- CBPM gain calibration - 4-wave method

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CESR acc. group meeting - Sept 18th, 2024

CBPM 4-wave gain calibration

Goal

- speed-up significantly data taking for gain calibration
- make full ring gain calibration a routine task

How

- introduce ring-wide wave to bump many locations at once
- 4 π/4 out-of-phase waves is enough for calibrating all locations

Machine study R&D

See instr. elog 2303

Message ID: **2303**	Entry time: **2024-06-11, 18:15, Tuesday**
Author:	Antoine T Chapelain, Vardan Khachatryan
Subject:	CBPM gain calibration R&D
Category:	Repair/Maintenance
Instrument:	CESR BPM
Sub-System:	CBPM_II
Shift Key:	20240611_1800

June 2024

before shutdown

Managed to collect **3** waves out of 4

See instr. elog 2330

Message ID: **2330**	Entry time: **2024-09-11, 16:19, Wednesday**
Author:	Antoine T Chapelain, Vardan Khachatryan
Subject:	CBPM calibration
Category:	Repair/Maintenance
Instrument:	CESR BPM
Sub-System:	CBPM_II
Shift Key:	20240911_1600

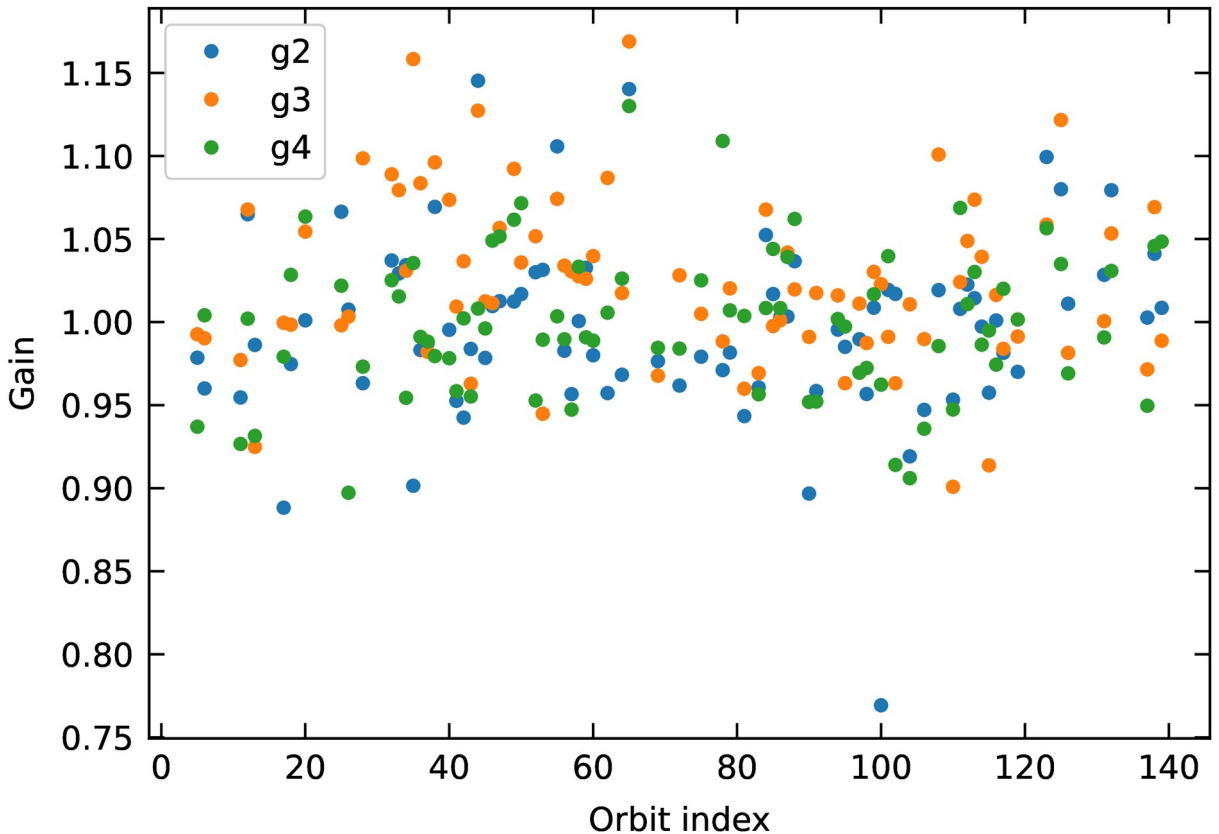
September 2024

after shutdown

Managed to collect **4** waves out of 4

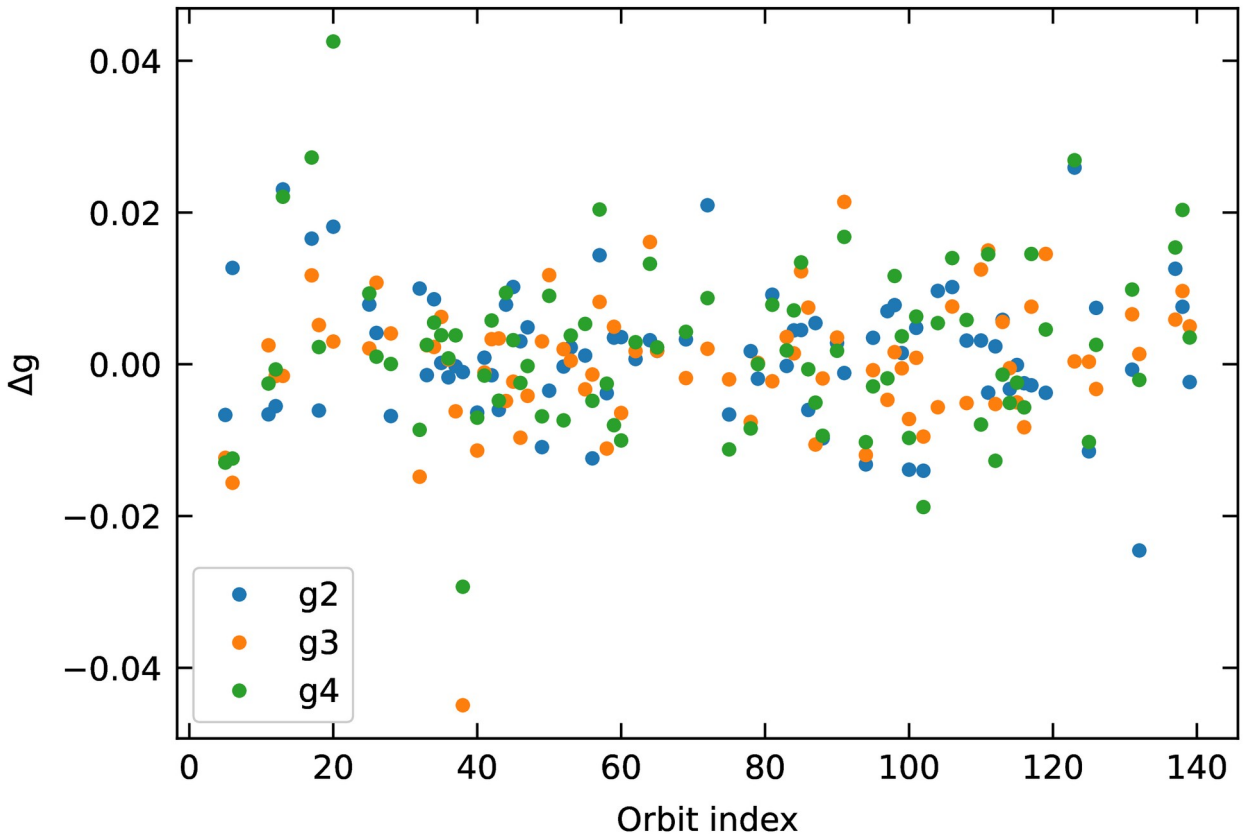
Measured gains

4 waves - exclude locations with only 3 working buttons, objective function **< 1e-4**



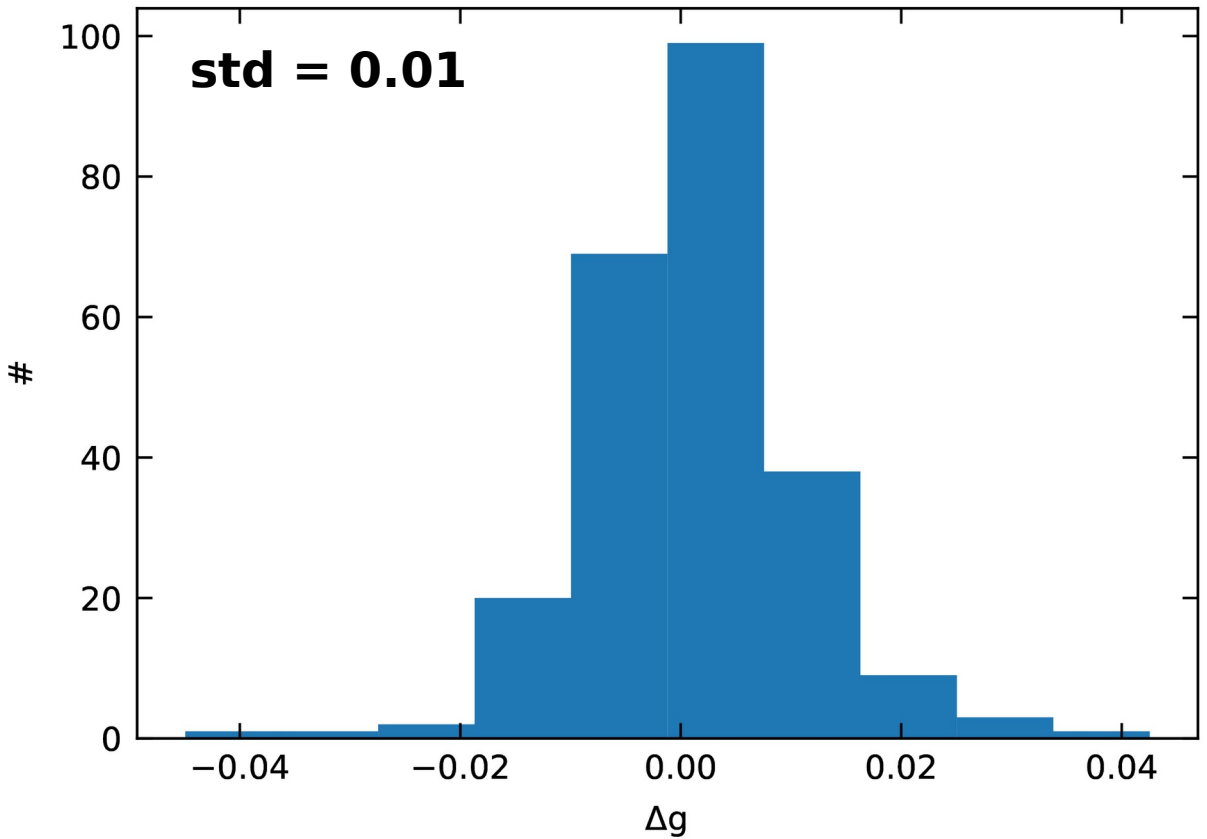
Comparison: 4 v. 3 waves

Exclude locations with only 3 working buttons, objective function **< 1e-4**



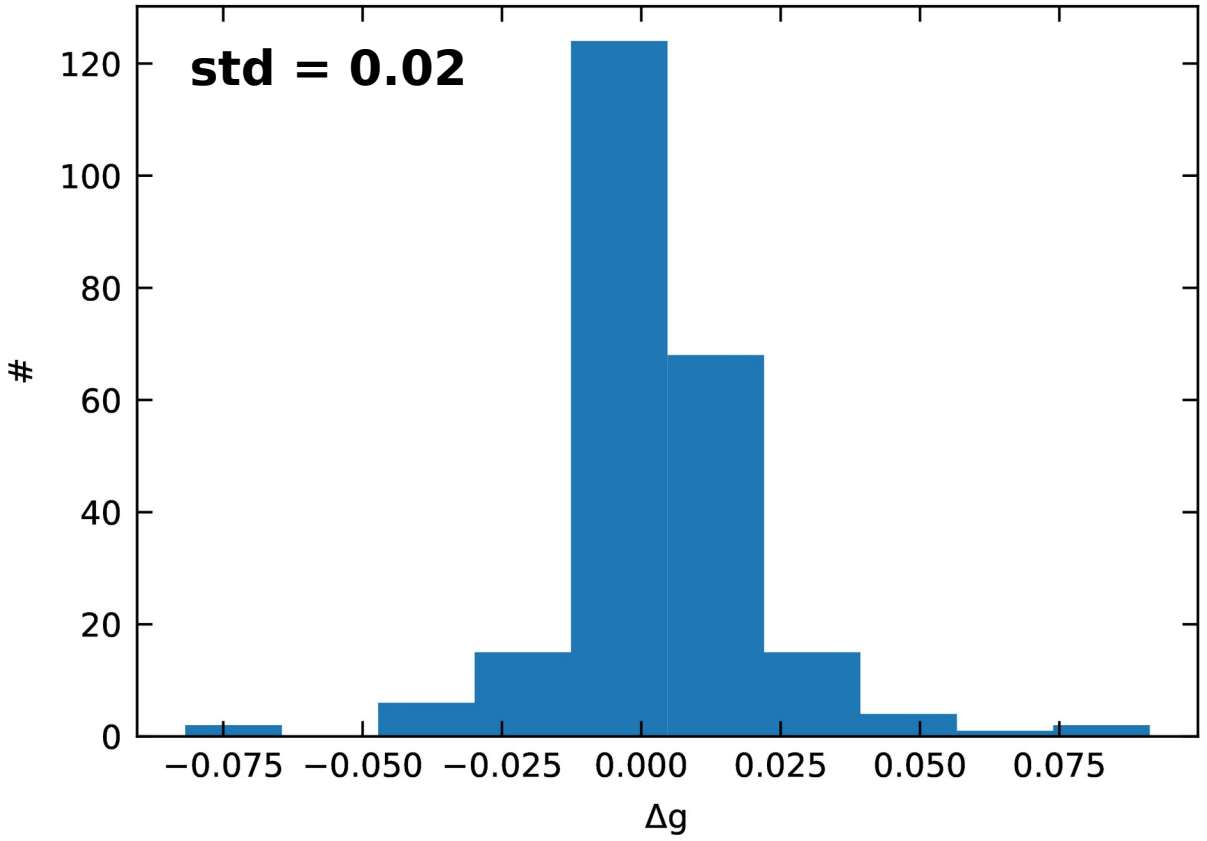
Comparison: 4 v. 3 waves

Exclude locations with only 3 working buttons, objective function **< 1e-4**



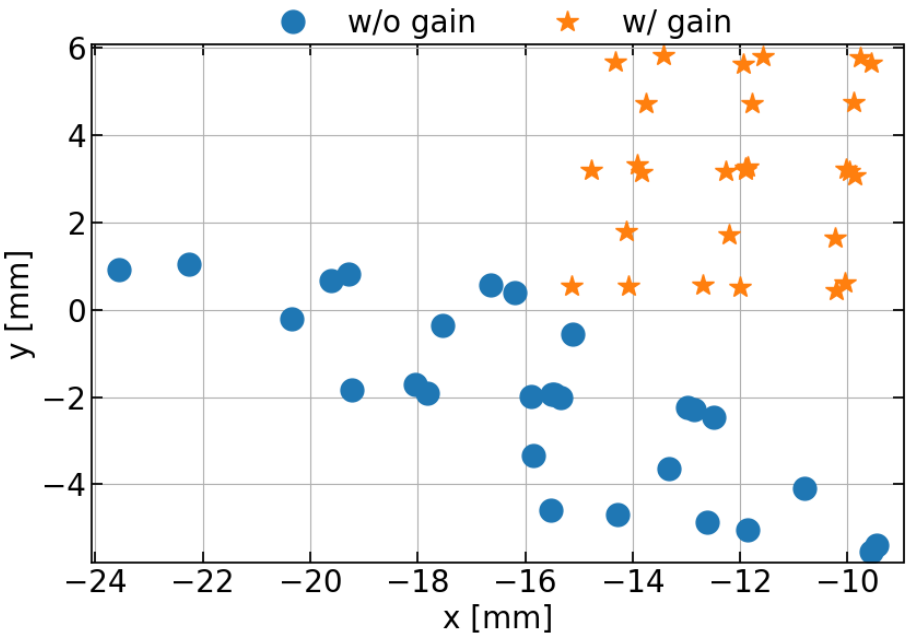
Comparison: 4-wave v. “bump gain”

Exclude locations with only 3 working buttons, objective function **< 1e-4**

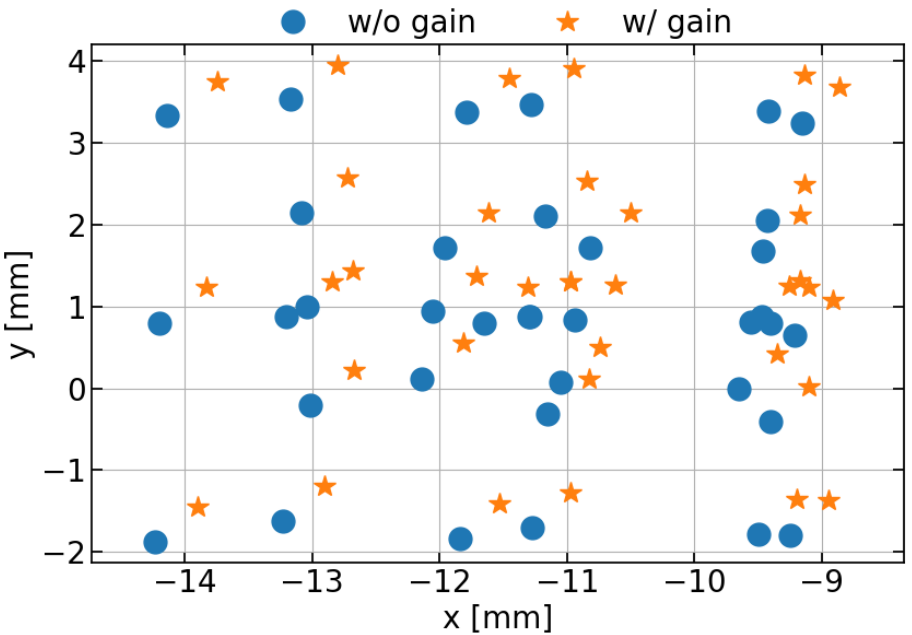


34W: 4 v. 3 waves

34W looking good this time around!



3 waves



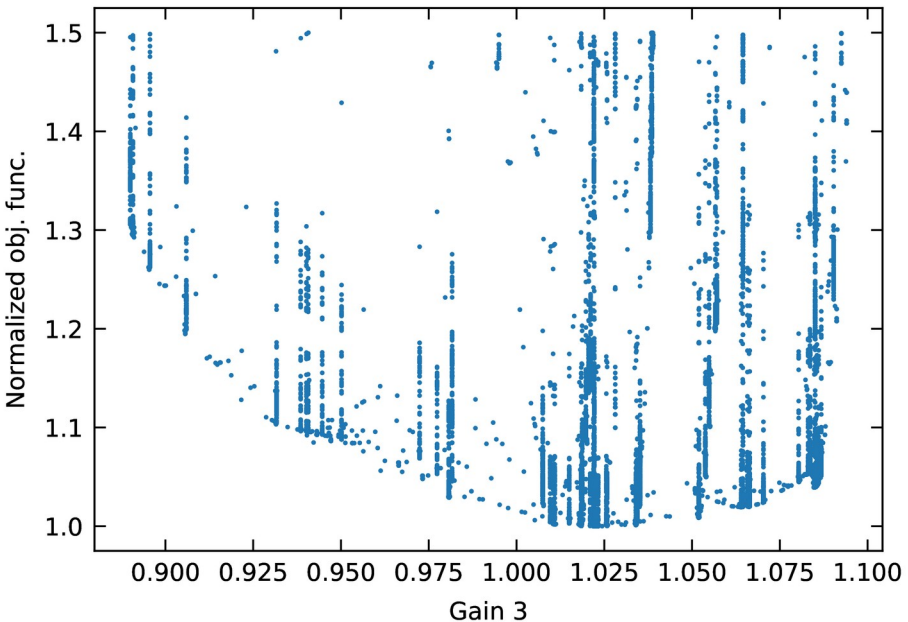
4 waves

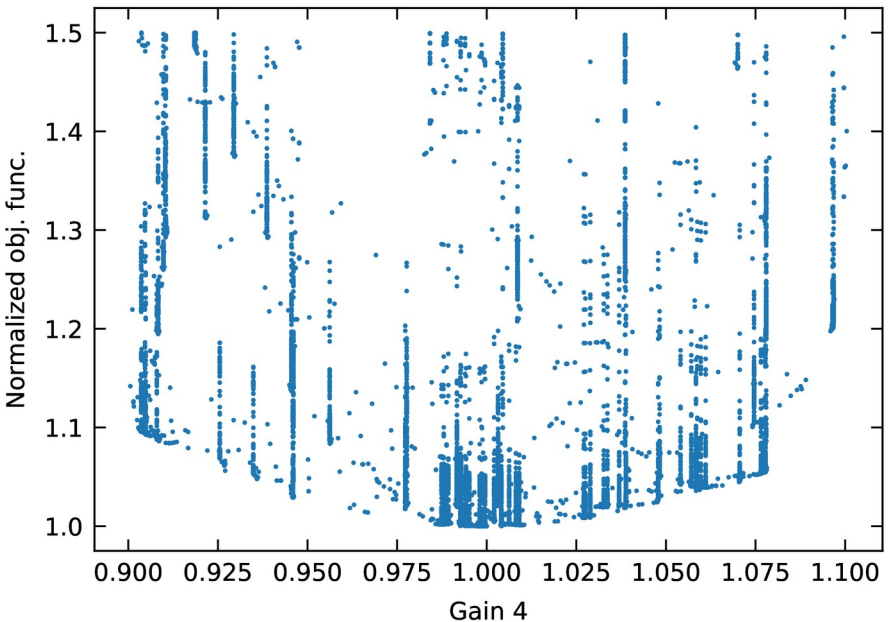
4-wave issue at some locations

Some locations showed obj. fun. > **1e-4**: X4A, 30E, 17E, X3D, 34E

- 34E had a timing issue
- other locations have no obvious issues

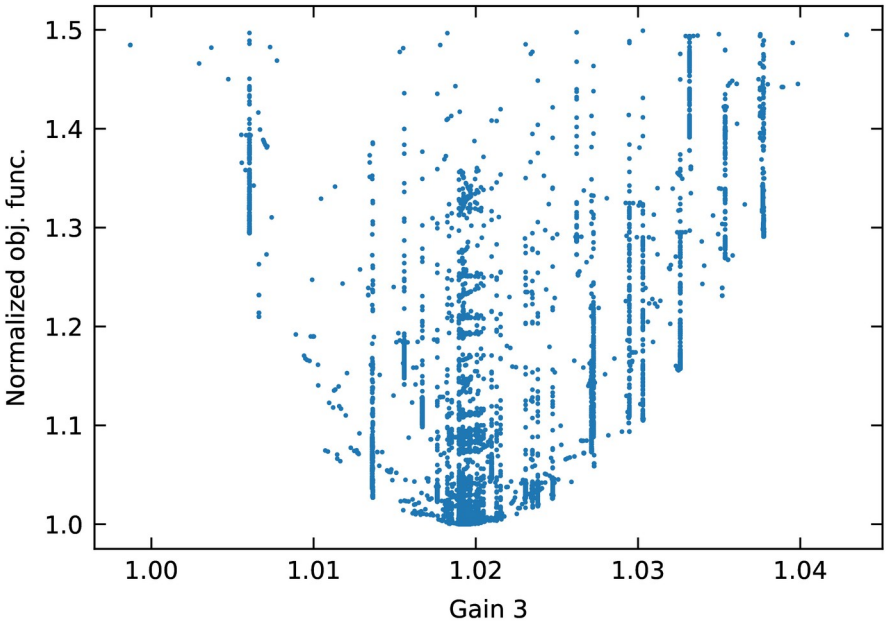
30E: a flat landscape

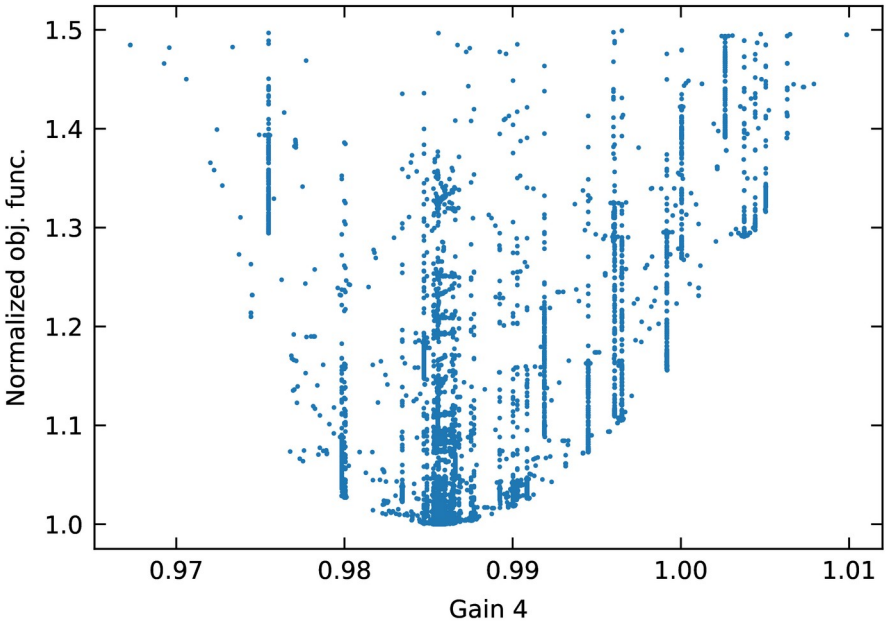




A “deep” landscape for comparison

18E





4 waves issue at some locations

Some locations showed obj. fun. > **1e-4**: X4A, 30E, 17E, X3D, 34E

- 34E had a timing issue
- 30E has a poor minimization convergence
- 17E, X3D and X4A look OK → need deeper dive

Takeaway

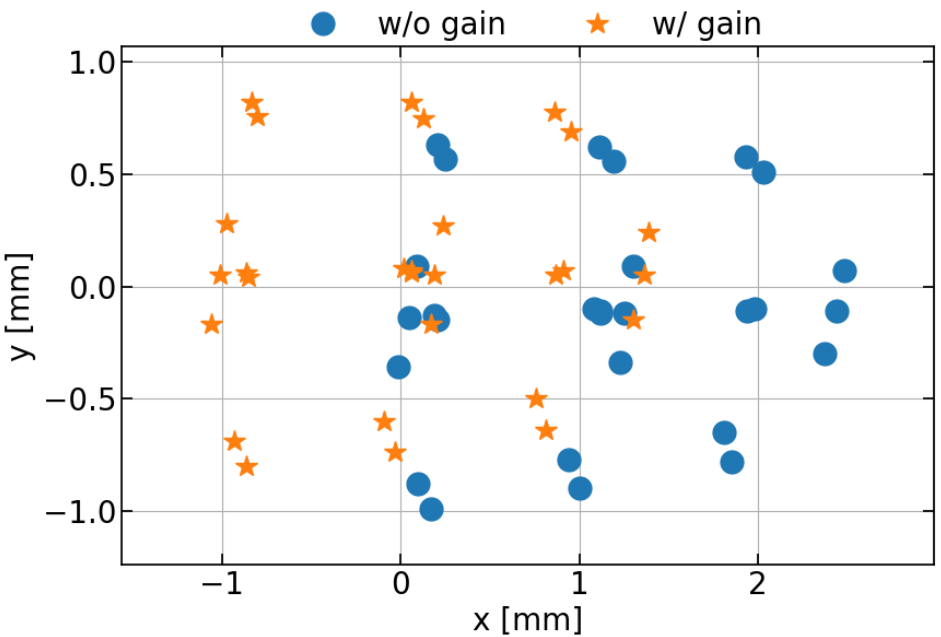
4-wave gain calibration is **a success**: 90 locations in one shift!

Let it become the standard procedure!

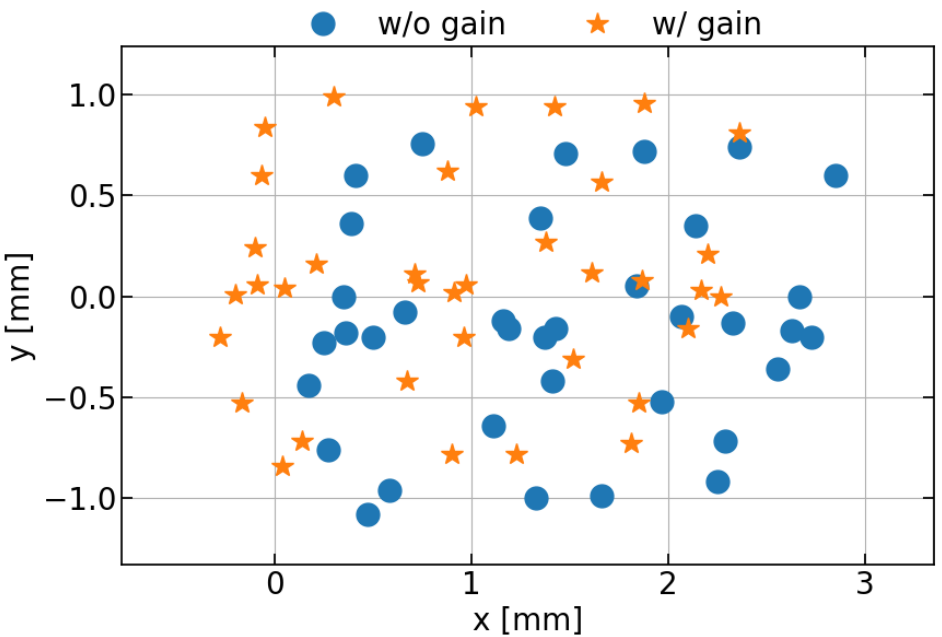
- automated data collection with steering strength change (10 minutes/wave)
- automated data analysis (15 minutes for the full 4-wave analysis)
- automated update of BPM_INST_params

Extras

X3D: 4 v. 3 waves



3 waves



4 waves