POSITRON EXPERIMENTS AT CERN AND KEK ?

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POSITRON EXPERIMENTS AT CERN AND KEK ?

- **1-EXPERIMENT AT CERN**
- **A proposition was made by Ulrik Uggerhoj from Aarhus University –during the Channeling workshop at Erice- for doing a test, implying collaboration with his group, on the site of NA63 experiment at CERN. His group is dealing with channeling experiments since many years. They are using the transfer lines of SPS, as we did for our experiment WA 103. Some peculiarities are associated to their installation and the discussion we had up to now has been promising but we have to check some additional points before taking a decision.**

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- **Short presentation of NA63**
- **The main aim of NA63 is the study of electromagnetic radiation of high energy (10 to 300 GeV) e-/e+ in crystal and amorphous targets. As examples, they are studying crystalline undulators, pair production and radiation in heavy crystals (with LPM effect), sandwich targets (with many layers)….**
- **The experimental group headed by U.Uggerhoj is continuing series of channeling experiments which were initiated earlier by Erik Uggerhoj et al**
- **Collaborating with such team may be very interesting**

POSITRON EXPERIMENTS AT CERN AND KEK?

- **CERN EXPERIMENT**
- **Simplified scheme of the NA63 experiment**
- **Only essential elements necessary for a e+ test are represented**
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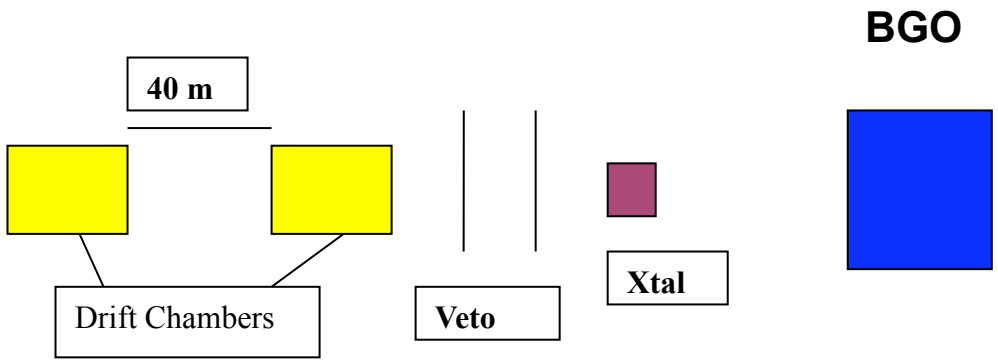

The incident beam on the crystal is controlled with Drift Chambers and trigger selection is using veto counters. The BGO calorimeter can be used.

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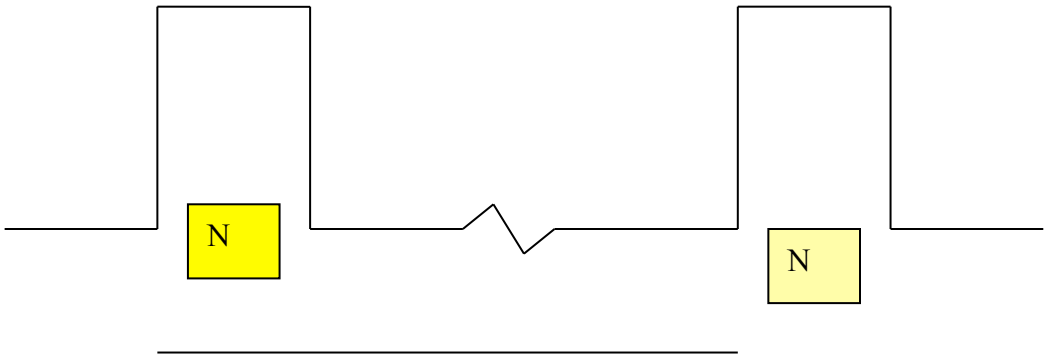
- **BEAM TIME STRUCTURE**



13 secondes

$N = 10^5$ e- ; at E-= 10 GeV , $N = 10^4$

Beam Divergence :100 μrad

E = 10 GeV is the minimum available energy

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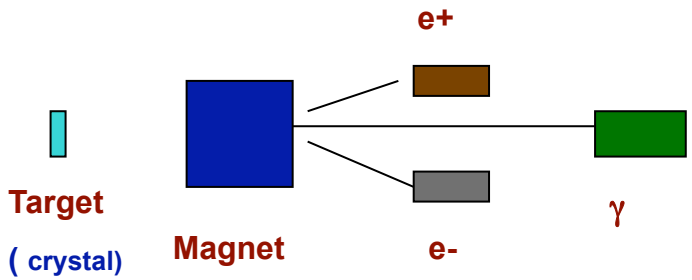
- **WHAT WOULD BE INTERESTING TO DO?**
- *** Positron and photon angular distributions (from crystal)**
- **Such a distribution can be measured with a detector placed after the crystal target and before the first magnet put after the target (for e+/e-). The available detector at NA63 is not useable (sensitivity to GeV particles). A new detector is under study at NA63 (We shall be informed). Photon angular distribution may be obtained after separation from e+/e-.**
- *** Separation of electrons and positrons**
- **In order to study the positron source, we have to separate both particles (after the angular measurement). A bending magnet is necessary. NA 63 team will look at that; the available magnet is too big.**
- *** Energy spectrum**
- **The BGO calorimeter can help to do that. Spectra measurements of e+, e- and γ require 3 calorimeters. It would be interesting to have a segmented calorimeter for the photons. That would give the lateral distribution of the γ As an example, the fiber calorimeter used in WA 103 and brought from Frascati would be interesting to use.**



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- **CERN EXPERIMENT: WHICH TESTS?**
- ***Tests with different crystals**
- **Besides tungsten crystals with <111> axial orientation, diamond crystals are available from NA63 colleagues.**
- **They have C(d)/diamond crystals of small lateral sizes and thicknesses of 0.5, 1.0 and 1.5 mm. There are oriented on <100> axis.**
- **Summarizing:**
- **#There is an interesting opportunity to make some tests at CERN on the NA63 installation. We can make profit of the available elements and of the already accepted NA63 experiment (by SPSC)**
- **# Some points must be checked before the decision**
- **Due to the beam structure this is a particle experiment; it provides precise informations , for example on the energy spectra.**

POSITRON EXPERIMENTS AT CERN AND KEK?

- **POSITRON EXPERIMENT WITH KEK TEST BEAM**
- **The wished measurements on the KEKB test area (where channeling tests have been performed) concern an hybrid target and the are the following:**
- **# Measurement of the permanent amorphous target heating: a system of thermocouples could be a solution**
- **# Measurement of the instantaneous heating on the exit face of the amorphous target. An infrared camera with a good spatial resolution might be the good means to get this information. (Are there intensified infrared cameras?)**
- **# Measurement of the positron yield**
- **# Measurement of the positron energy spectrum.**
- **The beam energy of 4 to 8 GeV is well suited for these experiments**
- **An intensity of 1 to 3 nC per bunch is wished.**

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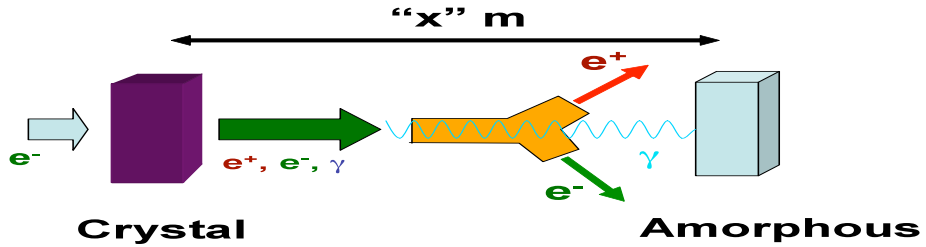
- **NEEDED AREA FOR THE TARGET SYSTEM**
- **The test of the hybrid target requires a minimum area for the two targets and the bending magnet in between.**



The distance x is typically of 2 meters; bending fields are < 1 kGauss

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- **What is needed for the observations:**
- **# a spectrometer for the positron beam spectrum**
- **# Thermocouples to measure the average energy**
- **# Infrared (intensified ?) camera to measure the pulse heating**
- **# Scintillators to measure the positron yield**
- **# Beam dimension monitors to control the impinging beam spot on the crystal**
- **# Beam position monitors to control the beam position on the crystal (it may be associated to the beam dimensions monitor)**

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- **SUMMARY**
- **The experiments at CERN and KEK are of different nature. At CERN it is a particle experiment with a few incident particles on the target. Precise measurements of the energy & angle distribution may be obtained. That could allow, in the future to select the charged particles impinging on the amorphous part of the hybrid target, by simple collimation.**
- **The experiment at KEK is essentially a beam experiment. It provides precious informations on the heating of the target which is of big concern. Other measurements are also expected.**
- **The two experiments may be complementary.**
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