Simulation of the background in BEAST

Igal Jaegle

University of Hawai'i at Mānoa

IN2P3-KEK collaboration on Belle II and BEAST meeting, 19.01.2015

Table of contents



- 2 BEAST II simulation status
- 3 Example: PIN-diode
- Example: micro-TPC in phase 2



Background simulation induced by SuperKEKB

Are produced by Nakayama-san, Ohnishi-san, Funakoshi-san, and Soloviev-san. They also did provide scripts and instruction to run it with basf2

- RBB (designed limunosity or phase 3)
- Coulomb (phase 1 and phase 3)
- Touschek (phase 1 and phase 3)
- Beam gas (phase 1)
- Synchroton radiation (phase 3)

We are using their event generators and their scripts.

- [software : 665] 10th background MC campaign, Nakayama-san
- Re : [software : 850] SynchRad files for BG mixing, Soloviev-san

BEAST II responsability

- Implement all BEAST II detectors into basf2 framework
- Produce witness histograms and money plots

BEAST II simulation status

Local release named beast with sub-directories corresponding to each sub-detectors, beam pipes, support structures and cave

e.g. svn list https://belle2.cc.kek.jp/svn/trunk/software/beast

- Detectors (parts) available:
 - ph1bpipe (done)
 - ph1sustr (done)
 - cave (done)
 - bgo (done)
 - Csl (done), Alex took over me
 - microtpc (done)
 - he3tube (done), Sam took over me
 - pindiode (done)
 - srsensor: silicon drift detectors, planar FE-14 and diamond sensors (done), Gianluca will take the relay ?
 - beamabort: diamond sensors

Digitization:

- Csl (done) wrote by Alex
- microtpc (done)
- he3tube (done) wrote by Sam
- pindiode (done)
- Analysis:
 - microtpc (done)

Simulation and analysis flow



Example: PIN-diode

beast/pindiode/data/

- box: 2 × 1 × 1 cm box w/ hole of 5.1 mm
- diode: 2.65 × 2.65 × 0.25 mm
- gold layer: 2.65 × 2.65 × 0.01 mm



Phase 1



Phase 1

Very preliminary results for phase 1

• Top row: pin diode with gold layer ie high-Z shield



• Al boxes shield particles for $\phi = 0^{\circ}$ and 180°

Example: micro-TPC in phase 2

TPCs positioned to disentangle the different sources of neutrons by measuring the angular distribution of the recoil nucleus.



Igal Jaegle (UH)

BEAST simulation

Recoil angle rate distribution in forward TPC / Example

MC simulation with 1 chip and $\mbox{He:CO}_2{:}70{:}30$ at 1 atm

- RBB LER dominates at end of phase2
- With single beams
 - No RBB
 - Measure Touschek
 - With vacuum bump Coulomb can be measured





Re-normalized distribution in forward TPC / Example

MC simulation with 1 chip and $He:CO_2{:}70{:}30$ at 1 atm

- Re-normalized distributions
- Clear difference visible





Recoil angle rate distribution in backward TPCs / Example

MC simulation with 1 chip and $\text{He:CO}_2{:}70{:}30$ at 1 atm

- RBB LER dominates at end of phase2
- With single beams
 - No RBB
 - Measure Touschek
 - With vacuum bump Coulomb can be measured





Re-normalized distribution in backward TPCs / Example

MC simulation with 1 chip and $He:CO_2:70:30$ at 1 atm

- Re-normalized distributions
- Clear difference visible





Several detectors are ready or did already produce witness histrograms for the phases where the background simulation induced by SuperKEKB are ready

- micro-TPC fast neutron
- PIN-diode
- Csl
- He3 tube slow neutron

Should be presented at the next B2GM,