$$\nabla \cdot K \nabla T - mT + \sigma |E|^2 = 0$$

BC: $-K \nabla T \cdot \hat{n} = h(T - T_a)$

* label contours! *

a) baseline

b) blood flow bladder = $\frac{1}{2}$ bloodflow muscle

c) which a orb is better (T of tumor larger)

node file (npeltr4)

global node #	x	y

element file (epeltr4)

element #	node 1	node 2	node 3	node 4	material

Boundary file (bpeltr4)

index	node #	3 for type III	neighbor 1	neighbor 2	h	Ta

heating rate file (ppeltr4)

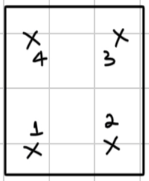
index	element #	$\sigma \|E\|^2$

$$\nabla \cdot K \nabla T - mT = -\sigma |E|^2$$

Galerkin:

$$\langle -K \nabla \phi_j \cdot \nabla \phi_i \rangle + \langle -m \phi_j \phi_i \rangle = \langle -\sigma |E|^2 \phi_i \rangle - \underbrace{\oint K \nabla T \cdot \hat{n} \, \phi_i \, ds}_{\frac{du}{dn} \phi_i ds}$$

$$A_{ij} = \langle K \frac{\partial \phi_j}{\partial x} \cdot \frac{\partial \phi_i}{\partial x} \rangle - \langle K \frac{\partial \phi_j}{\partial y} \cdot \frac{\partial \phi_i}{\partial y} \rangle + \langle -m \phi_j \phi_i \rangle$$



from table 9.5

	ξ	η	w
1	−0.57735027	−0.57735027	1
2	+0.57735027	−0.57735027	1
3	+0.57735027	+0.57735027	1
4	−0.57735027	+0.57735027	1

	ϕ	dphidE	dphidz	dphidy	dphidx
1	$(1-\eta)(1-\xi)/4$	$-(1-\eta)/4$	$-(1-\xi)/4$	for all 4	for all 4
2	$(1+\eta)(1-\xi)/4$	$-(1+\eta)/4$	$(1-\xi)/4$	−dxdE * dphidz	dydE * dphidz
3	$(1+\eta)(1+\xi)/4$	$(1+\eta)/4$	$(1+\xi)/4$	+dxdz * dphidE	−dydz * dphidE
4	$(1-\eta)(1+\xi)/4$	$(1-\eta)/4$	$-(1+\xi)/4$	for all 4	for all 4

```
dxdE = 0
for i in range(4):
    dxdE += elem.xs[i] * dphidE[i]
    dxdz += elem.xs[i] * dphidz[i]
    dydE += elem.ys[i] * dphidE[i]
    dydz += elem.ys[i] * dphidz[i]
DJ = dxdz * dydE - dxdE * dydz
```

BC: $-k \nabla T \cdot \hat{n} = h(T - T_a)$

$= hT - hT_a$

$b_i \mathrel{+}= hT_a$

$A_{ij} \mathrel{+}= -h_j$

$A_{i\,j+1} \mathrel{+}= -h_{j+1}$

$A_{i\,j-1} \mathrel{+}= -h_{j-1}$

$$\frac{\partial T}{\partial n} = h(T - T_a)$$

$$\frac{\partial T_b}{\partial n} = h\,(T - T_a)$$

$$\frac{\partial T_d}{\partial n} = hT - hT_a$$

$h = 45 \quad \& \quad T_\infty = -17$

$$b = -\underbrace{h}_{a} \frac{\partial T_c}{\partial n} \int_{I} \phi_c \phi_B \, ds - h \frac{\partial T_B}{\partial n} \int_{I+II} \phi_B \phi_B \, ds - h \frac{\partial T_D}{\partial n} \int_{II} \phi_D \phi_B \, ds$$

$$+ \underbrace{h T_\infty}_{c} \int_{I} \phi_B \, ds + \underbrace{h T_\infty}_{c} \int \phi_B \, ds$$

$$b = -a \frac{\partial T_c}{\partial n} \overbrace{\int_{I} \phi_c \phi_B \, ds}^{L_I/6} - a \frac{\partial T_B}{\partial n} \overbrace{\int_{I+II} \phi_B \phi_B \, ds}^{L_I/3 + L_{II}/3} - a \frac{\partial T_B}{\partial n} \overbrace{\int_{II} \phi_D \phi_B \, ds}^{L_{II}/6}$$

$$- c \underbrace{\int_{I} \phi_B ds}_{L_I/2} - c \underbrace{\int_{II} \phi_B ds}_{L_{II}/2}$$

$$\left.\begin{aligned} A_{bc} &-= a \left(\frac{L_I}{6}\right) \\ A_{bb} &-= a \left(\frac{L_I}{3} + \frac{L_{II}}{3}\right) \\ A_{bd} &-= a \left(\frac{L_{II}}{6}\right) \end{aligned}\right]$$

into A

into B

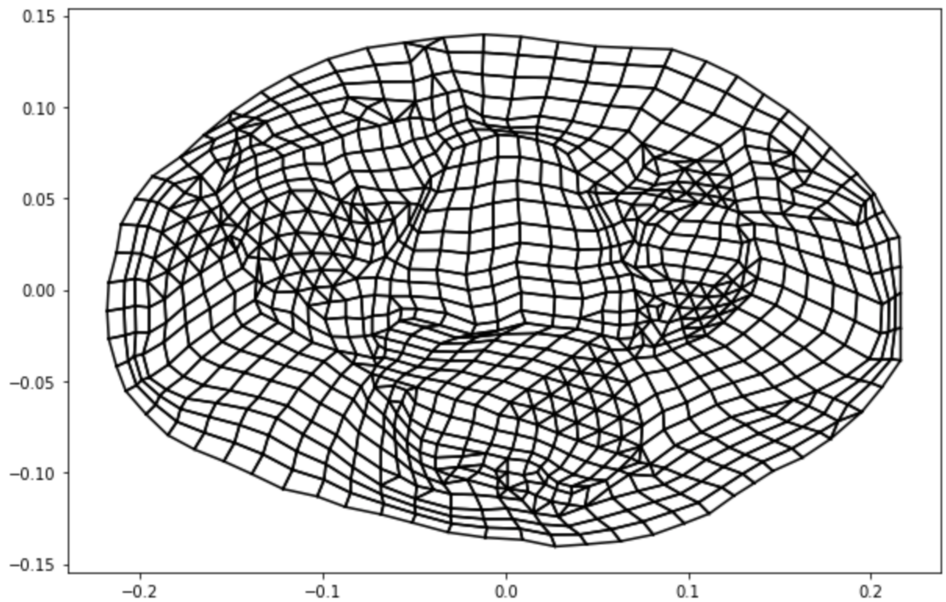
$$\left[\; B_b -= \frac{c}{2}(L_I + L_{II}) \right.$$

$$L_I = \sqrt{(x_b - x_c)^2 + (y_b - y_c)^2}$$

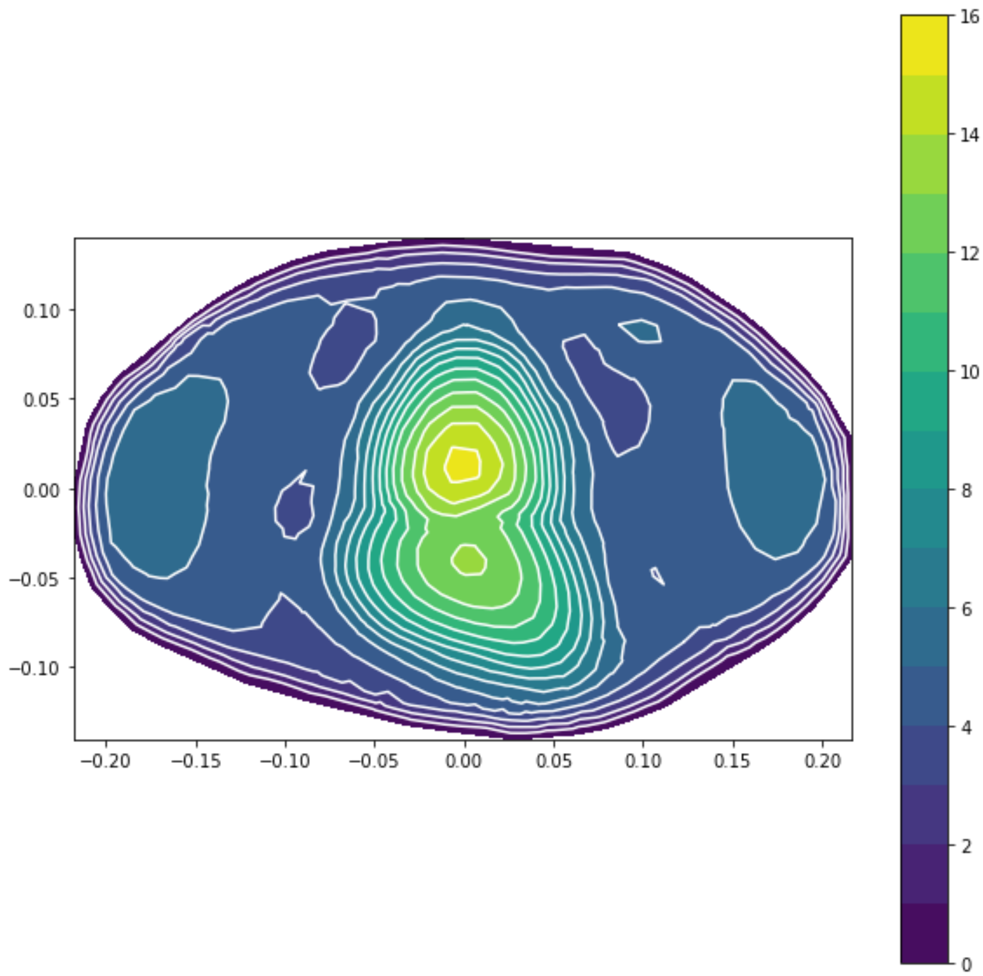
$$L_{II} = \sqrt{(x_b - x_D)^2 + (y_b - y_D)^2}$$

Increasing blood flow to the bladder is more effective at selectively targeting the tumor

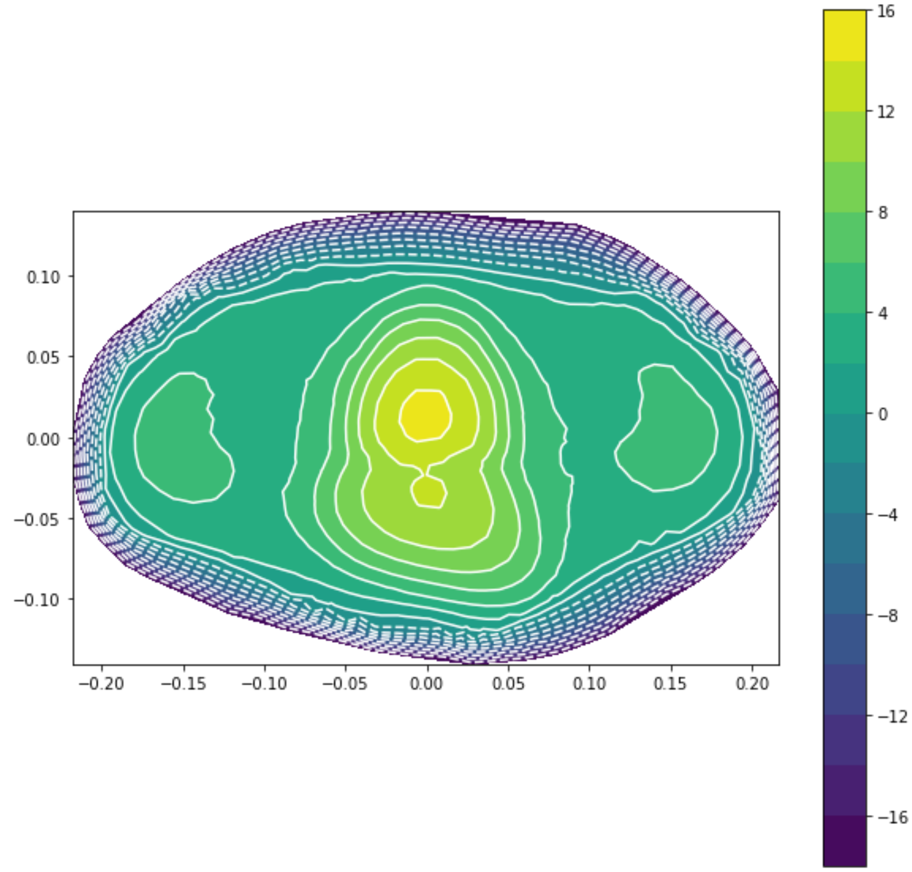
Mesh



Type I

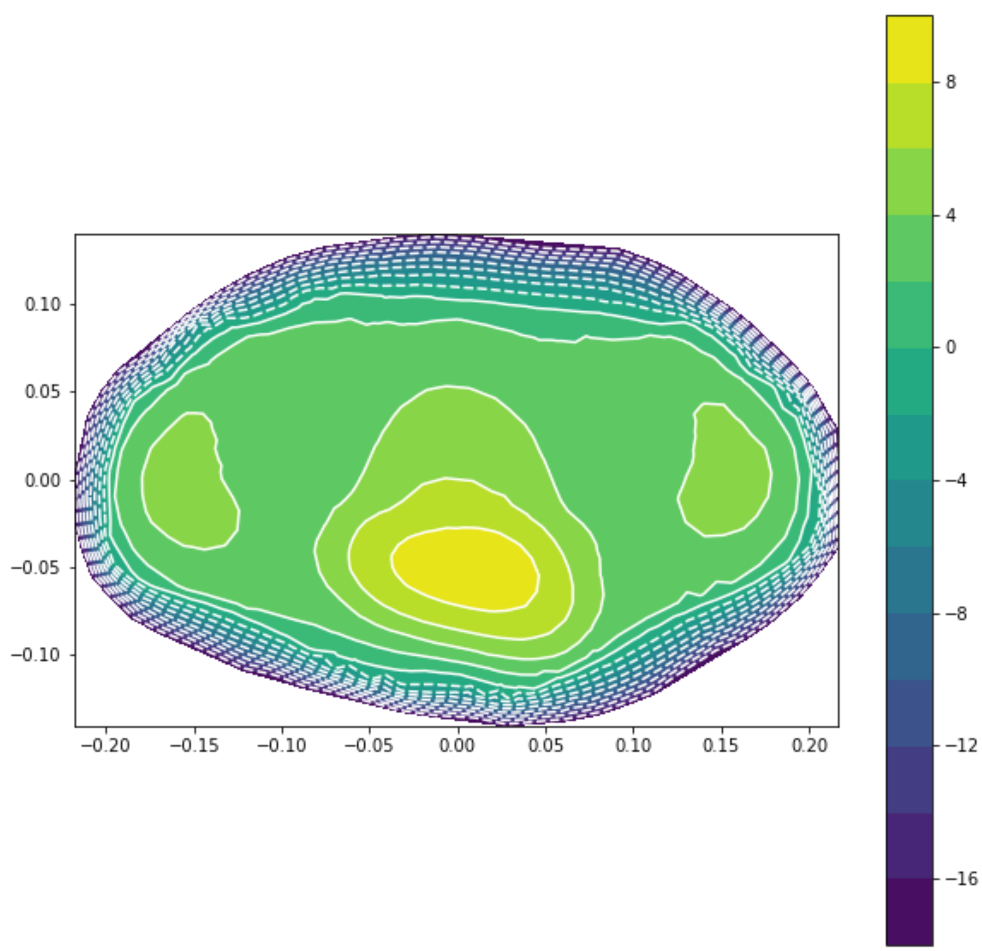


Type III (A)



0.10
0.05
0.00
−0.05
−0.10
−0.20
−0.15
−0.10
−0.05
0.00
0.05
0.10
0.15
0.20
16
12
8
4
0
−4
−8
−12
−16

Type III (B)



0.10
0.05
0.00
−0.05
−0.10
−0.20
−0.15
−0.10
−0.05
0.00
0.05
0.10
0.15
0.20
8
4
0
−4
−8
−12
−16