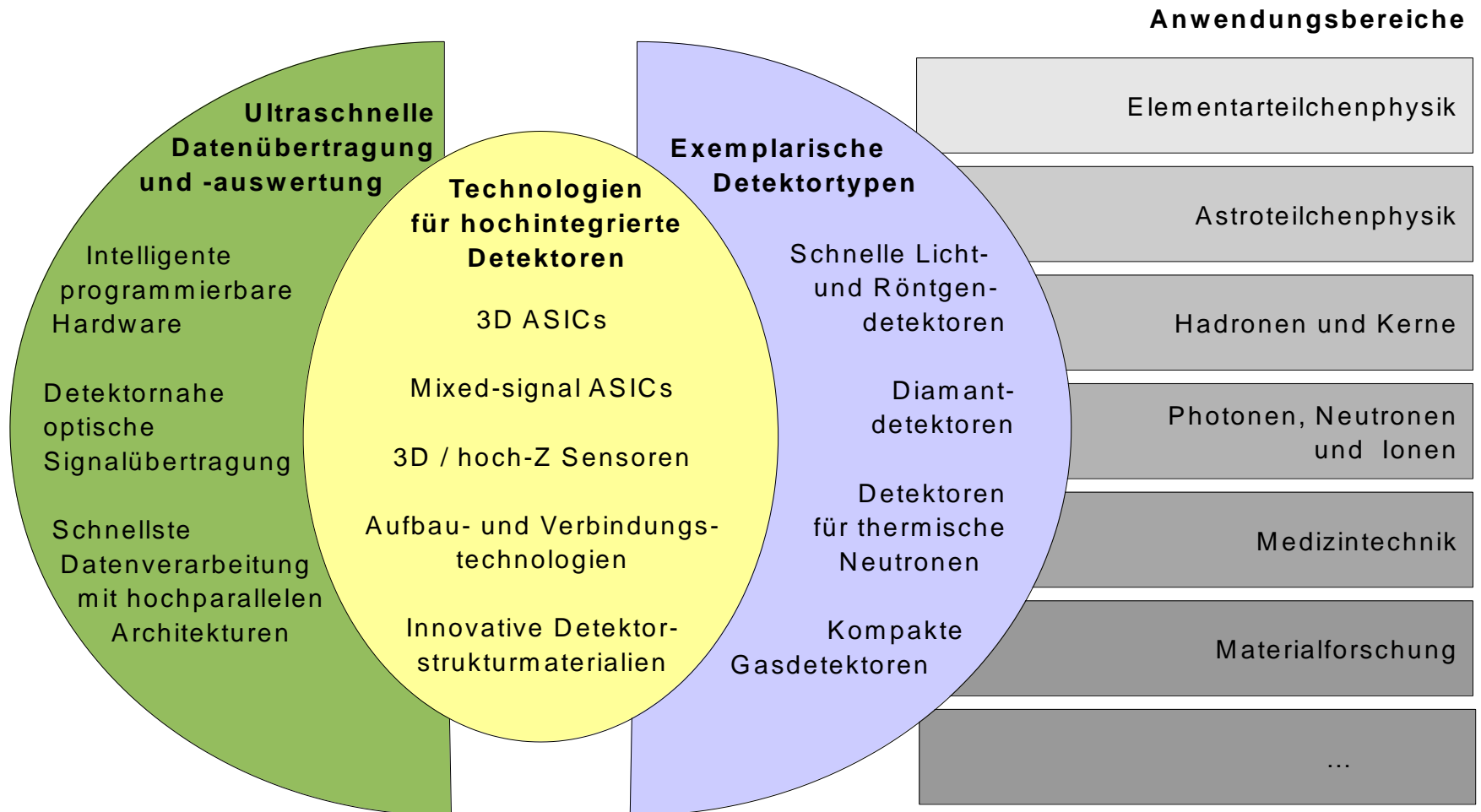# Detektor Technologie und System Platform

Pillar 1: Technologies for highly Integrated Detectors

Heinz Graafsma
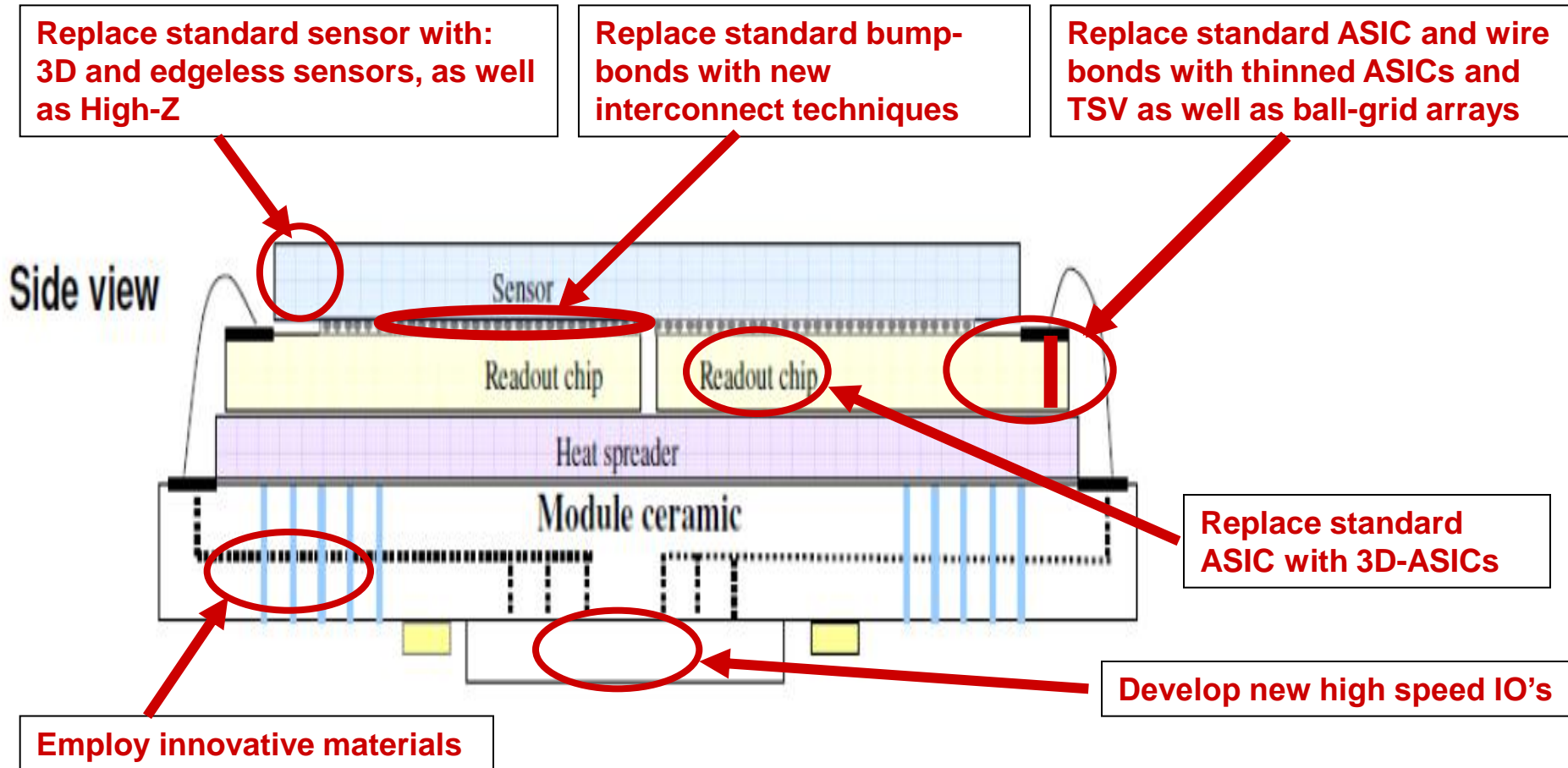
Kick-off meeting Feb 2012.

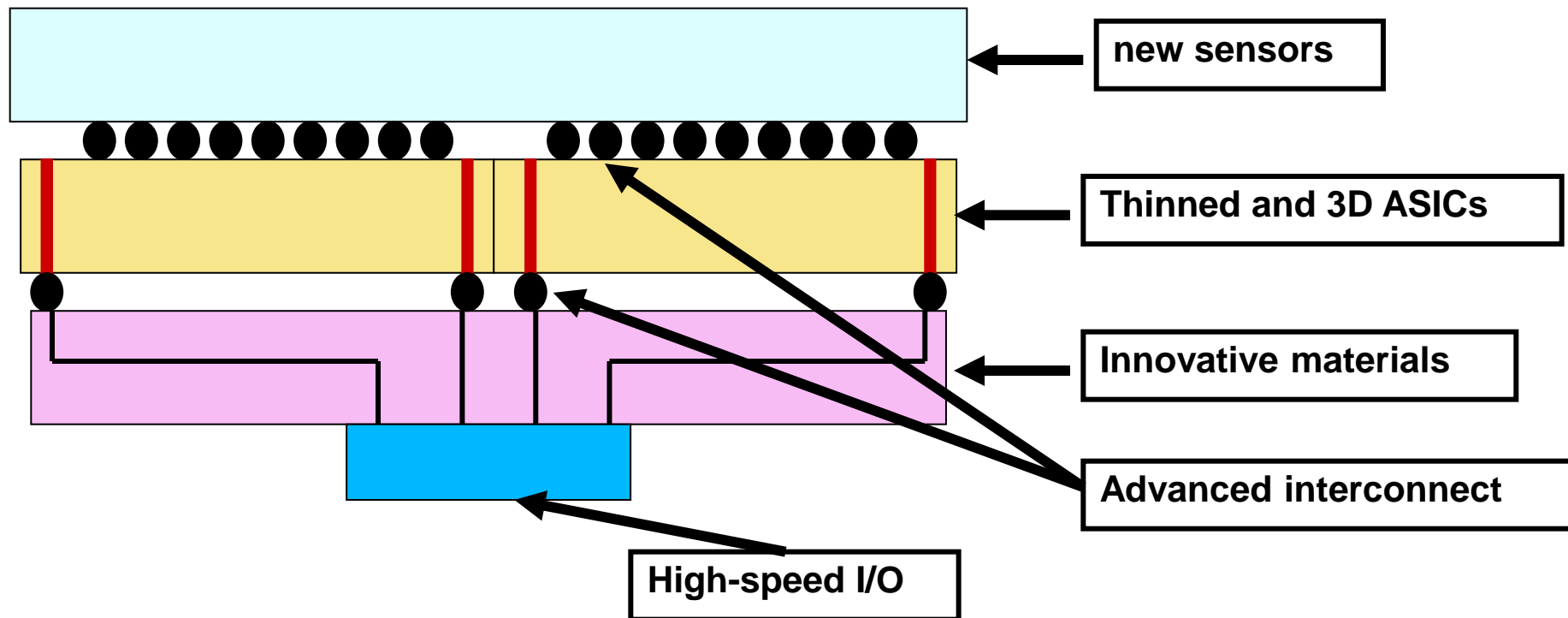HELMHOLTZ | GEMEINSCHAFT

DESY

Structure

Anwendungsbereiche

Ultraschnelle Datenübertragung und -auswertung

Intelligente programmierbare Hardware

Detektornahe optische Signalübertragung

Schnellste Datenverarbeitung mit hochparallelen Architekturen

Technologien für hochintegrierte Detektoren

3D ASICs

Mixed-signal ASICs

3D / hoch-Z Sensoren

Aufbau- und Verbindungs- technologien

Innovative Detektor- strukturmaterialien

Exemplarische Detektortypen

Schnelle Licht- und Röntgen- detektoren

Diamant- detektoren

Detektoren für thermische Neutronen

Kompakte Gasdetektoren

Elementarteilchenphysik

Astroteilchenphysik

Hadronen und Kerne

Photonen, Neutronen und Ionen

Medizintechnik

Materialforschung

...

DESY

Vertically Integrated Detector Technology

Replace standard sensor with: 3D and edgeless sensors, as well as High-Z

Replace standard bump-bonds with new interconnect techniques

Replace standard ASIC and wire bonds with thinned ASICs and TSV as well as ball-grid arrays

Replace standard ASIC with 3D-ASICs

Develop new high speed IO's

Employ innovative materials

Side view

Sensor

Readout chip   Readout chip

Heat spreader

Module ceramic

1. Säule: The "Helmholtz-Cube"

new sensors

Thinned and 3D ASICs

Innovative materials

Advanced interconnect

High-speed I/O

Pillar 1 Goals

1. Develop technologies

2. Make technologies available to HGF centers

3. Current focus on Hybrid Pixel Array Detectors

4. Future extension to other technologies: MAPs, SoI, …

3.1 3D-ASICs: WP-Leader: H. Graafsma *(DESY)*

> Beteiligte Zentren: DESY, GSI, KIT

> Externe Partner: Fraunhoferinstitute IZM, Universität Bonn, CERN, NIKHEF (Niederlande), VTT (Finnland), FNAL (USA)

1st Step:

Make inventory of know-how and experience + Share information, designs and tools.

3.2 Mixed-signal ASICs: WP-Leader: C. J. Schmidt *(GSI)*

> Beteiligte Zentren: DESY, FZJ, GSI, HIJ, KIT

> Externe Partner: Universität Heidelberg mit dem ASIC-Labor des KIP und ZITI, IPHC Strasbourg, AGH Krakow, Europractice, STFC Technology

Inventory of possible common technologies and libraries.

Maybe: Develop a "simple" chip for technology developments (e.g. TSV)?

3.3 3D/ Hoch-Z Sensoren: WP-Leader: M. Fiederle *(KIT)*

> Beteiligte Zentren: DESY, KIT

> Externe Partner: Freiburger Materialforschungszentrum der Universität Freiburg, STFC Technology

CdTe sensors possible in 15 months (how many?)

Edgeless and 3D silicon on going at various places ➔ needs an inventory of know-how

3.4 Aufbau- und Verbindungstechnologien: WP-Leader: T. Blank *(KIT)*

> Beteiligte Zentren: DESY, FZJ, GSI, KIT

Inventory of existing and missing technologies planned as first step.

3.5 Innovative Detektorstrukturmaterialien: WP-Leader: A. Mussgiller (DESY)

> Beteiligte Zentren: DESY, FZJ, GSI, HIM

Various options, including diamond, exists. Needs a meeting between interested partners

Decided to have a one day (lunch-to-lunch?) meeting with all partners and WP-leaders at DESY in Spring (May?) in order to decide on concrete actions and deliverables.