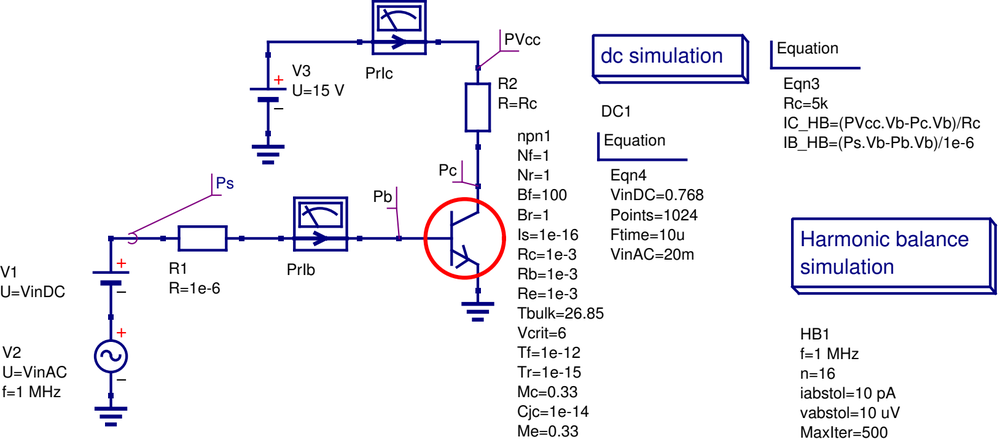

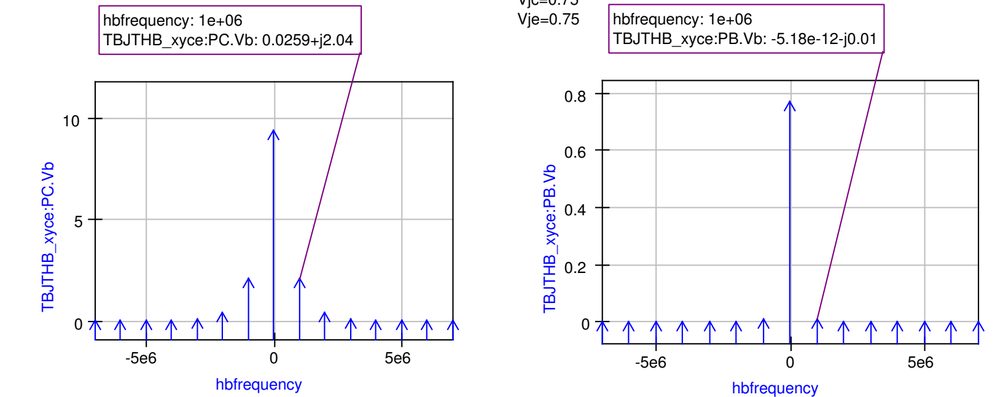

Xyce netlist

```
* Qucs 0.0.19  /home/vvk/.qucs/MIXDESBJTXyce_prj/TBJTHB.sch
* Qucs 0.0.19  npnBlock.sch
.SUBCKT npnBlock CI BI EI Nf=1 Nr=1 Is=1e-14 Bf=100
+ Br=1 Tbulk=26.85 Vcrit=6 Tf=1e-12 Tr=1e-15 Mc=0.33
+ Cjc=1e-14 Me=0.33 Cje=1e-14 Vjc=0.75 Vje=0.75
.PARAM kB=1.38e-23
.PARAM q=1.6e-19
.PARAM TKelvin={Tbulk+271.15}
.PARAM Deltaf={1.6021765e-19/(Nf*1.38065e-23*TKelvin)}
.PARAM Deltar={1.6021765e-19/(Nr*1.38065e-23*TKelvin)}
.PARAM Xcritf={Vcrit*Deltaf}
.PARAM Xcritr={Vcrit*Deltar}
.PARAM Excritf={exp(Xcritf)}
.PARAM Excritr={exp(Xcritr)}
.PARAM PCjc={Cjc*(2**Mc)}
.PARAM PCje={Cje*(2**Me)}
.PARAM Vmaxc={Vjc/2}
.PARAM Vmaxe={Vje/2}
R5 EI CI  1E9
R2 0 IEC  1
R4 BI CI  1E9
R1 0 ICC  1
R3 BI EI  1E9
BD3I0 0 IEC I=Is*(exp(Deltar*(V(BI)-V(CI)))-1)*stp(-Deltar*(V(BI)-V(CI))+Xcritr)+
+ Is*Excritr*(1+(Deltar*(V(BI)-V(CI))-Xcritr)*(1+(Deltar*(V(BI)-V(CI))-Xcritr)/2))*
+ stp(Deltar*(V(BI)-V(CI))-Xcritr)
BD3I1 BI CI I=0
BD2I0 0 ICC I=Is*(exp(Deltaf*(V(BI)-V(EI)))-1)*stp(-Deltaf*(V(BI)-V(EI))+Xcritf)+
+ Is*Excritf*(1+(Deltaf*(V(BI)-V(EI))-Xcritf)*(1+(Deltaf*(V(BI)-V(EI))-Xcritf)/2))*
+ stp(Deltaf*(V(BI)-V(EI))-Xcritf)
BD2I1 BI EI I=0
BD1I0 BI CI I=(V(IEC)-V(0))/Br
GD1Q0 BI CI nD1Q0 CI 1.0
LD1Q0 nD1Q0 CI 1.0
BD1Q0 nD1Q0 CI I=-(Tr*(V(ICC)-V(0))+PCjc*((V(BI)-V(CI))-Vmaxc)*
+ (1+((V(BI)-V(CI))-Vmaxc)*(0.5+((V(BI)-V(CI))-Vmaxc)/6)))
BD1I1 BI EI I=(V(ICC)-V(0))/Bf
GD1Q1 BI EI nD1Q1 EI 1.0
LD1Q1 nD1Q1 EI 1.0
BD1Q1 nD1Q1 EI I=-(Tf*(V(IEC)-V(0))+PCje*((V(BI)-V(EI))-Vmaxe)*
+ (1+((V(BI)-V(EI))-Vmaxe)*(0.5+((V(BI)-V(EI))-Vmaxe)/6)))
BD1I2 CI EI I=((V(ICC)-V(0))-(V(IEC)-V(0)))
BD1I3 ICC 0 I=0
BD1I4 IEC 0 I=0
.ENDS
* Qucs 0.0.19  npnBJT.sch
.SUBCKT npnBJT _net5 _net2 _net0 Nf=1 Nr=1 Bf=100 Br=1 Is=1e-14
+ Rc=0.1 Rb=1 Re=0.1 Tbulk=26.85 Vcrit=6 Tf=1e-12 Tr=1e-15
+ Mc=0.33 Cjc=1e-14 Me=0.33 Cje=1e-14 Vjc=0.75 Vje=0.75
R3 _net0 _net1  {RE}
R2 _net2 _net3  {RB}
R1 _net4 _net5  {RC}
XnpnBlock1  _net4 _net3 _net1 npnBlock Nf={NF} Nr={NR} Is={IS}
+ Bf={BF} Br={BR} Tbulk={TBULK} Vcrit={VCRIT} Tf={TF} Tr={TR}
+ Mc={MC} Cjc={CJC} Me={ME} Cje={CJE} Vjc={VJC} Vje={VJE}
.ENDS
.PARAM Rc={5k}
.PARAM VinDC=0.768
.PARAM Points=1024
.PARAM Ftime={10u}
.PARAM VinAC={20m}
R2 Pc PVcc  {RC}
Xnpn1  Pc Pb 0 npnBJT Nf=1 Nr=1 Bf=100 Br=1 Is=1E-16 Rc=1E-3 Rb=1E-3
+ Re=1E-3 Tbulk=26.85 Vcrit=6 Tf=1E-12 Tr=1E-15 Mc=0.33 Cjc=1E-14
+ Me=0.33 Cje=1E-14 Vjc=0.75 Vje=0.75
V1 Ps _net0 DC {VINDC}
V2 _net0 0 DC 0 SIN(0 {VINAC} 1MEG 0 0) AC {VINAC}
R1 Ps _net1  1E-6
V3 _net2 0 DC 15
VPrIc _net2 PVcc DC 0 AC 0
VPrIb _net1 Pb DC 0 AC 0
.options hbint numfreq=16 STARTUPPERIODS=2
.HB 1MEG
.PRINT  hb file=TBJTHB_hb.txt I(VPrIb) I(VPrIc) v(PVcc) v(Pb) v(Pc) v(Ps)
.END
```