7th meeting of the Board of Funders
Brussels, 01 December 2017

HBP and Graphene Flagships
State of Play

Aymard de Touzalin
Deputy Head of the Flagships Unit, DG Connect
European Commission
Graphene: State of Play

GRAPHENE FLAGSHIP

– Horizon 2020 → Operational phase (APR 2016 to 2023):
  ❖ 1st Core project: Apr 2016 to Mar 2018, 89 M€ (WP 2014-15)
    Year one review – Blogpost T. Skordas (Sept 2017)
  ❖ 2nd Core project: Apr 2018 to Mar 2020, 88 M€ (WP 2016-17)
    Positive evaluation – Grant preparation on-going
  ❖ 3rd Core project: Apr 2020 to Mar 2023, 150 M€ (WP 2018-20)
    WP adopted: invitation to submit by May-June 2019

– Key events
  ❖ Graphene week, 25-29 September, Athens
  ❖ Tallinn Digital Summit, 29 September
  ❖ EU-US workshop, 23-25 October, Arlington, VA
  ❖ Medica/Compamed tradefair, 13-16 November, Düsseldorf
"the Graphene Flagship continues to deliver exceptional results, and keeps showing good promise for major impact."

- Progressing towards industrial applications
- Focusing on innovation
- Exceeding performance targets
- Putting Graphene on the map

Collaborations
- 158 partners in 23 countries, 1252 people involved
- 73 associated members
- 18 partnering projects
- Academia 39%, RTOs 22%, industry 39%

Outputs (FP7+ SGA1/Year 1)
- 1400 scientific publications, 23000 citations
- 6 spin-offs, 37 patents applications, 39 prototypes, 17 products

Graphene CMOS device
Flagship Partners ICFO and Graphenea made a graphene-CMOS is able to sense UV, visible and infrared light at the same time.

Artificial Retina
Physicists at Technische Universität München are using the special properties of graphene to produce key elements of an artificial retina.

Ink-Jet Printable Electronics
Researchers from Manchester and Pisa have demonstrated fully ink-jet printed programmable memory devices, using biocompatible water-based inks

Graphene based Terahertz Absorbers
A terahertz absorber – a critical component in optical communication - with an order of magnitude higher performance than other devices produced to date

Using graphene in zero gravity
In collaboration with ESA, Flagship researchers are carrying out experiments for using graphene in thermal management (heat dissipation) and light propulsion (solar sails)

Graphene helmet
A graphene coating that allows better distribution of impact force makes the helmet less susceptible to damage compared to helmets without graphene, even in high temperature conditions thanks to a collaboration between IIT and Italian design company Momodesign
Increased focus on most promising technologies and more applied research

- Science and Technology Work Packages continuing with an increasing focus on pushing to higher TRLs

- 6 new cross-cutting "spearhead projects" to drive concrete innovation opportunities
  - Graphene-Photonics Integrated Circuits for the 5G Era
  - Printable Sensors Integrated with RFID Antenna
  - Graphene-Perovskite Solar Farm
  - Multifunctional Plaster Sensor for Human Skin, Based in Functionalized Graphene
  - Technology of Silicon Graphene Lithium-Ion Batteries for Large Scale Production
  - Self-Powered Graphene-Based Textile for Wearable Electronics
28 partners leaving the CP (a majority from academia and higher education)

15 new partners added through call for Expression of Interest (a large majority of them are from SME & Industry)

Consortium: 27% change; 8% reduction

<table>
<thead>
<tr>
<th>Type of organisation</th>
<th>Number</th>
<th>EC Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic / higher education</td>
<td>60+1 (42%)</td>
<td>47,0 M€ (53%)</td>
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<tr>
<td>Research Organisation</td>
<td>25+1 (18%)</td>
<td>24,6 M€ (28%)</td>
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<tr>
<td>Industry</td>
<td>23+2 (17%)</td>
<td>8,5 M€ (10%)</td>
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<tr>
<td>SME</td>
<td>17+11 (19%)</td>
<td>6,3 M€ (7%)</td>
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<tr>
<td>Other</td>
<td>5 (3%)</td>
<td>1,7 M€ (2%)</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>130+15</td>
<td><strong>88 M€</strong></td>
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[www.graphene-flagship.eu](http://www.graphene-flagship.eu)
HBP: State of Play

Human Brain Project

- Horizon 2020 → Operational phase (APR 2016 to 2023):
  - 1st Core project: Apr 2016 to Mar 2018, 89 M€ (WP 2014-15)
    Year one review completed
    Additional sub-projects reviews: SP8 (July), SP1 and SP10 (Oct.)
  - 2nd Core project: Apr 2018 to Mar 2020, 88 M€ (WP 2016-17)
    Positive evaluation – Grant preparations on-going
  - e-INFRA project: 25 M€ (WP 2016-17)
    Positive evaluation – Grant preparations on-going
  - 3rd Core project: Apr 2020 to Mar 2023, 150 M€ (WP 2018-20)
    Invitation to submit by May-June 2019

- Key events
  - Tallinn Digital Summit, 29 September
  - 5th Annual Human Brain Project Summit, 17-20 October
  - SfN annual conference "Neuroscience 2017", 11-15 Nov., Washington, DC
Overall good progress

Year 1 project review, June
- HBP has passed most of its milestones for the first year of the SGA1 grant, delivering on HBP roadmap regarding both science and the RI development. New HBP organisation well in place.
- Reorganisation of the central NIP platform work and teams was successfully completed
- Further focus is required on activities integration and on provision of facilities crucial for empowering neuroscience, brain medicine and brain-inspired computing

Additional sub-projects reviews, July, October:
- SP8: Focus on demonstrating MIP local & proof of concept for MIP federation for end of SGA1 and review future activities (SGA2) to reinforce medical impact of HBP
- SP1 and SP10: good technical progress but more connection with theory & simulation required

Collaborations
- 116 partners in 19 countries, 856 FTEs
- 9 associated members
- 7 partnering projects + 6 in prep.
- 87 universities, 26 research institutes, 2 companies

Outputs (FP7 & SGA1 Year 1)
- 700 scientific publications,
- 2 patents
- Platform users: 2.335 (1.412 external)
**HBP SGA1 - Success stories**

**Successful combination of physical & virtual experiments for studying cellular information**
Use of two-photon imaging, optogenetics, dual-colour uncaging of glutamate and GABA, and simulation. **SP6**

**First organisation of several long-term collections of functional EEG data**
Successful study of face recognition in healthy and diseased patients, using data uploaded by the international community. **SP2**

**Prototype of the 2nd generation of HBP neuromorphic chips**
SpiNNaker: 160 ARM cores and 80 GIPS/W per chip. BrainScaleS: Local learning, active dendrites. **SP9**

**Successful combination of virtual robotics and experimental neuroscience**
Rehabilitation of mice after stroke. **SP1 and 10**

**A new theory of perception at cellular level explaining the influence of top-down signals**
Dendritic calcium activity correlates to the “moment of perception” and manipulating dendritic excitability shifted the perceptual threshold. **SP3**

**Successful combination of theoretical and empirical neuroscience experiments and clinical practice**
New understanding of consciousness and different level of awareness in healthy and diseased patients. **SP3**

**First mouse hippocampus Calcium functional model with a resolution of 1’000 compartments/neuron**
4TB of output data. **SP6**

**Opinion on Data Protection and Privacy.** From experts and public consultation. **SP12**
A more unified and users-driven approach

❖ Building a Joint Platform Infrastructure addressing the research communities needs and based on the 6 ICT platforms

– High Level Support Team (HSLT) to provide S&T support to users, coordinate communities demands and infrastructure development.
– Foster external access and use of the HBP infrastructure (vouchers)
– More cross-cutting and co-design activities will be initiated via open calls
– New generation of neuromorphic chips (production of electronic masks)

❖ Accelerating Neuroscience knowledge

– Move modeling and simulation from structural to multi-level organization and function of the brain: detailed and molecular/cellular level simulation of hippocampus, basal ganglia and cortex
– Advance knowledge in learning and memory, in multisensory perception & integration and object recognition, and in brain states: linking neural correlates with behavioral and cognitive data. Verify the new hypotheses with simulations including using robots.
– Consolidation of open-access brain atlases and models
## HBP SGA2

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<th>Type of organisation</th>
<th>Number</th>
<th>EC Contribution</th>
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<td>20,9 M€ (24%)</td>
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<td>Incl. SME</td>
<td>1 (1%)</td>
<td>0,2 M€ (0%)</td>
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<tr>
<td>Public body (hospital)</td>
<td>1 (1%)</td>
<td>2,7 M€ (3%)</td>
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<tr>
<td>Other</td>
<td>1 (1%)</td>
<td>0,4 M€ (0%)</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>118</strong></td>
<td><strong>88 M€</strong></td>
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- **New partners** to be selected through Calls for Expression of Interest (EoI): on-going. Selected partners will join SGA2.

- **New activities** to be launched to reinforce medical impact: Call for EoI to be launched in January 2018.

- Towards the creation of the HBP Legal Entity

[www.humanbrainproject.eu](http://www.humanbrainproject.eu)
**HBP e-Infra: ICEI**

**FENIX:** Federated Engine for Information eXchange

Infrastructure as a Service (IaaS)

**HBP Research Infrastructure for Brain Data Analytics & Simulation**

**Other Communities via PRACE:**
- Material Science,
- Physical Sci. Experiments,
- Genomics

- ...
## Beneficiaries

<table>
<thead>
<tr>
<th>Beneficiary</th>
<th>Total costs</th>
<th>EC Contribution</th>
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<tbody>
<tr>
<td>EPFL (administrative coord.)</td>
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<tr>
<td>FZ Juelich – JSC (tech. coord.)</td>
<td>50 M€</td>
<td>25 M€</td>
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<td>BSC</td>
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<td>CEA - TGCC</td>
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<td>CINECA</td>
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<td>ETHZ - CSCS</td>
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## ICEI

Interactive Computing E-Infrastructure

### ICEI project in support to FENIX

- Coordinated procurements of Equipment + R&D services and exploiting the specifications developed during the HBP HPC PCP (FP7 ramp-up phase)
- Staged deployment and operation, including a fast-track at CSCS operational for SGA2 start (April 2018)
- EC funding plus equivalent amount of in-kind contributions by the HPC centers
- ICEI Technical and Executive Boards + Fenix Council
THANK YOU!