National funding structure and plans for future collider R&D

Mara Senghi Soares - 13/Oct/2024 - Future colliders for early-career researchers

The makings of a large experiment

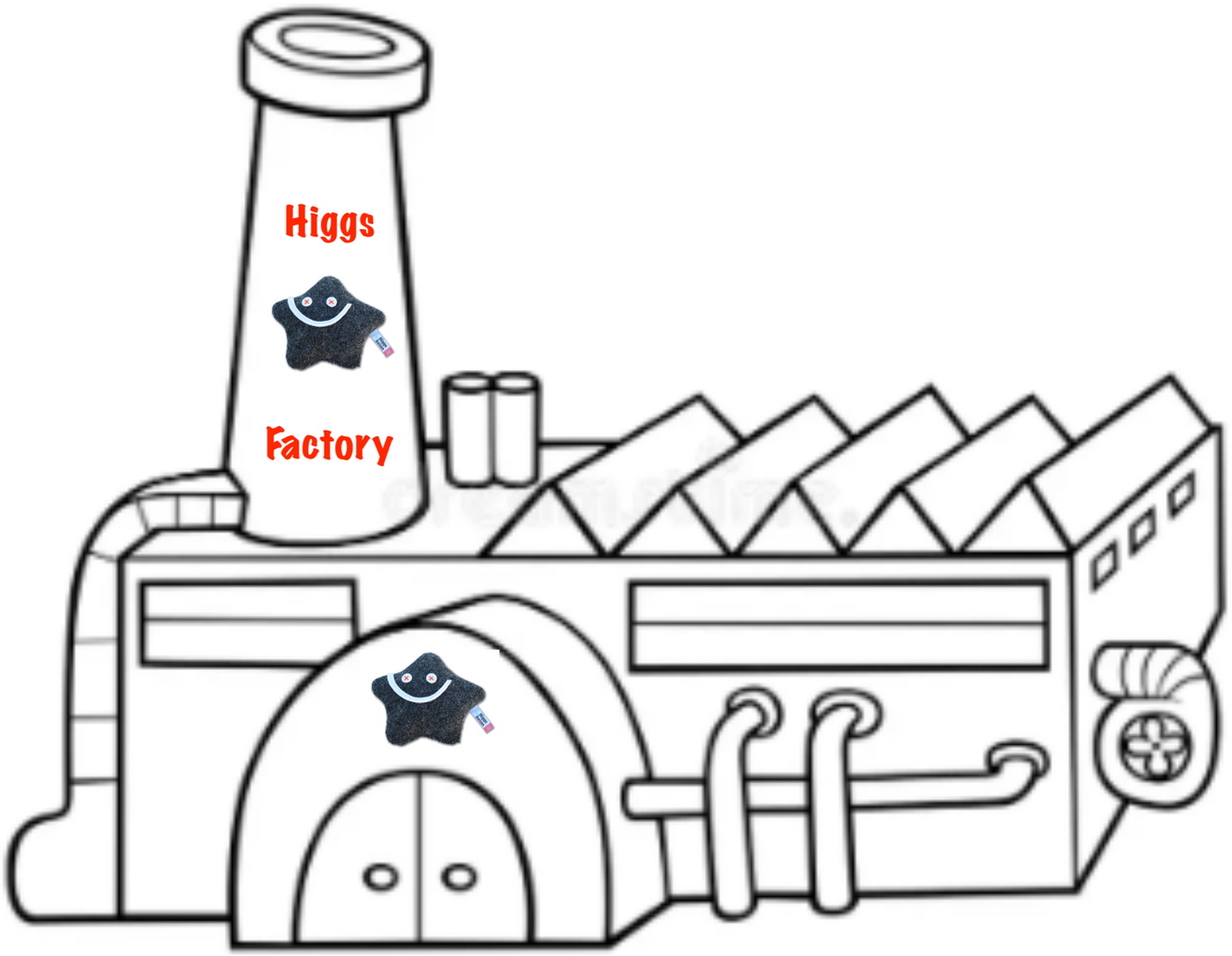
you know it already but…

Conceiving a HEP project

Everything starts with a scientific challenge

Conceiving a HEP project

Everything starts with a scientific challenge



Good idea

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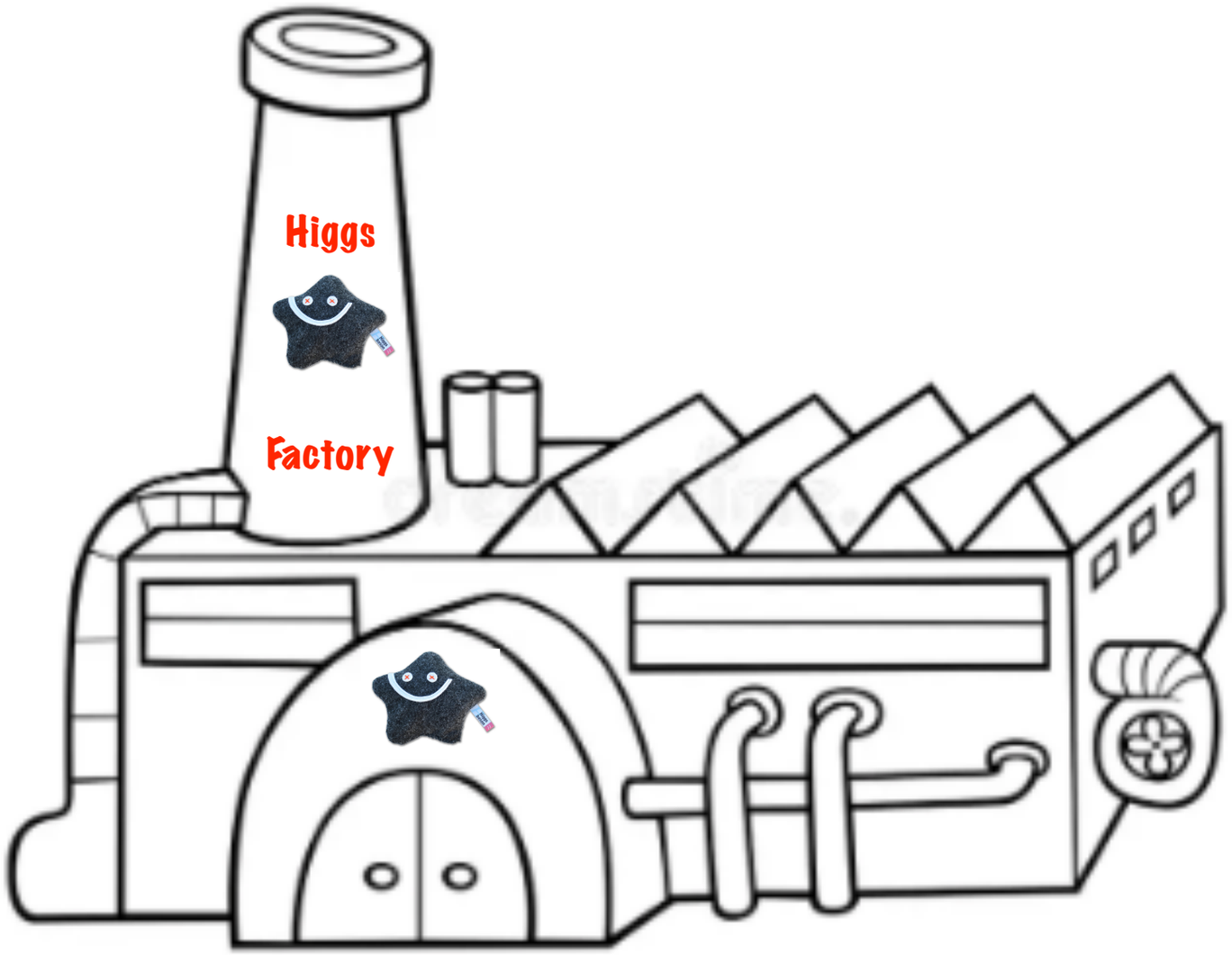
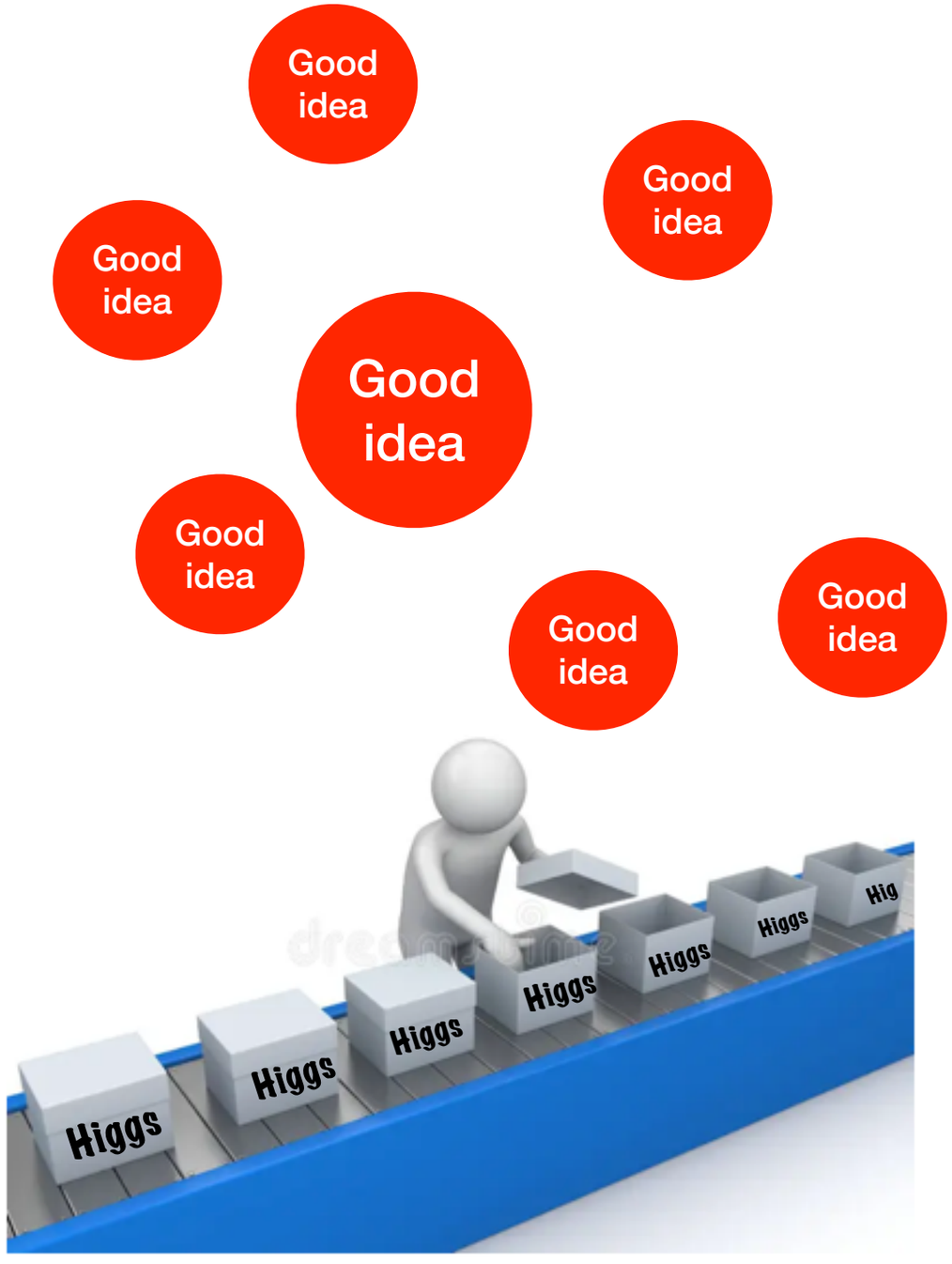
Conceiving a HEP project

Everything starts with a scientific challenge





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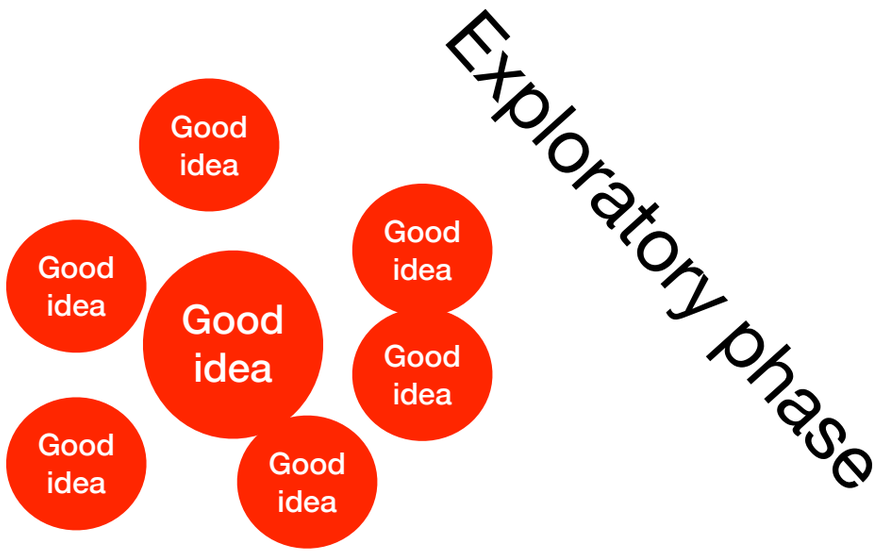

People: scientists
Modest resources

Feasibility studies, simulations, (prototypes?)…

Host country candidate
Enormous resources

Involves high instances of governments: site infrastructure, geopolitics, geological studies …

Conceiving a HEP project

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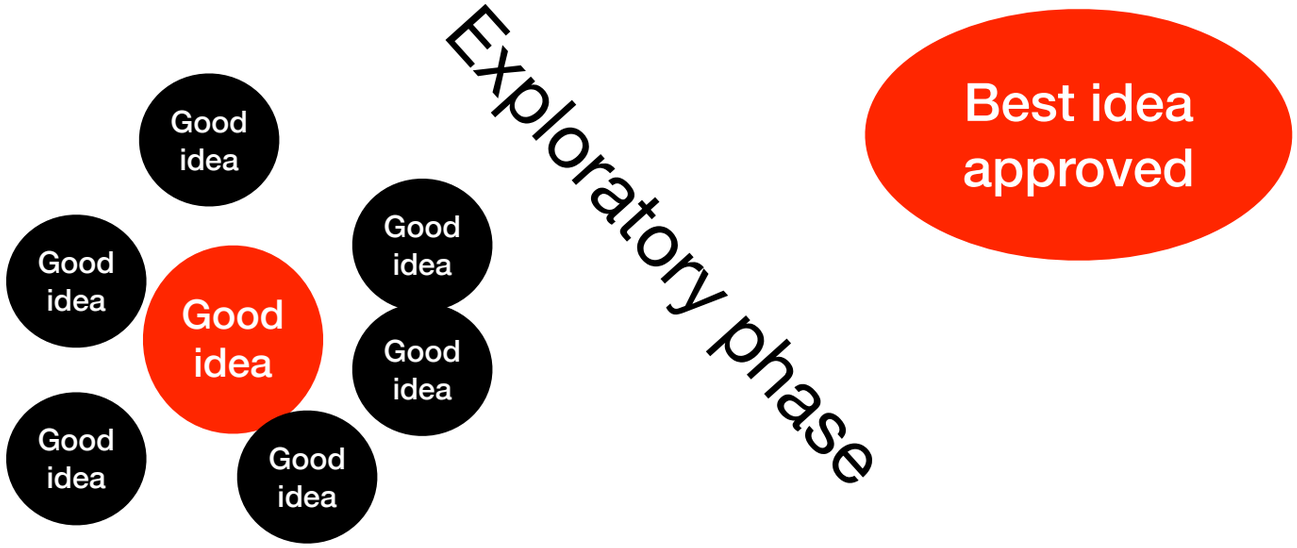

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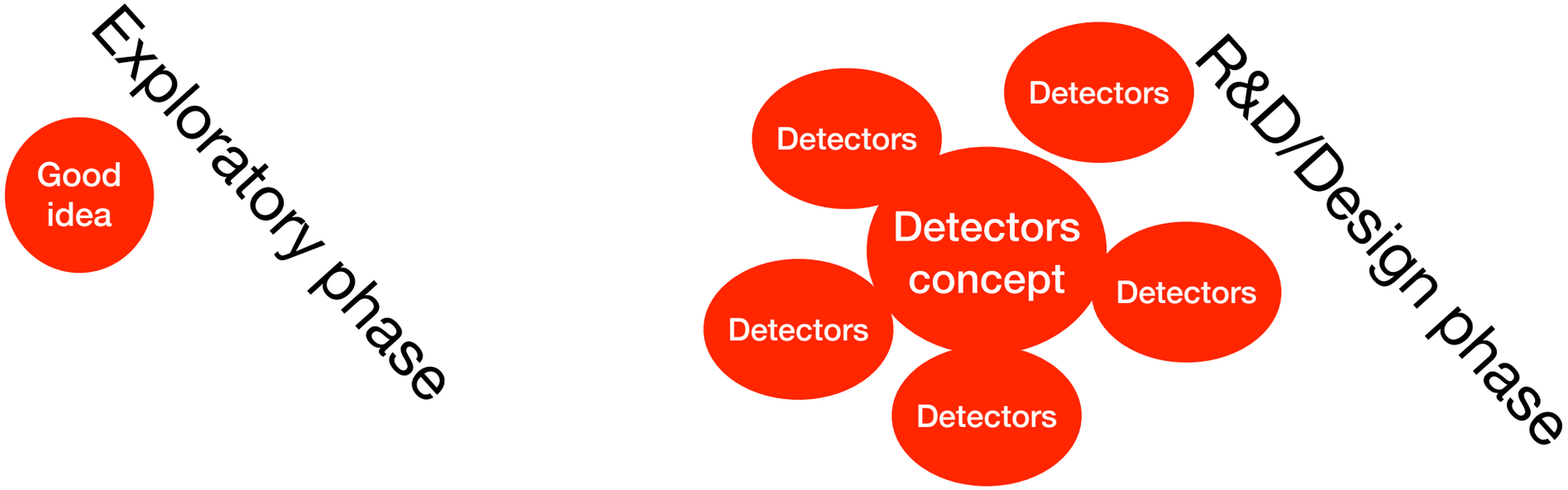

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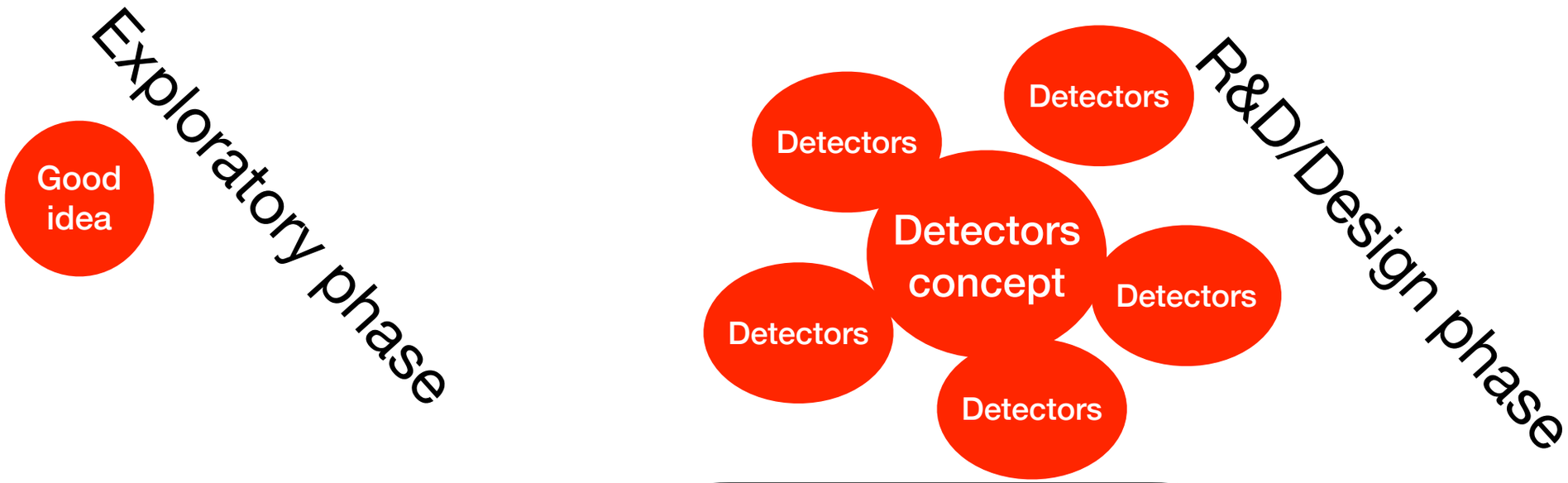

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People: scientists, technical staff

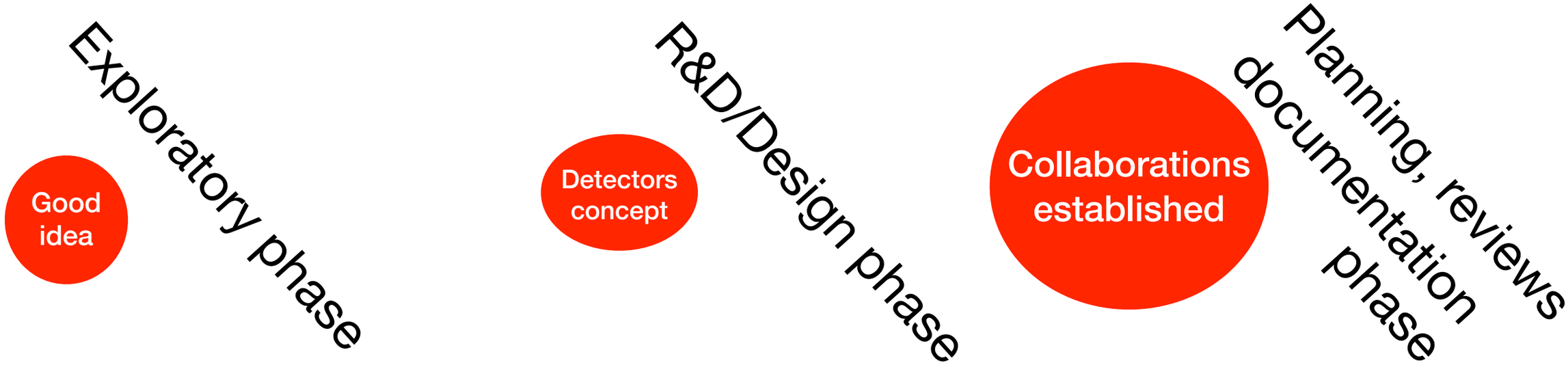
Simulations, engineering, professional design, prototypes…

Research groups
Sizeable resources

…expertise, new technologies, scientific interests…

Conceiving a HEP project

Ideas take shape: concept becomes a project



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…expertise, new technologies, scientific interests…

Commitment!!

Resources at all levels (countries, labs, groups, individuals) must be granted

The real is about to start

Conceiving a HEP project

Collaborations!

Letter of Intent

Commitment!!

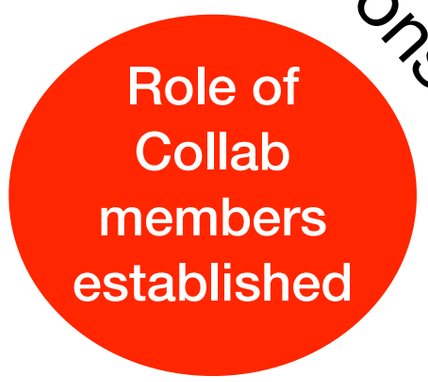
Memorandum of Understanding

Agreements

Conceiving a HEP project

Collaborations!

Planning, reviews documentation phase



More planning, more reviews… construction phase

Letter of Intent

Commitment!!

Technical Design Reviews

Memorandum of Understanding

Agreements

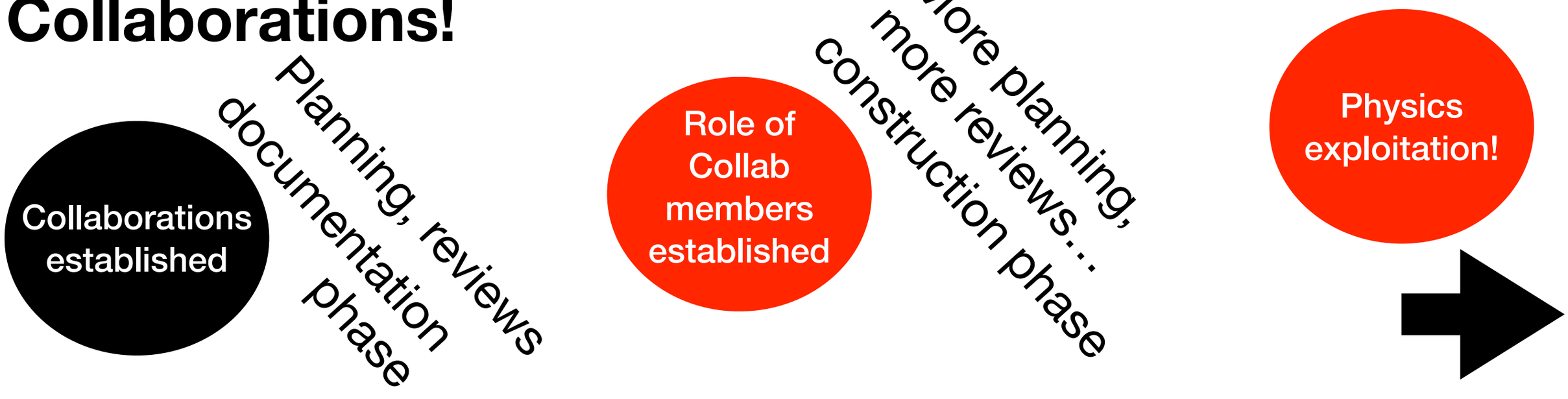
Final choice of detector concepts

to a large extent driven by proponents resources financial & technical

From words to action: resources need to be available

Conceiving a HEP project

Collaborations!



Letter of Intent

Commitment!!

Technical Design Reviews

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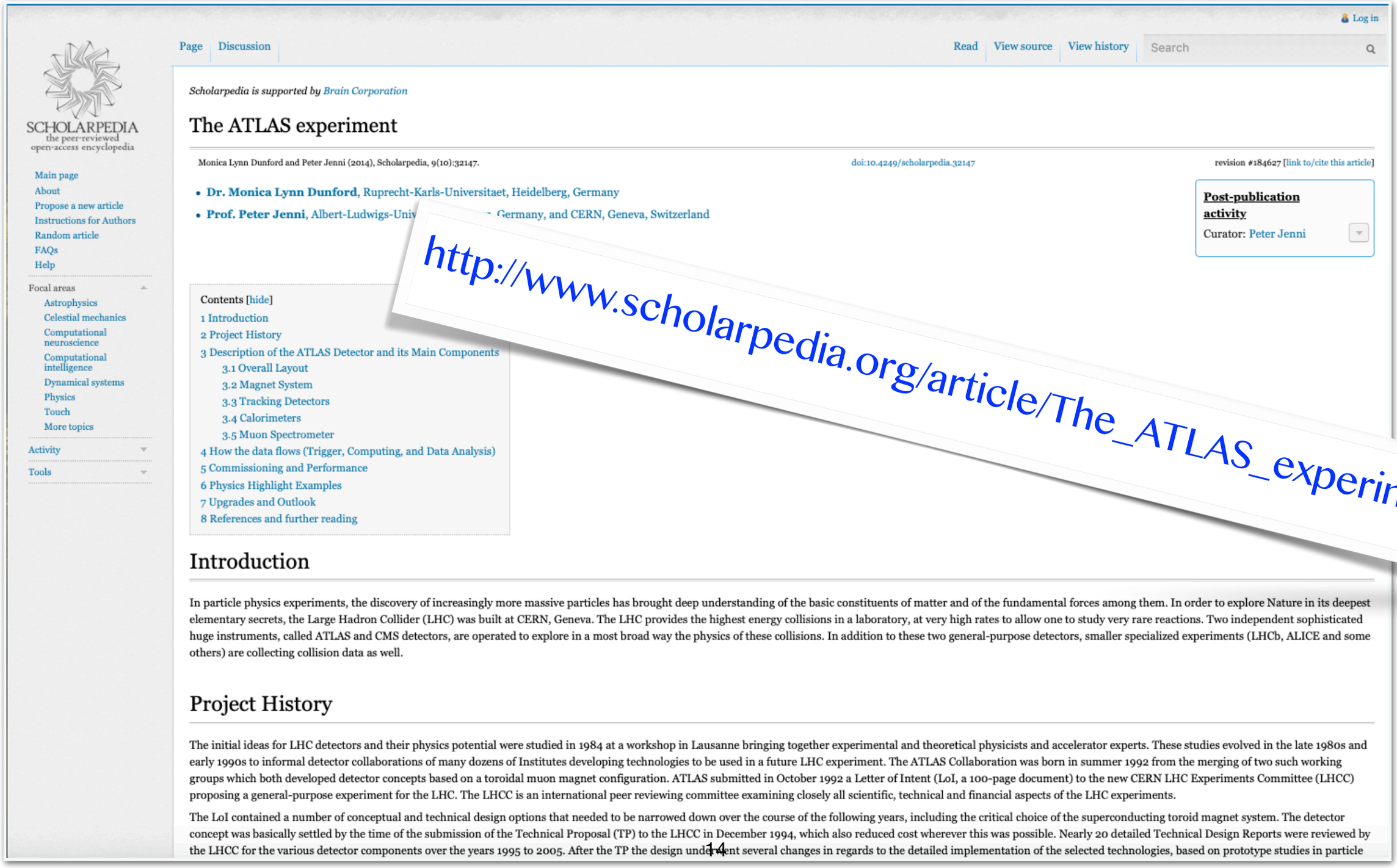
Next: story of ATLAS Collaboration

Conceiving a HEP project

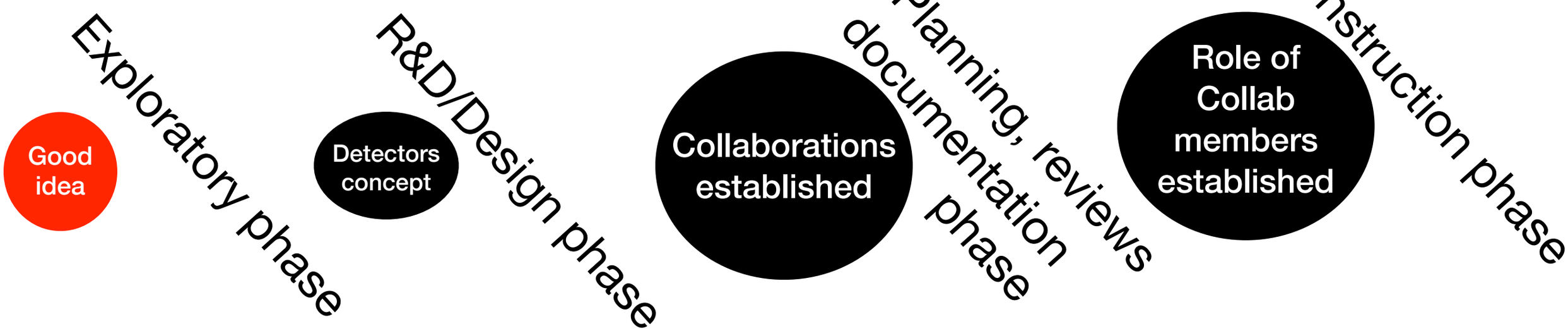
ATLAS Collaboration



http://www.scholarpedia.org/article/The_ATLAS_experiment

Conceiving a HEP project

Collaborations!



> “**The initial ideas** for LHC detectors and their physics potential were studied in 1984 at a workshop in Lausanne bringing together experimental and theoretical physicists and accelerator experts.
>
> In particle physics experiments, the discovery of increasingly more massive particles has brought deep understanding of the basic constituents of matter and of the fundamental forces among them. In order to explore Nature in its deepest elementary secrets, the Large Hadron Collider (LHC) was built at CERN, Geneva.”

http://www.scholarpedia.org/article/The_ATLAS_experiment

Conceiving a HEP project

Collaborations!

“The ATLAS Collaboration was born in summer 1992 from the merging of two (…) working groups which both developed detector concepts based on a toroidal muon magnet configuration. ATLAS submitted in October 1992 a Letter of Intent to the new CERN LHC Experiments Committee (LHCC) proposing a general-purpose experiment for the LHC.”

http://www.scholarpedia.org/article/The_ATLAS_experiment

Conceiving a HEP project

Collaborations!

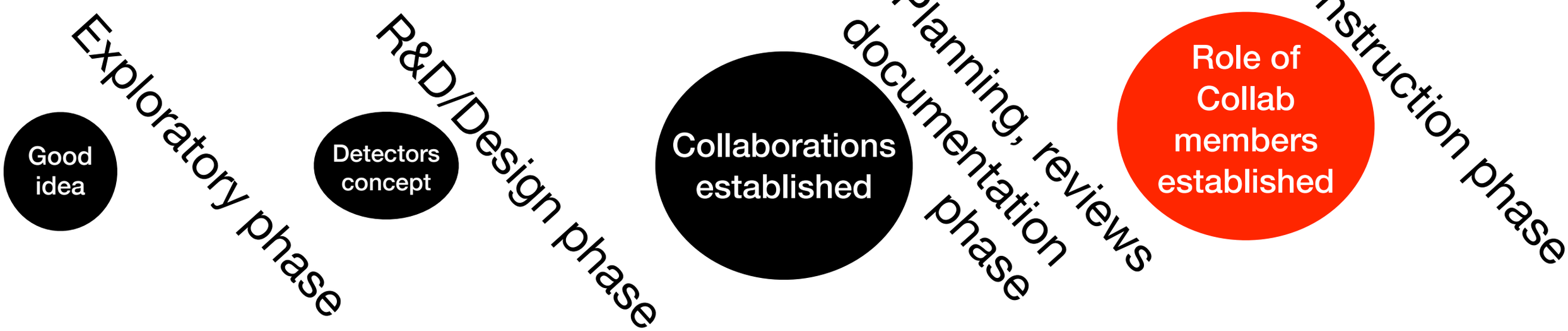
“The LoI contained a number of conceptual and technical design options that needed to be narrowed down over the course of the following years, including the critical choice of the superconducting toroid magnet system.

The detector concept was basically settled by the time of the submission of the Technical Proposal (TP) to the LHCC in December 1994, which also reduced cost wherever this was possible.”

http://www.scholarpedia.org/article/The_ATLAS_experiment

Conceiving a HEP project

Collaborations!



“The project was formally approved in January 1996, and the budget for the full construction was established with an expenditure ceiling set at 475 MCHF …

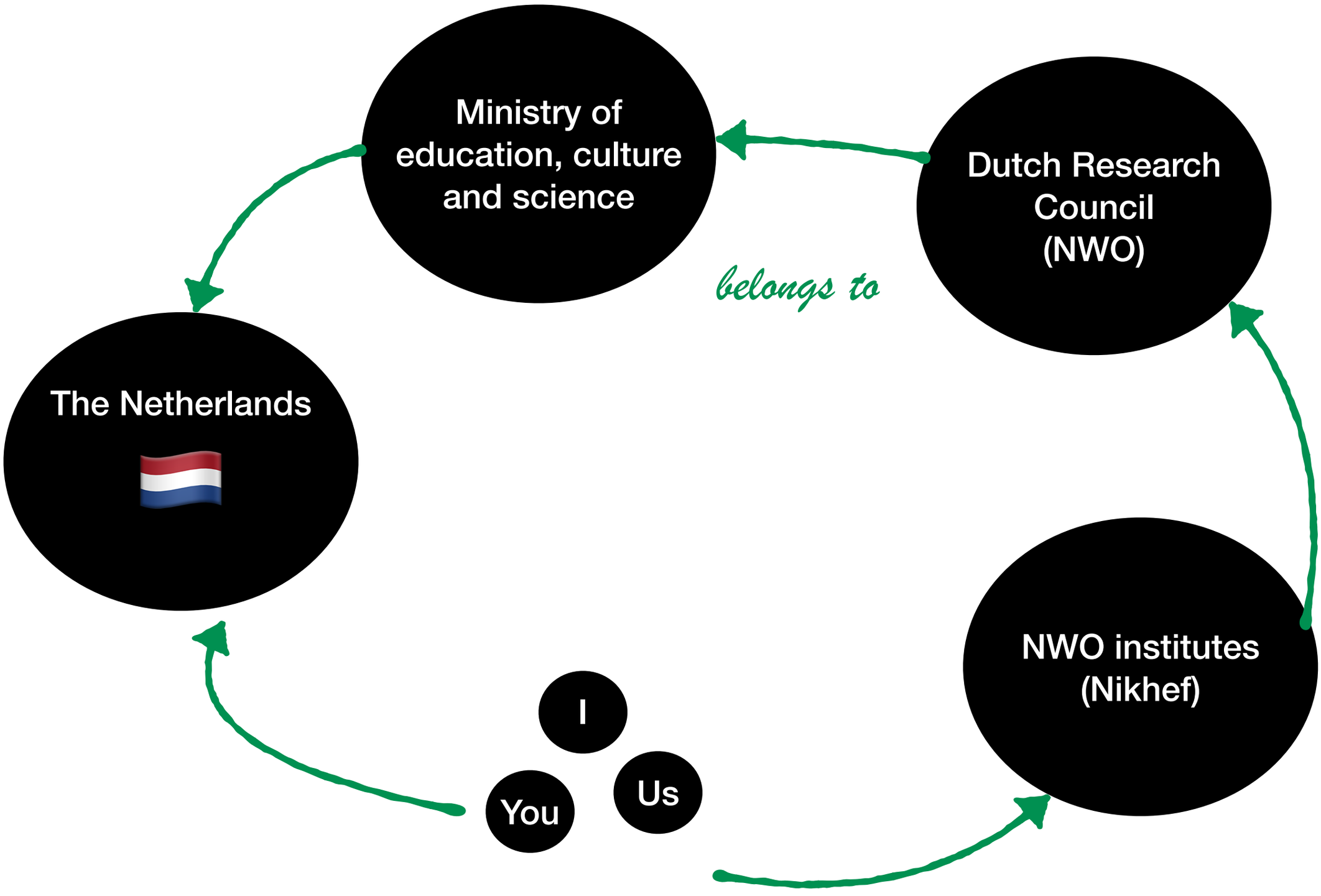
Only a small fraction of the funding, shared among all partners of the project, was centrally available.

Detector components were built all over the world in the collaboration Institutes and local industries, under their responsibility, and then delivered to CERN as ‘in-kind’ contributions to the ATLAS detector.”

Structural organisation of science & funding possibilities in the Netherlands

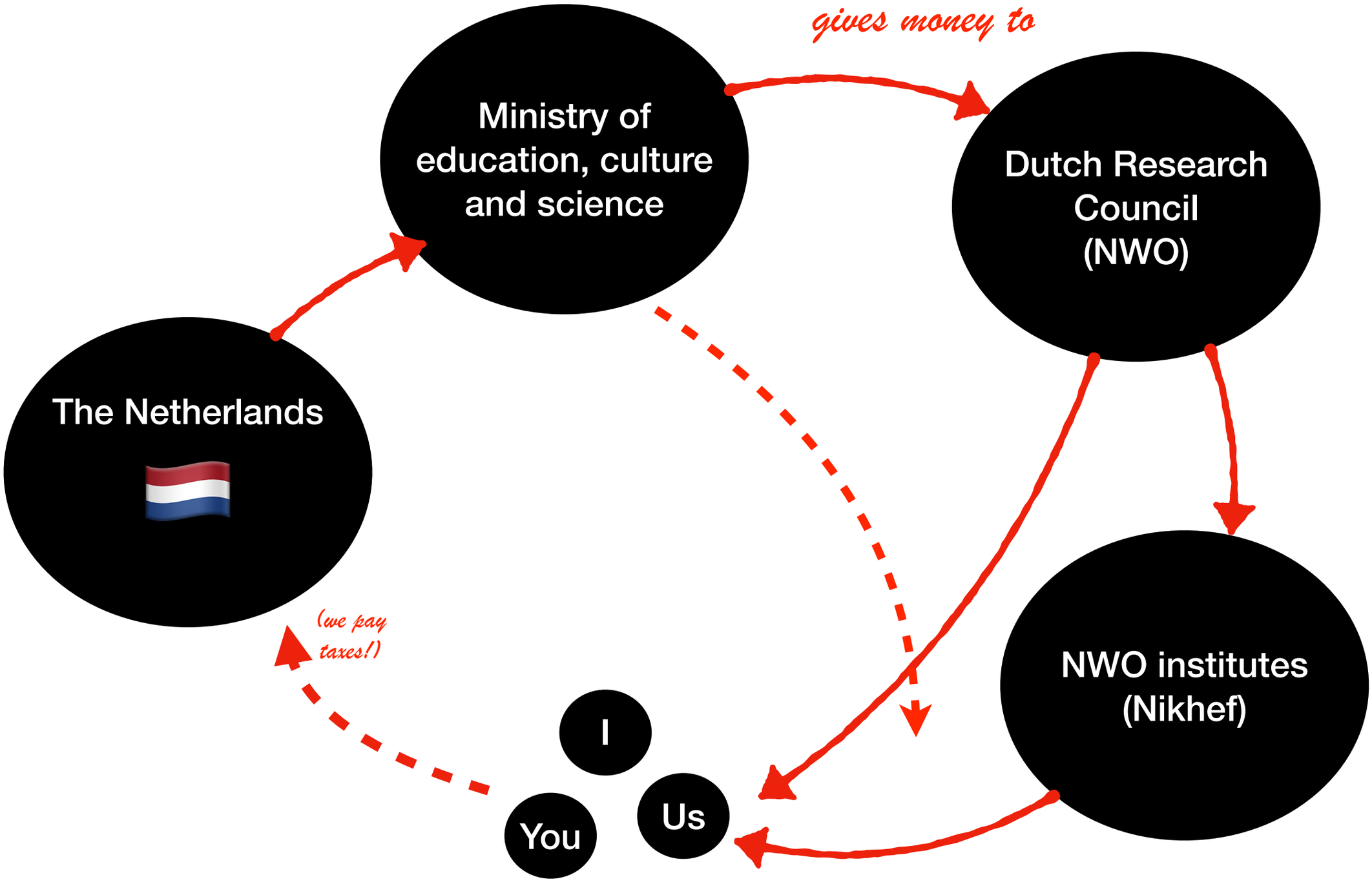
Science in the Netherlands

Structure in a nutshell



Science in the Netherlands

Structure in a nutshell



Science in the Netherlands

I - Ministry of education, culture and science

Not too relevant for us, FCC not in NL

Science in the Netherlands

II - Dutch Research Council NWO

(Nederlandse Organisatie voor Wetenshappelijk Onderzook)

Funding lines

Talent Programme

Veni:

own salary (postdoc)

Vidi/Vici (tenure track/ tenured):

small research group

Open Competition

small scale (M):

PhD/postdoc (max 2)

once a year

larger scale (XL):

PhD/postdoc (~10)

some material

every two years

mostly suitable for physics exploitation and modest hardware projects

Infrastructure

Digital research and data infrastructure (e.g. Computing time on National Computing Facilities)

Scientific Infrastructures, small or large-scale
Linked to the National scientific strategy

Infrastructure of interest: particle detectors

Calls typically ~2 years
"permission" (and need) applications ~10 years

'the' grant category to build a HEP experiment!

also (applied sciences):
Collaboration with knowledge users and society
Practice-oriented research

External funding possibilities

European-equivalent grants

- ERC ⇔ Talent programme (tenure track/tenured)

- Synergy grant ⇔ Open competition

https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-search

- Marie Skłodowska-Curie ⇔ Talent programme (postdoc)

https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/marie-sklodowska-curie-actions_en

- European Research Infrastructure ⇔ Infrastructure

https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/research-infrastructures_en

https://www.nwo.nl/en/governance-and-organisation

Science in the Netherlands

III - NWO-I, Institutes Organisation of NWO (nine)

- AMOLF , Physics of functional complex matter
- ARCNL , Advanced Research Center for Nanolithography
- ASTRON , Netherlands Institute for Radio Astronomy
- CWI , Centrum Wiskunde & Informatica
- DIFFER , Dutch Institute for Fundamental Energy Research
- Nikhef , National Institute of subatomic physics ❤️
- NIOZ , Royal Netherlands Institute for Sea Research
- NSCR , Netherlands Institute for the Study of Crime and Law Enforcement
- SRON , Netherlands Institute for Space Research

Science in the Netherlands

III - NWO-I, Institutes Organisation of NWO (nine)

"Mission budget"

scientific (permanent) staff

scientific (temporary) postdocs & PhD

technical staff

resources - computing, travel, materials…

administrative personnel

technical departments, …

managed by NWO-I directorate

Science in the Netherlands

III - Nikhef as NWO-I

Nikhef mission

Nikhef

The mission of the National Institute for Subatomic Physics Nikhef is to study the interactions and structure of all elementary particles and fields at the smallest distance scale and the highest attainable energy.

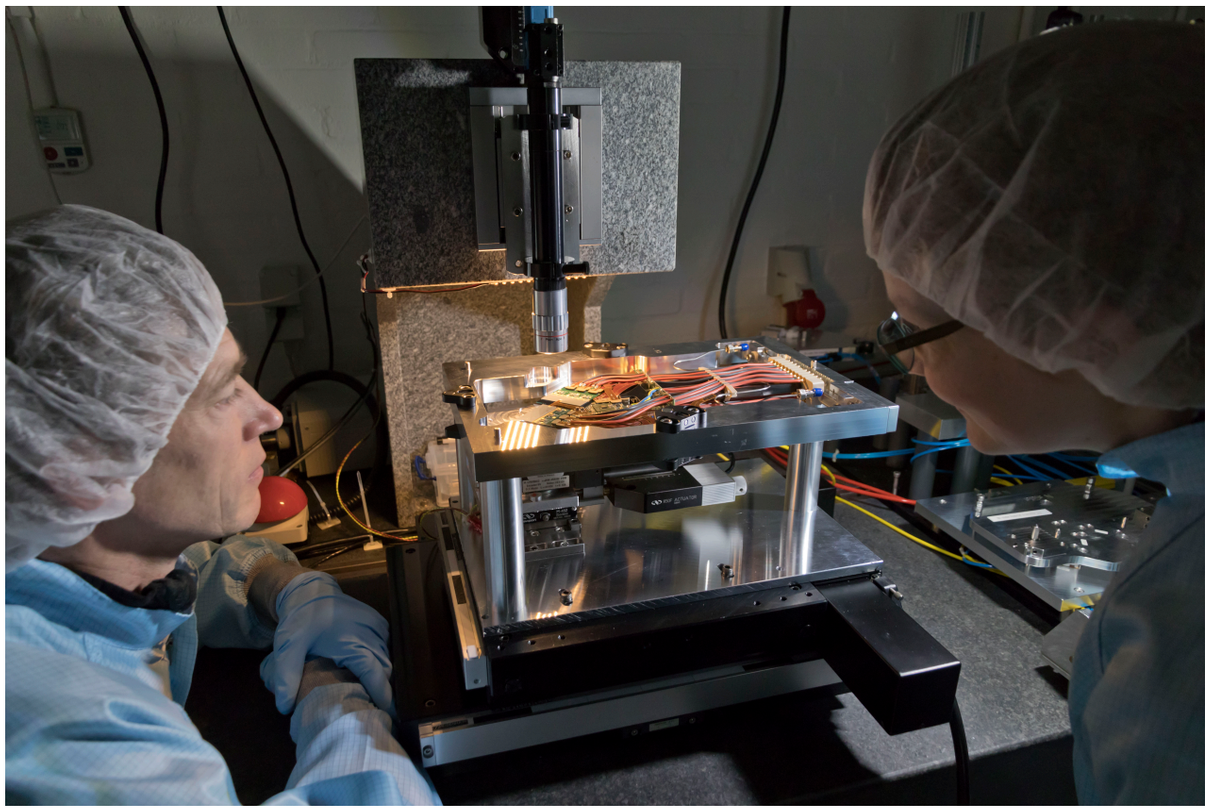
Two complementary approaches are followed:

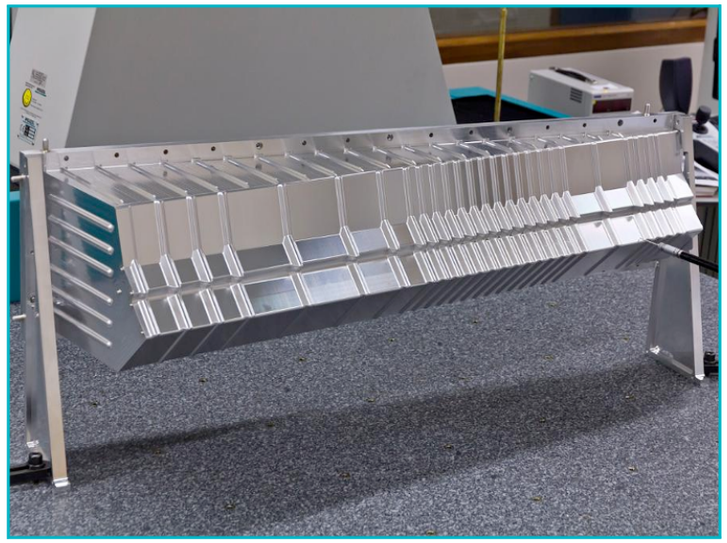
- Accelerator-based particle physics – Studying interactions in particle collision processes at particle accelerators, in particular at CERN;
- Astroparticle physics – Studying interactions of particles and radiation emanating from the Universe.

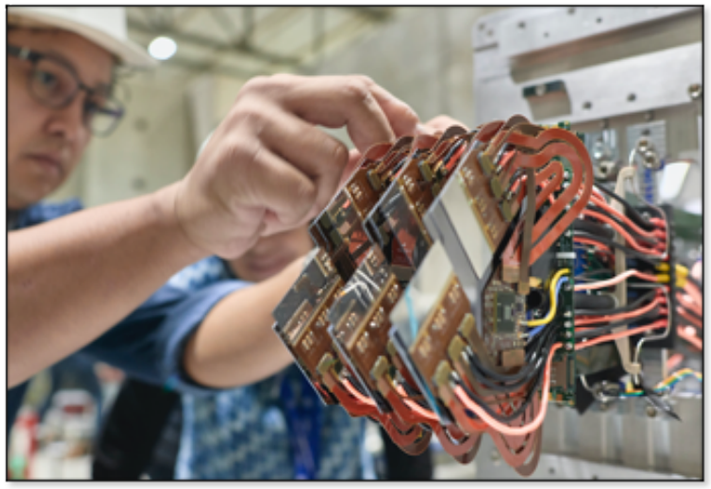
Nikhef coordinates and leads the Dutch experimental activities in these fields. The research at Nikhef relies on the development of innovative technologies. The knowledge and technology transfer to third parties, i.e., industry, civil society and general public, is an integral part of Nikhef's mission.

Science in the Netherlands

III - Nikhef as NWO-I

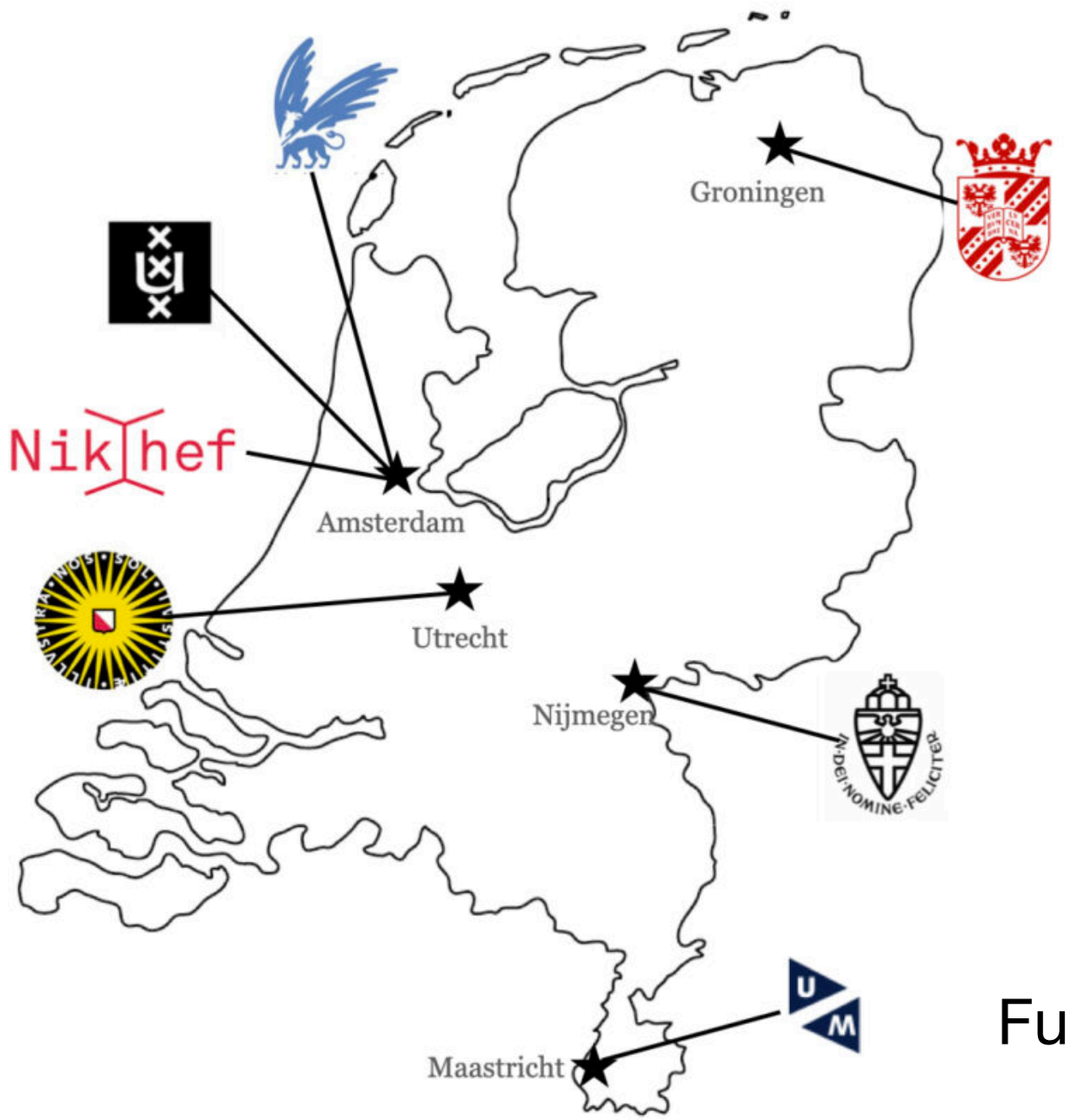






Science in the Netherlands

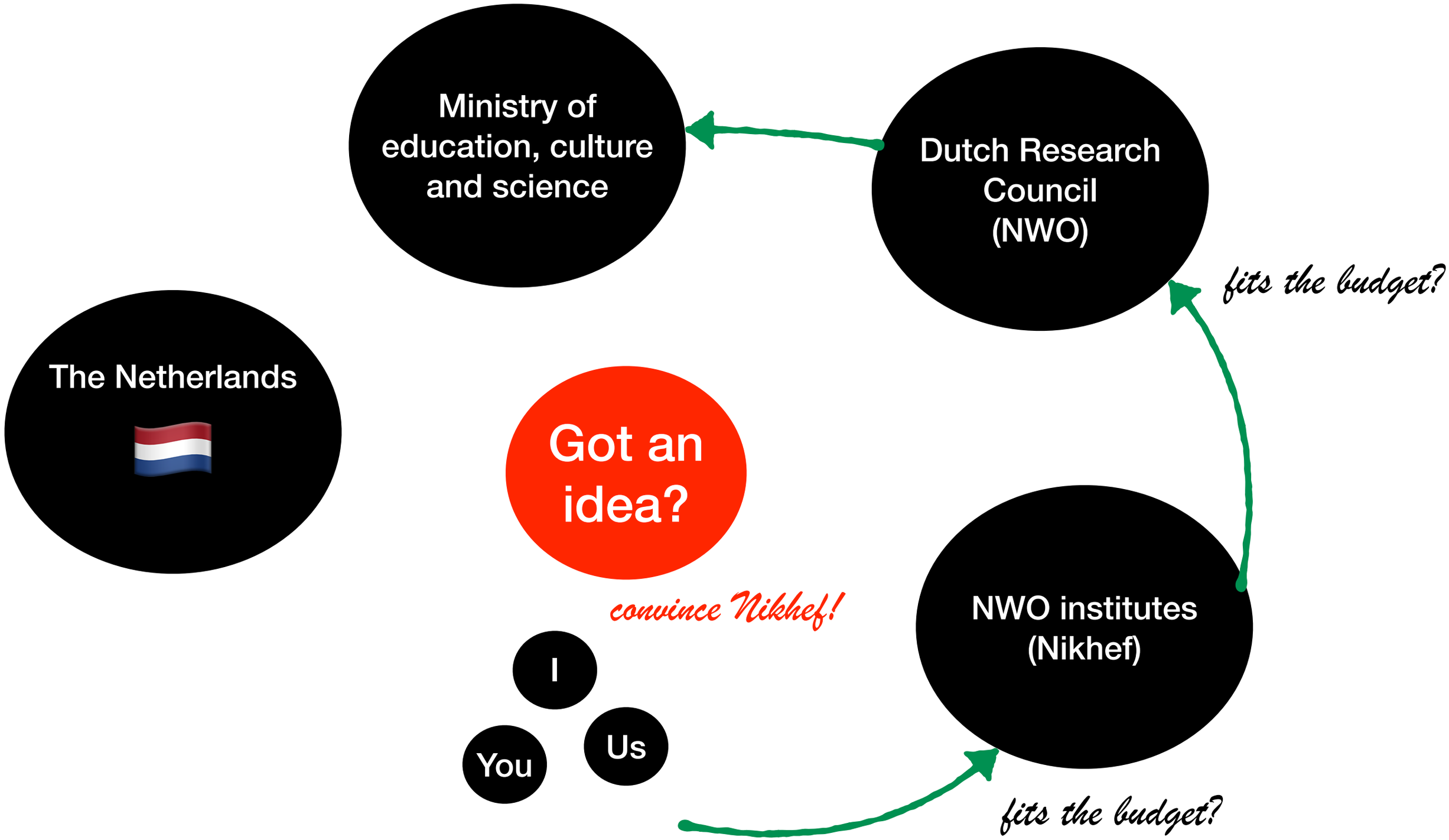
III - Nikhef as a NWO-I and National Consortium



Funds: mostly personnel
(with exceptions)

Science in the Netherlands

NL subatomic physics activities managed by Nikhef



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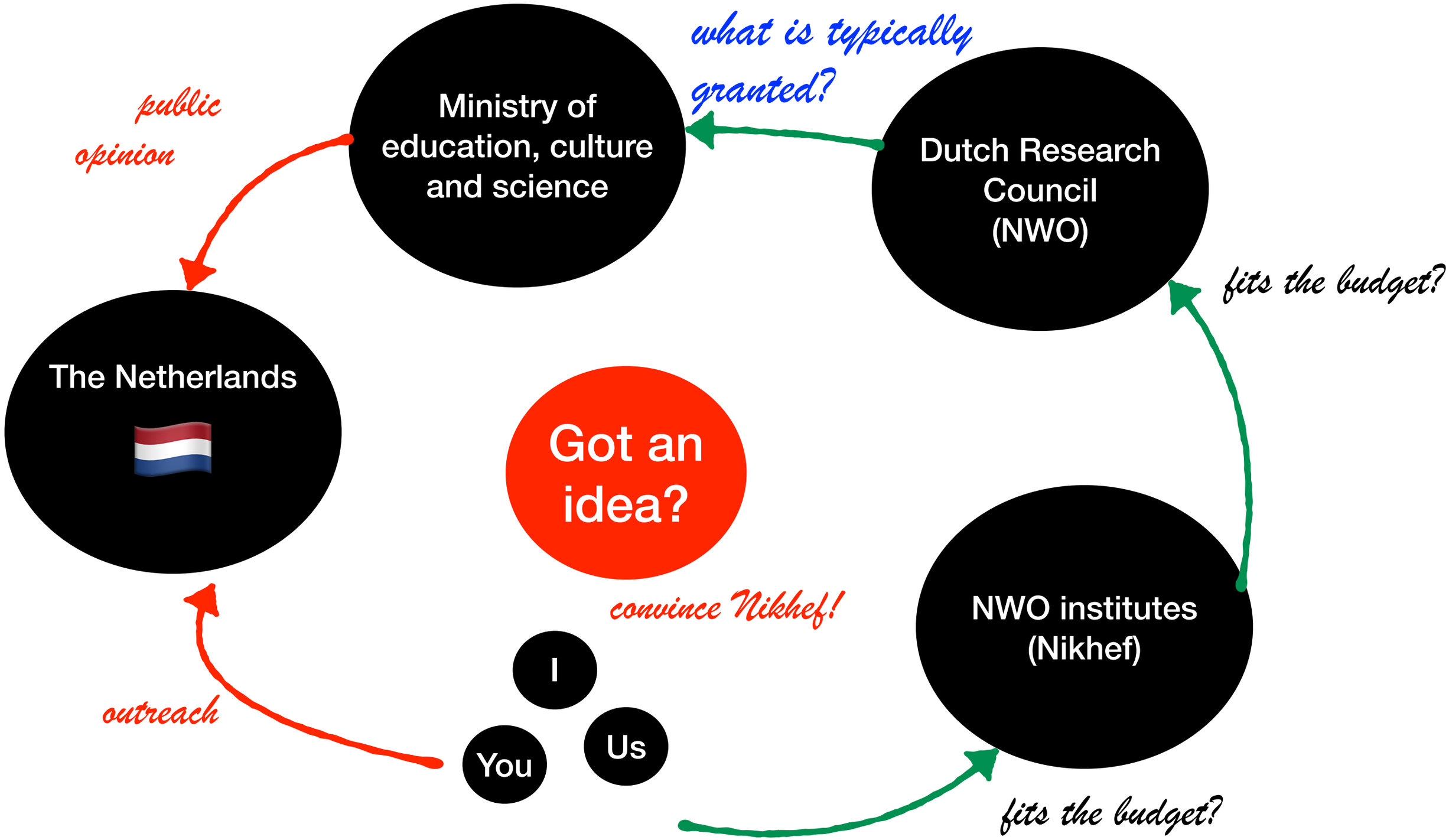

NWO decision-making role

Bijlage 1: De 25 routes van de NWA (link from the Ministry page)

1. De blauwe route: water als weg naar innovatieve en duurzame groei
2. Bouwstenen van materie en fundamenten van ruimte en tijd
3. Circulaire economie en grondstoffenefficiëntie: Duurzame circulaire impact
4. Duurzame productie van gezond en veilig voedsel
5. Energietransitie
6. Gezondheidsonderzoek, preventie en behandeling
7. Jeugd in ontwikkeling, opvoeding en onderwijs
8. Kunst: onderzoek en innovatie in de 21e eeuw
9. Kwaliteit van de omgeving
10. Levend verleden
11. Logistiek en Transport in een energieke, innovatie en duurzame samenleving
12. Materialen – Made in Holland
13. Meten en detecteren: altijd, alles en overal
14. NeurolabNL: de werkplaats voor hersen-, cognitie- en gedragsonderzoek.
15. De oorsprong van het leven – op aarde en in het heelal
16. Op weg naar veerkrachtige samenlevingen
17. Personalised medicine: uitgaan van het individu
18. De quantum/nanorevolutie
19. Regeneratieve Geneeskunde: game changer op weg naar brede toepassing
20. Smart Industry
21. Smart, liveable cities
22. Sport en Bewegen
23. Sustainable Development Goals voor inclusieve mondiale ontwikkeling
24. Tussen conflict en coöperatie
25. Waardecreatie door verantwoorde toegang tot en gebruik van data

"Long-term" (?) strategy

Nationale Wetenschapsagenda (NWA)

All sizeable commitments must fit into a NWA route

including new (large-scale) infrastructure as a HEP experiment

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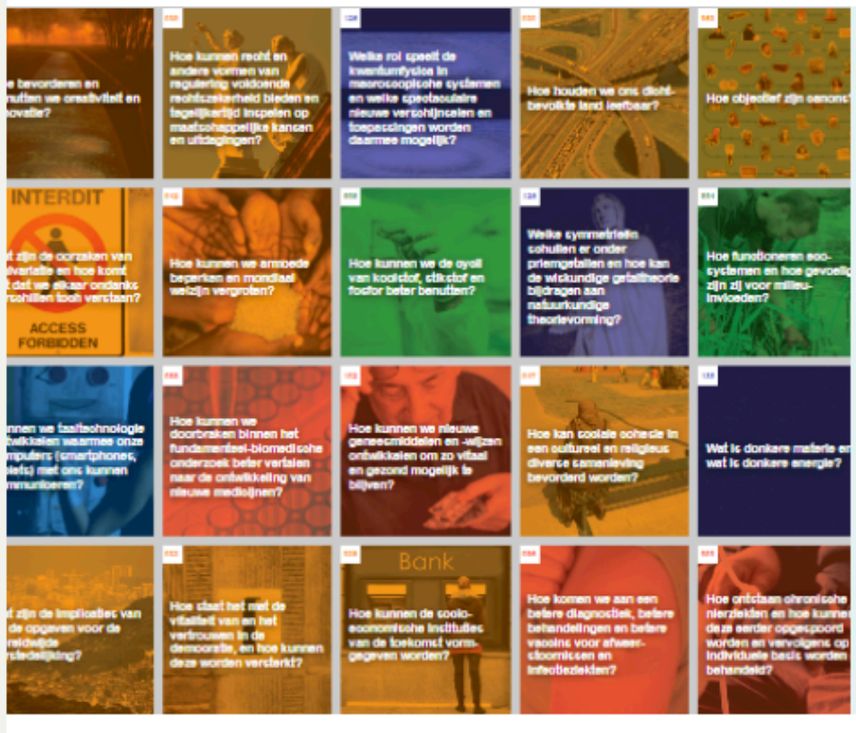
Million"Euros" question for Early Career:

How are the routes defined?

NWO decision-making role

Cluster questions

The Dutch Research Agenda brings together diverse research participants. The NWA strengthens and facilitates their productive interaction. Science and society come together, as do different scientific fields, forms of research (fundamental, applied, practice-oriented) and national and international research agendas.



Where society and science meet and strengthen each other

Under the flag of NWO, the NWA developed into a revolutionary programme in the Dutch (and even global) knowledge landscape, linking scientific breakthroughs to societal challenges, within 140 cluster questions and 25 routes.

The cluster questions emerged from Dutch society. The routes link these questions on the basis of themes and form networks of research with the societal field. Returning research results to society and increasing citizens' trust and involvement in science remain key elements of the agenda.

Routes goal:

to answer 140 questions emerged from society

Role of outreach

keep societal interest in fundamental physics

NWO decision-making role

https://www.nwo.nl/en/researchprogrammes/dutch-research-agenda-nwa/innovation-and-networks/cluster-questions/

Our route!

Building blocks of matter and fundaments of space and time

Our questions!

127. What are the origins, history, and future of the universe?

128. Have we identified all the elementary particles of matter?

129. What is the true nature of gravity, space, and time and what can we learn from black holes?

130. What is dark matter and what is dark energy?

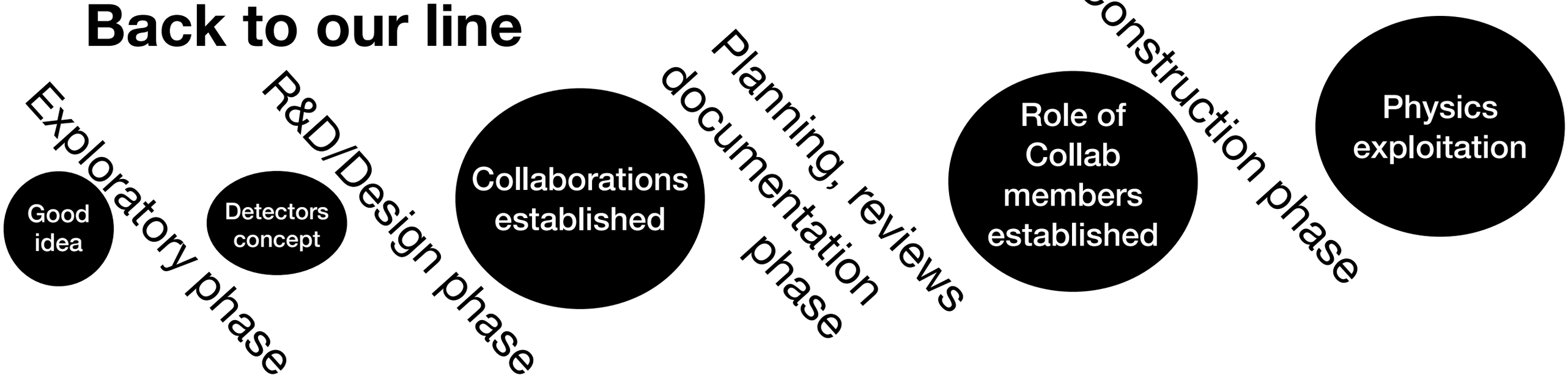
131. How are galaxies, stars, and planets born and how do they evolve?

Few examples

NL Subatomic Physics experiments at different phases

Selected examples

Back to our line



Randomly chosen!
Nikhef program is vast

Selected examples

Back to our line

Exploratory phase

Good idea

Government of the Netherlands

Home > Ministries > Ministry of Education, Culture and Science > News >

Government takes next step towards bringing Einstein Telescope to the Netherlands

News item | 24-10-2023 | 11:00

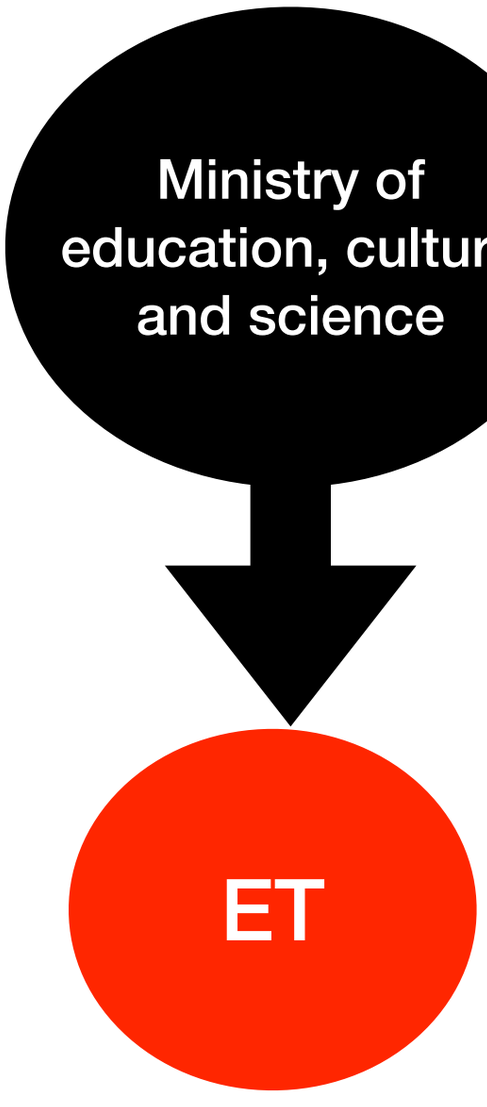
Lasers, mirror technology and vibration-free cooling equipment are just three of the innovative technologies that will be needed to build the Einstein Telescope. Minister of Education, Culture and Science Robbert Dijkgraaf announced today that businesses can now register for funding to develop and test these technologies. With this, the government is taking the next step towards bringing the Einstein Telescope to the Netherlands. The construction of the telescope is important. Not only will it increase understanding of gravitational waves, it will also be a major impulse for lasting scientific and economic growth in the Netherlands.

Host country candidate
Enormous resources

Involves high instances of governments: site infrastructure, geopolitics, geological studies …

https://www.government.nl/ministries/ministry-of-education-culture-and-science/news/2023/10/17/government-takes-next-step-towards-bringing-einstein-telescope-to-the-netherlands

Einstein Telescope



12 MEUR

42 MEUR

870 MEUR

Huge investment

Pole position for businesses

The government wants to encourage businesses to get started on developing these new technologies for the telescope now. That's why it's providing funding to develop and test them. A total of €12 million is available.

> *'I would love to have the Einstein Telescope here in the Netherlands,' says Mr Dijkgraaf. 'Its value for science and our economy isn't something you can express in terms of money. I want to achieve two things through this funding. First, by investing now in the knowledge and technology that we're going to need, we're making our plan more robust and increasing our chances of being able to build the telescope here. At the same time, we're driving innovation, and that's good for our economy and our employment market and for the strength of our knowledge.'*

Significant value

The construction of the Einstein Telescope in the Netherlands would be a valuable development for science in the Netherlands and the wider region. It would also be a boost for the local business sector and provide work for researchers, graduates and skilled workers. The project involves building work and maintenance as well as technology that businesses will supply. Since the telescope contributes to the Netherlands' earning potential in the longer term, the project has received €42 million from the National Growth Fund. The budget for this funding scheme is drawn from that.

The Ministry of Education, Culture and Science, the Ministry of Economic Affairs and Climate Policy, the province of Limburg, the regional development agency of the province of Limburg (LIOF) and the National Institute for Subatomic Physics (Nikhef) are working hard to bring the telescope to the Netherlands. They have carried out feasibility studies and geological surveys and are establishing cooperation with Germany and Belgium. The Dutch government has reserved another €870 million to cover part of the construction work.

On the other side of the spectrum

Experiments with (almost) no cost

Physics exploitation

NWO-I (Nikhef)

Dutch Research Council (NWO)

Scientific personnel

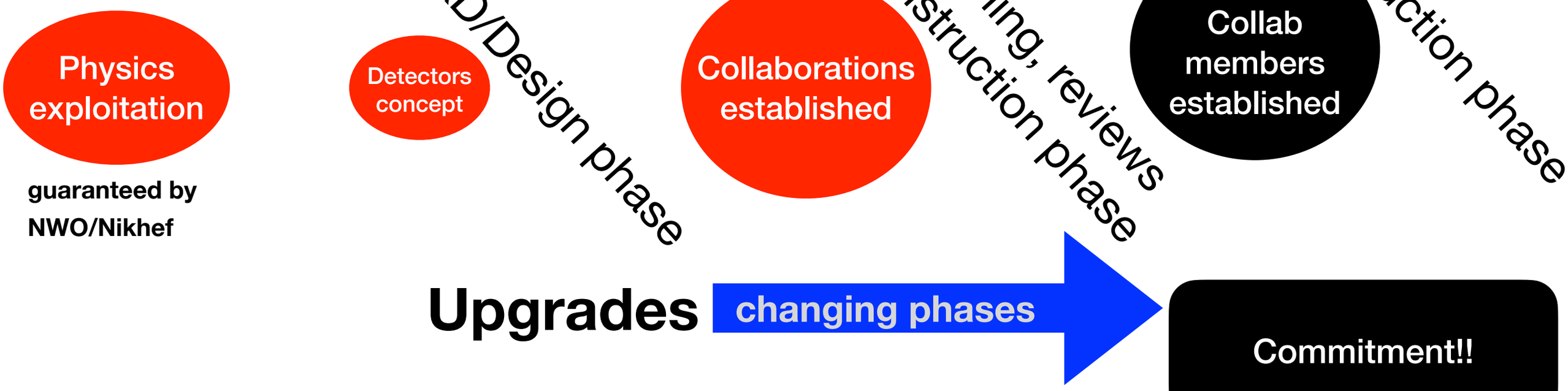
The FASER experiment is a relatively small detector set up in line with the ATLAS detector in the circular LHC accelerator. ATLAS itself has a blind spot in that direction because the accelerator tube is in the way. The FASER detector is some 480 meters away in a service tunnel, in a place where the accelerator tube is no longer in the way.

The experiment, which also involves a number of Nikhef physicists, was built in 2021 using mostly reused equipment from other experiments. From Nikhef, ATLAS physicist Lydia Brenner, among others, is collaborating on FASER.

https://www.nikhef.nl/en/news/faser-catches-first-neutrinos-straight-out-of-proton-collisions-in-atlas/

Just while we speak…

LHC experiments



Just while we speak…

LHC upgrades

Grant call:

Purpose and objectives

The National Roadmap for Large-Scale Research Facilities programme encourages the establishment or improvement of large research facilities with which the Netherlands can assume an important position internationally.

The National Roadmap for Large-Scale Research Facilities is intended for investments in:

- the implementation or upgrade of research facilities in the Netherlands with international allure;
- participation by the Netherlands in the construction of or substantial change to international research facilities.

NL, as most LHC countries

working *hard throughout the Summer!!!* to guarantee resources

enable strong participation in HL-LHC

paves the way for future facilities

Finally to the main topic

Plans and funding possibilities for future colliders

- Future colliders in exploratory phase and we are not hosts! Not the moment for funding request!

- Full Nikhef support to our involvement at the exploratory phase
    - need more resources for next phase (R&D/design) ? NWO funding lines, mission budget

- Dutch history: good score in recent experiments at various phases
    - “commitment” process expected to be smooth

- Roadmap for Large-Scale Reseach Facilities grant in 2024 *embraces* future generation of colliders
    - scope: new (tracking) technology for **future** detectors
    - schedule: running period 2025-2035
        - good timing e.g. for next CERN-project-specific request

- What is a good plan? *remain relevant !*

remain at the frontier of experimental physics / deliver best physics output in HL
play active role in European Strategy / keep NWA route alive