EE/Ae 157a

Homework #3
Due Date: Wednesday November 13, 2019

Problem 1 (20 points)

A telescope is orbiting the earth at 705 km altitude. The telescope lens diameter is 40 cm, the focal length is 120 cm, and the square focal plane is 10 cm on a side. The pixels in the detector are 10 microns on a side. Calculate the swath width, size of the pixels on the ground, and the number of pixels across the swath assuming a pushbroom design. Also, calculate the maximum integration time per pixel, and the resulting data rate.

The instrument is now changed into a spectrometer. The incoming light is dispersed using a prism such that the different colors are separated spatially in a direction orthogonal to the pushbroom line array as shown in the figure. To measure the different spectral components, the prism mechanism is scanned so that different colors sweep over the line array. Calculate the scan rate of the dispersion mechanism. If we are to measure 128 spectral channels, what would the integration time per spectral channel? What is the data rate of the spectrometer?

A different implementation arranges a stationary dispersive element such that the light from 0.4 microns to 0.9 microns fall in the vertical direction on an array that has 128 detector lines stacked on top of each other. What is the bandwidth per channel, the integration time per spectral channel, and the data rate in this case?