Status of the FEL test facility at MAX-lab

Sverker Werin

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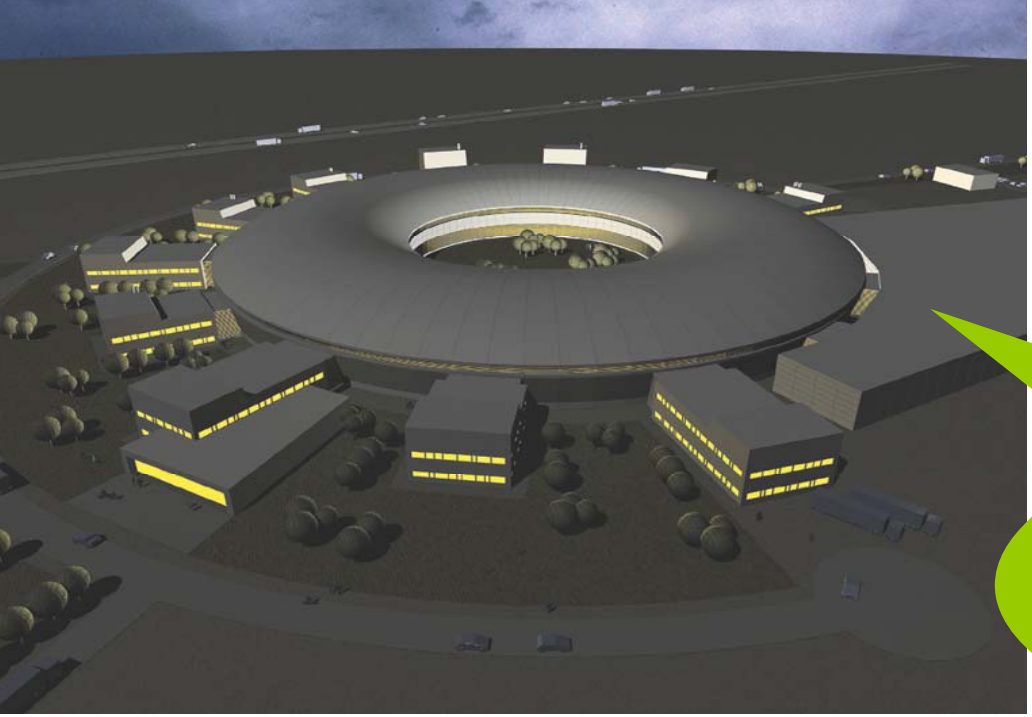
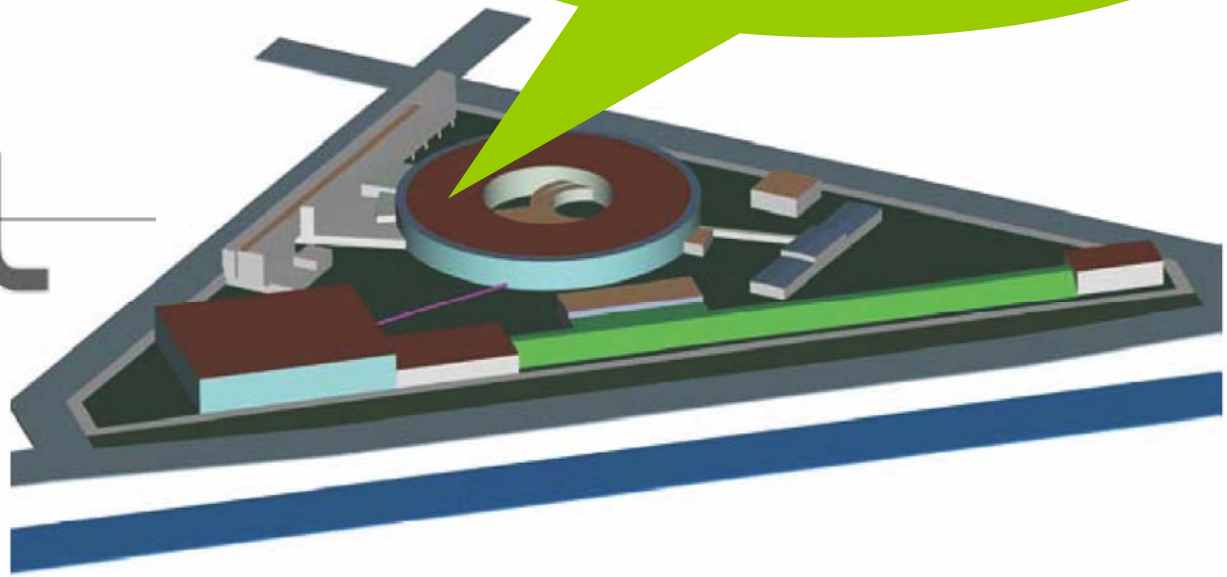
Anne L'Huillier; Lund University



MAX IV

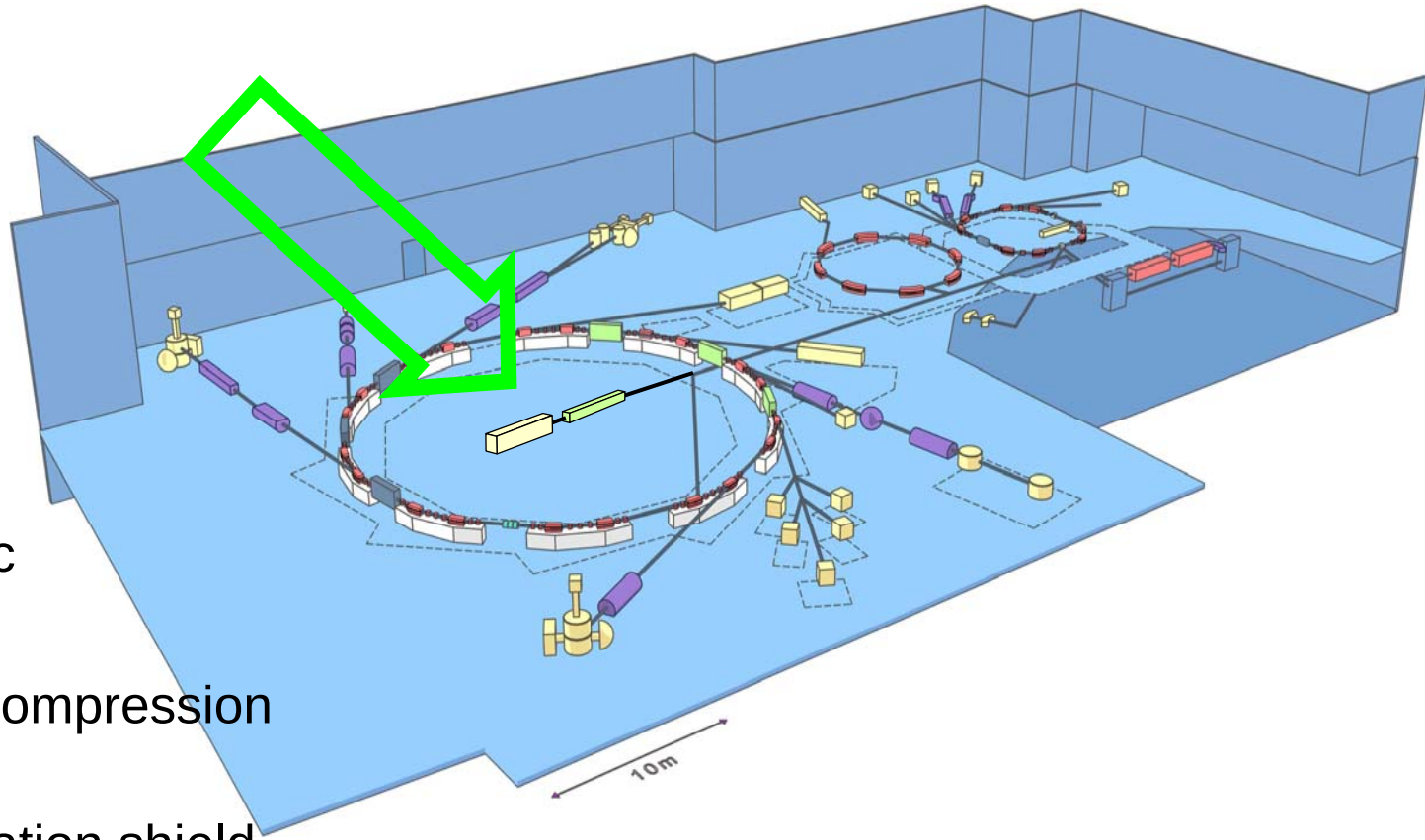
Approach issues for Harmonic Generation together

BESSY FEL



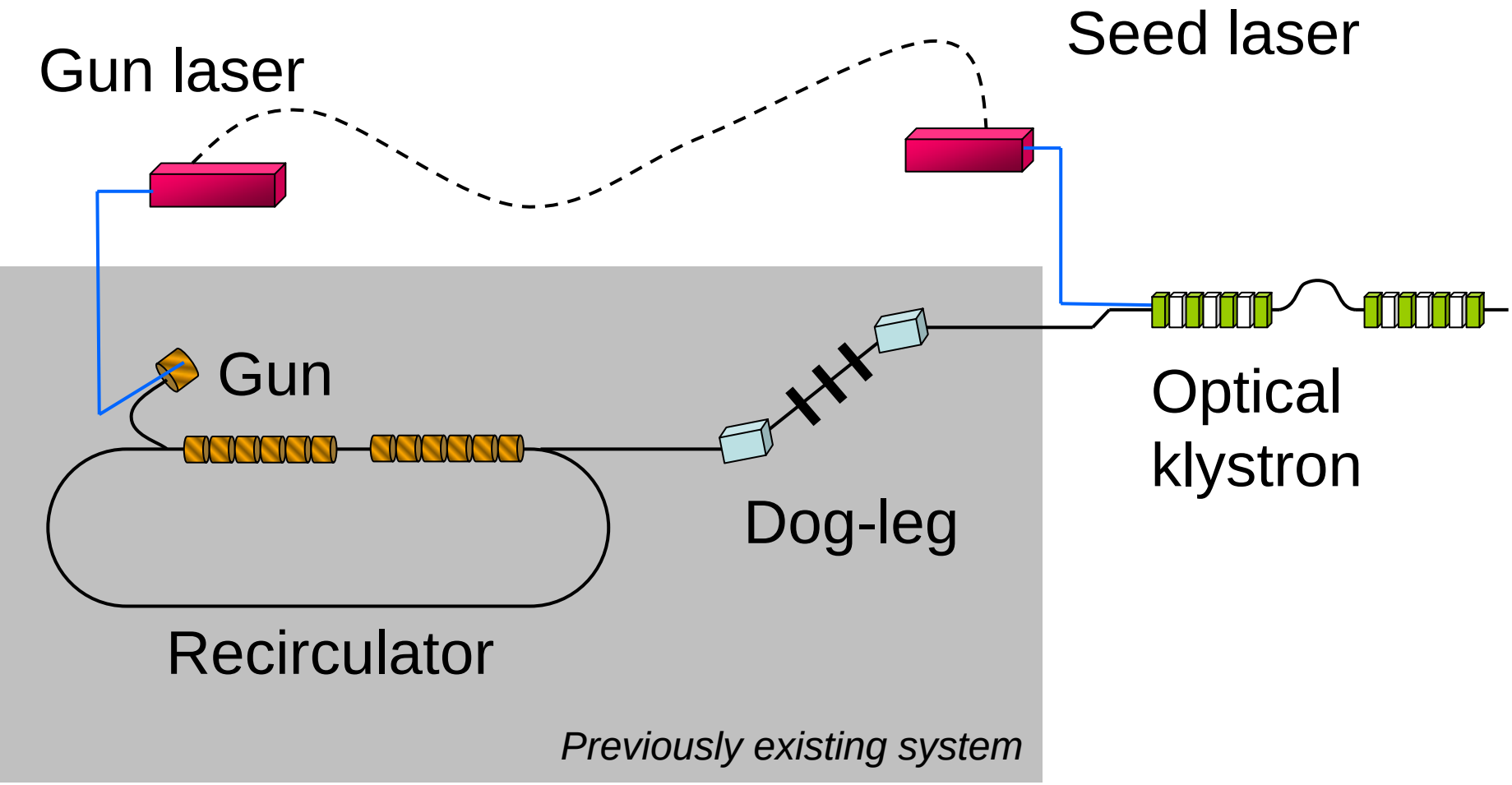
The idea was simple

Use the MAX-lab linac injector to create a test FEL for Harmonic generation at 3rd and 5 th harmonic of a 266 nm seed laser (88 nm resp. 53 nm)

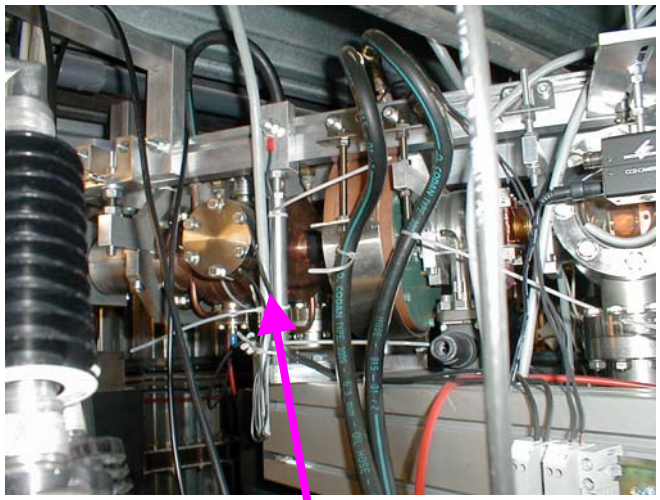


- 500 MeV linac
- RF gun
- Transport w compression capabilities
- Space in radiation shield
- Basic laser available

Overall layout



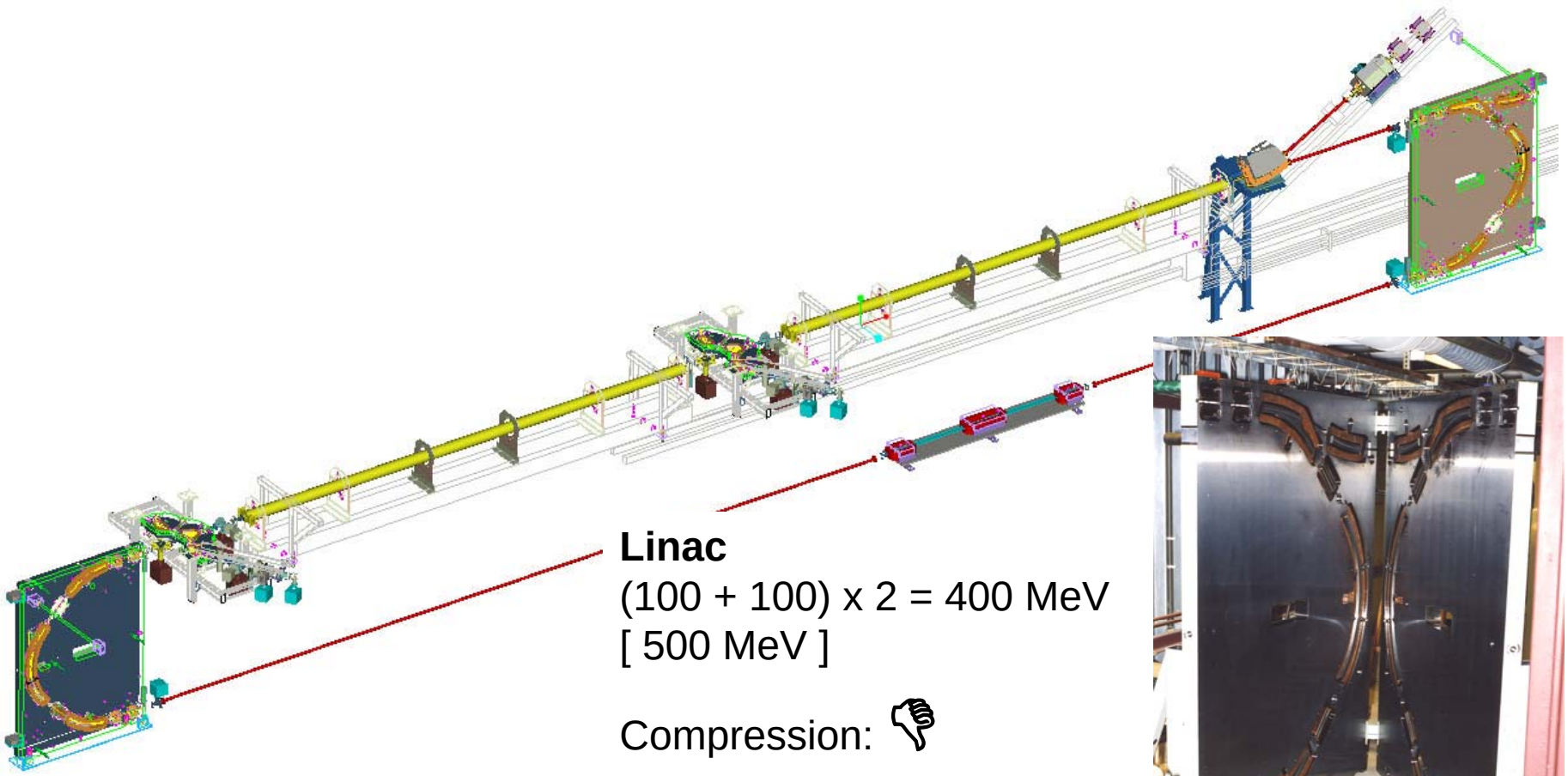
Gun, linac and transport



RF gun
2 MeV
Thermionic
Laser gated (5ns)

10 ps drive laser optimise emission phase

Gun, linac and transport



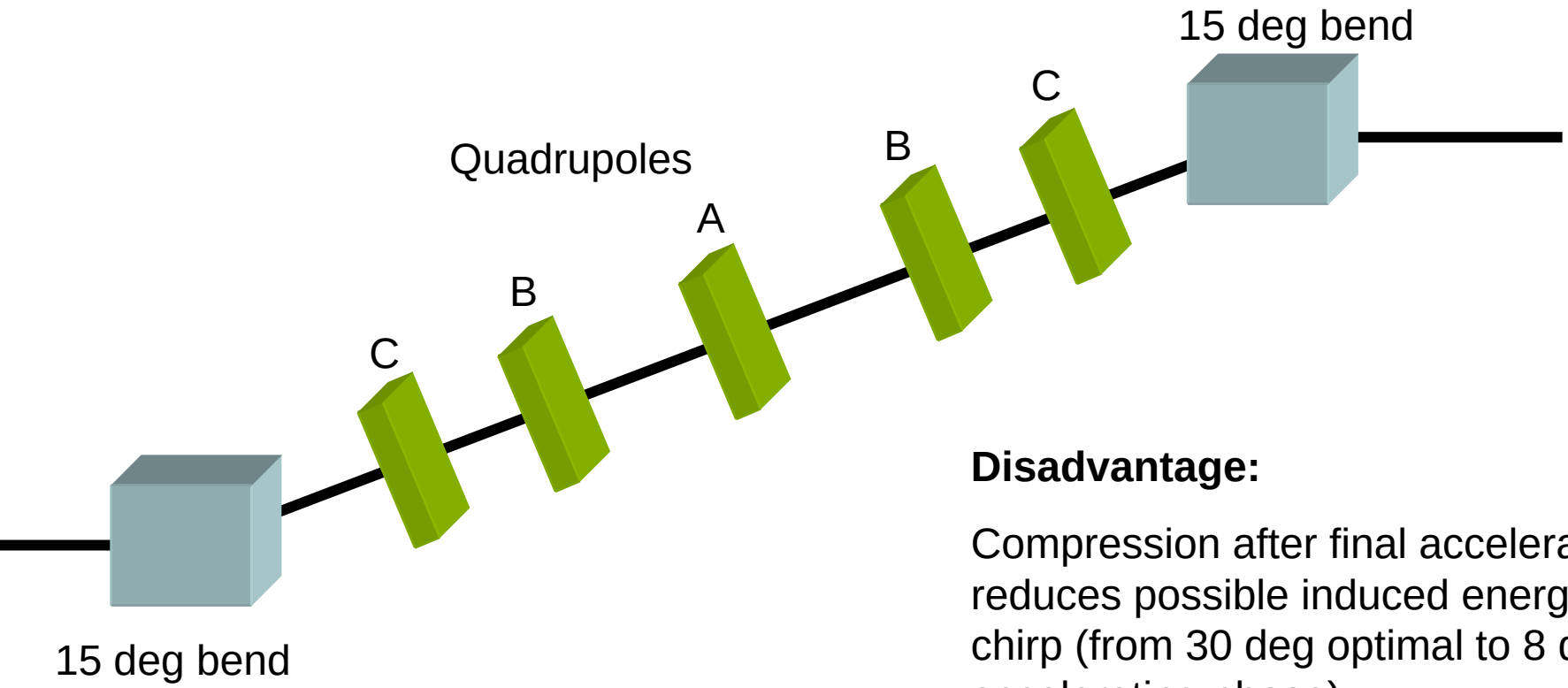
Linac
(100 + 100) x 2 = 400 MeV
[500 MeV]

Compression: 👎

Sextupoles to linearise compression (T566)

Bunch compression in transport

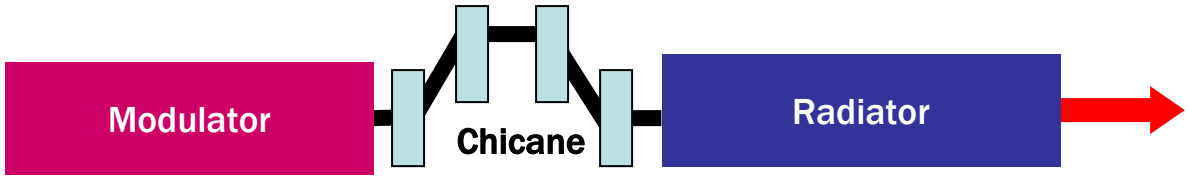
A: control the beta-function
C: close dispersion
B: modification of the beta function
*R*56 suitable for compressing

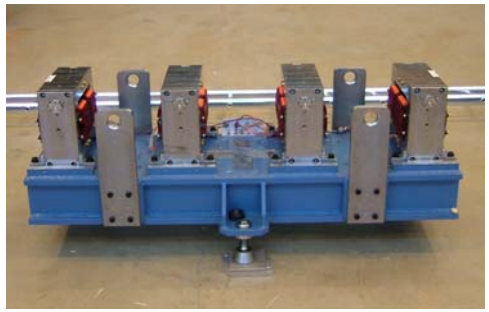


Disadvantage:

Compression after final acceleration reduces possible induced energy chirp (from 30 deg optimal to 8 deg accelerating phase)

Optical klystron

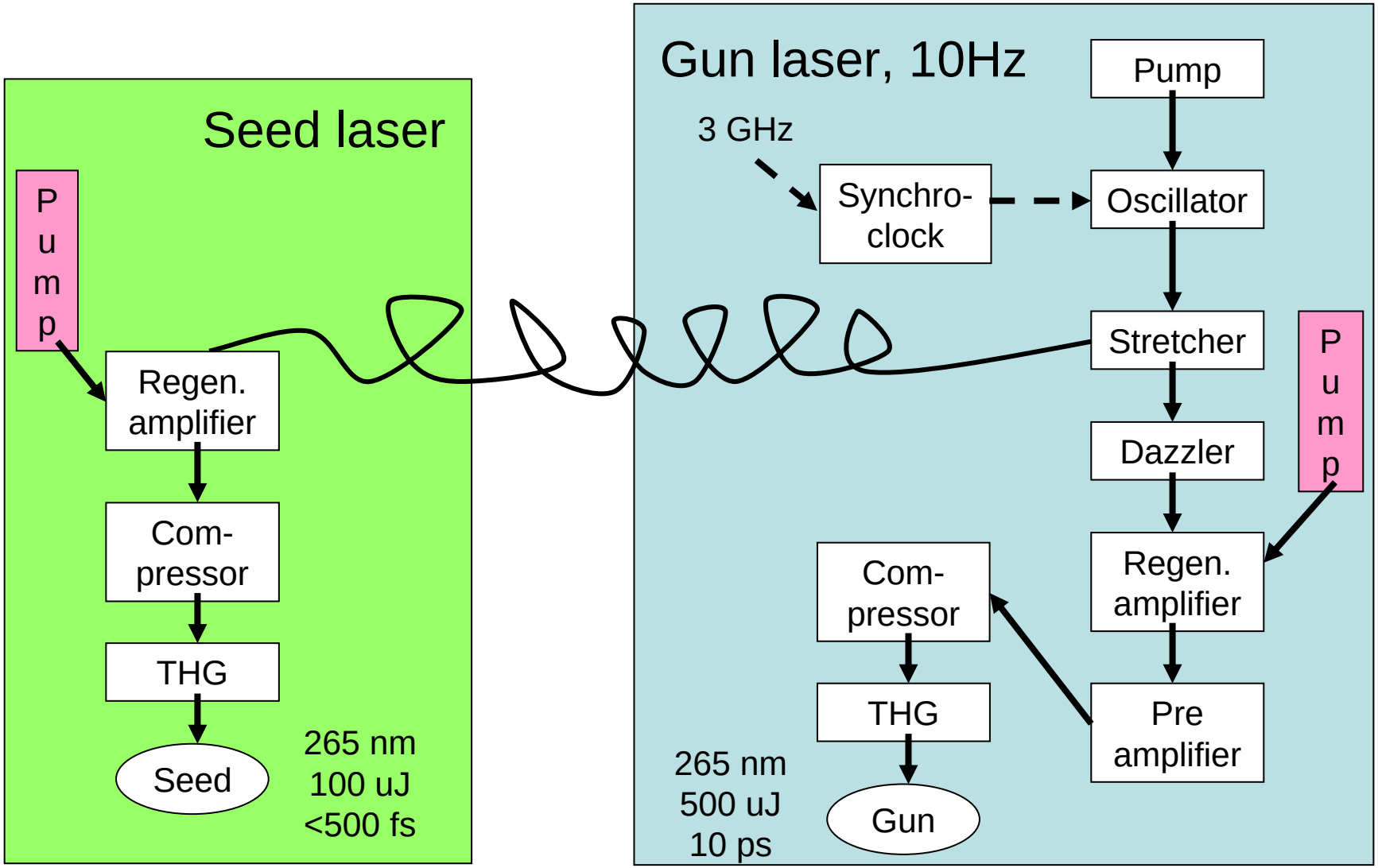




Modulator	Planar (ESRF)
Period	48 mm
# of periods	30
Min. gap	10 mm
K max	4.3
Radiator	Apple II (BESSY)
Period	56 mm
# of periods	30
Min. gap	12 mm
K max	4.3
Chicane	
# of magnets	4
Gap	15 mm
B max	0.2 T

Poster: MOPPH050

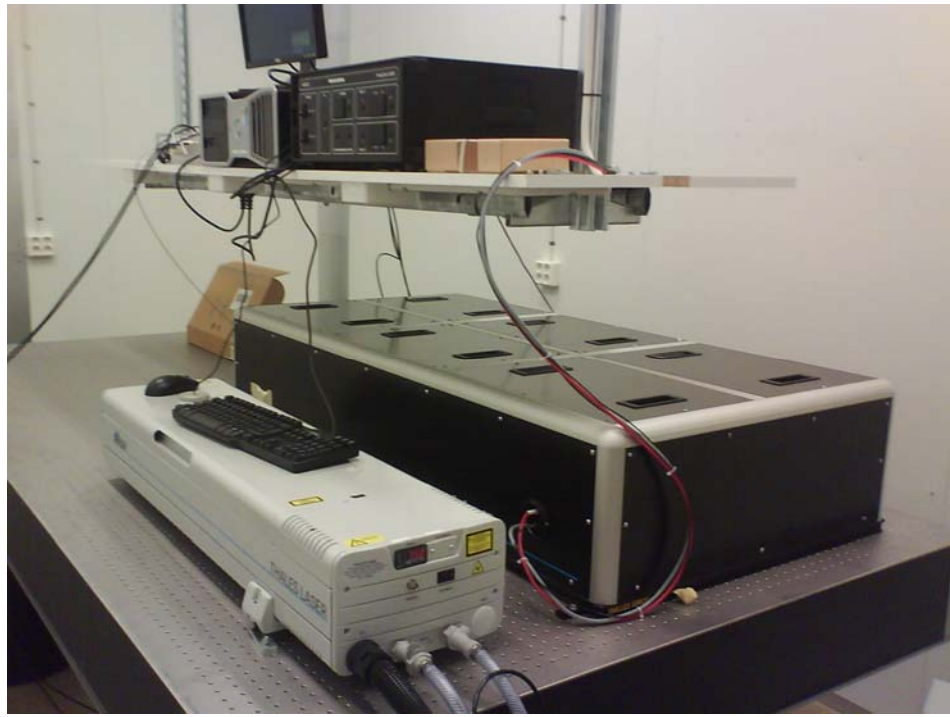
Laser system by Thales SA



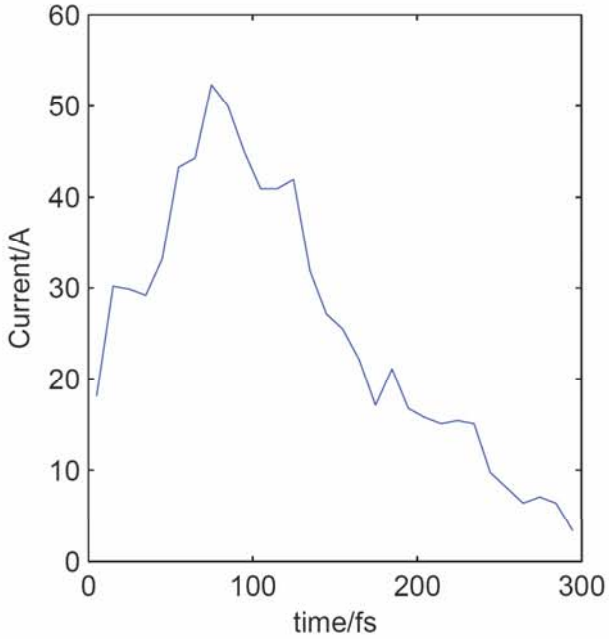
Laser system by Thales SA

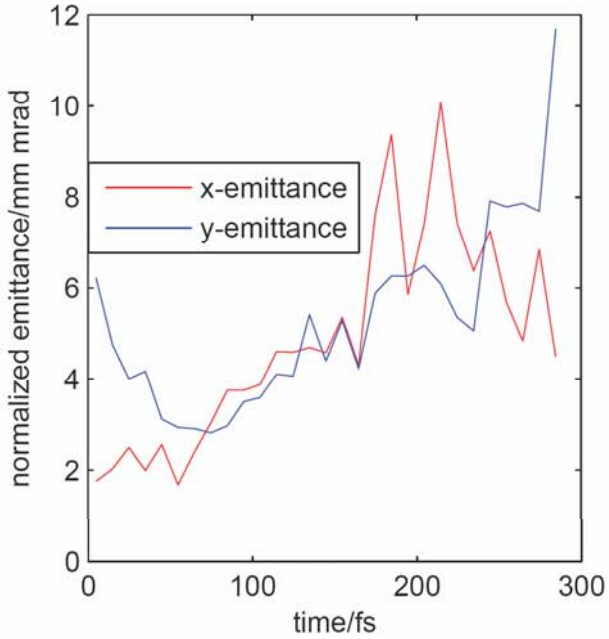
Ten boxes that will become table-top…

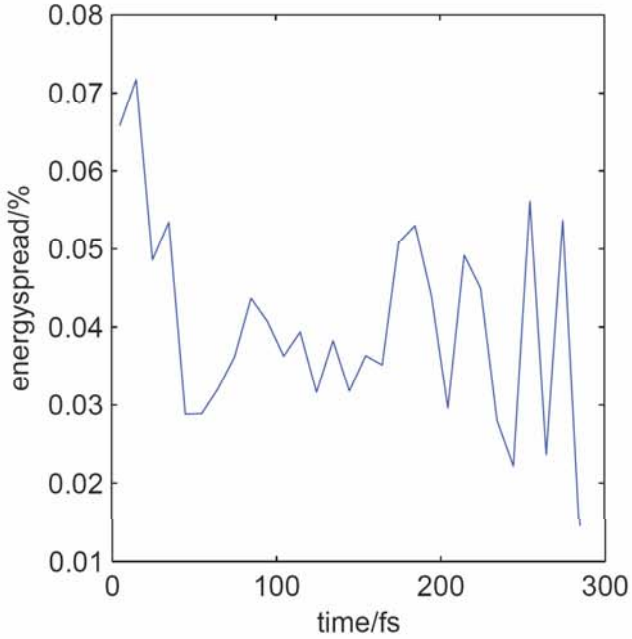
Seed laser being unpacked



Start-to-OK simulations Phase I







Window – time and mode overlap with seed pulse

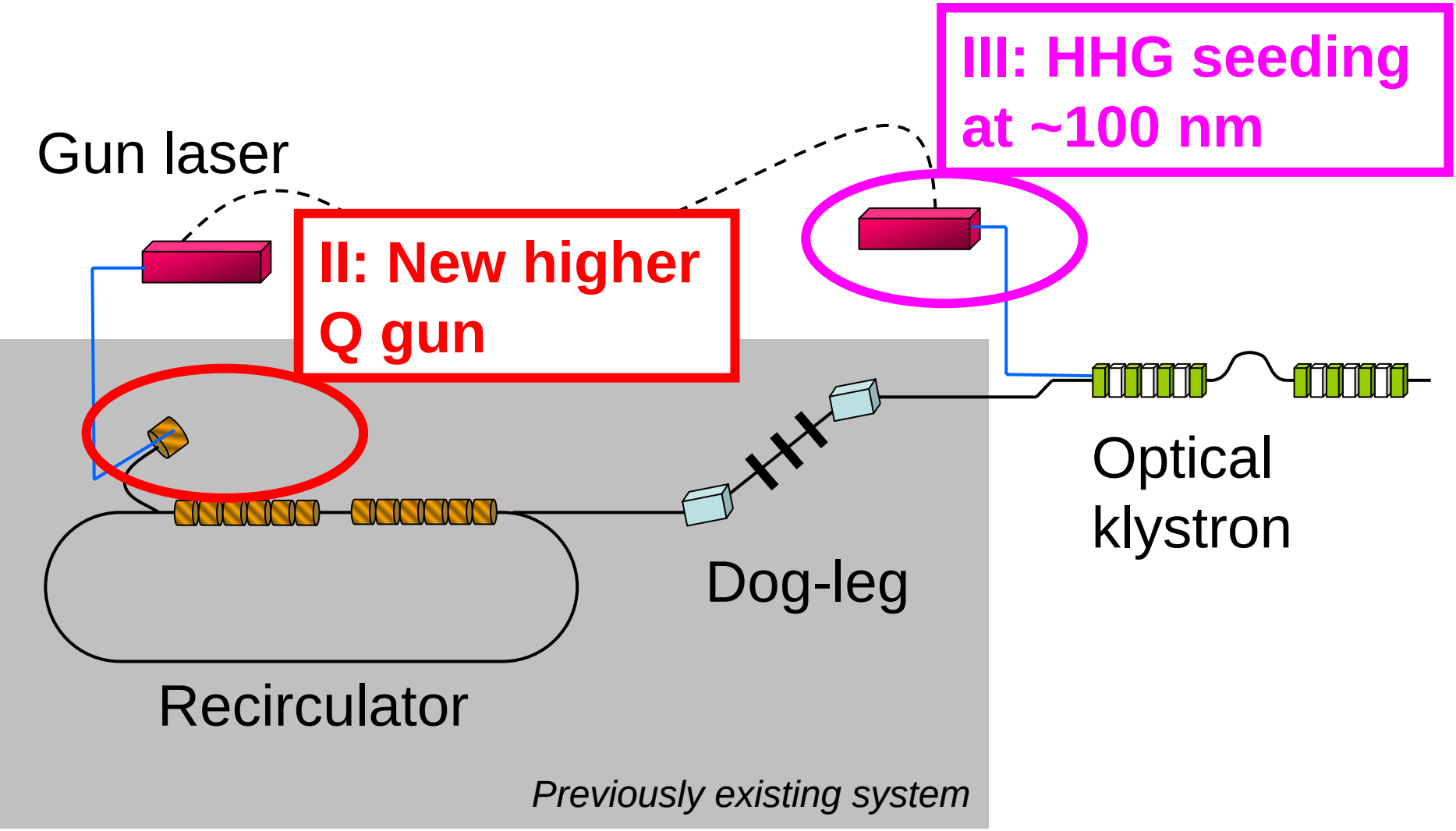
Q = 0.01 nC (existing non optimised gun system)

3rd harmonic 88 nm (1D-modelling):

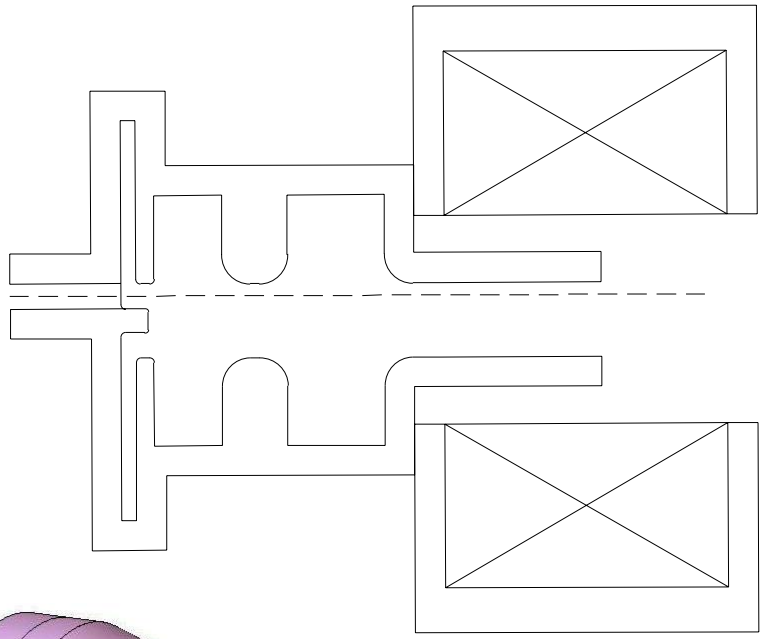
$E_{coherent}/E_{incoherent} = 6*10^3$ (total pulse)

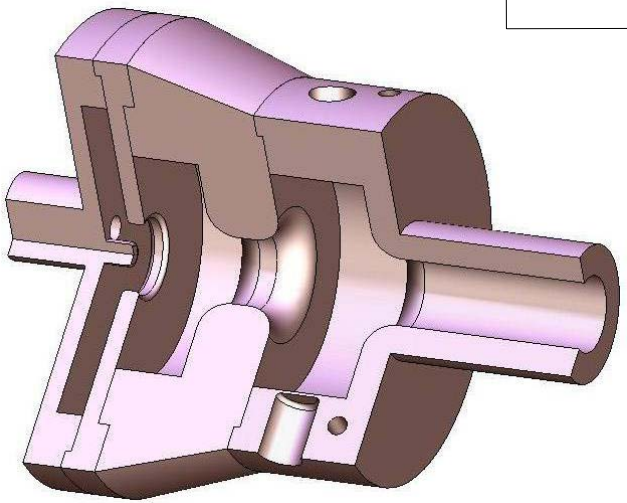
$P_{peak} = 0.2$ MW

Two development phases

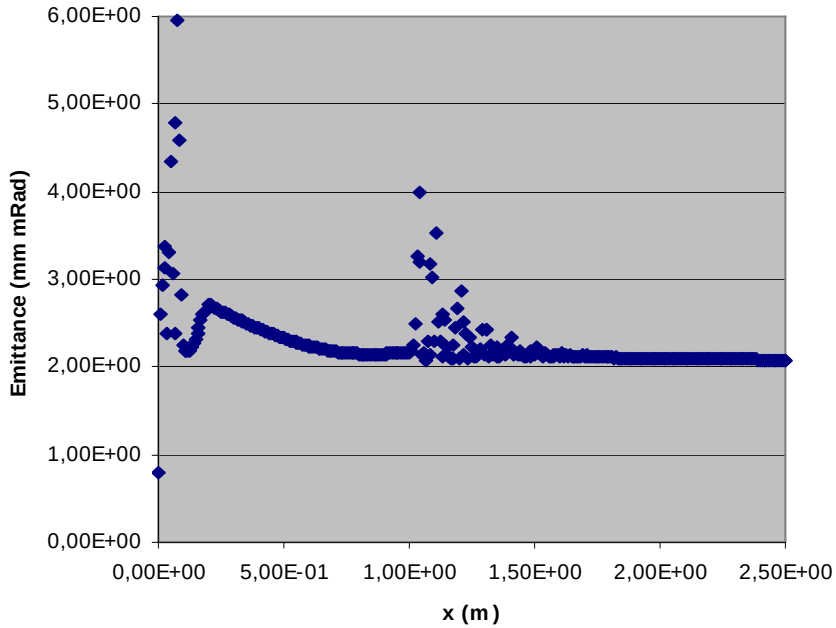


Phase II Gun



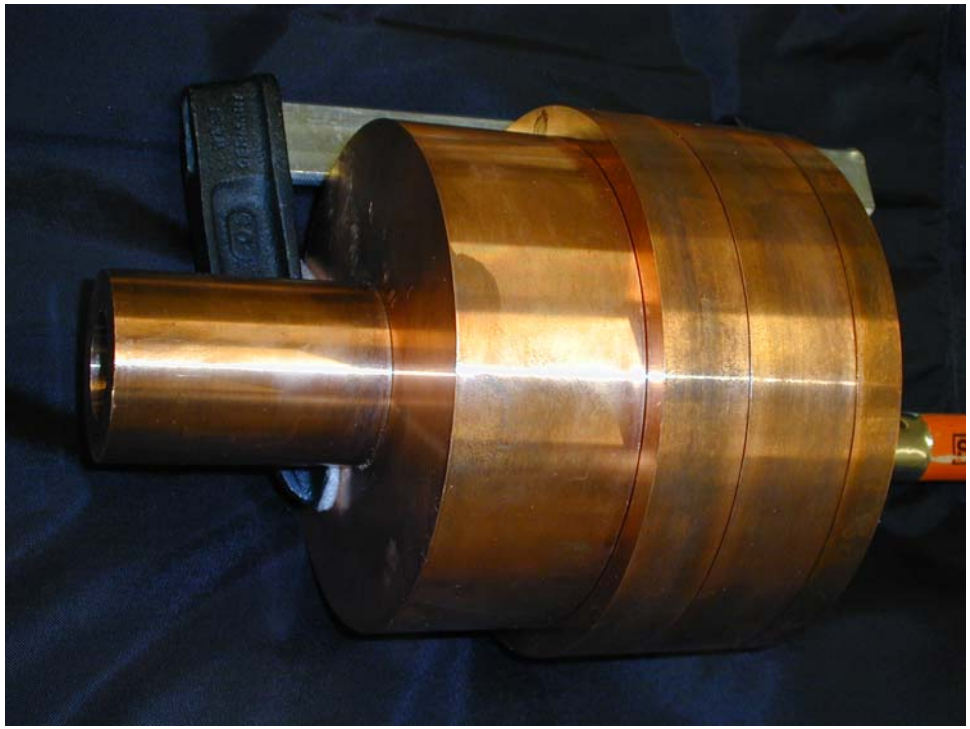


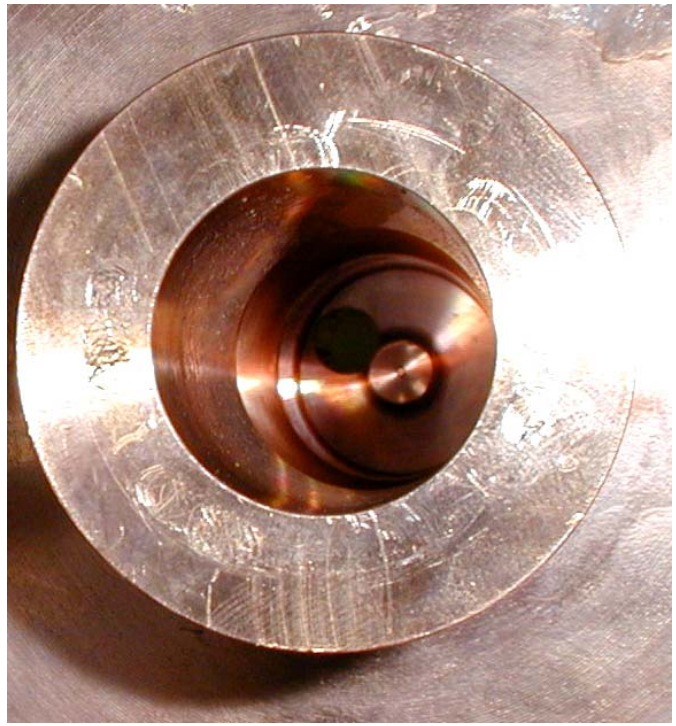
Q	0,5 nC
E_{kin}	4 MeV
ε_{norm}	< 3 mm mRad



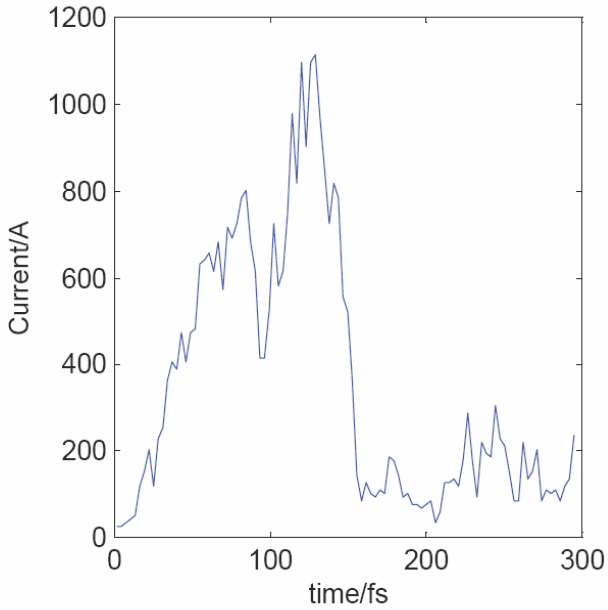
ASTRA

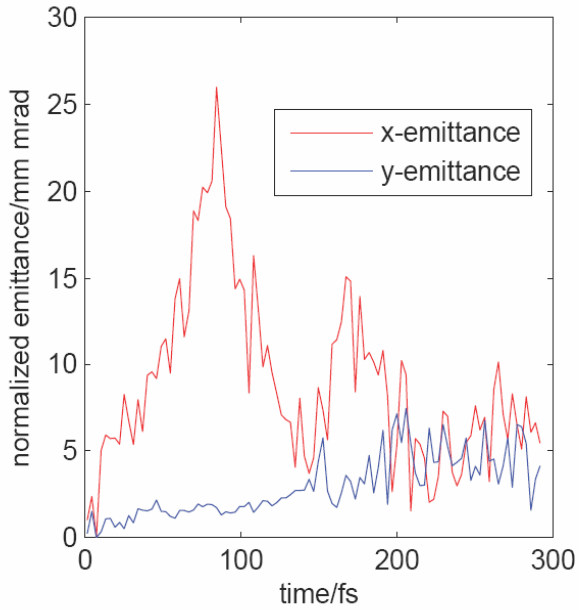
Phase II Gun

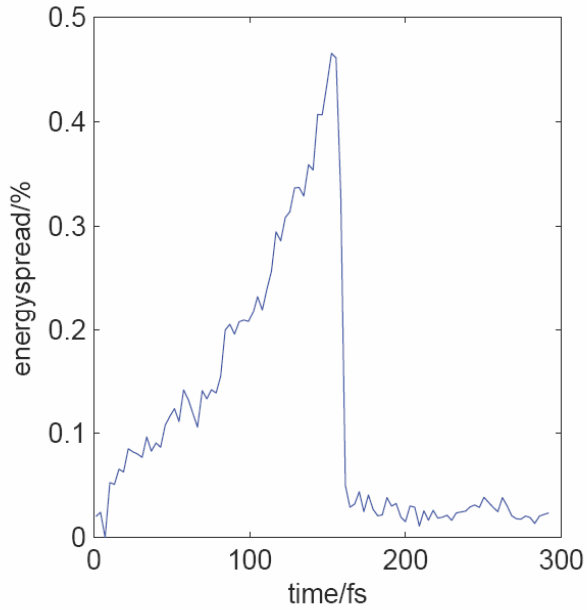




Start-to-end simulations Phase II







Final results to be published by S. Thorin & K. Goldammer

Window – time and mode overlap with seed pulse

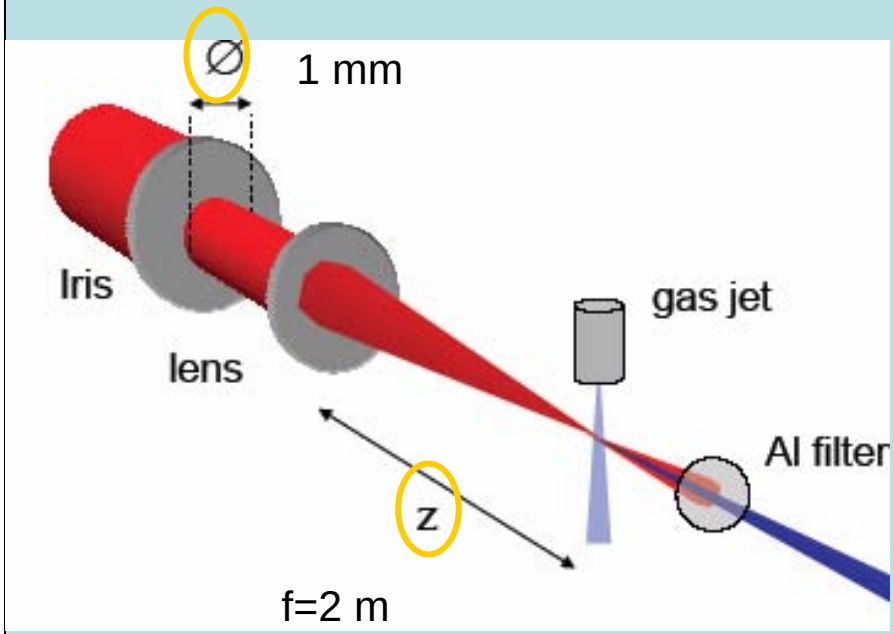
3rd harmonic at 88 nm: P_{peak} = 11 MW (Genesis 1.3)

5th harmonic at 53 nm: P_{peak} = 1.4 MW (Genesis 1.3)

Radiator too short to see gain (?)

Phase III – HHG source

800 nm
100mJ
37 fs



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Seeding > 100 nm (or seed on harmonics)

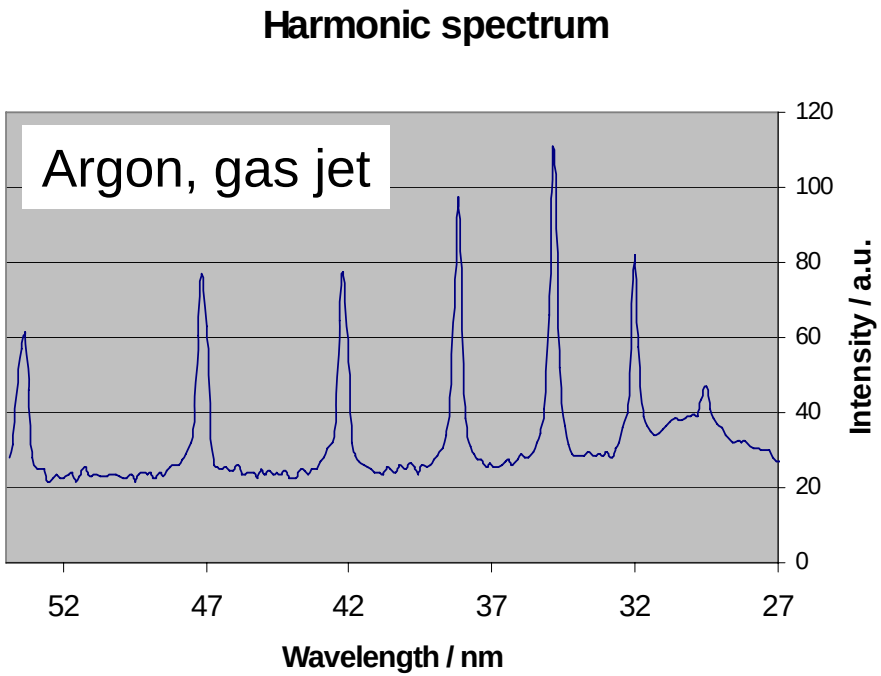
Applied for funding at Swedish Research council

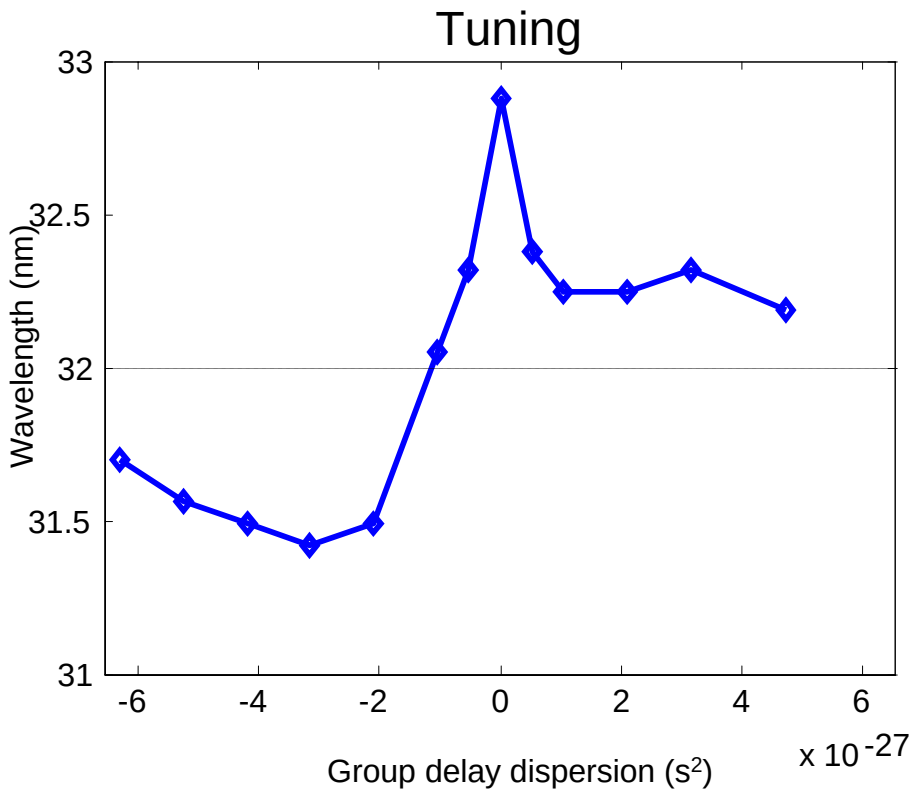
•HHG chamber

•Additional amplifier for seed laser

Lund Laser Centre

Phase III – HHG source





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Summary of status

- A test FEL for HG from 266 nm to 3rd & 5th harmonic
- Linac, gun and transport in operation
- Optical klystron installed
- Combined gun-seed-laser system currently being installed
- Electron beamline - immediate

This work has been partially supported by the:

• EU Commission in the Sixth Framework Program, Contract No. 011935 – EUROFEL

• Swedish Research Council

END