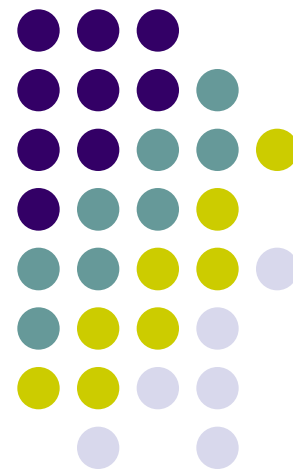
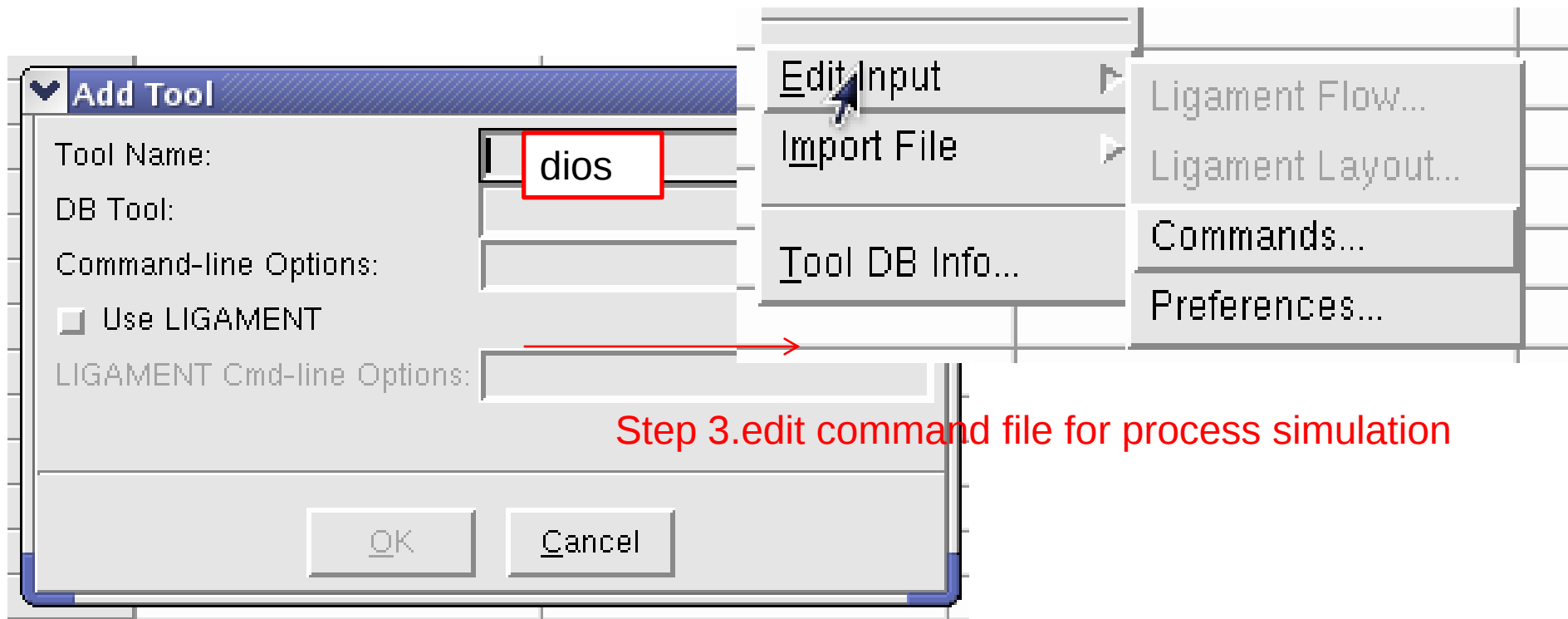
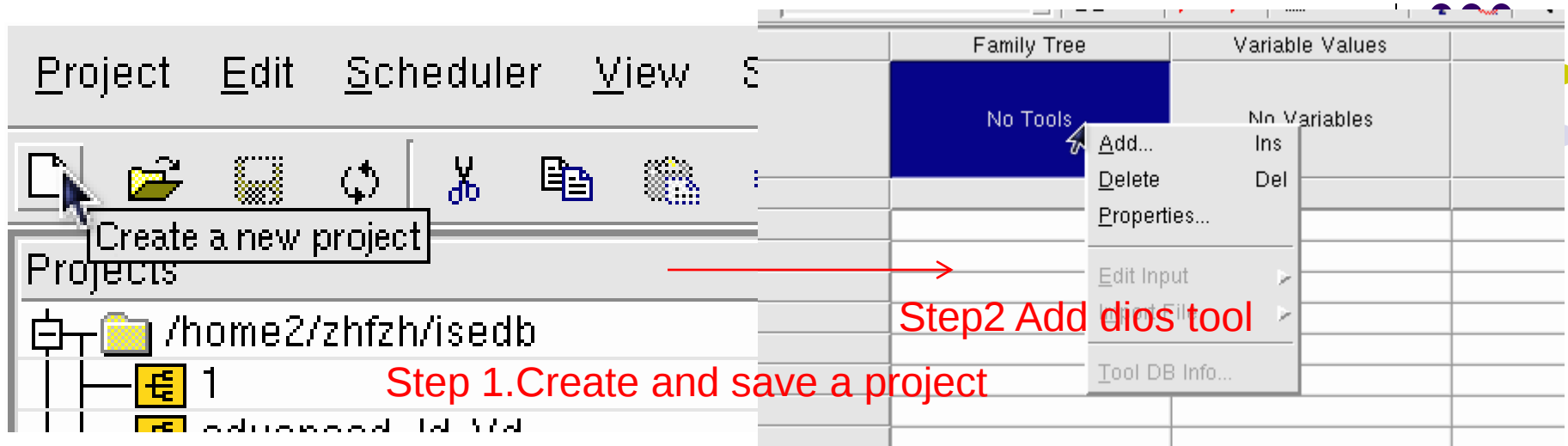


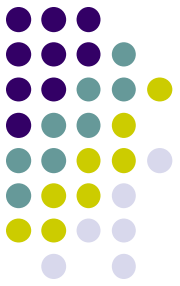
工艺模拟之二—— DIOS命令模式

DIOS命令文件说明与示例
dios_dio.cmd





Dios_dio.cmd



```
Title('pwell-cmos')
repl(cont(ngra=1000))
set sim_y1=-10
set sim_y2=10
set sim_x1=-15
set sim_x2=15
```

#标题

#

#尺寸坐标

```
Grid(X(-15,15),Y(-10,10),Nx=10)
```

#grid, 初始网格化分数

```
repl(cont(maxtrl=5,RefineGradient=-
6,RefineMaximum=0,RefineJunction=-6,RefineBoundary=-6))
```

#网格划分策略repl=replace,cont=control

! maxtrl=5 --- defines the max. number of subdivisions of an initial triangle

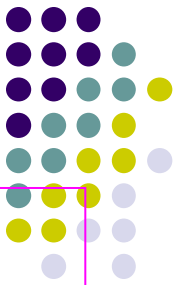
! RefineGradient=-6 --- max. level of subdivisions due to steep gradients

! RefineMaximum=0 --- max. level of subdivisions around the dopant maxima

! RefineJunction=-6 --- max. level of subdivisions at junctions

! RefineBoundary=-6 --- max. level of subdivisions at material interfaces

##和! 是注释符号



Substrate(Element=P, Ysubs=0, Orientation=100,
Cutline(0.0,0.0,15,0.0), Concentration=4.32e15)

#衬底材料及参数, **Element**-掺杂类型, **Orientation**-晶向,
Concentration-衬底掺杂

#扩散模型

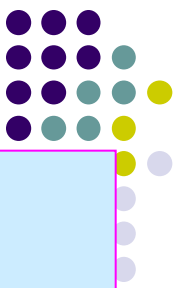
diff:(moddiff=Conventional)

diff:(modox=DealGrove)

#扩散模型

#**Conventional**-扩散模型

#**Deal-Grove**氧化模型



#P阱扩散-氧化+离子注入

Comment('p-well') #注释说明语句

Diffusion(Time=20, Temperature=1200, Atmosphere=Mixture
Flow(H2O=3) Pressure=1)

Diffusion, 扩散命令, 可用于模拟各种高温工艺, 用Atmosphere=xxx来控制;

Atmosphere=Mixture时混合气氛可由Flow(xx)和Pressure=1;

此处为生长氧化层, 湿氧氧化, H2O=3流量;

Time=20氧化时间, 默认单位min

Diffusion(Time=72, Temperature=1200, Atmosphere=Mixture
Flow(H2O=3) Pressure=1)

Diffusion(Time=54, Temperature=1200, Atmosphere=Mixture
Flow(H2O=3) Pressure=1)

save(n@node@_pwell_OX,type=MDRAW,compress=off)

#Save命令, 保存文件type可选, MDRAW为mdraw可编辑格式 (工艺模拟得到的结构

#模型经mdraw重新划分网格后, 做器件特性模拟, 可用来验证设计参数);

#文件格式为.grd、.dat、.bnd、.dmp, 可用Tecplot打开; .grd+.dat是掺杂分布

#和网格, 可Cut X=n取得纵向掺杂分布; .bnd是器件边界, 不带掺杂; .dmp是模

#拟时临时保存文件; compress=off压缩模式选择, 鉴于系统兼容问题, 建议off

Dios_dio.cmd

Mask(Material=Resist,Thickness=2um,X(-15.1,6,9.0,15.1))

#Mask命令,掩膜版, Material= Resist /PhotoResist /Ni(Si₃N₄) /P0(PolySi)

#X(-15.1,6,9.0,15.1), Resist型分别为x1Left、x1Right、x2Left、x2Right

etch(material=ox,stop=sigas,Rate(Aniso=10))

#etch命令,刻蚀;material要刻蚀的材料; stop定义etch边界;Rate定义etch速度,

Aniso=10各向异性,垂直etch,默认单位nm/min; iso,各向同性; Selectivity

#选择性刻蚀; Over,过刻蚀定义(Over=10,过刻蚀%比例,占总时间的;

OverThickness=5,厚度um; OverTime=10,时间min)

etch(material=Resist)



也可文本编辑器编辑
dios_dio.cmd文件, 然
后terminal窗口运行
Dios dios_dio.cmd &



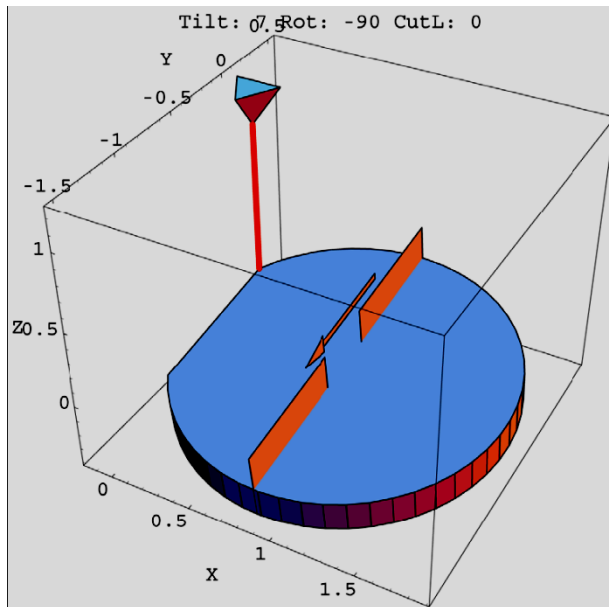
Implantation(Element=B,Dose=1.6e14,Energy=120,Tilt=0degree,Rotation=-90degree, NumSplits=2)

#离子注入命令, Element注入杂质, Dose剂量, Energy能量[keV], 旋转角度增量
360/NumSplits, 每次剂量1/NumSplits;如果halo注入NumSplits=4

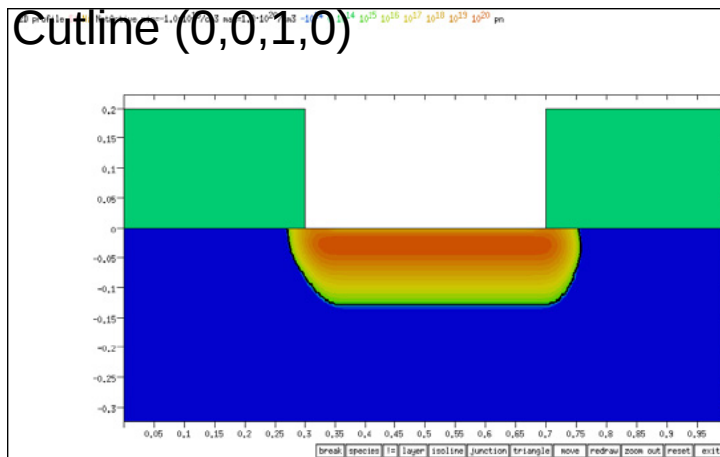
Diffusion(Time=150,Temperature=1050,Atmosphere=Mixture Flow(N2=3) Pressure=1)

etch(material=OX)

save(n@node@_pwell_imp,type=MDRAW,compress=off)



Tilt = 7
Rotation = -90
Cutline (0,0,1,0)



Dios_dio.cmd

Comment(Active area Mask')

Diffusion(Time=0.16666, Temperature=1200,
Atmosphere=Mixture Flow(o2=3) Pressure=1)

Deposit(Material=Nitride,Thickness=2um)

#淀积命令, Nitride(或Ni)是Si₃N₄; P0是PolySi, 可用Element和Conc定义多
#晶掺杂剂和浓度

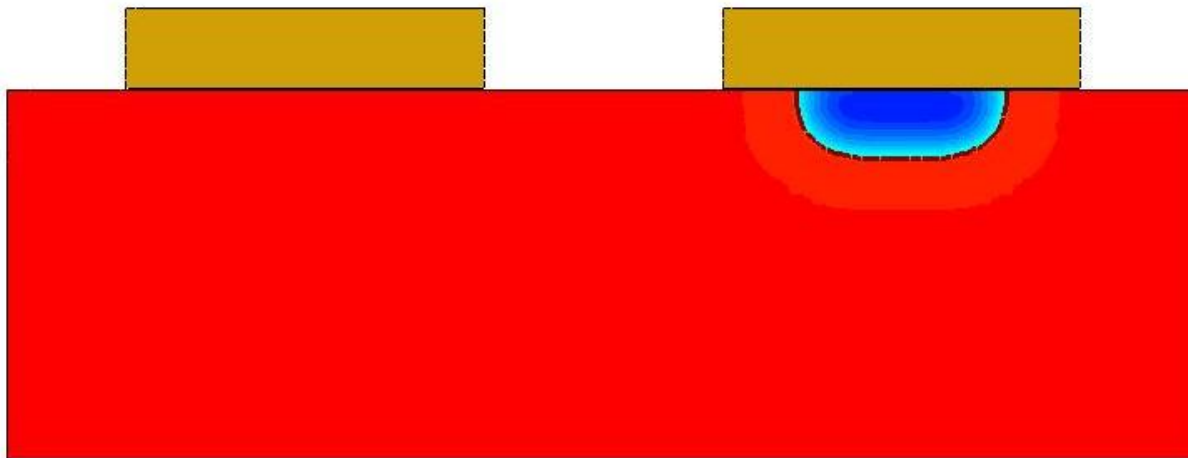
Mask(Material=Resist,Thickness=2um,X(-12.0,-3.0,3,12.0))

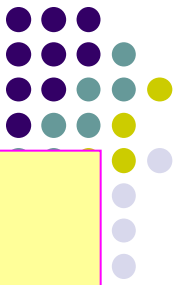
etch(material=Nitride,stop=OXgas,Rate(Aniso=10))

etch(material=Ox,stop=sigas)

etch(material=Resist)

save(n@node@_active,type=MDRAW,compress=off)





Comment('FOX')

Diffusion(Time=75, Temperature=1200, Atmosphere=Mixture
Flow(H2O=3) Pressure=1)

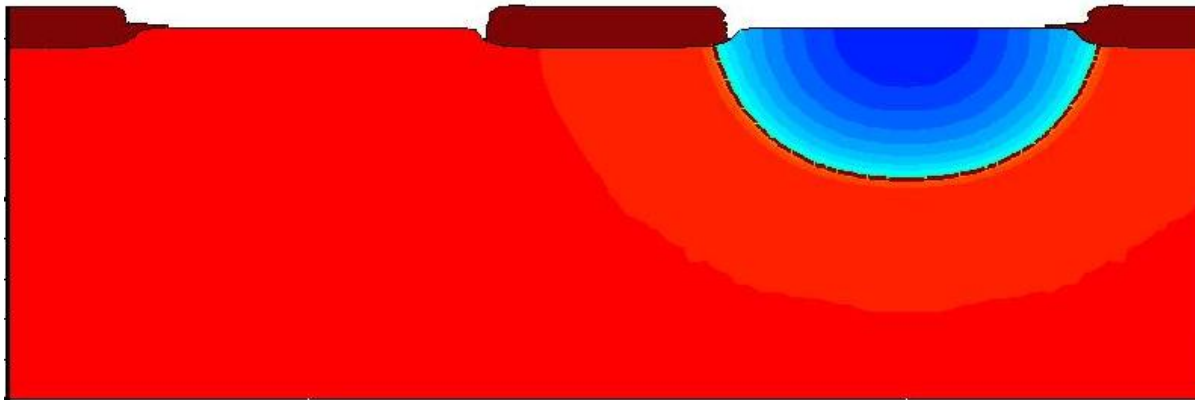
etch(material=Nitride)

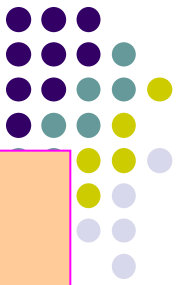
Mask(Material=Resist,Thickness=2um,X(-15.1,-11.0,-
3.0,3.0,11.0,15.1))

etch(material=ox,remove=0.4,Rate(Aniso=100),over=1)

etch(material=Resist)

save(n@node@_FOX,type=MDRAW,compress=off)





Comment('Polysil Gate ')

Diffusion(Time=0.16666, Temperature=1200,
Atmosphere=Mixture Flow(O2=3) Pressure=1)

Deposit(Material=PO,Thickness=0.5um,Element=P,Conc=1e20)

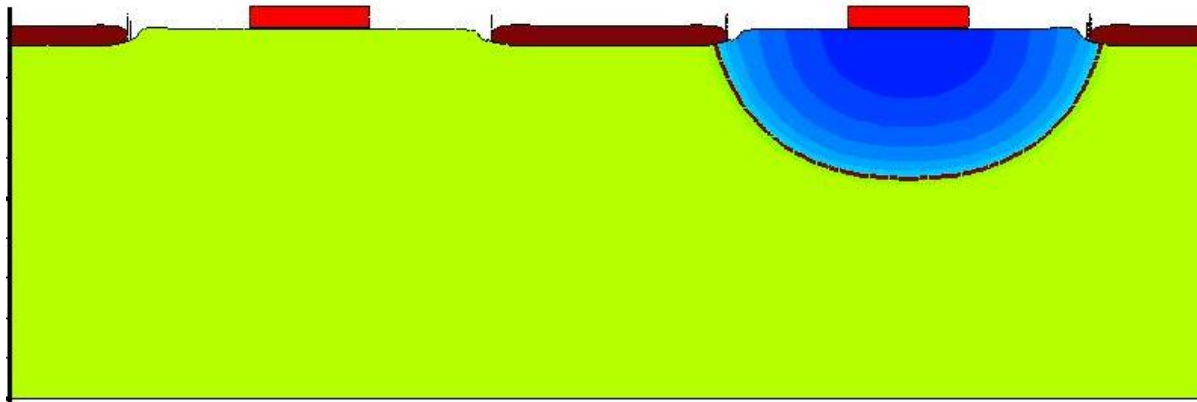
Mask(Material=Resist,Thickness=2um,X(-9.0,-6.0,6.0,9.0))

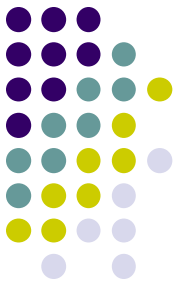
etch(material=PO,remove=1.5um,Rate(Aniso=100),over=0)

etch(material=OX,remove=0.5um,Rate(Aniso=100),over=0)

etch(material=Resist)

save(n@node@_Gate,type=MDRAW,compress=off)





```
Comment('p+ S/D--Boron Impant ')
```

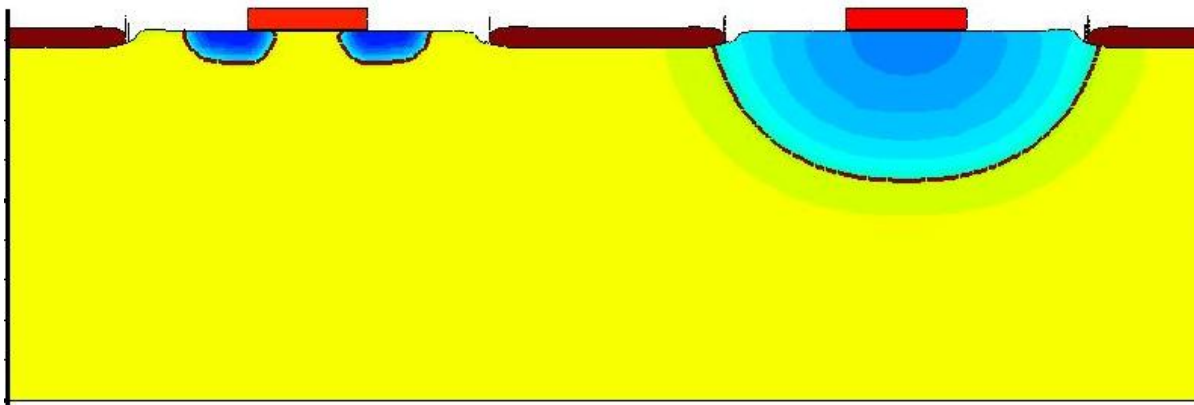
```
Mask(Material=Resist,Thickness=2um,X(-15.1,-10.0,-  
5.0,15.1))
```

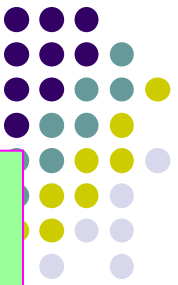
```
Implantation(Element=B,Dose=4e15,Energy=10,Tilt=0degr  
ee,Rotation=-90degree)
```

```
etch(material=Resist)
```

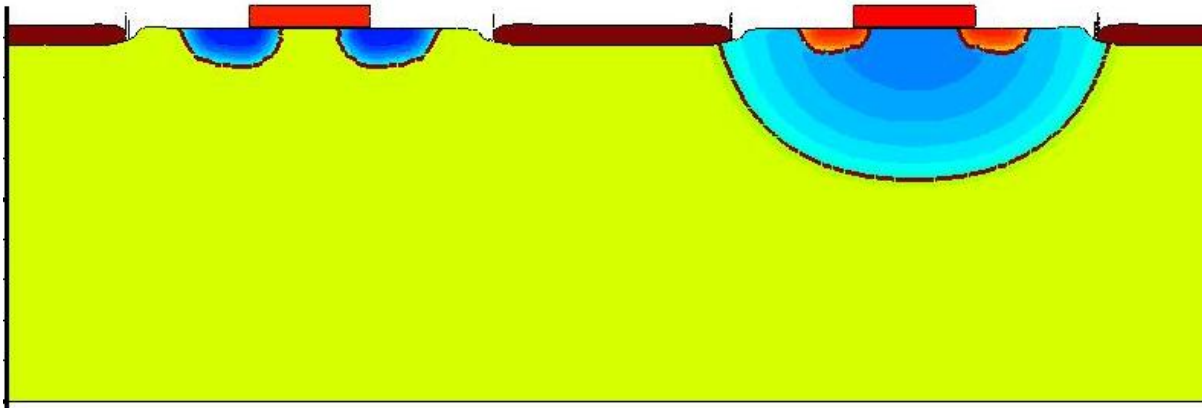
```
Diffusion(Time=5,Temperature=1050,Atmosphere=Mixture  
Flow(N2=3) Pressure=1)
```

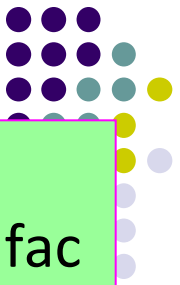
```
save(n@node@_pplus,type=MDRAW,compress=off)
```





```
Comment('n+ S/D--Phor Implant ')  
Mask(Material=Resist,Thickness=2um,X(-15.1,5.0,10.0,15.1))  
Implantation(Element=P,Dose=4e15,Energy=10,Tilt=0degree,R  
otation=-90degree,NumSplits=2)  
etch(material=Resist)  
Diffusion(Time=5,Temperature=1050,Atmosphere=Mixture  
Flow(N2=3) Pressure=1)  
save(n@node@_nplus,type=MDRAW,compress=off)
```





Comment('save profile')

```
1d(file=n@node@_nwell_to,xsection(7.5),spe(btot,ptot,itot),fact=-1,append=off)
```

#1d掺杂分布曲线(一般建议用tecPlot中CutX(X=nn)截取), xsection是从x=7.5处截取纵向掺杂分布曲线; Spe()是曲线中杂质, btot-B杂质总浓度, bactive-B离子浓度, ptot-P杂质总浓度, itot-间隙总浓度; fact=-1, 坐标比例因子#, Yfile=FACT·(ydios-SHIFT), append- Profiles are appended to an existing file (default), #append=on,多次cut的分布曲线显示在一图, =off则各自独立;
NOAPPend: overwrite the file.

```
1d(file=n@node@_nwell_field,xsection(-7.5),spe(btot,ptot,itot),fact=-1,append=off)
```

```
save(n@node@,type=dmp,compress=off)
```

```
!save(n@node@,type=dfise)
```

Dios_dio.cmd

```
save(file=n@node@,  
      type=MDRAW,  
      synonyms(po=metal,al=metal,ms=metal)  
      compress=off  
    )  
)  
exit  
!-----END, 用exit+end组合或quit  
end
```

```
#synonyms(po=metal,al=metal,ms=metal)  
#把PO、Al归类为metal, 去掉mdraw中mesh, 只具有边界属性  
#      contacts(  
          contact1(name='source', x, y,x,xe,ye)  
          contact2(name='gate', x, y,x,xe,ye)  
          contact3(name='drain', x, y,x,xe,ye)  
          contact4(name='substrate', location=bottom)  
      )
```

#可在此处添加contact电极, 或在mdraw中打开.bnd文件添加, 用于特性模拟

