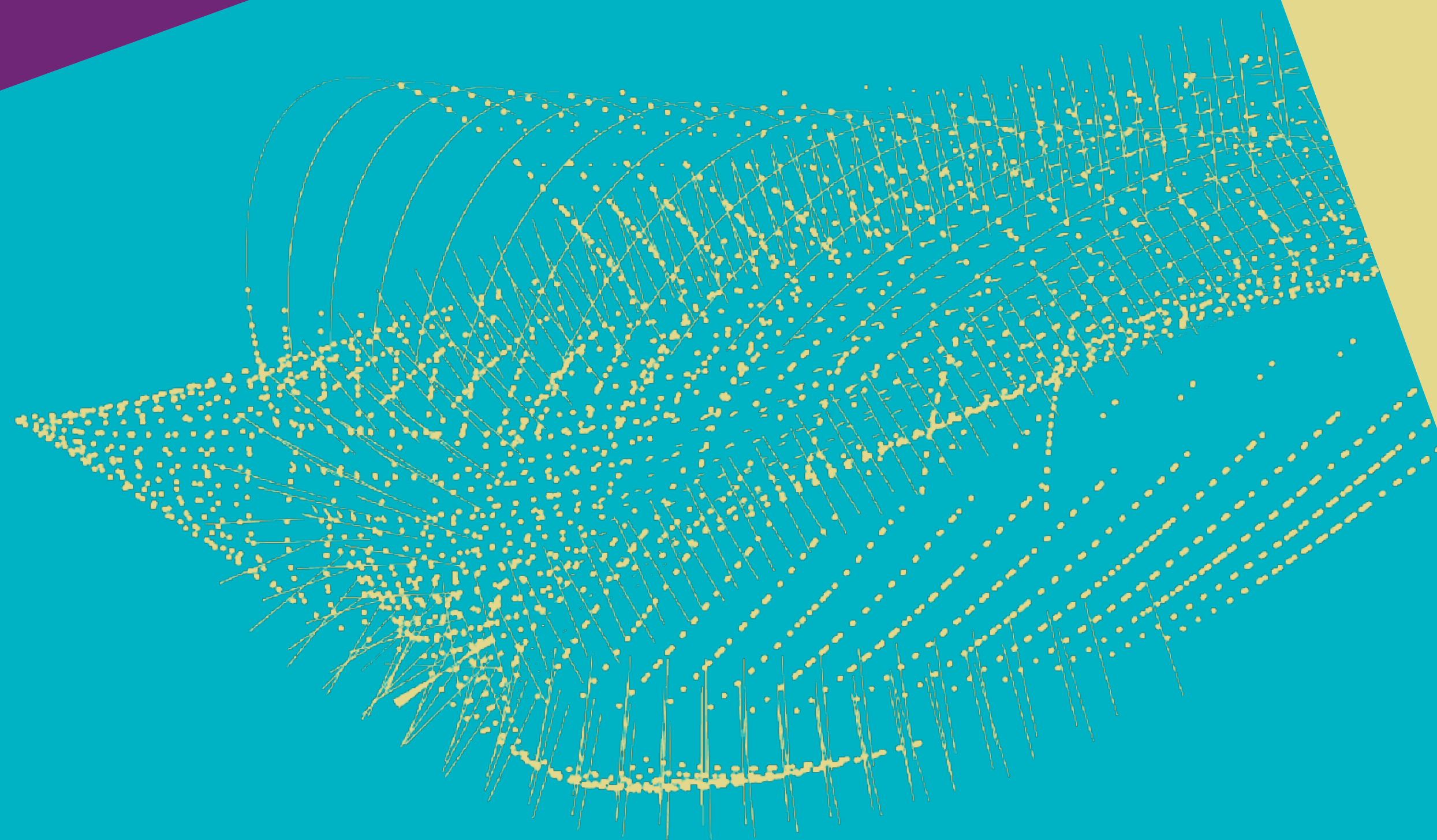


STAFF MEETING 06/09/2018

# ESPP-NL INPUT: SUMMARY OF VISTA25 OUTCOME

S. Bentvelsen, P. Ferrari, M.  
Merk



# INPUT FOR EUROPEAN STRATEGY FOR PARTICLE PHYSICS UPDATE (ESPPU)

## Provisionary meeting plan:

- Thursday September 6th
  - Nikhef staff meeting with presentations of Pamela and Stan to start the process.
  - Create working groups.
  - Target: awareness and stimulate discussions*
- Friday September 28
  - General meeting at Z011 with all staff, postdocs and PhD students invited.
  - Target: Identify all topics we like to address, draft text available*
- Wednesday October 10
  - Collection of all input – by OPL
  - Target: Next iteration of text – summary of
- Friday October 19
  - RECFA visit – first draft ESPPU-NL available
- Friday November 9
  - Target: Final text EPSS-NL discuss with staff

# WORKING GROUPS

- As presented by Stan, we are summarizing the VISTA25 outcome. What we present is based on what written in the Nikhef Strategy 2017-2022 document.
- The topics are grouped in categories that correspond to the working groups, that should give statements as input for the final recommendations from the Netherlands, starting from the VISTA25 output that I will summarize in the following.
- Some additional points, not contained in strategy document, are listed and have to be considered as invitation for group discussion.
- The role of the working groups and the procedure will be discussed in detail by Stan

# WORKING GROUPS

- CERN world leading laboratory of fundamental research:
  - HL-LHC, R&D, Theory, data processing
- Energy Frontier:
  - Fcc-pp, HE-LHC, SppC, muon collider
- Precision Frontier:
  - Fcc-ee, CEPC, ILC, CLIC, EDM, g-2
- Quark and lepton flavor and plasma:
  - LHCb II upgrade, Belle II, MEG II, MU2e, g-2, NA62, KOTO, Heavy Ion, DUNE, SHIP
- Multi-messenger universe:
  - KM3Net, VIRGO, LIGO, EINSTEIN TELESCOPE, AugerPrime upgrade, Xenon1T/nT, DARWIN



# CERN WORLD LEADING LABORATORY OF FUNDAMENTAL RESEARCH

## ATLAS

- Measure couplings and CP-properties of the Higgs particle, study Higgs production in exotic regimes, develop unified interpretation of Higgs measurements.
- Search for beyond-the-Standard-Model (BSM) physics: supersymmetry and lepton flavour violation
- Study interactions of the top quark.
- Upgrade DAQ system with Felix in LS2, construct an ITk strip detector end-cap to be ready for installation in LS3

## LHCb

- Study CP violation in B decays, test the CKM paradigm
- Search for rare decays, in particular  $B_d \rightarrow \mu^+\mu^-$  and  $B_s \rightarrow \mu^+\mu^-$
- Search for long lived particles
- Perform lepton non-universality and lepton flavor violation tests
- Contribute to detector upgrades for LS2: VELO pixel detector, Scintillating Fiber Tracker, High Level Trigger

# CERN WORLD LEADING LABORATORY OF FUNDAMENTAL RESEARCH

## ALICE

- Determine the elliptic flow of identified particles
- Study the energy loss of partons in the quark-gluon plasma
- Measure heavy-quark production
- Design and build inner silicon tracking detector for installation in LS2

## GOALS OF HL-LHC BEYOND 2022

- Utilize the rich ATLAS, LHCb and ALICE physics potential of the HL-LHC
- Realize the main long-term goals of ATLAS, such as a high-precision characterization of the Higgs boson, and in particular, the observation of the Higgs self-coupling

## THEORY

- Strengthen the role of Nikhef as a centre for theoretical particle phenomenology
- Continue to perform state-of-the art calculations relevant to LHC physics and astroparticle physics
- Consolidate the future of FORM

# CERN WORLD LEADING LABORATORY OF FUNDAMENTAL RESEARCH

## R&D

- Develop advanced gravitational wave detector instrumentation
- Develop new smart and fast pixel detectors
- Invest in relations with high-tech industry
- Invest in accelerator science→ not in Nikhef strategy document.

## PHYSICS DATA PROCESSING

- Augment PDP scientific staff with expertise in high-performance algorithms and programming
- Transition our Research Infrastructure to a more flexible virtualized system, capable of serving more sciences
- Design (via R&D projects) the Research Infrastructure and Infrastructure for Collaboration components for the HL-LHC era.

# CERN WORLD LEADING LABORATORY OF FUNDAMENTAL RESEARCH

NOT explicitly discussed in strategy document but there are several points that implicitly require this

- Ease the possibility to have inter-experiment activities. Presently very difficult with LHC

In particular this is linked to the new themes that are suggested to be initiated in the strategy document:

- Initiate the theme "Global fits to HEP data" to investigate the cohesion of various Standard Model measurements like the old LEP results and recent ATLAS, LHCb and XENON results
- Initiate the theme 'Neutrino Physics' to increase the cohesion between the Nikhef KM3NeT, DUNE and Auger activities.
- Initiate the theme 'Dark Matter' to increase the cohesion between ATLAS, LHCb, XENON1T/nT and KM3NeT programme activities.



# ENERGY FRONTIER

## FUTURE ACCELERATION

- Support an ambitious future accelerator programme at CERN.
- Exploit the unique opportunity opened by the next generation of pp accelerators at CERN (HE\_LHC, FCC-pp ) to explore the physics processes of the extremely early universe.
- muon collider : no input from strategy document.
- SppC: no input from strategy document.

# PRECISION FRONTIER

## FUTURE ACCELERATION .

- Contribute to detector construction and science exploitation in the case that Japan builds the ILC or China the CEPC.
- Prepare for hardware and analysis contributions for an experiment at the next linear  $e^+e^-$  collider
- Exploit the unique opportunity opened by the next generation of  $e^+e^-$  accelerators at CERN (CLIC, FCC-ee ) to perform precision measurements that will shed light on possible deviations from the SM
- Support plasma wakefield acceleration research (not mentioned in strategy document)

## ELECTRON EDM

- Complete the challenging beam and detector set-up
- Expand the theory needed for the measurement and its interpretation
- Prepare for a second-generation experiment

## g-2

- No input from strategy document

# QUARK AND LEPTON FLAVOR AND PLASMA

## Flavour physics opportunities

- beauty and charm flavour physics: LHCb Upgrade II, Belle II
- Kaon flavour physics: KOTO, NA62
- Muon flavour physics: MEGII, Mu2e, g-2

## Initiatives currently being explored:

- Exploit HL-LHC potential with LHCb Upgrade II (10x Lumi LHCb upgrade I)
- Develop pixel detectors with precision time measurement

## DUNE

- Prepare an extended neutrino physics programme by participating in the protoDUNE programme. The DUNE programme itself starts at FermiLab around 2025.

## Future of HI

- No input from strategy document

## SHIP: searching for very weakly interacting long lived particles at SPS

- No input from strategy document

# MULTI-MESSENGER UNIVERSE:

## KM3NeT

- Complete the KM3NeT-2.0 detector
- Determine the neutrino mass hierarchy and neutrino oscillation parameters
- Detect PeV neutrinos and search for point sources
- Search for BSM physics in cosmic neutrinos

## GRAVITATIONAL WAVES

- Commission Advanced Virgo, run jointly with LIGO, and participate in the mid-term upgrade.
- Study gravitational waves from binary black-hole mergers and test black hole physics
- Discover gravitational waves from neutron star coalescences and measure the neutron star equation of state
- Support involvement in LISA

## EINSTEIN TELESCOPE

- Explore the opportunity to host the ET in the Netherlands in order to present a realistic bid around 2020
- Connect all relevant national and international parties to optimize the Dutch bid
- Prepare and develop a local small-scale interferometer as technology demonstrator



# MULTI-MESSENGER UNIVERSE:

## Astro Particle Physics goals

- Develop a national programme on gravitational wave research encompassing Virgo, LISA and the Einstein Telescope, with the CAN binding the APP community.
- Develop, together with the CAN, a coherent approach to multi-messenger astrophysics and APP by combining information from gravitational waves, cosmic rays, neutrinos and potentially high-energy photons.

## ULTRA HIGH ENERGETIC COSMIC RAYS

- Complete the AugerPrime upgrade
- Study muon production in air showers
- Determine the mass composition of very high-energy cosmic rays
- Extend the radio array to enhance sensitivity to horizontal air showers

## DIRECT SEARCH FOR DARK MATTER

- Search for dark matter signals in the science runs of XENON1T
- Prepare for the upgrade of XENON1T to XENONnT
- Investigate the use of XENONnT for the search for neutrinoless double beta decay
- Prepare for the ultimate direct-detection dark-matter experiment DARWIN

# NIKHEF MISCELLANEA, RELEVANT FOR ESPPU?

## NIKHEF PARTNERSHIP

- Remain a strong institute with an excellent international reputation and leadership positions
- Remain open for collaboration with other universities such as Leiden, Delft and Twente.

## KNOWLEDGE AND TECHNOLOGY TRANSFER

- Increase valorisation efforts
- Continue spin-off policy
- Continue patent policy

## OUTREACH AND COMMUNICATION

- Increase the visibility of Nikhef and its continuing strong reputation
- Create content and stories to consistently convey the key messages to the different target groups
- Develop a new, modern visual identity for Nikhef
- Stimulate an interactive, two-way communication both in person and 'digitally' (website, social media)
- Assist the Nikhef employees in their outreach activities as ambassadors for the institute

## EDUCATION

- Enthuse young people and attract students into science and technology subjects.
- Foster young talents in the OSAF PhD programme and prepare for a career path.