DIP, A HIGH-POWER IR DISPERSION INTERFEROMETER USING OPGAAS CRYSTAL FOR ELECTRON DENSITY MEASUREMENT

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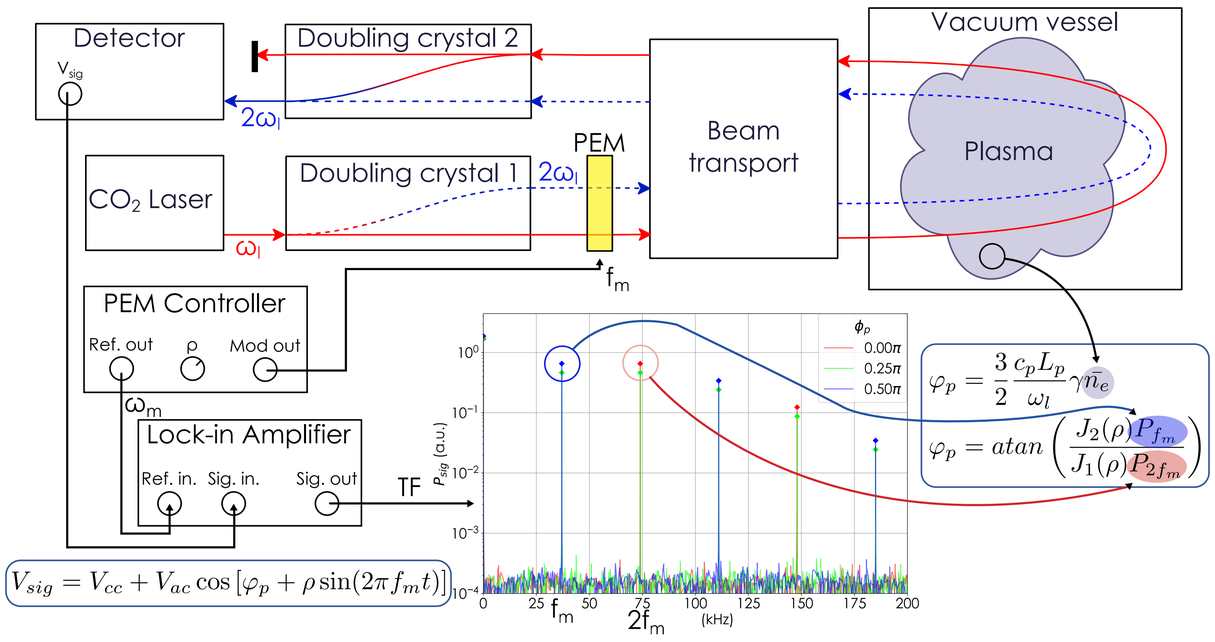
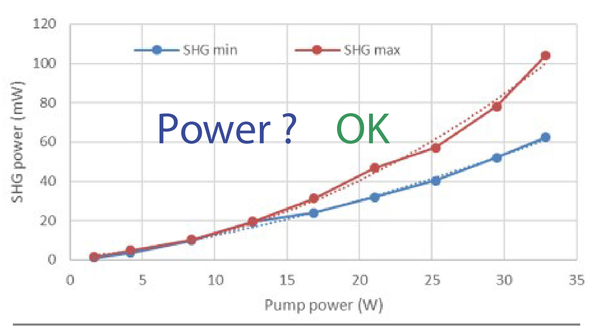
DISPERSION INTERFEROMETER PRINCIPLE

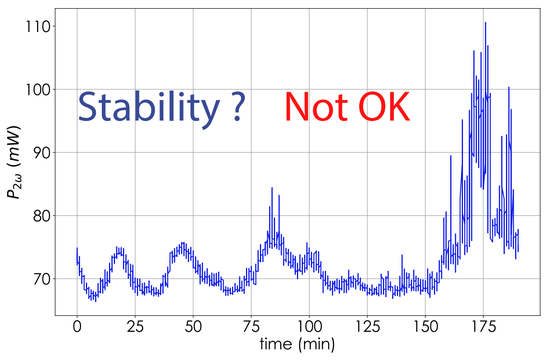


FREQUENCY DOUBLING WITH OPGaAs

OPGaAs doubling crystal

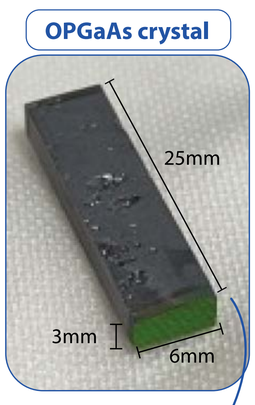
- Periodically polled: Quasi phase matching
- Low absorption (compared to $AgGaSe_2$): High pump power handling
- High effective nonlinearity d_{eff}: Efficient 2nd harmonic generation



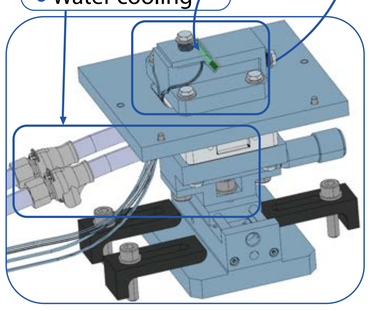


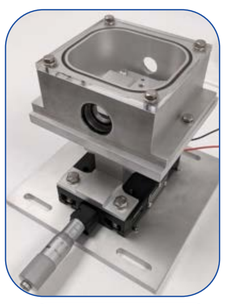
Crystal holder redesign

- Better thermal control
- Dust control
- More accurate crystal positioning and repositioning



Thermal control :
- Peltier module
- Water cooling





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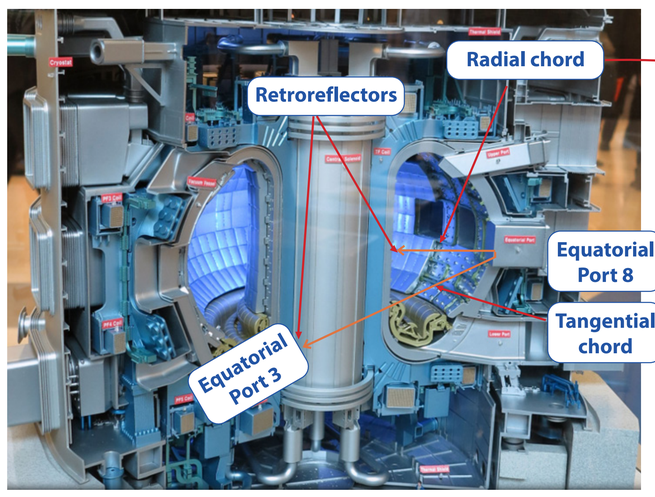
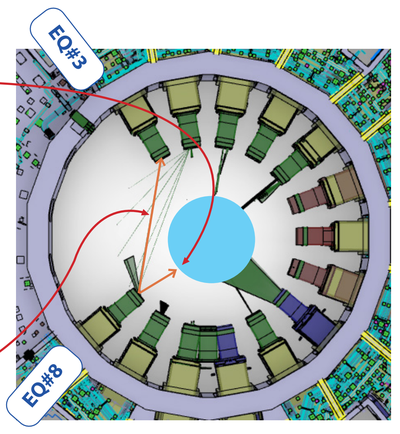
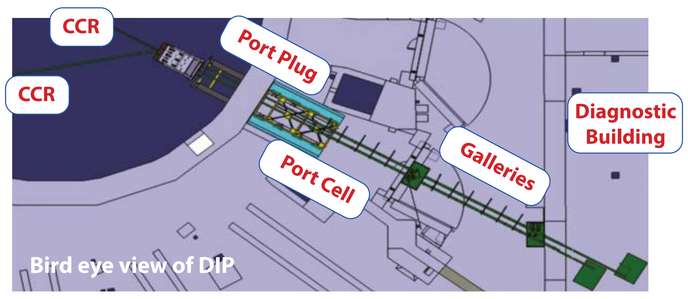






Interferometer key figures

A long interferometer:
- Propagation length≈120m

Phase accuracy :
- 220mrad ≈ 0.03 fringe

LWIR operation:
- 9.6 / 4.8µm

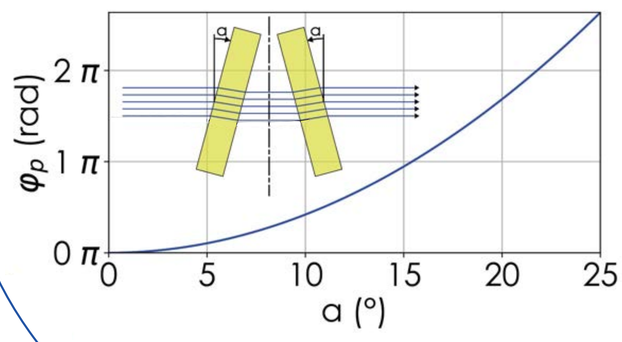
Laser operating power
- 30W @9.6µm / 100mW @4.8µm

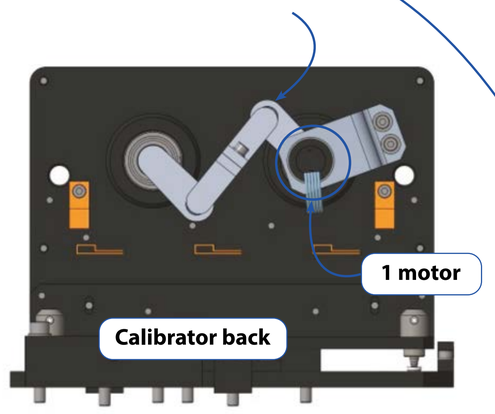
Operating environment:
- Harsh

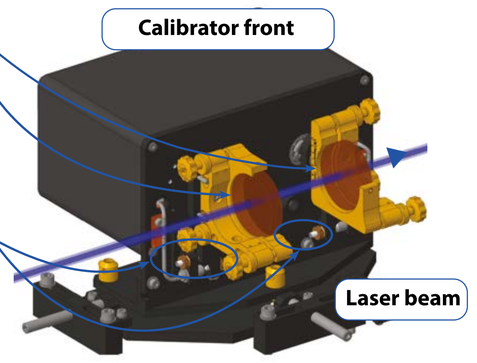
CALIBRATING THE INTERFEROMETER

Rotating plates design:

- Phase span: ≈ 2.5π rad
- Phase precision: < 5 mrad
- Symmetric design:
  - No beam displacement
  - No chromatic separation
- Simple optics: 2x 10 mm thick ZnSe windows
- Stability:
  - Zeroing via electromechanical endswitchs
  - Rigid link between plates





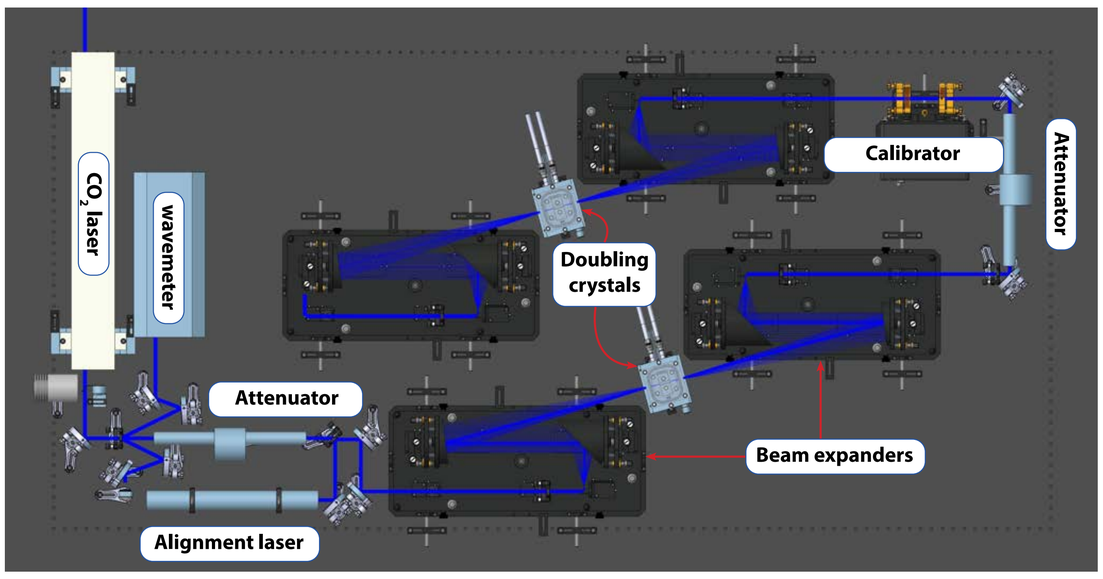


RD BENCH DESIGN : BUILD AND TEST THE INTERFEROMETER

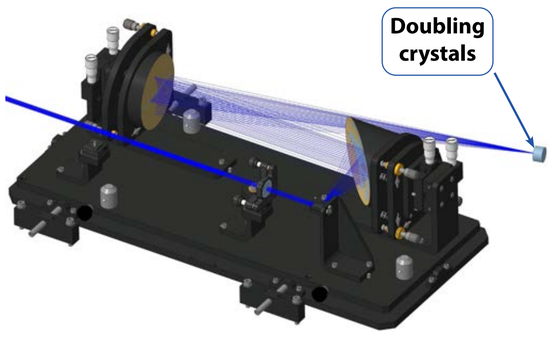
Current setup

Safety and cleanliness:
- Optical table enclosed under a clear air hood

Experiment control approximating ITER cubicles:
- 20 meter cables rack ↔ optical table when possible
- No USB: Ethernet or RS-232 only
- Automated measurements



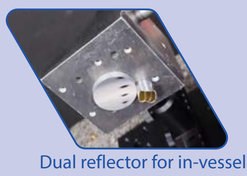
Beam expander:
- Focusing:
  - w_{1/e^2} : 2.4 mm → 85 µm @9.6 µm
- Fully reflective:
  - Achromatic
  - T > 90%
- Accurately repositionable:
  - Kelvin kinematic coupling
  - Built-in optical alignment features

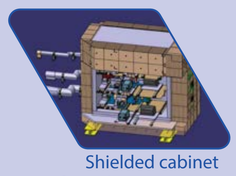


MORE ABOUT BERTIN

Bertin Technologies develops and installs plasma diagnostics for inertial and magnetic fusion:
- DP7-DP8: Visible optical diagnostics
- DP5: Visar diagnostic
- X-ray streak cameras


Rhodium coated mirror for In-vessel First Mirror


Dual reflector for in-vessel photometry calibration


Shielded cabinet for radiation protection


Laser Megajoule Common Reference

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