39th Tango Community Meeting

INAF, Giulianova, Italy

Distributed tracing in action at MAX IV

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22 May 2025

Overview

Intro

(Too many!) Examples

Performance impact

Compute resources for backend

Issues / ideas for improvement

Outro

Introduction

Overview

Observability

- Understand a complex system from outside
- Traces, metrics, logs

OpenTelemetry

- Observability framework
- Vendor agnostic
- Many programming languages

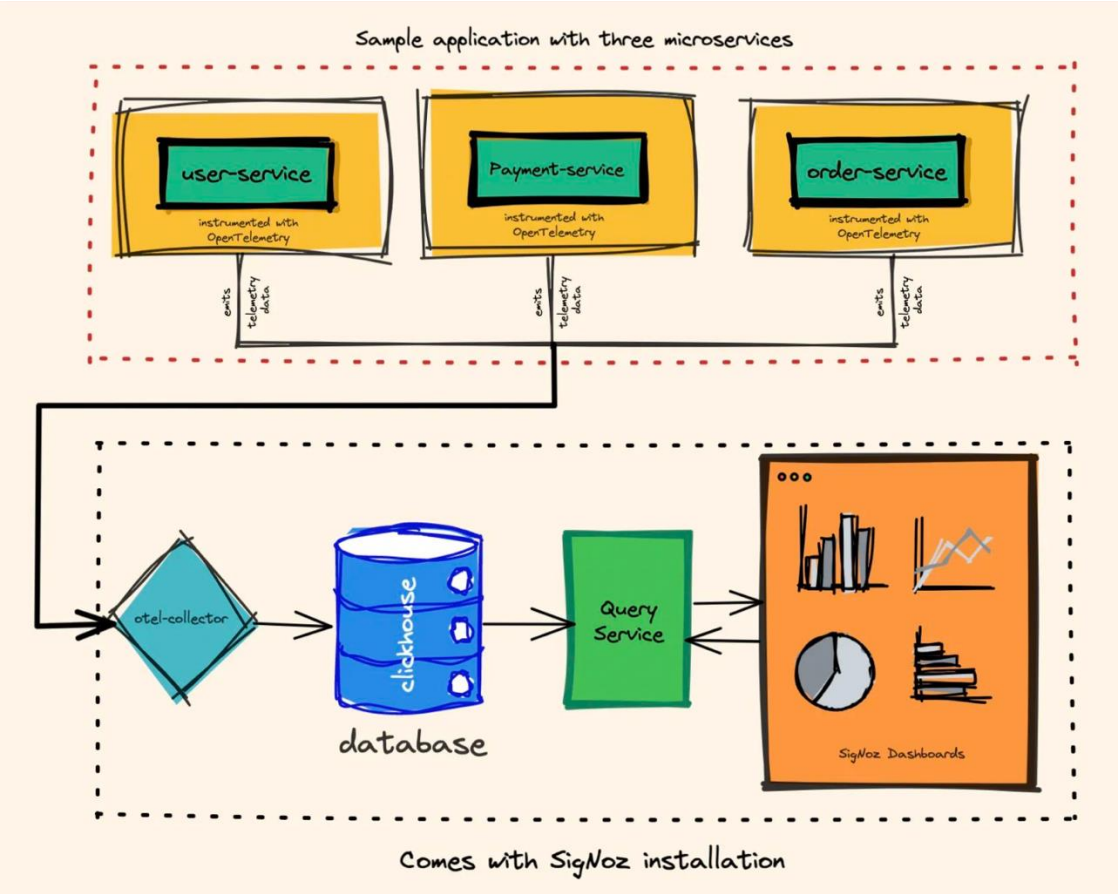


Image credit: https://signoz.io/blog/opentelemetry-backend/

Grafana Tempo and Loki

Tempo

Backend for traces and metrics

Loki

Backend for logs

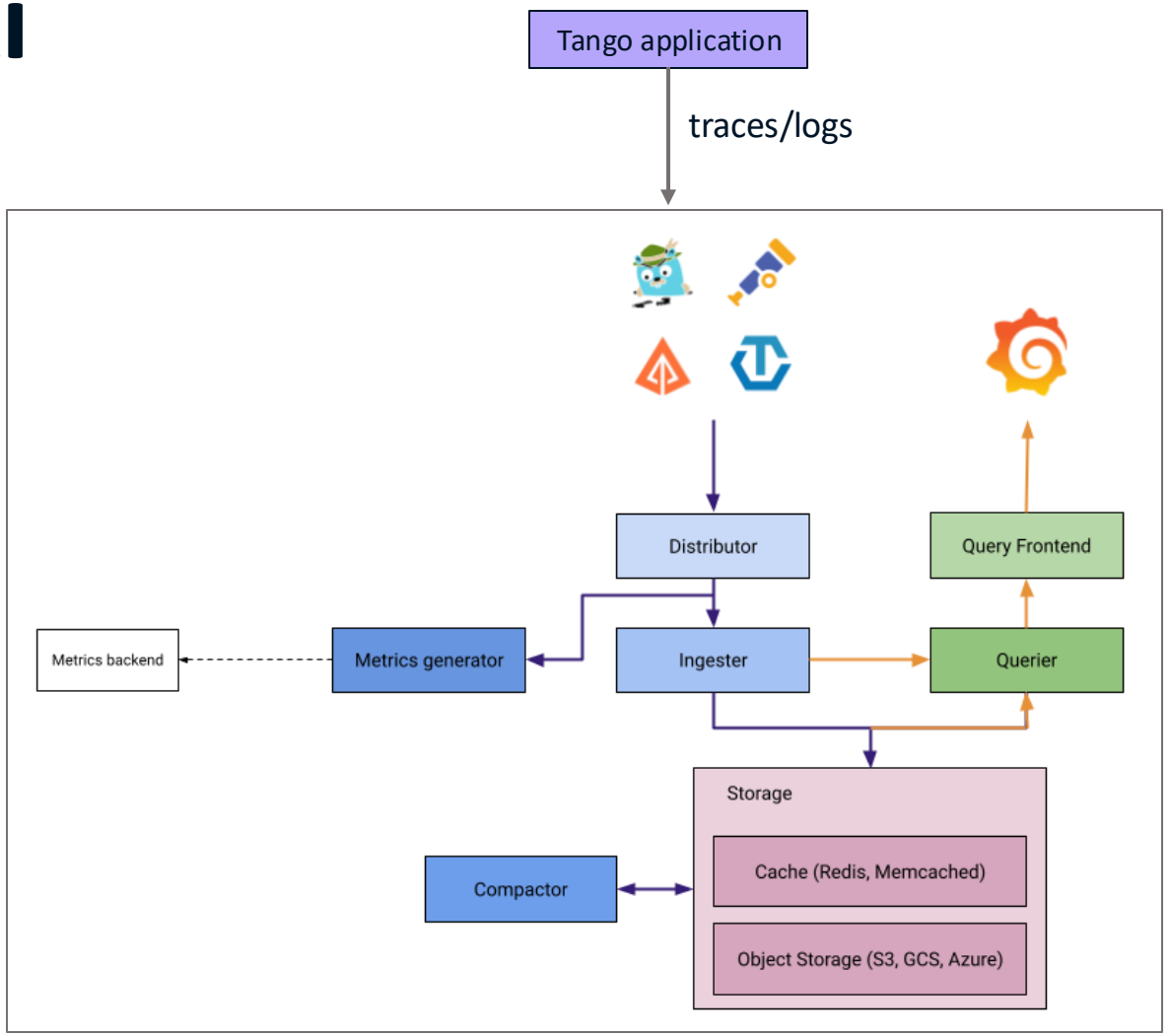


Image credit: https://grafana.com/docs/tempo/latest/operations/architecture/

Enabling in Tango

Available since Tango 10.0.0

Set environment variables, for example:

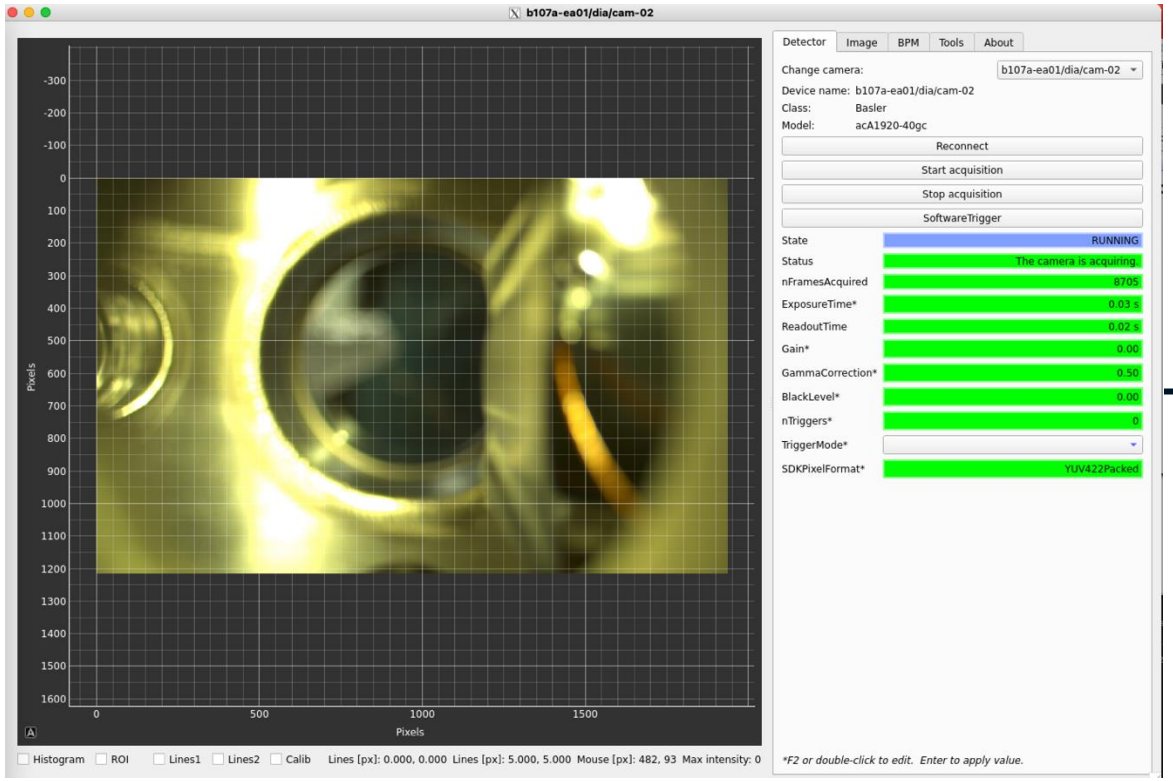
```
TANGO_TELEMETRY_ENABLE=on
TANGO_TELEMETRY_TRACES_EXPORTER=http
TANGO_TELEMETRY_TRACES_ENDPOINT=https://traces.institute.org:443/v1/traces
TANGO_TELEMETRY_LOGS_EXPORTER=http
TANGO_TELEMETRY_LOGS_ENDPOINT=https://logs.institute.org:443/otlp/v1/logs
```

Can also use HTTP, or GRPC for transport

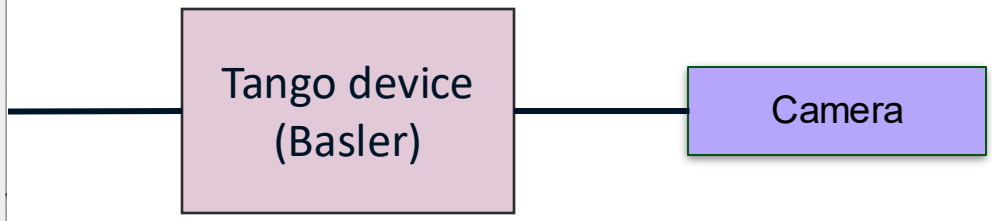
Can set environment variables in `/etc/tangorc`

Examples

GUI and Tango device for camera

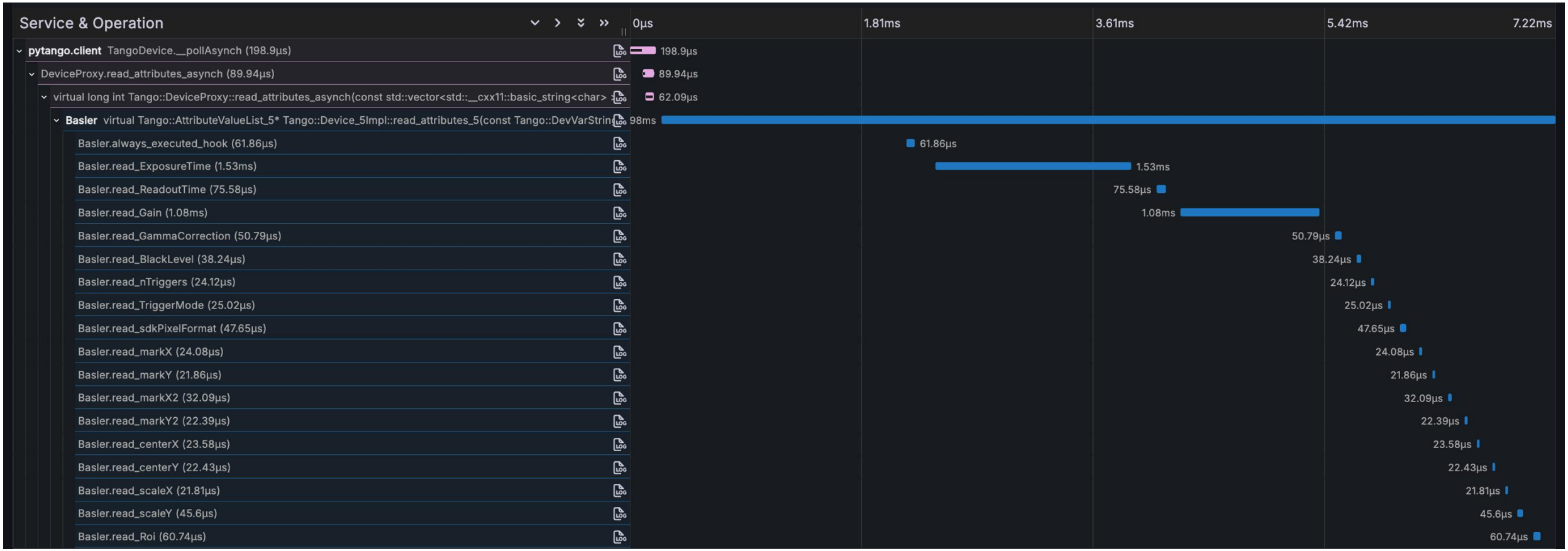


Taurus GUI (Lux Viewer)

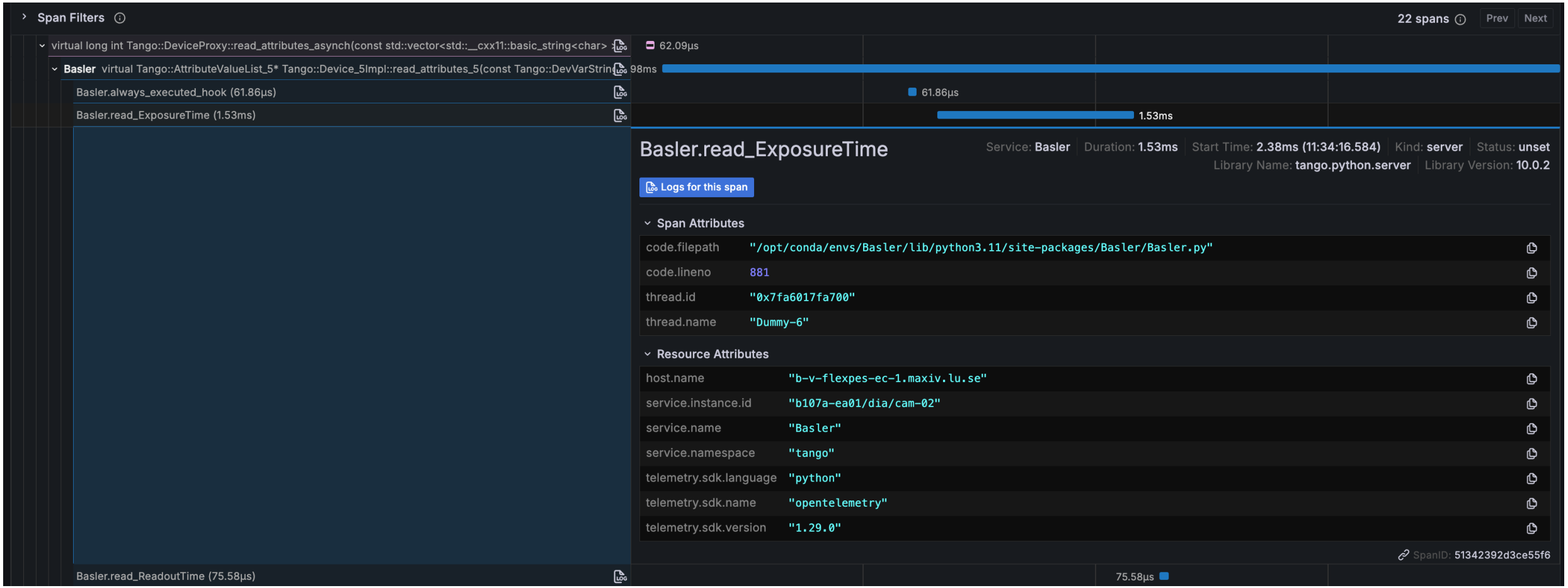


Trace overview

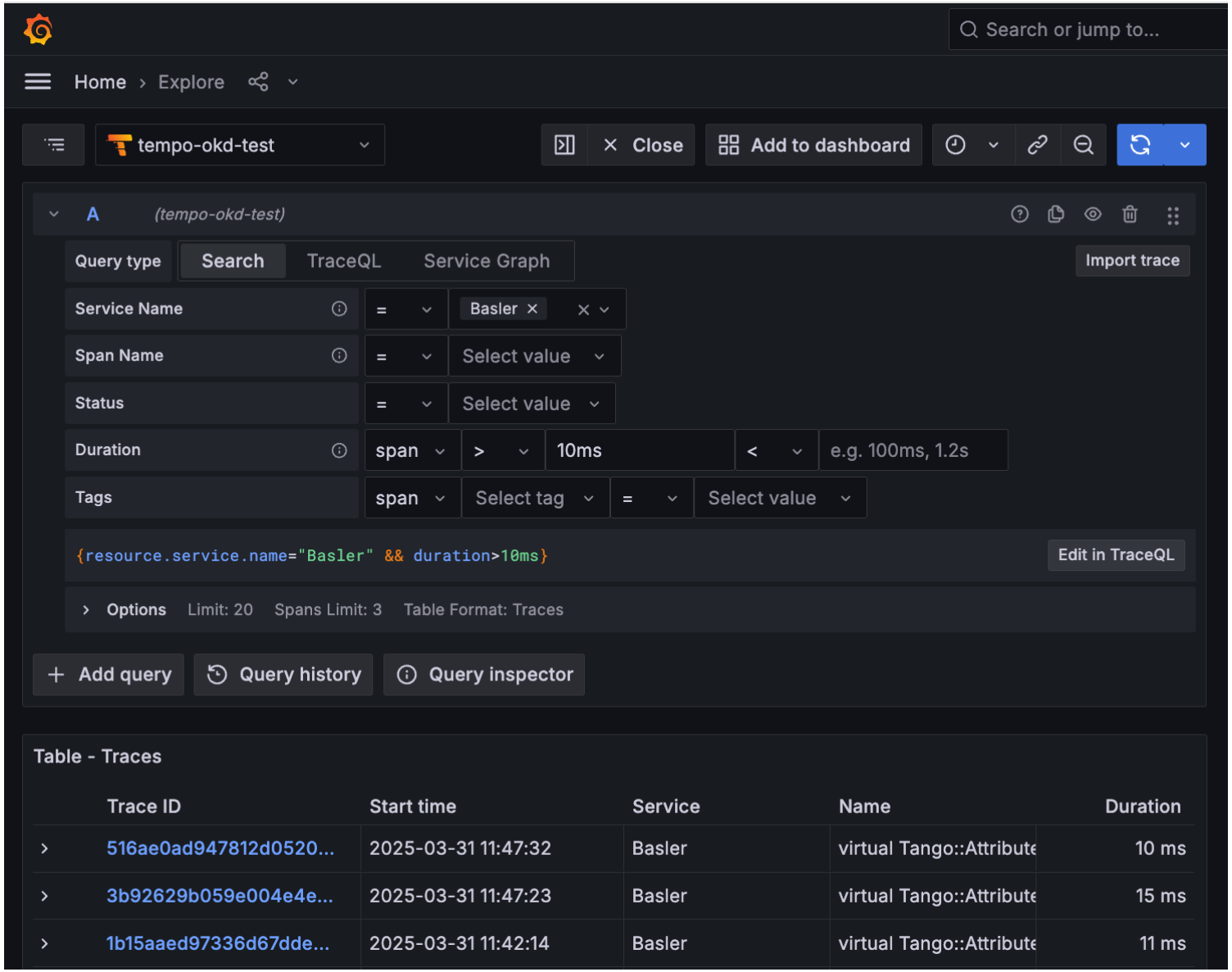
Trace detail



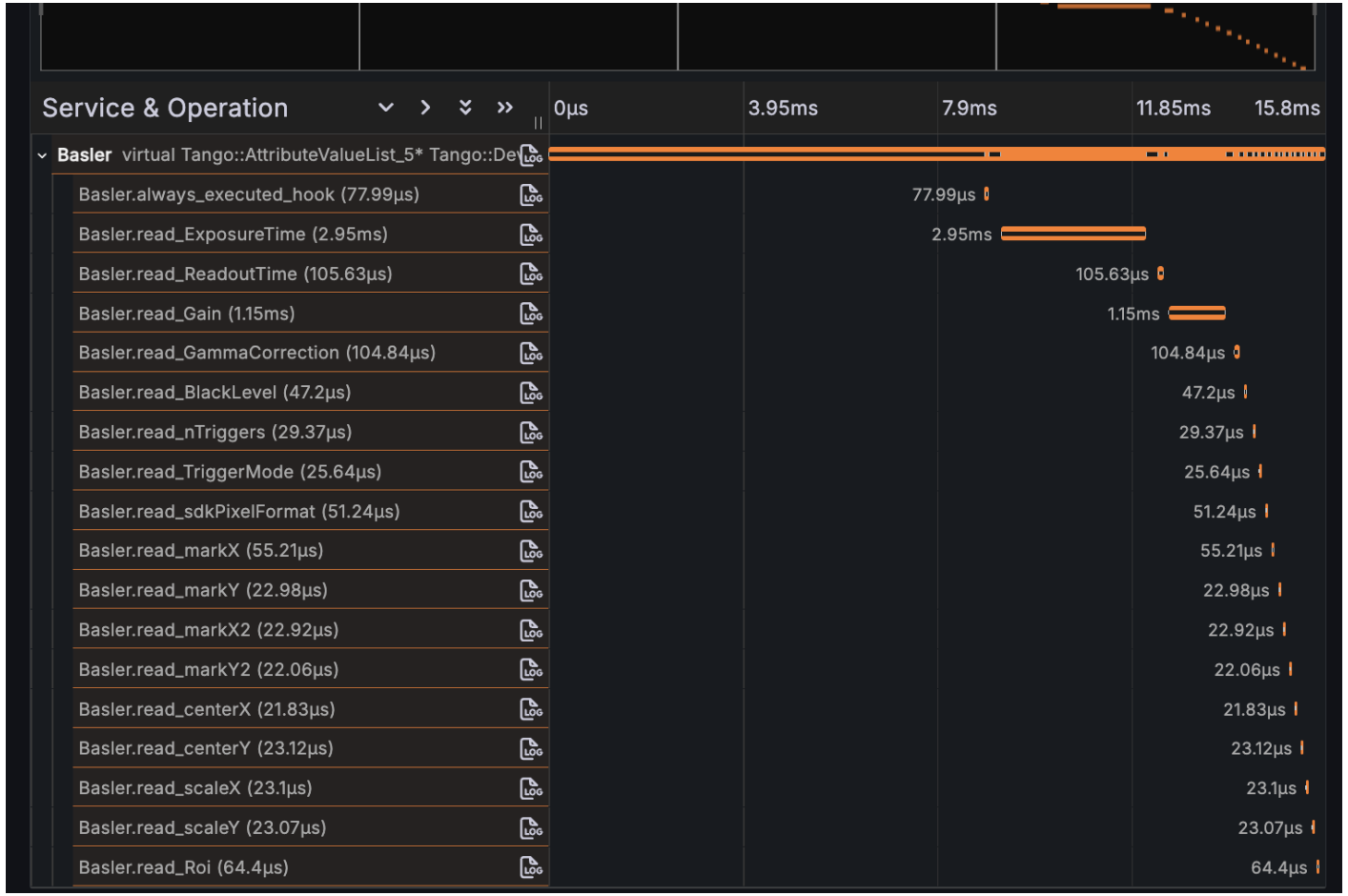
Span detail


Span Filters
22 spans
Prev
Next
virtual long int Tango::DeviceProxy::read_attributes_asynch(const std::vector<std::__cxx11::basic_string<char>
62.09µs
Basler virtual Tango::AttributeValueList_5* Tango::Device_5Impl::read_attributes_5(const Tango::DevVarStrin
98ms
Basler.always_executed_hook (61.86µs)
61.86µs
Basler.read_ExposureTime (1.53ms)
1.53ms
Basler.read_ExposureTime
Service: Basler
Duration: 1.53ms
Start Time: 2.38ms (11:34:16.584)
Kind: server
Status: unset
Library Name: tango.python.server
Library Version: 10.0.2
Logs for this span
Span Attributes
code.filepath "/opt/conda/envs/Basler/lib/python3.11/site-packages/Basler/Basler.py"
code.lineno 881
thread.id "0x7fa6017fa700"
thread.name "Dummy-6"
Resource Attributes
host.name "b-v-flexpes-ec-1.maxiv.lu.se"
service.instance.id "b107a-ea01/dia/cam-02"
service.name "Basler"
service.namespace "tango"
telemetry.sdk.language "python"
telemetry.sdk.name "opentelemetry"
telemetry.sdk.version "1.29.0"
SpanID: 51342392d3ce55f6
Basler.read_ReadoutTime (75.58µs)
75.58µs

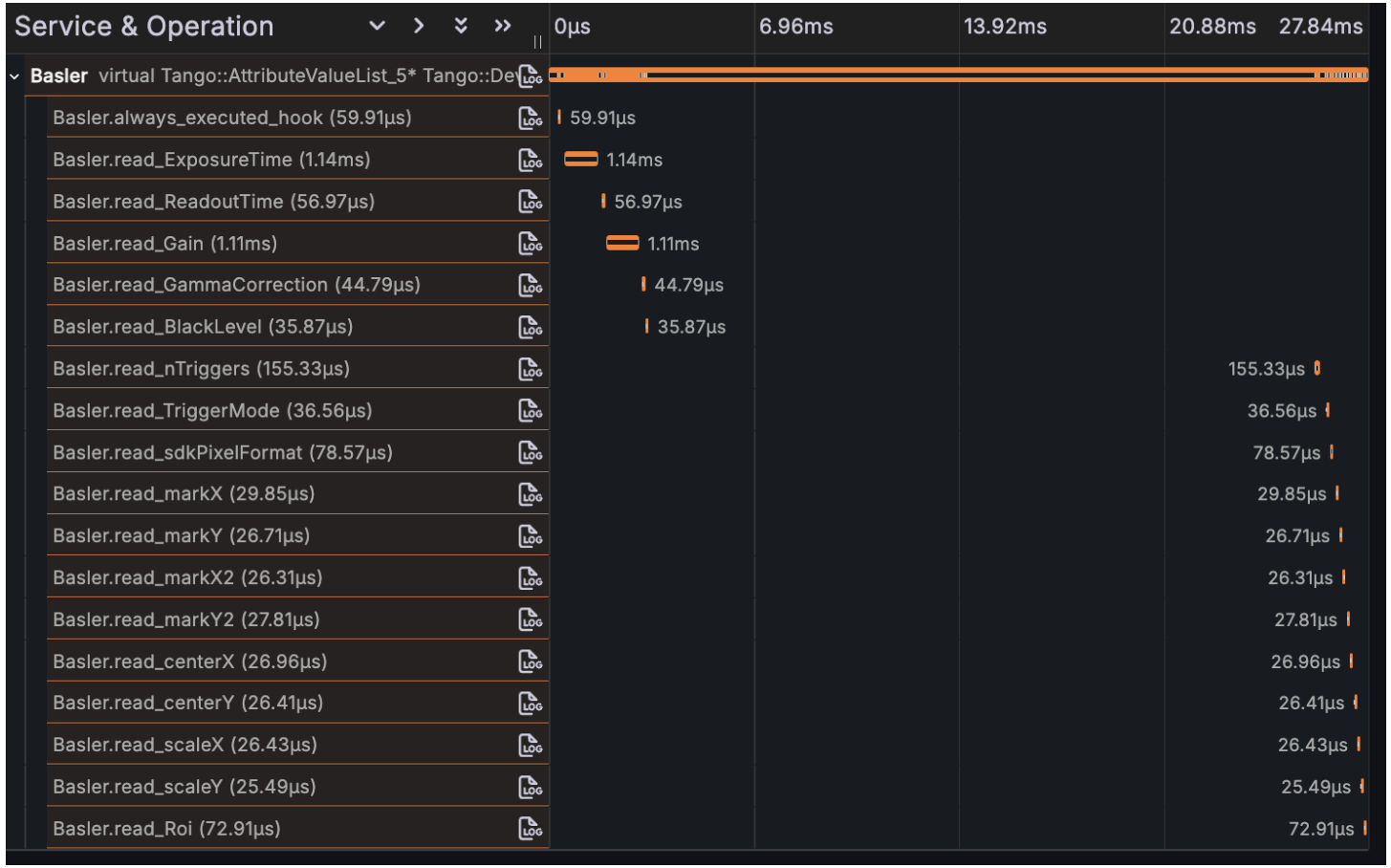
Simple search



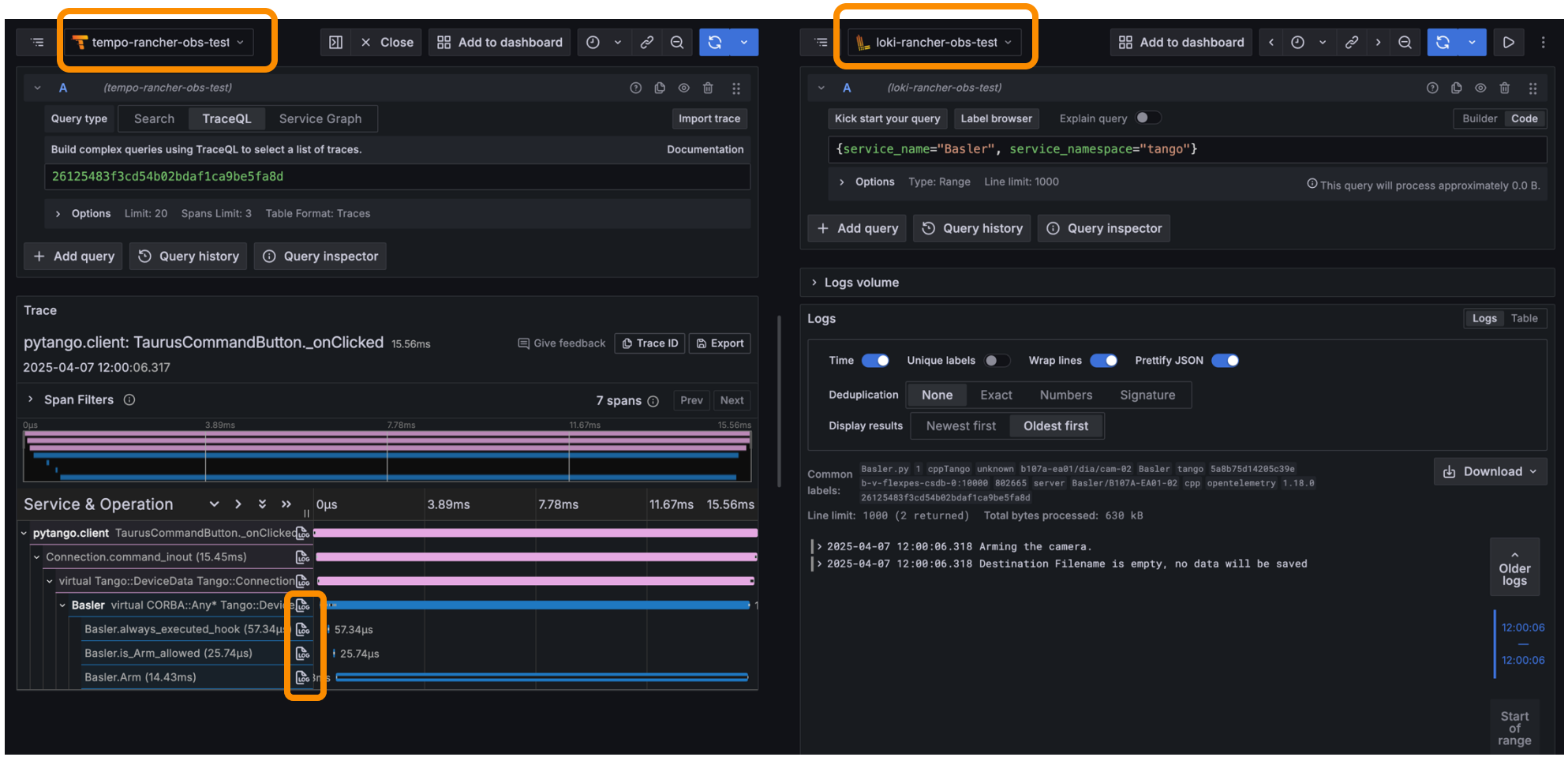
Slow traces


Service & Operation
0µs
3.95ms
7.9ms
11.85ms
15.8ms
Basler virtual Tango::AttributeValueList_5* Tango::De
Basler.always_executed_hook (77.99µs)
77.99µs
Basler.read_ExposureTime (2.95ms)
2.95ms
Basler.read_ReadoutTime (105.63µs)
105.63µs
Basler.read_Gain (1.15ms)
1.15ms
Basler.read_GammaCorrection (104.84µs)
104.84µs
Basler.read_BlackLevel (47.2µs)
47.2µs
Basler.read_nTriggers (29.37µs)
29.37µs
Basler.read_TriggerMode (25.64µs)
25.64µs
Basler.read_sdkPixelFormat (51.24µs)
51.24µs
Basler.read_markX (55.21µs)
55.21µs
Basler.read_markY (22.98µs)
22.98µs
Basler.read_markX2 (22.92µs)
22.92µs
Basler.read_markY2 (22.06µs)
22.06µs
Basler.read_centerX (21.83µs)
21.83µs
Basler.read_centerY (23.12µs)
23.12µs
Basler.read_scaleX (23.1µs)
23.1µs
Basler.read_scaleY (23.07µs)
23.07µs
Basler.read_Roi (64.4µs)
64.4µs

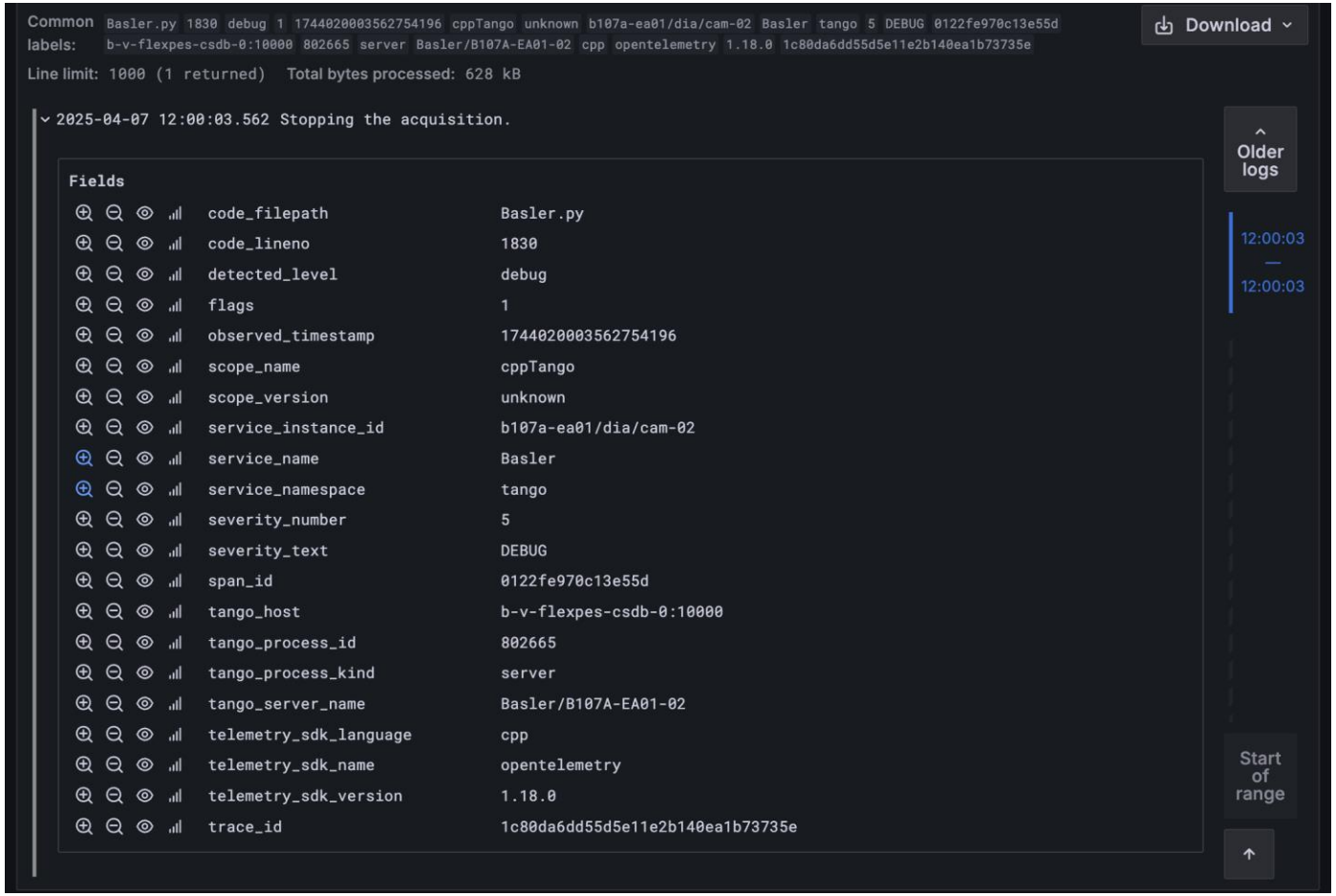
Slow traces


Service & Operation
0µs
6.96ms
13.92ms
20.88ms
27.84ms
Basler virtual Tango::AttributeValueList_5* Tango::De
Basler.always_executed_hook (59.91µs)
59.91µs
Basler.read_ExposureTime (1.14ms)
1.14ms
Basler.read_ReadoutTime (56.97µs)
56.97µs
Basler.read_Gain (1.11ms)
1.11ms
Basler.read_GammaCorrection (44.79µs)
44.79µs
Basler.read_BlackLevel (35.87µs)
35.87µs
Basler.read_nTriggers (155.33µs)
155.33µs
Basler.read_TriggerMode (36.56µs)
36.56µs
Basler.read_sdkPixelFormat (78.57µs)
78.57µs
Basler.read_markX (29.85µs)
29.85µs
Basler.read_markY (26.71µs)
26.71µs
Basler.read_markX2 (26.31µs)
26.31µs
Basler.read_markY2 (27.81µs)
27.81µs
Basler.read_centerX (26.96µs)
26.96µs
Basler.read_centerY (26.41µs)
26.41µs
Basler.read_scaleX (26.43µs)
26.43µs
Basler.read_scaleY (25.49µs)
25.49µs
Basler.read_Roi (72.91µs)
72.91µs

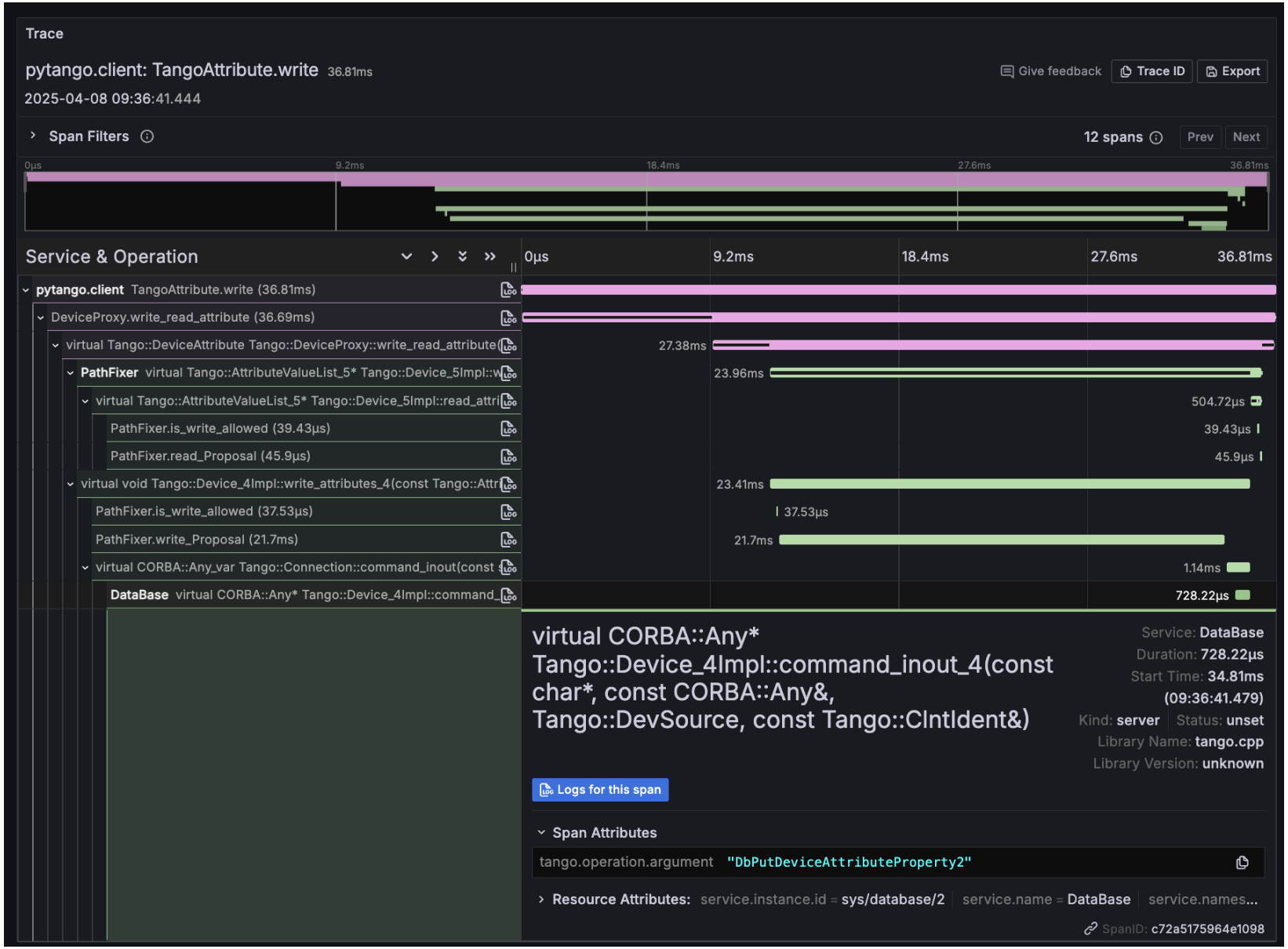
Logs


tempo-rancher-obs-test
Close
Add to dashboard
A (tempo-rancher-obs-test)
Query type
Search
TraceQL
Service Graph
Import trace
Build complex queries using TraceQL to select a list of traces.
Documentation
26125483f3cd54b02bdaf1ca9be5fa8d
Options Limit: 20 Spans Limit: 3 Table Format: Traces
Add query
Query history
Query inspector
Trace
pytango.client: TaurusCommandButton._onClicked 15.56ms
Give feedback
Trace ID
Export
2025-04-07 12:00:06.317
Span Filters
7 spans
Prev
Next
0µs
3.89ms
7.78ms
11.67ms
15.56ms
Service & Operation
pytango.client TaurusCommandButton._onClicked
Connection.command_inout (15.45ms)
virtual Tango::DeviceData Tango::Connection
Basler virtual CORBA::Any* Tango::Devi
Basler.always_executed_hook (57.34µs)
57.34µs
Basler.is_Arm_allowed (25.74µs)
25.74µs
Basler.Arm (14.43ms)
loki-rancher-obs-test
Add to dashboard
A (loki-rancher-obs-test)
Kick start your query
Label browser
Explain query
Builder
Code
{service_name="Basler", service_namespace="tango"}
Options Type: Range Line limit: 1000
This query will process approximately 0.0 B.
Add query
Query history
Query inspector
Logs volume
Logs
Logs
Table
Time
Unique labels
Wrap lines
Prettify JSON
Deduplication
None
Exact
Numbers
Signature
Display results
Newest first
Oldest first
Common labels:
Basler.py 1 cppTango unknown b107a-ea01/dia/cam-02 Basler tango 5a8b75d14205c39e
b-v-flexpes-csdb-0:10000 802665 server Basler/B107A-EA01-02 cpp opentelemetry 1.18.0
26125483f3cd54b02bdaf1ca9be5fa8d
Download
Line limit: 1000 (2 returned) Total bytes processed: 630 kB
2025-04-07 12:00:06.318 Arming the camera.
2025-04-07 12:00:06.318 Destination Filename is empty, no data will be saved
Older logs
12:00:06
12:00:06
Start of range

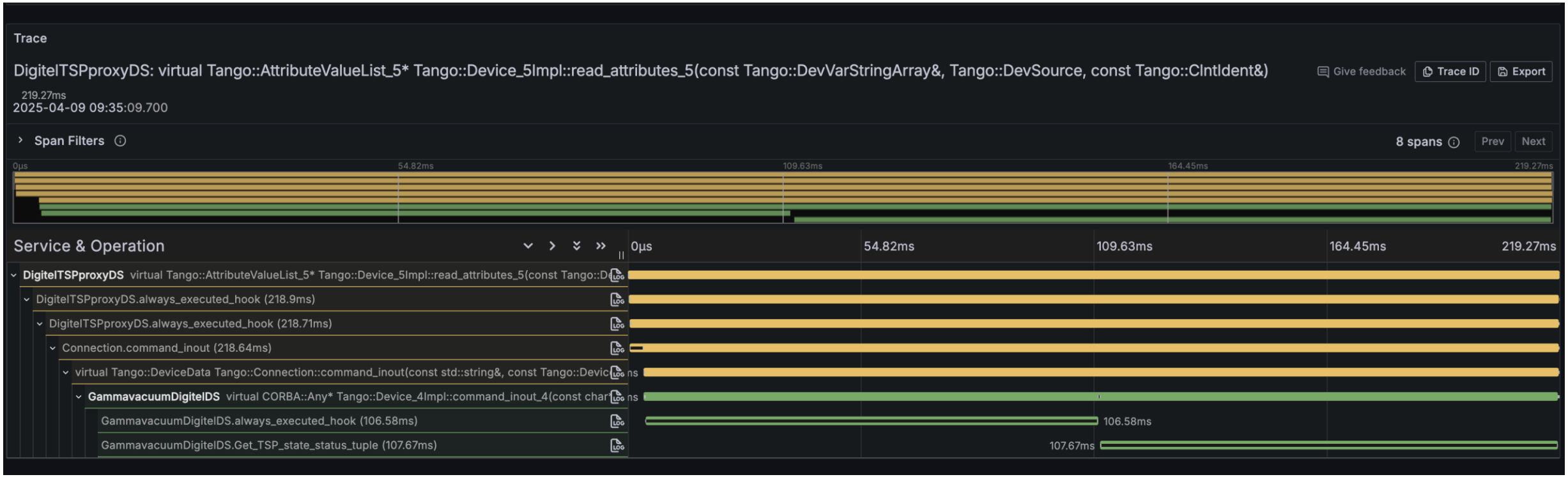
Log fields


Common labels: Basler.py 1830 debug 1 1744020003562754196 cppTango unknown b107a-ea01/dia/cam-02 Basler tango 5 DEBUG 0122fe970c13e55d b-v-flexpes-csdb-0:10000 802665 server Basler/B107A-EA01-02 cpp opentelemetry 1.18.0 1c80da6dd55d5e11e2b140ea1b73735e
Download
Line limit: 1000 (1 returned) Total bytes processed: 628 kB
2025-04-07 12:00:03.562 Stopping the acquisition.
Older logs
12:00:03 — 12:00:03
Fields
code_filepath Basler.py
code_lineno 1830
detected_level debug
flags 1
observed_timestamp 1744020003562754196
scope_name cppTango
scope_version unknown
service_instance_id b107a-ea01/dia/cam-02
service_name Basler
service_namespace tango
severity_number 5
severity_text DEBUG
span_id 0122fe970c13e55d
tango_host b-v-flexpes-csdb-0:10000
tango_process_id 802665
tango_process_kind server
tango_server_name Basler/B107A-EA01-02
telemetry_sdk_language cpp
telemetry_sdk_name opentelemetry
telemetry_sdk_version 1.18.0
trace_id 1c80da6dd55d5e11e2b140ea1b73735e
Start of range

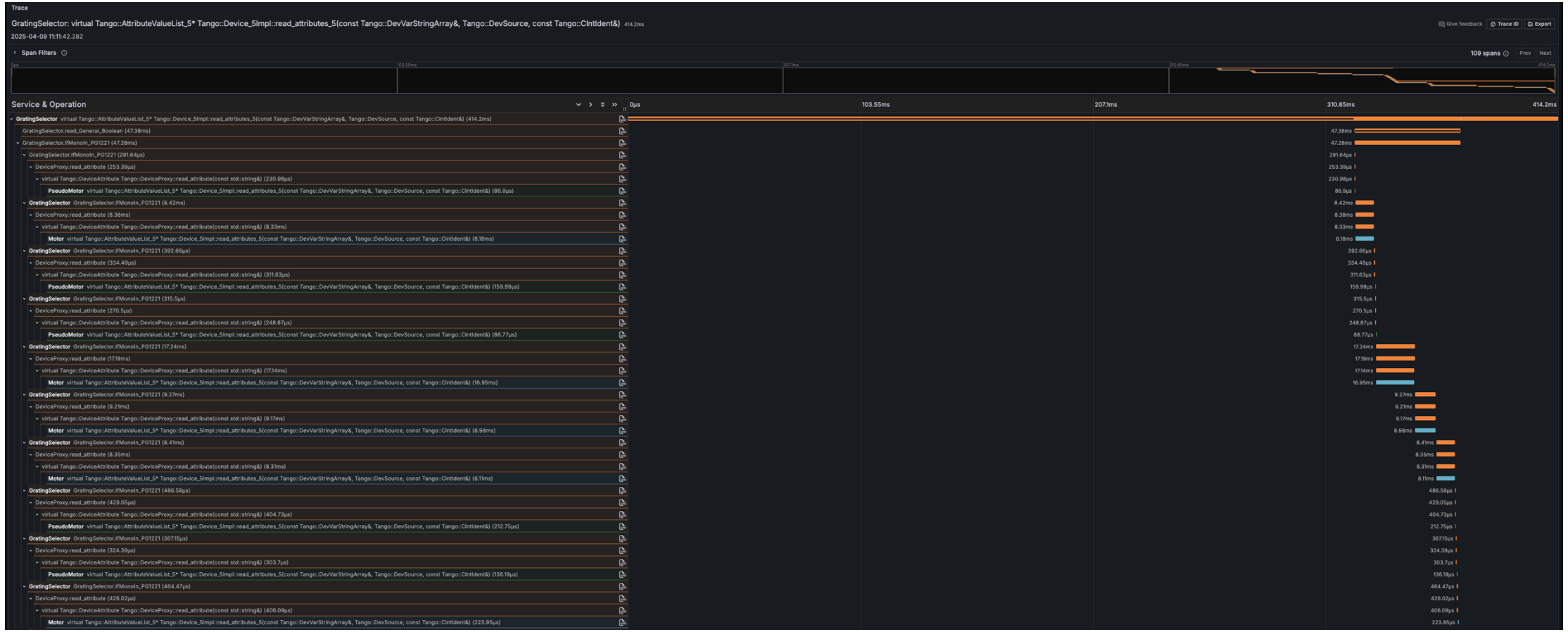
Multi-device



Two Python devices

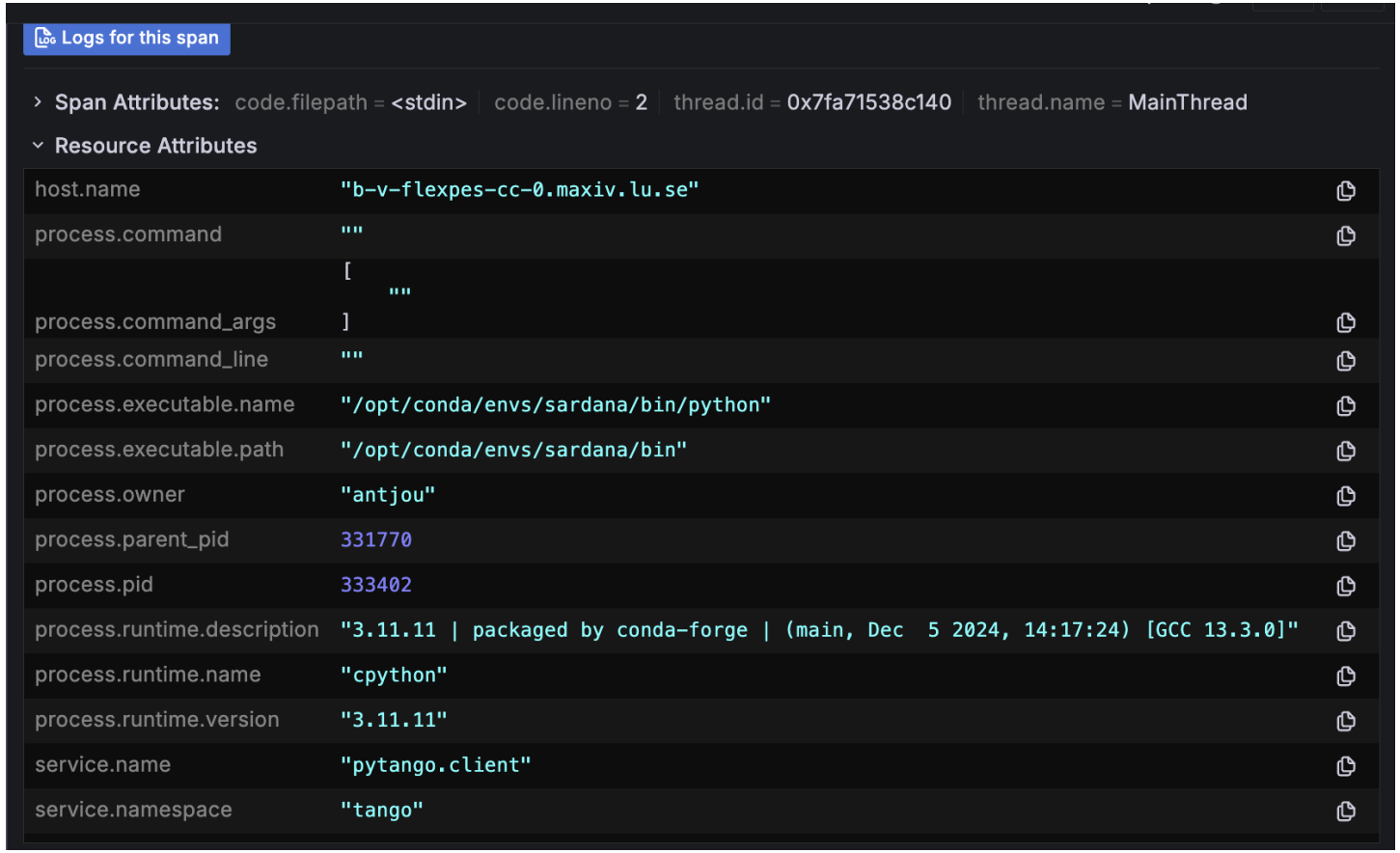


Deep traces

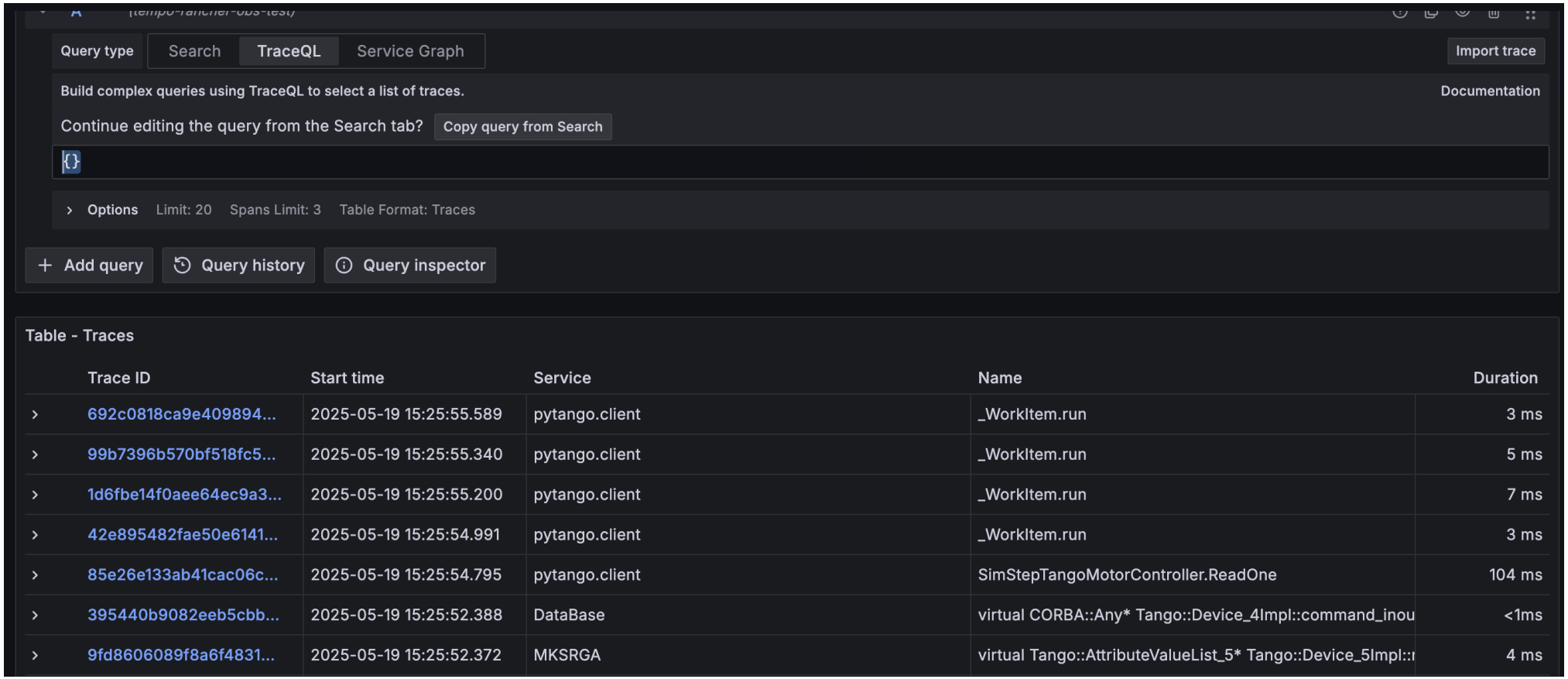

Trace
GratingSelector: virtual Tango::AttributeValueList_5* Tango::Device_5Impl::read_attributes_5(const Tango::DevVarStringArray&, Tango::DevSource, const Tango::ClntIdent&) 414.2ms
2025-04-09 11:11:42.282
Span Filters
109 spans
Service & Operation
0µs
103.55ms
207.1ms
310.65ms
414.2ms
GratingSelector virtual Tango::AttributeValueList_5* Tango::Device_5Impl::read_attributes_5(const Tango::DevVarStringArray&, Tango::DevSource, const Tango::ClntIdent&) (414.2ms)
GratingSelector.read_General_Boolean (47.38ms)
GratingSelector.IfMonoIn_PG1221 (47.28ms)
GratingSelector.IfMonoIn_PG1221 (291.64µs)
DeviceProxy.read_attribute (253.39µs)
virtual Tango::DeviceAttribute Tango::DeviceProxy::read_attribute(const std::string&) (230.98µs)
PseudoMotor virtual Tango::AttributeValueList_5* Tango::Device_5Impl::read_attributes_5(const Tango::DevVarStringArray&, Tango::DevSource, const Tango::ClntIdent&) (86.9µs)
GratingSelector GratingSelector.IfMonoIn_PG1221 (8.42ms)
DeviceProxy.read_attribute (8.38ms)
virtual Tango::DeviceAttribute Tango::DeviceProxy::read_attribute(const std::string&) (8.33ms)
Motor virtual Tango::AttributeValueList_5* Tango::Device_5Impl::read_attributes_5(const Tango::DevVarStringArray&, Tango::DevSource, const Tango::ClntIdent&) (8.18ms)
GratingSelector GratingSelector.IfMonoIn_PG1221 (392.66µs)
DeviceProxy.read_attribute (334.49µs)
virtual Tango::DeviceAttribute Tango::DeviceProxy::read_attribute(const std::string&) (311.63µs)
PseudoMotor virtual Tango::AttributeValueList_5* Tango::Device_5Impl::read_attributes_5(const Tango::DevVarStringArray&, Tango::DevSource, const Tango::ClntIdent&) (159.99µs)
GratingSelector GratingSelector.IfMonoIn_PG1221 (315.5µs)
DeviceProxy.read_attribute (270.5µs)
virtual Tango::DeviceAttribute Tango::DeviceProxy::read_attribute(const std::string&) (248.87µs)
PseudoMotor virtual Tango::AttributeValueList_5* Tango::Device_5Impl::read_attributes_5(const Tango::DevVarStringArray&, Tango::DevSource, const Tango::ClntIdent&) (88.77µs)
GratingSelector GratingSelector.IfMonoIn_PG1221 (17.24ms)
DeviceProxy.read_attribute (17.19ms)
virtual Tango::DeviceAttribute Tango::DeviceProxy::read_attribute(const std::string&) (17.14ms)
Motor virtual Tango::AttributeValueList_5* Tango::Device_5Impl::read_attributes_5(const Tango::DevVarStringArray&, Tango::DevSource, const Tango::ClntIdent&) (16.95ms)
GratingSelector GratingSelector.IfMonoIn_PG1221 (9.27ms)
DeviceProxy.read_attribute (9.21ms)
virtual Tango::DeviceAttribute Tango::DeviceProxy::read_attribute(const std::string&) (9.17ms)
Motor virtual Tango::AttributeValueList_5* Tango::Device_5Impl::read_attributes_5(const Tango::DevVarStringArray&, Tango::DevSource, const Tango::ClntIdent&) (8.98ms)
GratingSelector GratingSelector.IfMonoIn_PG1221 (8.41ms)
DeviceProxy.read_attribute (8.35ms)
virtual Tango::DeviceAttribute Tango::DeviceProxy::read_attribute(const std::string&) (8.31ms)
Motor virtual Tango::AttributeValueList_5* Tango::Device_5Impl::read_attributes_5(const Tango::DevVarStringArray&, Tango::DevSource, const Tango::ClntIdent&) (8.11ms)
GratingSelector GratingSelector.IfMonoIn_PG1221 (486.58µs)
DeviceProxy.read_attribute (429.05µs)
virtual Tango::DeviceAttribute Tango::DeviceProxy::read_attribute(const std::string&) (404.73µs)
PseudoMotor virtual Tango::AttributeValueList_5* Tango::Device_5Impl::read_attributes_5(const Tango::DevVarStringArray&, Tango::DevSource, const Tango::ClntIdent&) (212.75µs)
GratingSelector GratingSelector.IfMonoIn_PG1221 (367.15µs)
DeviceProxy.read_attribute (324.39µs)
virtual Tango::DeviceAttribute Tango::DeviceProxy::read_attribute(const std::string&) (303.7µs)
PseudoMotor virtual Tango::AttributeValueList_5* Tango::Device_5Impl::read_attributes_5(const Tango::DevVarStringArray&, Tango::DevSource, const Tango::ClntIdent&) (136.19µs)
GratingSelector GratingSelector.IfMonoIn_PG1221 (464.47µs)
DeviceProxy.read_attribute (426.02µs)
virtual Tango::DeviceAttribute Tango::DeviceProxy::read_attribute(const std::string&) (406.09µs)
Motor virtual Tango::AttributeValueList_5* Tango::Device_5Impl::read_attributes_5(const Tango::DevVarStringArray&, Tango::DevSource, const Tango::ClntIdent&) (223.95µs)

Process info

```
$ export OTEL_EXPERIMENTAL_RESOURCE_DETECTORS=process
$ python
```

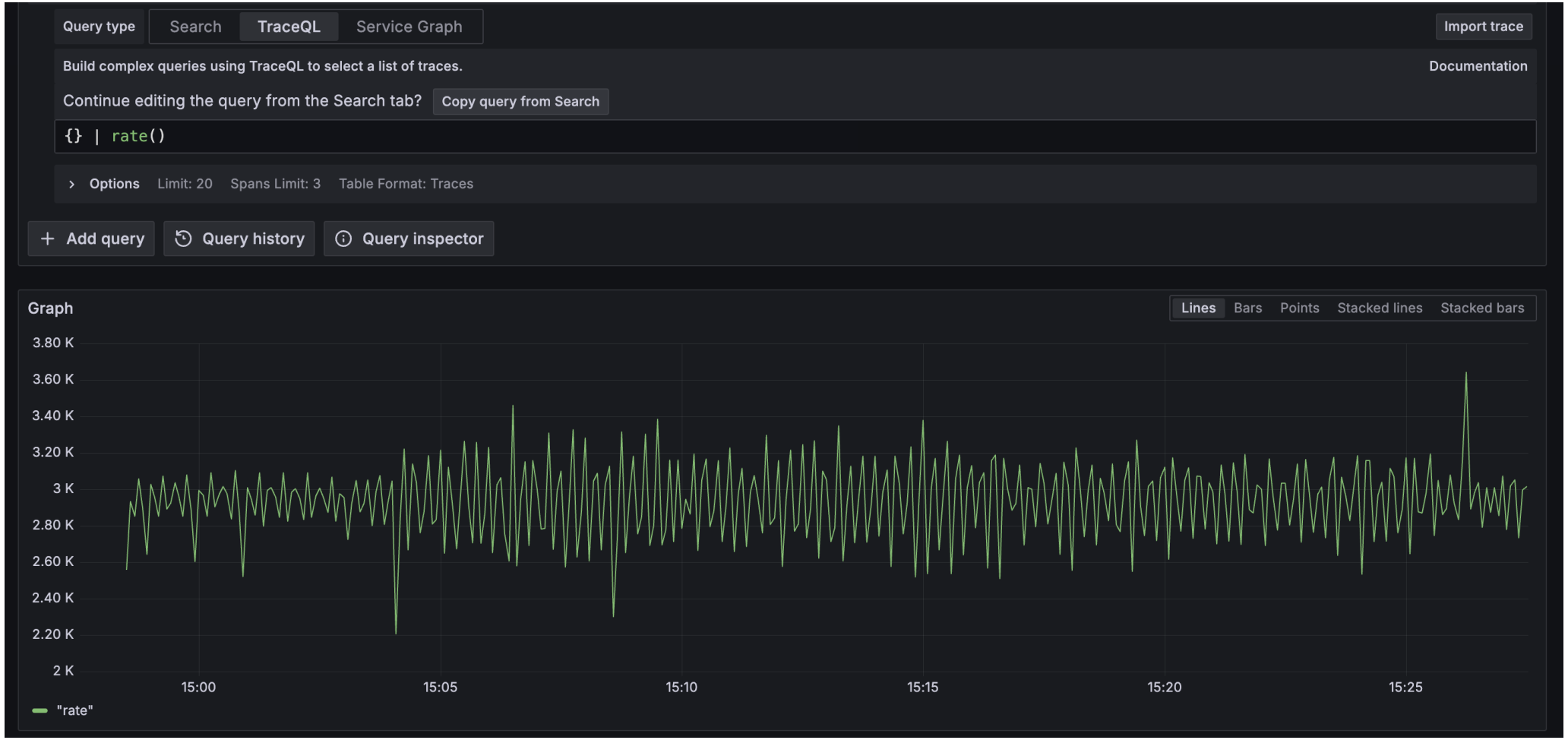


TraceQL


Query type
Search
TraceQL
Service Graph
Import trace
Build complex queries using TraceQL to select a list of traces.
Documentation
Continue editing the query from the Search tab?
Copy query from Search
{}
Options
Limit: 20
Spans Limit: 3
Table Format: Traces
Add query
Query history
Query inspector
Table - Traces
Trace ID
Start time
Service
Name
Duration
692c0818ca9e409894...
2025-05-19 15:25:55.589
pytango.client
_WorkItem.run
3 ms
99b7396b570bf518fc5...
2025-05-19 15:25:55.340
pytango.client
_WorkItem.run
5 ms
1d6fbe14f0aee64ec9a3...
2025-05-19 15:25:55.200
pytango.client
_WorkItem.run
7 ms
42e895482fae50e6141...
2025-05-19 15:25:54.991
pytango.client
_WorkItem.run
3 ms
85e26e133ab41cac06c...
2025-05-19 15:25:54.795
pytango.client
SimStepTangoMotorController.ReadOne
104 ms
395440b9082eeb5cbb...
2025-05-19 15:25:52.388
DataBase
virtual CORBA::Any* Tango::Device_4Impl::command_inou
<1ms
9fd8606089f8a6f4831...
2025-05-19 15:25:52.372
MKSRGA
virtual Tango::AttributeValueList_5* Tango::Device_5Impl::
4 ms

TraceQL

Note: max time range for `rate()` is 3h



TraceQL


Query type
Search
TraceQL
Service Graph
Import trace
Build complex queries using TraceQL to select a list of traces.
Documentation
Continue editing the query from the Search tab?
Copy query from Search
{} | rate() by (resource.service.name)
Options
Limit: 20
Spans Limit: 3
Table Format: Traces
Add query
Query history
Query inspector
Graph
Lines
Bars
Points
Stacked lines
Stacked bars
1.50 K
1.25 K
1 K
750
500
250
0
14:55
15:00
15:05
15:10
15:15
15:20
"AllenBradleyEIP"
"Basler"
"BranchSelector"
"CTExpChannel"
"DataBase"
"DigitelTSPproxyDS"
"Door"
"EndstationSelector"
"EurothermDS"
"GammaSPCe"
"GammavacuumDigitelDS"
"GratingSelector"
"HippieFeedbackSensor"
"LakeshoreDS"
"MKSRGA"
"MKSpdr2000controllerDS"
"Motor"
"MotorGroup"
"MotorSelector"
"PEAKserviceDS"
"PathFixer"
"PneumaticValve"
"PrevacIS40PowerSupplyDS"
"PseudoMotor"
"PyAlarm"
"SISOPID"
"SensorthermPyrometerDS"
"SimStepDS"
"Starter"
"TangoTest"
"VATmotorizedLeakValveDS"
"VacgenIGC5controllerDS"
"VacomMVCandJEVAmetVCUDS"
"pytango.client"
"tango.telemetry.default"

TraceQL


Query type
Search
TraceQL
Service Graph
Import trace
Build complex queries using TraceQL to select a list of traces.
Documentation
Continue editing the query from the Search tab?
Copy query from Search
{ resource.service.name != "AllenBradleyEIP" && resource.service.name != "pytango.client" } | rate() by(resource.service.name)
Options
Limit: 20
Spans Limit: 3
Table Format: Traces
Add query
Query history
Query inspector
Graph
Showing only 20 series
Show all 37
Lines
Bars
Points
Stacked lines
Stacked bars
175
150
125
100
75
50
25
0
15:05
15:10
15:15
15:20
15:25
15:30
"Basler"
"BranchSelector"
"CTExpChannel"
"Coboldpc"
"DataBase"
"DigitelTSPproxyDS"
"Door"
"EndstationSelector"
"EurothermDS"
"GammaSPCe"
"GammavacuumDigitelDS"
"GratingSelector"
"HippieFeedbackSensor"
"LakeshoreDS"
"MKSRGA"
"MKSpdr2000controllerDS"
"MacroServer"
"MeasurementGroup"
"Motor"
"MotorGroup"

TraceQL


A
(tempo-rancher-obs-test)
Query type
Search
TraceQL
Service Graph
Import trace
Build complex queries using TraceQL to select a list of traces.
Documentation
{} | quantile_over_time(duration, 0.99, 0.9, 0.8)
Options
Limit: 20
Spans Limit: 3
Table Format: Traces
Add query
Query history
Query inspector
Graph
Lines
Bars
Points
Stacked lines
Stacked bars
0.5
0.4
0.3
0.2
0.1
0
06:55
07:00
07:05
2025-05-22 07:05:25
0.9 0.00731
07:10
07:15
07:20
0.8
0.9
0.99

TraceQL examples

```
{ .service.name = "BrooksMFC0254"
    && duration > 500ms
    && resource.service.instance.id = "b108a-d100830cab11/gas/vfcc-02" }

{ resource.host.name = "host.institute.org"} >> { .service.name = "BrooksMFC0254"}

{ span.tango.operation.argument = "double_scalar" }

{ span.tango.operation.argument = "ZmqEventSubscriptionChange" }

{ name = "DeviceProxy.subscribe_event" }

{ name = "PandaPGMPCAPCoTiCtrl.ReadOne" }

{} | rate()

{} | rate() by(resource.host.hostname)

{} | quantile_over_time(duration, 0.99, 0.9, 0.5)
```

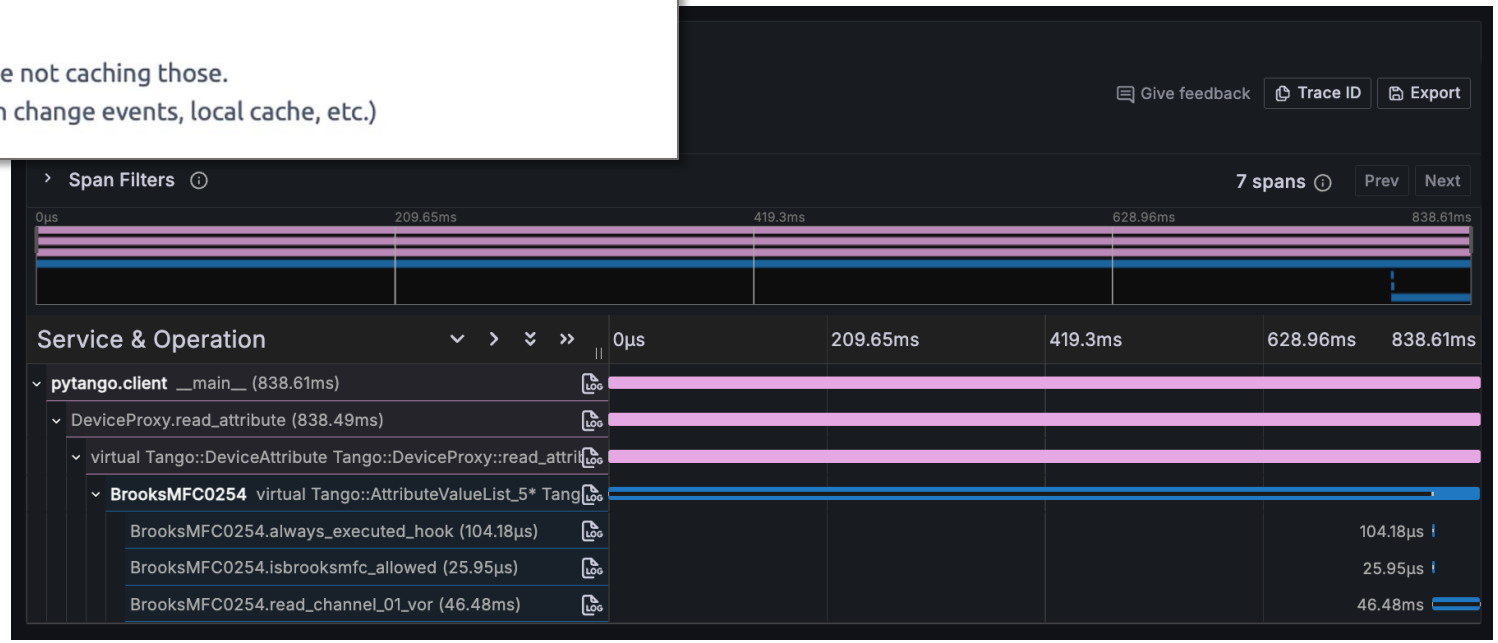
Real-life usage

#7752 SPECIES: Investigate slow communication with MFC and MOXA

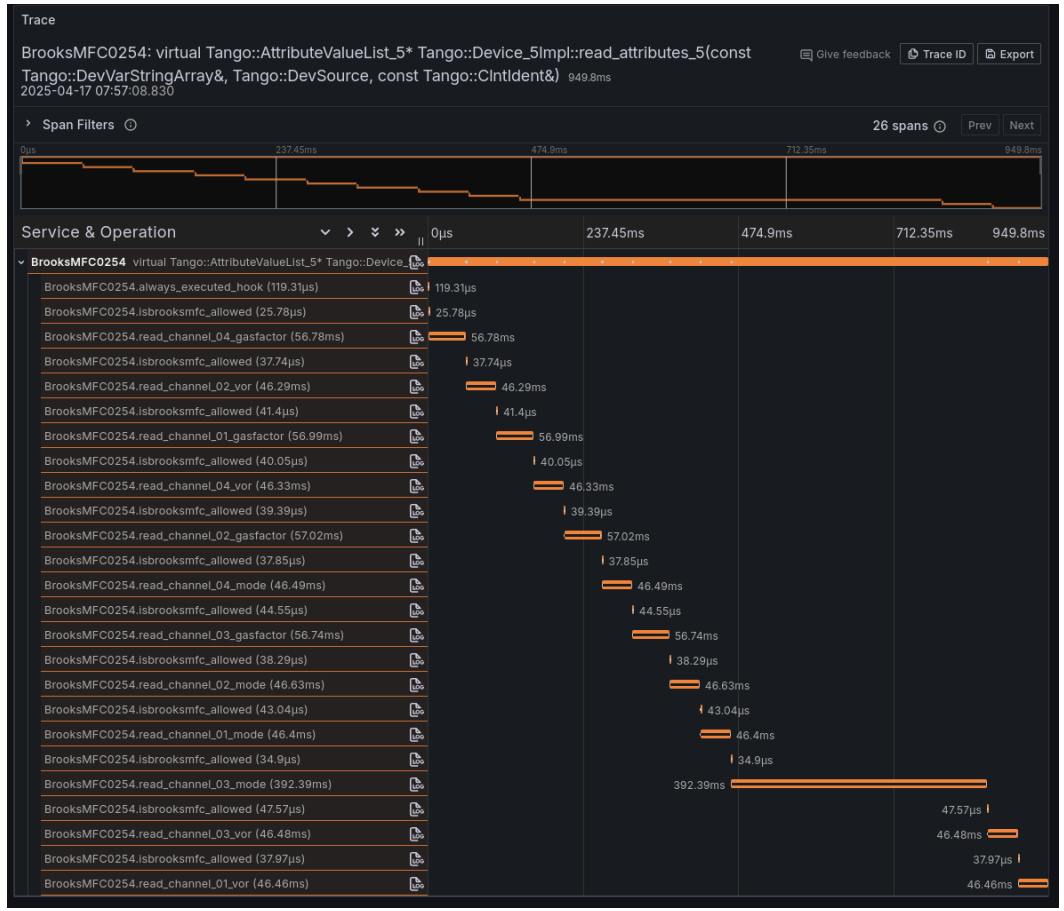
USER STORY

When multiple GUIs that are reading the MFC attributes are open, we notice that the device takes a considerable amount of time to respond.

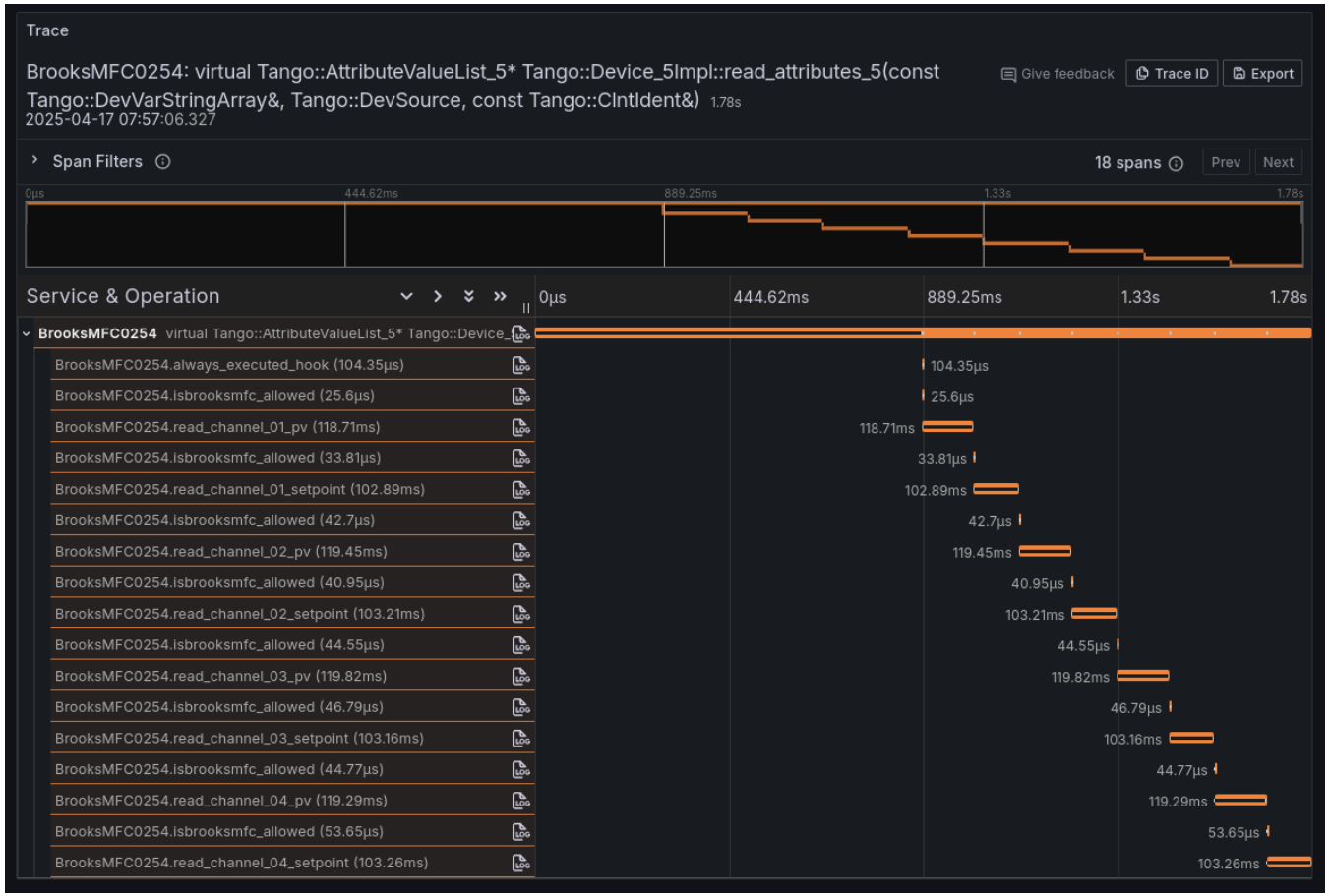
This is likely due to taurus reading the attributes constantly and the tango device not caching those.
Investigate if that is the actual cause and if it is, implement better solution (push change events, local cache, etc.)



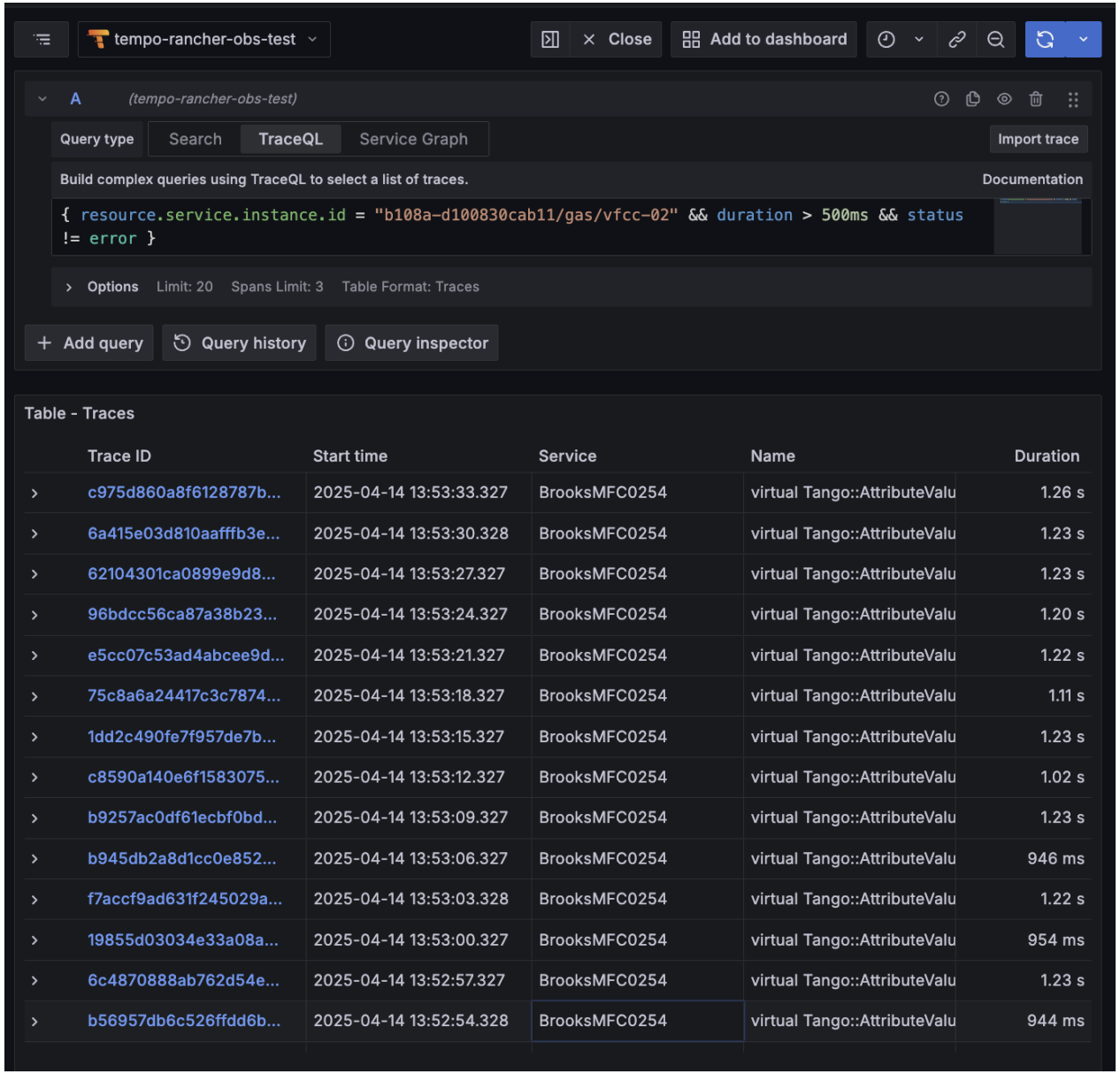
Request from Taurus GUI (12 attributes)



Request from Tango internal polling (8 other attributes)



Approx. 50 ms to 400 ms to read from hardware


tempo-rancher-obs-test
Close
Add to dashboard
A
(tempo-rancher-obs-test)
Query type
Search
TraceQL
Service Graph
Import trace
Build complex queries using TraceQL to select a list of traces.
Documentation
{ resource.service.instance.id = "b108a-d100830cab11/gas/vfcc-02" && duration > 500ms && status != error }
Options
Limit: 20
Spans Limit: 3
Table Format: Traces
Add query
Query history
Query inspector
Table - Traces
Trace ID
Start time
Service
Name
Duration
c975d860a8f6128787b...
2025-04-14 13:53:33.327
BrooksMFC0254
virtual Tango::AttributeValu
1.26 s
6a415e03d810aafffb3e...
2025-04-14 13:53:30.328
BrooksMFC0254
virtual Tango::AttributeValu
1.23 s
62104301ca0899e9d8...
2025-04-14 13:53:27.327
BrooksMFC0254
virtual Tango::AttributeValu
1.23 s
96bdcc56ca87a38b23...
2025-04-14 13:53:24.327
BrooksMFC0254
virtual Tango::AttributeValu
1.20 s
e5cc07c53ad4abcee9d...
2025-04-14 13:53:21.327
BrooksMFC0254
virtual Tango::AttributeValu
1.22 s
75c8a6a24417c3c7874...
2025-04-14 13:53:18.327
BrooksMFC0254
virtual Tango::AttributeValu
1.11 s
1dd2c490fe7f957de7b...
2025-04-14 13:53:15.327
BrooksMFC0254
virtual Tango::AttributeValu
1.23 s
c8590a140e6f1583075...
2025-04-14 13:53:12.327
BrooksMFC0254
virtual Tango::AttributeValu
1.02 s
b9257ac0df61ecbf0bd...
2025-04-14 13:53:09.327
BrooksMFC0254
virtual Tango::AttributeValu
1.23 s
b945db2a8d1cc0e852...
2025-04-14 13:53:06.327
BrooksMFC0254
virtual Tango::AttributeValu
946 ms
f7accf9ad631f245029a...
2025-04-14 13:53:03.328
BrooksMFC0254
virtual Tango::AttributeValu
1.22 s
19855d03034e33a08a...
2025-04-14 13:53:00.327
BrooksMFC0254
virtual Tango::AttributeValu
954 ms
6c4870888ab762d54e...
2025-04-14 13:52:57.327
BrooksMFC0254
virtual Tango::AttributeValu
1.23 s
b56957db6c526ffdd6b...
2025-04-14 13:52:54.328
BrooksMFC0254
virtual Tango::AttributeValu
944 ms

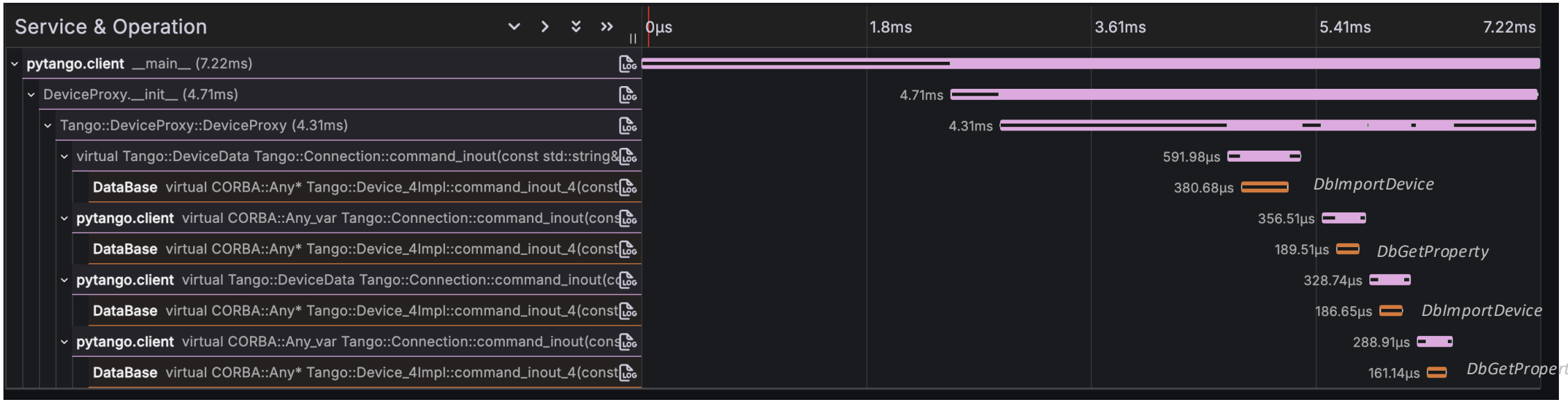

Outline
tempo-rancher-obs-test
Split
Add to dashboard
Last 5 minutes
Run query
A
(tempo-rancher-obs-test)
Query type
Search
TraceQL
Service Graph
Import trace
Build complex queries using TraceQL to select a list of traces.
Documentation
{ resource.service.instance.id = "b108a-d100830cab11/gas/vfcc-02" } | quantile_over_time(duration, 0.99, 0.9, 0.5)
Options
Limit: 20
Spans Limit: 3
Table Format: Traces
Add query
Query history
Query inspector
Graph
Lines
Bars
Points
Stacked lines
Stacked bars
2.25
2
1.75
1.5
1.25
1
0.75
0.5
0.25
0
13:48:30
13:48:45
13:49:30
13:49:45
13:50:00
13:50:15
13:50:30
13:50:45
13:51:00
13:51:15
13:51:30
13:51:45
13:52:00
13:52:15
13:52:30
13:52:45
13:53:00
13:53:15
2025-04-14 13:48:49
0.5 0.0000655
0.5
0.9
0.99

Event subscriptions

```
>>> import tango
>>> dp = tango.DeviceProxy("b107a-ea01/dia/cam-02")
>>> eid = dp.subscribe_event("lastImage", tango.EventType.CHANGE_EVENT, tango.utils.EventCallback())
2025-05-21 19:20:15.559263 B107A-EA01/DIA/CAM-02 LASTIMAGE CHANGE [ATTR_VALID] [[0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]
 ...
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]]
>>> dp.unsubscribe_event("lastImage")
Traceback (most recent call last):
  File "/opt/conda/envs/sardana/lib/python3.11/site-packages/tango/device_proxy.py", line 1794, in
__DeviceProxy__unsubscribe_event
    evt_info = se[event_id]
               ~~^^^^^^^^^^
...
KeyError: 'This device proxy does not own this subscription lastImage'
>>> dp.unsubscribe_event(eid)
>>>
```

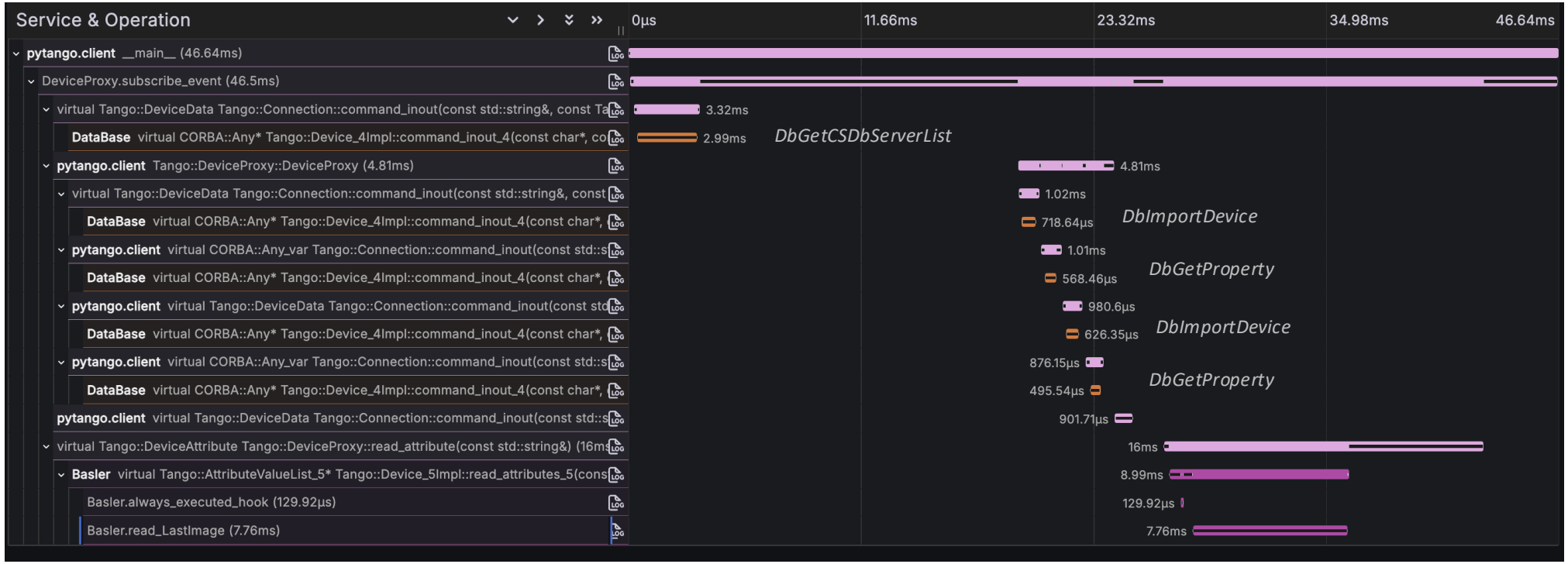
Event subscriptions

```
>>> dp = tango.DeviceProxy("b107a-ea01/dia/cam-02")
```



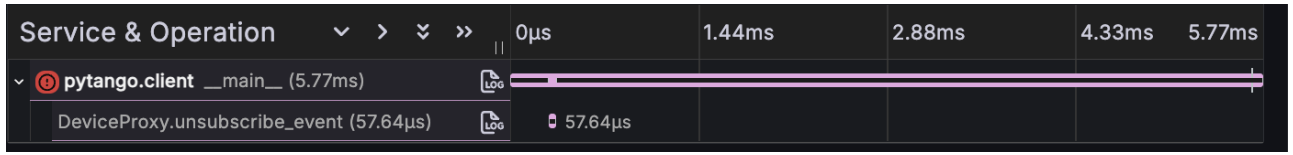
Event subscriptions

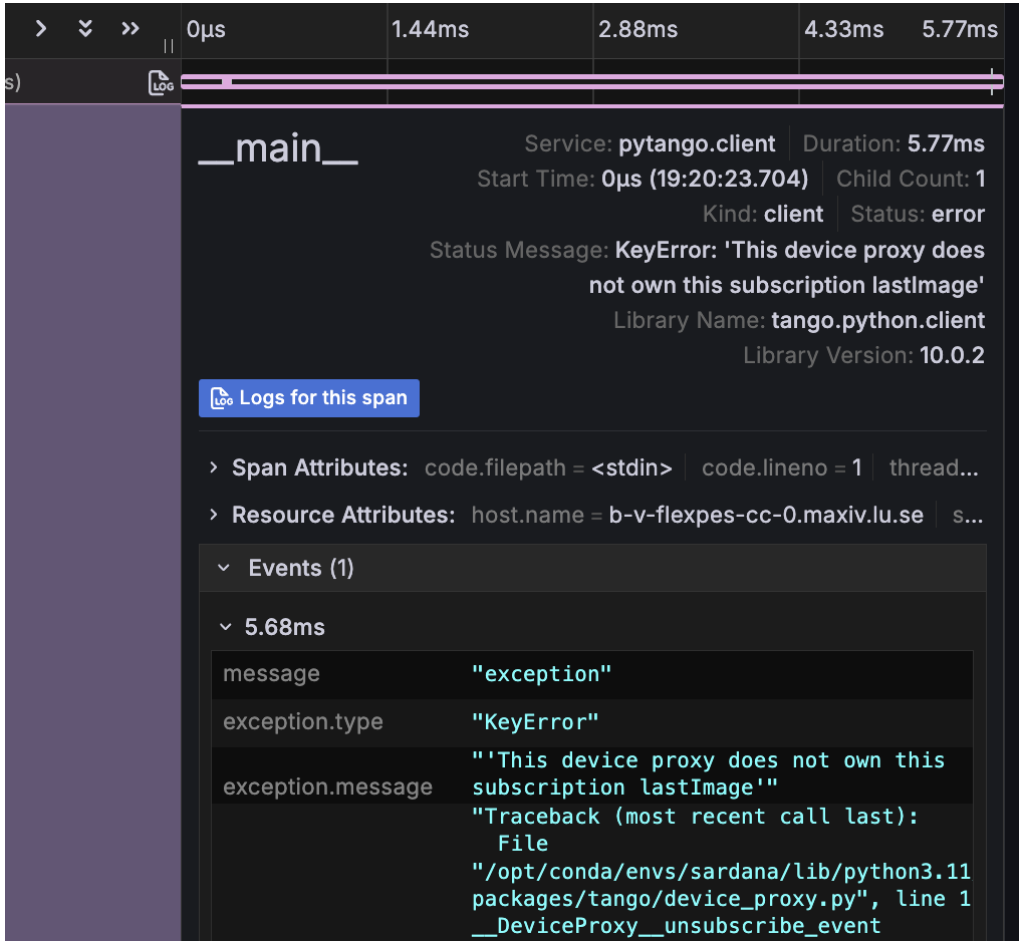
```
>>> eid = dp.subscribe_event("lastImage", tango.EventType.CHANGE_EVENT, tango.utils.EventCallback()
```



Event subscriptions

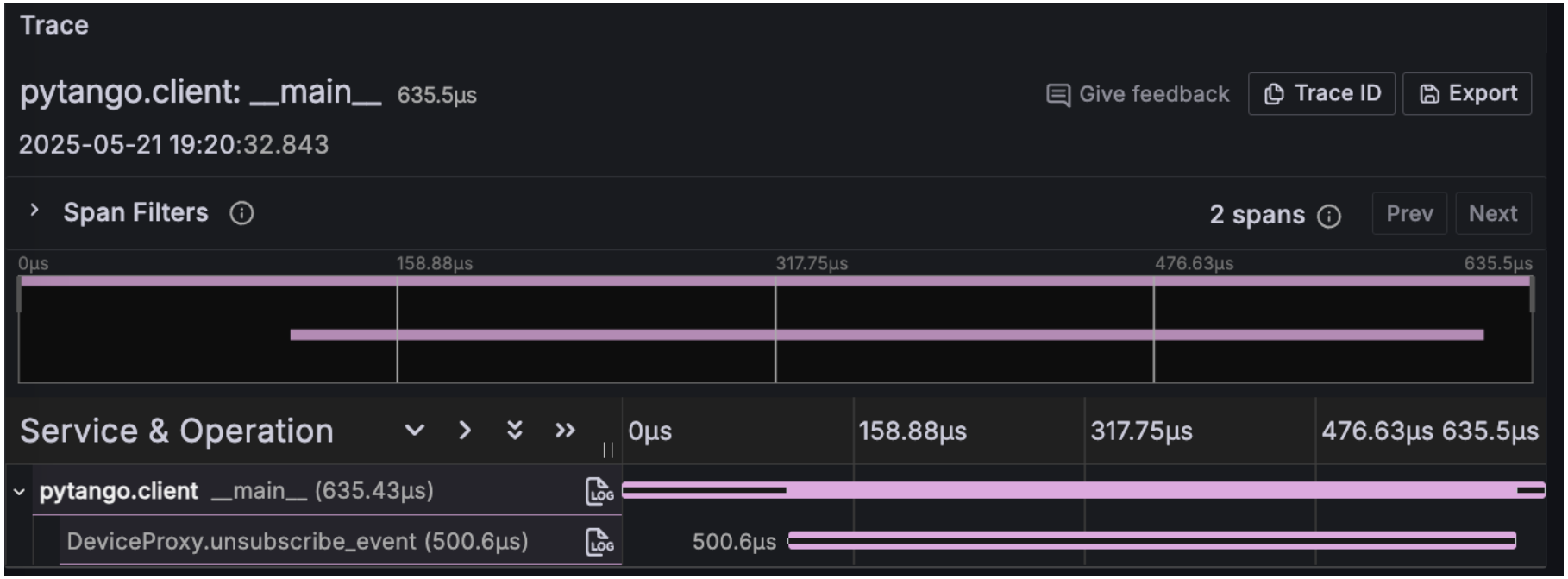
```
>>> dp.unsubscribe_event("lastImage")
Traceback (most recent call last):
...
```



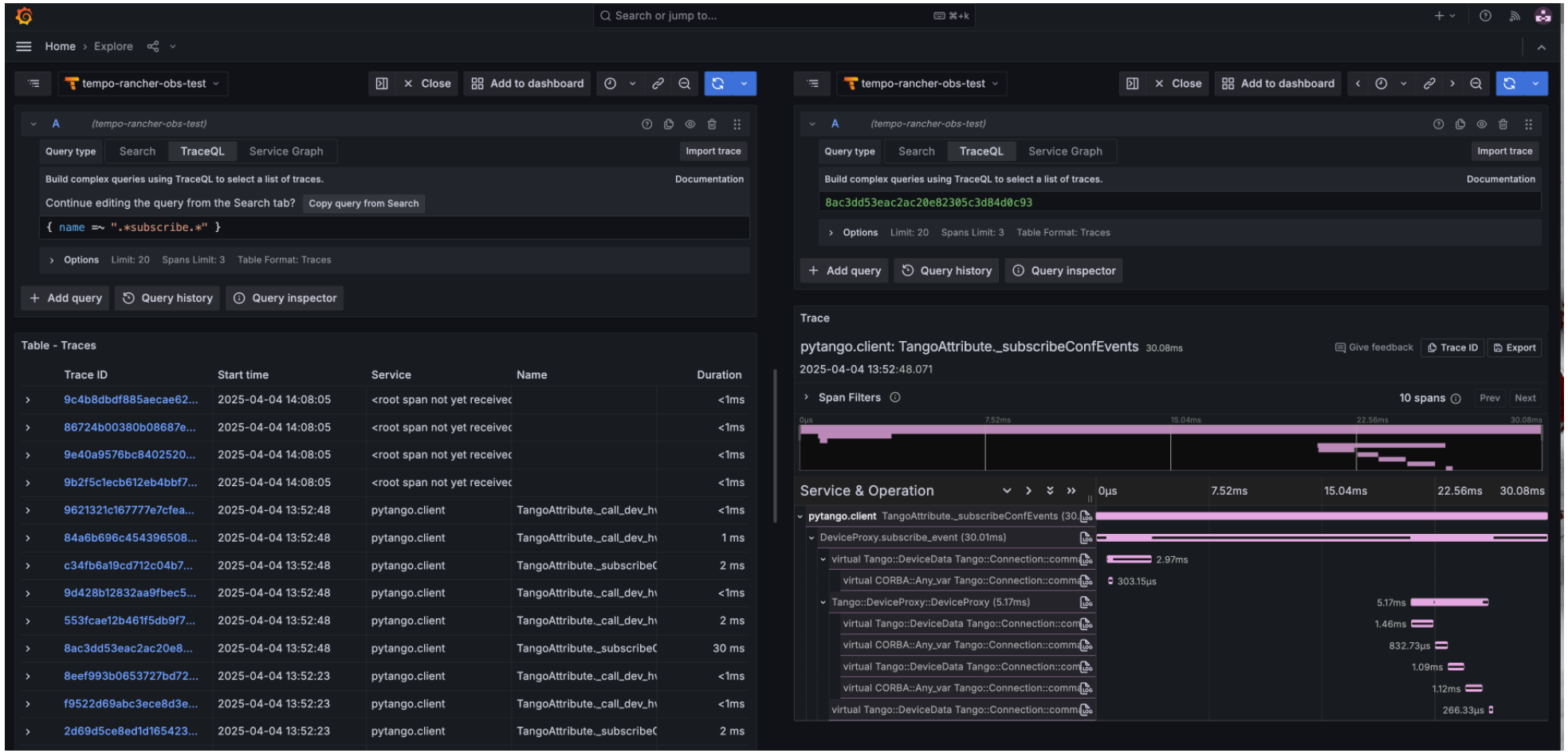


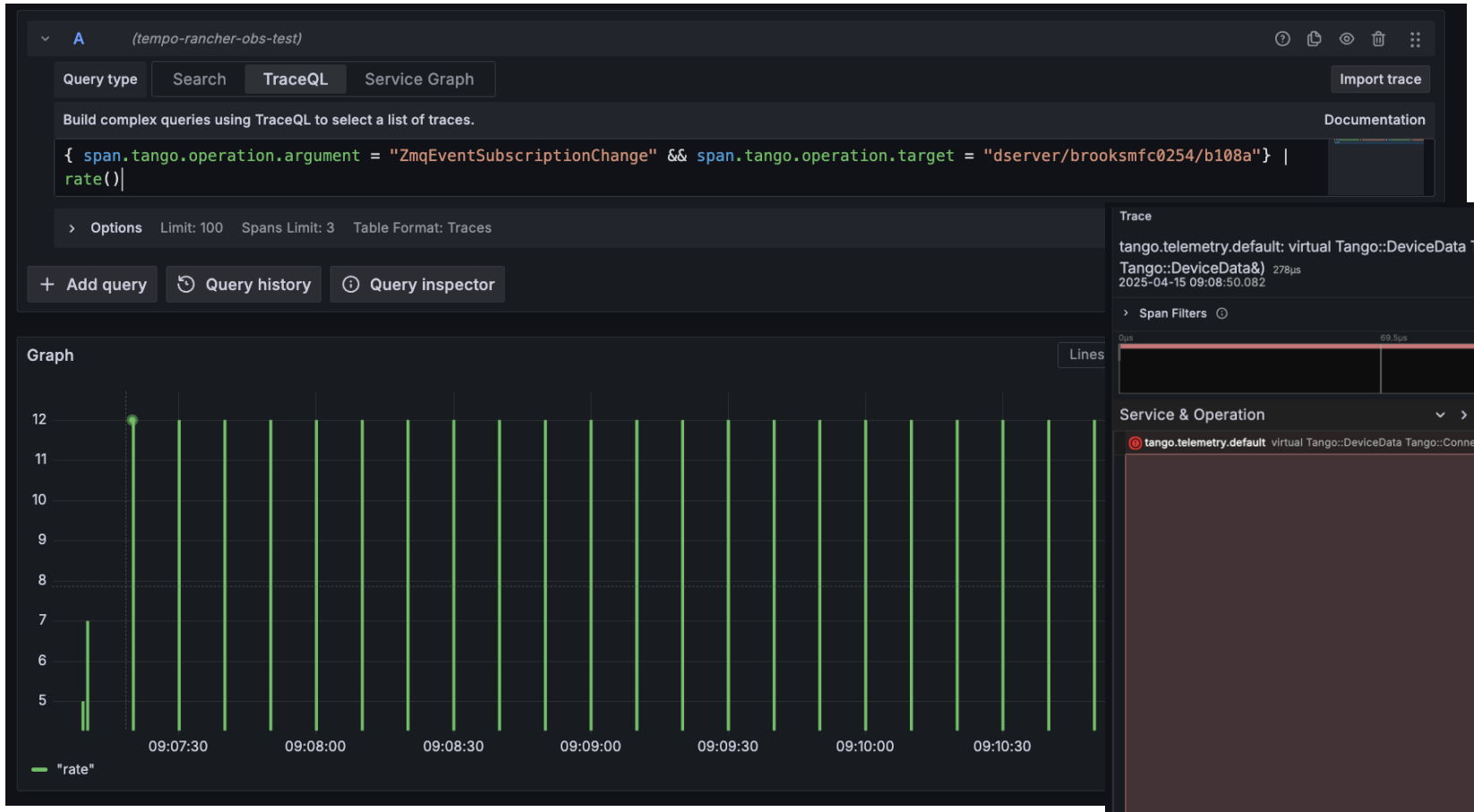
Event subscriptions

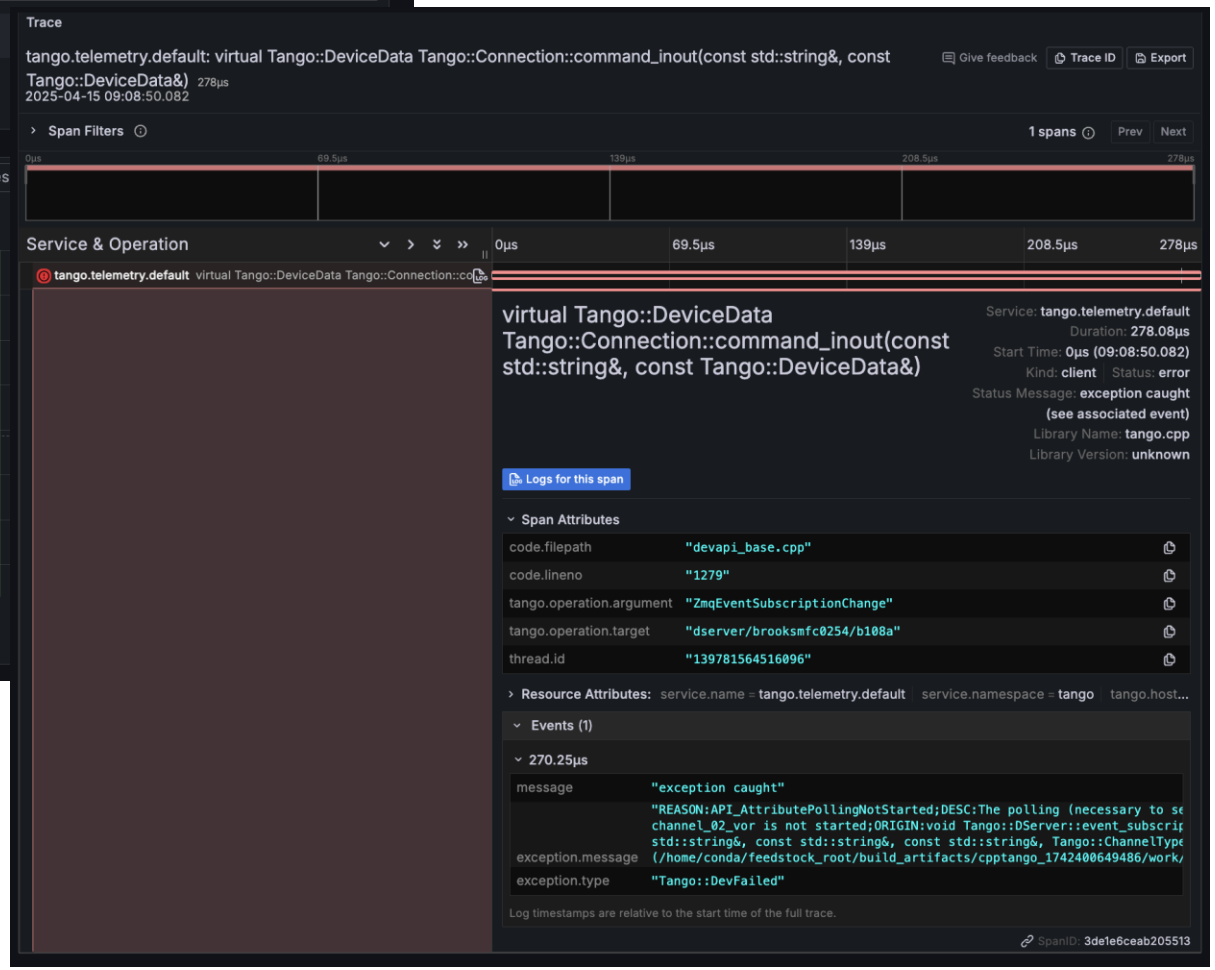
```
>>> dp.unsubscribe_event(eid)
```



Event subscriptions





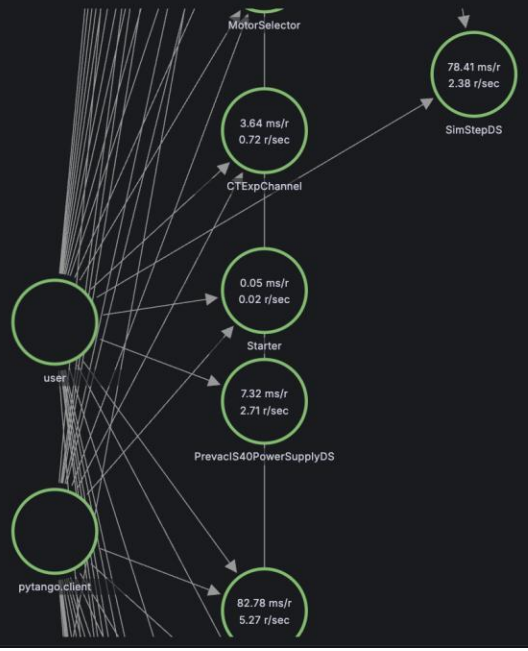


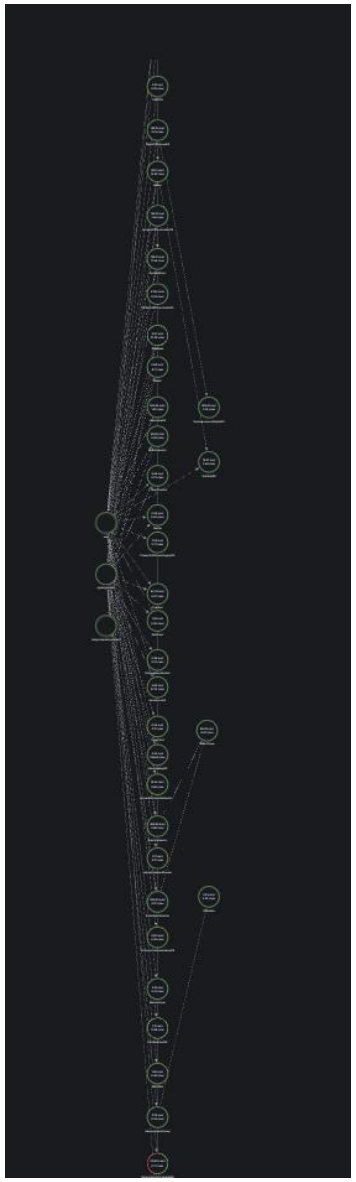
Taurus subscribes stateless, so every 10 seconds,
cppTango retries all the failed subscriptions
(some may never succeed)

Service graph

Name	Rate		Error Rate		Duration (p90)	Links
virtual Tango::AttributeValueList_5*	423.06	423.059	2.08	2.077	0 s	Tempo
AllenBradleyEIP.read_tag	274.74	274.736	0.00	0.000	0 s	Tempo
AllenBradleyEIP.is_tag_allowed	274.73	274.735	0.00	0.000	0 s	Tempo
AllenBradleyEIP.read_attr_hardware	273.80	273.801	0.00	0.000	0 s	Tempo
virtual CORBA::Any* Tango::Device_	49.74	49.737	0.34	0.340	0 s	Tempo

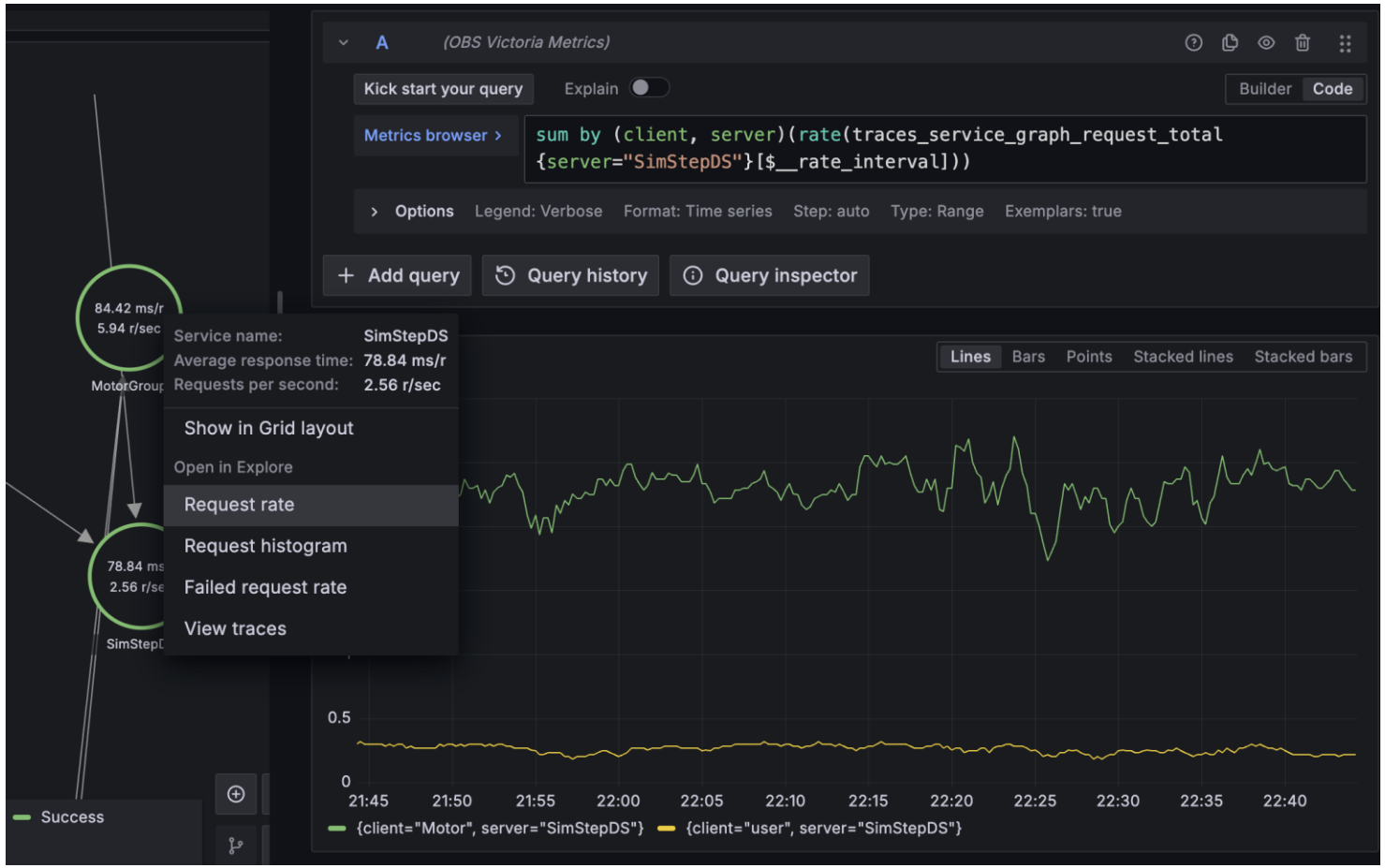
Node graph





Service graph

Service graph



Performance impact

CPU usage


beamline
flexpes
Table view
Fill
Actual
2025-03-31 08:00:00 to 2025-03-31 20:00:00
Host
b-v-flexpes-ec-1 : Basler cameras
Tango server high CPU usage
120%
100%
80%
60%
40%
20%
0%
2 cameras running
2 cameras running
1 camera running
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
Basler/B107A-EA01-02
Basler/B107A-EA01-05
Basler/B107A-FE-01
Basler/B107A-O02-01
Basler/B107A-O03-01
Basler/B107A-OA04-01
Basler/B107A-OA05-01
Basler/B107A-OA05-02
Basler/B107A-OB04-01
Basler/B107A-OB05-01
Basler/B107A-OB05-02
Starter/b-v-flexpes-ec-1
Telemetry disabled
Telemetry enabled
Telemetry disabled

Compute resources for backend

Infrastructure

Resources (2 replicas)
- 8 cores @ 2GHz each
- 16 GB RAM (250 MB / component: distributor, ingestor, compactor, querier, etc.)

Storage
- 50 GB/day (only keeping 150 GB)
- S3 storage
- 250 read/writes per second
- Ceph using 4 CPU cores, 20 GB RAM (minio would be better)
- 10k rpm SAS drives

Network
- 3k spans/second => ~230 HTTP requests/sec

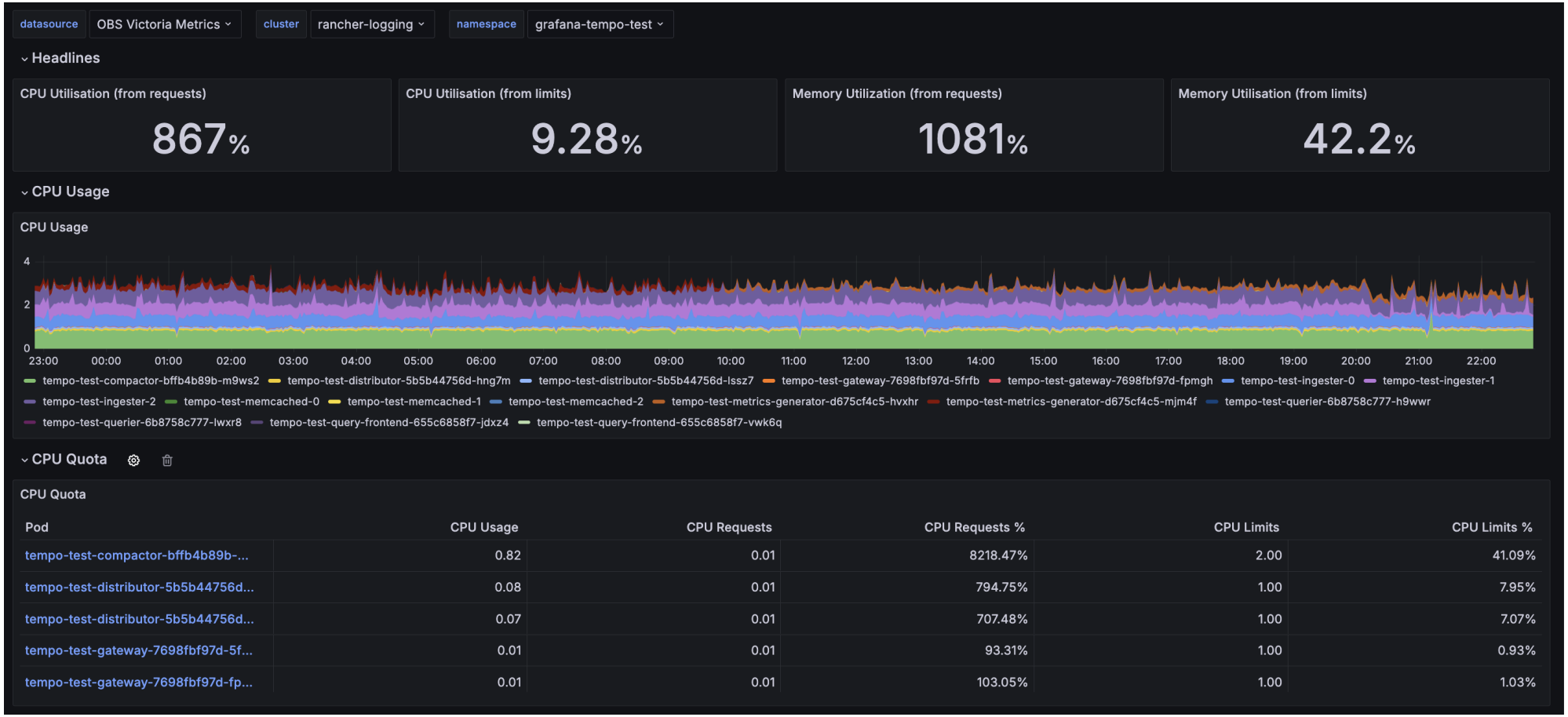
Tango applications

Telemetry enabled for only 1 out of 16 beamlines

900 devices with 11k commands, 17 k attributes
1 control room workstation (client applications)
Logging only enabled on 1 device

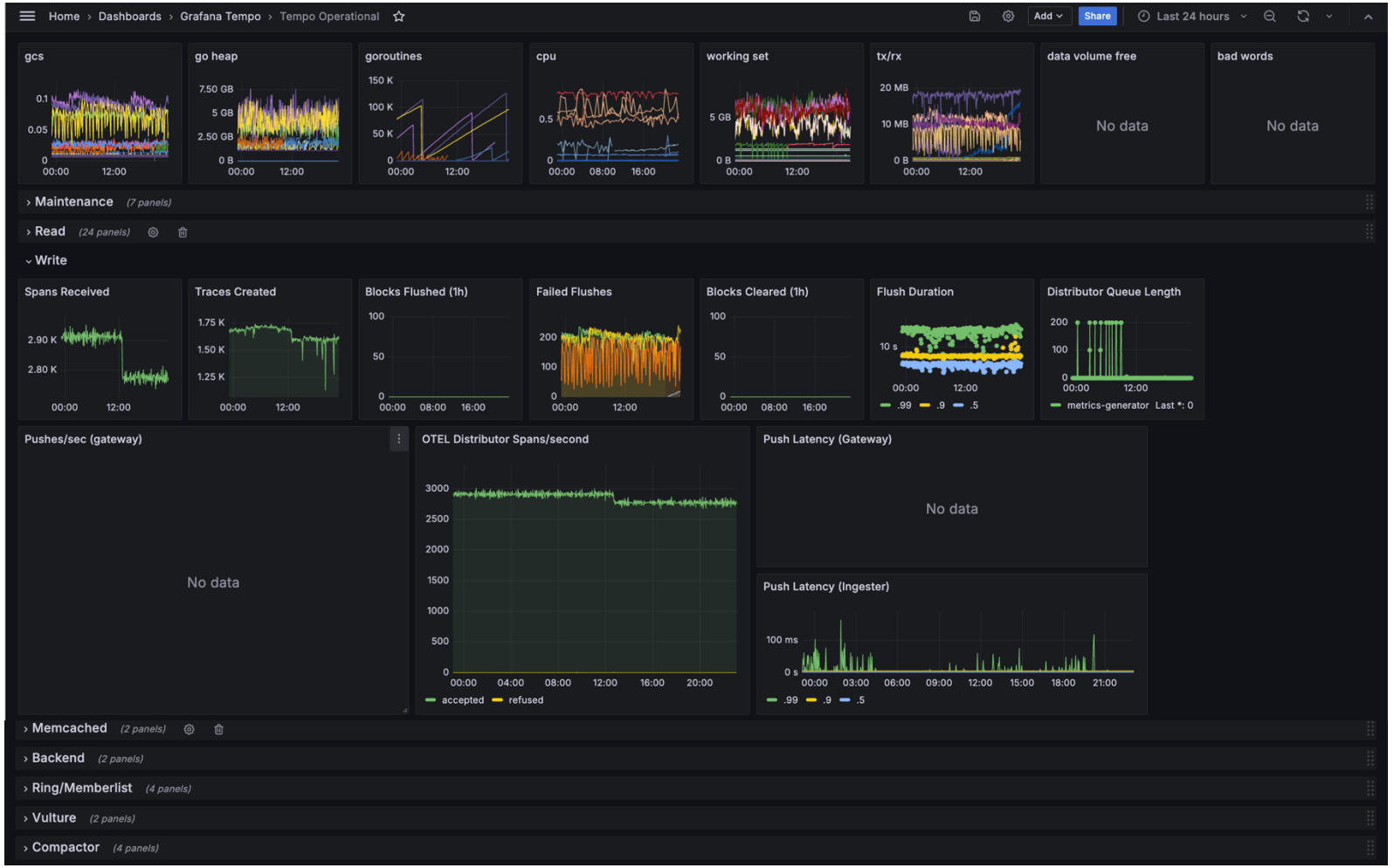
(MAX IV has 24k devices, in total)

K8s compute resources

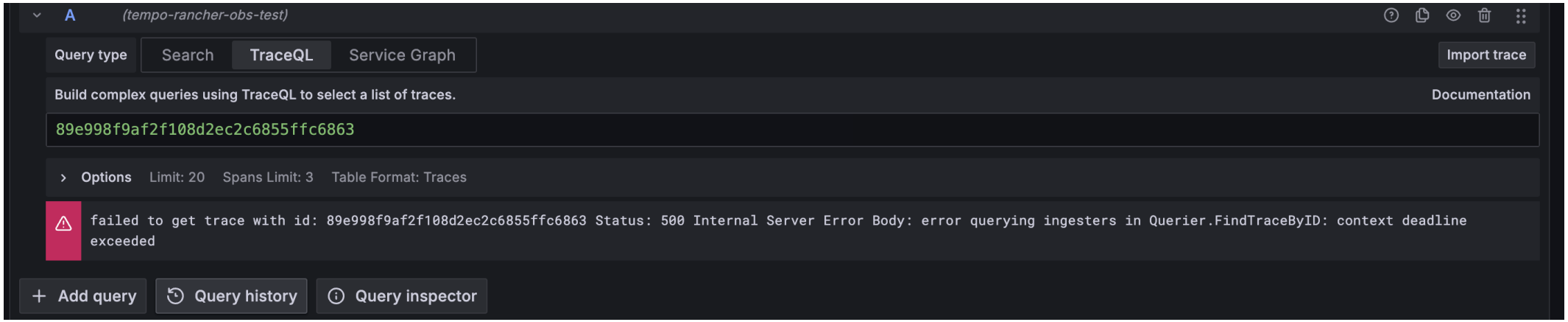


K8s compute resources

Tempo monitoring



Timeouts when querying backend

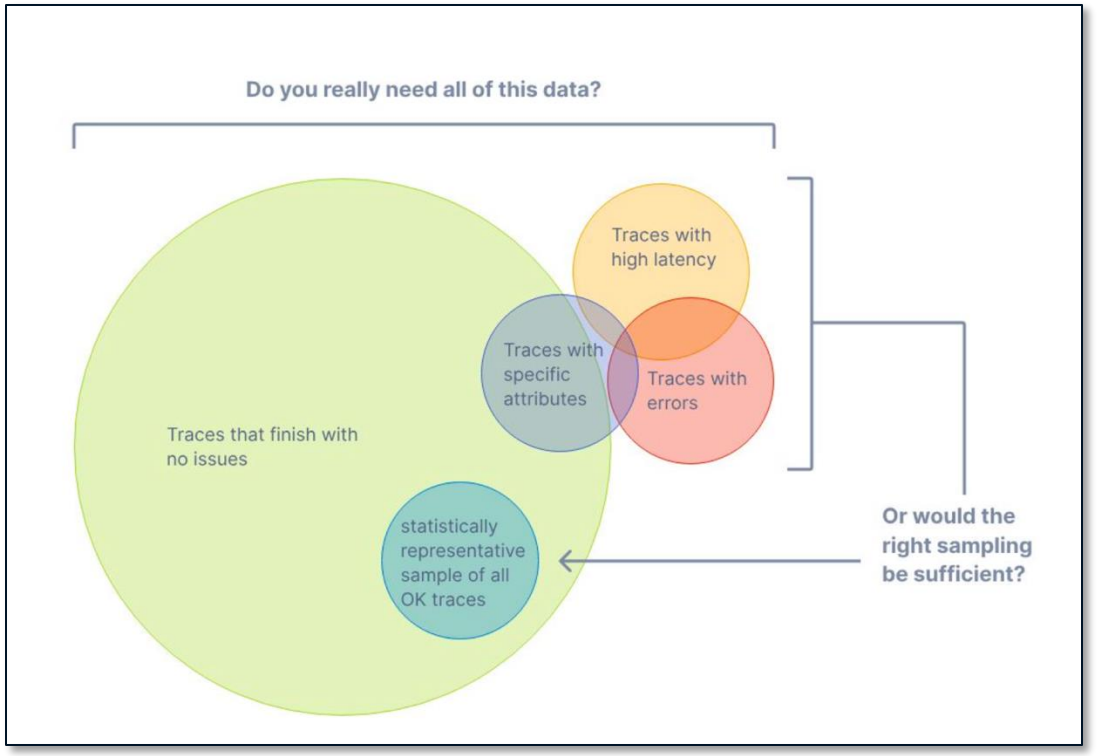


Resources are probably insufficient.
Also see some errors pushing spans from clients

Sampling to reduce trace volume

Plan to use Grafana Alloy to implement tail sampling

Keep traces if
- duration > 5ms
- status is error
- 5% of ”normal” traces

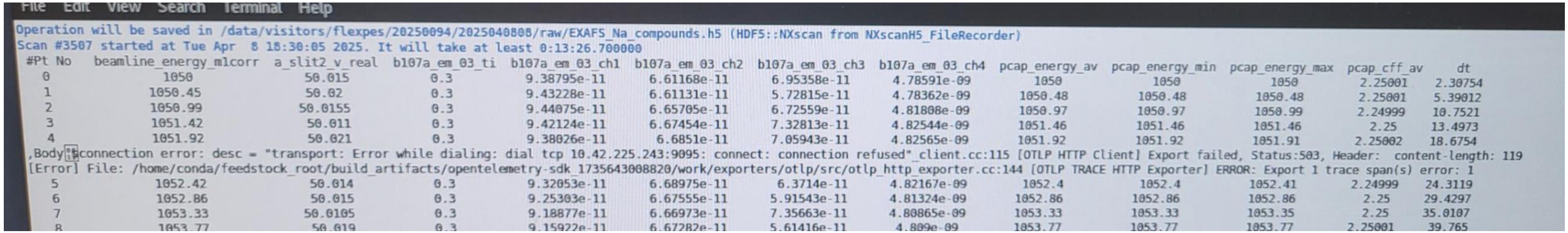


Source: https://opentelemetry.io/docs/concepts/sampling/

Issues / ideas for improvement

Warning logs

Sardana spock output:



File Edit View Search Terminal Help

Operation will be saved in /data/visitors/flexpes/20250094/2025040808/raw/EXAFS_Na_compounds.h5 (HDF5::NXscan from NXscanH5_FileRecorder)

Scan #3507 started at Tue Apr 8 18:30:05 2025. It will take at least 0:13:26.700000

#Pt No	beamline_energy_mlcorr	a_slit2_v_real	b107a_em_03_ti	b107a_em_03_ch1	b107a_em_03_ch2	b107a_em_03_ch3	b107a_em_03_ch4	pcap_energy_av	pcap_energy_min	pcap_energy_max	pcap_cff_av	dt
0	1050	50.015	0.3	9.38795e-11	6.61168e-11	6.95358e-11	4.78591e-09	1050	1050	1050	2.25001	2.30754
1	1050.45	50.02	0.3	9.43228e-11	6.61131e-11	5.72815e-11	4.78362e-09	1050.48	1050.48	1050.48	2.25001	5.39012
2	1050.99	50.0155	0.3	9.44075e-11	6.65705e-11	6.72559e-11	4.81808e-09	1050.97	1050.97	1050.99	2.24999	10.7521
3	1051.42	50.011	0.3	9.42124e-11	6.67454e-11	7.32813e-11	4.82544e-09	1051.46	1051.46	1051.46	2.25	13.4973
4	1051.92	50.021	0.3	9.38026e-11	6.6851e-11	7.05943e-11	4.82565e-09	1051.92	1051.92	1051.91	2.25002	18.6754

,Body:connection error: desc = "transport: Error while dialing: dial tcp 10.42.225.243:9095: connect: connection refused"_client.cc:115 [OTLP HTTP Client] Export failed, Status:503, Header: content-length: 119

[Error] File: /home/conda/feedstock_root/build_artifacts/opentelemetry-sdk_1735643008820/work/exporters/otlp/src/otlp_http_exporter.cc:144 [OTLP TRACE HTTP Exporter] ERROR: Export 1 trace span(s) error: 1

5	1052.42	50.014	0.3	9.32053e-11	6.68975e-11	6.3714e-11	4.82167e-09	1052.4	1052.4	1052.41	2.24999	24.3119
6	1052.86	50.015	0.3	9.25303e-11	6.67555e-11	5.91543e-11	4.81324e-09	1052.86	1052.86	1052.86	2.25	29.4297
7	1053.33	50.0105	0.3	9.18877e-11	6.66973e-11	7.35663e-11	4.80865e-09	1053.33	1053.33	1053.35	2.25	35.0107
8	1053.77	50.019	0.3	9.15922e-11	6.67282e-11	5.61416e-11	4.809e-09	1053.77	1053.77	1053.77	2.25001	39.765

Exiting Taurus application:

```
...
MainThread     WARNING  2025-04-04 14:08:02,003 opentelemetry.sdk.trace.export: Already shutdown,
dropping span.
MainThread     WARNING  2025-04-04 14:08:02,004 opentelemetry.sdk.trace.export: Already shutdown,
dropping span.
```

Improvement ideas

Shorter trace name for cppTango? E.g. change:

```
virtual CORBA::Any* Tango::Device_4Impl::command_inout_4(const char*, const CORBA::Any&,
Tango::DevSource, const Tango::ClntIdent&)
```

to:

`Tango::Device_4Impl::command_inout_4` and put full signature in a span attribute

Include data from read/write/command/get/put property in span attribute (limit size?)

Device must record client info (e.g., if client hasn't opted in to providing telemetry info, won't know where request came from)

Fix crash when doing a short client session with PyTango

Enable/disable/configure at runtime, similar to logging. cppTango #1398

Other clients

Instrument clients like Taurus GUI, Sardana, TangoGQL

Conclusion

Summary

Very powerful feature

Negligible impact on Tango device server performance

Backend needs “a lot” of compute resources

Trace sampling will be needed to reduce trace volume

Room for improvement

Useful links

PyTango documentation

https://tango-controls.readthedocs.io/projects/pytango/en/latest/how-to/telemetry.html

Observability and OpenTelemtery

https://opentelemetry.io/docs/concepts/observability-primer/

https://opentelemetry.io/docs/what-is-opentelemetry/

https://opentelemetry.io/docs/concepts/sampling/