IMPERIAL

grouch: binning and visualising build data

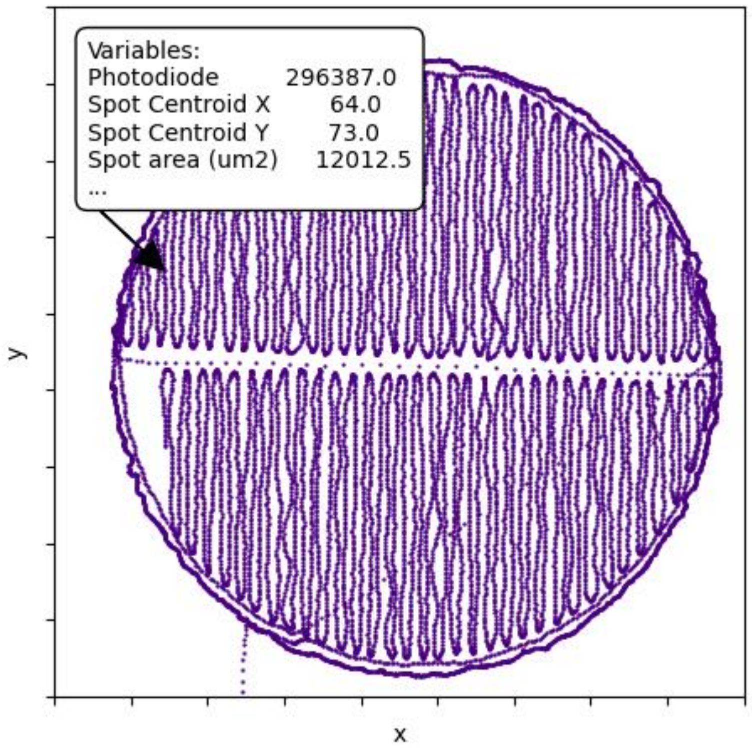
Using data binning to assess AM build quality and machine health

Patrick Taylor

17/04/2024

Basic idea

1. In-situ build data:
Variable measurements at *coordinates*.



2. Remove perimeter scan data and divide the coordinates into bins.

3. Calculate a measure (e.g. mean value) over all the data points in each bin.

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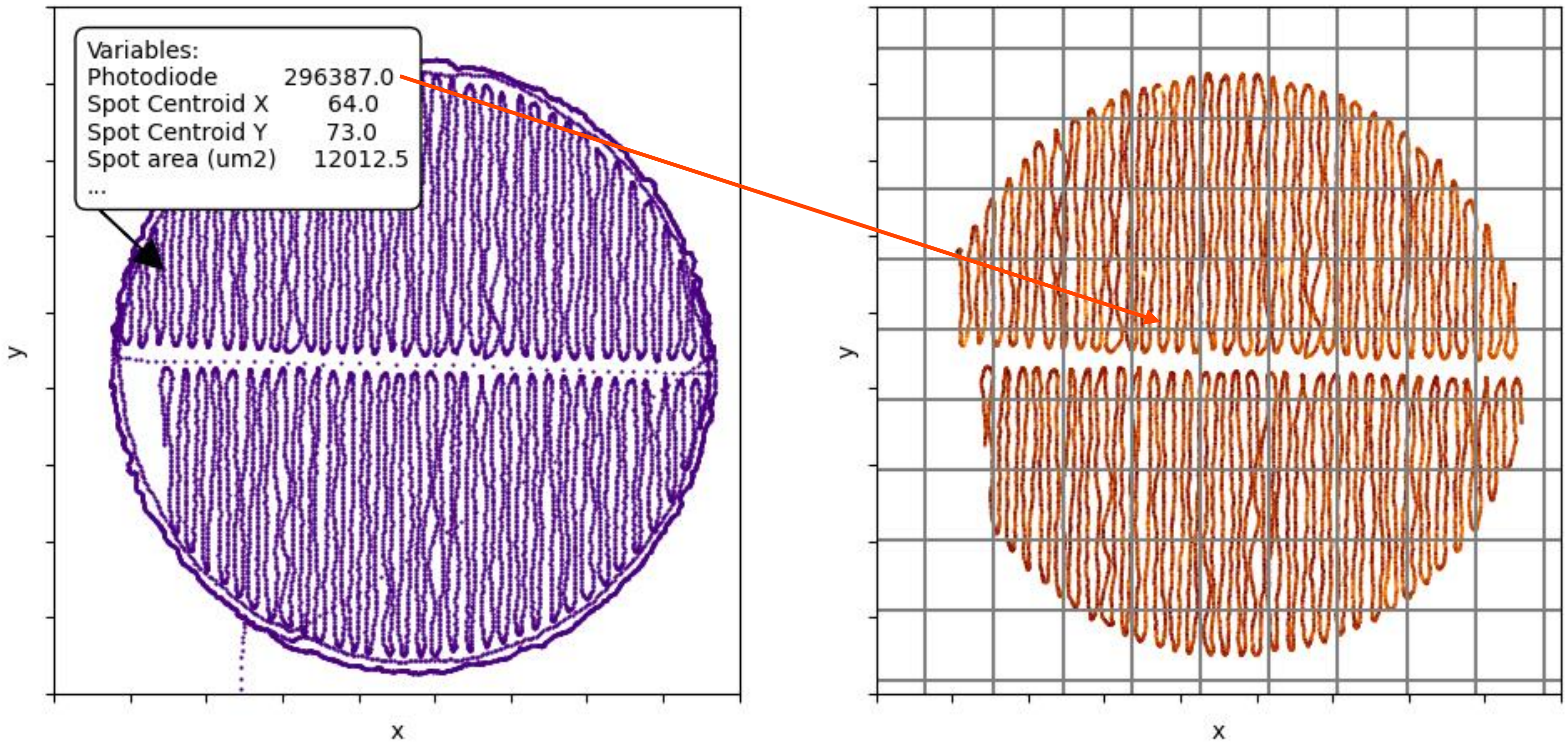

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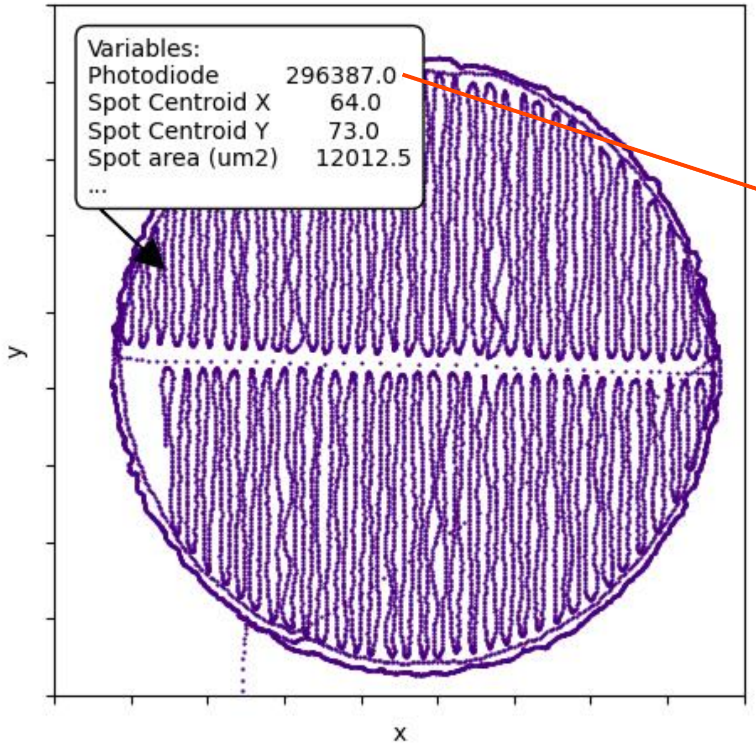

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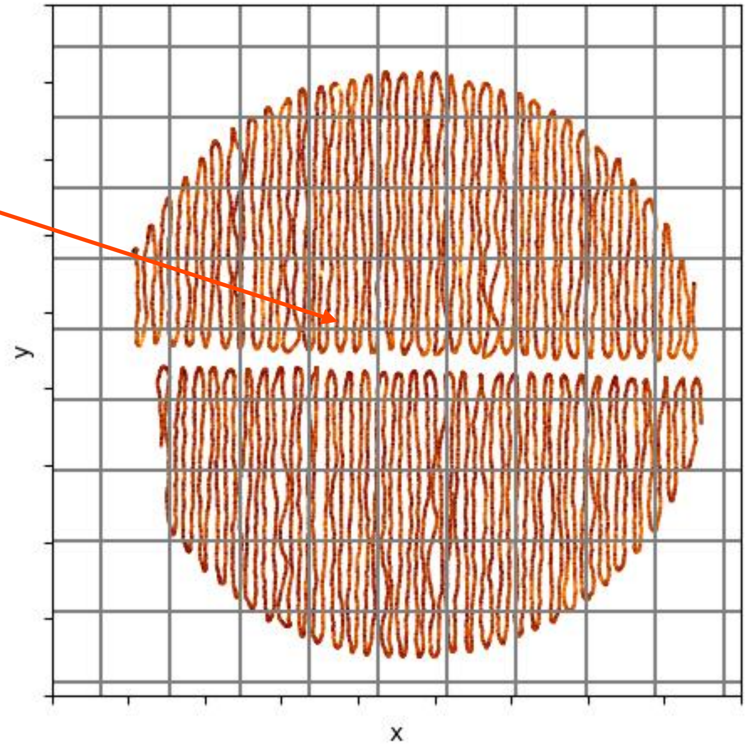

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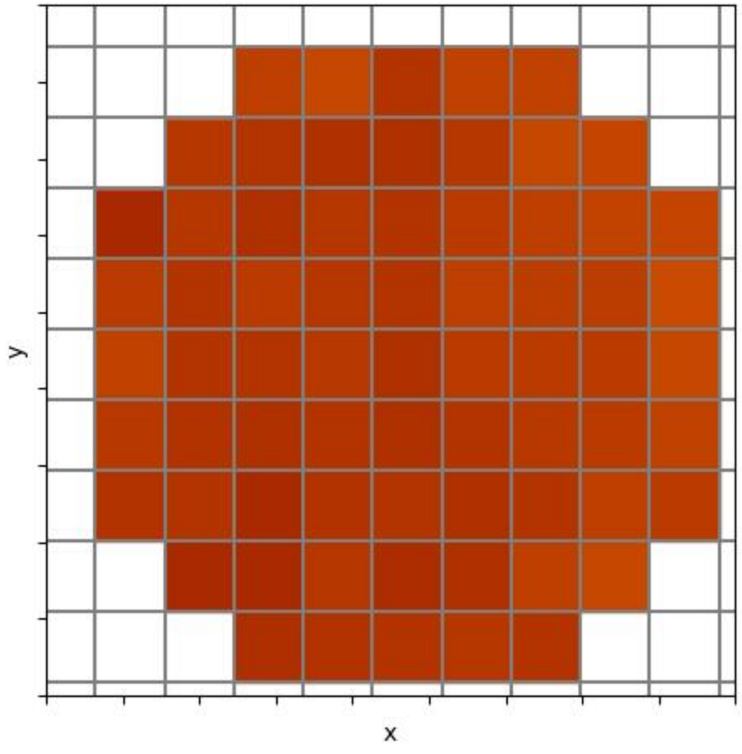
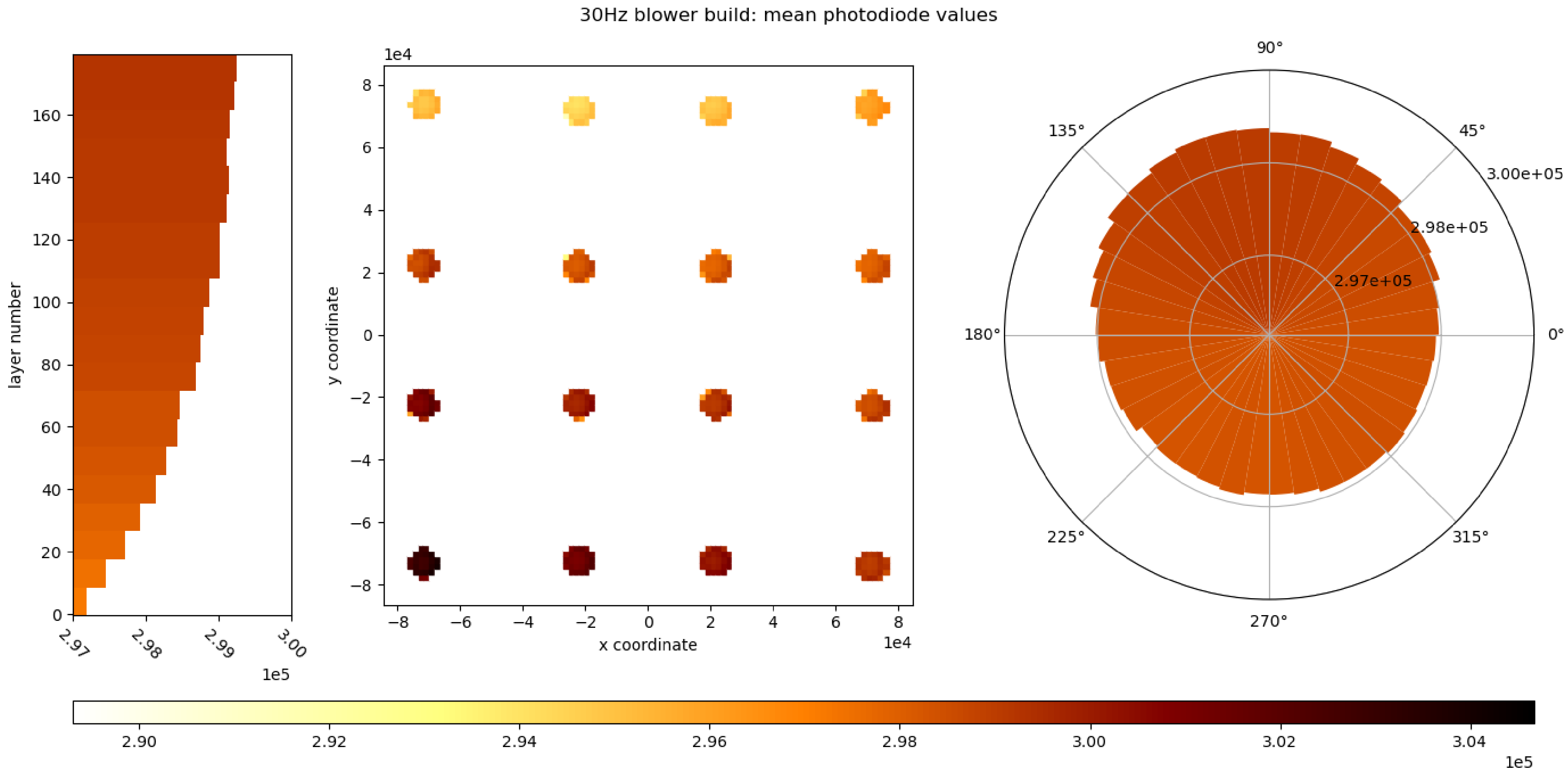


Case study: disrupted gas flow
Variable: photodiode values



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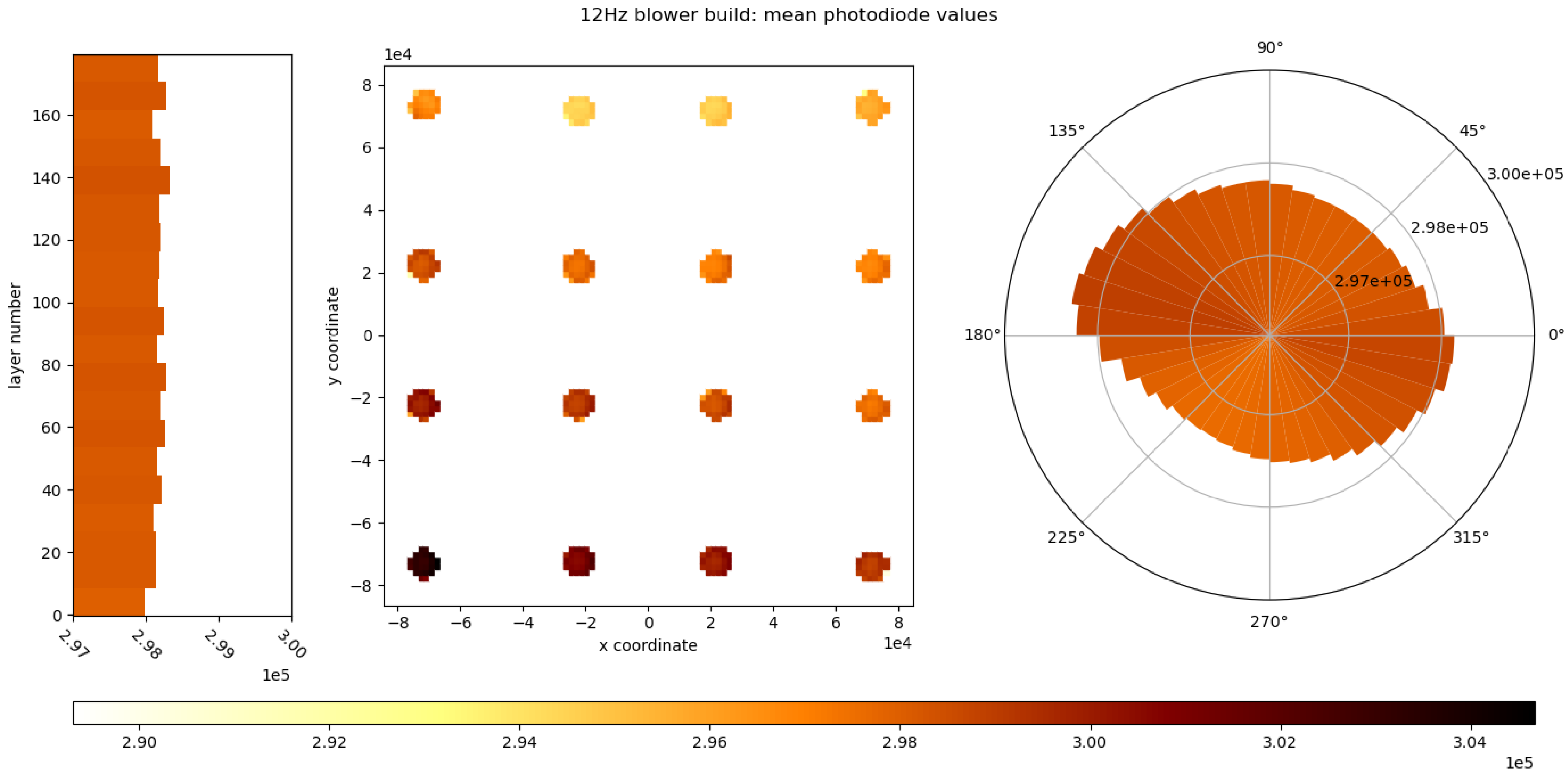

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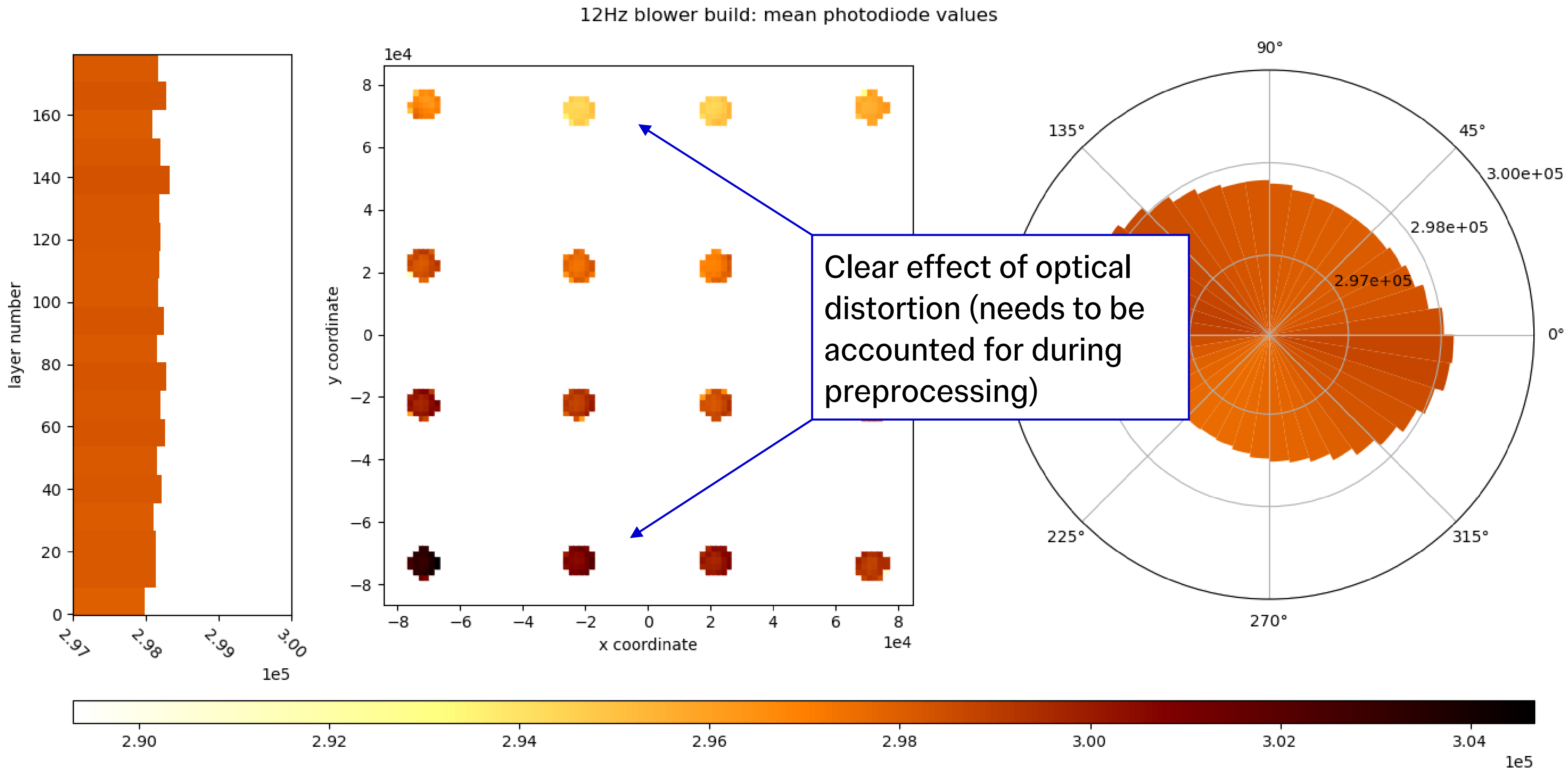

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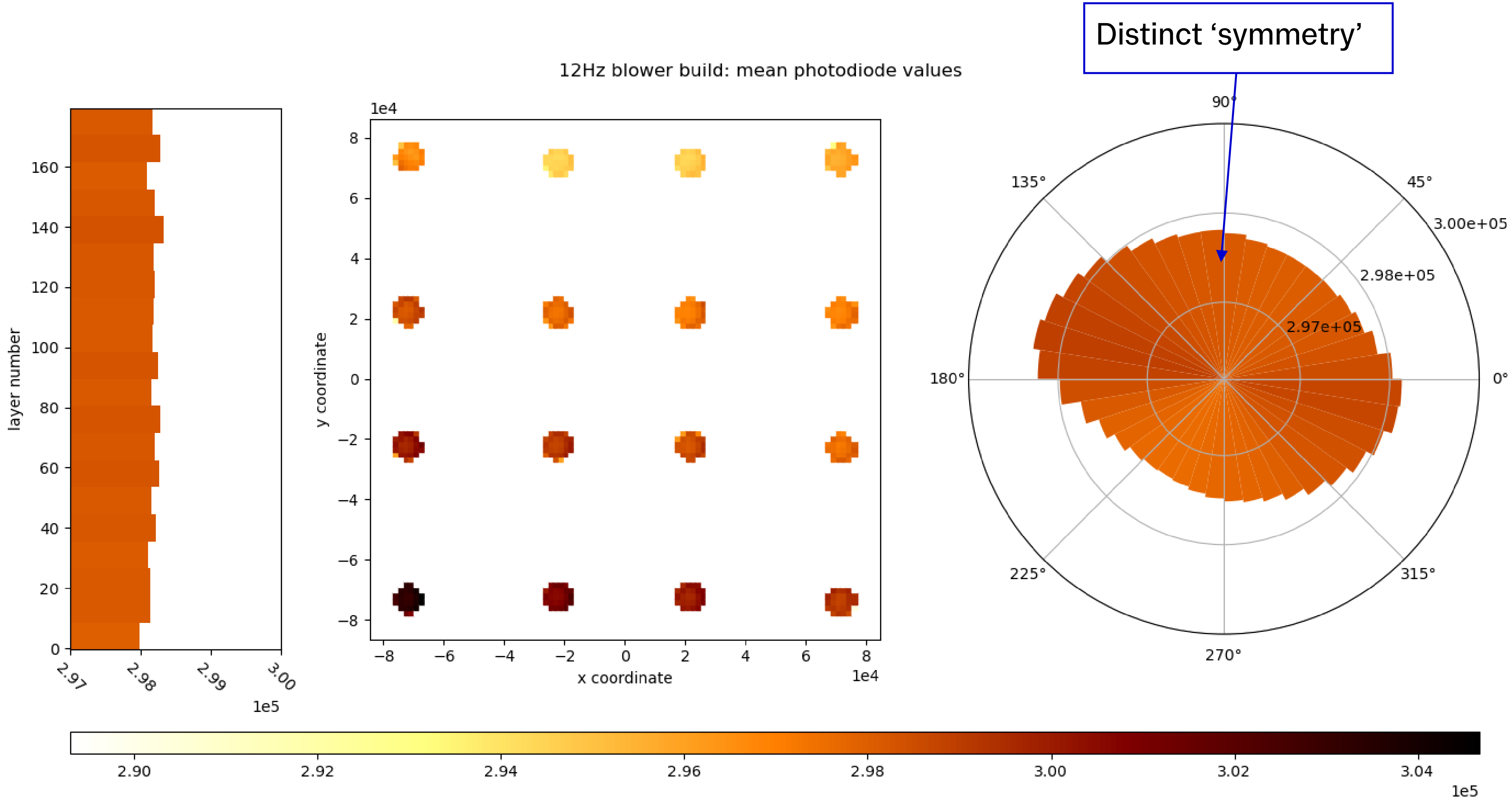
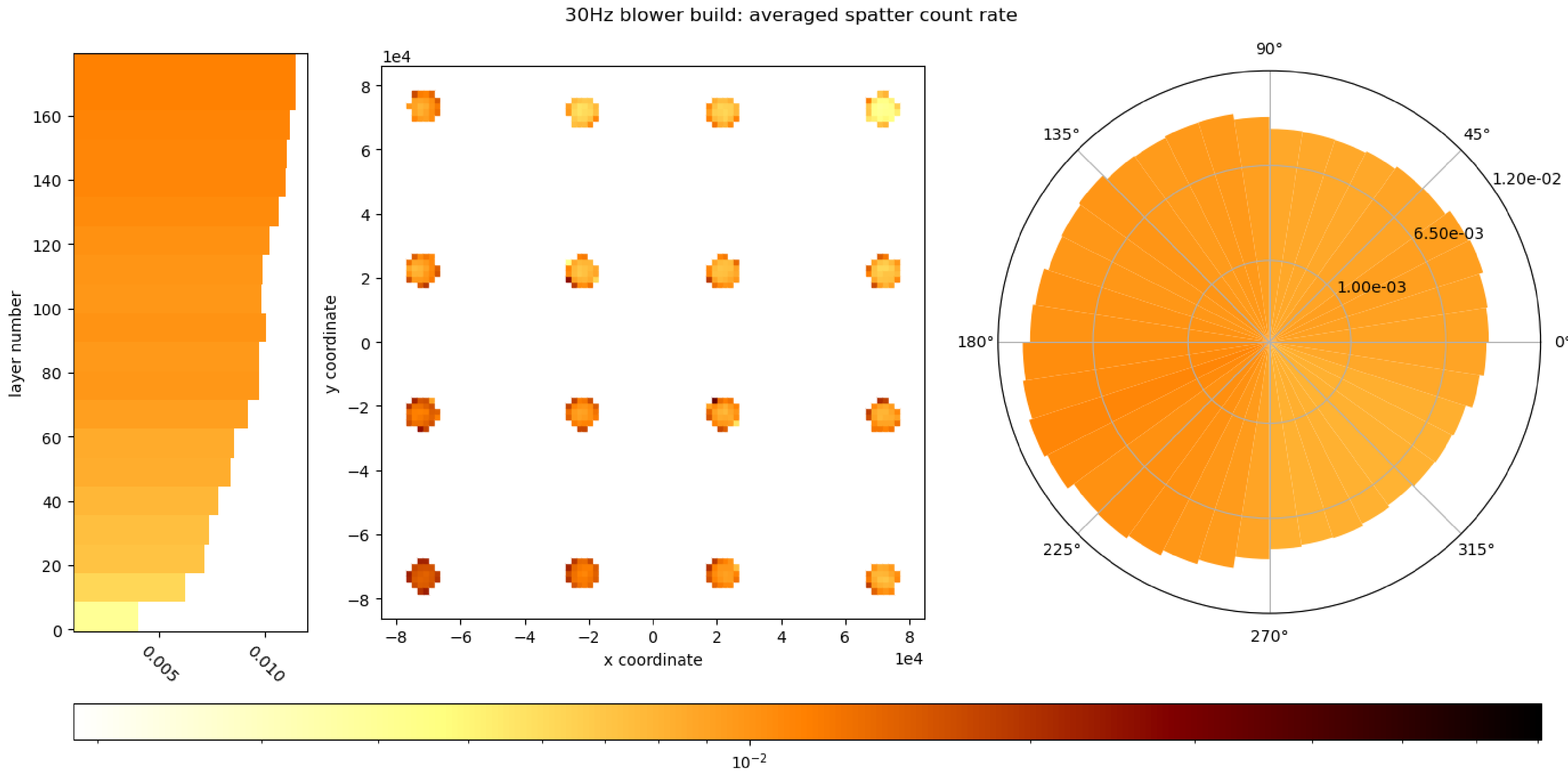


Case study: disrupted gas flow

Variable: total spatter area



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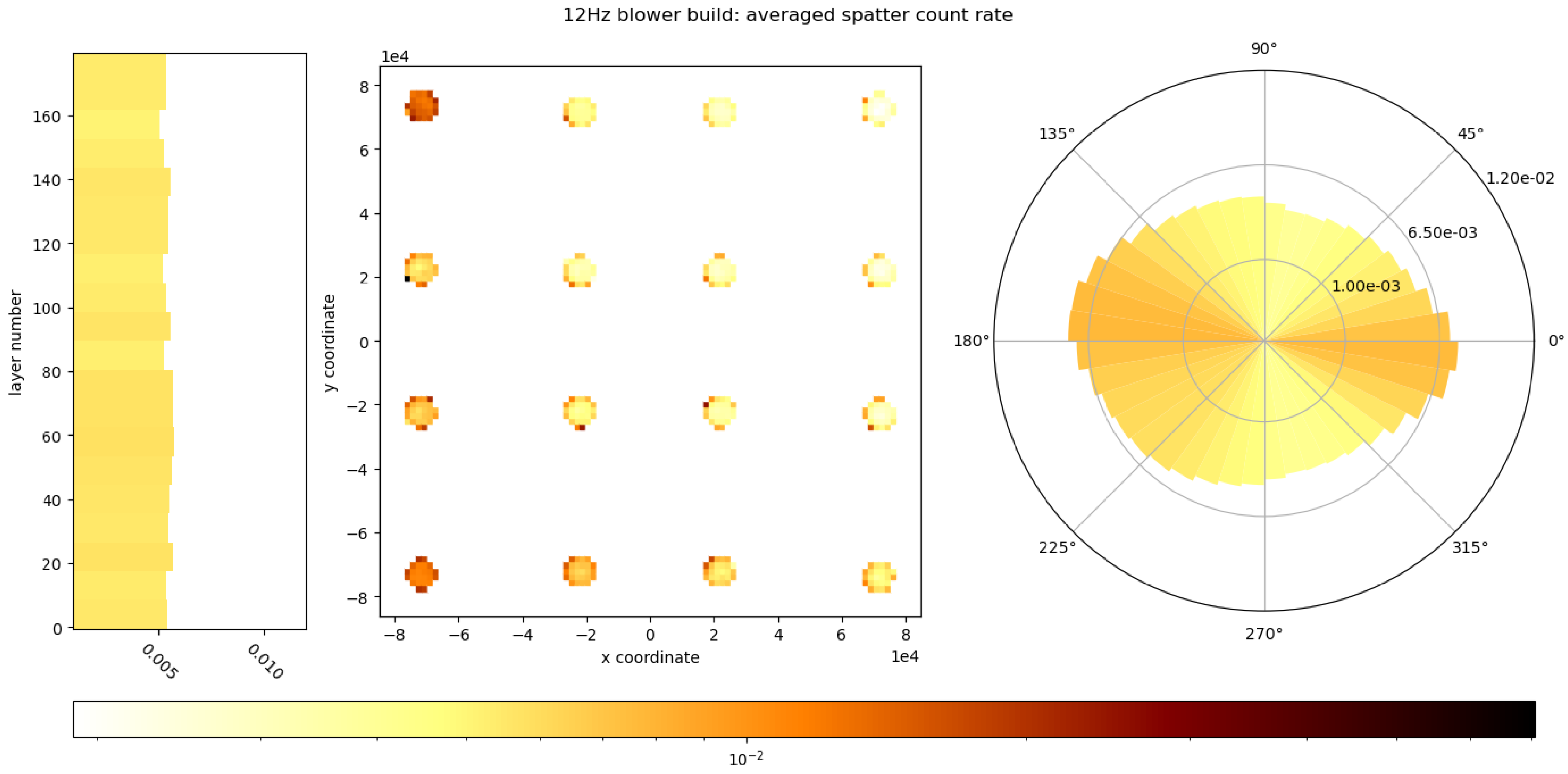

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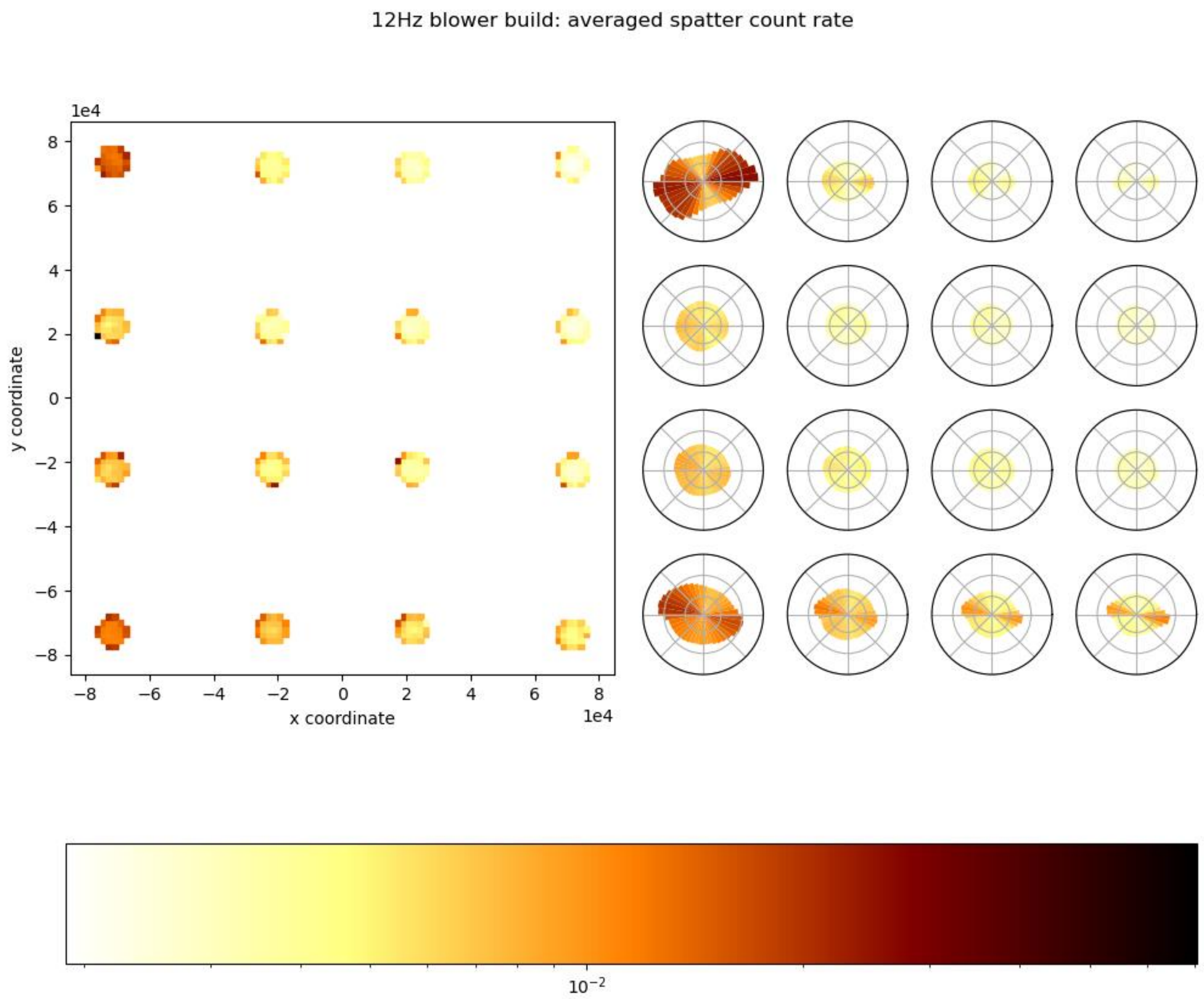
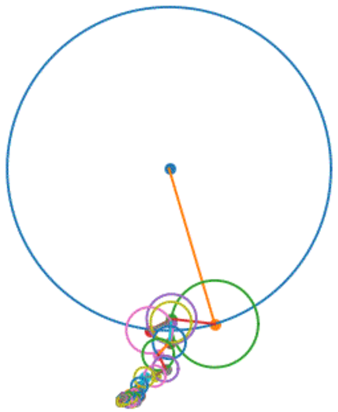


Methods
Hatch identification

The basic idea is to:

- Take each path section, a set of data coordinates $\{\boldsymbol{x}(t), \boldsymbol{y}(t)\}$.
- Apply a Fourier transform (FFT), $g(\boldsymbol{\omega}) = \mathcal{F}(\boldsymbol{x} + i\boldsymbol{y})$
- Filter out the high frequency components.
- Reconstruct / inverse transform (IFFT) and calculate a reconstruction score. Should fail to reconstruct hatch sections but not perimeter scan sections.
- Reject or accept sections based on this score.



Animation credit: https://towardsdatascience.com/teach-and-learn-the-fourier-transform-geometrically-ce320f4200c9

Methods

Code overview

I've put together a jupyter notebook with examples of how to use the code, and a detailed description of the workflow and visualisations in markdown:
https://github.com/PatLT/lpbf-dfct-analysis/blob/master/examples/complete_notes.ipynb

In addition, the library is fully documented via docstrings in the code.