IPAC23

14th International Particle Accelerator Conference

IPAC '23

7 - 12 May 2023
Venice, Italy

PARTICLE ACCELERATOR PROJECTS AND UPGRADES

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Convention Centre
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INFN
Istituto Nazionale di Fisica Nucleare

Elettra Sincrotrone Trieste

Introduction

IPAC23

For many years, the European Physical Society Accelerator Group (EPS-AG) that organizes the IPAC series in Europe has contacted major laboratories around the world to invite them to provide information on future accelerator projects and upgrades to exhibitors present at IPAC commercial exhibitions. This initiative has resulted in a series of booklets that is available to industry at the conferences or online.

This current edition builds on previous editions with updated information provided by the laboratories and research institutes. We would also like to acknowledge and thank everyone for contributing to this booklet in an effort to foster a closer collaboration between research and industry.

All of the information contained in this booklet is subject to confirmation by the laboratory and/or contact persons for each project.

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Project Region

EMEA

International Muon Collider Collaboration

Project Location	CERN is hosting the international collaboration with participants from all regions
Project Type	New Project
Project Description	The collaboration develops the design of a muon collider, a novel concept to extend the energy range of particle physics. This effort includes technology development and will require demonstrator facilities.
Requirements List Available	Yes
Approval Date	
Status of Contracting	The muon collider is being developed. It will require the development of prototypes and one or more demonstrator facilities.
Construction scheduled to start	01/01/2023
Estimated Project Cost	The current budget is in the order of 5 million EUR/year and could ramp up to a total project cost in the order of 10 Billion EUR range
Estimated Construction Duration	The project is a long-term development.
Type of Equipment to be Purchased	The full range of accelerator components will be required. In particular superconducting cables and magnets, normal-conducting magnets, normal and superconducting RF components.

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MYRRHA

Project Location	Belgium
Project Type	Project Update
Project Description	MYRRHA is designed as an Accelerator Driven System. In a first stage to a 600 MeV super-conducting linac, a 100 MeV proton linac will be constructed (until 2027). A connected proton target facility will serve for radioisotope production.
Requirements List Available	Yes
Approval Date	07/09/2018
Status of Contracting	The present protoyping will gradually lead to industrial supplies in the coming years.
Construction scheduled to start	01/03/2020
Estimated Project Cost	350 MEUR
Estimated Construction Duration	8
Type of Equipment to be Purchased	100 MeV proton linac consisting of a 17 MeV injector with 15 copper CH-cavities followed by a superconducting linac with 60 single spoke cavities. A proton target station is foreseen.

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Diamond-II

Project Location	Oxfordshire, England
Project Type	New Project
Project Description	Upgrade of the Diamond booster and storage rings
Requirements List Available	No
Approval Date	03/07/2023
Status of Contracting	Prototyping
Construction scheduled to start	03/07/2023
Estimated Project Cost	500M £
Estimated Construction Duration	7 years
Type of Equipment to be Purchased	Diagnostics, Magnets, RF, Vacuum components etc.

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European Synchrotron Radiation Facility - Extremely Brilliant Source

Project Location	Grenoble/France
Project Type	Project Update
Project Description	ESRF–EBS is the ESRF's facility upgrade, over 2015-2022, bringing its scientific users a first-of-a-kind, low-emittance, high-energy synchrotron light source and new, cutting-edge beamlines. With a revolutionary new storage ring concept that increases the brilliance and coherence of the X-ray beams produced by a factor of 100 compared to present-day light sources, ESRF–EBS represents a new generation of synchrotron, an extraordinary new tool for scientists to study the heart of matter, and an advanced platform for industry users in exploiting the ESRF's X-rays to innovate in their fields of activity.
Requirements List Available	Yes
Approval Date	
Status of Contracting	99.92%
Construction scheduled to start	28/02/2015
Estimated Project Cost	158M Euro for ESRF-EBS project
Estimated Construction Duration	7 years
Type of Equipment to be Purchased	vacuum components, RF components, diagnostics equipment, insertion devices, etc.

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GANIL-SPIRAL2: NewGAIN and DESIR

Project Location	France
Project Type	New Project
Project Description	Ion beam production, acceleration and detection
Requirements List Available	Yes
Approval Date	01/01/2023
Status of Contracting	0-75 % of the items are contracted depending on project
Construction scheduled to start	01/06/2023
Estimated Project Cost	not to be given
Estimated Construction Duration	2-4 years
Type of Equipment to be Purchased	vacuum components, RF-equipments, magnets, amplifiers, power supplies, beam diagnostics, mecanical frames, etc.

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PERLE: Powerful Energy Recovery Linac for Experiments

Project Location	France
Project Type	New Project
Project Description	PERLE is a multi-turn ERL (3 pass up + 3 pass down) operating at 20 mA average beam current and 500 MeV maximum energy after 3 accelerated passes. The electron source is a DC photo gun with photocathode illuminated by a 40 MHz laser pulses to produce bunches at 500 pC. The injection line contains a buncher cavity (800 MHz), a booster (5 Nb single cell, individually feeded and controlled in phase and amplitude and a murger to match the injector to the main loop. The main ERL loop in racetrack configuration contains 1 Cryomodule in each straight. and 3 stacked 180° circulation arcs for beams at 3 different energies. The Cryomodule and arcs are matched by magnetic switchyards (Spreader and recombiner) in each side.
Requirements List Available	No
Approval Date	
Status of Contracting	
Construction scheduled to start	01/01/2025
Estimated Project Cost	27 M EUR
Estimated Construction Duration	6 years
Type of Equipment to be Purchased	RF equipent, beam diagnostics, magnet and power supplies, SRF cavities, etc.

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Prototype Accelerator based Laser-pLASma technologies

Project Location	Orsay, France
Project Type	New Project
Project Description	The PALLAS (prototyping accelerator based on laser-plasma technology) project is aiming to build a laser-plasma injector accelerator test facility with the goal of delivering within a few years electron beams of 150-250 MeV, >30 pC, low energy spread and sub 1 mm.mrad emittance beam at 10 Hz with control and stability comparable with RF accelerator. The project approach is based on three research and development axis: advanced laser control, plasma target development and electron beam characterization. PALLAS take part of the R&D effort for EuPRAXIA technical design preparatory phase.
Requirements List Available	Yes
Approval Date	01/03/2021
Status of Contracting	> 65% are contracted
Construction scheduled to start	01/09/2020
Estimated Project Cost	3,5M EUR
Estimated Construction Duration	4
Type of Equipment to be Purchased	lasers, optomechanics, magnet, power supply, vacuum, optics, etc.

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Super Separator Spectrometer

Project Location	France
Project Type	New Project
Project Description	Development of a new separator for high intensity beams at GANIL-SPIRAL2
Requirements List Available	No
Approval Date	22/12/2010
Status of Contracting	95%
Construction scheduled to start	15/10/2011
Estimated Project Cost	23M EUR
Estimated Construction Duration	13
Type of Equipment to be Purchased	vacuum components, superconducting magnets, beam diagnostics, laser system

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Berlin Energy Recovery Linac Project

Project Location	Berlin, Germany
Project Type	Project Update
Project Description	The project was officialy accomplished with finalizing the building, the warm machine, the infrastructure and is now transferred to a facility in commissioning, which is mainly by stepwise setting up and operate the injector cryo-modules. As this facility will offer not only accelerator physics for ERL studies, it was renamed SEALab (SRF Electron Accelerator Laboratory) to open up for additional applications, like e.g. UED (ultrafast relativistic electron diffration). Still, bERLinPro will be kept as a label for all ERL studies of this machine.
Requirements List Available	No
Approval Date	01/01/2011
Status of Contracting	98%
Construction scheduled to start	25/02/2015
Estimated Project Cost	42M EUR
Estimated Construction Duration	7
Type of Equipment to be Purchased	SRF cavities, cryostats, solid-state amplifiers, klystrons (CW, 1.3 GHz), beamline vacuum, magnets, beam diagnostics, LLRF equipment, cooling water equipment, beam dump, local cleanrooms, power supplies

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BESSY III - The Materials Discovery Facility

Project Location	Germany
Project Type	New Project
Project Description	Integrated research facility, based on a 2.5 GeV soft-to-tender X-ray 4th generation storage ring based synchrotron radiation source.
Requirements List Available	No
Approval Date	30/06/2025
Status of Contracting	The project is in the pre-application phase. A pre-conceptional design report is written and has been evaluated. We are now entering the conceptional design phase, followed by the technical design phase. Up to now nothing is contracted.
Construction scheduled to start	01/01/2029
Estimated Project Cost	976 MEUR
Estimated Construction Duration	5.5 years
Type of Equipment to be Purchased	Civil construction, technical building infrastucture, MBA lattice (mainly PM magnets) based 2.5 GeV low emittance storage ring with full energy injector booster synchrotron and injector linac, in and out of vacuum insertion devices, PM and EM Magnets, including girder structures, etc.

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compact STorage ring for Accelerator Research and Technology at KIT, Germany

Project Location	Karlsruhe
Project Type	New Project
Project Description	The cSTART project at KIT aims to demonstrate, that injection of electron beams with parameters similar to laser-plasma-accelerated beams into a novel compact storage ring is feasible. Furthermore, the project aims to demonstrate the storage of ultra-short electron bunches and study their non-equilibrium dynamics. A cornerstone of the cSTART project is, therefore, the Very Large Acceptance compact Storage Ring VLA-cSR with its large momentum acceptance and flexible magnetic lattice. The non-ramping VLA-cSR will have the existing linac-based accelerator FLUTE as injector for tests with controlled beams with parameters close to potential future low-energy laser plasma accelerators. The bunches delivered by FLUTE cover a charge range from 1 pC up to 1 nC and a bunch length (duration) regime from 3 µm (10 fs) to 300 µm (1 ps) within an operational energy range from 40 to 60MeV. To store bunches with such a wide range of parameters, a novel compact storage ring with very large momentum acceptance is required. VLA-cSR must be compact enough to fit within the existing hall (about 15 by 14.5m) and has to be constructed at a height of about 4m. The three orders of magnitude covered by both the bunch charge and bunch length also pose a challenge to the turn-by-turn beam diagnostics. Due to the low electron energy, synchrotron radiation will not be available for stimulating the photodesorption process on the vacuum chamber surfaces and to achieve with this a vacuum quality of better than 10−8mb□r in VLA-cSR. For the same reason, synchrotron radiation damping is negligible, which requires an onaxis one-turn injection. The swap-out extraction requires a dedicated beam dump. An artistic view of VLA-cSR and the transfer line between the FLUTE and VLA-cSR is shown in https://www.ibpt.kit.edu/p_cSTART.php (https://www.ibpt.kit.edu/cstart) The main parameters of the VLA-cSR can be found in the follwing table:

Project Description	Parameter and Value Beam parameters Nominal electron energy 50MeV Energy range (no ramping operation) 40MeV to 60MeV Bunch length (duration) 3 µm to 300 µm (10 fs to 1 ps) Bunch charge (# electrons) 1 pC to 1 nC (7 × 106 to 7 × 109) Relative energy spread 10−4 to 10−2 Ring and magnetic lattice Circumference (footprint) 43.2 m (12.5 m x 12.5 m) Revolution period; frequency 144 ns; 6.9MHz Periodicity four cells, each cell 10.8m long Cell type 90° double bend achromat Straight sections four, each 3.85m long Injection type on-axis one-turn, single bunch Injection rate 10 Hz Extraction type swap-out one-turn, single bunch into dump Magnetic rigidity 0.133 Tm to 0.200 Tm Synchrotron radiation energy loss <0.5 eV per turn (at 50MeV) Damping time at 50 MeV (h/v/l) 37 s / 33 s / 16 s RF system (Radio Frequency system) RF frequency; RF harmonic number 500MHz; 72 Number of RF stations one RF voltage 500 kV Vacuum system Pressure (with electron beam and RF) less than 10−8mbar in VLA-cSR Beam pipe shape round and elliptic Beam pipe diameter up to 63mm
Requirements List Available	Yes
Approval Date	01/09/2023
Status of Contracting	about 10% is ordered and about 5% delivered
Construction scheduled to start	13/01/2025
Estimated Project Cost	5 to 9 M EUR depending on ordered options and KIT provisions
Estimated Construction Duration	1 year, with commissioning 1.5 years
Type of Equipment to be Purchased	magnets (50 µm aligment), vacuum components (10-e-8 mbar), RF system (options), Timing fitting to FLUTE, high speed, on-axis injection and swap-out extracting (rise time < 20 ns), 3D-transferlines (KIT provide magnets), e-beam diagnostics with e.g. BPM on turn-by-turn basis (6.9 MHz), SPS interconnections for KIT control system (KIT provide EPICS integration and CSS GUI), components with EPICS integration welcome, 3D support structure above 4 meters height

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Facility for Antiproton and Ion Research in Europe

Project Location	Darmstadt, Germany
Project Type	Project Update
Project Description	Full new built Accelerator complex
Requirements List Available	No
Approval Date	04/10/2010
Status of Contracting	70%
Construction scheduled to start	01/07/2017
Estimated Project Cost	3300M EUR
Estimated Construction Duration	9
Type of Equipment to be Purchased	all accelerator and experiment related components

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FLASH2020+

Project Location	Germany
Project Type	New Project
Project Description	Upgrade the FLASH Free-Electron Laser at DESY, Hamburg, Germany to extend the photon wavelength to the Oxygen K-edge and to provide as the first FEL in the world external seeding in the XUV and soft X-ray range with more than 5000 pulses per second. This will significantly enhance the scientfiic reach of the facility. In parallel, the second FLASH beamline will be upgraded to provide atto-second scale photon pulses in the soft X-ray welcomed by a large part of photon science experiments.
Requirements List Available	Yes
Approval Date	01/01/2020
Status of Contracting	all fine
Construction scheduled to start	16/11/2021
Estimated Project Cost	40M EUR
Estimated Construction Duration	Three phases: linac upgrade 16-Nov-2021 to 14-Aug-2022, FLASH1 beamine upgrade 10-Jun-2024 to 3-Aug-2025, FLASH2 upgrade to atto-second pulses not yet defined
Type of Equipment to be Purchased	typical for electron and photon beamlines plus modulators and radiators

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Mainz Energy-recovering Superconducting Accelerator

Project Location	Mainz/Germany
Project Type	Project Update
Project Description	Energy recovering electron accelerator for particle and nuclear physics
Requirements List Available	No
Approval Date	01/12/2012
Status of Contracting	75% contracted
Construction scheduled to start	01/01/2022
Estimated Project Cost	25 M EUR
Estimated Construction Duration	4
Type of Equipment to be Purchased	vacuum components, cryogenic components

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PETRA IV

Project Location	Germany
Project Type	Project Update
Project Description	PETRA IV is the upgrade of PETRA III, to an ultra low emittance 6 GeV ring, including the refurbishment of the injector chain and the construction of a new Experimental Hall on the DESY Campus.
Requirements List Available	No
Approval Date	01/06/24
Status of Contracting	0%, project not approved yet
Construction scheduled to start	30/01/25
Estimated Project Cost	N/A
Estimated Construction Duration	4
Type of Equipment to be Purchased	whole new accelerators, and refurbishment of ancillary infrastructure

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SINBAD - ARES

Project Location	Hamburg, Germany
Project Type	Project Update
Project Description	Accelerator Research and Development LINAC. Testbed for accelerator components R&D, like diagnostics development and hardware components. Tests of dielectric laser accelerators (DLA) and dielectric diagnostic methods. Experimental areas in air and in vacuum. Medical applications like VHEE and FLASH RT under study.
Requirements List Available	No
Approval Date	
Status of Contracting	
Construction scheduled to start	01/03/2019
Estimated Project Cost	15M EUR
Estimated Construction Duration	
Type of Equipment to be Purchased	RF equipment, vacuum components, diagnostics

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Soreq Applied Research Accelerator Facility

Project Location	Yavne, Israel
Project Type	Project Update
Project Description	This is an upgrade of the first phase of the SARAF accelerator (SARAF-I: 4-5 MeV protons and deuterons, 2 mA CW protons and 10% duty cycle deuterons) to its full capacity: 5 mA CW protons and deuterons, up to maximum energies of 35 MeV (175 kW) and 40 MeV (200 kW), respectively. This will be accomplished by the construction of a new Medium Energy Beam Transport line and four new cryomodules, housing a total of 27 superconducting half-wave-resonator cavities. The high-power beam will be utilized for a vast range of basic and applied research, by the use of gallium-indium liquid-jet targets that will be capable of handling a 200 kW beam. All components have been contracted. Installation of accelerator and target main components has started, and is planned to be completed towards the end of 2024.
Requirements List Available	Yes
Approval Date	15/04/2015
Status of Contracting	100% of the items are contracted
Construction scheduled to start	01/10/2019
Estimated Project Cost	N/A
Estimated Construction Duration	5 years
Type of Equipment to be Purchased	Beam transport lines including magnets, RF rebunchers and beam diagnostics, superconducting RF cavities and solenoids, cryomodules, solid-state RF amplifiers, vacuum equipment, control hardware and software.

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Elettra 2.0

Project Location	Trieste, Italy
Project Type	Project Update
Project Description	A complete upgrade of the existing 260 m circumference storage ring including some upgrades in the infrastructures and beam lines. Four new beam lines will be added.
Requirements List Available	Yes
Approval Date	19/04/2019
Status of Contracting	30%
Construction scheduled to start	02/07/2025
Estimated Project Cost	200M EUR
Estimated Construction Duration	1.5
Type of Equipment to be Purchased	magnets, supports, vacuum chambers and pumps, power supplies, kickers and septa, beam diagnostic, controls, front/ends, radiation instrumentation, radio-frequency, beam lines, electrical systems, piping and cooling.

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FERMI

Project Location	Trieste, Italy
Project Type	New Project
Project Description	FERMI is the free electron laser (FEL) facility in operation for external users at the Elettra Sincrotrone Trieste research institute. FERMI began user operation in 2012 with a scientific impact that has been one of the most successful of any new research facility, with an intense effect on different scientific fields, ranging from nonlinear optics to atomic and molecular science and from extreme thermodynamic conditions to ultrafast magnetism. The uniqueness of FERMI, being the first externally seeded free-electron laser, with unprecedented stability in terms of energy and time jitter, full wavelength and polarization tunability, is facilitating the marriage between the world of ultrafast science and that of X-ray spectroscopy and imaging. This resulted in the birth of unprecedented experimental approaches that, over the years, continuously developed through self-improving synergies between the experimental and machine teams at FERMI and the broad range of users, encompassing both synchrotron and ultrafast communities, that nowadays are routinely exploiting them in different contexts.
Requirements List Available	No
Approval Date	01/12/2004
Status of Contracting	100%
Construction scheduled to start	01/02/2005
Estimated Project Cost	150M EUR
Estimated Construction Duration	5
Type of Equipment to be Purchased	Instrumentation and systems necessary for the realization of the FEL

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I-LUCE

Project Location	Italy
Project Type	New Project
Project Description	Realisation of an Users' open laser facility where laser-driven beams (protons, ions, electrons, neutrons, gamma, etc.) will be put at disposal
Requirements List Available	No
Approval Date	01/01/2023
Status of Contracting	In progress: building realisation and laser system acquisition
Construction scheduled to start	01/01/2023
Estimated Project Cost	15M EUR
Estimated Construction Duration	3
Type of Equipment to be Purchased	Laser system, vacuum chamber, control system, diagnostics

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POTLNS

Project Location	Italy
Project Type	Project Update
Project Description	The project aims to upgrade the LNS superconductive Cyclotron, the beam lines and the ancillaries in order to increase of two order by magnitude the beam intensity.
Requirements List Available	Yes
Approval Date	14/06/2019
Status of Contracting	100% of the supplies have been contracted
Construction scheduled to start	01/03/2021
Estimated Project Cost	25M EUR
Estimated Construction Duration	three
Type of Equipment to be Purchased	Magnets, superconductive magnet, vacuum chamber for beam lines, power converter, diagnostic for beam lines

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SPES (Selective Production of Exotic Species)

Project Location	Italy
Project Type	New Project
Project Description	Facility for the production of radioactive ion-beams and radioisotopes for medicine.
Requirements List Available	No
Approval Date	
Status of Contracting	85% of the items are contracted
Construction scheduled to start	01/01/2012
Estimated Project Cost	60M EUR
Estimated Construction Duration	
Type of Equipment to be Purchased	Vacuum components, beamline instrumentation, HV platforms.

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SESAME injector's upgrade

Project Location	Allan / Jordan
Project Type	New Project
Project Description	The old control interface rack, that was based on Modicon PLCs, has been replaced with a new rack based on SIEMENS PLCs. The old obsolete Auxiliary Gun Power Supply (AGPS) (which heats up the cathode) has been replaced with a modern one that is built in-house, with a controller designed and built in house. The new AGPS has many advanced features and can be remotely controlled and monitored. It allows for better tuning for the cathode-auxiliary gun system. The old Thyratron based Modulator is being replaced with two state-of-the-art solid-state modulators from ScandiNova company (funded by INFN and PSI institutions). The new solid-state modulators will serve the electron gun and Magnetron independently. The unipolar power supplies of Microtron trim coils and transfer line magnets (their polarity was being changed through polarity-changing interface) have been replaced with new bipolar power supplies from CAEN company. Instability in the electric injection septum of the Booster has been reduced by improving its isolation through replacing its old cover with a Faraday cage designed and made in-house.
Requirements List Available	
Approval Date	28/02/2022
Status of Contracting	one year
Construction scheduled to start	
Estimated Project Cost	0.280M EUR
Estimated Construction Duration	
Type of Equipment to be Purchased	solid state modulators

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ALBA II Upgrade

Project Location	Spain
Project Type	New Project
Project Description	ALBA II is the Upgrade of ALBA from a 3rd to a 4th Generation Light Source. It will consist on three main actions: 1) Replace the existing storage ring by a complete new one (magnets, vacuum chambers, girders, RF amplifiers, power supplies, electronics...); 2) Renovate the existing beamlines with new detectors, optics and equipment; 3) Construction of new beamlines, including long beamlines in a new adjacent plot.
Requirements List Available	No
Approval Date	01/06/2024
Status of Contracting	Prototyping, no yet started the construction.
Construction scheduled to start	01/01/2026
Estimated Project Cost	120M EUR
Estimated Construction Duration	4
Type of Equipment to be Purchased	Magnets, vacuum, power supplies, girders, electronics, beamline components, etc.

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International Fusion Materials Irradiation Facility- DEMO Oriented Neutron Source

Project Location	Spain
Project Type	New Project
Project Description	IFMIF-DONES is a fusion-like neutron source for nuclear fusion materials research generated by the interaction between an accelerated deuteron beam and a liquid lithium target. The deuteron accelerator will be a 175 MHz, 125 mA CW, 40 MeV superconducting RF linac.
Requirements List Available	Yes
Approval Date	16/03/2023
Status of Contracting	No items yet are contracted
Construction scheduled to start	16/03/2023
Estimated Project Cost	700M EUR
Estimated Construction Duration	8
Type of Equipment to be Purchased	Deuteron CW ion sources, fast chopper, beam transport line elements (dipoles, quadrupoles, steerers, octupoles, dodecapoles), beam interceptive elements (scrapers, collimators, beam dump), SSPA RF Power Systems, LLRF, power converters, beam diagnostics (current transformers, BPM's, beam loss monitors, FPM's, IPM's, micro loss monitors), vacuum components, control systems (including timing systems, machine protection and safety), cryomodules, scHWR cavities, sc solenoids, IH bunching cavities, lithium loop elements, conventional equipment, cryogenics, remote handling equipment, radiation shieldings, radiation area detectors, infrastructure

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High Luminosity LHC

Project Location	Switzerland
Project Type	Project Update
Project Description	The Large Hadron Collider (LHC) is the largest scientific instrument ever designed and built for particle physics research. The LHC machine accelerates and collides proton beams but also heavier ion species at unprecedented energies of up to 14 TeV. The accelerator is installed in a 27 km long tunnel, about 100 m underground at CERN, the European Organization for Nuclear Research, on the Franco-Swiss border near Geneva, Switzerland. The LHC design is based on superconducting twin-aperture magnets, which are cooled with superfluid helium to their nominal operating temperature of 1.9 K, for the guidance of the particle beams. High Luminosity LHC (HL-LHC) is a project aiming at an upgrade of the LHC machine to maintain scientific progress and exploit its full capacity. By increasing its peak luminosity as of 2029 by a factor of five beyond its initial design value, it will allow collecting a ten times larger set of physics data than during the exploitation period of the nominal LHC. To this aim, HL-LHC is exploring new beam configurations and novel technologies in the domain of superconductivity, radiofrequency, cryogenics, radiation tolerant materials, electronics, and remote handling.
Requirements List Available	Yes
Approval Date	01/06/2016
Status of Contracting	About 70% of the tenders have already been adjudicated. For the rest, calls for tenders are in progress or will be launched in the next two years.
Construction scheduled to start	01/01/2018
Estimated Project Cost	Until the end of 2028
Estimated Construction Duration	1,140 M CHF (material cost) including R&D and in- kind contributions; Industrial contracts are about 700 M CHF
Type of Equipment to be Purchased	SC Magnets & components; SC RF cavities & components; Powering and controls devices for Magnets and Cavities; Collimators & precision mechanics special equipment; Vacuum equipment and beam diagnostics; Cryogenic plants and cryogenic equipment; SC links in MgB2 and High temperature superconductor current leads; Large & precision mechanical tools; technical infrastructures, manufacturing services.

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Compact Linear Collider

Project Location	CERN Geneva
Project Type	New Project
Project Description	Linear Collider based on normal conduction high gradient X-band (12 GHz) acceleration with initial stage at 380 GeV
Requirements List Available	Yes
Approval Date	01/01/2029
Status of Contracting	The project is the development phase and contracts at roughly 2% level have been placed over the last decade, as R&D components and studies, and prototypes
Construction scheduled to start	01/01/2032
Estimated Project Cost	6 BCHF (last complete estimate in 2018)
Estimated Construction Duration	7 years for first stage
Type of Equipment to be Purchased	RF components from structures to network to power sources, beam-diagnostics and instrumentation, control system elements, magnets, vacuum components, etc

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Future Circular Collider

Project Location	Switzerland and France
Project Type	New Project
Project Description	The FCC is a proposed new "90 km" accelerator infrastructure in the Lake Geneva basin, designed to push collision energy and luminosity far beyond the current state of the art. The FCC integrated programme comprises two stages. Stage 1 ("FCC-ee", operating ~2045-2060) is a circular electron-positron collider serving as Higgs factory, electroweak & top factory at highest luminosities. Stage 2 ("FCC-hh", 2065-2090) is a hadron collider with a proton-proton collision energy of about 100 TeV as a natural continuation at energy frontier, including ion-ion and lepton-hadron collision options.
Requirements List Available	No
Approval Date	01/07/2028
Status of Contracting	R&D stage. Limited prototyping of key components. Arc half cell and Interaction Region mock ups. RF developments (different types of SC cavities, high-efficiency klystrons). Critical site investigations scheduled for 2024-2025.
Construction scheduled to start	01/01/2032
Estimated Project Cost	11 Billion EUR for first stage
Estimated Construction Duration	13 years
Type of Equipment to be Purchased	SRF cavities (400 MHz, 800 MHz), RF power sources (klystrons and SSA's), vacuum chambers, magnet systems, some HTS magnets for stage 1; high-performance superconducting cable and high-field magnets (Nb3Sn, HTS, or hybrid HTS/Nb-Ti) for stage 2.

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SLS 2.0

Project Location	Switzerland
Project Type	Project Update
Project Description	Upgrade of Swiss Light Source SLS to MBA Lattice
Requirements List Available	No
Approval Date	01/01/2021
Status of Contracting	85% of storage ring items and 25% of photon beamline items are contracted
Construction scheduled to start	30/09/2023
Estimated Project Cost	129MCHF
Estimated Construction Duration	1.25
Type of Equipment to be Purchased	all components required for a electron storage ring operating as a synchrotron radiation source

Project Leader(s)	Hans Braun, Alun Ashton, Romain Ganter, Markus Jörg, Phil Willmott
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SwissFEL Porthos

Project Location	Switzerland
Project Type	New Project
Project Description	Second hard-X-ray undulator beamline for SwissFEL, comprising a transfer line, RF tuning linac, beam manipulation devices, undulators, front-end, optical transfer lines and up to three experimental stations.
Requirements List Available	No
Approval Date	01/12/2028
Status of Contracting	0% contracted (conceptual phase)
Construction scheduled to start	01/03/2029
Estimated Project Cost	140M CHF
Estimated Construction Duration	4
Type of Equipment to be Purchased	Cicil construction, basic infrastructure, vacuum components, magnets, undulator modules, RF equipment, optical components (mirrors, monochromators, spectrometers etc.), experimental equipment.

Project Leader(s)	Gabriel Aeppli, Christoph Bostedt, Hans Braun, Thomas Schietinger
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European Spallation Source

Project Location	Lund, Sweden
Project Type	New Project
Project Description	The European Spallation Source (ESS) is a multi-disciplinary research facility based on the world's most powerful neutron source. The unique capabilities of this new accelerator-driven facility will both greatly exceed and complement those of today's leading neutron sources, enabling new opportunities for researchers across the spectrum of scientific discovery, including life sciences, energy, environmental technology, cultural heritage and fundamental physics.
Requirements List Available	Yes
Approval Date	01/06/2014
Status of Contracting	>95% of accelerator items for construction phase are contracted. Spares, consumables and upgrades remain.
Construction scheduled to start	01/06/2014
Estimated Project Cost	2891 M EUR
Estimated Construction Duration	14
Type of Equipment to be Purchased	RF modulators, RF power sources, vacuum equipment, power supplies, spare parts, consumables

Project Leader(s)	Helmut Schober (Director General), Kevin Jones (Technical Director), Mirko Menninga (Head of Supply, Procurement and Logistics Division)
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Soft X Ray Laser at MAX IV

Project Location	Lund/Sweden
Project Type	New Project
Project Description	Free Electron laser generating extremely short pulses (< 1 fs) from 1 to 5 nm.
Requirements List Available	No
Approval Date	
Status of Contracting	0.0
Construction scheduled to start	01/01/2025
Estimated Project Cost	100M Euro
Estimated Construction Duration	4
Type of Equipment to be Purchased	Undulators, vacuum components, electromagnets, beamline isntrumentation

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Compact Linear Accelerator for Research and Applications (CLARA)

Project Location	United Kingdom
Project Type	Project Update
Project Description	The CLARA is a proposed FEL Test Facility, being built at STFC's Daresbury Laboratory. The project has been broken down into three phases so that progress can be made with beam commissioning of the first sections of CLARA (Phase 1) while the Phase 2 components are procured and assembled offline, Phase 3 is currently on hold as it is tied to UK XFEL project, which is currently in Conceptual Design and Options Analysis phase. The first phase of CLARA is fully installed and has already demonstrated electron beam at ~50 MeV. Beam from Phase 1 is delivered to an ambitious user exploitation programme covering a wide range of experiments following an open call and selection by Beam time Access Panel. The accelerator sections for the second phase have been assembled offline and the major RF systems are being commissioned. The radiation shielding for Phase 2 is complete and the assembled and tested accelerator modules are being installed in the Phase 2 area. A shutdown has started in March 2023 to install modules in Phase 1 area and technical systems commissioning followed by beam commissioning is expected to start in November 2023. Phase 2 will provide 250 MeV beam, 250 pC bunch charge high brightness electron beam at 100 Hz repetition rate. A separate dedicated full energy beam exploitation beam line (FEBE) is part of Phase 2 which will provide access to users in a shielded hutch. The design includes a recently approved high power laser for FEBE, which will open up unique possibilities for novel proof of principle experiments and as a test bench for accelerator instrumentation and technologies. It is expected that 250 MeV CLARA beam will be available for user experiments from early 2025.
Requirements List Available	No
Approval Date	
Status of Contracting	
Construction scheduled to start	01/04/2015
Estimated Project Cost	60M £ including resources
Estimated Construction Duration	10 years
Type of Equipment to be Purchased	Vacuum components, beam diagnostics, RF spares, optics for laser transport etc

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Project Region

America

Sirius Phase 2 Beamlines

Project Location	Brazil
Project Type	New Project
Project Description	Sirius is a fourth-generation synchrotron light source based on a 3-GeV storage ring with a Multi-Bend Achromat magnet lattice. It provides electron beams that match the phase space of x-ray photons and approach their diffraction limit for tender x-rays. The dramatic increase in brightness and coherence of the source, combined with advances in optics, precision mechatronics, detectors, and computing, opens new research avenues within previously inaccessible spatiotemporal scales. Besides the building and accelerators of the green field machine, the project's first phase provided 14 beamlines. Six are currently open for regular proposal calls, four in commissioning, and 4 in construction, giving scattering, imaging, and spectroscopy capabilities spanning length scales from centimeters to angstroms. Ten new beamlines are foreseen in the project's second phase, yet to be approved, covering THz, UV, soft x-ray, tender x-ray, and hard x-rays.
Requirements List Available	No
Approval Date	01/06/2023
Status of Contracting	0% of the items are contracted
Construction scheduled to start	01/06/2024
Estimated Project Cost	100 M USD
Estimated Construction Duration	5
Type of Equipment to be Purchased	Insertion devices, Detectors, Hutches, Optical components (slits, mirrors, monochromator, gratings), beam diagnostics, Vacuum components, Computing Infrastructure,

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ARIEL

Project Location	Vancouver, Canada
Project Type	Project Update
Project Description	ARIEL comprises a major expansion of the ISAC radioactive ion beam (RIB) facility. ISAC, operational since 1997, comprises a target area where RIBs are produced via bombardment of up to 50kW of protons from the 500MeV cyclotron onto a thick target. The ions are transported to low energy experiments or accelerated in a heavy ion linac to energies ranging from 0.15MeV/u to 17MeV/u. In ARIEL a new building will host two new target areas. The first will be bombarded by electrons from a superconducting electron linac with energy and intensity of 30MeV and 3mA (100kW). The second target area will be bombarded from a new beamline from the 500MeV cyclotron with beam power up to 50kW. The electron linac is now operational with demonstrated beam power of 10kW cw. The electron target station will be ready for beam commissioning by the end of 2025. The proton target station will be ready for beam by the end of 2026. The ARIEL facility will allow three simultaneous RIBs for the ISAC experimental program and triple the experimental beam time hours.
Requirements List Available	No
Approval Date	
Status of Contracting	65%
Construction scheduled to start	01/04/2015
Estimated Project Cost	100M$ CND
Estimated Construction Duration	11
Type of Equipment to be Purchased	Vacuum components, shielding, beamline components

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CLS Linac replacement

Project Location	Canada
Project Type	Project Update
Project Description	250 MeV electron linac injector for the Canadian Light Source
Requirements List Available	Yes
Approval Date	31/08/22
Status of Contracting	
Construction scheduled to start	01/02/24
Estimated Project Cost	15M CAD
Estimated Construction Duration	0.5
Type of Equipment to be Purchased	Project including electron source, modulators, klystrons, accelerating structures, waveguides, water cooling upgrades, diagnostics upgrades, power supply upgrades, vacuum components, critical spares.

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Solid State Amplifier for 2.9 GeV electron Storage Ring

Project Location	Canada
Project Type	New Project
Project Description	Procurement of a new 275 kW solid state amplifier to drive the 2.9 GeV electron storage ring superconducting RF cavity at the CLS
Requirements List Available	Yes
Approval Date	03/04/23
Status of Contracting	100%
Construction scheduled to start	01/06/23
Estimated Project Cost	5M CAD
Estimated Construction Duration	1.5
Type of Equipment to be Purchased	Solid State RF Amplifier

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APS Upgrade

Project Location	Lemont, Illinois, USA
Project Type	Project Update
Project Description	The APS-U is a comprehensive upgrade of the existing APS facility centered on the complete replacement of the storage ring with a new Multi Bend Achromat design, new insertion devices and front ends including diagnostics, and multiple beamline upgrades to take advantage of the new capabilities provided by the Upgrade.
Requirements List Available	Yes
Approval Date	19/12/2018
Status of Contracting	Over 90% of the items are contracted, with many being delivered.
Construction scheduled to start	25/07/2019
Estimated Project Cost	$815M
Estimated Construction Duration	Installation of the new machine will start in April 2023.
Type of Equipment to be Purchased	Most of the equipment orders have been placed and received at this time through best value procurements, and have ranged across everything needed at a light source facility.

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Cool Copper Collider

Project Location	TBD
Project Type	New Project
Project Description	C3 is a proposed 250/550 GeV center of mass linear collider (https://arxiv.org/abs/2110.15800). It is based on a distributed coupling accelerator concept for normal conducting accelerator technology. The accelerator operates at ~80K with the structures immersed in liquid nitrogen. We are presently pursuing a demonstration program to produce and test the first cryomodules for the main linac (https://arxiv.org/abs/2203.09076).
Requirements List Available	Yes
Approval Date	01/04/25
Status of Contracting	Not contracting
Construction scheduled to start	01/01/30
Estimated Project Cost	TBD
Estimated Construction Duration	8-10 years
Type of Equipment to be Purchased	rf sources, rf structures, vacuum vessel, cryogenic infrastructure

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Electron Ion Collider

Project Location	Upton, New York, USA
Project Type	New Project
Project Description	Using the superconducting rings of RHIC to collide polarized electrons with polarized hadrons by adding an 18 GeV electron storage ring in the RHIC tunnel which yields a maximum centre of mass of 140GeV. Target luminosity is up to 1E34/cm^2/s
Requirements List Available	Yes
Approval Date	19/12/2019
Status of Contracting	contracting planned to start in spring 2024
Construction scheduled to start	15/04/2025
Estimated Project Cost	2.4B $
Estimated Construction Duration	
Type of Equipment to be Purchased	magnets, vaccum, sc cavities, sc magnets, cryogenics, power technology, instrumentation, controls

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Future NSLS-II upgrade

Project Location	Upton, New York, USA
Project Type	New Project
Project Description	The future upgrade targets increase in brightness of insertion devices across wide range of photon energies as well as broadening capabilities of NSLS-II experimental program.
Requirements List Available	No
Approval Date	
Status of Contracting	R&D on key technologies is progressing
Construction scheduled to start	
Estimated Project Cost	
Estimated Construction Duration	
Type of Equipment to be Purchased	magnets, RF, chambers, diagnostics, power supplies

Project Leader(s)	
Affiliation	
e-mail	

Contact Person(s)	Timur Shaftan
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HELEN Linear Collider

Project Location	Batavia, Illinois, USA
Project Type	New Project
Project Description	Higgs-Energy LEptoN (HELEN) $e+e-$ linear collider is based on advanced traveling wave superconducting radio frequency technology. The proposed collider offers cost and AC power savings and smaller footprint relative to the ILC. After the initial physics run at 250 GeV center of mass, the collider could be upgraded either to higher luminosity or to higher energy.
Requirements List Available	Yes
Approval Date	
Status of Contracting	
Construction scheduled to start	01/01/2030
Estimated Project Cost	similar to ILC
Estimated Construction Duration	10
Type of Equipment to be Purchased	SRF cryomodules, RF equipment, vacuum systems, Sc and conventional magnets, cryogenic systems, beam diagnostics, etc.

Project Leader(s)	Sergey Belomestnykh
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High resolution ion beam analysis

Project Location	College Station, USA
Project Type	Project Update
Project Description	Improving energy resolution of ion beam analysis from 10s keV to <1keV
Requirements List Available	No
Approval Date	01/01/2023
Status of Contracting	10%
Construction scheduled to start	01/01/2023
Estimated Project Cost	0.5M EUR
Estimated Construction Duration	one year
Type of Equipment to be Purchased	two dimensional multichannel plate detector systems (at least two sets)

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Integrable Optics Test Accelerator / Fermilab Accelerator Science and Technology Facility

Project Location	Batavia, Illinois, USA
Project Type	Project Update
Project Description	One of the premiere R&D facilities for Accelerator Science and Technology, IOTA/FAST comprises a high-brightness electron photoinjector, a state of the art superconducting radio-frequency linear accelerator, a high-intensity proton injector and a flexible electron/proton storage ring with advanced control and diagnostic infrastructure. The facility's main science portfolio includes novel techniques for enabling next-generation discovery-science accelerators, optical-bandwidth beam-cooling technologies, advanced particle-beam manipulation, quantum and photon science with individual electrons, and artificial intelligence for accelerator diagnostics and controls.
Requirements List Available	No
Approval Date	01/10/ 2014
Status of Contracting	N/A
Construction scheduled to start	01/10/ 2015
Estimated Project Cost	N/A
Estimated Construction Duration	10 years
Type of Equipment to be Purchased	Full range of accelerator products and supporting infrastructure.

Project Leader(s)	N/A
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Linac Coherent Light Source II

Project Location	Menlo Park, California, USA
Project Type	Project Update
Project Description	1 MHz, CW, Free Electron Laser providing X-rays spanning 0.2 to 5.0 keV
Requirements List Available	Yes
Approval Date	01/04/2010
Status of Contracting	Project is in the final commissioning stage and will complete by August 2023
Construction scheduled to start	21/03/2016
Estimated Project Cost	$1.1B
Estimated Construction Duration	7 years
Type of Equipment to be Purchased	High Power Solid State Amplifiers, 37 Tesla-style cryomodules, cryogenic transfer lines, 2 4kW at 2K liquid helium refrigerators, vacuum components, electronics and control hardware, cable plant

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Linac Coherent Light Source II High Energy

Project Location	Menlo Park, California, USA
Project Type	Project Update
Project Description	LCLS-II-HE at SLAC will be a transformative X-ray tool for the scientific mission of DOE Basic Energy Sciences (BES) and for the nation. It represents the vital next step in the ongoing revolution in X-ray lasers, triggered by the world's first demonstration of a hard X-ray free-electron laser (XFEL) by LCLS in 2009. Its capability moves far beyond the present generation of XFELs and the ultimate potential of storage rings, firmly maintaining the U.S. as the international leader in the science enabled by X-ray sources. The unmatched performance of this facility will serve the needs of a broad scientific user community focused on some of the most critical challenges facing our society, while providing extraordinary potential for scientific discovery and attracting the best and brightest scientific talent.
Requirements List Available	No
Approval Date	05/12/16
Status of Contracting	
Construction scheduled to start	14/12/23
Estimated Project Cost	$710 M
Estimated Construction Duration	6 years
Type of Equipment to be Purchased	SRF, RF, Scientific Instruments

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Proton Improvement Plan II

Project Location	Batavia, Illinois, USA
Project Type	New Project
Project Description	The Proton Improvement Plan II, or PIP-II, is an essential enhancement to the Fermilab accelerator complex, powering the world most intense high-energy neutrino beam on its journey from Illinois to the Deep Underground Neutrino Experiment in South Dakota a distance of 1,300 kilometers (800 miles). DUNE scientists will use neutrinos to answer some of the most profound questions about our universe. In addition, over the next 50 years, PIP-II will drive a broad physics research program, delivering scientific breakthroughs and likely to reveal surprising answers to questions that are not yet contemplated.
Requirements List Available	No
Approval Date	01/12/2020
Status of Contracting	
Construction scheduled to start	18/04/2022
Estimated Project Cost	978M$
Estimated Construction Duration	6 years
Type of Equipment to be Purchased	SRF cavities, RF-equipment, vacuum components, beam diagnostics/instrumentation, magnets, etc.

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Proton Power Upgrade project

Project Location	Oak Ridge, Tennessee, USA
Project Type	Project Update
Project Description	Double accelerator power capability to 2 MW
Requirements List Available	Yes
Approval Date	17/01/2018
Status of Contracting	90% of procurements are in place
Construction scheduled to start	20/10/2020
Estimated Project Cost	272M $
Estimated Construction Duration	4
Type of Equipment to be Purchased	superconducting RF cryo-modules, high power RF, magnets, high power target equipment

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Muon-to-Electron Conversion Experiment

Project Location	Batavia, Illinois, USA
Project Type	New Project
Project Description	The Muon to Electron Conversion Experiment (Mu2e) experiment will search for Charged Lepton Flavor Violation (CLFV) in coherent conversion of muons into electrons in the field of a nucleus, probing new physics at mass scales that exceed the reach of the Large Hadron Collider.
Requirements List Available	Yes
Approval Date	04/03/2015
Status of Contracting	87%
Construction scheduled to start	04/03/2015
Estimated Project Cost	315.7M US Dollars
Estimated Construction Duration	10.5
Type of Equipment to be Purchased	Vacuum components, collimators, beam line magnet power supplies

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Project Region

Asia and Australasia

Australian Synchrotron Maintenance

Project Location	Australia
Project Type	Project Update
Project Description	In addition to the normal operations funding, this project is to maintain and upgrade many accelerator components at the Australian Synchrotron.
Requirements List Available	No
Approval Date	01/07/2016
Status of Contracting	Ongoing as needs arise
Construction scheduled to start	01/08/2016
Estimated Project Cost	50 M AUD
Estimated Construction Duration	10 years
Type of Equipment to be Purchased	RF hardware systems including klystrons and low level RF electronics, beam diagnostics for linac, transfer lines, booster synchrotron and storage ring, power amplifiers, feedback systems, power supplies.

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China Spallation Neutron Source

Project Location	China
Project Type	New Project
Project Description	The CSNS facility is designed to provide multidisciplinary research.
Requirements List Available	No
Approval Date	03/09/2011
Status of Contracting	Completed construction, open to users
Construction scheduled to start	20/10/2011
Estimated Project Cost	1.86632 Billion CNY
Estimated Construction Duration	6.5
Type of Equipment to be Purchased	a 80-MeV H- linac,a 1.6-GeV proton rapid cycling synchrotron (RCS), beam transport lines, a solid tungsten target station, and 4 instruments for the pulsed spallation . Beam power on target is 140kW.

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Chinese ADS superconducting Front-end demo linac

Project Location	China
Project Type	New Project
Project Description	Chinese ADS Superconducting Front-end demo linac (CAFe), designed to accelerate 5 to 10 mA Continuous-wave proton beam at 25 MeV, has been constructed to develop the key technologies of low-energy high-power sc-linac. What is more,the facility will be mainly to investigate the implementation strategies and techniques for the high readability and availability operation of high-power sc-linac. It is composed of a 2.45-GHz ion source, a 162.5-MHz radio frequency quadrupole accelerator (RFQ), a medium energy beam transport line (MEBT),a superconducting accelerating section with four cryomodules which contains Half Wave Resonators (HWR) and Spoke resonators and a high energy beam transport line (HEBT).It will keep upgrading to achieve the nominal beam power and the goal of low trip-rate of ADS.
Requirements List Available	Yes
Approval Date	18/01/2011
Status of Contracting	Finished, keep upgrading
Construction scheduled to start	01/04/2011
Estimated Project Cost	41M EUR
Estimated Construction Duration	6 YEARS
Type of Equipment to be Purchased	Low radiation beam dump of 200 kW for 10-MeV proton beam loss monitors at low energy section Low level RF and machine protection system base on FPGA

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Chinese initiative Accelerator Driven System

Project Location	China
Project Type	New Project
Project Description	CiADS is a research facility to demonstrate the feasibility of the key technologies and the integration and operational experience of accelerator-driven subcritical system.It consists of a continuous-wave superconducting proton LINAC with 500 MeV and 5 mA, a liquid LBE coolant fast reactor with 7.5 MWt, and a granular target employed to coupling the accelerator and the sub-critical core. The superconducting linac has five families, 162.5 MHz half wave resonators of beta 0.1 and 0.19, 325 MHz HWR resonators of beta 0.40, and 650 MHz elliptical resonators of beta 0.6 and 0.8. All resonators will be excited by solid state amplifiers with power range from 10 kW to 100 kW. The superconducting solenoids are employed to focus beam inside the cryomodules. The power supplies are modularization and can serve all the magnets by in series or in parallel. The prototypes of all the devices were purchased in 2020.
Requirements List Available	Yes
Approval Date	30/12/2015
Status of Contracting	Prototype purchasing and verification
Construction scheduled to start	01/07/2019
Estimated Project Cost	542 M EUR
Estimated Construction Duration	7 years
Type of Equipment to be Purchased	Low radiation beam dump of 200 kW for 10-MeV proton, beam loss monitors at low energy section, Low level RF and machine protection system base on FPGA

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Heavy Ion Research Facility at Lanzhou

Project Location	China
Project Type	Project Update
Project Description	The upgrade project of the HIRFL facility is to increase beam power. The existing facility consists of two cyclotrons (SFC and SSC) and two cooling storage rings (CSRm and CSRe). In the upgrade project, a new vacuum backing system will be used in both rings. Some beam diagnostics will be improved to measure the beam orbit and profile. With the upgrade, the charge state of Uranium beam in CSRm will be increased up to 74+. Correspondingly, the extraction energy will be improved to 500 MeV/u. The project received approval to proceed with construction in 2019. Most of installations will take place before 2023.
Requirements List Available	Yes
Approval Date	05/02/2019
Status of Contracting	>90% of the items are contracted
Construction scheduled to start	05/08/2021
Estimated Project Cost	20M CNY
Estimated Construction Duration	4 years
Type of Equipment to be Purchased	Vacuum backing system, beam diagnostics

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Hefei Advanced Light Facility

Project Location	China
Project Type	New Project
Project Description	Hefei Advanced Light Source (HALF) is the first low-energy fourth-generation synchrotron radiation source in China. It consists of a 2.2GeV storage ring with a circumference of 480m and a 6BA lattice structure, and a full energy injector with a thermal-cathode electron gunÔºåhosting up to 35 beamlines. HALF will be developed and constructed by the National Synchrotron Radiation Laboratory of the University of Science and Technology of China. It can strongly support scientific research in key fields such as functional and quantum materials, integrated circuits, energy materials, chemistry and chemical engineering, and major diseases, and help the high-quality development of related industries.
Requirements List Available	Yes
Approval Date	
Status of Contracting	None
Construction scheduled to start	20/09/2023
Estimated Project Cost	500M USD
Estimated Construction Duration	5.5 years
Type of Equipment to be Purchased	Magnet, vacuum components, RF-equipment, beam diagnostics

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High Intensity heavy-ion Acelerator Facility

Project Location	China
Project Type	New Project
Project Description	HIAF is a new accelerator facility under constructed at the Institute of Modern Physics (IMP) in China. The research mission of HIAF is to study interdisciplinary on nuclear physics, nuclear astrophysics, atomic physics and heavy ion applications. The facility consists of a superconducting ECR ion source (SECR), a CW super-conducting ion linac (iLinac), a fast ramping booster synchrotron (BRing) and a high precision spectrometer ring (SRing). A fragment separator (HFRS) is used to connect BRing and SRing. Six experimental terminals will be built at HIAF. The maximum magnetic rigidity is 34 Tm. The civil construction was already started in December of 2018. The accelerator tunnel and buildings will be complete in late 2023. First part of the accelerator will be installed in 2024. The goal is to have beam ready for the experiment by 2025.
Requirements List Available	Yes
Approval Date	31/12/2015
Status of Contracting	~85% of items are contracted
Construction scheduled to start	23/12/2018
Estimated Project Cost	450M USD
Estimated Construction Duration	7 years
Type of Equipment to be Purchased	Superconducting magnets, vacuum pumps, beam line magnets, electronics, etc.

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Shanghai HIgh repetitioN rate XFEL and Extreme light

Project Location	China
Project Type	Project Update
Project Description	SHINE is the largest XFEL project in China, driven by an 8 GeV CW SC Linac. Three FEL undulator lines, 10 X-ray end-stations, and an extreme light end-station with 100PW laser, will be delivered.
Requirements List Available	Yes
Approval Date	28/04/2017
Status of Contracting	
Construction scheduled to start	27/04/2018
Estimated Project Cost	~1.5B EUR
Estimated Construction Duration	
Type of Equipment to be Purchased	vacuum components, SRF equipments, beam instrumentation, magnet, power supply, cryogenics

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Beam Power Upgrade of J-PARC Main Ring

Project Location	Japan
Project Type	Project Update
Project Description	Shortening a repetition cycle to increase beam power of J-PARC MR.
Requirements List Available	Yes
Approval Date	
Status of Contracting	Beam commissioning has started in JFY2022. Approximately 85 % of the total cost has already been executed.
Construction scheduled to start	01/04/2016
Estimated Project Cost	100M US dollars
Estimated Construction Duration	
Type of Equipment to be Purchased	Magnet power supplies, RF systems, extraction systems, collimators, beam monitors, etc.

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iBNCT

Project Location	Japan
Project Type	New Project
Project Description	Development of a demonstration device for a linac-based BNCT system. Conduct clinical trials using this device. The final goal is to apply for regulatory approval of this device.
Requirements List Available	No
Approval Date	01/04/2012
Status of Contracting	99% of items are contracted
Construction scheduled to start	01/04/2012
Estimated Project Cost	18 M EUR
Estimated Construction Duration	5 years
Type of Equipment to be Purchased	Linac and neutron moderator matrials

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ILC

Project Location	Japan
Project Type	New Project
Project Description	The 125 GeV electron-positron collider, based on superconducting and nano-beam technologies
Requirements List Available	Yes
Approval Date	03/04/28
Status of Contracting	Technical Design Report (TDR) was published. Worldwide collaborative R&Ds (ILC technology network) will start in this year.
Construction scheduled to start	01/01/30
Estimated Project Cost	4780~5260MILCU (MILCU=M$ @2012)
Estimated Construction Duration	10 years
Type of Equipment to be Purchased	superconducting cavities, magnets, RF-equipment, beam diagnostics, vacuum components, cryogenics, control, computing, conventional facilities

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NanoTerasu

Project Location	Sendai city, Japan
Project Type	New Project
Project Description	https://www.nanoterasu.jp/
Requirements List Available	No
Approval Date	25/10/2019
Status of Contracting	
Construction scheduled to start	27/03/2020
Estimated Project Cost	36 Billion Japanese yen
Estimated Construction Duration	
Type of Equipment to be Purchased	Magnet, vacuum components, RF-equipment, beam diagnostics, etc.

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RIBF Upgrade Project

Project Location	Saitama, Japan
Project Type	Project Update
Project Description	This project aims at increasing the intensity of radioactive isotope beams by 20 times more than what is available now at RIKEN RI Beam Factory (RIBF). Reference: H. Imao 2020 JINST 15 P12036.
Requirements List Available	No
Approval Date	
Status of Contracting	Conceptual design completed. Prototypes of electromagnets have been fabricated.
Construction scheduled to start	01/04/2026
Estimated Project Cost	13,000M YEN
Estimated Construction Duration	5
Type of Equipment to be Purchased	Magnets, power supplies, rf cavites, rf amplifiers, beam chambers, vacuum system, beam diagnostics.

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SPring-8-II

Project Location	Japan
Project Type	Project Update
Project Description	This project aims at upgrading the light source performance by about two order in brilliance with a MBA lattice design, permanent-magnet based bending magnet, narrow aperture vacuum chamber, advanced in-vacuum undulator technology.
Requirements List Available	No
Approval Date	01/04/2024
Status of Contracting	Not started yet
Construction scheduled to start	20/12/2027
Estimated Project Cost	35 billion JPY
Estimated Construction Duration	15 months
Type of Equipment to be Purchased	magnet components, vacuum components, beam diagnostics, insertion devices

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Establishment of Heavy Ion Medical Accelerator

Project Location	Gijang-gun/Busan-si, South Korea
Project Type	Project Update
Project Description	Establishment of Heavy Ion Medical Accelerator
Requirements List Available	Yes
Approval Date	
Status of Contracting	
Construction scheduled to start	01/09/2023
Estimated Project Cost	200M USD
Estimated Construction Duration	
Type of Equipment to be Purchased	Heavy Ion Treatment System

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Multipurpose Synchrotron Radiation Construction Project

Project Location	South Korea
Project Type	New Project
Project Description	The Multi-purpose Synchrotron Radiation Construction Project was started officially on July, 2021 with the budget of 845.4 Billion KRW. This project aims to build 4 GeV storage ring with an emittance less than 100 pm by adopting multi-bend achromatic structure. Its circumference is about 800m with 28-fold symmetry, and the length of ID section is about 6.5m long. It can host more than 40 beamlines, but there are 10 beamlines in the initial stage.
Requirements List Available	No
Approval Date	01/07/2021
Status of Contracting	None
Construction scheduled to start	2024
Estimated Project Cost	845.4B KRW
Estimated Construction Duration	4 years
Type of Equipment to be Purchased	TBA after TDR is confirmed

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PAL-XFEL HX-2

Project Location	Pohang, South Korea
Project Type	Project Update
Project Description	Adding 2nd hard X-ray undulator line and experimental stations to existing PAL-XFEL
Requirements List Available	No
Approval Date	31/12/2025
Status of Contracting	0%
Construction scheduled to start	01/01/2026
Estimated Project Cost	100M USD
Estimated Construction Duration	two years
Type of Equipment to be Purchased	Undulator, beamline experimental components

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Advancements in Accelerator Technology and Energy Efficiency for Future Upgrade Project of TPS-II

Project Location	Hsinchu, Taiwan
Project Type	Project Update
Project Description	The Taiwan Photon Source (TPS) began user operations in 2016 and has been operating at its designed beam current of 500 mA since 2021. Currently, it offers users more than 4,600 hours of annual operating time, has a mean time between failures of approximately 130 hours, and achieved an availability rate of about 98.7% in 2022. In preparation for a potential upgrade plan in 10 years, we are allocating resources to advance our accelerator technology with the aim of improving the performance of the light source before the upgrade project begins. Our primary focus is on developing a superconducting third harmonic passive cavity (1.5 GeV), an in-vacuum cryogenic permanent undulator, a nonlinear injection kicker and pulser, and a NEG-coated long-sized vacuum chamber. Furthermore, we are pursuing energy-saving measures, including reducing infrastructure energy consumption in all directions, improving the energy conversion efficiency of our homemade 320 kW, 500 MHz solid-state high-power RF transmitter, and prototyping the replacement of the electromagnetic dipole in our previous light source, the Taiwan Light Source (TLS), with a permanent one. We aim to create a high-flux and bright green light source. The aforementioned technology development items play a critical role in achieving our ultimate goal.
Requirements List Available	No
Approval Date	01/01/2021
Status of Contracting	50% or more
Construction scheduled to start	01/01/2021
Estimated Project Cost	2M EUR annually
Estimated Construction Duration	10 years
Type of Equipment to be Purchased	Various

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Siam Photon Source II

Project Location	Thailand
Project Type	New Project
Project Description	3 GeV 4th Generation Synchrotron Light Source
Requirements List Available	No
Approval Date	
Status of Contracting	
Construction scheduled to start	01/01/2024
Estimated Project Cost	518.45M USD
Estimated Construction Duration	
Type of Equipment to be Purchased	RF equipment, beam diagnostics, magnet power supplies, control system, s-band linac, DLLRF system, insertion devices

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PARTICLE ACCELERATOR PROJECTS AND UPGRADES

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