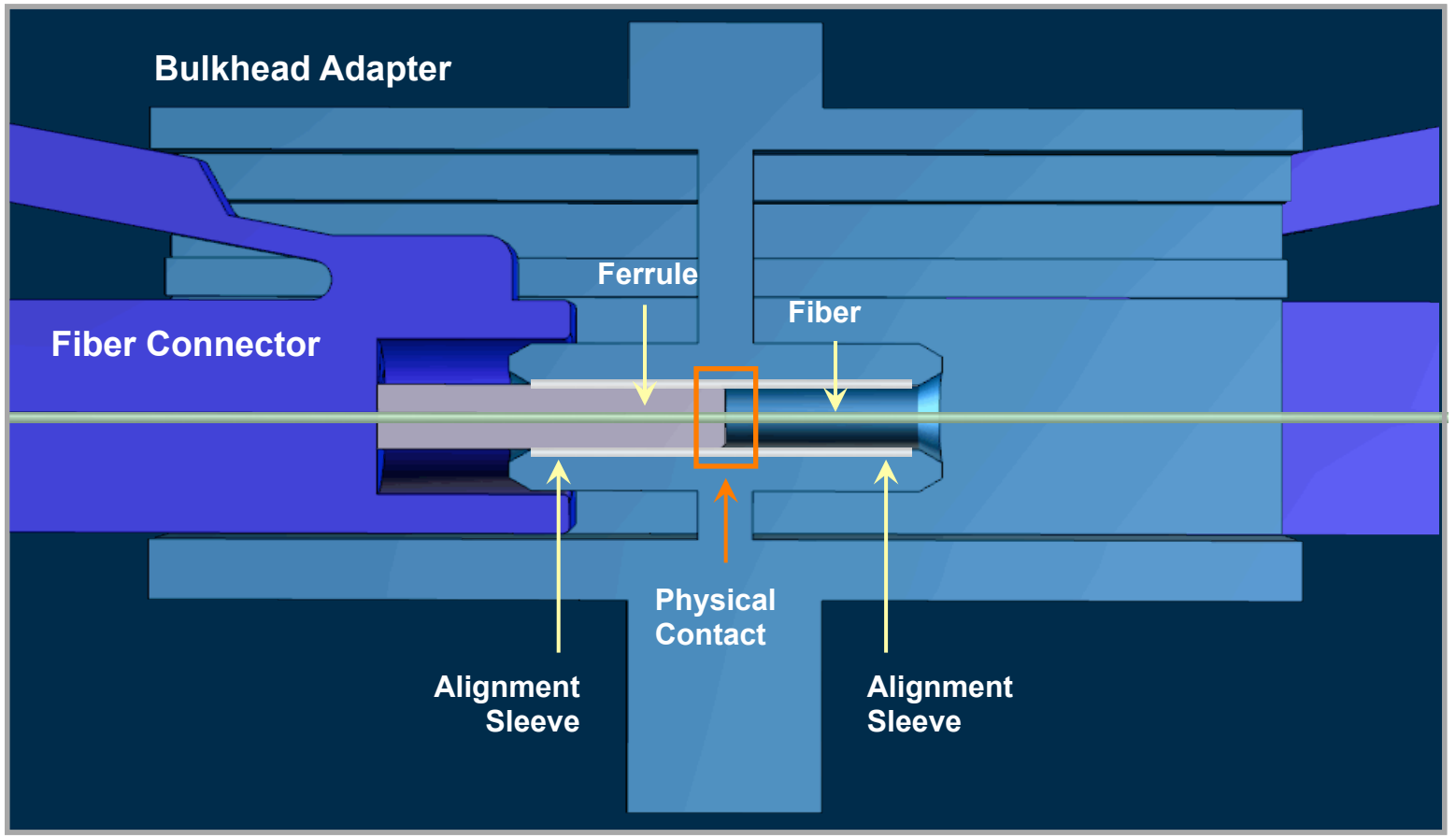
JDSU

Passive Component Loss Testing in Production and Assembly

Camille Magno

Focused On the Connection

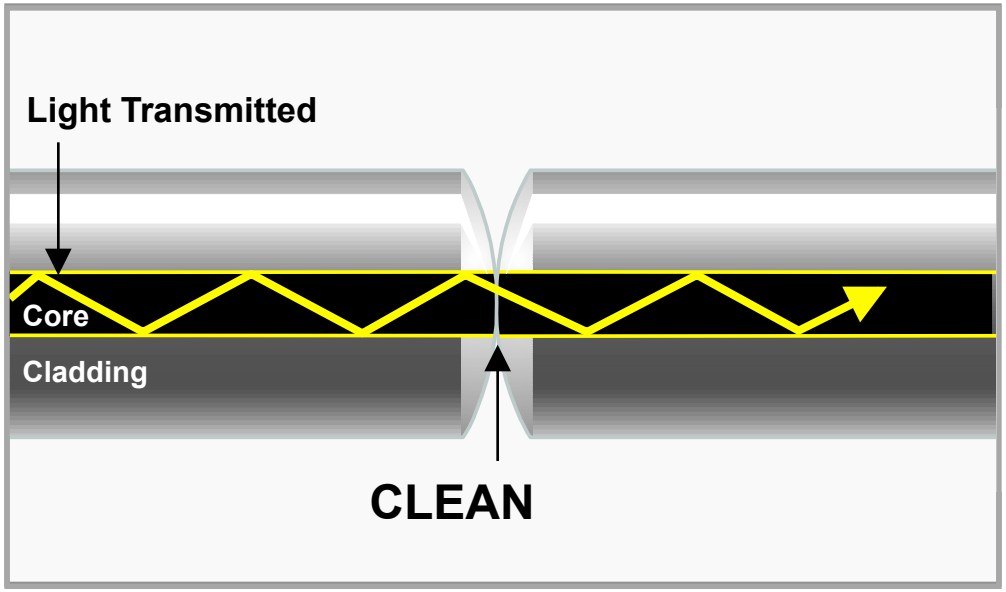


Fiber connectors are widely known as the **WEAKEST AND MOST PROBLEMATIC** points in the fiber network.

What Makes a GOOD Fiber Connection?

The 3 basic principles that are critical to achieving an efficient fiber optic connection are "The 3 P's":

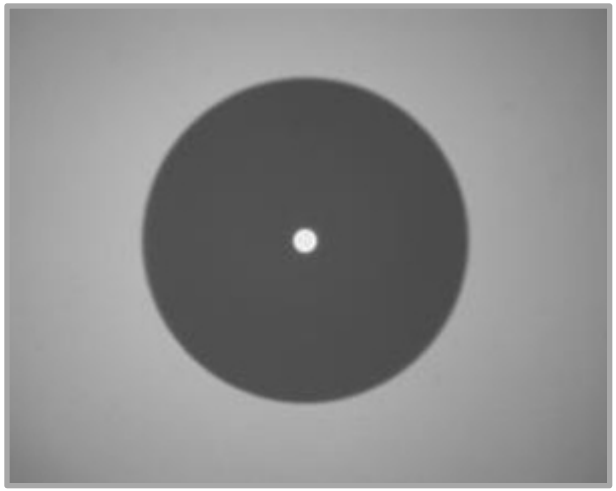
- **Perfect Core Alignment**
- **Physical Contact**
- **Pristine Connector Interface**



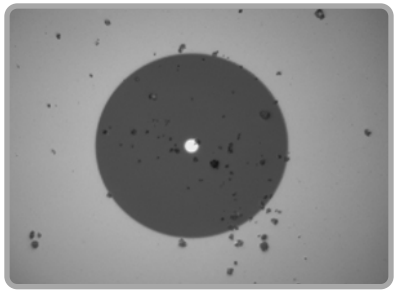
Types of Contamination

A fiber end face **should be free of any contamination or defects,** as shown below:

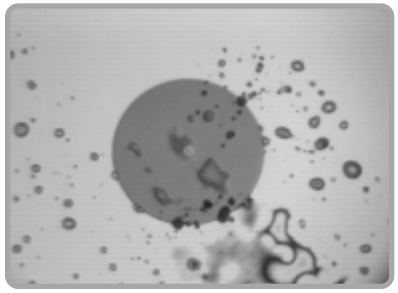
SINGLEMODE FIBER



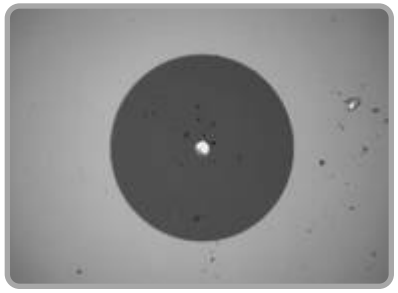
Common types of contamination and defects include the following:



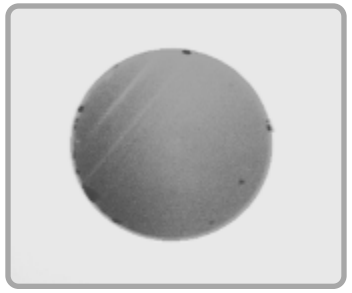
Dirt



Oil



Pits & Chips

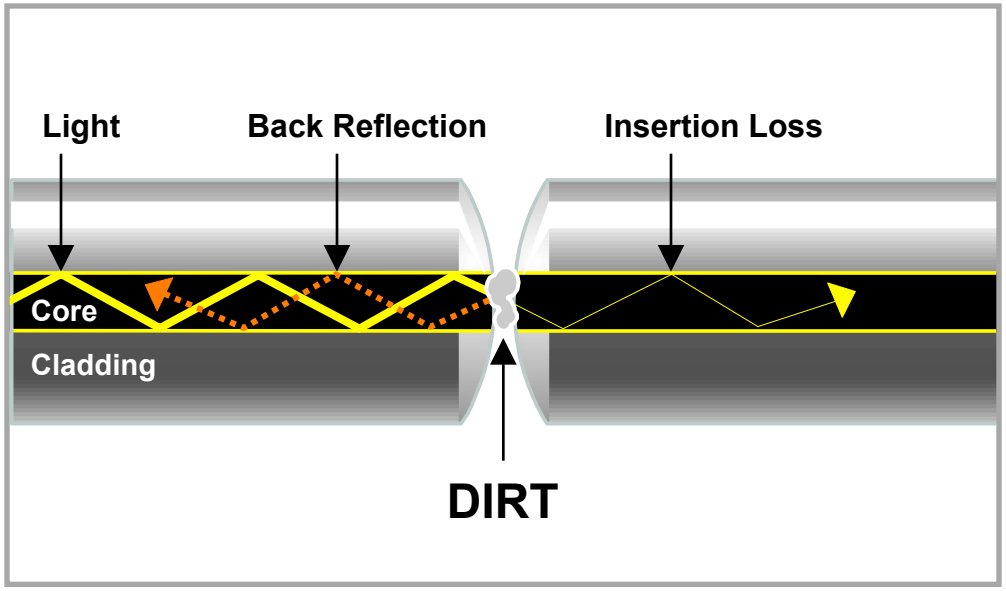


Scratches

Making Accurate ORL measurements

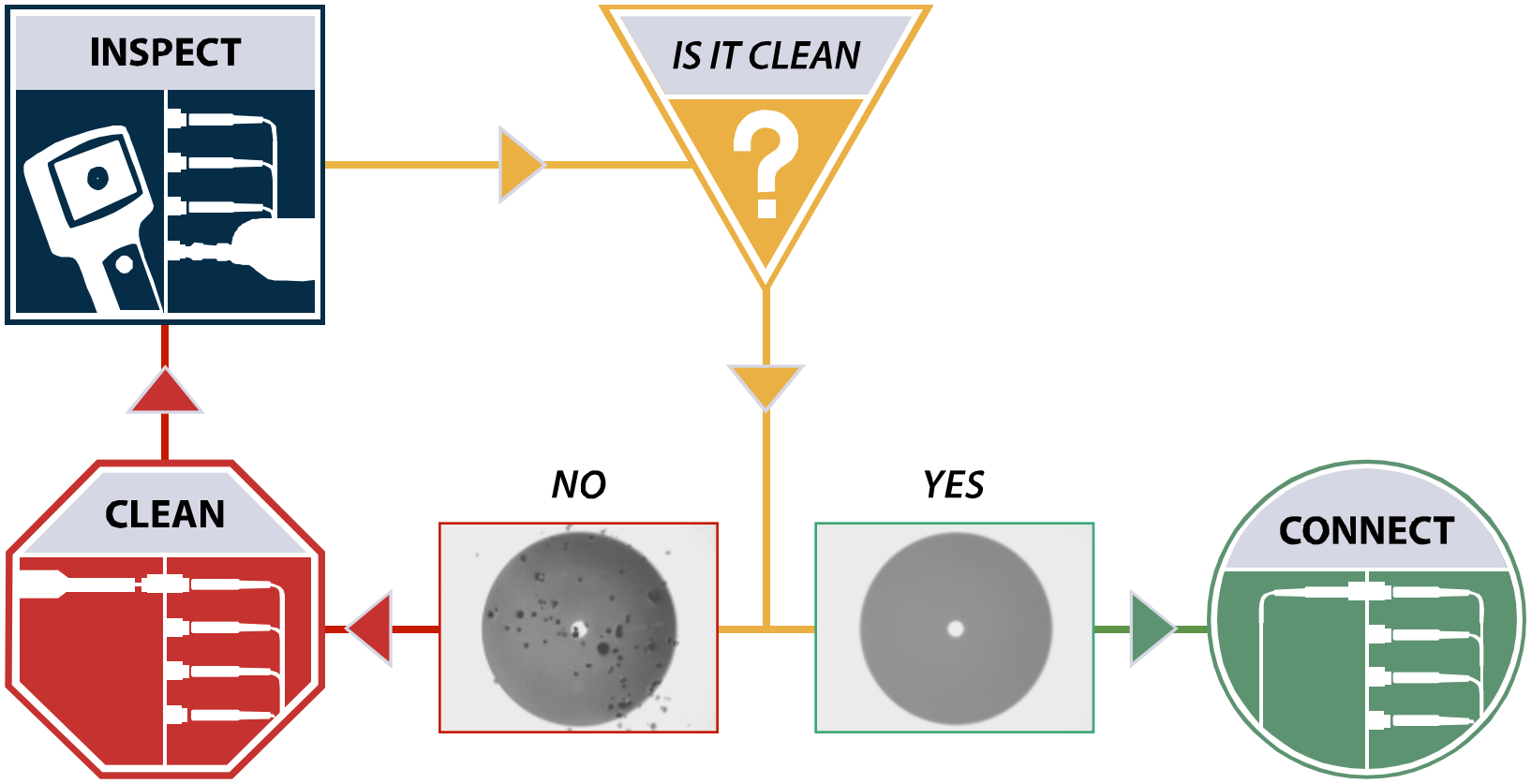
- **Tip #1: CLEAN!**
  - Carelessness and lack of cleaning during reference and DUT measurements will cost you more time and money than a modern cleaning solution
    - Lost test time
    - Damaged Connectors
    - Damaged Master Jumpers
    - Shipping dirty connectors to you customer
  - **Inspect Before You Connect!**

CleanBlast® Fiber Optic Connecter Cleaning System



Inspect Before You Connect℠

Follow this simple **"INSPECT BEFORE YOU CONNECT"** process to ensure fiber end faces are clean prior to mating connectors.

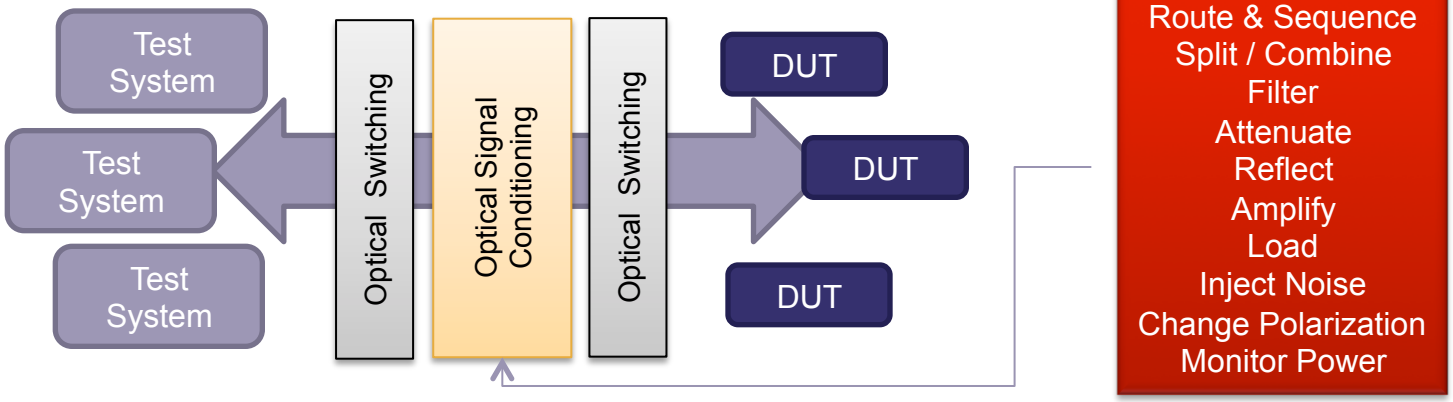


What is a “Photonic Test Automation Tool”?

Get the **RIGHT TEST SIGNAL**
To the **RIGHT D.U.T.**
With the **RIGHT POWER**
With the **RIGHT QUALITY**
At the **RIGHT TIME**

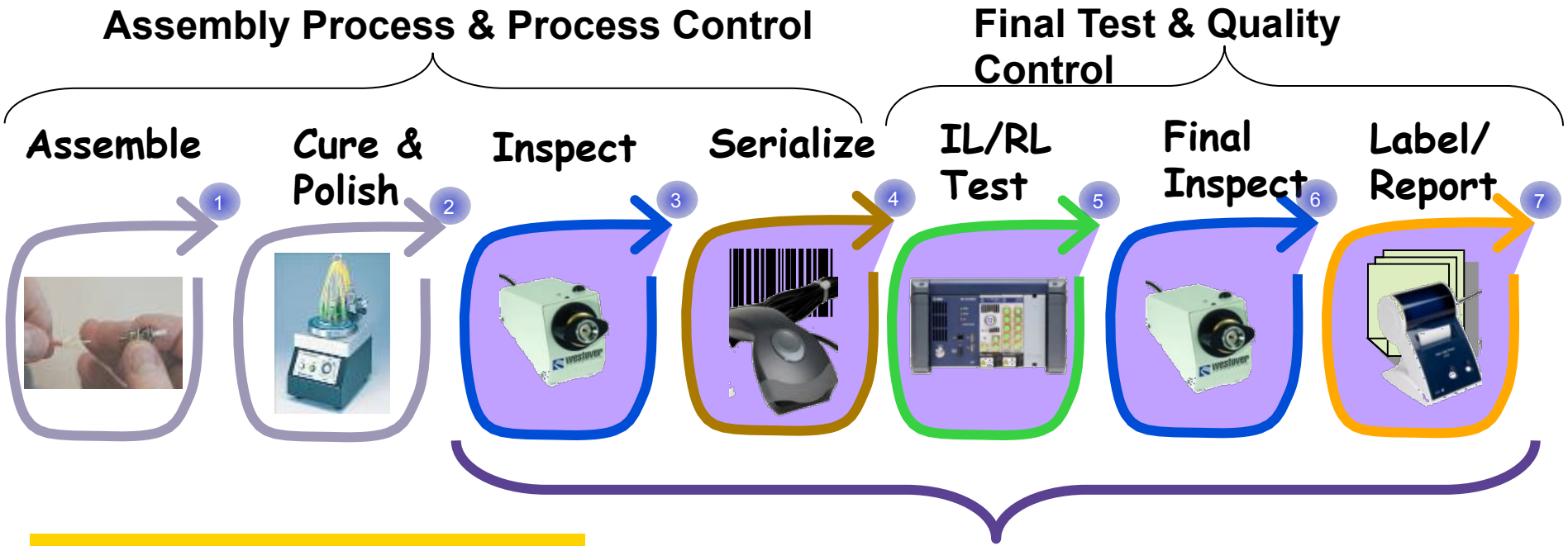
…FAST

- Class of instrument which manages, conditions, tunes or routes the optical signal in an ATE environment
  - Deliver the right **signal**, at the right **power**, with the right **impairments** and the right **time** to the DUT
- Decrease test time, reduce operator handling and increase capital utilization



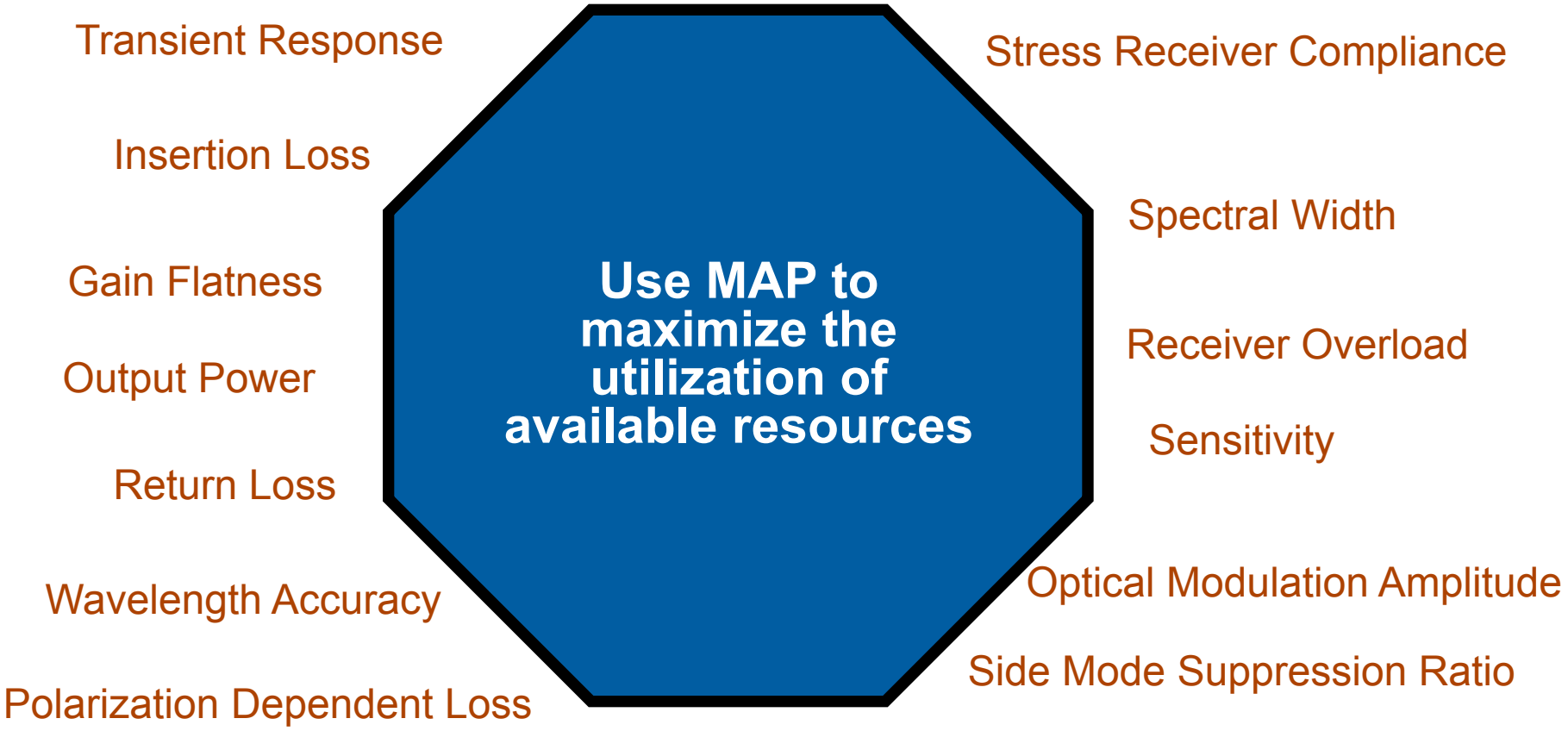
Density, low loss, software and module breadth are key considerations

mORL and PCT in the Process Flow



Single Complete Solution
mORL with PCT

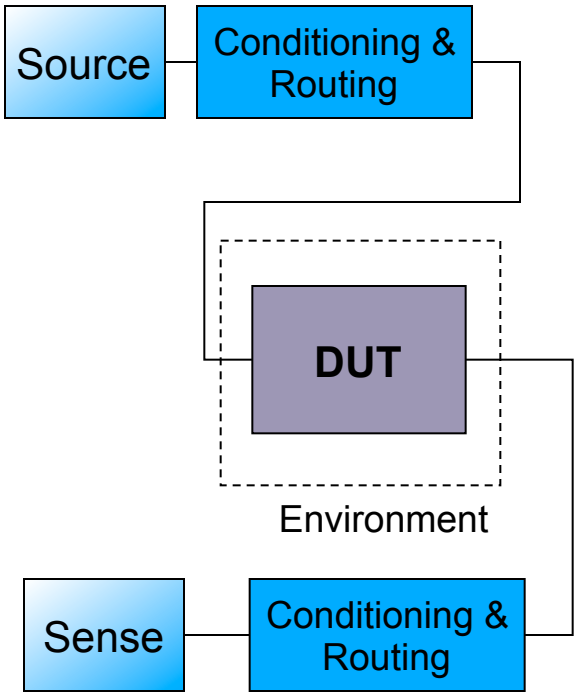
MAP Implementation: Test examples

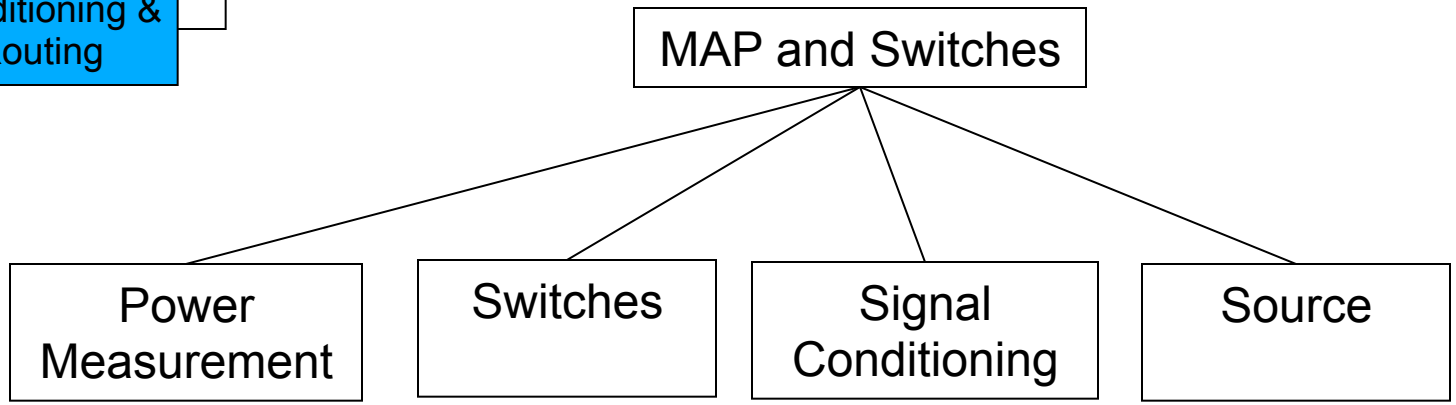


Optimized for performance

- **Optically transparent**
  - Minimize impairments
    - Example: low IL, BR, PDL, wavelength sensitivity and dispersion (chromatic, polarization & multimode)
- **Flexible**
  - Simplify implementation:
    - Example: Multiple interfaces, package size, and configurations
- **Repeatable & stable**
  - Limit measurement uncertainty.

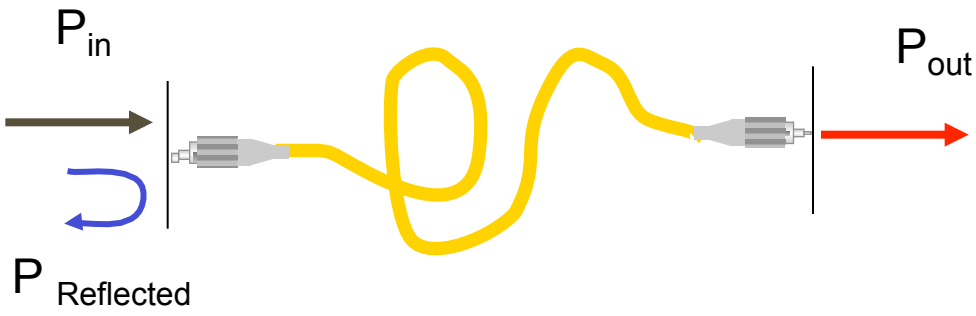
Simplified Test Set





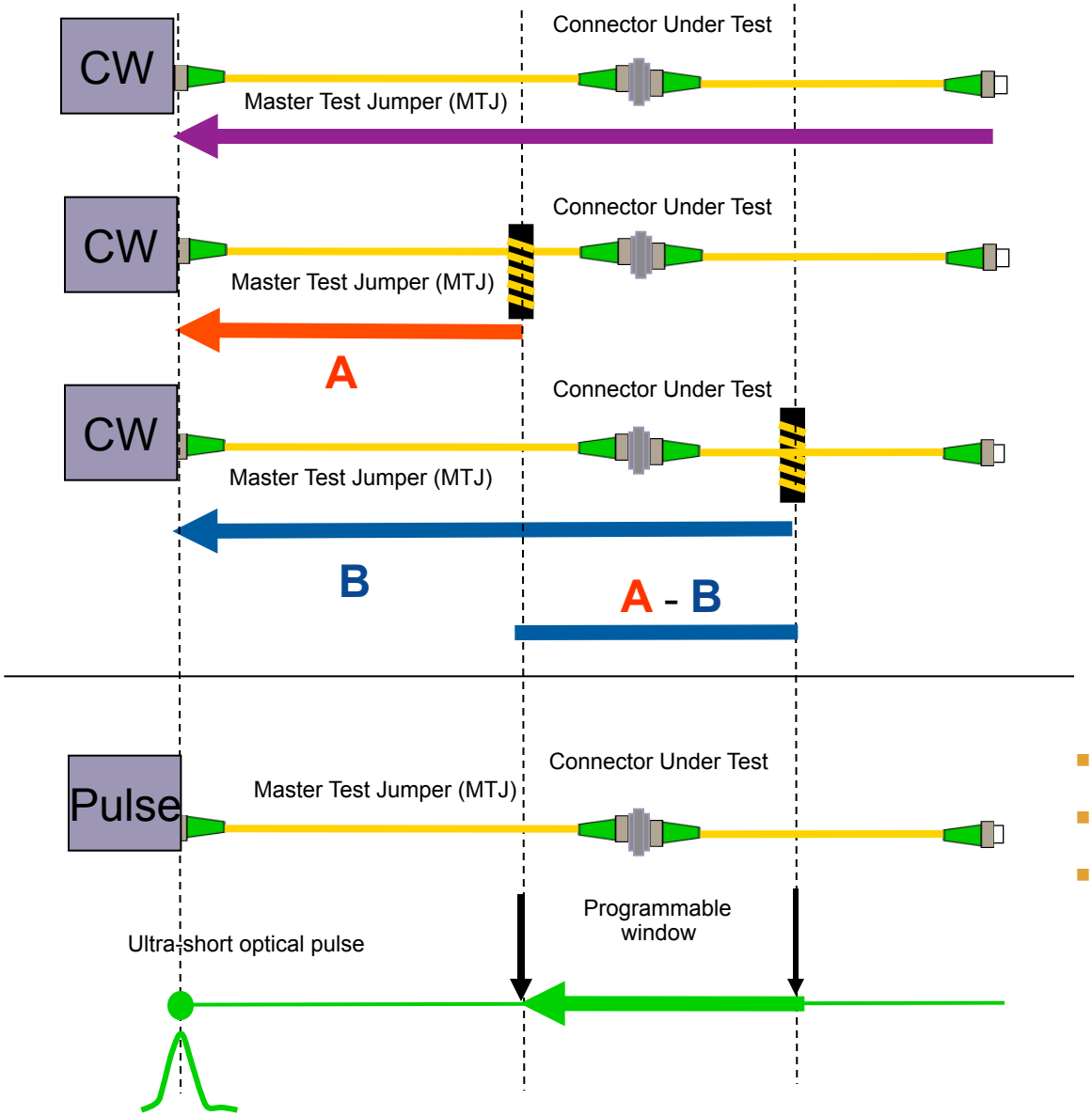
Basic Insertion Loss (IL) and Optical Return Loss (ORL)

- **Insertion loss (IL)** - The difference (expressed in dB) between the input power and output power
  - Dominated by connector loss (2 m fiber has almost no attenuation)
  - Optical connectors are typically between 0.05dB and 0.2dB
- **Optical Return Loss (RL)** - The difference (expressed in dB) between the input power and the power reflected
  - Flat connectors (FC/**PC**, or LC/**PC**) are typically 45 to 55 dB
  - Angled connectors (FC/**APC**, or LC/**APC**) are typically 55 to 75 dB
- Key measurement wavelengths 1310, 1490, 1550, 1625nm



$$IL\ [dB] = P_{in} - P_{out}$$
$$RL\ [dB] = P_{in} - P_{Reflected}$$

Continuous Wave vs. Pulse ORL Measurement



- Optical Source is always on
- With **NO** mandrel termination all the light scattered back to source is measured
- Termination measures backscatter up to connector under tets
- Termination blocks backscatter
- The Return Loss of the connector under test is A – B
- Termination must be done very accurately, are manual and directly impact the accuracy of the results

- Ultra-short optical pulse
- No terminations required
- Precision timing only measures backscatter from a specific portion of the fiber

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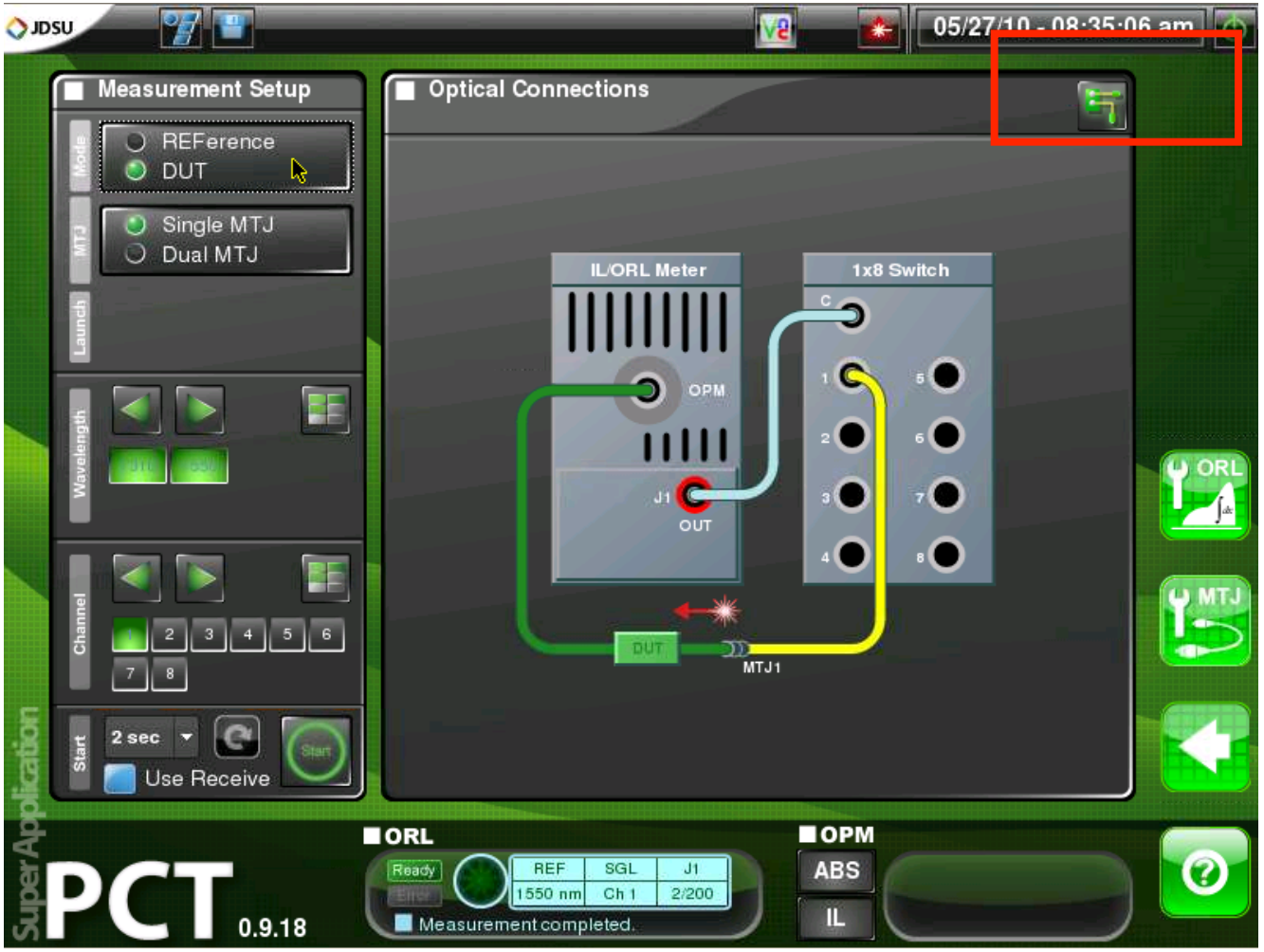
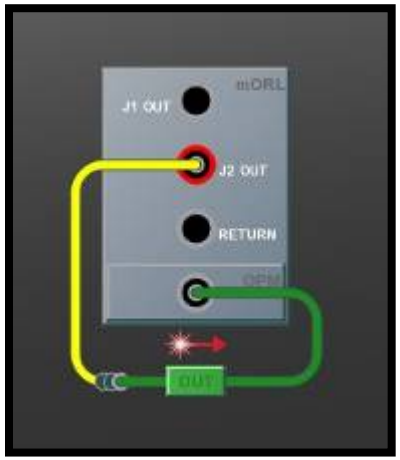
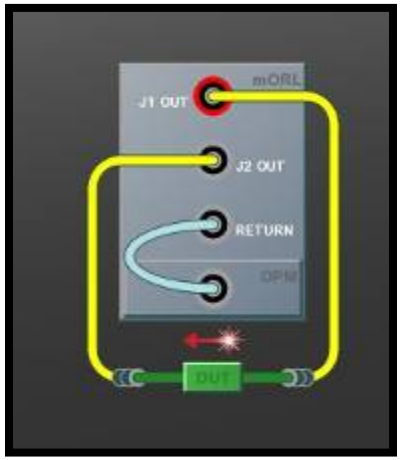
Quick Measure Mode:
Visual Step by Step Instructions



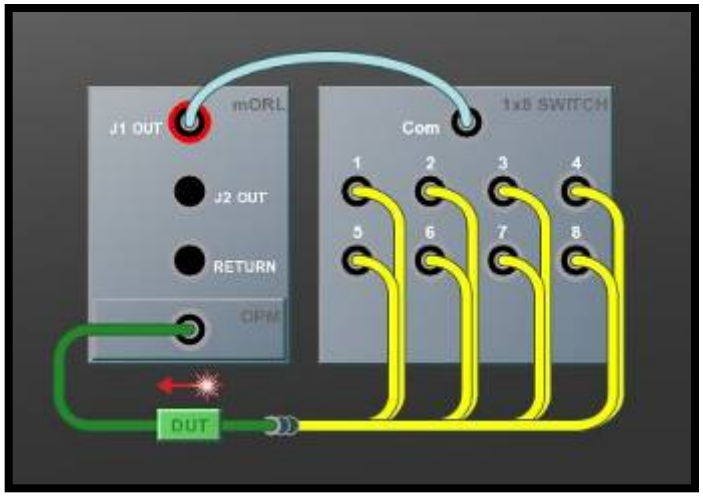
Visual toggle

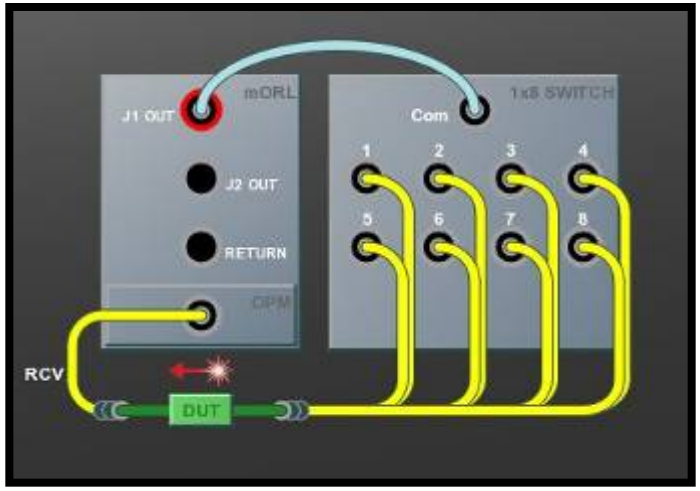
Switch Integration – Multi-fiber Productivity





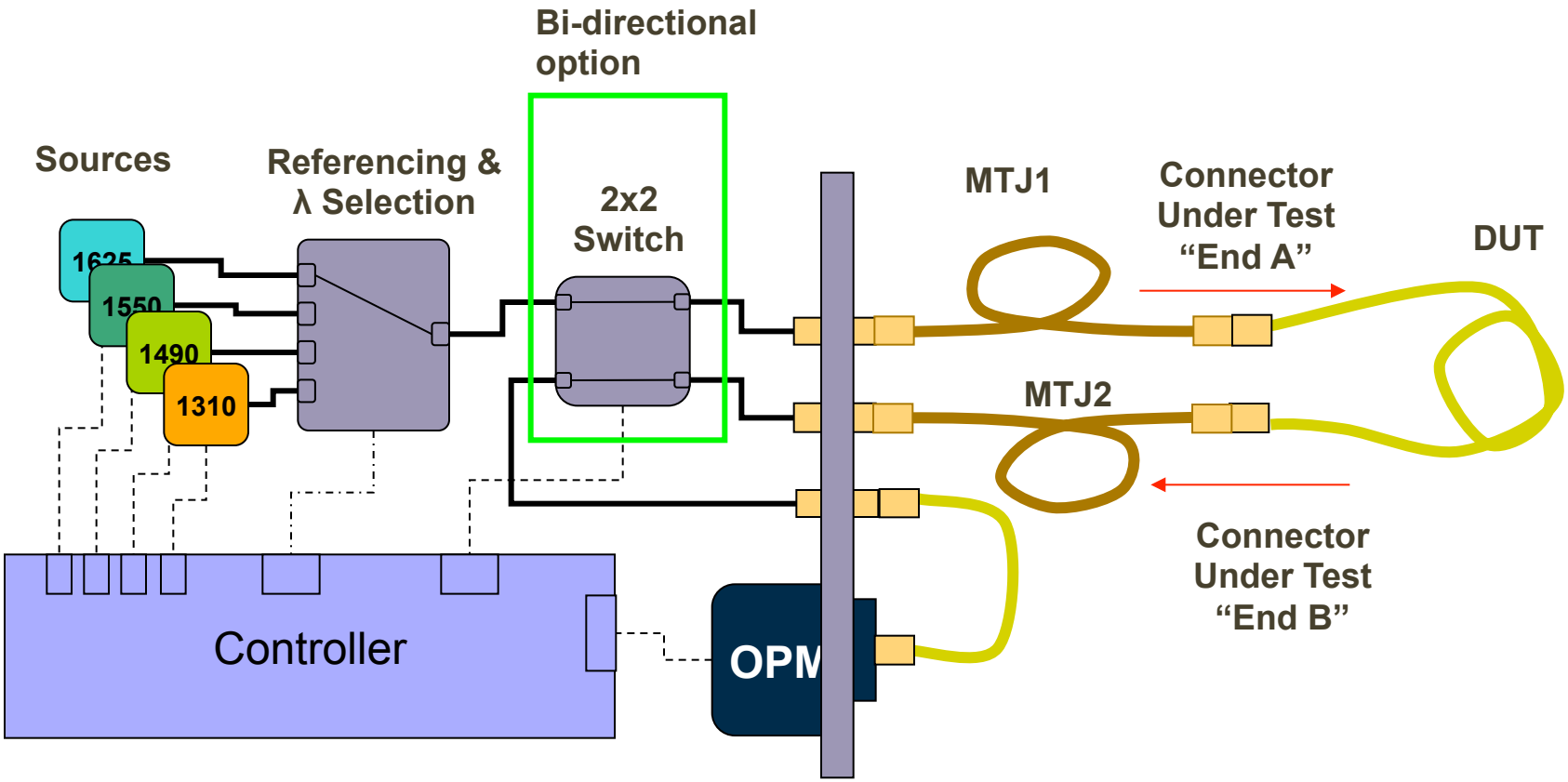
mORL module on its own





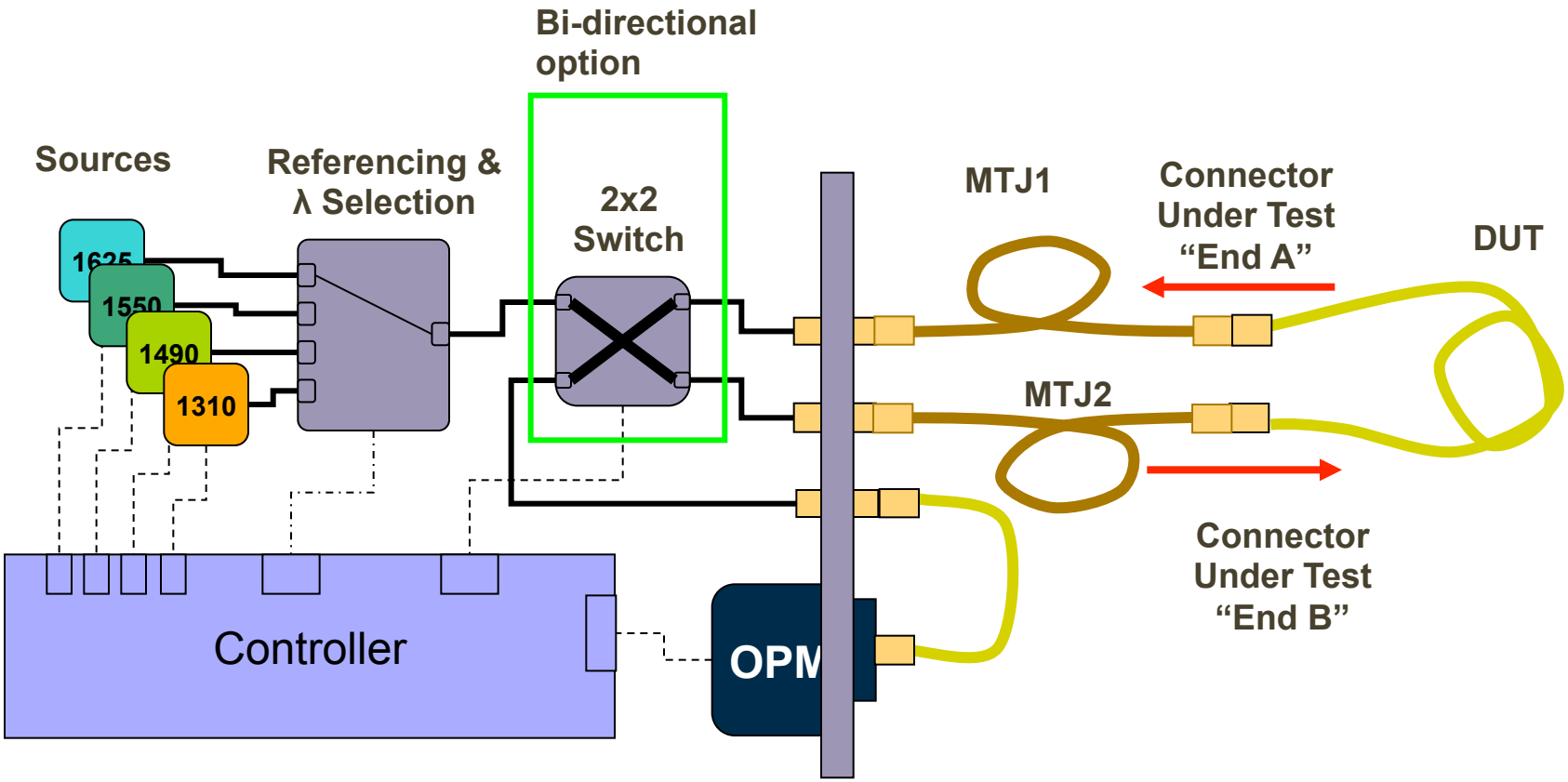
With 1xN Switch

mORL: Powerful Integration
Automated Bidirectional Measurement (1)



Full automated bi-directional testing in one connection
Available in SM and MM

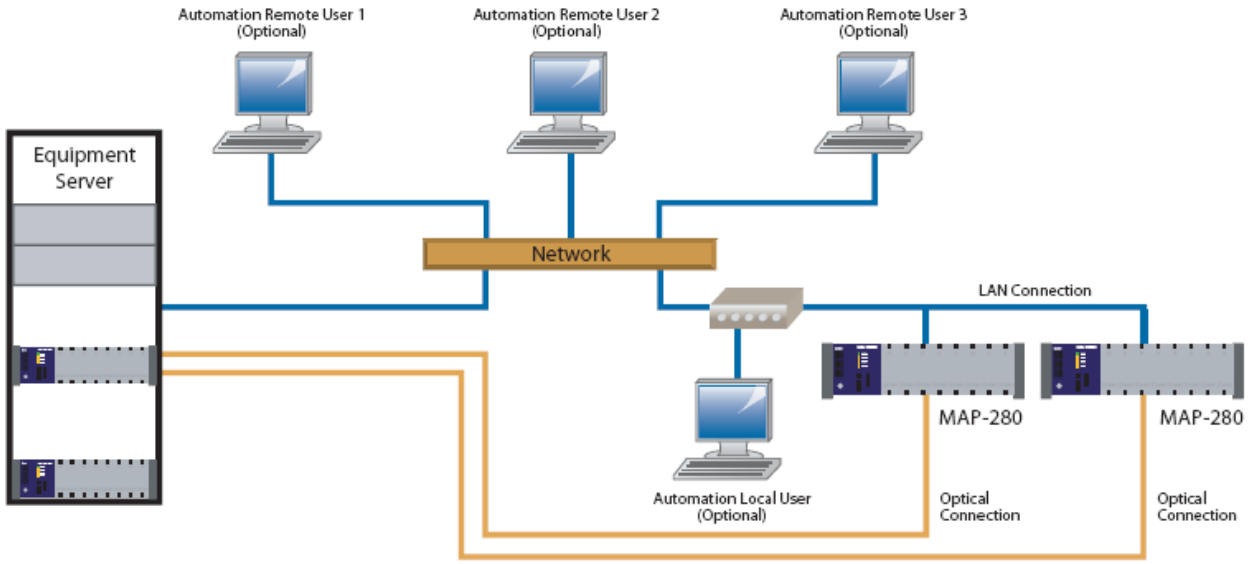
mORL: Powerful Integration
Automated Bidirectional Measurement (2)



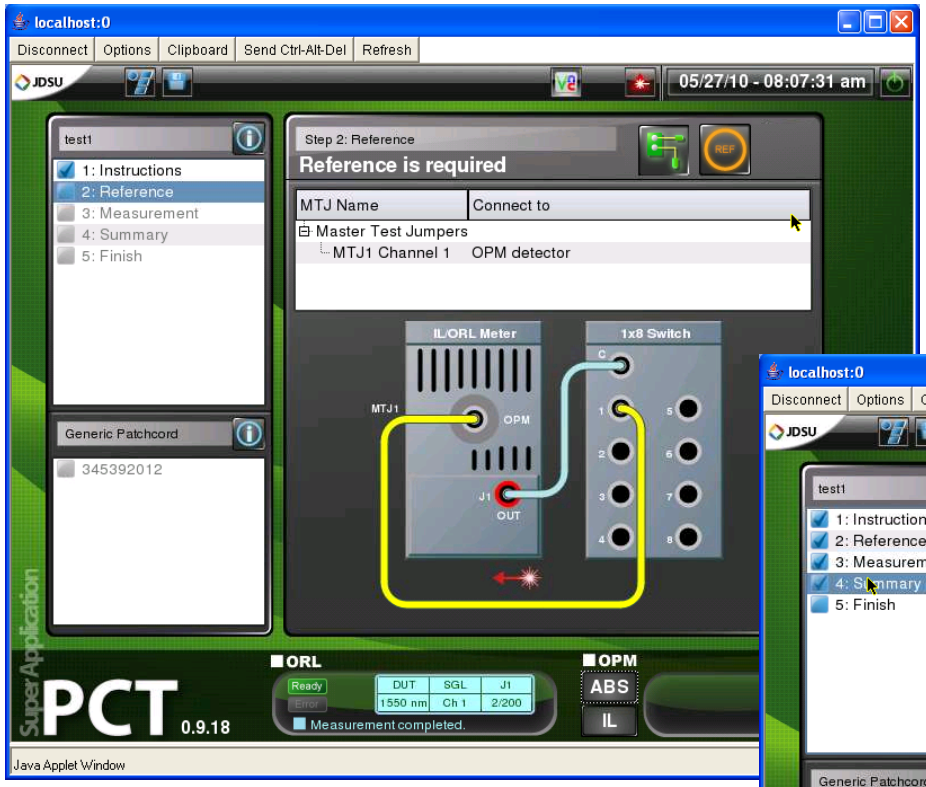
Full automated bi-directional testing in one connection
Available in SM and MM

MAP-200 Software Automation Features

- Supports automation via GPIB, Ethernet, VNC
- Compliance to the latest instrumentation standard LXI
- **Allows multi-user sharing**

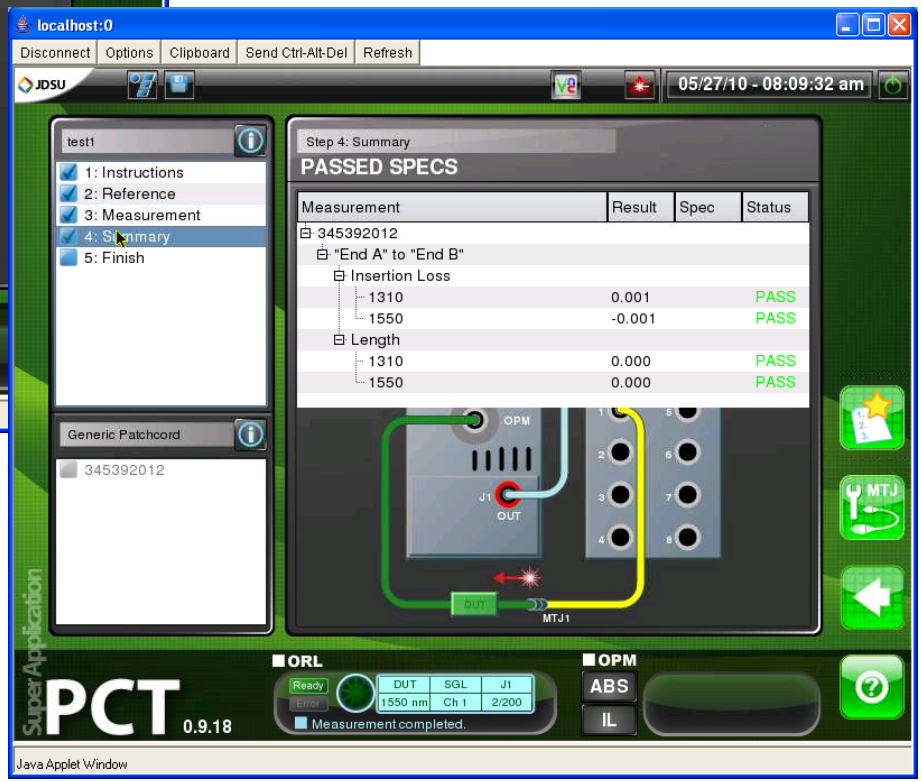


Scripting and Manufacturing Mode: Executing Scripts



Each step can be repeated as many times as the operator like.

Results are only written to the database when the operator advances to the next screen



Summary results with Pass / Fail

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Thank You

Product Highlight Summary

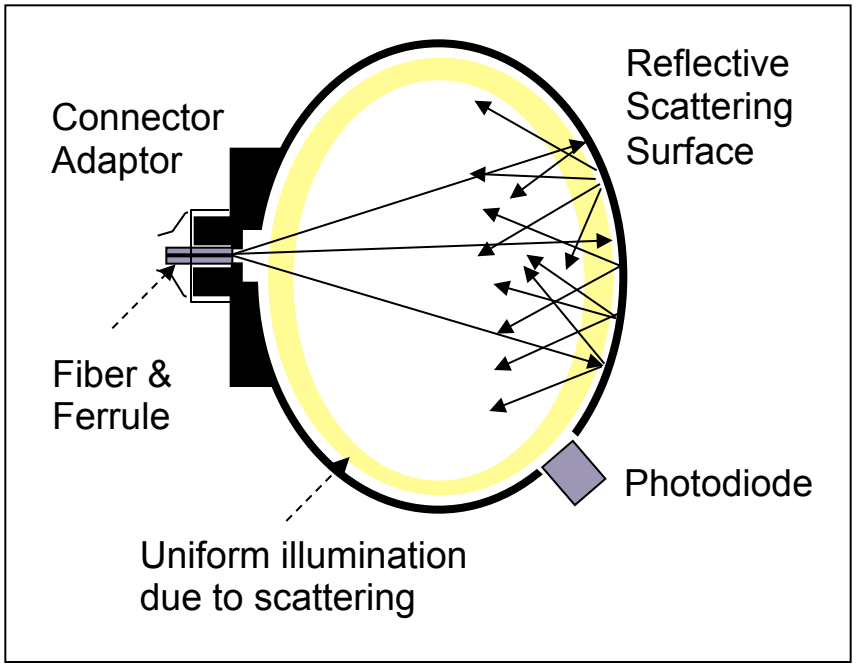
- **Performance:**
  - 80 dB ORL dynamic range
  - 0.001 dB IL resolution
  - Measure jumpers as short as 70cm
  - Fully programmable ORL window settings
  - 12 and 24 fiber MT connector ready
- **Fast:**
  - 2.5s per wavelength for both IL and RL
  - Integrated bi-directional testing option
- **Compact:**
  - 2 or 4 wavelengths in single width module with integrated power meter
  - Up to 1x24 switch in 3-slot chassis

All MAP applications feature FULL LXI / GPIB automation support

Key Feature: Integrating Sphere

Integrating Sphere for multi-fiber connectors

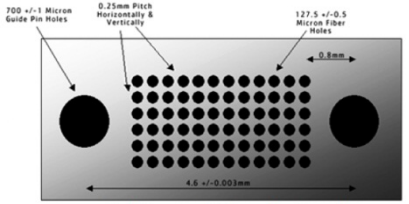
Cross Section of Integrating Sphere



Specification

Relative Positional Uncertainty Across Input Port Width	<±0.005 dB	From FC/PC reference at center of port to ±1.4 mm in width
Relative Positional Uncertainty Across Input Port Height	<±0.025 dB	From FC/PC reference at center of port to ±0.7 mm in height.

MT Connector End-face



High Density MT Interface Details