# A Novel Architecture based on Highly Nonlinear Fiber for All-Optical Binary Pattern Matching System

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## Abstract

We propose a novel architecture for all-optical binary pattern matching system which mainly consists of a highly nonlinear fiber and a regenerator. The system is simple and can recognize the target in high data rates.

## Introduction

As the core part of the photonic firewall, all-optical pattern matching system can identify the target in the data through all-optical signal processing technology and provide efficient protection for high-speed optical networks. The existing all-optical binary pattern matching systems are quite complex and based on SOA-MZI. They can only process the data at up to 42.6 Gbps due to the gain recovery time of SOA. The HNLF outperforms SOA as it is passive and has less response time. In this paper, we propose a novel architecture based on HNLF for all-optical binary pattern matching system. It is simpler, and can process the data with higher rate than the SOA-based one.

## Principle of Operation

A schematic of the proposed all-optical binary pattern matching system, and its operation illustrated by the waveforms in spectrum domain are shown in Fig. 1. The proposed system mainly consists of a length of HNLF, a band pass filter (BPF), and a regenerator, which are connected to form a recirculating loop. The procedure of searching for the target {1,0} in the data {1,1,0,1} is illustrated as follows. The result in the second frame is {0,0,1,0} where the "1" indicates not only the detection, but also the location of the target temporally.

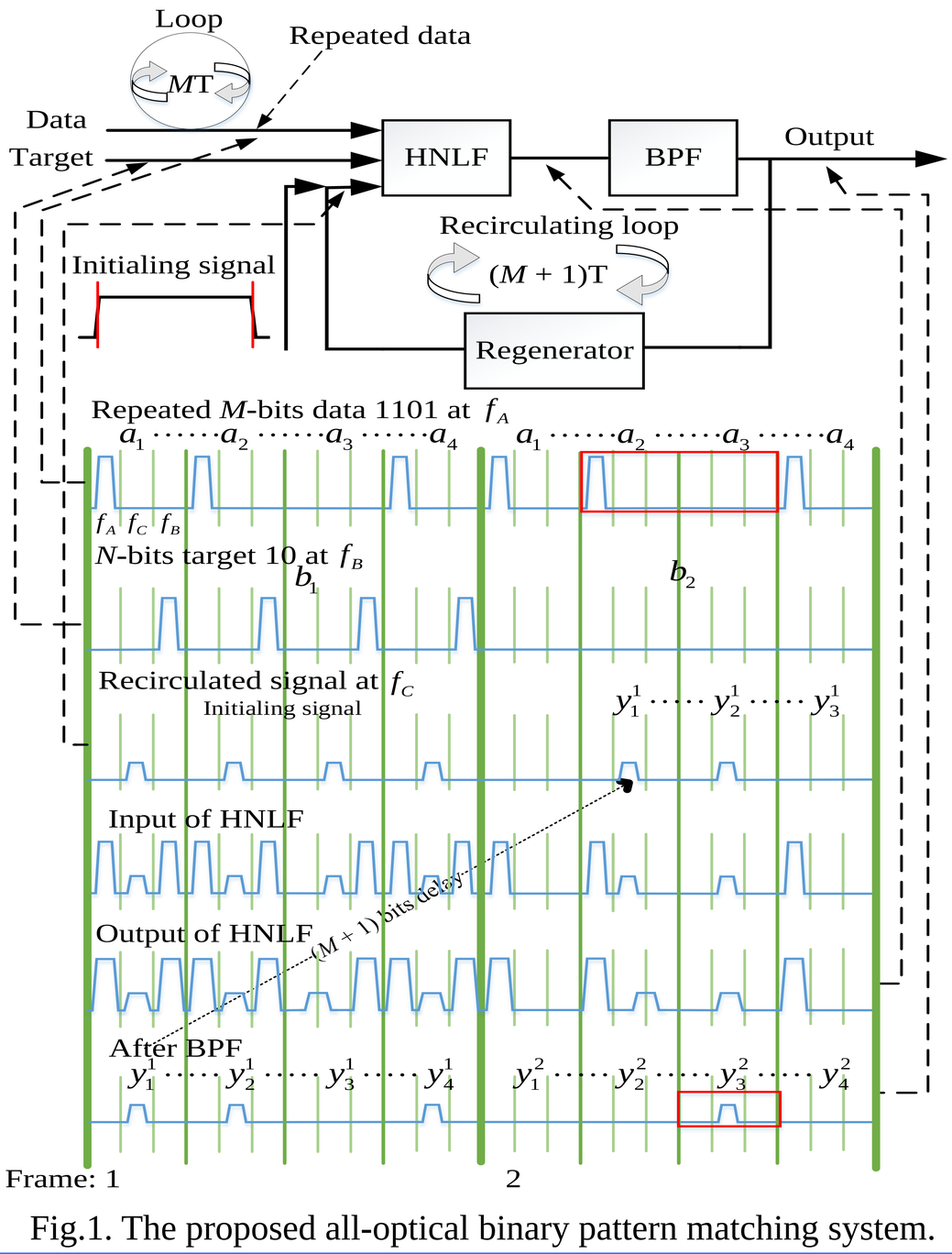


Fig.1. The proposed all-optical binary pattern matching system.

## Simulation Platform

A simulation platform is constructed by the software of VPItransmissionMaker 8.5 to verify the effectiveness of the proposed all-optical binary pattern matching system for the data with the transmission rates of 100 Gbps and 200 Gbps, as shown in Fig. 2.

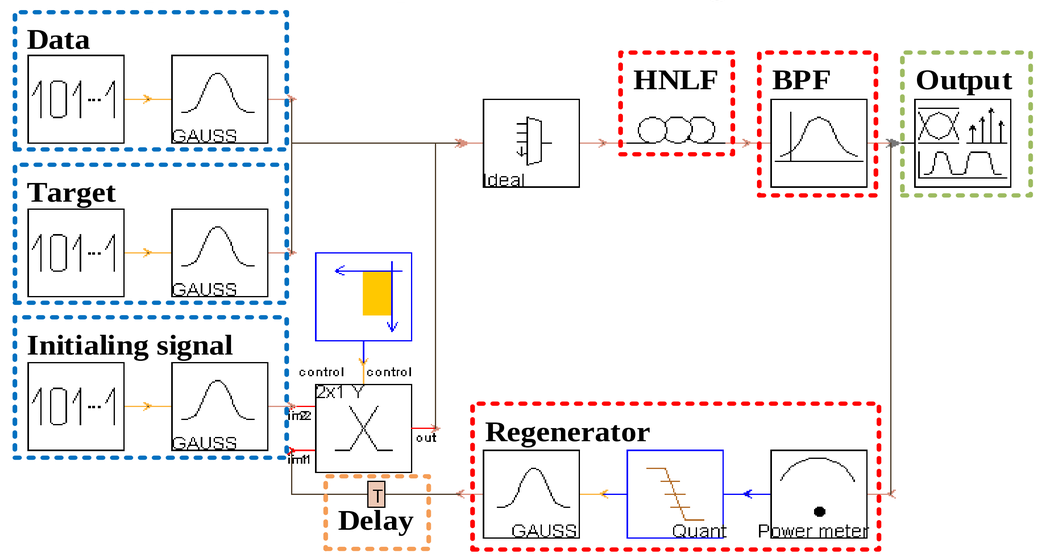


Fig.2. The simulation platform of proposed all-optical binary pattern matching system based on VPI.

## Simulation Results

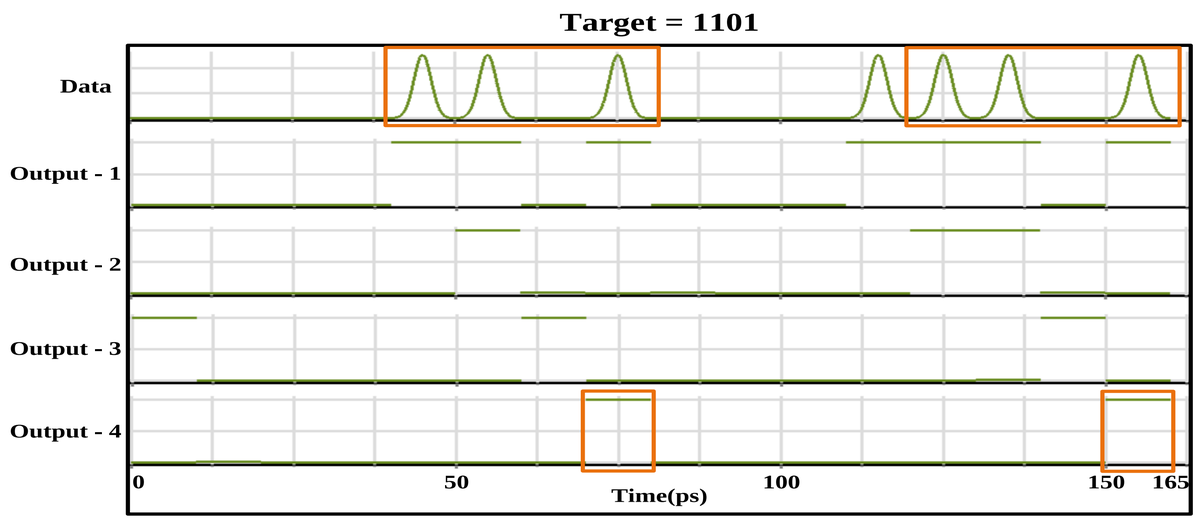


Fig.3. 100 Gbps pattern matching results of 4 bits target.

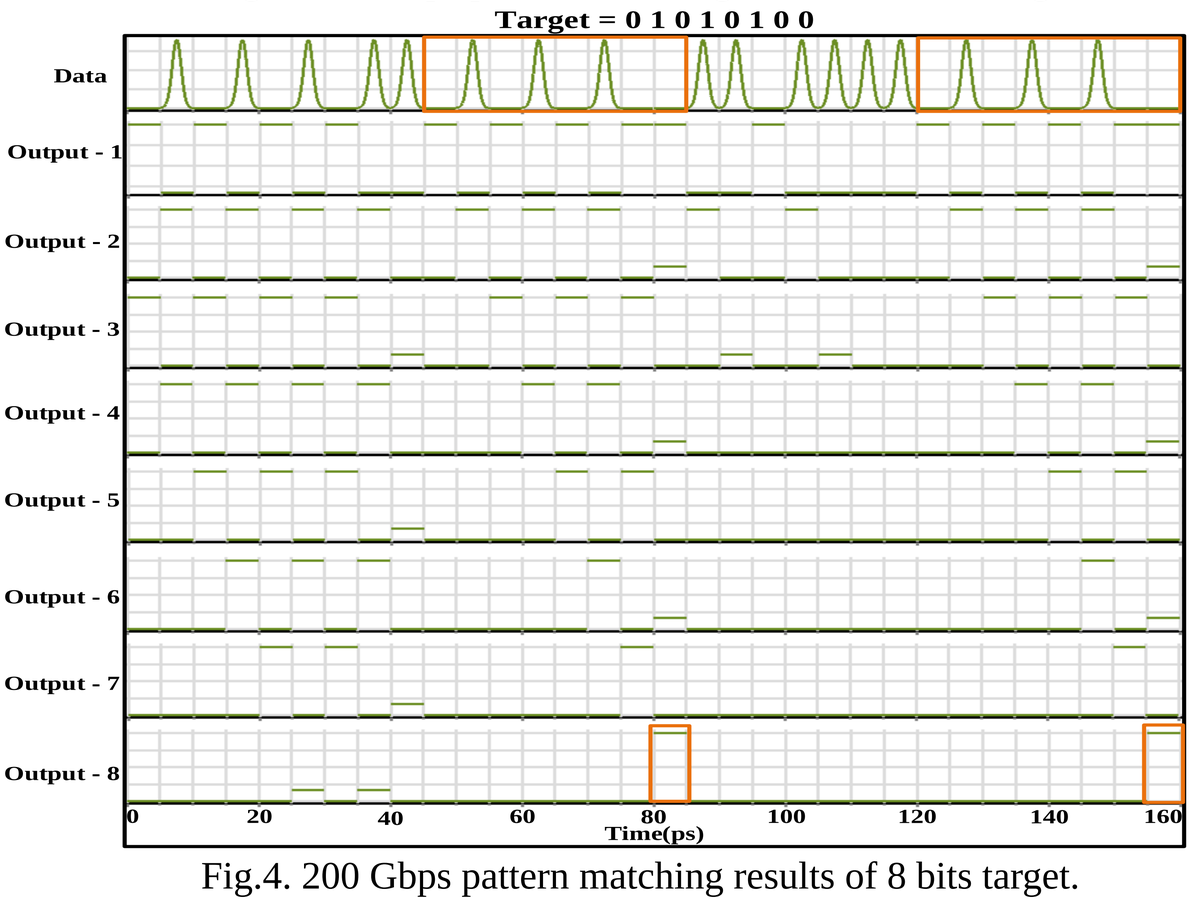


Fig.4. 200 Gbps pattern matching results of 8 bits target.

For 100 Gbps, there are two targets "1101" hidden in data "0000110100011101". The output of the last frame shows that there exist two pulses in the final frame, which are aligned with the positions of the last bit of the two targets in the data as expected. The extinction ratio of the output pulses is more than 10 dB, and no deterioration is observed even for the targets with more bits. When the longer data and target are applied, the system can still accurately determine the number and position of targets "01010100" in the data with higher transmission rate of 200 Gbps.