Observation Design and Early Results from Cassini RADAR SAR Imaging of Enceladus. R. West[1], K. Mitchell[1], B. Stiles[1], Y. Anderson[1], A. Le Gall[2], A. Hayes[3], M. Janssen[1], R. Kirk[4], R. Lopes[1], R. Lorenz[5], S. Wall[1], L. Wye[6], and H. Zebker[6], [1]Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Dr., Pasadena, CA 91109; Richard.west@jpl.nasa.gov, [2]LATMOS (Laboratoire Atmosphères, Milieux, Observations Spatiales) CNRS/UVSQ 11 Boulevard D'Alembert 78 280, [3]Miller Research Fellow UC Berkeley, Adjunct Assistant Professor Cornell, Berkeley, CA 94720, [4]USGS, Flagstaff, AZ, 86001, [5]Johns Hopkins University Applied Physics Lab, Laurel MD, 20723, [6]Dept. of Electrical Engineering, Stanford University, Stanford, CA 94305.

Introduction: On November 6, 2011, Cassini RADAR obtained a unique data set during a flyby of Enceladus. In the past, RADAR has only obtained data from long ranges for the icy satellites of Saturn. During this flyby, the radar collected SAR imaging data at closest approach with performance expected to be better than the normal Titan flybys. The flyby altitude of 500 km is much lower than the usual Titan flyby altitude of 1000 km, and this created some challenges for the observation design. One of five beams was used giving a swath width of about 24 km with 50 m by 240 m resolution. Signal to noise ratios were high due to the low altitude, but the number of looks was reduced due to the rapid motion of the beam footprint across the surface. The swath is aimed at about 66 S which is close to the active South polar rifted area.

Discussion: We will discuss the observation design and processing and present the data in preliminary form. Further science interpretation of this flyby is provided by K. Mitchell et al. (this issue). Fig. 1 shows the radar close approach SAR swath overlaid on an optical ISS mosaic of the Enceladus south polar area. The radar swath shows the same surface morphology, and there is a correlation between radar bright areas and optically "blue" (large grained H20 ice) areas. Fig. 2 shows a closeup from the SAR swath, demonstrating the high resolution achieved. Radar backscatter cross-sections in this image cover a wide range from 10 (+10 dB) and higher in the bright areas down to around 0.1 (-10 dB) in the dark channels. In addition to the close approach SAR swath, RADAR also obtained an inbound and outbound complete disk scan at ranges that permit lower resolution (>2 km) SAR imaging over much wider areas. Coincident radiometer data were also obtained for all of these RADAR observations. These data obtained at 2-cm wavelength will complement existing optical, radar, and infrared observations of Enceladus. The combined active and passive data can be used to infer dielectric and surface roughness properties. Enceladus is known to have an anomalously high radar backscatter from prior distant scatterometry observations, and this high-resolution data set will be examined for clues to the scattering processes at work.

Acknowledgments: This work is supported by the Cassini Project at JPL – Caltech.

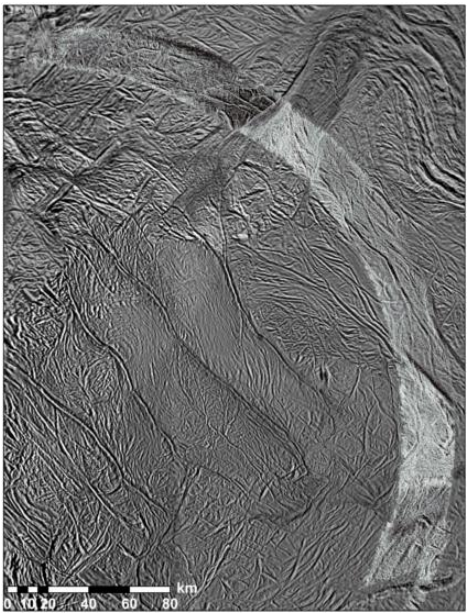

Fig. 1. SAR swath overlaid on ISS mosaic.

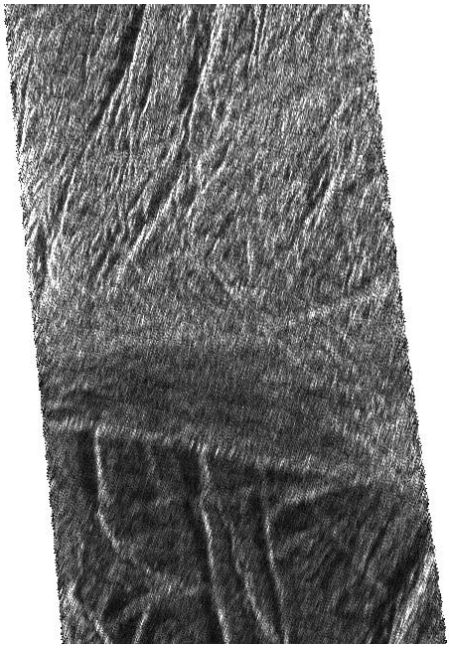

Fig 2. Excerpt from SAR swath.

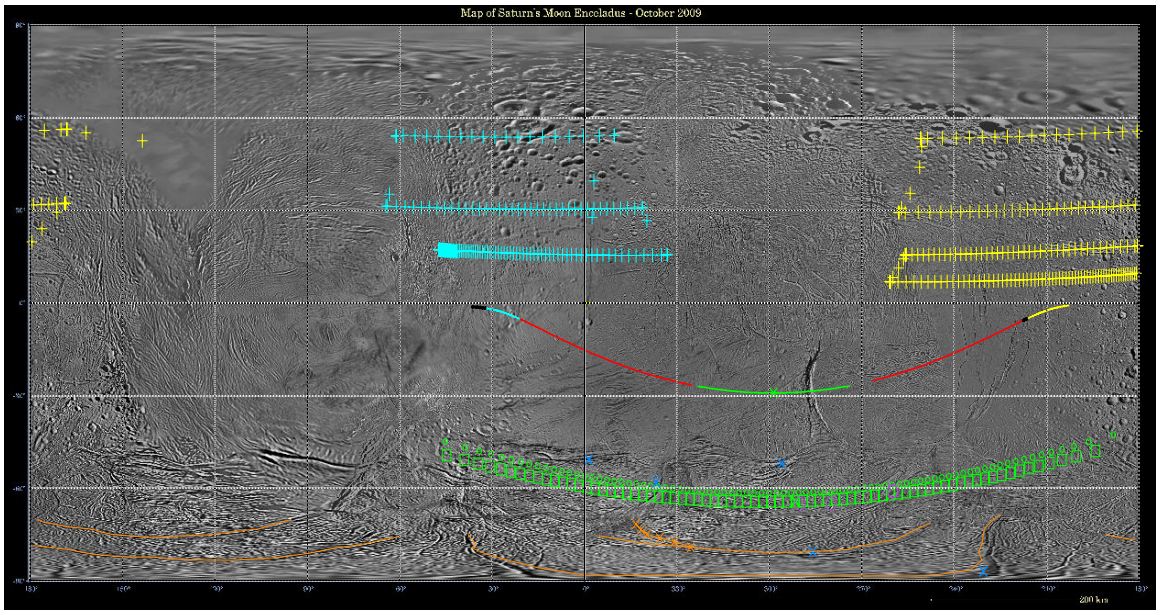

Fig. 3. Beam centres of Cassini RADAR in the different SAR modes of operation during the E16 Fly-by. Cyan and yellow crosses represent Hi-SAR with ~2 km imaging resolution, green squares (beam 4) and circles (beam 3) show SAR with 50 m by 240 m resolution during closest approach. Solid cyan, red, green, and yellow lines show the spacecraft nadir track during the observations. Orange lines show the location of active sulci. The background is an optical Cassini ISS mosaic.