



# VL53L0X RangingWithSatellites Nucleo Demo

## User Manual

Version 1.2

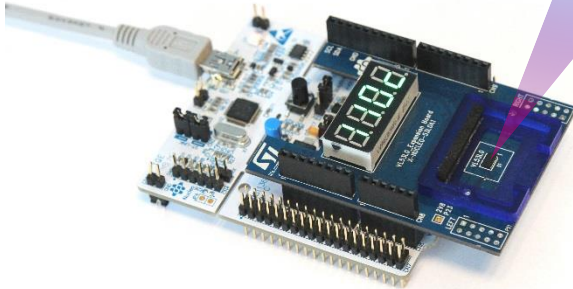
Version	Date	Comments
1.0	15 Mars 2016	Initial
1.1	29 Mars 2016	Added data logging feature description & usage
1.2	12 April 2016	Added details about trace capabilities

- Key features:

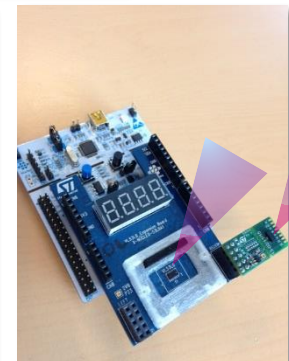
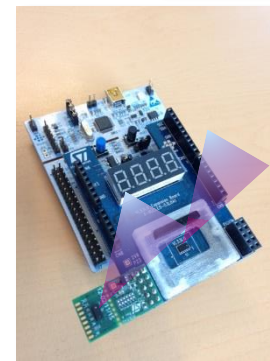
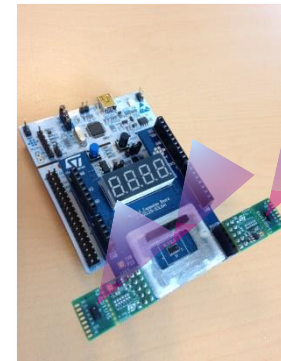
- VL53L0X Ranging from one device or multiple devices
- Several Ranging configurations supported : LongRange, HighSpeed, HighAccuracy
- Ranging data logging through Serial COM over USB

- Hardware :

- Nucleo F401RE, L476RG
- Optional VL53L0X satellites : left or right or both



**Single VL53L0X device**



**Multiple VL53L0X devices**



Short press

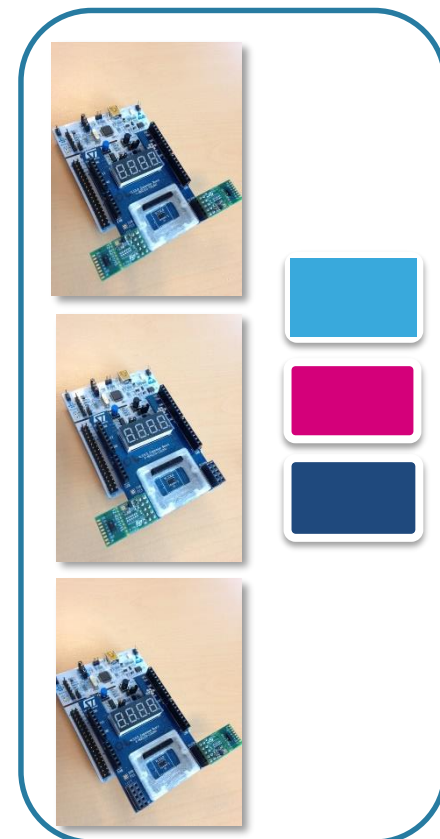
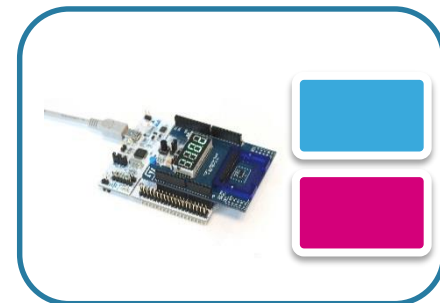
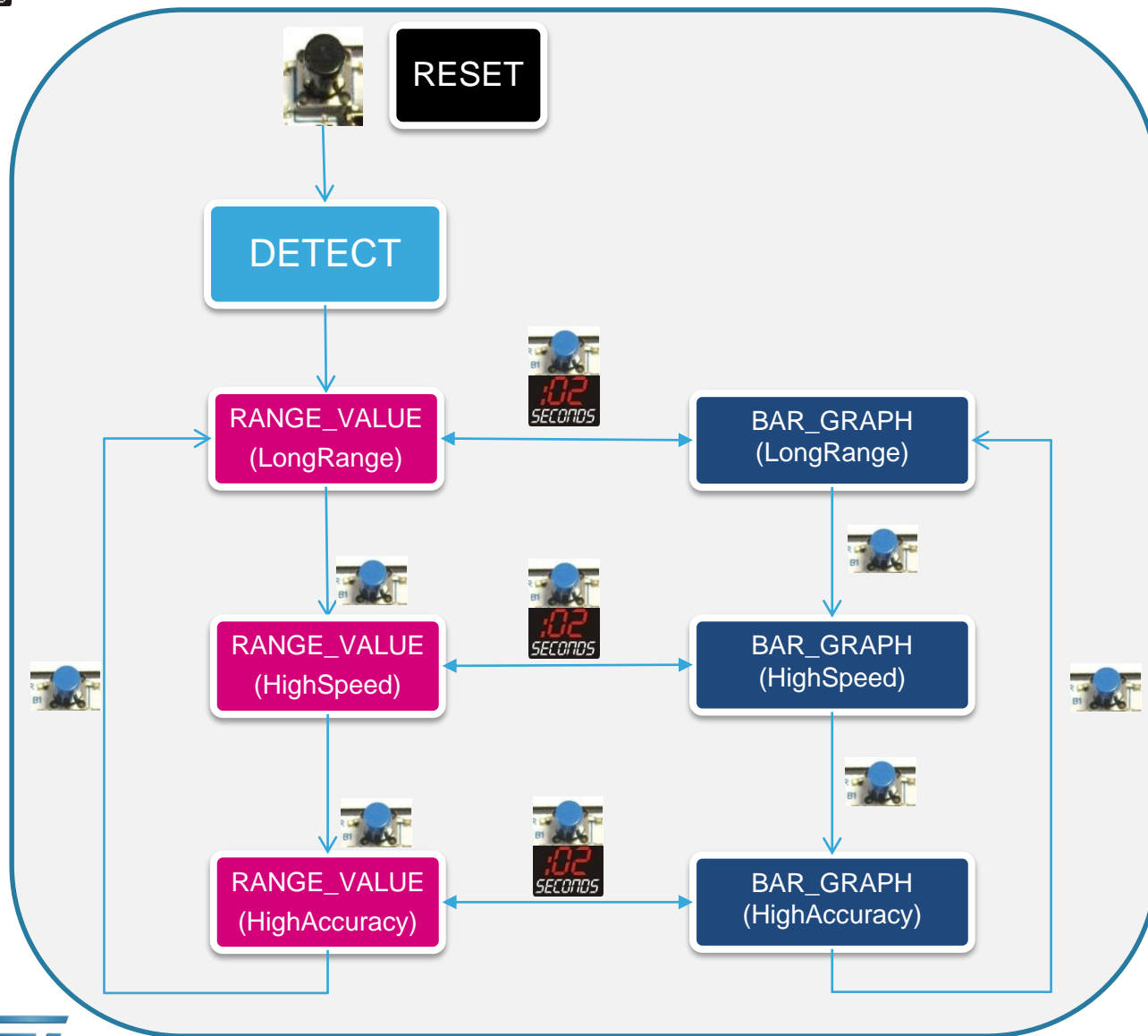


Long press (> 2sec)



# Demo modes

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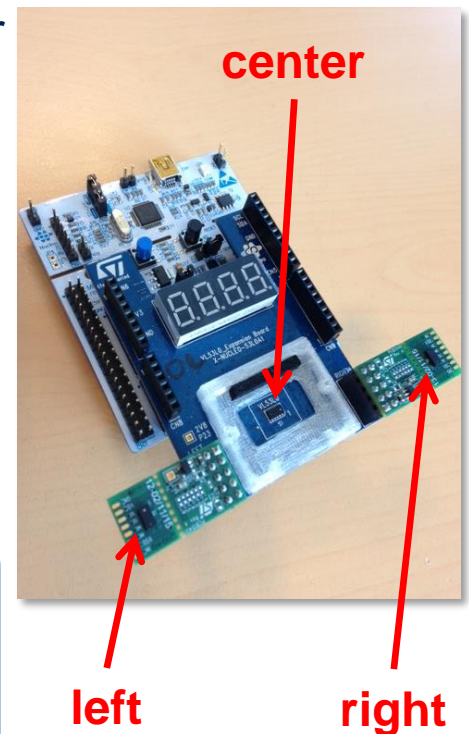
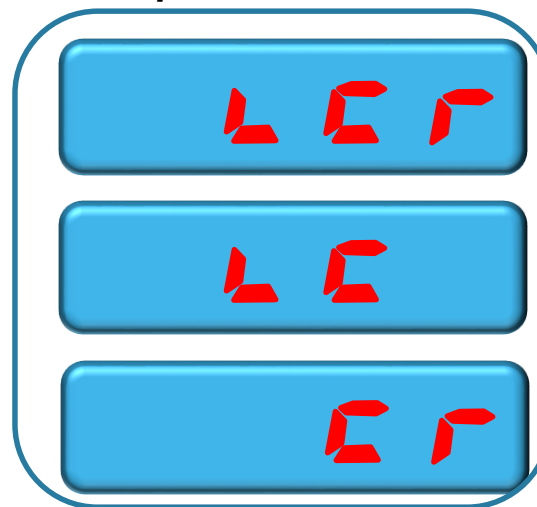


- Automatically detect number and location of VL53L0X devices present on the board
- Display (during 1 sec) detected devices with a single letter
  - **C** : Center device
  - **L** : Left device
  - **R** : Right device
- Each digit of the display is associated with a device
- Supported configurations are

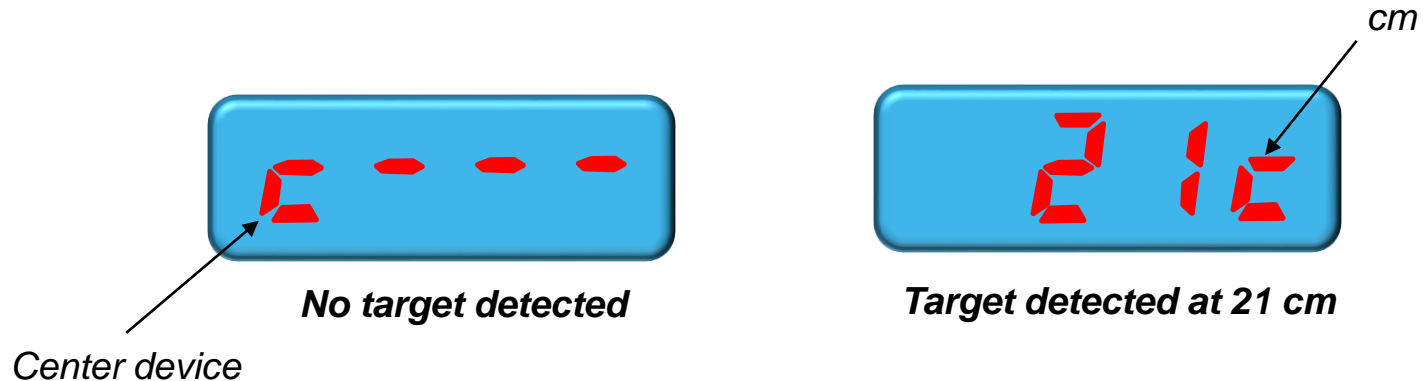
*Single VL53L0X device*



*Multiple VL53L0X devices*



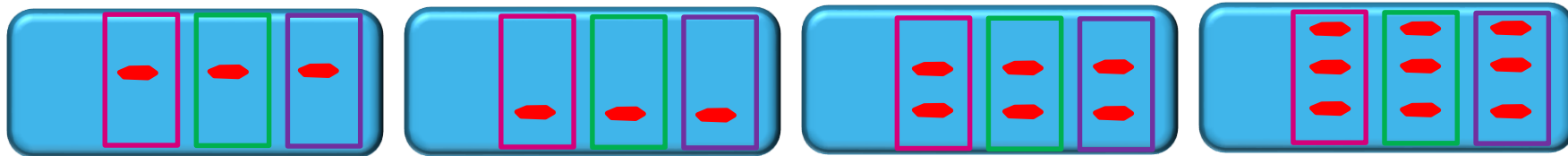
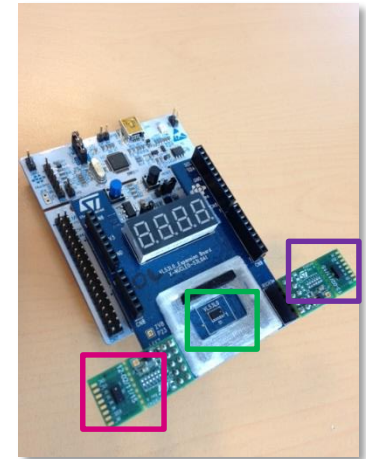
- “**RNG**” is displayed during 1 sec to indicate the RANGE\_VALUE demo mode
- Ranging configuration is displayed during 1 sec
  - “**LR**” : Long Range
  - “**HS**” : High Speed
  - “**HA**” : High Accuracy
- Then, live ranging (in cm) is displayed from single device (Center)
- A short press on blue button allows to change the ranging configuration
  - “LR” => “HS” => “HA” => “LR”



# BAR\_GRAPH

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- “**rb**” is displayed after 2 sec the button has been pressed by the user : this means user can **R**elease the **B**utton
- “**bar**” is displayed during 2 sec
- Ranging mode is displayed during 1 sec
  - “**LR**” : Long Range
  - “**HS**” : High Speed
  - “**HA**” : High Accuracy
- Then, live ranging from each device is displayed in a bar graph manner
- A short press on blue button allows to change the ranging configuration
  - “LR” => “HS” => “HA” => “LR”



No target detected

Target < 10 cm

10 cm < Target < 30 cm

30 cm < Target

# Ranging Data Logging (1/3)

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- Key ranging data are outputted from Nucleo to PC through serial com over USB. This provides an easy way to collect data for device evaluation or GUI building
- Following data are logged over the time:
  - Sensor ID : 0 for LEFT, 1 for CENTER, 2 for RIGHT
  - Time Stamp in usec : time when ranging measure is returned by the VL53L0X API
  - RangeStatus returned by VL53L0X API. Typical values are (refer to product User Manual for more details)
    - 0 : Range Valid
    - 1 : Sigma Fail
    - 2 : Signal Fail
    - 3 : Min Range Fail
    - 4 : Phase Fail
  - RangeMillimeter : Distance in mm returned by VL53L0 API (valid only if RangeStatus is null)
  - SignalRate : Return rate in Mcps coded as a 16.16 fixed-point value
    - Divide the integer value by 65536.0 to get the floating point value (in Mcps)
- By default, ranging data logging is enabled
  - Set TRACE\_UART macro to 0 to disable



# Ranging Data Logging (2/3)

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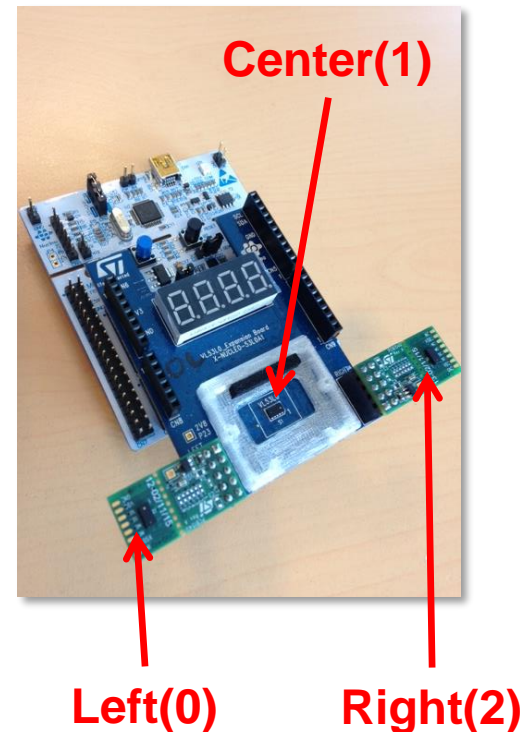
- Data logging format:

- SensorID, Timestamp, RangeStatus, RangeMillimeter, SignalRate

1,25048709,4,8190,16384  
1,25083710,0,2071,20992  
1,25118709,4,8190,29184  
1,25153708,0,2013,32256  
1,25188709,0,2060,44544  
1,25223709,0,2002,19456  
1,25258709,0,1955,30720

- Multi-devices example

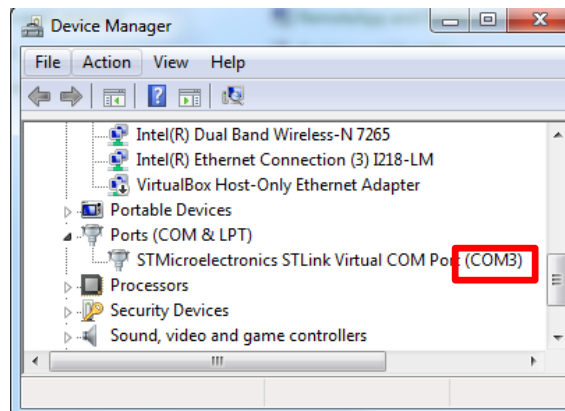
0,155049708,0,118,1435648  
1,155071708,0,143,1364480  
2,155093708,0,97,1511936  
0,155115707,0,112,1451520  
1,155137707,0,141,1361920  
2,155159707,0,95,1474048  
0,155181708,0,112,1438208



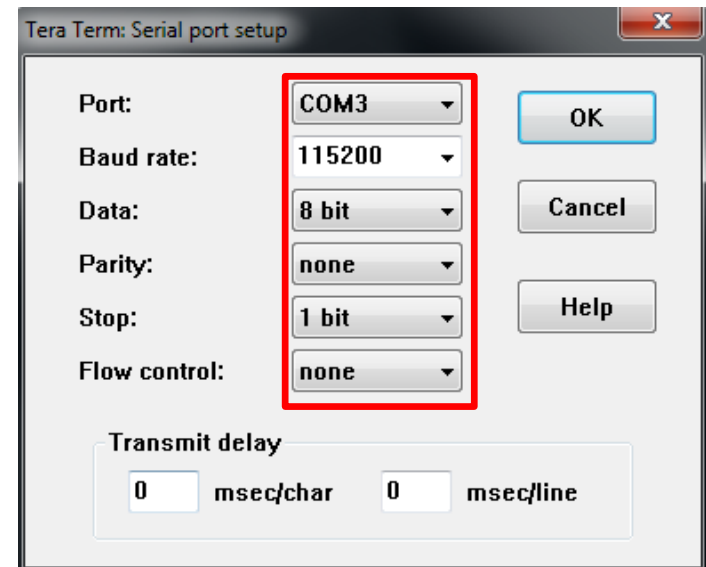
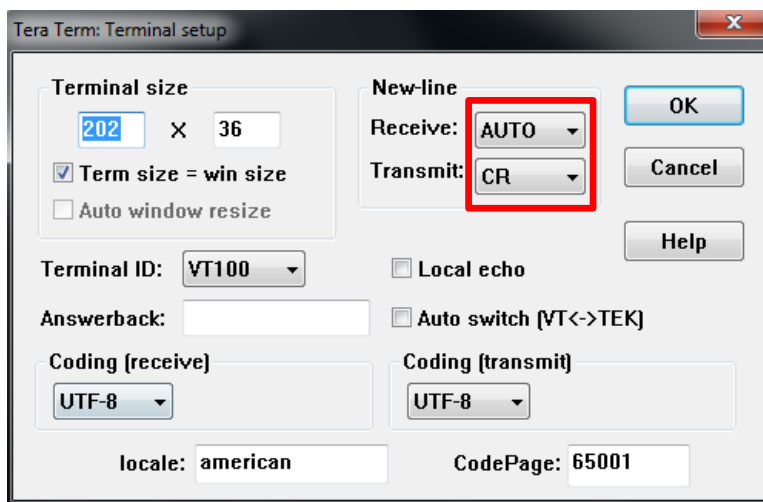
# Ranging Data Logging (3/3)

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- Get COM number from Device Manager



- Serial COM settings (Tera Term example on COM3)



# Project trace/logging macros

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- Following macros are defined in the project (by default)
  - **VL53L0A1\_HAVE\_UART 1**
    - Used in X-NUCLEO-53L0A1.h to compile UART resources for logging/trace purpose
    - It is recommended to keep it to 1
  - **TRACE\_UART 1**
    - Used in uart\_trace.c to compile trace\_printf() function for logging/trace purpose
    - If TRACE\_UART is 1, then VL53L0A1\_HAVE\_UART must be also set to 1
    - Setting TRACE\_UART to 0 will disable all logging/trace on serial com port : this allows to reduce the code size
  - **VL53L0X\_LOG\_ENABLE**
    - Used in VL53L0X API to enable API logging (with several logging levels)
    - By default VL53L0X API logging level is set to None (no logging) in main.c file
    - Use VL53L0X\_trace\_config() function to change logging level in main.c file
  - **XNUCLEO53L0A1\_TRACE 1**
    - Used in X-NUCLEO-53L0A1.c to trace X-NUCLEO-53L0A1 errors
    - It is recommended to leave this macro to 1 to see potential errors

# Typical configurations

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- The default : Ranging data logging enabled + XNCULEO53L0A1 errors trace

- VL53L0A1\_HAVE\_UART 1
- TRACE\_UART 1
- VL53L0X\_LOG\_ENABLE

```
1,234176152,0,2016,22528
1,234209152,0,2103,23040
1,234242152,0,2042,15360
1,234275152,0,2082,22016
1,234308152,0,2058,20480
1,234341152,4,8190,20992
```

- main.c:

- VL53L0X\_trace\_config(NULL, TRACE\_MODULE\_NONE, TRACE\_LEVEL\_NONE, TRACE\_FUNCTION\_NONE); // No trace

- XNUCLEO53L0A1\_TRACE 1

- Enable VL53L0X API logging (in addition to above logging)

- VL53L0A1\_HAVE\_UART 1
- TRACE\_UART 1
- VL53L0X\_LOG\_ENABLE

```
24947 <END> VL53L0X_StartMeasurement 0
24950 <START> VL53L0X_measurement_poll_for_completion
24954 <START> VL53L0X_GetMeasurementDataReady
24958 <START> VL53L0X_GetInterruptMaskStatus
24963 <END> VL53L0X_GetInterruptMaskStatus 0
24967 <END> VL53L0X_GetMeasurementDataReady 0
24972 <START> VL53L0X_GetMeasurementDataReady
24975 <START> VL53L0X_GetInterruptMaskStatus
24979 <END> VL53L0X_GetInterruptMaskStatus 0
24983 <END> VL53L0X_GetMeasurementDataReady 0
24987 <END> VL53L0X_measurement_poll_for_completion 0
24991 <END> VL53L0X_PerformSingleMeasurement 0
24995 <START> VL53L0X_GetRangingMeasurementData
25000 <START> VL53L0X_get_pal_range_status
25004 <START> VL53L0X_GetLimitCheckEnable
25008 <END> VL53L0X_GetLimitCheckEnable 0
25011 <START> VL53L0X_calc_sigma_estimate
25015 <START> VL53L0X_get_total_signal_rate
```

- main.c:

- VL53L0X\_trace\_config(NULL, TRACE\_MODULE\_ALL, TRACE\_LEVEL\_ALL, TRACE\_FUNCTION\_ALL); // Full trace

- XNUCLEO53L0A1\_TRACE 1

- Disable all logging

- TRACE\_UART 0

