

Mini-Magnetospheric Plasma Propulsion (M2P2)

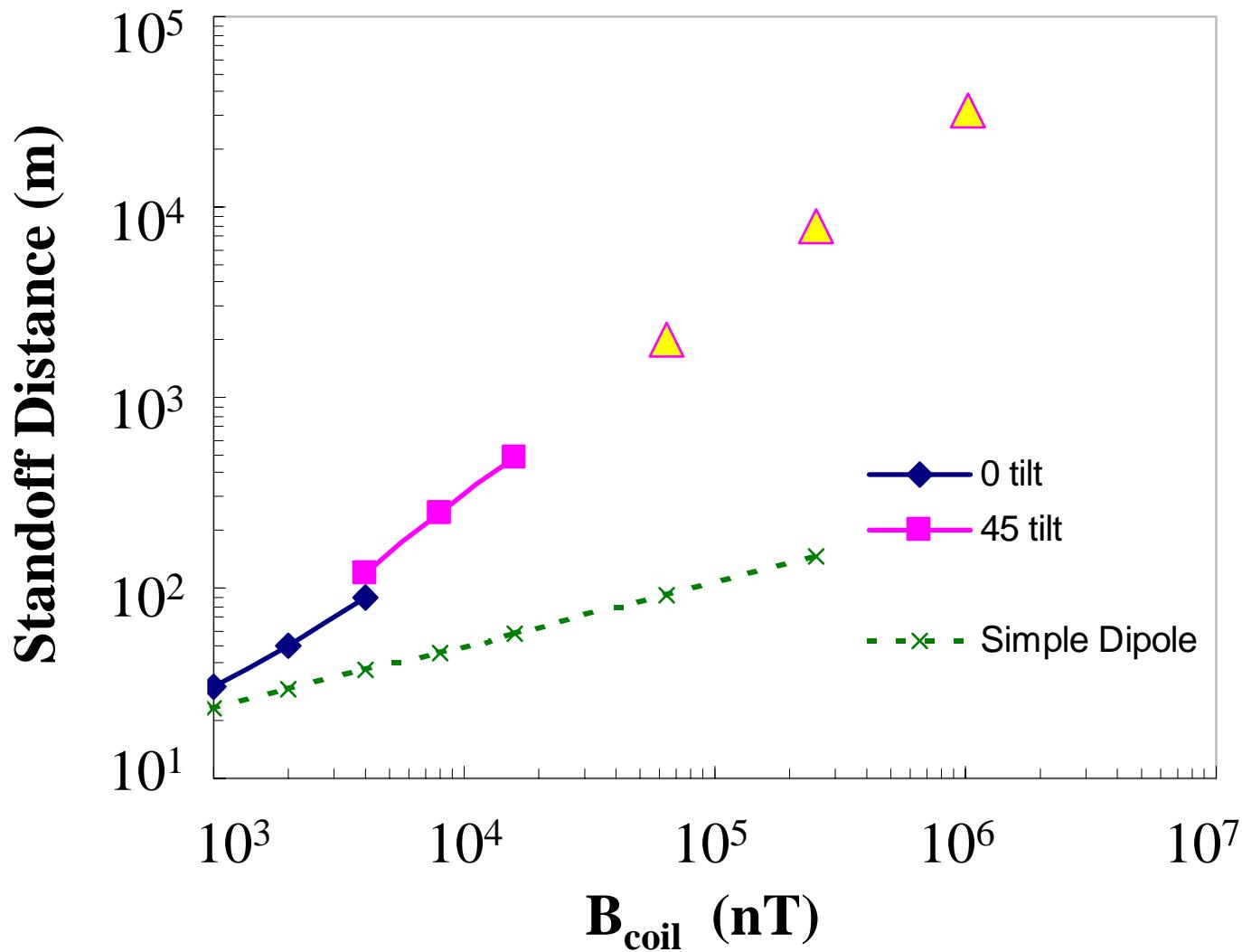
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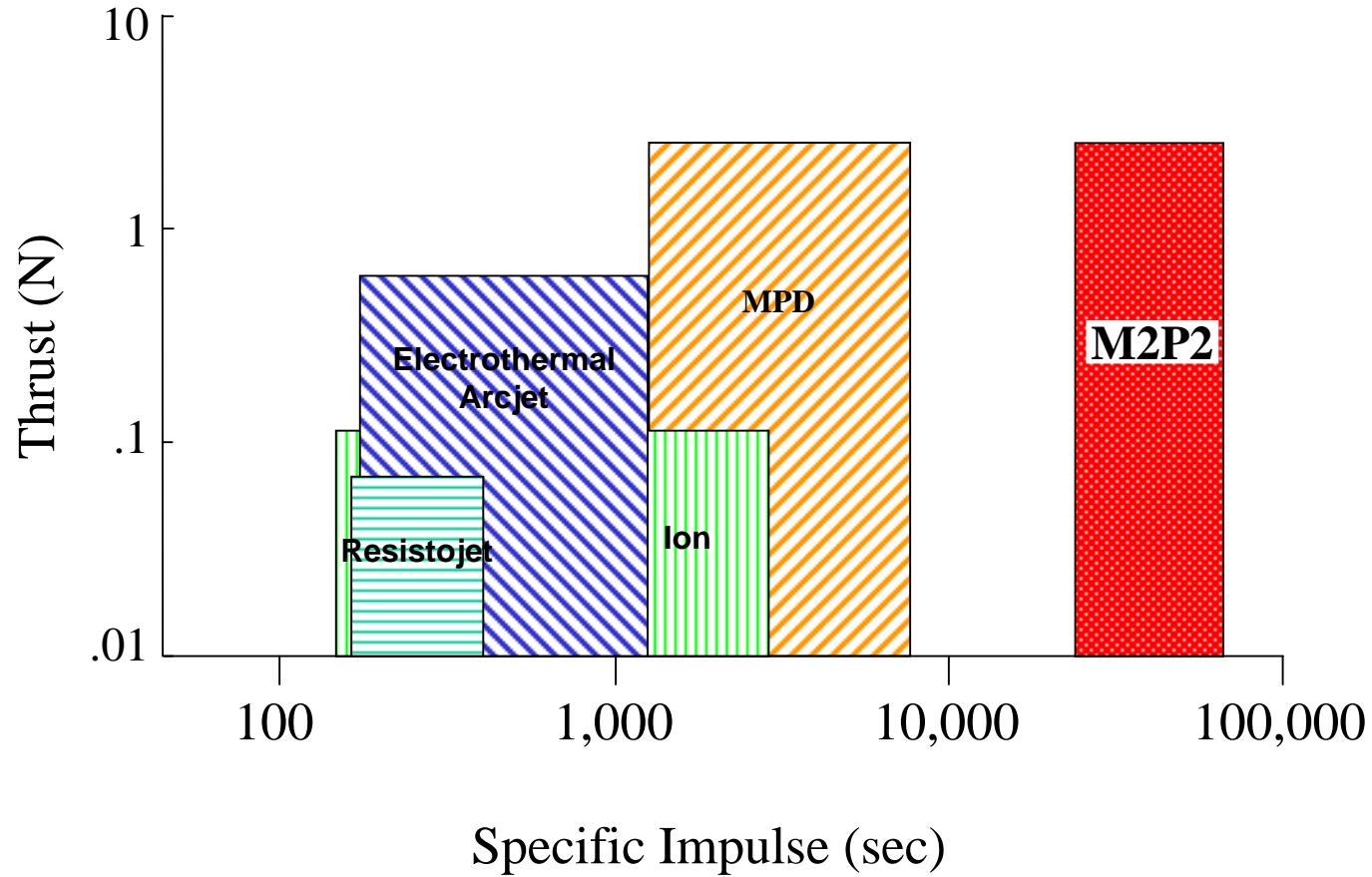
Mini-Magnetospheric Plasma Propulsion (M2P2)

- Facilitate High Speed Spacecraft
For the Exploration of the Solar System and Beyond
- Enabling Technology Exists Today
to attain 50-80 km/s in 3 month accel. period
- Immediate Return to NASA Missions
 - **Interstellar Probe Precursor**
race Voyager 1 out of the Solar System
 - **Geostorm** - *Solar Wind Monitoring*
 - **Sun Synchronous Orbiter**
 - **Mercury Orbiter**

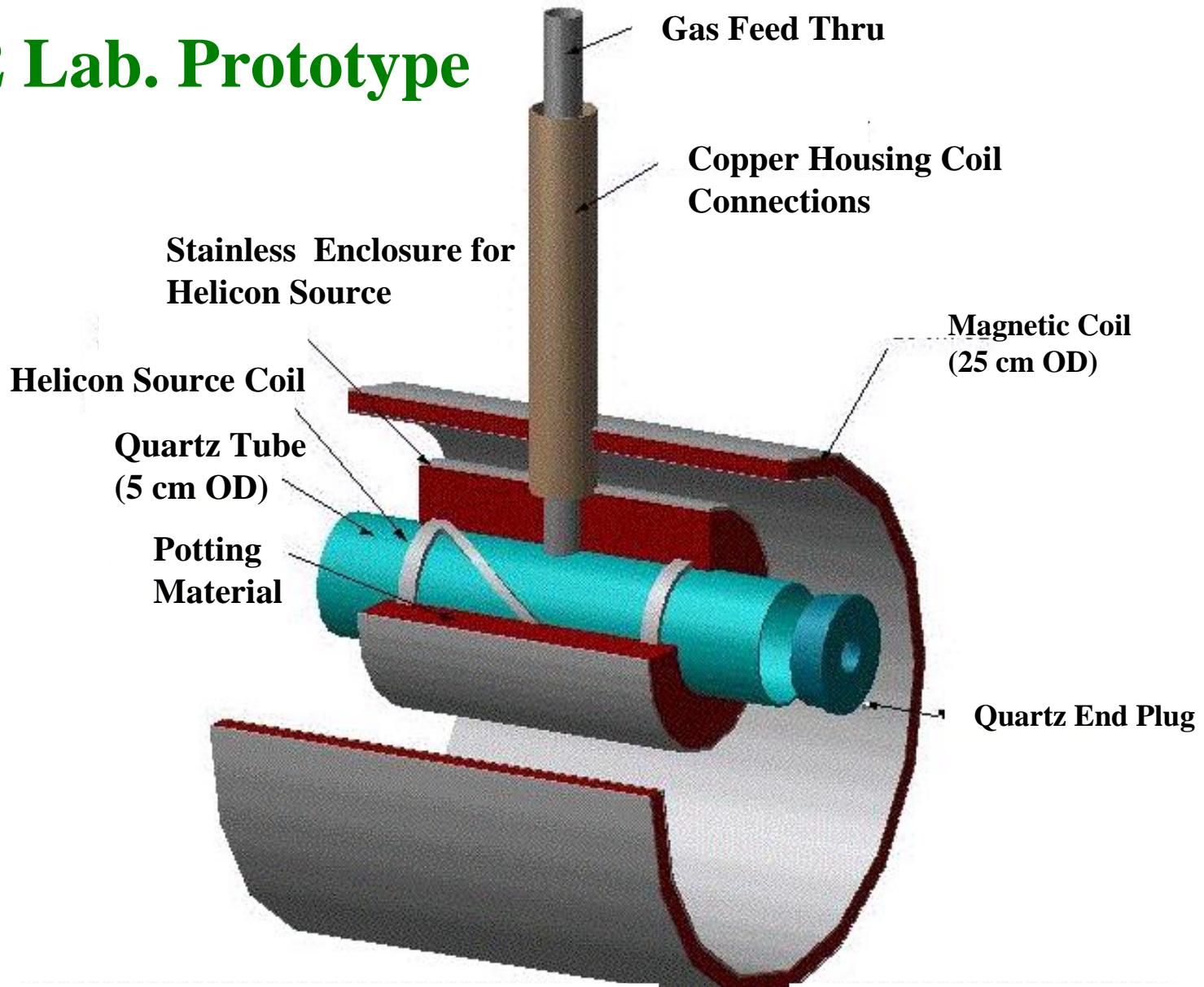
Standoff Distance : 10 m Inner Radius

(Solar Wind - 500 km/s @ 6 particles/cc)

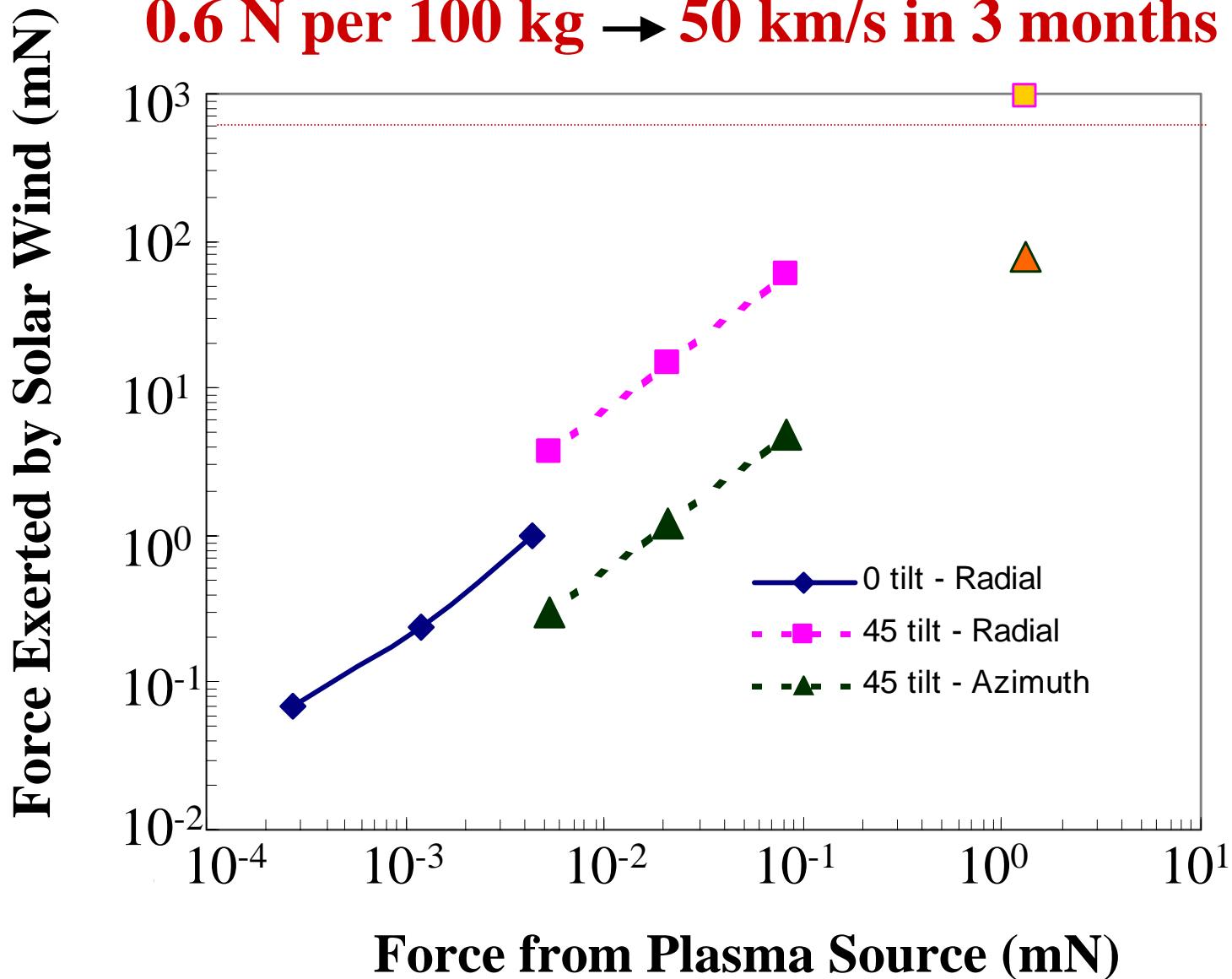




M2P2 Lab. Prototype

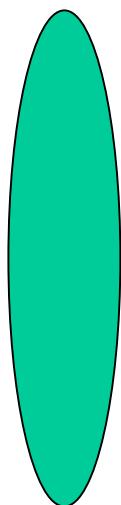


0.6 N per 100 kg → 50 km/s in 3 months



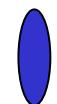
M2P2 : 1 mN *Expended* : 400 mN For Acceleration

M2P2



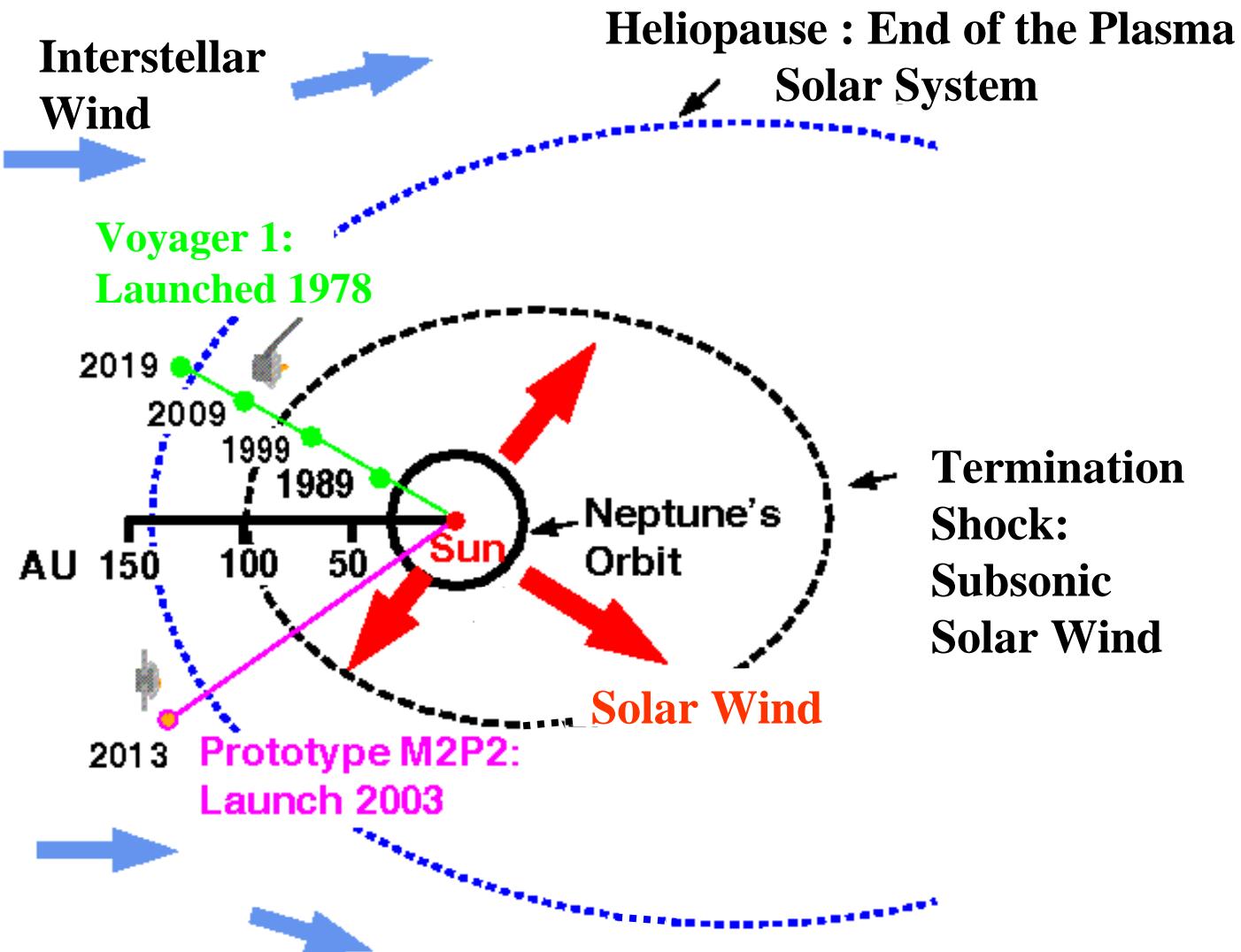
15- 30 km

Near Future Solar Sails (e.g Geostorm)



40 - 70 m

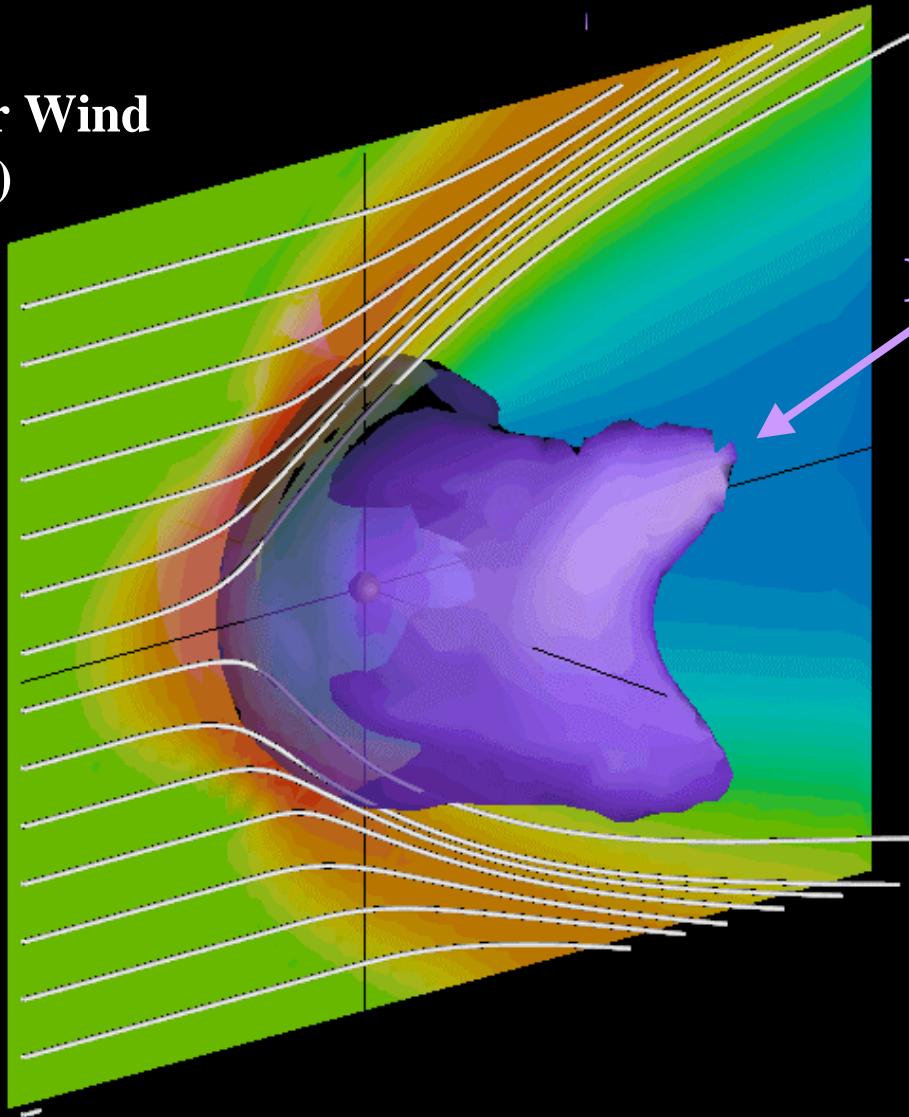
Momentum Flux :	1 nN/m ²	4.7 uN/m ²
Total Force :	0.6 -3 N	0.025 - 0.075 N
Weigh :	20 - 40 kg	100 kg
Power :	3 kW	0 W
Method :	Electromagnetic	Mechanical



Formation of a Magnetic Wall

Supersonic Solar Wind
(400 - 1000 km/s)

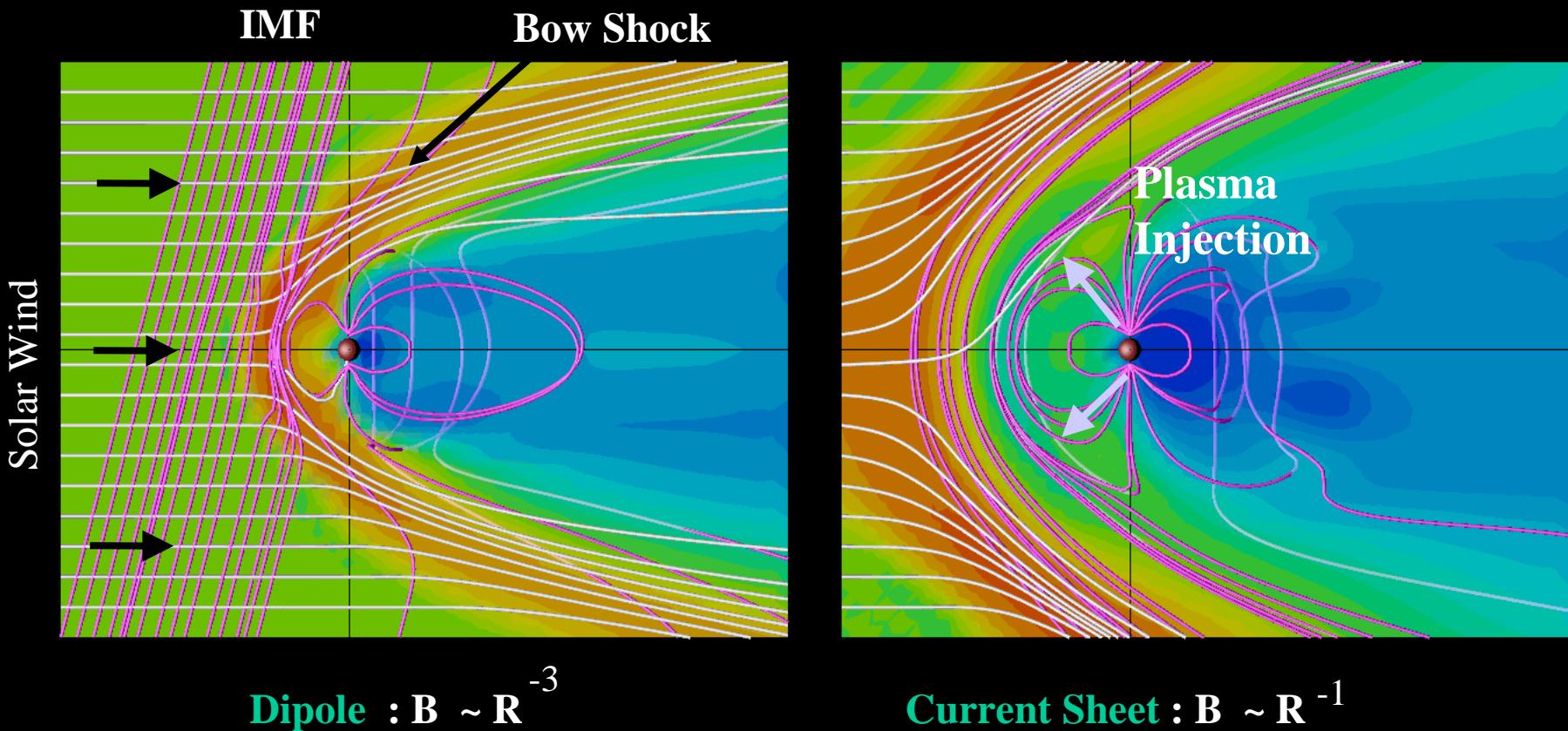
Streamlines
&
Contours of
density



- 15 - 30 km radius
- **Electromagnetic-Plasma Interaction**
- Not Mechanical
- Constant Force Surface

Creating A Mini-Magnetosphere

Magnetic Field + Plasma Injection = Strong Solar Wind Coupling



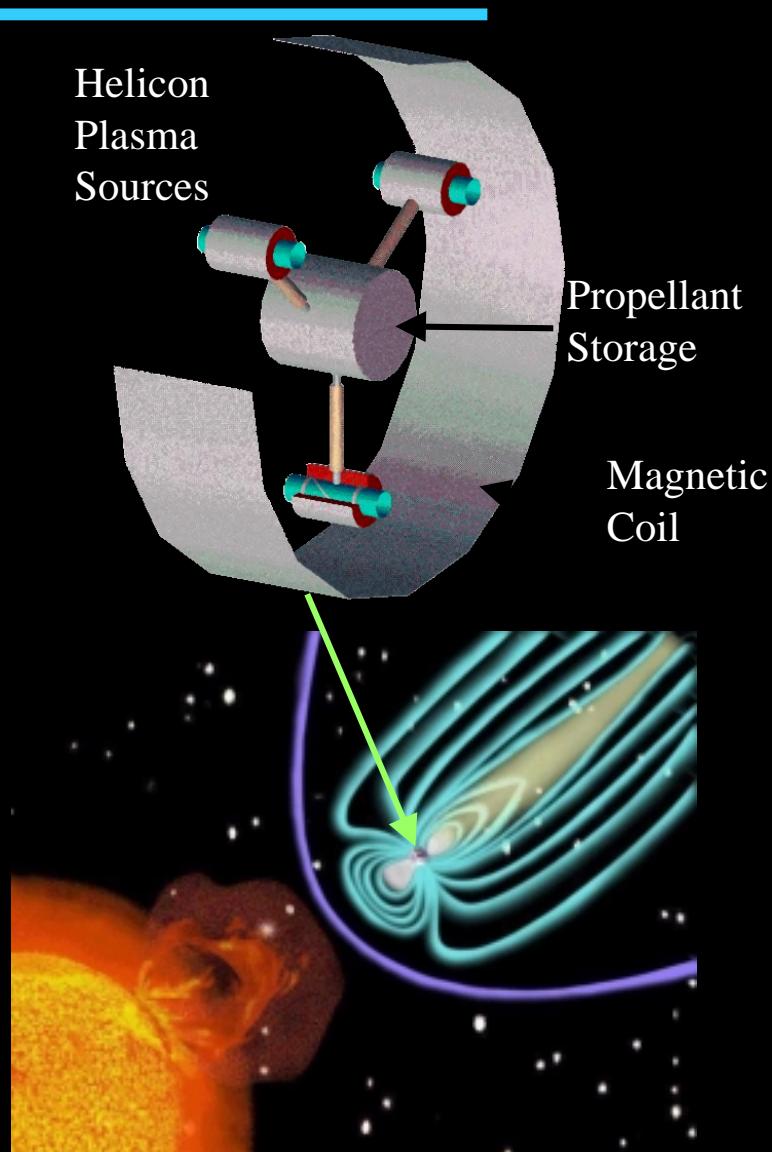
Mini-Magnetospheric Plasma Propulsion

- STRONG COUPLING through Plasma Injection + Magnetic Field to the Solar Wind (400 - 1000 km/s)

Azimuthal : Inner Solar System

Radial : Outer Solar System

- Constant Force is attained irrespective of position in the Solar System
- Enabling Technology Exists



Status of Present Work

- Completed computer simulations showing feasibility
- Lab. Prototype fully designed and being constructed

Near-Future

- Demonstrate magnetic wall inflation
 - Small Tank (factor of 2)
 - Large Tank (factor of 10)
- Specify spacecraft mission for proof of principle goal of **50-80 km/s in 3 months**
 - Facilitate exploration of outer solar system

Long Term

- Constant power supply for 1 yr allow **200-320 km/s**
- Utilization of Dusty Plasma would allow propulsion by Solar Photons without the need for mechanical struts with unprecedented area to attain **10,000 km/s**