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Initial Attempts to model azimuthally asymmetric current contact for Maglif style Liner Implosions

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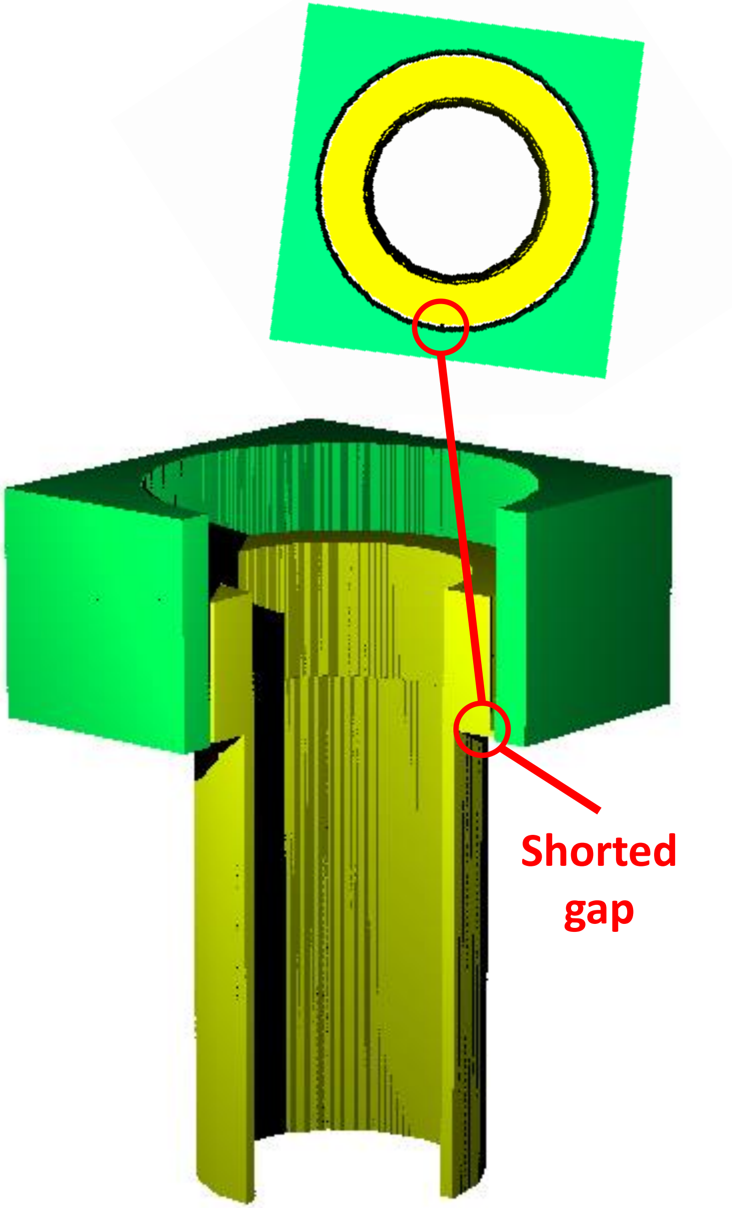
MHD modeling of how electrode contact asymmetries may influence liner implosions is very challenging

Electron emission breakdown processes not captured here, but we can try to study how an intentionally shorted gap affects later time current distribution.

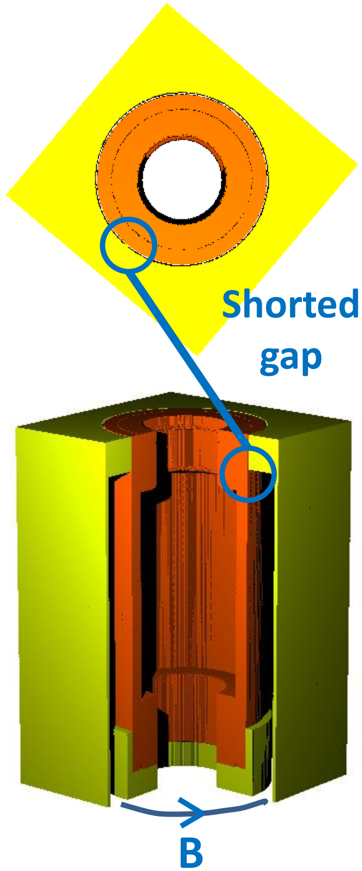
Computationally challenging:

- Inherently 3D with large target sizes (cm's) combined with small electrode gaps (microns).
- To be tractable we typically focus calculations the load and only adjacent electrodes – so must then impose field boundaries.
- Drive current is typically supplied through a magnetic field boundary that assumes something about current distribution (e.g. cylindrical symmetry)
- A close in boundary that allows self consistent evolution of asymmetric current distribution without dictating the solution is non-trivial, and extending modelled volume to sizes where this is less of a concern is computationally prohibitive.



Attempt to construct Maglif scale Liner driven by Z current to study shorted gap affect on implosion symmetry

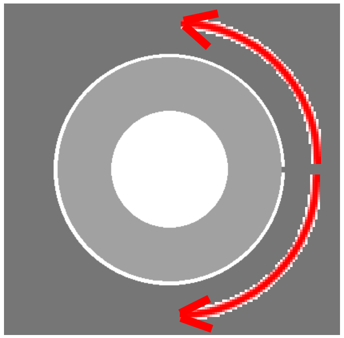
Gap shorted at top of target to allow distance for asymmetries to develop

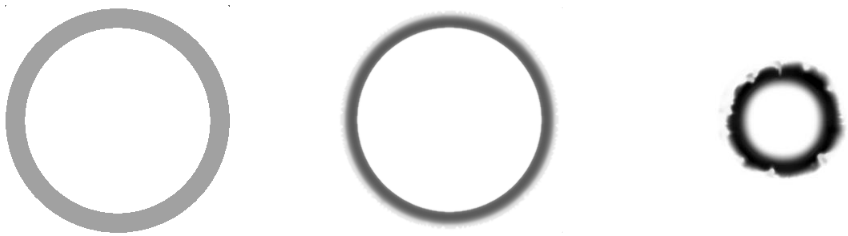


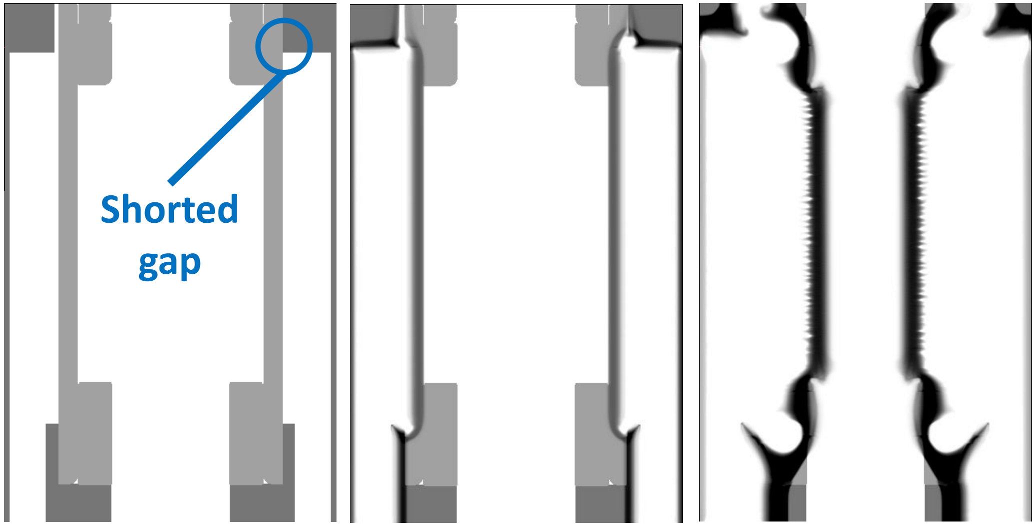
Close in return can to reduces computational volume

Azimuthally current / B-field set on bottom boundary

- Current rapidly azimuthally redistributed from contact point.
- Ablates electrodes, closing small gap
- Leads to symmetric field and implosion.
- How much of this is driven by symmetric bottom boundary

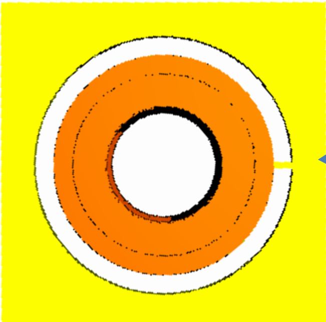






Density Distributions

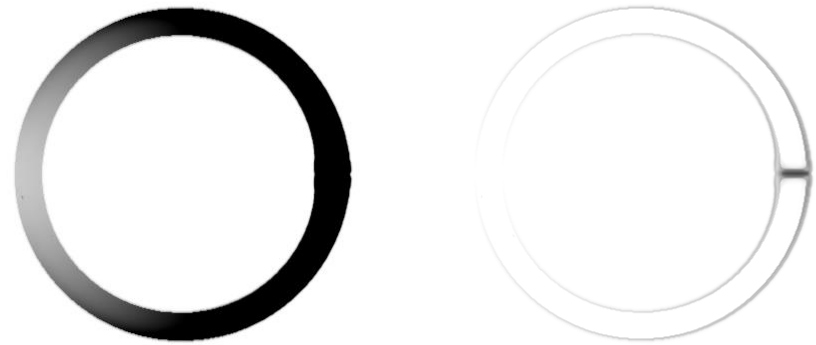
Potential Issues more apparent of we grossly exaggerate the gap



Expanding to a shorted 500 micron gap

Very large gaps can break feedback between current density ablating electrode plasma to short gaps and further symmetrizing current delivery

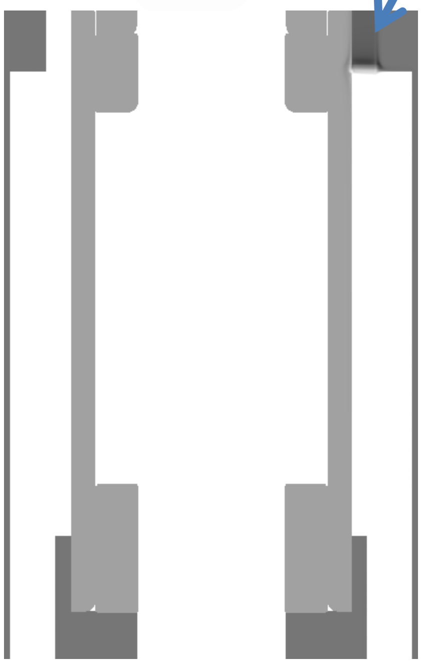
Current/field redistributing azimuthally at top of target



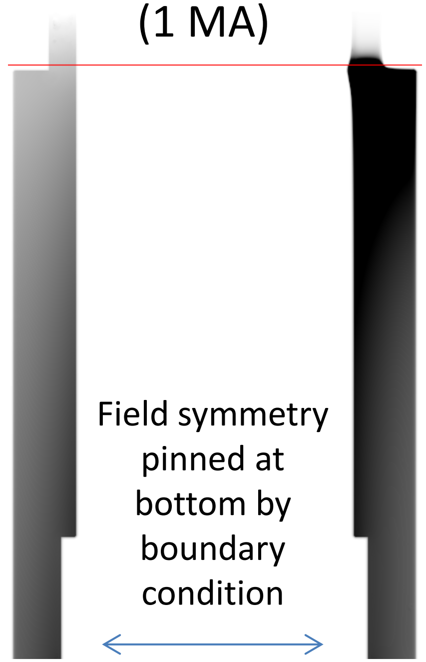
Magnetic Field

Azimuthal Cur. Density

Density



Magnetic Field (1 MA)



Field symmetry pinned at bottom by boundary condition

This field distribution indicates boundary condition may be playing a role in symmetrizing current in calculations

Can be addressed:

- Model much larger volume encompassing more electrode hardware (computationally intensive)
- Link computational boundary to spatially distributed transmission line network that can support and evolve large current asymmetries (more development required)