



LHC Injectors Upgrade

LIU-BWS Production Calibration

Results Vol.2

BWS-Project Meeting

15.04.2019

J.L. Sirvent



1. Scanners Calibrations Summary

1.1 Numbers to the date

SCANNER INFORMATION	
Scanner Name:	PXBWSRA005-CR000010
Scanner Type:	PSB
Electronic Serial:	S074

SCANNER INFORMATION	
Scanner Name:	PXBWSRA005-CR000006
Scanner Type:	PSB
Electronic Serial:	S070

SCANNER INFORMATION	
Scanner Name:	PXBWSRA005-CR000004
Scanner Type:	PSB
Electronic Serial:	S068

CALIBRATIONS			
Calibration Name	Speed [rad/s]	Scans Number	Control System
S074_2019_02_19_14_35	55	303	New Dspace
S074_2019_02_20_11_20	55	303	
S074_2019_02_28_09_20	55	303	
S074_2019_02_28_09_52	55	303	
S074_2019_03_05_11_11	55	303	Old Dspace
S074_2019_03_05_11_44	55	303	
S074_2019_03_05_14_00	110	303	
S074_2019_03_05_14_47	110	303	
S074_2019_03_05_15_57	133	303	
S074_2019_03_05_16_30	133	303	
S074_2019_03_08_10_47	133	303	
Total Scans :		3333	

CALIBRATIONS			
Calibration Name	Speed [rad/s]	Scans Number	Control System
S070_2019_03_20_11_26	55	333	Old Dspace
S070_2019_03_20_13_39	110	333	
S070_2019_03_20_15_28	133	333	
S070_2019_03_20_16_12	55	333	
S070_2019_03_21_11_02	110	333	VFC FPGA
S070_2019_03_21_11_49	133	333	
S070_2019_03_21_15_05	55	333	
S070_2019_03_21_15_46	110	333	
S070_2019_03_21_16_28	133	333	
S070_2019_03_27_15_31	110	333	
S070_2019_03_27_17_09	110	333	
S070_2019_03_28_11_04	110	333	
		3996	

CALIBRATIONS HIS			
Calibration Name	Speed [rad/s]	Scans Number	Control System
S068_2019_04_05_11_22	55	333	Old Dspace
S068_2019_04_10_10_58	130	333	FPGA VFC
S068_2019_04_10_14_44	130	333	FPGA VFC
S068_2019_04_11_16_06	55	333	
S068_2019_04_11_16_42	110	333	Old Dspace
S068_2019_04_11_17_19	130	333	
		1998	

<https://issues.cern.ch/browse/BIBWSLIU-43>

11 Calibrations

<https://issues.cern.ch/browse/BIBWSLIU-47>

12 Calibrations

<https://issues.cern.ch/browse/BIBWSLIU-48>

6 Calibrations

Plans (As agreed last week)

1. Finish with CR000004 and install another PSB BWS
2. Check for performance differences with both control systems (finish validation with 3 scanners)
3. Perform calibrations at 3 speeds (old Dspace) and VFC-FPGA
4. Install PS BWS → Investigations on distorted beam profiles



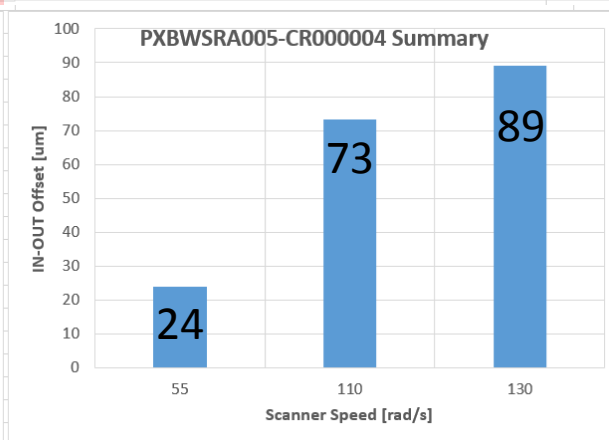
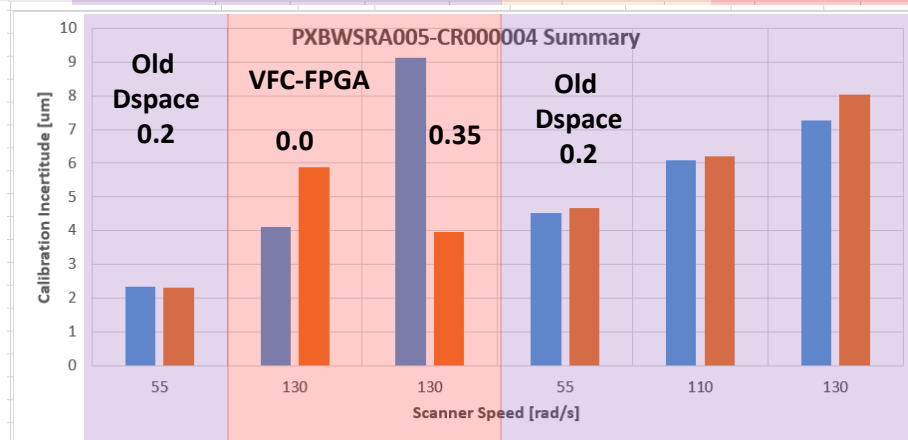
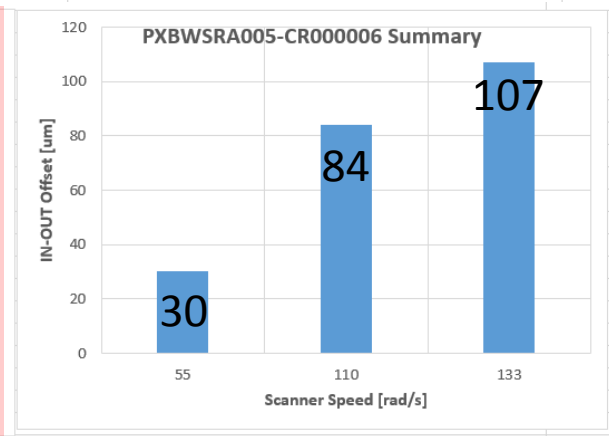
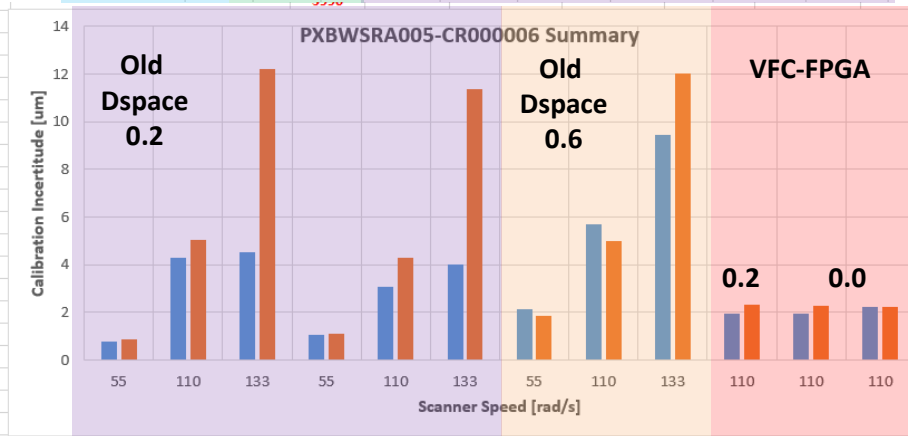
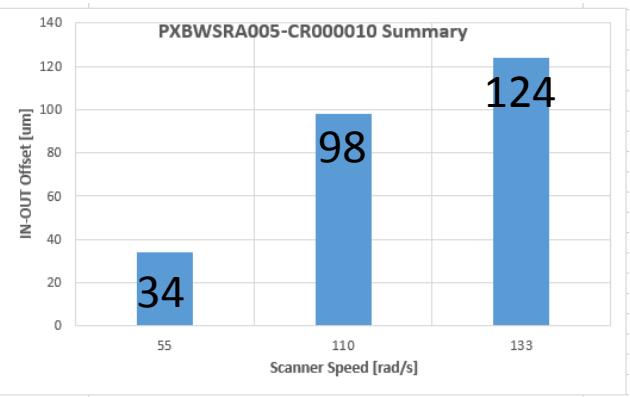
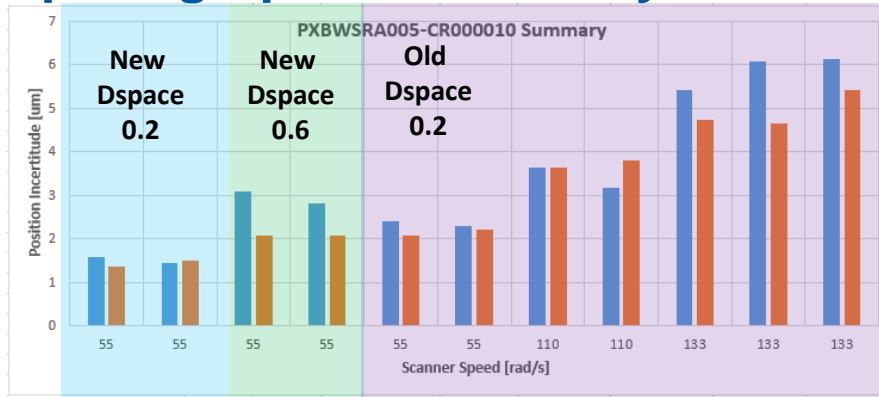


1. Scanners Calibrations Summary

1.2 A quick graphical summary

Different configs.:

- Starting Angle
- Control System
- Speed Profile





2. Tests Performed

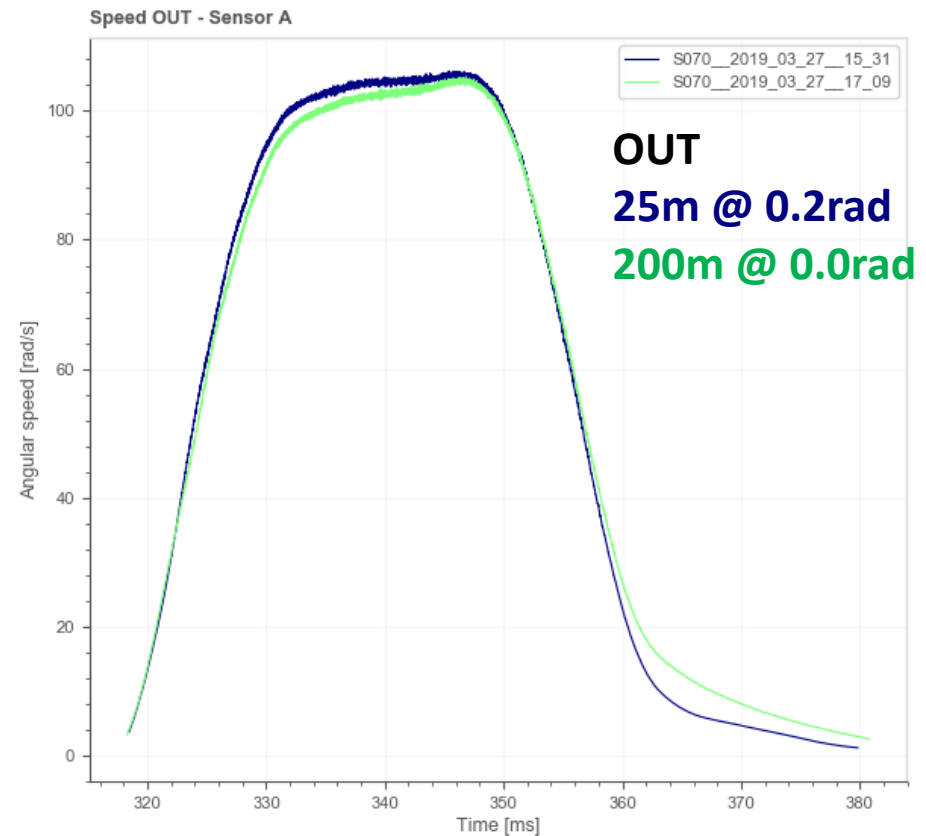
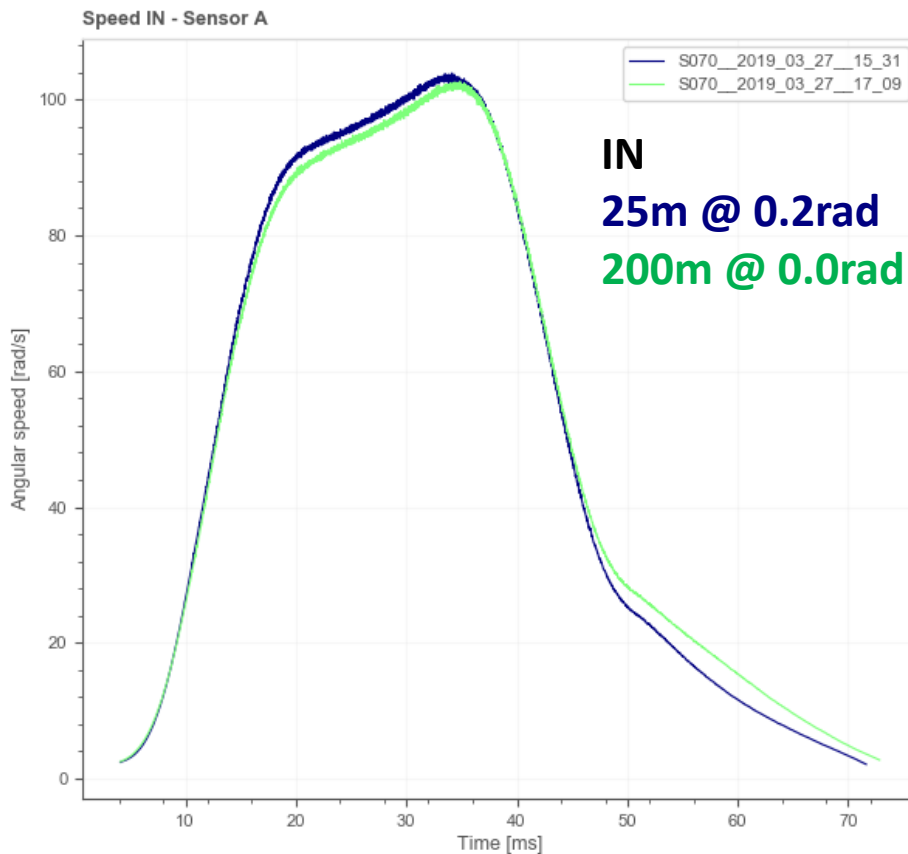
2.1 Influence of Cable Length (Speed Profiles)

Scanner: PSB_PXBWSRA005-CR000006

Control System: VFC-FPGA @ 110rs-1

25m @ 0.2rad

200m @ 0.0rad





2. Tests Performed

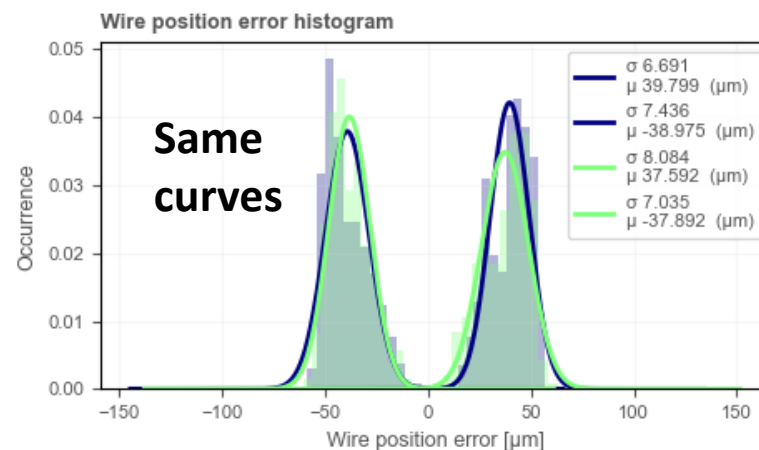
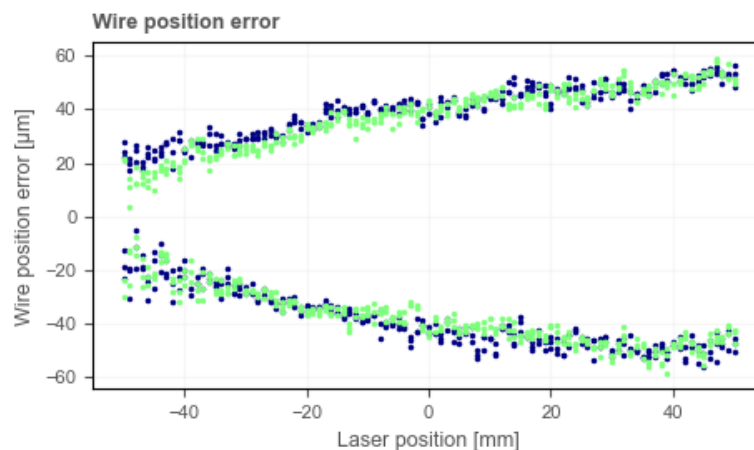
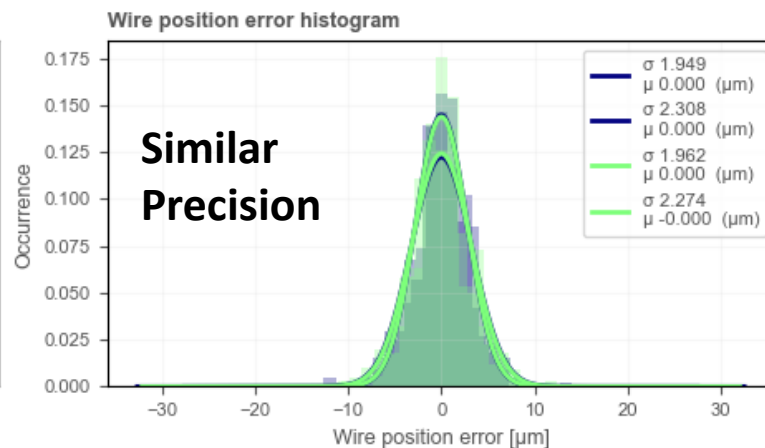
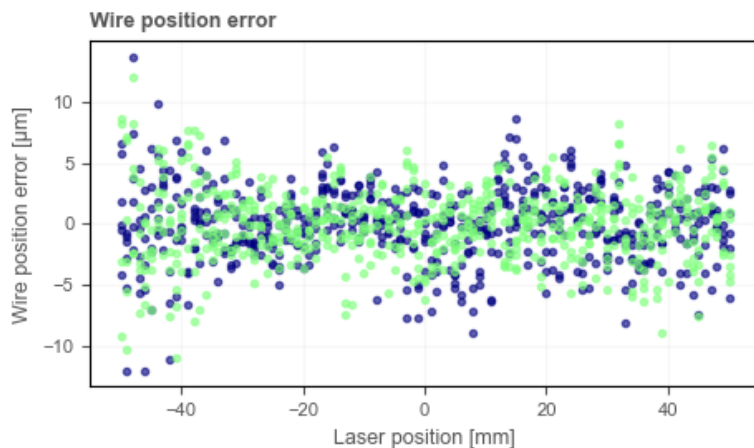
2.1 Influence of Cable Length (Performance)

Scanner: PSB_PXBWSRA005-CR000006

Control System: VFC-FPGA @ 110rs-1

25m @ 0.2rad

200m @ 0.0rad





2. Tests Performed

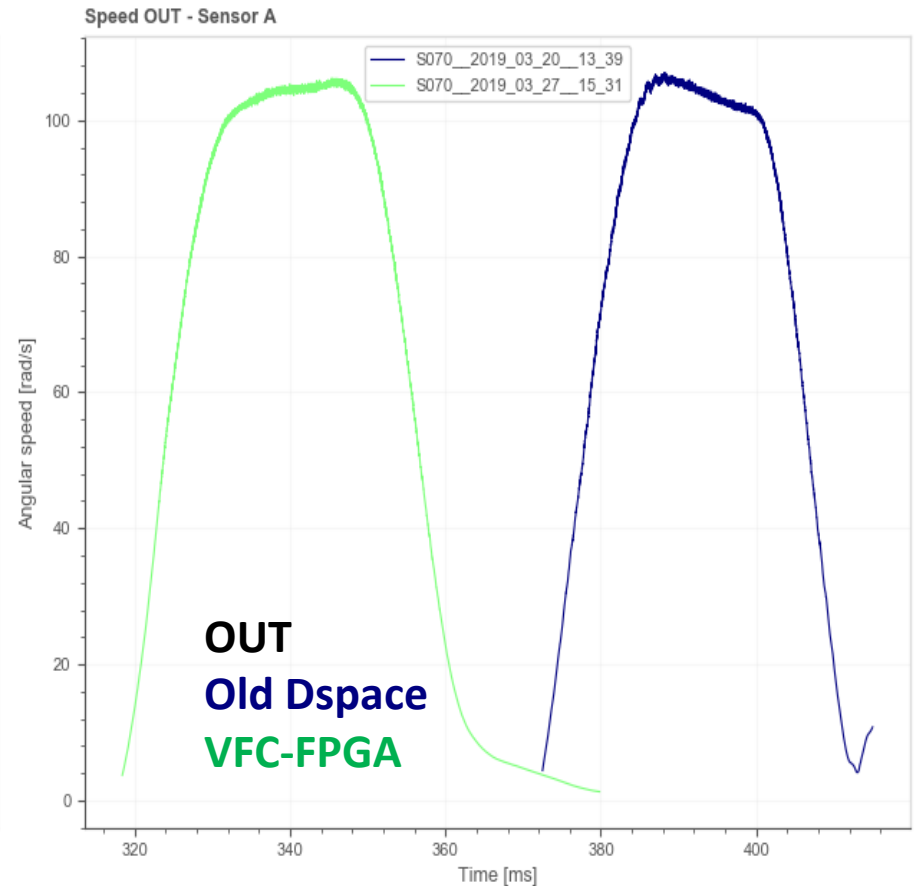
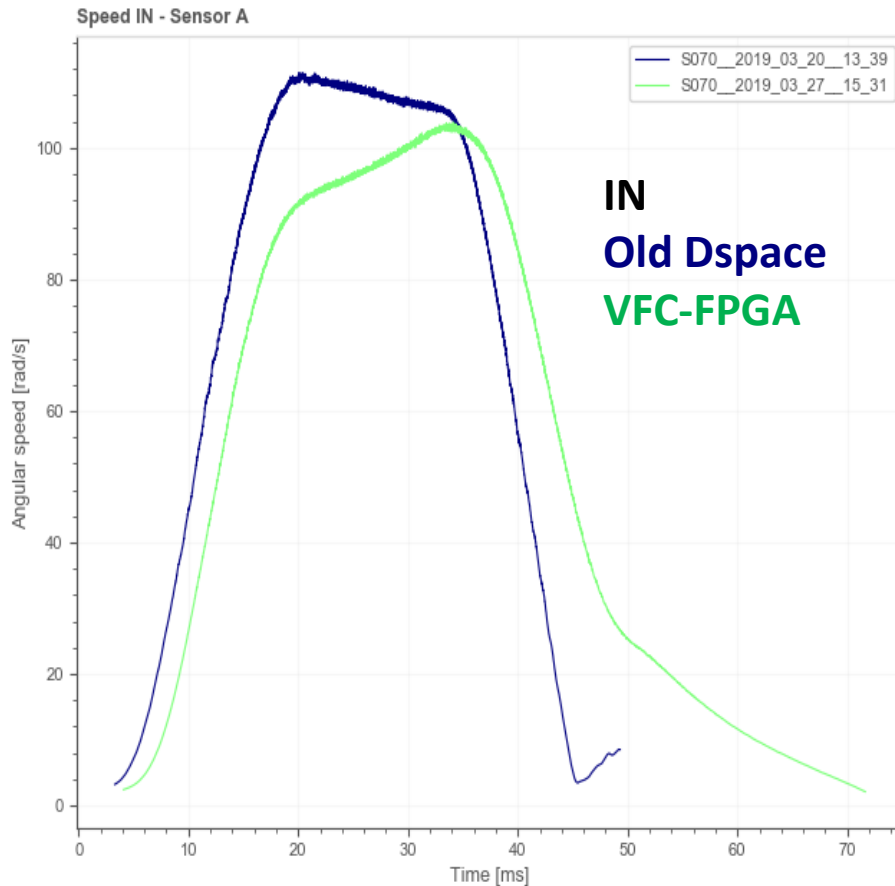
2.2 Influence of Control Electronics 110rs-1 (Speed Prof)

Scanner: PSB_PXBWSRA005-CR000006

Control System: VFC-FPGA & Old Dspace

Old Dspace @ 110rs-1 & 0.2rad

VFC-FPGA @ 110rs-1 & 0.0rad





2. Tests Performed

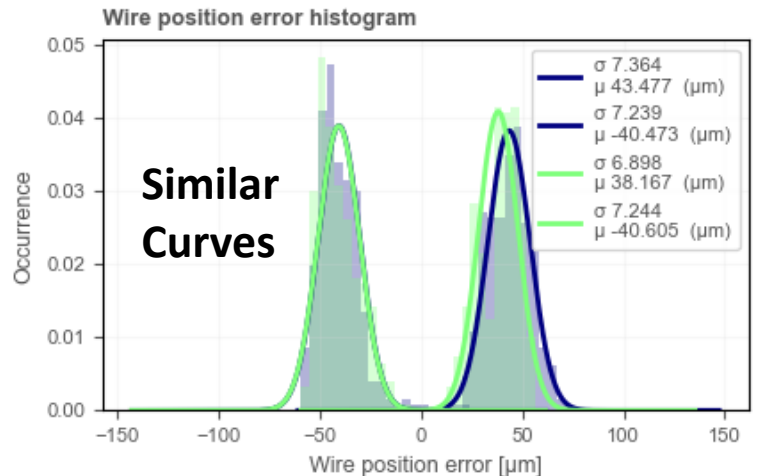
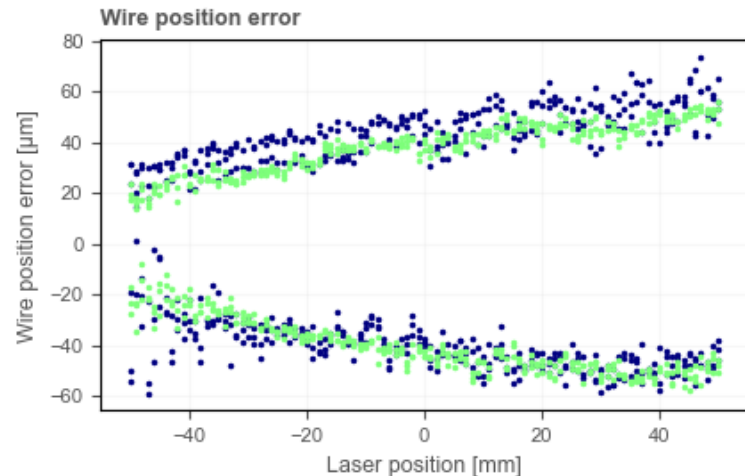
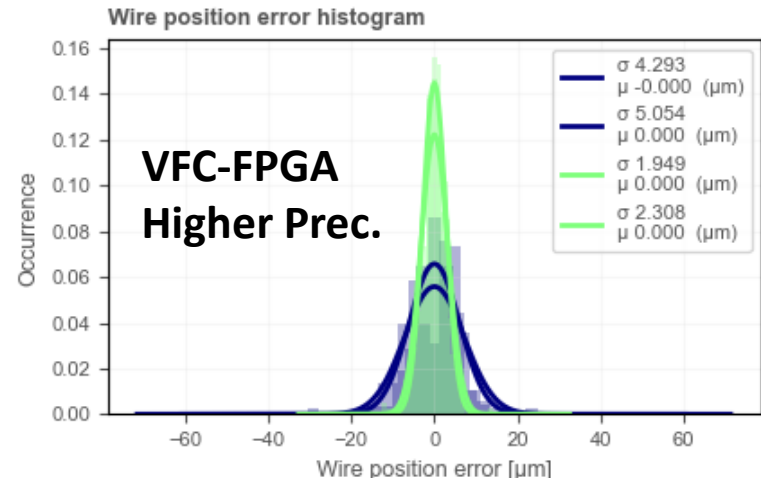
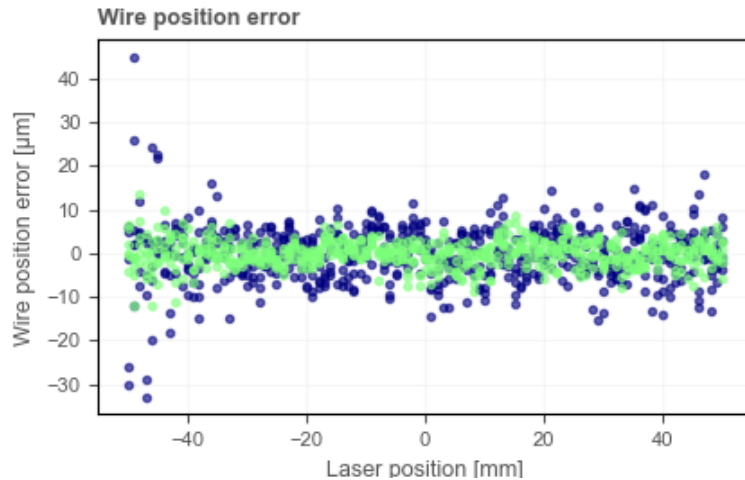
2.2 Influence of Control Electronics 110rs-1 (Performance)

Scanner: PSB_PXBWSRA005-CR000006

Control System: VFC-FPGA & Old Dspace

Old Dspace @ 110rs-1 & 0.2rad

VFC-FPGA @ 110rs-1 & 0.2rad





2. Tests Performed

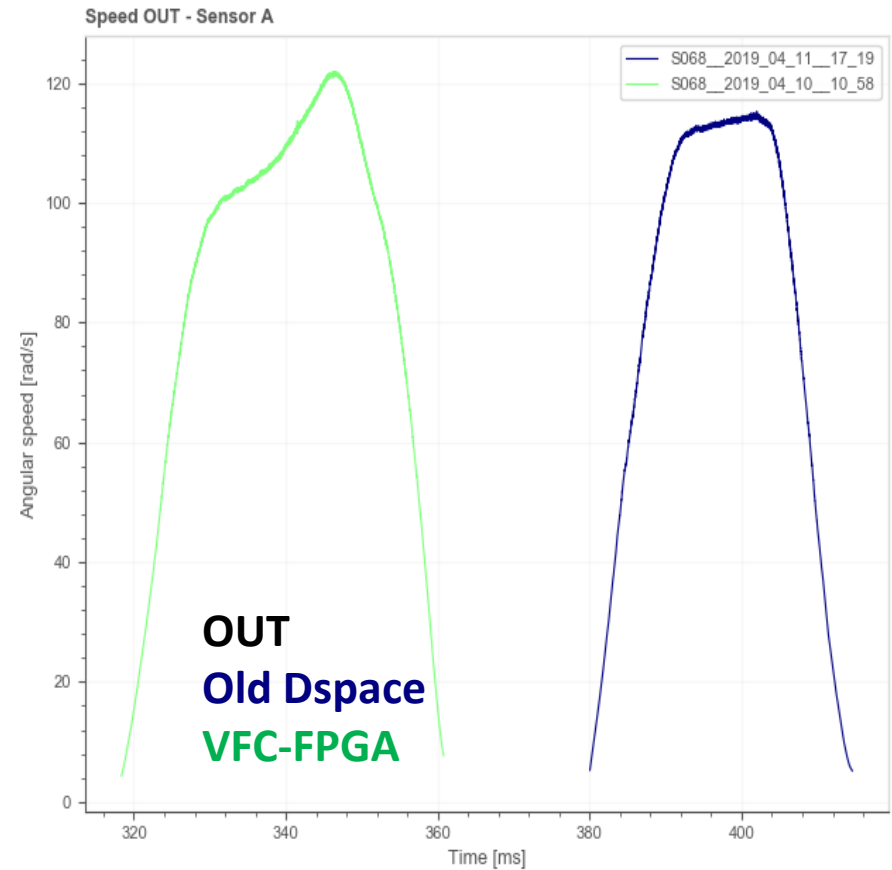
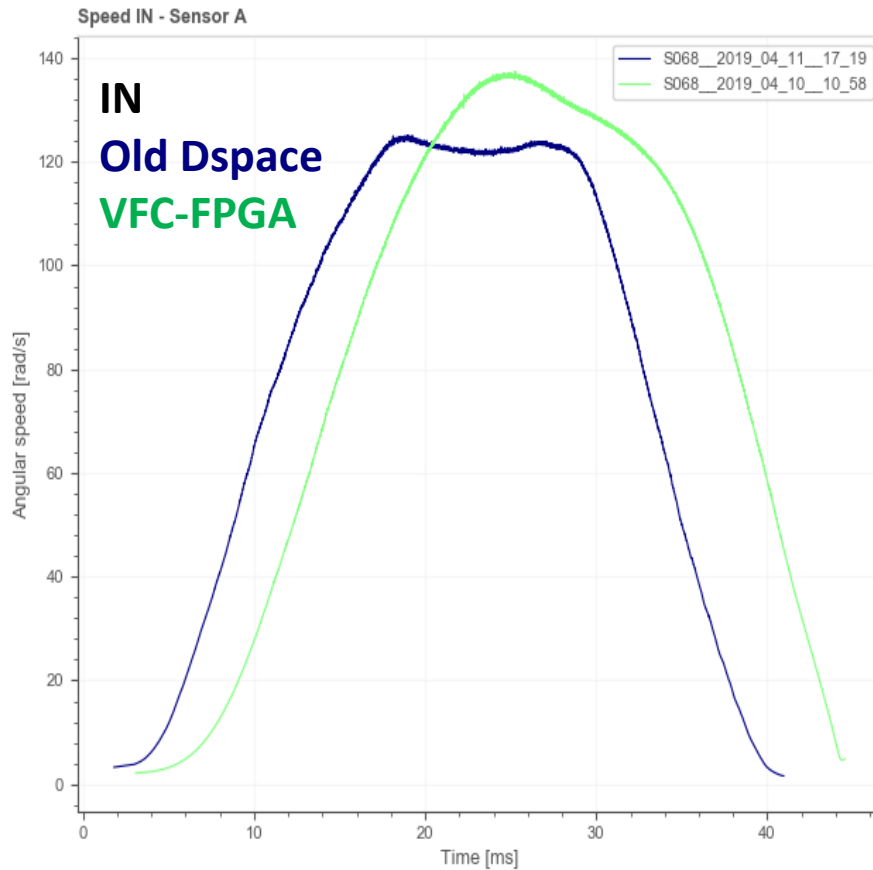
2.2 Influence of Control Electronics 130 rs-1 (Speed Prof)

Scanner: PSB_PXBWSRA005-CR000004

Control System: VFC-FPGA & Old Dspace

Old Dspace @ 130rs-1 & 0.2rad

VFC-FPGA @ 130rs-1 & 0.0rad





2. Tests Performed

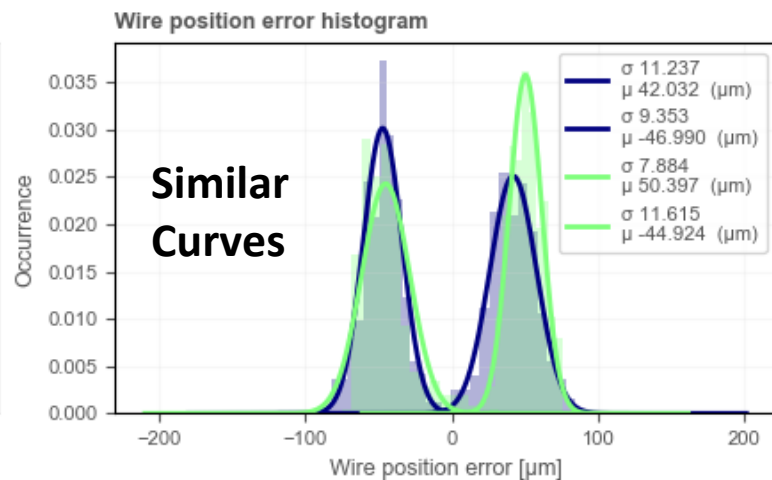
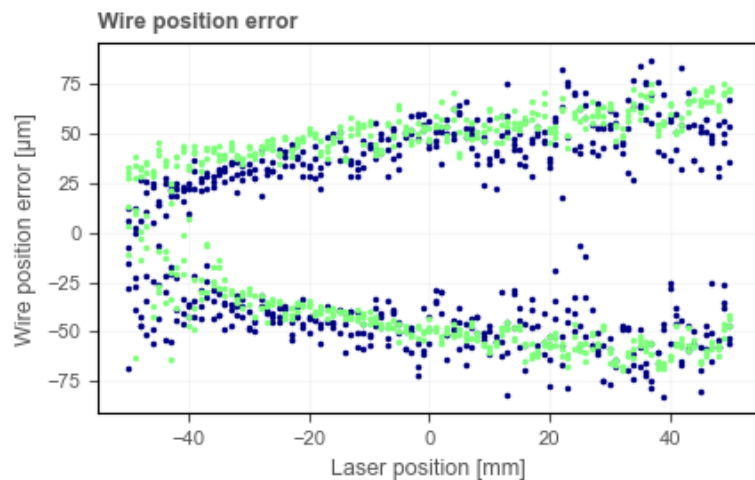
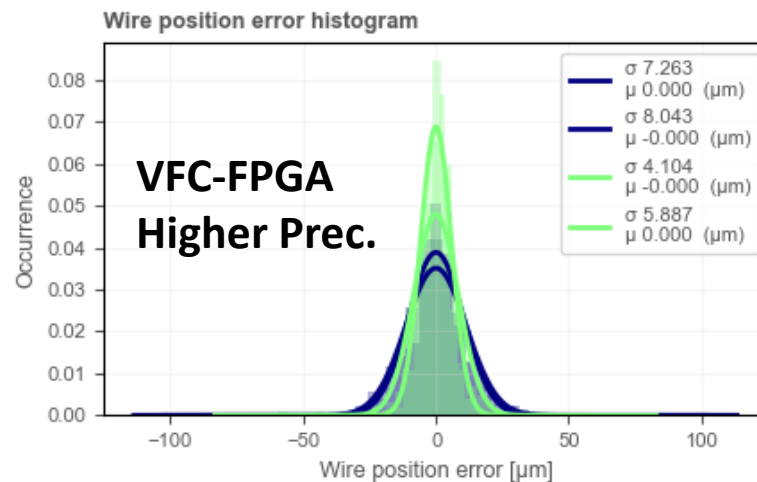
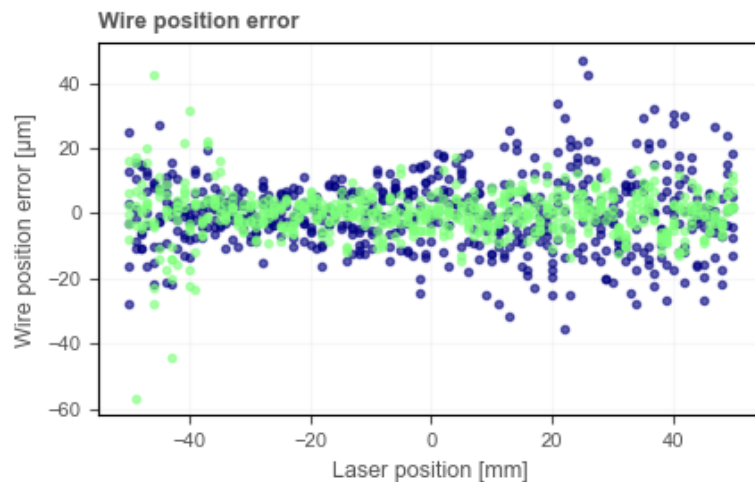
2.2 Influence of Control Electronics 130 rs-1 (Performance)

Scanner: PSB_PXBWSRA005-CR000004

Control System: VFC-FPGA & Old Dspace

Old Dspace @ 130rs-1 & 0.2rad

VFC-FPGA @ 130rs-1 & 0.0rad

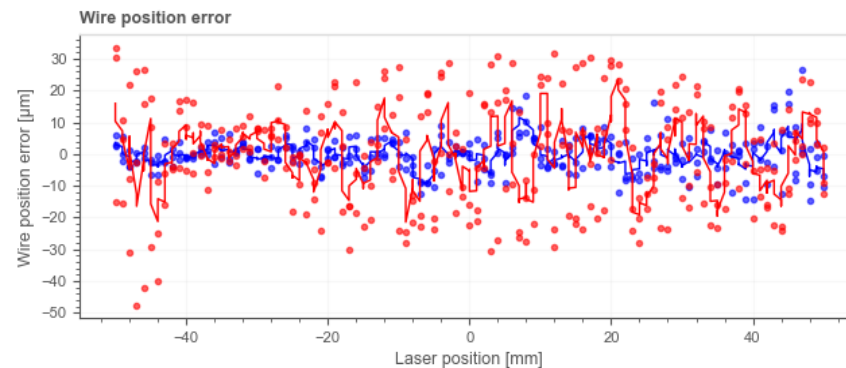
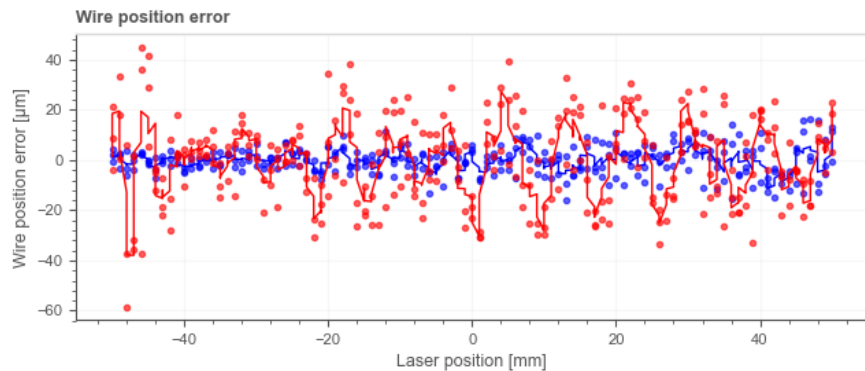




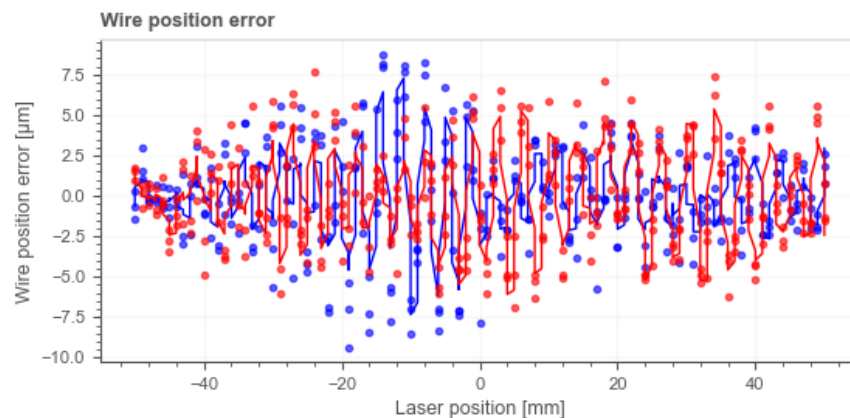
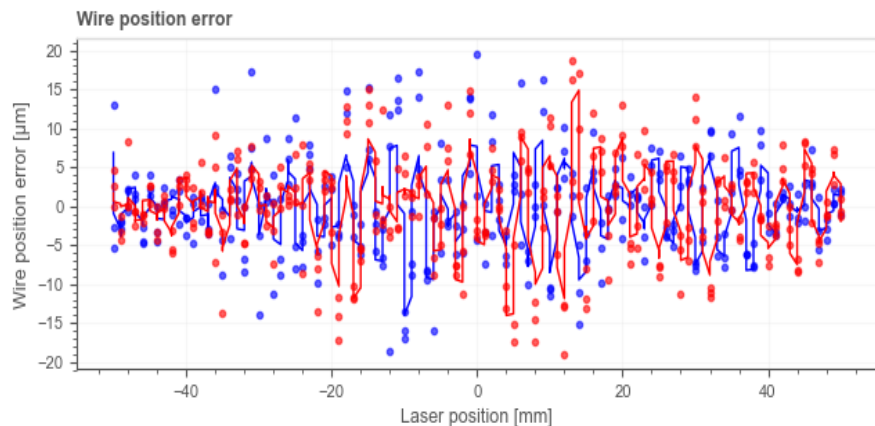
3. Some interesting behaviours

3.1 Clearly... something is vibrating, but what??...

Scanner: PSB_PXBWSRA005-CR000006 **Control System:** Old Dspace @ 133rs-1



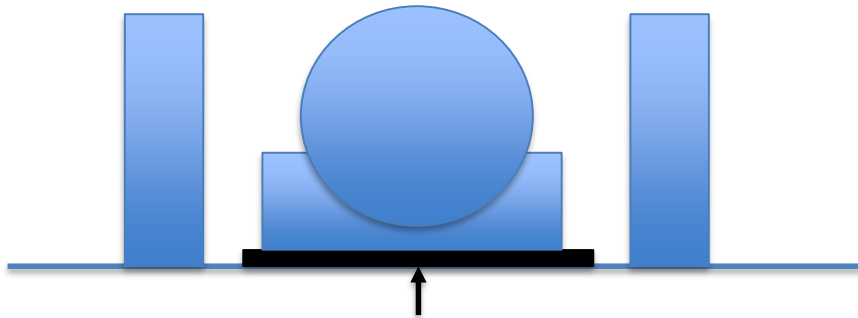
Scanner: PSB_PXBWSRA005-CR000004 **Control System:** Old Dspace @ 55rs-1



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3. Outcome

1. With the data we have today it is fully possible calibrate the scanners with Dspace
It would be still nice to double check this with the next PSB scanner
2. IN – OUT Slack is consistent between scanners for diff. speeds
3. Instruments performance consistent (~ 2- 4um @ 55rs-1, ~8-10um @ 130rs-1)
4. Wire determination precision in c.bench is limited in some cases by vibrations
Is there something we can do to void it? Just an idea...



Try with soft Rubber Mount??
Avoid BWS Vibrations to propagate to laser
Better insight on what is vibrating (wire, scanner...)



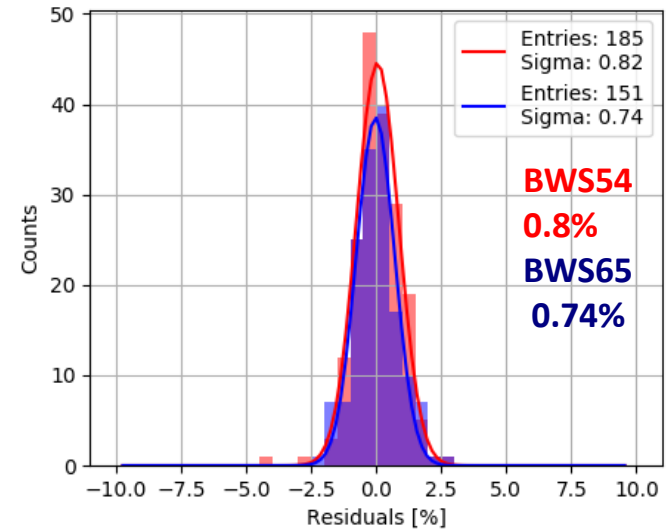
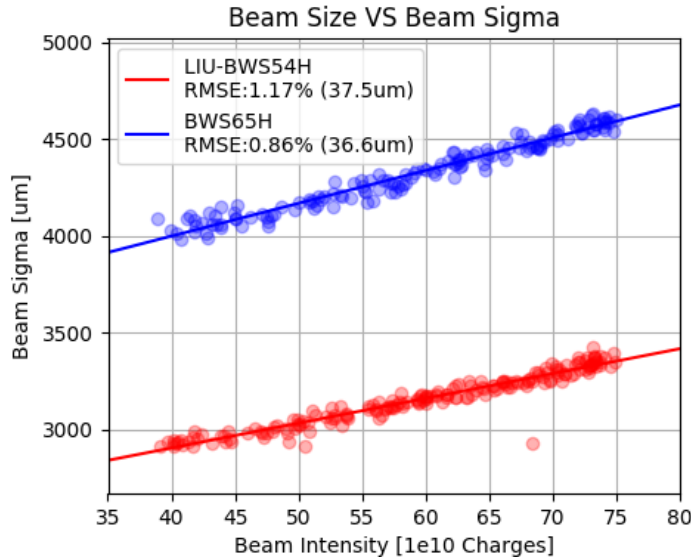


4. Some interesting plots from this week

1. Brightness curves

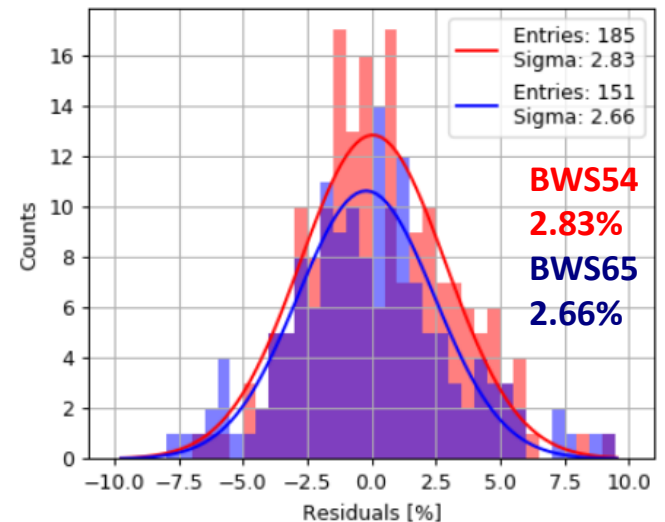
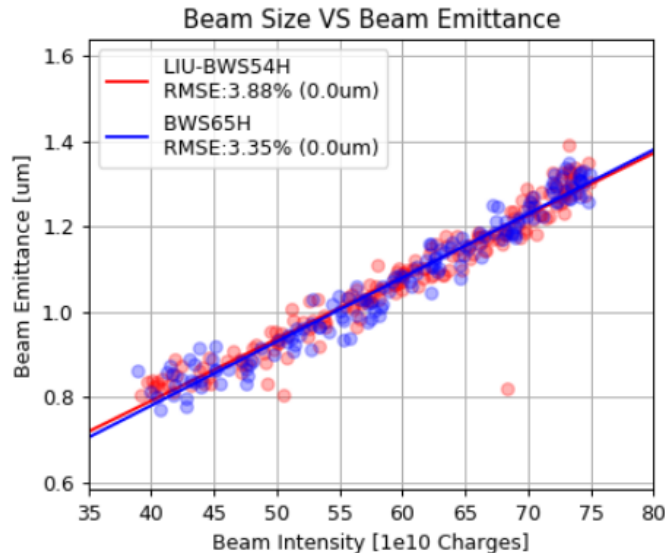
OP-BWS65H
2018_10_12 (IN)
980 ms

LIU-BWS54H
Original optics!
2018_11_01 (OUT)
180 + 200 ms



Accelerator Optics
BWS_54B = 12.7
BWS_54D = 2.22

BWS_65B = 22.3
BWS_65D = 3.2



Handwritten mark resembling a stylized 'Y' or '4'.



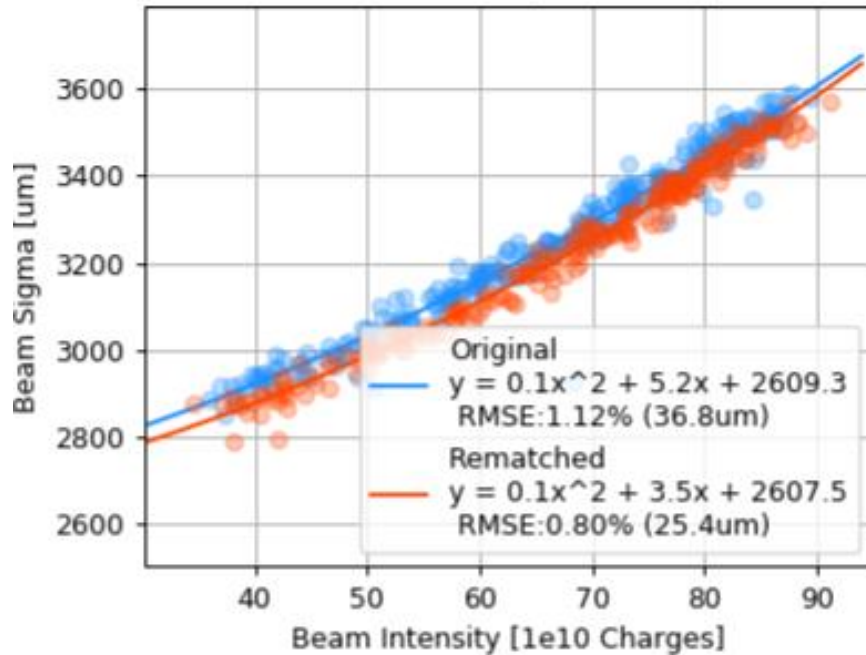
4. Some interesting plots from this week

2. Different Optics in PSB-PS Transfer Line (Optimized for low E blow-up)

Rematched optics showing systematically narrower beam sizes (smaller emittance blow-up??) This effect was hidden with prior processing....

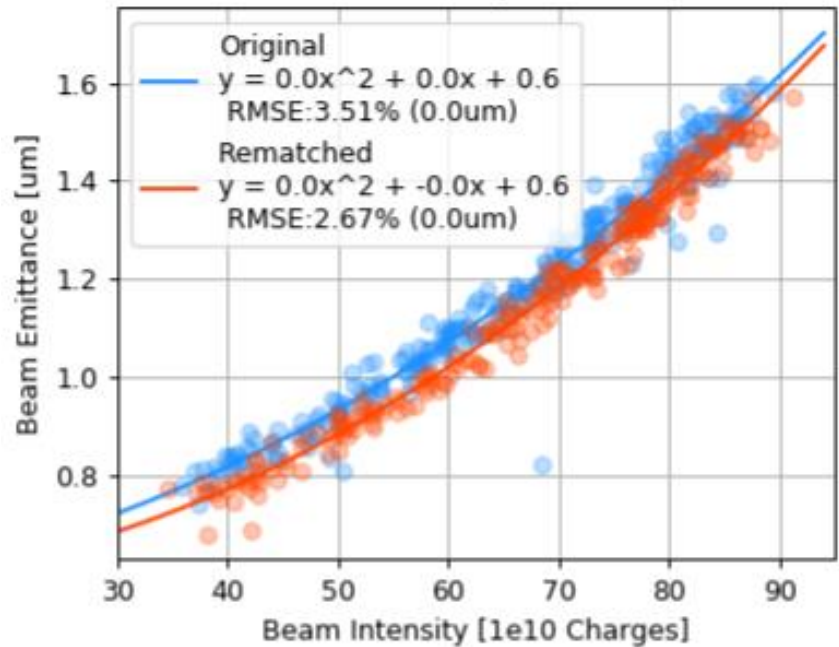
Beam Size

LIU-BWS CPS (BWS.54.H)



Beam Emittance

LIU-BWS CPS (BWS.54.H)



~2.5% Smaller Emittance for Rematched optics?





LHC Injectors Upgrade

