

# Effect of Beam Dynamics Processes in the Low Energy Ring ThomX

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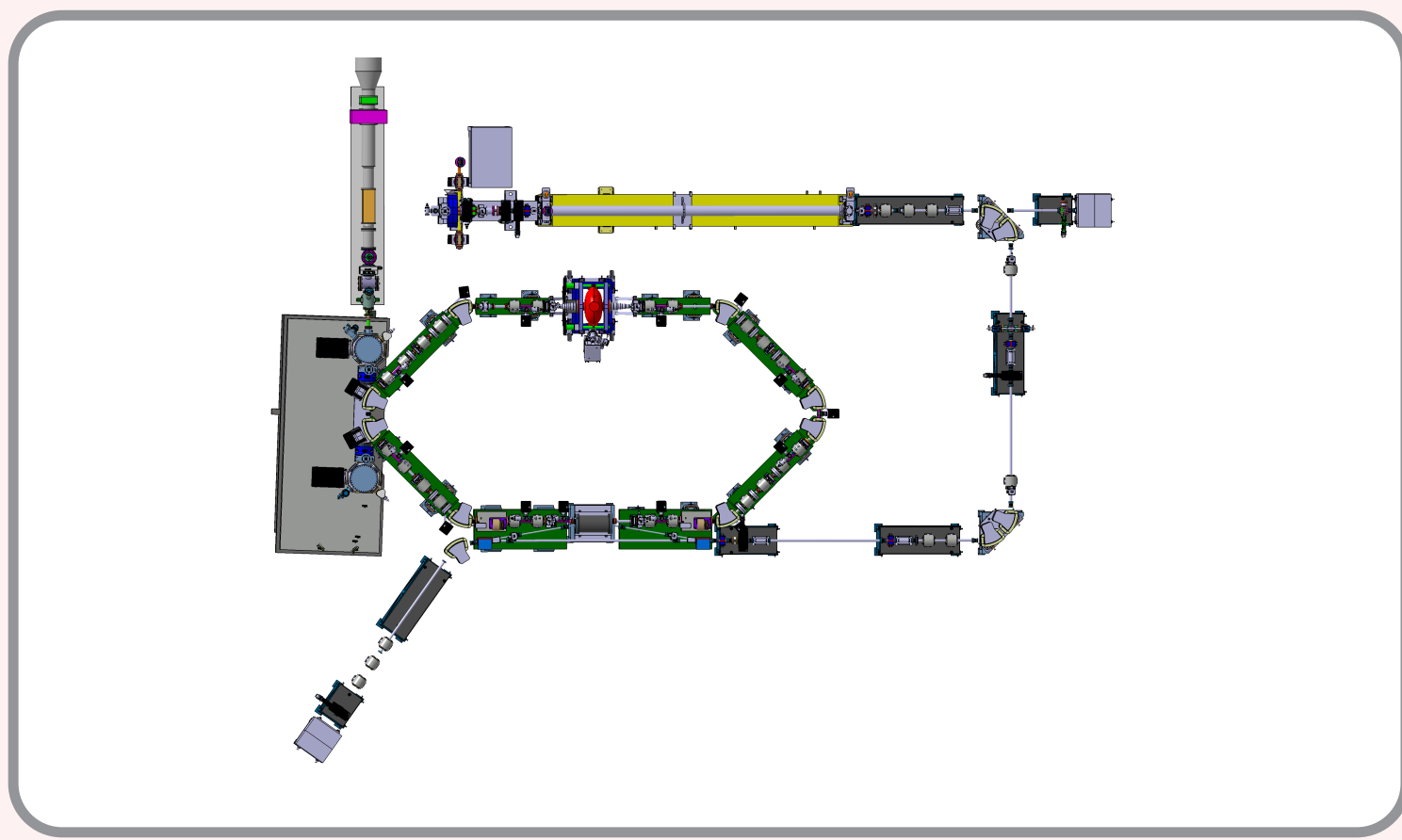
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## ThomX

- ThomX: Compact Light Source based on Compton Scattering.
- LINAC + Ring (Compton interactions in the ring).
- Beam energy 50 MeV.
- Damping time  $\gg$  storage time (20ms).
- Bunch length 4ps at injection, 30ps at the end of the cycle.
- Ring circumference: 16.8 m (under review)
  - ☞ New beam dynamics regime.

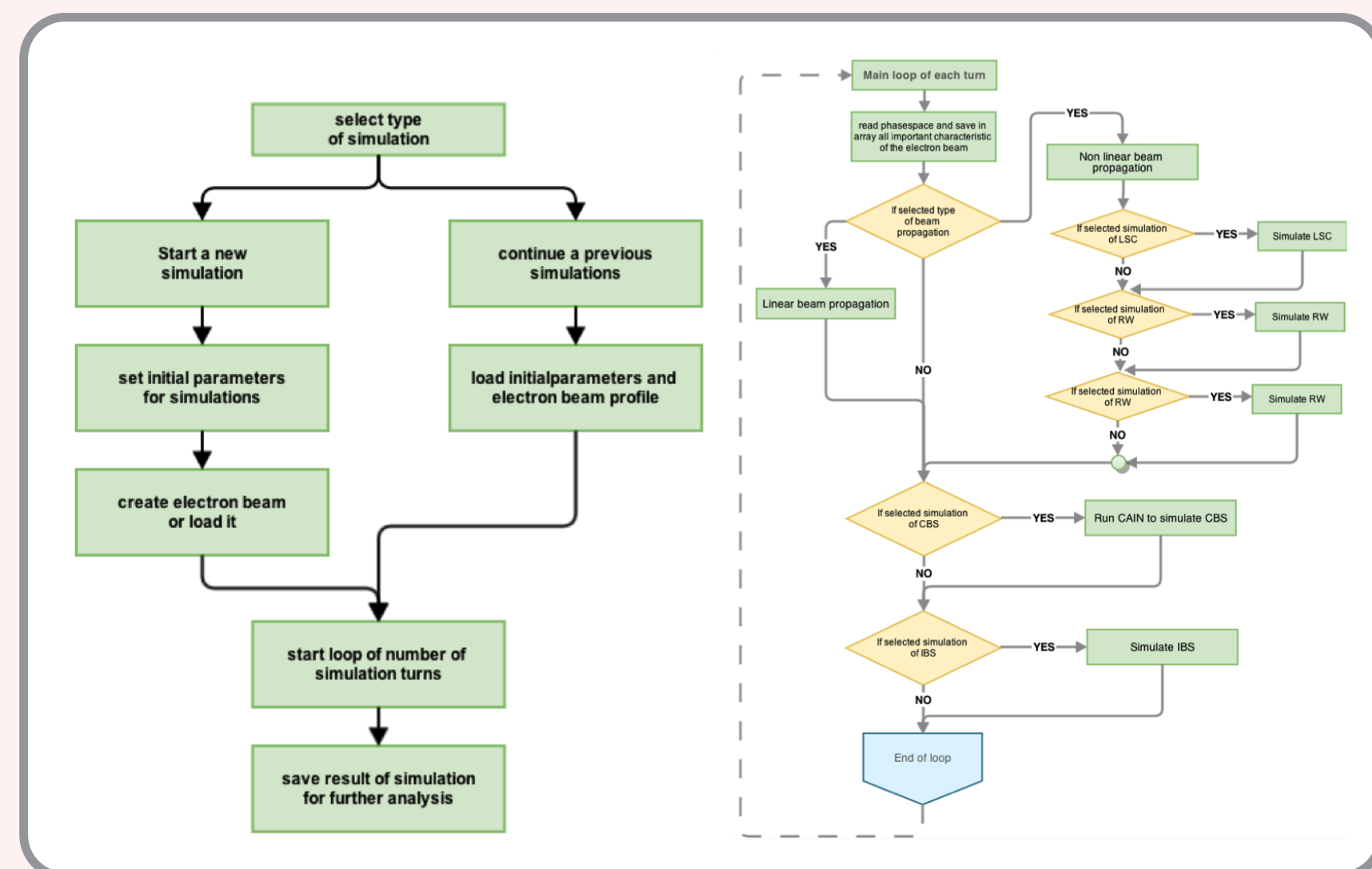


## Beam dynamics at ThomX

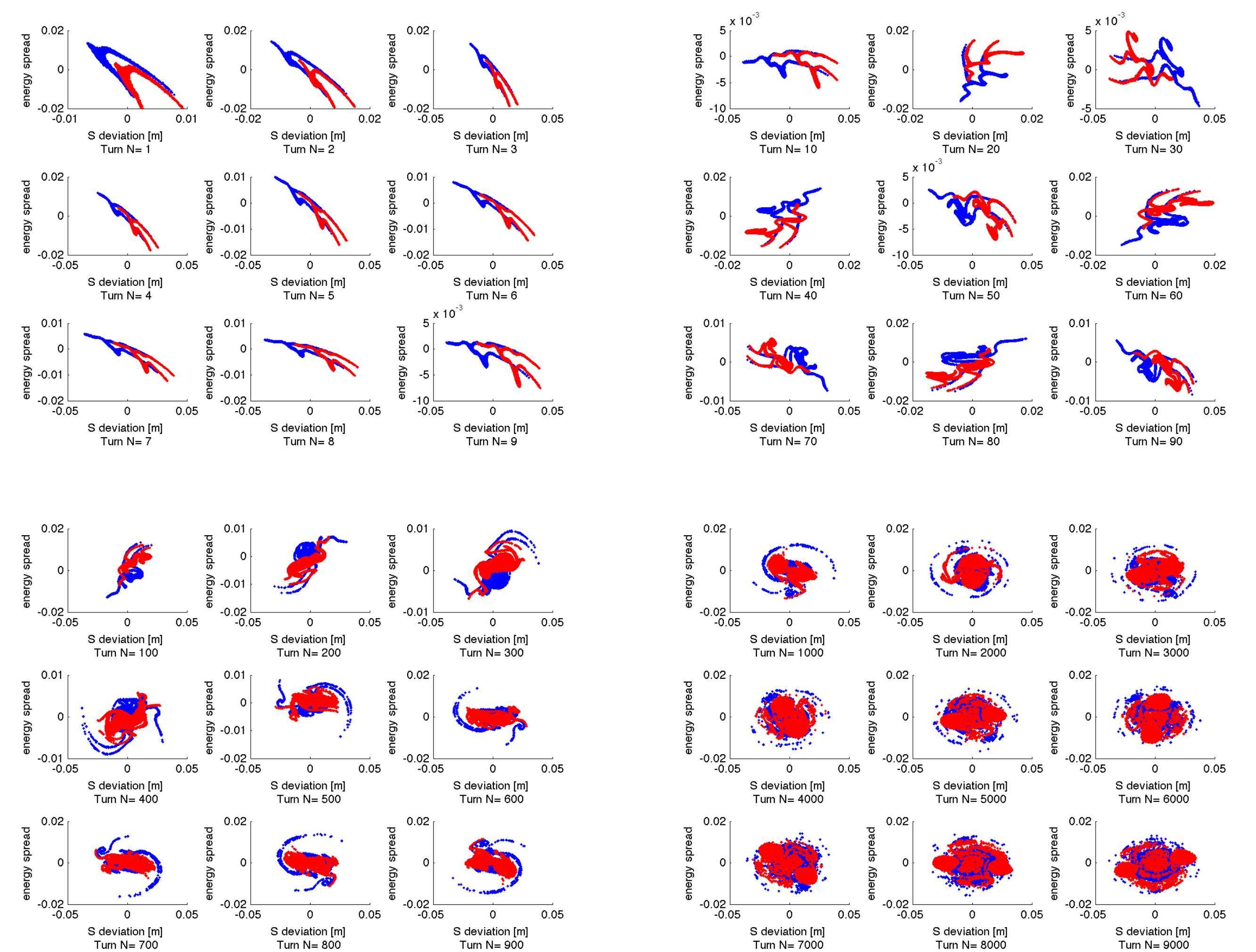
- The following beam dynamics effects are expected to play an important role:
  - ☞ Intrabeam scattering (IBS)
  - ☞ Compton beam scattering (CBS) [ laser at interaction point]
  - ☞ Coherent Synchrotron radiation (CSR)
  - ☞ Longitudinal space charge & Resistive wall effect
  - ☞ Non linear tracking

## Simulation code

- Based on Matlab and Cain
- Implement most important beam dynamics effect (using code from SOLEIL)
- Runs on computer farm
- Able to simulate a week cycle from injection to extraction (20ms & 400000 turns)



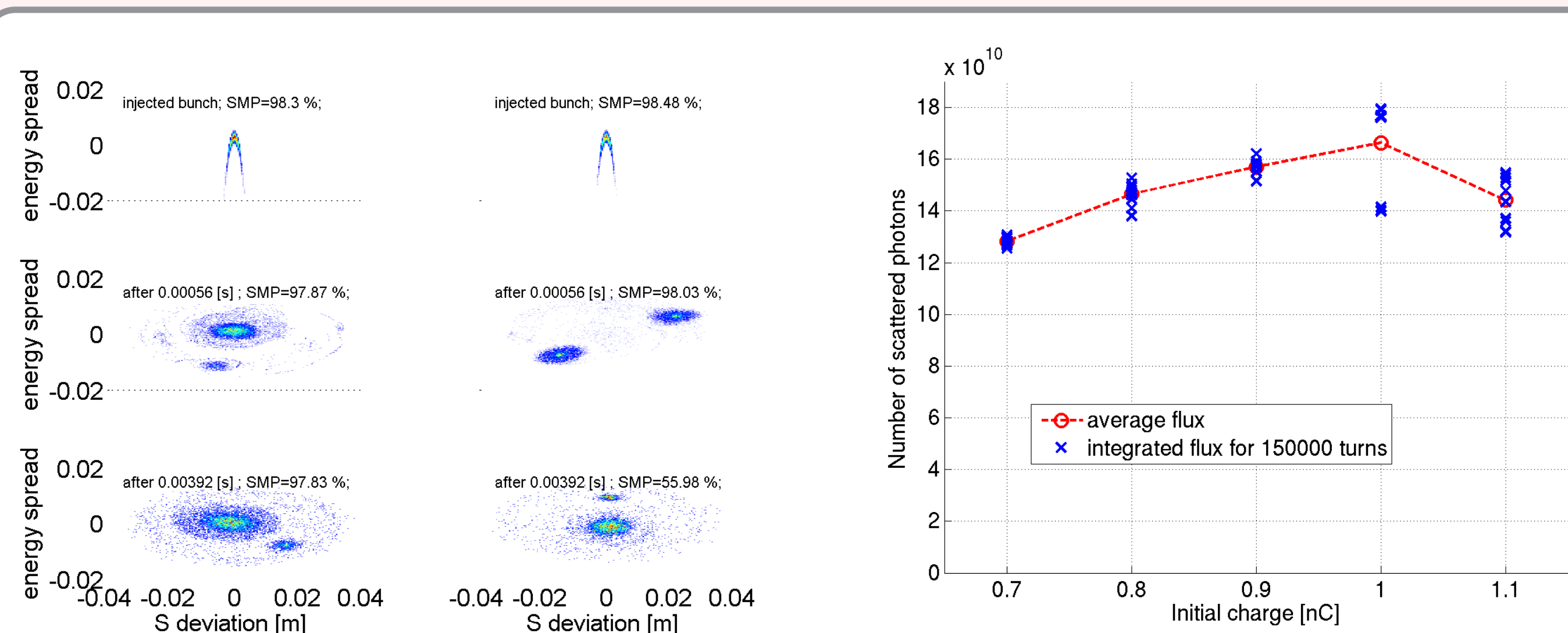
## Transient regime at injection



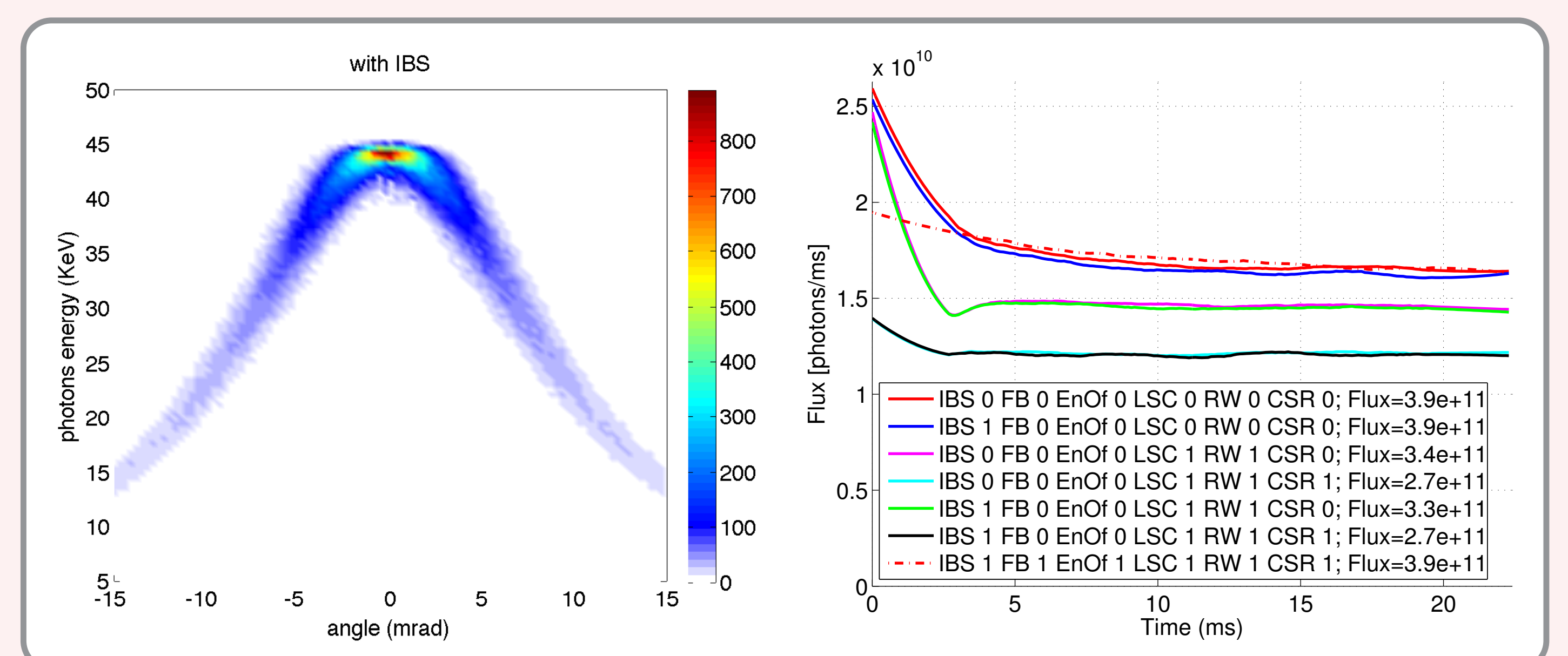
Blue: with initial offset; Red: without initial offset. Energy spread expressed as fraction of 1.

## Effect of CSR

- Beam is not matched (longitudinally) at injection.
  - ☞ Very strong CSR during first turns.
  - ☞ Beam can be split and partially lost.
  - ☞ Longitudinal feedback needed to stabilise the beam.



## All effects combined



- Photon flux much higher at injection.
- Most beam degradation occurs in the first 5ms.
- Well suited longit. feedback (FB=1) can help recover 25% of the flux.

## References

- The ThomX Project. Proceedings of IPAC2011, A.Variola, San Sebastián, Spain (2011).
- ThomX Technical Design Report, LAL RT 14/21, SOLEIL /SOU-RA-3629

## Outlook

- Beam dynamics will be challenging.
- First turns will be critical for the survival of the beam.
- Risk of beam splitting at high bunch charge.
- Importance of controlling dispersion in the ring.