

Course Activity

On-off keying

LED to camera communication

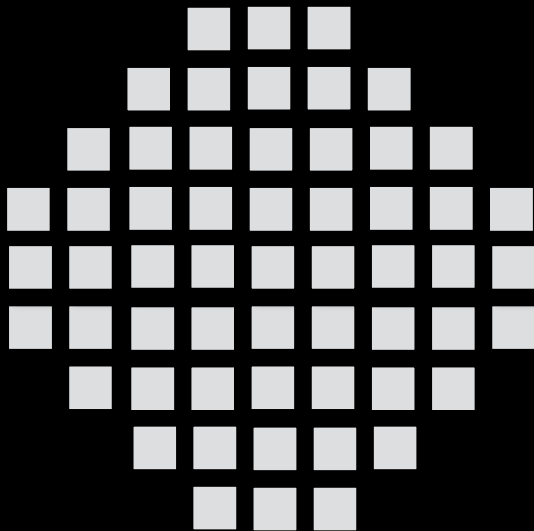
- CamCom
- Intuitive / Visible
- Clear and simple channel
- Easy encoding / low data rate

Camera

- Raspberry pi
- Frame rate 30fps
- Shutter speed = 1us
- Resolution 1920*1080

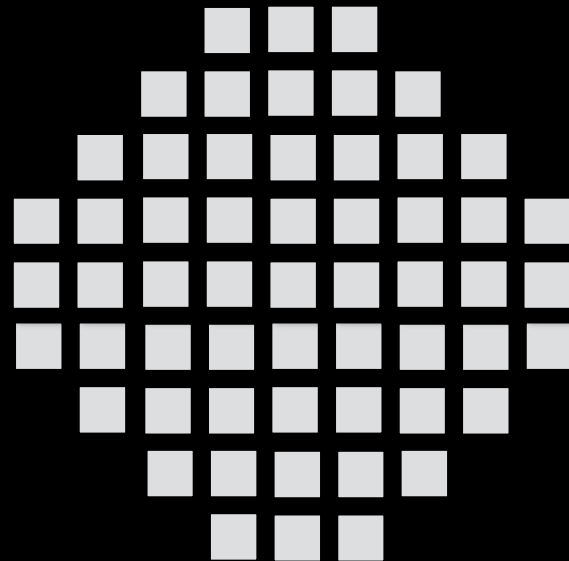
Camera – Rolling Shutter

Global Shutter



Pixels exposed
SIMULTANEOUSLY

Rolling Shutter



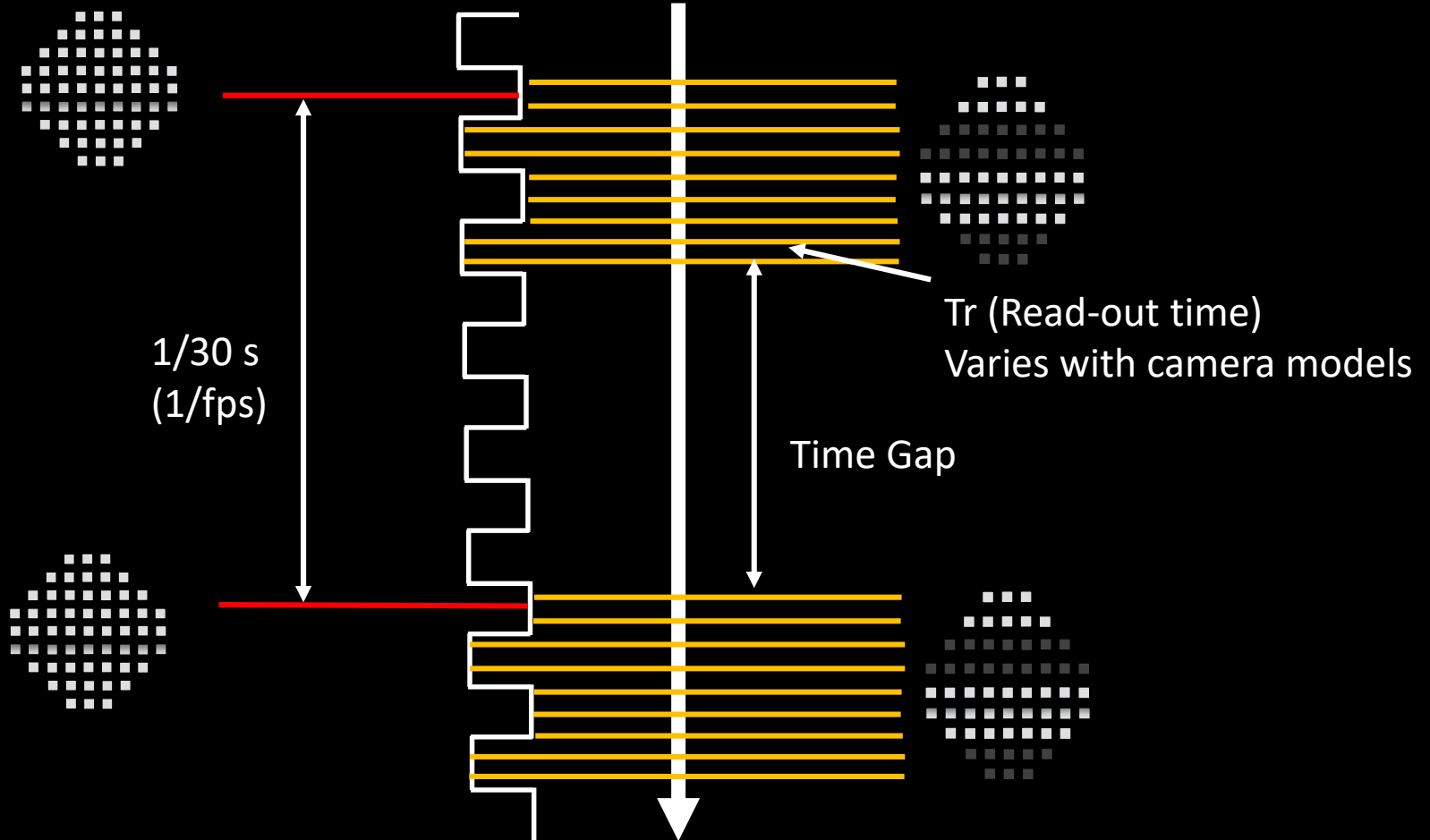
Pixels exposed
ROW BY ROW

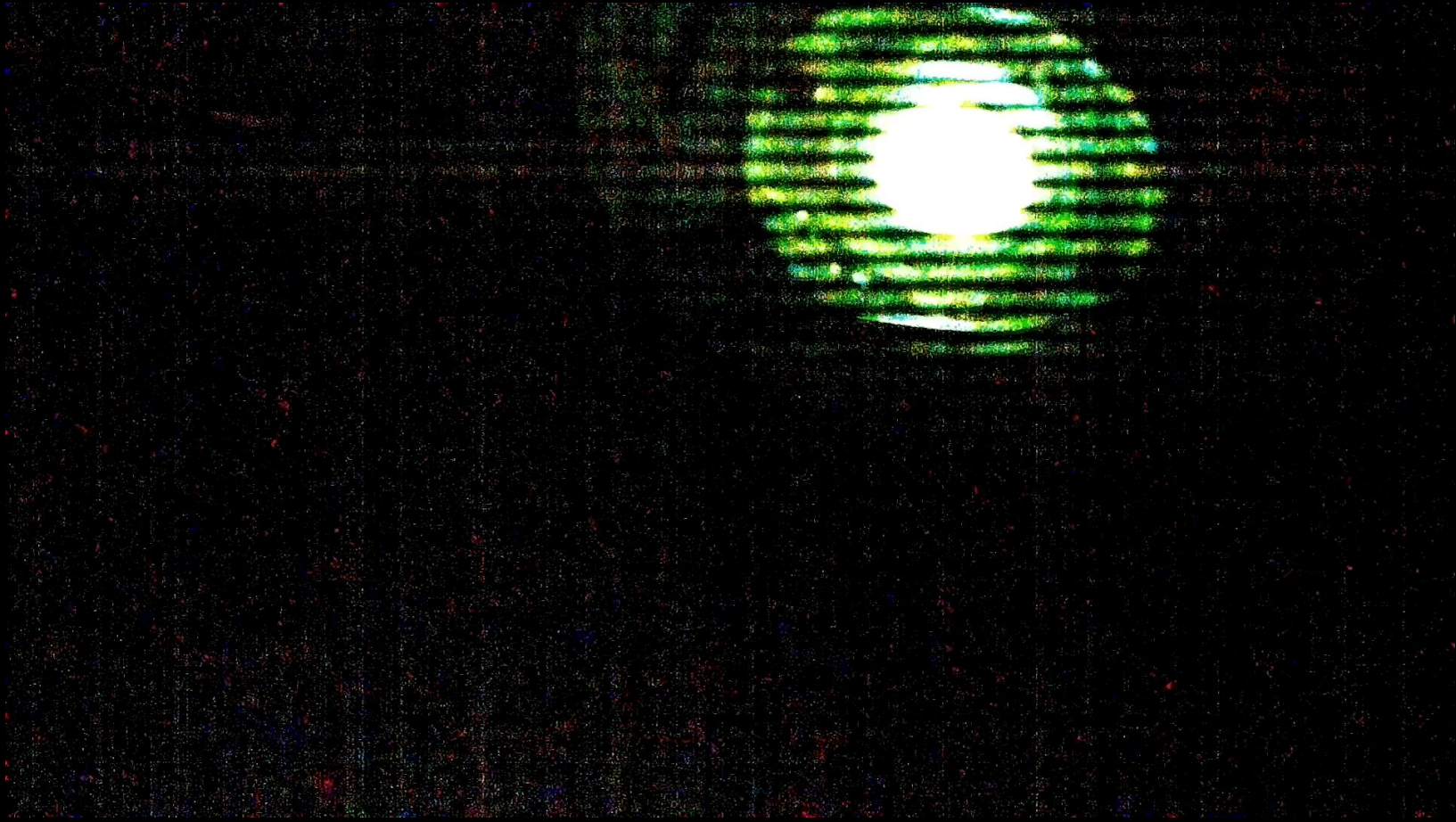
How rolling shutter works ?

Global Shutter

Signal Time

Rolling Shutter

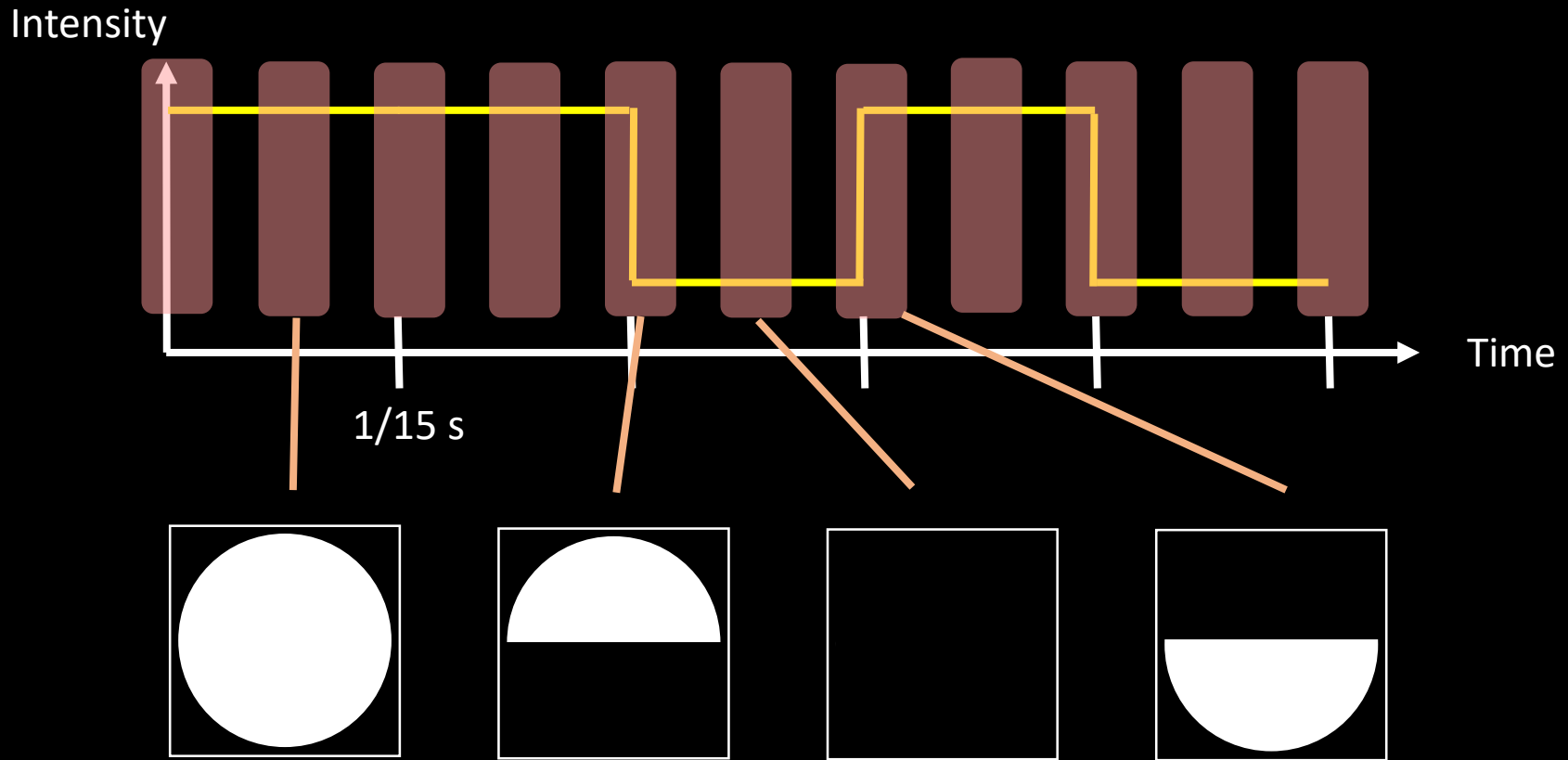




On-Off keying

- 1 = bright = on
- 0 = dark = off
- 1 second = 30 frames = 30 samples
- Symbol duration = $1/15$ second
- Self designed preamble (e.g. $1/5$ second bright

On-Off keying



Discard mixed frame, 1~2 frames = 1 bit, 3 frames = 2 bit

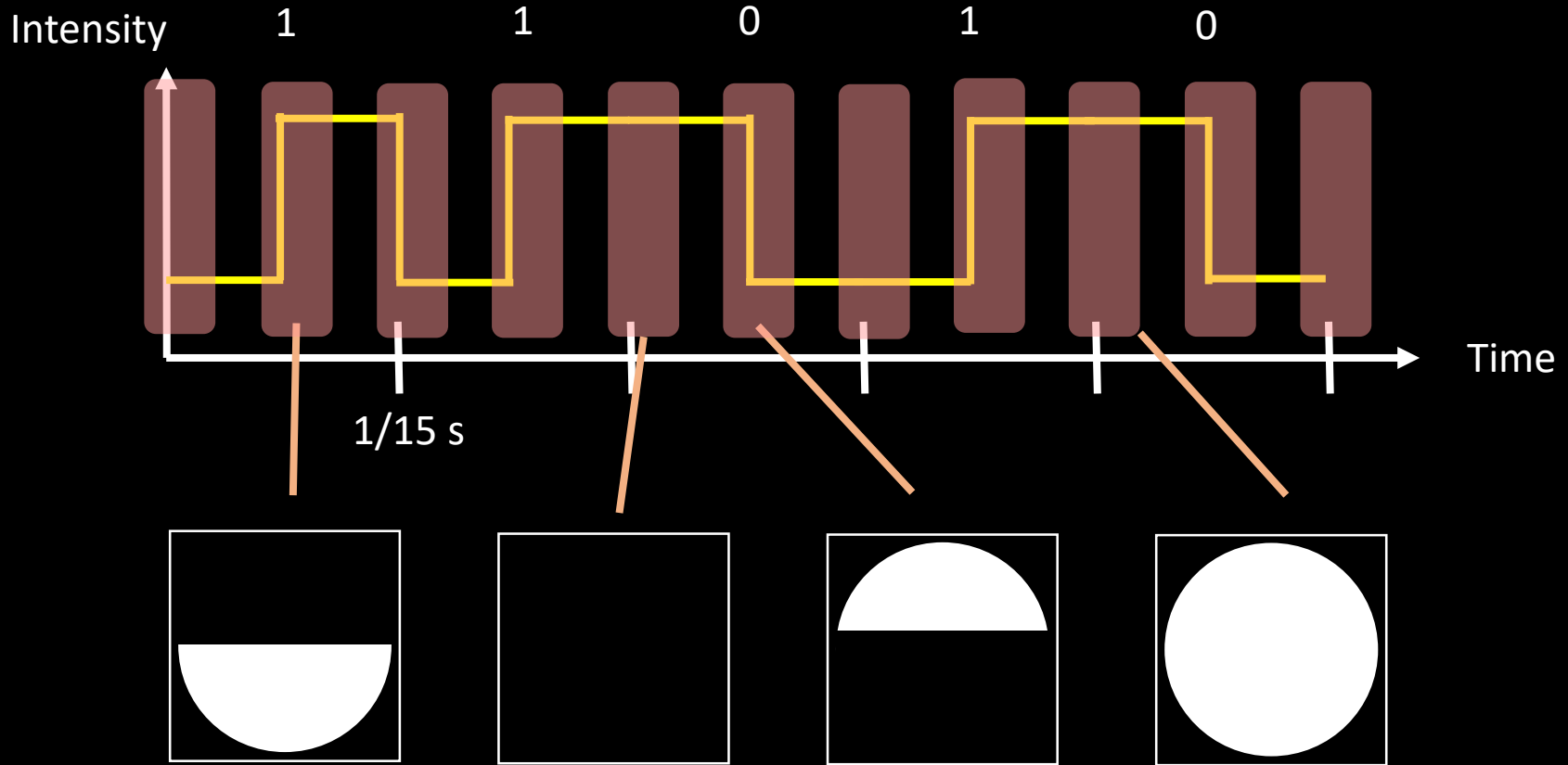
On-Off keying

- Problem : #On != #off, intensity changes
- No synchronization between Tx / Rx
 - E.g. Rx = 28 fps, Tx = 30fps
 - 30 consecutive '1' s fail

Manchester coding

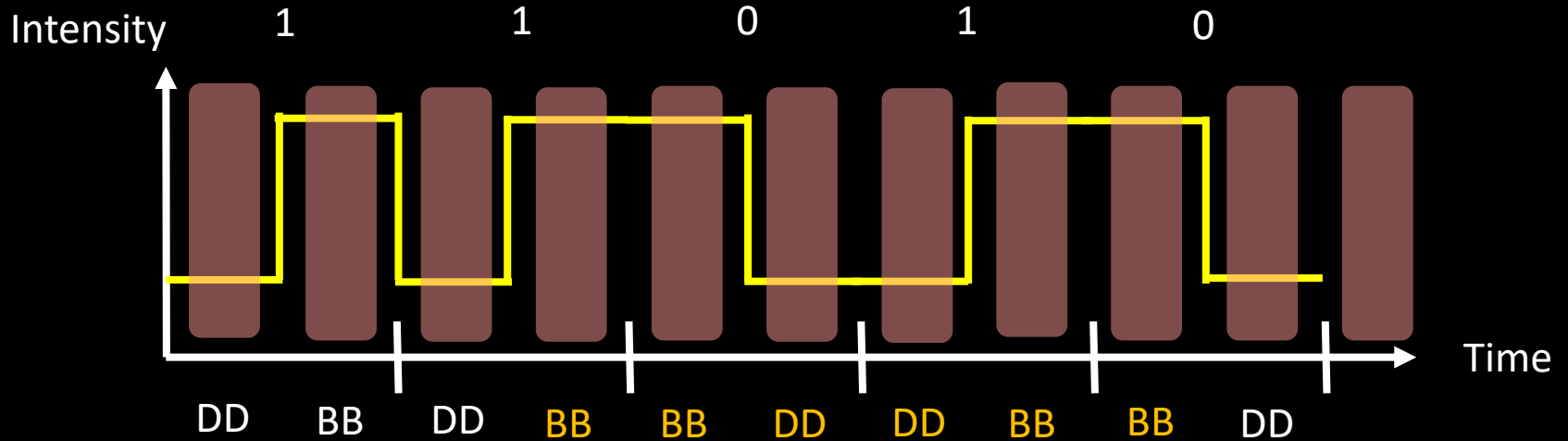
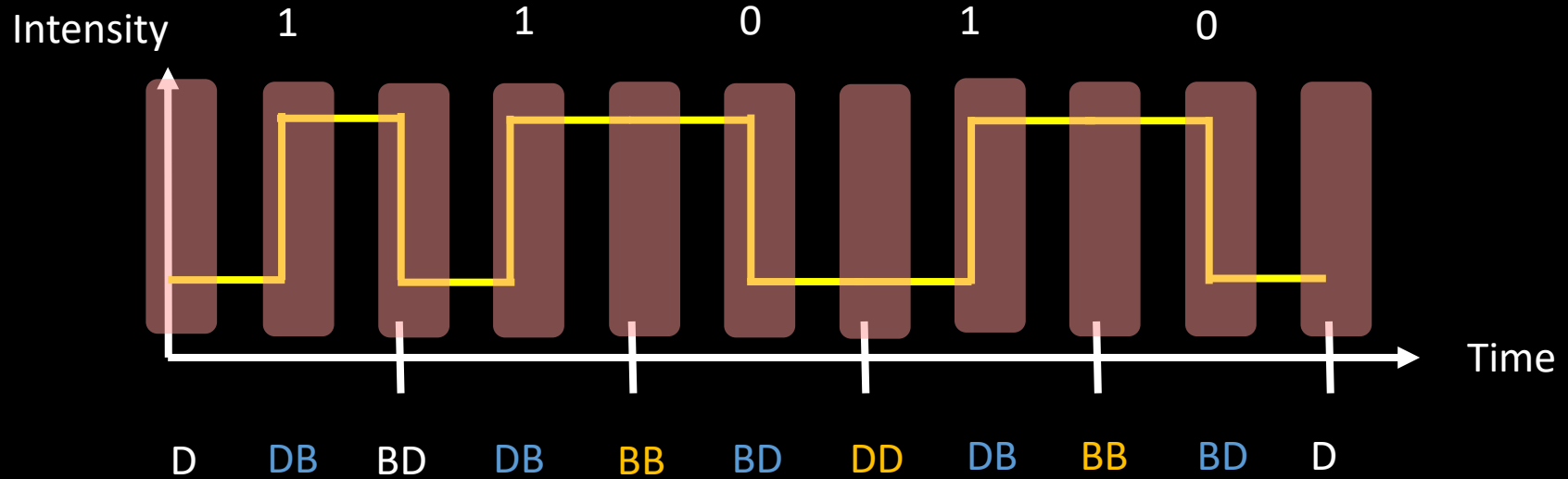
- 1 = dark -> bright
- 0 = bright -> dark
- Intensity changes in EVERY symbol
 - Provide synchronization
- Symbol duration = $1/15$ second
- Self designed preamble (e.g. $1/5$ second bright

Manchester coding



Discard mixed frame, 1~2 frames = 1 bit, 3 frames = 2 bit

Manchester decoding



Course Activity

- In-class exercise
 - Deadline : Wednesday (maybe extended)
 - Inter/ inner group discussion ok !
 - Inter group code exchange FORBIDDEN
 - DO NOT SHOW YOUR CODE TO OTHERS EXCEPT YOUR TEAMATE

Activity #2 : CamCom Manchester

- Tx
 - USRP control LED
 - Fixed Sampling rate : 200K
 - 1 = bright, 0 = dark. Linear scale (0.5 = half intensity)
 - **Sample MATLAB file create bin file**
 - https://drive.google.com/file/d/0B_Z-TUMjZ2A8ZDNLM0FMQ0U1TUU/view
 - **Upload your bin file through**
 - `scp teamN_v#.bin wn@10.5.7.182:~/ook-vlc/`
 - Password: wnfa2017

Activity #2 : CamCom Manchester

- Rx
 - Raspberry camera
 - Fixed 30fps 1920*1080 mp4
 - **Captured video in**
 - <http://mvnl.csie.ntu.edu.tw/~wnfa/wn17fall/>
 - test.mp4 – sample video for 1kHz cosine wave
 - **Download the video and decode**
 - Read video sample code in
 - <https://www.dropbox.com/s/5zx14ozqg408san/OOKRxDemo.m?dl=0>

Requirement

- Decode 1 byte (1 char) from 1s video

Submit

- courses.dlc.ntu.edu.tw
 - Exercise > OOK
 - .zip containing encode.m/ decode.m/ report.pdf

Activity #2 : Rolling Shutter Manchester

- Tx
 - USRP control LED
 - Fixed Sampling rate : 200K
 - 1 = bright, 0 = dark. Linear scale (0.5 = half intensity)
 - **Sample bin file created by MATLAB**
 - **Sample MATLAB file create bin file**
 - **Upload your bin file to**

Activity #2 : Rolling Shutter Manchester

- Rx
 - Raspberry camera
 - Fixed 30fps 1920*1080 mp4
 - **Captured video in**
 - <http://mvnl.csie.ntu.edu.tw/~wnfa/wn17fall/>
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