

ESS - ILL Topical workshop on Fundamental and Particle Physics

Valentina Santoro
ESS

Welcome to the second ESS ILL User Meeting



In 2018, ILL and ESS hosted their first European Users Meeting in Grenoble.

This successful meeting provided the opportunity to review the achievements of the user community, present the current status of ILL and ESS and, most importantly, to look forward to the scientific opportunities ahead for neutron science.

Plenary session on 23-25 September 2020

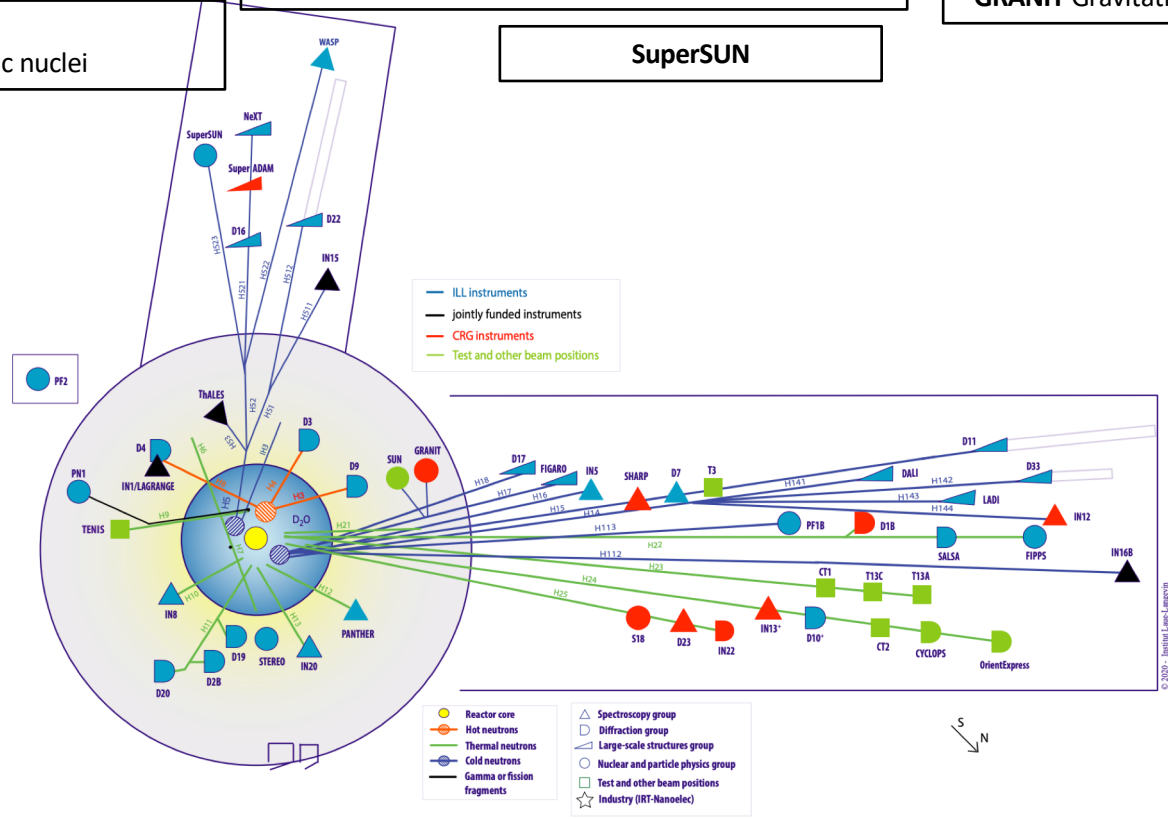
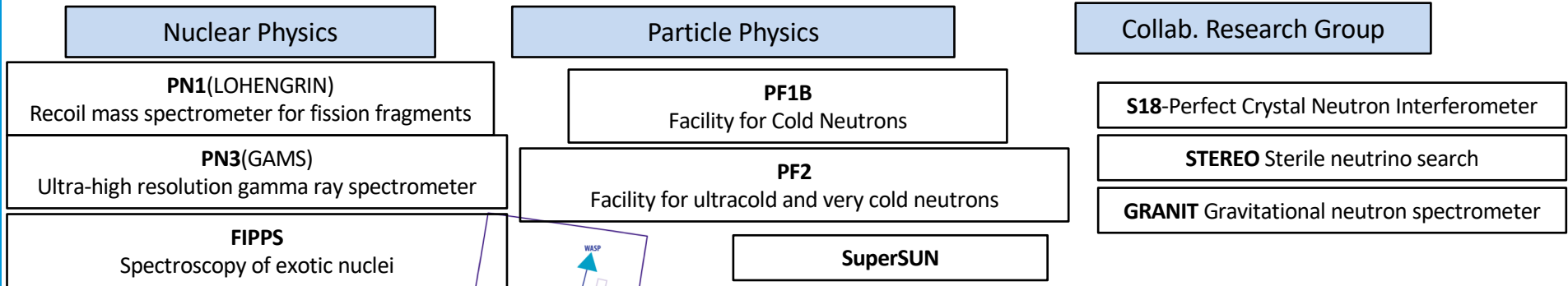
Most of the presentations are available on-line <http://www.neutrons4europe.com/>



Due to the pandemic the parallel session became Topical Workshop

The ILL example

At ILL, fundamental physics is pursued within the **N**uclear and **P**article **P**hysics (NPP) group together with the user community. Current flagship experiments cover neutron beta decay (lifetime and angular correlations), searches for an electric dipole moment, searches for dark matter and dark energy using gravity resonance spectroscopy, and a search for sterile neutrinos.



Courtesy of P. Geltenbort

Fundamental & Particle Physics @ ESS (I)



Standard Model of particle physics (SM)

Precision experiments

Beyond SM
New interactions

Neutron antineutron
oscillation beamline
(NNbar)

High Intensity
Baryon Extraction
and Measurement
(HIBEAM)

Baryon asymmetry
of the Universe

Cold neutron
beamline (ANNI)

Neutron beta decay
Hadronic parity
violation
Electromagnetic
properties of the
neutron

UCN beamline

Gravity resonance
spectroscopy

Neutron
interferometry

Neutron beta decay



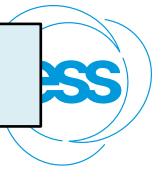
Standard Model of particle physics (SM)

Precision experiments

Beyond SM
New interactions

ESSnuSB
Discover and
measure neutrino CPV

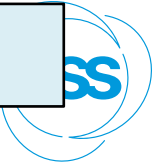
Coherent Elastic
Neutrino-Nucleus
Scattering at the ESS
High-statistics, precision
CEvNS measurements



- ESS Science Management team has identified the members of the committee for the Scientific and Technical Advisory Panel (**STAP**)
- They will be inviting members in the coming weeks with a view to having a meeting before the end of the year.



- The scope of ESS, as defined in the ESS statutes, is to build and operate 22 world-leading instruments in an open user program. Of these, the first 15 will be brought on-line by the end of 2025.
- Regarding instruments 16-22 a document from ESS (The ESS Instrument Suite – A Capability Gap Analysis (<https://europeanspallationsource.se/instruments/capability-gap-analysis>) has analysed the capability gaps
- Result of this analysis has shown that one of the community that is not catered is the particle physics community.
Therefore filling this capability gap is given the highest priority.




- The recent update of the European Strategy for Particle Physics emphasises the need for a more diverse program beyond that at CERN: *"Experiments in such diverse areas that offer potential high-impact particle physics programmes at laboratories in Europe should be supported."*
- It is also to be noted that the strategy refers to "laboratories" and not "national laboratories" as in earlier updates, to take account a fundamental physics program at the ESS

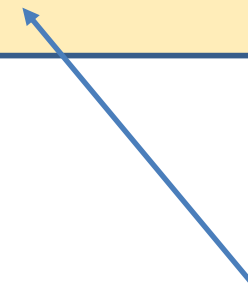
<https://home.cern/sites/home.web.cern.ch/files/2020-06/2020%20Update%20European%20Strategy.pdf>

ESS - ILL Topical workshop on Fundamental and Particle Physics




13:00	→ 13:10	Introduction Speaker: Valentina Santoro	🕒 10m	✎
13:10	→ 13:35	The ESS neutrino Super Beam Design Study (ESSnuSB) and the High Intensity Frontier Initiative (HIFI) Speaker: Tord Ekelof (Uppsala University)	🕒 25m	✎
13:35	→ 14:00	Coherent Elastic Neutrino-Nucleus Scattering at the European Spallation Source Speaker: Juan Collar	🕒 25m	✎
14:00	→ 14:25	New platforms for ultra cold neutron production: SuperSUN and beyond Speaker: Skyler Degenkolb	🕒 25m	✎
14:25	→ 14:50	Neutron Beam EDM Experiment Speaker: Florian Piegsa	🕒 25m	✎
14:50	→ 15:05	Virtual Coffee Break	🕒 15m	
15:05	→ 15:30	Sterile Neutron Searches at ORNL Speaker: Leah Broussard	🕒 25m	✎
15:30	→ 15:55	The HIBEAM and NNBAR experiment Speaker: David Milstead (Stockholms Universitet)	🕒 25m	✎
15:55	→ 16:20	Antineutron optics Speaker: William Snow (Indiana University)  nnbartalkWMSESS....	🕒 25m	✎
16:20	→ 16:35	A combined paper on fundamental physics possibilities at ESS? Speakers: David Milstead (Stockholms Universitet), Valery Nesvizhevsky	🕒 15m	✎

We start with neutrinos



ESS - ILL Topical workshop on Fundamental and Particle Physics




13:00	→ 13:10	Introduction Speaker: Valentina Santoro	🕒 10m	✎
13:10	→ 13:35	The ESS neutrino Super Beam Design Study (ESSnuSB) and the High Intensity Frontier Initiative (HIFI) Speaker: Tord Ekelof (Uppsala University)	🕒 25m	✎
13:35	→ 14:00	Coherent Elastic Neutrino-Nucleus Scattering at the European Spallation Source Speaker: Juan Collar	🕒 25m	✎
14:00	→ 14:25	New platforms for ultra cold neutron production: SuperSUN and beyond Speaker: Skyler Degenkolb	🕒 25m	✎
14:25	→ 14:50	Neutron Beam EDM Experiment Speaker: Florian Piegsa	🕒 25m	✎
14:50	→ 15:05	Virtual Coffee Break	🕒 15m	
15:05	→ 15:30	Sterile Neutron Searches at ORNL Speaker: Leah Broussard	🕒 25m	✎
15:30	→ 15:55	The HIBEAM and NNBAR experiment Speaker: David Milstead (Stockholms Universitet)	🕒 25m	✎
15:55	→ 16:20	Antineutron optics Speaker: William Snow (Indiana University)  nnbartalkWMSESS....	🕒 25m	✎
16:20	→ 16:35	A combined paper on fundamental physics possibilities at ESS? Speakers: David Milstead (Stockholms Universitet), Valery Nesvizhevsky	🕒 15m	✎

We move to current running experiments

ESS - ILL Topical workshop on Fundamental and Particle Physics




13:00	→ 13:10	Introduction Speaker: Valentina Santoro	🕒 10m	✎
13:10	→ 13:35	The ESS neutrino Super Beam Design Study (ESSnuSB) and the High Intensity Frontier Initiative (HIFI) Speaker: Tord Ekelof (Uppsala University)	🕒 25m	✎
13:35	→ 14:00	Coherent Elastic Neutrino-Nucleus Scattering at the European Spallation Source Speaker: Juan Collar	🕒 25m	✎
14:00	→ 14:25	New platforms for ultra cold neutron production: SuperSUN and beyond Speaker: Skyler Degenkolb	🕒 25m	✎
14:25	→ 14:50	Neutron Beam EDM Experiment Speaker: Florian Piegsa	🕒 25m	✎
14:50	→ 15:05	Virtual Coffee Break	🕒 15m	
15:05	→ 15:30	Sterile Neutron Searches at ORNL Speaker: Leah Broussard	🕒 25m	✎
15:30	→ 15:55	The HIBEAM and NNBAR experiment Speaker: David Milstead (Stockholms Universitet)	🕒 25m	✎
15:55	→ 16:20	Antineutron optics Speaker: William Snow (Indiana University)  nnbartalkWMSESS....	🕒 25m	✎
16:20	→ 16:35	A combined paper on fundamental physics possibilities at ESS? Speakers: David Milstead (Stockholms Universitet), Valery Nesvizhevsky	🕒 15m	✎

We go to ORNL



ESS - ILL Topical workshop on Fundamental and Particle Physics




13:00	→ 13:10	Introduction Speaker: Valentina Santoro	🕒 10m	✎
13:10	→ 13:35	The ESS neutrino Super Beam Design Study (ESSnuSB) and the High Intensity Frontier Initiative (HIFI) Speaker: Tord Ekelof (Uppsala University)	🕒 25m	✎
13:35	→ 14:00	Coherent Elastic Neutrino-Nucleus Scattering at the European Spallation Source Speaker: Juan Collar	🕒 25m	✎
14:00	→ 14:25	New platforms for ultra cold neutron production: SuperSUN and beyond Speaker: Skyler Degenkolb	🕒 25m	✎
14:25	→ 14:50	Neutron Beam EDM Experiment Speaker: Florian Piegsa	🕒 25m	✎
14:50	→ 15:05	Virtual Coffee Break	🕒 15m	
15:05	→ 15:30	Sterile Neutron Searches at ORNL Speaker: Leah Broussard	🕒 25m	✎
15:30	→ 15:55	The HIBEAM and NNBAR experiment Speaker: David Milstead (Stockholms Universitet)	🕒 25m	✎
15:55	→ 16:20	Antineutron optics Speaker: William Snow (Indiana University)  nnbartalkWMSESS....	🕒 25m	✎
16:20	→ 16:35	A combined paper on fundamental physics possibilities at ESS? Speakers: David Milstead (Stockholms Universitet), Valery Nesvizhevsky	🕒 15m	✎

We move to neutrons oscillations

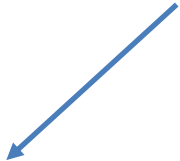


ESS - ILL Topical workshop on Fundamental and Particle Physics



13:00	→ 13:10	Introduction Speaker: Valentina Santoro	🕒 10m	✎
13:10	→ 13:35	The ESS neutrino Super Beam Design Study (ESSnuSB) and the High Intensity Frontier Initiative (HIFI) Speaker: Tord Ekelof (Uppsala University)	🕒 25m	✎
13:35	→ 14:00	Coherent Elastic Neutrino-Nucleus Scattering at the European Spallation Source Speaker: Juan Collar	🕒 25m	✎
14:00	→ 14:25	New platforms for ultra cold neutron production: SuperSUN and beyond Speaker: Skyler Degenkolb	🕒 25m	✎
14:25	→ 14:50	Neutron Beam EDM Experiment Speaker: Florian Piegsa	🕒 25m	✎
14:50	→ 15:05	Virtual Coffee Break	🕒 15m	
15:05	→ 15:30	Sterile Neutron Searches at ORNL Speaker: Leah Broussard	🕒 25m	✎
15:30	→ 15:55	The HIBEAM and NNBAR experiment Speaker: David Milstead (Stockholms Universitet)	🕒 25m	✎
15:55	→ 16:20	Antineutron optics Speaker: William Snow (Indiana University)  nnbartalkWMSESS....	🕒 25m	✎
16:20	→ 16:35	A combined paper on fundamental physics possibilities at ESS? Speakers: David Milstead (Stockholms Universitet), Valery Nesvizhevsky	🕒 15m	✎

We conclude with a discussion towards a combined paper



- There is a need for a fundamental physics program at ESS
- ILL should really be the example to follow
- A combined paper could be the first step



“There is nothing like a dream to create the future”

Victor Hugo