History and Impact of Computers in Music

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Why Computers & Music?

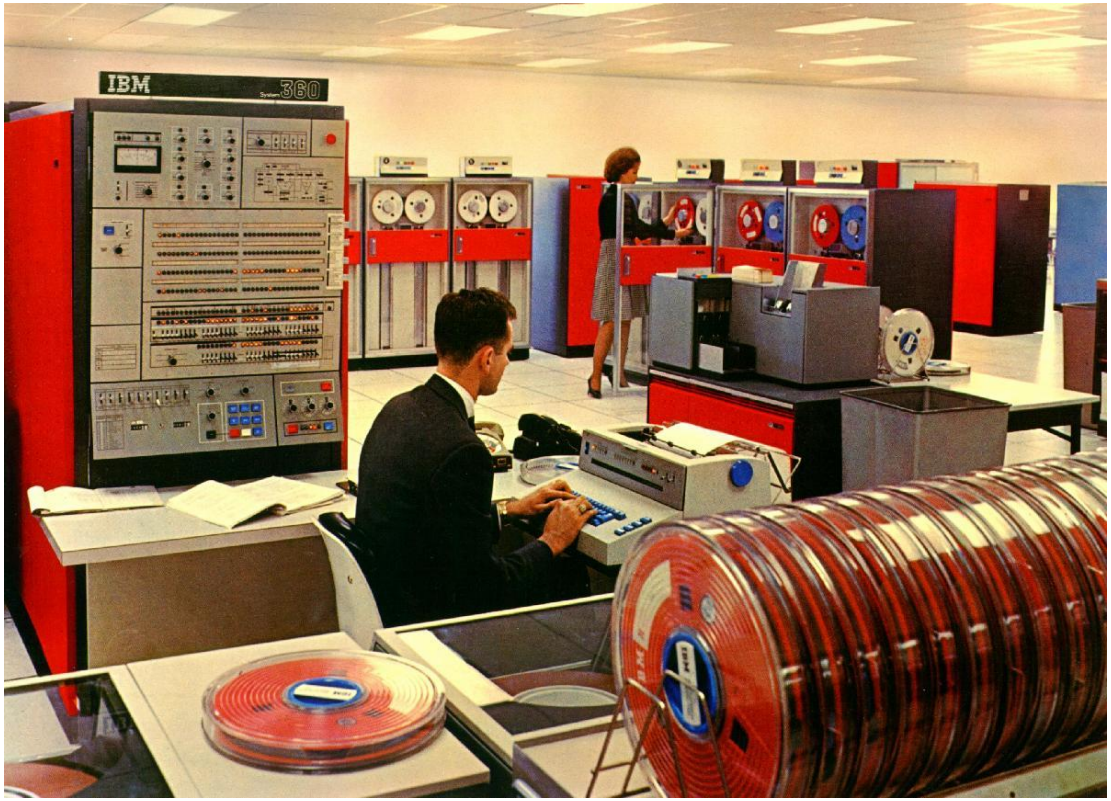
- Store & Retrieve
- Manipulate
  - Cut, Copy, Paste, Undo
  - Non-destructive editing
- Network
  - Control, Share, Expand
- Cost
- Time

Why Computers & Music?

- Sampling
- Size reduction
- Complexity
- Electronic musicians like to hook up stuff to other stuff
  - Geek factor

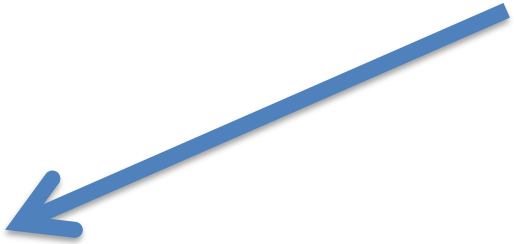
The 1970’s

In the early 1970’s, computer components shrink dramatically.



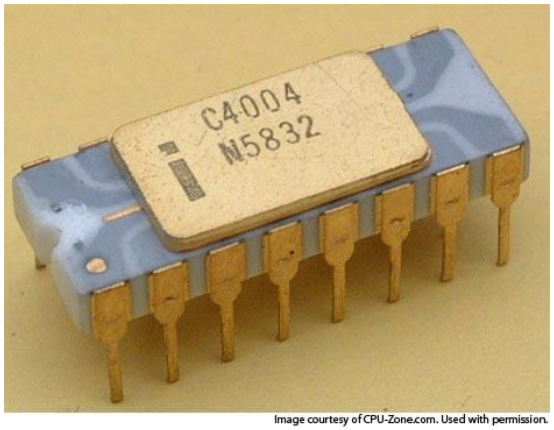
1960s IBM Mainframe

12AX7
TUNG-SOL
DE IN RUS

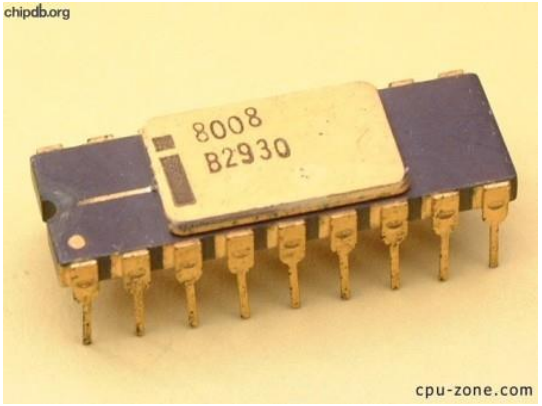


M8412
LM
741CN

The Microprocessor

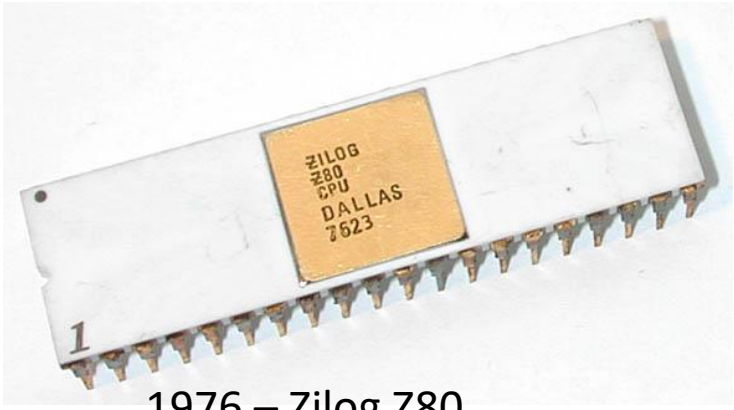


1971 – Intel 4004



1972 – Intel 8008

1974 – Motorola MC6800



1976 – Zilog Z80

Late 1970s –> 1980s

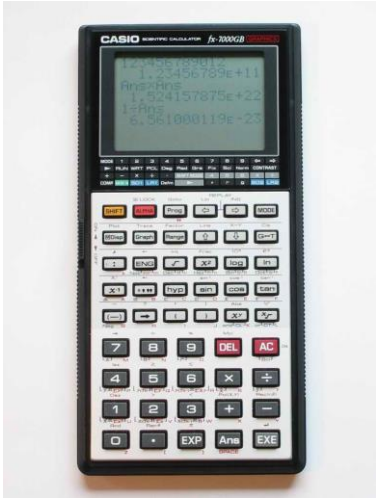
The reduction of both size and cost of computer parts results in a huge wave of microprocessor controlled devices and personal computers

This puts computing power and speed in the hands of a much wider range of people

Electronic Instruments

Personal Computers

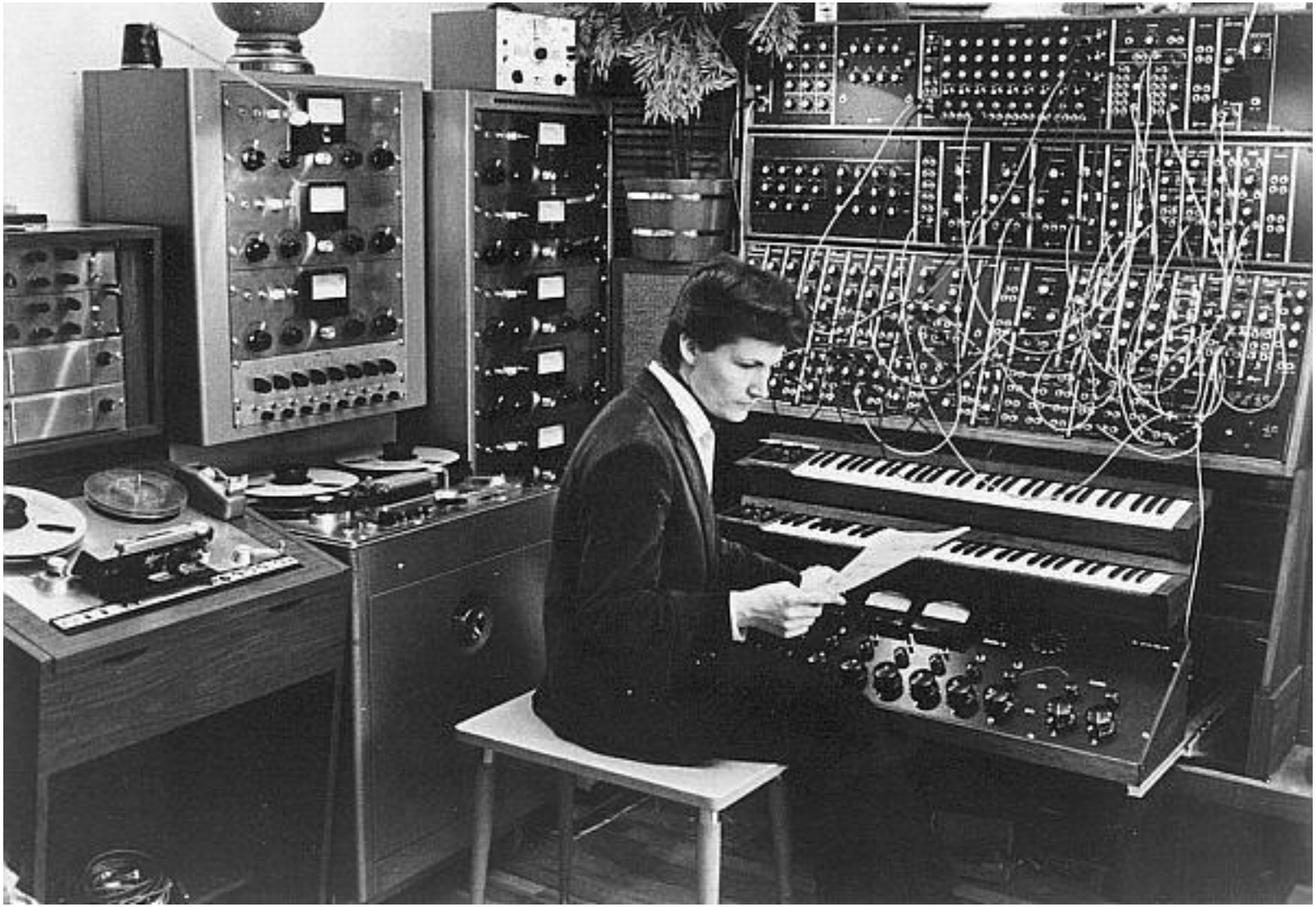
1978 – 1985 The Golden Age of Arcade Video Games



Advanced Calculators

Impact

- Keyboard players benefit early on from the use of microprocessors
  - Many keyboard players are already “techy”
  - Store and retrieve programs or “patches”
  - Store and retrieve sequences of notes
  - Gain greater polyphony
    - Can play more notes at the same time
  - Advanced sounds and effects



Wendy Carlos – late 1960s

1978 - Sequential Circuits Prophet-5

1979 - Oberheim OB-X Series

Led Zeppelin – Mid 1970s

Depeche Mode – Early 1980s

MIDI

- Most keyboard manufactures are using proprietary systems at this time
  - Very hard or impossible to connect devices from different manufacturers together
- A common communication protocol was needed so musical devices could control, share, store, and retrieve

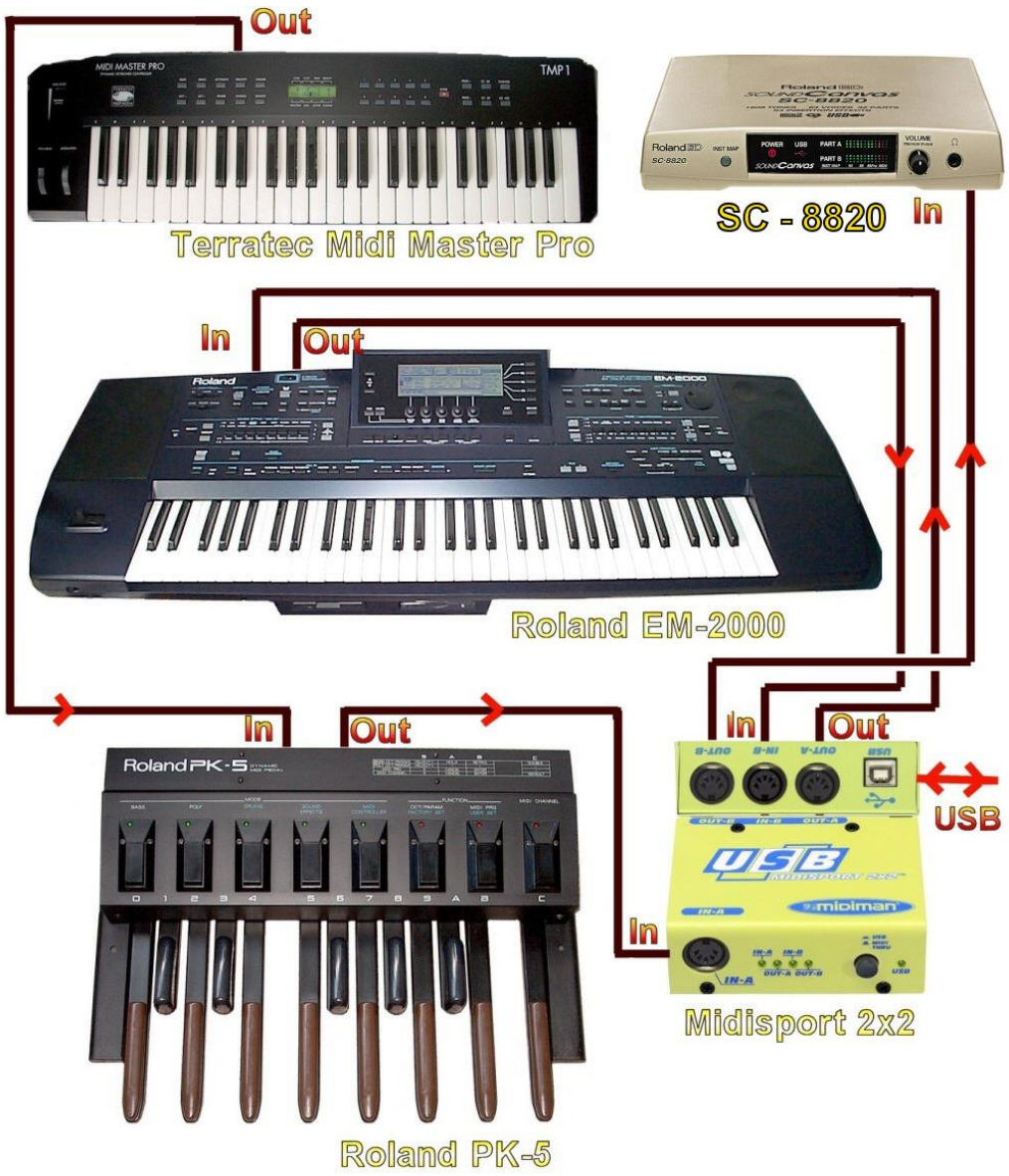
MIDI

- Musical Instrument Digital Interface
- Standardized in 1983 by a panel of music industry representatives
- 16 channels of information
- Note on/off, tempo, control change, program change, Sysex (System Exclusive)

MIDI

MIDI Connections – uses 5 pin DIN plugs and cables

MIDI allows many different devices, from many different manufacturers, to communicate

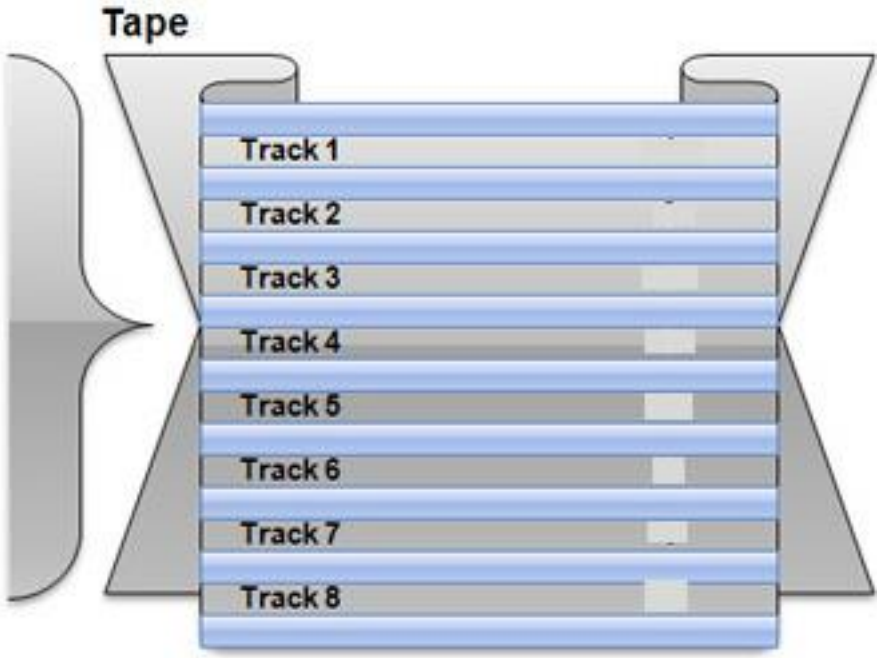


Computer Recording

1985 – Atari 1040ST

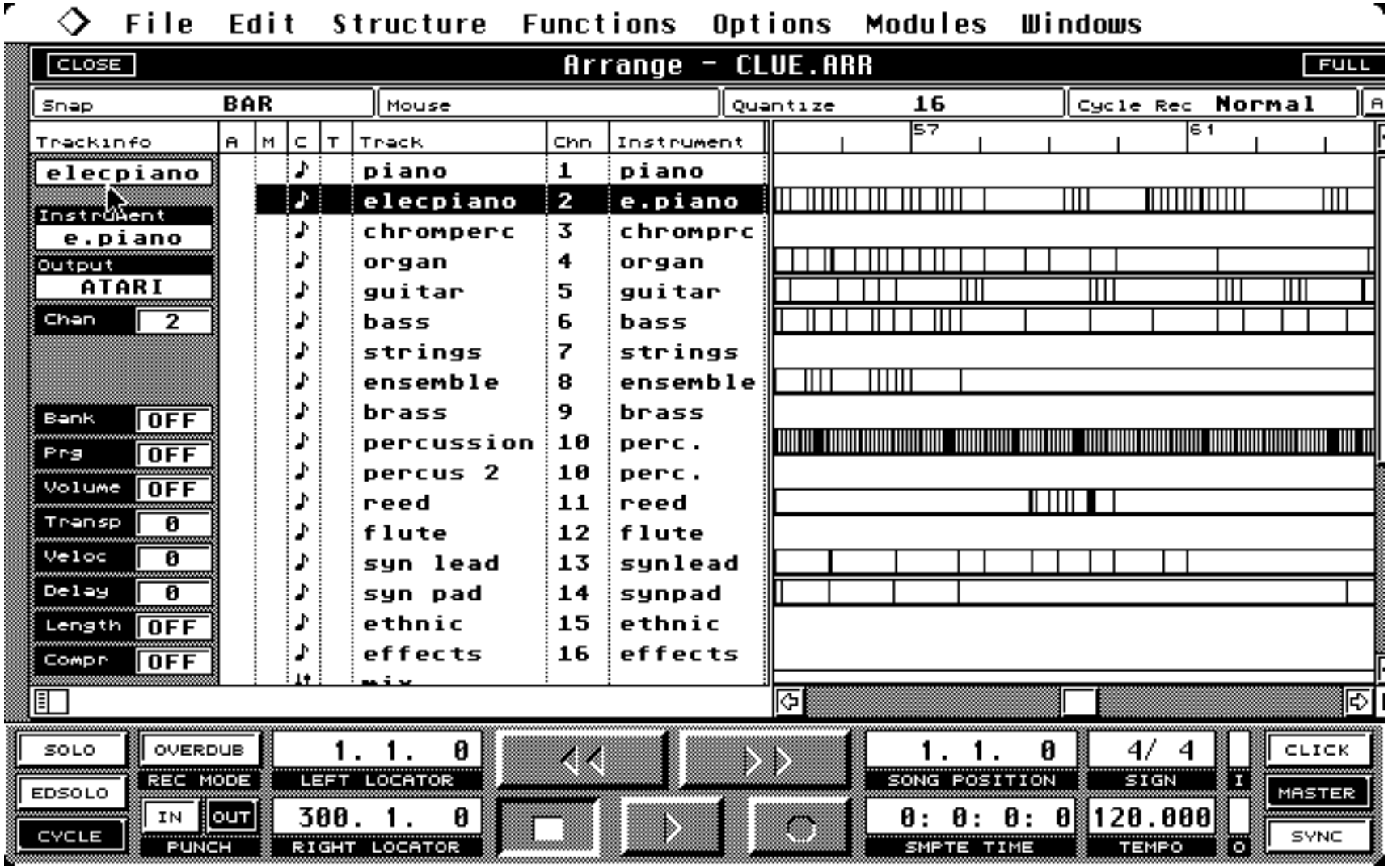
Comes with MIDI ports from the factory

Computer Recording

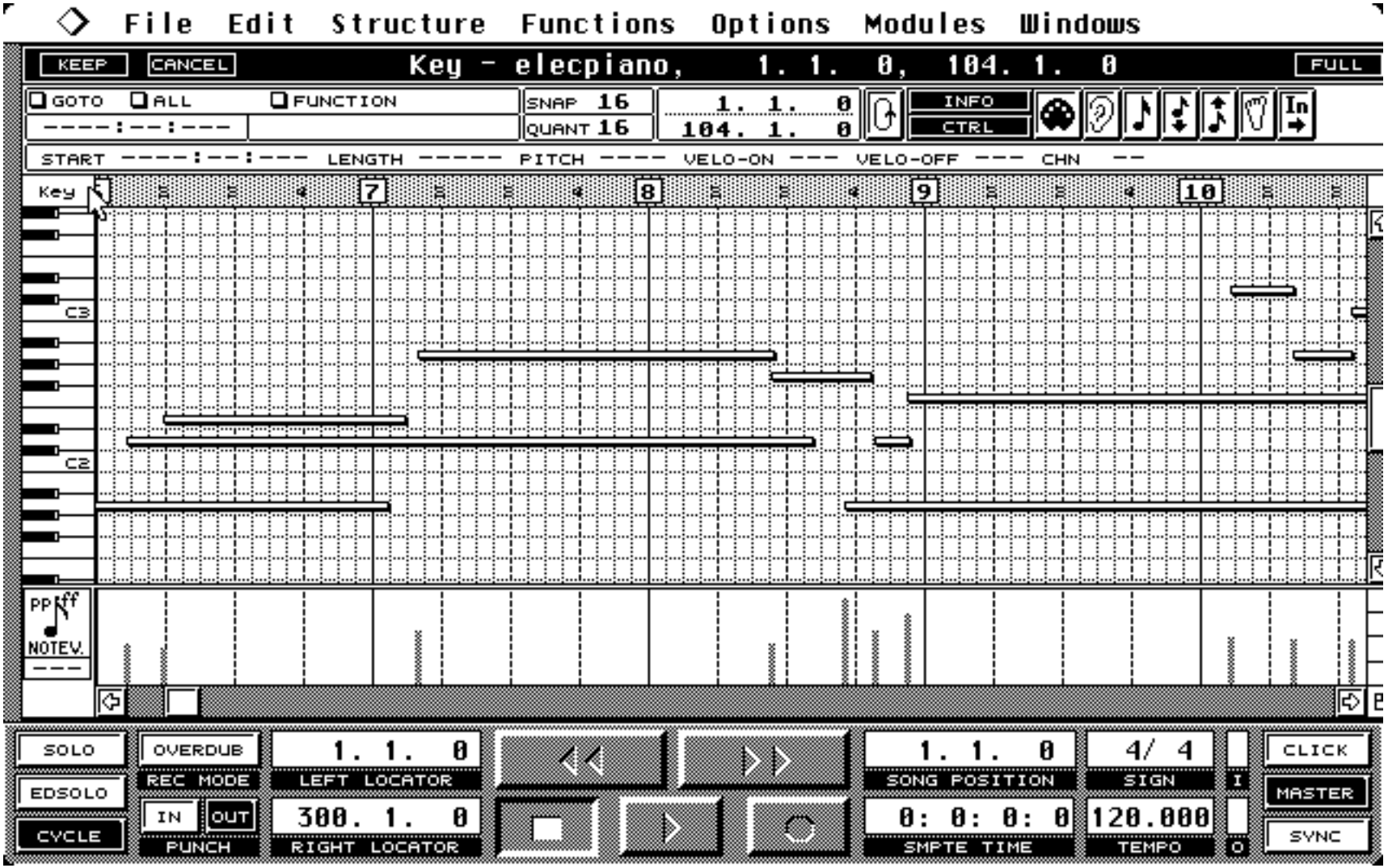


Tape system

Computer Recording



Computer Recording



Impact

- All keyboard parts can be recorded at one time
- Parts can be perfected and manipulated
  - Cut, copy, paste, edit, delete, undo
    - Non-destructive editing
- Quantization – perfect timing
  - Good or bad?

Impact

- Memory at the time is still very expensive
- Because MIDI information is just hexadecimal data, its small size makes it economical to store.

Drums

Standard acoustic drum set

Drums

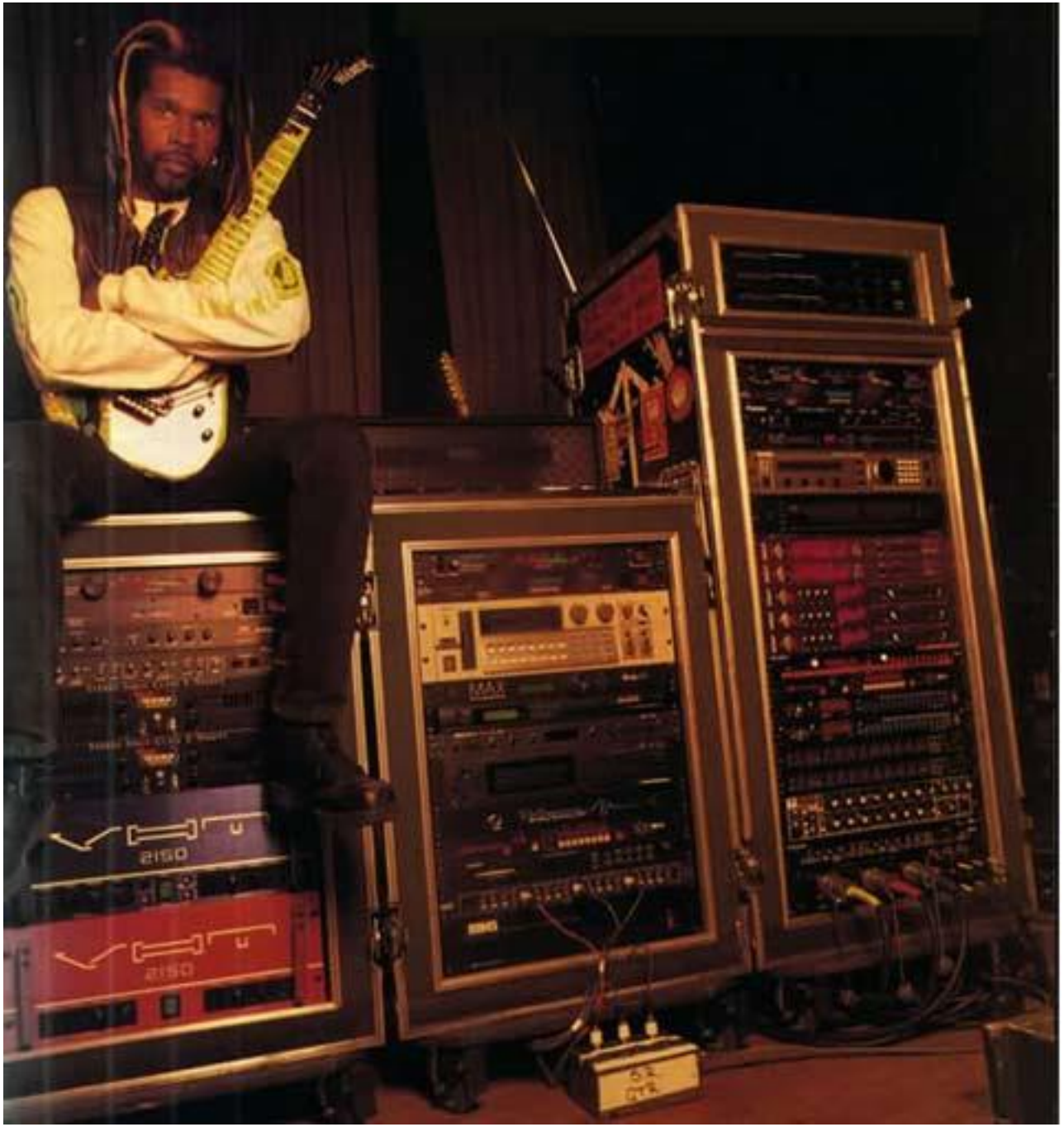
Electronic Drums – drum pads or “triggers” control keyboards or can be recorded through MIDI

Drums

Drum Machine

Guitar

Standard Guitar Setup



Advanced guitar setup using microprocessor controlled devices

Guitar

ADA MP-1 Guitar Preamp – Microprocessor driven, MIDI controlled

Guitar

Synth Guitar – allows guitar players to play synth parts

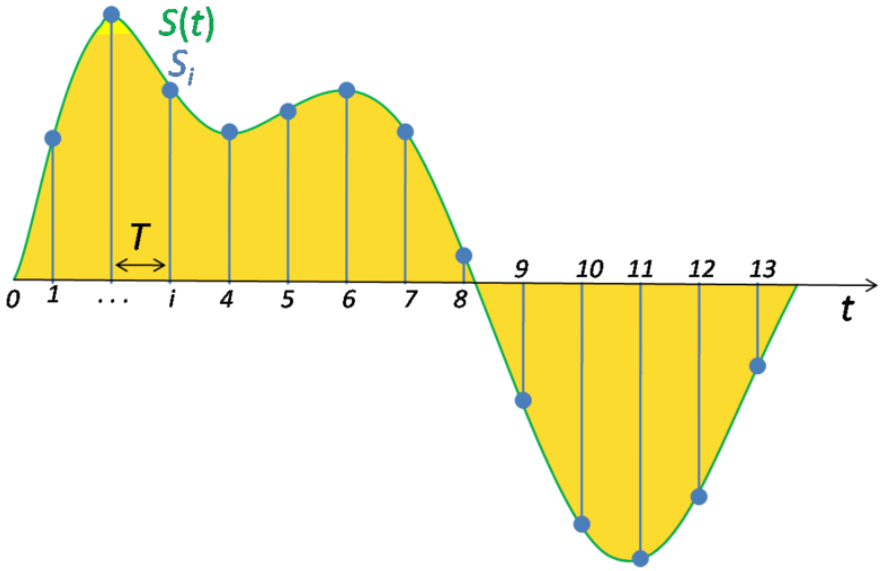
Impact

- The rest of the band can exploit the power of MIDI
- Allows for complex sounds that can be changed, stored, and recalled at the touch of a button
- Smaller and cheaper gear that has several functions
- Some people get carried away

Sampling

- As processing speed increases and memory cost decreases, real sounds are able to be captured and stored in memory, through a process known as **sampling**
- Uses a device known as the **Digital-to-Analog Converter (DAC)** & the **Analog- to-Digital Converter (ADC)**

Sampling



Sampling Rate -
Number of samples per second.
Measured in Hz or Khz

Sampling

1980s Linn Drum Computer – $5 000

Generated sounds vs. manipulating captured sounds

1980s Fairlight –
$20 000 - $50 000

1980s Synclavier–
Up to $200 000

Sampling

1988 AKAI S1000 -
$5 000

Impact

- Sounds no longer need to be electronically generated, but real sounds can be captured and manipulated
- Sounds are manipulated digitally
- Range of sounds available become unlimited

Impact

- Rap/Hip Hop artists grab on to this new technology
- Sampling bits of older songs and incorporating them into their own music

Funky Cold Medina – Tone Loc

Foreigner *Hot Blooded* + Kiss *Christine Sixteen*

Impact

- CD – Compact Disc
  - Music digitally stored, read by a laser
  - Sampling rate of 44.1 kHz

Computer Recording

- As the price of personal computers, memory, and storage drops, as well as processing speed increases, computer recording allows MIDI and real audio files to be used together.
- Eventually, prices drop so low that anyone can afford to produce very high quality recordings at home
- Today, everything can be done on the computer, with very little outboard gear

Shuffle
Spot
Slip
Grid
Main
175| 2| 429
Sub
13669965
Start
End
Length
Grid
Nudge
Cursor
Timeline
Session
Bars:Beats
Min:Secs
Samples
Tempo
Meter
Key
Markers
135
Default: 4/4
Default: C major
BD
Snare
OH/L
OH/R
Bass
GT1
waveform
dyn
read
Polyphonic

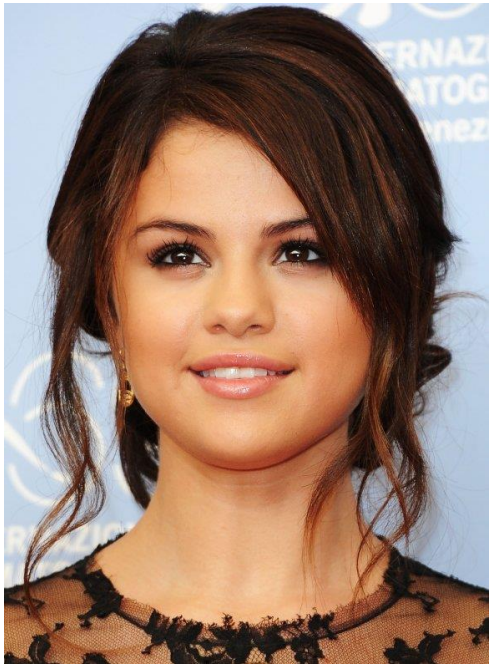
Pro Tools

Computer Recording

- Like Photoshop, recording software can be expanded through the use of PLUGINS
  - Synths, effects, virtual instruments, virtual guitar amplifiers, etc.
  - Much of the music we hear today has no “real” instruments on it

Computer Recording

- The most infamous of these plugins is probably AUTOTUNE
- used both in the studio and live



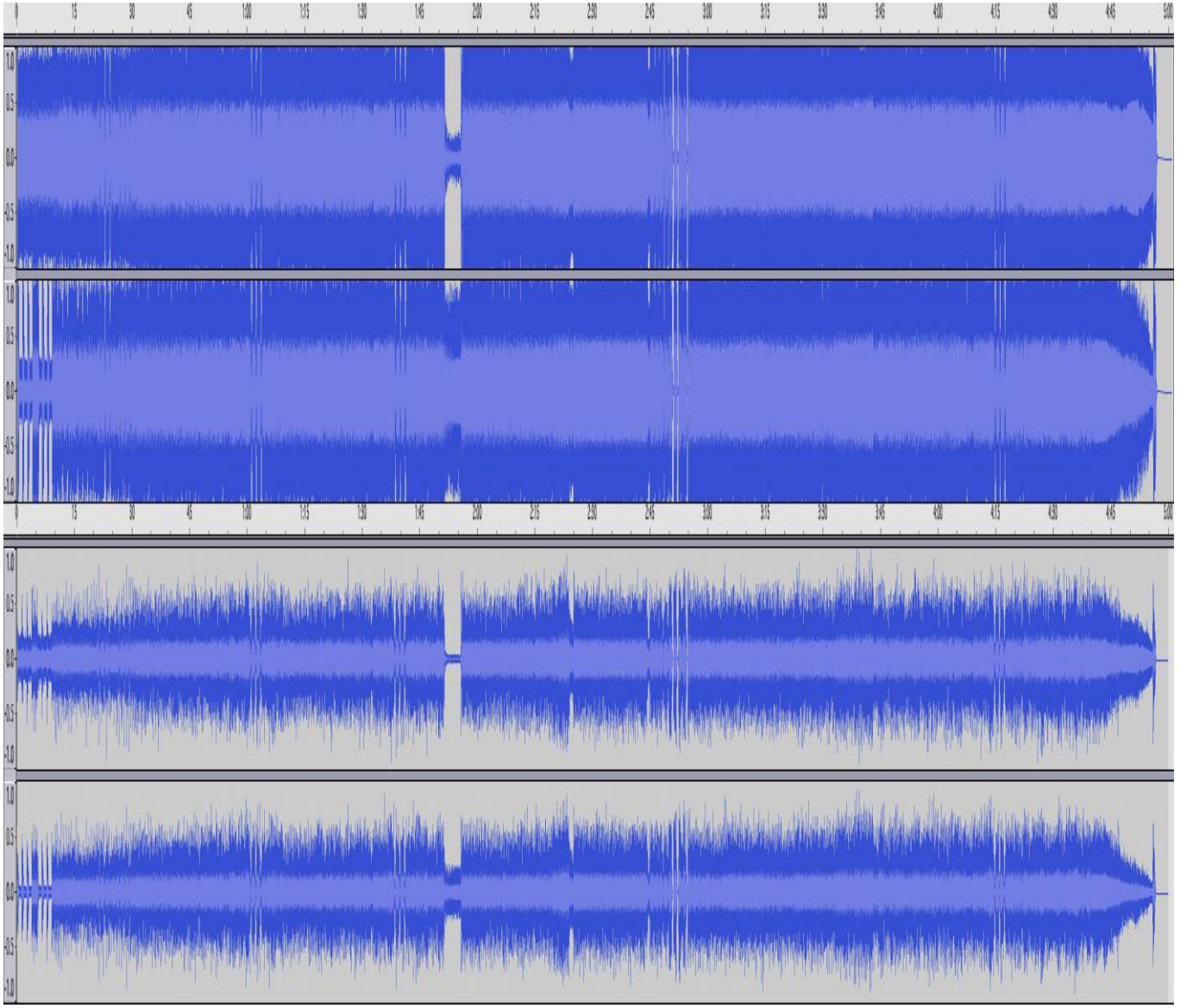
MP3

- July 1994, the Fraunhofer Society released the first software MP3 encoder called l3enc
- Lossy compression format
- Shrink a 60 meg cd track into 3-4 megs
- These explode onto the internet in the later 1990s,
  - allowing the illegal sharing of songs
  - The rise of the mp3 player (iPod, etc)

- MP3 and other compression formats make way for the iTunes store and others

19. Buffalo, New York

Source.

The Loudness War

- Advanced dynamic compression plugins have influenced The Loudness War
- Songs are compressed very heavily during the mastering stage to make them sound as loud as possible,
  - to make them stand out on radio, tv, etc.
- Every instrument and vocal are at the same volume as each other
- There is a growing backlash against this