

**WG7 Report to the IUPAP General Assembly**  
**(International Committee on Ultra-High Intensity Lasers (ICUIL))**  
**Oct. 2025**

**Background**

The ICUIL community unites developers of ultra-high-intensity lasers with scientists advancing fundamental science and applications. Rapid increases in peak power and focal intensity, driven by needs in fusion energy, materials science, medicine, security, and compact accelerators, have made high-intensity lasers peer instruments to accelerators and synchrotrons. Laser-plasma accelerators now surpass 10 GeV over centimetre scales (*e.g.*, at the Texas Petawatt), while focal intensities near  $10^{23}$  W cm<sup>-2</sup> (*e.g.*, CoReLS) access regimes where matter is fully ionized, plasmas are relativistic and nonlinear, and strong-field QED effects emerge. Next-generation platforms (such as ELI, XCELS, SIOM, and Vulcan 20-20) will extend this “intensity frontier,” enabling high-energy-density studies relevant to astrophysics and inertial fusion, as well as compact radiation sources with attosecond duration, coherence, and MeV-scale photon energies, all of which are complementary to FELs and synchrotrons.

Globally, facilities have tripled over the past decade, spanning national labs and smaller centres that train the workforce and seed theory, modelling, diagnostics, and data science. Scaling pressures are catalyzing innovations, such as coherent beam combining, plasma-based optics, robust contrast control, and AI-assisted optimization, while remote/automated operations (accelerated during COVID-19) broaden access and talent discovery, including in less-resourced regions. ICUIL’s mission is to knit this ecosystem together: convening a forum for facilities and users, fostering collaborations and exchanges of people/equipment/ideas, promoting diversity and early-career development, and aligning with adjacent communities (accelerators, FELs, medical technologies). The field’s transformative impact is underscored by recent Nobel Prizes - CPA (2018) for enabling ultrashort, ultra-intense pulses and attosecond science (2023) for revealing electron dynamics. Looking ahead, ICUIL will continue to expand equitable access to capabilities, training, and technology transfer, ensuring that the societal benefits of high-intensity lasers (including scientific insights, healthcare advances, clean energy pathways, and resilient industries) are shared widely.

**Facilities & Technical Highlights**

ICUIL members report steady progress across flagship facilities and enabling technologies; below is a condensed overview.

- Apollon (France): a multi-PW user facility currently operated at the 3 PW level, continued optimization toward higher on-target intensity and energy ramp-up to 9 PW
- CoReLS (Korea): adaptive-optics-assisted tight focusing sustaining  $\sim 10^{23}$  W cm<sup>-2</sup>-class focal intensities, enabling strong-field QED-relevant studies.
- UK Central Laser Facility: EPAC (1-PW/10-Hz) build-out; HiLUX ultrafast platform upgrades; Vulcan 20-20 roadmap targeting 20-PW and kJ-class long pulses.
- J-KAREN-P (Japan): plasma-mirror temporal-contrast upgrades (post-compressor) for high-contrast ion acceleration and XUV/HHG.
- ZEUS (USA): front-end commissioning to >200-TW with high Strehl; roadmap to 1–3 PW and multi-area user modes.

- OMEGA/EP (USA): advanced high-intensity probes (protons, electrons, X-rays) and TW-class THz generation via laser-solid interactions. Additionally, LLE's FLUX platform is advancing to provide high-repetition-rate ultrafast probe capabilities for HED and ICF-relevant experiments.
- SIOM (China): SULF — current status update toward FEL operation (FEL light has also been obtained at HZDR)

### **ICUIL 2024 Conference (Cozumel, Mexico, 9 - 13 September 2024)**

The 10<sup>th</sup> International Conference on Ultrahigh Intensity Lasers (ICUIL 2024) was hosted on Cozumel Island, Mexico, at the El Cozumeleño Beach Resort, Chaired by Eric Rosas (Clúster Mexicano de Fotónica), Christian Schubert (Universidad Michoacana de San Nicolás de Hidalgo, Mexico) and Tsuneyuki Ozaki (INRS, Canada). It marked the first ICUIL conference in Latin America, emphasizing equity, diversity, and inclusion while broadening participation from new regions. The scientific scope encompassed ultra-high-intensity laser sources and beamlines (PW to multi-PW), facility roadmaps, diagnostics, and spatiotemporal control, advanced targets and contrast management, laser-plasma accelerators and compact radiation sources (XUV to  $\gamma$ ), strong-field quantum electrodynamics, high-energy-density physics, and applications in medicine, industry, and security.

The program featured plenary and invited talks, contributed sessions, and poster sessions, with dedicated space for student and early-career engagement. Facility and network updates (CLF/EPAC, Apollon, CoReLS, ZEUS, LaserNetUS, ELI sites, *etc.*) provided a comparative view of performance, user access modes, and upgrade paths. Local information and logistics were coordinated by the organizing team via the "Mexico Territorial Committee for Optics" (CTOM), the official representative of Mexico to the International Commission for Optics (ICO, AC1 of IUPAP), including venue details, travel arrangements, and practical guidance for attendees.

### **ICUIL 2026 Conference (Preview)**

The 11<sup>th</sup> ICUIL Conference will be hosted by the UK's Central Laser Facility, chaired by John Collier, in the historic town of St Andrews, Scotland, from 8 - 13 November 2026. The meeting will build on the progress of multi-PW facility and compact-source advances, and is expected to feature strong engagement from European, UK, and international UHIL communities.

### **ICUIL Prizes & Honours (2024)**

#### **Yoshiaki Kato Award (inaugural, 2024) – Prof. Ulrich Schramm (HZDR, Germany)**

Awarded during ICUIL 2024 to Prof. Ulrich Schramm, recognizing his groundbreaking achievements in laser particle acceleration and its applications. Recent highlights include cascaded-regime laser-driven proton beams reaching  $\sim 150$  MeV at application-relevant yields using repetitive PW-class lasers, as well as sustained progress with the DRACO/ELBE platform toward reliable high-energy ion sources.

#### **IUPAP ICUIL Prize for Early Career Scientist (2024) – Dr. Yang Wan (Zhengzhou University, China)**

Awarded to Dr. Yang Wan, recognized for outstanding contributions to laser-wakefield acceleration (LWFA), particularly novel ultrafast diagnostics that directly visualize wakefield dynamics using femtosecond relativistic electron probes, clarifying injection, nonlinear evolution, and beam-plasma coupling and informing next-generation compact accelerators.

### **1st Latin American ICUIL Workshop**

ICUIL held its first Latin American workshop, chaired by Tsuneyuki Ozaki (INRS, Canada), to scope a practical roadmap for a regional network - provisionally referred to as "LAsERLAB Latin America (LA<sup>3</sup>)" - that could interoperate with existing user ecosystems (*e.g.*, LaserNetUS). Discussions emphasized collaborative access (including to femtosecond, mJ-class systems for experiments that do not require ultra-intense conditions), mobility and training for students and postdocs, and the creation of a technician/engineer pipeline for user-facility operations. A central highlight was Brazil's Instituto de Pesquisas Energéticas e Nucleares (IPEN, São Paulo), which is establishing Latin America's first ICUIL user

facility — a ~15-TW femtosecond Ti:sapphire system to support a broad user base. The workshop also identified mechanisms for travel support (such as IUPAP C13 conference support and bilateral programs like EduCanada and Mitacs) and opportunities for hands-on staff training at established laboratories (*e.g.*, ALLS), while mitigating brain-drain through regionally anchored programs.

#### **ICUIL Governance & Leadership**

In July 2025, ICUIL Chair Prof. Dino Jaroszynski announced his intention to step down, and Prof. Chang-Hee Nam likewise indicated that he would step down as co-Chair. ICUIL extends its sincere gratitude to Dino and Chang-Hee for their exemplary leadership and steady stewardship of the committee. Their efforts helped strengthen global coordination across ultra-high-intensity laser facilities and broaden the community's engagement. Following the recent election, Tsuneyuki Ozaki was elected as the new Chair in August 2025, and a new Co-Chair will be announced shortly to ensure a smooth transition and continuity of initiatives. We also warmly thank Sylvie Jacquemot (Co-Chair), Jake Bromage (Secretary) and Vincent Bagnoud (Treasurer) for their continuing service and dedication to ICUIL.