PIEPS® DSP

The digital revolution!

IKAR 2007

1972 Start
PIEPS R&D

1973
PIEPS 1

1977
PIEPS 2

1981
PIEPS 3

1984 PIEPS DF

1985 PIEPS SF

1991 PIEPS 457

1992 PowderPeep

1998 PIEPS Opti-4

2003 PIEPS DSP

2007 PIEPS Freeride

2008
PIEPS

- More than 30 years of experience in developing and manufacturing of avalanche beacons
- More than 250.000 pcs. sold worldwide
- Now full offer of avalanche safety gear available
  Probes, Shovels, Backpacks

Elementary beacon performance: RANGE

Focusing on elementary beacon performance:

- **Achieving a Search Strip Width as big as possible!!**
- **3rd Antenna for Pinpointing !!**
- **Support for multiple burials !!**

Elementary beacon performance: RANGE

Situation:

• **Every rescuer** who is involved in an accident **should have a „first signal“** after switching on the receiving mode **immediately**

• If there is no „first signal“ a **very big search strip width** should be possible **without turning around the receiving beacon**

Elementary beacon performance: RANGE

The Pieps-approach:

For the digital range (i.e. full indication of distance and direction) the following basics are essential:

- The determining factor is the full digital range in **worst antenna position of the transmitting (buried) beacon**. This defines the **width of the searching strip.**

- The **range** has to be **constant** over the **entire bandwidth** of received beacon frequencies (requirement from the standard +-80Hz!!)

Elementary beacon performance: RANGE

The PIEPS way to determine the receiving performance:

STEP1: Determining the Receiving performance of the X-Antenna

Test with aligned Transmitter 0Hz, 80Hz and -80Hz deviation!!

Elementary beacon performance: RANGE

STEP2: Determining the Receiving performance of the Y-Antenna

TX

Test with aligned Transmitter 0Hz, 80Hz and -80Hz deviation!!

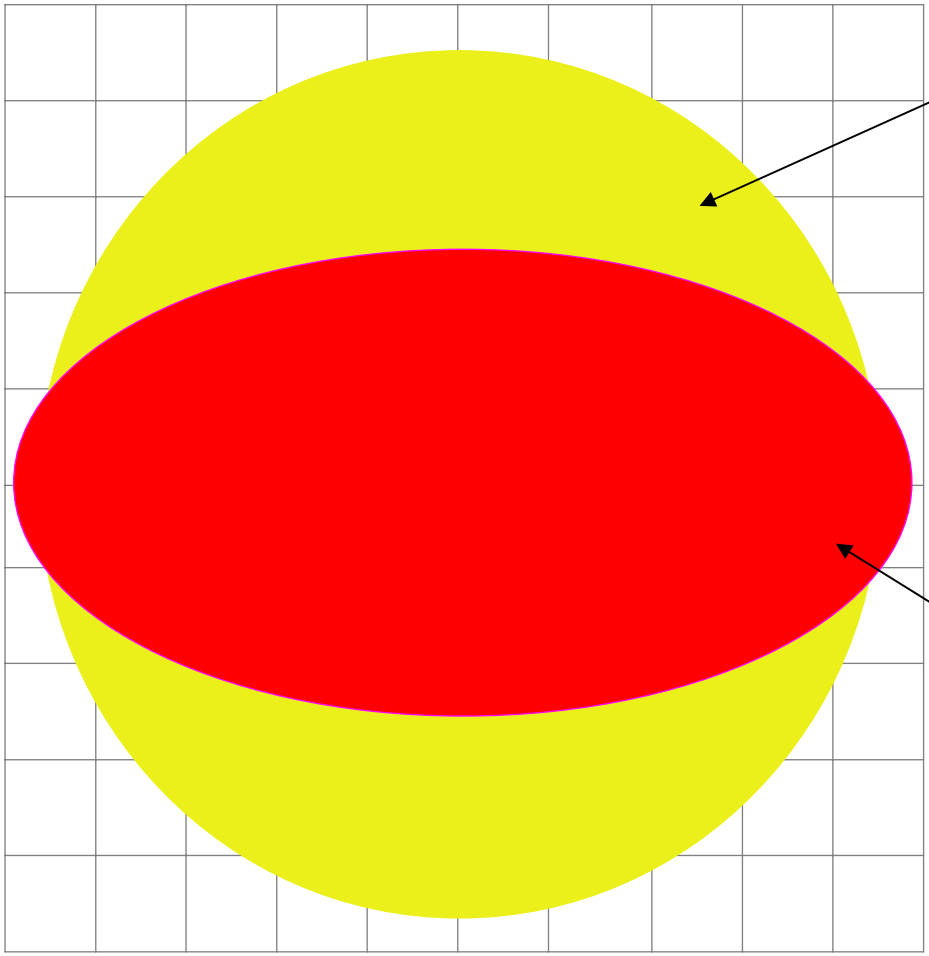
Elementary beacon performance: RANGE

STEP3: Determining the Receiving performance of the worst of X/Y Antenna with a vertical TX-Antenna!

Test with vertical Transmitter 0Hz, 80Hz and -80Hz deviation!!

Elementary beacon performance: RANGE

Result of the Receiving performance of X/Y Antennas

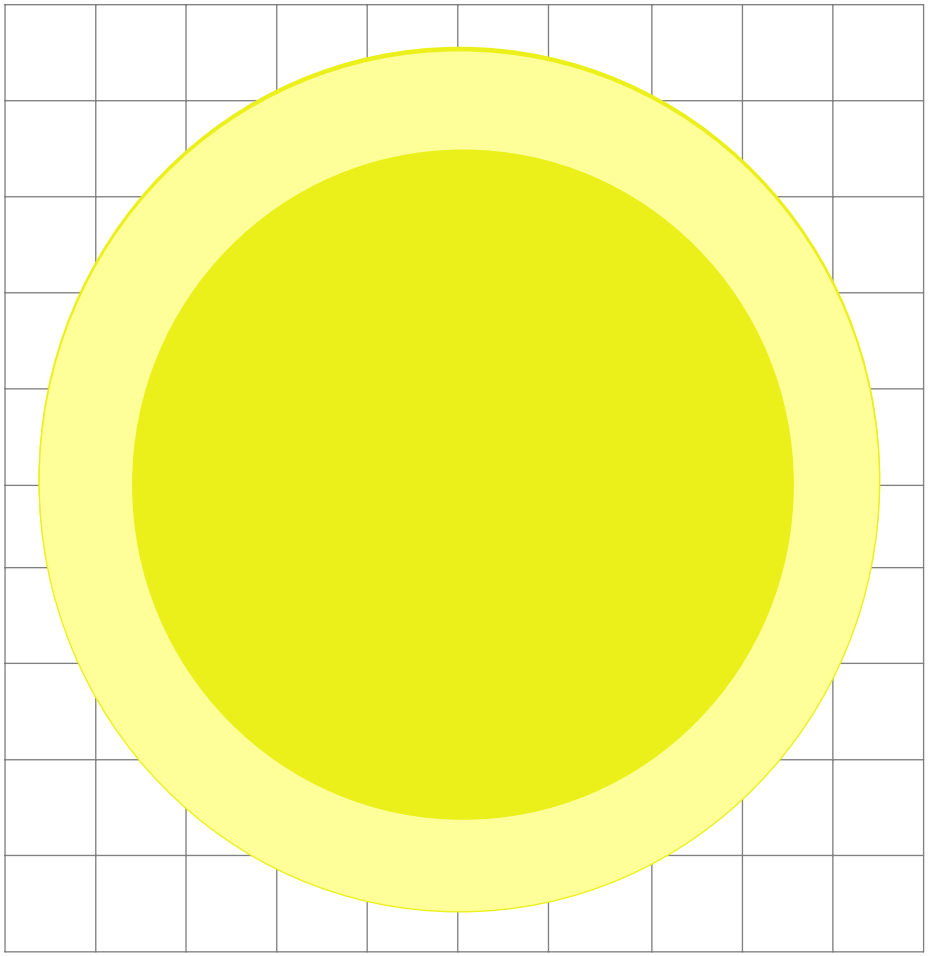


Circular Shape = IDEAL
(like the PIEPS DSP)

Elliptic shape
(most other beacons)

Elementary beacon performance: RANGE

Why is the shape that important !?!?!

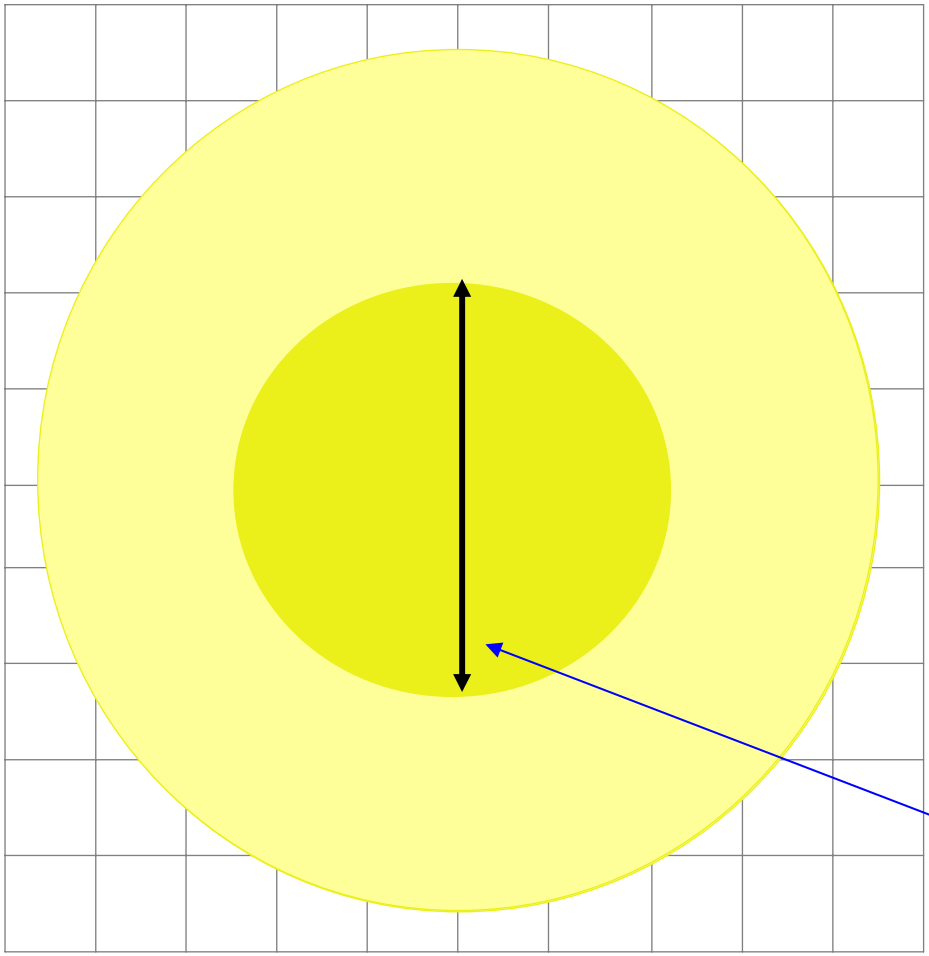


Circular Shape = IDEAL
(like the PIEPS DSP)

Reduction about 30% with parallel antenna (not aligned)

Elementary beacon performance: RANGE

Why is the shape that important !?!?!



Circular Shape = IDEAL (like the PIEPS DSP)

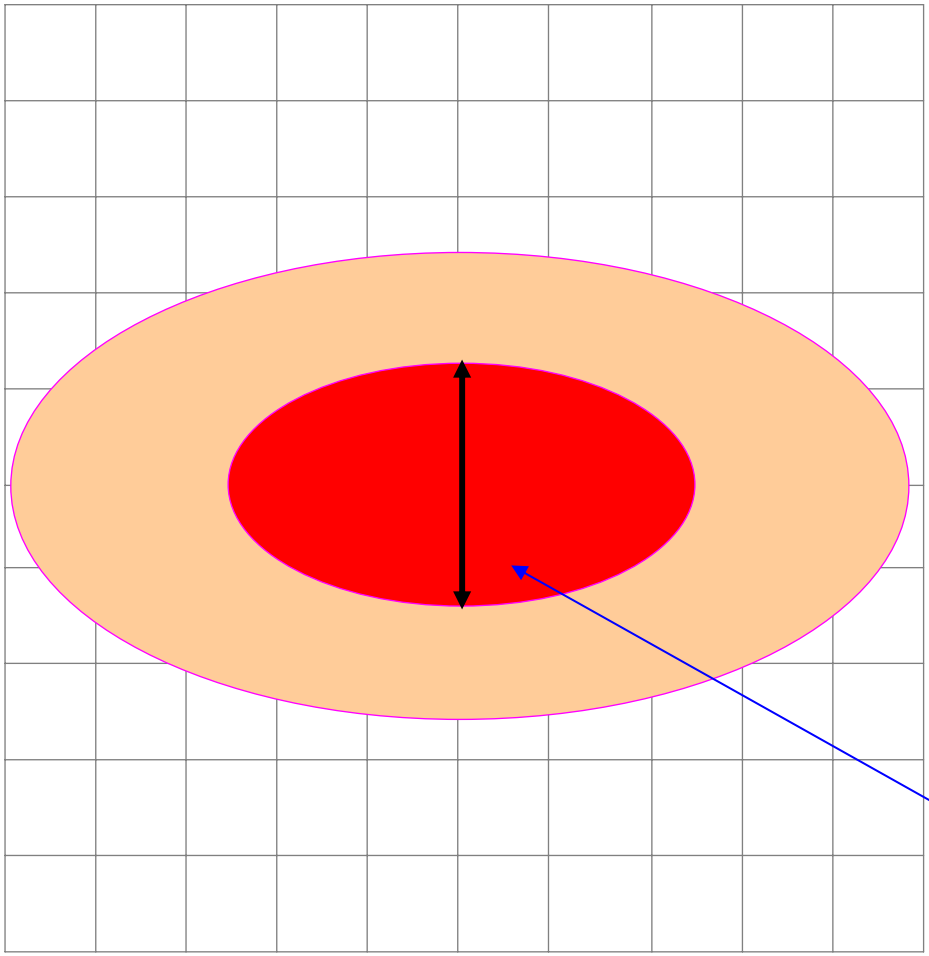
Reduction about 30% with parallel antenna (not aligned)

Reduction about 50% with Vertical antenna (theoreticaly to 0% !)

Useful Range: SMALLEST AXE!

Elementary beacon performance: RANGE

Why is the shape that important !?!?!



Circular Shape = IDEAL (like the PIEPS DSP)

Reduction about 30% with parallel antenna (not aligned)

Reduction about 50% with Vertical antenna (theoreticaly to 0% !)

Exactly the same happens to an elliptic shape!!

Useful Range: SMALLES AXE!

Elementary beacon performance: RANGE

SIMULATION PROGRAM

CONCLUSIONS

- **Turning a beacon while searching for the first signals need strongly to be eliminated!**
  (because in an real emergency nobody does it in the real and slowly way!)

- **Bandwidth as given by the Standard has to be fully supported!!!**
  (for the time being, a beacon at the edge of the standard should'nt have a disadvantage!)

- **Further improvements are possible if the bandwidth could be reduced significantly in the standard!**
  (Older beacons should be banned within a specific period of time!!)

Elementary beacon performance: 3RD-ANTENNA

Situation:

•Misleading maximums are not manageable for non-professionals!!

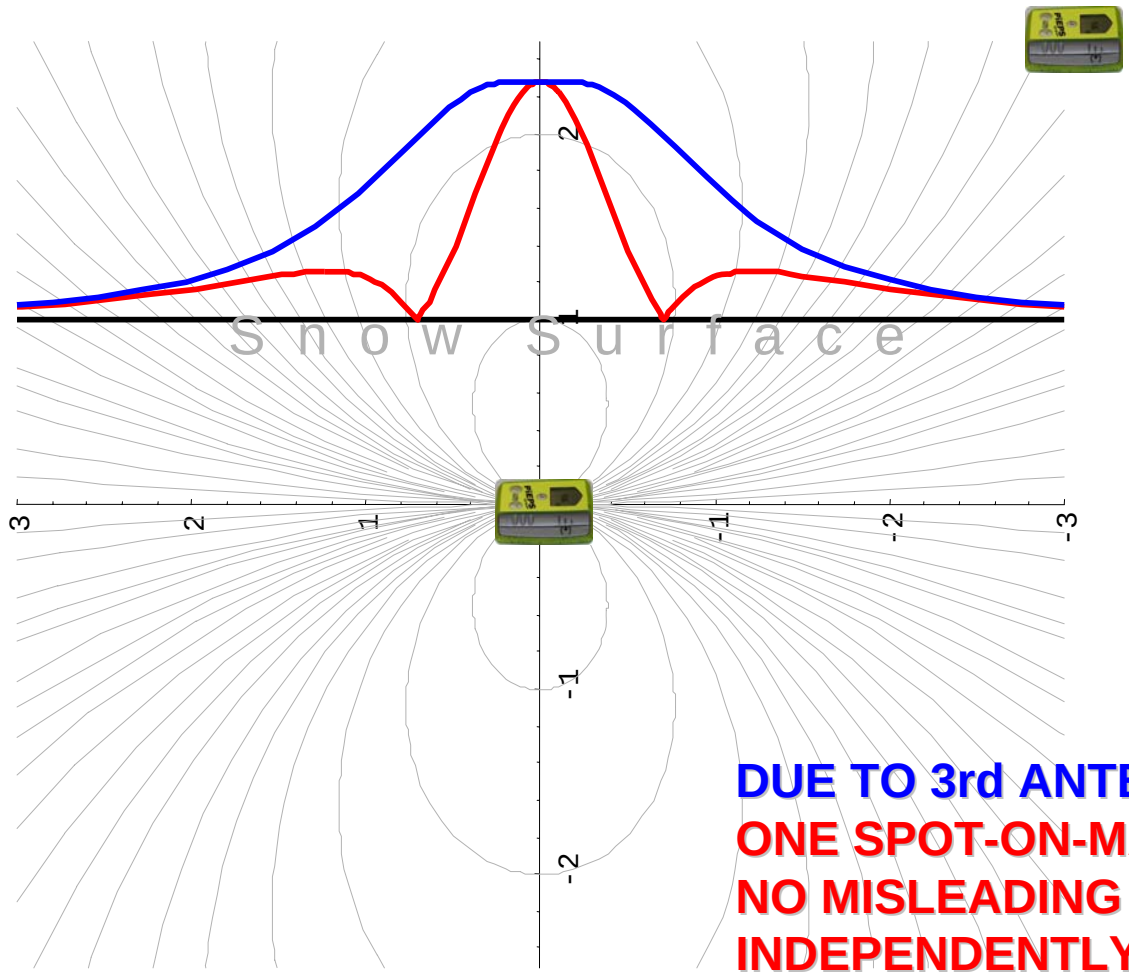
•3-Antenna technology for avalanche transceivers has been introduced be **PIEPS in 2003!!**

•Others manufacturer are following, which is an improvement for the overall situation

Pieps-Approache:

• **3rd Pieps DSP antenna** has **12 meters**

Elementary beacon performance: 3RD ANTENNA



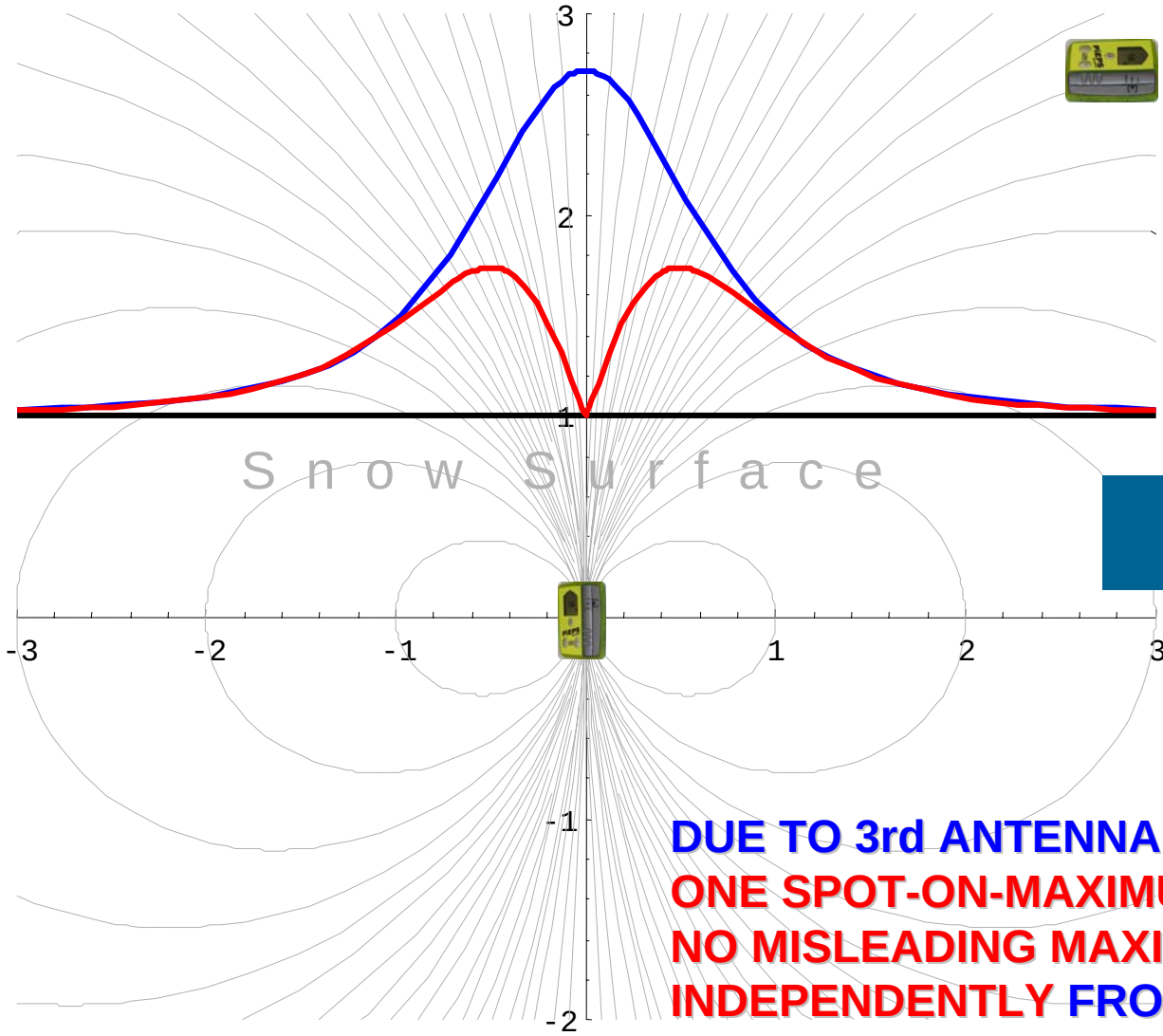
3-Antennas

1 or. 2 Antennas

Position: horizontal

DUE TO 3rd ANTENNA ONLY ONE SPOT-ON-MAXIMUM – NO MISLEADING MAXIMAS, INDEPENDENTLY FROM POSITION OF THE VICTIM!!!

Elementary beacon performance: 3RD ANTENNA



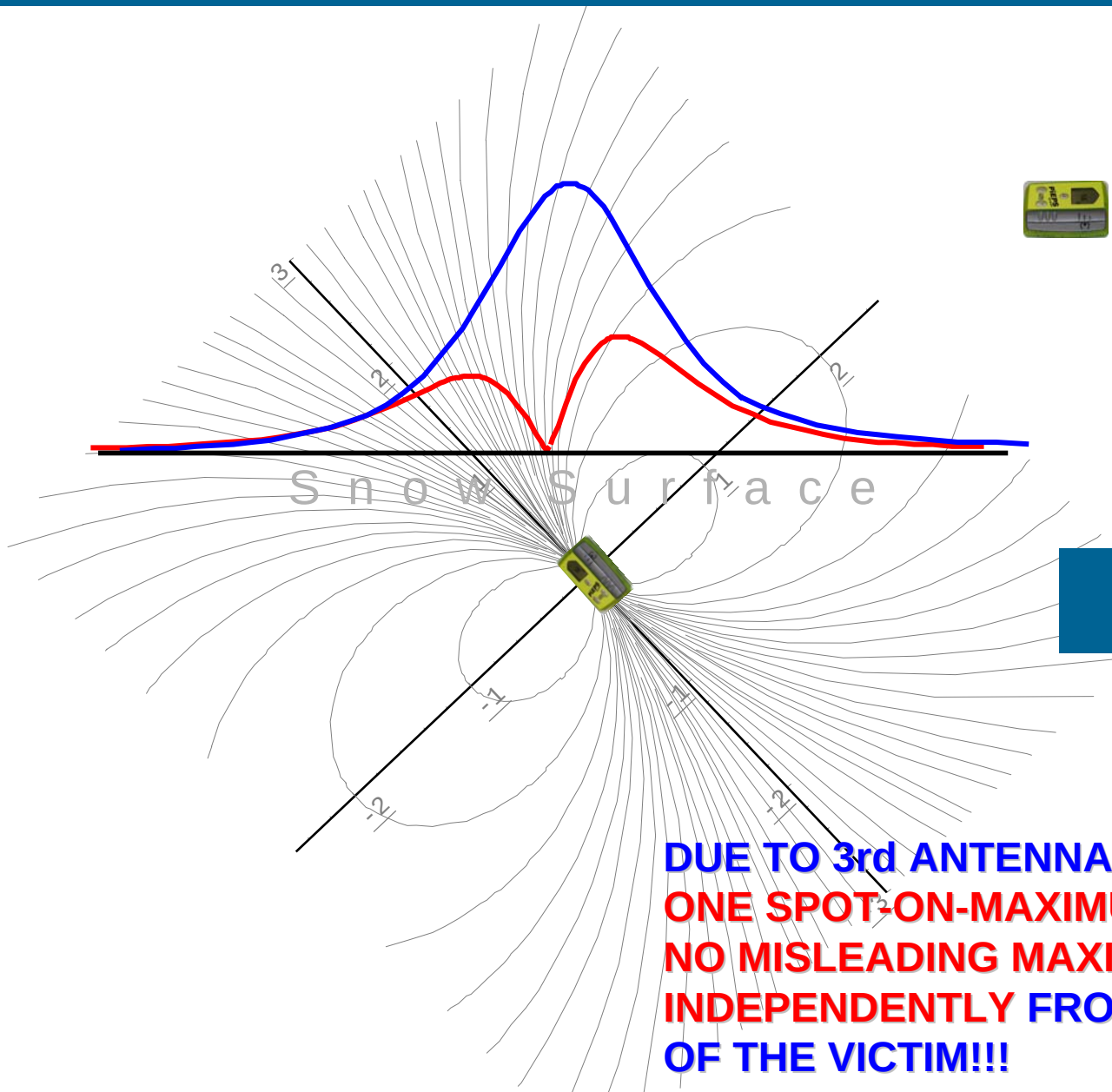
3 Antennas

1 or 2 Antennas

Position: Vertical

DUE TO 3rd ANTENNA ONLY ONE SPOT-ON-MAXIMUM – NO MISLEADING MAXIMAS, INDEPENDENTLY FROM POSITION OF THE VICTIM!!!

Elementary beacon performance: 3RD ANTENNA



3 Antennas

1 or 2 Antennas

Position: random…

DUE TO 3rd ANTENNA ONLY ONE SPOT-ON-MAXIMUM – NO MISLEADING MAXIMAS, INDEPENDENTLY FROM POSITION OF THE VICTIM!!!

CONCLUSIONS

- **3-Antenna technology is State-of-the-Art for High-End beacons**
- **It significantly changed the practice for pinpointing!**

  (if you have a 3-antenna beacon -> go for only one Maximum)
- **For solving deep burials (>1.5m) a minimum range of 5-6 meters is required!!**

  (when do you know to go for more than one maximum?)
- **Minimum Range for the Z-antenna must be stated in the Standard to guaranty a 3rd antenna working properly!**

Elementary beacon performance: Support for Multiple Burials

Situation:

•Signal suppressing methods for avalanche transceivers has been introduced be **PIEPS in 2003!!**

•Others manufacturer are following, which is an improvement for the overall situation!

Pieps-Approache:

• **MARK and SCAN** with given (and always told) limitation…

Elementary beacon performance: MULTIPLE BURIALS

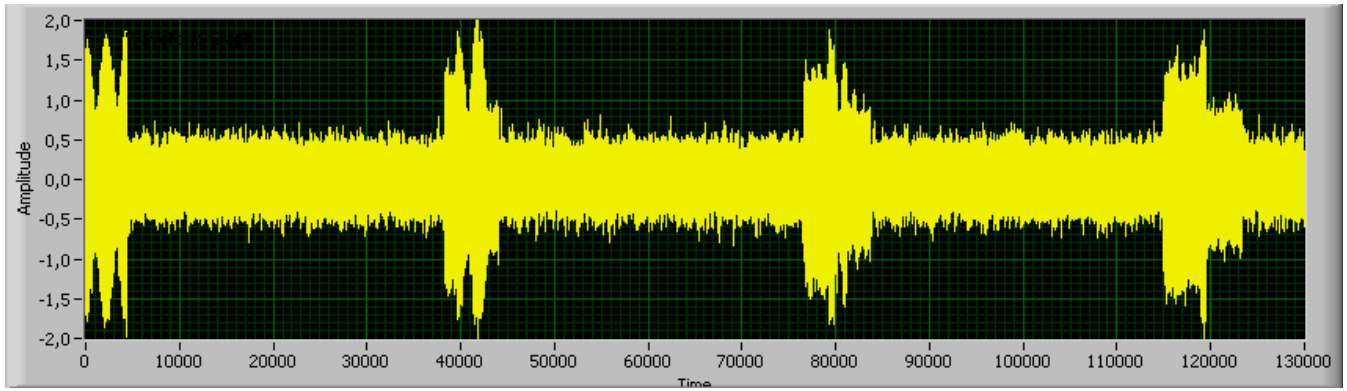
Background of the physics:

- **The ability for Marking a signal depends strongly on the accuracy of measuring a specific signal!**

- **Maintaining the required Bandwidth (Standard!!) reduces this accuracy!**

- **Maintaining a high Range reduces this accuracy even more!**

- **Old beacons (continuous carrier, very broad pulses) have also negative impact to Marking Quality…**



Elementary beacon performance: MULTIPLE BURIALS

Our PIEPS PHILOSOPHY

- **PIEPS goes strait for keeping the same Range, even for the second or third victim!**

  (When range is important for the first victim, why should it be less important for the second???)

- **PIEPS does not simplify this situation by ignoring the fact, that beacons with different frequency deviations are buried.**

  (for the time being, a beacon at the edge of the standard should’nt have a disadvantage!)

CONCLUSIONS

- **Currently the suppressing method has given physical limits and can't be improved significantly!**

- **A manufacturer has to choose between the quality of marking versus maintaining Bandwidth and Range!**

(What is more important ? Is it allowed to ignore frequency deviations?)

- **An improvement only can be archived when a the standard is revised in allowed max. frequency deviations, max. pulse times, min. period times.**

(Older beacons should be banned within a specific period of time!!)

The alternative solution

If you switch off the transmitting beacon

- **no overlapping signals**
- **no confusion because of losing a marked signal**
- **no reduction of the range for the second victim because of a marked first victim**

The solution 2007 by Pieps …

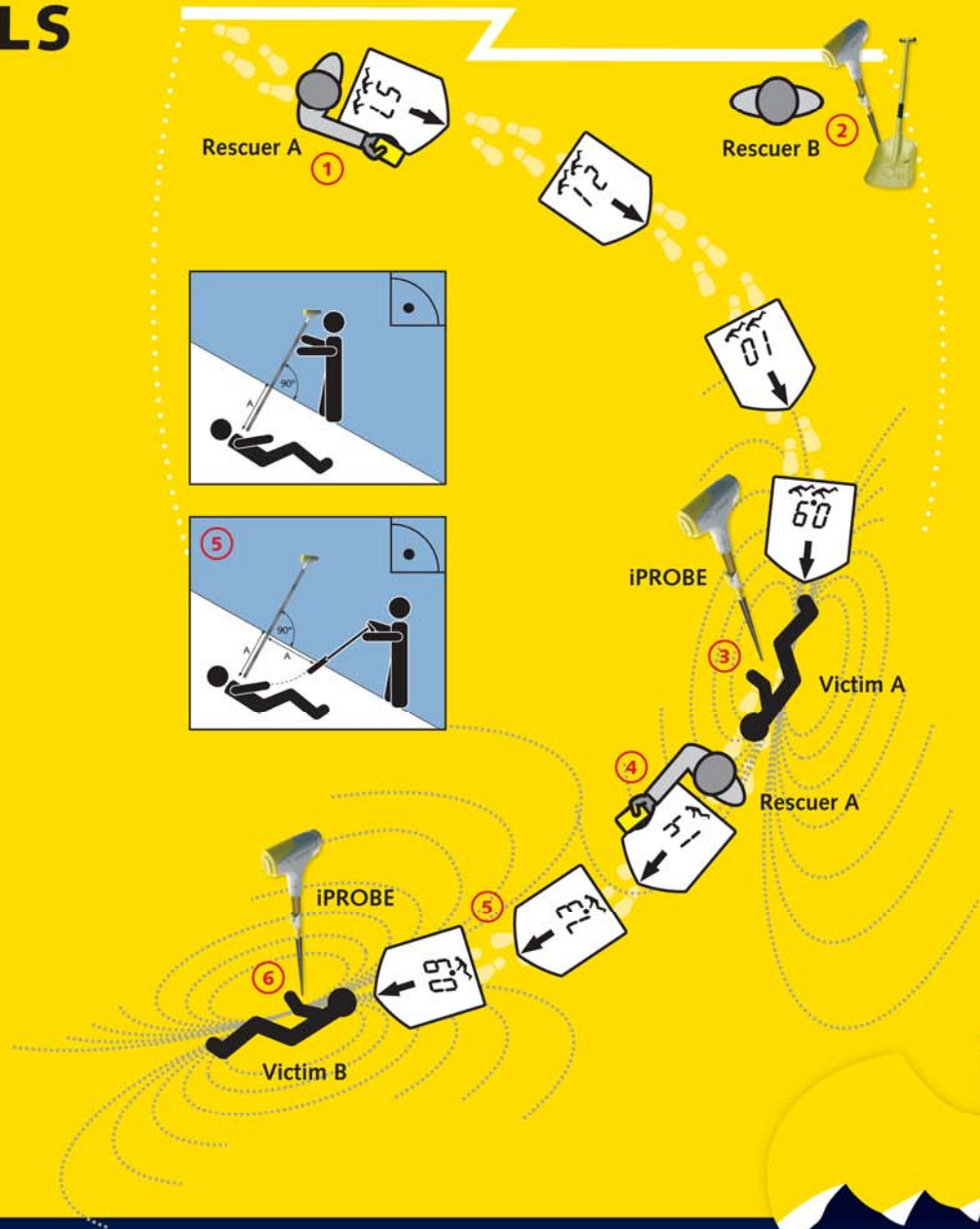
- **Pieps iProbe**
- **Pieps freeride und DSP 5.0**

MULTIPLE BURIALS

SOLUTION with the PIEPS safety system:

SITUATION:

2 burials having transceivers with PIEPS iPROBE-Support (PIEPS Free-ride and PIEPS DSP 5.0). Two rescuer are equipped with the PIEPS safety system: Rescuer A with PIEPS DSP 5.0, electronic probe PIEPS iRPOBE, PIEPS shovel PRO. Rescuer B with PIEPS Freeride, electronic probe PIEPS iPROBE, PIEPS shovel PRO.



PREMIUM ALPINE PERFORMANCE

www.pieps.com

This presentation
the simulation program
the study from DAV Sicherheitsforschung
(Chris Semml)

can be downloaded at

http: //www.pieps.com/ikar2007

Thanks for your attention!