Interval Measurement Software for Measuring Aging Parameters

Student Project (5. Semester)

Supervisor: Sascha Braun
Examiner: Prof. Wolfram Haupt
Student: Don Winter

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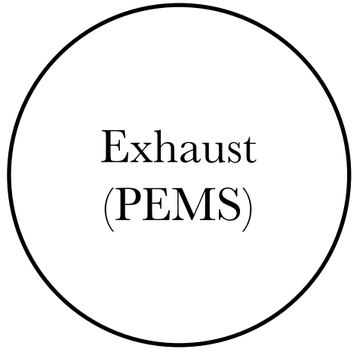
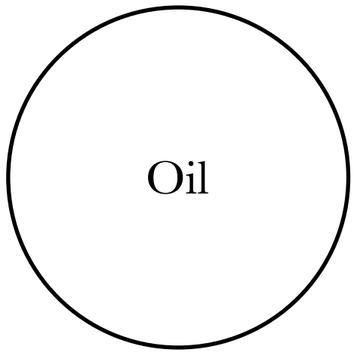
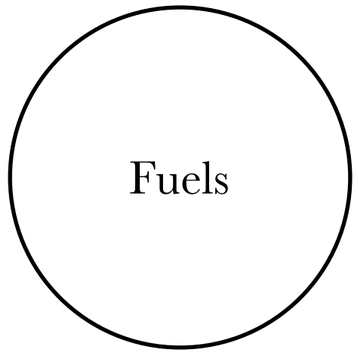
Research at Hochschule Coburg







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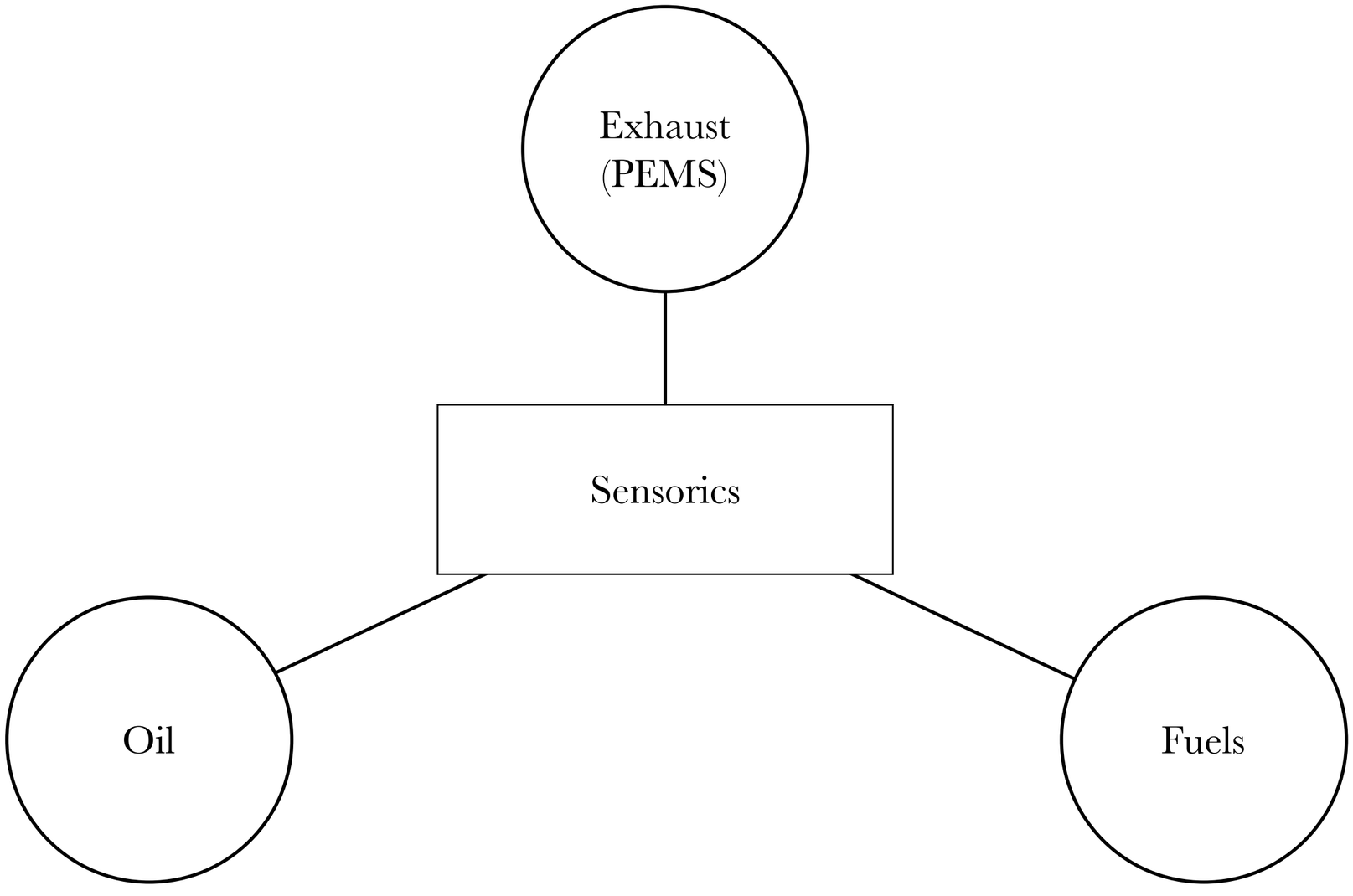

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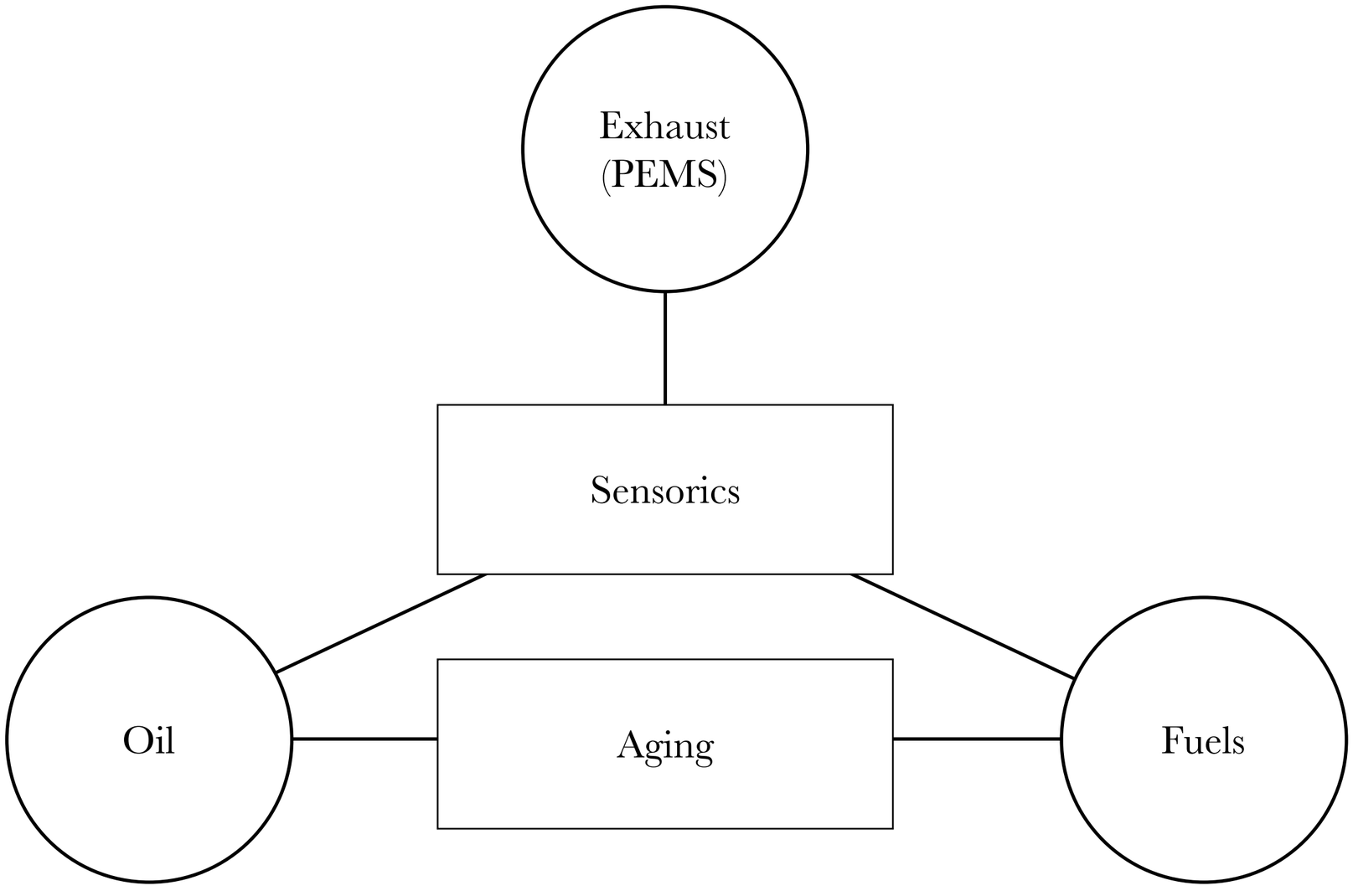

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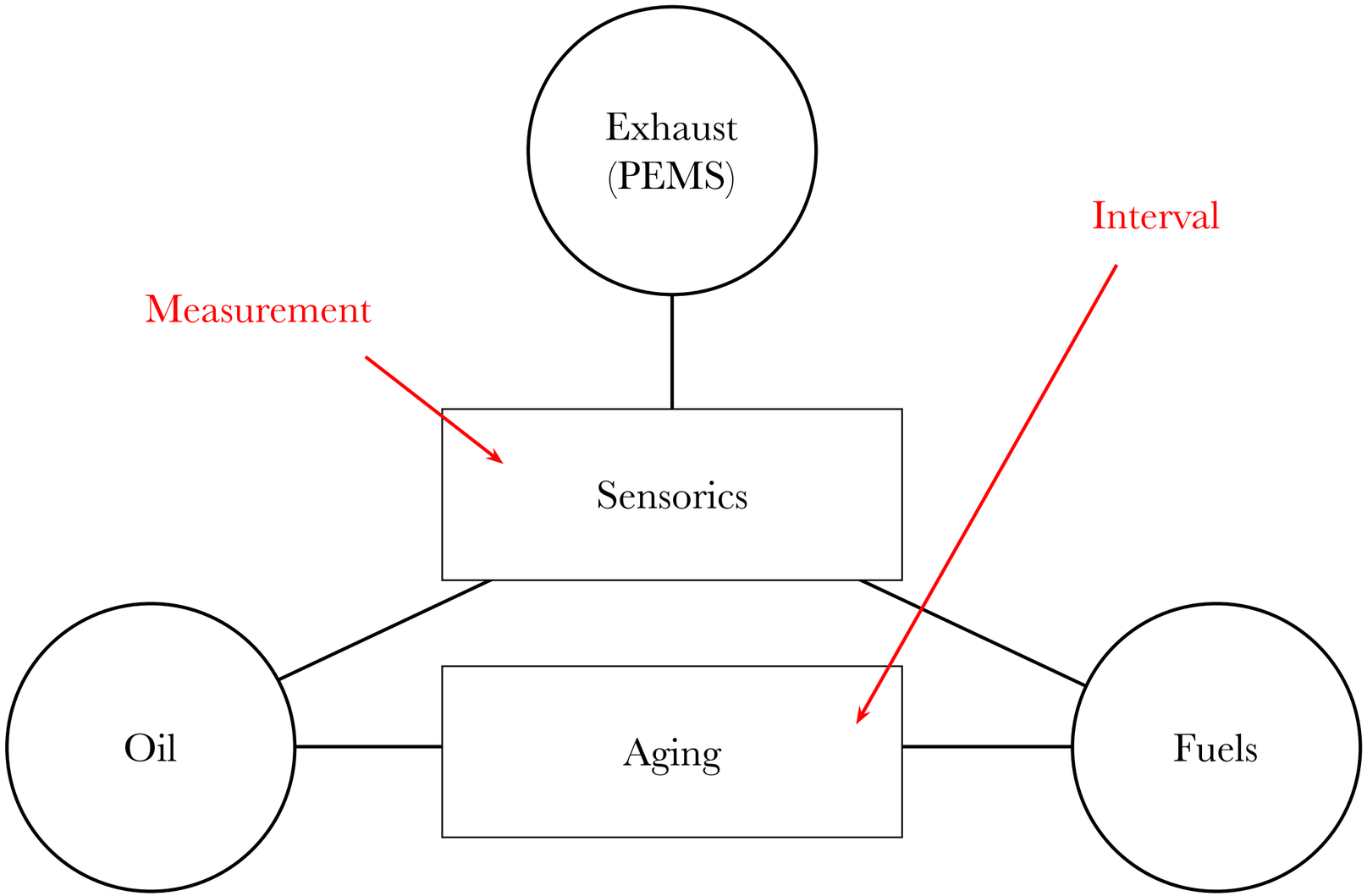
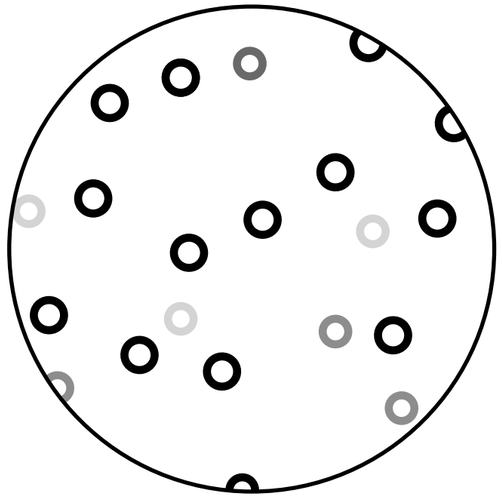


Aging

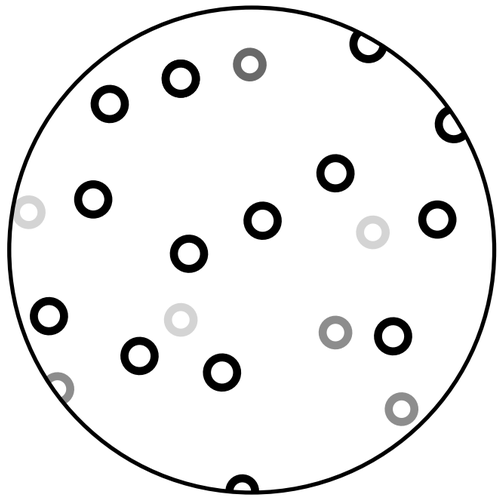
Process of adverse physical or chemical changes due to long-term storage of fuel/oil in a system.

Aging Parameters



Additive consumption

Aging Parameters



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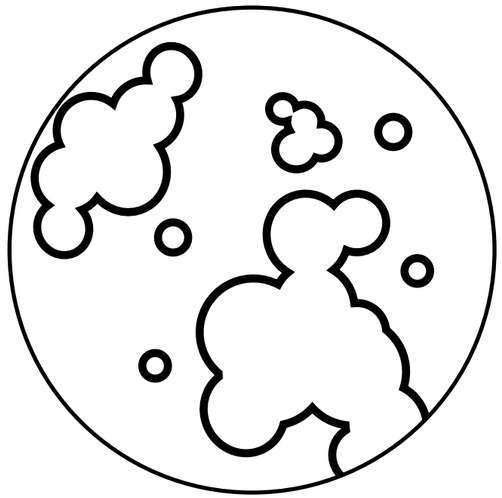
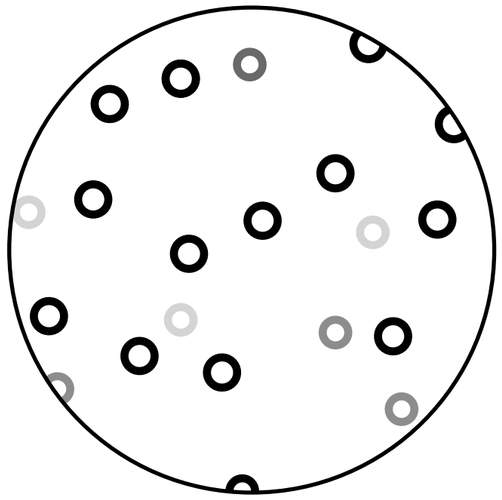


Creation of Oligomeres

Aging Parameters



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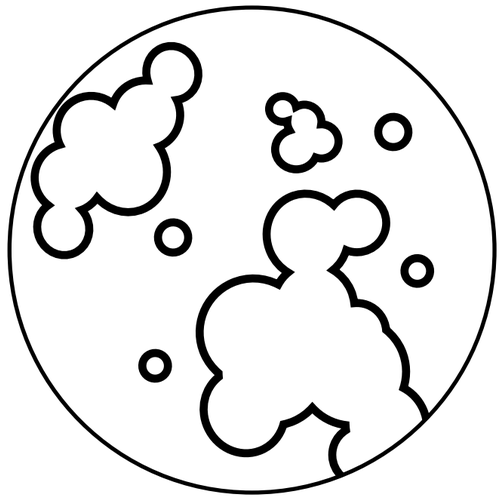

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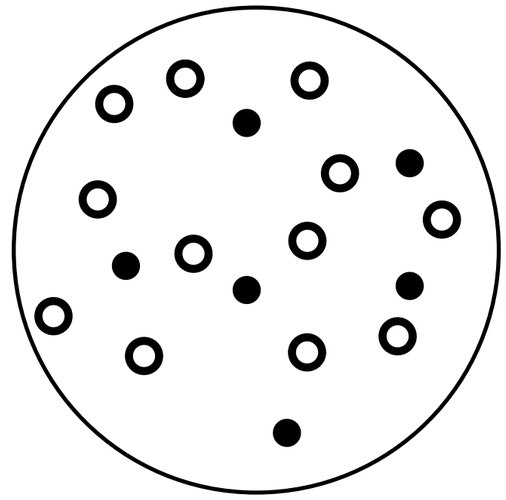
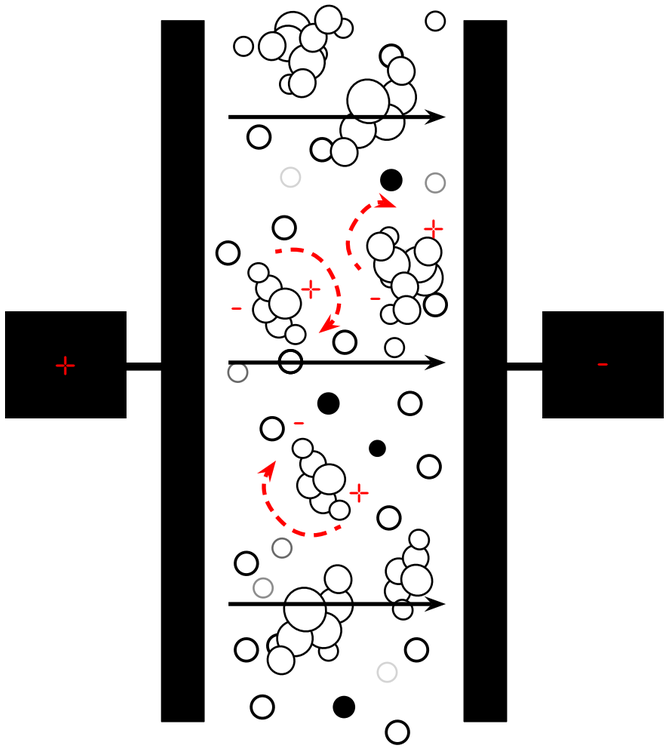


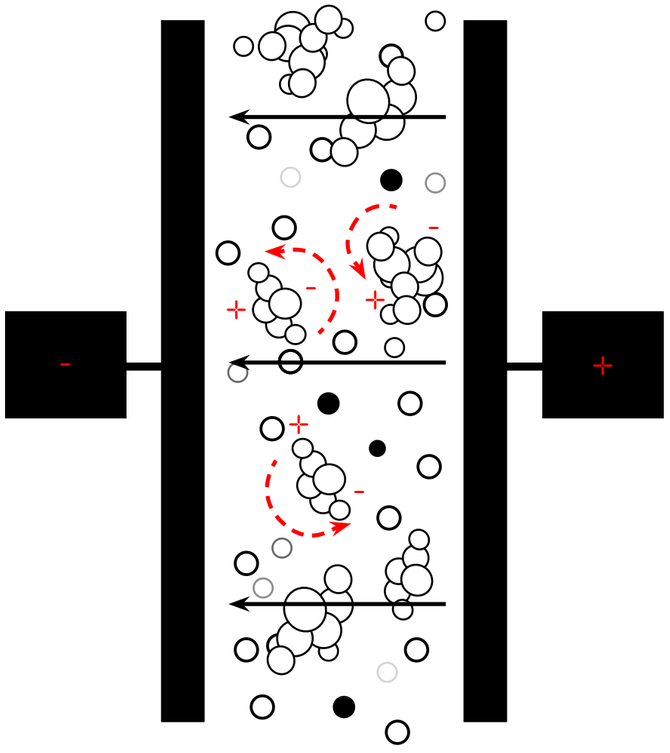
Particle contamination

Aging Measurement



Dielectric Permittivity
Capacitive Sensor + Keysight E4990A

Aging Measurement



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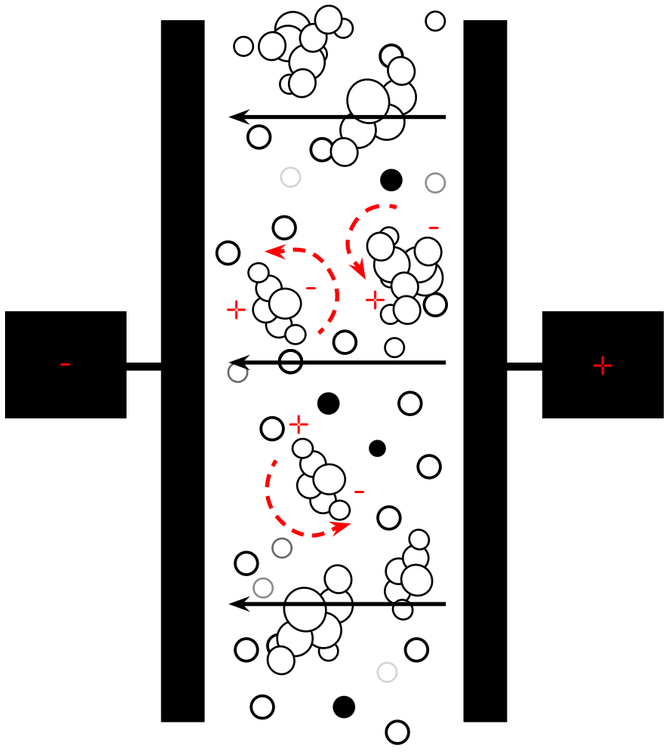
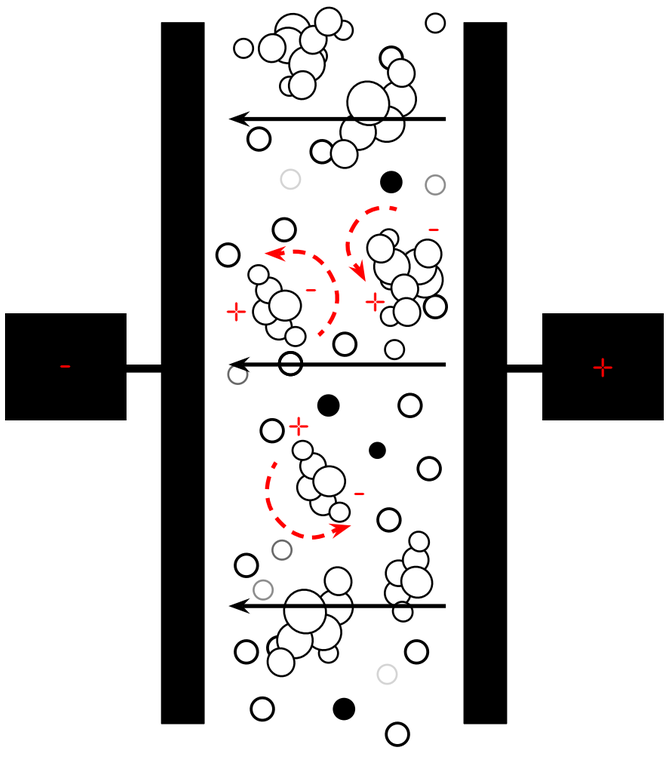


Dielectric Permittivity
Capacitive Sensor + Keysight E4990A

Impedance Z = (DC) Resistance Z' + (AC) Reactance jZ''
Reactance = Capacitance R_C + Inductance R_L

Aging Measurement



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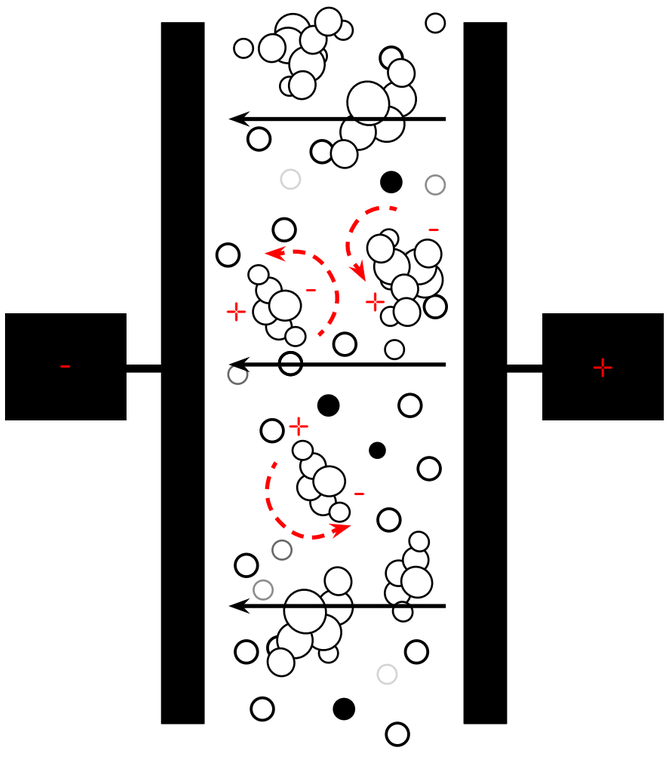

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$$\varepsilon^* = \varepsilon' - j\varepsilon'' \qquad tan\,\delta = \frac{\varepsilon''}{\varepsilon'}$$

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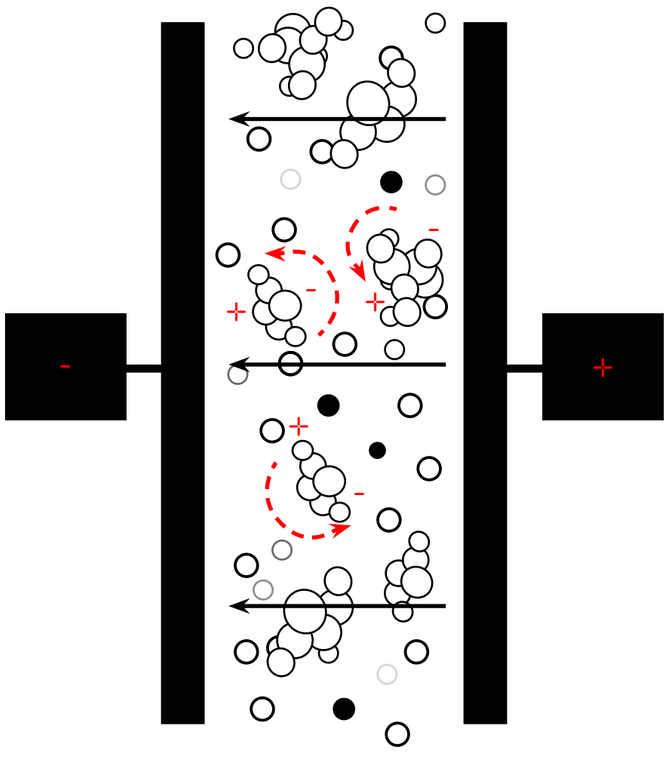

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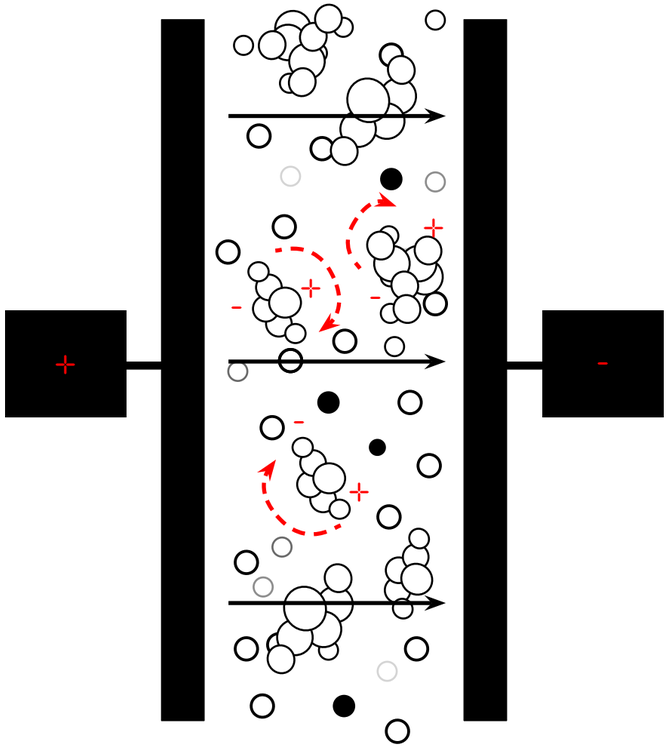
... the permittivity is a measure of a combination of chemical and physical effects due to aging (for example length of molecules)

Aging Measurement



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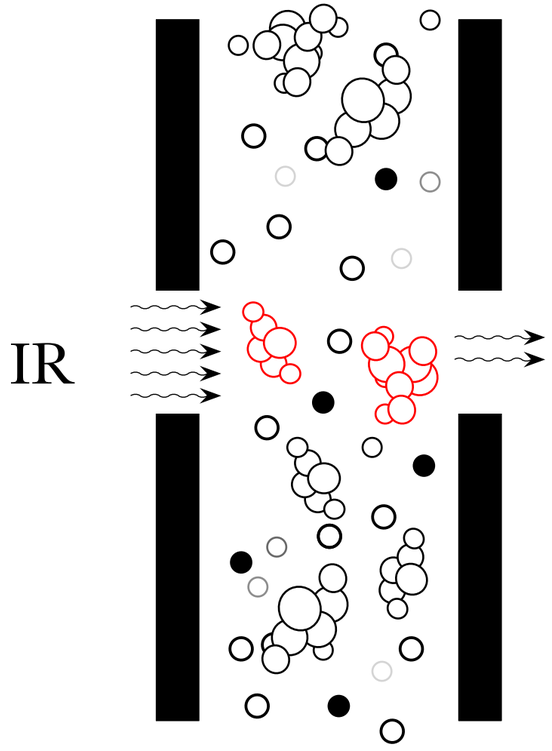
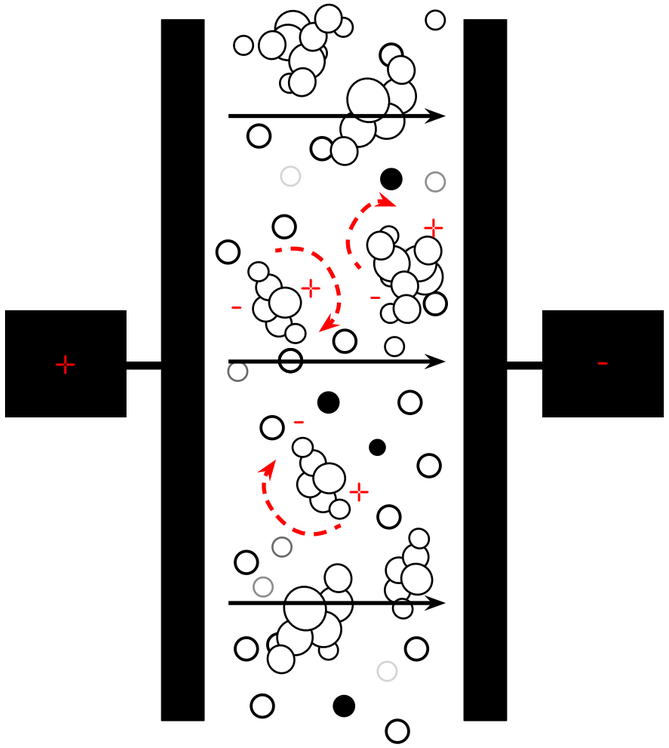


Near Infrared Spectroscopy
not implemented yet.

Aging Measurement



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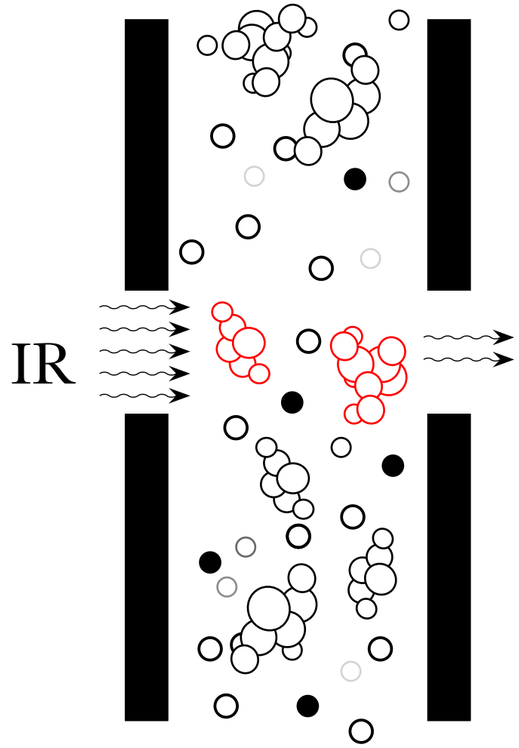

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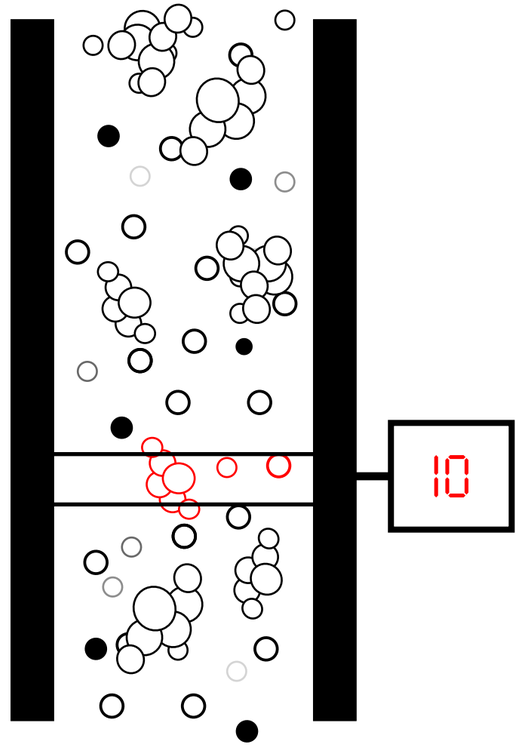
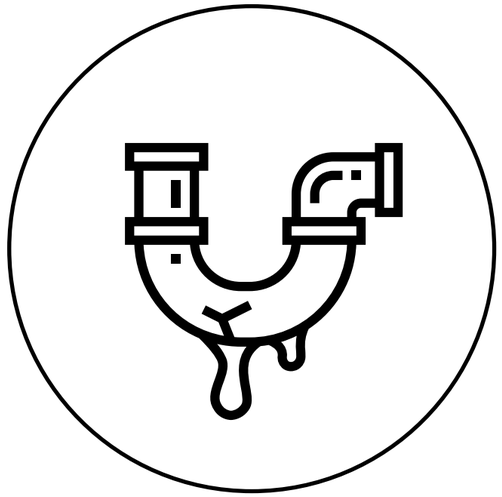


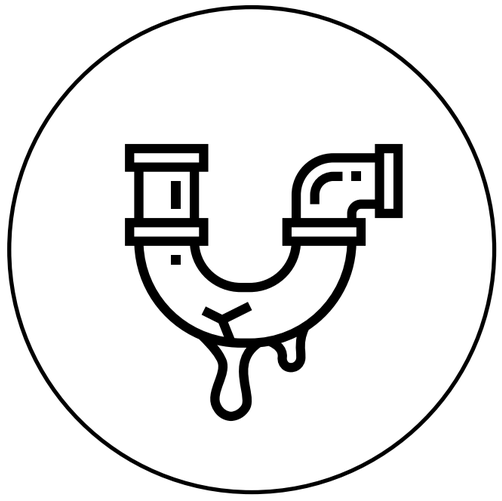
Particle Counter
will not be implemented.

Performance Indicators



Damage

Performance Indicators



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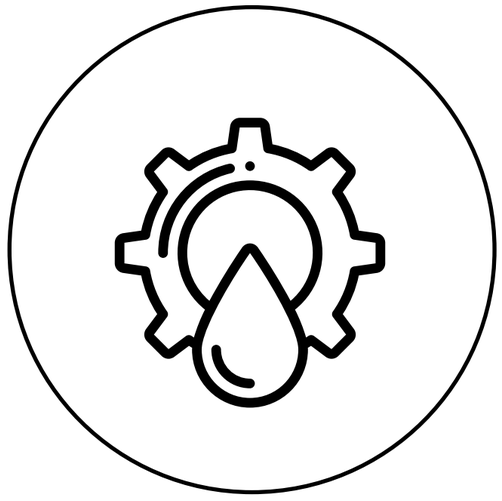
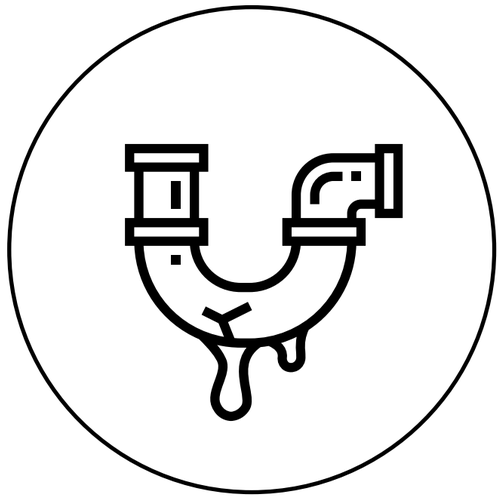
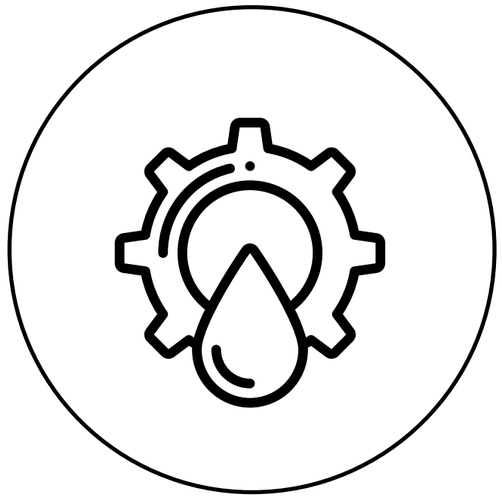


Maintainance

Performance Indicators



Damage



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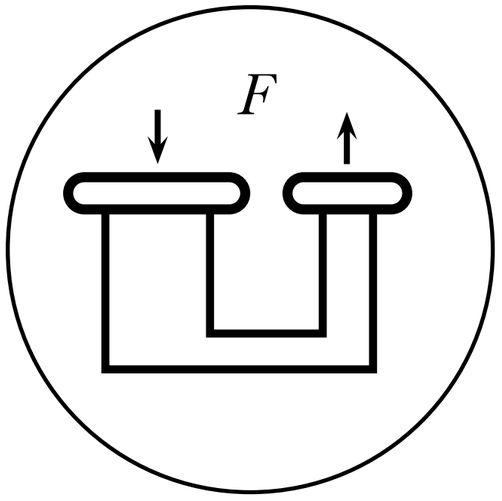
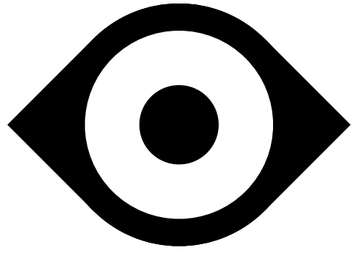


Efficiency

Researching the influence of aging parameters on performance indicators allows development of countermeasures.



Observer

Purpose of the Program

Continuously measure aging parameters.

Store data efficiently for later evaluation and comparison.

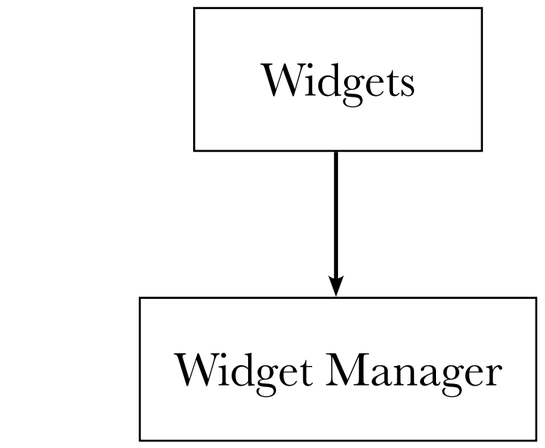
Program Overview

Widgets

Buttons, Lists, .. used in GUI

Class

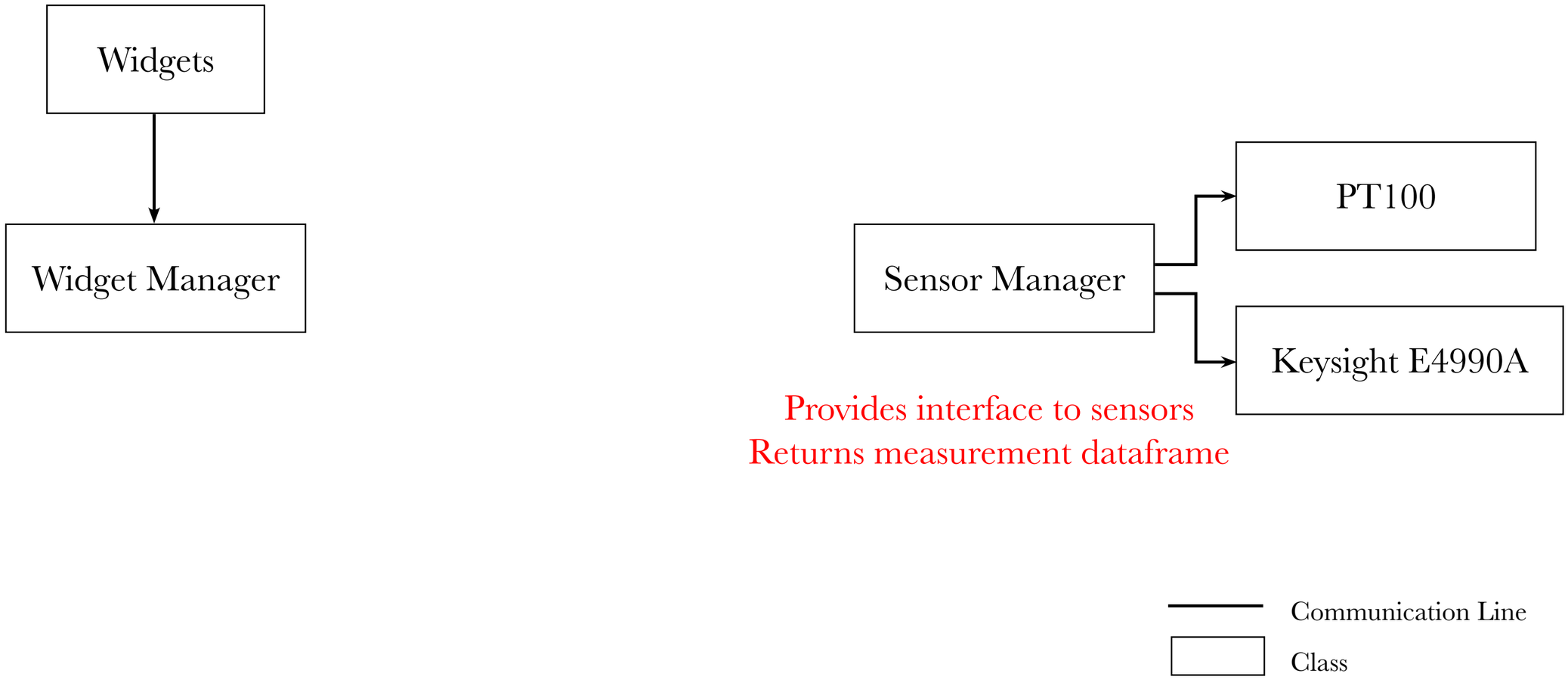
Program Overview



Renders the front end
Allows for simple assembly of GUI

Program Overview

Program Overview



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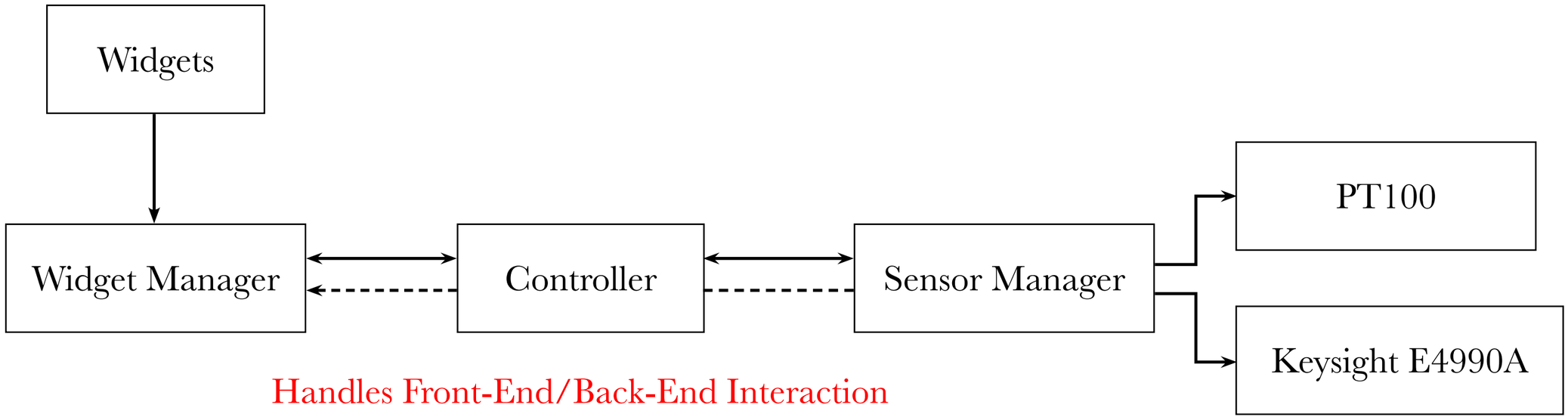
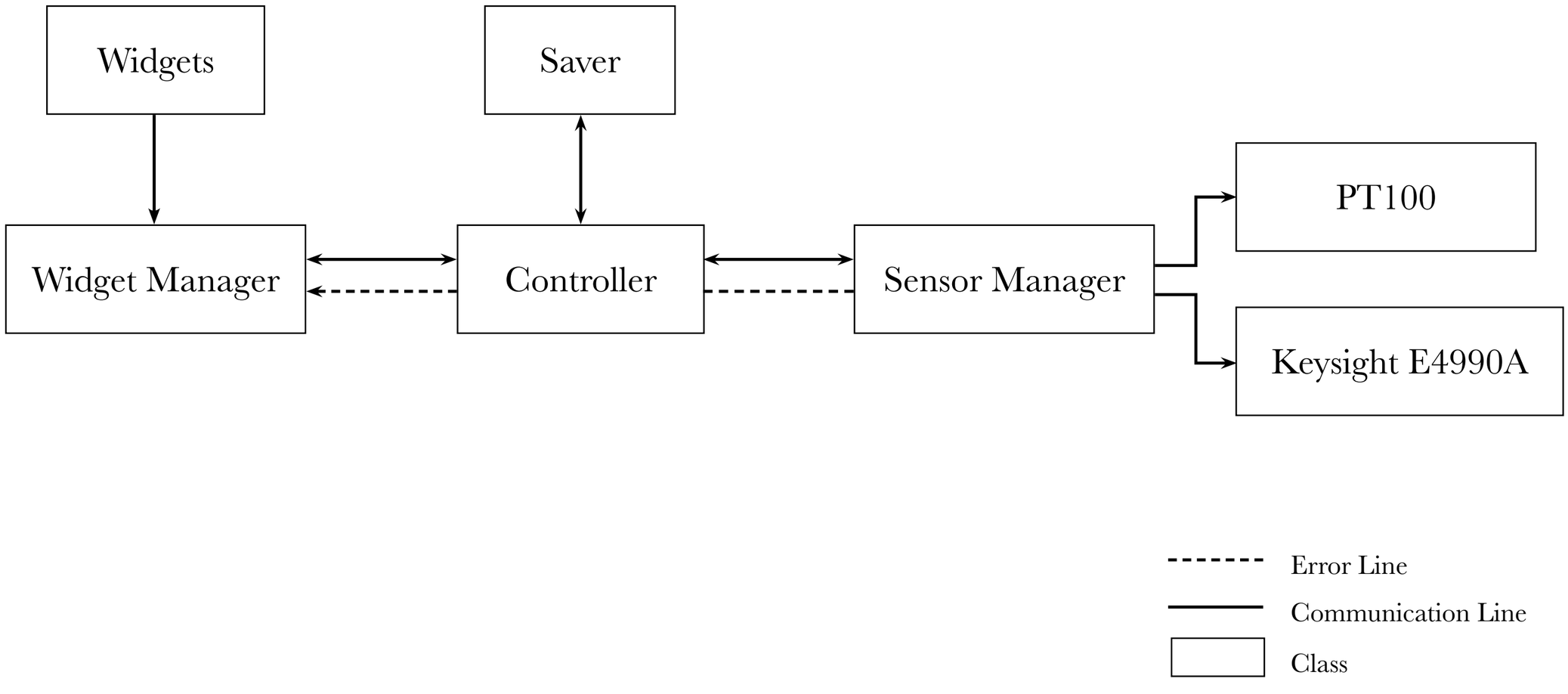


Handles Front-End/Back-End Interaction
Forwards Errors to Front-End

Error Line
Communication Line
Class

Program Overview



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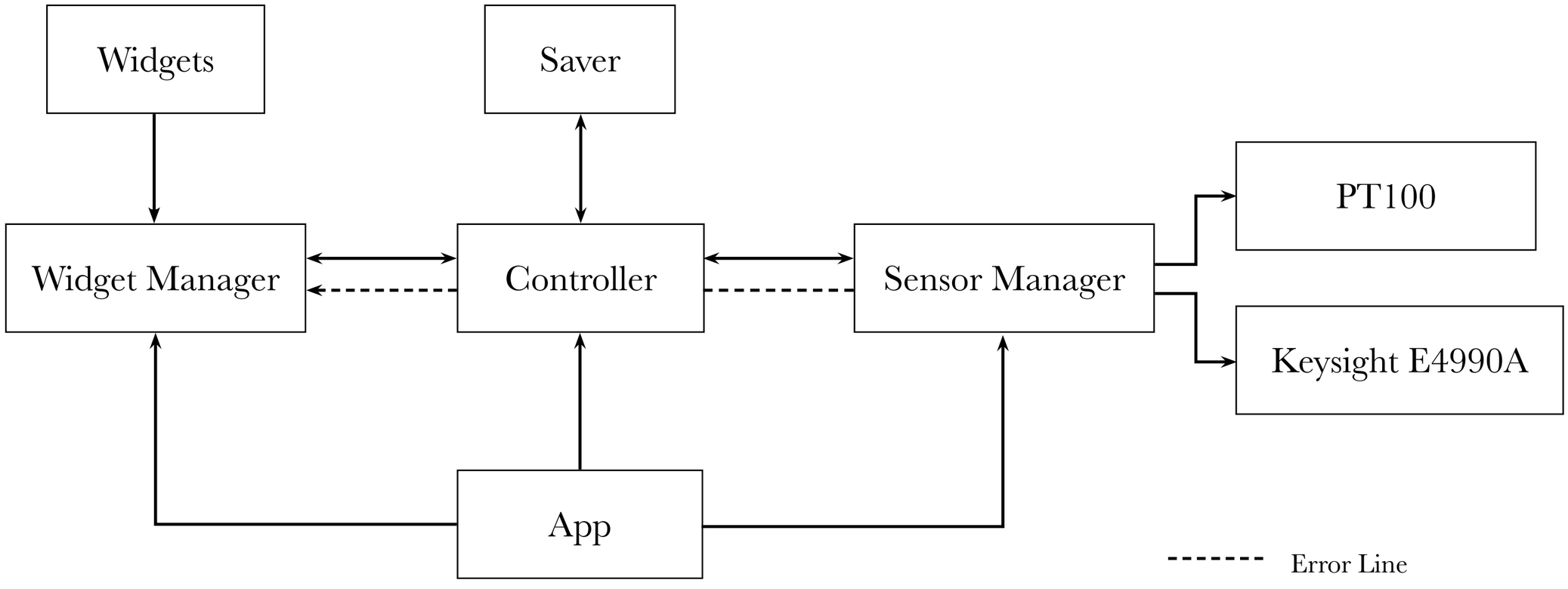
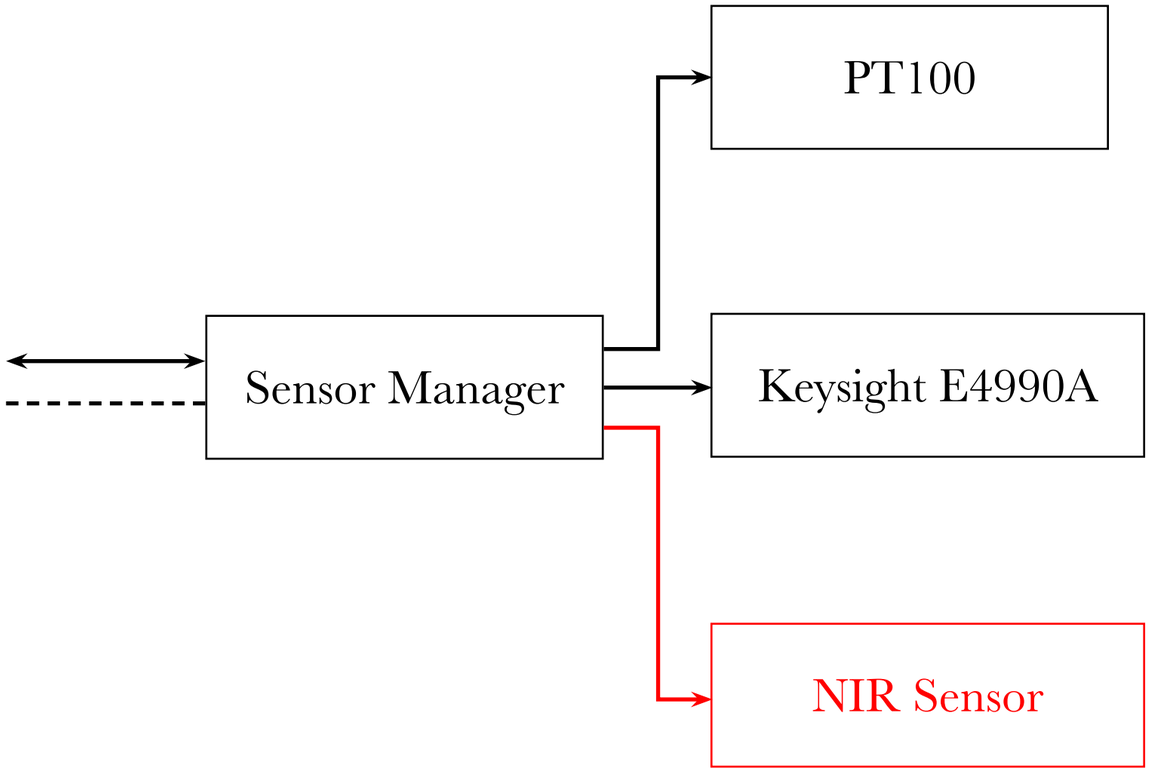
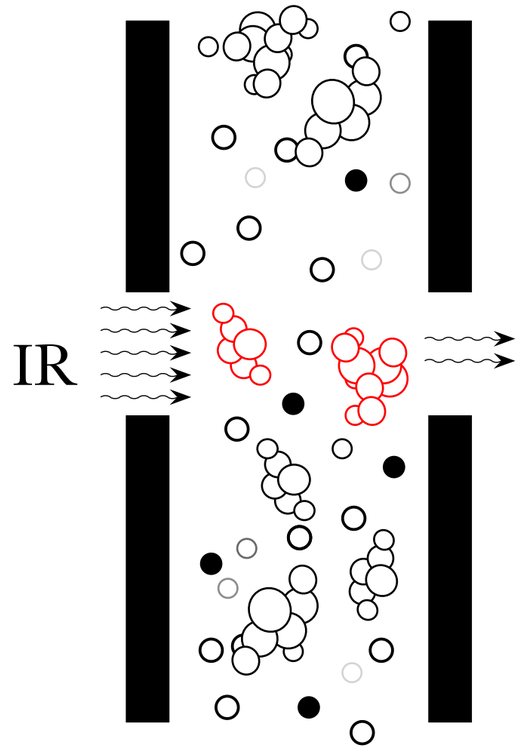


Connect Main Components
Container for Program

Exemplary extension of NIR Sensors





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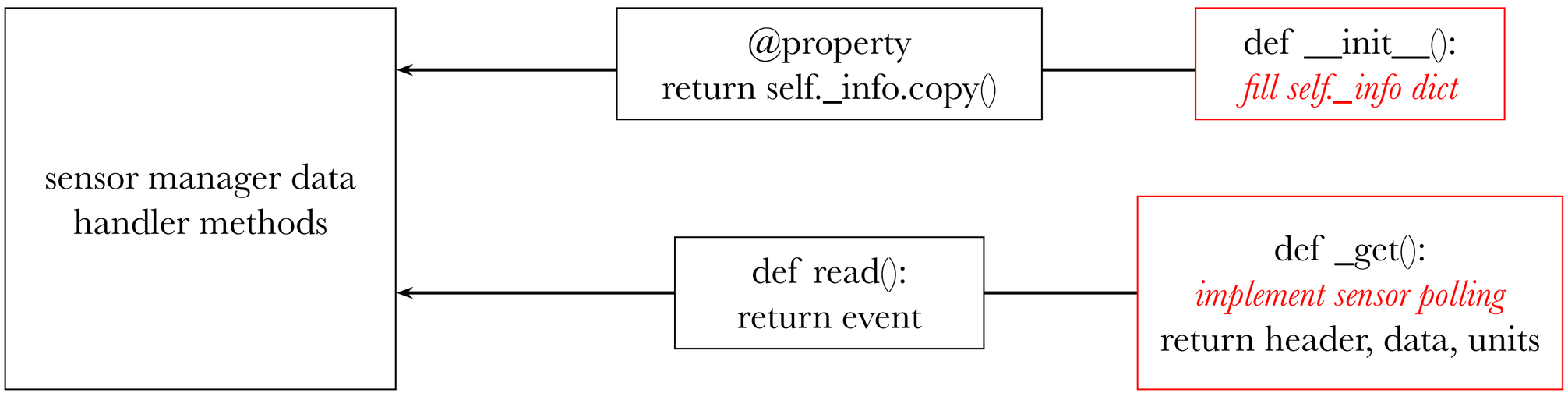

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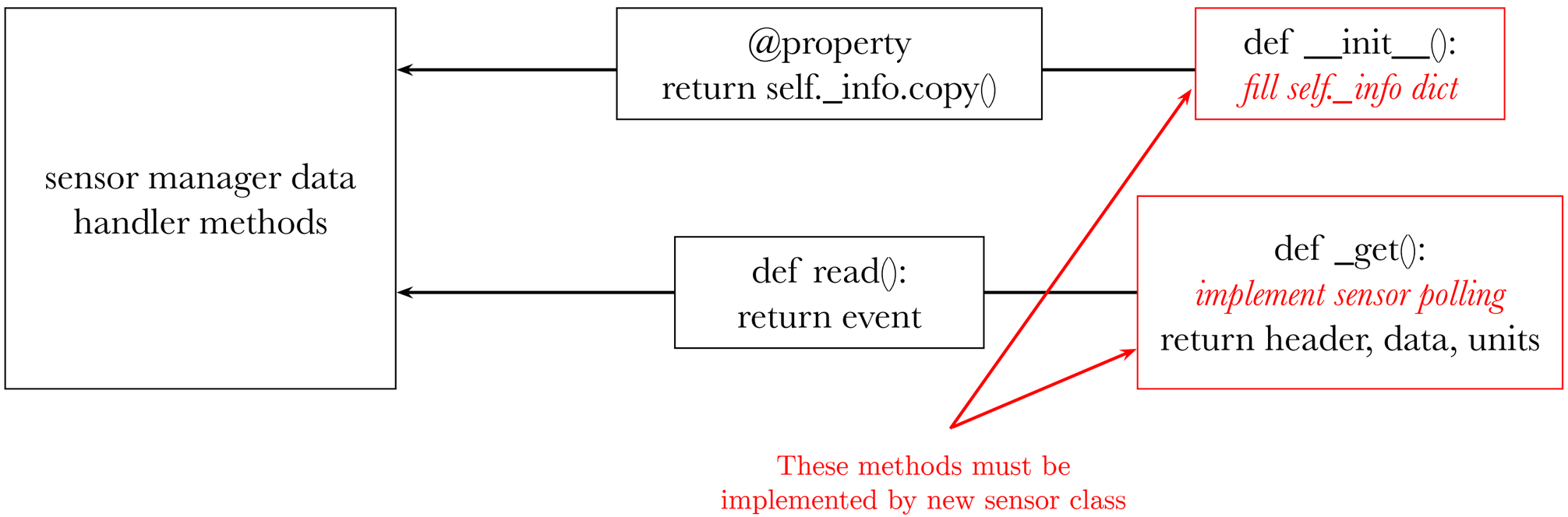
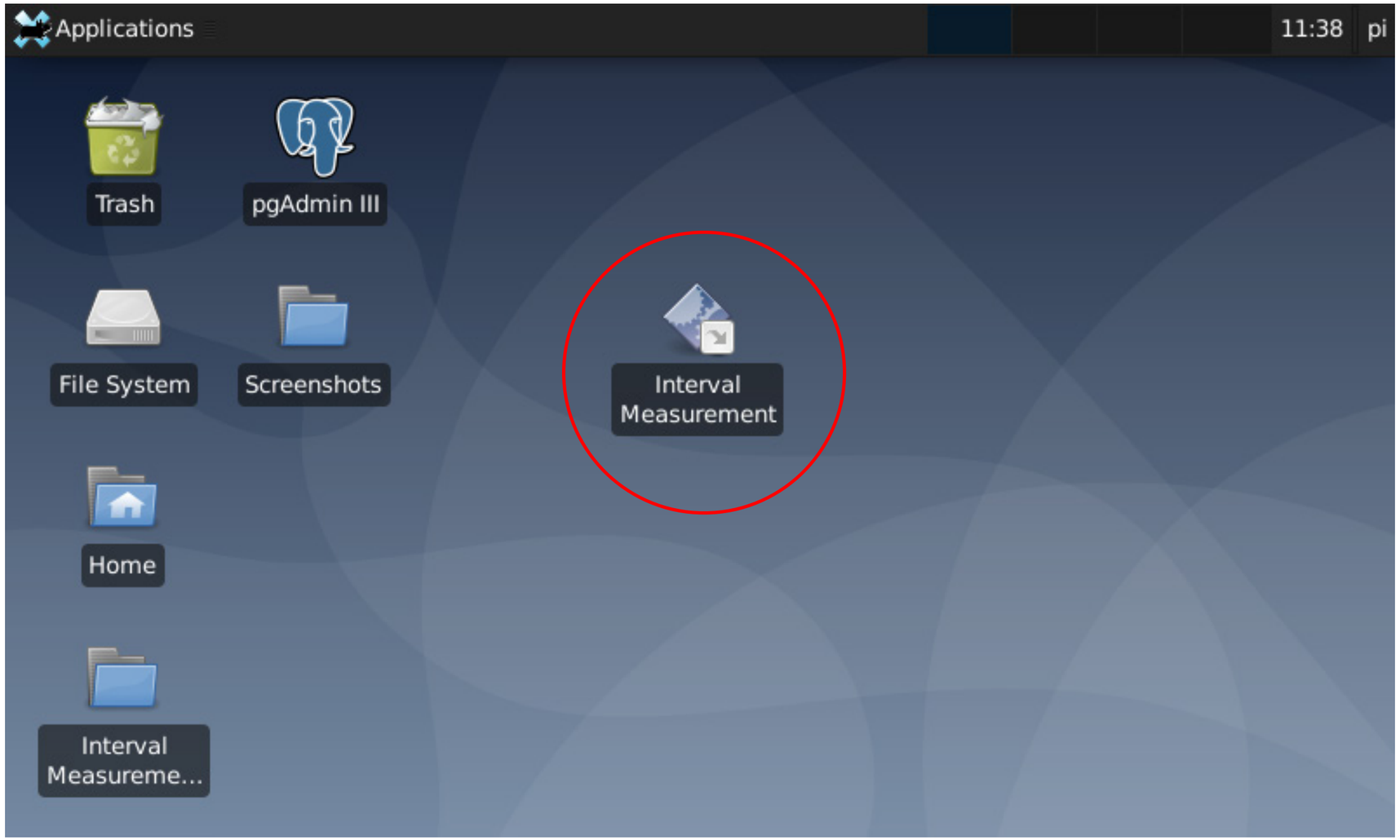


Observer Interface Tour



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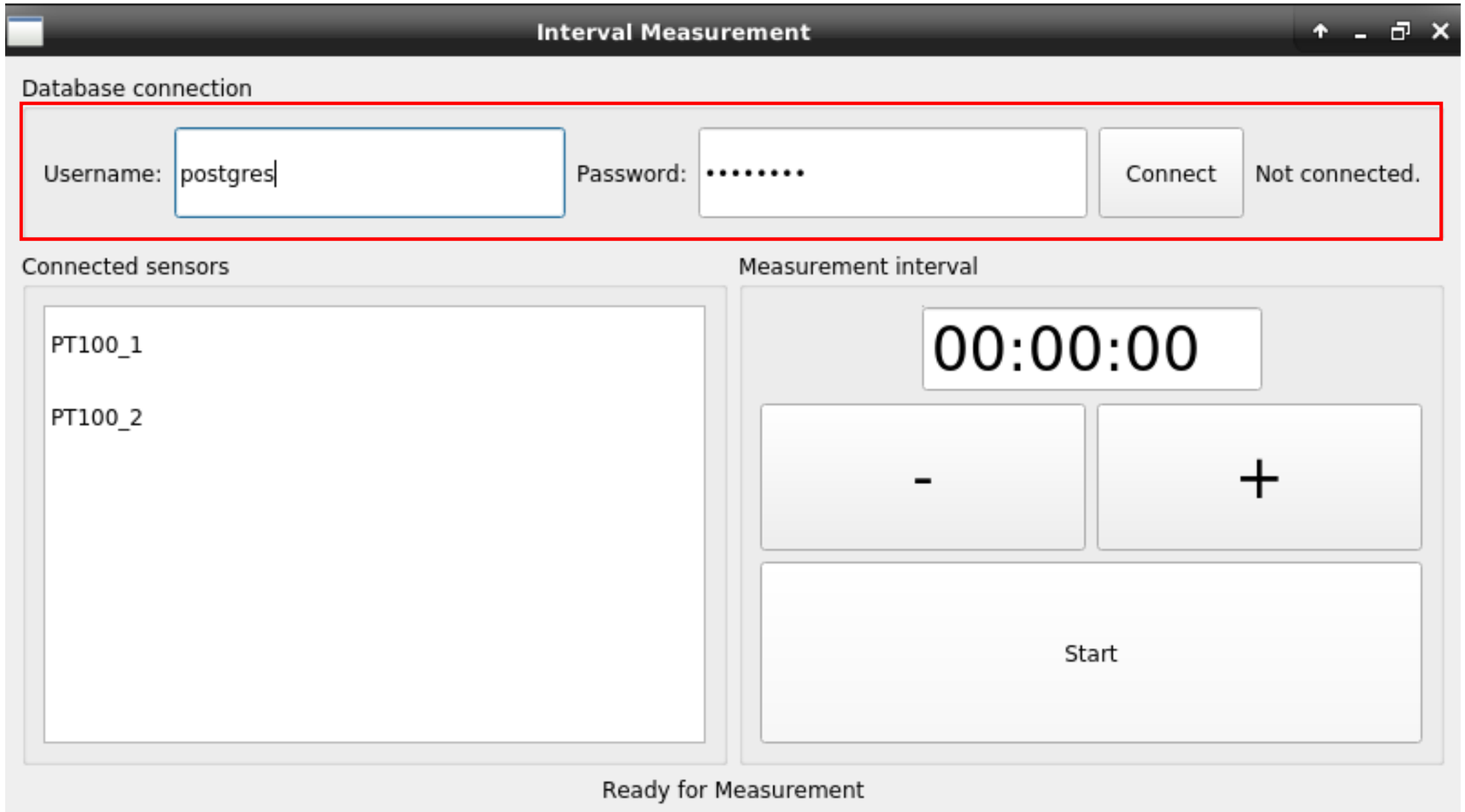

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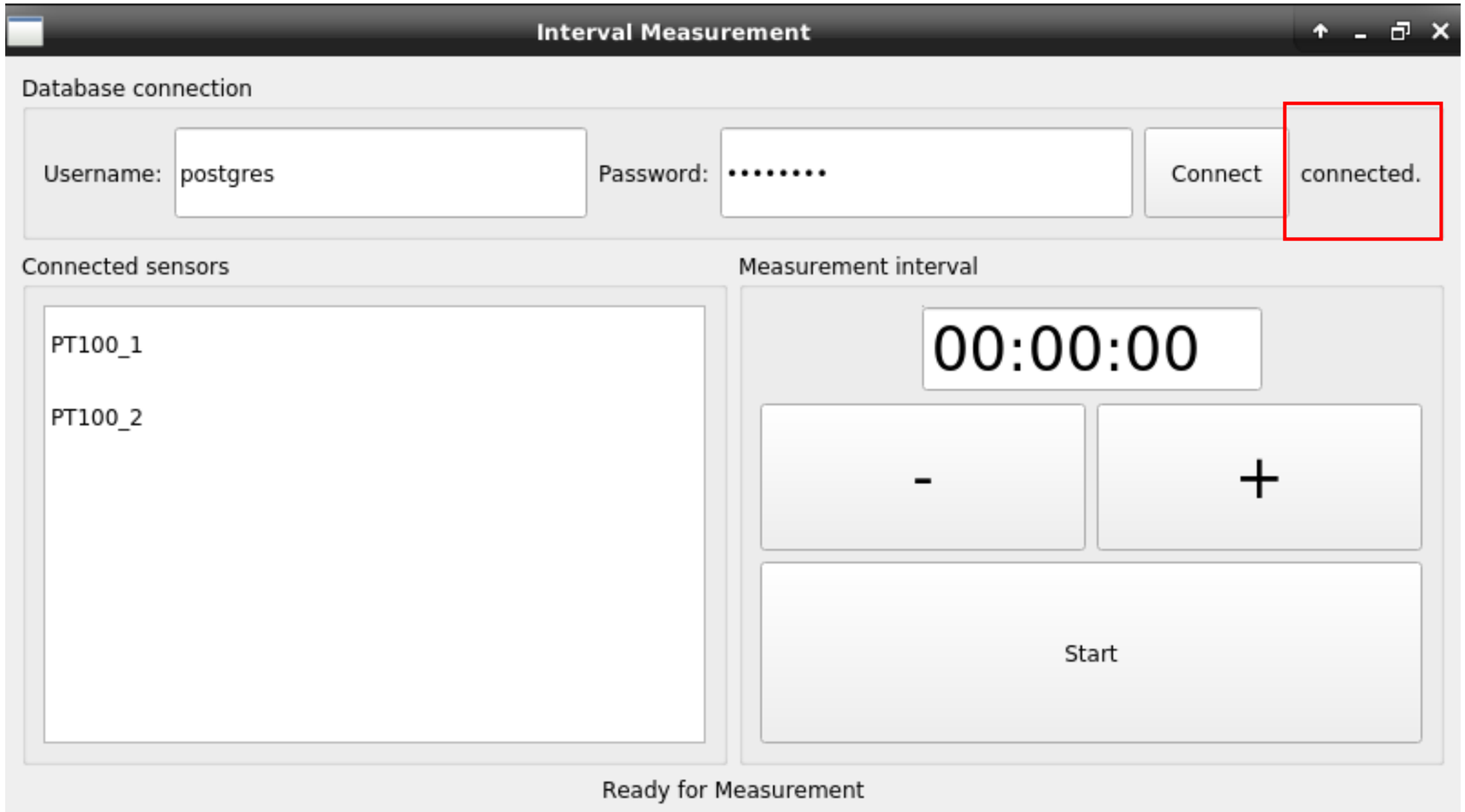

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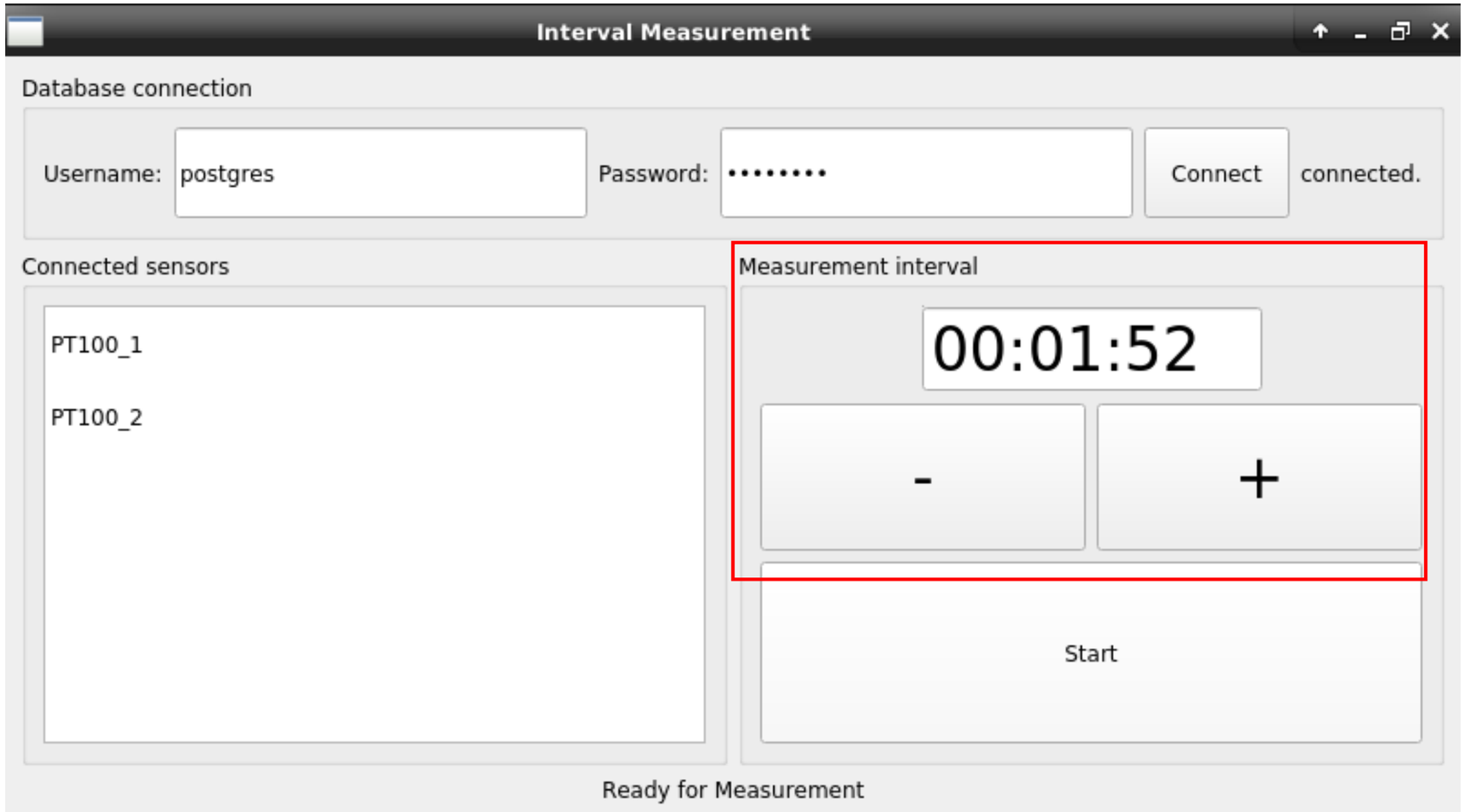

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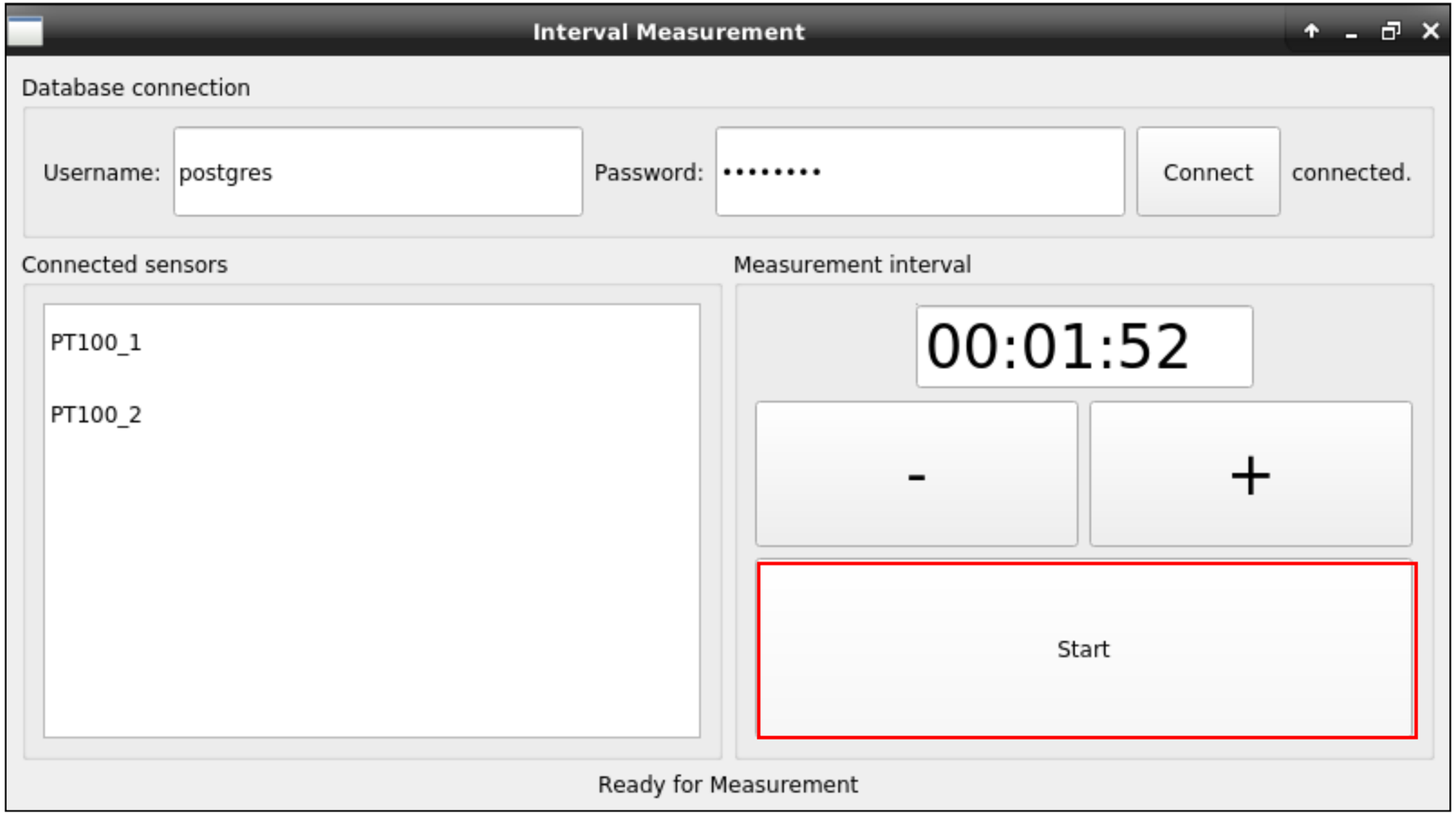

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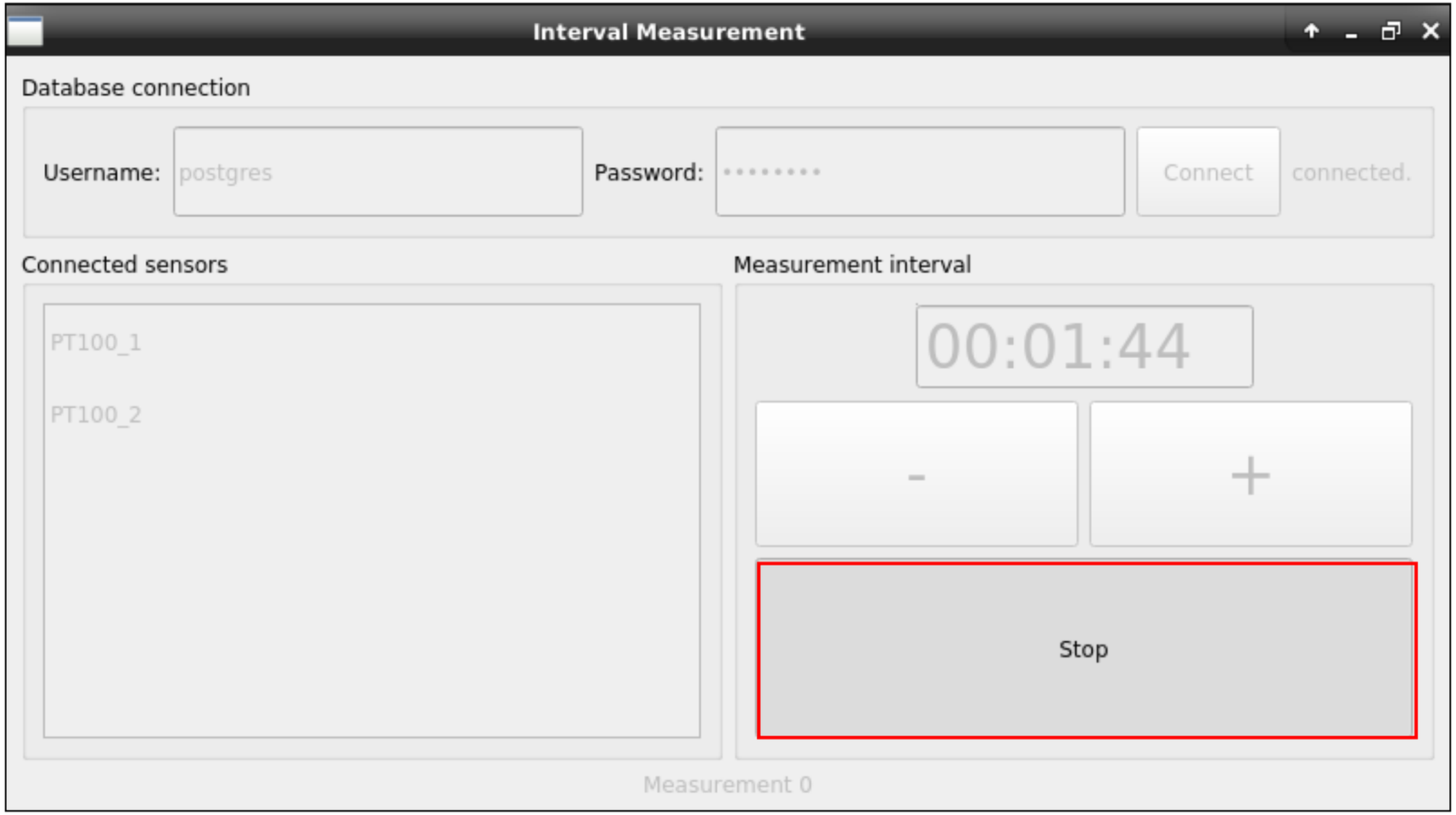
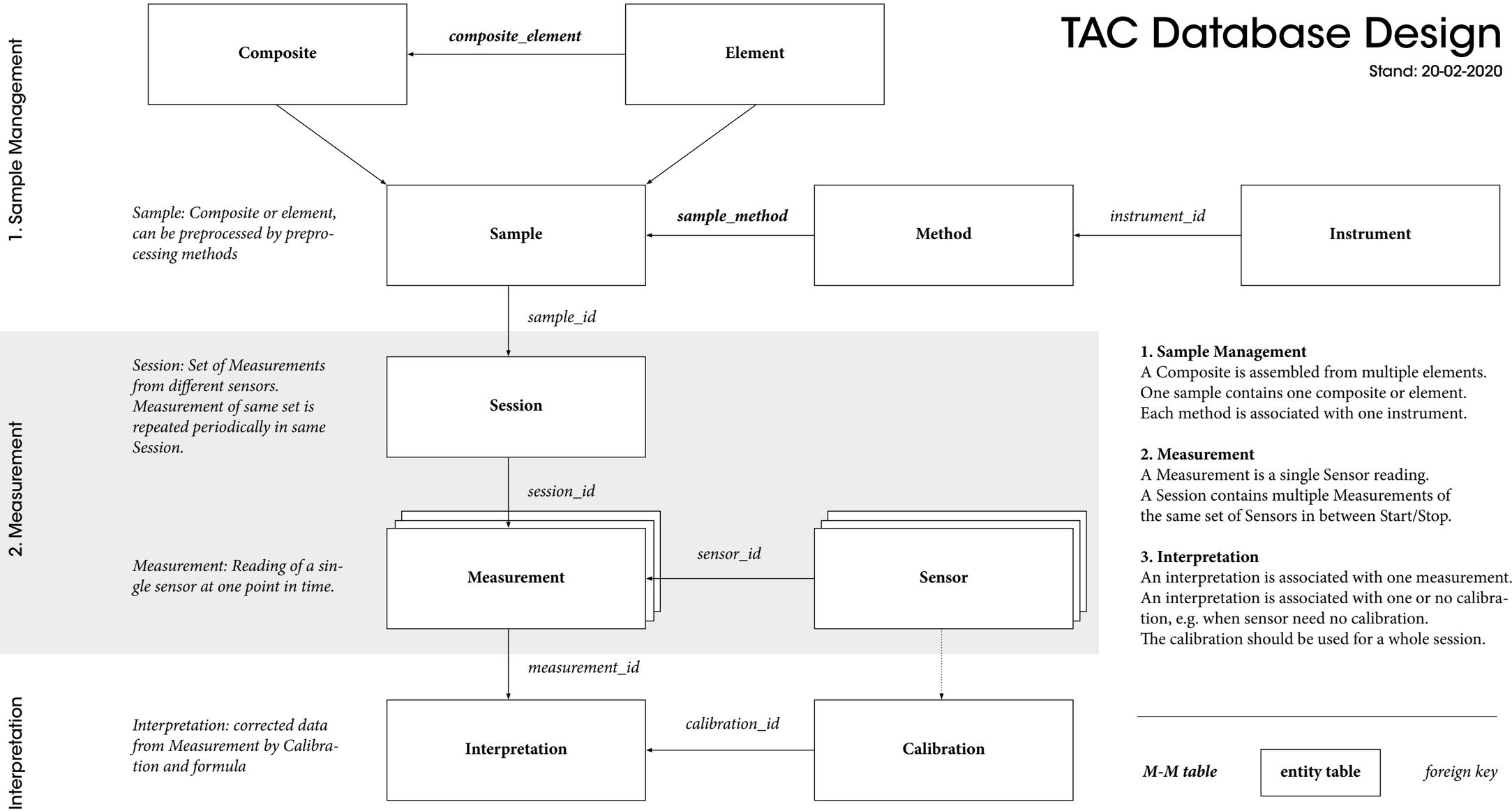


Database

TAC Database Design

Stand: 20-02-2020



1. Sample Management
A Composite is assembled from multiple elements.
One sample contains one composite or element.
Each method is associated with one instrument.

2. Measurement
A Measurement is a single Sensor reading.
A Session contains multiple Measurements of the same set of Sensors in between Start/Stop.

3. Interpretation
An interpretation is associated with one measurement.
An interpretation is associated with one or no calibration, e.g. when sensor need no calibration.
The calibration should be used for a whole session.

M-M table | **entity table** | *foreign key*

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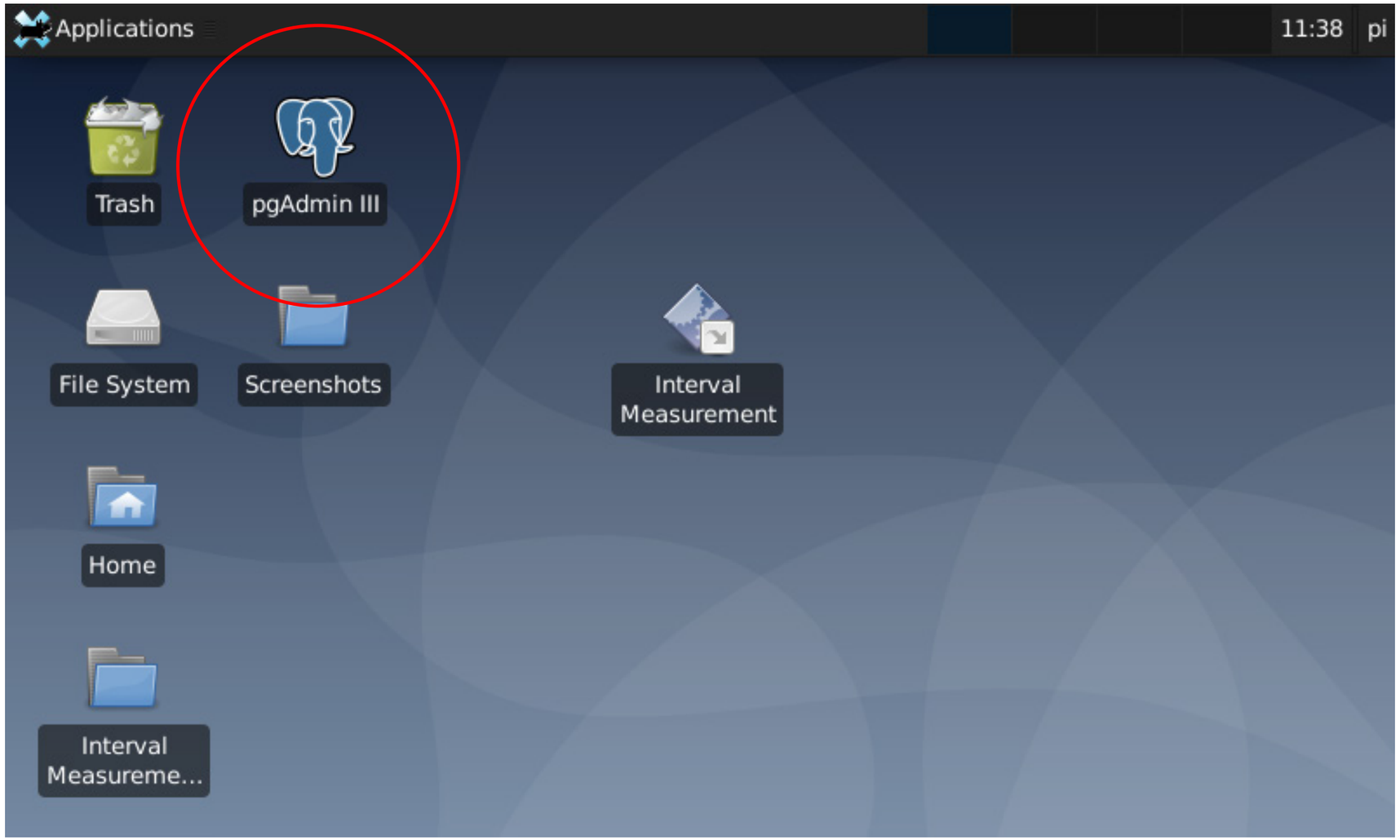
contact me for further information.

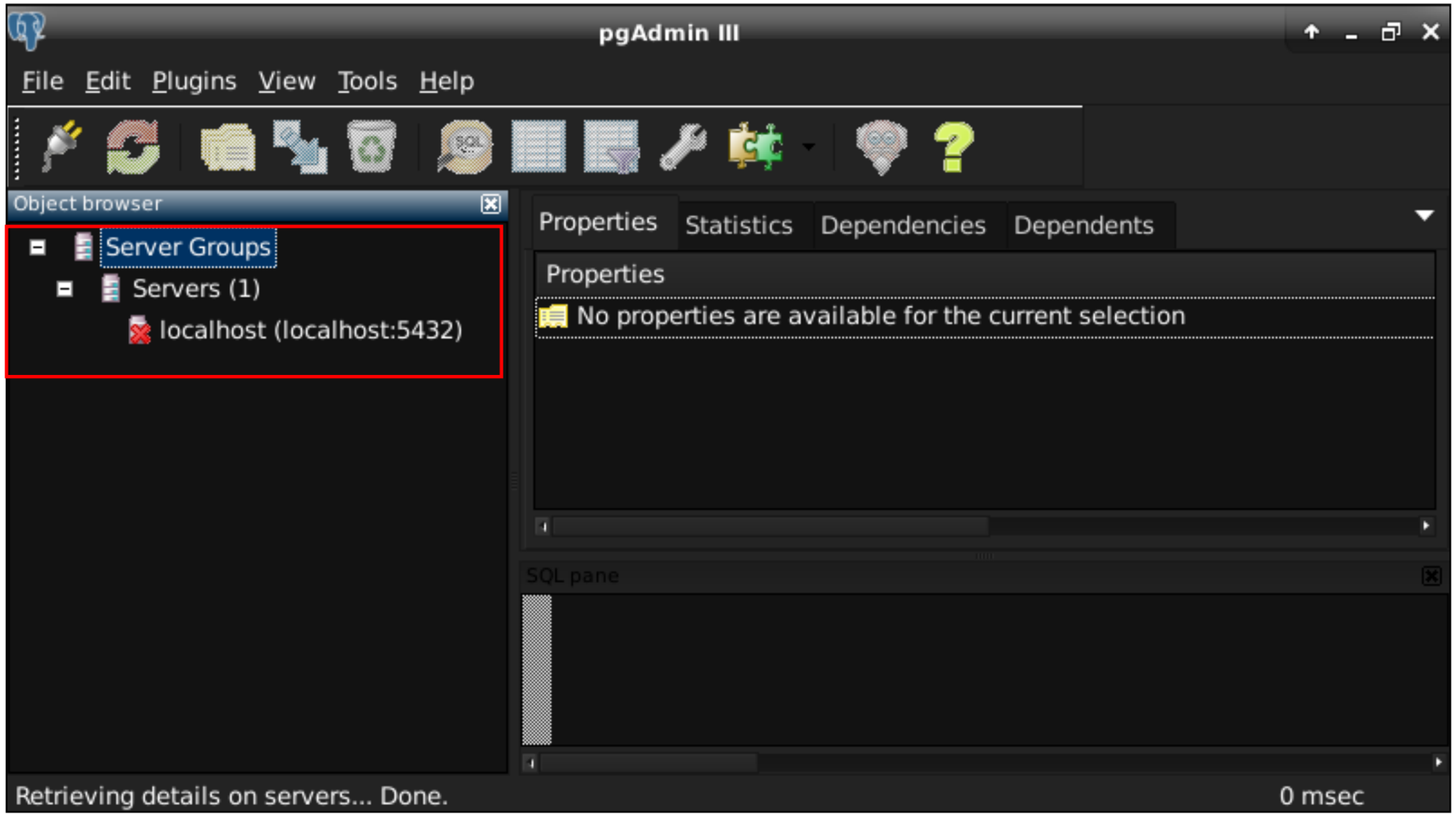
Appendix

pgAdmin Interface Tour



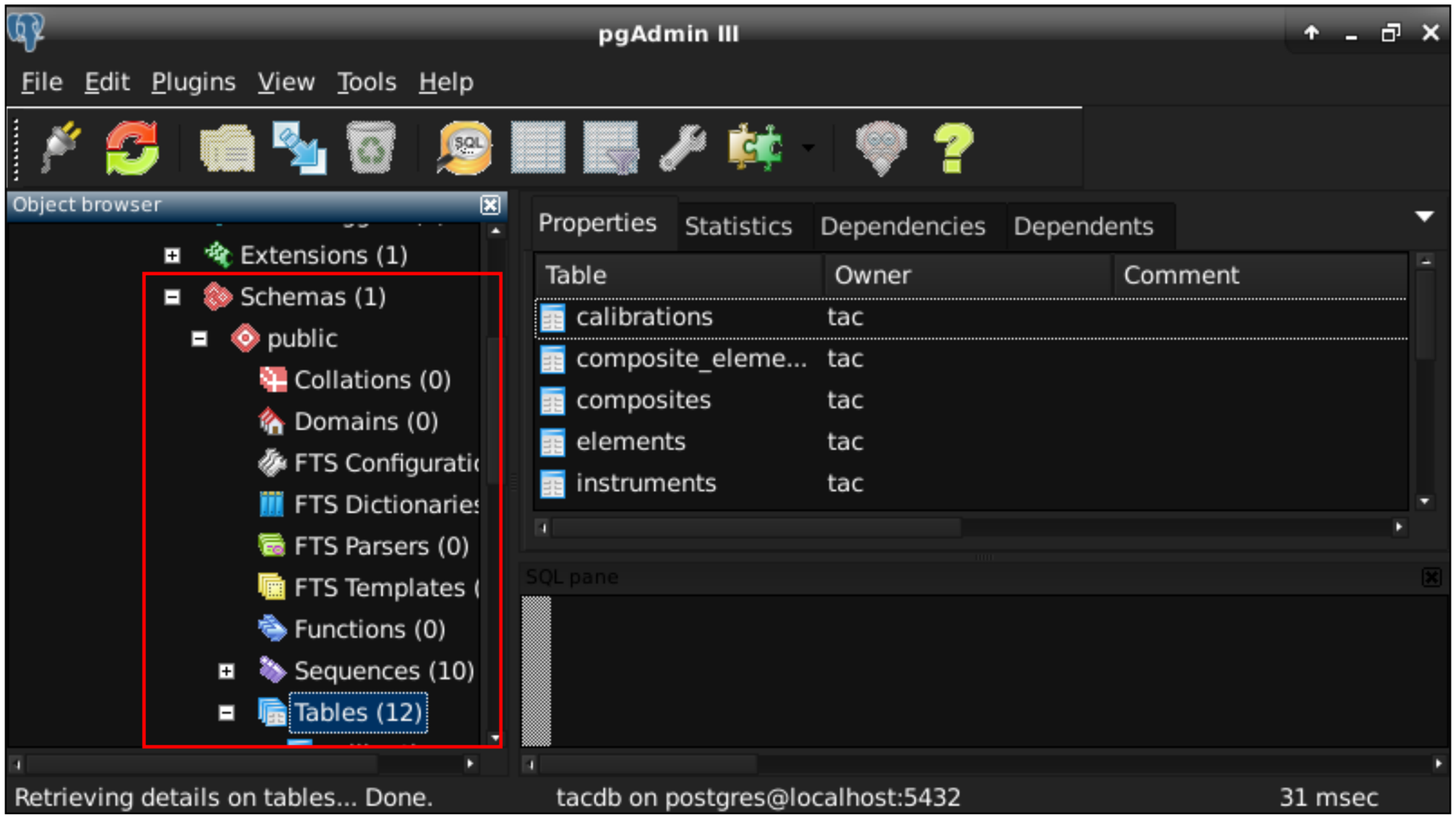
pgAdmin Interface Tour

Connect to local psql Server on port 5432 (localhost:5432)



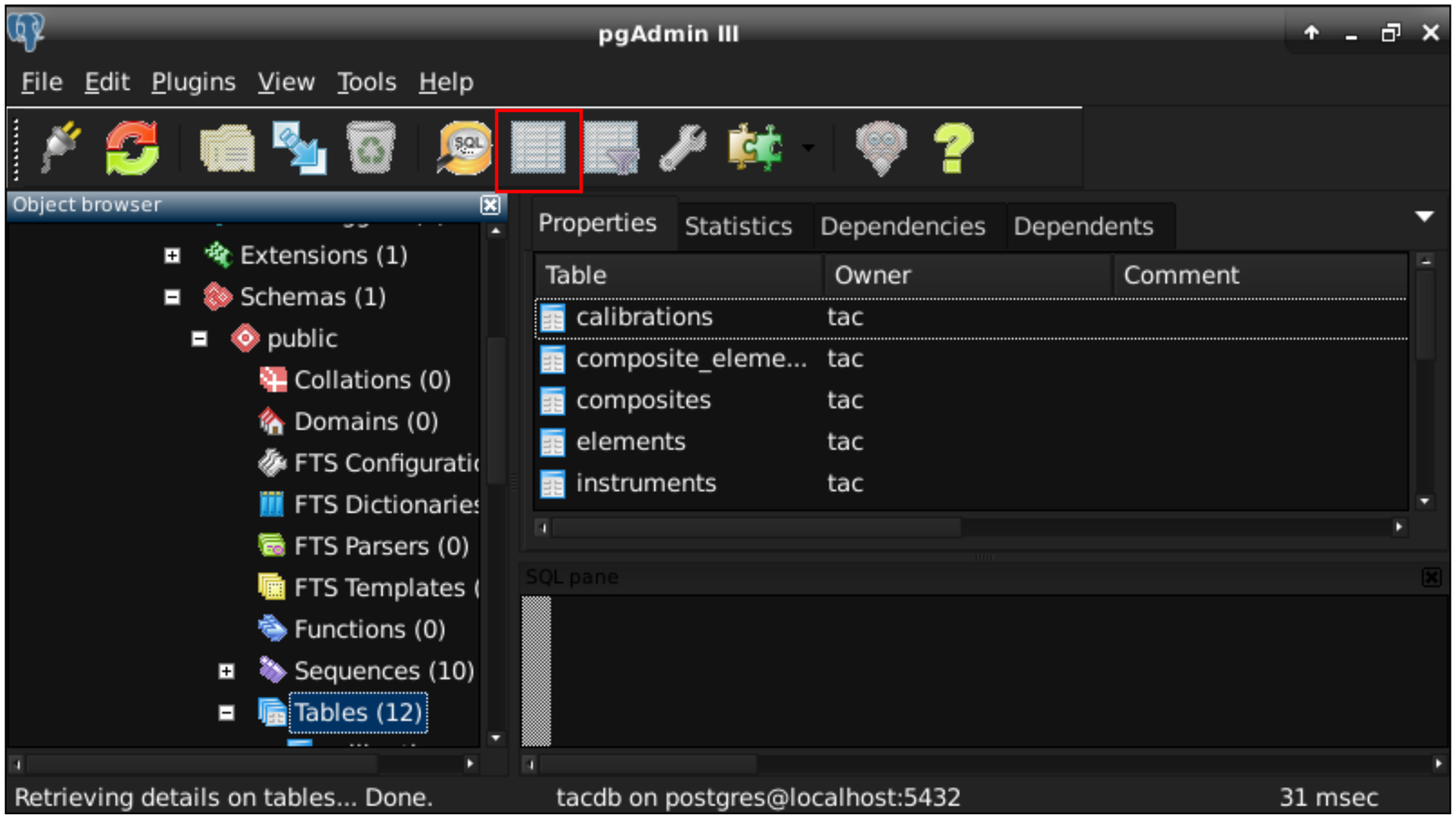
pgAdmin Interface Tour

Tables can be found under Schemas > public > Tables



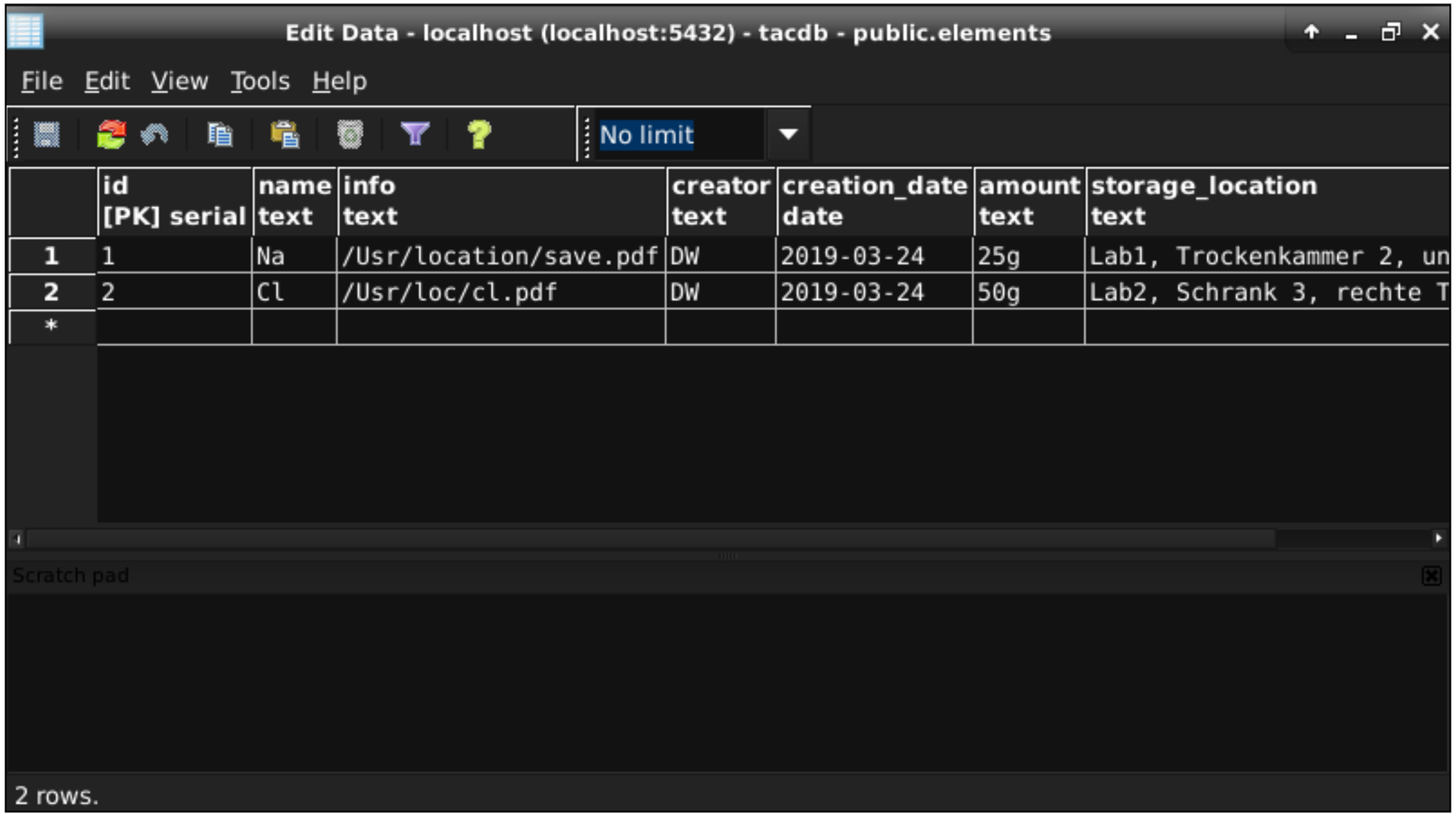
pgAdmin Interface Tour

List the content of a Table



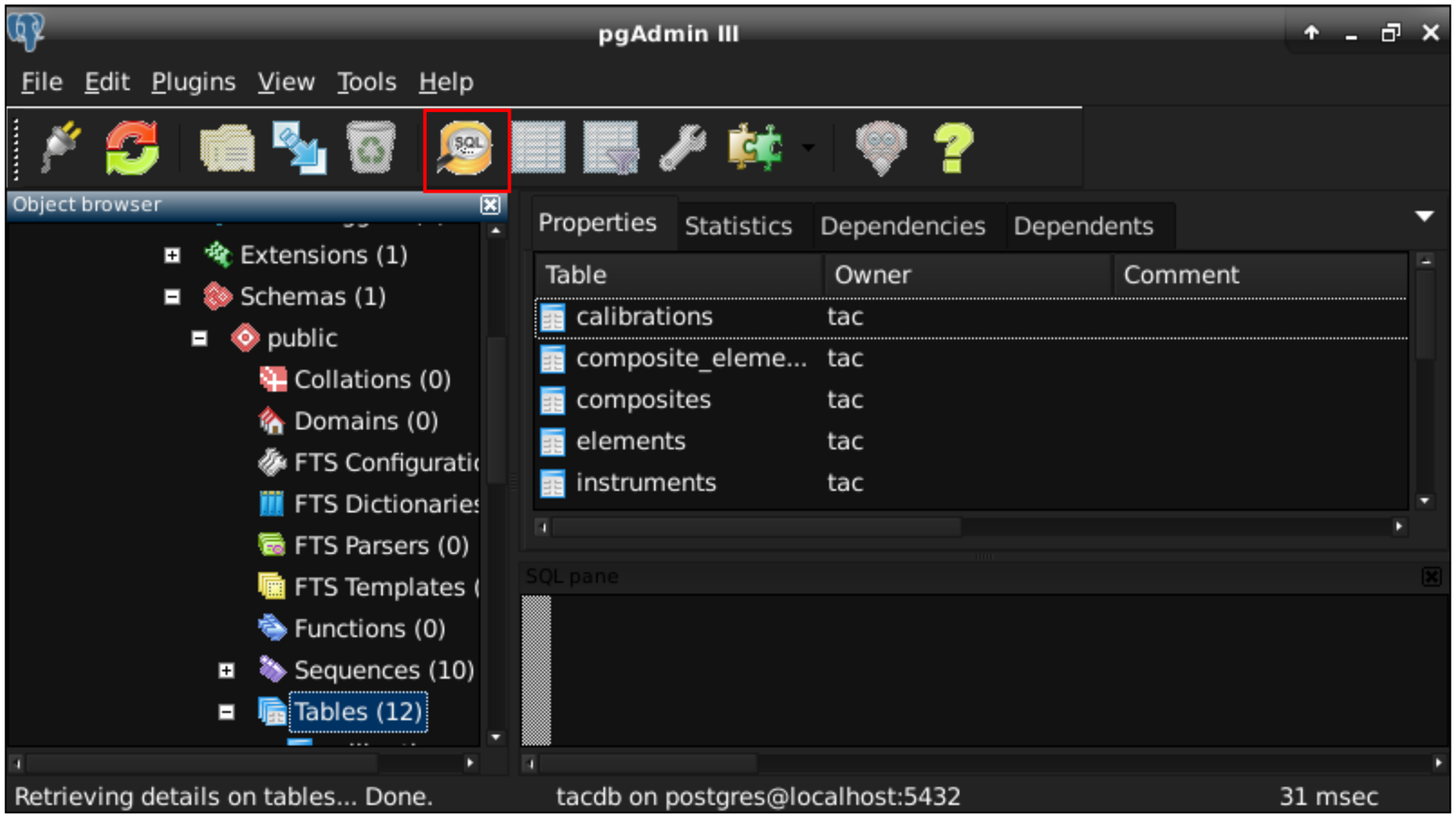
pgAdmin Interface Tour

The list view allows for manipulation and export of Table data

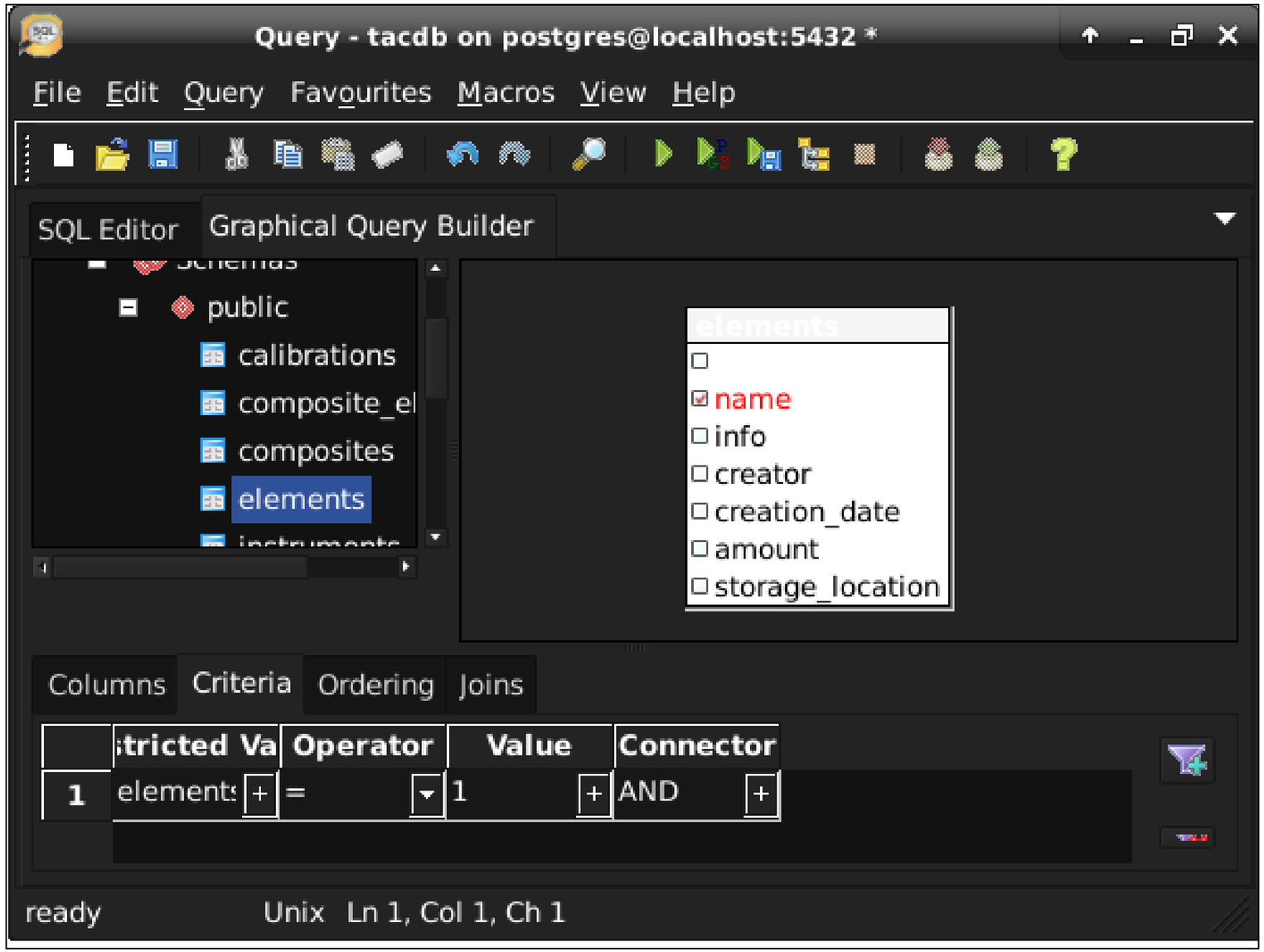


pgAdmin Interface Tour

The Query Tool allows for Searching inside the database or single tables

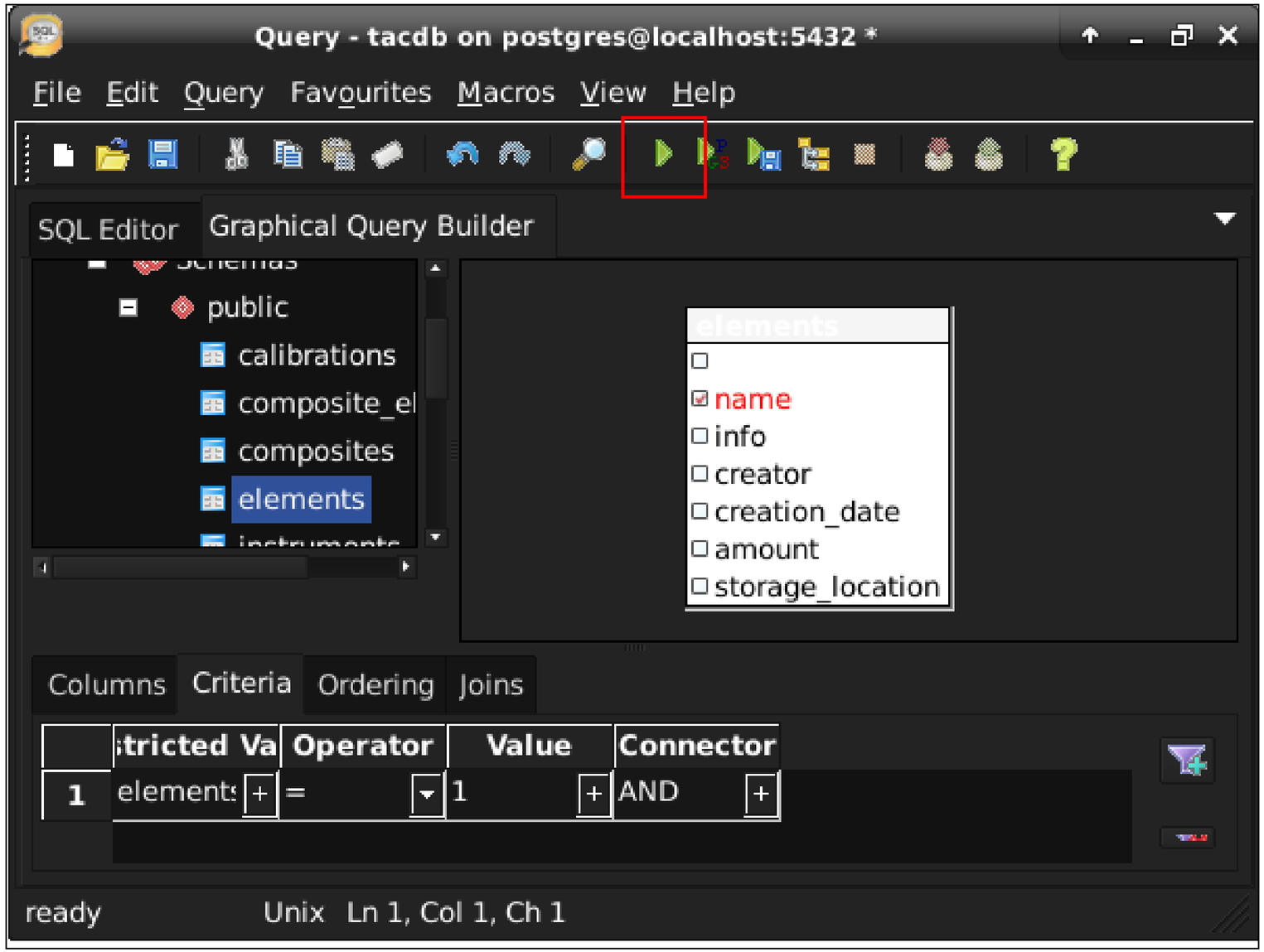


pgAdmin Interface Tour



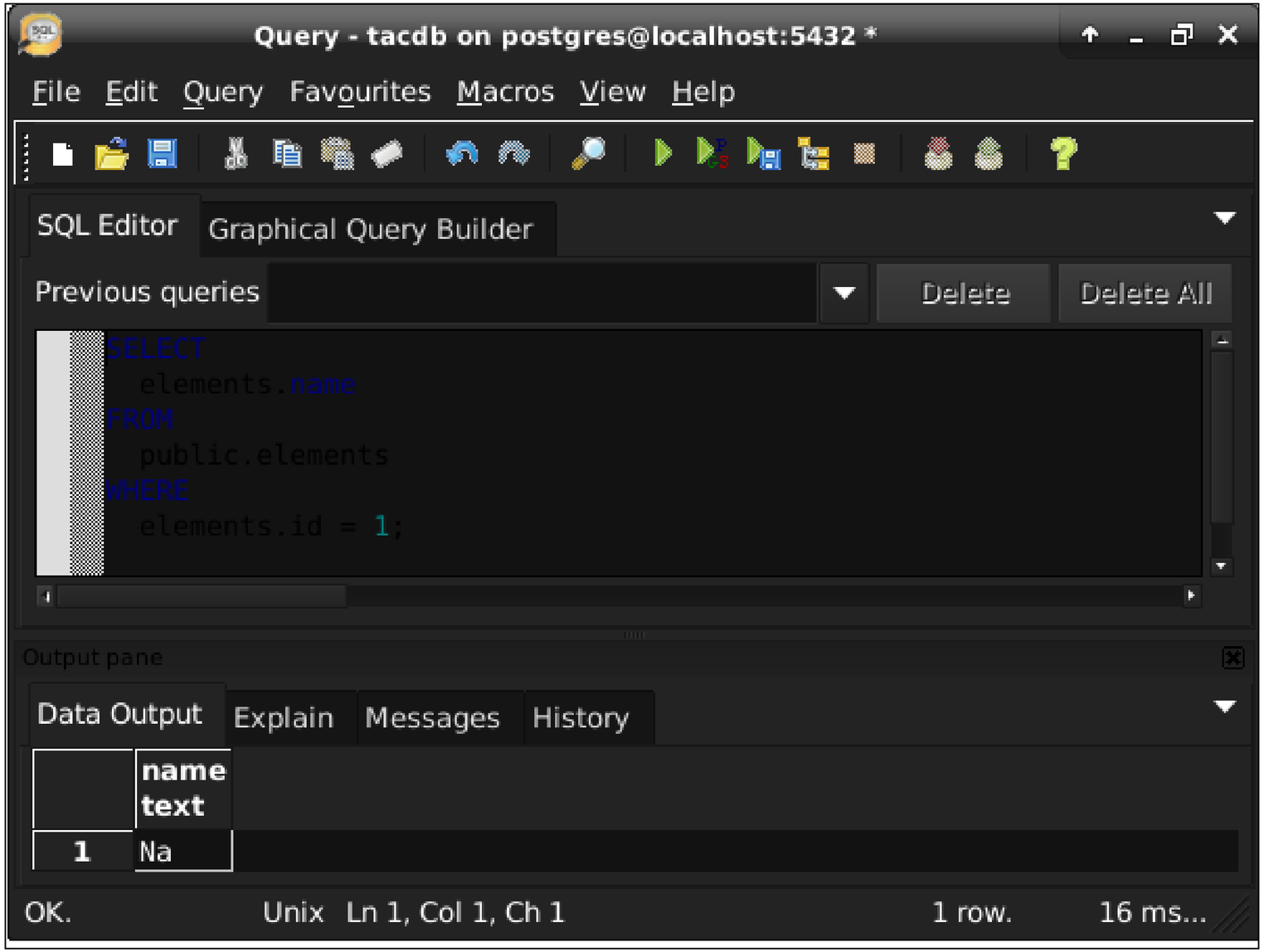
Build Query with Graphical Query Builder

pgAdmin Interface Tour



Run Query

pgAdmin Interface Tour



Extract
Query
Results