Synchotron radiation study December 2019

Offline calibrated data

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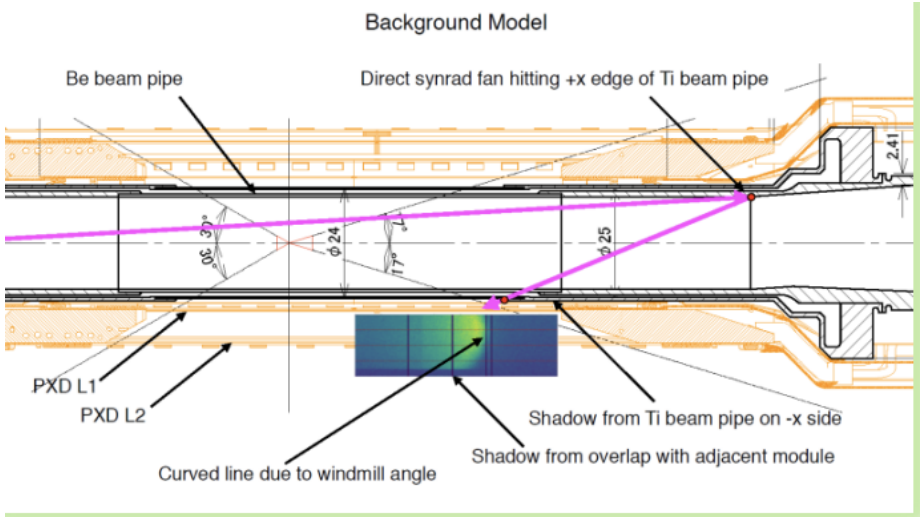
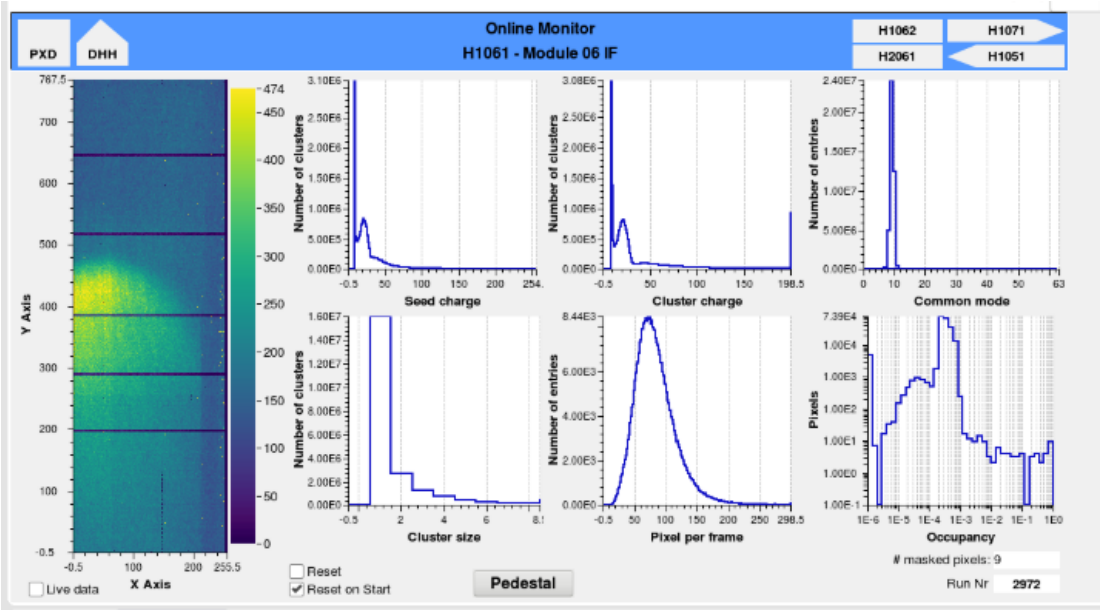
Introduction

- In the autumn run 2019 → **substantial** synchrotron radiation observed
- Need to understand the origin, i.e if beam optics is responsible
- Need to develop tools to protect PXD, i.e give direction for the development of synchrotron radiation monitor
- Need to evaluate background dose



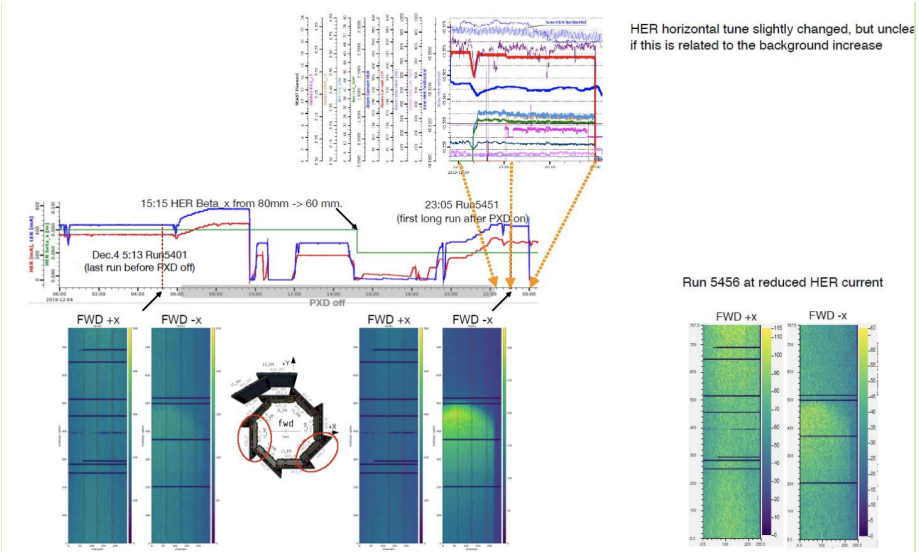
SR Characteristics

- Single pixel cluster
- Forward -X (module 1.4.1, 1.5.1, 1.6.1)



The incidents

- In spring run 2019 (23.6), synchrotron radiation observed → highly correlated with the change of the HER vertical tune
- In autumn run 2019 (05.12) synchrotron radiation reappeared → characteristic shade in -X direction → HER vertical tune adjustment did not help



Data

- Beam parameters: BELLE archiver
- PXD hit rates: Offline (*preliminary*) calibrated data
- **SoftPhotonFlux**: single-pixel cluster and $6 < E < 10$ KeV
- **HardPhotonFlux**: single-pixe cluster and $E > 10$ KeV
- **ChargedFlux**: multiple-pixel cluster and $E > 10$ KeV

Analysis strategy

Two aims:

> Time evolution of synchrotron radiation

> Differentiation between injection on/injection off

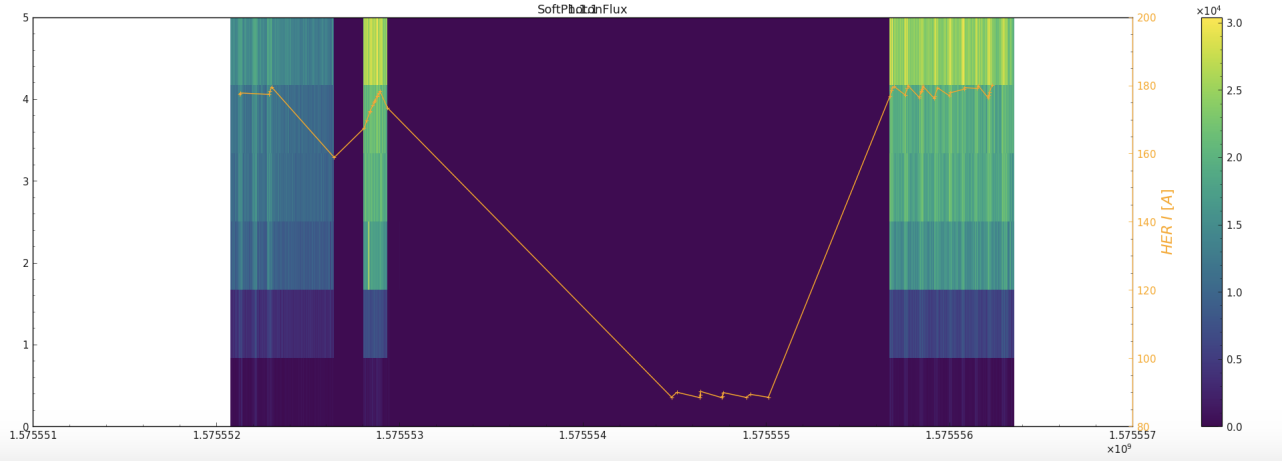
Strategy:

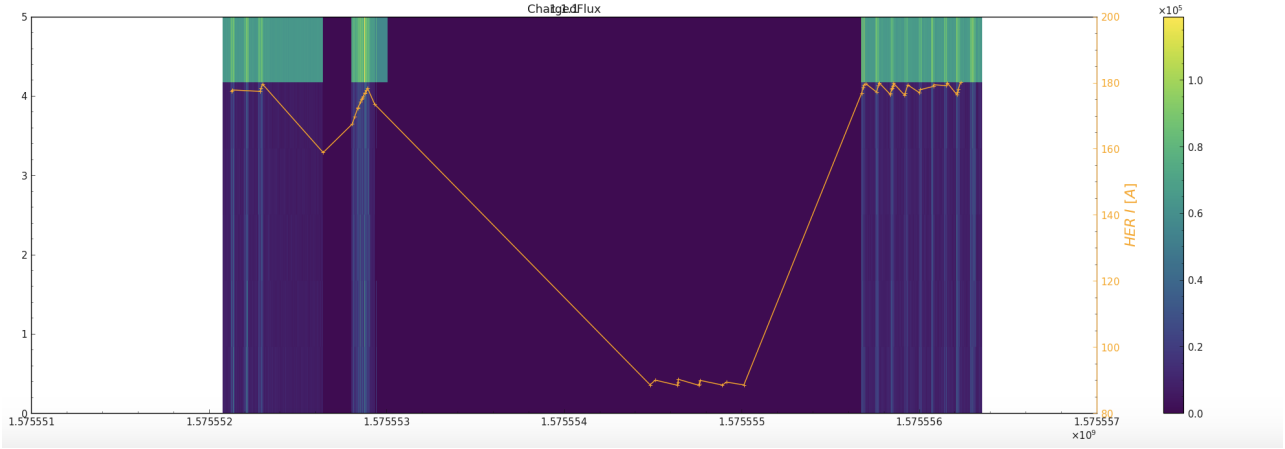
> Split data in 2s averages

> Split modules into 6 ASIC regions

05.12.2019 - Time evolution

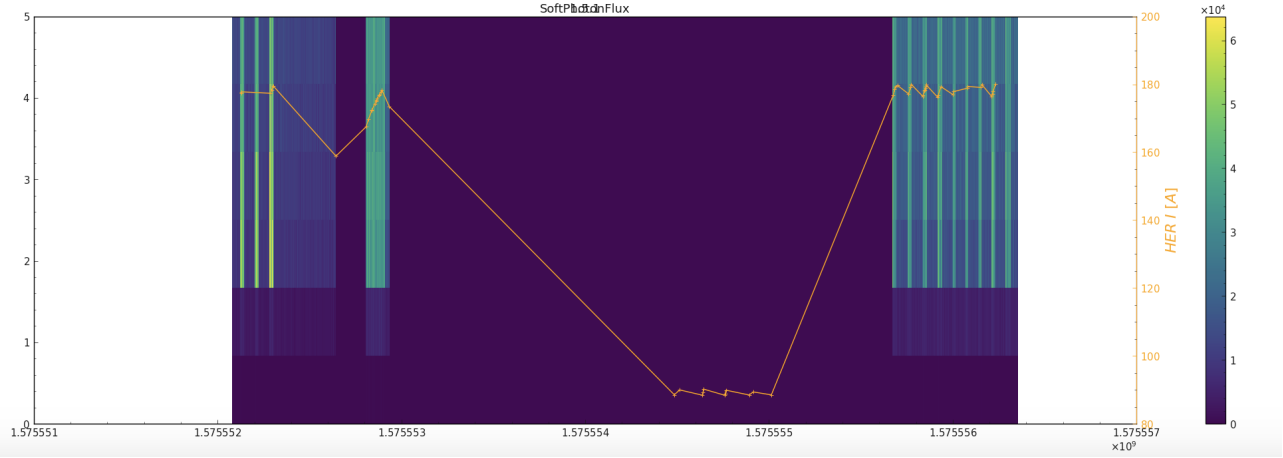
Module 1.1.1: runs (5524 - 5527)

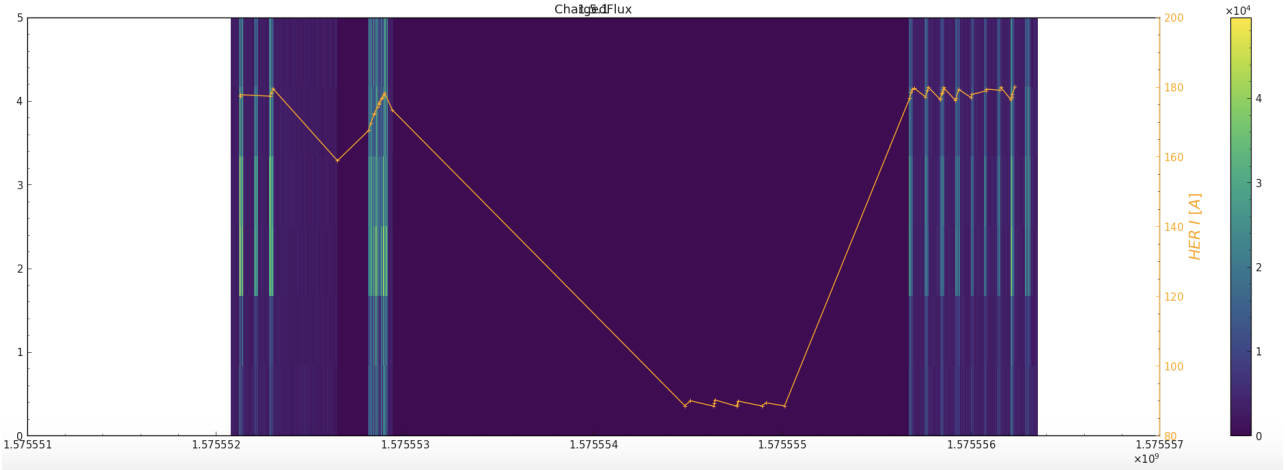




05.12.2019 - Time evolution (TE)

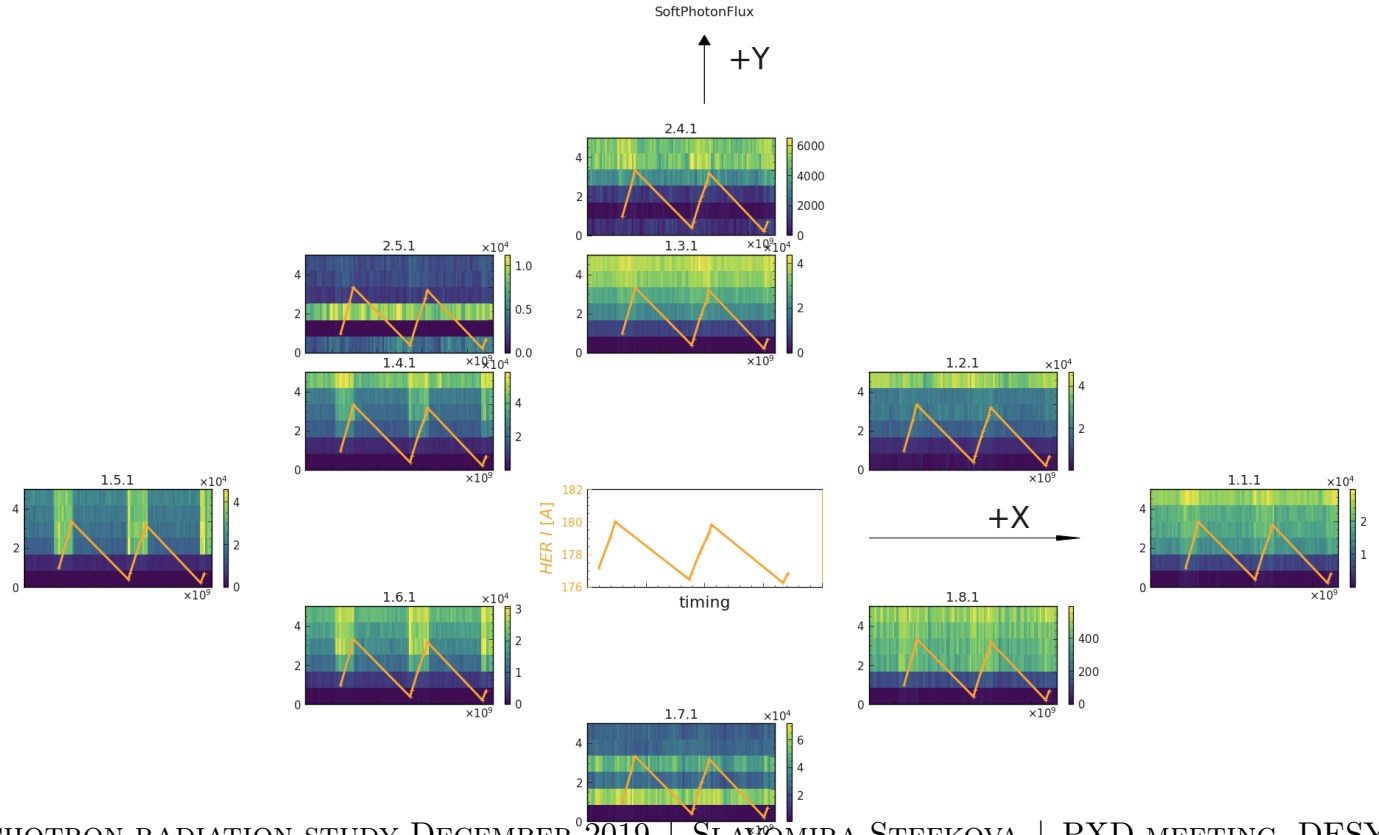
Module 1.5.1: runs (5524 - 5527)





05.12.2019 - TE - Zoom In

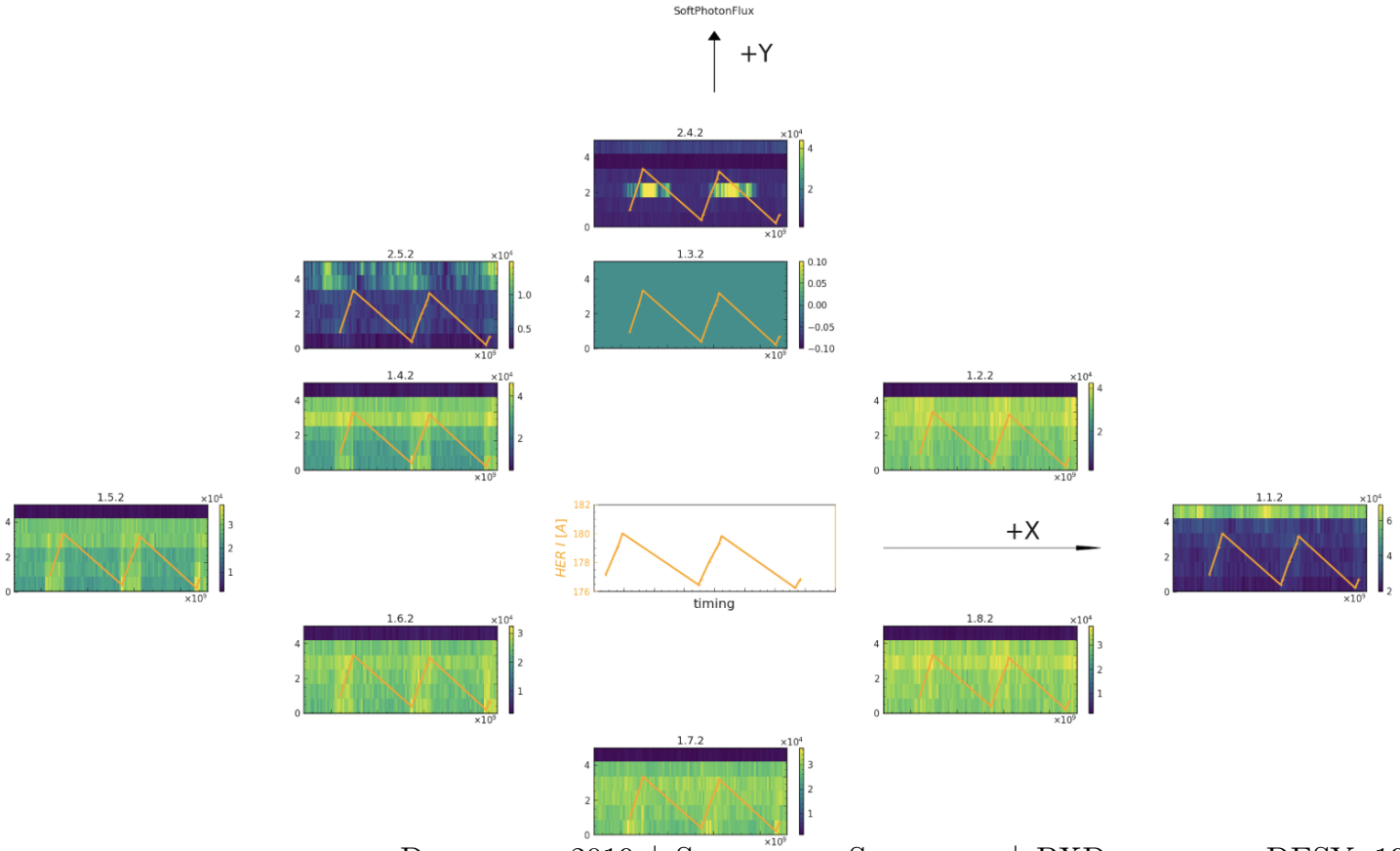
- all fwd modules, run: 5527, time: 3.23-3.25, quantity: soft photon flux
- synch radiation on -X side ✓
- injection = increase in rates



05.12.2019 - TE - Zoom In

> all bwd modules, run: 5527, time: 3.23-3.25, quantity: soft photon flux

> injection = increase in rates

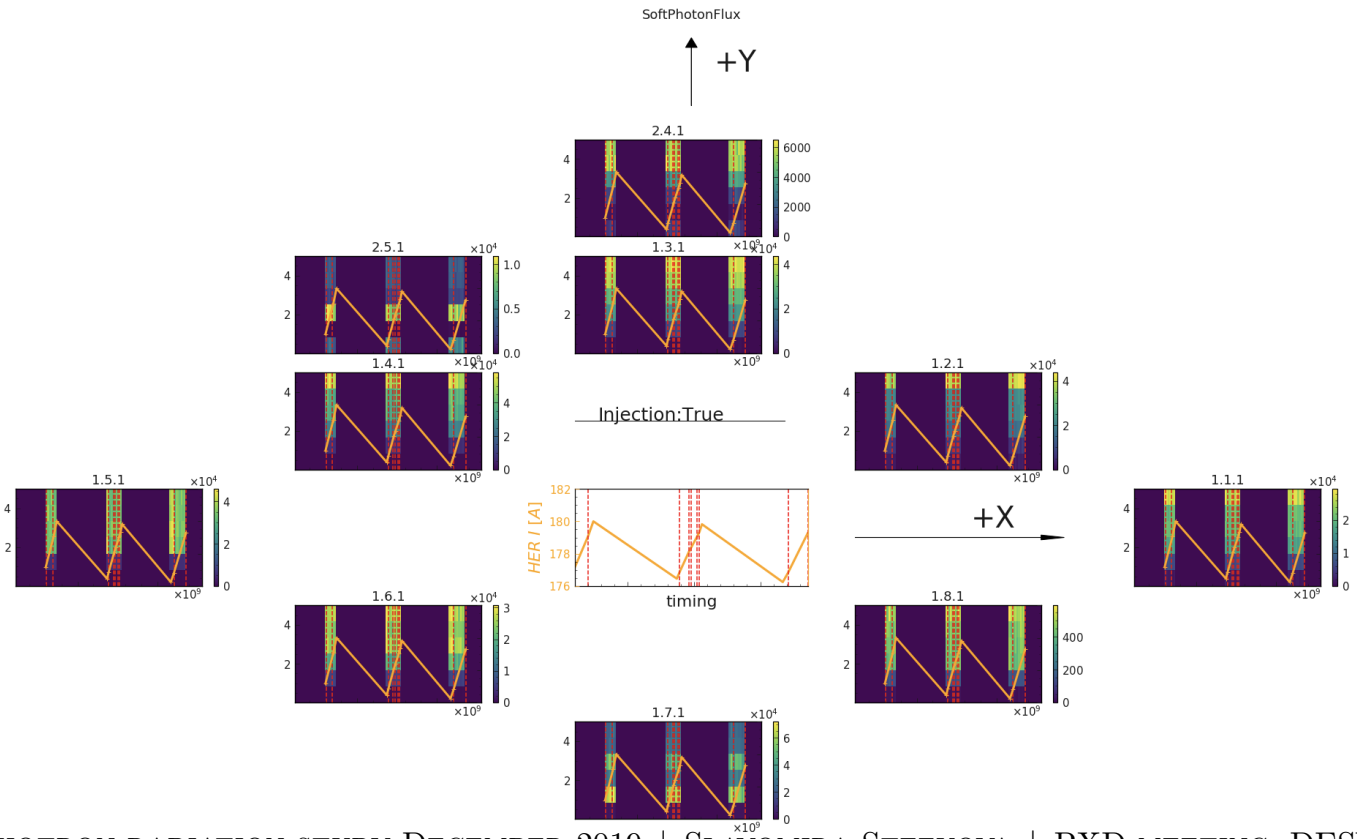


05.12.2019 - TE - Photon Energy split

- Soft Photon Flux vs Charged Photon Flux
- injection = increase in rates
- Hard Photon Flux at z=5 most prominent, Soft Photon Flux at z=1,..4
- Different SR source hypothesis

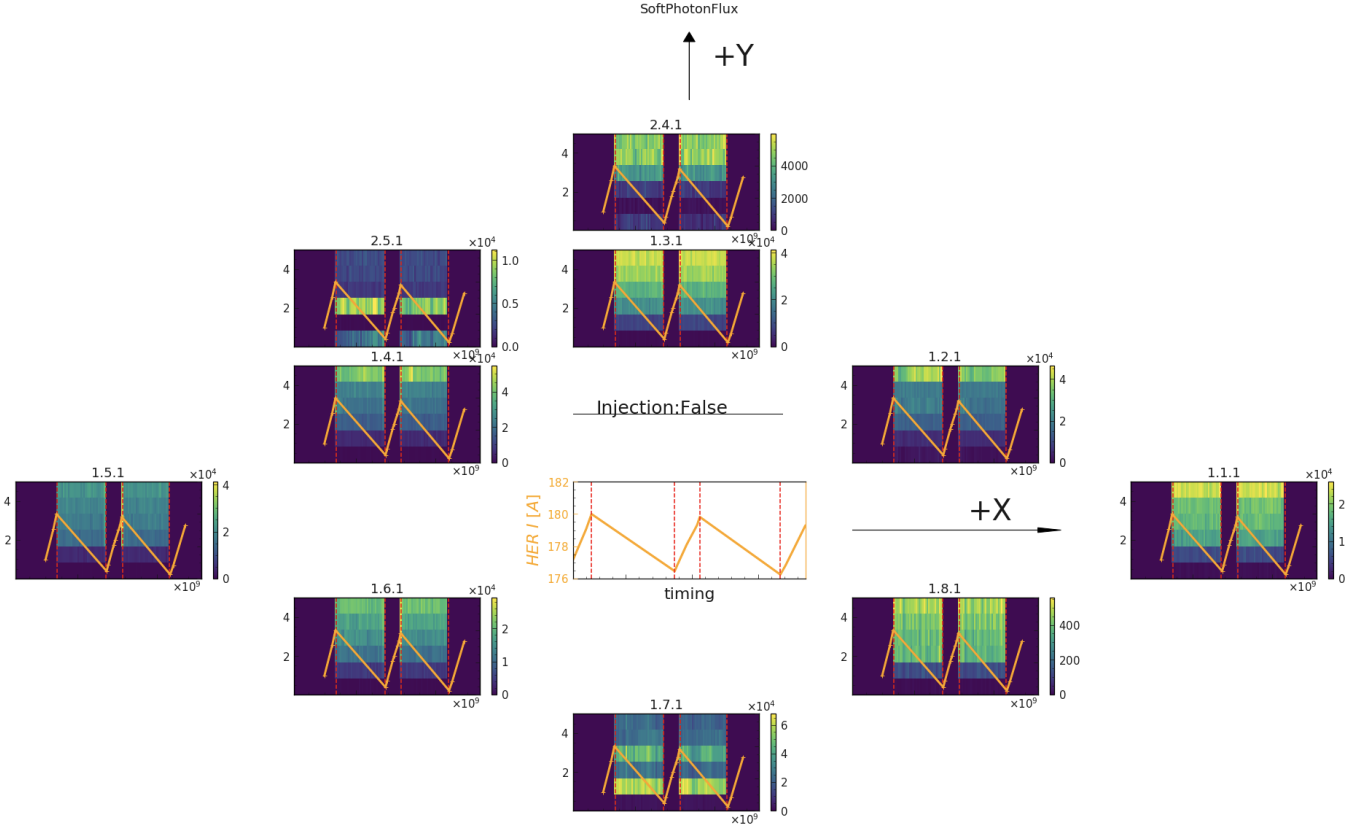
05.12.2019 - TE - Injection/no injection split

- all fwd modules, run: 5527, time: 3.23-3.25, quantity: soft photon flux, **injection: True**
- aim: temporal/quantitative behaviour difference between injection on/off



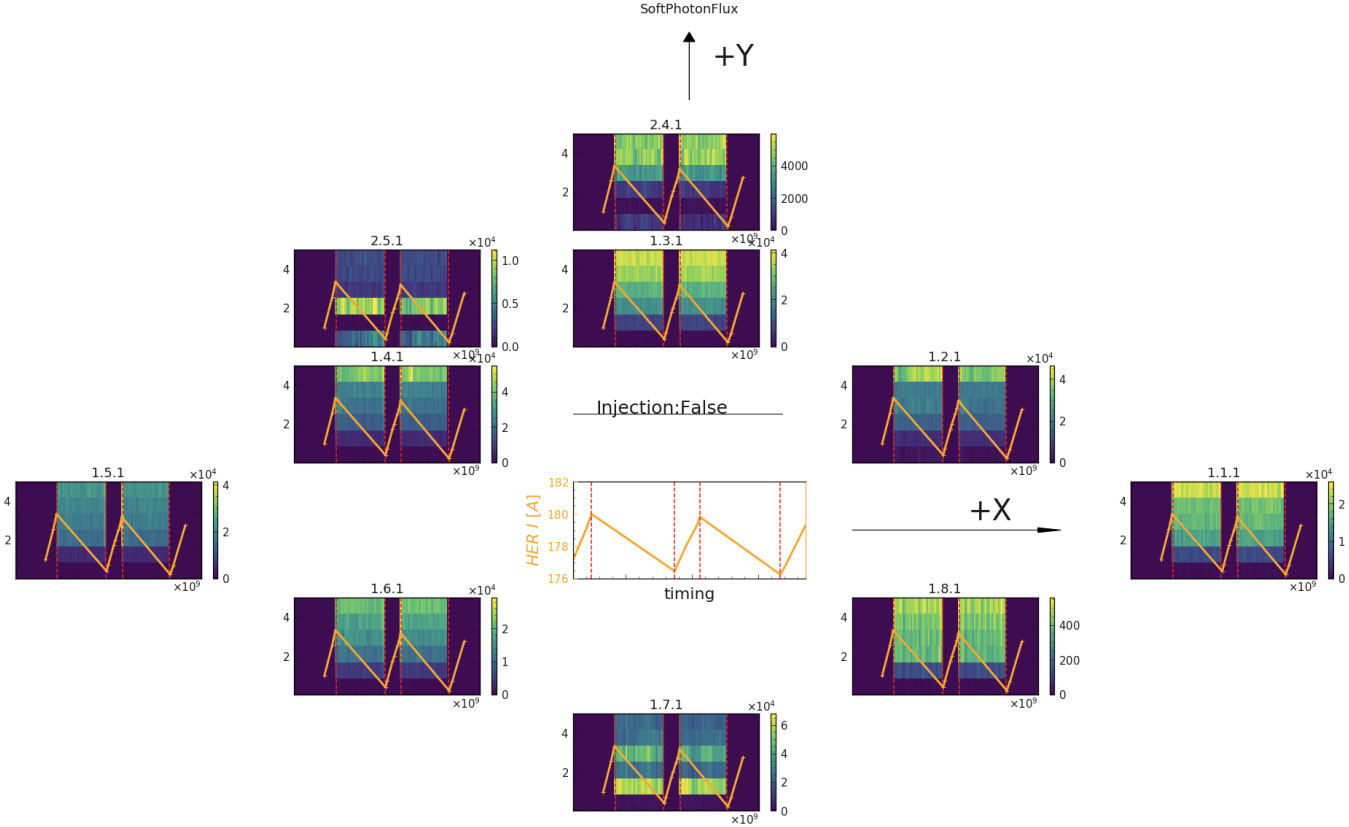
05.12.2019 - TE - Injection/no injection split

> all fwd modules, run: 5527, time: 3.23-3.25, quantity: soft photon flux, **injection: False**



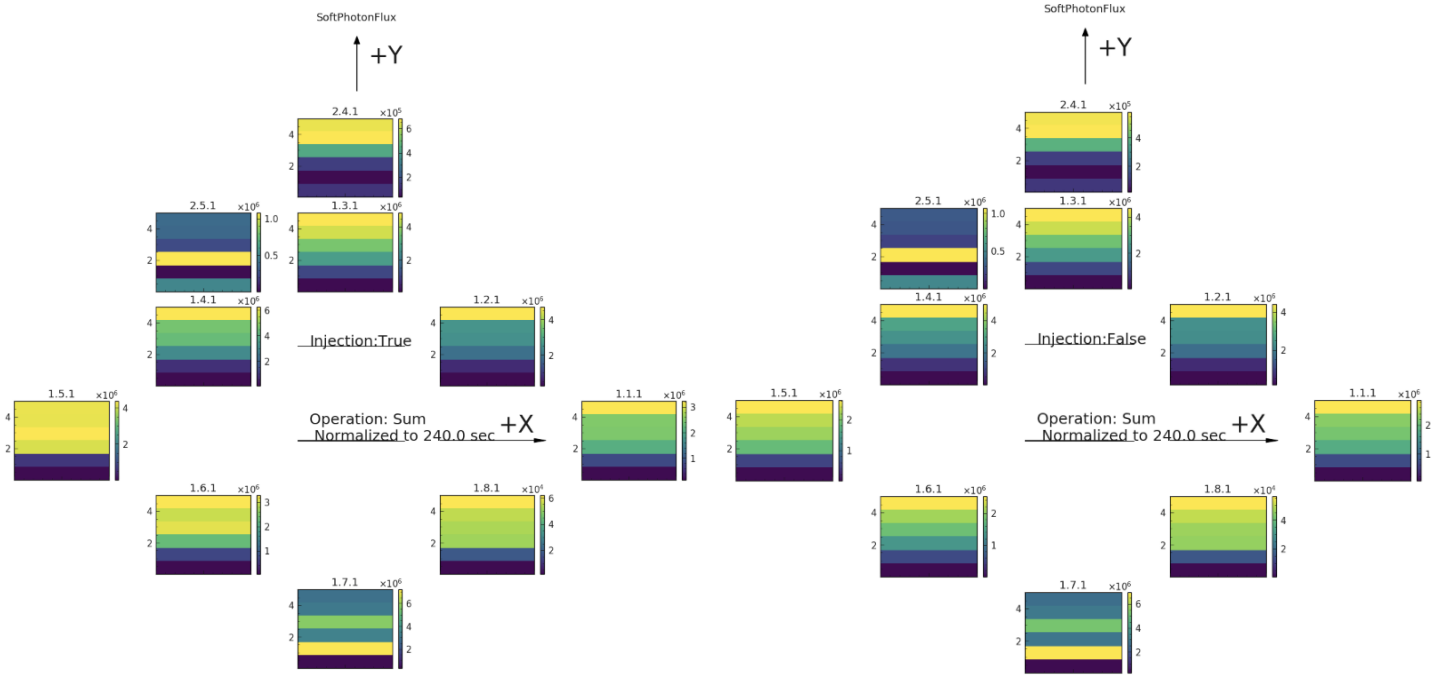
05.12.2019 - TE - Injection/no injection split

> all fwd modules, run: 5527, time: 3.23-3.25, quantity: soft photon flux, **injection: False**



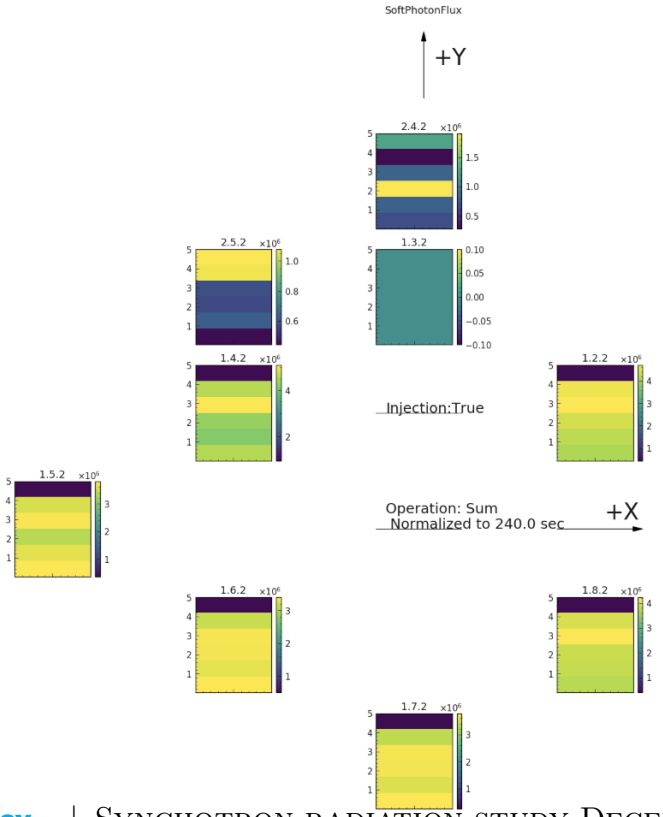
05.12.2019 - Norm.- Injection/no injection split

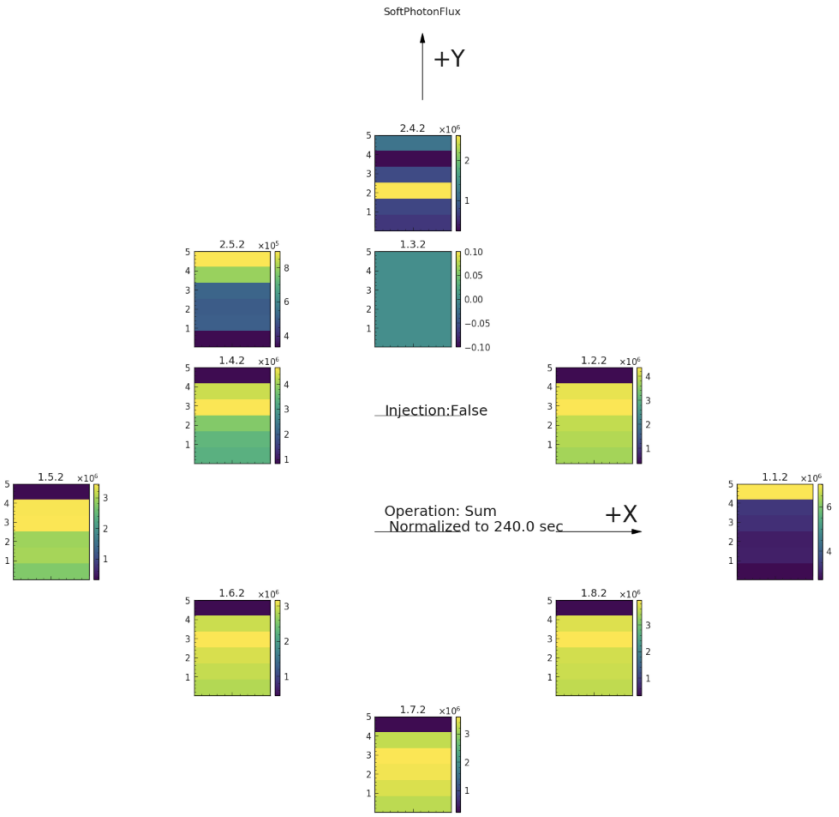
- all fwd modules, run: 5527, time: 3.23-3.25, quantity: soft photon flux, normalized, **injection: True/False**
- Injection → higher rate
- Difference in behaviour for 1.4.1, 1.5.1, 1.6.1 (more synch.-like behaviour with injection)



05.12.2019 - Normalized - Injection/no injection split

> all bwd modules, run: 5527, time: 3.23-3.25, quantity: soft photon flux, normalized, **injection: True/False**





Conclusion

- Geometrical dependency of synchtrotron radiation is studied with -X modules exhibiting familiar pattern
- Its correlation with current shows expected behaviour
- Energy difference of single-pixel cluster rates point to different background origin
- Injection and non-injection periods are differentiated
- **To do:** Granularity along u/v direction, confirmation of behaviour in other runs, beam dependencies....