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SwissFEL Laser Heater

Volker Ziemann

Department of Physics and Astronomy
Uppsala University



Background and ...

- UU is responsible for the XFEL Laser Heater
- Presentation at the XFEL MAC in May 2011
- Hans Braun, who is a member of the MAC, asked me whether I am interested in the SwissFEL laser heater (emphatic YES!)
- I gave a talk at PSI in August
- Hans and I wrote draft of EoI
- and asked Janos whether he is interested to write a section in the EoI (another emphatic YES!)



... Status

- In a convoluted line of action we were asked to submit a detailed application to Mats Johnsson at the ministry of education
- Which we (J+V) did in November 2011
- I asked last week about progress
- Received reply from Mats Johnsson
 - that MofE has asked the Research Council for a scientific evaluation. Next VR meeting is on March 30.
 - MofE will decide based on the evaluation from VR.
 - Swiss government is informed.



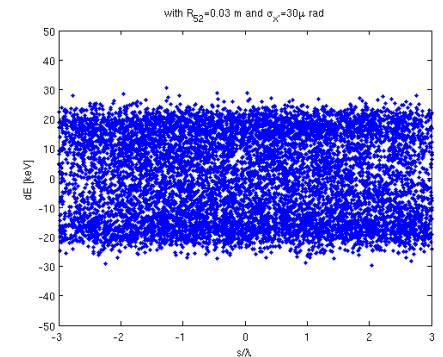
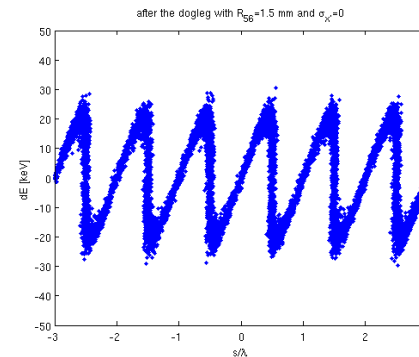
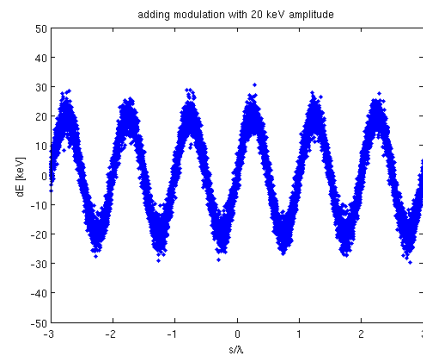
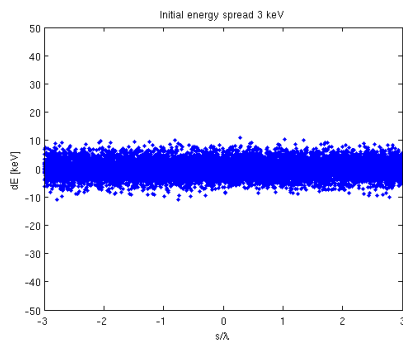
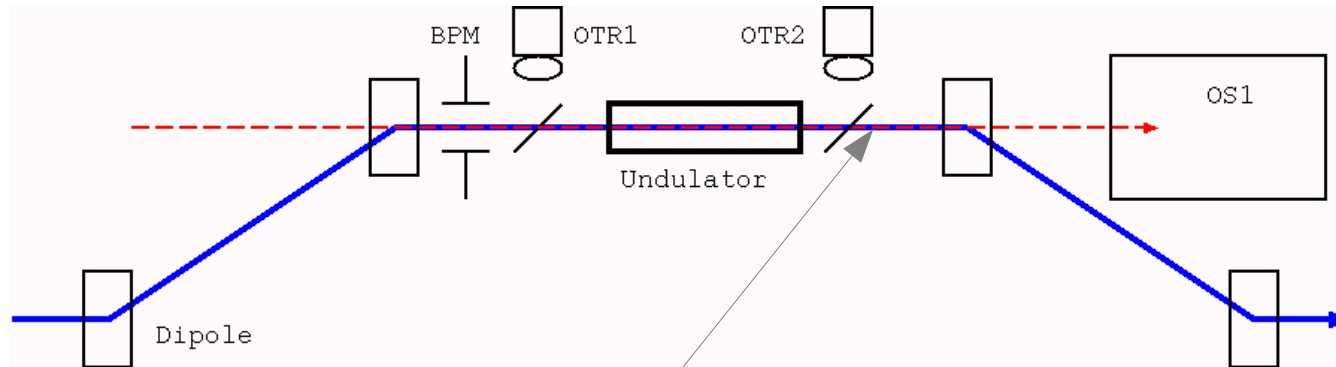
Why a Laser Heater?

- Electrons are born in the photo cathode with a very small momentum spread (~ 3 keV)
 - makes them susceptible to microbunching instability on their travel through the linear accelerator and bunching chicanes
- Add Landau damping (decoherence) in a well-controlled way to increase momentum spread
 - induce moderate momentum modulation by passing a laser over the electrons in an undulator
 - and smear out by coupling some of the angular spread into the longitudinal plane



How ...

- Pass IR laser over beam in undulator \rightarrow modulate dE
- R_{52} of 2nd leg of chicane couples 'transverse heat' into the longitudinal plane and smears out the modulation

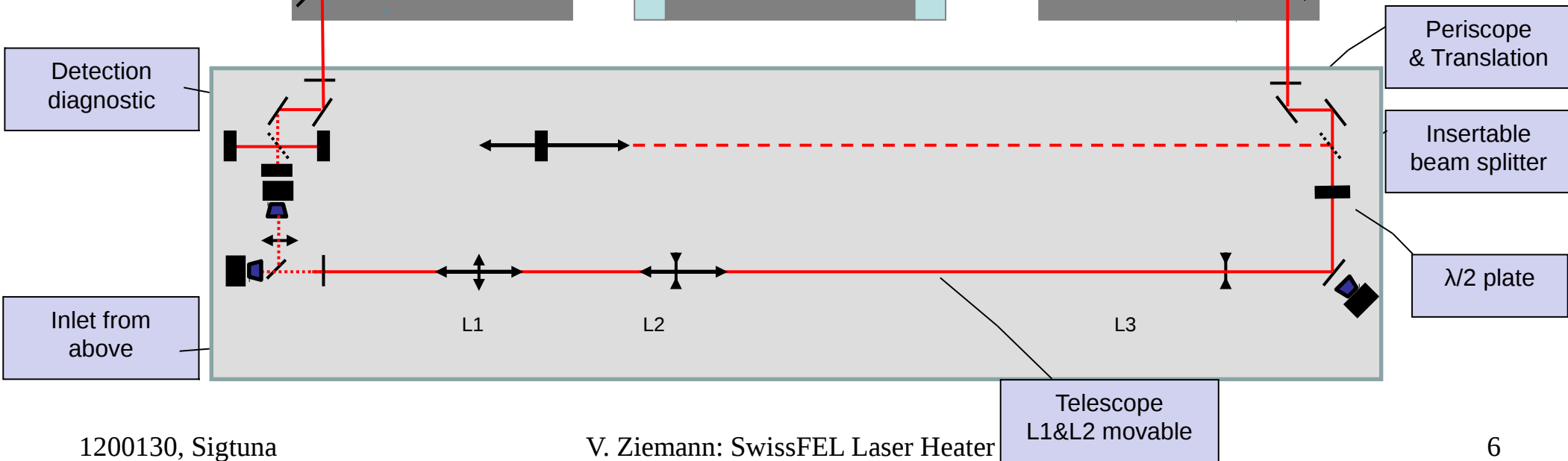
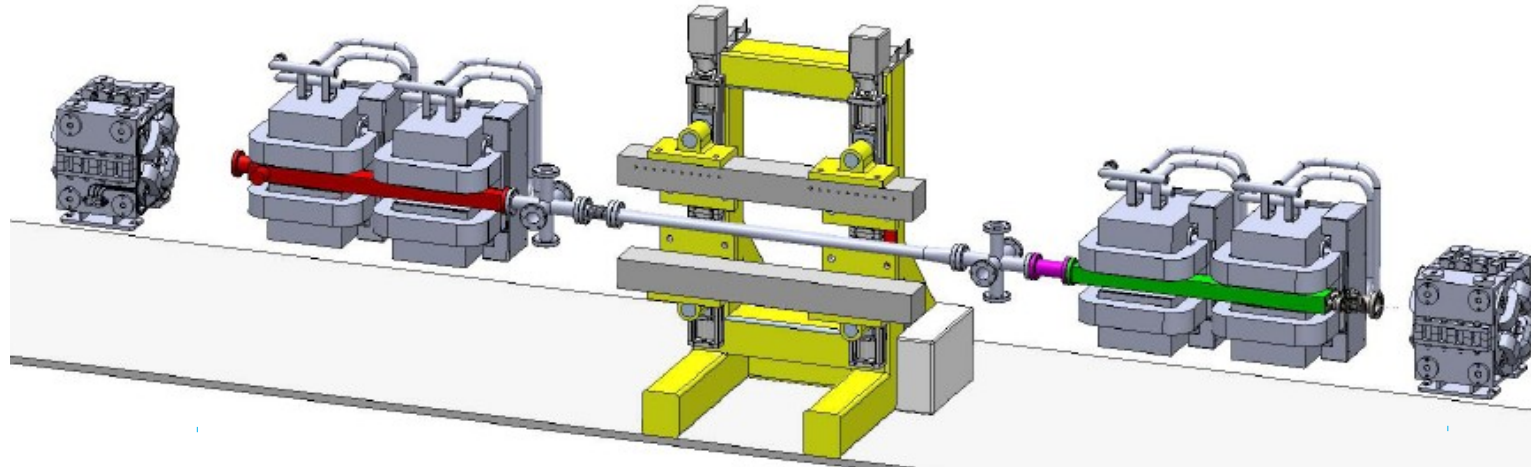




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Chicane Layout

European
XFEL



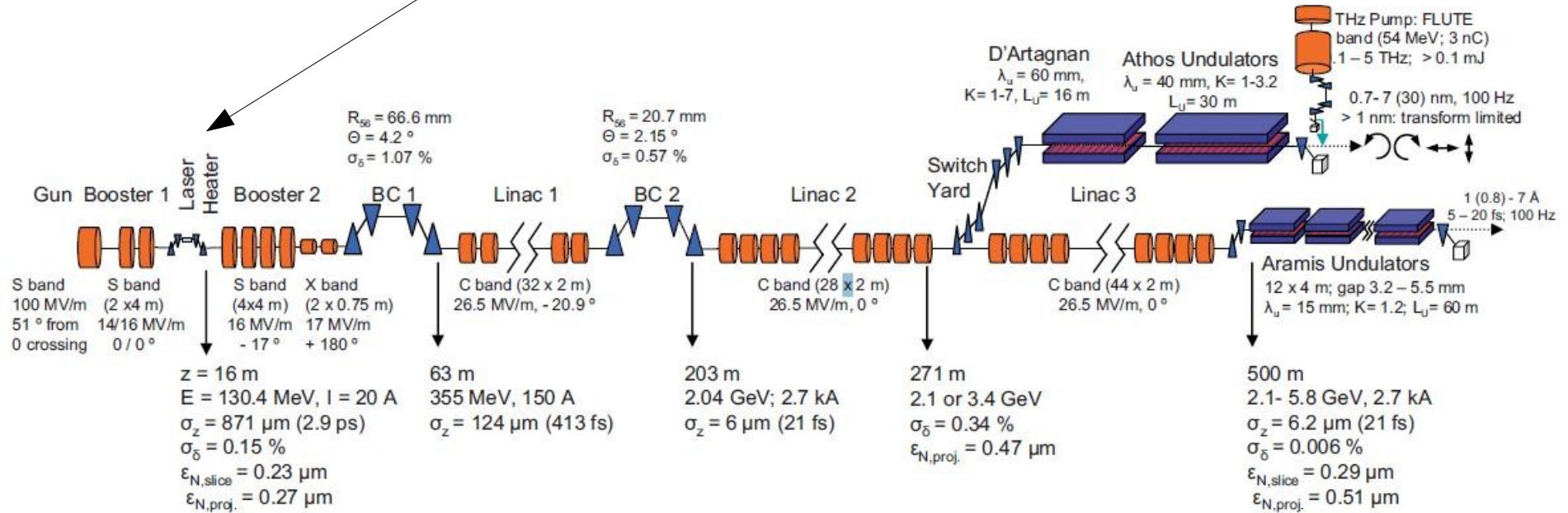


Our contribution

- Project management: 4.5 FTE
- Mechanical engineering: 2/3 FTE (8 month)
- Laser transport and pointing stability
- Laser diagnosis for size and transverse and temporal overlap, its controls and its integration
- Electron vacuum system
- Integration with electron beam diagnostics
- Mechanical support and girders
- (Dipole magnets are standard components and undulator is already done in UK)



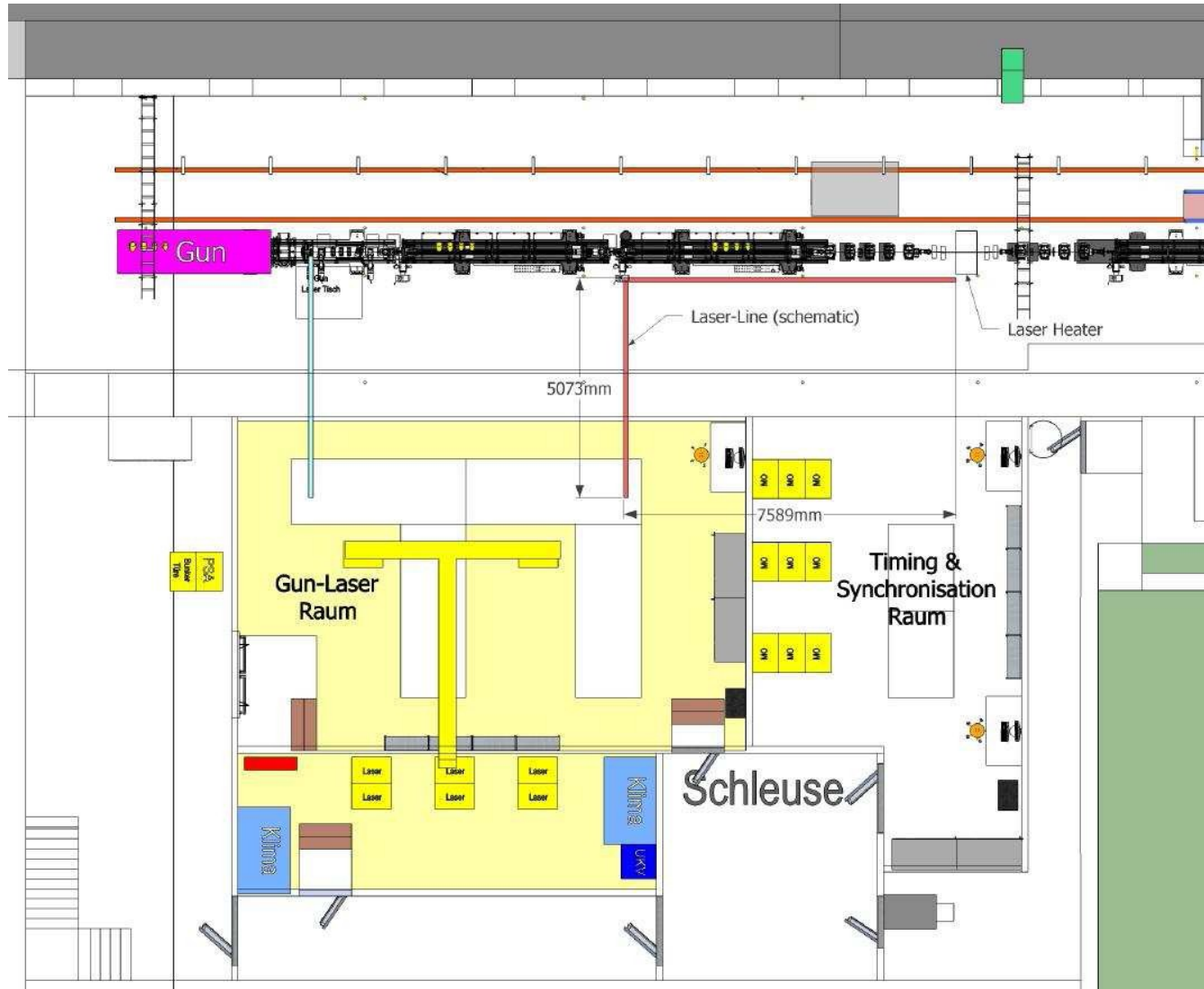
Where?



- In the injector complex of SwissFEL
- Beam energy about 130 MeV



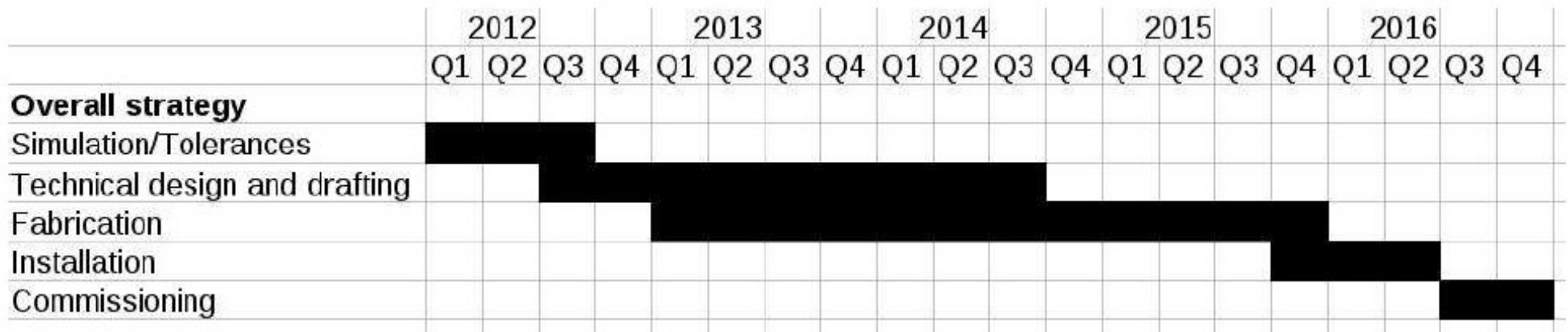
Location in real life





Schedule

- Anticipated start in early 2012
- will have to adjust and push back somewhat
- Scope suitable for PhD thesis work
- Nicely aligned with our work for XFEL





Budget

| Item | Total | 2012 | 2013 | 2014 | 2015 | 2016 | |
|----------------------|-------|------|------|------|------|------|------|
| Project leader | 0 | 0 | 0 | 0 | 0 | | kSeK |
| Project manager | 4050 | 450 | 900 | 900 | 900 | 900 | kSeK |
| Mechanical engineer | 600 | 200 | 200 | 200 | | | kSeK |
| Travel | 780 | 100 | 180 | 180 | 160 | 160 | kSeK |
| On the laser table | 200 | | 100 | 100 | | | kSeK |
| Evacuated laser pipe | 250 | | 50 | 100 | 100 | | kSeK |
| Optics | 800 | | 200 | 200 | 400 | | kSeK |
| Laser diagnostics | 500 | | 125 | 125 | 250 | | kSeK |
| Laser safety | 100 | | | | 100 | | kSeK |
| Electron vacuum | 300 | | | 150 | 150 | | kSeK |
| Mech. Support/Girder | 200 | | | 100 | 100 | | kSeK |
| Controls | 100 | | | | 100 | | kSeK |
| Cabling | 100 | | | | | 100 | kSeK |
| Grand total | 7980 | 750 | 1755 | 2055 | 2260 | 1160 | kSeK |



Conclusions

- Great continuation of our XFEL activities
- Started already discussions
- Have the laser heater application 'ready to go'
- Of course we're interested in other accelerator related activities, there were some in the EoI
 - participating in seeding experiments, which suits our background (optical replica) nicely.
- But we are open for more...