Morse code – Alive and Kicking!

Translated from the original presentation
„Betriebsart CW – Morsen lebt!“

Version with verbose annotations:
http://fkurz.net/ham/fn2011/

Fabian Kurz, DJ1YFK
http://fkurz.net/
dj1yfk@darc.de

About the author: Fabian Kurz, DJ1YFK

- Born 1983, licensed since 1997
- Self-taught in Morse Code
- Activities related to Telegraphy:
  - Contesting (DL1A, DM7A, DA0HQ, etc.)
  - Ham radio software development (LCWO.net, ebook2cw, ...)
  - High Speed Telegraphy Competitions (DTP, HST)

- Morse Potpourri:
  - How to learn the Morse code in 2011
  - CW Skimmer and the Reverse Beacon Network
  - Morse Code and psycho acoustics
  - High Speed Telegraphy Competitions
  - Books in Morse Code

Potpourri, topic 1:

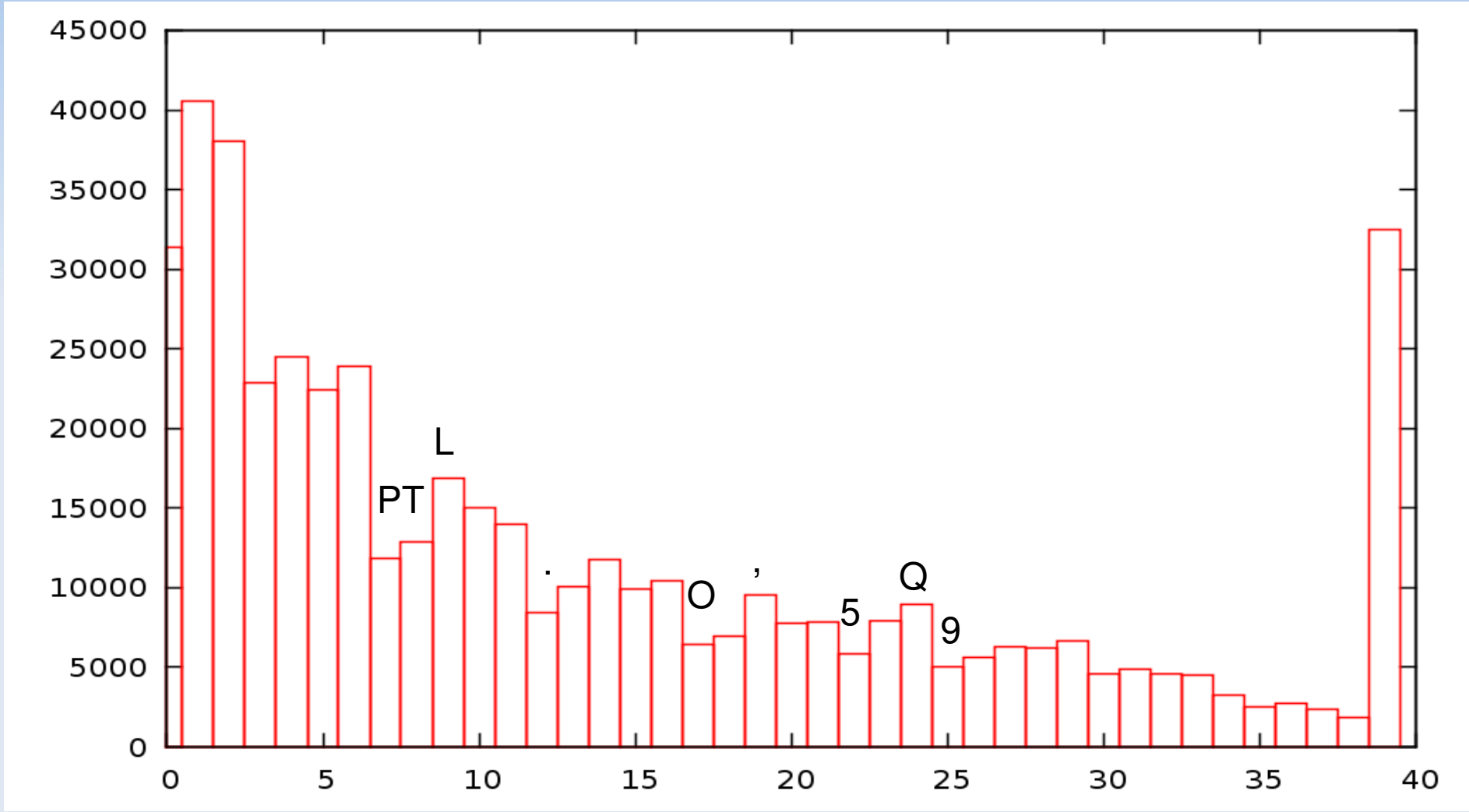
Learn CW Online

- Learn CW Online – In your web browser!
  - Full Morse code course (Koch method)
  - Callsign-, Word-, Plain text training, etc.

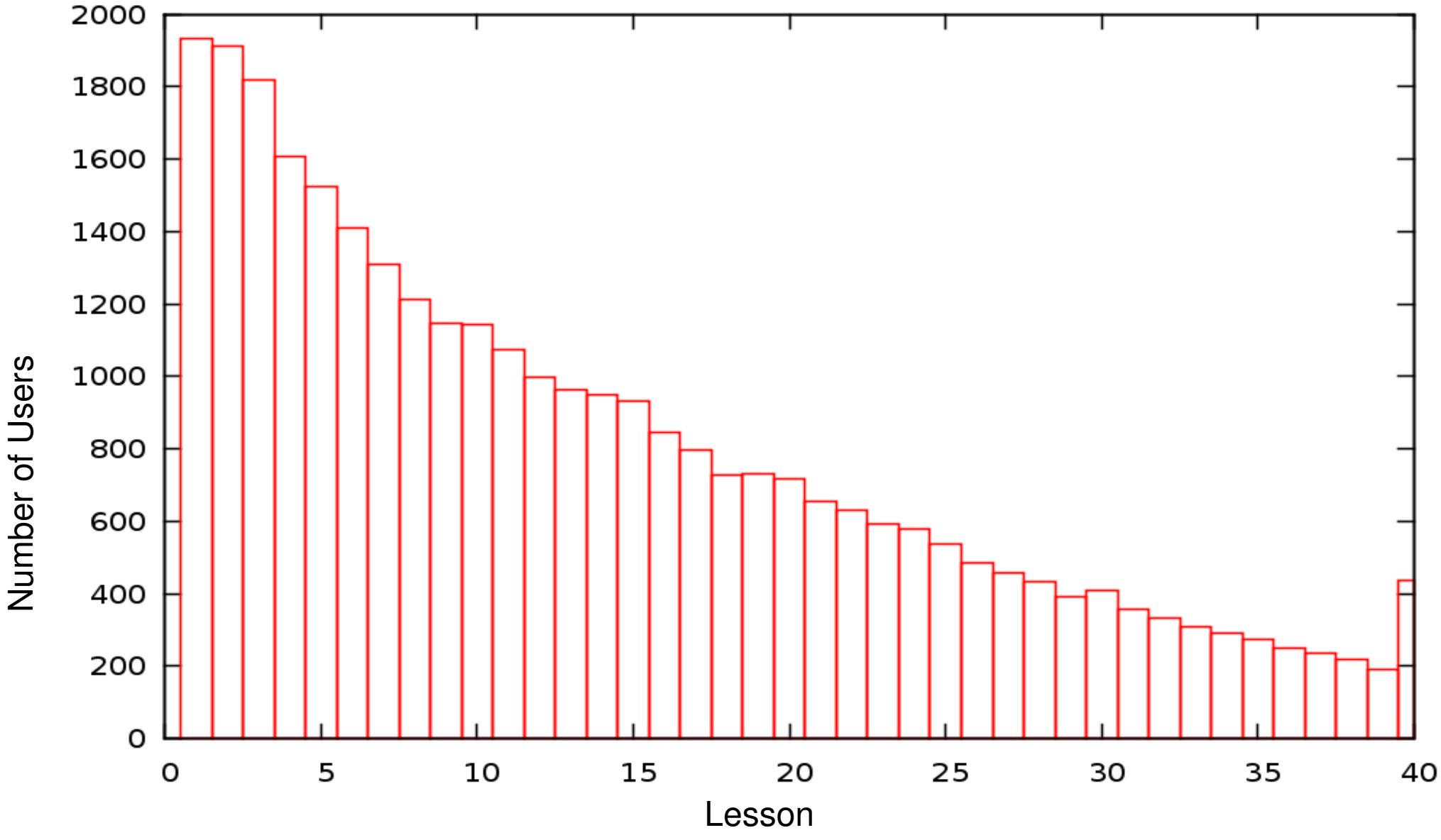
LCWO Statistics (1)

- ca. 10k active users (not only learning, also training)
- Results are saved on the server: Over 1 million datasets available to generate statistics
- Koch course: ca. 2000 „serious“ users (more than 100 attempts over more than two weeks, 480k datasets)
- Question: Which letters are easy, which difficult?
- Where do most learners give up?
- **How to improve the learning experience?**

LCWO Statistics (2)



LCWO Statistics (3)



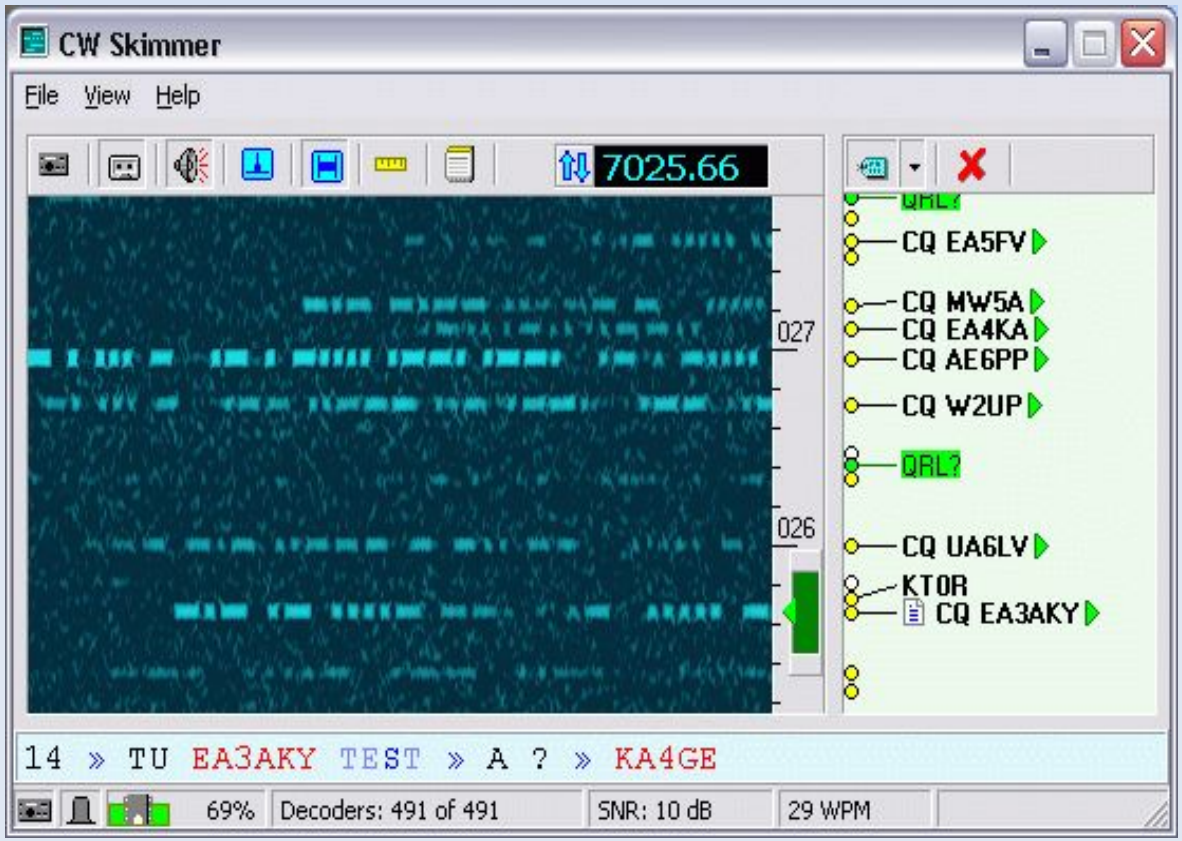
LCWO Statistics (4)

- Most quit very early (as expected).
- Only 10% finish all lessons?
  - In the higher lessons, pupils often skip lessons!
  - The statistics include many who are still studying!
  - Threshold to identify „serious“ users too high?
    - 300 attempts: 370 users, 100 in lesson 40, ca. 100 still learning and on their way to lesson 40.
- Easy letters (P, T, O) vs. difficult letters (L)
- Results of statistics will influence further development

Potpourri, topic 2:

CW Skimmer

- Multichannel CW decoder, written by Alex, VE3NEA
- Allows to observe a whole band in real time (with a SDR)



- Aggregated data of many Skimmers: RBN
- Role reversal: „Receiving Bacons“
  - *All* stations that call CQ in CW are „spotted“
- Information exchange over the internet
- Current status:
  - ca. 50 Skimmers QRV and online, 160m to 6m
  - all continents covered

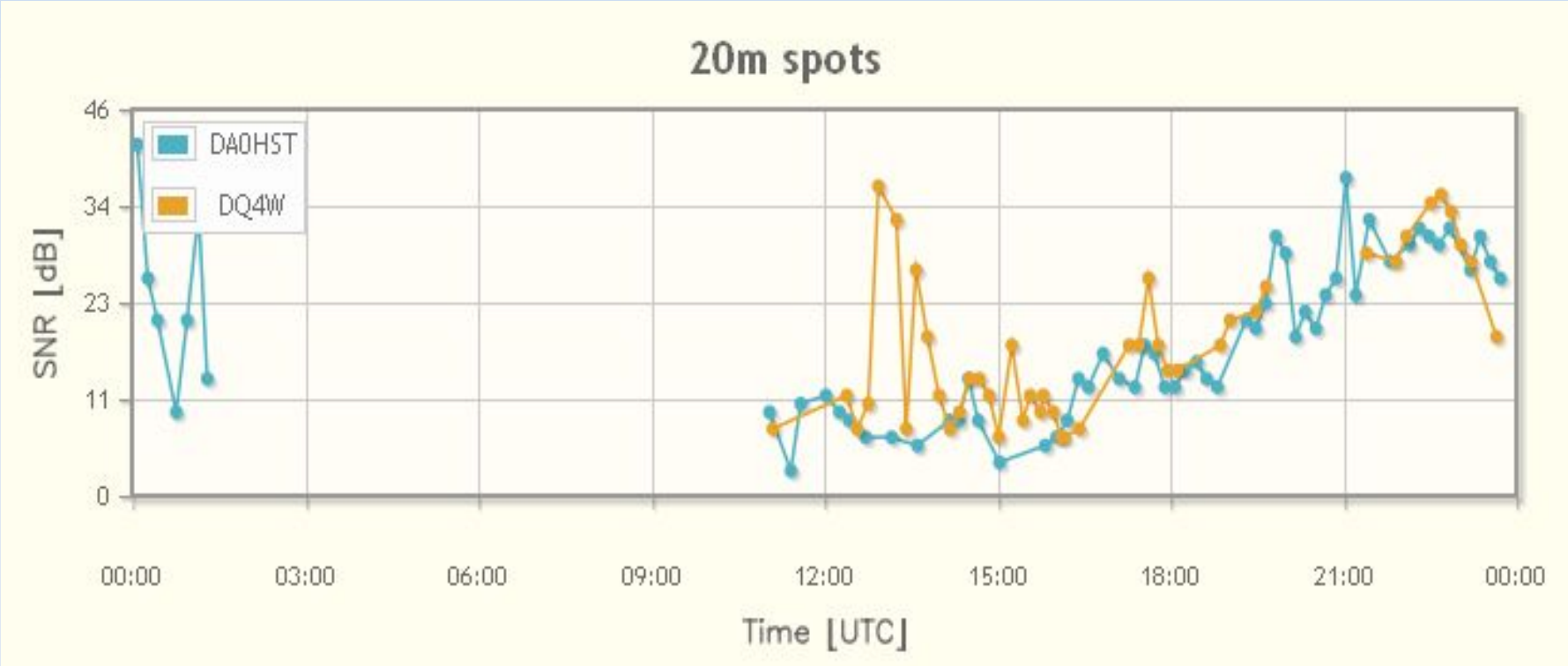
RBN example

- DJ6ZM calls CQ on 20m: 13 spots from 3 continents

de	dx	freq	cq/dx	snr	speed	time
DL8LAS	DJ6ZM	14022.0	CQ [LoTW]	12 dB	32 wpm	1554z 22 Jun
S50ARX	DJ6ZM	14022.1	CQ [LoTW]	11 dB	31 wpm	1554z 22 Jun
SV8RV	DJ6ZM	14022.1	CQ [LoTW]	6 dB	32 wpm	1554z 22 Jun
G0KTN	DJ6ZM	14022.0	CQ [LoTW]	17 dB	32 wpm	1554z 22 Jun
JA4ZRK	DJ6ZM	14022.0	CQ [LoTW]	23 dB	32 wpm	1553z 22 Jun
RN4WA	DJ6ZM	14022.1	CQ [LoTW]	21 dB	32 wpm	1553z 22 Jun
UA9CLB	DJ6ZM	14022.1	CQ [LoTW]	34 dB	29 wpm	1553z 22 Jun
TF3Y	DJ6ZM	14022.0	CQ [LoTW]	16 dB	32 wpm	1553z 22 Jun
LA5EKA	DJ6ZM	14022.0	CQ [LoTW]	41 dB	31 wpm	1553z 22 Jun
GW8IZR	DJ6ZM	14022.0	CQ [LoTW]	31 dB	31 wpm	1553z 22 Jun
HA6PX	DJ6ZM	14022.1	CQ [LoTW]	9 dB	32 wpm	1553z 22 Jun
WZ7I	DJ6ZM	14022.0	CQ [LoTW]	6 dB	33 wpm	1553z 22 Jun
VE2WU	DJ6ZM	14022.0	CQ [LoTW]	16 dB	32 wpm	1553z 22 Jun

http://www.reversebeacon.net/

- RBN offers signal strength comparison tools



RBN: Statistics

- Statistics were generated from raw data from the RBN
- Time range: 01.01.2011 – 22.06.2011
- 20.5 mio. (!) CQ spots recorded!
- How many unique calls do you guess there were?

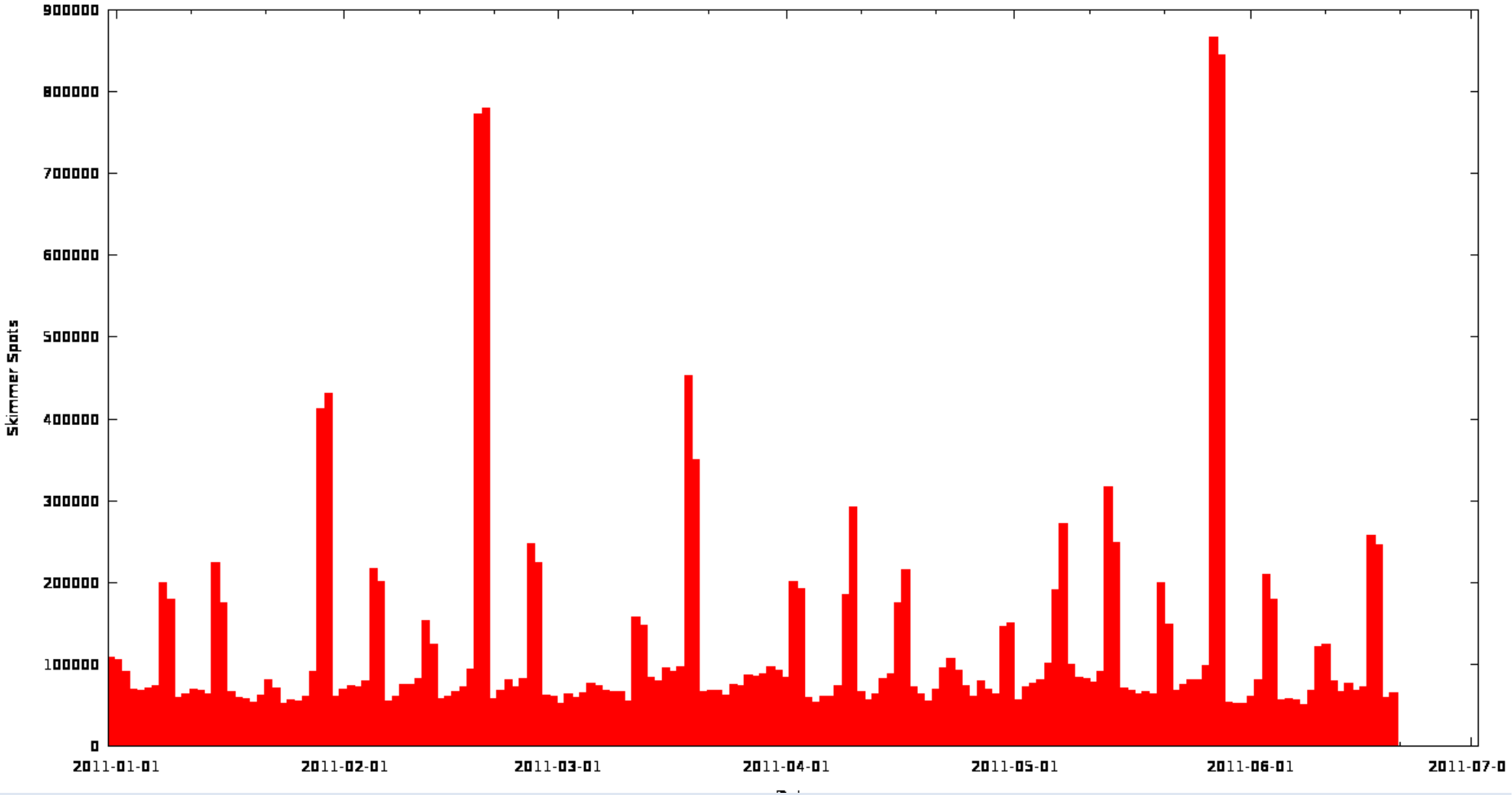
“ *Never trust a statistics you didn't forge yourself...*

RBN: Statistics

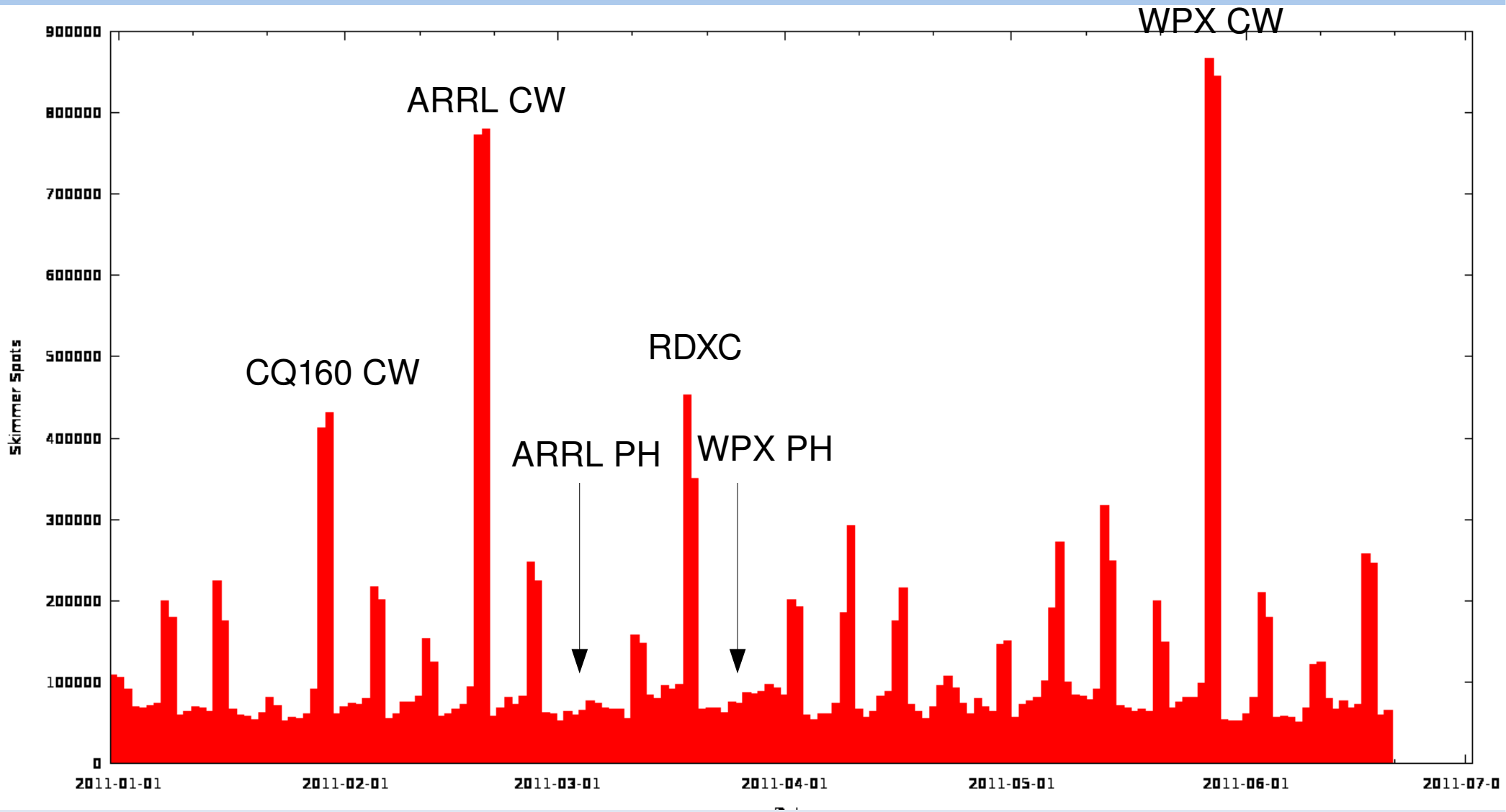
- Statistics were generated from raw data from the RBN
- Time range: 01.01.2011 – 22.06.2011
- 20.5 mio. (!) CQ spots recorded!
- 163,453 unique calls (unfiltered)

“ *Never trust a statistics you didn't forge yourself...*

RBN: Statistics (2)



RBN: Statistics (3)



RBN: Statistics (4)

- Strange distribution of spot frequencies?

Top Ten Spots		Spot #	Frequency
55079	F5IN	>10000	176
31977	LZ9W	>5000	681
30669	NR4M	>1000	4933
29210	NQ4I	>500	8052
27968	AA3B	>100	18177
25446	RL3A	>50	24138
25241	CO8LY	>25	31353
25229	UA2FL	>10	43593
24085	LZ5R	>1	77101
23323	EA6UN	1	163452

RBN: Statistics (5)

- Automated Morse Decoders and their limits...

Count	Call
5948	5B/US7IDX
102	5B/US7ID
5	5B/US7TDX
4	HB/US7IDX
4	5B/US7IT
3	5B/US7I
3	5B/US7DX
2	5B/US7ITX
1	HB/US7ID

Count	Call
1	5B/US7IX
1	5B/US7INX
1	5B/US7IN
1	5B/US7IE
1	5B/US7IDV
1	5B/US7IDT
1	5B/US7IDD
1	5B/US7EDX
1	5B/US7DN

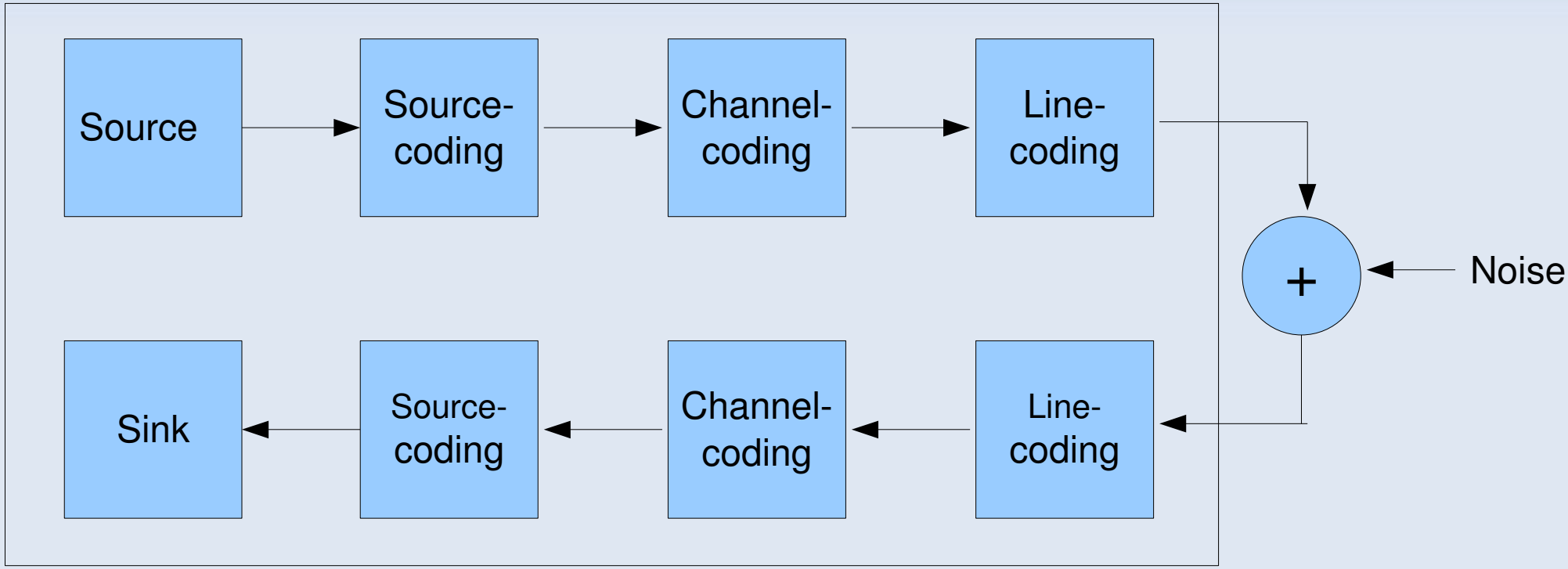
RBN: Statistics (6)

- Stations with more than 10 RBN spots so far (January to June) in 2011: **43593**
- EU: 54%, NA: 30%, AS: 11%
- K: 26,5%, UA: 8,6%, DL: 7,4%, JA: 5,5%
- RBN *only* detects CQing stations
- Guesstimate: over 50,000 stations active in CW

Potpourri, topic 3:

Morse Code and Psychoacoustics

- Morse's alive? So is the best CW decoder!
- The operator as a part of the block diagram:



- Source coding: Reduction of redundance
  - e.g. using abbreviations
- Channel coding: Protection against errors
  - e.g. repetition of important words
- Line code: „Morse code“ itself

Many complicated processes which an experienced CW operator intuitively handles.

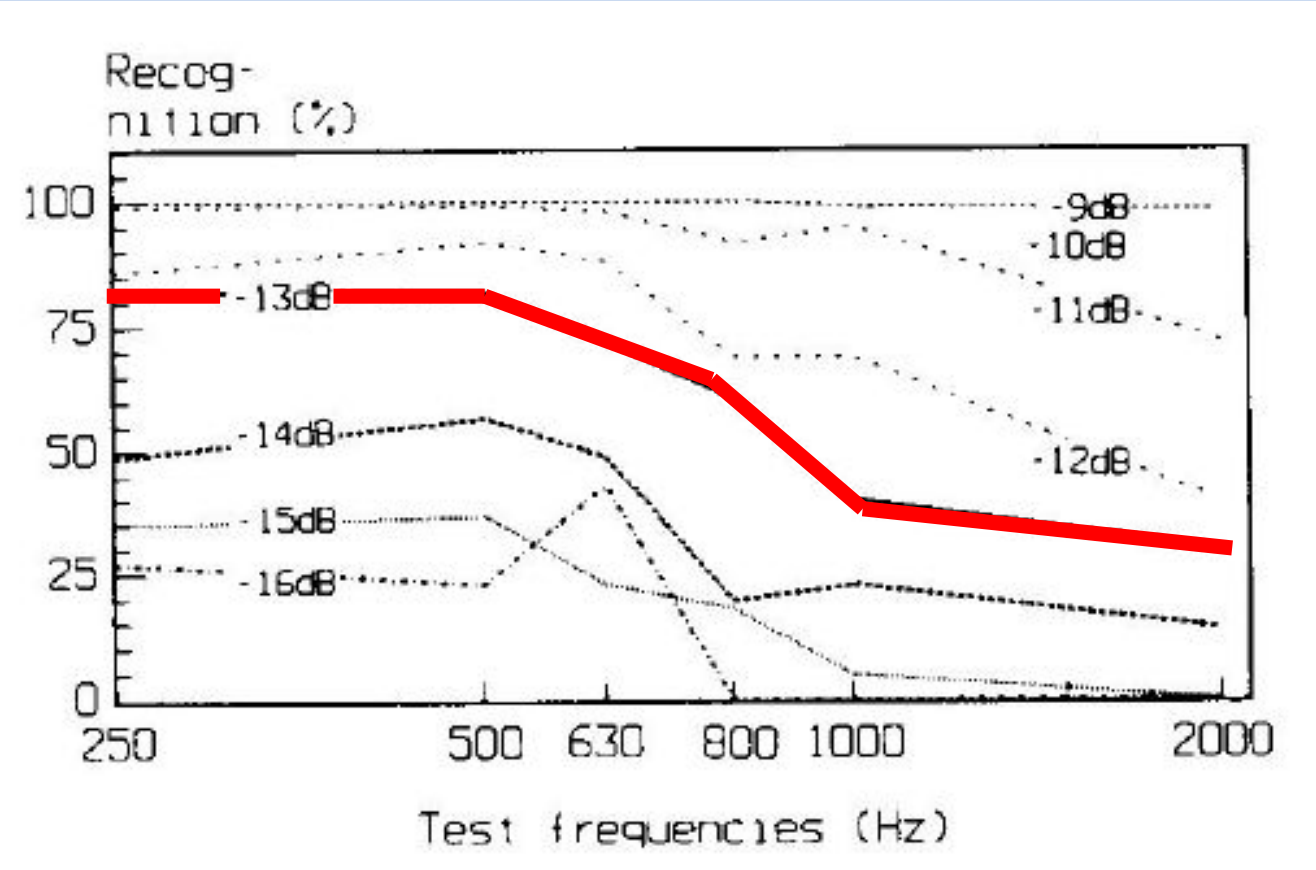
CW and psychoacoustics

- Ear and brain: Ingenious „Signal Processor“
- Optimization of CW operation possible!
- The ear works as a filter band: „Critical bands“
  - Each about 100 Hz wide up to approx. 500 Hz
  - Above: About a minor third (freq ratio 1.19)
- Copying Telegraphy in Noise, effective SNRs
    - CW signal at 1 kHz: eff. BW = 160 Hz
    - CW signal at 500 Hz: eff. BW = 100 Hz
    - „Gain“: 10 log (160/100) = 2 dB!

CW and psychoacoustics (2)

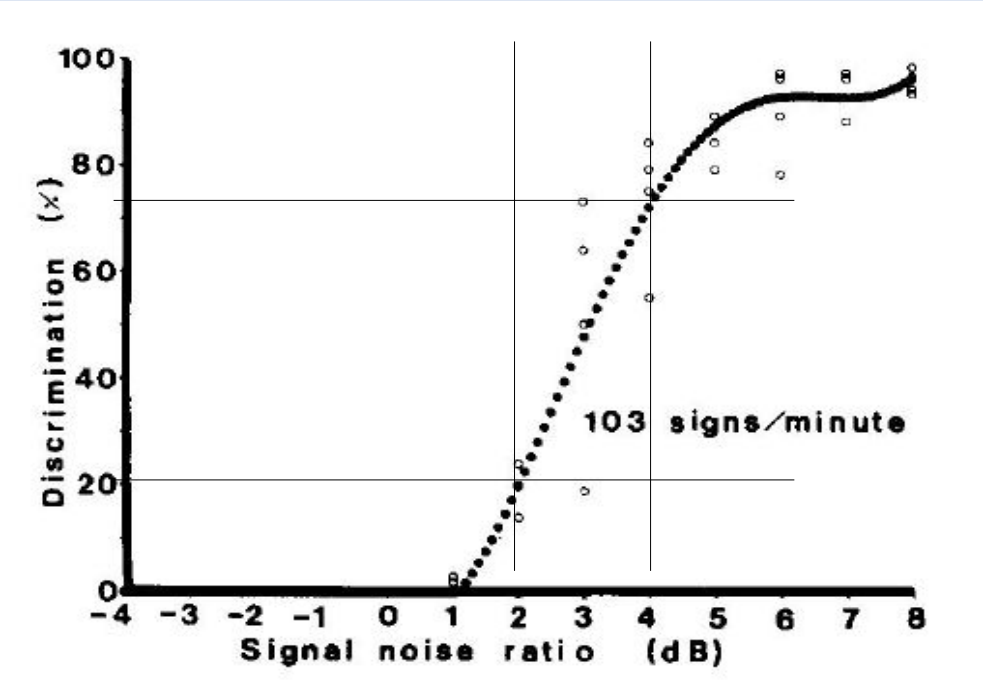
- Gray theory or can it be demonstrated?
  - And what's 2 dB anyway?
- „Signal Detection in Noise with special reference to Telegraphy“
  - Dissertation of Peter Montnémery, SM7CMY
  - Influence of various parameters (SNR, tone frequency, loudness, usw.) on CW reception
  - Researched with scientific methods

- Recognition rate vs. tone frequency



CW and psychoacoustics (4)

- Discrimination rate vs. SNR
  - Tested with 10 experienced CW operators



- Conclusions
  - Best frequency for Morse code: about 500 Hz
    - „Standard“ (TRXs, software, ...) at 700 – 800 Hz
    - By optimum parametrization, 2 dB of „passive gain“
  - Narrow CW filters are not always useful
    - Without any interferers in the passband, the ear does the job already
    - Very narrow filters, below the critical bandwidth, do help
- Other topics
  - CW volume is important (temporal masking effects)!

Potpourri, topic 4

High Speed Telegraphy Competitions

- High Speed Telegraphy
- History:
  - Since abt 1935: Contests in the USSR and the USA
    - Copying code groups, often professional CW operators
    - 1939: Ted McElroy (USA): 376 CpM (typewriter)
    - 1954: Fedor Rosljakow (USSR): 440 CpM (typewriter)
    - 1954: Wesselin Borisov (Bulgaria): 400 CpM (pencil!)
  - New era: IARU HST Competitions since 1995
    - 2011: First IARU HST World Championships in Germany

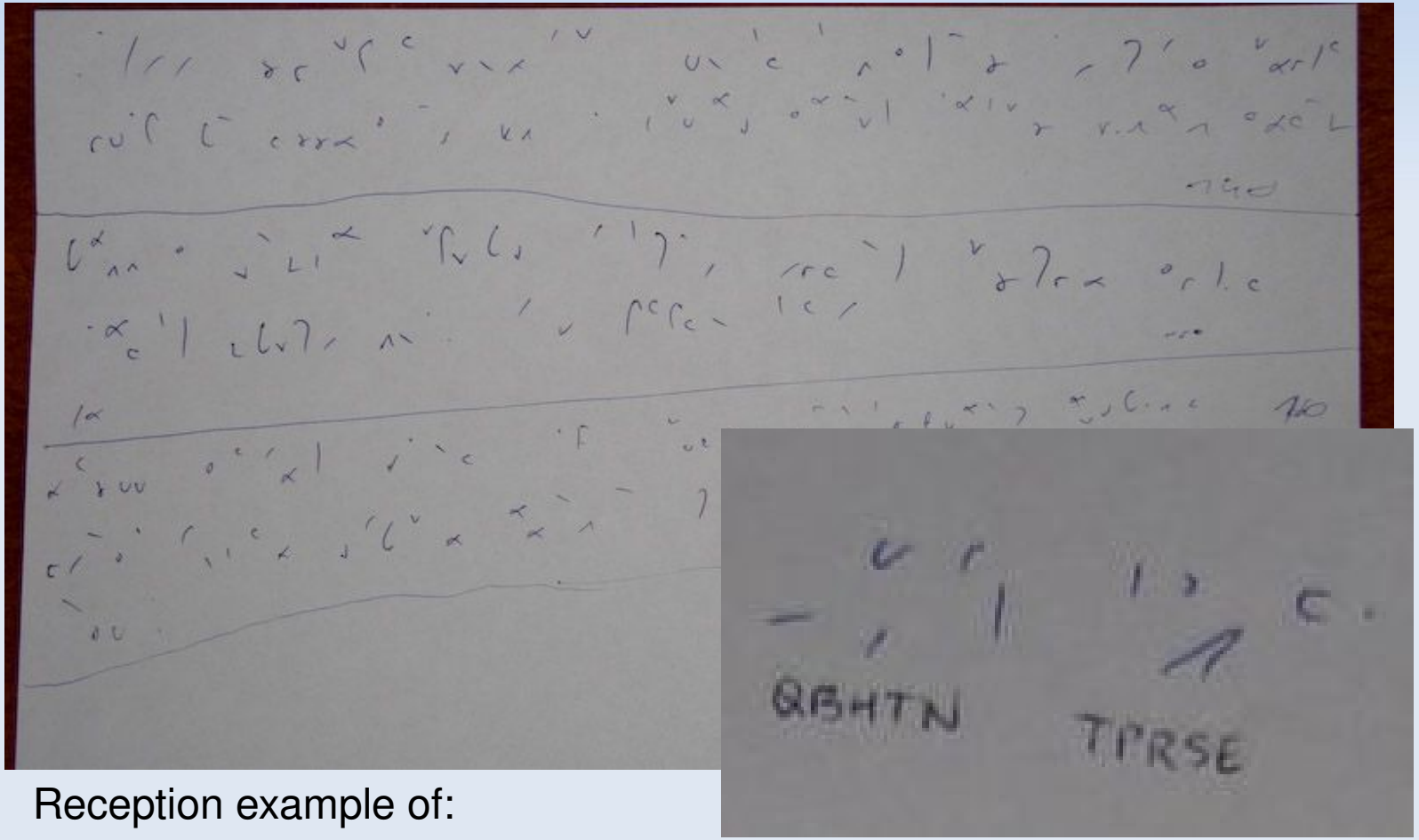
HST: IARU-Competitions

- Stronger focus on ham radio than classic competitions
  - New disciplines: Callsign receiving, Pileup competition
  - Participants must be licensed radio amateurs
- World- and IARU R1-championships each other year
- The DARC team took part in 12 competitions ('97-'10)
  - Results: 2 x gold, 4 x bronze
- HST dominated by teams from eastern EU (EW, UA, YO)
- HST in October 2011 in Bielefeld, Germany
  - About 150 participants from 19 nations registered
  - Website: http://www.hst2011.de/

- Classic disciplines:
  - Code groups (Letters, Figures, Mixed text)
    - Reception (QRQ by 10cpm until the last one gives up)
    - Transmission (speed chosed by participants)
- Amateur radio competitions:
  - RufzXP – Callsign receiving (by DL4MM)
  - MorseRunner – Pileup competition (by VE3NEA)
- Why no head-copy competition?
  - Doesn't allow objective scoring, language barriers!

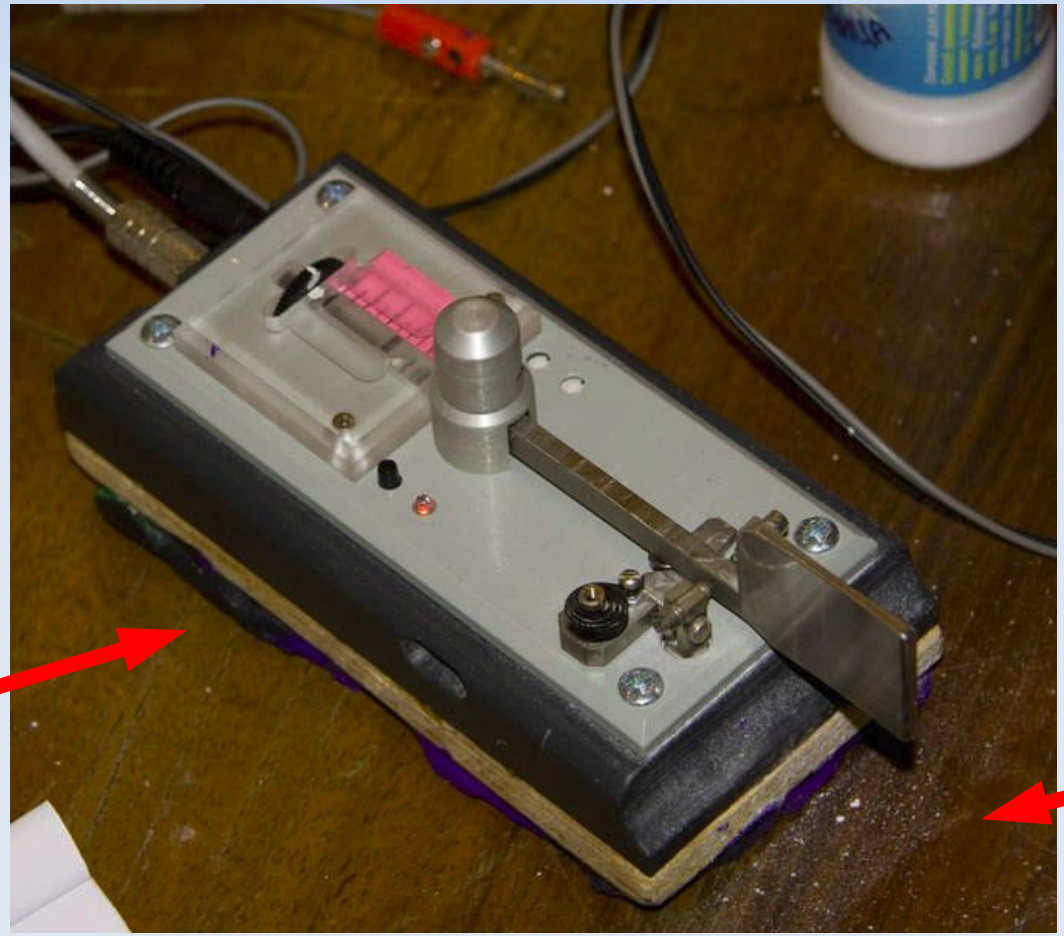
HST: Shorthand for code groups

- Code groups: The challenge is to write, not to hear!



Reception example of:
UT5URM

- Transmission: „forceful precision“ engineering



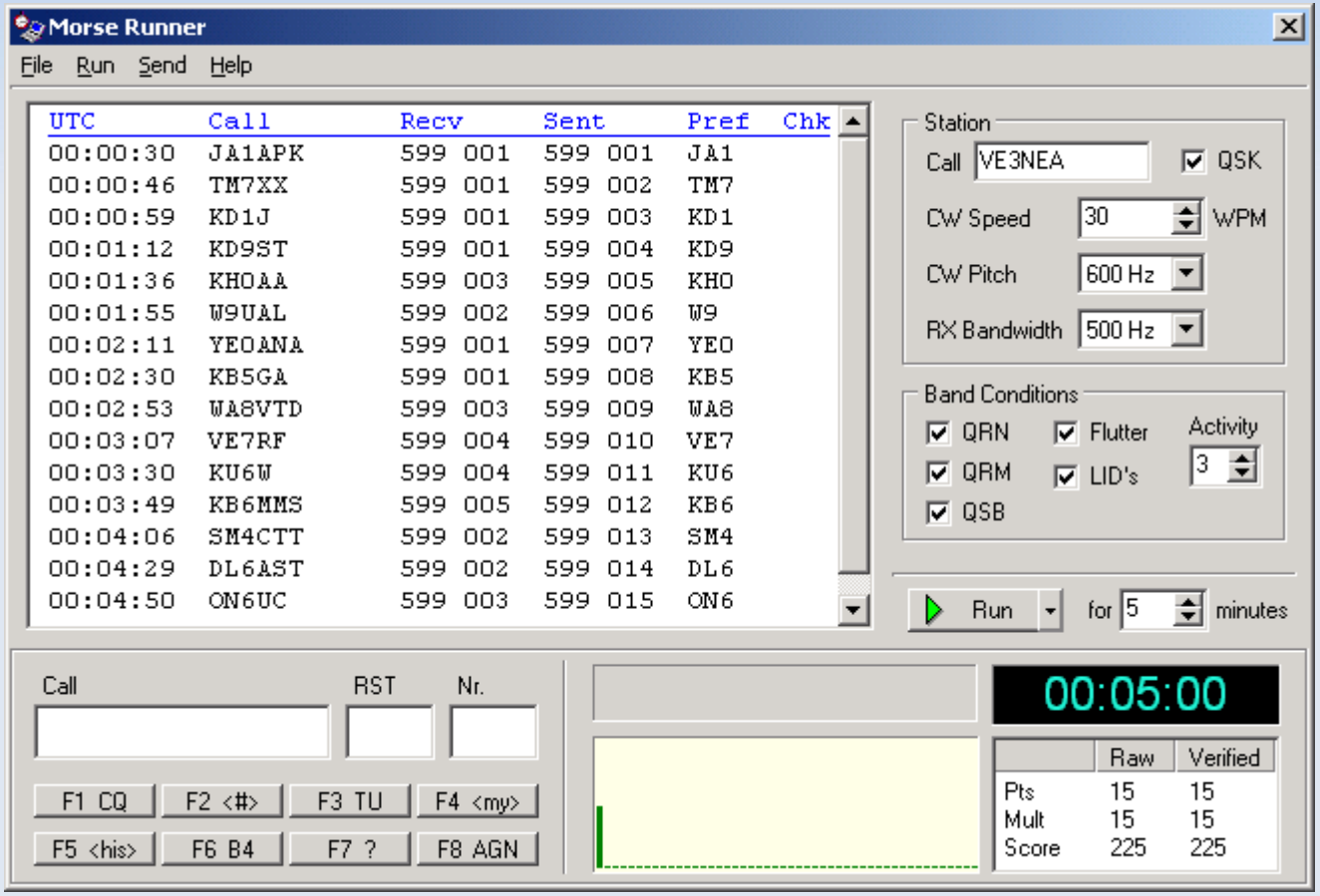
Keys fixed to the table by putty

Magnesia, not dust!

- RufzXP – Callsign reception without a speed limit

Errors (37)	Transmitted callsigns (50)	Received callsigns	Speed	Max points	Gained points	Elapsed time [ms]	Frequency
0	PY1ARS/4	PY1ARS/4	723 CPM	7641	7276	1542	800 Hz
1	W3GM	W2GM	745 CPM	6284	1516	1091	786 Hz
0	G0DEH	G0DEH	723 CPM	6393	6187	1011	836 Hz
0	PY7GK	PY7GK	745 CPM	6788	3259	1262	637 Hz
0	ER/UT7ND	ER/UT7ND	767 CPM	8599	8072	2022	757 Hz
0	N8BB/M	N8BB/M	790 CPM	8160	7744	1652	734 Hz
0	AA1CA	AA1CA	814 CPM	8104	7792	1222	825 Hz
0	LA7IJA	LA7IJA	838 CPM	9181	8716	1642	784 Hz
1	EA3URO	EA3ARO	863 CPM	9738	2272	2223	874 Hz
0	SV8/OE3MZC	SV8/OE3MZC	838 CPM	11245	10546	2053	606 Hz
0	AA6M	AA6M	863 CPM	8433	8040	1502	788 Hz
0	EA8/DL7AU	EA8/DL7AU	889 CPM	12117	11334	2143	874 Hz
1	AB2BK	AB2SK	916 CPM	10262	2351	2864	679 Hz
0	W1ZA	W1ZA	889 CPM	8949	8689	911	817 Hz
1	UA9FAR	UA9FAN	916 CPM	10970	2616	1483	902 Hz
0	CT3/OK2BOB/P	CT3/OK2BOB/P	889 CPM	13670	12810	2083	907 Hz
0	W8SSI	W8SSI	916 CPM	10262	9554	2304	973 Hz
0	DL7VZF/m	DL7VZF/M	943 CPM	12999	12408	1463	954 Hz

- MorseRunner – Pileup competition



HST: No lack of young blood!

Team YO

Team EW

Potpourri, topic 5

Audio books in Morse Code

- Books and plays in Morse code

Thanks!

Slides (PDF) and links:

http://dj1yfk.de/ham/fn2011/