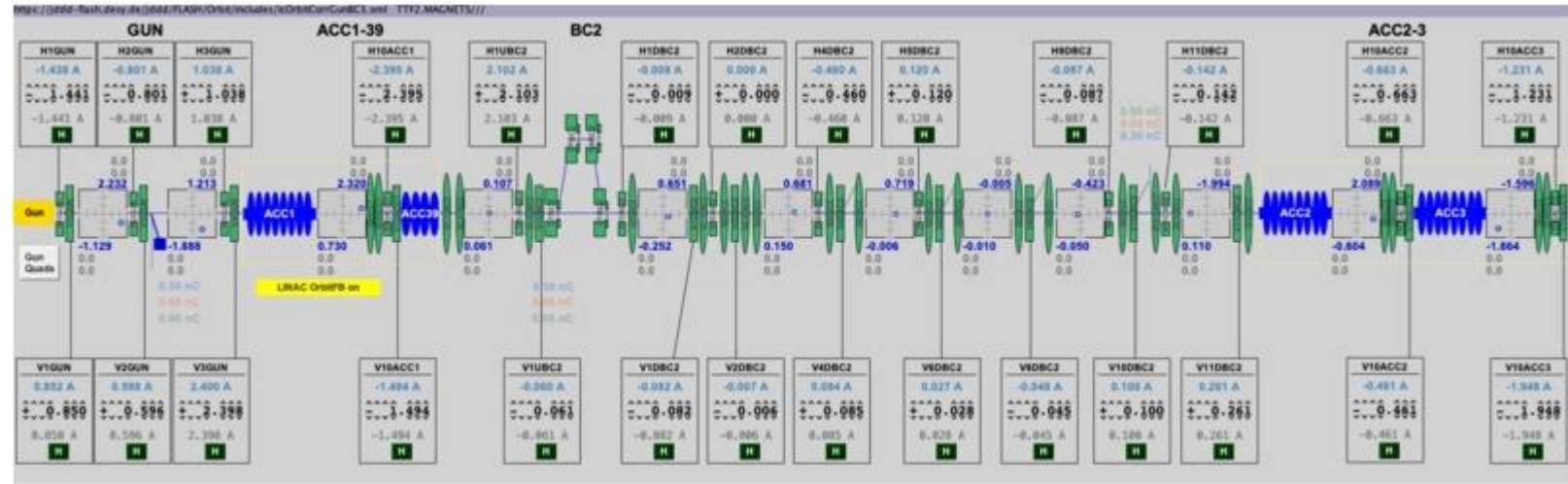# BPM Studies at FLASH 18.05.2021M
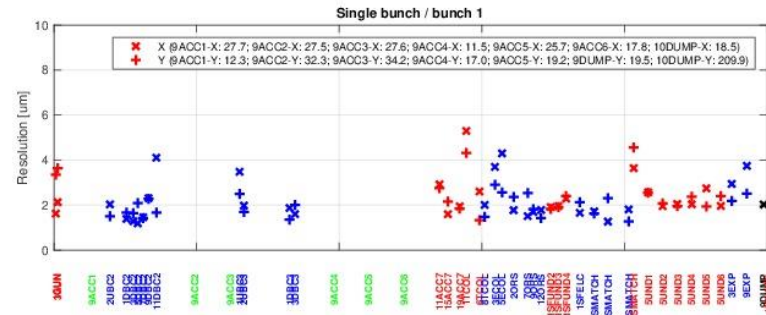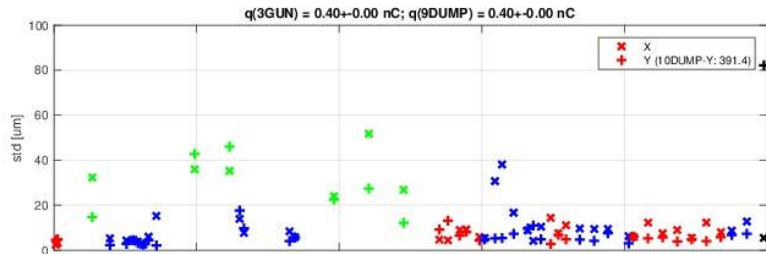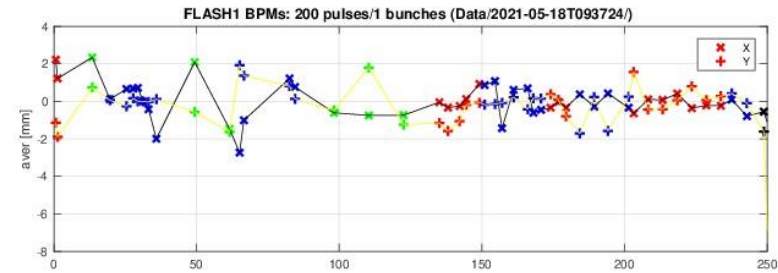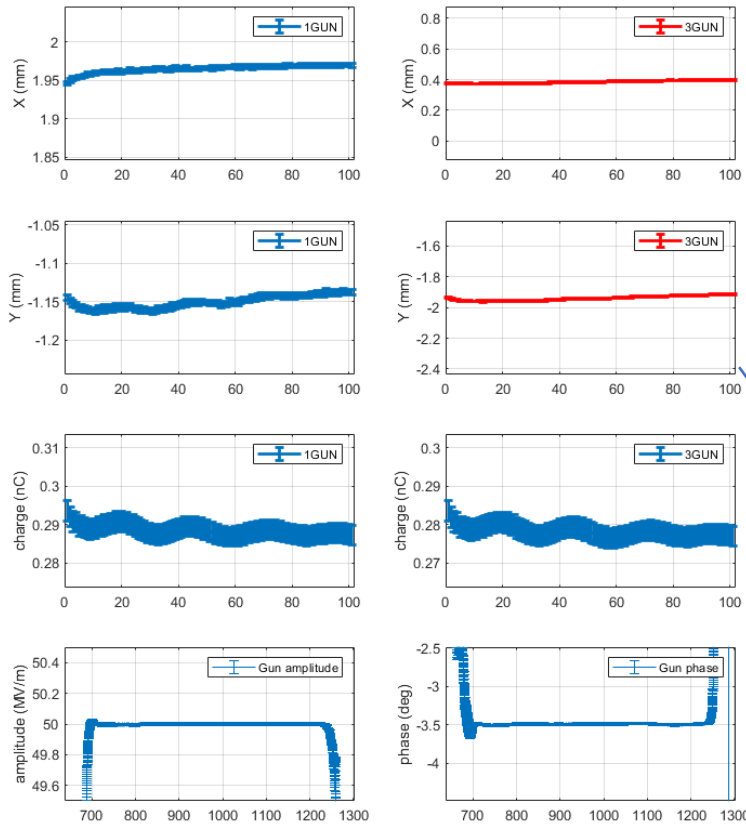
N. Baboi, S. Schreiber, M. Krasilnikov

Preparations, machine setup

FLASH 1: BPM Statistics and Resolution (SINGLE BUNCH)
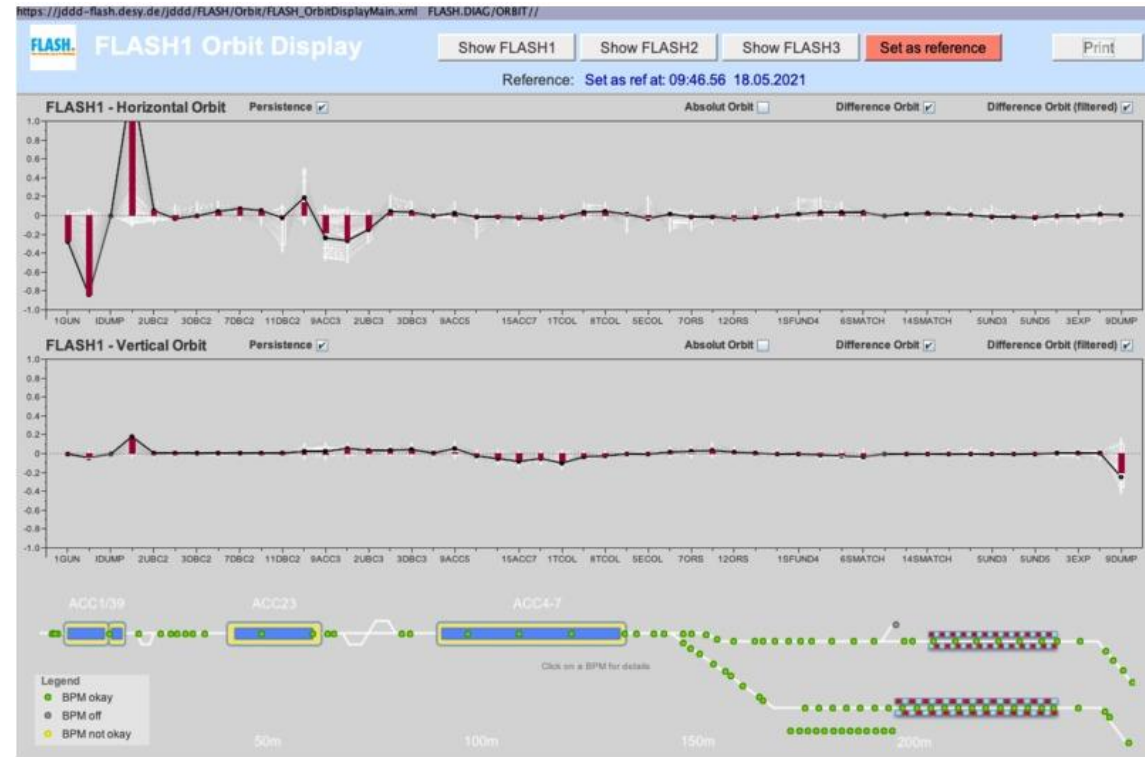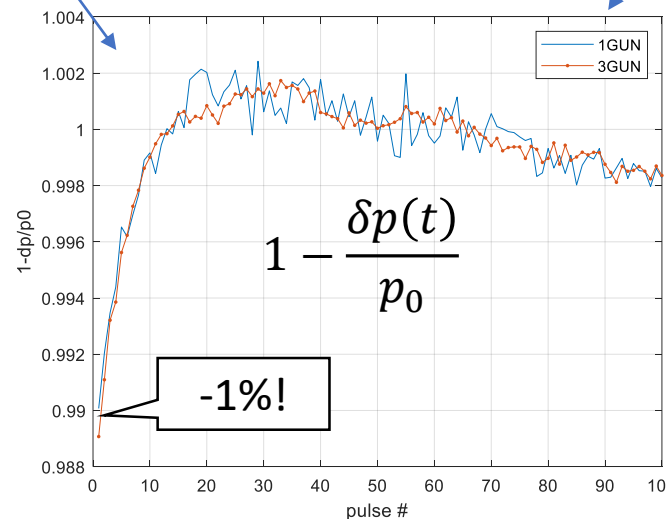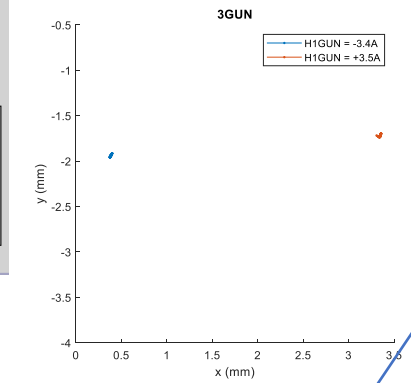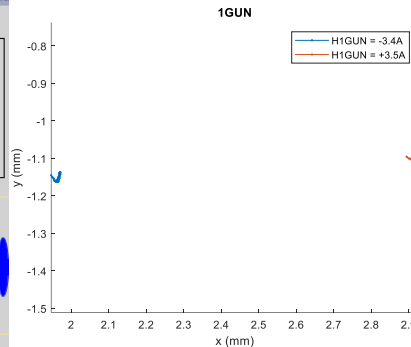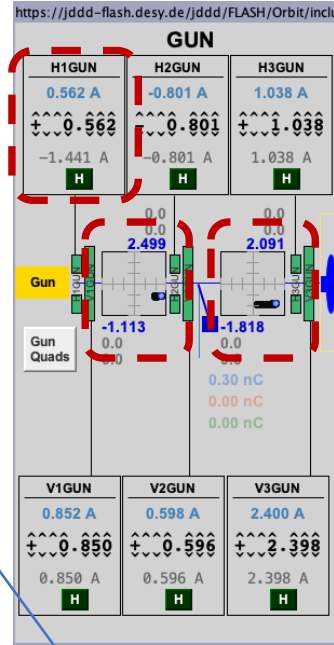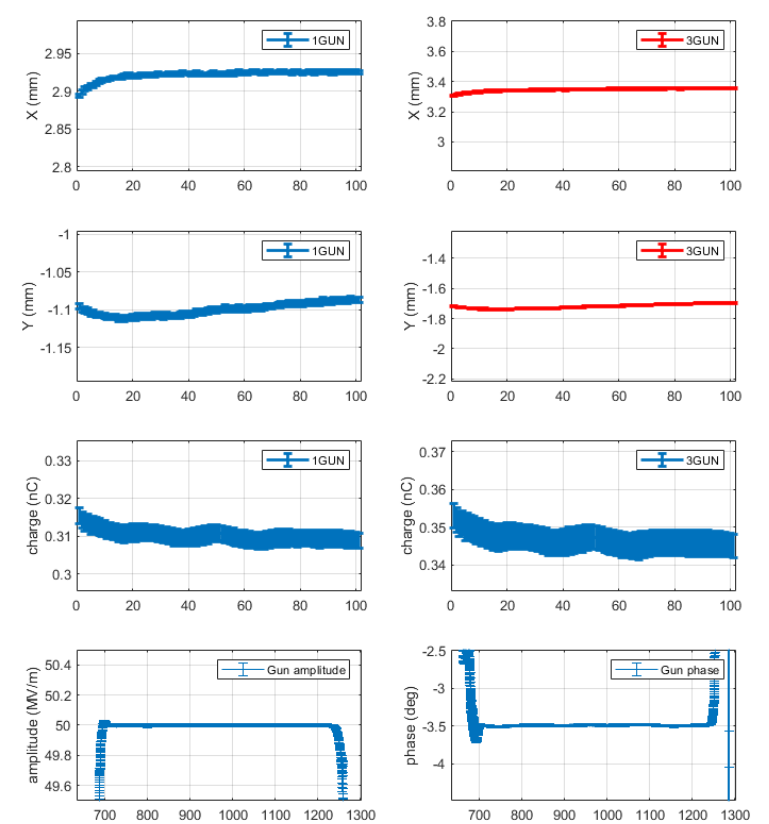
1GUN and 3GUN BPMs (horizontal steering)

H1GUN = -3.4A: FLASH_BPMs_18_May_2021_10_13_39.mat

H1GUN = 3.5A: FLASH_BPMs_18_May_2021_11_04_50.mat

Data saved to \\afs\ifh.de\group\pitz\data\kras\sim5\CouplerKick\BPMatFLASH\scripts4FLASH\20210518\FLASH_BPMs_18_May_2021_10_13_39.mat
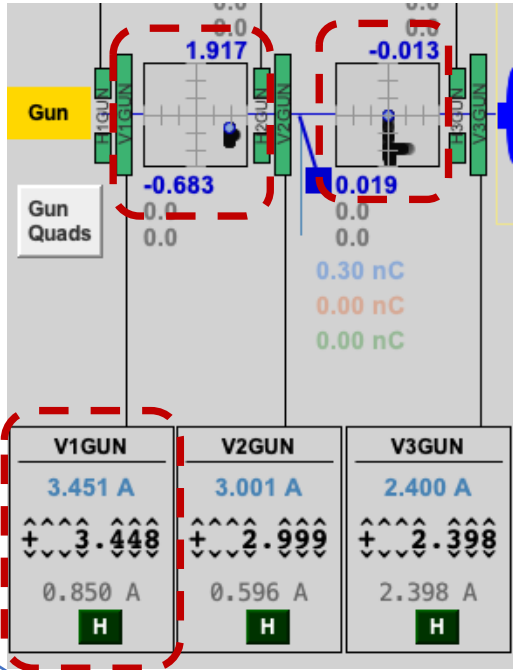
Data saved to \\afs\ifh.de\group\pitz\data\kras\sim5\CouplerKick\BPMatFLASH\scripts4FLASH\20210518\FLASH_BPMs_18_May_2021_11_04_50.mat

$$1 - \frac{\delta p(t)}{p_0} = \frac{\sqrt{[x_{BPM}(+3.5A, t) - x_{BPM}(-3.4A, t)]^2 + [y_{BPM}(+3.5A, t) - y_{BPM}(-3.4A, t)]^2}}{I_{st} \cdot \sqrt{A_x^2 + A_y^2}}$$
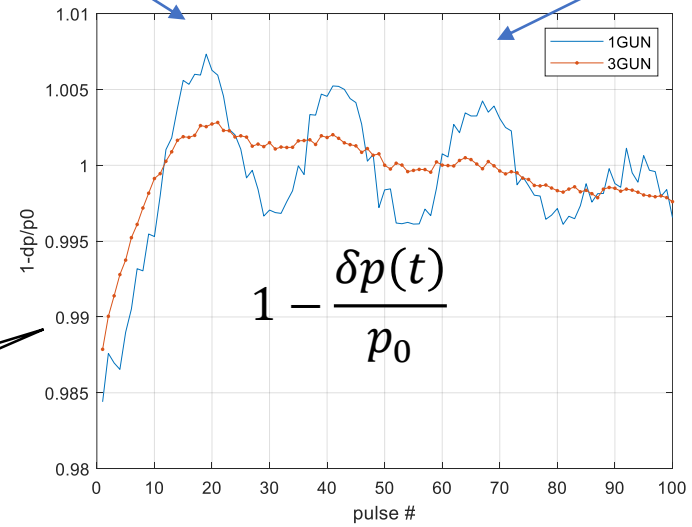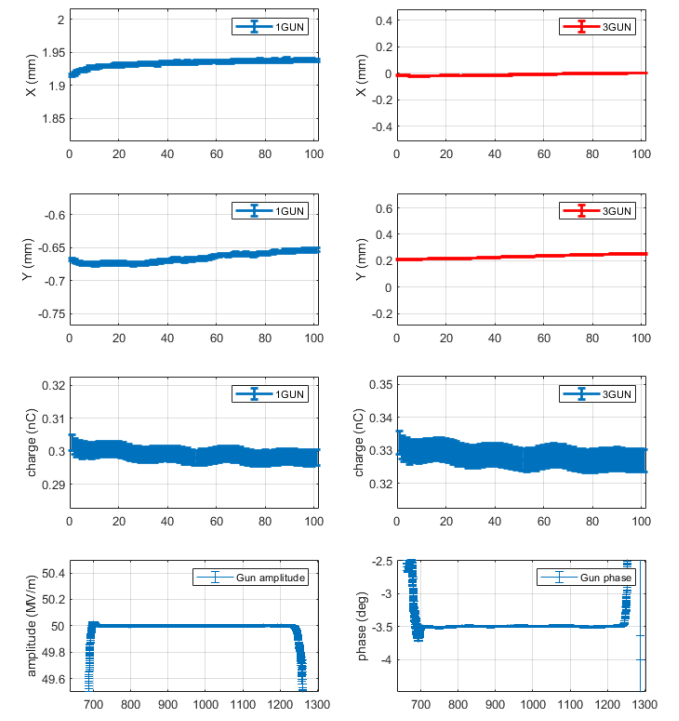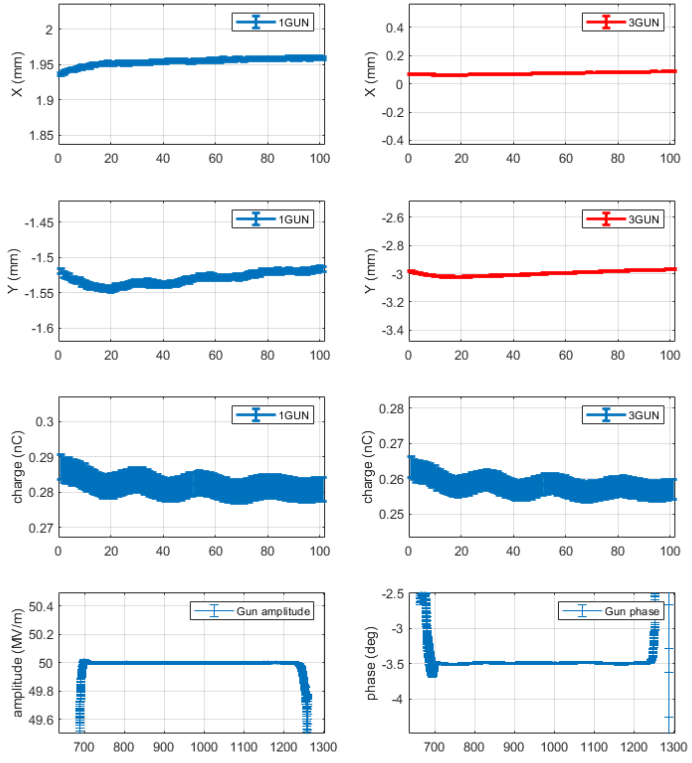
$$\int_{\#20}^{\#100} \frac{\delta p(t)}{p_0} dt = 0$$

$$1 - \frac{\delta p(t)}{p_0}$$

-1%!

1GUN and 3GUN BPMs (vertical steering)

V1GUN = -1.5A: FLASH_BPMs_18_May_2021_11_31_50.mat

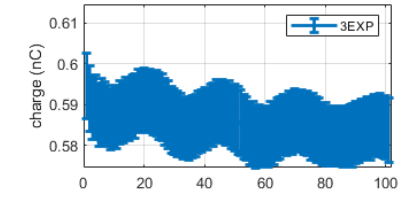V1GUN =. 3.5A, V2GUN = 3.5A:
FLASH_BPMs_18_May_2021_11_40_36.mat

$$1 - \frac{\delta p(t)}{p_0}$$

-1%!

NB:
- 1GUN-Y modulated signal?

Measurements in EXP-section

Switched THz feedback off: Aligned beam in the EXP BPMs

EXP BPMs (horizontal steering)
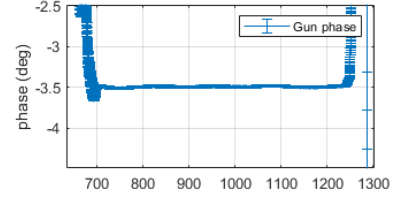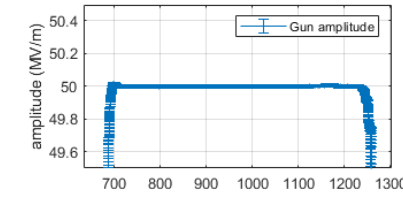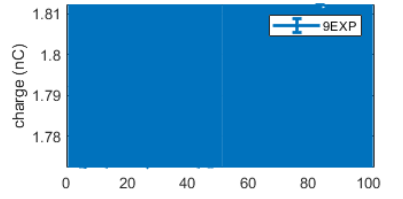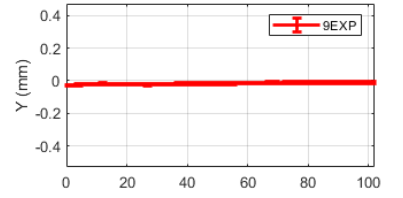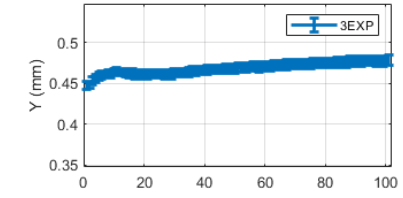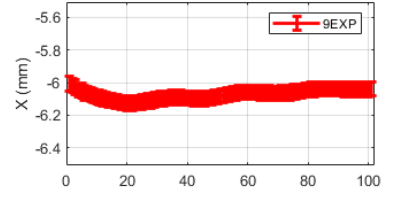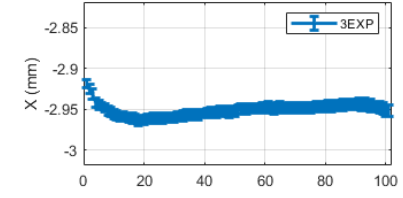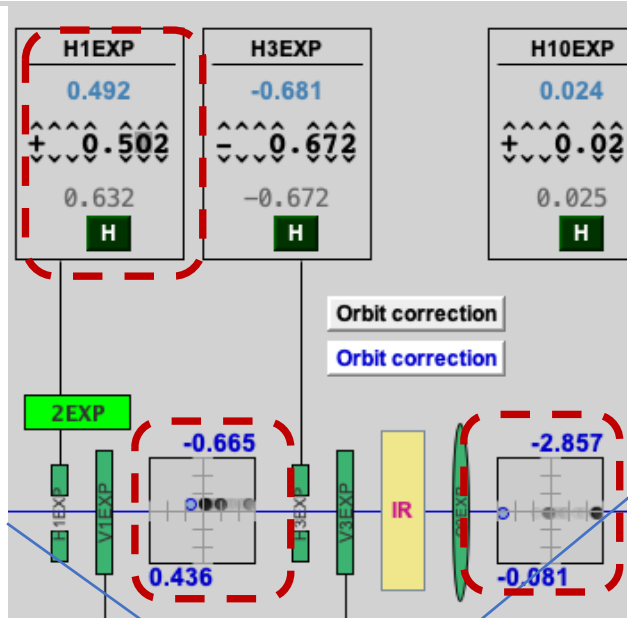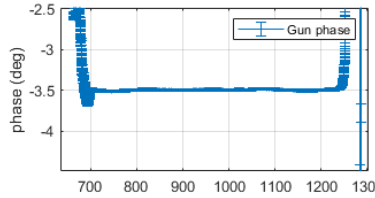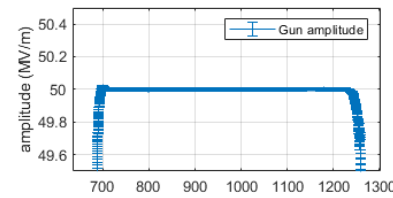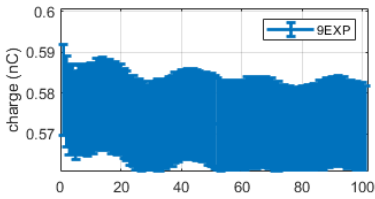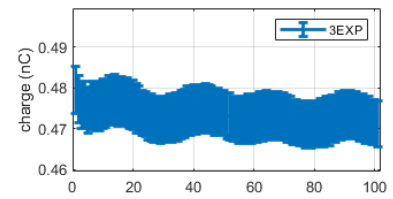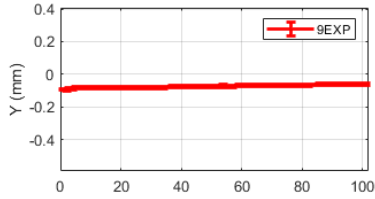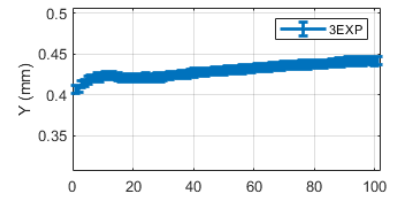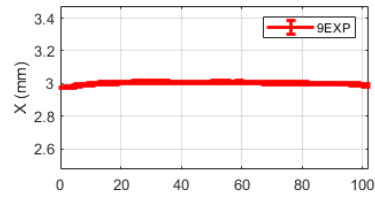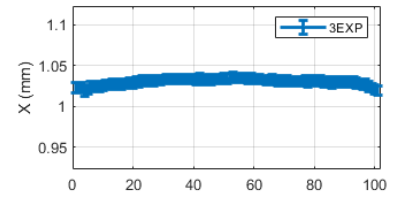
$$1 - \frac{\delta p(t)}{p_0}$$

-1%!
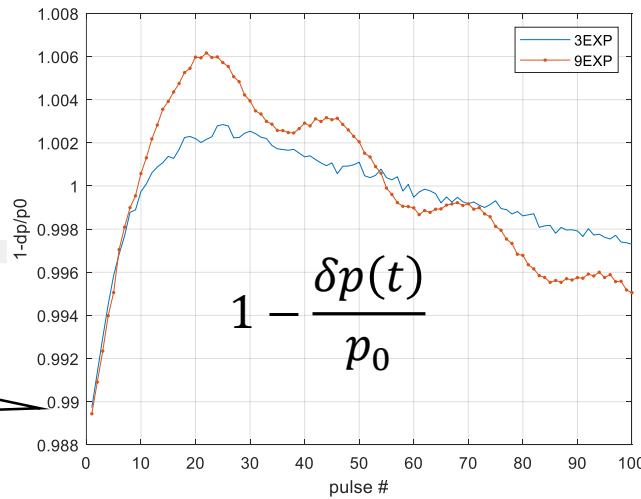
NB:
- ?Charge calibration?
- 3EXP-X out of linear range

EXP BPMs (vertical steering)

BPMs: 1.2/2.9mm: FLASH_BPMs_18_May_2021_12_40_45.mat
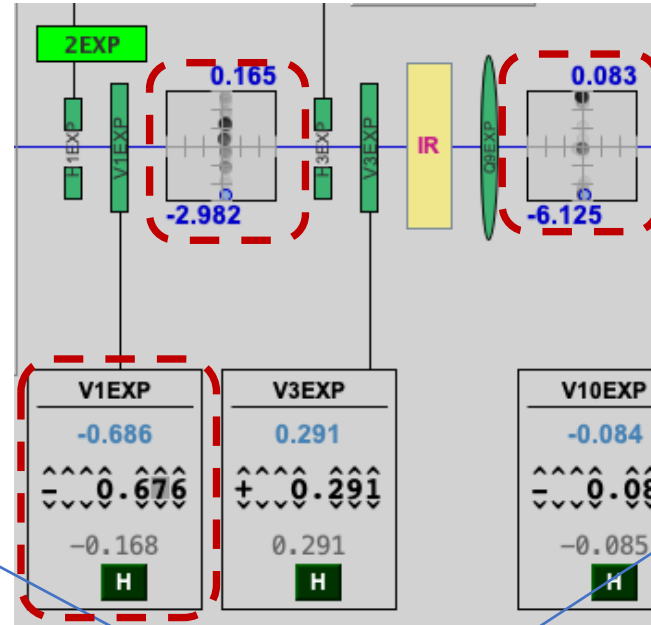
BPMs: -3/-61mm: FLASH_BPMs_18_May_2021_12_45_12.mat

$$1 - \frac{\delta p(t)}{p_0}$$

-1%!
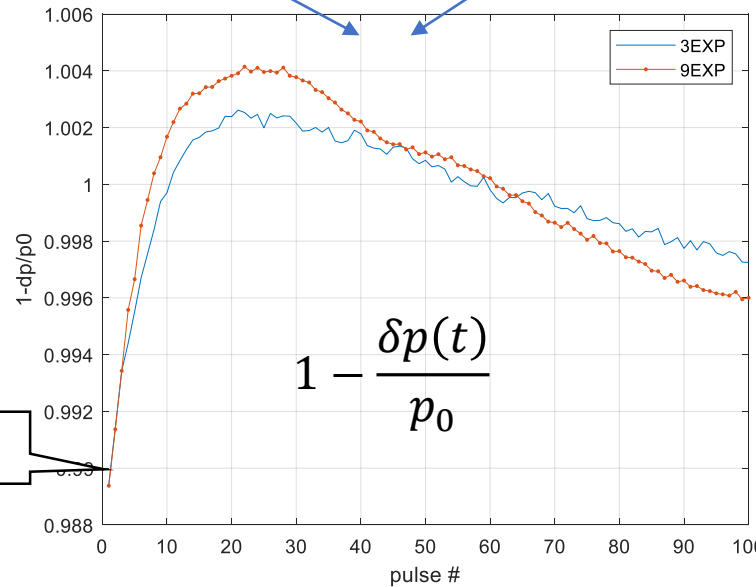
NB: ?Charge calibration?

Measurements in ACC67-section

?repeat the measurement for BPMs in ACC6 and ACC7, since different type of BPMs (cold cavity BPMs)

ACC67 is off. Q10ACC6 = 4.2A; Q10ACC7 = -2.6A

Try to put the quads slowly down to 0, and meanwhile correct the transmission (with steerers and quads upstream), but without success.
➔ Decided to take quick measurements with 30 bunches only

Cycle quads Q10ACC6 and Q10ACC7 to 0. Switch briefly the beam on, take data, then off; 30 bunches, short pulse mode

Measuring BPMs:
9ACC6 – cold BPM, different electronics!
11ACC7 – cold BPM, same electronics
9ACC7 – not existing
15ACC7 – button type BPM (larger buttons ~@GUN)

Steerers used: H/V10ACC5

NB:
- corrupted data for 9ACC6 (1st 9-10 pulses missed)
- no data for 9ACC7 (wrong address?)
- But data for 15ACC7
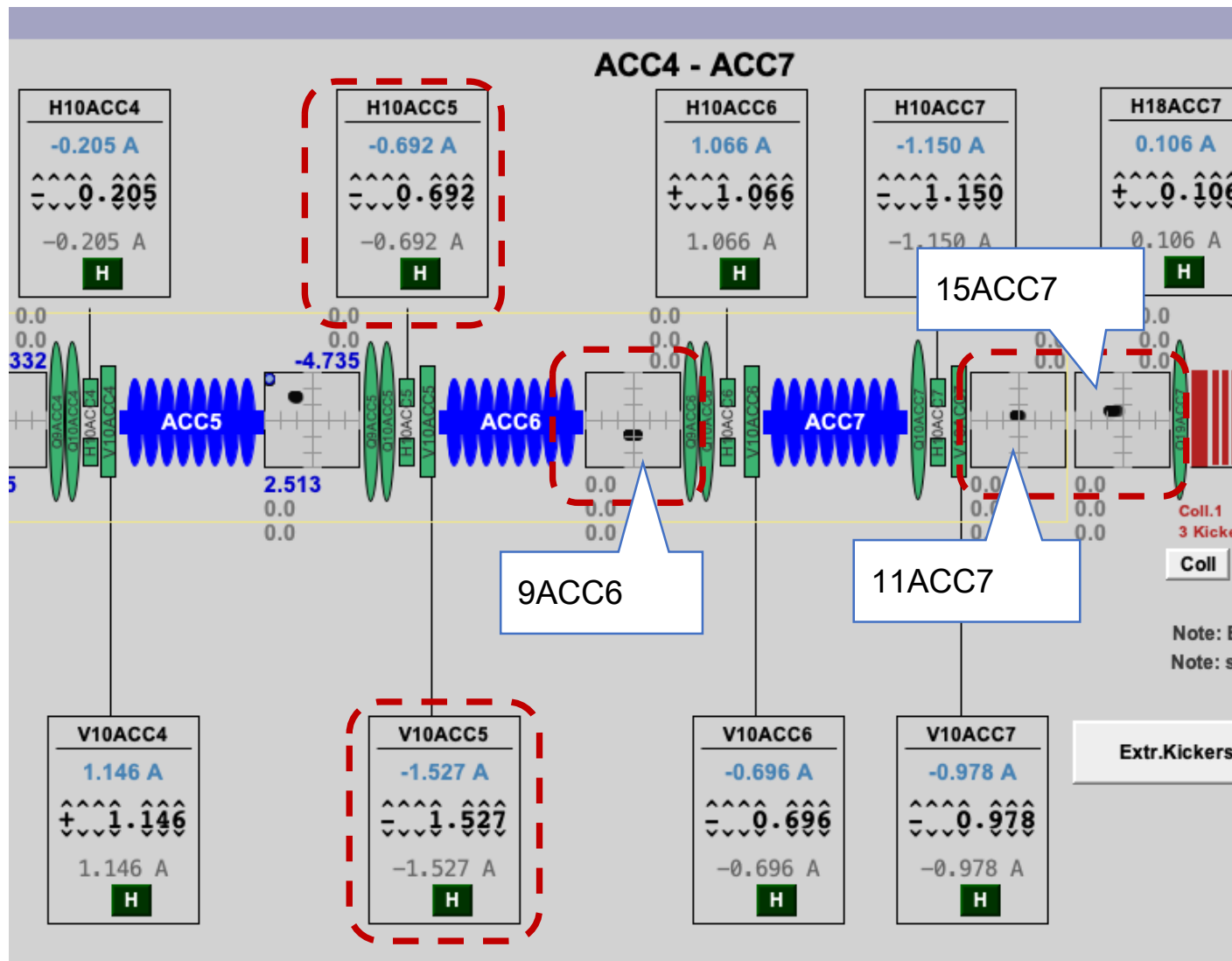
9ACC6* and 15ACC7 BPM

H = -0.7A/V = 5.5A: FLASH_BPMs_18_May_2021_14_24_19.mat

15ACC7

H = -1.7A/V = -1.5A: FLASH_BPMs_18_May_2021_14_30_03.mat

9ACC6 (cold)
Pulses#11-30
Flat !?

$1 - \dfrac{\delta p(t)}{p_0}$

-1%!

$1 - \dfrac{\delta p(t)}{p_0}$

15ACC7
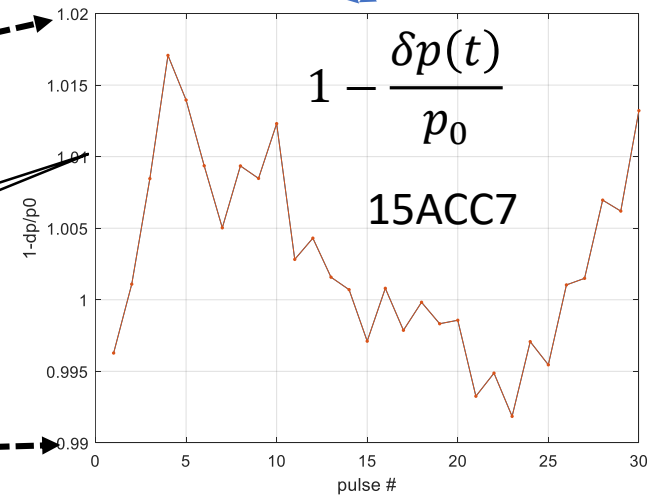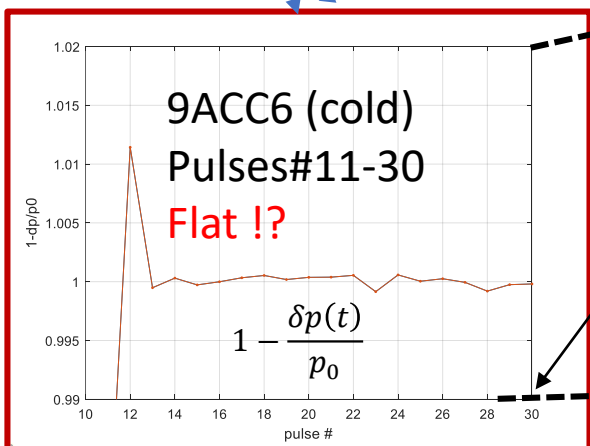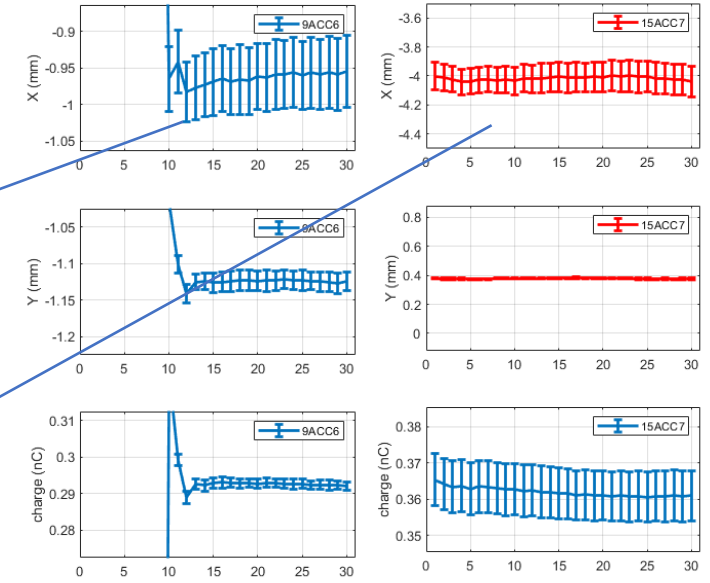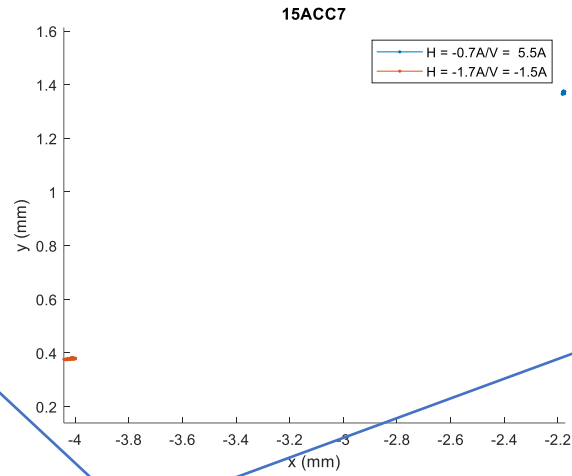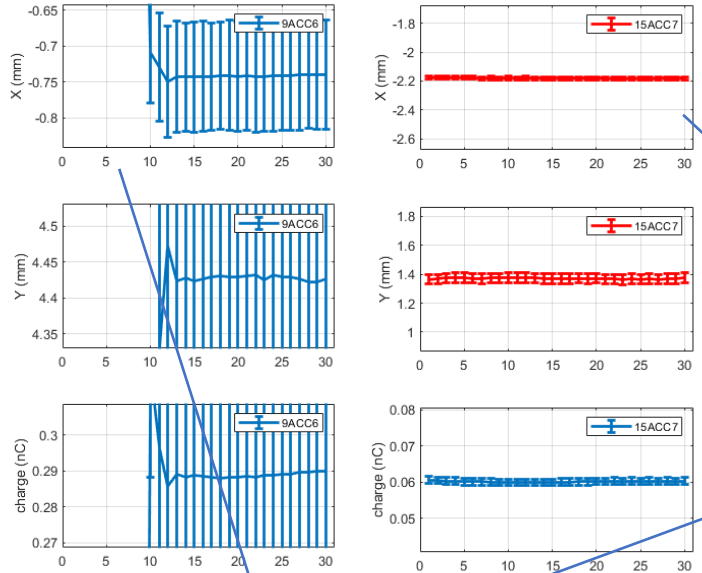
$$1 - \frac{\delta p(t)}{p_0} = \frac{\sqrt{[x_{BPM}(+3.5A,t) - x_{BPM}(-3.4A,t)]^2 + [y_{BPM}(+3.5A,t) - y_{BPM}(-3.4A,t)]^2}}{I_{st} \cdot \sqrt{A_x^2 + A_y^2}}$$

$$\int_{\#20}^{\#30} \frac{\delta p(t)}{p_0} dt = 0$$

9ACC6* BPM

H = -0.7A/V = -1.5A: FLASH_BPMs_18_May_2021_14_06_06.mat (the beam was off for some pulses)
H = -0.7A/V = -0.5A: FLASH_BPMs_18_May_2021_14_11_39.mat (")
H = -0.7A/V = 2.5A: FLASH_BPMs_18_May_2021_14_14_56.mat (")
H = -0.7A/V = 5.5A: FLASH_BPMs_18_May_2021_14_24_19.mat
H = -0.7A/V = -2.5A: FLASH_BPMs_18_May_2021_14_26_08.mat (")
H = -0.7A/V = -7.5A: FLASH_BPMs_18_May_2021_14_28_13.mat. (")
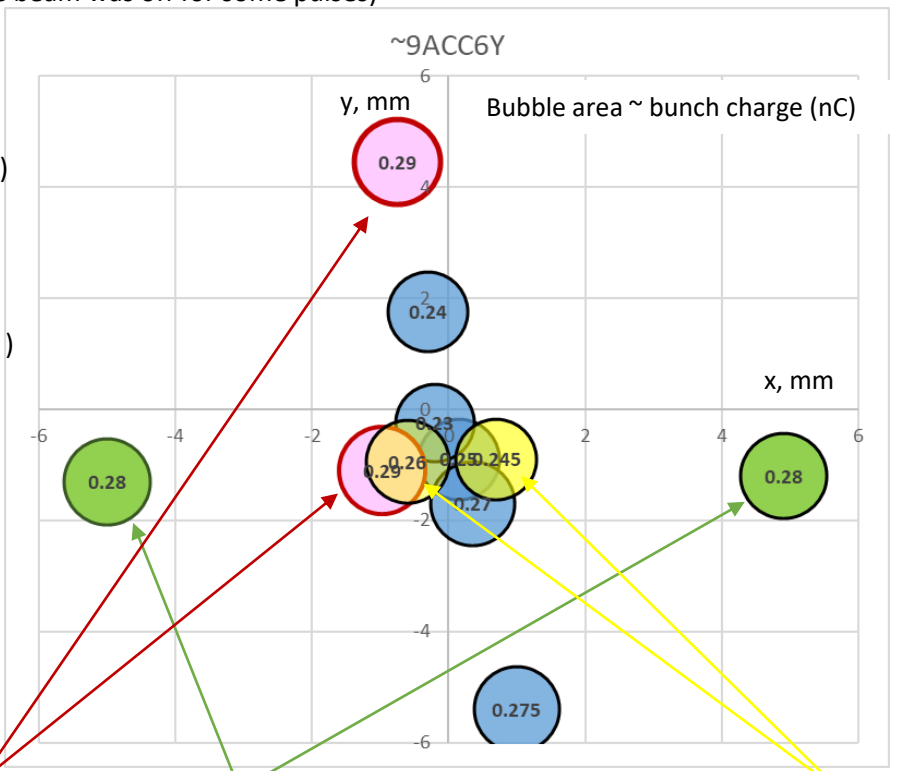H = -1.7A/V = -1.5A: FLASH_BPMs_18_May_2021_14_30_03.mat
H = -6.7A/V = -1.5A: FLASH_BPMs_18_May_2021_14_32_28.mat (")
H = 0.3A/V = -1.5A: FLASH_BPMs_18_May_2021_14_35_34.mat (")
H = 5.3A/V = -1.5A: FLASH_BPMs_18_May_2021_14_37_40.mat (")
H = -1.3A/V = -1.5A: FLASH_BPMs_18_May_2021_14_39_58.mat (")

*NB:
- Current measurements Q~250-300pC, cold BPM dynamic range >400pC
- Linear range: ±10 mm (beam pipe 78mm)
- Close to 0, the sign could be wrong (→ another reason for "yellow case"?)
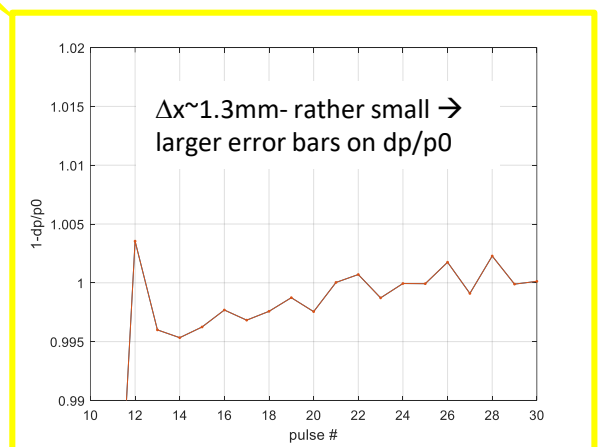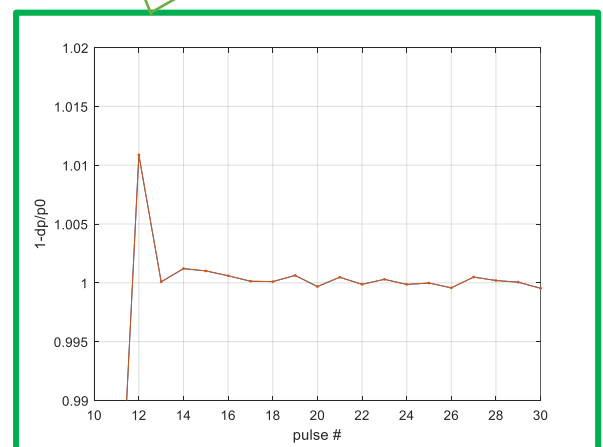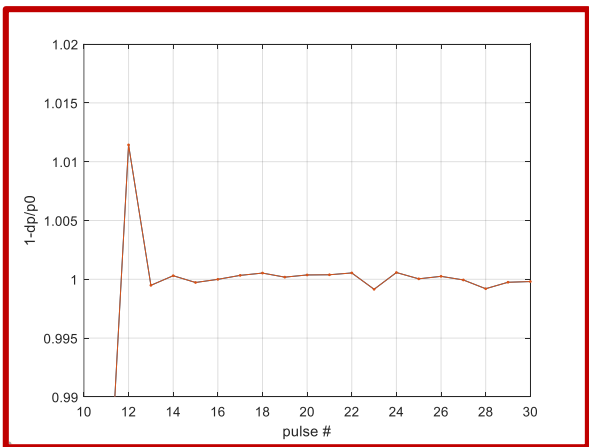
Conclusions

- "Effective-Pz" pulse train profile:
  - 1GUN and 3GUN – confirmed and very similar for NoP=100
  - 3EXP anf 9EXP – the same effect observed for NoP=100
  - 15ACC7 shows also ~1% for NoP=30
  - But 9ACC6 (cold, different electronics!) → rather flat "effective-Pz" profile for available pulses (#11…30)
- Preliminary conclusion: → cross-talk of BPM electronics?