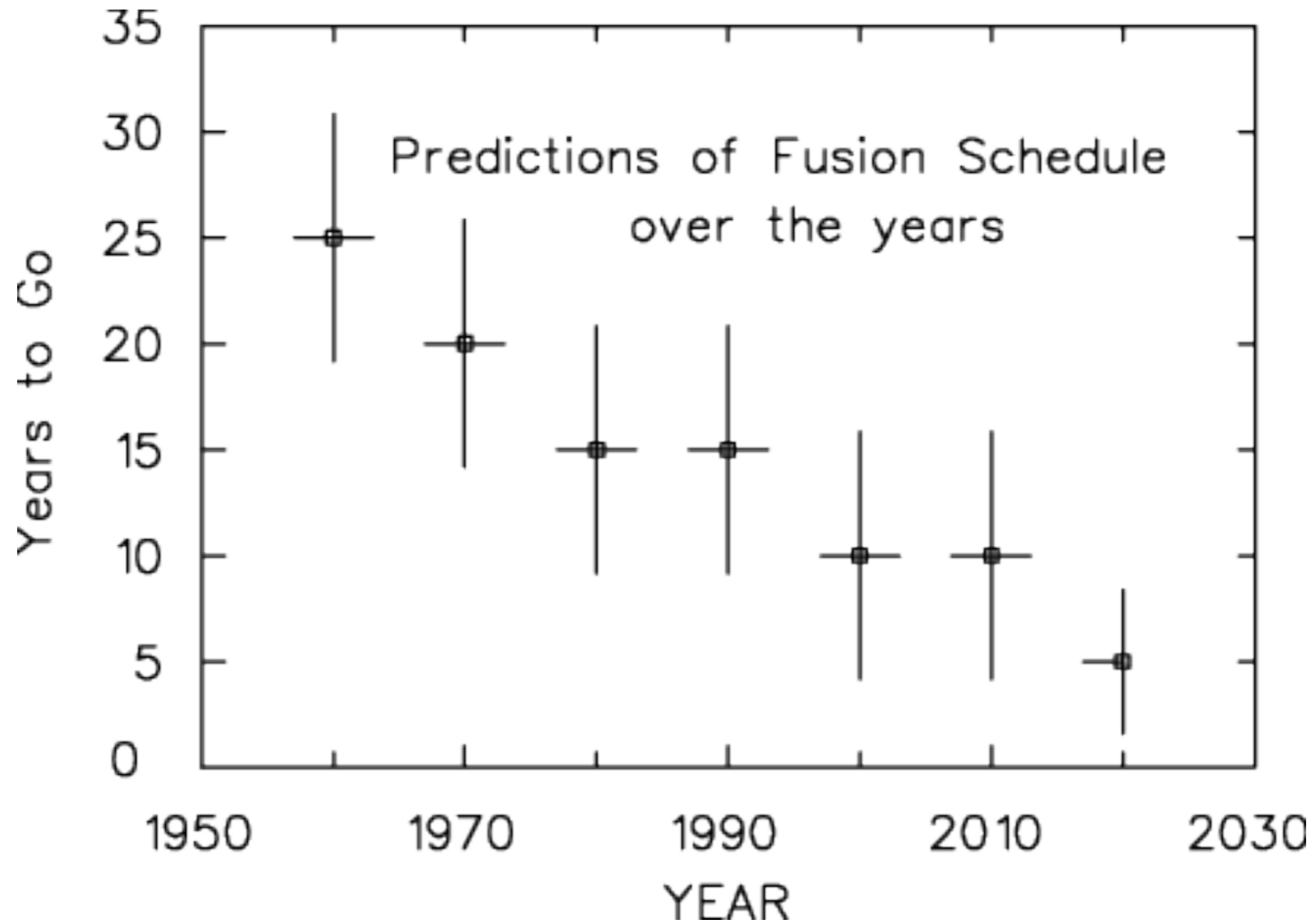


What About **FUSION?**

Answer to all the world's energy needs?

Or “forever 20 years in the future”?

When will we have Fusion Power?



How “Clean” is Fusion?

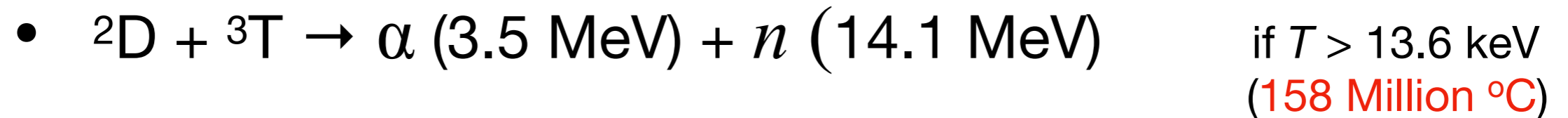
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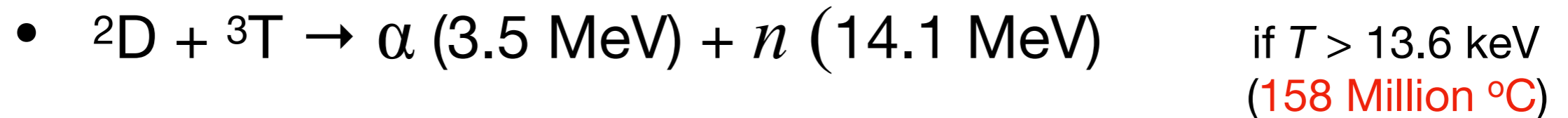
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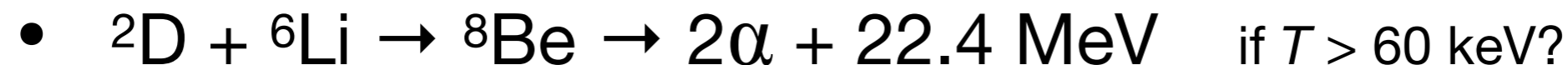
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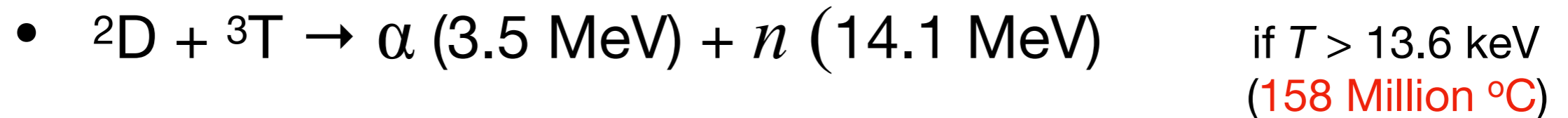


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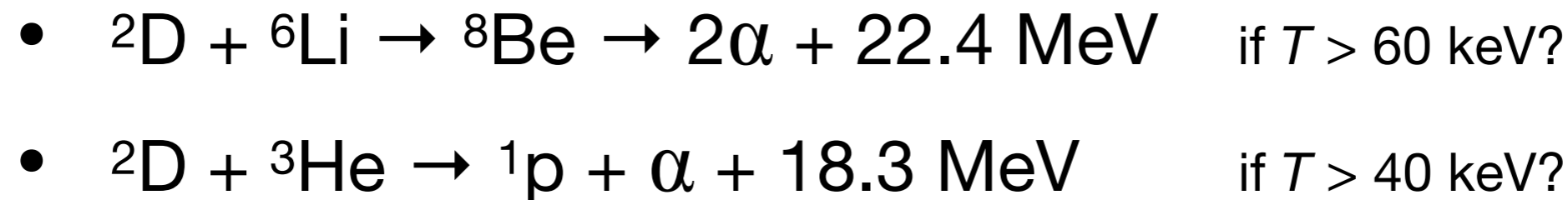


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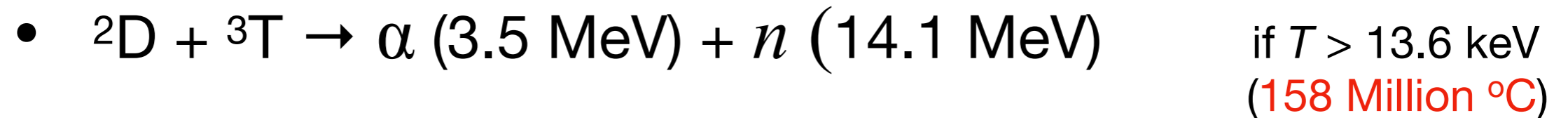


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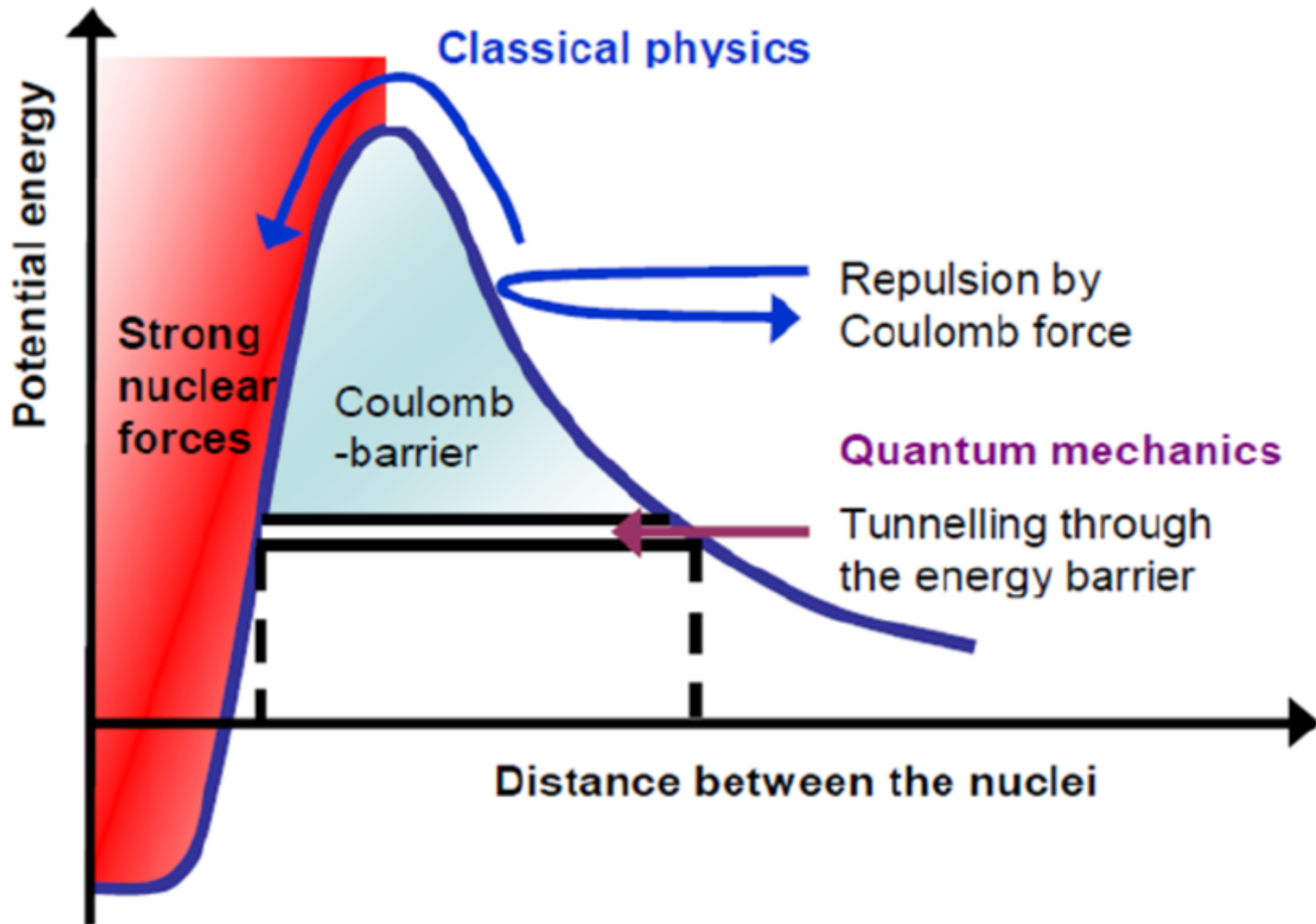
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(158 Million °C)

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- ${}^1\text{p} + {}^{11}\text{B} \rightarrow 3\alpha + 8.7 \text{ MeV}$ if $T > 123 \text{ keV}$

The $d-t$ Potential



Types of *Proposed* Fusion

- Magnetic Confinement (e.g. Tokamaks & Stellarators)
- Inertial Confinement (miniature H-bombs)
- Laser-driven 1p into laser-generated ^{11}B plasma (HB11 Energy)
- Self-colliding Beams (e.g. Bogdan Maglich's *Migma cell*)
- Sonoluminescent Bubbles (dubious)
- Muon Catalyzed Fusion (forever frustrating)
- "Cold Fusion" (completely bogus)

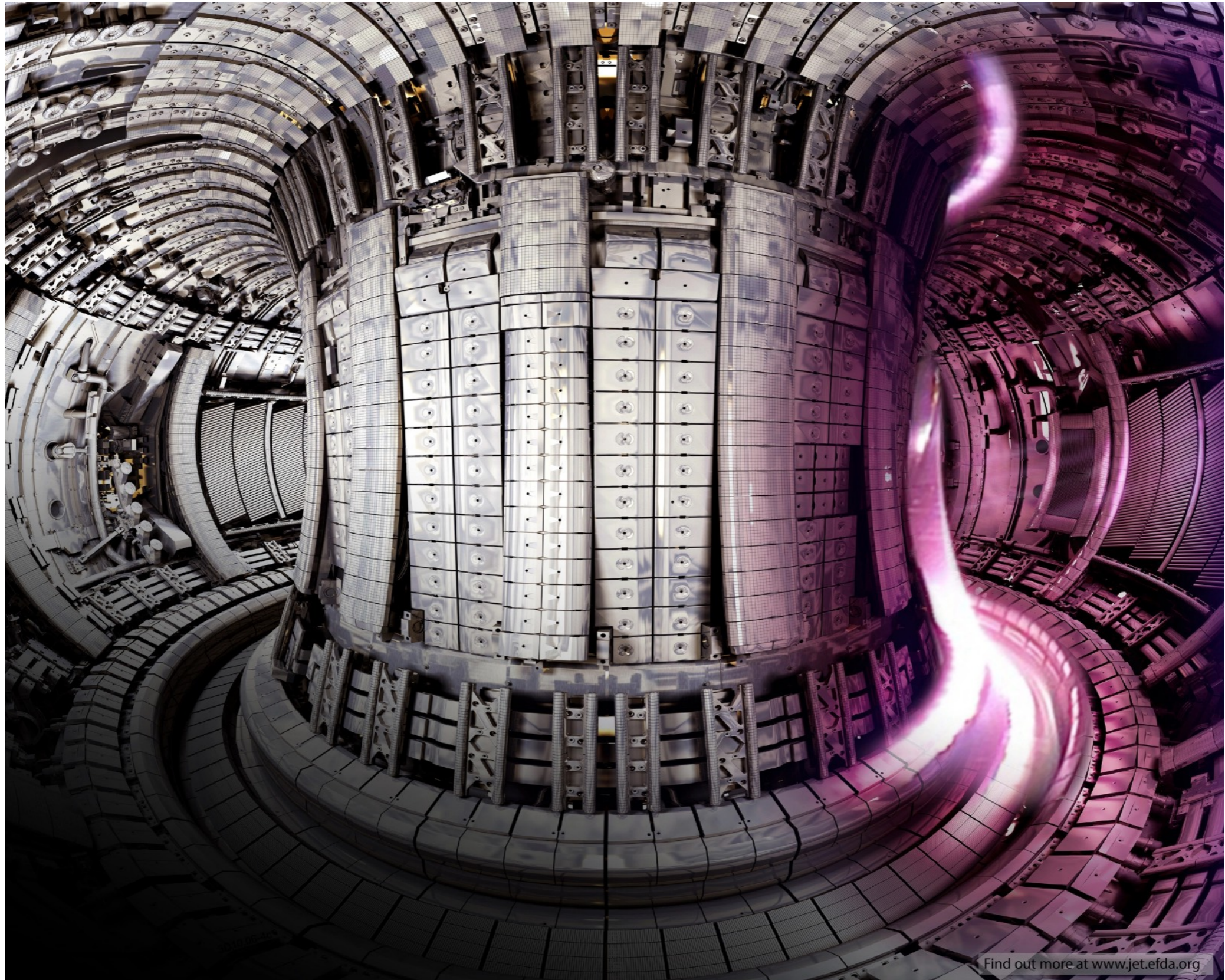
International *T*hermonuclear *E*xperimental *R*eactor



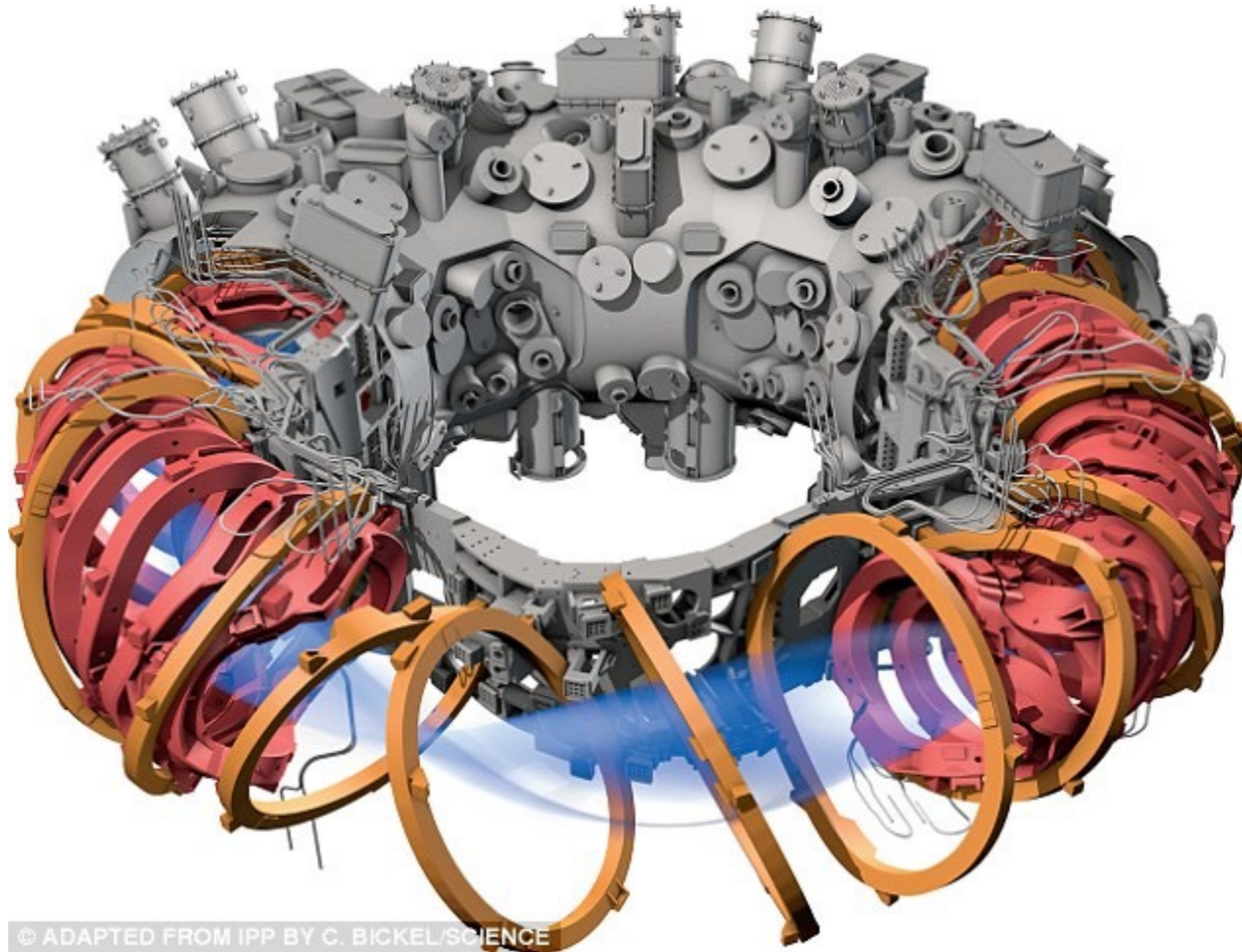
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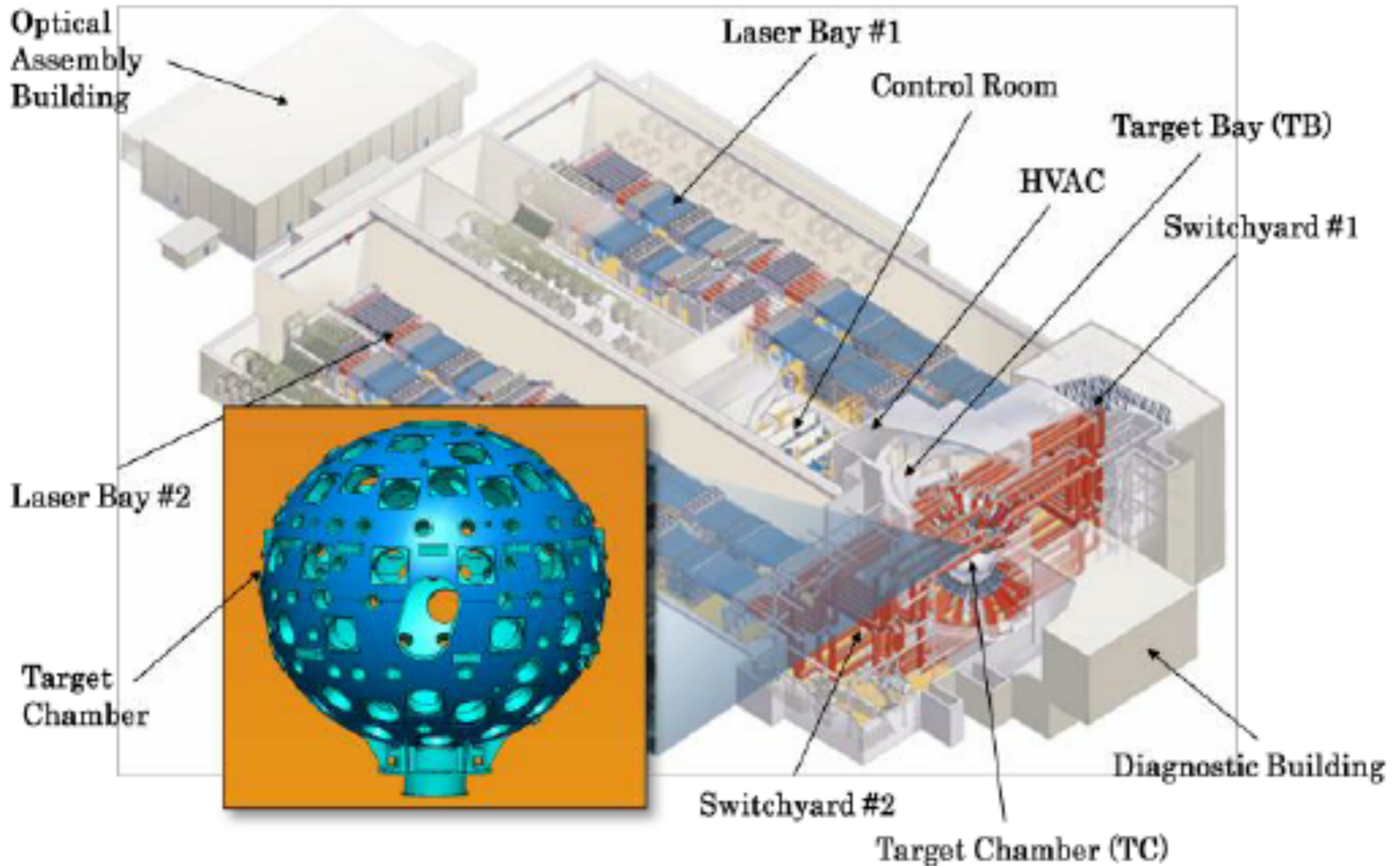


Stellarator

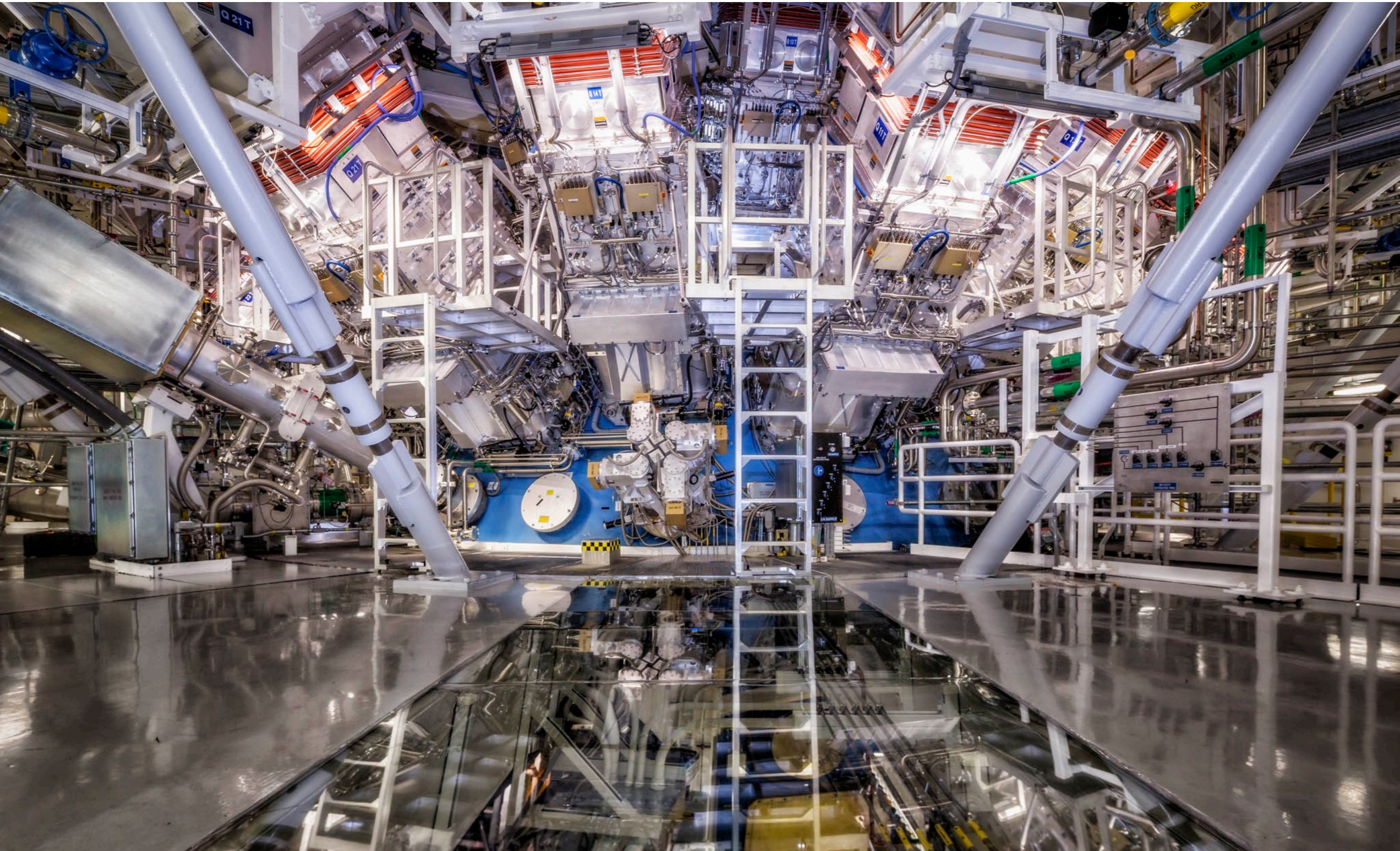


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National Ignition Facility



National Ignition Facility



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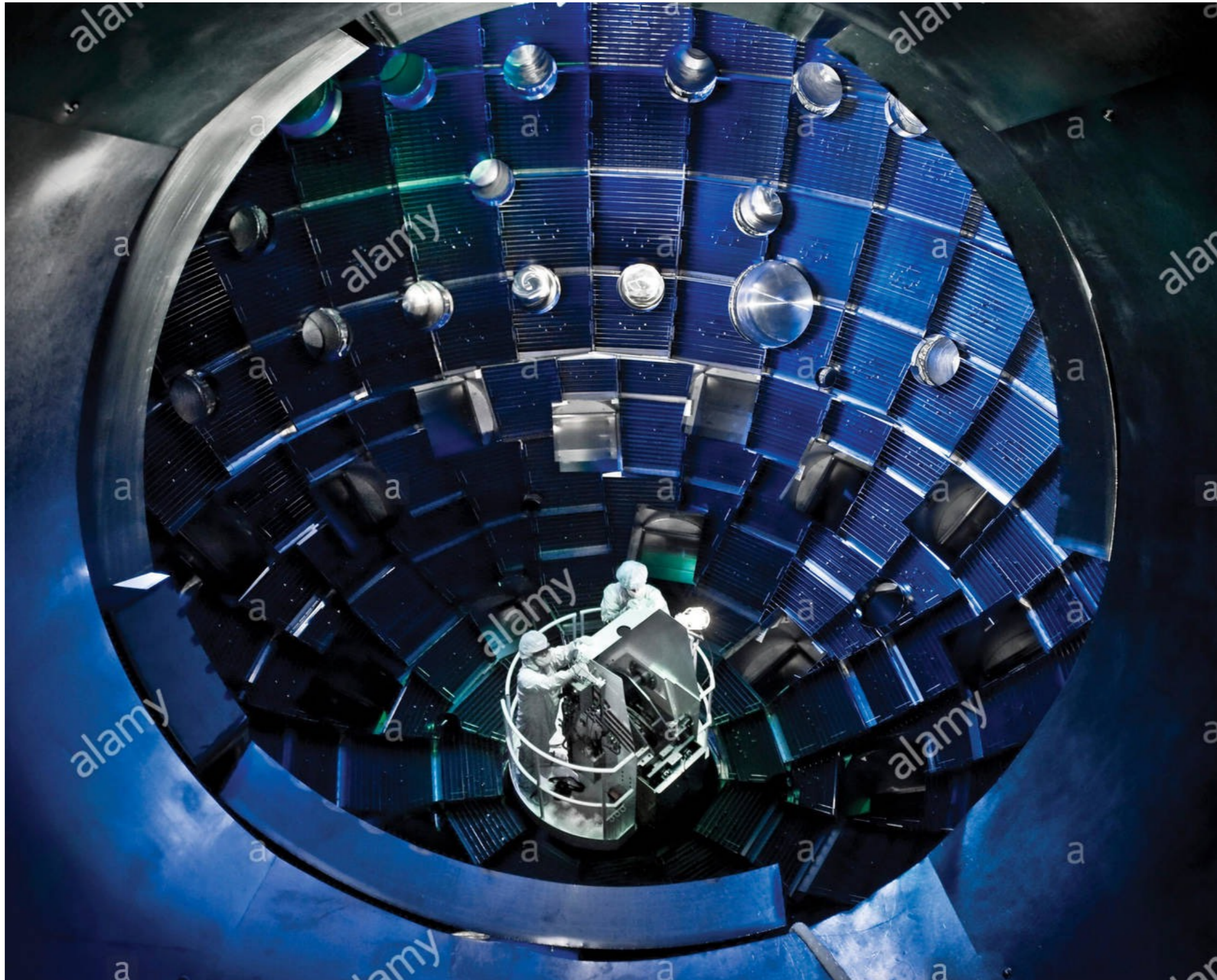


National Ignition Facility

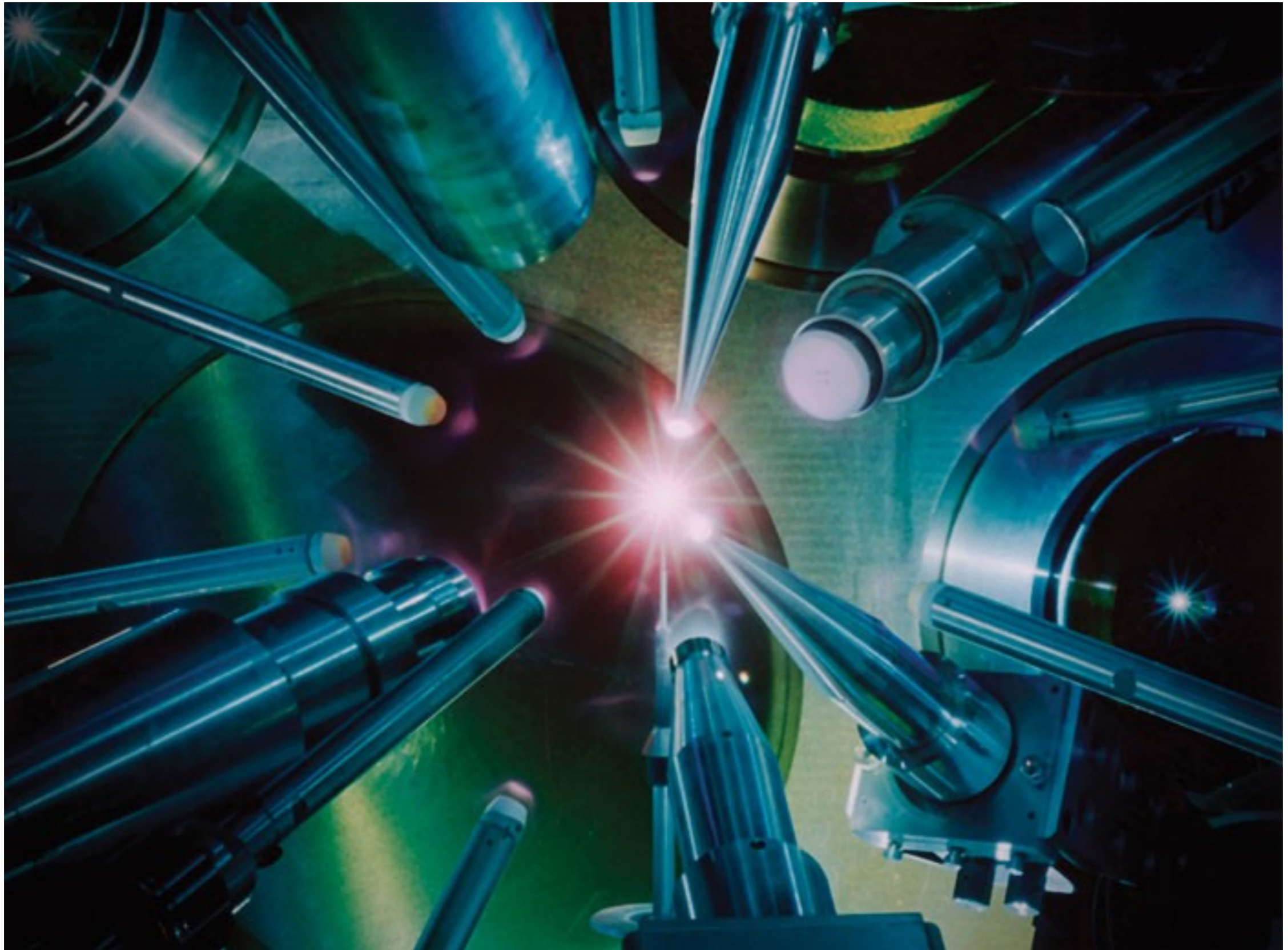
Laser Bay



National Ignition Facility

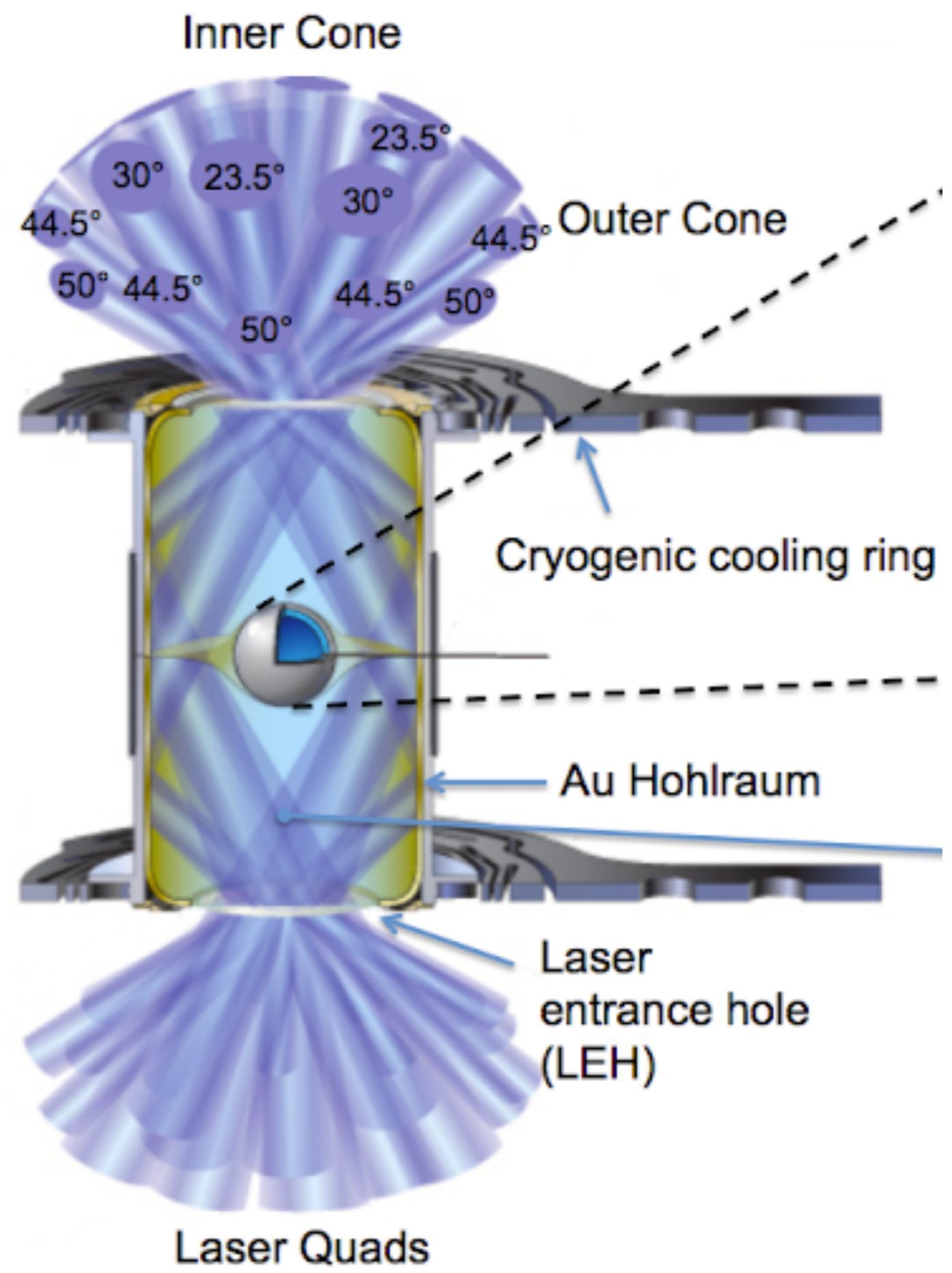


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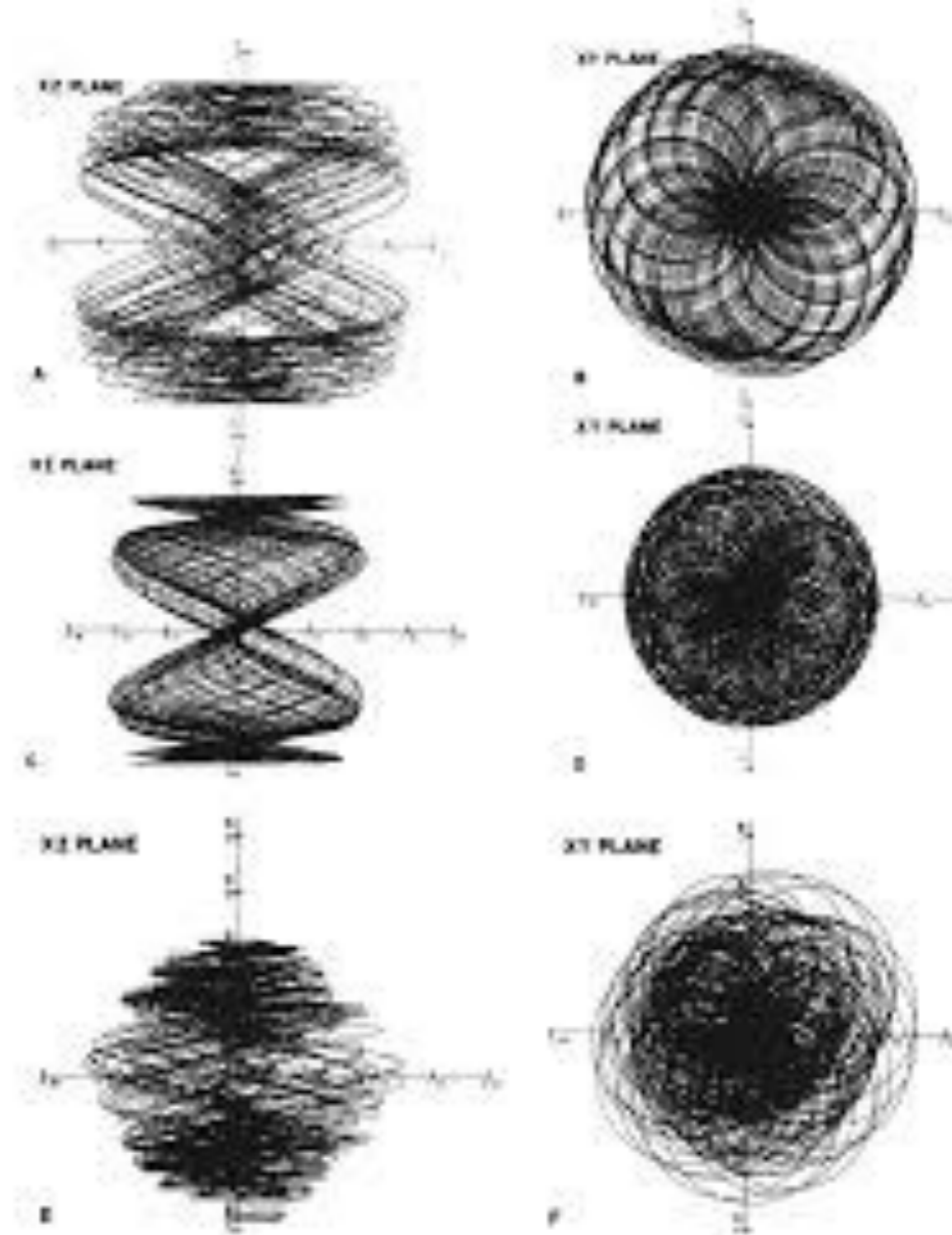
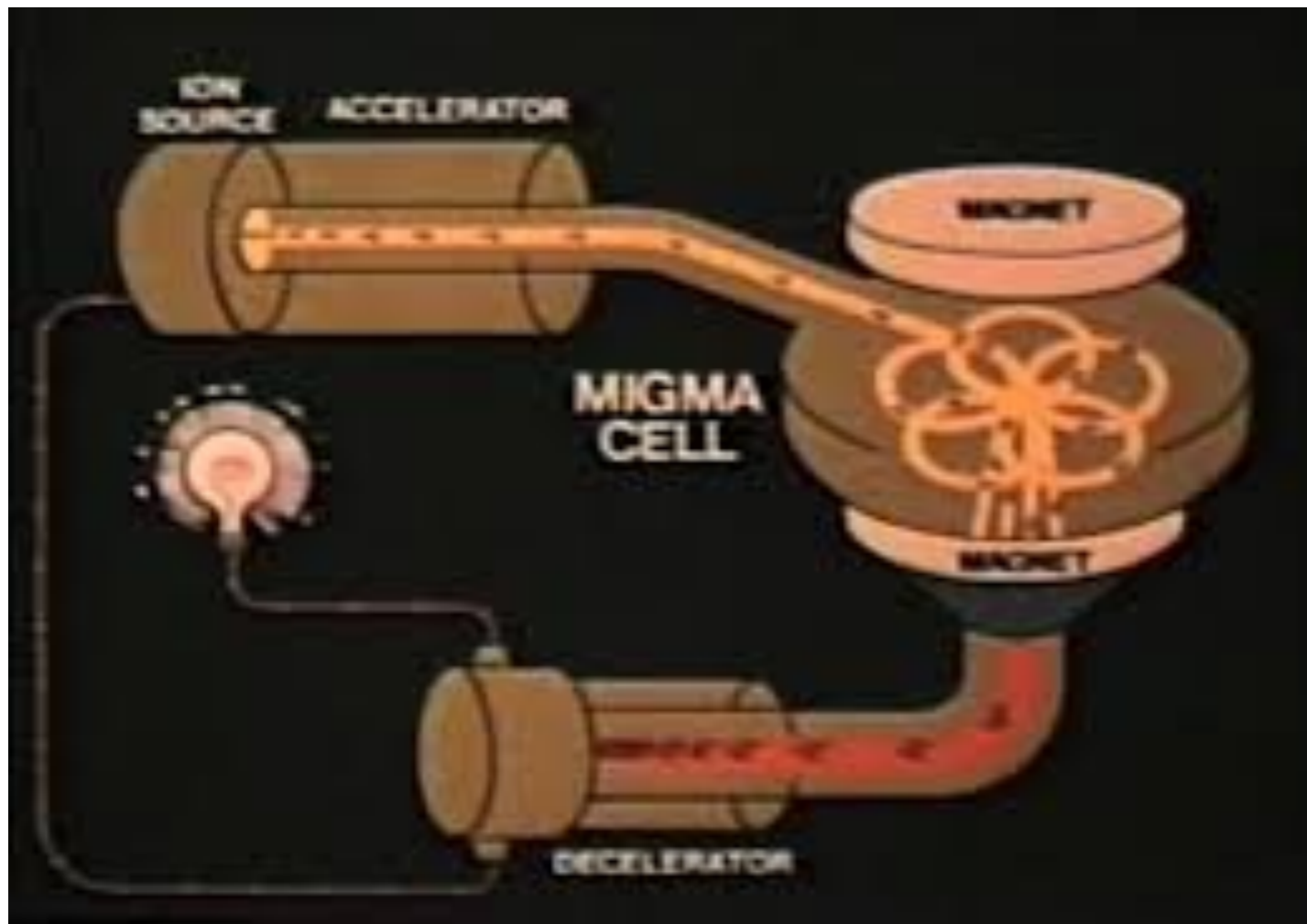
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HOHLRAUM



The *Migma* Cell

- Self-Colliding Beam
- Invented by Bogdan Maglich in 1975
- World record “confinement”: 24 s



The *Aiming* Problem



The *Aiming* Problem

- To make a ${}^1\text{p} + {}^{11}\text{B} \rightarrow 3\alpha + 8.7 \text{ MeV}$ reaction, in principle all you need is to accelerate your proton to 123 keV and hit a boron target with it, right?

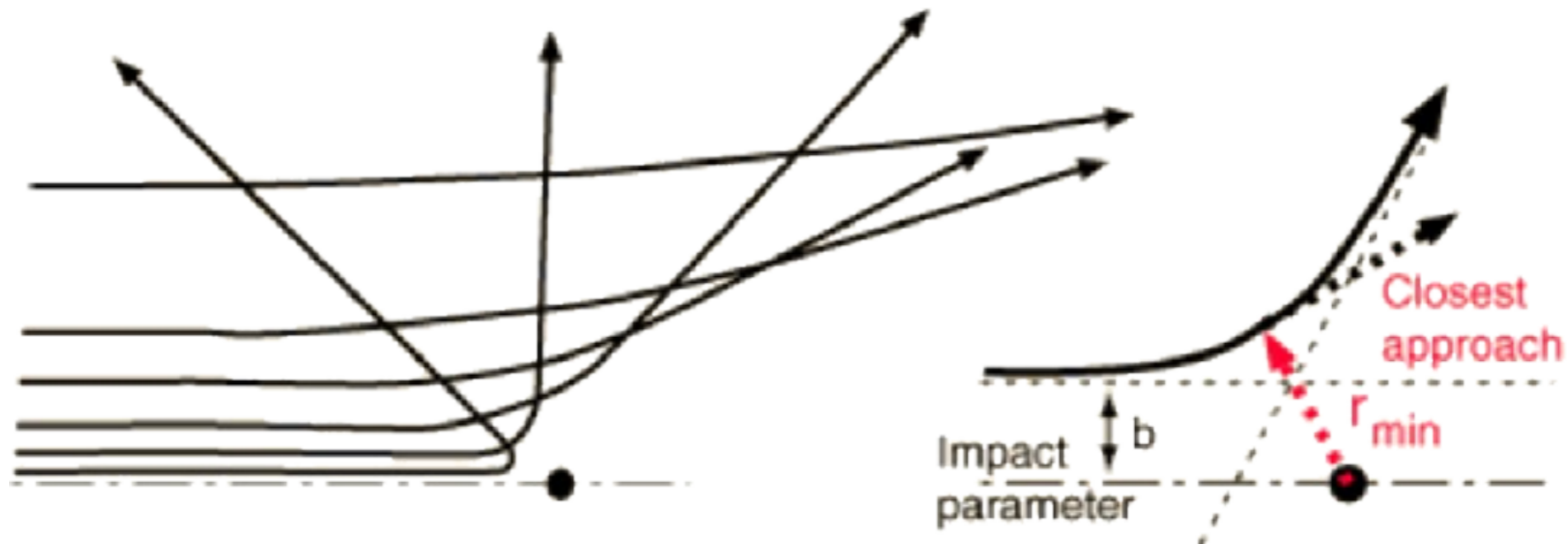


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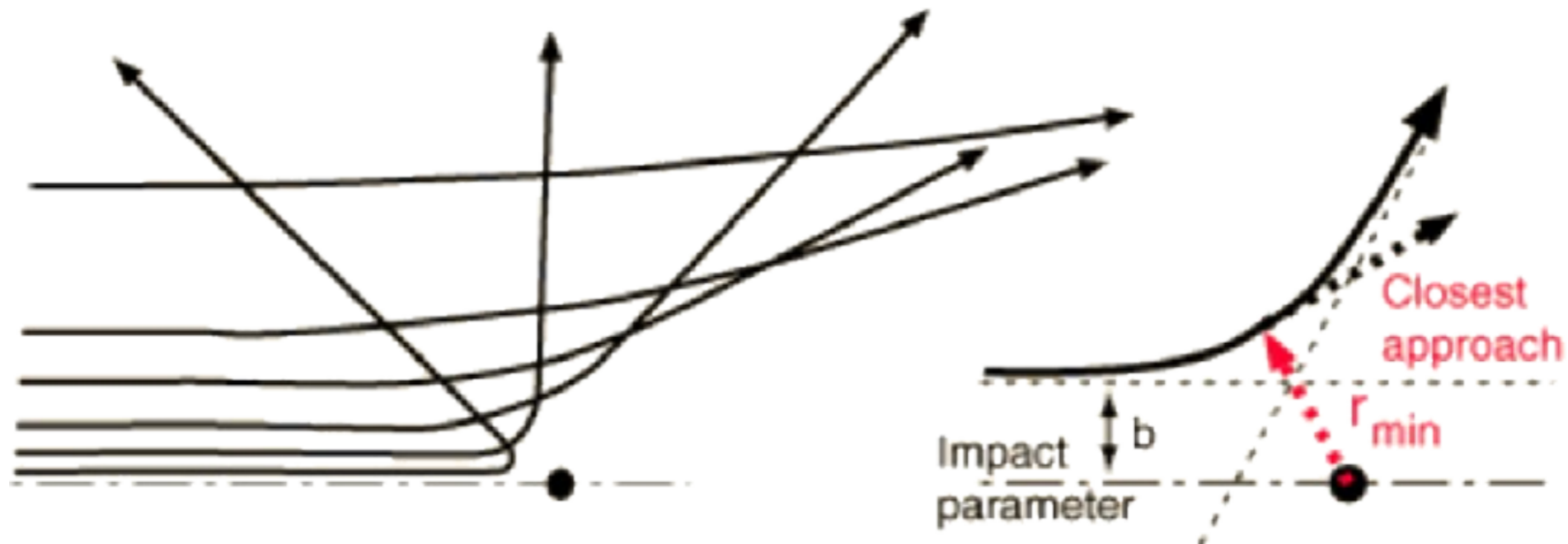


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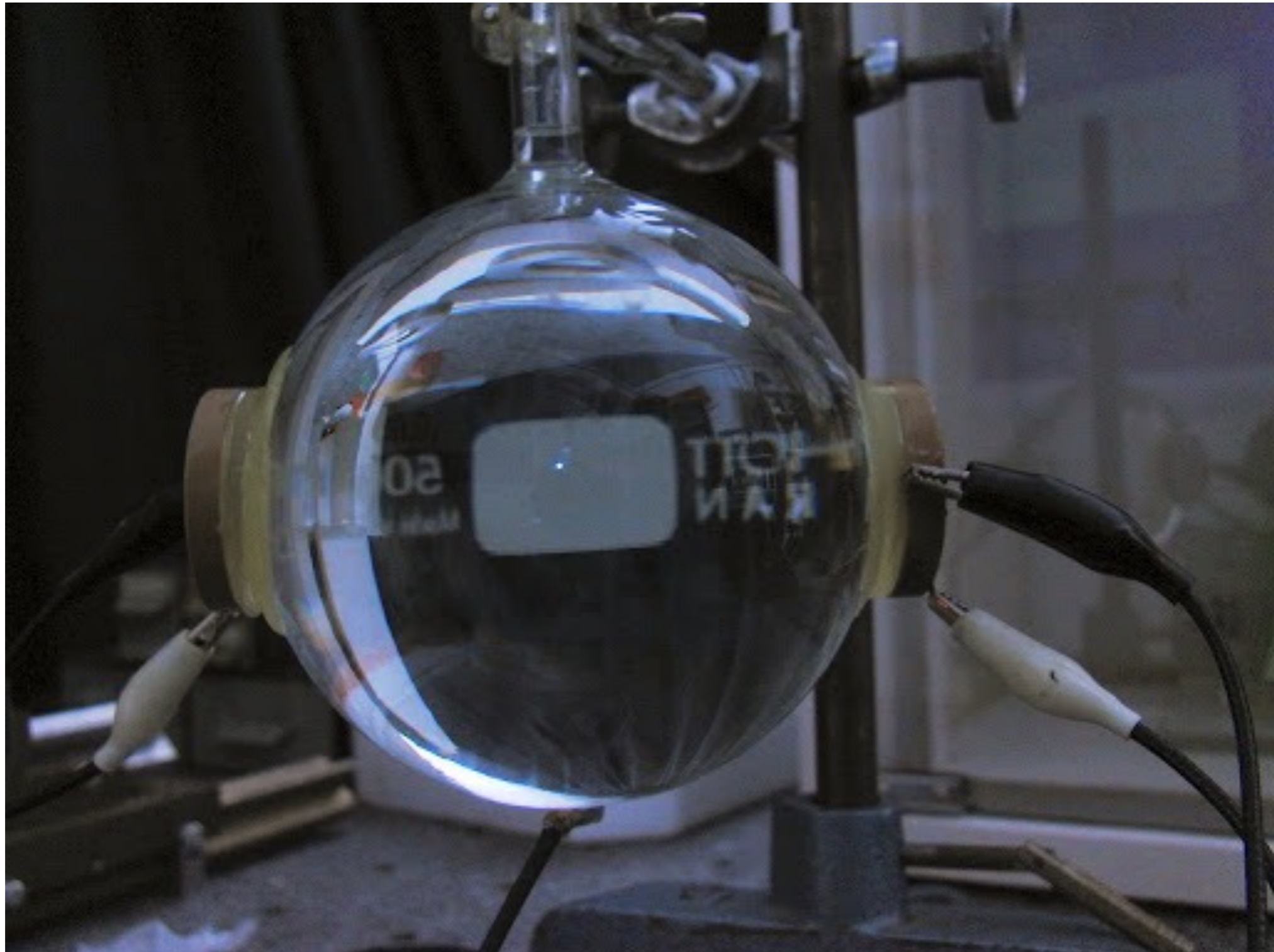


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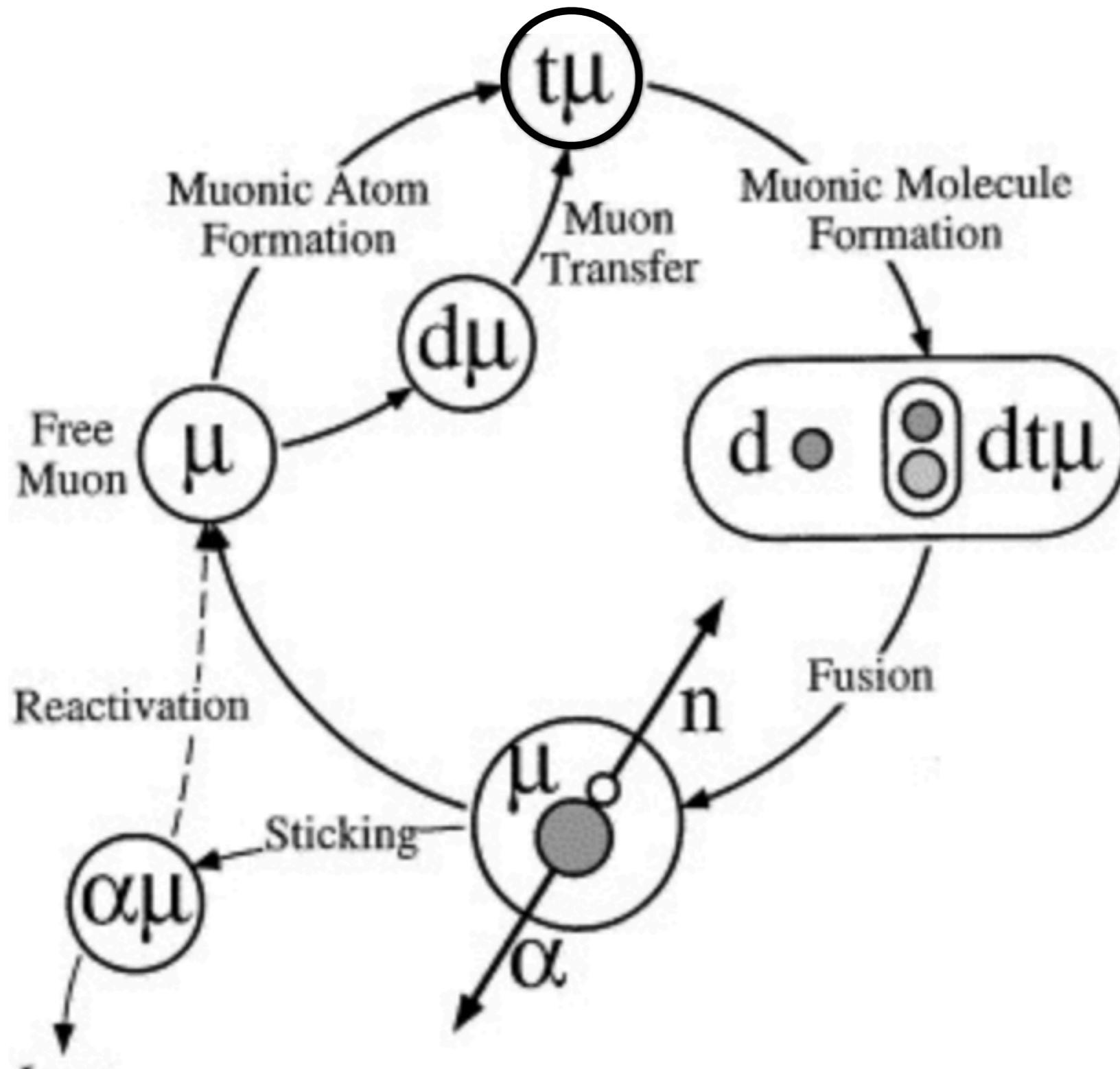


- This renders all “colliding beams” ideas implausible, IMO.

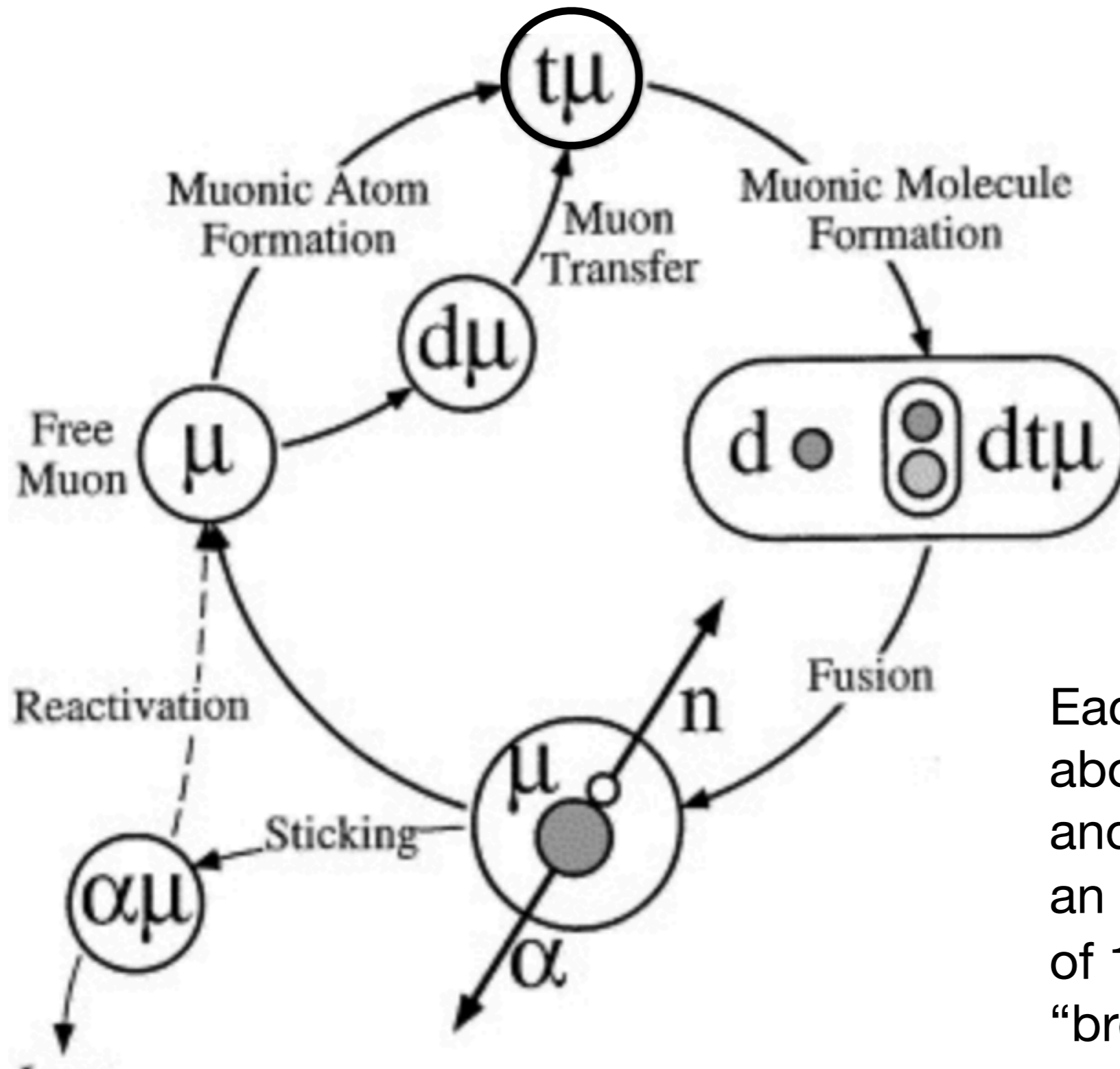
Sonoluminescence



μCF = Muon Catalyzed Fusion

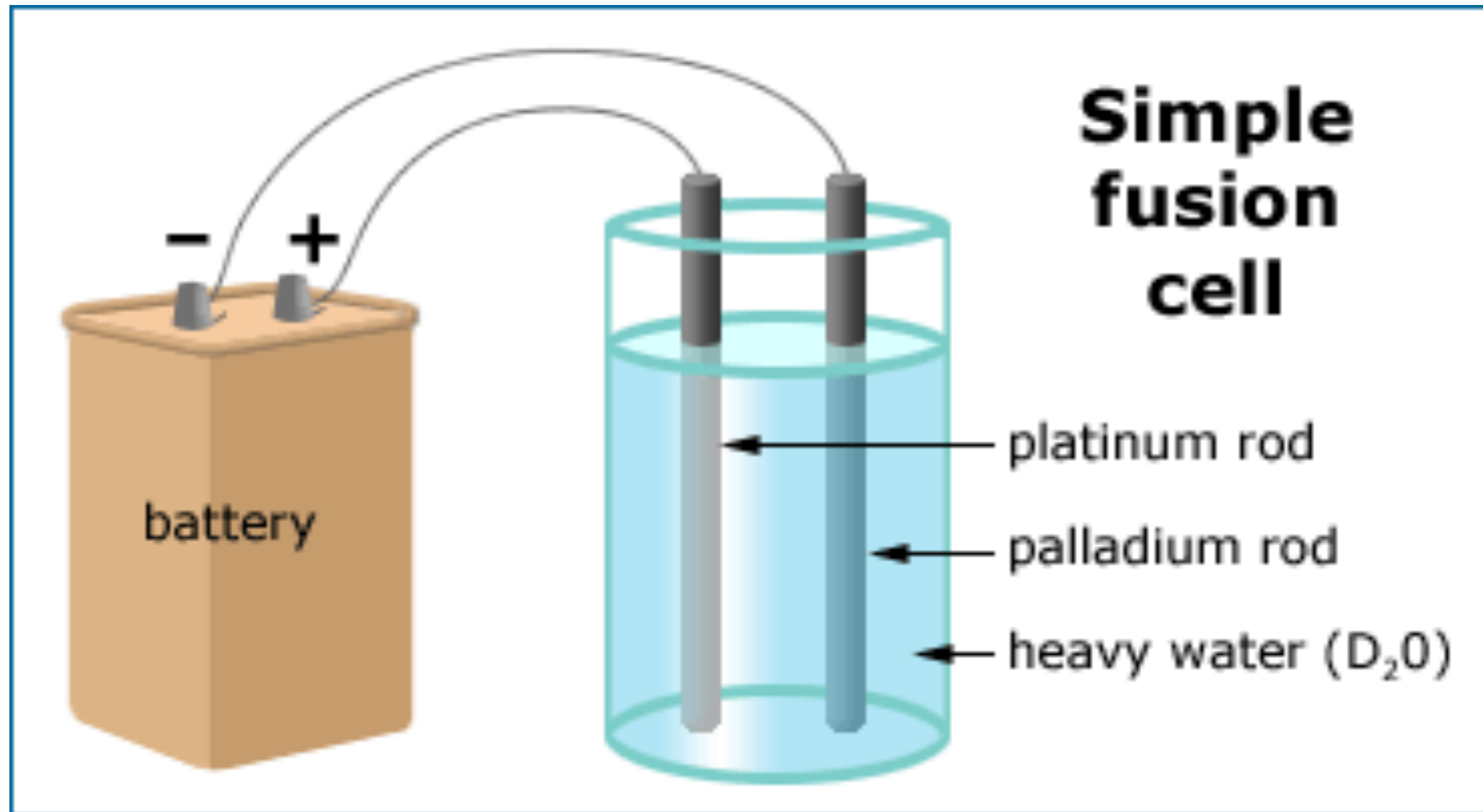


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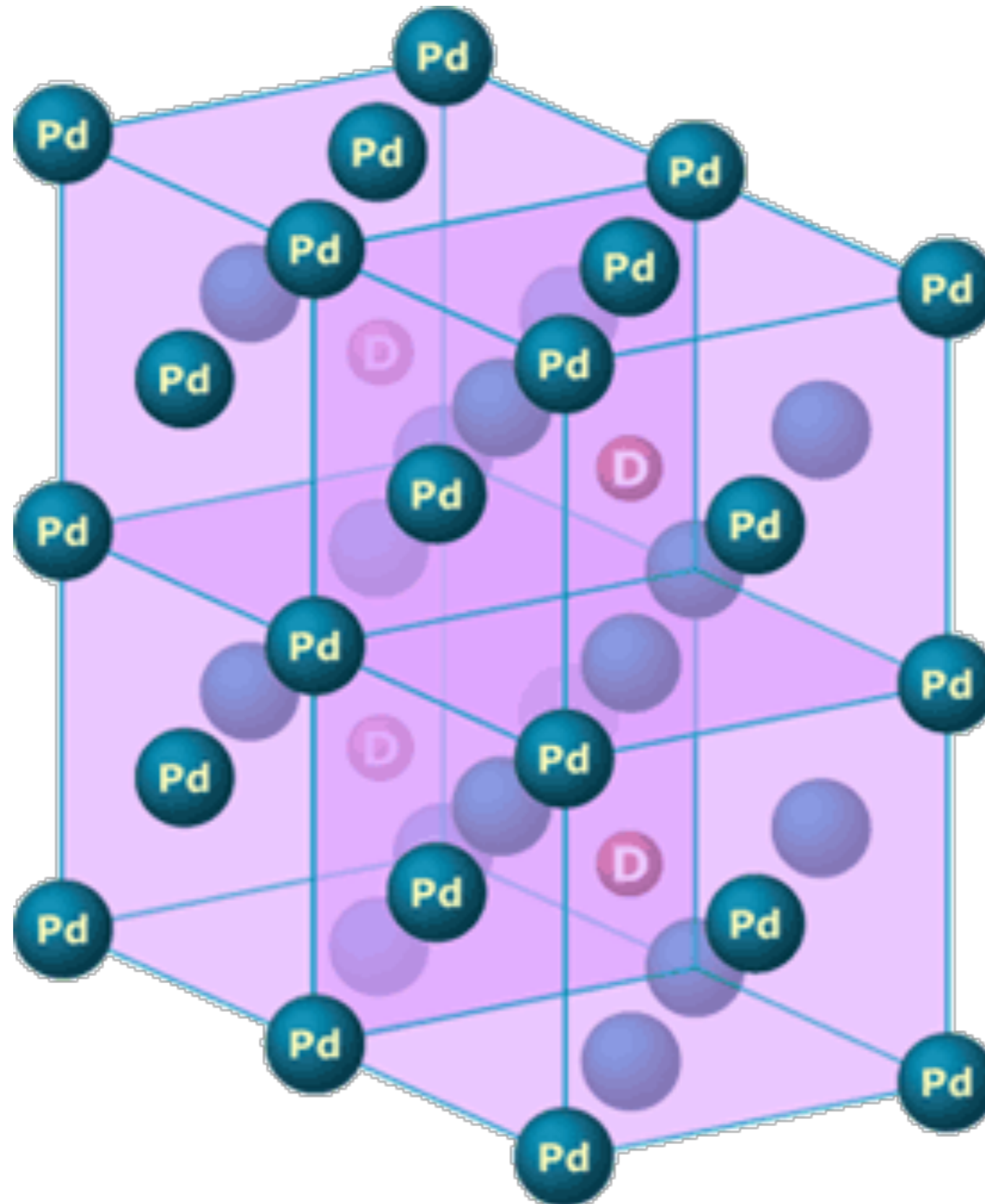


Each μ^- catalyzes about 200 d-t fusions and then “sticks” to an α^{++} . Another factor of 10 is needed for “break-even”. :-)

“Cold Fusion”



Palladium Deuteride



“Cold Fusion”

