PFS H4RG N2 PERSISTENCE ANALYSIS (1)

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Experiment summary

run	soak	IRP	gain	frames
1st	2.5 frame soak at 80% fullwell	IRP1:1	7	PFJB02473783 - PFJB02484883
2nd	0 frame soak at 80% fullwell	IRP1:1	7	PFJB02485483 - PFJB02489083
3rd	1 frame soak at 80% fullwell	IRP1:1	7	PFJB02494683 - PFJB02502583
4th	1 frame soak at 20% fullwell	IRP1:1	7	PFJB02505883 - PFJB02508383
5th	1 frame soak at 40% fullwell	IRP1:1	7	PFJB02508683 - PFJB02511983
6th	1 frame soak at 55% fullwell	IRP1:1	7	PFJB02512883 - PFJB02516083
7th	1 frame soak at 1.5x fullwell	IRP1:1	7	PFJB02516383 - PFJB02519583
8th	1 frame soak at 3x fullwell	IRP1:1	7	PFJB02519883 - PFJB02522283
9th	1 frame soak at 6x fullwell	IRP1:1	**5**	PFJB02536583 - PFJB02548183
10th	1 frame soak at 20% fullwell	**IRP0**	**5**	PFJB02653283 - PFJB02657183
11th	1 frame soak at 6x fullwell	**IRP0**	**5**	PFJB02657483 - PFJB02666083

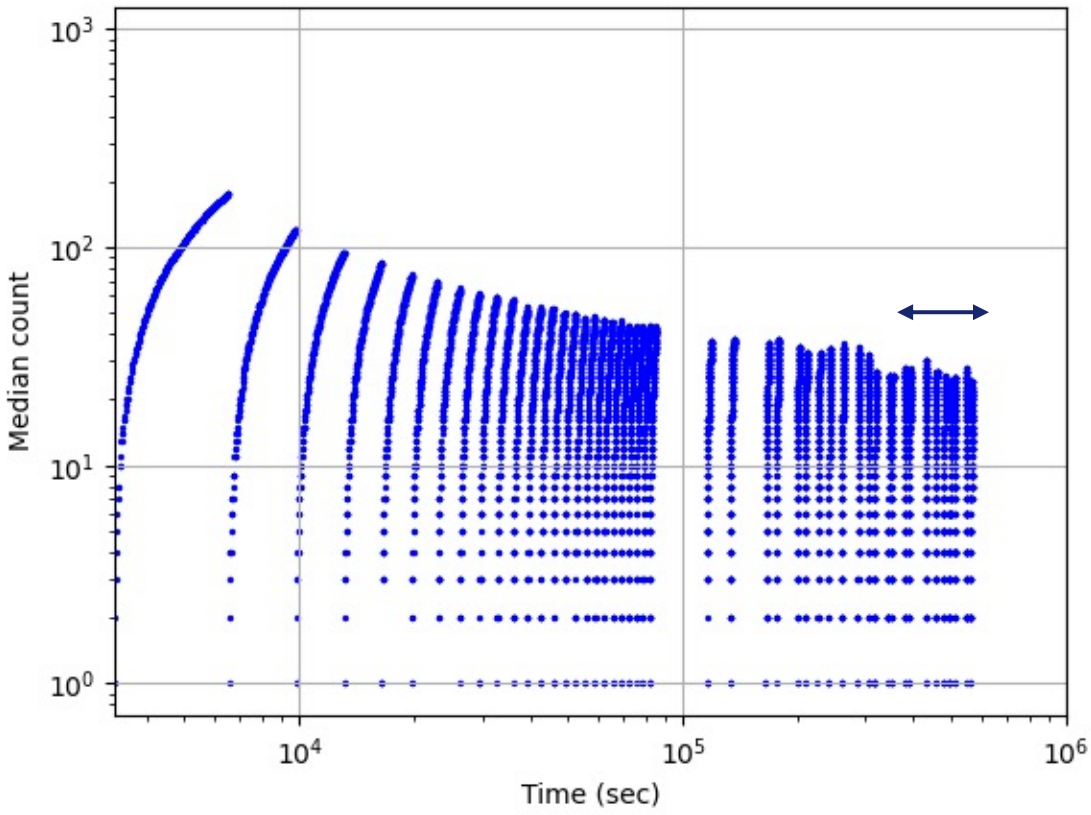
Soak time dependence

Stimulus dependence

Dark

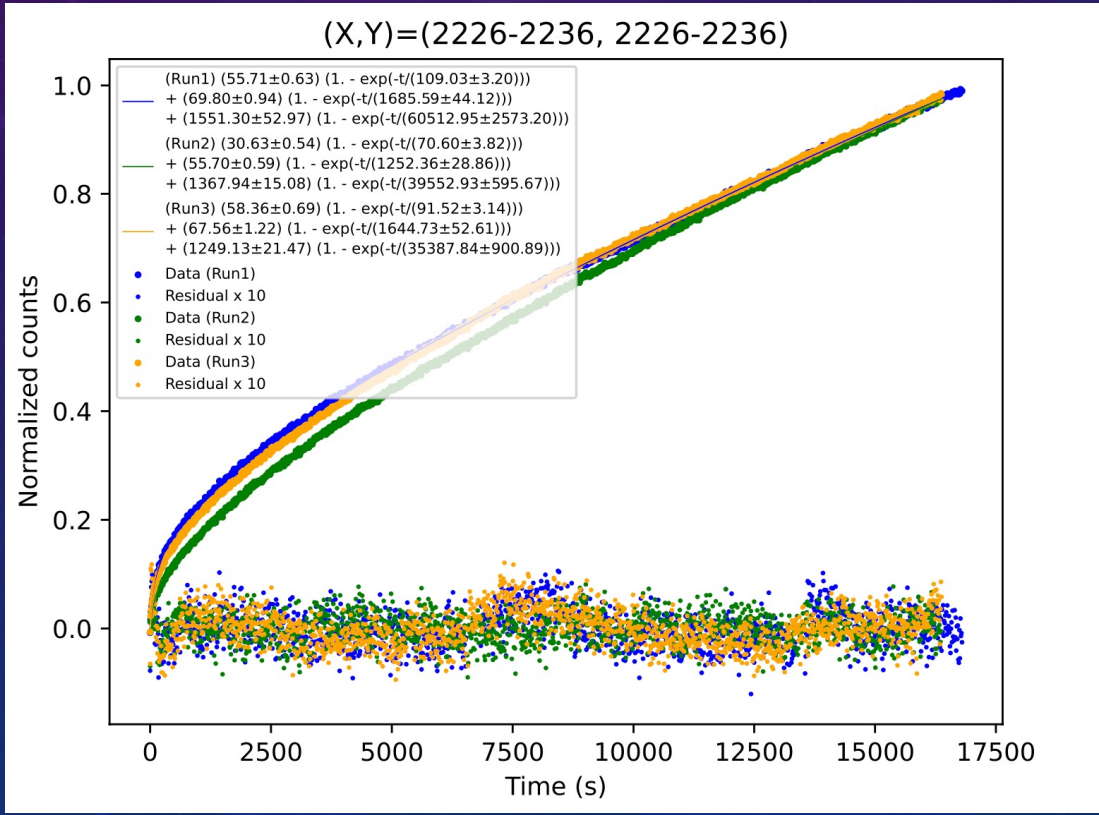
- Dark current rate was estimated from the count rate of the last 10 frames of 3rd run using the center region of the array where the persistence appears to disappear.
- The dark rate was estimated as 0.017 e- / sec, which was subtracted in the persistence analysis.

Median count of the center region (X=1500-2500, Y=1500-2500)



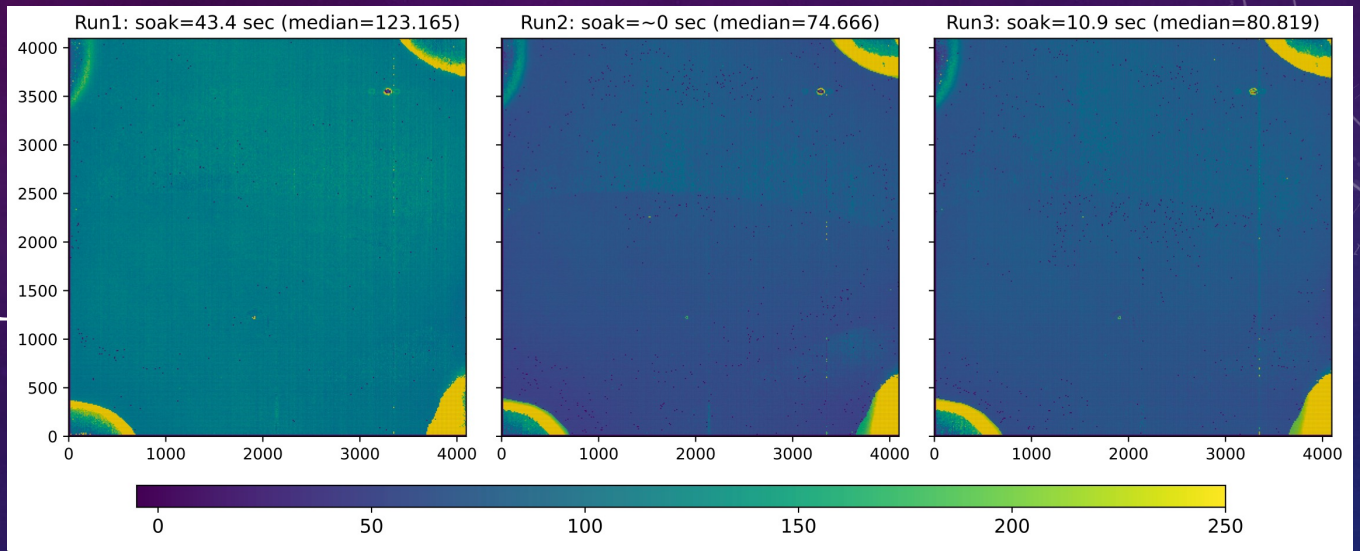
Soak time dependence

- Data: Run 1-3 (t<1.8e+4 sec)
- Fitting function: $f(t) = \sum_{i=1}^{3} a_i \left(1 - \exp\left(-\frac{t}{\tau_i}\right)\right)$
- Free parameters: a_i, τ_i $(i = 1,2,3)$

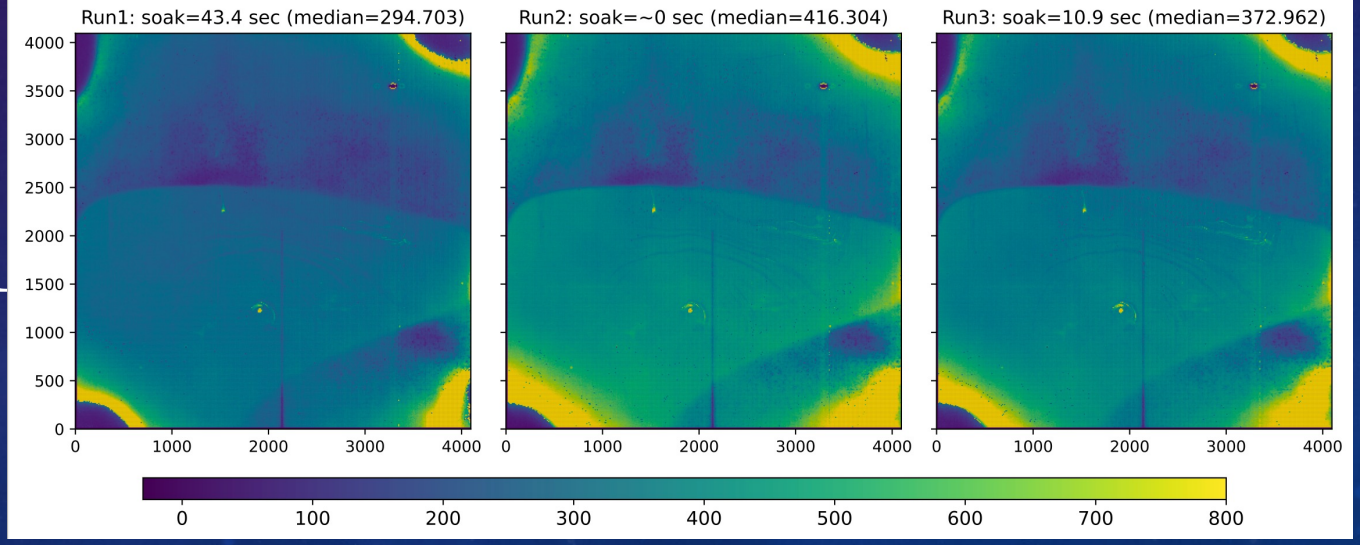


Results ($i = 1$)

τ_1

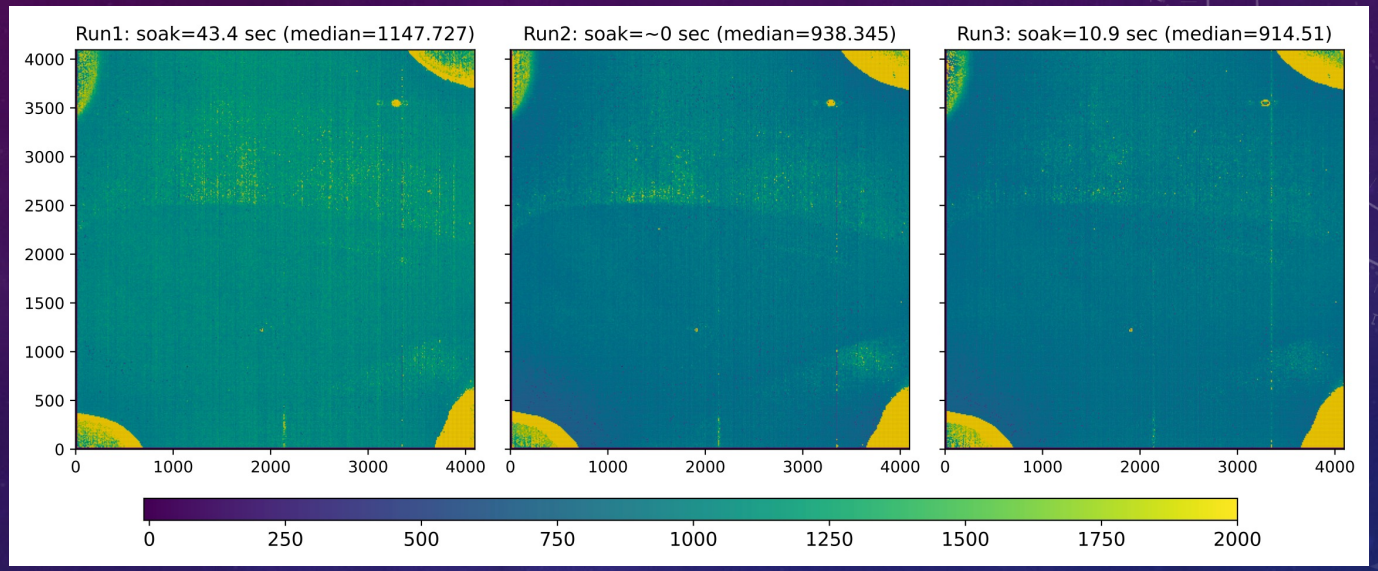


a_1

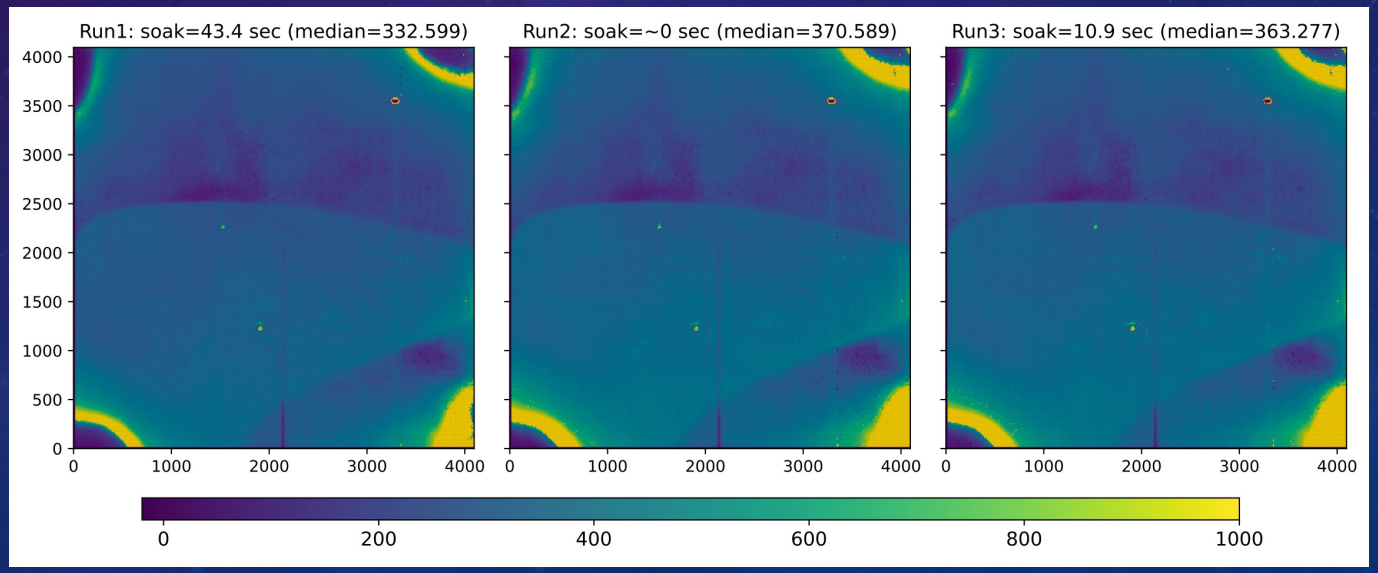


Results ($i = 2$)

τ_2

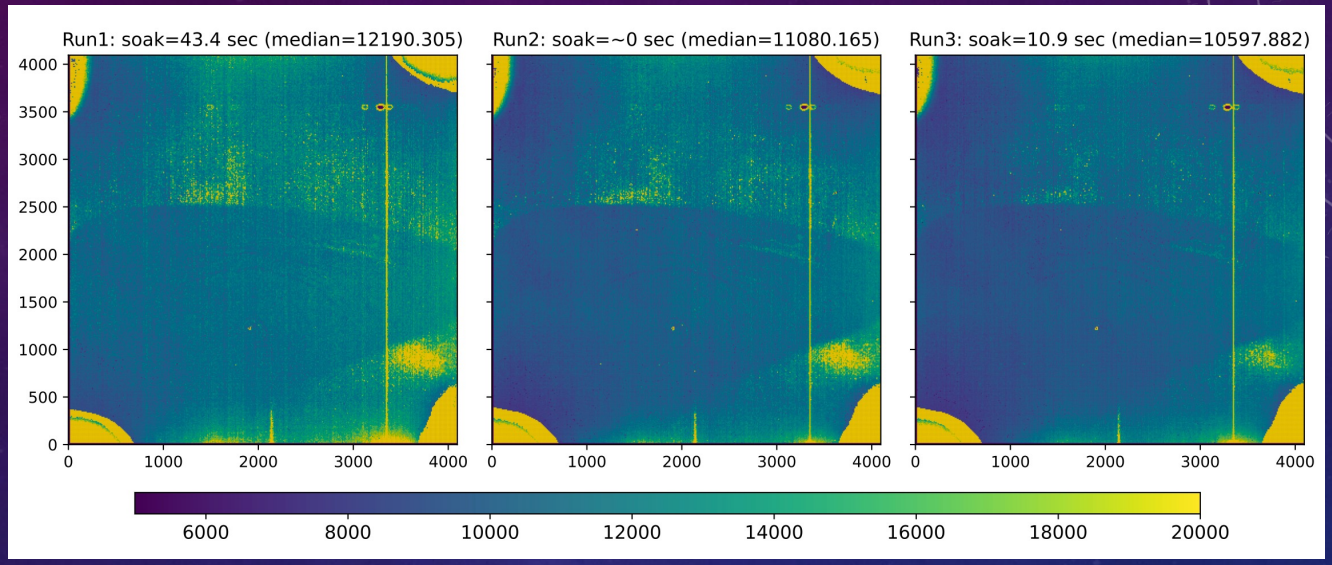


a_2

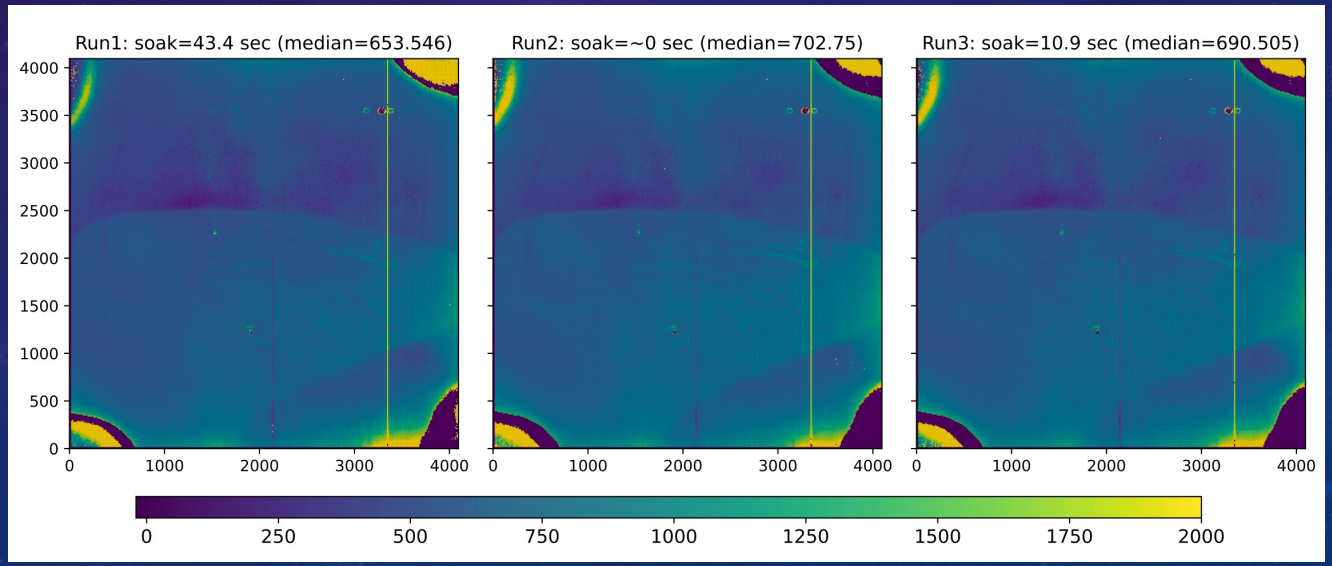


Results ($i = 3$)

τ_3



a_3



Results

Median of parameters

Run	1	2	3
Soak time	43.4 sec	~0 sec	10.9 sec
τ_1	123	75	81
a_1	295	416	373
τ_2	1148	938	915
a_2	333	371	363
τ_3	12190	11080	10598
a_3	654	703	691

The decaying time constants depend on the soak time.

Data request

- Dark without persistence
  - Count rate of the dark current was estimated from the last 10 frames of the 3rd run. Although the persistence signal seems to disappear in those frames, it is possible that the long-lasting persistence component is contaminated. Therefore, the dark data without persistence signal should be obtained.
  - About 10 dark frames with the same setting (exposure time, NDR, IRP, gain, etc.) are probably enough for achieving enough S/N.
- A variety of soak time
  - With the current dataset, the persistence dependence on the soak time was found. More datasets with various soak time are necessary for understanding the persistence properties more precisely.
  - For example, the persistence data with soak time = 450 sec and 900 sec should be obtained considering planned PFS operation.
- Dataset for testing the persistence model
  - If we construct some persistence model based on the current dataset, the validity of the model should be checked with the other data which is not used in constructing the model.