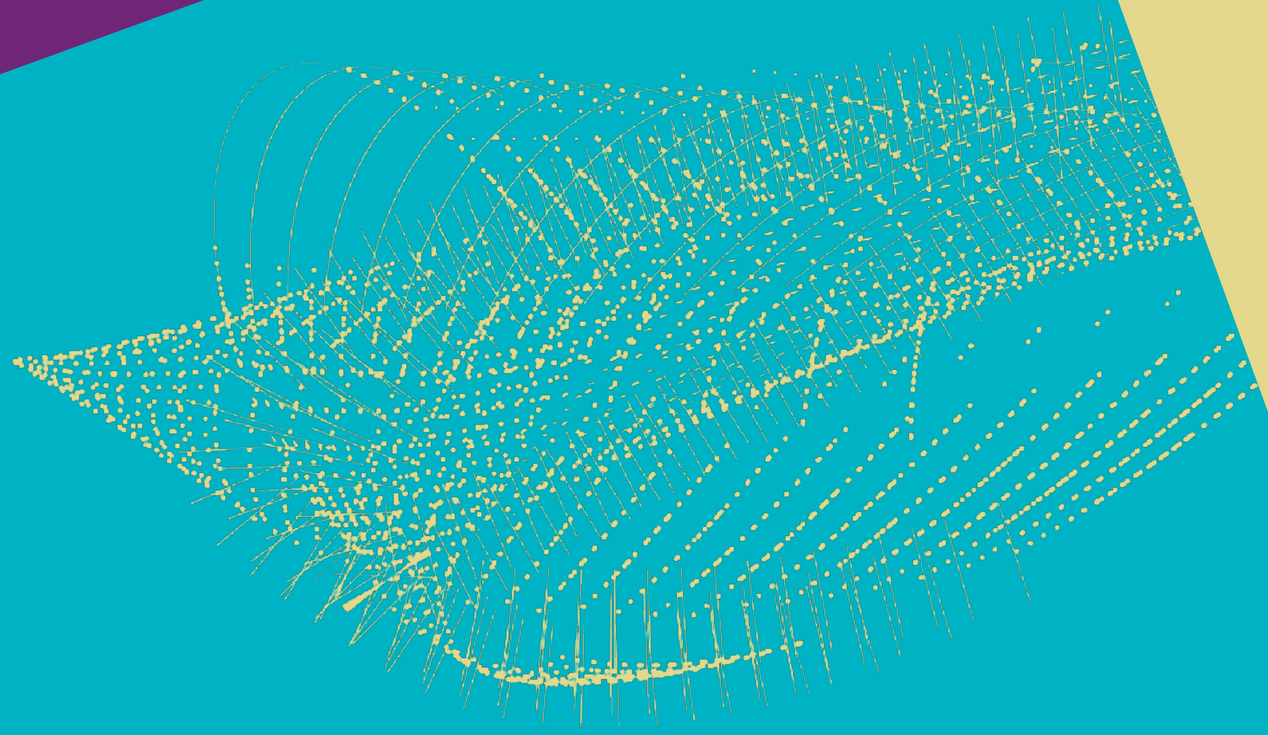
Nikhef



ECFA MID-TERM REVIEW THE NETHERLANDS

Stan Bentvelsen,
November 17, 2022

RECFA VISIT THE NETHERLANDS: OCT 19+20, 2018

Chaired by Jorgen D'Hondt

NATIONAL SCIENCE PROGRAM

Symbiosis between NWO institute and University partners

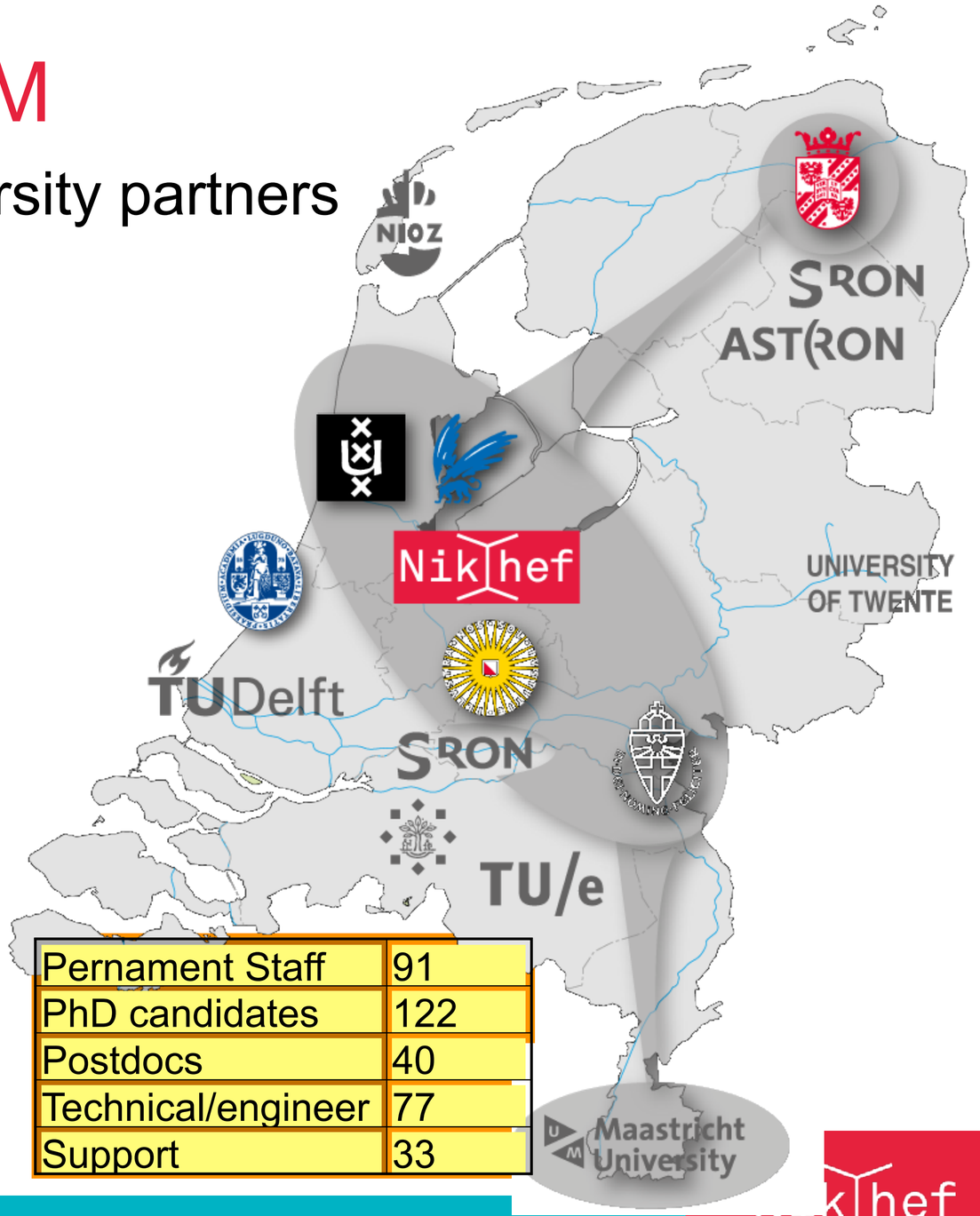
- University partners in key positions
  - Leaders of the scientific programs
- Added value institute infrastructure
  - Technical competence and support

Science portfolio PP & APP

- CERN related activities ~50%

Finance of our Nikhef National Strategy

NWO Mission ~16 ME	Open competition and data centre ~16 ME	Universities ~16 ME



Pernament Staff	91
PhD candidates	122
Postdocs	40
Technical/engineer	77
Support	33

PARTICLE AND ASTROPARTICLE PHYSICS

Nikhef basically covers all PP&APP activities in the Netherlands

- Technical Universities (Delft, Enschede, Eindhoven) are not part of Nikhef
  - Important for instrumentation topics, e.g. Enschede for cryogenics

University Maastricht is a ***new*** Nikhef partner - since 2019

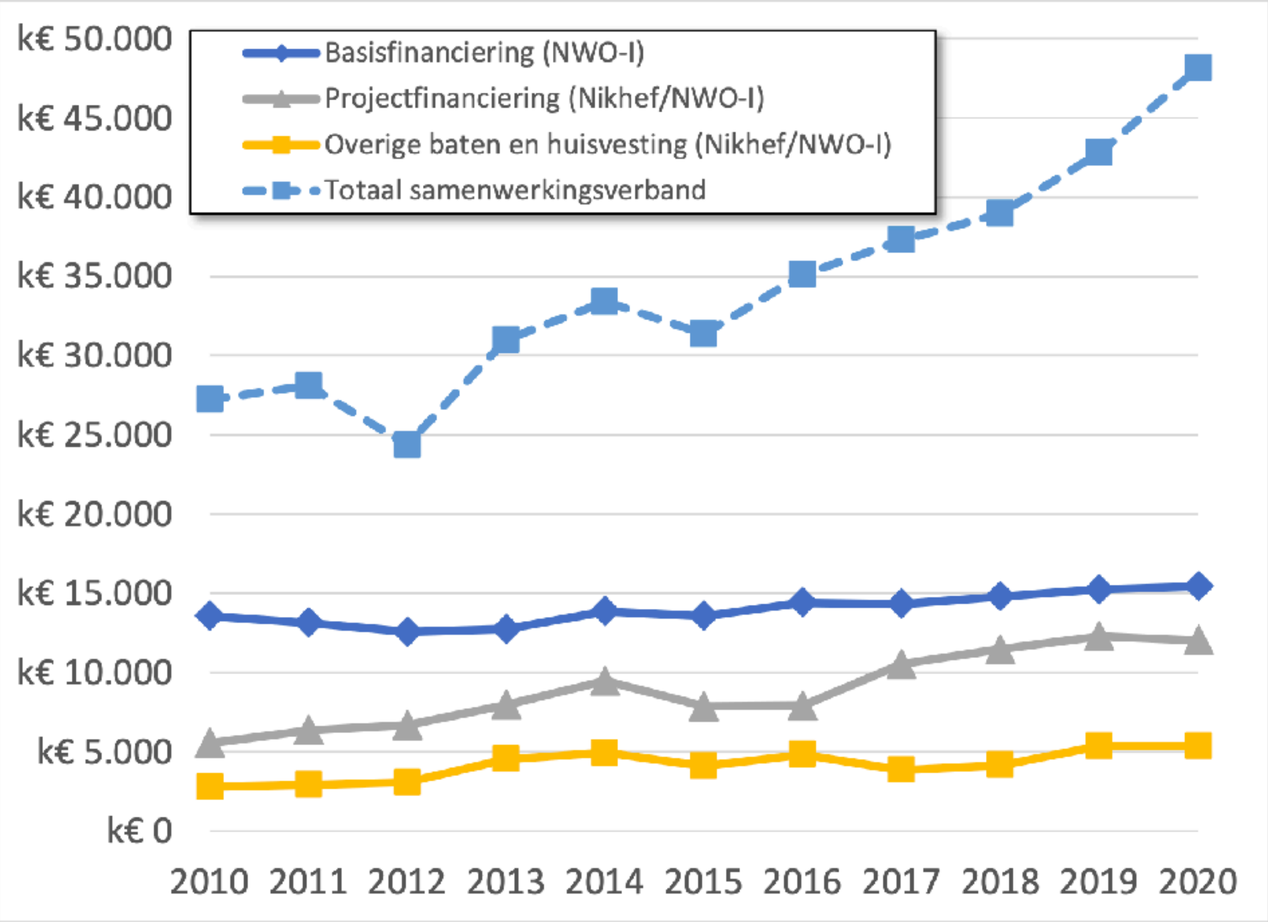
- Large group on Gravitational Waves installed
  - Instrumentation activities: the ETpathfinder : see later
- Growing group in LHCb
- Sizable activities in (quantum) computing
  - Connection with IBM - Switzerland

ECFA - 2018:
Dutch involvement in high-energy physics via NIKHEF, which is one of the strongest particle and astroparticle physics institutes in Europe, is an exemplary model that merges a national laboratory with universities.

FINANCIAL DEVELOPMENT

Increase of total funding

- University partners growing
  - New members Groningen and Maastricht
  - Further support for science activities at our universities
- Institute “mission” budget remains constant
  - Increasingly difficult for the institute to play the ‘nexus’ role with universities



INSTITUTE VERSUS UNIVERSITY PARTNERS

University Partners play a more important role

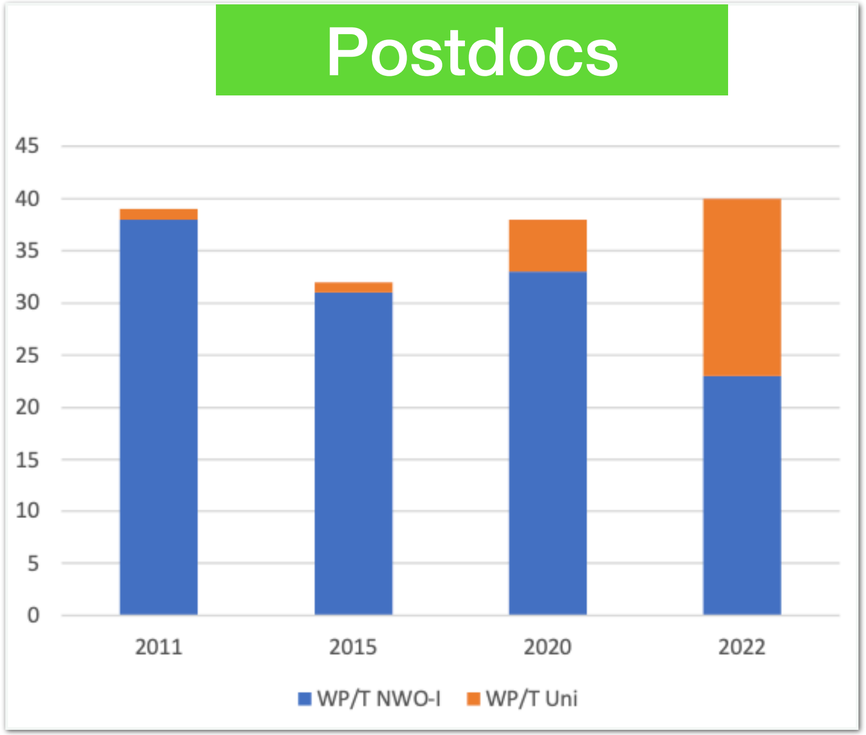
- ‘Help’ activities in need of PhD and PD under stress

Institute

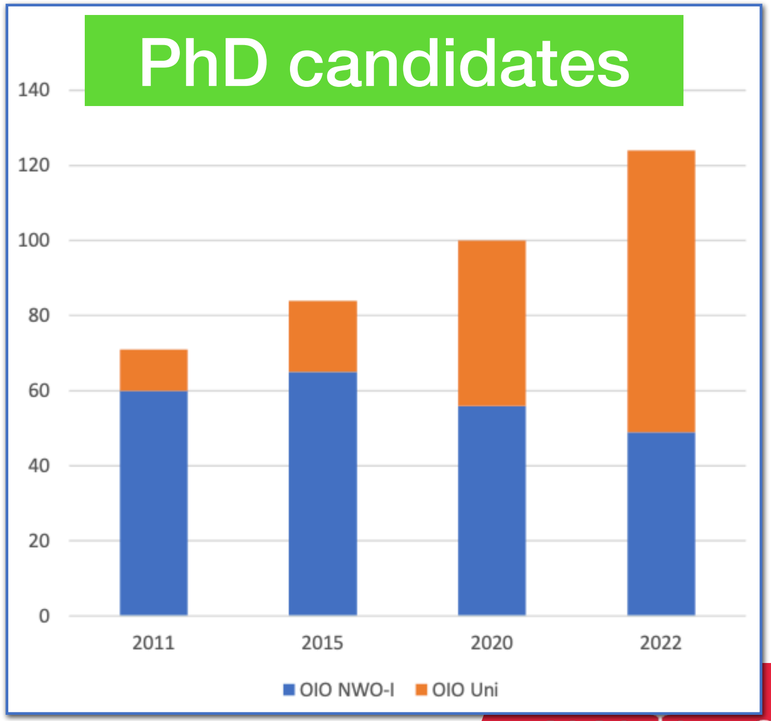
University Partners

Permanent staff

Postdocs



PhD candidates



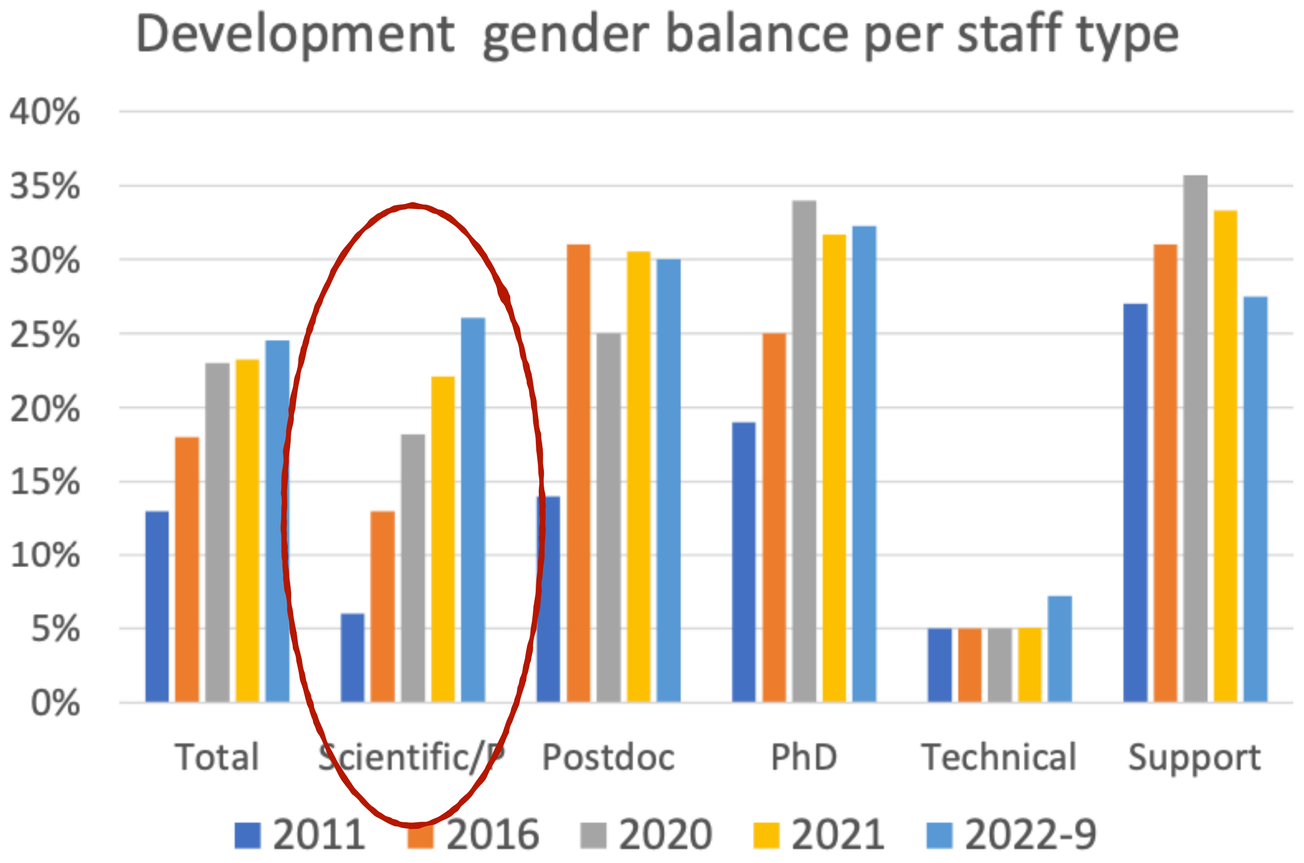
GENDER DIVERSITY

Gender diversity of the scientific staf greatly improved

- Diversity is OK, but inclusion..

Diversity & Inclusion

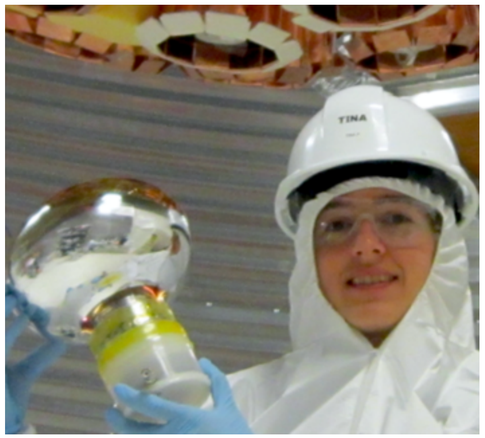
- Engage in the conversation about equality, diversity and inclusion, and to increase the diversity of the organization
- Dedicated D&I team installed



COLLEAGUES

Some recent new Nikhef hires

Clara Nellist



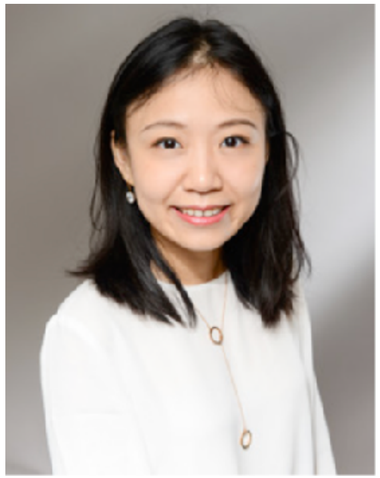
Tina Pollmann

Andreas Freise

Conor Mow-Lowry

Maria Haney

Keri Vos

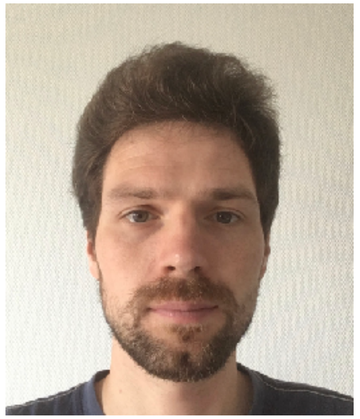


Mengqing Wu

Jory Sonneveld

Lydia Brenner

Flavia de Almeida Diaz



Kristof de Bruyn

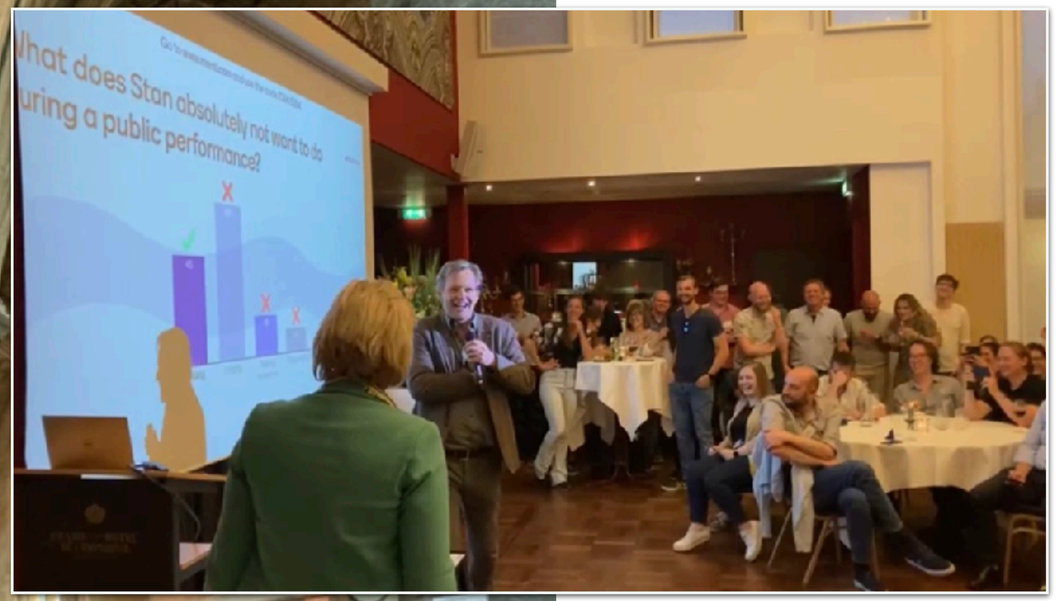
NEW PROFESSORSHIPS (EXAMPLES)

Prof Charles Timmermans
Experimental and instrumental Astroparticle Physics, RU

Prof Auke Colijn
Experimental Techniques in Astroparticle Physics, UvA

Prof Juan Rojo
Theoretical physics, VU

Prof Pamela Ferrari
Instrumentation in particle physics, RU



ANNUAL SCIENTIFIC JAMBOREE

Nikhef

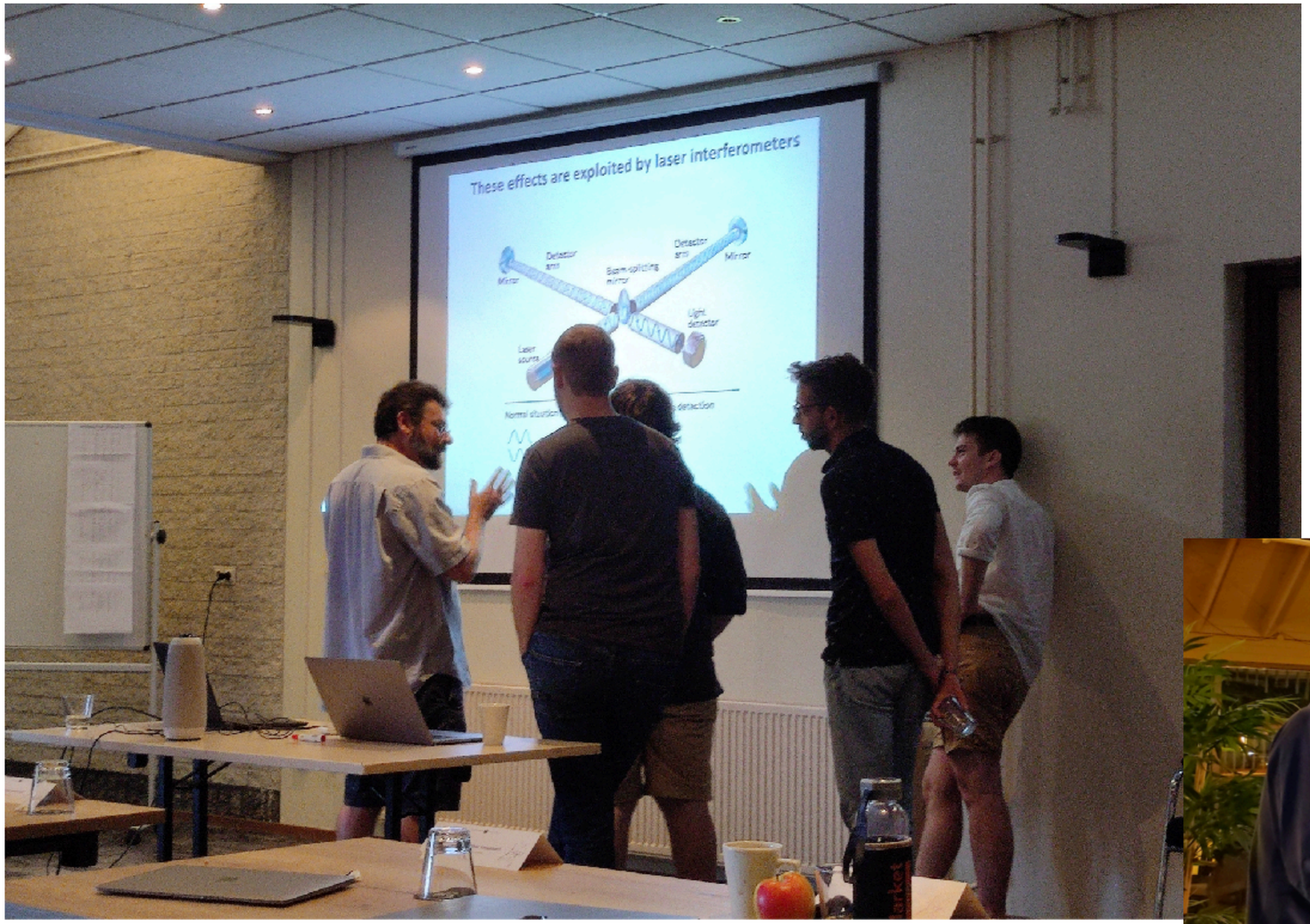
PHD CANDIDATES AT NIKHEF

ECFA 2018 on Education
The education system is very impressive and clearly a source of great motivation for PhD students.
They would, however, welcome additional mentoring during the early stages of their courses, which might prompt them to aim for ambitious objectives in their future academic careers.

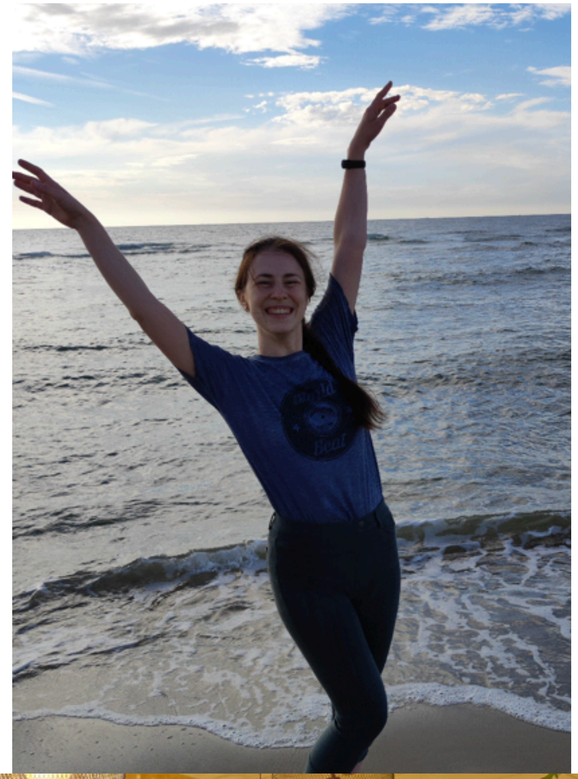
Education - research school

- Strengthening and streamlining the mentoring system to provide strong mentoring at early stages
  - Multiple ‘oversight’ meetings in the first year, increase the role of the ‘outside’ mentor
- We started a PhD supervision course pilot,
  - Supervisors will learn how to improve their mentoring, supervision, and communication skills
- There is a new system to PhD buddy peers
  - PhDs are paired with advanced PhDs to provide mentoring

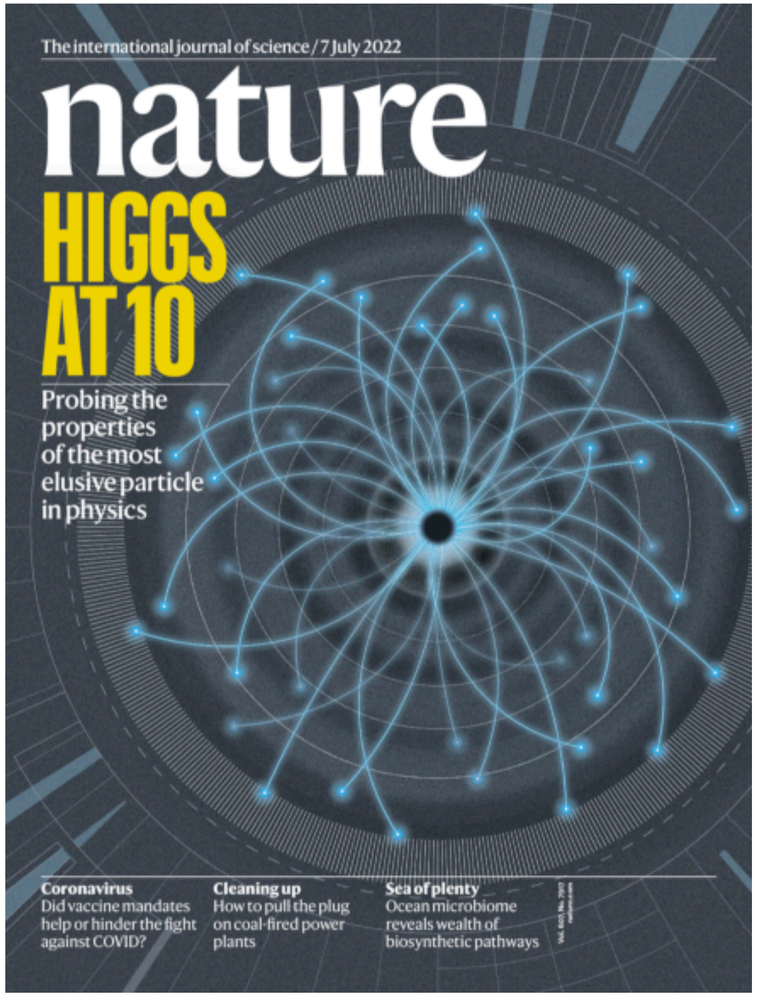
BND SCHOOL - RESEARCH SCHOOL



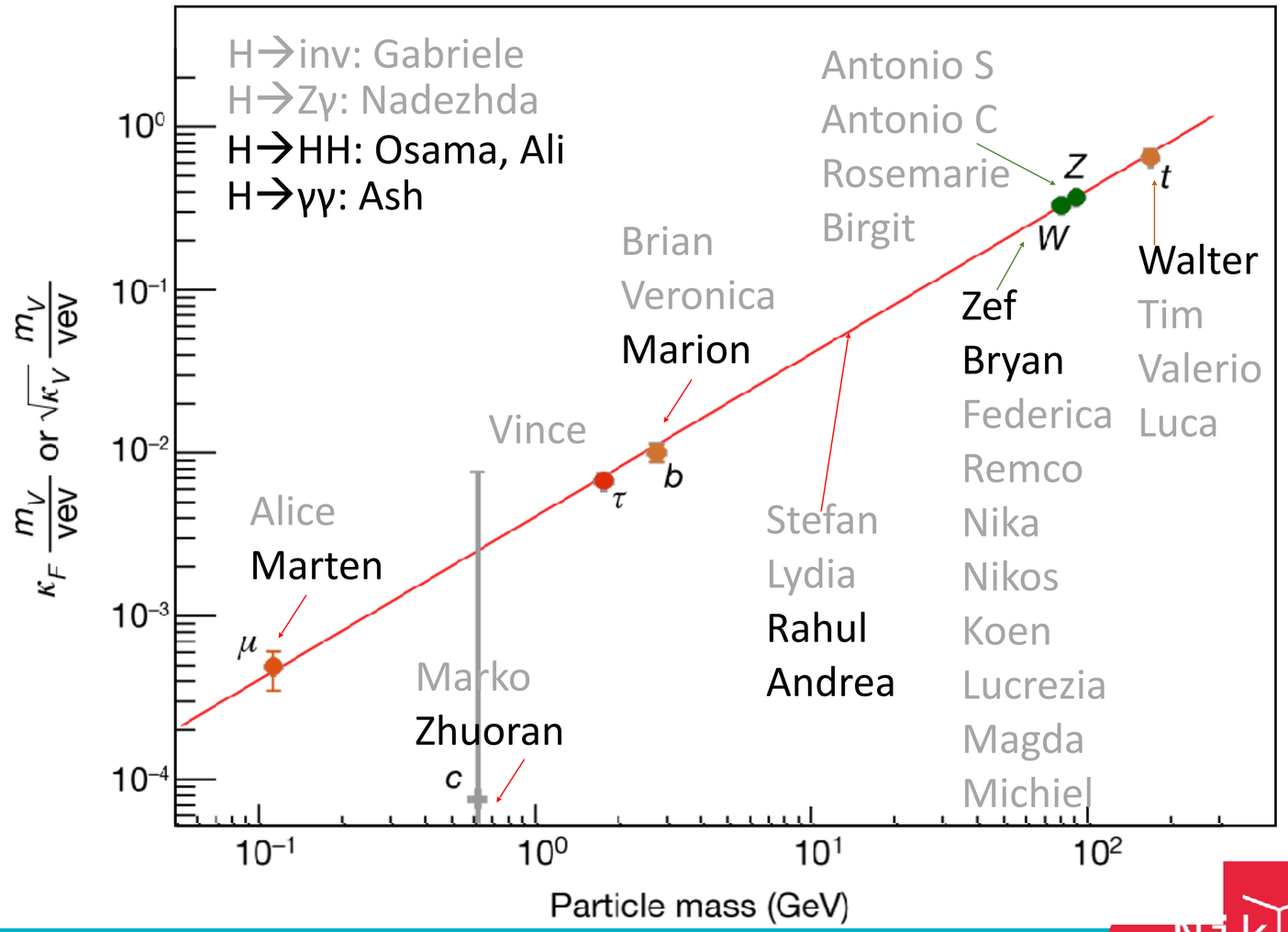
Combined German-Belgium-Dutch school



10 YEAR ATLAS HIGGS, NATURE PAPER



Nikhef 10 year Higgs PhD candidates



10 YEARS HIGGS

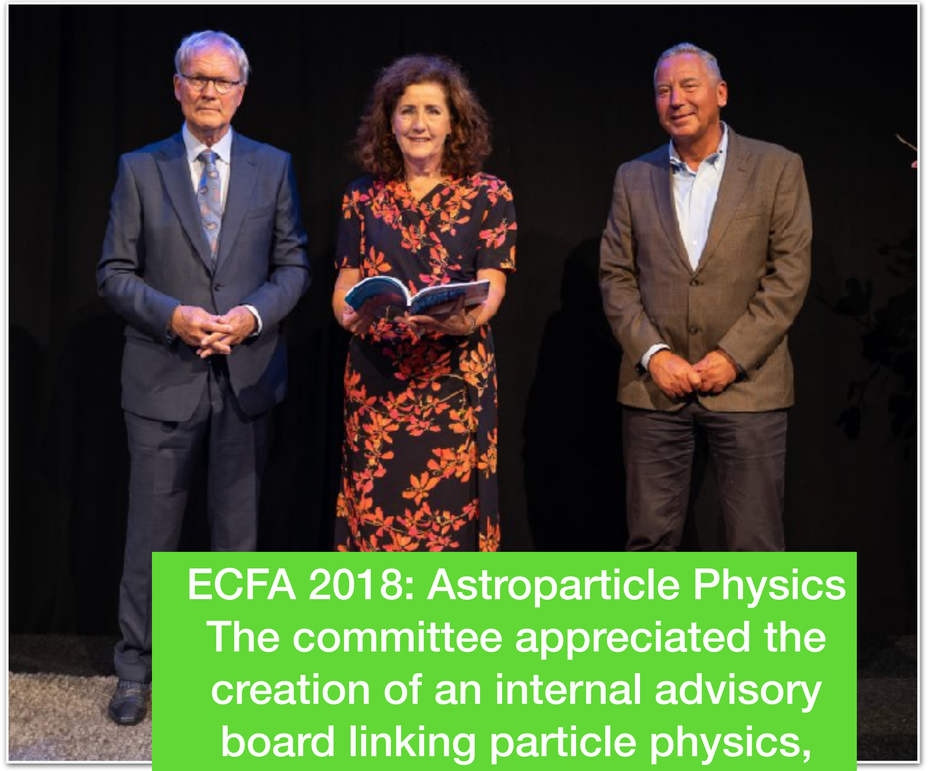
FUNDING: NWO ROADMAP

Roadmap for infrastructures

- LHC upgrades (2014) - 15.8 ME
  - Current upgrades for LS2 and LS3
- KM3NeT (2018): NIOZ, TNO - 12.7 ME
  - Construction lines - see next slides
- FuSE (2020) ICT: ASTRON, SURF - 11.9 (28) ME
  - Tier-1 LHC until 2025, KM3NeT, SKA

Upcoming roadmap plans

- Decadal plan constructed jointly with astronomy
  - 2021: LISA (astronomy): SRON and Nikhef (ET/ETpathfinder component)
  - 2023: LHC upgrade plans LS4 and beyond
  - 2023: Neutrino and Dark Matter
  - 2025 and beyond: Einstein Telescope instrumentation …



ECFA 2018: Astroparticle Physics
The committee appreciated the creation of an internal advisory board linking particle physics, astroparticle physics and astronomy in the Netherlands

This is tough competition!

FUNDING: NATIONAL GROWTH FUND

ET in the Euregio Meuse-Rhine (EMR)

- 42 ME awarded *now*
  - 19 ME: connections to industry for research and innovation: ‘the aim of this programme is to optimally position […] in particular Dutch industry, for R&D and orders related to Einstein Telescope’
  - 23 ME: ‘for the preparation toward the realisation of the underground infrastructure […]’, project organisation and management
- 870 ME have been reserved for the construction of the ET infrastructure
  - If the EMR site is selected as the location for ET

Funding from economic affairs, not science!

FUNDING: SMALLER INSTRUMENTS

Long term strategic funding for PhD and PD *does not exists anymore*

- We do not give up to convince the FA's on our long-term commitments

Medium-term funding instruments with some successes, some failures

- Open competition - we simply submit many proposals
- Recent succes is quite impressive - example:
  - Higgs physics and beyond
    - ATLAS Higgs analyses and EFT
  - 4D fast timing reconstructions
    - Preparations for LS4 upgrades R&D
  - Electric dipole moment of the electron
    - Construction of the decelerator in Groningen for world-class electron edm
  - Nuclear force in neutron stars and ALICE
    - Joint proposal from Heavy Ions and Gravitational Waves to measure e.o.s.

RECFA 2018 on funding
It is becoming challenging to continue the funding in the CERN context

DUTCH ILO-NET AND CERN

ILO-net is aiming to stimulate:

- Co-development;
- Knowledge transfer;
- Geo-return

Maintain and expand network of Dutch companies involved

- Synergy with the Dutch Key Enabling Technologies and the technological challenges facing Big Science organisation

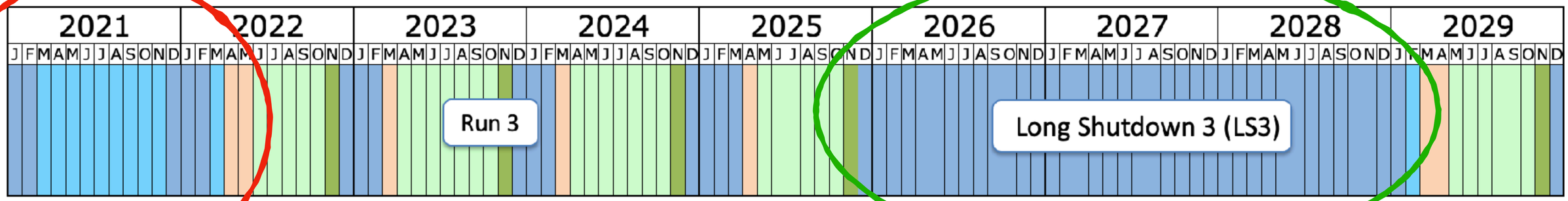
CERN return figures are still a topic of concern

- Overall (poorly balanced) 2021: 0.34
- 2018-2021: 0.54

Big Science Business Forum 2022

Dutch presence:
14 companies, 7 ILO's
Ministries of Science & Economic affairs

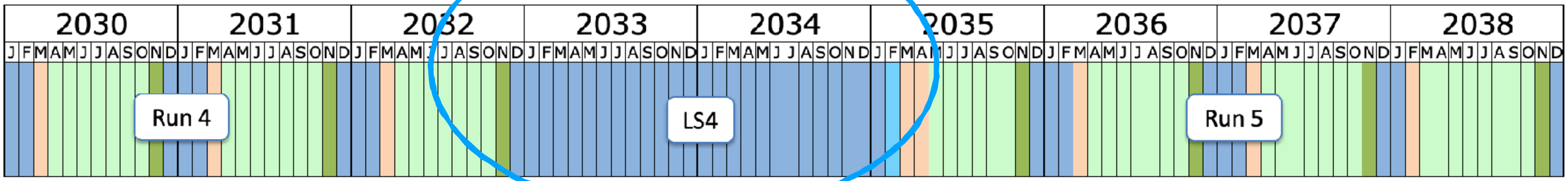
LONG TERM LHC ACTIVITIES OF NIKHEF



LHCb: RF box, VELO modules, SciFi tracker, HLT/GPU
ALICE: ITS-2 Alpine modules
ATLAS: NSW - services

ATLAS: ITk endcaps, FELIX TDAQ
LHCb: 4d fast timing R&D
ALICE: ITS-3 design

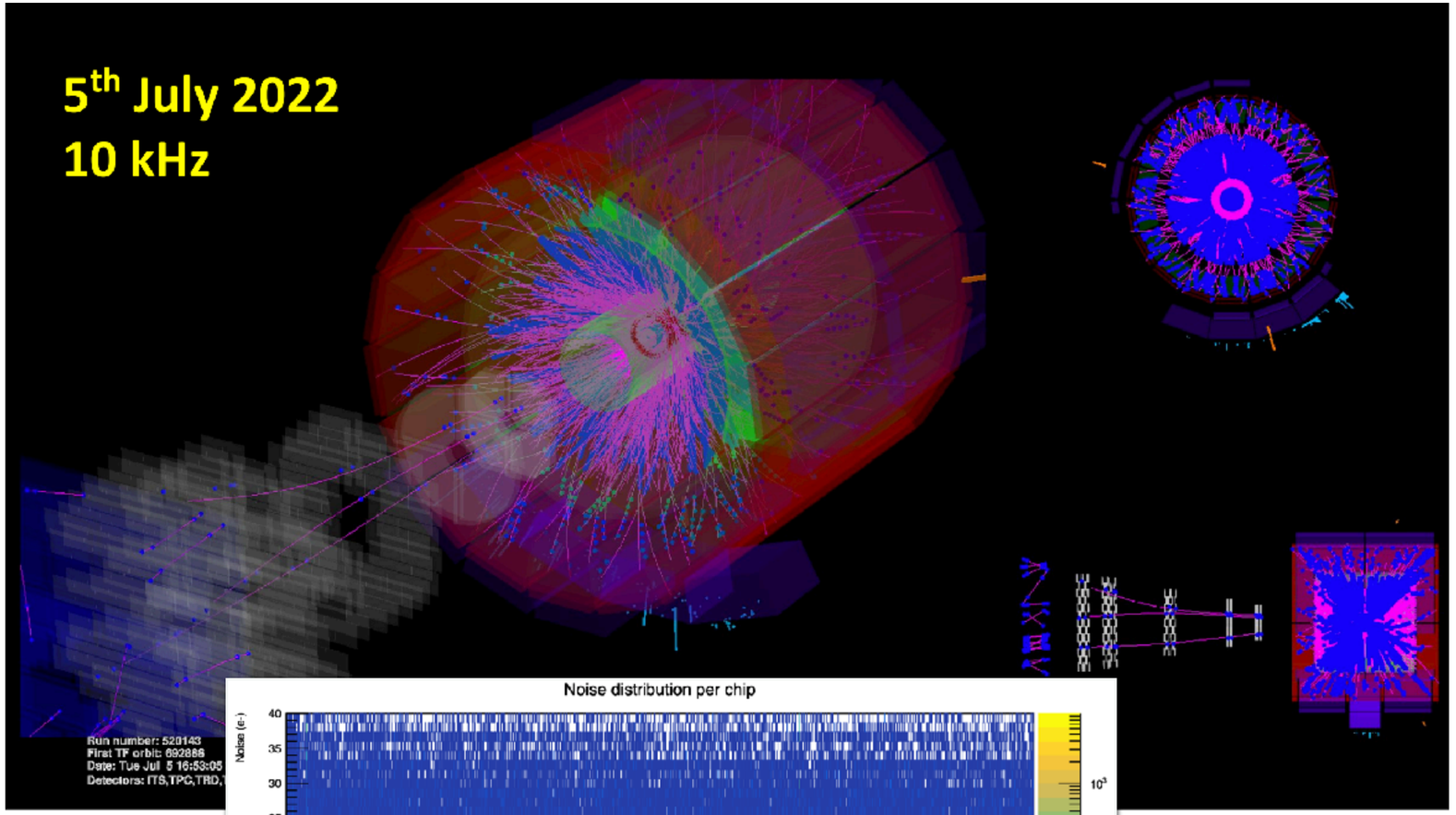
In line with ESPPU: ambitions on 4d fast timing tracking, R&D started
Joint efforts for ITS-3 (ALICE), HGTD (ATLAS), VELO-3 (LHCb)

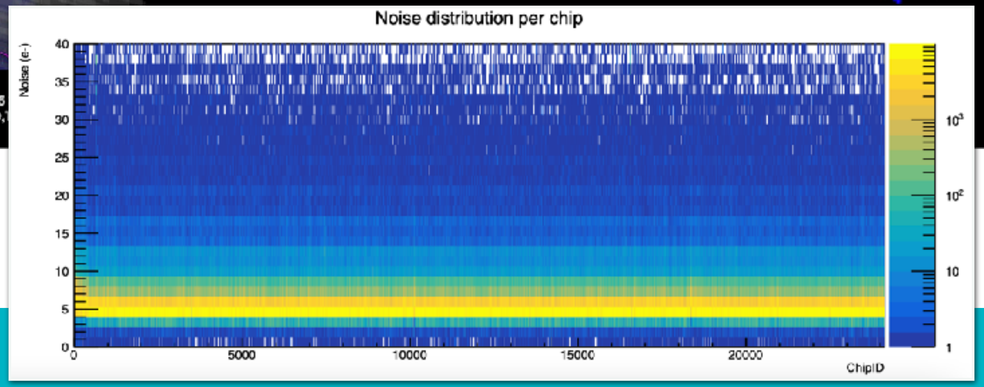


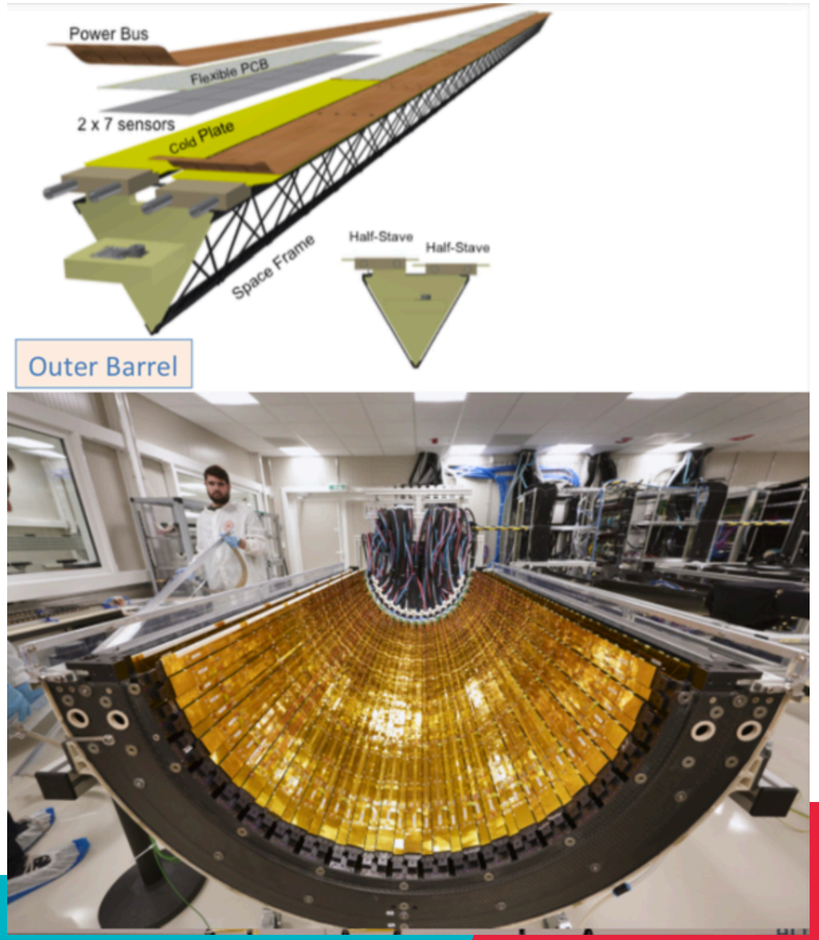
ALICE UPGRADES ITS-2

Start of data taking with upgraded detectors

- ITS pixel detector fully calibrated and operational







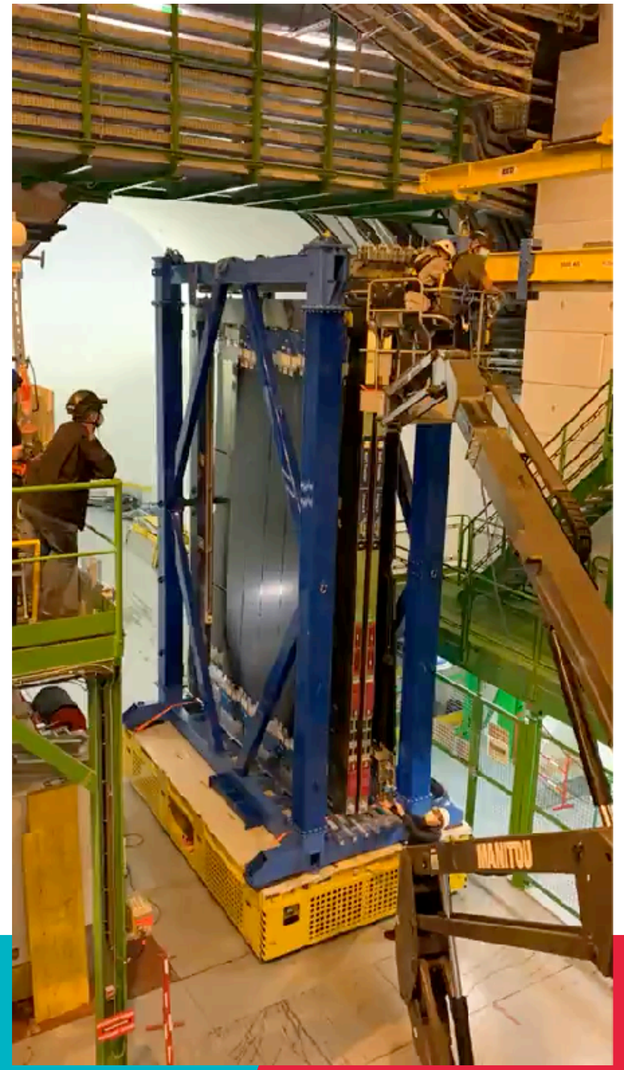
LHCB UPGRADES

VELO RF box, modules

SciFi tracker

High Level

Trigger

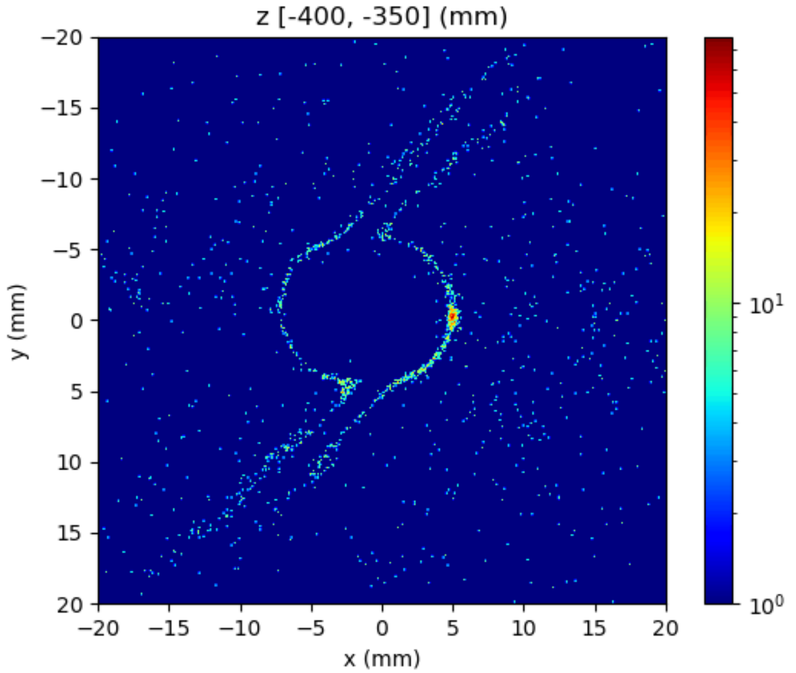


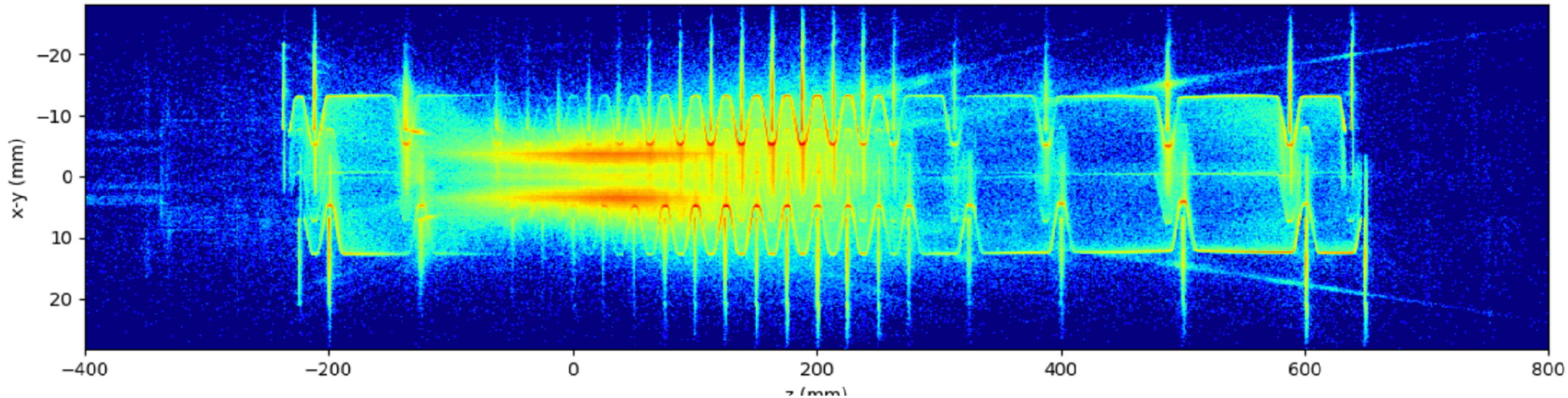
LHCB VERTEX DETECTOR

Positions of vertices

- Created as interactions with the foil and detectors reconstructed by the detectors themselves

vertices reconstructed by C side only
Bright center is the collision point.

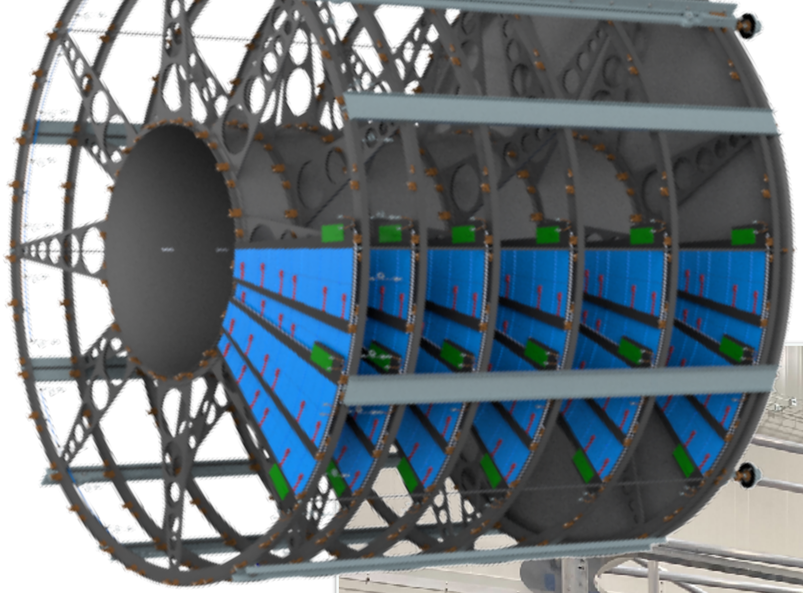




ATLAS ITK UPDATE

ITk endcaps - ATLAS

- Two structures produced @ Nikhef
  - Carbon fibre with services
- Instrument with petals
  - Final assembly one endcap
  - Other endcap @ DESY



NIKHEF PLANS TO INVEST IN 4D FAST TIMING

Detector R&D
with 3 LHC experiments

- New and fast silicon technologies for the trackers of ALICE, LHCb and ATLAS
- Preparations for (large) funding

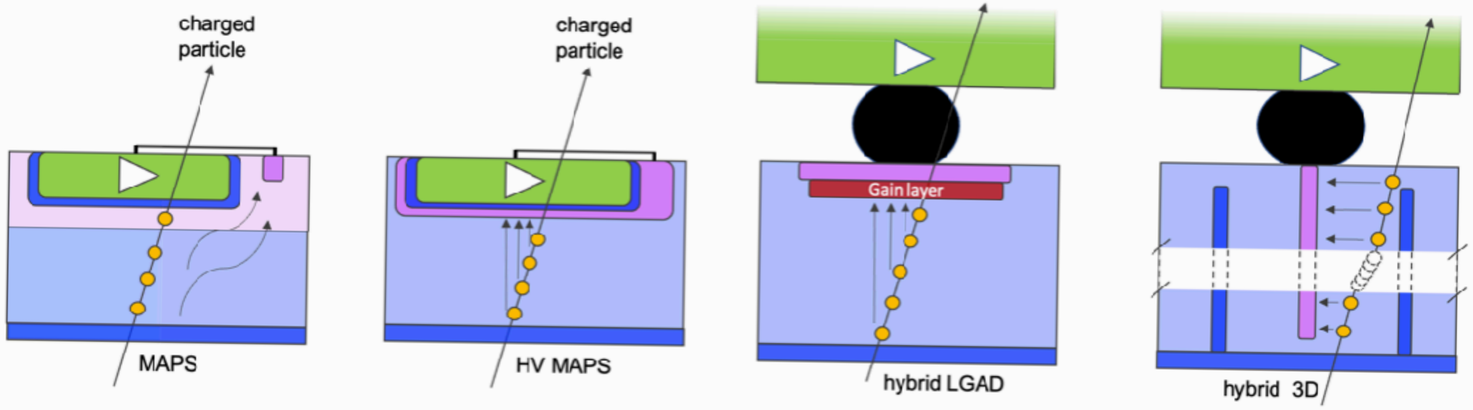
Our route to beyond LHC

- Need further collaboration

ECFA 2018 on R&D
To remain at the forefront in Europe, we encourage NIKHEF to sustain its mission for a strong R&D component in instrumentation, to foster a sense of innovation and to prepare, in a timely fashion, its workshops for the future beyond the already foreseen projects.

R&D

R&D group investigates all 4 technologies
(together with the experiments of course)

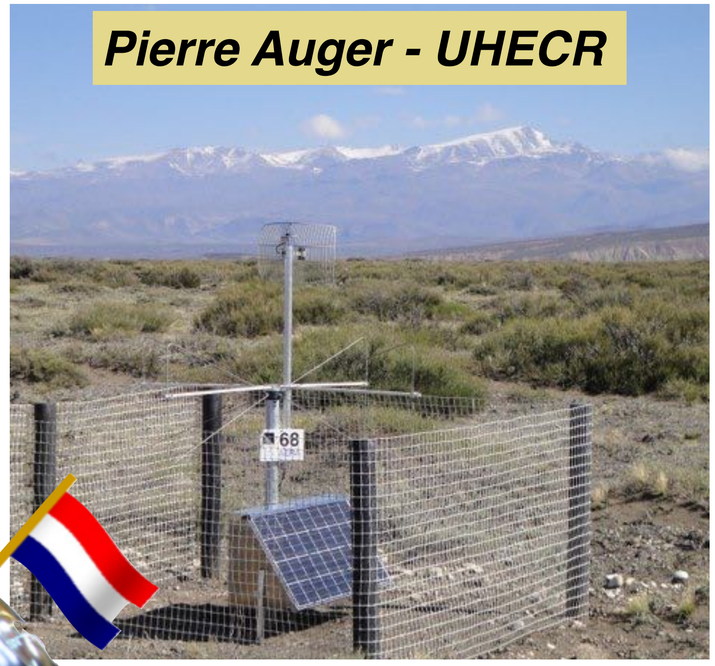


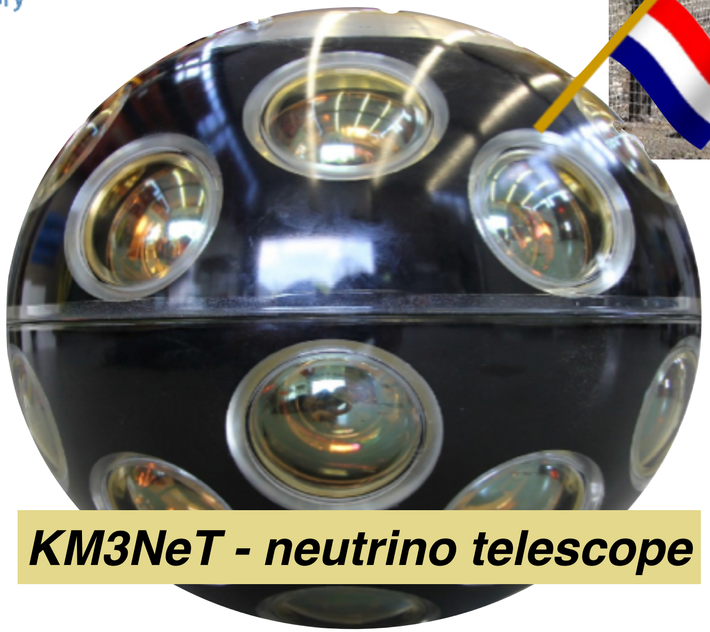
LHC roadmap, R&D view Martin van Beuzekom 26/8/2022 Ni

ASTROPARTICLE PORTFOLIO @ NIKHEF

- AMS-02 (Alpha Magnetic Sectrometer)
- ANTARES (Astronomy with a Neutrino Telescope and Abyss environmental RESearch)
- CTA (Cherenkov Telescope Array)
- ET (Einstein Telescope)
- GRAND (Giant Radio Array for Neutrino Detection)
- HiSPARC (High School Project on Astrophysics Research with Cosmics)
- LISA (Laser Interferometer Space Antenna)
- KM3NeT (KM^3 Neutrino Telescope)
- LOFAR (Low Frequency Array)
- LOPES (LOFAR Prototype Station)
- Pierre Auger Cosmic Ray Observatory
- VIRGO gravitational wave detector
- XENON dark matter experiment

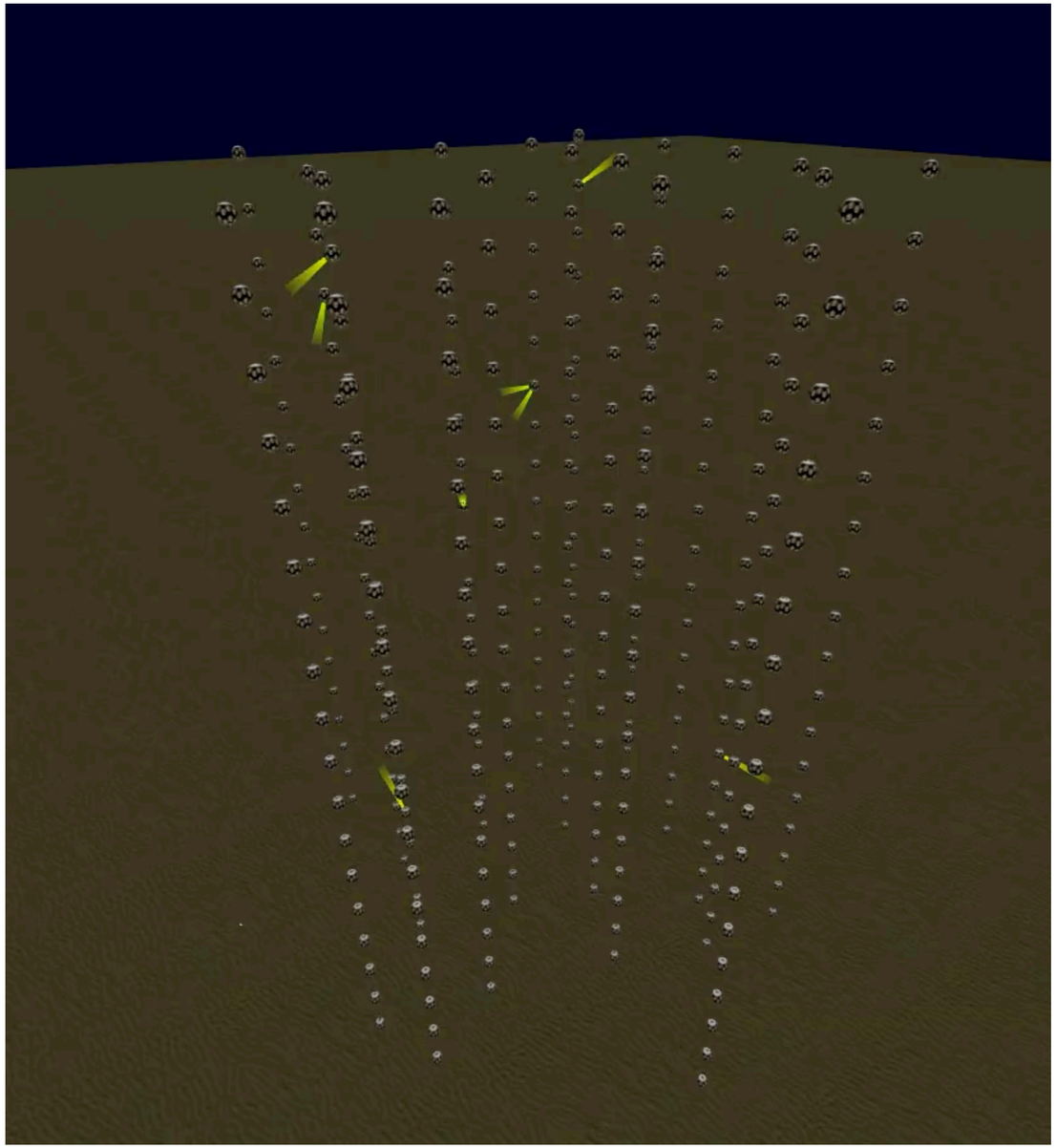
APP astronomy & PP





KM3NET

2018 production at RECFA visit

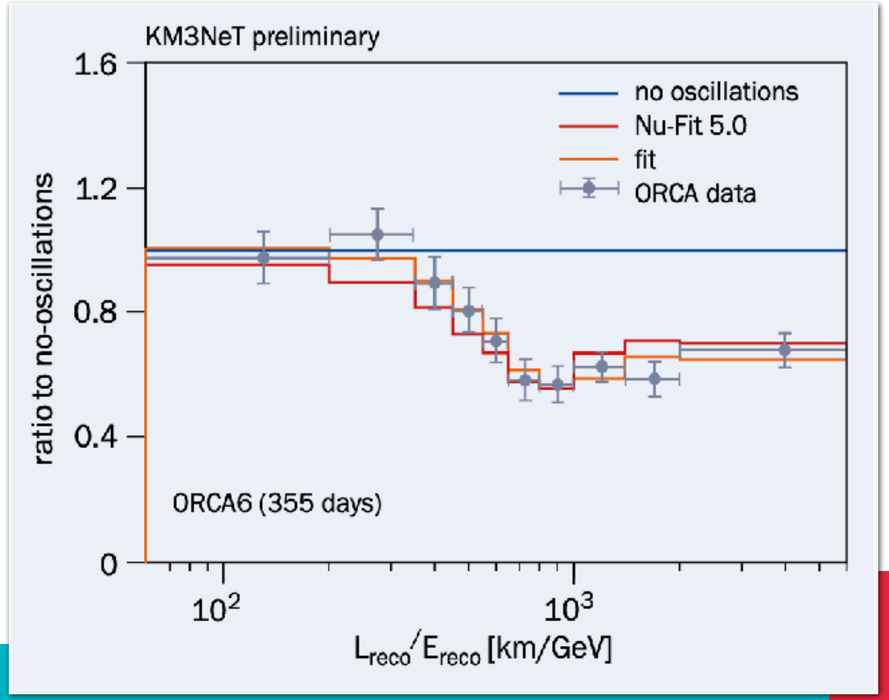


KM3NET DEPLOYMENTS

Collaboration with Italy, France and the Netherlands as the main drivers

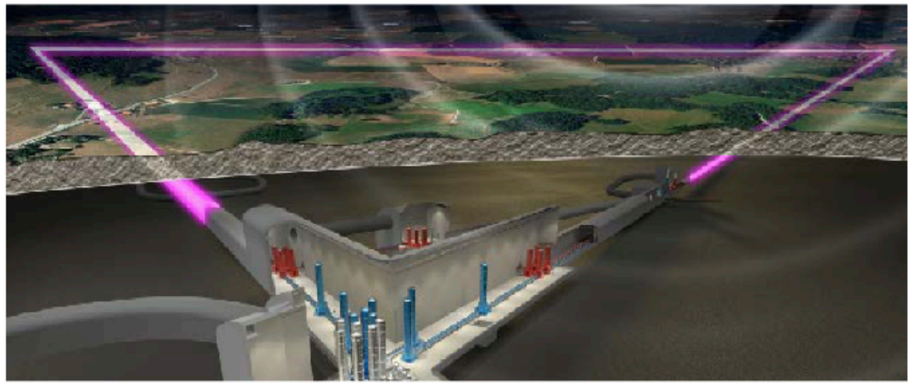
- ORCA11: start to see oscillations
- ARCA21: better pointing than IceCube

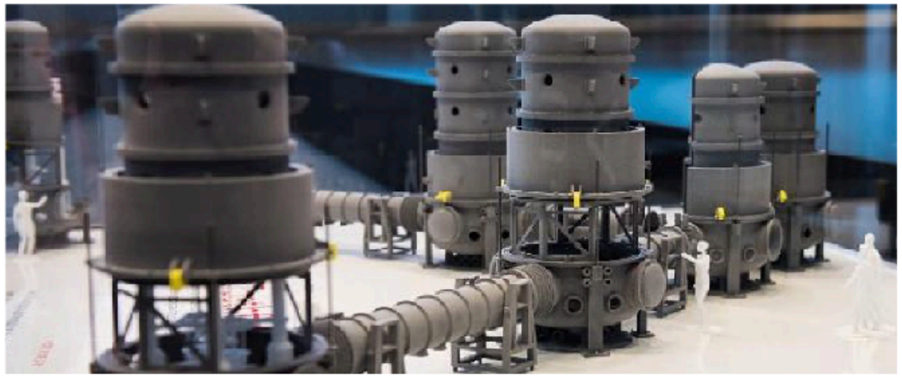
Join this beautiful experiment!



Growing number of strings, 18000 PMTs in the water!
Upward-going muon, energy estimation 62 GeV

Nikhef





GROUND BASED GW PROJECTS

Virgo:

- Currently being upgraded
  - Nikhef recently installed FDS system

Einstein Telescope:

- Plan for future observatory in Europe
  - Site selection foreseen ~2025

ETpathfinder:

- 10m scale prototype interferometer
  - Testbed for future GW technologies

VIRGO UPGRADE

01.01.2021: Nikhef full member of EGO

- European Gravitational Observatory
- Founding fathers France and Italy

Nikhef contributions for Advanced Virgo Plus

- Vibration isolation for the FDS (frequency dependent squeezer)
  - Two MultiSAS bench suspensions for optical telescopes
  - Two newly designed vacuum towers housing the suspensions
- 300m long Nikhef-designed vacuum pipe housing the cavity beam

ETPATHFINDER OVERVIEW

Testing ET technology

- Low-noise, full-interferometer

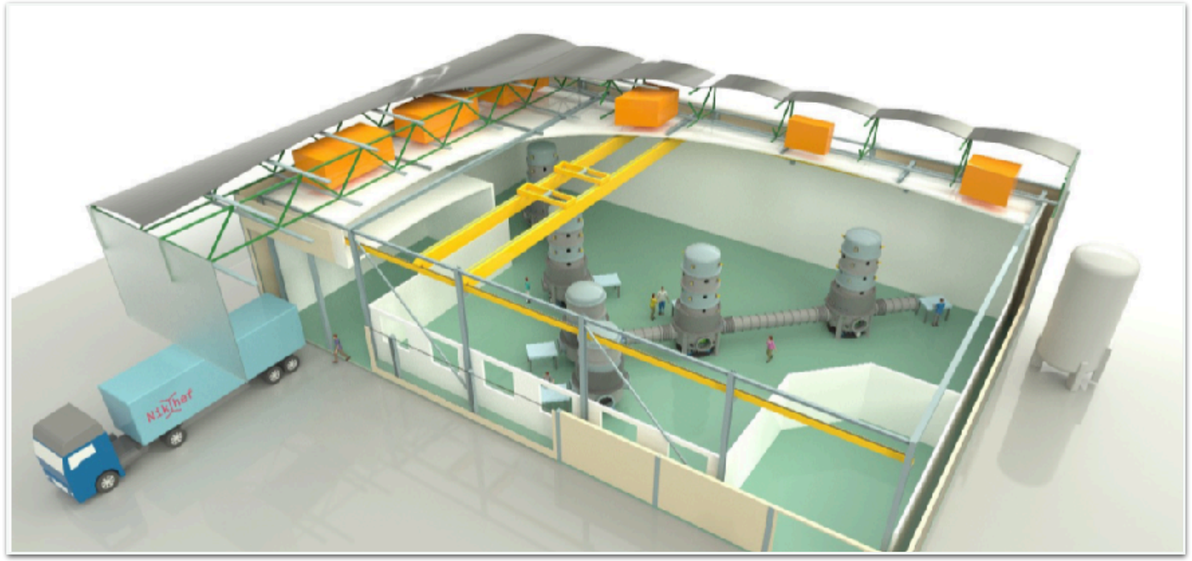
Key aspects:

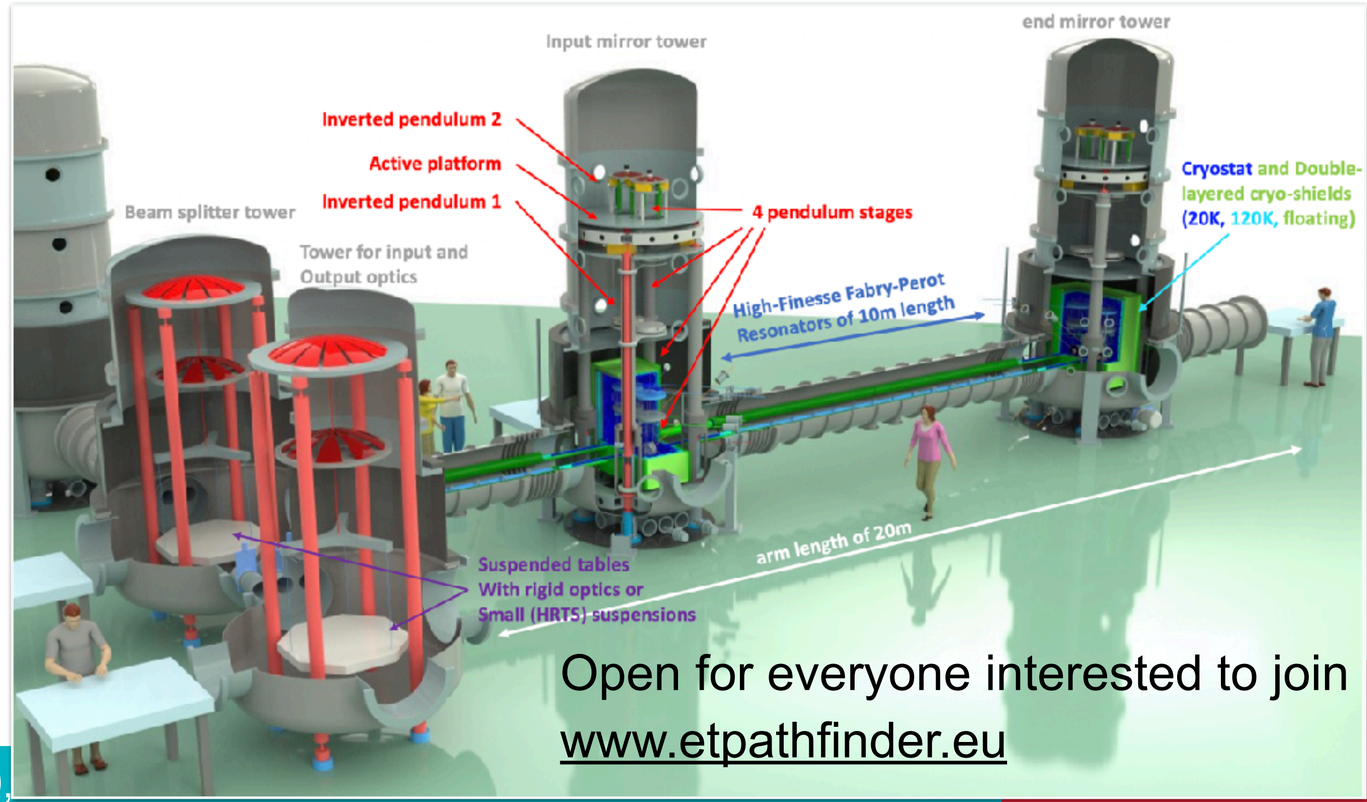
- Silicon mirrors
- Cryogenics (cryogenic liquids and sorption coolers, water/ice management),
- “New” wavelengths
- New coatings

Start with 2 FPMI,

- One initially at 120K and one 15K

Initial capital funding of 14.5 MEuro





Open for everyone interested to join

www.etpathfinder.eu

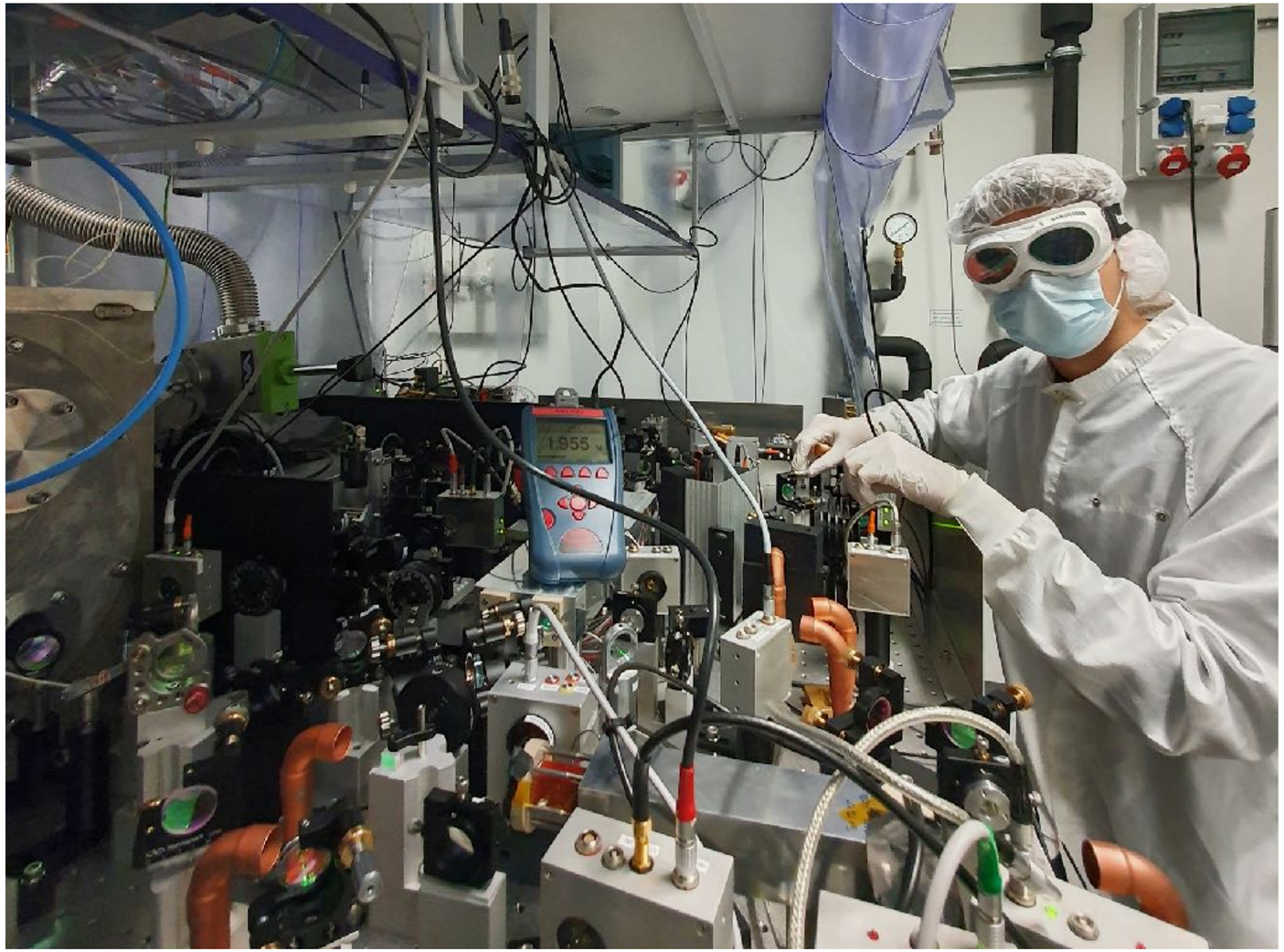

Ca. 1980s
FERAG

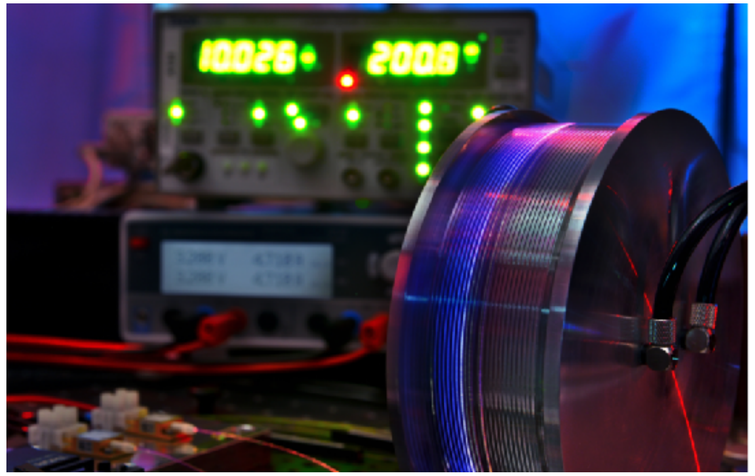

January 2020


ALTMANN - 2 x 2 to
Summer 2021


Now

R&D EXAMPLE: NEW LASERS AND QUANTUM TRICKS





RENOVATION

Includes a factor 1.5 enlargement of our computing/data centre

- PUE=1.3. Powered by 100% green electricity and reuses 40% of its waste heat for heating of student housing.

RECFA 2018 on renovation
Embrace the upgrade vision for the data center supporting particle physics and other research fields.

Nikhef

WE LOOK FORWARD TO WELCOME MANY OF YOU!