

# IMMPRINT: Integrated molecular imaging for personalized biomarker-based breast cancer characterization and treatment

(TOPIC 2 - Individualised diagnostic and therapeutic procedures with regard to optimisation of the benefit/risk ratio)

## Project coordinator:

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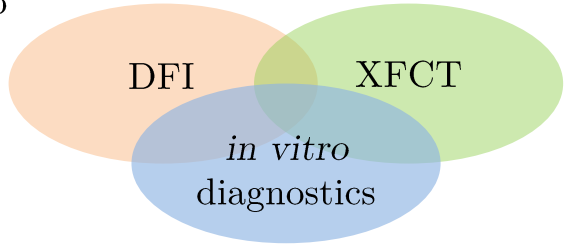
## Partners:

**OvGU** - Otto-von-Guericke-University, Magdeburg, Germany  
**HHU** - Heinrich Heine University Düsseldorf, Düsseldorf, Germany  
**NNK** - National Public Health Center, Budapest, Hungary  
**JSI** - Jožef Stefan Institute, Ljubljana, Slovenia  
**CSIC** - Agencia Estatal Consejo Superior de Investigaciones Científicas, Paterna, Spain  
**EURAMED** - European Alliance for Medical Radiation Protection Research, Wien, Austria

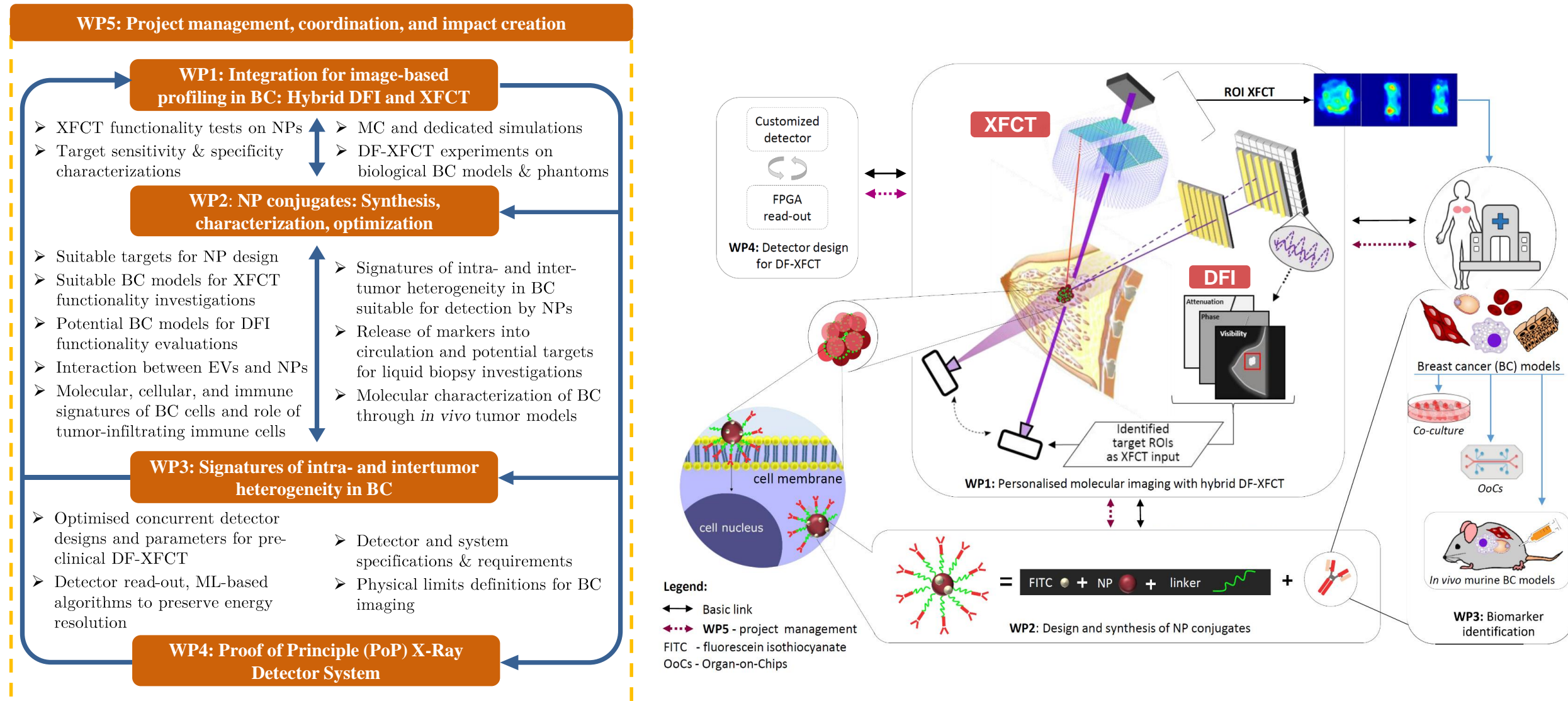
## IMMPRINT's goals and focus

- Developing advanced *in vivo* imaging tools and methodologies for better characterization of breast cancer (BC) disease and radiation sensitivity on per patient basis.
- These tools intended also to evaluate biomarkers for individual radiation responses → future fast optimisation of radiation therapy (RT) protocols and IR-based applications in clinical practice and protection of healthy tissues at risk.
- Enhanced protection of healthy tissues in BC patients, specifically, critical and at risk patients, by minimising potential IR-induced health effects and treatment-related toxicities.

### DF-XFCT: integrated and novel hybrid tool for personalised *in vivo* tumor profiling

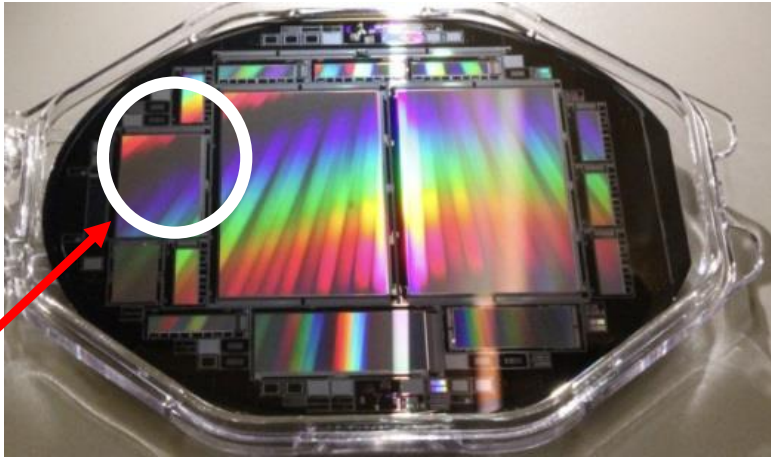
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- Microstructural information beyond conventional radiography's resolution
  - Enhanced contrast information (sensitive to structural variations at nm-um scales)
  - Optimization towards low-dose BC imaging → leverages higher X-ray energies (~ 30-50 keV)
  - Potential to surpass PET/SPECT in spatial resolution and MRI in sensitivity and specificity for human-sized cases
  - High spatial resolution → dose optimised characterization of tissues and heterogeneities to be targeted by RT
    - Biologically optimised and dedicated *in vivo* molecular imaging approach
  - *in vitro* diagnostics identifying BC biomarkers
  - Synergistic approach → Combining hybrid imaging and biopsy methods

## IMMPRINT's methodology and WP interactions





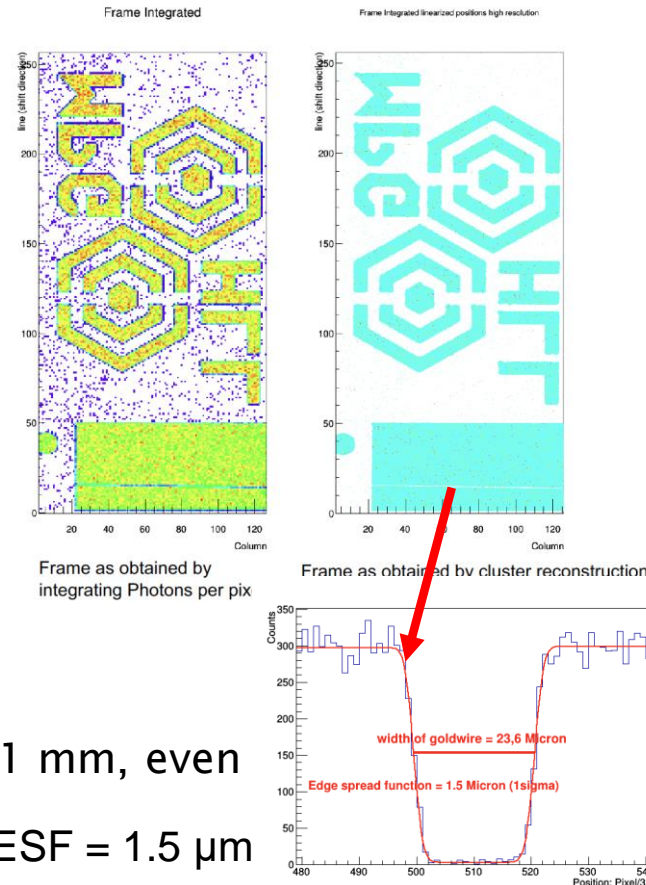
# Detector development...



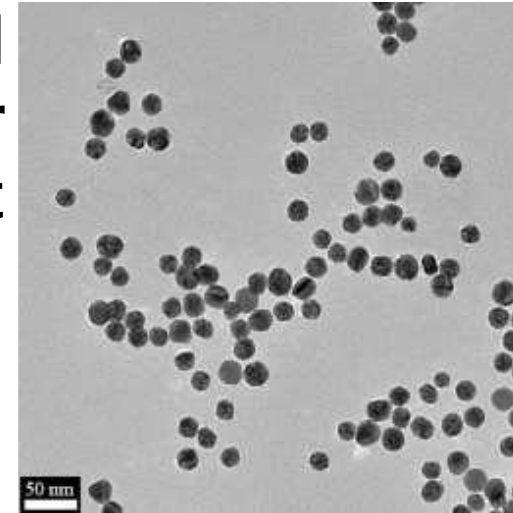
- Small pixel pnCCD
  - Small sensors from existing wafers
  - $4 \times 2.1 \text{ cm}^2$ , pixel  $36 \times 36 \mu\text{m}^2$
  - Energy resolution at the intrinsic limit
  - R/O rate  $> 1 \text{ kHz}$
  - 3-side abutable, stackable,  $450 \mu\text{m}$  thick
    - No technical problem for processing  $1 \text{ mm}$ , even  $2 \text{ mm}$  in principle ok

## Device characteristics:

- pnCCD concept:
  - Backside illuminated,
  - frame store,
  - split frame,
  - column-parallel readout

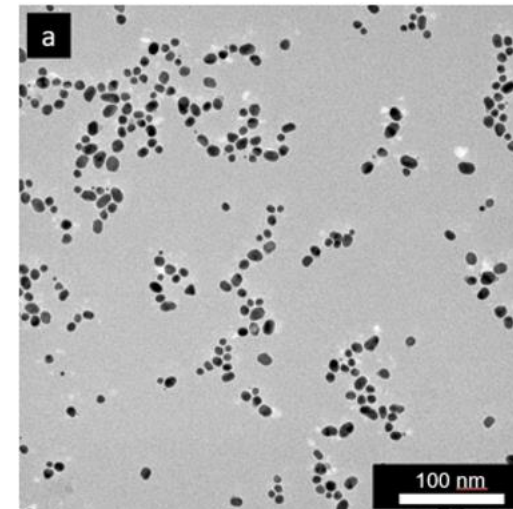


# ... and marker development



Citrate stabilised gold NP (AuNP@Cit)

Polyvinylalcohol stabilised gold NP (AuNP@PVA)



## IMMPRINT's potential outcomes and added value

- Improved radiation protection of BC patients
- Better characterization of BC patients → advancing personalised BC medicine.
- High-resolution 3D quantitative imaging *in vivo* → aiding understanding of mechanisms driving heterogeneity and immunological interactions as well as individual radiation sensitivity
- Connection with other projects from PIANOFORTE
- Improved tools for monitoring disease and guiding individualised treatment decisions for improved benefit/risk ratios → imaging-assisted optimisation of individualised and novel therapies, e.g., RT and combinatorial approaches
- Long-term perspective and goal: European-wide integration of methods and tools into clinical routine → clinical implementation strategies, commercialisation of the technologies involving diagnostic & therapeutic nanotechnologies, detector technologies, DFI and XFI technologies
- Strategies for clinical transfer and translation tasks will be developed already within IMMPRINT:
  - ✓ Strong links of consortium members with clinical groups for post-project implementation
  - ✓ Collaboration (within IMMPRINT and related projects) will foster integration of diverse EU-wide perspectives
  - ✓ Industry engagement in various EU member states

! Thank you for your attention !

Questions?