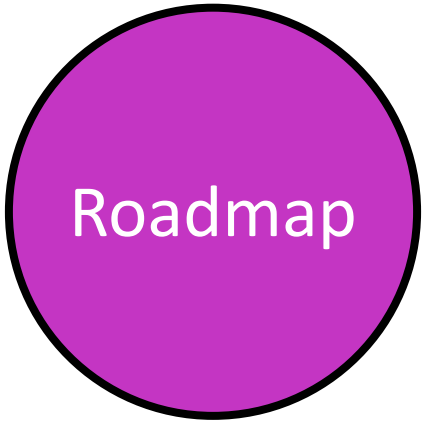
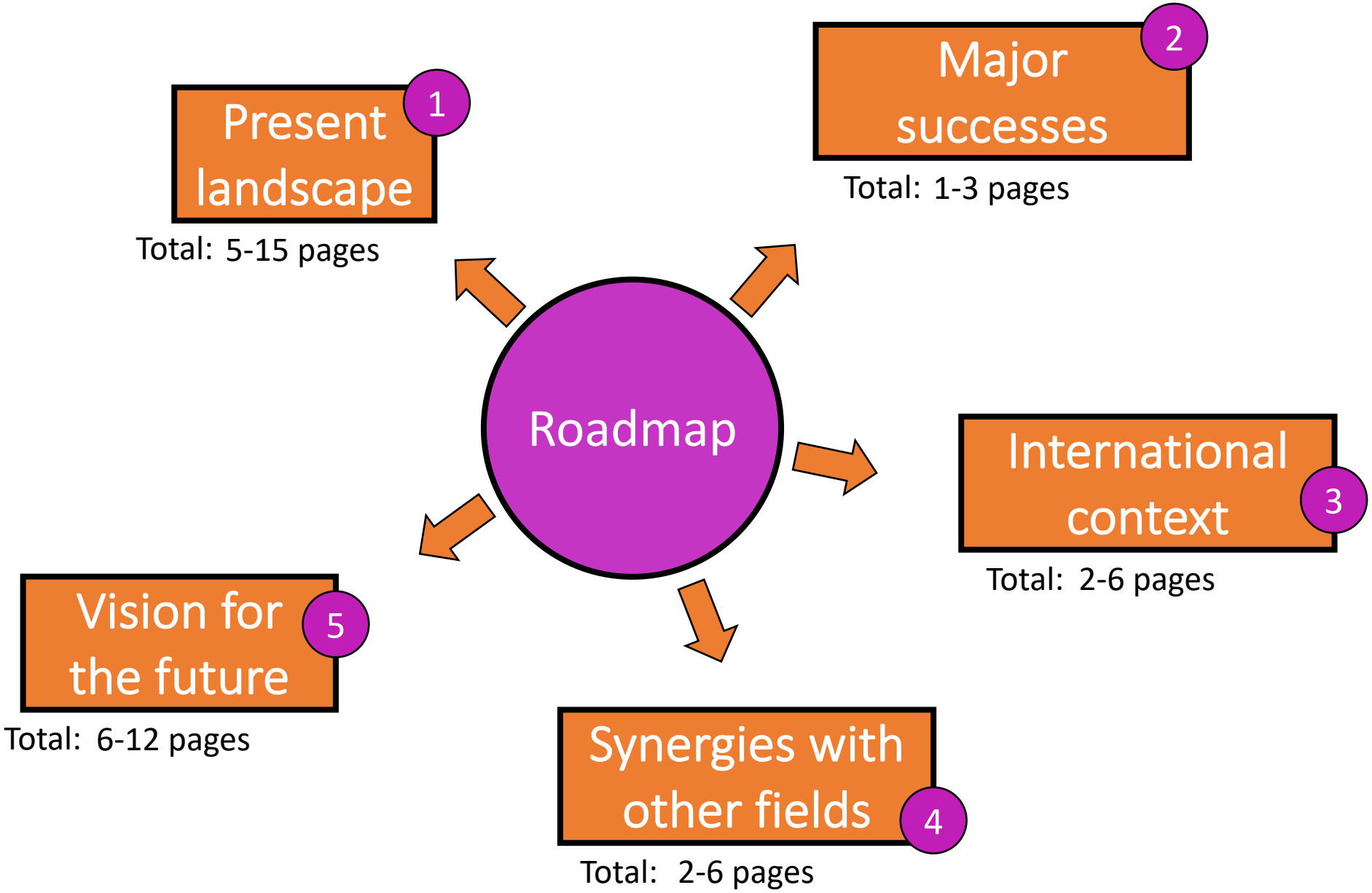
Pillar 1 contributions to SERI Roadmap

For discussion at Kandersteg Workshop

27-28 August 2020

Anna Sfyrla, UniGe


Roadmap



Based on guidelines received; listing here items related to Pillar 1 specifically

What follows?

Goal of the Pillar-1 editing sessions:

1. Discuss and agree on content at “high level”
2. Proceed to detail editorial discussion in groups
   a. Thursday: Items 1-4
   b. Friday: Item 5
3. Review what has been produced in the end

Agenda

Thu 13:45-15:15 — 1, 2a
Fri 09:15-10:45 — 1, 2b
Fri 11:15-12:15 — 3

In what follows, the contents of the document that was circulated on Monday are presented in summary to discuss point 1 from the list above.

- Hoping everyone has read the document and knows the contents in more detail than what is presented here
- Please discuss!

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Fri 09:15-10:45 1
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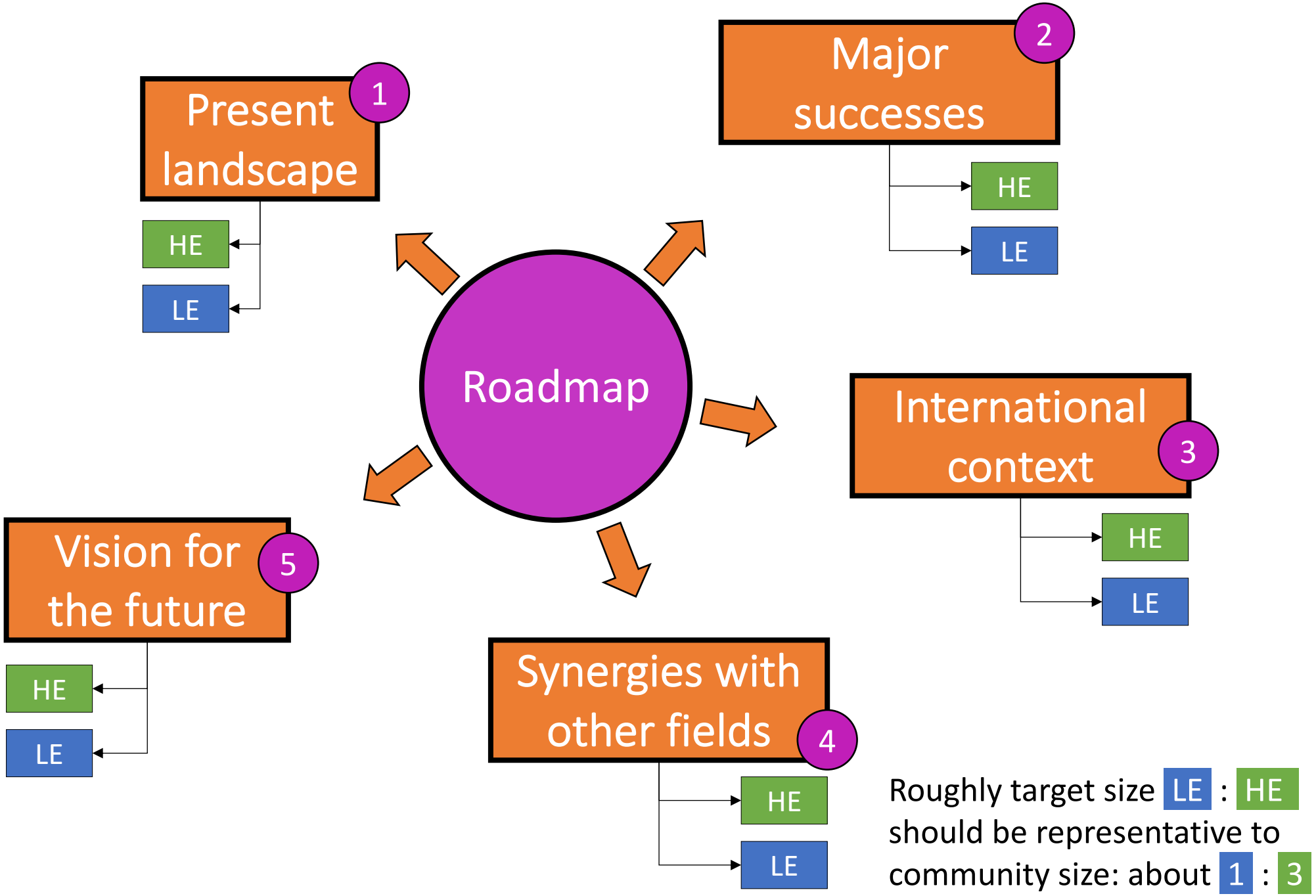
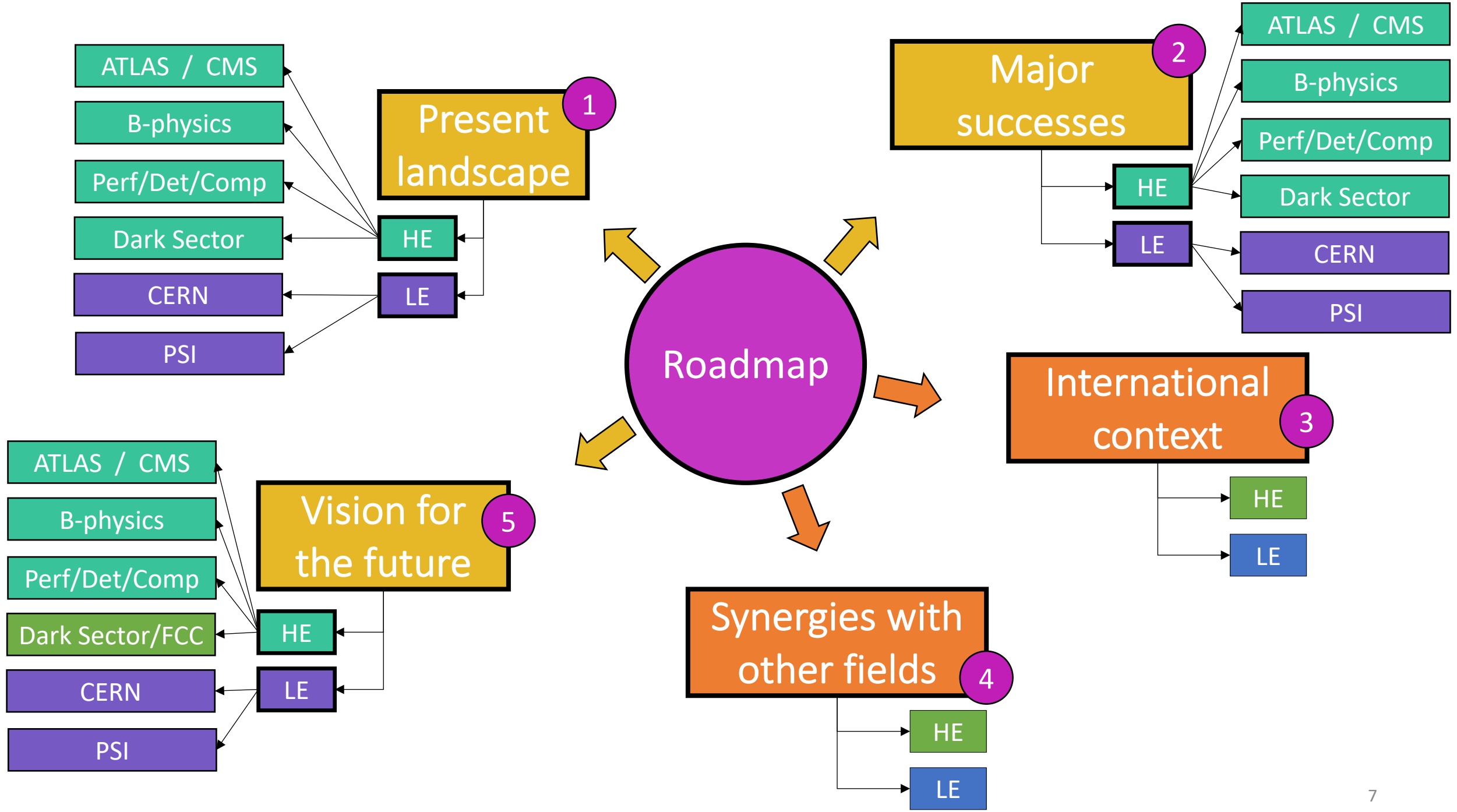
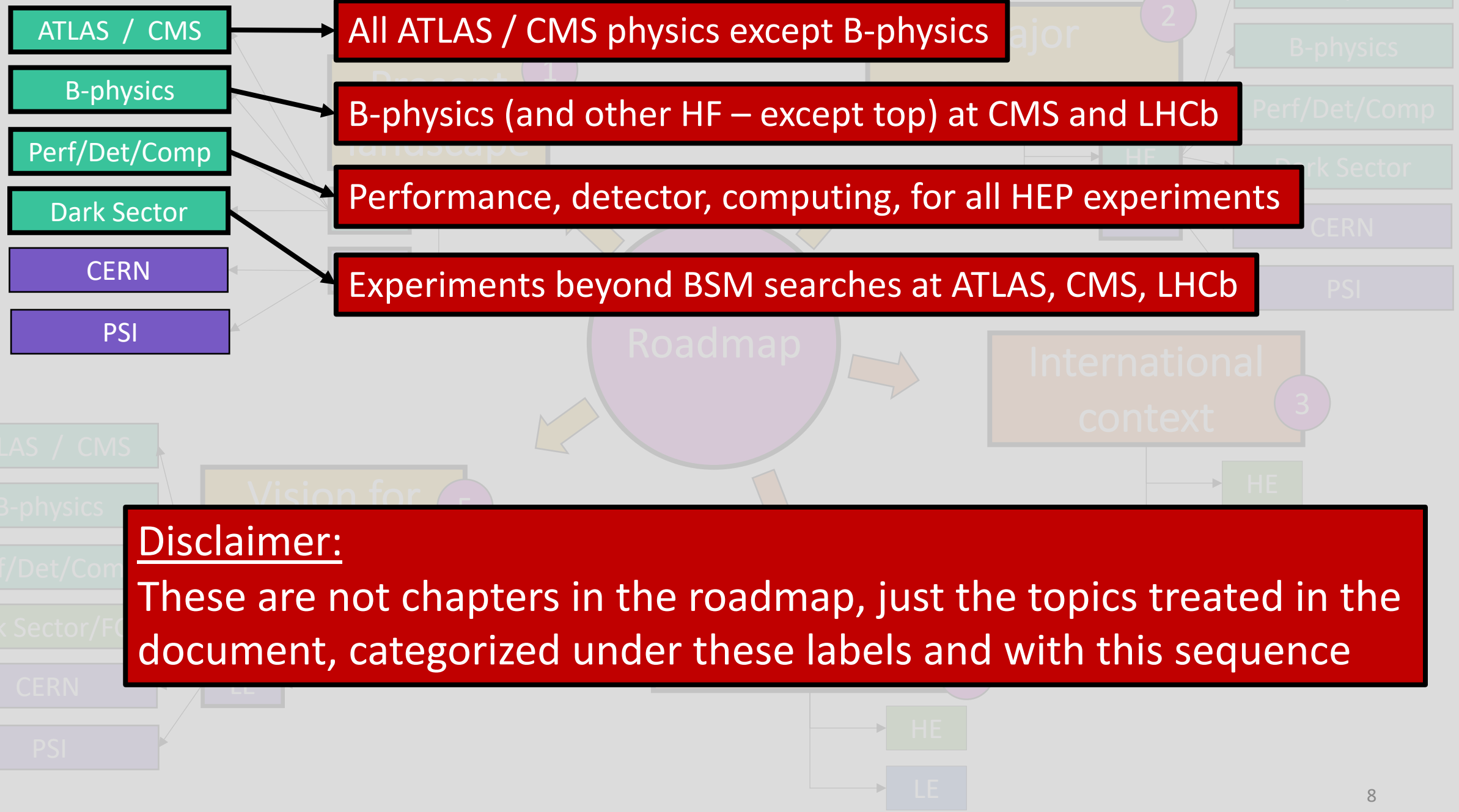


Roughly target size LE : HE
should be representative to
community size: about 1 : 3


Roadmap
Present landscape
1
ATLAS / CMS
B-physics
Perf/Det/Comp
Dark Sector
CERN
PSI
HE
LE
Major successes
2
ATLAS / CMS
B-physics
Perf/Det/Comp
Dark Sector
CERN
PSI
HE
LE
International context
3
HE
LE
Synergies with other fields
4
HE
LE
Vision for the future
5
ATLAS / CMS
B-physics
Perf/Det/Comp
Dark Sector/FCC
CERN
PSI
HE
LE


ATLAS / CMS
B-physics
Perf/Det/Comp
Dark Sector
CERN
PSI
All ATLAS / CMS physics except B-physics
B-physics (and other HF – except top) at CMS and LHCb
Performance, detector, computing, for all HEP experiments
Experiments beyond BSM searches at ATLAS, CMS, LHCb
Roadmap
International context
3
HE
LE
Disclaimer:
These are not chapters in the roadmap, just the topics treated in the document, categorized under these labels and with this sequence

General editorial actions:

1. **In any further editing, remember to keep the level to ~ outreach**
2. **Make text more concise and brief**
3. Add short introductions / summaries to all chapters
4. Where possible, merge HE and LE
5. Consider whether dark sector parts should include current LHC (ATLAS and CMS) status or whether dark-sector-related discussion is OK left together with other BSM for ATLAS and CMS
6. Make more clear the swiss contributions (as a final review step)

7. We need to point out synergies between all pillars (intro/summary)

Higgs physics
- Bits of “history”
- Discovery and its importance
- Properties and their importance for SM and BSM
- Examples of specific swiss contributions (channels)

Other SM physics
- Top primarily and its importance for SM and BSM

Direct searches
- Examples of search directions
- Examples of improvements in relation to those

B-physics
- Goals, at LHCb
- Examples of recent measurements / searches

Detector & computing
- Presentation of challenges
- Bits of “history”
- HL-LHC upgrade
- Computing status, WLCG

Dark Sector
- NA64 and FASER

ATLAS / CMS

B-physics

Perf/Det/Comp

Dark Sector

CERN

PSI

Present landscape

HE

LE

CERN
- AD / Elena

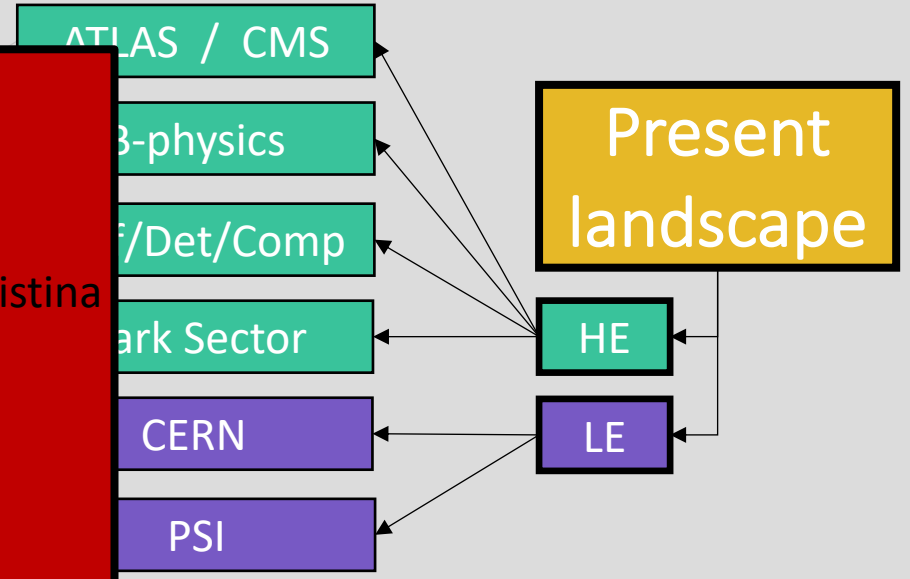
PSI
- HIPA; The emphasis of the document

Currently: LE : HE << 1 : 3

HE talks about future experiments where significant work has started, should probably do so for LE too (possibly also HiMB?).

Primary actions:

1. Reduce (significantly) detail in Higgs Ben
2. Add concrete summary of results of searches Cristina
3. Add motivation to recent B-physics excitement (flavor anomalies and pentaquarks) Olivier
4. Add efforts on B-physics from CMS Olivier
5. Balance NA64/FASER and introduce back SHiP at high level, i.e. as enabler of dark sector program (e.g. PBC at CERN) with important swiss contributions Anna - Nico



Elena

; The emphasis of the document

Currently: LE : HE << 1 : 3

HE talks about future experiments where significant work has started, should probably do so for LE too (possibly also HiMB?).

- Bits of "history"
- HL-LHC upgrade
- Computing status, WLCG

Dark Sector

- NA64 and FASER

(2017-2020)

Major successes

- HE
- LE

- ATLAS / CMS
- B-physics
- Perf/Det/Comp
- Dark Sector
- CERN
- PSI

Higgs physics
- H->γγ, ττ, bb; ttH
- Connection to BSM via detailed measurements

Other SM physics
- Top: 4-top, tt+jets

Direct searches
- SUSY and dark-matter searches

B-physics
- Reference to B_s->μμ

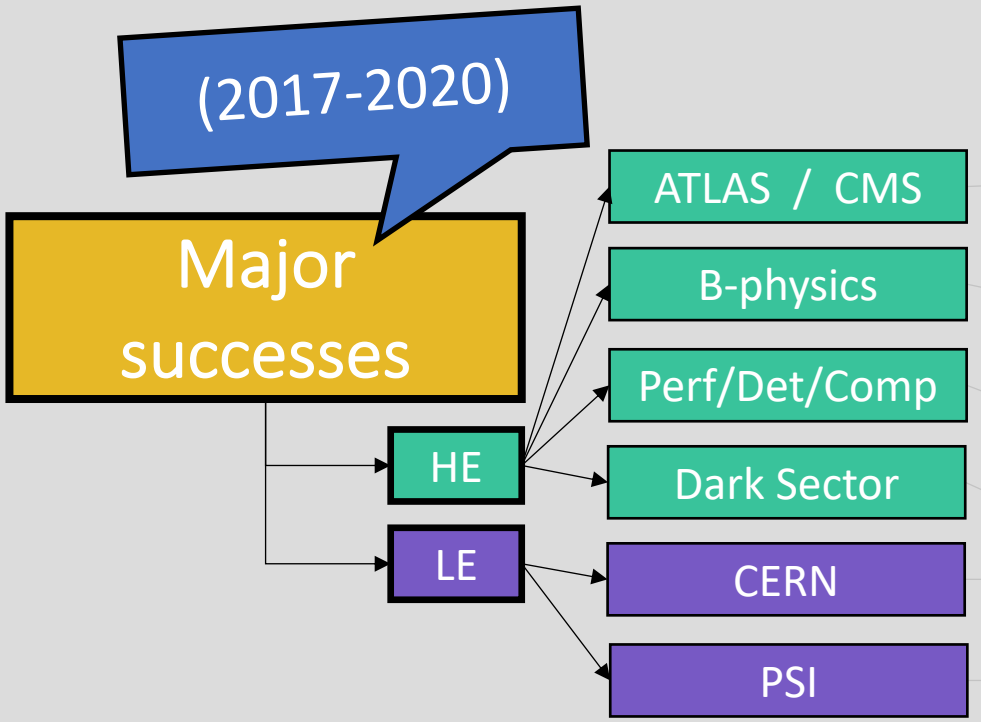
Detector & computing
- Detector performance
- Progress in upgrade
- Computing infrastructure

Dark Sector
- NA64 results
- FASER approval

CERN
- Should GBAR be mentioned here?
- Anything else?

PSI
- Results reported for nEDM, MEG, CREMA, Mu-MASS, muX
- HiMB introduction and muCool

Currently: LE : HE = 1 : 2



Primary actions:

1. Reduce Higgs Ben
2. Enhance B-physics, also adding CMS contributions now limited to BSM B-physics (if needed!) Lesya
3. Add something on GBAR milestone Paolo
4. Add something on MICE, maybe linked to results from muCool (think how) Alain

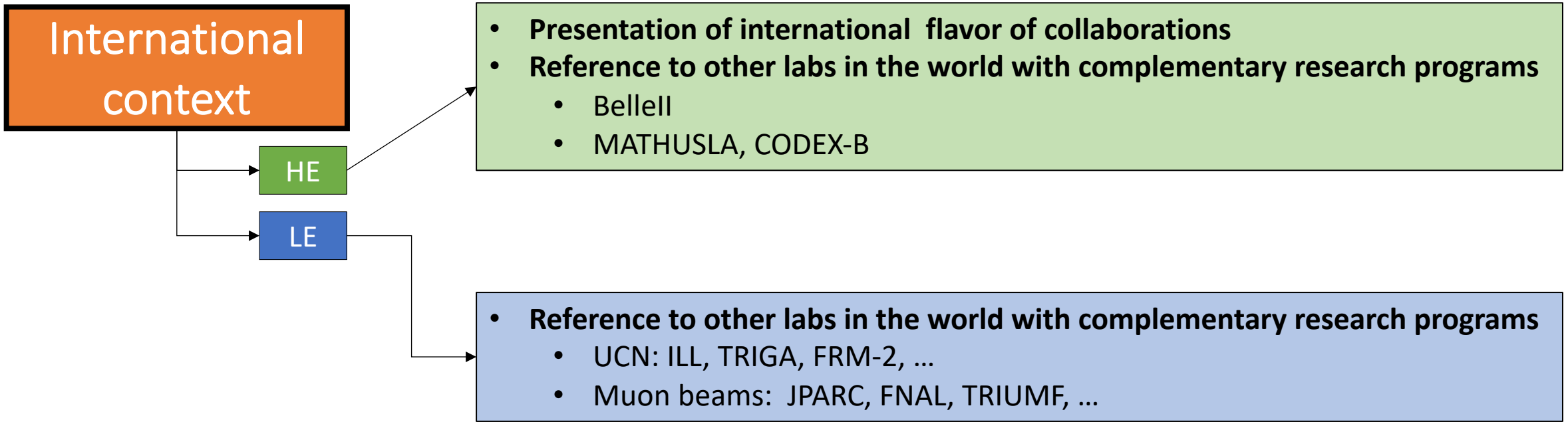
- Computing infrastructure

CERN
- Should GBAR be mentioned here?
- Anything else?

Dark Sector
- NA64 results
- FASER approval

PSI
- Results reported for nEDM, MEG, CREMA, Mu-MASS, muX
- HiMB introduction and muCool

Currently: LE : HE = 1 : 2



Currently: LE : HE = 1 : 1

Synergies with other fields

HE

LE

- **Higgs physics**
  - detector technology, methodology, theory (solid state, cosmology)
- **Data analysis (machine learning) and modern engineering**
- **Detector development**
  - Material science and engineering
  - Medical imaging
- **Computing, networks**

- **Technology transfer**
  - Use of technology and know how to other applications
- **Particles as probes**
  - Material science, chemistry, medical physics, …
- **Transfer of technology from other fields**

- **Examples given for each of the three categories**

Currently: LE : HE = 1 : 1

Synergies with other fields

- HE
- LE

Primary actions:

1. Merge HE and LE, removing specific connections to Higgs. Use categories introduced at LE and use examples in a way that makes the case strongest (per category). No need to keep LE:HE ratios here. Do this merging globally for all pillars, when each indidivual contribution is mature enough. Annapaola

- Use of technology and know how to other applications
- **Particles as probes**
  - Material science, chemistry, medical physics, …
- **Transfer of technology from other fields**
- **Examples given for each of the three categories**

Currently: LE : HE = 1 : 1

Higgs physics
- Emphasis to HH and H->fermions. Also BSM, e.g. H->μτ

Indirect searches
- Top and EFTs in connection to BSM

Direct searches
- Examples of search directions

Detector upgrade in connection to physics goals
- Examples of timing detector and tracking at trigger

Performance improvements
- Trigger, reco, simulation
- Mention of machine learning as a tool

B-physics
- A potential HL-LHC upgrade introduced and motivated

Detector & computing
- Focus: commissioning, operation and RnD for beyond
- Potential HL-LHC Run5 upgrades
- Heterogeneous computing, ML and HSF

Probing particle physics further
- NA64 upgrade, FASER2
- FCC

ATLAS / CMS

B-physics

Perf/Det/Comp

Dark Sector/FCC

CERN

PSI

Vision for the future

HE

LE

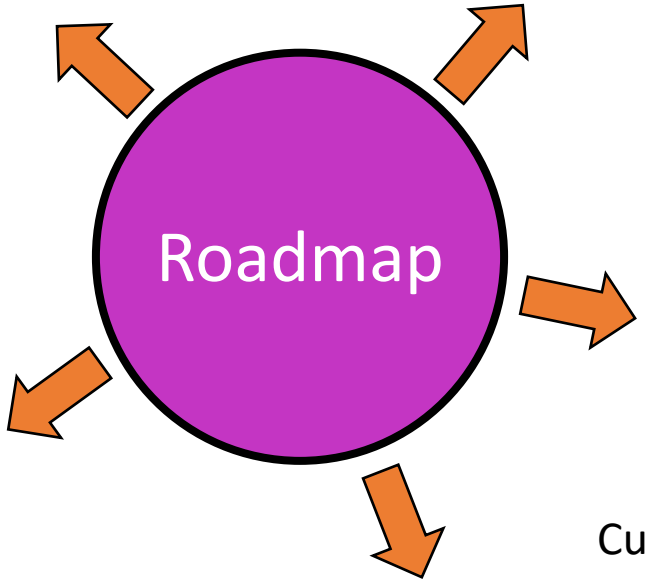
CERN
- AD / Elena
- GBAR

PSI
- UCN
- HiMB: most important facility project
  - MEGII and mu3e

Currently: LE : HE = 1 : 3

Primary actions:

1. Add an extended introduction / global vision that outlines the complementarity of all machines (HL-LHC, FCC and at PSI, primarily HiMB). Add a timeline for facilities/projects. Think if SHiP is to be included here. Gino/Klaus
2. Condense Higgs (e.g. remove details in channels) and add FCC prospect. Mention importance of top Yukawa measurement beyond HH. Complementarity of machines Ben
3. Strengthen EFTs (beyond just top) Florencia
4. Reduce detail in how detector connects to physics, possibly merging with other performance-related text Anna
5. Add b-physics program in Run4 for CMS and LHCb Lesya
6. Review Run5 prospects for LHCb Olivier
7. Give the importance/prospect of a SHiP-like experiment Nico
8. Add FCC detector RnD prospects and challenges Alain
9. Add CERN BASE experiment in the LE part Anna (LE)



1 Present landscape

Total: 5-15 pages

Current Pillar1: 5.5 pages

2 Major successes

Total: 1-3 pages

3 pages

3 International context

Total: 2-6 pages

Current Pillar1: 1 pages

4 Synergies with other fields

Total: 2-6 pages

Current Pillar1: 2 pages

5 Vision for the future

Total: 6-12 pages

Current Pillar1: 4 pages


Roadmap