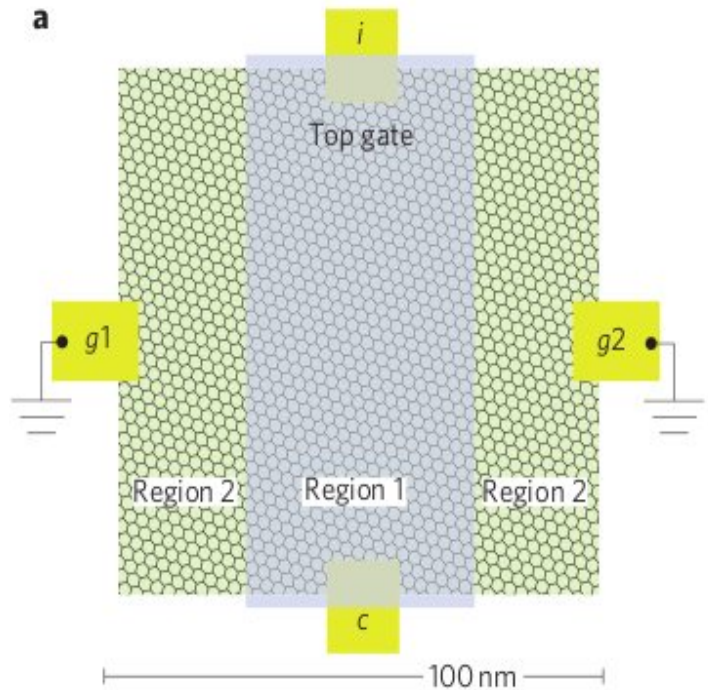


Φ – 575 Διάλεξη 14

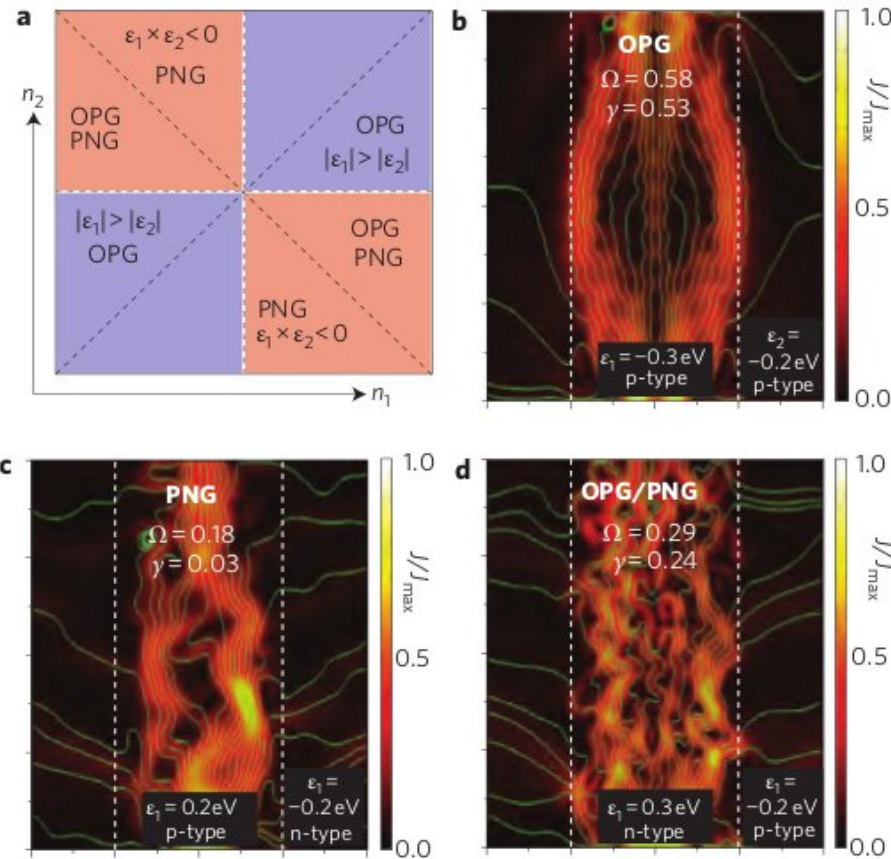
Φυσική διατάξεων δισδιάστατων ημιαγωγών

Γιώργος Δεληγεώργης (deligeo@physics.uoc.gr)



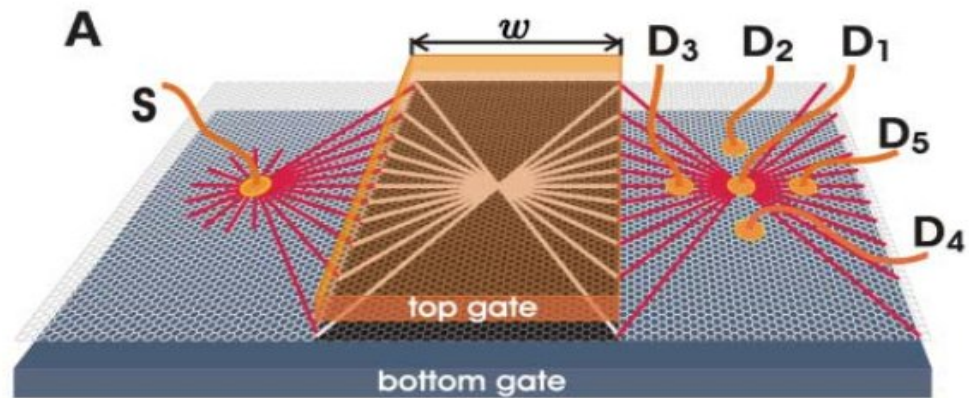
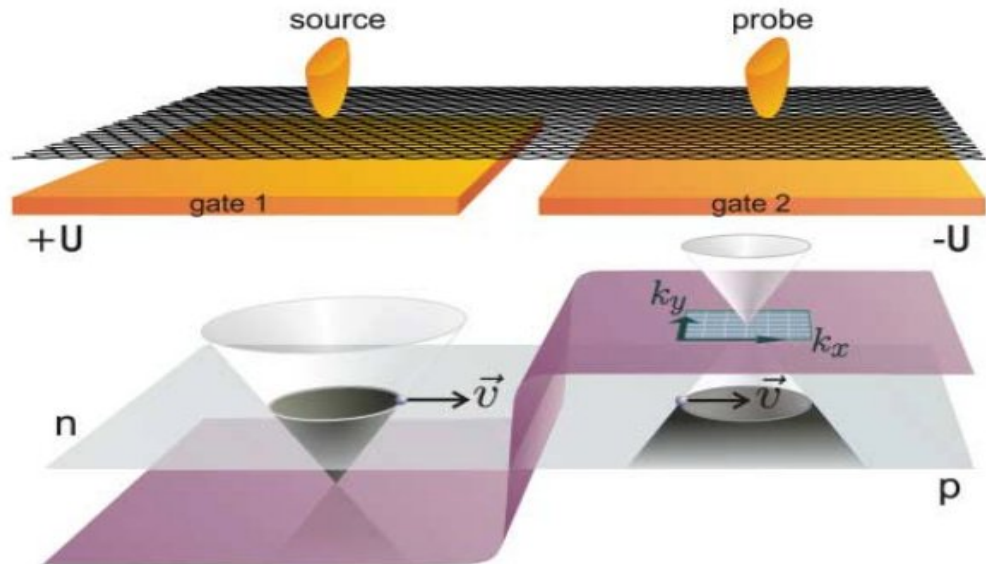


*Diffusion is no longer the dominant conduction mechanism.
Ballistic electronics!*



J.R. Williams et al N.Nano Vol.6 p222 (2011)

Treat electrons like photons
Use “lenses” to focus them
Veselago is an electronic lens

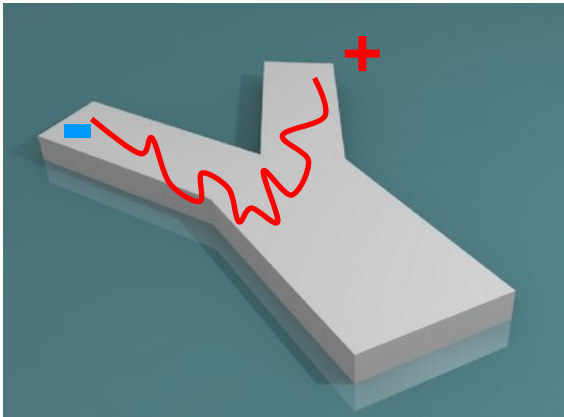


V.V.Cheianov, et al. Science 315, 1252 (2007)

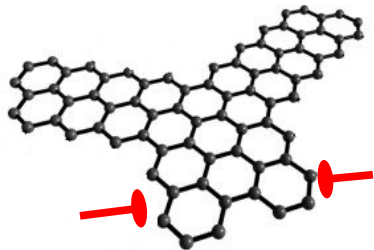
Semiconductor @ Room T

Mean Free Path: $\sim 30\text{nm}$

e motion (drift)



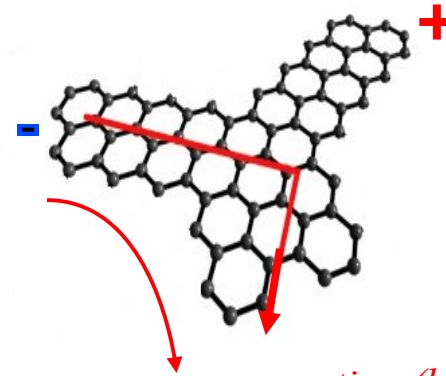
Dimensions check



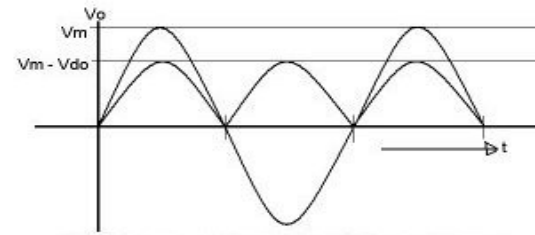
$\sim 100\text{nm}$

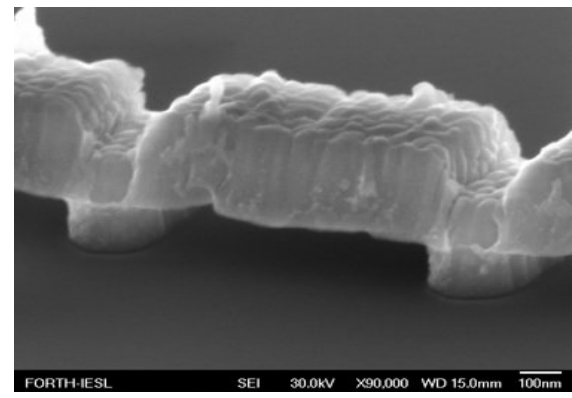
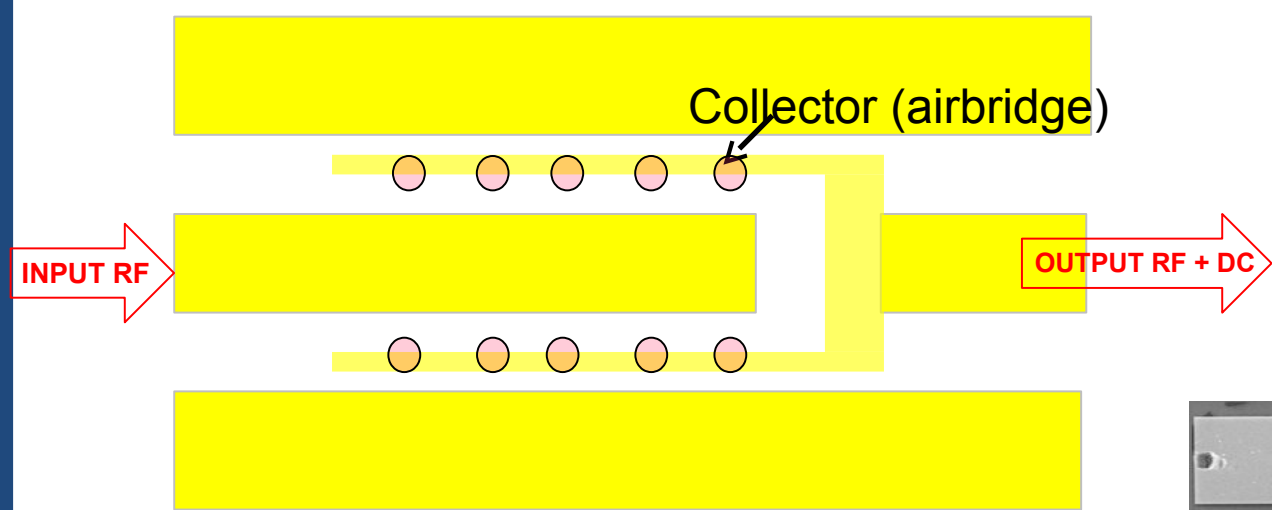
Graphene based device

Mean Free Path: $\sim 300\text{nm}$



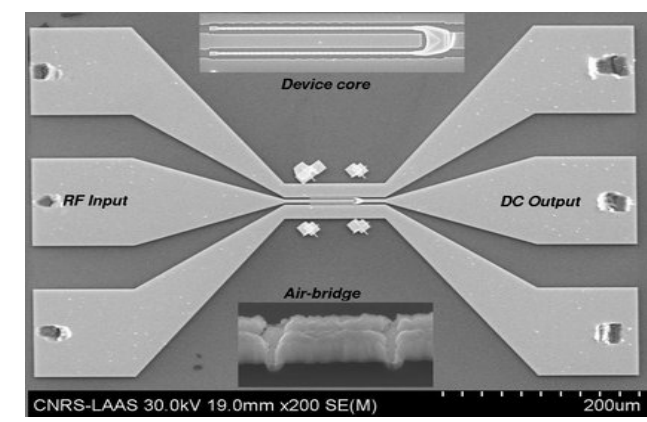
e motion (ballistic)



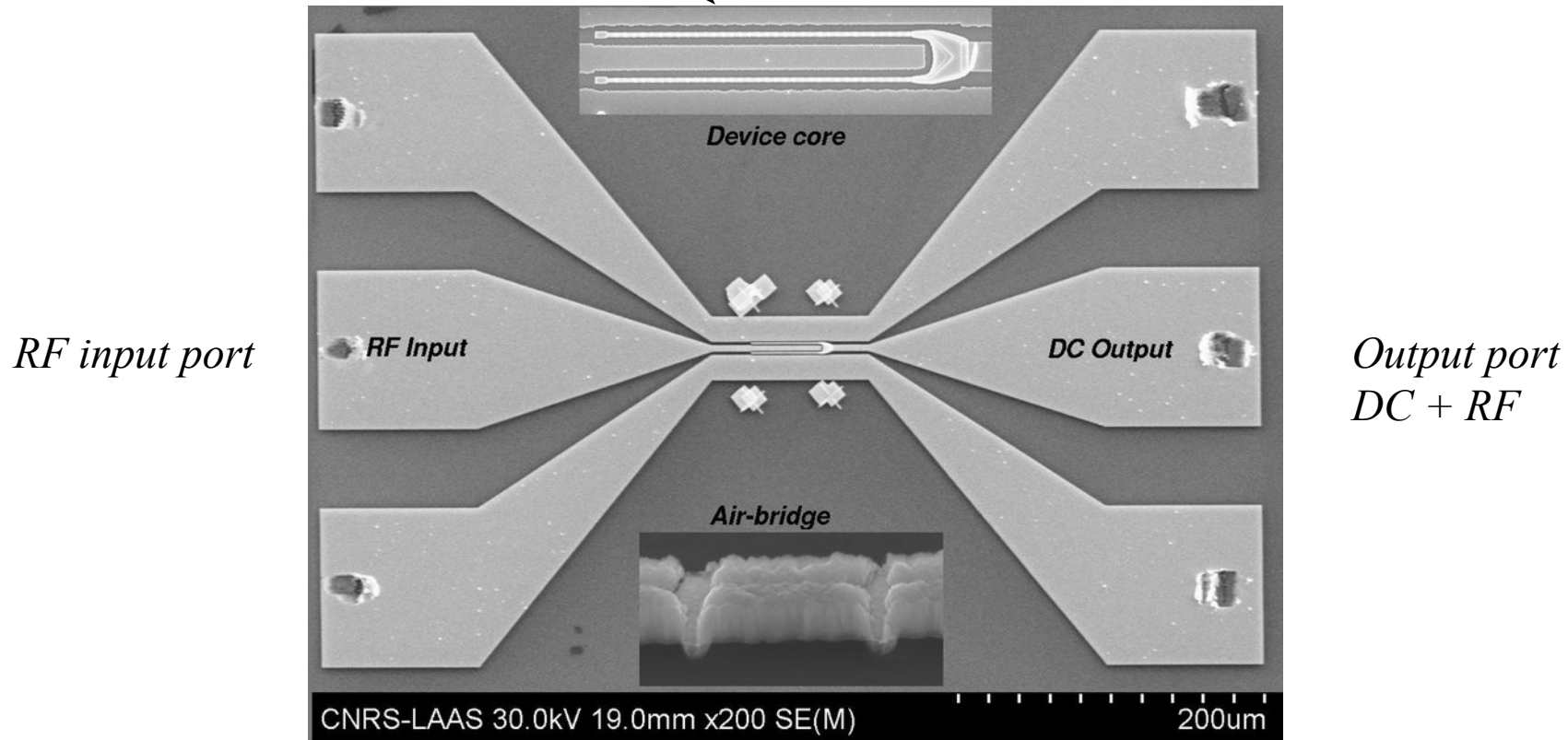


100 Y-junctions in parallel

- *A Coplanar Waveguide design 2 μ m slot*
- *100 (2 x 50) Graphene Y-junction*
- *Airbridge structure collector 700 nm wide and 300 nm airgap*

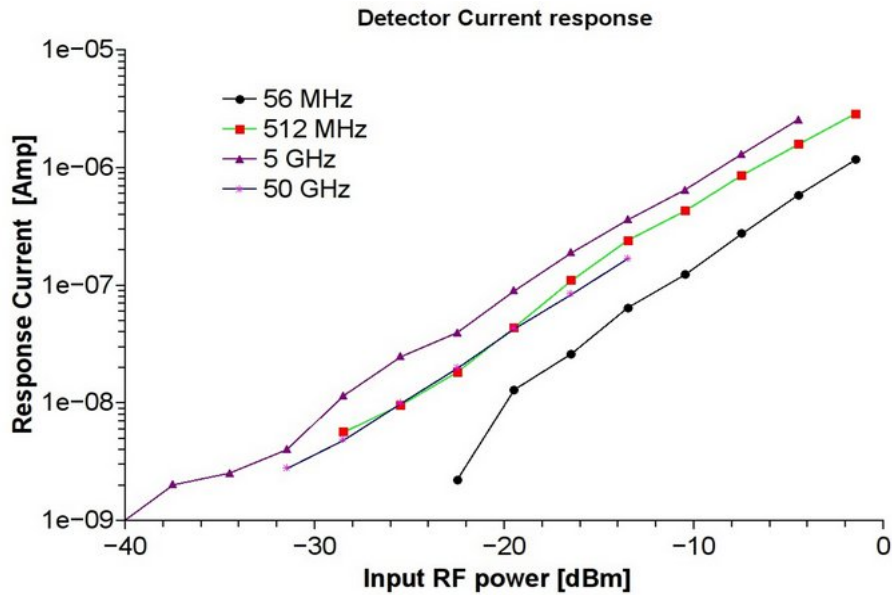


100 Y-junctions in parallel



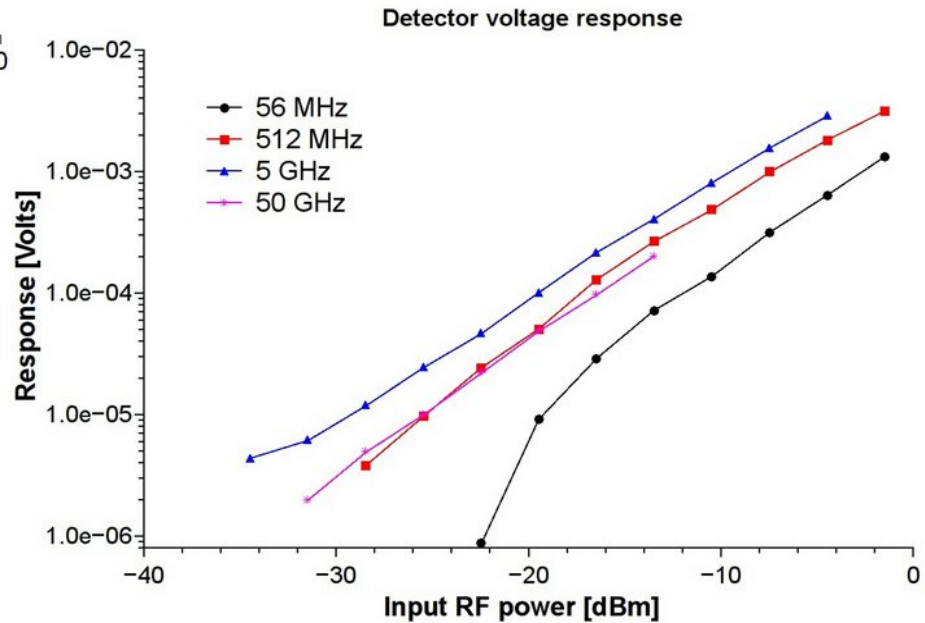
Poor RF matching

G.Deligeorgis et al APL 101(1) No.013502 (2012)



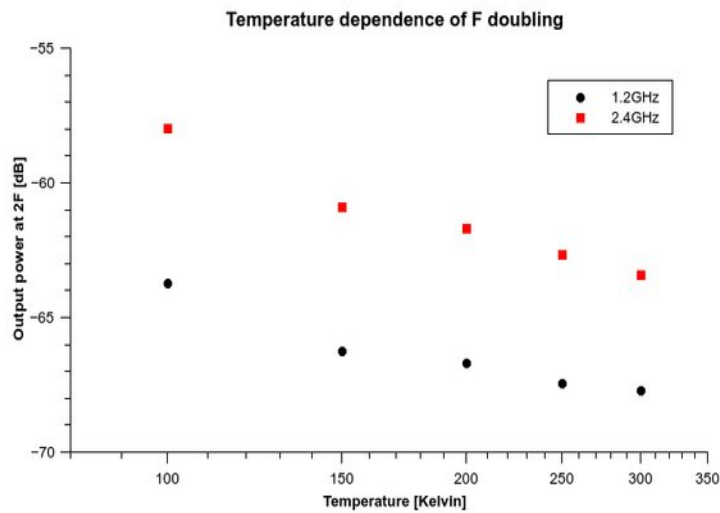
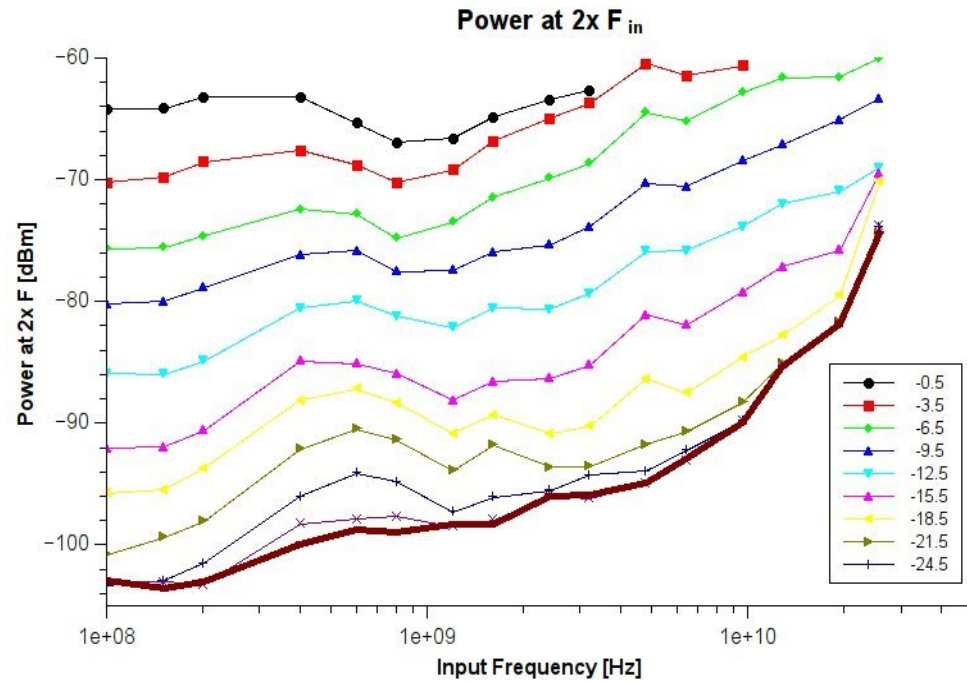
Power Linearity
•(> 40dB)

Response (10V/W)
•*Frequency cut-off (35GHz)*



G.Deligeorgis et al APL vol. 101, no. 1, pp. 013502–013502 (2012)

- *Constant conversion efficiency*
- *No cut-off within measured range*



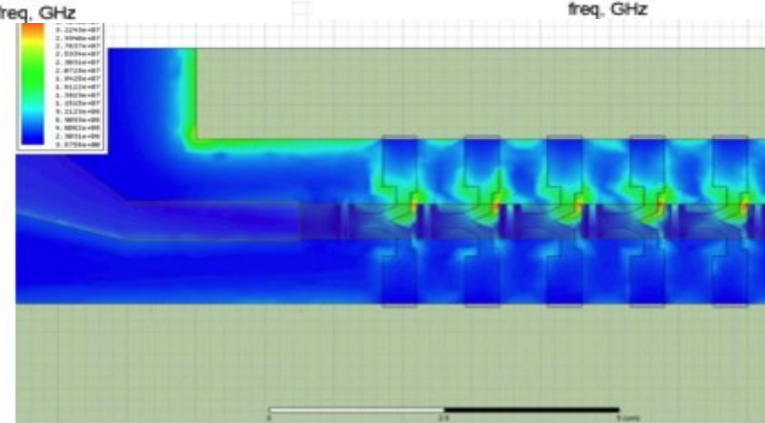
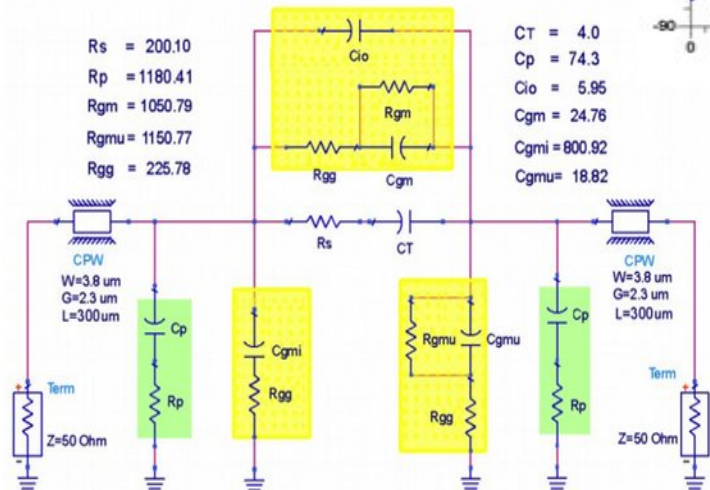
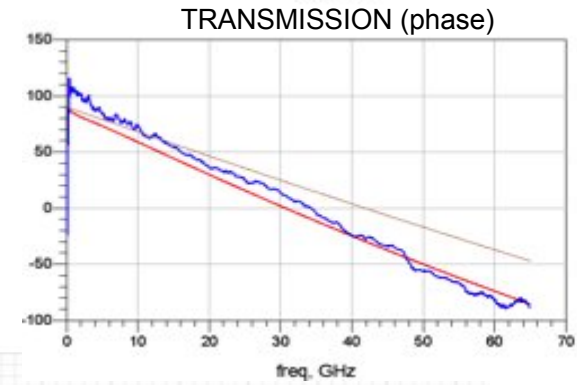
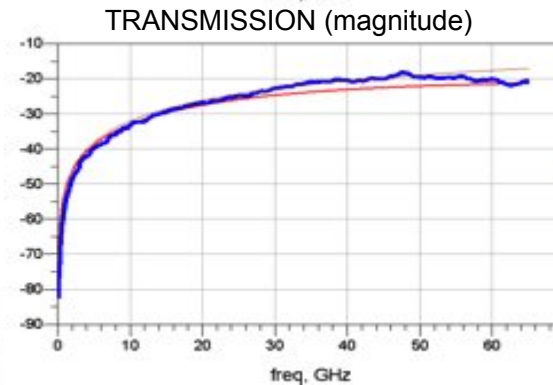
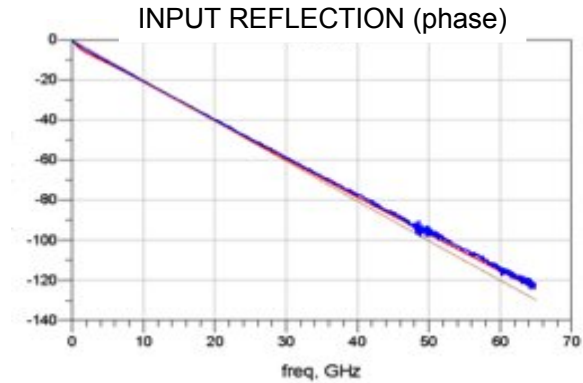
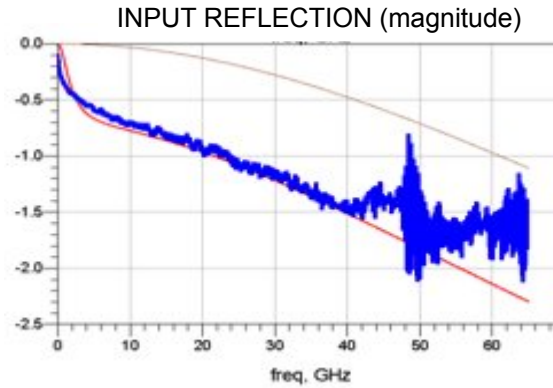
- *Efficiency increases at lower T*

Measurement

Model w/o substrate

Model with substrate

• Substrate limits high frequency performance



F.Cocchetti et al IMS 2013