NU 2016

ASTRON Nikhef

NWO FOM

Ministerie van Onderwijs, Cultuur en Wetenschap

Nikhef: national institute

- Particle physics in the Netherlands coordinated by Nikhef:
  - partnership NWO/FOM and 5 Universities
  - close collaboration Leiden, Delft, Twente
- GRID computing
  - Nikhef/SARA as centre-of-excellence
- Dutch industry plays important role

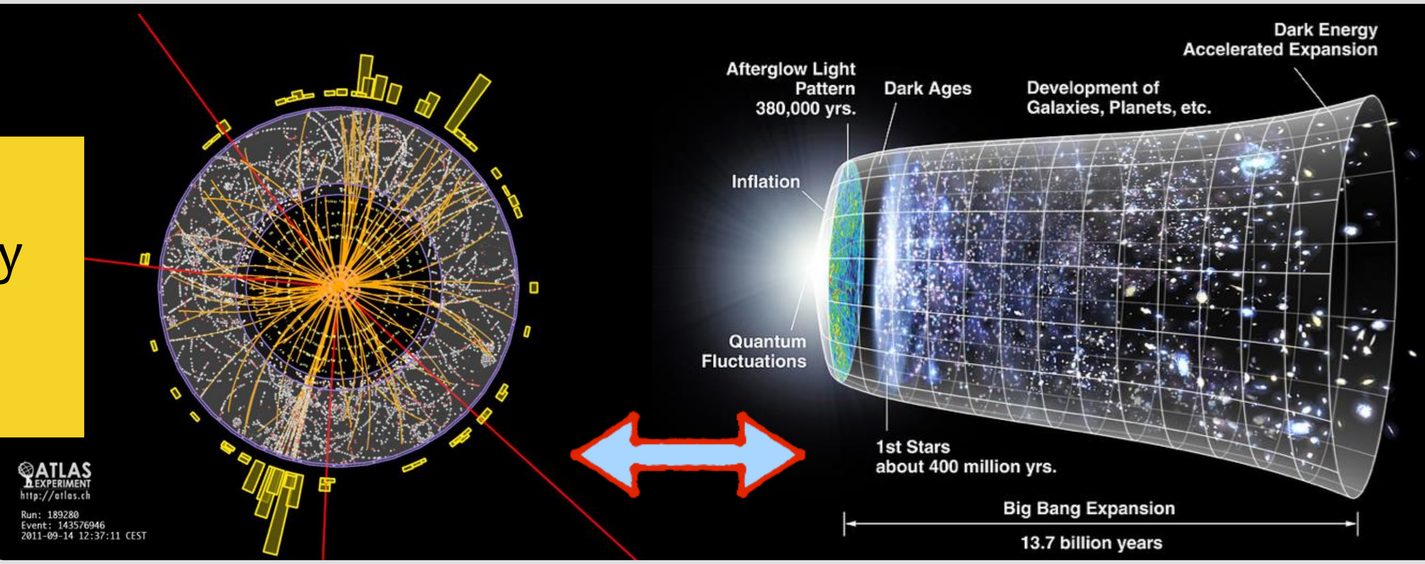
Pernament Staff	68
OIO+PD	125
Technical/engineer	75
Support	26

Science program Nikhef

Game change:

After the Higgs particle: What is beyond the Standard Model and how can we observe this?

LHC run-2 (2015+)
Full collision energy
Much larger beam intensities



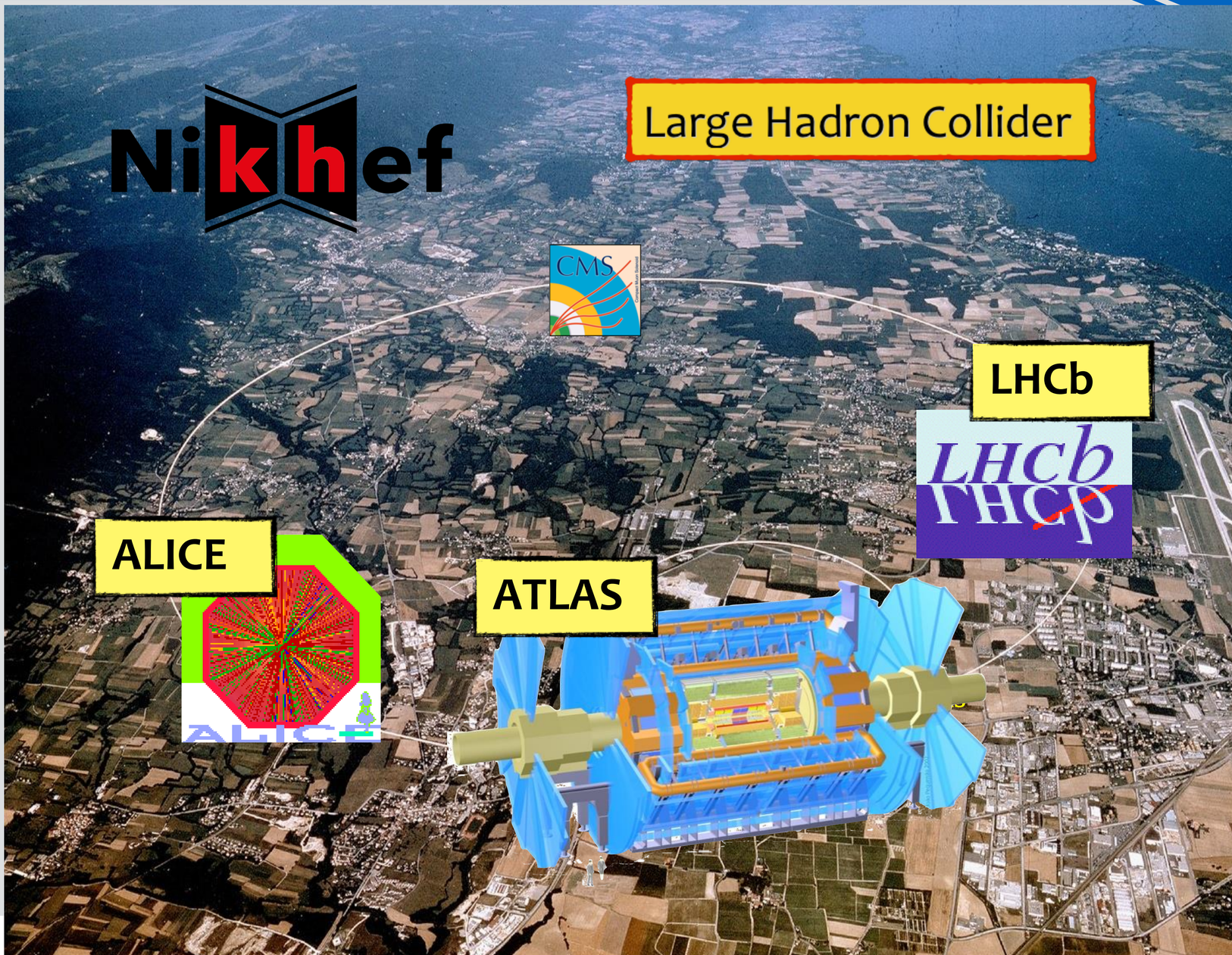
Observations in APP(2016+)
Gravitational Waves, Dark Matter, Neutrino telescope, Cosmic Rays

LHC experiments form ‘backbone’ of Nikhef

Astroparticle physics experiment is a central activity

Nikhef at LHC

- **ATLAS**
  - Higgs physics
  - New particles beyond the Standard Model
- **LHCb**
  - Rare decays
  - Matter-anti-matter differences
- **ALICE**
  - Plasm of quarks and gluons
  - Phase transitions



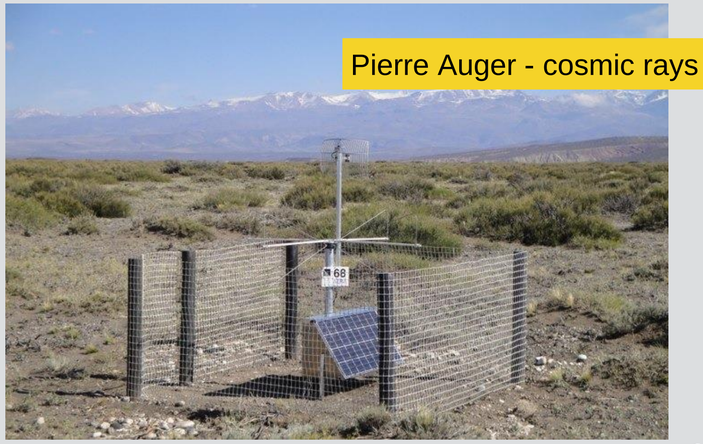
Nikhef astroparticle physics

- **KM3NeT**
  - Neutrino telescope
- **aVirgo/LIGO**
  - Observation gravitational waves
- **Xenon**
  - Search for Dark Matter
- **Auger**
  - Ultra high energetic cosmic rays

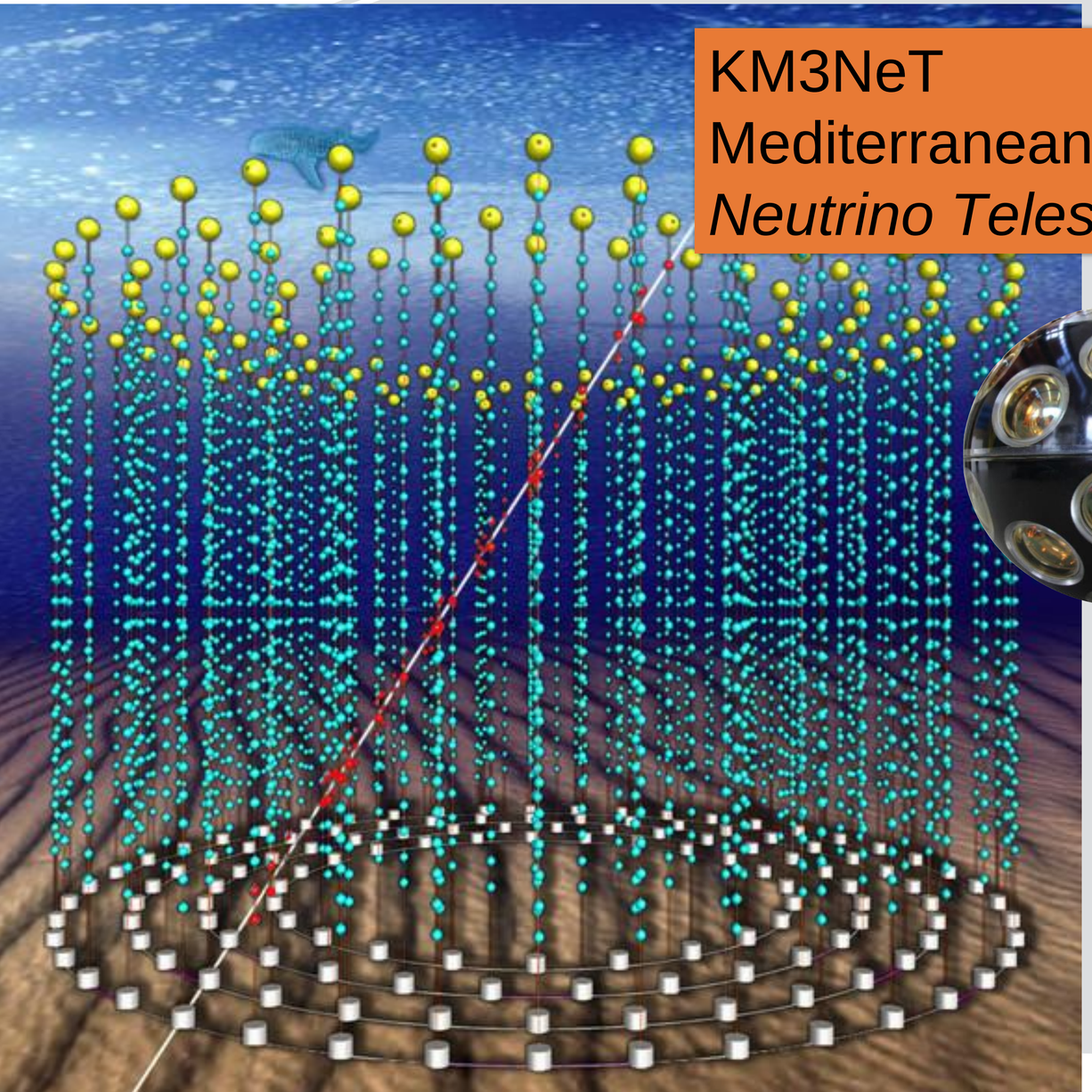

Adv VIRGO - Gravitational Waves


KM3NeT - neutrino detection

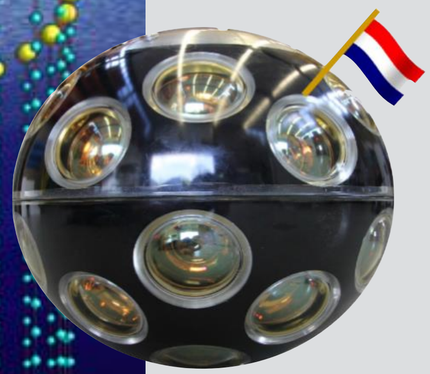

Xenon1T - Dark Matter

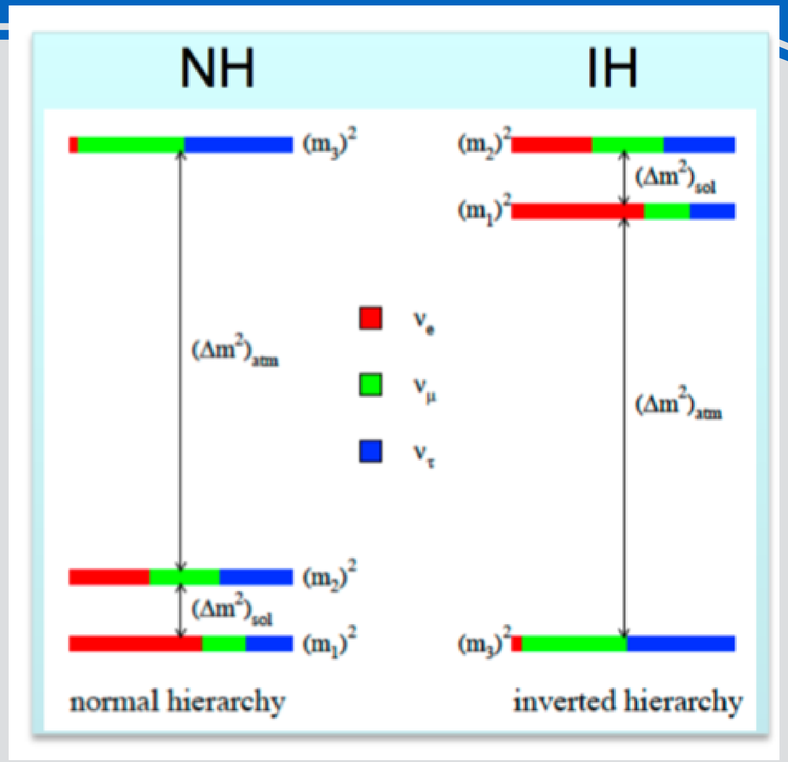

Pierre Auger - cosmic rays

Nikhef APP: KM3NeT



KM3NeT
Mediterranean sea
Neutrino Telescope





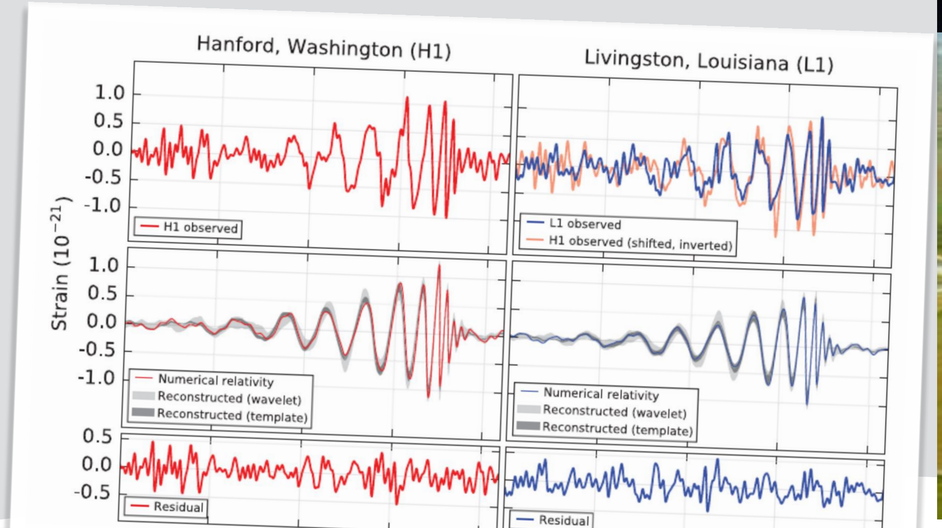
- Particle Physics (ORCA)
  - properties of neutrino's
- Astrophysics (ARCA)
  - neutrino point sources

Nikhef astroparticle physics

- Search for Dark Matter
  - Same particles as LHC may find?
  - XENON1T starts now!

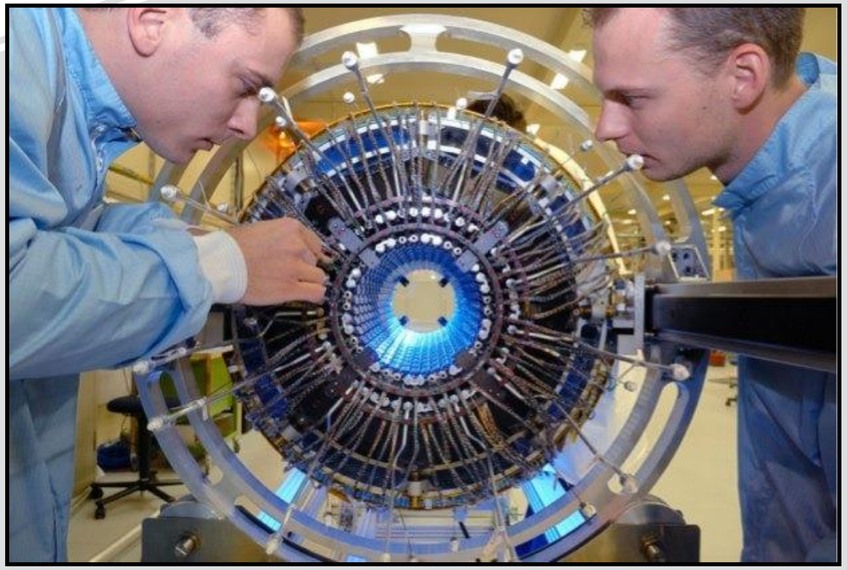
Gravitational waves: 11.02.2016

- Start new discipline
  - Einstein Telescope as potential next infrastructure (~2028)
    - Partnership Albert Einstein Institute
    - Interesting site @ Limburg



aVIRGO/LIGO
Cascina - PISA
Gravitational waves

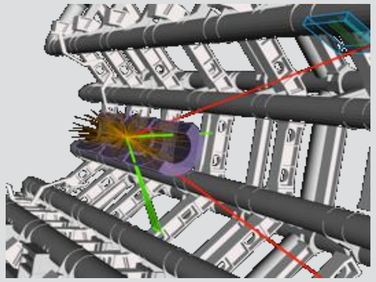
Construction@LHC

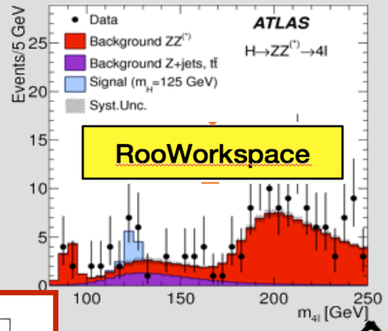


NIKHEF projects and industry

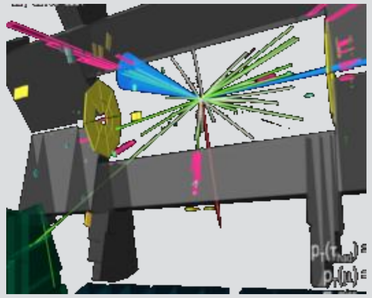
Science with Higgs et al.

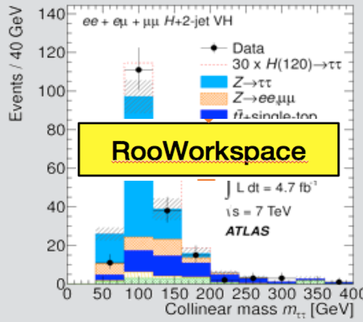
H→ZZ→llll



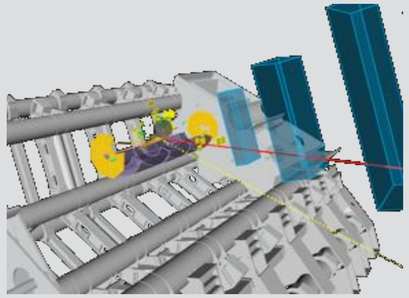


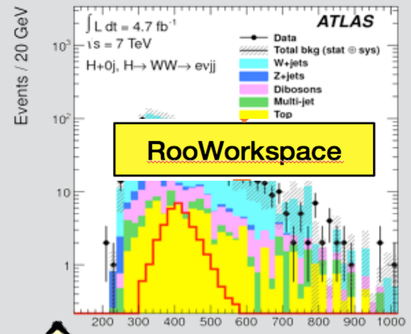
H→ττ



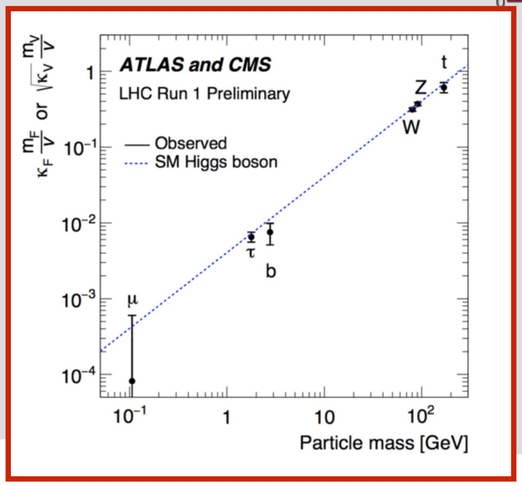


H→WW→μνjj





+...



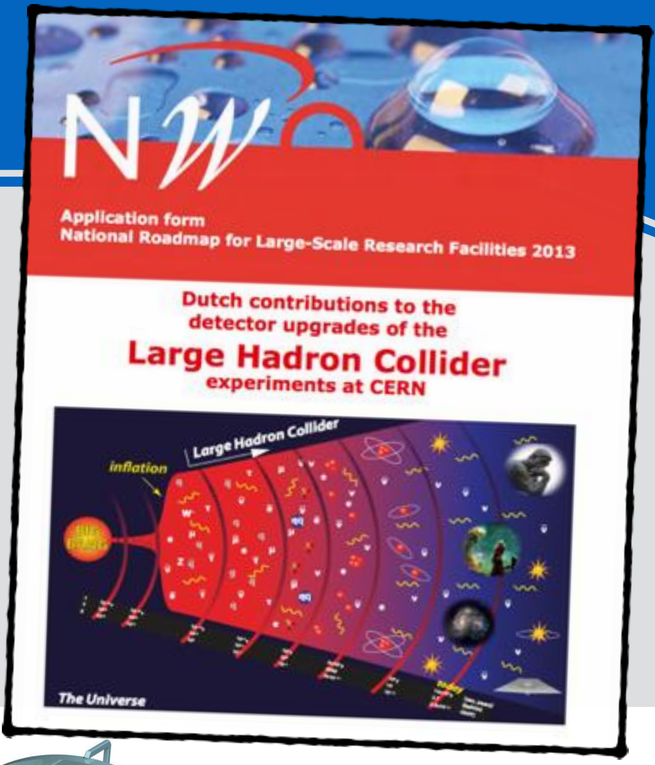
RooWorkspace

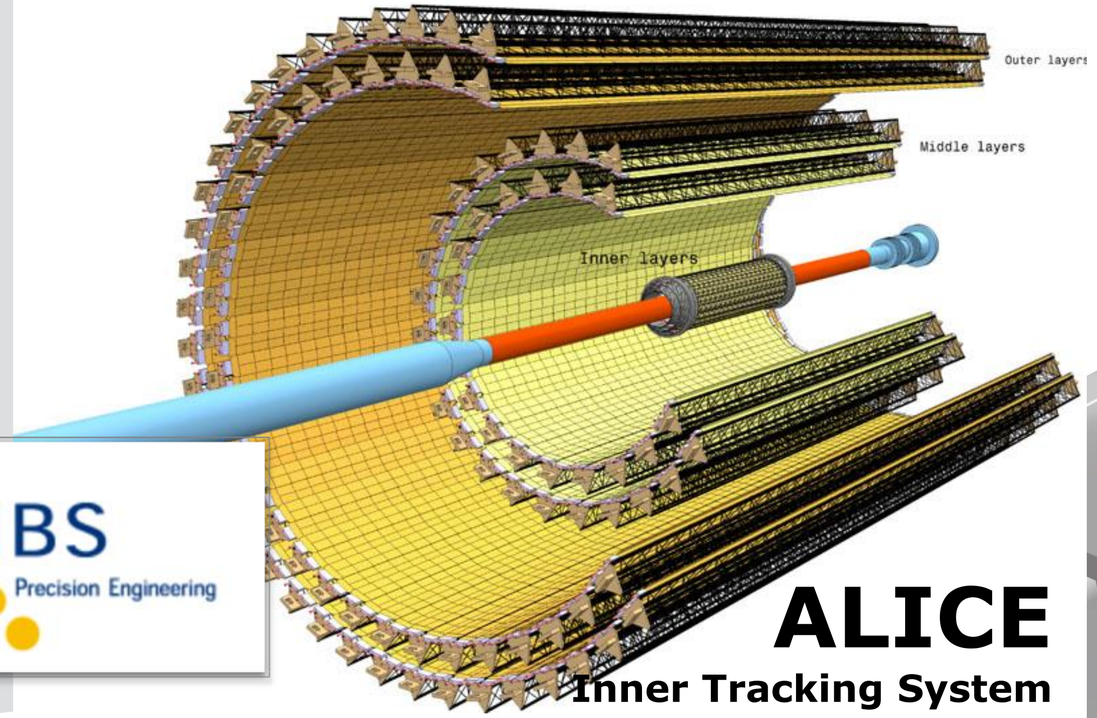
$$L(\mu,\vec{\theta}) = L_{H\to WW}(\mu_{WW},\vec{\theta})\cdot L_{H\to\gamma\gamma}(\mu_{\gamma\gamma},\vec{\theta})\cdot L_{H\to ZZ}(\mu_{ZZ},\vec{\theta})\cdot\ldots$$

Detector upgrade LS2

- Dutch National roadmap ~15.4 M€
  - Upgrade LHC detectors
  - Computing infrastructure

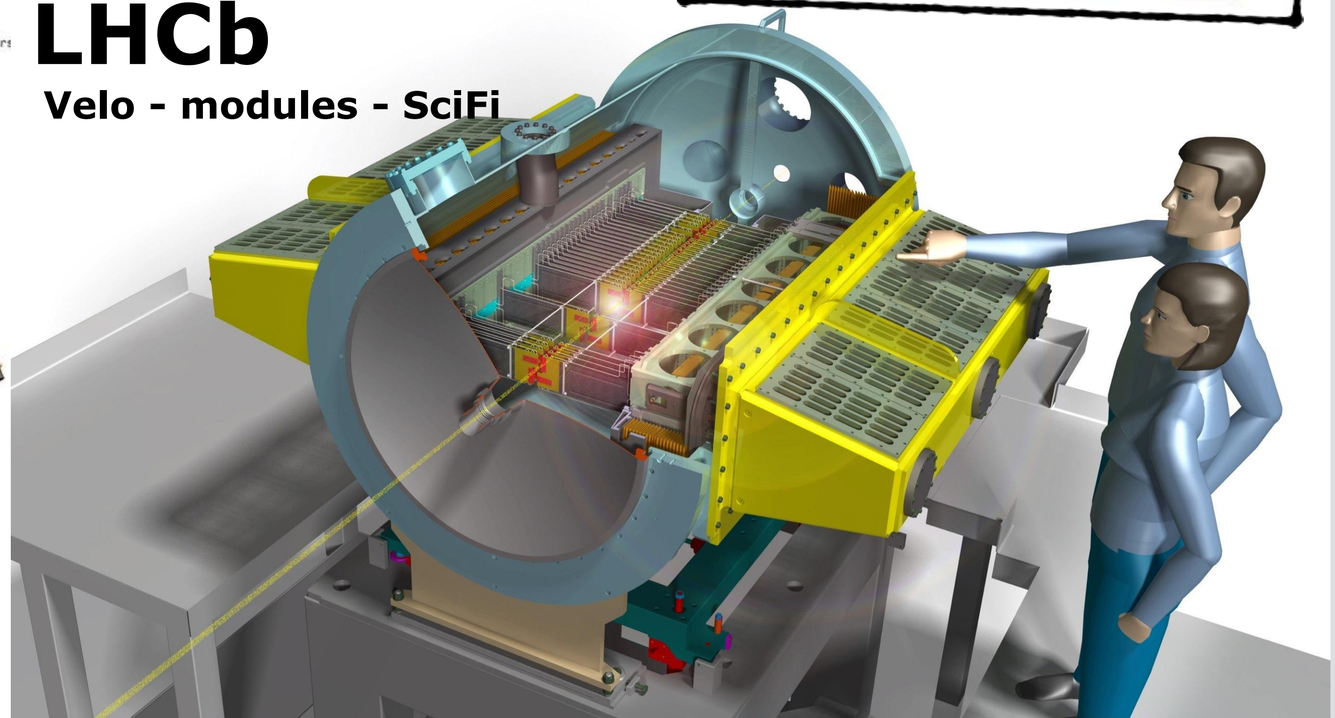
ATLAS:	5.2 M€
LHCb	4.0 M€
ALICE	2.3 M€
NL/Tier1	3.74 M€





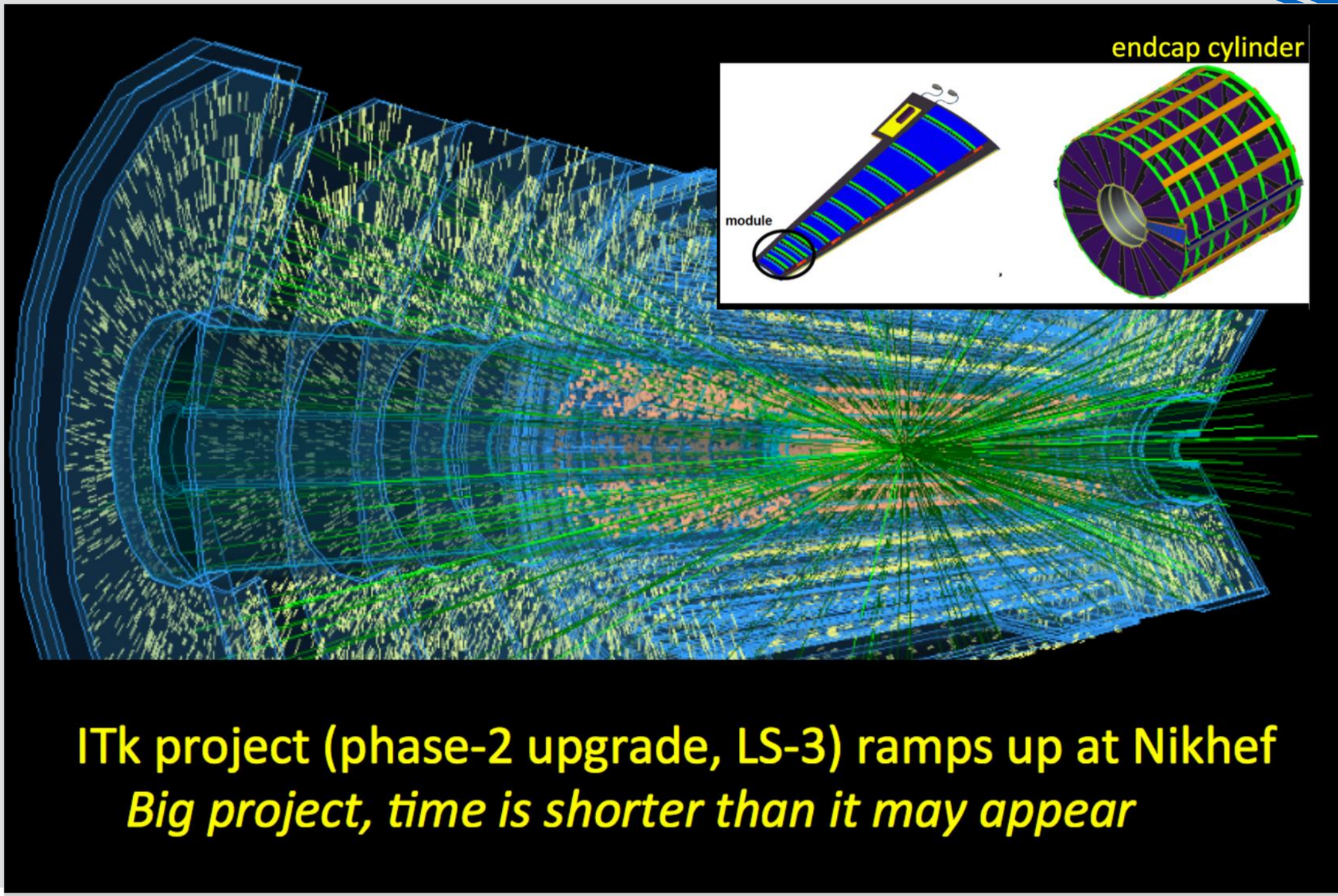
ALICE
Inner Tracking System

LHCb
Velo - modules - SciFi

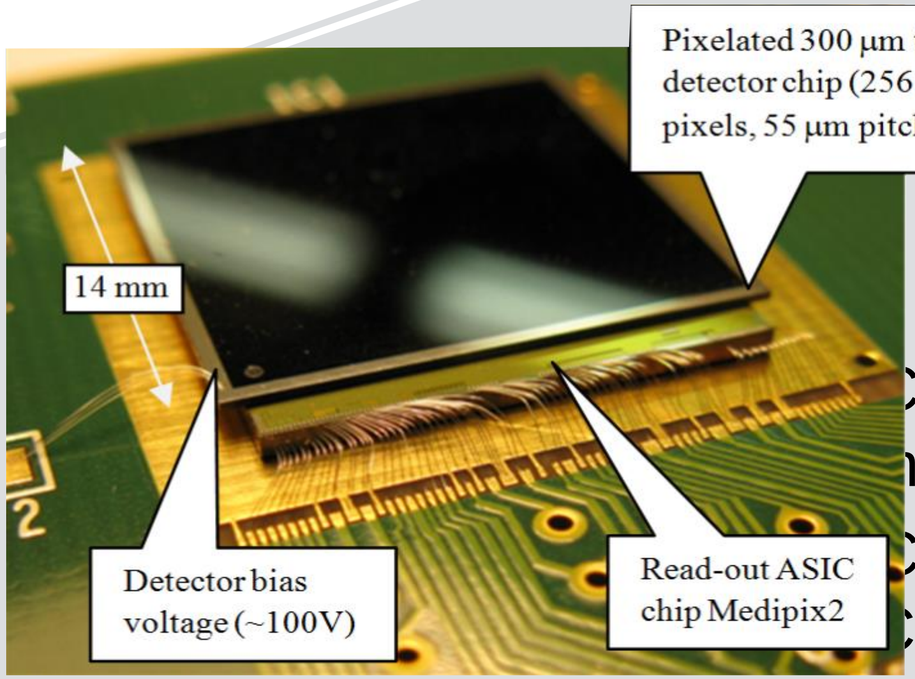


ATLAS Inner Tracker plans 2024

- HL-LHC: replace inner trackers
  - Typically ten times higher beam intensity
    - Produce 140 collisions each bunches crossing
- Assembly ITk endcap at Nikhef

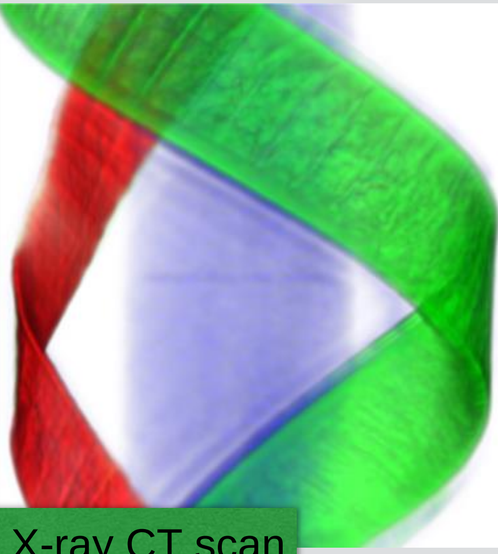


Medipix and applications

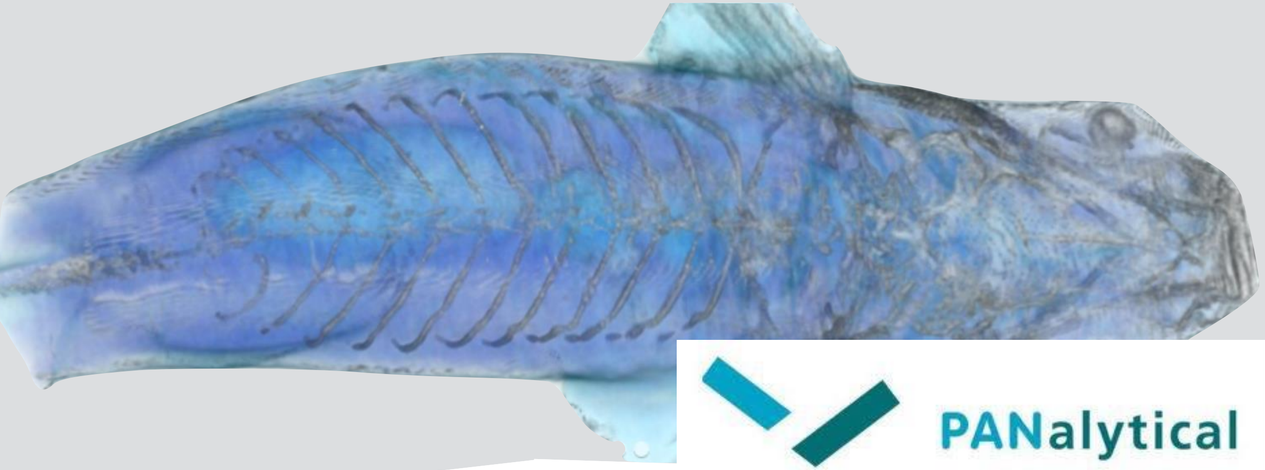


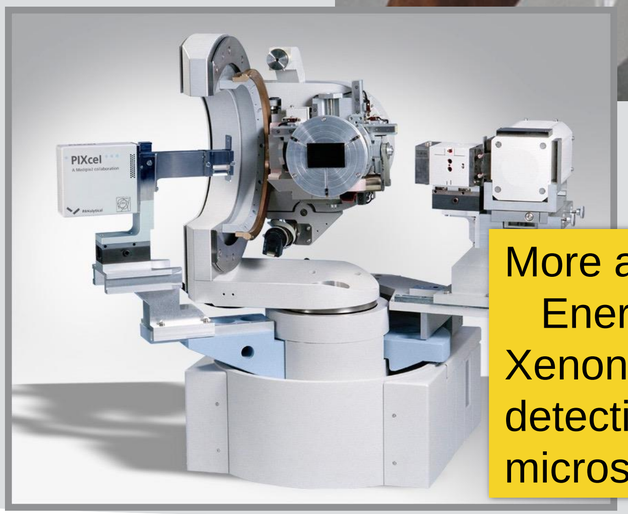
Camera Image based on individual particles

Collaboration with CERN



Color X-ray CT scan





More and more applications
Energy dispersive X-ray, Xenon TPC, polarised X-ray detection, proton radiography, electron microscopy, molecular histology,...

Industry parterships

Pilot project Tata Steel:
Tomography using Cosmic muons
Density profile steel ovens

Proof of concept award
dr Mark Bleeker
Innoseis

FOM valorization prize
prof Jo van den Brand
Gravitational Wave research

INNOSEIS

TremorNet
Dramatically reduce land seismic acquisition costs with the industry's lightest sensing system

National Research Agenda

nationale wetenschaps agenda

- NWA route 4+5 theme “curiosity driven”
  - Science and life - enabling technologies - education
- Inspiring meetings
  - Connect academia, HBO, industry
- Game changer:
  - Einstein telescope

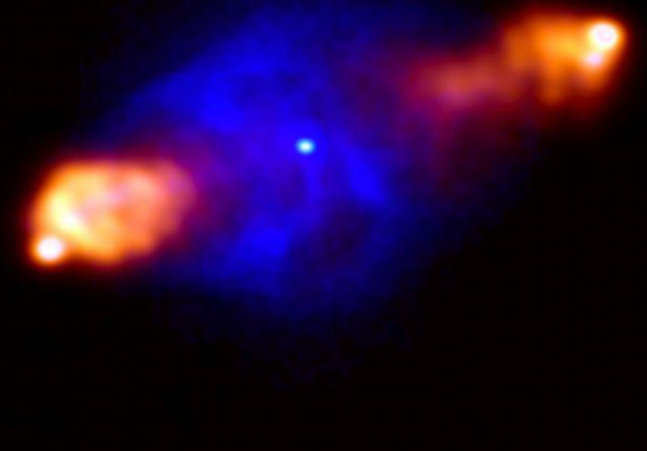
BOUWSTENEN VAN MATERIE EN FUNDAMENTEN VAN RUIMTE EN TIJD

ASTRON Netherlands Institute for Radio Astronomy

The Connecting Strength of Big Science Projects

nU 2016

Dr. Marco de Vos – ASTRON Managing Director
(devos@astron.nl)

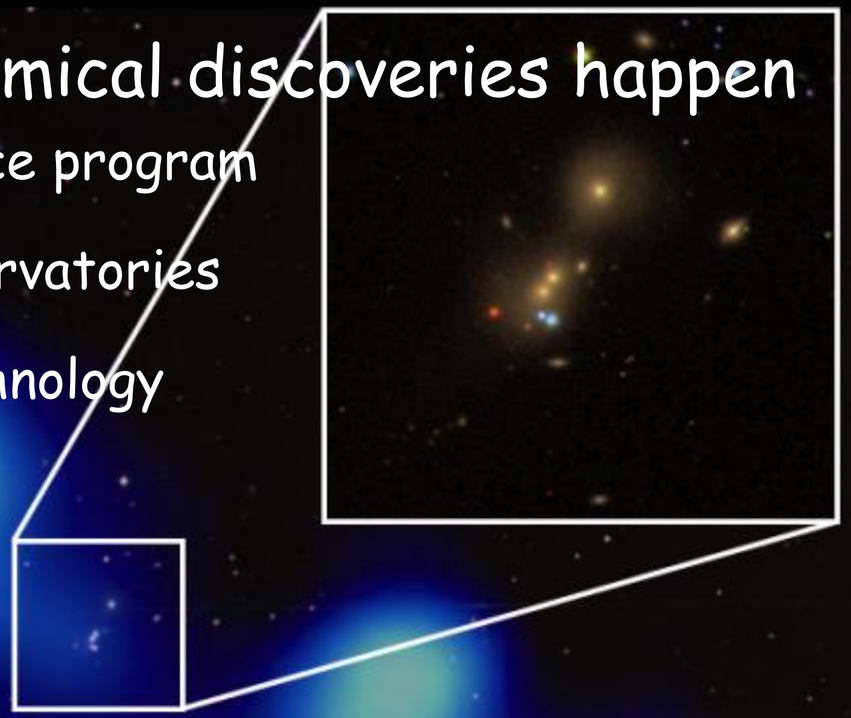


Making radio-astronomical discoveries happen

- Fundamental science program

- World-class observatories

- Innovative technology



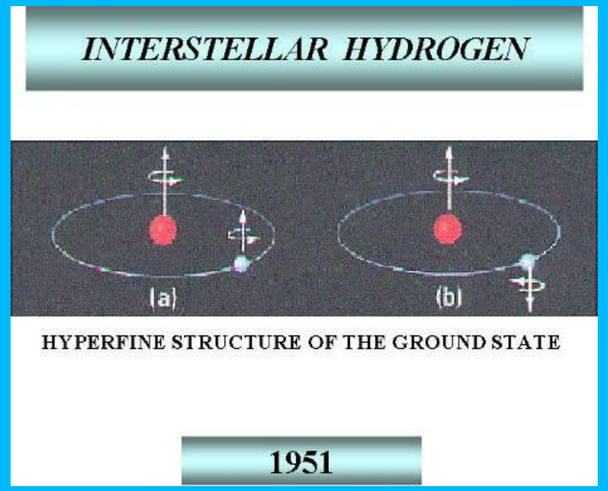
Making innovation happen through Astronomy

Implement mission such that relevance for
society and economic impact are maximized

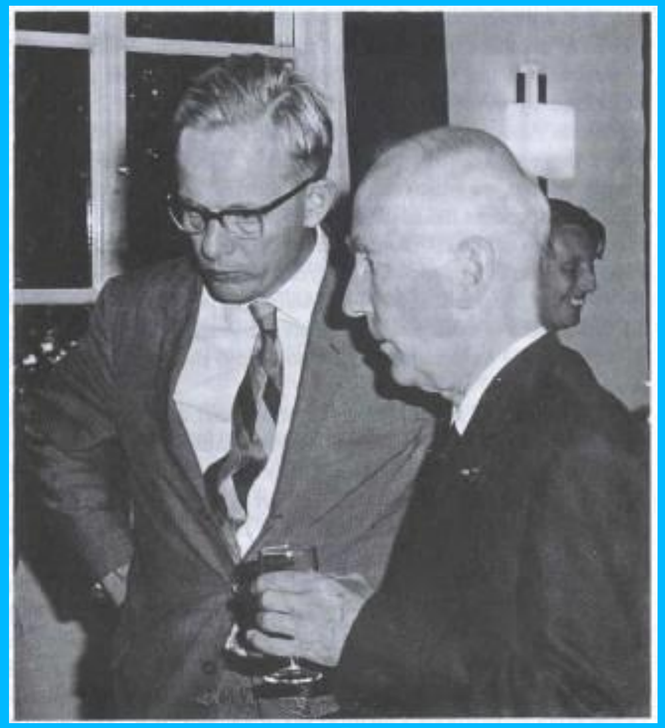
Institute of the Netherlands Organisation for Scientific Research (NWO)

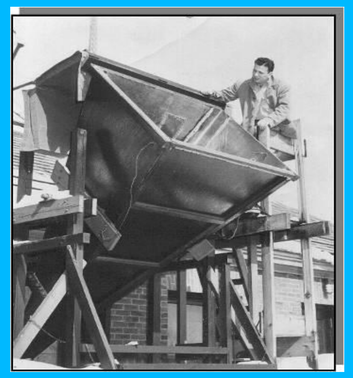
160 FTE

17M€ yearly turnover
9M€ base funding from NWO
8M€ obtained in competition


INTERSTELLAR HYDROGEN
(a)
(b)
HYPERFINE STRUCTURE OF THE GROUND STATE
1951

1944





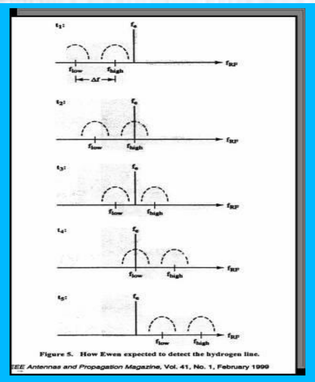
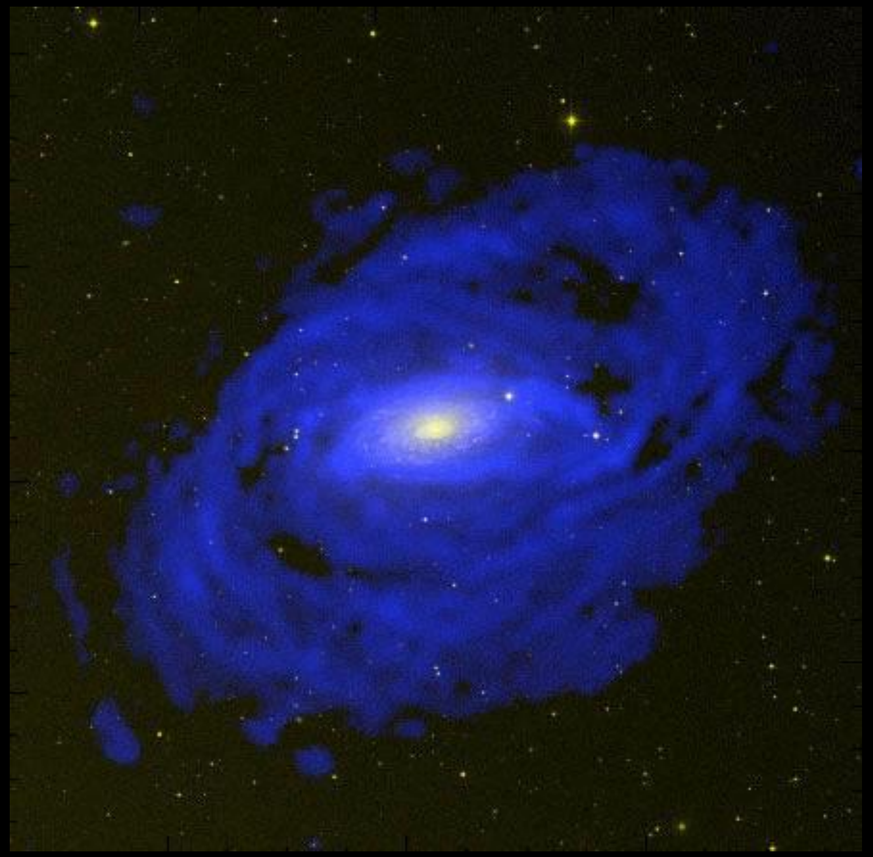


Figure 5. How E-was expected to detect the hydrogen line.
IEEE Antennas and Propagation Magazine, Vol. 41, No. 1, February 1999

1951

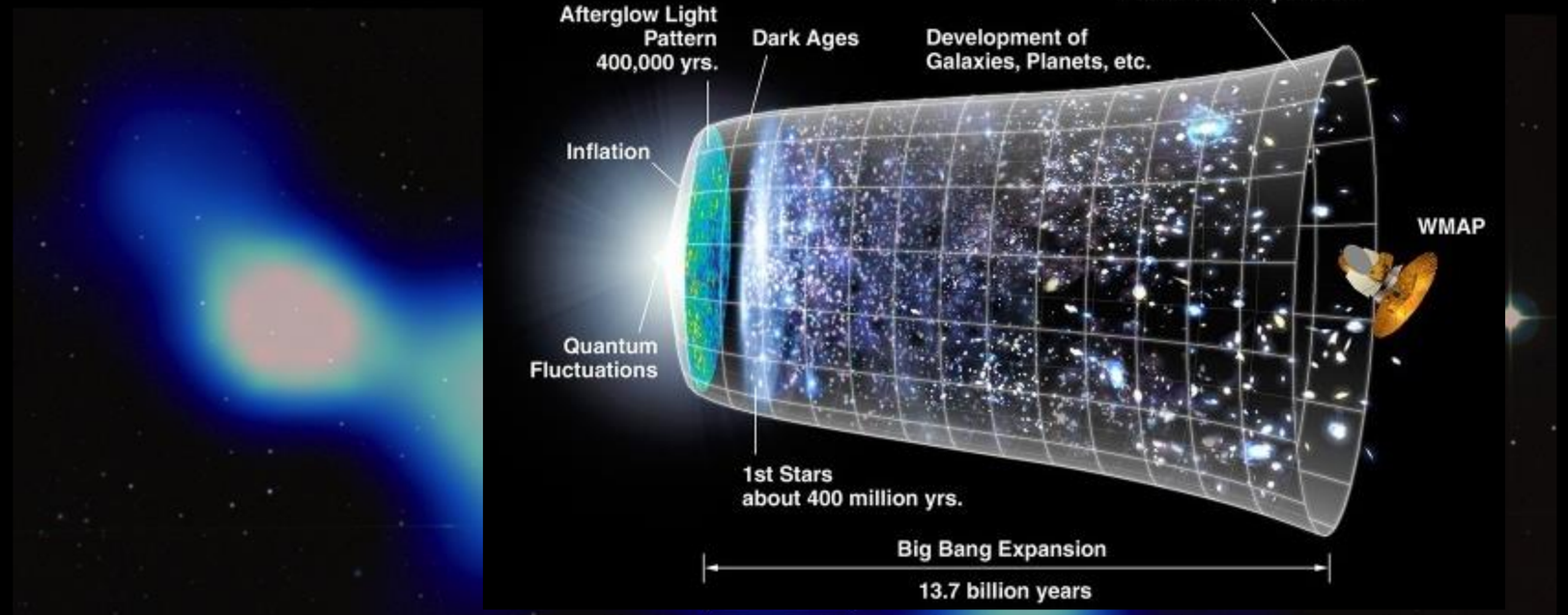

1956



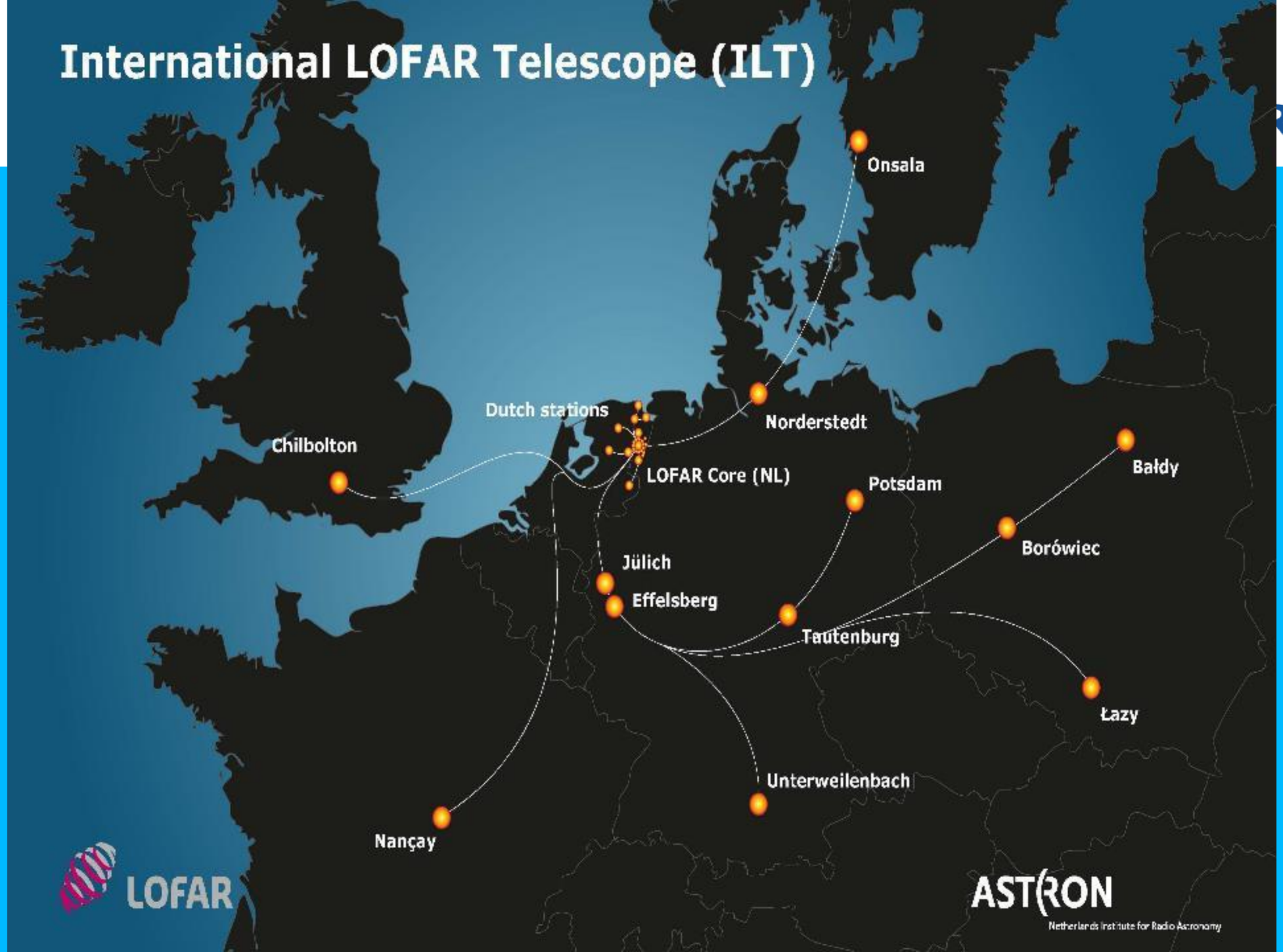

1970

JIVE
Joint Institute for VLBI ERIC

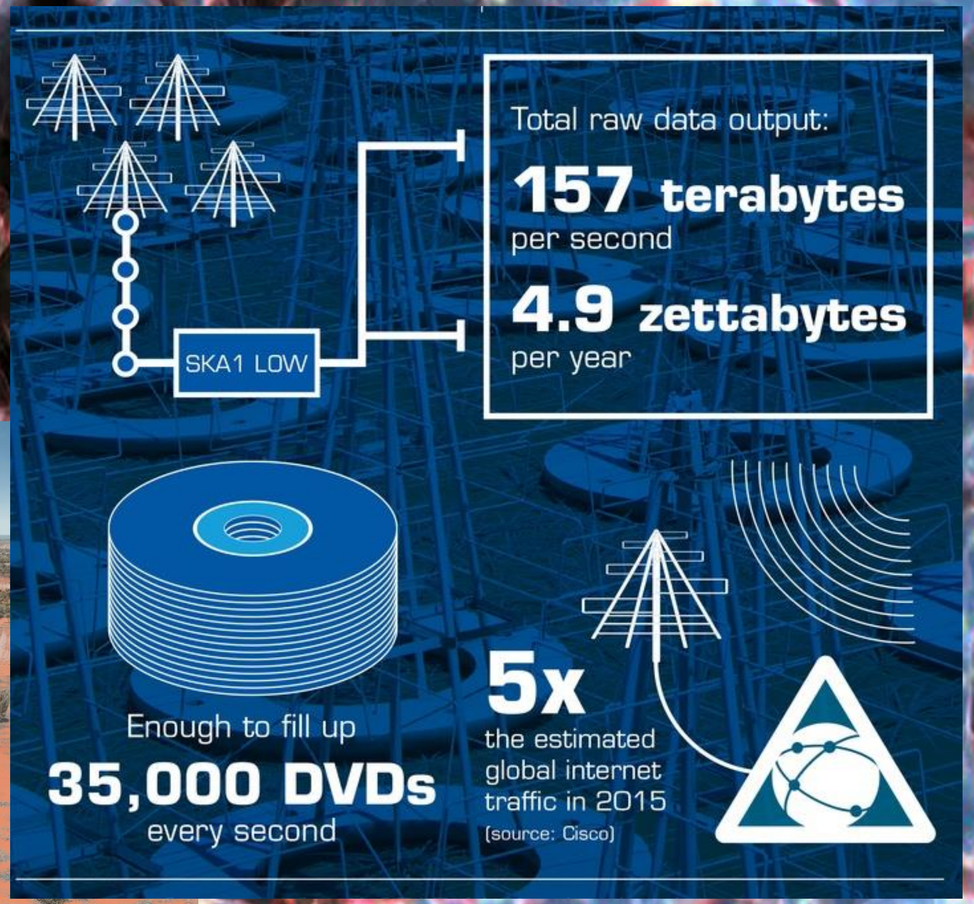
RON



Giant Radio Galaxy in UGC9555,
George Heald *et al*, ASTRON., 2013


International LOFAR Telescope (ILT)
Onsala
Dutch stations
Norderstedt
Chilbolton
LOFAR Core (NL)
Potsdam
Bałdy
Borówiec
Jülich
Effelsberg
Tautenburg
Łazy
Unterweilenbach
Nançay
LOFAR
ASTRON
Netherlands Institute for Radio Astronomy


2020


SKA1 LOW
Total raw data output:
157 terabytes
per second
4.9 zettabytes
per year
Enough to fill up
35,000 DVDs
every second
5x
the estimated
global internet
traffic in 2015
(source: Cisco)

'Data niet meer naar computer, maar computer naar de data'

DVHN | Gepubliceerd op 20 november 2015, 07:00
Laatst bijgewerkt op 19 november 2015, 20:35

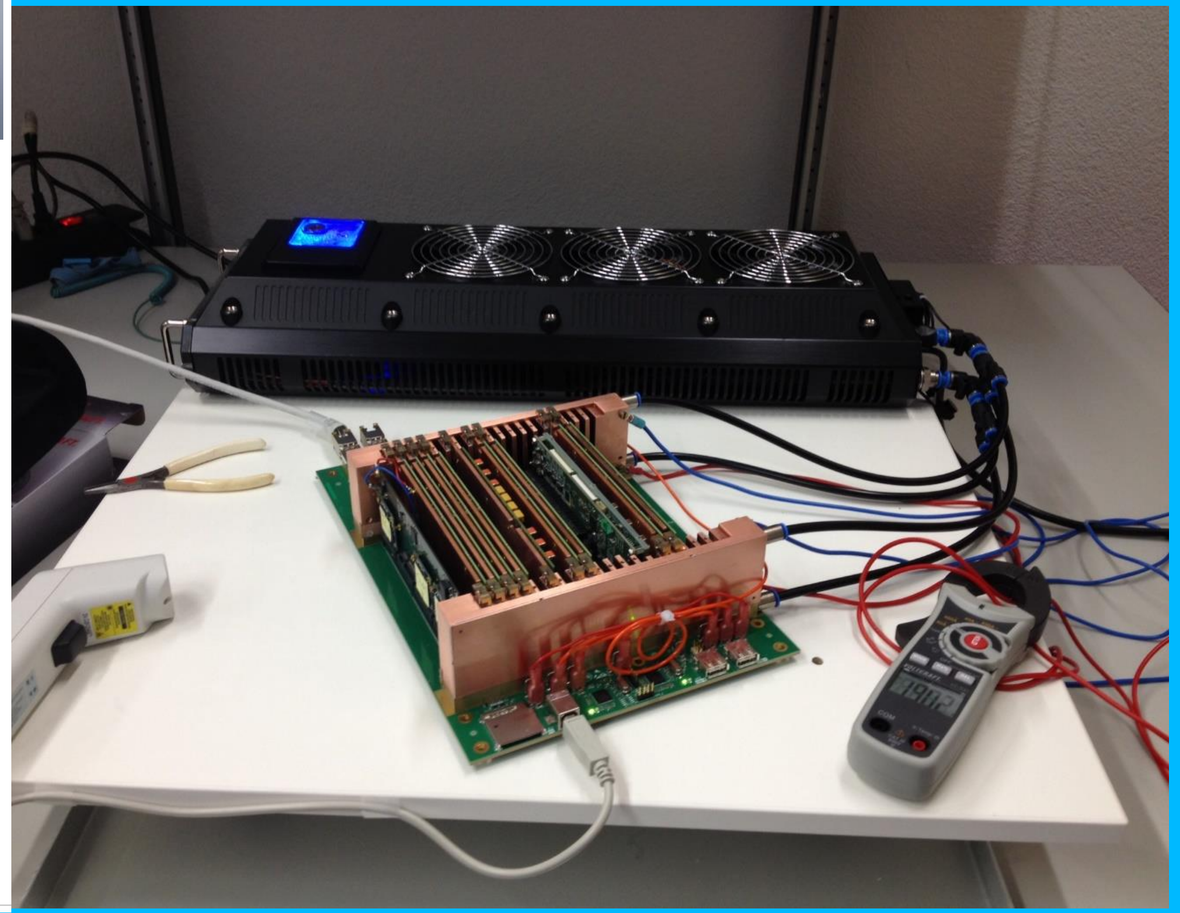
DWINGELOO - De nieuwe microserver van ASTRON en IBM plaveit de weg naar een toekomst waarin zowel dataverkeer als gebruik van sensors explosief zal groeien. Dat denkt Gert Kruithof van ASTRON.

Kruithof voerde donderdag het woord toen bij sterrenkundig instituut ASTRON in Dwingeloo de microserver officieel werd gepresenteerd. Het nieuwe type server is vier tot tien keer kleiner dan de tot nog toe gangbare servers. Bovendien gebruikt het apparaat, onder meer dankzij de koeling door water in plaats van lucht, veel minder energie. Kruithof voorspelde ook dat dankzij de microserver de verwerking van dataverkeer een ander karakter zal krijgen: ,,Nu worden data over het algemeen verzameld en verwerkt op een centraal punt. Door de snelle toename van big data redden we dat over afzienbare tijd niet meer. Dan zullen computers richting de data moeten. Veel kleinere servers, zoals deze, maken dat mogelijk." Volgens Marco de Vos van ASTRON kan de microserver makkelijk voor honderden nieuwe banen in Noord-Nederland zorgen.

De Drentse gedeputeerde Henk Brink reikte drie eerste exemplaren van de microserver uit aan mensen van respectievelijk Philips Drachten, Sensor City Assen en de Technische Universiteit Eindhoven. ,,Bluetooth is ooit in Emmen ontwikkeld maar wie weet dat nog? Het lijkt de provincie uit de vingers geglipt. Laat dat nu niet weer gebeuren!", sprak Brink.

Sensor City zet de microserver in op het TT-circuit om grote hoeveelheden meetgegevens, bijvoorbeeld over CO2-uitstoot, meteen te kunnen analyseren. Jan Post van Philips legde uit dat de microserver het in Drachten mogelijk moet maken om vlotter nieuwe scheerapparaten in productie te nemen: ,,De server staat veel hogere rekensnelheden toe. Dat maakt onze robots flexibeler."

ASTRON & IBM
Center for Exascale Technology



RON

HIGH TECH SYSTEMS & MATERIALS

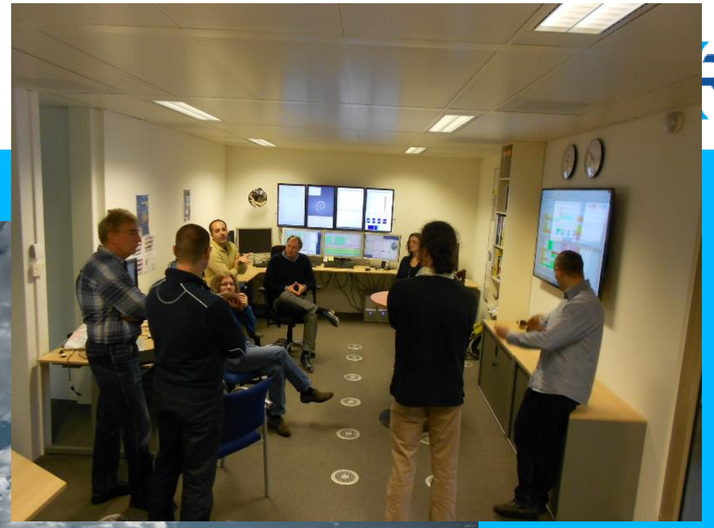
NORTHERN NETHERLANDS

ERCET™

European Research Centre for Exascale Technology

NORTH EAST NETHERLANDS REGION OF

SMARTFACTORIES




ASTRON
Closed Prototype