# STARFISH[PY]

## D. Lens[1], H. Klingbeil[2]: A Versatile Toolchain for the Analysis of Synchrotron RF Systems' Data
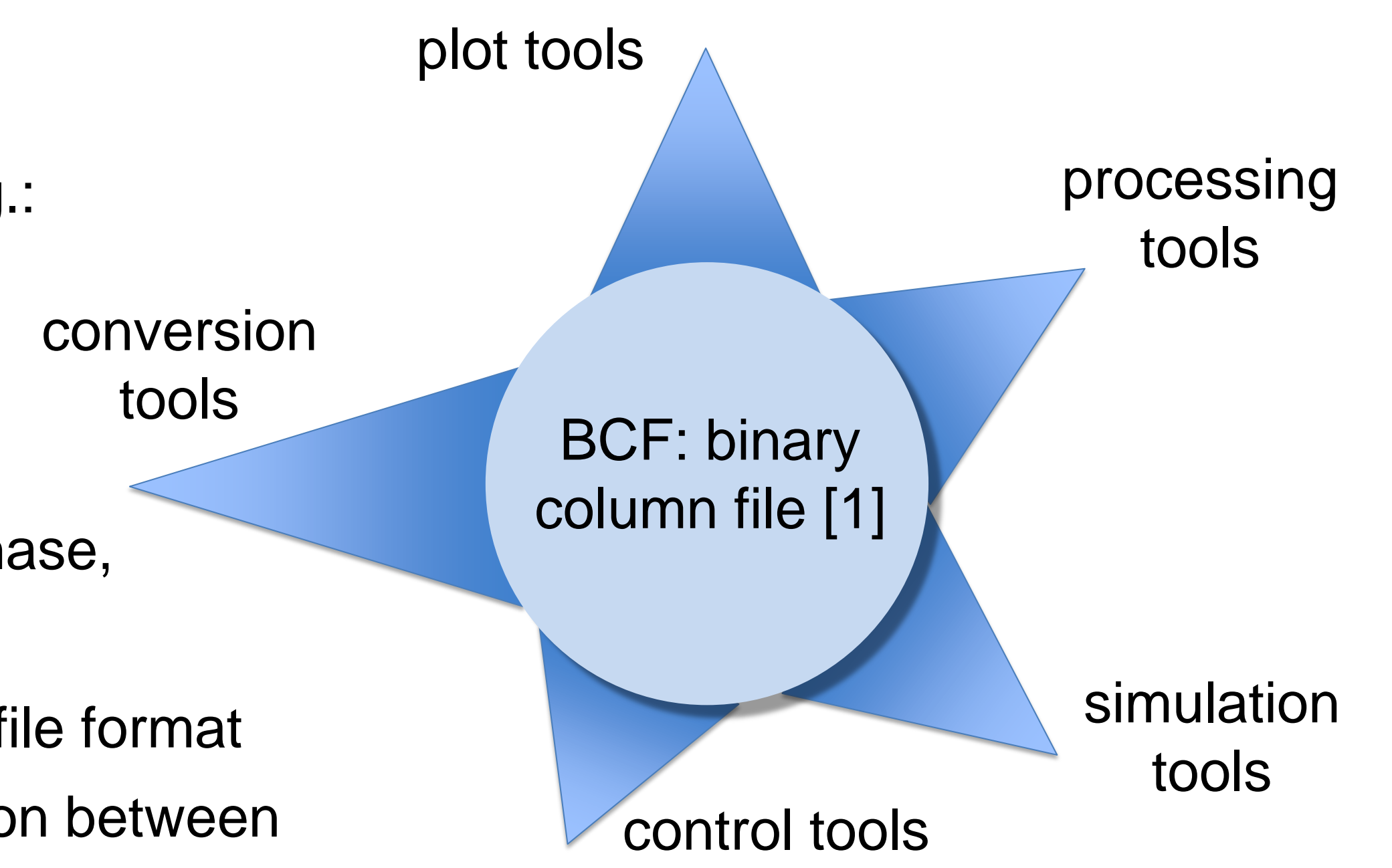
**GSI**

### Overview:

- **S**oftware **T**ools for **A**ccelerator **RF** **I**nstrumentation via Command **Sh**ell using **Py**thon
- Set of command-line tools, combination in batch scripts to realize more complex operations
- Standardized file formats for data exchange [1]
- Demonstration on **experimental data of heavy-ion synchrotron SIS18 at GSI**
- Publication under GNU GPL Version 3 after implementation of more tools is planned

Measurement data (continuous, segmented) e.g.:

- Gap voltage signal
- Beam current signal
- Reference signals
- Setpoint ramp signals: phase, amplitude, ...

Conversion to standardized file format that is used as communication between all tools (input/output files)
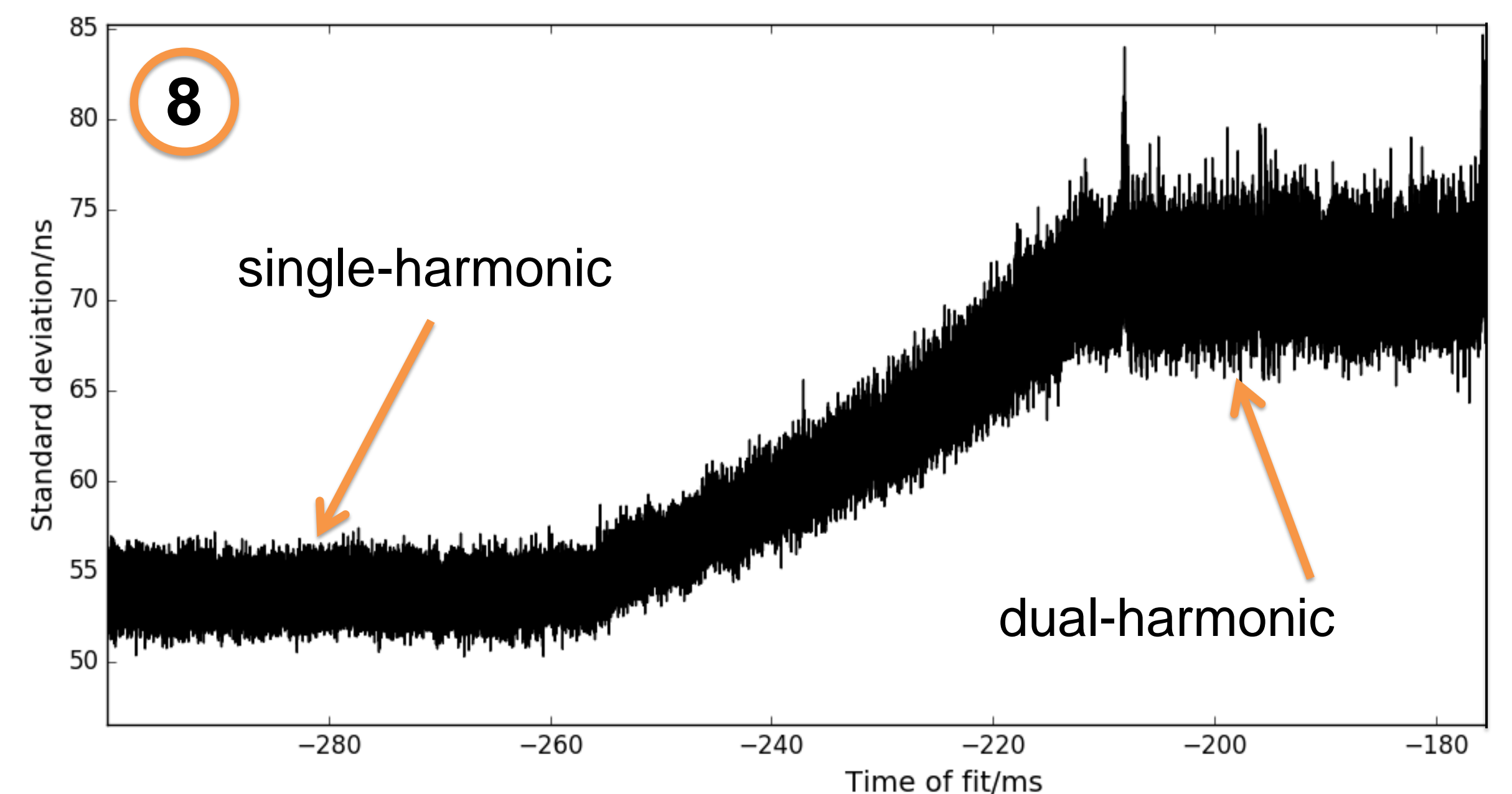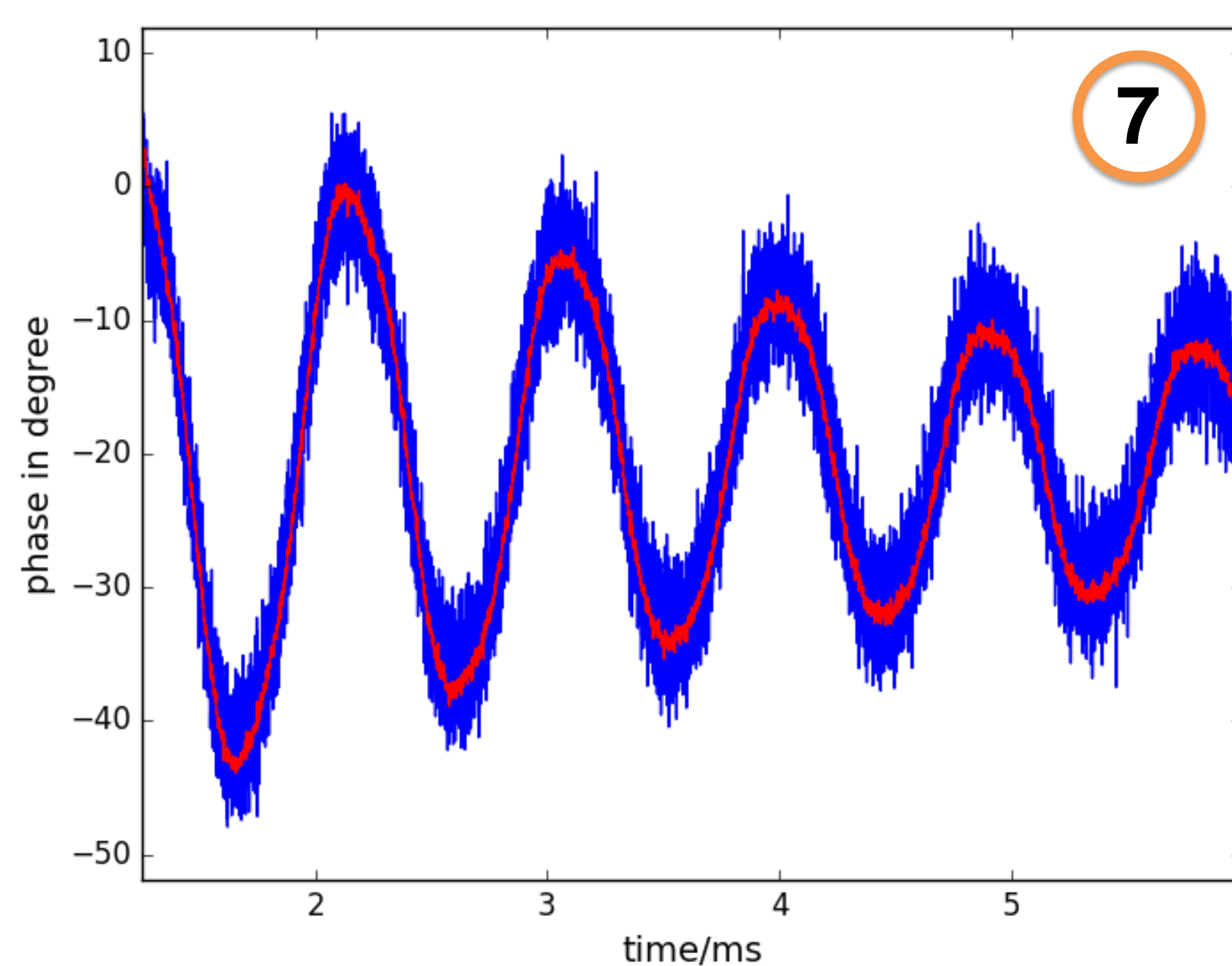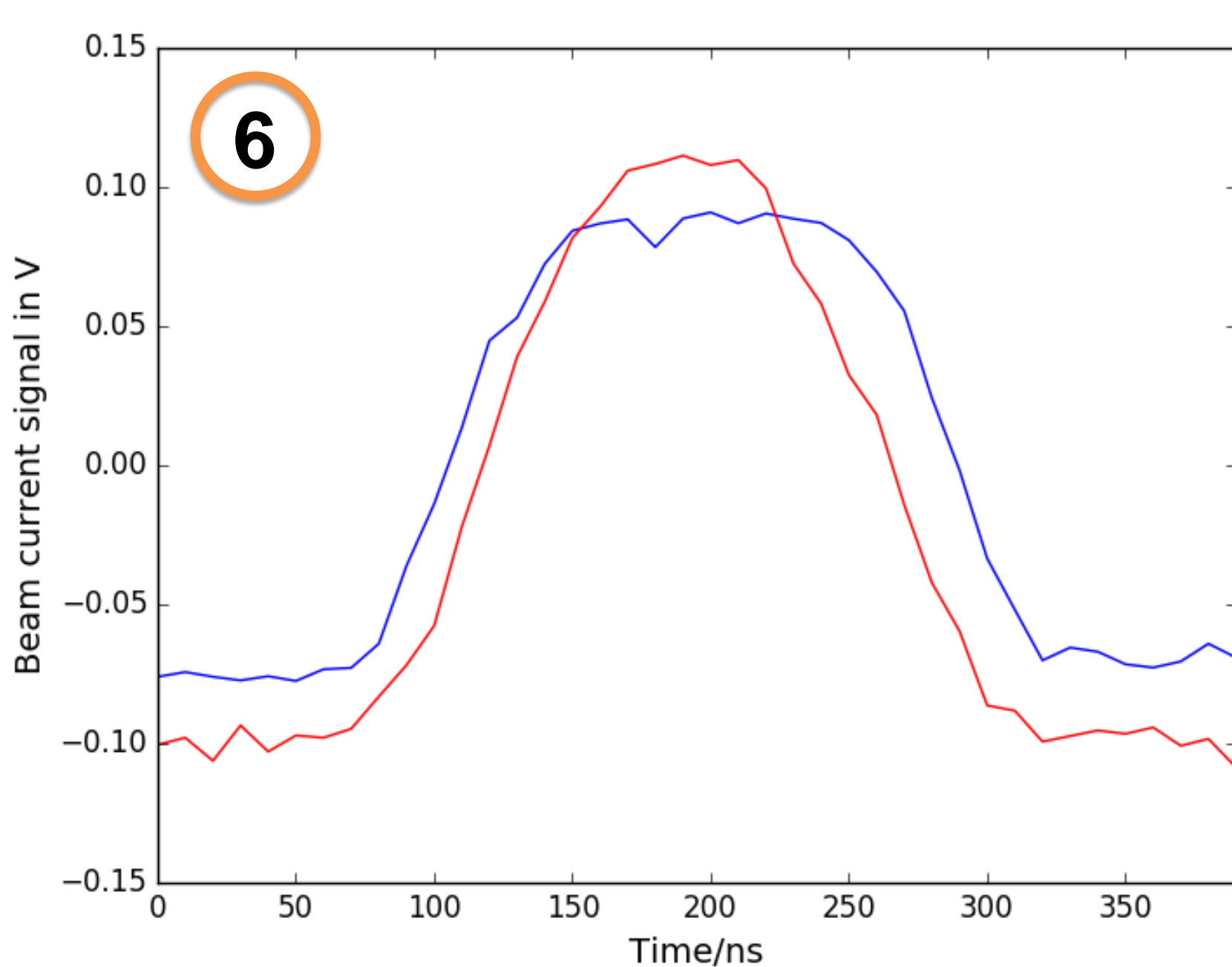
plot tools
processing tools
conversion tools
BCF: binary column file [1]
simulation tools
control tools

1. **Sine fit** tool estimates parameters of DDS reference signal

2. **Select** tool & **waterfall plot** tool: one RF period, i.e. one bunch, is selected

3. Analyze dipole oscillations at flattop

4. **Gaussian fit** tool: beam phase calculation

5. **Ramp data calculation** tool (from gap voltage and synchrotron parameters), including use of **averaging** tool



frequency jump: 200 Hz

**Beam Current Signal**
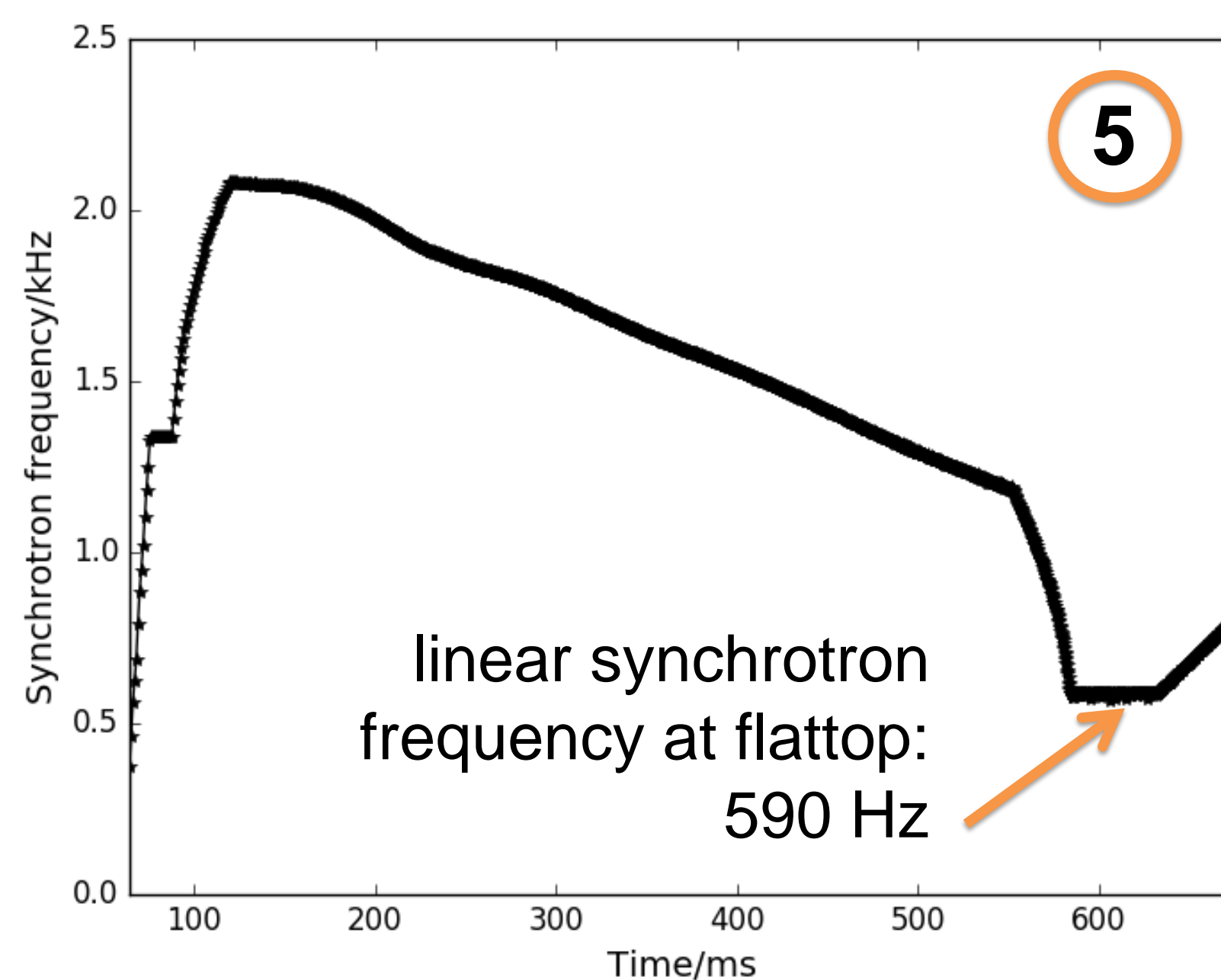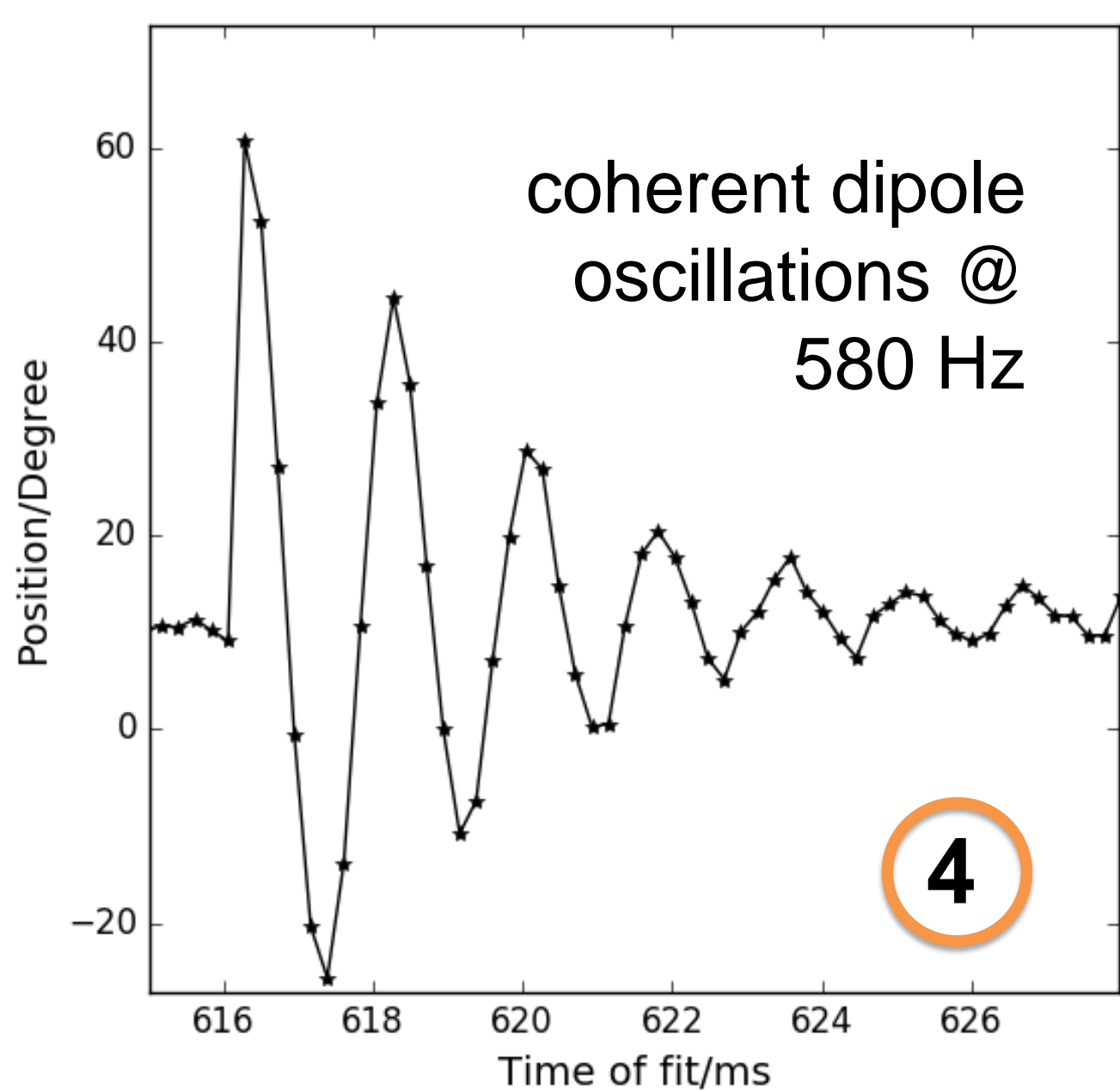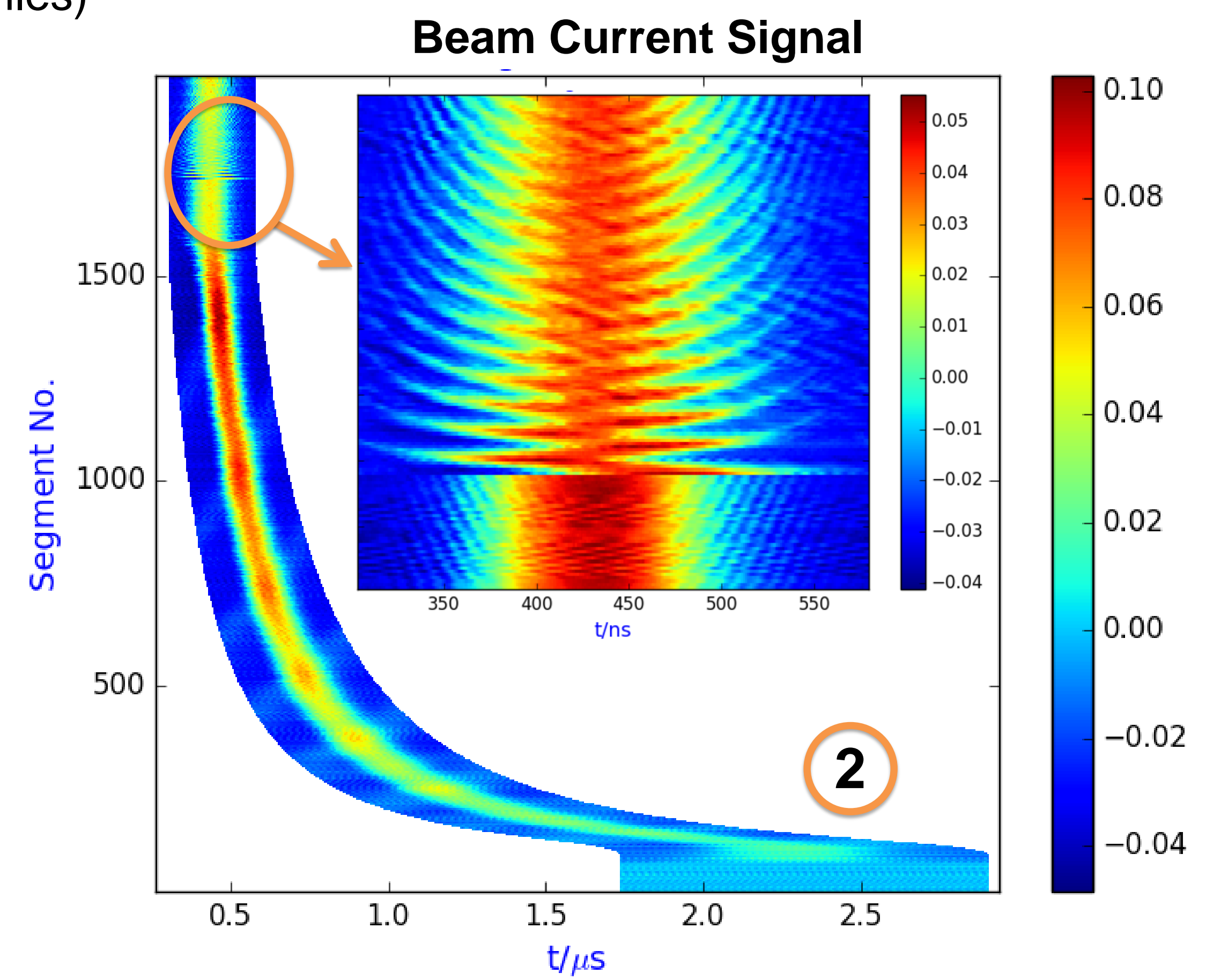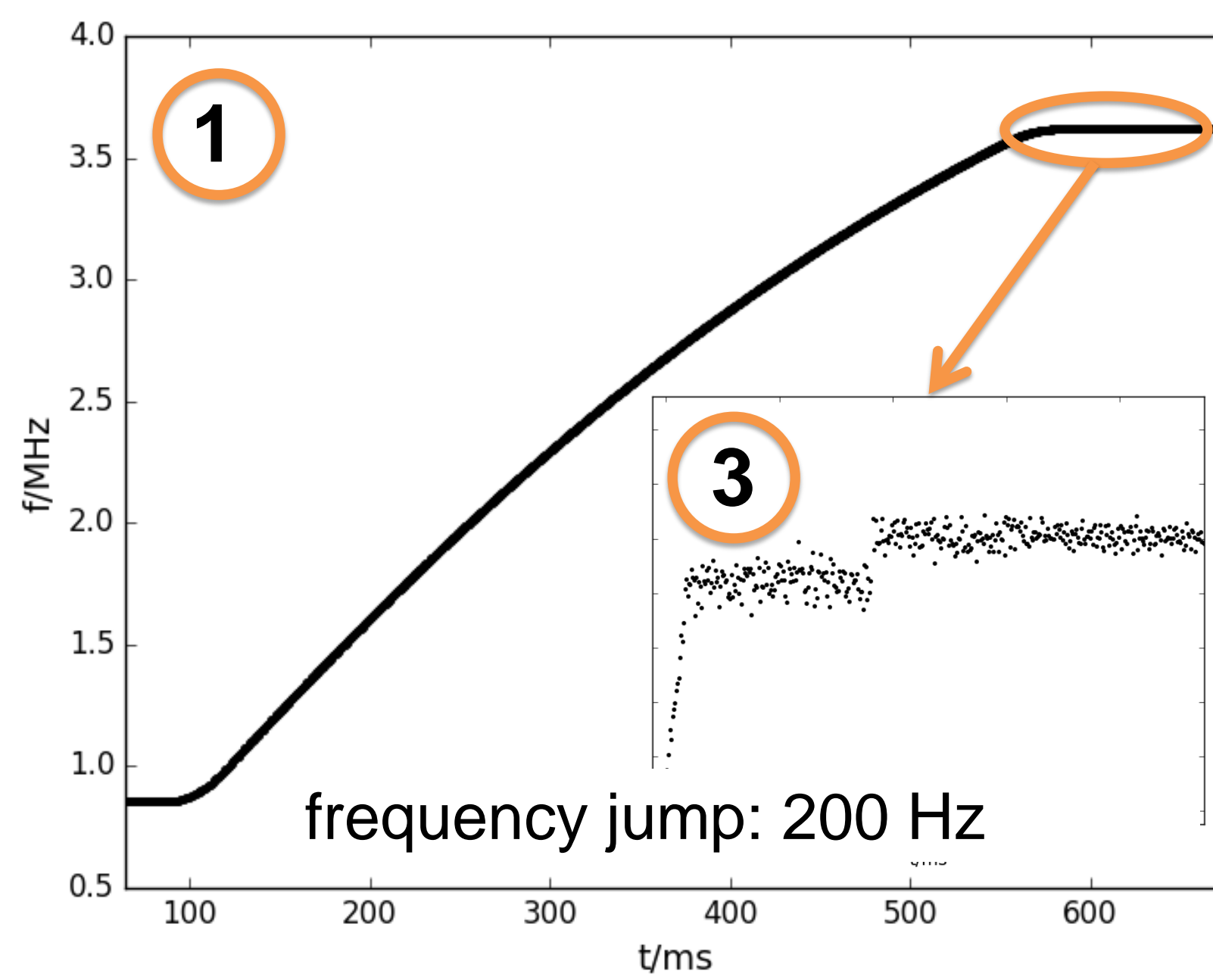
6. Bunch profile comparison: **single-** versus **dual-harmonic**

**Bunch parameter estimation:**

7. • Bunch phase (**Gaussian fit** of scope data versus **DSP system based online measurement**)

8. • Bunch size: standard deviation

coherent dipole oscillations @ 580 Hz

linear synchrotron frequency at flattop: 590 Hz

single-harmonic

dual-harmonic

9. Mountainrange plot of beam current signal: beam phase control without overshoot using numerical differentiation algorithm, phase change in 1.5 ms

10. Beam current signal of bunch merging during an intermediate flattop
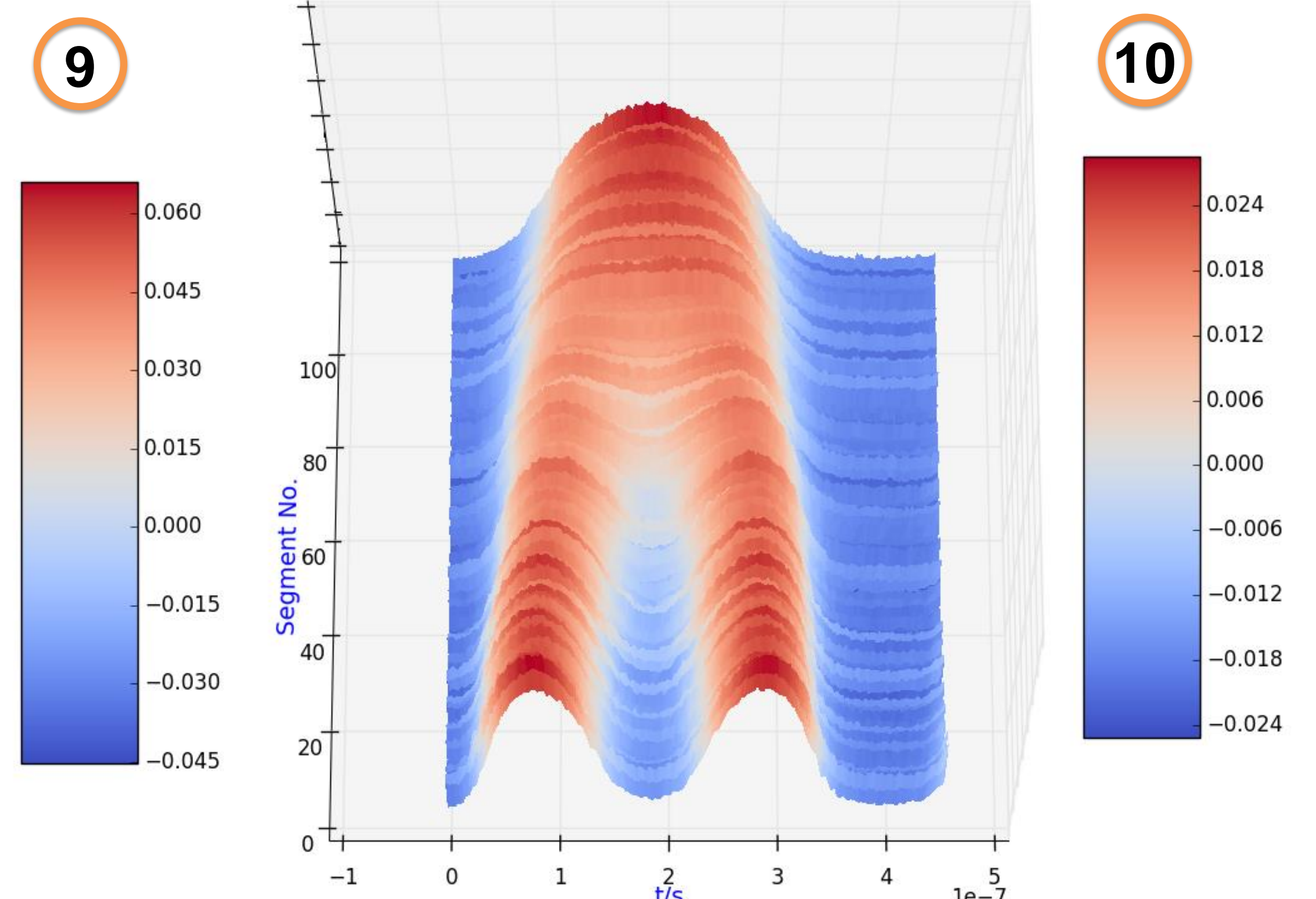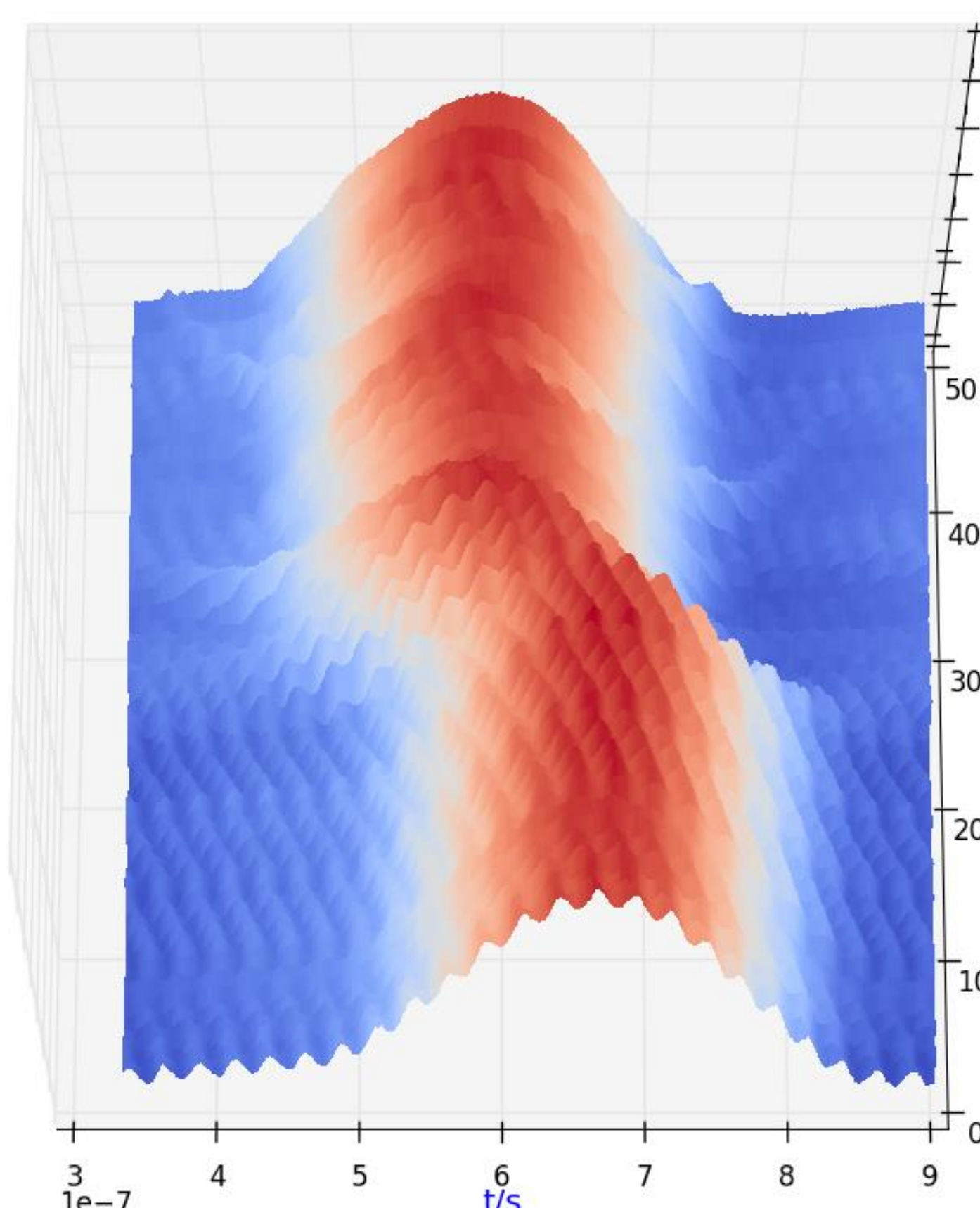
[1] H. Klingbeil et al.: „Data Analysis File Formats for RF Applications", GSI Note, Rev. 1.00, 11.10.2017.

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