

ILD code to compute NSF uncertainties for single-shot L1 profiles

```
Pro compute_Unc, unc, NSF, Nbin, Nshot, r, E, C, AB, RMS, GA
    unc = fltarr(583)
    for i = 0, 582 do begin
        unc(i) = (NSF^2*r(i)^2*AB(i)/E/C +
(r(i)^2*RMS/E/C/GA)^2)^0.5/(Nbin(i)*Nshot(i))^0.5
    endfor
End
```

```
pro example_uncertainty_l1
```

```
filename = 'filename'
print, 'opening ', filename
```

```
SDinterface_id = HDF_SD_START(filename, /read)
```

```
HDF_SD_Fileinfo, SDinterface_id, Datasets, Attributes
```

```
index = HDF_SD_NAMETOINDEX(SDinterface_id, 'Latitude')
SDdataset_id=HDF_SD_SELECT(SDinterface_id, index)
HDF_SD_GETDATA, SDdataset_id, lat, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id
```

```
index = HDF_SD_NAMETOINDEX(SDinterface_id, 'Longitude')
SDdataset_id=HDF_SD_SELECT(SDinterface_id, index)
HDF_SD_GETDATA, SDdataset_id, lon, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id
```

```
index = HDF_SD_NAMETOINDEX(SDinterface_id,
'Total_Attenuated_Backscatter_532')
SDdataset_id=HDF_SD_SELECT(SDinterface_id, index)
HDF_SD_GETDATA, SDdataset_id, Bks532, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id
```

```
index = HDF_SD_NAMETOINDEX(SDinterface_id,
'Perpendicular_Attenuated_Backscatter_532')
SDdataset_id=HDF_SD_SELECT(SDinterface_id, index)
HDF_SD_GETDATA, SDdataset_id, Bks532_per, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id
```

```
index = HDF_SD_NAMETOINDEX(SDinterface_id,
'Attenuated_Backscatter_1064')
SDdataset_id=HDF_SD_SELECT(SDinterface_id, index)
HDF_SD_GETDATA, SDdataset_id, Bks064, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id
```

```
index = HDF_SD_NAMETOINDEX(SDinterface_id,
'Noise_Scale_Factor_532_Parallel')
SDdataset_id=HDF_SD_SELECT(SDinterface_id, index)
HDF_SD_GETDATA, SDdataset_id, NSF_par, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id
```

```
index = HDF_SD_NAMETOINDEX(SDinterface_id,
'Noise_Scale_Factor_532_Perpendicular')
SDdataset_id=HDF_SD_SELECT(SDinterface_id, index)
```

```

HDF_SD_GETDATA, SDdataset_id, NSF_per, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id

index = HDF_SD_NAMETOINDEX(SDinterface_id, 'Parallel_RMS_Baseline_532')
SDdataset_id=HDF_SD_SELECT(SDinterface_id,index)
HDF_SD_GETDATA, SDdataset_id, RMS_par, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id

index = HDF_SD_NAMETOINDEX(SDinterface_id,
'Perpendicular_RMS_Baseline_532')
SDdataset_id=HDF_SD_SELECT(SDinterface_id,index)
HDF_SD_GETDATA, SDdataset_id, RMS_per, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id

index = HDF_SD_NAMETOINDEX(SDinterface_id,
'Parallel_Amplifier_Gain_532')
SDdataset_id=HDF_SD_SELECT(SDinterface_id,index)
HDF_SD_GETDATA, SDdataset_id, Gain_par, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id

index = HDF_SD_NAMETOINDEX(SDinterface_id,
'Perpendicular_Amplifier_Gain_532')
SDdataset_id=HDF_SD_SELECT(SDinterface_id,index)
HDF_SD_GETDATA, SDdataset_id, Gain_per, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id

index = HDF_SD_NAMETOINDEX(SDinterface_id, 'Amplifier_Gain_1064')
SDdataset_id=HDF_SD_SELECT(SDinterface_id,index)
HDF_SD_GETDATA, SDdataset_id, Gain_064, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id

index = HDF_SD_NAMETOINDEX(SDinterface_id,
'Depolarization_Gain_Ratio_532')
SDdataset_id=HDF_SD_SELECT(SDinterface_id,index)
HDF_SD_GETDATA, SDdataset_id, PGR, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id

index = HDF_SD_NAMETOINDEX(SDinterface_id, 'Calibration_Constant_532')
SDdataset_id=HDF_SD_SELECT(SDinterface_id,index)
HDF_SD_GETDATA, SDdataset_id, cal532, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id

index = HDF_SD_NAMETOINDEX(SDinterface_id, 'Laser_Energy_532')
SDdataset_id=HDF_SD_SELECT(SDinterface_id,index)
HDF_SD_GETDATA, SDdataset_id, Energy_532, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id

index = HDF_SD_NAMETOINDEX(SDinterface_id, 'Noise_Scale_Factor_1064')
SDdataset_id=HDF_SD_SELECT(SDinterface_id,index)
HDF_SD_GETDATA, SDdataset_id, NSF_064, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id

index = HDF_SD_NAMETOINDEX(SDinterface_id, 'Calibration_Constant_1064')
SDdataset_id=HDF_SD_SELECT(SDinterface_id,index)
HDF_SD_GETDATA, SDdataset_id, cal064, /NOREVERSE
HDF_SD_ENDACCESS, SDdataset_id

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```

index = HDF_SD_NAMETOINDEX(SDinterface_id, 'Laser_Energy_1064')
SDdataset_id=HDF_SD_SELECT(SDinterface_id,index)
HDF_SD_GETDATA, SDdataset_id, Energy_064, /NOVERSE
HDF_SD_ENDACCESS, SDdataset_id

index = HDF_SD_NAMETOINDEX(SDinterface_id, 'RMS_Baseline_1064')
SDdataset_id=HDF_SD_SELECT(SDinterface_id,index)
HDF_SD_GETDATA, SDdataset_id, RMS_064, /NOVERSE
HDF_SD_ENDACCESS, SDdataset_id

index = HDF_SD_NAMETOINDEX(SDinterface_id, 'Spacecraft_Altitude')
SDdataset_id=HDF_SD_SELECT(SDinterface_id,index)
HDF_SD_GETDATA, SDdataset_id, Satellite_H, /NOVERSE
HDF_SD_ENDACCESS, SDdataset_id

index = HDF_SD_NAMETOINDEX(SDinterface_id, 'Number_Bins_Shift')
SDdataset_id=HDF_SD_SELECT(SDinterface_id,index)
HDF_SD_GETDATA, SDdataset_id, Nshift, /NOVERSE
HDF_SD_ENDACCESS, SDdataset_id

index = HDF_SD_NAMETOINDEX(SDinterface_id, 'Off_Nadir_Angle')
SDdataset_id=HDF_SD_SELECT(SDinterface_id,index)
HDF_SD_GETDATA, SDdataset_id, Cita, /NOVERSE
HDF_SD_ENDACCESS, SDdataset_id

HDF_SD_END, SDinterface_id

fid=hdf_open(filename,/read)

vds_id = HDF_VD_LONE(fid)
vdata_id=HDF_VD_ATTACH(fid,vds_id,/read)

HDF_VD_GET,vdata_id,name=var,count=cnt,fields=flds,size=sze,nfields=nflds

nrec = HDF_VD_READ(vdata_id,altitude,fields='Lidar_Data_Altitudes')
nrec = HDF_VD_READ(vdata_id,Met_alt,fields='Met_Data_Altitudes')

HDF_VD_DETACH,vdata_id

Bks532_par = Bks532-Bks532_per

Nbin532 = filtarr(583) & Nbin064 = filtarr(583) & Nshot = filtarr(583)
Nbin532(0:32) = 20. & Nbin064(0:32) = 20. & Nshot(0:32) = 15.
Nbin532(33:87) = 12. & Nbin064(33:87) = 12. & Nshot(33:87) = 5.
Nbin532(88:287) = 4. & Nbin064(88:287) = 4. & Nshot(88:287) = 3.
Nbin532(288:577) = 2. & Nbin064(288:577) = 4. & Nshot(288:577) = 1.
Nbin532(578:582) = 20. & Nbin064(578:582) = 20. & Nshot(578:582) = 1.

f_correct532 = filtarr(7,583) & f_correct064 = filtarr(7,583)
f_correct532(0,0:32) = 1.598 & f_correct532(1,0:32) = 1.450
f_correct532(2,0:32) = 1.324 & f_correct532(3,0:32) = 1.226
f_correct532(4,0:32) = 1.163 & f_correct532(5,0:32) = 1.141
f_correct532(6,0:32) = 1.163
f_correct532(0,33:87) = 1.578 & f_correct532(1,33:87) = 1.350
f_correct532(2,33:87) = 1.192 & f_correct532(3,33:87) = 1.134

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f_correct532(4,33:87) = 1.192 & f_correct532(5,33:87) = 1.350
f_correct532(6,33:87) = 1.578
f_correct532(0,88:287) = 1.489 & f_correct532(1,88:287) = 1.105
f_correct532(2,88:287) = 1.489 & f_correct532(3,88:287) = 1.105
f_correct532(4,88:287) = 1.489 & f_correct532(5,88:287) = 1.105
f_correct532(6,88:287) = 1.489
f_correct532(0:6,288:577) = 1.386
f_correct532(0,578:582) = 1.598 & f_correct532(1,578:582) = 1.450
f_correct532(2,578:582) = 1.324 & f_correct532(3,578:582) = 1.226
f_correct532(4,578:582) = 1.163 & f_correct532(5,578:582) = 1.141
f_correct532(6,578:582) = 1.163

f_correct064 = f_correct532
f_correct064(0:6,288:577) = 1.489

num_profile = n_elements(lat)
Unc_per = filtarr(num_profile,583) & Unc_par = filtarr(num_profile,583)
Unc_tot = filtarr(num_profile,583) & Unc_064 = filtarr(num_profile,583)

For j = 0L,num_profile-1L do begin
  r = (Satellite_H(j) - altitude)/cos(cita(j)/180.*3.1415926)

  AB = Bks532_per(j,*)
  compute_Unc, unc, NSF_per(j), Nbin532, Nshot, r, Energy_532(j),
  Cal532(j)*PGR(j), AB, RMS_per(j), Gain_per(j)
  Unc_per(j,*) = unc(*)*f_correct532(abs(Nshift(j)),*)

  AB= Bks532_par(j,*)
  compute_Unc, unc, NSF_par(j), Nbin532, Nshot, r, Energy_532(j),
  Cal532(j), AB, RMS_par(j), Gain_par(j)
  Unc_par(j,*) = unc(*)*f_correct532(abs(Nshift(j)),*)

  Unc_tot(j,*) = (Unc_per(j,*)^2+Unc_par(j,*)^2)^0.5

  AB= Bks532_per(j,*)
  compute_Unc, unc, NSF_064(j), Nbin064, Nshot, r, Energy_064(j),
  Cal064(j), AB, RMS_064(j), Gain_064(j)
  Unc_064(j,*) = unc(*)*f_correct064(abs(Nshift(j)),*)
Endfor

End

```