



Collaborative Research and Information Sharing Platform

Collaborative Tools for ePIC and RHIC experiments

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2026-06-17



Preface: Service Name Evolution

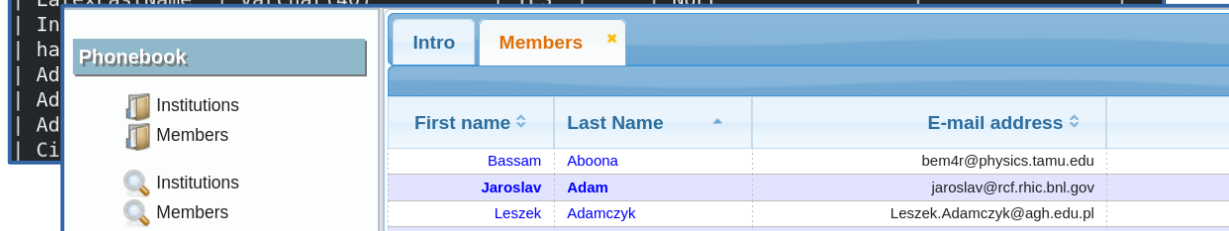
Phonebook: historic name from ~2003, when STAR had a db-based actual phonebook of online expert names + cell numbers... Really sticky nickname!

Membership DB service: a database that contained Members and Institutions data + history of changes + author lists + API

CRISP: Collaborative Research and Information Sharing Platform: includes Members, Institutions, Groups, Documents, Meetings, Tasks, Workflows, Utilities, API, Federated Auth, Document Storage, and more...

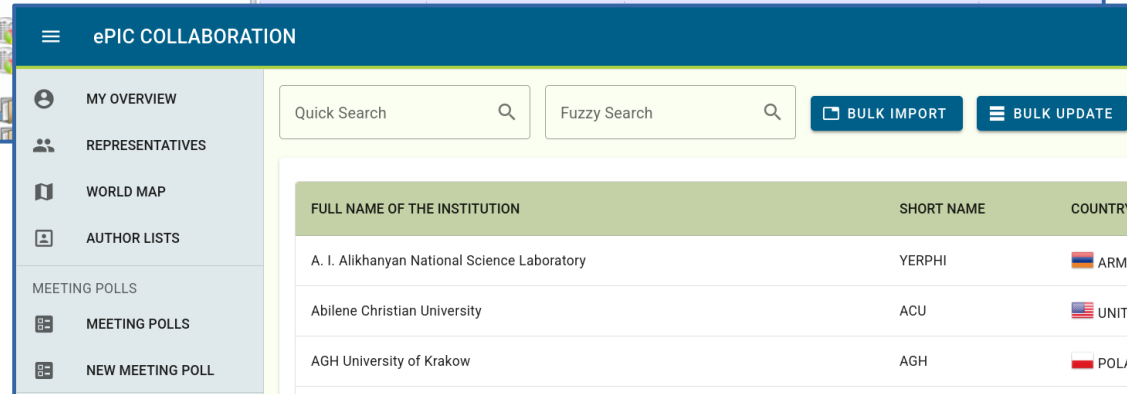
...feel free to call it whatever you like, everything works...

Field	Type	Null	Key	Default	Extra
Id	smallint(5) unsigned	NO	PRI	NULL	auto_increment
LastName	varchar(40)	NO			
FirstName	varchar(20)	NO			
Initials	varchar(8)	YES		NULL	
LatexLastName	varchar(40)	YES		NULL	



The screenshot shows a web interface for a 'Phonebook' service. It has a sidebar with 'Institutions' and 'Members' sections. The main content area is titled 'Members' and displays a table with columns for 'First name', 'Last Name', and 'E-mail address'. The table contains three entries:

First name	Last Name	E-mail address
Bassam	Aboona	bem4r@physics.tamu.edu
Jaroslav	Adam	jaroslav@rcf.rhic.bnl.gov
Leszek	Adamczyk	Leszek.Adamczyk@agh.edu.pl

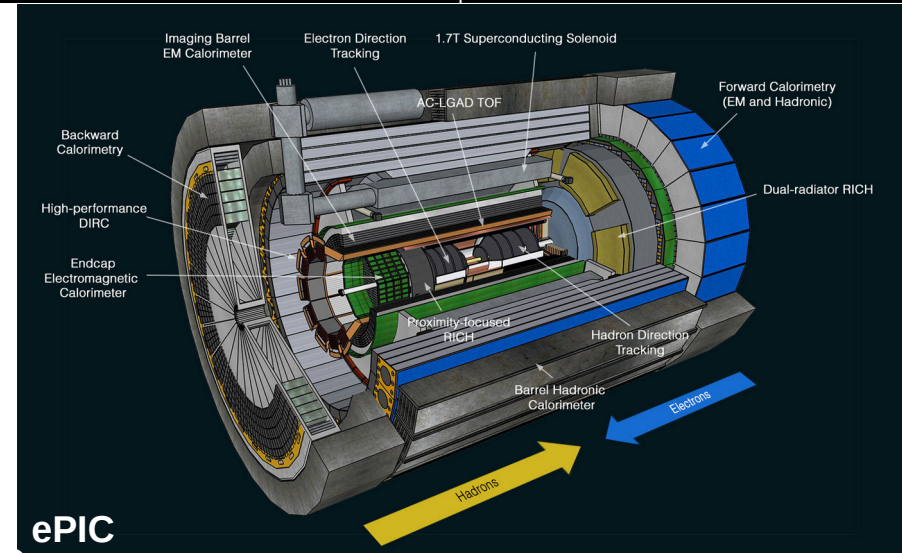
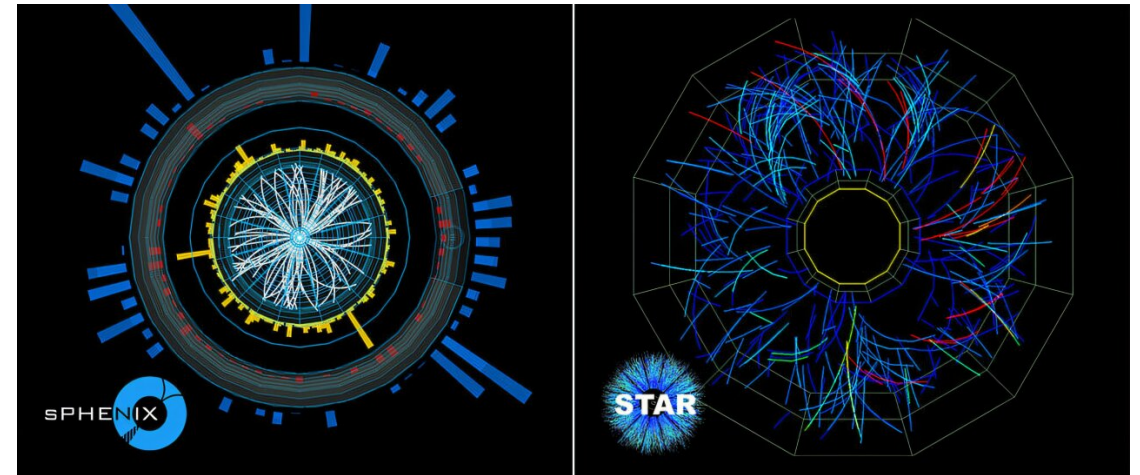


The screenshot shows the 'ePIC COLLABORATION' web interface. It features a sidebar with navigation options like 'MY OVERVIEW', 'REPRESENTATIVES', 'WORLD MAP', 'AUTHOR LISTS', and 'MEETING POLLS'. The main content area has search bars for 'Quick Search' and 'Fuzzy Search', along with 'BULK IMPORT' and 'BULK UPDATE' buttons. Below these is a table listing institutions:

FULL NAME OF THE INSTITUTION	SHORT NAME	COUNTRY
A. I. Alikhanyan National Science Laboratory	YERPHI	ARMENIA
Abilene Christian University	ACU	UNITED STATES
AGH University of Krakow	AGH	POLAND

Collaborative Tools: What is it and Why we need it?

- Software to facilitate effective communication, coordination, and cooperation among collaboration members
- Typical off-the-shelf collaborative software: Mattermost, Overleaf, Github, Google Docs, Hardware DB
- Custom software: Shift Signup, Event Display, Membership DB, Document DB, Conditions DB,...
- Membership DB: needed to collect and maintain key information about the collaboration and its members, including a history of changes
 - individual/institute membership,
 - groups, roles, publications and their authors, meetings, events, tasks, statement of service (SoS)
 - enable collaborative processes and workflows like publication reviews and release to public
- Scientific collaborative tools are essential for international research



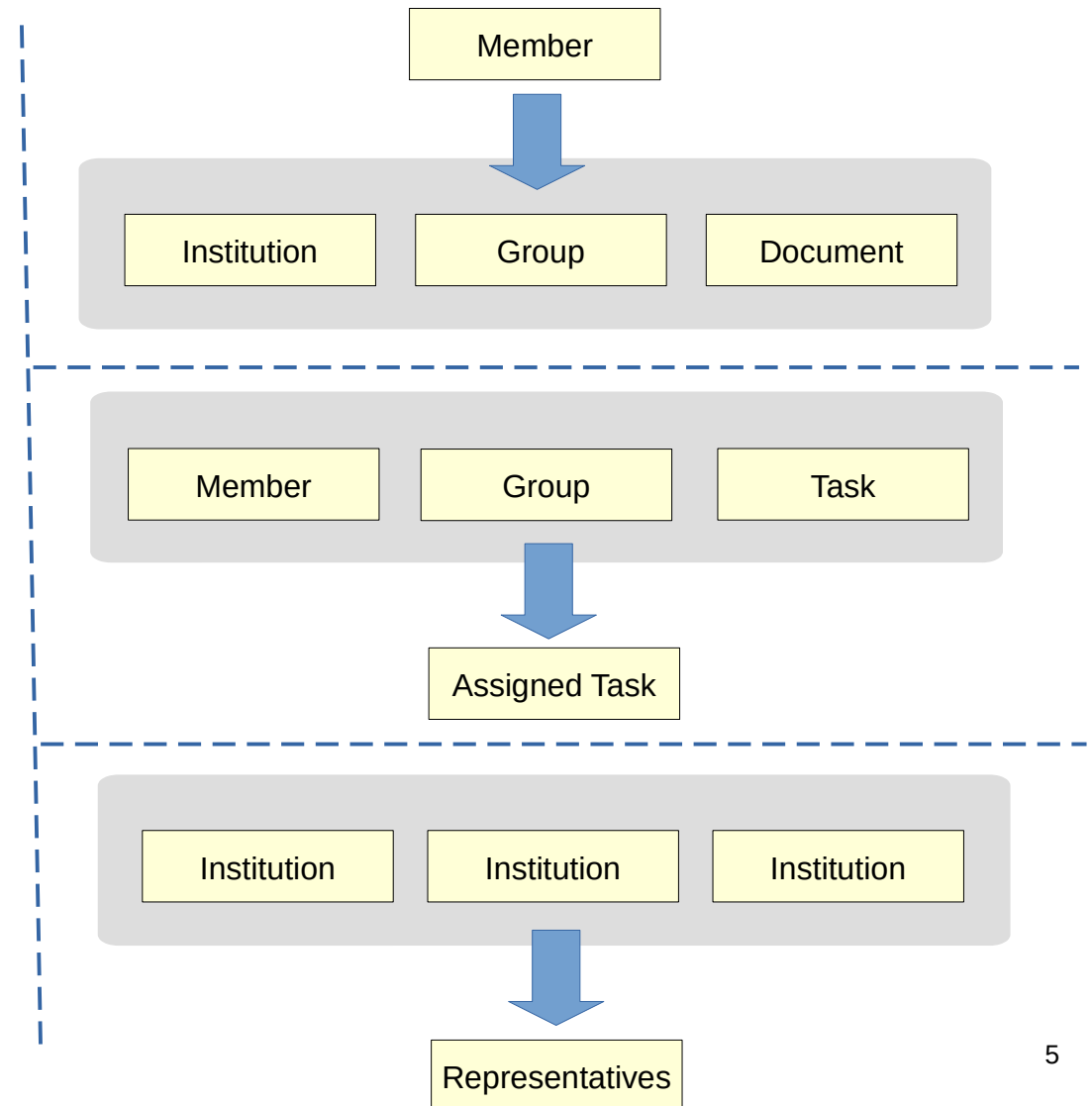
FAQ: Why can't we use some pre-existing service?

- Is off-the-shelf Membership software available for HEP/NP?
 - There is no “standard” or recommended implementation of the Membership DB. All known attempts are lacking import/export/integrations interfaces, history support, APIs, and support for ORCID/RORID identifiers
- How about Glance @ CERN?
 - Unfortunately, Glance is hardwired to use CERN infrastructure – can't use it outside of CERN ecosystem: accounts, membership, groups, ...
- Evolving requirements mandate custom software development
 - need to accommodate for the needs of past and future experiments
 - need to “make it right”: standards, interfaces, IDs, future-proof maintainable software
 - need to allow integration with services and tools
 - bottom-up development model: no bloat, only the required features are implemented
- Why CRISP?
 - not dependent on BNL/JLAB/CERN infrastructure
 - modular, extensible
 - uses standard interfaces and recommended IDs
 - uses federated authentication
 - allows authorization control via Members + Groups
 - allows easy integration with external tools

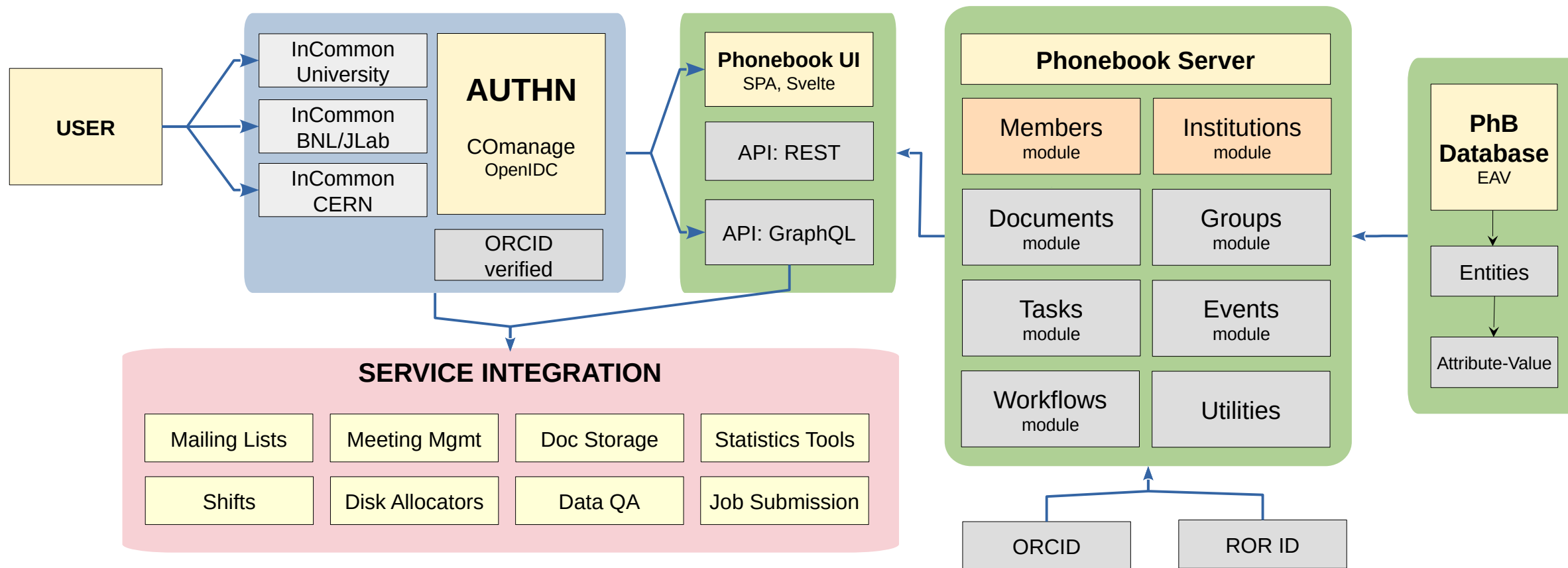
	Custom Software	Off-the-shelf Software
Complete Customization	✓	x
Quick Implementation	x	✓
Adaptable to needs	✓	x
Technical Support	✓	✓
Scalability	✓	x

CRISP: Collaborative Research Information Sharing Platform

- CRISP: a modular service for collaboration information management
 - Database with information about Members, Institutions, Groups, Documents, Tasks, Events and their relations + history of changes for all entities
 - User-centric web interface providing controlled access to various directory views: members, institutions, publications, representatives, author lists, and various management features
 - GraphQL API for data queries, service integration and Command-Line access
 - Document Storage: digital repository that stores internal and public documents
 - Authentication across integrated tools is handled by CManage: federated auth, ability to “merge” multiple accounts into one, Single-Signon

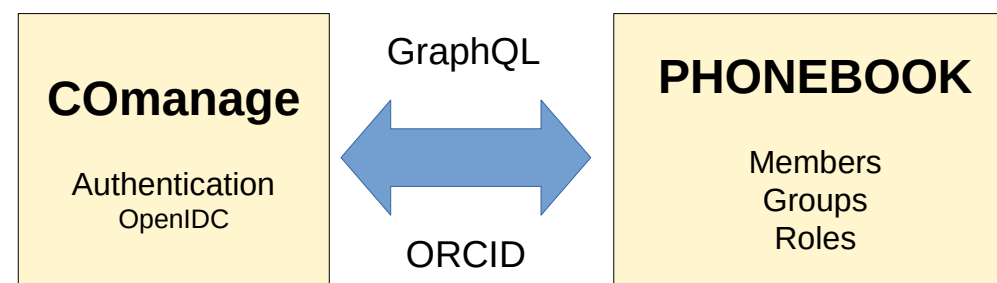
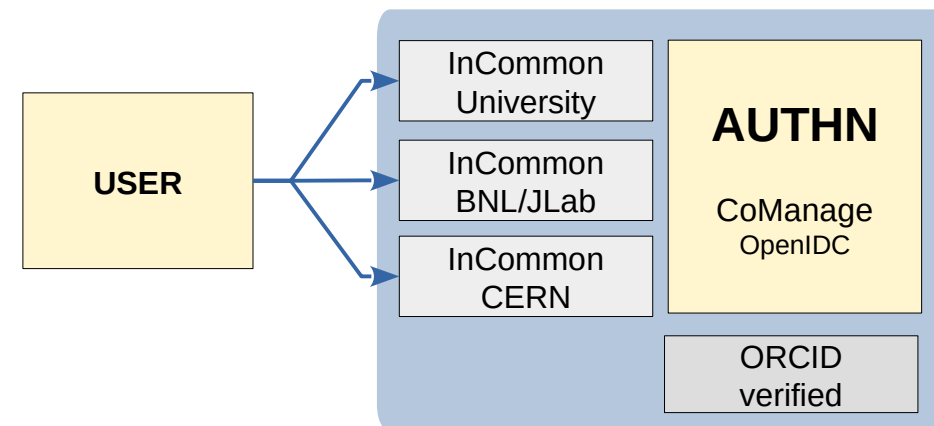


CRISP: Component Overview



CRISP: Authentication

- **COmanage Registry** leverages federated identity management services and enables authentication and authorization in a single, efficient flexible system. This system automatically creates the accounts and access controls for tools such as wikis, calendars, conferencing tools, and other domain applications.
- **COmanage Match** performs identity de-duplication in order to help minimize the creation of duplicate accounts for the same individual.
- Comanage uses Phonebook as a “source of truth”, updating its list of members and groups from the Phonebook information (live)
- ePIC/RHIC users:
 - please enroll into COmanage
 - link your ORCID - mandated by DOE
- Usage Workflow: User → Application → CoManage (authn) → IdP (Institution, BNL/JLab, CERN) → CoManage (authz: Groups + Roles) → CILogon → token for Application



Q: Do I need to create yet another account to remember?

A: You do not need to create a “COmanage account”. Use your University account (if part of InCommon), or BNL/Jlab account, or CERN account with COmanage.

CRISP: Institutions

- Phonebook contains a searchable list of past and present Institutions
- Institutions are keyed by RORID (Research Organization Registry)
- Support for bulk upload, active/inactive status, history of changes, representatives per Institution, virtual institutions
- Self-service:
 - Institutional Representatives can update the Institution's information and the list of Members, as well as update the list of Tasks for their Institution

FULL NAME OF THE INSTITUTION	SHORT NAME	COUNTRY	REGION
A. I. Alikhanyan National Science Laboratory	YERPHI	ARMENIA	ASIA
Abilene Christian University	ACU	UNITED STATES OF AMERICA	NORTH AMERICA
AGH University of Krakow	AGH	POLAND	EUROPE
Aligarh Muslim University	AMU	INDIA	ASIA
American University in Cairo		EGYPT	AFRICA
Argonne National Laboratory	ANL	UNITED STATES OF AMERICA	NORTH AMERICA
Augustana University	AUGIE	UNITED STATES OF AMERICA	NORTH AMERICA

ROLE	FIRST NAME	LAST NAME	EMAIL	ORCID
Representative	Niseem	Abdelrahman	niseem.abdelrahman@tsu.edu	0000-0002-6
Representative	Raktim	Abir	raktim.ph@amu.ac.in	0000-0002-9
Representative	Jaroslav	Adam	jaroslav.adam@jfjl.cvut.cz	0000-0003-4
Representative	Kevin	Adkins	jkadkins@moreheadstate.edu	0009-0004-6
Representative	Christine	Aidala	caidala@umich.edu	0000-0001-9
Representative	Ayman	Al-bataineh	abataineh@yu.edu.jo	0000-0003-4

CRISP: Members

- Phonebook contains a searchable list of past and present Members
- Members are keyed by ORCID – mandated by DOE
- Support for bulk upload, active/inactive states, history of changes, author lists, checks for duplicates
- Self-service:
 - Members can update their photo and selected list of profile fields (configurable), apply to Groups, and see which documents they have authored

Quick Search Fuzzy Search **BULK IMPORT**

BULK UPDATE

FIRST NAME	LAST NAME	EMAIL	ORCID	INSTITUTION
Kentaro	Motohashi	25ss209a@shinshu-u.ac.jp	XXXX-XXXX-XXXX-XXXX	Shinshu University
Kyohei	Ono	24ss202a@shinshu-u.ac.jp	XXXX-0000-0000-0000	Shinshu University
Raghad A.	Ababneh	2022106004@ses.yu.edu.jo	0009-0003-5832-0197	Yarmouk University
David	Abbott	abbottd@jlab.org	XXXX-0000-0000-0104	Jefferson Lab
Niseem	Abdelrahman	niseem.abdelrahman@tsu.edu	0000-0002-6458-6552	Texas Southern University
Raktim	Abir	raktim.ph@amu.ac.in	0000-0002-9334-9871	Aligarh Muslim University
Ibrahim	Abualrob	iabualro@cougarnet.uh.edu	0000-0000-0000-0000	University of Houston

Dmitry Arkhipkin
Brookhaven National Laboratory
member created: 2024-09-17 10:44:25

DATE	FIELD	OLD VALUE	NEW VALUE	METADATA
2026-05-26 06:03:55	Join date	2000-01-01 00:00:00	=> 2022-12-14 00:00:00	SDCC1000010 161.200.190.205
2026-05-08 14:39:27	GitHub ID		=> dmarkh	SDCC1000169 130.199.251.1
2026-04-27 15:56:09	Member Role	Member	=> Representative (ex-officio)	SDCC1000169 130.199.251.1
2026-04-27 15:56:09	Additional Institution Affiliations	0	=> 0	SDCC1000169 130.199.251.1
2026-04-17 15:33:50	Member Role	Representative (ex-officio)	=> Member	SDCC1000169 130.199.251.1
2026-04-17 15:33:50	Additional Institution Affiliations	0	=> 0	SDCC1000169 130.199.251.1
2026-01-05				

CRISP: Personal Area

- Includes:
 - photo
 - personal info
 - Institution
 - groups, documents, tasks, ...
- User-centric, self-service UI:
 - update curated list of own fields
 - join/leave Groups
 - register Documents and run Document Workflows
- (optional) Utilities:
 - meeting polls
 - event display

The screenshot shows the 'ePIC COLLABORATION' user interface. The top navigation bar includes a hamburger menu, the text 'ePIC COLLABORATION', and icons for a moon, a search icon, and a user profile icon. The left sidebar contains a 'MY OVERVIEW' section with icons for 'REPRESENTATIVES', 'WORLD MAP', and 'AUTHOR LISTS'. Below this are sections for 'MEETING POLLS' (with 'MEETING POLLS' and 'NEW MEETING POLL' options), 'STATISTICS' (with 'STATISTICS' and 'TASK STATS' options), and 'INSTITUTIONS' (with 'INSTITUTIONS' and 'FILTER INSTITUTIONS' options). The main content area is titled 'MY BIO' and features a profile card for 'Dmitry Arkhipkin' with the email 'arkhipkin@bnl.gov' and affiliation 'Brookhaven National Laboratory, UNITED STATES OF AMERICA'. Below the profile card is a table of user details:

ORCID	0000-0002-7952-918X	
FIRST NAME	Dmitry	
FAMILY NAME	Arkhipkin	
EMAIL	arkhipkin@bnl.gov	
ALT EMAIL	arkhipkin@gmail.com	
GITHUB ID	dmarkh	

CRISP: Author Lists and Stats

- Author List generation: multiple formats supported (LaTeX, Inspire), retrieval of the author list for a specified date in the past
- Basic Statistics: number of members, institutions, world map, task list, etc;
- Detailed statistics: Statistics Dashboard (Eric)
- Statistics module is to be greatly expanded next year
- Statistics will greatly benefit from the AI module (TBD)

Timestamp: 2026-06-05

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE collaborationauthorlist SYSTEM "author.dtd">
<collaborationauthorlist
xmlns:foaf="http://xmlns.com/foaf/0.1/"
xmlns:cal="http://inspirehep.net/info/HepNames/tools/authors_xml/">
<cal:creationDate>2026-06-05</cal:creationDate>
<cal:publicationReference></cal:publicationReference>
<cal:collaborations>
<cal:collaboration id="epic">
<foaf:name>ePIC</foaf:name>
<cal:experimentNumber>BNL-EIC-EPIC</cal:experimentNumber>
</cal:collaboration>
</cal:collaborations>
<cal:organizations>
<foaf:organization id="a495">
<foaf:name>YERPHI</foaf:name>
<cal:orgName_source="ROR">https://ror.org/00ad27c73</cal:orgName>
<cal:orgName_source="ROR">https://ror.org/00ad27c73</cal:orgName>
<cal:collaborationid="epic">Member</cal:orgStatus>
<cal:orgAddress">ARMENIA</cal:orgAddress>
</foaf:organization>
</cal:organizations>
</cal:collaborationauthorlist>
```

AUTHORLIST DATE: MM/DD/YYYY

DOWNLOAD

MEMBERS: 1158 | INSTITUTIONS: 183 | COUNTRIES: 25 | REGIONS: 4

Regional Distribution:

- ASIA, 21.50%
- EUROPE, 30.66%
- NORTH AMERICA, 46.29%
- AFRICA, 1.55%

Country Distribution:

- JAPAN, 4.15%
- UNITED STATES OF AMERICA, 44.82%
- JORDAN, 0.35%
- INDIA, 6.56%
- ITALY, 14.68%
- CZECH REPUBLIC, 2.68%
- POLAND, 1.21%
- UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND, 0.86%
- HUNGARY, 0.86%
- FRANCE, 4.32%
- SENEGAL, 0.52%
- KOREA, REPUBLIC OF, 5.01%
- NORWAY, 0.26%
- MOROCCO, 0.86%

CRISP: Groups Support

- Group examples: Management, Physics, Detectors, Software, ...
- Groups contain Members, who have Roles, and associated emails (mailing lists)
- Groups are hierarchical, form an OrgChart-like graph
- Phonebook groups are used for the integration with the external tools – primarily for access authorizations
- Every non-member role considered a manager role for export purposes

The screenshot shows the 'Group: Membership Committee' page in the ePIC COLLABORATION system. The page is divided into a left sidebar with navigation options (Filter Members, Add New Member, Member Changes, Groups, Documents, Tasks) and a main content area. The main content area has tabs for VIEW, EDIT, MEMBERS, ROLES, TASKS, and GRAPH. The 'VIEW' tab is active, showing the following details:

PARENT GROUP	Collaboration Council Chair Office
NAME	Membership Committee (Collaboration Committees)
DESCRIPTION	The ePIC membership committee (eMC) is responsible for the development of the Membership policy & oversight of its fair implementation. The Membership Policy defines the process for establishing, and maintaining "Good Standing" status for Collaboration members, and the primary requirements for the authorship within ePIC. The committee will assist the Council in developing and enforcing, upon adoption of, the ePIC Membership policy.
EMAIL	epic-cc-membership-committee-l@lists.bnl.gov
URL	
INVENIO	HTTPS://EPIC-INVENIO.SDCC.BNL.GOV/COMMUNITIES/EPIC-MEMBERSHIP_COMMITTEE
PRIVACY	PUBLIC

At the bottom of the page, there is a section labeled 'Members'.

The screenshot shows the 'Group Roles: Membership Committee' page in the ePIC COLLABORATION system. The page is divided into a left sidebar with navigation options (Filter Members, Add New Member, Member Changes, Groups, Documents, Tasks) and a main content area. The main content area has tabs for VIEW, EDIT, MEMBERS, ROLES, TASKS, and GRAPH. The 'ROLES' tab is active, showing a form to add a new role and a table of existing roles.

NEW ROLE NAME*

ADD NEW ROLE

Roles

NAME	OPERATION
Chair	REMOVE EDIT
Vice-Chair	REMOVE EDIT
Member	REMOVE EDIT

CRISP: Doc-t Management and Workflows

- Documents:
 - Phonebook contains document references only, it does not handle file uploads, but it tracks authors and reviewers!
 - Phonebook allows to create and execute Workflows over Document references. Workflows could be assembled from pre-made blocks

How-To:

upload the document to Invenio, work on it until it is ready for approvals, go to the Phonebook, register your document with the Phonebook using the Invenio link, assign a Workflow to the document, click “run Workflow”, respond to email requests.

The screenshot shows the 'ePIC COLLABORATION' interface. The main content area is titled 'WORKFLOW: Talk Review' with the subtitle 'Unified talk and content review workflow'. On the left, there is a sidebar with navigation options: EVENTS, FILTER EVENTS, ADD NEW EVENT, WORKFLOWS (selected), ADD NEW WORKFLOW, DESCRIPTORS (INSTITUTION FIELDS, MEMBER FIELDS, INSTITUTION FIELDGRO..., MEMBER FIELDGROUPS, DOCUMENT FIELDS), and TASK FIELDS. The main area contains three workflow steps, each with a 'NOTIFY via email' action and an 'ADD TO WORKFLOW' button. Step 1: 'ASSIGN Internal DocID' (Automatically assigns the internal DocID to the document). Step 2: 'NOTIFY via email: AUTHORS' (Request comments from the Authors of the document). Step 3: 'NOTIFY via email: GROUP by Role' (Request comments from the Group members specified by Role). A 'SAVE CHANGES' button is at the bottom.

The screenshot shows the 'ePIC COLLABORATION' interface for a document titled 'ePIC membership policy v1.1'. The left sidebar includes: FILTER MEMBERS, ADD NEW MEMBER, MEMBER CHANGES, GROUPS (ADD NEW GROUP), DOCUMENTS (selected) (DOCUMENTS, FILTER DOCUMENTS, ADD NEW DOCUMENT), TASKS (ASSIGNED TASKS, TASKS). The main area shows a table with columns STATE, WORKFLOW, and DESCRIPTION. The table contains one row: 'COMPLETED', 'MoveToPrivate', 'Move a document from a community to ePIC-Internal'. Below the table are sections for 'Workflow Steps' and 'Workflow Actions History'. The 'Workflow Steps' section shows two steps: 1. 'ASSIGN Internal DocID' (Automatically assigns the internal DocID to the document) and 2. 'RELEASE document: INTERNAL' (Moves/copies the document from the Originating Group to the 'Internal' community in Invenio). The 'Workflow Actions History' section shows a 'STEP-STARTED' action at '2026-06-04 16:20:02, STEP' and an 'ASSIGN-DOCID' action with the note '[docid] DocID assigned = ePIC-INT-2026-BBYNCJ'.

CRISP: Task Management

- Task Management for the Collaboration:
 - Tasks, Assigned Tasks
 - Member Tasks, Group Tasks, Institution Tasks,
 - Detailed statistics available via the Dashboard (Eric)
- ePIC Membership group is drafting the Workflow for Tasks
 - Task assignment validations by Group/Institution
 - Notifications and Deadline reminders
 - Annual summaries

ASSIGNED TASKS

DATES	TASK ↑	MEMBER	INSTITUTION
2025-01-01 - 2025-12-31	software	Villegas, Gema	Florida International University
2025-01-01 - 2025-12-31	convener	Szumila-Vance, Holly	Florida International University
2025-01-01 - 2025-12-31	general engineering	Karmarkar, Sushrut	Purdue University
2025-01-01 - 2025-12-31	general engineering	Denos, Ben	Purdue University
2025-01-01 - 2025-12-31	local group management	Prozorov, Alexandr	Czech Technical University in Prague
2025-01-01 - 2025-12-31	sensor characterization	Marcisovska, Maria	Czech Technical University in Prague
2025-01-01 - 2025-12-31	simulation	Prozorov, Matěj	Czech Technical University in Prague

EXPORT TO EXCEL

GROUP: Production

VIEW EDIT MEMBERS ROLES TASKS GRAPH

SELECT TASK

SELECT MEMBER

FTE 0

BEGIN TIME 01 / 01 / 2026

END TIME 12 / 31 / 2026

ASSIGN TASK

ASSIGNED TASKS BY YEAR 2026

(optional) Utilities & Common Tools

- Meeting Scheduling
 - select between when2meet-like and doodle-like polls
- Event Display
 - native GDML format support, transparency, SVG support, many hit types

The screenshot shows the 'ePIC COLLABORATION' interface with a sidebar on the left containing navigation options like 'MY OVERVIEW', 'REPRESENTATIVES', 'WORLD MAP', 'AUTHOR LISTS', 'MEETING POLLS', 'STATISTICS', and 'INSTITUTIONS'. The main content area displays a 'Test Doodle Poll' created by Dmitry Arkhipkin. It includes a location, time zone, and a calendar grid for June 2nd to 8th. A legend shows voting options: pending, yes, if need be, and no. The poll shows 1 participant (Dmitry Arkhipkin) with votes for 'yes' on June 2, 3, and 4, and 'if need be' on June 8.

	JUN 2 TUE	JUN 3 WED	JUN 4 THU	JUN 5 FRI	JUN 8 MON
Location: Test Doodle Location					
Timezone: America/New_York					
Legend					
pending					
yes					
if need be					
no					
PARTICIPANTS: Dmitry Arkhipkin	1	1	1	0	1 (0)
YOUR VOTE	✓	✓	✓	✗	↻

The screenshot shows the 'ePIC COLLABORATION' interface with the 'EVENT DISPLAY' option selected in the sidebar. The main content area displays a 3D visualization of a particle detector structure, likely a calorimeter, with a grid of yellow and blue points representing hits. The text 'ePIC Run: 1, Event: 1' is visible in the top left corner of the visualization area.

CRISP: Import/Export, Data Interfaces

- Phonebook provides:
 - advanced configurable filters
 - Excel import/export for most entities
- GraphQL endpoint for data retrieval:
 - well-known standard, like REST
 - request over HTTP
 - output in JSON format
 - no output bloat and overfetching, request just the fields you need
 - all newly created fields are automatically available via dynamic GraphQL schema

ePIC COLLABORATION

NEW MEETING POLL

STATISTICS

STATISTICS

TASK STATS

INSTITUTIONS

INSTITUTIONS

FILTER INSTITUTIONS

ADD NEW INSTITUTION

INSTITUTION CHANGES

MEMBERS

MEMBERS

FILTER MEMBERS

ADD NEW MEMBER

FILTER INSTITUTIONS

FILTERS

Match ALL criteria Match ANY criteria

FIELD: Full name of the insti... OPERATION: is not empty VALUE: + -

DISPLAY FIELDS

FIELD: ID + -

FIELD: ROR ID (URL) + -

FIELD: Full name of the institution (ASCII) + -

FIELD: Institution acronym + -

SORT FIELDS (ORDER MATTERS)

FIELD: Region of the World + -

FIELD: Country + -

FIELD: Full name of the institution (ASCII) + -

APPLY FILTERS

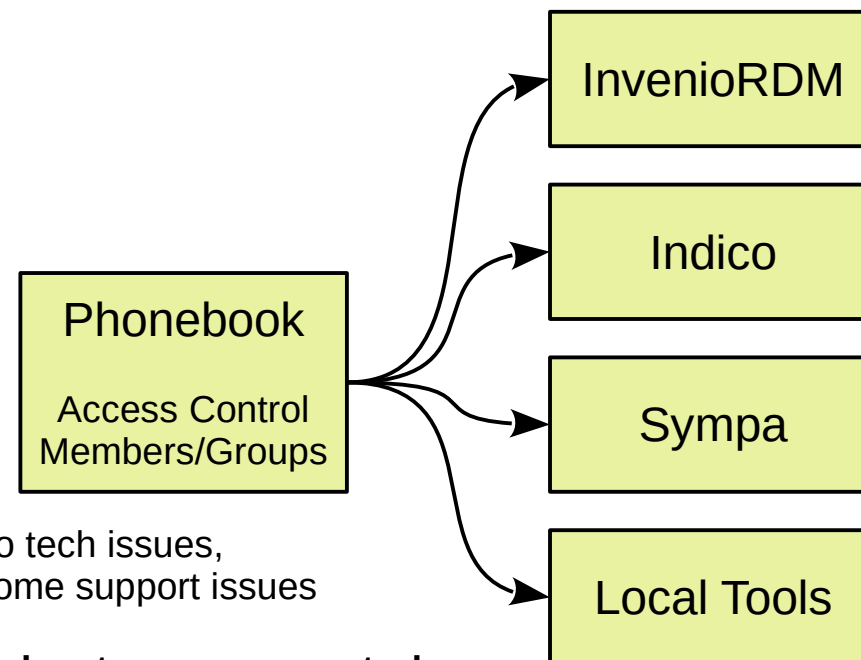
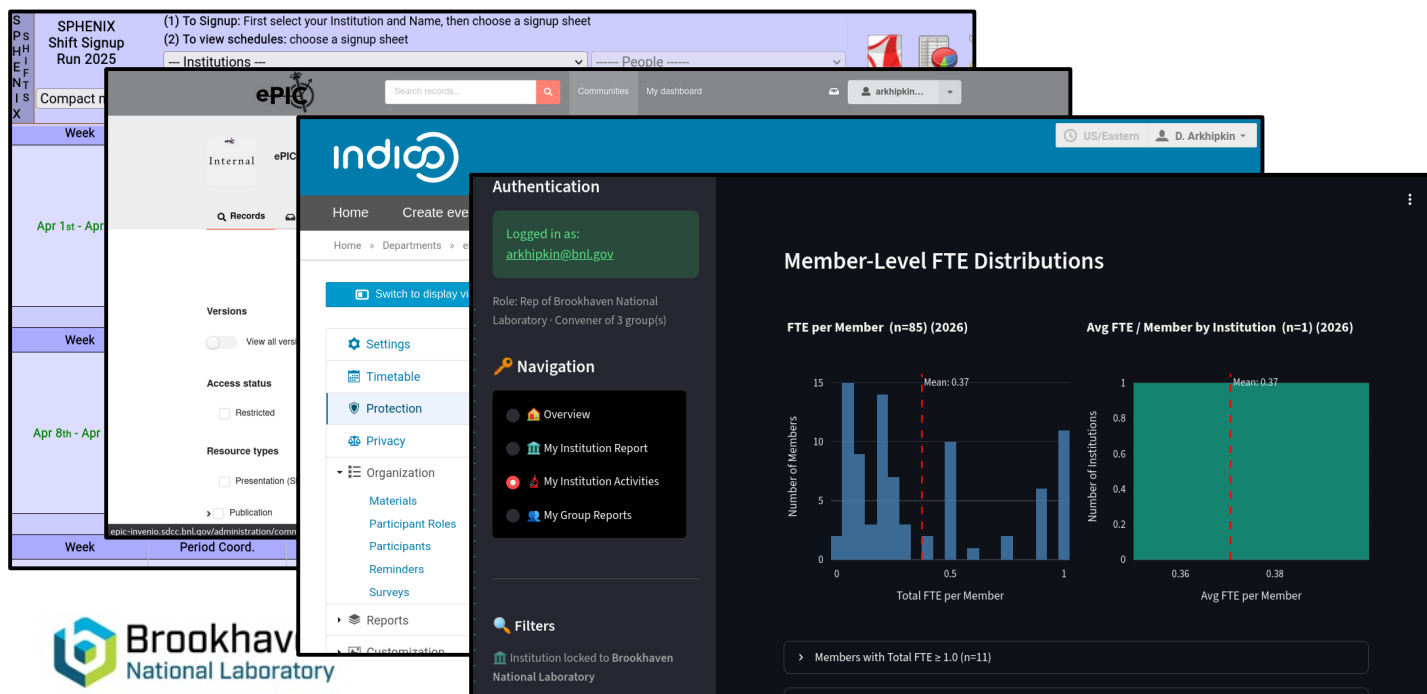
GraphQL: shell/curl, python, php, js, c++

```
curl -s \  
  --header "Content-Type: application/json" \  
  --header "Authorization: Bearer XXXXXXXXXXXXXXXXXXXX" \  
  --request POST \  
  --url https://phonebook.sdcc.bnl.gov/graphql/ePIC/ \  
  --data '{ "query": "query { members{id,orcid_id,name_first,name_last,email,groups{name,category,role},institution{id,ror_id,name_full}}}"' |  
  json_pp
```

CRISP: Service Integration and Access Control

Absolutely all attempted integrations were successful:

- Phonebook → Members, Groups, Roles → GraphQL → Services → AuthN / AuthZ (requires support from app owners: ITD, SCDF, experiment)
- Experiments:
 - **STAR**: Shift Signup, Online QA, Disk Space allocators, Mailing Lists (Sympa), Drupal, Gitea, InvenioRDM (in future)
 - **sPHENIX**: Shift Signup, Event Display (standalone), InvenioRDM (tbc)
 - **ePIC**: Dashboard, InvenioRDM, Indico, Mailing Lists (Sympa), PanDA (tbc)

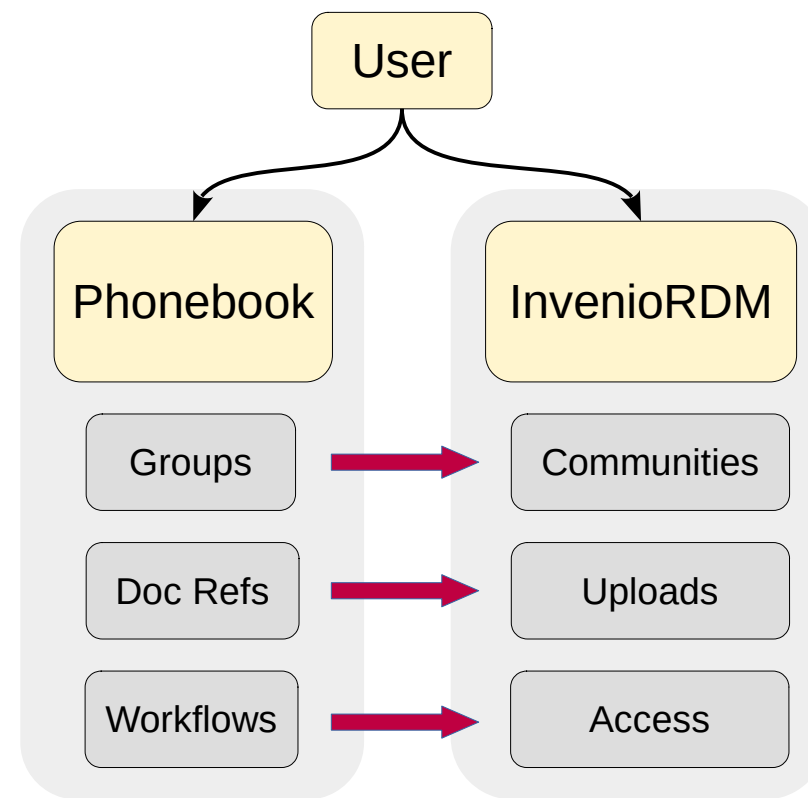


no tech issues,
some support issues

**Delegates access control
from the Facility to Experiments**

Service Integration: InvenioRDM

- InvenioRDM: Document Storage
 - uses CManage auth
 - Phonebook groups and roles are mapped to InvenioRDM communities upon user login
 - Keywords and DOI are enabled
 - Comments on documents: expected in InvenioRDM v14
- Phonebook Document refs:
 - title, description
 - author, primary authors, reviewers
 - document reference to the Document Storage
 - workflows:
 - handle the lifecycle of the document
 - manage notifications, assign internal/external IDs, perform reviews, publish documents (changes access level at InvenioRDM)
 - Any document (external url) is supported, with limited control (no access)



InvenioRDM: document storage
Phonebook: access control, workflows, statistics

Zenodo: manual maintenance of access is near-impossible because of 1100+ people!

CRISP: Status and Plans

- Current Status:
 - CRISP Includes a multi-functional membership directory, document management tools and workflows, and more
 - Phonebook is currently in use by STAR, sPHENIX, and ePIC collaborations
 - Migration to CRISP (Phonebook + Auth + Document Storage) is ongoing
 - Successfully Integrates with many services – just need an integrations maintainer and coordination of all involved parties (Physics, SCDF, ITD)
- Plans and Priorities FY26/27:
 - Iteratively expand existing **management and reporting tools** based on user feedback
 - Maintain and improve existing **integrations** with external tools
 - Implement **AI support** for increased efficiency.
 - Needs local AI hardware to satisfy the privacy requirements and regulations. Unfortunately, Genesis had no category for Collaborative Tools, and our recent LDRD attempt was not successful – will be trying PD next.
 - Implement **new tools**, e.g. PKI infrastructure tools, similar to STAR SKM (integrates well with Members, Groups)
- Required effort (excluding general facility support):
 - Integrations: ~0.5 FTE
 - AI development: ~1 FTE (postdoc) + 0.2 FTE (lead, combined)

