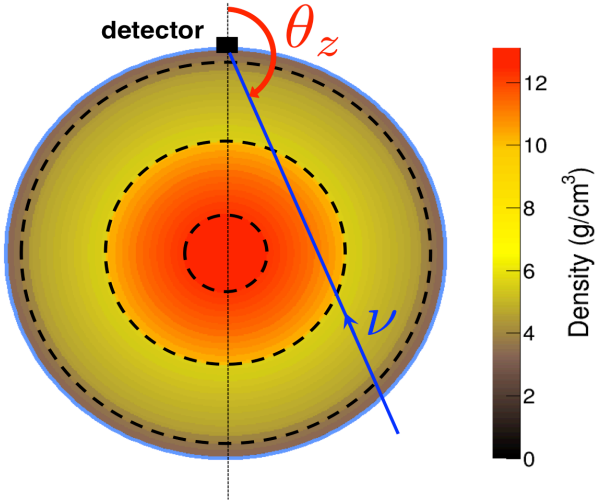
Probing the Earth core composition with neutrinos

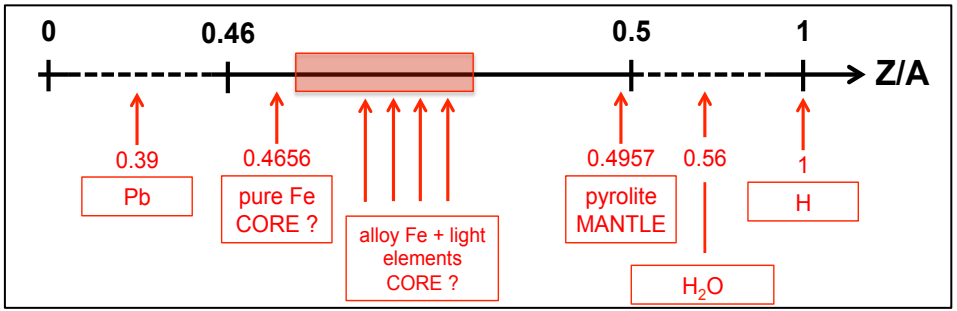
Atmospheric neutrino oscillations

$$N_e = \frac{N_A}{m_n} \times \frac{Z}{A} \times \rho_{matter}$$

assume known matter density profile (PREM)



Constrain $\frac{Z}{A} = \sum_i w_i \frac{Z_i}{A_i}$



S. Bourret. J. Coelho, E. Kaminski & V. Van Elewyck

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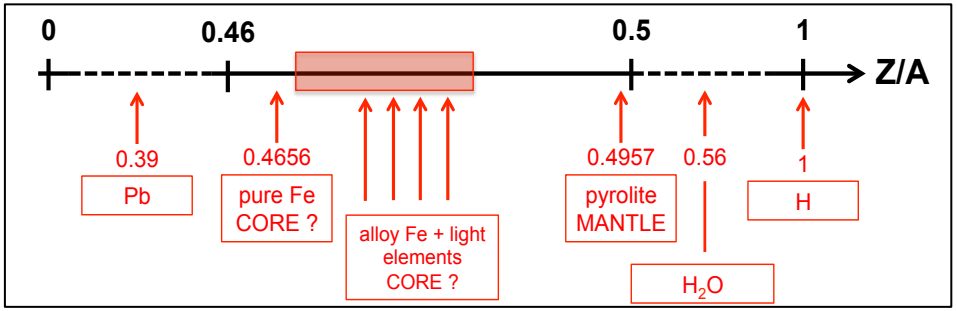
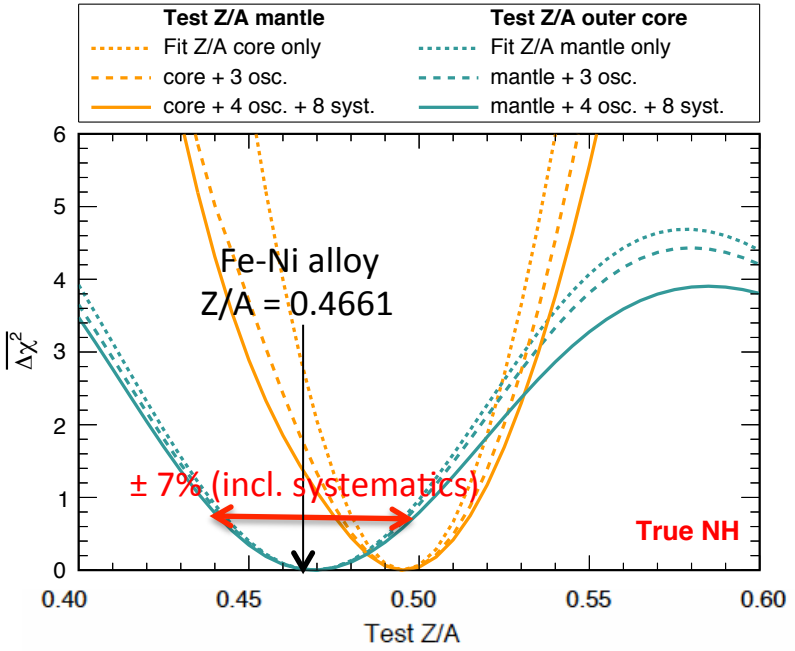


KM3NeT/ORCA sensitivity projection:
few % on outer core Z/A after 10 yr
(systematics included):

..not enough to constrain specific light elements abundances



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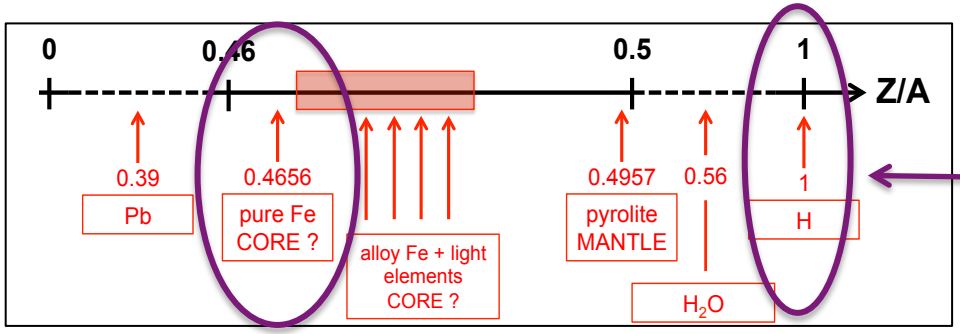


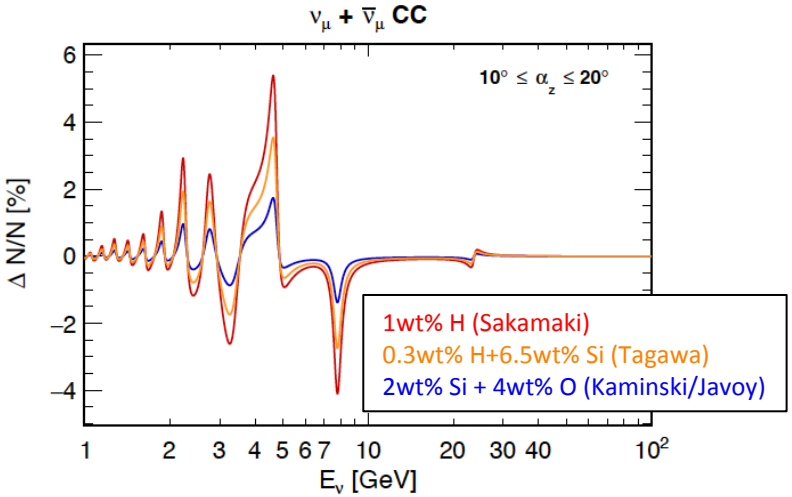
…CAN WE DO BETTER ?

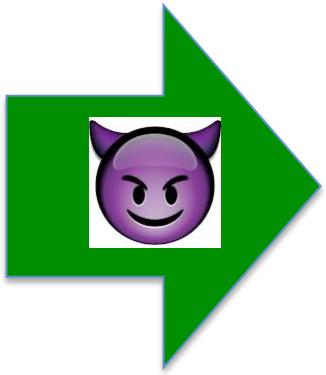
Benchmark goal:

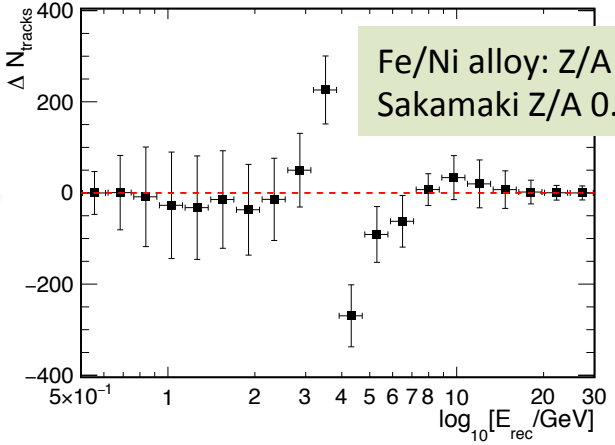
Constrain the H content at 1%wt level

In the outer core

→ Discriminate between different compositional models ?



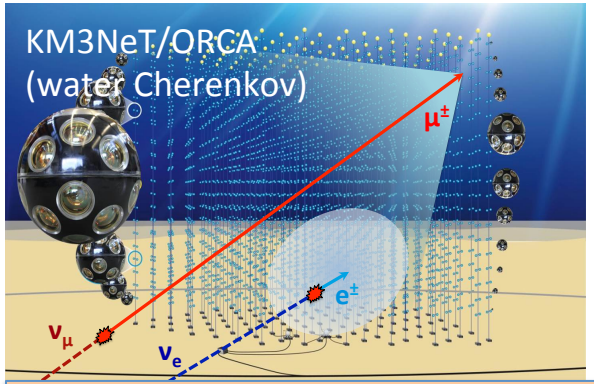


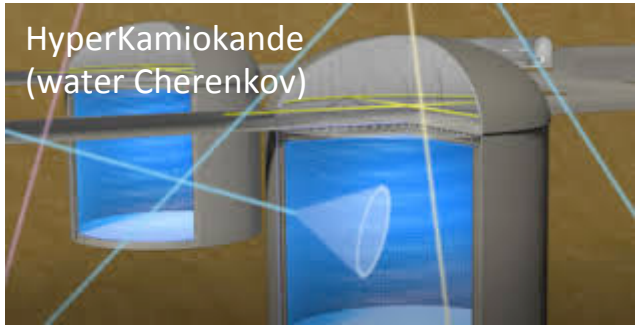


Theoretical answer: YES !

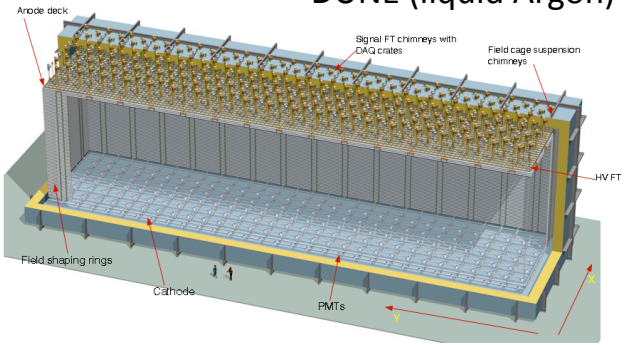
Experimental answer: …HOPEFULLY !

Which neutrino detectors for core tomography ?





DUNE (liquid Argon)



KEY (DESIRABLE) SPECIFICATIONS

Effective mass	→ need > 10 Mton
Energy threshold	→ need < 1 GeV
Track/shower identification	→ need > 95%
Energy resolution	→ need < 15%
Angular resolution	→ need < 10°

…the case for SuperORCA ?

..and normal mass hierarchy of neutrinos (to be measured by ORCA, JUNO, DUNE,…)