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SLAC, March 19

Low Angle Bhabha Events and Electron Veto. Comparison Between Different Crossing Angle Designs

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Motivation

Bhabha scattering:

- $e^+ + e^- \rightarrow e^+ + e^- + (n\gamma)$
- $\partial\sigma/\partial\theta \sim 1/\theta^3 \rightarrow$ high probability at very small angles
  ≡ BeamCal is the most hit sub-detector

Veto rate:

- incomplete reconstructed events will be vetoed

Incomplete reconstruction:

- kinematics, i.e. γ-radiation deflects particles
- reconstruction problem on top of the beamstrahlung remnants

Study:

- Impact of Bhabha events on the veto rate for different crossing angles

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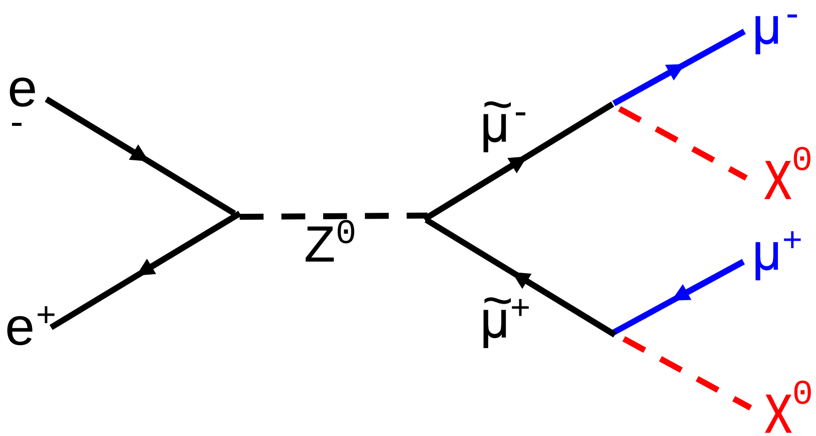
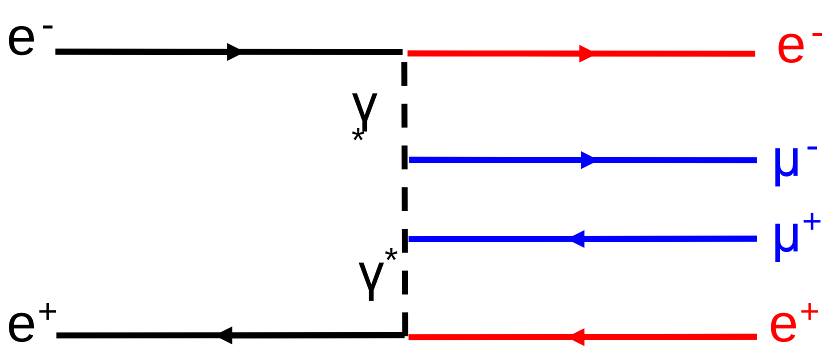
New Particle Searches



The Physics:
smuon pair production
Signature:
$\mu^+ \mu^-$ + missing energy
$\sigma \sim 10^2$ fb (SPS1a)



The Background:
two-photon events
Signature:
$\mu^+ \mu^-$ + missing energy
(if electrons are not tagged)
$\sigma \sim 10^6$ fb

$$e^+ + e^- \to e^+ + e^- + (n\gamma)$$
$$e^+ + e^- \to \tilde{\mu}^+ + \tilde{\mu}^- \to \mu^+ + \mu^- + \chi^0 + \chi^0$$
$$= e^+ + e^- \to e^+ + e^- + \mu^+ + \mu^-$$

i.e. mimic two-photon event → to be vetoed

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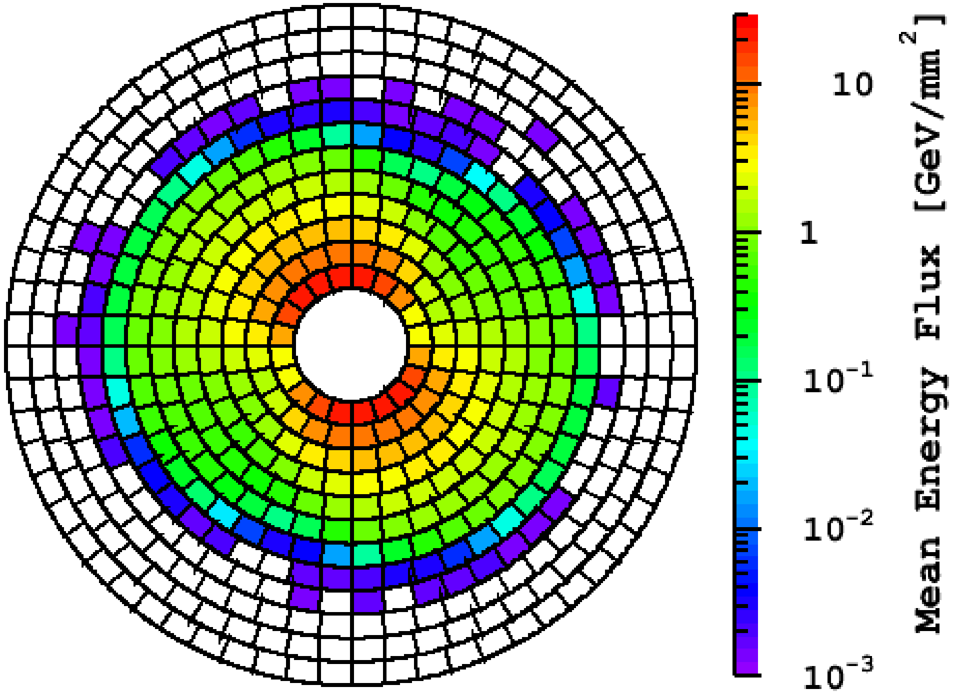
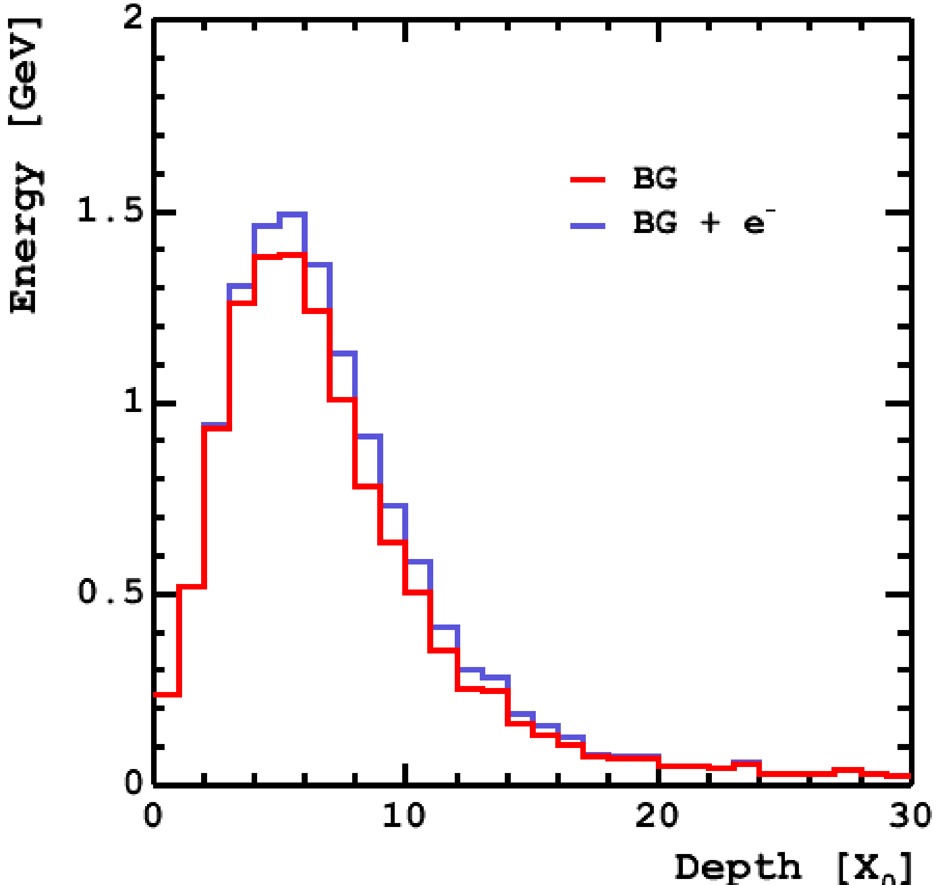
Beamstrahlung remnants. Pairs

BeamCal will be hit by beamstrahlung remnants carrying about 20 TeV of energy per bunch crossing.

the distribution of this energy per bunch crossing at √s = 500GeV



100GeV electron on top of beamstrahlung



Severe background for electron recognition

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Simulation Procedure

Geometry:
- 3 designs

Generation:
- BHLUMI + TEEGG

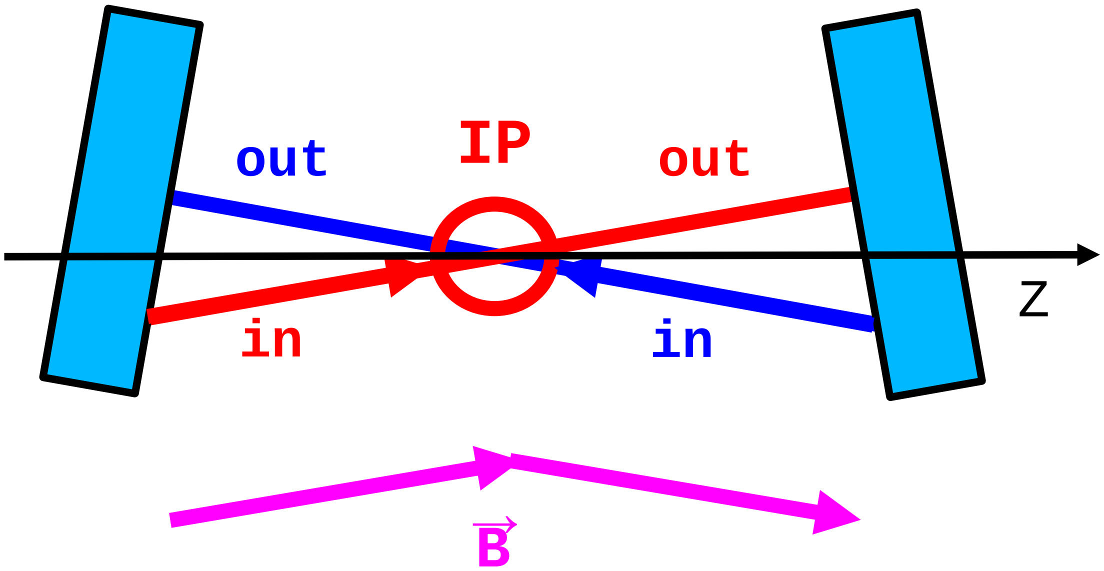
4-momenta recalculation:
- Lorentz boost for finite X-angle designs

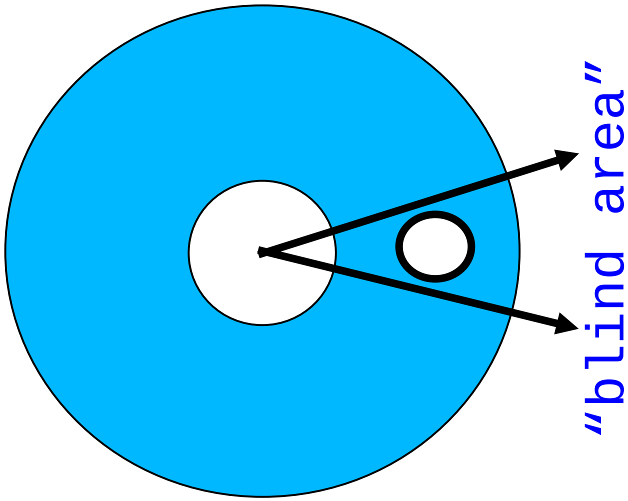
Tracking in magnetic field:
- GEANT4

Detection efficiency for each particle:
- parametrization routines

Calculation of probabilities:
- lost
- incomplete reconstruction ≡ veto
- full reconstruction

Geometry





X-angle, mrad	0	2	20
blind area	-	-	+
L, cm		370	
Rmin, cm	1.5	2	2
Rmax, cm		10	

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Bhabha generation

BHLUMI:
+ all topologies
- minimal angle > 0

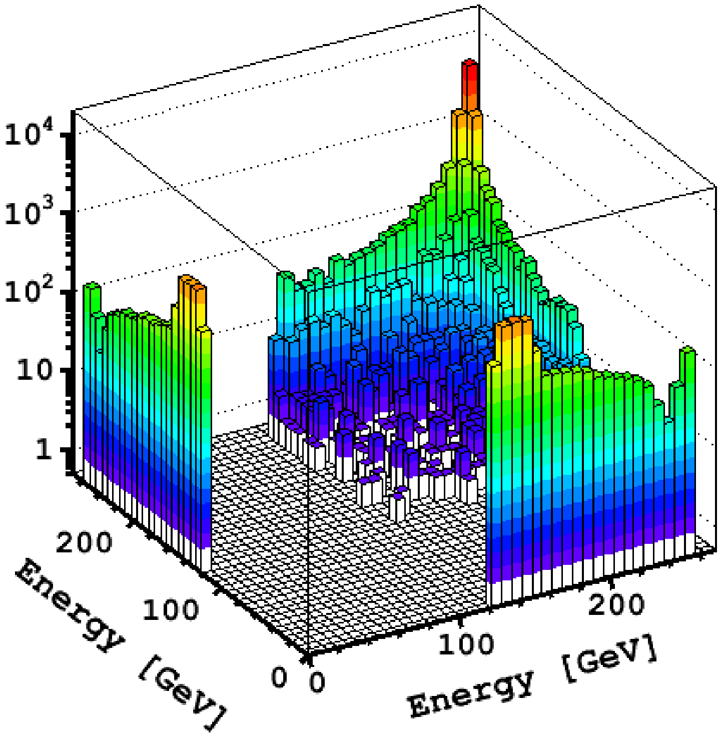
compensate

TEEGG:
+ 1 particle in BCal
+ minimal angle ≈ 0

Selection

BHLUMI:
- both particles above BCal

TEEGG:
- 1 particle in BCal



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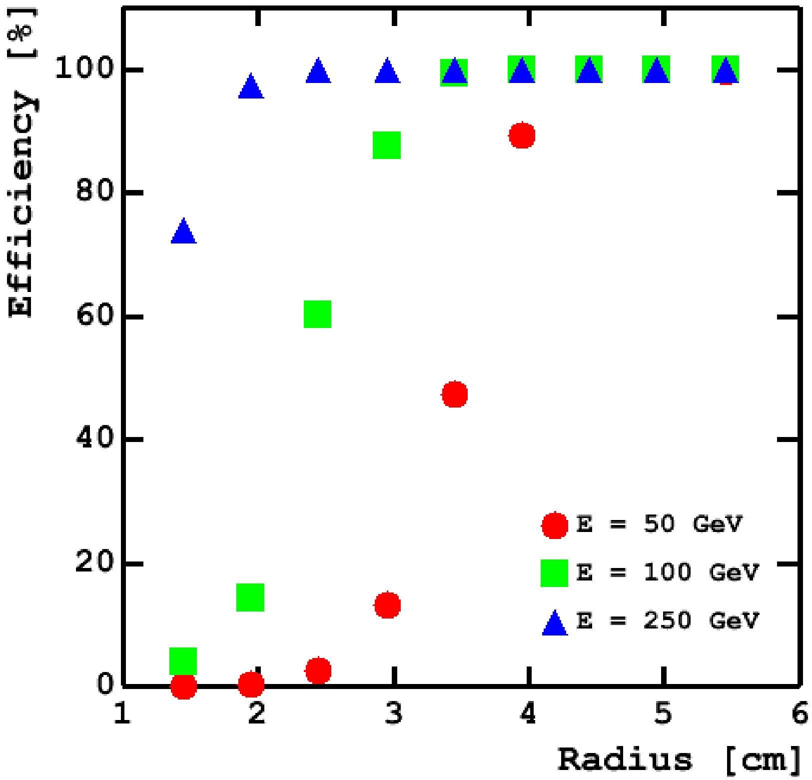
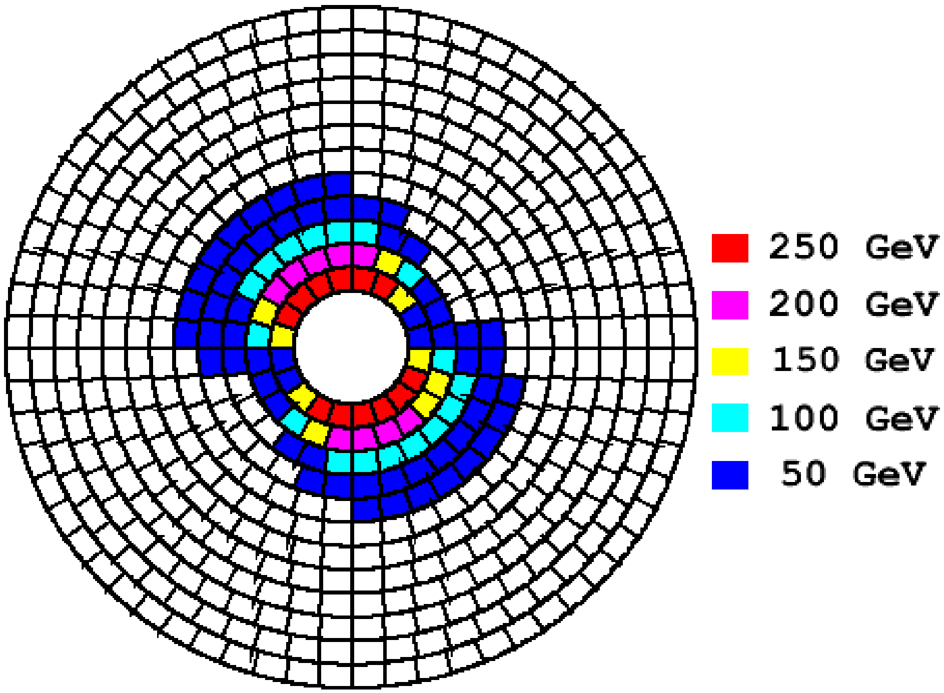
Electron Recognition Efficiency -- $\sqrt{s}$ = 500GeV

Fake rate is less then 1%

chain of towers at φ = 90°
(the most affected)



cells are colored when
the efficiency is less then 90%



Recognition efficiency are parametrized as function of:

- electron energy
- pairs energy density

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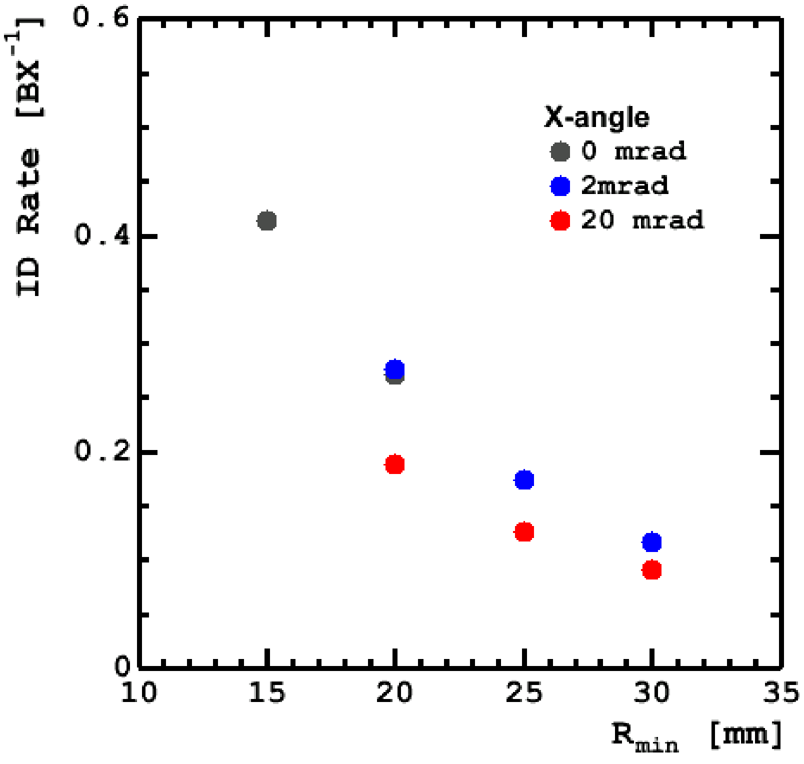
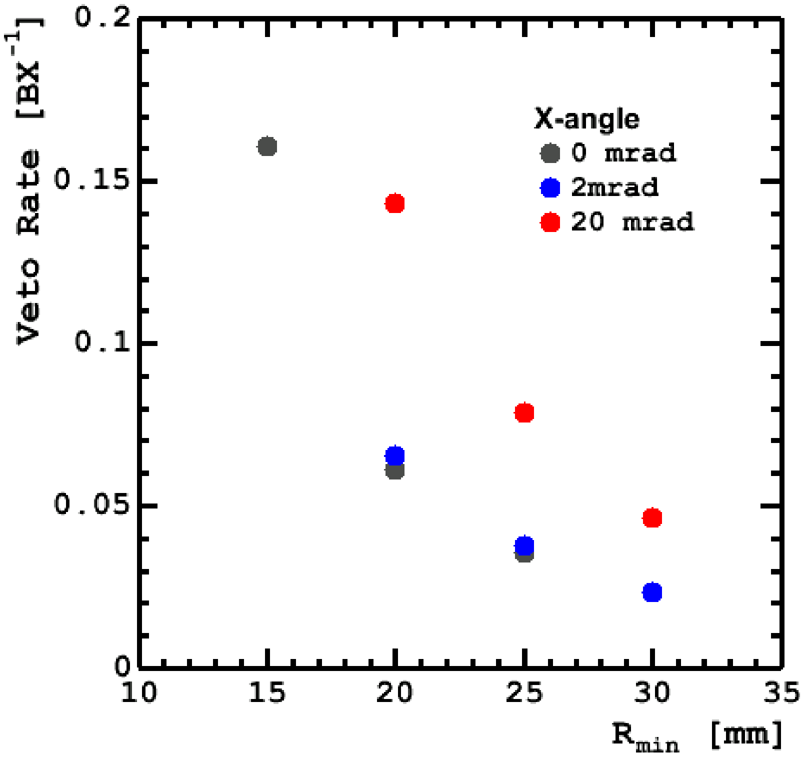
Results

Note:

- Energy cut = 150GeV
- energy resolution is not included





Conclusions:

- appreciable contribution to veto rate
- 2 mrad scheme: insignificant rise
- 20 mrad scheme: rise by a factor of 2