# SAMPEX Microburst Widths Update

Mykhaylo Shumko

20 October 2020

# Summary of changes

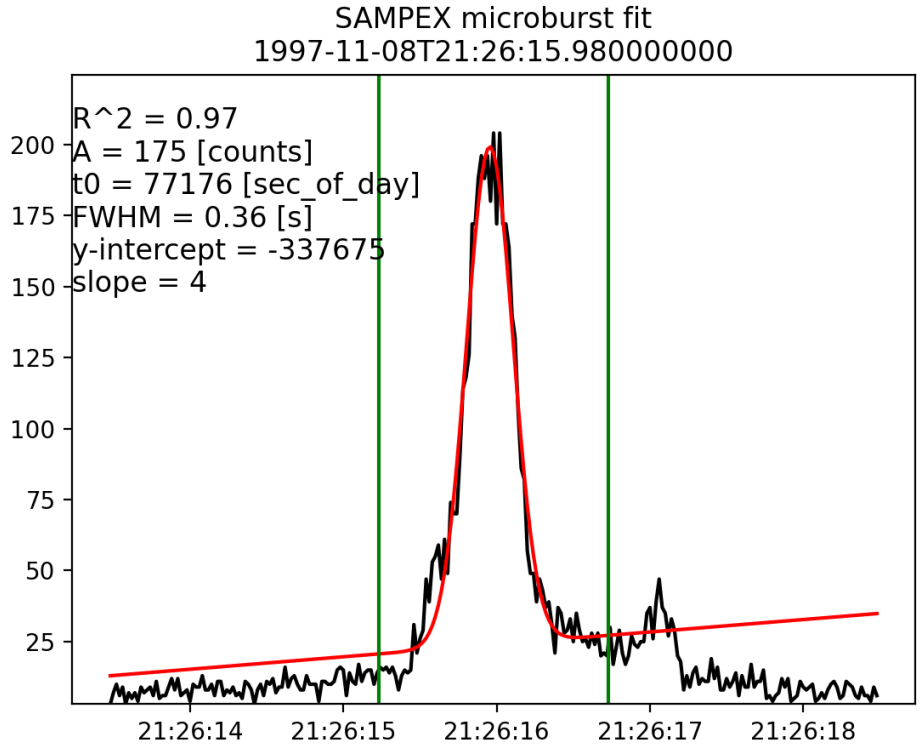
- Created a microburst catalog using the O'Brien et al., 2003's burst parameter.
  - Used a 0.5 s baseline (the exact burst parameter… this is the A500 param in O'Brien et al., 2003) microburst_catalog_02.csv
  - Also generated a microburst list using a 1 s baseline microburst_catalog_00.csv and microburst_catalog_01.csv
- Estimated widths at half of the peak prominence (width_s column) as well as the Gaussian FWHM from the fit (fwhm column).
  - Gaussian function is superposed with a linear trend (5 parameters total)
- Implemented the R^2 and adjusted R^2 goodness of fit tests (r2 and adj_r2 columns)

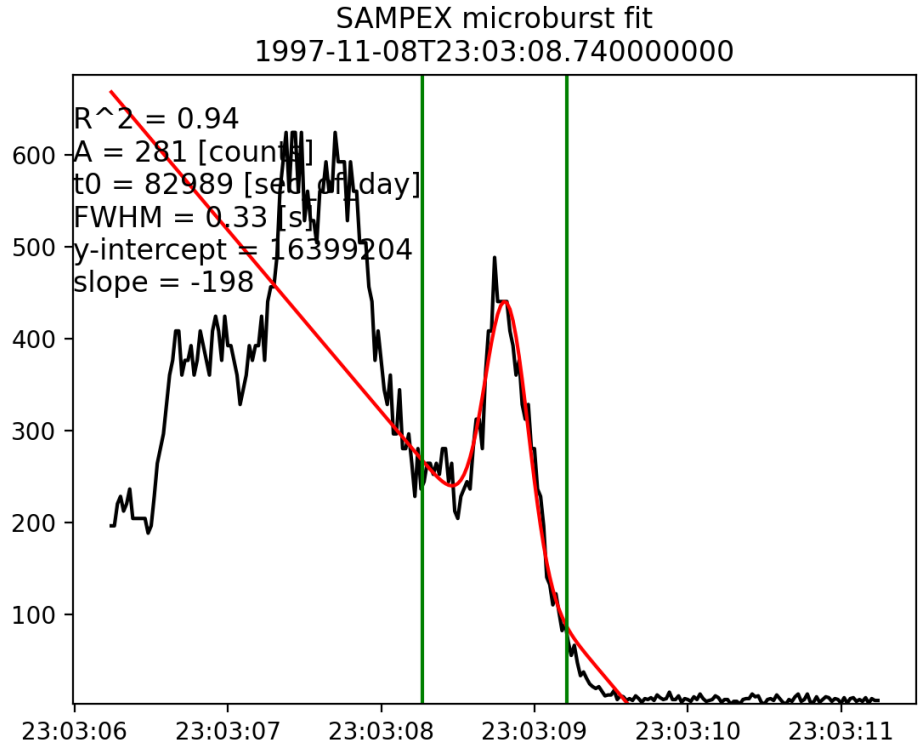
# Fit Details

- Used a Gaussian for the peak, and a linear trend to account for the drift loss cone background.
- The time slice for the fit is:
  - by default 4x the prominence width
  - 500 ms if the 4x prominence width is less than 100 ms (5 data points). This is a failsafe in case the prominence method fails and width_s is 0.
- Initial parameter guesses
  - Amplitude from prominence
  - t0 from microburst detection
  - Width from prominence
  - Y-intercept = 50
  - Slope = 0
- The saved fwhm units is seconds, t0 is datetime string, amplitude is counts. Y-intercept and slope have units of counts and counts/sec_of_day, respectively.
- If fit did not converge, the detection fit parameters are NaN (in a csv it is nothing, i.e. “,,”)

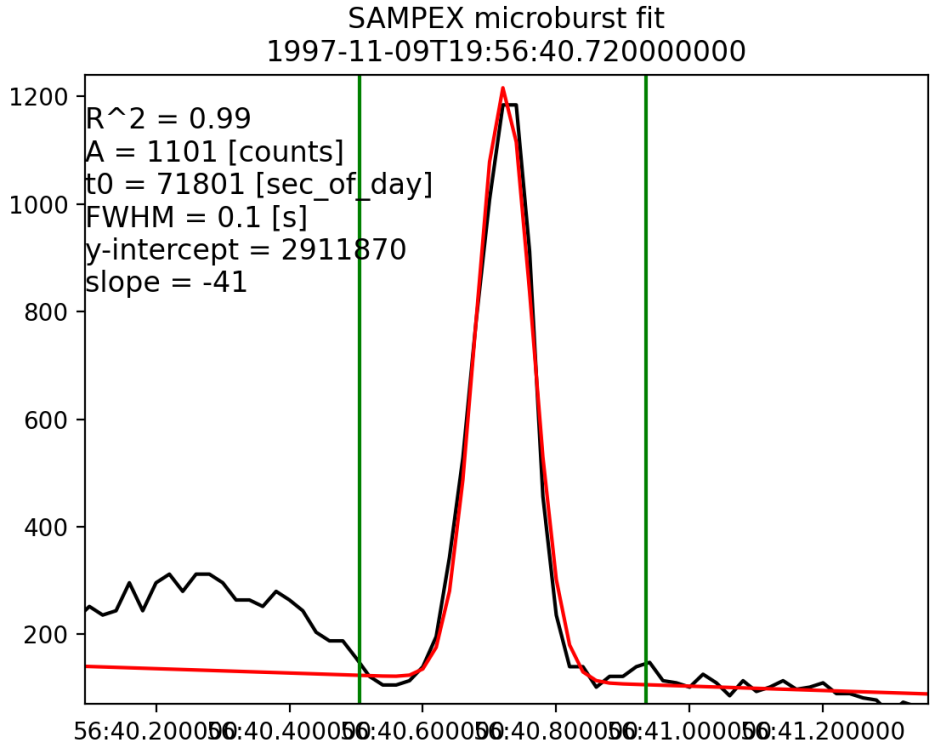
# Results: Example microbursts with fits

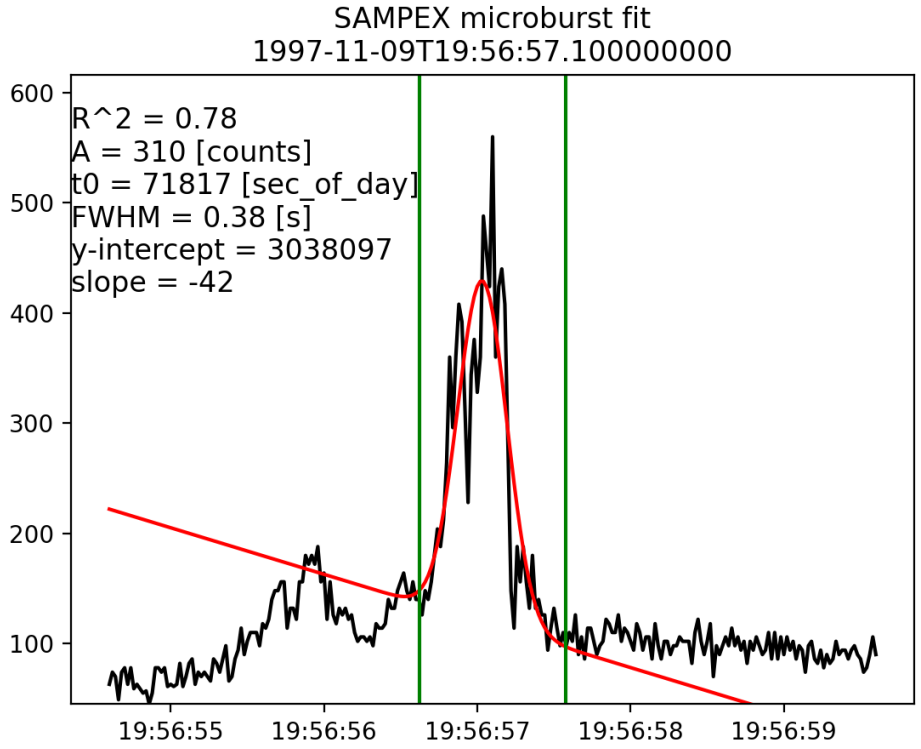
Green: fit bounds
Red: Gaussian + linear trend



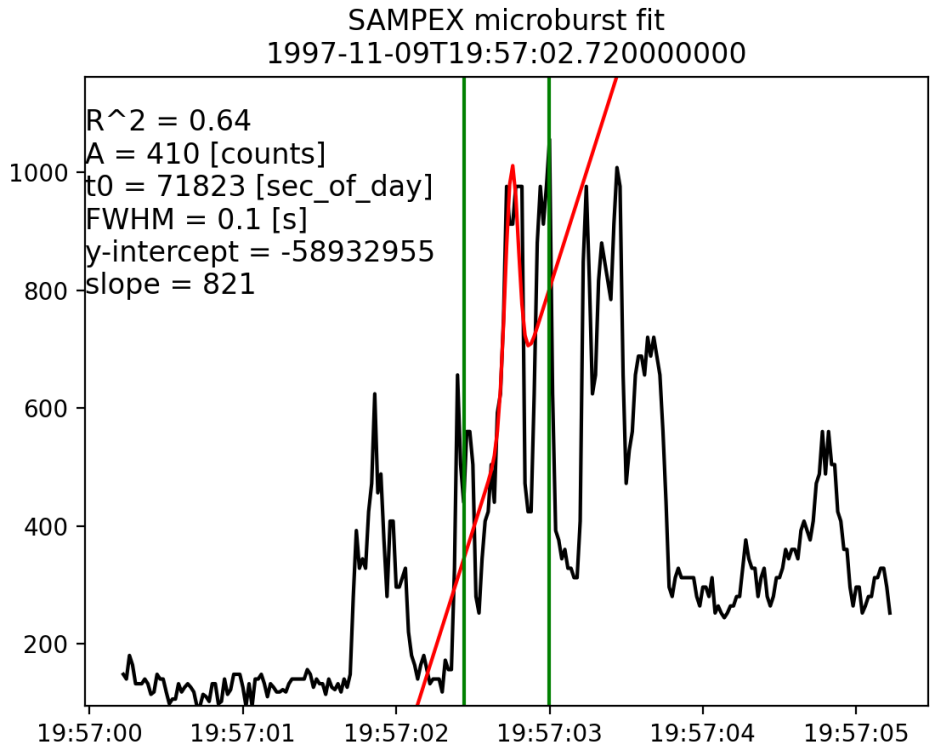



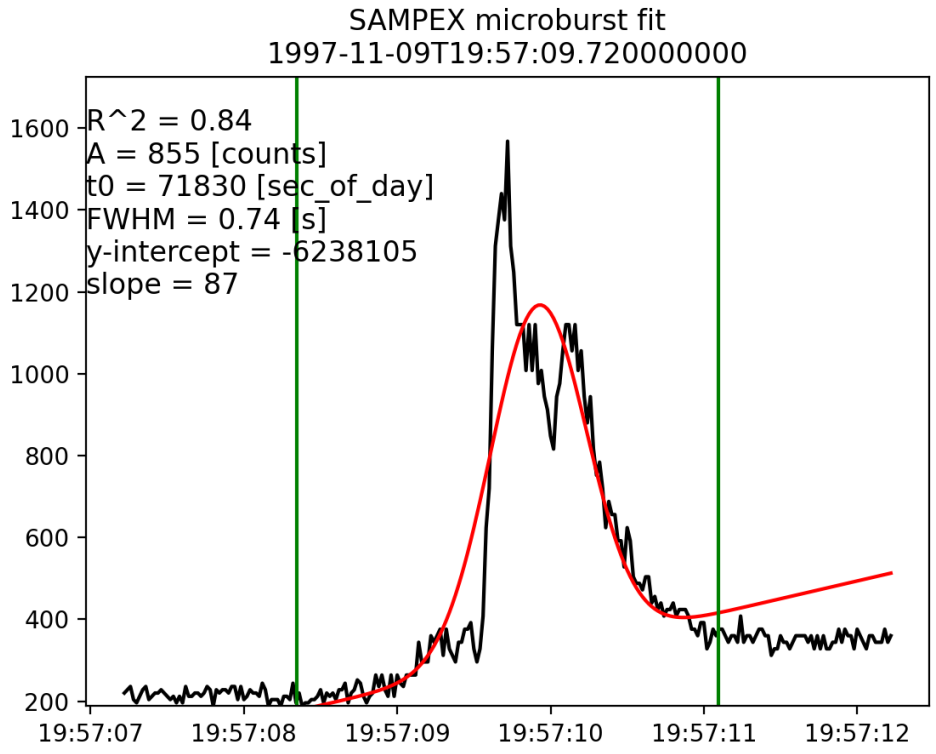
# Results: Example microbursts with fits



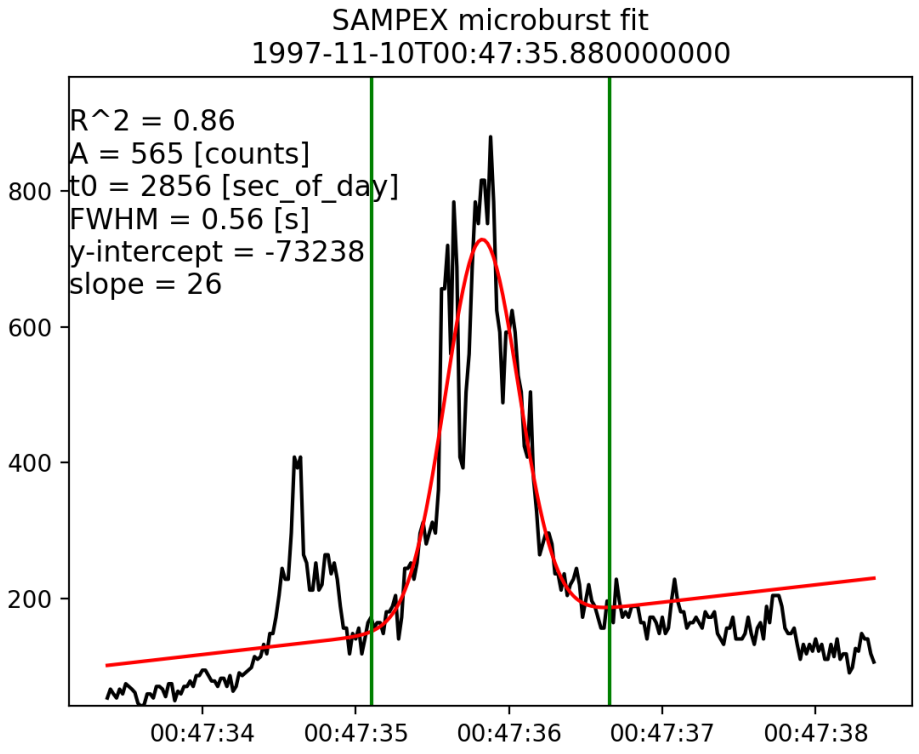



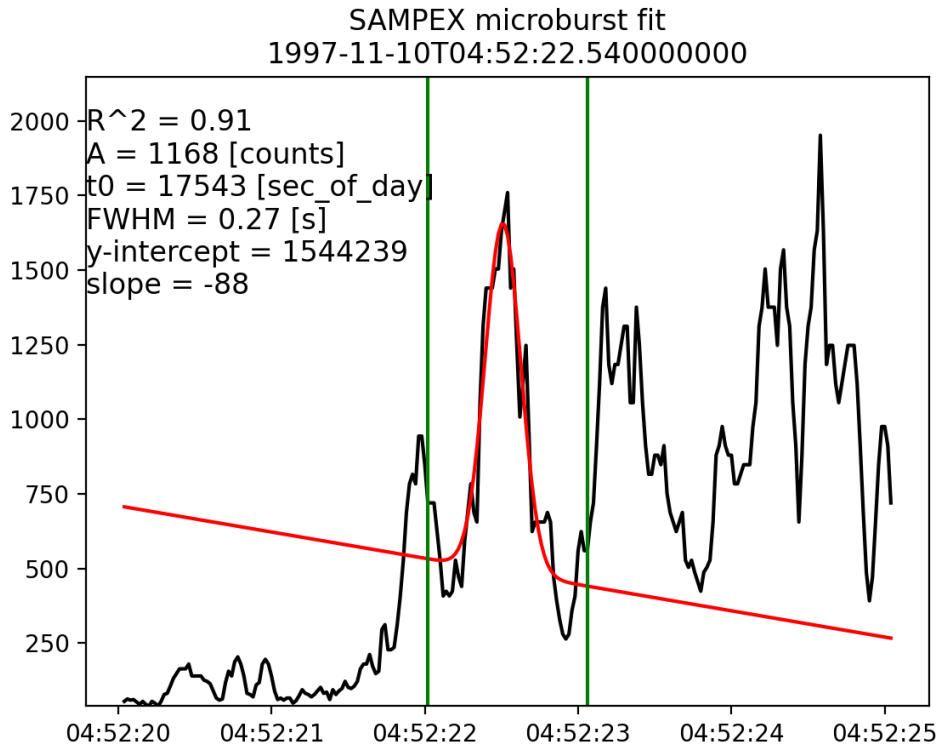
# Results: Example microbursts with fits



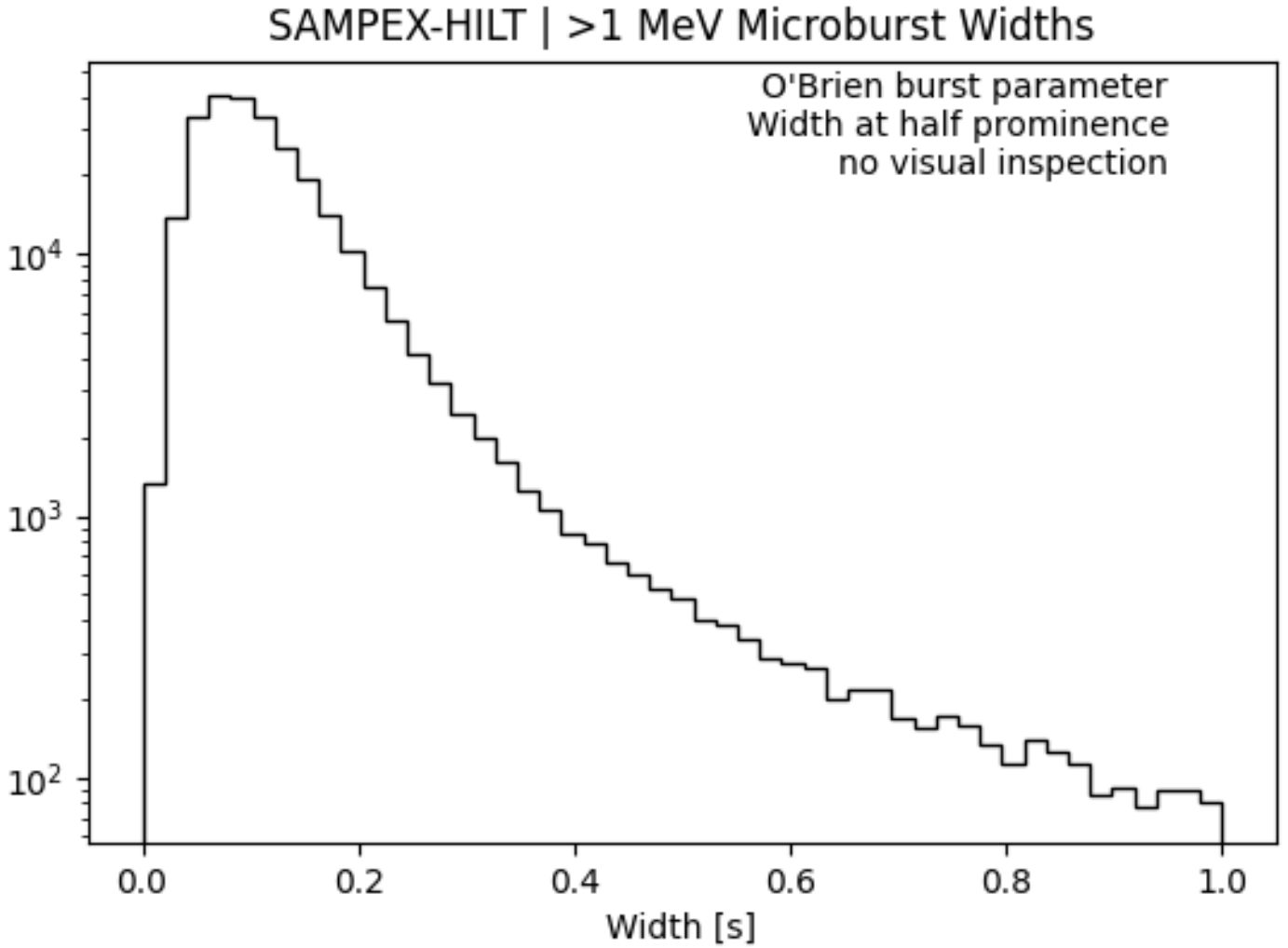



# Results: Example microbursts with fits



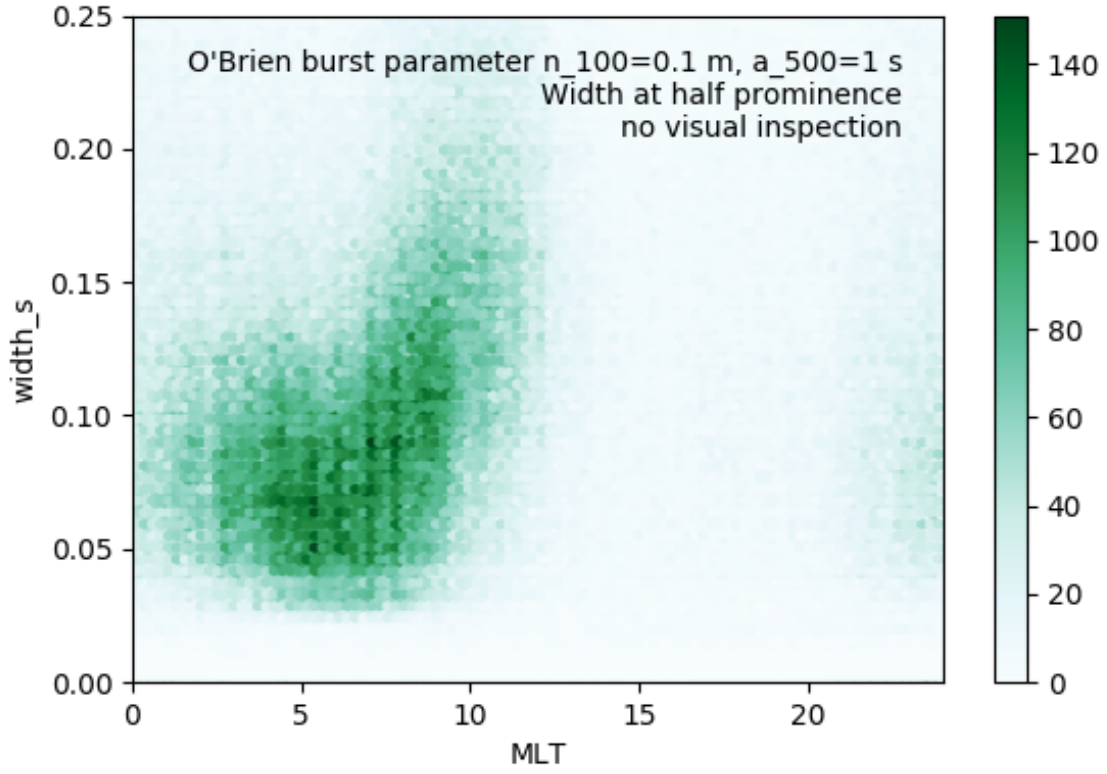



# Results: Microburst width histogram



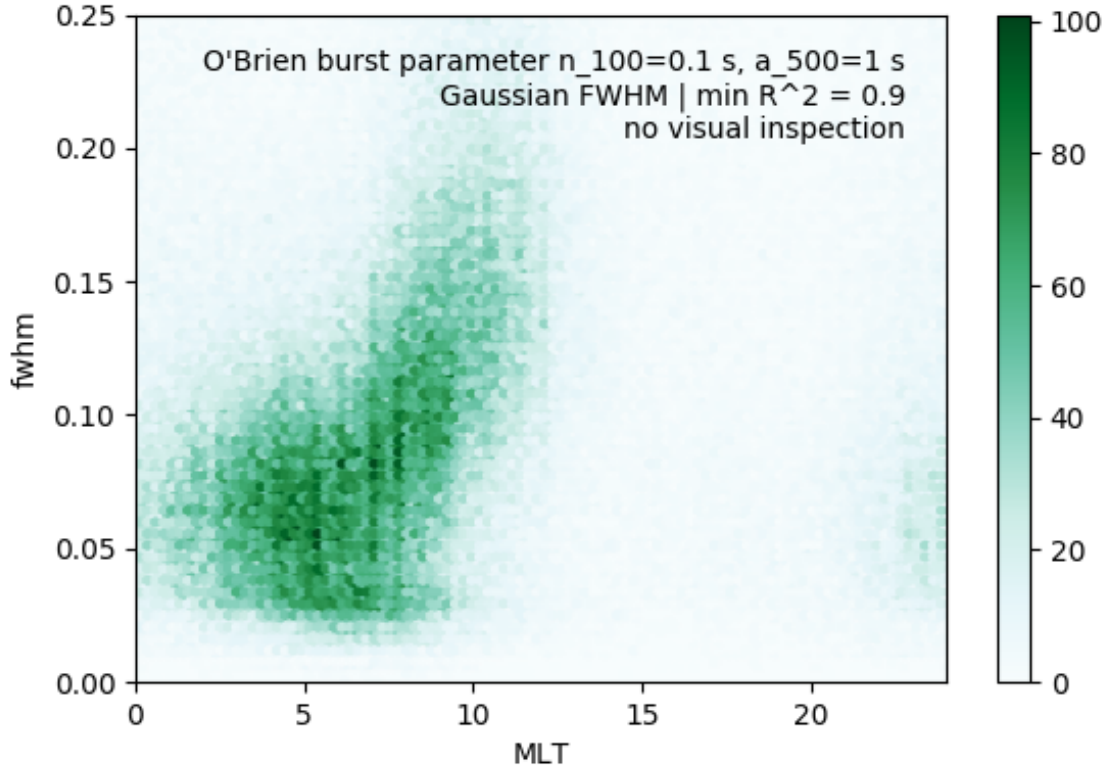
# Results: width-MLT distribution

## Width at half prominence



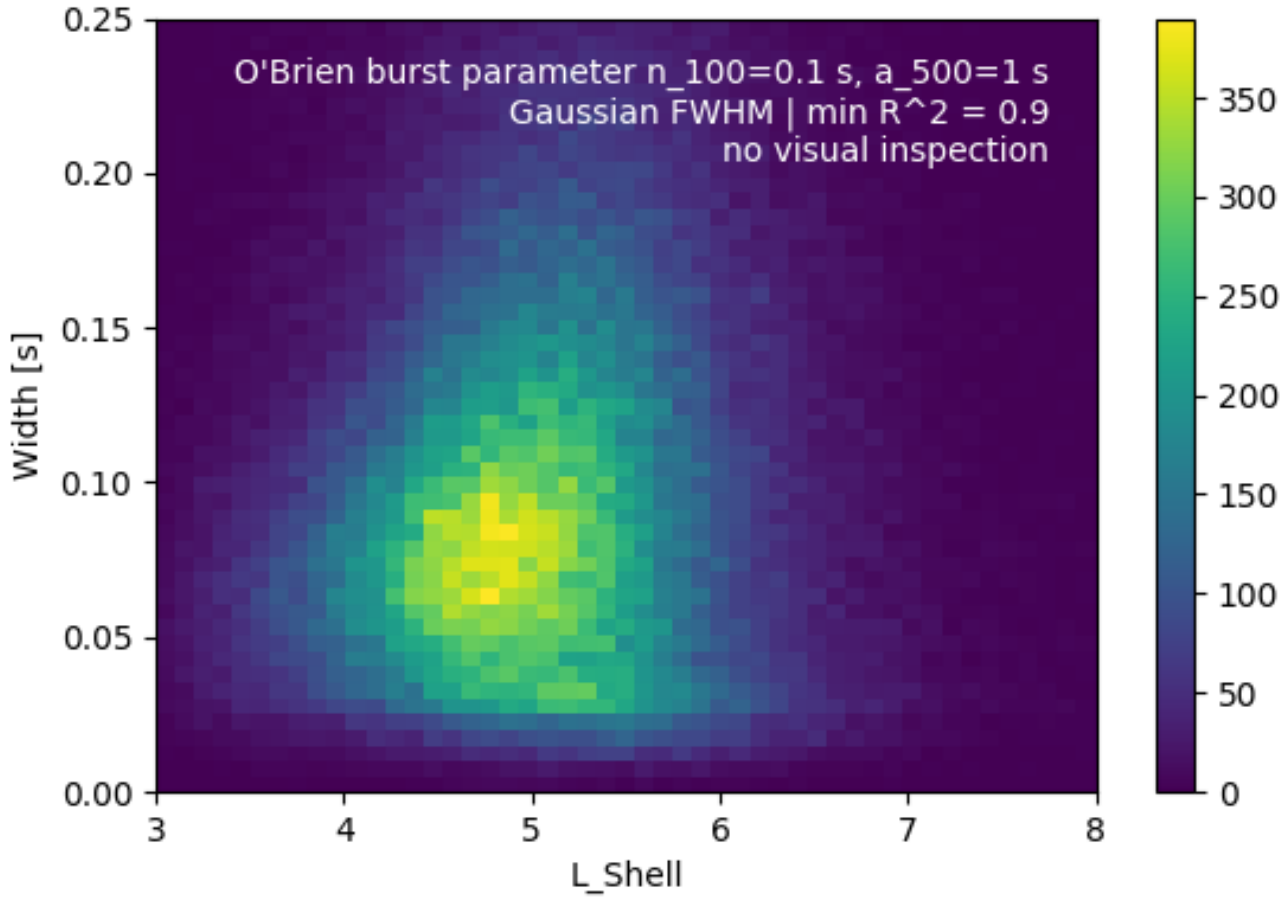

Generated at 2020/10/14 14:00:17 by main() in microburst_width_mlt.py

## Gaussian fit with R^2 > 0.9



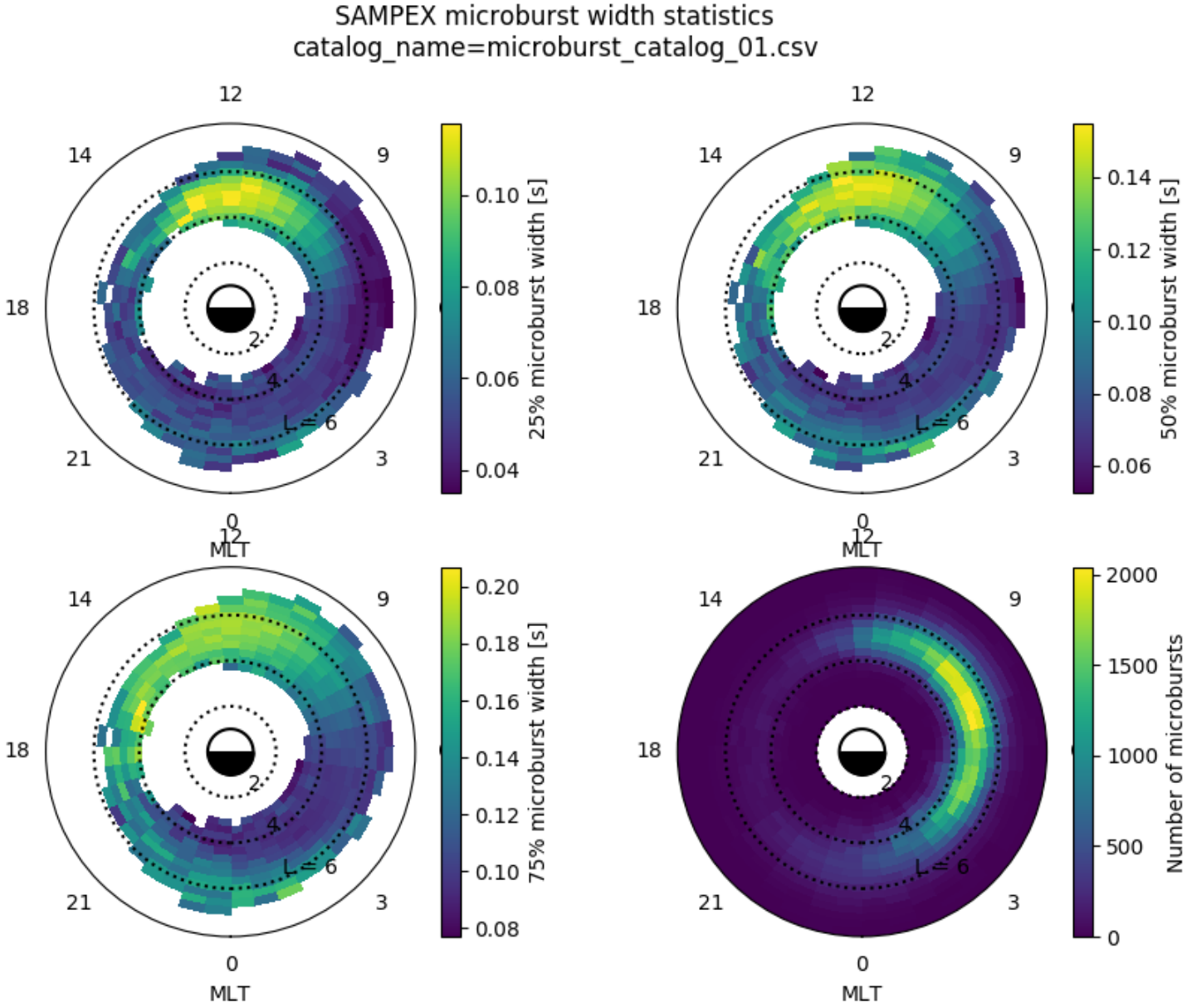

Generated at 2020/10/20 11:54:48 by main() in microburst_width_mlt.py

# Results: width-L shell distribution




Generated at 2020/10/20 12:25:22 by main() in microburst_width_l.py

# Results: L-MLT distribution






Generated at 2020/10/20 13:18:56 by main() in microburst_width_l_mlt.py

# Up next

- Finish documenting code