WORKSHOP
"MASTERING YOUR COMMUNICATION"

Faculty of Applied Sciences

2016-2017

Université de Liège

Motivation for the workshop

Two ingredients of scientific work

Content the research itself and its results

Form written and oral communication

Focus

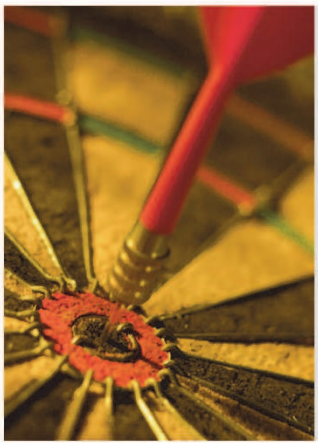
equally important!

Many **opportunities** to practice

but

recurrent problems and bad habits

Objectives of the workshop



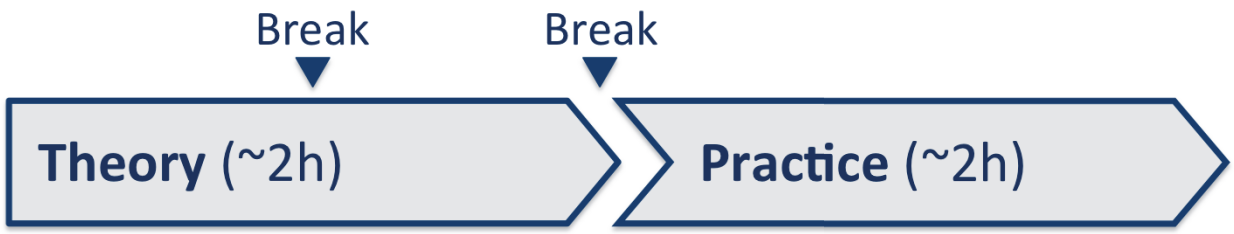
- Present **key principles** for good written and oral communication
- Show good and bad **examples**
- Give you the opportunity to **practice**

There is not only one good way to do it, but there are certainly many bad ones

Disclaimer:

- The following are general guidelines: **deviations** from them might be required depending on the context.
- They are **not exhaustive**, but only address common mistakes.

Format of the workshop



- Key principles
- Examples
- Quiz

- Case study (in groups)
- Discussion
- Presentation

Active participation expected!

Topics

The written report

The oral presentation

The literature review

Writing in English

The written report

Topics

- Key principles
- Structure
- Style
- Tools
- Quiz

Key principles

Goals of a report

- To provide **information**
- To be read and understood by **different people**

- Based on **facts**
- **Neutral** (not a personal diary)
- **Logically** (not chronologically) structured
  - ➡ top-down: from big picture to details
- Clear, precise and **concise**

- A report is a **rigorous** presentation of the procedures carried out and results obtained.
- Exclude comments on **erring ways** (unless a reflexive analysis is expected).
- The report should be understandable for **non-expert readers.**
- **No plagiarism!!!** (see https://www.ulg.ac.be/upload/docs/application/pdf/2015-07/brochure_-_le_plagiat_pas_pour_moi.pdf)

Structure

Front page

Abstract

For longer reports:
Table of content
Nomenclature
(List of figures)
(List of tables)

Introduction

Body

Conclusion

If relevant:
Acknowledgement

Appendix

Bibliography

Hierarchy
- Chapters, sections…
- Numbered
- Not too many levels
- Of comparable length

- The **order** of the some of these items might sometimes different (also between French and English).
- **Acknowledgements** can also be at the beginning of the document.
- The **list of figures** and **tables** is often unnecessary.

Structure

- **Front page**
- Abstract
- Introduction
- Body
- Conclusion
- Appendix
- Bibliography

- Sufficiently **specific**
- Not too technical
- Adapted to the targeted **reader**
- Not too long

- Required elements and their **position** on the page depend on the context.
- Both an illustrating **figure** and some **logos** can also be added.

Structure

- Front page
- **Abstract**
- Introduction
- Body
- Conclusion
- Appendix
- Bibliography

Standalone summary of research topic, methodology, key **results** and conclusions

- Concise
- With key words
- Not too technical

- The **length** of an abstract is typically:
  - < 250 words for **a journal article** or a short report (single paragraph)
  - < 1 page for a **thesis** (3-5 paragraphs)
- Do not use **symbols**, **acronyms** or **citations** in the abstract.

Structure

- Front page
- Abstract
- **Introduction**
- Body
- Conclusion
- Appendix
- Bibliography

Guides the reader towards the topic

- Context and motivation
- Objectives
- (State-of-the-art)
- Preview of the methodology
- Structure of the report

Many only read the introduction and the conclusion

- The **state-of-the-art** in the introduction can be brief without too many references.
- More **in-depth literature review** is usually left for a specific chapter or in chapters about methodology, etc.
- It is useful to formulate the objectives as **key questions.**
- The introduction should give a brief answer to "**why?**" "**what?**" and "**how?**".
- Sometimes a brief summary of the **key results** can be provided.
- For a **technical report**, precise the topic of the document and of the overall study (often much larger) it is related to. Indicate also the concrete issues to solve and the involved partners.
- Do not argue that your topic is the most important topic (it is not).

Structure

- Front page
- Abstract
- Introduction
- **Body**
- Conclusion
- Appendix
- Bibliography

The **core** of the work

- Theoretical background
- Methodology
- Key results
- Discussion

The exact structure depends on the context

- In dissertations, the broad description of **standard textbook** knowledge should be avoided, unless new relationships or aspects are worked out.
- In student projects / Master thesis, the description of textbook knowledge is possible, but with the appropriate granularity and logical flow.
- Long mathematical **derivation** should be in the appendix.
- It is often better to put **theoretical considerations** into those sections where they are actually applied than into a dedicated chapter.

Structure

- Front page
- Abstract
- Introduction
- **Body**
- Conclusion
- Appendix
- Bibliography

The **core** of the work

- Theoretical background
- Methodology
- Key results
- Discussion

The exact structure depends on the context

- Describe model, numerical method, and/or experimental approach and setup.
- Give detailed description of **experimental devices** / substances (type, manufacturer, city, country) and their measurement accuracy.
- Give **all details** necessary for the reader to reproduce the results.
- **Reproducibility** of experimental measurements should be demonstrated.
- Highlight all **assumptions** and **simplifications**.
- Use **schematics** for illustration.
- **Source code** should be found in the appendix, only the basic procedure and key aspects are described in the core text.

Structure

- Front page
- Abstract
- Introduction
- **Body**
- Conclusion
- Appendix
- Bibliography

The **core** of the work

- Theoretical background
- Methodology
- Key results
- Discussion

The exact structure depends on the context

- Summarize **processed** results.
- Do not embellish data.
- Indicate the **error estimation** / uncertainty on the results.
- Do not show **every result** (add those not directly relevant to the storyline to the appendix).
- Compare with results from the **literature**.
- Use a **logical** structure (e.g., milestones), not necessarily a chronological ordering.
- Separate result **description** and **interpretation**.

Structure

- Front page
- Abstract
- Introduction
- **Body**
- Conclusion
- Appendix
- Bibliography

The **core** of the work

- Theoretical background
- Methodology
- Key results
- Discussion

The exact structure depends on the context

- Highlight **key** results.
- **Link** with the objectives and results of other previous work.
- Discuss the impact of **assumptions** made.
- **Interpret** the physics, as supported by the data.
- Suggest possible **improvements**.

Structure

Front page

Abstract

Introduction

Body

Conclusion

Appendix

Bibliography

Summary of **key results** and take-away **messages** in relation with **objectives,** and suggestions for **future work**

Nothing new added, except

- Suggestions for improvement
- New questions

- Again, many readers only read the **introduction** and **conclusion**.
- The conclusion is thus a key part of the report.

Structure

- Front page
- Abstract
- Introduction
- Body
- Conclusion
- **Appendix**
- Bibliography

Additional information not directly required by the average reader

- Long mathematical derivation, raw data, drawings, technical specifications, source code, etc.
- Must be referenced in the main text

- Information **not required to understand** the report should be included in an appendix.

Structure

- Front page
- Abstract
- Introduction
- Body
- Conclusion
- Appendix
- **Bibliography**

List of **sources cited** in the text and used to **support** the argumentation

- Provide **all** reference details
- Avoid referencing **webpages**
- Do not cite sources that are **not accessible** to all

- Every statement that **does not originate** from the author's work (thoughts or results of the current report) **must** be followed by the citation of the corresponding source (more details on the bibliography are given in the following).
- If more than **8 successive words** are copied, they should be in italic, within quote marks (**citation**).
  - Words can be added in **[ ]** to precise the signification of a word: "They [the researchers] …".
  - If words are omitted on purpose, they should be replaced by **[...]**.
  - If an error is present in the original citation, add **(sic)** to indicate that the quote has been taken as-is from the source.
- For a **webpage**, indicate the access date.
- **BibTeX** is a very useful tool to manage the bibliography (but in some cases it might still require some manual modifications).

Structure

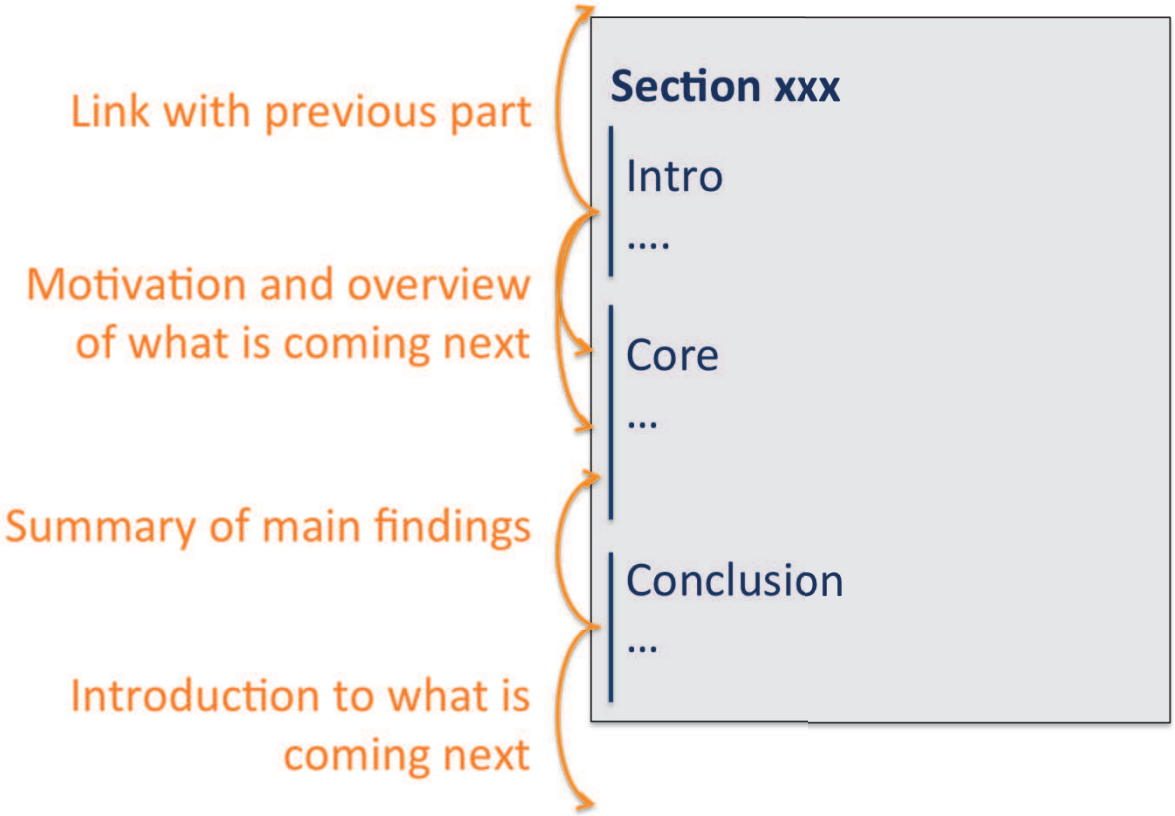
Top-down: from general to specific

Continuous, like a novel: no back and forth

Reader should always know where he/she is, and where (and why) he/she is going next

- The focus should be on the **reader**, not on the writer.

Structure



- A good way to introduce what is coming next is by formulating a **dedicated question**.

Structure – Good example

Chapter 4 – Results

The model developed in the chapter 2 is applied in this chapter to both the inviscid and viscous flow around an airfoil. Different flow conditions are analyzed and results are compared to experimental data (…)

Brief introduction to chapter

4.1 Inviscid case

The first case investigated corresponds to an inviscid flow at different Mach numbers. The objective is to assess the ability of the model (…) In particular, the flow field and aerodynamic forces are compared to measurements obtained by Smith & Blake [12] (…)

Introduction to section

4.1.1 Flow field

(…)

4.1.2 Aerodynamic forces

(…)

4.2 Viscous case

4.3 Discussion

Structure – Bad example

Dans ce chapitre, le comportement thermomécanique de matériaux composites est exploité. Tout d'abord, des essais de traction sur des éprouvettes [0/90] et [−45/45] à température ambiante et aux températures de $80_{[°C]}$, $130_{[°C]}$, $150_{[°C]}$ et $180_{[°C]}$, sont effectués.

Ainsi, les modes de rupture dans le matériau composite sont caractérisés à chaque température. Le module de Young et la contrainte de rupture ou la contrainte maximale sont exploités. Leur évolution en fonction de la température est déterminée pour chaque empilement du PRFC.

Finalement, des critères de rupture dans le matériau composite sont présentés, un choix de critère est effectué afin d'être utilisé dans le chapitre (5). Les paramètres nécessaires à l'application de ce critère sont identifiés sur base de résultats expérimentaux.

4.1 Essai thermomécanique de traction

Un essai de traction sur des éprouvettes en PRFC avec un empilement [0/90] ou [−45/45] à température ambiante et aux températures de $80_{[°C]}$, $130_{[°C]}$, $150_{[°C]}$ et $180_{[°C]}$ est effectué.

Cet essai permet premièrement de déterminer les modes de rupture à différentes températures pour les deux types d'empilement.

Deuxièmement, il permet de déterminer l'évolution du module de Young E du PRFC ainsi que de la contrainte de rupture σ_{res} ou de la contrainte maximale σ_{max} en fonction de la température des deux types d'empilement.

Granularity not appropriate !

4.1.1 Informations de base

L'essai de traction est à effectuer sur des éprouvettes en époxy renforcée par fibres de carbone tissées. Deux orientations du tissu sont testées : [0/90] et [−45/45]. Pour les deux types d'empilement, l'essai est effectué aux températures suivantes : $23_{[°C]}$, $80_{[°C]}$, $130_{[°C]}$, $150_{[°C]}$ et $180_{[°C]}$. Pour chaque température, au moins 3 éprouvettes sont testées.

- Too many details are given at the beginning (introduction of the chapter).
- This leads to heavy repetitions.

Style

Neutral
Clear
Concise

- Do not write a personal **diary**
- Use the **passive** form (avoid “I” or “we”)
- Favor short and **concise** sentences
- Use a sober and **uniform** style

- There should be only **one statement per sentence**.
- Avoid more than 2 levels of “**of**” (possession / connection).
- Avoid more than 1 level of “**like**” / “**as**” and “**that**” / “**which**”.
- Keep it **sober** and **uniform** throughout the document, including the figures (titles, notations, symbols).
- Be **consistent** (e.g., “Fig.” or “figure” throughout the report).
- Avoid **footnotes**, favor brackets (if short) or appendix (if long).
- Use **synonyms** instead of repeating many times the same word (if feasible, sometimes it can introduce confusion).
- Again, the structure should **follow the logic**, not the of work performed.

Style

Syntax
Grammar
Spelling

- Always have a subject and a verb in a sentence
- Group sentences with a common idea into **paragraphs**
- Pay attention to **logical connections**
- Choose the **correct words**
- Use the **spell check**!!!

- A **paragraph** should have more than 1 sentence.
- Ensure that the noun that each **pronoun** replaces (and refers to) is clearly and uniquely identified.
- **Main statements** should not be contained in sub-clauses.
- **Main statements** should be at the beginning of a sentence.
- Use the correct **logical connectors** (however, nevertheless, in fact, thus, …).
- Use the correct **punctuation**.
- Only objects of a **same nature** (substantives, adjectives, verbs, etc.) can be connected by the conjunctions "**and**", "**or**", etc.
- Respect the **conventions** of the domain (technical words, notation, …).

Style – Bad examples

Make sure that the logical argumentation is correct

"Real violent coughing and sneezing led to a theoretical modeling which was validated by simplified experiments."

"Only a few experiments are sufficient to fit the results to mathematical models. "

- Coughing cannot lead to a model.
- A better sentence would be: "Understanding coughing and its implications for disease spreading motivated the development of theoretical models".

- One does not fit experimental data to a model, but one calibrates the model parameters to experimental data.

Style – Bad examples

Separate into several sentences

"… the complete study of the numerical simulation of a solar system that allows to measure the power of the radiation that we find at the output of the setup as the heat of a heat-transfer fluid flowing at constant flow rate."

Style – Bad examples

Do not write as you speak!

"By the way, …"

"As you may know, …"

"The solution went crazy and convergence was never observed."

"A bit of numerics now, to perform a unsteady analysis, the type of unsteady simulation has to be specified."

Style – Bad examples

Do not write a personal diary!

"… Looking at one of the last tail boom plan (figure 19) of the (…) prototype, we first thought to realize a similar internal structure with a constant circular cross-section along the model. However, since we wanted the cylinder to be installed on a support in such a way …"

"… Besides, since previous experimental investigations (…) used empty cylinders, it was decided …"

Style – Typography

Roman		Italic	
• Numbers:	3.1412	• Variables:	$m, x, y, t, \ldots$
• Units:	g, m, s, ...	• Parameters:	$g, L_x, \ldots$
• Descriptive indices:	$r_{\mathrm{A}}, N_{\mathrm{A}}, r_{\mathrm{A}}, t_{\mathrm{init}}$	• Variable indices:	$c_p, u_x, \ldots$
• Math entities:	cos, e, ln, dx, max, min, ...		
• Words in equations:	if, for, ...		
• Chemical elements:	$\mathrm{H_2}$, Cu		

- Non-dimensional numbers (Re or Re)
- et al. or *et al.*

- The correct typography should also be used for **figures** and **tables** (labels, captions, etc.).
- For more details, see for instance the IUPAC green book.

Style – Typography

Other common issues	LaTeX
• Use math typeset also in text: x-axis …	x-axis
• Put multiplier in scientific notation: 1.23×10^4 or $1.23 \cdot 10^4$	\times or \cdot
• Avoid line jumps between “Fig.” (“Tab.”, “Eq.”) and “1”	Fig.~\ref{figref}

Style – Equations

The temperature T at time t is obtained by solving the heat equation

$$\frac{\partial T}{\partial t} = \frac{\partial}{\partial x}\left(\alpha \frac{\partial T}{\partial x}\right) = \alpha \frac{\partial^2 T}{\partial x^2}, \quad (2.1)$$

where x is the coordinate along the rod and α the constant thermal diffusivity. Two boundary conditions are required to solve Eq. (2.1).

Equations belong to the text (**punctuation**!)

Number equations by chapter (not every line!)

Define all variables the 1st time they are used

Reference an equation only after it has been defined

Use a **unique** and **consistent name** for each variable (favor standard practice)

- Make sure that the **punctuation** in equations does not introduce any confusion.
- **A mathematical development** cannot be reduced to a succession of equations and/or formulas: a structure, a clarification and some explanations are absolutely necessary.
- Numbering **all** equations avoids to have to decide which ones are important (i.e., numbered) and provide an easy way for referring to them.
- A **nomenclature** can also be added to the report.
- When citing an equation from **other sources**, adapt its nomenclature to yours.

Style – Tables

Description of rows and columns

Units

	U	α	C_l	C_d
	m/s	-	-	-
2D simulation	10.0	0	0.12	0.017
2D simulation	10.0	10	1.11	0.073
3D simulation	10.0	0	0.18	0.031
Smith & Blake	9.5	0	0.16	0.045

Only **significant** digits

Table **number**

Table 2.1: Lift and drag coefficient for different free stream velocities U and angles of attack α obtained from simulations, and experimental data from Smith & Blake [12].

Caption with enough information to understand the table without reading the text

Citation in caption

- Favor **a graphical rather than a tabular** representation in the main text, keeping (large) tables for the appendix.
- Tables must be **referenced** in the same order as their number (i.e., mention Tab. 1 in the text before Tab. 2).
- In other words, tables must be in the same order as they are referenced in the text.
- Reference tables before describing them.
- Tables must always be **discussed** in the main text.
- The caption should be **self-sufficient** to understand the table, but the table should not have a title above it.

Style – Figures

Choice of figure

- Show only **relevant** figures
- Compare things in the **same** figure

Digital quality

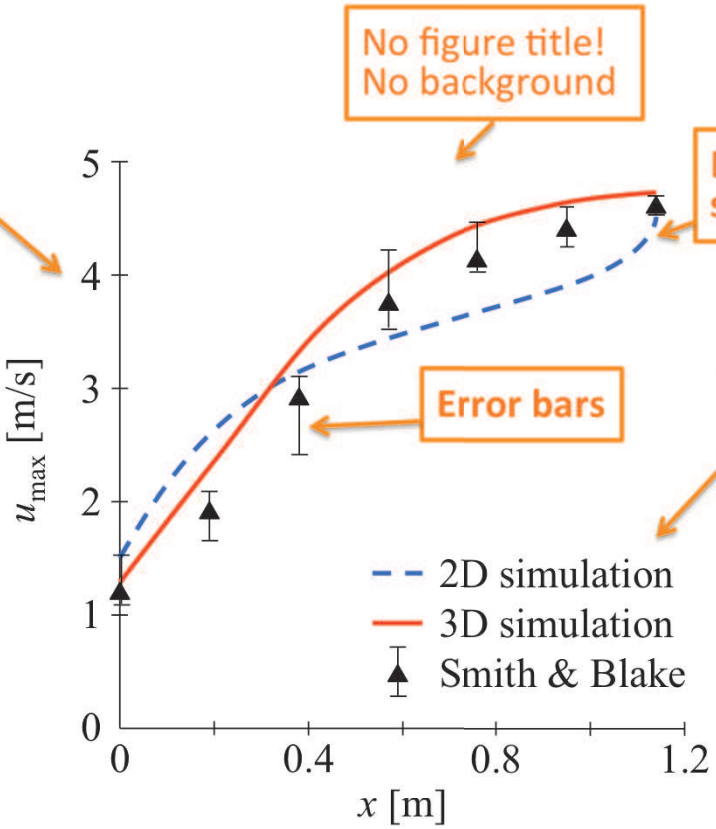
- Use **vector** graphics (pdf or eps)
- **Digitize** external data that you want to compare to

Plot style

- Use symbols for **discrete** data (e.g. experiment)
- Must be readable (colors / styles / # lines)

- All figures in the main text should have a meaningful **complementarity** with the line of thought; figures not considered as directly relevant should be in the appendix.
- All figures should be **referred to** and **discussed** in the main text.

Style – Figures

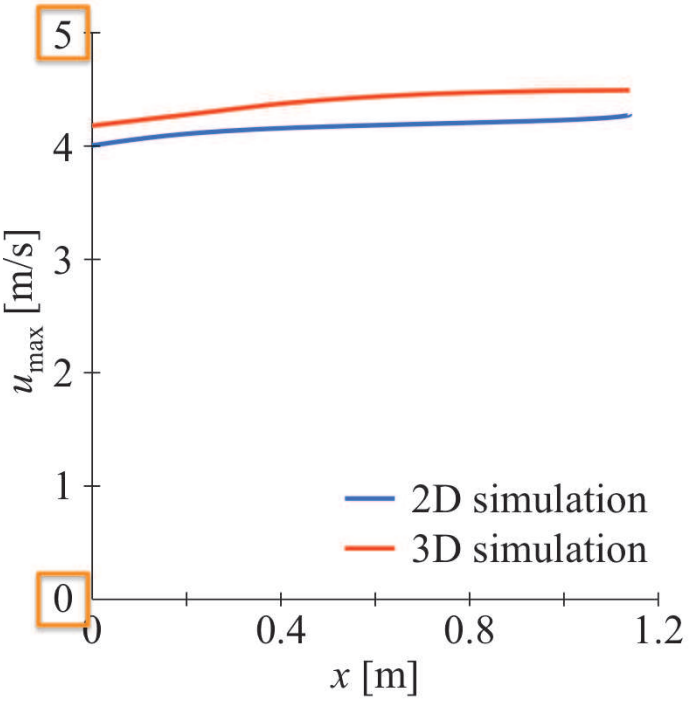


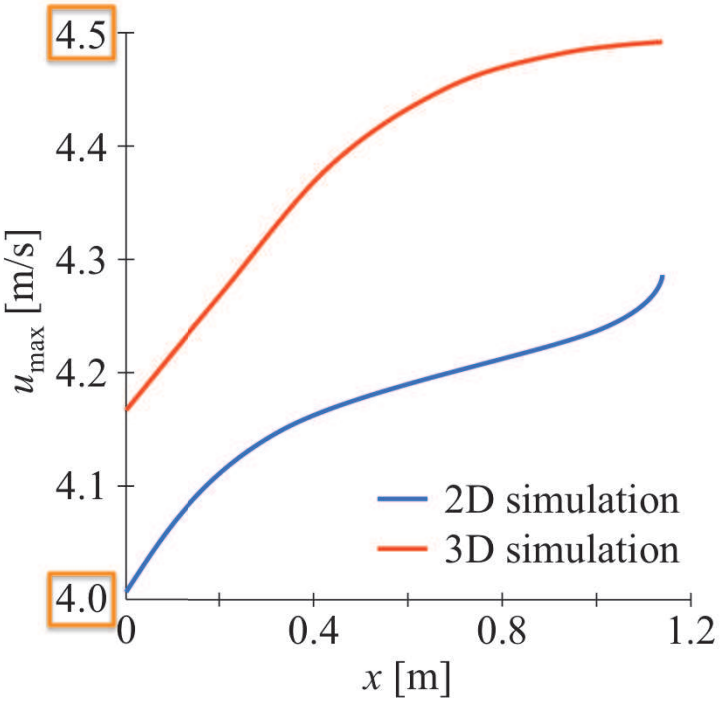
Caption
- Fig. number
- Sufficient information
- But no interpretation
- Citation

Figure 4.1: Maximum velocity along the channel obtained from 2D and 3D simulations and experimental measurements from Smith & Blake [12] for the steady case at Re = 1.

- All figures must be **referenced** in the text, in the same order as their number (i.e., in the text mention Fig. 1 before Fig. 2).
- In other words, figures must be in the same order as they are referenced in the text.
- Reference figures before describing them.
- The caption should be **self-sufficient** to understand the figure.
- Discrete data should be shown as **symbols** (e.g., experimental data), while **lines** are used for continuous data (e.g., mathematical model).
- Make sure that symbols can be **distinguished** form each other (type, color, overlap).
- Use the **same** font for the **figures** as for the **text**, make sure that the font is **large enough**.
- Unlike the example above, usually **one difference** between lines is sufficient (either color, or style).

Style – Figures

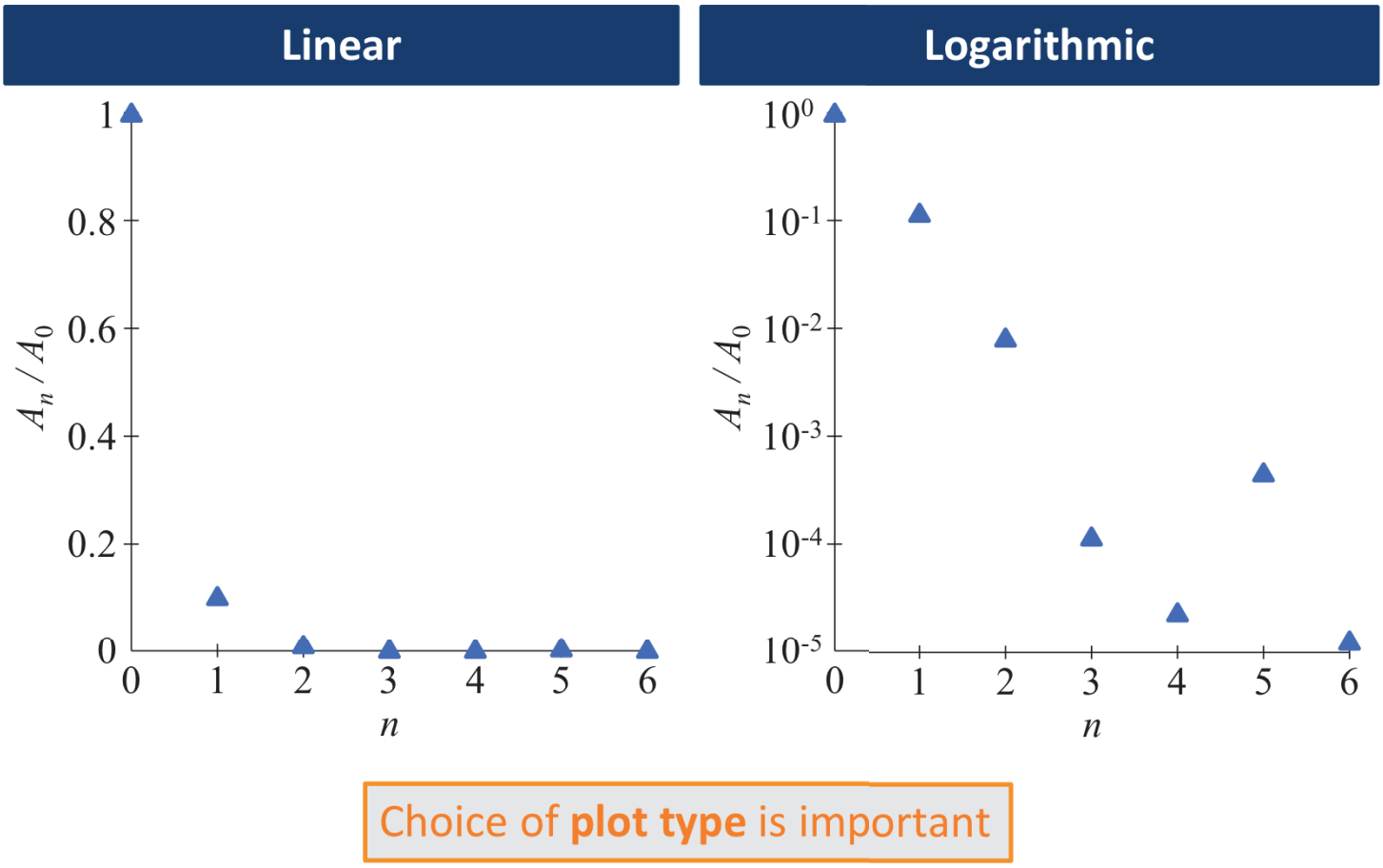




Choice of **scale** / **range** depends on what you want to highlight

- Think about the **message** you want to convey.

Style – Figures



Choice of **plot type** is important

- Use a logarithmic scale for data that cover **more than one decade** or to demonstrate some **power-law scaling**.

Style – Subfigures

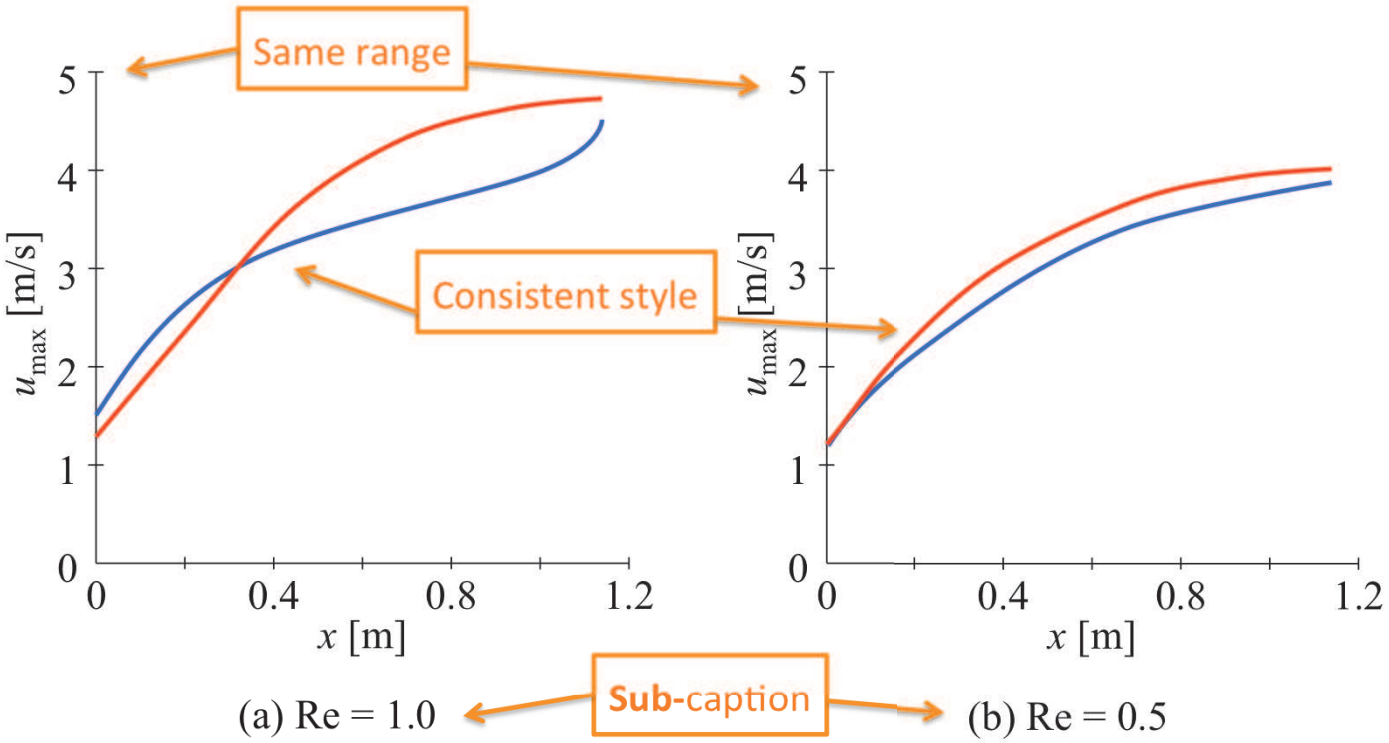
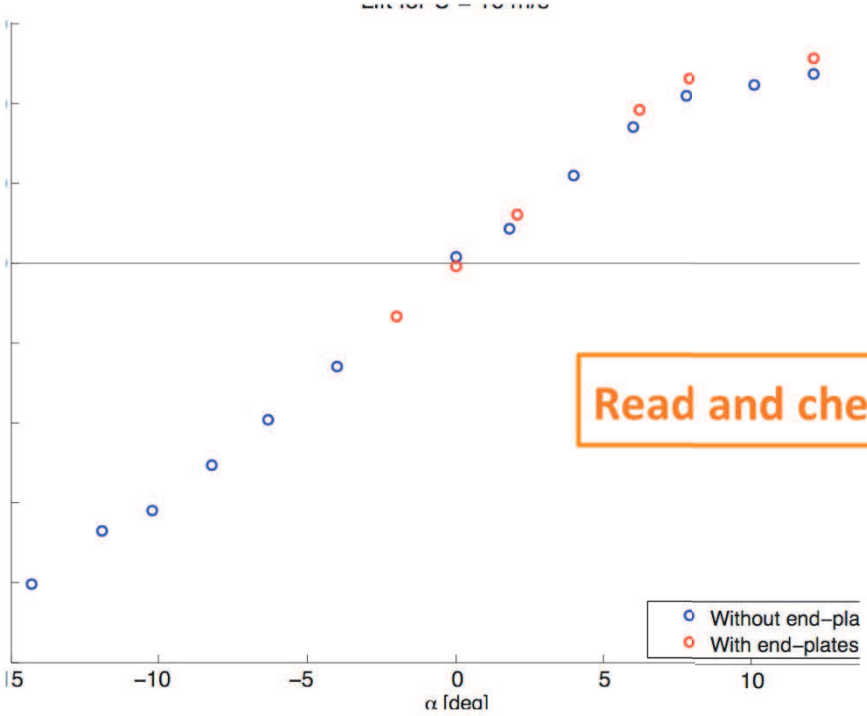


Figure 4.2: Maximum velocity along the channel for the steady case at two different Reynolds numbers. Red: 3D simulation; blue: 2D simulation.

Main caption

- Use only subfigures **for related data** (the main caption should be much larger than the sub-captions).
- In the text, **refer** specifically to subfigures: e.g. "[…] as illustrated in Fig. 4.2(a)".
- In LaTeX, labels used for referencing (\label{xxx}) can be added to both the overall figure (main caption) and/or to the individual subfigures (sub-captions).

Style – Bad figure



Read and check your report!

FIGURE 59 – Evolution of the lift calculated by integration of the pressure coefficients at 16m/s

- The figure is cut and unreadable.
- There should not be a figure title, but only an exhaustive caption.
- Axes should have a title.

Style – Bibliography

Citation in text

Automatic with LaTeX / BibTeX

Alphabetical (Harvard)

- "It was shown that …. (Smith & Blake, 2010)."
- "… as shown by Blake *et al.* (2012)."

If more than 2 authors

Numerical (Vancouver)

- "It was shown that …. [1]."
- "It was shown that … [1,3]."
- "… as shown by Blake *et al.* [2]."

Other styles exist

39

- "Alphabetical"
  - in the bibliography list: **ordered alphabetically** according to the first author name;
  - cited with the author names and year in the text;
  - easy to find a work / author in the list;
  - easy to identify the publication when reading the text.
- "Numerical"
  - in the bibliography list: ordered **by order of appearance** in the text;
  - cited with the corresponding number (with square brackets [1] or superscrit[1]);
  - easy to identify first citation in the text of a specific publication.
- Other styles that **combine** both alphabetical and numerical styles are also found (e.g., the bibliography is ordered alphabetically but citations are indicated by numbers).
- Choose one and stick to it throughout the report (the choice might be dictated by the context).

Style – Bibliography

Reference in bibliography

Automatic with LaTeX / BibTeX

Alphabetical (Harvard)

Blake, J., Mortimer, N. & Smith, J. 2012 On bird flight. *Nature* **12** (2), 23-27.

Smith, J. & Blake, J. 2010 Bridge stability under wind loads. *J. Fluid Mech*. **37**, 52-59.

Numerical (Vancouver)

[1] J. Smith, J. & Blake, "Bridge stability under wind loads", *J. Fluid Mech*. **37**, 52-59 (2010).

[2] J. Blake, N. Mortimer, and J. Smith, "On bird flight", *Nature* **12** (2), 23-27 (2012).

- For a journal article:
  - name of all authors (initials of first name),
  - publication title,
  - journal title (often abbreviated according to international standards),
  - volume number (and issue number, if present),
  - year of publication,
  - page number.
- For a book:
  - name of all authors (initials of first name),
  - book title,
  - edition number,
  - volume,
  - page,
  - publisher (name, location),
  - year of publication,
  - ISBN (if possible).
- The order and style of this information can depend on the **context**.

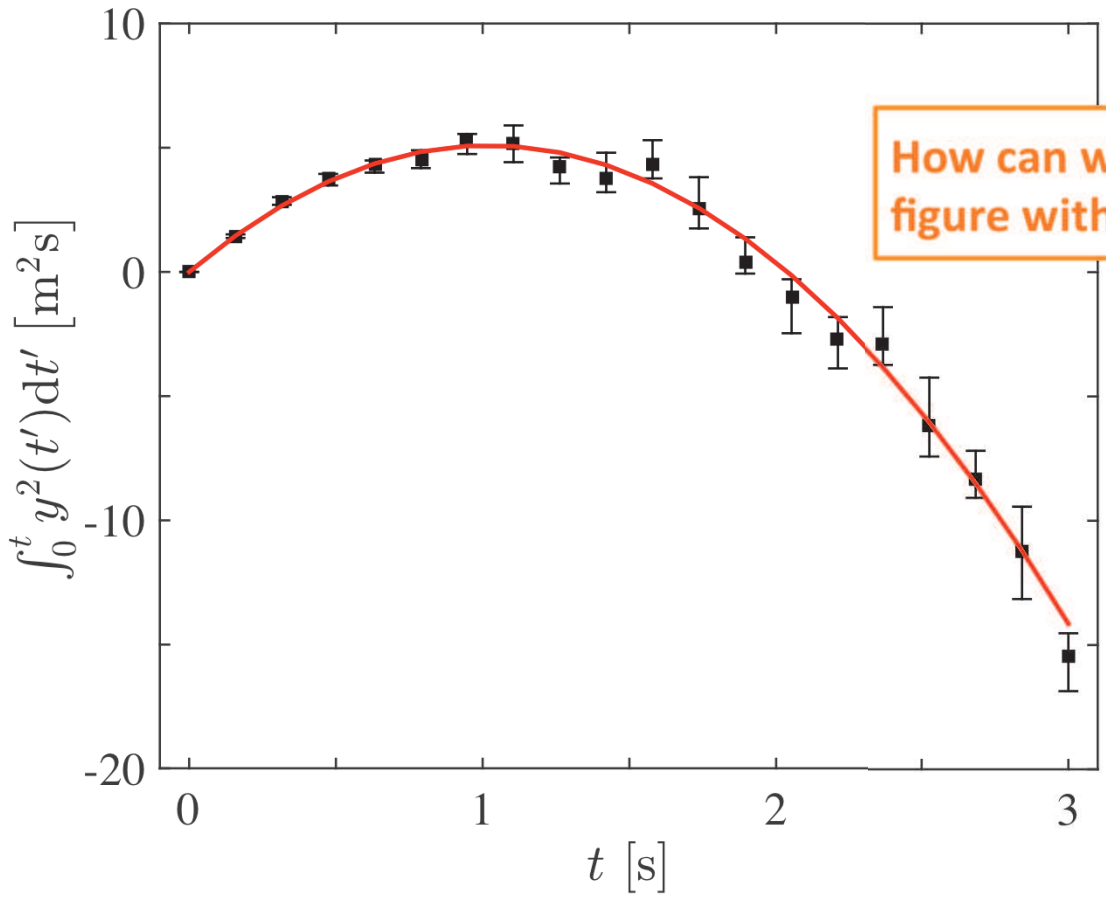
Examples of tools

Text	Figures	Bibliography	Others
LaTeX BibTeX	MATLAB	MENDELEY	Plot Digitizer
W	ORIGIN	JabRef	Xfig
PAGES	gnuplot	THOMSON REUTERS ENDNOTE	

… or any other tool of your choice

- … but not **Excel**!!!

Tools



How can we create this figure with MATLAB?

Tools

MATLAB script

```
Figure1=figure(1); clf; set(Figure1,'defaulttextinterpreter','latex');   ⇒ To use LaTeX
errorbar(t,Yexp,dYl,dYu,'s','color',[0 0 0],'markersize',6,'markerfacecolor',[0 0 0]);
hold on;
plot(t,Yth,'r','linewidth',2.0);
xlabel('$t$ [s]');
ylabel('$\int_0^t y^2(t'') \mathrm{d}t'' \left[\mathrm{m}^2\mathrm{s}\right]$');   } LaTeX axis titles
set(gca,'fontsize',24,'fontname','Times', 'LineWidth',0.5);
set(gca,'XLim',[-0.1 3.1]);
set(gca,'YLim',[-20 10]);                                   } Axes range
set(gca,'XTick',[0:0.5:3]);
set(gca,'YTick',[-20:5:10]);                                } Position of ticks
set(gca,'XTickLabel',['0';' ';'1';' ';'2';' ';'3']);
set(gca,'YTickLabel',['-20';'  ';'-10';'  ';' 0';'  ';' 10']);
set(gca,'XMinorTick','off','YMinorTick','off')
set(gcf, 'paperunits', 'inches');
Lx=8; Ly=6;
set(gcf, 'papersize', [Lx Ly]);                             } Size of exported figure and position
set(gcf, 'PaperPosition', [0.01*Lx 0.01*Ly 1.05*Lx 1.02*Ly]);
print -dpdf Figure1.pdf;   ⇒ Export as pdf
```


- Do not import a **standard** Matlab (or Excel) figure "as is", but adapt it to **improve** it (like in the above example).
- The LaTeX package "**psfrag**" can be used to replace some text in the figure (as eps) by a LaTeX text.

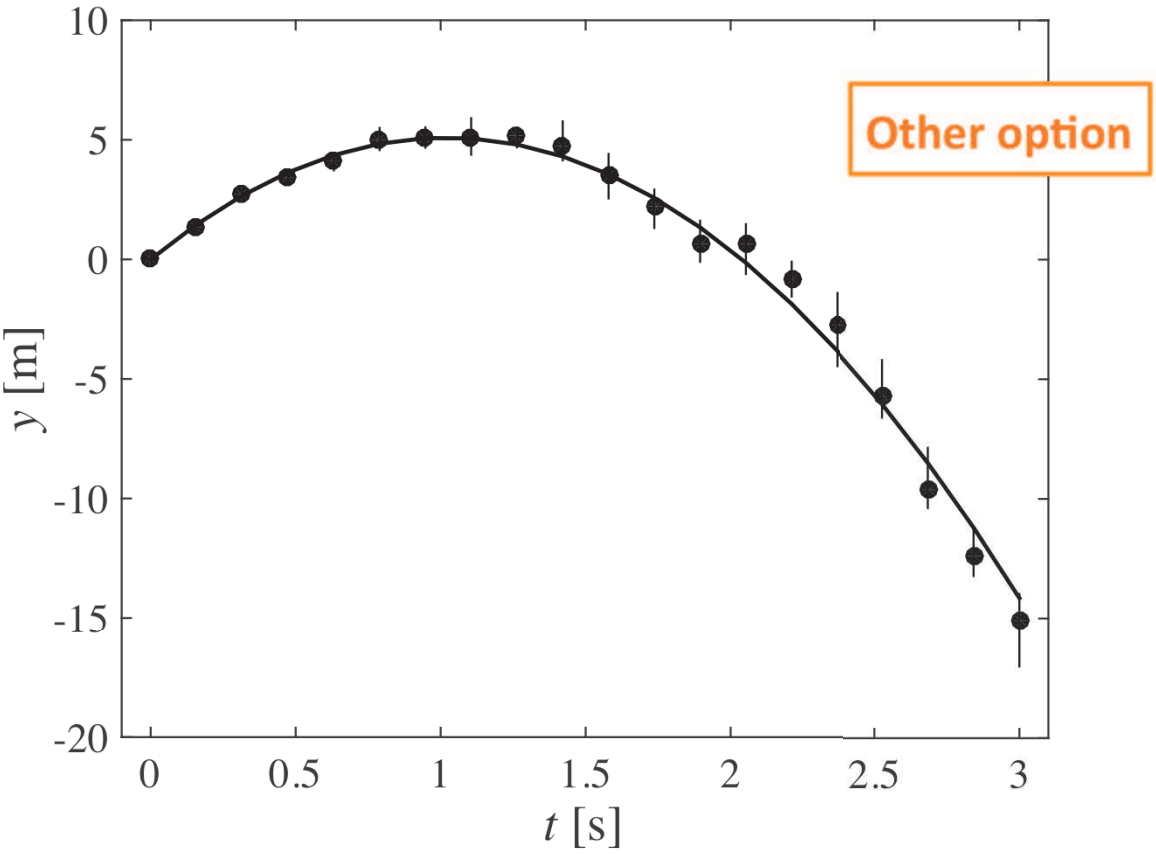
Tools

MATLAB script (other version)

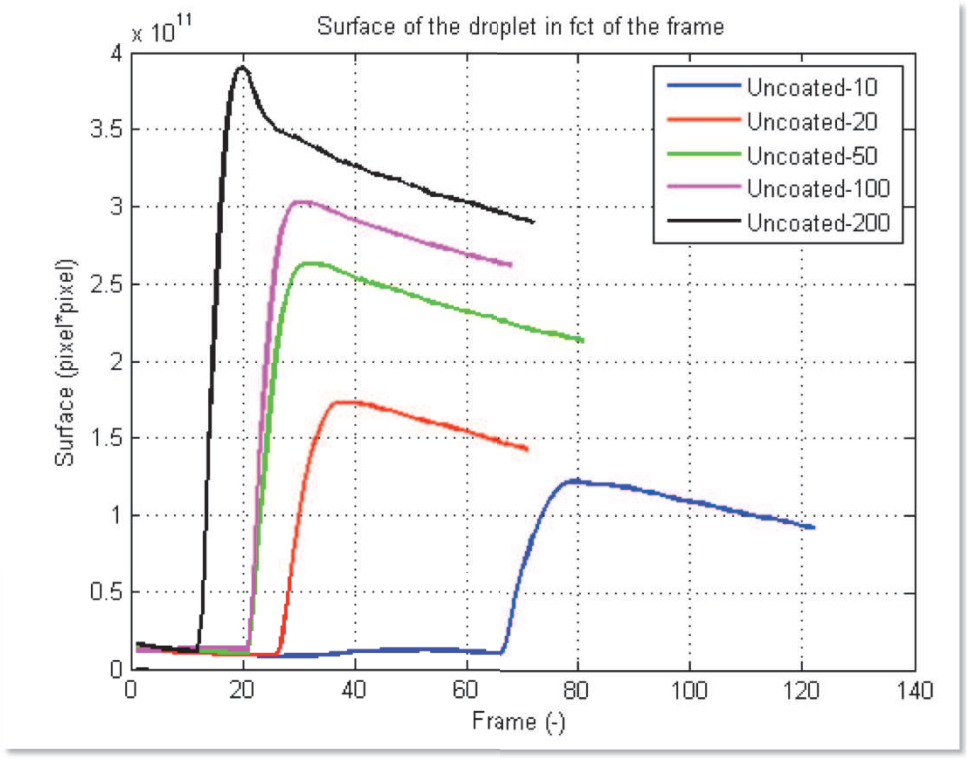
```
plot(t,yexp,'o','color',[0 0 0],'markersize',8,'markerfacecolor',[0 0 0]);
hold on;
for k=1:numel(t),
    plot(t(k)*[1 1],yexp(k)+[-dylexp(k) dyuexp(k)],'k','linewidth',1);  ⇒ Error bars
end;
plot(t,yth,'k','linewidth',2.0);

axis([-0.1 3.1 -20 10]);  ⇒ Axes range
xlabel('{\itt} [s]','fontsize',24,'fontname','Times');
ylabel('{\ity} [m]','fontsize',24,'fontname','Times');   } Axis titles
set(gca,'fontsize',20,'fontname','Times'); ⇒ Font
print -deps Example.eps; ⇒ Export as eps
```

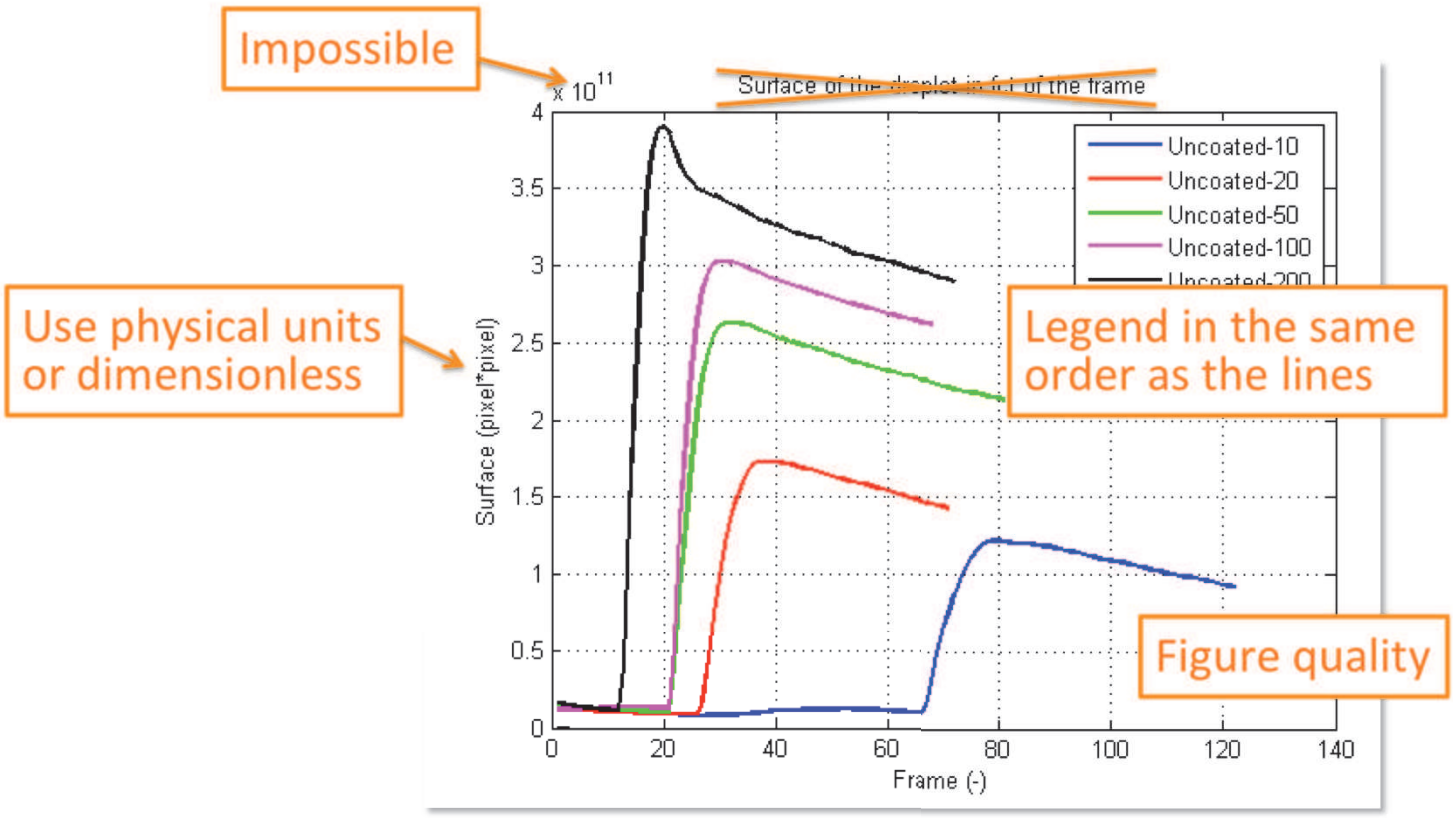
Tools



Quiz – How can we improve this?



Quiz – How can we improve this?



- It is much easier to read the figure if the legend is directly next to the corresponding line in the same color as the line.

Quiz – How can we improve this?

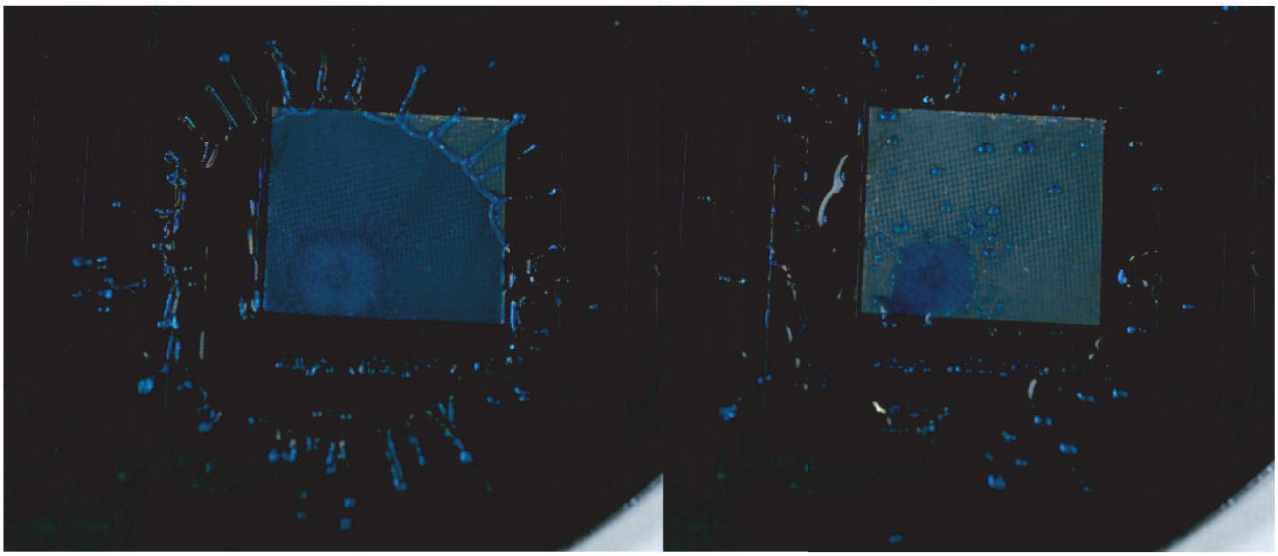


Figure 14: diameter 50μm, depth 100μm, height 10cm

Quiz – How can we improve this?

Increase contrast

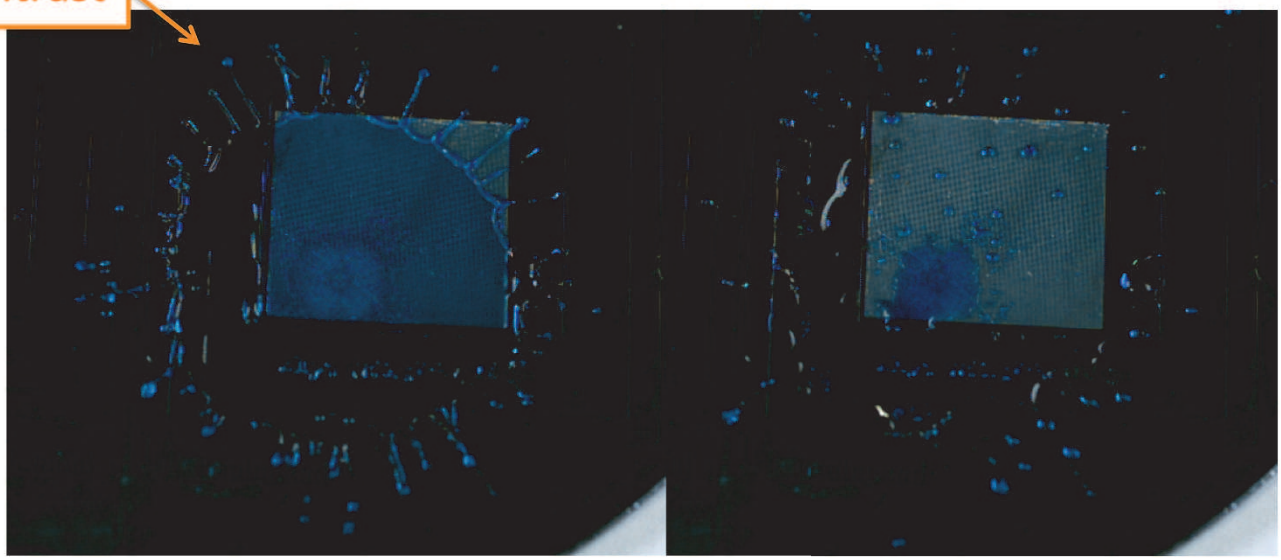


Figure 14: diameter 50μm, depth 100μm, height 10cm

What is it? What are the experimental conditions?

What are these diameter, depth and height?

Quiz – How can we improve this?

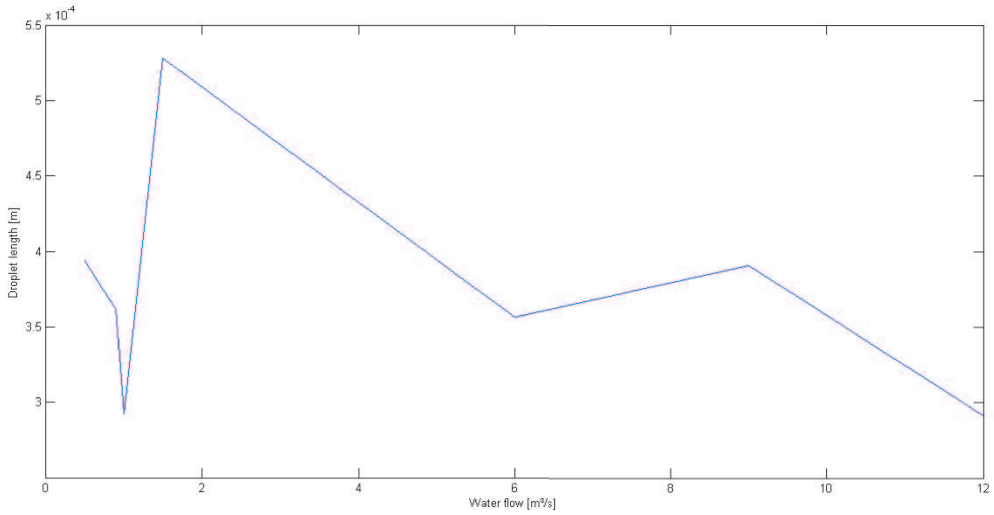


Figure 23: Droplet length as a function of the water flow.

Quiz – How can we improve this?

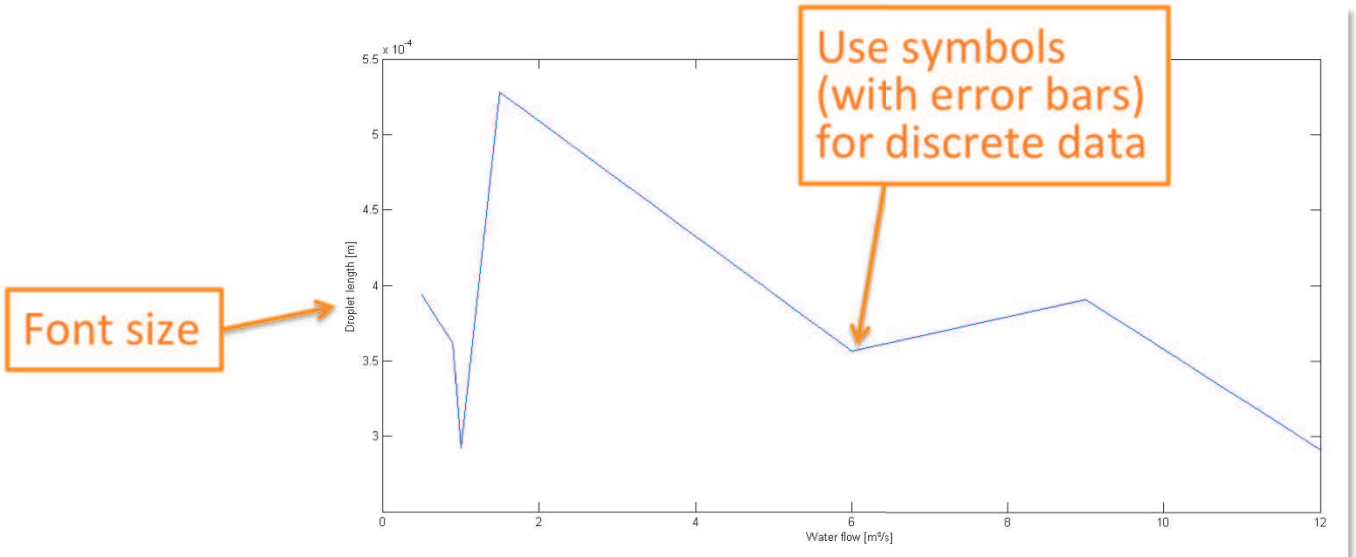
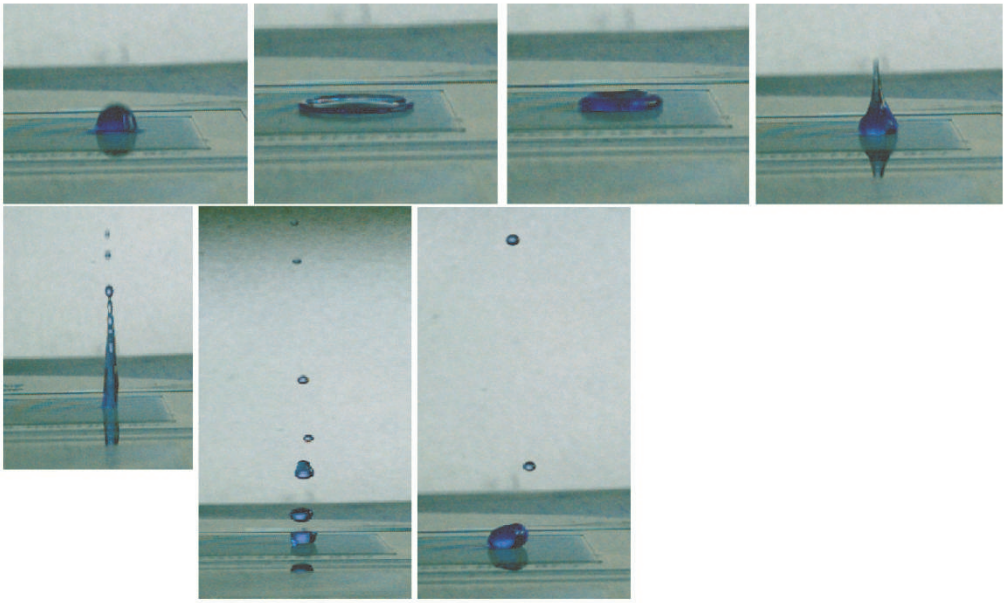


Figure 23: Droplet length as a function of the water flow.

What is it? What are the experimental conditions?

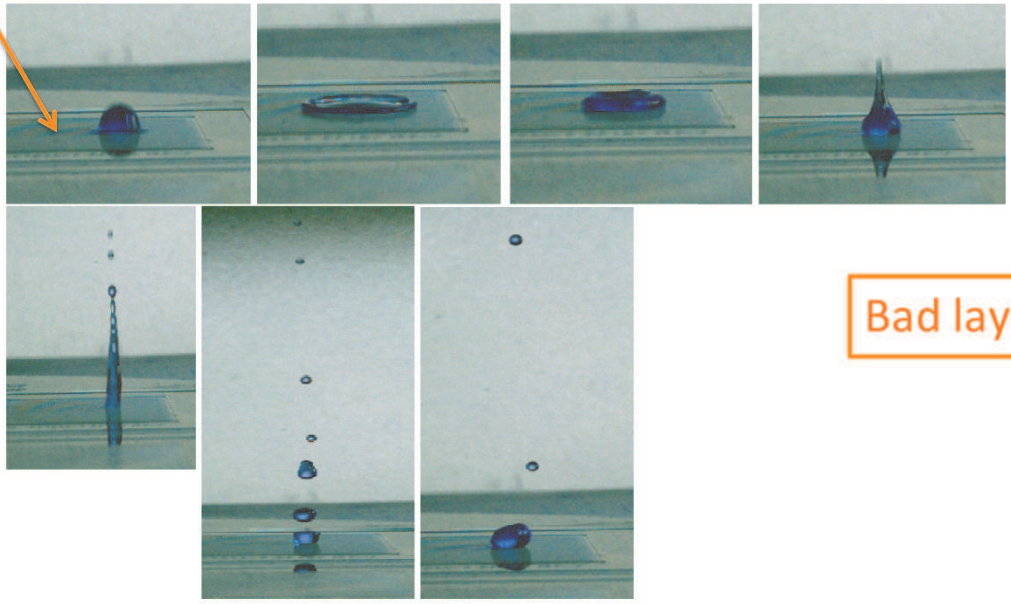
Quiz – How can we improve this?



(a) Dynamic interaction of a droplet with a lithography surface - height = 10cm

Quiz – How can we improve this?

Time missing



(a) Dynamic interaction of a droplet with a lithography surface - height = 10cm

Bad layout

What is it? What are the experimental conditions?

Quiz – How can we improve this?

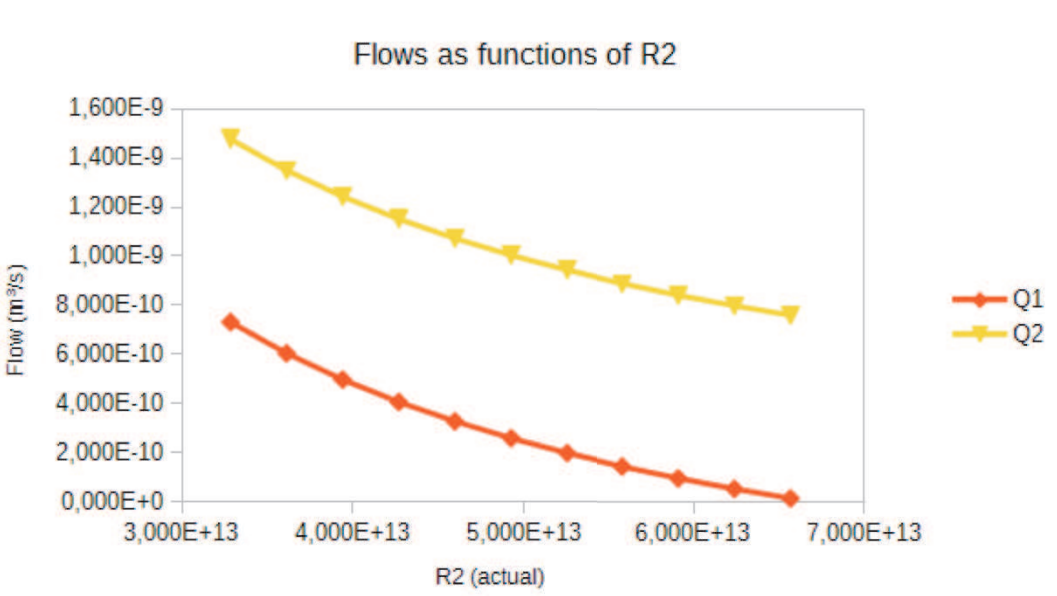


Figure 6: Simulation of flows through the chip.

Quiz – How can we improve this?

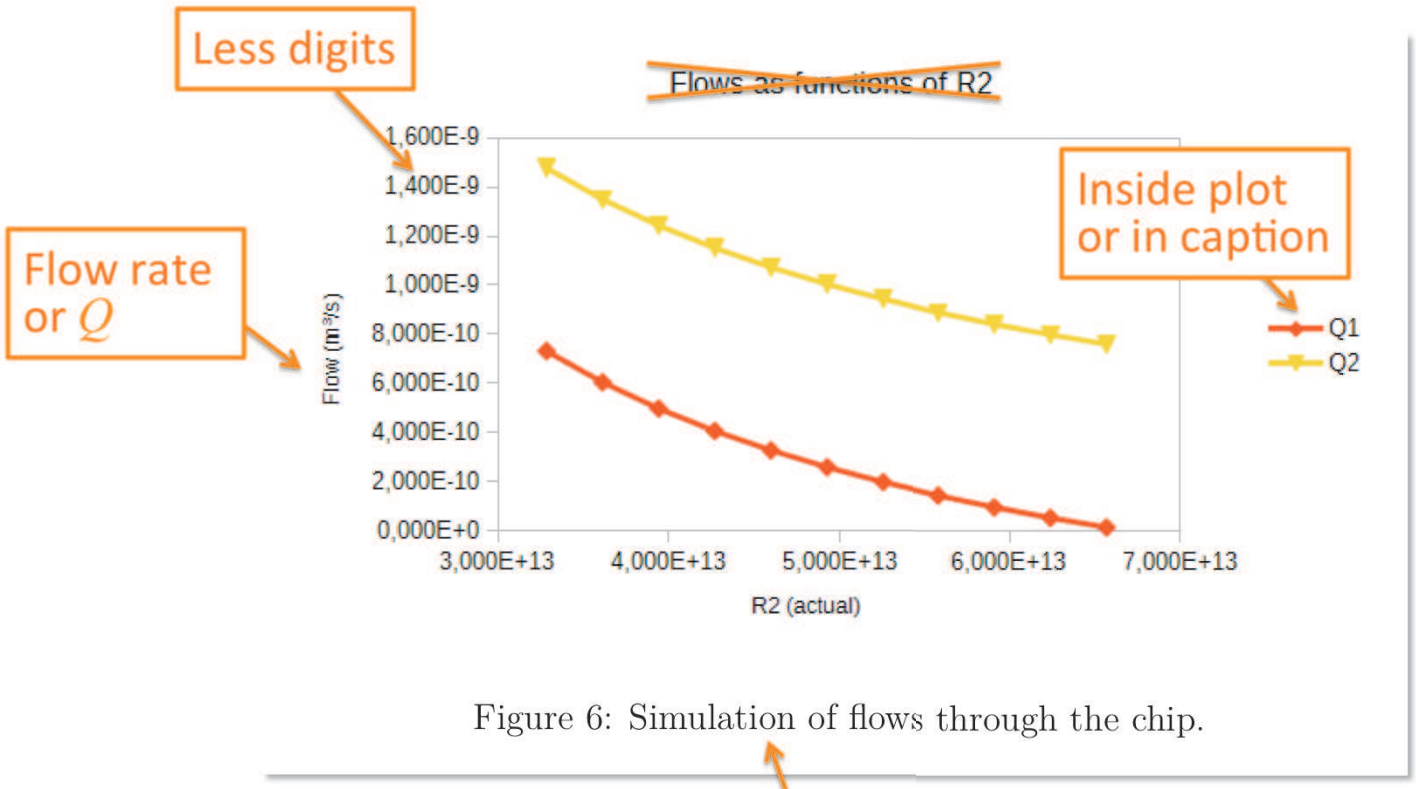


Figure 6: Simulation of flows through the chip.

Incomplete

Quiz – How can we improve this?

Video	Q_oil (µl/min)	Q_water (µl/min)	p (mbar)	Speed (mm/s)	Stdev (mm/s)
M1_200fps	10,0	1,0	69	65,0547	0,36497
M2_200fps	5,0	1,0	110	128,0755	0,63202
M3_200fps	2,5	0,5	92	107,1488	0,65771
M4_l_200fps	5,0	1,5	62	38,9552	0,20621
M7_l_200fps	4,5	1,0	62	43,4173	0,15467
M8_l_200fps	4,5	0,5	47	30,4486	0,39636
M9_l_200fps	5,0	0,5	41	26,7773	0,54554
M10_l_200fps	4,0	0,5	44	30,7845	0,39236
M11_l_200fps	4,0	0,5	50	35,9092	0,27718
M12_l_200fps	4,0	0,5	63	45,9789	0,18524
M13_l_200fps	4,0	0,5	56	41,5303	1,16128
M15_l_400fps	20,0	6,0	134	88,5603	0,73911
M16_l_400fps	20,0	6,0	180	133,7163	0,54241
M17_l_400fps	20,0	6,0	210	158,8474	0,62690
M18_l_400fps	20,0	6,0	240	182,8703	0,62515
M19_l_750fps	40,0	12,0	450	372,8719	4,35640
M20_l_750fps	30,0	9,0	350	273,6366	1,33549
M21_l_750fps	30,0	9,0	400	320,1101	0,89747
M22_l_750fps	30,0	9,0	450	363,0828	1,45808
M23_l_1300fps	30,0	9,0	500	401,5714	2,02264

Figure 18: Average droplet speed

Quiz – How can we improve this?

Video names are meaningless

Math font

Too many digits

Video	Q_oil (µl/min)	Q_water (µl/min)	p (mbar)	Speed (mm	
M1_200fps	10,0	1,0	69	65,0547	0,36497
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M23_l_1300fps	30,0	9,0	500	401,5714	2,02264

Frame rate as a separate column

A figure would be better than a table

Figure 18: Average droplet speed

Complete with more information

Quiz – How can we improve this?

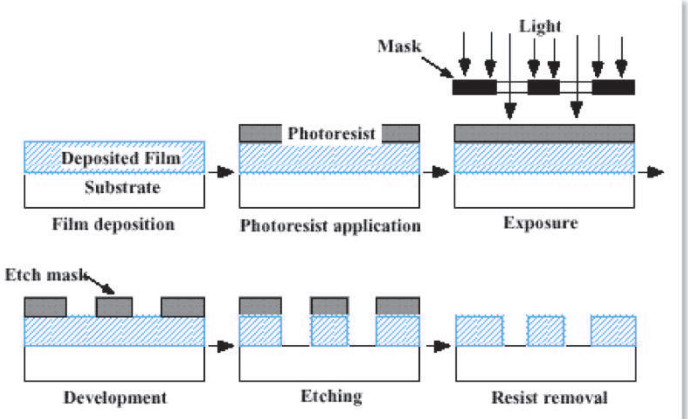


Figure 7: Photolithography method

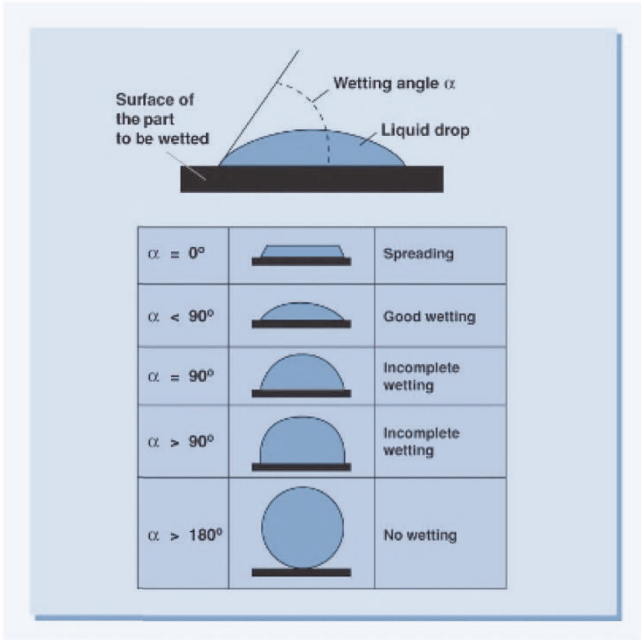
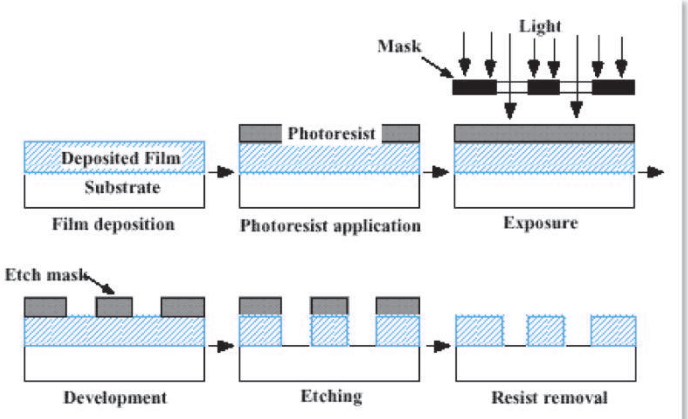


Figure 9: Definition of contact angle and classification

Quiz – How can we improve this?



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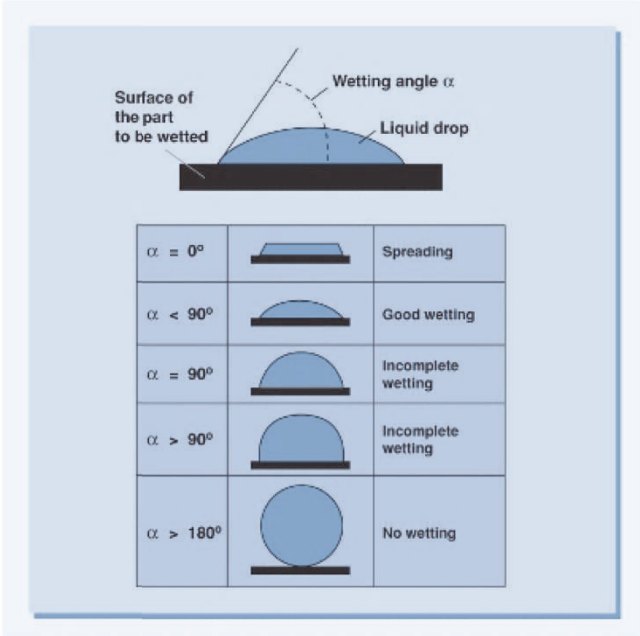

Figure 9: Definition of contact angle and classification

Add citation to caption

Quiz – How can we improve this?

After the first process, we take the plate and observe it with many tools. We see that the columns are not perfectly straight as we see in the FIGURE 2 . This is due to the difficulty to ablate matter deeply.

Figure 2: Side cut of the plate after being dug

Quiz – How can we improve this?

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Figure 2: Side cut of the plate after being dug

The figure does not illustrate the observations mentioned in the text!
Show actual observations.
Mention the tools used for the observation.

Quiz – How can we improve this?

6 Conclusion

During this case study, we saw the basics of the conception of a capacitive accelerometer. Once again, this analyse shows us that michrotechnologies are handling with a lot of different domains.

Quiz – How can we improve this?

6 Conclusion

During this case study, we saw the basics of the conception of a capacitive accelerometer. Once again, this analyse shows us that michrotechnologies are handling with a lot of different domains.

The conclusion is meaningless!
This is not the adequate place to give your feelings about what you experienced while doing the work

Bad English

Quiz – How can we improve this?

Question 4 : Which material is used ? What is the Young's modulus ? Can you estimate the bending stiffness of your micropillars ?

- Material : `BEMIS 5250` – A thermoplastic composed by a material close to polyester
- Young's modulus : $2000 - 2700\text{MPa}$
- Tensile strength at break : $57 - 60\text{MPa}$
- Flexural strength at yield or break : $83 - 115\text{MPa}$

For a hair of diameter ϕ :

$$I = \frac{\pi\phi^4}{32} \text{ and } K = EI \sim 4 \cdot 10^{-7}\,\text{kg} \cdot \text{m}^3 \cdot \text{s}^{-2} \tag{4}$$

Quiz – How can we improve this?

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Add variable name

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$$I = \frac{\pi\phi^4}{32} \text{ and } K = EI \sim 4 \cdot 10^{-7}\,\text{kg} \cdot \text{m}^3 \cdot \text{s}^{-2} \tag{4}$$

Indicate the value of the diameter

Quiz – How can we improve this?

1. SU-8 "deposition" step: the very first step we had to perform was to spread the photoresist on the silicon wafer as uniformly as possible. This was done with the help of a device known as a "spin-coater". To ensure the step was going to be carried out effectively, we first put the wafer without any photoresist in the device, and we tested whether the wafer was well stuck on the rotating plate (by the vacuum pump) and if the rotation of the wafer was stable at various speeds. Then, we poured some SU-8 on the wafer. On the advice of our supervisor, we let it "flow" and rest for around 1 minute, and then started a spin cycle by switching on the spin coater. When the cycle was finished, we switched the vacuum pump off and we took the wafer with a uniform layer of SU-8 on top out of the device. Figure 1 shows a picture of a spin-coater similar to the one we used:

Quiz – How can we improve this?

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Add details on SU-8 (type, physical properties, …)

Indicate rotation speed and time so that reader can reproduce the process

It sounds like a novel

Quiz – How can we improve this?

"Since the chemical industry is nowadays mainly based on petrochemicals, biomass will gain more importance, as it is the only renewable carbon source in the nature. "

Quiz – How can we improve this?

"Since the chemical industry is nowadays mainly based on petrochemicals, biomass will gain more importance, as it is the only renewable carbon source in the nature."

The logical connections implied by this sentence are wrong!

- Biomass will not gain more importance **because** petrochemicals are mostly used today (the logical causality implied by the sentence is wrong)
- Moreover, the fact that biomass is the only renewable carbon source in the nature does not imply its increasing importance

Quiz – How can we improve this?

"Before going into the details, here is a picture of the domain and an example of mesh:"

"… as said in the Hirsch CFD book, …"

Quiz – How can we improve this?

"Before going into the details, here is a picture of the domain and an example of mesh:"

"The computational domain and corresponding mesh are shown in Fig. 2."

"… as said in the Hirsch CFD book, …"

"… [12], …"

Quiz – How can we improve this?

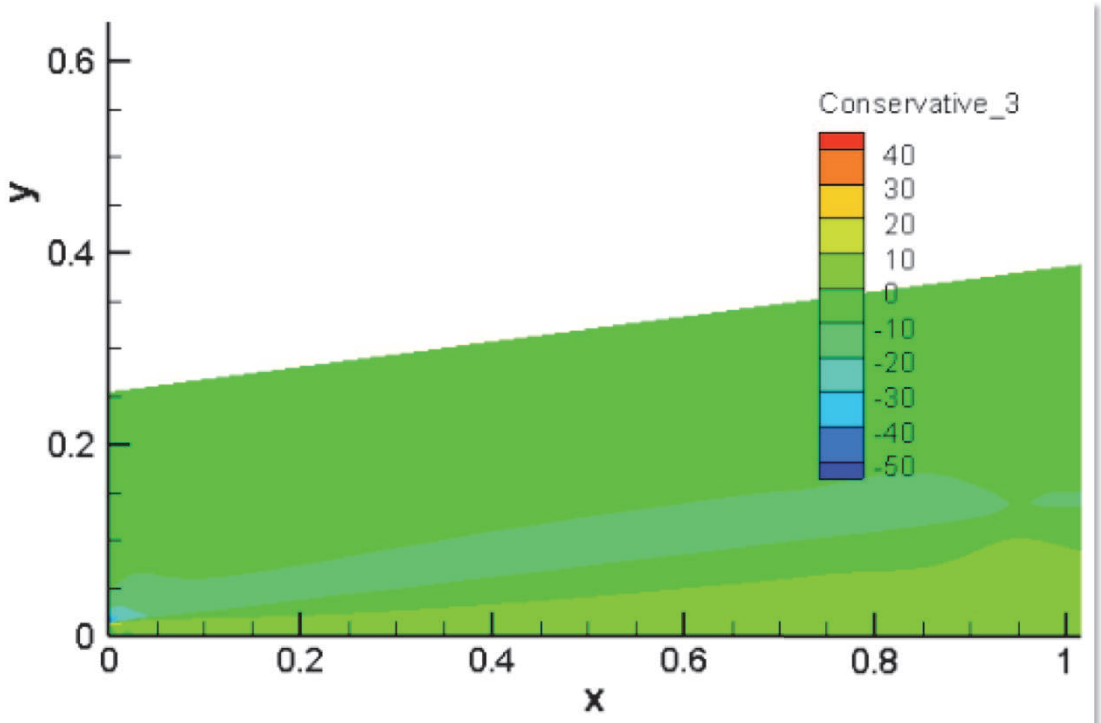
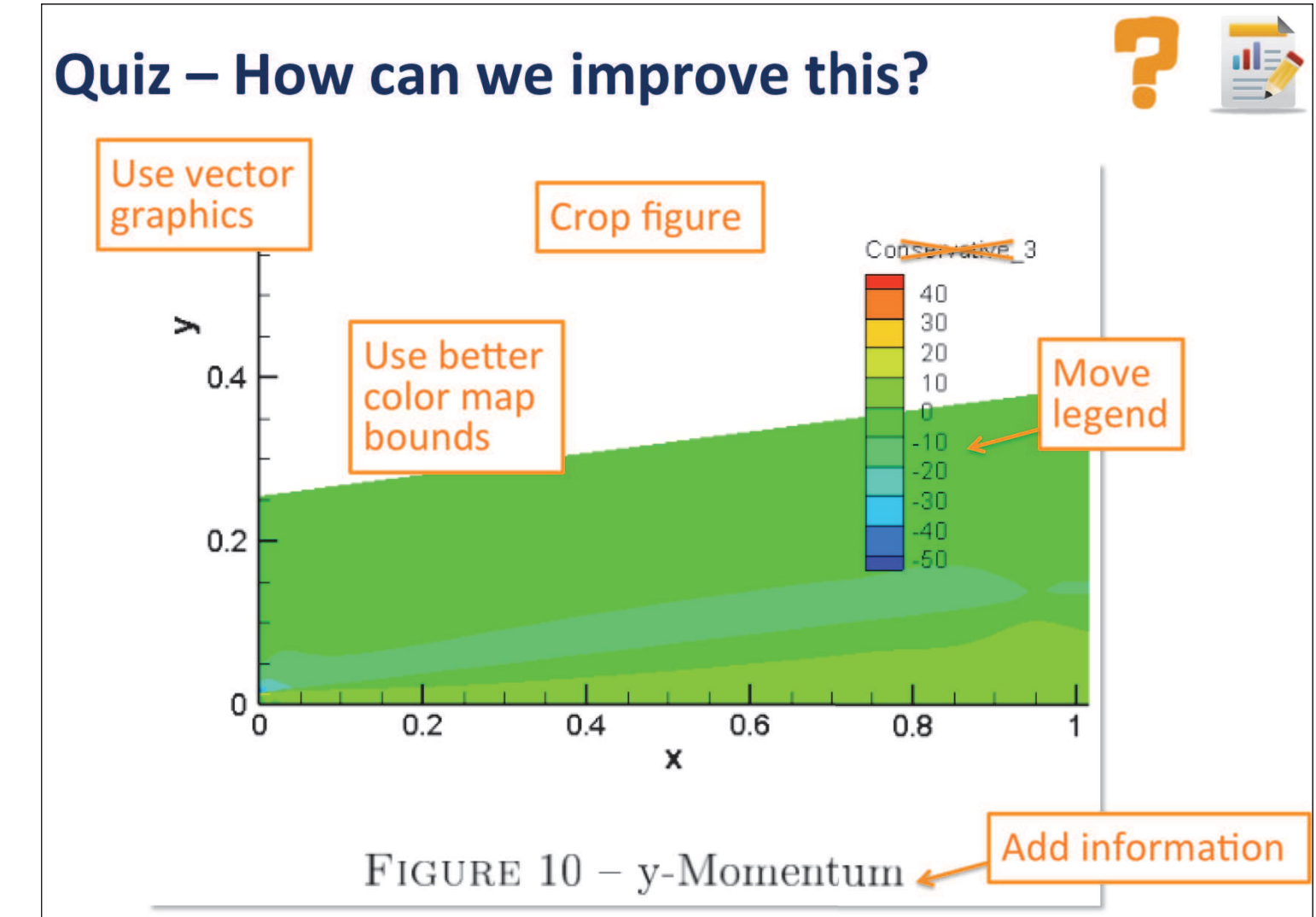


FIGURE 10 – y-Momentum

Quiz – How can we improve this?



Quiz – How can we improve this?

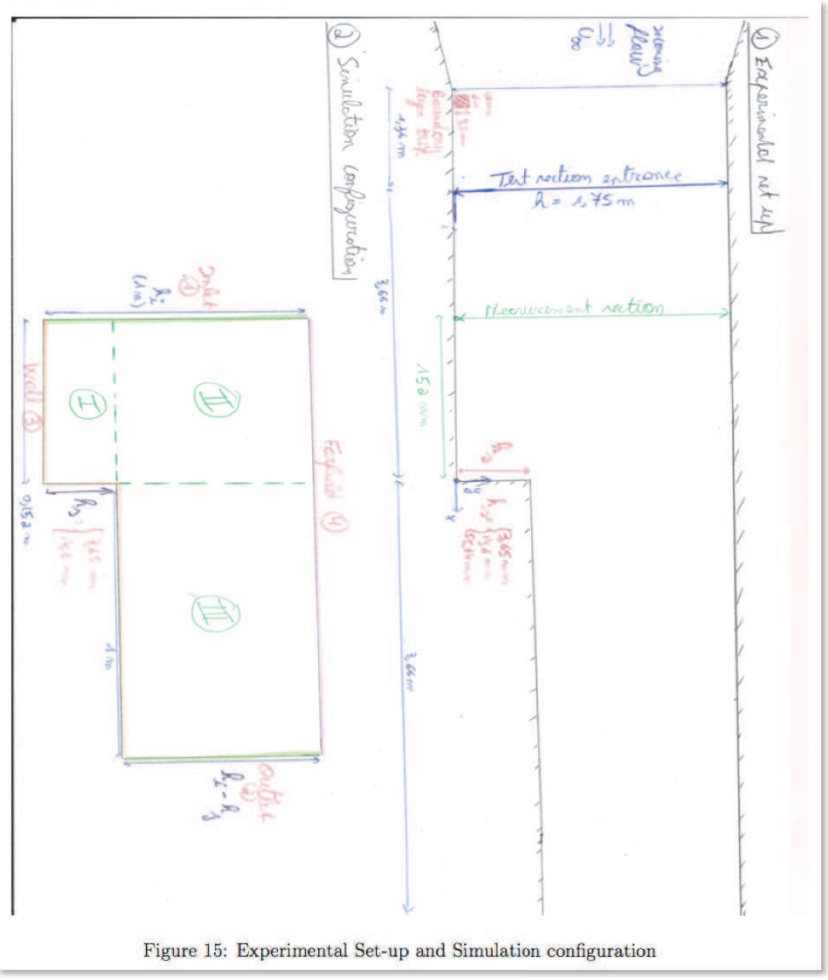
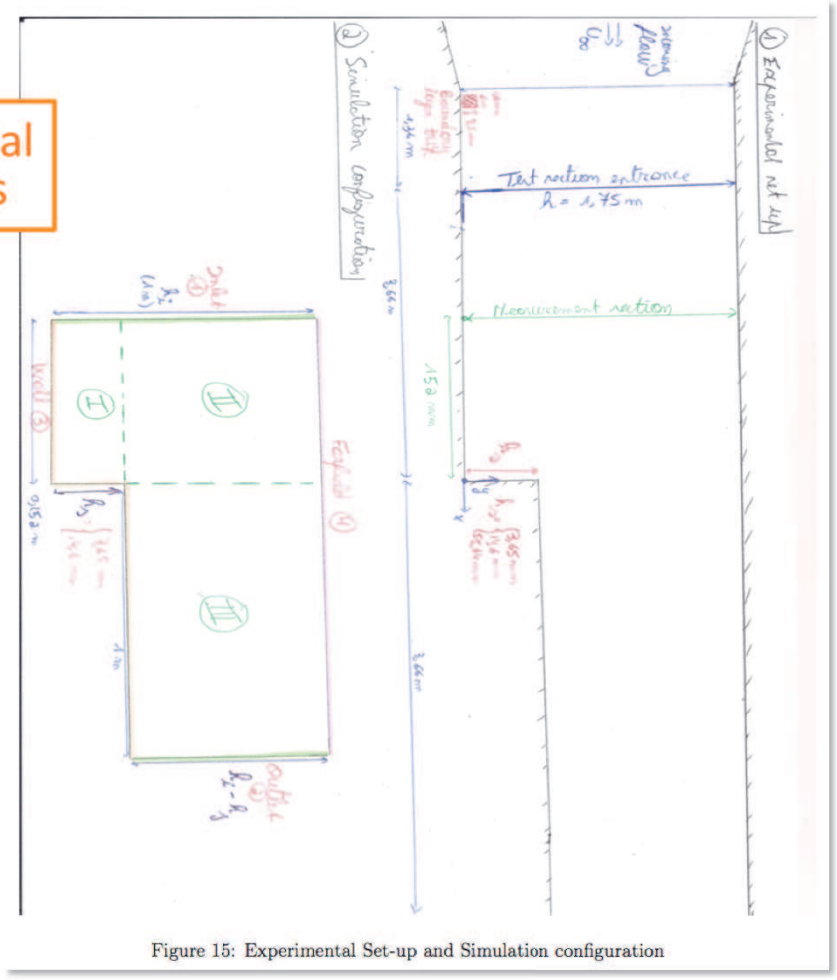


Figure 15: Experimental Set-up and Simulation configuration

Quiz – How can we improve this?

Make digital schematics



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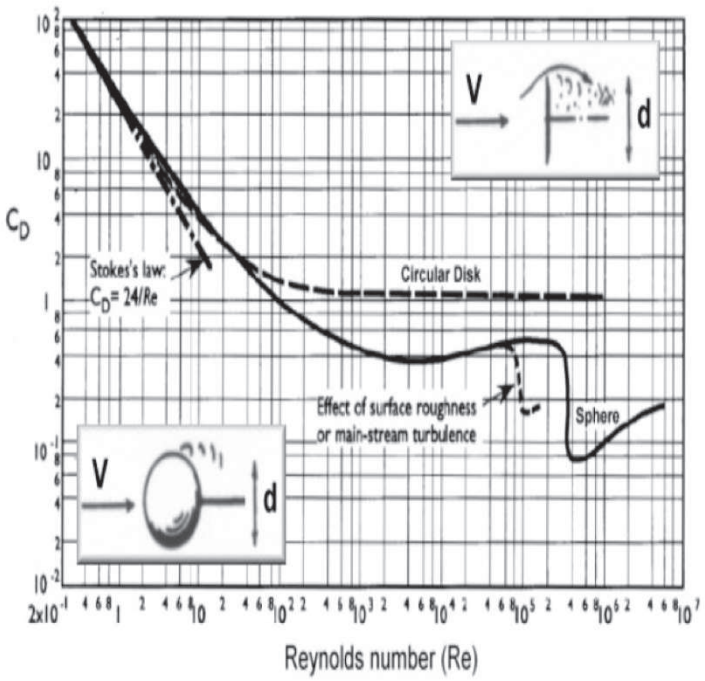
Quiz – How can we improve this?



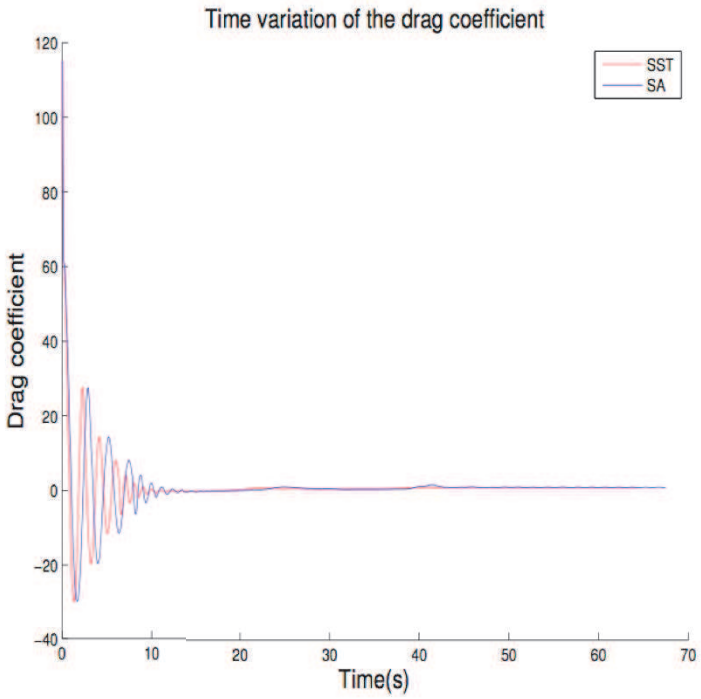
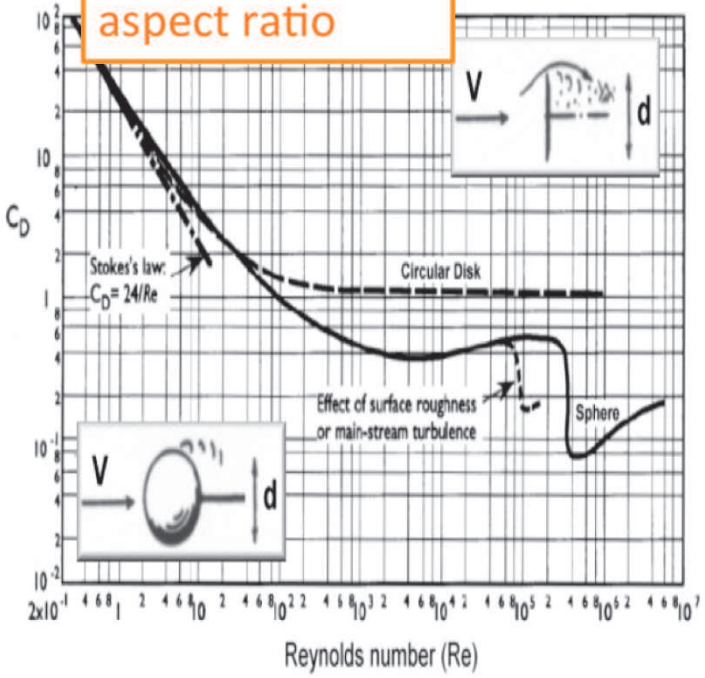
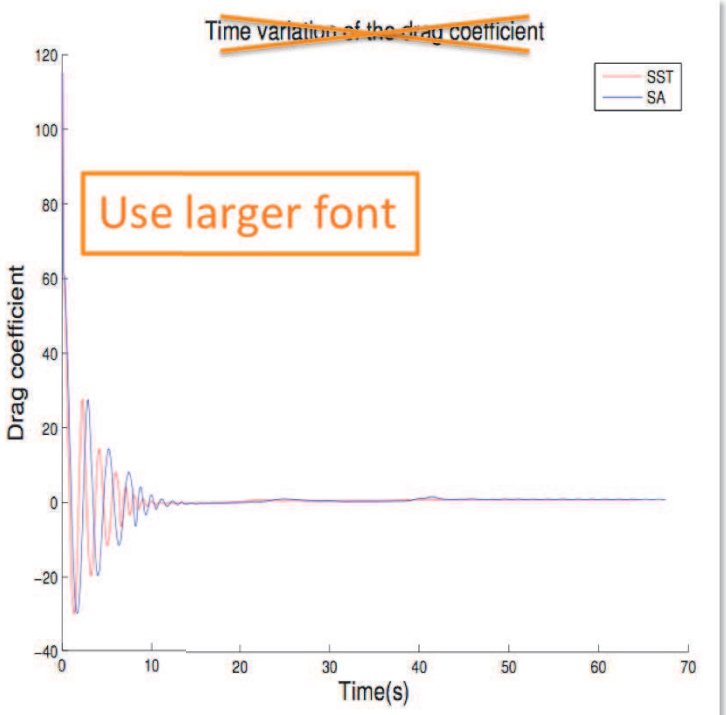


Figure 8: Time variation of the drag coefficients for both models

Quiz – How can we improve this?

Keep the correct aspect ratio





Use larger font

Figure 8: Time variation of the drag coefficients for both models

Add citation

Use 2 figures with a caption for each

Quiz – How can we improve this?

5.4.2 Uncertainties on other parameters

Parameters that can introduce uncertainties in our results can be multiples. We will overview here briefly some of them.

- Δp in the pressure channel is supposed to be constant during one dripping regime. However, it appears to slightly change during an experiment. This will introduce an error in the R_{tot} computed, as $R_tot = \Delta p/Q$. This could be the reason for the "inverse slope" in the result for the fitting for video 10.
- Droplet length L_d is supposed to be constant during one dripping regime too. We saw in section 5.1 that it can be true in a first approximation, but assuming this can lead to errors when computing resistances.
- We supposed that the resistance per unit length of the four channels were the same. However, there is always manufacturing defects (roughness, irregularities, etc).

Quiz – How can we improve this?

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- We supposed that the resistance per unit length of the four channels were the same. However, there is always manufacturing defects (roughness, irregularities, etc).

Add quantification / estimation of these uncertainties!
Assess whether these errors significantly affect the results.