ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

University of Waterloo

Academic Exchange to EPFL **October 2005 – October 2006**

Benjamin James Sanders **bsanders@uwaterloo.ca** **3B & 4A Electrical**

(this report is a supplement to my Work Term Report from CERN which, together, satisfy GENE303)

The Hardest Part:

The hardest part about an academic exchange is actually committing to go. The paperwork may seem daunting, the distance and time away a challenging leap, but it will be the pinnacle learning experience of your undergraduate degree. It certainly was for me. Those who choose to stay home ultimately miss what I feel is an entirely new dimension to the academic pursuit. It will not only enrich the scholastic portion of your work, but also expand and diversify your approach to life. Make the choice now to go. You'll look back and wonder why you ever gave it a second thought.

The purpose of this report is to give you some general background on my exchange experience at Ecole Polytechnique Fédérale de Lausanne (EPFL) in Lausanne, Switzerland. My goal is to help you paddle through some of the boggy details, share some of my own experience and hopefully make your transition a more comfortable one. But this is only a broad level report.

One external resource you should not overlook is a handy document distributed by EPFL to its incoming exchange students:

- http://www.epfl.ch/soc/mobilite/PDF/SOC_guide_broch.pdf

Throughout my report, I will point you to other valuable sources where you can find helpful links and additional detail; but rather than simply repeating them here in the same form, I hope to give you a more personal perspective on my own specific experience. Here we go.

Why Switzerland:

Growing up in Winnipeg, I had never really known a mountainous life. So after narrowing my choice to Europe, the decision wasn't very hard at all. First and foremost, I was drawn to the Alps. But there were many reasons for which I found EPFL extremely appealing. One important element for me was French. Lausanne is located in the French side of Switzerland. I hadn't used French much since coming to Waterloo and was looking for a way to jump back in. It can be intimidating to pick a foreign location *and* compound that with a new linguistic environment too, but if you want to maximize the experience, do both. Switzerland's central location, right smack in the middle of mainland Europe, was another winning attribute. School must be the primary focus of your exchange, but you would be missing out if you did not also take some time to travel and explore along the way.

Bordering five countries, Switzerland stands out visibly as one of the few non-members of the European Union. It maintains its own currency even as the Euro has clearly become the dominant economic medium throughout most other countries on the continent. This neutrality is also the reason Switzerland hosts many international headquarters. The United Nations, the World Health

Organization, the World Trade Organization, the International Olympic Committee, etc. These are but a few of the numerous examples.

Strategically placed amidst the Alps, its natural beauty is crisp and serene. Even today there are still entire towns accessible only by rail. The government is quite de-centralized and each of the 26 cantons governs its own police force and regulates the majority of local affairs. The mountains have also been strategically important throughout its history. I was surprised to learn that Switzerland has the largest army (per capita) in the world. But outside of initial training, there are no active troops serving anywhere in the world (other than symbolically at the Vatican in Rome). Nonetheless, after performing their mandatory military training/service, all men are urged to keep their firearm at home. Most old buildings are also equipped with nuclear bunkers in the basement and I once heard that there is enough collective space to protect every citizen against such an attack. It is no wonder why historically, Switzerland has been and continues to be regarded as such a safe and neutral site.

Why EPFL:

I was also looking for a really challenging school. In that respect, EPFL certainly jumped out. It is consistently ranked as one of Europe's top 10 universities and is often placed among the world's top 35. Like Waterloo, EPFL is younger than many of its neighbouring schools but what it may lack in history, this Swiss powerhouse certainly makes up for in innovative spirit – and then some! I was particularly intrigued by three specific projects: the solar-plane being designed to circumnavigate the globe, the Blue Brain project aimed at mapping a 3D electronic model of the mammalian brain, and CERN (a project not officially linked to the school but one which was not too far away).

The Solar Impulse project has caught a great deal of international attention already and the final product is still years away. Bertrand Piccard, the first man to fly non-stop around the world in a hot air balloon is hoping he's new project will perform the same feat. This time the vehicle will be an airplane powered entirely by the sun. I was able to tag up with the team at EPFL and work on the project in my spare time.

- http://solar-impulse.epfl.ch/

I was also able to pick up some paid work in a medical lab on campus which was totally cool. Working with the Blue Brain project team, I took thinly-sliced specimen from rat brains, used a powerful microscope to isolate individual neurons and used special software to trace a 3-dimentional digital map of the cell's structure on a computer. The resulting data were handed over to technicians who compiled hundreds of these samples in a special IBM supercomputer (at the time it was one of the 10 fastest in the world) which interpreted variances among the sampled cells, generated a plethora of new

ones with uniquely defined alterations so as to mimic the actual differences one would find if tens of thousands of these cells were actually all traced by hand, and then compiles everything together with the hope of building a digital model of the neural cortex. Pretty wild stuff!

- http://bluebrain.epfl.ch/

And finally, I was able to secure a summer co-op at CERN, home of the world's largest particle physics laboratory. Here's the link (more details later):

- http://www.cern.ch/

EPFL has quite a large exchange program. They usually receive more than 350 new exchange students every year. Figure 1 shows the breakdown for 2004-05.

As you can see, Canada represents a significant slice and you will surely meet other Canadians while there. Outside of Waterloo, most of them are studying in Quebec, but I did meet one or two from schools out West. The Quebec accent will surely standout and many assume you'll have it too.

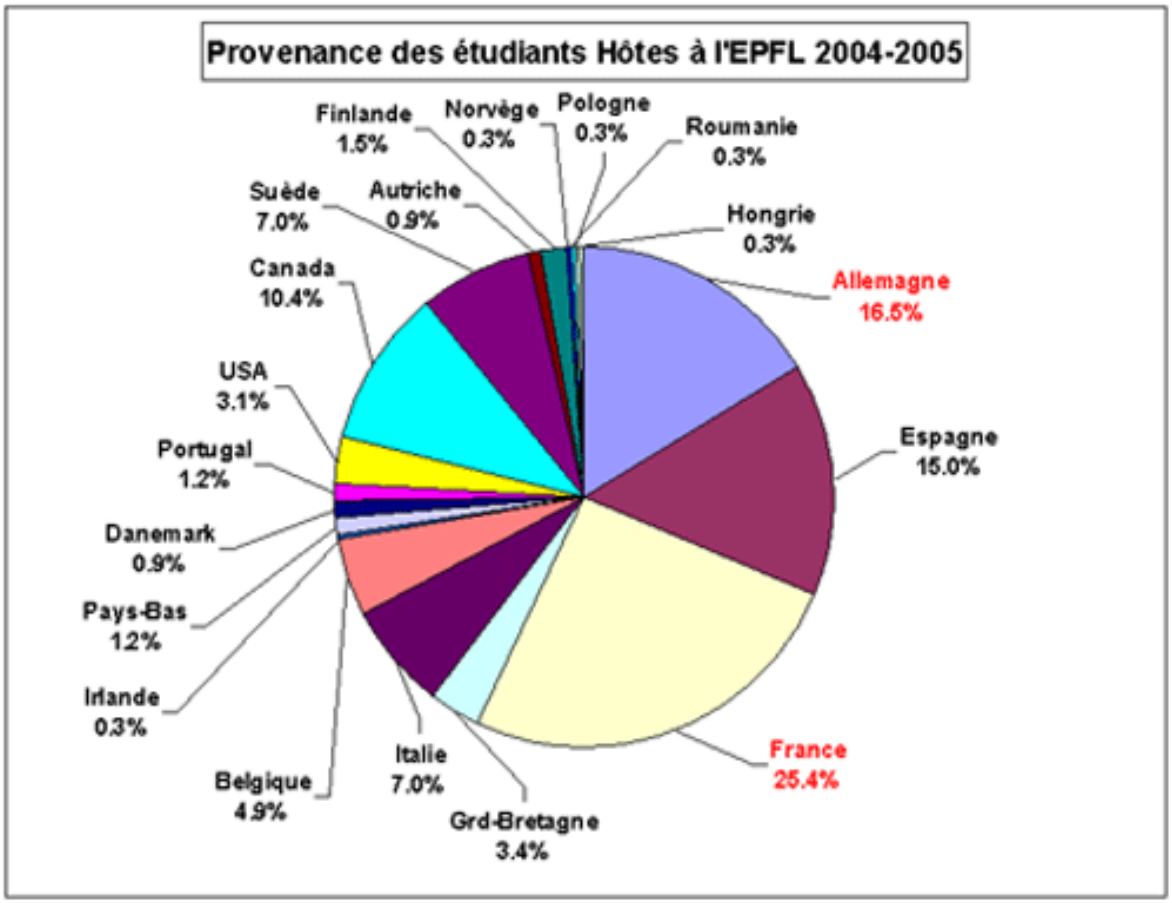


Figure 1: Exchange student origin by home country, 2004-2005.

Getting In:

While the Swiss are known for their punctuality and efficiency, their bureaucracy is just as bloated as anywhere else. Getting into the school is one thing, but securing your student visa paperwork can be a headache on its own.

As is mentioned later in this report, EPFL must receive your academic application by April 1st. For this part, though, I will focus more on getting into the country. In fact, getting in isn't terribly hard, but you need to prepare all the paperwork so that, once there, you can stay. Here are the steps:

- Obtain a temporary permit at the General Consulate of Switzerland in Toronto. They will need your passport and the appropriate paperwork. Once approved, you will receive a colourful sticker in your passport. Most Canadian tourists or other travelers can enter Switzerland without this and legally stay for up to 3 months, but you'll need this sticker to stay any longer. You'll have to pay for this sticker in Canada.

http://www.eda.admin.ch/eda/en/home/reps/nameri/vcan/cantor.html

- Now the sticker only gets you in the door. Upon arrival (and within your 8 days) you will need to present yourself to the local "Commune de Résidence" and apply for a more permanent visa (permit B). Bring with your passport, 2 photos, your proof of entry to EPFL and some recent bank statements or a letter from your parents explicitly proving that you have enough money in order to stay (a minimum of 1600 CHF per month is required). You'll have to pay again for this next document, the "Permit B," in Switzerland and you likely won't receive it for 4-6 weeks.

Academic:

One of the biggest adjustments for me was EPFL's academic evaluation process. Most classes involved fewer labs and a lower number of official assignments, but don't mistake this for a lighter load. The education style demands a much greater autonomy from its students.

What may really surprise you though are the 100%, 15-minute, oral (in French) final exams. Often they work like this:

- You schedule a time in accordance with the other students in the class.
- While the student before you presents, you are invited into the empty classroom and asked to draw a card from a deck.
- This card will randomly generate your specific question.
- Often the question has two parts: one is more numerical and involves calculations while the other will be more conceptual in nature.
- You have 15 minutes to prepare your answer and then 15 minutes to present. The audience comprises only your professor and a witness.

- The trick is that with an oral exam, they can really tell whether or not you know the material.
- Keep in mind that the excuse, "I was prepared for everything but that question," won't fly.
- In general, I enjoyed this format more. It more adequately measures what you have learned, not just what you can reproduce. Be confident, study hard and you should be fine.

Residence:

This can make or break your experience. My advice is to secure housing early and try to get a spot in Cèdres. It's easily the best option in terms of price, location and layout. I opted for the apartment style section of Cèdres. It has 5 students to an apartment, each with their own private room but a common kitchen and two washrooms. The equivalent here at UW would be something close to Mackenzie King Village. Unlike Waterloo, EPFL does not currently offer much in the way of on campus housing. There are no dorm rooms. Instead, they are affiliated with an external group, FMEL, which operates a number of off-campus apartment-style sites. As they are all filled with students, you can essentially think of them as residences, but simply spread throughout the city. While there are many options to choose from, places are limited and you will not be guaranteed a place. Book early (I would encourage you to begin in January if you intend to begin studying that September) and call often (they usually won't slot you in on the first call, so be persistent and call every month to check-in). Below you'll find the link to FMEL and a more exhaustive comparison between the various residences they offer.

- http://www.fmel.ch (Consult Figure 2 below for their locations)

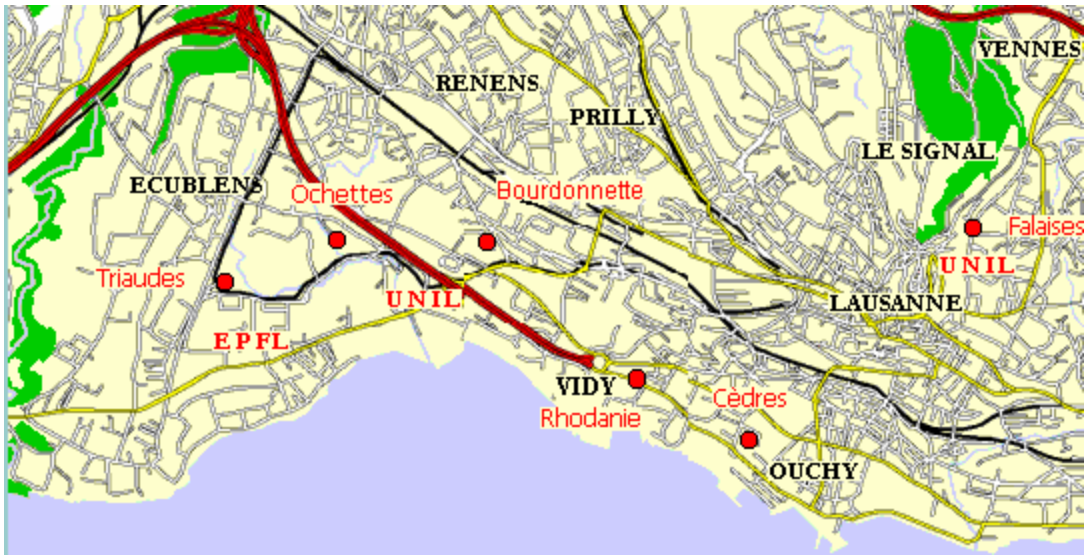


Figure 2: Various off-campus residence options administered by FMEL.

If you're really stuck and can't get in to residence (because you didn't apply early enough) or if you want to find accommodation on your own, here are some other options:

- http://www.epfl.ch/soc/social/logement.html

Living Costs:

I'm sure you've heard the rumours. Well, they're true – almost. Switzerland is notoriously expensive, and while many travellers quickly rack up the bills (hotel and restaurants in particular) I found that living there was surprisingly reasonable. The trick is to get a spot in residence (since it is subsidized) and to bring a cookbook because you'll likely be making most of your food at home. I found that my weekly grocery bill in Switzerland was comparable to my expenses back in Waterloo except for a few key differences. I ate less meat because it is substantially more expensive. Fresh fruit was also a little higher. But the balance certainly came in a heavily cheese and chocolate oriented diet – these items were not only better than anything I'd ever had at home, but at least half the price. The bottom line is you can make it work. I was more frugal and only ate out once a week, choosing instead to keep some extra cash for skiing or weekend trips. Aside from tuition, I spent roughly 450 CHF on rent per month and 200 CHF on food.

Tuition:

While at EPFL you continue to pay Waterloo your full tuition. While this may seem rough since most locals shell out only a fraction of that price and even the Canadians on exchange in Germany get away with local rates, being in Switzerland, and especially in Lausanne, is well worth it. The good news is that EPFL will provide you a cheque to offset some of the tuition costs. I received roughly 3500 CHF over two school terms. Again, these savings helped offset some of the higher costs of food and exploration.

Language:

How's your French? Don't feel that you should shy away entirely from an exchange at EPFL simply because it's not perfect. This is a terrific opportunity to hone your skills. Hopefully you've already learned the basics and if you're feeling rusty, take a few courses in Waterloo before you leave. I was fortunate to grow up bilingual so the transition wasn't too hard for me. My recommendation would be to register for the pre-term French boot camp at EPFL. I didn't do it simply because I felt quite comfortable with my French, but thinking back, it would have been worth it just for the experience alone. Think of it like a two-week frosh session with all the new exchange students. Not only will you have the opportunity to brush up on your linguistic breadth but it's a wonderful way to make some friends and see the town before school picks up. Also, EPFL offers free language lessons throughout the school year. I picked up Italian and German while I was there. Check out the following link:

- http://langues.epfl.ch/

Banking:

Haven't you always wanted a Swiss bank account? Here's your chance. But if you want all the secrecy and Hollywood glamour of a numbered account, then you have to be willing to shell out big bucks. Rest assured, there are a few regular banks which won't feel any different from those back home, but you can still tell your friends that you've opened a Swiss account (which is true because it's in Switzerland!) and they'll never quite know the difference. There are two obvious options: UBC and La Poste (affiliated with the post office). Both offer ATM's on campus. I would recommend opening an account, not just for the novelty, but because it's quite handy. With La Poste, I was able to withdraw money in either Euro or CHF. Since there are post offices in nearly every town, I was always covered. Keep in mind that the card they provide will only allow you to deposit and extract funds directly from the bank. As a temporary visitor, I was unable to get a card which would allow me to pay via Interact (at stores or restaurants). The account setup was fairly straightforward, but you will need some ID and proof of your stay in the country. In fact, I was able to open a bank account long before I could secure a mobile phone.

Cell phone:

While the bank was able to open my account with only my temporary visa (the passport sticker) as proof, the cell phone providers generally demand your formal residency permit (the Permit B which takes 4-6 weeks to process after you arrive). This was a bit of a pain, but I'd highly recommend grabbing a phone plan nonetheless. I went with Orange simply because I had a Blackberry and wanted to use it there, but there are cheaper options so look around. In fact, if you opt for pay-as-you-go rather than a monthly bill, you might not need to show the Permit B. Not many people use the phone, but text messaging is essential and even with all the mountains, there are rarely any areas in Switzerland where you cannot find good coverage.

Paperwork:

Cindy Howe is a lifesaver! As your primary point of contact here in Waterloo, she will help you with all of the paperwork both before you leave and after you get back. Be nice to her – she's your best friend! You can find her in the Engineering First Year office (CPH 1320) or via email: cindy@engmail.uwaterloo.ca.

You will want to apply to EPFL by April 1st for September entrance of the same year. But that means all of your paperwork must be received in EPFL by then. So really, you should be coordinating with Cindy as early as January or February just to be sure.

Cindy's equivalent at EPFL is Eliane Reuille (eliane.reuille@epfl.ch).

- http://www.epfl.ch/soc/mobilite/

Whereas Eliane Reuille is your primary contact for all general aspects of the exchange, likely you will want to coordinate with the main liaison for your specific program or faculty. For those program specific details (anything related to class selections or other specific academic issues), contact your academic correspondent from the following list:

- http://www.epfl.ch/soc/mobilite/ResponsableMob.html

Insurance:

Health insurance is mandatory. Unless you can prove that you are adaequately covered through your insurance plan from home, the "Organe Cantonal de Controle" will require you to opt into their system and it can cost more than 200 CHF per month. Either way you will have to deal with them. I provided a written statement from my Canadian insurance company outlining the extent and amount of my existing coverage and they exempted me from this additional fee. You will also have to pay a small monthly fee for liability insurance (it covers household theft or flooding – things of that nature not covered under your health insurance from home). Additional details for both can be found on the following website:

- http://www.occ.ch

Xchange:

One of the first things you should do upon arrival is tag up with EPFL's student-run group for exchange students. It is amazing! Funded by the school, this club is unlike anything we have here in Waterloo. It's actually so popular that even the local students, those not affiliated with an exchange, often want to tag along. "Xchange" organizes all sorts of social outings, sight-seeing tours, ski trips and other exciting events. There's something going on every week.

- http://esn.epfl.ch

Travel:

Get your homework out of the way during the week so that you can head out exploring on the weekends. You're right in the middle of Europe and there are plenty of fabulous places to see, cultures to experience, foods to taste, etc.

Here are some tips:

Rail:

Get a ½ price card. For 150 CHF this card, good for one-year, will cut your train travel within Switzerland by 50%. The rail network is impressive, but

expensive so this is really a great bargain and you'll quickly cover the one-time fee in future savings. The added bonus is that you can use it to apply for a free RailPlus certificate which then gives you a 25% rebate on most rail service across Europe! Another great option is the "Voie 7". With your ½ price card, you can tack on this option for another 100 CHF. It is probably work purchasing the ½ price card simply to get the Voie 7. How it works is that you can travel anywhere in the country for free after 7pm. I did most of my travelling at night and this opened so many doors. Get it!

- http://www.sbb.ch (click on "Travel" then "Railpasses" for more info)

Flights:

The train will take you directly from Lausanne to Geneva's airport. You can also fly out of Basel to the north or Zurich which is further east. Most of mainland Europe can cram into an area comparable with that of the province of Ontario. Nothing is really all that far away. That's why the low-cost airlines in Europe offer such eye-popping rates. RyanAir is a big one, but they currently do not fly out of Switzerland. EasyJet is your best bet.

- http://www.easyjet.com/

I would also highly recommend using the following site to find great deals. You can identify your preferred departure and/or destination and it will give you the best rates for any number of airlines. Often, since there was so much in Europe to see, I would simply put in Geneva as my departure and see what came up as the cheapest destination on the next particularly weekend. That way I would be sure to find something new, but at the very best rate.

- http://www.skyscanner.net/

Polyathlon:

This was one of the highlights of my trip. I trained for and participated in the Polyathlon – the world's highest Ironman. It consists of a 12km run, archery, 2km swim, 160km cycle, and a 6-8 hour trek up the Alps with snowshoe or special climbing skis. This one-day event was the most physically exhausting experience of my life, but the challenge and inspiration was phenomenal. What a wonderful way to experience Switzerland!

- http://polyathlon.epfl.ch/

When to go:

When I went to Switzerland, their fall schedule began in late October. Essentially the entire school calendar was shifted 2 months later (finishing in June rather than April). Now though they have moved things up by at least a month so you will have to look into it. I went for my 3B and 4A terms. So after

3A, I skipped my co-op and went to Switzerland in the fall. I began my 3B term essentially 2 months earlier than my colleagues back in Waterloo (who were still on co-op and wouldn't begin until January of the following year). When the second school term was over in early July, I began a co-op in Geneva at CERN and worked there for 3 months. Back home, but class was finishing 4A in August (by then I was half-way through my final co-op) and heading out on their final co-op in September. So at the end of the day, I had to skip one of my 6 co-ops to make this work, and it essentially gave me two months off after 3A in Waterloo and 2 months off before 4B back in Waterloo. Ultimately I couldn't have stayed for the second term either had I not made arrangements with my fourth year design team. That's another consideration if you want to go during the same time, but that varies depending on your program so I won't elaborate further. Ultimately the timing can be tricky so be sure your plan will work for you.

Work:

You cannot work in Switzerland before the first 6 months are up and even then you are restricted to no more than 15 hours per week. I picked up some shifts in the cool Blue Brain lab during my second term that not only exposed me to some leading-edge research, but it also helped pay a few bills down the stretch. Here's where I learned that to Swiss people, Switzerland isn't really all that expensive. The reason is that local salaries are considerably higher so even though price tags are larger, most everyone is simply earning more. My minimum-wage lab work paid nearly 20 CHF an hour. Not bad!

Work Term:

As I had mentioned earlier, the final highlight of my experience was working at CERN. Now I can't offer any useful advice on how to get a position there. I kind of lucked out. There is a summer program available to European students but it is generally not directly available to Canadians. My advice would be to contact the Canadian team (led by the University of Toronto) working on ATLAS at CERN and see if you might have some luck that way. It's what I did and it worked. The following is an extract from my CERN Work Term Report.

CERN is the European Organization for Nuclear Research – home of the world's largest particle physics accelerator. While at CERN in Geneva last fall, I worked for the SUSY group in the department responsible for ATLAS, one of the six particle detector experiments being constructed at the new Large Hadron Collider (LHC). CERN represents a consortium of twenty European member states in their collective efforts to investigate some of the world's most puzzling and complex fundamental scientific questions. How was the Universe created? How has it evolved? What are the elemental building blocks of the physical world? More than 2000 physicists from over 30 countries, including Canada, are engaged in experimentation and future development aimed at finding some of the answers. Here scientists use some of the largest, most

complex machines ever built, to detect and analyze the smallest objects in the universe.

While working at CERN, I led the engineering analysis and subsequent development for the improved data management system outlined in this report. The remainder of my time was devoted to the analysis of scientific particle-event simulation. Since the ATLAS detector will not go online until later this year, a labyrinth of preparatory testing was performed with simulated detector output data, which I then used to help improve our interpretive diagnostic tools. This involved a great deal of coding, but I was also active in some hardware installation and testing for early cosmic ray runs.

The LHC is CERN's latest project. Situated 100 metres below the surface of the Earth is a circular tunnel, 27km in circumference, with a tubular cross section just wide enough to squeeze in your car. Its 27 kilometre circumference straddles the border between France and Switzerland. Once fully operational in 2008, it will power a fleet of nearly 1200 superconducting dipole magnets to transmit a narrow beam of charged particles barrelling around the tunnel close to the speed of light. The stream of accelerated particles is in fact a series of approximately 2800 discrete bunches separated by a near vacuum void. These bunches of charged particles will travel around the tunnel in two small tubes — one clockwise and the other counter-clockwise — no larger than the average toilet paper roll. At six points along the tunnel, the tubes will meet. These are the locations of six giant detectors where the protons, each carrying 7 TeV of energy, will collide with the collective force of 14 TeV. Although the proton stream has been focused intensely by the magnets, still only twenty out of billions in each bunch will actually collide head-on. The impact will cause a scattering effect of newly generated particles. The detector must capture this resulting event and offload the data extremely rapidly since the next bunch of protons will arrive in roughly 25 nanoseconds. Thus the information must be captured, saved and moved to an external location so that the buffers can be cleared and prepped for the next incoming collision. If not executed properly, the data is corrupted by overlapping events.

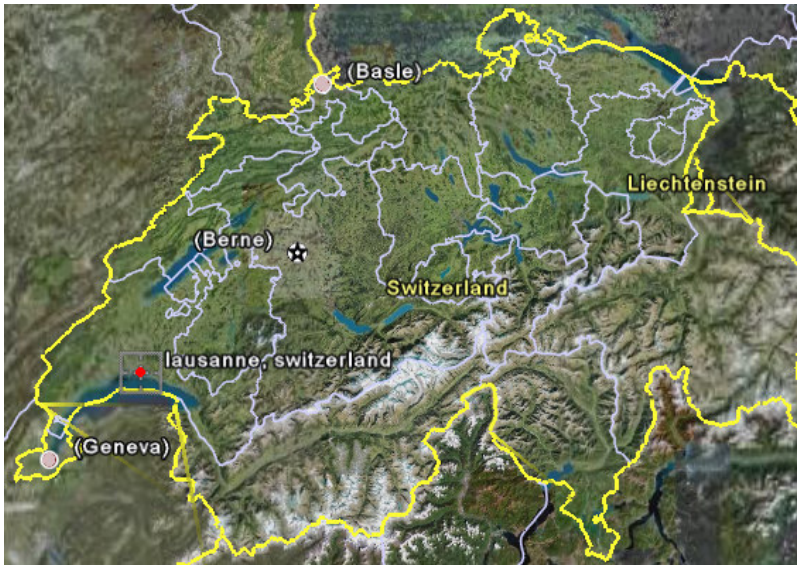
All this produces an extreme amount of information. Once fully operational, the LHC will effectively create 1% of the world's digital data**Error! Reference source not found.**. CERN's scientific research intentions rely heavily on their hardware to perform these operations quickly and on their computational ability to manage the vast amount of incoming information.

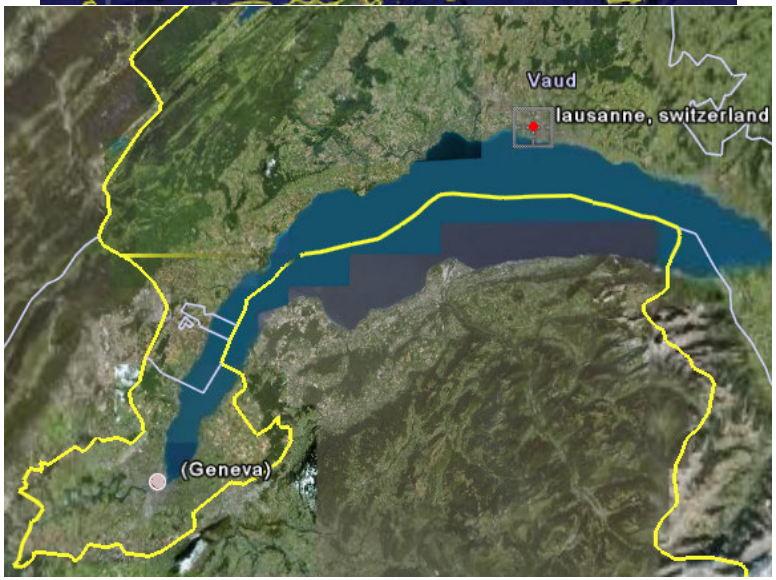
Although the primary focus is on theoretical physics, the nature of such research demands the very latest in data management technology. These computational demands led to such notable creations as the World Wide Web – a project which was designed to help researchers share information collectively. CERN is also leading the way in the emerging new area of GRID computing – a tool which uses a series of networked computers to crunch large-

scale computational problems and share storage resources. My project dealt with this. Figure 3 shows me down in the tunnel with part of my team.

Figure 3: Underground at CERN near the ATLAS detector.

I hope this report was useful. The following is simply a compilation of visuals to help show you a little bit of Switzerland through my eyes. Enjoy.

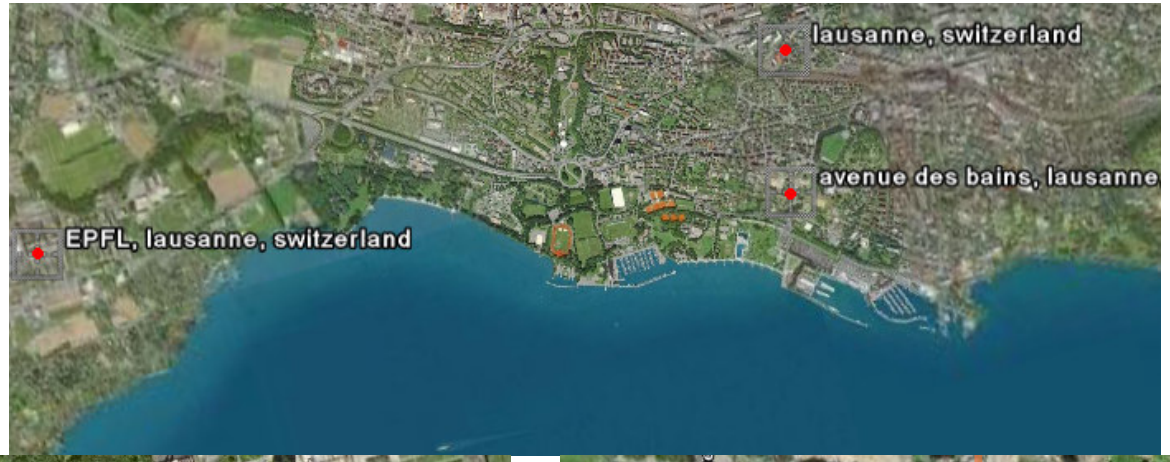




Switzerland by the numbers:
Bordering Countries: 5
Official Languages: 4
Population: 7.2 million
Largest (per capita) army in the world

EPFL by the numbers:
6550 students
107 nationalities
250 labs

Lausanne by the numbers:
135,000 people
1 official Olympic Committee Headquarters



EPFL

Cèdres (Avenue des Bains): My home away from home

In and around Lausanne…

Studying outside…

What an inspiring view

It's a lot like Stanley Park

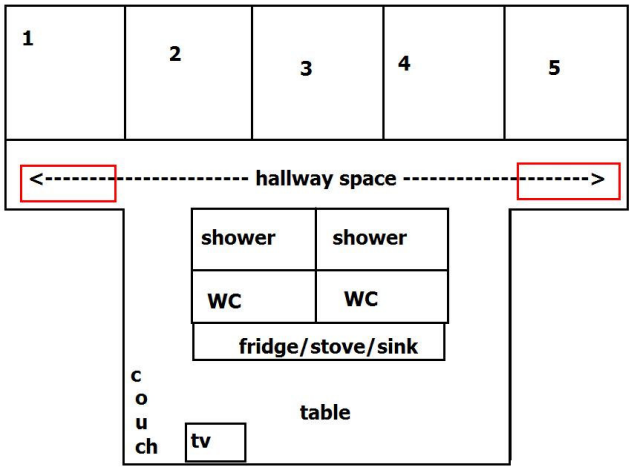
Vineyards

The Alps

Rollerblading by the lake

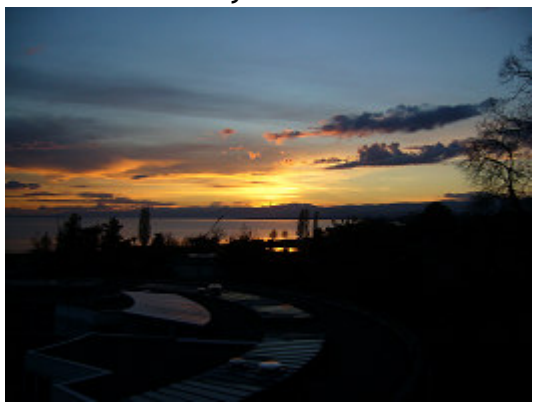
Cèdres: My home away from home…

My room



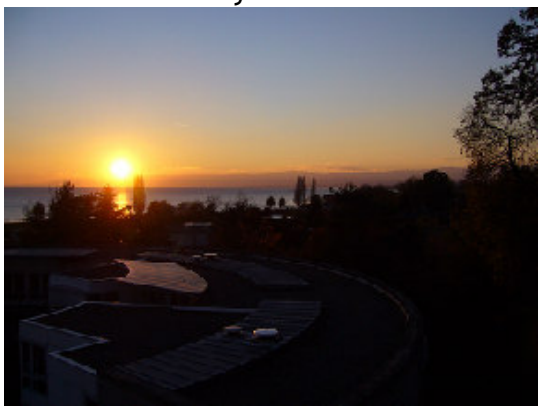
Cèdres Apartment Layout

My room



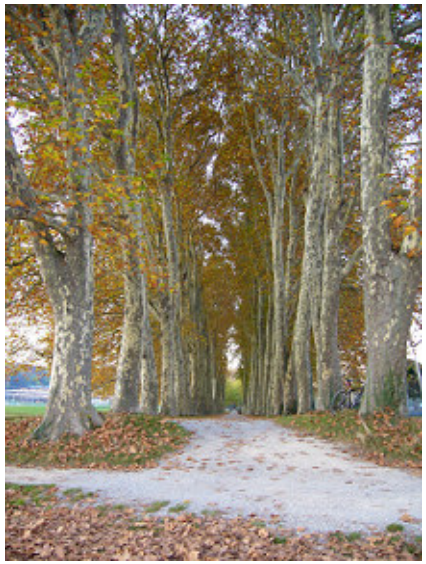
My view

Cèdres



My view

EPFL: Campus…



ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Random shots…

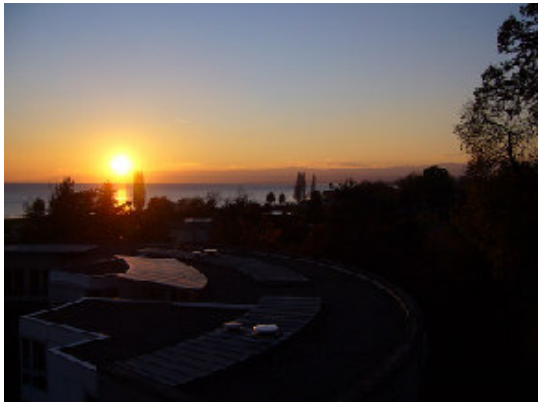
Lausanne's tower offers quite a view

How much more Swiss can you get?

Cheese!

My favourite swimming spot

Swans live year-round on the lake



The view from my room window

Other spots in Switzerland…

Geneva: Famous fountain

Montreux: Jazz

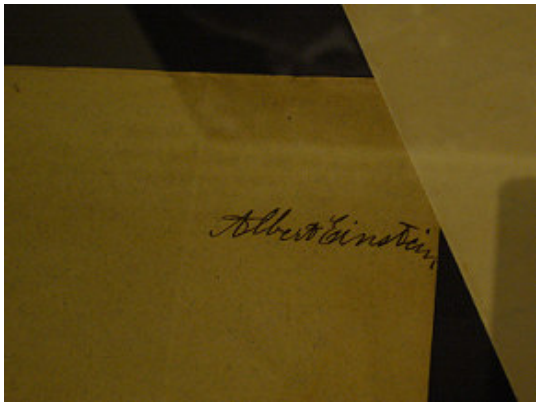
Zermatt: Matterhorn

Bern: Cool museums

Bern: Swiss capital

Bettmeralp Glacier

Skiing is only ever an hour away



Even Einstein isn't perfect

At the United Nations in Geneva

Geneva from the UN

Good luck on your adventure. Soak up every moment. Before long you'll be back home writing one of these, remembering what a truly magnificent adventure you have lived. All the best & do drop me a line if you have any big questions (bsanders@uwaterloo.ca). But whatever you do, just go for it!