Strategic R&D Programme on Technologies for future Experiments

EP R&D DAY

Summary and next steps

20 February 2023

https://ep-rnd.web.cern.ch/

EP-R&D-II

1.1 Hybrid Pixel Si

- Fast (10ps), precise, high rate, high fluence.

- PicoPix, 28 nm process. Interest by LHCb and CMS.

- SiEM concept.

1.2 MAPS

- MAPS based on 65 nm CMOS.

- MOSS ER2 => ALICE.

- MOST, timing, radhard, => future

1.3 Si Modules

Module technologies.

- Very thin hybrid pixel modules.

- ACF and ACP

- RDL, Cu-Cu bonds

- incl. photonic chips

- low mass large area modules

1.4 Si simul & charact.

- timing dets. w/ and wo/ gain.

- 'RD50'-like studies

- CARIBOU

- Beam telescope

- Tools for Si charact.

4 Mechanics ++

- Low mass mech. structures, incl. gas or liquid cooling, retractable vertex detector
- Robotics (incl. extra grant)
- New coolants (delay!)

5 ASIC

- technology evaluation and radiation effect (28, 16 nm)
- system-on-chip radiation tolerant eco-system (SOCRATES)
- powering, 2-stage design (48 =. 0.9 V) => 90
- high density interconnect (synergy e.g. with 1.1 and 1.3)

6 Links

- ASICS: consolidation DART28 and DART28HV. SiPH-Demo
- rad hard embedded eFPGA
- Silicon photonics, rad hard design, incl. packaging

2 Gaseous det.

- novel micropattern structures

- large area systems

- picosec detectors

- gas studies

- tools for modelling and simulations

- lab test electronics

3 Calorimetry & light based

- Noble liquid calorimetry. LAr with finer segmentation. Prototype.

- R&D on scintillator based calo., shashlik, very good timing and rad hard, link to LHCb ECAL upgrade.

- 'Pure R&D'

- RICH

Highlight yield fibres.

7 Software

- Faster simulation, incl . GPU
- Rec. in high-multiplicity environment
- efficient use of anlaysis facility

- turnkey software stack
- HEP core software library

8 Magnets

- Advanced magnet powering
- Al-stabilised reinforced SC cable

- new 4T facility
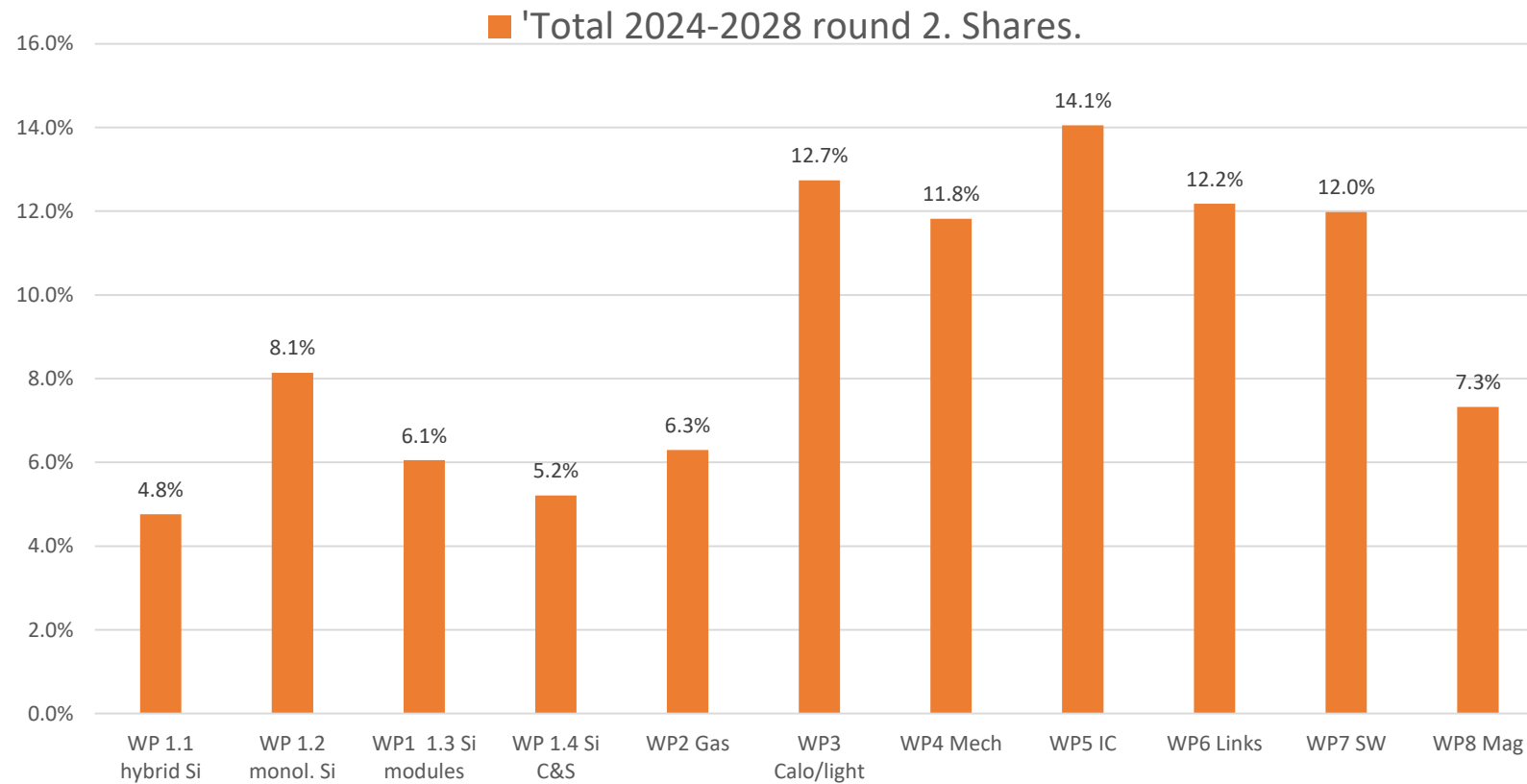- Magnet controls and instrumentation

Current budget requests for extension EP-R&D-II.

(All items (fellows and students) converted to money.

20 February 2023   EP R&D Day
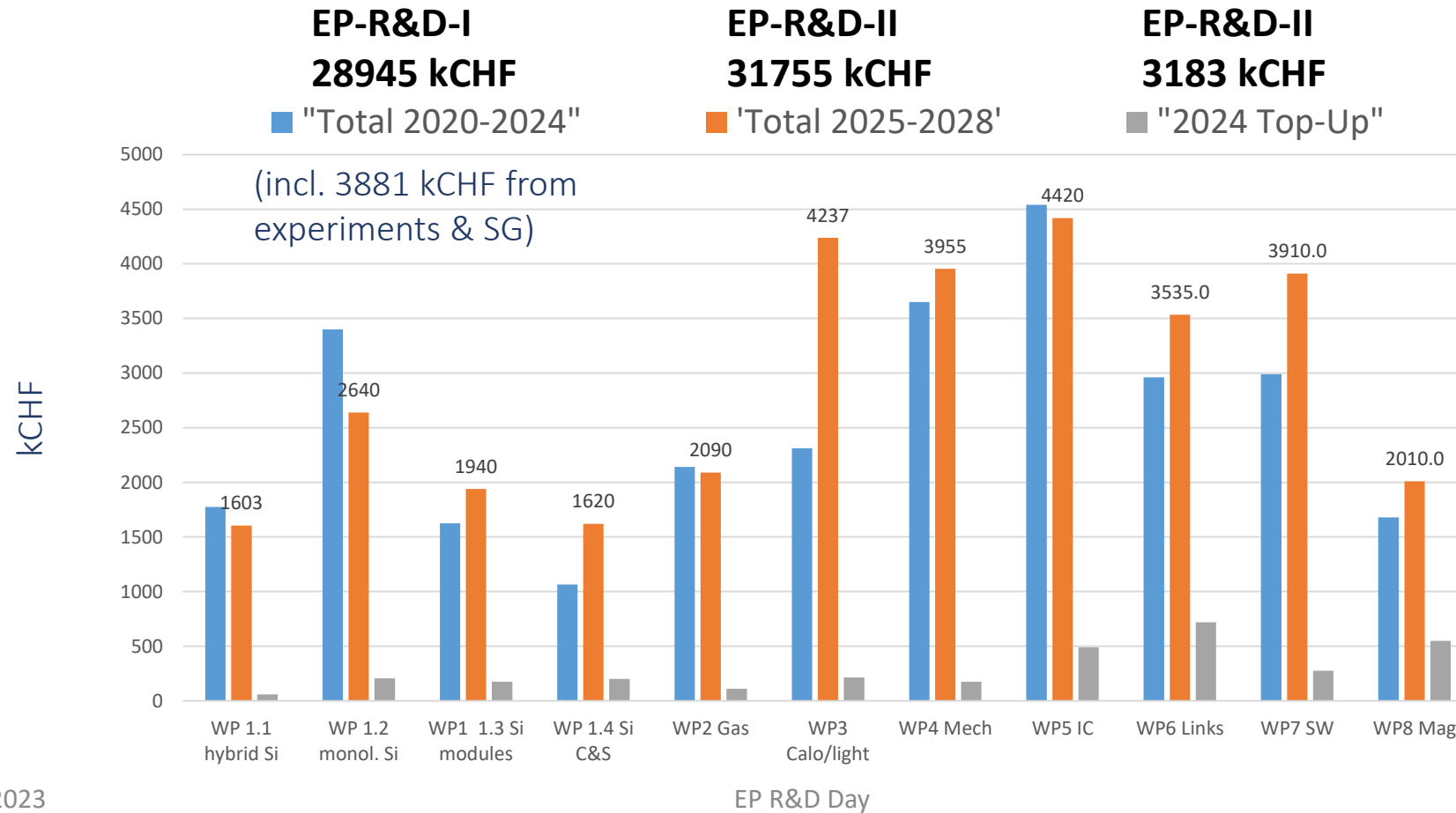
Relative shares by WP.

Fellows and Students
2025-2028.
(excl. top-up)

Higher than expected (140)

■ Fellows 2025-2028 PY   Total = 154

■ Students 2025-2028 PY   Total = 111

Current budget requests

Round 2. Time profile of total (kCHF)

Year	Value
2024 top up	3183
2025	8185
2026	9340
2027	8665
2028	5565
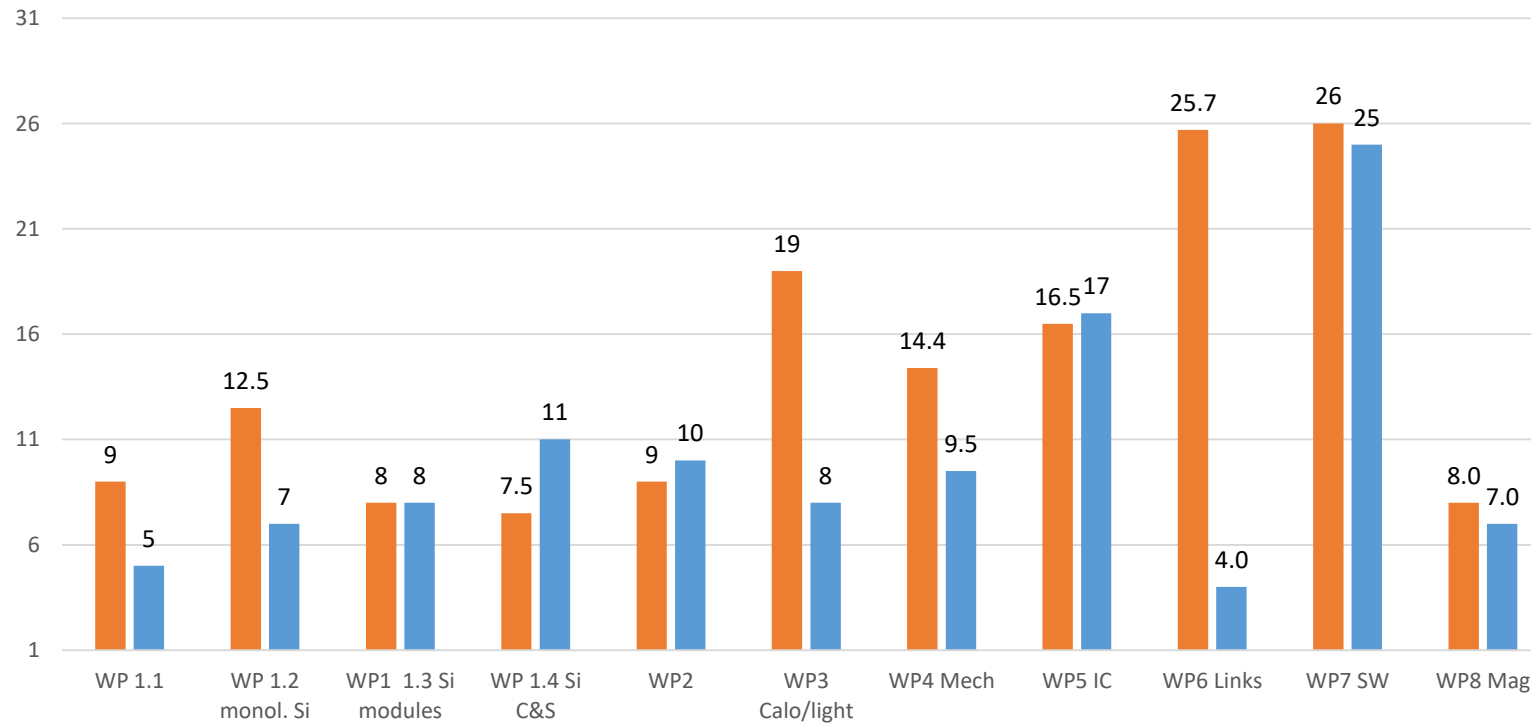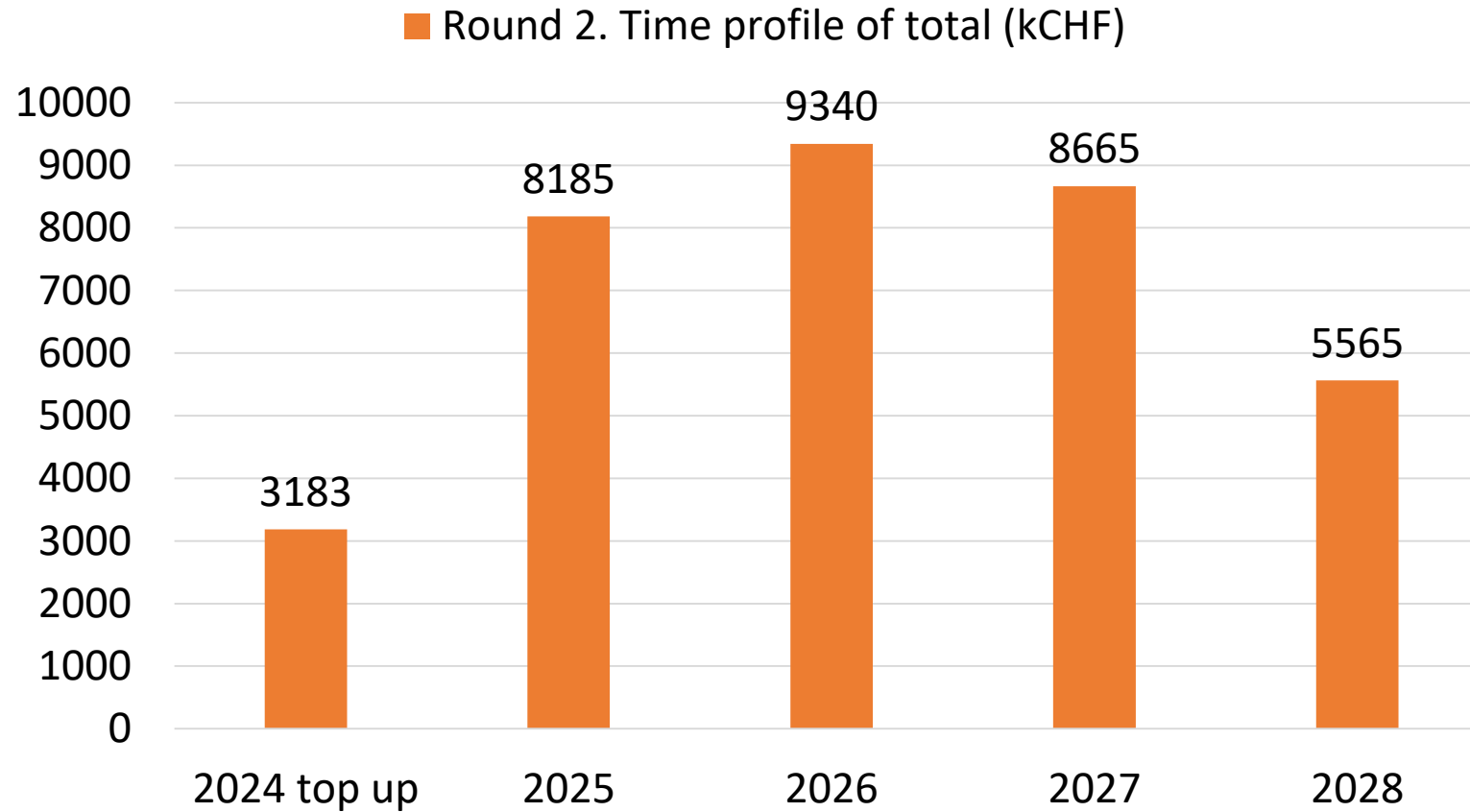
EP R&D (v1.0)
Expected financial situation at end of 2024

Under the assumption that all material, fellows and students are spent / recruited as planned, we expect to be left with a balance of about **+640* kCHF** (Veronique Nazical).

The budget of EP R&D was 28,945 KCHF and has been spent effectively.

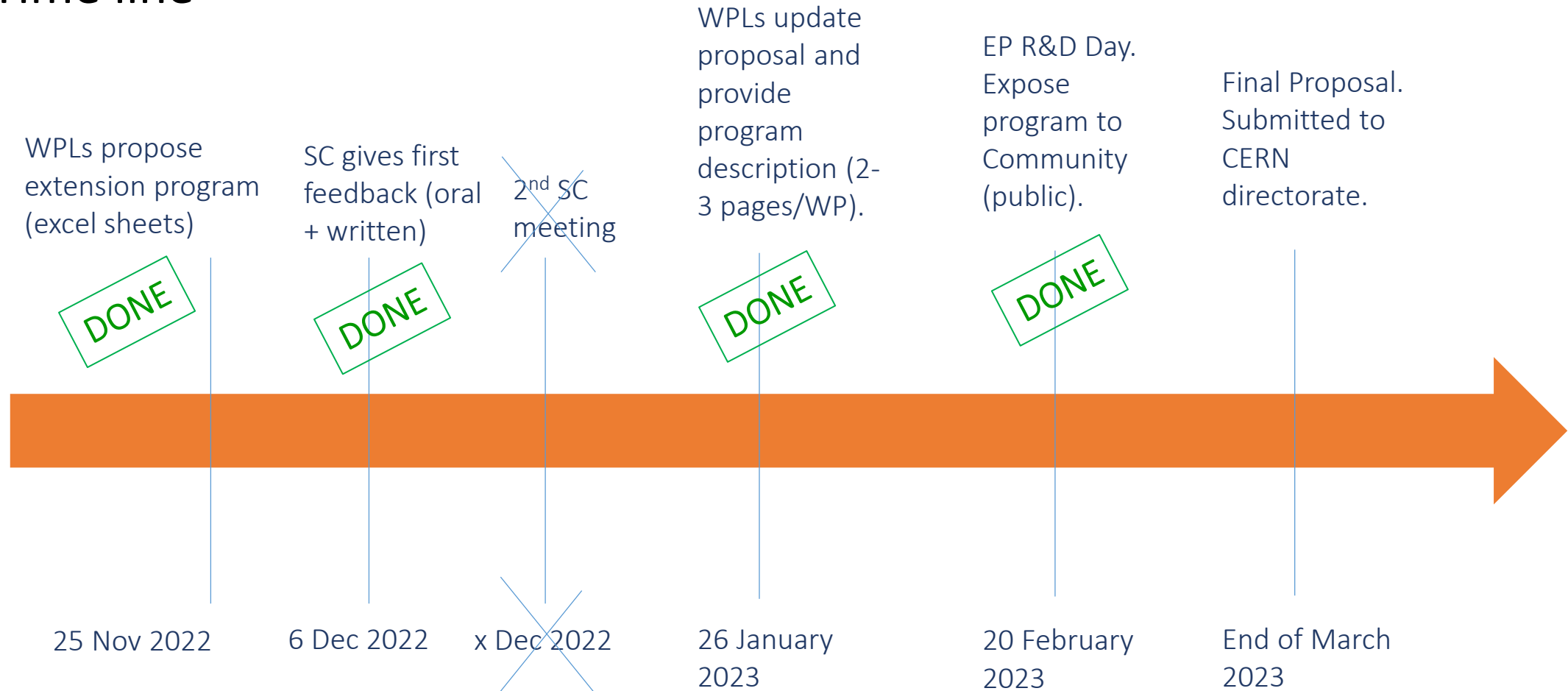We will deduct these 640 kCHF from the 2024 request for a top-up.

(*the number doesn't include the special funds for robotics R&D, 1 MCHF, 2023-2026).

Prel. conclusion:

- We have defined a coherent and convincing extension of EP R&D

- Projects in progress are continuing, new ones were added.

- Any comments, suggestions of today shall be implemented asap., particularly if they have an impact on the budget.

- Financially, the work program is not far from our (own) target

- Once the requests from all WPs will have been finalised and trimmed, the proposed programme will be discussed with the CERRN management:

- Further adjustments will be carried out as needed prior to launching EP-R&D-II.

EP R&D extension

Time line

WPLs propose extension program (excel sheets)

DONE

25 Nov 2022

SC gives first feedback (oral + written)

DONE

6 Dec 2022

2nd SC meeting

x Dec 2022

WPLs update proposal and provide program description (2-3 pages/WP).

DONE

26 January 2023

EP R&D Day. Expose program to Community (public).

DONE

20 February 2023

Final Proposal. Submitted to CERN directorate.

End of March 2023

Prel. conclusion:

- The work plan is compatible with the ECFA roadmap

- Whenever adequate, activities should be carried out under the umbrella of possible DRDs.

- We are open to collaborate with other groups, in/outside DRDs.

- Work program and finances remain under our control. There is no direct money transfer EP R&D => DRD.

Next steps (1)

- Prepare a full R&D proposal
  - Introduction
  - Requirements (update, refer to ECFA, CERN specificities)
  - 11 chapters à 5 pages
  - Budget (only in special version for directorate)

WPLs to provide their chapter.   DL: 12 March 2023

Content (guideline):
  - Major achievements in EP R&D
  - Main goals and challenges for coming 5 years
  - Work plan, Roadmap integration

Next steps (2)

- Annual report 2022
  - 11 chapters à 5 pages (a few more for WP3)

- WPLs to provide their chapter.   DL: 31 March 2023

- Content (guideline): as in previous years.
  - Major achievements (don't hide delays, unforeseen problems)
  - Contributions to conferences and publications

- When assembling the report, numbering of sections and sub-sections, references and figures gave trouble in past years. I would prefer if every chapter is fully <u>hard-numbered</u>.

- There will be a common list of authors. Don't mention them in your chapter.