Requirements for generating LIDAR Level 0 (HDF) and Level 1A files process

Generating LIDAR Level 0 (HDF) and Level 1A files

The LIDAR Level 0 (L0) raw data files are in CCSDS packet format. These files are binary files and are not easy to read and access. Moreover, each channel has its own input file. The first process of the LIDAR Level 1 is converted the binary L0 files (3 channels; 532 nm parallel, 532 nm perpendicular, and 1064 nm) into HDF4 files with matching the 3 channels data. This process only requires the coefficient conversion ancillary input files and they are static files. This process can be started when the L0 files arrive.

The generating Level 1A (L1A) process applies the Level 1A correction and normalizes the raw data with the laser energy and variable gain to the 3 channel raw data. This process is similar with the generating L0 process; it only requires the L1A correction coefficients ancillary input file, which is a static file.

Since these two processes do not require any dynamic input files, they can be put into same process. The input files are three channel L0 data file (90 minutes data) and the output files are also with the same amount data (90 minutes). The two processes are shown in Figure 1.

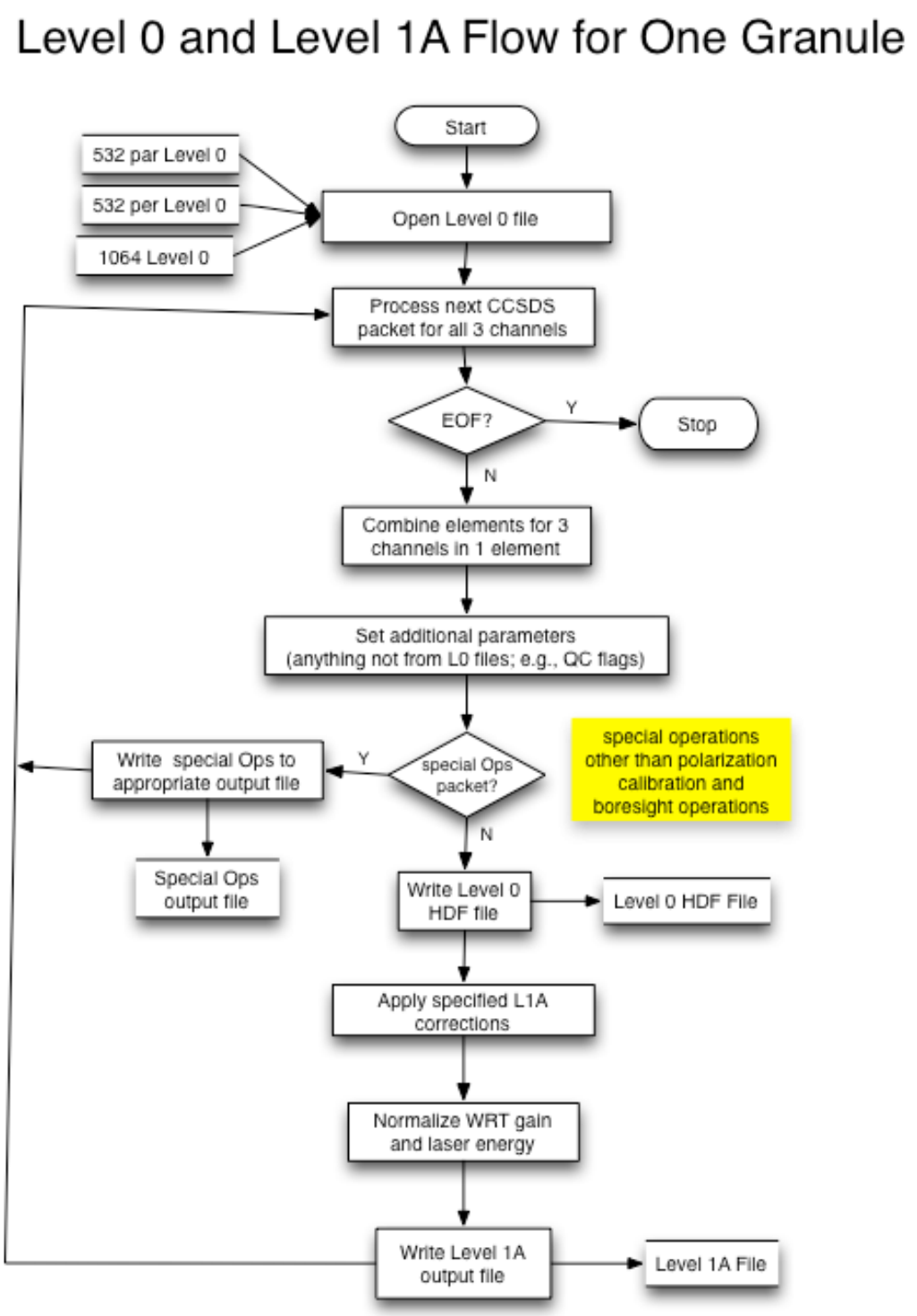

Figure 1 Top level flow of the Level 0 and Level 1A processes

Input files

The input files are three channels raw data L0 files and ancillary input files that include conversion coefficients files and Level 1A correction coefficients file. The contents of the L0 files are given in DRD-14 and it does not show in this document.

Output files

The L0 output file will contain the same amount of binary L0 data file (90 minutes) as shown in Table 1.

Table 1: LIDAR L0 Record

Parameter Name	Data Type	Elem/Rec
Profile_Time (TAI time)	Float_64	1
Profile_UTC_Time (yyyymmdd.ffffff)	Float_64	1
Profile_ID	Int_32	1
Day_Night_Flag	Int_8	1
QC_Flag	Uint_32	1
Lidar_Mode	Int_16	1
Lidar_Submode	Int_16	1
Frame_Number	Int_16	1
PMT_Parallel_Box_Temp	Uint_16	1
PMT_Perpendicular_Box_Temp	Uint_16	1
APD_Post_Amp_Temp	Uint_16	1
LRE_ADC_Temp	Uint_16	1
Laser_Radiator_Temp	Uint_16	1
Telescope_Primary_Mirror_Temp_1	Uint_16	1
Telescope_Primary_Mirror_Temp_2	Uint_16	1
Optical_Bench_Temp_2	Unt_16	1
Etalon_1_Temp	Uint_16	1
Etalon_2_Temp	Uint_16	1
APD_Heater_Temp	Uint_16	1
Parallel_Amplifier_Gain_532	Float_32	1
Perpendicular_Amplifier_Gain_532	Float_32	1
Amplifier_Gain_1064_High	Float_32	1
Amplifier_Gain_1064_Low	Float_32	1
High_Gain_ADC_Offset_532_Par	Uint_16	1
Low_Gain_ADC_Offset_532_Par	Uint_16	1
High_Gain_ADC_Offset_532_Per	Uint_16	1
Low_Gain_ADC_Offset_532_Per	Uint_16	1
High_Gain_ADC_Offset_1064	Uint_16	1
Low_Gain_ADC_Offset_1064	Uint_16	1
Laser_Energy_Monitor_532	Float_32	1

Parameter Name	Data Type	Elem/Rec
Laser_Energy_Monitor_1064	Float_32	1
Parallel_Background_Monitor_532	Float_32	1
Perpendicular_Background_Monitor_532	Float_32	1
Lidar_Receiver_Electronics_Status_532_Par	Uint_32	1
Lidar_Receiver_Electronics_Status_532_Per	Uint_32	1
Lidar_Receiver_Electronics_Status_1064	Uint_32	1
Active_Laser_Number	Uint_16	1
HVPS_Output_Monitor_532_Par	Uint_16	1
HVPS_Output_Monitor_532_Per	Uint_16	1
HVPS_Output_Monitor_1064	Uint_16	1
Dynode_Current_Monitor_532_Par	Uint_16	1
Dynode_Current_Monitor_532_Per	Uint_16	1
Quality_Flags_532_Par	Uint_16	1
Quality_Flags_532_Per	Uint_16	1
Quality_Flags_1064	Uint_16	1
Laser_Latitude	Float_32	1
Laser_Longitude	Float_32	1
Range_To_Mean_Sea_Level	Float_32	1
Backscatter_Start_Altitude	Float_32	1
Region_6_Low_Gain_Raw_Mean_532_Par	Float_32	1
Region_6_Low_Gain_Raw_Mean_532_Per	Float_32	1
Region_6_Low_Gain_Raw_Mean_1064	Float_32	1
Region_6_Low_Gain_Frame_RMS_Noise_532_Par	Float_32	1
Region_6_Low_Gain_Frame_RMS_Noise_532_Per	Float_32	1
Region_6_Low_Gain_Frame_RMS_Noise_1064	Float_32	1
Region_6_Low_Gain_Overflows_532_Par	Uint_16	1
Region_6_Low_Gain_Overflows_532_Per	Uint_16	1
Region_6_Low_Gain_Overflows_1064	Uint_16	1
Region_6_Low_Gain_Underflows_532_Par	Uint_16	1
Region_6_Low_Gain_Underflows_532_Per	Uint_16	1
Region_6_Low_Gain_Underflows_1064	Uint_16	1
Region_3_Low_Gain_Raw_Mean_532_Par	Float_32	1
Region_3_Low_Gain_Raw_Mean_532_Per	Float_32	1
Region_3_Low_Gain_Raw_Mean_1064	Float_32	1
Region_2_Low_Gain_Overflows_532_Par	Uint_16	1
Region_2_Low_Gain_Overflows_532_Per	Uint_16	1
Region_2_Low_Gain_Overflows_1064	Uint_16	1
Region_1_Low_Gain_Overflows_532_Par	Uint_16	1
Region_1_Low_Gain_Overflows_532_Per	Uint_16	1
Region_1_Low_Gain_Overflows_1064	Uint_16	1
Region_0_Low_Gain_Raw_Mean_532_Par	Float_32	1
Region_0_Low_Gain_Raw_Mean_532_Per	Float_32	1
Region_0_Low_Gain_Raw_Mean_1064	Float_32	1
Region_6_High_Gain_Raw_Mean_532_Par	Float_32	1

Parameter Name	Data Type	Elem/Rec
Region_6_High_Gain_Raw_Mean_532_Per	Float_32	1
Region_6_High_Gain_Raw_Mean_1064	Float_32	1
Region_6_High_Gain_Frame_RMS_Noise_532_Par	Float_32	1
Region_6_High_Gain_Frame_RMS_Noise_532_Per	Float_32	1
Region_6_High_Gain_Frame_RMS_Noise_1064	Float_32	1
Region_6_High_Gain_Overflows_532_Par	Uint_16	1
Region_6_High_Gain_Overflows_532_Per	Uint_16	1
Region_6_High_Gain_Overflows_1064	Uint_16	1
Region_6_High_Gain_Underflows_532_Par	Uint_16	1
Region_6_High_Gain_Underflows_532_Per	Uint_16	1
Region_6_High_Gain_Underflows_1064	Uint_16	1
Region_3_High_Gain_Overflows_532_Par	Uint_16	1
Region_3_High_Gain_Overflows_532_Per	Uint_16	1
Region_3_High_Gain_Overflows_1064	Uint_16	1
Region_2_High_Gain_Overflows_532_Par	Uint_16	1
Region_2_High_Gain_Overflows_532_Per	Uint_16	1
Region_2_High_Gain_Overflows_1064	Uint_16	1
Region_6_Merged_Background_Mean_532_Par	Float_32	1
Region_6_Merged_Background_Mean_532_Per	Float_32	1
Region_6_Merged_Background_Mean_1064	Float_32	1
Region_6_Merged_Shot_RMS_Noise_532_Par	Float_32	1
Region_6_Merged_Shot_RMS_Noise_532_Per	Float_32	1
Region_6_Merged_Shot_RMS_Noise_1064	Float_32	1
Region_5_Merged_Backscatter_Mean_532_Par	Float_32	1
Region_5_Merged_Backscatter_Mean_532_Per	Float_32	1
Region_4_Merged_Backscatter_Mean_532_Par	Float_32	1
Region_4_Merged_Backscatter_Mean_532_Per	Float_32	1
Region_4_Merged_Backscatter_Mean_1064	Float_32	1
Region_3_Merged_Backscatter_Mean_532_Par	Float_32	1
Region_3_Merged_Backscatter_Mean_532_Per	Float_32	1
Region_3_Merged_Backscatter_Mean_1064	Float_32	1
Region_2_Merged_Backscatter_Mean_532_Par	Float_32	1
Region_2_Merged_Backscatter_Mean_532_Per	Float_32	1
Region_2_Merged_Backscatter_Mean_1064	Float_32	1
Region_1_Merged_Backscatter_Mean_532_Par	Float_32	1
Region_1_Merged_Backscatter_Mean_532_Per	Float_32	1
Region_1_Merged_Backscatter_Mean_1064	Float_32	1
Region_0_Merged_Backscatter_Mean_532_Par	Float_32	1
Region_0_Merged_Backscatter_Mean_532_Per	Float_32	1
Region_0_Merged_Backscatter_Mean_1064	Float_32	1
Gain_Coeff_A_532_Par	Float_32	1
Gain_Coeff_B_532_Par	Float_32	1
Gain_Coeff_C_532_Par	Float_32	1
Gain_Coeff_D_532_Par	Float_32	1

Parameter Name	Data Type	Elem/Rec
Gain_Coeff_A_532_Per	Float_32	1
Gain_Coeff_B_532_Per	Float_32	1
Gain_Coeff_C_532_Per	Float_32	1
Gain_Coeff_D_532_Per	Float_32	1
Gain_Coeff_A_1064	Float_32	1
Gain_Coeff_B_1064	Float_32	1
Gain_Coeff_C_1064	Float_32	1
Gain_Coeff_D_1064	Float_32	1
Backscatter_532_Parallel	Float_32	583
Backscatter_532_Perpendicular	Float_32	583
Backscatter_1064	Float_32	583

The L0 HDF file will also contains one record of the Lidar_Data_Altitude with data type as Float_32 and has 583 values.

The contents for the Level 1A output file is shown in Table 2. Each file contains same amount data of L0 raw data. The Metadata for these output products is shown in Table 3.

Table 2: LIDAR Level 1A Record

Parameter Name	Data Type	Elem/Rec
Profile_Time (TAI time)	Float_64	1
Profile_UTC_Time (yyyymmdd.ffffff)	Float_64	1
Profile_ID	Int_32	1
Day_Night_Flag	Int_8	1
Frame_Number	Int_16	1
Lidar_Mode	Int_16	1
Lidar_Submode	Int_16	1
Lidar_Receiver_Electronics_Status_532_Par	Uint_32	1
Lidar_Receiver_Electronics_Status_532_Per	Uint_32	1
Lidar_Receiver_Electronics_Status_1064	Uint_32	1
Active_Laser_Number	Uint16	1
Laser_Latitude	Float_32	1
Laser_Longitude	Float_32	1
Range_To_Mean_Sea_Level	Float_32	1
Backscatter_Start_Altitude	Float_32	1
Laser_Energy_Monitor_532	Float_32	1
Perpendicular_Amplifier_Gain_532	Float_32	1
Parallel_Amplifier_Gain_532	Float_32	1
Perpendicular_Background_Monitor_532	Float_32	1
Parallel_Background_Monitor_532	Float_32	1
Normalized_Backscatter_532_Parallel	Float_32	583
Normalized_Backscatter_532_Perpendicular	Float_32	583
Region_6_Merged_Shot_RMS_Noise_532_Per	Float_32	1
Region_6_Merged_Shot_RMS_Noise_532_Par	Float_32	1

Parameter Name	Data Type	Elem/Rec
Laser_Energy_Monitor_1064	Float_32	1
Amplifier_Gain_1064	Float_32	1
Normalized_Backscatter_1064	Float_32	583
Region_6_Merged_Shot_RMS_Noise_1064	Float_32	1
QC_Flag	Uint_32	1
QC_Flag_2	Uint_32	1

Table 3: LIDAR Level 1A Metadata Record

Parameter Name	Data Type	Elem/Rec
Product_ID	Char	80
Date_Time_at_Granule_Start	Char	28
Date_Time_at_Granule_End	Char	28
Date_Time_of_Production	Char	28
Initial_Subsatellite_Latitude	Float_32	1
Initial_Subsatellite_Longitude	Float_32	1
Final_Subsatellite_Latitude	Float_32	1
Final_Subsatellite_Longitude	Float_32	1
Orbit_Number_at_Granule_Start	Uint_32	1
Orbit_Number_at_Granule_End	Uint_32	1
Orbit_Number_Change_Time	Float_64	1
Path_Number_at_Granule_Start	Uint_16	1
Path_Number_at_Granule_End	Uint_16	1
Path_Number_Change_Time	Float_64	1
Lidar_L0_Files_Used	Char	240
Number_of_Good_Profiles	Int_32	1
Number_of_Bad_Profiles	Int_32	1
Percent_532-parallel_Bad	Float_32	1
Percent_532-perpendicular_Bad	Float_32	1
Percent_1064_Bad	Float_32	1
Percent_532-parallel_Missing	Float_32	1
Percent_532-perpendicular_Missing	Float_32	1
Percent_1064_Missing	Float_32	1
Lidar_Data_Altitudes	Float_32	583