

General information

General information	<i>Monojit Ghosh</i>
<i>WING I, Ivan Supek lecture Hall, Ruđer Bošković Institute</i>	14:00 - 14:05
The MAPS project	<i>Monojit Ghosh</i>
<i>WING I, Ivan Supek lecture Hall, Ruđer Bošković Institute</i>	14:05 - 14:30
Discussion: Superscaling variable at ESSnuSB and T2HK	
<i>Dinesh Kumar Singha, Elena Abad Díaz, Prof. Federico Sanchez, Lounes Amziane, Monojit Ghosh</i>	
<i>WING I, Ivan Supek lecture Hall, Ruđer Bošković Institute</i>	14:30 - 15:30
coffee	
<i>WING I, Ivan Supek lecture Hall, Ruđer Bošković Institute</i>	15:30 - 16:00

The MAPS project

Monojit Ghosh

Ruđer Bosković Institute, Zagreb, Croatia



MAPS in-person meeting
IRB, Zagreb, 29 June - 3 July 2026

The project

Title: Bringing theory and experiments together for precision neutrino physics

Institutes: University of Geneva, Switzerland,
Ruder Boškovic Institute, Croatia,
University of Silesia in Katowice, Poland

PI: Federico Sanchez (CH)
Monojit Ghosh (HR)
Janusz Gluza (PL)

Funding: Swiss National Foundation (SNSF), Croatian Science Foundation (HRZZ)

Duration: 1.7.2025 – 30.6.2029

Main Goal

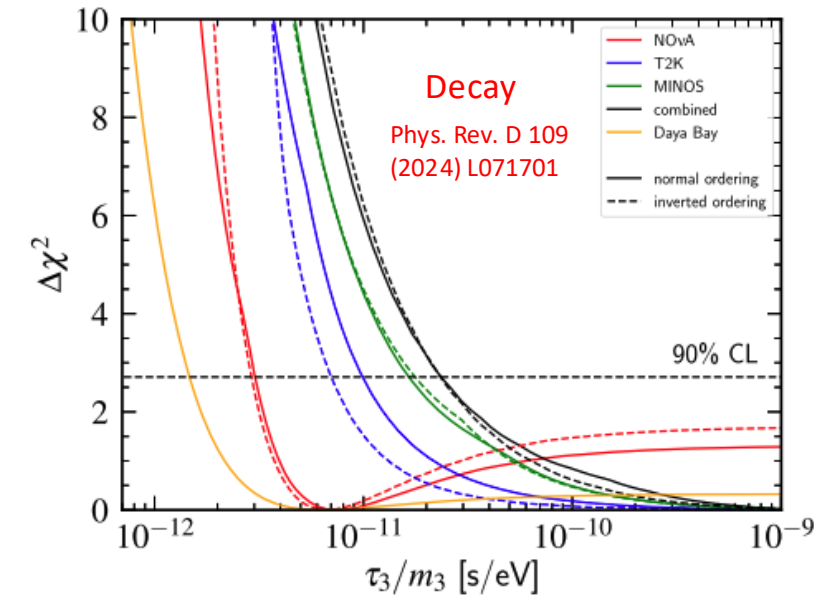
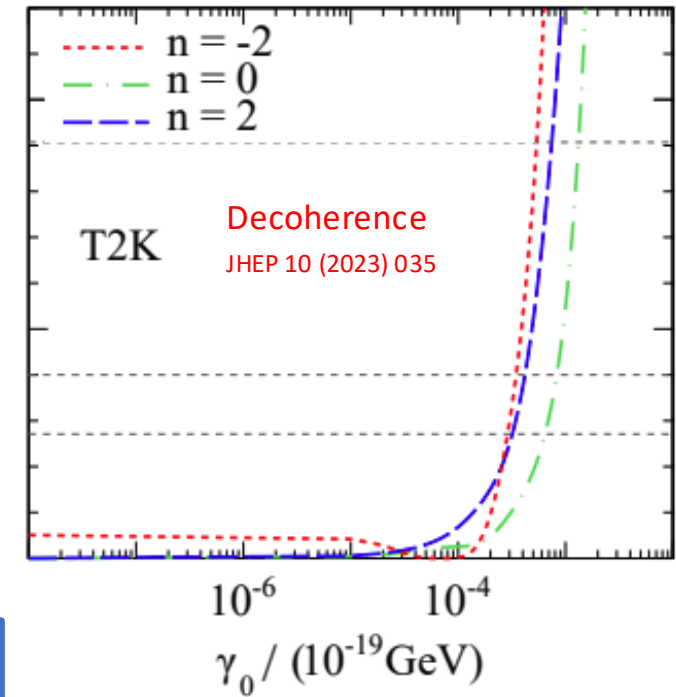
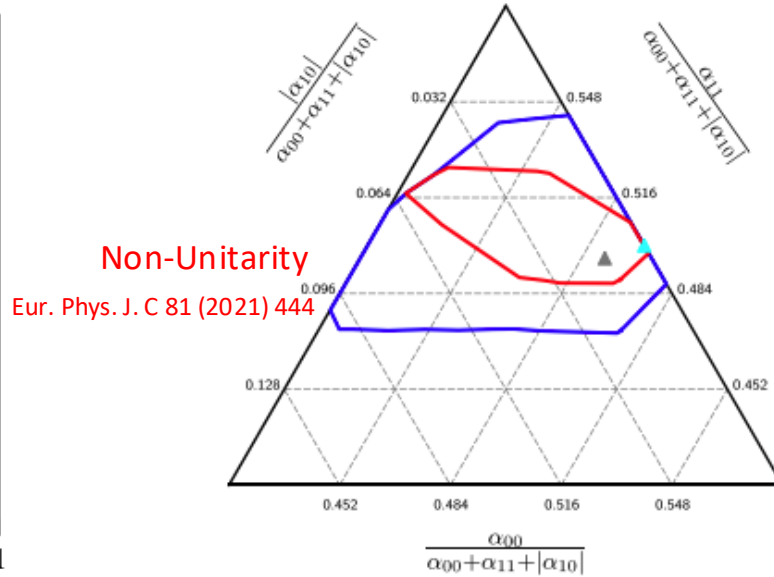
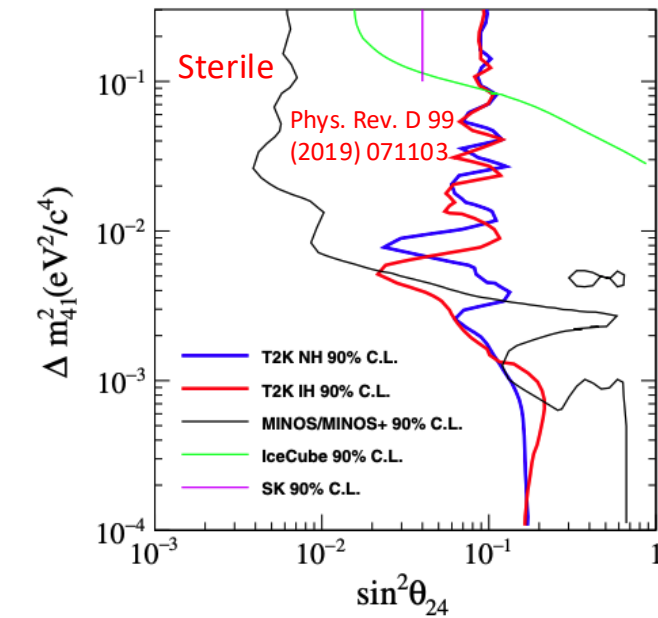
Experimentalists + Phenomenologists

cross-sections and their impact on neutrino oscillations and model building

Two broad research areas:

- A. Study of neutrino oscillation phenomenology with T2K, ESSnuSB and other experiments.
- B. Setting up a special activity among ESSnuSB, NINJA and T2K groups for cross-section measurements.

A.1 Phenomenological analysis of T2K data to look for new physics



Our goal:

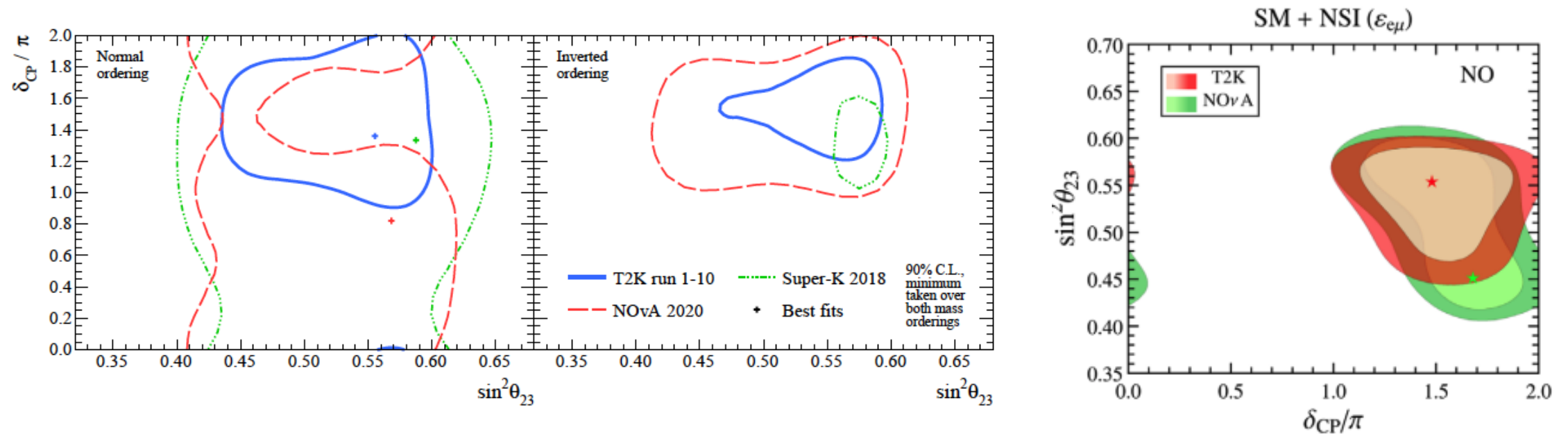
Look for more new physics cases:

- Long-range force,
- Large extra dimensions,
- NSI mediated by a scalar field,
- Lorentz and CPT violation and
- Effect of curved space time and more

Update so far:

- Post-doc at HR has started last week
- Started working on reproducing the T2K results

A.2 Study of T2K data to understand its mismatch from NOvA



Our goal:

Look for possible solutions:

- Only statistics ?
- Some new physics scenarios ?
- Cross-section modelling ?

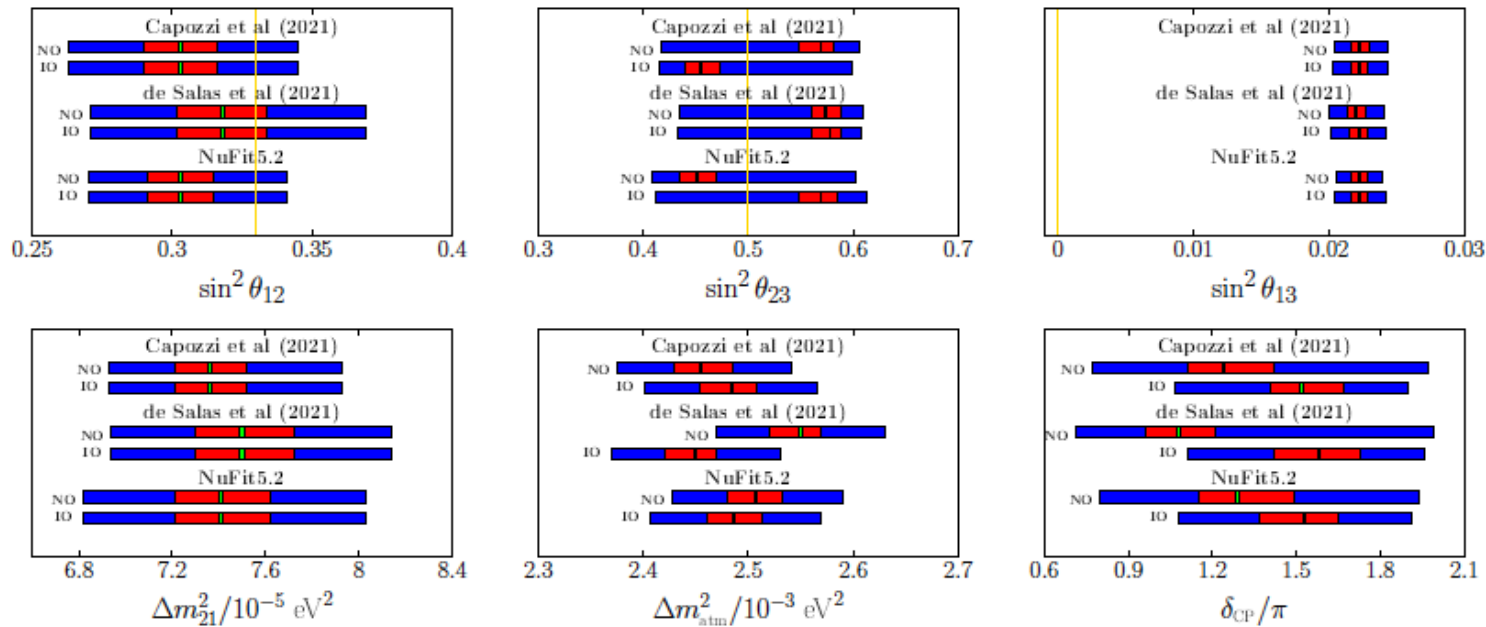
Update so far:

- Post-doc at HR has started working on reproducing the T2K and NOvA results
- HR and CH have started looking at cross-section modelling based on superscaling theory

In this meeting:

- I will review the current status of T2K and NOvA tension
- Dinesh will review the existing solutions

A.3 Study testable flavor models in neutrino experiments



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non-Abelian discrete flavor symmetric models can predict the values of the oscillation parameters

In this meeting:

- Biswajit will discuss the $SO(3)$ model
- Elena will discuss implications in DUNE
- Janusz will discuss oscillations in the context of discrete flavor models
- Marek will discuss texture zero models
- Szymon will discuss correlations in oscillation parameters (online)

Our goal:

Look for possible solutions:

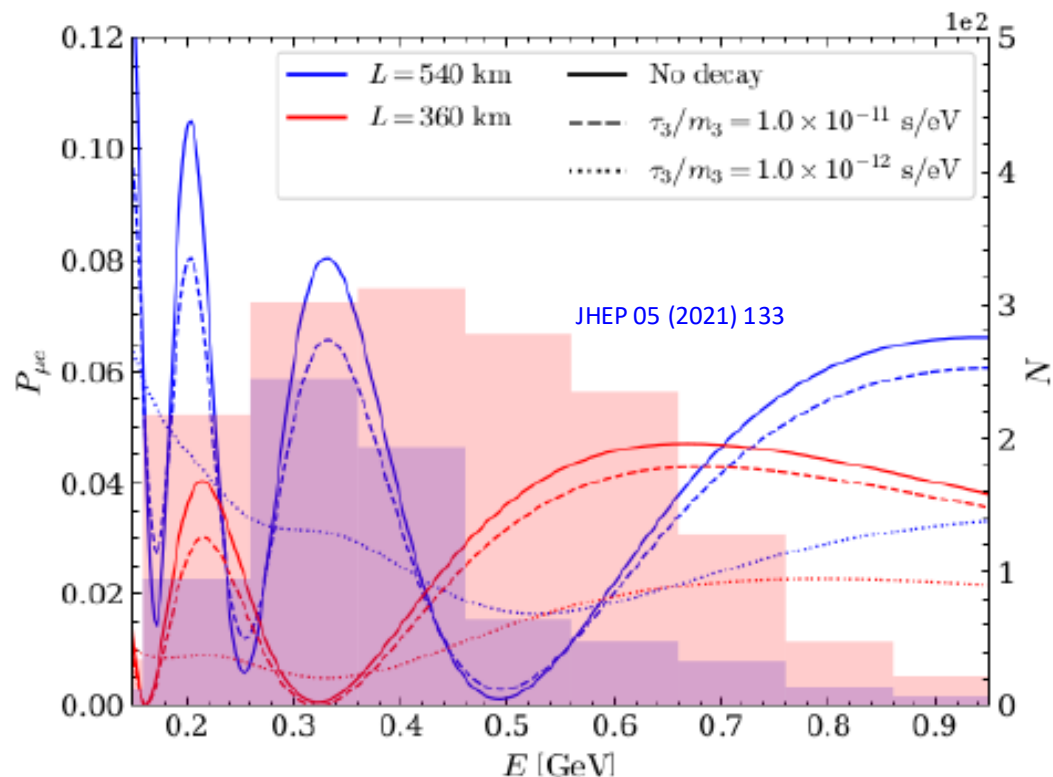
- Develop models to explain the current data
- Study its implication in future experiments

Update so far:

Excellent progress

- PL group already developed a model based on $SO(3)$ symmetry (Phys.Lett.B 874 (2026))
- HR and PL group studying implication of this model in DUNE
- HR and PL studying texture zero models

A.4 Understanding the effects of systematic uncertainties on the sensitivity new physics phenomena in neutrino experiments



- The effect of new physics is small
- Uncertainty due to systematics is large
- New physics can be confused with systematics

Update so far:

- Waiting for post-doc in PL to join
- HR and PL will start looking at it

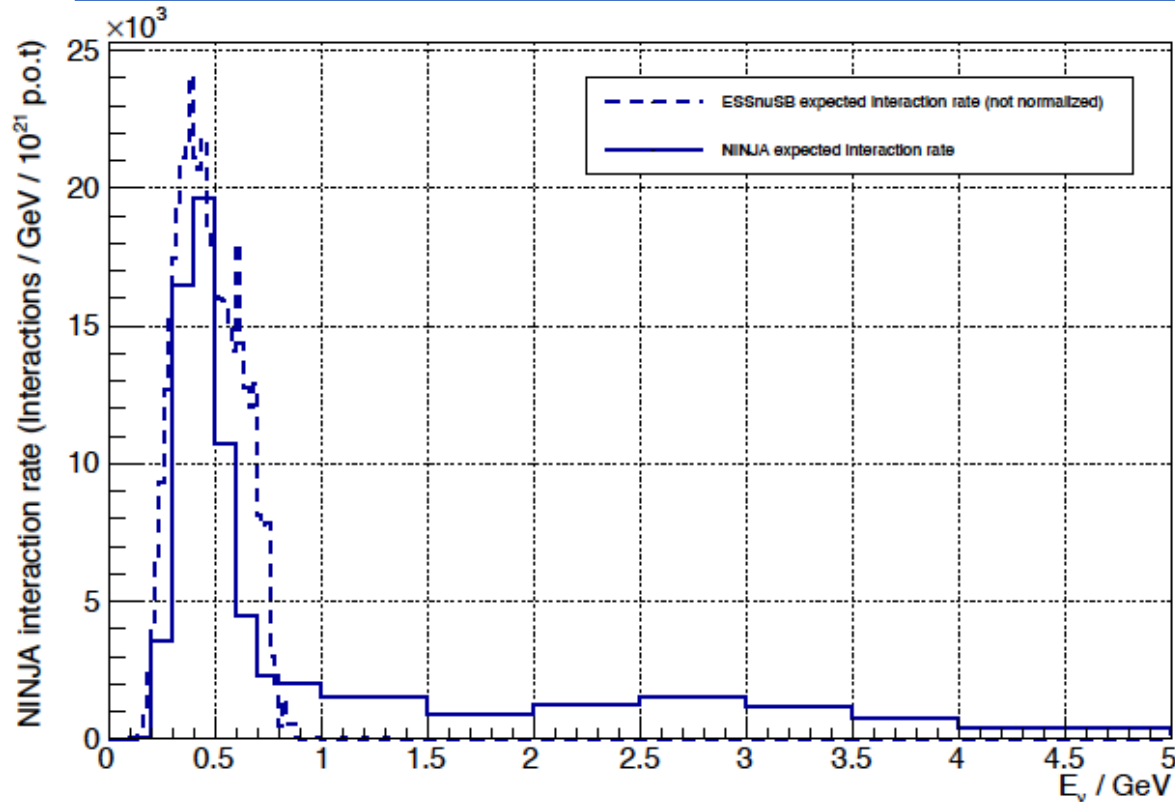
Our goal:

- Disentangle new physics from systematics
- Quantify required systematics

In this meeting:

- Timo will discuss NSI (online)

B.1 Using NINJA to measure cross-section at the ESSnuSB energies



By placing a dedicated NINJA detector at the ground floor of the NM building, we can measure the cross-sections for ESSnuSB

Update so far:

Excellent progress

HR group performed a test experiment at J-PARC to measure the cosmic background

Our goal:

- Design and optimization of the ground level NINJA detector
- determine whether the cosmic background allows measurements at that location

In this meeting:

- Mahesh will give overview of NINJA experiment
- Bruno will discuss the test experiment
- Leon will give overview of ESSnuSB experiment

B.2 NINJA to measure cross-sections at T2K energies

NINJA data can be used for cross-section modelling and the re scattering process which can improve the cross-section measurement of the 1p1h and 2p2h processes of the T2K experiment.

Our goal:

- Develop cross-section theories which can be measured in the NINJA data
- Theories to quantify correct cross-section model
- Study its implication in ESSnuSB, Hyper-K etc

Update so far:

Excellent progress

- CH group developed a cross-section theory based on superscaling variable
- CH and HR looking at the possibility to probe this theory in NINJA data and its implication on ESSnuSB and T2HK

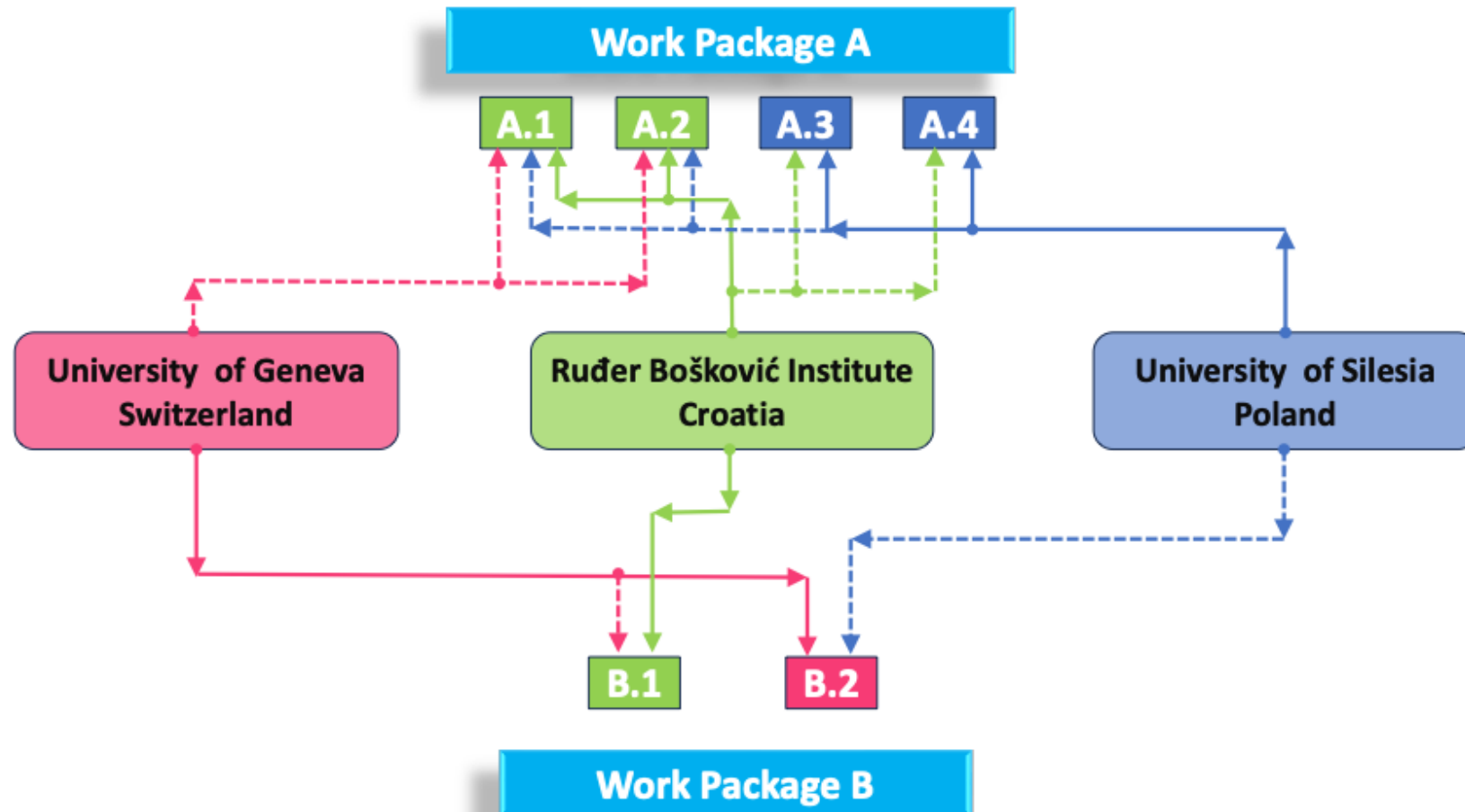
In this meeting:

- Federico will discuss UniGe activity on cross-section
- Lounes will discuss superscaling variable

Work Plan

Summary: neutrino interaction cross-sections and their impact on neutrino oscillations and model building for neutrino masses and mixings.

Objectives: 4 theoretical (A.1, A.2, A.3 and A.4) and 2 experimental (B.1 and B.2)



Other Agenda

3 Invited talks

Valdimir Tello (University of Split) : Left-Right symmetry models with Dirac neutrinos

Mariam Tortolla (University of Valencia): Global fit of the neutrino oscillation data

Raoul Serao (University of Zagreb): Quantum Many-Body Dynamics in Neutrino Physics

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Thank You, let's discuss