# HIGH ENERGY PROTON DECHANNELING IN SILICON CRYSTALS

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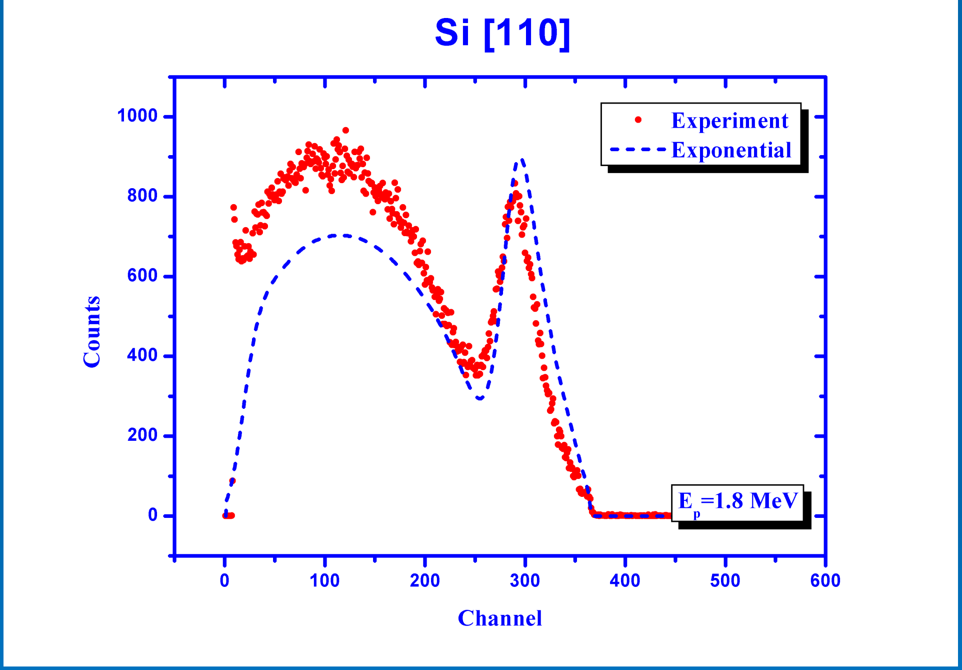
## OUTLINE OF THE TALK

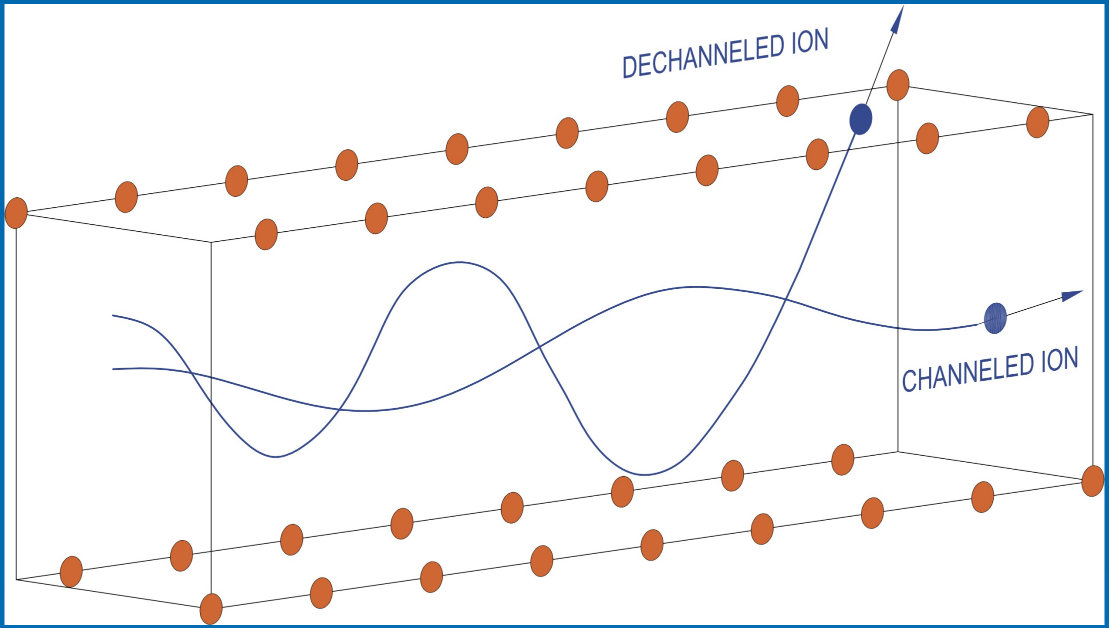
- Formulation of the dechanneling problem
- Theory of the dechanneling
- Results and perspective

# Formulation of the dechanneling problem




1. Energy loss of protons in silicon in the <110> direction, $S_{ch} = \alpha S_{ran,}$ $\alpha$ = const.
2. Exponential dechanneling function.

# Ion dechanneling effect

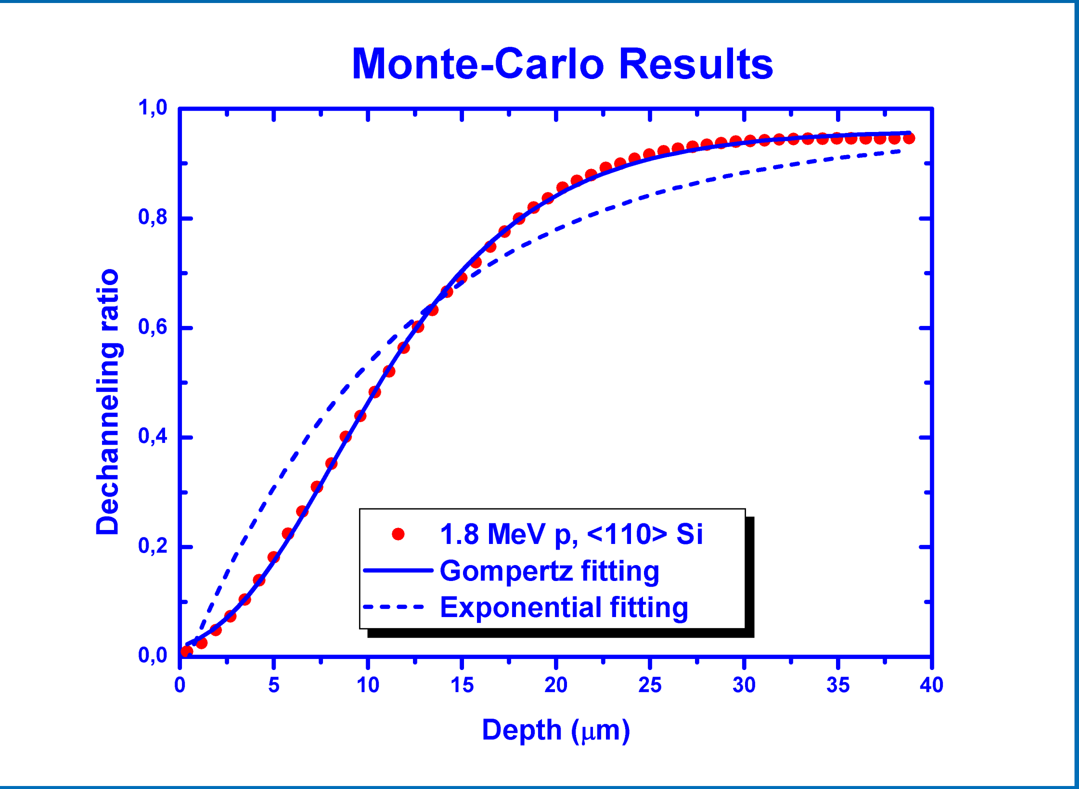



Dechanneling function represents the number of dechanneled ions with respect to the total number of channeled ions (dechanneling ratio) after some crystal depth.

# Theory of the dechanneling

- The dechanneling function is generated by a realisitic Monte-Carlo computer simulation code using the numerical solution of the proton equations of motion in the transverse plane.
- Continuum approximation is assumed with the continuum potential obtained from the Moliere’s ion-atom interaction potential.
- Thermal vibrations of the crystal atoms, the energy loss of the proton and proton-electron multiple scatering are included in the code.
- The obtained dechanneling function is fitted with the appropriate analytical expression.

# Gomperz type sigmoidal dechanneling function



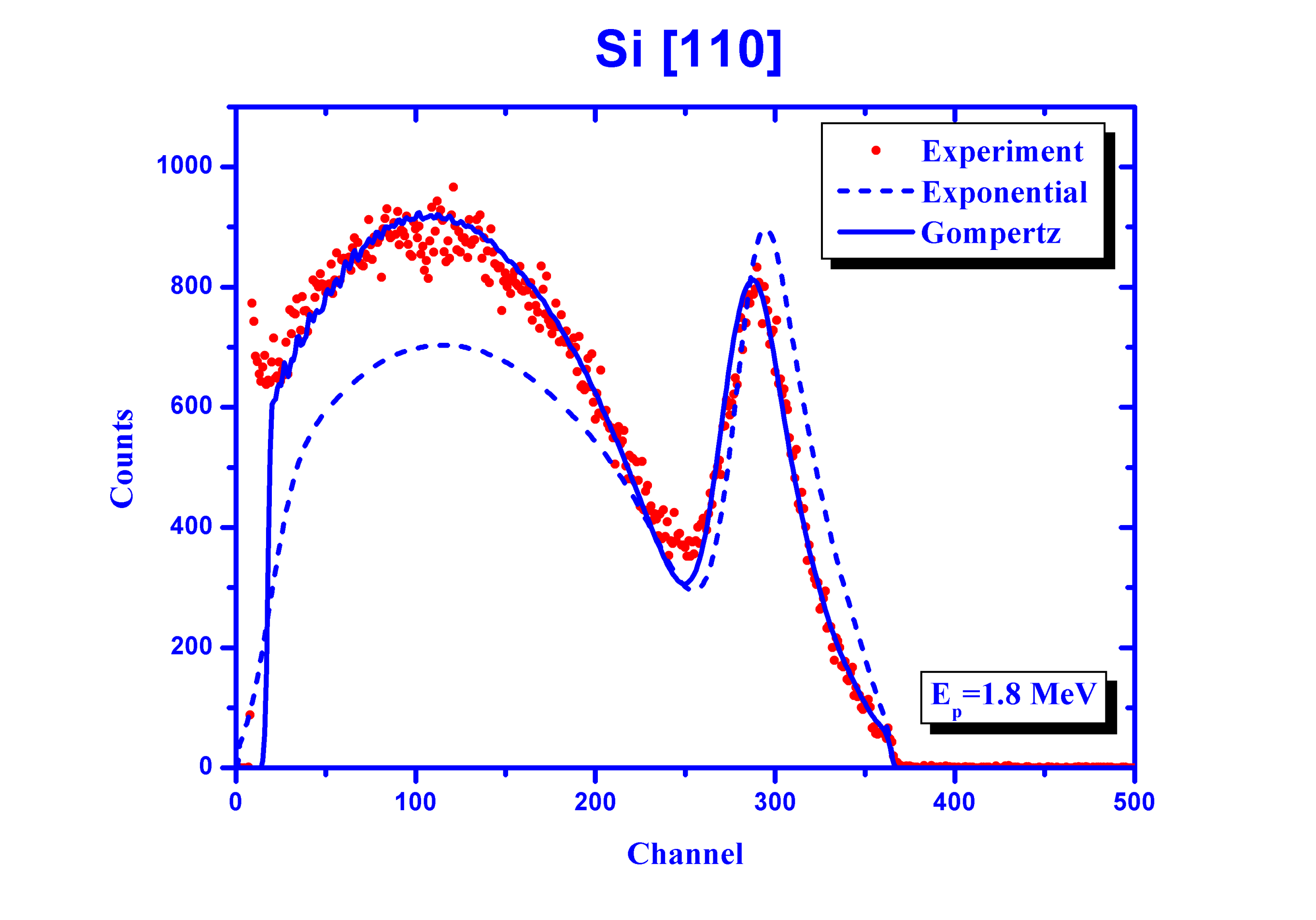

Gompertz dechanneling function

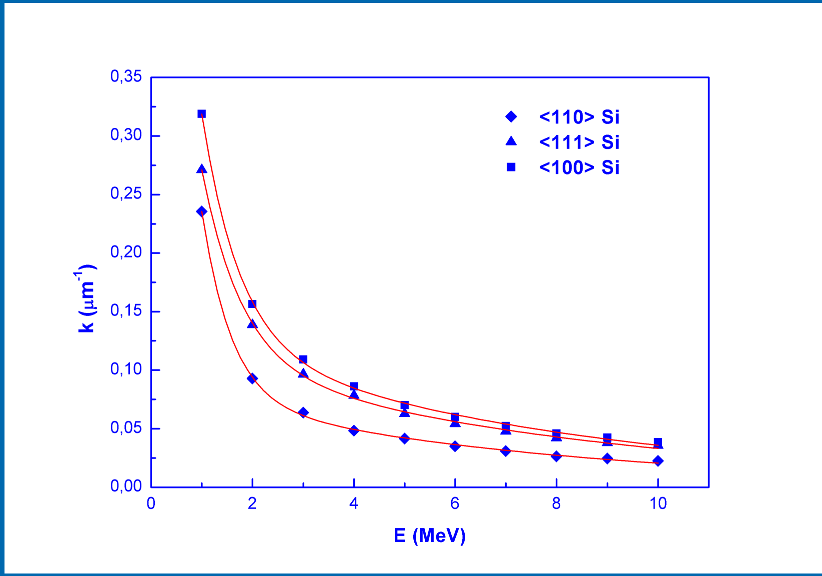
$$N_d = N_o \frac{e^{-\exp(-k(x-x_c))} - e^{-\exp(kx_c)}}{1 - e^{-\exp(kx_c)}}$$

Exponential dechanneling function

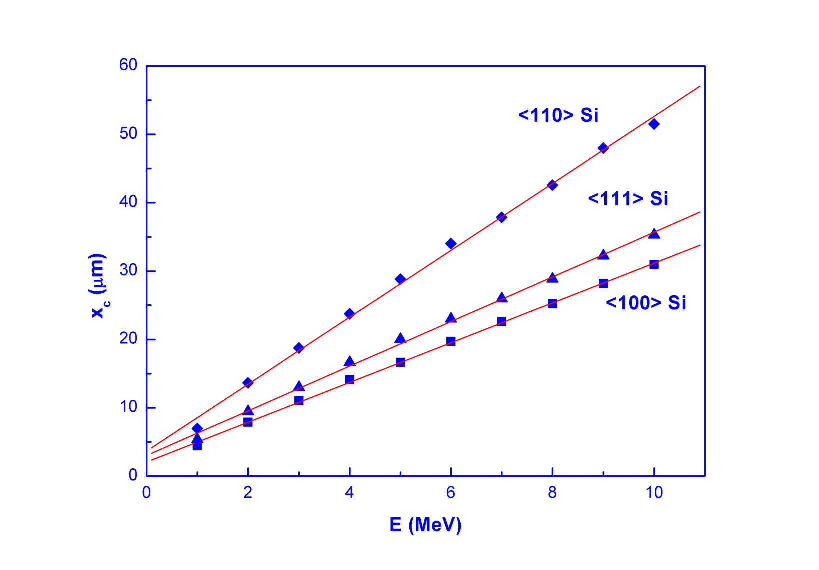
$$N_d = N_o\left(1 - e^{-kx}\right)$$

# Results

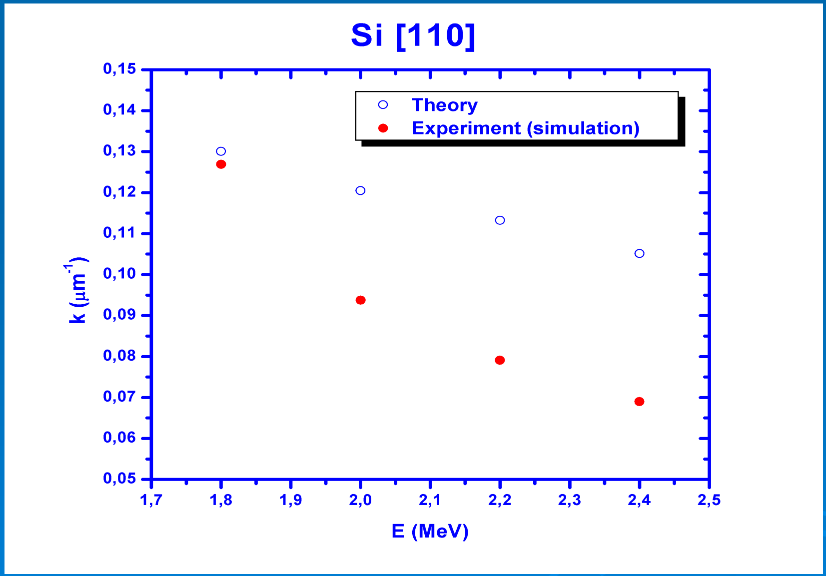

Si [110]
Experiment
Exponential
Gompertz
$E_p$=1.8 MeV
Counts
Channel
0
200
400
600
800
1000
0
100
200
300
400
500



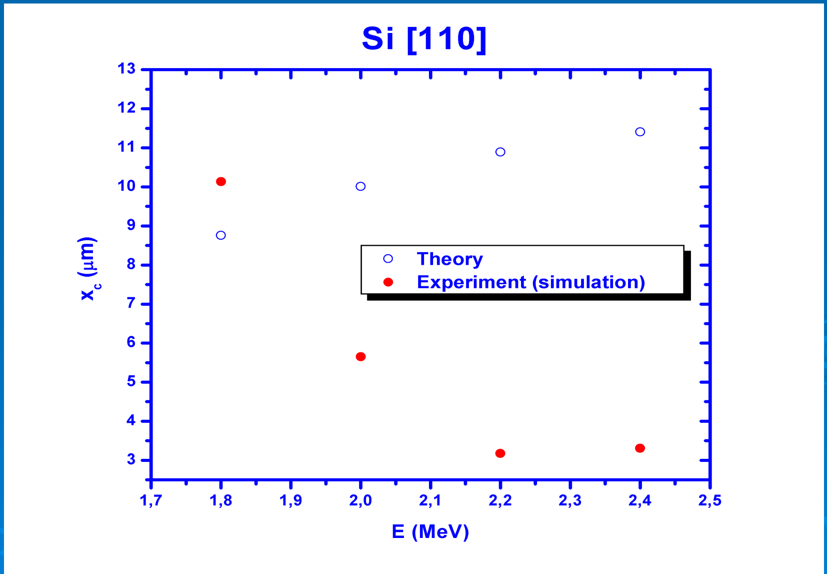
k (μm⁻¹)
E (MeV)
<110> Si
<111> Si
<100> Si

x_c (μm)
E (MeV)
<110> Si
<111> Si
<100> Si

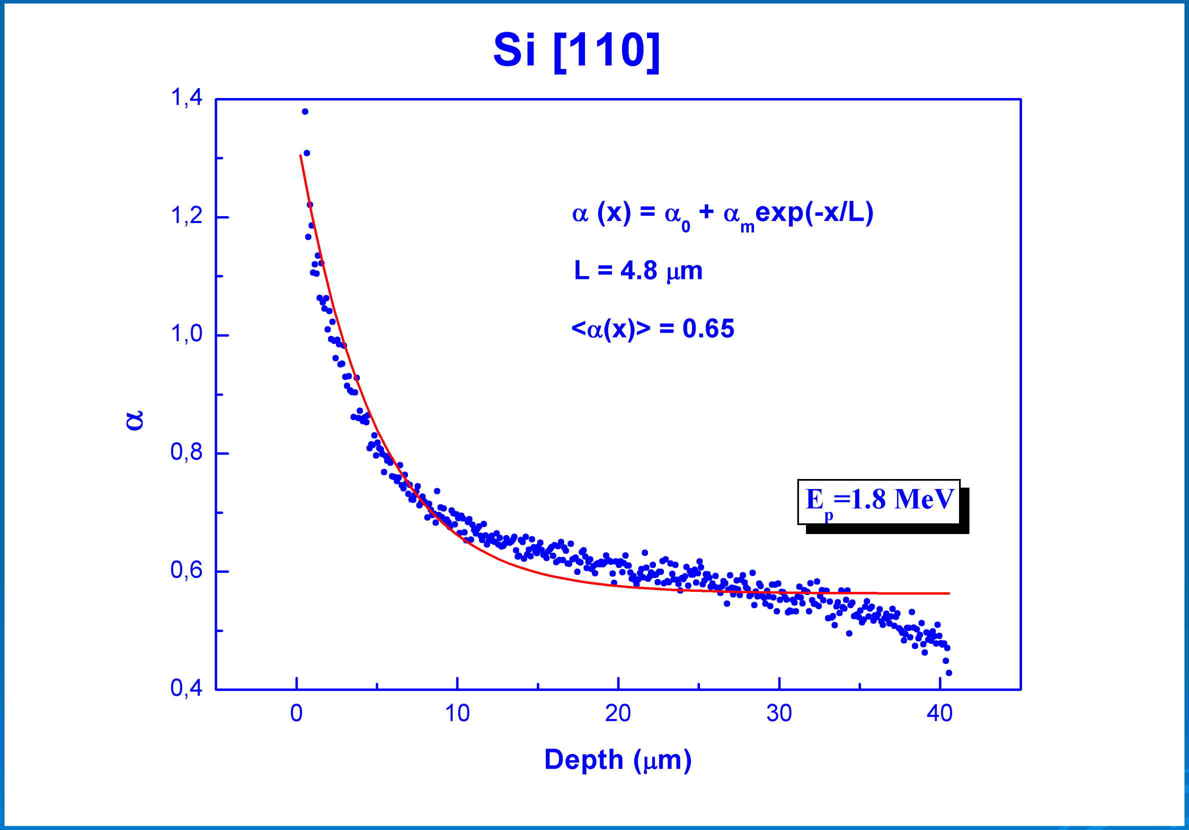
Si [110]
Theory
Experiment (simulation)
k (μm⁻¹)
E (MeV)

Si [110]
Theory
Experiment (simulation)
x_c (μm)
E (MeV)

# Energy loss of channeled ions

$$S_{ch} = \alpha(x) S_{ran}$$



**Thank you for your attention**