# Geometry Optimization

# 1. Reducing collimator 2 outer acceptance

- 103-> 101

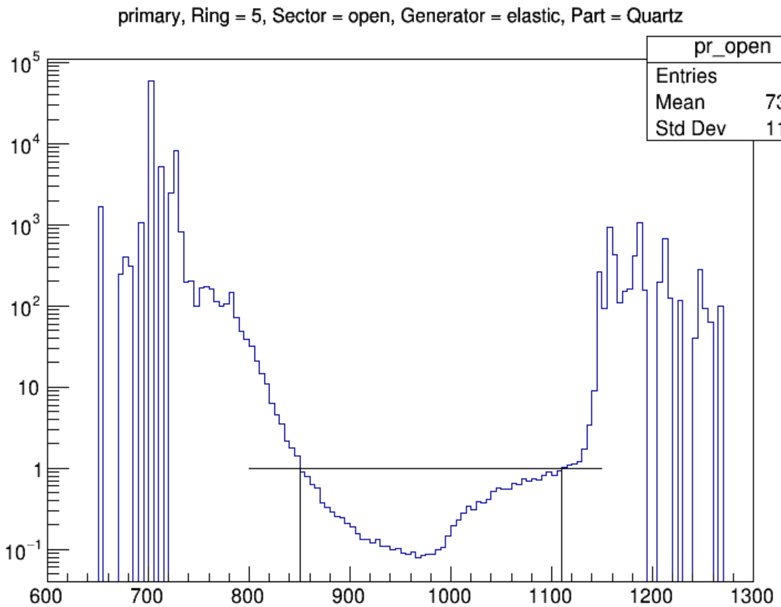
Cuts to determine radial ranges of detectors in ring 5:

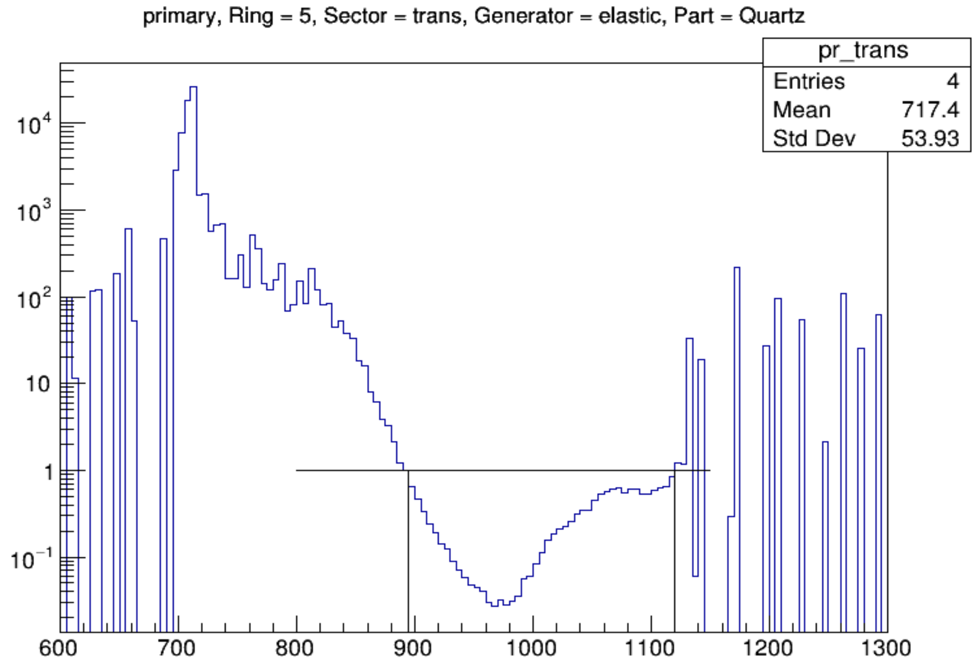
1) Relative ratio of ep/ee <=1

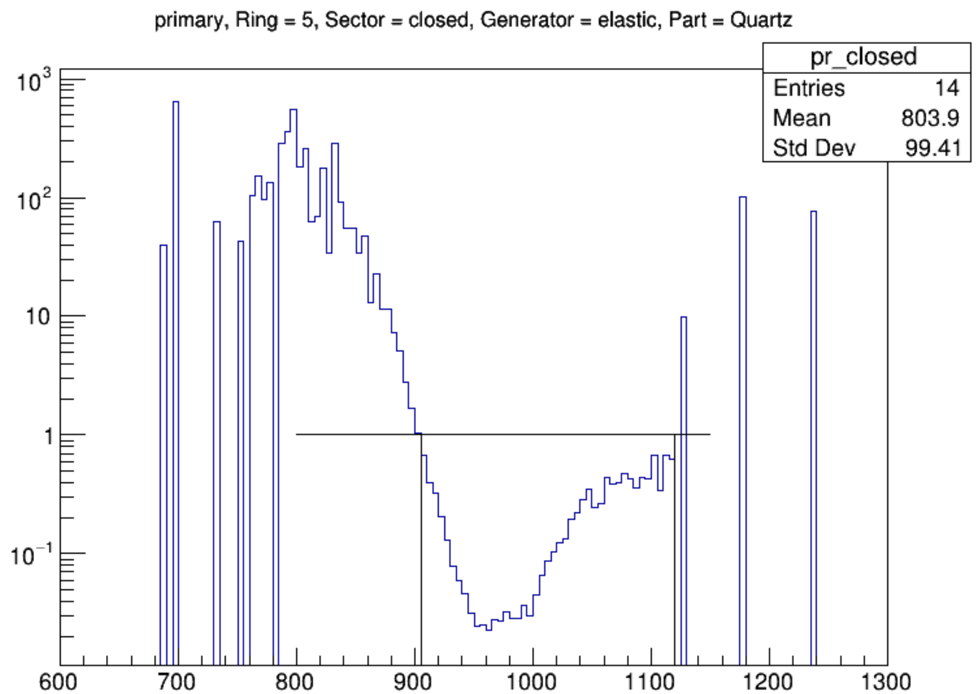
2) FOM=Rate*A^2 (GHz-ppb^2/sep/5mm) >=35 for open and trans, >=10 for closed

| | | Open | Trans | Closed |
|---|---|---|---|---|
| 103 | Cut1 | 855-1105 | 890-1105 | 905-1105 |
| | Cut 2 | 855-1070 | 900-1060 | 915-1055 |
| 101 | Cut1 | 850-1110 | 895-1120 | 905-1120 |
| | Cut 2 | 855-1070 | 900-1060 | 915-1055 |

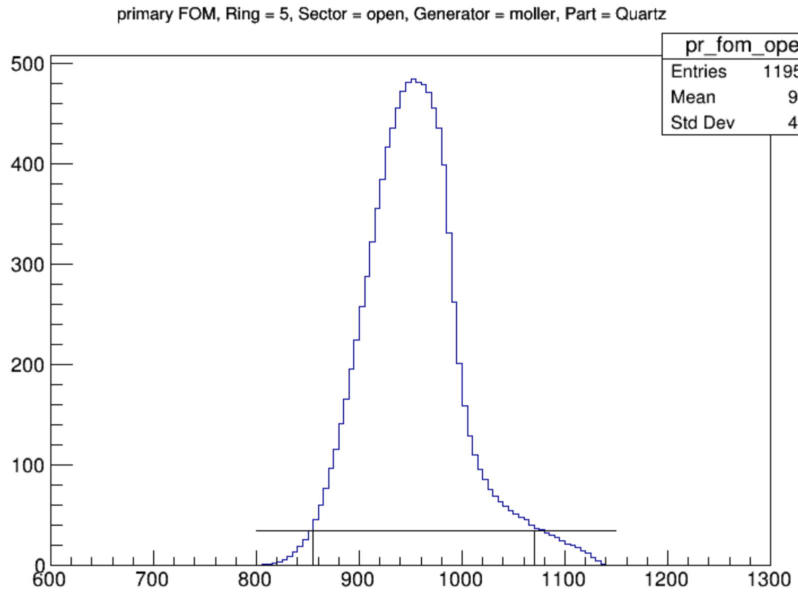
# Cut 1: ep/ee ratio

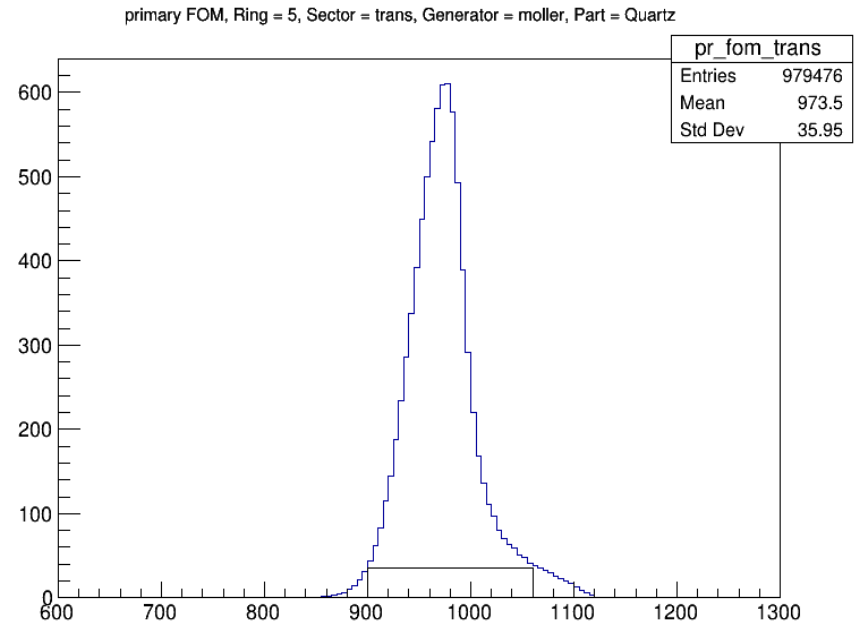


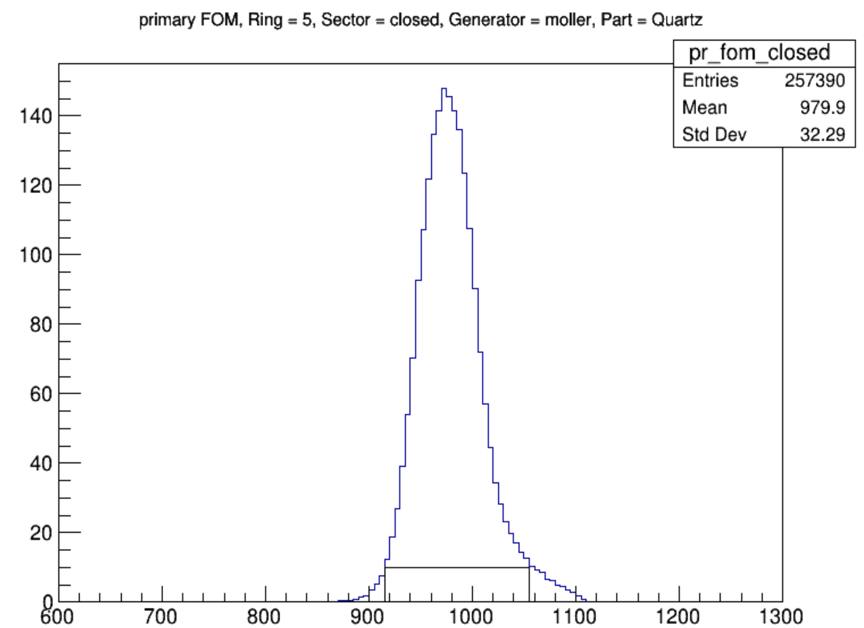



# Cut 2: FOM


primary FOM, Ring = 5, Sector = open, Generator = moller, Part = Quartz
pr_fom_open
Entries 1195154
Mean 953.7
Std Dev 48.52
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300


primary FOM, Ring = 5, Sector = trans, Generator = moller, Part = Quartz
pr_fom_trans
Entries 979476
Mean 973.5
Std Dev 35.95
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300


primary FOM, Ring = 5, Sector = closed, Generator = moller, Part = Quartz
pr_fom_closed
Entries 257390
Mean 979.9
Std Dev 32.29
0
20
40
60
80
100
120
140
600
700
800
900
1000
1100
1200
1300

# Ep/ee and integrated FOM for chosen range

| | | Rate (GHz) | Integrated FOM (GHz-ppb^2) | FOM ratio wrt 103 | ep/ee |
|---|---|---|---|---|---|
| 103 | Moller | 134.9 | 144517 | 1 | 12% |
| | Elastic | 16.1 | | | |
| 101 | Moller | 129.5 | 141289 | 1.01 | 12% |
| | Elastic | 15.9 | | | |

# Consequence of smaller staggered quartz in ring 5

- Use different FOM threshhold for inner and outer edge

| | | Rate (GHz) | Integrated FOM (GHz-ppb^2) | FOM ratio wrt 103 | ep/ee |
|---|---|---|---|---|---|
| 103 | Moller | 134.9 | 144517 | 1 | 12% |
| | Elastic | 16.1 | | | |
| 101 | Moller | 120.0 | 134394.39 | 1.04 | 10% |
| | Elastic | 12.2 | | | |

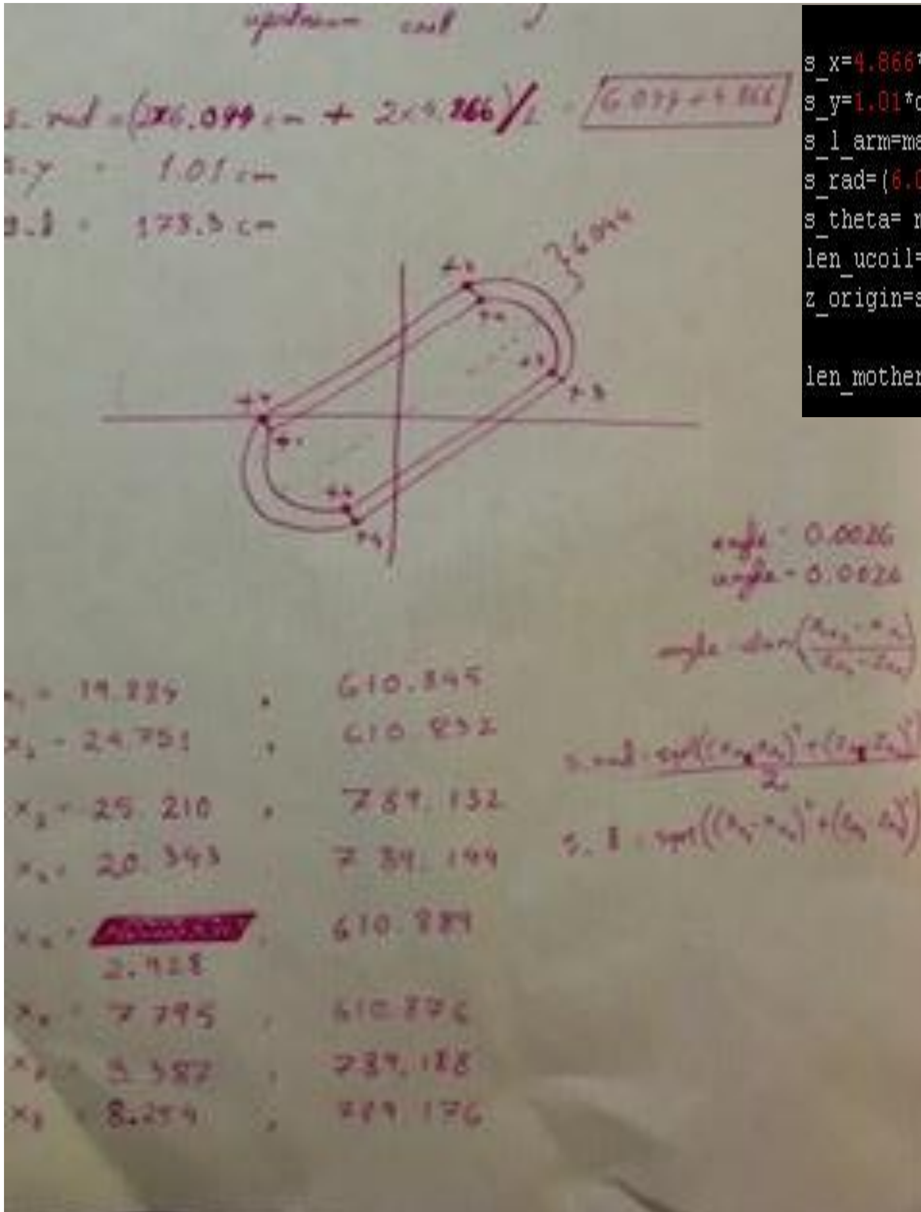
# Consequence of smaller uniform quartz in ring 5

| | | Rate (GHz) | Integrated FOM (GHz-ppb^2) | FOM ratio wrt 103 | ep/ee |
|---|---|---|---|---|---|
| 103 | Moller | 134.9 | 144517 | 1 | 12% |
| | Elastic | 16.1 | | | |
| 101 | Moller | 120.1 | 134848 | 1.04 | 11% |
| | Elastic | 13.3 | | | |

# What happens if beam energy is 10.6 instead of 11 GeV?

| | | Rate (GHz) | Integrated FOM (GHz-ppb^2) | FOM ratio wrt 11 GeV | ep/ee |
|---|---|---|---|---|---|
| 10.6 GeV | Moller | 133.9 | 136988.68 | 1.015 | 13% |
| | Elastic | 17.5 | | | |
| 11 GeV | Moller | 129.5 | 141289 | 1 | 12% |
| | Elastic | 15.9 | | | |

# 2. Toroid Generators



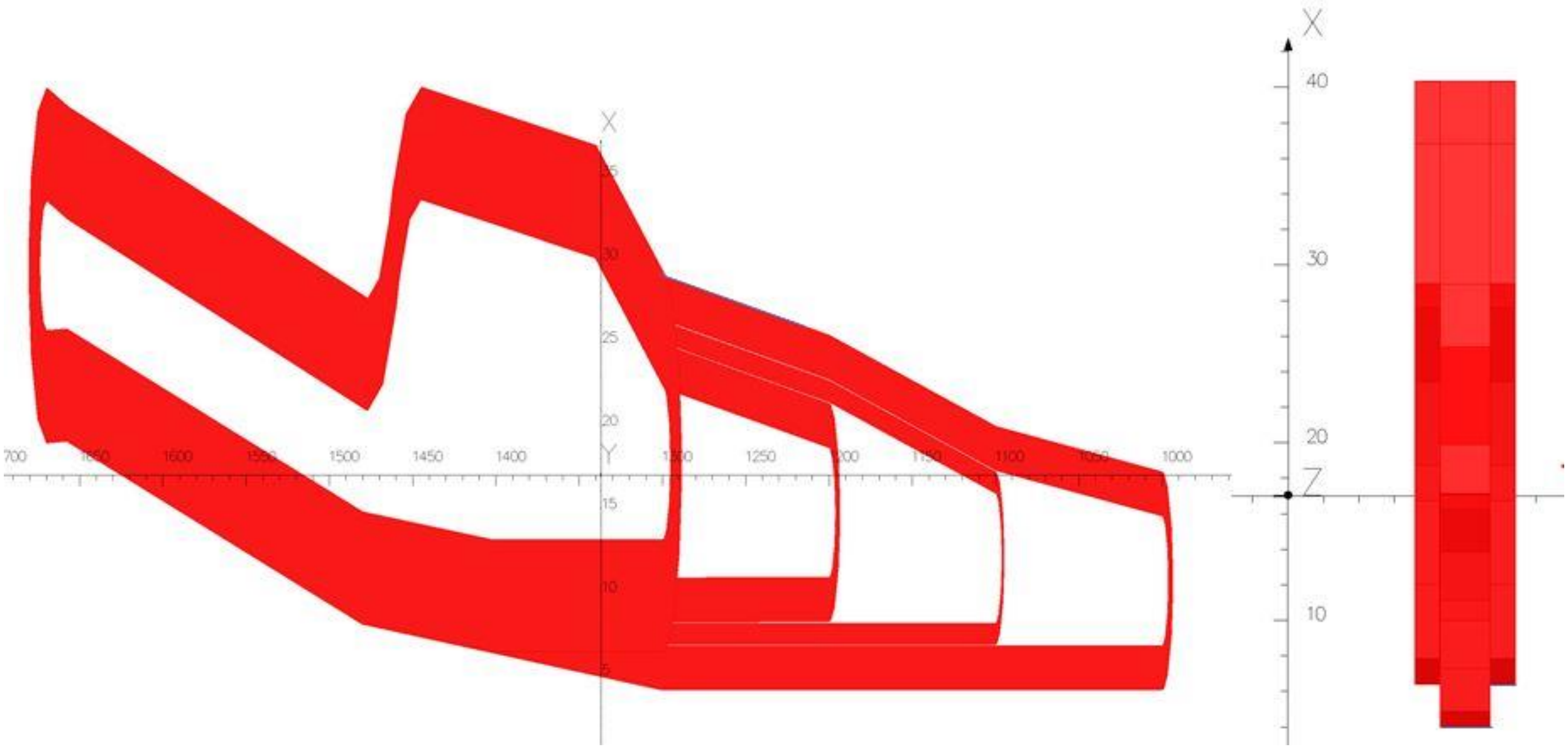
```
s_x=4.866*cm
s_y=1.01*cm
s_l_arm=math.sqrt(math.pow((25.210-24.751),2)+math.pow((789.132-610.832),2))*cm
s_rad=(6.044+4.866)*cm
s_theta= math.atan((25.210-24.751)/(789.132-610.832))
len_ucoil=2*s_rad+s_l_arm
z_origin=s_rad-len_ucoil/2

len_mother=len_ucoil+20
```

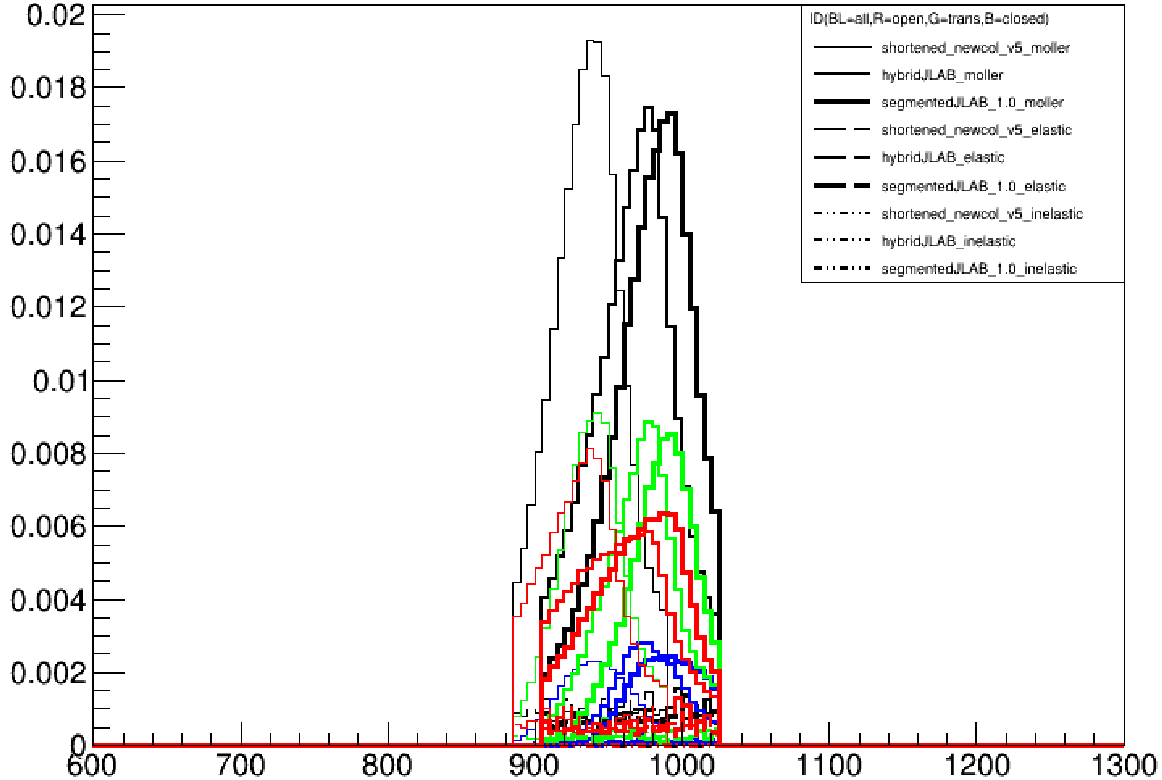
## Upstream

# Hybrid

```
<material name="G4_CW95" state="solid">
        <D value="18.0" unit="g/cm3"/>
        <fraction n="0.9500" ref="G4_W"/>
        <fraction n="0.015" ref="G4_Cu"/>
        <fraction n="0.015" ref="G4_Ni"/>
</material>
```



# Focus in hybrid vs segmented



# 3. Final Geometry for simulations