Slovenia
Mid-Term Report

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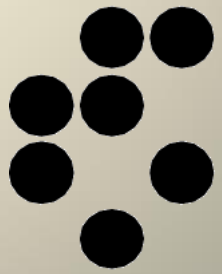
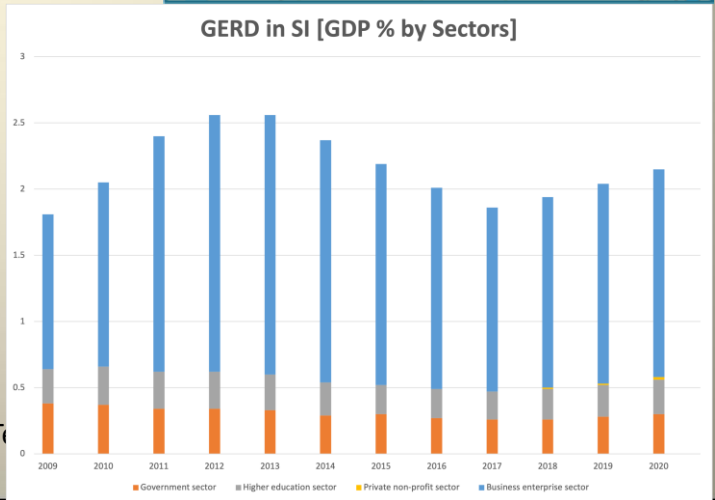
Plenary ECFA Meeting
November 17, 2022



Slovenia – Basics

- Small middle-European country
  - Size: 2 million, 20000 km^2
  - GDP: ~60 GEUR ~30 kEUR/cap. (PPP)
  - ~2 orders of magnitude smaller than Germany
    - ~1 order of magnitude smaller than Poland
  - ~0.5% GDP public spending on R&D
    - positive trend in recent years
- New law on R&D passed end 2021
  - Autonomy of Institutes for R&D expenditure
  - Gradual rise of public R&D spending up to 1%
  - Looks (too?) good, some (infant?) problems in implementation

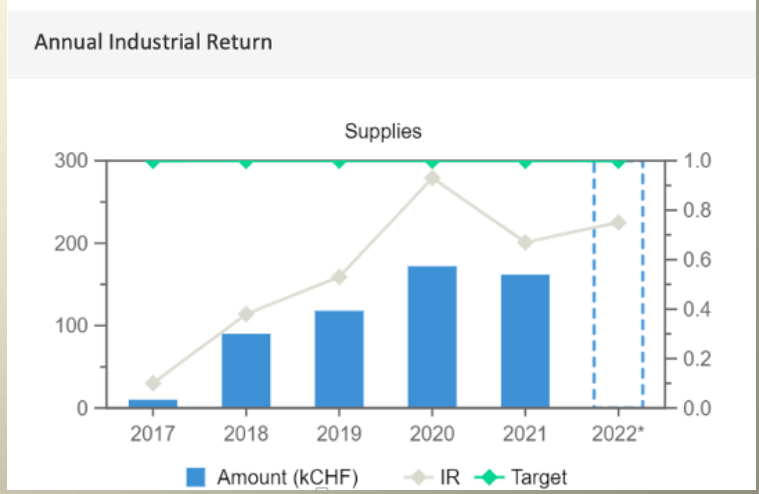


HEP in Slovenia

- The Slovenian HEP community is composed of researchers from Jožef Stefan Institute (JSI) and three Slovenian Universities (Ljubljana, Maribor, Nova Gorica)
  - Experimental and Theoretical Particle Physics effort led by JSI
    - Astro-Particle by University of Nova Gorica
    - Nuclear Physics at JSI

Slovenia in CERN/ECFA

- Slovenia is *Associate Member State of CERN in the pre-stage to Membership* from *July 4th 2017* (5y after Higgs discovery)
- In ECFA from 2018
  - Initial Country Visit in April 2019
- Were set to proceed to full membership for the 10th Higgs anniversary
- Request to extend Associate Membership status for 2 years submitted to Council in Summer 2021
  - Approved in the December 2021 Council session
- Work ahead to keep momentum to accomplish the membership goal in July 2024
  - Servicing of Associate State contributions present in the budget
  - Industrial return: Return factor increasing, now *poorly balanced*
  - Personnel: 2 fellows



HEP in SI: Experiment

- Led by Experimental Particle Physics Department of JSI – Head count: ~30 researchers
- Currently active in two major HEP collaborations
  - ATLAS at the LHC in CERN
  - Belle2 at Super-KEKB in KEK
    - Technical Associate in LHCb (RICH upgrade)
- Detector development
  - Also as part of two R&D collaborations at CERN (merging in DRD3)
    - RD-42: diamond detectors
    - RD-50: radiation-hard silicon detectors
- Computing

RECFA Visit Recommendations

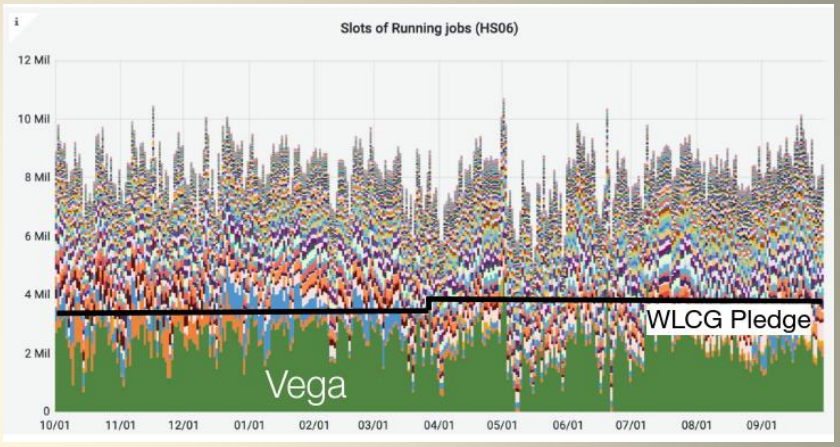
- The strategic focus on the ATLAS and Belle2 experiments has resulted in a high level of visibility for the Slovenian particle physics research groups. Keeping the model.
- The Committee strongly appreciates the efforts by the funding bodies to maintain an adequate budget supporting long-term engagement in high-energy physics experiments, and especially to secure the necessary funding for the upcoming upgrade of the ATLAS detector at CERN. The budget has been kept at ~same level, boosted by ERC Advanced Grant – slide.
- The continuous exploration of synergies between the research interests of the Slovenian theoretical and experimental groups in high-energy physics is excellent, and such collaborations should be supported. Continued, even more synergy in ATLAS analysis.
- The Slovenian groups working in detector R&D are to be commended for their strong ambition and experience, but the overall lack of technical support for high-energy physics research needs to be addressed. Not really resolved.
- Thanks to its standards of excellence, the computing team is deeply involved in both international and Slovenian computing developments, which should result in a leading role for them when the planned High-Performance Computing resources are deployed in Slovenia. Excellent development - slide.
- The Committee is of the opinion that, given the strength of the research groups, more PhD students can be trained in experimental particle physics, assuming that additional funding can be allocated to this. Boosted by ERC, not really resolved in the long term.
- The Committee recommends that the Ministry sustain the excellent level of participation in the Slovenian teachers programme at CERN. Sustained – slide.

FAIME: ERC AdG project

- PI: Prof. Peter Križan
- Aim: Investigate flavour anomalies on a large sample of data collected by the Belle II spectrometer. Develop advanced particle identification methods.
- Of particular interest for this project are measurements of processes that satisfy the following conditions:
  - Possibility of relatively large NP contribution to the process;
  - Current experimental accuracy not enabling a clear answer on (dis)agreement with the SM prediction;
  - Clear theoretical prediction;
  - Complementarity in NP searches to other experimental efforts (e.g. $R(\pi)$, a fully inclusive measurement of flavour universality at at $\Upsilon(4S)$ etc).
- An integral part of the effort is also the development of advanced particle identification methods that are a prerequisite for the successful completion of the project: separation of low momentum pions, electrons and muons in the Cherenkov detectors and by a ML-based pattern discrimination in the electromagnetic calorimeter.

High-Performance Computing

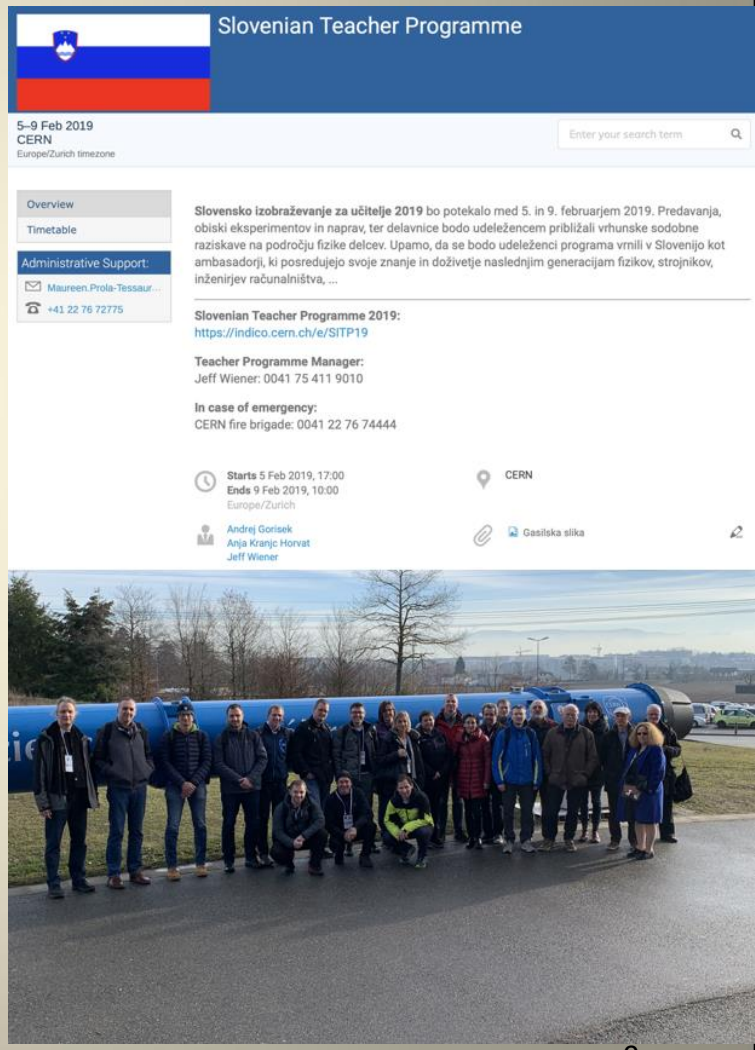
- Supercomputer Vega started operation in April 2021 as the 1st EuroHPC machine, and is one of the most popular EuroHPCs
- JSI HEP computing group played the leading role in designing the architecture, in procurement, and then in making it operational and applicable to as many sciences as possible, including LHC computing
- JSI HEP team is an integral part of several EU projects (EuroCC, InterTwin, several CoEs, EUMaster4HPC, SMASH…)
- Vega is delivering a significant amount of computing resources to ATLAS and Belle2, demonstrating the usability of supercomputers for data intensive processing and storage



https://home.cern/news/news/computing/harnessing-supercomputer-atlas

Slovenian Teacher Programme

- Organised 2 events at CERN
  - Feb 2019: the inaugural event, 24 participants (mostly physics teachers at high schools)
  - Mar 2021: online event due to COVID-19 restrictions, more participants
- In person variety has a lot of advantages
  - Many hands-on workshops and visits
- Lectures by well established Slovenian academics and scientists form the field
- Networking events organised for the community on regular/yearly basis



Summary

- Slovenian HEP is carrying on with the good work observed during the initial RECFA visit
- Most of recommendations from the Executive Summary addressed in an adequate way
- Consorted effort needed to accomplish CERN membership status in 2024