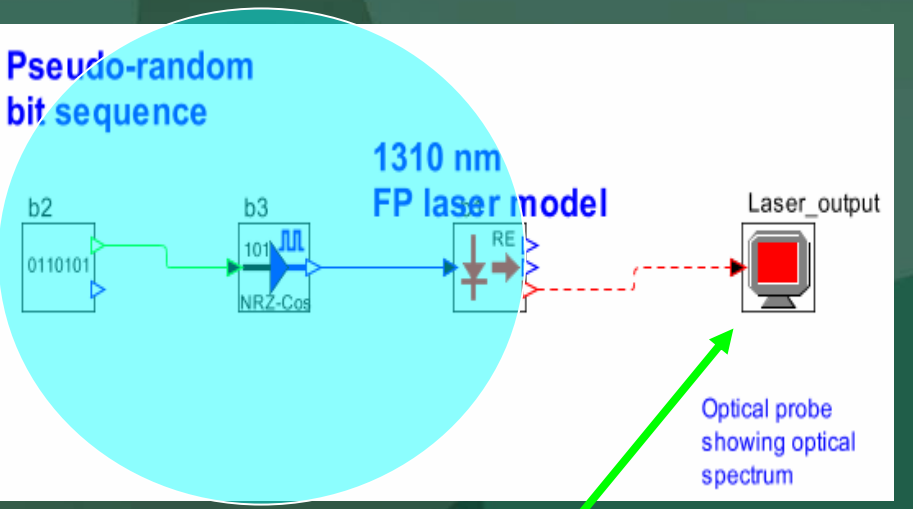
LASERS

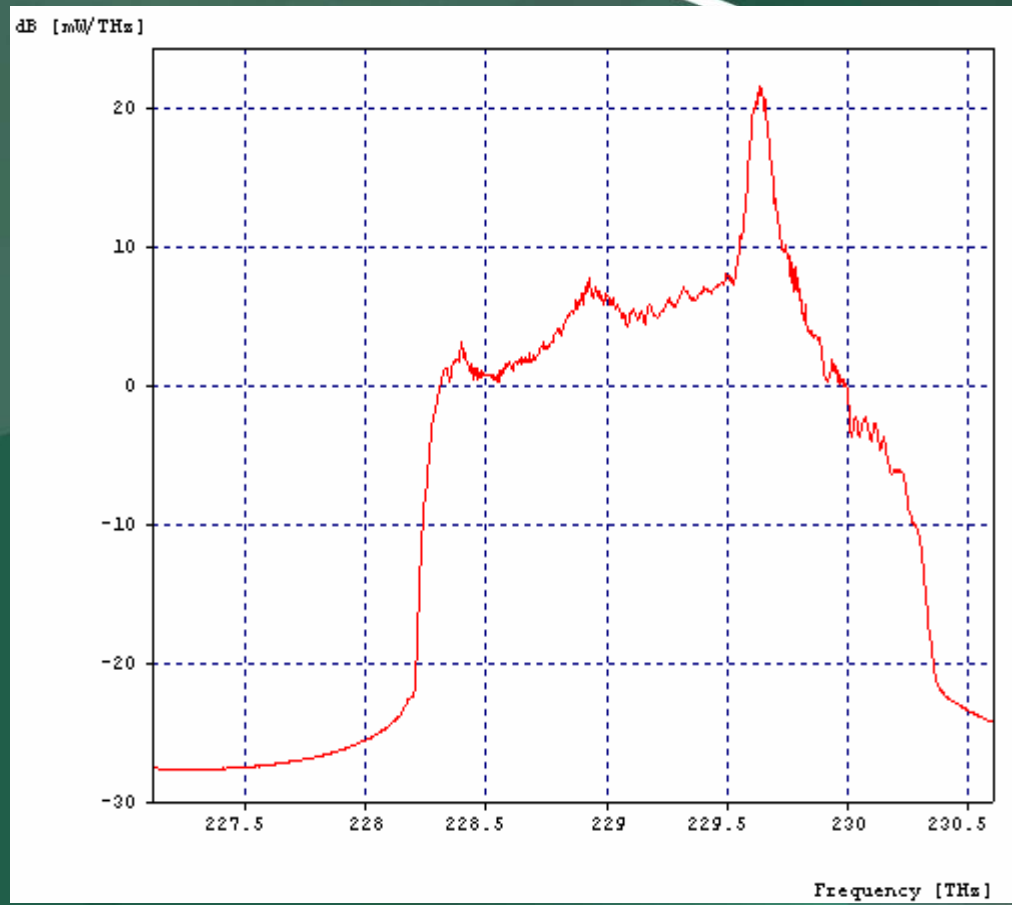
- Fabry Perot (FP)
- Distributed Feedback (DFB)
- Vertical Cavity Surface Emitting Laser (VCSEL)

Fabry Perot

Source



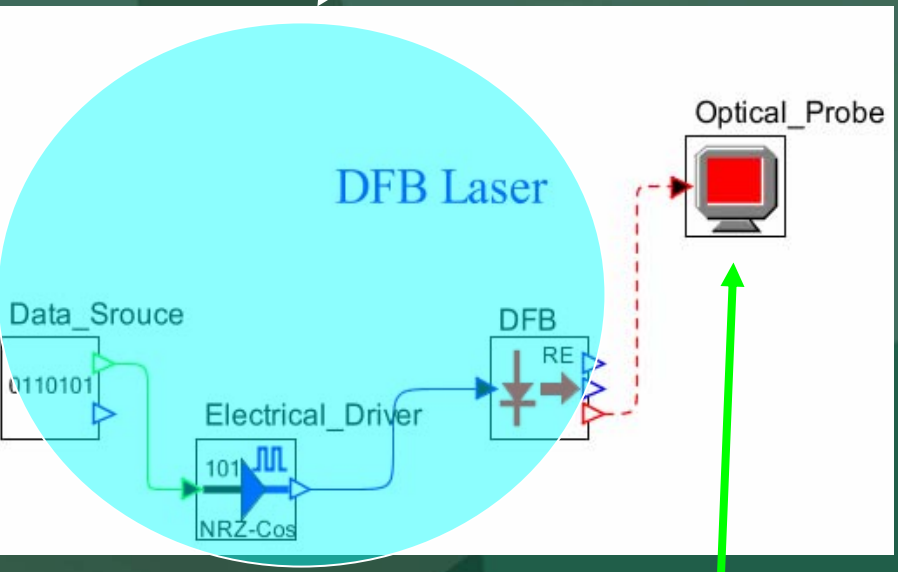
Optical Probe

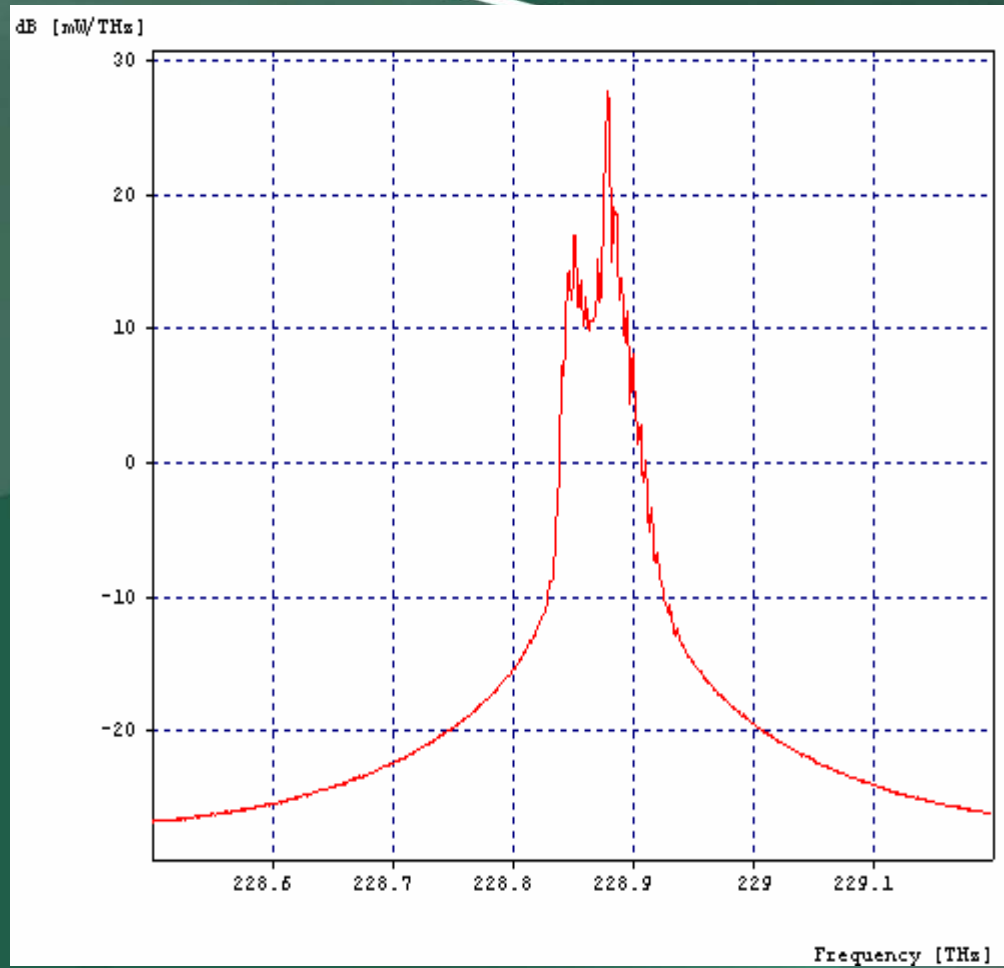


- Peak Frequency = 229.644 THz [1310nm]
- It can be inferred from the spectrum that spectral width of a FP is quite broad [~1.7 THz]

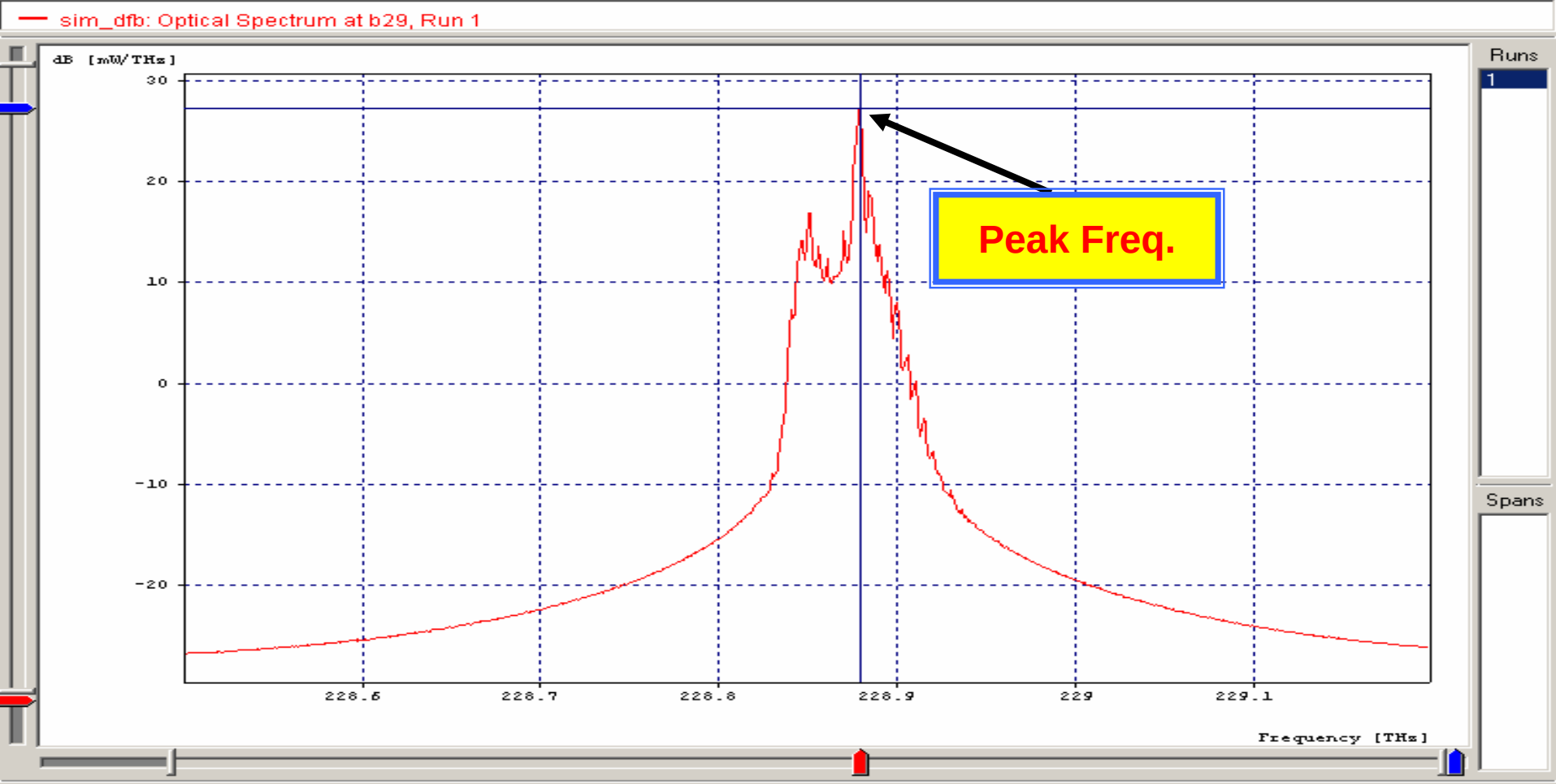
DFB

Source





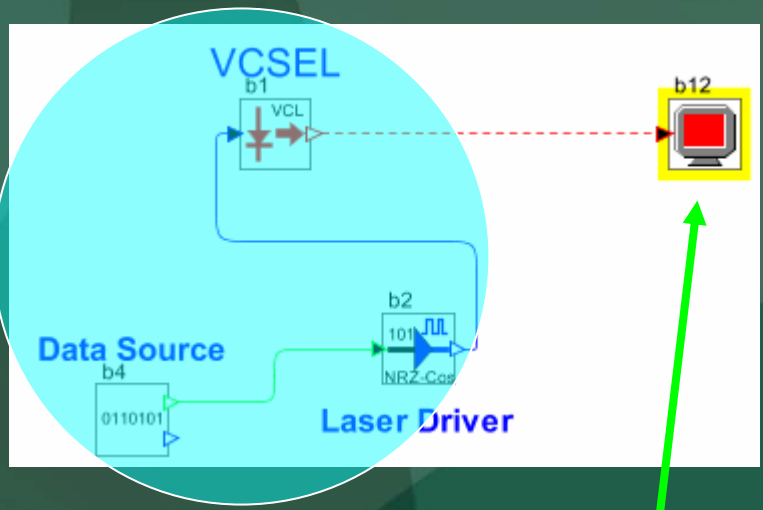
Optical Probe



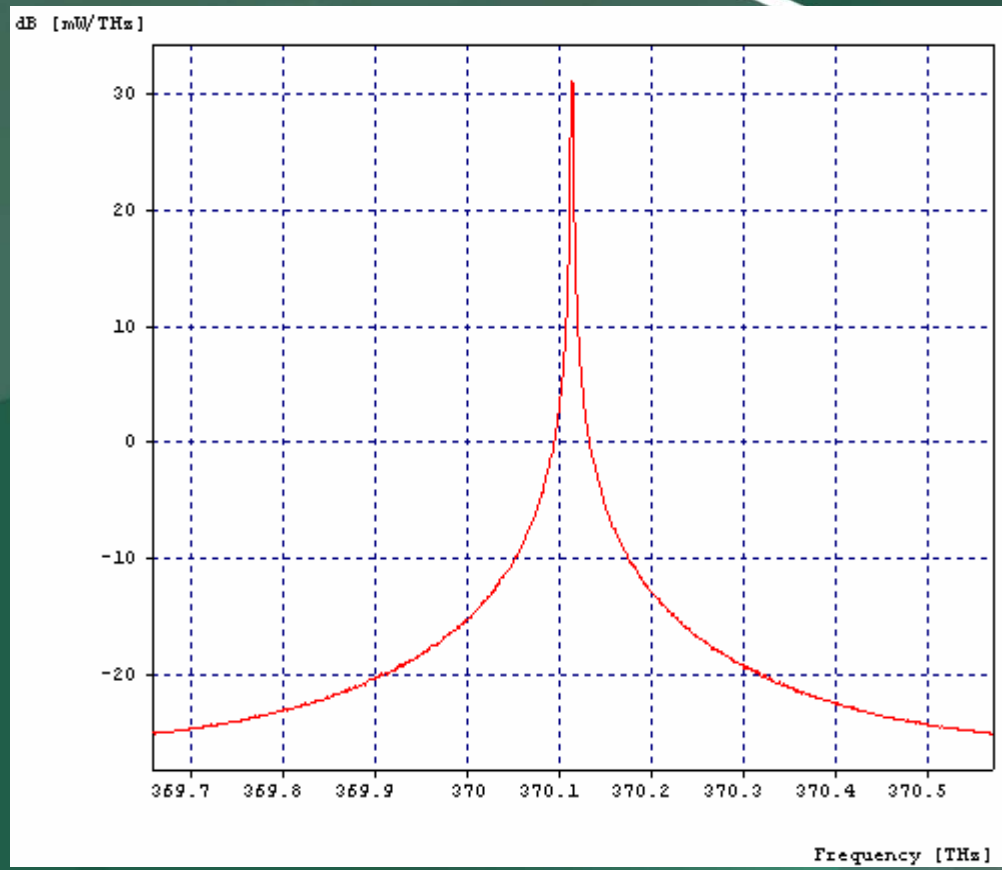
- Peak Frequency = 228.879 THz [1310 nm]
- Line width of a DFB Laser is narrower [~0.07THz]as compared to FP Laser which makes it suitable for long haul communications

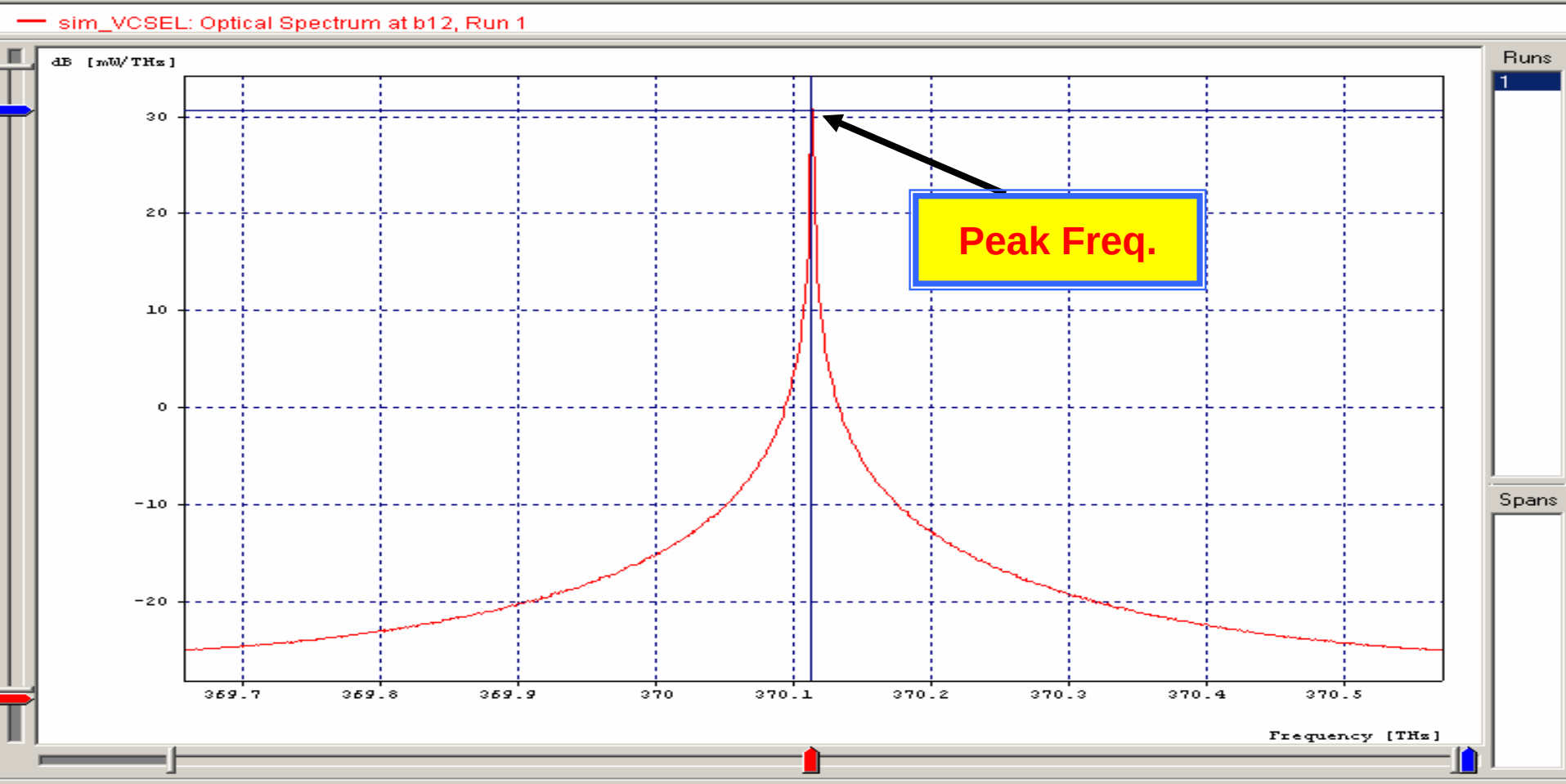
VCSEL

Source



Optical Probe





- Peak Frequency = 370.114 THz
- Line width of a VCSEL is better than the two. [~0.04 THz] Because of low power it is suitable for short haul communications

Optsim

Presented by: Fawad Khan

What is Optsim?

Optsim Simulation Software

Used to design and optimize:

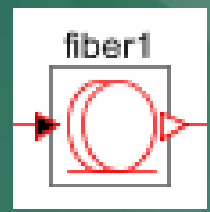
- DWDM and CWDM amplified systems
- FTTX/PON systems
- OTDM systems
- CATV digital/analog systems
- Optical LANs
- Ultra long-haul terrestrial and submarine systems

Motivation

- Since mid-90's, computer simulations have been used to realistically model optical communication systems
- Computer-aided design techniques if used appropriately
  1. optimize entire system
  2. provide optimum values of system parameters
  3. Design goals are met with minimal time and cost
- Commercially available design software packages
  - Optiwave, VPITransmission Maker, Optnet,ZeMax

Optsim Methodology

- Optsim uses block-orientated simulation methodology in which each block models a component or subsystem
- Each block model is presented graphically as an icon, has own set parameters which can be modified by user

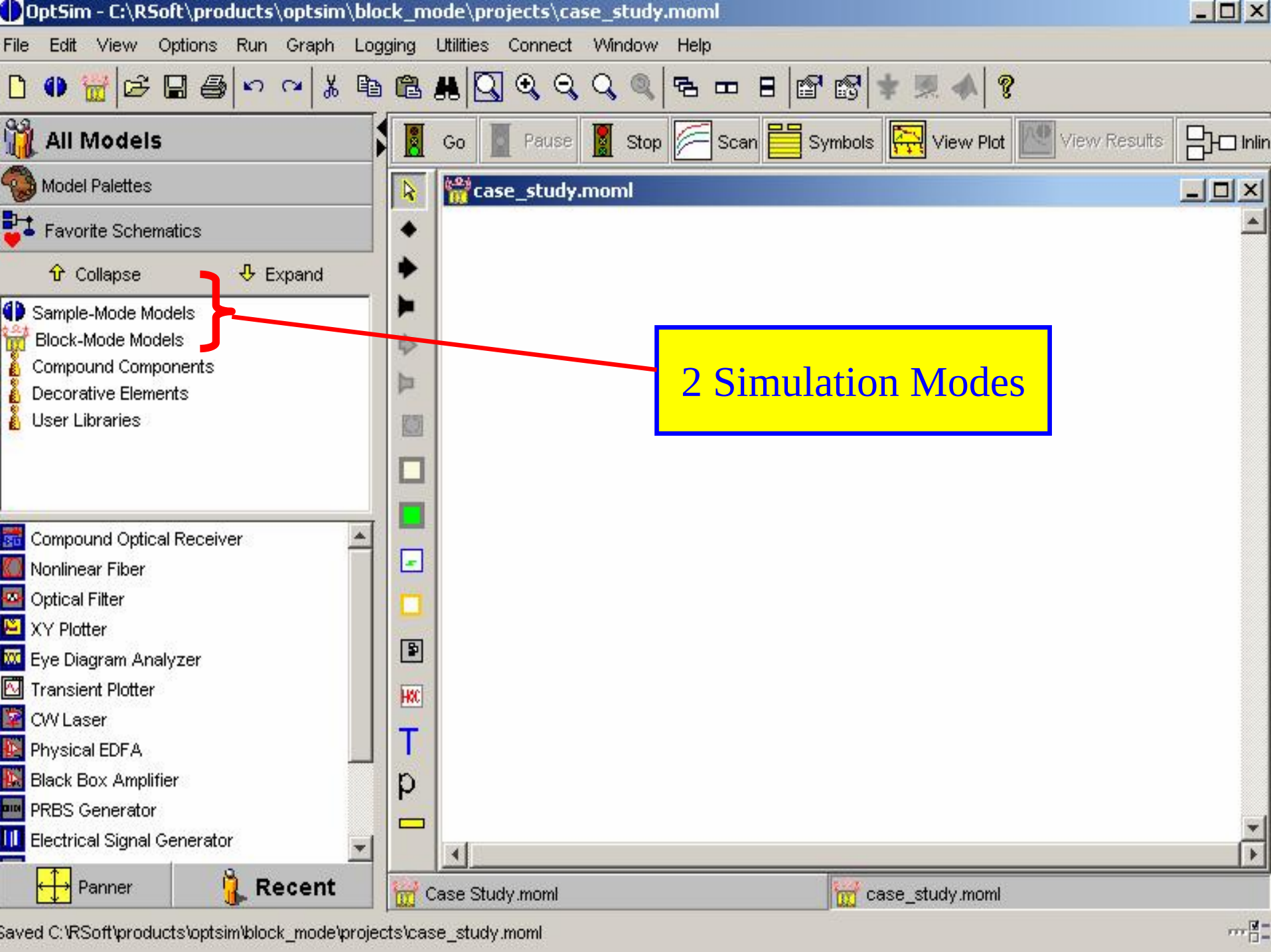


Simulation Approaches

Optsim supports two simulation engines:

1. Block mode simulation engine: signal data is represented as one block of data and is passed between block to block

2. Sample mode simulation engine: signal data is represented as single sample that is passed between block to block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All Models
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Favorite Schematics
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Sample-Mode Models
Block-Mode Models
Compound Components
Decorative Elements
User Libraries
Compound Optical Receiver
Nonlinear Fiber
Optical Filter
XY Plotter
Eye Diagram Analyzer
Transient Plotter
CW Laser
Physical EDFA
Black Box Amplifier
PRBS Generator
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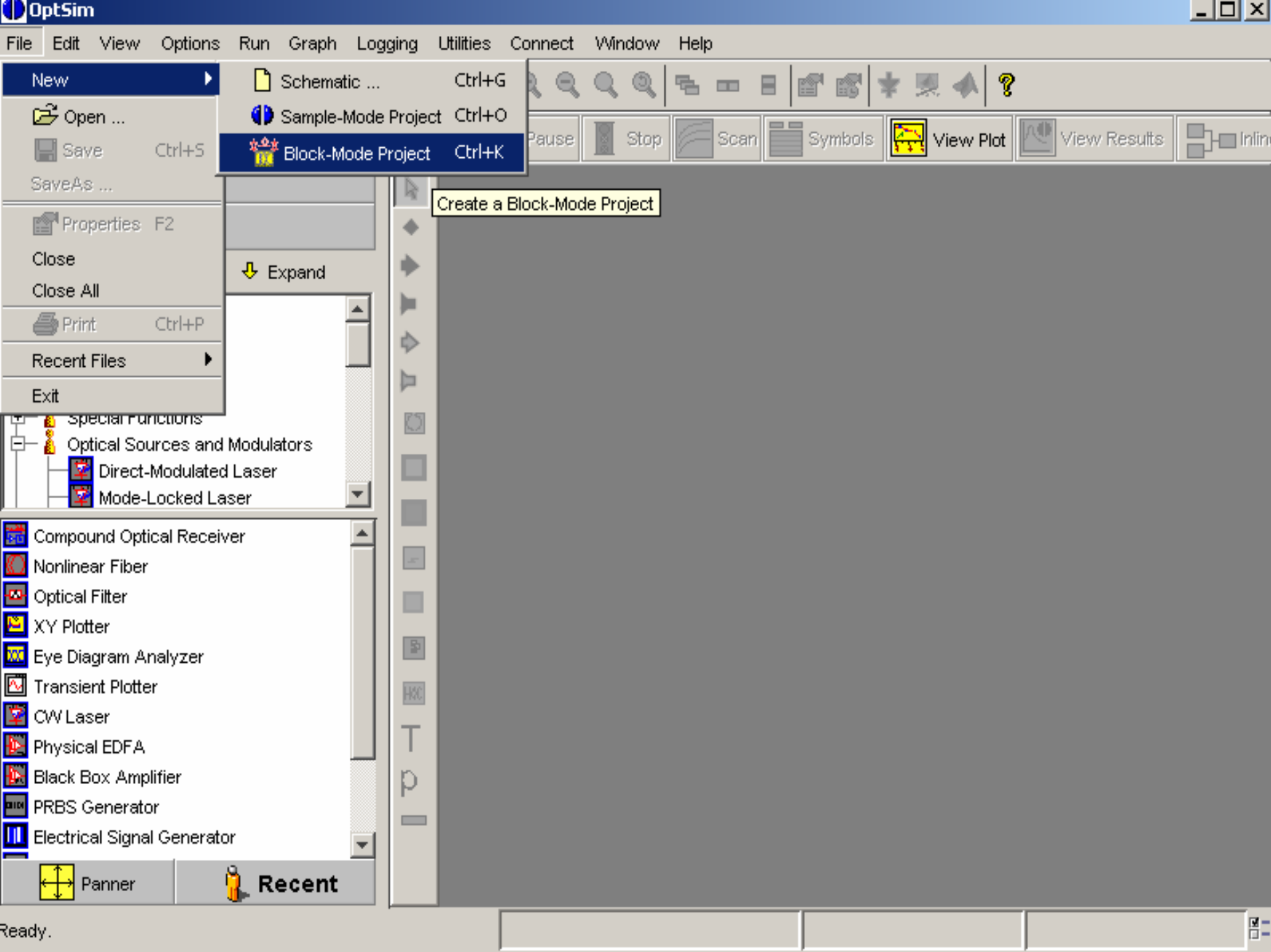
Simulation Steps

Five steps to setting up a simulation of a communication system:

1. Create Optsim project and set simulation parameters (Block mode Vs Sample mode)
2. Draw the schematic diagram
3. Set parameter values of block models
4. Run simulation
5. View results with data display tools


OptSim
File
Edit
View
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Close
Close All
Print Ctrl+P
Recent Files
Exit
Schematic ... Ctrl+G
Sample-Mode Project Ctrl+O
Block-Mode Project Ctrl+K
Create a Block-Mode Project
Pause
Stop
Scan
Symbols
View Plot
View Results
Expand
Optical Sources and Modulators
Direct-Modulated Laser
Mode-Locked Laser
Compound Optical Receiver
Nonlinear Fiber
Optical Filter
XY Plotter
Eye Diagram Analyzer
Transient Plotter
CW Laser
Physical EDFA
Black Box Amplifier
PRBS Generator
Electrical Signal Generator
Panner
Recent
Ready.

Modeling Stages

- Stage 1: General Model (Modeling preliminaries)
- Stage 2: Select optimum parameters (Performance Evaluation)
- Stage 3: See results after simulation (Optsim Validation)

Stage 1 - General Model

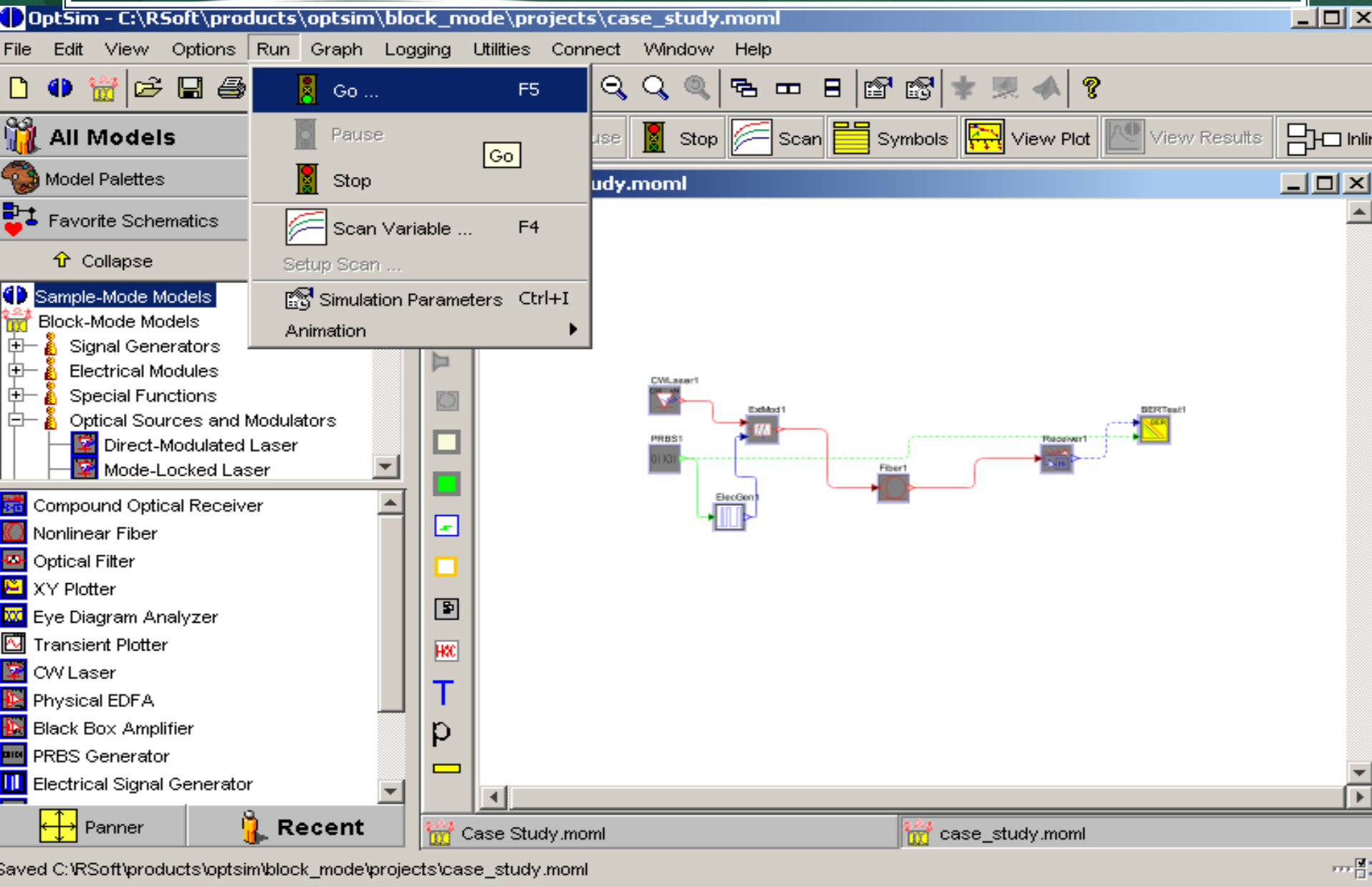
- Design of optical communication systems involves optimizing a large number of parameters such as:
- Transmitters, optical fibers, amplifiers, receivers
- MUX/DEMUX, optical filters,
- Optical cross connects, optical add drop multiplexers etc

Stage 2 - Select Optimum Parameters

- We need to know what type of noise is present and how to eliminate or reduce its impact
- Better SNR (BER) should be accomplished

- Attenuation minima at 1550nm
- Transmitter noise could be handled by using filters
- Quantum noise in case of photodiodes

Running the Simulation



Stage 3 - Optsim Validation

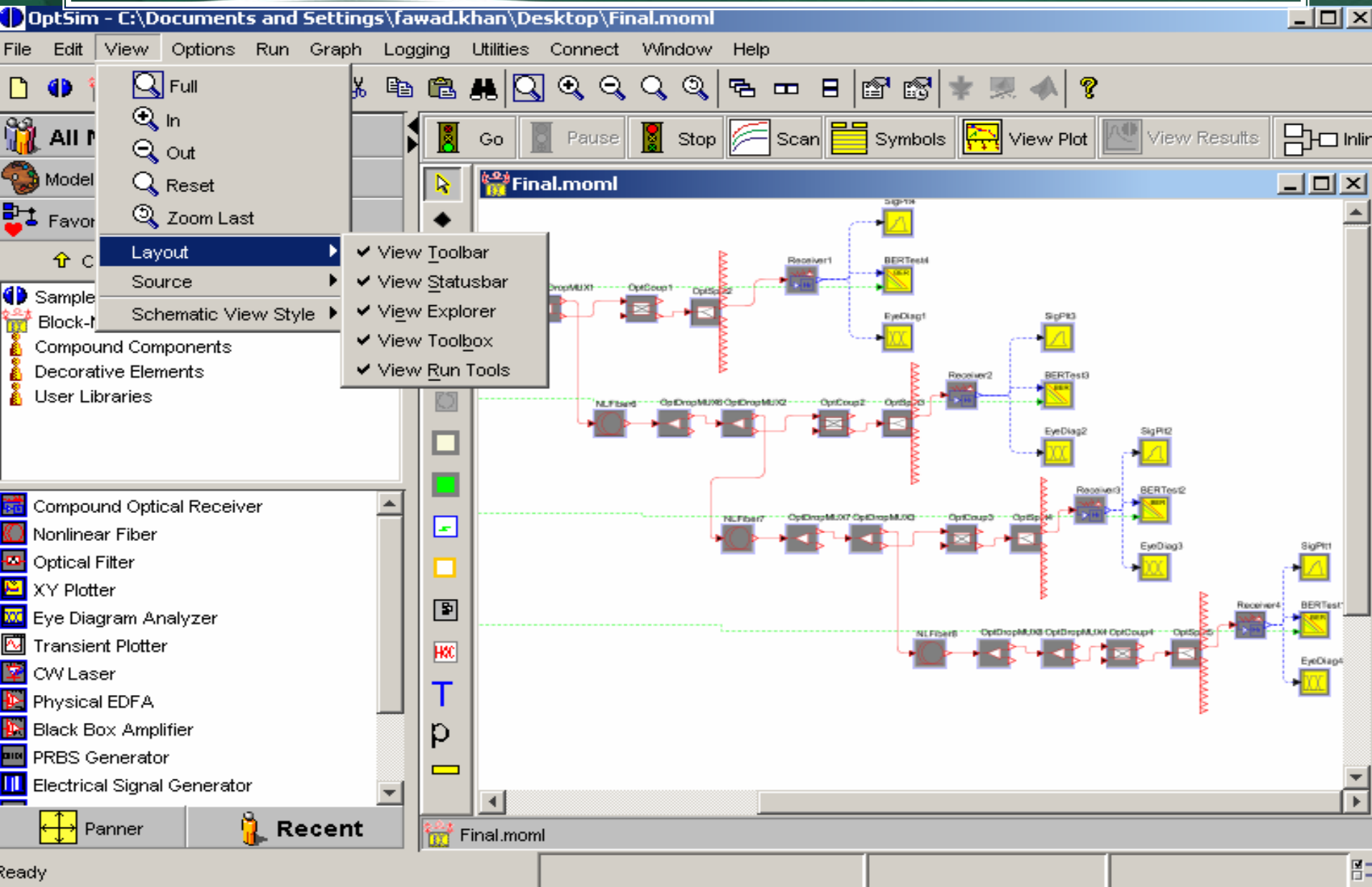
- *OptSim* features performance analysis:
- For example Q value
- BER (Bit error rate)
- Eye opening/closure

- Spectrum Analyzer
- Signal Analyzer
- Multimeter

Analysis Tools

Case Study

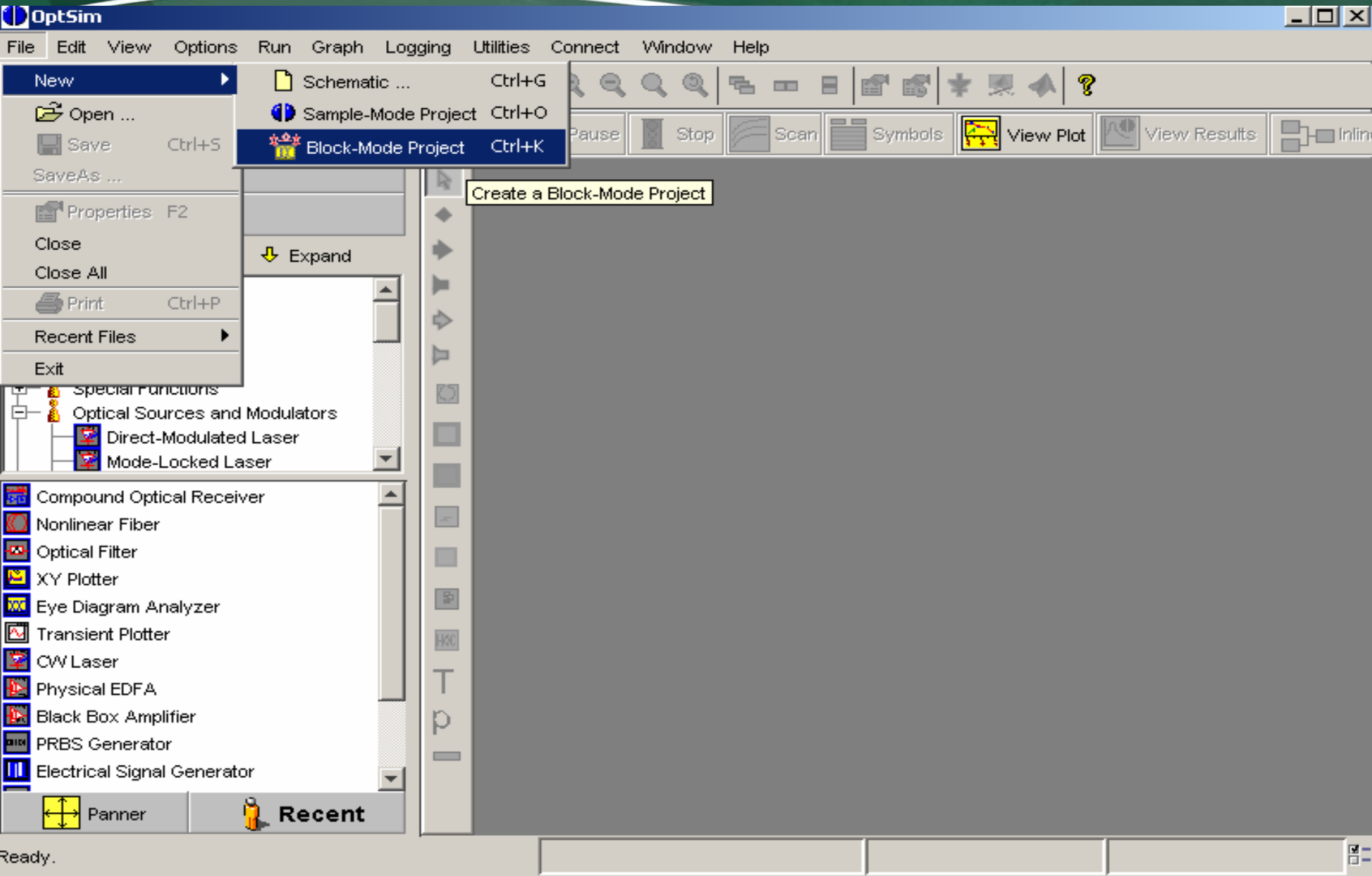
Optsim View Layouts



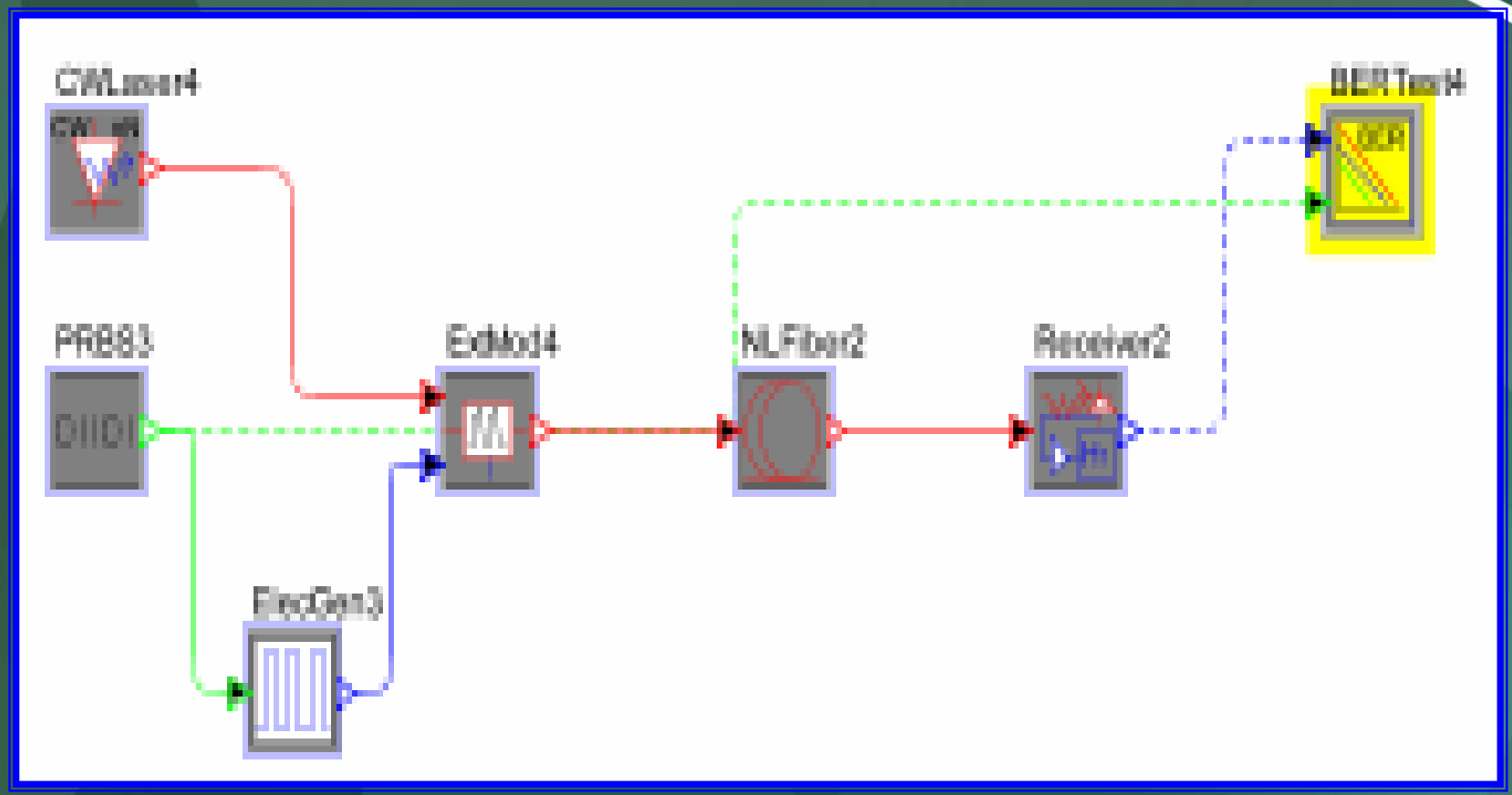
Case Study

- Take the example of a simple transmission system with following specs:
  - Tx (Laser)
  - Modulator
  - Transmission Media (Fiber)
  - Rx (Photodiode)
  - Performance Analyzer Tool (BER Tester)

Step 1:Create Project in Block Mode

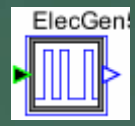


Step 2: Design Model/Schematic

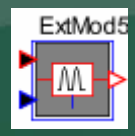


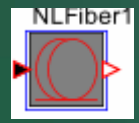
Components

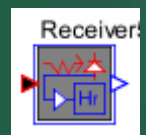
- PRBS Generator
- Electrical Generator
- CW Laser



- External Modulator
- Fiber
- Receiver

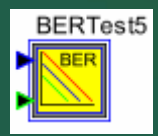






Plotting Components

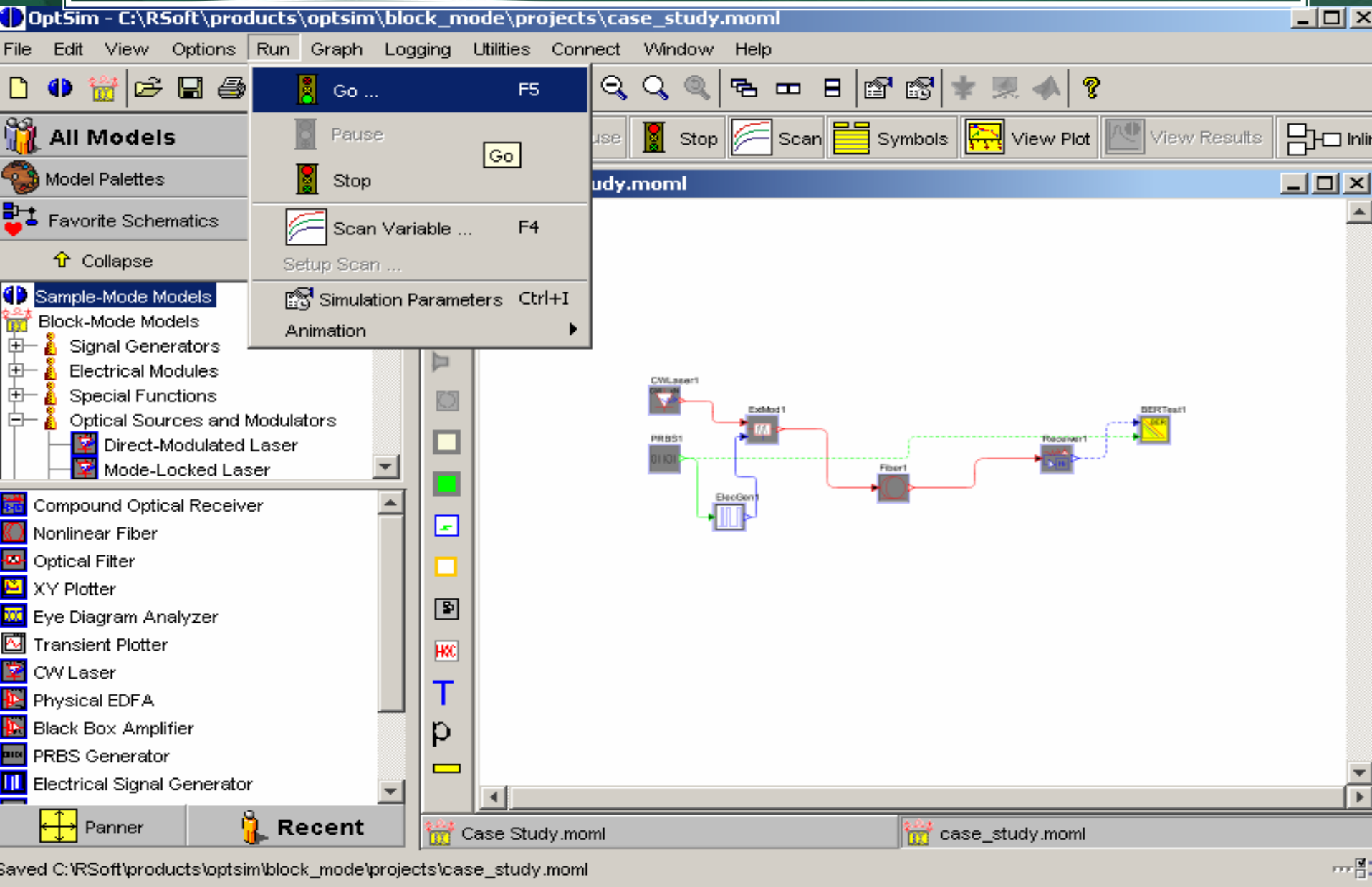
- **BER Tester**



Step 3: Select Parameters

- Laser
  - **Output Power = 4.7 dBm (Approx)**
  - **Wavelength = 1480 nm**
  - **Linewidth = 0.1nm**
- Fiber
  - Length = 10Km
  - Loss / km = 0.25 dB
- Receiver
  - Quantum Efficiency = 0.85

Step 4: Run the Simulation



Step 5: View Results/Validate

RUN#	BER	BER_lo	BER_hi
1	8.8266e-055	1.2298e-059	3.8846e-050

After viewing the output using BER Tester we found out that 8.826e-55 is very good result

Thank You!