



LNE06 Transfer Line Commissioning

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Acknowledgments: W. Bartmann, C. Carli, M. Fraser,
D. Gamba, L. Ponce and All Operators

22 Feb 2021

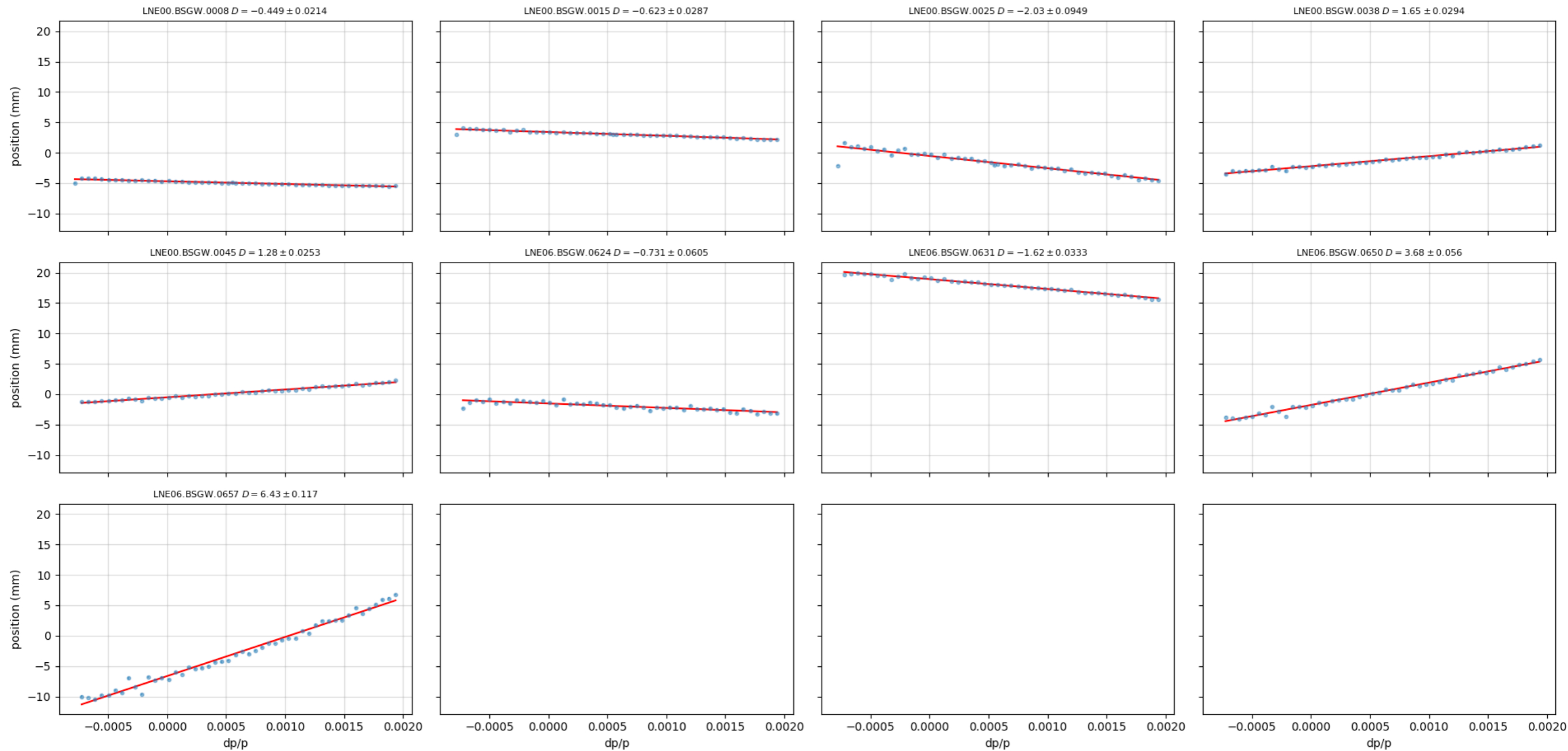
Outline

1. Dispersion Measurement at LNE06 (& Comparison with LNE00s)
2. Optics Measurement using different LNE06.BSGs
3. LNE06 Optics Comparison
4. Comparison with LNE00s

Conclusion & Outlook

1.1. Horizontal Dispersion Measurement

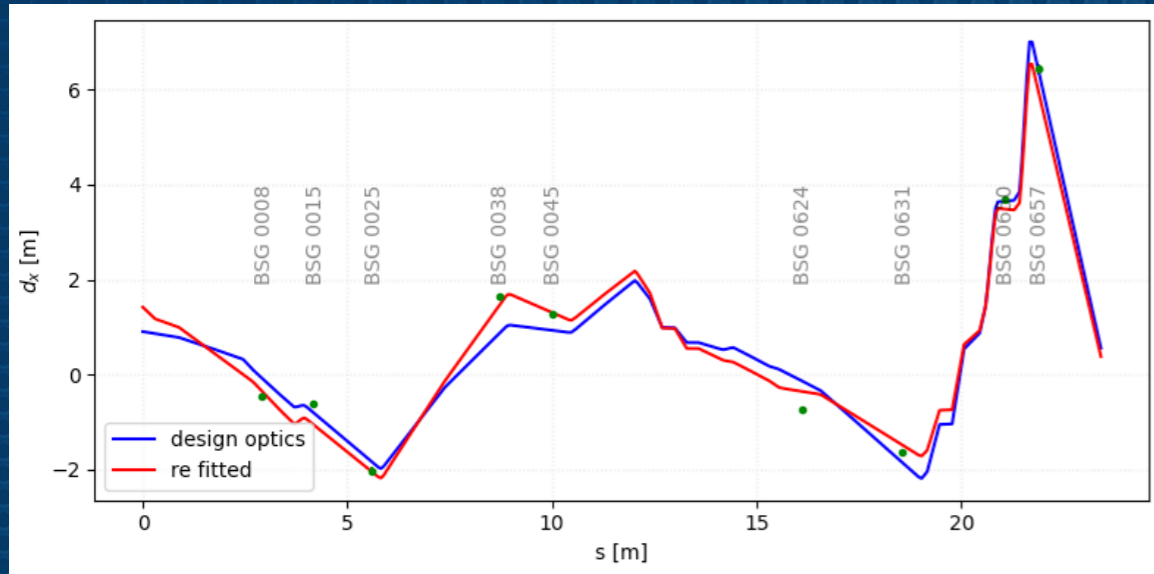
Measurement Date: 04 Feb 2021



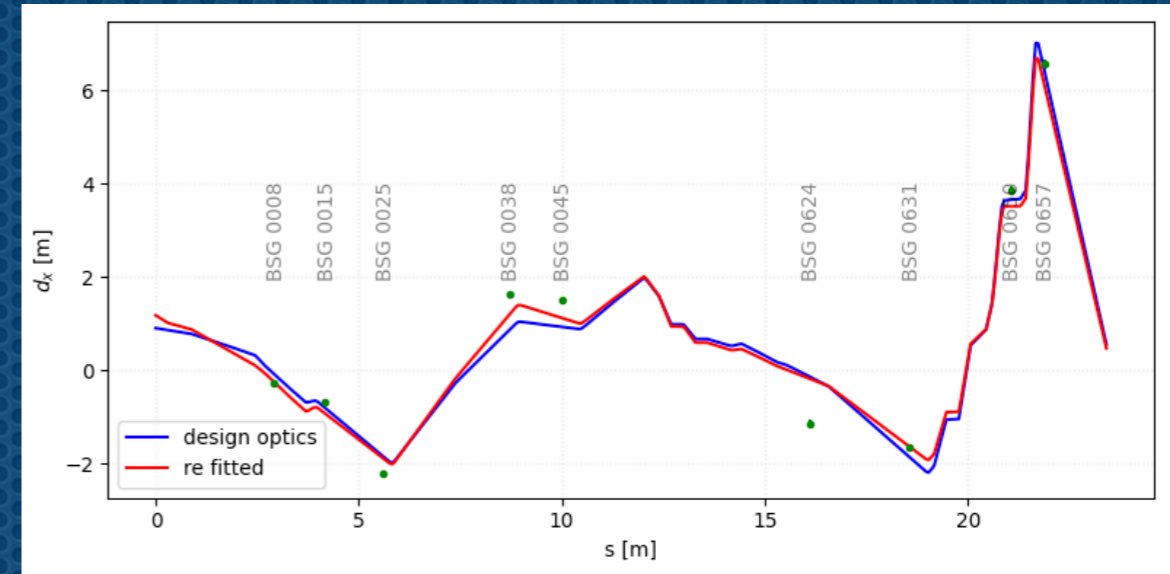
- The dispersion values at each Grid Monitor (**except 0611**) towards ASACUSA-I exp. line. Note that ± 150 Hz vicinity of 144 kHz is scanned, and calculations are made for the theoretical revolution frequency ~ 143940.5 Hz.

1.1. Horizontal Dispersion Measurement

Measurement Date: 04 Feb 2021



Measurement Date: 12 Feb 2021

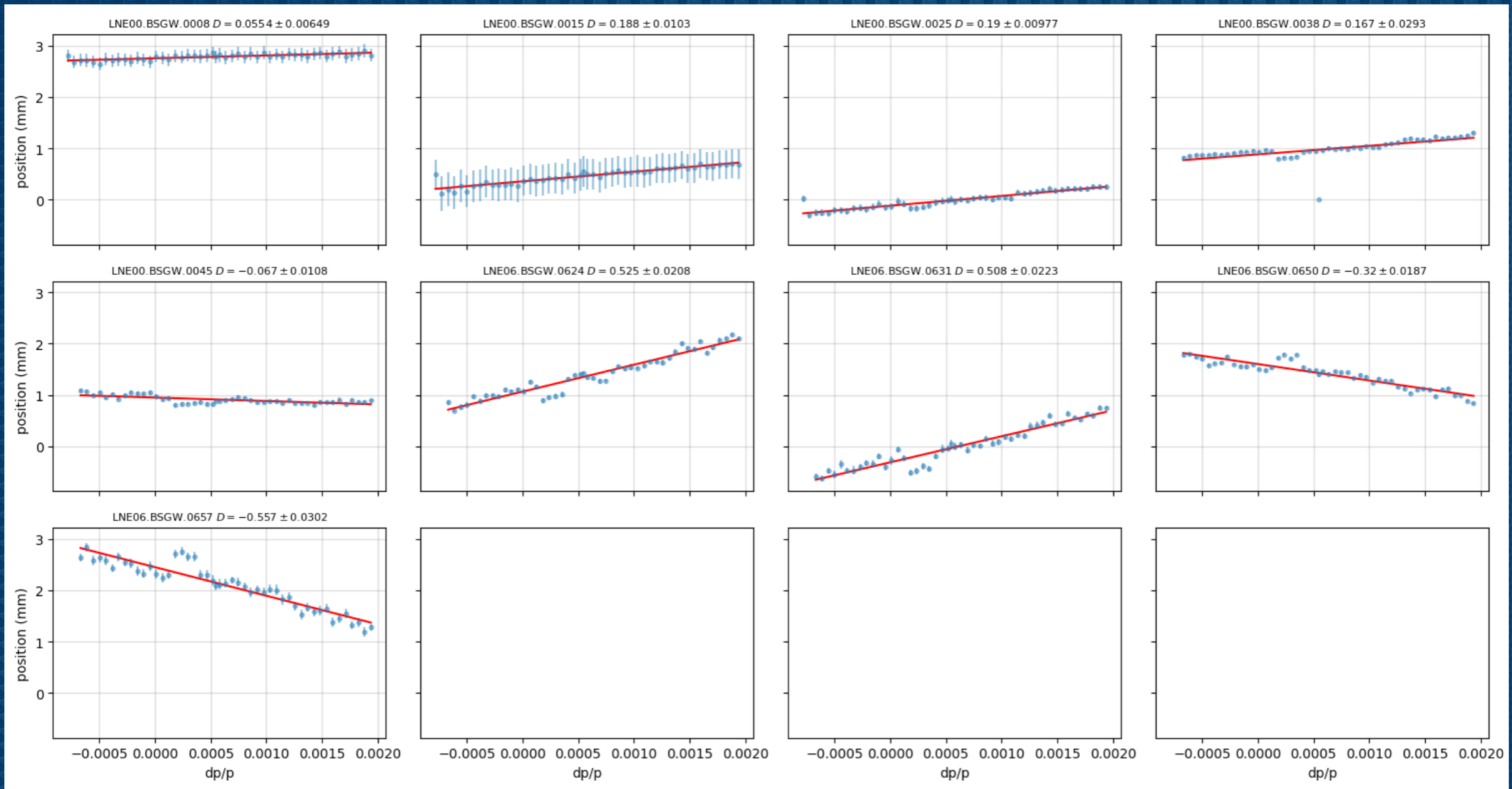


Location	D_x (m)	D_{px} (rad)
LNE00 Start Design	0.904	0.234
LNE00 Start- Meas. 04 Feb	1.420	-0.069
LNE00 Start- Meas. 12 Feb	1.179	0.053

❖ Change of working point seems to make measured horizontal dispersion closer to the design.

1.2. Vertical Dispersion Measurement

Measurement Date: 04 Feb 2021

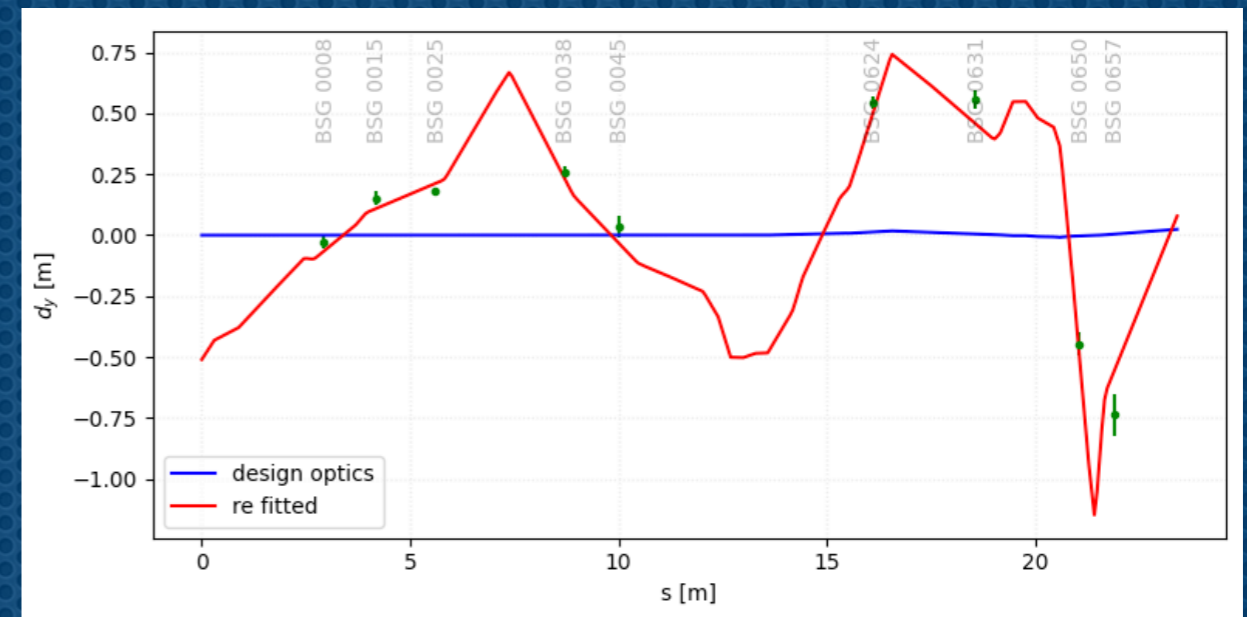
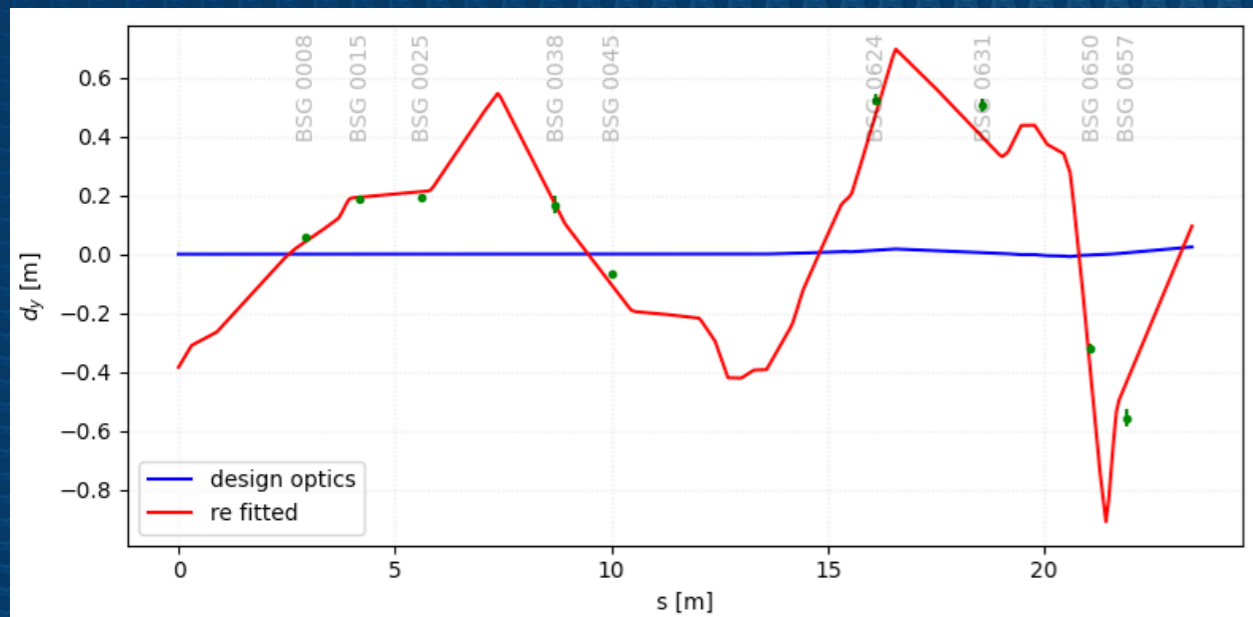


- The dispersion values at each Grid Monitor (**except 0611**) towards ASACUSA-I exp. line. Note that ± 150 Hz vicinity of 144 kHz is scanned, and calculations are made for the theoretical revolution frequency ~ 143940.5 Hz.

1.2. Vertical Dispersion Measurement

Measurement Date: 04 Feb 2021 14h26

Measurement Date: 12 Feb 2021

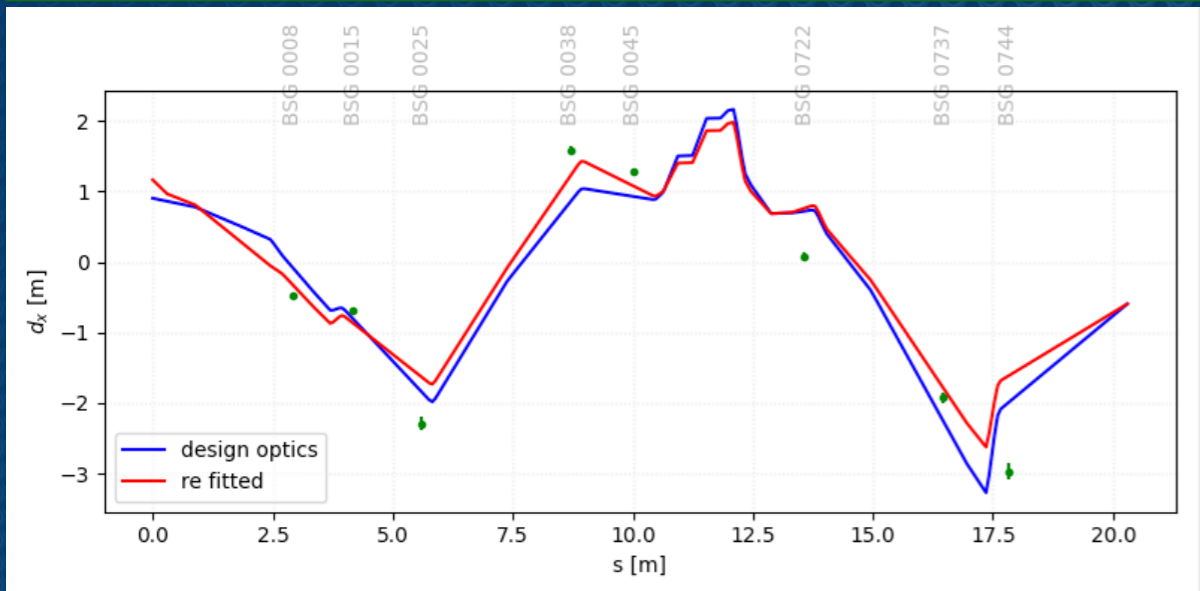


Location	D_y (m)	D_{py} (rad)
LNE00 Start Design	0	0
LNE00 Start- Meas. 04 Feb	-0.384	0.118
LNE00 Start- Meas. 12 Feb	-0.510	0.124

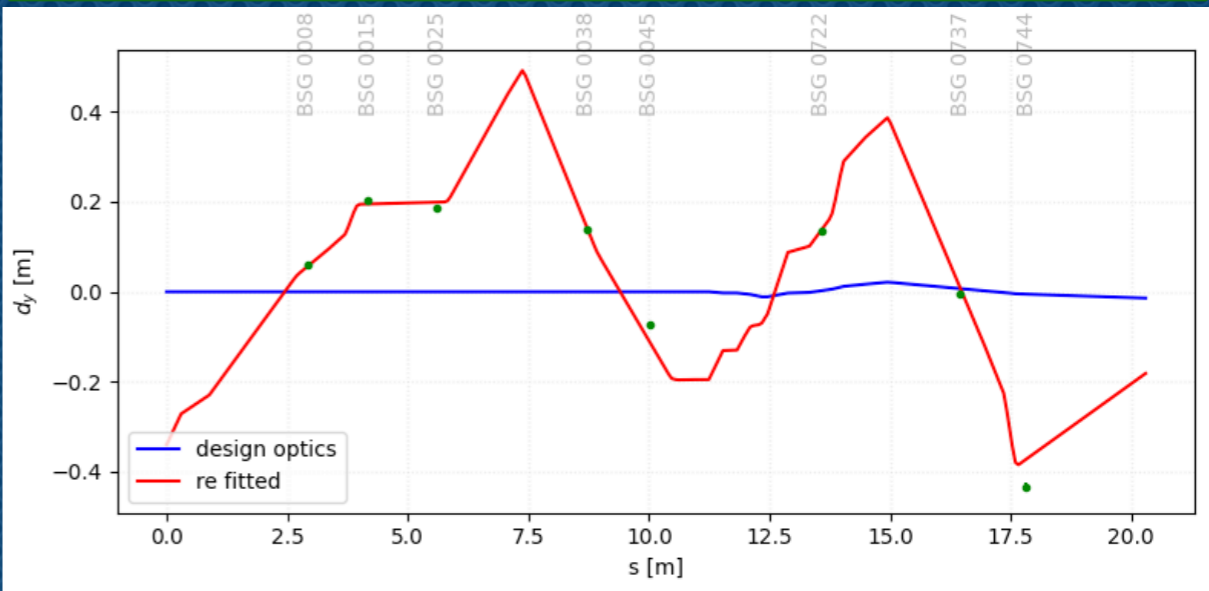
❖ Change of working point seems to increase the vertical dispersion leakage ?!

h/v Dispersion in LNE00s 04Feb

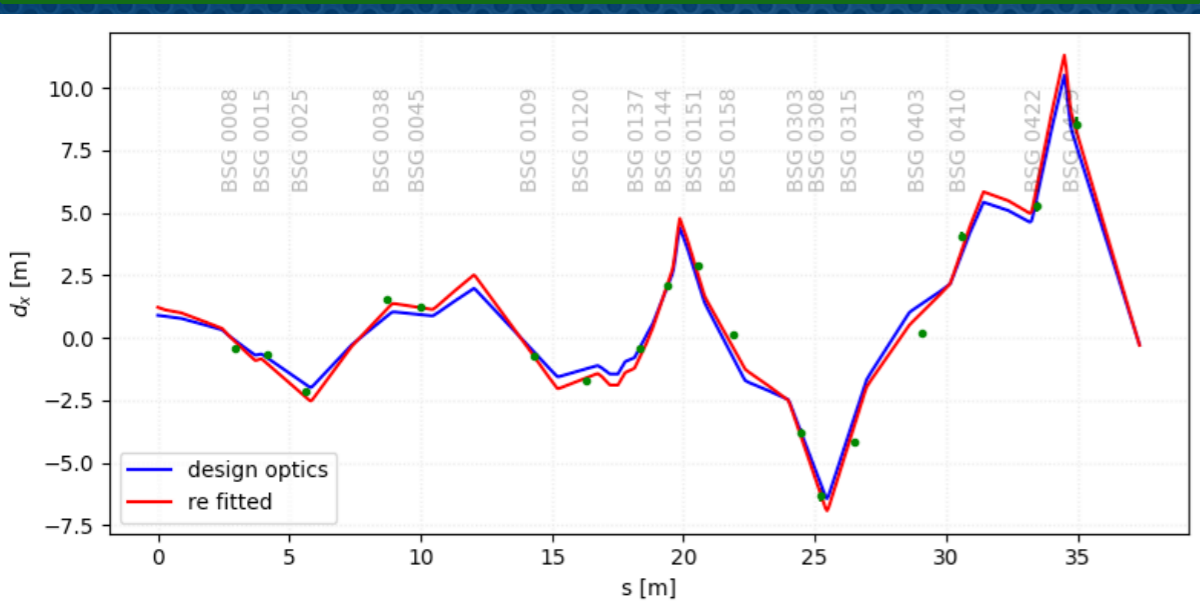
Horizontal towards LNE07 on 04 Feb 2020 16h34



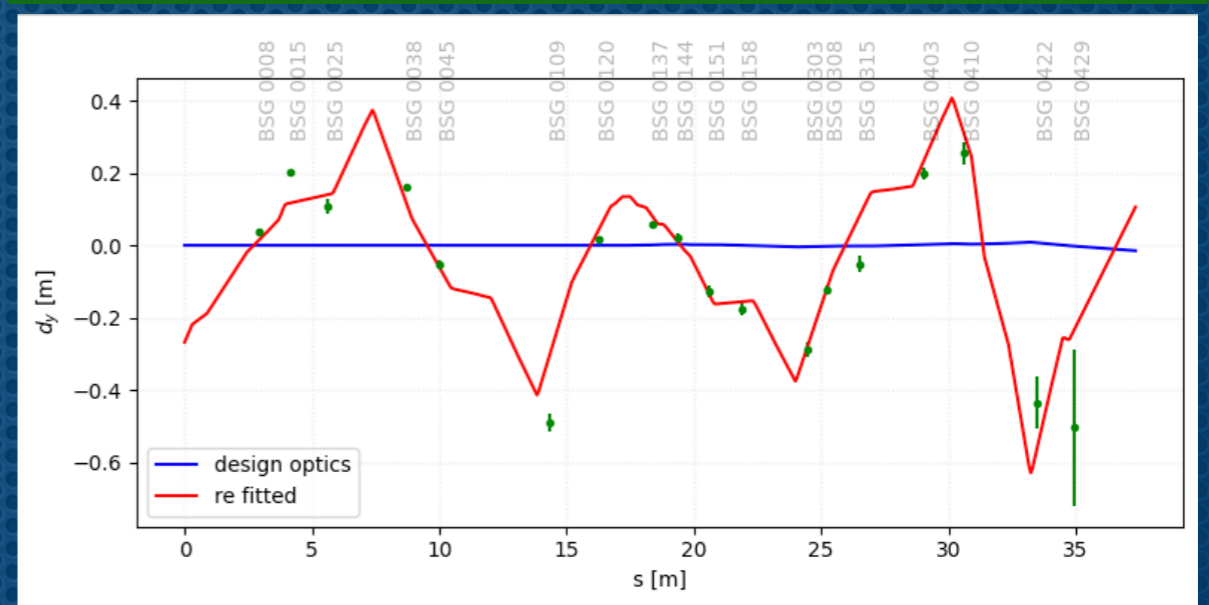
Vertical towards LNE07 on 04 Feb 2020 16h34



Horizontal towards LNE04 on 04 Feb 2020 15h40

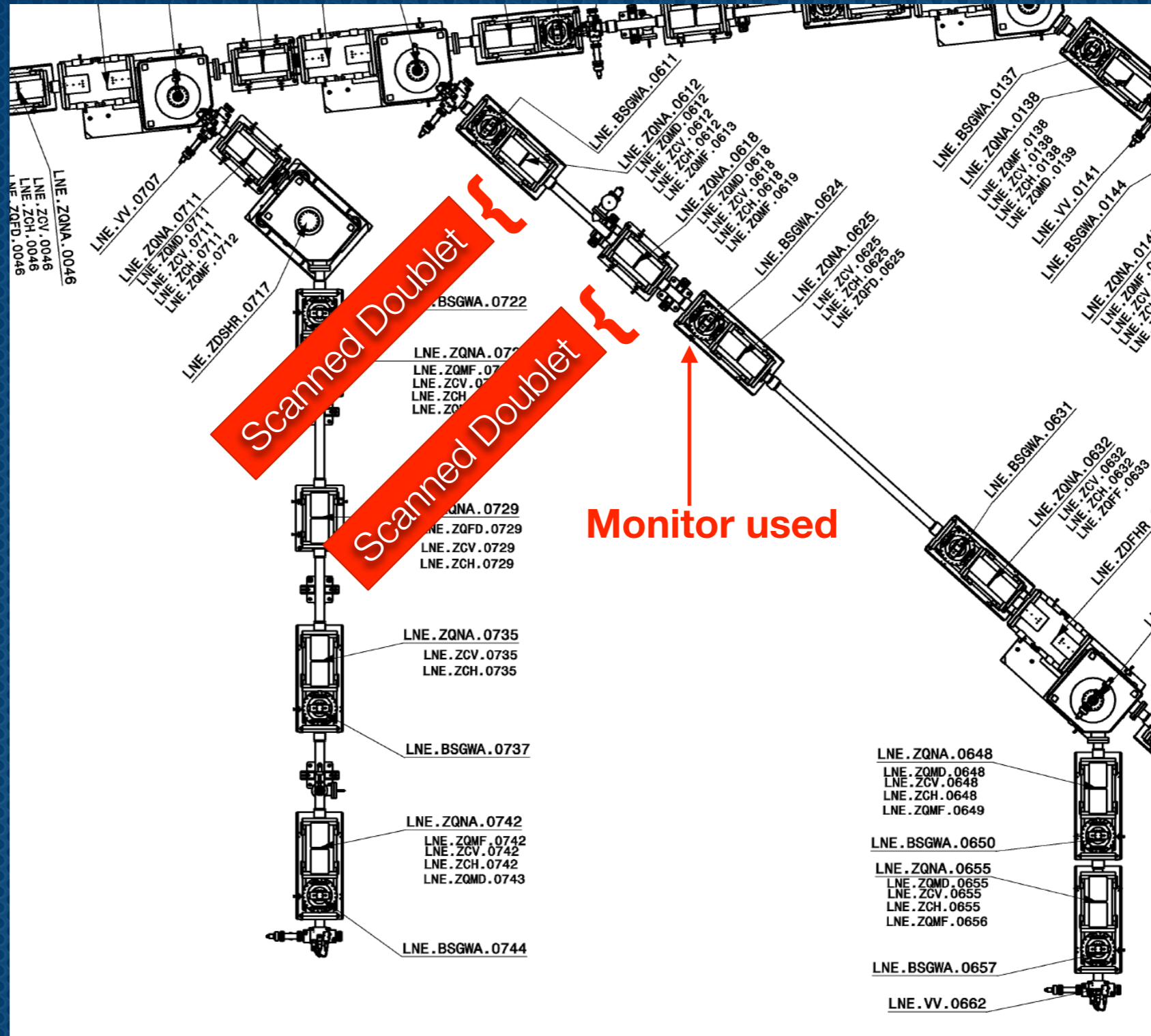


Horizontal towards LNE04 on 04 Feb 2020 15h40



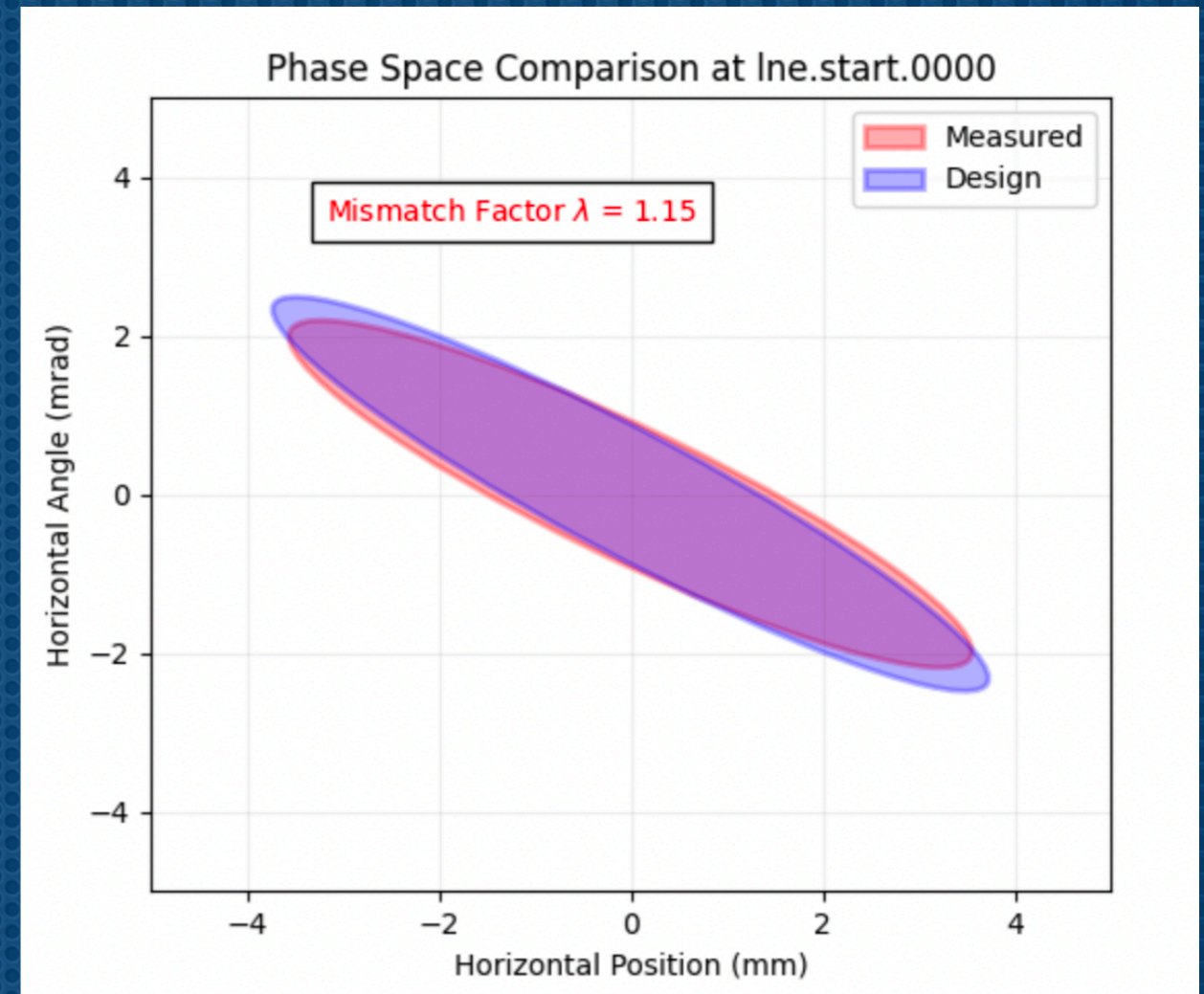
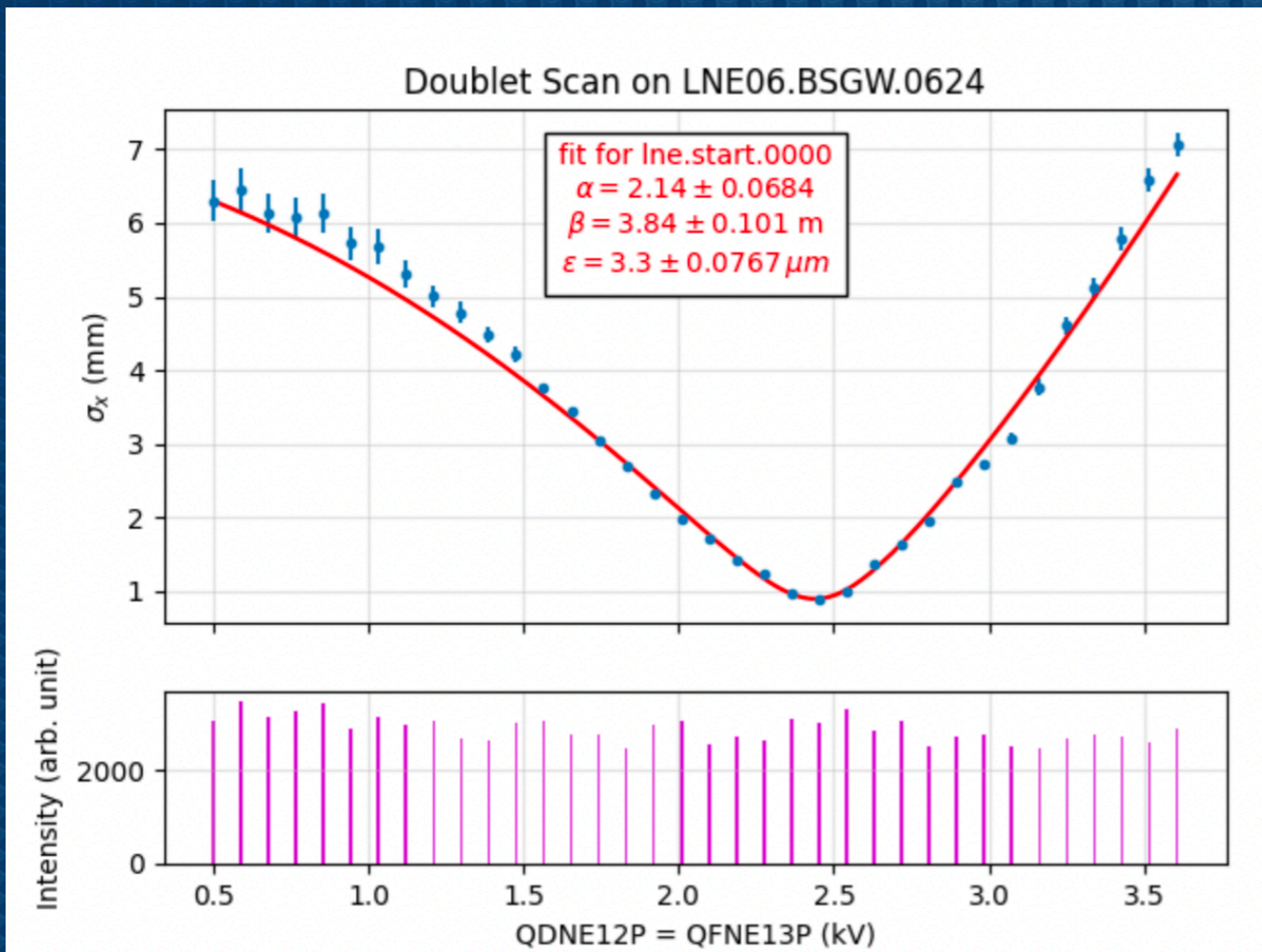
Location	D_x (m)	D_{px} (rad)	D_y (m)	D_{py} (rad)
LNE00 Start Nominal	0.904	0.234	0	0
LNE00 Start on Feb 04 towards BASE	1.165	-0.008	-0.340	0.109
LNE00 Start on Feb 04 towards Alpha	1.224	0.150	-0.268	0.078

2.1. Optics Measurement at BSGW.0624



2.1. Optics Measurement at BSGW.0624

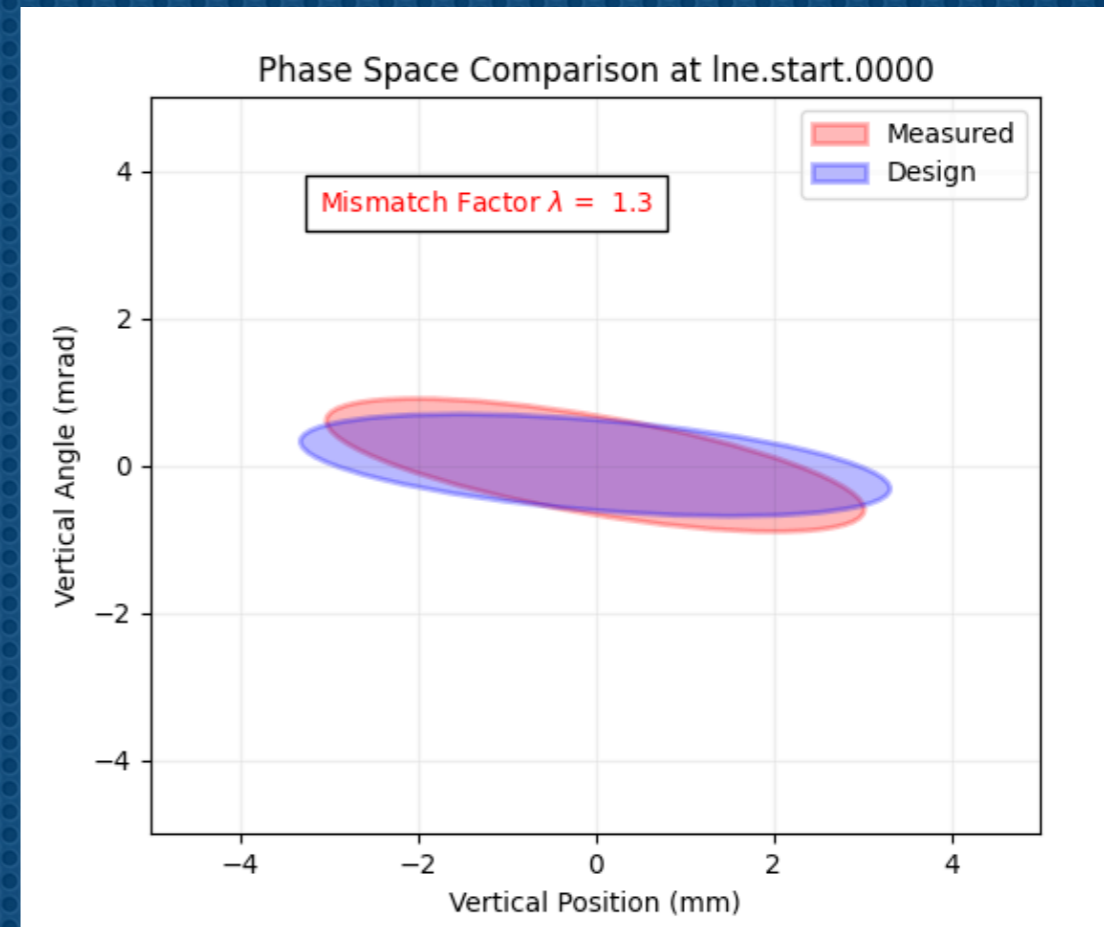
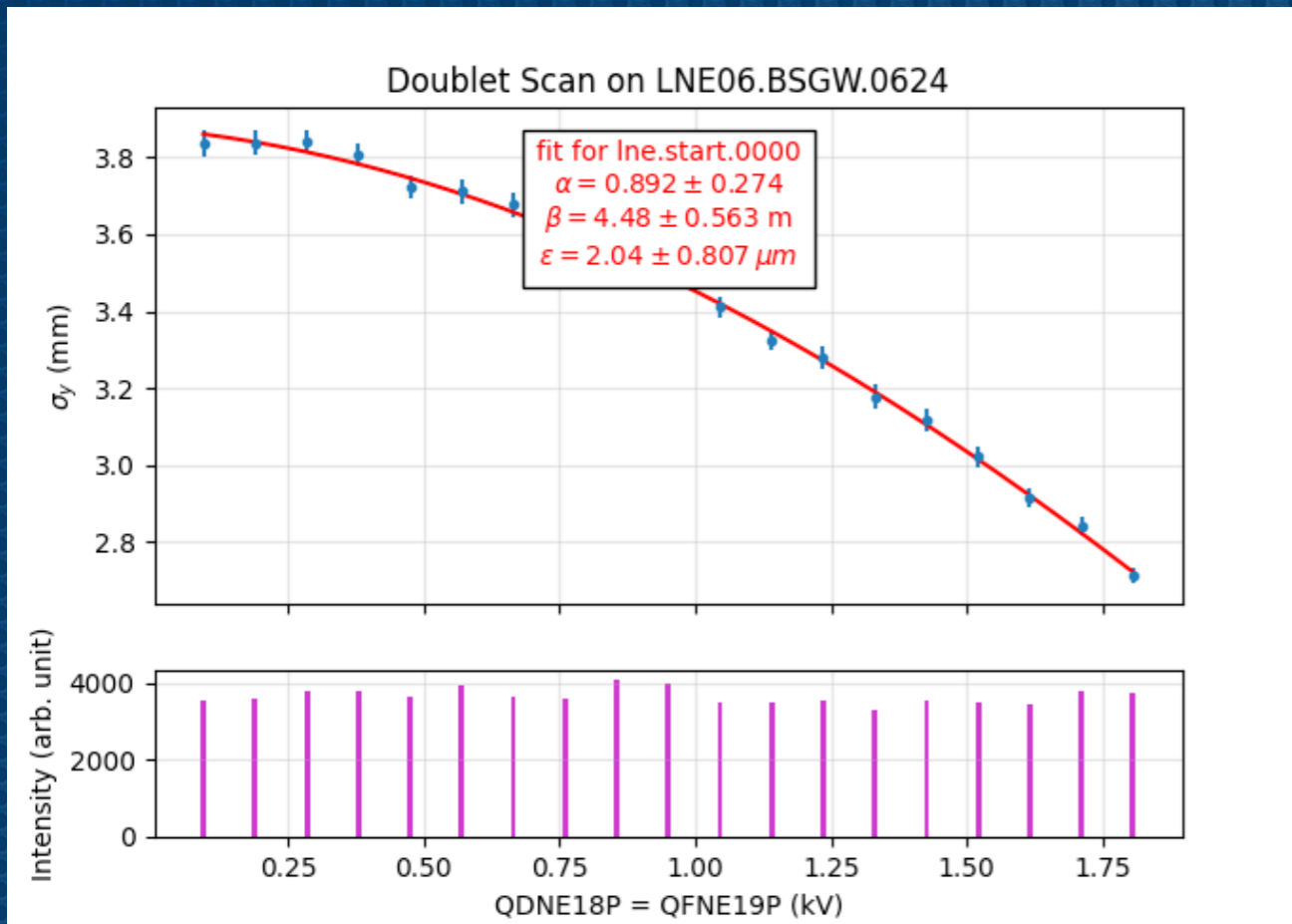
Measurement Date: 05 Feb 2020



❖ In this measurements, we scan QD.0612 and QF.0613 **simultaneously to the same voltage** and record with BSG.0624.

2.1. Optics Measurement at BSGW.0624

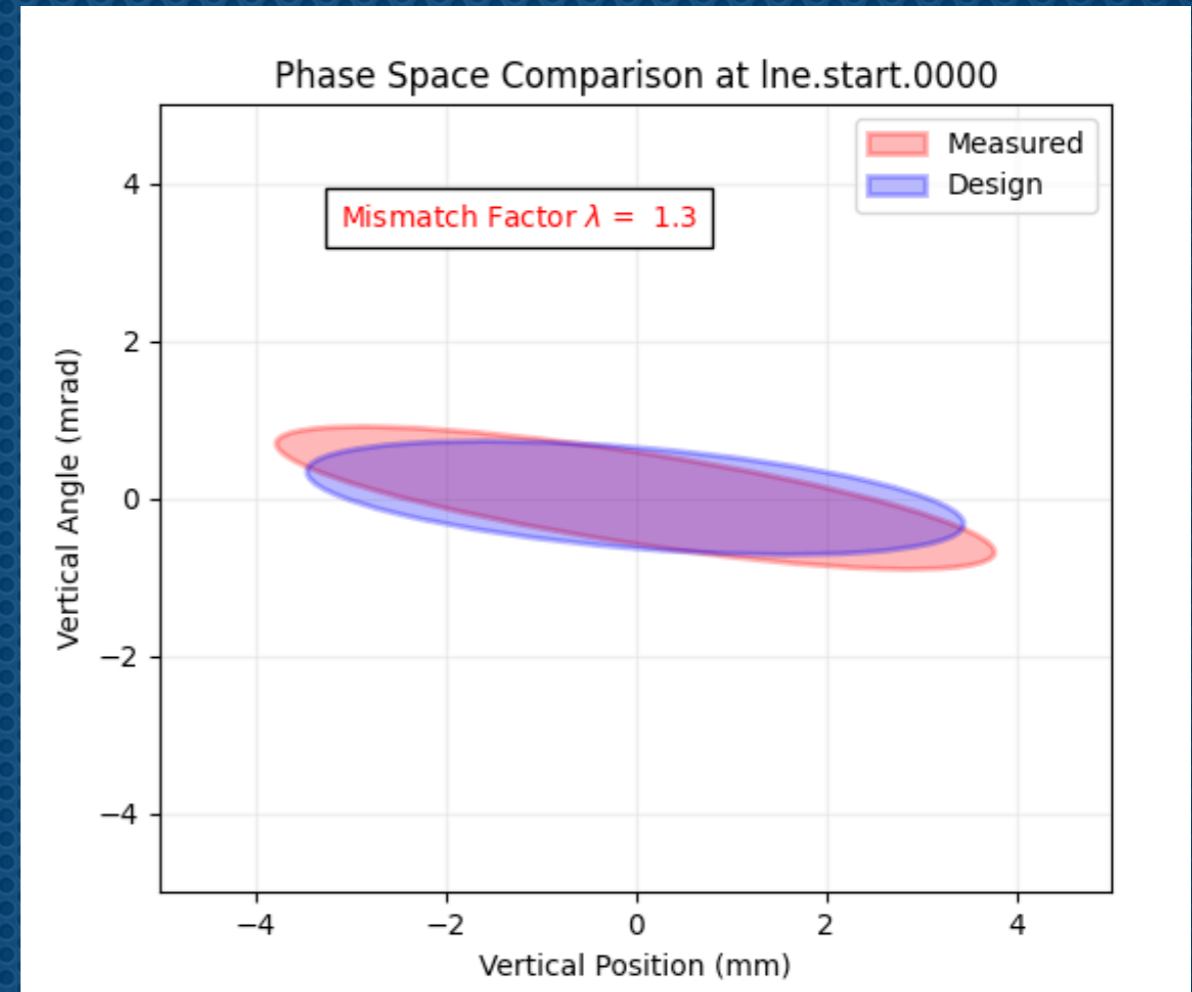
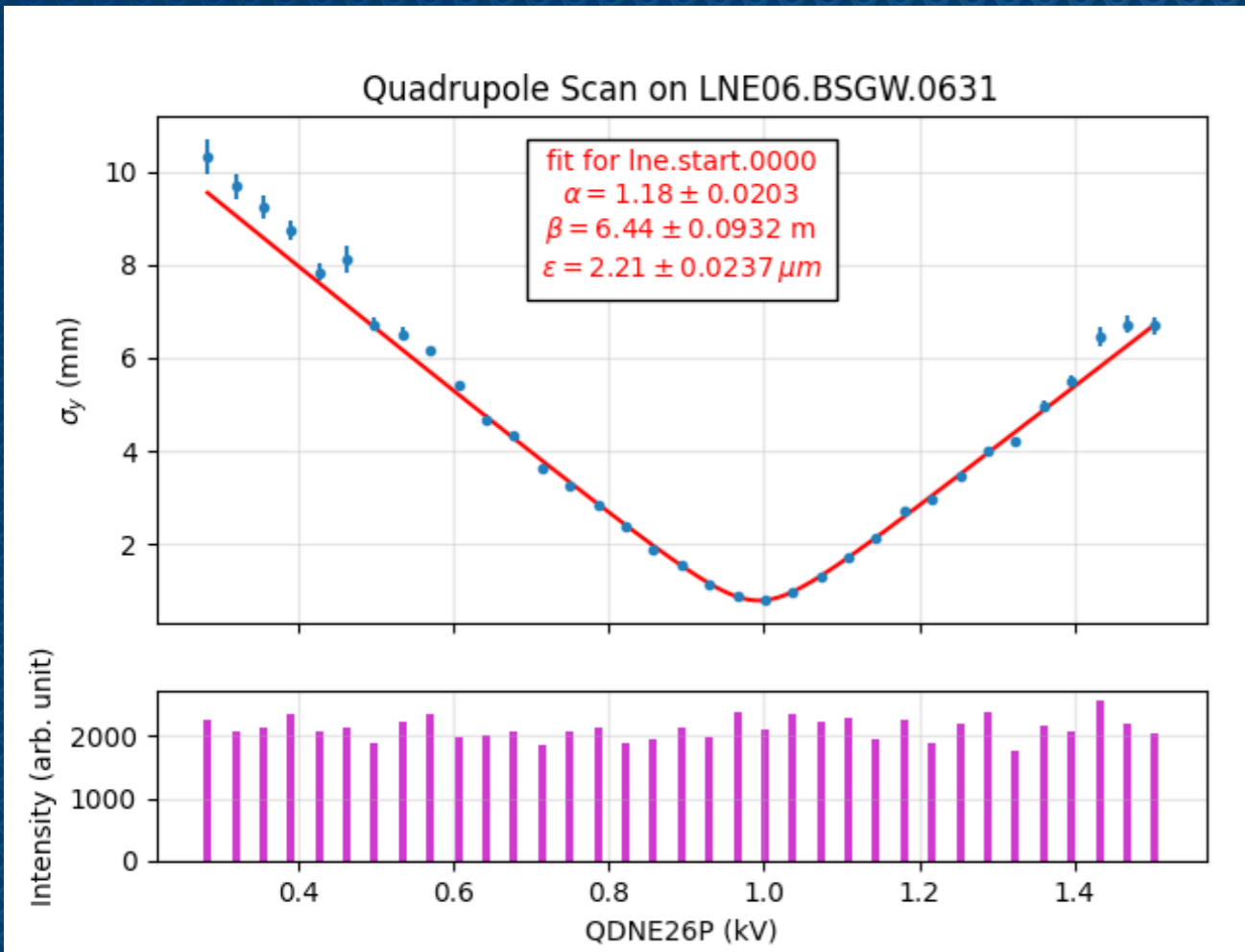
Measurement Date: 12 Feb 2020



❖ In this measurements, we scan QD.0618 and QF.0619 **simultaneously to the same voltage** and record with BSG.0624, vertical beam waist is not found, less trustworthy measurement ?!

2.2. Optics Measurement at BSGW.0631

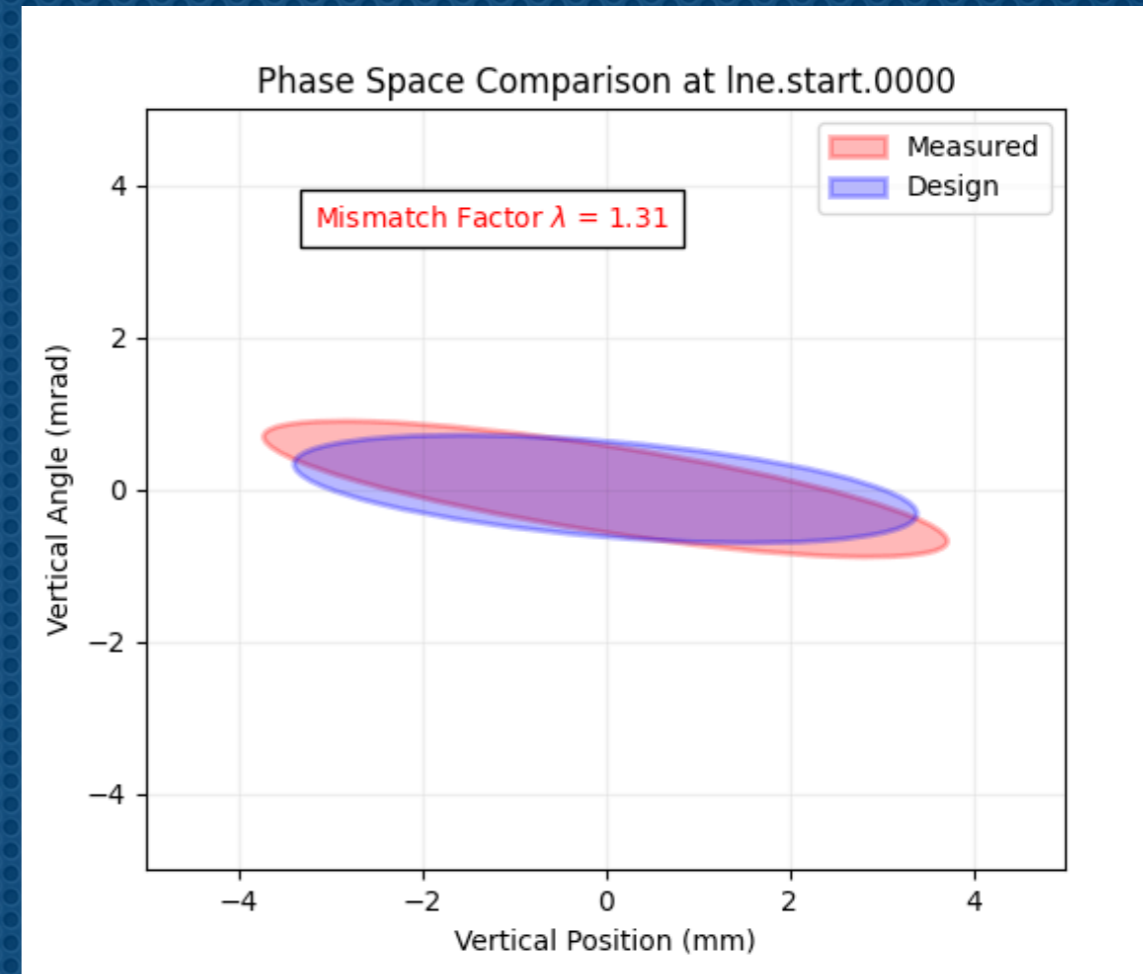
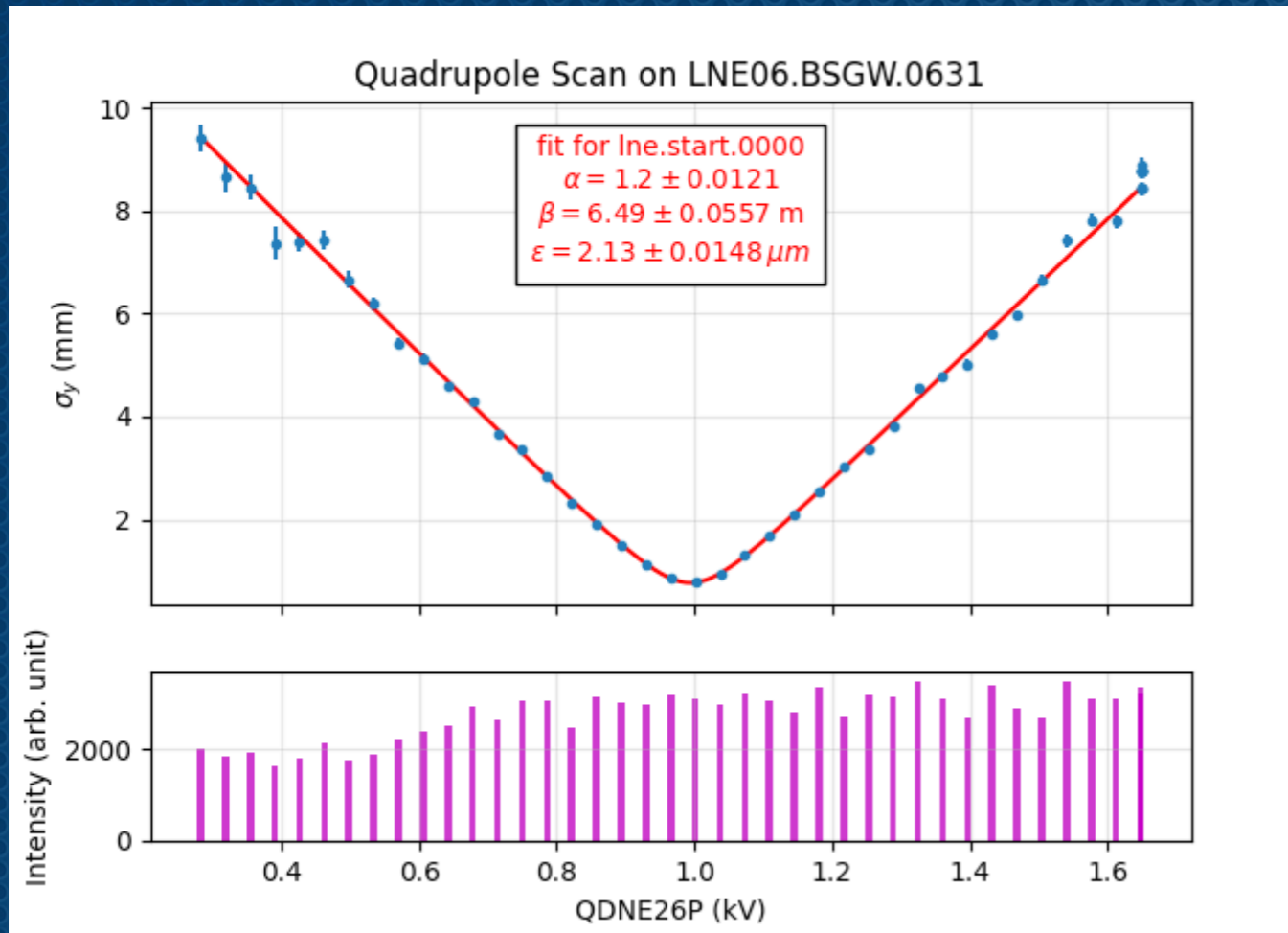
Measurement Date: 05 Feb 2020



❖ In this measurements, we scan QD.0626 and record with BSG.0631.

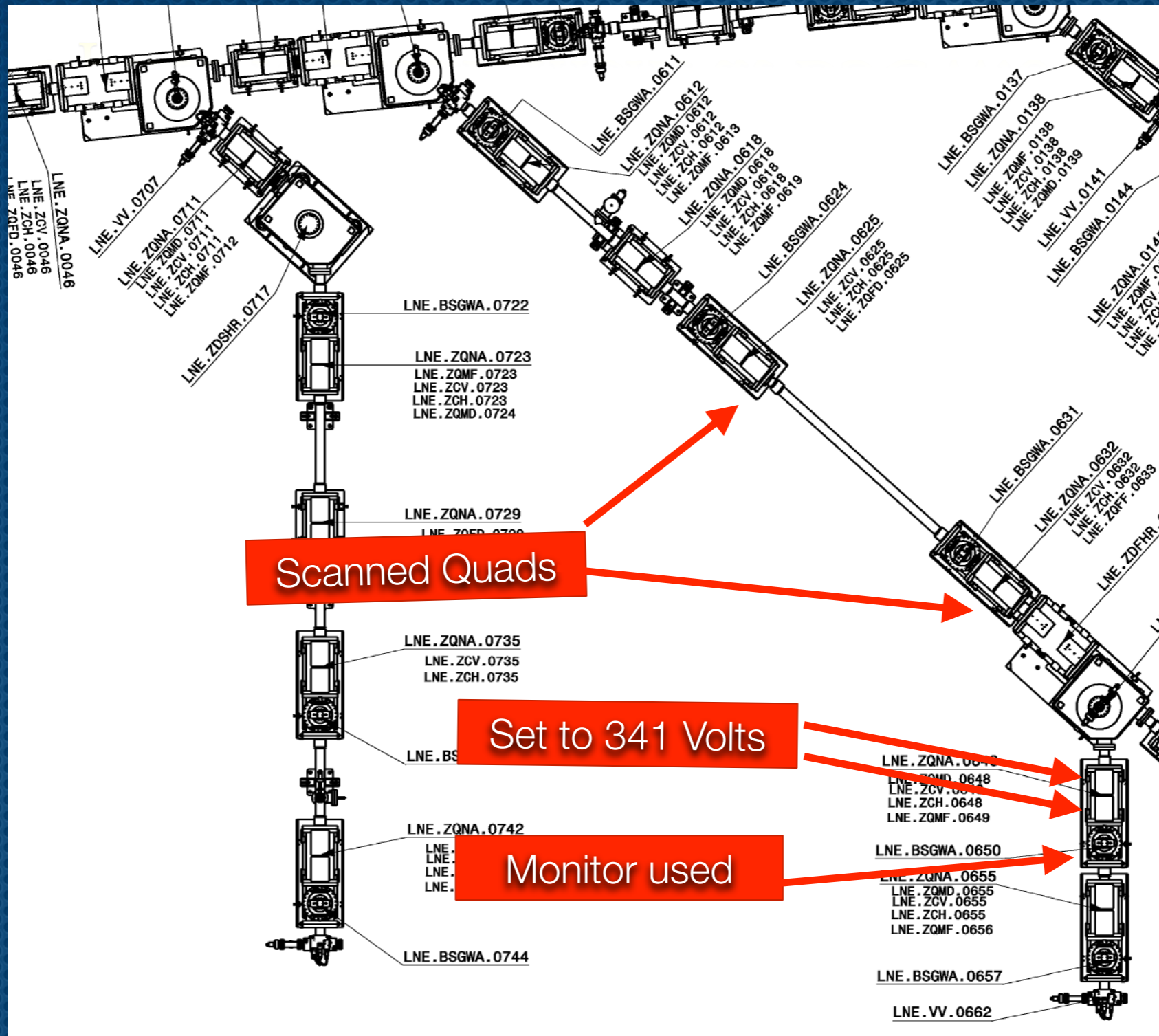
2.2. Optics Measurement at BSGW.0631

Measurement Date: 12 Feb 2020



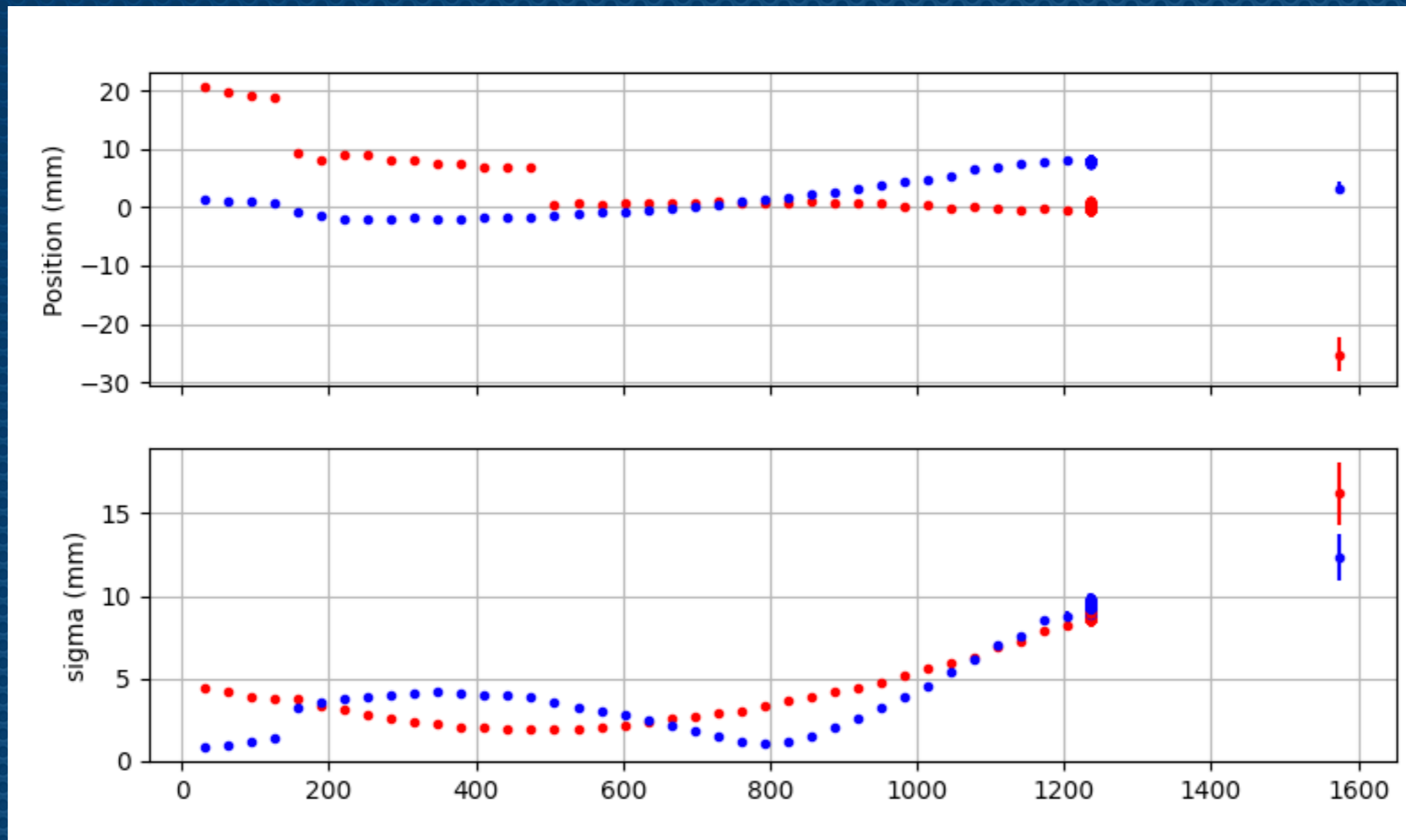
❖ In this measurements, we scan QD.0626 and record with BSG.0631.

2.3. Optics Measurement at BSGW.0650



❖ In the following measurement, we scan QD.0626 and QF.0633 two quadrupoles simultaneously to the same voltage, QD.0648 and QF.0649 are set to 341 Volts and record with BSG.0650, where in between there are Fast +ES Bends!

2.3. Optics Measurement at BSGW.0650

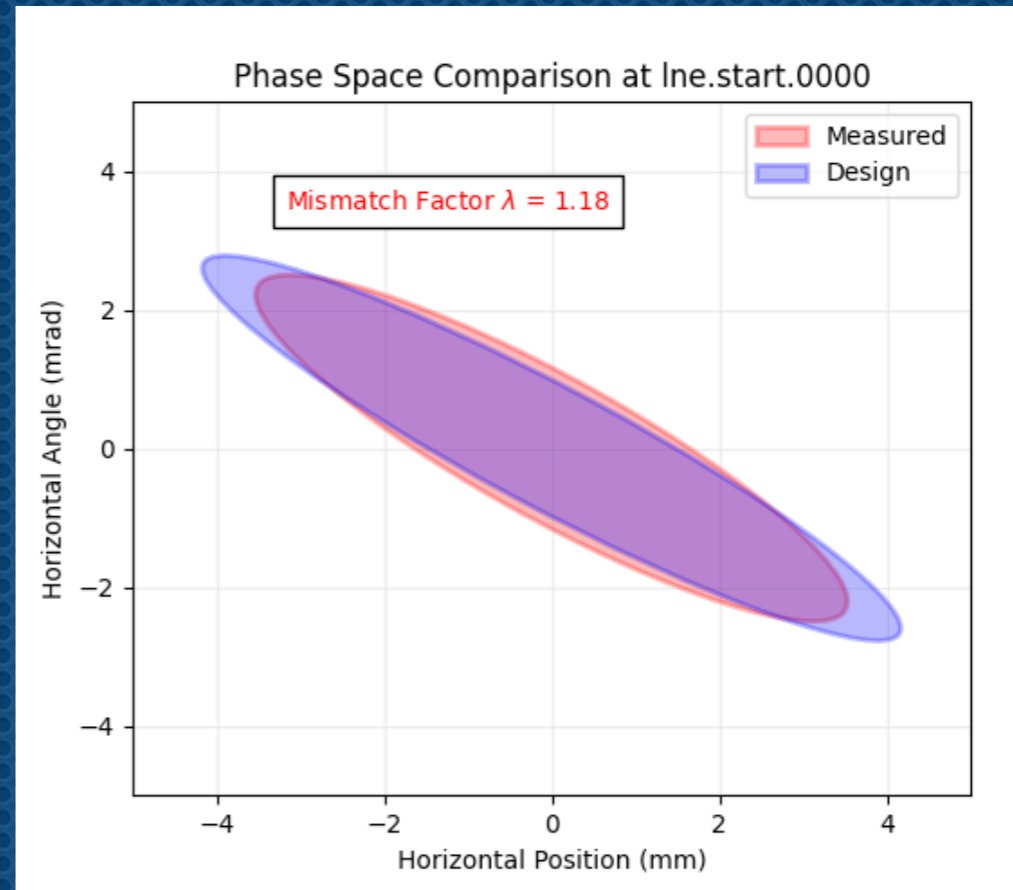
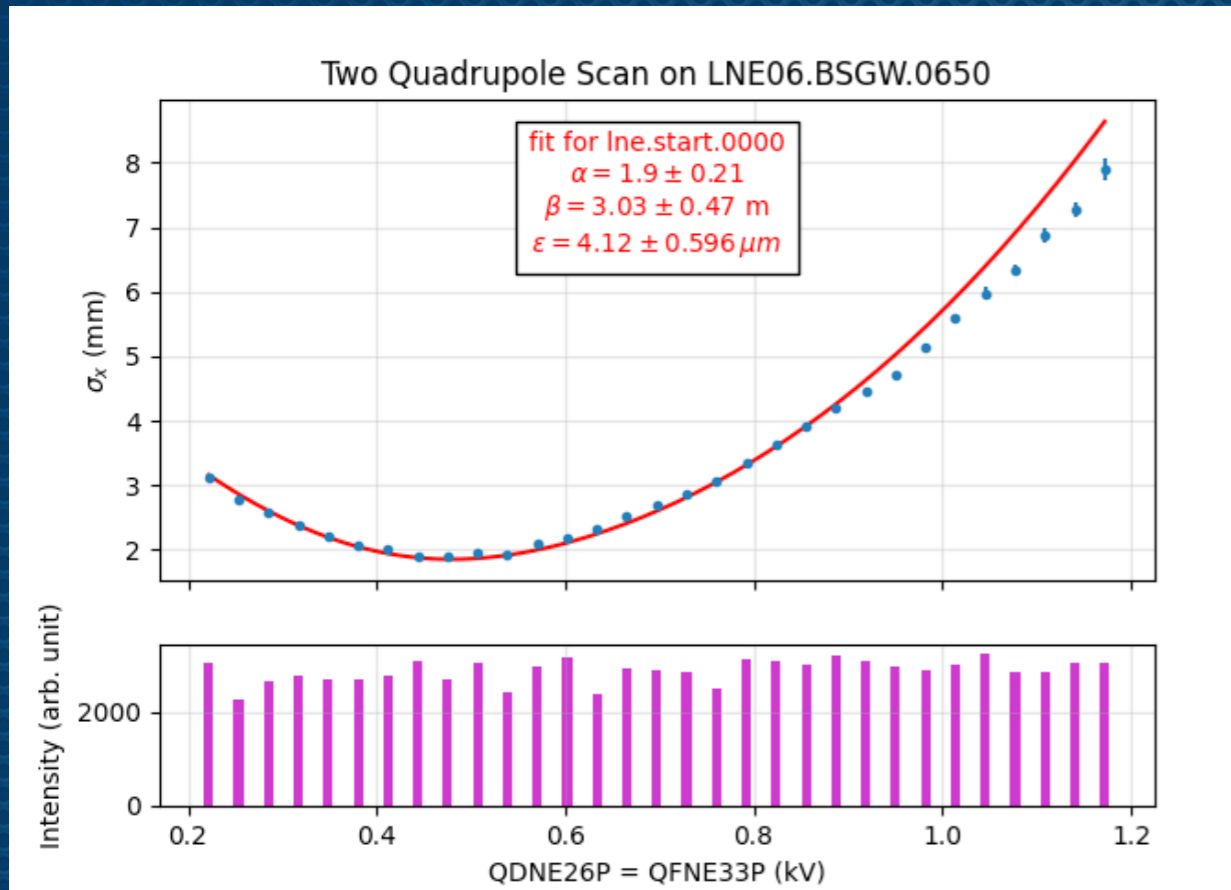


- ❖ In the raw data, we scan QD.0626 and QF.0633 two quadrupoles simultaneously to the same voltage, and QD.0648 and QF.0649 are set to 341 Volts and record with BSG.0650, where in between there is an Fast +ES Bends!

Both horizontal and vertical beam waist at different low voltages ?

2.3. Optics Measurement at BSGW.0650

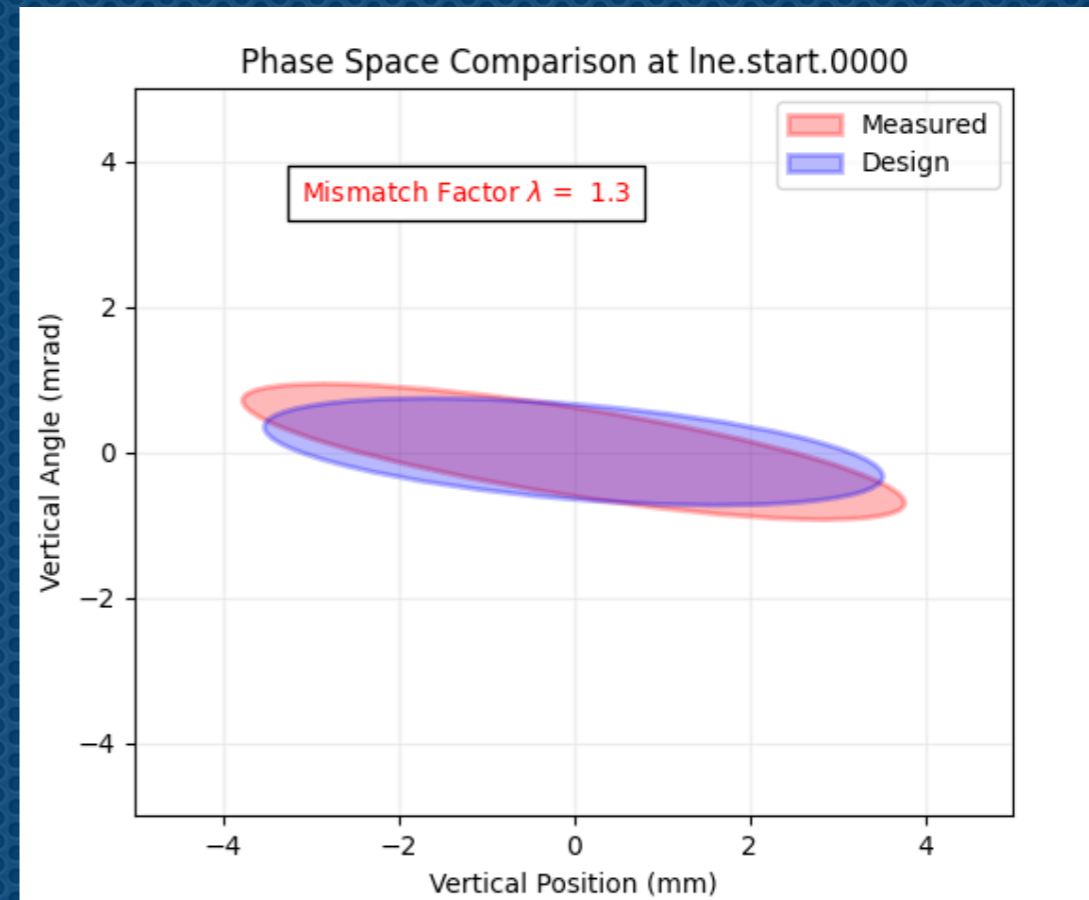
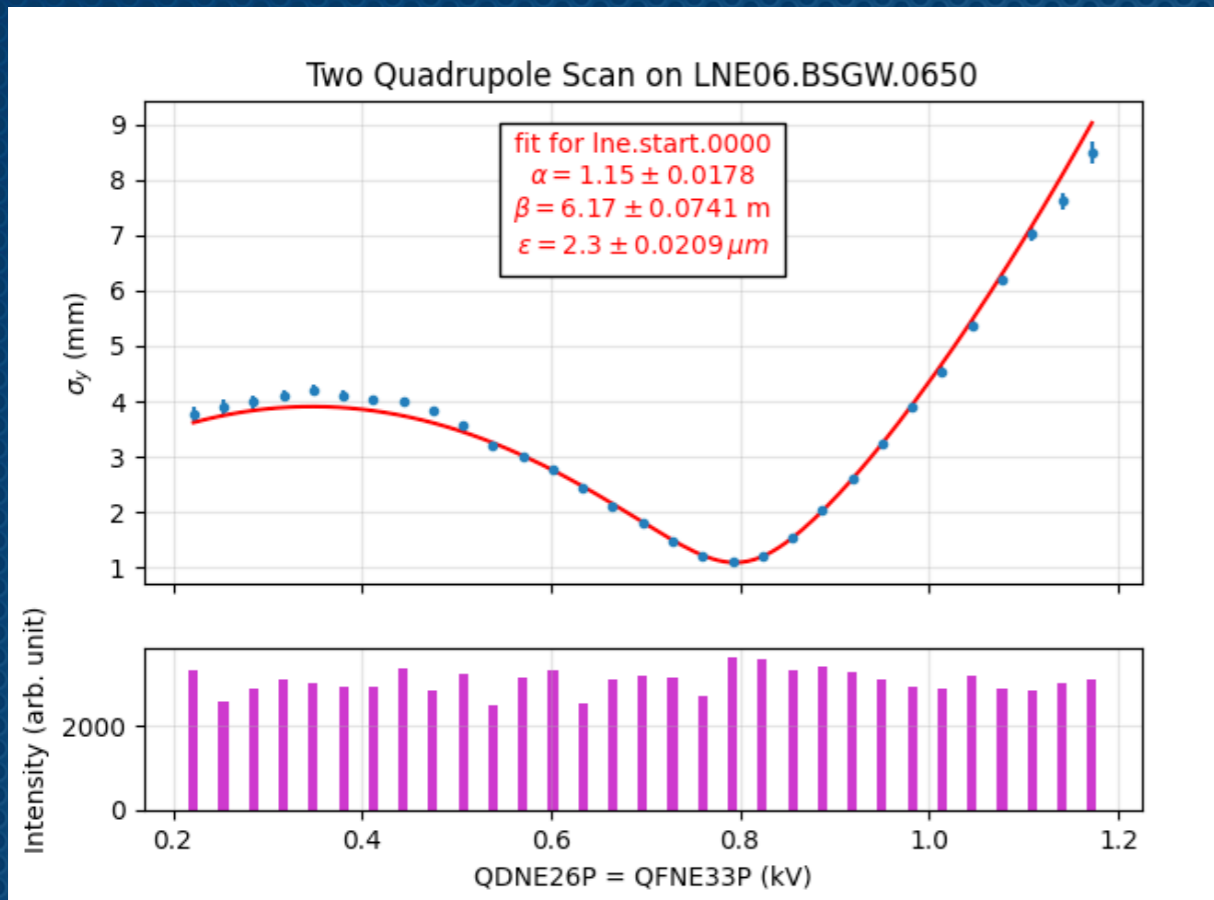
Measurement Date: 12 Feb 2020



- ❖ We scan QD.0626 and QF.0633 two quadrupoles simultaneously to the same voltage, and QD.0648 and QF.0649 are set to 341 Volts and record with BSG.0650, where in between there are Fast +ES Bends!

2.3. Optics Measurement at BSGW.0650

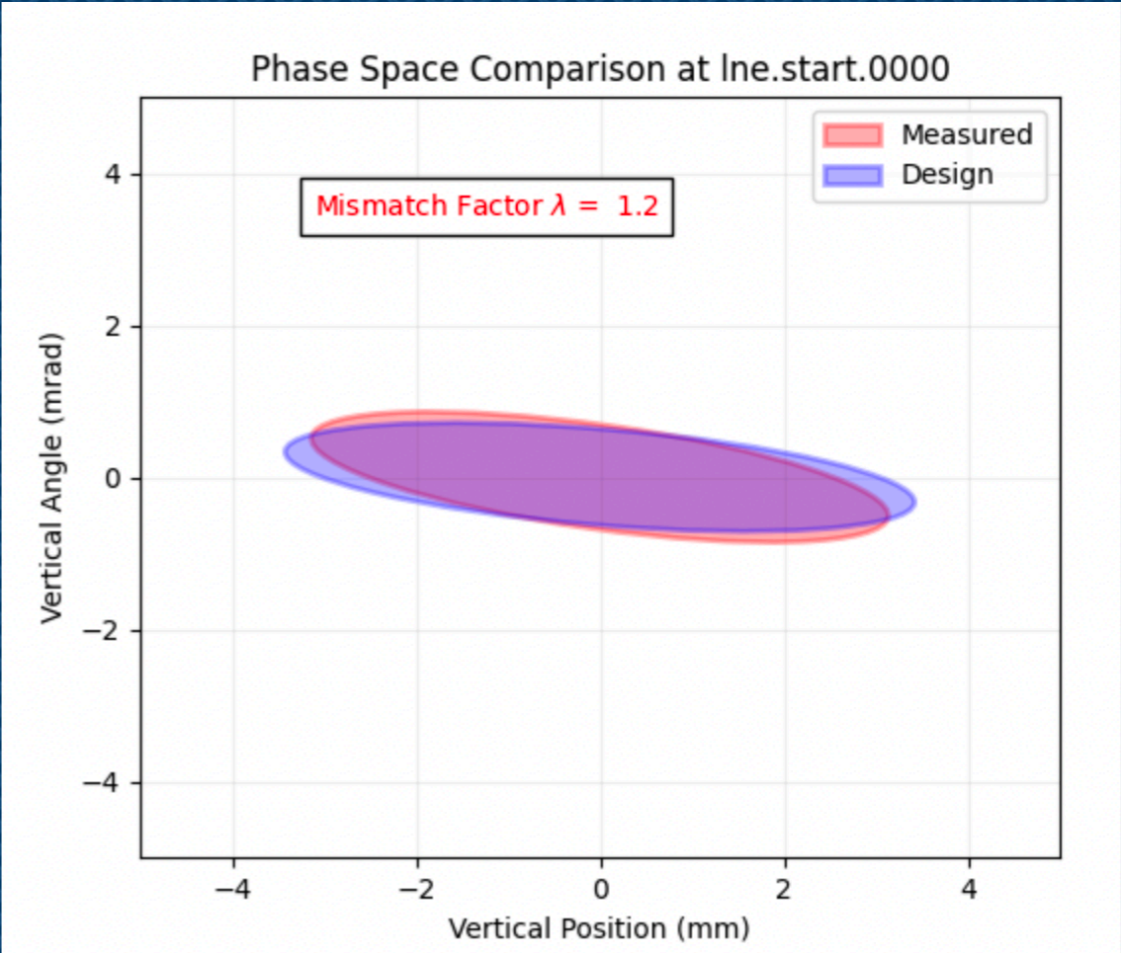
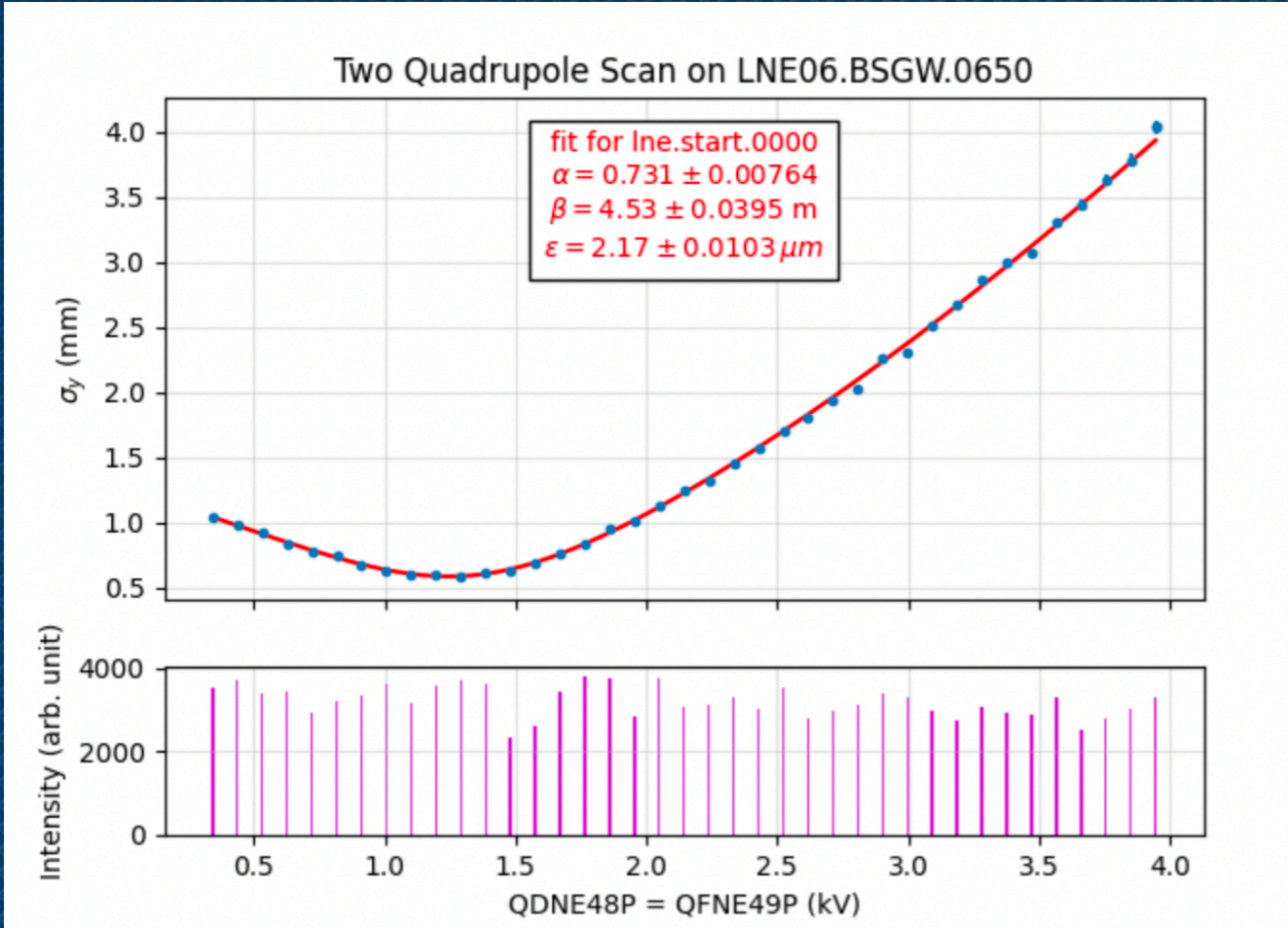
Measurement Date: 12 Feb 2020



- ❖ We scan QD.0626 and QF.0633 two quadrupoles simultaneously to the same voltage, and QD.0648 and QF.0649 are set to 341 Volts and record with BSG.0650.
- ❖ 2 Single Quads are scanned and a Doublet voltage is lowered, there are Fast +ES Bends between the scanned quadrupoles and the recorded monitor!

2.3. Optics Measurement at BSGW.0650

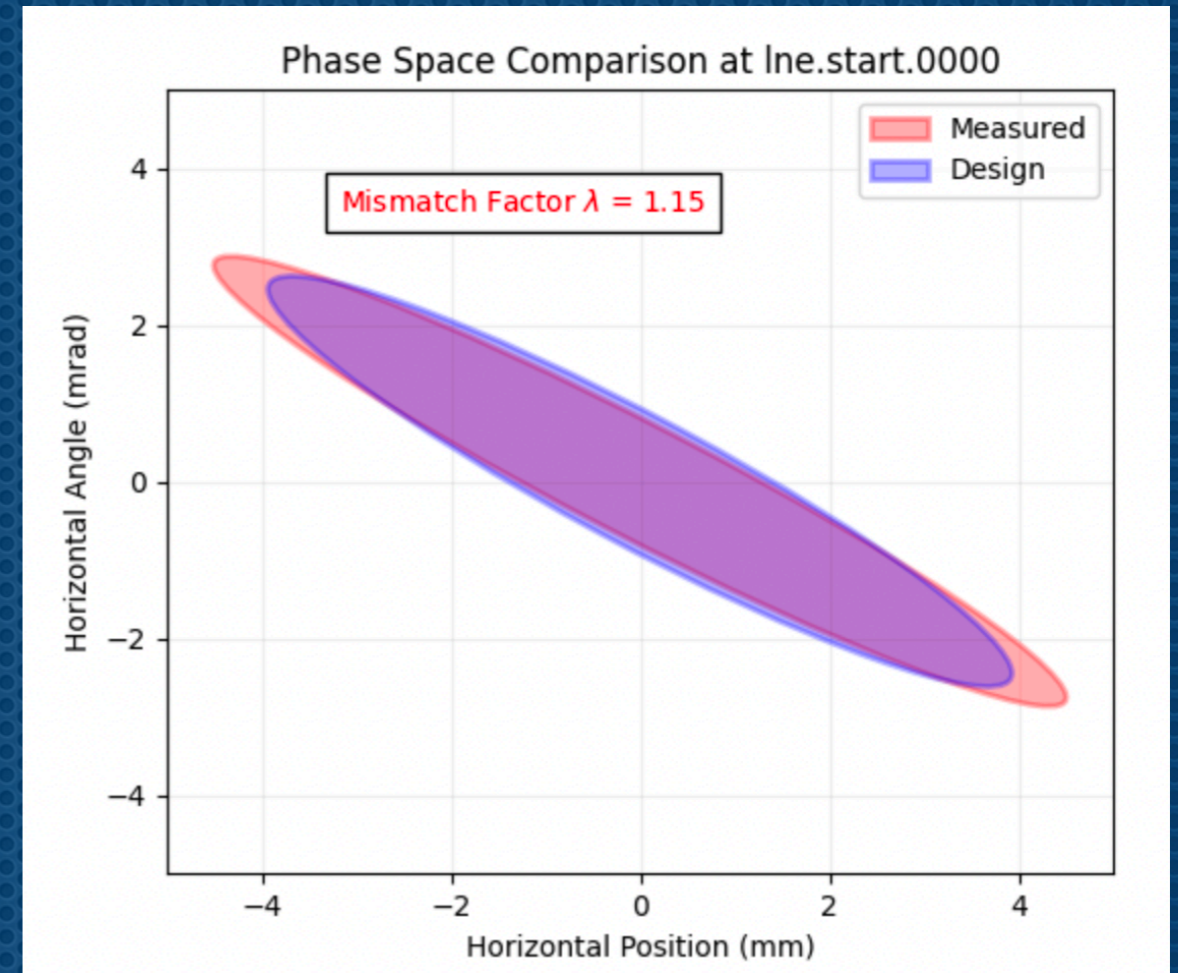
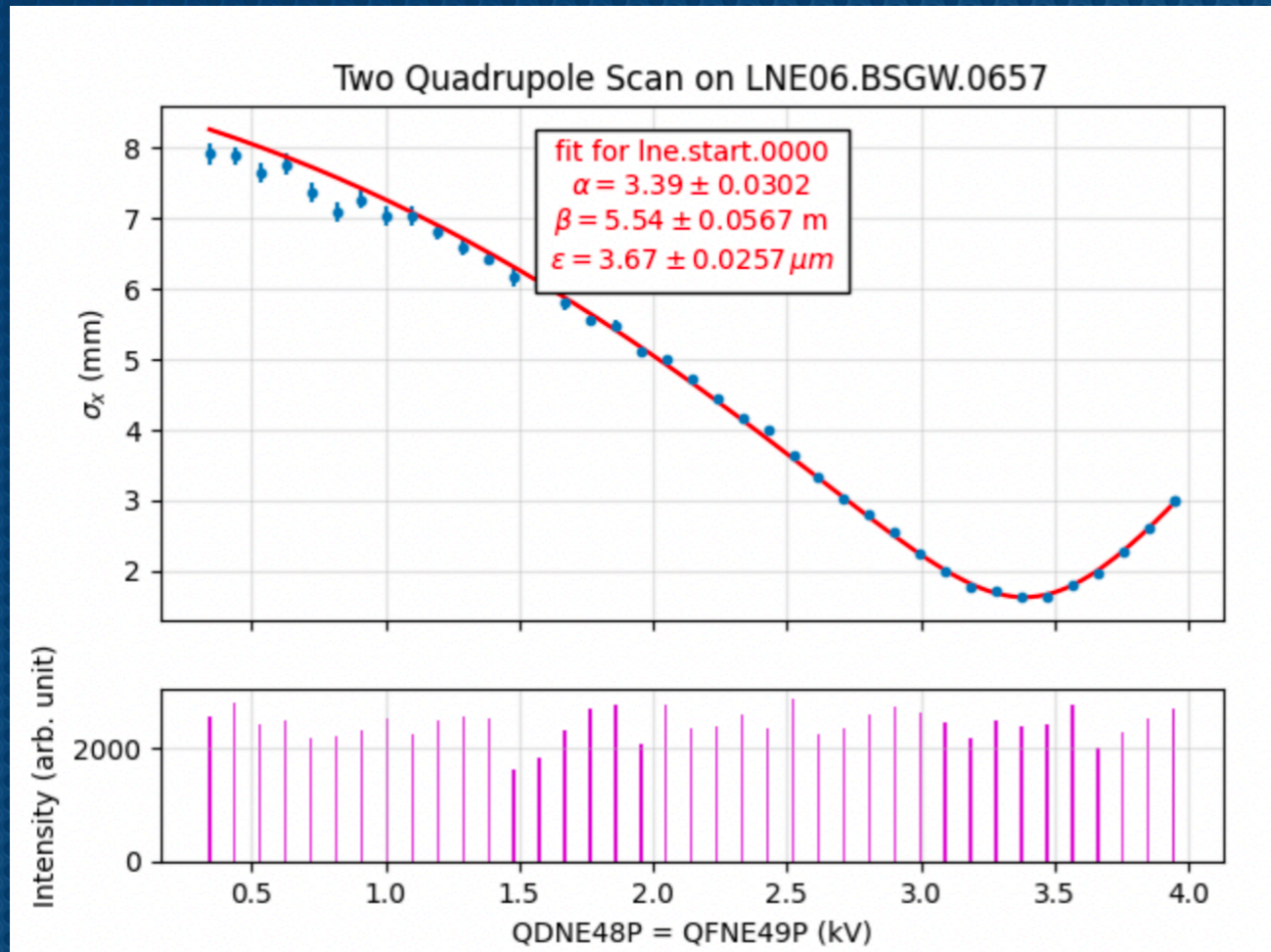
Measurement Date: 12 Feb 2020



- ❖ We scan QD.0648 and QF.0649 two quadrupoles simultaneously to the same voltage and record with BSG.0650.
- ❖ 2 Single Quads are scanned and a Doublet voltage is lowered, there are Fast +ES Bends between the scanned quadrupoles and the recorded monitor!

2.4. Optics Measurement at BSGW.0657

Measurement Date: 12 Feb 2020



- ❖ We scan QD.0648 and QF.0649 scanned to the same voltage and record with 0650.
- ❖ The same scan data as the previous vertical plot but this is the horizontal.

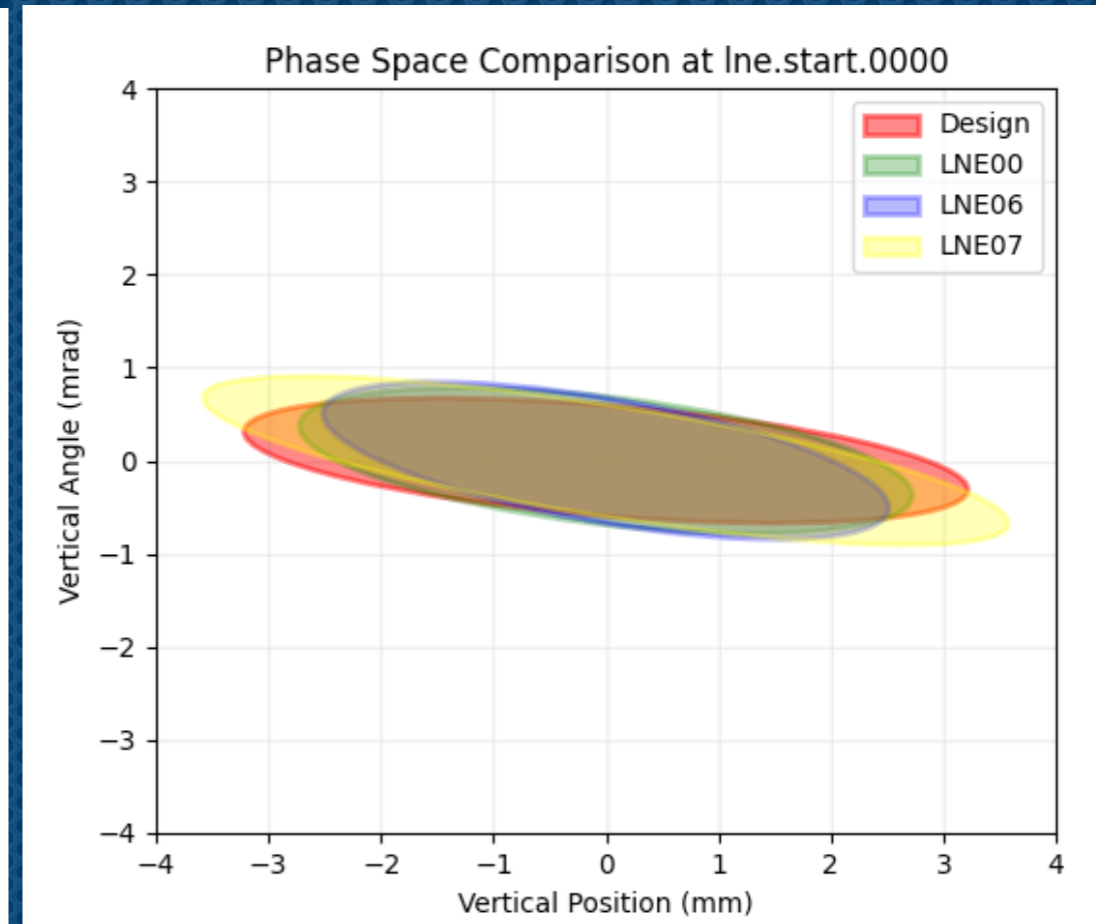
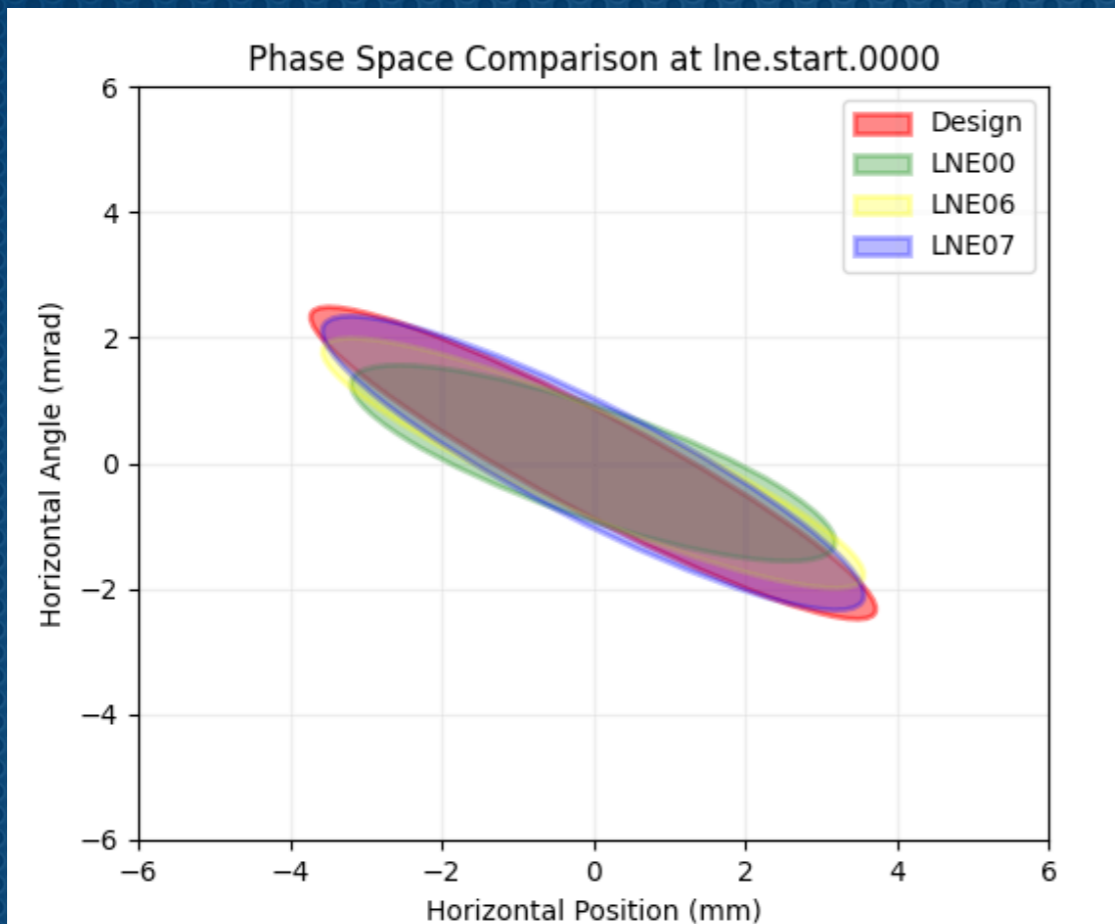
3. LNE07 Optics Measurements - Comparison

❖ OPTICS for LNE.0000.START !

Date	Monitor	Scan	ϵ_x (μm)	α_x	β_x	ϵ_y (μm)	α_y	β_y
5 Feb	BSG.0624	QD12 & QF13	3.3	2.14	3.84			
12 Feb	BSG.0624	QD18 & QF19				2.04	0.892	4.48
5 Feb	BSG.0631	QD26				2.21	1.18	6.44
12 Feb	BSG.0631	QD26				2.13	1.2	6.49
12 Feb	BSG.0650	QD26 & QF33	4.12	1.9	3.03			
12 Feb	BSG.0657	QD26 & QF33				2.3	1.15	6.17
Average LNE07			3.71	2.02	3.44	2.17	1.11	5.90
Design				2.63	4.22		0.52	5.39

4. LNE00 Optics Measurements - Comparison

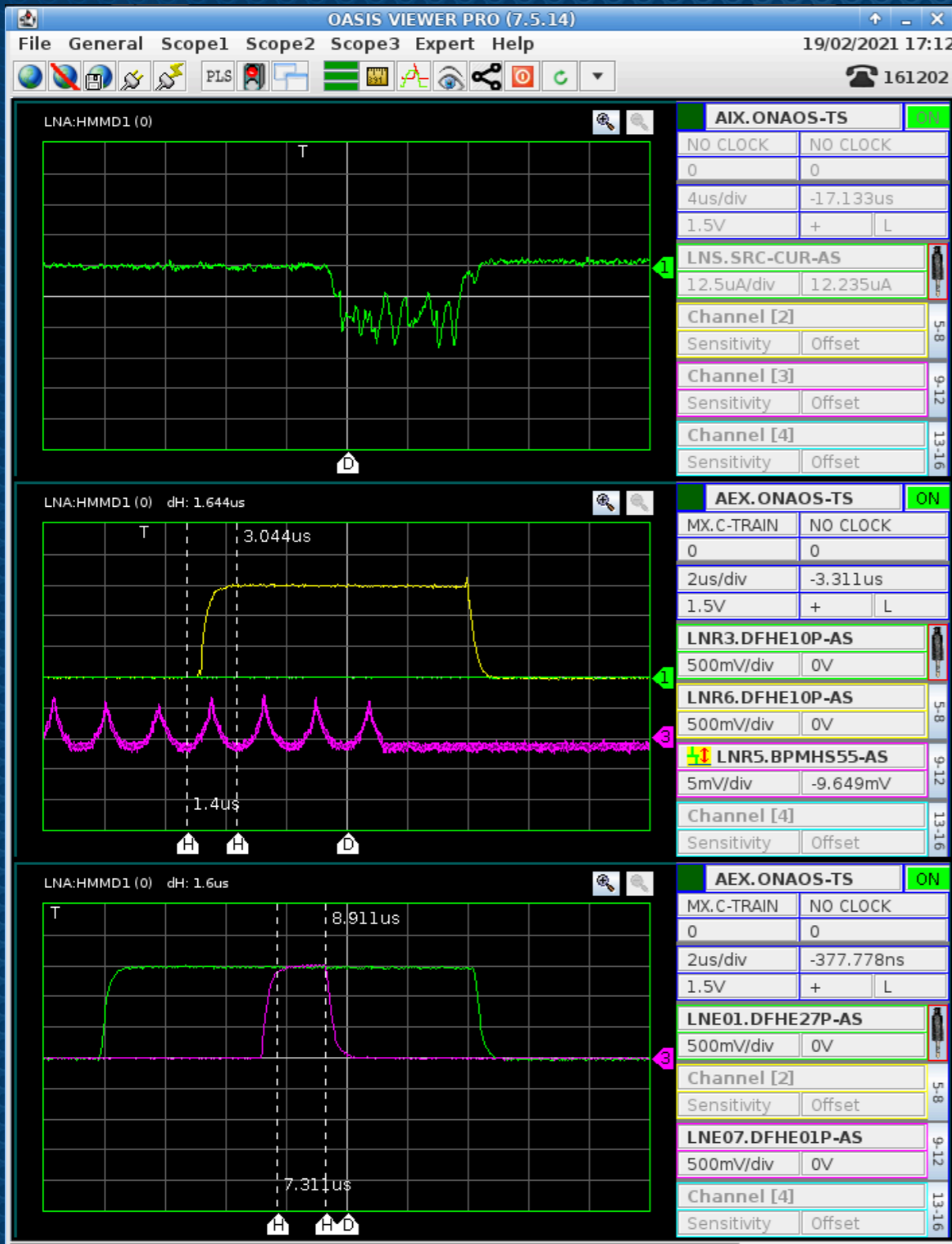
Date	Monitor	Scan	ϵ_x (μm)	α_x	β_x	ϵ_y (μm)	α_y	β_y
Average LNE00			2.97	1.35	3.43	1.88	0.54	3.95
Average LNE06			3.19	1.99	4.00	1.70	0.75	3.72
Average LNE07			3.71	2.02	3.44	2.17	1.11	5.90
Design				2.63	4.22		0.52	5.39



- ❖ LNE00 measurements (BSG0008 and BSG0015) are made on 28 October 2020.
- ❖ LNE06 measurements (BSG0624 up to 0657) are made on 5 and 12 Feb 2021.
- ❖ LNE07 measurements (BSG0722 up to 0744) are made on 14 Dec and 12 Feb 2021.

Conclusions

- ❖ Beam stability and intensity seemed to be improved (thanks to all involved)!
- ❖ Measurements for LNE06 were done on HMPROD2, higher intensity!
- ❖ Vertical emittance and vertical dispersion are seemed to get bigger after WP change. Horizontal counterparts are getting closer to the design.
- ❖ All LNE00s optics are compatible.



- ❖ **This week acquisition:**
 continuation with $h=4$ bunches, to separate them bunch by bunch without disturbing the other experiments.
- ❖ We developed a script to scan start/stop fine delays and/or pulse width. However, The bunch separation is compatible with the fast deflector rise time ?!
- ❖ **This week analysis: GBAR coupling.**