M²OLIE

Mannheim Molecular Intervention Environment

BioRN Lounge – 28.05.2019

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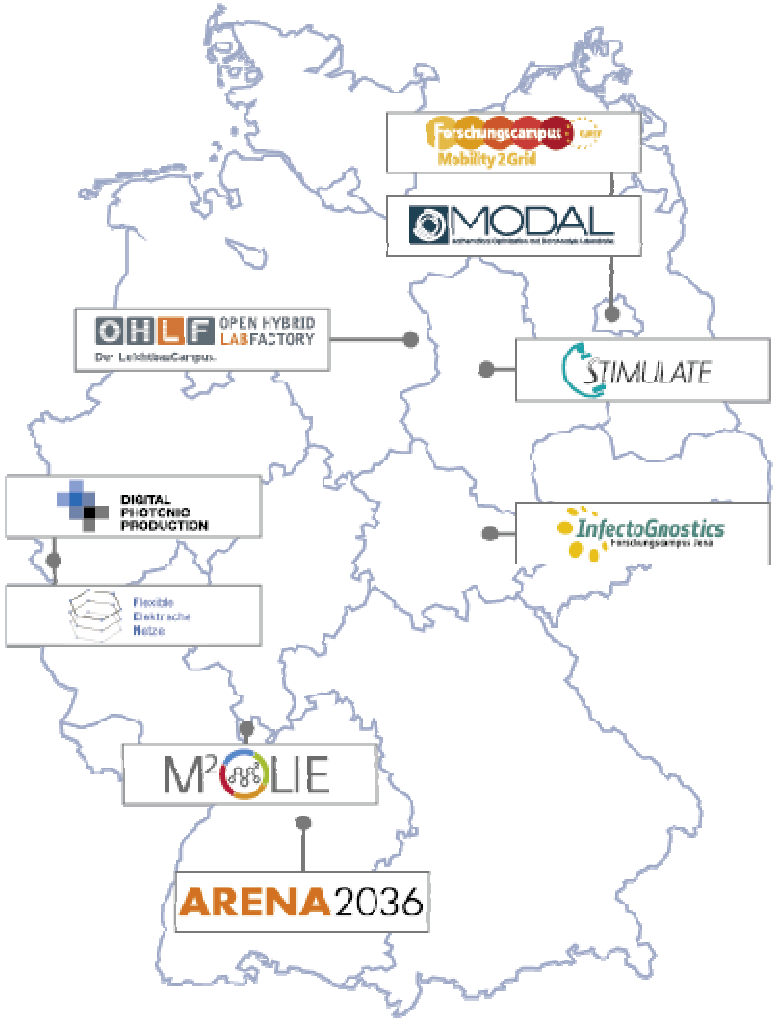
Federal Ministry of Education and Research

Public-Private-Partnerships around Germany



- ARENA 2036 - Active Research Environment for the Next Generation of Automobiles, Stuttgart
- Digital Photonic Production, Aachen
- Elektrische Netze der Zukunft (Future Power grids), Aachen
- Mobility2Grid, Berlin
- INFECTOGNOSTICS, Jena
- **M²OLIE - Mannheim Molecular Intervention Environment, Mannheim**
- MODAL AG, Mathematical Optimization and Data Analysis Laboratory, Berlin
- Open Hybrid LabFactory, Wolfsburg
- STIMULATE - Solution Centre for Image Guided Local Therapies, Magdeburg

M²OLIE in a nutshell

- Funded by the Federal Ministry of Education and Research (BMBF)
- Public-Private-Partnership
- Part of the hightech-strategy of the federal government
- Project start:
  - 02/2013 – 06/2014 prephase
  - 01/2015 – 12/2018 1st funding period
  - 06/2019 – 05/2024 2nd funding period
- Funding period: up to 15 years
- Funding volume: up to 2 million €/year
- Location: University Hospital Mannheim

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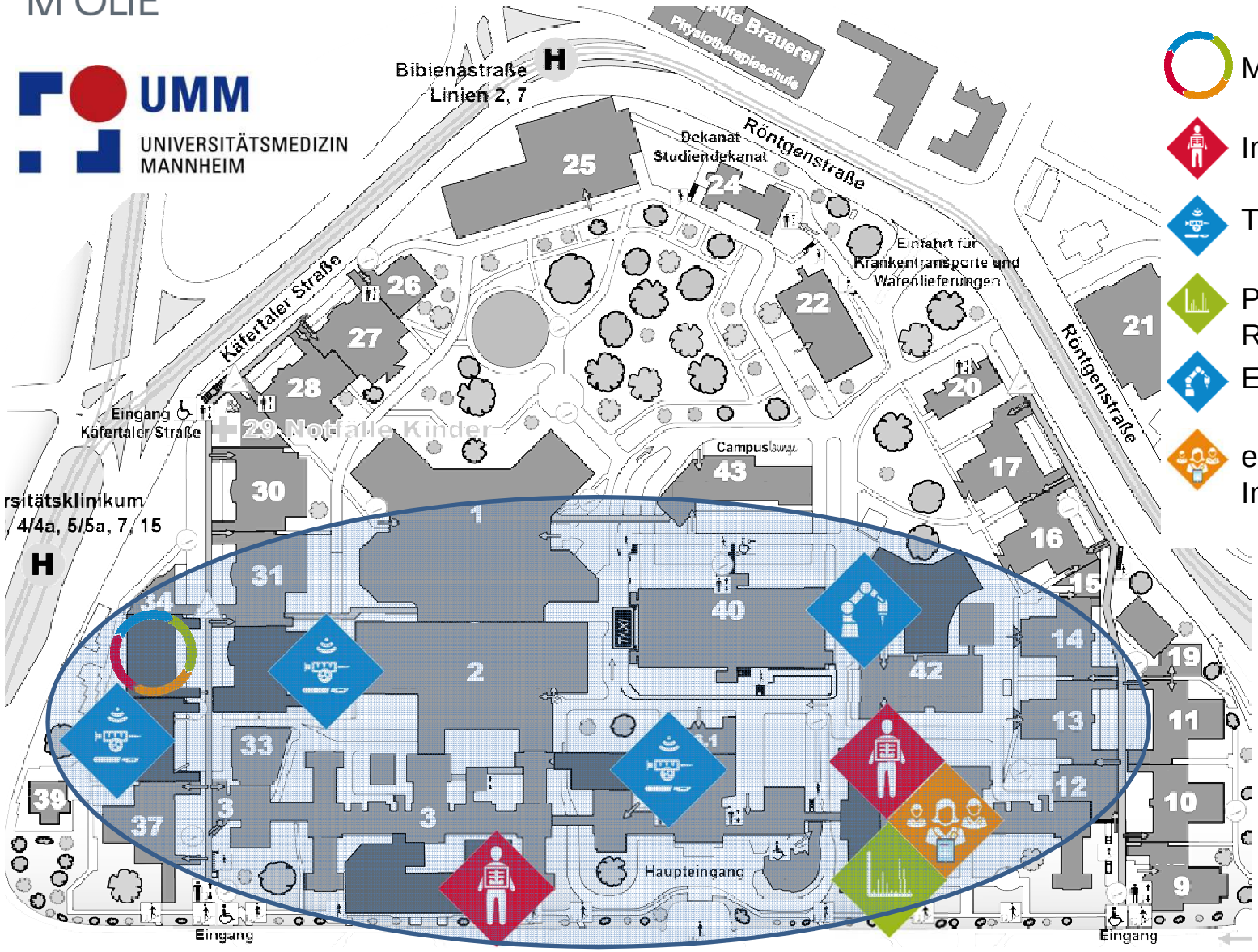
M²OLIE with cross section competencies for the University Medical Center Mannheim

M²OLIE

UMM UNIVERSITÄTSMEDIZIN MANNHEIM

UNIVERSITÄT HEIDELBERG ZUKUNFT SEIT 1386



- M²OLIE-Centre
- Imaging
- Therapy
- Preclinical Research
- Experimental OP
- el. Patient Information

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Vision

Cure of Cancer despite Metastases

Aim

Individualised Treatment of Oligometastatic Cancer Patients

Strategy

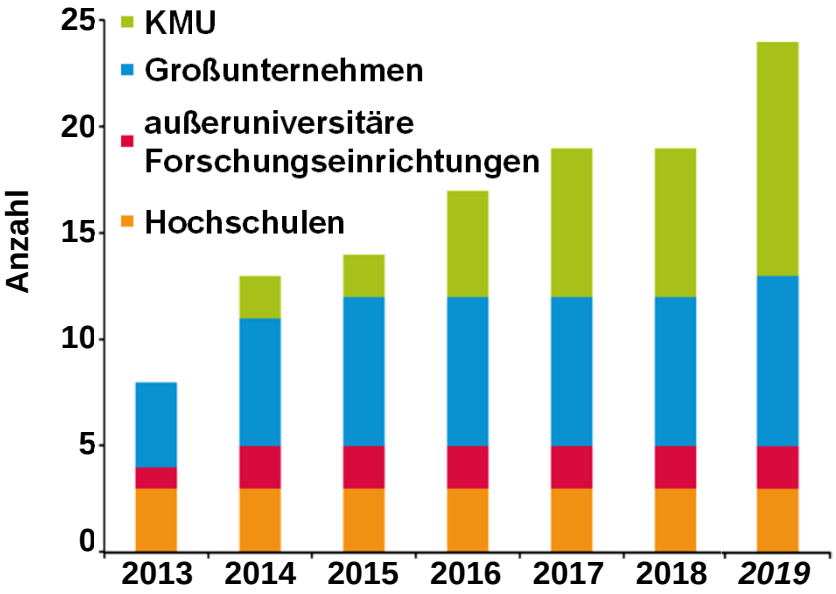
Automation for increased Efficiency, Precision, and Acceleration of Diagnosis and Therapy in the Closed-Loop-Process

M²OLIE **Hospital of the Future** M²OLIE

Governance	Promotion of Young Academics	Associated Projects	Internal Funding	External Funding
Infrastructure	Exploitation	Spin-offs	M²OLIE Technology Platform	M²OLIE Service Station

Academia and Industry below one Roof

The Partners of M²OLIE



in 2019 about 60 %
of industrial partners are SME

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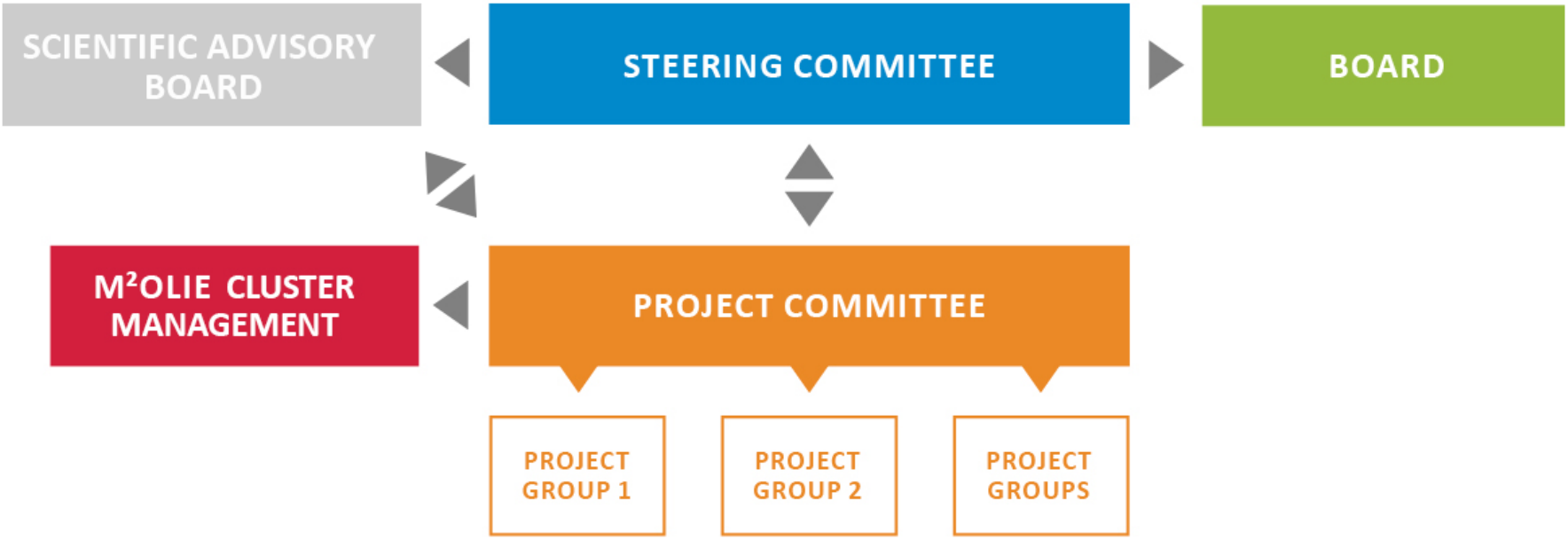
Governance
operative – strategic – political



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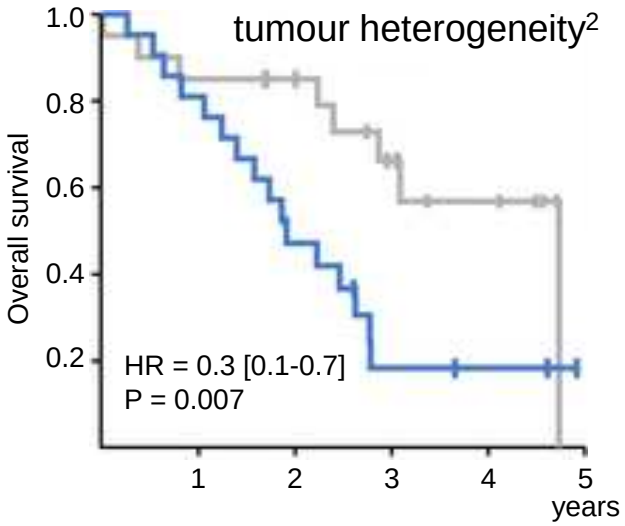
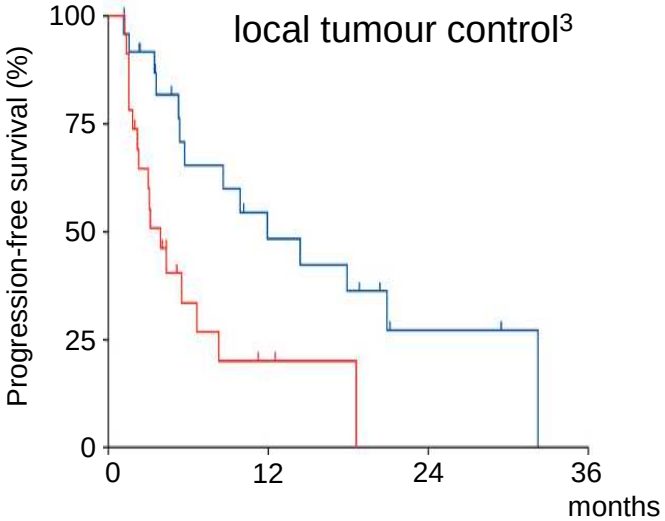
The aim ofM²OLIE: therapy of oligometastases

Medical Problem

- **20 Mio. humans** with cancer worldwide in 2020 (500 000 in Germany)
- **50 %** of patients **die** due to tumour disease
- **90 % of mortality** as a result of metastases*
- tumour patients with **oligometastatic disease** (few, usually up to **5 metastases** in one organ or depending on the location also in the whole body) actually only with **palliative treatment**
- no consideration of **tumour heterogeneity** for therapy decision
- **fragmented diagnostics and treatments** cover several weeks until now

Potential





[1] Hunter et al. (2018) Nat Rev Cancer. 18(4):211-223
[2] Sveen et al. (2016) PLOS Genetics 12(7):e1006225
[3] Gomez et al. (2016) Lancet Oncol 17:1672-82
[4] Gomez et al. (2018) ASTRO

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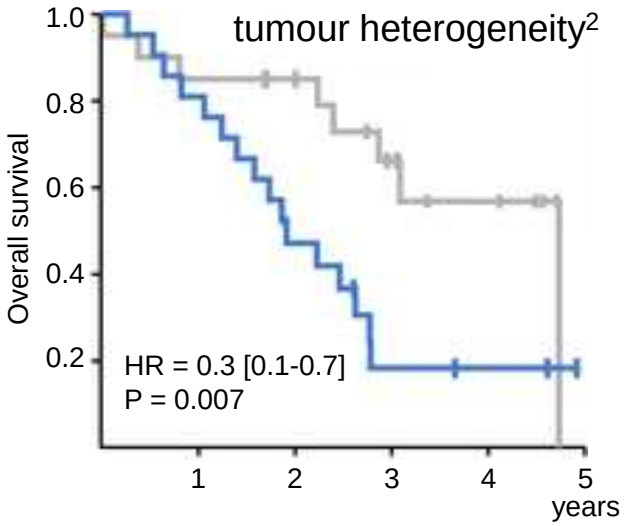

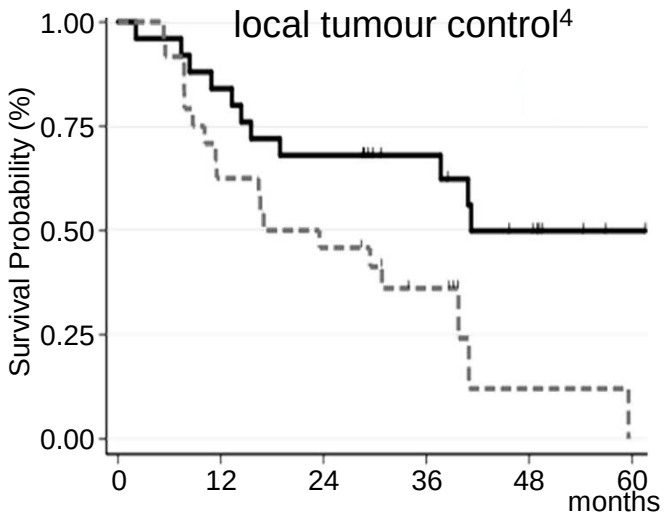

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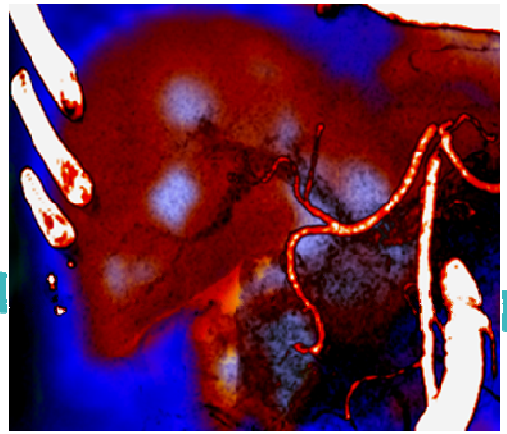
The aim of M²OLIE: Cancer as a chronic disease

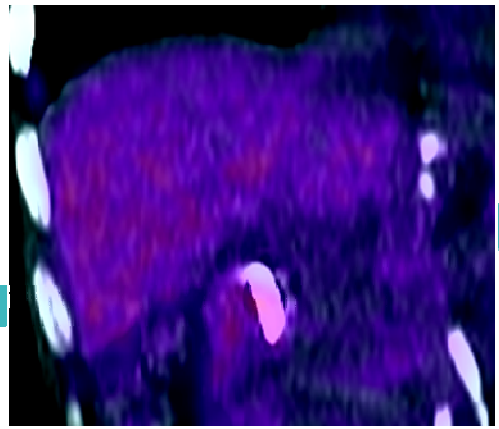
Solution for the individual treatment of all metastases

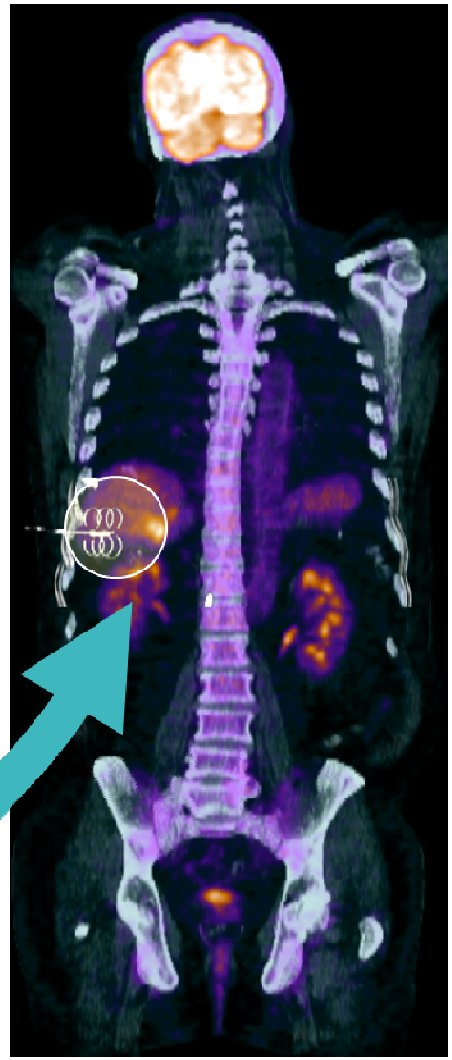
- “detect
- “visualise“
- “characterise”
- “destroy completely“

➔ **Curative treatment of patients with oligometastases by iterative and optimised cycles of diagnosis and therapy**

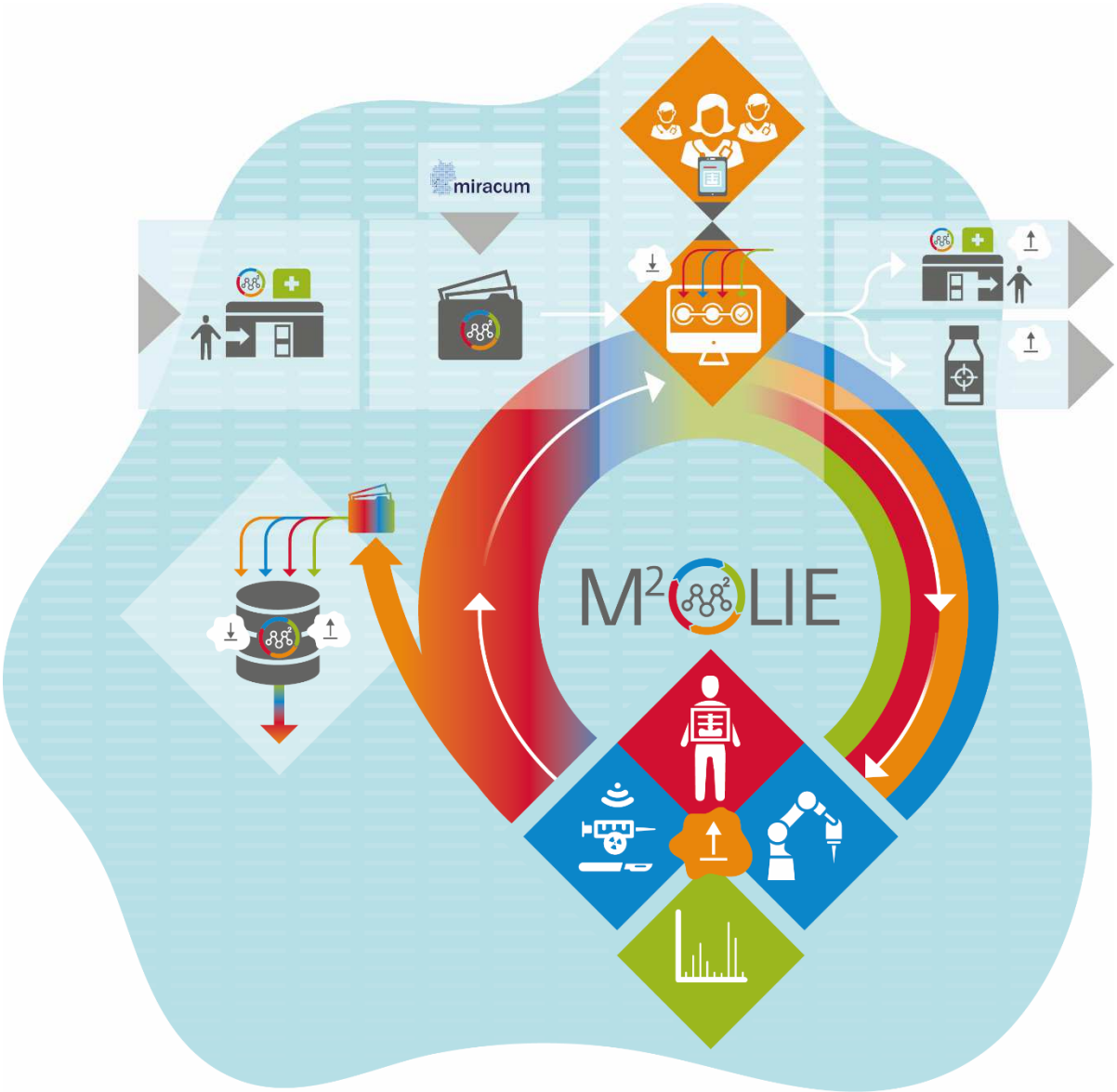
➔ **„Cancer as a chronic disease“**







The concept of M²OLIE: Improved Closed-Loop-Process



Three interdisciplinary research programs with physicians, biomedical engineers, biologists, chemists, physicists, and information scientists

Results of 1. Funding Period
M²IBID and M²INT

- 2015 Establishment of **low-dose perfusion-CT**
- 2017 **Double resonant MRT coil** for simultanous $^{1}H/^{23}Na$-imaging
- 2018 **Integrated workflow** for image-guided, multimodal and minimally invasive interventions

- 2015 Implementing of experimental **intervention room**
- 2016 Automated biopsy **at phantoms**
- 2018: Development of a **integration platform** for multi-functional therapy systems
  Applications: biopsy, kypho-IORT, seed-application, needle guidance
  for electroporation

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Results of 1. Funding Period
M²oBiTE, ProM²OLIE and M²ProcIT

- 2014 Implementation of **three preclinical reference centres**
- 2016 **GMP-compliant production** of ^{68}Ga-PSMA-11
- 2018 Reduction of **tumour characterisation to four hours** by infrated guidance of MS-imaging and semi-automated image processing

- 2014 **Complete process modelling** and identification of the crucial bottlenecks
- 2016 Clinical evaluation of the **electronical patient information system**
- 2018 Technical evaluation of the **ad hoc tumourboard**

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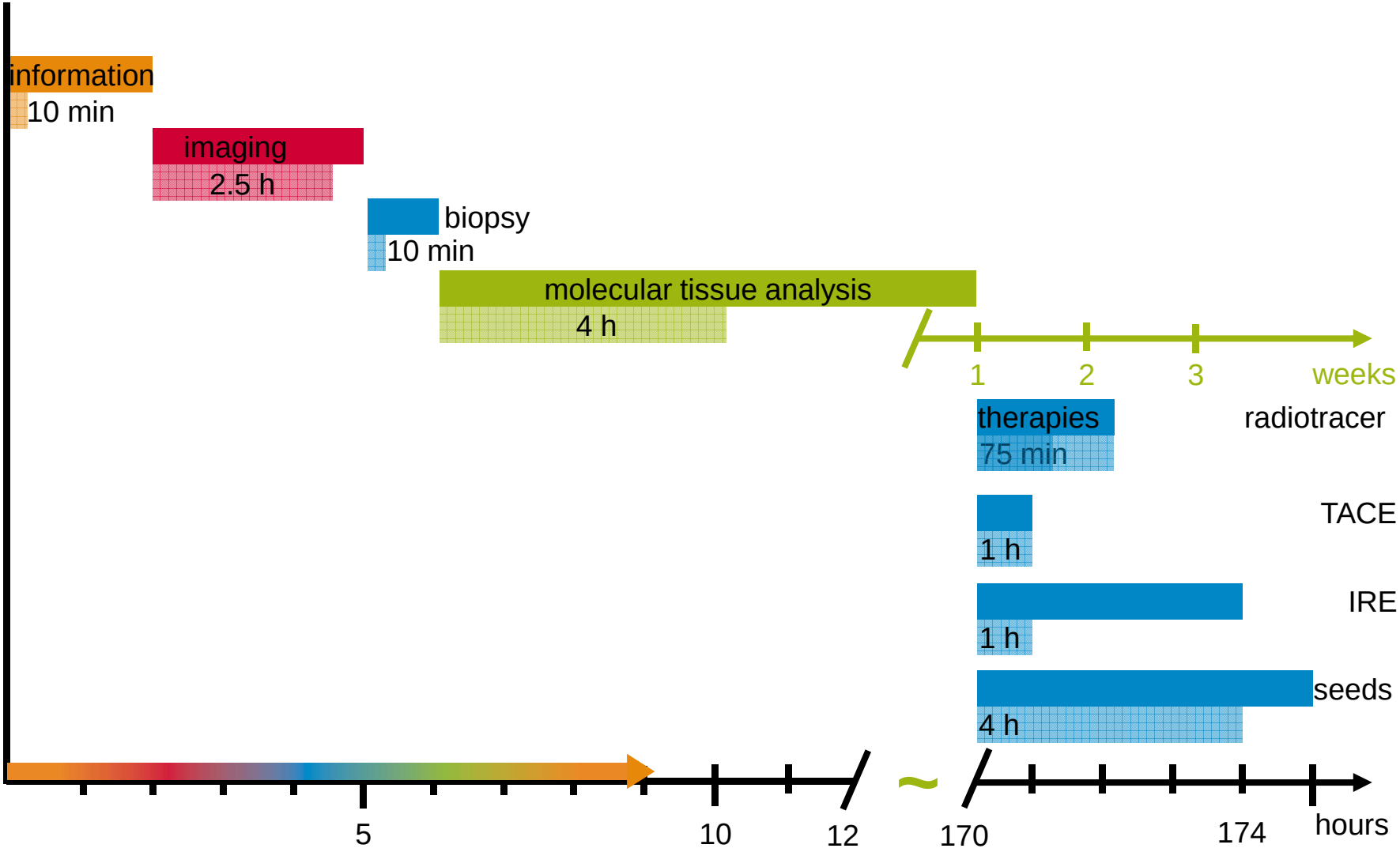
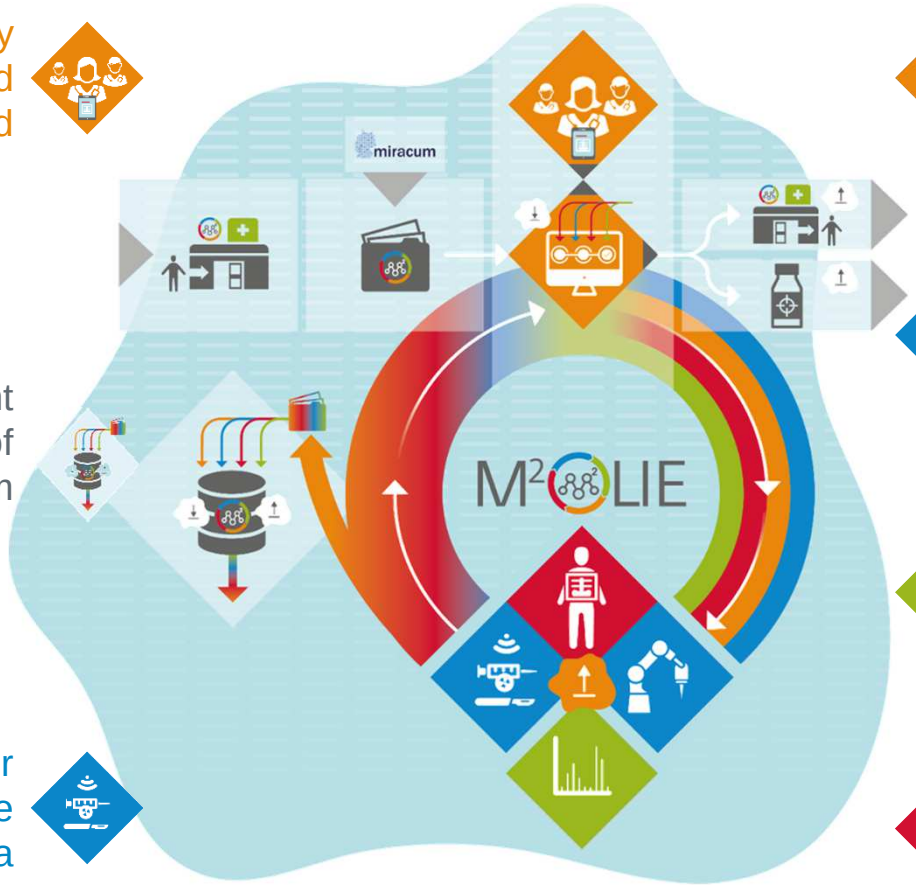
Potentials for time saving



The M²OLIE Closed-Loop-Process

central controls by (semi-)automated tumour board

efficient, automated processes for new generations of applications



use of the robotic assisted biopsy in patients

process management system as central part of the intervention room

classification of metastases < 1 hour by LESA in combination with ESI-MS/MS

^{212}Pb-peptide or ^{198}Au-nanoparticle as theranostika

radiomics-analyses of liver metastases

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Patient-centred Approach in the 2. Funding Period

In **three joint projects** to a prospective **phase IIa study** for the improvement of minimally invasive therapies:

M²IBID – Molecular innovative imaging for individualised diagnostic

- Deep integration of real-time imaging data, just-in-time biotechnology, molecular pathology and radiopharmacology for accurate presentation of metastatic dissemination

M²INT – Development of a system platform for minimally invasive, assisted molecular intervention

- Robotic assisted minimally invasive therapy: Inducing growth in the market by approving technologies that are largely independent of the user's level of experience
- Minimally invasive therapy as a service on a technology platform
  → Qualification of the physician for a clinically holistic treatment and patient management

M²DATA – M²OLIE data acquisition, -transfer and -analyses

- Individualised adaptive controls of the whole diagnostic and treatment process on the basis of self-learning methods
- Consideration of the individual patient risk on the basis of combined imaging and molecular data

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Cluster Management

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