



PHYSICS OPPORTUNITIES OF LARGE LIQUID SCINTILLATOR DETECTORS

Town Hall

U Mainz

October 13-15th, 2026

Gabriel D. Orebi Gann (LBNL, UC Berkeley)



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Thank you to the organisers!

Gabriel D. Orebi Gann (LBNL, UC Berkeley)

From physics goals to detector possibilities

- Explored a broad range of technologies and approaches
 - Identified opportunities, challenges, R&D priorities
 - Start on bringing elements together into detector concepts
-
- **Energy resolution:** how close can we get to the Poisson limit?
 - **Isotope loading:** can we decouple loading from transparency (& stability, radiopurity)?
 - **Photon detection:** More. Better. Does topological information deliver sufficient gain in physics / \$?
 - **Integration:** Depth. Backgrounds. Calibration. Reconstruction. Engineering.

Town Hall series

Town Hall I

PHYSICS



CAPABILITIES



Town Hall II

CAPABILITIES



TECHNOLOGY



Town Hall III

TECHNOLOGY



STRATEGY



Town Hall IV

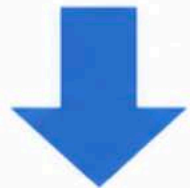
STRATEGY



ACTION

Town Hall I — Irvine (June 2026)

PHYSICS



CAPABILITIES

- Is there a compelling scientific case for another large liquid scintillator detector, beyond those in operation?
- What physics program should drive its design?
- What detector capabilities are required to realize that physics program?



UC IRVINE



Berkeley
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Town Hall series

Town Hall I

PHYSICS



CAPABILITIES

Town Hall I — Irvine (June 2026)

PHYSICS



CAPABILITIES

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UC IRVINE



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UNIVERSITY

Town Hall II

CAPABILITIES



TECHNOLOGY

Town Hall II — Mainz (October 2026)

CAPABILITIES



TECHNOLOGY

- What technologies can achieve those capabilities?

Hosted by

Alfons Weber and Michi Wurm

October 13–15, 2026



Cluster of Excellence
PRiSMA+
Precision Physics, Fundamental Interactions
and Structure of Matter



JOHANNES GUTENBERG
UNIVERSITÄT MAINZ

Town Hall III

TECHNOLOGY



STRATEGY

Town Hall IV

STRATEGY



ACTION

Town Hall series

Town Hall I

PHYSICS



CAPABILITIES

Town Hall I — Irvine (June 2026)

PHYSICS



CAPABILITIES

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CAPABILITIES



TECHNOLOGY

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TECHNOLOGY

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JOHANN
UN

Town Hall III

TECHNOLOGY



STRATEGY

Town Hall III — Canada (2027)

TECHNOLOGY



STRATEGY

- What detector concepts and technologies can deliver the required physics capabilities?
- How do we develop a coherent, large-scale strategy for next-generation liquid scintillator detectors?
- What are the key elements, priorities, and open questions for a community white paper?

Hosted by

Site: SNOLAB? Toronto?

Dates: TBC

Town Hall IV

STRATEGY

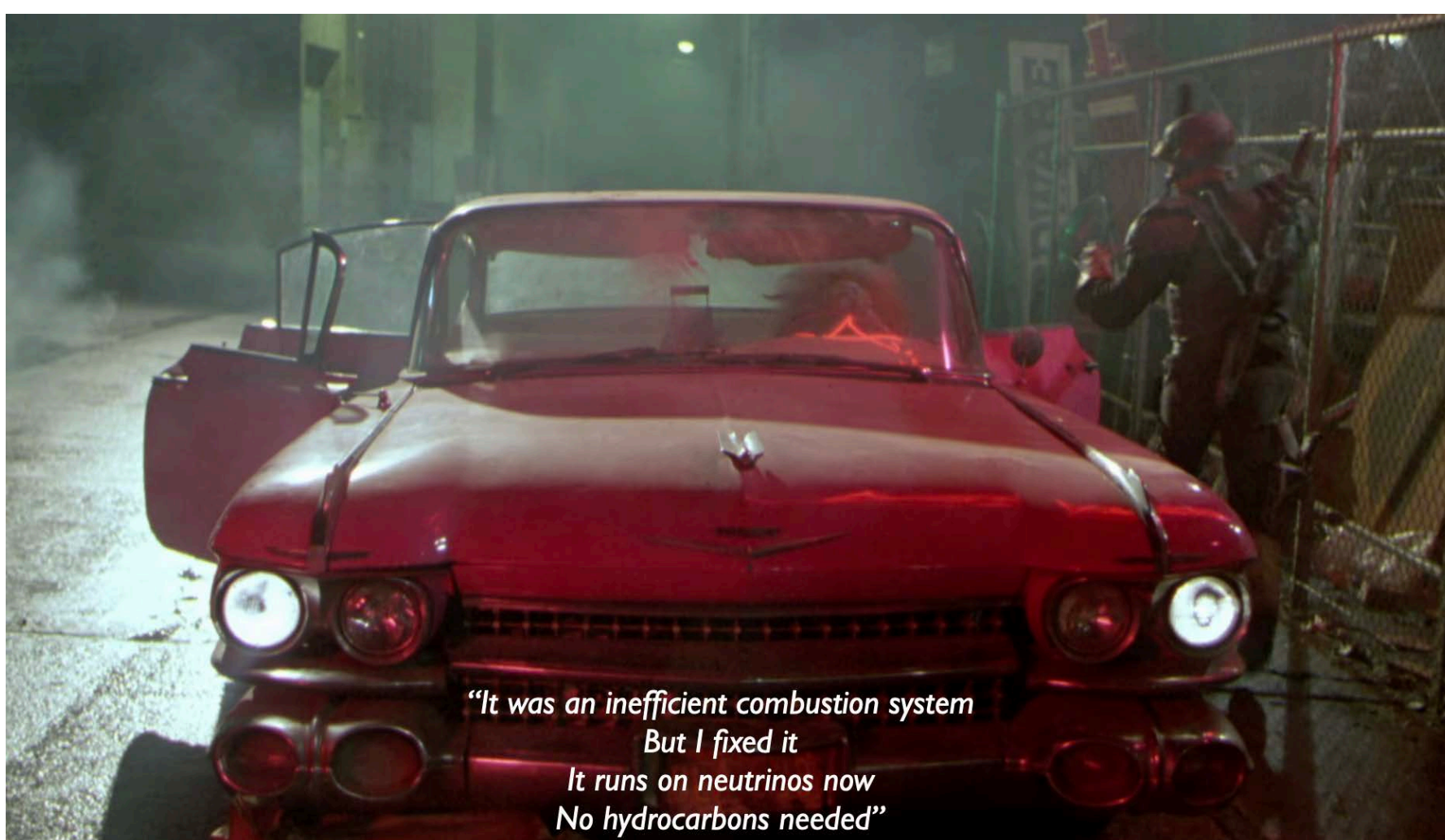


ACTION

Town Hall series



Town Hall series



Town Hall series



Town Hall series



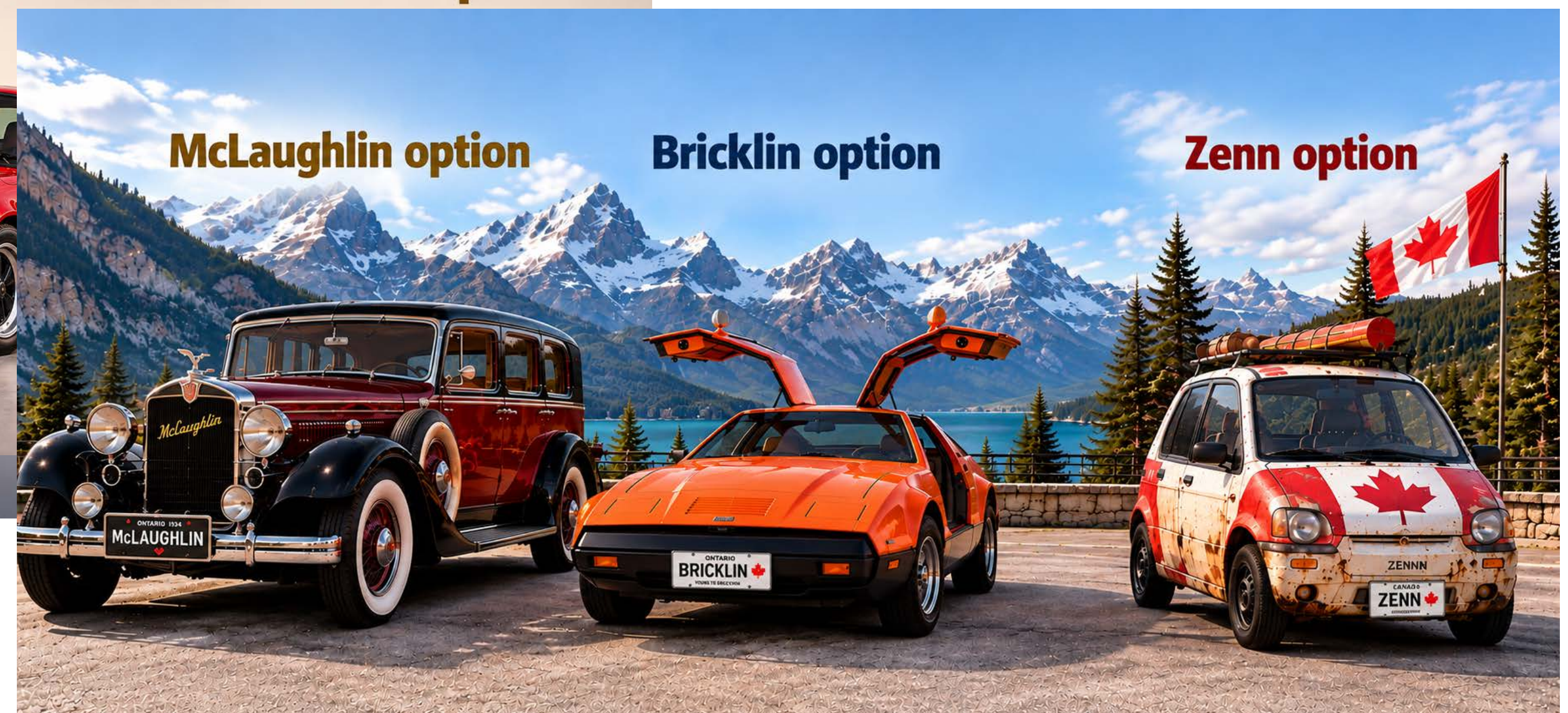
Town Hall series



Mercedes option

Porsche option

Trabant option



McLaughlin option

Bricklin option

Zenn option

Town Hall series



Rolls-Royce option

Morgan option

Mini option





SNOLAB 
A bullet for $0\nu\beta\beta$!

BOULBY 
A salty solution!

- ☒ LAPPDs
- ☒ Large PMTs
- ☒ Dichroicons
- ☒ Analog readout
- ☒ Digital readout
- ☒ Calibration
- ☒ Isotope loading
- ☒ Reconstruction
- ☒ AI/ML
- ☒ Engineering
- ☒ Underground site

Dichroicons
Spectral Sorting

THE OPTIMAL DETECTOR?

- ☐ Sensitivity?
- ☐ Energy resolution?
- ☐ Backgrounds?
- ☐ Depth & site?
- ☐ Reconstruction?
- ☐ Cost?
- ☐ Timeline?
- ☐ Community?



Low backgrounds,
high spirits.

BOULBY SHOP
- Salt chips
- Low U/Th
- Natural shielding
- High purity(?)
- Free snacks!

AI/ML Foundation Models

- ☒ event ID
- ☐ energy
- ☐ position
- ☐ reconstruction

- Calibration
- ☐ Sources
 - ☐ Deployment
 - ☐ Positions
 - ☐ Modeling

- Scintillator Chemistry
- Isotope Loading
- Photon Detection
- Electronics & DAQ
- Reconstruction & AI/ML
- Engineering & Site

From ideas
to a community
detector...

THANK YOU!

Mainz Town Hall II
13-15 October 2026