DarkSide-20k Project Execution Plan

The Global Argon Dark Matter Collaboration

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1. INTRODUCTION

1.1. Scientific Objectives

The DarkSide-20k project will be a comprehensive search for high-mass WIMPs using a dual-phase argon time projection chamber (LAr TPC). DarkSide-20k is planned to run for ten years, accumulating a total exposure of 200 t yr, and will have sensitivity to a WIMP-nucleon cross section of $7.4 \times 10^{-48}\,\mathrm{cm}^2$ ($6.9 \times 10^{-47}\,\mathrm{cm}^2$) for $1\,\mathrm{TeV}/c^2$ ($10\,\mathrm{TeV}/c^2$) WIMPs. Within this exposure, we expect 3.2 events induced by high-energy atmospheric neutrinos recoiling from argon nuclei, making DarkSide-20k the first experiment capable of exploring the neutrino background that defines the so-called "neutrino floor." DarkSide-20k will also be able to perform a high precision measurement of neutrinos in the event of a galactic supernova burst.

In order to achieve this sensitivity, DarkSide-20k will be constructed from ultra-low background materials and employ techniques to actively identify background events. The scintillating LAr target used in the TPC will be low-radioactivity argon extracted from an underground source. This scintillation light will be detected by cryogenic silicon photomultipliers (SiPMs) that have been designed to maximize blue photon detection efficiency while minimizing background. The LAr TPC will be surrounded by an active LAr veto housed inside of a membrane cryostat, a technology developed at CERN for the ProtoDUNE experiments. The design of the LAr TPC and the membrane cryostat veto are scalable, making DarkSide-20k a crucial step towards a future, several hundred tonne LAr detector.

1.2. Scientific Requirements

The scientific requirements for the DS-20k project are driven by the need to reduce and/or actively discriminate background events originating from naturally occurring radiation to a level below <0.1 events in the full exposure of 200 t yr, thereby maximizing the discovery potential of the experiement. The major scientific requirements are:

The procurement and purification of low-radioactivity argon: Argon extracted from the atmosphere (AAr) contains ^{39}Ar with a specific activity of 1 Bq/kg, leading to an unsustainable pile-up rate in a detector the size of DarkSide-20k. The DarkSide-50 detector demonstrated that argon extracted from an underground source (UAr) has an ^{39}Ar concentration 1400 times lower than that of AAr and is suitable for use in a multi-ton LAr TPC. The procurement and purification of 60 t of low-radioactivity UAr argon is a pre-requisite for the DarkSide-20k project and will be carried out by the Urania underground argon extraction plant and the Aria cryogenic distillation column.

The manufacture of low-background, large-area SiPM photosensors: The high cost, unreliable performance at 87 K, and intrinsic radioactive contamination of PMTs makes them unsuitable for use in DarkSide-20k. Instead, DarkSide-20k will rely on silicon photomultiplier (SiPM) based photodetector modules for light detection. In order to meet the event reconstruction requirements of DarkSide-20k, they must have an active area of $50 \times 50\,\mathrm{mm}^2$, photo-detection efficiency better than 40 %, the ability to detect single photons with a signal to noise ratio better than 8, and a timing resolution of 10 ns. They must also contribute much less than the <0.1 events allotted for the overall background in the full 200 t yr exposure due to their own intrinsic radioactivity.

The ability to veto neutron backgrounds: Neutrons elastically scattering from argon nuclei are indistinguishable from WIMPs. The background rate from all sources of neutrons, including radiogenic neutrons from (α,n), fission decays in the TPC materials, and cosmogenic neutrons, must be suppressed far below the <0.1 events allotted for the overall background in the full 200 t yr exposure. The total number of neutrons entering the detector will be reduced by the careful selection and screening of detector construction materials. Neutron events will be rejected by fiducializing the sensitive argon volume and by tagging events with multiple interaction sites, techniques afforded by the sub-centimeter position resolution of the LAr TPC [1]. The residual neutron rate will be measured and efficiently rejected using a veto detector consisting of two volumes of AAr separated by a thin layer of Gd-doped ultra-high purity acrylic (poly(methyl methacrylate), PMMA) and instrumented with PDMs.

The ability to reject electron recoil backgrounds: The rate of electron recoil backgrounds misidentified as nuclear recoil events must be kept well below the total background of <0.1 events allotted for the the full exposure of 200 t yr. This will be accomplished by the careful selection and screening of detector materials and by the use of pulse shape discrimination (PSD) to identify electron recoil events. The PSD performance is heavily dependent on the efficient detection of single photons and is the chief driver of the performance requirements for the photodetectors. The DEAP-3600 experiment has used PSD to suppress electron recoil events in a LAr detector to better than a factor 2.4×10^8 [2].

1.3. Facility/Infrastructure

Several major pieces of infrastructure are needed to meet the scientific requirements of DS-20k. These include:

Urania: UAr with ultra-low levels of ^{39}Ar can be obtained from gas wells in Cortez, Colorado, USA, the only well-characterized source of low-radioactivity argon in the world capable of sustained, high throughput production. The Urania plant will extract 60 t of UAr from this gas stream as part of the science program of DS-20k. Urania is an industrial-scale chemical plant, designed to extract UAr at a rate of 250 kg/d, delivering UAr with a chemical purity of 99.9 %. Construction of the Urania plant is the responsibility of INFN, which has issued a tender that is nearing the adjudication phase. The contracted vendor will build the plant and ship it to the Kinder Morgan site in Cortez. Installation of the plant will be carried out by the GADMC. We project that the batch of UAr necessary for DS-20k will be completed by the middle of 2022.

Aria: The UAr extracted by Urania must be 99.999 % pure prior to the use of Zr0-based getters as point-of-use purifiers during the DarkSide-20k LAr TPC fill. This level of purity will be reached by purification with the Aria facility, specifically with Seruci-I, a 350 m high cryogenic distillation column for high-throughput, high-resolution chemical purification and active isotopic separation. Seruci-I can perform the necessary chemical purification of UAr at a rate of O(1 t/d). Seruci-I was also designed to test the possibility of separating ^{39}Ar from ^{40}Ar by exploiting the tiny difference in the relative volatility of the two isotopes. When operating at a reduced throughput of 10 kg/d, Seruci-I is predicted to deplete ^{39}Ar by a factor of 10 per pass. By processing the intended target multiple times, Seruci-I could further suppress ^{39}Ar by three orders of magnitude. A 24 m tall prototype column, called Seruci-0, has recently been completed and will start operations in June 2019, enabling a comprehensive test of the cryogenics and slow controls of Seruci-I.

NOA: the *Nuova Officina Assergi* (NOA) is a custom-built cleanroom packaging facility for the high-throughput assembly of SiPM-based photosensors funded by Regione Abruzzo and the Italian Government. The NOA facility will be located in a cleanroom at the *Tecnopolo dell'Aquila* that will be repurposed and made available by the Gran Sasso Science Institute (GSSI). NOA will feature state-of the art silicon back-end packaging equipment, including an automated cryogenic wafer probe, a high-throughput automated flip chip bonding machine, and an x-ray inspection machine. INFN is responsible for the procurement of all major equipment and all major contracts have been already signed. During the production of the DS-20k PDMs, NOA will be staffed with sixteen engineers and technicians. The NOA facility will begin operations at the of 2019 and full production is planned to begin in earl 2020.

ProtoDUNE LAr cryostat: Following the approval of the experiment in 2017, LNGS requested that the GADMC reconsider its original approved plan, an organic liquid scintillator veto detector nested inside a water Cherenkov veto detector, in order to minimize any possible environmental impacts of underground LNGS operations. Following this recommendation, the GADMC abandoned its original plan and developed a new solution based on the ProtoDUNE membrane cryostats developed at CERN. The LAr TPC of DS-20k is placed at the center of the ProtoDUNE cryostat, which will be filled with 700 t of liquefied AAr, part of which will be instrumented and serve as a scintillation (and Cherenkov) anti-coincidence veto detector. The veto detector is composed of an inner volume of active liquid atmospheric argon (Inner Argon Buffer, IAB) surrounding the TPC, a passive Gd-loaded octagonal acrylic (PMMA) shell (GdAS) that completely surrounds the IAB, and an outer active volume of atmospheric argon (Outer Argon Buffer, OAB). A copper Faraday cage electrical and optically isolates the OAB from the rest of the argon volume. The IAB and the OAB will be instrumented with a variant of the PDMs designed for the DS-20k LAr TPC.

Sealed PMMA TPC: The adoption of the ProtoDUNE cryostat meant the vacuum cryostat surrounding the LAr TPC, a major source of radiogenic neutrons, could be replaced by a sealed, ultra-pure PMMA vessel. The vessel serves to contain the UAr and is used as a structural element of the TPC.

1.4. Scientific and Broader Societal Impacts

The DS-20k project has a diverse portfolio of scientific and educational broader impacts. The technologies developed for the experiment have applications in medical diagnostics, advanced photon detection, and isotope separation, including the discovery of a novel, commercially viable helium source that today supplies 15 % of the US production; the production of hundreds of tonnes of low-radioactivity UAr for DS-20k as well as for other technical uses including nuclear test ban verification and radiometric dating; and the development of low-background, large-area, single-photon, cryogenic photosensors. The planned Aria project for UAr purification may improve the worldwide availability of valuable stable rare isotopes such as ^{18}O, ^{15}N, and ^{13}C, which are used for various medical, industrial, and energy generation applications. DS technology has also led to 3Dπ, an innovative, patent-pending LAr-based TOF-PET system that can enhance cancer screening sensitivity while dramatically lowering patient radiation dose, under development at Princeton University and Università degli Studi di Cagliari.

Specific education and outreach programs are planned as part of the DS-20k project with a focus on educating K-12 teachers about basic physics and its relation to dark matter detection, re-starting a summer school experience for high-school and undergraduate students, and giving education and training opportunities to undergraduate students at participating underrepresented-minority serving institutions.

1.4.1. Scientific Impacts

SiPMs for Medical Diagnostics: INFN and Princeton University filed patent P137IT00 for 3Dπ, an innovative high-definition 3D Positron annihilation vertex imager. 3Dπ is designed to overcome the limitations of conventional Positron Emission Tomography (PET) and Time-Of-Flight PET (TOF-PET) nuclear imaging techniques that are used in the fight against cancer. The market for PET and TOF-PET machines is valued in the hundreds of million of dollars per year and is expanding rapidly. With traditional PET and TOF-PET machines, poor time of flight resolution inhibits the 3D position reconstruction of the point where the positron annihilates and the gamma-rays are generated. Therefore, PET and TOF-PET machines reconstruct clinical images by 2D tomography, first determining the 2D projections in surfaces perpendicular to the γ-rays line of flight and then combining and fitting the 2D projections obtained for different angles to reconstruct the 3D image. As a consequence, resolution, contrast, and brightness of clinical images obtained with PET and TOF-PET machines are sub-optimal. A 3Dπ machine would directly reconstruct the 3D position of individual positron annihilation vertices, event by event. If developed and commercialized, a 3Dπ machine would turn into an extremely powerful weapon in the fight against cancer. The key technological advances of 3Dπ are (a) the replacement of crystal scintillators with doped liquid argon, which combines a fast decay time with a very high scintillation light yield; (b) the replacement of traditional PMTs with SiPMs; (c) and the operation of SiPMs at cryogenic

(87 K) temperature, which dramatically reduces the noise of the SiPMs. The development of 3Dπ is synergistic with the DarkSide program, both will use cryogenic SiPMs and LAr as a scintillator. A Time-Of-Flight resolution of 60 ps is anticipated with 3Dπ, enabling the direct reconstruction of the 3D position of each individual positron annihilation vertex. Reaching this long-sought milestone would be transformative for nuclear imaging. The unique capabilities of 3Dπ would include:

(a) The ability to obtain clinical images with $\sim$ mm resolution, allowing oncologists to detect smaller tumors and more precisely define their position;
(b) An improvement in the SNR of commercial TOF-PET machines, which would create brighter and higher contrast clinical images and allow a reduction of the radiation doses administered to patients from 10 mSv to 0.1 mSv, thereby decreasing the chances of radiation-induced cancer recurrences. This is of special significance for pediatric patients, who may be subjected to multiple checkup imaging exams in their post-surgery life span;
(c) The ability to precisely identify the position of mis-folded proteins (Amyloid-beta, Tau, Alpha-Synuclein, etc.) with long-latency accumulation times, which may be responsible for the onset of neurodegenerative disorders such as Alzheimer and Parkinson diseases. Very low-dose tracers for these proteins could be used in healthy subjects for preventive and therapeutic treatments;
(d) The ability to precisely determine the differential dose delivered to cancerous and healthy cells during hadrotherapy sessions. This revolutionary capability, described in patent P137IT00, would be achieved by injecting patients with special, cancer cell-targeting tracers prior to the therapy session. These tracers would be loaded with stable isotopes selected for their propensity to be activated into positron emitters by the hadron beam delivered during therapy.

SiPMs for Science and National Security: The development of SiPMs for DS-20k will drive substantial improvement in this promising technology. SiPMs have potential impact in many applications over a variety of fields: SiPMs could replace PMTs in many particle physics experiments, especially those with the option of operating SiPMs at cryogenic temperatures; SiPMs could also outfit future generation of detectors used for national security; the functional unit of the SiPM, the SPAD, is used for fast light detection with broad application, including distance sensing in cars. Support for DarkSide-20k will directly and indirectly support this entire range of activities.

^{4}He: Helium is a non-renewable resource that is essential for many high-tech industries, for scientific research, and plays a strategic role in the defense and space exploration industry. The Bureau of Land Management (BLM) operates the National Helium Reservoir in Amarillo, Texas, the sole governmental helium storage reservoir, and provides on its webpage a list of industrial processes dependent on helium and a list of governmental users that are potentially affected by helium shortages [3]. With helium demand growing since the end of the financial crisis, many U.S. universities and laboratories are suffering from rising prices and cutbacks to their helium deliveries. Since 2008, the DarkSide collaboration has been extracting UAr and measuring the content of helium and ^{39}Ar at the Kinder Morgan Doe Canyon CO_2 facility in southwestern Colorado, enabling the start of the first commercial enterprise to extract helium from a CO_2 stream. Air Products built a helium production plant treating the entire CO_2 stream produced by Kinder Morgan at Cortez [4]. Production started in July 2015 and will replace a 15 % fraction of the declining helium production from the National Helium Reservoir.

^{3}He: DarkSide collaborators are studying methods to separate ^{3}He from massive streams of helium, such as the one that is available at Doe Canyon. If successful, this effort could help solve future shortages of ^{3}He [5]. ^{3}He is a very rare element with applications in nuclear fusion and neutron detection. It is also a strategic asset, as its role in dilution refrigerators to reach base temperatures of a few mK cannot be easily replaced. Happer and colleagues developed the technique of lung imaging with hyperpolarized ^{3}He [6], whose deployment on a large scale, contingent the development of large-scale processes for ^{3}He production, could significantly enhance the capability of early detection of a number of lung diseases.

^{37}Ar: The noble gas radioisotope ^{37}Ar is of great interest in the detection of underground nuclear tests. The production of ^{37}Ar via the reaction $^{40}\mathrm{Ca}(n,\alpha)^{37}\mathrm{Ar}$ has a relatively high cross section and is expected to provide a signature of large numbers of neutrons interacting with the soil [7]. As a noble gas, ^{37}Ar is expected to migrate to the surface following an underground nuclear test, and with a (50.51 ± 0.03) d mean life, it is sufficiently long-lived to allow time for soil-gas sampling. The chemistry of argon recovery and purification is important for preparing soil-gas samples for treaty verification measurements. This chemistry is synergistic with the challenge of recovering and purifying geologic argon for use in a dark matter detector. However, ^{37}Ar detection is quite challenging, as it decays via electron capture, emitting low-energy Auger electrons and X-rays. Perhaps the most well-known high-sensitivity measurement of ^{37}Ar was performed as a means of measuring the solar neutrino flux incident on the Earth [8]. The major emissions of ^{37}Ar decay are summarized in that work. Nominally, only two K-capture decay channels are important, both with total energy summing to 2.82 keV. In the first channel, which has a branching ratio of 81.5 %, decays yield only Auger electrons. This is the easiest decay channel to detect, as the electrons will deposit their energy in a short range in a proportional counting gas held at typical spectrometer pressures. In the second decay channel, which has a branching ratio of 8.7 %, most or all of the energy is emitted as X-rays. The efficiency for detecting the full energy of these X-ray emissions varies with the proportional counter operating pressure and geometry. An ideal ^{37}Ar measurement would have sensitivity beyond the expected ^{37}Ar background rate, 1 mBq/m^3 to 200 mBq/m^3 [7] and would provide sufficient capacity to support a worldwide characterization of background ^{37}Ar. Several laboratories have this capability, notably the University of Bern, but in the last decade, a need has been identified for a U.S.-based ^{37}Ar measurement effort with the capacity for many parallel measurements. Filling this gap was one of the motivations for the recent development of a shallow underground laboratory [9] and a new proportional counter design [10] at PNNL. In this treaty verification application, the chemistry of argon recovery and purification is important for preparing soil-gas samples for measurement. This chemistry is synergistic with the challenge of recovering and purifying geologic argon for use in a dark matter detector. PNNL's focus on ^{37}Ar for detection of underground nuclear tests [10], as well as their focus on ^{39}Ar as an age-dating tracer of aquifer residence time, are natural technical complements to a scientific interest in detecting and elucidating the nature of dark matter with a LAr detector.

^{39}Ar: Internal-source argon gas-proportional counters are used to detect isotopes useful as environmental radiotracers. This is one of the most sensitive methods for the routine assay of challenging radionuclides like tritium [11] and ^{39}Ar, which are important for the age-dating of water [12]. As with dark matter detection, the ^{39}Ar background in atmospheric-sourced argon becomes an important limit to sensitivity. The availability of geologic argon from methods developed for DarkSide will extend the reach of these low-level measurements and their application as tracers of environmental processes, such as groundwater residence times, allowing the study of effects occurring on the time-scale relevant for modern climate change patterns.
A U.S.-based effort has been established at PNNL for ultra-low-level proportional counter measurements of argon to support treaty verification and water reserve characterization. Geologic argon samples from the DarkSide collaboration R&D effort have been used at PNNL to characterize ultra-low-background proportional counters [13, 14] and estimate the age-dating sensitivity of the technology for modest-sized samples. The extraction of UAr central to the physics reach of DarkSide-20k will significantly enhance the ability of researchers to employ ^{39}Ar as an environmental radiotracer for hydrologic transport.

Ultra-Pure Gases: Technologies for gas purification are extremely important in some market segments, including the pharmaceutical and semiconductor industries. The Aria distillation columns have the unique capability of producing high-purity gases, thanks to their thousands of equilibrium stages. Perfection of this technology would have application in these sectors.

Electronics and Microelectronics: As the size of transistors in memory and processors continues to shrink, multi-bit flips due to natural and cosmogenic radioactivity is of growing concern. The radon-abated CR1 and CRH clean rooms, with their world-leading 5 mBq/m^3 limit on Rn activity, could benefit studies to characterize and minimize surface α-emitter contamination on silicon chips. A viable measurement technique for surface α-emitter contamination that makes use of silicon CCDs was recently introduced in Ref. [15] and could be useful for this purpose.

IV Generation Nuclear Plants: The Aria cryogenic distillation columns for isotopic separation will have the ability to separate ^{15}N from atmospheric nitrogen gas, nitric oxide or ammonia.

Uranium nitride ($U_n{}^{15}N_m$) is among the best candidates for fueling IV Generation nuclear reactors due to its superior thermal and mechanical properties [16–18]. The main drawback of uranium nitride is that it must synthesized from ^{15}N with purity greater than 99 % to avoid neutron absorption on ^{14}N. Uranium nitride fuels allow a decreased frequency of refueling shutdowns, higher reactor up-time, and greater economy. Additionally, the higher density, higher melting temperature, better thermal conductivity, and lower heat capacity of uranium nitride [19, 20] helps improve the safety margin in reactor design [21]. The adoption of uranium nitride as the fuel of choice for IV Generation nuclear reactors would create a new market for ^{15}N, valued in the hundreds of millions of dollars per year.

Precision cleaning: The custom precision cleaning facility developed for cleaning DarkSide mechanical parts achieved benchmark levels of cleanliness and cleanliness certification. The European market for precision cleaning is comparatively underdeveloped. This represents a unique occasion for the creation of a technology startup in the L'Aquila district based on a proven technology of interest to the aerospace and pharmaceutical industries.

Nuclear Medicine: There is great interest in augmented means of production for ^{18}O and ^{13}C, which are used as precursors of tracer isotopes for tumor therapy, clinical studies, and the development of new drugs. The development of the Aria cryogenic distillation columns for isotopic separation will lead the way to new methods of producing these important isotopes, improving their availability and lowering costs. ^{18}O is a precursor of the positron emitter ^{18}F, the core ingredient of ^{18}F-FluoroDeoxyGlucose (^{18}F-FDG) [22], a glucose analog with replacement of a hydroxil group with ^{18}F. This is the most common radiopharmaceutical used in medical imaging by PET, TOF-PET, and PET/CT [23, 24]. ^{18}F-FDG also plays an important role in neurosciences [25]. ^{13}C is a marker used in thousands of stable isotope labeled, custom synthesized organic compounds which are used in applications like the ^{13}C-Urea breath test, which replaces gastroscopy for identifying infections from Helicobacter pylori [26], and the ^{13}C-Spirulina platensis gastric emptying breath test [27]. It is also used in fundamental studies in proteomics, carbon fixation, and many other applications.

1.4.2. Educational Broader Impacts

The DarkSide-20k project will make an educational impact on society by improving public understanding of our basic physics research techniques and goals and by offering STEM educational and training opportunities that reach populations of underrepresented students. This is possible thanks to the diverse composition and outreach experience of the collaboration.

As a central outreach portion of this project, the collaboration plans to run a program for the education and training of students from the argon trail: the Cortez-Durango area, Abruzzo, Italy, and Sardinia, Italy. For this purpose, we plan to re-establish the Princeton-Gran Sasso Summer School of Physics with help from the entire DarkSide Collaboration and in cooperation with the Gran Sasso Science Institute (GSSI). This Summer School will give rising high-school seniors and rising freshman undergraduate students the opportunity to spend a week each at Princeton and at least one other DarkSide-collaborating institution in Italy where they will participate in educational and research activities related to the DS program.

The focus of the U.S. portion of the collaboration will be the recruitment of students from the Cortez-Durango area, where the Urania plant will operate. This initiative will be led by faculty members at Fort Lewis College, which, by statute, is "to be maintained as an institution of learning to which Indian students will be admitted free of tuition and on an equality with white students" in perpetuity (Act of 61st Congress, 1911). We are requesting funds to support up to five students per year from the Cortez-Durango area to participate in the Princeton-Gran Sasso Summer School of Physics, and we expect significant participation of Native American students. The students will attend a period of courses at Princeton followed by a research experience at the Urania facility in Colorado, the Aria facility in Sardinia, or LNGS. Each student will gain an appreciation for the skills one needs to work in these types of environments and the experience will spur their interest in dark matter physics, engineering, and STEM-related topics in general. In addition to an educational experience, participants will have the opportunity to meet researchers and professionals in industry, establishing a professional network that can assist them with future career opportunities. This program will be evaluated on a yearly basis with a survey of the students that gauges their perceived benefits from the program as well as long term follow-ups with past participants to determine any career benefits from their participation. The participation of students from the argon trail in Italy, Sardinia and Abruzzo, will be enabled through separate funds raised from governmental and private sources in Italy.

The DarkSide collaborating institutions serve a diverse group of undergraduate students. Fort Lewis College is a Native American Serving institution and is regionally connected to populations of rural, first-generation immigrants and low-income students. This complements the diverse, urban populations served by our team members from larger institutions, several of which are minority serving (Houston for example is a Hispanic and Asian serving institution). We will engage these students in undergraduate research and, through partnerships within the collaboration, give them access to an interdisciplinary, cutting-edge research program operating at a global scale.

The DarkSide team has experience building compelling narratives around the DarkSide project and the science and engineering challenges involved therein. These narratives form the basis of a curriculum that will be used by the DarkSide team to conduct outreach to our regional communities. This curriculum may also be shared with K-12 educators as a resource to add locally relevant context to the science they are learning in the classroom. For example, science teachers in the Montezuma-Cortez, Colorado, school district will be encouraged to use DS-supplied materials based on the argon extraction happening in the region. Similar activities may take place in the Sulcis-Iglesiente district of Sardinia in the context of the Aria project.

To date, the DarkSide Collaboration has conducted educational outreach to local public schools (K-12) and engaged high school and undergraduate students in meaningful research related to DarkSide science. The scale of the DS-20k project gives us the opportunity to expand upon, integrate, and formalize these efforts so that we can reach a larger, more diverse population of students. In doing so, we promote the science of DarkSide to a broader audience and build a cadre of scientists and engineers prepared to enter the STEM workforce.

2. ORGANIZATION

2.1. Governance & Organization and Communication

The organization structure of the GADMC and of the DarkSide project is defined in Fig. 1. The governance of the GADMC is carried out by two distinct branches: the policy-making branch and the executive branch.

Policy-making is done by the **Institutional Board (IB)**. Each institution is represented within the IB by its PI. The IB is guided by an elected **IB Chair** with a renewable 2 year mandate. The IB is responsible for the definition of rules and the governance of the Collaboration, the overall organization of the Collaboration, the appointment of all managers belonging to the policy-making and executive branches; the final approval of major design changes proposed by the executive branch; and the control of financial and human resources. The current IB Chair is G. Batignani (Pisa), elected in November 2016 and re-confirmed in November 2018.

Within the policy-making branch there are three committees charged with providing recommendations to the IB and its Chair. The members of the three committees are appointed by the IB upon proposal of the IB Chair, taking into account the composition of the Collaboration and the need to represent its diverse composition. These three committees are:

The Advisory Board, consisting of the IB Chair and 6 senior IB members nominated by the IB Chair, of which 2 members are from Italian institutions, 1 member is from a US institution, 1 member is from a Canadian institution, and 2 members are from institutions outside the

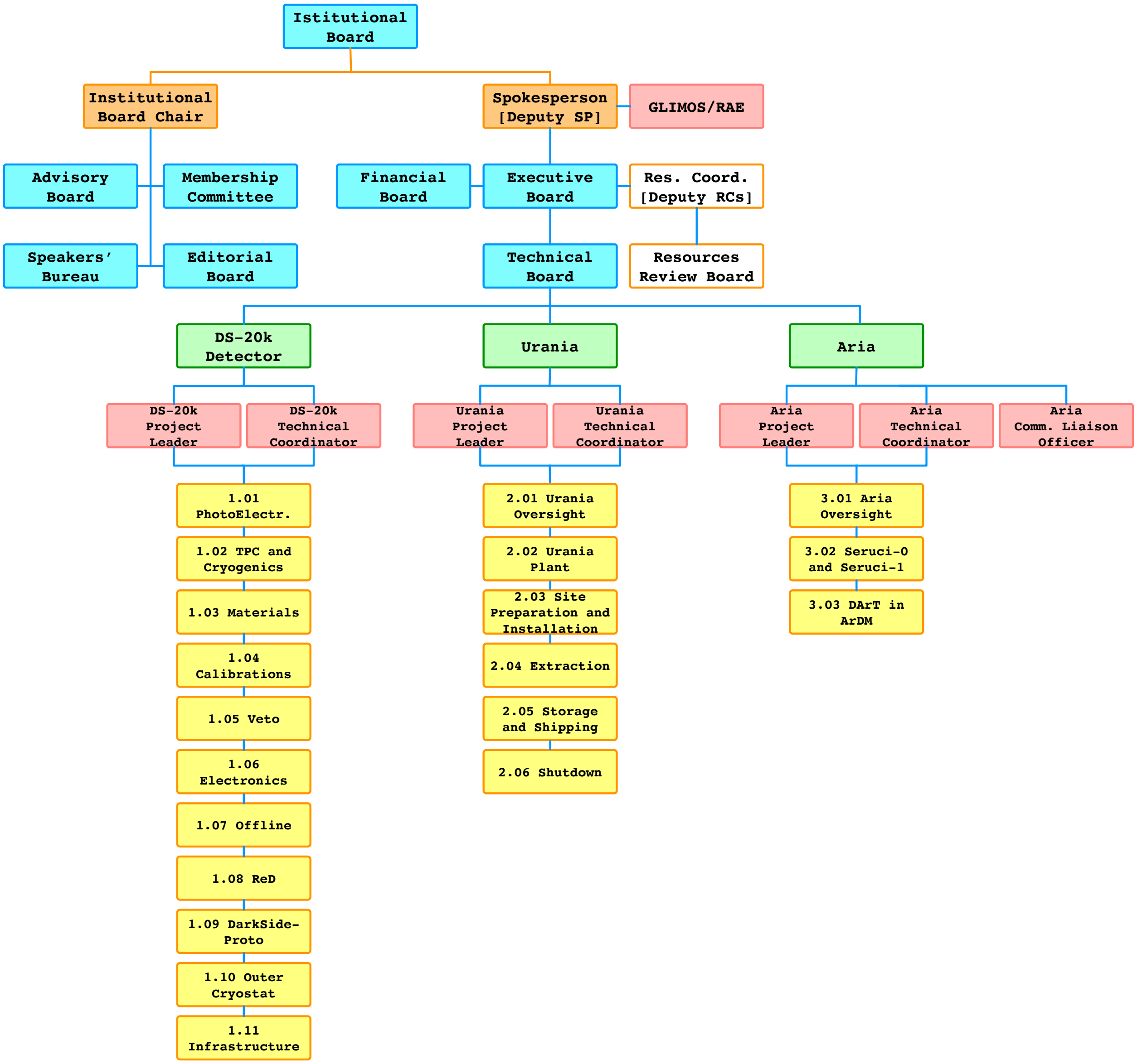

FIG. 1. The organization structure of the GADMC and of the DarkSide project.

three countries already listed. This committee is mandated with advising the IB Chair on IB management issues.

The Membership Committee, consisting of 6 members nominated by the Advisory Board and confirmed by the IB, as well as 2 *ex officio* Advisory Board members. This committee addresses requests from new groups wishing to join the Collaboration, helps define the commitments of new groups, and maintains the database and mailing lists of the collaboration.

There are two additional committees within the policy-making branch charged with providing recommendations to the IB on the communication of scientific and technological results. The members of the two committees are appointed by the IB upon proposal of the IB Chair, taking into account the composition of the Collaboration and the need to represent its diverse composition. The two committees are:

The Speakers' Bureau, consisting of 5 members nominated by the Advisory Board and confirmed by the IB, 1 *ex officio* Advisory Board member, and the SP and Deputy SP. This committee appoints speakers at conferences and workshops and approves material that will be presented on behalf of the Collaboration.

The Editorial Board, consisting of 6 members nominated by the Advisory Board and confirmed by the IB. This committee approves the start of paper preparation, guides the internal paper review process, and issues final approval of papers before publication.

The executive branch of the GADMC is led by an elected **Spokesperson (SP)**. The primary responsibility of the SP is to oversee the DS-20k experiment, oversee any other scientific efforts pursued by the Collaboration, and act as the Collaboration's primary public face. The SP is assisted by an elected **Deputy SP (dSP)**. The mandates of the SP and dSP are 3 years, renewable. C. Galbiati and G. Fiorillo were elected as SP and Deputy SP respectively in December 2016.

The DarkSide-20k project is organized into 3 sub-projects: **the DS-20k detector**, **Urania**, and **Aria**. Each of the sub-projects is managed by two **Project Coordinators (PCs)**, *i.e.*, a **Project Leader (PL)** and a **Technical Coordinator (TC)**. The PL manages the overall progress of the sub-project and is responsible for and coordinates the **Level-1 (L1) Work Groups (WGs)** in which the sub-project tasks and objectives are subdivided and organized, ensuring that the design and construction of the sub-project is carried out on schedule, within the cost ceiling, and in a way that meets the performance and reliability requirements determined within the framework of GADMC resource planning. The PL plans the schedule and budget, sets deadlines, and monitors quality and progress of the sub-project under their oversight. The TC is responsible for the sub-project construction and the technical integration of all its components. The TC ensures the implementation of engineering standards and procedures, monitors the overall construction of detectors and infrastructure, and is responsible for the sub-project's integration and safety. The Aria sub-project, due to its complex nature, has an additional PC, a **Community Liaison Officer** charged to act as a link with the local authorities in Sardinia.

In addition to the PCs defined above, three **Project Scientists (PSs)** are charged with the scientific oversight of the detector design and construction to ensure that all technical decisions are fully compliant with the requirements of the project and compatible across all sub-systems.

The management of each sub-project is divided between **Level-1 (L1) Managers** and **Level-2 (L2) Managers**, who are responsible for the direction of the **L1** and **L2 WGs** in which the sub-project are organized and structured.

The **Executive Board (EB)**, which is chaired by the SP and includes as members the dSP, the PSs, all PCs, and all L1 Managers, manages the executive branch of the GADMC. The IB Chair is an *ex officio* member of the EB. The SP regularly invites senior PIs charged with significant organization and funding responsibilities but without a formal PC role to the EB meetings.

The PSs and the PCs of DS-20k and Urania report to the EB. The PCs of Aria report to the **Scientific Responsible (SR) of Aria**, which is jointly appointed by INFN and the Regione Autonoma della Sardegna. The SR of Aria is C. Galbiati, the inventor and founder of the Aria program. The SR of Aria reports to the EB.

All PCs and PSs are nominated by the SP to the EB, proposed by the EB to the IB, and appointed by the IB. PCs are required to pledge that DS-20k will be their top scientific priority and that they will dedicate a dominant fraction of their research time to their effort within the GADMC. The EB and by the IB monitor closely the effectiveness of the PCs.

The L1 Managers are proposed by the PCs, confirmed by the EB, and appointed by the IB. The L1 Managers report to the PCs. The L2 Managers are proposed by the L1 coordinators in concurrence with the PCs, confirmed by the EB, and appointed by the IB. The L2 Managers report to the L1 Managers.

The **Technical Board (TB)**, chaired by the SP and with a membership of the dSP, the PSs, all PCs, and all L1 and L2 Managers, is responsible for the execution of the project. The IB Chair is an *ex officio* member of the TB. All TB meetings and calls are open to the entire Collaboration. The TB is the forum where all major and minor decisions affecting the project are debated and finalized. In its decision making process, the TB typically operates by building consensus. The TB also monitors the execution of the individual sub-projects and discusses matters at the interface between different sub-projects. All TB meetings are prepared and chaired by the DS-20k TC.

The DarkSide resource coordination is delegated to a **Resources Coordinator (RC)**, who has responsibility for the administration of the common fund. The RC is appointed by the IB upon proposal of the EB.

The **Resources Review Board (RRB)** is made up of representatives from the funding agencies providing major contributions to the project, the IB Chair, the SP, the dSP, the RC, and the **Country Representatives (CRs)**, who are appointed by the assembly of PIs supported by any given funding agency and is in charge of the relationship with said agency. The RRB responsibilities include the monitoring and management of the financial instruments that constitute the GADMC resources, defining the national and regional contributions to the project, developing the MoU, and approving in-kind contributions. The **Financial Board (FB)** is composed of the **CRs** and advises the SP on the specific allocation of tasks and funding requests.

A requirement of the LNGS Safety Management System is the appointment of a collaborator as a **Group Leader in Matters of Safety (GLIMOS)**. The GLIMOS has the primary responsibility for health and safety within the Collaboration, providing an interface with LNGS. The GLIMOS is appointed by the LNGS Director upon recommendation by the Collaboration. An additional requirement of the LNGS Environmental Management System is the appointment of a collaborator as contact person for environmental issues or **Referente Ambientale dell'Esperimento (RAE)**. The RAE acts as the link between the experimental collaboration and LNGS for all matters concerning environmental protection. The RAE is appointed by the LNGS Director upon recommendation by the Collaboration management

2.2. Specific Roles and Responsibilities

Table I offers a brief summary of the most significant executive responsibilities within the 3 sub-projects.

2.3. Partnerships

The Global Argon Dark Matter Collaboration (GADMC) is composed of scientists from four LAr dark matter projects (ArDM at LSC, DS-50 at LNGS, and DEAP-3600 and MiniCLEAN at SNOLAB) who have agreed to unify efforts and construct DarkSide-20k at LNGS [28]. These same scientists have signed a Letter of Intent signaling their interest in continuing the collaboration beyond DS-20k to build a LAr detector with a several hundred tonne fiducial mass. The GADMC will oversee the open access of the currently operating LAr dark matter experiments (DS-50 and DEAP-3600) and scientific data to all GADMC institutions, coordinate the construction of DS-20k at LNGS, and coordinate the development of a future LAr dark matter detector with a several hundred tonne fiducial mass.

The GADMC collaboration is currently composed of 59 institutions and 371 scientists from 15 nations: Brazil, Canada, China, France, Germany, Greece, Italy, Mexico, Poland, Romania, Russia, Spain, Switzerland, the United Kingdom, and the United States of America.

DS-20k was jointly proposed to the US NSF, the Italian INFN, and LNGS, the host laboratory, in December 2015. The experiment was first reviewed by a joint panel charged by the Italian INFN and the US NSF. The joint review was made possible by NSF statute NSF-14-1999 "Dear Colleague Letter - International Activities within the Physics Division - Potential International Co-Review" [29] following approval by the US State Department. Following the first joint review, the experiment was also reviewed by the INFN *Commissione Scientifica Nazionale Seconda* (CSN2), the INFN *Comitato Tecnico Scientifico* (CTS), the LNGS Scientific Committee, and the "Particle Astrophysics – Experiment" panel of NSF. Following all reviews, the experiment was approved by INFN and LNGS in April 2017 and by NSF in October 2017. Following a meeting of participating international funding agencies and laboratories held at the Embassy of Canada in Rome in September 2017, the experiment was officially supported by three participating underground laboratories: the host laboratory LNGS, Laboratorio Subterráneo de Canfranc (LSC), and SNOLAB. Future

Project Scientists		P. Meyers	Princeton
		W. Bonivento	INFN Cagliari
		A. Razeto	INFN LNGS
DS-20k Project Coordinators	Project Leader	E. Scapparone	INFN Bologna
	Technical Coordinator	An. Ianni	Princeton
DS-20k L1 Managers	DarkSide-Proto Managers	G. Fiorillo	INFN Napoli
	Technical Integration Manager	T. Napolitano	INFN LNF
	Materials Manager	R. Santorelli	CIEMAT
	ArDM Manager	C. Regenfus	ETH Zürich
	Inner Detector Manager	H. Wang	UCLA
	Deputy Inner Detector Manager	E. Pantic	UC Davis
	Outer Detector Manager	G. Testera	INFN Genova
	Deputy Outer Detector Manager	J. Monroe	RHUL
	PhotoElectronics Manager	A. Razeto	INFN LNGS
	Electronics Manager	M. Rescigno	INFN Roma 1
	Calibration Manager	J. Maricic	Hawai'i
	Offline Manager	D. Franco	CNRS/IN2P3
	ReD Manager	L. Pandola	INFN LNS
	Outer Cryostat Manager	M. Nessi	CERN
Urania Project Coordinators	Project Leader	M. Simeone	INFN Napoli
	Technical Coordinator	A. Renshaw	University of Houston
Urania L1 Managers	Plant Manager	M. Simeone	INFN Napoli
	Site Preparation and Installation	A. Renshaw	Houston
	Extraction	H. Back	PNNL
Aria Project Coordinators	Project Leader	W. Bonivento	INFN Cagliari
	Deputy Project Leader	F. Gabriele	INFN LNGS
	Technical Coordinator	R. Tartaglia	INFN LNGS
	Deputy Technical Coordinator	M. Razeti	INFN Cagliari
	Community Liason Officer	A. Devoto	INFN Cagliari
Aria L1 Managers	Seruci-I Manager	F. Gabriele	INFN LNGS
	DArT Manager	W. Bonivento	INFN Cagliari

TABLE I. Overview of the most significant managerial roles within the DarkSide sub-projects.

reviews of the experiment's progress may also involve a coordinated effort by the Directorates of the three laboratories.

INFN has provided most of the capital funds needed to support the DS-20k project. R&D and laboratory set-up costs have been covered by INFN CSN2. Additional funding in Italy, including support for the Urania, Aria, and NOA facilities, comes from special and regional funds, the Ministero dello Sviluppo Economico (MISE), the Ministero dell'Istruzione, from the Universita e Ricerca (MIUR), the Regione Abruzzo, and the Regione Autonoma della Sardegna. The Regione Autonoma della Sardegna and INFN instituted a Comitato di Indirizzo to manage the Aria project. The Regione Autonoma della Sardegna and INFN instituted a *Comitato di Indirizzo* to oversee and monitor the Aria project.

Several groups from Canada joined the Collaboration in September 2017. They have secured funding for the large scale extraction of low-radioactivity argon from CFI in Canada and funding for DEAP-3600 R&D from NSERC. An internal proposal for capital funds to support DS-20k activities was submitted to TRIUMF in October 2017 and was approved for funding. A proposal to the Canadian CFI for additional capital funds will be submitted October 2019.

University groups from Poland, Russia, Spain, and Switzerland are funded to work on DS-20k by their funding agencies. University groups from France, Germany, and the UK are currently participating with support from internal resources and are preparing proposals to each of their funding agencies.

Recently, INFN and The Institute of High Energy Physics of the Chinese Academy of Sciences (CAS-IHEP) reached an agreement to produce the acrylic material for both the TPC and the veto detectors in China. The production will be carried out by DonChamp, Inc. in Changzhou, the same company providing acrylic for the JUNO experiment. The CAS-IHEP group submitted a request for capital funding to the Chinese Ministry of Science to support the acquisition of the PMMA for the the veto detector and the LAr TPC.

The DS-20k experiment is hosted by LNGS. The LNGS Scientific Committee, which meets two times per year, has oversight of the experiment and has assigned two Committee members as reviewers of DS-20k. The reviewers evaluate technical developments, schedule compliance, and collaboration issues, and report their findings to the LNGS Scientific Committee. The LNGS Scientific Committee regularly requests that the GADMC provide a written report from the collaboration two weeks before its meetings and present technical results during the meetings' open session, and that the Collaboration management be available for discussion in its closed sessions. The LNGS Scientific Committee issues a report with its findings after each meeting, which details the progress of the Collaboration and offers recommendations. The GADMC is also requested to release an annual document to LNGS for inclusion in the *LNGS Annual Report*.

Within INFN, the experiment is regularly reviewed by the CSN2, which oversees technical developments and budget, collaboration, and schedule issues. CSN2 appoints six permanent referees charged with the review and monitoring of DS-20k. CSN2 meets every second month and on average deals with DS-20k matters in its plenary session twice per year.

A strong connection between the DS-20k funding agencies is fostered through ad-hoc meetings between the INFN management and the management of other funding agencies, including the US NSF, the US DOE, the Chinese CAS-IHEP, the French IN2P3, and CERN. In addition, the DarkSide-20k management has organized six meetings at the Canadian Embassies of Italy, France, Spain, Mexico, and Poland, and at the Italian Consulate in Montreal, Canada. The six meetings celebrated the Nobel Prize in Physics awarded to Prof. Art McDonald, who is a founding member of the GADMC and an active participant in DS-20k, and took the opportunity to present to a broad audience, which included agency officials and government representatives, the short- and long-term plans of the GADMC.

2.4. External Organization and Communication

The Spokesperson is responsible for external communications. Relationships with the funding agencies are maintained by the Country Representatives and by the Spokesperson.

2.5. Institutional Responsibilities

The assignment of tasks and responsibilities to the various collaborating institutions is captured in a Primavera P6-based resource-loaded work breakdown structure (WBS) managed by the DS-20k TC and by the project controls team. The WBS is presented in schematic form in Fig. 3 and a summary of the institutional participation by task is summarized in Table II.

2.6. Community Relations and Outreach

The GADMC outreach group, led by *Museo Storico della Fisica e Centro Studi e Ricerche Enrico Fermi*, has started the production of a promotional video that starts with a basic introduction to dark matter and its search, continues with a discussion of the design and implementation of the DS-20k experiment, and concludes with an overview of the societal benefits of the overall GADMC program. The promotional video will be used online and during live events, such as conferences, seminars, and presentations devoted to the general public. It will include 2D and 3D video simulations of the future DS-20k detector, video footage of key elements and locations of the experiment, video recording from the Aria facility featuring the Seruci-0 column and the ongoing

Outer cryostat	INFN (L), CERN, UCLA, Princeton
Inner detector	UCLA (L), FNAL, UMass, INFN, Alberta, Carleton, Queens, Houston, UC Davis
Photoelectronics	INFN (L), GSSI, UMass, Princeton
Outer detector	Genova (L), LNGS, AstroCeNT, Virginia Tech, Royal Holloway, CAS-IHEP
Calibration	Hawai'i (L), Temple, Princeton, BNRU/RSU, Virginia Tech, Krakow, LNGS, LNF
Electronics	INFN (L), CERN, TRIUMF
Online&Offline SW	APC Paris (L), INFN, LPNHE, Paris
Material screening	CIEMAT (L), SNOLAB, Krakow, INFN, LSC, LNL, Zaragoza
ReD	INFN (L), APC, LNS, USP
DS-Proto	INFN (L), most GADMC institutions
Urania	INFN (L), Houston (L), UMass, PNNL, Carleton
Aria	INFN (L), Princeton, FNAL, CERN
DArT	LSC (L), ETHZ, CIEMAT, APC, Carleton, Zaragoza

TABLE II. Breakdown of institutional responsibilities. Lead institutions are marked with (L).

preparation for Seruci-I, and simulations of the Urania facility. The voiceover will be available in several languages.

The Princeton-Gran Sasso Summer School that was established during the operations of DarkSide-50 is being reinstated and will focus on high-school and undergraduate students from the Cortez-Durango area in Colorado, USA, the area where the Urania plant will be installed and operated. The program is expected to benefit the underrepresented Native American population through a partnership established with Fort Lewis College in Durango, CO, USA. The students selected for the program will be offered a course in physics in Princeton followed by an internship at one of the project facilities or partnering institutions for real-world training in technical STEM related areas.

Additional outreach activities will include the organization of visits to LNGS and to the Seruci site of Aria by secondary school students. Students will be prepared in advance of their visit by one-day masterclasses at their local institutions administered by GADMC researchers, during which they will learn about dark matter and the experimental strategy for its detection. During their visits, they will participate in interactive tutorials on data analysis and will then perform measurements of the cosmic ray flux at different depths using SiPM-based cosmic ray telescopes.

3. DESIGN AND DEVELOPMENT

3.1. Project Development Plan

A "Preliminary Design Report" was prepared in 2016 and later published as Ref. [30]. However, following the approval of the experiment in 2017, LNGS requested that the GADMC reconsider its original approved plan, an organic liquid scintillator veto detector nested inside a water Cherenkov veto detector, in order to minimize any possible environmental impacts of underground LNGS operations. Following this recommendation, the GADMC abandoned its original plan and developed a new solution based on the ProtoDUNE membrane cryostats developed at CERN. The LAr TPC of DS-20k is placed at the center of the ProtoDUNE cryostat, which will be filled with 700 t of liquefied AAr. Part of this volume will be instrumented and serve as a scintillation (and Cherenkov) anti-coincidence veto detector.

The GADMC has invested four years of research and development towards a final design for the DS-20k experiment. The remaining design tasks for the project are a small fraction of the overall project scope and are captured in the work breakdown structure (WBS) included in Appendix A. Fig. 2 shows an engineering drawing of the DS-20k detector hosted in Hall C of LNGS. Many of the DS-20k systems are visible, including the membrane cryostat filled with 700 t of AAr that acts as an external veto, the data acquisition system on top of the cryostat, the cryogenics systems that handle the veto argon and the UAr inside the TPC, the test facilities, and the radon-suppressed clean room facilities.

The new design basis is captured in an "Intermediate Design Report," appended as a Supplementary Document. A detailed "Technical Design Report" is in preparation and its completion is expected by the spring of 2020.

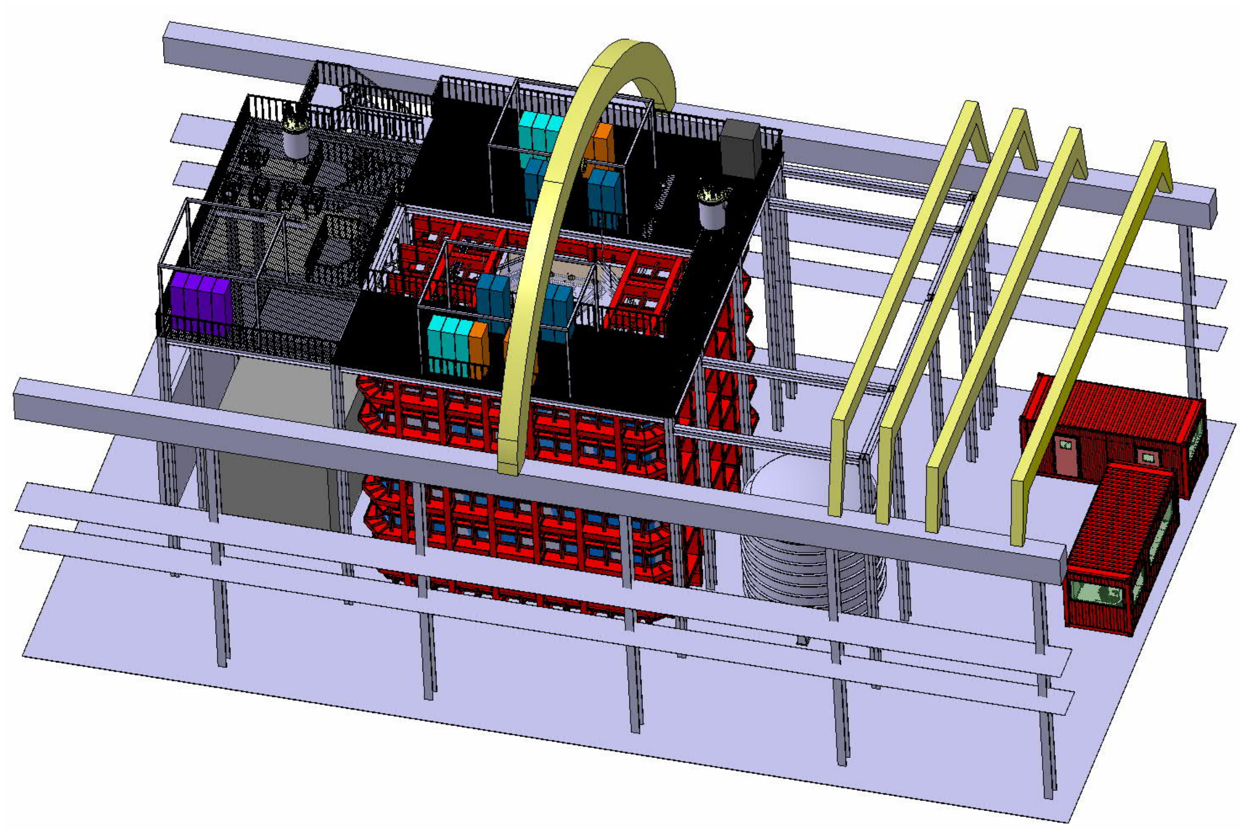

FIG. 2. Artist rendering of the DS-20k experiment in Hall C of LNGS.

3.2. Development Budget and Funding Sources

The organizations proposing this work, including the sub-award recipients, are all part of two existing collaborative NSF awards that have Princeton as the lead-institution. The award numbers for the Princeton component are PHY-1812540 and PHY-1622415, but all associated collaborative awards fall within the same scope. These grants run through 2022 and 2023, respectively, and will cover design and development costs that fall outside of the scope of this Mid-scale RI-1 Program request, but within the same time period. The first award provides personnel support and operations costs for DS-20k and the second provides the initial funding for the development and construction of components for DS-20k. Foreign and Domestic partners have received similar grant awards and regional funding to provide the same support for their groups.

3.3. Development Schedule

The schedule developed using the Primavera P6 project management system captures activities related to the design and development of the DS-20k detector components. It is expected that the first prototype of the TPC will operate in summer of 2019. The DarkSide-Proto (DS-Proto)

1 tonne-scale prototype will operate in 2020. The Aria facility is currently in the implementation phase. The Urania development schedule is set by the ongoing tender process, which will select the contractor to build the plant. A vendor will be selected before the end of 2019: at that point, the final design of the plant will be released by the vendor, and the final schedule for the plant site preparation work will be determined.

4. CONSTRUCTION PROJECT DEFINITION

4.1. Summary of Total Project Definition

The DarkSide-20k project includes three sub-projects: DarkSide-20k, a LAr TPC WIMP detector and its veto detector; Urania, a high-throughput plant that will extract low-radioactivity underground argon; and Aria, a cryogenic distillation column for the purification and isotopic separation of argon and other elements. The work breakdown structure (WBS), which includes the development, procurement, installation and commissioning of all of the sub-projects, has been developed by the collaboration. Fig. 3 shows the overall structure of the project, including each of the sub-projects and their breakdown at Level 1.

Included in the preparation of the WBS was the preparation of a resource-loaded schedule that takes into account the funding profile for awards already secured and those which are currently being sought. The WBS, schedule and funding profile have been reviewed and vetted by the INFN *Comitato Tecnico Scientifico* (CTS) and the INFN *Commissione Scientifica Nazionale Seconda* (CSN2), two independent committees operating under a joint charge from INFN to perform a detailed review DS-20k.

4.2. Work Breakdown Structure (WBS)

The DarkSide-20k project is organized into a WBS that completely defines the project scope and forms the basis for planning, executing, and controlling project activities. This WBS is included in the form of summary tables. The WBS is based on the collaboration's experience building progressively larger detectors, which has informed our estimates of cost and schedule when scaling-up this complex technology. In addition, DS-Proto, presently under construction at CERN, will test the technical solutions adopted for DS-20k without some of the procedural complexities associated with the final, ultra-low background DS-20k.

4.3. WBS Acronyms and Dictionary

4.3.1. WBS acronyms

INFN → Instituto Nazionale di Fisica Nucleare (Italy);
NSF → US National Science Foundation;
NSFMid-scale → Specific NSF funding solicitation which has been applied to;
DOE → US Department of Energy;
RAS → funds from Regione Sardinia (Italy);
RA-CIPE → funds from Regione Abtruzzo (Italy);
MIUR → The Italian Ministry of Research and Education;
PREMIALE → A special MIUR fund, reserved for a small number of selected projects;
CSN2 → The INFN Scientific Commission II, focusing on astrophysics and neutrino physics;
PON → Programma Operativo Nazionale, a special MIUR fund, devoted to the infrastructure building;
MP → Masterplan, a governament plan to develop the economy of the Regione Abruzzo;

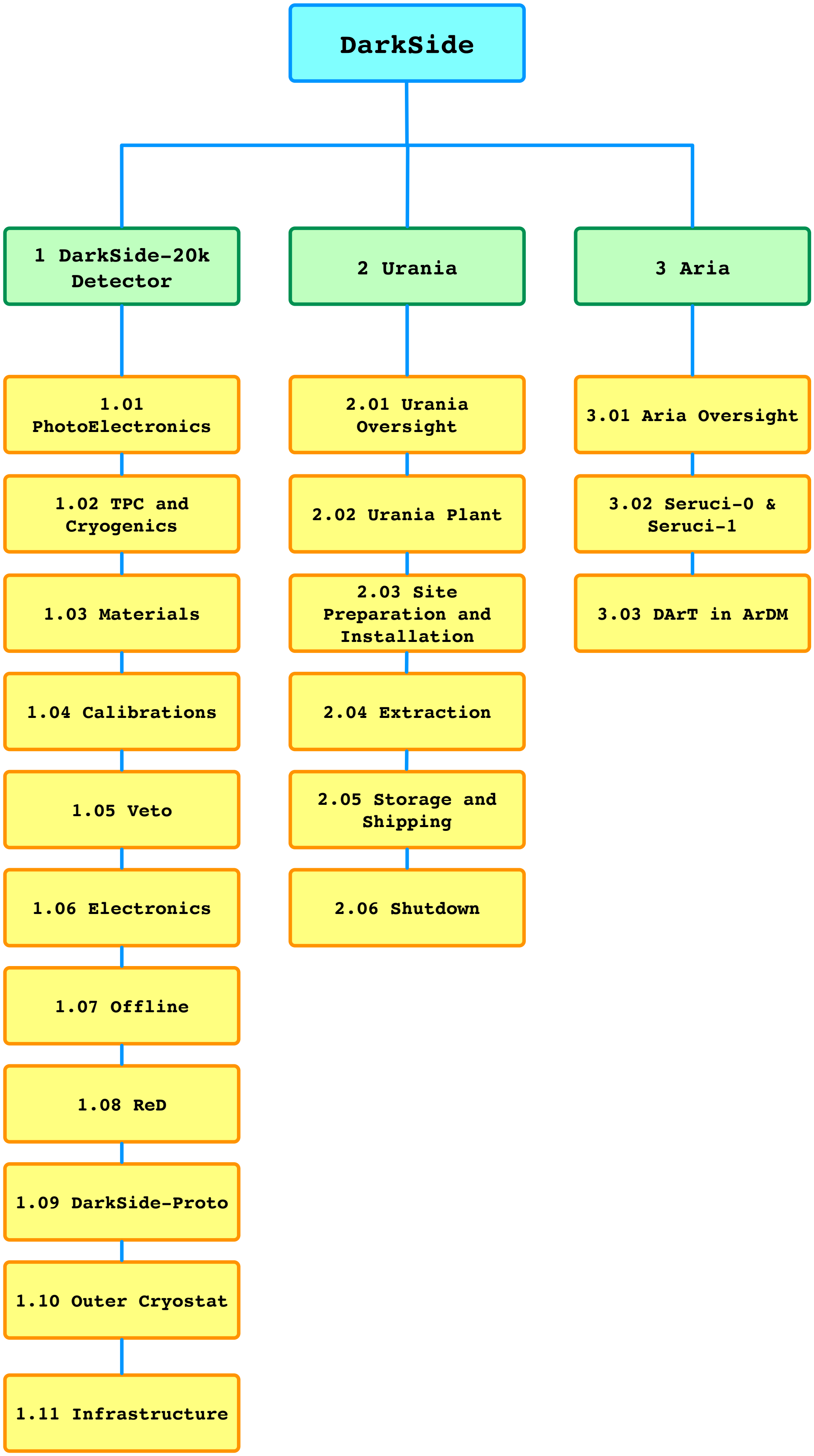

FIG. 3. Schematics of the primary elements of the Work Breakdown Structure (WBS), with details extending to Level 1.

PNNL LDRD → PNNL Laboratory Directed Research & Development;
STFC → Science and Technology Facilities Counting, a UK organisation for Research and Innovation;
CFI → Canadian Foundation for Innovation;
CAS-IHEP → Institute for High Energy Physics of the Chinese Academy of Science (China);
CNRS → The French National Centre for Scientific Research;
IN2P3 → National Institute of Nuclear and Particle Physics;
AstroCeNT → Astrophysics research centre in Poland;
UAr → Underground Argon;
AAr → Atmospheric Argon.

4.3.2. WBS Item description

Table III shows the WBS dictionary detailed to Level 1, with a brief description of the scope of each WBS item.

4.4. Scope Management Plan and Scope Contingency

The scope of the project will be managed by the Project Scientists working in conjunction with the TB. Changes in scope will be discussed within the TB as soon as the need for change is realized. The TB will receive the request for a change in scope, and after discussion with the Project Scientists, approve the change at a technical level or request a revised proposal for the change of scope. After technical approval, the change will go to the RRB who will confirm resources are available to accommodate the change. Final approvals will be made by the supporting funding agency, following which, the change will go into effect.

Changes in scope must fall within the overall contingency of the project, which typically comes in the form of a 20 %, built in contingency for major equipment and components and therefore should not result in an increase to the total project cost or to the cost of any single funding agency or partnering organization.

4.5. Cost Estimating Plan, Cost Reports, and Baseline Budget

Cost and schedule estimates are based on the WBS. The project has secured or anticipates funding from funding agencies across the globe operating in different currencies. Every item in the WBS clearly indicates the responsible funding agency and details the deliverable cost in the corresponding currency. Appendix B presents the WBS organized by the activities assigned to each funding agency.

In addition, the funding agencies have been grouped into four different macro-areas, identified by the corresponding currency (USA (USD), Canada (CAN), Europe (EUR), and UK (GBP)). Each of these macro-areas is split into three columns (Labor Cost, Non-Labor Cost, and Total Cost), for a total of 12 columns in the WBS. In addition, the global cost of the project, converted to USD where necessary, is shown in the three similar columns and identified by the name "Global Cost" (i.e. Global Labor Cost, Global Non-labor Cost, Global Total Cost). The time schedule is reported in the form of a GANTT chart, also shown as part of the WBS tables in Appendix A and Appendix B.

WBS	WBS Name	WBS Dictionary
1	**DarkSide-20k Detector**	LAr TPC and associated veto detector to be operated at LNGS for WIMP dark matter searches.
1.01	PhotoElectronics	R&D, fabrication, and testing of PDMs low-background photosensors with photocathodic area of $21\,\mathrm{m}^2$, including procurement of SiPMs, front end electronics, and optolink.
1.02	TPC and Cryogenics	Construction of TPC, including HV feedthrough and feed system, PMMA vessel, coating with TPB wavelength shifter, associated cryogenic purification and cooling loop, and UAr storage and recovery systems.
1.03	Materials	Material screening ad assay required to ensure achievement of overall background budget, including program of measurements with ICP-MS and HPGe detectors and special Pb/Po assay methods.
1.04	Calibrations	Detector calibrations at large, including source deployment system, γ-rays, ^{241}Am^{13}C, ^{241}AmBe, ^{241}AmLi, and ^{252}Cf sources, and UV LEDs.
1.05	Veto	Anti-coincidence AAr-based veto detector, including IAB, GdAS, and OAB instrumented with variant of the LAr TPC PDMs.
1.06	Electronics	Systems for DAQ, trigger, and slow controls, including procurement of signal digitizers, VME crates, racks, development of DAQ and slow controls software, and development of trigger architecture.
1.07	Offline	CPU and data storage, including development of overall computing model, data reconstruction frameworks and codes, data analysis frameworks and codes, and Monte-Carlo simulations.
1.08	ReD	Off-site, accelerator-based program of measurements for characterization of LAr TPCs response to NRs and assessment of their possible directional response.
1.09	DarkSide-Proto	Development, construction, and operation at CERN of the $\sim$1 t prototype required for a the characterization of the DS-20k LAr TPC construction methods, photoelectronics, readout electronics, DAQ and cryogenics.
1.10	Outer Cryostat	Development, construction, and commissioning of the ProtoDUNE-like cryostat and associated cryogenics, and procurement of its AAr fill.
1.11	Infrastructure	Management of planning and installation of all necessary infrastructure items at LNGS, including all safety analysis required for installation and operation.
2	**Urania**	Extraction, preliminary purification, and delivery of the 60 t UAr batch required for the DarkSide-20k target.
2.01	Urania Oversight	Project management oversight of the Urania sub-project installation, commissioning, and operation at the Kinder Morgan Doe Canyon Facility in Cortez, Colorado.
2.02	Urania Plant	Design and construction of a plant capable of extracting UAr at a rate of 250 kg/d and chemical purity of 99.9 %, also including delivery at the Kinder Morgan Doe Canyon Facility in Cortez, Colorado.
2.03	Site Preparation and Installation	Site preparation and development for the installation of the Urania plant, including concrete work, electrical installation, feed optimization, procurement of control room and its installation, construction of buildings necessary to provide cover for the main equipment items, procurement of UAr storage and shipping vessels, and development of truck loading and unloading areas.
2.04	Extraction	Management oversight and labor required to perform the UAr extraction, plant maintenance, and procurement of consumables (*i.e.*, electricity, LN_2, and other utilities).
2.05	Storage and Shipping	Procurement of shipping and storage vessels for the 60 t UAr batch, and shipping of said UAr batch in said vessels from Cortez, Colorado, to Sardinia, Italy, and then from Sardinia to LNGS, Italy.
2.06	Shutdown	Hand off of the Urania site and plant to the next project assuming the lead for UAr extraction at the Kinder Morgan Doe Canyon facility in Cortez, Colorado.
3	**Aria**	Chemical purification into detector grade argon of the the 60 t UAr batch required for the DarkSide-20k target, verification of the UAr purity with the DArT detector at LSC, study of isotopic separation capability of the Seruci-I column, and its verification via the DArT detector.
3.01	Aria Oversight	Project management oversight and installation, commissioning, and operation of the Aria sub-project at the Seruci, Sardinia, Italy site of the "Monte Sinni" mine operated by Carbosulcis, inclusive of labor and travel costs for the facility construction and labor and travel costs of regular staff of engineers and scientists for operation of the columns.
3.02	Seruci-0 and Seruci-I	Procurement, construction, and installation of the Seruci-0 and Seruci-I columns, including final dimensional verification and certification of leak rates first at the production site and then at CERN, procurement and installation of the equipment and facilities items required for the operation of the columns, and labor costs required to assemble, train, and support the Operational Group for the columns run.
3.03	DArT in ArDM	Development, construction, installation, commissioning, and operation of the DArT detector at LSC, for the verification of the ^{39}Ar content of small argon batches processed with the Seruci-I column.

TABLE III. WBS Dictionary.

4.6. Budget contingency

The DarkSide-20k project has identified cost, schedule, and contingency based on risks and uncertainties. Deliverable contingency is already included in the costs funded by INFN and NSF at a level of 20 % for major equipment and components. Some of the WBS deliverables are not subject to contingency because the relevant contracts have already been executed and therefore costs are fixed and contingency could be safely removed. As an example, the contracts for the equipment items for SiPM packaging at NOA (about $4M) and the SiPM production by LFoundry (about $6M) are already executed. The contingency on the packaging equipment items was removed. The contingency on unitary cost of SiPMs was also removed. The contingency on the required quantity of SiPMs remains at the appropriate 20 % level. Other deliverable contingency mitigation strategies include realistic costs based on procurement offers and the selection of companies that in past interactions minimized the gap between the scheduled and the final cost. In addition, as a safety margin, the savings that will come from the competition among different companies submitting tender offers was not considered in the budget. It is worth noting that a large fraction of the budget has already been secured. A few potential triggers that would require the execution of a contingency plan have been identified. These are the possible loss of funding not yet secured, deliverable delays that impact personnel costs, and possible deliverable VAT increases. The management of the budget contingency falls under the responsibility of the RRB.

4.7. Cost Book, Cost Model Data Set, and Basis of Estimate

The Cost Book is stored within the Primavera P6 framework and is built from the bottom-up activity-based WBS. The resulting output can be seen in Figure 4, in a rolled-up form that shows the total project cost associated with each funding agency for both labor and non-labor elements of the project. The full book, including all activities, is shown in Appendix B. The cost model data set comes from the L1 Managers after consultation with the L2 Managers and key responsible people within the Work Groups. The data is maintained in an Excel spreadsheet and includes the hard-coded costs for each of the activities in the responsible institution's home currency. This avoids complications due to fluctuating exchange rates and the corresponding issues that might arise in the P6 system. This also allows for bookkeeping of activities in the currency that supports the effort. These can then be entered into the P6 system using global exchange rates to calculate the total project cost, either as a whole or on a per agency/institution basis, and presented in any of the four main currencies in use in the project. It is worth noting that Kinder Morgan provides UAr to Princeton University for free.

The project management team is working to obtain a proper Basis of Estimate for all major pieces of equipment using a bottom-up approach. This will continue until the project is defined down to single procurements or level of effort activities. Some of the large and expensive components of the project have already had their procurement process started, and, in some cases, the tender for bidders to win the procurement or fabrication contract has been initiated. For these items, the Basis of Estimate is quite well known and stems from quotes and or contracts that have been written for those specific items. Other large pieces of equipment and components do not have a final design and therefore do not have official quotes. These have been estimated based on the prior experience of the Collaboration and/or on information from companies involved in the work. For instance, many of the costs that have been assigned to the Urania site preparation and installation are proposals based on preliminary costs provided by contractors who will carry out the work; communications with vendors who will provide equipment, materials, and components; and the expert opinion of Kinder Morgan, which has experience in building industrial gas processing plants on the same site. This same methodology has been used for other parts of the project, although in some cases, when a main detector component is built from many smaller components, an engineering driven cost has been estimated based on the collaboration's experience in detector development, fabrication and installation, as well as quotes from vendors and local machine shops that carry out major

DarkSide Current | DS Layout-Summary by Funding Source | 18-May-19 12:15

Activity ID	Activity Name	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]	Labor Cost USA [USD]	Non Labor Cost USA [USD]	Total Cost USA [USD]	Labor Cost CAN [CAD]	Non Labor Cost CAN [CAD]	Total Cost CAN [CAD]	Labor Cost EU [EUR]	Non Labor Cost EU [EUR]	Total Cost EU [EUR]	Labor Cost UK [GBP]	Non Labor Cost UK [GBP]	Total Cost UK [GBP]
AstroCeNT		1461	01-May-19	30-Apr-23	$2,887,500.00	$275,000.00	$3,162,500.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	2625000.00	250000.00	2875000.00	0.00	0.00	0.00
CFI-Argon		366	01-Jan-20	31-Dec-20	$0.00	$980,000.00	$980,000.00	$0.00	$0.00	$0.00	0.00	1400000.00	1400000.00	0.00	0.00	0.00	0.00	0.00	0.00
CFI-DarkSide		1385	01-Apr-17	13-Oct-22	$1,946,000.00	$8,032,500.00	$9,978,500.00	$0.00	$0.00	$0.00	2780000.00	11475000.00	14255000.00	0.00	0.00	0.00	0.00	0.00	0.00
DOE		1085	01-Jun-18	30-Sep-22	$3,156,581.30	$3,664,270.23	$6,820,851.53	$3,156,581.30	$3,664,270.23	$6,820,851.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHZ		92	30-Apr-19	30-Jul-19	$0.00	$38,500.00	$38,500.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	35000.00	35000.00	0.00	0.00	0.00
GSSI		731	01-Jan-20	31-Dec-21	$0.00	$1,100,000.00	$1,100,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	1000000.00	1000000.00	0.00	0.00	0.00
IHEP		366	30-Mar-20	30-Mar-21	$0.00	$605,000.00	$605,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	550000.00	550000.00	0.00	0.00	0.00
INFN-MIUR		1308	01-Jul-17	28-Jan-21	$0.00	$8,853,900.00	$8,853,900.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	8049000.00	8049000.00	0.00	0.00	0.00
INFN-CIPE-1		1646	30-Jun-18	31-Dec-22	$0.00	$12,214,400.00	$12,214,400.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	11104000.00	1104000.00	0.00	0.00	0.00
INFN-CIPE-2		1368	01-Apr-19	28-Dec-22	$0.00	$4,468,200.00	$4,468,200.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	4062000.00	4062000.00	0.00	0.00	0.00
INFN-CSN2		2121	01-Jan-17	22-Oct-22	$0.00	$5,629,800.00	$5,629,800.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	5118000.00	5118000.00	0.00	0.00	0.00
INFN-MP		2101	01-Apr-17	31-Dec-22	$5,497,800.00	$0.00	$5,497,800.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	4998000.00	0.00	4998000.00	0.00	0.00	0.00
INFN-FISR		2585	01-Feb-16	28-Feb-23	$34,100.00	$4,343,900.00	$4,378,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	31000.00	3949000.00	3980000.00	0.00	0.00	0.00
INFN-PON		1543	11-Oct-18	31-Dec-22	$0.00	$18,373,300.00	$18,373,300.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	16703000.00	6703000.00	0.00	0.00	0.00
IN2P3		1582	01-Oct-18	29-Jan-23	$203,500.00	$0.00	$203,500.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	185000.00	0.00	185000.00	0.00	0.00	0.00
INFN-PREMIALE		2585	01-Feb-16	28-Feb-23	$204,925.60	$536,553.60	$741,479.20	$0.00	$0.00	$0.00	0.00	0.00	0.00	186296.00	487776.00	674072.00	0.00	0.00	0.00
INFN-RAS		2585	01-Feb-16	28-Feb-23	$1,146,481.60	$6,223,518.40	$7,370,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	1042256.00	5657744.00	6700000.00	0.00	0.00	0.00
INFN-in-Kind		1736	01-Apr-17	31-Dec-21	$0.00	$638,000.00	$638,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	580000.00	580000.00	0.00	0.00	0.00
INFN-Computing		1644	01-Apr-18	30-Sep-22	$0.00	$2,403,500.00	$2,403,500.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	2185000.00	2185000.00	0.00	0.00	0.00
NSF		1178	01-Jan-18	14-Sep-22	$144,000.03	$1,081,000.00	$1,225,000.03	$144,000.03	$1,081,000.00	$1,225,000.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NSF-Mid-scale		875	01-Jul-19	31-Dec-22	$2,659,894.40	$9,140,444.00	$11,800,338.40	$2,659,894.40	$9,140,444.00	$11,800,338.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PNNL-in-Kind		788	23-Jul-19	14-Sep-22	$0.00	$1,500,000.00	$1,500,000.00	$0.00	$1,500,000.00	$1,500,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PNNL-LDRD		484	05-Jul-18	31-Oct-19	$0.00	$400,000.00	$400,000.00	$0.00	$400,000.00	$400,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poland-in-Kind		1736	01-Apr-17	31-Dec-21	$0.00	$27,500.00	$27,500.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	25000.00	25000.00	0.00	0.00	0.00
Poland		1004	01-Jul-19	30-Mar-22	$5,500.00	$16,500.00	$22,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	5000.00	15000.00	20000.00	0.00	0.00	0.00
Russia		1004	01-Jul-19	30-Mar-22	$121,000.00	$209,000.00	$330,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	110000.00	190000.00	300000.00	0.00	0.00	0.00
Spain		1437	01-Apr-17	30-Dec-22	$234,575.00	$181,500.00	$416,075.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	213250.00	165000.00	378250.00	0.00	0.00	0.00
Spain-in-Kind		1736	01-Apr-17	31-Dec-21	$0.00	$694,100.00	$694,100.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	631000.00	631000.00	0.00	0.00	0.00
STFC		912	01-Jan-20	30-Jun-22	$1,950,000.00	$0.00	$1,950,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	0.00	0.00	1500000.00	0.00	1500000.00

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FIG. 4. Cost Book rolled up by funding agency.

Funding Source	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	Total
DOE			\$1,853	\$7,647	\$1,394,168	\$1,157,566	\$4,259,618		\$6,820,852
NSF			\$132,090	\$472,713	\$384,315	\$73,332	\$162,550		\$1,225,000
NSF Mid-scale				\$745,068	\$4,867,707	\$4,588,856	\$1,554,922	\$43,786	\$11,800,338
PNNL In-Kind				\$22,321	\$499,621	\$501,282	\$476,776		\$1,500,000
PNNL LDRD			\$72,727	\$301,653	\$25,620				\$400,000
AstroCeNT				\$302,387	\$792,483	\$927,255	\$721,381	\$418,994	\$3,162,500
CFI-Argon					\$733,661	\$246,339			\$980,000
CFI-DarkSide		\$316,312	\$636,199	\$1,259,810	\$2,360,536	\$2,968,285	\$2,399,952	\$37,405	\$9,978,500
ETHZ				\$38,500					\$38,500
GSSI					\$412,312	\$549,248	\$138,440		\$1,100,000
IHEP					\$305,806	\$299,194			\$605,000
Poland-in-Kind		\$2,899	\$5,782	\$5,782	\$5,798	\$5,782	\$1,457		\$27,500
Spain-in-Kind		\$72,009	\$143,624	\$143,648	\$152,789	\$145,829	\$36,201		\$694,100
INFN-in-Kind		\$15,074	\$86,564	\$468,568	\$30,149	\$30,066	\$7,578		\$638,000
IN2P3				\$44,657	\$49,278	\$49,143	\$46,119	\$14,303	\$203,500
INFN-CIPE-1			\$138,654	\$1,193,692	\$4,516,106	\$3,821,251	\$2,538,237	\$6,460	\$12,214,400
INFN-CIPE-2				\$234,768	\$2,244,249	\$1,603,220	\$349,251	\$36,713	\$4,468,200
INFN-Computing			\$267,543	\$533,624	\$535,086	\$533,624	\$533,624		\$2,403,500
INFN-CSN2		\$524,326	\$868,166	\$1,001,529	\$2,000,689	\$894,370	\$292,319	\$48,400	\$5,629,800
INFN-FISR	\$996,340	\$1,508,057	\$1,508,057	\$348,817	\$4,910	\$4,896	\$4,896	\$2,026	\$4,378,000
INFN-MIUR		\$11,864	\$47,069	\$47,069	\$6,252,294	\$2,495,604			\$8,853,900
INFN-MP		\$16,814	\$67,596	\$312,706	\$1,776,720	\$1,580,194	\$1,454,719	\$289,051	\$5,497,800
INFN-PON				\$2,007,013	\$8,834,101	\$5,412,501	\$1,928,362	\$191,323	\$18,373,300
INFN-PREMIALE	\$111,552	\$167,557	\$167,557	\$98,014	\$57,762	\$57,604	\$57,604	\$23,831	\$741,479
INFN-RAS	\$323,557	\$500,049	\$513,503	\$1,330,585	\$2,024,425	\$1,071,073	\$1,222,740	\$384,068	\$7,370,000
Poland				\$1,048	\$14,970	\$3,999	\$1,983		\$22,000
Russia				\$30,239	\$120,299	\$119,970	\$59,492		\$330,000
Spain		\$10,117	\$23,974	\$153,808	\$104,428	\$70,638	\$44,284	\$8,826	\$416,075
STFC					\$585,855	\$780,428	\$583,717		\$1,950,000
Grand Total	\$1,431,449	\$3,145,078	\$4,680,960	\$11,105,664	\$41,086,136	\$29,991,549	\$18,876,223	\$1,505,184	\$111,822,244

TABLE IV. DarkSide-20k funding profile with breakdown by funding source and fiscal year.

fabrication work. The quotes for the most significant items planned to purchase with NSF funds are included as Supplementary Documents.

4.8. Funding Profile

The funding profile is built from the WBS, the resource driven schedule, and the negotiated division of responsibilities between collaborating institutions. The expected funding profile for each of the US sources involved can be seen in Table 4 4.8. The funding profile is deliverable-oriented and will be managed by the RRB. The most important part of the funding profile is related to the construction of infrastructure required for deliverables, such as the Urania and Aria plants and the NOA facility. Some deliverables, such as the SiPM wafers, 12,000 channels of electronic digitizers, and many of the major detector components, are provided by companies or institutions selected through public tenders and already engaged through fixed terms contracts already executed.

Deliverables will be acquired using best-offer contracts based on detailed technical specifications. Offers will be scored based on the provided technical specification and the cost. The overall DarkSide-20k project execution will be managed by INFN, in close communication with NSF (and all peer funding agencies), and in accordance with the latest editions of relevant INFN and NSF manuals, guides and directives, industry codes and standards, and best practices in construction management. Specific sub-deliverables under the exclusive responsibility of NSF (or other agency) will be managed in accordance with local manuals, guides, and directives.

4.9. Baseline Schedule Estimating Plan and Integrated Schedule

The integrated schedule is built within the Primavera P6 system. Each of the activities that are required for the success of the project have been included along with their expected duration time and their dependencies on other activities. With these inputs, the logical ordering of the activities

Institution	Position	FY2020	FY2021	FY2022
UC Davis	assistant specialist	12	12	12
Hawaii	mechanical engineer	6	4	1.5
	postdoc	12	12	12
Houston	postdoc	12	12	12
UMass	PI (summer)	0.7	0.7	0.7
	off-site postdoc	12	12	12
	off-site project engineer	12	12	12
Princeton	packaging technician	3	3	3
	off-site technician	12	12	12
	postdoc	3	3	3
Virginia Tech	postdoc	12	12	12

TABLE V. Summary of requested support for personnel. Figures represent yearly effort expressed in months.

drives the baseline schedule, which has been produced and is shown in the right-most portion of the appropriate and relevant tables in the Appendices.

4.10. Schedule Contingency

The built-in schedule contingency for NSF and INFN is generally quantifiable as 20%. This level of contingency has been added into the expected duration of the activities and sets a baseline for the overall contingency. Many of the activities have been estimated in terms of the most conservative scenario possible within the schedule of the project.

In some specific cases, schedule contingency is dealt with directly. For example, the Urania tender includes a penalty that the contractor will incur if they miss the agreed upon delivery date. Other large tender items will follow a similar policy. It is worth noting that 57 % of the funding for the project has been already secured, about 4 % is partially secured, and just 39 % is still being sought, of which, roughly 30 % is for labor and 70 % for non-labor. In the case that the remaining labor funding were not secured, the most predictable consequence would be a delay of the project time schedule. If the non-labor were not secured, an alternative plan would have to be implemented, for example sharing the unfunded costs between other funding agencies and/or involving new agencies.

5. STAFFING

5.1. Staffing Plan

Table V summarizes the personnel support specifically requested in this proposal. Academic personnel involved in the proposed activities but not listed are supported through other awards.

5.2. Hiring and Staff Transition Plan

Five postdocs are included as key members, one each for the Hawai'i, Houston, UMass, Virginia Tech, and Princeton groups. They will be searched for with high priority in the early stages of the period covered by this proposal. The University of Hawai'i postdoc will focus on the development of the calibrations systems and the software that will be used to simulate the calibration data. The University of Houston postdoc will be involved in the construction of the wire extraction grid for DS-Proto and DS-20k and will cover important construction-related tasks within the Urania sub-project. The UMass postdoc will take a leading role in the integration of the photodetector plane with the TPC and, while based at CERN, will be part of the core team of DarkSide personnel for DS-Proto and general TPC assembly, and will work with the UMass PI on the Urania pre-commissioning site operations. The Princeton postdoc will focus on the development and characterization of the PDMs. The Virginia Tech postdoc will be involved with the camera system of the calibrations working group and the development and implementation of the slow controls system for the DS-20k detector.

The requested engineering support is as follows. One full-time, off-site Princeton project engineer will have oversight of the cryogenic and gas handling system. The Hawai'i engineer will be responsible for the design and construction (design, custom assemblies, enclosures, housing) of the DD neutron generator and the photo-neutron source deployment system. The Department of Physics at University of Hawai'i has a well equipped shop with CNC capabilities and two technicians are supported full-time by the university. The PI intends to use their services for all standard parts fabrication, for which no support for these technicians' time is requested. Funding is requested by the Princeton group for support to the SiPM packaging operations and, through a full-time off-site technician, for the SiPM detector assembly in Italy. The UC Davis assistant specialist will supervise the production of the components for the high voltage systems, field cages, and reflector cages, and help with the testing and final integration of those components into the DS-proto and DS-20k TPC. The specialist will also supervise UC Davis undergraduate students involved in the process.

6. RISK AND OPPORTUNITY MANAGEMENT

6.1. Risk Management Plan

The project is developing two risk assessments for the project, a preliminary risk assessment and a quantitative risk assessment. The Preliminary Risk Assessment (PRA) uses qualitative and semi-quantitative methods and techniques, such as hazards identification (HazID), hazard and operability studies (HazOp), and failure modes and effects criticality analysis (FMEA/FMECA). Using these techniques, risks will be identified and defined and a preliminary risk characterization will be developed, from which, a definition and adoption of preventive and protective measures will be developed.

The Quantitative Risk Analysis (QRA) builds on the PRA using quantitative methodologies and techniques, such as Fault Tree Analysis (FTA), Event Tree Analysis (ETA), and Consequence Modeling Analysis (CMA). Potential adverse events will be identified and quantified with a likelihood of occurrence that provides a basis for evaluating the acceptability of risks and defining a risk matrix. In the risk matrix, each risk will be analyzed and evaluated to determine its probability and consequence, both economic and social. This will provide the management with a basis for understanding and defining corrective actions and strategies that ensure the successful completion of the project.

Our risk handling strategy can be summarized in a few sequential actions:

Avoid: eliminate the event leading to the risk;
Transfer: allocate the risk to a party more capable of dealing with it;
Control: reduce (or eliminate) the likelihood, impact, or both of the risk to an acceptable level;
Accept: acknowledge that some risks are not avoidable and should be transferred and/or mitigated.

The opportunity handling strategy can be summarized as follows:

Enhance: enhance the likelihood of the opportunity;
Share: develop teams/partnerships that will increase the opportunity's probability;
Exploit: increase (or facilitate) the impact, likelihood, or both of the opportunity;
Ignore: ignore the opportunities with insufficient return on investment;
Place: place on a watch-list and/or a check-list to monitor.

Using a well defined methodology and tools to monitor, control, and audit risks and opportunities will increase our understanding of the project status and allow us to employ the most effective strategies to see the project to timely completion.

Since the project's inception, regular meetings have been organized to discuss the WBS and the overall risk management plan in co-operation with the host laboratory, LNGS. Going forward, we will hold monthly meetings and employ internal and external consultants, who will review the project and provide advice on project risks and their concerns throughout the projects duration.

7. SYSTEMS ENGINEERING

7.1. Systems Engineering Plan

Systems engineering responsibility falls within each of the project Work Groups (WGs). Each WG is responsible for the design of their system and ensuring that it meets all project requirements, interfaces, and can be deployed and operated. Tests and checks will be performed before a design is considered ready. Designs that have been finalized and approved by the Technical Board are then subjected to an external review committee, consisting of a few members from the project team and engineers and scientists from national labs that are qualified to assess the system. It is the job of the project Technical Coordinator to ensure that systems engineering is done in collaboration between WGs and that WGs are aware of all interfaces.

7.2. Systems Engineering Requirements

The design of each system should be validated with full prototyping, and if necessary, by stand-alone tests. The requirements for the design's interface with other systems must be met and fully assessed prior to approval. All risks must be assessed and will be included in the preliminary risk assessment (PRA).

7.3. Interface Management Plan

The Management Structure of the GADMC is designed to manage three sub-projects that must ultimately converge to complete the project. The interfaces between DarkSide-20k, Aria, and Urania are under the control of the Spokesperson, Executive Board and Institutional Board and the Technical Coordinators of the sub-projects.

7.4. QA/QC, Operations, and Facility Divestment Plans

The Collaboration is developing a QA/QC plan that will tie to the WBS and will define the sub-system specific tests. Plans for QA/QC are put in place during the engineering of each system, and each will be described in the WBS by its own line item. As the systems are developed, and then fabricated, required tests and checks will be made to ensure that specifications are achieved as defined in the WBS.

Effective QA/QC is fundamental for the project. During the development of the final project design, comprehensive Monte Carlo simulations and material screening campaigns will be done to validate design choices. These design choices will be certified following a period of research and development, prototyping, and tests performed under stringent conditions. During the massive production of PDMs, the UAr extraction in Colorado and the purification of the UAr in Aria, a specific set of instruments and human resources will be devoted to fulfill the QA/QC of the final products.

7.5. Concept of Operations Plan

Each of the three sub-projects, the DS-20k detector, Urania, and Aria, will have their own **Operations Plan (OP)**. Each OP will take into account the personnel in each sub-project (operations manager, process engineer, operators) that will form an **Operations Group (OG)** and the availability of operating fund from their respective funding agencies. For instance, the Urania project will hire a full-time plant staff through the support of PNNL and Carleton University. This staff will include a plant manager, extraction operations engineer, process engineer, technical engineer, and up to 9 plant operators for standard operational shifting. This OG for Urania will also include the Urania Project Leader, Technical Coordinator, and L1 managers to ensure safe operations of the facility and the overall success of the project.

7.6. Facility Divestment Plan

Most of the facilities that will be part of DarkSide-20k can benefit future applications. For example, UAr extracted with Urania has application in other particle physics experiments. The same is true of Aria, which could be used for the chemical purification of other gasses, the isotopic cryo-distillation of isotopes useful in medical applications (^{18}O, ^{13}C) or for producing fuel for future nuclear power plants (^{15}N). For such facilities, a divestment plan will be managed by a Memorandum of Understanding for the future use of the DS-20k systems. For the remaining systems and/or subsystems that will be used by DS-20k and the joint sub-projects, the divestment plan will take into consideration a plan for 10 years of operations starting from the start of data taking with DarkSide-20k.

8. CONFIGURATION CONTROL

8.1. WBS Control Plan

The Technical Coordinators are responsible for carrying out the configuration control plan per the process for managing changes to said plan, laid out by the project controls team which worked with the Collaboration to develop and maintain the WBS. The WBS contains data from the control systems and is the basis for information entered into the Primavera P6 system. This WBS provides the essential earned value information needed for management control of the project and maintains the database for progress reporting. The system integrates the cost and schedule baselines and provides the tools to monitor project performance. The technical coordinators will keep track of project related documentation, act as a point of contact between the L1 Managers and the project controls team, ensure appropriate approvals are received, and notify the collaborators when changes and updates have been made. The changes themselves will be vetted by the Technical Board before implementation into official documentation.

8.2. Change Control Plan

The project has implemented a change control plan that requires a Change Control Board (CCB) to review any changes that impact the projects scope, cost and/or schedule. The process promotes orderly evolution from the baseline design, and ensures that the effect of changes on cost, schedule, and technical scope performance are properly evaluated and documented by project management and the CCB. A Baseline Change Request (BCR) must be initiated when there will be an impact on any of the cost, schedule, or scope baselines. Thresholds for determining the BCR approval level during project execution are still being defined but will be in place before the start of the project.

8.3. Document Control Plan

The aim of the document control plan is to control the storage of documents and important historical data and information. The plan establishes a methodology for the creation, update, and arrangement of documents. This plan will be evaluated annually and updated as necessary to ensure continuous improvement. Project collaborators will be responsible for the creation and storage of documents and for completion of document profiles. The Project Scientists will act as the project document librarians, keeping track of versioning. All documents will be stored in a permanent repository with access to all collaborators. When a document is ready for replacement by a new version, the Project Scientists will ensure the new version abides by the project standards for that document type.

9. ACQUISITIONS

9.1. Acquisitions Plans

Acquisition of the equipment requested in this proposal will take place at the participating institutions, subrecipient to the grant received by Princeton University. Thus, each institution will be responsible for the acquisition of the materials and equipment necessary to fullfill their overall assigned task. As part of the proposal preparation, each subrecipient institution (University of California at Los Angeles (UCLA), University of California at Davis (UC Davis), University of Houston (Houston), University of Massachusetts Amherst (UMass), University of Hawai'i (Hawai'i), and Virginia Tech (VT)) submitted their Statement of Work, a detailed budget, and a budget justification, approved by both Princeton University's and their own research office prior to proposal submission. In addition, every subrecipient submitted Princeton University's Subrecipient Commitment form, completed and signed by the authorized official of the institution. Sub-awards will be distributed according to the budgets submitted for the mid-scale proposal and acquisition plans will follow the budgeted material and equipment allocations. In certain cases, subcontracts will be issued to companies for a specific work related to fabrication or facilities required to carry out the work. Subcontracts will be issued by the subrecipient institutions that require the work. All subcontract preparation will adhere to the federal policies, and signatures will be carried out by the subrecipient contracts office. Table VI lists the participating universities acquisition responsibilities for the DarkSide-20k detector, while the intended dates for acquisitions related to Urania are listed in Table VII.

9.2. Acquisition Approval Process

The acquisition process will involve institutional, Collaboration, and funding agency approvals as needed. All institutions will follow federal guidance for large cost acquisition items, requiring three vendor quotes in order to get the most competitive cost. In addition, the acquisition items that will be used to fabricate parts of the TPC will undergo strict scrutiny for radio purity and the necessary radioassays will be funded from the Princeton portion of the grant or external sources. In case of any conflicting results that may impact the detector sensitivity or schedule, the problem will be discussed within the appropriate Work Group and within the Technical Board, prior to proceeding with the final decision and then enacting the appropriate acquisition plan. Some of the acquisition items may have long lead times, from several months to a year, so the acquisition plan includes the anticipated lead-time. Special attention will be paid to subcontracts requiring a request for proposal and notices will be sent to prospective vendors. A typical 1-3 month period will be allocated for collecting proposals and another month planned until the most competitive bids are selected. Thus, large subcontracts will include a 12 month planning period to cover the bidding, selection, and lead time required.

Item/Service	Institution	FY2020	FY2021	FY2022
Cryogenics	Princeton	$230,000	$180,000	$82,000
TPC Assays	Princeton	$40,000	$40,000	$40,000
LAr Purification Getter	Princeton	$250,000	$250,000	$250,000
R&D Fabrication Charges	Princeton	$150,000	$25,000	$5,000
UArPurification System	UCLA	$129,840	$132,360	$137,400
High Voltage System	UC Davis	$56,000	$95,000	
Field Cage	UC Davis	$22,000	$15,000	
Reflector Cage	UC Davis	$14,000	$20,000	
Fused Silica R&D	UMass	$11,593		
Fused Silica	UMass	$375,605	$187,802	
Veto Camera System	Hawai'i	$15,000	$25,000	
Sources [Internal, γ, (α, n), (γ, n)]	Hawai;i	$47,000	$90,000	$55,000
Calibration Insertion Systems	Hawai'i	$60,000	$50,000	
Calibration $ Integrated Monitoring System	Virginia Tech	$21,000	$27,000	$24,000
Wire Winding Machine Construction	Houston	$30,058	$20,058	
DS-Proto Wire Grid	Houston	$35,000		
DS-20k Wire Grid	Houston		$45,000	
R&D Fabrication Charges	Houston	$15,000	$15,000	$5,000

TABLE VI. Program of acquisitions divided by the main recipient or subrecipient institution with profile of expenditure detailed by year.

Item/service	Institution	FY2020	FY2021	FY2022
Site Feed Gas Optimization	Houston	$100,000		
Site Preparation, Tools, and Equipment	Houston	$150,000		
Inlet and Outlet Piping	Houston	$120,000		
Site Electrical Installation	Houston	$650,000		
Site Concrete Installation	Houston	$250,000		
Site Control Room Installation	Houston	$215,872		
Site Plant Readiness Work	Houston		$200,000	
Plant Mechanical Erection	Houston		$350,000	
Plant Interconnections	Houston		$120,000	
Cold Boxes Setup	Houston		$350,000	
Plant Interconnection and Instrumentation	Houston		$250,000	
Site Control Room Installation	Houston		$215,872	
Plant Commissioning Equipment and tools	Houston			$100,000
Plant Commissioning Liquid Nitrogen	Houston			$150,000
Plant Commissioning Power and Utilities	Houston			$975,000
Cryogenic Storage Vessels	Houston			$265,372

TABLE VII. Program of acquisitions for Urania that will be made by University of Houston, one of the subrecipient institutions, with profile of expenditure detailed by year.

The largest acquisitions are related to the construction of the Urania plant. Anticipated costs and details of the plant have been developed in close cooperation with the Kinder Morgan CO2 Company, which owns the mineral rights to the gas stream which the UAr is extracted from. This close cooperation is expected to continue with PI A. Renshaw from University of Houston as the Urania Technical Coordinator serving as the liaison with Kinder Morgan, whose corporate headquarter is also based in Houston. The bidding process for the electrical work, concrete work, and other civil constructions will be led by the University of Houston, via the request for proposal process, while adhering to the federal guidelines and in cooperation with the Kinder Morgan expectations.

10. PROJECT MANANGEMENT CONTROLS

10.1. Project Management Control Plan

The GADMC has a well-established project management scheme that includes a top-down flow of information, stemming from the Institutional Board. This board consists of one representative from each of the participating institutions and is responsible for the governing of the project. Outside of this board, the project contains Work Groups and committees which report the progress of related tasks to the governing boards. Decisions on the management structure are made within the Institutional Board.

The cost estimating plan and the WBS are used to establish the roles and responsibilities within the collaboration. The cost model data and the resource loaded schedule allow for the implementation of the Earned Value Management System (EVMS) methodology, integrating cost, schedule, and scope. Risks will be recorded in a Risk Registry to record uncertainty that can affect cost, schedule, and/or performance. All risks that can impact the program will be reported directly to the management for mitigation.

10.2. Earned Value Management System (EVMS) Plan

The project has adopted the Primavera P6 project management software, which will be utilized for the tracking of the project with an earned value approach and for producing necessary reports used to assess the progress of the project. The EVMS will allow the accurate forecasting of potential performance problems and the efficient tracking of project progress. Project tracking will be carried out by the implementation of the project plan, a valuation of the planned work, and the predefinition of metrics which quantify the accomplishment of work. The input to the EVMS will be the resource loaded schedule, the institutional accounting information, and the output of the risk analysis.

11. SITE AND ENVIRONMENT

The DS-20k detector, Urania, and Aria sub-project sites have been selected based on the scientific requirements of the sub-projects and the available on-site resources. Agreements for siting equipment and systems have been established with the primary landowners or hosting institution of each site as documented by the Supplementary Documents included with the proposal. The permitting process for each of the sites has begun, or in some cases concluded, and is expected to proceed as defined in the project schedule. The DS-20k detector will be located in Hall C of LNGS. The overall layout of the facility is shown in Figure 2. The Urania facility will be located on land owned by Kinder Morgan that is adjacent to the gas processing facility handling the feed gas stream containing the UAr. A preliminary layout of the Urania facility is shown in Figure 5. The Aria project is already under construction at the Monte Sinni mine of the Carbosulcis Company in Sardinia, Italy, where a vertical shaft has been completely refurbished and outfitted to accommodate 350 m tall distillation columns.

The GADMC will designate a Work Group charged with ensuring that proper permitting and site assessments are performed in line with the requirements of the host site and following all local and national regulations.

FIG. 5. Preliminary layout of the Urania facility within the approved facility boundary adjacent the Kinder Morgan CO2 Company gas processing facility.

12. CYBERINFRASTRUCTURE

12.1. Cyber-Security Plan

Data, hardware, and network security will be handled by LNGS as the host laboratory and by the facilities operating the storage and computing resources of the project, with support from the Collaboration. Computing resources will be accessed through Grid middleware components that provide services for software installation and publication, data access through a uniform security and authorization infrastructure, interfaces for remote job submission and data retrieval, and scheduling tools designed to optimize utilization of computing resources. The Grid infrastructure will be based on the infrastructure and the software tools and services developed for the LHC Computing Grid (LCG) project.

12.2. Code Development Plan

The DarkSide-20k project will use an object-oriented approach to software design, based primarily on the C++ programming language with some components implemented using other high level languages. A software framework was built during the DarkSide-50 experiment that met the basic processing needs of the experiment and was sufficiently flexible to meet changing requirements. A similar framework was developed for the DEAP-3600 experiemnt. The collaboration is currently developing event reconstruction code for several small-scale prototype detectors, drawing from the DarkSide-50 and DEAP-3600 experiences. In order to support code reuse, the system will be optimized to handle both the offline and software trigger environments and provide common user access to low-level algorithms used for I/O and data persistency.

The computing group will provide and maintain the software development environment. This includes supporting code management tools (Git, Github, etc.), defining the use of external software (for example CERN Root, Geant4, theory interpretation codes, etc.), providing scripting for building software releases, producing code distribution kits, and providing documentation such as web, wiki pages, and bug reporting. The computing group plans to make use of standard quality assurance and quality control tools used in HEP large experiments. Doxygen and Twiki web pages will be used to document code, version the software for specific sub-projects, and provide instructions and tutorials. Production releases will be used to define the stable code used for production and end-user analysis. Production release builds will be managed and supervised by a team of librarians within the computing group. The librarians will ensure tall software components work coherently and will patch production releases with bug-fixes when needed. Production releases will be installed on the Grid using the methods developed for LCG.

12.3. Data Management Plan

The data collected by the DS-20k experiment will probe novel parameter space for WIMP dark matter, and as such, the results of the experiment will be of interest to the particle physics, astrophysics, and astronomy communities. The GADMC will engage with its host Laboratory to develop protocols for data archiving, retrieval, security, and dissemination as detailed below. Routine data backups will be performed, with at least one backup off-site. All researchers will be obliged to adhere to the data management plan as a requirement for data usage.

Expected Data: Data will consist of records that represent the response of photodetectors to light signals generated by particle interactions in the detector. The raw data will contain the necessary information to reconstruct each photodetector's response as a function of time along with metadata stored in headers. Accompanying the raw data will be electronic log files and an indexed laboratory notebook narrative that can be cross-referenced with the raw events. Raw data will be stored on disk and immediately processed to monitor the data in real time. Once processed, the events will be stored in an open source documented format. Both raw data files and processed event files will be preserved off-site at the National Center for Frame Analysis (CNAF) copies on LTO tapes and RAID arrays. Copies of the electronic logbook and the original laboratory notebooks will be preserved and secured at the storage facilities of collaborating institutions.

Data Processing: Primary event processing will occur at the experimental site in the software trigger farm. Pre-processed data is archived on temporary storage at the experimental site then copied to central computing centers (Tier-1/Tier-2). These facilities archive the pre-processed data, provide reprocessing capacity, and allow analysis of the processed data. Derived datasets produced in the physics analyses will also be copied to the Tier-1/Tier-2 facilities for further analysis and long-term storage. The Tier-1/Tier-2 facilities will also provide the processing capacity for detector simulations. The safety of archived raw data will be assured by creating multiple copies of data, either on tape and disk or by distributing copies across several data centers in Europe and America. Bulk data processing is expected to be performed using low cost commodity cluster computing based on commercial CPUs. Final data analysis will be performed either directly at the Tier-1/Tier-2 centers or on commercial CPUs hosted at institutes participating in the experiment.

Data Storage: Currently, the amount of short term storage currently available at LNGS for DarkSide-50 consists of 7 TB of front-end storage used as a temporary buffer and located in the underground laboratory plus 710 TB of disk space in the above ground computing center for short- and long-term storage of DarkSide-50 data. From there, raw data are copied to CNAF and Fermilab for reprocessing and analysis. CNAF provides 1 PB of disk storage and 300 TB of tape storage. At Fermilab, there is 50 TB of fault-tolerant disk storage and about 620 TB on the dCache-based tape system for long-term storage. It is expected that that a factor of twenty more resources will be needed for a ten year run of DS-20k. The total amount of storage for the ten years of data-taking, including physics, calibration, and simulated data, will be 20 PB of disk storage and 20 PB of tape storage. The processing power currently used for reprocessing and analysis of DarkSide-50 data includes a farm of 400 cores at LNGS for production and validation, plus 400 job queues at CNAF and 60 guaranteed batch slotson the Fermilab grid system. A factor of twenty increase is also needed for the CPU resources assuming only a modest increase in the analysis code execution time is required given the highly compressed data format. Assuming a factor two increase in the CPU time needed to reconstruct an event and a factor ten to simulate a full event, DS-20k needs in total about 1500 dedicated cores to maintain reconstruction in realtime of the collected data and to produce simulated samples.

Period of Data Retention: The data will be preserved for at least three years beyond the award period, as required by NSF guidelines. All data will be held on tape for at least ten years. One month before deletion of any data, the collaboration will be informed that the data will be removed so that there is sufficient time to request an extension and/or download the files. A second warning will be sent two weeks before the action and a final warning will be distributed in the last week.

Data Formats and dissemination: All significant findings stemming from the research program will be promptly prepared and submitted for publication with authorship that accurately reflects the contributions of those involved as decided by the IB. Data will also be used to produce posters, talks, papers, and informative reports for both expert and non-expert audiences. After publications are generated and accepted by the relevant journals and thesis works are published, data generated from this project may be released upon request to non-collaboration members, at the discretion of the GADMC, provided that the release does not compromise the ability of the Collaboration to perform and publish additional analyses. We do not anticipate that there will be any significant intellectual property issues involved with the acquisition, processing, or analysis of the data. In the event that discoveries or inventions are made in direct connection with this data, access to the data will be granted upon request once appropriate invention disclosures and/or provisional patent filings are made. Access to the data will be provided via written request to the Spokesperson.

This project will not involve the acquisition of either animal or human subjects data.

13. ENVIRONMENTAL, SAFETY AND HEALTH

13.1. Environmental, Safety and Health Plans

The Collaboration is developing an environment, safety, and health plan in cooperation with the host laboratory ESH Staff that is in accordance with ISO and OHSAS codes and conforms to all applicable US, European, and Italian HSE Regulations and Standards, as well as the national laboratory internal guidelines and procedures. For each sub-project, the collaboration will perform a PRA (Preliminary Risk Assessment), build a QRA (Quantitative Risk Assessment), and define a safety plan that is reviewed and revised as the project evolves. Development of the QRA will be carried out by experts from the relevant funding agencies, GADMC member institutions, and external consultants. A similar scheme was successfully implemented for DarkSide-50. The safety plan will cover the health and safety of all personnel and the potential environmental impacts of activities.

14. REVIEW AND REPORTING

The Technical Coordinators will lead quarterly reviews on technical progress, cost, schedule, and safety and report the results to the NSF Program Officer and the appropriate partnering funding agencies. The TCs will monitor technical performance throughout the design and construction stage. Internal design reviews and performance testing will ensure that the detector subsystems meet the requirements of the project.

The reporting requirements include the preparation of regular quarterly reports as well as other reports as appropriate. The following reports will be required:

- Status and performance reports (quarterly), which will cover technical progress, cost, schedule, and safety;
- Technical Board meeting notes (weekly) summarizing progress;
- Variance reports (as needed);
- Change requests (as needed); and
- Annual reports.

15. INTEGRATION AND COMMISSIONING

The three DarkSide sub-projects are developing their own integration and commissioning plans with specific criteria for approving operational readiness. The final plans will be vetted and approved by the Technical Board and, when appropriate, by an external review committees. Clear specifications are defined for the acceptance of any vendor-provided sub-systems that integrate into the project.

15.1. Integrations and Commissioning Plan

DS-20k: The DS-20k detector integration plan is incorporated in the WBS. Each sub-project will be tracked by the Technical Coordinator and Project Leader to ensure timely completion. The Integration group and the Infrastructure group will handle issues related to the integration of the DS-20k detector into Hall C of LNGS.

Urania: Princeton University and the Kinder-Morgan CO2 Company have executed agreements to extract the 60 t of UAr from the feed gas stream. Currently, the design and skid mounted construction of the Urania plant is in a tender process in Italy. A contract with the selected company from the tender process is expected to be in place by November 2019. During the Urania plant construction, the Urania site will be prepared with all required infrastructure. This includes all permits required for the Urania plant installation and operations, electricity, an adequate foundation (as defined by the Urania plant design), communication equipment, and arrangements for delivery of consumables (e.g., liquid nitrogen). Once the Urania plant is delivered and installed, final gas connections will be made, feed gas flow will start, and commissioning will begin.

Commissioning will be led by the collaboration under the guidance of the company that designed and built the Urania plant. Staff will be hired specifically for the integration and commissioning, and will then transition to extraction operations. In addition to these primary Urania full-time staff, members of the collaboration will take part in the commissioning. The commissioning will include a full leak-check of the plant, establishing the PLC communications between Urania and the Kinder-Morgan facility, cooling down the plant, and finally flowing gas. Each processing set of the plant will be optimized for maximum final purity and throughput. The commissioning will also be used to train staff for operations after the close out of the project.

Aria: The Aria plant is under construction at the Monte Sinni mine of the Carbosulcis company in Sardinia, Italy, that recently ended its cycle of coal extraction. The availability of an unused well in the mining site of Seruci, now completely refurbished and outfitted to support the Aria sub-project, will allow the construction of the plant with minimal environmental impact and relatively low cost. The Seruci-I cryogenic distillation column is about 350 m high and is composed of 28 identical intermediate modules each 12 m tall, as well as a top condenser and a bottom reboiler module. Once completed, it will be the highest distillation column in the world. Authorization for the installation and commissioning of Seruci-I has already been granted (an excerpt of the original document in Italian and it translation into English are included as Supplementary Documents.) The construction of the Seruci-I column was preceded by the prototype Seruci-0 column, a 30 m tall prototype column composed of one intermediate module, a top condenser, and a bottom reboiler. The construction of Seruci-0 is nearly complete, and operations will start in June 2019. The column will purify UAr at a rate of O(1 t/d), inline with the 250 kg/d production of UAr from Urania. The plant will be assembled, tested, and operated by a team of institutions including Princeton, INFN, CERN, Università degli Studi di Cagliari, FNAL, and Carbosulcis.

15.2. Acceptance/Operational Readiness Plan

DS-20k: Operational readiness requirements will be defined by the TB for each of the sub-systems that integrate into the DS-20k detector. The responsible Work Groups will asses their systems readiness. The DS-20k detector will be operational when these sub-systems are fully integrated and the detector is operating sufficiently well to take science quality data.

Urania: The Urania plant will be ready for extraction operations when production of UAr with a 99.9 % chemical purity at a rate of 250 kg/d has been demonstrated, for a period of seven consecutive days, as spelled out in the tender requirements. Operational readiness will require fully trained staff that will transition to operations as the plant shifts from the commissioning phase to the operation phase. Plans for supplying consumables to the plant and for transporting the pure UAr from Urania are under development. Vendors have been identified and the plan will be in place at the onset of the operation phase.

Aria: Initial quality and acceptance tests have already been performed on the Seruci-I modules, including helium leak tests at the production site for all 28 central modules, as well as the top and bottom modules, leak tests at CERN for all of the modules, cryogenic test of bottom module, and an X-ray weld tests during the installation of Seruci-0. Before operation, a final global leak test will be performed. Seruci-0 will inform the definition of the most appropriate processing parameters for the operation of the column and will train the operators and technicians involved. Seruci-0 is expected to operate for approximately 6 mo to 12 mo for Seruci-0. At the end of this activity, the elements of the prototype (column plus auxiliary equipment) will be recovered and used to complete the installation of Seruci-I. The allotted period of operations for Seruci-I is 3 yr. The Aria project also includes the DArT detector, an experiment to measure the residual radioactivity of the argon after purification with Aria.

The funds needed for construction and commissioning of Seruci-I and DArT were obtained from the Regione Autonoma della Sardegna (RAS), INFN, and the Ministero dell'Istruzione dell'Università e della Ricerca (MIUR). The available funds have been used to procure all the modules for Seruci-I and most components for its operation, all of which are now on site.

16. PROJECT CLOSE-OUT

16.1. Transition to Operations Plan

DS-20k: We will use experiences from the operation of DarkSide-50 and DarkSide-Proto to estimate the operational requirements for the DS-20k detector. Standard operations of the DS-20k detector will include full-time monitoring via software and at least one person at site. We foresee on-site shifts at LNGS during the commissioning and initial calibrations, but once detector operations have stabilized over an extended period of time, on-site shifting will be transformed into fully-remote data taking operations. Some of the routine calibrations, such as neutron calibration runs will still require on-site shifts. Responsibilities for shifts will be shared among all groups in the collaboration. Some support for the operations portion of the project has already been awarded, including base-funding from NSF. It is expected that the same level of base-funding would continue throughout the operations phase of the DS-20k detector.

Urania: The same plant staff personnel that were trained during the commissioning phase of the project will transition directly into operations. The operations of Urania falls within the overall project scope here since it provides the target for the DS-20k detector. These staff members will be both the primary Urania full-time plant staff, as well as any DarkSide collaboration members taking part in Urania operations. The methods for supplying Urania with the consumables during operations will be established, including contracts and required delivery schedule. The costs of operations for the Urania facility during the extraction of the UAr for DS-20k will be supported largely by CFI and PNNL.

Aria: The Seruci-0 prototype will test the purification process of the design, as well as the components that will be implemented in the Seruci-I distillation column. It will start with operations in June 2019 and will lay the groundwork for the standard operating procedures of the Seruci-I column. The Seruci-I plant will run for the time necessary for the production and purification of the 60 t of UAr necessary for filling the DS-20k detector, and therefore falls under the scope of this project. The Seruci-I plant is estimated to be able to chemically purify the UAr at a rate of O(1 t/d), with operations starting in 2021. Hence, Aria will be ready to receive the UAr from Urania by the time extraction starts, and the combination of the two will be able to deliver all the necessary UAr within the project schedule.

We have secured some funds for the operation and maintenance of Aria. We are in the process of receiving another award from the Regione Autonoma della Sardegna, which will complete the funds required. Operations costs have been calculated assuming the prototype column will operate for 6 mo to 12 mo and Seruci-I will operate for a period of about 3 yr. In order to achieve the design goal, the Seruci-0 prototype column and the Seruci-I column need to be operated 24 h/d. The facility will be operated on shift by crews with 2 to 3 people per shift, 8 h per crew. The crew will include staff personnel from INFN and temporary contract workers. Carbosulcis employees will also be involved as necessary to ensure the safety of operations.

16.2. Project Close-out Plan

DS-20k: Construction of the facilities in Hall C of LNGS will be completed by the middle of 2021. The cryogenic system of the inner and outer detector will be completed and tested by the middle of 2021. The components and subsystems for the inner and outer detector will be fabricated, assembled and delivered to LNGS by the middle of 2021. DS-20k Photodetector Modules (PDMs) will be assembled at NOA and intensively tested at at various partnering institutions. The electronics, DAQ, and slow control systems will be partially commissioned before their delivery to LNGS. Several tests of the DS-20k TPC inside a test dewar are planned prior to its installation inside the outer veto detector. The tests will include: assembly procedure, mechanical stability of the TPC and its hanging structure, detailed characterization of the SiPMs, leak check of the sealed TPC vessel, HV stability, and TPC operation in LAr. The time anticipated for the tests of the inner detector inside the test dewar, assembly, installation and commissioning of the inner TPC and outer veto detector is 6-12 months. Commissioning is the final stage of the project and it will start when both the inner and outer detectors are installed in the AAr cryostat and the cryostat is sealed. We foresee a period of up to 6 months for simultaneous filling of the inner and outer detectors with UAr and AAr, respectively. The project will be finalized with initial calibrations of both the inner and outer detectors to fully characterize their performances such as leveling of the liquid surface for the inner detector, light yield calibrations for both the inner and outer detector and electron drift life-time in the inner detector. After this point, normal data taking operations will begin.

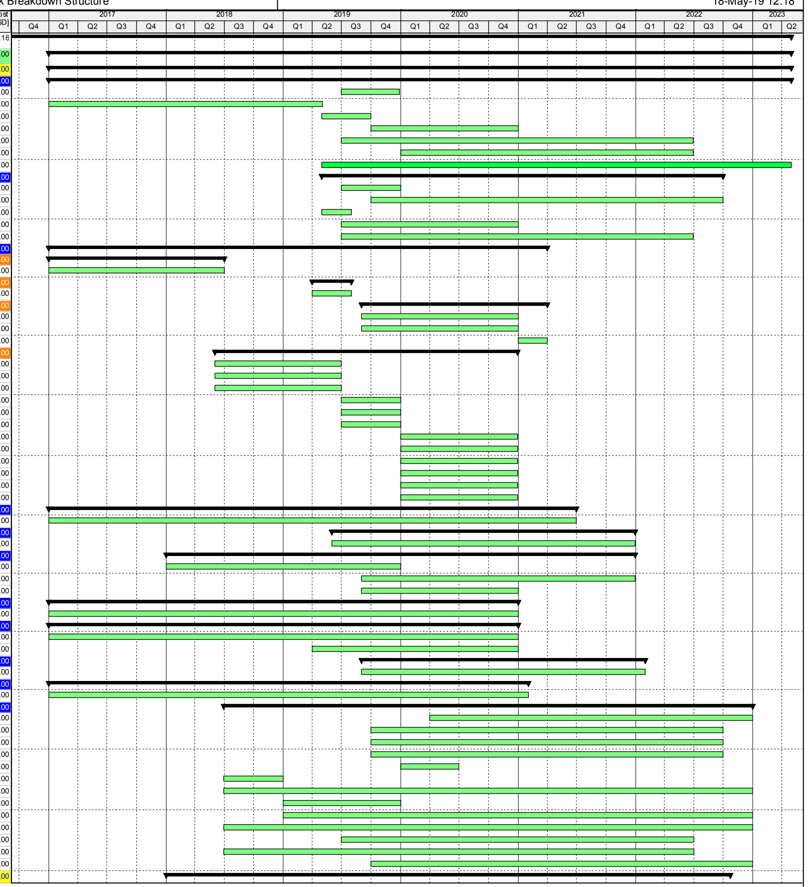
Urania: The Urania sub-project will be closed-out when the Urania plant has produced the 60 t of UAr required for DS-20k and it has been shipped from the extraction site in Cortez, CO, USA to the Aria site in Sardinia, Italy. It is anticipated that the Urania facility will continue to operate after this project, since it represents the only established source of UAr in the world. It is likely that the GADMC will take over operations with a new project that will be put in place for the Argo experiment. In this case, the close-out of the Urania sub-project will be in the form of a hand-off of the facility responsibility and operations to the new project team. The agreement between the current project team and the project team that will take over the Urania facility will be worked out during the final year of this project, with the expectation that the new project team would come on board during the final 3 months of this project in order to be trained on how the facility had been operating up to that point. It is likely that many members of the current project team would also be members of the new project team, in this case the transition to the new project would be seamless.

Aria: The close-out of Aria in relation to this project will occur when Seruci-I has chemically purified all 60 t of UAr for DS-20k. The Aria facility will then be transferred to the next project, in similar fashion as to the method of transfer for Urania. The current project team members who have Aria related responsibilities will stay on board for the next project that will use the Aria infrastructure, ensuring a seamless closeout.

Appendix A: Work Breakdown Structure

DarkSide Current | DS Layout-Work Breakdown Structure | 18-May-19 12:18

Activity ID	Activity Name	DS_Funding Source	DS_Institution	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]
DarkSide DarkSide Current				1812	01-Feb-16	30-Apr-23	$20,191,857.93	$91,630,386.23	$111,822,244.16
DarkSide.1 DarkSide-20k				1581	01-Jan-17	30-Apr-23	$15,123,097.00	$59,241,874.00	$74,364,971.00
DarkSide.1.01 Photo Electronics				2311	01-Jan-17	30-Apr-23	$11,059,300.00	$28,223,000.00	$39,282,300.00
DarkSide.1.01.01 SiPM				2311	01-Jan-17	30-Apr-23	$5,306,100.00	$7,488,000.00	$12,794,100.00
DS-1111000	SiPM- TSVs	NSF-Mid-scale	UMass	180	01-Jul-19*	27-Dec-19	$0.00	$580,000.00	$580,000.00
DS-1111001	SiPM-R&D	INFN-CSN2	LNGS	851	01-Jan-17*	01-May-19	$0.00	$121,000.00	$121,000.00
DS-1111002	SiPM - Preproduction	INFN-CIPE-1	INFN-BO	153	01-May-19*	30-Sep-19	$0.00	$540,100.00	$540,100.00
DS-1111003	SiPM - Production	INFN-PON	INFN-BO	458	01-Oct-19	31-Dec-20	$0.00	$6,246,900.00	$6,246,900.00
DS-1111004	SiPM-Technician	INFN-MP	INFN-BO	1096	01-Jul-19*	30-Jun-22	$468,600.00	$0.00	$468,600.00
DS-1111005	SiPM- Packaging technician	STFC	INFN-BO	912	01-Jan-20*	30-Jun-22	$1,950,000.00	$0.00	$1,950,000.00
DS-1111006	SiPM - Scientists	AstroCeNT	INFN-BO	1461	01-May-19*	30-Apr-23	$2,887,500.00	$0.00	$2,887,500.00
DarkSide.1.01.02 Tile and Substrates				1249	01-May-19	30-Sep-22	$648,800.00	$959,800.00	$1,608,600.00
DS-1112000	Tile and substrates - R&D	NSF-Mid-scale	Princeton	184	01-Jul-19*	31-Dec-19	$0.00	$263,500.00	$263,500.00
DS-1112001	Tile and substrates - Labor	NSF-Mid-scale	Princeton	1096	01-Oct-19*	30-Sep-22	$508,000.00	$0.00	$508,000.00
DS-1112002_1	Tile and substrates - Preproduction	INFN-CIPE-1	LNGS	92	01-May-19	31-Jul-19	$0.00	$35,200.00	$35,200.00
DS-1112003	Tile and substrates - PCB and components	INFN-CIPE-1	LNGS	550	01-Jul-19*	31-Dec-20	$0.00	$661,100.00	$661,100.00
DS-1112004	Tile and substrates - Technicians	INFN-MP	LNGS	1096	01-Jul-19*	30-Jun-22	$140,800.00	$0.00	$140,800.00
DarkSide.1.01.03 Front-end electronics				1551	01-Jan-17	31-Mar-21	$634,000.00	$1,240,200.00	$1,874,200.00
DarkSide.1.01.03.01 FEB prototyping				546	01-Jan-17	30-Jun-18	$0.00	$82,500.00	$82,500.00
DS-1113100	FEB prototyping	INFN-CSN2	LNGS	546	01-Jan-17*	30-Jun-18	$0.00	$82,500.00	$82,500.00
DarkSide.1.01.03.02 FEB preproduction				122	01-Apr-19	31-Jul-19	$0.00	$36,300.00	$36,300.00
DS-1113200	FEB preproduction	INFN-CIPE-1	LNGS	122	01-Apr-19*	31-Jul-19	$0.00	$36,300.00	$36,300.00
DarkSide.1.01.03.03 FEB production				578	01-Sep-19	31-Mar-21	$0.00	$906,400.00	$906,400.00
DS-1113300	FEB production -TPC	INFN-CIPE-1	LNGS	488	01-Sep-19*	31-Dec-20	$0.00	$534,600.00	$534,600.00
DS-1113301	FEB production - consumables	INFN-CSN2	LNGS	488	01-Sep-19*	31-Dec-20	$0.00	$27,500.00	$27,500.00
DS-1113302	FEB production - Veto	INFN-CIPE-2	LNGS	90	01-Jan-21	31-Mar-21	$0.00	$344,300.00	$344,300.00
DarkSide.1.01.03.04 Steering Module				944	01-Jun-18	30-Dec-20	$634,000.00	$215,000.00	$849,000.00
DS-1113411	Printed circuit boards - prototyping	DOE	BNL	395	01-Jun-18*	30-Jun-19	$0.00	$2,000.00	$2,000.00
DS-1113412	Run prototyping	DOE	BNL	395	01-Jun-18*	30-Jun-19	$0.00	$2,000.00	$2,000.00
DS-1113413	Argon for cryogenics test - prototyping	DOE	BNL	395	01-Jun-18*	30-Jun-19	$0.00	$2,000.00	$2,000.00
DS-1113421	Printed circuit boards - preproduction	DOE	BNL	184	01-Jul-19*	31-Dec-19	$0.00	$2,000.00	$2,000.00
DS-1113422	Run - preproduction	DOE	BNL	184	01-Jul-19*	31-Dec-19	$0.00	$4,000.00	$4,000.00
DS-1113423	Argon for cryogenics test - preproduction	DOE	BNL	184	01-Jul-19*	31-Dec-19	$0.00	$1,000.00	$1,000.00
DS-1113431	PCB Material - Production	DOE	BNL	365	01-Jan-20*	30-Dec-20	$0.00	$8,000.00	$8,000.00
DS-1113432	Printed circuit boards - Production	DOE	BNL	365	01-Jan-20*	30-Dec-20	$0.00	$9,000.00	$9,000.00
DS-1113433	Run - Production	DOE	BNL	365	01-Jan-20*	30-Dec-20	$0.00	$170,000.00	$170,000.00
DS-1113434	Material burden	DOE	BNL	365	01-Jan-20*	30-Dec-20	$0.00	$15,000.00	$15,000.00
DS-1113435	Steering module production labor	DOE	BNL	365	01-Jan-20*	30-Dec-20	$134,000.00	$0.00	$134,000.00
DS-1113435_1	Steering module production Engineer	DOE	BNL	365	01-Jan-20*	30-Dec-20	$500,000.00	$0.00	$500,000.00
DarkSide.1.01.04 Detector module integration				1642	01-Jan-17	30-Jun-21	$0.00	$397,100.00	$397,100.00
DS-111400	Detector module integration	INFN-CSN2	INFN-PI	1642	01-Jan-17*	30-Jun-21	$0.00	$397,100.00	$397,100.00
DarkSide.1.01.05 Motherboard characterization				945	01-Jun-19	31-Dec-21	$0.00	$1,040,600.00	$1,040,600.00
DS-111500	Motherboard characterization (LN2 tests)	INFN-CSN2	INFN-NA	945	01-Jun-19*	31-Dec-21	$0.00	$1,040,600.00	$1,040,600.00
DarkSide.1.01.07 Optolink				1461	01-Jan-18	31-Dec-21	$0.00	$5,604,500.00	$5,604,500.00
DS-111700	Optolink - Prototyping and preproduction	INFN-CSN2	LNGS	730	01-Jan-18*	31-Dec-19	$0.00	$300,300.00	$300,300.00
DS-111800	Optolink - TPC, Veto fibers + Optical driver PCB	INFN-CIPE-1	LNGS	853	01-Sep-19*	31-Dec-21	$0.00	$3,348,400.00	$3,348,400.00
DS-111900	Optolink - Receivers and Driver components	INFN-CIPE-2	LNGS	488	01-Sep-19*	31-Dec-20	$0.00	$1,955,800.00	$1,955,800.00
DarkSide.1.01.08 Cabling				1461	01-Jan-17	31-Dec-20	$0.00	$249,700.00	$249,700.00
DS-111901	Cabling	INFN-CSN2	INFN-MI	1461	01-Jan-17*	31-Dec-20	$0.00	$249,700.00	$249,700.00
DarkSide.1.01.09 Motherboard				1461	01-Jan-17	31-Dec-20	$0.00	$468,600.00	$468,600.00
DS-112000	Motherboard Production	INFN-CSN2	INFN-BO	1461	01-Jan-17*	31-Dec-20	$0.00	$193,600.00	$193,600.00
DS-112100	Motherboard-cleaning	INFN-CIPE-2	LNL	641	01-Apr-19*	31-Dec-20	$0.00	$275,000.00	$275,000.00
DarkSide.1.01.10 SiPM power supplies				884	01-Sep-19	31-Jan-22	$0.00	$1,061,500.00	$1,061,500.00
DS-112110	SiPM power supplies - TPC and VETO	INFN-CIPE-2	INFN-BO	884	01-Sep-19*	31-Jan-22	$0.00	$1,061,500.00	$1,061,500.00
DarkSide.1.01.11 Integrated electronics				1492	01-Jan-17	31-Jan-21	$0.00	$344,300.00	$344,300.00
DS-112112	Integrated electronics	INFN-CSN2	INFN-TO	1492	01-Jan-17*	31-Jan-21	$0.00	$344,300.00	$344,300.00
DarkSide.1.01.12 NOA				1646	30-Jun-18	31-Dec-22	$4,470,400.00	$9,368,700.00	$13,839,100.00
DS-501000	Clean Room	INFN-PON	LNGS	1005	01-Apr-20*	31-Dec-22	$0.00	$2,090,000.00	$2,090,000.00
DS-502000	Packaging facility, housing, refurbishing, gas and electricity	INFN-CIPE-1	LNGS	1096	01-Oct-19*	30-Sep-22	$0.00	$2,665,300.00	$2,665,300.00
DS-503000	Silicon packaging equipments Part1	INFN-CIPE-1	INFN-BO	1096	01-Oct-19*	30-Sep-22	$0.00	$3,795,000.00	$3,795,000.00
DS-503001	Silicon packaging equipments Part2	INFN-CIPE-2	INFN-BO	1096	01-Oct-19*	30-Sep-22	$0.00	$220,000.00	$220,000.00
DS-504000	LA-ICPMS	INFN-MP	LNGS	182	01-Jan-20*	30-Jun-20	$157,300.00	$0.00	$157,300.00
DS-505000	Mechanical-3D Equipment	INFN-CIPE-1	LNGS	185	30-Jun-18*	31-Dec-18	$0.00	$268,400.00	$268,400.00
DS-505001	Mechanical-3D Labor	INFN-MP	LNGS	1646	30-Jun-18*	31-Dec-22	$157,300.00	$0.00	$157,300.00
DS-506000	NOA Infrastructures	INFN-CIPE-1	LNGS	365	01-Jan-19*	31-Dec-19	$0.00	$220,000.00	$220,000.00
DS-507000	Website & Outreach	INFN-CIPE-1	LNGS	1461	01-Jan-19*	31-Dec-22	$0.00	$44,000.00	$44,000.00
DS-508000	Travels	INFN-CIPE-1	LNGS	1646	30-Jun-18*	31-Dec-22	$0.00	$66,000.00	$66,000.00
DS-509000	Administrative personnel	INFN-MP	LNGS	1097	01-Jul-19*	01-Jul-22	$140,800.00	$0.00	$140,800.00
DS-510000	Faculty personnel (PS)	INFN-MP	LNGS	1463	30-Jun-18*	01-Jul-22	$396,000.00	$0.00	$396,000.00
DS-511000	Faculty personnel, engineers, technicians	INFN-MP	LNGS	1188	01-Oct-19*	31-Dec-22	$3,619,000.00	$0.00	$3,619,000.00
DarkSide.1.02 DarkSide-20k Inner Detector and Cryogenics				1756	01-Jan-18	22-Oct-22	$1,815,955.00	$7,381,407.00	$9,197,362.00



Remaining Level of Effort | Actual Work | Critical Remaining Work
Actual Level of Effort | Remaining Work ◆ | ◆ Milestone

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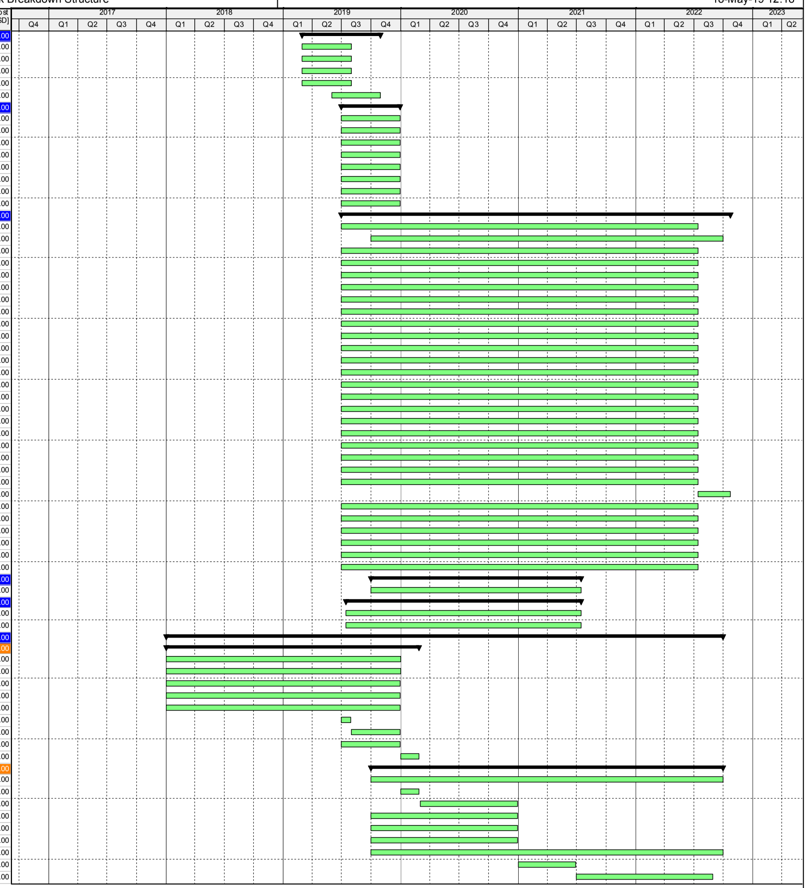
DarkSide Current

DS Layout-Work Breakdown Structure

18-May-19 12:18

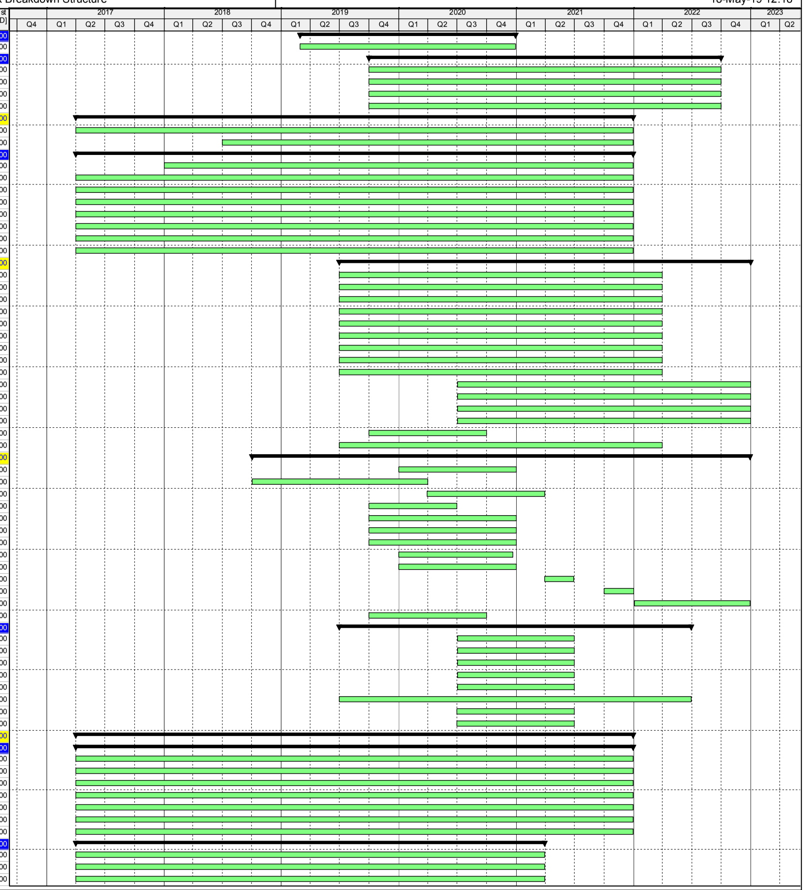
Activity ID	Activity Name	DS_Funding Source	DS_Institution	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]
DarkSide.1.02.01 Proto-Proto TPC				244	01-Mar-19	30-Oct-19	$0.00	$43,000.00	$43,000.00
DS-120640	Field Cage	NSF	UC Davis	153	01-Mar-19*	31-Jul-19	$0.00	$10,000.00	$10,000.00
DS-120660	Reflector Cage	NSF	UC Davis	153	01-Mar-19*	31-Jul-19	$0.00	$5,000.00	$5,000.00
DS-120680	HV System	NSF	UC Davis	153	01-Mar-19*	31-Jul-19	$0.00	$5,000.00	$5,000.00
DS-120700	Extraction Grid (Wire and Frame)	NSF	Houston	153	01-Mar-19*	31-Jul-19	$0.00	$10,000.00	$10,000.00
DS-120720	TPC integration at CERN	NSF	UCLA	152	01-Jun-19*	30-Oct-19	$0.00	$13,000.00	$13,000.00
DarkSide.1.02.02 Prototype TPC				183	01-Jul-19	30-Dec-19	$0.00	$1,274,700.00	$1,274,700.00
DS-121320	Prototype TPC Components	INFN-PON	INFN-Roma1	183	01-Jul-19*	30-Dec-19	$0.00	$165,000.00	$165,000.00
DS-121320_1	TPC vessel test facility	INFN-PON	INFN-Roma1	183	01-Jul-19*	30-Dec-19	$0.00	$634,700.00	$634,700.00
DS-121980	TPC Acrylic Vessel	CFI-DarkSide	Alberta	183	01-Jul-19*	30-Dec-19	$0.00	$140,000.00	$140,000.00
DS-122640	Field Cage	NSF	UC Davis	183	01-Jul-19*	30-Dec-19	$0.00	$32,000.00	$32,000.00
DS-123300	Reflector Cage	NSF	UC Davis	183	01-Jul-19*	30-Dec-19	$0.00	$32,000.00	$32,000.00
DS-123960	HV System	NSF	UC Davis	183	01-Jul-19*	30-Dec-19	$0.00	$53,000.00	$53,000.00
DS-123960_1	HV System (Power supplies)	NSF	UC Davis	183	01-Jul-19*	30-Dec-19	$0.00	$60,000.00	$60,000.00
DS-1246201	Extraction Grid (Wire and Frame)	NSF	Houston	183	01-Jul-19*	30-Dec-19	$0.00	$158,000.00	$158,000.00
DarkSide.1.02.03 DarkSide-20k TPC				1210	01-Jul-19	22-Oct-22	$1,167,970.00	$3,694,097.00	$4,862,067.00
A1110	TPC Materials Assays	NSF-Mid-scale	Princeton	1110	01-Jul-19*	14-Jul-22	$0.00	$120,000.00	$120,000.00
A1120	Proposal IDC	NSF-Mid-scale	Princeton	1096	01-Oct-19*	30-Sep-22	$0.00	$521,877.00	$521,877.00
DS-122600	Acrylic Bonding	CFI-DarkSide	Alberta	1110	01-Jul-19*	14-Jul-22	$0.00	$140,000.00	$140,000.00
DS-122620	Acrylic bonding structure	CFI-DarkSide	Alberta	1110	01-Jul-19*	14-Jul-22	$0.00	$210,000.00	$210,000.00
DS-1226401	Q/A Slow Control Bonding Test	CFI-DarkSide	Alberta	1110	01-Jul-19*	14-Jul-22	$0.00	$105,000.00	$105,000.00
DS-122660	Annealing and control	CFI-DarkSide	Alberta	1110	01-Jul-19*	14-Jul-22	$0.00	$70,000.00	$70,000.00
DS-122680	Vessel Engineering	CFI-DarkSide	Alberta	1110	01-Jul-19*	14-Jul-22	$350,000.00	$0.00	$350,000.00
DS-122700	Vessel Engineer Travel	CFI-DarkSide	Alberta	1110	01-Jul-19*	14-Jul-22	$0.00	$70,000.00	$70,000.00
DS-122720	Contract to RPT/X	CFI-DarkSide	Alberta	1110	01-Jul-19*	14-Jul-22	$0.00	$1,400,000.00	$1,400,000.00
DS-122740	TPC Vessel Support	CFI-DarkSide	Alberta	1110	01-Jul-19*	14-Jul-22	$0.00	$105,000.00	$105,000.00
DS-122760	Technician Support	CFI-DarkSide	Alberta	1110	01-Jul-19*	14-Jul-22	$280,000.00	$0.00	$280,000.00
DS-122780	Technician travel	CFI-DarkSide	Alberta	1110	01-Jul-19*	14-Jul-22	$0.00	$70,000.00	$70,000.00
DS-122800	Physiciat Travel	CFI-DarkSide	Alberta	1110	01-Jul-19*	14-Jul-22	$0.00	$70,000.00	$70,000.00
DS-122820	RPT/X for R&D	CFI-DarkSide	Alberta	1110	01-Jul-19*	14-Jul-22	$0.00	$70,000.00	$70,000.00
DS-123500	Field Cage (Materials)	NSF	UC Davis	1110	01-Jul-19*	14-Jul-22	$0.00	$54,000.00	$54,000.00
DS-123500_1	Field Cage	NSF-Mid-scale	UC Davis	1110	01-Jul-19*	14-Jul-22	$0.00	$52,610.00	$52,610.00
DS-123501	Field Cage Labor	NSF-Mid-scale	UC Davis	1110	01-Jul-19*	14-Jul-22	$95,985.00	$0.00	$95,985.00
DS-123800	Reflector Cage (Material)	NSF	UC Davis	1110	01-Jul-19*	14-Jul-22	$0.00	$29,000.00	$29,000.00
DS-123800_1	Reflector Cage	NSF-Mid-scale	UC Davis	1110	01-Jul-19*	14-Jul-22	$0.00	$49,610.00	$49,610.00
DS-123801	Reflector Cage Labor	NSF-Mid-scale	UC Davis	1110	01-Jul-19*	14-Jul-22	$95,985.00	$0.00	$95,985.00
DS-123980	Extraction Grid (Wire and Frame)	NSF-Mid-scale	Houston	1110	01-Jul-19*	14-Jul-22	$0.00	$270,000.00	$270,000.00
DS-123981	Extraction Grid (Wire and Frame) Labor	NSF-Mid-scale	Houston	1110	01-Jul-19*	14-Jul-22	$118,000.00	$0.00	$118,000.00
DS-124420	TPC integration at LNGS	INFN-CSN2	INFN-NA	100	15-Jul-22*	22-Oct-22	$0.00	$220,000.00	$220,000.00
DS-124620	SiPM related Interfacing (Integration of the PDM MB assembly)	NSF-Mid-scale	UMass	1110	01-Jul-19*	14-Jul-22	$0.00	$22,000.00	$22,000.00
DS-124621	SiPM related Interfacing (Integration of the PDM MB assembly)	NSF-Mid-scale	UMass	1110	01-Jul-19*	14-Jul-22	$72,000.00	$0.00	$72,000.00
DS-124640	SiPM related Interfacing (MotherBoard on Support Structure)	NSF-Mid-scale	UMass	1110	01-Jul-19*	14-Jul-22	$0.00	$22,000.00	$22,000.00
DS-124641	SiPM related Interfacing (MotherBoard on Support Structure) L	NSF-Mid-scale	UMass	1110	01-Jul-19*	14-Jul-22	$76,000.00	$0.00	$76,000.00
DS-124660	SiPM related Interfacing (PDM assembly to TPC)	NSF-Mid-scale	UMass	1110	01-Jul-19*	14-Jul-22	$0.00	$23,000.00	$23,000.00
DS-124661	SiPM related Interfacing (PDM assembly to TPC) Labor	NSF-Mid-scale	UMass	1110	01-Jul-19*	14-Jul-22	$80,000.00	$0.00	$80,000.00
DarkSide.1.02.04 Internal Argon Loop Planning and Testing				653	01-Oct-19	14-Jul-21	$0.00	$40,000.00	$40,000.00
DS-124460	Internal Argon Loop Planning and Testing Procurement	NSF	UCLA	653	01-Oct-19*	14-Jul-21	$0.00	$40,000.00	$40,000.00
DarkSide.1.02.05 HV System				731	15-Jul-19	14-Jul-21	$95,985.00	$166,610.00	$262,595.00
DS-124880	HV System Procurement	NSF-Mid-scale	UC Davis	731	15-Jul-19*	14-Jul-21	$0.00	$166,610.00	$166,610.00
DS-124900	HV System Labor	NSF-Mid-scale	UC Davis	731	15-Jul-19*	14-Jul-21	$95,985.00	$0.00	$95,985.00
DarkSide.1.02.06 DarkSide-20k UAr Cryogenics System				1734	01-Jan-18	30-Sep-22	$0.00	$1,652,000.00	$1,652,000.00
DarkSide.1.02.06.01 Cryogenics test@CERN				788	01-Jan-18	27-Feb-20	$0.00	$535,000.00	$535,000.00
DS-125680	Condenser Box	NSF	UCLA	730	01-Jan-18*	31-Dec-19	$0.00	$82,000.00	$82,000.00
DS-125880	Gas Circulation Pump	NSF	UCLA	730	01-Jan-18*	31-Dec-19	$0.00	$75,000.00	$75,000.00
DS-126120	Gas Panel	NSF	UCLA	729	01-Jan-18*	30-Dec-19	$0.00	$121,000.00	$121,000.00
DS-126300	Transfer Lines	NSF	UCLA	729	01-Jan-18*	30-Dec-19	$0.00	$35,000.00	$35,000.00
DS-126460	Slow Control	NSF	UCLA	729	01-Jan-18*	30-Dec-19	$0.00	$10,000.00	$10,000.00
DS-126480	Test System Integration at CERN	NSF	UCLA	30	01-Jul-19*	30-Jul-19	$0.00	$15,000.00	$15,000.00
DS-126500	Test at CERN	NSF	UCLA	152	01-Aug-19*	30-Dec-19	$0.00	$12,000.00	$12,000.00
DS-126600	Integrated Radon Trap	NSF-Mid-scale	UCLA	183	01-Jul-19*	30-Dec-19	$0.00	$165,000.00	$165,000.00
DS-126800	Transportation to LNGS	NSF	UCLA	58	01-Jan-20*	27-Feb-20	$0.00	$20,000.00	$20,000.00
DarkSide.1.02.06.02 DS-20k UAr Cryogenics System @LNGS				1096	01-Oct-19	30-Sep-22	$0.00	$1,117,000.00	$1,117,000.00
DS-126840	Getter system (SAES hot getter system "Mega-Torr")	NSF-Mid-scale	Princeton	1096	01-Oct-19*	30-Sep-22	$0.00	$750,000.00	$750,000.00
DS-126900	Internal surface treatment requirement and procedure for all pa	NSF-Mid-scale	UCLA	58	01-Jan-20*	27-Feb-20	$0.00	$5,000.00	$5,000.00
DS-126920	Final Condenser Box	NSF-Mid-scale	UCLA	305	01-Mar-20*	30-Dec-20	$0.00	$30,000.00	$30,000.00
DS-126980	Final Gas circulation pump	NSF-Mid-scale	UCLA	457	01-Oct-19*	30-Dec-20	$0.00	$130,000.00	$130,000.00
DS-127060	Final gas panel and piping	NSF-Mid-scale	UCLA	457	01-Oct-19*	30-Dec-20	$0.00	$55,000.00	$55,000.00
DS-127100	Final transfer line	NSF-Mid-scale	UCLA	457	01-Oct-19*	30-Dec-20	$0.00	$35,000.00	$35,000.00
DS-127120	Slow Control - Cryogenics	NSF-Mid-scale	Princeton	1096	01-Oct-19*	30-Sep-22	$0.00	$82,000.00	$82,000.00
DS-127140	Integration at LNGS	NSF-Mid-scale	UCLA	181	31-Dec-20*	29-Jun-21	$0.00	$20,000.00	$20,000.00
DS-127160	Test and commissioning	NSF-Mid-scale	UCLA	426	01-Jul-21*	30-Aug-22	$0.00	$10,000.00	$10,000.00



Remaining Level of Effort | Actual Work | Critical Remaining Work
Actual Level of Effort | Remaining Work ◆ | ◆ Milestone

TASK filter: (Untitled Filter).

Activity ID	Activity Name	DS_Funding Source	DS_Institution	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]
DarkSide.1.02.07 DarkSide-Prototype Cryogenics System				671	01-Mar-19	30-Dec-20	$0.00	$50,000.00	$50,000.00
DS-127200	DarkSide-Prototype Cryogenics System	NSF	UCLA	671	01-Mar-19*	30-Dec-20	$0.00	$50,000.00	$50,000.00
DarkSide.1.02.08 UAr Storage and Recovery System				1096	01-Oct-19	30-Sep-22	$552,000.00	$461,000.00	$1,013,000.00
DS-127780	Project Engineer	NSF-Mid-scale	Princeton	1096	01-Oct-19*	30-Sep-22	$552,000.00	$0.00	$552,000.00
DS-127800	Condenser	NSF-Mid-scale	Princeton	1096	01-Oct-19*	30-Sep-22	$0.00	$127,000.00	$127,000.00
DS-127820	Gas Panel	NSF-Mid-scale	Princeton	1096	01-Oct-19*	30-Sep-22	$0.00	$267,000.00	$267,000.00
DS-127840	Compressor	NSF-Mid-scale	Princeton	1096	01-Oct-19*	30-Sep-22	$0.00	$67,000.00	$67,000.00
DarkSide.1.03 Materials				1736	01-Apr-17	31-Dec-21	$148,775.00	$913,600.00	$1,062,375.00
DS-130100	Background Budget - Assay oversight	Spain	CIEMAT	1736	01-Apr-17*	31-Dec-21	$95,975.00	$0.00	$95,975.00
DS-130400	Cosmogenic & Intrinsic Activity	Spain	Zaragoza Un	1280	01-Jul-18*	31-Dec-21	$52,800.00	$0.00	$52,800.00
DarkSide.1.03.01 Materials Radiopurity Assay				1736	01-Apr-17	31-Dec-21	$0.00	$913,600.00	$913,600.00
DS-130502	Materials Radiopurity Assay - Temple assays	NSF	Temple	1461	01-Jan-18*	31-Dec-21	$0.00	$60,000.00	$60,000.00
DS-130503	Materials Radiopurity Assay - LSC assays	Spain-in-Kind	CIEMAT	1736	01-Apr-17*	31-Dec-21	$0.00	$275,000.00	$275,000.00
DS-130504	Materials Radiopurity Assay - Radioch. And Mass. Spec. - CIEI	Spain-in-Kind	CIEMAT	1736	01-Apr-17*	31-Dec-21	$0.00	$176,000.00	$176,000.00
DS-130505	Materials Radiopurity Assay - Radioc. And Mass. Spec. - LSC a	Spain-in-Kind	Zaragoza Un	1736	01-Apr-17*	31-Dec-21	$0.00	$176,000.00	$176,000.00
DS-130506	Materials Radiopurity Assay - Large surf. Assay - LSC assays	Spain-in-Kind	Zaragoza Un	1736	01-Apr-17*	31-Dec-21	$0.00	$56,100.00	$56,100.00
DS-130507	Materials Radiopurity Assay - Large surf. Assay - Krakow assa	Poland-in-Kind	Krakow	1736	01-Apr-17*	31-Dec-21	$0.00	$16,500.00	$16,500.00
DS-130508	Materials Radiopurity Assay - Pb/Po - Krakow assays	Poland-in-Kind	Krakow	1736	01-Apr-17*	31-Dec-21	$0.00	$11,000.00	$11,000.00
DS-130509	Materials Radiopurity Assay - LNGS assays	INFN-in-Kind	LNGS	1736	01-Apr-17*	31-Dec-21	$0.00	$143,000.00	$143,000.00
DarkSide.1.04 Calibrations				875	01-Jul-19	31-Dec-22	$459,980.00	$796,760.00	$1,256,740.00
DS-141001	Sources - Gas sources	NSF-Mid-scale	Hawaii	1004	01-Jul-19*	30-Mar-22	$0.00	$15,000.00	$15,000.00
DS-141002	Sources - Gas sources	Poland	Krakow	1004	01-Jul-19*	30-Mar-22	$5,500.00	$5,500.00	$11,000.00
DS-141003	Sources - Gamma-ray	NSF-Mid-scale	Hawaii	1004	01-Jul-19*	30-Mar-22	$0.00	$30,000.00	$30,000.00
DS-141004	Sources - AmC, AmBe, AmLi	NSF-Mid-scale	Hawaii	1004	01-Jul-19*	30-Mar-22	$4,000.00	$36,000.00	$40,000.00
DS-141005	Sources - 252Cf	Russia	BNRU / MSU	1004	01-Jul-19*	30-Mar-22	$11,000.00	$22,000.00	$33,000.00
DS-141006	Sources - UV led for VETO calibration	Russia	BNRU / MSU	1004	01-Jul-19*	30-Mar-22	$0.00	$22,000.00	$22,000.00
DS-141007	Sources - Pyroelectric neutron generator	Russia	BNRU / MSU	1004	01-Jul-19*	30-Mar-22	$110,000.00	$165,000.00	$275,000.00
DS-142001	TPC guide mechanics Labor	IN2P3	IN2P3	1004	01-Jul-19*	30-Mar-22	$16,500.00	$0.00	$16,500.00
DS-142001_1	TPC guide mechanics Production	NSF-Mid-scale	Hawaii	1004	01-Jul-19*	30-Mar-22	$0.00	$80,000.00	$80,000.00
DS-143000	External deployment system for Photoneutron source Labor	NSF-Mid-scale	Hawaii	914	01-Jul-20*	31-Dec-22	$258,000.00	$0.00	$258,000.00
DS-143000_1	External deployment system for Photoneutron source Productic	NSF-Mid-scale	Hawaii	914	01-Jul-20*	31-Dec-22	$0.00	$30,000.00	$30,000.00
DS-143000_2	Photoneutron source	NSF-Mid-scale	Hawaii	914	01-Jul-20*	31-Dec-22	$0.00	$107,000.00	$107,000.00
DS-143000_3	Camera system	NSF-Mid-scale	Hawaii	914	01-Jul-20*	31-Dec-22	$0.00	$40,000.00	$40,000.00
DS-143000_4	Camera Integration	NSF-Mid-scale	Virginia Tech.	251	01-Oct-19*	30-Sep-20	$54,980.00	$64,260.00	$119,240.00
DS-143000_5	Postdoc for Calibration Work	NSF-Mid-scale	Hawaii	1004	01-Jul-19*	30-Mar-22	$0.00	$180,000.00	$180,000.00
DarkSide.1.05 Outer Detector				1059	01-Oct-18	28-Dec-22	$488,087.00	$3,538,220.00	$4,026,307.00
A1160	Long Term UAr Storage	CFI-Argon	Carleton	366	01-Jan-20*	31-Dec-20	$0.00	$980,000.00	$980,000.00
DS-151000	Development of Gd loaded acrylic	INFN-CSN2	INFN-GE	547	01-Oct-18*	30-Mar-20	$0.00	$116,600.00	$116,600.00
DS-152000	Procurement of the VETO acrylic	IHEP	IHEP	366	30-Mar-20*	30-Mar-21	$0.00	$605,000.00	$605,000.00
DS-153000	Development of VETO Reflectors	Poland	AstroCeNT	275	30-Sep-19*	30-Jun-20	$0.00	$11,000.00	$11,000.00
DS-155000	Development of VETO electronics	INFN-CSN2	INFN-GE	459	30-Sep-19*	31-Dec-20	$0.00	$11,000.00	$11,000.00
DS-155000_1	Optical VETO Calibration	INFN-CSN2	INFN-GE	459	30-Sep-19*	31-Dec-20	$0.00	$198,000.00	$198,000.00
DS-155001	Development of VETO electronics - radiopurity	Spain-in-Kind	CIEMAT	459	30-Sep-19*	31-Dec-20	$0.00	$11,000.00	$11,000.00
DS-156000	VETO Prototype	INFN-CSN2	INFN-GE	356	01-Jan-20*	21-Dec-20	$0.00	$11,000.00	$11,000.00
DS-157000	VETO Mechanics	INFN-CSN2	INFN-GE	366	01-Jan-20*	31-Dec-20	$0.00	$352,000.00	$352,000.00
DS-157000_1	Acrylic Cleaning	INFN-CIPE-2	LNL	90	31-Mar-21	28-Jun-21	$0.00	$22,000.00	$22,000.00
DS-158000	PDM VETO Installation	INFN-CIPE-2	INFN-GE	94	01-Oct-21*	02-Jan-22	$0.00	$16,500.00	$16,500.00
DS-158000_1	VETO installation and commissioning	INFN-CIPE-2	INFN-GE	360	03-Jan-22	28-Dec-22	$0.00	$148,500.00	$148,500.00
DS-158000_2	Integral Detector Stability Monitoring	NSF-Mid-scale	Virginia Tech.	251	01-Oct-19*	30-Sep-20	$334,087.00	$76,020.00	$410,107.00
DarkSide.1.05.01 Procurement of VETO Reflectors				1096	01-Jul-19	30-Jun-22	$154,000.00	$979,600.00	$1,133,600.00
DS-154001	Procurement of VETO Reflectors - 3M foil	CFI-DarkSide	AstroCeNT	366	01-Jul-20	01-Jul-21	$0.00	$280,000.00	$280,000.00
DS-154002	Procurement of VETO Reflectors - 3M foil	INFN-CIPE-2	AstroCeNT	366	01-Jul-20	01-Jul-21	$0.00	$89,100.00	$89,100.00
DS-154003	Procurement of VETO Reflectors - 3M foil	AstroCeNT	AstroCeNT	366	01-Jul-20	01-Jul-21	$0.00	$137,500.00	$137,500.00
DS-154004	Procurement of VETO Reflectors - TPB	INFN-CIPE-2	AstroCeNT	366	01-Jul-20	01-Jul-21	$0.00	$82,500.00	$82,500.00
DS-154005	Procurement of VETO Reflectors - TPB	AstroCeNT	AstroCeNT	366	01-Jul-20*	01-Jul-21	$0.00	$137,500.00	$137,500.00
DS-154005_1	VETO Reflectors Labor	INFN-MP	LNGS	1096	01-Jul-19*	30-Jun-22	$154,000.00	$0.00	$154,000.00
DS-154006	Procurement of VETO Reflectors - Evaporation systems and c	INFN-CIPE-2	LNGS	366	30-Jun-20*	30-Jun-21	$0.00	$242,000.00	$242,000.00
DS-154007	Procurement of VETO Reflectors - Packaging	INFN-CIPE-2	LNGS	366	30-Jun-20*	30-Jun-21	$0.00	$11,000.00	$11,000.00
DarkSide.1.06 ELECTRONICS (DAQ, Trigger and Slow Control)				1736	01-Apr-17	31-Dec-21	$859,500.00	$3,228,400.00	$4,087,900.00
DarkSide.1.06.01 Readout				1736	01-Apr-17	31-Dec-21	$859,500.00	$2,562,900.00	$3,422,400.00
DS-161001	Readout boards for Proto	INFN-CSN2	INFN-Roma1	1736	01-Apr-17*	31-Dec-21	$0.00	$104,500.00	$104,500.00
DS-161001_1	Readout boards for TPC Non Labor	INFN-CSN2	INFN-Roma1	1736	01-Apr-17*	31-Dec-21	$0.00	$206,800.00	$206,800.00
DS-161002	Readout boards for TPC Non Labor	CFI-DarkSide	TRIUMF	1736	01-Apr-17*	31-Dec-21	$0.00	$1,566,600.00	$1,566,600.00
DS-161003	Readout boards for TPC Labor	CFI-DarkSide	TRIUMF	1736	01-Apr-17*	31-Dec-21	$700,000.00	$0.00	$700,000.00
DS-161004	Readout boards Labor	INFN-MP	INFN-Roma1	1736	01-Apr-17*	31-Dec-21	$159,500.00	$0.00	$159,500.00
DS-161005	Readout boards for veto	CFI-DarkSide	TRIUMF	1736	01-Apr-17*	31-Dec-21	$0.00	$630,000.00	$630,000.00
DS-161005_1	Readout boards for R&D	INFN-CSN2	INFN-Roma1	1736	01-Apr-17*	31-Dec-21	$0.00	$55,000.00	$55,000.00
DarkSide.1.06.02 Trigger				1460	01-Apr-17	30-Mar-21	$0.00	$307,500.00	$307,500.00
DS-162001	Trigger - clock distribution	CFI-DarkSide	TRIUMF	1460	01-Apr-17*	30-Mar-21	$0.00	$87,500.00	$87,500.00
DS-162002	Trigger - Event builder + Cluster	INFN-CSN2	INFN-Roma1	1460	01-Apr-17*	30-Mar-21	$0.00	$198,000.00	$198,000.00
DS-162002_1	Cluster for Master Trigger Development	INFN-CSN2	LNGS	1460	01-Apr-17*	30-Mar-21	$0.00	$22,000.00	$22,000.00



Remaining Level of Effort | Actual Work | Critical Remaining Work
Actual Level of Effort | Remaining Work ◆ | ◆ Milestone

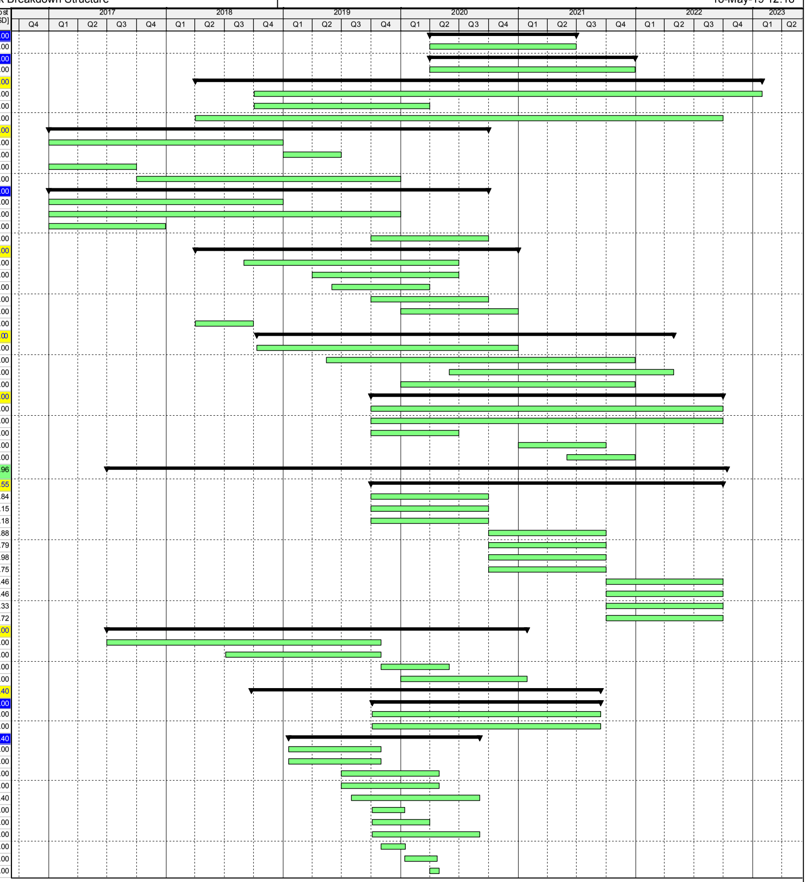
TASK filter: (Untitled Filter).

DarkSide Current

DS Layout-Work Breakdown Structure

18-May-19 12:18

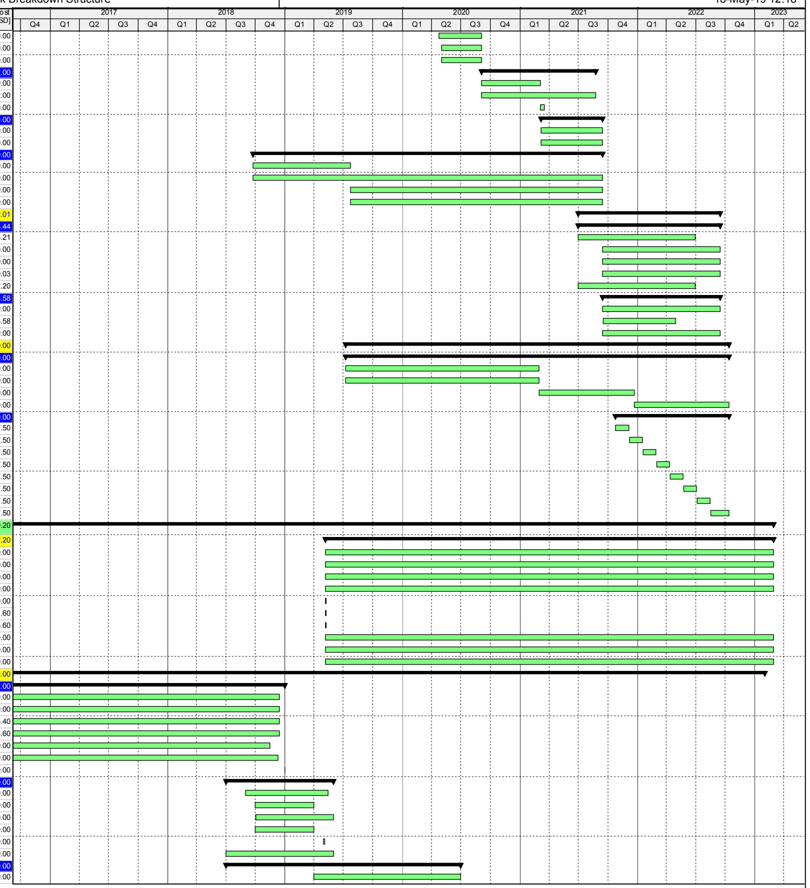
Activity ID	Activity Name	DS_Funding Source	DS_Institution	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]
DarkSide.1.06.03 Slow Control				456	01-Apr-20	30-Jun-21	$0.00	$50,000.00	$50,000.00
DS-163000	Slow Control - DAQ	NSF-Mid-scale	Princeton	456	01-Apr-20*	30-Jun-21	$0.00	$50,000.00	$50,000.00
DarkSide.1.06.04 Infrastructure and Power supply				640	01-Apr-20	31-Dec-21	$0.00	$308,000.00	$308,000.00
DS-164000	Infrastructure and Power supply	CFI-DarkSide	TRIUMF	640	01-Apr-20*	31-Dec-21	$0.00	$308,000.00	$308,000.00
DarkSide.1.07 Offline				1765	01-Apr-18	29-Jan-23	$291,500.00	$2,403,500.00	$2,695,000.00
DS-172000	Reconstruction software	IN2P3	IN2P3	1582	01-Oct-18*	29-Jan-23	$187,000.00	$0.00	$187,000.00
DS-172002	Reconstruction software engineer	INFN-MP	INFN-Roma1	548	01-Oct-18*	31-Mar-20	$104,500.00	$0.00	$104,500.00
DS-175000	HW CPU and Storage	INFN-Computi	INFN-Roma1	1644	01-Apr-18*	30-Sep-22	$0.00	$2,403,500.00	$2,403,500.00
DarkSide.1.08 ReD				1368	01-Jan-17	29-Sep-20	$0.00	$938,900.00	$938,900.00
DS-180400	Neutron Beam	INFN-CSN2	LNS	730	01-Jan-17*	31-Dec-18	$0.00	$55,000.00	$55,000.00
DS-180400_1	Neutron Beam	INFN-in-Kind	LNS	181	01-Jan-19*	30-Jun-19	$0.00	$11,000.00	$11,000.00
DS-180500	nToF Spectrometer	INFN-CSN2	INFN-Roma1	273	01-Jan-17*	30-Sep-17	$0.00	$58,300.00	$58,300.00
DS-180600	Commissioning & operation	INFN-CSN2	INFN-NA	822	01-Oct-17*	31-Dec-19	$0.00	$88,000.00	$88,000.00
DarkSide.1.08.01 GAP-TPC				1368	01-Jan-17	29-Sep-20	$0.00	$726,600.00	$726,600.00
DS-180310	TPC & Cryogenics	INFN-CSN2	INFN-NA	730	01-Jan-17*	31-Dec-18	$0.00	$185,900.00	$185,900.00
DS-180320	FE & DAQ	INFN-CSN2	INFN-NA	1095	01-Jan-17*	31-Dec-19	$0.00	$25,300.00	$25,300.00
DS-180330	Slow Control	INFN-CSN2	INFN-GE	365	01-Jan-17*	31-Dec-17	$0.00	$15,400.00	$15,400.00
DS-180340	Offsite calibration	DOE	BNL	365	01-Oct-19*	29-Sep-20	$0.00	$500,000.00	$500,000.00
DarkSide.1.09 DarkSide Proto				1006	01-Apr-18	31-Dec-20	$0.00	$895,400.00	$895,400.00
DS-191000	Integration	INFN-CSN2	INFN-NA	669	01-Sep-18*	30-Jun-20	$0.00	$67,100.00	$67,100.00
DS-192000	DAQ	INFN-CSN2	INFN-Roma1	457	01-Apr-19*	30-Jun-20	$0.00	$132,000.00	$132,000.00
DS-193000	Calibration Setup	INFN-CSN2	INFN-NA	305	01-Jun-19*	31-Mar-20	$0.00	$60,500.00	$60,500.00
DS-194000	Commissioning	INFN-CSN2	INFN-NA	366	01-Oct-19*	30-Sep-20	$0.00	$55,000.00	$55,000.00
DS-195000	Operation	INFN-CSN2	INFN-NA	366	01-Jan-20*	31-Dec-20	$0.00	$508,200.00	$508,200.00
DS-196000	Cryostat	INFN-CSN2	INFN-Roma1	183	01-Apr-18*	30-Sep-18	$0.00	$72,600.00	$72,600.00
DarkSide.1.10 Outer Cryostat				1297	11-Oct-18	29-Apr-22	$0.00	$10,111,200.00	$10,111,200.00
DS-110100	Warm Structure	INFN-PON	CERN	813	11-Oct-18*	31-Dec-20	$0.00	$2,299,000.00	$2,299,000.00
DS-110200	Cold Cryostat	INFN-PON	CERN	962	15-May-19*	31-Dec-21	$0.00	$4,160,200.00	$4,160,200.00
DS-110300	Cryogenics System	INFN-PON	UCLA	698	01-Jun-20*	29-Apr-22	$0.00	$2,552,000.00	$2,552,000.00
DS-110300_1	Procurement of 100 Tonnes of AAr	GSSI	GSSI	731	01-Jan-20*	31-Dec-21	$0.00	$1,100,000.00	$1,100,000.00
DarkSide.1.11 Infrastructures				1096	01-Oct-19	30-Sep-22	$0.00	$811,487.00	$811,487.00
A1130	Princeon-Gran Sasso SummerSchool at Princeton	NSF-Mid-scale	Princeton	1096	01-Oct-19*	30-Sep-22	$0.00	$12,654.00	$12,654.00
A1140	Princeon-Gran Sasso SummerSchool at FLC	NSF-Mid-scale	Fort Lewis	1096	01-Oct-19*	30-Sep-22	$0.00	$197,733.00	$197,733.00
DS-411000	Safety Analysis	INFN-CSN2	LNGS	274	01-Oct-19*	30-Jun-20	$0.00	$55,000.00	$55,000.00
DS-412100	Building	INFN-PON	LNGS	273	01-Jan-21*	30-Sep-21	$0.00	$225,500.00	$225,500.00
DS-412500	Storage @ LNGS	CFI-DarkSide	Carleton	214	01-Jun-21*	31-Dec-21	$0.00	$320,600.00	$320,600.00
DarkSide.2 Urania				1321	01-Jul-17	13-Oct-22	$3,597,453.73	$20,574,940.23	$24,172,393.96
DarkSide.2.01 Urania Project Management Oversight				751	01-Oct-19	30-Sep-22	$945,465.89	$58,893.65	$1,004,359.55
DS-200000	Project Management for FY20	DOE	BNL	251	01-Oct-19*	30-Sep-20	$165,275.84	$0.00	$165,275.84
DS-200010	Project Controls for FY20	DOE	BNL	251	01-Oct-19*	30-Sep-20	$86,245.15	$0.00	$86,245.15
DS-200030	Travel for FY20	DOE	BNL	251	01-Oct-19*	30-Sep-20	$0.00	$11,574.18	$11,574.18
DS-200040	Project Management for FY21	DOE	BNL	250	01-Oct-20	30-Sep-21	$211,062.88	$0.00	$211,062.88
DS-200050	Project Controls for FY21	DOE	BNL	250	01-Oct-20	30-Sep-21	$88,228.79	$0.00	$88,228.79
DS-200060	Safety Oversight for FY21	DOE	BNL	250	01-Oct-20	30-Sep-21	$49,090.98	$0.00	$49,090.98
DS-200070	Travel for FY21	DOE	BNL	250	01-Oct-20	30-Sep-21	$0.00	$23,390.75	$23,390.75
DS-200080	Project Management for FY22	DOE	BNL	250	01-Oct-21	30-Sep-22	$189,656.46	$0.00	$189,656.46
DS-200090	Project Controls for FY22	DOE	BNL	250	01-Oct-21	30-Sep-22	$50,462.46	$0.00	$50,462.46
DS-200100	Safety Oversight for FY22	DOE	BNL	250	01-Oct-21	30-Sep-22	$105,443.33	$0.00	$105,443.33
DS-200110	Travel for FY22	DOE	BNL	250	01-Oct-21	30-Sep-22	$0.00	$23,928.72	$23,928.72
DarkSide.2.02 Urania Plant Fabrication and Delivery				1308	01-Jul-17	28-Jan-21	$0.00	$9,253,900.00	$9,253,900.00
DS-200200	R&D activitty in support of PSA design	INFN-MIUR	INFN-NA	853	01-Jul-17*	31-Oct-19	$0.00	$110,000.00	$110,000.00
DS-200220	Feed Characterization	PNNL-LDRD	PNNL	484	05-Jul-18*	31-Oct-19	$0.00	$400,000.00	$400,000.00
DS-200230	Plant Design	INFN-MIUR	INFN-NA	213	01-Nov-19	31-May-20	$0.00	$550,000.00	$550,000.00
DS-200240	Plant Construction, Performance Check and Shipment	INFN-MIUR	INFN-NA	394	01-Jan-20*	28-Jan-21	$0.00	$8,193,900.00	$8,193,900.00
DarkSide.2.03 Urania Cortez Site Prep & Plant Installation				743	24-Sep-18	13-Sep-21	$807,672.40	$5,719,970.00	$6,527,642.40
DarkSide.2.03.01 Project Management				485	04-Oct-19	13-Sep-21	$246,400.00	$750,000.00	$996,400.00
DS-200320	Extraction Operations Engineering and PNNL Support	PNNL-in-Kind	PNNL	485	04-Oct-19*	13-Sep-21	$0.00	$750,000.00	$750,000.00
DS-200330	Process Engineering Support	CFI-DarkSide	Carleton	485	04-Oct-19*	13-Sep-21	$246,400.00	$0.00	$246,400.00
DarkSide.2.03.02 Preliminary Site Work				411	17-Jan-19	03-Sep-20	$238,000.40	$1,716,000.00	$1,954,000.40
DS-200360	Gas Sampling and Shipping	NSF	Houston	200	17-Jan-19*	31-Oct-19	$0.00	$15,000.00	$15,000.00
DS-200370	Gas Sample Analysis	NSF	Houston	200	17-Jan-19*	31-Oct-19	$0.00	$35,000.00	$35,000.00
DS-200390	Procurement of Control Room	NSF-Mid-scale	Houston	209	01-Jul-19*	30-Apr-20	$0.00	$56,000.00	$56,000.00
DS-200400	Plant, electrical, storage and truck building materials and suppli	NSF-Mid-scale	Houston	209	01-Jul-19*	30-Apr-20	$0.00	$100,000.00	$100,000.00
DS-200420	Postdoc	NSF-Mid-scale	Houston	275	01-Aug-19*	03-Sep-20	$238,000.40	$0.00	$238,000.40
DS-200430	Phase I Installation	NSF-Mid-scale	Houston	66	04-Oct-19*	13-Jan-20	$0.00	$200,000.00	$200,000.00
DS-200440	Land development for slabs	NSF-Mid-scale	Houston	120	04-Oct-19*	31-Mar-20	$0.00	$300,000.00	$300,000.00
DS-200470	Tools and Equipment for Site Prep	NSF-Mid-scale	Houston	230	04-Oct-19*	03-Sep-20	$0.00	$150,000.00	$150,000.00
DS-200480	Pipe Work	NSF	Houston	49	01-Nov-19	15-Jan-20	$0.00	$50,000.00	$50,000.00
DS-200490	Phase II Installation	NSF-Mid-scale	Houston	71	14-Jan-20	23-Apr-20	$0.00	$200,000.00	$200,000.00
DS-200500	Pouring of concrete slabs	NSF-Mid-scale	Houston	22	01-Apr-20	30-Apr-20	$0.00	$350,000.00	$350,000.00



Remaining Level of Effort
Actual Level of Effort
Actual Work
Remaining Work ◆
Critical Remaining Work
◆ Milestone

TASK filter: (Untitled Filter).

Activity ID	Activity Name	DS_Funding Source	DS_Institution	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]
DS-200510	Phase III Installation	NSF-Mid-scale	Houston	93	24-Apr-20	03-Sep-20	$0.00	$200,000.00	$200,000.00
DS-200520	Control Room Installation	NSF-Mid-scale	Houston	88	01-May-20	03-Sep-20	$0.00	$25,000.00	$25,000.00
DS-200530	Plant, electrical, storage and truck area building erection	NSF-Mid-scale	Houston	88	01-May-20	03-Sep-20	$0.00	$35,000.00	$35,000.00
DarkSide.2.03.03 Plant & Site Integration				241	04-Sep-20	23-Aug-21	$76,872.00	$1,130,570.00	$1,207,442.00
DS-200550	Plant Installation	NSF-Mid-scale	Houston	121	04-Sep-20	04-Mar-21	$0.00	$1,000,000.00	$1,000,000.00
DS-200560	PI for 2.02.03 Plant and Site Integration	NSF-Mid-scale	UMass	354	04-Sep-20*	23-Aug-21	$76,872.00	$9,570.00	$86,442.00
DS-200570	Coupling Between KM and Urania	NSF-Mid-scale	Houston	10	05-Mar-21	18-Mar-21	$0.00	$121,000.00	$121,000.00
DarkSide.2.03.04 Full System Start-up & Commissioning				133	08-Mar-21	13-Sep-21	$0.00	$1,641,000.00	$1,641,000.00
DS-200580	Plant start-up and commissioning Equipment and Tools	NSF-Mid-scale	Houston	133	08-Mar-21*	13-Sep-21	$0.00	$341,000.00	$341,000.00
DS-200590	Plant consumables for Start-up and Commissioning	NSF-Mid-scale	Houston	133	08-Mar-21*	13-Sep-21	$0.00	$1,300,000.00	$1,300,000.00
DarkSide.2.03.05 QA/QC Instrumentation Installation				743	24-Sep-18	13-Sep-21	$246,400.00	$482,400.00	$728,800.00
DS-200600	Procure gas analysis instrumentation	CFI-DarkSide	Carleton	206	24-Sep-18*	22-Jul-19	$0.00	$160,300.00	$160,300.00
DS-200610	PI for 2.02.05 QA/QC Inst Installation	CFI-DarkSide	Carleton	1086	24-Sep-18*	13-Sep-21	$246,400.00	$0.00	$246,400.00
DS-200620	Installation and characterization of gas analysis instrumentation	CFI-DarkSide	Carleton	537	23-Jul-19	13-Sep-21	$0.00	$72,100.00	$72,100.00
DS-200630	Production and Installation of large sample collecitons system	PNNL-in-Kind	PNNL	537	23-Jul-19	13-Sep-21	$0.00	$250,000.00	$250,000.00
DarkSide.2.04 Extraction				302	01-Jul-21	14-Sep-22	$1,844,315.44	$3,459,676.58	$5,303,992.01
DarkSide.2.04.01 Project Management				302	01-Jul-21	14-Sep-22	$1,844,315.44	$450,000.00	$2,294,315.44
DS-200650	Field Operations Engineering Support	DOE	BNL	261	01-Jul-21*	30-Jun-22	$410,563.21	$0.00	$410,563.21
DS-200660	Extraction Operations Engineering and PNNL Support	PNNL-in-Kind	PNNL	251	14-Sep-21	14-Sep-22	$0.00	$450,000.00	$450,000.00
DS-200670	Process Engineer	CFI-DarkSide	Carleton	251	14-Sep-21	14-Sep-22	$123,200.00	$0.00	$123,200.00
DS-200680	Technical Engineer	NSF	Houston	251	14-Sep-21*	14-Sep-22	$144,000.03	$0.00	$144,000.03
DS-200690	Plant Operations Support	DOE	BNL	261	01-Jul-21*	30-Jun-22	$1,166,552.20	$0.00	$1,166,552.20
DarkSide.2.04.02 Plant Operations				251	14-Sep-21	14-Sep-22	$0.00	$3,009,676.58	$3,009,676.58
DS-200700	Precision gas analysis	CFI-DarkSide	Carleton	251	14-Sep-21*	14-Sep-22	$0.00	$69,300.00	$69,300.00
DS-200710	Utilities, Consumables and Plant Maintenance	DOE	BNL	153	17-Sep-21	29-Apr-22	$0.00	$2,890,376.58	$2,890,376.58
DS-200720	Large Volume Sample Collection	PNNL-in-Kind	PNNL	251	14-Sep-21	14-Sep-22	$0.00	$50,000.00	$50,000.00
DarkSide.2.05 Storage and Shipping				1194	08-Jul-19	13-Oct-22	$0.00	$2,082,500.00	$2,082,500.00
DarkSide.2.05.01 Shipping and Storage Vessels Procurement				1194	08-Jul-19	13-Oct-22	$0.00	$1,729,000.00	$1,729,000.00
DS-200830	Procurement of shipping vessels 1-2	CFI-DarkSide	Carleton	602	08-Jul-19*	28-Feb-21	$0.00	$420,000.00	$420,000.00
DS-200840	Procurement of shipping vessel filling equipment	CFI-DarkSide	Carleton	602	08-Jul-19*	28-Feb-21	$0.00	$49,000.00	$49,000.00
DS-200860	Procurement of shipping vessels 3-5	CFI-DarkSide	Carleton	296	01-Mar-21	21-Dec-21	$0.00	$630,000.00	$630,000.00
DS-200870	Procurement of shipping vessels 6-8	CFI-DarkSide	Carleton	296	22-Dec-21	13-Oct-22	$0.00	$630,000.00	$630,000.00
DarkSide.2.05.02 Ship Product				354	25-Oct-21	13-Oct-22	$0.00	$353,500.00	$353,500.00
DS-200890	Shipment of first batch to Sardinia	CFI-DarkSide	Carleton	42	25-Oct-21*	05-Dec-21	$0.00	$44,187.50	$44,187.50
DS-200900	Shipment of Second batch to Sardinia	CFI-DarkSide	Carleton	42	07-Dec-21	17-Jan-22	$0.00	$44,187.50	$44,187.50
DS-200910	Shipment of third batch to Sardinia	CFI-DarkSide	Carleton	42	18-Jan-22	28-Feb-22	$0.00	$44,187.50	$44,187.50
DS-200920	Shipment of fourth batch to Sardinia	CFI-DarkSide	Carleton	42	01-Mar-22	11-Apr-22	$0.00	$44,187.50	$44,187.50
DS-200930	Shipment of fifth batch to Sardinia	CFI-DarkSide	Carleton	42	12-Apr-22	23-May-22	$0.00	$44,187.50	$44,187.50
DS-200940	Shipment of sixth batch to Sardinia	CFI-DarkSide	Carleton	42	24-May-22	04-Jul-22	$0.00	$44,187.50	$44,187.50
DS-200950	Shipment of seventh batch to Sardinia	CFI-DarkSide	Carleton	42	05-Jul-22	15-Aug-22	$0.00	$44,187.50	$44,187.50
DS-200960	Shipment of eigth batch to Sardinia	CFI-DarkSide	Carleton	59	16-Aug-22	13-Oct-22	$0.00	$44,187.50	$44,187.50
DarkSide.3 ARIA				1769	01-Feb-16	28-Feb-23	$1,471,307.20	$11,813,572.00	$13,284,879.20
DarkSide.3.01 Aria Project Management Oversight				1394	07-May-19	28-Feb-23	$835,507.20	$305,800.00	$1,141,307.20
A1010	Travel	INFN-FISR	INFN-CA	1394	07-May-19*	28-Feb-23	$0.00	$18,700.00	$18,700.00
A1020	Travel	INFN-PREMIA	INFN-CA	1394	07-May-19*	28-Feb-23	$0.00	$55,000.00	$55,000.00
A1030	Travel	INFN-RAS	INFN-CA	1394	07-May-19*	28-Feb-23	$0.00	$67,100.00	$67,100.00
A1040	Travel	INFN-RAS	INFN-CA	1394	07-May-19*	28-Feb-23	$0.00	$55,000.00	$55,000.00
A1050	Personnel Spent	INFN-FISR	INFN-CA	1	07-May-19*	07-May-19	$34,100.00	$0.00	$34,100.00
A1060	Personnel Spent	INFN-RAS	INFN-CA	1	07-May-19*	07-May-19	$46,481.60	$0.00	$46,481.60
A1070	Personner spent	INFN-PREMIA	INFN-CA	1	07-May-19*	07-May-19	$39,925.60	$0.00	$39,925.60
A1080	Personnel	INFN-PREMIA	INFN-CA	1394	07-May-19*	28-Feb-23	$165,000.00	$0.00	$165,000.00
A1090	Personnel RAS4	INFN-RAS	INFN-CA	1394	07-May-19*	28-Feb-23	$550,000.00	$0.00	$550,000.00
A1100	Safety	INFN-RAS	INFN-CA	1394	07-May-19*	28-Feb-23	$0.00	$110,000.00	$110,000.00
DarkSide.3.02 Seruci-0 and Seruci-1				2557	01-Feb-16	31-Jan-23	$550,000.00	$10,984,072.00	$11,534,072.00
DarkSide.3.02.01 Column Sections Construction and Tests				1065	01-Feb-16	31-Dec-18	$0.00	$6,301,372.00	$6,301,372.00
DS-3111	Column Sections Construction	INFN-FISR	LNGS	1049	01-Feb-16*	15-Dec-18	$0.00	$4,290,000.00	$4,290,000.00
DS-3112	Column Sections Construction P1	INFN-RAS	LNGS	1049	01-Feb-16*	15-Dec-18	$0.00	$880,000.00	$880,000.00
DS-3113	Column Sections Construction P2	INFN-RAS	LNGS	1049	01-Feb-16*	15-Dec-18	$0.00	$503,518.40	$503,518.40
DS-3114	Column Construction	INFN-PREMIA	LNGS	1049	01-Feb-16*	15-Dec-18	$0.00	$481,553.60	$481,553.60
DS-3115	Leak Test at Polaris (travel)	INFN-FISR	INFN-CA	837	01-Aug-16*	15-Nov-18	$0.00	$35,200.00	$35,200.00
DS-3116	Leak Test at CERN (travel)	INFN-RAS	INFN-NA	861	02-Aug-16*	10-Dec-18	$0.00	$44,000.00	$44,000.00
DS-3117	Leak Test at CERN (measurement)	INFN-RAS	CERN	1	31-Dec-18*	31-Dec-18	$0.00	$67,100.00	$67,100.00
DarkSide.3.02.02 Seruci-0				335	01-Jul-18	31-May-19	$0.00	$706,200.00	$706,200.00
DS-3121	Nitrogen Recovery (Stirling)	INFN-in-Kind	LNGS	257	01-Sep-18*	15-May-19	$0.00	$484,000.00	$484,000.00
DS-3122	Nitrogen Storage for Seruci-0	INFN-RAS	LNGS	183	30-Sep-18*	31-Mar-19	$0.00	$44,000.00	$44,000.00
DS-3125	Chiller	INFN-RAS	LNGS	243	01-Oct-18*	31-May-19	$0.00	$47,300.00	$47,300.00
DS-3126	Water Cooling System for Seruci-0	INFN-RAS	LNGS	183	30-Sep-18*	31-Mar-19	$0.00	$55,000.00	$55,000.00
DS-3127	Leak Detector	INFN-RAS	LNGS	5	30-Apr-19*	04-May-19	$0.00	$44,000.00	$44,000.00
DS-3128	Electrical and Vacuum Components	INFN-RAS	LNGS	335	01-Jul-18*	31-May-19	$0.00	$31,900.00	$31,900.00
DarkSide.3.02.03 Seruci-1				731	01-Jul-18	30-Jun-20	$0.00	$1,606,000.00	$1,606,000.00
DS-3123	Service Gas for Installation	INFN-RAS	LNGS	457	01-Apr-19*	30-Jun-20	$0.00	$55,000.00	$55,000.00



Remaining Level of Effort | Actual Work | Critical Remaining Work
Actual Level of Effort | Remaining Work ◆ | ◆ Milestone

TASK filter: (Untitled Filter).

DarkSide Current									

DS Layout-Work Breakdown Structure

18-May-19 12:18

Activity ID	Activity Name	DS_Funding Source	DS_Institution	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]
DS-3124	Engineering and Review	INFN-RAS	LNGS	516	01-Feb-19*	30-Jun-20	$0.00	$88,000.00	$88,000.00
DS-31281	Electrical and Vacuum Components 2	INFN-RAS	LNGS	731	01-Jul-18*	30-Jun-20	$0.00	$33,000.00	$33,000.00
DS-3129	Residual Gas Analyzer	INFN-RAS	LNGS	154	01-May-19*	01-Oct-19	$0.00	$134,200.00	$134,200.00
DS-3131	Piller (UPS)	INFN-RAS	LNGS	1	01-May-20*	01-May-20	$0.00	$605,000.00	$605,000.00
DS-3132	Cables and Installation for Seruci-1	INFN-RAS	LNGS	1	01-May-20*	01-May-20	$0.00	$66,000.00	$66,000.00
DS-3133	Cryogenic Transfer Lines for Seruci-1	INFN-RAS	INFN-CA	1	01-May-20*	01-May-20	$0.00	$199,100.00	$199,100.00
DS-31341	Fine Tuning System	INFN-RAS	LNGS	261	15-Apr-19*	31-Dec-19	$0.00	$66,000.00	$66,000.00
DS-3135	Disassembling Seruci-0 + Reassembling in Seruci-1	INFN-RAS	LNGS	91	01-Mar-20*	30-May-20	$0.00	$110,000.00	$110,000.00
DS-3136	Nitrogen Storage for Seruci-1	INFN-RAS	LNGS	335	01-Jul-19*	30-May-20	$0.00	$209,000.00	$209,000.00
DS-3137	Water Cooling System for Seruci-1 (Vacuum system)	INFN-RAS	LNGS	213	01-Oct-19*	30-Apr-20	$0.00	$40,700.00	$40,700.00
DarkSide.3.02.04 Installation Commissioning & Running				1492	01-Jan-19	31-Jan-23	$550,000.00	$2,370,500.00	$2,920,500.00
DS-3141	Installation Commissioning & Running Seruci-0	INFN-RAS	LNGS	214	01-Jun-19*	31-Dec-19	$0.00	$110,000.00	$110,000.00
DS-3142	Energy and Maintenance for Seruci-0	INFN-RAS	INFN-CA	365	01-Jan-19*	31-Dec-19	$0.00	$220,000.00	$220,000.00
DS-3143	Commissioning & Running Seruci-1	INFN-RAS	INFN-CA	944	01-Jun-20*	31-Dec-22	$0.00	$335,500.00	$335,500.00
DS-3144	argon storage facilities at Seruci	INFN-RAS	INFN-CA	1310	01-Jun-19*	31-Dec-22	$0.00	$55,000.00	$55,000.00
DS-3145	Energy and Maintenance for Seruci-1 purification mode	INFN-RAS	INFN-CA	944	01-Jun-20*	31-Dec-22	$0.00	$1,320,000.00	$1,320,000.00
DS-3146	Waste disposal	INFN-RAS	INFN-CA	944	01-Jun-20*	31-Dec-22	$0.00	$110,000.00	$110,000.00
DS-3147	Shipping from Seruci to LNGS	INFN-RAS	INFN-CA	396	01-Jan-22*	31-Jan-23	$0.00	$220,000.00	$220,000.00
DS-3148	Personnel on Shift	INFN-RAS	INFN-CA	1341	01-Jun-19	31-Jan-23	$550,000.00	$0.00	$550,000.00
DarkSide.3.03 DArT in ArDM				961	28-Feb-19	30-Dec-22	$85,800.00	$523,700.00	$609,500.00
DS-327	Acrylic machining	CFI-DarkSide	Carleton	62	28-Feb-19*	30-Apr-19	$0.00	$1,400.00	$1,400.00
DS-328	Clean TPB-coatings	CFI-DarkSide	Carleton	62	01-May-19*	01-Jul-19	$0.00	$1,400.00	$1,400.00
DS-329	Acrylic machining radio-pure	CFI-DarkSide	Carleton	31	30-Nov-19*	30-Dec-19	$0.00	$1,400.00	$1,400.00
DS-330	Clean TPB-coatings radio-pure	CFI-DarkSide	Carleton	31	31-Dec-19*	30-Jan-20	$0.00	$1,400.00	$1,400.00
DS-331	Cryogenics and gas system DART	INFN-RAS	INFN-CA	31	30-Apr-19*	30-May-19	$0.00	$132,000.00	$132,000.00
DS-3331	DART Integration and tests	Spain	CIEMAT	119	02-Jul-19*	23-Dec-19	$33,000.00	$0.00	$33,000.00
DarkSide.3.03.03 DART				62	30-Apr-19	30-Jun-19	$52,800.00	$27,500.00	$80,300.00
DS-323	machining DART (inkind)	Spain	CIEMAT	1	30-Apr-19*	30-Apr-19	$33,000.00	$0.00	$33,000.00
DS-324	cleaning DART (inkind)	Spain	CIEMAT	31	01-May-19*	31-May-19	$19,800.00	$0.00	$19,800.00
DS-325	Slow Control DART	INFN-RAS	UNICA	62	30-Apr-19*	30-Jun-19	$0.00	$16,500.00	$16,500.00
DS-326	Front-end DART	INFN-RAS	LNGS	31	30-Apr-19*	30-May-19	$0.00	$11,000.00	$11,000.00
DarkSide.3.03.04 ArDM single phase refurbishing				92	30-Apr-19	30-Jul-19	$0.00	$38,500.00	$38,500.00
DS-332	infrastructure update at LSC (inkind)	ETHZ	ETHZ	31	30-Jun-19*	30-Jul-19	$0.00	$5,500.00	$5,500.00
DS-333	new single phase setup design and assembly ArDM	ETHZ	ETHZ	62	30-Apr-19*	30-Jun-19	$0.00	$33,000.00	$33,000.00
DarkSide.3.03.05 DART Integration and tests				244	30-Apr-19	29-Dec-19	$0.00	$46,200.00	$46,200.00
DS-334	purchases DART integration	INFN-RAS	INFN-CA	31	30-Apr-19*	30-May-19	$0.00	$11,000.00	$11,000.00
DS-335	purchases DART integration	Spain	CIEMAT	31	30-Apr-19*	30-May-19	$0.00	$11,000.00	$11,000.00
DS-336	travel from INFN DART integration	INFN-RAS	INFN-CA	57	02-Jul-19*	27-Aug-19	$0.00	$11,000.00	$11,000.00
DS-337	Transportation to LSC DART	INFN-RAS	INFN-CA	6	23-Dec-19*	29-Dec-19	$0.00	$13,200.00	$13,200.00
DarkSide.3.03.06 DAQ and trigger				92	30-Apr-19	30-Jul-19	$0.00	$42,900.00	$42,900.00
DS-338	trigger integration	Spain	Zaragoza Un	92	30-Apr-19*	30-Jul-19	$0.00	$5,500.00	$5,500.00
DS-339	DAQ integration	INFN-RAS	Zaragoza Un	92	30-Apr-19*	30-Jul-19	$0.00	$37,400.00	$37,400.00
DarkSide.3.03.07 Lead belt structure				276	30-Apr-19	30-Jan-20	$0.00	$38,500.00	$38,500.00
DS-340	Lead purchase inkind	Spain	LSC	245	30-Apr-19*	30-Dec-19	$0.00	$33,000.00	$33,000.00
DS-341	Leadstructure and belt installation	Spain	CIEMAT	31	31-Dec-19*	30-Jan-20	$0.00	$5,500.00	$5,500.00
DarkSide.3.03.08 Assembly and operation at LSC and argon shipping				1250	30-Jul-19	30-Dec-22	$0.00	$71,500.00	$71,500.00
DS-343	travel from CIEMAT to LSC	Spain	CIEMAT	1250	30-Jul-19*	30-Dec-22	$0.00	$5,500.00	$5,500.00
DS-344	travel from INFN TO LSC	INFN-RAS	INFN-CA	1250	30-Jul-19*	30-Dec-22	$0.00	$55,000.00	$55,000.00
DS-345	argon shipping from Aria	INFN-RAS	INFN-CA	1250	30-Jul-19*	30-Dec-22	$0.00	$8,800.00	$8,800.00
DS-347	argon shipping from DS50	INFN-RAS	INFN-CA	32	30-Dec-19*	30-Jan-20	$0.00	$2,200.00	$2,200.00
DarkSide.3.03.09 Gas detector proposal				1341	30-Apr-19	30-Dec-22	$0.00	$121,000.00	$121,000.00
DS-349	Feasibility Study Gas Detector Proposal (inkind)	Spain	Zaragoza Un	154	30-Apr-19*	30-Sep-19	$0.00	$11,000.00	$11,000.00
DS-350	Construction and operation Gas Detector Proposal	Spain	Zaragoza Un	1188	30-Sep-19*	30-Dec-22	$0.00	$110,000.00	$110,000.00

Remaining Level of Effort
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone

TASK filter: (Untitled Filter).

Appendix B: Agency View of WBS

DarkSide Current — DS Layout-Agency View of WBS — 18-May-19 12:22

Activity ID	Activity Name	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]	Labor Cost USA [USD]	Non Labor Cost USA [USD]	Total Cost USA [USD]	Labor Cost CAN [CAD]	Non Labor Cost CAN [CAD]	Total Cost CAN [CAD]	Labor Cost EU [EUR]	Non Labor Cost EU [EUR]	Total Cost EU [EUR]	Labor Cost UK [GBP]	Non Labor Cost UK [GBP]	Total Cost UK [GBP]
AstroCeNT		1461	01-May-19	30-Apr-23	$2,887,500.00	$275,000.00	$3,162,500.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	2625000.00	250000.00	2875000.00	0.00	0.00	0.00
DS-1111006	SiPM - Scientists	1461	01-May-19*	30-Apr-23	$2,887,500.00	$0.00	$2,887,500.00	$0.00	$0.00	$0.00			0.00	2625000.00		2625000.00			0.00
DS-154003	Procurement of VETO Reflectors - 3M foil	366	01-Jul-20	01-Jul-21	$0.00	$137,500.00	$137,500.00	$0.00	$0.00	$0.00			0.00		125000.00	125000.00			0.00
DS-154005	Procurement of VETO Reflectors - TPB	366	01-Jul-20*	01-Jul-21	$0.00	$137,500.00	$137,500.00	$0.00	$0.00	$0.00			0.00		125000.00	125000.00			0.00
CFI-Argon		366	01-Jan-20	31-Dec-20	$0.00	$980,000.00	$980,000.00	$0.00	$0.00	$0.00	0.00	1400000.00	1400000.00	0.00	0.00	0.00	0.00	0.00	0.00
A1160	Long Term UAr Storage	366	01-Jan-20*	31-Dec-20	$0.00	$980,000.00	$980,000.00	$0.00	$0.00	$0.00		1400000.00	1400000.00			0.00			0.00
CFI-DarkSide		1385	01-Apr-17	13-Oct-22	$1,946,000.00	$8,032,500.00	$9,978,500.00	$0.00	$0.00	$0.00	2780000.00	11475000.00	14255000.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-121980	TPC Acrylic Vessel	183	01-Jul-19*	30-Dec-19	$0.00	$140,000.00	$140,000.00	$0.00	$0.00	$0.00		200000.00	200000.00			0.00			0.00
DS-122600	Acrylic Bonding	1110	01-Jul-19*	14-Jul-22	$0.00	$140,000.00	$140,000.00	$0.00	$0.00	$0.00		200000.00	200000.00			0.00			0.00
DS-122620	Acrylic bonding structure	1110	01-Jul-19*	14-Jul-22	$0.00	$210,000.00	$210,000.00	$0.00	$0.00	$0.00		300000.00	300000.00			0.00			0.00
DS-1226401	Q/A Slow Control Bonding Test	1110	01-Jul-19*	14-Jul-22	$0.00	$105,000.00	$105,000.00	$0.00	$0.00	$0.00		150000.00	150000.00			0.00			0.00
DS-122660	Annealing and control	1110	01-Jul-19*	14-Jul-22	$0.00	$70,000.00	$70,000.00	$0.00	$0.00	$0.00		100000.00	100000.00			0.00			0.00
DS-122680	Vessel Engineering	1110	01-Jul-19*	14-Jul-22	$350,000.00	$0.00	$350,000.00	$0.00	$0.00	$0.00	500000.00		500000.00			0.00			0.00
DS-122700	Vessel Engineer Travel	1110	01-Jul-19*	14-Jul-22	$0.00	$70,000.00	$70,000.00	$0.00	$0.00	$0.00		100000.00	100000.00			0.00			0.00
DS-122720	Contract to RPT/X	1110	01-Jul-19*	14-Jul-22	$0.00	$1,400,000.00	$1,400,000.00	$0.00	$0.00	$0.00		2000000.00	2000000.00			0.00			0.00
DS-122740	TPC Vessel Support	1110	01-Jul-19*	14-Jul-22	$0.00	$105,000.00	$105,000.00	$0.00	$0.00	$0.00		150000.00	150000.00			0.00			0.00
DS-122760	Technician Support	1110	01-Jul-19*	14-Jul-22	$280,000.00	$0.00	$280,000.00	$0.00	$0.00	$0.00	400000.00		400000.00			0.00			0.00
DS-122780	Technician travel	1110	01-Jul-19*	14-Jul-22	$0.00	$70,000.00	$70,000.00	$0.00	$0.00	$0.00		100000.00	100000.00			0.00			0.00
DS-122800	Physiciat Travel	1110	01-Jul-19*	14-Jul-22	$0.00	$70,000.00	$70,000.00	$0.00	$0.00	$0.00		100000.00	100000.00			0.00			0.00
DS-122820	RPT/X for R&D	1110	01-Jul-19*	14-Jul-22	$0.00	$70,000.00	$70,000.00	$0.00	$0.00	$0.00		100000.00	100000.00			0.00			0.00
DS-154001	Procurement of VETO Reflectors - 3M foil	366	01-Jul-20	01-Jul-21	$0.00	$280,000.00	$280,000.00	$0.00	$0.00	$0.00		400000.00	400000.00			0.00			0.00
DS-161002	Readout boards for TPC Non Labor	1736	01-Apr-17*	31-Dec-21	$0.00	$1,566,600.00	$1,566,600.00	$0.00	$0.00	$0.00		2238000.00	2238000.00			0.00			0.00
DS-161003	Readout boards for TPC Labor	1736	01-Apr-17*	31-Dec-21	$700,000.00	$0.00	$700,000.00	$0.00	$0.00	$0.00	1000000.00		1000000.00			0.00			0.00
DS-161005	Readout boards for veto	1736	01-Apr-17*	31-Dec-21	$0.00	$630,000.00	$630,000.00	$0.00	$0.00	$0.00		900000.00	900000.00			0.00			0.00
DS-162001	Trigger - clock distribution	1460	01-Apr-17*	30-Mar-21	$0.00	$87,500.00	$87,500.00	$0.00	$0.00	$0.00		125000.00	125000.00			0.00			0.00
DS-164000	Infrastructure and Power supply	640	01-Apr-20*	31-Dec-21	$0.00	$308,000.00	$308,000.00	$0.00	$0.00	$0.00		440000.00	440000.00			0.00			0.00
DS-200330	Process Engineering Support	485	04-Oct-19*	13-Sep-21	$246,400.00	$0.00	$246,400.00	$0.00	$0.00	$0.00	352000.00		352000.00			0.00			0.00
DS-200600	Procure gas analysis instrumentation	206	24-Sep-18*	22-Jul-19	$0.00	$160,300.00	$160,300.00	$0.00	$0.00	$0.00		229000.00	229000.00			0.00			0.00
DS-200610	PI for 2.02.05 QA/QC Inst Installation	1086	24-Sep-18*	13-Sep-21	$246,400.00	$0.00	$246,400.00	$0.00	$0.00	$0.00	352000.00		352000.00			0.00			0.00
DS-200620	Installation and characterization of gas analysis instrumentation	537	23-Jul-19	13-Sep-21	$0.00	$72,100.00	$72,100.00	$0.00	$0.00	$0.00		103000.00	103000.00			0.00			0.00
DS-200670	Process Engineer	251	14-Sep-21	14-Sep-22	$123,200.00	$0.00	$123,200.00	$0.00	$0.00	$0.00	176000.00		176000.00			0.00			0.00
DS-200700	Precision gas analysis	251	14-Sep-21*	14-Sep-22	$0.00	$69,300.00	$69,300.00	$0.00	$0.00	$0.00		99000.00	99000.00			0.00			0.00
DS-200830	Procurement of shipping vessels 1-2	602	08-Jul-19*	28-Feb-21	$0.00	$420,000.00	$420,000.00	$0.00	$0.00	$0.00		600000.00	600000.00			0.00			0.00
DS-200840	Procurement of shipping vessel filling equipment	602	08-Jul-19*	28-Feb-21	$0.00	$49,000.00	$49,000.00	$0.00	$0.00	$0.00		70000.00	70000.00			0.00			0.00
DS-200860	Procurement of shipping vessels 3-5	296	01-Mar-21	21-Dec-21	$0.00	$630,000.00	$630,000.00	$0.00	$0.00	$0.00		900000.00	900000.00			0.00			0.00
DS-200870	Procurement of shipping vessels 6-8	296	22-Dec-21	13-Oct-22	$0.00	$630,000.00	$630,000.00	$0.00	$0.00	$0.00		900000.00	900000.00			0.00			0.00
DS-200890	Shipment of first batch to Sardinia	42	25-Oct-21*	05-Dec-21	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
DS-200900	Shipment of Second batch to Sardinia	42	07-Dec-21	17-Jan-22	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
DS-200910	Shipment of third batch to Sardinia	42	18-Jan-22	28-Feb-22	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
DS-200920	Shipment of fourth batch to Sardinia	42	01-Mar-22	11-Apr-22	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
DS-200930	Shipment of fifth batch to Sardinia	42	12-Apr-22	23-May-22	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
DS-200940	Shipment of sixth batch to Sardinia	42	24-May-22	04-Jul-22	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
DS-200950	Shipment of seventh batch to Sardinia	42	05-Jul-22	15-Aug-22	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
DS-200960	Shipment of eigth batch to Sardinia	59	16-Aug-22	13-Oct-22	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
DS-327	Acrylic machining	62	28-Feb-19*	30-Apr-19	$0.00	$1,400.00	$1,400.00	$0.00	$0.00	$0.00		2000.00	2000.00			0.00			0.00
DS-328	Clean TPB-coatings	62	01-May-19*	01-Jul-19	$0.00	$1,400.00	$1,400.00	$0.00	$0.00	$0.00		2000.00	2000.00			0.00			0.00
DS-329	Acrylic machining radio-pure	31	30-Nov-19*	30-Dec-19	$0.00	$1,400.00	$1,400.00	$0.00	$0.00	$0.00		2000.00	2000.00			0.00			0.00
DS-330	Clean TPB-coatings radio-pure	31	31-Dec-19*	30-Jan-20	$0.00	$1,400.00	$1,400.00	$0.00	$0.00	$0.00		2000.00	2000.00			0.00			0.00
DS-412500	Storage @ LNGS	214	01-Jun-21*	31-Dec-21	$0.00	$320,600.00	$320,600.00	$0.00	$0.00	$0.00		458000.00	458000.00			0.00			0.00
DOE		1085	01-Jun-18	30-Sep-22	$3,156,581.30	$3,664,270.23	$6,820,851.53	$3,156,581.30	$3,664,270.23	$6,820,851.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-1113411	Printed circuit boards - prototyping	395	01-Jun-18*	30-Jun-19	$0.00	$2,000.00	$2,000.00	$0.00	$2,000.00	$2,000.00			0.00			0.00			0.00
DS-1113412	Run prototyping	395	01-Jun-18*	30-Jun-19	$0.00	$2,000.00	$2,000.00	$0.00	$2,000.00	$2,000.00			0.00			0.00			0.00
DS-1113413	Argon for cryogenics test - prototyping	395	01-Jun-18*	30-Jun-19	$0.00	$2,000.00	$2,000.00	$0.00	$2,000.00	$2,000.00			0.00			0.00			0.00
DS-1113421	Printed circuit boards - preproduction	184	01-Jul-19*	31-Dec-19	$0.00	$2,000.00	$2,000.00	$0.00	$2,000.00	$2,000.00			0.00			0.00			0.00
DS-1113422	Run - preproduction	184	01-Jul-19*	31-Dec-19	$0.00	$4,000.00	$4,000.00	$0.00	$4,000.00	$4,000.00			0.00			0.00			0.00
DS-1113423	Argon for cryogenics test - preproduction	184	01-Jul-19*	31-Dec-19	$0.00	$1,000.00	$1,000.00	$0.00	$1,000.00	$1,000.00			0.00			0.00			0.00
DS-1113431	PCB Material - Production	365	01-Jan-20*	30-Dec-20	$0.00	$8,000.00	$8,000.00	$0.00	$8,000.00	$8,000.00			0.00			0.00			0.00
DS-1113432	Printed circuit boards - Production	365	01-Jan-20*	30-Dec-20	$0.00	$9,000.00	$9,000.00	$0.00	$9,000.00	$9,000.00			0.00			0.00			0.00
DS-1113433	Run - Production	365	01-Jan-20*	30-Dec-20	$0.00	$170,000.00	$170,000.00	$0.00	$170,000.00	$170,000.00			0.00			0.00			0.00
DS-1113434	Material burden	365	01-Jan-20*	30-Dec-20	$0.00	$15,000.00	$15,000.00	$0.00	$15,000.00	$15,000.00			0.00			0.00			0.00
DS-1113435	Steering module production labor	365	01-Jan-20*	30-Dec-20	$134,000.00	$0.00	$134,000.00	$134,000.00	$0.00	$134,000.00			0.00			0.00			0.00
DS-1113435_1	Steering module production Engineer	365	01-Jan-20*	30-Dec-20	$500,000.00	$0.00	$500,000.00	$500,000.00	$0.00	$500,000.00			0.00			0.00			0.00
DS-180340	Offsite calibration	365	01-Oct-19*	29-Sep-20	$0.00	$500,000.00	$500,000.00	$0.00	$500,000.00	$500,000.00			0.00			0.00			0.00
DS-200000	Project Management for FY20	251	01-Oct-19*	30-Sep-20	$165,275.84	$0.00	$165,275.84	$165,275.84	$0.00	$165,275.84			0.00			0.00			0.00
DS-200010	Project Controls for FY20	251	01-Oct-19*	30-Sep-20	$86,245.15	$0.00	$86,245.15	$86,245.15	$0.00	$86,245.15			0.00			0.00			0.00
DS-200030	Travel for FY20	251	01-Oct-19*	30-Sep-20	$0.00	$11,574.18	$11,574.18	$0.00	$11,574.18	$11,574.18			0.00			0.00			0.00
DS-200040	Project Management for FY21	250	01-Oct-20	30-Sep-21	$211,062.88	$0.00	$211,062.88	$211,062.88	$0.00	$211,062.88			0.00			0.00			0.00

DarkSide Current | DS Layout-Agency View of WBS | 18-May-19 12:22

Activity ID	Activity Name	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]	Labor Cost USA [USD]	Non Labor Cost USA [USD]	Total Cost USA [USD]	Labor Cost CAN [CAD]	Non Labor Cost CAN [CAD]	Total Cost CAN [CAD]	Labor Cost EU [EUR]	Non Labor Cost EU [EUR]	Total Cost EU [EUR]	Labor Cost UK [GBP]	Non Labor Cost UK [GBP]	Total Cost UK [GBP]
DS-200050	Project Controls for FY21	250	01-Oct-20	30-Sep-21	$88,228.79	$0.00	$88,228.79	$88,228.79	$0.00	$88,228.79			0.00			0.00			0.00
DS-200060	Safety Oversight for FY21	250	01-Oct-20	30-Sep-21	$49,090.98	$0.00	$49,090.98	$49,090.98	$0.00	$49,090.98			0.00			0.00			0.00
DS-200070	Travel for FY21	250	01-Oct-20	30-Sep-21	$0.00	$23,390.75	$23,390.75	$0.00	$23,390.75	$23,390.75			0.00			0.00			0.00
DS-200080	Project Management for FY22	250	01-Oct-21	30-Sep-22	$189,656.46	$0.00	$189,656.46	$189,656.46	$0.00	$189,656.46			0.00			0.00			0.00
DS-200090	Project Controls for FY22	250	01-Oct-21	30-Sep-22	$50,462.46	$0.00	$50,462.46	$50,462.46	$0.00	$50,462.46			0.00			0.00			0.00
DS-200100	Safety Oversight for FY22	250	01-Oct-21	30-Sep-22	$105,443.33	$0.00	$105,443.33	$105,443.33	$0.00	$105,443.33			0.00			0.00			0.00
DS-200110	Travel for FY22	250	01-Oct-21	30-Sep-22	$0.00	$23,928.72	$23,928.72	$0.00	$23,928.72	$23,928.72			0.00			0.00			0.00
DS-200650	Field Operations Engineering Support	261	01-Jul-21*	30-Jun-22	$410,563.21	$0.00	$410,563.21	$410,563.21	$0.00	$410,563.21			0.00			0.00			0.00
DS-200690	Plant Operations Support	261	01-Jul-21*	30-Jun-22	$1,166,552.20	$0.00	$1,166,552.20	$1,166,552.20	$0.00	$1,166,552.20			0.00			0.00			0.00
DS-200710	Utilities, Consumables and Plant Maintenance	153	17-Sep-21	29-Apr-22	$0.00	$2,890,376.58	$2,890,376.58	$0.00	$2,890,376.58	$2,890,376.58			0.00			0.00			0.00
ETHZ		92	30-Apr-19	30-Jul-19	$0.00	$38,500.00	$38,500.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	35000.00	35000.00	0.00	0.00	0.00
DS-332	infrastructure update at LSC (inkind)	31	30-Jun-19*	30-Jul-19	$0.00	$5,500.00	$5,500.00	$0.00	$0.00	$0.00			0.00		5000.00	5000.00			0.00
DS-333	new single phase setup design and assembly ArDM	62	30-Apr-19*	30-Jun-19	$0.00	$33,000.00	$33,000.00	$0.00	$0.00	$0.00			0.00		30000.00	30000.00			0.00
GSSI		731	01-Jan-20	31-Dec-21	$0.00	$1,100,000.00	$1,100,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	1000000.00	1000000.00	0.00	0.00	0.00
DS-110300_1	Procurement of 100 Tonnes of AAr	731	01-Jan-20*	31-Dec-21	$0.00	$1,100,000.00	$1,100,000.00	$0.00	$0.00	$0.00			0.00		1000000.00	1000000.00			0.00
IHEP		366	30-Mar-20	30-Mar-21	$0.00	$605,000.00	$605,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	550000.00	550000.00	0.00	0.00	0.00
DS-152000	Procurement of the VETO acrylic	366	30-Mar-20*	30-Mar-21	$0.00	$605,000.00	$605,000.00	$0.00	$0.00	$0.00			0.00		550000.00	550000.00			0.00
INFN-MIUR		1308	01-Jul-17	28-Jan-21	$0.00	$8,853,900.00	$8,853,900.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	8049000.00	8049000.00	0.00	0.00	0.00
DS-200200	R&D activitty in support of PSA design	853	01-Jul-17*	31-Oct-19	$0.00	$110,000.00	$110,000.00	$0.00	$0.00	$0.00			0.00		100000.00	100000.00			0.00
DS-200230	Plant Design	213	01-Nov-19	31-May-20	$0.00	$550,000.00	$550,000.00	$0.00	$0.00	$0.00			0.00		500000.00	500000.00			0.00
DS-200240	Plant Construction, Performance Check and Shipment	394	01-Jan-20*	28-Jan-21	$0.00	$8,193,900.00	$8,193,900.00	$0.00	$0.00	$0.00			0.00		7449000.00	7449000.00			0.00
INFN-CIPE-1		1646	30-Jun-18	31-Dec-22	$0.00	$12,214,400.00	$12,214,400.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	11104000.00	11104000.00	0.00	0.00	0.00
DS-1111002	SiPM - Preproduction	153	01-May-19*	30-Sep-19	$0.00	$540,100.00	$540,100.00	$0.00	$0.00	$0.00			0.00		491000.00	491000.00			0.00
DS-1112002_1	Tile and substrates - Preproduction	92	01-May-19	31-Jul-19	$0.00	$35,200.00	$35,200.00	$0.00	$0.00	$0.00			0.00		32000.00	32000.00			0.00
DS-1112003	Tile and substrates - PCB and components	550	01-Jul-19*	31-Dec-20	$0.00	$661,100.00	$661,100.00	$0.00	$0.00	$0.00			0.00		601000.00	601000.00			0.00
DS-1113200	FEB preproduction	122	01-Apr-19*	31-Jul-19	$0.00	$36,300.00	$36,300.00	$0.00	$0.00	$0.00			0.00		33000.00	33000.00			0.00
DS-1113300	FEB production -TPC	488	01-Sep-19*	31-Dec-20	$0.00	$534,600.00	$534,600.00	$0.00	$0.00	$0.00			0.00		486000.00	486000.00			0.00
DS-111800	Optolink - TPC, Veto fibers + Optical driver PCB	853	01-Sep-19*	31-Dec-21	$0.00	$3,348,400.00	$3,348,400.00	$0.00	$0.00	$0.00			0.00		3044000.00	3044000.00			0.00
DS-502000	Packaging facility, housing, refurbishing, gas and electricity	1096	01-Oct-19*	30-Sep-22	$0.00	$2,665,300.00	$2,665,300.00	$0.00	$0.00	$0.00			0.00		2423000.00	2423000.00			0.00
DS-503000	Silicon packaging equipments Part1	1096	01-Oct-19*	30-Sep-22	$0.00	$3,795,000.00	$3,795,000.00	$0.00	$0.00	$0.00			0.00		3450000.00	3450000.00			0.00
DS-505000	Mechanical-3D Equipment	185	30-Jun-18*	31-Dec-18	$0.00	$268,400.00	$268,400.00	$0.00	$0.00	$0.00			0.00		244000.00	244000.00			0.00
DS-506000	NOA Infrastructures	365	01-Jan-19*	31-Dec-19	$0.00	$220,000.00	$220,000.00	$0.00	$0.00	$0.00			0.00		200000.00	200000.00			0.00
DS-507000	Website & Outreach	1461	01-Jan-19*	31-Dec-22	$0.00	$44,000.00	$44,000.00	$0.00	$0.00	$0.00			0.00		40000.00	40000.00			0.00
DS-508000	Travels	1646	30-Jun-18*	31-Dec-22	$0.00	$66,000.00	$66,000.00	$0.00	$0.00	$0.00			0.00		60000.00	60000.00			0.00
INFN-CIPE-2		1368	01-Apr-19	28-Dec-22	$0.00	$4,468,200.00	$4,468,200.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	4062000.00	4062000.00	0.00	0.00	0.00
DS-1113302	FEB production - Veto	90	01-Jan-21	31-Mar-21	$0.00	$344,300.00	$344,300.00	$0.00	$0.00	$0.00			0.00		313000.00	313000.00			0.00
DS-111900	Optolink - Receivers and Driver components	488	01-Sep-19*	31-Dec-20	$0.00	$1,955,800.00	$1,955,800.00	$0.00	$0.00	$0.00			0.00		1778000.00	1778000.00			0.00
DS-112100	Motherboard-cleaning	641	01-Apr-19*	31-Dec-20	$0.00	$275,000.00	$275,000.00	$0.00	$0.00	$0.00			0.00		250000.00	250000.00			0.00
DS-112110	SiPM power supplies - TPC and VETO	884	01-Sep-19*	31-Jan-22	$0.00	$1,061,500.00	$1,061,500.00	$0.00	$0.00	$0.00			0.00		965000.00	965000.00			0.00
DS-154002	Procurement of VETO Reflectors - 3M foil	366	01-Jul-20	01-Jul-21	$0.00	$89,100.00	$89,100.00	$0.00	$0.00	$0.00			0.00		81000.00	81000.00			0.00
DS-154004	Procurement of VETO Reflectors - TPB	366	01-Jul-20	01-Jul-21	$0.00	$82,500.00	$82,500.00	$0.00	$0.00	$0.00			0.00		75000.00	75000.00			0.00
DS-154006	Procurement of VETO Reflectors - Evaporation systems and c	366	30-Jun-20*	30-Jun-21	$0.00	$242,000.00	$242,000.00	$0.00	$0.00	$0.00			0.00		220000.00	220000.00			0.00
DS-154007	Procurement of VETO Reflectors - Packaging	366	30-Jun-20*	30-Jun-21	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-157000_1	Acrylic Cleaning	90	31-Mar-21	28-Jun-21	$0.00	$22,000.00	$22,000.00	$0.00	$0.00	$0.00			0.00		20000.00	20000.00			0.00
DS-158000	PDM VETO Installation	94	01-Oct-21*	02-Jan-22	$0.00	$16,500.00	$16,500.00	$0.00	$0.00	$0.00			0.00		15000.00	15000.00			0.00
DS-158000_1	VETO installation and commissioning	360	03-Jan-22	28-Dec-22	$0.00	$148,500.00	$148,500.00	$0.00	$0.00	$0.00			0.00		135000.00	135000.00			0.00
DS-503001	Silicon packaging equipments Part2	1096	01-Oct-19*	30-Sep-22	$0.00	$220,000.00	$220,000.00	$0.00	$0.00	$0.00			0.00		200000.00	200000.00			0.00
INFN-CSN2		2121	01-Jan-17	22-Oct-22	$0.00	$5,629,800.00	$5,629,800.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	5118000.00	5118000.00	0.00	0.00	0.00
DS-1111001	SiPM-R&D	851	01-Jan-17*	01-May-19	$0.00	$121,000.00	$121,000.00	$0.00	$0.00	$0.00			0.00		110000.00	110000.00			0.00
DS-1113100	FEB prototyping	546	01-Jan-17*	30-Jun-18	$0.00	$82,500.00	$82,500.00	$0.00	$0.00	$0.00			0.00		75000.00	75000.00			0.00
DS-1113301	FEB production - consumables	488	01-Sep-19*	31-Dec-20	$0.00	$27,500.00	$27,500.00	$0.00	$0.00	$0.00			0.00		25000.00	25000.00			0.00
DS-111400	Detector module integration	1642	01-Jan-17*	30-Jun-21	$0.00	$397,100.00	$397,100.00	$0.00	$0.00	$0.00			0.00		361000.00	361000.00			0.00
DS-111500	Motherboard characterization (LN2 tests)	945	01-Jun-19*	31-Dec-21	$0.00	$1,040,600.00	$1,040,600.00	$0.00	$0.00	$0.00			0.00		946000.00	946000.00			0.00
DS-111700	Optolink - Prototyping and preproduction	730	01-Jan-18*	31-Dec-19	$0.00	$300,300.00	$300,300.00	$0.00	$0.00	$0.00			0.00		273000.00	273000.00			0.00
DS-111901	Cabling	1461	01-Jan-17*	31-Dec-20	$0.00	$249,700.00	$249,700.00	$0.00	$0.00	$0.00			0.00		227000.00	227000.00			0.00
DS-112000	Motherboard Production	1461	01-Jan-17*	31-Dec-20	$0.00	$193,600.00	$193,600.00	$0.00	$0.00	$0.00			0.00		176000.00	176000.00			0.00
DS-112112	Integrated electronics	1492	01-Jan-17*	31-Jan-21	$0.00	$344,300.00	$344,300.00	$0.00	$0.00	$0.00			0.00		313000.00	313000.00			0.00
DS-124420	TPC integration at LNGS	100	15-Jul-22*	22-Oct-22	$0.00	$220,000.00	$220,000.00	$0.00	$0.00	$0.00			0.00		200000.00	200000.00			0.00
DS-151000	Development of Gd loaded acrylic	547	01-Oct-18*	30-Mar-20	$0.00	$116,600.00	$116,600.00	$0.00	$0.00	$0.00			0.00		106000.00	106000.00			0.00
DS-155000	Development of VETO electronics	459	30-Sep-19*	31-Dec-20	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-155000_1	Optical VETO Calibration	459	30-Sep-19*	31-Dec-20	$0.00	$198,000.00	$198,000.00	$0.00	$0.00	$0.00			0.00		180000.00	180000.00			0.00
DS-156000	VETO Prototype	356	01-Jan-20*	21-Dec-20	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-157000	VETO Mechanics	366	01-Jan-20*	31-Dec-20	$0.00	$352,000.00	$352,000.00	$0.00	$0.00	$0.00			0.00		320000.00	320000.00			0.00
DS-161001	Readout boards for Proto	1736	01-Apr-17*	31-Dec-21	$0.00	$104,500.00	$104,500.00	$0.00	$0.00	$0.00			0.00		95000.00	95000.00			0.00
DS-161001_1	Readout boards for TPC Non Labor	1736	01-Apr-17*	31-Dec-21	$0.00	$206,800.00	$206,800.00	$0.00	$0.00	$0.00			0.00		188000.00	188000.00			0.00
DS-161005_1	Readout boards for R&D	1736	01-Apr-17*	31-Dec-21	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00

Activity ID	Activity Name	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]	Labor Cost USA [USD]	Non Labor Cost USA [USD]	Total Cost USA [USD]	Labor Cost CAN [CAD]	Non Labor Cost CAN [CAD]	Total Cost CAN [CAD]	Labor Cost EU [EUR]	Non Labor Cost EU [EUR]	Total Cost EU [EUR]	Labor Cost UK [GBP]	Non Labor Cost UK [GBP]	Total Cost UK [GBP]
DS-162002	Trigger - Event builder + Cluster	1460	01-Apr-17*	30-Mar-21	$0.00	$198,000.00	$198,000.00	$0.00	$0.00	$0.00			0.00		180000.00	180000.00			0.00
DS-162002_1	Cluster for Master Trigger Development	1460	01-Apr-17*	30-Mar-21	$0.00	$22,000.00	$22,000.00	$0.00	$0.00	$0.00			0.00		20000.00	20000.00			0.00
DS-180310	TPC & Cryogenics	730	01-Jan-17*	31-Dec-18	$0.00	$185,900.00	$185,900.00	$0.00	$0.00	$0.00			0.00		169000.00	169000.00			0.00
DS-180320	FE & DAQ	1095	01-Jan-17*	31-Dec-19	$0.00	$25,300.00	$25,300.00	$0.00	$0.00	$0.00			0.00		23000.00	23000.00			0.00
DS-180330	Slow Control	365	01-Jan-17*	31-Dec-17	$0.00	$15,400.00	$15,400.00	$0.00	$0.00	$0.00			0.00		14000.00	14000.00			0.00
DS-180400	Neutron Beam	730	01-Jan-17*	31-Dec-18	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
DS-180500	nToF Spectrometer	273	01-Jan-17*	30-Sep-17	$0.00	$58,300.00	$58,300.00	$0.00	$0.00	$0.00			0.00		53000.00	53000.00			0.00
DS-180600	Commissioning & operation	822	01-Oct-17*	31-Dec-19	$0.00	$88,000.00	$88,000.00	$0.00	$0.00	$0.00			0.00		80000.00	80000.00			0.00
DS-191000	Integration	669	01-Sep-18*	30-Jun-20	$0.00	$67,100.00	$67,100.00	$0.00	$0.00	$0.00			0.00		61000.00	61000.00			0.00
DS-192000	DAQ	457	01-Apr-19*	30-Jun-20	$0.00	$132,000.00	$132,000.00	$0.00	$0.00	$0.00			0.00		120000.00	120000.00			0.00
DS-193000	Calibration Setup	305	01-Jun-19*	31-Mar-20	$0.00	$60,500.00	$60,500.00	$0.00	$0.00	$0.00			0.00		55000.00	55000.00			0.00
DS-194000	Commissioning	366	01-Oct-19*	30-Sep-20	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
DS-195000	Operation	366	01-Jan-20*	31-Dec-20	$0.00	$508,200.00	$508,200.00	$0.00	$0.00	$0.00			0.00		462000.00	462000.00			0.00
DS-196000	Cryostat	183	01-Apr-18*	30-Sep-18	$0.00	$72,600.00	$72,600.00	$0.00	$0.00	$0.00			0.00		66000.00	66000.00			0.00
DS-411000	Safety Analysis	274	01-Oct-19*	30-Jun-20	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
INFN-MP		2101	01-Apr-17	31-Dec-22	$5,497,800.00	$0.00	$5,497,800.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	4998000.00	0.00	4998000.00	0.00	0.00	0.00
DS-1111004	SiPM-Technician	1096	01-Jul-19*	30-Jun-22	$468,600.00	$0.00	$468,600.00	$0.00	$0.00	$0.00			0.00	426000.00		426000.00			0.00
DS-1112004	Tile and substrates - Technicians	1096	01-Jul-19*	30-Jun-22	$140,800.00	$0.00	$140,800.00	$0.00	$0.00	$0.00			0.00	128000.00		128000.00			0.00
DS-154005_1	VETO Reflectors Labor	1096	01-Jul-19*	30-Jun-22	$154,000.00	$0.00	$154,000.00	$0.00	$0.00	$0.00			0.00	140000.00		140000.00			0.00
DS-161004	Readout boards Labor	1736	01-Apr-17*	31-Dec-21	$159,500.00	$0.00	$159,500.00	$0.00	$0.00	$0.00			0.00	145000.00		145000.00			0.00
DS-172002	Reconstruction software engineer	548	01-Oct-18*	31-Mar-20	$104,500.00	$0.00	$104,500.00	$0.00	$0.00	$0.00			0.00	95000.00		95000.00			0.00
DS-504000	LA-ICPMS	182	01-Jan-20*	30-Jun-20	$157,300.00	$0.00	$157,300.00	$0.00	$0.00	$0.00			0.00	143000.00		143000.00			0.00
DS-505001	Mechanical-3D Labor	1646	30-Jun-18*	31-Dec-22	$157,300.00	$0.00	$157,300.00	$0.00	$0.00	$0.00			0.00	143000.00		143000.00			0.00
DS-509000	Administrative personnel	1097	01-Jul-19*	01-Jul-22	$140,800.00	$0.00	$140,800.00	$0.00	$0.00	$0.00			0.00	128000.00		128000.00			0.00
DS-510000	Faculty personnel (PS)	1463	30-Jun-18*	01-Jul-22	$396,000.00	$0.00	$396,000.00	$0.00	$0.00	$0.00			0.00	360000.00		360000.00			0.00
DS-511000	Faculty personnel, engineers, technicians	1188	01-Oct-19*	31-Dec-22	$3,619,000.00	$0.00	$3,619,000.00	$0.00	$0.00	$0.00			0.00	3290000.00		3290000.00			0.00
INFN-FISR		2585	01-Feb-16	28-Feb-23	$34,100.00	$4,343,900.00	$4,378,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	31000.00	3949000.00	3980000.00	0.00	0.00	0.00
A1010	Travel	1394	07-May-19*	28-Feb-23	$0.00	$18,700.00	$18,700.00	$0.00	$0.00	$0.00			0.00		17000.00	17000.00			0.00
A1050	Personnel Spent	1	07-May-19*	07-May-19	$34,100.00	$0.00	$34,100.00	$0.00	$0.00	$0.00			0.00	31000.00		31000.00			0.00
DS-3111	Column Sections Construction	1049	01-Feb-16*	15-Dec-18	$0.00	$4,290,000.00	$4,290,000.00	$0.00	$0.00	$0.00			0.00		3900000.00	3900000.00			0.00
DS-3115	Leak Test at Polaris (travel)	837	01-Aug-16*	15-Nov-18	$0.00	$35,200.00	$35,200.00	$0.00	$0.00	$0.00			0.00		32000.00	32000.00			0.00
INFN-PON		1543	11-Oct-18	31-Dec-22	$0.00	$18,373,300.00	$18,373,300.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	16703000.00	16703000.00	0.00	0.00	0.00
DS-110100	Warm Structure	813	11-Oct-18*	31-Dec-20	$0.00	$2,299,000.00	$2,299,000.00	$0.00	$0.00	$0.00			0.00		2090000.00	2090000.00			0.00
DS-110200	Cold Cryostat	962	15-May-19*	31-Dec-21	$0.00	$4,160,200.00	$4,160,200.00	$0.00	$0.00	$0.00			0.00		3782000.00	3782000.00			0.00
DS-110300	Cryogenics System	698	01-Jun-20*	29-Apr-22	$0.00	$2,552,000.00	$2,552,000.00	$0.00	$0.00	$0.00			0.00		2320000.00	2320000.00			0.00
DS-1111003	SiPM - Production	458	01-Oct-19	31-Dec-20	$0.00	$6,246,900.00	$6,246,900.00	$0.00	$0.00	$0.00			0.00		5679000.00	5679000.00			0.00
DS-121320	Prototype TPC Components	183	01-Jul-19*	30-Dec-19	$0.00	$165,000.00	$165,000.00	$0.00	$0.00	$0.00			0.00		150000.00	150000.00			0.00
DS-121320_1	TPC vessel test facility	183	01-Jul-19*	30-Dec-19	$0.00	$634,700.00	$634,700.00	$0.00	$0.00	$0.00			0.00		577000.00	577000.00			0.00
DS-412100	Building	273	01-Jan-21*	30-Sep-21	$0.00	$225,500.00	$225,500.00	$0.00	$0.00	$0.00			0.00		205000.00	205000.00			0.00
DS-501000	Clean Room	1005	01-Apr-20*	31-Dec-22	$0.00	$2,090,000.00	$2,090,000.00	$0.00	$0.00	$0.00			0.00		1900000.00	1900000.00			0.00
IN2P3		1582	01-Oct-18	29-Jan-23	$203,500.00	$0.00	$203,500.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	185000.00	0.00	185000.00	0.00	0.00	0.00
DS-142001	TPC guide mechanics Labor	1004	01-Jul-19*	30-Mar-22	$16,500.00	$0.00	$16,500.00	$0.00	$0.00	$0.00			0.00	15000.00		15000.00			0.00
DS-172000	Reconstruction software	1582	01-Oct-18*	29-Jan-23	$187,000.00	$0.00	$187,000.00	$0.00	$0.00	$0.00			0.00	170000.00		170000.00			0.00
INFN-PREMIALE		2585	01-Feb-16	28-Feb-23	$204,925.60	$536,553.60	$741,479.20	$0.00	$0.00	$0.00	0.00	0.00	0.00	186296.00	487776.00	674072.00	0.00	0.00	0.00
A1020	Travel	1394	07-May-19*	28-Feb-23	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
A1070	Personner spent	1	07-May-19*	07-May-19	$39,925.60	$0.00	$39,925.60	$0.00	$0.00	$0.00			0.00	36296.00		36296.00			0.00
A1080	Personnel	1394	07-May-19*	28-Feb-23	$165,000.00	$0.00	$165,000.00	$0.00	$0.00	$0.00			0.00	150000.00		150000.00			0.00
DS-3114	Column Construction	1049	01-Feb-16*	15-Dec-18	$0.00	$481,553.60	$481,553.60	$0.00	$0.00	$0.00			0.00		437776.00	437776.00			0.00
INFN-RAS		2585	01-Feb-16	28-Feb-23	$1,146,481.60	$6,223,518.40	$7,370,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	1042256.00	5657744.00	6700000.00	0.00	0.00	0.00
A1030	Travel	1394	07-May-19*	28-Feb-23	$0.00	$67,100.00	$67,100.00	$0.00	$0.00	$0.00			0.00		61000.00	61000.00			0.00
A1040	Travel	1394	07-May-19*	28-Feb-23	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
A1060	Personnel Spent	1	07-May-19*	07-May-19	$46,481.60	$0.00	$46,481.60	$0.00	$0.00	$0.00			0.00	42256.00		42256.00			0.00
A1090	Personnel RAS4	1394	07-May-19*	28-Feb-23	$550,000.00	$0.00	$550,000.00	$0.00	$0.00	$0.00			0.00	500000.00		500000.00			0.00
A1100	Safety	1394	07-May-19*	28-Feb-23	$0.00	$110,000.00	$110,000.00	$0.00	$0.00	$0.00			0.00		100000.00	100000.00			0.00
DS-3112	Column Sections Construction P1	1049	01-Feb-16*	15-Dec-18	$0.00	$880,000.00	$880,000.00	$0.00	$0.00	$0.00			0.00		800000.00	800000.00			0.00
DS-3113	Column Sections Construction P2	1049	01-Feb-16*	15-Dec-18	$0.00	$503,518.40	$503,518.40	$0.00	$0.00	$0.00			0.00		457744.00	457744.00			0.00
DS-3116	Leak Test at CERN (travel)	861	02-Aug-16*	10-Dec-18	$0.00	$44,000.00	$44,000.00	$0.00	$0.00	$0.00			0.00		40000.00	40000.00			0.00
DS-3117	Leak Test at CERN (measurement)	1	31-Dec-18*	31-Dec-18	$0.00	$67,100.00	$67,100.00	$0.00	$0.00	$0.00			0.00		61000.00	61000.00			0.00
DS-3122	Nitrogen Storage for Seruci-0	183	30-Sep-18*	31-Mar-19	$0.00	$44,000.00	$44,000.00	$0.00	$0.00	$0.00			0.00		40000.00	40000.00			0.00
DS-3123	Service Gas for Installation	457	01-Apr-19*	30-Jun-20	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
DS-3124	Engineering and Review	516	01-Feb-19*	30-Jun-20	$0.00	$88,000.00	$88,000.00	$0.00	$0.00	$0.00			0.00		80000.00	80000.00			0.00
DS-3125	Chiller	243	01-Oct-18*	31-May-19	$0.00	$47,300.00	$47,300.00	$0.00	$0.00	$0.00			0.00		43000.00	43000.00			0.00
DS-3126	Water Cooling System for Seruci-0	183	30-Sep-18*	31-Mar-19	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
DS-3127	Leak Detector	5	30-Apr-19*	04-May-19	$0.00	$44,000.00	$44,000.00	$0.00	$0.00	$0.00			0.00		40000.00	40000.00			0.00
DS-3128	Electrical and Vacuum Components	335	01-Jul-18*	31-May-19	$0.00	$31,900.00	$31,900.00	$0.00	$0.00	$0.00			0.00		29000.00	29000.00			0.00
DS-31281	Electrical and Vacuum Components 2	731	01-Jul-18*	30-Jun-20	$0.00	$33,000.00	$33,000.00	$0.00	$0.00	$0.00			0.00		30000.00	30000.00			0.00
DS-3129	Residual Gas Analyzer	154	01-May-19*	01-Oct-19	$0.00	$134,200.00	$134,200.00	$0.00	$0.00	$0.00			0.00		122000.00	122000.00			0.00

DarkSide Current						DS Layout-Agency View of WBS													18-May-19 12:22
Activity ID	Activity Name	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]	Labor Cost USA [USD]	Non Labor Cost USA [USD]	Total Cost USA [USD]	Labor Cost CAN [CAD]	Non Labor Cost CAN [CAD]	Total Cost CAN [CAD]	Labor Cost EU [EUR]	Non Labor Cost EU [EUR]	Total Cost EU [EUR]	Labor Cost UK [GBP]	Non Labor Cost UK [GBP]	Total Cost UK [GBP]
DS-3131	Piller (UPS)	1	01-May-20*	01-May-20	$0.00	$605,000.00	$605,000.00	$0.00	$0.00	$0.00			0.00		550000.00	550000.00			0.00
DS-3132	Cables and Installation for Seruci-1	1	01-May-20*	01-May-20	$0.00	$66,000.00	$66,000.00	$0.00	$0.00	$0.00			0.00		60000.00	60000.00			0.00
DS-3133	Cryogenic Transfer Lines for Seruci-1	1	01-May-20*	01-May-20	$0.00	$199,100.00	$199,100.00	$0.00	$0.00	$0.00			0.00		181000.00	181000.00			0.00
DS-31341	Fine Tuning System	261	15-Apr-19*	31-Dec-19	$0.00	$66,000.00	$66,000.00	$0.00	$0.00	$0.00			0.00		60000.00	60000.00			0.00
DS-3135	Disassembling Seruci-0 + Reassembling in Seruci-1	91	01-Mar-20*	30-May-20	$0.00	$110,000.00	$110,000.00	$0.00	$0.00	$0.00			0.00		100000.00	100000.00			0.00
DS-3136	Nitrogen Storage for Seruci-1	335	01-Jul-19*	30-May-20	$0.00	$209,000.00	$209,000.00	$0.00	$0.00	$0.00			0.00		190000.00	190000.00			0.00
DS-3137	Water Cooling System for Seruci-1 (Vacuum system)	213	01-Oct-19*	30-Apr-20	$0.00	$40,700.00	$40,700.00	$0.00	$0.00	$0.00			0.00		37000.00	37000.00			0.00
DS-3141	Installation Commissioning & Running Seruci-0	214	01-Jun-19*	31-Dec-19	$0.00	$110,000.00	$110,000.00	$0.00	$0.00	$0.00			0.00		100000.00	100000.00			0.00
DS-3142	Energy and Maintenance for Seruci-0	365	01-Jan-19*	31-Dec-19	$0.00	$220,000.00	$220,000.00	$0.00	$0.00	$0.00			0.00		200000.00	200000.00			0.00
DS-3143	Commissioning & Running Seruci-1	944	01-Jun-20*	31-Dec-22	$0.00	$335,500.00	$335,500.00	$0.00	$0.00	$0.00			0.00		305000.00	305000.00			0.00
DS-3144	argon storage facilities at Seruci	1310	01-Jun-19*	31-Dec-22	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
DS-3145	Energy and Maintenance for Seruci-1 purification mode	944	01-Jun-20*	31-Dec-22	$0.00	$1,320,000.00	$1,320,000.00	$0.00	$0.00	$0.00			0.00		1200000.00	1200000.00			0.00
DS-3146	Waste disposal	944	01-Jun-20*	31-Dec-22	$0.00	$110,000.00	$110,000.00	$0.00	$0.00	$0.00			0.00		100000.00	100000.00			0.00
DS-3147	Shipping from Seruci to LNGS	396	01-Jan-22*	31-Jan-23	$0.00	$220,000.00	$220,000.00	$0.00	$0.00	$0.00			0.00		200000.00	200000.00			0.00
DS-3148	Personnel on Shift	1341	01-Jun-19	31-Jan-23	$550,000.00	$0.00	$550,000.00	$0.00	$0.00	$0.00			0.00	500000.00		500000.00			0.00
DS-325	Slow Control DART	62	30-Apr-19*	30-Jun-19	$0.00	$16,500.00	$16,500.00	$0.00	$0.00	$0.00			0.00		15000.00	15000.00			0.00
DS-326	Front-end DART	31	30-Apr-19*	30-May-19	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-331	Cryogenics and gas system DART	31	30-Apr-19*	30-May-19	$0.00	$132,000.00	$132,000.00	$0.00	$0.00	$0.00			0.00		120000.00	120000.00			0.00
DS-334	purchases DART integration	31	30-Apr-19*	30-May-19	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-336	travel from INFN DART integration	57	02-Jul-19*	27-Aug-19	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-337	Transportation to LSC DART	6	23-Dec-19*	29-Dec-19	$0.00	$13,200.00	$13,200.00	$0.00	$0.00	$0.00			0.00		12000.00	12000.00			0.00
DS-339	DAQ integration	92	30-Apr-19*	30-Jul-19	$0.00	$37,400.00	$37,400.00	$0.00	$0.00	$0.00			0.00		34000.00	34000.00			0.00
DS-344	travel from INFN TO LSC	1250	30-Jul-19*	30-Dec-22	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
DS-345	argon shipping from Aria	1250	30-Jul-19*	30-Dec-22	$0.00	$8,800.00	$8,800.00	$0.00	$0.00	$0.00			0.00		8000.00	8000.00			0.00
DS-347	argon shipping from DS50	32	30-Dec-19*	30-Jan-20	$0.00	$2,200.00	$2,200.00	$0.00	$0.00	$0.00			0.00		2000.00	2000.00			0.00
INFN-in-Kind		1736	01-Apr-17	31-Dec-21	$0.00	$638,000.00	$638,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	580000.00	580000.00	0.00	0.00	0.00
DS-130509	Materials Radiopurity Assay - LNGS assays	1736	01-Apr-17*	31-Dec-21	$0.00	$143,000.00	$143,000.00	$0.00	$0.00	$0.00			0.00		130000.00	130000.00			0.00
DS-180400_1	Neutron Beam	181	01-Jan-19*	30-Jun-19	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-3121	Nitrogen Recovery (Stirling)	257	01-Sep-18*	15-May-19	$0.00	$484,000.00	$484,000.00	$0.00	$0.00	$0.00			0.00		440000.00	440000.00			0.00
INFN-Computing		1644	01-Apr-18	30-Sep-22	$0.00	$2,403,500.00	$2,403,500.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	2185000.00	2185000.00	0.00	0.00	0.00
DS-175000	HW CPU and Storage	1644	01-Apr-18*	30-Sep-22	$0.00	$2,403,500.00	$2,403,500.00	$0.00	$0.00	$0.00			0.00		2185000.00	2185000.00			0.00
NSF		1178	01-Jan-18	14-Sep-22	$144,000.03	$1,081,000.00	$1,225,000.03	$144,000.03	$1,081,000.00	$1,225,000.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-120640	Field Cage	153	01-Mar-19*	31-Jul-19	$0.00	$10,000.00	$10,000.00	$0.00	$10,000.00	$10,000.00			0.00			0.00			0.00
DS-120660	Reflector Cage	153	01-Mar-19*	31-Jul-19	$0.00	$5,000.00	$5,000.00	$0.00	$5,000.00	$5,000.00			0.00			0.00			0.00
DS-120680	HV System	153	01-Mar-19*	31-Jul-19	$0.00	$5,000.00	$5,000.00	$0.00	$5,000.00	$5,000.00			0.00			0.00			0.00
DS-120700	Extraction Grid (Wire and Frame)	153	01-Mar-19*	31-Jul-19	$0.00	$10,000.00	$10,000.00	$0.00	$10,000.00	$10,000.00			0.00			0.00			0.00
DS-120720	TPC integration at CERN	152	01-Jun-19*	30-Oct-19	$0.00	$13,000.00	$13,000.00	$0.00	$13,000.00	$13,000.00			0.00			0.00			0.00
DS-122640	Field Cage	183	01-Jul-19*	30-Dec-19	$0.00	$32,000.00	$32,000.00	$0.00	$32,000.00	$32,000.00			0.00			0.00			0.00
DS-123300	Reflector Cage	183	01-Jul-19*	30-Dec-19	$0.00	$32,000.00	$32,000.00	$0.00	$32,000.00	$32,000.00			0.00			0.00			0.00
DS-123500	Field Cage (Materials)	1110	01-Jul-19*	14-Jul-22	$0.00	$54,000.00	$54,000.00	$0.00	$54,000.00	$54,000.00			0.00			0.00			0.00
DS-123800	Reflector Cage (Material)	1110	01-Jul-19*	14-Jul-22	$0.00	$29,000.00	$29,000.00	$0.00	$29,000.00	$29,000.00			0.00			0.00			0.00
DS-123960	HV System	183	01-Jul-19*	30-Dec-19	$0.00	$53,000.00	$53,000.00	$0.00	$53,000.00	$53,000.00			0.00			0.00			0.00
DS-123960_1	HV System (Power supplies)	183	01-Jul-19*	30-Dec-19	$0.00	$60,000.00	$60,000.00	$0.00	$60,000.00	$60,000.00			0.00			0.00			0.00
DS-124460	Internal Argon Loop Planning and Testing Procurement	653	01-Oct-19*	14-Jul-21	$0.00	$40,000.00	$40,000.00	$0.00	$40,000.00	$40,000.00			0.00			0.00			0.00
DS-1246201	Extraction Grid (Wire and Frame)	183	01-Jul-19*	30-Dec-19	$0.00	$158,000.00	$158,000.00	$0.00	$158,000.00	$158,000.00			0.00			0.00			0.00
DS-125680	Condenser Box	730	01-Jan-18*	31-Dec-19	$0.00	$82,000.00	$82,000.00	$0.00	$82,000.00	$82,000.00			0.00			0.00			0.00
DS-125880	Gas Circulation Pump	730	01-Jan-18*	31-Dec-19	$0.00	$75,000.00	$75,000.00	$0.00	$75,000.00	$75,000.00			0.00			0.00			0.00
DS-126120	Gas Panel	729	01-Jan-18*	30-Dec-19	$0.00	$121,000.00	$121,000.00	$0.00	$121,000.00	$121,000.00			0.00			0.00			0.00
DS-126300	Transfer Lines	729	01-Jan-18*	30-Dec-19	$0.00	$35,000.00	$35,000.00	$0.00	$35,000.00	$35,000.00			0.00			0.00			0.00
DS-126460	Slow Control	729	01-Jan-18*	30-Dec-19	$0.00	$10,000.00	$10,000.00	$0.00	$10,000.00	$10,000.00			0.00			0.00			0.00
DS-126480	Test System Integration at CERN	30	01-Jul-19*	30-Jul-19	$0.00	$15,000.00	$15,000.00	$0.00	$15,000.00	$15,000.00			0.00			0.00			0.00
DS-126500	Test at CERN	152	01-Aug-19*	30-Dec-19	$0.00	$12,000.00	$12,000.00	$0.00	$12,000.00	$12,000.00			0.00			0.00			0.00
DS-126800	Transportation to LNGS	58	01-Jan-20*	27-Feb-20	$0.00	$20,000.00	$20,000.00	$0.00	$20,000.00	$20,000.00			0.00			0.00			0.00
DS-127200	DarkSide-Prototype Cryogenics System	671	01-Mar-19*	30-Dec-20	$0.00	$50,000.00	$50,000.00	$0.00	$50,000.00	$50,000.00			0.00			0.00			0.00
DS-130502	Materials Radiopurity Assay - Temple assays	1461	01-Jan-18*	31-Dec-21	$0.00	$60,000.00	$60,000.00	$0.00	$60,000.00	$60,000.00			0.00			0.00			0.00
DS-200360	Gas Sampling and Shipping	200	17-Jan-19*	31-Oct-19	$0.00	$15,000.00	$15,000.00	$0.00	$15,000.00	$15,000.00			0.00			0.00			0.00
DS-200370	Gas Sample Analysis	200	17-Jan-19*	31-Oct-19	$0.00	$35,000.00	$35,000.00	$0.00	$35,000.00	$35,000.00			0.00			0.00			0.00
DS-200480	Pipe Work	49	01-Nov-19	15-Jan-20	$0.00	$50,000.00	$50,000.00	$0.00	$50,000.00	$50,000.00			0.00			0.00			0.00
DS-200680	Technical Engineer	251	14-Sep-21*	14-Sep-22	$144,000.03	$0.00	$144,000.03	$144,000.03	$0.00	$144,000.03			0.00			0.00			0.00
NSF-Mid-scale		875	01-Jul-19	31-Dec-22	$2,659,894.40	$9,140,444.00	$11,800,338.40	$2,659,894.40	$9,140,444.00	$11,800,338.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A1110	TPC Materials Assays	1110	01-Jul-19*	14-Jul-22	$0.00	$120,000.00	$120,000.00	$0.00	$120,000.00	$120,000.00			0.00			0.00			0.00
A1120	Proposal IDC	1096	01-Oct-19*	30-Sep-22	$0.00	$521,877.00	$521,877.00	$0.00	$521,877.00	$521,877.00			0.00			0.00			0.00
A1130	Princeon-Gran Sasso SummerSchool at Princeton	1096	01-Oct-19*	30-Sep-22	$0.00	$12,654.00	$12,654.00	$0.00	$12,654.00	$12,654.00			0.00			0.00			0.00
A1140	Princeon-Gran Sasso SummerSchool at FLC	1096	01-Oct-19*	30-Sep-22	$0.00	$197,733.00	$197,733.00	$0.00	$197,733.00	$197,733.00			0.00			0.00			0.00
DS-1111000	SiPM- TSVs	180	01-Jul-19*	27-Dec-19	$0.00	$580,000.00	$580,000.00	$0.00	$580,000.00	$580,000.00			0.00			0.00			0.00
DS-1112000	Tile and substrates - R&D	184	01-Jul-19*	31-Dec-19	$0.00	$263,500.00	$263,500.00	$0.00	$263,500.00	$263,500.00			0.00			0.00			0.00
DS-1112001	Tile and substrates - Labor	1096	01-Oct-19*	30-Sep-22	$508,000.00	$0.00	$508,000.00	$508,000.00	$0.00	$508,000.00			0.00			0.00			0.00

DarkSide Current					DS Layout-Agency View of WBS														18-May-19 12:22
Activity ID	Activity Name	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]	Labor Cost USA [USD]	Non Labor Cost USA [USD]	Total Cost USA [USD]	Labor Cost CAN [CAD]	Non Labor Cost CAN [CAD]	Total Cost CAN [CAD]	Labor Cost EU [EUR]	Non Labor Cost EU [EUR]	Total Cost EU [EUR]	Labor Cost UK [GBP]	Non Labor Cost UK [GBP]	Total Cost UK [GBP]
DS-123500_1	Field Cage	1110	01-Jul-19*	14-Jul-22	$0.00	$52,610.00	$52,610.00	$0.00	$52,610.00	$52,610.00			0.00			0.00			0.00
DS-123501	Field Cage Labor	1110	01-Jul-19*	14-Jul-22	$95,985.00	$0.00	$95,985.00	$95,985.00	$0.00	$95,985.00			0.00			0.00			0.00
DS-123800_1	Reflector Cage	1110	01-Jul-19*	14-Jul-22	$0.00	$49,610.00	$49,610.00	$0.00	$49,610.00	$49,610.00			0.00			0.00			0.00
DS-123801	Reflector Cage Labor	1110	01-Jul-19*	14-Jul-22	$95,985.00	$0.00	$95,985.00	$95,985.00	$0.00	$95,985.00			0.00			0.00			0.00
DS-123980	Extraction Grid (Wire and Frame)	1110	01-Jul-19*	14-Jul-22	$0.00	$270,000.00	$270,000.00	$0.00	$270,000.00	$270,000.00			0.00			0.00			0.00
DS-123981	Extraction Grid (Wire and Frame) Labor	1110	01-Jul-19*	14-Jul-22	$118,000.00	$0.00	$118,000.00	$118,000.00	$0.00	$118,000.00			0.00			0.00			0.00
DS-124620	SiPM related Interfacing (Integration of the PDM MB assembly)	1110	01-Jul-19*	14-Jul-22	$0.00	$22,000.00	$22,000.00	$0.00	$22,000.00	$22,000.00			0.00			0.00			0.00
DS-124621	SiPM related Interfacing (Integration of the PDM MB assembly)	1110	01-Jul-19*	14-Jul-22	$72,000.00	$0.00	$72,000.00	$72,000.00	$0.00	$72,000.00			0.00			0.00			0.00
DS-124640	SiPM related Interfacing (MotherBoard on Support Structure)	1110	01-Jul-19*	14-Jul-22	$0.00	$22,000.00	$22,000.00	$0.00	$22,000.00	$22,000.00			0.00			0.00			0.00
DS-124641	SiPM related Interfacing (MotherBoard on Support Structure) L	1110	01-Jul-19*	14-Jul-22	$76,000.00	$0.00	$76,000.00	$76,000.00	$0.00	$76,000.00			0.00			0.00			0.00
DS-124660	SiPM related Interfacing (PDM assembly to TPC)	1110	01-Jul-19*	14-Jul-22	$0.00	$23,000.00	$23,000.00	$0.00	$23,000.00	$23,000.00			0.00			0.00			0.00
DS-124661	SiPM related Interfacing (PDM assembly to TPC) Labor	1110	01-Jul-19*	14-Jul-22	$80,000.00	$0.00	$80,000.00	$80,000.00	$0.00	$80,000.00			0.00			0.00			0.00
DS-124880	HV System Procurement	731	15-Jul-19*	14-Jul-21	$0.00	$166,610.00	$166,610.00	$0.00	$166,610.00	$166,610.00			0.00			0.00			0.00
DS-124900	HV System Labor	731	15-Jul-19*	14-Jul-21	$95,985.00	$0.00	$95,985.00	$95,985.00	$0.00	$95,985.00			0.00			0.00			0.00
DS-126600	Integrated Radon Trap	183	01-Jul-19*	30-Dec-19	$0.00	$165,000.00	$165,000.00	$0.00	$165,000.00	$165,000.00			0.00			0.00			0.00
DS-126840	Getter system (SAES hot getter system "Mega-Torr")	1096	01-Oct-19*	30-Sep-22	$0.00	$750,000.00	$750,000.00	$0.00	$750,000.00	$750,000.00			0.00			0.00			0.00
DS-126900	Internal surface treatment requirement and procedure for all pa	58	01-Jan-20*	27-Feb-20	$0.00	$5,000.00	$5,000.00	$0.00	$5,000.00	$5,000.00			0.00			0.00			0.00
DS-126920	Final Condenser Box	305	01-Mar-20*	30-Dec-20	$0.00	$30,000.00	$30,000.00	$0.00	$30,000.00	$30,000.00			0.00			0.00			0.00
DS-126980	Final Gas circulation pump	457	01-Oct-19*	30-Dec-20	$0.00	$130,000.00	$130,000.00	$0.00	$130,000.00	$130,000.00			0.00			0.00			0.00
DS-127060	Final gas panel and piping	457	01-Oct-19*	30-Dec-20	$0.00	$55,000.00	$55,000.00	$0.00	$55,000.00	$55,000.00			0.00			0.00			0.00
DS-127100	Final transfer line	457	01-Oct-19*	30-Dec-20	$0.00	$35,000.00	$35,000.00	$0.00	$35,000.00	$35,000.00			0.00			0.00			0.00
DS-127120	Slow Control - Cryogenics	1096	01-Oct-19*	30-Sep-22	$0.00	$82,000.00	$82,000.00	$0.00	$82,000.00	$82,000.00			0.00			0.00			0.00
DS-127140	Integration at LNGS	181	31-Dec-20*	29-Jun-21	$0.00	$20,000.00	$20,000.00	$0.00	$20,000.00	$20,000.00			0.00			0.00			0.00
DS-127160	Test and commissioning	426	01-Jul-21*	30-Aug-22	$0.00	$10,000.00	$10,000.00	$0.00	$10,000.00	$10,000.00			0.00			0.00			0.00
DS-127780	Project Engineer	1096	01-Oct-19*	30-Sep-22	$552,000.00	$0.00	$552,000.00	$552,000.00	$0.00	$552,000.00			0.00			0.00			0.00
DS-127800	Condenser	1096	01-Oct-19*	30-Sep-22	$0.00	$127,000.00	$127,000.00	$0.00	$127,000.00	$127,000.00			0.00			0.00			0.00
DS-127820	Gas Panel	1096	01-Oct-19*	30-Sep-22	$0.00	$267,000.00	$267,000.00	$0.00	$267,000.00	$267,000.00			0.00			0.00			0.00
DS-127840	Compressor	1096	01-Oct-19*	30-Sep-22	$0.00	$67,000.00	$67,000.00	$0.00	$67,000.00	$67,000.00			0.00			0.00			0.00
DS-141001	Sources - Gas sources	1004	01-Jul-19*	30-Mar-22	$0.00	$15,000.00	$15,000.00	$0.00	$15,000.00	$15,000.00			0.00			0.00			0.00
DS-141003	Sources - Gamma-ray	1004	01-Jul-19*	30-Mar-22	$0.00	$30,000.00	$30,000.00	$0.00	$30,000.00	$30,000.00			0.00			0.00			0.00
DS-141004	Sources - AmC, AmBe, AmLi	1004	01-Jul-19*	30-Mar-22	$4,000.00	$36,000.00	$40,000.00	$4,000.00	$36,000.00	$40,000.00			0.00			0.00			0.00
DS-142001_1	TPC guide mechanics Production	1004	01-Jul-19*	30-Mar-22	$0.00	$80,000.00	$80,000.00	$0.00	$80,000.00	$80,000.00			0.00			0.00			0.00
DS-143000	External deployment system for Photoneutron source Labor	914	01-Jul-20*	31-Dec-22	$258,000.00	$0.00	$258,000.00	$258,000.00	$0.00	$258,000.00			0.00			0.00			0.00
DS-143000_1	External deployment system for Photoneutron source Productic	914	01-Jul-20*	31-Dec-22	$0.00	$30,000.00	$30,000.00	$0.00	$30,000.00	$30,000.00			0.00			0.00			0.00
DS-143000_2	Photoneutron source	914	01-Jul-20*	31-Dec-22	$0.00	$107,000.00	$107,000.00	$0.00	$107,000.00	$107,000.00			0.00			0.00			0.00
DS-143000_3	Camera system	914	01-Jul-20*	31-Dec-22	$0.00	$40,000.00	$40,000.00	$0.00	$40,000.00	$40,000.00			0.00			0.00			0.00
DS-143000_4	Camera Integration	251	01-Oct-19*	30-Sep-20	$54,980.00	$64,260.00	$119,240.00	$54,980.00	$64,260.00	$119,240.00			0.00			0.00			0.00
DS-143000_5	Postdoc for Calibration Work	1004	01-Jul-19*	30-Mar-22	$0.00	$180,000.00	$180,000.00	$0.00	$180,000.00	$180,000.00			0.00			0.00			0.00
DS-158000_2	Integral Detector Stability Monitoring	251	01-Oct-19*	30-Sep-20	$334,087.00	$76,020.00	$410,107.00	$334,087.00	$76,020.00	$410,107.00			0.00			0.00			0.00
DS-163000	Slow Control - DAQ	456	01-Apr-20*	30-Jun-21	$0.00	$50,000.00	$50,000.00	$0.00	$50,000.00	$50,000.00			0.00			0.00			0.00
DS-200390	Procurement of Control Room	209	01-Jul-19*	30-Apr-20	$0.00	$56,000.00	$56,000.00	$0.00	$56,000.00	$56,000.00			0.00			0.00			0.00
DS-200400	Plant, electrical, storage and truck building materials and suppli	209	01-Jul-19*	30-Apr-20	$0.00	$100,000.00	$100,000.00	$0.00	$100,000.00	$100,000.00			0.00			0.00			0.00
DS-200420	Postdoc	275	01-Aug-19*	03-Sep-20	$238,000.40	$0.00	$238,000.40	$238,000.40	$0.00	$238,000.40			0.00			0.00			0.00
DS-200430	Phase I Installation	66	04-Oct-19*	13-Jan-20	$0.00	$200,000.00	$200,000.00	$0.00	$200,000.00	$200,000.00			0.00			0.00			0.00
DS-200440	Land development for slabs	120	04-Oct-19*	31-Mar-20	$0.00	$300,000.00	$300,000.00	$0.00	$300,000.00	$300,000.00			0.00			0.00			0.00
DS-200470	Tools and Equipment for Site Prep	230	04-Oct-19*	03-Sep-20	$0.00	$150,000.00	$150,000.00	$0.00	$150,000.00	$150,000.00			0.00			0.00			0.00
DS-200490	Phase II Installation	71	14-Jan-20	23-Apr-20	$0.00	$200,000.00	$200,000.00	$0.00	$200,000.00	$200,000.00			0.00			0.00			0.00
DS-200500	Pouring of concrete slabs	22	01-Apr-20	30-Apr-20	$0.00	$350,000.00	$350,000.00	$0.00	$350,000.00	$350,000.00			0.00			0.00			0.00
DS-200510	Phase III Installation	93	24-Apr-20	03-Sep-20	$0.00	$200,000.00	$200,000.00	$0.00	$200,000.00	$200,000.00			0.00			0.00			0.00
DS-200520	Control Room Installation	88	01-May-20	03-Sep-20	$0.00	$25,000.00	$25,000.00	$0.00	$25,000.00	$25,000.00			0.00			0.00			0.00
DS-200530	Plant, electrical, storage and truck area building erection	88	01-May-20	03-Sep-20	$0.00	$35,000.00	$35,000.00	$0.00	$35,000.00	$35,000.00			0.00			0.00			0.00
DS-200550	Plant Installation	121	04-Sep-20	04-Mar-21	$0.00	$1,000,000.00	$1,000,000.00	$0.00	$1,000,000.00	$1,000,000.00			0.00			0.00			0.00
DS-200560	PI for 2.02.03 Plant and Site Integration	354	04-Sep-20*	23-Aug-21	$76,872.00	$9,570.00	$86,442.00	$76,872.00	$9,570.00	$86,442.00			0.00			0.00			0.00
DS-200570	Coupling Between KM and Urania	10	05-Mar-21	18-Mar-21	$0.00	$121,000.00	$121,000.00	$0.00	$121,000.00	$121,000.00			0.00			0.00			0.00
DS-200580	Plant start-up and commissioning Equipment and Tools	133	08-Mar-21*	13-Sep-21	$0.00	$341,000.00	$341,000.00	$0.00	$341,000.00	$341,000.00			0.00			0.00			0.00
DS-200590	Plant consumables for Start-up and Commissioning	133	08-Mar-21*	13-Sep-21	$0.00	$1,300,000.00	$1,300,000.00	$0.00	$1,300,000.00	$1,300,000.00			0.00			0.00			0.00
PNNL-in-Kind		788	23-Jul-19	14-Sep-22	$0.00	$1,500,000.00	$1,500,000.00	$0.00	$1,500,000.00	$1,500,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-200320	Extraction Operations Engineering and PNNL Support	485	04-Oct-19*	13-Sep-21	$0.00	$750,000.00	$750,000.00	$0.00	$750,000.00	$750,000.00			0.00			0.00			0.00
DS-200630	Production and Installation of large sample collecitons system	537	23-Jul-19	13-Sep-21	$0.00	$250,000.00	$250,000.00	$0.00	$250,000.00	$250,000.00			0.00			0.00			0.00
DS-200660	Extraction Operations Engineering and PNNL Support	251	14-Sep-21	14-Sep-22	$0.00	$450,000.00	$450,000.00	$0.00	$450,000.00	$450,000.00			0.00			0.00			0.00
DS-200720	Large Volume Sample Collection	251	14-Sep-21	14-Sep-22	$0.00	$50,000.00	$50,000.00	$0.00	$50,000.00	$50,000.00			0.00			0.00			0.00
PNNL-LDRD		484	05-Jul-18	31-Oct-19	$0.00	$400,000.00	$400,000.00	$0.00	$400,000.00	$400,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-200220	Feed Characterization	484	05-Jul-18*	31-Oct-19	$0.00	$400,000.00	$400,000.00	$0.00	$400,000.00	$400,000.00			0.00			0.00			0.00
Poland-in-Kind		1736	01-Apr-17	31-Dec-21	$0.00	$27,500.00	$27,500.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	25000.00	25000.00	0.00	0.00	0.00
DS-130507	Materials Radiopurity Assay - Large surf. Assay - Krakow assa	1736	01-Apr-17*	31-Dec-21	$0.00	$16,500.00	$16,500.00	$0.00	$0.00	$0.00			0.00		15000.00	15000.00			0.00
DS-130508	Materials Radiopurity Assay - Pb/Po - Krakow assays	1736	01-Apr-17*	31-Dec-21	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
Poland		1004	01-Jul-19	30-Mar-22	$5,500.00	$16,500.00	$22,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	5000.00	15000.00	20000.00	0.00	0.00	0.00

DarkSide Current | DS Layout-Agency View of WBS | 18-May-19 12:22

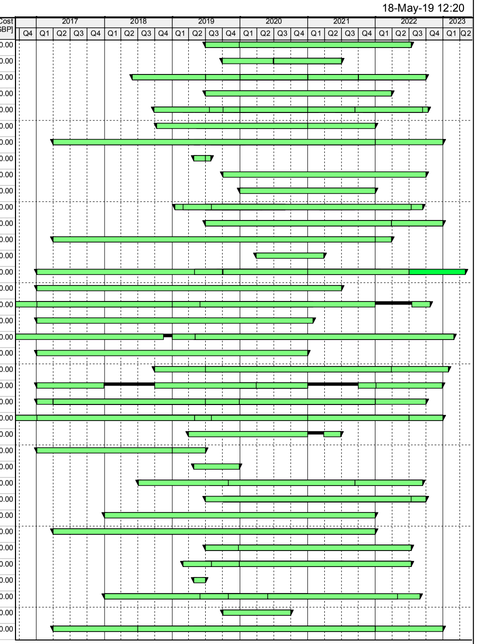
Activity ID	Activity Name	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]	Labor Cost USA [USD]	Non Labor Cost USA [USD]	Total Cost USA [USD]	Labor Cost CAN [CAD]	Non Labor Cost CAN [CAD]	Total Cost CAN [CAD]	Labor Cost EU [EUR]	Non Labor Cost EU [EUR]	Total Cost EU [EUR]	Labor Cost UK [GBP]	Non Labor Cost UK [GBP]	Total Cost UK [GBP]
DS-141002	Sources - Gas sources	1004	01-Jul-19*	30-Mar-22	$5,500.00	$5,500.00	$11,000.00	$0.00	$0.00	$0.00			0.00	5000.00	5000.00	10000.00			0.00
DS-153000	Development of VETO Reflectors	275	30-Sep-19*	30-Jun-20	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
Russia		1004	01-Jul-19	30-Mar-22	$121,000.00	$209,000.00	$330,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	110000.00	190000.00	300000.00	0.00	0.00	0.00
DS-141005	Sources - 252Cf	1004	01-Jul-19*	30-Mar-22	$11,000.00	$22,000.00	$33,000.00	$0.00	$0.00	$0.00			0.00	10000.00	20000.00	30000.00			0.00
DS-141006	Sources - UV led for VETO calibration	1004	01-Jul-19*	30-Mar-22	$0.00	$22,000.00	$22,000.00	$0.00	$0.00	$0.00			0.00		20000.00	20000.00			0.00
DS-141007	Sources - Pyroelectric neutron generator	1004	01-Jul-19*	30-Mar-22	$110,000.00	$165,000.00	$275,000.00	$0.00	$0.00	$0.00			0.00	100000.00	150000.00	250000.00			0.00
Spain		1437	01-Apr-17	30-Dec-22	$234,575.00	$181,500.00	$416,075.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	213250.00	165000.00	378250.00	0.00	0.00	0.00
DS-130100	Background Budget - Assay oversight	1736	01-Apr-17*	31-Dec-21	$95,975.00	$0.00	$95,975.00	$0.00	$0.00	$0.00			0.00	87250.00		87250.00			0.00
DS-130400	Cosmogenic & Intrinsic Activity	1280	01-Jul-18*	31-Dec-21	$52,800.00	$0.00	$52,800.00	$0.00	$0.00	$0.00			0.00	48000.00		48000.00			0.00
DS-323	machining DART (inkind)	1	30-Apr-19*	30-Apr-19	$33,000.00	$0.00	$33,000.00	$0.00	$0.00	$0.00			0.00	30000.00		30000.00			0.00
DS-324	cleaning DART (inkind)	31	01-May-19*	31-May-19	$19,800.00	$0.00	$19,800.00	$0.00	$0.00	$0.00			0.00	18000.00		18000.00			0.00
DS-3331	DART Integration and tests	119	02-Jul-19*	23-Dec-19	$33,000.00	$0.00	$33,000.00	$0.00	$0.00	$0.00			0.00	30000.00		30000.00			0.00
DS-335	purchases DART integration	31	30-Apr-19*	30-May-19	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-338	trigger integration	92	30-Apr-19*	30-Jul-19	$0.00	$5,500.00	$5,500.00	$0.00	$0.00	$0.00			0.00		5000.00	5000.00			0.00
DS-340	Lead purchase inkind	245	30-Apr-19*	30-Dec-19	$0.00	$33,000.00	$33,000.00	$0.00	$0.00	$0.00			0.00		30000.00	30000.00			0.00
DS-341	Leadstructure and belt installation	31	31-Dec-19*	30-Jan-20	$0.00	$5,500.00	$5,500.00	$0.00	$0.00	$0.00			0.00		5000.00	5000.00			0.00
DS-343	travel from CIEMAT to LSC	1250	30-Jul-19*	30-Dec-22	$0.00	$5,500.00	$5,500.00	$0.00	$0.00	$0.00			0.00		5000.00	5000.00			0.00
DS-349	Feasibility Study Gas Detector Proposal (inkind)	154	30-Apr-19*	30-Sep-19	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-350	Construction and operation Gas Detector Proposal	1188	30-Sep-19*	30-Dec-22	$0.00	$110,000.00	$110,000.00	$0.00	$0.00	$0.00			0.00		100000.00	100000.00			0.00
Spain-in-Kind		1736	01-Apr-17	31-Dec-21	$0.00	$694,100.00	$694,100.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	631000.00	631000.00	0.00	0.00	0.00
DS-130503	Materials Radiopurity Assay - LSC assays	1736	01-Apr-17*	31-Dec-21	$0.00	$275,000.00	$275,000.00	$0.00	$0.00	$0.00			0.00		250000.00	250000.00			0.00
DS-130504	Materials Radiopurity Assay - Radioch. And Mass. Spec. - CIEI	1736	01-Apr-17*	31-Dec-21	$0.00	$176,000.00	$176,000.00	$0.00	$0.00	$0.00			0.00		160000.00	160000.00			0.00
DS-130505	Materials Radiopurity Assay - Radioc. And Mass. Spec. - LSC a	1736	01-Apr-17*	31-Dec-21	$0.00	$176,000.00	$176,000.00	$0.00	$0.00	$0.00			0.00		160000.00	160000.00			0.00
DS-130506	Materials Radiopurity Assay - Large surf. Assay - LSC assays	1736	01-Apr-17*	31-Dec-21	$0.00	$56,100.00	$56,100.00	$0.00	$0.00	$0.00			0.00		51000.00	51000.00			0.00
DS-155001	Development of VETO electronics - radiopurity	459	30-Sep-19*	31-Dec-20	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
STFC		912	01-Jan-20	30-Jun-22	$1,950,000.00	$0.00	$1,950,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	0.00	0.00	1500000.00	0.00	1500000.00
DS-1111005	SiPM- Packaging technician	912	01-Jan-20*	30-Jun-22	$1,950,000.00	$0.00	$1,950,000.00	$0.00	$0.00	$0.00			0.00			0.00	1500000.00		1500000.00

Appendix C: Institutional View of WBS

DarkSide Current | DS Layout-Institutional View of WBS | 18-May-19 12:20

Activity ID	Activity Name	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]	Labor Cost USA [USD]	Non Labor Cost USA [USD]	Total Cost USA [USD]
Alberta		1110	01-Jul-19	14-Jul-22	$630,000.00	$2,450,000.00	$3,080,000.00	$0.00	$0.00	$0.00
AstroCeNT		641	30-Sep-19	01-Jul-21	$0.00	$737,600.00	$737,600.00	$0.00	$0.00	$0.00
BNL		1085	01-Jun-18	30-Sep-22	$3,156,581.30	$3,664,270.23	$6,820,851.53	$3,156,581.30	$3,664,270.23	$6,820,851.53
BNRU / MSU		1004	01-Jul-19	30-Mar-22	$121,000.00	$209,000.00	$330,000.00	$0.00	$0.00	$0.00
Carleton		1014	24-Sep-18	13-Oct-22	$616,000.00	$3,690,400.00	$4,306,400.00	$0.00	$0.00	$0.00
CERN		1178	11-Oct-18	31-Dec-21	$0.00	$6,526,300.00	$6,526,300.00	$0.00	$0.00	$0.00
CIEMAT		1437	01-Apr-17	30-Dec-22	$181,775.00	$484,000.00	$665,775.00	$0.00	$0.00	$0.00
ETHZ		92	30-Apr-19	30-Jul-19	$0.00	$38,500.00	$38,500.00	$0.00	$0.00	$0.00
Fort Lewis		1096	01-Oct-19	30-Sep-22	$0.00	$197,733.00	$197,733.00	$0.00	$197,733.00	$197,733.00
GSSI		731	01-Jan-20	31-Dec-21	$0.00	$1,100,000.00	$1,100,000.00	$0.00	$0.00	$0.00
Houston		917	17-Jan-19	14-Sep-22	$500,000.43	$4,916,000.00	$5,416,000.43	$500,000.43	$4,916,000.00	$5,416,000.43
Hawaii		1280	01-Jul-19	31-Dec-22	$262,000.00	$518,000.00	$780,000.00	$262,000.00	$518,000.00	$780,000.00
Krakow		1825	01-Apr-17	30-Mar-22	$5,500.00	$33,000.00	$38,500.00	$0.00	$0.00	$0.00
IHEP		366	30-Mar-20	30-Mar-21	$0.00	$605,000.00	$605,000.00	$0.00	$0.00	$0.00
INFN-BO		2311	01-Jan-17	30-Apr-23	$5,306,100.00	$12,057,100.00	$17,363,200.00	$0.00	$0.00	$0.00
INFN-PI		1642	01-Jan-17	30-Jun-21	$0.00	$397,100.00	$397,100.00	$0.00	$0.00	$0.00
INFN-NA		2273	02-Aug-16	22-Oct-22	$0.00	$11,148,500.00	$11,148,500.00	$0.00	$0.00	$0.00
INFN-TO		1492	01-Jan-17	31-Jan-21	$0.00	$344,300.00	$344,300.00	$0.00	$0.00	$0.00
INFN-CA		2403	01-Aug-16	28-Feb-23	$1,385,507.20	$3,033,800.00	$4,419,307.20	$0.00	$0.00	$0.00
INFN-MI		1461	01-Jan-17	31-Dec-20	$0.00	$249,700.00	$249,700.00	$0.00	$0.00	$0.00
IN2P3		1582	01-Oct-18	29-Jan-23	$203,500.00	$0.00	$203,500.00	$0.00	$0.00	$0.00
INFN-GE		2188	01-Jan-17	28-Dec-22	$0.00	$869,000.00	$869,000.00	$0.00	$0.00	$0.00
INFN-Roma1		2099	01-Jan-17	30-Sep-22	$264,000.00	$4,030,400.00	$4,294,400.00	$0.00	$0.00	$0.00
LNGS		2526	01-Feb-16	31-Dec-22	$4,765,200.00	$21,888,372.00	$26,653,572.00	$0.00	$0.00	$0.00
LNL		820	01-Apr-19	28-Jun-21	$0.00	$297,000.00	$297,000.00	$0.00	$0.00	$0.00
LNS		911	01-Jan-17	30-Jun-19	$0.00	$66,000.00	$66,000.00	$0.00	$0.00	$0.00
LSC		245	30-Apr-19	30-Dec-19	$0.00	$33,000.00	$33,000.00	$0.00	$0.00	$0.00
PNNL		1050	05-Jul-18	14-Sep-22	$0.00	$1,900,000.00	$1,900,000.00	$0.00	$1,900,000.00	$1,900,000.00
Princeton		1188	01-Jul-19	30-Sep-22	$1,060,000.00	$2,261,031.00	$3,321,031.00	$1,060,000.00	$2,261,031.00	$3,321,031.00
Temple		1461	01-Jan-18	31-Dec-21	$0.00	$60,000.00	$60,000.00	$0.00	$60,000.00	$60,000.00
TRIUMF		1736	01-Apr-17	31-Dec-21	$700,000.00	$2,592,100.00	$3,292,100.00	$0.00	$0.00	$0.00
UMass		1110	01-Jul-19	14-Jul-22	$304,872.00	$656,570.00	$961,442.00	$304,872.00	$656,570.00	$961,442.00
UC Davis		1232	01-Mar-19	14-Jul-22	$287,955.00	$548,830.00	$836,785.00	$287,955.00	$548,830.00	$836,785.00
UNICA		62	30-Apr-19	30-Jun-19	$0.00	$16,500.00	$16,500.00	$0.00	$0.00	$0.00
UCLA		1703	01-Jan-18	30-Aug-22	$0.00	$3,475,000.00	$3,475,000.00	$0.00	$923,000.00	$923,000.00
Virginia Tech.		251	01-Oct-19	30-Sep-20	$389,067.00	$140,280.00	$529,347.00	$389,067.00	$140,280.00	$529,347.00
Zaragoza Univ.		2100	01-Apr-17	30-Dec-22	$52,800.00	$396,000.00	$448,800.00	$0.00	$0.00	$0.00

Activity ID	Labor Cost CAN [CAD]	Non Labor Cost CAN [CAD]	Total Cost CAN [CAD]	Labor Cost EU [EUR]	Non Labor Cost EU [EUR]	Total Cost EU [EUR]	Labor Cost UK [GBP]	Non Labor Cost UK [GBP]	Total Cost UK [GBP]
Alberta	900000.00	3500000.00	4400000.00	0.00	0.00	0.00	0.00	0.00	0.00
AstroCeNT	0.00	400000.00	400000.00	0.00	416000.00	416000.00	0.00	0.00	0.00
BNL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BNRU / MSU	0.00	0.00	0.00	110000.00	190000.00	300000.00	0.00	0.00	0.00
Carleton	880000.00	5272000.00	6152000.00	0.00	0.00	0.00	0.00	0.00	0.00
CERN	0.00	0.00	0.00	0.00	5933000.00	5933000.00	0.00	0.00	0.00
CIEMAT	0.00	0.00	0.00	165250.00	440000.00	605250.00	0.00	0.00	0.00
ETHZ	0.00	0.00	0.00	0.00	35000.00	35000.00	0.00	0.00	0.00
Fort Lewis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSSI	0.00	0.00	0.00	0.00	1000000.00	1000000.00	0.00	0.00	0.00
Houston	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hawaii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Krakow	0.00	0.00	0.00	5000.00	30000.00	35000.00	0.00	0.00	0.00
IHEP	0.00	0.00	0.00	0.00	550000.00	550000.00	0.00	0.00	0.00
INFN-BO	0.00	0.00	0.00	3051000.00	10961000.00	4012000.00	1500000.00	0.00	1500000.00
INFN-PI	0.00	0.00	0.00	0.00	361000.00	361000.00	0.00	0.00	0.00
INFN-NA	0.00	0.00	0.00	0.00	10135000.00	0135000.00	0.00	0.00	0.00
INFN-TO	0.00	0.00	0.00	0.00	313000.00	313000.00	0.00	0.00	0.00
INFN-CA	0.00	0.00	0.00	1259552.00	2758000.00	4017552.00	0.00	0.00	0.00
INFN-MI	0.00	0.00	0.00	0.00	227000.00	227000.00	0.00	0.00	0.00
IN2P3	0.00	0.00	0.00	185000.00	0.00	185000.00	0.00	0.00	0.00
INFN-GE	0.00	0.00	0.00	0.00	790000.00	790000.00	0.00	0.00	0.00
INFN-Roma1	0.00	0.00	0.00	240000.00	3664000.00	3904000.00	0.00	0.00	0.00
LNGS	0.00	0.00	0.00	4332000.00	19898520.00	4230520.00	0.00	0.00	0.00
LNL	0.00	0.00	0.00	0.00	270000.00	270000.00	0.00	0.00	0.00
LNS	0.00	0.00	0.00	0.00	60000.00	60000.00	0.00	0.00	0.00
LSC	0.00	0.00	0.00	0.00	30000.00	30000.00	0.00	0.00	0.00
PNNL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Princeton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Temple	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRIUMF	1000000.00	3703000.00	4703000.00	0.00	0.00	0.00	0.00	0.00	0.00
UMass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UC Davis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNICA	0.00	0.00	0.00	0.00	15000.00	15000.00	0.00	0.00	0.00
UCLA	0.00	0.00	0.00	0.00	2320000.00	2320000.00	0.00	0.00	0.00
Virginia Tech.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zaragoza Univ.	0.00	0.00	0.00	48000.00	360000.00	408000.00	0.00	0.00	0.00



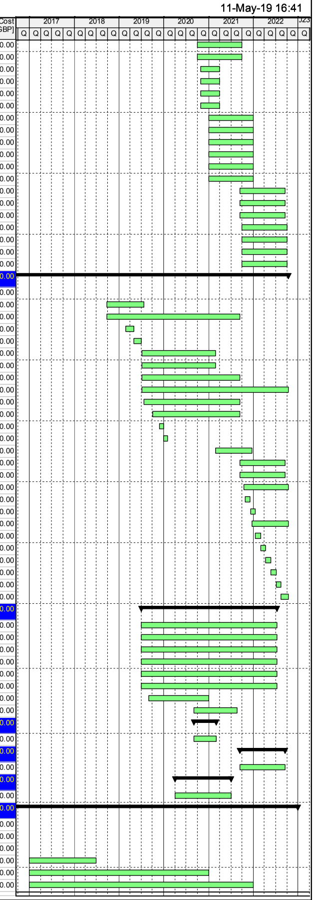
Remaining Level of Effort | Actual Work | Critical Remaining Work
Actual Level of Effort | Remaining Work ◆ | ◆ Milestone

Page 1 of 1

TASK filter: (Untitled Filter).

DarkSide Current		DS Layout-All Currencies		11-May-19 16:41

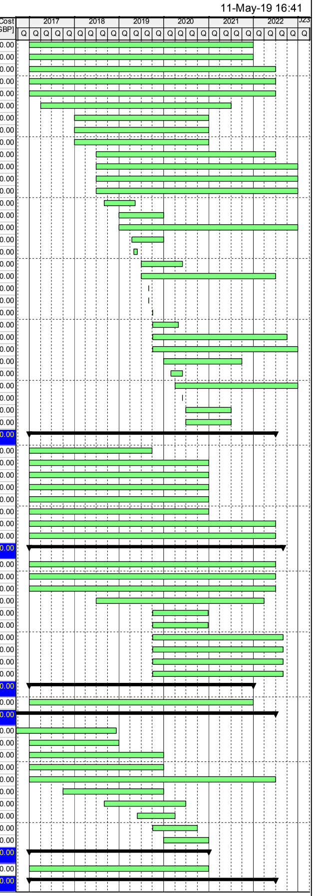
Activity ID	Activity Name	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]	Labor Cost USA [USD]	Non Labor Cost USA [USD]	Total Cost USA [USD]	Labor Cost CAN [CAD]	Non Labor Cost CAN [CAD]	Total Cost CAN [CAD]	Labor Cost EU [EUR]	Non Labor Cost EU [EUR]	Total Cost EU [EUR]	Labor Cost UK [GBP]	Non Labor Cost UK [GBP]	Total Cost UK [GBP]
DS-200060	Safety Oversight for FY21	250	01-Oct-20	30-Sep-21	$189,473.95	$0.00	$189,473.95	$189,473.95	$0.00	$189,473.95			0.00			0.00			0.00
DS-200070	Travel for FY21	250	01-Oct-20	30-Sep-21	$0.00	$19,122.64	$19,122.64	$0.00	$19,122.64	$19,122.64			0.00			0.00			0.00
DS-1113420	Steering Module preproduction	152	31-Oct-20*	31-Mar-21	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-1113421	Printed circuit boards	152	31-Oct-20*	31-Mar-21	$0.00	$2,000.00	$2,000.00	$0.00	$2,000.00	$2,000.00			0.00			0.00			0.00
DS-1113422	Run - preproduction	152	31-Oct-20*	31-Mar-21	$0.00	$4,000.00	$4,000.00	$0.00	$4,000.00	$4,000.00			0.00			0.00			0.00
DS-1113423	Argon for cryogenics test	152	31-Oct-20*	31-Mar-21	$0.00	$1,000.00	$1,000.00	$0.00	$1,000.00	$1,000.00			0.00			0.00			0.00
DS-1113430	Steering module Production	365	01-Jan-21*	31-Dec-21	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-1113431	Substrates	365	01-Jan-21*	31-Dec-21	$0.00	$8,000.00	$8,000.00	$0.00	$8,000.00	$8,000.00			0.00			0.00			0.00
DS-1113432	Printed circuit boards	365	01-Jan-21*	31-Dec-21	$0.00	$9,000.00	$9,000.00	$0.00	$9,000.00	$9,000.00			0.00			0.00			0.00
DS-1113433	Run-production	365	01-Jan-21*	31-Dec-21	$0.00	$170,000.00	$170,000.00	$0.00	$170,000.00	$170,000.00			0.00			0.00			0.00
DS-1113434	Material burden	365	01-Jan-21*	31-Dec-21	$0.00	$15,000.00	$15,000.00	$0.00	$15,000.00	$15,000.00			0.00			0.00			0.00
DS-1113435	Steering module production labor	365	01-Jan-21*	31-Dec-21	$500,000.00	$0.00	$500,000.00	$500,000.00	$0.00	$500,000.00			0.00			0.00			0.00
DS-200650	Field Operations Engineering Support	251	14-Sep-21	14-Sep-22	$436,223.96	$0.00	$436,223.96	$436,223.96	$0.00	$436,223.96			0.00			0.00			0.00
DS-200690	Plant Operations Support	251	14-Sep-21*	14-Sep-22	$1,570,406.26	$0.00	$1,570,406.26	$1,570,406.26	$0.00	$1,570,406.26			0.00			0.00			0.00
DS-200710	Utilities, Consumables and Plant Maintenance	251	14-Sep-21	14-Sep-22	$0.00	$5,274,255.26	$5,274,255.26	$0.00	$5,274,255.26	$5,274,255.26			0.00			0.00			0.00
DS-200080	Project Management for FY22	250	01-Oct-21	30-Sep-22	$351,363.55	$0.00	$351,363.55	$351,363.55	$0.00	$351,363.55			0.00			0.00			0.00
DS-200090	Project Controls for FY22	250	01-Oct-21	30-Sep-22	$90,258.05	$0.00	$90,258.05	$90,258.05	$0.00	$90,258.05			0.00			0.00			0.00
DS-200100	Safety Oversight for FY22	250	01-Oct-21	30-Sep-22	$195,347.64	$0.00	$195,347.64	$195,347.64	$0.00	$195,347.64			0.00			0.00			0.00
DS-200110	Travel for FY22	250	01-Oct-21	30-Sep-22	$0.00	$19,562.46	$19,562.46	$0.00	$19,562.46	$19,562.46			0.00			0.00			0.00
Carleton		1697	01-Jan-16	13-Oct-22	$616,000.00	$2,710,400.00	$3,326,400.00	$0.00	$0.00	$0.00	880000.00	3872000.00	4752000.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-412500	Storage @ LNGS	1	01-Jan-16*	01-Jan-16	$0.00	$320,600.00	$320,600.00	$0.00	$0.00	$0.00		458000.00	458000.00			0.00			0.00
DS-200600	Procure gas analysis instrumentation	206	24-Sep-18*	22-Jul-19	$0.00	$160,300.00	$160,300.00	$0.00	$0.00	$0.00		229000.00	229000.00			0.00			0.00
DS-200610	PI for 2.02.05 QA/QC Inst Installation	1086	24-Sep-18*	13-Sep-21	$246,400.00	$0.00	$246,400.00	$0.00	$0.00	$0.00	352000.00		352000.00			0.00			0.00
DS-327	Acrylic machining	62	28-Feb-19*	30-Apr-19	$0.00	$1,400.00	$1,400.00	$0.00	$0.00	$0.00		2000.00	2000.00			0.00			0.00
DS-328	Clean TPB-coatings	62	01-May-19*	01-Jul-19	$0.00	$1,400.00	$1,400.00	$0.00	$0.00	$0.00		2000.00	2000.00			0.00			0.00
DS-200830	Procurement of shipping vessels 1-2	602	08-Jul-19*	28-Feb-21	$0.00	$420,000.00	$420,000.00	$0.00	$0.00	$0.00		600000.00	600000.00			0.00			0.00
DS-200840	Procurement of shipping vessel filling equipment	602	08-Jul-19*	28-Feb-21	$0.00	$49,000.00	$49,000.00	$0.00	$0.00	$0.00		70000.00	70000.00			0.00			0.00
DS-200850	PI for 2.04.01 Shipping and Storage Vessels Procuremen	796	08-Jul-19*	10-Sep-21	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-200820	PI for 2.04 Storage and Shipping	1194	08-Jul-19*	13-Oct-22	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-200620	Installation and characterization of gas analysis instrumer	537	23-Jul-19	13-Sep-21	$0.00	$72,100.00	$72,100.00	$0.00	$0.00	$0.00		103000.00	103000.00			0.00			0.00
DS-200330	Process Engineering Support	485	04-Oct-19*	13-Sep-21	$246,400.00	$0.00	$246,400.00	$0.00	$0.00	$0.00	352000.00		352000.00			0.00			0.00
DS-329	Acrylic machining radio-pure	31	30-Nov-19*	30-Dec-19	$0.00	$1,400.00	$1,400.00	$0.00	$0.00	$0.00		2000.00	2000.00			0.00			0.00
DS-330	Clean TPB-coatings radio-pure	31	31-Dec-19*	30-Jan-20	$0.00	$1,400.00	$1,400.00	$0.00	$0.00	$0.00		2000.00	2000.00			0.00			0.00
DS-200860	Procurement of shipping vessels 3-5	296	01-Mar-21	21-Dec-21	$0.00	$630,000.00	$630,000.00	$0.00	$0.00	$0.00		900000.00	900000.00			0.00			0.00
DS-200670	Process Engineer	251	14-Sep-21	14-Sep-22	$123,200.00	$0.00	$123,200.00	$0.00	$0.00	$0.00	176000.00		176000.00			0.00			0.00
DS-200700	Precision gas analysis	251	14-Sep-21*	14-Sep-22	$0.00	$69,300.00	$69,300.00	$0.00	$0.00	$0.00		99000.00	99000.00			0.00			0.00
DS-200880	PI for 2.04.04 Ship Product	365	14-Oct-21*	13-Oct-22	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-200890	Shipment of first batch to Sardinia	42	25-Oct-21*	05-Dec-21	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
DS-200900	Shipment of Second batch to Sardinia	42	07-Dec-21	17-Jan-22	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
DS-200870	Procurement of shipping vessels 6-8	296	22-Dec-21	13-Oct-22	$0.00	$630,000.00	$630,000.00	$0.00	$0.00	$0.00		900000.00	900000.00			0.00			0.00
DS-200910	Shipment of third batch to Sardinia	42	18-Jan-22	28-Feb-22	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
DS-200920	Shipment of fourth batch to Sardinia	42	01-Mar-22	11-Apr-22	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
DS-200930	Shipment of fifth batch to Sardinia	42	12-Apr-22	23-May-22	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
DS-200940	Shipment of sixth batch to Sardinia	42	24-May-22	04-Jul-22	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
DS-200950	Shipment of seventh batch to Sardinia	42	05-Jul-22	15-Aug-22	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
DS-200960	Shipment of eigth batch to Sardinia	59	16-Aug-22	13-Oct-22	$0.00	$44,187.50	$44,187.50	$0.00	$0.00	$0.00		63125.00	63125.00			0.00			0.00
UMass		1110	01-Jul-19	14-Jul-22	$361,216.00	$649,570.00	$1,010,786.00	$361,216.00	$649,570.00	$1,010,786.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-124620	SiPM related Interfacing (Integration of the PDM MB asse	1110	01-Jul-19*	14-Jul-22	$0.00	$18,000.00	$18,000.00	$0.00	$18,000.00	$18,000.00			0.00			0.00			0.00
DS-124621	SiPM related Interfacing (Integration of the PDM MB asse	1110	01-Jul-19*	14-Jul-22	$92,000.00	$0.00	$92,000.00	$92,000.00	$0.00	$92,000.00			0.00			0.00			0.00
DS-124640	SiPM related Interfacing (MotherBoard on Support Structi	1110	01-Jul-19*	14-Jul-22	$0.00	$23,000.00	$23,000.00	$0.00	$23,000.00	$23,000.00			0.00			0.00			0.00
DS-124641	SiPM related Interfacing (MotherBoard on Support Structi	1110	01-Jul-19*	14-Jul-22	$95,000.00	$0.00	$95,000.00	$95,000.00	$0.00	$95,000.00			0.00			0.00			0.00
DS-124660	SiPM related Interfacing (PDM assembly to TPC)	1110	01-Jul-19*	14-Jul-22	$0.00	$24,000.00	$24,000.00	$0.00	$24,000.00	$24,000.00			0.00			0.00			0.00
DS-124661	SiPM related Interfacing (PDM assembly to TPC) Labor	1110	01-Jul-19*	14-Jul-22	$98,000.00	$0.00	$98,000.00	$98,000.00	$0.00	$98,000.00			0.00			0.00			0.00
DS-1111000	SiPM-Fused Silica	488	01-Sep-19*	31-Dec-20	$0.00	$575,000.00	$575,000.00	$0.00	$575,000.00	$575,000.00			0.00			0.00			0.00
DS-200560	PI for 2.02.03 Plant and Site Integration	354	04-Sep-20*	23-Aug-21	$76,216.00	$9,570.00	$85,786.00	$76,216.00	$9,570.00	$85,786.00			0.00			0.00			0.00
UH		121	04-Sep-20	04-Mar-21	$0.00	$1,046,000.00	$1,046,000.00	$0.00	$1,046,000.00	$1,046,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-200550	Plant Installation	121	04-Sep-20	04-Mar-21	$0.00	$1,046,000.00	$1,046,000.00	$0.00	$1,046,000.00	$1,046,000.00			0.00			0.00			0.00
Fort Lewis		251	14-Sep-21	14-Sep-22	$144,000.03	$0.00	$144,000.03	$144,000.03	$0.00	$144,000.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-200680	Technical Engineer	251	14-Sep-21	14-Sep-22	$144,000.03	$0.00	$144,000.03	$144,000.03	$0.00	$144,000.03			0.00			0.00			0.00
TBD		456	01-Apr-20	30-Jun-21	$0.00	$50,000.00	$50,000.00	$0.00	$50,000.00	$50,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-163000	Slow Control	456	01-Apr-20*	30-Jun-21	$0.00	$50,000.00	$50,000.00	$0.00	$50,000.00	$50,000.00			0.00			0.00			0.00
LNGS		2557	01-Jan-16	31-Dec-22	$4,611,200.00	$14,440,800.00	$19,052,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	4192000.00	13128000.00	7320000.00	0.00	0.00	0.00
DS-411000	Safety Analysis	1	01-Jan-16*	01-Jan-16	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
DS-412000	Facilities	1	01-Jan-16*	01-Jan-16	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-412100	Building	1	01-Jan-16*	01-Jan-16	$0.00	$225,500.00	$225,500.00	$0.00	$0.00	$0.00			0.00		205000.00	205000.00			0.00
DS-1113100	FEB prototyping	546	01-Jan-17*	30-Jun-18	$0.00	$82,500.00	$82,500.00	$0.00	$0.00	$0.00			0.00		75000.00	75000.00			0.00
DS-1111001	SiPM-R&D	1461	01-Jan-17*	31-Dec-20	$0.00	$121,000.00	$121,000.00	$0.00	$0.00	$0.00			0.00		110000.00	110000.00			0.00
DS-1113300	FEB production -TPC	1826	01-Jan-17*	31-Dec-21	$0.00	$534,600.00	$534,600.00	$0.00	$0.00	$0.00			0.00		486000.00	486000.00			0.00



Remaining Level of Effort | Actual Work | Critical Remaining Work
Actual Level of Effort | Remaining Work ◆ | ◆ Milestone

TASK filter: All Activities

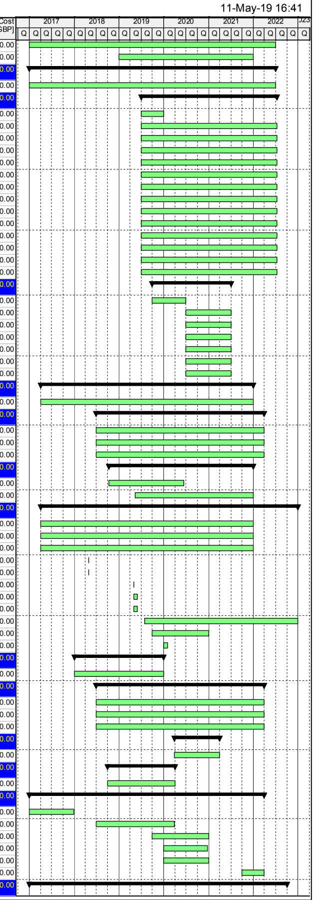
Activity ID	Activity Name	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]	Labor Cost USA [USD]	Non Labor Cost USA [USD]	Total Cost USA [USD]	Labor Cost CAN [CAD]	Non Labor Cost CAN [CAD]	Total Cost CAN [CAD]	Labor Cost EU [EUR]	Non Labor Cost EU [EUR]	Total Cost EU [EUR]	Labor Cost UK [GBP]	Non Labor Cost UK [GBP]	Total Cost UK [GBP]
DS-1113301	FEB production - consumables	1826	01-Jan-17*	31-Dec-21	$0.00	$27,500.00	$27,500.00	$0.00	$0.00	$0.00			0.00		25000.00	25000.00			0.00
DS-1113302	FEB production - Veto	1826	01-Jan-17*	31-Dec-21	$0.00	$344,300.00	$344,300.00	$0.00	$0.00	$0.00			0.00		313000.00	313000.00			0.00
DS-1112003	Tile and substrates -PCB and components	2007	01-Jan-17*	30-Jun-22	$0.00	$695,200.00	$695,200.00	$0.00	$0.00	$0.00			0.00		632000.00	632000.00			0.00
DS-1112004	Tile and substrates - Technicians	2007	01-Jan-17*	30-Jun-22	$140,800.00	$0.00	$140,800.00	$0.00	$0.00	$0.00			0.00	128000.00		128000.00			0.00
DS-1113000	Front-end electronics	2007	01-Jan-17*	30-Jun-22	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-130300	Spreadsheet and database	1552	01-Apr-17*	30-Jun-21	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-111700	Optolink -Prototyping and preproduction	1096	01-Jan-18*	31-Dec-20	$0.00	$300,300.00	$300,300.00	$0.00	$0.00	$0.00			0.00		273000.00	273000.00			0.00
DS-111800	Optolink - TPC, Veto fibers + Optical driver PCB	1096	01-Jan-18*	31-Dec-20	$0.00	$3,348,400.00	$3,348,400.00	$0.00	$0.00	$0.00			0.00		3044000.00	3044000.00			0.00
DS-111900	Optolink - Receivers and Driver components	1096	01-Jan-18*	31-Dec-20	$0.00	$1,955,800.00	$1,955,800.00	$0.00	$0.00	$0.00			0.00		1778000.00	1778000.00			0.00
DS-510000	Faculty personnel (PS)	1463	30-Jun-18*	01-Jul-22	$396,000.00	$0.00	$396,000.00	$0.00	$0.00	$0.00			0.00	360000.00		360000.00			0.00
DS-505000	Mechanical-3D	1646	30-Jun-18*	31-Dec-22	$0.00	$268,400.00	$268,400.00	$0.00	$0.00	$0.00			0.00		244000.00	244000.00			0.00
DS-505001	Mechanical-3D	1646	30-Jun-18*	31-Dec-22	$157,300.00	$0.00	$157,300.00	$0.00	$0.00	$0.00			0.00	143000.00		143000.00			0.00
DS-508000	Travels	1646	30-Jun-18*	31-Dec-22	$0.00	$66,000.00	$66,000.00	$0.00	$0.00	$0.00			0.00		60000.00	60000.00			0.00
DS-3121	Nitrogen Recovery (Stirling) (Inkind)	257	01-Sep-18*	15-May-19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-506000	NOA Infrastructures	365	01-Jan-19*	31-Dec-19	$0.00	$220,000.00	$220,000.00	$0.00	$0.00	$0.00			0.00		200000.00	200000.00			0.00
DS-507000	Web sie & Outreach	1461	01-Jan-19*	31-Dec-22	$0.00	$44,000.00	$44,000.00	$0.00	$0.00	$0.00			0.00		40000.00	40000.00			0.00
DS-31341	Fine Tuning System	261	15-Apr-19*	31-Dec-19	$0.00	$66,000.00	$66,000.00	$0.00	$0.00	$0.00			0.00		60000.00	60000.00			0.00
DS-326	Front-end DART	31	30-Apr-19*	30-May-19	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-3136	Nitrogen Storage for Seruci-1	335	01-Jul-19*	30-May-20	$0.00	$209,000.00	$209,000.00	$0.00	$0.00	$0.00			0.00		190000.00	190000.00			0.00
DS-509000	Administrative personnel	1097	01-Jul-19*	01-Jul-22	$140,800.00	$0.00	$140,800.00	$0.00	$0.00	$0.00			0.00	128000.00		128000.00			0.00
DS-3131	Piller (UPS)	1	01-Sep-19*	01-Sep-19	$0.00	$605,000.00	$605,000.00	$0.00	$0.00	$0.00			0.00		550000.00	550000.00			0.00
DS-3132	Cables and Installation for Seruci-1	1	01-Sep-19*	01-Sep-19	$0.00	$66,000.00	$66,000.00	$0.00	$0.00	$0.00			0.00		60000.00	60000.00			0.00
DS-504000	LA-ICPMS	1	01-Oct-19*	01-Oct-19	$157,300.00	$0.00	$157,300.00	$0.00	$0.00	$0.00			0.00	143000.00		143000.00			0.00
DS-3137	Water Cooling System for Seruci-1 (Vacuum system)	213	01-Oct-19*	30-Apr-20	$0.00	$40,700.00	$40,700.00	$0.00	$0.00	$0.00			0.00		37000.00	37000.00			0.00
DS-502000	Packaging facility, housing, refurbishing, gas and electricit	1096	01-Oct-19*	30-Sep-22	$0.00	$2,665,300.00	$2,665,300.00	$0.00	$0.00	$0.00			0.00		2423000.00	2423000.00			0.00
DS-511000	Faculty personnel, engineers, technicians	1188	01-Oct-19*	31-Dec-22	$3,619,000.00	$0.00	$3,619,000.00	$0.00	$0.00	$0.00			0.00	3290000.00		3290000.00			0.00
DS-1113200	FEB preproduction	639	01-Jan-20*	30-Sep-21	$0.00	$36,300.00	$36,300.00	$0.00	$0.00	$0.00			0.00		33000.00	33000.00			0.00
DS-3135	Disassembling Seruci-0 + Reassembling in Seruci-1	91	01-Mar-20*	30-May-20	$0.00	$110,000.00	$110,000.00	$0.00	$0.00	$0.00			0.00		100000.00	100000.00			0.00
DS-501000	Clean Room	1005	01-Apr-20*	31-Dec-22	$0.00	$2,090,000.00	$2,090,000.00	$0.00	$0.00	$0.00			0.00		1900000.00	1900000.00			0.00
DS-110400	Argon 5.0	1	01-Jun-20*	01-Jun-20	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-154006	Procurement of VETO Reflectors - Evaporation systems	366	30-Jun-20*	30-Jun-21	$0.00	$242,000.00	$242,000.00	$0.00	$0.00	$0.00			0.00		220000.00	220000.00			0.00
DS-154007	Procurement of VETO Reflectors - Packaging	366	30-Jun-20*	30-Jun-21	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
INFN-BO		2007	01-Jan-17	30-Jun-22	$5,306,100.00	$8,042,100.00	$13,348,200.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	3051000.00	7311000.00	0362000.00	1500000.00	0.00	1500000.00
DS180200	ReD Photoelectronics	1003	01-Jan-17*	30-Sep-19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-1111002	SiPM - Protorype	1461	01-Jan-17*	31-Dec-20	$0.00	$540,100.00	$540,100.00	$0.00	$0.00	$0.00			0.00		491000.00	491000.00			0.00
DS-1111003	SiPM - Production	1461	01-Jan-17*	31-Dec-20	$0.00	$6,246,900.00	$6,246,900.00	$0.00	$0.00	$0.00			0.00		5679000.00	5679000.00			0.00
DS-1111004	SiPM-Technician	1461	01-Jan-17*	31-Dec-20	$468,600.00	$0.00	$468,600.00	$0.00	$0.00	$0.00			0.00	426000.00		426000.00			0.00
DS-1111005	SiPM- Packaging technician	1461	01-Jan-17*	31-Dec-20	$1,950,000.00	$0.00	$1,950,000.00	$0.00	$0.00	$0.00			0.00			0.00	1500000.00		1500000.00
DS-1111006	SiPM - Scientists	1461	01-Jan-17*	31-Dec-20	$2,887,500.00	$0.00	$2,887,500.00	$0.00	$0.00	$0.00			0.00	2625000.00		2625000.00			0.00
DS-112000	Motherboard	2007	01-Jan-17*	30-Jun-22	$0.00	$193,600.00	$193,600.00	$0.00	$0.00	$0.00			0.00		176000.00	176000.00			0.00
LATER1	SiPM power supplies	2007	01-Jan-17*	30-Jun-22	$0.00	$1,061,500.00	$1,061,500.00	$0.00	$0.00	$0.00			0.00		965000.00	965000.00			0.00
Princeton		2068	01-Jan-17	30-Aug-22	$1,736,000.00	$1,772,000.00	$3,508,000.00	$1,736,000.00	$1,772,000.00	$3,508,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-1112000	Tile and substrates-R&D	2007	01-Jan-17*	30-Jun-22	$0.00	$490,000.00	$490,000.00	$0.00	$490,000.00	$490,000.00			0.00			0.00			0.00
DS-1112001	Tile and substrates-Scientists	2007	01-Jan-17*	30-Jun-22	$577,000.00	$0.00	$577,000.00	$577,000.00	$0.00	$577,000.00			0.00			0.00			0.00
DS-1112002	Tile and substrates - Packaging at PU	2007	01-Jan-17*	30-Jun-22	$600,000.00	$0.00	$600,000.00	$600,000.00	$0.00	$600,000.00			0.00			0.00			0.00
DS-141001	Sources - Gas sources	1369	01-Jul-18*	30-Mar-22	$7,000.00	$40,000.00	$47,000.00	$7,000.00	$40,000.00	$47,000.00			0.00			0.00			0.00
DS-126840	Getter system (SAES hot getter system "Mega-Torr")	457	01-Oct-19*	30-Dec-20	$0.00	$750,000.00	$750,000.00	$0.00	$750,000.00	$750,000.00			0.00			0.00			0.00
DS-127120	Slow Control	457	01-Oct-19*	30-Dec-20	$0.00	$82,000.00	$82,000.00	$0.00	$82,000.00	$82,000.00			0.00			0.00			0.00
DS-127780	Project Engineer	1065	01-Oct-19*	30-Aug-22	$552,000.00	$0.00	$552,000.00	$552,000.00	$0.00	$552,000.00			0.00			0.00			0.00
DS-127800	Condenser	1065	01-Oct-19*	30-Aug-22	$0.00	$110,000.00	$110,000.00	$0.00	$110,000.00	$110,000.00			0.00			0.00			0.00
DS-127820	Gas Panel	1065	01-Oct-19*	30-Aug-22	$0.00	$250,000.00	$250,000.00	$0.00	$250,000.00	$250,000.00			0.00			0.00			0.00
DS-127840	Compressor	1065	01-Oct-19*	30-Aug-22	$0.00	$50,000.00	$50,000.00	$0.00	$50,000.00	$50,000.00			0.00			0.00			0.00
INFN-PI		1826	01-Jan-17	31-Dec-21	$0.00	$397,100.00	$397,100.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	361000.00	361000.00	0.00	0.00	0.00
DS-111400	Detector module integration	1826	01-Jan-17*	31-Dec-21	$0.00	$397,100.00	$397,100.00	$0.00	$0.00	$0.00			0.00		361000.00	361000.00			0.00
INFN-NA		2159	02-Aug-16	30-Jun-22	$0.00	$2,074,600.00	$2,074,600.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	1886000.00	1886000.00	0.00	0.00	0.00
DS-3116	Leak Test at CERN (travel)	861	02-Aug-16*	10-Dec-18	$0.00	$44,000.00	$44,000.00	$0.00	$0.00	$0.00			0.00		40000.00	40000.00			0.00
DS-180310	TPC & Cryogenics	730	01-Jan-17*	31-Dec-18	$0.00	$185,900.00	$185,900.00	$0.00	$0.00	$0.00			0.00		169000.00	169000.00			0.00
DS-180300	GAP-TPC	1095	01-Jan-17*	31-Dec-19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-180320	FE & DAQ	1095	01-Jan-17*	31-Dec-19	$0.00	$25,300.00	$25,300.00	$0.00	$0.00	$0.00			0.00		23000.00	23000.00			0.00
DS-111500	Motherboard characterization	2007	01-Jan-17*	30-Jun-22	$0.00	$1,040,600.00	$1,040,600.00	$0.00	$0.00	$0.00			0.00		946000.00	946000.00			0.00
DS-180600	Commissioning & operation	822	01-Oct-17*	31-Dec-19	$0.00	$88,000.00	$88,000.00	$0.00	$0.00	$0.00			0.00		80000.00	80000.00			0.00
DS-191000	Integration	669	01-Sep-18*	30-Jun-20	$0.00	$67,100.00	$67,100.00	$0.00	$0.00	$0.00			0.00		61000.00	61000.00			0.00
DS-193000	Calibration Setup	305	01-Jun-19*	31-Mar-20	$0.00	$60,500.00	$60,500.00	$0.00	$0.00	$0.00			0.00		55000.00	55000.00			0.00
DS-194000	Commissioning	366	01-Oct-19*	30-Sep-20	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
DS-195000	Operation	366	01-Jan-20*	31-Dec-20	$0.00	$508,200.00	$508,200.00	$0.00	$0.00	$0.00			0.00		462000.00	462000.00			0.00
INFN-MI		1461	01-Jan-17	31-Dec-20	$0.00	$249,700.00	$249,700.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	227000.00	227000.00	0.00	0.00	0.00
DS-111901	Cabling	1461	01-Jan-17*	31-Dec-20	$0.00	$249,700.00	$249,700.00	$0.00	$0.00	$0.00			0.00		227000.00	227000.00			0.00
LNL		2007	01-Jan-17	30-Jun-22	$0.00	$275,000.00	$275,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	250000.00	250000.00	0.00	0.00	0.00



Remaining Level of Effort | Actual Work | Critical Remaining Work
Actual Level of Effort | Remaining Work ◆ | ◆ Milestone

TASK filter: All Activities

Activity ID	Activity Name	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]	Labor Cost USA [USD]	Non Labor Cost USA [USD]	Total Cost USA [USD]	Labor Cost CAN [CAD]	Non Labor Cost CAN [CAD]	Total Cost CAN [CAD]	Labor Cost EU [EUR]	Non Labor Cost EU [EUR]	Total Cost EU [EUR]	Labor Cost UK [GBP]	Non Labor Cost UK [GBP]	Total Cost UK [GBP]
DS-112100	Motherboard-cleaning	2007	01-Jan-17*	30-Jun-22	$0.00	$275,000.00	$275,000.00	$0.00	$0.00	$0.00			0.00		250000.00	250000.00			0.00
DS-130200	Surface contamination, Handling & Process Development	1096	01-Jan-19*	31-Dec-21	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
INFN-TO		2007	01-Jan-17	30-Jun-22	$0.00	$344,300.00	$344,300.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	313000.00	313000.00	0.00	0.00	0.00
LATER2	Integrated electronics	2007	01-Jan-17*	30-Jun-22	$0.00	$344,300.00	$344,300.00	$0.00	$0.00	$0.00			0.00		313000.00	313000.00			0.00
Alberta		1110	01-Jul-19	14-Jul-22	$630,000.00	$5,530,000.00	$6,160,000.00	$0.00	$0.00	$0.00	900000.00	7900000.00	8800000.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-121980	TPC Acrylic Vessel	183	01-Jul-19*	30-Dec-19	$0.00	$140,000.00	$140,000.00	$0.00	$0.00	$0.00		200000.00	200000.00			0.00			0.00
DS-122580	Vessel (Acrylic)	1110	01-Jul-19*	14-Jul-22	$0.00	$3,080,000.00	$3,080,000.00	$0.00	$0.00	$0.00		4400000.00	4400000.00			0.00			0.00
DS-122600	Acrylic Bonding	1110	01-Jul-19*	14-Jul-22	$0.00	$140,000.00	$140,000.00	$0.00	$0.00	$0.00		200000.00	200000.00			0.00			0.00
DS-122620	Acrylic bonding structure	1110	01-Jul-19*	14-Jul-22	$0.00	$210,000.00	$210,000.00	$0.00	$0.00	$0.00		300000.00	300000.00			0.00			0.00
DS-1226401	Q/A Slow Control Bonding Test	1110	01-Jul-19*	14-Jul-22	$0.00	$105,000.00	$105,000.00	$0.00	$0.00	$0.00		150000.00	150000.00			0.00			0.00
DS-122660	Annealing and control	1110	01-Jul-19*	14-Jul-22	$0.00	$70,000.00	$70,000.00	$0.00	$0.00	$0.00		100000.00	100000.00			0.00			0.00
DS-122680	Vessel Engineering	1110	01-Jul-19*	14-Jul-22	$350,000.00	$0.00	$350,000.00	$0.00	$0.00	$0.00	500000.00		500000.00			0.00			0.00
DS-122700	Vessel Engineer Travel	1110	01-Jul-19*	14-Jul-22	$0.00	$70,000.00	$70,000.00	$0.00	$0.00	$0.00		100000.00	100000.00			0.00			0.00
DS-122720	Contract to RPT/X	1110	01-Jul-19*	14-Jul-22	$0.00	$1,400,000.00	$1,400,000.00	$0.00	$0.00	$0.00		2000000.00	2000000.00			0.00			0.00
DS-122740	TPC Vessel Support	1110	01-Jul-19*	14-Jul-22	$0.00	$105,000.00	$105,000.00	$0.00	$0.00	$0.00		150000.00	150000.00			0.00			0.00
DS-122760	Technician Support	1110	01-Jul-19*	14-Jul-22	$280,000.00	$0.00	$280,000.00	$0.00	$0.00	$0.00	400000.00		400000.00			0.00			0.00
DS-122780	Technician travel	1110	01-Jul-19*	14-Jul-22	$0.00	$70,000.00	$70,000.00	$0.00	$0.00	$0.00		100000.00	100000.00			0.00			0.00
DS-122800	Physiciat Travel	1110	01-Jul-19*	14-Jul-22	$0.00	$70,000.00	$70,000.00	$0.00	$0.00	$0.00		100000.00	100000.00			0.00			0.00
DS-122820	RPT/X for R&D	1110	01-Jul-19*	14-Jul-22	$0.00	$70,000.00	$70,000.00	$0.00	$0.00	$0.00		100000.00	100000.00			0.00			0.00
AstroCeNT		640	30-Sep-19	30-Jun-21	$0.00	$737,600.00	$737,600.00	$0.00	$0.00	$0.00	0.00	400000.00	400000.00	0.00	416000.00	416000.00	0.00	0.00	0.00
DS-153000	Development of VETO Reflectors	275	30-Sep-19*	30-Jun-20	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-154000	Procurement of VETO Reflectors	366	30-Jun-20*	30-Jun-21	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-154001	Procurement of VETO Reflectors - 3M foil	366	30-Jun-20*	30-Jun-21	$0.00	$280,000.00	$280,000.00	$0.00	$0.00	$0.00		400000.00	400000.00			0.00			0.00
DS-154002	Procurement of VETO Reflectors - 3M foil	366	30-Jun-20*	30-Jun-21	$0.00	$89,100.00	$89,100.00	$0.00	$0.00	$0.00			0.00		81000.00	81000.00			0.00
DS-154003	Procurement of VETO Reflectors - 3M foil	366	30-Jun-20*	30-Jun-21	$0.00	$137,500.00	$137,500.00	$0.00	$0.00	$0.00			0.00		125000.00	125000.00			0.00
DS-154004	Procurement of VETO Reflectors - TPB	366	30-Jun-20*	30-Jun-21	$0.00	$82,500.00	$82,500.00	$0.00	$0.00	$0.00			0.00		75000.00	75000.00			0.00
DS-154005	Procurement of VETO Reflectors - TPB	366	30-Jun-20*	30-Jun-21	$0.00	$137,500.00	$137,500.00	$0.00	$0.00	$0.00			0.00		125000.00	125000.00			0.00
BHSU		1736	01-Apr-17	31-Dec-21	$0.00	$90,000.00	$90,000.00	$0.00	$90,000.00	$90,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-130501	Materials Radiopurity Assay - BHSU assays	1736	01-Apr-17*	31-Dec-21	$0.00	$90,000.00	$90,000.00	$0.00	$90,000.00	$90,000.00			0.00			0.00			0.00
BNRU / MSU		1369	01-Jul-18	30-Mar-22	$121,000.00	$209,000.00	$330,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	110000.00	190000.00	300000.00	0.00	0.00	0.00
DS-141005	Sources - 252Cf	1369	01-Jul-18*	30-Mar-22	$11,000.00	$22,000.00	$33,000.00	$0.00	$0.00	$0.00			0.00	10000.00	20000.00	30000.00			0.00
DS-141006	Sources - UV led for VETO calibration	1369	01-Jul-18*	30-Mar-22	$0.00	$22,000.00	$22,000.00	$0.00	$0.00	$0.00			0.00		20000.00	20000.00			0.00
DS-141007	Sources - Pyroelectric neutron generator	1369	01-Jul-18*	30-Mar-22	$110,000.00	$165,000.00	$275,000.00	$0.00	$0.00	$0.00			0.00	100000.00	150000.00	250000.00			0.00
CERN		1178	11-Oct-18	31-Dec-21	$0.00	$6,459,200.00	$6,459,200.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	5872000.00	5872000.00	0.00	0.00	0.00
DS-110100	Warm Structure	614	11-Oct-18*	15-Jun-20	$0.00	$2,299,000.00	$2,299,000.00	$0.00	$0.00	$0.00			0.00		2090000.00	2090000.00			0.00
DS-110200	Cold Cryostat	962	15-May-19*	31-Dec-21	$0.00	$4,160,200.00	$4,160,200.00	$0.00	$0.00	$0.00			0.00		3782000.00	3782000.00			0.00
CIEMAT		2100	01-Apr-17	30-Dec-22	$38,500.00	$566,000.00	$604,500.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	35000.00	30000.00	65000.00	0.00	410000.00	410000.00
DS-130100	Background Budget	1736	01-Apr-17*	31-Dec-21	$38,500.00	$0.00	$38,500.00	$0.00	$0.00	$0.00			0.00	35000.00		35000.00			0.00
DS-130503	Materials Radiopurity Assay - LSC assays	1736	01-Apr-17*	31-Dec-21	$0.00	$325,000.00	$325,000.00	$0.00	$0.00	$0.00			0.00			0.00		250000.00	250000.00
DS-130504	Materials Radiopurity Assay - Radioch. And Mass. Spec.	1736	01-Apr-17*	31-Dec-21	$0.00	$208,000.00	$208,000.00	$0.00	$0.00	$0.00			0.00			0.00		160000.00	160000.00
DS-321	Simulation and sensitivity studies (Inkind)	1	30-Apr-18*	30-Apr-18	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-322	Mechanical drawings with CAD (inkind)	1	01-May-18*	01-May-18	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-323	machining DART (inkind)	1	30-Apr-19*	30-Apr-19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-335	purchases DART integration	31	30-Apr-19*	30-May-19	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-324	cleaning DART (inkind)	31	01-May-19*	31-May-19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-343	travel from CIEMAT to LSC	1250	30-Jul-19*	30-Dec-22	$0.00	$5,500.00	$5,500.00	$0.00	$0.00	$0.00			0.00		5000.00	5000.00			0.00
DS-155001	Developent of VETO electronics - radiopurity	459	30-Sep-19*	31-Dec-20	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-341	Leadstructure and belt installation	31	31-Dec-19*	30-Jan-20	$0.00	$5,500.00	$5,500.00	$0.00	$0.00	$0.00			0.00		5000.00	5000.00			0.00
FNAL		729	01-Jan-18	30-Dec-19	$0.00	$15,000.00	$15,000.00	$0.00	$15,000.00	$15,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-126300	Transfer Lines	729	01-Jan-18*	30-Dec-19	$0.00	$15,000.00	$15,000.00	$0.00	$15,000.00	$15,000.00			0.00			0.00			0.00
Hawaii		1369	01-Jul-18	30-Mar-22	$0.00	$16,500.00	$16,500.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	15000.00	15000.00	0.00	0.00	0.00
DS-141000	Sources	1369	01-Jul-18*	30-Mar-22	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-142000	TPC guide mechanics	1369	01-Jul-18*	30-Mar-22	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-142001	TPC guide mechanics	1369	01-Jul-18*	30-Mar-22	$0.00	$16,500.00	$16,500.00	$0.00	$0.00	$0.00			0.00		15000.00	15000.00			0.00
IHEP		366	30-Mar-20	30-Mar-21	$0.00	$605,000.00	$605,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	550000.00	550000.00	0.00	0.00	0.00
DS-152000	Procurement of the VETO acrylic	366	30-Mar-20*	30-Mar-21	$0.00	$605,000.00	$605,000.00	$0.00	$0.00	$0.00			0.00		550000.00	550000.00			0.00
IN2P3		548	01-Oct-18	31-Mar-20	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-172000	Reconstruction software	548	01-Oct-18*	31-Mar-20	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
INFN-GE		1915	01-Jan-17	30-Mar-22	$0.00	$869,000.00	$869,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	790000.00	790000.00	0.00	0.00	0.00
DS-180330	Slow Control	365	01-Jan-17*	31-Dec-17	$0.00	$15,400.00	$15,400.00	$0.00	$0.00	$0.00			0.00		14000.00	14000.00			0.00
DS-151000	Development of Gd loaded acrylic	639	01-Jul-18*	30-Mar-20	$0.00	$116,600.00	$116,600.00	$0.00	$0.00	$0.00			0.00		106000.00	106000.00			0.00
DS-155000	Developent of VETO electronics	459	30-Sep-19*	31-Dec-20	$0.00	$209,000.00	$209,000.00	$0.00	$0.00	$0.00			0.00		190000.00	190000.00			0.00
DS-156000	VETO Prototype	356	01-Jan-20*	21-Dec-20	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-157000	VETO mechanics	366	01-Jan-20*	31-Dec-20	$0.00	$352,000.00	$352,000.00	$0.00	$0.00	$0.00			0.00		320000.00	320000.00			0.00
DS-158000	VETO installation nad commissioning	182	30-Sep-21*	30-Mar-22	$0.00	$165,000.00	$165,000.00	$0.00	$0.00	$0.00			0.00		150000.00	150000.00			0.00
INFN-Roma1		2099	01-Jan-17	30-Sep-22	$264,000.00	$772,200.00	$1,036,200.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	240000.00	702000.00	942000.00	0.00	0.00	0.00

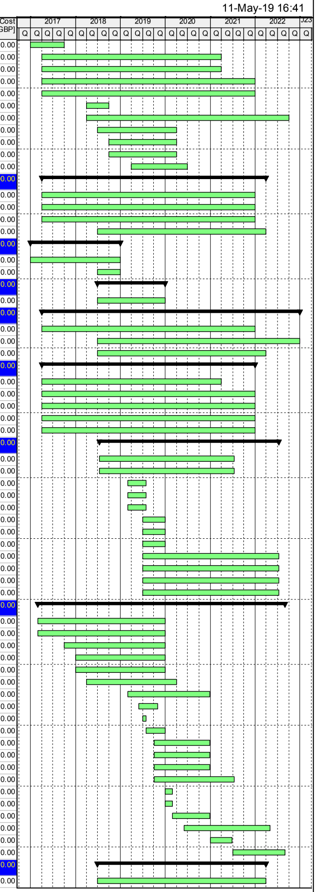


Remaining Level of Effort | Actual Work | Critical Remaining Work
Actual Level of Effort | Remaining Work ◆ | ◆ Milestone

TASK filter: All Activities

DarkSide Current | DS Layout-All Currencies | 11-May-19 16:41

Activity ID	Activity Name	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]	Labor Cost USA [USD]	Non Labor Cost USA [USD]	Total Cost USA [USD]	Labor Cost CAN [CAD]	Non Labor Cost CAN [CAD]	Total Cost CAN [CAD]	Labor Cost EU [EUR]	Non Labor Cost EU [EUR]	Total Cost EU [EUR]	Labor Cost UK [GBP]	Non Labor Cost UK [GBP]	Total Cost UK [GBP]
DS-180500	nToF Spectrometer	273	01-Jan-17*	30-Sep-17	$0.00	$58,300.00	$58,300.00	$0.00	$0.00	$0.00			0.00		53000.00	53000.00			0.00
DS-162000	Trigger	1460	01-Apr-17*	30-Mar-21	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-162002	Trigger - Event builder + Cluster	1460	01-Apr-17*	30-Mar-21	$0.00	$198,000.00	$198,000.00	$0.00	$0.00	$0.00			0.00		180000.00	180000.00			0.00
DS-161001	Readout boards	1736	01-Apr-17*	31-Dec-21	$0.00	$311,300.00	$311,300.00	$0.00	$0.00	$0.00			0.00		283000.00	283000.00			0.00
DS-161004	Readout boards	1736	01-Apr-17*	31-Dec-21	$159,500.00	$0.00	$159,500.00	$0.00	$0.00	$0.00			0.00	145000.00		145000.00			0.00
DS-196000	Cryostat	183	01-Apr-18*	30-Sep-18	$0.00	$72,600.00	$72,600.00	$0.00	$0.00	$0.00			0.00		66000.00	66000.00			0.00
DS-175000	HW CPU and Storage	1644	01-Apr-18*	30-Sep-22	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-171000	SW Package	640	01-Jul-18*	31-Mar-20	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-172001	Reconstruction software	548	01-Oct-18*	31-Mar-20	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-172002	Reconstruction software engineer	548	01-Oct-18*	31-Mar-20	$104,500.00	$0.00	$104,500.00	$0.00	$0.00	$0.00			0.00	95000.00		95000.00			0.00
DS-192000	DAQ	457	01-Apr-19*	30-Jun-20	$0.00	$132,000.00	$132,000.00	$0.00	$0.00	$0.00			0.00		120000.00	120000.00			0.00
Krakow		1825	01-Apr-17	30-Mar-22	$5,500.00	$38,000.00	$43,500.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	5000.00	5000.00	10000.00	0.00	25000.00	25000.00
DS-130500	Materials Radiopurity Assay	1736	01-Apr-17*	31-Dec-21	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-130507	Materials Radiopurity Assay - Large surf. Assay - Krakow	1736	01-Apr-17*	31-Dec-21	$0.00	$19,500.00	$19,500.00	$0.00	$0.00	$0.00			0.00			0.00		15000.00	15000.00
DS-130508	Materials Radiopurity Assay - Pb/Po - Krakow assays	1736	01-Apr-17*	31-Dec-21	$0.00	$13,000.00	$13,000.00	$0.00	$0.00	$0.00			0.00			0.00		10000.00	10000.00
DS-141002	Sources - Gas sources	1369	01-Jul-18*	30-Mar-22	$5,500.00	$5,500.00	$11,000.00	$0.00	$0.00	$0.00			0.00	5000.00	5000.00	10000.00			0.00
LNS		730	01-Jan-17	31-Dec-18	$0.00	$66,000.00	$66,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	60000.00	60000.00	0.00	0.00	0.00
DS-180400	Meutron Beam	730	01-Jan-17*	31-Dec-18	$0.00	$66,000.00	$66,000.00	$0.00	$0.00	$0.00			0.00		60000.00	60000.00			0.00
DS-180100	Simulations & Analysis	184	01-Jul-18*	31-Dec-18	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
LPNHE		549	01-Jul-18	31-Dec-19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-174000	Physics and Analysis Interface	549	01-Jul-18*	31-Dec-19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
Temple		2101	01-Apr-17	31-Dec-22	$249,000.00	$245,000.00	$494,000.00	$249,000.00	$245,000.00	$494,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-130502	Materials Radiopurity Assay - Temple assays	1736	01-Apr-17*	31-Dec-21	$0.00	$60,000.00	$60,000.00	$0.00	$60,000.00	$60,000.00			0.00			0.00			0.00
DS-143000	External deployment system, Photoneutron source and ca	1646	30-Jun-18*	31-Dec-22	$245,000.00	$147,000.00	$392,000.00	$245,000.00	$147,000.00	$392,000.00			0.00			0.00			0.00
DS-141004	Sources - AmC, AmBe, AmLi	1369	01-Jul-18*	30-Mar-22	$4,000.00	$38,000.00	$42,000.00	$4,000.00	$38,000.00	$42,000.00			0.00			0.00			0.00
TRIUMF		1736	01-Apr-17	31-Dec-21	$859,500.00	$2,284,100.00	$3,143,600.00	$0.00	$0.00	$0.00	1000000.00	3263000.00	4263000.00	145000.00	0.00	145000.00	0.00	0.00	0.00
DS-162001	Trigger - clock distribution	1460	01-Apr-17*	30-Mar-21	$0.00	$87,500.00	$87,500.00	$0.00	$0.00	$0.00		125000.00	125000.00			0.00			0.00
DS-161000	Readout	1736	01-Apr-17*	31-Dec-21	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-161002	Readout boards	1736	01-Apr-17*	31-Dec-21	$0.00	$1,566,600.00	$1,566,600.00	$0.00	$0.00	$0.00		2238000.00	2238000.00			0.00			0.00
DS-161003	Readout boards	1736	01-Apr-17*	31-Dec-21	$700,000.00	$0.00	$700,000.00	$0.00	$0.00	$0.00	1000000.00		1000000.00			0.00			0.00
DS-161005	Readout boards for veto	1736	01-Apr-17*	31-Dec-21	$159,500.00	$630,000.00	$789,500.00	$0.00	$0.00	$0.00		900000.00	900000.00	145000.00		145000.00			0.00
UC Davis		1461	15-Jul-18	14-Jul-22	$276,900.00	$548,800.00	$825,700.00	$276,900.00	$548,800.00	$825,700.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-124880	HV System Procurement	1096	15-Jul-18*	14-Jul-21	$0.00	$183,600.00	$183,600.00	$0.00	$183,600.00	$183,600.00			0.00			0.00			0.00
DS-124900	HV System Labor	1096	15-Jul-18*	14-Jul-21	$92,300.00	$0.00	$92,300.00	$92,300.00	$0.00	$92,300.00			0.00			0.00			0.00
DS-120640	Field Cage	153	01-Mar-19*	31-Jul-19	$0.00	$7,000.00	$7,000.00	$0.00	$7,000.00	$7,000.00			0.00			0.00			0.00
DS-120660	Reflector Cage	153	01-Mar-19*	31-Jul-19	$0.00	$5,000.00	$5,000.00	$0.00	$5,000.00	$5,000.00			0.00			0.00			0.00
DS-120680	HV System	153	01-Mar-19*	31-Jul-19	$0.00	$5,000.00	$5,000.00	$0.00	$5,000.00	$5,000.00			0.00			0.00			0.00
DS-122640	Field Cage	183	01-Jul-19*	30-Dec-19	$0.00	$22,000.00	$22,000.00	$0.00	$22,000.00	$22,000.00			0.00			0.00			0.00
DS-123300	Reflector Cage	183	01-Jul-19*	30-Dec-19	$0.00	$17,000.00	$17,000.00	$0.00	$17,000.00	$17,000.00			0.00			0.00			0.00
DS-123960	HV System	183	01-Jul-19*	30-Dec-19	$0.00	$76,000.00	$76,000.00	$0.00	$76,000.00	$76,000.00			0.00			0.00			0.00
DS-123500	Field Cage	1110	01-Jul-19*	14-Jul-22	$0.00	$119,600.00	$119,600.00	$0.00	$119,600.00	$119,600.00			0.00			0.00			0.00
DS-123501	Field Cage Labor	1110	01-Jul-19*	14-Jul-22	$92,300.00	$0.00	$92,300.00	$92,300.00	$0.00	$92,300.00			0.00			0.00			0.00
DS-123800	Reflector Cage	1110	01-Jul-19*	14-Jul-22	$0.00	$113,600.00	$113,600.00	$0.00	$113,600.00	$113,600.00			0.00			0.00			0.00
DS-123801	Reflector Cage Labor	1110	01-Jul-19*	14-Jul-22	$92,300.00	$0.00	$92,300.00	$92,300.00	$0.00	$92,300.00			0.00			0.00			0.00
UCLA		2009	01-Mar-17	30-Aug-22	$0.00	$4,044,000.00	$4,044,000.00	$0.00	$1,492,000.00	$1,492,000.00	0.00	0.00	0.00	0.00	2320000.00	2320000.00	0.00	0.00	0.00
DS-125680	Condenser Box	1035	01-Mar-17*	30-Dec-19	$0.00	$72,000.00	$72,000.00	$0.00	$72,000.00	$72,000.00			0.00			0.00			0.00
DS-126600	Integrated Radon Trap	1035	01-Mar-17*	30-Dec-19	$0.00	$165,000.00	$165,000.00	$0.00	$165,000.00	$165,000.00			0.00			0.00			0.00
DS-125880	Gas Circulation Pump	821	01-Oct-17*	30-Dec-19	$0.00	$50,000.00	$50,000.00	$0.00	$50,000.00	$50,000.00			0.00			0.00			0.00
DS-126120	Gas Panel	729	01-Jan-18*	30-Dec-19	$0.00	$101,000.00	$101,000.00	$0.00	$101,000.00	$101,000.00			0.00			0.00			0.00
DS-126460	Slow Control	729	01-Jan-18*	30-Dec-19	$0.00	$10,000.00	$10,000.00	$0.00	$10,000.00	$10,000.00			0.00			0.00			0.00
DS-197000	Cryogenics	731	01-Apr-18*	31-Mar-20	$0.00	$584,000.00	$584,000.00	$0.00	$584,000.00	$584,000.00			0.00			0.00			0.00
DS-127200	DarkSide-Prototype Cryogenics System	671	01-Mar-19*	30-Dec-20	$0.00	$50,000.00	$50,000.00	$0.00	$50,000.00	$50,000.00			0.00			0.00			0.00
DS-120720	TPC integration at CERN	152	01-Jun-19*	30-Oct-19	$0.00	$13,000.00	$13,000.00	$0.00	$13,000.00	$13,000.00			0.00			0.00			0.00
DS-126480	Test System Integration at CERN	30	01-Jul-19*	30-Jul-19	$0.00	$5,000.00	$5,000.00	$0.00	$5,000.00	$5,000.00			0.00			0.00			0.00
DS-126500	Test at CERN	152	01-Aug-19*	30-Dec-19	$0.00	$2,000.00	$2,000.00	$0.00	$2,000.00	$2,000.00			0.00			0.00			0.00
DS-126980	Final Gas circulation pump	457	01-Oct-19*	30-Dec-20	$0.00	$235,000.00	$235,000.00	$0.00	$235,000.00	$235,000.00			0.00			0.00			0.00
DS-127060	Final gas panel and piping	457	01-Oct-19*	30-Dec-20	$0.00	$55,000.00	$55,000.00	$0.00	$55,000.00	$55,000.00			0.00			0.00			0.00
DS-127100	Final transfer line	457	01-Oct-19*	30-Dec-20	$0.00	$35,000.00	$35,000.00	$0.00	$35,000.00	$35,000.00			0.00			0.00			0.00
DS-124460	Internal Argon Loop Planning and Testing Procurement	653	01-Oct-19*	14-Jul-21	$0.00	$30,000.00	$30,000.00	$0.00	$30,000.00	$30,000.00			0.00			0.00			0.00
DS-126800	Transportation to LNGS	58	01-Jan-20*	27-Feb-20	$0.00	$20,000.00	$20,000.00	$0.00	$20,000.00	$20,000.00			0.00			0.00			0.00
DS-126900	Internal surface treatment requirement and procedure for	58	01-Jan-20*	27-Feb-20	$0.00	$5,000.00	$5,000.00	$0.00	$5,000.00	$5,000.00			0.00			0.00			0.00
DS-126920	Final Condenser Box	305	01-Mar-20*	30-Dec-20	$0.00	$30,000.00	$30,000.00	$0.00	$30,000.00	$30,000.00			0.00			0.00			0.00
DS-110300	Cryogenics System	698	01-Jun-20*	29-Apr-22	$0.00	$2,552,000.00	$2,552,000.00	$0.00	$0.00	$0.00			0.00		2320000.00	2320000.00			0.00
DS-127140	Integration at LNGS	181	31-Dec-20*	29-Jun-21	$0.00	$20,000.00	$20,000.00	$0.00	$20,000.00	$20,000.00			0.00			0.00			0.00
DS-127160	Test and commissioning	426	01-Jul-21*	30-Aug-22	$0.00	$10,000.00	$10,000.00	$0.00	$10,000.00	$10,000.00			0.00			0.00			0.00
Virginia Tech.		1369	01-Jul-18	30-Mar-22	$5,000.00	$30,000.00	$35,000.00	$5,000.00	$30,000.00	$35,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-141003	Sources - ?-ray	1369	01-Jul-18*	30-Mar-22	$5,000.00	$30,000.00	$35,000.00	$5,000.00	$30,000.00	$35,000.00			0.00			0.00			0.00

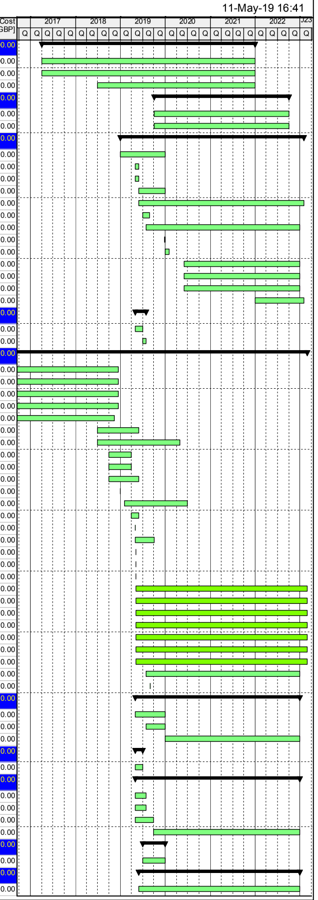


Remaining Level of Effort | Actual Work | Critical Remaining Work
Actual Level of Effort | Remaining Work ◆ | ◆ Milestone

TASK filter: All Activities

DarkSide Current — DS Layout-All Currencies — 11-May-19 16:41

Activity ID	Activity Name	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]	Labor Cost USA [USD]	Non Labor Cost USA [USD]	Total Cost USA [USD]	Labor Cost CAN [CAD]	Non Labor Cost CAN [CAD]	Total Cost CAN [CAD]	Labor Cost EU [EUR]	Non Labor Cost EU [EUR]	Total Cost EU [EUR]	Labor Cost UK [GBP]	Non Labor Cost UK [GBP]	Total Cost UK [GBP]
Zaragoza Univ.		1736	01-Apr-17	31-Dec-21	$0.00	$274,300.00	$274,300.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	211000.00	211000.00
DS-130505	Materials Radiopurity Assay - Radioc. And Mass. Spec. -	1736	01-Apr-17*	31-Dec-21	$0.00	$208,000.00	$208,000.00	$0.00	$0.00	$0.00			0.00			0.00		160000.00	160000.00
DS-130506	Materials Radiopurity Assay - Large surf. Assay - LSC as	1736	01-Apr-17*	31-Dec-21	$0.00	$66,300.00	$66,300.00	$0.00	$0.00	$0.00			0.00			0.00		51000.00	51000.00
DS-130400	Cosmogenic & Intrinsic Activity	1280	01-Jul-18*	31-Dec-21	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
Bologna		1096	01-Oct-19	30-Sep-22	$0.00	$4,015,000.00	$4,015,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	3650000.00	3650000.00	0.00	0.00	0.00
DS-503000	Silicon packaging equipments	1096	01-Oct-19*	30-Sep-22	$0.00	$3,795,000.00	$3,795,000.00	$0.00	$0.00	$0.00			0.00		3450000.00	3450000.00			0.00
DS-503001	Silicon packaging equipments	1096	01-Oct-19*	30-Sep-22	$0.00	$220,000.00	$220,000.00	$0.00	$0.00	$0.00			0.00		200000.00	200000.00			0.00
CA		1492	01-Jan-19	31-Jan-23	$550,000.00	$2,539,900.00	$3,089,900.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	500000.00	2309000.00	2809000.00	0.00	0.00	0.00
DS-3142	Energy and Maintenance for Seruci-0	365	01-Jan-19*	31-Dec-19	$0.00	$220,000.00	$220,000.00	$0.00	$0.00	$0.00			0.00		200000.00	200000.00			0.00
DS-331	Cryogenics and gas system DART	31	30-Apr-19*	30-May-19	$0.00	$132,000.00	$132,000.00	$0.00	$0.00	$0.00			0.00		120000.00	120000.00			0.00
DS-334	purchases DART integration	31	30-Apr-19*	30-May-19	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-3141	Installation Commissioning & Running Seruci-0	214	01-Jun-19*	31-Dec-19	$0.00	$110,000.00	$110,000.00	$0.00	$0.00	$0.00			0.00		100000.00	100000.00			0.00
DS-3148	Personnel on Shift	1341	01-Jun-19	31-Jan-23	$550,000.00	$0.00	$550,000.00	$0.00	$0.00	$0.00			0.00	500000.00		500000.00			0.00
DS-336	travel from INFN DART integration	57	02-Jul-19*	27-Aug-19	$0.00	$11,000.00	$11,000.00	$0.00	$0.00	$0.00			0.00		10000.00	10000.00			0.00
DS-344	travel from INFN TO LSC	1250	30-Jul-19*	30-Dec-22	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
DS-337	Transportation to LSC DART	6	23-Dec-19*	29-Dec-19	$0.00	$13,200.00	$13,200.00	$0.00	$0.00	$0.00			0.00		12000.00	12000.00			0.00
DS-347	argon shipping from DS50	32	30-Dec-19*	30-Jan-20	$0.00	$2,200.00	$2,200.00	$0.00	$0.00	$0.00			0.00		2000.00	2000.00			0.00
DS-3143	Commissioning & Running Seruci-1	944	01-Jun-20*	31-Dec-22	$0.00	$335,500.00	$335,500.00	$0.00	$0.00	$0.00			0.00		305000.00	305000.00			0.00
DS-3145	Energy and Maintenance for Seruci-1 purification mode	944	01-Jun-20*	31-Dec-22	$0.00	$1,320,000.00	$1,320,000.00	$0.00	$0.00	$0.00			0.00		1200000.00	1200000.00			0.00
DS-3146	Waste disposal	944	01-Jun-20*	31-Dec-22	$0.00	$110,000.00	$110,000.00	$0.00	$0.00	$0.00			0.00		100000.00	100000.00			0.00
DS-3147	Shipping from Seruci to LNGS	396	01-Jan-22*	31-Jan-23	$0.00	$220,000.00	$220,000.00	$0.00	$0.00	$0.00			0.00		200000.00	200000.00			0.00
ETHZ		92	30-Apr-19	30-Jul-19	$0.00	$38,500.00	$38,500.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	35000.00	35000.00	0.00	0.00	0.00
DS-333	new single phase setup design and assembly ArDM	62	30-Apr-19*	30-Jun-19	$0.00	$38,500.00	$38,500.00	$0.00	$0.00	$0.00			0.00		35000.00	35000.00			0.00
DS-332	infrastructure update at LSC (inkind)	31	30-Jun-19*	30-Jul-19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
INFN-CA		2585	01-Feb-16	28-Feb-23	$835,507.20	$7,303,472.00	$8,138,979.20	$0.00	$0.00	$0.00	0.00	0.00	0.00	759552.00	6639520.00	7399072.00	0.00	0.00	0.00
DS-3111	Column Sections Construction	1049	01-Feb-16*	15-Dec-18	$0.00	$4,290,000.00	$4,290,000.00	$0.00	$0.00	$0.00			0.00		3900000.00	3900000.00			0.00
DS-3112	Column Sections Construction	1049	01-Feb-16*	15-Dec-18	$0.00	$880,000.00	$880,000.00	$0.00	$0.00	$0.00			0.00		800000.00	800000.00			0.00
DS-3113	Column Sections Construction	1049	01-Feb-16*	15-Dec-18	$0.00	$503,518.40	$503,518.40	$0.00	$0.00	$0.00			0.00		457744.00	457744.00			0.00
DS-3134	Column Construction	1049	01-Feb-16*	15-Dec-18	$0.00	$481,553.60	$481,553.60	$0.00	$0.00	$0.00			0.00		437776.00	437776.00			0.00
DS-3115	Leak Test at Polaris (travel)	837	01-Aug-16*	15-Nov-18	$0.00	$35,200.00	$35,200.00	$0.00	$0.00	$0.00			0.00		32000.00	32000.00			0.00
DS-3128	Electrical and Vacuum Components	335	01-Jul-18*	31-May-19	$0.00	$31,900.00	$31,900.00	$0.00	$0.00	$0.00			0.00		29000.00	29000.00			0.00
DS-31281	Electrical and Vacuum Components 2	670	01-Jul-18*	30-Apr-20	$0.00	$33,000.00	$33,000.00	$0.00	$0.00	$0.00			0.00		30000.00	30000.00			0.00
DS-3122	Nitrogen Storage for Seruci-0	183	30-Sep-18*	31-Mar-19	$0.00	$44,000.00	$44,000.00	$0.00	$0.00	$0.00			0.00		40000.00	40000.00			0.00
DS-3126	Water Cooling System for Seruci-0	183	30-Sep-18*	31-Mar-19	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
DS-3125	Chiller	243	01-Oct-18*	31-May-19	$0.00	$47,300.00	$47,300.00	$0.00	$0.00	$0.00			0.00		43000.00	43000.00			0.00
DS-3117	Leak Test at CERN (measurement)	1	31-Dec-18*	31-Dec-18	$0.00	$67,100.00	$67,100.00	$0.00	$0.00	$0.00			0.00		61000.00	61000.00			0.00
DS-3124	Engineering and Review	516	01-Feb-19*	30-Jun-20	$0.00	$88,000.00	$88,000.00	$0.00	$0.00	$0.00			0.00		80000.00	80000.00			0.00
DS-3123	Service Gas for Installation	61	01-Apr-19*	31-May-19	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
DS-3127	Leak Detector	5	30-Apr-19*	04-May-19	$0.00	$44,000.00	$44,000.00	$0.00	$0.00	$0.00			0.00		40000.00	40000.00			0.00
DS-3129	Residual Gas Analyzer	154	01-May-19*	01-Oct-19	$0.00	$134,200.00	$134,200.00	$0.00	$0.00	$0.00			0.00		122000.00	122000.00			0.00
A1050	Personnel Spent	1	07-May-19*	07-May-19	$34,100.00	$0.00	$34,100.00	$0.00	$0.00	$0.00			0.00	31000.00		31000.00			0.00
A1060	Personnel Spent	1	07-May-19*	07-May-19	$46,481.60	$0.00	$46,481.60	$0.00	$0.00	$0.00			0.00	42256.00		42256.00			0.00
A1070	Personner spent	1	07-May-19*	07-May-19	$39,925.60	$0.00	$39,925.60	$0.00	$0.00	$0.00			0.00	36296.00		36296.00			0.00
A1010	Travel	1394	07-May-19*	28-Feb-23	$0.00	$18,700.00	$18,700.00	$0.00	$0.00	$0.00			0.00		17000.00	17000.00			0.00
A1020	Travel	1394	07-May-19*	28-Feb-23	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
A1030	Travel	1394	07-May-19*	28-Feb-23	$0.00	$67,100.00	$67,100.00	$0.00	$0.00	$0.00			0.00		61000.00	61000.00			0.00
A1040	Travel	1394	07-May-19*	28-Feb-23	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00
A1080	Personnel	1394	07-May-19*	28-Feb-23	$165,000.00	$0.00	$165,000.00	$0.00	$0.00	$0.00			0.00	150000.00		150000.00			0.00
A1090	Personnel RAS4	1394	07-May-19*	28-Feb-23	$550,000.00	$0.00	$550,000.00	$0.00	$0.00	$0.00			0.00	500000.00		500000.00			0.00
A1100	Safety	1394	07-May-19*	28-Feb-23	$0.00	$110,000.00	$110,000.00	$0.00	$0.00	$0.00			0.00		100000.00	100000.00			0.00
DS-345	argon shipping from Aria	1250	30-Jul-19*	30-Dec-22	$0.00	$8,800.00	$8,800.00	$0.00	$0.00	$0.00			0.00		8000.00	8000.00			0.00
DS-3133	Cryogenic Trasnfer Lines for Seruci-1	1	01-Sep-19*	01-Sep-19	$0.00	$199,100.00	$199,100.00	$0.00	$0.00	$0.00			0.00		181000.00	181000.00			0.00
LSC		1341	30-Apr-19	30-Dec-22	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DS-340	Lead purchase inkind	245	30-Apr-19*	30-Dec-19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-346	Inkind operation electricity costs and atmospheric argon v	154	30-Jul-19*	30-Dec-19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-348	Inkind operation electricity costs and atmospheric argon	1097	30-Dec-19*	30-Dec-22	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
UNICA		62	30-Apr-19	30-Jun-19	$0.00	$16,500.00	$16,500.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	15000.00	15000.00	0.00	0.00	0.00
DS-325	Slow Control DART	62	30-Apr-19*	30-Jun-19	$0.00	$16,500.00	$16,500.00	$0.00	$0.00	$0.00			0.00		15000.00	15000.00			0.00
UZ		1341	30-Apr-19	30-Dec-22	$0.00	$152,900.00	$152,900.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	139000.00	139000.00	0.00	0.00	0.00
DS-338	trigger integration	92	30-Apr-19*	30-Jul-19	$0.00	$5,500.00	$5,500.00	$0.00	$0.00	$0.00			0.00		5000.00	5000.00			0.00
DS-339	DAQ integration	92	30-Apr-19*	30-Jul-19	$0.00	$37,400.00	$37,400.00	$0.00	$0.00	$0.00			0.00		34000.00	34000.00			0.00
DS-349	Feasibility study Gas Detector Proposal (inkind)	154	30-Apr-19*	30-Sep-19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-350	Construction and operation Gas Detector Proposal	1188	30-Sep-19*	30-Dec-22	$0.00	$110,000.00	$110,000.00	$0.00	$0.00	$0.00			0.00		100000.00	100000.00			0.00
Rome1		183	01-Jul-19	30-Dec-19	$0.00	$165,000.00	$165,000.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	150000.00	150000.00	0.00	0.00	0.00
DS-121320	Prototype TPC Components	183	01-Jul-19*	30-Dec-19	$0.00	$165,000.00	$165,000.00	$0.00	$0.00	$0.00			0.00		150000.00	150000.00			0.00
No DS_Institution		895	01-Jun-19	31-Dec-22	$0.00	$363,000.00	$363,000.00	$0.00	$0.00	$0.00	0.00	440000.00	440000.00	0.00	50000.00	50000.00	0.00	0.00	0.00
DS-3144	argon storage facilities at Seruci	1310	01-Jun-19*	31-Dec-22	$0.00	$55,000.00	$55,000.00	$0.00	$0.00	$0.00			0.00		50000.00	50000.00			0.00

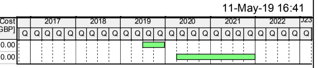


Remaining Level of Effort — Actual Level of Effort — Actual Work — Remaining Work — Critical Remaining Work — ◆ Milestone

TASK filter: All Activities

DarkSide Current | DS Layout-All Currencies | 11-May-19 16:41

Activity ID	Activity Name	Original Duration	Start	Finish	Global Labor Cost [USD]	Global Non Labor Cost [USD]	Global Total Cost [USD]	Labor Cost USA [USD]	Non Labor Cost USA [USD]	Total Cost USA [USD]	Labor Cost CAN [CAD]	Non Labor Cost CAN [CAD]	Total Cost CAN [CAD]	Labor Cost EU [EUR]	Non Labor Cost EU [EUR]	Total Cost EU [EUR]	Labor Cost UK [GBP]	Non Labor Cost UK [GBP]	Total Cost UK [GBP]
DS-3331	DART Integration and tests	119	02-Jul-19*	23-Dec-19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00			0.00			0.00			0.00
DS-164000	Infrastructure and Power supply	640	01-Apr-20*	31-Dec-21	$0.00	$308,000.00	$308,000.00	$0.00	$0.00	$0.00		440000.00	440000.00			0.00			0.00



Remaining Level of Effort
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone

TASK filter: All Activities

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