

Proposal to

## **Extreme Light Infrastructure ERIC (ELI ERIC)**

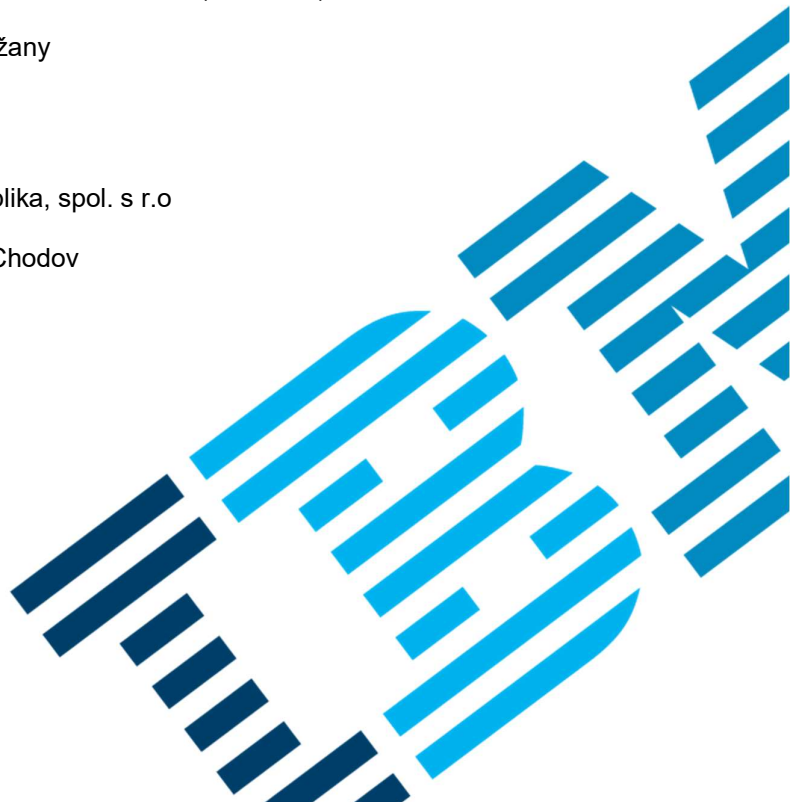
for

### **Pilot of confirmation hypothesis – How to manage scientific facility using analytical data**

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Prepared for: Extreme Light Infrastructure ERIC (ELI ERIC)  
Za Radnicí 835  
252 41 Dolní Břežany  
Czech Republic  
Contact person: Roman Kuřátko

Submitted by: IBM Česká republika, spol. s r.o.  
V parku 2294/4  
148 00 Praha 4 Chodov  
Contact person: Michal Tesař



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Neither party will have any liability or obligation to the other based on this proposal. Any such liability or obligation will become binding upon the parties only to the extent it is included in a final written agreement signed by both parties.

Final pricing is contingent upon the validation of all baseline information and assumptions presented in this document.

Any IBM Česká republika, spol. s r.o. deliveries will be based on **Client Relationship Agreement, version 08-2023** which is attached and can be found at <https://www.ibm.com/support/customer/csol/terms/?ref=Z126-6548-11-08-2023-cz-en>.

Any differing commercial terms are hereby expressly rejected by IBM.

#### GDPR:

a. By issuing the Purchase Order/ signing the Agreement based on this Proposal the Client represents and warrants, under its own responsibility, that no Personal Data subject to the Act No. 110/2019 Coll., on the personal data processing and the Regulation (EU) 2016/679 of the European Parliament and of the Council on the protection of natural persons with regard to the processing of personal data and on the free movement of such data and repealing Directive 95/46/EC („GDPR”) are or will be processed by IBM as a Processor on behalf of the Client as part of the Service provision.

b. The Client shall communicate to IBM in writing, without undue delay, any anticipated change affecting Client's representation and warranty in Section a. above. The parties then agree to enter into a data processing agreement, which shall amend the Agreement/Purchase Order, as is reasonably required (1) to reflect their obligations and risks under the GDPR and (2) for IBM to provide the Services in a manner that allows Client and IBM to comply with their respective obligations under the GDPR prior to the change affecting Client's representation and warranty in Section a., above.

c. The Client agrees to assist IBM in any request or procedure by a national data protection supervisory authority, or in any lawsuit, relating to the processing of any Personal Data covered by the representation and warranty in Section a., above.

**This proposal is valid for 90 days from its submission.**

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# 1 Management Summary

## 1.1 Our understanding of your goals for smart monitoring and control system

This project aims to implement a pilot (proof of concept) for an integrated smart room monitoring and control system leveraging IBM's environment with (BBT) integration. It is important to emphasize that this initial implementation is strictly a proof of concept and not a production-ready solution. The primary purpose is to confirm or disprove the hypothesis presented by IBM, which should subsequently lead to a comprehensive building management concept.

During Phase 0, we will test our approach by identifying and documenting appropriate room sensors and control systems for the feasibility study. We will provision a dedicated IBM environment for BBT with VPN access, but this will be configured specifically for testing purposes and not designed for full-scale deployment.

The project will establish MQTT connectivity and protocol setup to test communication capabilities between sensors and systems. We will develop both a data ingestion pipeline for BBT to collect sensor data and a control pipeline from BBT to room controls, allowing us to verify the bidirectional communication concept.

Initial connectivity tests will be performed to validate our approach and identify potential technical challenges or limitations. We will also begin persisting room data for future analytics to demonstrate the potential value of historical data analysis.

The results from this pilot will be thoroughly evaluated to determine whether the proposed solution is viable and scalable. Based on these findings, we will either confirm or disprove IBM's hypothesis, informing the development of a comprehensive building management concept that could be implemented in a future production environment.

This exploratory phase is crucial for reducing risk before any significant investment in a full production implementation, allowing us to identify technical hurdles, refine requirements, and validate the expected benefits of the proposed system.

- Having large facility with lot of rooms, experiments and devices leads to generation of vast amount of IoT data.
- There are several applications how to leverage such data to increase quality of experiments and reduce costs of operations and maintenance.
- We decided to focus on one specific use case:
  - Predictive control to optimally target room temperature and humidity

## 1.2 Our solution

This pilot aims to implement an integrated smart room monitoring and control system leveraging IBM's environment with other (BBT) integration. The project will establish a complete data pipeline from room sensors to analytics platform, enabling both monitoring and control capabilities.

The project begins with identifying and documenting appropriate room sensors and control systems for the feasibility study. These sensors will monitor various room parameters such as temperature, humidity, occupancy, and other environmental factors.

We will provision a dedicated IBM environment for BBT implementation with secured VPN access to ensure proper system security and accessibility for authorized personnel. This environment will serve as the central processing hub for all sensor data and control commands.

A critical technical component involves establishing MQTT connectivity and configuring the protocol setup. MQTT (Message Queuing Telemetry Transport) will serve as the lightweight messaging protocol for sensor communications, enabling efficient data transfer from multiple sensors to the central system.

The data flow will be managed through two primary pipelines: a data ingestion pipeline bringing sensor information from the room environment into the BBT system, and a control pipeline sending commands from BBT back to the room control systems. These bidirectional pipelines will enable both monitoring and active control of room conditions.

Initial connectivity tests will validate the end-to-end system functionality, ensuring reliable communication between all components – from sensors to the IBM environment and back to control systems.

The final phase includes implementing persistent data storage for room metrics, enabling future analytics capabilities. This historical data repository will support advanced analytics for pattern recognition, predictive maintenance, optimization of room conditions, and potential energy savings.

#### Analytical approach

- 1) Train initial model on room historical data
- 2) Based on past 2 hours, predict temperature for next 60 minutes
- 3) Set target temperature and humidity
- 4) Generate optimal control schedule for every minute of next 60 minutes satisfying prescribed constraints and minimizing the temperature and humidity converge gap (difference between target and projected by control)
- 5) After 15 minutes start with 2) again

## 1.3 Our value

This pilot project for an integrated smart room monitoring and control system will deliver significant added value for the client beyond basic technical validation. The client will receive comprehensive insights and strategic recommendations through some deliverables.

The feasibility study will include a thorough analytical approach, presenting not just technical findings, but meaningful business insights derived from the collected data. This analysis will help the client understand the potential operational efficiencies, cost savings, and environmental benefits that could be achieved through a full implementation. The whole comprehensive environment and compute capacity will be hosted on IBM dedicated environment simulated on-premise devices.

Our team will compare all iterations of the system configuration throughout the pilot, measuring and documenting performance gains with each adjustment. This iterative approach will demonstrate how different sensor placements, sampling rates, or control algorithms impact system effectiveness and efficiency. The client will gain visibility into which specific configurations deliver optimal performance for their particular environment and requirements.

At the conclusion of the pilot, we will define clear feasibility study conclusions that address both technical viability and business value.

We will document all findings and develop detailed recommendations for Phase 1 implementation should the client decide to proceed. These recommendations will outline the optimal system architecture, required components, integration points with existing building systems, resource requirements, and implementation timeline.

Finally, the client will receive a comprehensive whitepaper that captures all aspects of the pilot project. This document will serve as both a record of the proof of concept and a strategic roadmap for future smart building initiatives. The whitepaper will include executive summaries appropriate for different stakeholder groups, allowing the client to easily communicate the value and findings across their organization.

This pilot project is designed not simply as a technical exercise, but as a strategic initiative to help the client validate IBM's building management hypothesis and make informed decisions about future investments in smart building technology.

## 1.4 Why choose IBM?

With extensive experience in solving complex, multidisciplinary challenges, we have successfully led and contributed to projects covering IT, IoT, electrical systems, control systems and customized customer solutions. During our collaboration with MONITORE SE, we worked closely together to prepare and understand and solve complex technical problems, including the control and maintenance of critical parameters in highly specialized environments. Our expertise was essential in transferring knowledge, designing innovative solutions such as digital twin technology, and developing a functional DEMO box for simulating and validating the proposed systems. This practical experience demonstrates the team's ability to combine technical expertise with practical, client-focused results and ensure the delivery of feasible and effective solutions for unique and challenging projects.

In the preparatory phase (Phase -1), during our analysis, we prepared a concept that we can currently verify and during the PoC, ensure the confirmation or rejection of this hypothesis as a possible facility command and control solution.

## 2 Company information – IBM Česká republika, spol. s r.o.

<b>Commercial name of the company</b>	IBM Česká republika, spol. s r.o
<b>Head office</b>	V parku 2294/4, 148 00 Praha 4 Chodov
<b>Registered with</b>	Municipal Court in Prague, section C, insert No. 692
<b>Legal status</b>	Limited liability company
<b>Statutory representatives</b>	Ing. Petr Havlík, Executive Officer Miroslav Petrřa, Executive Officer Ing. Lukáš Kubelka, Executive Officer
<b>Company Registration Number (IČO)</b>	14890992
<b>VAT Registration Number (DIČ)</b>	CZ14890992
<b>Bank account</b>	Raiffeisenbank a.s., account Nr. 1001042725/5500
<b>Telephone</b>	+420 272 131 111
<b>E-mail</b>	infocz@cz.ibm.com

Your contact in IBM:

<b>IBM representative</b>	Michal Tesař
<b>Telephone</b>	+420 731 435 603
<b>E-mail</b>	<a href="mailto:michal.tesar@cz.ibm.com">michal.tesar@cz.ibm.com</a>

## 3 Company Profile

### 3.1 About IBM

IBM was established under a name C-T-R in the US in 1911. Company accepted its present name of **International Business Machines** (IBM) in 1924, as it expanded to Canada and Europe.

As a globally integrated enterprise, IBM operates in more than 175 countries and is continuing to shift our business to the higher value segments of enterprise IT. Our global workforce is highly skilled, reflective of the work we do for our clients' digital transformations and in support of their mission-critical operations.

Our global workforce includes developers, consultants, client delivery and services specialists, research scientists and others. Our employees are among the world's leading experts in cloud, AI, quantum computing, cybersecurity and industry-specific solutions.

In November 2021, we took an important step with the spin-off of our managed infrastructure services business, now known as Kyndryl.

World-wide yearly turnover of IBM

- in 2022 amounted to \$ 60,530 billion
- in 2023 amounted to \$ 61,860 billion
- in 2024 amounted to \$ 62,753 billion

Number of IBM's staff World-Wide (wholly owned subsidiaries)

- in 2022: 288 300 employees
- in 2023: 282 200 employees
- in 2024: 270 300 employees

In Czechoslovakia, IBM was established in 1932 for the first time as the sixth branch in Europe. In 1948, it was nationalized. In 1979, the company founded a commerce representation in Prague, which became the twentieth IBM company in Europe under name IBM ČSFR, spol. s r.o. on 25th January 1991.

IBM Česká republika, společnost s ručením omezeným (limited liability company), was founded in early 1993 through a split of the IBM ČSFR, spol. s r.o.

The shareholder of IBM Česká republika, spol. s r.o. is IBM Central and Eastern Europe B.V. with its seat in Amsterdam, the Netherlands, with a business share of 100 %.

**Detailed financial and other information about IBM can be found at [www.ibm.com](http://www.ibm.com), annual reports at <http://www.ibm.com/annualreport/>.**

Our platform-centric hybrid cloud and AI strategy is executed through our operations and consists of four business segments: **Software, Consulting, Infrastructure and Financing** – please see information below.



## 3.2 IBM business segments and capabilities

### 3.2.1 Software

Software provides software solutions that address client needs for a hybrid cloud platform, data and AI, automation, and security on their journey to hybrid cloud. It includes all software, except operating system software reported in the Infrastructure segment.

Software comprises two business areas – Hybrid Platform & Solutions and Transaction Processing, which have the following capabilities:

**Hybrid Platform & Solutions:** includes software, infused with AI, to help clients operate, manage, and optimize their IT resources and business processes within hybrid, multi-cloud environments. It includes the following:

**Red Hat:** provides enterprise open-source solutions, for hybrid, multi-cloud environments, which includes Red Hat Enterprise Linux (RHEL), OpenShift, our hybrid cloud platform, as well as Ansible

**Automation:** optimizes processes from business workflows to IT operations with AI-powered automation. Automation includes software for business automation, IT automation, integration, and application runtimes.

**Data & AI:** accelerates data-driven agendas by infusing AI throughout the enterprise, empowering intelligent decision making. The portfolio includes capabilities that simplify data consumption through data fabric with data management, optimize lifecycle management, and make better predictions through business analytics. Data & AI capabilities facilitate sustainable, resilient businesses and enable intelligent management of enterprise assets and supply chains with environmental intelligence.

**Security:** creates a risk-aware, secure business by gaining real-time threat insights, orchestrating actions and automating responses across all touchpoints, in line with a zero-trust security strategy. Security includes software for data security, identity and access management, and threat management.

**Transaction Processing:** supports clients' mission-critical, on-premise workloads in industries such as banking, airlines and retail. This includes transaction processing software such as Customer Information Control System and storage software, as well as the analytics and integration software running on IBM operating systems such as DB2 and WebSphere running on z/OS.

### 3.2.2 Consulting

Consulting provides deep domain, technical, and industry expertise and market-leading capabilities in business transformation, technology implementation and managed services, including cloud managed and application services. Consulting designs, builds and operates technology and business processes based on open, hybrid cloud architectures leveraging the power of generative AI, with IBM technology and ecosystem partner technologies. Consulting uses its IBM Garage method and assets deployed through IBM Consulting Advantage to convene experts to co-create solutions with clients to accelerate their digital transformations through AI and automation.

Consulting comprises three business areas – Business Transformation, Technology Consulting and Application Operations which have the following capabilities:

**Business Transformation:** provides strategy, process design, system implementation and operations services to improve and transform key experiences and business processes. These services deploy AI and automation in business processes to exploit the value of data and include an ecosystem of partners alongside IBM technology, including strategic partnerships with Adobe, Oracle, Salesforce and SAP, among others.

**Technology Consulting:** helps clients architect and implement solutions securely across cloud platforms, including Amazon, Microsoft, Palo Alto Networks, and IBM, and deploy strategies to transform the enterprise experience and enable innovation, including data transformation for AI with watsonx and application modernization for hybrid cloud with Red Hat OpenShift.

**Application Operations:** focuses on managing, optimizing, orchestrating, and securing custom application and ISV packages for clients. Services include application management, platform engineering, and security services across hybrid cloud environments.

### 3.2.3 Infrastructure

Infrastructure provides trusted and secure solutions for hybrid cloud, and is optimized for infusing AI into mission-critical transactions.

Infrastructure comprises two business areas – Hybrid Infrastructure and Infrastructure Support, which have the following capabilities:

**Hybrid Infrastructure:** provides clients with innovative infrastructure platforms to help meet the new requirements of hybrid multi- cloud and enterprise AI workloads leveraging flexible and as-a-service consumption models.

Hybrid Infrastructure includes IBM Z and Distributed Infrastructure.

**IBM Z:** the premier transaction processing platform with leading security, resilience and scale, highly optimized for mission-critical, high-volume transaction workloads and enabled for enterprise AI and hybrid cloud. It includes zSystems and LinuxONE, with a range of high-performance systems designed to address enterprise computing capacity, security and performance needs, z/OS, a security-rich, high-performance enterprise operating system, as well as Linux and other operating systems.

**Distributed Infrastructure:** includes Power, Storage and IBM Cloud Infrastructure-as-a-Service (IaaS). Power consists of high- performance servers, designed and engineered for data intensive and AI-enabled workloads and optimized for hybrid cloud and Linux. The Storage portfolio consists of a broad range of storage hardware and software-defined offerings, including Z-attach and distributed flash, tape solutions, software-defined storage controllers, data protection software and network-attach storage. IBM Cloud IaaS is built on enterprise-grade hardware with leading security and compliance capabilities and offers flexible computing options across architectures to meet client workload needs.

**Infrastructure Support:** delivers comprehensive, proactive and AI-enabled maintenance and support services to maintain and improve the availability and value of clients' IT infrastructure (hardware and software) both on-premises and in the cloud including maintenance for IBM products and other technology products.

### 3.2.4 Financing

Financing facilitates IBM clients' acquisition of hardware, software and services through its financing solutions. The financing arrangements are predominantly for products or services that are critical to the end users' business operations and support IBM's hybrid cloud platform and AI strategy. Financing conducts a comprehensive credit evaluation of its clients prior to extending financing. As a captive financier, Financing has the benefit of both deep knowledge of its client base and a clear insight into the products and services financed. These factors allow the business to effectively manage two of the primary risks associated with financing, credit and residual value, while generating strong returns on equity.

Financing comprises the following two business areas – Client Financing and Commercial Financing.

**Client Financing:** lease, installment payment plan and loan financing to end-user clients for terms generally up to seven years. Assets financed are primarily new and used IBM hardware, software and services.

**Commercial Financing:** short-term working capital financing to business partners and distributors primarily of IBM products and services. The company has an existing agreement with a third-party investor to sell IBM short-term commercial financing receivables on a revolving basis.

## 3.3 Certification

For the list of valid ISO certifications of IBM please visit

<https://www.ibm.com/support/pages/ibm-iso-management-system-certifications>.

## 4 Solution proposal

In view of the above, the step-by-step procedure and individual steps that will be carried out within the framework of a given PoC are described below. These following steps also describe the individual parts and phases of the project. However, this is a Proof of Concept, i.e. verification of one's own hypothesis. Only after verification of this phase will a full-fledged project be developed, which will be developed based on the results of this pilot project.

Describe the solution we are proposing using the following examples of the content:

- Provided and persisted data quality analysis
- Train BBT with historical room data (provided and persisted)
- Monitor BBT performance and collect operational logs
- Gather relevant metrics for evaluation
- Add to initial data also data from first run
- Train a new version of the BBT model with emphasis on latest data
- Monitor BBT performance and collect operational logs
- Gather relevant metrics for evaluation
- Comparison analysis of initial BBT metrics with BBT v2 metrics
- Success criteria for Feasibility Study
- Showing improvement in temperature and humidity oscillation after Iteration 1 – showing that the approach is able to learn to be more accurate (after trained on more and more data)

As part of the PoC itself, interoperability requirements will be defined, which will be submitted to ELI-Beamlines within the framework of the own project. In the same way, interoperability will be ensured by Monitore SE.

The actual pilot project (Proof of Concept) will be divided into a preparatory phase and actual testing on real technology and the final processing of a feasibility study, which will summarize the results of measurements and further iterations.

The expected scope of activities (see above) should be completed within 3 months of signing the contract. It will depend on cooperation from ELI-Beamlines.

## 5 Pricing

The price for the delivered solution described in this proposal is **420.000,- CZK** without VAT.

Customer agrees to pay the services/the goods including the valid VAT which shall be added to the price according to the valid legislation.

Invoices will contain all datas based on Law Nr. 235/2004 and § 435 of Civil Code.

The delivered solution will be accepted on the basis of acceptance protocol signed by the customer. The date of the taxable supply on the issued invoice shall be the date of the acceptance protocol signature. This protocol will be attachment of the invoice.

Amounts are due upon receipt of the invoice from IBM and payable within 30 days of the invoice date to an account specified by IBM and late payment fees may apply.