**Single Lidar Profile: C1412316.263354**

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| Code |
| import matplotlib.pyplot as plt  # Plot with altitude on Y-axis  bin\_size = 0.1  plt.figure(figsize=(5, 8))  plt.plot(binary\_data, altitude)  plt.xlabel("Signal Intensity")  plt.ylabel("Altitude (m)")  plt.title("Single Lidar Profile")  plt.grid(True)  plt.show() |
| Output |
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**RTI - Range Time Intensity**

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| Code |
| import numpy as np  import matplotlib.pyplot as plt  # Load the combined data  data = np.load("combined\_lidar\_data.npy")  # shape: (altitude\_bins, time\_steps)  print("Data shape:", data.shape)  # Just to confirm  # Set bin size  bin\_size = 0.1  # Altitude axis  altitude\_axis = np.arange(data.shape[0]) \* bin\_size  # RTI Plot  plt.figure(figsize=(12, 6))  plt.imshow(data, aspect='auto', cmap='jet', origin='lower',             extent=[0, data.shape[1], altitude\_axis[0], altitude\_axis[-1]])  plt.colorbar(label='Signal Intensity')  plt.xlabel("Time Index")  plt.ylabel("Altitude (m)")  plt.title("RTI - Range Time Intensity")  plt.tight\_layout()  plt.show() |
| Output |
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| Code |
| import numpy as np  import matplotlib.pyplot as plt  from scipy.fft import fft, fftfreq  # Load combined data  data = np.load("combined\_lidar\_data.npy")  # Parameters  bin\_size = 0.1  # meters  dt = 30         # seconds between time steps  Fs = 1 / dt     # sampling frequency  # Select bins every ~200m  start\_bin = 100  # skip low altitudes  bin\_step = 27  num\_bins = 10  bins = [start\_bin + i \* bin\_step for i in range(num\_bins)]  altitudes = [b \* bin\_size for b in bins]  # Store results  results = []  # Time and frequency setup  N = data.shape[1]  xf = fftfreq(N, dt)[:N // 2]  # Plot FFT for each bin  plt.figure(figsize=(10, 18))  for i, b in enumerate(bins):      signal = data[b, :]      yf = fft(signal)      amplitude = 2.0 / N \* np.abs(yf[:N // 2])      dom\_freq = xf[np.argmax(amplitude[1:]) + 1]  # skip 0 Hz      period\_min = 1 / dom\_freq / 60 if dom\_freq > 0 else np.inf      results.append((b, b \* bin\_size, dom\_freq, period\_min))      plt.subplot(num\_bins, 1, i + 1)      plt.plot(xf, amplitude)      plt.title(f"FFT @ {b\*bin\_size:.0f} m (Dominant Period: {period\_min:.1f} min)")      plt.xlim(0, 0.01)      plt.ylabel("Amplitude")  plt.xlabel("Frequency (Hz)")  plt.tight\_layout()  plt.show()  # Display Summary Table  import pandas as pd  df = pd.DataFrame(results, columns=["Bin Index", "Altitude (m)", "Dominant Frequency (Hz)", "Wave Period (min)"])  print(df) |
| Output |
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| Bin Index Altitude (m) Dominant Frequency (Hz) Wave Period (min)  0 100 10.0 0.015044 1.107895  1 127 12.7 0.015044 1.107895  2 154 15.4 0.015044 1.107895  3 181 18.1 0.000040 421.000000  4 208 20.8 0.000079 210.500000  5 235 23.5 0.000435 38.272727  6 262 26.2 0.000040 421.000000  7 289 28.9 0.000277 60.142857  8 316 31.6 0.000040 421.000000  9 343 34.3 0.000277 60.142857 |

**From the Code Result:**

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| **Altitude (m)** | **Wave Period (min)** | **Interpretation** |
| 750–1155 | ~1.1 mins | Could be **high-frequency noise** or local turbulence, not gravity waves ⚠️ |
| 1357–2370 | 210–421 mins | This is in the **long-period gravity wave** or **convective plume** range ✅ |
| 1762.5 | ~38 mins | This is **very relevant**! Likely a **gravity wave signal** ✅ |
| 2167.5, 2572.5 | ~60 mins | Classic **CBL convection-triggered wave periods** ✅ |

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| Code |
| import numpy as np  import matplotlib.pyplot as plt  # Load data  data = np.load("combined\_lidar\_data.npy")  bin\_size = 0.1  dt = 30  # seconds  time = np.arange(data.shape[1]) \* dt / 60  # time in minutes  # Bin indices and their corresponding altitudes  bin\_indices = [100, 127, 154, 181, 208, 235, 262, 289, 316, 343]  altitudes = [b \* bin\_size for b in bin\_indices]  # Loop and plot each graph separately  for b, alt in zip(bin\_indices, altitudes):      signal = data[b, :]        plt.figure(figsize=(10, 4))      plt.plot(time, signal, color='blue')      plt.xlabel("Time (minutes)")      plt.ylabel("Signal Intensity")      plt.title(f"Signal Intensity vs Time at {alt:.1f} m (Bin {b})")      plt.grid(True)      plt.tight\_layout()      plt.show() |
| Output |
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**RESULTS & OBSERVATIONS**

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| **Altitude (m)** | **Dominant Frequency (Hz)** | **Wave Period (min)** | **Interpretation** |
| 750.0 | 0.01504 | ~1.1 | Likely noise/turbulence |
| 1762.5 | 0.00043 | ~38.3 | Gravity wave candidate |
| 2167.5 | 0.00027 | ~60.1 | Gravity wave signature |
| 2572.5 | 0.00027 | ~60.1 | Gravity wave signature |