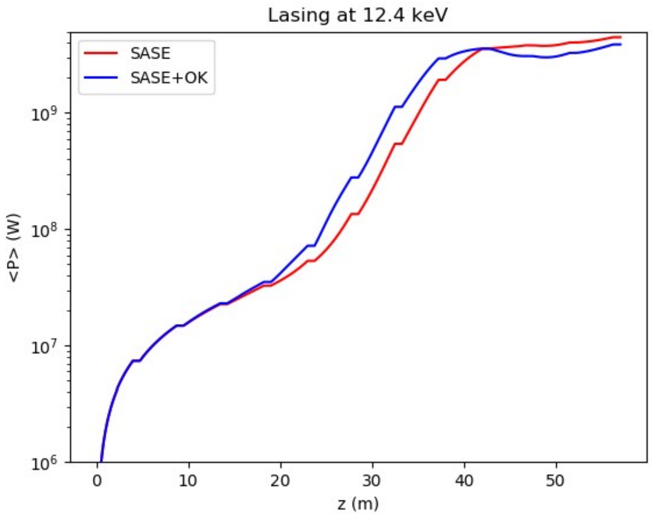
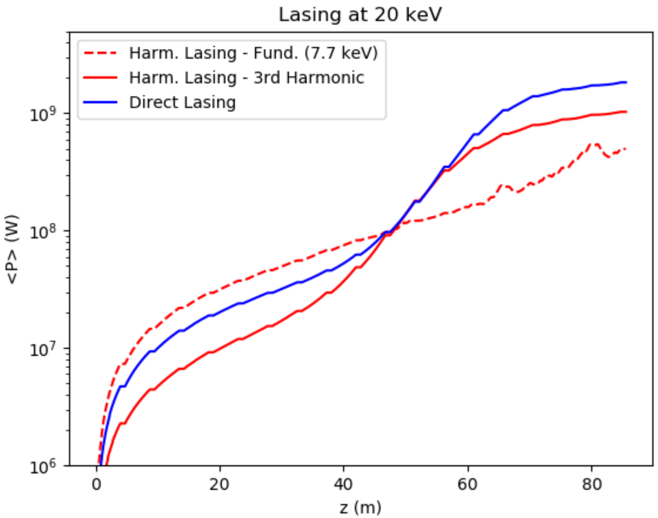
Porthos Simulations (S. Reiche)

Electron beam parameters: E = 7 GeV, I = 2 kA, Q = 200 pC, ε = 300 nm, σ_E = 1 MeV

λ_u = 15 mm, K = 1–2.5
"Aramis" type

- CHIC between undulators (75 cm every 4 m)
- Optical klystron effect not helping a lot (conservative assumption for energy spread)
- Saturation after 40 m (12.4 keV) or 80–90 m (20 keV).
- In the case of 20 keV no gain from harmonic lasing (saturation length, maximum power)





Porthos Simulations (E. Prat)

Electron beam parameters: E = 7 GeV, I = 2 kA, Q = 200 pC, ε = 300 nm, σ_E = 1 MeV

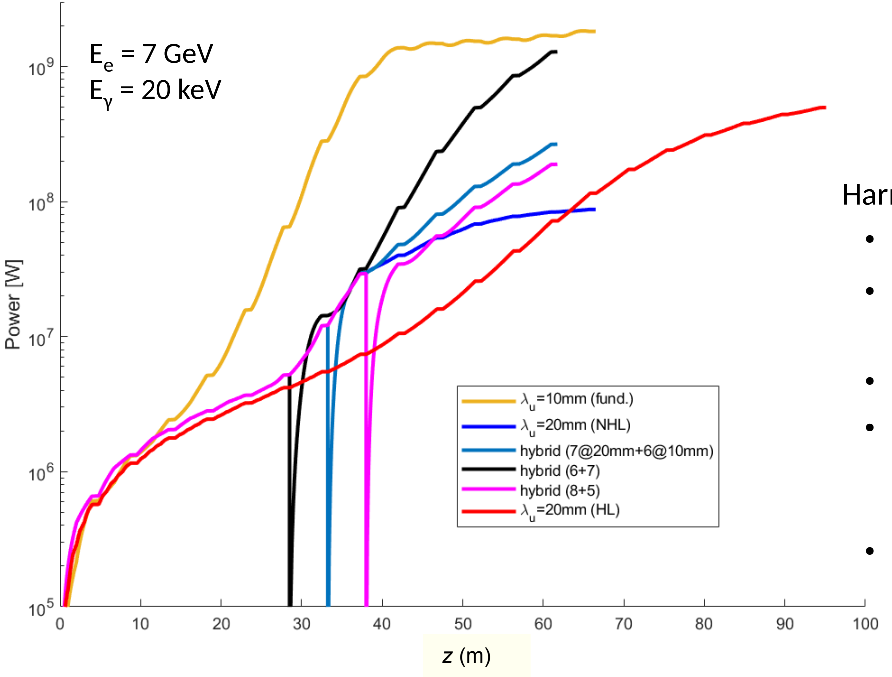
Hybrid setup:

λ_u = 20 mm, K = 2.18 (6.9 keV)
"Athos" type

λ_u = 10 mm, K = 1.62 (20.6 keV)
"HTS" type

Hybrid configuration:

- Amplification of 3rd harmonic with second stage.
- Varying number of undulators in first stage (6, 7 and 8). For each configuration the field of the 2nd stage is optimized (to match the third harmonic).
- Observation: Fastest growth with 6 undulators in the first stage (black curve). In this case it takes 7 modules in the 2nd section to reach 1 GW – only two modules less than in the case of only 10 mm undulators (yellow curve)…



Harmonic lasing:

- Amplification of 3rd harmonic in same stage.
- For λ_u = 20 mm tuned to 6.9 keV photon energy (0.18 nm) for the fundamental (power curve not shown).
- NHL: non-linear harmonic lasing, no suppression of the fundamental.
- HL: harmonic lasing where the fundamental is suppressed with phase shifters (one phase shifter after every meter of undulator).
  12 random configurations tried, the best is shown.
- Observation: NHL grows faster but does not reach 0.1 GW, HL needs more space but can grow to ~0.5 GW in 90 m (80 m of effective undulator length).