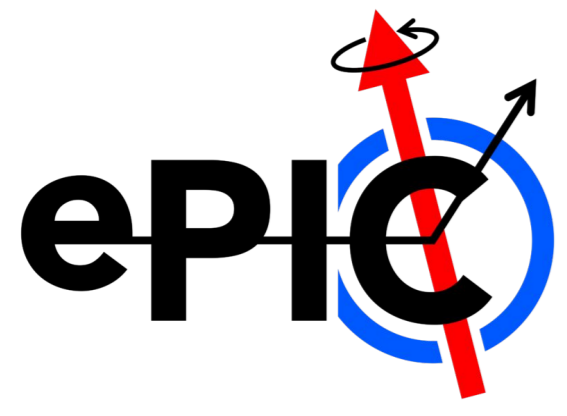


Collaborative Tools for the ePIC Experiment



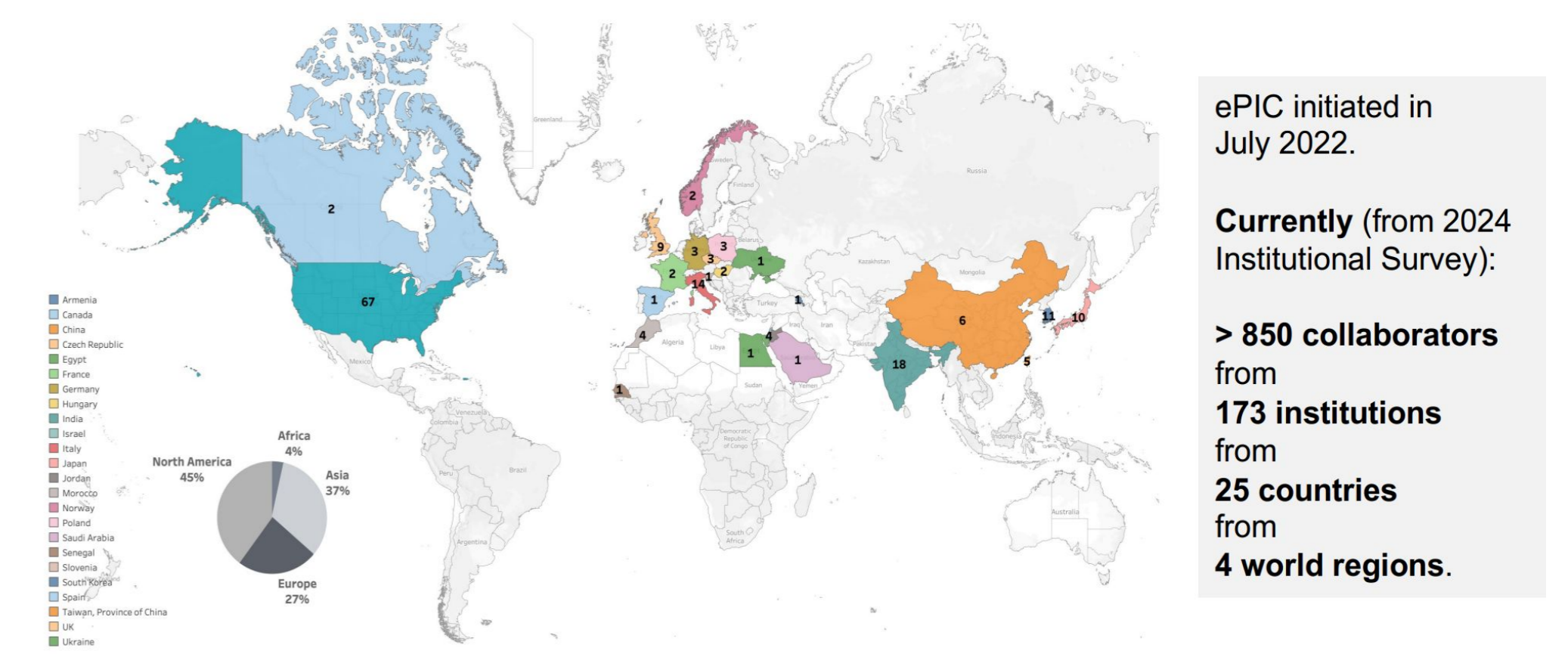
M. Potekhin
Brookhaven National Laboratory
for the ePIC Collaboration

The ePIC Collaboration is working on the design of a future particle detector for the Electron-Ion Collider (EIC) to be built at the Brookhaven National Laboratory. This experiment will collide a high-energy electron beam with protons and ions, and will use streaming readout to seamlessly deliver the data captured by its DAQ systems to distributed computing facilities for processing. This will make possible analyses that will address some of the most fundamental questions in science regarding the visible world, including the origin of the nucleon mass, the nucleon spin, and the emergent properties of a dense system of gluons.

Currently the Collaboration is working on the Technical Design Report (TDR) for its detector, which requires a plethora of physics and detector studies based on sophisticated and well-coordinated simulations. Work is underway on the ePIC streaming readout, and its software and computing framework.

These activities are conducted by a large international Collaboration with over 850 members from 25 countries, and require an effective set of Collaborative Tools and an open, collaborative environment in order to succeed.

THE EPIC COLLABORATION



ePIC Collaborative Tools by Category

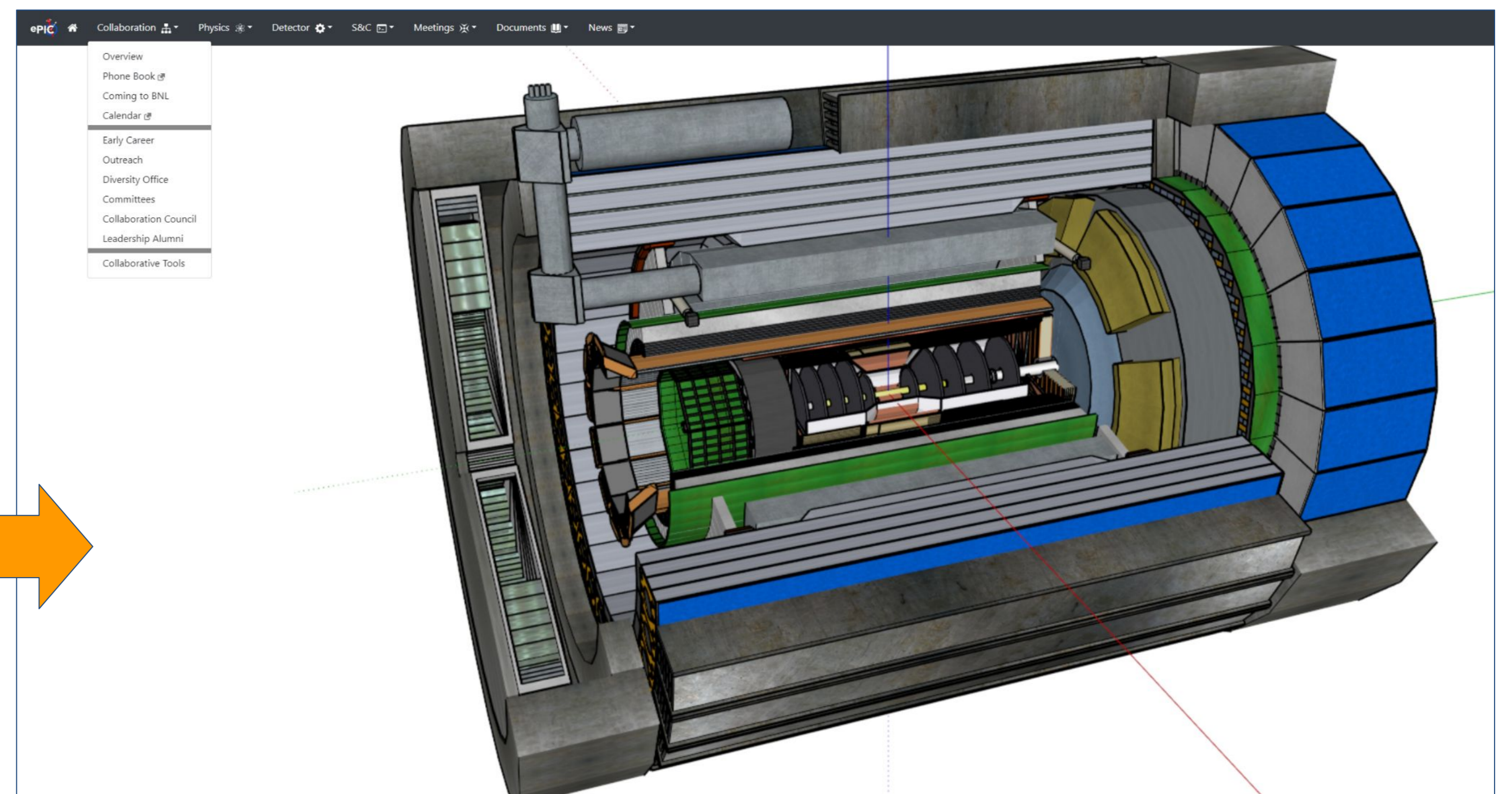
- Web Presence
- Digital Repositories
- Collaborative Document Development
- Collaborative Software Development
- File Sharing and Data Delivery
- Collaborative Communication

Leveraging the Experience of the PHENIX Experiment at RHIC

- The PHENIX Experiment has performed a complete redesign of its documentation management, including:
- **Web Presence:** curated migration of previously fragmented legacy web resources to a new website, using the “**static website generator**” technology
 - Addressed prior cybersecurity issues and dramatically reduced the required long-term maintenance effort
 - **Digital Repositories:** migrated from a custom legacy document DB, to the modern **Zenodo repository at CERN**
 - Vastly enhanced the visibility of the experiment’s research documents, with the new website integration
 - Reduced the required maintenance effort
 - More than 700 items committed to Zenodo, including systematized contributions to 134 conferences

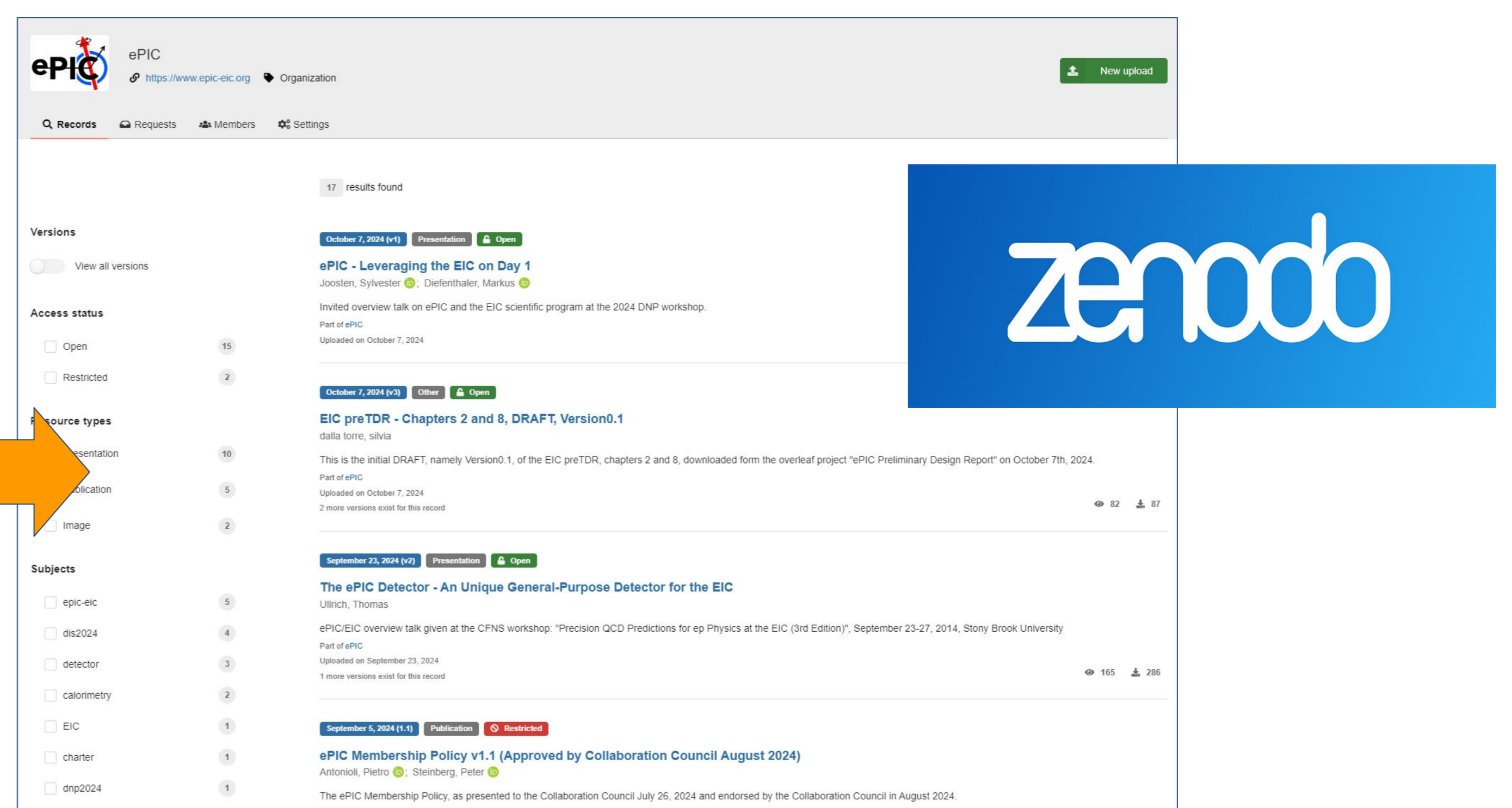
The New Website (in Development)

- **Static website generation (Jekyll)** – same as on the GitHub pages
- Sophisticated use of structured data is possible by parsing files formatted in **YAML** with the help of the **Liquid** template language
- The text content format is **Markdown**
- Once generated, the site becomes a static collection of HTML files that can be deployed on any web server, and offers the following advantages:
 - High performance (due to the static nature of the content)
 - Security (due to absence of a live backend database)

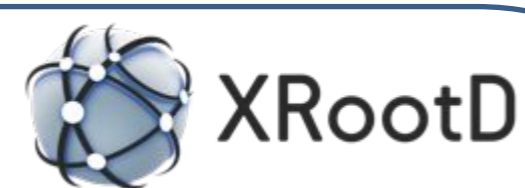


The Digital Repository

- ePIC uses a state-of-the-art digital repository – **Zenodo at CERN**
- Recent advances in this technology platform include powerful management tools for the content curated by the organization (the “Zenodo Communities”)
- ePIC keeps a *list of managed keywords*, with automatic links on the website for easy and efficient queries of the materials hosted on Zenodo
- Given the convergence of Zenodo and Invenio RDM, techniques for migration to a possible future document development workflow system based on Invenio are being investigated



File Sharing and Data Delivery



- Google Drive remains a popular tool for live document sharing and collaborative development in ePIC, complementing the repository function of Zenodo
- Regarding the needs of data handling at scale, ePIC is informed by the extensive experience of many HEP/NP experiments, and is utilizing XRootD to share and store the data needed for its Monte Carlo campaigns necessary for the TDR, and its software training program
- ePIC is operating a XRootD cluster deployed at Jefferson Laboratory as its central data hub, with token-based authentication for access control
- There are plans to enhance the ePIC distributed storage capability by deploying another XRootD cluster at Brookhaven National Laboratory
- Please see the talk “**The ePIC Simulation Campaign Workflow on the Open Science Grid**” given at this conference: <https://indico.cern.ch/event/1338689/contributions/6011093/>

Collaborative Software Development: GitHub

- Please see the talk “**Collaborative software and maintainability for ePIC experiment at EIC**” given at this conference: <https://indico.cern.ch/event/1338689/contributions/6010402/>

Scheduling and Communication Tools

- Indico
- Zoom
- Mattermost

Collaborative Document Development

- Overleaf for large and complex documents like the TDR
- Google docs – for working documents and meeting preparation
- Document review in the ePIC Community on Zenodo



Summary

The ePIC Collaboration is actively engaged in the development of the Technical Design Report (TDR) for its future detector to operate at the Electron-Ion Collider, and its software and computing capability necessary for this research. In support of this work, the Collaboration has undertaken a vigorous effort in the area of Collaborative Tools, utilizing best practices and platforms.