



IC@MS — Integrated Critical Alarms Management Software

40th Tango Community meeting
at ALBA

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Thomas Juerges (SKAO).

The GSI - Gesellschaft für Schwerionenforschung (Society for Heavy Ion Research)

GSI was founded in **1969**.

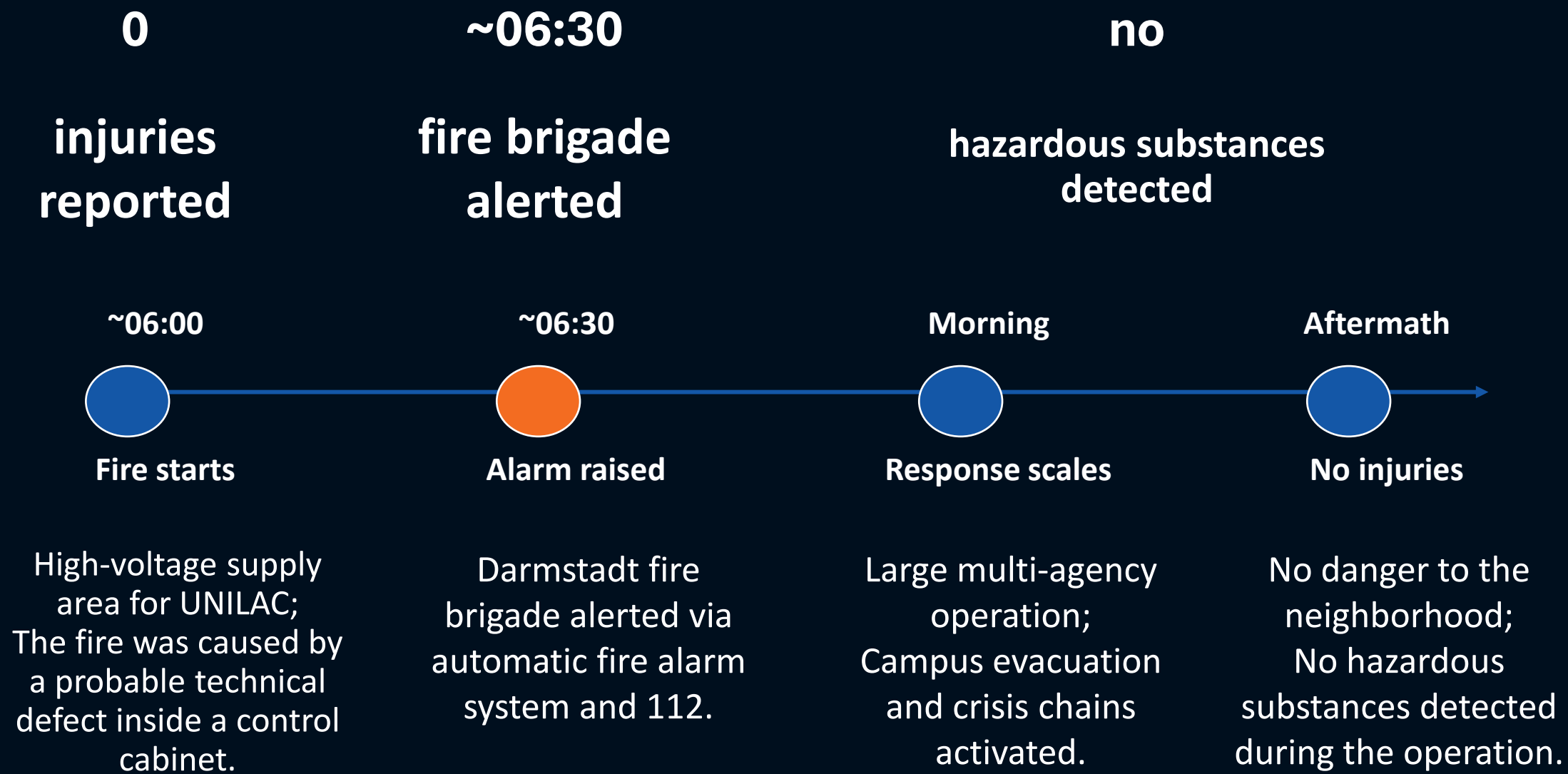
- employs around **1520 Staff**,
- ~1200 international user community.

GSI's accelerator complex includes:

1. **UNILAC linear accelerator,**
2. **SIS heavy-ion synchrotron,**
3. **ESR experimental storage ring,**
4. **FRS fragment separator,**
5. **PHELIX high-energy/high-performance laser,**
6. Large spectrometer and detector systems, a medical irradiation facility for cancer-therapy research.



5 February 2026, the GSI Helmholtzzentrum für Schwerionenforschung in Darmstadt



www.fr.de/rhein-main/darmstadt/brand-im-forschungszentrum-in-darmstadt-hat-enorme-auswirkungen-94157055.html

Even with fast response, the cost of downtime was severe

Alarm systems do not eliminate incidents; They reduce escalation, casualties, and secondary losses.

Reported impacts

UNILAC building severely affected

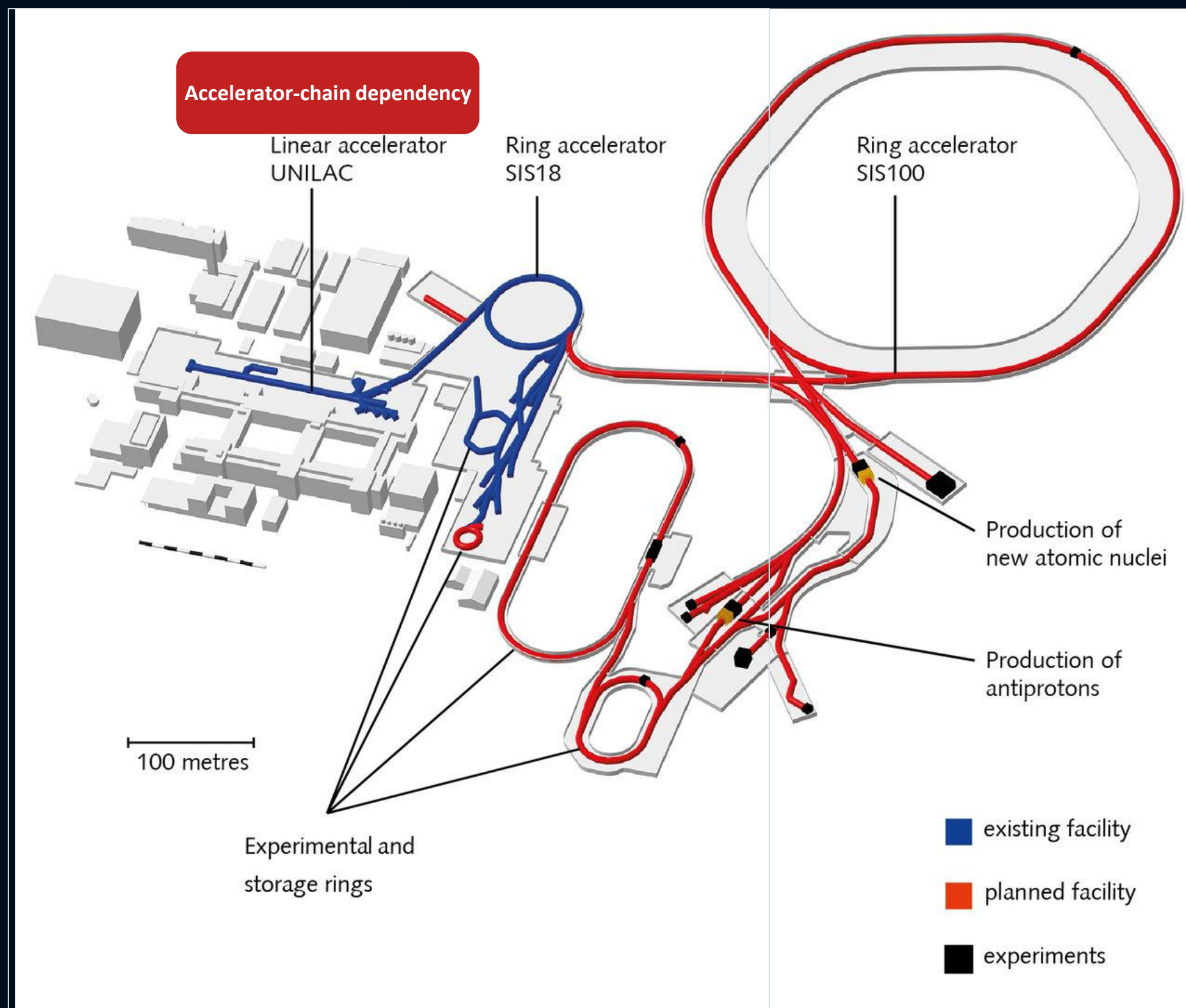
The operation of the accelerator facility was not possible after the incident.

Beamtime disruption

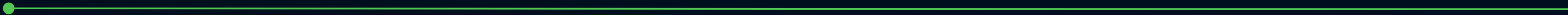
2026/27 beamtime cannot run as planned; no 2026 beamtime expected at UNILAC-dependent facilities.

Long restoration path

Full restoration of damaged infrastructure can take years; alternative technical solutions are being developed.



Alarms System ≠ Alarms Software

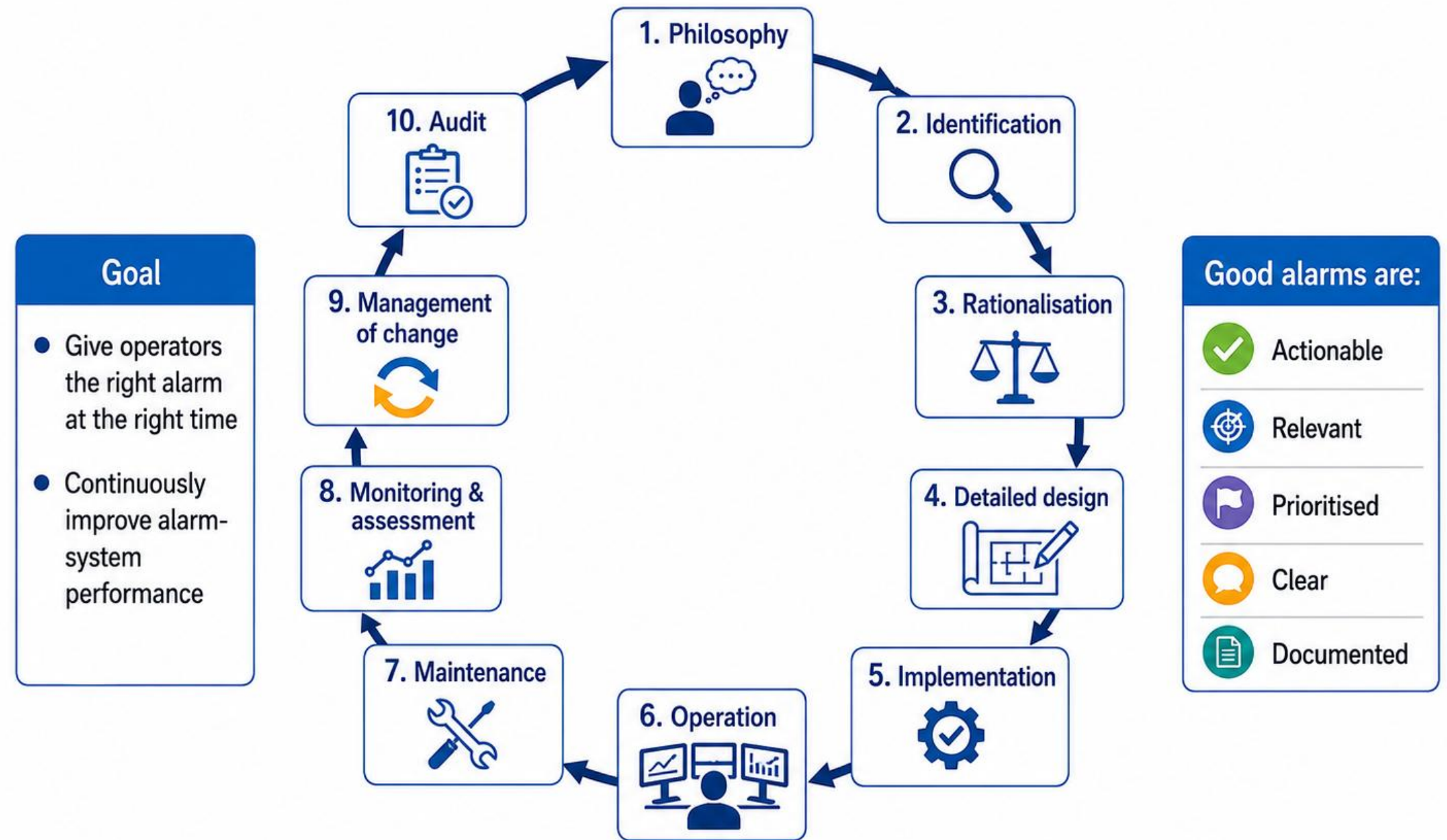


IEC 62682

How do we ensure that alarms shown to operators are:

1. meaningful,
2. actionable,
3. prioritised,
4. documented,
5. maintainable,
6. not overwhelming?

IEC 62682 Alarm Management Lifecycle



Widely used as a best-practice framework for process and control-system alarm management.

Integrated Critical Alarms Management Software

icams



How does it work?

INPUT DATA
(Distributed
Control System)

**NOTIFICATION
FORMULA**
(PYALARM /
AlarmHandler)

BACKEND

icams

Temperature
sensor

If temperature is
higher than 50
-> trigger alarm.

- Web API
- MongoDB CACHE
- Advanced logging
- Speed-up PANIC

- Operated at IC@MS
- Processed by Alarm-Handler/PyAlarm/ Achtung
 - notifications
 - logging

What IC@MS does?

Area

Functions identified

Alarm monitoring

Active alarms, inactive alarms, alarm details, filters, alarm state, severity, device and tag search

Alarm lifecycle

Add, modify, remove, acknowledge, reset, enable, disable

History and archiving

Alarm history, history by tag, snapshot/archive access

Operator workflows

Comments on actions, saved filters, table column configuration, recent searches

Notification/contact management

Panic phonebook, alarm mail, alarm notification configuration

Datasource/composer layer

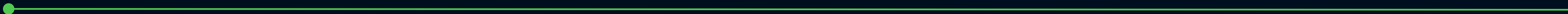
HTTP, MQTT and Modbus datasource handling; composer creation and attribute mapping

Administration/security

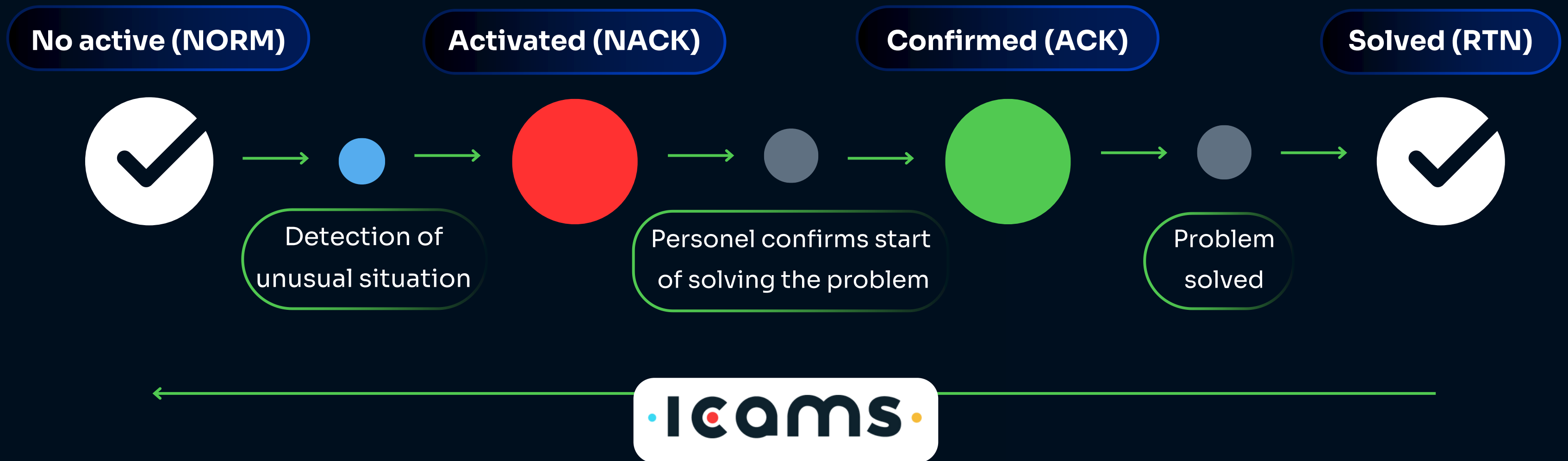
Login, users, roles, groups, admin panel, password reset, mail configuration

Deployment

Docker Compose, Kubernetes, Helm charts, MongoDB, TangoDB, SNAP/PyTangoArchiving containers



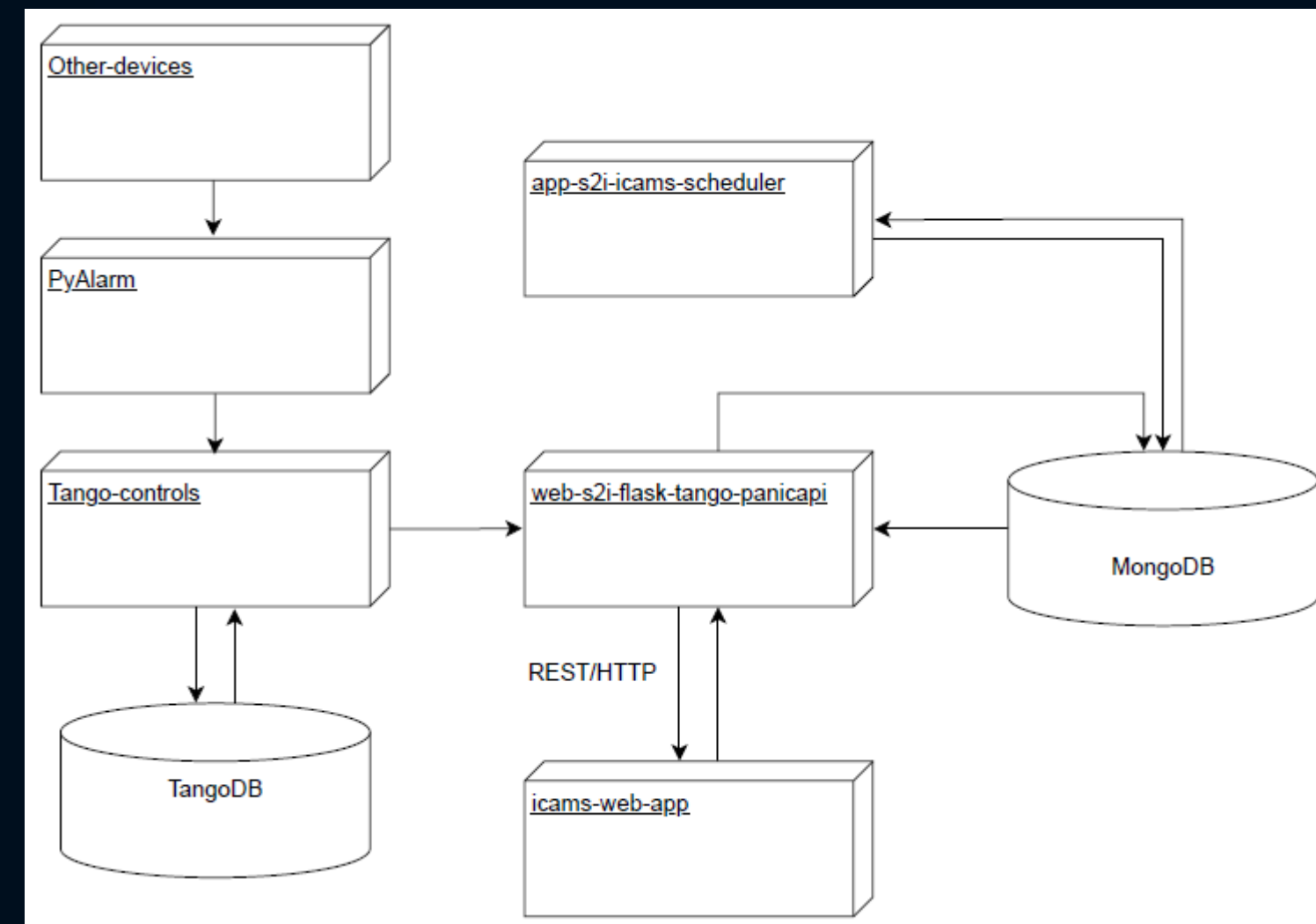
IC@MS is focused on daily operation



IC@MS is Integrated Critical Alarms Management Software

A web-based alarm-management and integration layer for Tango-based facilities, **NOT** as a replacement for **PANIC/PyAlarm** or **Elettra AlarmHandler**.

- **Frontend:** React/Redux web application for operators and engineers.
- **Backend API:** Flask/Python REST API exposing alarm, history, phonebook, datasource, composer, mail and user-management operations.
- **Scheduler/integration service:** Python service that synchronizes alarm-provider state and archived snapshots into MongoDB.



Why IC@MS?

i



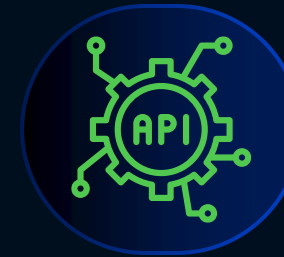
Better user interface for everyday use



Access from anywhere through web browser



No need to install on the client's computer



Web API



Multiple access roles



Integration with Active Directory /
MAX-IV login.

Why IC@MS?

i

Advantage

Brownfield integration

Web-native operations

Open handover model

Deployment readiness

Operator workflow layer

Commercial + community model

Why it matters

IC@MS can sit above PyAlarm/PANIC, Achtung, and AlarmHandler instead of forcing facilities to replace proven alarm engines. PANIC is already a mature Tango alarm suite with configuration, triggering, acknowledgement, distributed PyAlarm engines and notification actions.

Operators and engineers access alarms through a browser; no desktop Panic GUI installation is needed. The IC@MS is a web equivalent/extension of Panic GUI.

SKAO received source code, repository history, documentation and deployment artefacts under BSD-3-compatible licensing information, which allows independent extension.

Docker/Kubernetes deployment files, build instructions and deployment notes make IC@MS easier to adopt in modern facility infrastructure.

Alarm list, acknowledgement, reset/disable actions, history, filtering, RBAC and APIs create an operational console.

SKAO can maintain or extend the code independently, while S2Innovation can still provide engineering support, customisation and long-term maintenance.

Why IC@MS?

i

IC@MS is the missing web-based operational layer between mature Tango alarm engines and modern facility operations: it keeps PyAlarm/PANIC, Achtung, and AlarmHandler useful, but makes them easier to deploy, operate, integrate and support at scale.

←
icams



The speed

- SKAO test results with the following loads:
- 100 dummy alarms --> nearly instant trigger of the test alarm,
- 300 dummy alarms --> nearly instant trigger of the test alarm,
- 500 dummy alarms --> 1-1.5s latency of the test alarm.



Thank You

For Your Attention

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We recognise and acknowledge the Indigenous peoples and cultures that have traditionally lived on the lands on which our facilities are located.



Many thanks: Thomas Juerges, Matteo Canzari, Marco Bartolini, Sonja Vrcic, Ugur Yilmaz

www.skao.int

Accelerators productivity increase



Logging page



- Support for logging using LDAP for different providers
- Forgot password supported
- Permissions by roles

IC@MS

Regular login

Sign In

Username

Password

Log in!

The screenshot shows the IC@MS home page. At the top left is the logo 'IC@MS' with the text 'Logged as: admin@gmail.com' and 'Version: 0.9.0_#9999'. On the top right are navigation links: 'Home', 'Admin', 'Configuration', and 'Logout'. Below the navigation is a search bar with a 'Search' button. Underneath are filter buttons for 'Severity' (set to 'All'), 'State' (set to 'All'), 'Alarm provider class' (set to 'All'), and 'Active since'. The main content is divided into two sections: 'Active alarms' and 'Not active alarms'. The 'Active alarms' section shows a table with one row: 'tg_test' with severity 'ALARM' and state 'UNACK'. The 'Not active alarms' section shows a table with five rows, each with a different severity and state, and a color-coded background (red, orange, yellow, green, blue).

Alarm	Severity	State	Active since	Description	Formula	Device
tg_test	ALARM	UNACK	Mon, 06 Feb 2023 11:51:46 GMT	TangoTest alarms mod	{ sys/tg_test/1/double_scal...	test/pyalarm/1

Alarm	Severity	State	Description	Formula	Device
ahdev3	WARNING	RTNUN	Test alarm for alarm handler	{ alarm/test/01/condition ==...	alarm/handler/01
ahdev6	WARNING	RTNUN	Test alarm for alarm handler	{ alarm/test/01/condition ==...	alarm/handler/01
ahdev2	ALARM	RTNUN	Test alarm for alarm handler	{ alarm/test/01/condition ==...	alarm/handler/01
ahdev4	ALARM	RTNUN	Test alarm for alarm handler	{ alarm/test/01/condition ==...	alarm/handler/01
CHINA_CPU_USAGE	WARNING	NORM	CHINA_CPU_USAGE too ...	any([s.value > 6 for s in FIN...	test/pyalarm/1

Home page



- Separation for active and not active alarms
- Colors indicating severities
- Search by severity, state, alarm provider class provided (PyAlarm, AlarmHandler)

Home page



- Perform actions for alarms: acknowledge, reset, disable
- Possibility to choose multiple or all alarms and perform actions
- Pagination allows to choose how many alarms is visible

Severity	State	Active since	Description	Formula	Device
WARNING	NORM		CANADA_CPU_USAGE too...	any([s.value > 96 for s in FI...	test/pyalarm/1
WARNING	NORM		CHINA_CPU_USAGE too high	any([s.value > 6 for s in FIN...	test/pyalarm/1
ALARM	NORM		FRANCE_CPU_USAGE too ...	any([s.value > 31 for s in FI...	test/pyalarm/1
WARNING	NORM		GERMANY_CPU_USAGE t...	any([s.value > 43 for s in FI...	test/pyalarm/1
WARNING	NORM		INDIA_CPU_USAGE too high	any([s.value > 37 for s in FI...	test/pyalarm/1
WARNING	NORM		ITALY_CPU_USAGE too high	any([s.value > 7 for s in FIN...	test/pyalarm/1

ALARM: FRANCE_CPU_USAGE
Description FRANCE_CPU_USAGE too high mod
Device: test/pyalarm/1

Date/Time	Event	Formula
Thu, 01 Jan 1970 01:00:00 GMT	FRANCE_CPU_USAGE too high mod	any([s.value > 31 for s in FIND(station/France/server*/cpu_usage)])

Snap data

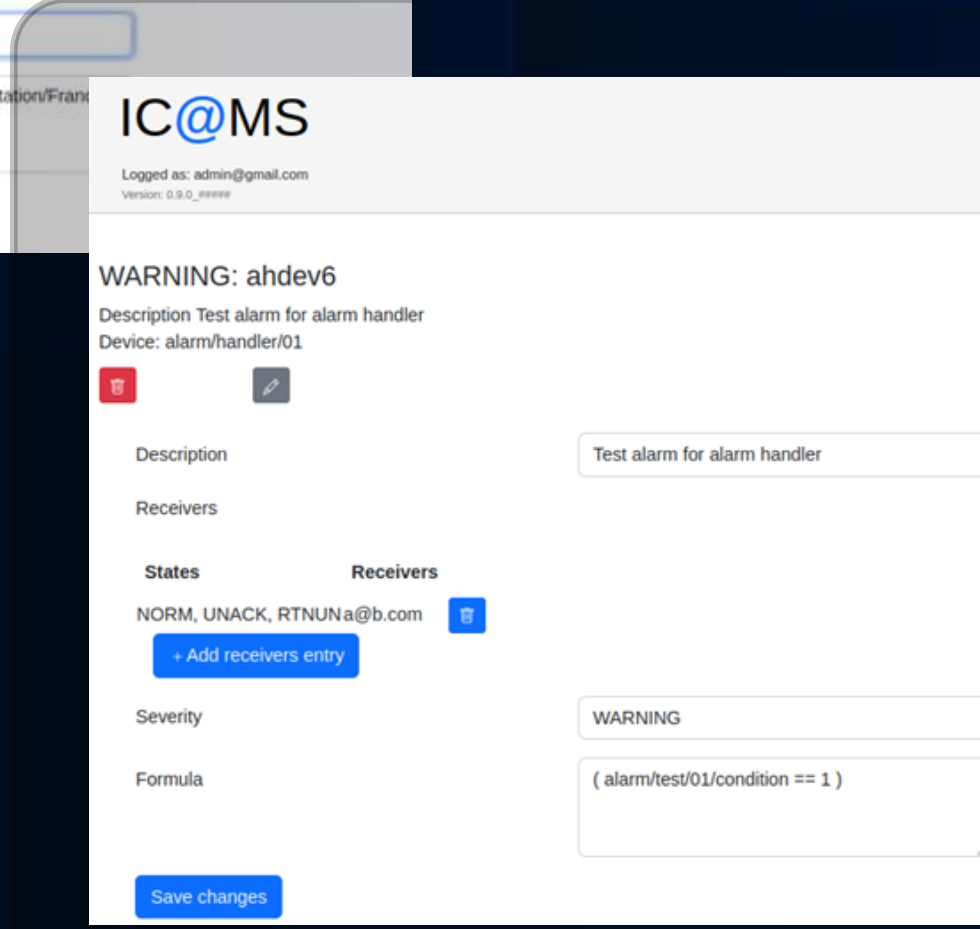
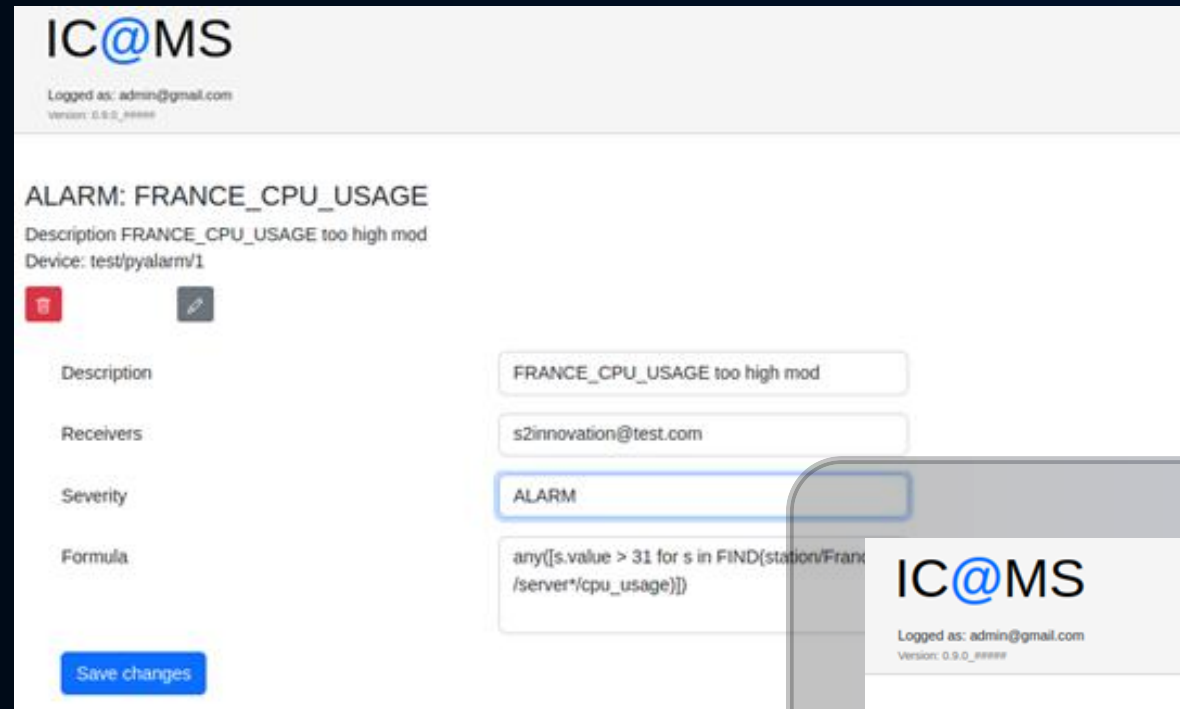
Date	Comment	Value
Fri, 03 Feb 2023 13:48:23 GMT	ALARM: FRANCE_CPU_USAGE too high	①
Fri, 03 Feb 2023 13:47:39 GMT	ACKNOWLEDGED: RESET	①
Fri, 03 Feb 2023 13:46:52 GMT	ACKNOWLEDGED: ACKNOWLEDGED	①
Fri, 03 Feb 2023 13:10:16 GMT	ALARM: FRANCE_CPU_USAGE too high	①
Wed, 01 Feb 2023 16:08:05 GMT	ACKNOWLEDGED: ACKNOWLEDGED	①

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Alarm details page



- Possibility to modify existing alarm
- Show history of alarm from Tango Snap archiving with values used to calculate formula



Alarm details page



Possibility to modify existing alarm
– supported for both PyAlarm and
AlarmHandler alarms

Alarms history page



- See history for all alarms
- Search alarm history by name, comment, severity, date...

IC@MS
Logged as: admin@gmail.com
Version: 0.9.0_#xxxx

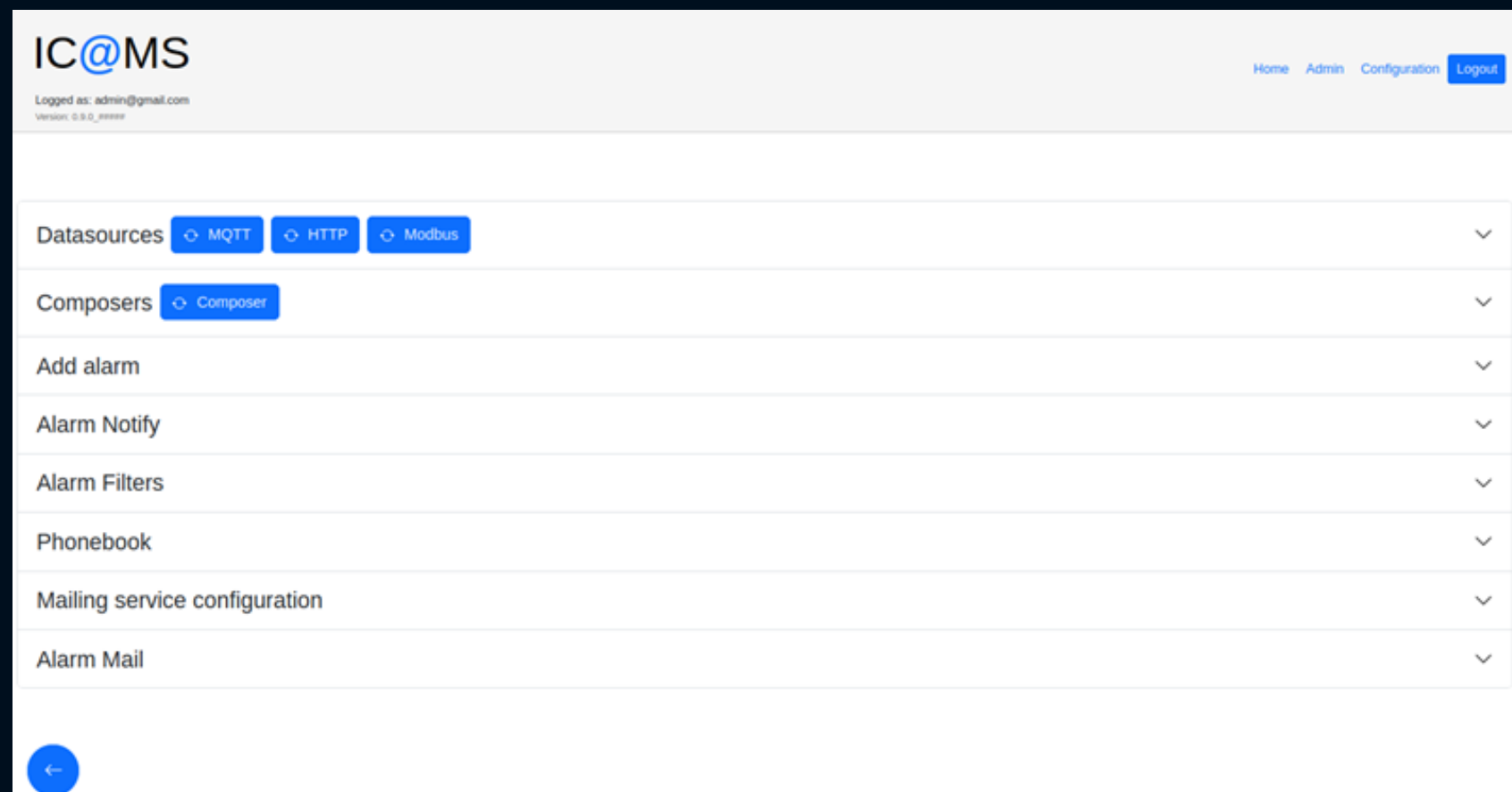
Home Admin Configuration Logout

alarm Search

Severity All State All Active since

History

Alarm	Severity	Date/Time	Comment	Description	Device
ampli_test_new	ALARM	Fri, 03 Feb 2023 12:51:41 GMT	ACKNOWLEDGED: RESET	Test ampli alarm	test/pyalarm/1
ampli_test_new	ALARM	Fri, 03 Feb 2023 12:51:18 GMT	ACKNOWLEDGED: ACKNOWLEDGED	Test ampli alarm	test/pyalarm/1
ampli_test_new	ALARM	Fri, 03 Feb 2023 12:05:27 GMT	ALARM: Test ampli alarm	Test ampli alarm	test/pyalarm/1
ampli_test_new	ALARM	Fri, 03 Feb 2023 12:04:52 GMT	ACKNOWLEDGED: RESET	Test ampli alarm	test/pyalarm/1
ampli_test_new	ALARM	Fri, 03 Feb 2023 12:04:33 GMT	ACKNOWLEDGED: ACKNOWLEDGED	Test ampli alarm	test/pyalarm/1
ampli_test_new	ALARM	Fri, 03 Feb 2023 12:00:39 GMT	ALARM: Test ampli alarm	Test ampli alarm	test/pyalarm/1
tg_test	ALARM	Wed, 01 Feb 2023 16:21:17 GMT	ALARM: TangoTest alarms	TangoTest alarms mod	test/pyalarm/1
tg_test	ALARM	Wed, 01 Feb 2023 16:08:08 GMT	ACKNOWLEDGED: ACKNOWLEDGED	TangoTest alarms mod	test/pyalarm/1
tg_test	ALARM	Wed, 01 Feb 2023 10:42:18 GMT	ACKNOWLEDGED: ACKNOWLEDGED	TangoTest alarms mod	test/pyalarm/1
tg_test	ALARM	Wed, 01 Feb 2023 09:49:19 GMT	ALARM: TangoTest alarms	TangoTest alarms mod	test/pyalarm/1



Configuration page



Allows to configure devices
and alarms

Add alarm form



- Allows to create new alarm
- Possible to choose provider class (PyAlarm, AlarmHandler) and device for which alarm will be created

The screenshot shows a web form titled "Add alarm". The form contains the following fields and controls:

- Name: Text input field.
- Description: Text input field.
- Change server: Checked checkbox.
- Alarm provider class: Dropdown menu with "PyAlarm" selected and a green checkmark.
- Device: Text input field with "test/pyalarm/1" entered.
- Receivers: Text input field.
- Severity: Text input field.
- Formula: Text area.
- Save new alarm: Blue button.

Phonebook

+ Add phonebook entry

Name

E-mail

Phone number

Submit phonebook entry

Name	E-mail	Phone number
TEST	test12345@test.com	+49123456789

Phonebook



Allows to modify entries in PANIC phonebook
After add, you can use entries to choose receivers in PyAlarm alarms

The screenshot shows a web-based configuration interface for 'Alarm Notify'. At the top left, there is a blue button labeled '+ Add alarm notify'. Below this, there are several input fields: 'Device name' (empty), 'Subscribe period' (set to 10), and 'Property list' (empty). Under the 'Group receivers' section, there are tabs for 'Group Name', 'States', and 'Receivers'. The 'Group Name' tab is active, showing a 'Group Name' input field with 'Cancel' and 'Save' buttons. The 'States' tab shows a list of states: NORM, UNACK, RTNUN, and OOSRV. The 'Receivers' tab shows an empty input field. At the bottom left, there are buttons for '+ Add receivers entry' and 'Submit'. At the bottom of the interface, there is a table with the following data:

Device	Property list	Subscribe period
alarmhandler14	AlarmHandlerDeviceList1	20

Alarm notify



- Allows to create and modify AlarmNotify devices which are notification devices for Elletra AlarmHandler
- Allows to define groups

Data sources



- Allows to create on-the-fly Tango devices to fetch data from HTTP server, MQTT or Modbus
- Different authorisation types supported (basic, cert, token)

The screenshot shows a web interface for configuring data sources. At the top, there are tabs for 'MQTT', 'HTTP', and 'Modbus'. Below the tabs is a '+ Add Datasource' button. The main form contains the following fields:

- Choose protocol: MQTT (selected)
- Choose authorization: basic (selected)
- Datasource name: [empty text box]
- Username: [empty text box]
- Password: [empty text box]
- Host: [empty text box]
- IP of MQTT broker: [empty text box]
- Port: [empty text box]
- Default: 1883
- Keep alive: [empty text box]
- Default: 60

At the bottom of the form is a 'Save datasource' button. Below the form is a table listing existing data sources:

Data source name	Protocol	Actions
access01	HTTP	[stop] [edit]
less02	HTTP	[stop] [edit]

The screenshot shows a web interface for creating a 'Composer' device. The form has the following fields:

- Composer name:
- Constants:
- Choose datasource:
- Attribute name:
- Choose attribute type:
- Query_value:
- Pointer:
- Response_type:

A blue 'Submit' button is located at the bottom left of the form. Below the form, there are three tabs: 'Composer name', 'Composer attributes', and 'Composer Values'. The 'Composer name' tab is currently selected.

Composer devices

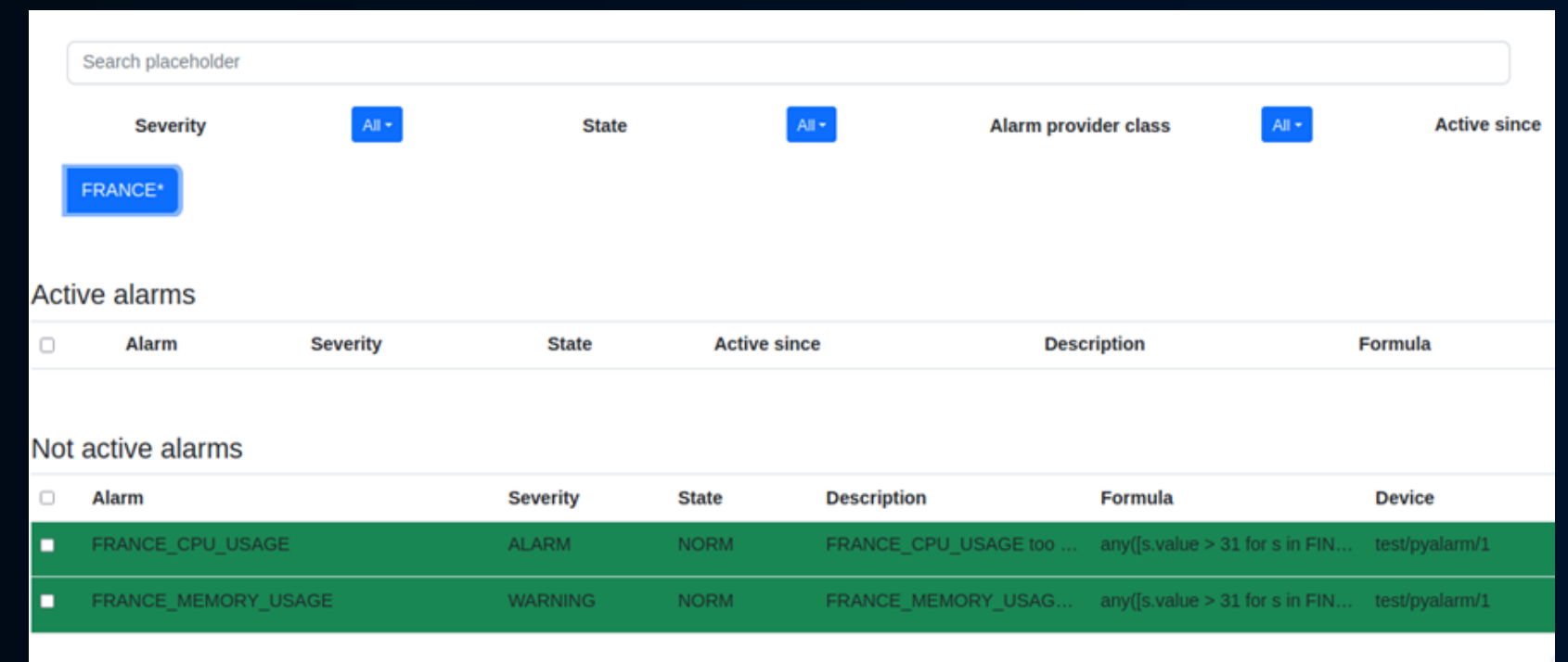
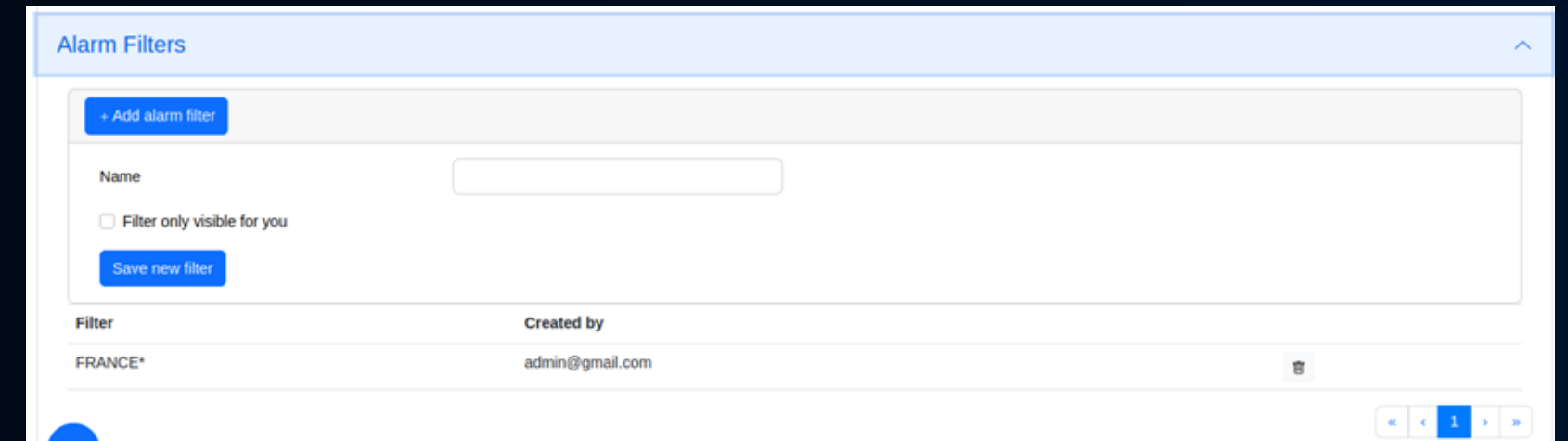


Allows to create on-the-fly Tango devices to compose data from different Tango data source devices (HTTP, MQTT and from Epics PV read from channel access)

Alarm Filters



- Allows to create filters used to easily search alarms in history or home page
- Possible to choose visible level



Admin panel



- Implemented using Flask admin
- Allows to manage users and groups (e.g. roles for users)
- Each group has provider classes

	Name	Alarm Provider
<input type="checkbox"/>	S2Innovation	PyAlarm, AlarmHandler

Roles

- viewer
- alarm_operator
- alarm_editor
- datasource_creator
- datasource_editor
- composer_creator
- composer_editor

	Login	Phone	Roles	Group	Searches	Provider
<input type="checkbox"/>	admin@gmail.com	+48123456789	admin	S2Innovation		

Flasgger http://localhost:3010/apispec_1.json Explore

IC@MS app
API

- alarms
- alarms-archive
- alarms-filters
- alarms-phonebook
- devices
- composers
- datasource
- alarms-history
- login
- mail-config
- protocols

[BASE URL: , API VERSION: 0.0.1]
Powered by Swagger

POST /api/alarms/inactive/{page_number} Get the information about alarms

Implementation Notes
:return: dict with keys=data, pages

Response Class (Status 200)
OK

Model Example Value

```
{
  "_id": {
    "_id": "string"
  },
  "activation_time": {},
  "description": "string",
  "device": "string",
  "formula": "string",
  "is_active": true,
  "is_disabled": true,
  "receivers": "string"
}
```

Response Content Type application/json

Parameters

Parameter	Value	Description	Parameter Type	Data Type
page_number	1	Page number	path	undefined
body		Filters	body	undefined

Parameter content type: application/json

Response Messages

Swagger

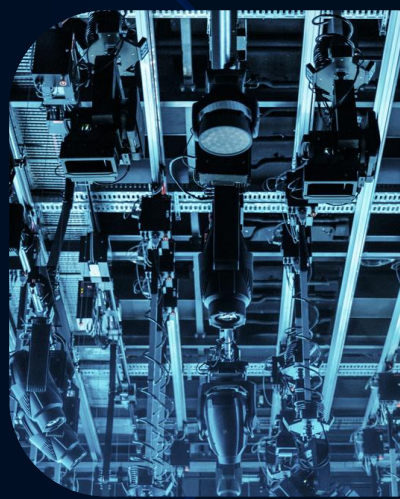


- We are using Flask framework for backend, we use REST communication
- Swagger is tool to document and endpoints
- Endpoints are grouped and well defined to simplify development and testing



Thank You

For Your Attention



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