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# European Strategy Update 2025-2026

Strong Interaction group

Andrea Dainese (INFN Padova)

# European Strategy Update - timeline



# Physics Working Group on Strong Interaction

- **Strong Interaction, one of the nine working groups**
- **Tasks for working groups:**
  - reach out to community to encourage submission of inputs
  - analyse inputs received by 31 March
  - discuss comparison and complementarity of physics programmes
  - prepare parallel session of Symposium (presentations, discussion)
  - prepare contribution to “briefing book”
    - 2019 book: <https://cds.cern.ch/record/2691414/files/1910.11775.pdf>
- Strong Interaction - conveners: A. Dainese (Padova), C. Diaconou (Marseille)
- **Physics areas:**
  - Hot and dense QCD
  - Precision QCD
  - Inner structure of protons and nuclei
  - QCD in hadronic, nuclear and astro(particle)physics
- 2-3 experts for each area will form the working group (ongoing, will converge in two weeks)

# Physics Working Group on Strong Interaction

- **Hot and dense QCD**
  - Physics: Heavy ions, Quark-gluon plasma, Collectivity in QCD
  - Machines: HL-LHC, SPS, FAIR, FCC-hh / ions
- **Precision QCD**
  - Physics: elementary processes,  $\alpha_S$ , fragmentation, hadronization, photon-photon
  - Machines: HL-LHC, FCC-ee, other lepton collider options
- **Inner structure of protons and nuclei**
  - Physics: PDFs and nuclear PDFs, gluon saturation, proton spin
  - Machines: HL-LHC, EIC, LHeC/FCC-eh
- **QCD connections with hadron physics, nuclear physics and astro(particle)physics**
  - Physics: hadron spectroscopy and exotica, hadron-hadron strong interaction, QCD in cosmic-ray physics (incl. DM searches), QCD in neutron star cores, QCD in nuclear structure
  - Machines; HL-LHC, SPS, FAIR

# Heavy ions: national and community inputs

- **Important to have a large number of inputs related to QCD and to heavy ions**
- **HI@CERN Town Meeting** in discussion with working group members
  - Possible date: Monday 17 February
- **National inputs coordinated by FAs** should have QCD/HI at CERN as a prominent item
- **National inputs prepared by the heavy-ion communities** important as well (theory, multiple experiments)
- **Inputs on specific aspects of the programme**, especially with impact outside HI/QGP, enrich the physics standing of the future HI programme

# Additional information

# Physics Preparatory Group

PPG MEMBERS	
<b>Strategy Secretariat</b>	
Scientific Secretary (Chair)	Prof. Karl Jakobs (DE)
SPC Chair	Dr Hugh Montgomery (USA)
ECFA Chair	Prof. Pareskevas Sphicas (GR)
LDG Chair	Prof. Dave Newbold (UK)
<b>SPC</b>	
Prof. Pilar Hernandez (ES)	
Prof. Gino Isidori (CH)	
Prof. Fabio Maltoni (BE/IT)	
Prof. Jocelyn Monroe (UK)	
<b>ECFA</b>	
Dr Tommaso Boccali (IT)	
Dr Thomas Bergauer (AT)	
Dr Cristinel Diaconu (FR)	
Prof. Monica Dunford (DE)	
<b>CERN</b>	
Dr Gianluigi Arduini (CERN)	
<b>ASIA/AMERICAS</b>	
Dr Anadi Canepa (USA)	
Prof. Xinchou Lou (China)	
Prof. Rogerio Rosenfeld (Brazil)	
Prof. Yuji Yamazaki	

Working Group		
	Co-convenor (PPG member)	Co-convenor
Electroweak physics	Monica Dunford (DE, exp)	Jorge de Blas (ES, theory)
Strong interaction	Cristinel Diaconu (FR, exp)	Andrea Dainese (IT, exp, HI)
Flavour physics	Gino Isidori (CH, theory)	Marie-Hélène Schune (FR, exp)
BSM physics	Fabio Maltoni (BE/IT, theory)	Rebeca Gonzalez Suarez (SE, exp)
Neutrino physics and cosmic messengers	Pilar Hernandez (ES, theory)	Sara Bolognesi (FR, exp)
Dark matter and dark sector	Jocelyn Monroe (UK, exp)	Matthew McCullough (CERN, theory)
Accelerator science and technology	Gianluigi Arduini (CERN, acc)	Phil Burrows (UK, exp, acc)
Detector instrumentation	Thomas Bergauer (AT, exp)	Ulrich Husemann (DE, exp)
Computing	Tommaso Boccali (IT, exp, comp)	Borut Kersevan (SL, exp, comp)



# European Strategy Update - mandate

- In June 2024, the CERN Council established and approved the **remit of the European Strategy Group:**

”The aim of the Strategy update should be to develop a **visionary and concrete plan** that greatly advances human knowledge in fundamental physics through the **realisation of the next flagship project at CERN**. This plan should attract and value **international collaboration** and should **allow Europe to continue to play a leading role in the field.**”

- The Strategy update should include the **preferred option** for the next collider at CERN and **prioritized alternative options** to be pursued if the chosen preferred plan turns out not to be feasible or competitive.
- The Strategy update should also indicate **areas of priority for exploration complementary to colliders** and for other experiments to be considered **at CERN** and **at other laboratories in Europe**, as well as for participation **in projects outside Europe**.

## **Clarification on HL-LHC programme (discussed in Physics Preparatory Group):**

- **The full exploitation of HL-LHC, including flavour and heavy-ion physics, was recommended in the 2020 Update**
- **Given that the funding approval (TDRs, MoUs) of the proposed LS4 upgrades of ALICE and LHCb takes place after the Strategy Update 2025-2026, the scope of the HL-LHC physics programme is part of the process**



# 2019 inputs on Strong Interaction

## Category: Facilities and experiments with strong interactions as key topic

- (Id13) NA61++ (SPS)
- (Id42) PBC@CERN, COMPASS++, MUSE@PSI, MUonE, DIRAC++, NA61++
- (Id46) Heavy flavour in HI
- (Id47 and Id67 and Id110) LHC-FT: ALICE and LHCb (LHCSpin)
- (Id90) NA60+ (SPS)
- (Id110) ALICE upgrade for HL-LHC
- (Id135) QCD/HI at FCC-hh and FCC-eh
- (Id143) COMPASS++/AMBER (SPS)
- (Id152) QCD/HI at HL-LHC
- (Id159) LHeC/PERLE
- (Id160) QCD/HI at HE-LHC

## Category: Synergies on a global scale

- (Id76) J-PARC
- (Id93) NICA
- (Id99) US-based EIC

## Category: Facilities & experiments with strong interactions as a topic

- (Id13 and Id50) AWAKE
- (Id49) Super Charm-Tau Factory

## Category: QCD results in support for other programs

- (Id117) Auger experiment
- (Id131) LBNF/DUNE
- (Id151) New physics with HI collisions

## Category: QCD theory in support

- (Id100 and Id101) Precise calculations @ colliders
- (Id114) MC generators
- (Id163) QCD theory

## Category: QCD and nuclear physics

- (Id39) ISOLDE/EPIC

## Category: National roadmaps

- (Id21) INFN Hadron
- (Id37) Germany ALICE
- (Id56) INFN HI
- (Id115) Germany Hadron

## Category: Individual and community thoughts

- (Id48) Town meeting on Heavy Ions
- (Id103) DIS
- (Id140) personal input
- (Id148) NuPECC