

无线通信实验在线开放课程

主讲人：吴光 博士

广东省教学质量工程建设项目





Lab 9: Text Transmission using USRP

主讲人：吴光 博士

Email: wug@sustech.edu.cn



Lab 9: USRP Text Transmission

1 Pre-Labs

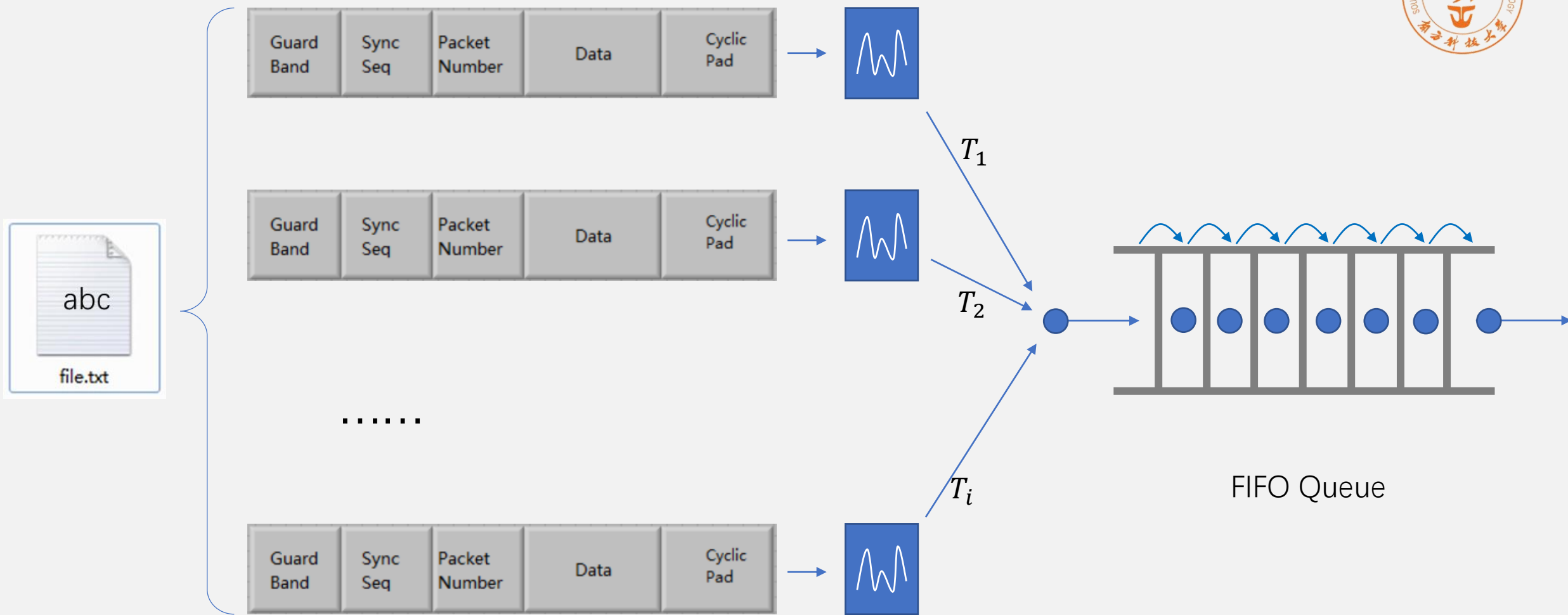
2 Tranceiver Design and Simulation

3 USRP Verification

4 Comparison and Analysis



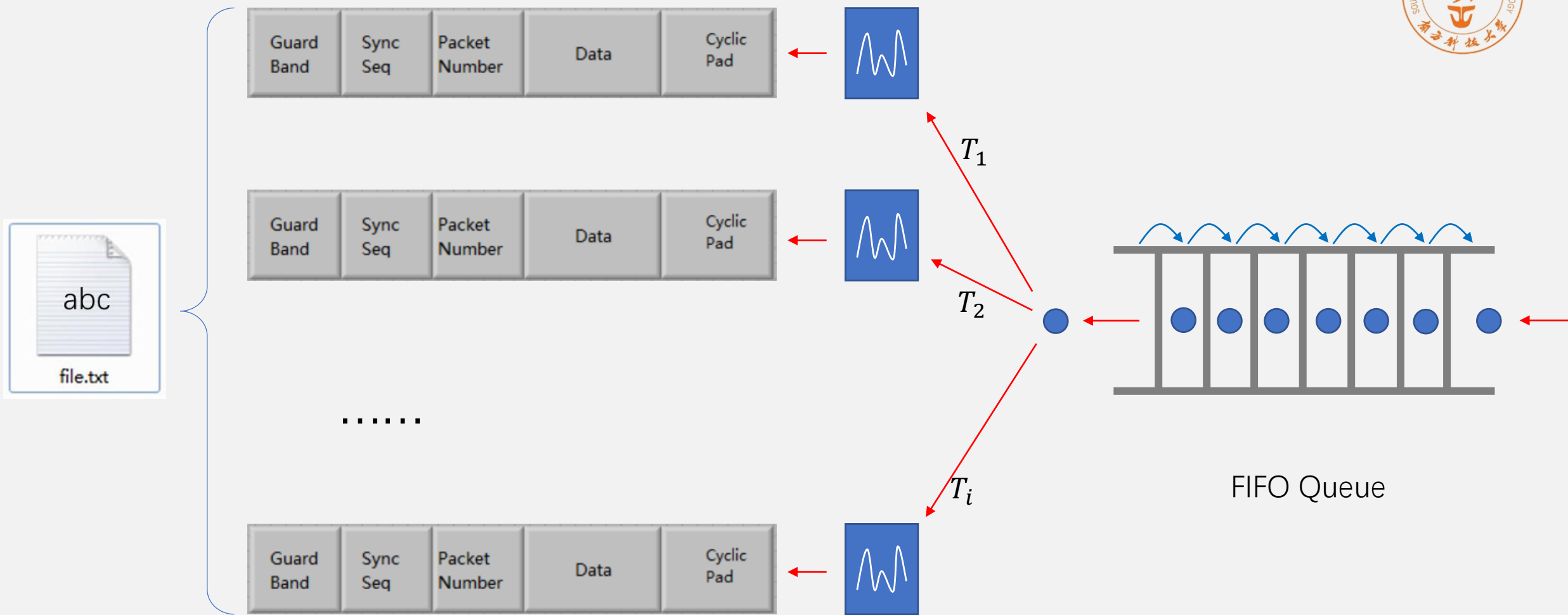
Demo: USRP Text Transmission



Data Encapsulation

Complex Baseband

Transmission Queue



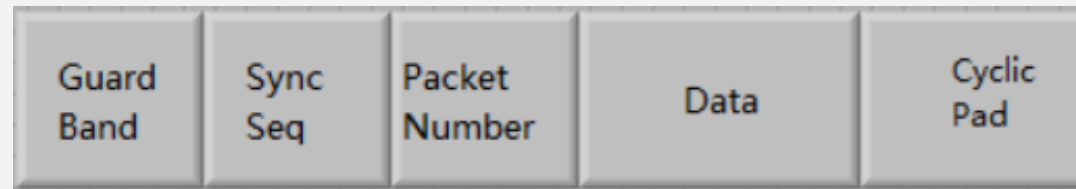
Data Decapsulation

Complex Baseband

Reception Queue

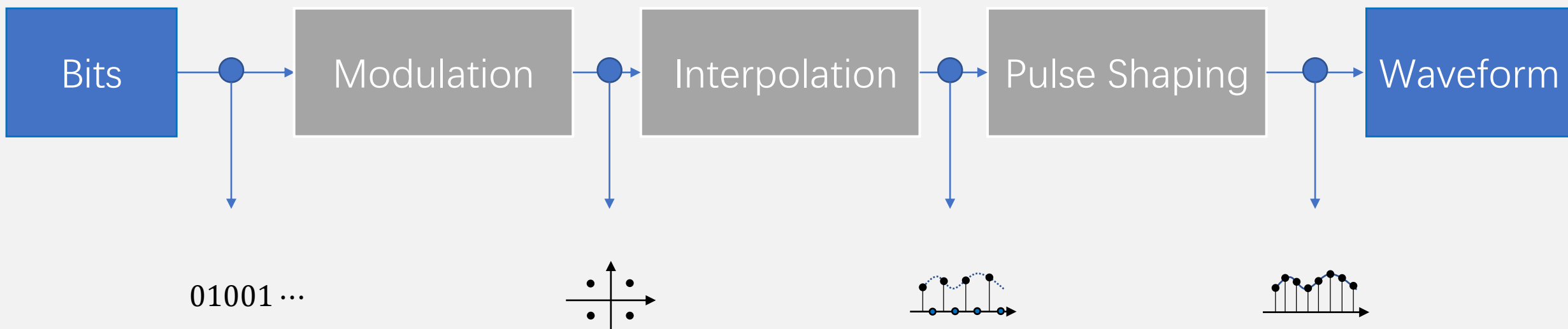


Packet Format



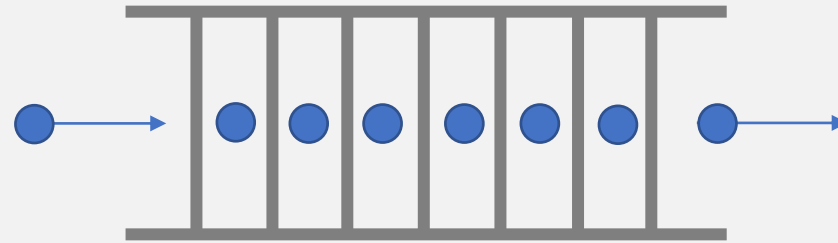


Complex Baseband Waveform





Transmission Queue






Transmission Queue

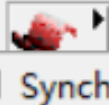




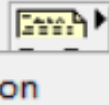
Demo: Queue Management




Synchroniza...




RF Communic...




Measurement



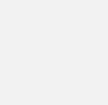
Instrument I/O



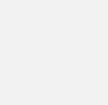
Mathematics



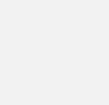
Signal Proces...



Data Communication




Connectivity




Express

Synchronization




Notifier Op...




Queue Ope...

First Call?


Queue Operations



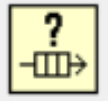
Obtain Que...




Enqueue El...



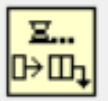
Preview Qu...




Get Queue ...



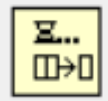
Release Qu...




Lossy Enqu...



Enqueue El...



Dequeue El...



Flush Queue



Exercise: Random data buffering



Lab 9: USRP Text Transmission

1 Pre-Labs

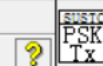
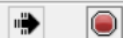
2 Tranceiver Design and Simulation

3 USRP Verification

4 Comparison and Analysis



Demo: Text Transmission Simulation



Packet Transmitter

Message Text

Two roads diverged in a yellow wood,
And sorry I could not travel both
And be one traveler, long I stood
And looked down one as far as I could
To where it bent in the undergrowth.

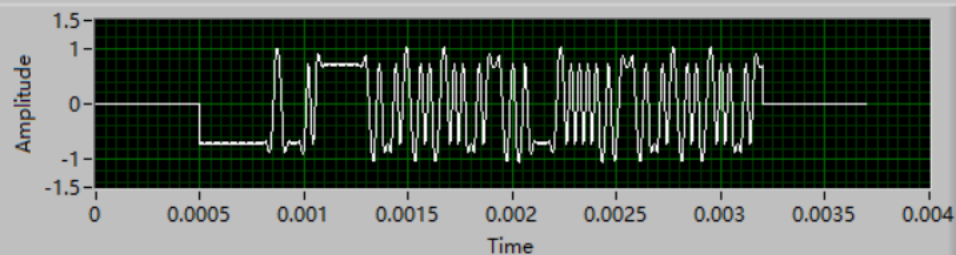
Then took the other, as just as fair,
And having perhaps the better claim,
Because it was grassy and wanted wear;
Though as for that the passing there
Had worn them really about the same.

And both that morning equally lay
In leaves no step had trodden black.
Oh, I kept the first for another day!
Yet knowing how way leads on to way,
I doubted if I should ever come back.

I shall be telling this with a sigh
Somewhere ages and ages hence:
Two roads diverged in a wood, and I--
I took the one less traveled by,
And that has made all the difference.

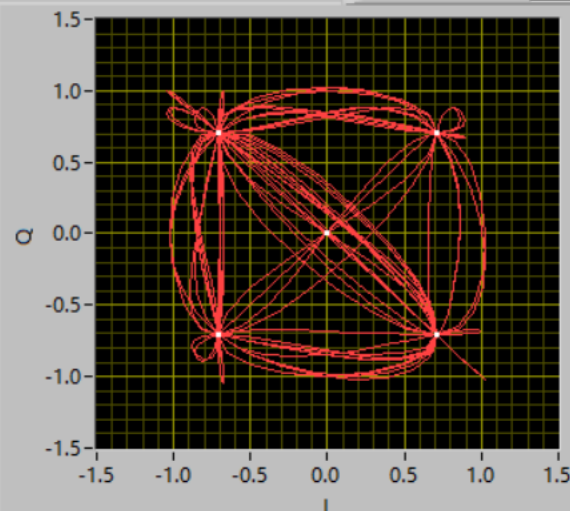
Transmitted Signal

Plot 0



Constellation Graph

Constellation



Modulation type

QPSK

Sample Rate [s/sec]

400k

Symbol Rate [symbols/sec]

50k

Pulse Shaping

Filter Parameters

TX Filter

Raised Cosine

Alpha

0.50

Filter Length

6





Packet Receiver

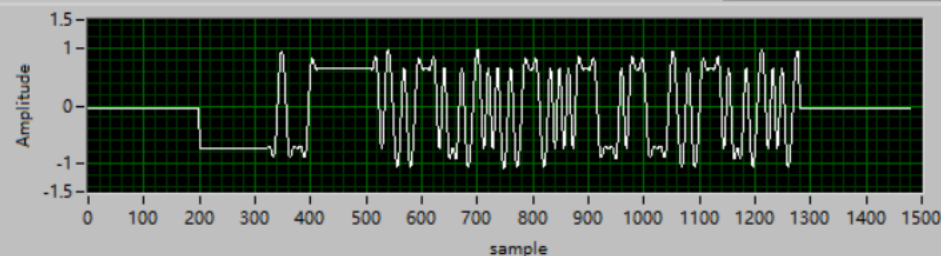
Recovered Message

ed in a yellow wood,
And sorry I could not travel both
And be one traveler, long I stood
And looked down one as far as I could
To where it bent in the undergrowth.

Then took the other, as just as fair,
And having perhaps the better claim,
Because it was grassy and wanted wear;
Though as for that the passing there
Had worn them really about the same.

And both that morning equally lay
In leaves no step had trodden black.
Oh, I kept the first for another day!
Y

Received Signal (Raw)



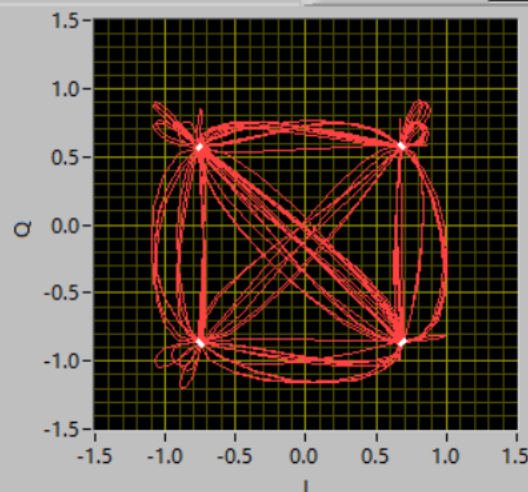
Constellation



Transitions



Constellation Graph



Modulation type

QPSK

Sync Found



Rx IQ Sampling
Rate [s/sec]

400k

Symbol Rate [symbols/sec]

50k

Matching Filter Parameters

TX Filter

Raised Cosine

Alpha

0.50

Filter Length

6

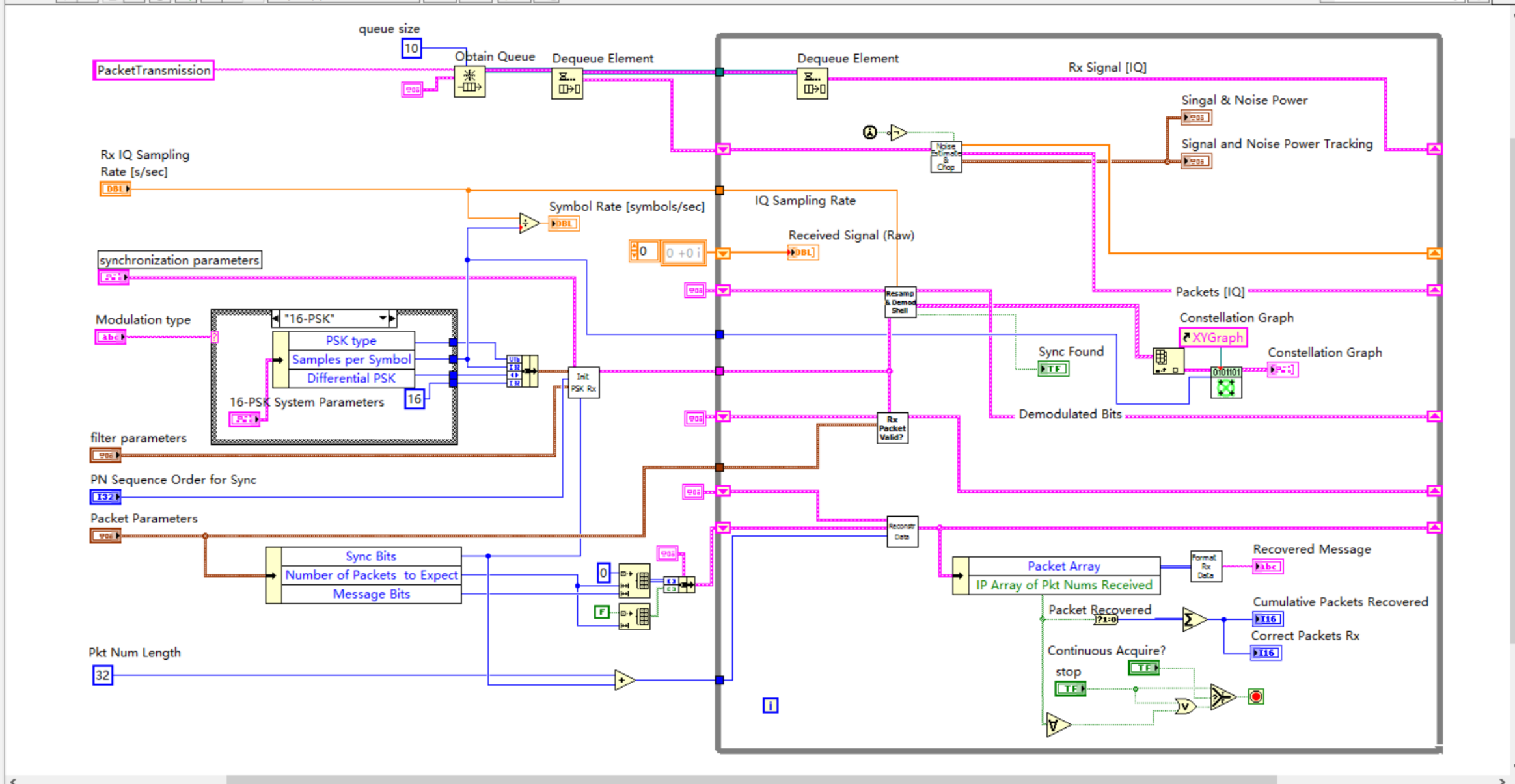
USRP Packet Receiver_Queue.vi Block Diagram

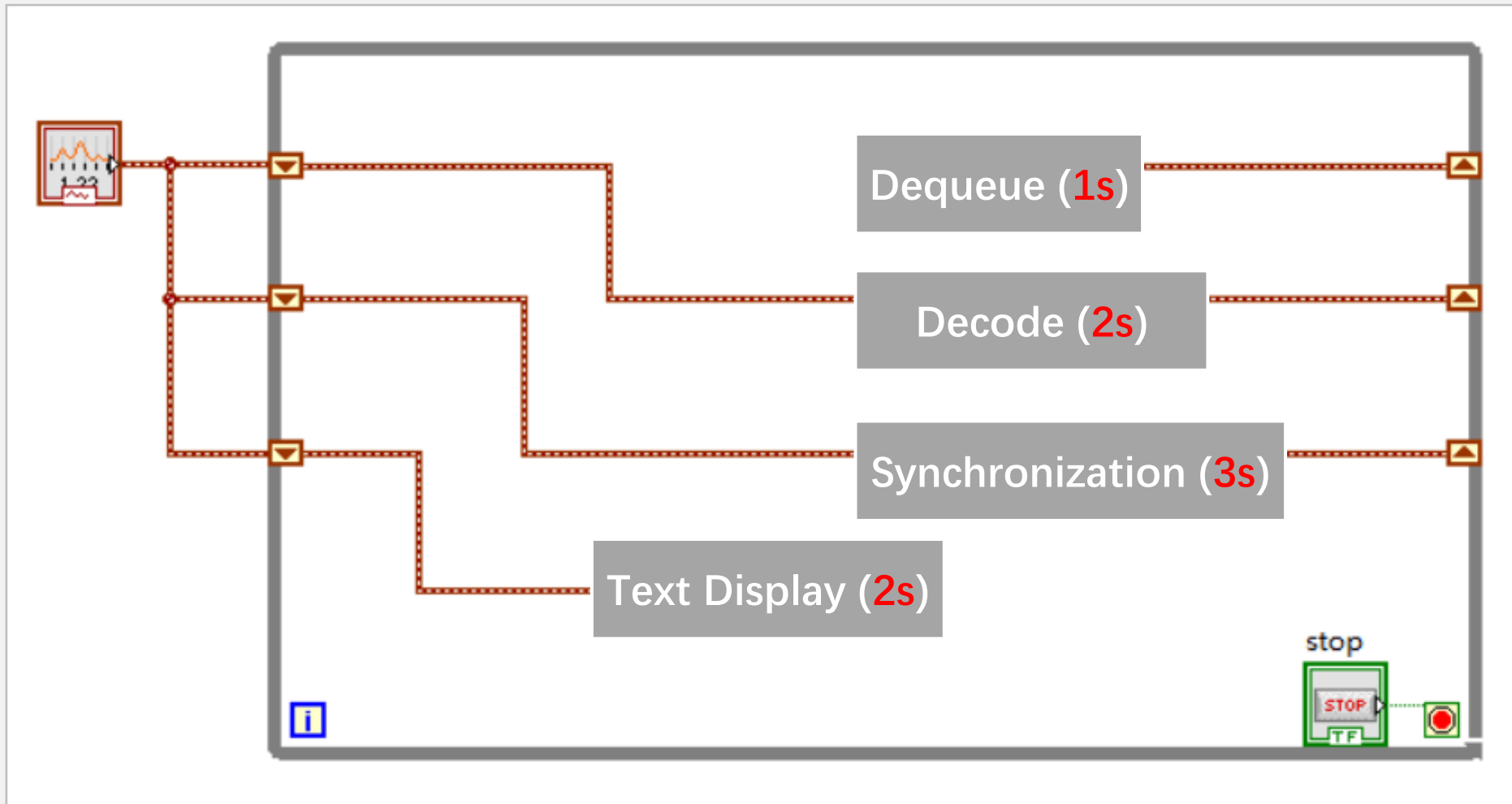
File Edit View Project Operate Tools Window Help

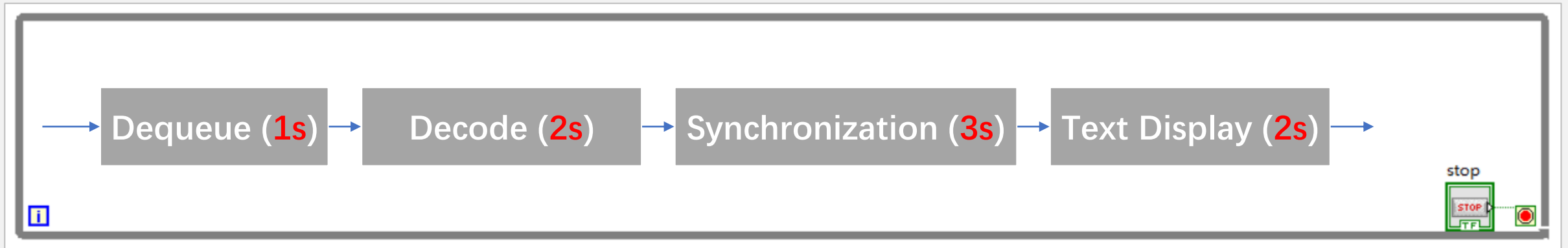
18pt Application Font

Search

Basic PSK Rx









Lab 9: USRP Text Transmission

1 Pre-Labs

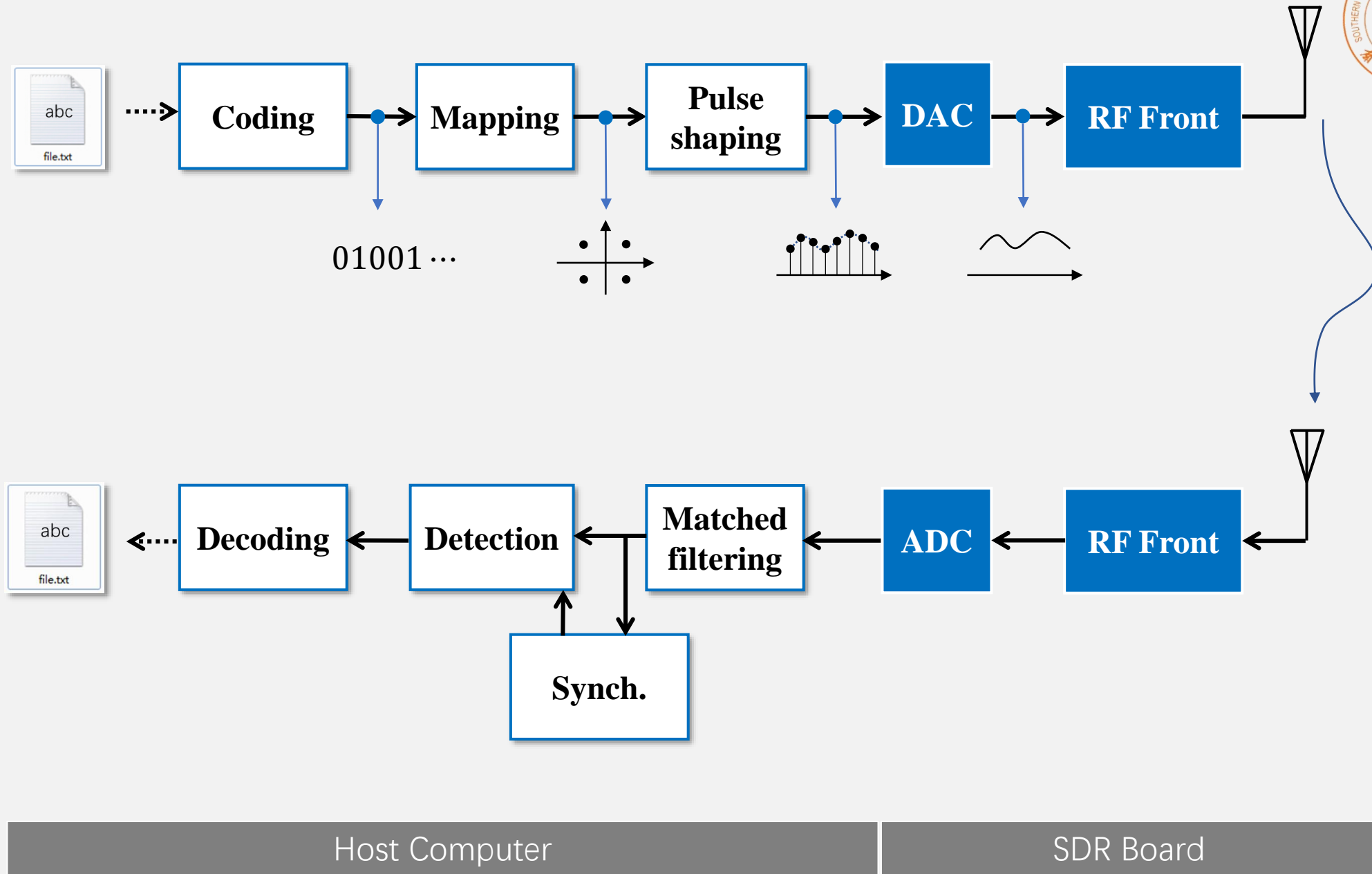
2 Tranceiver Design and Simulation

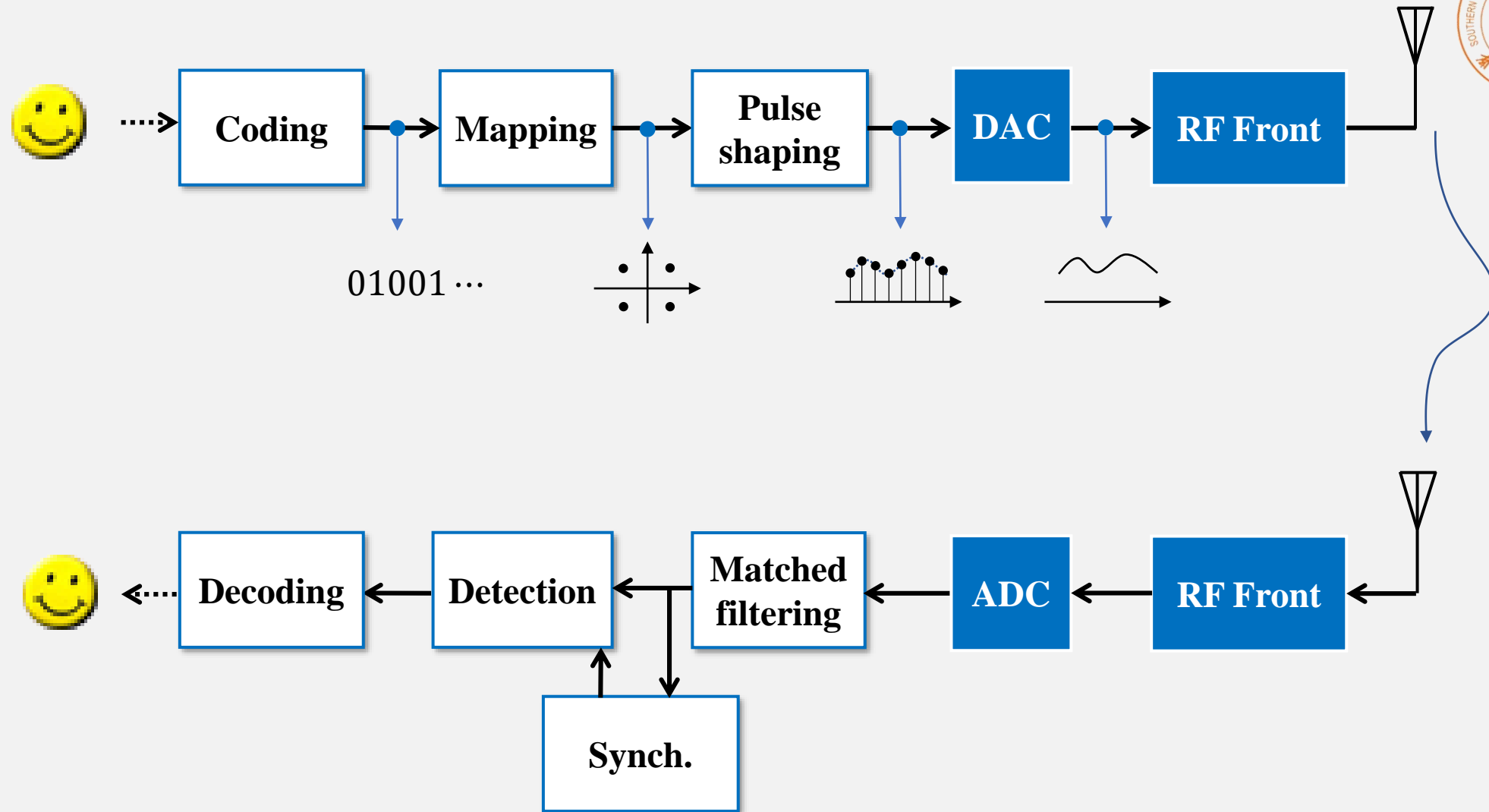
3 USRP Verification

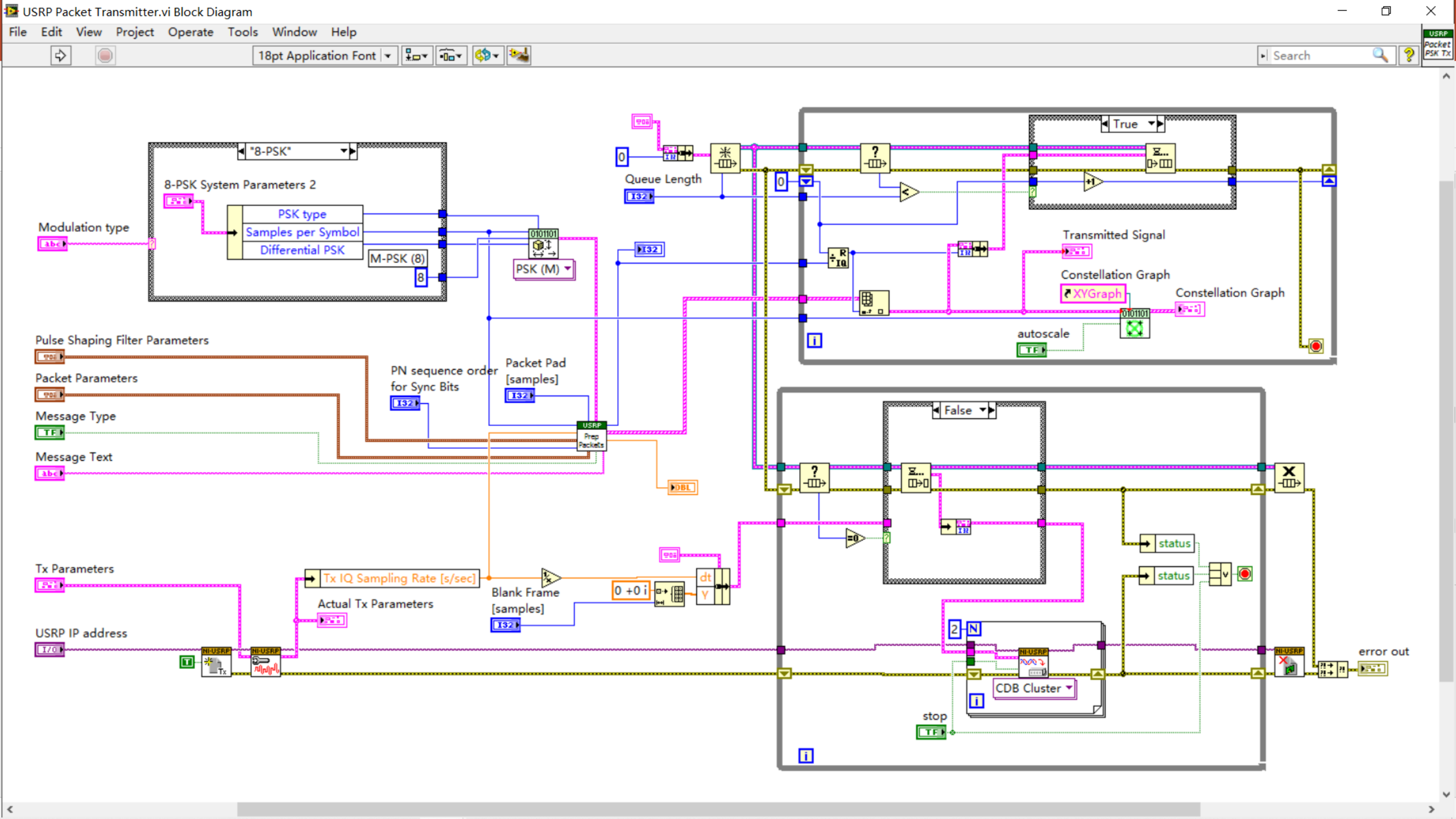
4 Comparison and Analysis

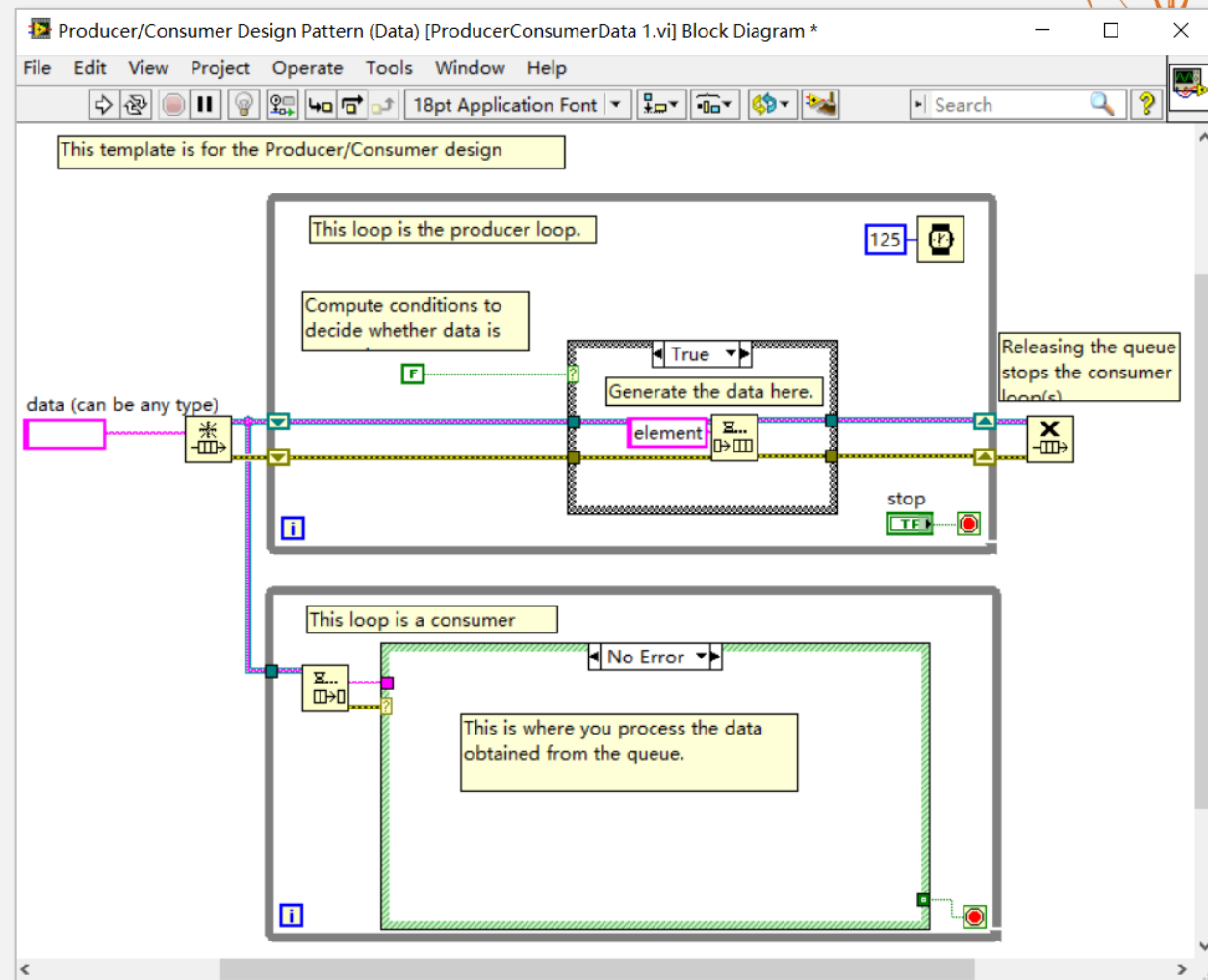
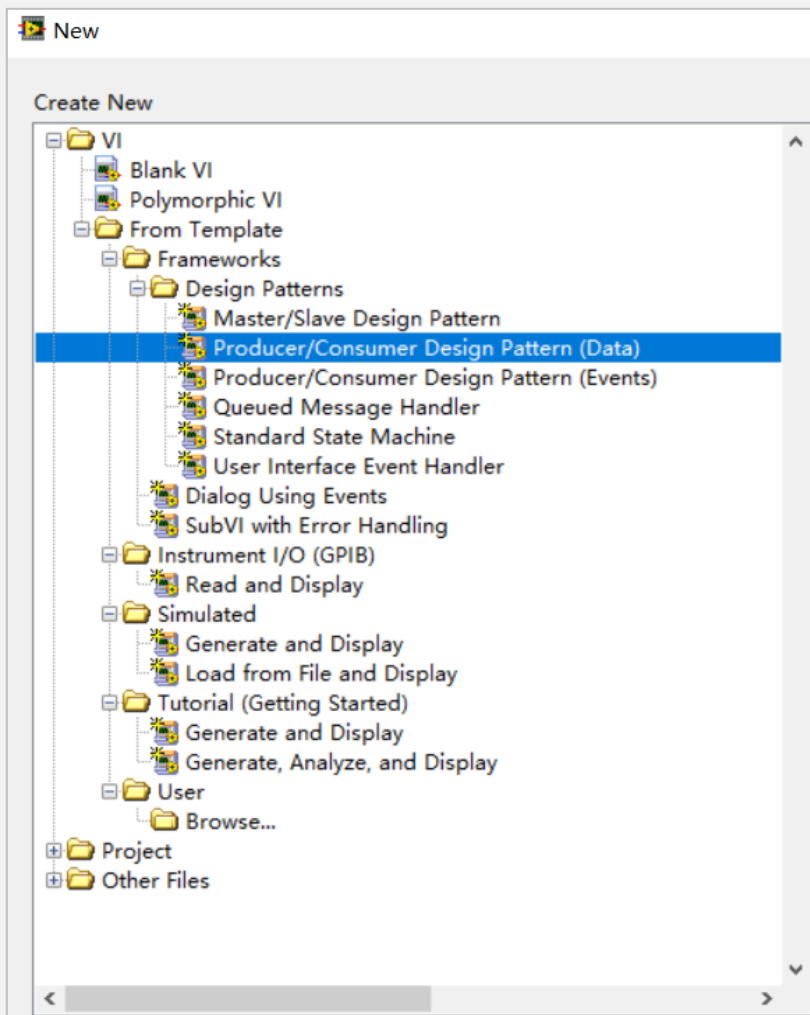
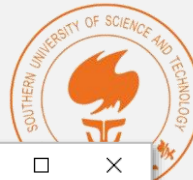


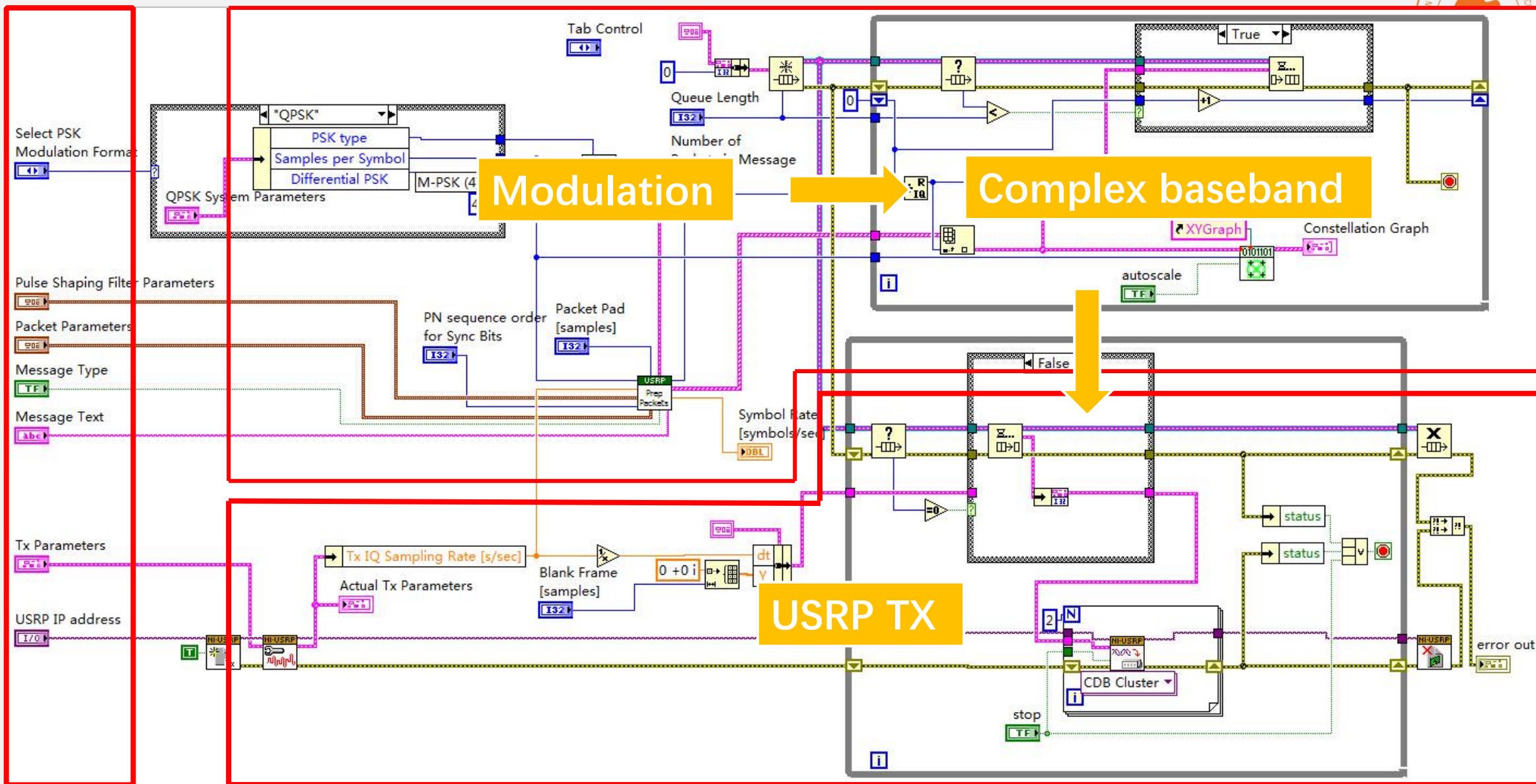
Demo: USRP Text Transmission

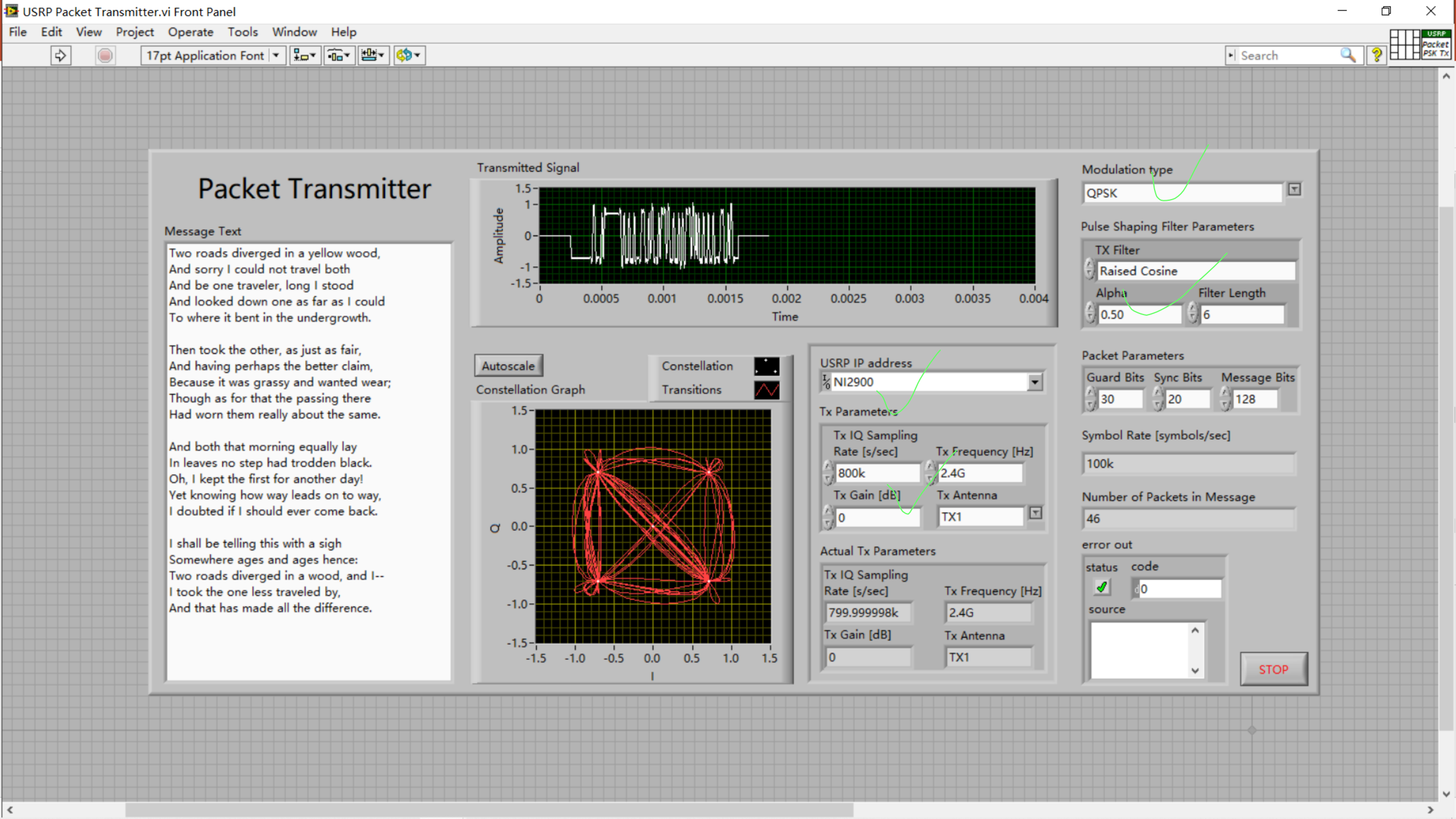


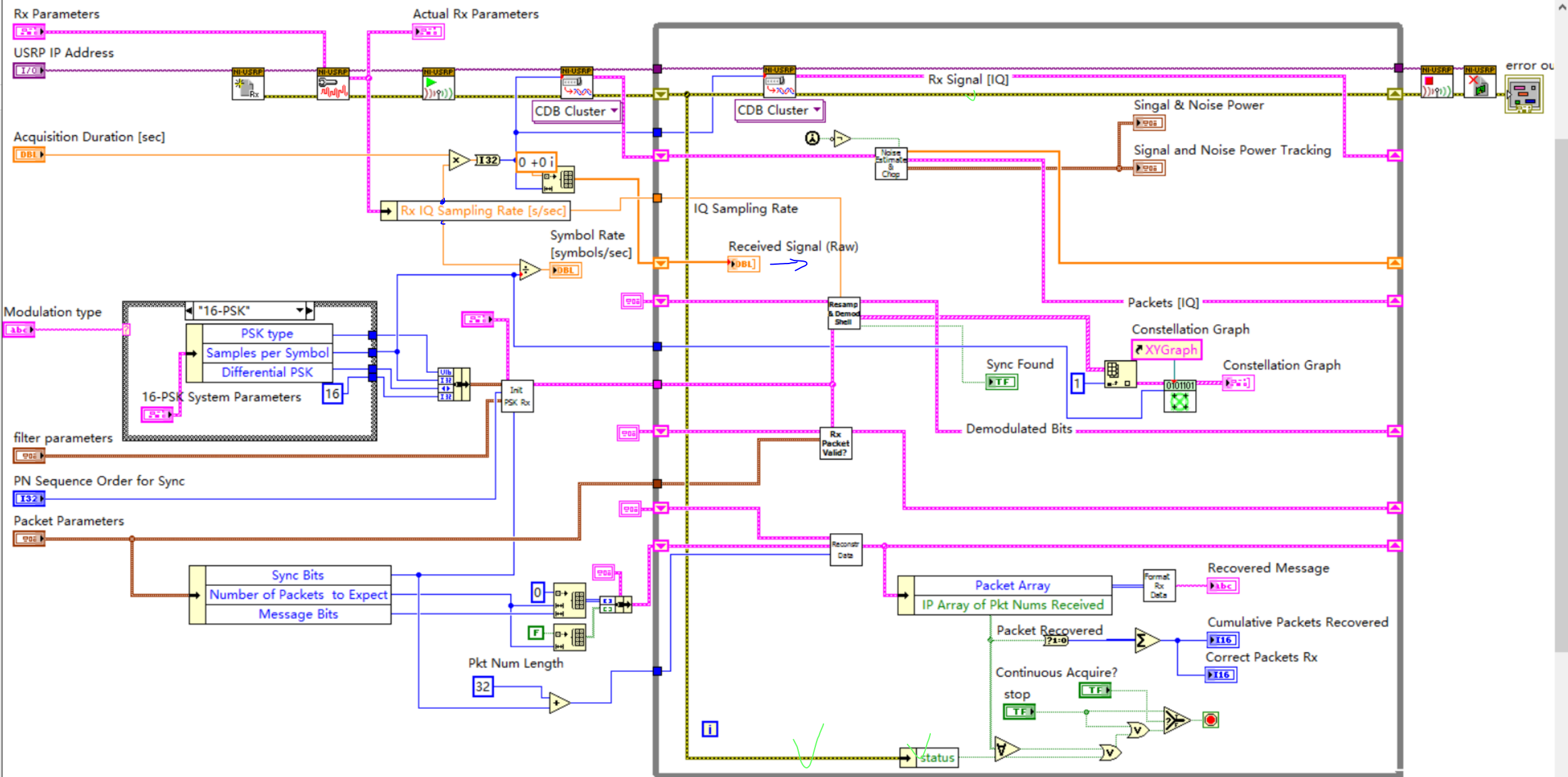












Packet Receiver

Recovered Message

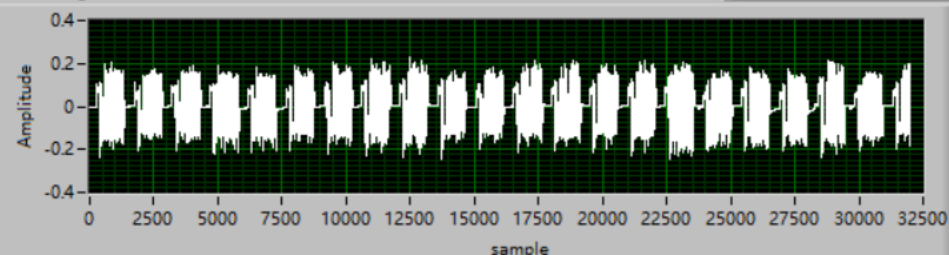
Two roads diverged in a yellow wood,
And sorry I could not travel both
And be one traveler, long I stood
And looked down one as far as I could
To where it bent in the undergrowth.

Then took the other, as just as fair,
And having perhaps the better claim,
Because it was grassy and wanted wear;
Though as for that the passing there
Had worn them really about the same.

And both that morning equally lay
In leaves no step had trodden black.
Oh, I kept the first for another day!
Yet knowing how way leads on to way,
I doubted if I should ever come back.

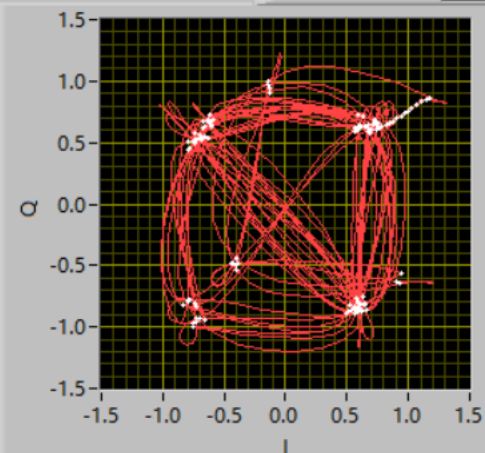
I shall be telling this with a sigh
Somewhere ages and ages hence:
Two roads diverged in a wood, and I--
I took the one less traveled by,
And that has made all the difference.

Received Signal (Raw)



Sync Found

Constellation Graph



Constellation

Transitions

USRP IP Address

1% NI2900

Rx Parameters

Rx IQ Sampling Rate [s/sec] 800k
Rx Gain [dB] 20
Rx Frequency [Hz] 2.4G
Rx Antenna RX2

Actual Rx Parameters

Rx IQ Sampling Rate [s/sec] 799.999998k
Rx Gain [dB] 20
Rx Frequency [Hz] 2.4G
Rx Antenna RX2

Modulation type

QPSK

Matching Filter Parameters

TX Filter Raised Cosine
Alpha 0.50
Filter Length 6

Acquisition Duration [sec]

40m

Symbol Rate

[symbols/sec]

100k

Correct Packets Rx

46

Signal & Noise Power

signal_power 0.0520785
noise_power 2.75247E-5

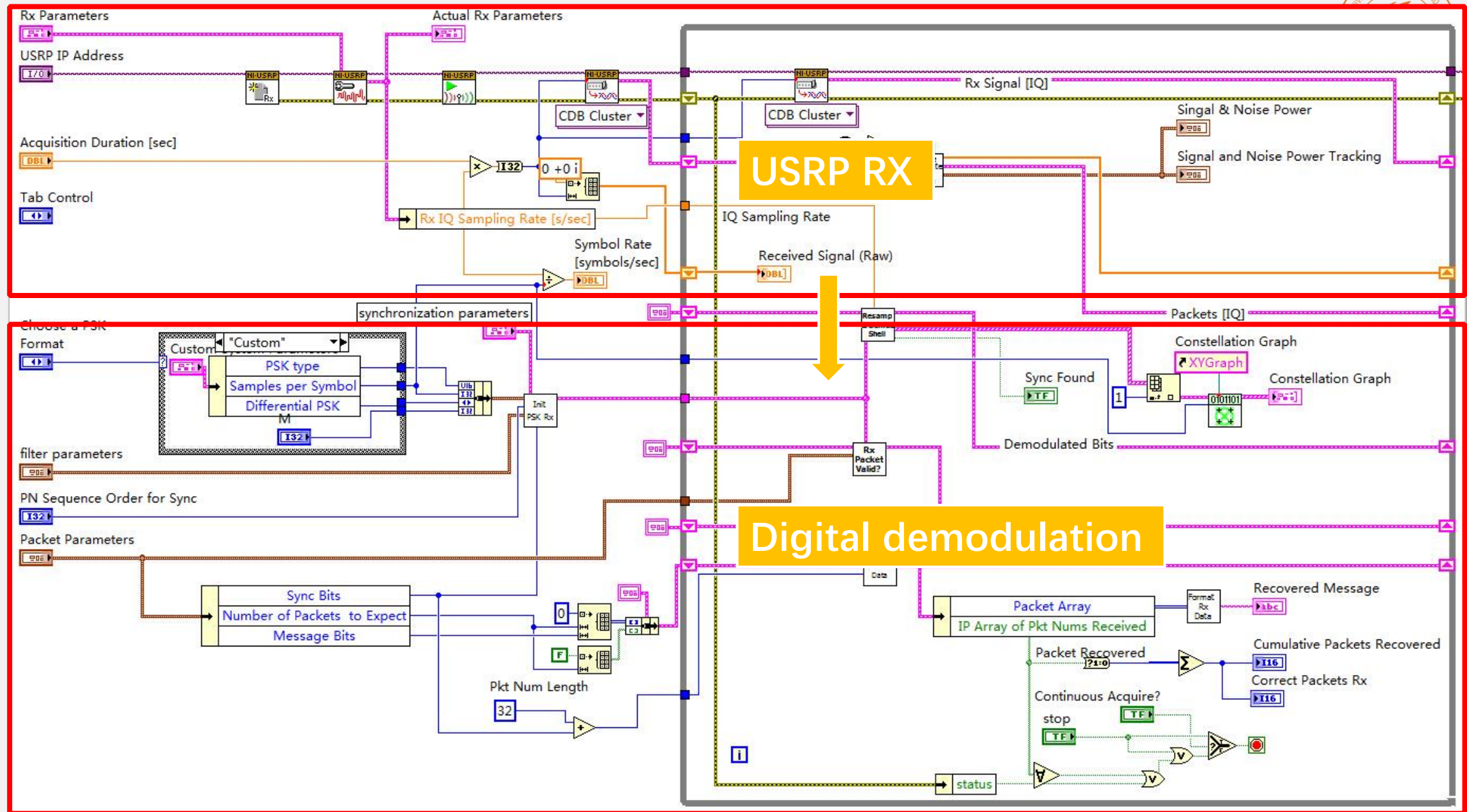
error out

status code

d0

source

STOP





Demo: Bit-Error-Ratio



Lab 9: USRP Text Transmission

1 Pre-Labs

2 Tranceiver Design and Simulation

3 USRP Verification

4 Comparison and Analysis



- Question ?





研究问题:

- 1、目标：利用USRP进行文本传输
- 2、文本如何切割成数据包（包格式，重点说包头作用）；
- 3、发射延时如何仿真（生产者-消费者模型）；
- 4、不同程序之间如何进行数据包传输（全局变量）；
- 5、实现16-PSK、8-PSK、4-PSK、BPSK；
- 6、信号的信噪比和误码率之间的关系；
- 7、讨论alpha、带宽和误码率之间的关系；
- 8、ASK、FSK的文本传输；
- 9、ASK、FSK的图像传输；

Packet Receiver

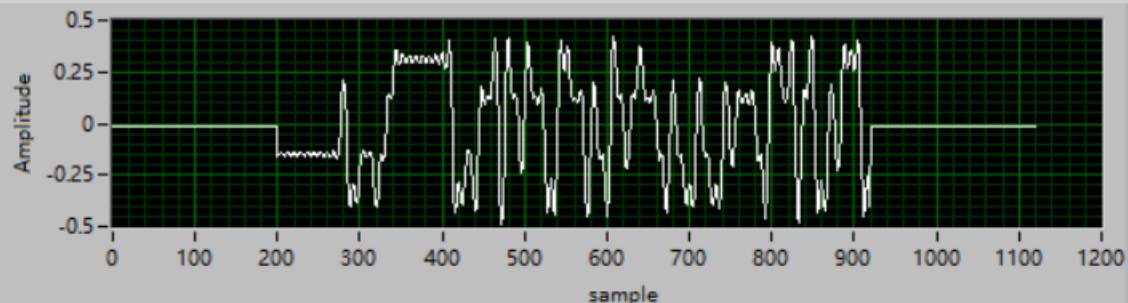
Recovered Message

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And sorry I could not travel both
And be one traveler, long I stood
And looked down one as
where it bent in the undergrowth.

Then took the other, as just as fair,
And having perhaps the better claim,
Because it was grassy and wanted wear;
Though as for that the passing there
Had worn them really about the
same. morning equally lay
In leaves no step had trodden black.
Oh, I kept the first for another day!
Yet knowing how way leads on to way,
I doubted if I should ever come back.

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I took the one less traveled by,
And that has made all the difference.

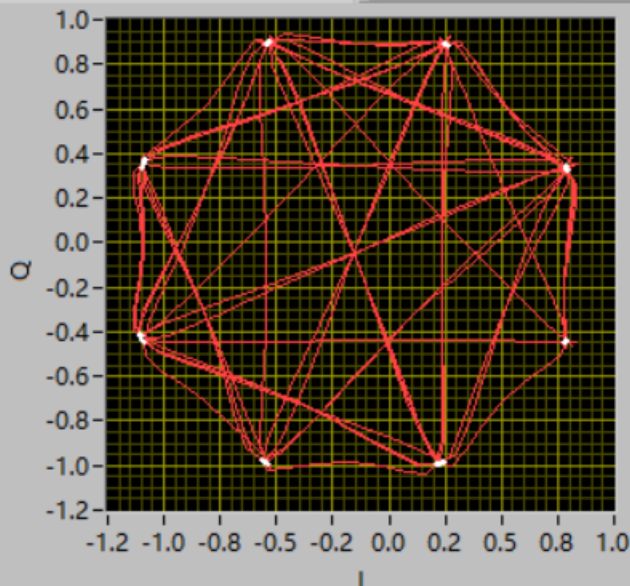
Received Signal (Raw)



Constellation

Transitions

Constellation Graph



Modulation type

8-PSK

Sync Found



Rx IQ Sampling
Rate [s/sec]

400k

Symbol Rate [symbols/sec]

50k

Matching Filter Parameters

TX Filter

Root Raised Cos

Alpha

1.00

Filter Length

6