overview

February 18, 2025

[1]:
```
import numpy as np
from rich.pretty import Pretty
from sigpyproc.readers import FilReader
```

```
OMP: Info #276: omp_set_nested routine deprecated, please use
omp_set_max_active_levels instead.
```

[2]:
```
import matplotlib.pyplot as plt
from matplotlib.colors import LogNorm
```

[3]:
```
off_Fil = FilReader("/home/jovyan/work/phys641data/Data/blank_sky.fil") # off
on_Fil = FilReader("/home/jovyan/work/phys641data/Data/calibrator_source.fil")␣
  ↪# on
```

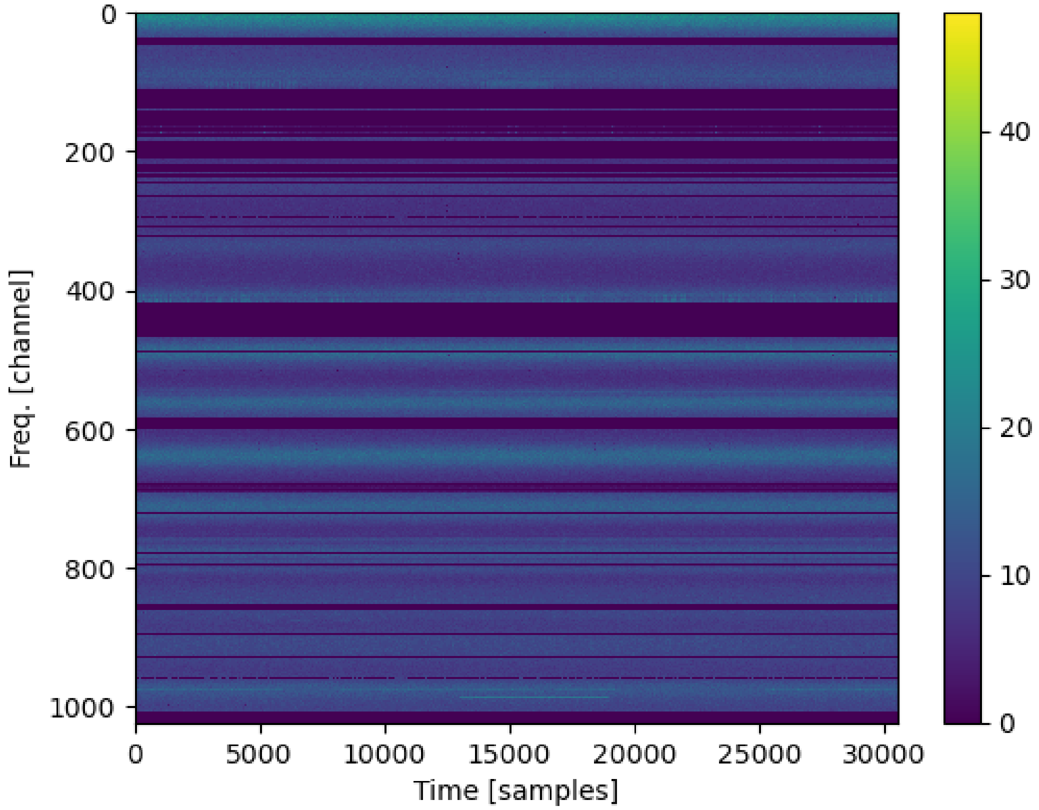
[4]:
```
Pretty(on_Fil.header)
```

[4]:
```
Header(
    filename='/home/jovyan/work/phys641data/Data/calibrator_source
.fil',
    data_type='filterbank',
    nchans=1024,
    foff=-0.390625,
    fch1=800.0,
    nbits=32,
    tsamp=0.00032768,
    tstart=60638.353596809546,
    nsamples=30518,
    nifs=1,
    coord=<SkyCoord
(ICRS): (ra,
dec) in deg
    (72.26000547,
45.02999878)>,
    azimuth=<Angle 0. deg>,
    zenith=<Angle 0.
deg>,
    telescope='CHIME',
    backend='CHIME',
    source='Fake',
    frame='topocentric',
    ibeam=1,
    nbeams=1,
    dm=0.0,
    period=0,
    accel=0,
    signed=0,
    rawdatafile='test.dat',
    stream_info=StreamInfo(
        entries=[
            FileInfo(
                filename='/home/jovyan/work/phys641data/Data/calib
rator_source.fil',
                hdrlen=414,
                datalen=125001728,
                nsamples=30518,
                tstart=60638.353596809546,
                tsamp=0.00032768
            )
        ]
    )
)
```

[9]:
```
off_data = off_Fil.read_block(0,off_Fil.header.nsamples,off_Fil.header.
 ↪fch1,off_Fil.header.nchans)
```

[10]:
```
off_data_array = off_data.data
```

[11]:
```
plt.figure()
plt.imshow(off_data_array,aspect='auto',interpolation='nearest')
plt.colorbar()
plt.xlabel('Time [samples]')
plt.ylabel('Freq. [channel]')
plt.show()
```

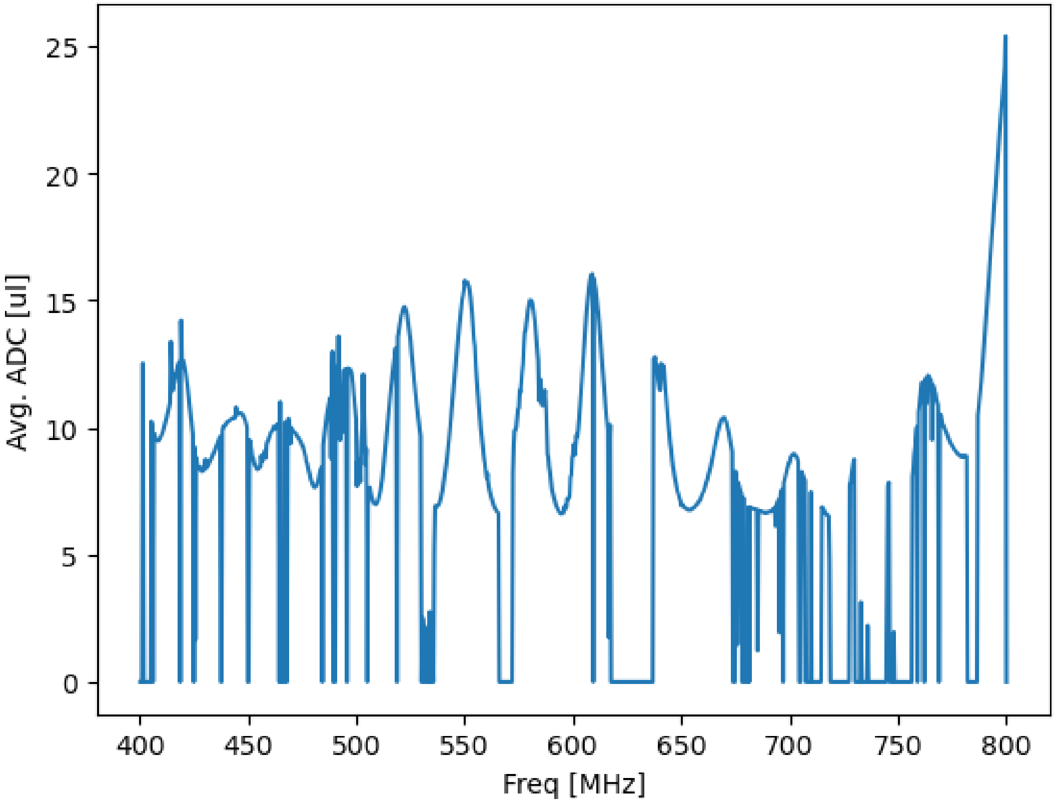


1 Compute Stats

[16]:
```
off_Fil.compute_stats()
```

```
Output()
```

[23]:
```
plt.figure()
plt.plot(off_Fil.header.chan_freqs, off_Fil.chan_stats.mean)
plt.ylabel('Avg. ADC [ul]')
plt.xlabel('Freq [MHz]')
plt.show()
```



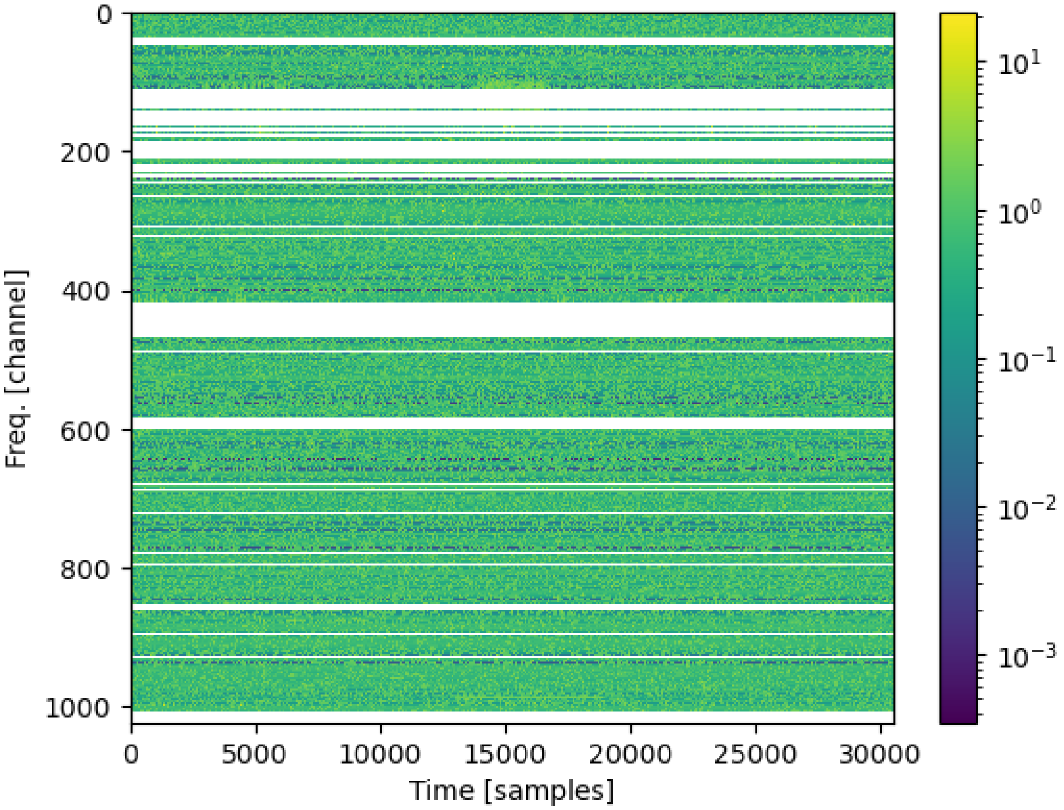
[18]:

```python
norm_off_data_array = (off_data_array - off_Fil.chan_stats.mean[:,None]) / off_Fil.chan_stats.std[:,None]
```

```
/tmp/ipykernel_37896/2855290139.py:1: RuntimeWarning: invalid value encountered
in divide
  norm_off_data_array = (off_data_array - off_Fil.chan_stats.mean[:,None]) /
off_Fil.chan_stats.std[:,None]
```

[68]:

```python
plt.figure()
plt.imshow(np.abs(norm_off_data_array),aspect='auto',interpolation='nearest',norm='log')
plt.colorbar()
plt.xlabel('Time [samples]')
plt.ylabel('Freq. [channel]')
plt.show()
```



2 Flag RFI

```
[100]: _, chan_mask = off_Fil.clean_rfi(method="mad",threshold=3)
```

```
Output()
```

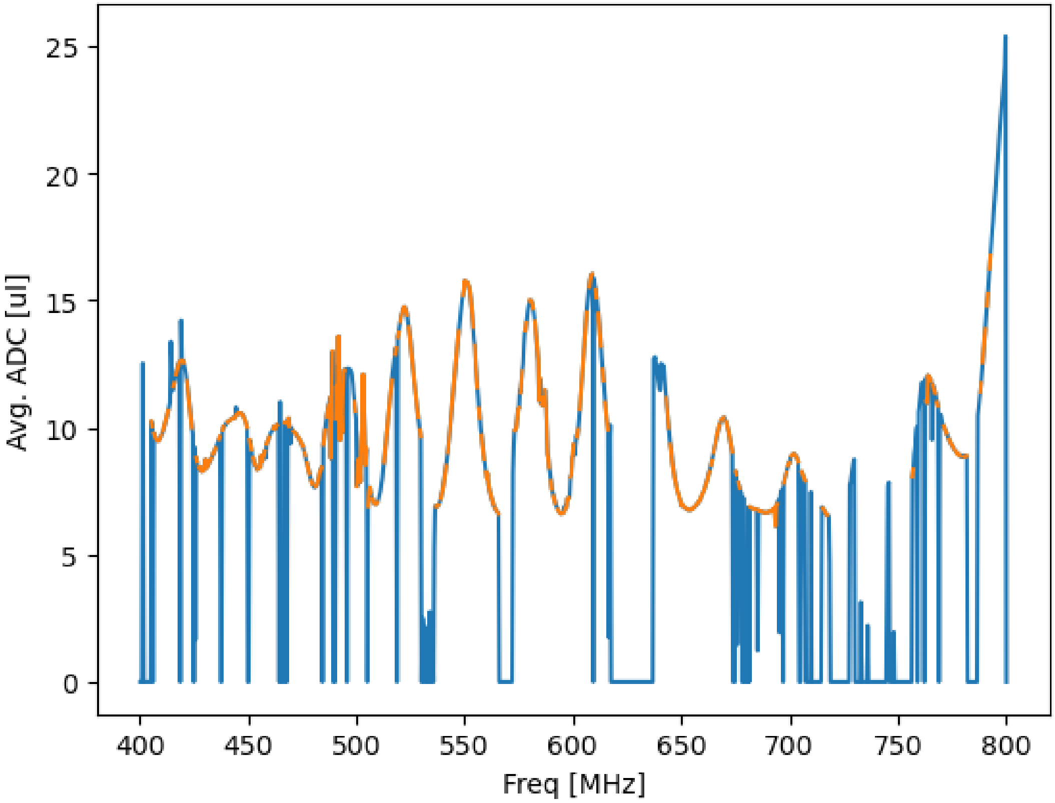
```
[101]: off_Fil_masked = FilReader("/home/jovyan/work/phys641data/Data/blank_sky_masked.
         ↪fil") # off
```

```
[102]: off_Fil_masked.compute_stats()
```

```
Output()
```

```
[103]: freq_mask = off_Fil_masked.chan_stats.mean == 0
       plt.figure()
       plt.plot(off_Fil_masked.header.chan_freqs,
                off_Fil.chan_stats.mean)
```

```
plt.plot(off_Fil_masked.header.chan_freqs,
         np.where(~freq_mask,off_Fil_masked.chan_stats.mean,np.nan))
plt.ylabel('Avg. ADC [ul]')
plt.xlabel('Freq [MHz]')
plt.show()
```



3 Downsample

[104]:
```
off_Fil_masked.downsample(tfactor=32)
```

```
Output()
```

[104]:
```
'blank_sky_masked_f1_t32.fil'
```

[105]:
```
off_Fil_32 = FilReader("/home/jovyan/work/phys641data/Data/
 ↪blank_sky_masked_f1_t32.fil")
```

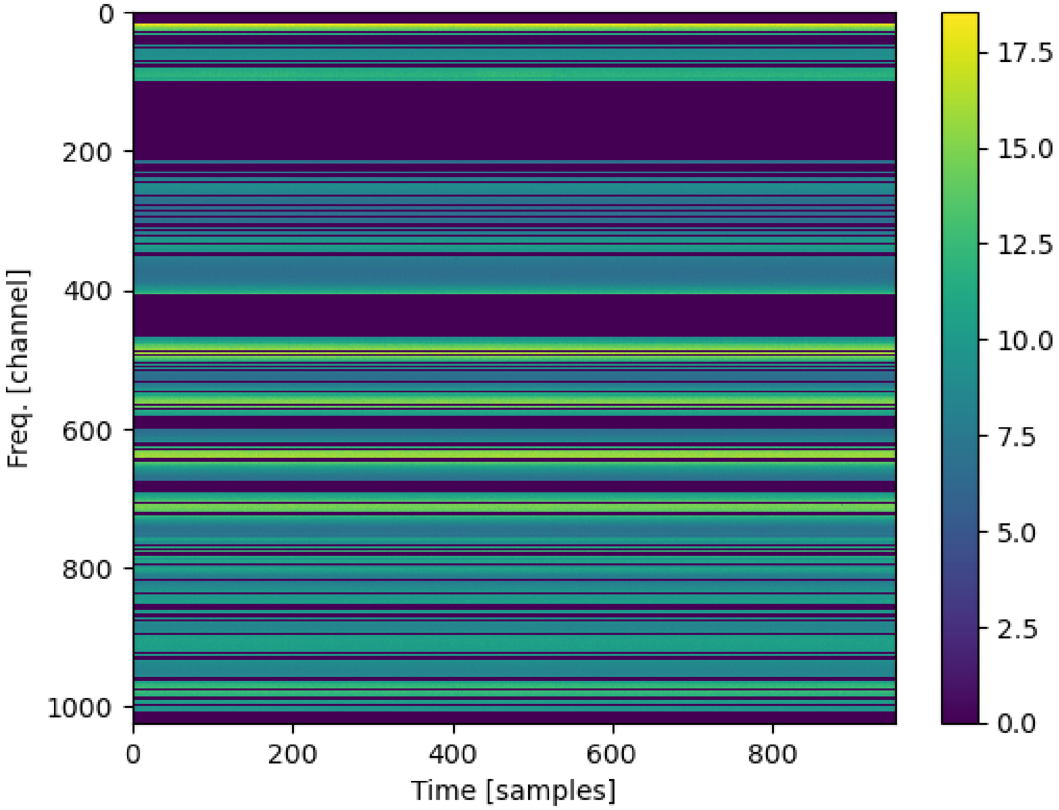
[106]:
```
off_data_32 = off_Fil_32.read_block(0,off_Fil_32.header.nsamples,off_Fil_32.
 ↪header.fch1,off_Fil_32.header.nchans)
```

[107]:

```
off_data_32_array = off_data_32.data
```

[108]:

```
plt.figure()
plt.imshow(off_data_32_array,aspect='auto',interpolation='nearest')
plt.colorbar()
plt.xlabel('Time [samples]')
plt.ylabel('Freq. [channel]')
plt.show()
```



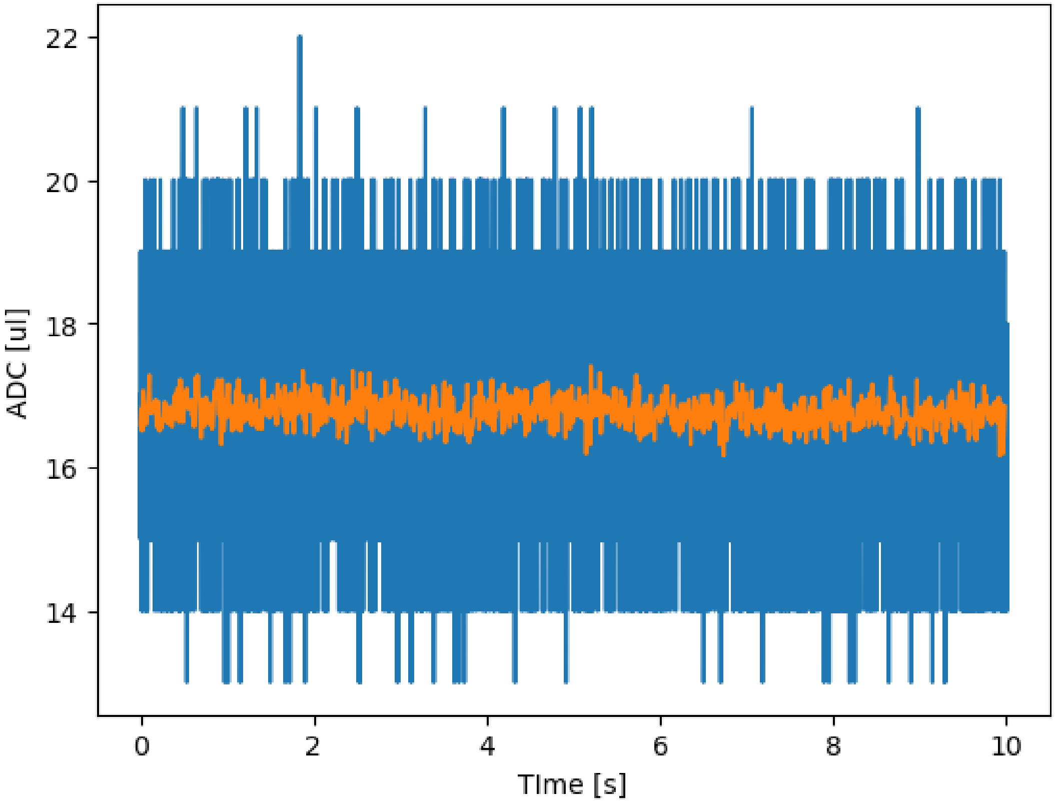
[109]:

```
off_Fil_32.compute_stats()
```

```
Output()
```

[110]:

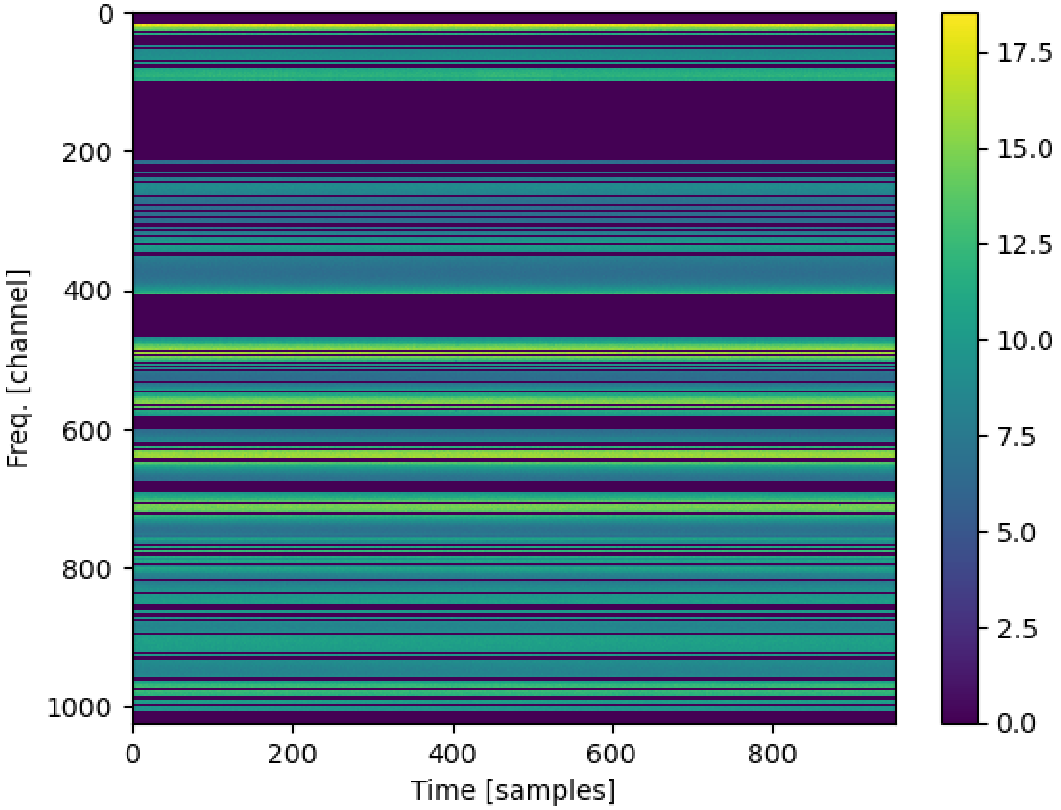
```
plt.figure()
plt.plot(np.arange(off_Fil.header.nsamples)*off_Fil.header.
  ↪tsamp,off_data_array[~freq_mask,:][1,:])
plt.plot(np.arange(off_Fil_32.header.nsamples)*off_Fil_32.header.
  ↪tsamp,off_data_32_array[~freq_mask,:][1,:])
plt.ylabel('ADC [ul]')
plt.xlabel('TIme [s]')
plt.show()
```



4 Dedisperse

[43]:
```
off_data_32_d2 = off_data_32.dedisperse(2)
```

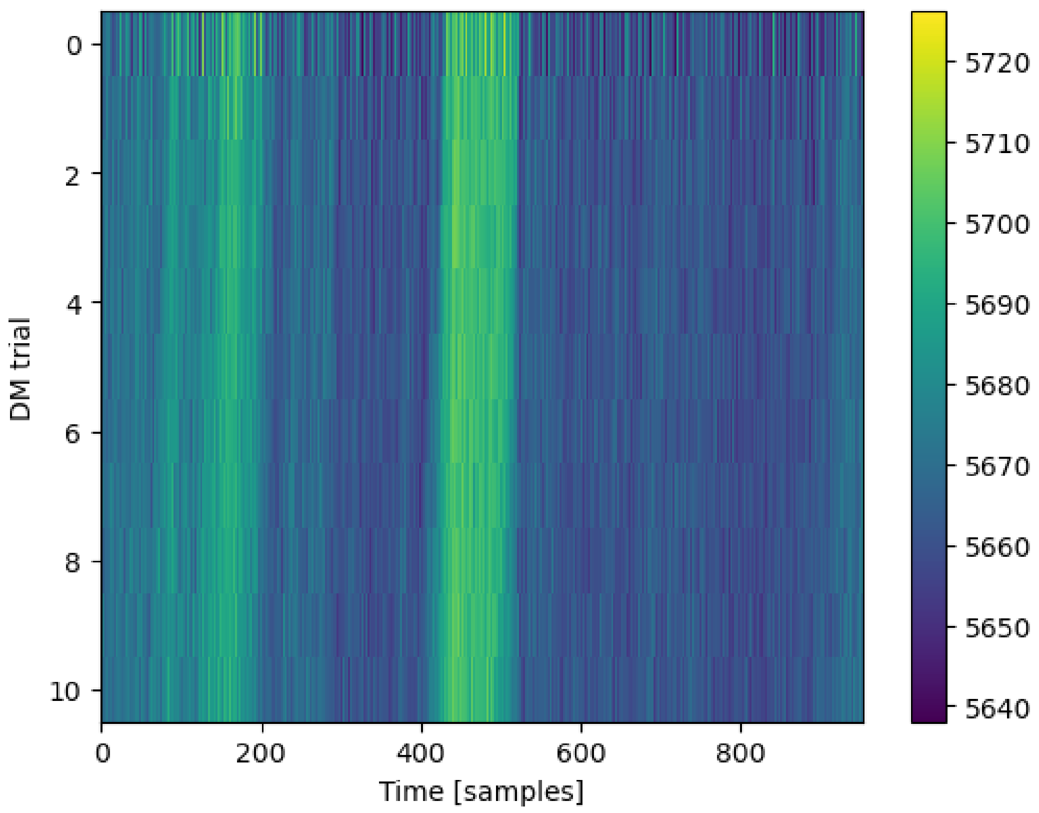
[45]:
```
plt.figure()
plt.imshow(off_data_32_d2.data,aspect='auto',interpolation='nearest')
plt.colorbar()
plt.xlabel('Time [samples]')
plt.ylabel('Freq. [channel]')
plt.show()
```



[64]:
```
off_data_32_dmt = off_data_32.dmt_transform(10,dmsteps=11)
```

[65]:
```
print(off_data_32_dmt.dms)
plt.figure()
plt.imshow(off_data_32_dmt.data[:,:],aspect='auto',interpolation='nearest')
plt.colorbar()
plt.xlabel('Time [samples]')
plt.ylabel('DM trial')
plt.show()
```

```
[ 0.   2.   4.   6.   8. 10. 12. 14. 16. 18. 20.]
```

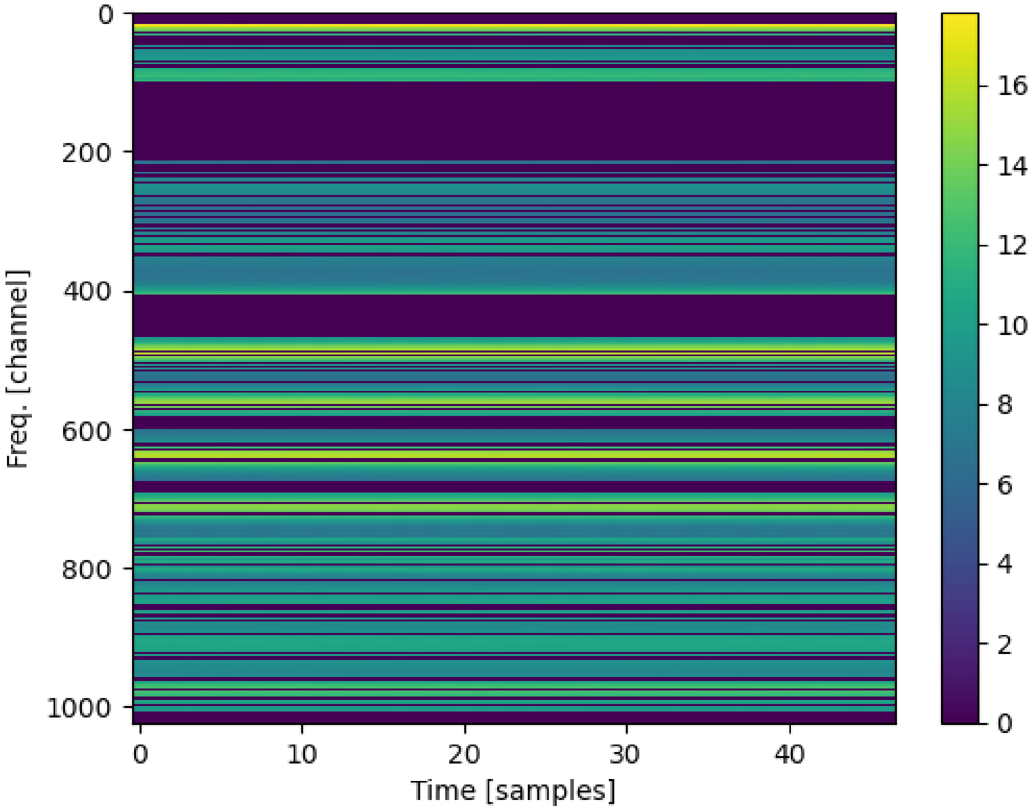


5 Fold

```
[113]: off_data_32_folded = off_Fil_32.fold(0.5,2,nints=1,nbands=1024,nbins=int(0.5//
         ↪off_Fil_32.header.tsamp))
```

```
Output()
```

```
[114]: plt.figure()
       plt.imshow(off_data_32_folded.data[0,:,:],aspect='auto',interpolation='nearest')
       plt.colorbar()
       plt.xlabel('Time [samples]')
       plt.ylabel('Freq. [channel]')
       plt.show()
```

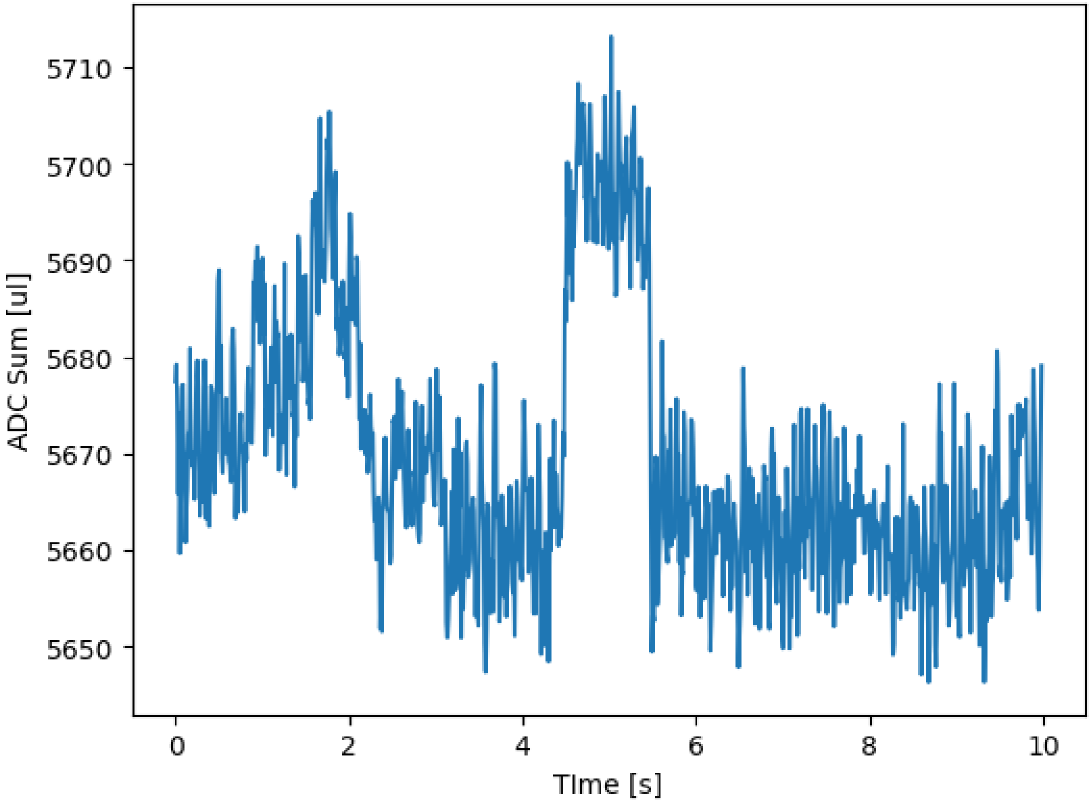


6 Power Spec

[115]:
```
off_data_32_d2 = off_data_32.dedisperse(2)
```

[116]:
```
off_data_ts = off_data_32_d2.get_tim()
```

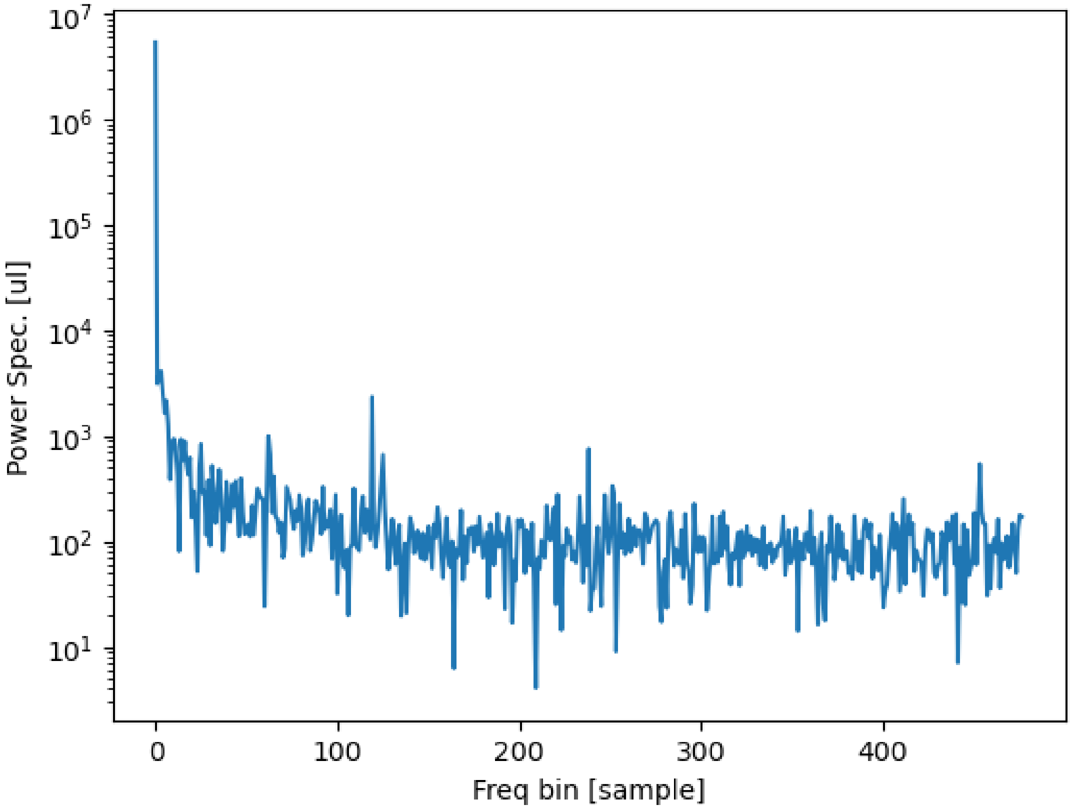
[122]:
```
plt.figure()
plt.plot(np.arange(off_Fil_32.header.nsamples)*off_Fil_32.header.tsamp,
         off_data_ts.data)
plt.ylabel('ADC Sum [ul]')
plt.xlabel('TIme [s]')
plt.show()
```



[123]:
```
off_data_spec = off_data_ts.rfft()
```

[124]:
```
off_data_pspec = off_data_spec.form_spec()
```

[129]:
```
plt.figure()
plt.plot(off_data_pspec.data)
plt.yscale('log')
plt.ylabel('Power Spec. [ul]')
plt.xlabel('Freq bin [sample]')
plt.show()
```


10^7
10^6
10^5
10^4
10^3
10^2
10^1
Power Spec. [ul]
0
100
200
300
400
Freq bin [sample]

```
[ ]:
```