians

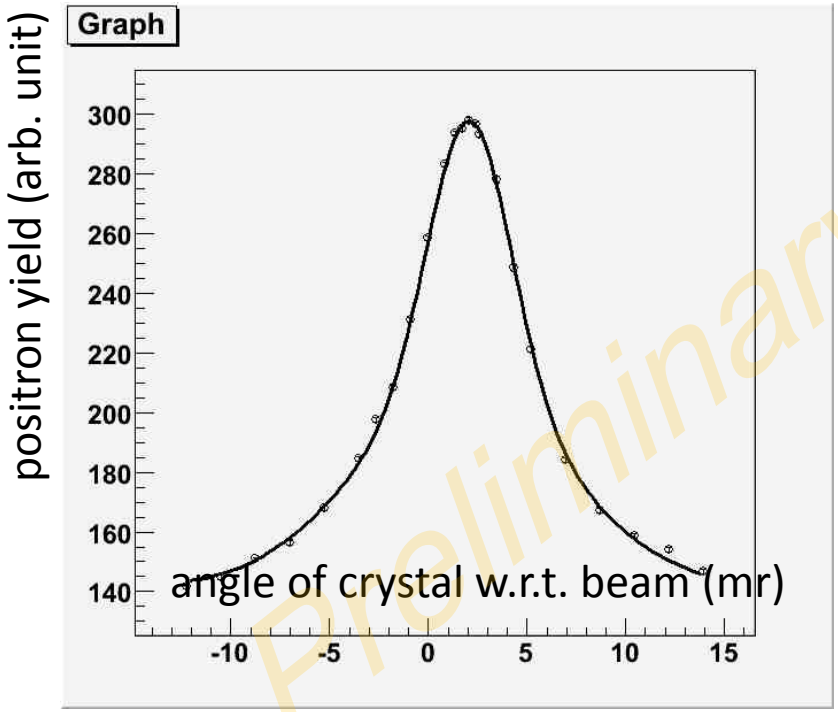
Width is wider than the critical angle

reasonable but need detail investigation

Rocking curve







$$f(\theta) = Ae^{-\frac{(\theta-\langle\theta\rangle)^2}{2\sigma_1^2}} + Be^{-\frac{(\theta-\langle\theta\rangle)^2}{2\sigma_2^2}} + Const$$

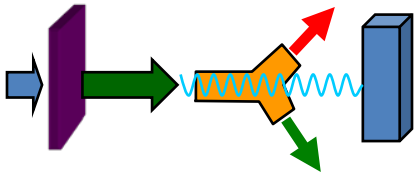
$$\sigma_1 = 2.07 \pm 0.04$$

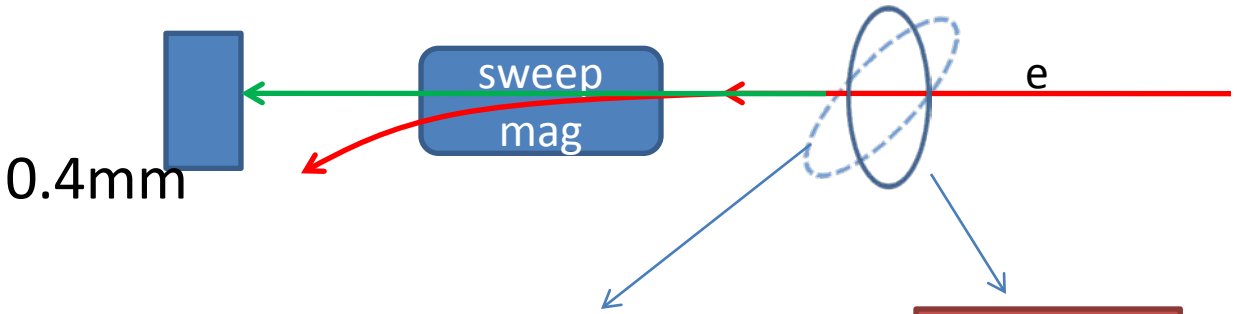
$$\sigma_2 = 5.3 \pm 0.2$$

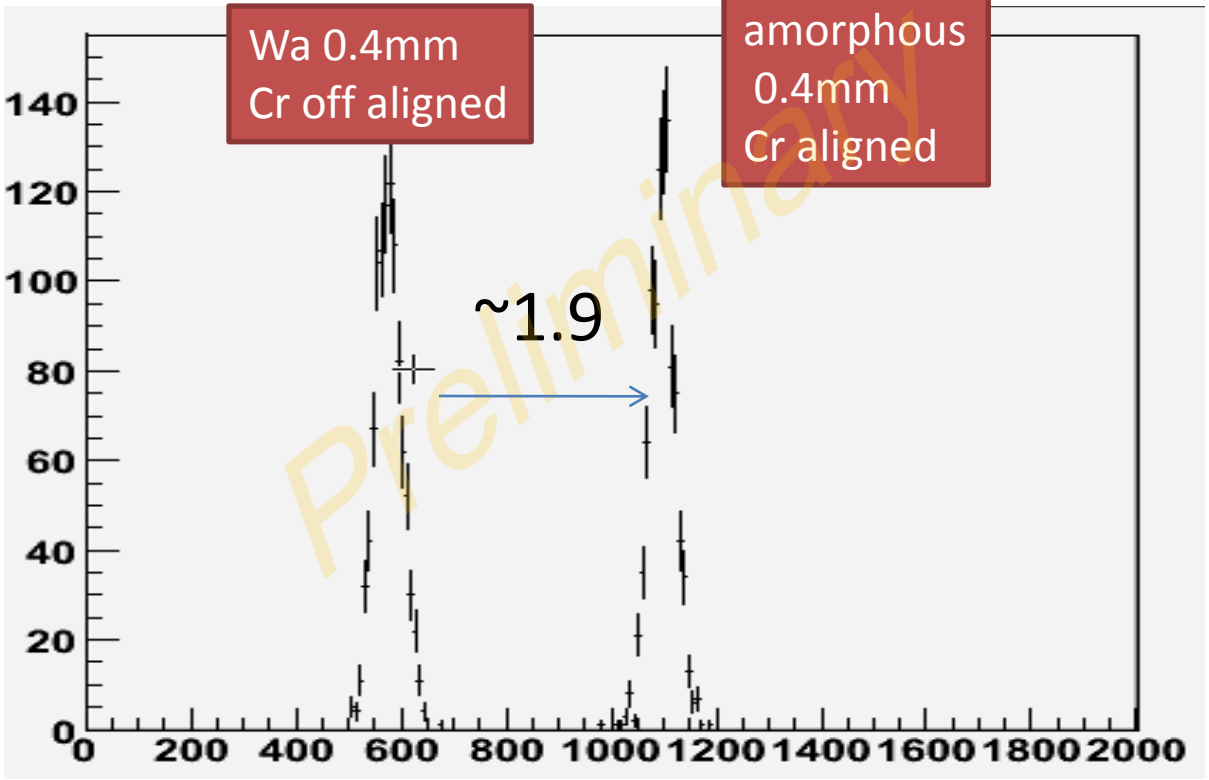
$$const = 141 \pm 1$$

same shape in rocking curve
=>indicated axis channeling

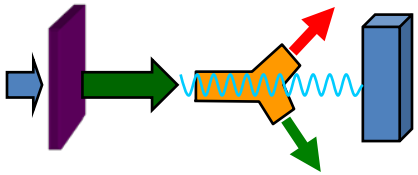
Data looks like

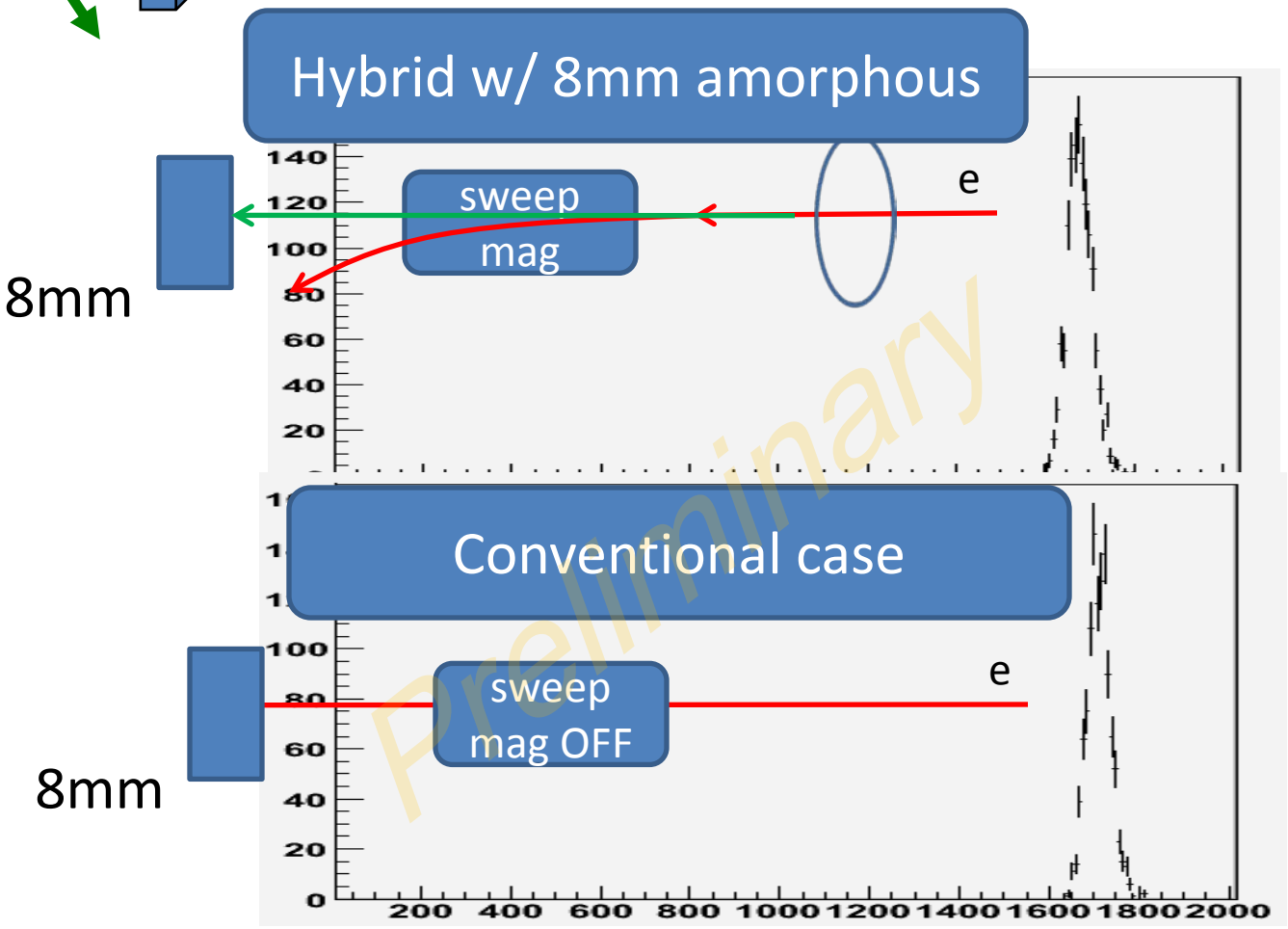






Data looks like

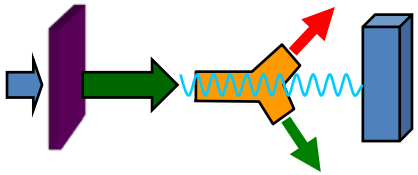


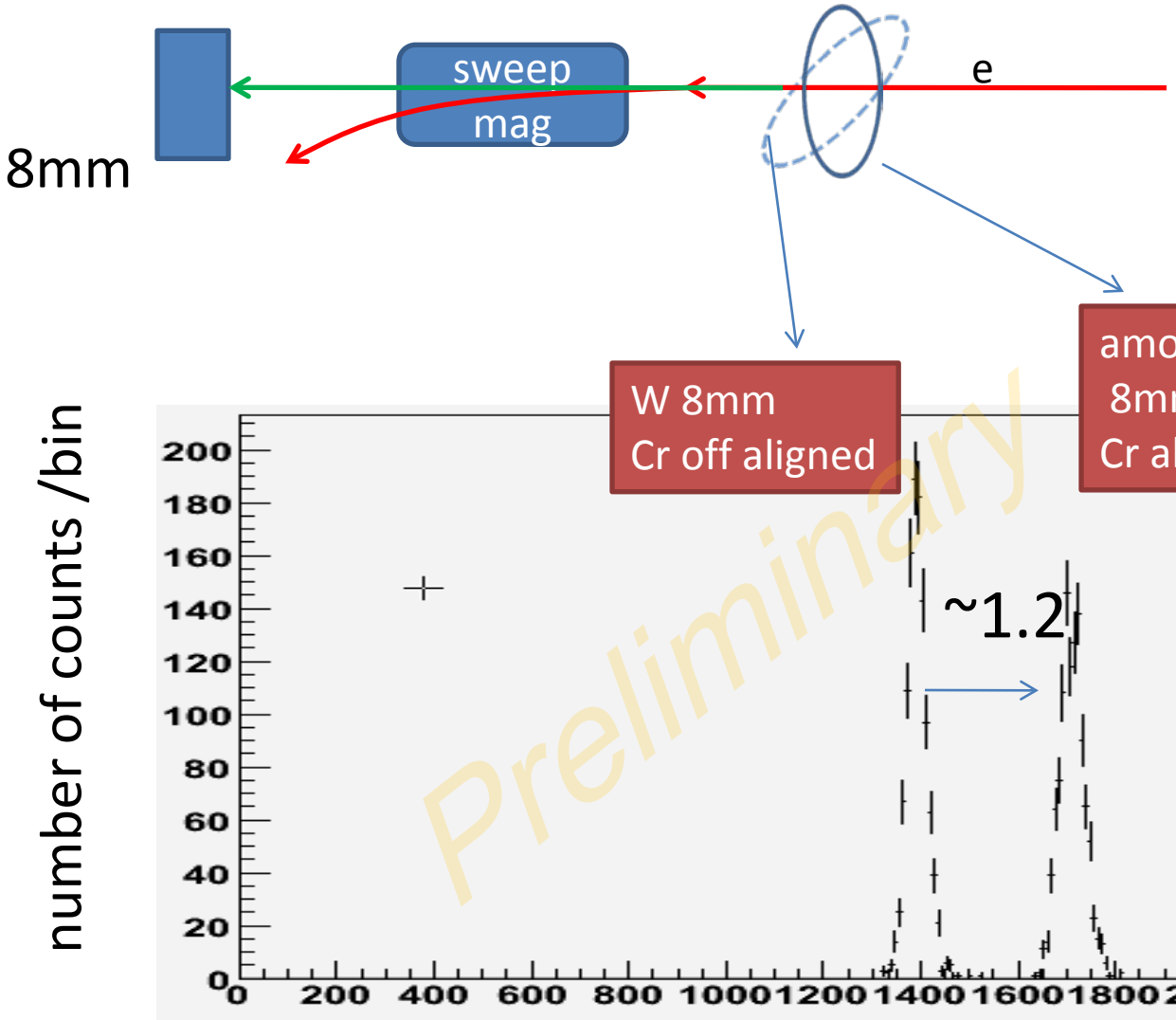


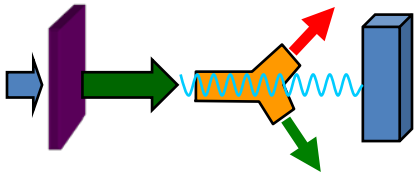
Positron yield(arb. unit)

Looks almost same amount of e+

Data looks like







Summray

- Set up works !
  - Very small background
  - DAQ seems good enough
- Results are preliminary and too soon to discuss quantitively , but
- We already have
  - many data to be analyzed
  - worth to be compared with simulation
- Next experiment is expected in
  - January 9 - 11