RONJA
Optical datalink

RONJA PROJECT

- 1998: Experiments with IR 115.2kBaud
- 2004:
  - 10Mbps
  - Full duplex
  - 1.4km range
- User Controlled Technology (UCT)

Prehistory: Heliograph

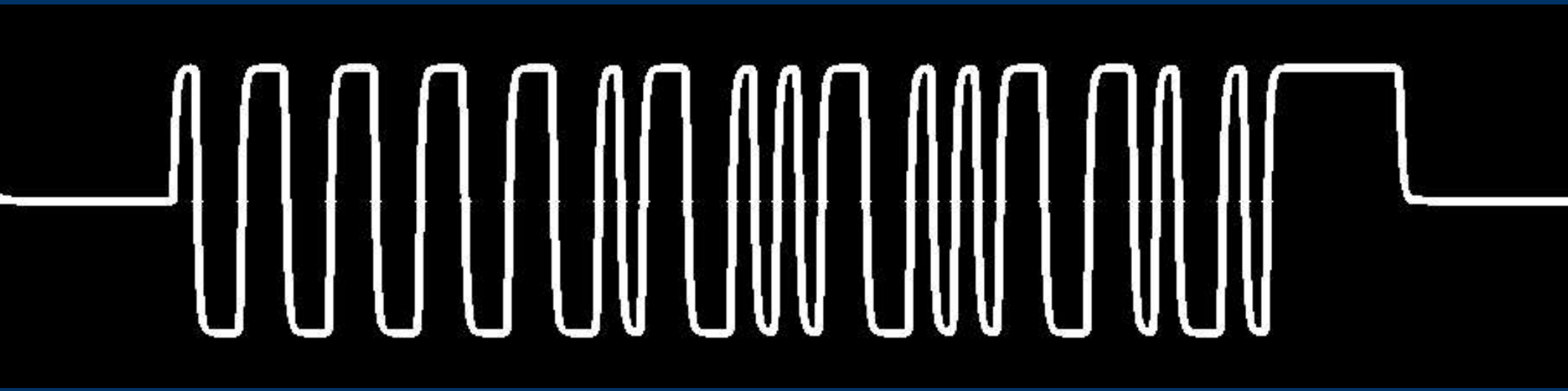
- 405 B.C. Ancient Greeks
- 1910
- -1960

Aldis Lamp

- Late 19th century – 1997
- Naval radio silence, early ATC

Simple encoding

- ½ sec. Light, ½ sec. Dark -> logical 0
- ½ sec. Dark, ½ sec. Light -> logical 1
- Speed up 10,000x : 10Base ethernet



Transmitter

- LED + 13cm lens, 17mW of light
- Unconditionally eye safe
- 10MBaud, 100% depth
- 14' divergence
- 4m spot @ 1km

Advantages

- No interference
- No spectrum regulation
- No electrosmog
- Difficult eavesdropping
- Smooth throughput
- Full duplex
- BER 10^{-9}

Disadvantages

- Dropouts on fog
- Mount requirements
- PtP topology only
- Range limited by extinction
- Mechanics: 10-20kg

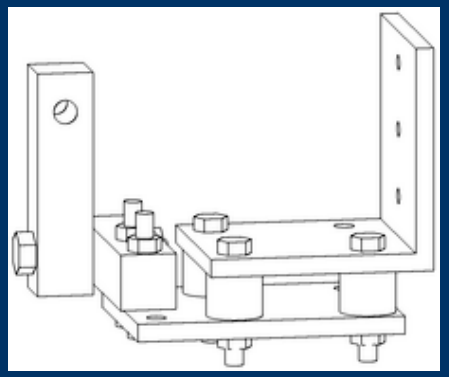
Range

- Rain OK
- Visibility = 17dB attenuation of light
- Divergence 4mrad FWHM
- 1.4km range @4km visibility
- Stable, given by white noise from Sun

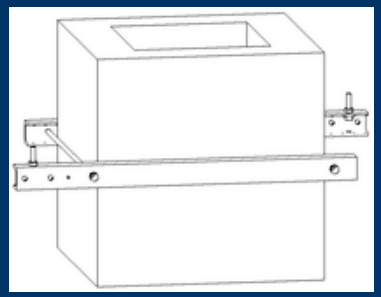
Ronja + WiFi backup

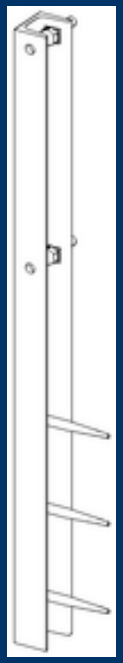
- Reliability
- Throughput
- Special SW requirements
  - Immediate dropout detection

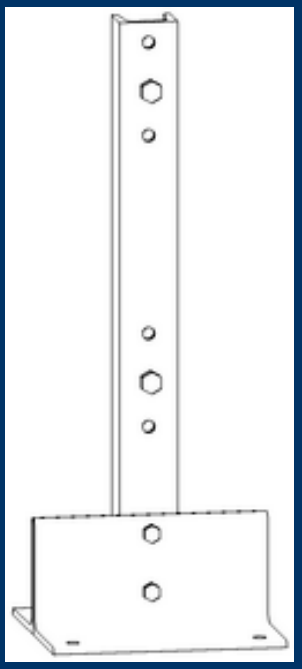
Mechanical mounting

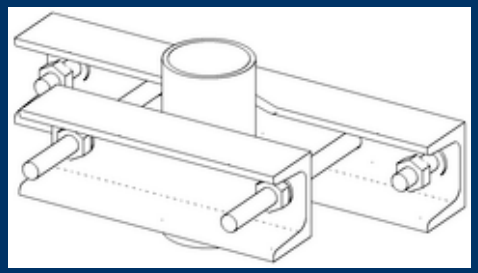


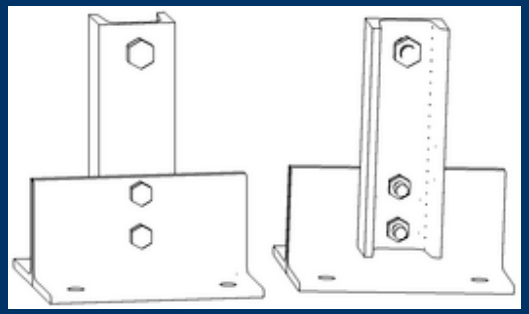
- Holder with fine and rough alignment
- 5 types of console
  - Chimney
  - Parallel
  - Perpendicular
  - Mast
  - Corner



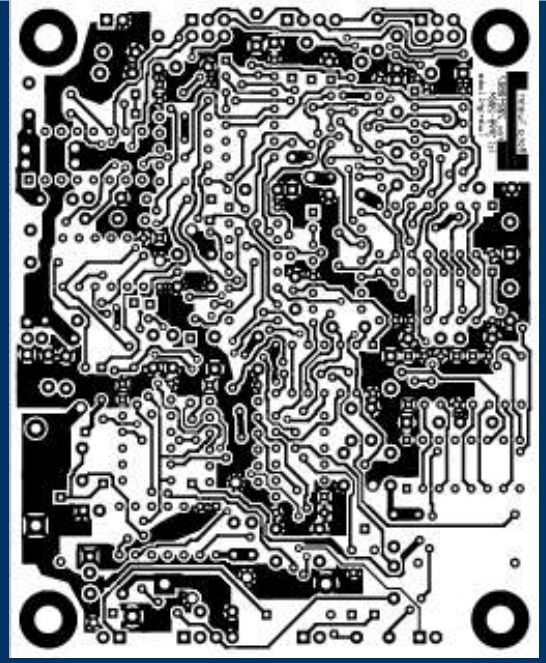








Manufacture



- DIY
- PCB in a factory
- Manual population
- Drilling, cutting, painting etc.
- Various operations can be ordered

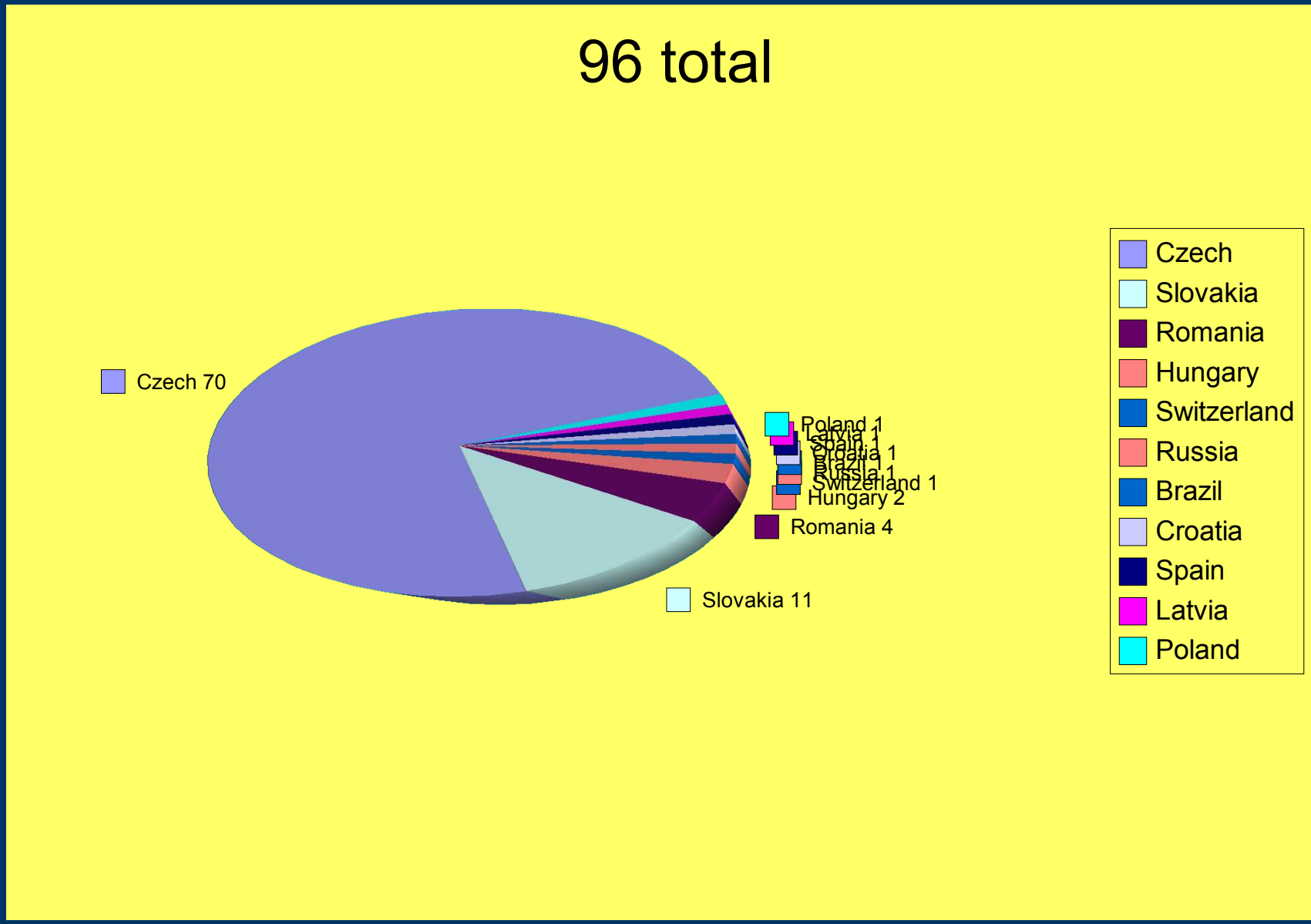
Installations

- 96 registered installations
- 54 km total length
- 9 countries

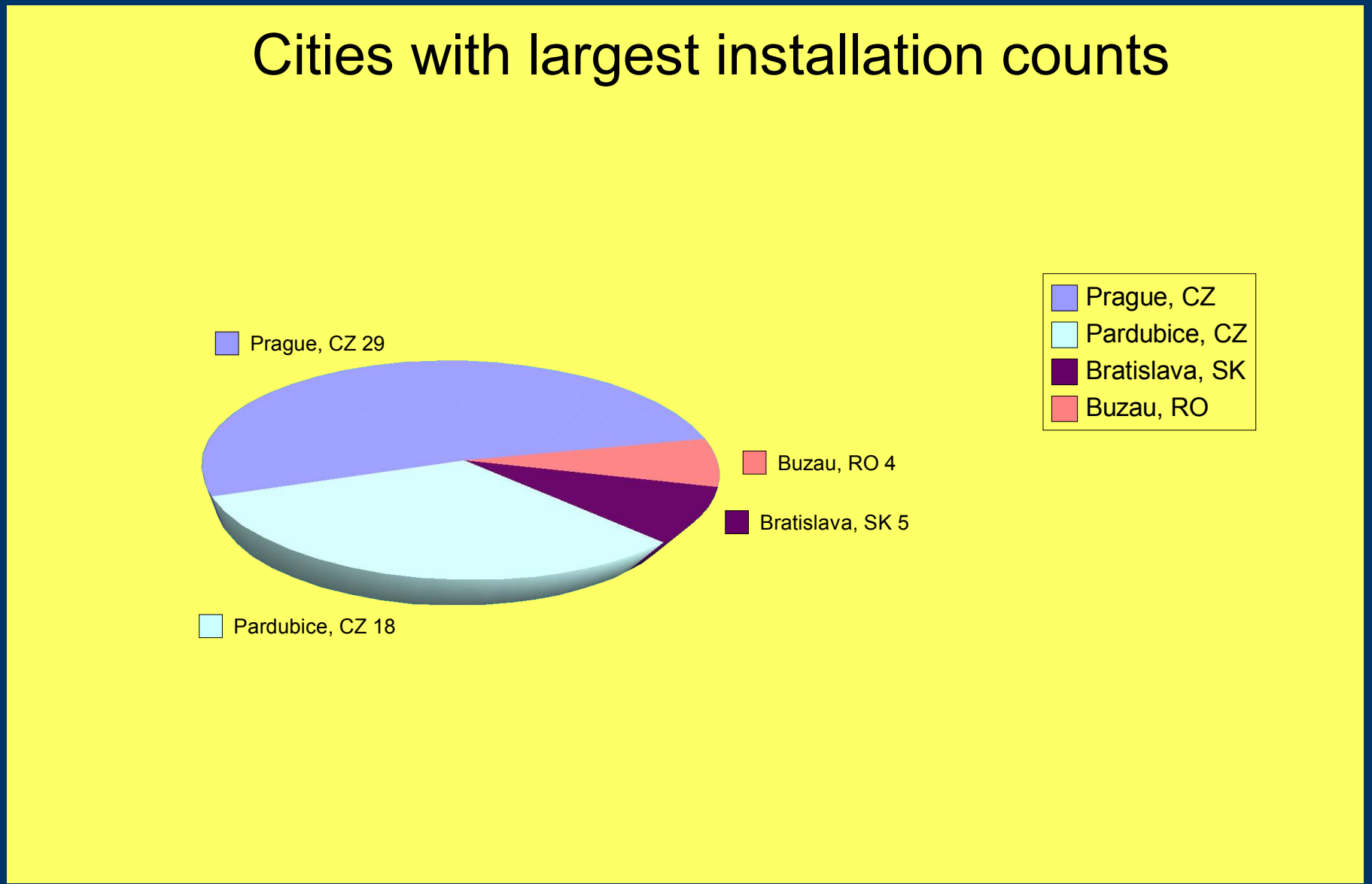
Nearest Installation

Lausanne
300m, since 2003

Installatios by country



Top 4 cities

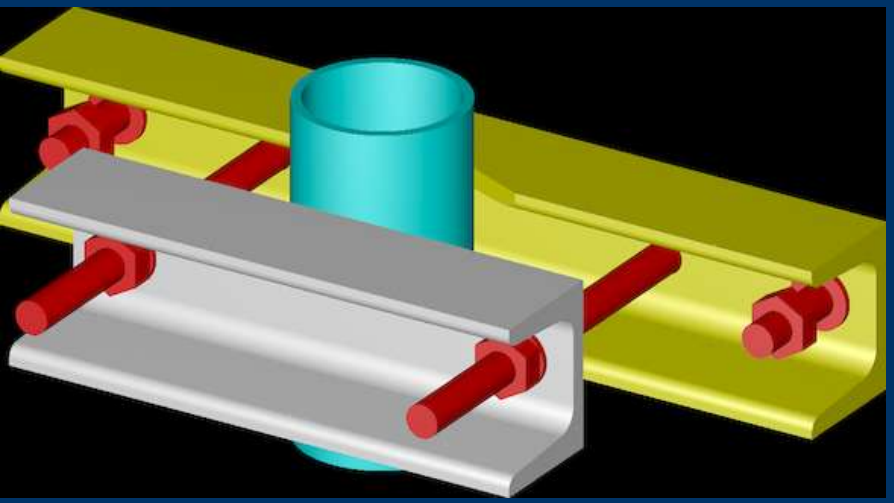

Cities with largest installation counts
Prague, CZ 29
Buzau, RO 4
Bratislava, SK 5
Pardubice, CZ 18
Prague, CZ
Pardubice, CZ
Bratislava, SK
Buzau, RO

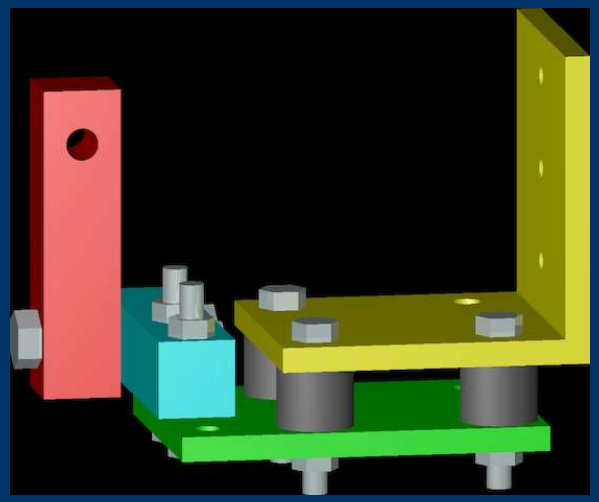
BRL-CAD

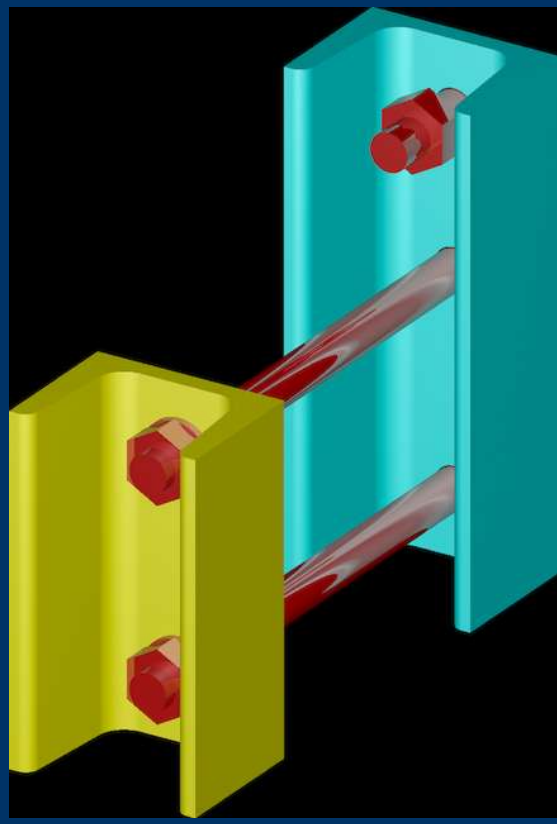
- Devel since 1979 by U. S. Army
- Since Dec 2004 continues as free SW

CSG modelling

- OR, AND, SUB on solid bodies
- Cylinder, box, sphere, torus, cone,...
- Weight etc. natively calculated

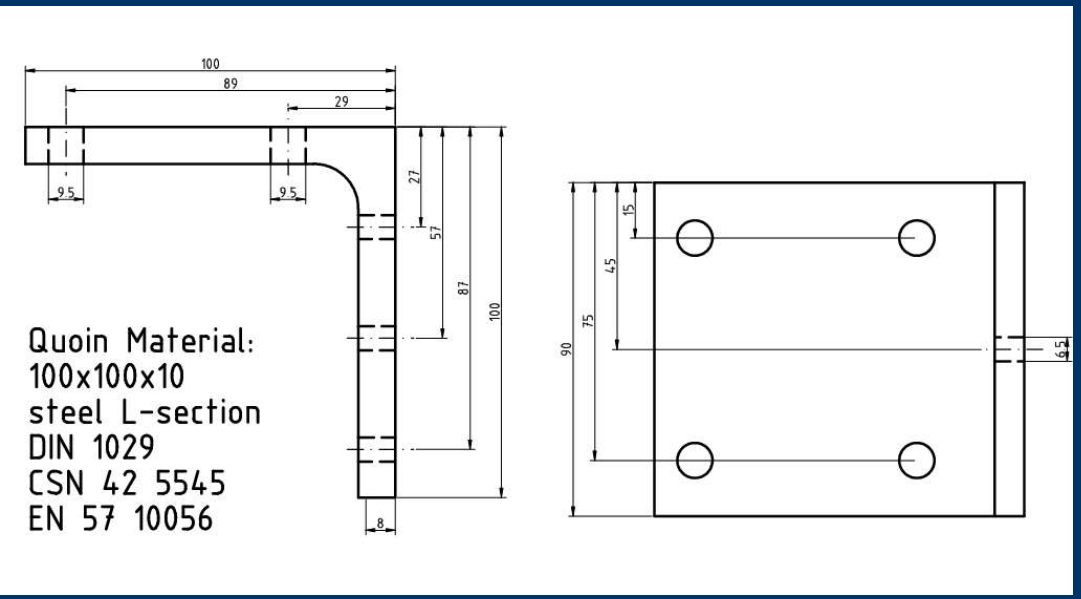


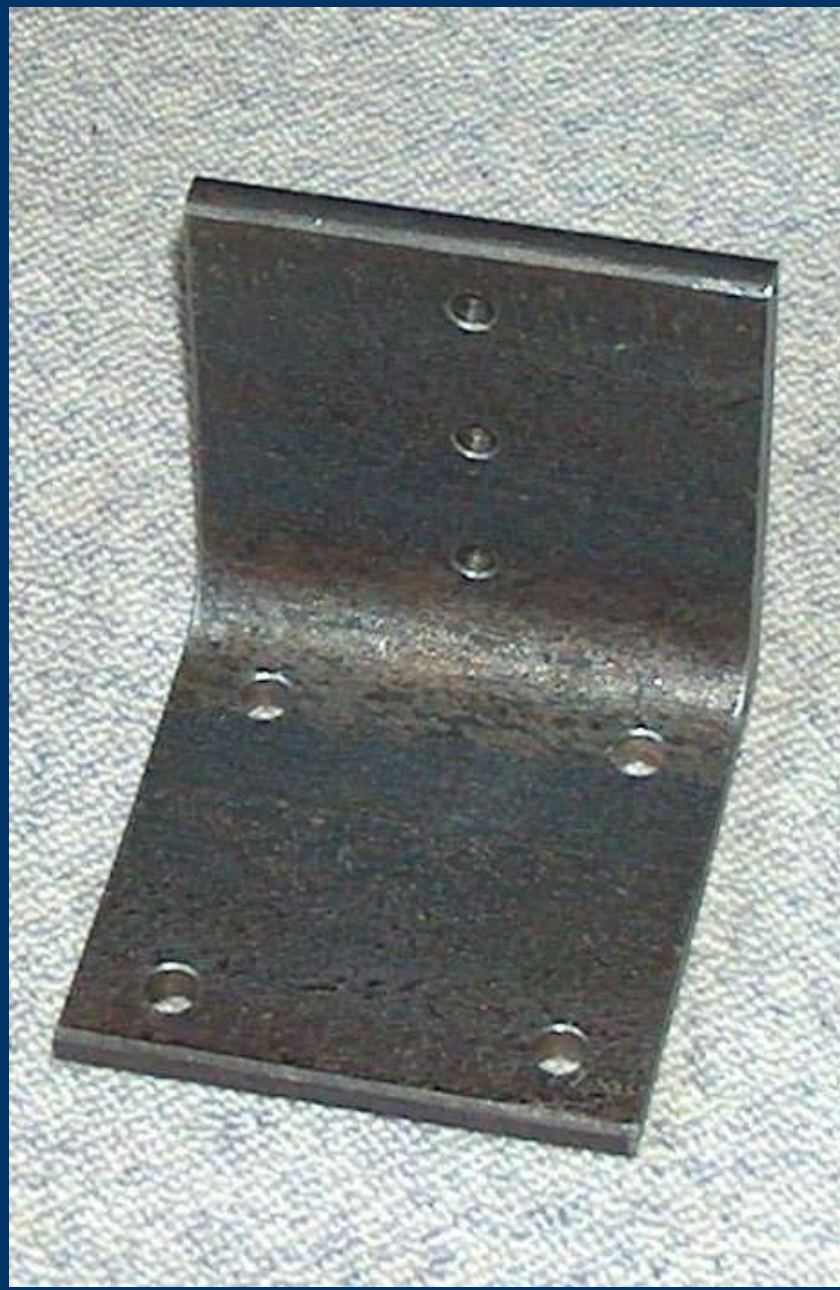




2D Drafting

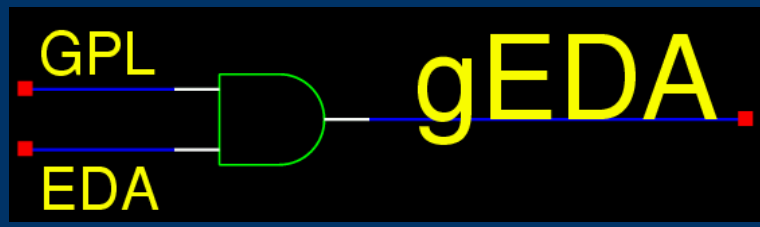
- QCAD free SW
- Swiss
- DXF format
- Sketches: Sodipodi

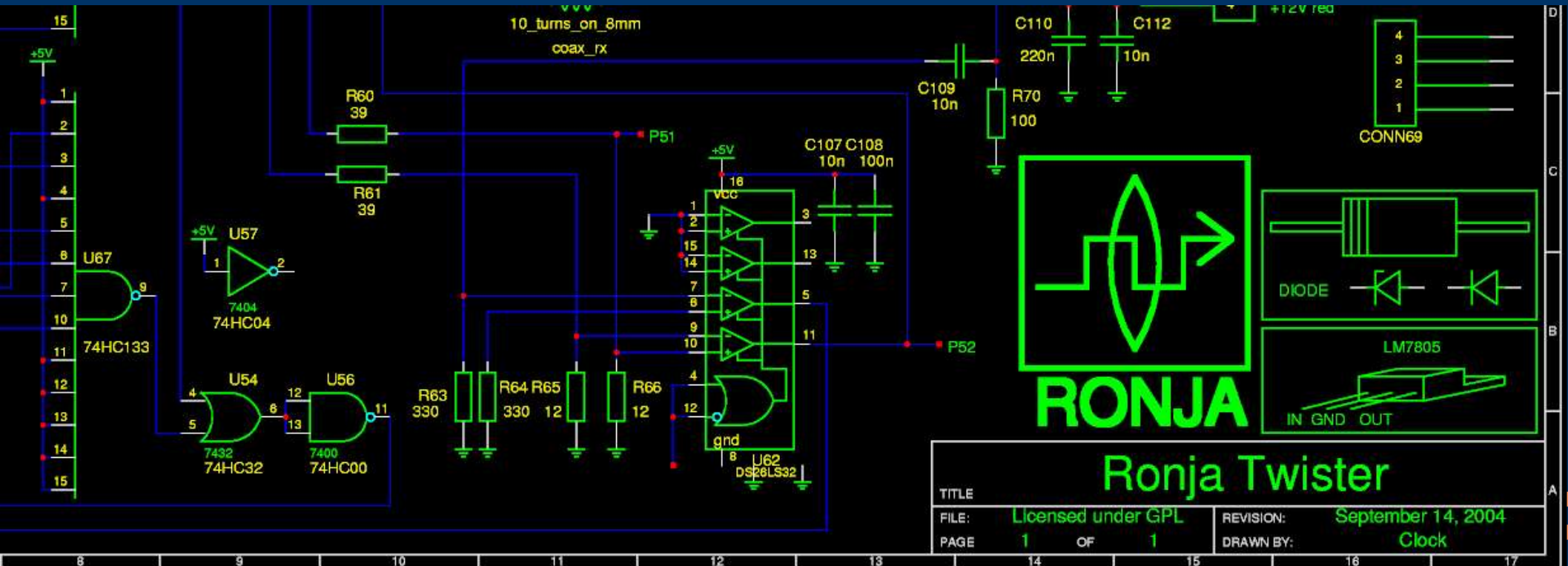




Schematics

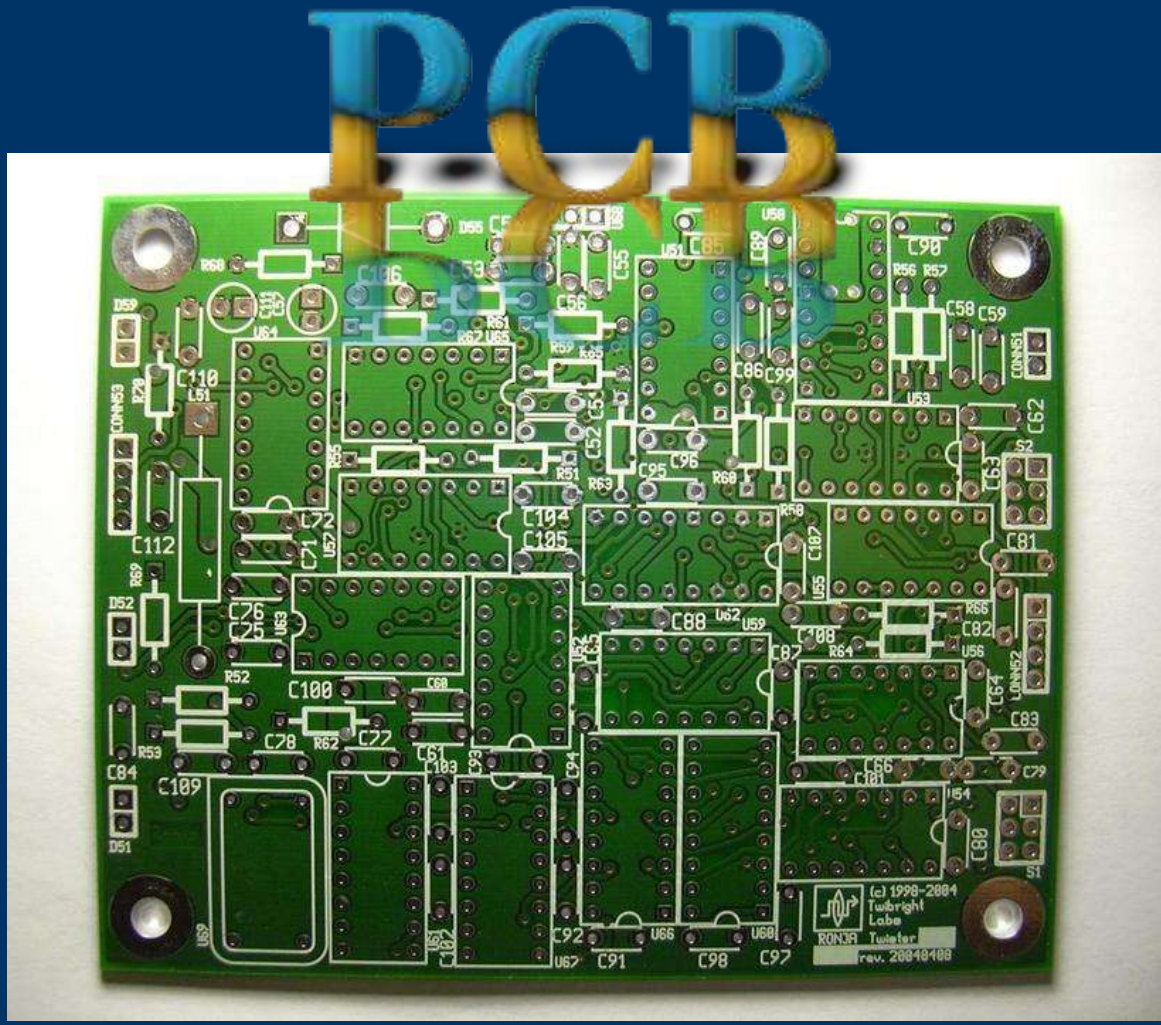
- gEDA gschem
- Free SW
- ASCII file format
- Guile scripting





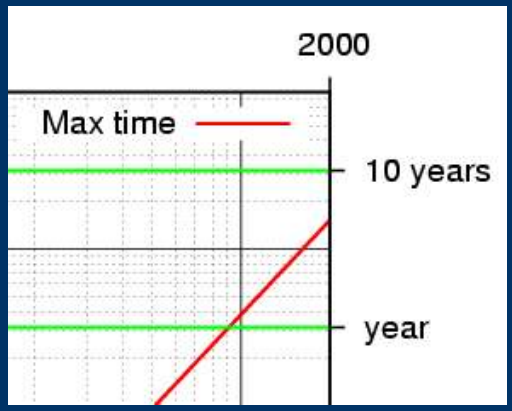
PCB design

- Free SW “PCB”
- ASCII file
- Up to 8 layers
- Soldermask
- Silkscreen
- Gerber RS274-X
- Gerbv



Scientific data visualisation

- Eye safety data
- Range & gain
- Oscilloscope waveforms
- Packetloss benchmarks
- gnuplot
- GNU R



Web

- Apache
- PHP
- Rsync

Infrastructure

- GNU Make
- Perl scripts
- GNU Arch

End