



Avalanche-, Debris Flow- and Mudslide RADAR 10 years experience

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About IBTP Koschuch e.U.

IBTP Koschuch was founded in 2010 to make application-oriented physical methods available for the public, for companies and for private individuals.

About DI Dr. Koschuch Richard:

- **1990-1998 Technical physics studies at the TU-Graz. Diploma thesis at the institute for nuclear physics. Dosimetry during patient transportation within the Gamma Knife treatment.**
- **1998-2002 Technical sciences studies at the TU-Graz and the institute of biophysics and X-ray structure physics of the Austrian Academy of Sciences. Dissertation at the Institute of Biophysics and X-Ray Structure Physics of the Austrian Academy of Sciences.**
- **1998-2003 Employed at the Institute of Biophysics and X-Ray Structure Physics of the Austrian Academy of Sciences.**
- **2002-2006 Chief of development and production at Hecus XRS.**
- **2006-2008 Inspector for the investigation of radioactivity in food and environment at the Austrian Agency for Health and Food Safety (AGES).**
- **2009 Preliminary work for the company foundation**
- **2010 Establishment of IBTP Koschuch**
- **2010-2015 Chief of development and production at H&S Hochfrequenztechnik**

IBTP Koschuch e.U. Organigram

IBTP Koschuch e.U.

X-Ray
Systems
SAXS
HF-
Equipment

Engineering

Natural
Hazard
Detection

Avalanche
Radar

Mudslide-
Debris Flow-
Radar

IBTP Koschuch e.U. Organigram

R. Koschuch
Owner / CEO

H.M. Winter

IT
Monitoring
Production
Service

P. Jocham

IT
Software-
Development

G. Hofbauer

Radar-
Electronics-
Development

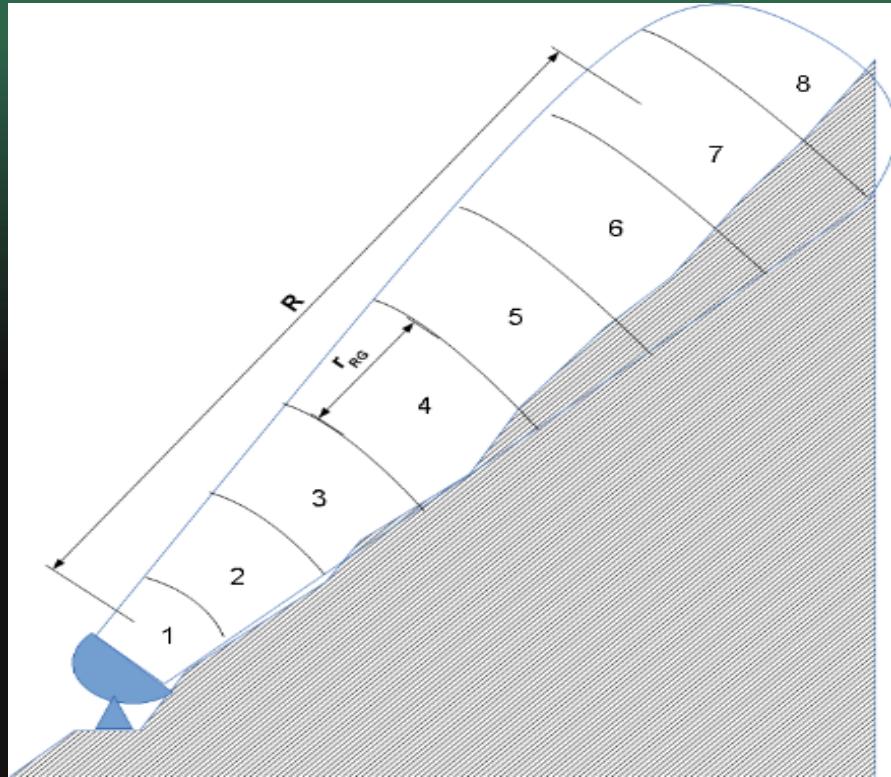
D. Stock

Assistant
Sales
Marketing

M. Koschuch

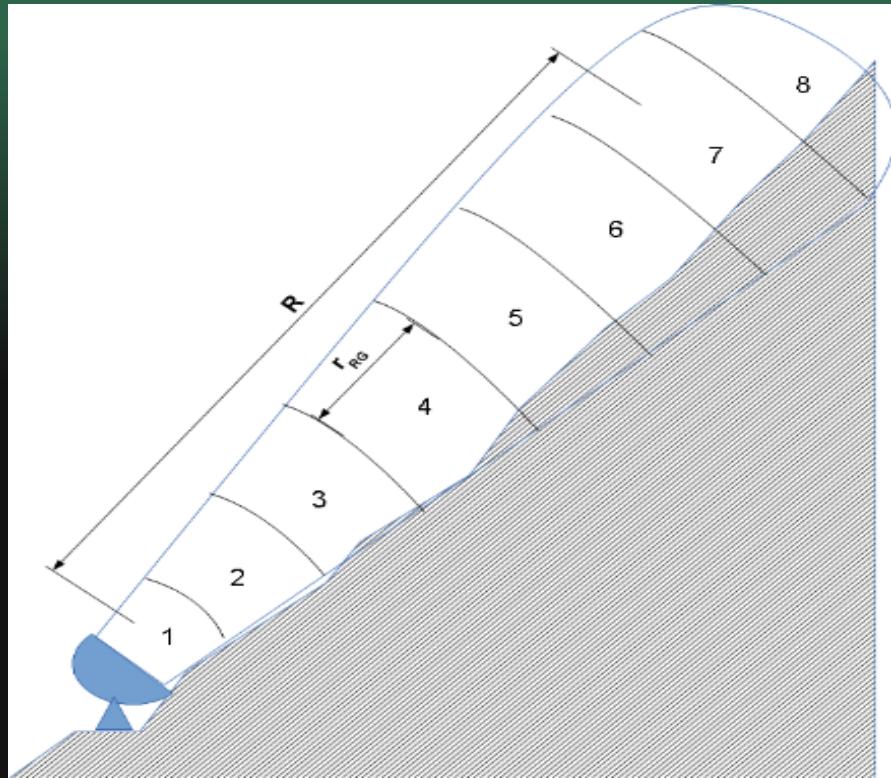
Assistant
Geo-
engineer

Principle of the Radar



- The RADAR emits modulated pulses
- Max. measurement distance $R= 5\text{ km}$
- RG-length $r_{RG}=15\text{-}250\text{ m}$
- Velocities up to 300 km/h are detected simultaneously in each RG
- If there is a hazardous event (fast moving objects), a alarming trigger is activated.

Areas of application for the Radar



- **Snow Avalanches**
- **Debris Flow**
- **Water Level Detection**
- **Rain Detection**
- **Rockfall**
- **Man Detection**

Specification



Parameter	Quantity	Tolerance	Unit
Mode	Pulse/PCM		
Frequency	10,0-10,5		GHz
Power C.	40	<	W
Range	30-5000		m
Targetszie	1	min > at 2km	m ²
	0,25	min > at 1km	m ²
Velocity	0,2-100	min/max	m/s
RG	128	max	
RG-length	15-250	min/max	m

Function I: Mobile RADAR



Mobile Radar in Action; Fotos Daniel Lussi, SLF

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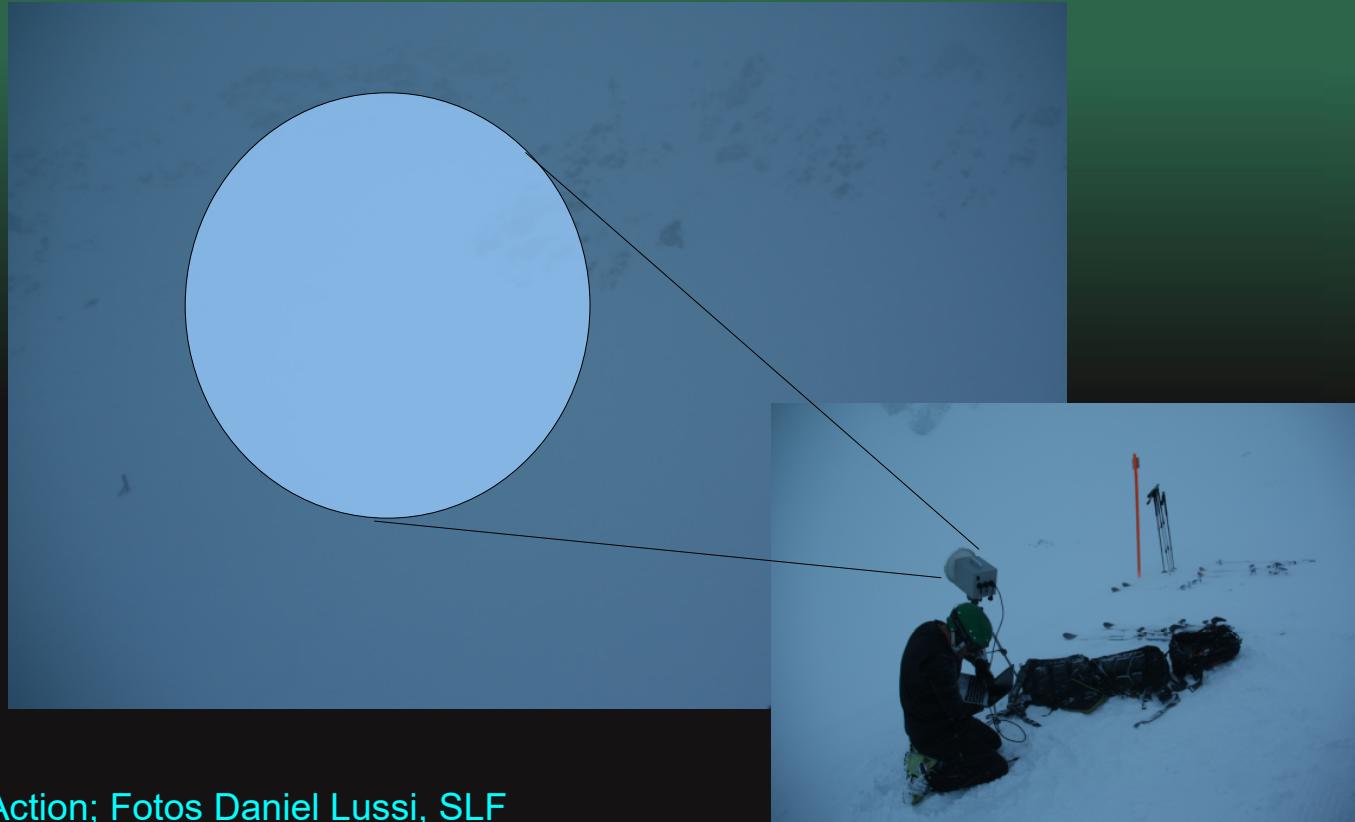
Function I: Mobile RADAR



Mobile Radar in Action; Fotos Daniel Lussi, SLF

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Function I: Mobile RADAR



Mobile Radar in Action; Fotos Daniel Lussi, SLF

Function II: Fix Installation Ischgl



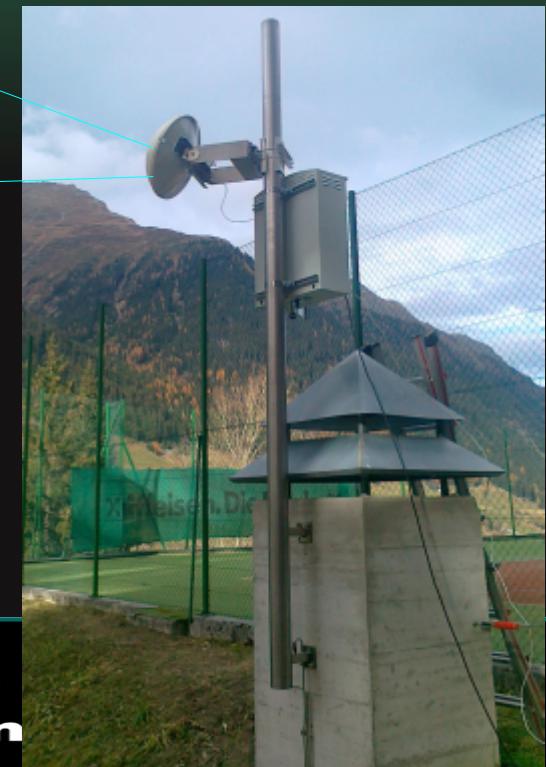
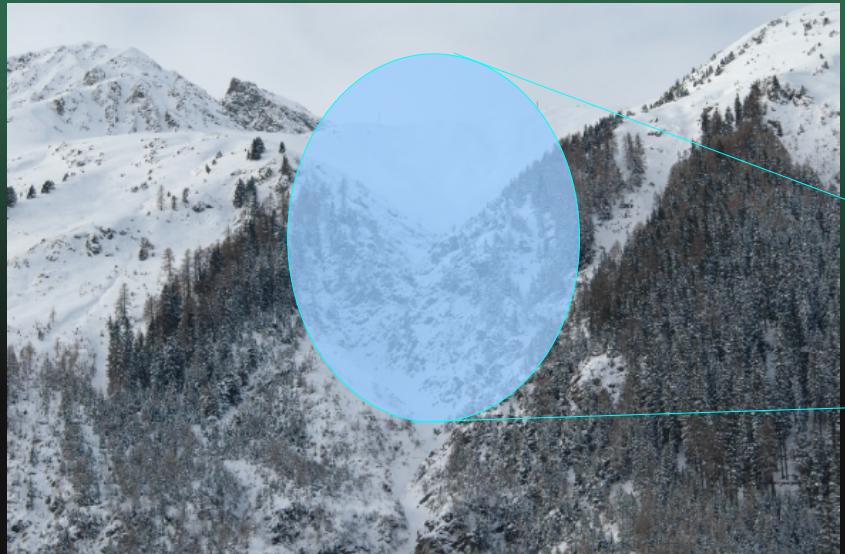
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Function II: Fix Installation Ischgl



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Function II: Fix Installation Ischgl



04.01.2018 14:00:01

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Function II: Fix Installation Ischgl

A connection

Range Gates 50
Alarm Stage 0

Radar Ischgl
by avalancheradar.com

Live View

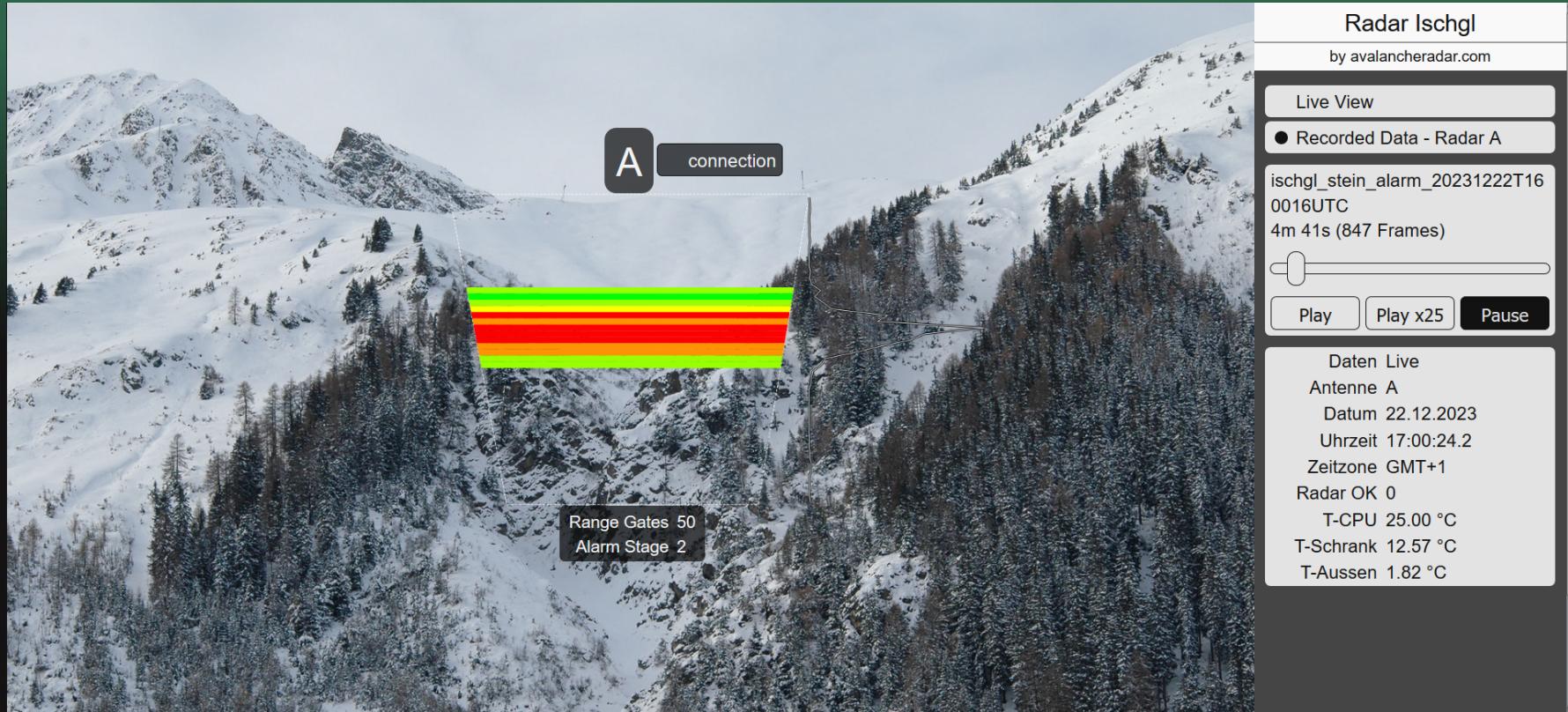
Recorded Data - Radar A

ischgl_stein_alarm_20231222T160016UTC
4m 41s (847 Frames)

Play Play x25 Pause

Daten Live
Antenne A
Datum 22.12.2023
Uhrzeit 17:00:13.6
Zeitzone GMT+1
Radar OK 0
T-CPU 25.00 °C
T-Schrank 12.57 °C
T-Aussen 1.82 °C

Function II: Fix Installation Ischgl



Function II: Fix Installation Ischgl

A screenshot of a live video feed from a fixed avalanche radar installation at Ischgl. The scene shows a snow-covered mountain slope with a dense forest of coniferous trees in the foreground. A horizontal radar signal is overlaid on the image, consisting of several colored bars (green, yellow, red) indicating the range of the radar. A black box in the center of the signal displays the text "Range Gates 50" and "Alarm Stage 2". In the top left corner of the video frame, there is a small graphic element with a letter "A" and a "connection" label. To the right of the video, there is a sidebar with the following information:

Radar Ischgl
by avalancheradar.com

Live View
Recorded Data - Radar A

ischgl_stein_alarm_20231222T16
0016UTC
4m 41s (847 Frames)

Play Play x25 Pause

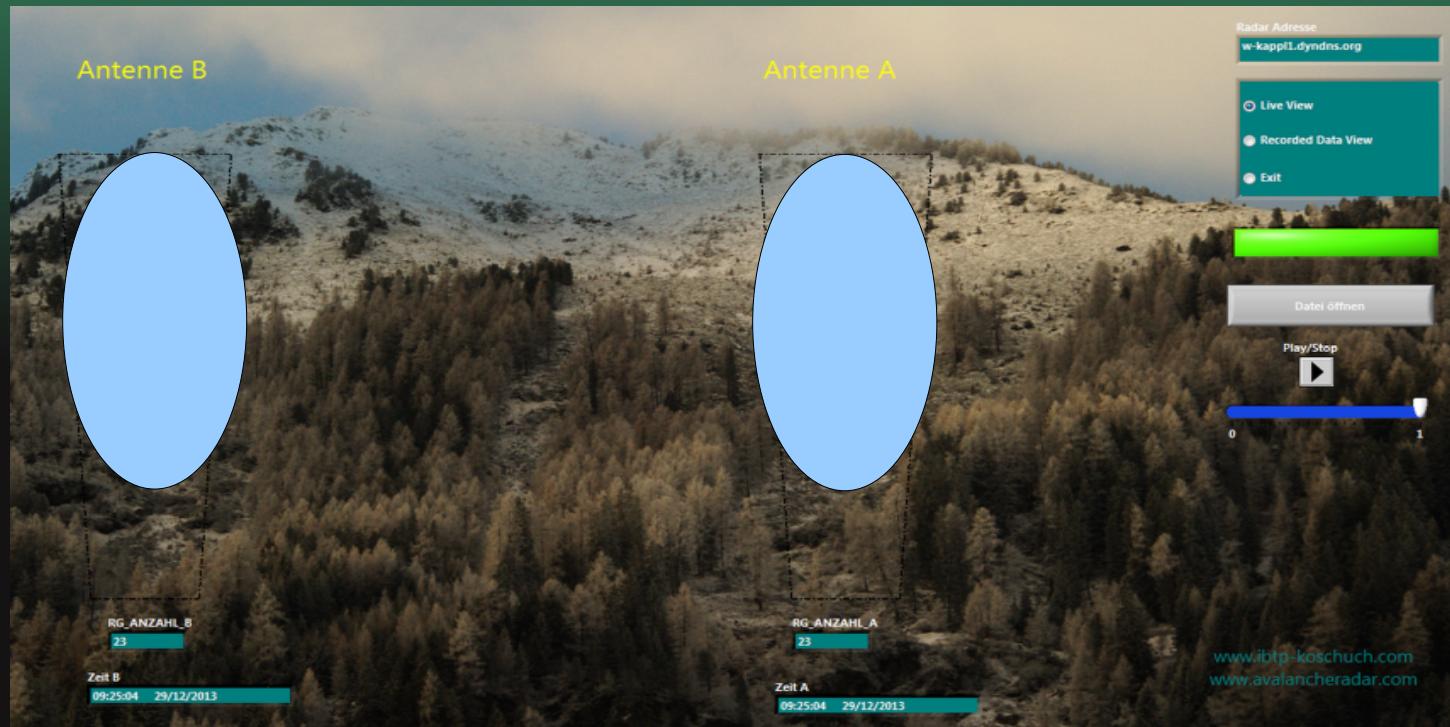
Daten Live
Antenne A
Datum 22.12.2023
Uhrzeit 17:00:36.5
Zeitzone GMT+1
Radar OK 0
T-CPU 25.00 °C
T-Schrank 12.63 °C
T-Aussen 1.88 °C

Function II: Installation Pitztal



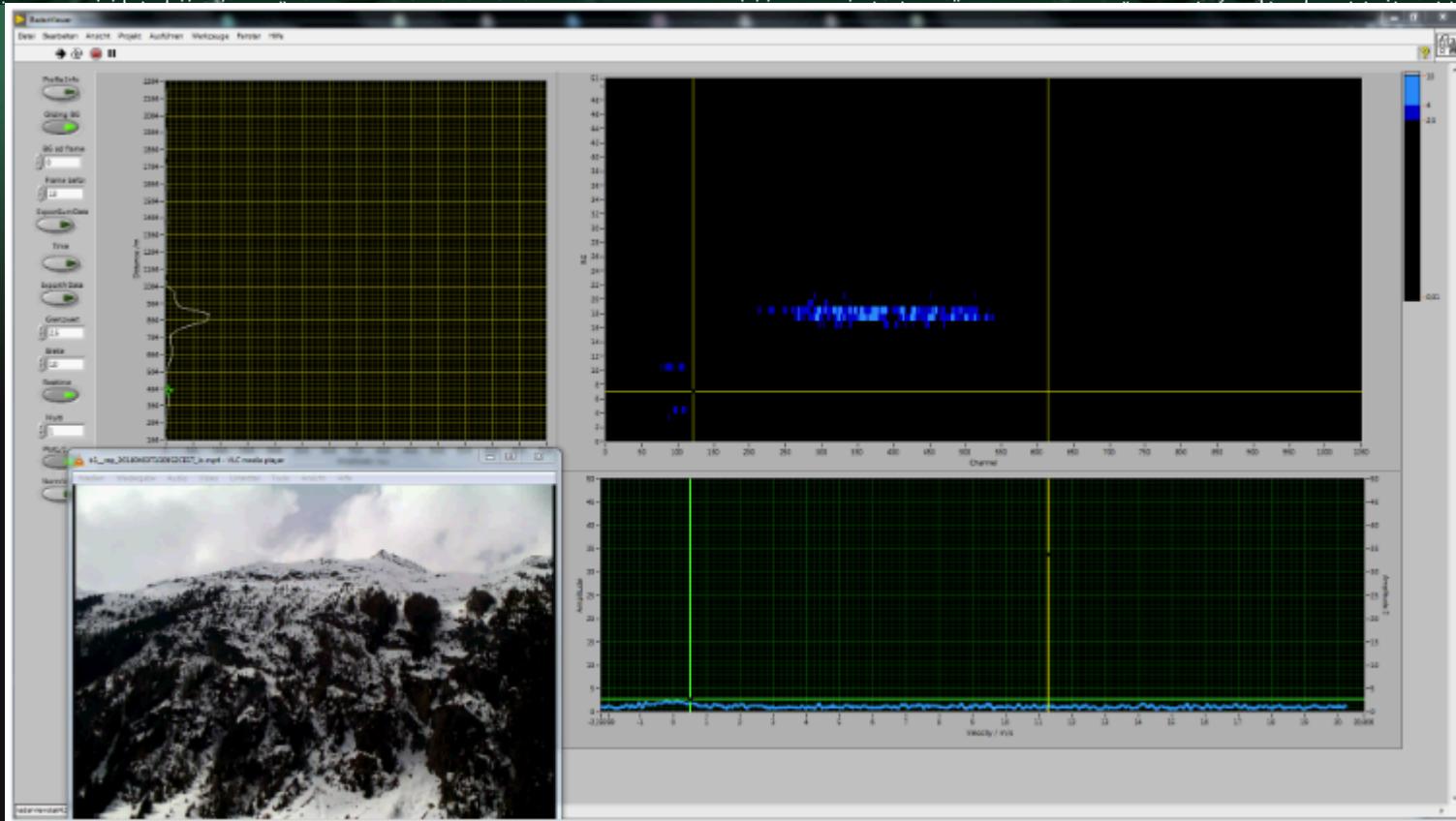
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Function II: Installation Pitztal



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Function II: Avalanche Sölden



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Project Avalanche Detection Systems SLF

Summary Comparison Tests SLF:

Tabelle 10: Ermittelte Leistungsparameter im Winter 2011/2012

Standort	System	a	b	c	POD	FAR
Täsch	ARFANG	3	10	138	0.77	0.93
Belalp/Blatten	ARFANG	-	-	-	-	-
Lavin	ARFANG	10	40	205	0.8	0.84
Lavin	Geophone AlpuG	28	9	0	0.24	0
Sedrun	Radar H&S	0	11	7	1	0.39
Ischgl	Radar H&S	0	17	0	1	0

Tabelle 8: Kategorien für Quantifizierung der Leistung

- | | |
|------------------------|--|
| Verpasste Lawine (a) | Ein Lawinenabgang fand statt (bestätigt durch lokalen Beobachter), doch das Detektionssystem hat diesen nicht gemeldet. |
| Detektierte Lawine (b) | Ein Lawinenabgang fand statt (bestätigt durch lokalen Beobachter), das Detektionssystem hat diesen erfasst und gemeldet. |
| Fehlalarm (c) | Es fand kein Lawinenabgang statt, doch das Detektionssystem hat einen Abgang gemeldet. |

Master Thesis BOKU Vienna

Summary Thesis Christian Kienberger 2013:

„Evaluation of Avalanche Detection Systems and Development of a Plan for a Simple Detection System“

Avalancheradar

Standort	System	Technologie	Verbesserungen	Zuverlässigkeit	Verfügbarkeit	Zukunftschancen
Gonda	ARFANG	Infrasound	keine	unbefriedigend	unbefriedigend	keine weiteren Investitionen, mit Ablaufdatum
Gonda	UHU	Infrasound	-	unbefriedigend	unbefriedigend	möglich, Sensorenstandorte als großes Problem
Gonda	AlpuG Geophon West	Seismik	keine	unbefriedigend	hervorragend	groß, vor allem in Kombination mit Infrasound
Gonda	AlpuG Geophon Ost	Seismik	ja	unbefriedigend	hervorragend	groß, vor allem in Kombination mit Infrasound
Ischgl	Lawinen – Radar	Radar – technologie	keine	hervorragend	hervorragend	groß
Ischgl	IDA	Infrasound	-	unbefriedigend	-	groß, sofern Weiterentwicklung erfolgt

Debris Flow Lattenbach ÖBB Project

Location: Grins Lattenbach 10°30'38" O and 47°08'32" N



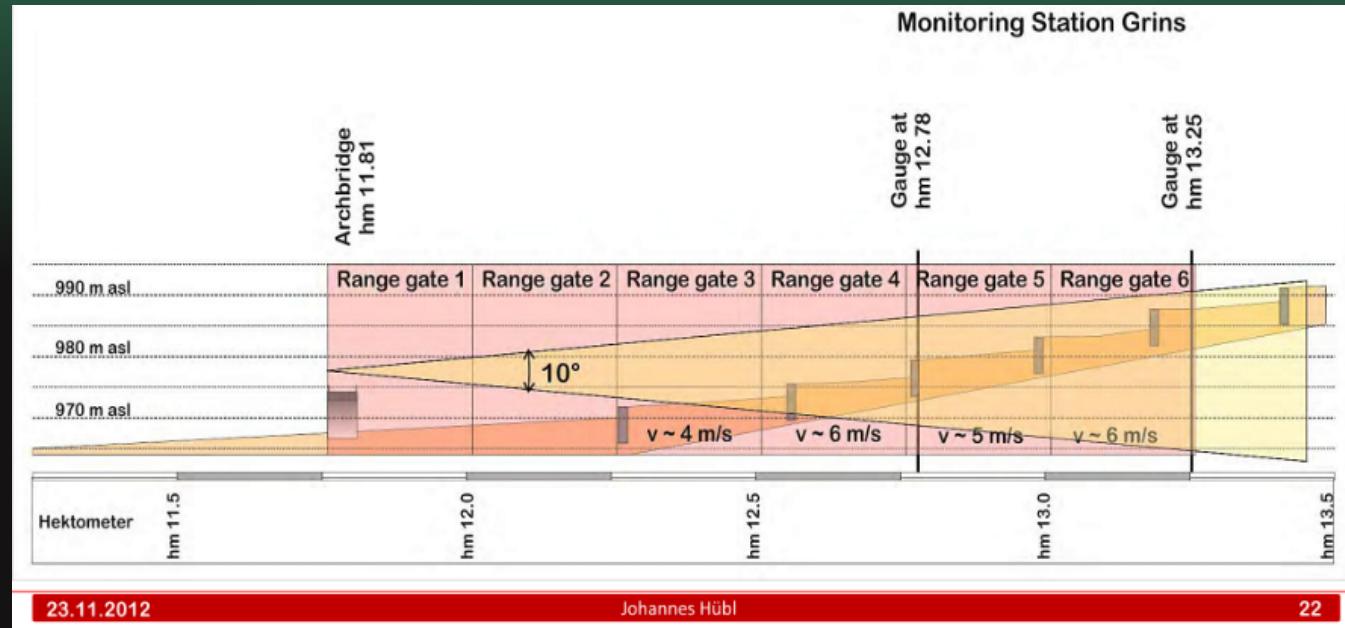
Debris Flow Lattenbach

View

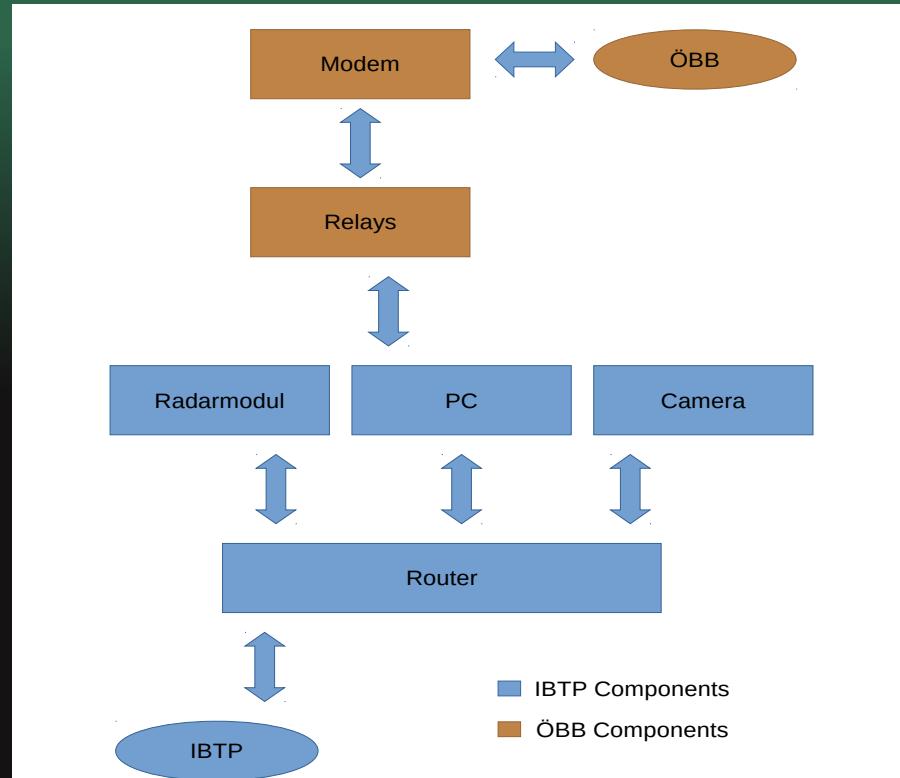


Debris Flow Lattenbach

Situation Lattenbach



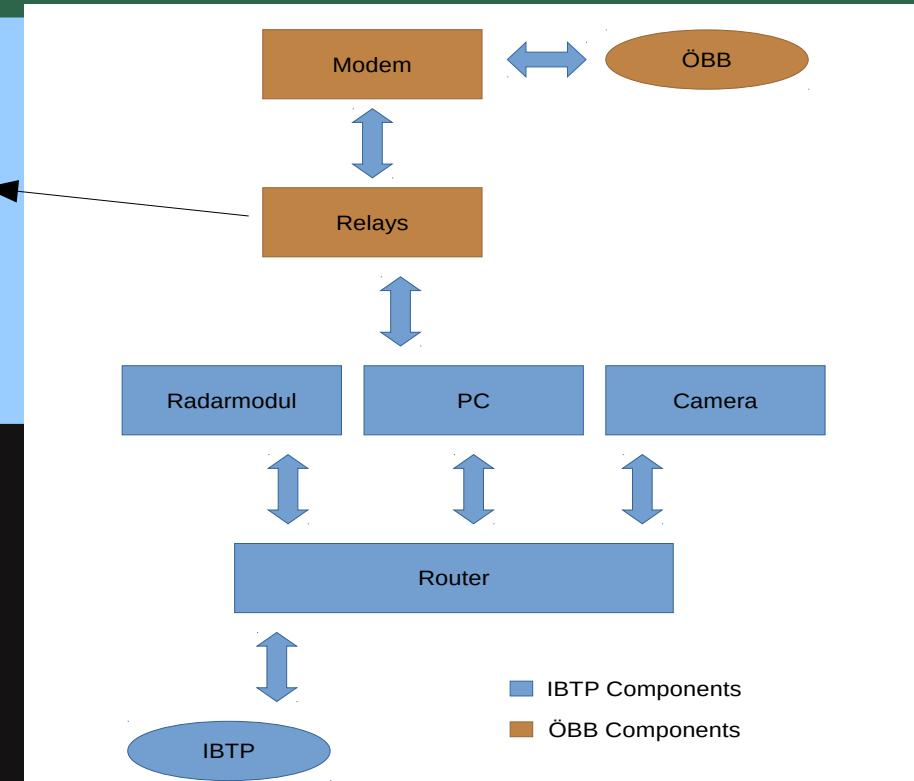
Lattenbach ÖBB Project



Lattenbach ÖBB Project

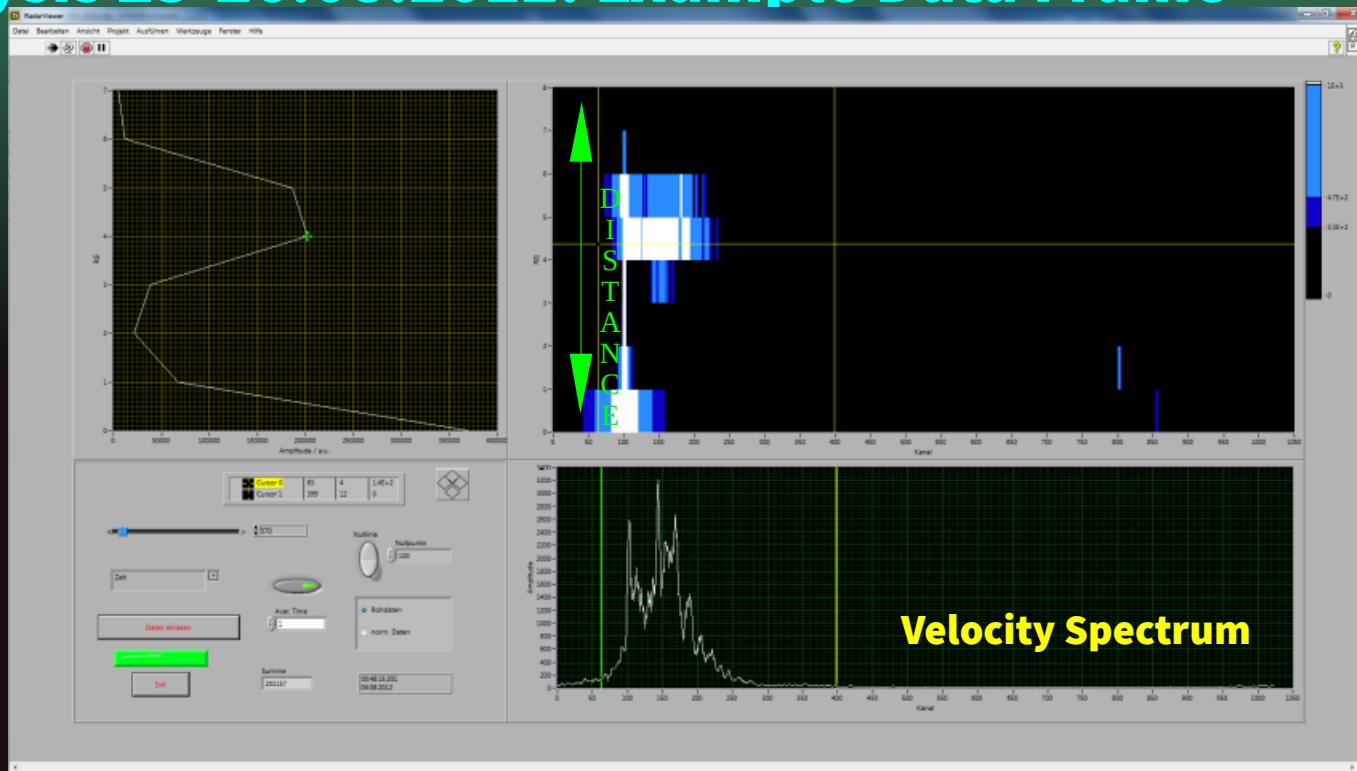
4 Relays

- Radar OK
- Water Level
- Debris Flow Small Event
- Debris Flow Big Event



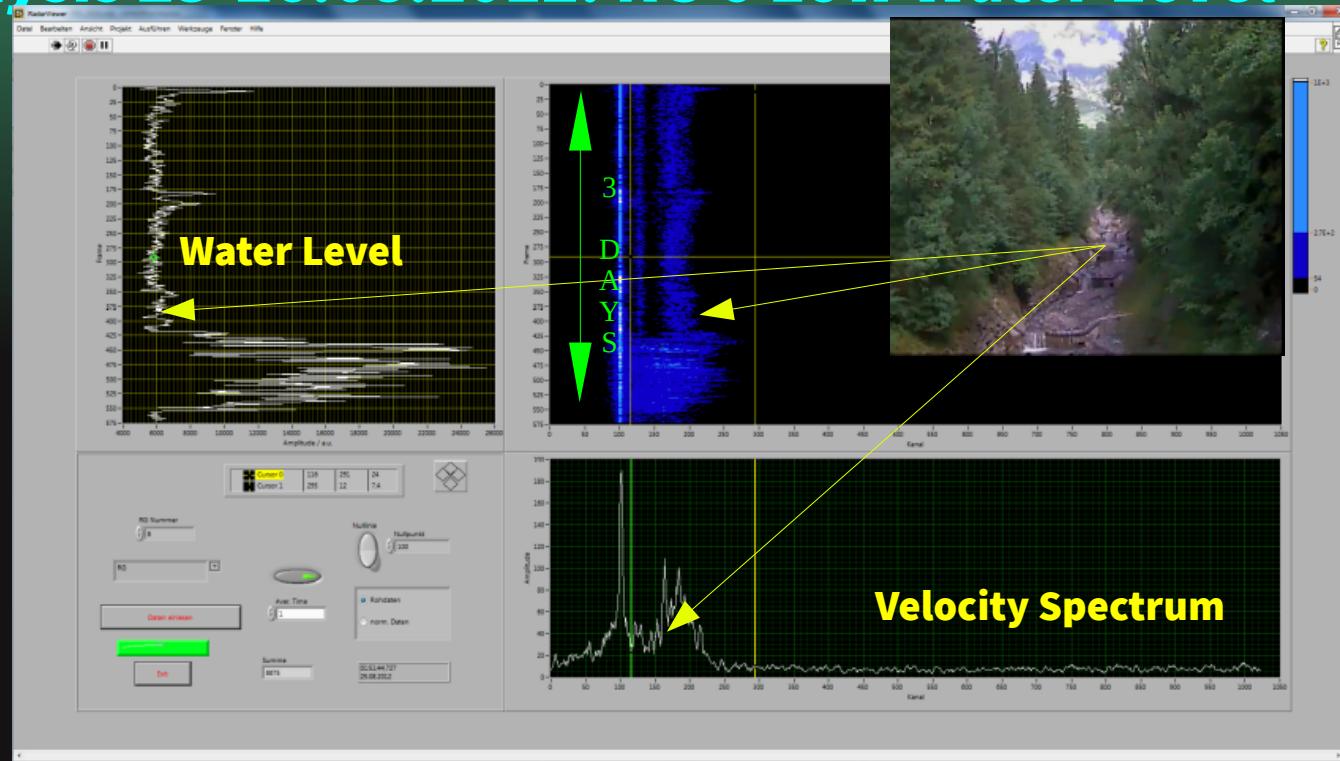
Debris Flow Lattenbach

Data Analysis 23-26.08.2012: Example Data Frame



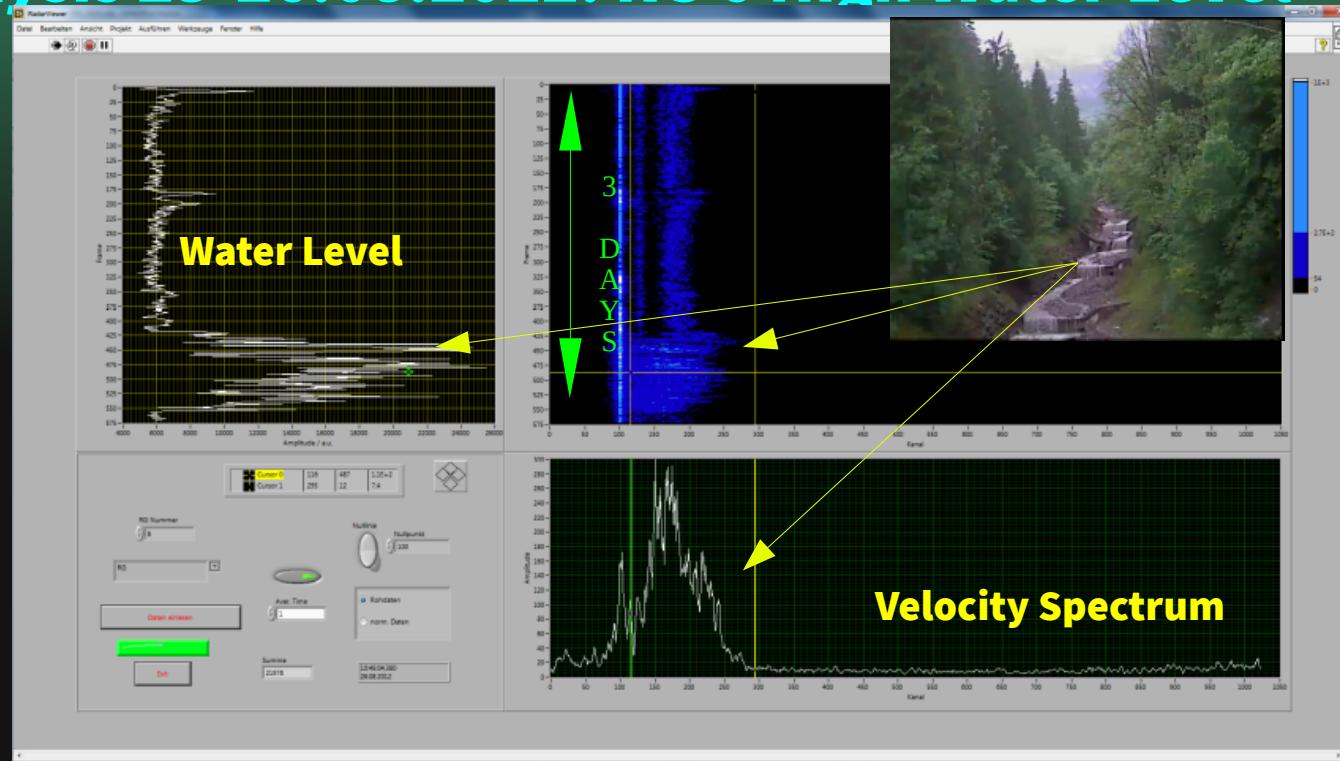
Debris Flow Lattenbach

Data Analysis 23-26.08.2012: RG 6 Low Water Level



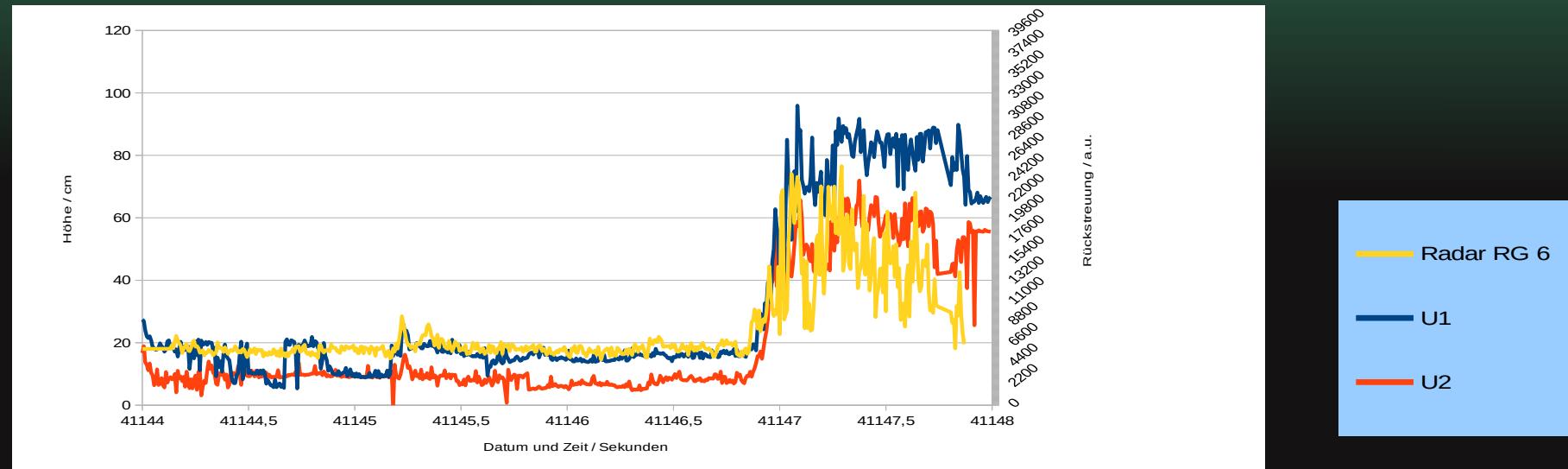
Debris Flow Lattenbach

Data Analysis 23-26.08.2012: RG 6 High Water Level



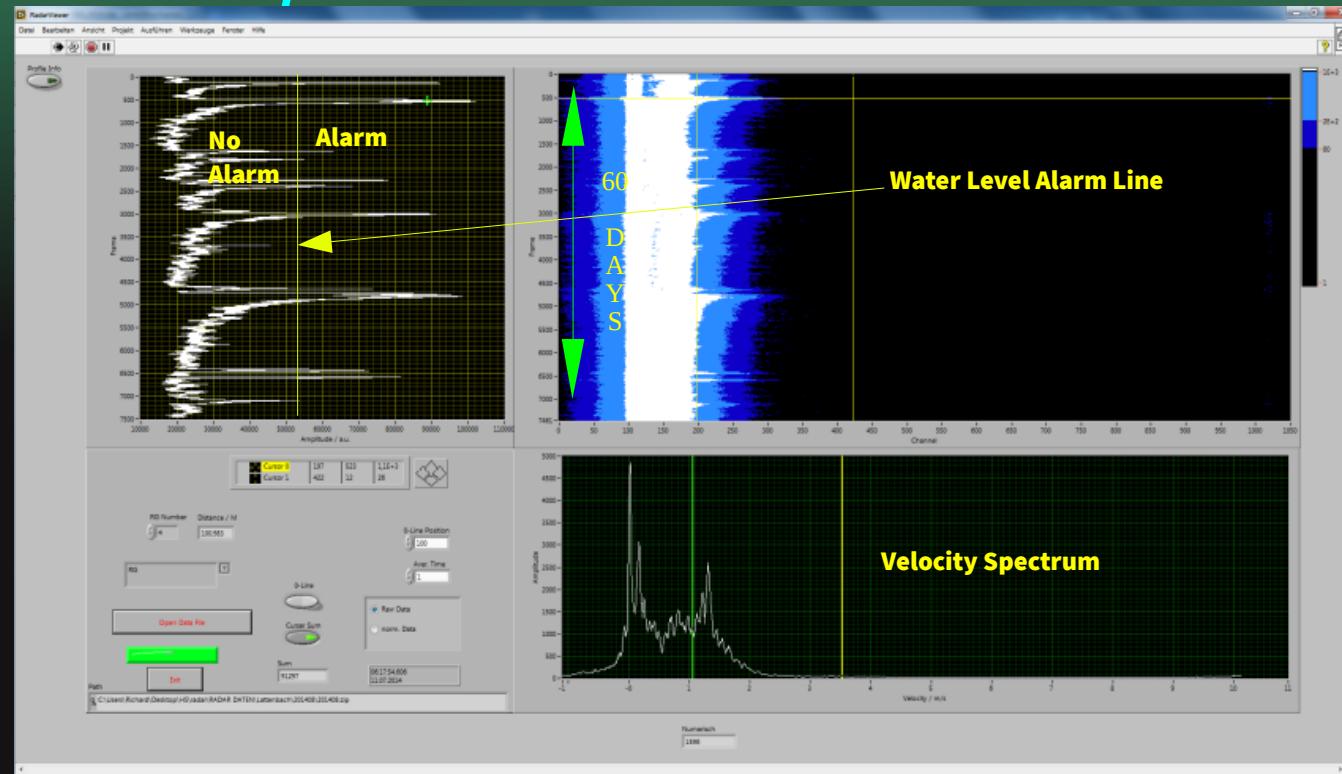
Debris Flow Lattenbach

Data Analysis 23-26.08.2012: Water Level Radar versus Ultrasound sensor U1;U2



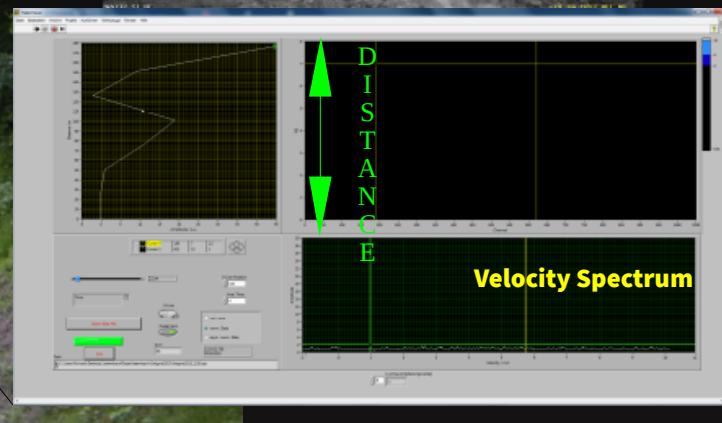
Debris Flow Lattenbach

Data: 2 months 07/08 2014



Debris Flow Lattenbach

Debris Flow Event from 09.08.2015 21:03



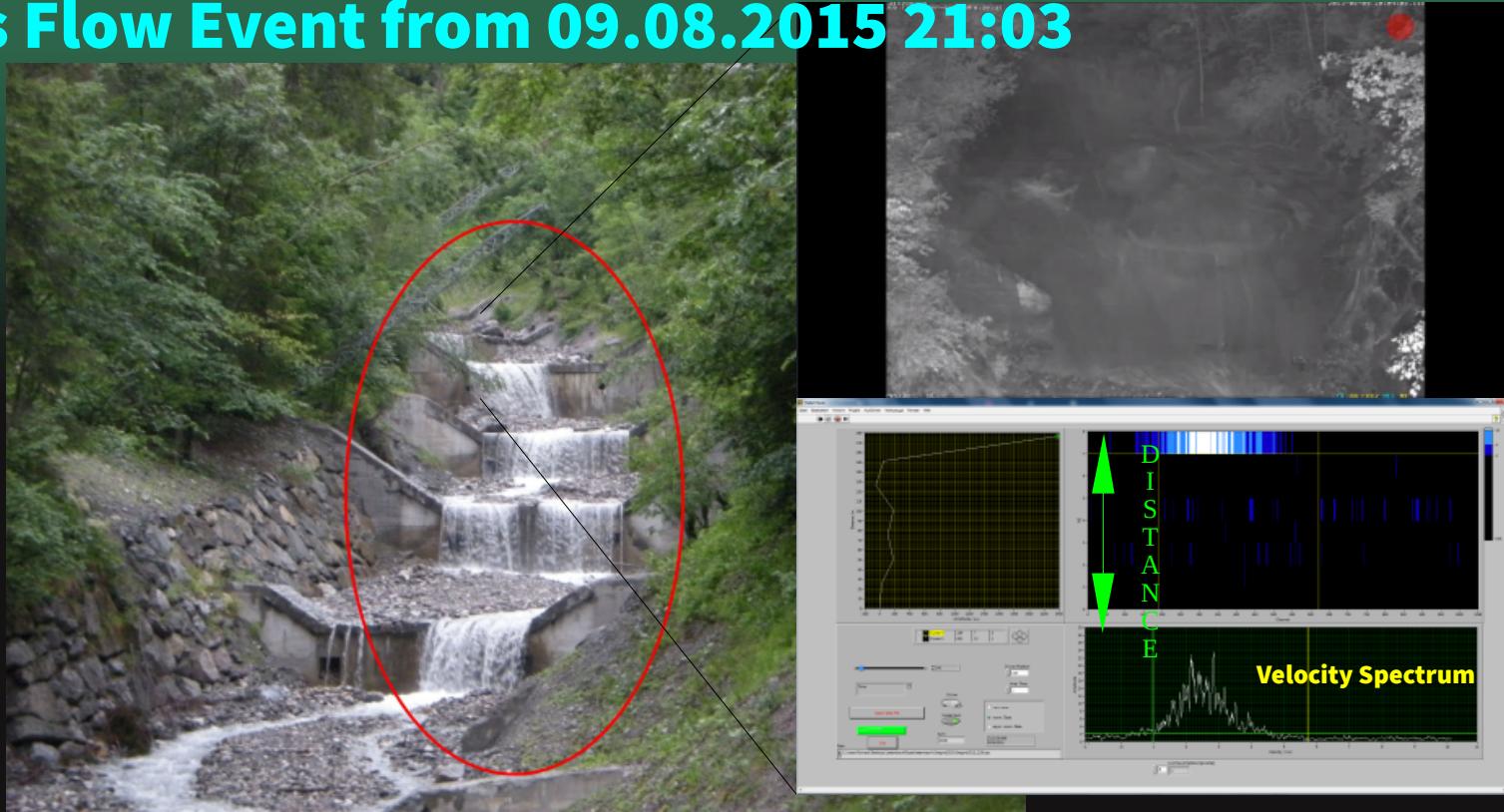
Debris Flow Lattenbach

Debris Flow Event from 09.08.2015 21:03



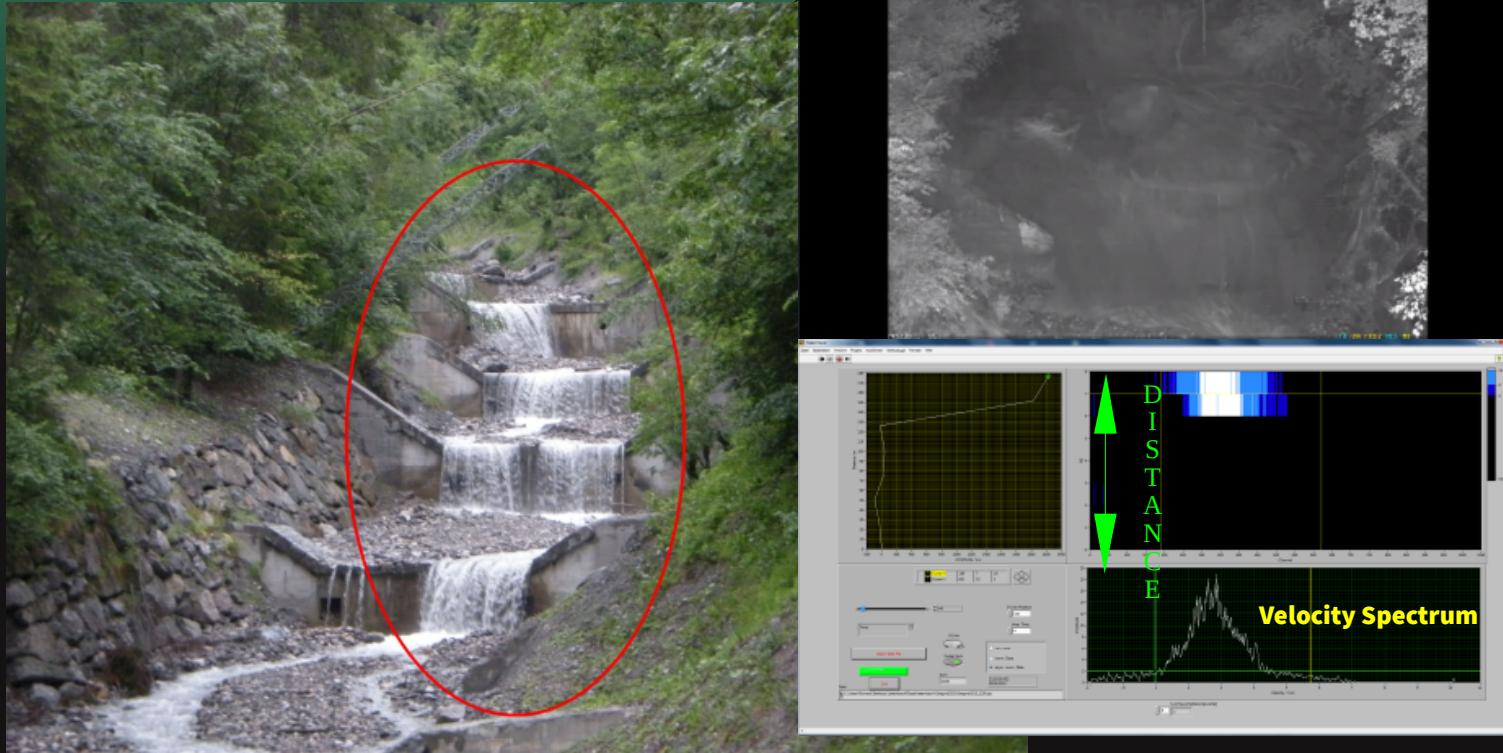
Debris Flow Lattenbach

Debris Flow Event from 09.08.2015 21:03



Debris Flow Lattenbach

Debris Flow Event from 09.08.2015 21:03



Debris Flow Lattenbach

Debris Flow Event from 09.08.2015 21:03



Debris Flow Umhausen

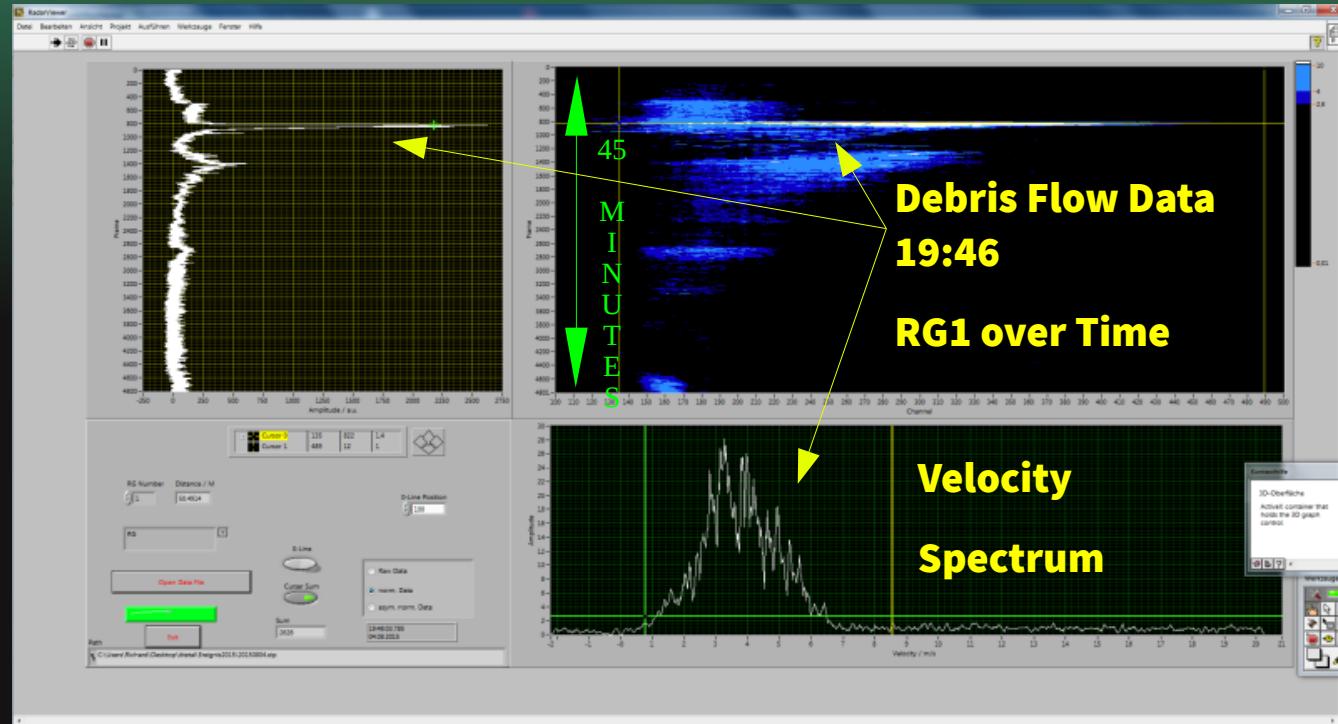
System Umhausen



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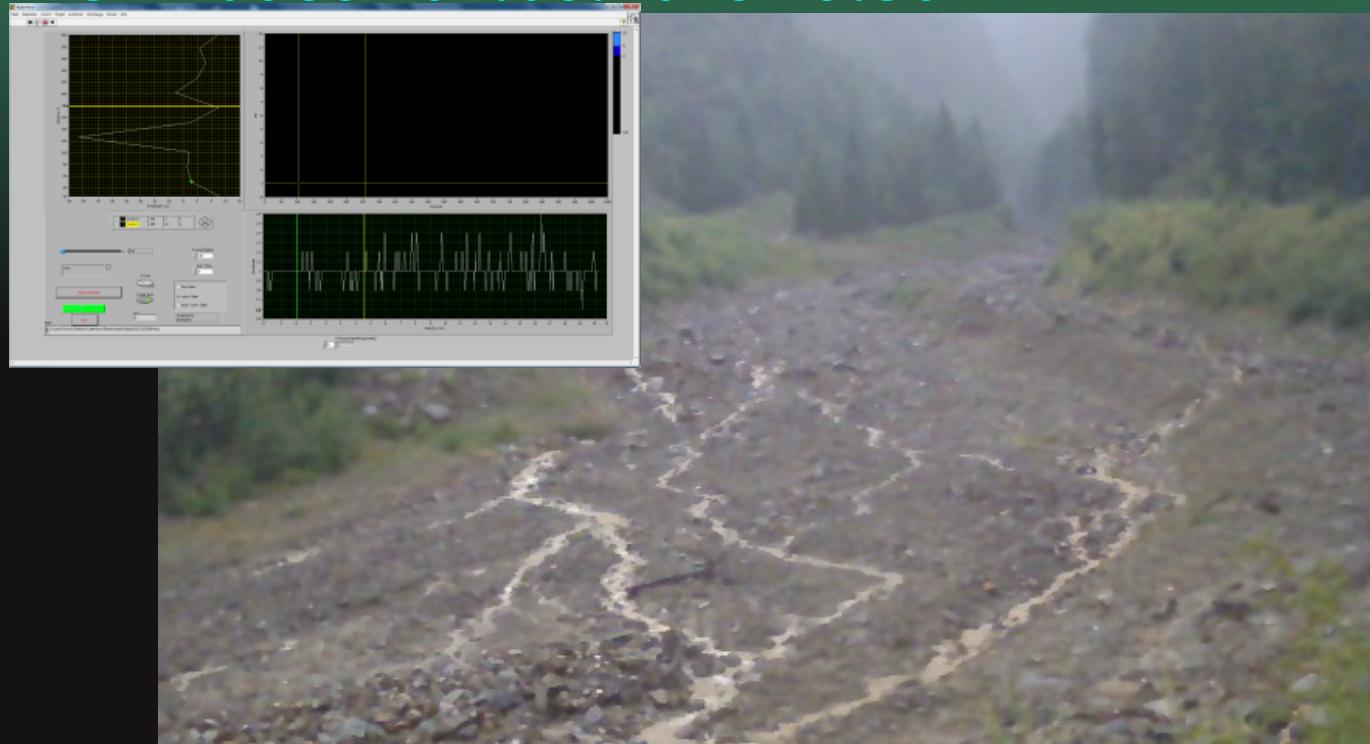
Debris Flow Umhausen

System Umhausen RG1 04.08.2015



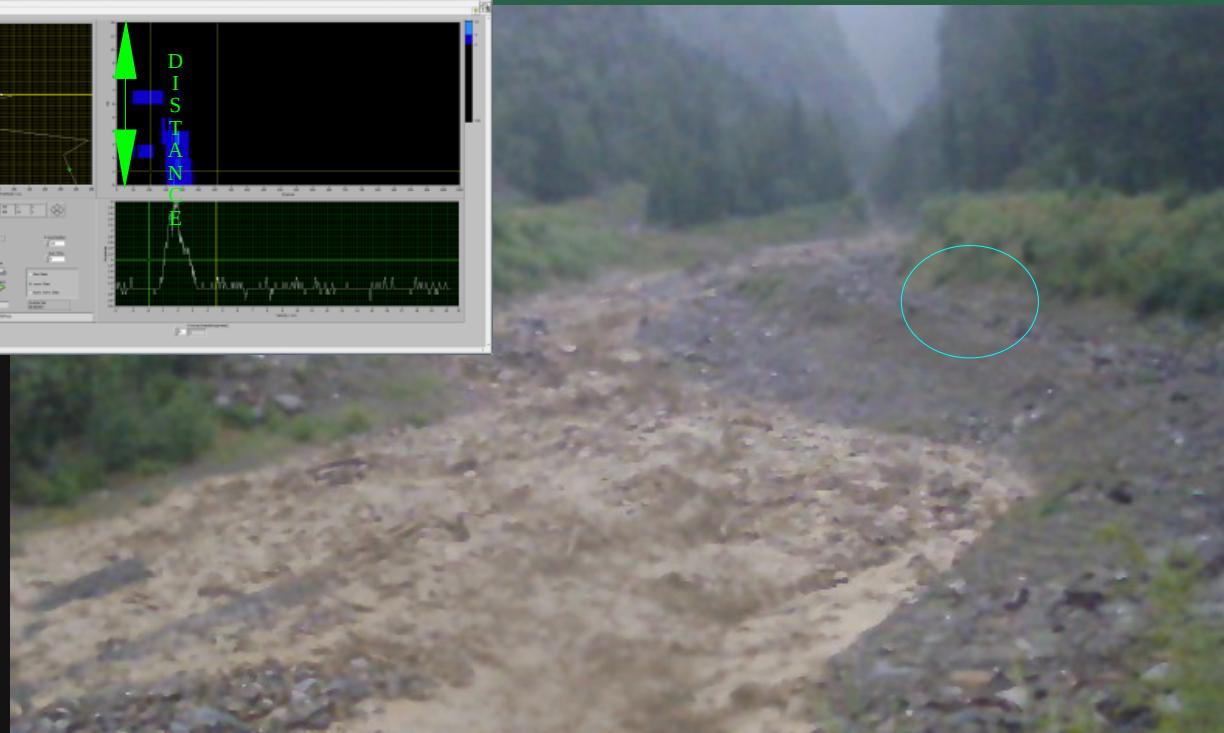
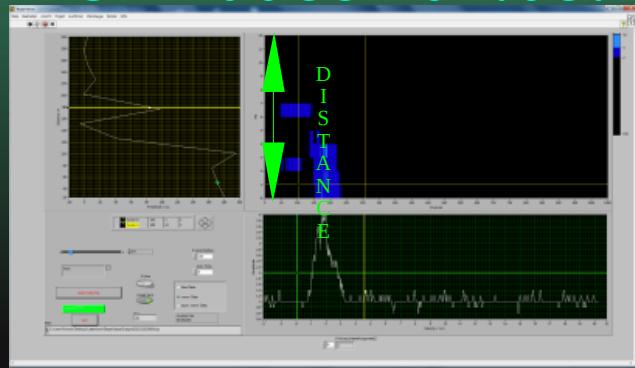
Debris Flow Umhausen

System Umhausen 04.08.2015 19:30



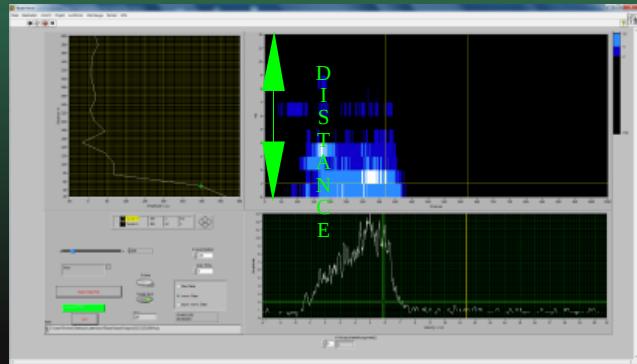
Debris Flow Umhausen

System Umhausen 04.08.2015 19:45



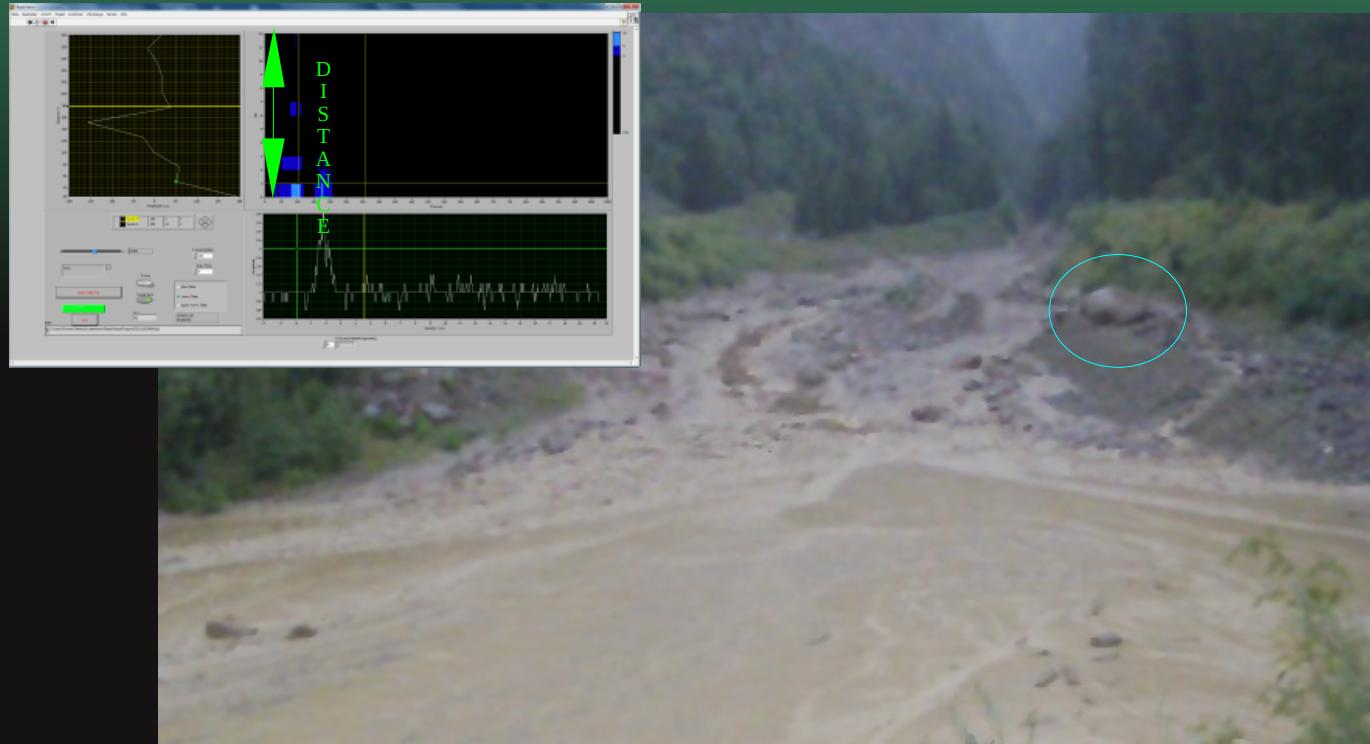
Debris Flow Umhausen

System Umhausen 04.08.2015 19:46



Debris Flow Umhausen

System Umhausen 04.08.2015 20:00



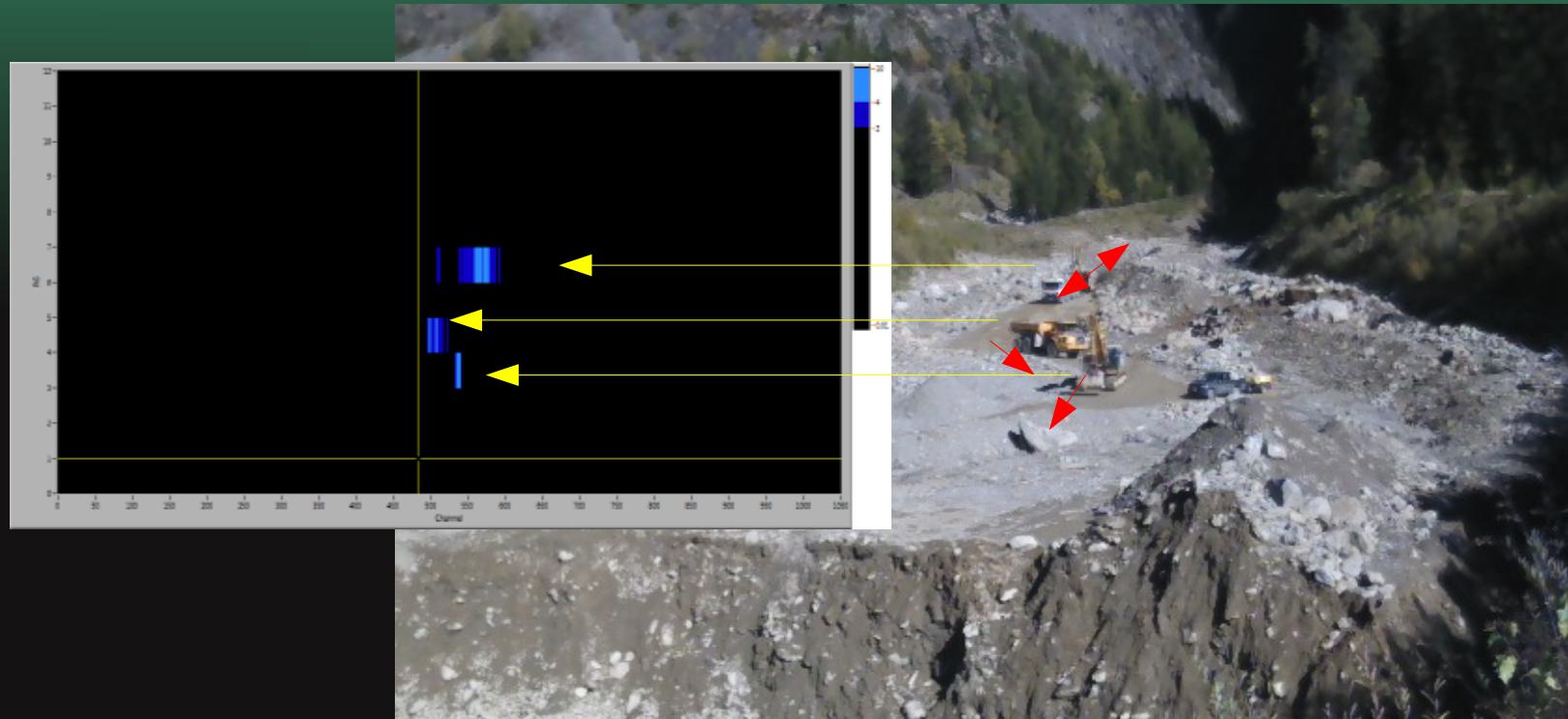
Debris Flow Umhausen

System Umhausen 04.08.2015 20:30

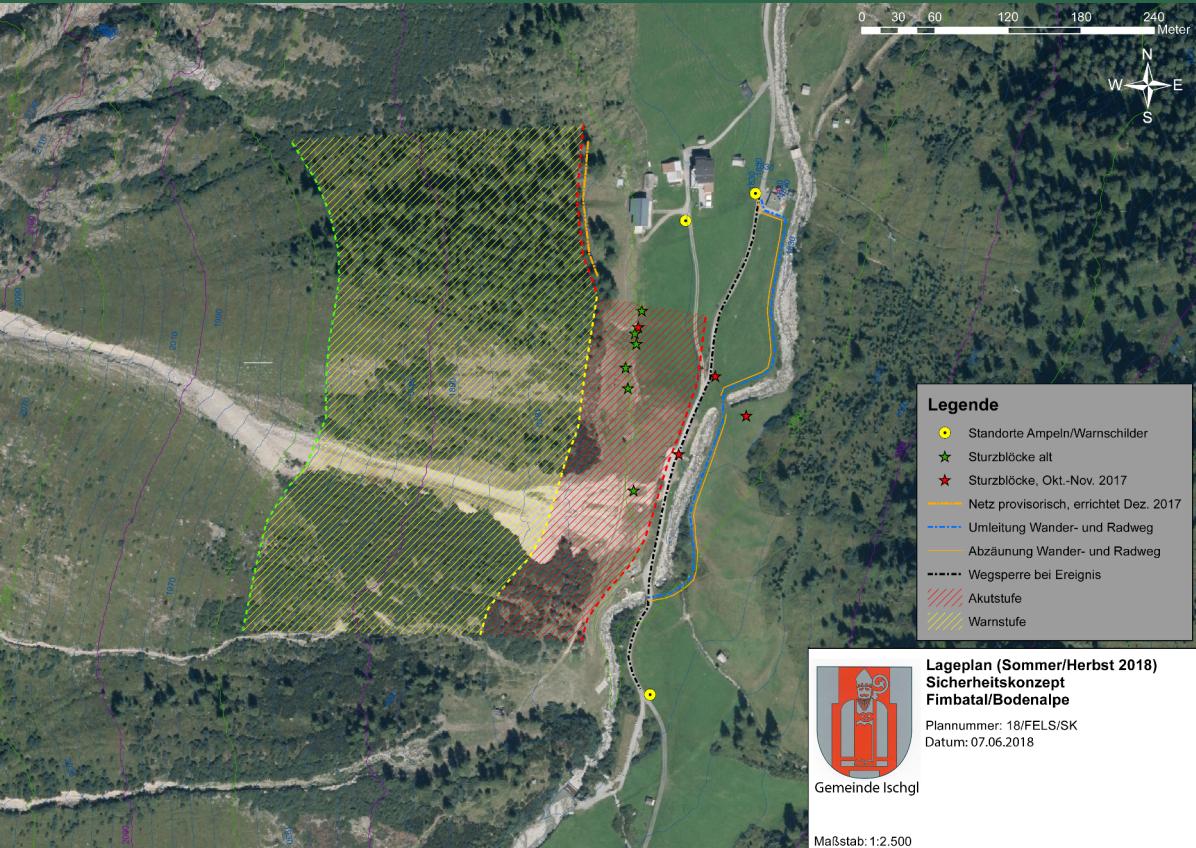


Debris Flow Umhausen

System Umhausen Moving Objects



Rockfall Radar Ischgl



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Rockfall Radar Ischgl



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Rockfall Radar Ischgl



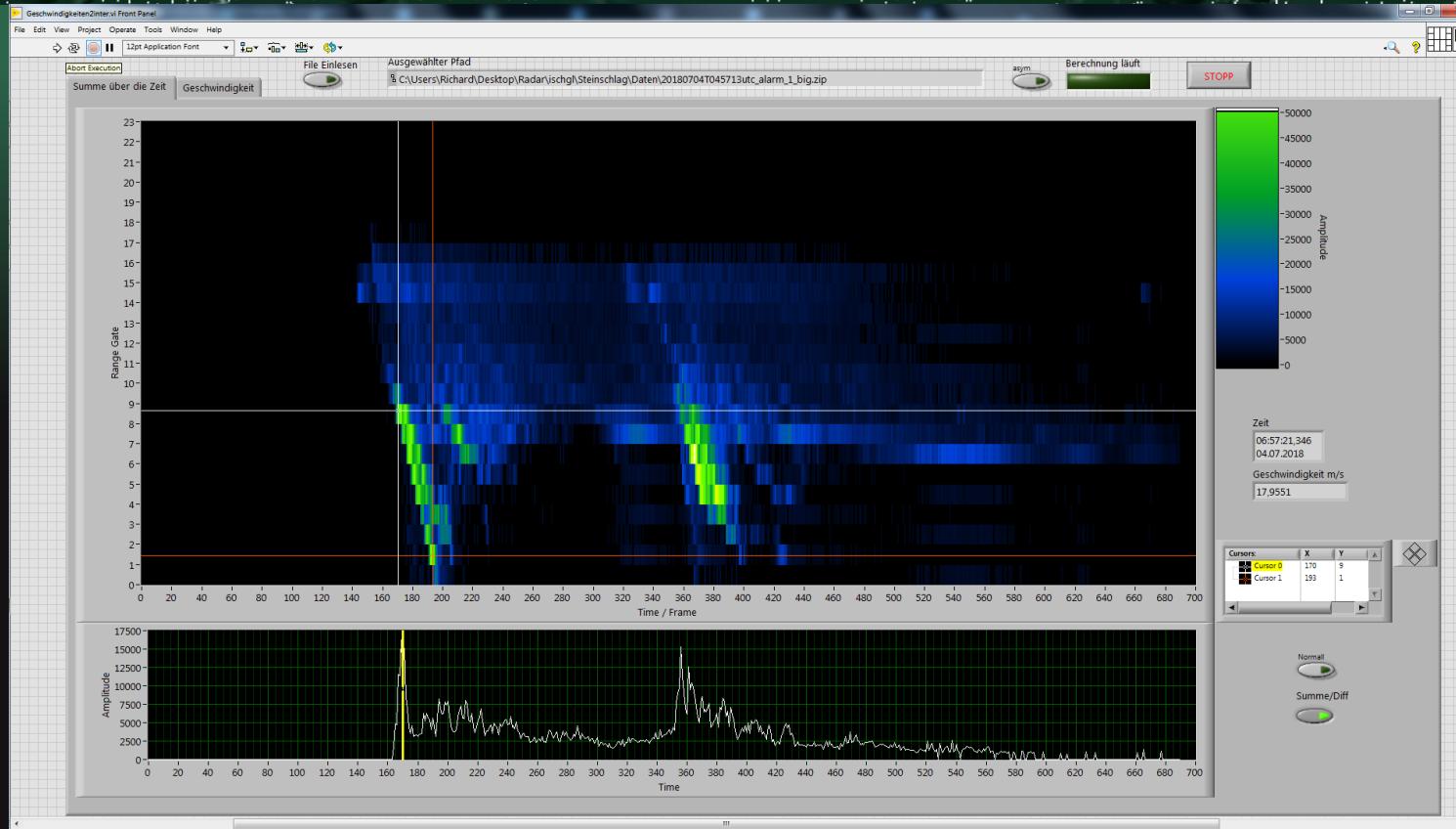
Schematic draw of the monitoring area.

The traffic lights are triggered by detecting stones entering the red region.

If stones run through this area, additional a horn is switched on.

Depending of the size of the event, the traffic lights are switched back to green or stay red.

Rockfall Radar Ischgl



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Avalanche Detection Radar

Avalanche Detection Rate for installed Radar Systems:

Hazard	Number of Installation	Alarm and Avalanche	False Alarm	No Alarm but Avalanche
Avalanche	15	>5000	22*	2**
Debris Flow	4	15	0	0
Rock Fall	3	>100	0	0

* Radar was irritated by an object in the cone. This events would not occur anymore as an alarm

** Radar detected the avalanche, but the phone connection was broken

Technology and Benefits of the System I

- Reliable recognition of avalanches, mudslides, debris flow and water level changes
 - Minimization of false alerts
- Low transmitted power
 - Energy and environment friendly
- Possibility of mobile operations
- Low installation requirements
 - Only a mast and a power supply of 40 W

Technology and Benefits of the System II

- Recognition of risk in real time (within a second)
 - **maximum warning**
- Multifunctional alert system
 - **trigger to local signal systems**
 - **real time information to central warning institutions via SMS, Email, LiveViewer...**
 - **fast, save and regardless from weather conditions**

Conclusion

- We are able to detect reliable even smallest debris flows and avalanches
- We are able to detect very accurate water levels
- We are able to trigger an alarming system within a second
- We are also able to detect heavy rainfalls up in the sky

New Developments

- Rain Radar
- Remote Motor Antenna
- Multi Feed Antenna

Thank You

Thank You

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