

Questions for P-982 LAr5

- Where can costs be reduced in large liquid argon detectors? What are the prospects for industrialization?
- Can you comment on the interplay of microBooNE with respect to LAr5?

Large LAr Detector - on surface

Task	per unit estimate
Liquid Argon procurement & delivery	\$1 Million per kiloton
Cryogenic Tank fabrication	\$3.75 M + 0.4M/kiloton
Cryogenic Tank Roof customizing	\$4500/m ²
Purification and Cryo System fabrication	\$4M
TPC and Cathode System	\$50K/panel
Electronics, Data Acquisition and Slow Control	\$200K + \$50/channel
Cables in and out of cryostat	\$50/channel
Photomultiplier Tubes and Readout	\$7.5K/pmt
Detector Installation and Integration	\$200K/month
Engineering and Engineering Support	\$150K per person-year

Table 1: *Preliminary* estimates of per unit cost drivers.

Parameter	5 kT	7 kT	10 kT
Cryogenic Tank diameter(m)	15	19	24
Cryogenic Tank height (m)	14	15	16 m
Cryogenic Tank volume (m ³)	2500	4250	7235
Tank roof area (m ²)	177	283	452
TPC sense panels (#)	20	29	44
Sense wires per panel (30 ⁰) (#)	2700	2700	2700
TPC interleaved cathode panels (#)	18	28	40
TPC circumferential gradient panels (#)	20	24	36
Electronics channels (#)	54,000	78,300	118,800
Photomultiplier tubes (#)	48	60	72

Table 2: Detector parameters used for estimating the cost range of a Liquid Argon detector in the 5-10 kiloton mass range.

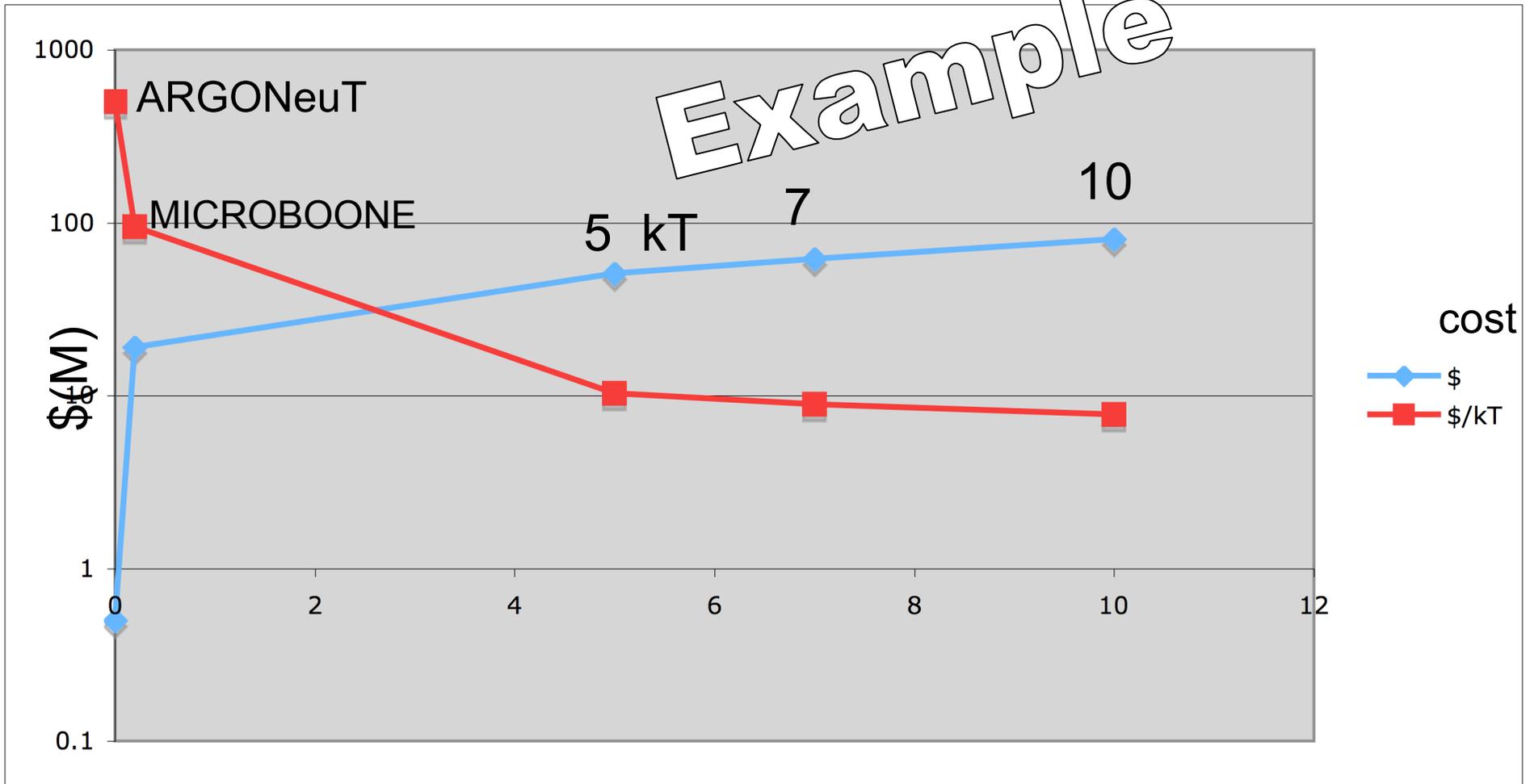
From
DRAFT
LOI for
LAr5 @
Ash
River

WORK IN PROGRESS

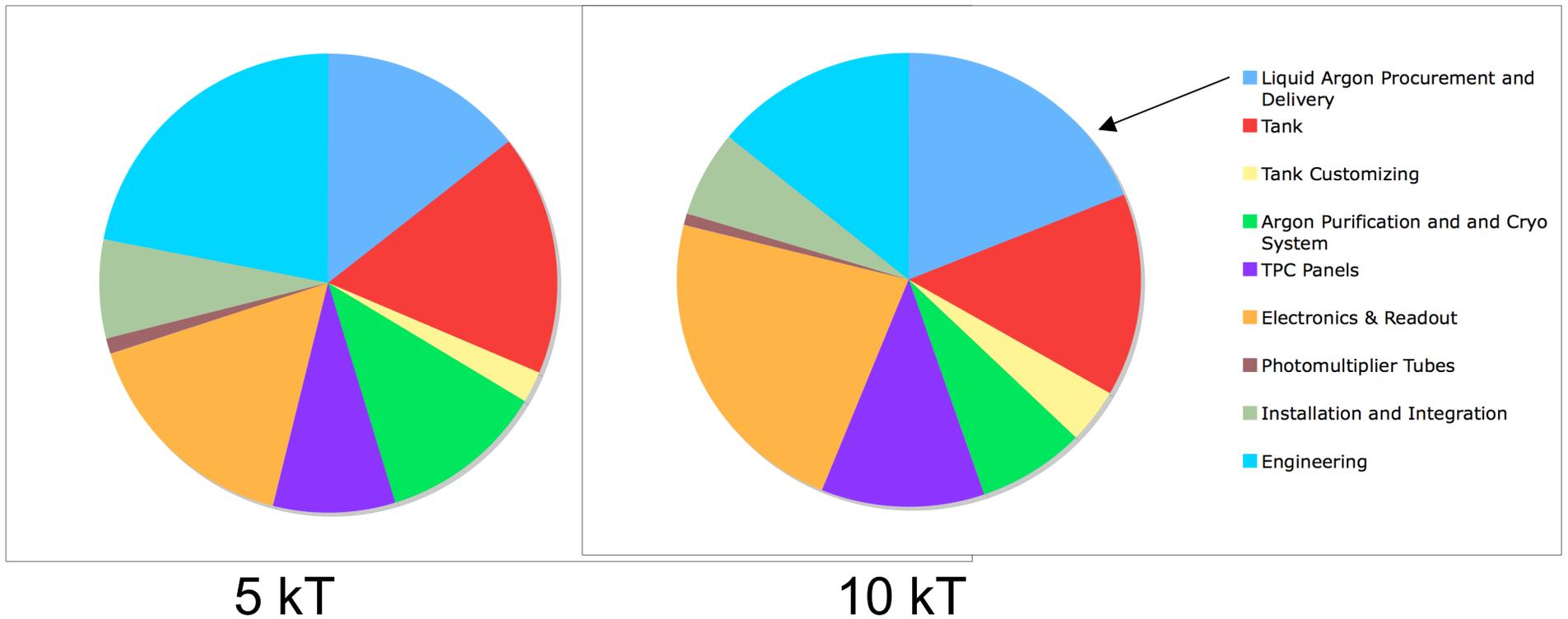
	5 kton	7 kton	10 kton
Site Preparation and Infrastructure			
Liquid Argon Procurement and Delivery	\$7,000,000	\$7,000,000	\$10,000,000
Tank	\$7,750,000	\$6,550,000	\$7,750,000
Tank Customizing	\$1,980,000	\$1,273,500	\$2,034,000
Argon Purification and and Cryo System	\$4,000,000	\$4,000,000	\$4,000,000
TPC Panels	\$2,900,000	\$4,050,000	\$6,000,000
Electronics & Readout	\$5,600,000	\$8,030,000	\$12,080,000
Photomultiplier Tubes	\$360,000	\$450,000	\$540,000
Installation and Integration	\$2,400,000	\$2,800,000	\$3,200,000
Engineering	\$7,500,000	\$7,500,000	\$7,500,000
Base Cost	\$34,306,500	\$41,653,500	\$53,104,000
Cost per kiloton	\$6,861,300	\$5,950,500	\$5,310,400
Contingency (50%)	\$17,153,250	\$20,826,750	\$26,552,000
Total	\$51,459,750	\$62,480,250	\$79,656,000

What we know about cost scaling

Example



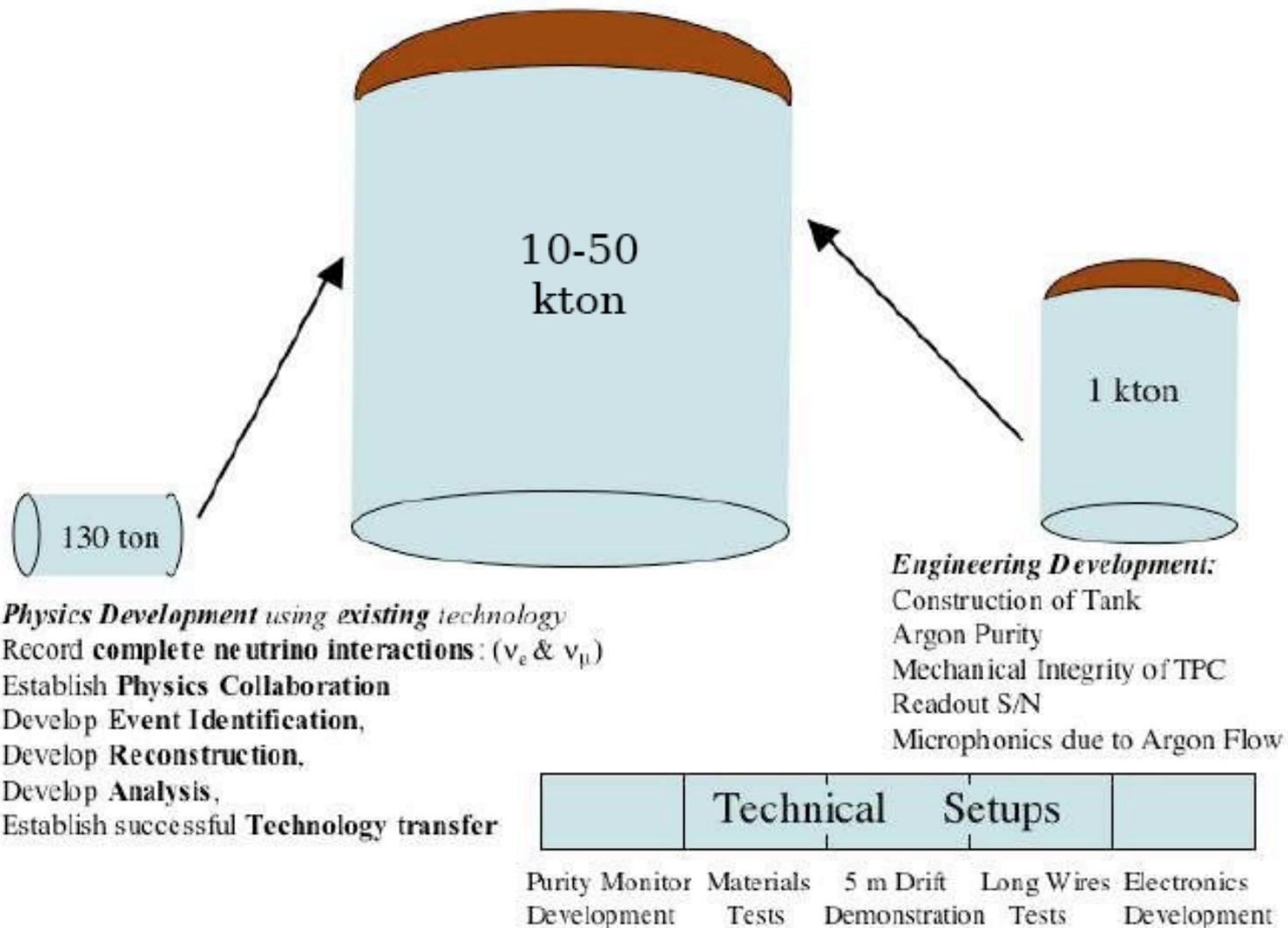
Analysis we can do



Industrialization ?

- Most likely best to buy the Argon
- Cryostat
 - Surface - use industry standard
 - Underground - ?
- TPC's
 - Modular concept, assembled off-site
 - Perfect university projects

From the LArTPC report to NuSAG in 2005 and presentation to NuSAG in 2006



start doing
physics here!



Fall 2007

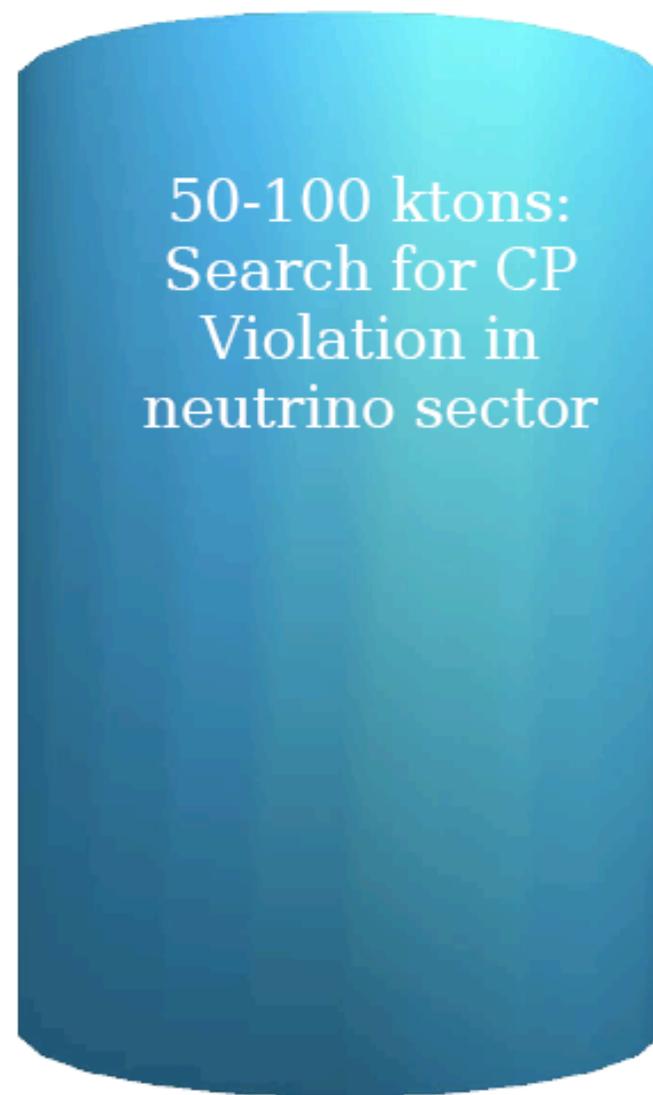
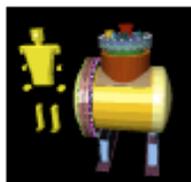
5 kton:
sensitivity to
mass
hierarchy,
increase
sensitivity to
 θ_{13}

50-100 ktons:
Search for CP
Violation in
neutrino sector

MicroBooNE
170 ton

20 ton
purity
demon-
stration

Test stands:
ArgoNeuT
Materials Test



2007

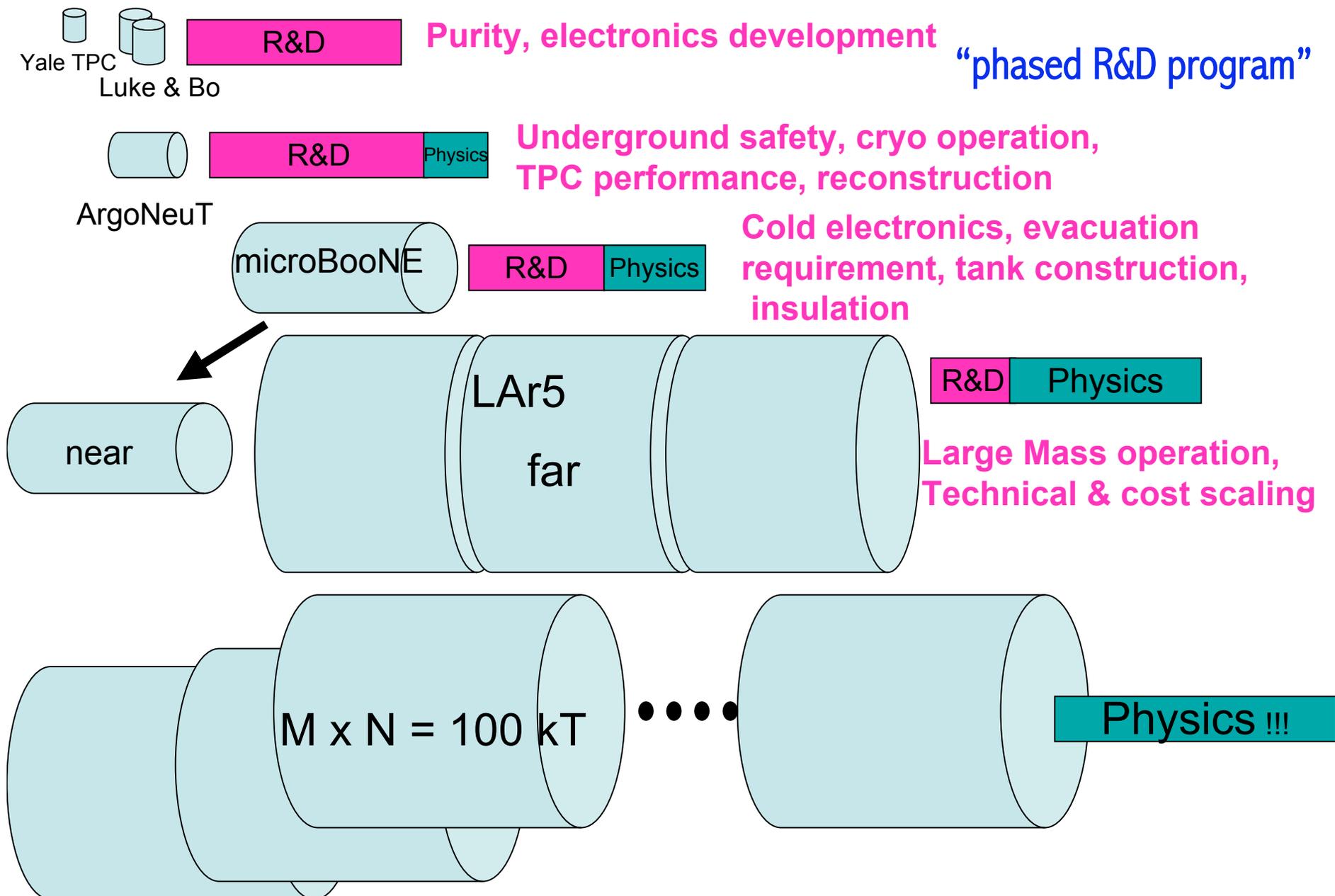
2008

2010

2013-15

201?

Evolution of the Liquid Argon Physics Program



Argoneut/MicroBooNE/LAr5 interplay

