What

Why

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Demo

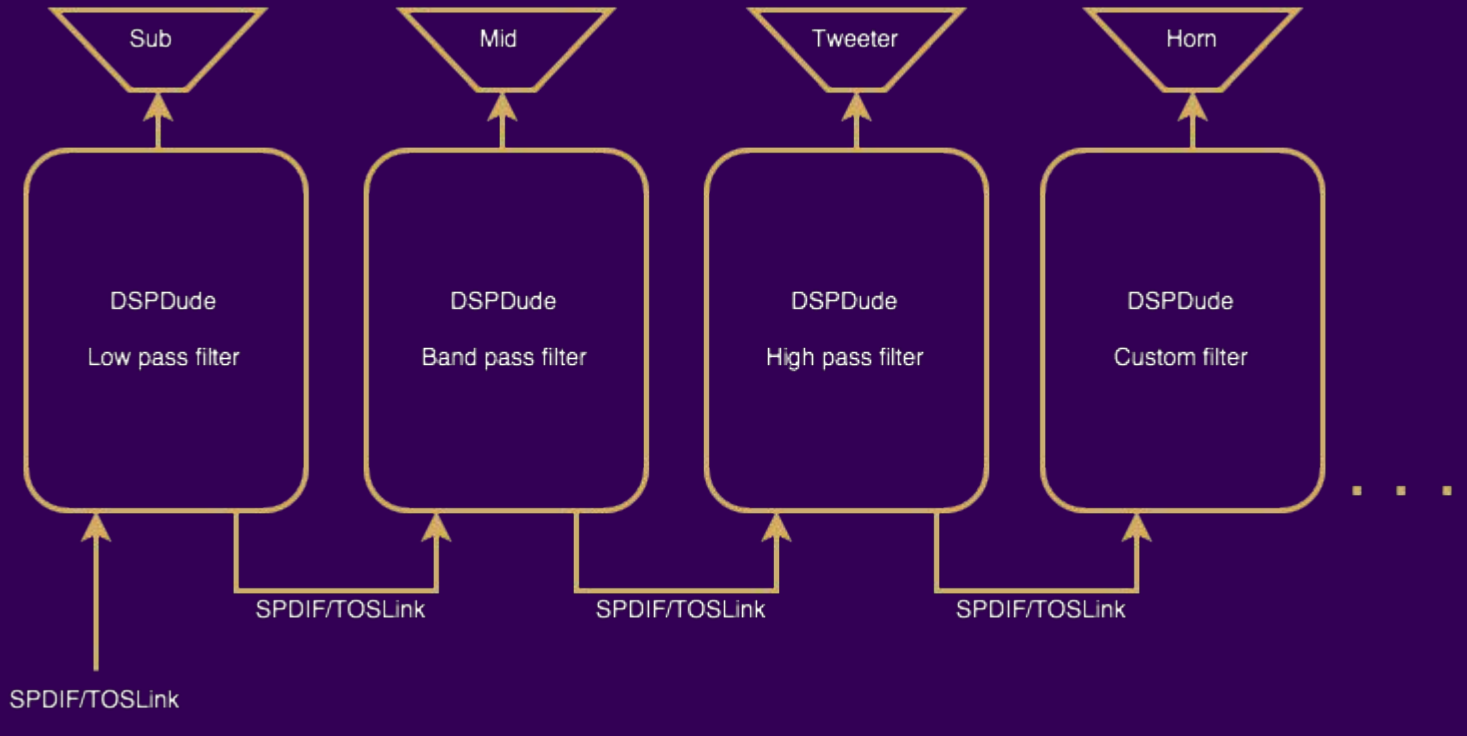
Timeline

DSPDude

Re-programmable audio Digital Signal Processor

Valentina Chamorro & Yanni Coroneos

- daisy-chainable
- interchangeable filters via sdcard
- high-quality 24bit, 192KHz, dual-channel output
- isolated communications over fiber-optic



Why Not Analog Filters?

- analog filters are not reconfigurable
  - All passives must be recalculated
- analog filters are big and expensive
  - Different circuit for every filter
- we can reasonably get higher order filters with an fpga
  - Just need faster clock and more FIR coefficients OR more slices

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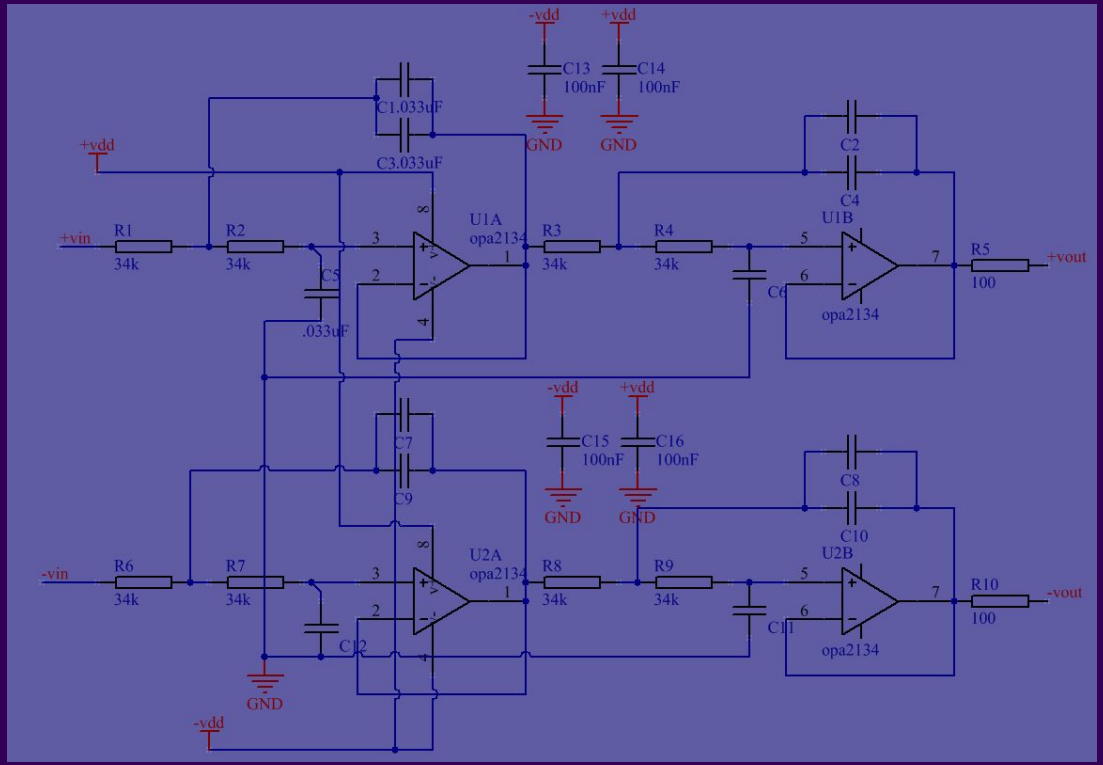
4th Order Analog Filter

- Good luck



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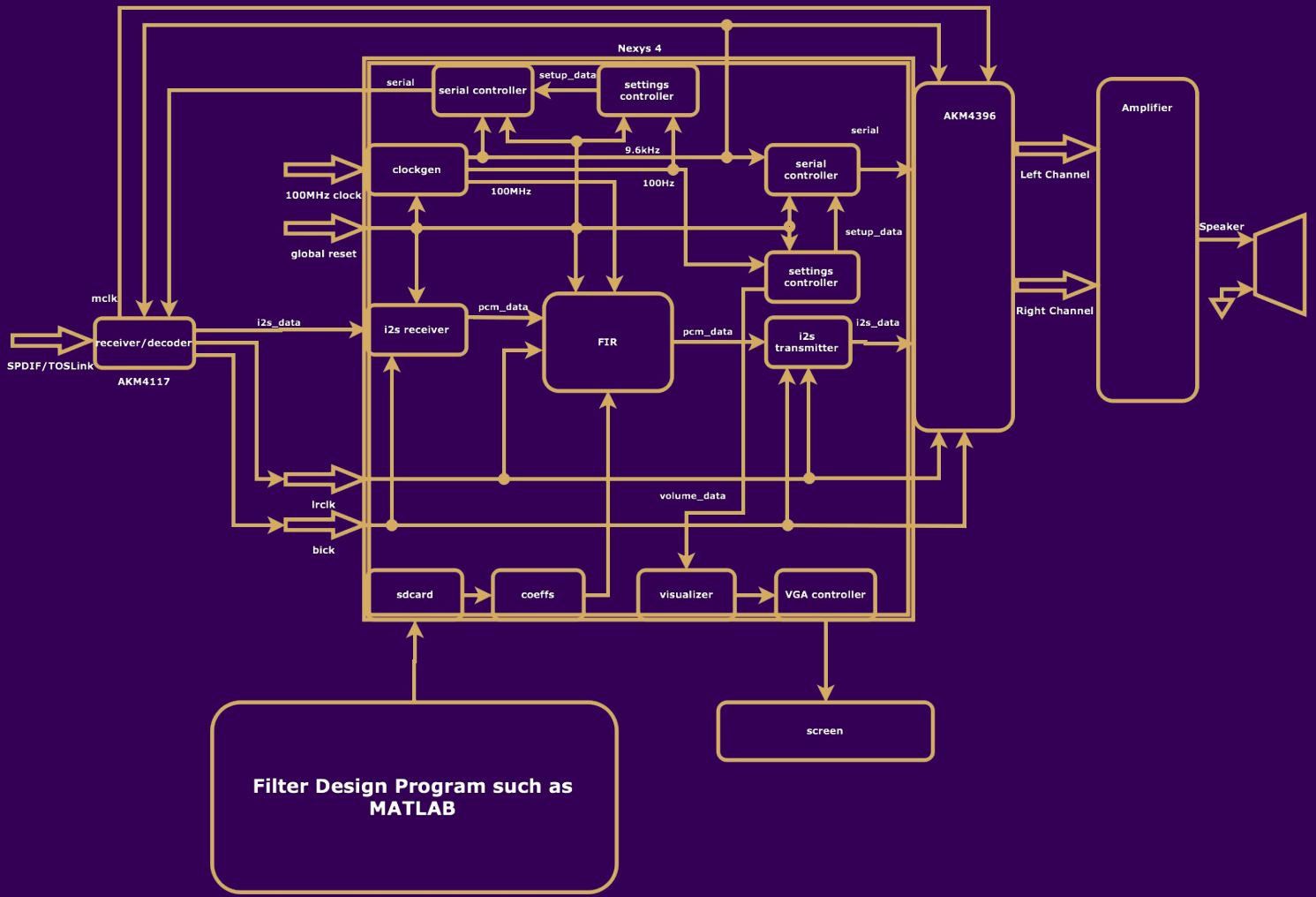

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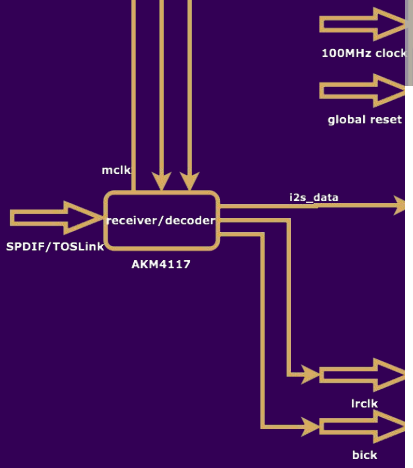
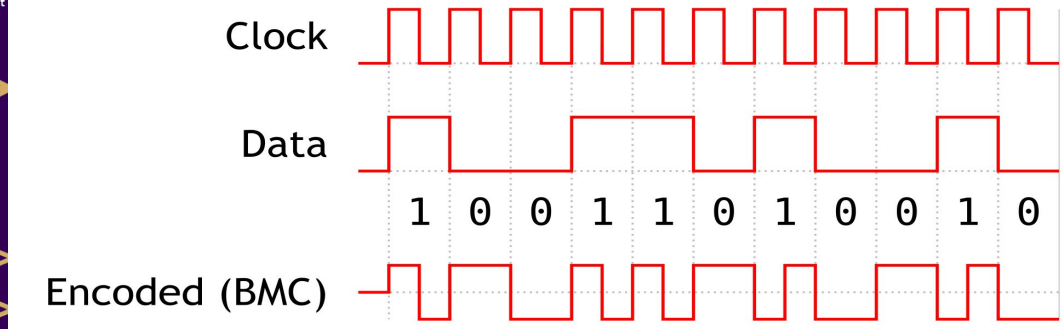
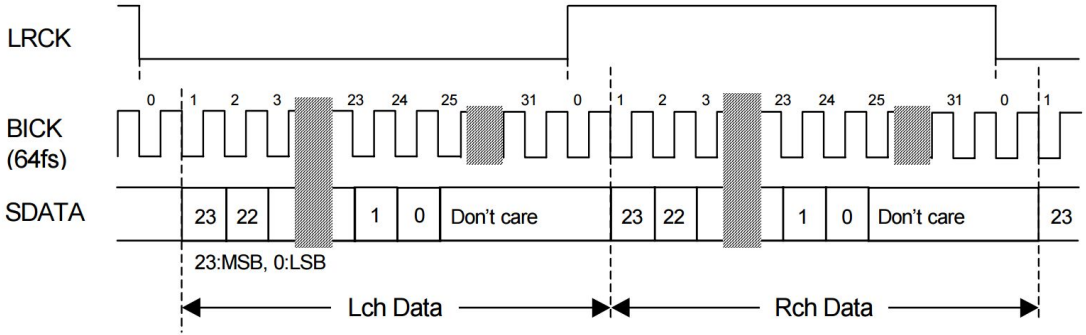
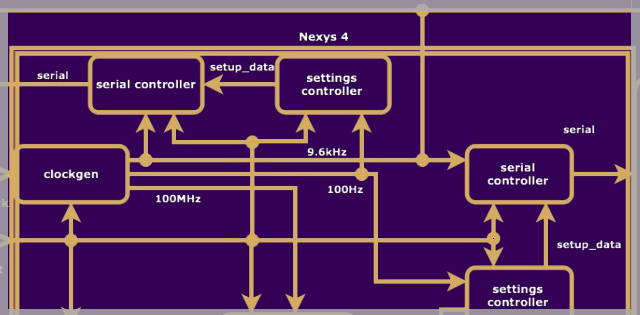
Input Stage

- SPDIF/TOSLink
- AK4117 decodes SPDIF to i2s



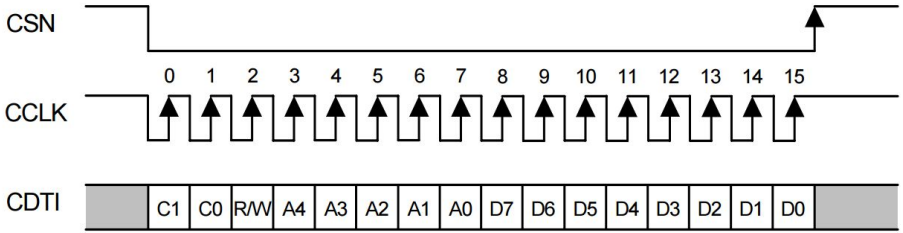






Serial & FSM's

- AK4117 and AK4396 have control registers
- Programmed with 16bit SPI



C1-C0: Chip Address (C1=CAD1, C0=CAD0)
R/W: READ/WRITE (Fixed to "1", Write only)
A4-A0: Register Address
D7-D0: Control Data

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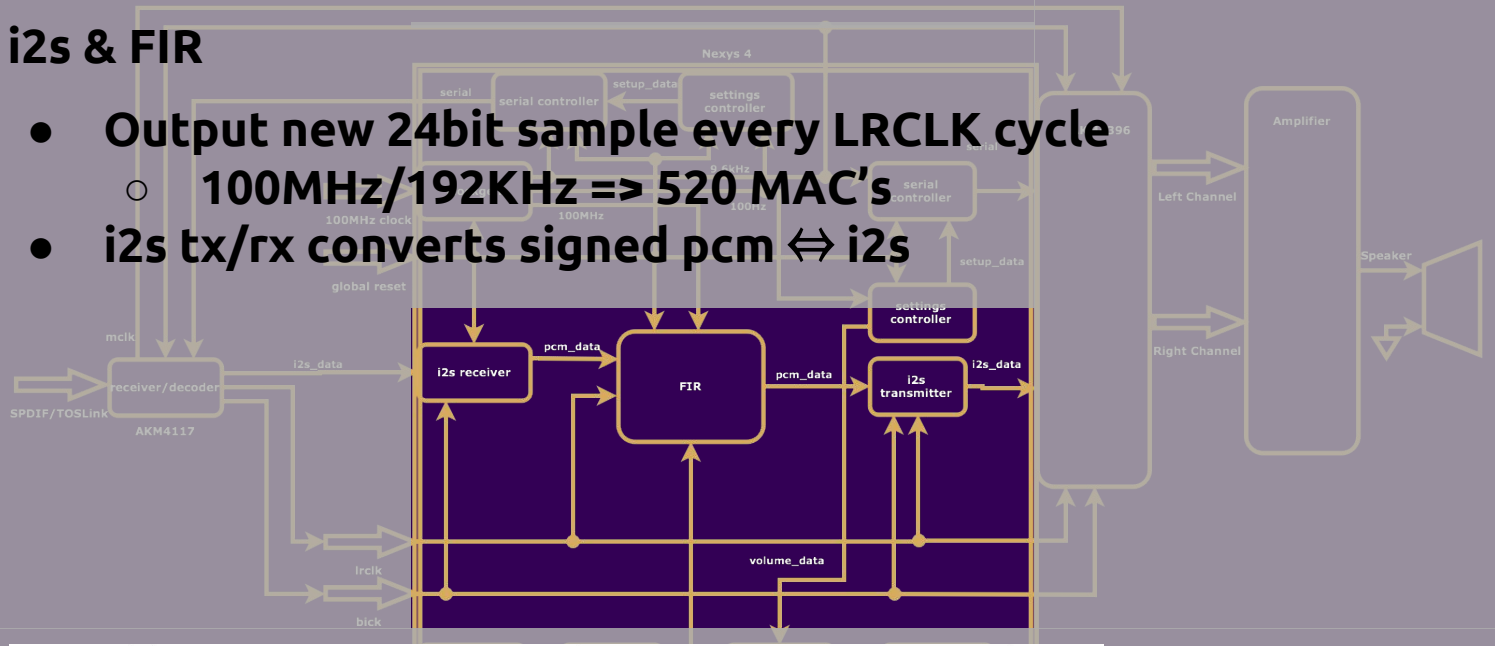
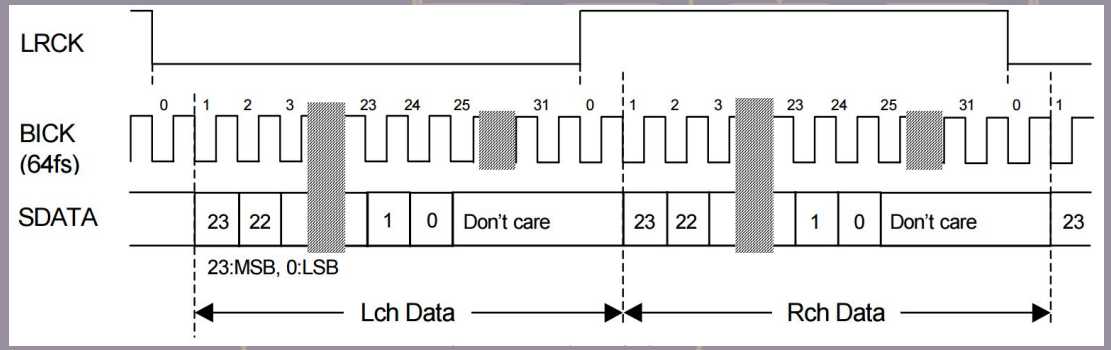
Timeline

i2s & FIR

- Output new 24bit sample every LRCLK cycle
  - 100MHz/192KHz => 520 MAC's
- i2s tx/rx converts signed pcm ⇔ i2s





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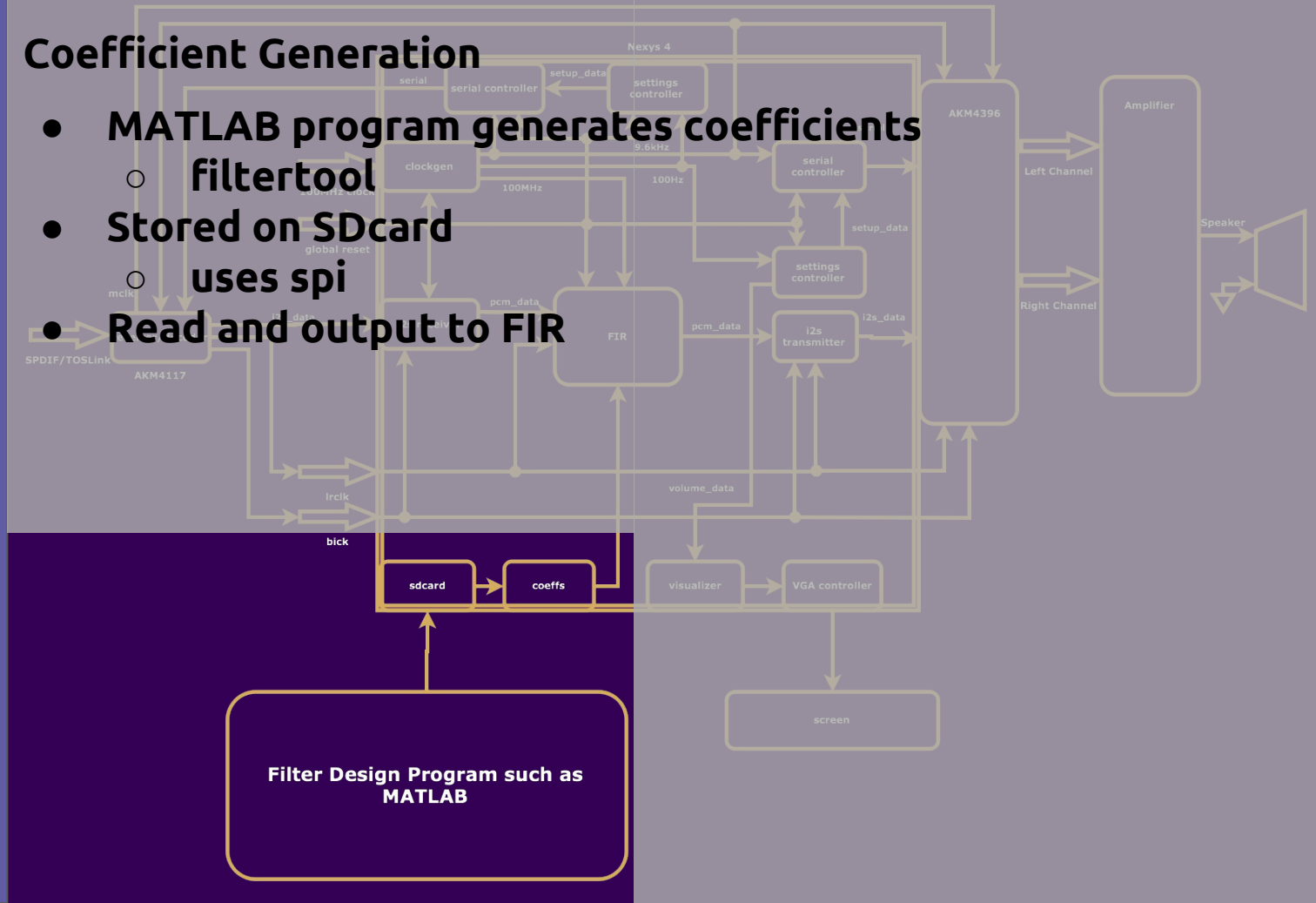
Timeline

Coefficient Generation

- MATLAB program generates coefficients
  - filtertool
- Stored on SDcard
  - uses spi
- Read and output to FIR



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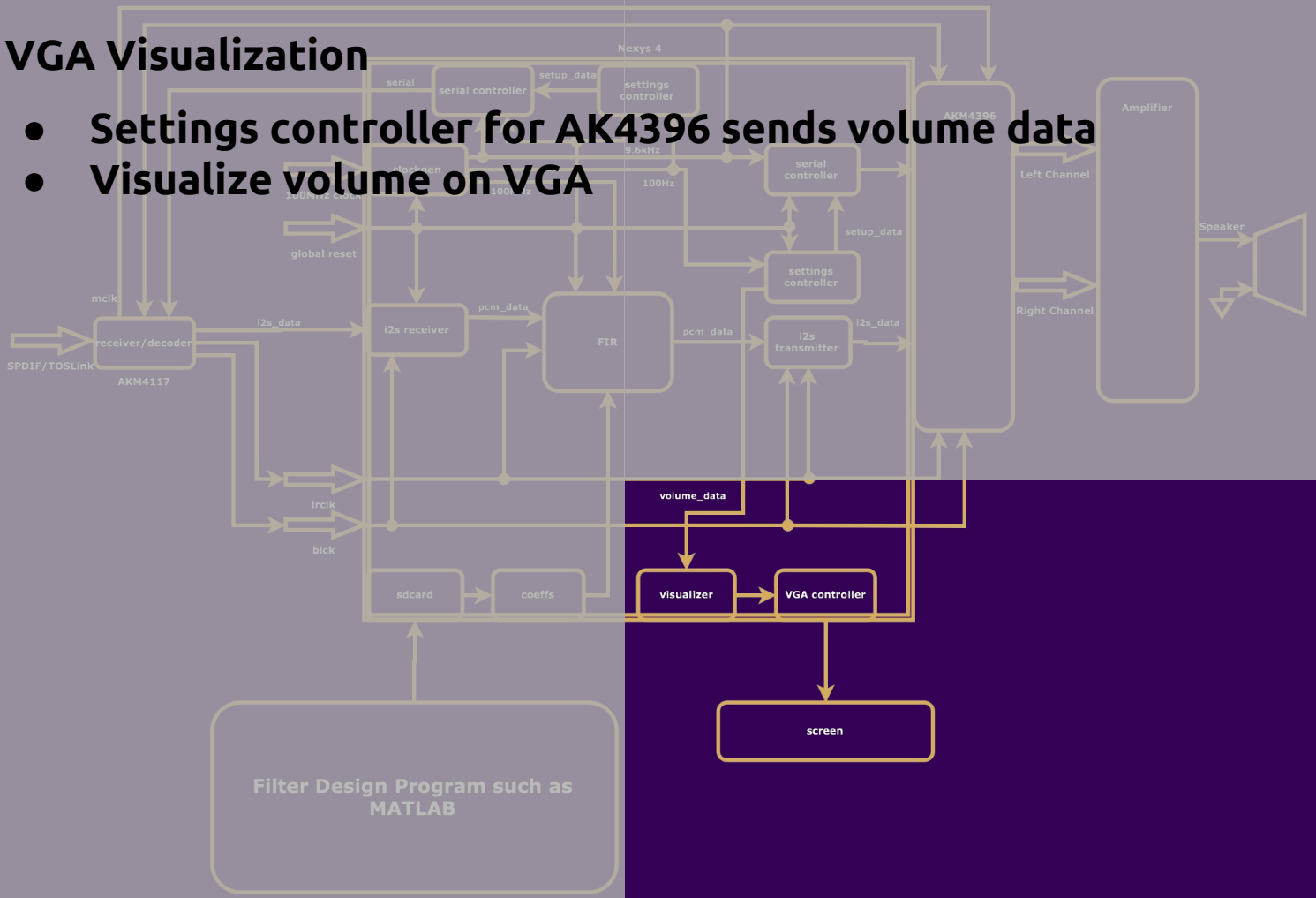
Timeline

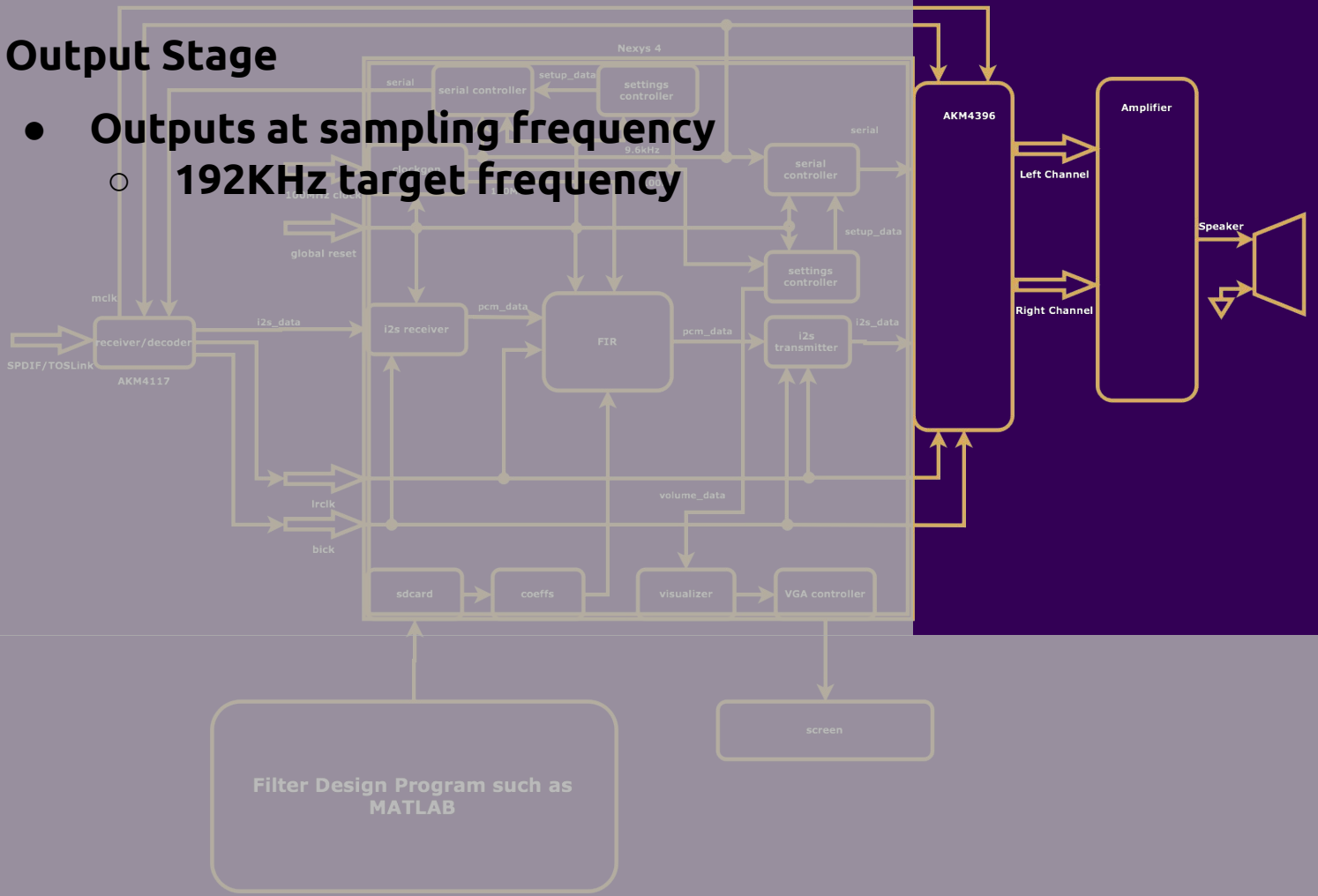
VGA Visualization

- Settings controller for AK4396 sends volume data
- Visualize volume on VGA



Output Stage

- Outputs at sampling frequency
  - 192KHz target frequency



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Generating Coefficients

- How to generate FIR coefficients in MATLAB

Timeline

	10/25/2015	11/1/2015	11/8/2015	11/15/2015	11/22/2015	11/29/2015	12/6/2015
clock gen module							
serial controller module							
i2s transmitter module							
settings controller module							
codec outputs sound							
generate fir coefficients							
r/w coefficients to sdcard							
i2s receiver module							
fir module							
interface amplifier and speakers with fpga							
volume control							
vga controller module							
check off							

Questions?