

# New Multibeam Processing Schemes for High Throughput Satellites

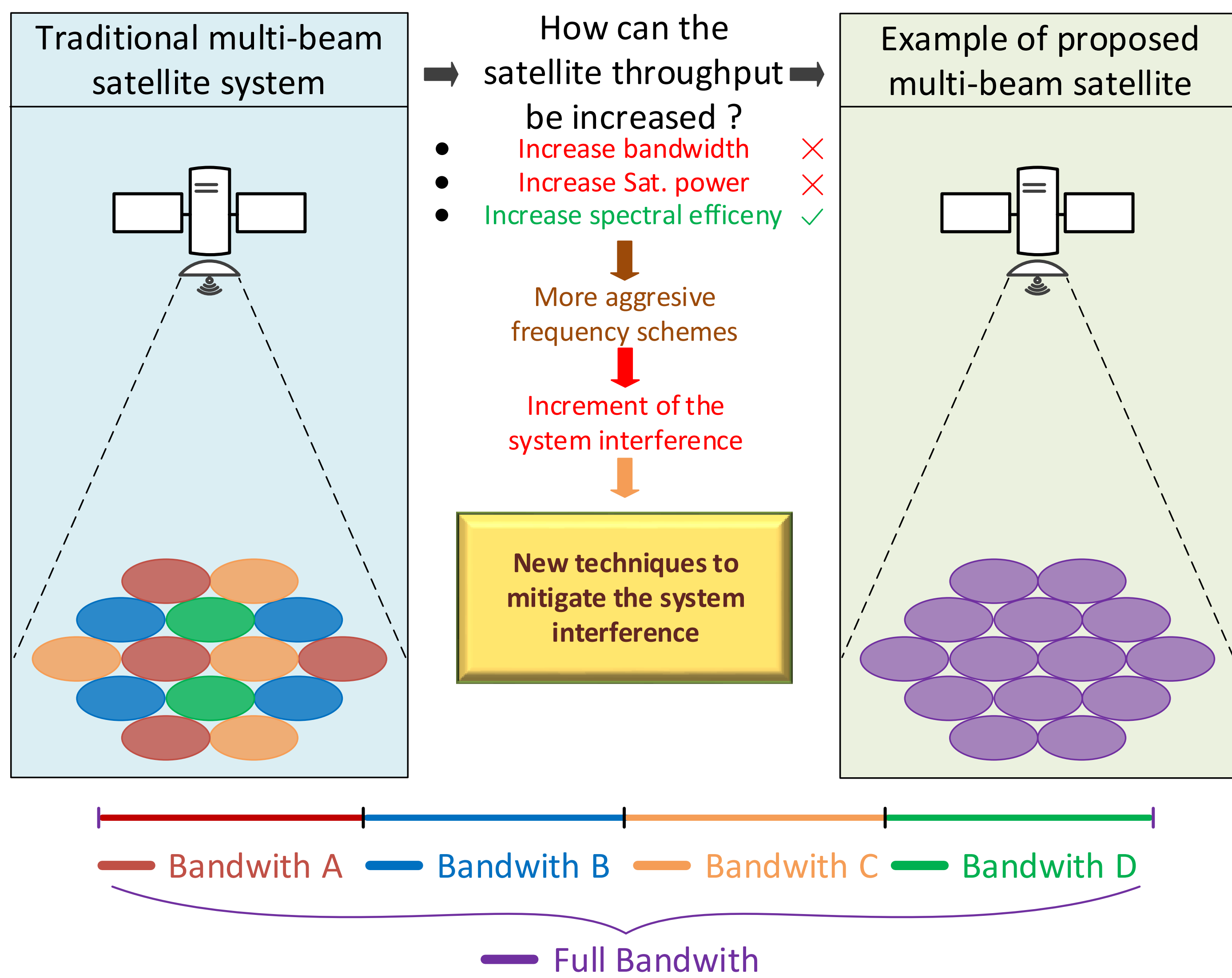
Tomás Ramírez Parracho

Advisor Carlos Mosquera Nartallo

Signal Processing in Communications Group(GPSC). AtlanTTic. Universidade de Vigo

## MOTIVATION

- Satisfy the ever-growing throughput demand in satellite systems.



## THESIS OBJECTIVES

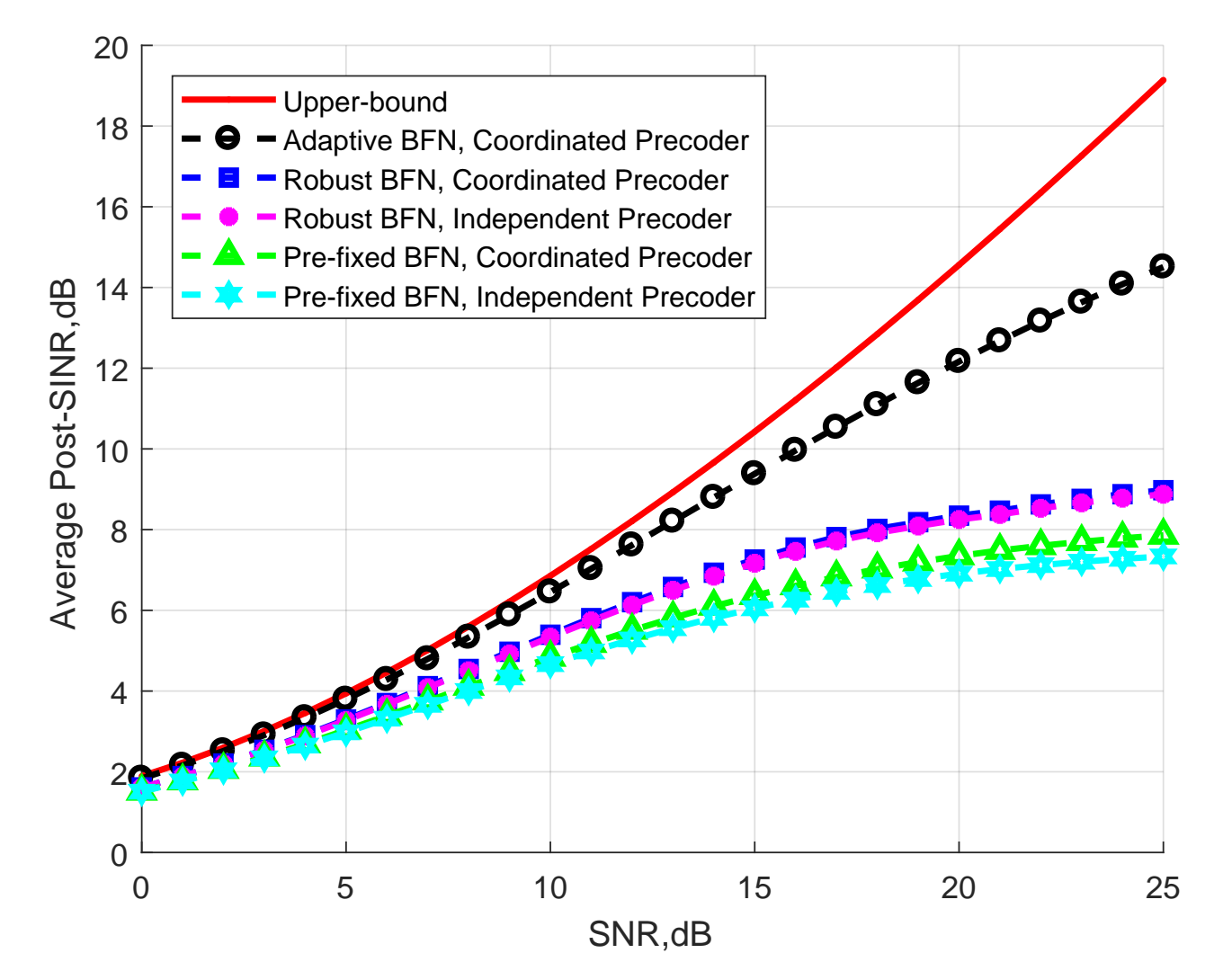
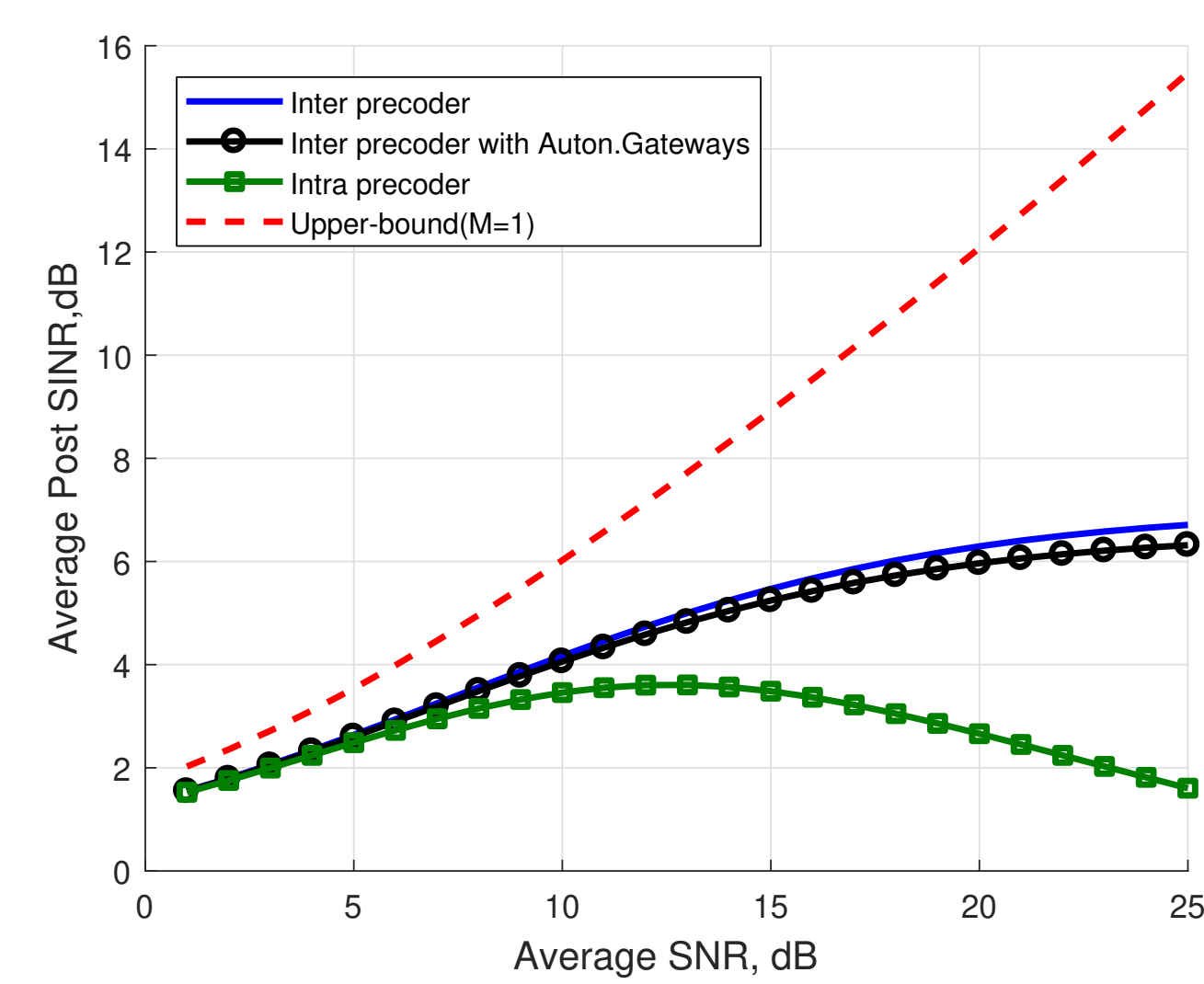
- **Objective:** Develop new satellite multi-beam techniques to mitigate the system interference.
  - Two different approaches about channel state information at the transmitter (CSIT):
    - \* With full CSIT: Linear precoding
    - \* With partial CSIT: Rate-splitting and interference cancellation.
  - Validate the new techniques with simulations
    - \* Diagram pattern of multi-beam satellite is provided European Space Agency (ESA)
- **Challenges:**
  - Implementation of the new techniques under current satellite standards
  - Practical aspects about satellite systems:
    - \* Synchronization among different signals
    - \* Architecture of the satellite payload
    - \* User scheduling
    - \* Receivers complexity

## RESEARCH PLAN

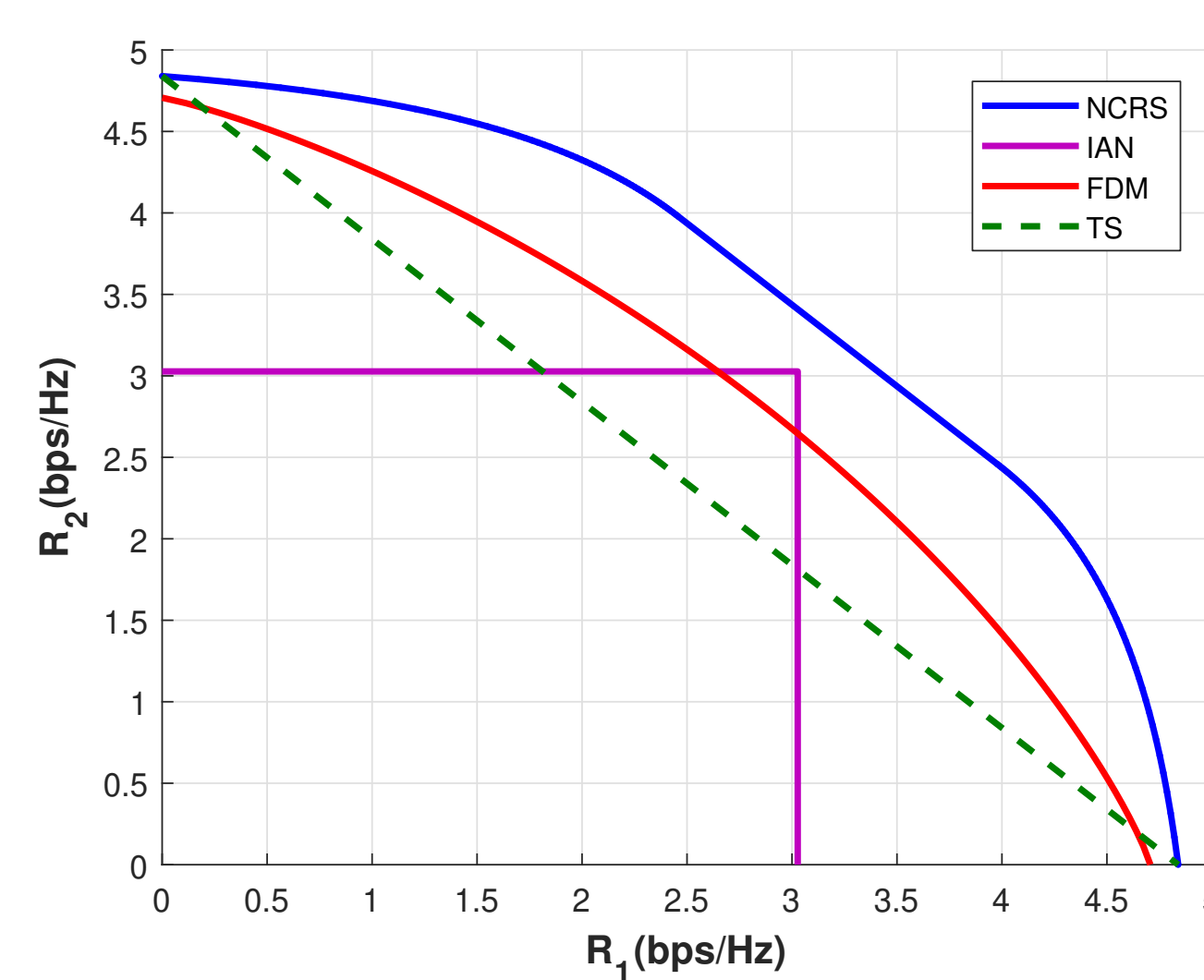
	2017		2018		2019		2020	
	S2	S1	S2	S1	S2	S1	S2	
Literature review								
Joint EURASIP/IEEE SPS Summer School								
Collaboration with Satellite Network of Experts (SatNEX) IV								
Develop new multibeam satellite techniques (with full and partial CSIT)								
Study the implementation challenges under current standards and technologies								
Long stay in a international research center								
Participation in group R&D activities for training purposes								
Writing and thesis defense								

## RESULTS

### - New techniques with CSIT [1] [2]



### - New technique with partial CSIT [3]



## BIBLIOGRAPHY

- [1] C. Mosquera, López-Valcarce, and T. Ramírez, "Distributed precoding systems in multi-gateway multibeam satellites," in *35th AIAA International Communications Satellite Systems Conference*, 2017.
- [2] T. Ramírez, C. Mosquera, and López-Valcarce, "Two-Level Precoding for High Throughput Satellites with non-Cooperative Gateways," in *22nd International Workshop on Smart Antennas (WSA)*, 2018.
- [3] M. Caus, A. Pastore, M. Navarro, T. Ramírez, C. Mosquera, N. Noels, N. Alagha, and A. I. Perez-Neira, "Exploratory Analysis of Superposition Coding and Rate-Splitting for Multibeam Satellite Systems," in *15th International Symposium on Wireless Communications Systems*, 2018.
- [4] D. Christopoulos, P.-D. Arapoglou, and S. Chatzinotas, "Linear Precoding in Multibeam SatComs: Practical Constraints," in *31st AIAA International Communications Satellite Systems Conference, ICSSC 2013*, Oct. 2013, ISBN: 978-1-62410-244-8.
- [5] G. Taricco, "Linear precoding methods for multi-beam broadband satellite systems," in *European Wireless 2014; 20th European Wireless Conference*, May 2014, pp. 1–6.
- [6] S. A. Jafar and A. Goldsmith, "On the capacity region of the vector fading broadcast channel with no CSIT," in *Proc. IEEE Intern. Conf. Commun.*, vol. 1, Jun. 2004, pp. 468–472.

## NEXT YEAR PLANNING

- Develop new satellite multi-beam techniques
- Long stay in a international research center.
- Study the implementations of the new techniques under current satellite standards and technologies.

## ACKNOWLEDGMENT

Tese financiada polas axudas de apoio á etapa predoutoral nas universidades do Sistema universitario galego cuxo financiamento procede do Fondo Social Europeo e da Secretaría Xeral de Universidades da Xunta de Galicia