
USPAS from a student's perspective: learning about accelerator physics.

Evgenya Smirnova

*Los Alamos National Laboratory, Los Alamos, NM
87545, USA*

APS2008, April 13, 2008

Outline

- Motivation: US education in accelerators and microwaves.
- From the start: applying to USPAS and choosing a class.
- Curriculum: My two USPAS experiences.
- Extra curriculum.
- Conclusion: thank you, USPAS!

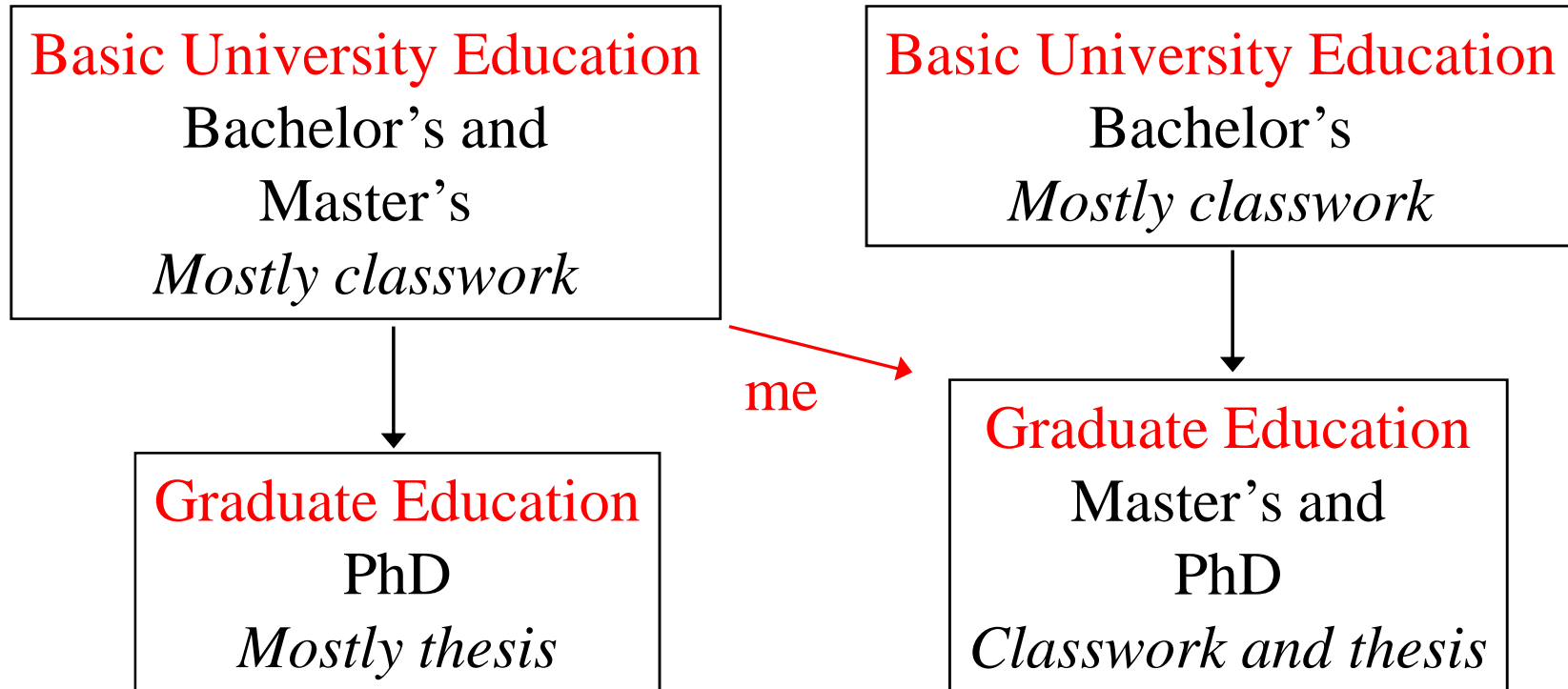
Motivation: US education in accelerators and microwaves.



European vs. US education

Europe

USA



Classwork is an essential part of the US graduate education.

My MIT education

- I came to MIT to learn about the accelerator physics.
- MIT's program in accelerators and microwaves: 8 students enrolled currently, 1-3 students graduate yearly.
- MIT's curriculum does not have classes in accelerator physics or microwaves.
- My MIT transcript included: Statistical Physics, Quantum Physics, Intro to Plasma Physics I&II, Solid State Physics, Astrophysics, Plasma Waves, Magneto-hydrodynamics, High Energy Plasmas, Plasma Transport.

My Russian education

- I started my MIT PhD research relying on my Russian background in microwaves.
- My education from Russia included training in:
 - Vacuum electronics (undergraduate);
 - Quasioptical systems;
 - Physics of electron beams;
 - Waves in media;
 - Propagation and diffraction of waves;
 - Laboratory in high power electronics.

Education in other US universities

University	# of classes in accelerators
Stanford University	2
UCLA	2 (4 more in microwaves)
University of Maryland	1 (in microwaves)
Indiana University	1
University of Wisconsin – Madison	4

Two-week courses: June 16-27, 2008

(each of the following full courses earns 3 credits from the University of Maryland)

- Fundamentals of Accelerator Physics and Technology with Simulations and Measurements Lab (undergraduate level)
Mike Wilson and Steven McChilton, Duke
- Beam Dynamics Experiments on the University of Maryland Electron Ring
Rami Kishek, Santiago Bernal, Ralph Fiorito, David Ciskovic and the UMD/ERL Staff

Applying to USPAS and choosing^s a class

- RF Superconductivity: Physics, Technology and Applications
Jean Delayen, Jefferson Lab
- Beam Physics with Intense Space Charge
John Barnard and Steven Lund, Lawrence Livermore National Lab

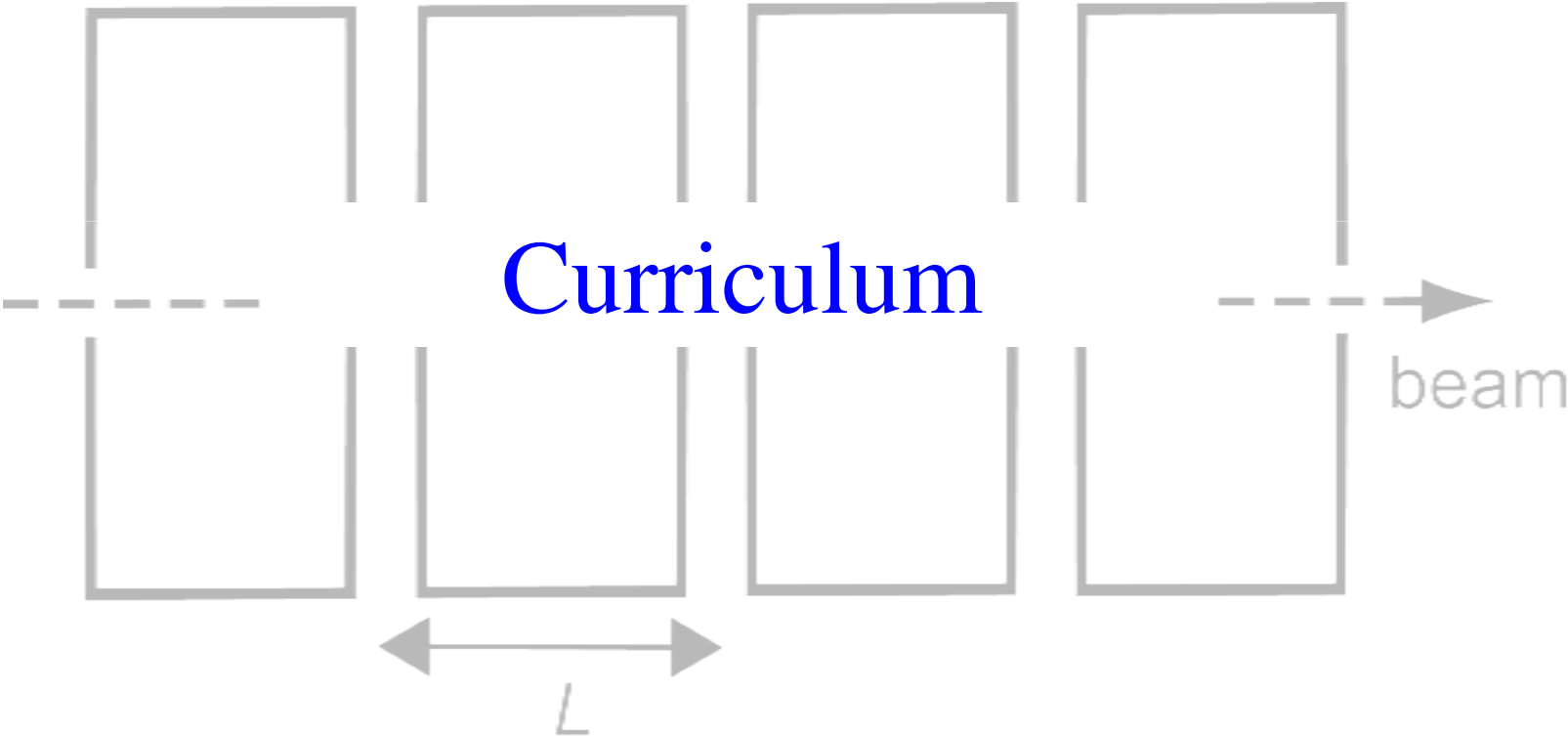
Talking to my supervisor

- My supervisor was very supportive of my first attempt to go to USPAS.
- Second time he was very surprised “*Why do you need to go for the second time, you have already been to USPAS last year?*”
- He never had time to give me suggestions on the classes to take.



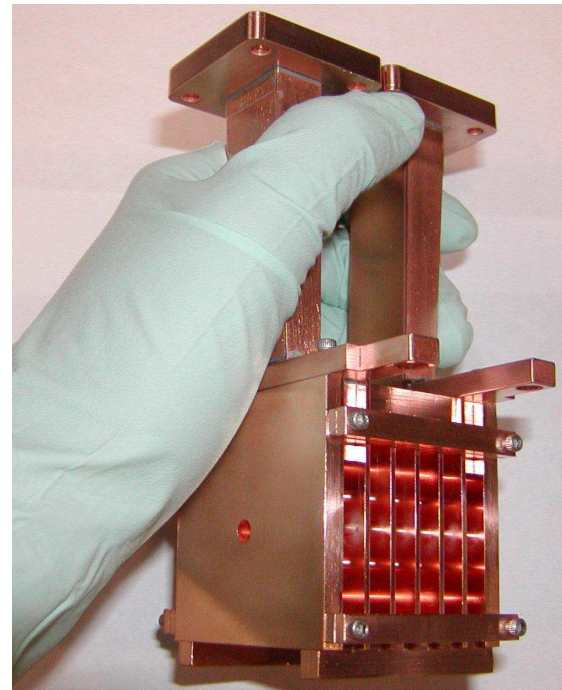
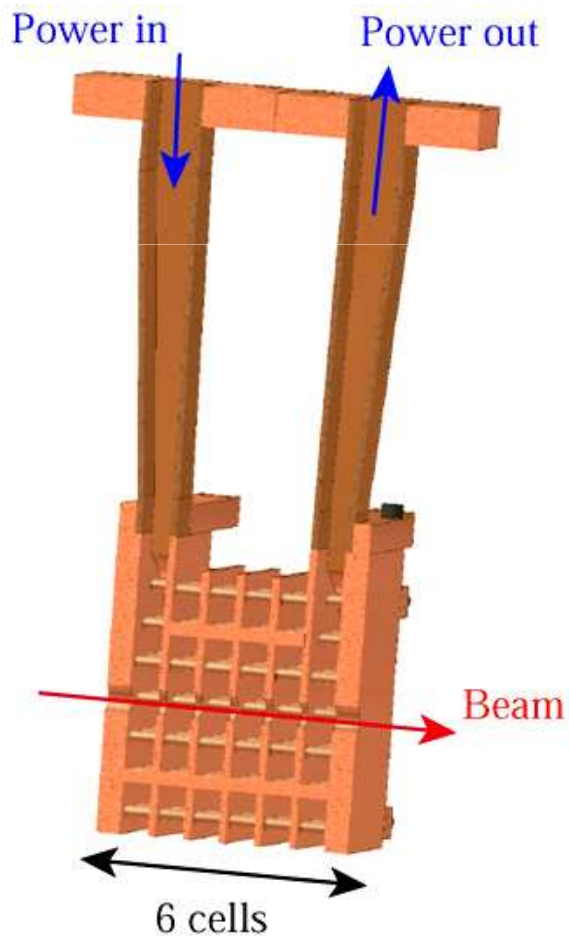
Choosing a class

- In my first visit I took “Linear accelerators” class, because I needed background to progress in my thesis work.
- In my second visit I took “Accelerator physics” class to learn about the accelerator physics in general.
- I wish USPAS had an academic advisor to help students choose the right class for them.



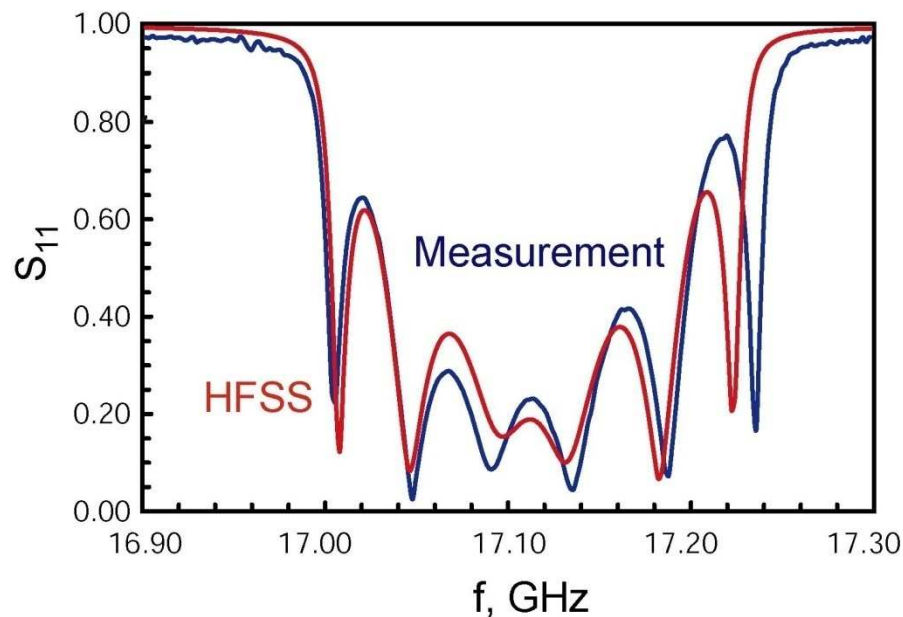
Linear Accelerators class

The class on Linear Accelerators helped me design the traveling-wave $2\pi/3$ PBG accelerator structure.

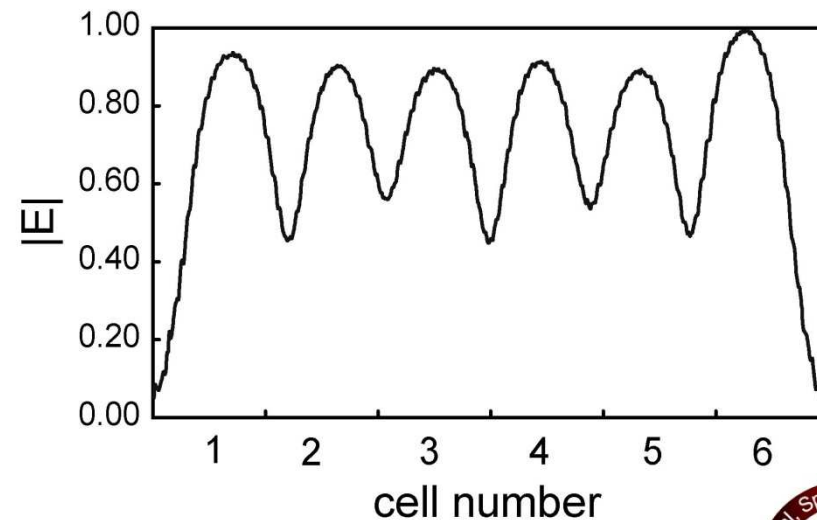


Linear Accelerators class: cont.

I learned about structure's shunt impedance, quality factor, coupling, and measuring the field's profile with bead-pull. I applied this knowledge to my research right away.



Measured field profile
(bead pull)



Accelerator Physics class

- Introduced in 1997 and has been presented at every school starting in 1998.
- One of the two most popular classes at USPAS (Accelerator Fundamentals is the other most popular class).
- Must teach about history and various types of accelerators, beams and rf, and applications of accelerators.

Accelerator Physics class: cont.

In my class I learned about:

- FODO lattice, FODO lattice once again, FODO lattice for the third time...

- Well, beam dynamics is important. But should not the Accelerator Physics class have a rigid curriculum year to year?





Extra curriculum



Extracurricular program: communication

USPAS should foster the sense of community among young accelerator physicists. Daily homework, breakfasts and dinners together serve the purpose!



What I did on the weekends ☺

On the weekends I went skiing...



Should I have been learning about the accelerator physics instead ?

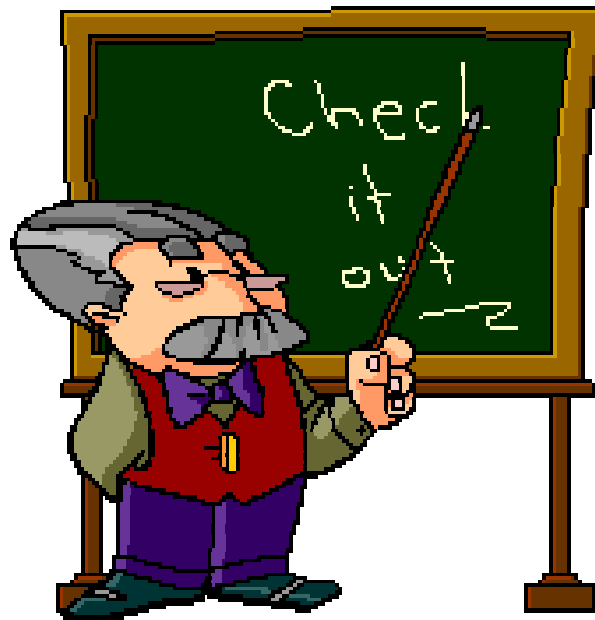
Extracurricular program: tour

- A visit to a major accelerator laboratory would be of a great interest to most students.
- According to Prof. Wiedemann such a tour would be hard to organize due to the big size of the school.
- Size of each USPAS is about 150 students. PAC tours involve more than 400 people. Tours should be possible for USPAS students.



Learning about today's state-of-the-art

Many students would love to hear an easy introductory talk about new big accelerator projects, such as SNS, RHIC, LHC, and the current status of ILC.



Suggestions

- Educate University professors about the importance of the School.
- Develop core curriculum (Accelerator Physics class).
- Introduce tours of the US accelerator facilities and talks about the-state-of-the art.

Conclusion

- We are unlucky not to have an adequate accelerator physics curriculum in our Universities.
- The USPAS plays an essential role substituting for regular University classes in Accelerator physics for the US students.
- USPAS will succeed even more if we work with our accelerator community promoting the school.