



NVE

VANNFØRINGSMÅLING MED MOBILTELEFON

LSPIV

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(Large Scale) Particle Image Velocimetry – LSPIV

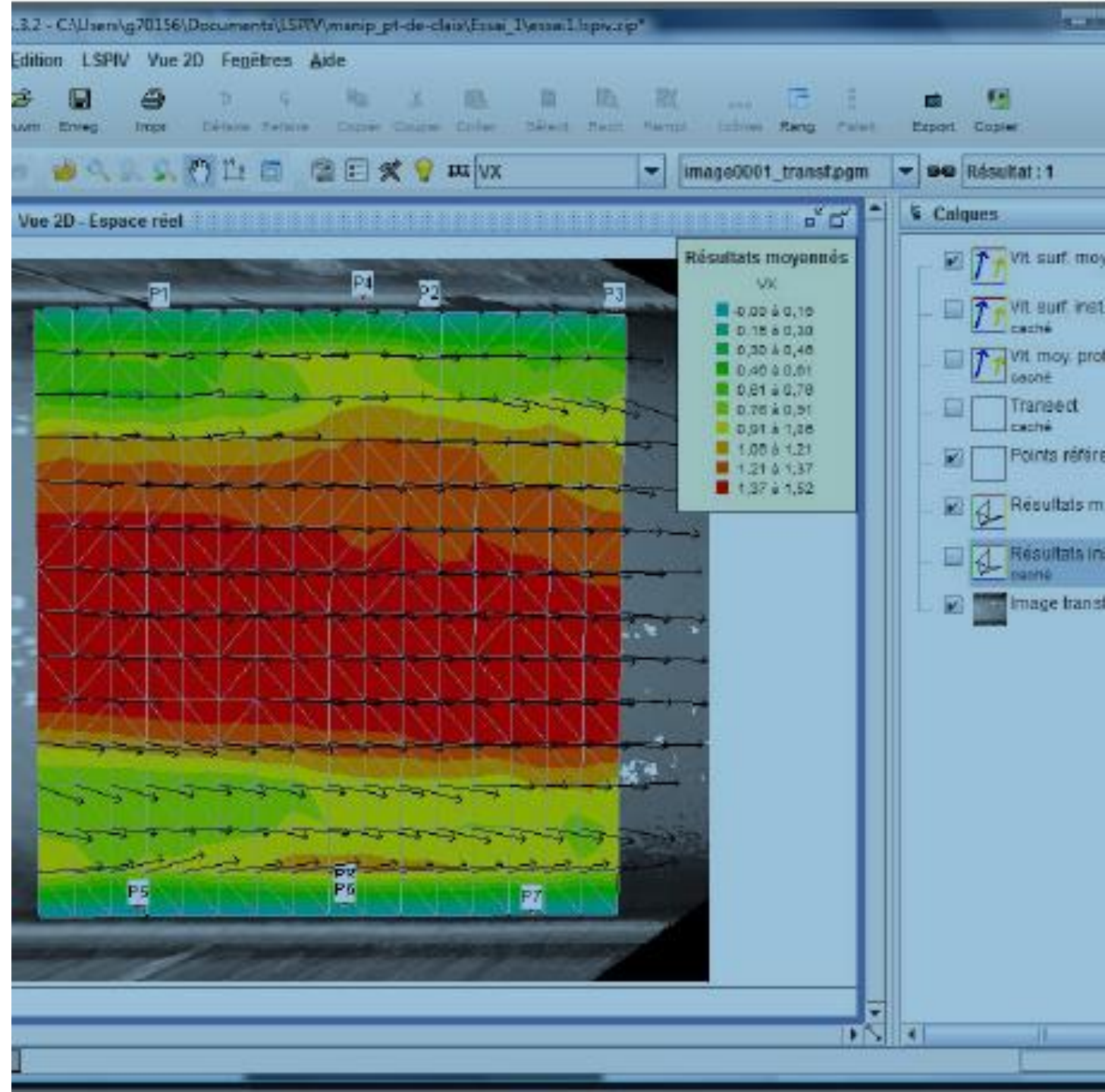
- Vannføringsmåling fra video / bilder
- PIV = veletablert metode i laboratorier og forskning
- Large Scale = videreført til elver





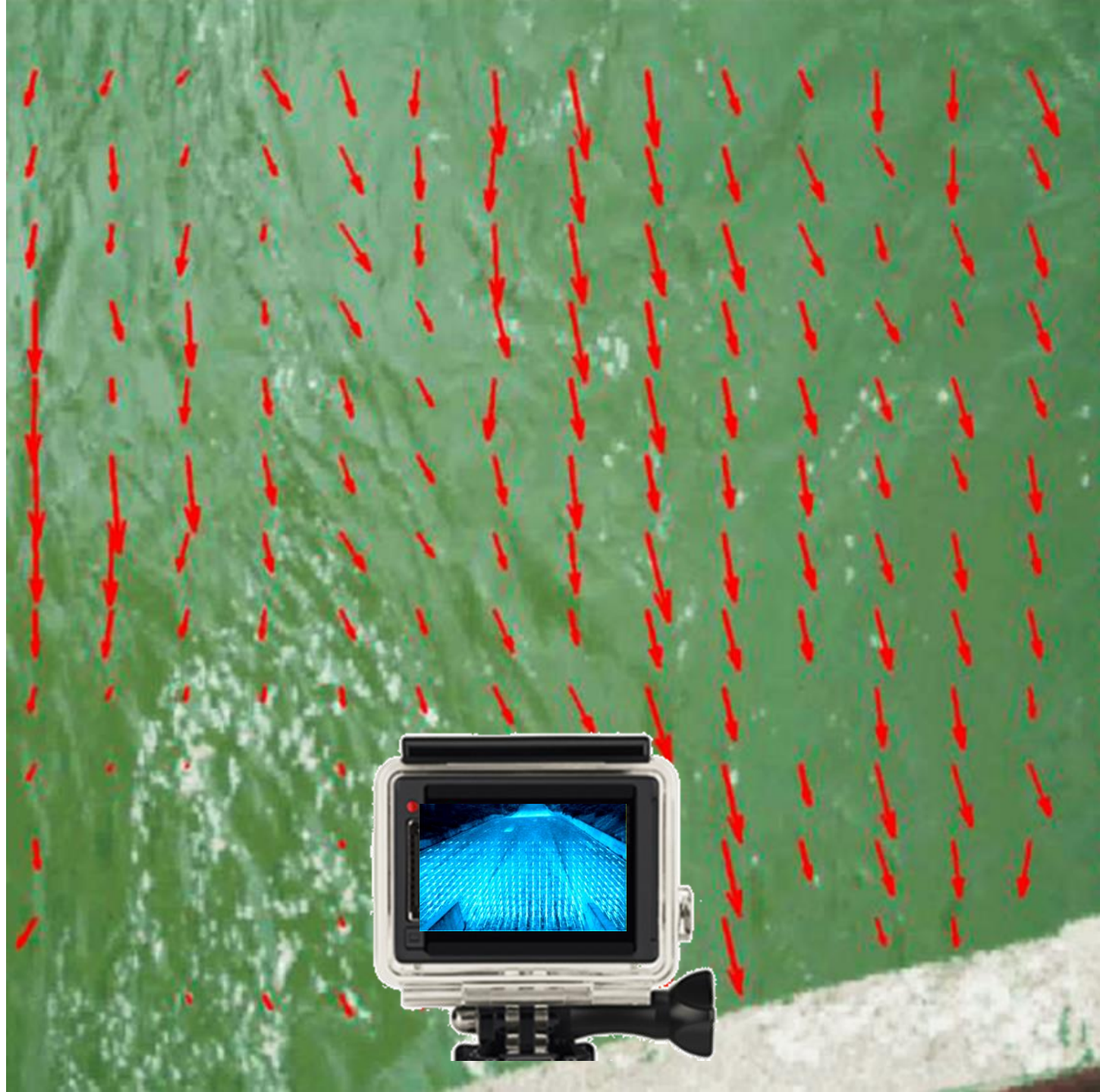
(Large Scale) Particle Image Velocimetry – LSPIV

- Hydrometribasert analyse av bildesekvenser
- 2D hastighetsområde
- Sporningsindikatorer (org.materiale,bobler, turbulens)
- Synlig bevegelse



LSPIV utstyr

- Kamera (infrarød)
- Overføring av data, telemetri
- Software
 - Fudaa-LSPIV free software
<https://forge.irstea.fr/projects/fudaa-lspiv>
 - LSPIV RIVeR USGS free software
<http://riverdischarge.blogspot.no/p/download.html>





Hvilket kamera trenger jeg?

- Stort sett alle dagens kameraer!
- Unngå linser som forvrenger bildet
- Oppløsning minst $680 * 480$ piksler



Utplassering utstyr

- Bru
- Stang/mast
- Drone
- Helikopter
- Menneske



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Innsamling av data

- Kamera eller filmkamera
- Ønsket område
- Kontrollpunkter med X,Y og Z koordianter



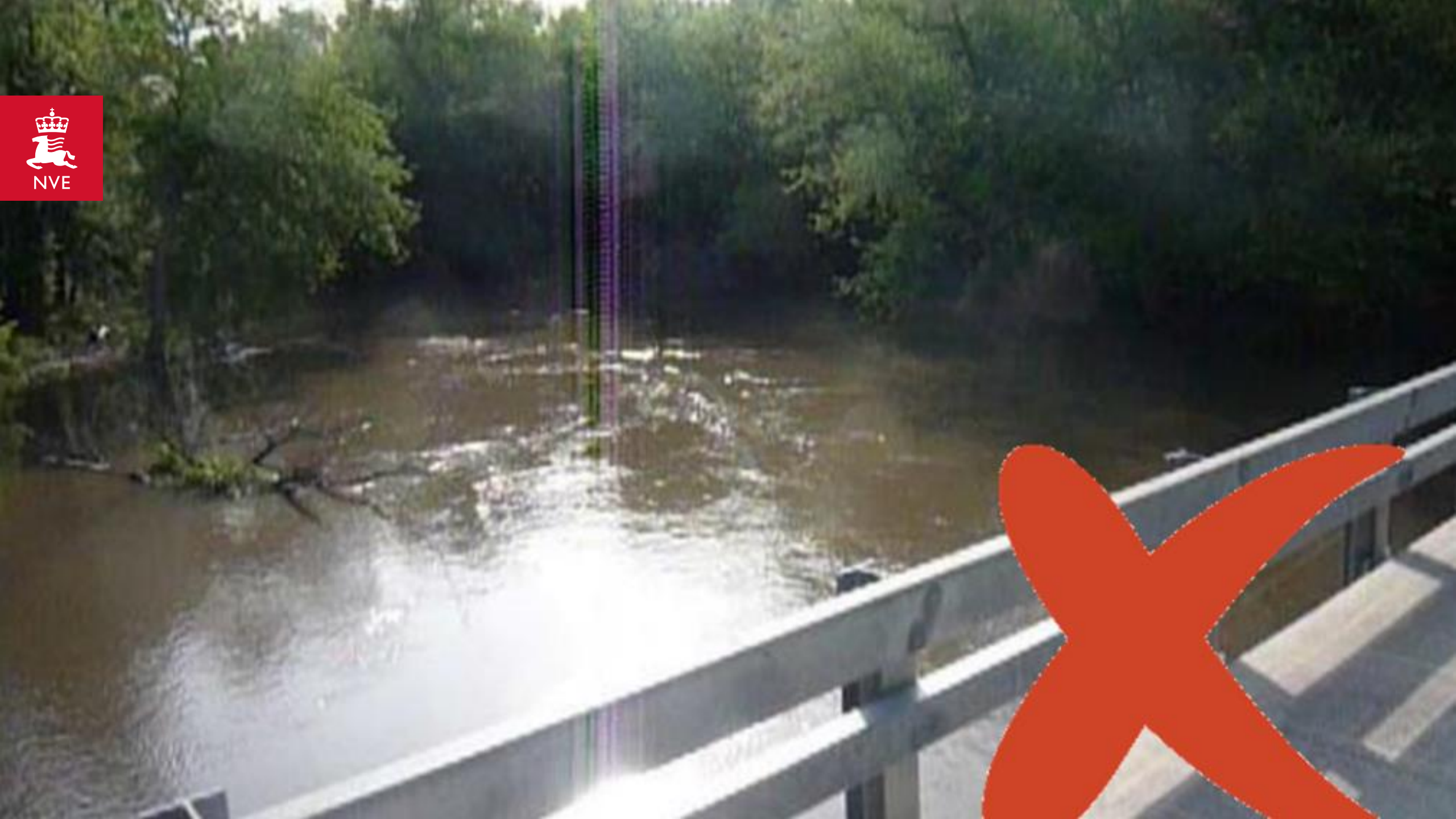
Hvordan gjøre opptak?

- Hele bredden, bredde synlig begge sider
- Alle kameraer, unngå linser som påvirker naturlig bilde
- Stabil filming
- 5 sek nok, helst 1 min
- Dato/tid samt presis lokasjon
- Høyest mulig, heller bru enn bredden



Hvordan gjøre opptak?

- Stabile/permanente referansepunkter
- Strømningsforhold mest mulig jevne
- Helst stabile bunnforhold
- Unngå:
 - Refleksjoner, skygger, urolige mønstre overflate
 - Vegetasjon
 - Mennesker og dyr





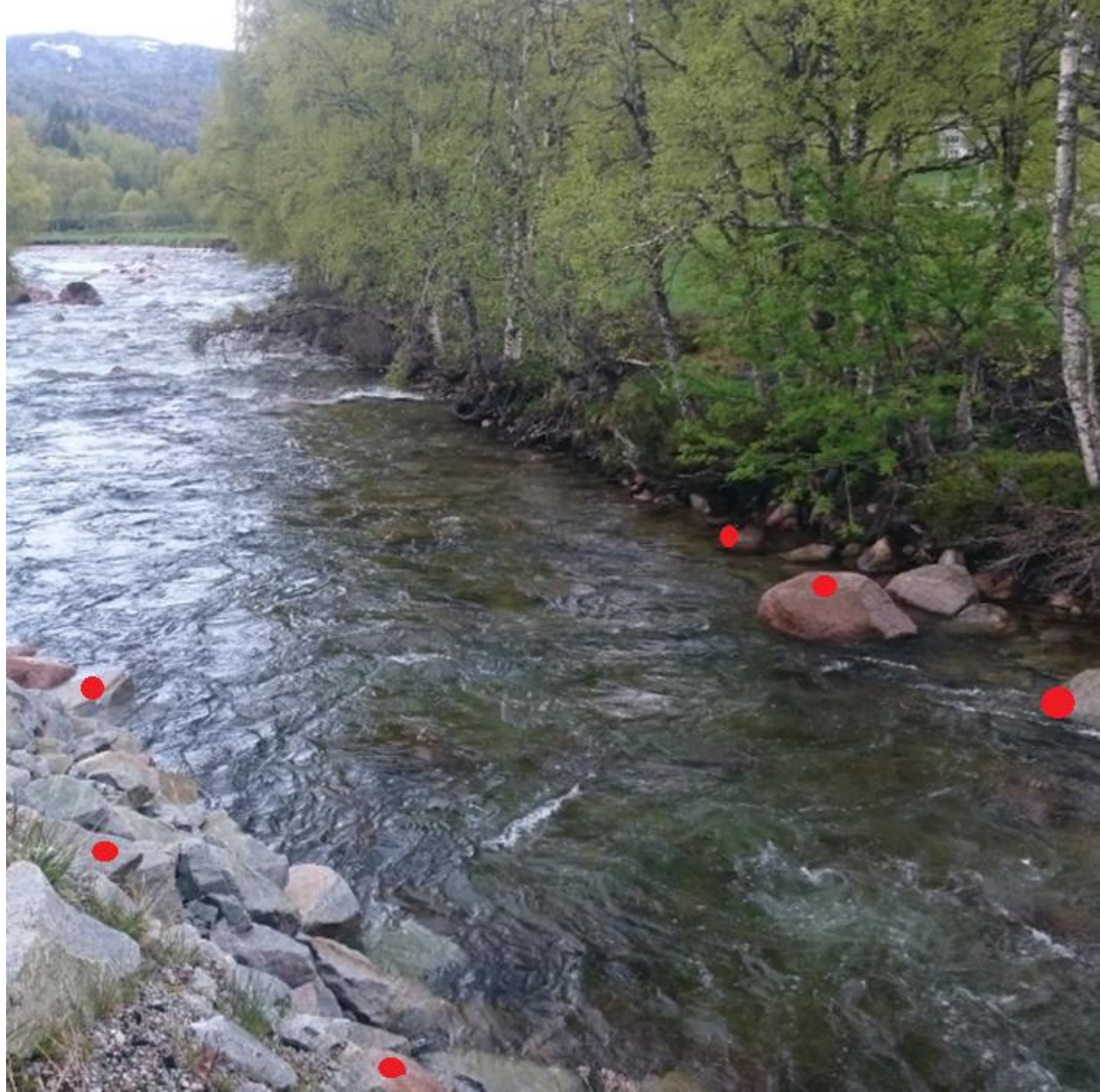
CP₁

CP₄



Kontrollpunkter, CP

- Minimum 6 (4)
 - x,y,z koordinater
- DGPS eller totalstasjon
- Geometrisk korrigering
 - «True earth dimensions»





Kontrollpunkter, CP

— Unngå CP som;

- Kan bevege seg
- Drukne
- Mangler kontrast
- Lite synlige
- Kan overskygges



CP₂

CP₁

CP₃

CP₄







LSPIV vannføring

— $\text{Vannføring} = \text{overflatehastighet} * \text{reduksjonsfaktor} * \mathbf{dyp}$



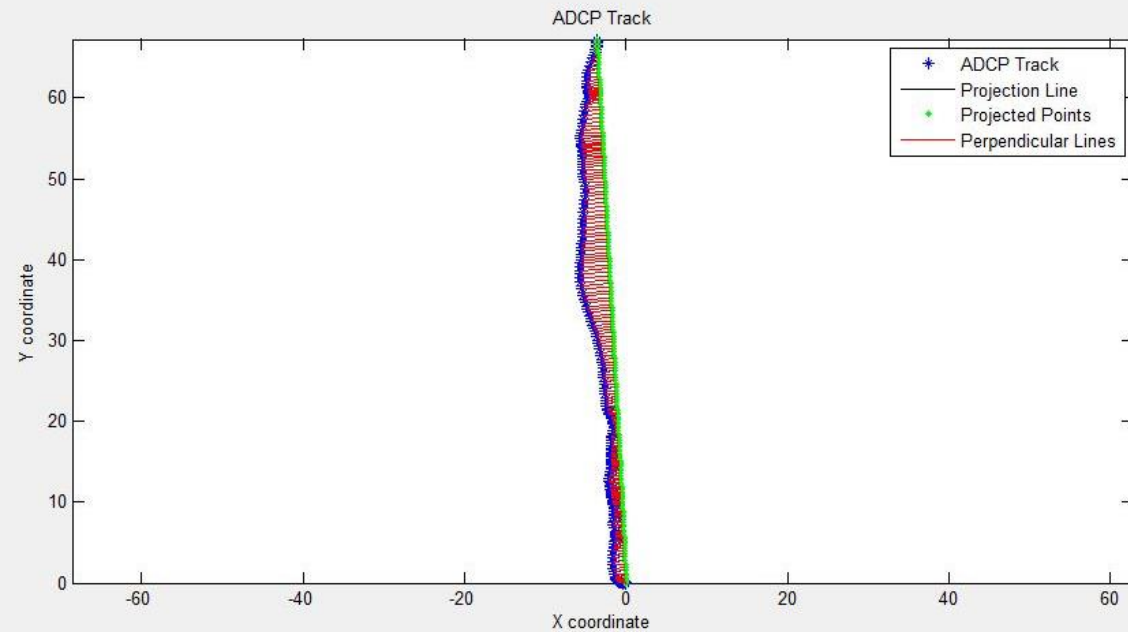
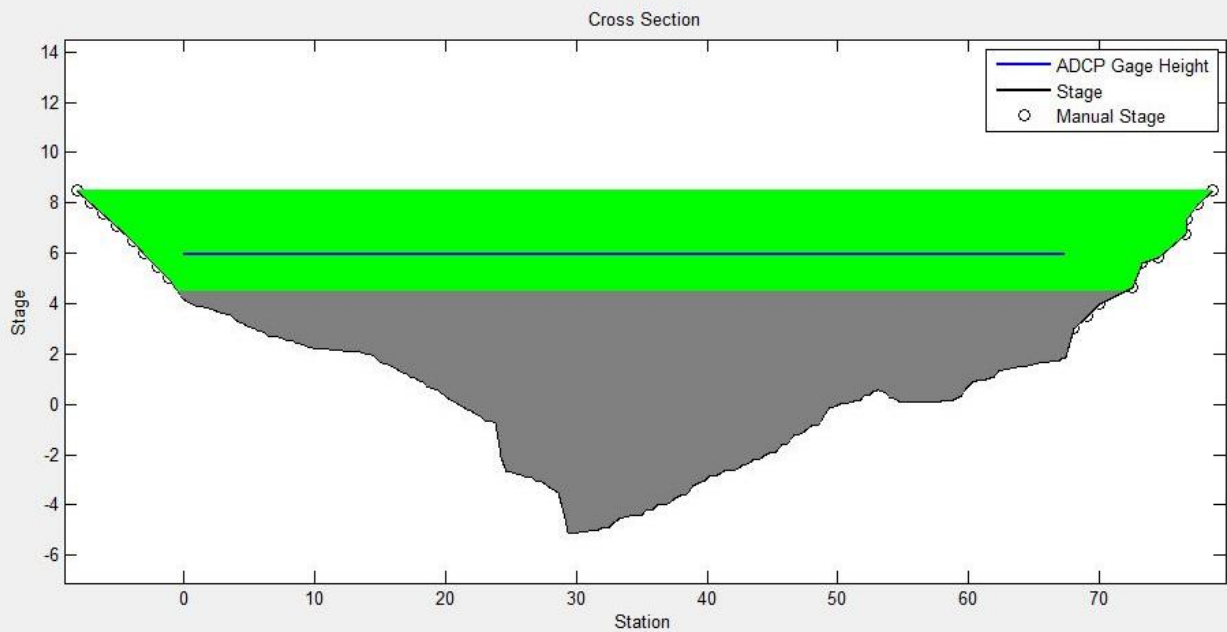
Date:

Station Number:

User Name:

Comments:

Profillet målt opp i kabelbane den 27.10.2014. Punktene på land målt opp den 22.04.2015.



ADCP

File:

Gage Height:

Starting Station:

Station and Stage Table

	Station	Stage
1	-8.1500	8.5000
2	-7.1500	8
3	-6.1400	7.5750
4	-5.0900	7.0700
5	-3.8600	6.4970
6	-3	6.0120
7	-2.0200	5.4670
8	-1.1200	5.0350
9	0	4.1811
10	0.0214	4.1645
11	0.0373	4.1507
12	0.0442	4.1698
13	0.0455	4.1933
14	0.0548	4.1507
15	0.0648	4.1366
16	0.0716	4.1366
17	0.0947	4.1380
18	0.0974	4.1507

Buttons: Add, Delete

Stage Area Relationship

Max Stage:

Min Stage:

Increment:

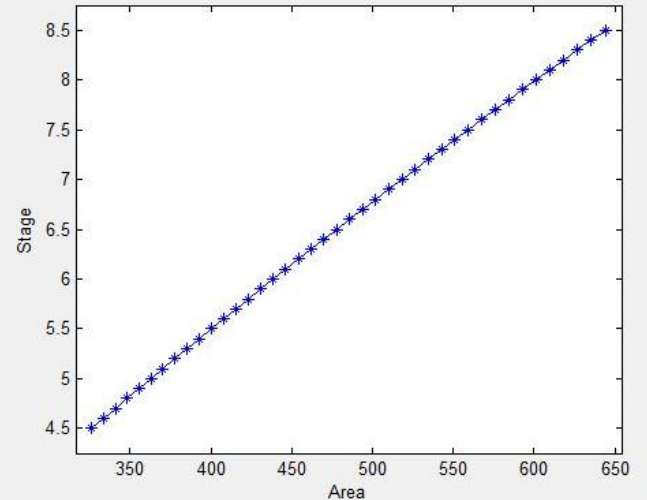
Buttons: Set Default Values, Compute

CSV

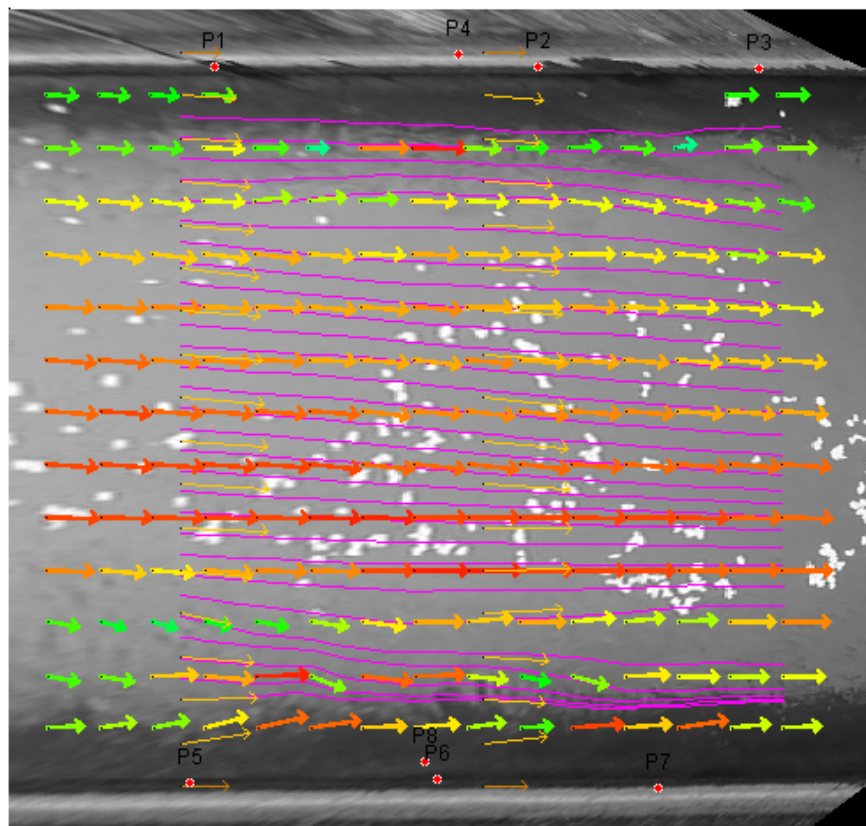
File:

Gage Height:

Starting Station:



2D view - Real space



Vit. moy. prof.	Vit. surf. moy.	Particules (res. moy.) NORME
<p>1.0 m/s</p> <p>Interpolated</p> <p>Extrapolated</p>	<p>3.0 m/s</p> <ul style="list-style-type: none"> 0.00 à 0.05 0.05 à 0.10 0.10 à 0.15 0.15 à 0.20 0.20 à 0.25 0.25 à 0.30 0.30 à 0.35 0.35 à 0.40 0.40 à 0.46 0.46 à 0.51 0.51 à 0.56 0.56 à 0.61 0.61 à 0.66 0.66 à 0.71 0.71 à 0.76 0.76 à 0.81 0.81 à 0.86 0.86 à 0.91 0.91 à 0.96 0.96 à 1.01 1.01 à 1.06 1.06 à 1.11 1.11 à 1.16 1.16 à 1.21 1.21 à 1.26 1.26 à 1.32 1.32 à 1.37 1.37 à 1.42 1.42 à 1.47 1.47 à 1.52 	<ul style="list-style-type: none"> 0.00 à 0.05 0.05 à 0.10 0.10 à 0.15 0.15 à 0.20 0.20 à 0.25 0.25 à 0.30 0.30 à 0.35 0.35 à 0.40 0.40 à 0.46 0.46 à 0.51 0.51 à 0.56 0.56 à 0.61 0.61 à 0.66 0.66 à 0.71 0.71 à 0.76 0.76 à 0.81 0.81 à 0.86 0.86 à 0.91 0.91 à 0.96 0.96 à 1.01 1.01 à 1.06 1.06 à 1.11 1.11 à 1.16 1.16 à 1.21 1.21 à 1.26 1.26 à 1.32 1.32 à 1.37 1.37 à 1.42 1.42 à 1.47 1.47 à 1.52

Layers

- Points référence
- Discharge
- Transects hidden
- Vit. moy. prof.
- Average surf. vel.
- Filtered inst. sur
- Raw inst. surf. v
- Image transform

2D view - Real space

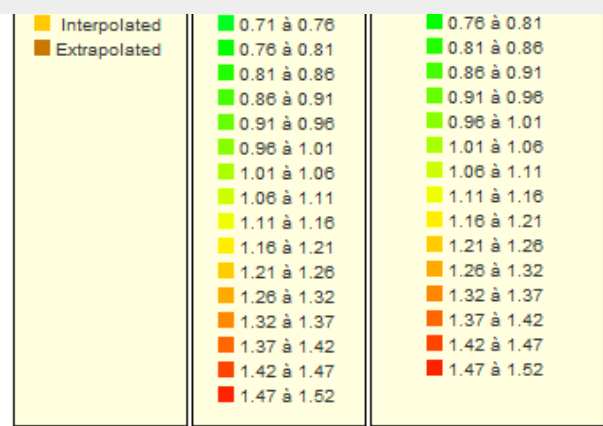


Calculation results

Transects list

#	Total Q (m³/s)	Gap (%)	Wetted area (m²)	Gap (%)	Ave. vel. (m/s)	Gap (%)	Measured Q (m³/s)	Measured Q / Total Q (%)
1	-14.016	+1.3	13.125	+0.0	-1.068	+1.3	-13.978	99.7
2	-13.653	-1.3	13.125	+0.0	-1.040	-1.3	-13.615	99.7
Average	-13.834	-0.0	13.125	+0.0	-1.054	-0.0	-13.797	99.7

Validate





Praktiske fordeler LSPIV

- Koster lite, «alle» har et kamera
- Sikkerhet
- Enkel datainnsamling
- Kan bruke «crowd-sourced» data
- Flommer som har vært!



Fordeler vannføring/hydrologi LSPIV

- Kan integrere fullstendig bredde av elva
- Høy tidsmessig oppløsning
- Bildesekvenser kan brukes til andre formål
 - Erosjon og sedimenttransport



Praktiske ulemper LSPIV

- Sårbar mot dårlig lys
- Infrarød om natt
- Store datamengder



Ulemper vannføring LSPIV

- Måler kun overflatehastighet
- Avhengig av sporingsindikatorer
- Vind kan påvirke
- Usikkerhet

Hvem leder an?

- Japan (Fujita m.fl)
- Frankrike (Le Coz m.fl)
- Argentina
- USA (Engel m.fl)

Mange andre land undersøger





Hvor kan man finne info om dette?

— Google Fudaa-LSPIV

- (<https://forge.irstea.fr/projects/fudaa-lspiv/files>)

Fichiers

FICHER ▲	DATE	TAILLE	D/L	MD5
documentation_Fudaa-LSPIV_FR-EN.zip	15/04/2015 10:28	5,132 Mo	897	57b3d1b22cebb6e41e1d322420deb998
exe_fudaa_w7_32.zip	01/02/2018 18:24	8,005 Mo	14	2a2c70e0702c8e0b396c90870e20f618
exe_fudaa_w7_64.zip	01/02/2018 18:24	8,671 Mo	43	34cc1717317496ee72b98353056f6ac4
Fudaa-LSPIV-1.5.1.zip	18/04/2017 16:56	98,579 Mo	269	2eaa573e78911231c2e2aac44457dc19
Fudaa-LSPIV-1.5.2.zip	09/10/2017 15:40	93,35 Mo	159	a3a097e68aa84e3c85984f76766a7d54
Fudaa-LSPIV-1.6.1.zip	12/01/2018 15:03	93,169 Mo	43	34d75631ef61cd44511906c7c325cb39
Fudaa-LSPIV-1.6.2.zip	01/02/2018 16:10	93,2 Mo	116	8fed7ed69ebecd22c5dfd306cfd84fe6
fudaa-lspiv-lastversion.txt	25/01/2018 09:19	5 octets	62	861d527b8d01e8fe1552e0cc56e05073
PtClaix_test_data.zip	22/05/2017 09:25	169,449 Mo	207	2b718492862a63cdf9cb00c3a3fee2f1
randens2011_12H25_fudaa.lspiv.zip	20/12/2017 14:35	24,836 Mo	38	cc7c7e5e455c2dc91f6965df047c3469
randens_test_data.zip	20/05/2017 14:37	11,537 Mo	138	5bb81e65d07c283fc132146120cf25f5



Hvor kan man finne info om dette?

- USGS → <https://www.usgs.gov/>
 - Programmet heter RIVeR

How to process a video with RIVER Software

Opprettet av Bohman, Larry R., sist endret av Engel, Frank på des 18, 2017

HOW TO PROCESS A VIDEO USING THE RIVER 2.2 LSPIV SOFTWARE

See also: <http://riverdischarge.blogspot.com/p/tutorial.html>

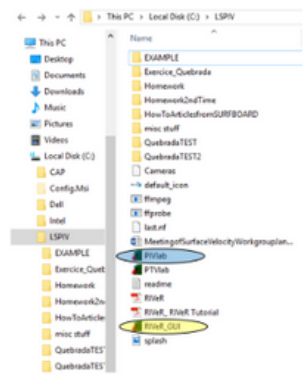
Setup

Since RIVER is a compiled freeware made in the Matlab environment you should:

1. Download and install the Matlab Runtime version #R2015a (64-bit)
2. Download the latest version of [RIVER](#)



3. RIVER uses results from image velocimetry software like [PIVlab](#) and [PTVlab](#). For this example, we will only use PIVLab. Both programs are open-source software available on the Matworks file exchange platform as source code. You must have a Matlab license in order to use them otherwise you can always contact me for a compiled version.
 - File location/structure: Because the software doesn't like long pathnames or spaces, I put my files on my C-drive as follows. Note the programs are in the upper level file with folders containing individual videos, referenced point lengths, and cross-section information. Navigate to: C:\LSPIV (Location of files on L. Bohman Computer)



- Decide on a 10-sec cut of a longer video (an entire video should be 30-60 seconds)
- Open River 2.2 (RIVER_GUI) (circled in yellow above). This may take a while....
- **File ► Extract Images From File** (note that filenames CANNOT have imbedded spaces)
- Click on the target video file, then **OPEN**.



Hvor langt har NVE kommet?



Apper på mobil

- Discharge (ch)
- <https://www.youtube.com/watch?v=KGe5kLDzbUY>
- CrowdWater (SNF-funded project at the University of Zurich)
- https://www.youtube.com/watch?v=hDq5_UFX8HY



