The Secondary Electron Yield Model in ECLOUD and Comparison to CLOUDLAND

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Electron Cloud Simulations Meeting

Wilson Lab

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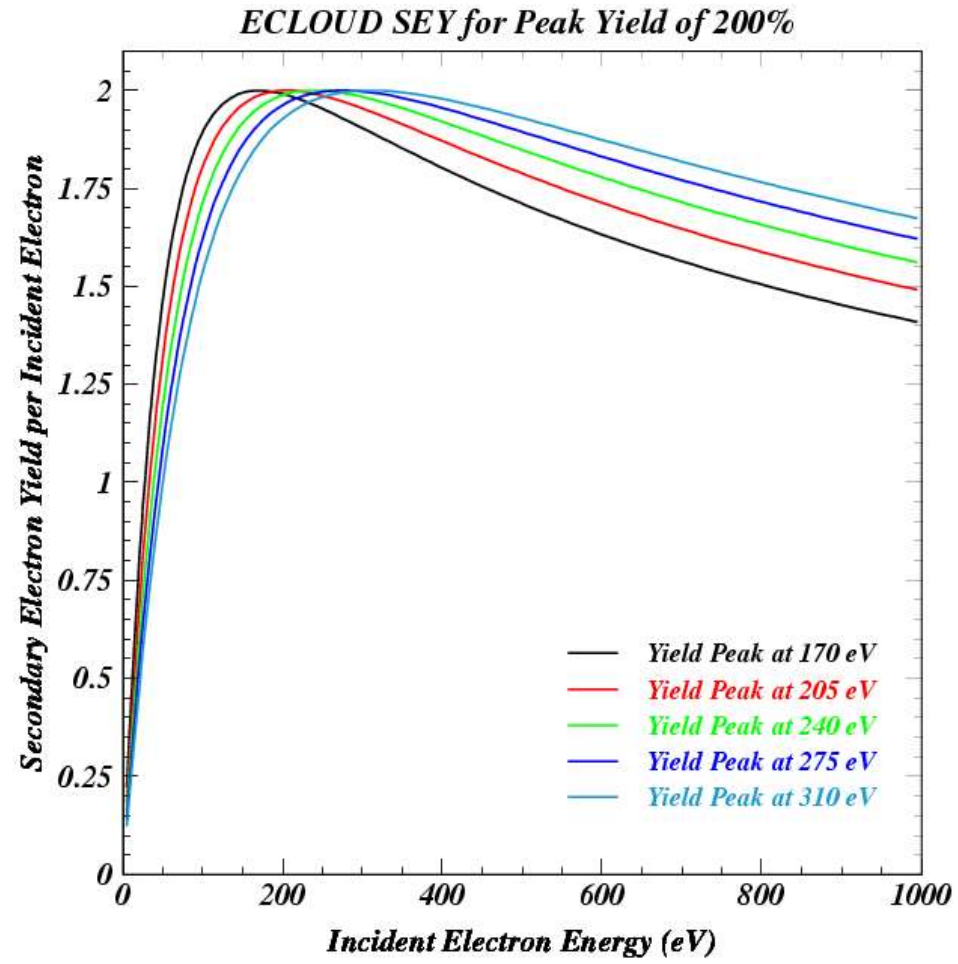
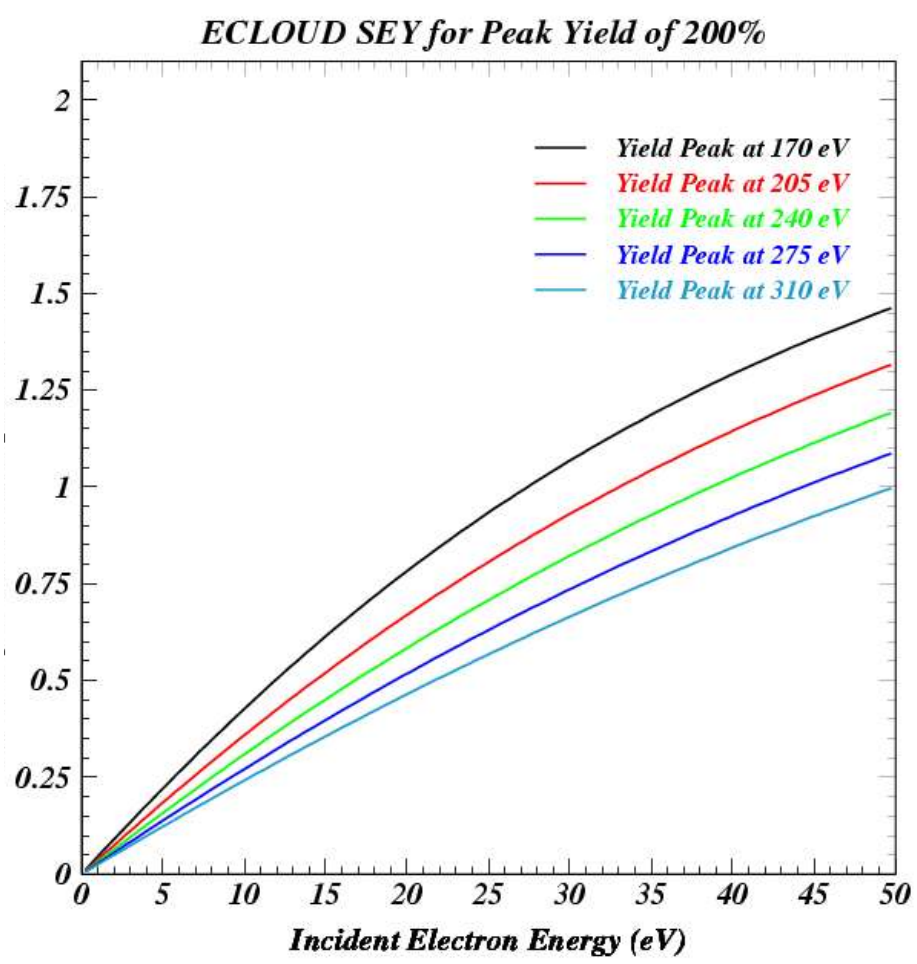
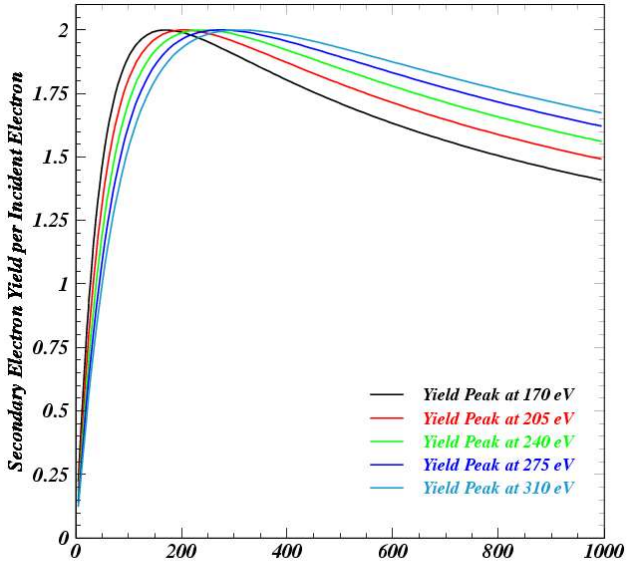
Charge Yield vs Energy

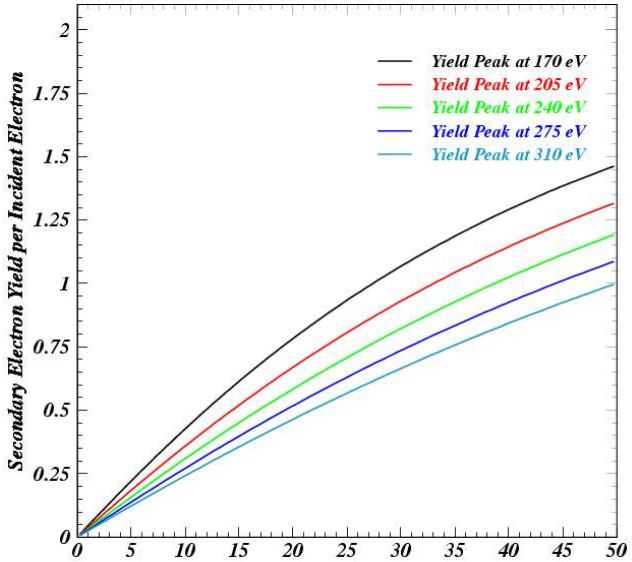
Two input parameters: Peak Yield and Energy of Peak Yield
Parameterization for Aluminum
Default is "Noel" distribution of 2001



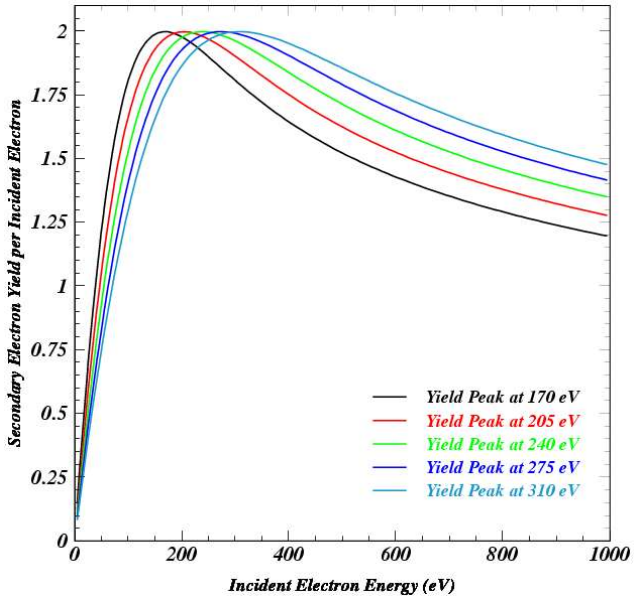


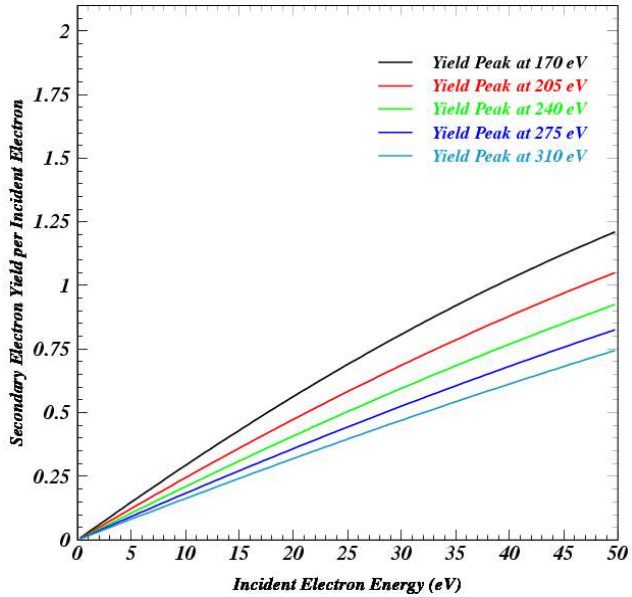
Charge Yield vs Energy
ECLOUD vs CLOUDLAND





ECLOUD



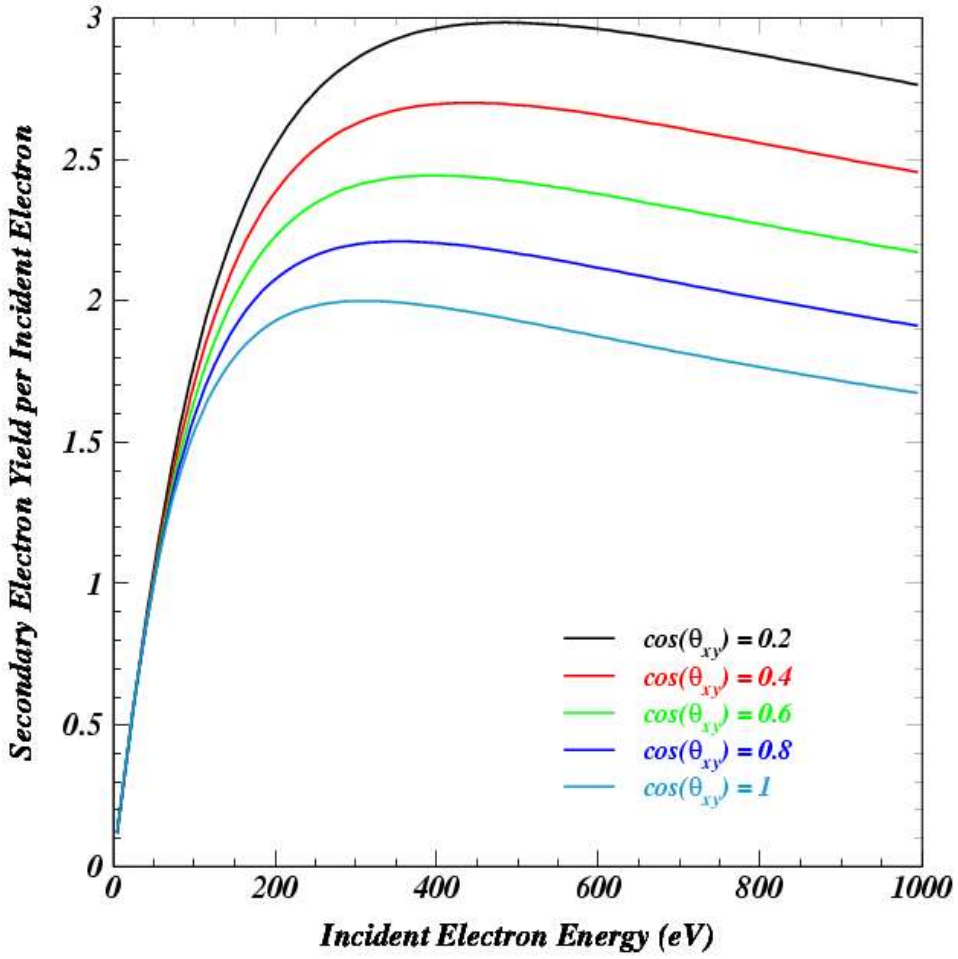


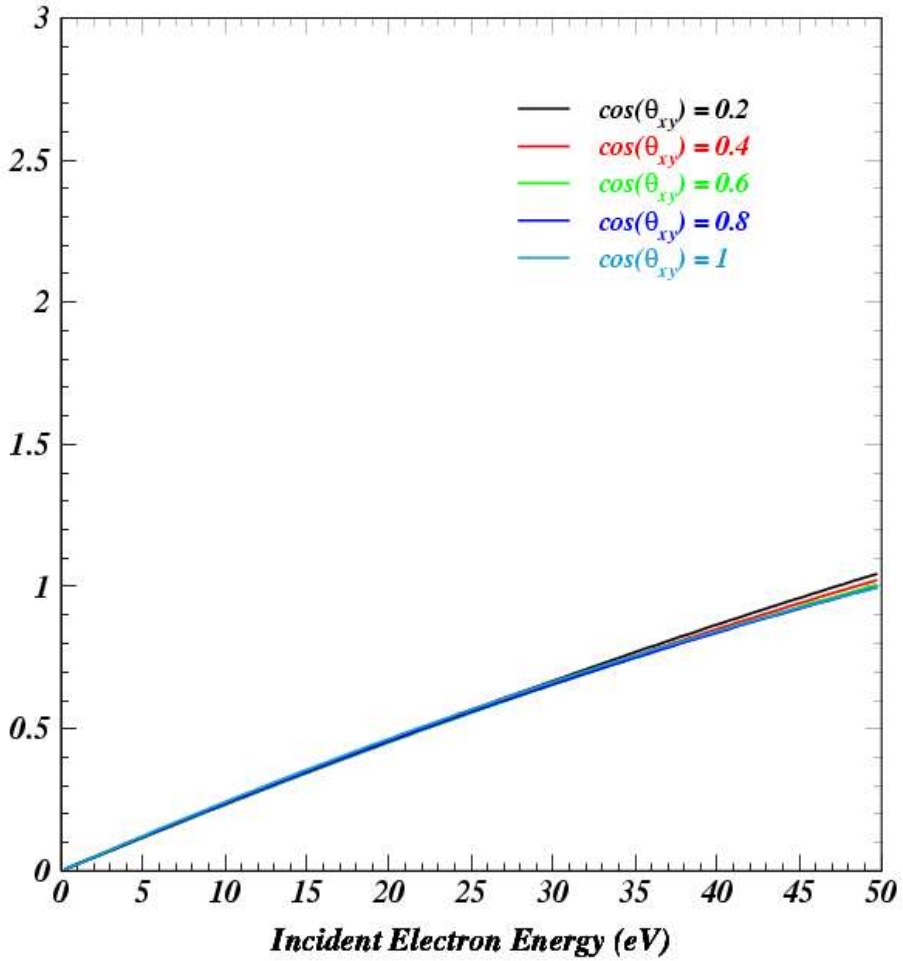
CLOUDLAND

Fortran functions
`sey_ecloud.f`
and
`sey_cloudland.f`
are posted on the CesrTA Electron Cloud Simulation wiki

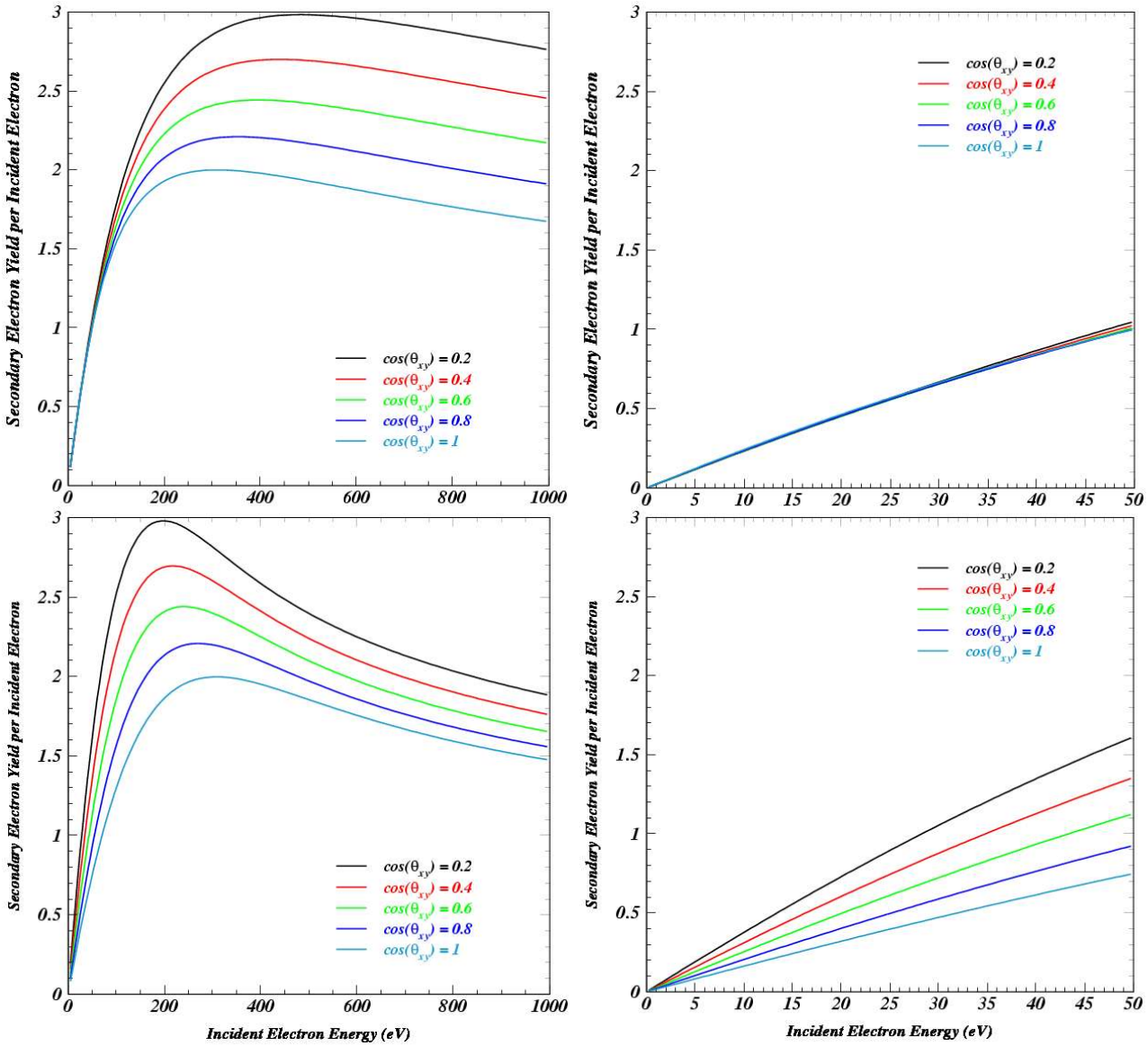
Charge Yield Dependence on Incident Angle Relative to Perpendicular

Angle out of transverse plane ignored
Incident angles larger than cos Θ_{xy}<0.2 set to cos Θ_{xy}=0.2





Charge Yield Dependence on Incident Angle
ECLOUD vs CLOUDLAND

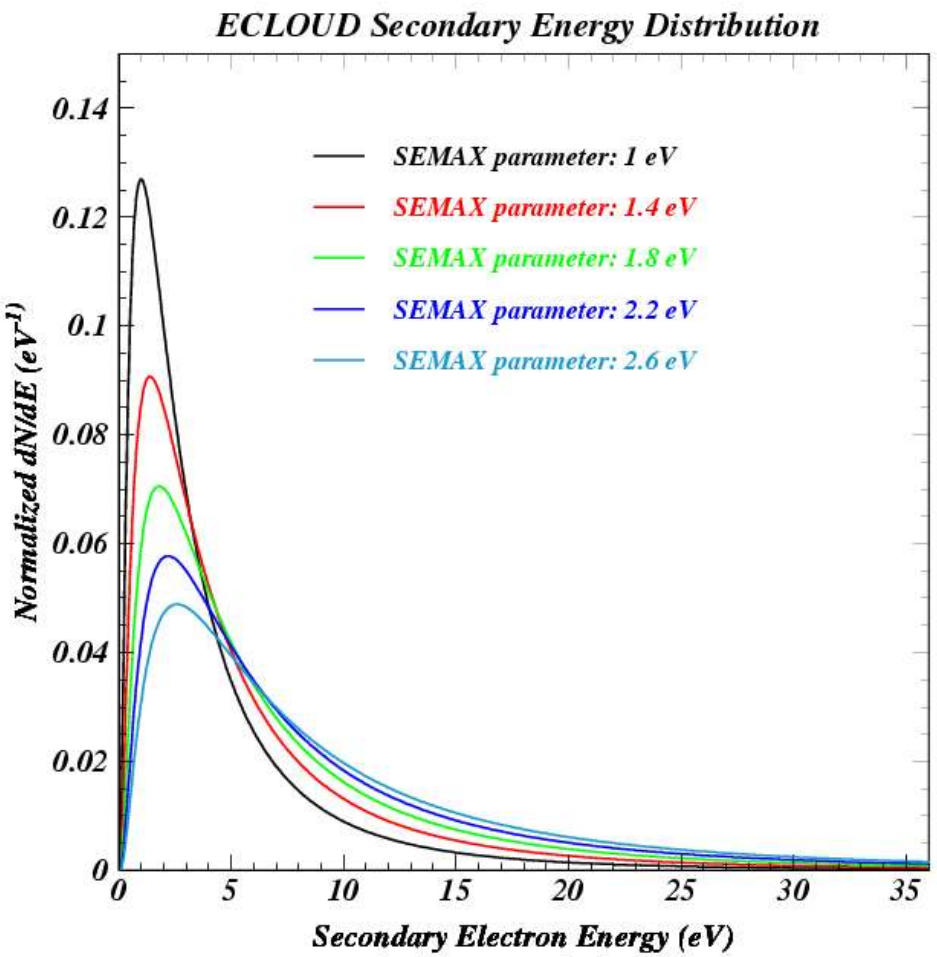


ECLOUD

CLOUDLAND

Angular dependence at low energy very different !

Energy Distribution for Secondaries



Non-elastic Fraction

Input parameter SEMAX

(typically 1.8 eV in simulation guidance)

Energy cutoff at E < 12 x SEMAX

Log normal distribution

Elastic Fraction

Determined by parametrization of incident energy

Parametrization differs for E <> 300 eV

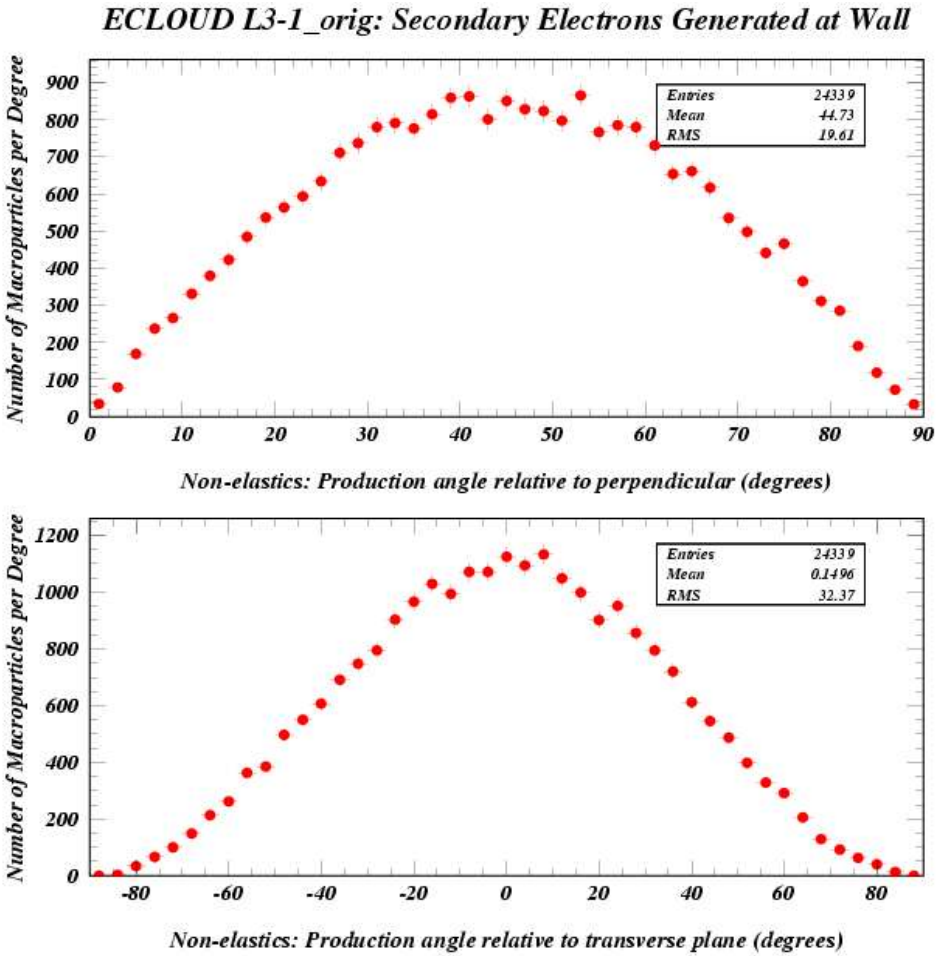
Ref: LHC-Project-Report 472

Macroparticle fraction adjusted for secondary charge

Kinetic energy set equal to incident energy

Momentum vector determined by reflection off wall

Momentum Vector for True Secondaries



Hard-coded angular distribution with $\sin^2 \Theta$ uniform from 0 to 1

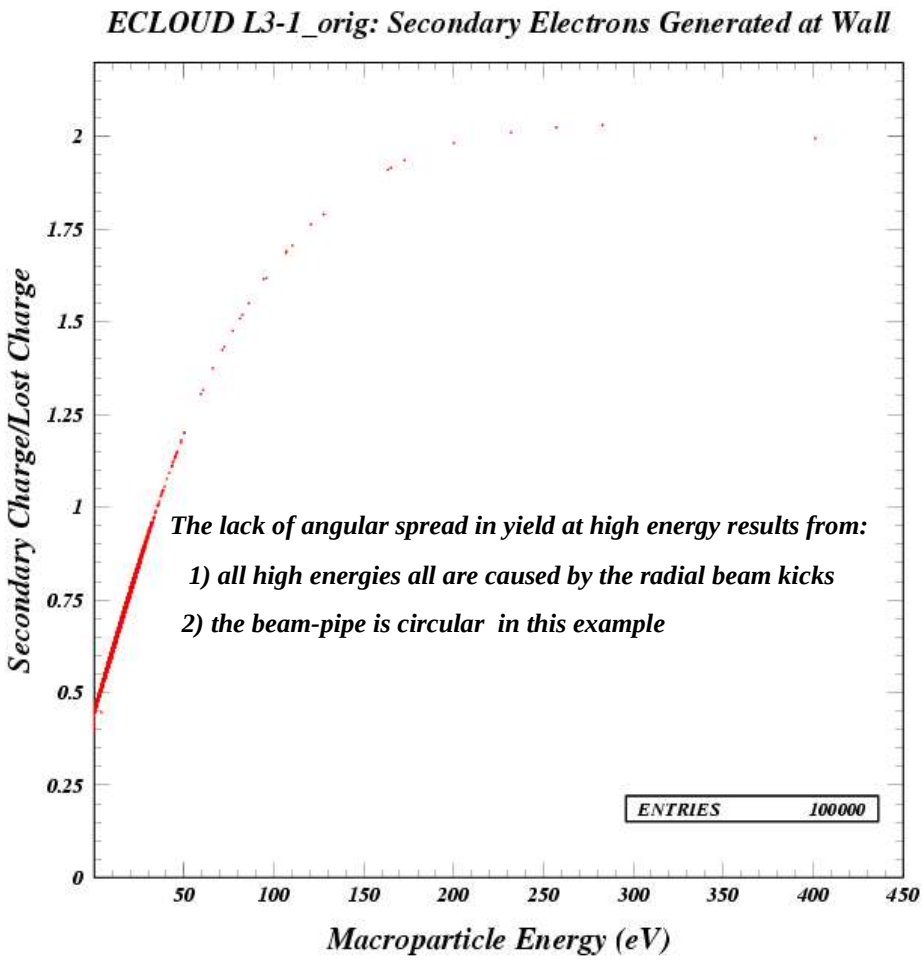
Most probable polar angle 45 degrees

Angle out of transverse plane results from azimuthal angle thrown uniformly around wall normal vector

This slide and those following show results from an example L3-1 run using the ECLOUD original primary p.e. generation model

Secondary Yield vs Incident Energy

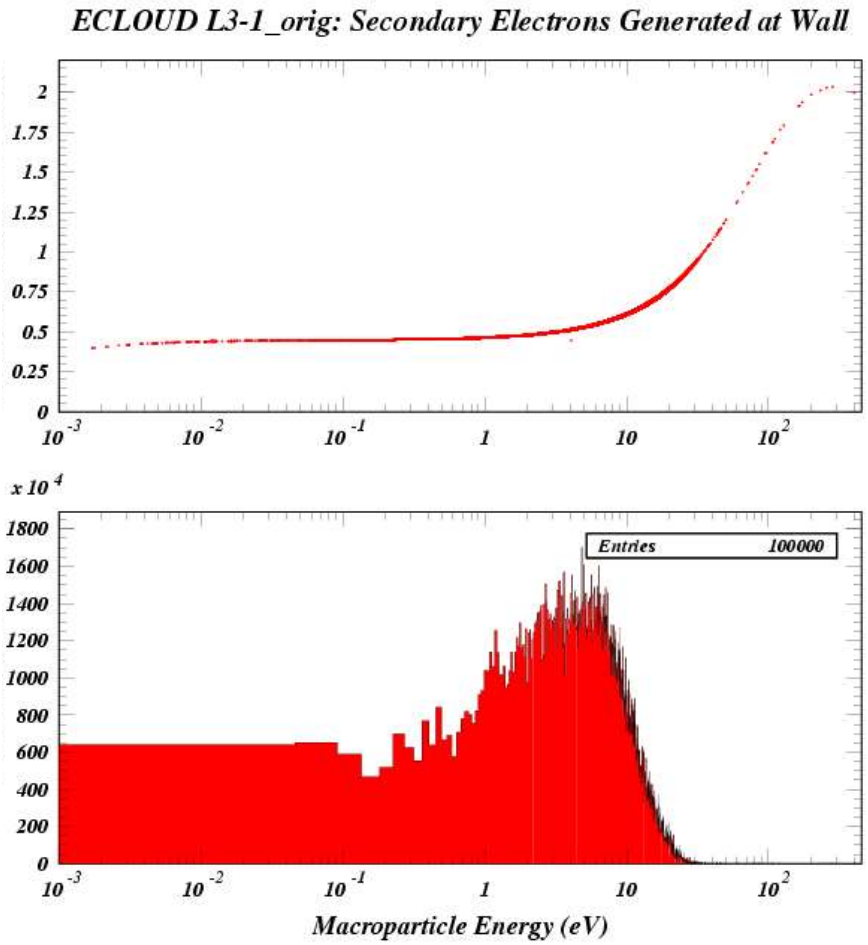
Peak yield 2.0
Peak energy 310 eV



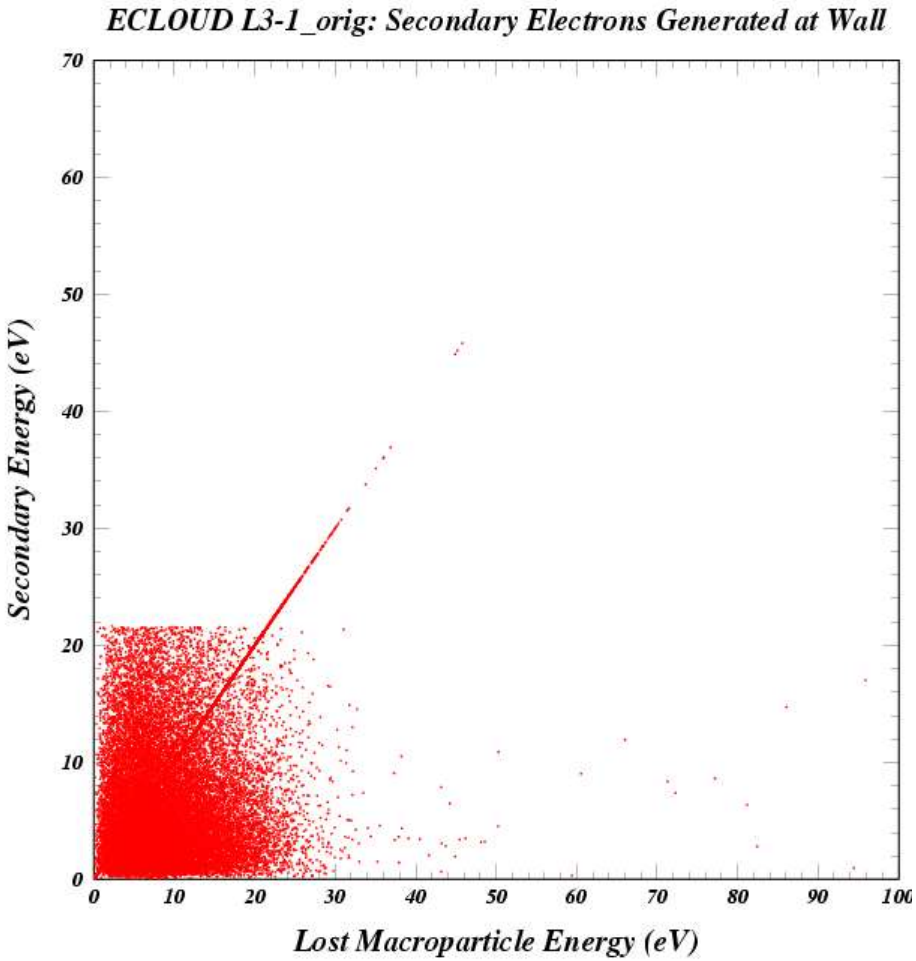
The lack of angular spread in yield at high energy results from:

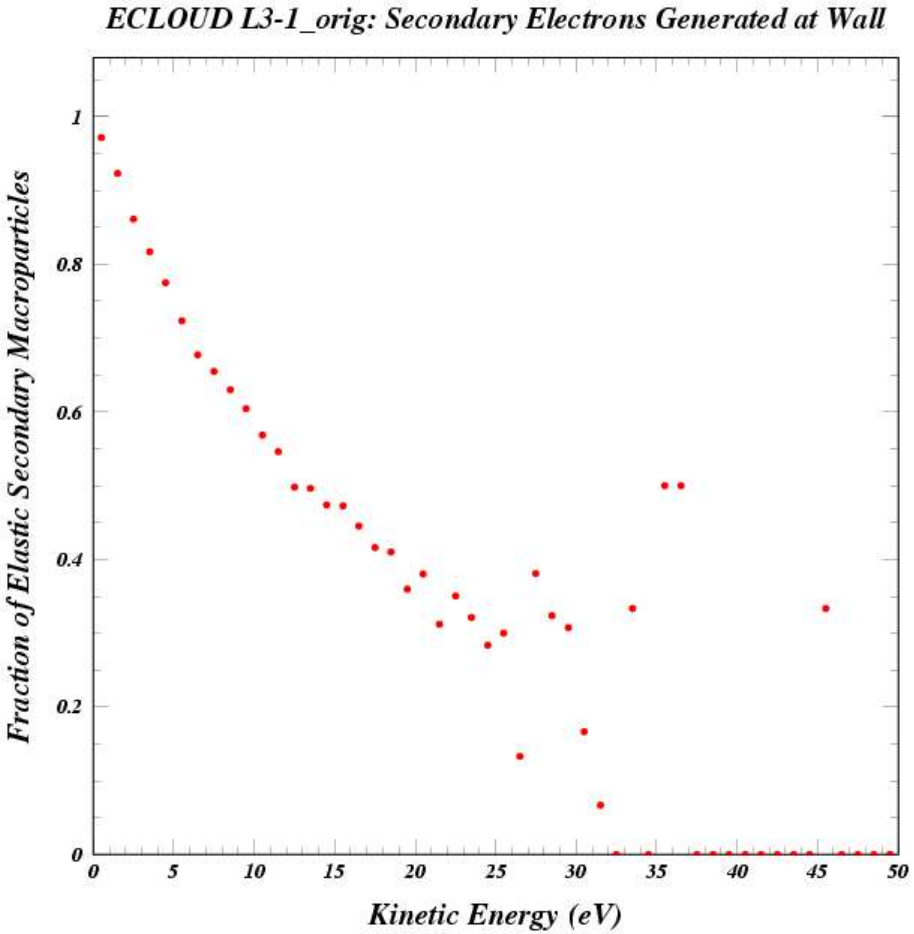
1) all high energies all are caused by the radial beam kicks

2) the beam-pipe is circular in this example

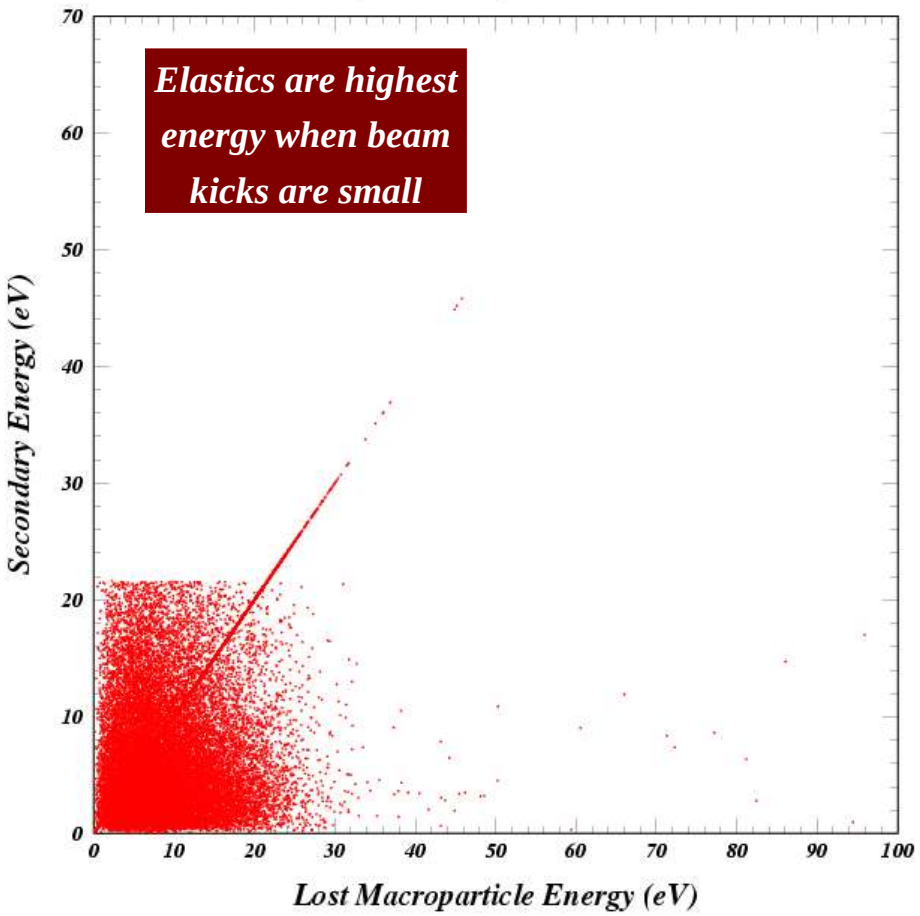


Energy Distribution and Elastic Fraction

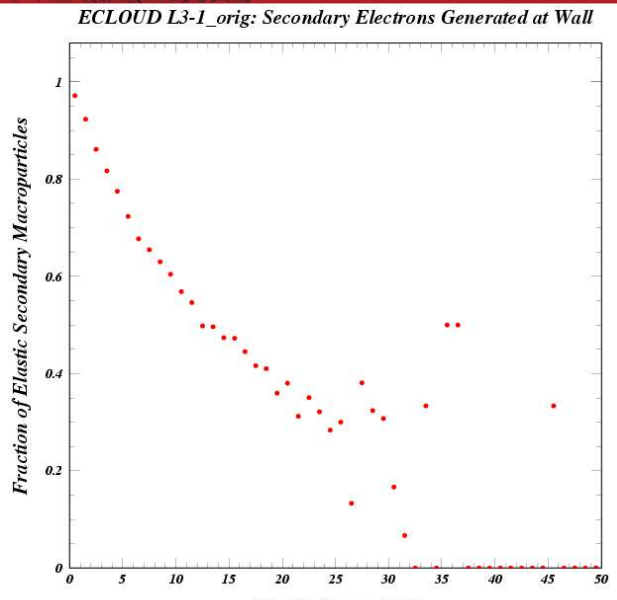




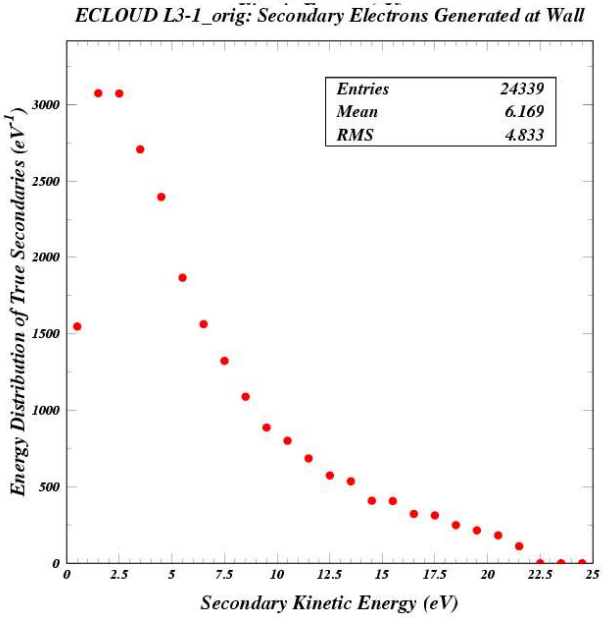
Energy Distribution and Elastic Fraction



Elastics are highest energy when beam kicks are small



100% elastic at E=0



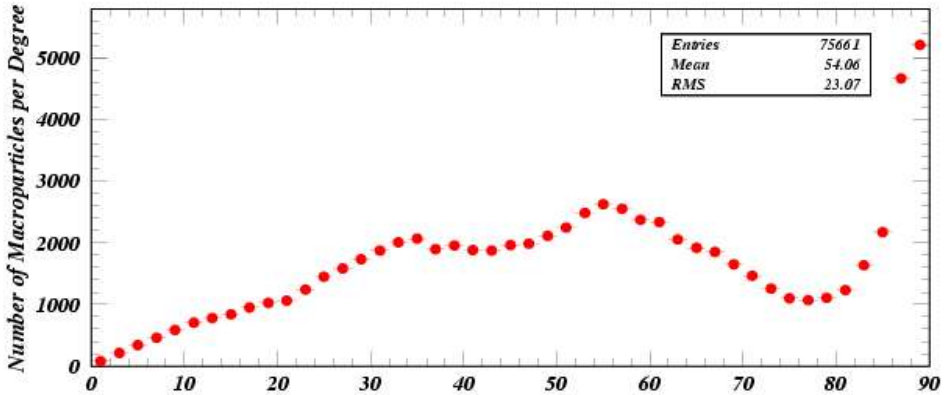
Non-elastic Cutoff at 21.6 eV

Angular Distributions for Elastics and Non-elastics

Elastic angular distribution shows grazing angles resulting from ECLOUD default primary p.e. grazing angles

Elastic polar angular distribution shows reflection
Non-elastics show generated distribution
sin Θ = sqrt(ran), φ = 2π ran

ECLOUD L3-1_orig: Secondary Electrons Generated at Wall



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