15th IPPW | June 2018 | Boulder, CO

MULTIPROBE MISSION DESIGN WITH APPLICATIONS TO THE OUTER PLANETS

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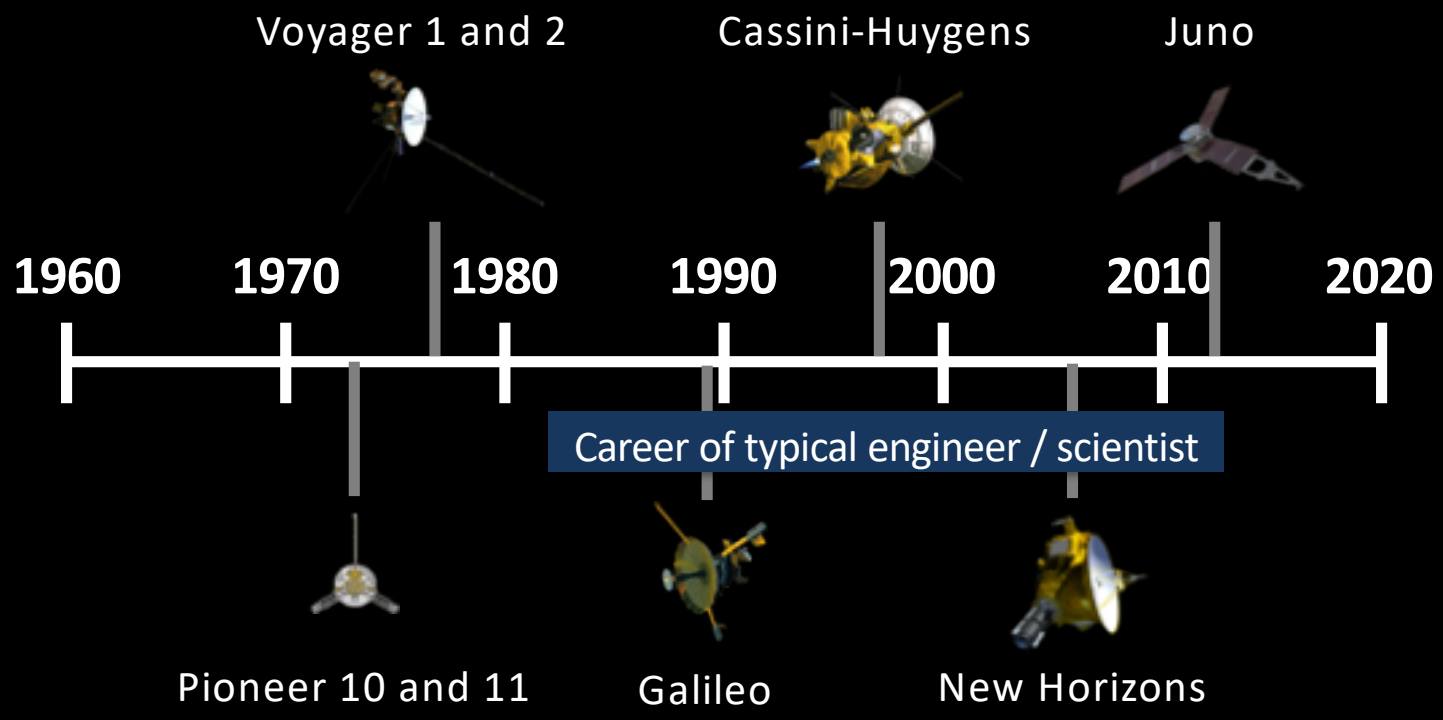
I gratefully acknowledge IPPW for providing funding

Credit: SNAP: Small Next-generation Atmospheric Probe, PSDS3

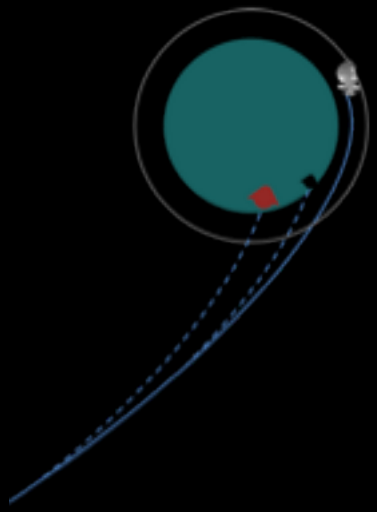
Why would we want multiple atmospheric probes?



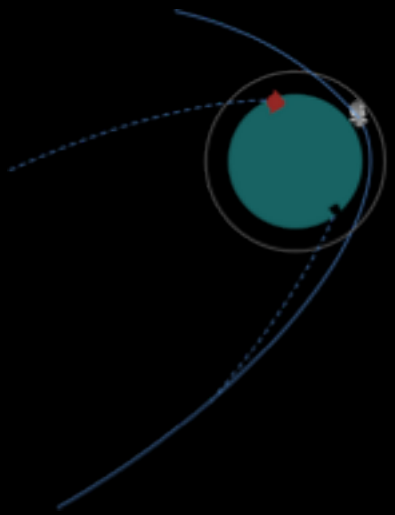
- An extra small probe would greatly increase science
- Deploy multiple probes at one body
- Deploy probes during flybys

How would we design a multiprobe mission?

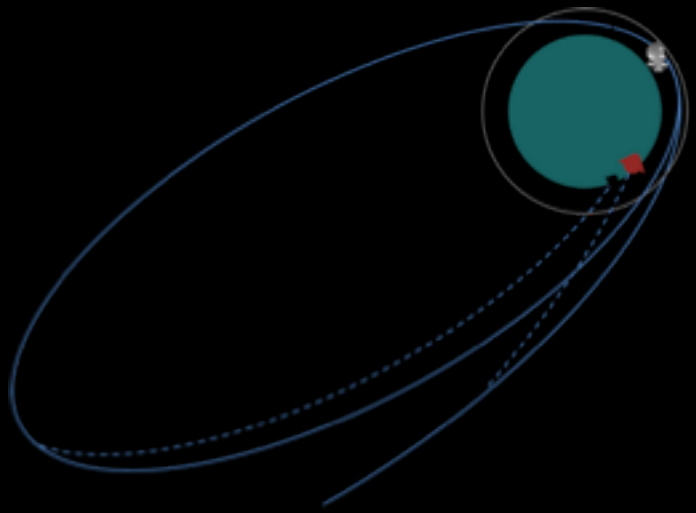
- One orbiter and two atmospheric probes in a single mission
- Deploy both probes at Uranus



Both probes same side
(Prograde or retrograde)



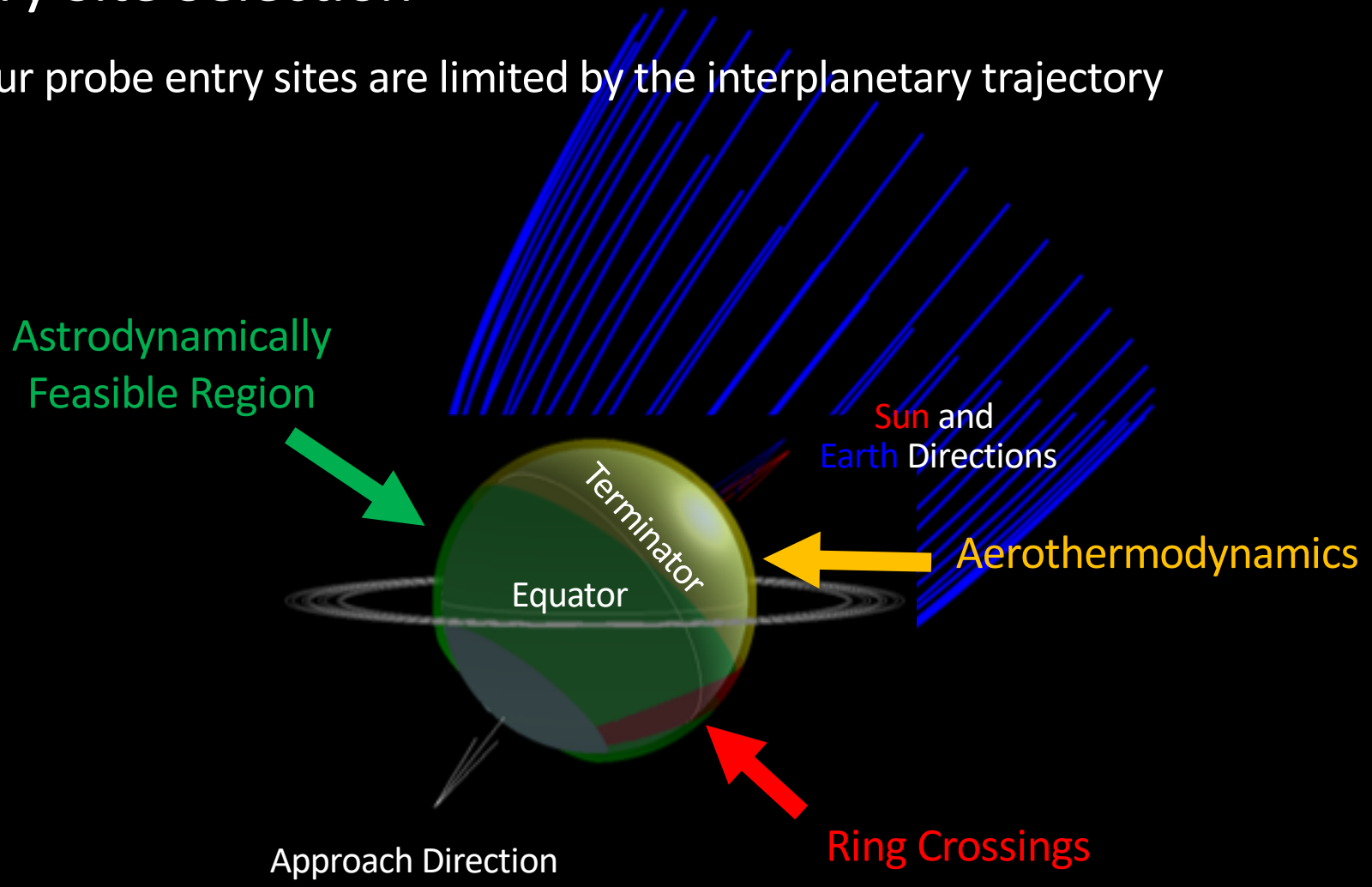
Both probes
opposite sides



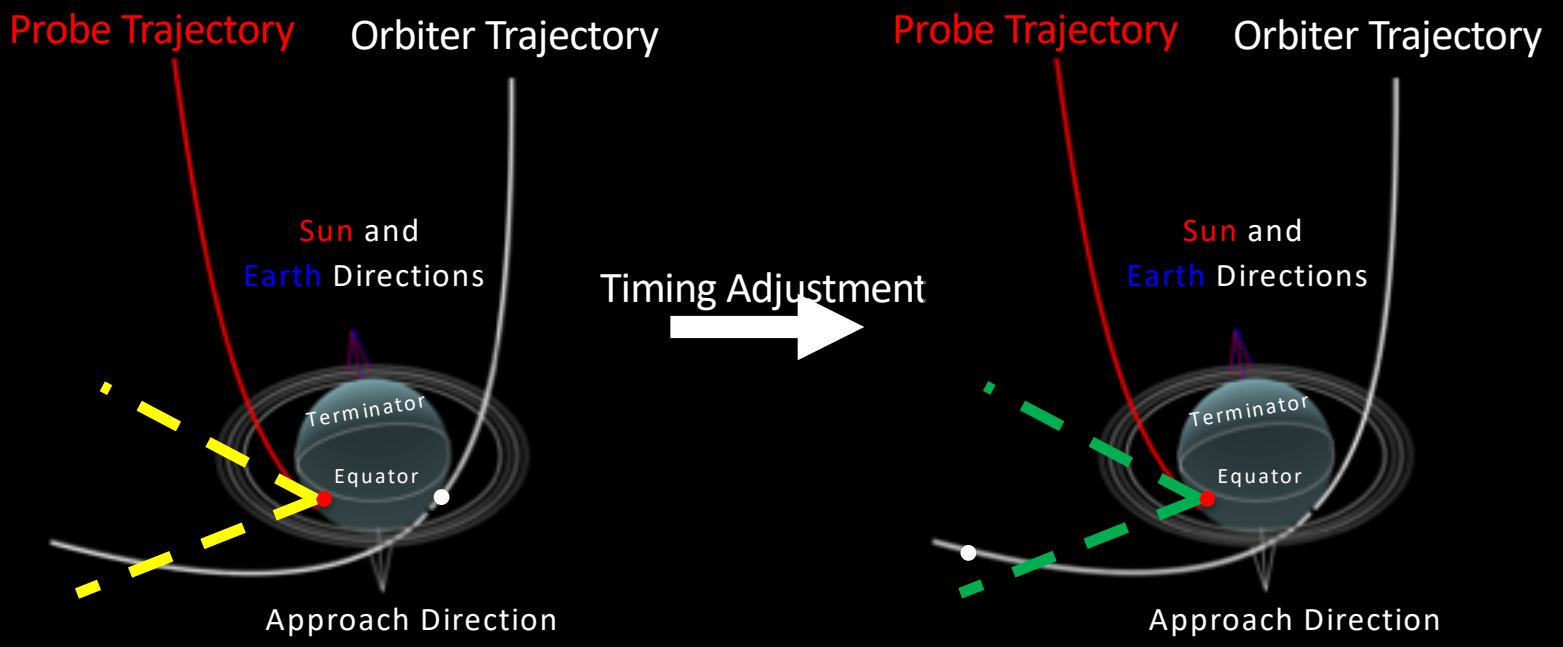
One probe delivered before capture
(Prograde or retrograde)
and one after capture

Entry Site Selection

- Our probe entry sites are limited by the interplanetary trajectory

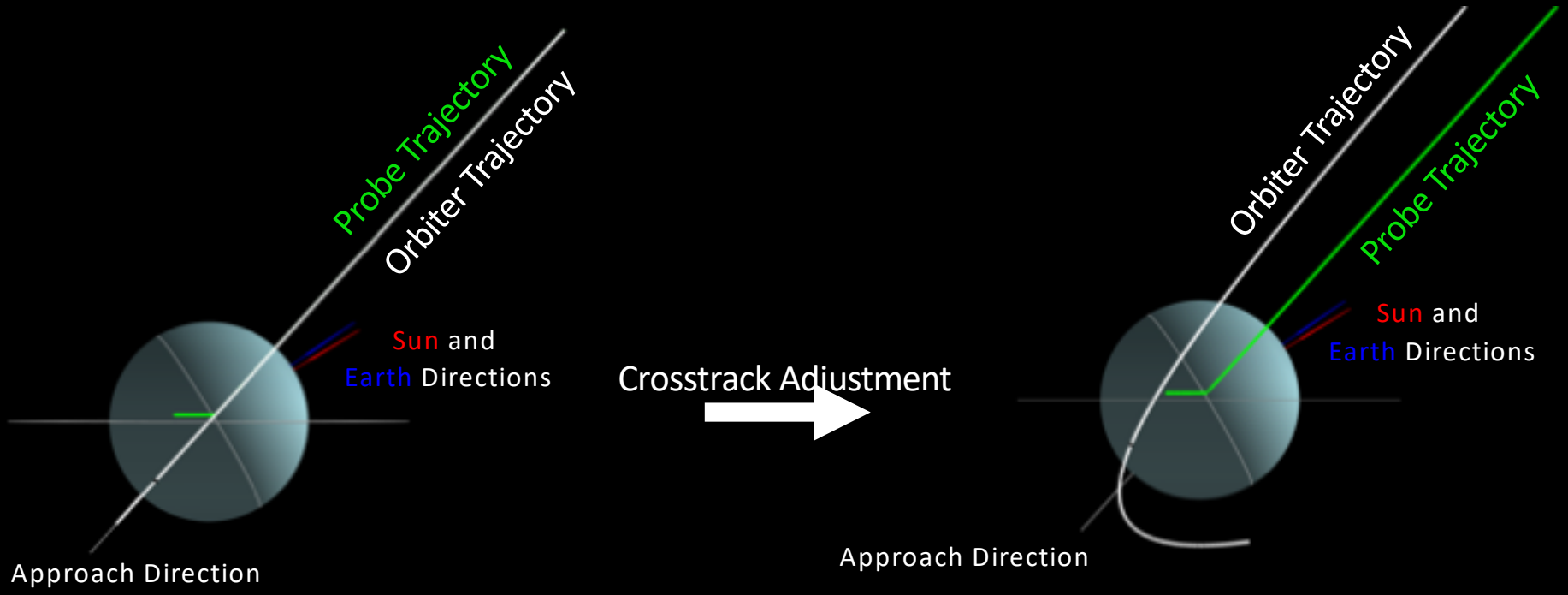


Timing Adjustment ΔV



- Both spacecraft travel at the same rate
- Orbiter is not in line of sight of the probe
- Orbiter needs to speed up to meet probe

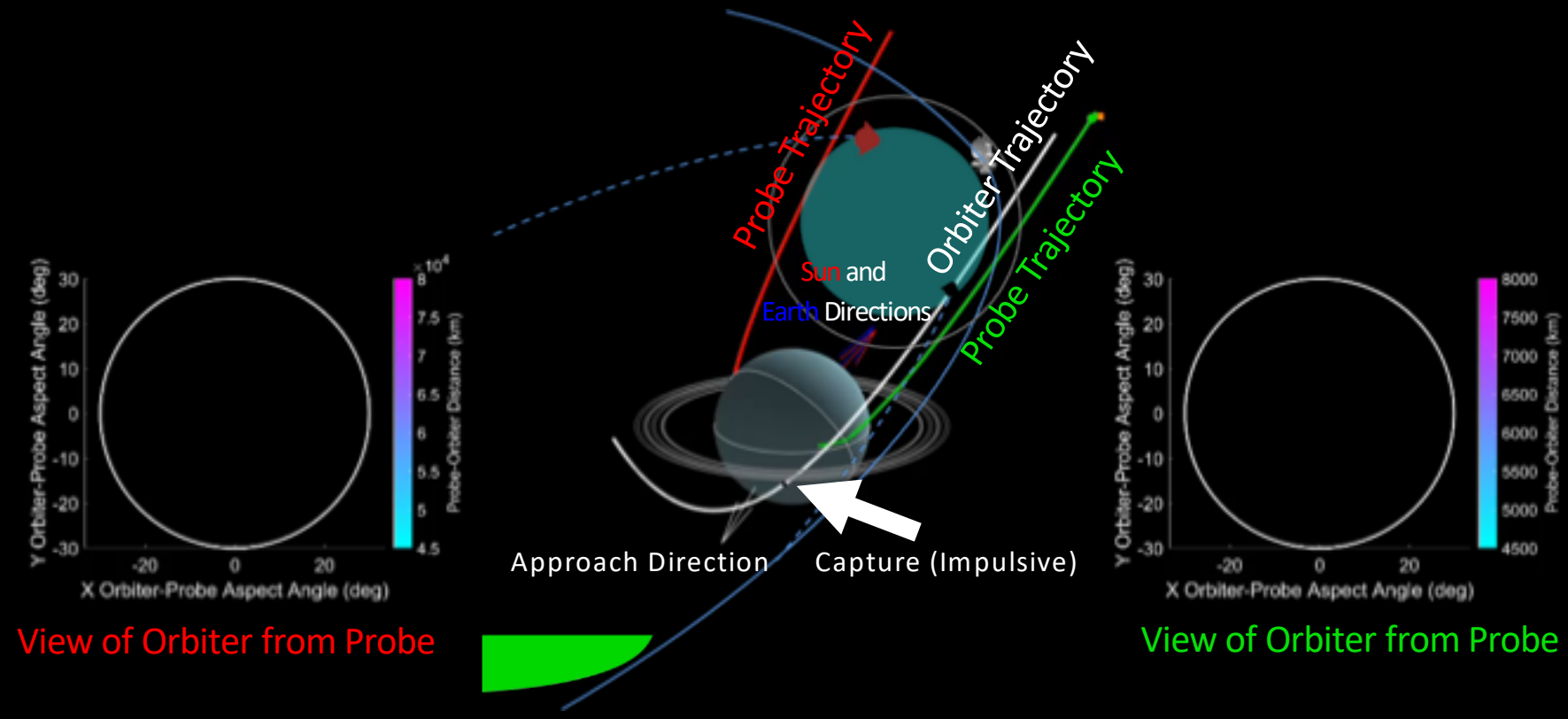
Crosstrack Adjustment ΔV



- The probe rotates out-of-plane with the atmosphere as it descends
- This causes a loss of line-of-sight with the orbiter
- Orbiter requires a slight inclination change to keep contact

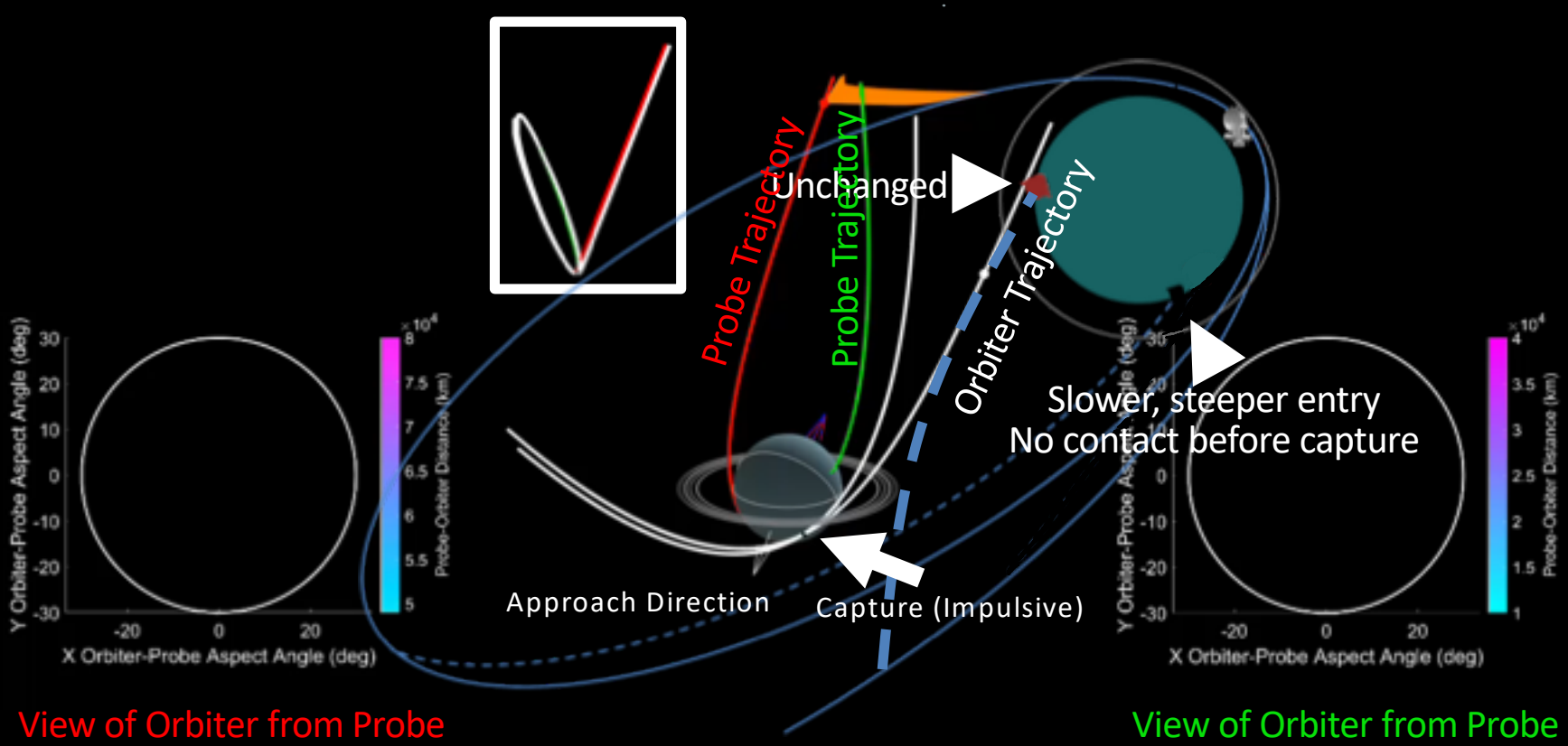
Architecture Comparison: Case 1

Example mission: Given an interplanetary trajectory, we would like one probe to enter on the day side and one on the night side of Uranus



- Green probe does not enter far enough into day side
- Not enough separation between contact and capture

Architecture Comparison: Case 2



- Probe enters into day side, clear of capture conflict
- Feasible design

Summary

1. Multiple ways to conduct a multiprobe mission
    - Drop-off during flybys
    - Drop-off multiple at a single body

2. Provides additional science opportunities for low cost
    - Flybys of Venus, Jupiter, Saturn

3. Key design aspects
    - Interplanetary trajectory
    - Architecture selection
    - Entry site selection (fixes entry flight path angle + entry velocity)
    - Deflection maneuvers