

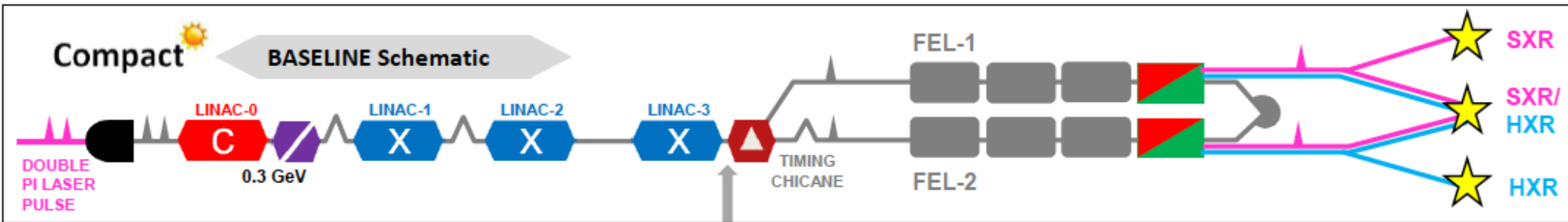


WP5 Summary Report

*3rd CompactLight Annual Meeting
(a.k.a. 2nd Virtual Glasgow) – November 24th 2020*

F. Nguyen on behalf of the WP5

'Dual Mode Linac' – single linac, single klystron



0.97 to 2.4 GeV @ 250 Hz (SXR/SXR)
2.75 to 5.5 GeV @ 100 Hz (HXR/HXR)

Courtesy of N. Thompson

Both Soft and Hard X-Ray configurations foresee a SASE line based on Helical SCUs plus an Afterburner line based on Apple-X undulators

As shown by V. Goryashko and discussed at the last WP5 meeting, attaining variable polarisation by means of optical HXR manipulation is highly inefficient → deemed too risky for a User Facility!



Fixing the SCU parameters (from N. Thompson)

- ▶ 15 mm gives too long saturation length at 16 keV and only better performance in SXR from 0.25 keV to 0.8 keV
- ▶ 11 mm gives marginally better performance 8 keV to 16 keV
- ▶ 13 mm gives nearly double the pulse energy in the SXR compared to 11 mm with only a small compromise in pulse energy and saturation length
- ▶ **13 mm looks the best choice**

Courtesy of A. Bernhard

Undulator (SC helical)		
period length (refined)	mm	13
length (incl. matching periods)	mm	1755
magnetic gap (refined)	mm	4.2
beam pipe bore diameter	mm	3
a_w (8 keV)		1.33
a_w (16 keV)		0.617
B_{max} on axis	T	1.09

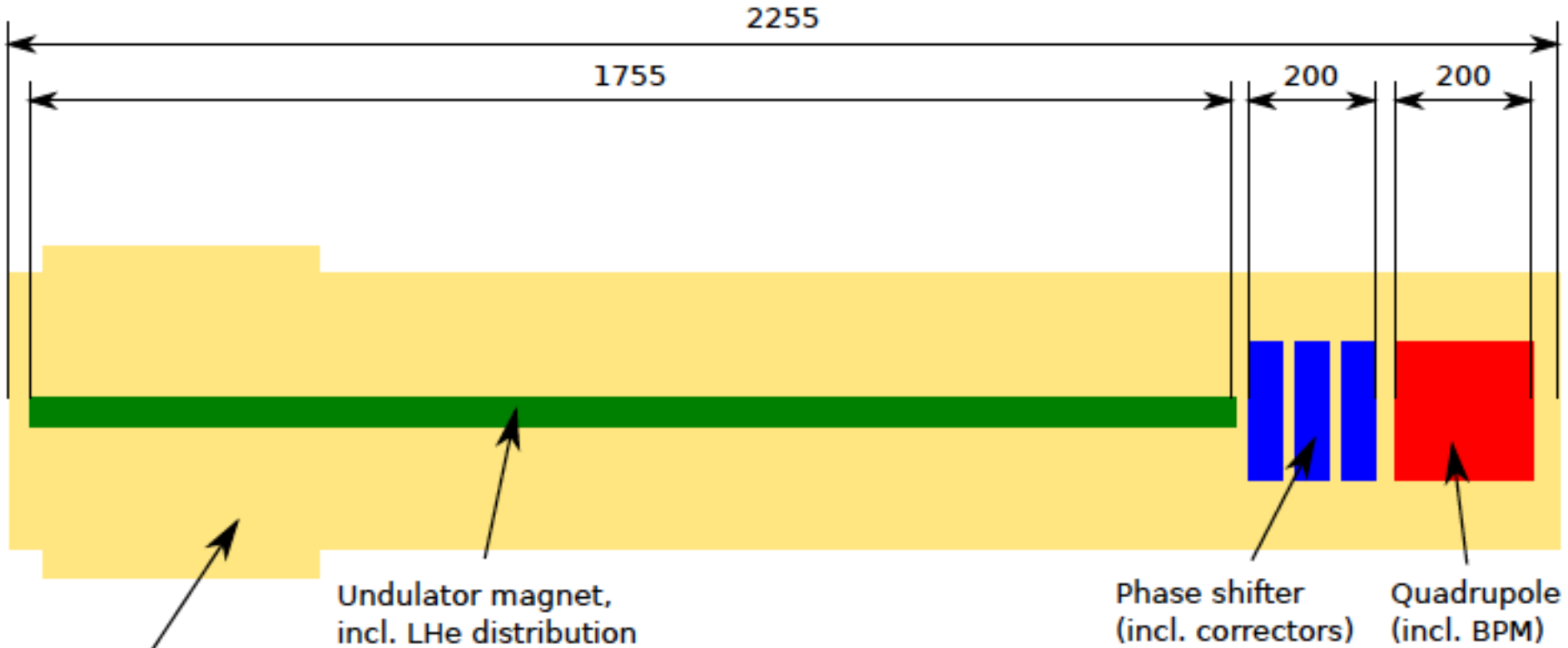
Then the AB parameters (from N. Thompson)

If we take 13mm as undulator period, we have to choose the afterburner parameters to cover the same tuning range, i.e. 650eV to 2keV @ 2.36GeV

Min Gap	3 mm	4mm
Period	18mm	19mm
a_w @ 650 eV	1.96	1.75
a_w @ 2 keV	0.68	0.62

Final decision after assessing the HXR output

And after SXR vs. HXR trade-off (from H.M.C. Cortes)



Vessel e.g. DN 400, consisting of 6-way cross, tube, bellow

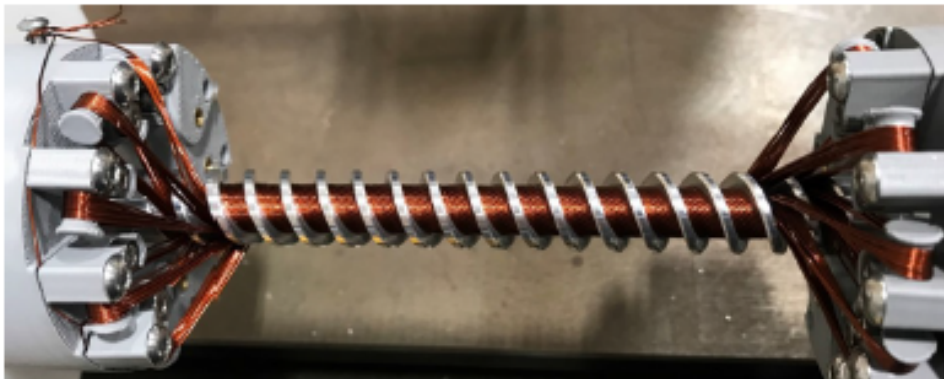
Courtesy of A. Bernhard

- ▶ requirement for 1 XLS-FEL line:

Cooling power @ 4.2 K ~40 W

- ▶ *Example* Linde's smallest standard Helium liquifying/forced flow cooling system LR70 provides 130 W to 190 W at 4.4 K (13 bar)
- ▶ sufficient for FEL1&FEL2 including factor of 2 margin relaxing cryostat design requirements

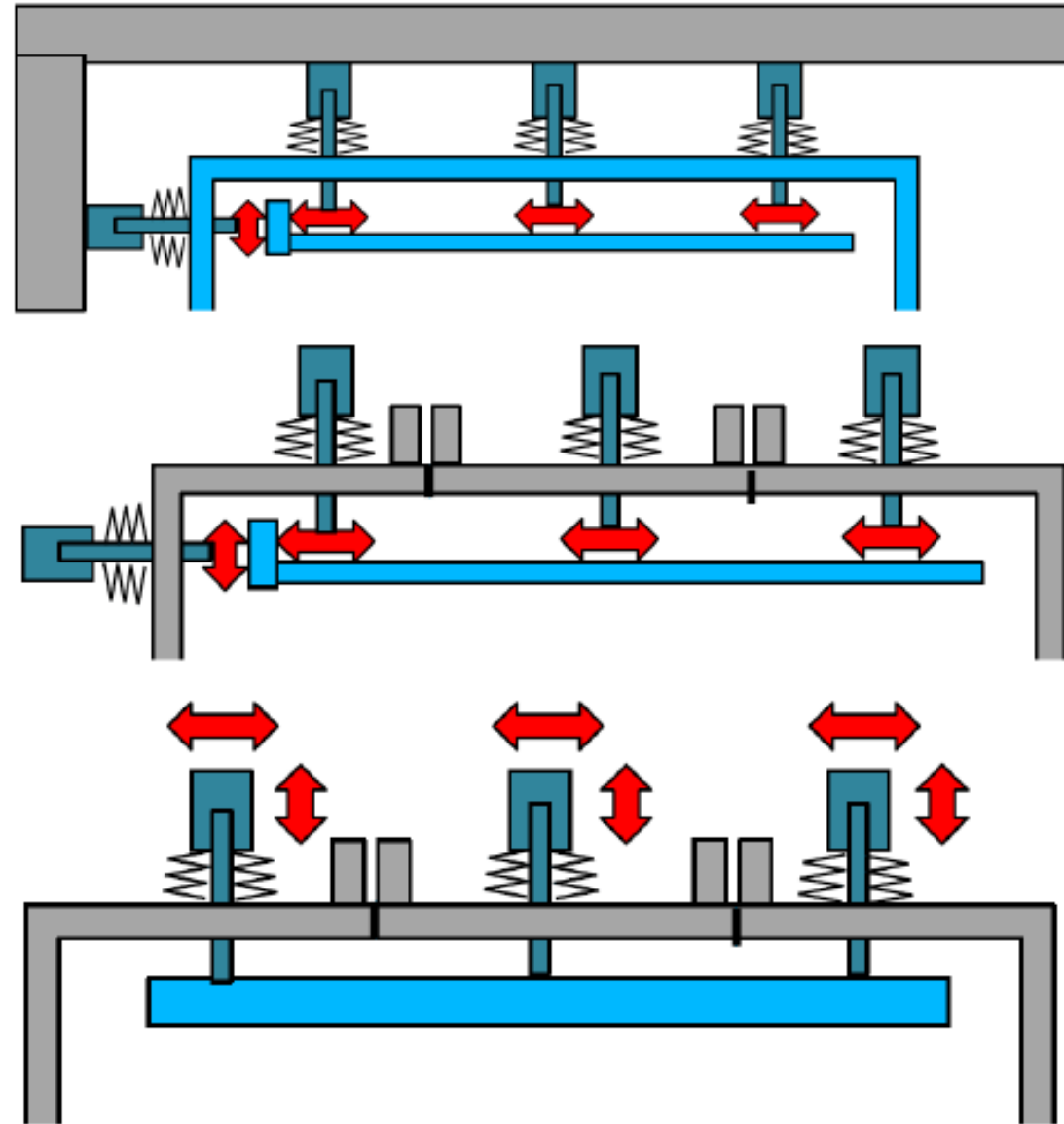
- ▶ Stage 1: 30 cm model, 13 mm period
- ▶ Design work carried out at Daresbury to optimize turnarounds and correctors
- ▶ Winding trials ongoing at RAL
- ▶ Full former wound with copper wire →
- ▶ Work starting on winding with SC wire ↓

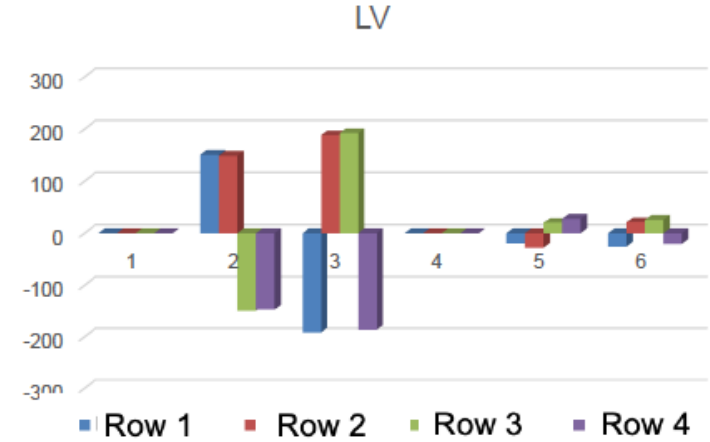
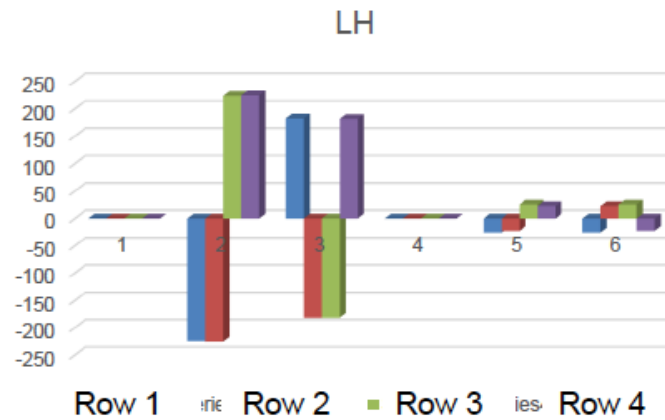
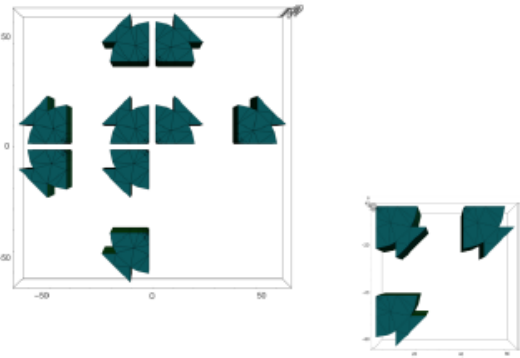


Courtesy: Ben Shepherd

- Development directions proposed by Thomas Schmidt (WP5)
- Provisional set of undulator parameters
- Three possible solutions for Radial and Phase Motion realization
 1. Fixed frame, traditional VC
 2. Segmented VC as support structure, separate radial and phase motion
 3. Segmented VC as support structure, combined radial and phase motion

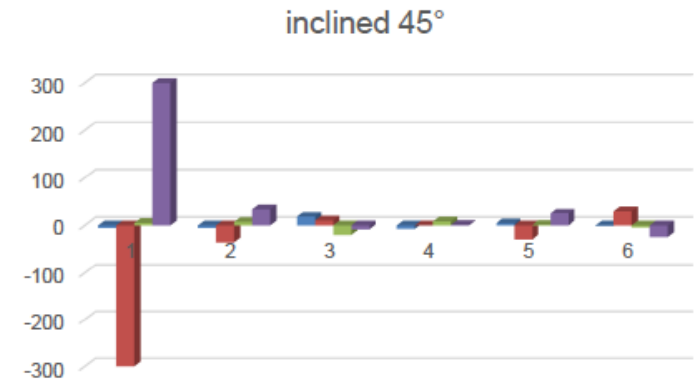
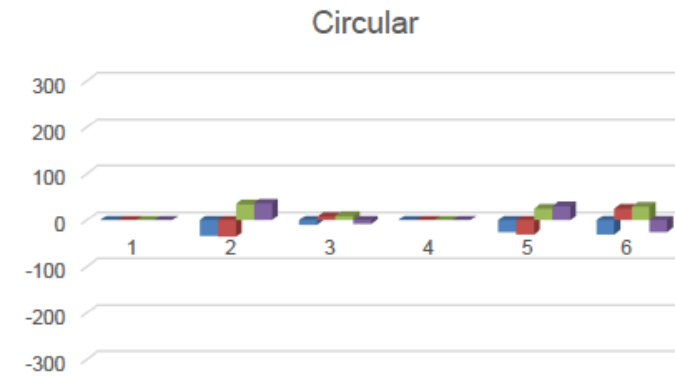
Courtesy of T. Milharcic





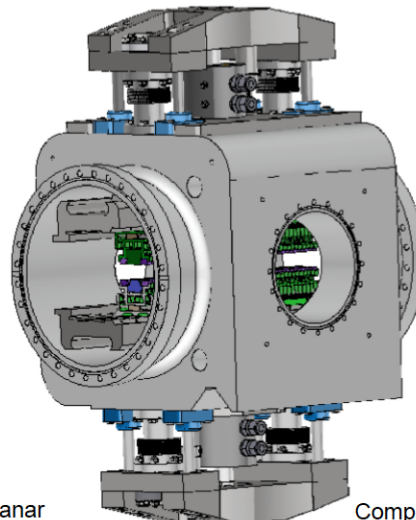
Force compensation

- works in all modes
- does not change in major operation modes
- is the key to compact design

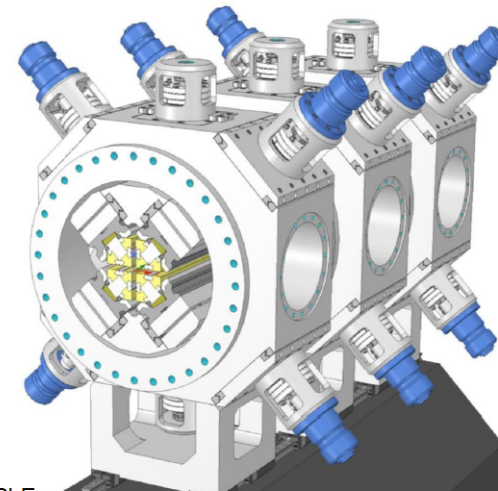


Courtesy of T. Schmidt

Synergy with SLS 2.0



PSI planar



Compact Light APPLE



A big warm thank you to all WP5 collaborators for their contributions during these hard times!

- **SASE line: parameters and main concept are in place, a lot of progress on**
 - ✓ **Quadrupoles**
 - ✓ **Phase shifters**

- **AB line: main design solution proposed, **have to fix the AB undulator parameters to make both HXR and SXR fulfill WP2 FEL performance****

To do by March 31st

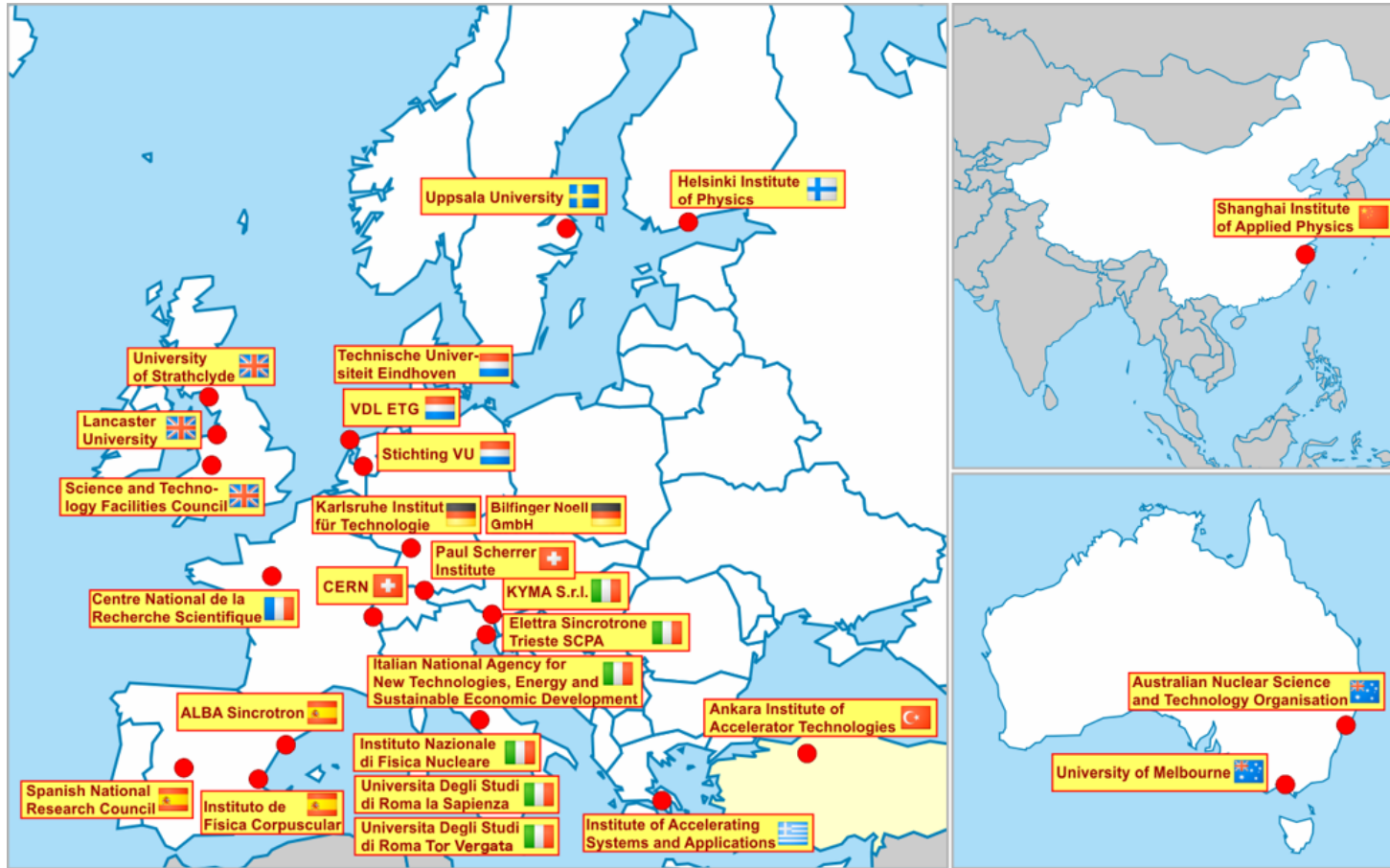
Write !



Thank you!

CompactLight@elettra.eu

www.CompactLight.eu



CompactLight is funded by the European Union's Horizon2020 research and innovation programme under Grant Agreement No. 777431.

