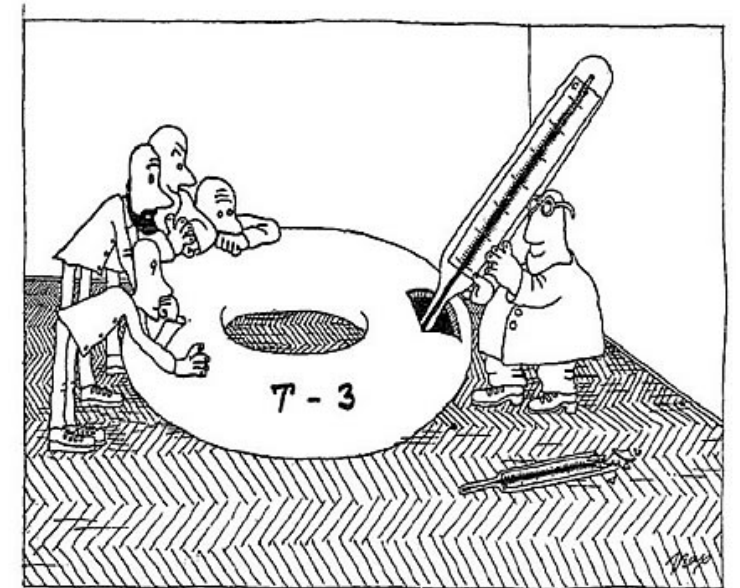


FUSION Diagnostics First Annual Review: Introduction and Meeting Objectives

Scott Hsu, Program Director, ARPA-E

March 5, 2021



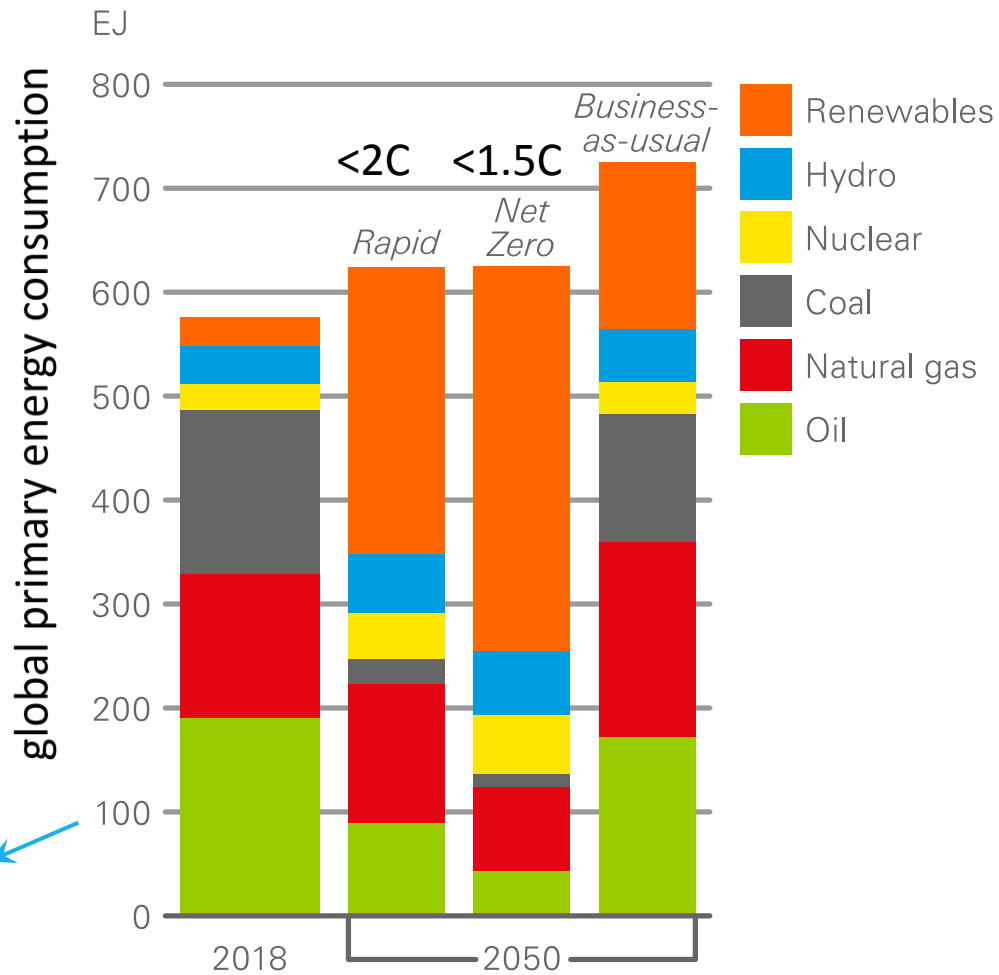
From talk given by B.B. Kadomtsev at Culham
in 1988 (courtesy EUROfusion).

Outline

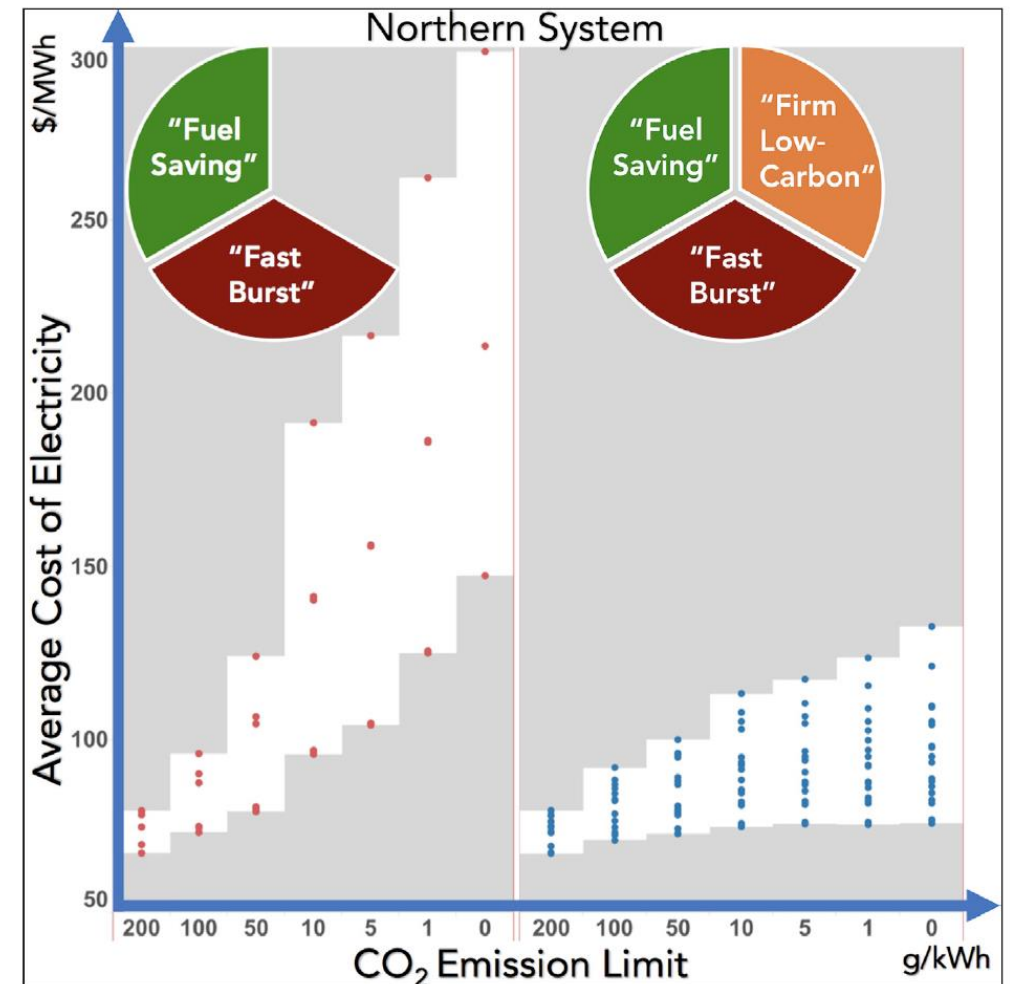
- ▶ Introduction to ARPA-E fusion programs
- ▶ Motivation of the FUSION Diagnostics mini-program and “capability teams”
- ▶ Meeting overview/objectives

Framing fusion energy

Need massive shift away from fossil fuels



Need firm, low-carbon sources for cost-effective deep decarbonization

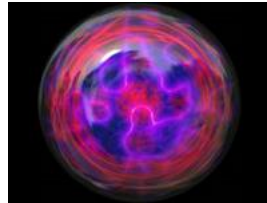


ARPA-E fusion timeline/programs

Program Director Dr. Pat McGrath decides to develop a fusion program



ALPHA



Yours truly “goes to Washington”



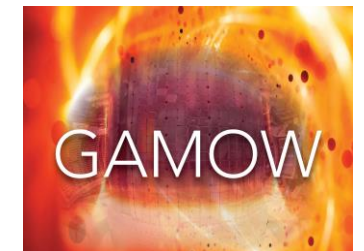
Program	Projects	Approximate Budget
ALPHA	9	\$30M
OPEN 2018	3	\$11M
FUSION Diagnostics	8	\$7.4M
BETHE	18	\$40M (incl/\$5M FES)
GAMOW	14	\$30M (incl/\$15M FES)
Total	52	\$118.4M (incl/\$20M FES)

OPEN 2018

77 PROJECTS

Included three fusion projects

Diagnostic “capability teams”



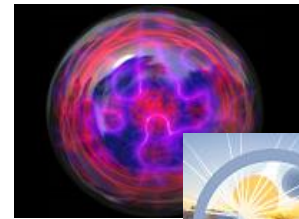
joint with FES

Overarching themes of the ARPA-E fusion portfolio

Support potentially transformational R&D to enable a commercially viable DEMO on a two-decade time scale

Technical drivers

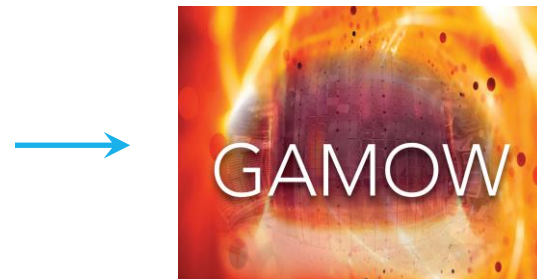
More *low-cost* approaches at higher levels of fusion performance



ALPHA



+ capability teams



joint with FES

Accelerate progress in developing required technologies/materials from first wall to heat exchanger

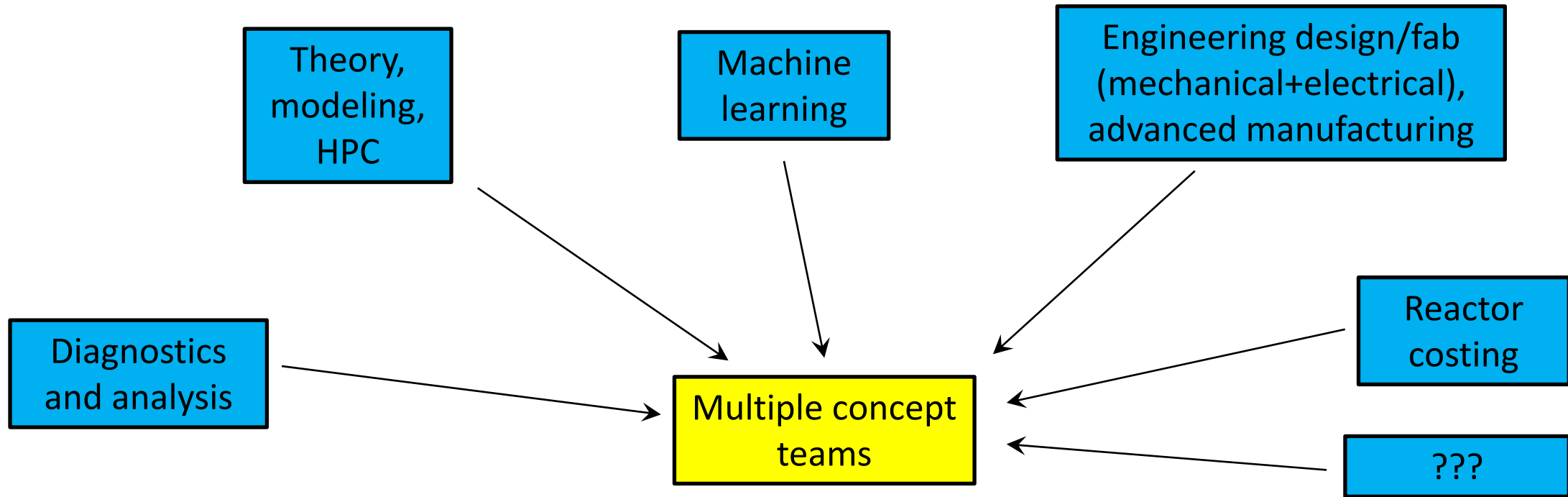
Programmatic drivers

Engage larger portion of the fusion R&D community

Leverage SotA expertise/capabilities

Incentivize publicly and privately funded teams to work together

Rationale for “capability teams”



Leverage the best expertise

Avoid reinventing the wheel by each concept team

Stretch limited \$\$

Build public-private partnerships

FUSION Diagnostics mini-program objectives

Transportable
diagnostics

High-quality data on
ARPA-E-supported
fusion experiments

Leverage expertise
of entire fusion
community

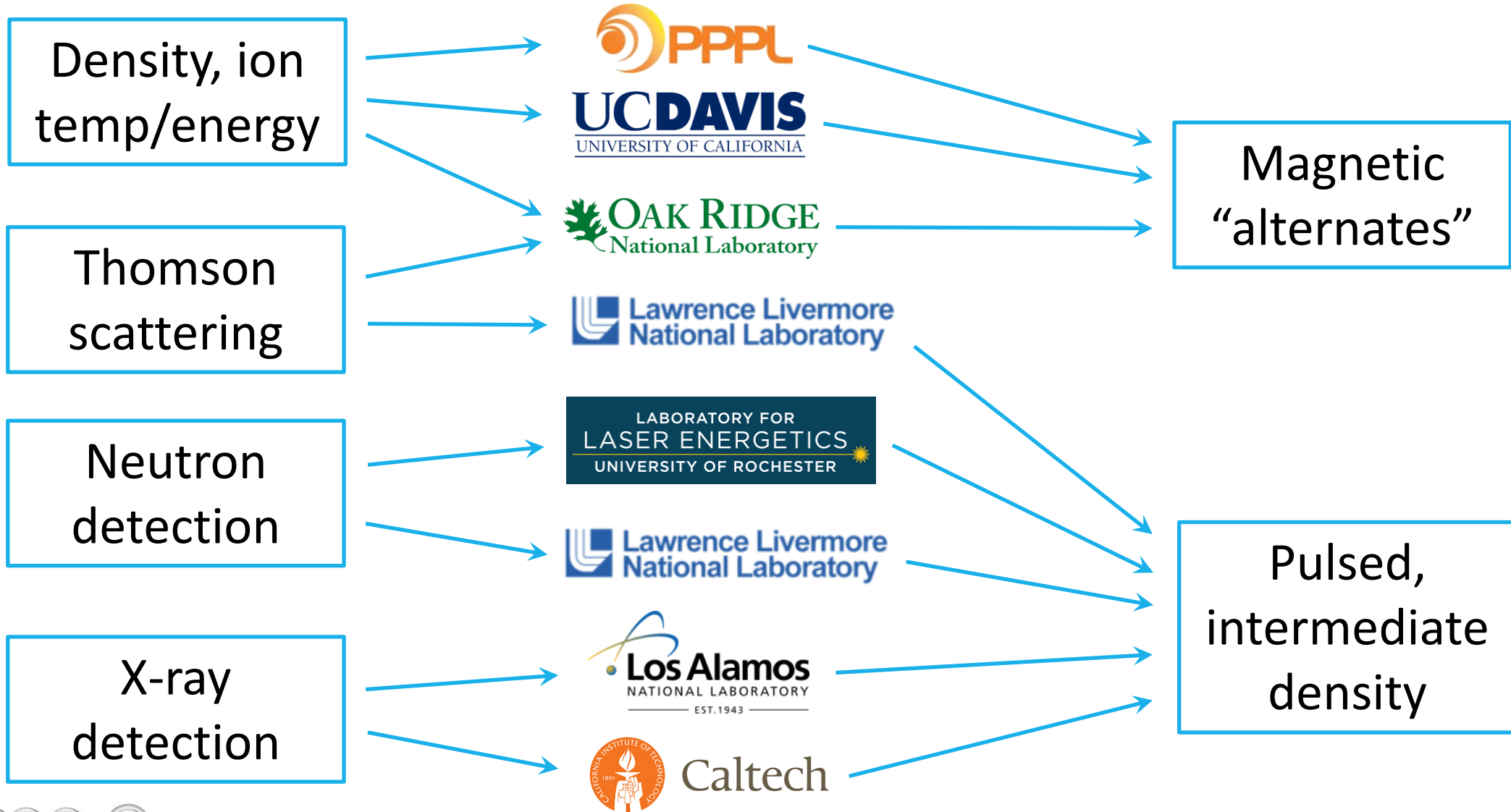
Build the teams &
experience for
PPP programs

Technical parameters of interest (from the FOA)

Table 2. Parameters of interest and their approximate range of values for the two classes of priority concepts given in Table 1.

Parameter of interest	Magnetically confined	Pulsed, intermediate density
Ion and electron density	10^{13} – 10^{14} cm ⁻³	10^{16} – 10^{21} cm ⁻³
Electron temperature	10–2000 eV	100–3000 eV
Ion temperature	10–2000 eV	100–10000 eV
Magnetic field	0.1–3 T	1–1000 T
Neutron yields	N/A	10^6 – 10^{12} (DD)
Neutron energy	N/A	2.3–2.8 MeV w/few-keV resolution
Neutron duration	N/A	10 ns – 10 μ s
Desired time resolution	< 100 μ s	1–1000 ns
Desired spatial resolution	< 1 cm	< 1 mm

Eight projects selected spanning range of diagnostics and plasma parameters



Meeting objectives

- ▶ Technical updates from all the project teams (plus two “bonus” diagnostic capability teams)
- ▶ ARPA-E legal team presentation on IP agreements with Q&A
- ▶ INFUSE and FIA perspectives
- ▶ Discussion/feedback



U.S. DEPARTMENT OF
ENERGY

<https://arpa-e.energy.gov>