

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

N. Delerue<sup>a</sup>, C. Bruni, I Chaikovska,  
I. Drebot<sup>b</sup>, M. Jacquet, A. Variola, F. Zomer<sup>1</sup>  
A. Loulergue<sup>2</sup>

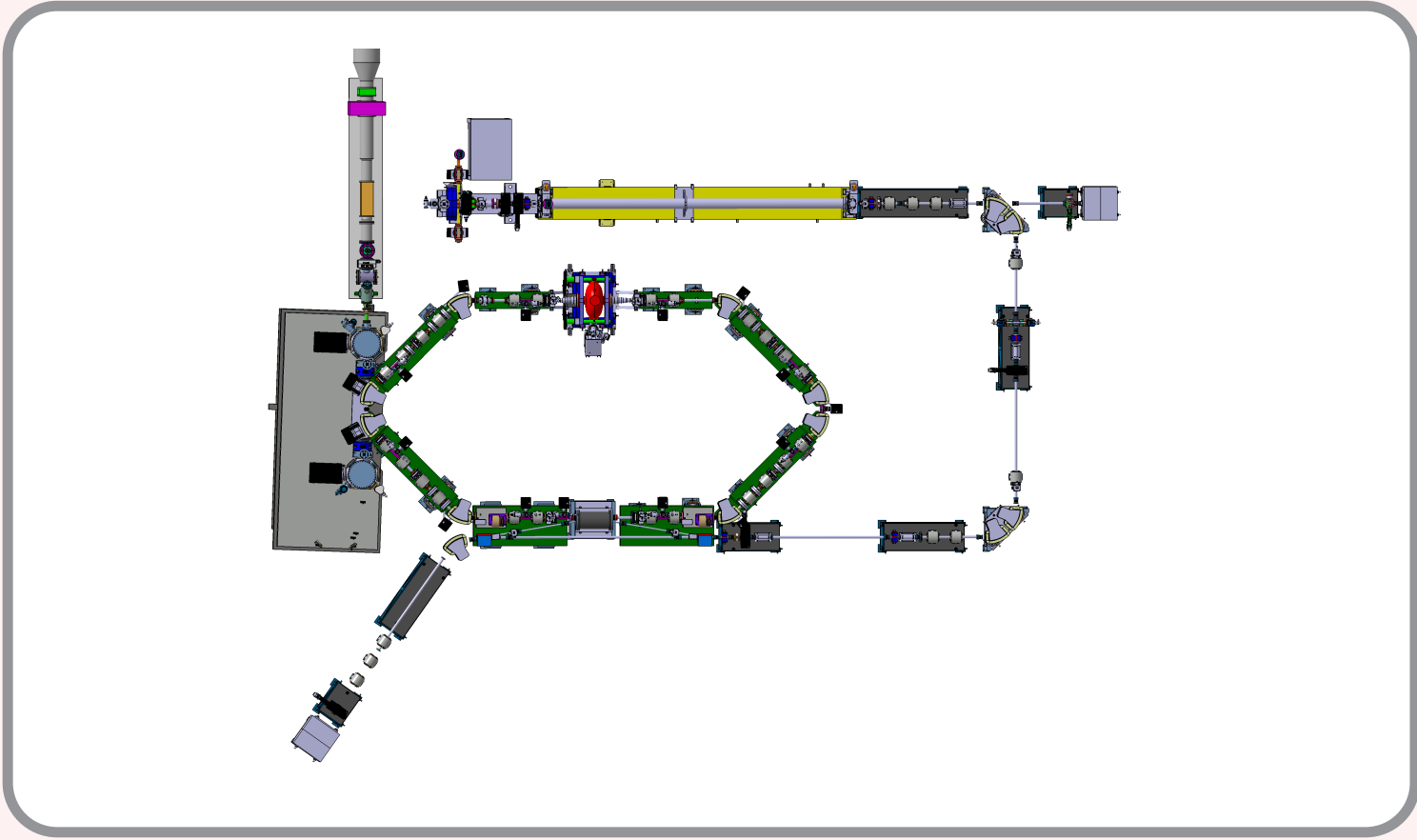
<sup>a</sup>delerue@lal.in2p3.fr  
<sup>b</sup>drebot@lal.in2p3.fr now at XXX  
<sup>1</sup> Laboratoire de l'Accélérateur Linéaire (LAL), Université Paris-Sud XI, F-91898 Orsay, France  
<sup>2</sup> Synchrotron SOLEIL, St Aubin, France

This work is supported by the French "Agence Nationale de la Recherche" as part of the program "investing in the future" under reference ANR-10-EQPX-51. This work was also supported by grants from Région Ile-de-France.



## ThomX

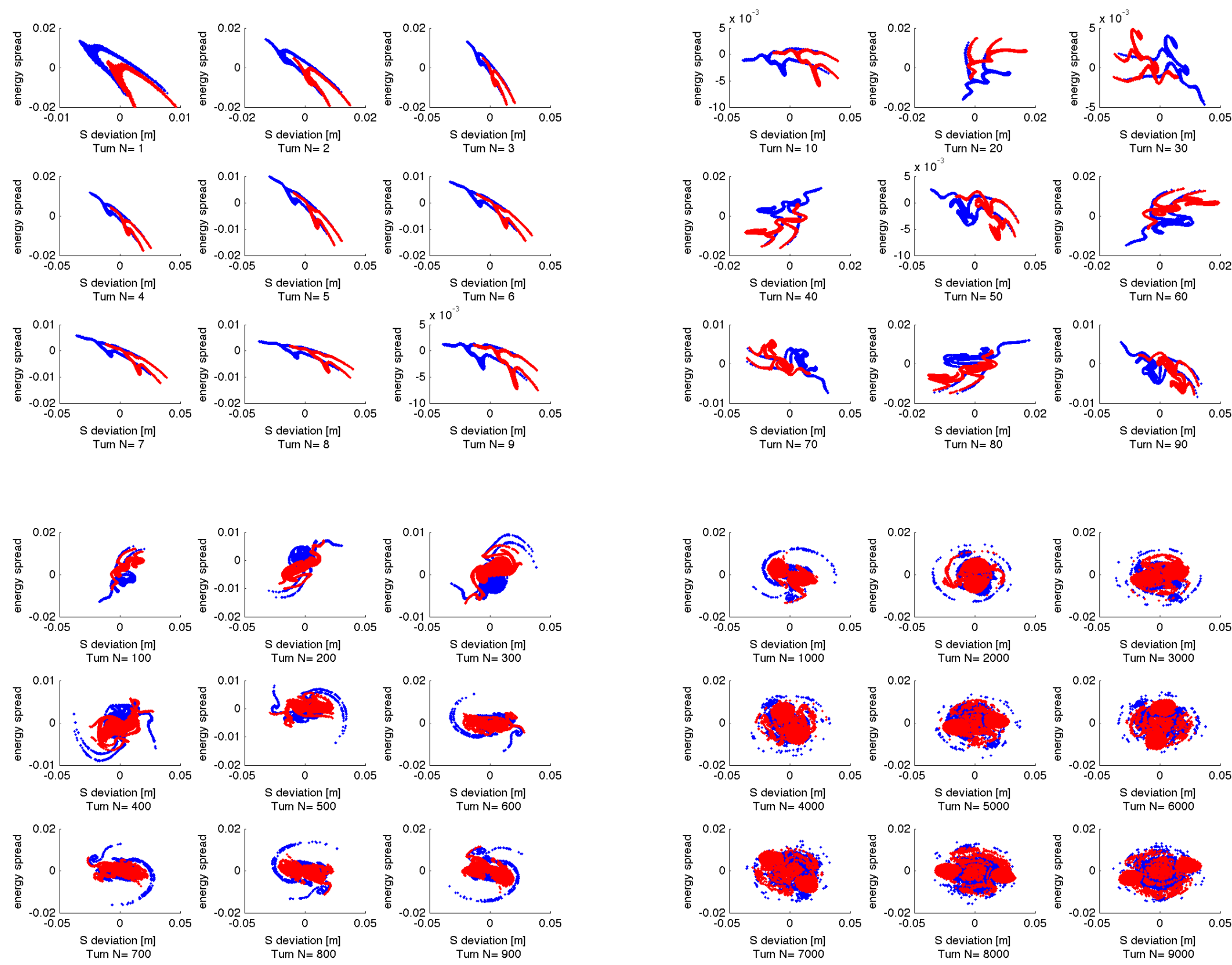
- ThomX: Compact Light Source based on Compton Scattering.
- LINAC + Ring (Compton interactions in the ring).
- Beam energy 50 MeV.
- Damping time >> storage time (20ms).
- Bunch length 4ps at injection, 30ps at the end of the cycle.
- Ring circumference: 16.8 m (under review)
  - ☞ New beam dynamics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



## Beam dynamics at ThomX

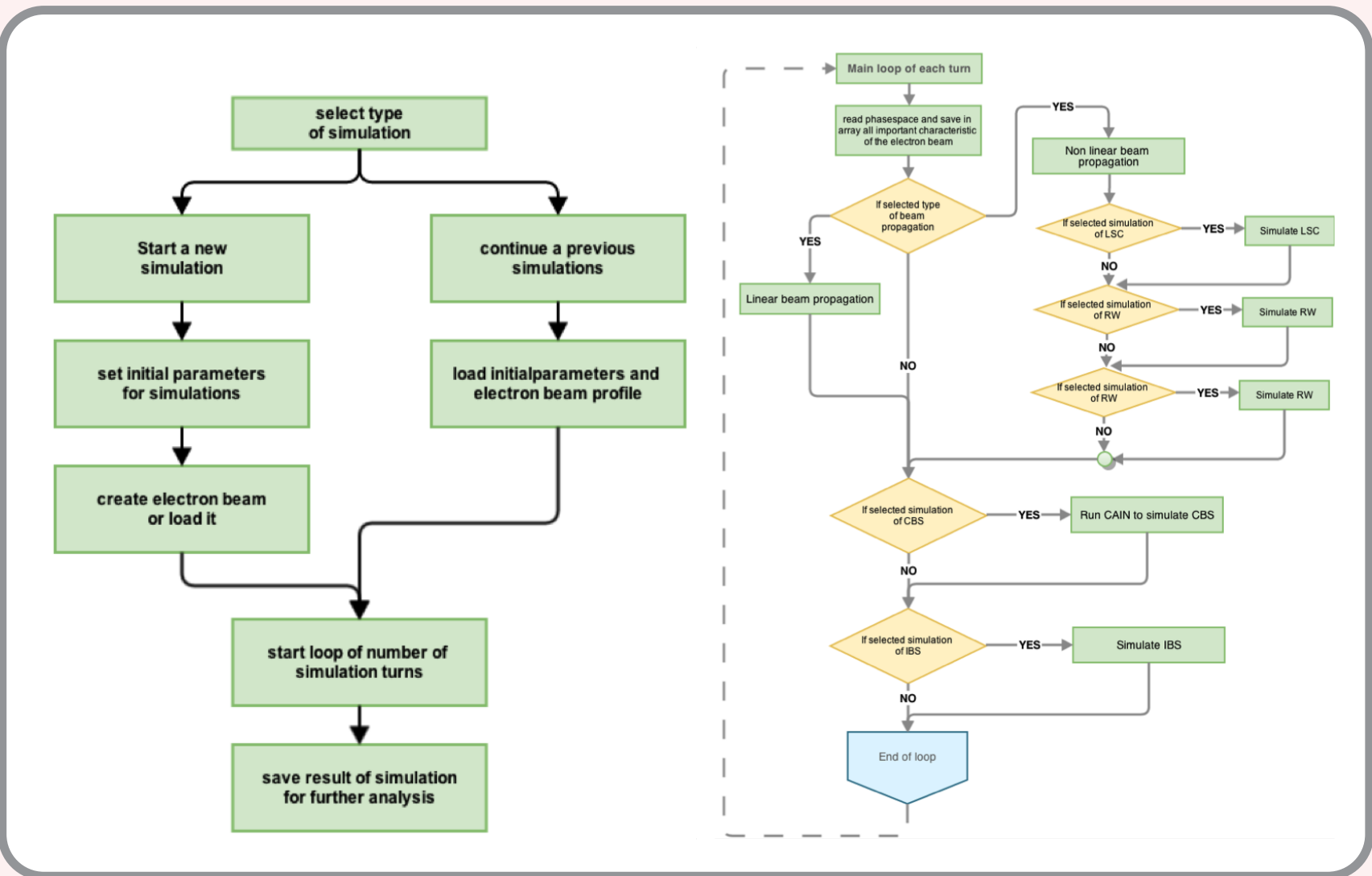
- The following beam dynamics effects are expected to play an important role:
  - ☞ Intrabeam scattering (IBS)
  - ☞ Compton beam scattering (CBS) [on the laser at the interaction point]
  - ☞ Coherent Synchrotron radiation (CSR)
  - ☞ Non linear tracking
  - ☞ Longitudinal space charge & Resistive wall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

## Transient regime at injection



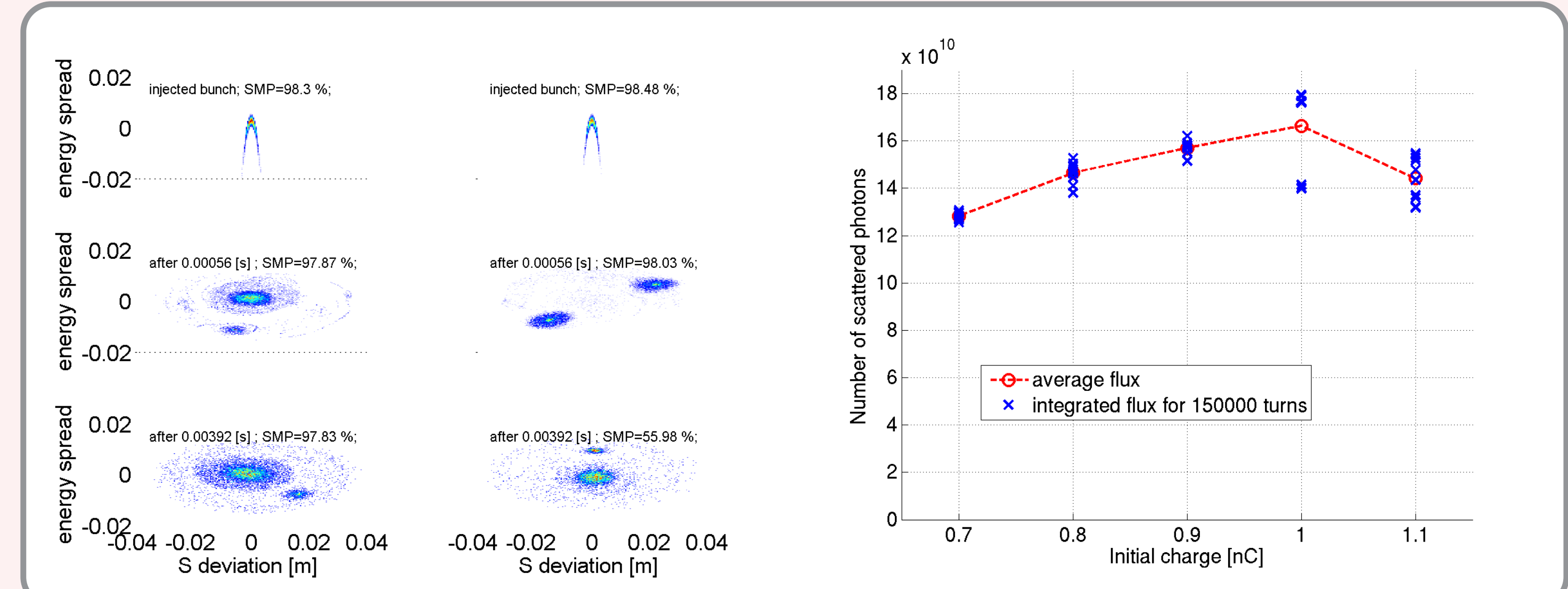
## Simulation code

- 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)

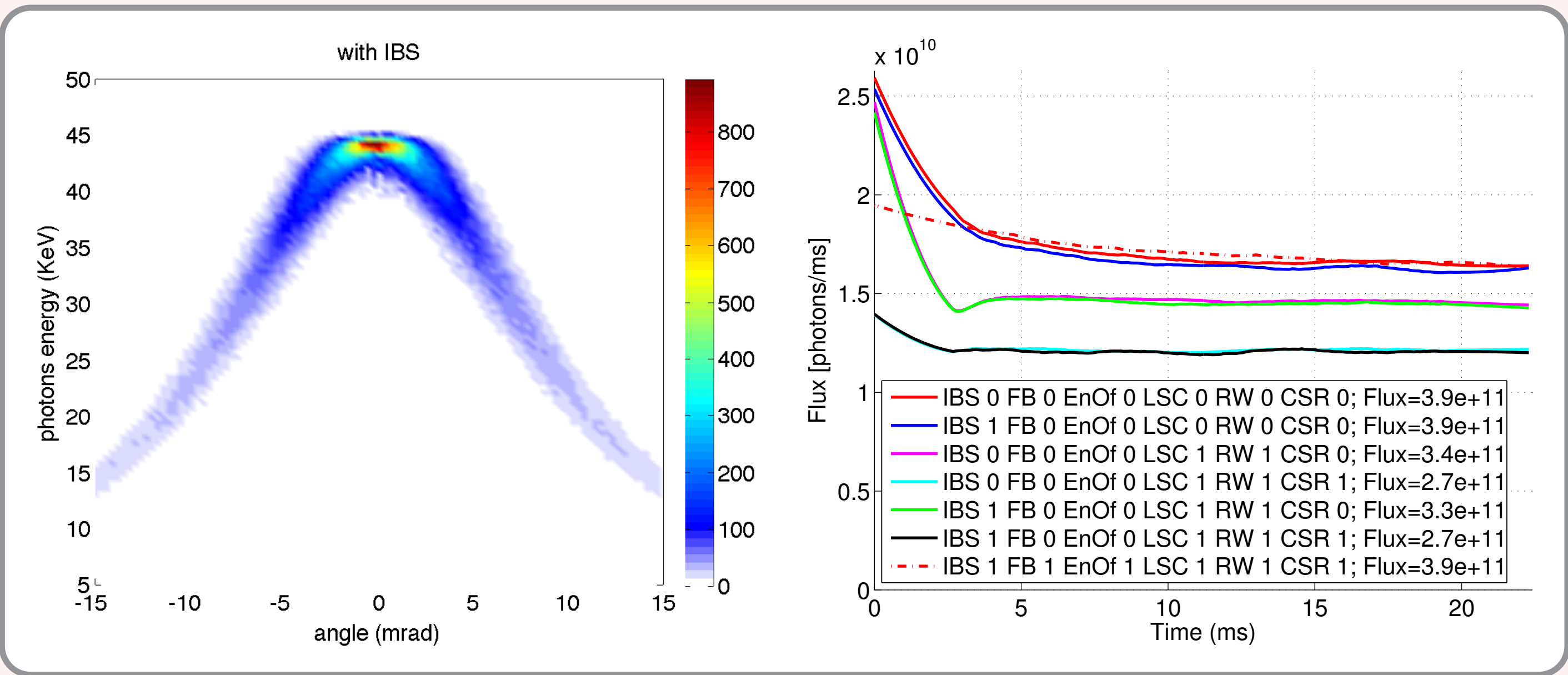


## Effect of CSR

- Beam is not matched at injection.
  - ☞ Very strong CSR during first turns.
  - ☞ Beam can be split and partially lost.
  - ☞ 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 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 turn will be critical for the survival of the beam.
- Risk of beam splitting at high bunch charge.
- Importance of controlling dispersion in the ring.