WP 16 - Control System

- activities for the short-medium term
- strategy for defining the control framework

On behalf of the Control Service team

2021

2022

2023

2024

TDR released☞

EuPRAXIA@SPARC_LAB TDR I Review Committee -

Short-medium term strategy

Propaedeutic activities

!CHAOS qualification

Collection of specifications
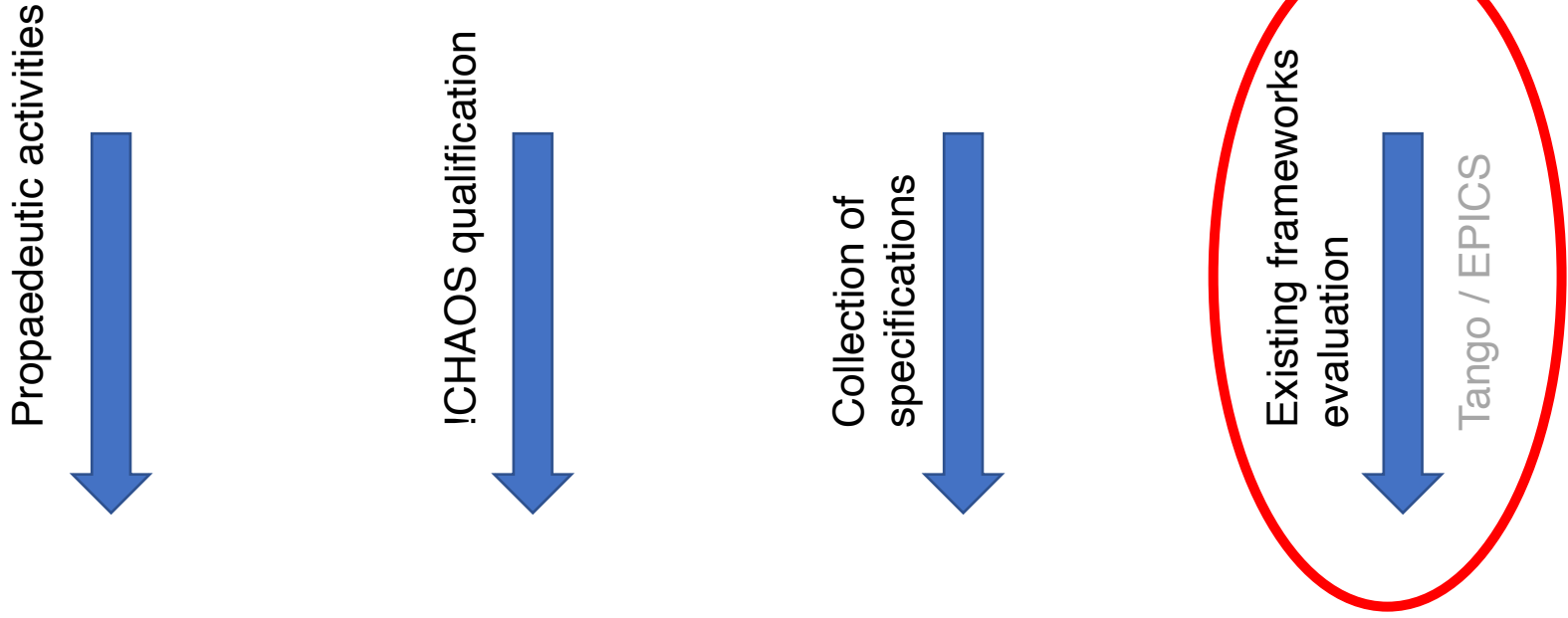
Existing frameworks evaluation

Tango / EPICS

Propaedeutic activities

> - Prepare the **tools** necessary to work efficiently
> - Explore **promising technologies** that can be applied to the EuPRAXIA control.

- In view of the activities on EuPRAXIA, a course - held by an Atlassian Platinum Partner - was organized on *Jira*, to encourage people to work with a modern **project tracking tool** and follow *agile* methodologies.

- A collaboration with the Project Manager is in progress for the creation (outsourced) of a document management system to be used for all EuPRAXIA documents (**ESSENTIAL for the collection of specifications**).

- We are setting up a collaboration (born by the recent *Interlab meeting*) with Elettra and ENEA to explore arguments of common interest and have graduate/PhD students working on them.

Short-medium term strategy

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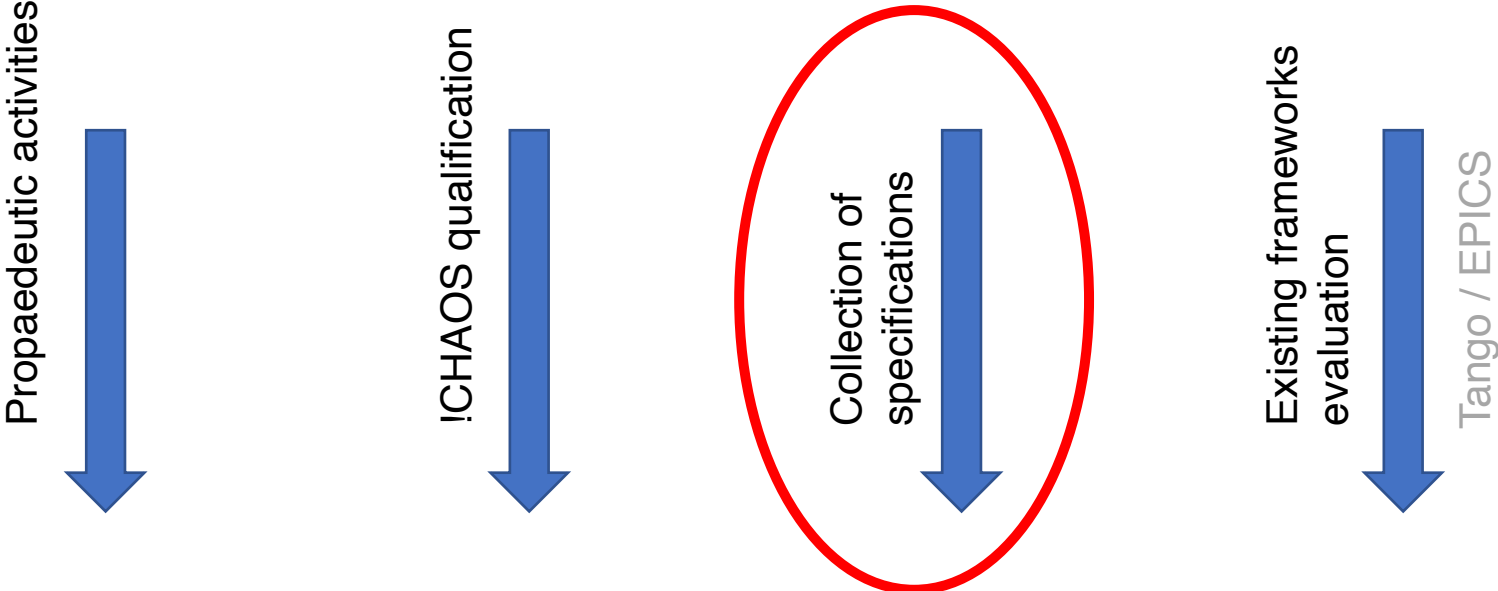Tango / EPICS

Existing frameworks evaluation

> Following the recommendations of the Review Committee, an in-depth analysis of the existing and widespread control frameworks is underway.

Given that – besides those developed in-house for DAFNE and SPARC – we have limited knowledge of other control frameworks, we started a training program:

- a 3-days training course on Tango <u>was attended</u>
  Held by Lorenzo Pivetta (Elettra) on 28th, 29th and 30th of sep 2020

- a 3-days training course on EPICS <u>is in preparation</u>
  To be held by Mauro Giacchini and Maurizio Montis (INFN-LNL) within march/April 2021

Besides the training outcomes, we have also to take into account the existing in-house knowledge on EPICS (S. Pioli) and the overall value derived from the 2.5 M€ investiment on the ELI-NP software control integration (see TEX slides later).

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Tango / EPICS

Collection of specifications (hardware form)

> We are presenting this form to WP leaders in the next days

> Other forms for front-end SW and high level SW are in preparation

General part	
Description	Digital Voltmeter
Nr. of devices	...
System	B
Family	INSTR
Type	DVM
Brand & Model	Agilent, ..., ...
Documentation	

Analog input		
name	Output reference	
type	Voltage	
unit	V	
impedance [ohm]	50	
range	0.00,+10.00	
resolution	.01	
synchronization	-	
trigger	-	
timing	BW [Hz]	-
	duration [s]	-
setting rate	<1s	

Digital input		
name	Auto cal.	
# of bits	1	
setting rate	<< 1s	
level	TTL	
sinking/sourcing		
synchronization		
trigger	-	

Data input		
name	Control Port	
Channel	Ethernet	
Protocol	Agilent propietary	
Meaningful data	Config. parameters	
setting rate [Hz]		

Analog output		
name		
type		
unit		
impedance [ohm]		
range		
resolution		
synchronization		
trigger		
timing	BW [Hz]	
	duration [s]	
readout rate		
continuous	rate	
storage	retention time	
burst storage	burst size [byte]	
	rate	
	retention time	

Digital output		
name		
# of bits		
readout rate		
level		
sinking/sourcing		
syncronization		
trigger		
continuous storage	rate	
	retention time	
	burst size [byte]	
burst storage	rate	
	retention time	

Data output		
name		
channel		
Protocol		
Meaningful data		
readout rate [Hz]		
continuous	rate	
storage	retention time	
	burst size [byte]	
burst storage	rate	
	retention time	

Short-medium term strategy

Propaedeutic activities

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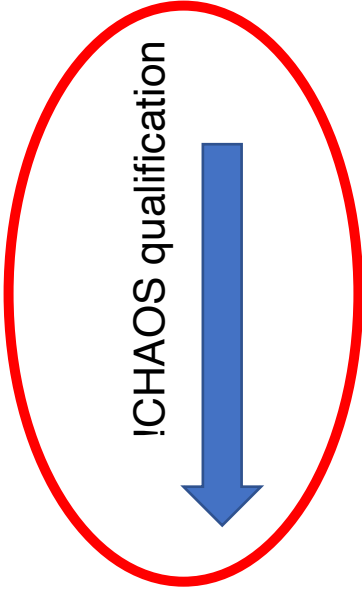
Collection of specifications
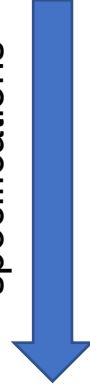
Existing frameworks evaluation
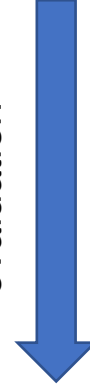
Tango / EPICS

Recap of previous RC

RC point 1	It is not clear which advantages !CHAOS might offer respect to other widespread systems.
Answer	We presented a summary of what – in our opinion – are the innovative features of !CHAOS.
RC point 2	It is not clear how widespread systems would not be adeguate for the EuPRAXIA control.
Answer	There are no reasons for such frameworks not to be considered suitable for EuPRAXIA.
RC point 3	It seems risky to employ a new framework for the EuPRAXIA control.
Answer	The possible adoption of !CHAOS is subject to the success of a qualification program and to the approval of our management.

!CHAOS qualification

Restrictions due to COVID-19 impacted on physical activities causing some delay to the program progress

FLAME control	essentially completed -> commissioning/feedbacks from users. New power server acquired to boost performances
BTF control	**limited implementation** (DAQ, camera acquisition)
DAFNE data logging	the transition from the legacy system is now a chore
DAFNE subsystems	DAFNE's operations have just started again: no news since previous review committee
TEX data logging	*dry-tested* and installed (facility not yet operational)

The !CHAOS system responds well and we are going to have the first feedbacks from users operating in a real context.

Then we have to go through an objective assesment and work out more quantitative evaluations of RELIABILITY, AVAILABILITY and PERFORMANCE.

FLAME laser control

STATE

- 11 Motors (Micos, Thorlabs, Standa) + 3 not yet online
- 16 Cameras (Basler, IDS)
- 2 vacum meters (Leybold)
- EU processes for laser beam analysis
- Control scripts for acquisition sequence
- Control and monitoring Web dashboards

ONGOING

- Optimization of latency for images from camera (now 150 ms), high camera refresh rate (>25Hz) (Web push technology)
- Automatization, test and optimization of user operations
- Active synoptic view of the plant
- Instant messaging, bugs and backlog
- Authentication and Authorization

!CHAOS qualification @FLAME - Web Dashboard (camera view)

!CHAOS qualification @FLAME - Web timelogs and state (camera data)
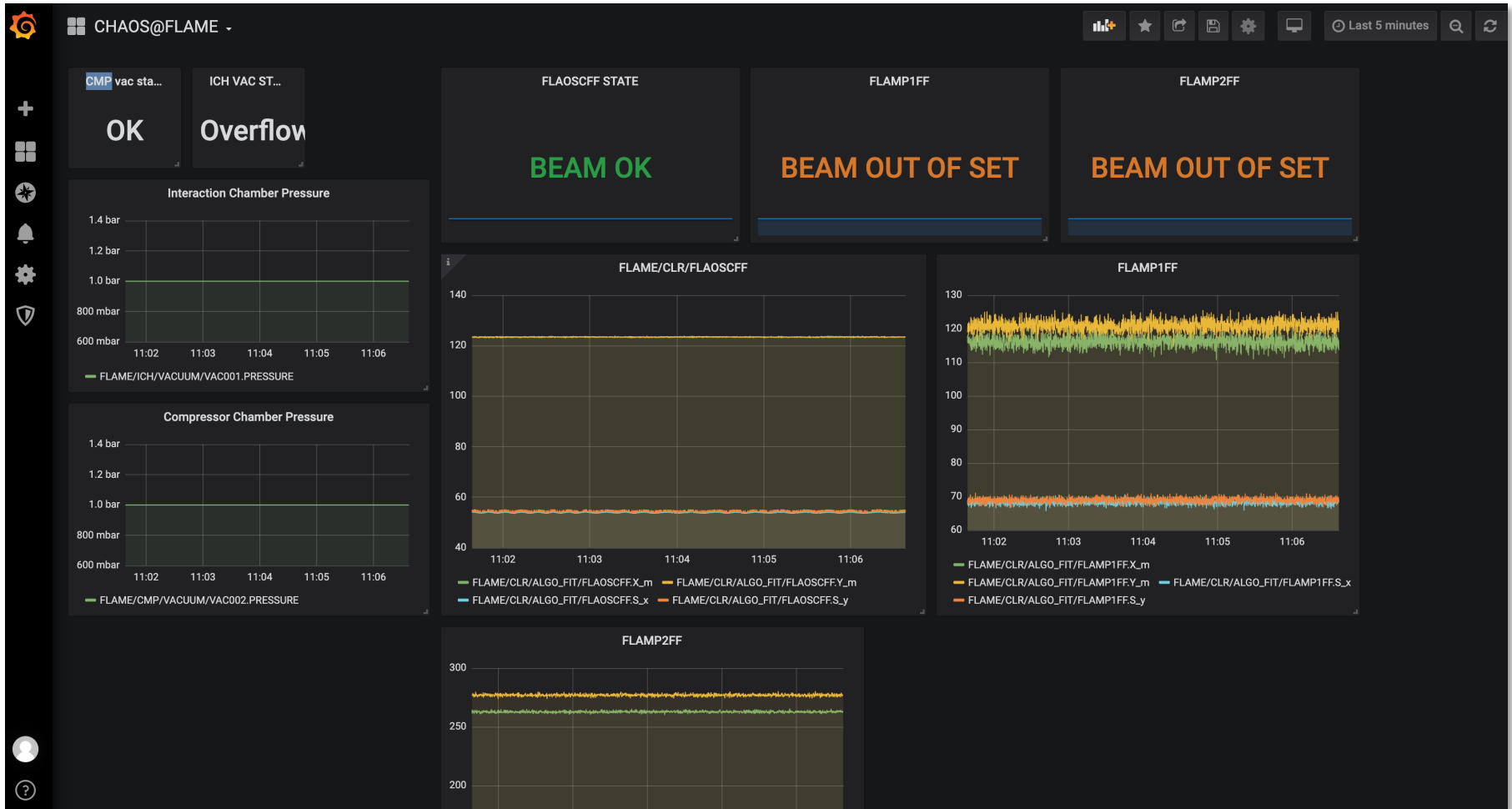
!CHAOS qualification @TEX (TEst-stand for X-band)

LNF brand new test facility for X-band accelerating structures conditioning for EuPRAXIA, CLIC and SME (LATINO Project)
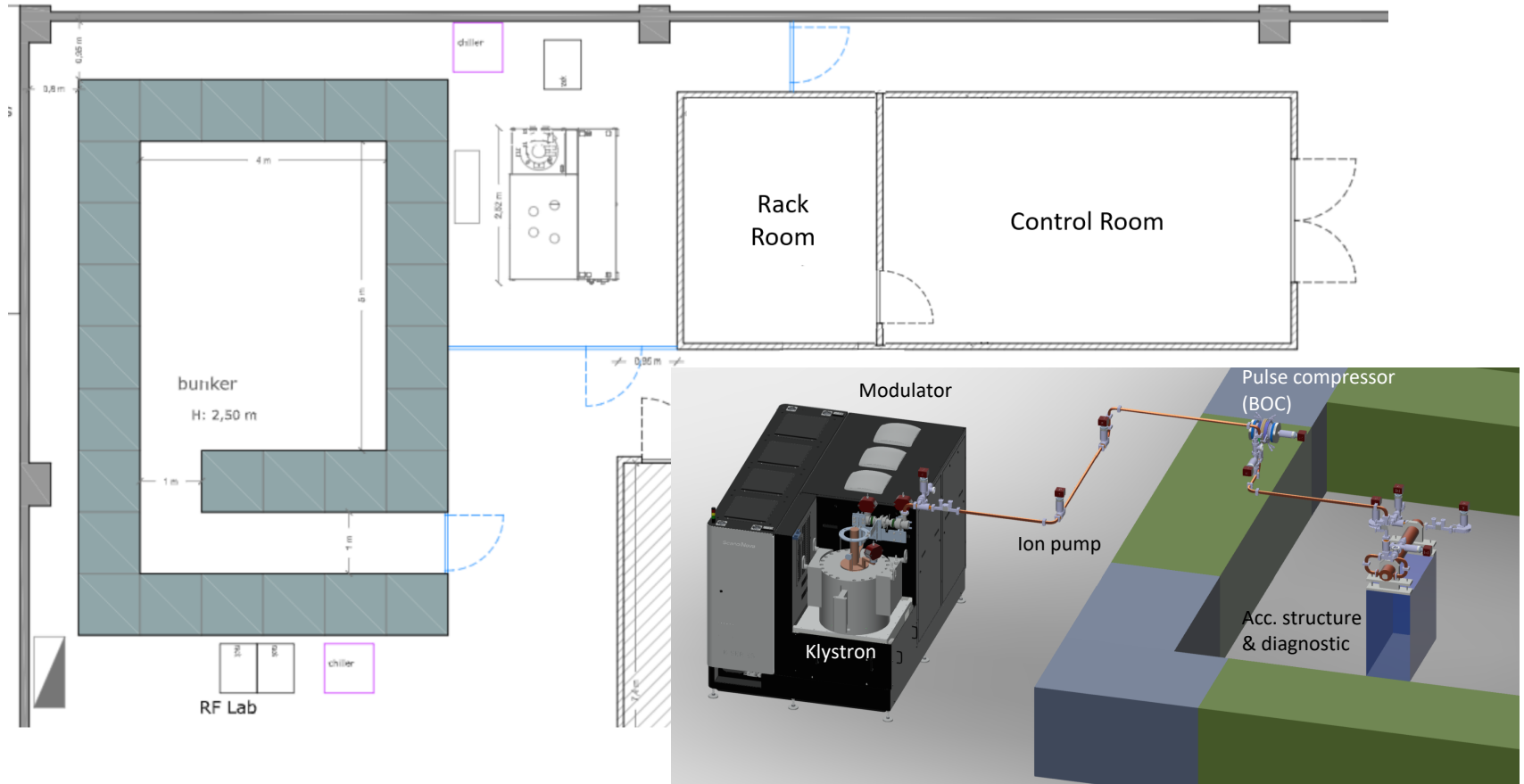
!CHAOS qualification @TEX (TEst-stand for X-band)

TEX – Control System
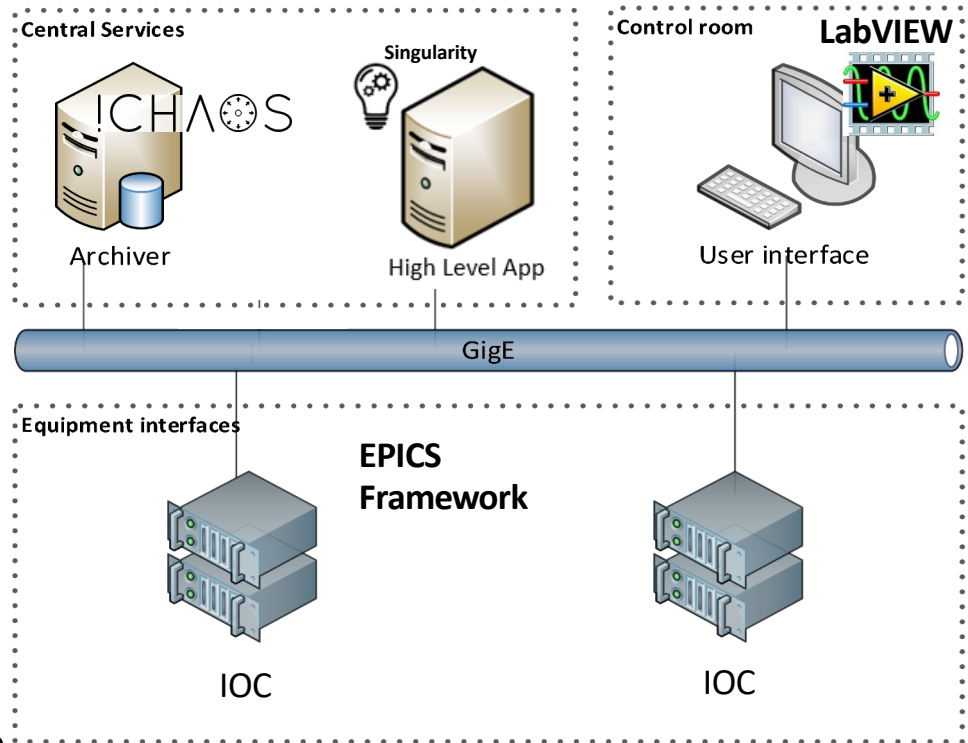**EPICS ready from ELI-NP**

Front-end devices:
- Modulator
- Faraday cups
- LLRF
- Ion Pumps & Gauges
- Functional Safety
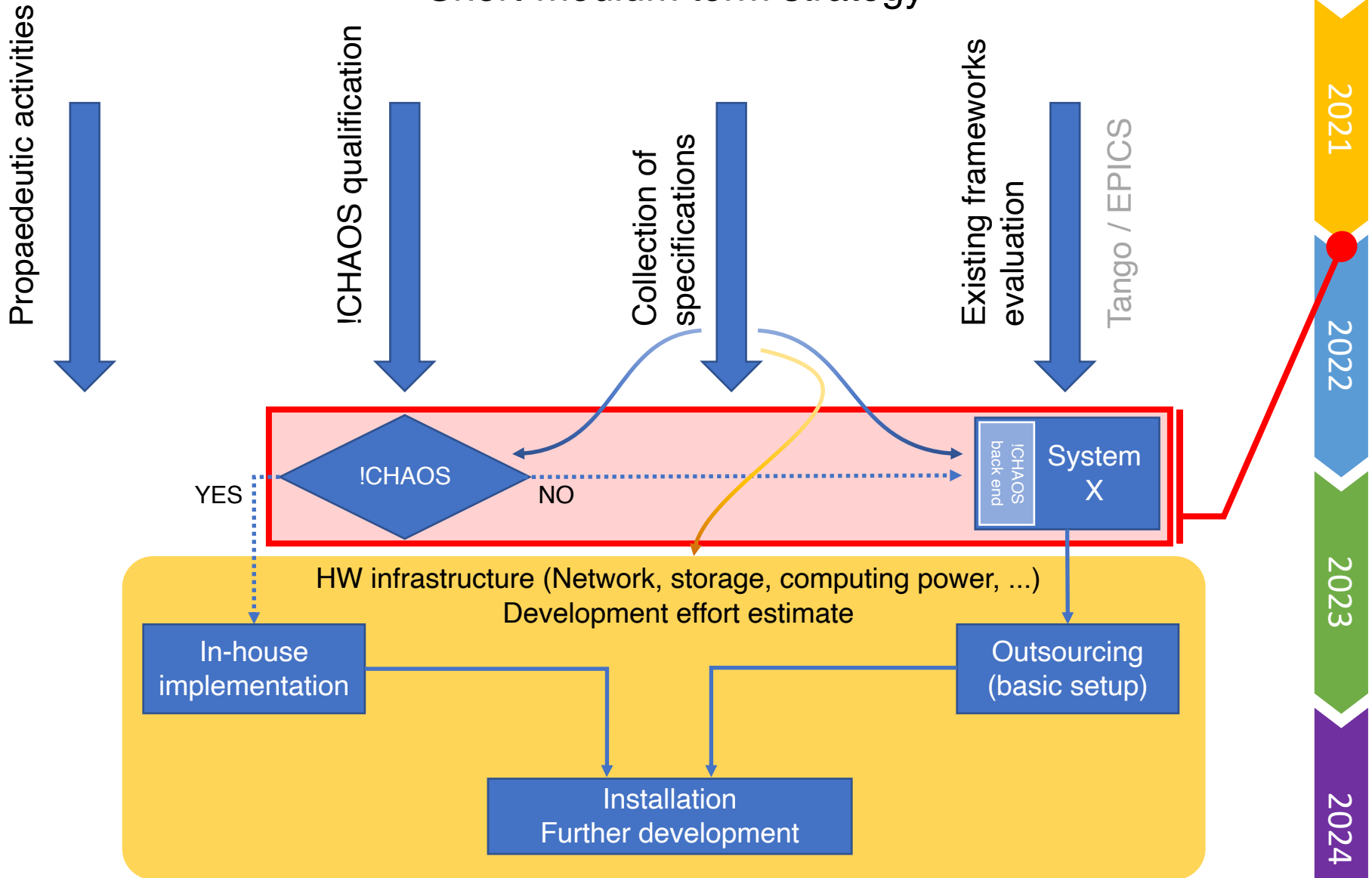- Chillers
- RF Amp.

Services:
- !CHAOS framework for data archiving
- Singularity (CSN5 Project) for machine learning based High Level Application

Control Room:
- LabVIEW-UI (Web-UI upgrade ongoing)

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YES

!CHAOS

NO

!CHAOS back end

System X

HW infrastructure (Network, storage, computing power, ...)
Development effort estimate

In-house implementation

Outsourcing (basic setup)

Installation
Further development

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Conclusions

Propaedeutic activities

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Propaedeutic activities have an overall significance and will go on with no deadline

This line of development will continue regardless of the hypothesis of adopting !CHAOS for EuPRAXIA (the installations on FLAME and DAFNE will remain in operation)

Collection of specs is an **iterative process** that will converge as the EuPRAXIA complex reaches its definitive design

After the courses we will deepen our knowledge on TANGO & EPICS and evaluate them with a view to EuPRAXIA

TDR released☞