

EZSLAMX

Training Program



CHAPTER 2

Standard Measurement



STS102, Slide 1

Property of EZ Metrology © 2022. All rights reserved.

1

Standard Measurement

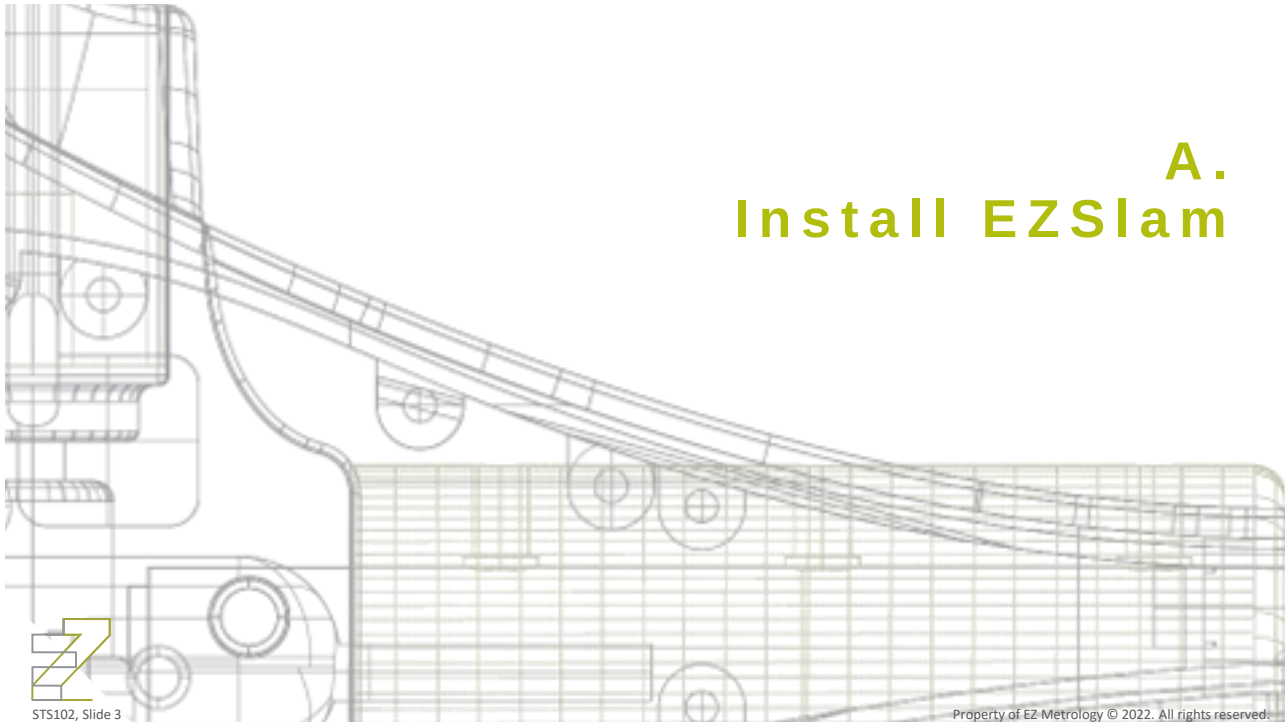
- A. Install EZSlam
- B. Start a Session
- C. Record Runs
- D. View Data



STS102, Slide 2

Property of EZ Metrology © 2022. All rights reserved.

2



3

A. Install EZSlam

1. Door Unit

Step-1 Sensor Side (Rear)

Position the rear of the unit (sensor end) within 2 to 5 mm from the hem edge (non-hinge end) of the door and secure it using the integrated suction cup.

Push the unit against the door surface and push 5-7 times on the plunger until the red line of the plunger is no longer visible.



Hidden red line means sufficient suction! In case the red line becomes visible, act quickly and pump the plunger a couple times to improve the vacuum and adhesion.



Property of EZ Metrology © 2022. All rights reserved.

4

Video

Step-1 Sensor Side (Rear)

Position the rear of the unit (sensor end) within 2 to 5 mm from the hem edge (non-hinge end) of the door and secure it using the integrated suction cup.

Push the unit against the door surface and push 5-7 times on the plunger until the red line of the plunger is no longer visible.



Hidden red line means sufficient suction! In case the red line becomes visible, act quickly and pump the plunger a couple times to improve the vacuum and adhesion.

STS102, Slide 5

Property of EZ Metrology © 2022. All rights reserved.

5

A. Install EZSlam

1. Door Unit

Step-2 Battery Side (Front)

Loosen the telescopic connections and expand all tube sections equally while expanding.

Extend the connection bar so that the front of the Door Unit is around 100mm from the front hem edge (hinge end) .

Secure it using the integrated suction cup using the plunger and compress it until the red line on the plunger is hidden.

It may be helpful to install the unit while the door is open to prevent pinching between the quarter panel.



Attention! Make sure when opening the door, the front of the unit does not come in contact with the fender.

STS102, Slide 6

Property of EZ Metrology © 2022. All rights reserved.

6

Video

Step-2 Battery Side (Front)

Loosen the telescopic connections and expand all tube sections equally while expanding.

Extend the connection bar so that the front of the Door Unit is around 100mm from the front hem edge (hinge end).



Attention! Make sure when opening the door, the front of the unit does not come in contact with the fender.



STS102, Slide 7

Property of EZ Metrology © 2022. All rights reserved.

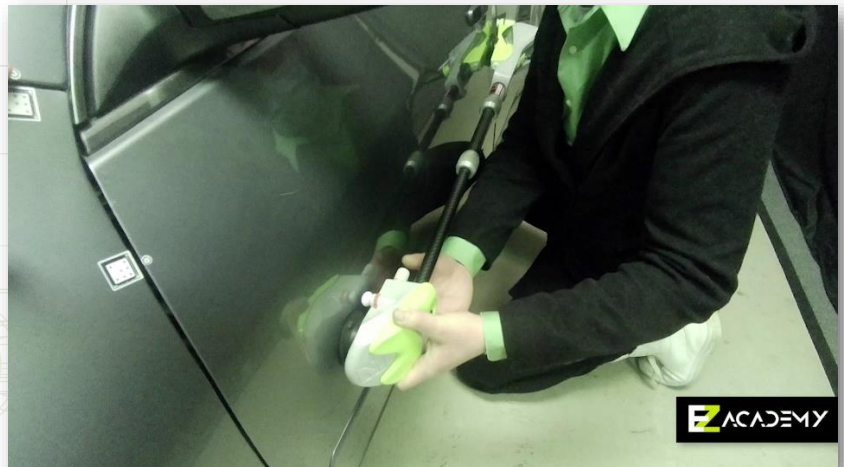
7

Video

Step-2 Battery Side (Front)

Secure the front of the unit by using the integrated suction cup using the plunger and compress it until the red line on the plunger remains invisible.

It may be helpful to install the unit while the door is open to prevent pinching between the quarter panel.



Attention! Make sure when opening the door, the front of the unit does not come in contact with the fender.



STS102, Slide 8

Property of EZ Metrology © 2022. All rights reserved.

8

Video

Step-2 Battery Side (Front)

Secure the front of the unit by using the integrated suction cup using the plunger and compress it until the red line on the plunger remains invisible.

It may be helpful to install the unit while the door is open to prevent pinching between the quarter panel.



Attention! Make sure when opening the door, the front of the unit does not come in contact with the fender.



STS102, Slide 9

Property of EZ Metrology © 2022. All rights reserved.

9

A. Install EZSlam

1. Door Unit

Step-3 Level the unit

Untighten the red screw on the rear of the Door Unit. The sensor side can now be rotated around the carbon tube until the top of the gray body is approximately level to the ground.

The accuracy of the level is not critical. The main purpose is to align the direction of the force handle in the plane of rotation of the door.

When the leveling is completed, tighten the red knob to lock the rotation.



STS102, Slide 10

Property of EZ Metrology © 2022. All rights reserved.

10

Video

Step-3 Level the unit

Untighten the red top screw on the rear of the Door Unit. The sensor side can now be rotated around the carbon tube until the top of the gray body is approximately level to the ground.

The accuracy of the level is not critical. The main purpose is to align the direction of the force handle in the plane of rotation of the door.

When the levelling is completed, tighten the red knob to lock the rotation.



STS102, Slide 11

Property of EZ Metrology © 2022. All rights reserved.

11

A. Install EZSlam

1. Door Unit

Step-4 Feet

Drop the stabilization feet onto the sheet metal of the body to prevent the unit from flexing around the suction cup.

This is best achieved by a quick, counter-clockwise, spinning motion of the red wheel. A rapid rubbing motion over the wheel will allow the point to come in contact and stops spinning to avoid jacking up the device.



There is no need to use wrenches or force to lower the feet. They will simply push the device up for no reason. A light contact with the surface is sufficient to stabilize the unit.



STS102, Slide 12

Property of EZ Metrology © 2022. All rights reserved.

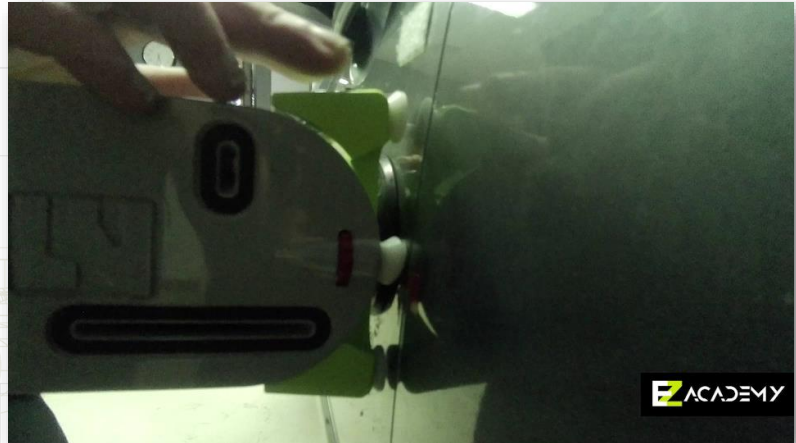
12

Video

Step-4 Feet

Drop the stabilization feet onto the sheet metal of the body to prevent the unit from flexing around the suction cup.

This is best achieved by a quick, counter-clockwise, spinning motion of the red wheel. A rapid rubbing motion over the wheel will allow the point to come in contact and stops spinning to avoid jacking up the device.



There is no need to use wrenches or force to lower the feet. They will simply push the device up for no reason. A light contact with the surface is sufficient to stabilize the unit.

STS102, Slide 13

Property of EZ Metrology © 2022. All rights reserved.

13

Video

Step-4 Feet

Drop the stabilization feet onto the sheet metal of the body to prevent the unit from flexing around the suction cup.

This is best achieved by a quick, counter-clockwise, spinning motion of the red wheel. A rapid rubbing motion over the wheel will allow the point to come in contact and stops spinning to avoid jacking up the device.



There is no need to use wrenches or force to lower the feet. They will simply push the device up for no reason. A light contact with the surface is sufficient to stabilize the unit.

STS102, Slide 14

Property of EZ Metrology © 2022. All rights reserved.

14

A. Install EZSlam

1. Door Unit

Step-5 Telescope

Last, all sections of the telescopic handles and screws are tightened so the Door Unit does not shift during acquisitions.



STS102, Slide 15

Property of EZ Metrology © 2022. All rights reserved.

15

A. Install EZSlam

1. Door Unit

Step-5 Telescope

Last, all sections of the telescopic handles and screws are tightened so the Door Unit does not shift during acquisitions.



STS102, Slide 16

Property of EZ Metrology © 2022. All rights reserved.

16

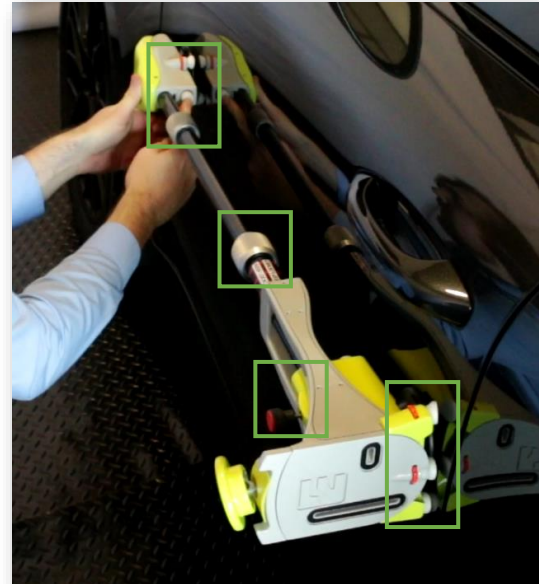
A. Install EZSlam

1. Door Unit

Step-6 Verification

Verify that all handles and screws are locked:

- 2 Suction Cups (red line!)
- 5 Feet are lowered in contact with body panel
- 2 Telescope locks
- 1 Red knob



Property of EZ Metrology © 2022. All rights reserved.

STS102, Slide 17

17

A. Install EZSlam

2. Body Unit

Step-1 Suction cup

Position the black suction cup of the Body Unit about 100mm away from the door edge.

Step-2 Flex Arm and clamp

Make sure to expand the tightening mechanism next to the suction cup and loosen the arm.

Step-3 Positioning

Use the flexible arm on the Body Unit to position the two clear suction cups as close to the edge as possible [2mm-6mm from edge].

Aim to align the outer contour of the Body Unit with the outer contour of the Door Unit.



Mounting tolerances are relatively large; ~15mm in Z and ~80mm in X. Any incorrect mount will result in immediate remark from the software during first acquisition.

STS102, Slide 18

Property of EZ Metrology © 2022. All rights reserved.

18

Video

Step-1 Suction cup

Position the suction cup of the Body Unit about 100mm away from the door edge.

Step-2 Flex Arm and clamp

Make sure to expand the tightening mechanism next to the suction cup and loosen the arm.



Mounting tolerances are relatively large; ~15mm in Z and ~80mm in X. Any incorrect mount will result in immediate remark from the software during first acquisition.

STS102, Slide 19

Property of EZ Metrology © 2022. All rights reserved.

19

Video

Step-3 Positioning

Use the flexible arm on the Body Unit to position the two clear suction cups as close to the edge as possible [2mm-6mm from edge].

Aim to align the outer contour of the body unit with the outer contour of the door unit.



Mounting tolerances are relatively large; ~15mm in Z and ~80mm in X. Any incorrect mount will result in immediate remark from the software during first acquisition.

STS102, Slide 20

Property of EZ Metrology © 2022. All rights reserved.

20

A. Install EZSlam

2. Body Unit

Step-4 Tighten the arm

Tighten the knob located at the elbow of the arm to fix the geometry.

Step-5 Close the clamp

Close the clamp located on the black suction cup to pre-tension the suction cup mounting and eliminate play to a reasonable amount.



STS102, Slide 21

Property of EZ Metrology © 2022. All rights reserved.

21

Video

Step-4 Tighten the arm

Tighten the knob located at the elbow of the arm to fix the geometry.

Step-5 Close the clamp

Close the clamp located on the black suction cup to pre-tension the suction cup mounting and eliminate play to a reasonable amount.



STS102, Slide 22

Property of EZ Metrology © 2022. All rights reserved.

22

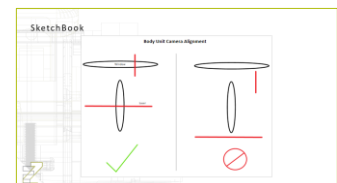
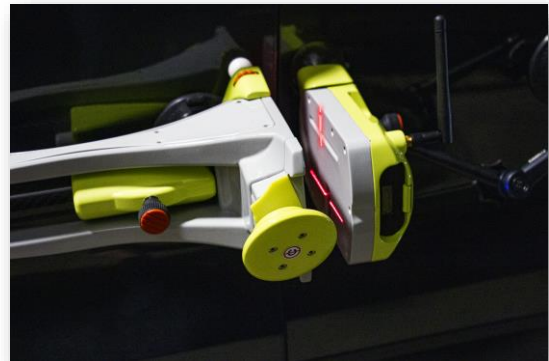
A. Install EZSlam

2. Body Unit

Step-6 Verification

When the unit is activated using Live Mode, the laser lines emitting from the Door Unit should shine on the camera openings in the Body Unit.

The lasers should illuminate the aperture while they are in front of each other, and they should not shine into each others window.



Property of EZ Metrology © 2022. All rights reserved.

STS102, Slide 23

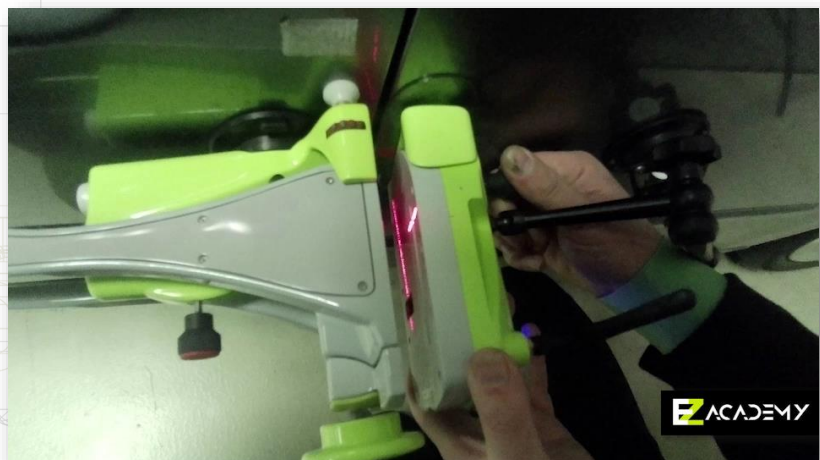
23

Video

Step-6 Verification

When the unit is activated using Live Mode, the laser lines emitting from the Door Unit should shine on the camera openings in the Body Unit.

The lasers should illuminate the aperture while they are in front of each other, and they should not shine into each others window.



STS102, Slide 24

Property of EZ Metrology © 2022. All rights reserved.

24

A. Install EZSlam

3. Cabin Unit

Step-1 Positioning

Mount the small antenna on the Cabin Unit and place the unit on the seat adjacent to the door that is being tested.

Certain preference might be to place the unit on the center console depending on application.



Property of EZ Metrology © 2022. All rights reserved.

25

Video

Step-1 Positioning

- Mount antenna.
- Place on seat nearest door being measured or center console.



Property of EZ Metrology © 2022. All rights reserved.

26

A. Install EZSlam

4. Base Station

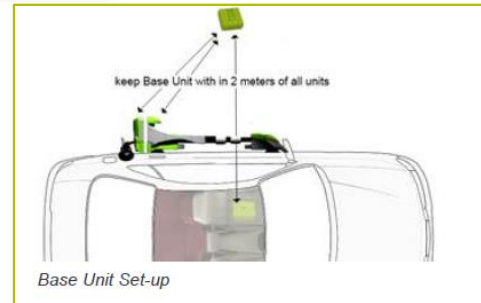
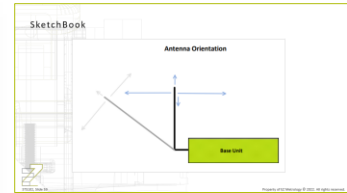
Step-1 Positioning

Connect the Base Unit with the large antenna and plug the included USB cable into the unit and computer.

A green light on the Base Unit will light up to indicate that the unit is powered and active.

Position the Base unit within 2m of the other units for good wireless communication, preferably within line of sight.

Once the software detects the other units and establishes communication, the blue light will turn solid.



In case of frequent communication drops, attempt to re-orientate the antennas.

Note that the software must be configured for the right communication port.

STS102, Slide 27

Property of EZ Metrology © 2022. All rights reserved.

27

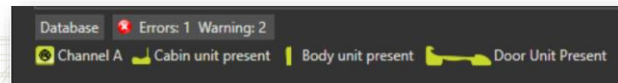
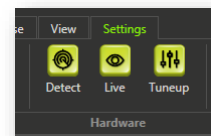
A. Install EZSlam

5. Verification

Step-1 Detect

If Base Unit is not detected, verify the active port in Windows Device Manager and match the number in the EZSlam general settings.

When detection was successful, green icons will appear on the bottom left of the screen.



Step-2 Live

Click on the Live Mode to activate a readout window of the connected sensors.

STS102, Slide 28

Property of EZ Metrology © 2022. All rights reserved.

28

A. Install EZSlam

5. Verification

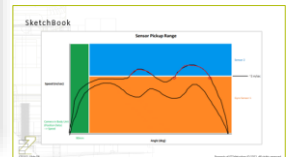
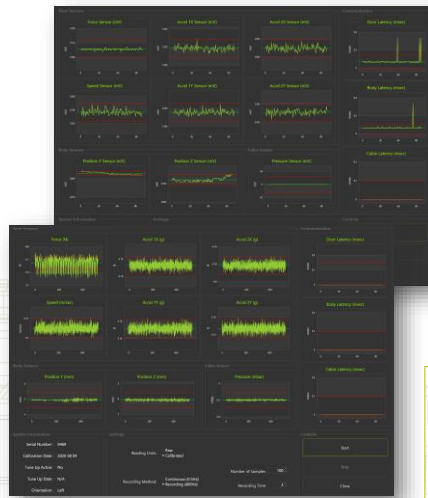
Raw / Calibrated Values

The data represented in the graphs is the raw data obtained from each individual sensor or the data can be processed and transformed into a physical value based on the calibration information.

Live / Recording

Provide data in an endless loop (limited).

Record data at high data rate but only for a predefined recording time.



This view is not meant to take actual data. The displayed data is not processed and has no optimized filtering nor is the data corrected for signal offsets.

STS102, Slide 29

Property of EZ Metrology © 2022. All rights reserved.

29

B. Start New Session

STS102, Slide 30

Property of EZ Metrology © 2022. All rights reserved.

30

B. Start New Session

1. Create New

Step-1 Create New

In the Session menu, click the 'New' button.

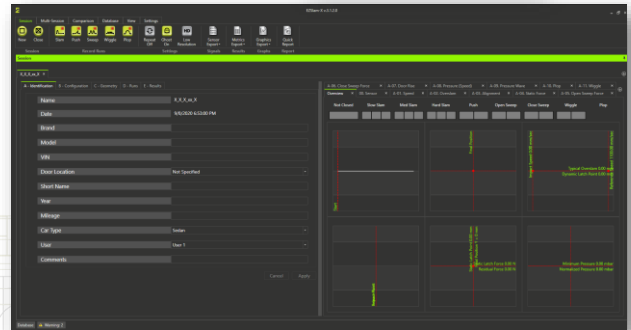
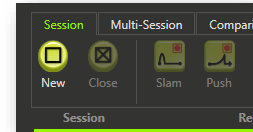
Step-2 Session Window

A new Session window opens

- Left half: Information fields and tables
- Right half: All graphical feedback

The middle divider can be moved to divide the screen and provide more room for the left or right side.

A double click in the middle divider will collapse the left (table) side and provide maximum room for the graphs.



As long as the hardware did not move on the door, data collection may continue (current session).

If the unit has been moved from its original location, it is strongly recommended to start a new session and NOT add data to an existing session.

STS102, Slide 31

Property of EZ Metrology © 2022. All rights reserved.

31

B. Start New Session

1. Create New

Step-3 Identification

It is recommended to provide information on the session so that it can be identified over time:

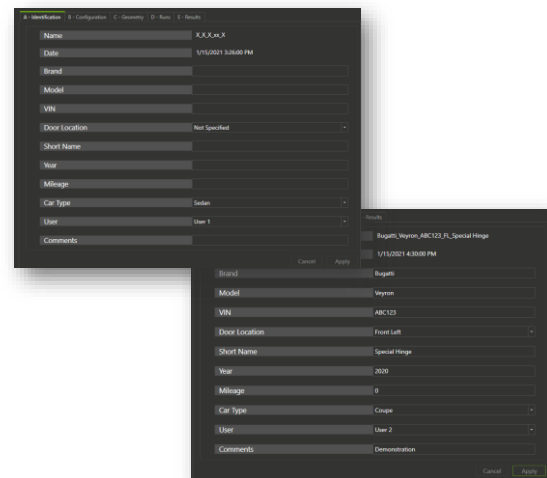
- Name : Auto generated based on the fields
- Date : Auto generated based on the first recording
- Door Location : Required
- Other : Free text fields
- Car Type and User : Custom List

Hit Apply to save the changes.

Step-4 Skip Configuration

The additional consecutive steps will be skipped for now and will be addressed later in the training.

- Configuration : Apply existing profiles to this session
- Geometry : Provide information on the door shape



STS102, Slide 32

Property of EZ Metrology © 2022. All rights reserved.

32

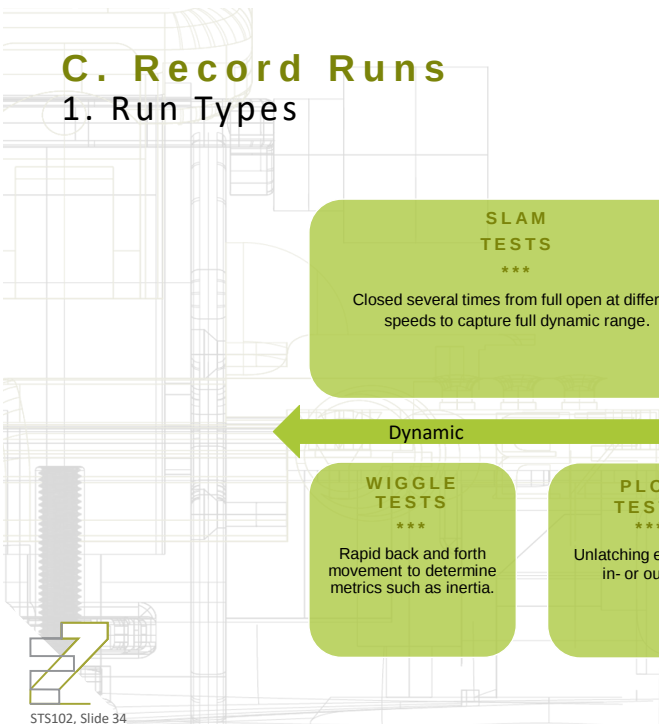
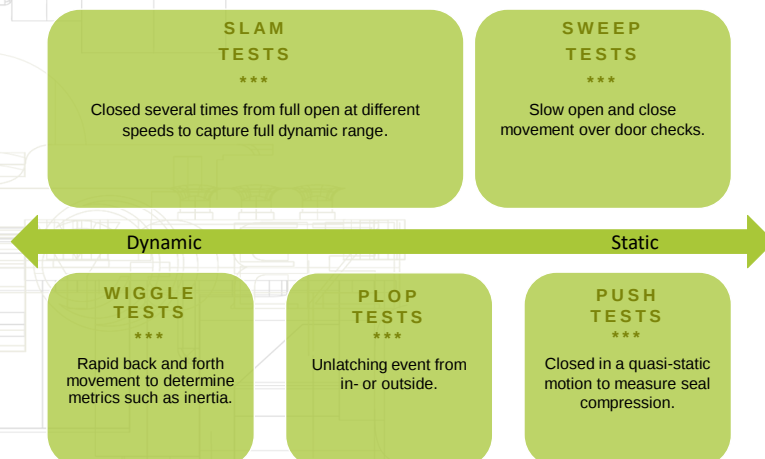
C. Record Runs



33

C. Record Runs

1. Run Types



34

Video

Slam

- Closed several times at different speeds.



STS102, Slide 35

Property of EZ Metrology © 2022. All rights reserved.

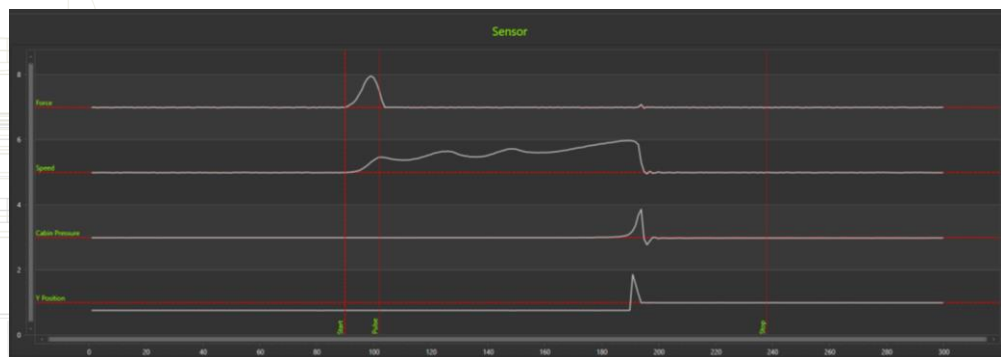
35

C. Record Runs

1. Run Types

Slam Sensor Output

- Force: impulse at start
- Velocity: curve from start to end
- Y Position: signal near closed position trending to 0
- Pressure: wave around closing event



STS102, Slide 36

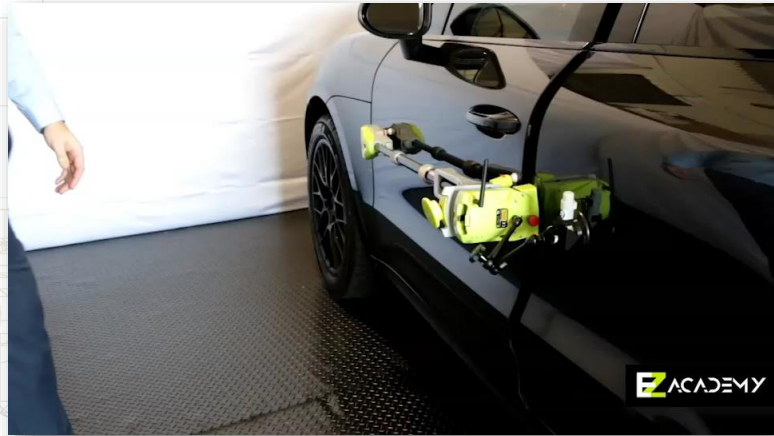
Property of EZ Metrology © 2022. All rights reserved.

36

Video

Sweep

- Slow open or close movement over checks.



STS102, Slide 37

Property of EZ Metrology © 2022. All rights reserved.

37

C. Record Runs

1. Run Types

Sweep Sensor Output

- Force and speed correspond to checks.



STS102, Slide 38

Property of EZ Metrology © 2022. All rights reserved.

38

Video

Push

- Closed in quasi-static motion
- Measures seal compression



STS102, Slide 39

Property of EZ Metrology © 2022. All rights reserved.

39

C. Record Runs

1. Run Types

Push Sensor Output

- Force: starting low and gradually increasing
- Velocity: Negligible
- Pressure: N/A
- Y Position: decreasing from start past 0 to rest at 0



STS102, Slide 40

Property of EZ Metrology © 2022. All rights reserved.

40

Video

Wiggle

- Rapid back and forth motion
- Measures inertia



STS102, Slide 41

Property of EZ Metrology © 2022. All rights reserved.

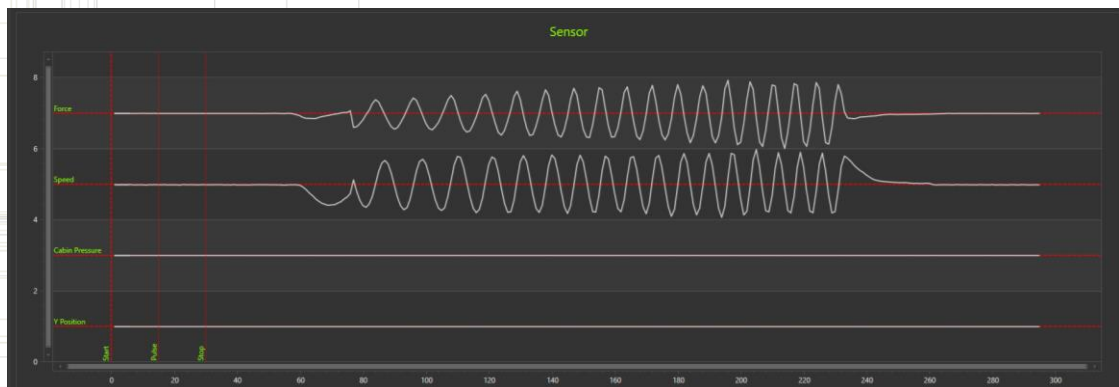
41

C. Record Runs

1. Run Types

Wiggle Sensor Output

- Force: sine wave with increasing frequency



STS102, Slide 42

Property of EZ Metrology © 2022. All rights reserved.

42

Video

Plop

- Unlatching event from in/outside



STS102, Slide 43

Property of EZ Metrology © 2022. All rights reserved.

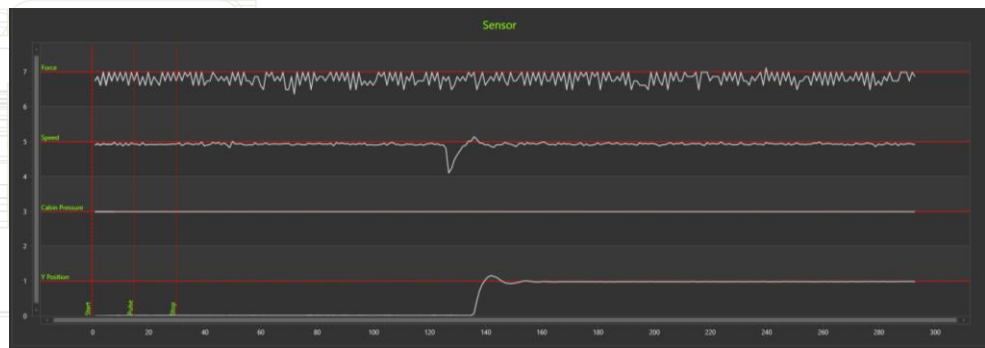
43

C. Record Runs

1. Run Types

Plop Sensor Output

- Force: N/A
- Speed: negative blip during unlatching
- Pressure: N/A
- Y Position: increased position coming to rest at secondary latch point or seals



STS102, Slide 44

Property of EZ Metrology © 2022. All rights reserved.

44

C. Record Runs

2. Record Additional Run

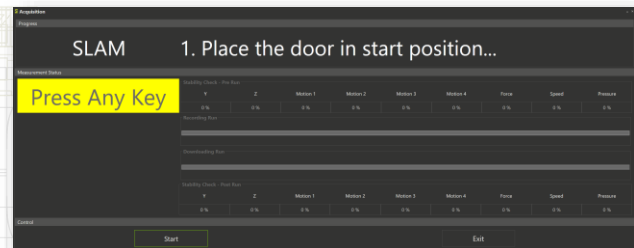
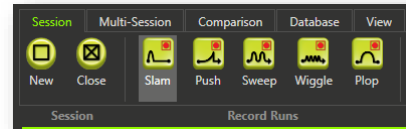
Step-1 Select the Run Type

Select the run type that will be recorded next.

Step-2 Place the door in Start Position

Depending on the test type, put the door in the respective start position:

- Slam, Sweep (Close) → fully opened position
- Push, Sweep (Open), Wiggle → near seals
- Plop → fully closed position



Property of EZ Metrology © 2022. All rights reserved.

45

C. Record Runs

2. Record Additional Run

Step-3 Record

Push the record button and follow the on-screen instructions:

- **Stabilizing:** The system is verifying the door is no longer shaking or already moving.
- **Recording:** There is a time frame of about 25 seconds to perform the run.
- **End Recording:** Hit any key (spacebar).
- **Stabilizing:** The system will verify that the devices are at rest.
- **Saving and processing:** All data is automatically saved at this point in time.



Property of EZ Metrology © 2022. All rights reserved.

46

C. Record Runs

3. Run Counter

Gray Boxes

Indicates the minimum required runs to be recorded.

Green Boxes

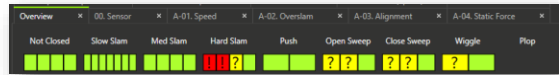
Runs are recorded and data is compatible (<5%).

Yellow Boxes(with '?')

Runs are recorded but data is questionably compatible (>5%).

Red Boxes(with '!')

Runs are recorded but data is not compatible (>10%).



The distribution of certain run counts can change during the process of acquisition. This is due to a better understanding of the current door system with additional data input.

Data compatibility between the runs and corrective actions will be addressed later in the course.

STS102, Slide 47

Property of EZ Metrology © 2022. All rights reserved.

47

C. Record Runs

4. Dynamic Analysis

More Runs = Better Analysis

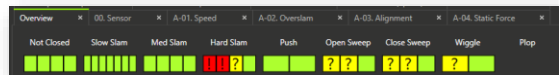
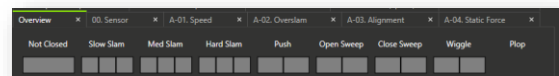
As data is acquired, the software will be able to better characterize the door.

Slam Sorting

The software will do its best to sort Slam runs as more runs are performed.

Achieving Gap

Default gap between lowest closed and highest not closed is 50mm/s. Slams are best organized once gap has been achieved.



The distribution of certain run counts can change during the process of acquisition. This is due to a better understanding of the current door system with additional data input.

Data compatibility between the runs and corrective actions will be addressed later in the course.

STS102, Slide 48

Property of EZ Metrology © 2022. All rights reserved.

48

C. Record Runs

4. Dynamic Analysis

Interplay

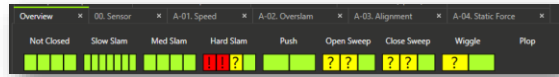
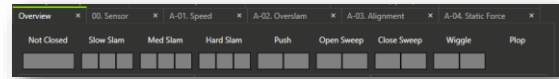
As the software gets a better characterization of the door, Slam runs may be reorganized, and values recalculated.

Push

Push tests can affect slam analysis once latching force is known.

Wiggle

Measuring inertia and radius will affect calculated closing speeds of previous slam measurements.



The distribution of certain run counts can change during the process of acquisition. This is due to a better understanding of the current door system with additional data input.

Data compatibility between the runs and corrective actions will be addressed later in the course.

STS102, Slide 49

Property of EZ Metrology © 2022. All rights reserved.

49

D. View Data

STS102, Slide 50

Property of EZ Metrology © 2022. All rights reserved.

50

D. View Data

1. Run Table

Runs

All the runs that make up the current session are listed individually.

They can be selected in the table to be highlighted in the graphs or vice-versa.

The table displays important information regarding the run as well as a status and how well the data fits with other runs.

Number	Enabled	View	Eval	Type	Closed	Comment	Status	Speed	Energy	Force	Rat
01	✓	✓	✓	Wiggle	-	-	-	-	-	-	-
02	✓	✓	✓	Stem	Yes	Notice	I <A-11, Wiggle> shows lack of symmetry during Wiggle (7.6%)	-	-	-	-
03	✓	✓	✓	Stem	Yes	Notice	I <A-03, Alignment> shows an unusual deviation (1.8mm)	1.86	14.9	-	-
04	✓	✓	✓	Stem	Yes	Notice	I <A-03, Alignment> shows an unusual deviation (0.8mm)	1.62	16.6	-	-
05	✓	✓	✓	Stem	Yes	Notice	I <A-03, Alignment> shows an unusual deviation (0.8mm)	1.81	16.1	-	-
06	✓	✓	✓	Stem	Yes	OK	-	1.12	4.4	-	-
07	✓	✓	✓	Stem	No	OK	-	1.09	5.9	-	-
08	✓	✓	✓	Stem	Yes	OK	-	1.13	7.3	-	-
09	✓	✓	✓	Stem	Yes	OK	-	1.13	4.7	-	-
10	✓	✓	✓	Stem	Yes	OK	-	1.13	6.2	-	-
11	✓	✓	✓	Stem	No	OK	-	1.11	5.8	-	-
12	✓	✓	✓	Stem	Yes	OK	-	1.14	6.3	-	-
13	✓	✓	✓	Stem	No	OK	-	1.09	4.3	-	-
14	✓	✓	✓	Stem	Yes	OK	-	1.14	6.2	-	-
15	✓	✓	✓	Stem	Yes	OK	-	1.23	8.9	-	-
16	✓	✓	✓	Stem	Yes	OK	-	1.29	8.9	-	-
17	✓	✓	✓	Stem	Yes	OK	-	1.39	8.8	-	-
18	✓	✓	✓	Stem	Yes	OK	-	1.40	9.5	-	-
19	✓	✓	✓	Stem	Yes	OK	-	1.17	6.8	-	-
20	✓	✓	✓	Stem	Yes	OK	-	1.22	10.2	-	-
21	✓	✓	✓	Stem	Yes	OK	-	1.67	13.9	-	-
22	✓	✓	✓	Push	Yes	OK	-	-	0.42	115.0	-
23	✓	✓	✓	Push	Yes	OK	-	-	0.42	117.9	-
24	✓	✓	✓	Open Sweep	-	-	-	-	3.69	-	-
25	✓	✓	✓	Close Sweep	-	-	-	-	1.03	-	-
26	✓	✓	✓	Open Sweep	-	Notice	Total Sweep Angle has large variation (5.8%)	-	3.44	-	-
27	✓	✓	✓	Close Sweep	-	Notice	Total Sweep Angle has large variation (6.5%)	-	1.48	-	-
28	✓	✓	✓	Open Sweep	-	Notice	Total Sweep Angle has large variation (5.7%)	-	3.72	-	-
29	✓	✓	✓	Close Sweep	-	Notice	Total Sweep Angle has large variation (7.1%)	-	1.56	-	-
30	✓	✓	✓	Sweep	-	Disabled	-	-	-	-	-

Data compatibility between the runs and corrective actions will be addressed later in the course.

Property of EZ Metrology © 2022. All rights reserved.

51

D. View Data

2. Metric Table

Metrics

A table containing all numerical values that describe the door.

Each value is accompanied with a legend, clarifying the data if necessary.

The content of the table is a function of the view level that is active (Basic, Advanced or Expert).

The universal table control allows the user to show/hide certain columns (tolerances, deviations, definitions, etc.).

Simplify the view by sorting the table contents by type.

Name	Eval	Actual	Unit	Legend
Type: 01 General				
Type: 02 Closing Dynamics				
Minimum Closing Speed	1.11	1.11	mm/sec	Minimum speed at 90 mm
Minimum Pulse - Full Open	12.30	12.30	J	I <C-11, User Force> Release point...
Minimum Pulse - Outer Detent	8.51	8.51	J	I <C-11, User Force> Release Angle...
Minimum Pulse - Inner Detent	8.38	8.38	J	Closing Hum 32 degrees
Type: 03 Latch & Seal System				
Slaker Alignment	0.55	0.55	mm	I <A-03, Alignment> shows an un...
Latching Force	128.1	128.1	N	To reach Y = 0.70 mm overlam (3)...
Type: 05 Check System				

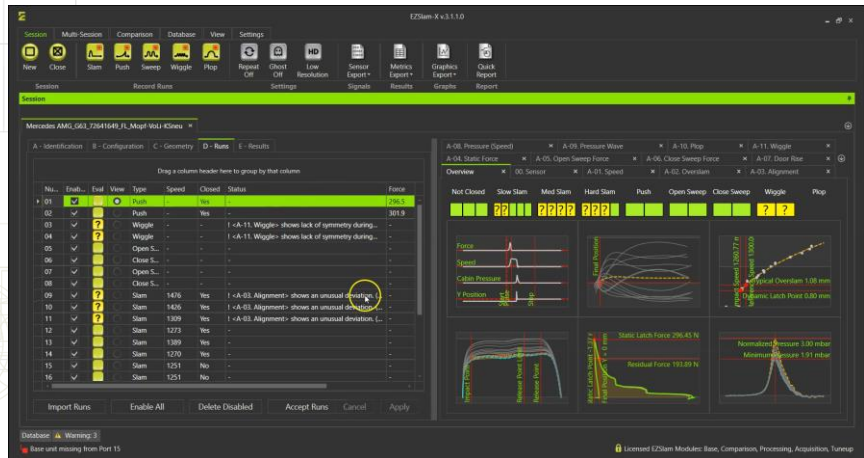
Property of EZ Metrology © 2022. All rights reserved.

52

Video

Metrics

- A table containing all numerical values that describe the door.
- Each value is accompanied with a legend.
- View level determines content.
- Show/hide columns as needed.
- Simplify the view by sorting the table contents by type.



STS102, Slide 53

Property of EZ Metrology © 2022. All rights reserved.

53

D. View Data

3. Graphs

Graphs

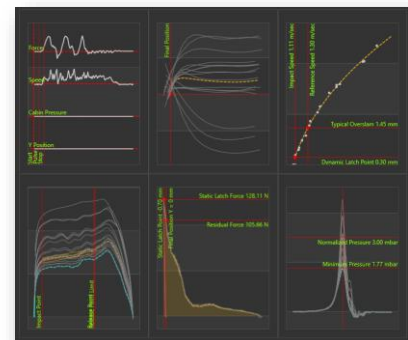
The results from the different test will be displayed in their respective graphical representation.

Clicking on a line will highlight the specific run in the Runs table. This will assist in identifying any outliers.

Certain types of tests will only be displayed in certain graphs.

The graphs are divided into 3 groups. This group is indicated by the prefix to the title:

- A Type (Basic View) → contain all physical characteristics.
- B Type (Advanced View) → show all energy related graphs.
- C Type (Expert View) → shows intermediate correlations required for metric calculations.



STS102, Slide 54

Property of EZ Metrology © 2022. All rights reserved.

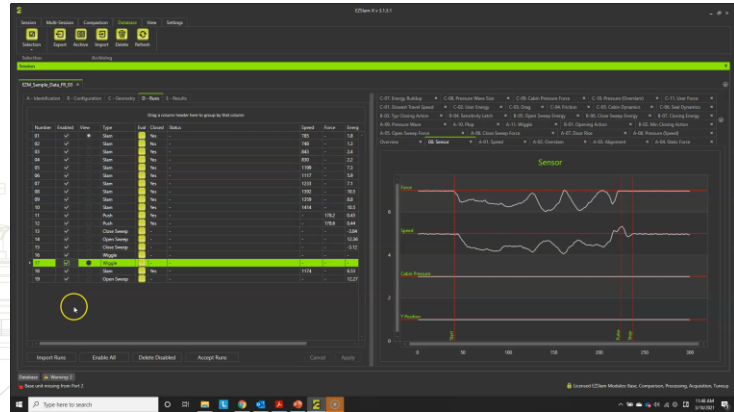
54

Video

Sensor Data

The sensor data graph always displays ***the last run recorded.***

To see a previous run's sensor data, disable the run and re-enable it.



STS102, Slide 55

Property of EZ Metrology © 2022. All rights reserved.

55

E. Review



STS102, Slide 56

Property of EZ Metrology © 2022. All rights reserved.

56

E. Review

1. Chapter 2

Topics addressed during this chapter:

Install EZSlam

Door, Body, and Cabin Unit.

Session

- Start New Session
- Record Slam Runs
- Record Push Runs
- Record Sweep Runs
- Record Wiggle Runs
- Record Plop Runs
- View Data

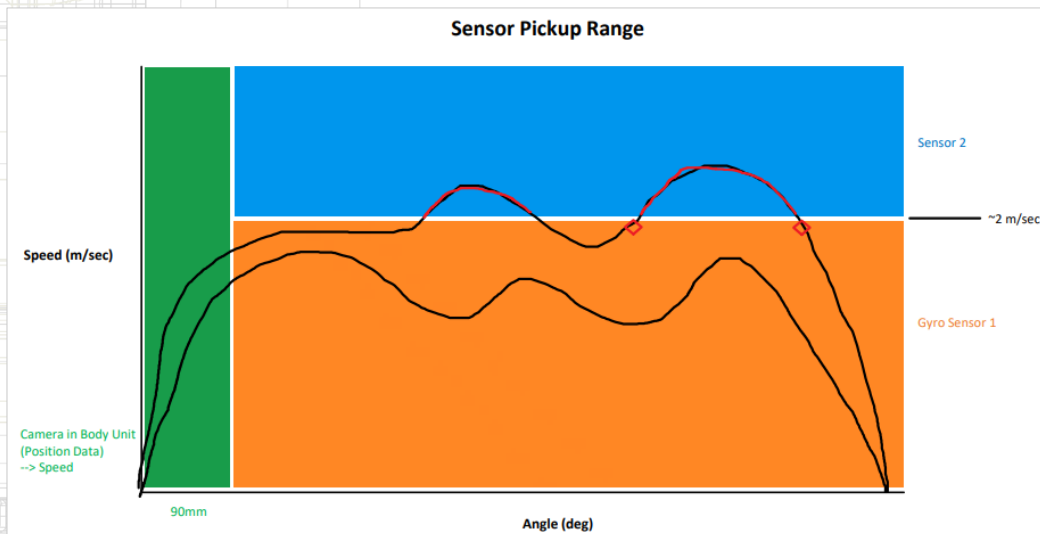


STS102, Slide 57

Property of EZ Metrology © 2022. All rights reserved.

57

SketchBook

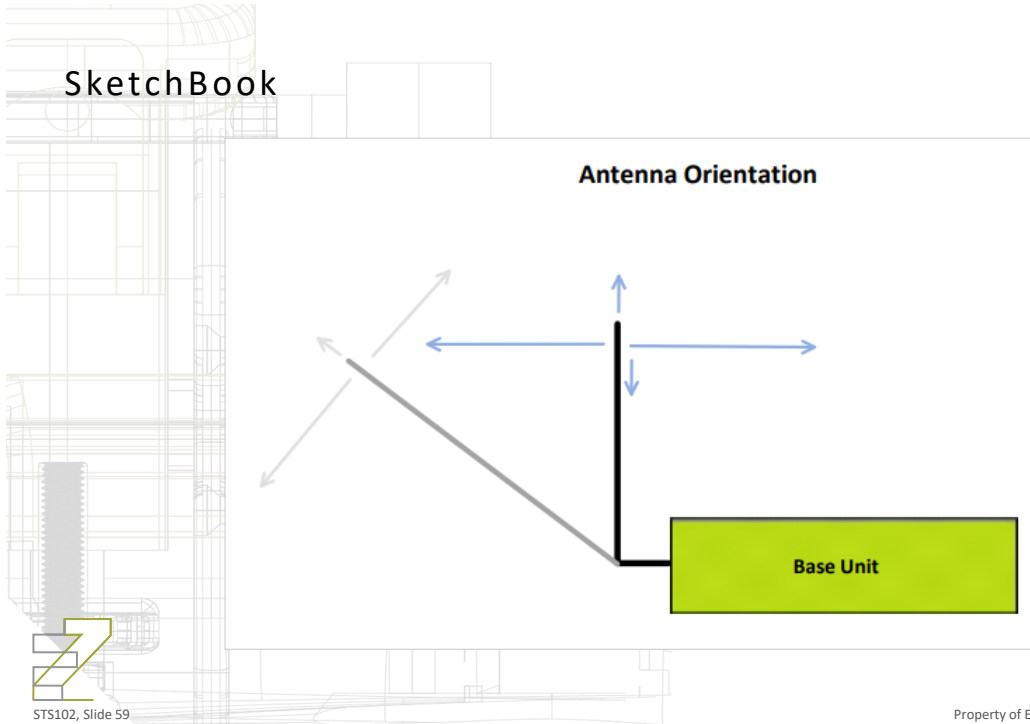


STS102, Slide 58

Property of EZ Metrology © 2022. All rights reserved.

58

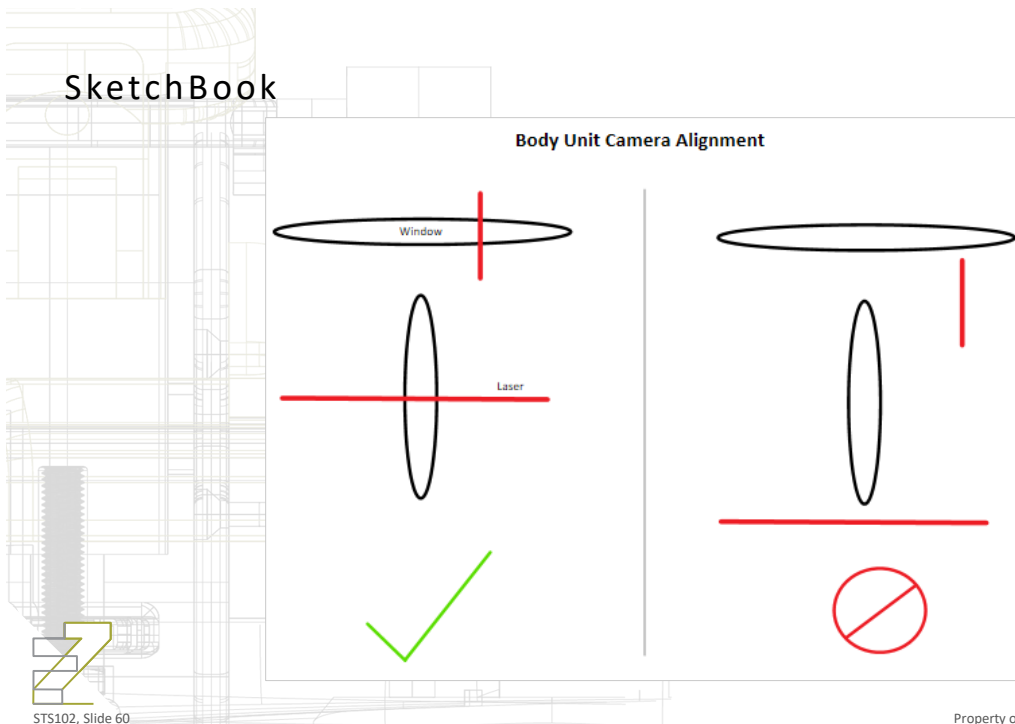
SketchBook



Property of EZ Metrology © 2022. All rights reserved.

59

SketchBook



Property of EZ Metrology © 2022. All rights reserved.

60