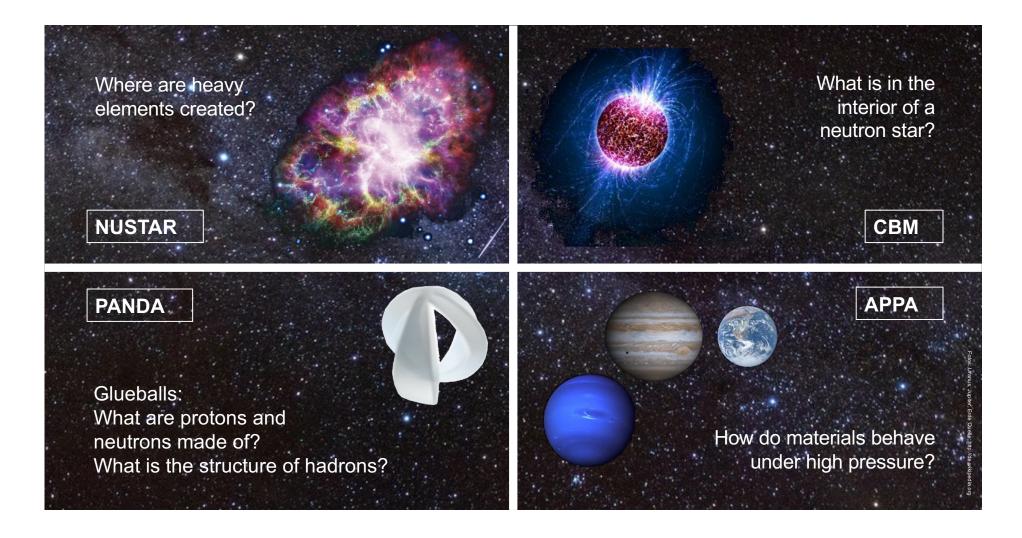


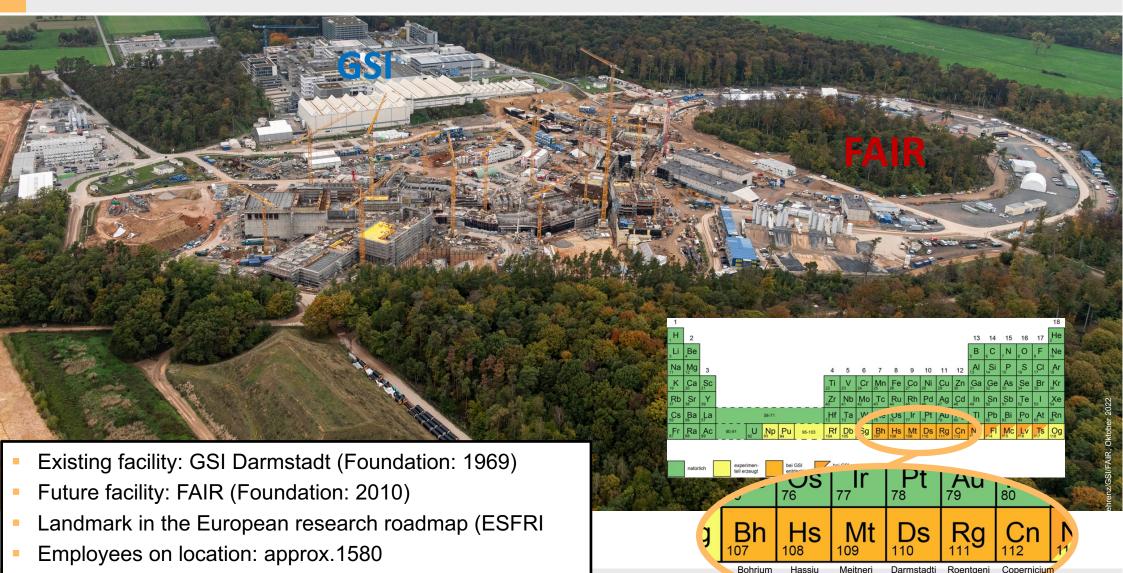
## The Universe in the Lab ... FAIR 4 research pillars





# GSI GmbH – Helmholtzzentrum für Schwerionenforschung FAIR GmbH – Facility for Antiproton and Ion Research





# FAIR: a World-wide project





- FAIR governed by international convention
  - 9 shareholders:



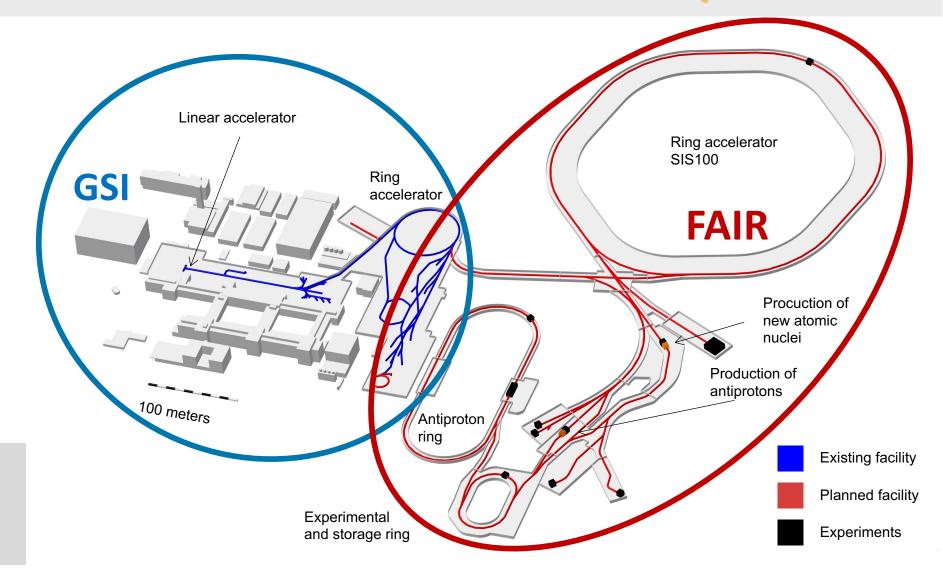
+ 1 aspirant partner:



- Over 3000 Scientists and Engineers from all over the world
- More than 200 institutions from 53 countries are involved with their scientists (orange + blue)

#### **GSI/FAIR** – The facility

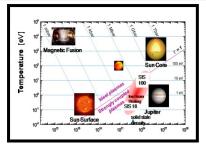




- Intensity
- Precision
- Storage rings

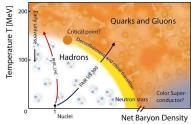
# The FAIR science: four pillars





atomic physics, biophysics, plasma physics, material research

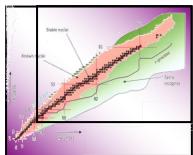




nuclear- and quark-matter

**CBM** 





nuclear structure and nuclear astrophysics

**NUSTAR** 



hadron structure and dynamics

**PANDA** 

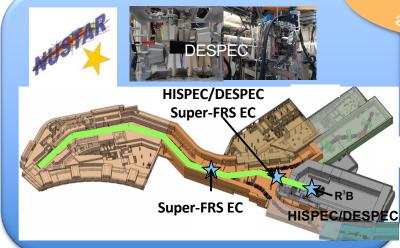
#### **Experiment Construction**





Same event
Mixed vernt
Mixed v

the part of FAIR which will be available by 2028

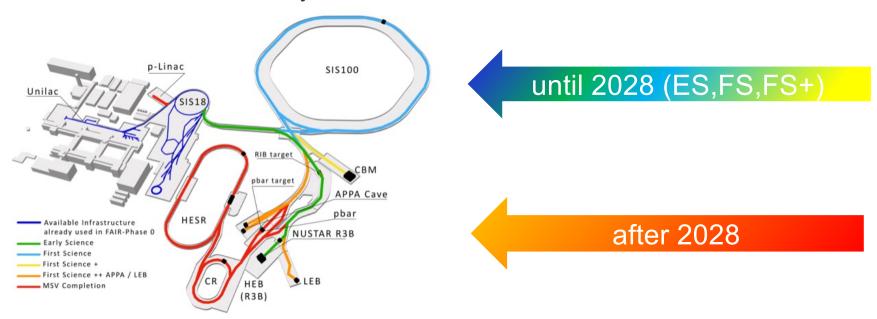




#### **Current status following FAIR Council decisions in March 2023**



- Due to budget constraints a Scientific Review panel was tasked by the FAIR Council in 2022 to perform a "First Science and Staging Review of the FAIR Project".
- The Scientific Review panel recommended in October 2022 that the scenario FS+ (SIS100, Super-FRS-HEB and CBM) would be the most appropriate starting scenario to achieve world leading science.
- FAIR Council decided on 9th & 10th March 2023 to use the additional funds provided by Germany to proceed with FS and to make further decisions on FS+ based on the contributions by other shareholders in future meetings, possibly already in July 2023. Council stated that "the realisation of the MSV....remains the aim of the FAIR-Project"



#### Nomenclature: Steps of FAIR



Currently running **FAIR Phase-0** experiments will mostly continue to operate on the GSI/FAIR campus, while the step below are progressively implemented

Steps for the construction of new facilities (defined by Review/Council)

- **Early Science (ES):** FAIR pre-cursor programme at the Super-Fragment-Separator (S-FRS) und NUSTAR High-Energy Branch (HEB) served by beams from SIS18.
- **First Science (FS):** first science at the Super-Fragment-Separator (S-FRS) und NUSTAR High-Energy Branch (HEB) served by beams from SIS100.
- First Science + (FS+): in addition to FS the CBM branch served by beams from SIS100.
- First Science ++ (FS++): in addition to FS+:
  - the branch into the APPA cave, and
  - the NUSTAR Low-Energy Branch (LEB)
- MSV completion (MSVc): Completion of the Modularised Start Version.

The steps are incremental, i.e. earlier steps are completely subsumed in the later steps.

**FAIR 2028** 

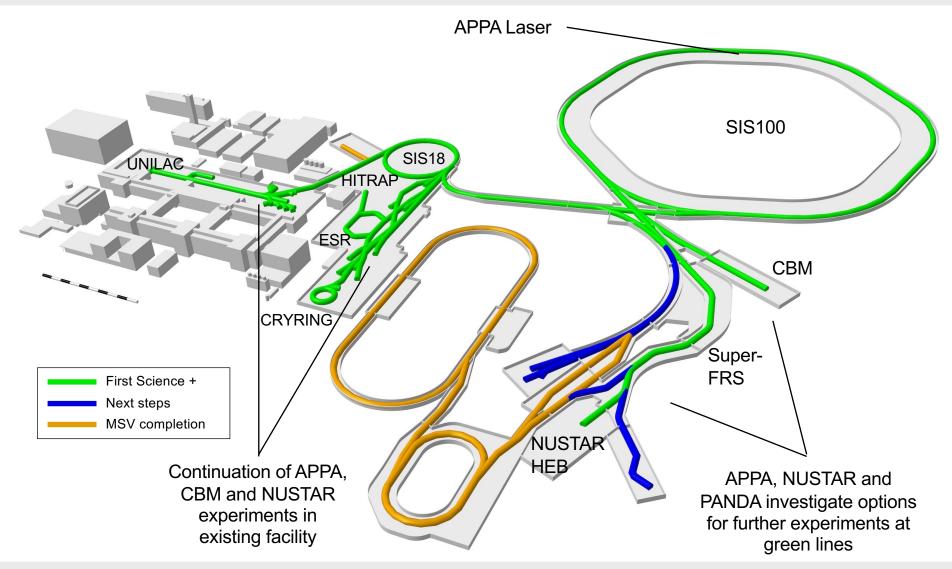
#### Our vision for the medium-term future: FAIR 2028



- FAIR in 2028 will feature the most valuable science program which can be hosted in the FS+ infrastructure.
- The "FAIR 2028" science program will include:
  - APPA experiments at the low-energy rings, at SIS100, at the caves at SIS18 and UNILAC with and at PHELIX and a limited set of experiments which could be hosted at all the caves served by SIS100
  - NUSTAR at the Super FRS with SIS100 beams, plus SHE and MATS experiments at UNILAC and ILIMA at the low-energy rings
  - CBM at the new cave with SIS100 beams, and HADES at SIS18
  - PANDA is developing a hadron physics program to be carried as bridge towards the program with antiprotons, when possible using the caves and beams available at GSI/FAIR and synergies with other experiments.

#### **FAIR 2028**





### **Evolution towards FAIR 2028**



- Up to 2025 we continue with FAIR the annual block of continuous beamtime for Phase-0, from 2026 onwards we enter the mixed-mode of Phase-0 with the commissioning of the new beamlines.
- Annual beamtime for science will increase progressively, to reach full year operation from 2028 onwards.
- Some experiments at the Super-FRS will start already in 2027 using SIS18 beams ("Early Science")
- We will try to keep a broad research programme on campus, which will also serve the long-term goals of FAIR.

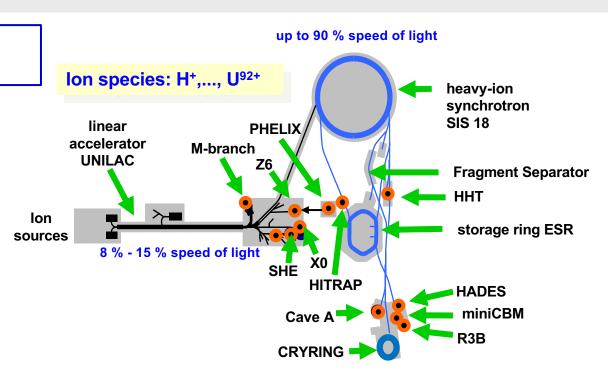
The construction of further components towards the completion of the MSV will require additional funding. If provided by ~ 2026, the MSV could be completed by 2031-2032. The timetable is dictated by the availability of funds

# Ongoing: Early science program FAIR Phase-0



- Started in 2019, annual runs of ~110 days until FAIR operation
- Supported by FAIR partners, so far: Finland, France, Germany, Romania, Sweden and the UK





- Science while commissioning FAIR
  - 2021 and 2022 runs completed as planned
  - The program will continue in the coming years
  - Up to 2025 we continue with FAIR Phase-0, from 2026 onwards we enter the mixed-mode with the commissioning of the new beamlines

## **Beamtime proposals 2022**



- 124 proposals submitted (to all 4 PACs: G-PAC, Mat-PAC, Bio-PAC and PPAC)
- 1729 participants of proposals
- From institutes in 45 countries (15% internal users)
- Committee evaluation took place in September 2022
- Beamtime granted in October 2022

