



# Electric capacitance calculation with QuickField

## Part 2. 3D Analysis



**Vladimir Podnos,**  
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[Overview](#)



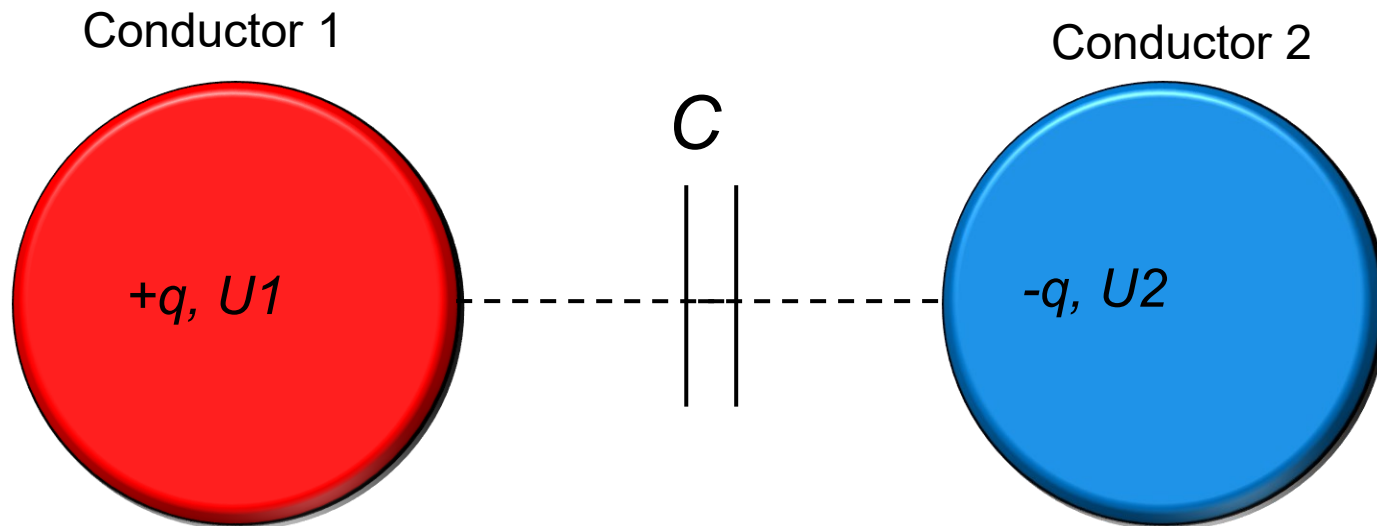
**Alexander Lyubimtsev**  
**Support Engineer**  
**Tera Analysis Ltd.**

[QuickField 3D live demonstration](#)



# Capacitance between two conductors

- $U = 0$



Capacitance:  $C = q / (U2 - U1)$

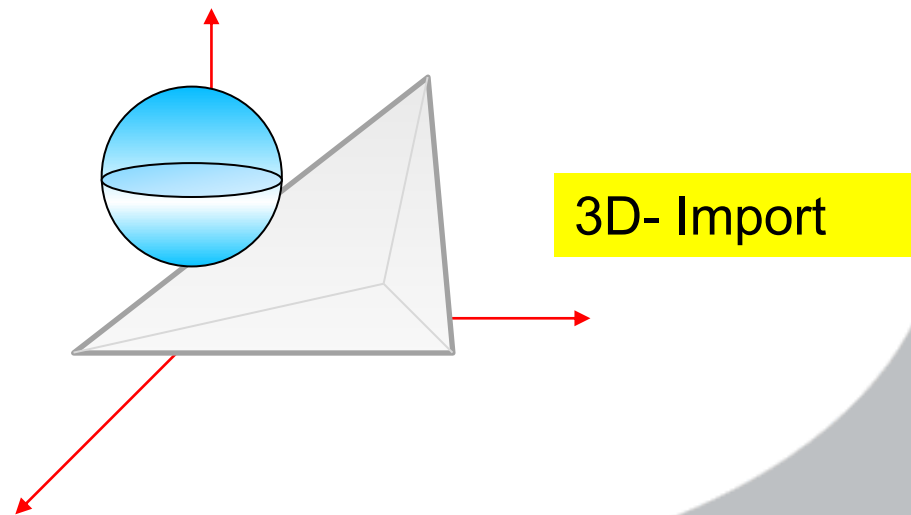
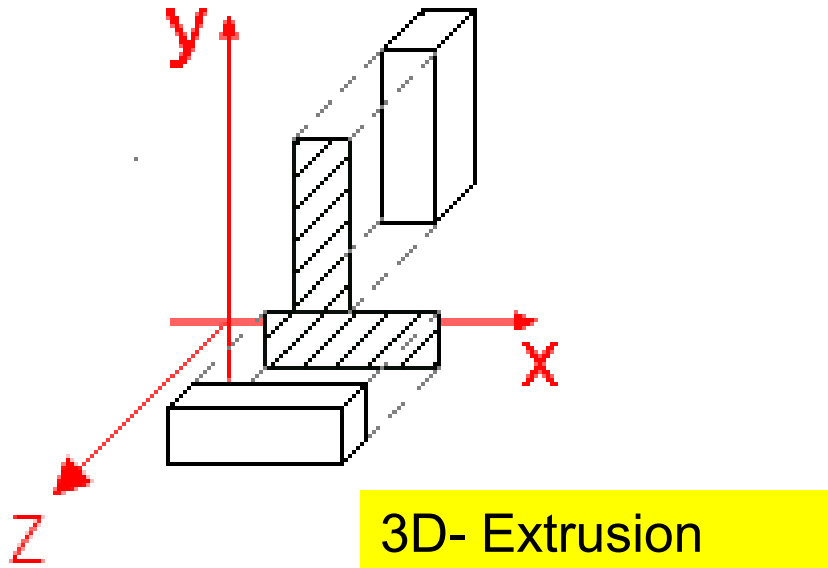
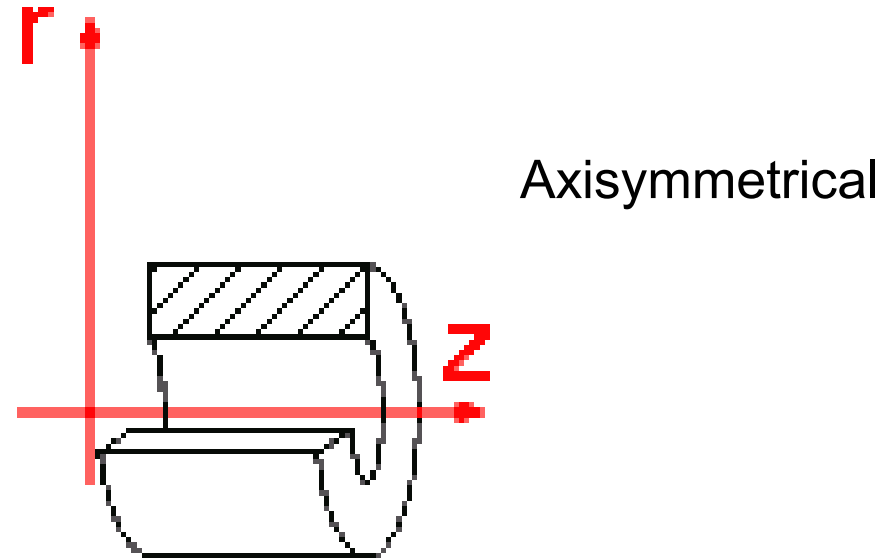
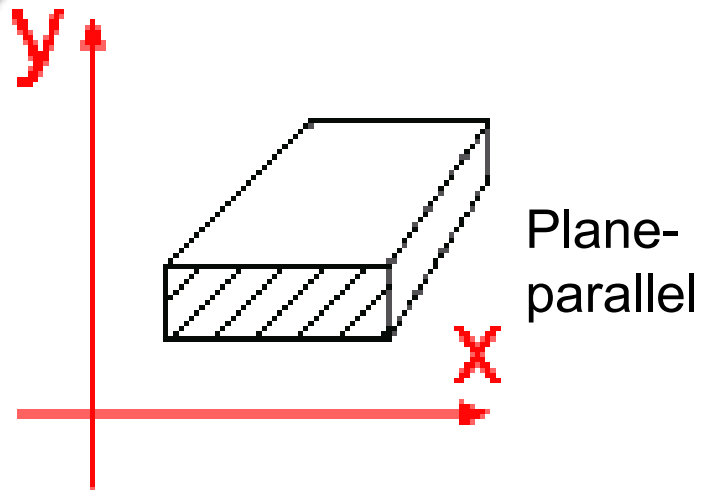


# QuickField analysis options

<b>Magnetic analysis suite</b>	
Magnetic Problems	Magnetostatics
	AC Magnetics
	Transient Magnetic
<b>Electric analysis suite</b>	
Electric Problems	Electrostatics (2D,3D) and DC Conduction (2D,3D)
	AC Conduction
	Transient Electric field
<b>Thermostructural analysis suite</b>	
Thermal and mechanical problems	Steady-State Heat transfer (2D,3D)
	Transient Heat transfer
	Stress analysis



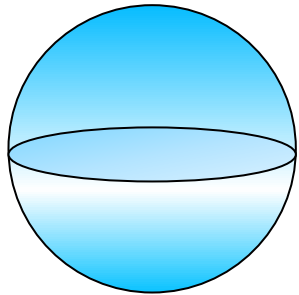
# QuickField geometry model class



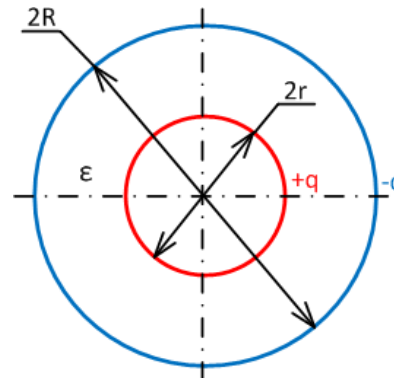


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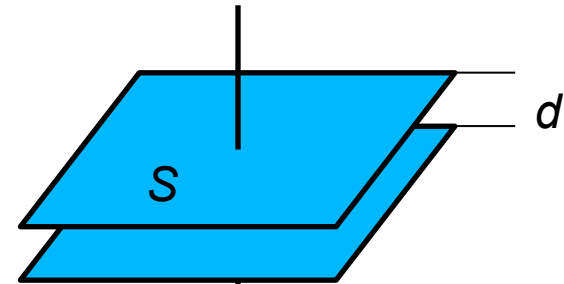
Part 1.



Sphere capacitance



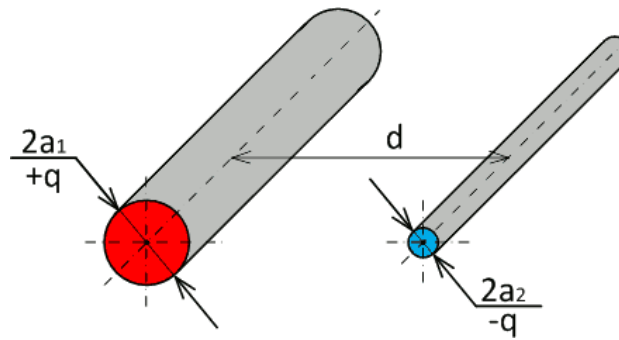
Spherical capacitor



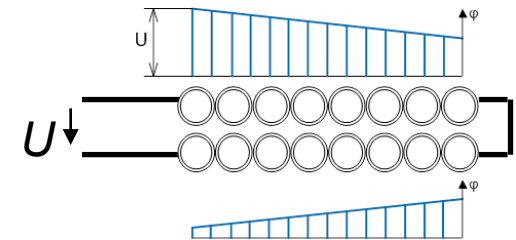
Plane capacitor



Cylindrical capacitor



Parallel wires



Winding capacitance



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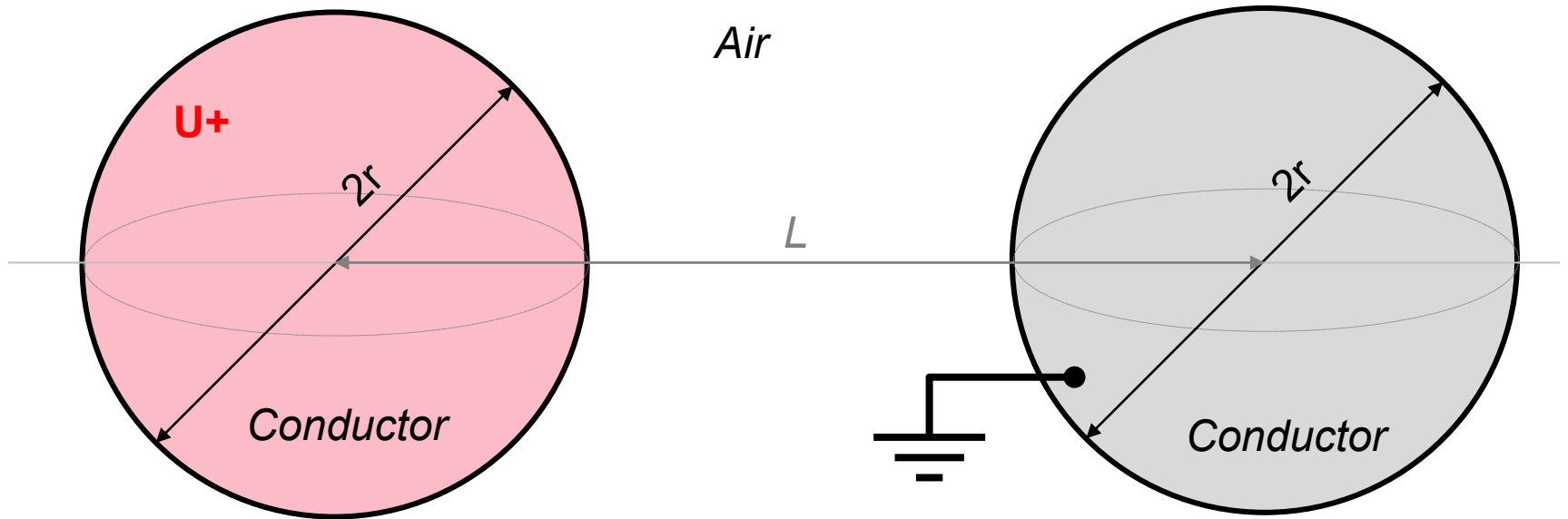


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# Sphere to sphere capacitance



<https://en.wikipedia.org/wiki/Capacitance>

$$C \approx 2\pi\epsilon\epsilon_0 r \left\{ \frac{1}{2D} + \frac{1}{4D^2} + \frac{1}{8D^3} + \frac{1}{8D^4} + \frac{3}{32D^5} \right\}, \quad \text{where } D = L/r$$

Input data:

$r = 100 \text{ mm}$ ,  $L = 500 \text{ mm}$

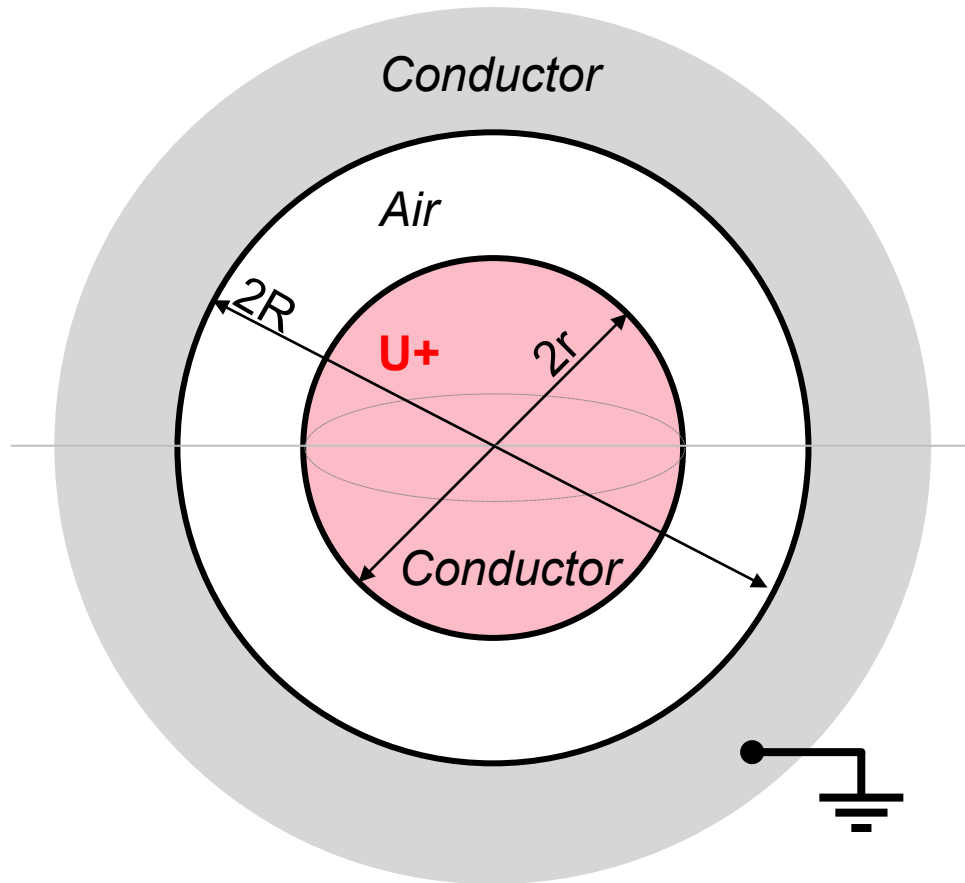
$U_+ = 1 \text{ V}$

Capacitance:  $C = 6,99 \text{ pF}$

[https://quickfield.com/advanced/non-concentric\\_spheres\\_capacitance.htm](https://quickfield.com/advanced/non-concentric_spheres_capacitance.htm)



# Spherical capacitor



Input data:

$$r = 100 \text{ mm}, R = 200 \text{ mm}$$

$$U_+ = 1 \text{ V}$$

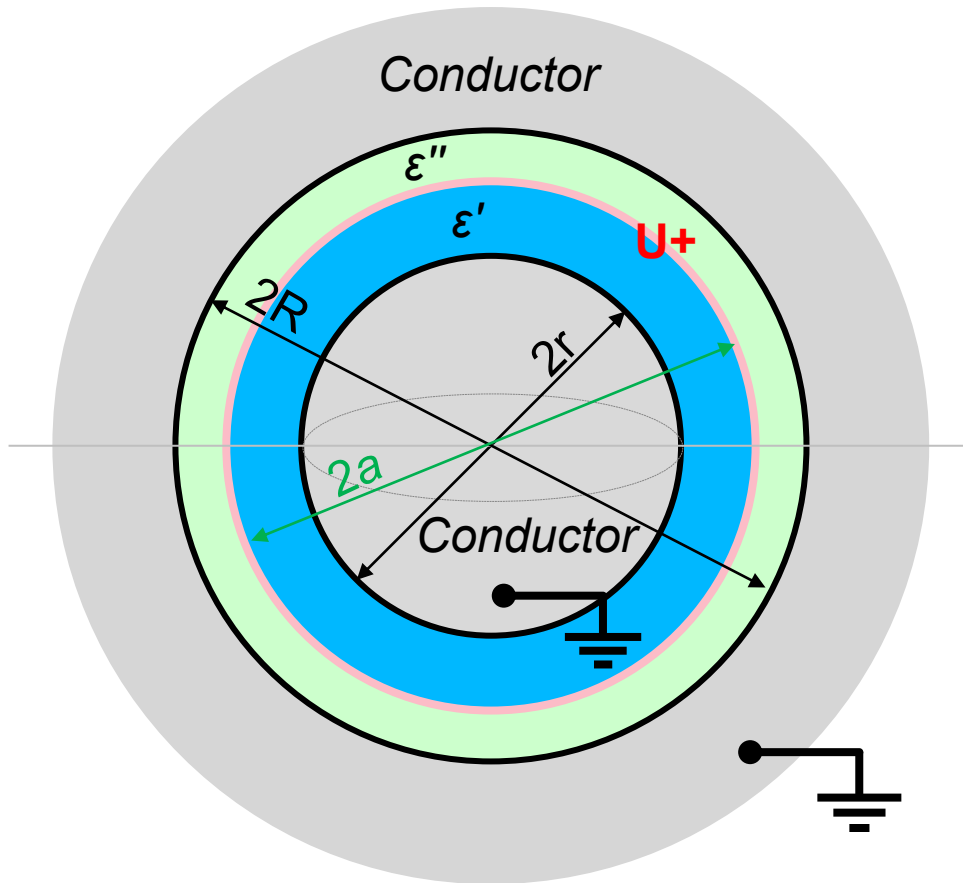
$$C = \frac{4\pi\epsilon\epsilon_0}{\frac{1}{r} - \frac{1}{R}}$$

Capacitance:

$$C = 22,2 \text{ pF}$$



# Spherical capacitor with foil



Input data:

$$\begin{aligned}\epsilon' &= 6, & \epsilon'' &= 2 \\ r &= 100 \text{ mm}, & R &= 200 \text{ mm} \\ a &= 150 \text{ mm} \\ U+ &= 1 \text{ V}\end{aligned}$$

$$C' = \frac{4\pi\epsilon'\epsilon_0}{\frac{1}{r} - \frac{1}{a}}$$

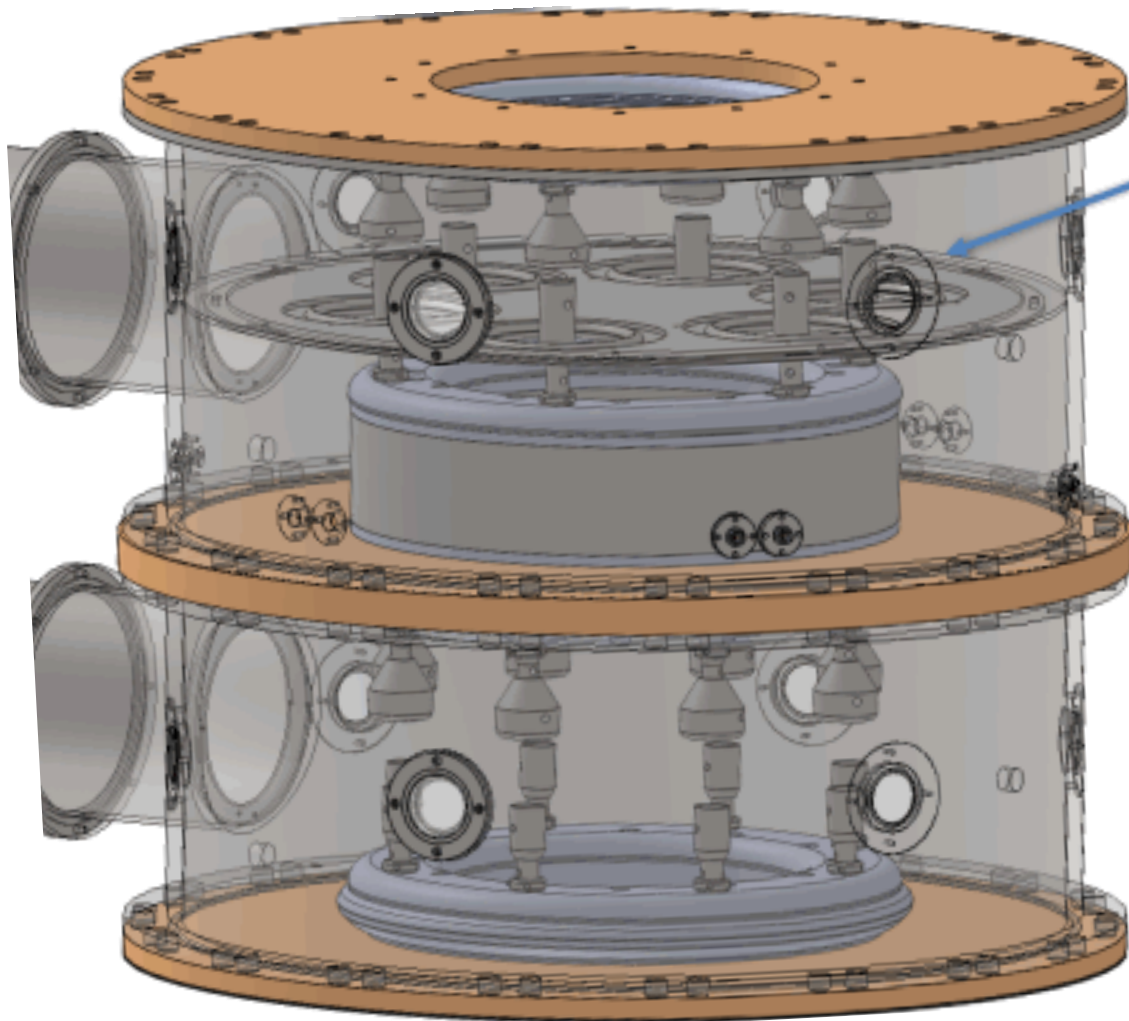
$$C'' = \frac{4\pi\epsilon''\epsilon_0}{\frac{1}{a} - \frac{1}{R}}$$

Capacitance:

$$C' = 200 \text{ pF}, \quad C'' = 133 \text{ pF}$$



# Prepulse switch



Input data:

$$U_+ = 4 \text{ MV}$$