

Non-collider Physics

Short intro to spark discussion



Focus and perimeter of ESPPU

- We are preparing the European Strategy Particle Physics Update
 - **Strategy** → focus on the physics outcome of ‘big science’ projects, which require large resources
 - **CERN** is organizing the EPPSU effort → focus on the projects at CERN

Therefore the main focus is the choice of the next collider project at CERN ...

- ... **but the European Particle Physics is more than that !**

We should include some short considerations on the importance of the **physics return of non-collider projects**, notably for **big/strategic projects hosted in Europe and particularly supported by France**

→ next slide (NOT A PRIORITIZATION ! We want to be sure that we mention all major/strategic aspects for Europe and France in particular)

Particle Physics in Europe beyond the next collider



- **Neutrinos** : focus on LBL and CERN Neutrino Platform, but also included ESSnuSB as prospect also mentioned ORCA&JUNO and stressed physics importance of θ_{mub} (with bolometers at Gran Sasso), neutrino telescopes (with Km3Net in the Mediterranean sea)
- **Dark Matter** : **do we cover enough the direct detection?** WIMPs (with experiments such as DarkSide or XENON) in GT1, or axions (eg MADMAX) with haloscopes in GT1 and GT2 + a contribution for European Network for Dark Matter Technology mentioned in GT1
- **Gravitational Waves** (**nowhere in the document, need to add a sentence ?**) :
 - There is a proposal from part of **Einstein Telescope community to host one of the detectors at CERN** (to exploit and enhance CERN expertise) → Can be supported as a way to diversify the physics portfolio of CERN
 - Important **connection of GW with particle physics**
(eg, cosmological stochastic backgrounds as probe of temperature phase transitions, inflation and new heavy particles; imprint of new very light particles on dynamics of BH mergers; gravitational wave antenna based on accelerator technologies, ...)
- **Flavour**: well covered by GT2 EDM (e,n), $m \rightarrow e\gamma$ (COMET), nuclear beta decay, PIONEER@PSI g-2 covered by GT4
Anything else ?
- **EW measurements** in GT1 (measure $\sin 2\theta_W$ at different energy scales, α_{QED}), Eg PAX
- **Low energy/fixed target experiments** Eg, experiments at PSI, MAMI
- **Societal applications** Eg biomedical imaging in GT1, anything else in other GTs? **Do we need a dedicated sentence?**

Message for the document

- The present status of the Standard Model investigation pushes to maintain a **diversified approach** in the Particle Physics strategy
- Common feedback from many submissions :
 - **The next flagship project at CERN should be implemented in a way that is not detrimental in terms of resources for the other important research lines of Particle Physics (mentioned above)**
- Also nice sentence from GT2 :
 - « ... it is important to keep investing in **smaller dedicated experiment** with potential high-impact discoveries »

Major infrastructures not at CERN

- **Modane (LPSC) and Gran Sasso** for underground physics
- **Prospects of ESS in Sweden** as future center for particle physics (physics with neutrons and with neutrinos beyond LBL, eg CEvNS)
- **Mainz & PSI** accelerators for low energy physics (with high-intensity e- and p beams)
- **Ganil** : a submission about DESIR facility (see next slide about interface with nuclear physics)
- **DESY** : eg, high intensity magnets for Axion searches (mentioned in one submission)

Do we need to say anything about the strategic importance for European Particle Physics of these major infrastructures ?

Interfaces with other domains

- Main question : does the French community feel that the experiments/topics at the interface are well organized and funded ? Or do we need to improve ?
- **Nuclear physics** : eg, 'precision' nuclear physics modeling for particle physics (neutrinos, ...)
- **Astrophysics, cosmology** : eg, GW, neutrino telescopes, ...
- **Atomic physics** : probe of SM in an unexplored regime