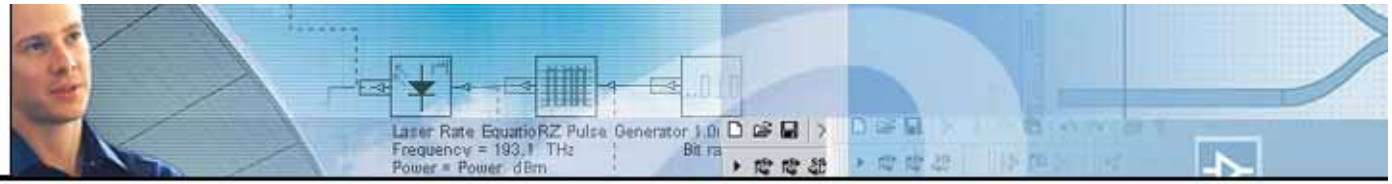
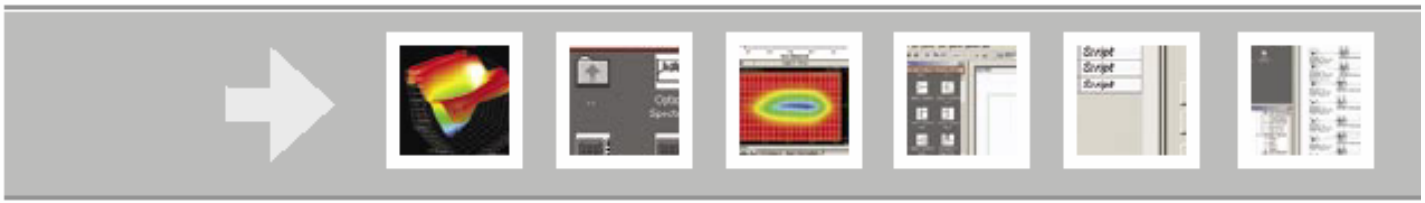
Optiwave

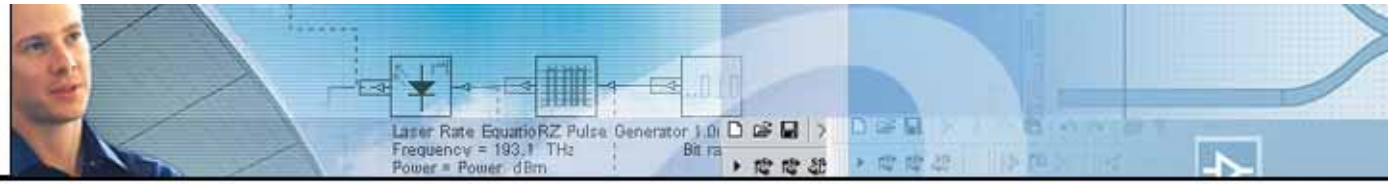


OptiSystem



OptiSystem 3.0

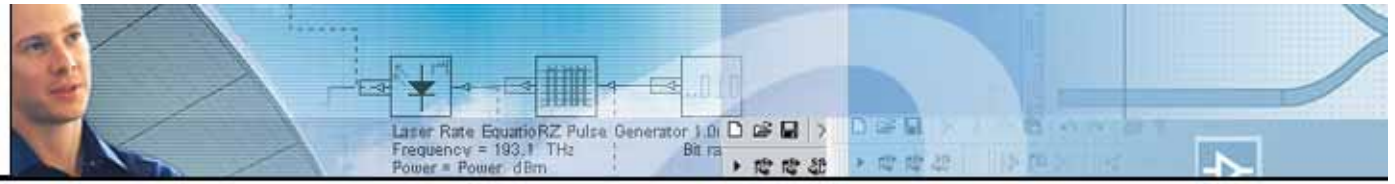
New components and features



概要

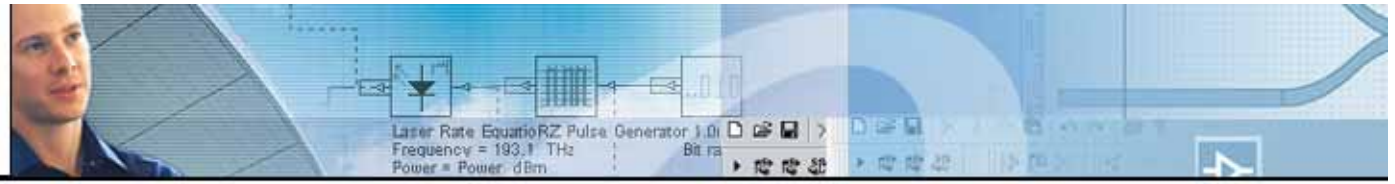
光通信の技術発展動向とユーザニーズに踏まえ、去年11月にリリースされた OptiSystem2.2**に引き続き**OptiSystem3.0**を今年**10**月にリリースします。**

OptiSytem3.0**の素子ライブラリは新しい素子を加え、**287**個と充実され、さらに多数の新機能が追加されます。**



What’s new in OptiSystem 3.0

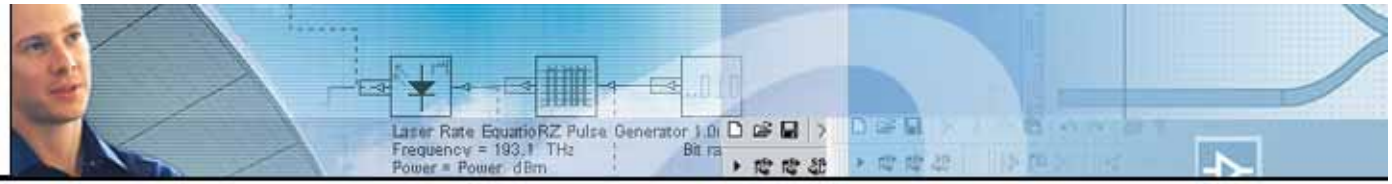
- 新しい素子の追加
- 既存素子の強化
- 機能の追加と強化
- 新しいサンプルの追加
- 既存サンプルの改善



新しい素子 (1)

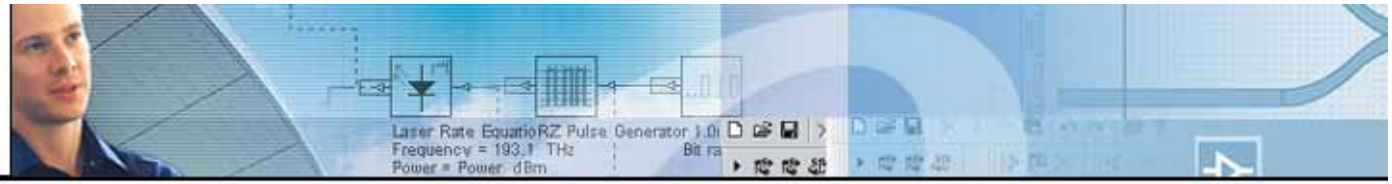
- Optical Transmitters
  - -- WDM Transmitter
- Optical Sources
  - -- CW Laser Array ES
- Optical Pulse
  - -- TRC Measurement Data
- Multiplexers/Demultiplexers
  - -- WDM Mux ES
  - -- WDM Demux ES
- Optical Fibers
  - -- Improved Optical Fiber
- Optical Amplifiers
  - -- Er-Yb Codoped Waveguide
  - -- Er-Yb Codoped Fiber
  - -- Raman Amplifier - Average Power Model
  - -- Raman Amplifier - Dynamic Model
- Electrical Amplifiers
  - -- AGC Amplifier

注: 下線をついている項目は本資料で紹介するものです。



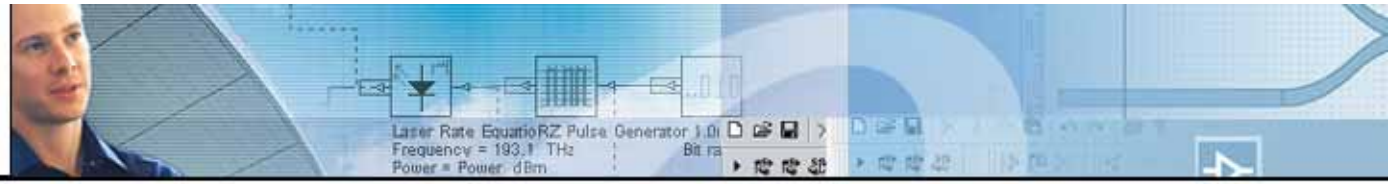
新しい素子 (2)

- Polarization Devices
  - -- PMD Emulator
- Regenerators
  - -- 3R Regenerator
- Optical Signal Processing
  - -- Convert To Parameterized
  - -- Convert To Noise Bins
- Binary Signal Processing
  - -- Duobinary Procoder
- Tools Library
  - -- Limiter
  - -- Initializer
  - -- Electrical Ring Controller
  - -- Command Line Application
- EDA Cosimulation
  - -- Load Spice CSDF File
  - -- Save Spice Stimulus File
  - -- Triggered Load Spice CSDF File
  - -- Triggered Save Spice CSDF File



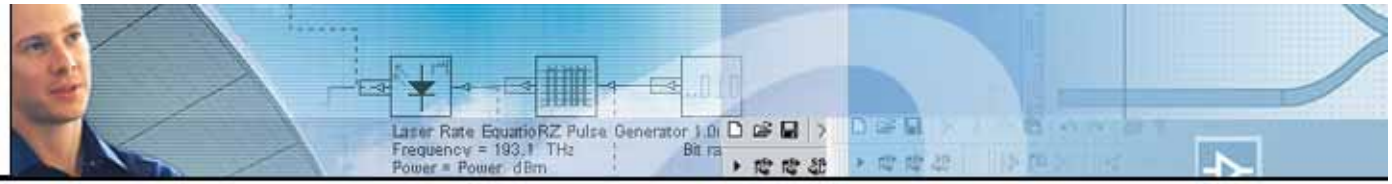
強化された素子 (1)

- Optical Sources
  -- Laser Rate Equations
- Optical Sources
  -- Laser Measured
- Optical Modulators
  -- Signal Drive Mach-Zehnder Modulator Measured
  -- Dual Drive Mach-Zehnder Modulator Measured
  -- Dual Port Dual Drive Mach-Zehnder Modulator Measured
- Optical Modulators
  -- Electroabsorption Modulator Measured
- Optical Fibers
  -- Linear Multimode Fiber
- Optical Amplifiers
  -- EDF Dynamic Analytical
- Electrical Amplifiers
  -- Limiting Amplifier
- Regenerators
  -- Data Recovery
- Matlab library
  -- MATLAB Component



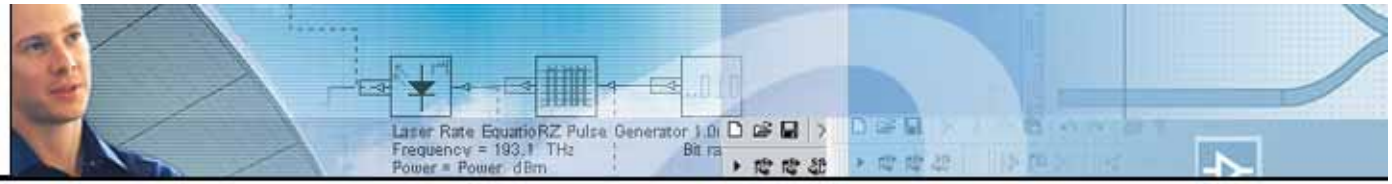
強化された素子 (2)

- Visualizers
  - -- BER Analyzer
  - -- WDM Analyzer
  - -- Dual Port WDM Analyzer



新機能・強化された機能 (1)

- Signal Tracing
  - -- Improved signal tracing algorithm
- Optimizations
  - -- Multiple Parameters Multiple Result Optimizations (MPO)
  - -- Signal Parameter Signal Result Optimization
- Project Browser
  - -- Customized tree control
  - -- Search Engine
  - -- Sorting of Layout information
  - -- Second column for user selected data
  - -- Display filters
- Script Page
  - -- COM Technology
  - -- Standardization
  - -- Automatic Script Generation
  - -- Script editor
  - -- Full automation of OptiSystem
  - -- Optimizations
- Calculation Schedulers
- Bill of Materials



新機能･強化された機能 (2)

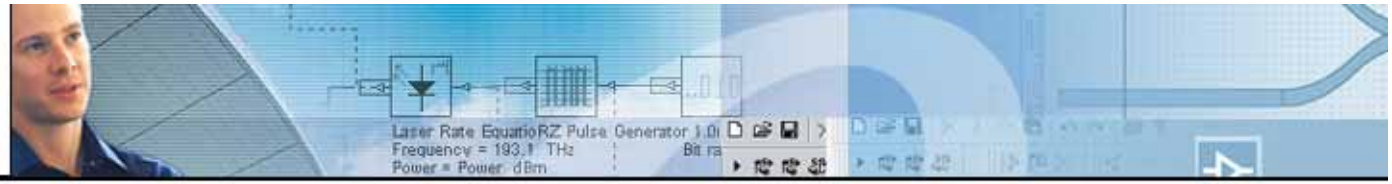
– Report Page

主な機能

-- Customization
-- Dynamic update after simulation
-- Templates (Pre-formatted layouts)
-- Full Printing and Print Preview Functionality
-- Multiple Page Reports
-- Editing and viewing standard features
-- HTML export
-- Project Browser integration

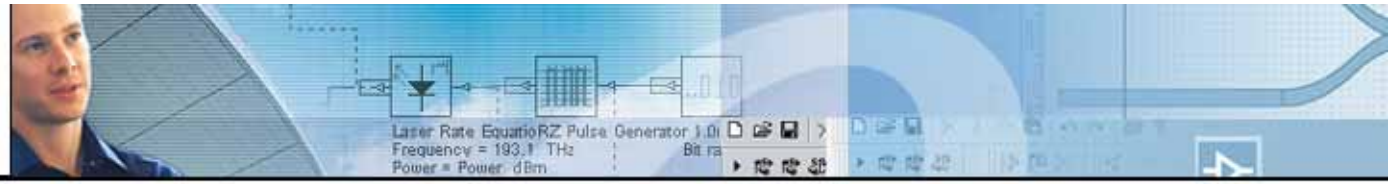
リポート内容

-- 2D Graph Control
-- 3D Graph
-- Grid Control
-- Rich Text Control



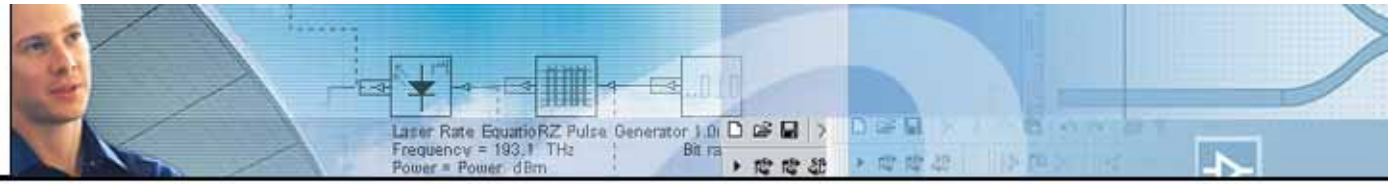
新しいサンプル (1)

- Optical transmitters
  - -- LED Modulation response
  - -- Laser L-I curve
  - -- Semiconductor Laser Modulation response
  - -- Semiconductor Laser Large Signal Modulation
- Modulators
  - -- Chirp in Mach-Zehnder Lithium Niobate Modulators
- New Optical Fiber Model
  - -- Polarization mode dispersion
  - -- SPM induced spectral broadening
  - -- Combined effects of GVD and SPM：Modulation instability
  - -- Cross-phase modulation effect
  - -- Four-wave mixing effect
  - -- Raman amplification: scalar and vector one
- New PMD emulator component
  - -- Effects of PMD on pulse propagation



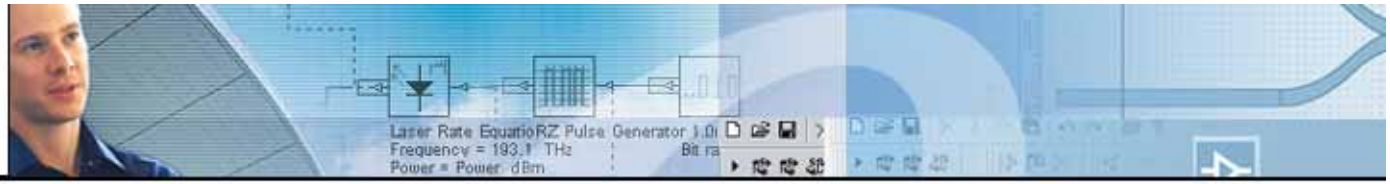
新しいサンプル (2)

- New EDFA component
  - -- Gain and noise characteristics of EDFA
  - -- Excited state absorption impact on the EDFA performance
  - -- Lon-ion interaction effects
  - -- Rayleigh backscattering in EDFA
  - -- Inhomogeneous broadening
  - -- Temperature dependence of the gain
  - -- Transients in EDFA
  - New Raman average power model, steady state and dynamic models
    - -- Raman threshold calculation
    - -- 100 nm bandwidth flatten – gain Raman amplifier – Average power model
    - -- Raman amplifier - Dynamic model
    - -- Raman amplifier - Steady state model
    - -- Gain in Raman Fiber Amplifiers
    - -- Flattening the gain of broad band Raman amplifier
    - -- Optimizing the pump powers and frequencies of Raman amplifier



新しいサンプル (3)

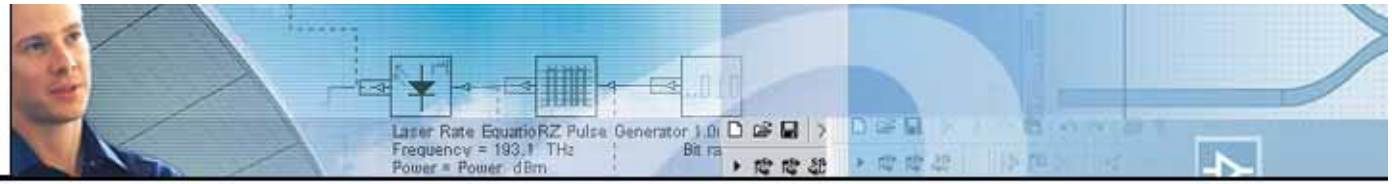
- New wave guide amplifier model
  - -- Improved gain characteristics in high-concentration Er3+/Yb3+ co-doped glass waveguide amplifiers
- Dispersion compensation and Cosimulation with OptiGrating
  - -- Compensation of dispersion - ideal dispersion compensation
  - -- Compensation of dispersion - Fiber Bragg Grating
  - -- Compensation of dispersion with OptiGrating
- Soliton effects
  - -- Birefringence and solitons
  - -- Soliton iterations
  - -- Decay of higher order solitons in the presence of the third-order of dispersion
  - -- Decay of higher order solitons in the presence of intrapulse Raman scattering
  - -- Decay of higher order solitons in the presence of self-steepening
- Multi-parameter optimization Engines
  - -- Extracting the thermal noise parameter for specific receiver sensitivity
  - -- Optimizing the EDFA gain for WDM lightwave systems
- Matlab component
  - -- Amplitude modulator
  - -- Designing a Visualizer using the Matlab Component



改善されたサンプル

- System modeling
  - -- Dispersion compensation schemes - a system perspective
  - -- Comparison of RZ and NRZ modulation formats for 16/32 channels
  - -- WDM 40 Gb/s transmission systems
  - -- Engineering the fiber nonlinearities and dispersion
- Optically “transparent” networks
  - -- Power level management in optical metro networks
  - -- Migrating to 10 Gb/s in Metro Networks
  - -- Negative Dispersion Fiber for Metro Networks
  - -- Interchannel Crosstalk in Metro Networks
  - -- WDM Ring - Wavelength Independent Subscriber Equipment

注: 下線をついている項目は本資料で紹介するものです。



EDA Cosimulation

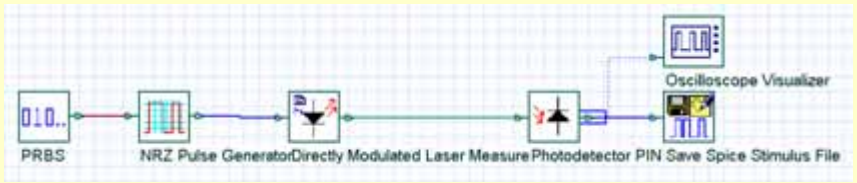
-- Load Spice CSDF File

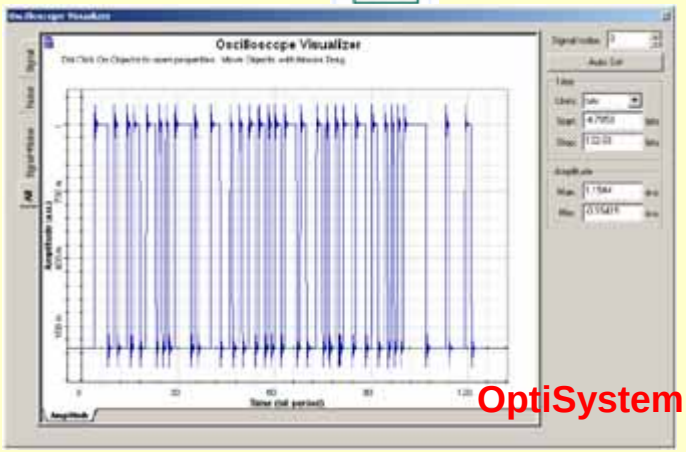
-- Save Spice Stimulus File

-- Triggered Load Spice CSDF File

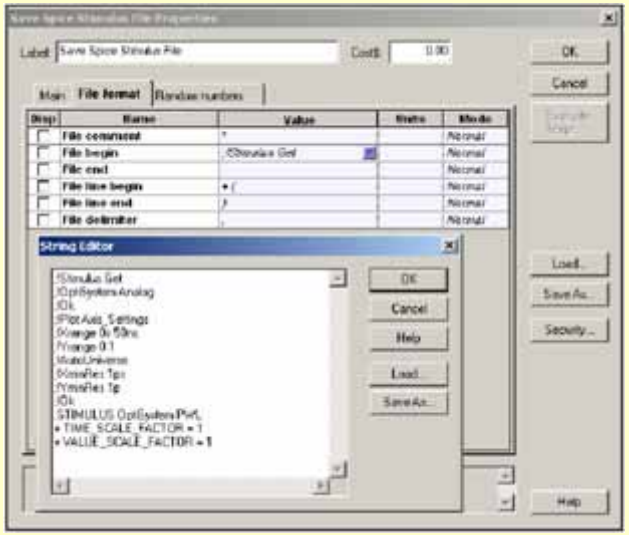
-- Triggered Save Spice CSDF File

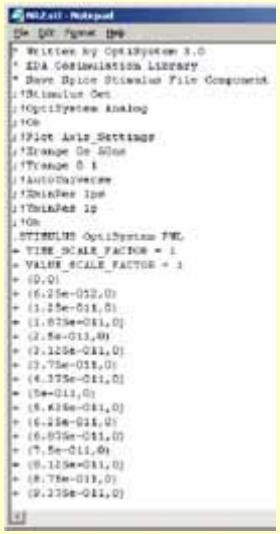
Save Spice SCDF Fileの使用例

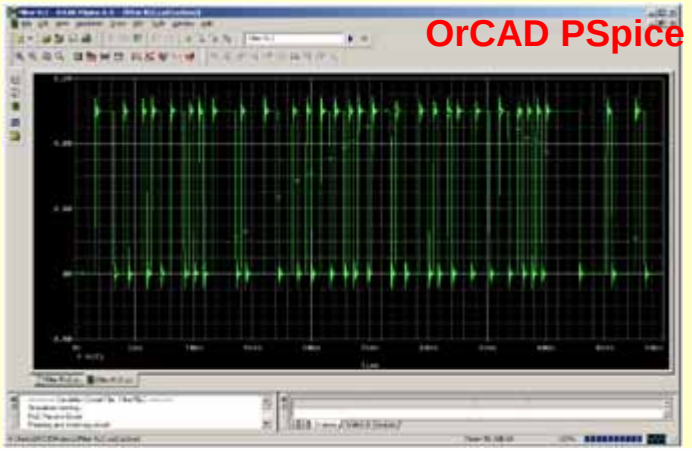




OptiSystem

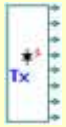


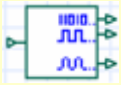




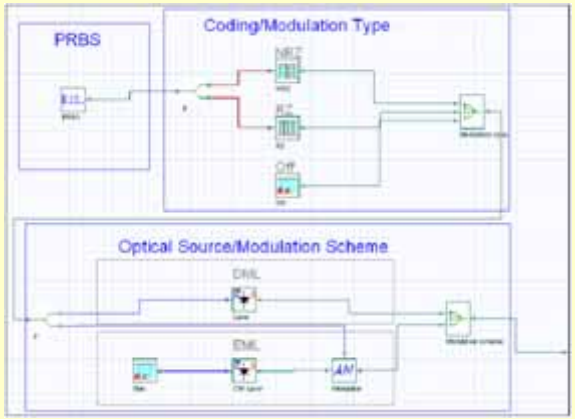
OrCAD PSpice

WDM TransmitterとRegenerator

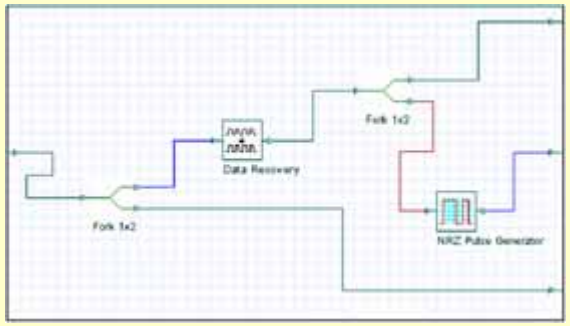
-- WDM Transmitter 

-- 3R Regenerator 

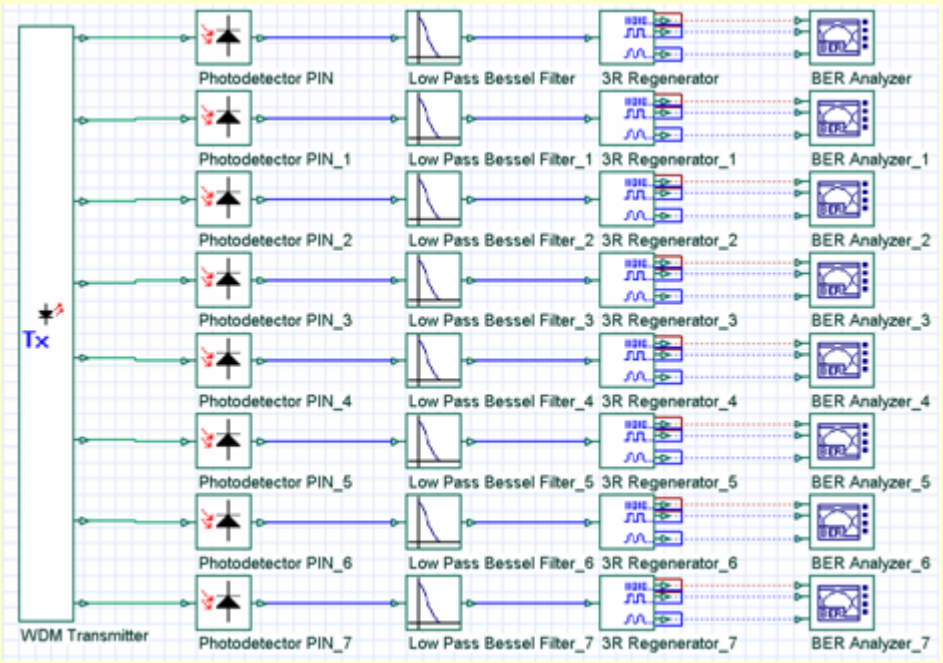
WDM Transmitterの内部構造 (1チャネル)



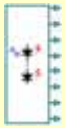
3R Regeneratorの内部構造

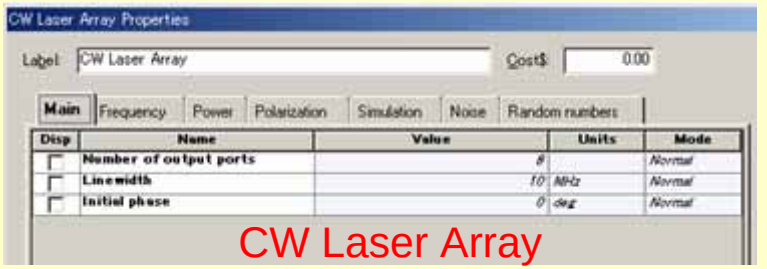


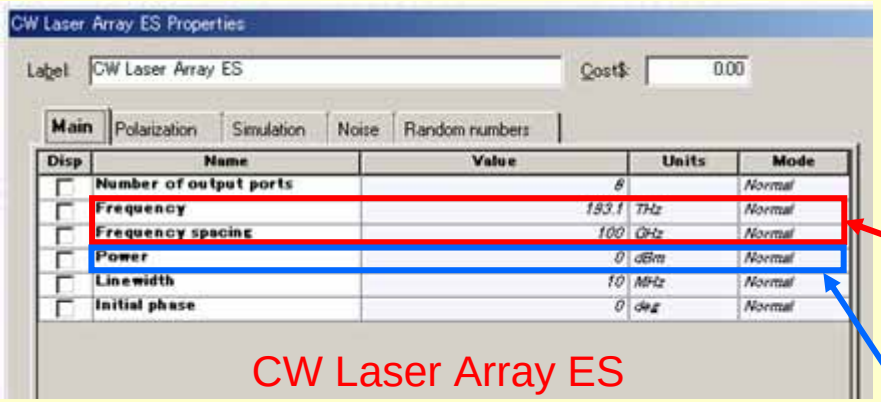
3R RegeneratorによるBER Analyzerの利用

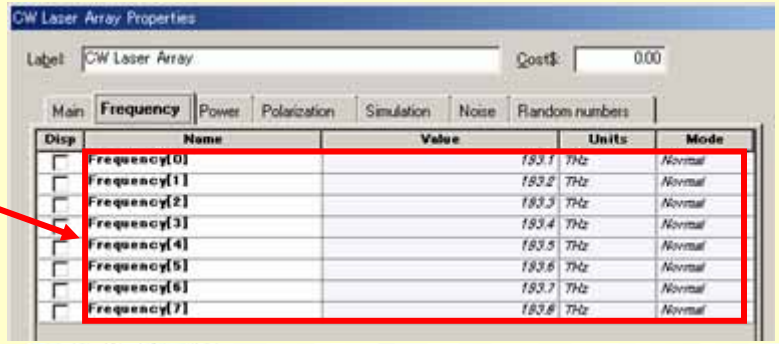


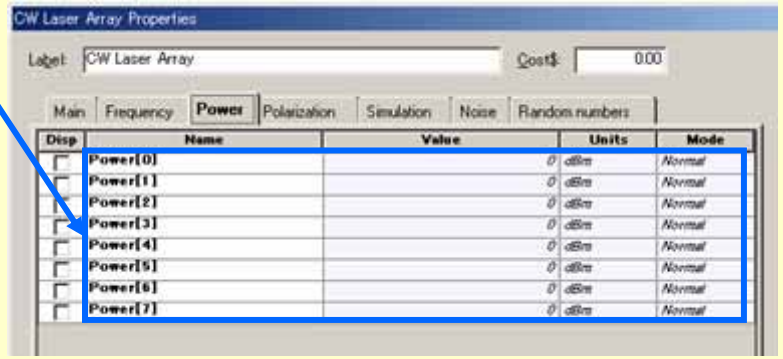
CW Laser Array ES

-- CW Laser Array ES 





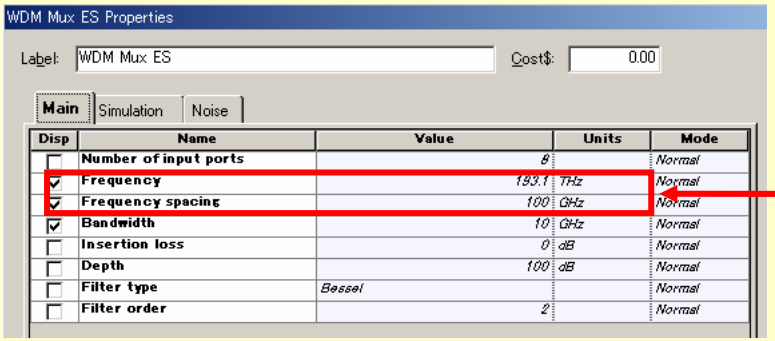




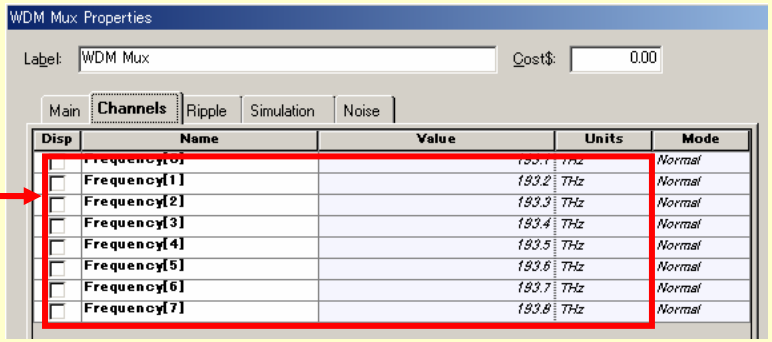
WDM Mux ES
WDM Demux ES

-- WDM Mux ES 

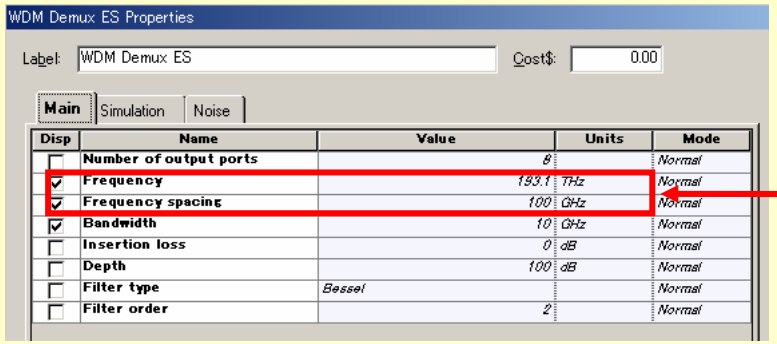
-- WDM Demux ES 



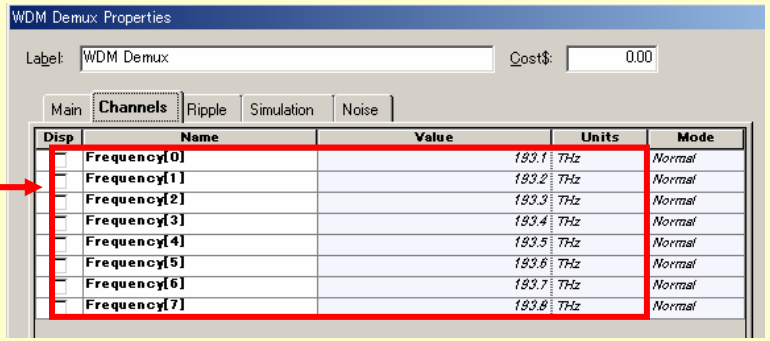
WDM Mux ES



WDM Mux



WDM Demux ES



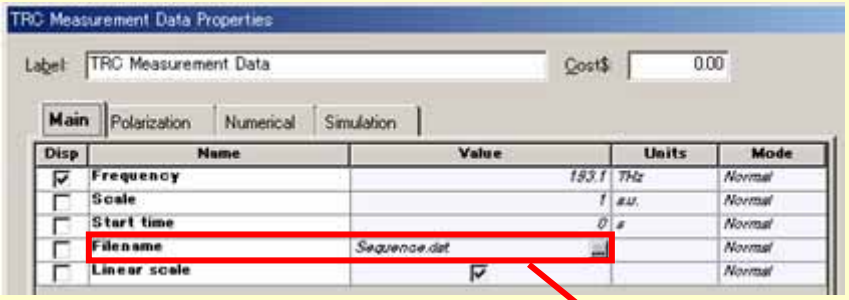
WDM Demux

TRC Measurement Data

-- TRC Measurement Data 

注:
TRC – Time Resolve Chirp

TRC Measurement Dataの設定画面

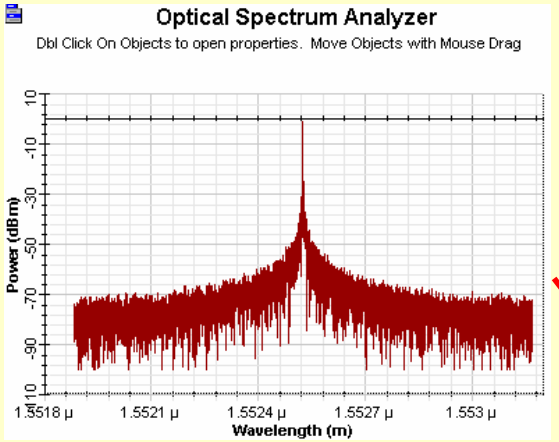


TRCのデータフォーマット

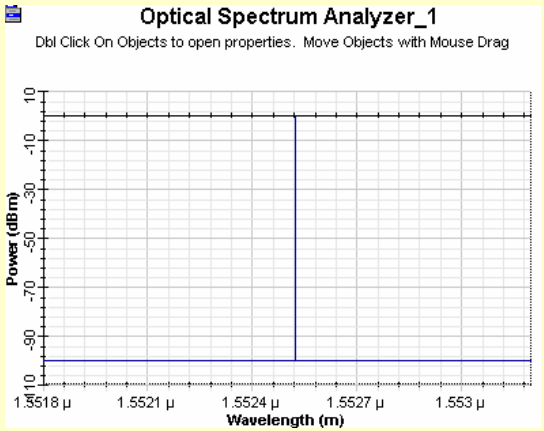
Time	Signal power (W or dBm)	Signal chirp
0	1.27617e-006	-7.80425e+009
6.25e-012	1.139e-006	-4.94806e+009
1.25e-011	1.46161e-006	-6.57706e+009
1.875e-011	1.33136e-006	-6.10874e+009
2.5e-011	1.54705e-006	-2.89844e+009
3.125e-011	1.03595e-006	-7.38826e+009
...	...	...

Convert To Parameterized Component
Convert To Noise Bins Component

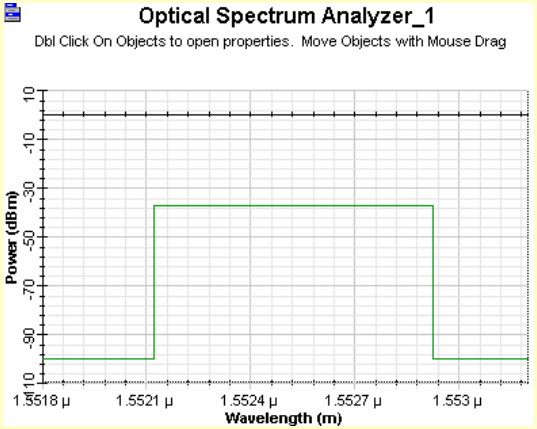
-- **Convert To Parameterized Component**  -- **Convert To Noise Bins Component** 



Convert To Parameterized



Convert To Noise Bins

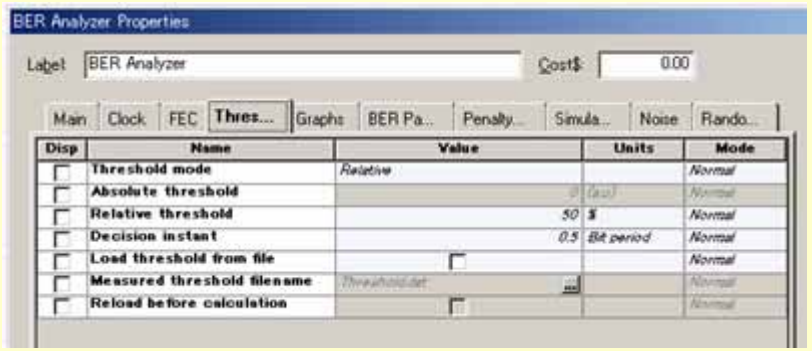


BER Analyzer

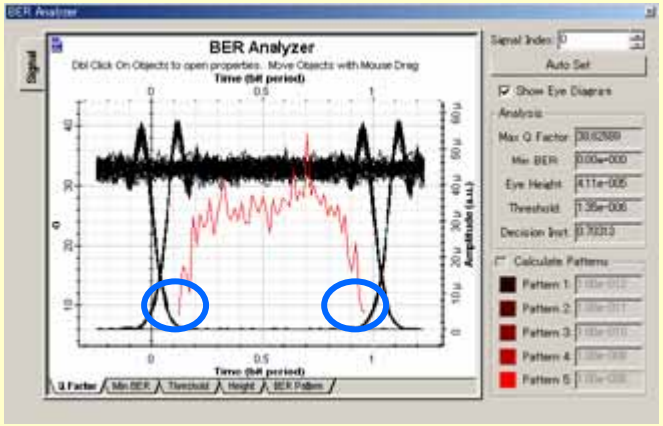
-- BER Analyzer 

ユーザ定義しきい値機能の追加
計算範囲の定義

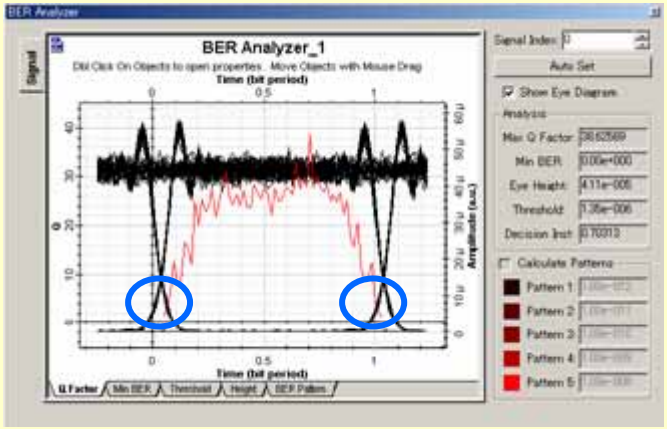
BER Analyzerのしきい値の設定画面



従来のもの（計算範囲の自動設定）



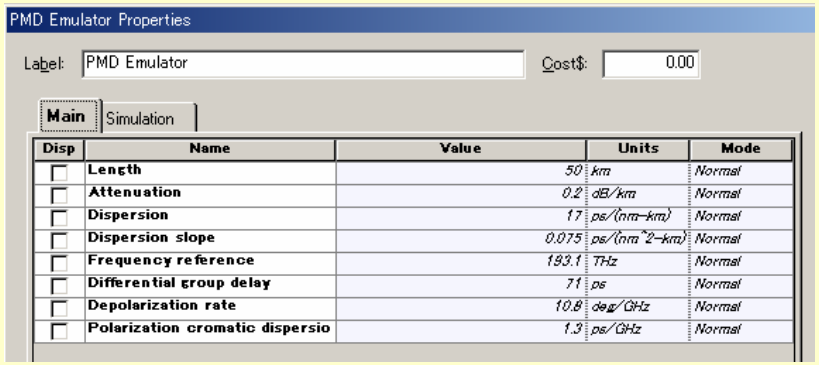
新しいもの（計算範囲を結果に合わせて設定）

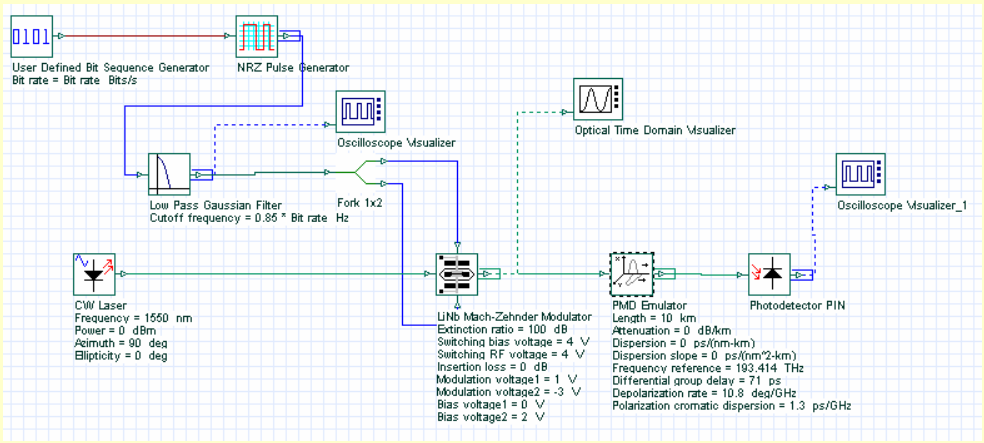


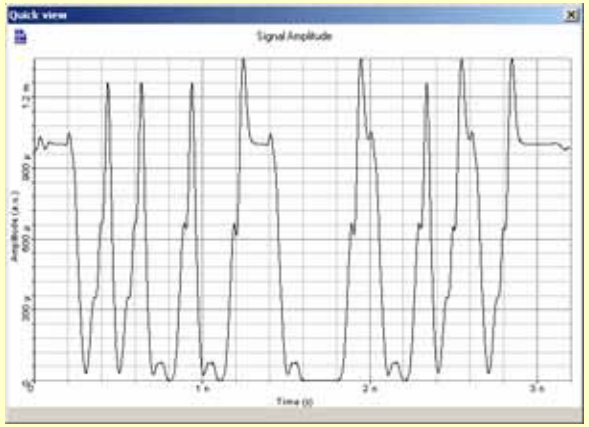
PMD Emulator

-- PMD Emulator 

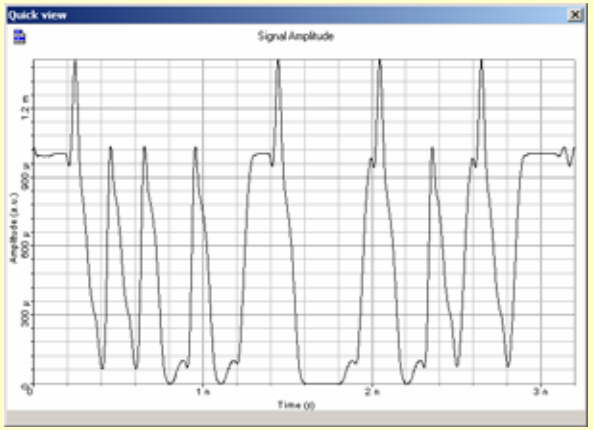
-- 1次、2次PMD計算できます。





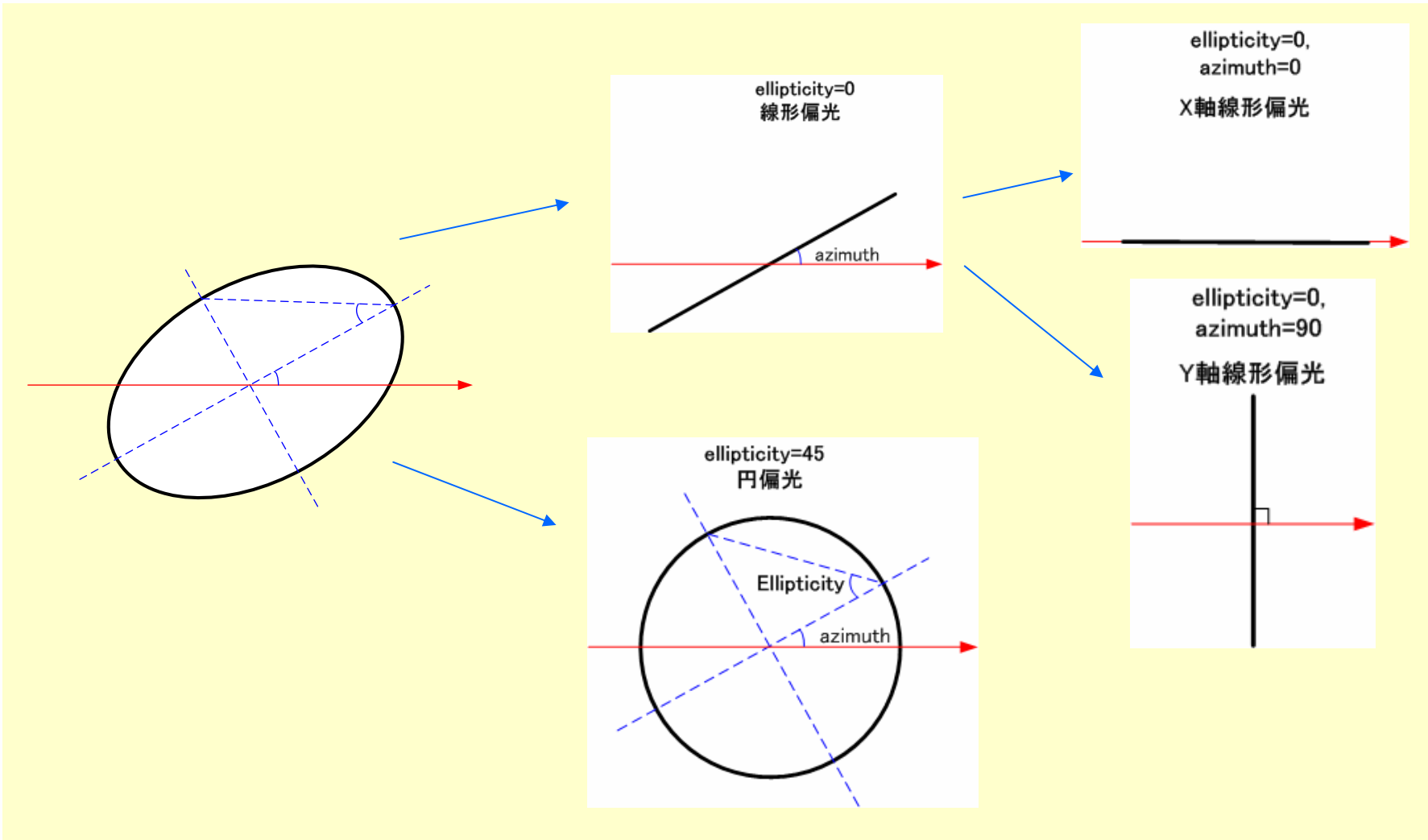


azimuth = 0deg, ellipticity = 0deg.



azimuth = 90deg, ellipticity = 0deg.

偏波の補足説明

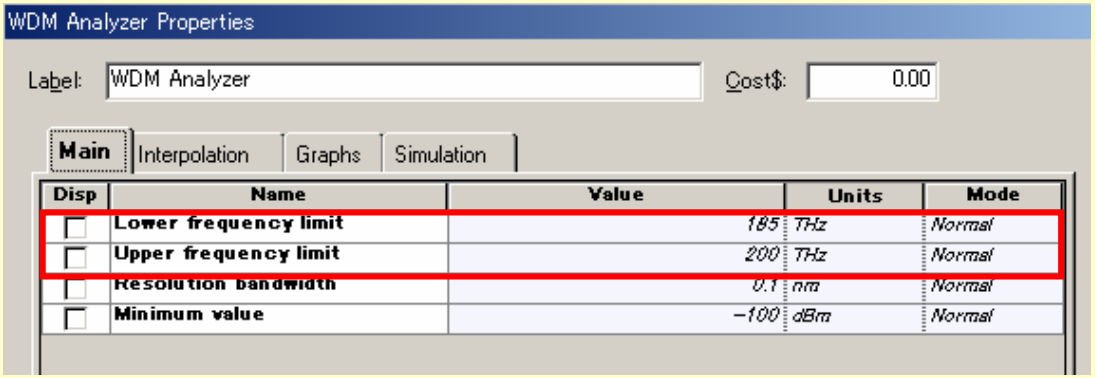

ellipticity=0
線形偏光
azimuth
ellipticity=0,
azimuth=0
X軸線形偏光
ellipticity=0,
azimuth=90
Y軸線形偏光
ellipticity=45
円偏光
Ellipticity
azimuth

WDM Analyzer
Dual Port WDM Analyzer

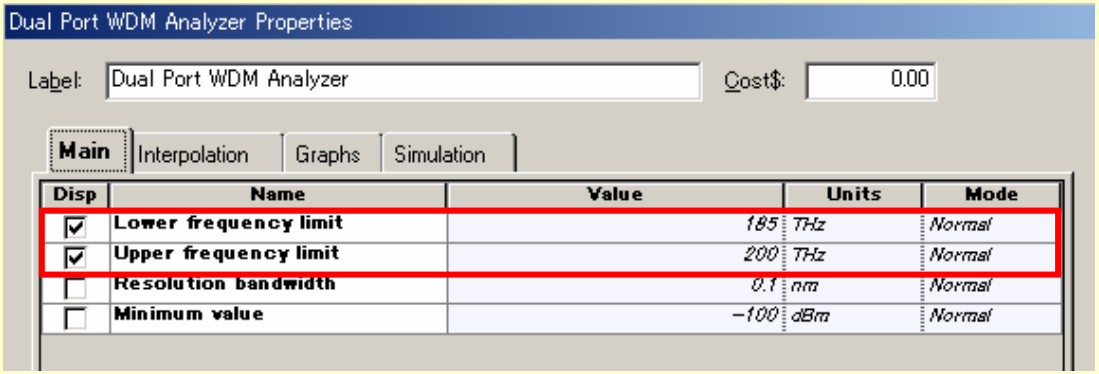
-- WDM Analyzer 

-- Dual Port WDM Analyzer 

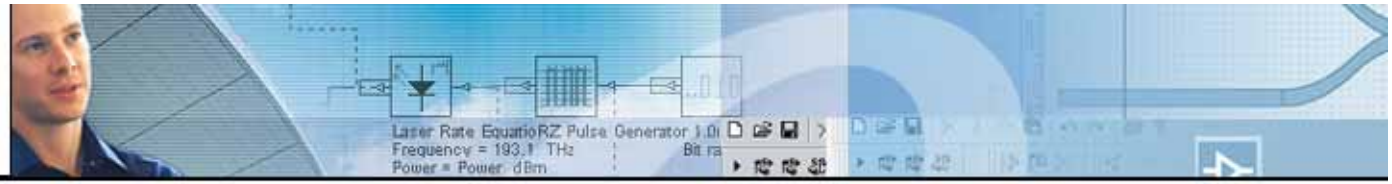
計算の周波数･波長の範囲の指定は可能になりました。



WDM Analyzer



Dual Port WDM Analyzer



MATLAB Component

-- Matlab Component 

-- OptiSystemとMATLAB間リンクする光信号データにチャンネルの波長情報の追加
-- MATLAB素子計算後MATLABを閉じるかの選択機能
-- MATLAB素子計算中エラーが出た場合、ソースプログラム (mフィル) に問題がある場所を示す機能

OptiSystem3.0	
TypeSignal	Optical
Sampled	[struct]
Parameterized	[struct]
Noise	[struct]
Channels	[channels array]

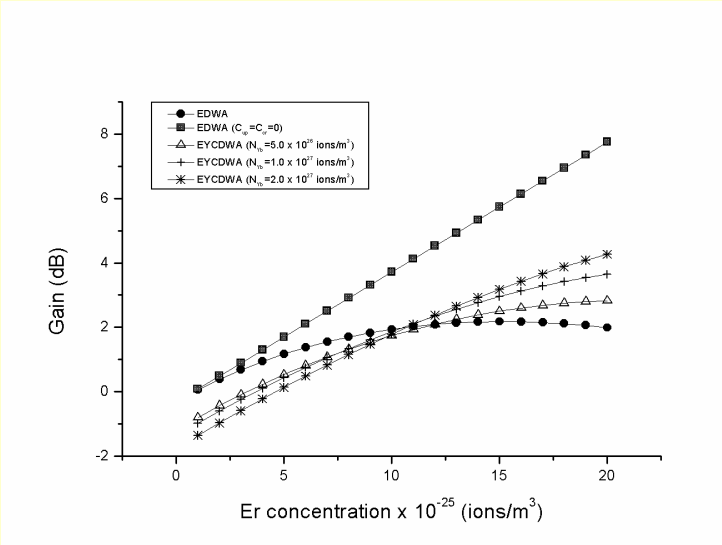
OptiSystem2.0	
TypeSignal	Optical
Sampled	[struct]
Parameterized	[struct]
Noise	[struct]

```
* Calculation started! *
Calculating Project:Project1, Layout:Layout 1, Sweep 1 of 1
Calculating WDM Transmitter...
WDM Transmitter... Completed successfully.
Calculating WDM Mux 8x1...
WDM Mux 8x1... Completed successfully.
Calculating MATLAB Component...
Line 2:??? 'InputPort01' は未定義の関数、または変数です。
Warning  while calculating, component  MATLAB Component
Completed successfully.
Calculation warning!
Wrapping up MATLAB Component...
MATLAB Component... Completed successfully.
Wrapping up WDM Transmitter...
WDM Transmitter... Completed successfully.
Wrapping up WDM Mux 8x1...
WDM Mux 8x1... Completed successfully.
Wrapping up Optical Spectrum Analyzer...
Optical Spectrum Analyzer... Completed successfully.
* Calculation finished! *
```

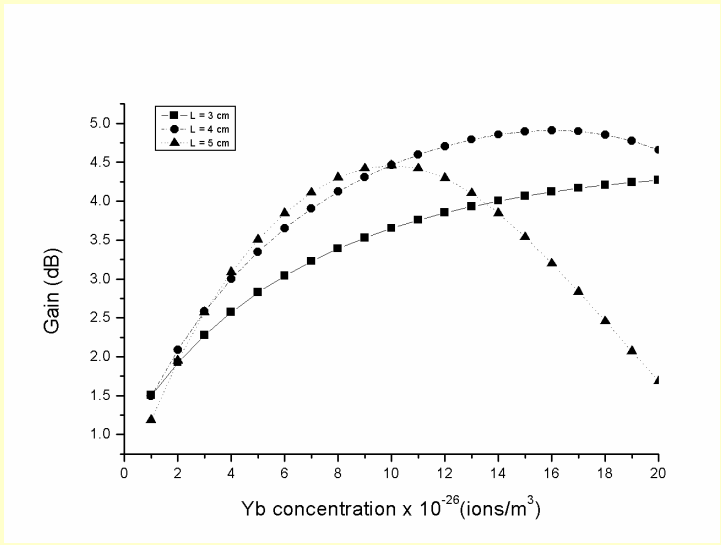
Er-Yb Codoped Waveguide (1)

-- Er-Yb Codoped Waveguide 

-- Er Doped Waveguide Amplifier (EDWA)とEr-Yb Codoped Waveguide Amplifier**両方対応**
-- **基本パラメーターによる物理的なシミュレーション**
-- **任意の空間の屈折率とドーピングプロフィール定義**
-- **モードソルバーを持ちまして励起光、信号光のマルチモード計算**
-- **励起光の**ESA**を考慮**
-- **前方･後方**ASE**を計算**
-- **前方･後方**ASE**や信号、励起光など3次元グラフ表示**



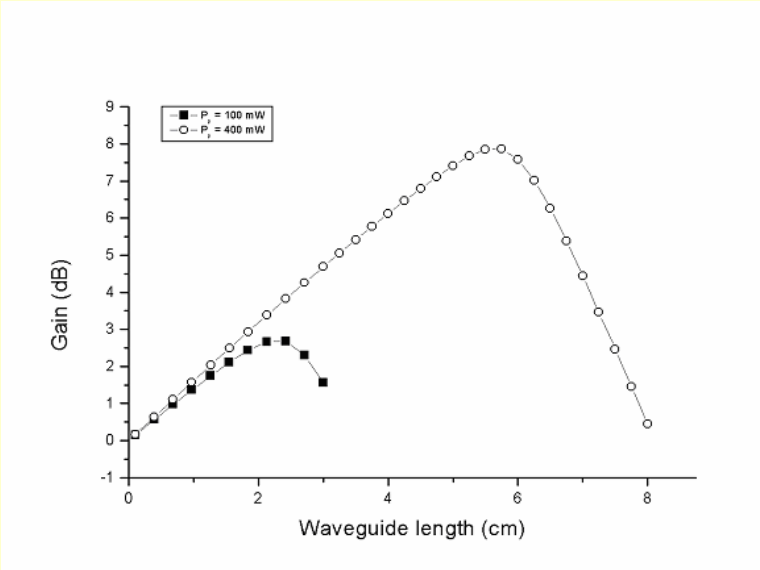
利得 vs. Er**濃度**



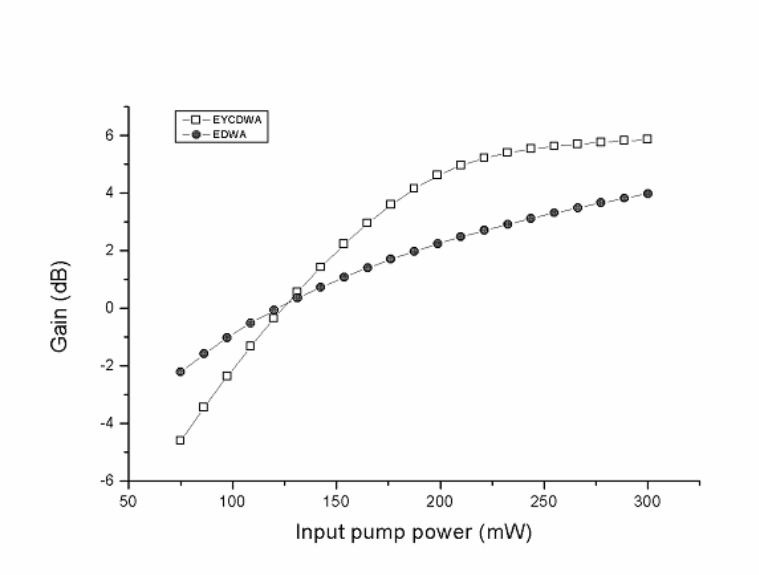
利得 vs. Yb**濃度**

Er-Yb Codoped Waveguide (2)

-- Er-Yb Codoped Waveguide 



利得 vs. 導波路の長さ



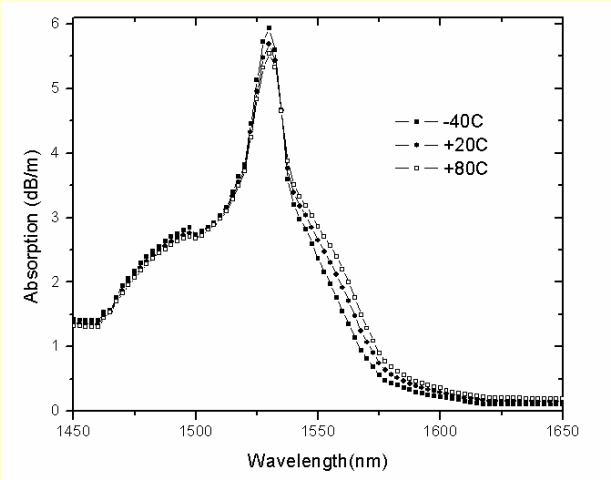
利得 vs. 励起光パワー

Erbium Doped Fiber (1)

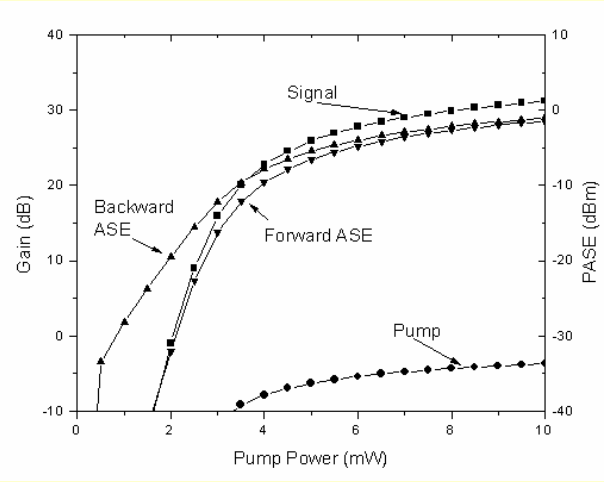
-- Erbium Doped Fiber 

-- **双方向シミュレーション**
-- ESA (Excited-state absorption) **は** EDFA**の特性に反映**
-- **イオン－イオン間の相互作用効果、均一分布アップコンバージョン** (homogeneous up conversion: HUC) **の計算**
-- **レイリー後方散乱、**2**重レイリー散乱の計算**
-- **利得の温度依存性計算**
-- cross-section**と**Giles parameters**データを取り込むことが可能**
-- **計算アルゴリズムの選択**： Saleh、Jopson、Giles**と**Inhomogeneous
-- **損失の波長依存性の考慮**
-- **前方･後方**ASE**や信号、励起光など**3**次元グラフ表示**

・・　・・　・・



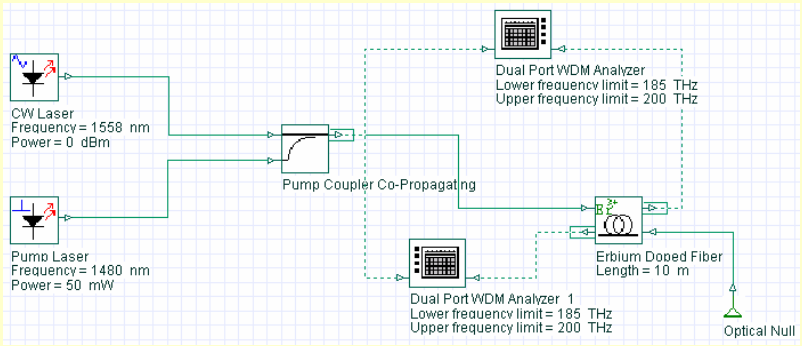
吸収係数の温度による影響

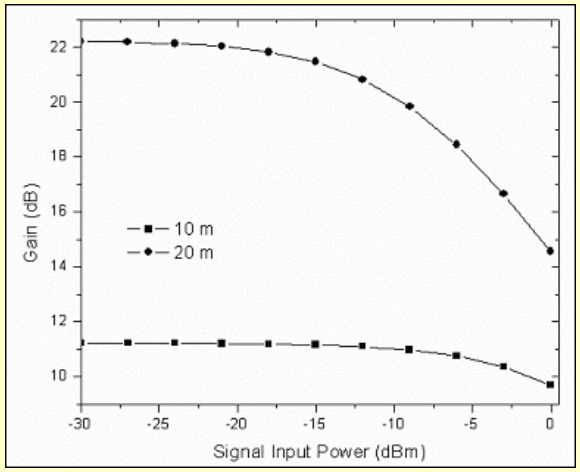


利得とASE**パワー** vs.**励起光パワー**

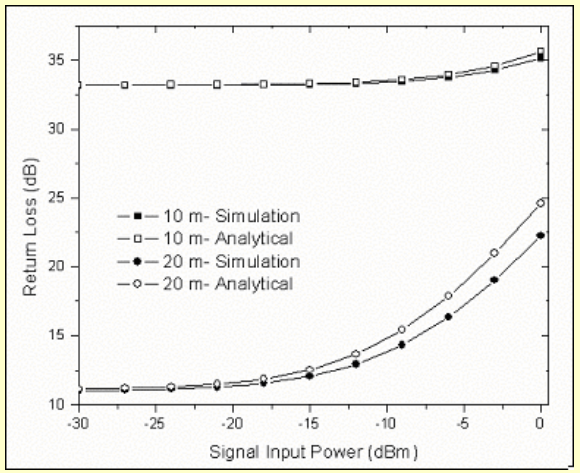
Erbium Doped Fiber (2)

レイリー散乱の計算サンプル

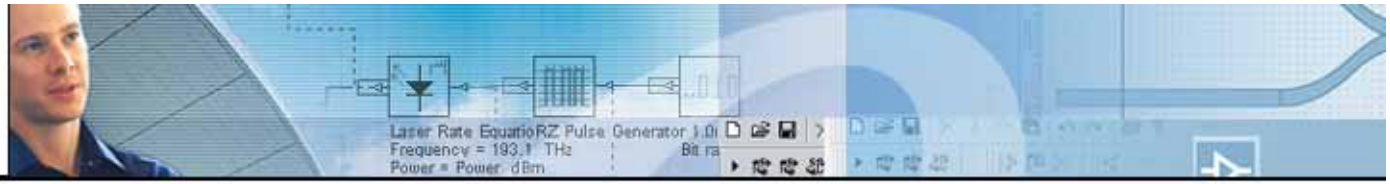




利得 vs. シグナルパワー



利得とASEパワー vs.励起光パワー



Er-Yb Codoped Fiber

-- Er-Yb Codoped Fiber 

-- **5レベルのレート方程式利用**
-- Analyticalとnumerical **ソルバーで幅広い励起光波長に対応**
-- **損失の波長依存性の考慮**
-- **イオン濃度依存の均一分布モデル利用**
-- **前方･後方**ASEや信号、励起光など3次元グラフ表示

・・　・・　・・

Main | Doping | Cross-s... | Enhanced | Numerical | Graphs | Simulation | Noise | Random...

Disp	Name	Value	Units	Mode
☑	Length	1	m	Normal
☐	Core radius	2	um	Normal
☐	Doping radius	2	um	Normal
☐	Numerical aperture	0.15		Normal
☐	Loss data type	Constant		Normal
☐	Signal loss	0.1	dB/m	Normal
☐	Pump loss	0.15	dB/m	Normal
☐	Loss vs. wavelength	Loss.dat		Normal

Main | Doping | Cross-s... | Enhanced | Numerical | Graphs | Simulation | Noise | Random...

Disp	Name	Value	Units	Mode
☐	Calculate upconversion	☑		Normal
☐	C14	5.2834e-024	m^-3/s	Normal
☐	C16	3.44e-022	m^-3/s	Normal
☐	Cup	5.2834e-024	m^-3/s	Normal
☐	A32	1000000000	1/s	Normal
☐	A43	1000000000	1/s	Normal

Main | Doping | Cross-s... | Enhanced | Numerical | Graphs | Simulation | Noise | Random...

Disp	Name	Value	Units	Mode
☐	Er ion density	5.14e+025	m^-3	Normal
☐	Yb ion density	6.2e+026	m^-3	Normal
☐	Er metastable lifetime	10	ms	Normal
☐	Yb metastable lifetime	1.5	ms	Normal

Main | Doping | Cross-s... | Enhanced | Numerical | Graphs | Simulation | Noise | Random...

Disp	Name	Value	Units	Mode
☐	OptiAmplifier format	☐		Normal
☐	File frequency unit	nm		Normal
☐	Er cross section file name	Erbium.dat		Normal
☐	Yb cross section file name	Ytterbium.dat		Normal

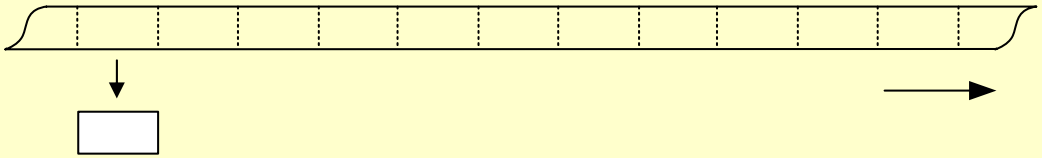
Main | Doping | Cross-s... | Enhanced | Numerical | Graphs | Simulation | Noise | Random...

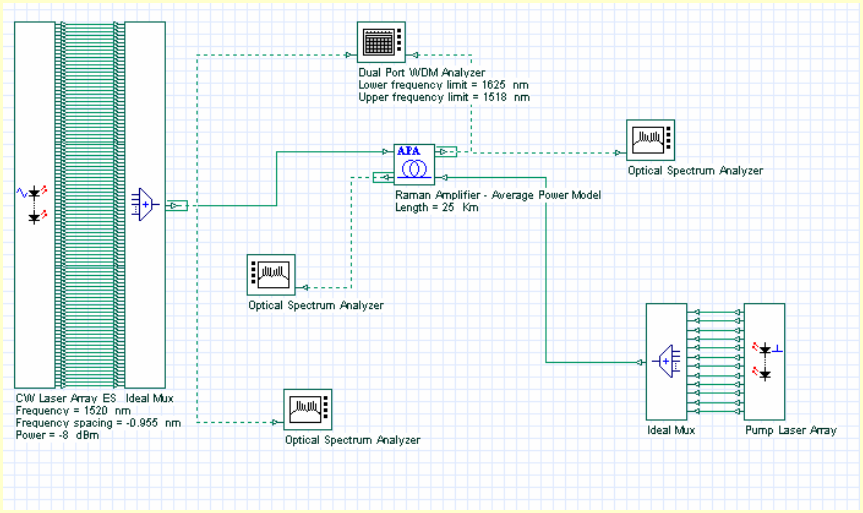
Disp	Name	Value	Units	Mode
☐	Relative error	0.001		Normal
☐	Max. number of iterations	150		Normal
☐	Longitudinal steps	100		Normal
☐	Radial steps	50		Normal
☐	Numerical solver	☐		Normal

Raman Amplifier – Average Power Model

-- Raman Amplifier – Average Power Model 

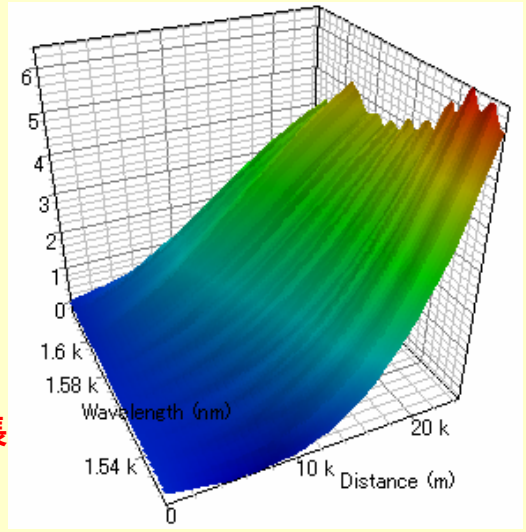
-- **スピードが速い、標準モデルの約１００倍**
-- Average power approachを**採用**　(**標準モデル**：direct integration approach – four-order Runge-Kutta)





100**波長**、1520～1620.82nm
励起光、12**波長**、30～175mw

ファイバ長さ25k**m**
計算時間10分



利得

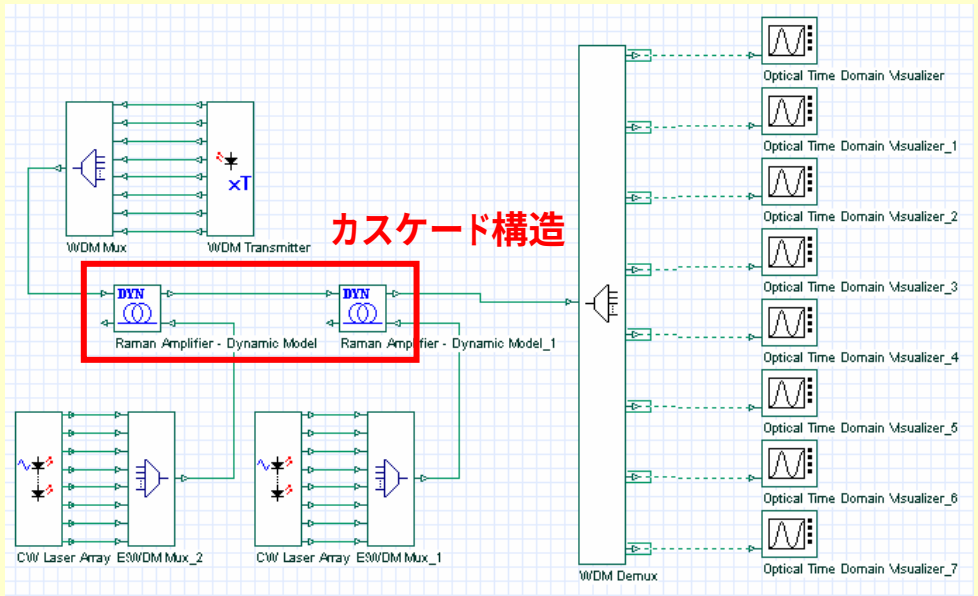
波長

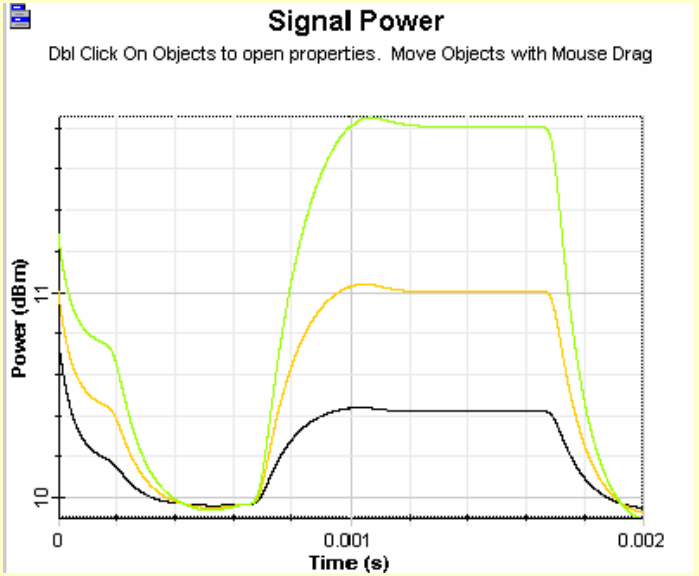
ファイバ長さ

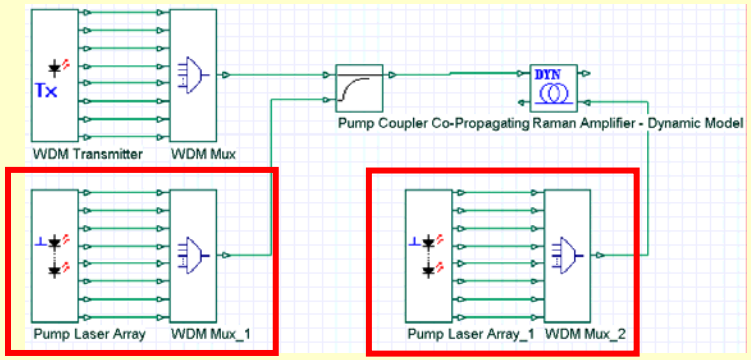
Raman Amplifier – Dynamic Model

-- Raman Amplifier – Dynamic Model

- -- 多波長の過渡応答を同時に調査
- -- カスケード構造の解析可能
- -- 双方向伝播計算
- -- 前方、後方励起光利用可能





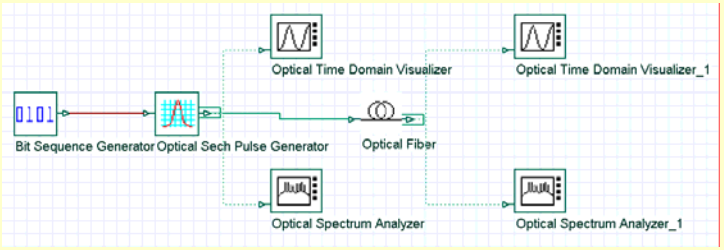


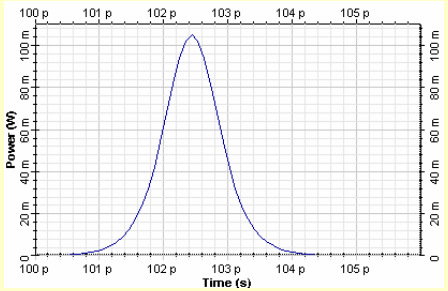
Nonlinear Dispersive Fiber – Total field

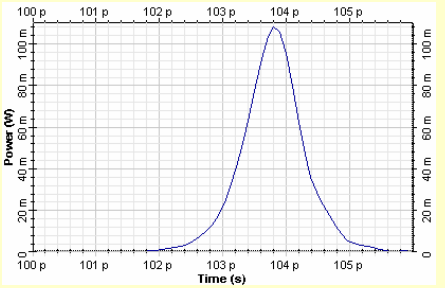
-- Nonlinear Dispersive Fiber – Total field 

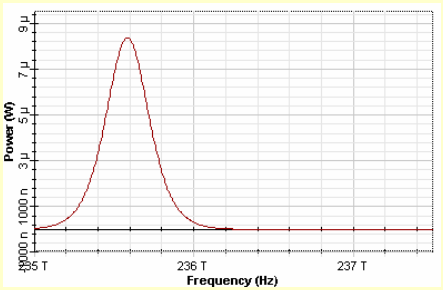
-- **ラマン散乱：スカラーモデルまたはベクトルモデル**
-- **偏波モード分散** (PMD) **：最上級ソルバーの採用**
-- **波長分散表現方法：波長領域分散か周波数領域分散かを選べられることが可能**
-- **非線形効果：計算する方法は**"exponential", "Runge-Kutta 4th", "Runge-Kutta 2th"**に選択**
"Runge-Kutta 4th"**を選択した場合、ベクトルの誘導ラマン散乱を計算**
-- **高度なアルゴリズムを利用、計算ステップは自動定義**
-- **自己パルス急峻** (**急峻**) **化効果** (Self-steepening effect)
-- **ユーザ定義の一次分散データの基で**"five-term Sellmeier formula"**で高次分散を求める**

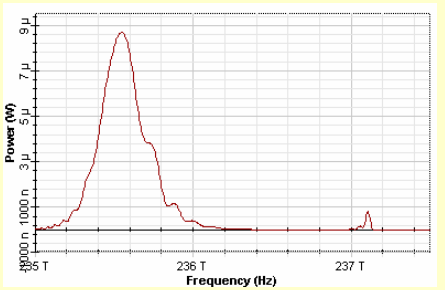
Solitonに対する3次分散の影響調査







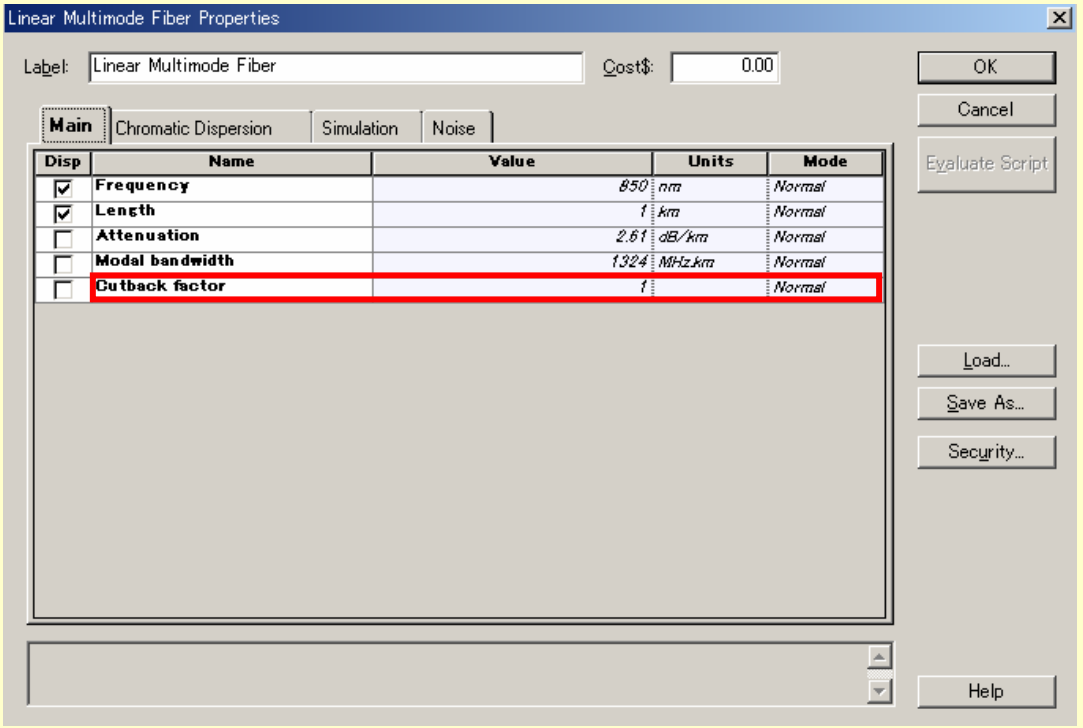




Linear Multimode Fiber

-- Linear Multimode Fiber 

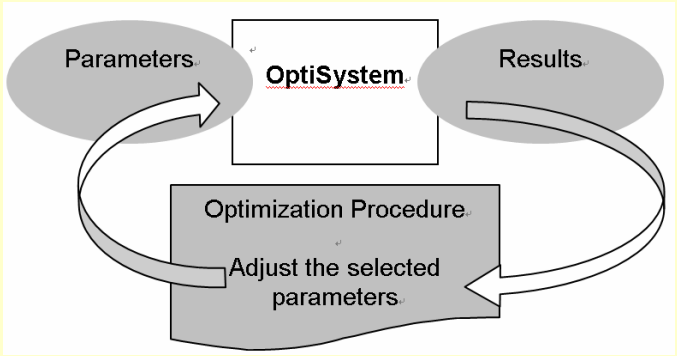
-- cutback factor**の追加**
-- **モード･カップリング** (mode coupling) **の計算**
-- **モード混合** (mode mixing) **の計算**
-- **結合効果** (concatenation effects) **の計算**



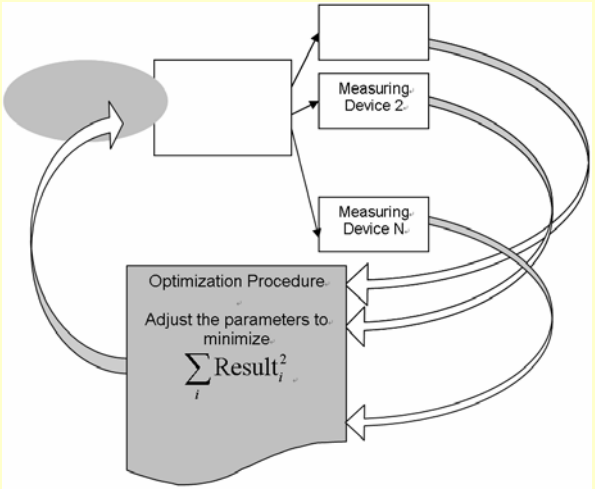
Multi-parameter optimization (MPO)

-- **最適化種類**

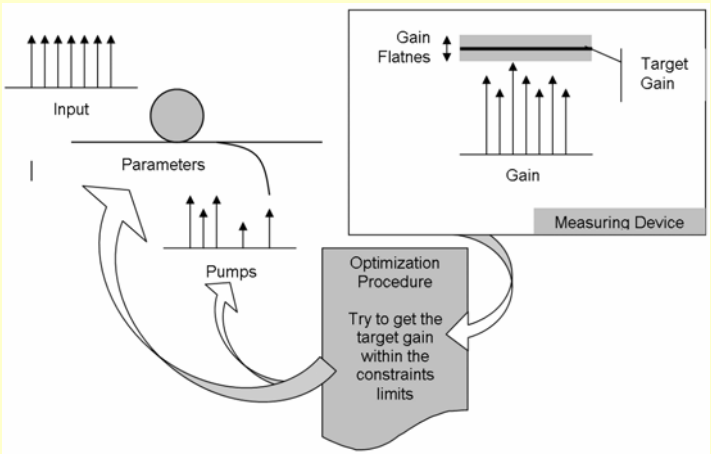
-- Minimization (**最小値を求める**)
Interior-reflective Newton method
-- Maximization (**最大値を求める**)
Interior-reflective Newton method
-- Goal Attaining (**多数目標値を求め**)
Sequential Quadratic Programming (SQP) method
-- Nonlinear Least Square (LSQ) Optimization (Min Σa_i^2)
Interior-reflective Newton method
-- Gain Flattening(**励起光の最適周波数とパワーを求める**)



最適化計算の流れ



Nonlinear Least Square Optimization

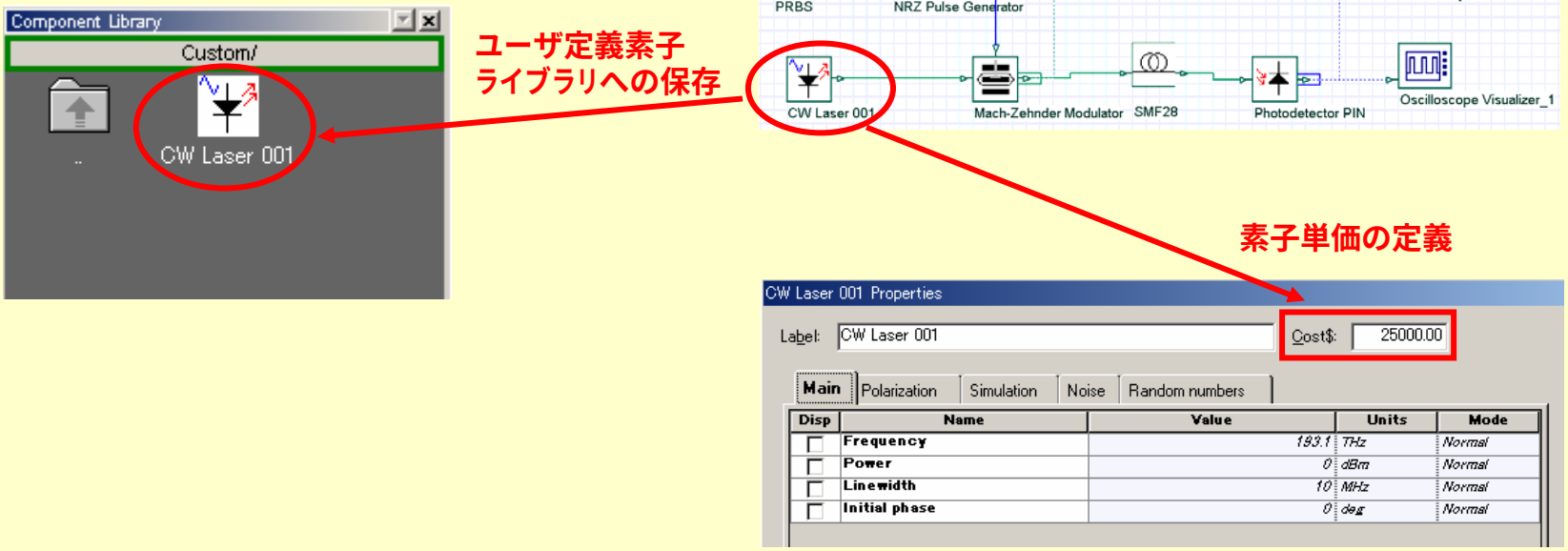


Gain Flattening

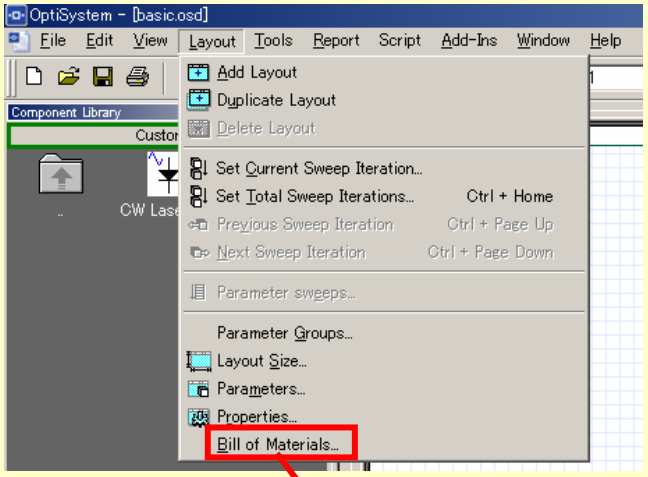
Bill of Materials (1)

-- Bill of Materials (**コスト管理ツール**)

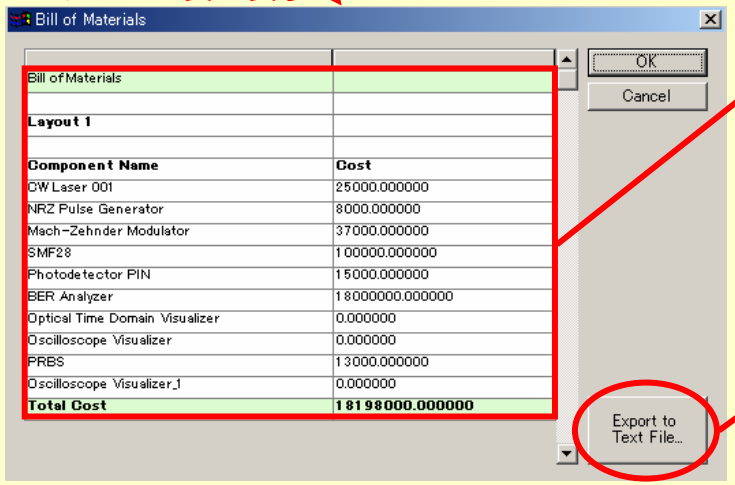
-- **素子の単価定義、ユーザ定義素子のパラメーターとして保存**
-- **全プロジェクト素子価額表の自動作成、トータル・コストの計算**
-- **エクスポート可能**



Bill of Materials (2)



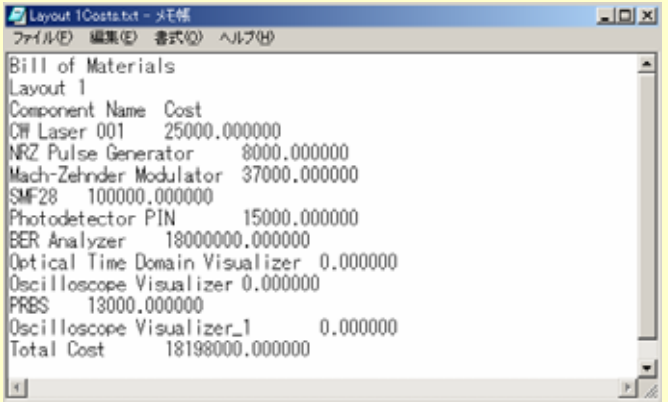
プロジェクトコスト表の表示



Excelへコピー

	A	B	C	D
1				
2		Bill of Materials		
3				
4		Layout 1		
5				
6		Component Name	Cost	
7		CW Laser 001	25000	
8		NRZ Pulse Generator	8000	
9		Mach-Zehnder Modulator	37000	
10		SMF28	100000	
11		Photodetector PIN	15000	
12		BER Analyzer	18000000	
13		Optical Time Domain Visualizer	0	
14		Oscilloscope Visualizer	0	
15		PRBS	13000	
16		Oscilloscope Visualizer_1	0	
17		Total Cost	18198000	
18				

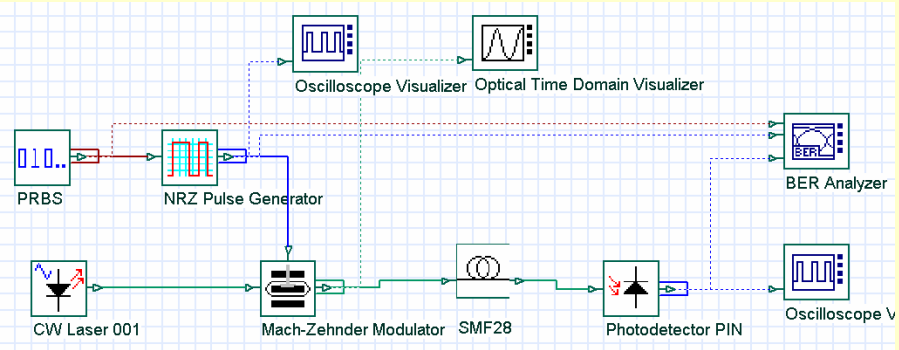
テキストファイルへ
エクスポート



Script Function (1)

-- Script Function

- -- Visual Basic言語で操作する機能
- -- プロジェクトScriptの自動作成
- -- Script pageでのプロジェクト操作
- -- 計算の後処理

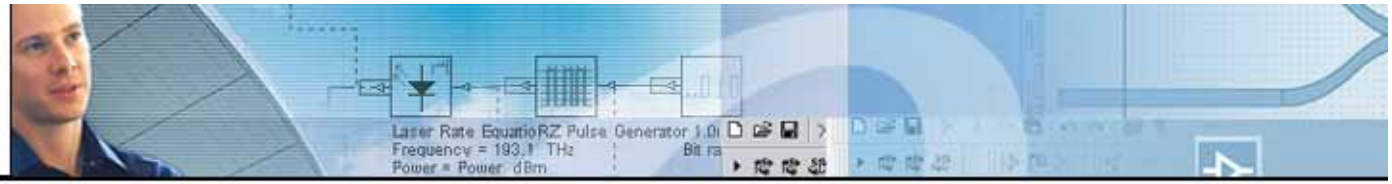


Script page

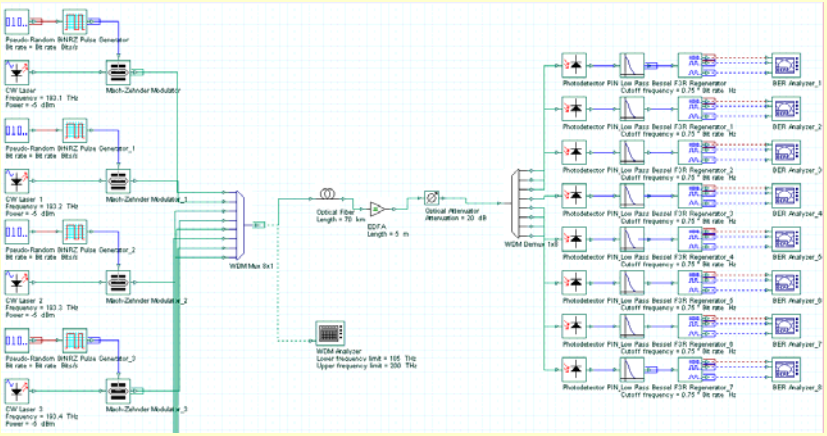
```
'Get Layout Manager.
Dim Lm
Set Lm = Document.GetLayoutMgr

'SCRIPT for Layout 1

'Get Current Layout.
Dim Layout1
Set Layout1 = Lm.GetCurrentLayout
Layout1.Name  = "Layout 1"
 'Set Total Sweep Iterations
Layout1.SetTotalSweepIterations(1)
 'Set Current Sweep Iteration
Layout1.SetCurrentSweepIteration(1)
'Get Current Canvas.
Dim Canvas1
Set Canvas1 = Layout1.GetCurrentCanvas
'SCRIPT for Layout global parameters.
Layout1.SetParameterMode "Simulation window", 0
Layout1.SetParameterValue "Simulation window", "Set bit rate"
Layout1.SetParameterMode "Reference bit rate", 0
Layout1.SetParameterValue "Reference bit rate", TRUE
Layout1.SetParameterMode "Bit rate", 0
Layout1.SetParameterValue "Bit rate", 2.5e+009
Layout1.SetParameterMode "Time window", 0
Layout1.SetParameterValue "Time window", 5.12e-008
Layout1.SetParameterMode "Sample rate", 0
Layout1.SetParameterValue "Sample rate", 1.6e+011
Layout1.SetParameterMode "Sequence length", 0
Layout1.SetParameterValue "Sequence length", 128
Layout1.SetParameterMode "Samples per bit", 0
Layout1.SetParameterValue "Samples per bit", 64
Layout1.SetParameterMode "Number of samples", 0
Layout1.SetParameterValue "Number of samples", 8192
Layout1.SetParameterMode "Iterations", 0
Layout1.SetParameterValue "Iterations", 1
Layout1.SetParameterMode "Parameterized", 0
Layout1.SetParameterValue "Parameterized", FALSE
Layout1.SetParameterMode "Convert noise bins", 0
Layout1.SetParameterValue "Convert noise bins", FALSE
Layout1.SetParameterMode "Calculate signal tracing", 0
Layout1.SetParameterValue "Calculate signal tracing", TRUE
Layout1.SetParameterMode "Power unit", 0
Layout1.SetParameterValue "Power unit", "dBm"
Layout1.SetParameterMode "Frequency unit", 0
Layout1.SetParameterValue "Frequency unit", "THz"
Layout1.SetParameterMode "Decimal places", 0
Layout1.SetParameterValue "Decimal places", 4
```



Script Function (2)



計算の後処理

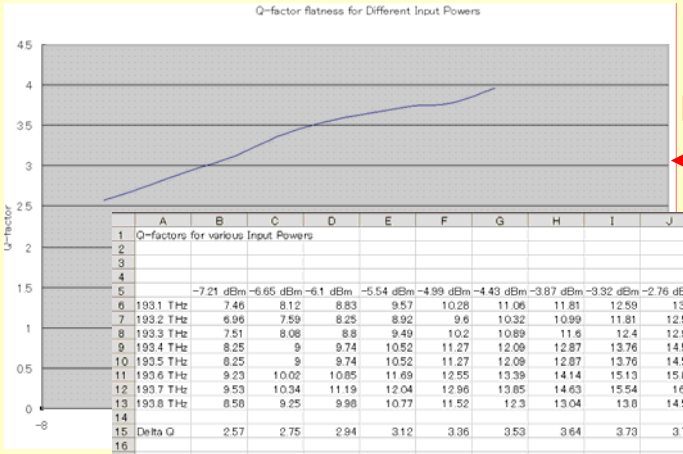
```
Worksheet.Cells(1,1) = "Q-factors for various Input Powers"

For i = 0 to Iterations-1
    Worksheet.Cells(5,2+i)= CStr(Round(Power.GetValue(i+1),2))+ " dBm"
    Worksheet.Cells(6,2+i) = Round(Q1.GetValue(i+1), 2)
    Worksheet.Cells(7,2+i) = Round(Q2.GetValue(i+1), 2)
    Worksheet.Cells(8,2+i) = Round(Q3.GetValue(i+1), 2)
    Worksheet.Cells(9,2+i) = Round(Q4.GetValue(i+1), 2)
    Worksheet.Cells(10,2+i) = Round(Q5.GetValue(i+1), 2)
    Worksheet.Cells(11,2+i) = Round(Q6.GetValue(i+1), 2)
    Worksheet.Cells(12,2+i) = Round(Q7.GetValue(i+1), 2)
    Worksheet.Cells(13,2+i) = Round(Q8.GetValue(i+1), 2)
Next

For i = 0 to 7
    Worksheet.Cells(i+6,1) = CStr(Round(Frequencies(i),2)) + " THz"
next


If Input = 1 then
    Worksheet.Cells(3,13) = "Information below is for graphing purposes"
    Worksheet.Cells(15,1) = "Delta Q"
    Worksheet.Cells(5,13) = "Power [dBm]"
    Worksheet.Cells(5,14) = "Delta Q"
    best = 1000
    index = 0
    For i = 0 to Iterations-1
        min = 1000
        max = -1000
        For j = 0 to 7
            If Worksheet.Cells(6+j,2+i) < min then
                min = Worksheet.Cells(6+j,2+i)
            Elseif Worksheet.Cells(6+j,2+i) > max then
                max = Worksheet.Cells(6+j,2+i)
            End if
        Next
        Worksheet.Cells(15,2+i) = max - min
        if (max - min < best) then
            best = max - min
            index = i
        End if
        Worksheet.Cells(6+i,13) = Round(Power.GetValue(i+1),2)
        Worksheet.Cells(6+i,14) = Round(max-min,2)
    Next
    Title = "Q-factor flatness for Different Input Powers"
    TitleX = "Power [dBm]"
```

Excelでの処理結果表示



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Q-factors for various Input Powers															
2																
3													Information below is for graphing purposes			
4																
5		-7.21 dBm	-6.65 dBm	-6.1 dBm	-5.54 dBm	-4.99 dBm	-4.43 dBm	-3.87 dBm	-3.32 dBm	-2.76 dBm	-2.21 dBm		Power [dBm]	Delta Q		
6	193.1 THz	7.46	8.12	8.83	9.57	10.28	11.06	11.81	12.59	13.4	14.18		-7.21	2.57		
7	193.2 THz	6.96	7.59	8.25	8.92	9.6	10.32	10.99	11.81	12.52	13.32		-6.65	2.75		
8	193.3 THz	7.51	8.08	8.8	9.49	10.2	10.89	11.6	12.4	12.96	13.93		-6.1	2.94		
9	193.4 THz	8.25	9	9.74	10.52	11.27	12.09	12.87	13.76	14.54	15.42		-5.54	3.12		
10	193.5 THz	8.25	9	9.74	10.52	11.27	12.09	12.87	13.76	14.54	15.42		-4.99	3.36		
11	193.6 THz	9.23	10.02	10.85	11.69	12.55	13.39	14.14	15.13	15.89	16.72		-4.43	3.53		
12	193.7 THz	9.53	10.34	11.19	12.04	12.96	13.85	14.63	15.54	16.3	17.28		-3.87	3.64		
13	193.8 THz	8.58	9.25	9.98	10.77	11.52	12.3	13.04	13.8	14.56	15.28		-3.32	3.73		
14													-2.76	3.78		
15	Delta Q	2.57	2.75	2.94	3.12	3.36	3.53	3.64	3.73	3.78	3.96		-2.21	3.96		
16																
17																
18	The flattest Q-factor occurs at -7.21 dBm with a flatness of +/- 2.57															
19																

Report Page

-- **主な機能**

- -- **カスタマイズ**
- -- **表示の自動更新**
- -- **複数ページ作成可能**
- -- **プレビュー機能**
- -- **グラフコントロール可能**
- -- Pre-formatted layouts

-- **リポート内容**

- -- **2Dグラフ**
- -- **3Dグラフ**
- -- **素子パラメーター**
- -- **計算結果**
- -- Rich Text**入力**