

Teaching and Research at the University of Sydney

Philip Leong 梁恆惠

philip.leong@sydney.edu.au

School of Electrical and Information Engineering



THE UNIVERSITY OF
SYDNEY



Overview

- Introduction to USyd and 2+2 Programme
- Research in my lab
- How to write a report

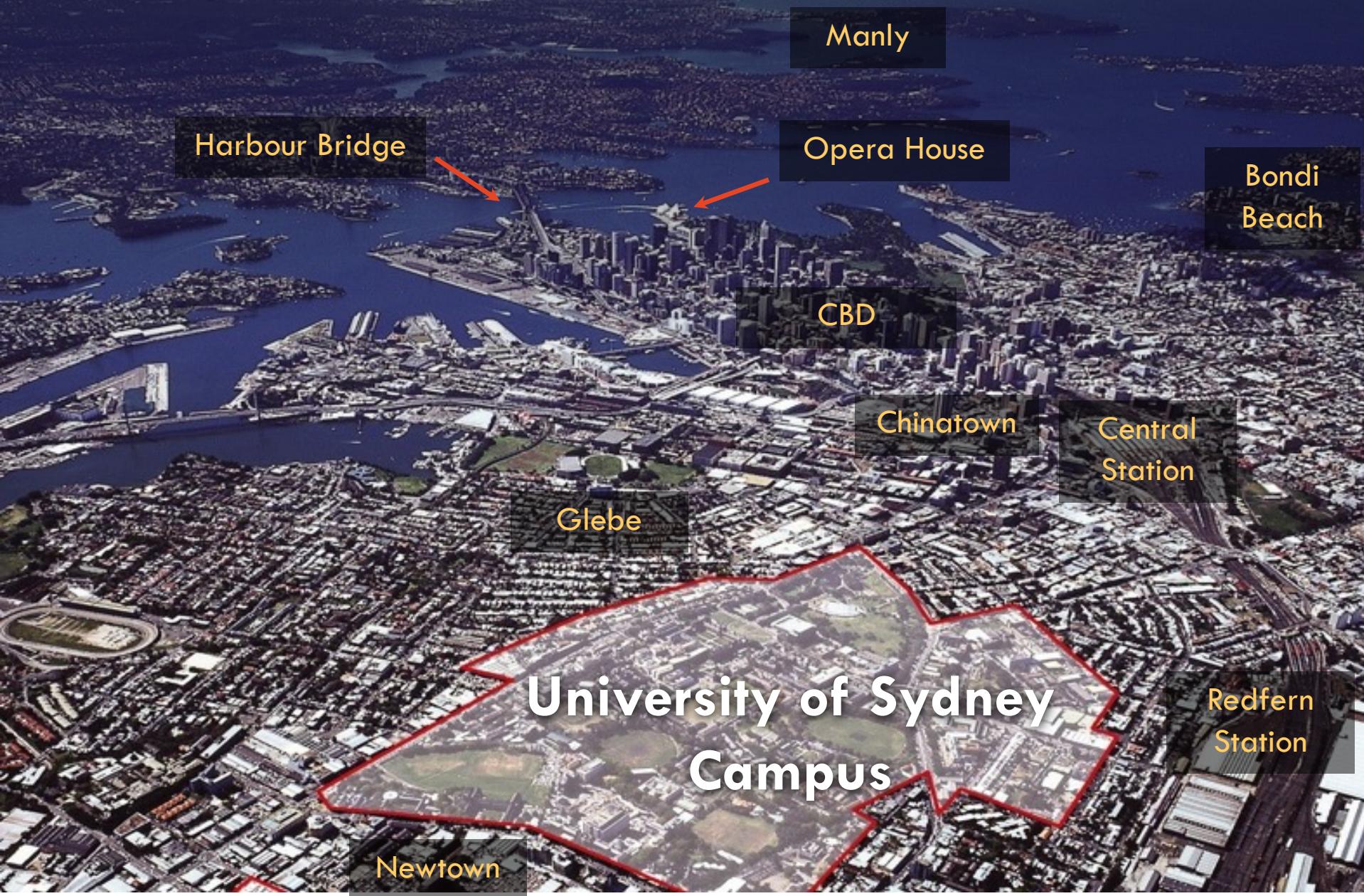




“Sydney is the 9th most desirable destination in the world for international students”

-- 2018 QS Best Student Cities Index

In the heart of Sydney - near everything the city has to offer

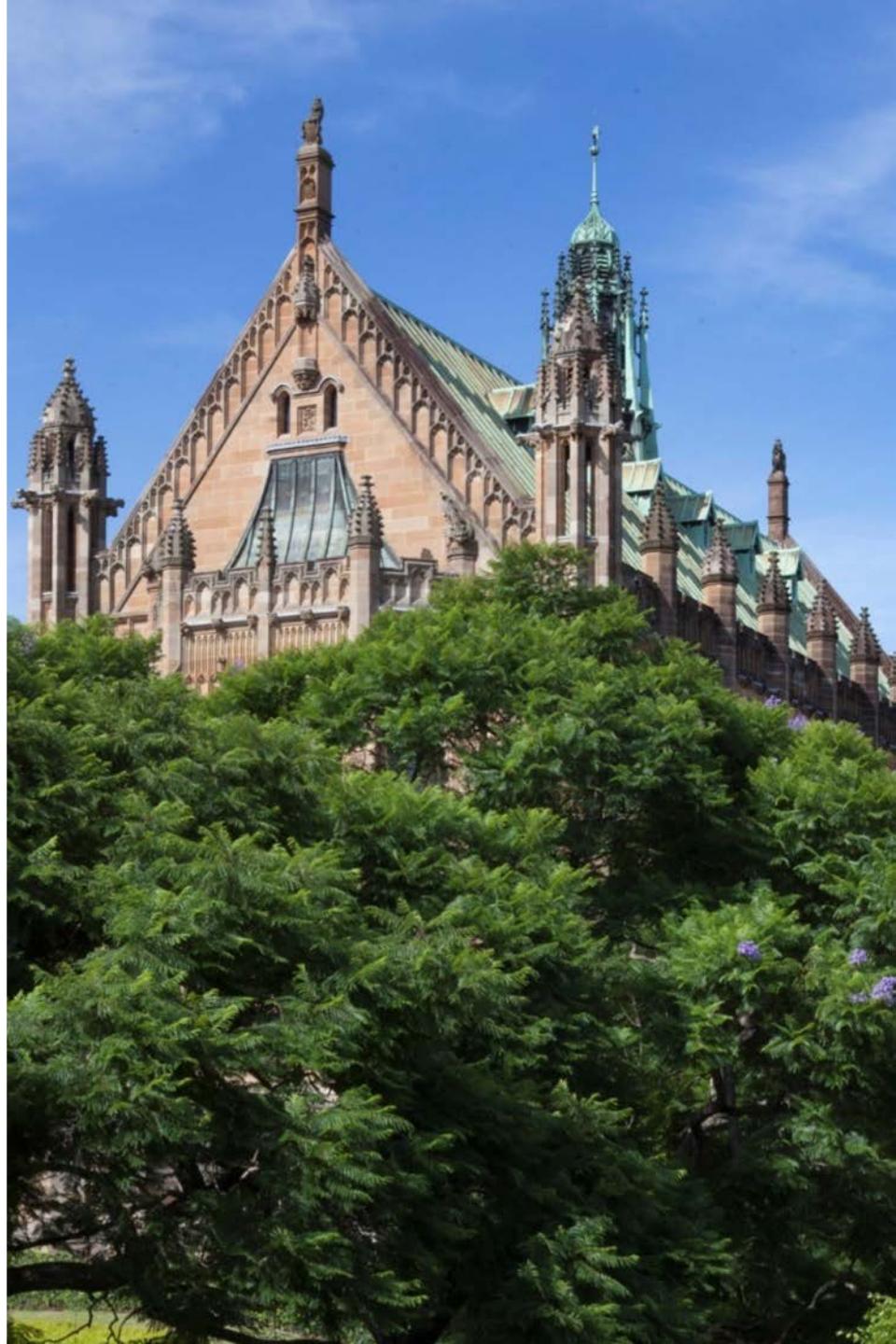


Faculty of Engineering & IT

Australia's oldest engineering school
founded in **1920**:

- 5176 undergraduates
- 2109 postgraduates
- 615 PhD students
- 50% of students international
- 430 staff

We've taught notable alumni
including John Bradfield, designer of
the Sydney Harbour Bridge and
Matt Barrie, CEO of Freelancer



Why study with us?

**1st in Australia
& 4th in the
world for
graduate
employability¹**

**1st in Australia
& 28th globally
for research
innovation²**



Connect with a
**network of over
1200**
engineering,
technology &
government
organisations



More than **double
the national
average of
women** are
studying engineering
& technology with us

**#1 in Australia
for student
experience³**

**\$10 million in
scholarships
offered every
year⁵**

**Top 3
universities in
Australia for
Engineering &
Technology⁴**



**ENGINEERS
AUSTRALIA**

1 QS Graduate Employability Rankings 2017
2 Thomson Reuters' Top 75: Asia's Most 3 Innovative Universities 2016
3 National Union of Students Quality Survey 2010, 2011, 2013, 2015
4 QS World University Rankings 2016–17

Our Sydney Lunabotics team travelled to the Kennedy Space Center to compete in the **NASA Lunabotics Mining Competition**



Rory Green is completing a semester of his degree on **exchange** at Imperial College London

Students undertaking a humanitarian-aid project, **Water for Life Peru**, as part of their Engineering (Civil) honours degree.

Global Opportunities

- Field trips to developing parts of the world, exciting global projects but also opportunities in rural and remote Australia
- International professional placements
- Short term programs
- Semester & year long exchanges with more than 300 partner universities worldwide



Why study with us? > Leadership

Leadership development: The Student Leadership Academy

- Led by students for students
- Collaborate with others from diverse discipline backgrounds
- Leadership development to complement the expertise and knowledge you will gain through your degree
- Insights from industry through guest speaker events, workshops, projects and competitions.

Why choose USYD?

The primary inventor of two technologies that led to significant areas of application and start-up companies — a FFT chip that led to Lake Technologies and the 802.11a/g wireless LAN, where he solved problems considered intractable by the major companies in the space globally.



Dr John O'Sullivan
B.E., PhD (1974)
Department of Electrical
Engineering
The University of Sydney

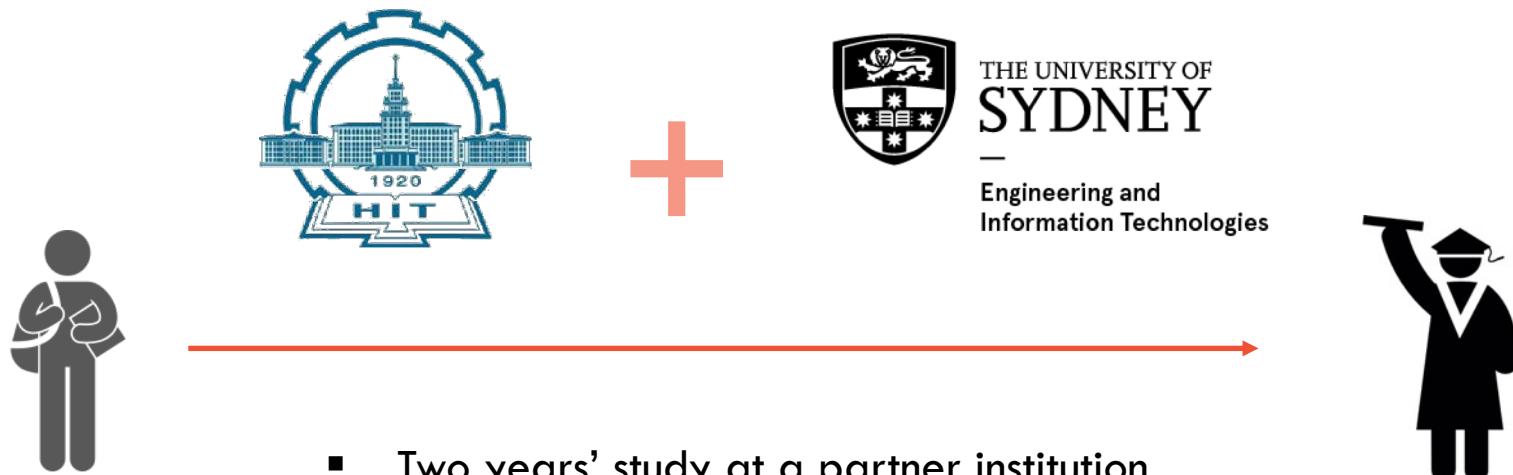
Bachelor of Engineering (Honours)

Clearest pathways, widest choice:

- simply entry pathways
- ability to tailor your degree with **24** majors
- Based on your bachelors degree at HIT, you have flexibility to choose combinations of specialist majors
 - *Computer Engineering*
 - *Internet of Things*
 - *Power*
 - *Telecommunication*
- option to broaden career options even further by combining your degree with studies in arts, law, architecture, science, commerce, music or medical science.



USYD 2+2 Credit Recognition Agreement Program



- Two years' study at a partner institution
- Two years' study at the Faculty of
Engineering and IT, University of Sydney

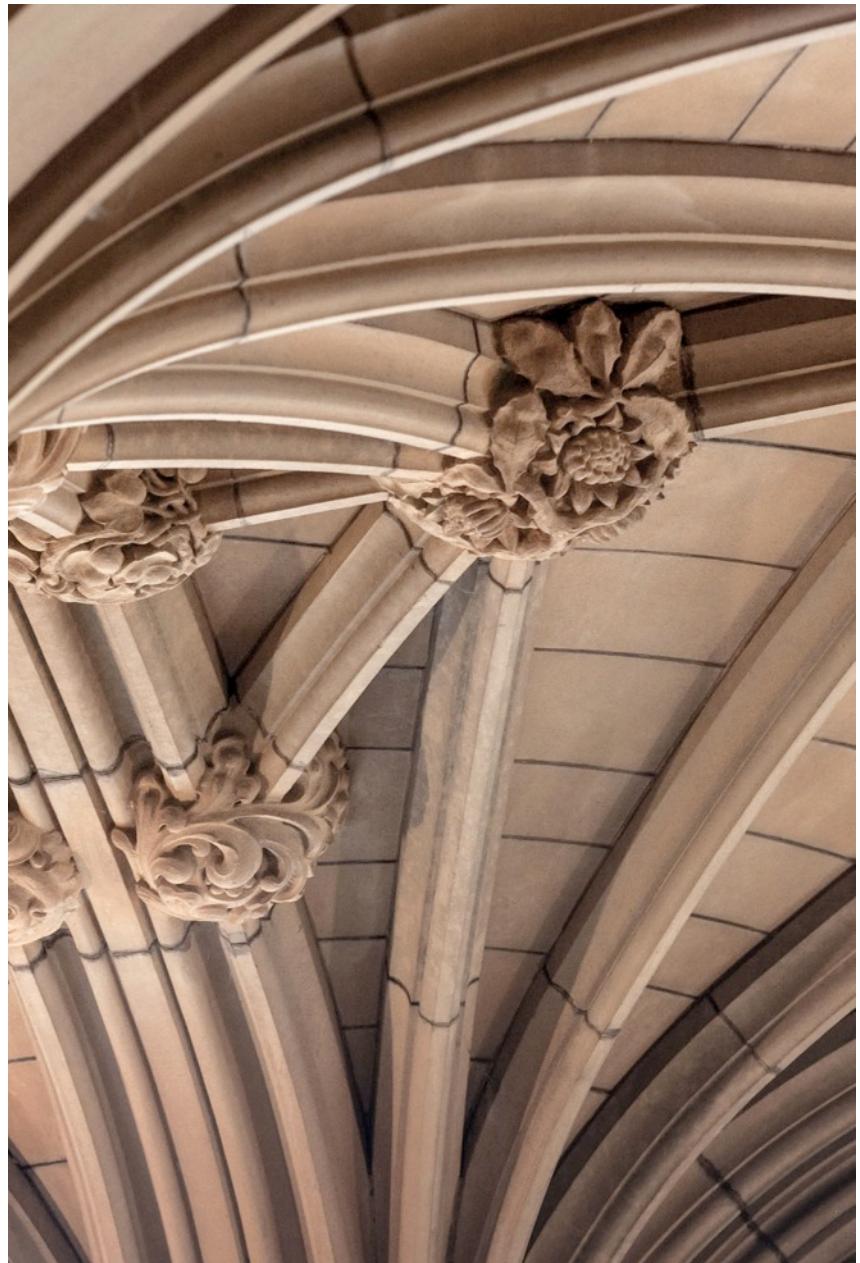
Credit Recognition Agreement Scholarship with HIT

Eligibility

- Enrol in the USYD 2+2 program degree at HIT or HIT (Weihai)
- Achieve a weighted average mark (WAM) higher than 75% in the first two years' study
- Maintain a WAM higher than 65% while studying at USYD in the final two years

Amount

\$5,000 Australian dollars per annum during the final two years studying at USYD



Master of Professional Engineering (MPE)

- Courswork degree accredited by Engineers Australia and recognized globally
- 3 year full time program for:
 - Students who do not have an Engineering degree
 - Students who have an engineering degree but would like to move to a different engineering discipline
- MPE (Accelerated) is a 2 year version for applicants with an undergraduate engineering degree who want to obtain an Australian accredited degree in a related field of engineering



- Aerospace
- Biomedical
- Chemical & Biomolecular
- Civil
- Electrical
- Fluids
- Geomechanical
- Mechanical
- Power
- Software
- Structural
- Telecommunications



Postgraduate Research Degrees

Master of Philosophy (MPhil)

- 1-2 years full time
- Research that makes original contribution to the field
- Submission of a thesis
- Good entry point for PhD

Doctor of Philosophy (PhD)

- 3-4 years full time
- Research that makes substantial and original contribution to the field
- Publish papers and attend conferences
- Complete extensive thesis

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Computer Engineering Laboratory

- Focuses on how to use parallelism to solve demanding problems
 - Novel architectures, applications and design techniques using VLSI, FPGA and parallel computing technology
- Research
 - Reconfigurable computing
 - Machine learning
 - Nanoscale interfaces
- Collaborations
 - Intel/Altera
 - Xilinx
 - Exablaze
 - DST Group



Reconfigurable Computing

- FPGAs offer an Energy, Parallelism, Integration and Customisation (EPIC) advantage
 - Developing hardware-friendly machine learning (ML) algorithms on FPGAs

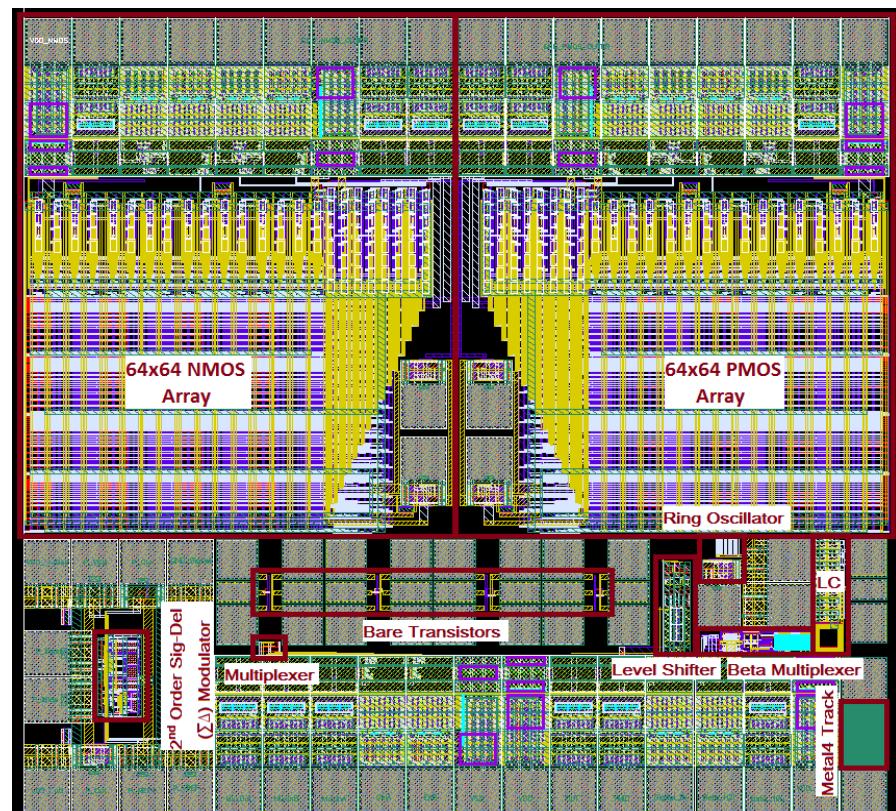


Applying ML to radio-frequency signals

Cool Transistors (0.35 μ CMOS C35B4C3)

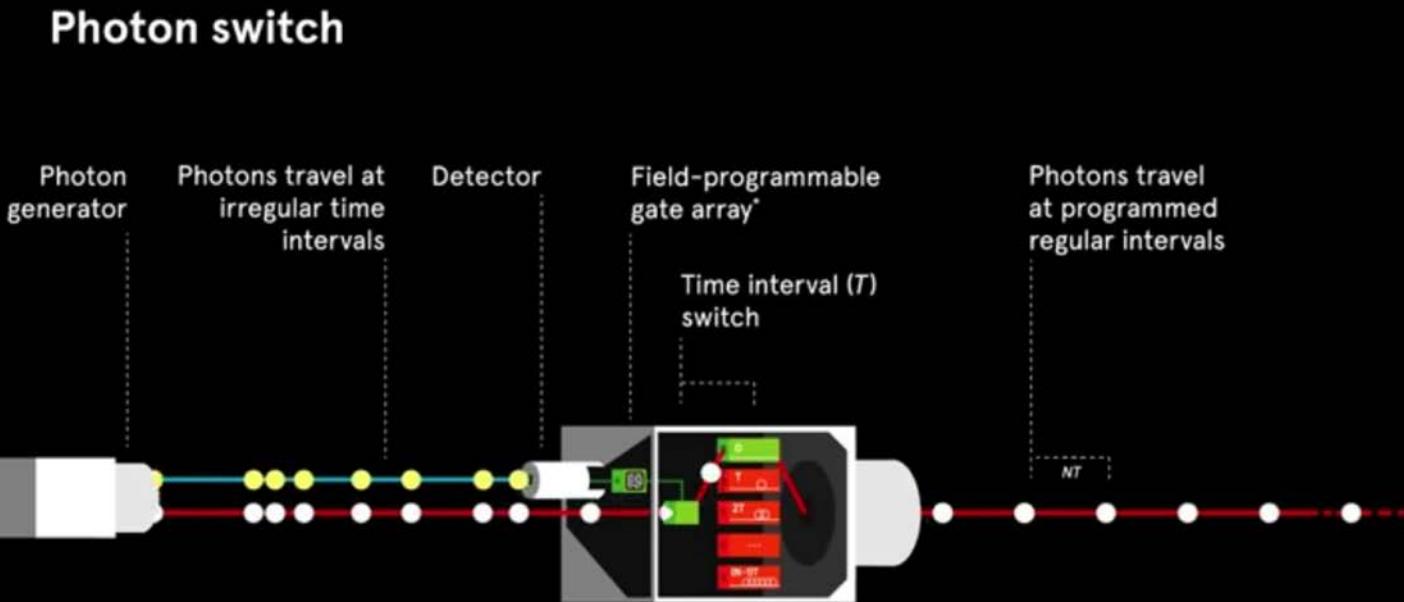
Purposes:

- To characterize CMOS transistors
- Evaluate matching property of CMOS transistors
- Test analog circuits: ADC, Level Shifter, Ring Oscillator, Beta Multiplier, Passive LC circuit, Metal tracks, ...



Layout of QNL2_CMOS

Time Multiplexing of Single Photons



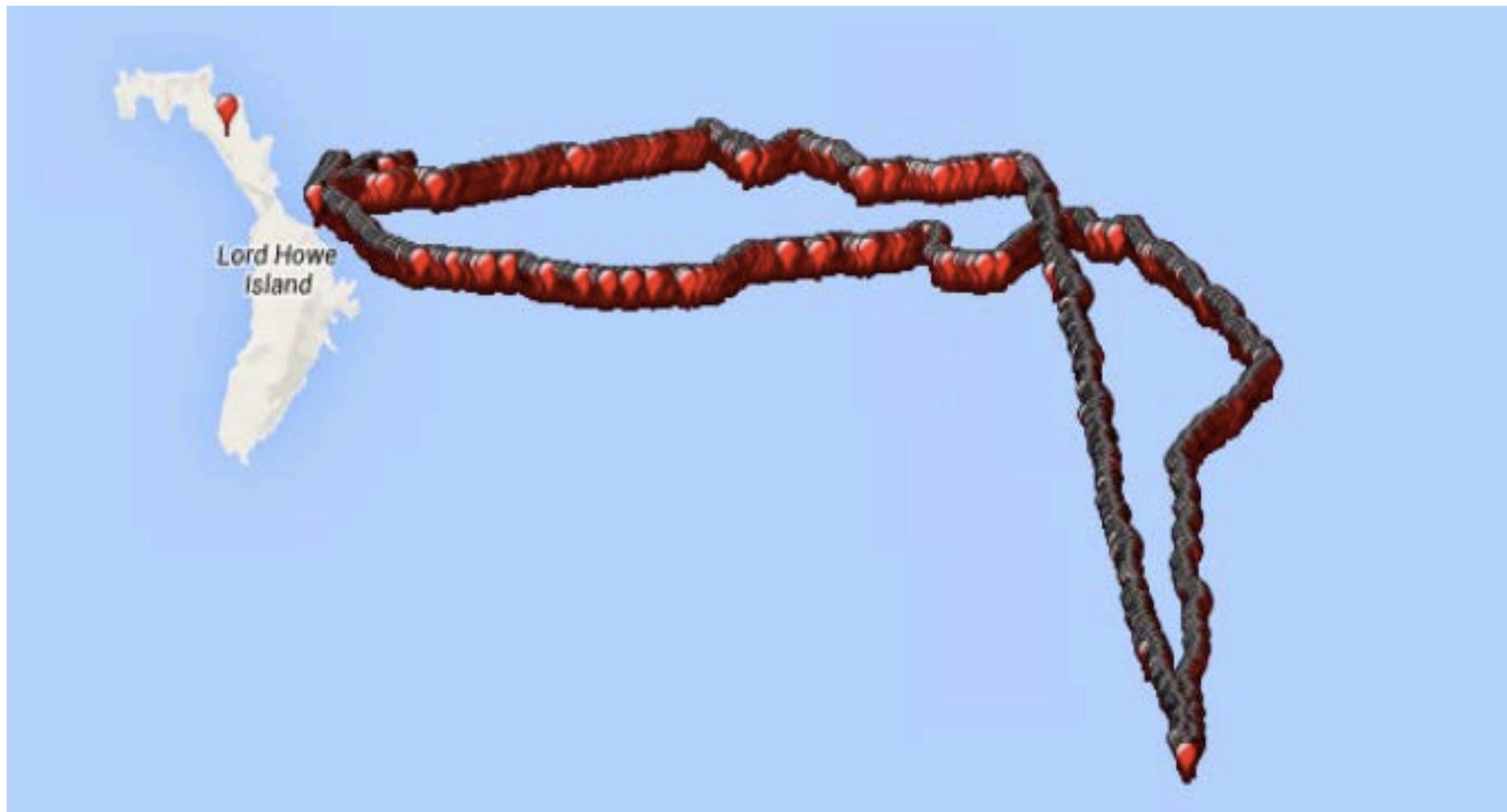
Tracking Masked Boobies (*Sula dactylatra*)

- We developed first device capable of recording 20 hours of continuous video and used it to record masked boobies (alas, no GPS)
- Develop improved low-power video+GPS using microcontroller
- Understand nutrition of animals in wild



GPS Tracking

Nobody had recorded entire flight path of masked booby (nutritional data)



Masked Booby Diving



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Importance of Writing

- Writing is the single most important skill for your career
- Like everything requires lots of practise
- Helps
 - Clarify and communicate your ideas
 - Get what you want e.g. complain, admitted, job, girlfriend/boyfriend
- Focus on writing a technical report, research article, thesis
 - Abstract
 - Ch1 Introduction
 - Ch 2 Background
 - Ch 3-X The idea
 - Ch X+1 Results
 - Ch X + 2 Conclusion

Abstract / Introduction

- Abstract needs to give problem, approach, solution and summarize results
- First think about the story you want to tell and stay on point
- Suggested structure
 - Introductory comment about why this article is timely
 - Motivation and aims, what problem are we trying to solve and why is it important? What is the key insight that differentiates this from past work.
 - Contributions, what have you done to advance knowledge in this area
 - Good to use words like “first” and “best”
 - Make this a bulleted list, possibly with references to sections where they are found
 - Optionally explain how the rest of the paper is organized

Background

- Introduce all terminology, mathematical symbols and concepts the reader might not know
 - To do this you need to understand your audience
- Summarize all relevant previous work
 - An afternoon in the library can save a year in the lab
 - A good researcher knows who are the key researchers in their area, what they have done, what problems are yet to be solved
- Put your work in context
 - Explain how the work in your paper is different to previously published works

Middle Parts

- Explain your approach and ideas
 - Use figures in the introductory sections to set scene
 - Worry a lot about whether the reader will understand (this is the most common problem)
- Talk about methodology
- Think about what is important and what is not
- **Think about how you present your work in the most general manner so it is applicable to a wider audience**

Results

- Explain how the results were obtained
- Compare with other works
 - This is crucial unless this is the very first work in the area
 - Even if it is the first work, there must be something you can compare with
 - If your work is better
- Distill the results into easily digestible graphs and tables
 - Use graphs to compare things, tables to convey several different measurements
 - Do not include everything you've ever done, just what is necessary to tell story
- Interpret the results
 - Do they address the aims?
- Try to make your results repeatable or at least possible to compare against
 - Standard benchmarks, standard datasets, open source

Conclusion

- This needs to be different to the abstract and introduction
 - Can summarize main findings but do not repeat anything
- Synthesize the results and work and give big picture significance of your work

General Comments

- Learn from good writers
 - Study papers you think are good and ask why
 - Review papers to learn what is good and bad
- Be concise ask whether every word/sentence/subsection/section serves a purpose (delete those that don't)
- Improve your vocabulary as words are the basis for writing
- Be consistent in notation and terminology
- **Be critical, take a step back and objectively ask yourself if it is a good paper**
- Avoiding common mistakes
 - Use a spelling checker
 - Don't report measurements to more significant digits than necessary
 - Make sure references are cited properly
 - Don't use first person
 - Figures should be viewable in B&W or color and fonts should not be too small to read

Thank you!



Philip Leong 梁恆惠 (philip.leong@sydney.edu.au)
<http://phwl.org/talks>