

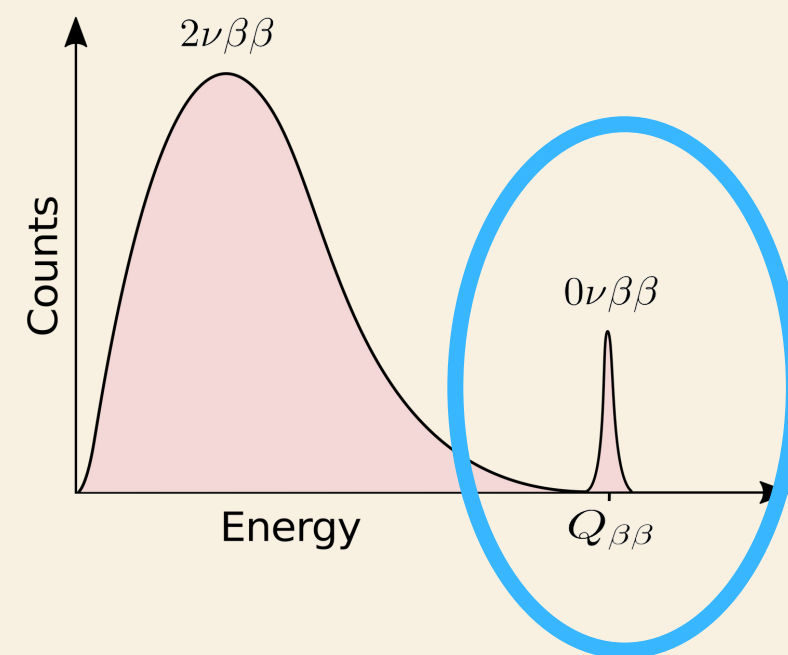
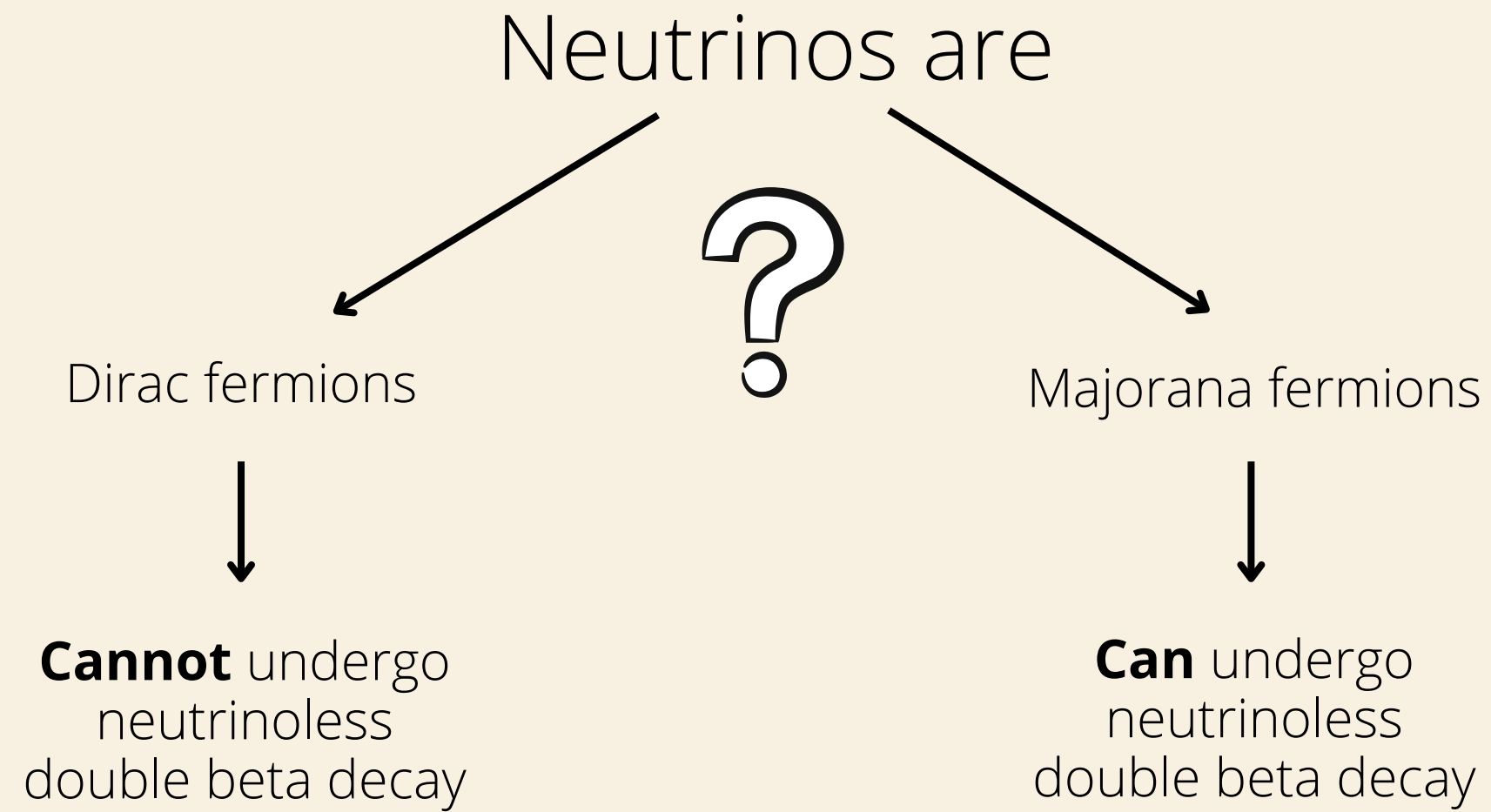
Searching for Neutrinoless Double Beta Decay with the LEGEND Experiment

Giovanna Saleh - University of Padova, INFN Padova
On behalf of the LEGEND Collaboration
giovanna.saleh@phd.unipd.it

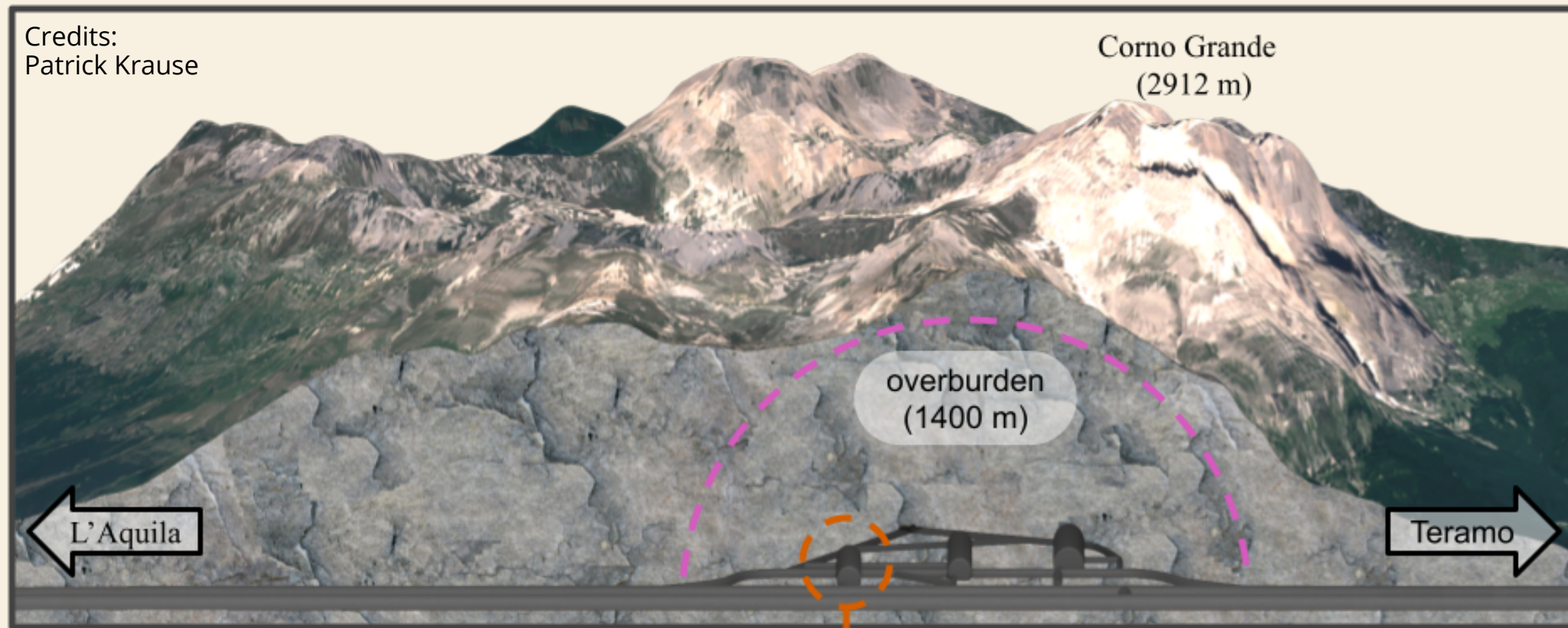


NuPhys2023 - King's College London
18 - 20th December 2023



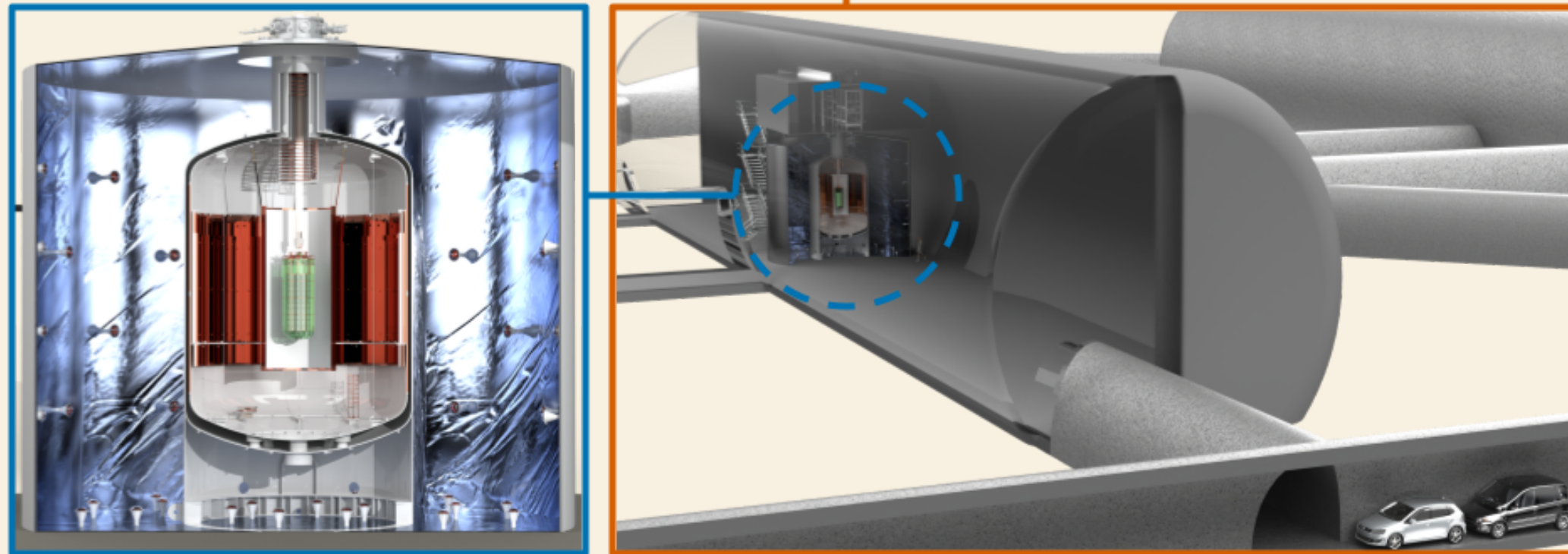


Experimental signature
of neutrinoless
double beta decay

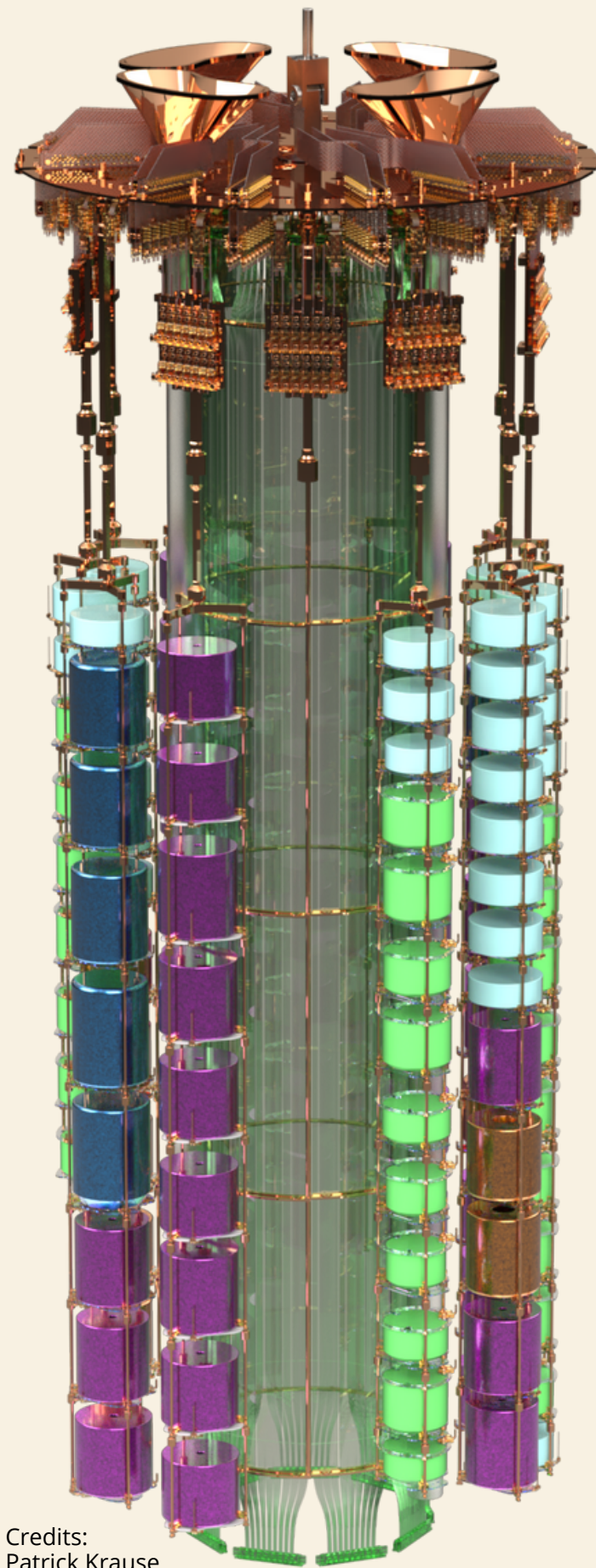


↖
Outside
the laboratories

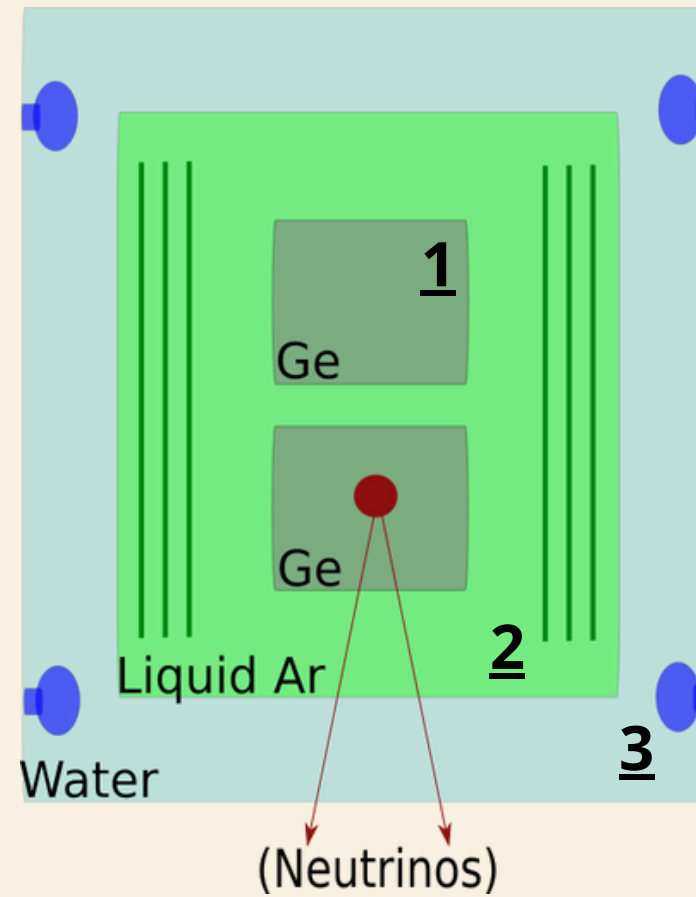
Inside
the experiment



Gran Sasso National Laboratories (LNGS), Italy



Credits:
Patrick Krause



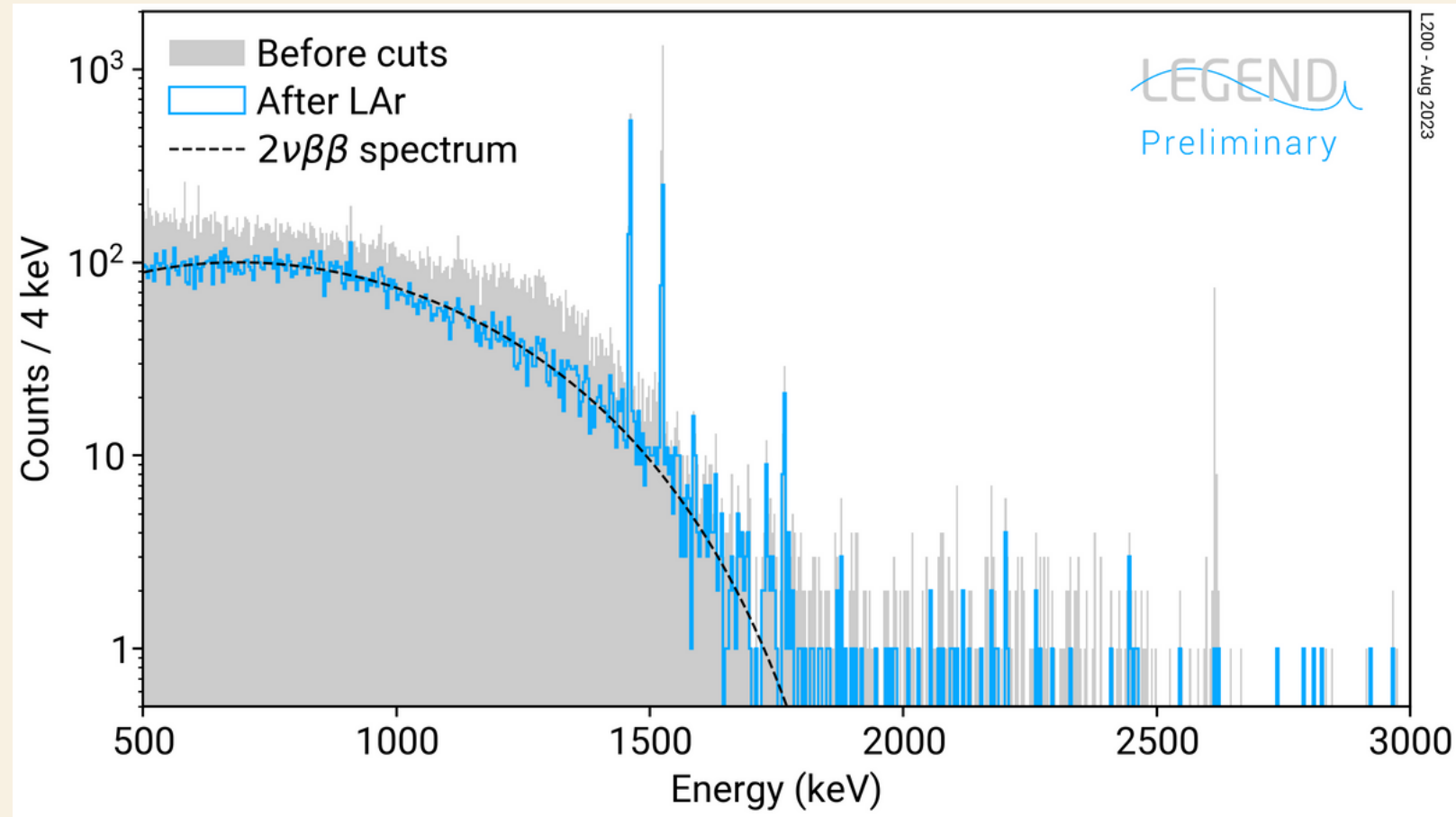
- 1: Ge detectors strings**
- 2: Liquid Argon (LAr) cryostat:**
cooler and active veto (SiPMs)
- 3: Water tank:**
shielding and active veto (PMTs)

Isotope: ^{76}Ge

Reaction: $^{76}\text{Ge} \rightarrow ^{76}\text{Se} + 2e^-$

Q-value: $Q_{\beta\beta} = 2039 \text{ keV}$

Resolution: $\text{FWHM}(Q_{\beta\beta}) \approx 3 \text{ keV}$

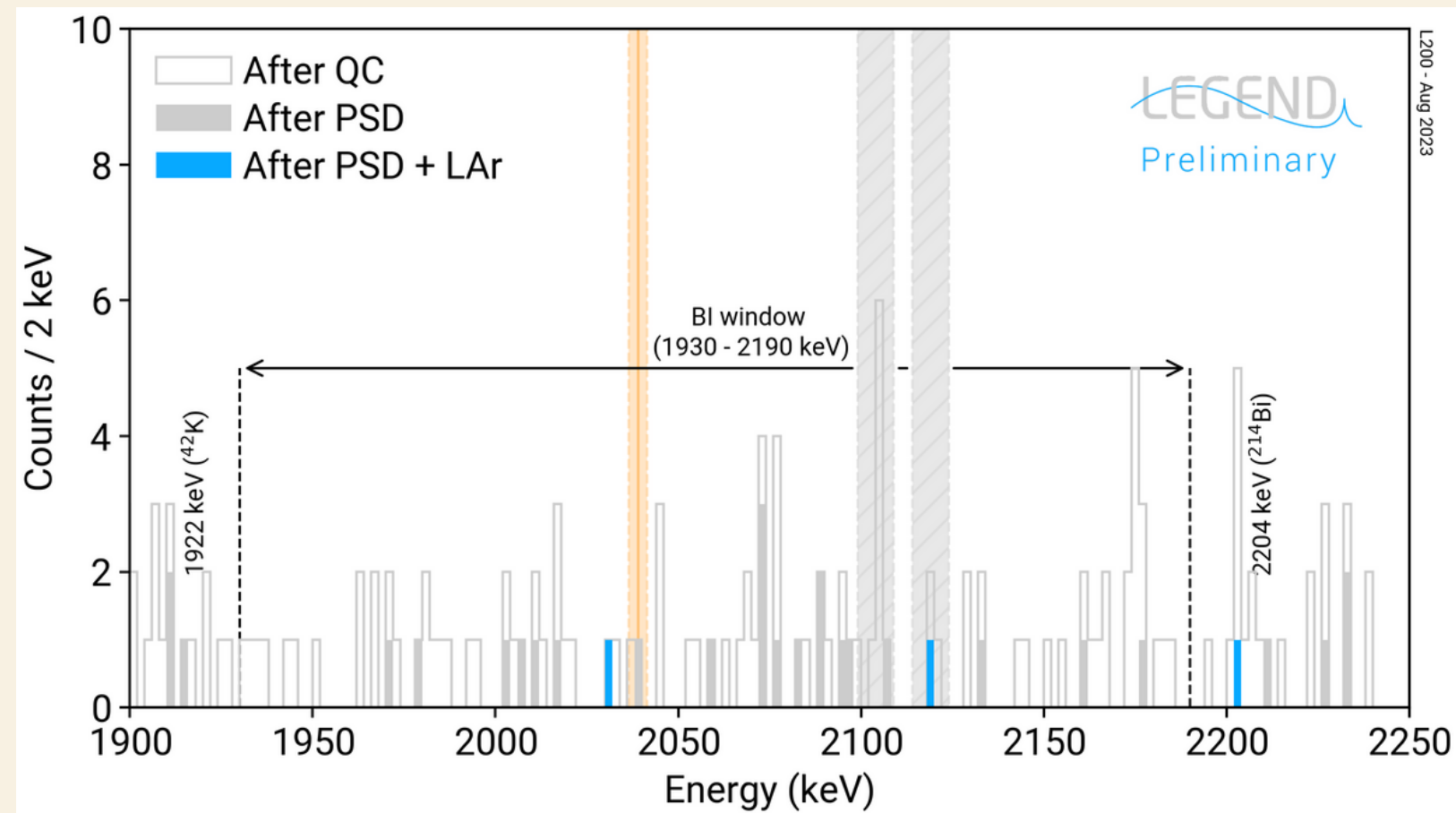


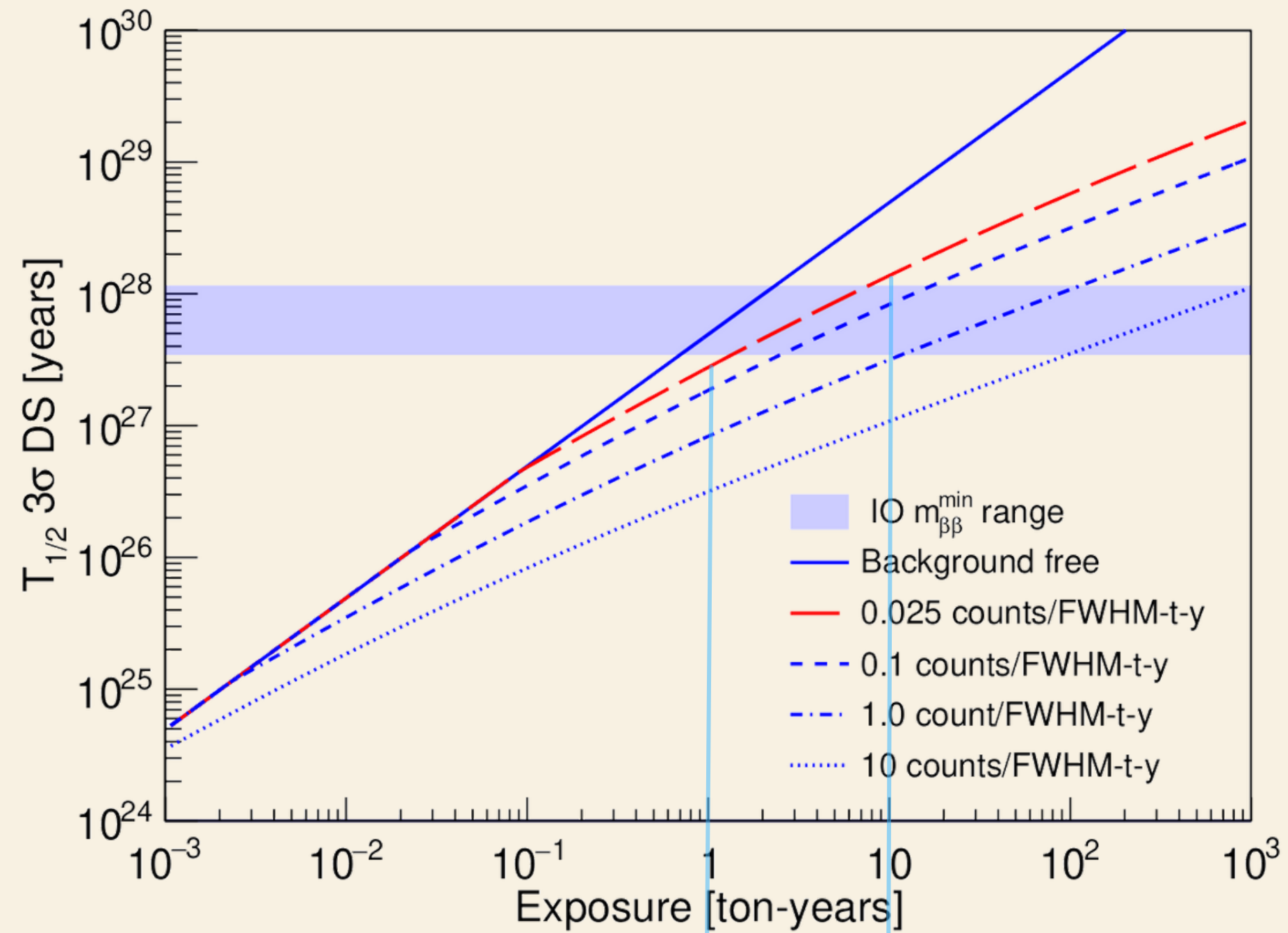
First data release in August 2023:
10.1 kg yr of exposure

Energy spectrum compatible with $2\nu\beta\beta$ after LAr veto (anti-coincidences with LAr instrumentation)

Background Index achieved in a 260 keV analysis window around $Q\beta\beta$:

$$B. I. = 4.1 [1.5, 11.4] \times 10^{-4} \text{ cts}/(\text{keV kg yr}), \text{ at } 68\% \text{ CL}$$





LEGEND-200

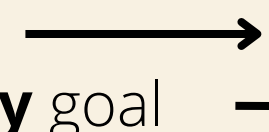
200 kg of Germanium
 B.I. $\leq 2 \times 10^{-4}$ cts/(keV kg yr)
 $T_{1/2}(0\nu) = 1.5 \times 10^{27}$ yr (3σ)

LEGEND-1000

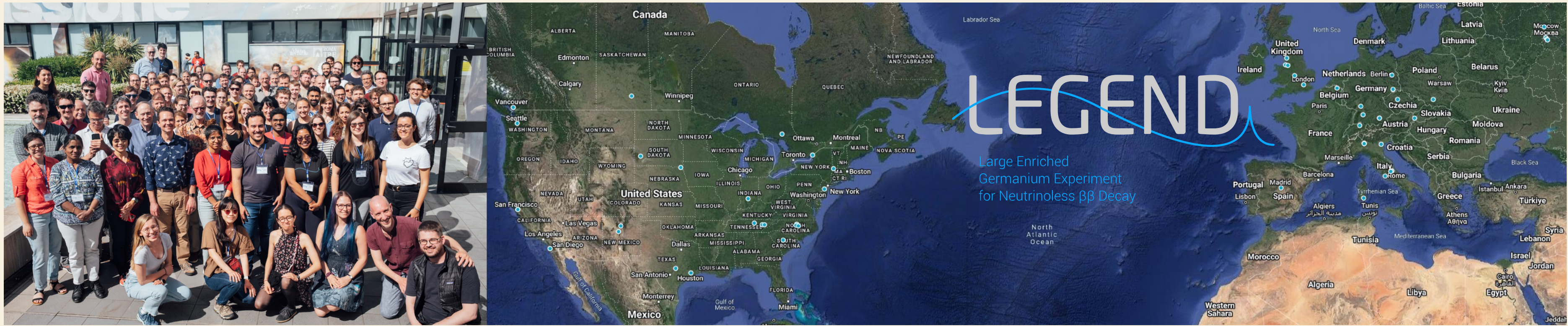
1000 kg of Germanium
 B.I. $\leq 1 \times 10^{-5}$ cts/(keV kg yr)
 $T_{1/2}(0\nu) = 1.3 \times 10^{28}$ yr (3σ)

Background goal →

Half life discovery sensitivity goal →



The LEGEND Collaboration



CIEMAT
Comenius Univ.
Czech Tech. Univ. Prague and
IEAP Daresbury Lab.
Duke Univ. and TUNL
Gran Sasso Science Inst.
Indiana Univ. Bloomington
Inst. Nucl. Res. Rus. Acad. Sci.
Jagiellonian Univ.
Joint Inst. for Nucl. Res.
Joint Res. Centre Geel
Lab. Naz. Gran Sasso
Lancaster Univ.
Leibniz Inst. for Crystal Growth

Leibniz Inst. for Polymer
Research Los Alamos Natl. Lab.
Max Planck Inst. for Nucl. Phys.
Max Planck Inst. for Physics
Natl. Res. Center Kurchatov Inst.
Natl. Res. Nucl. Univ. MEPhI
North Carolina State Univ.
Oak Ridge Natl. Lab.
Polytech. Univ. of Milan
Princeton Univ.
Queen's Univ.
Roma Tre Univ. and INFN
Simon Fraser Univ.
SNOLAB

South Dakota Mines
Tech. Univ. Dresden
Tech. Univ. Munich
Tennessee Tech. Univ.
Univ. of California and LBNL
Univ. College London
Univ. of L'Aquila and INFN
Univ. of Cagliari and INFN
Univ. of California San Diego
Univ. of Houston
Univ. of Liverpool
Univ. of Milan and INFN
Univ. of Milano Bicocca and INFN
Univ. of New Mexico

Univ. of North Carolina at Chapel Hill
Univ. of Padova and INFN
Univ. of Regina
Univ. of South Carolina
Univ. of South Dakota
Univ. of Tennessee
Univ. of Texas at Austin
Univ. of Tuebingen
Univ. of Warwick
Univ. of Washington and CENPA
Univ. of Zurich
Williams College