CASPAR – A Low Energy Underground Nuclear Astrophysics Accelerator

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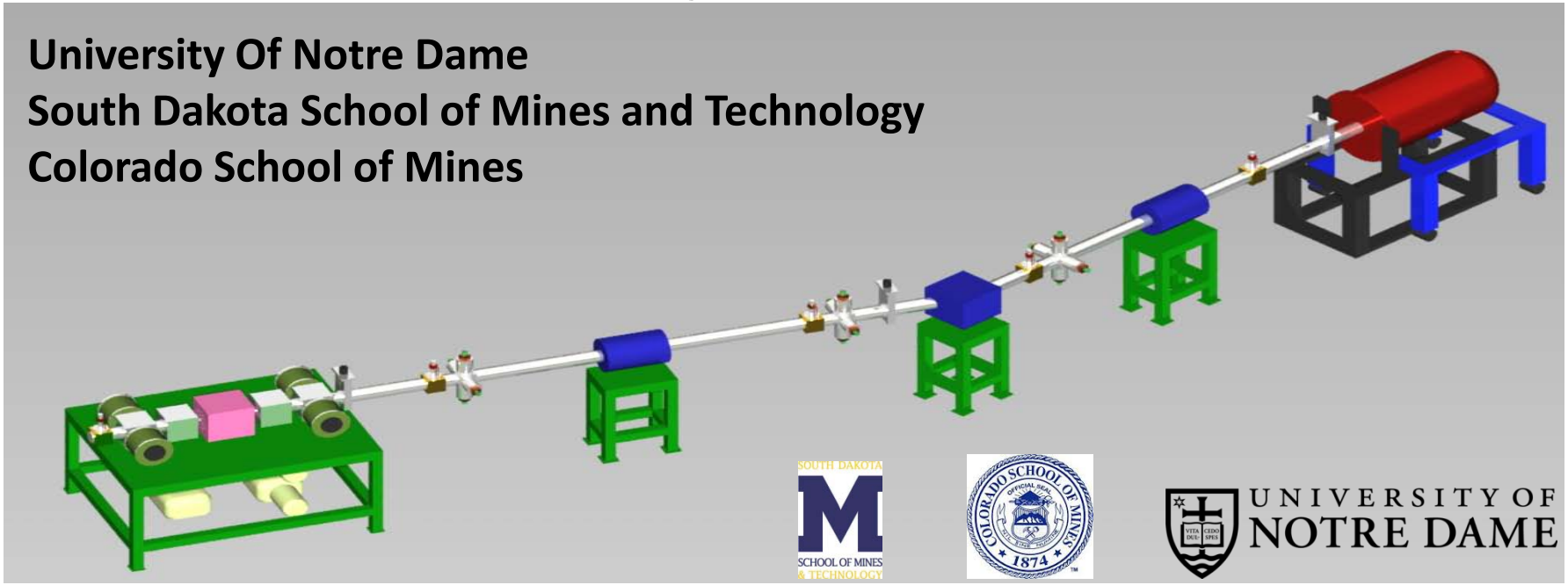
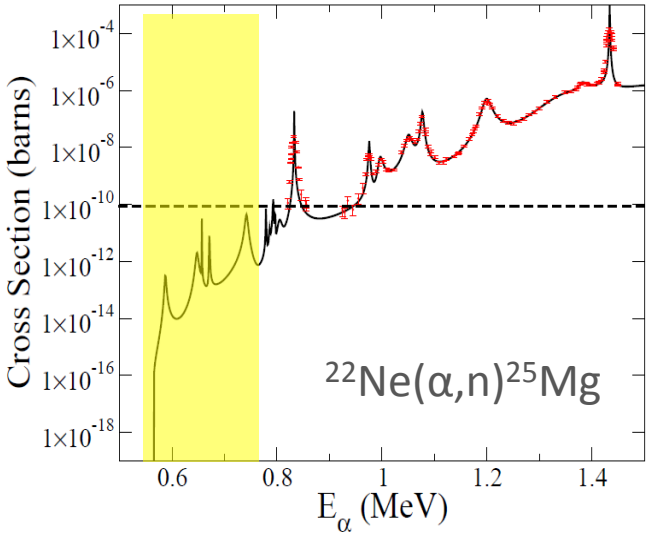
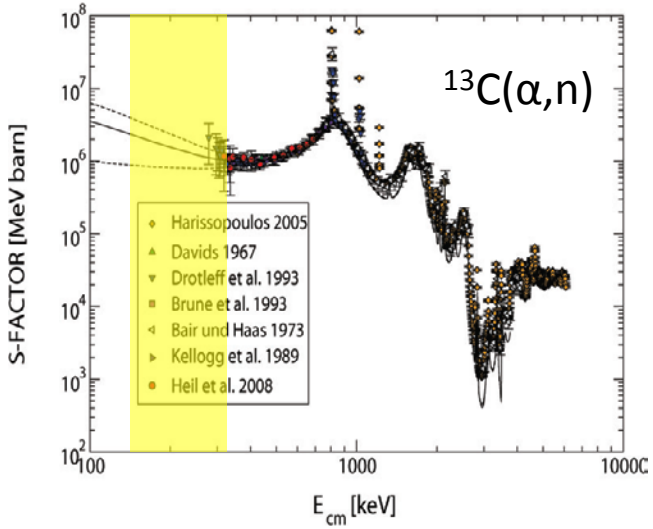
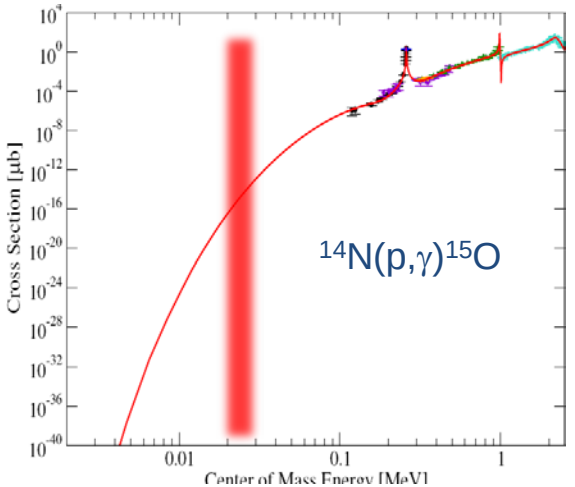
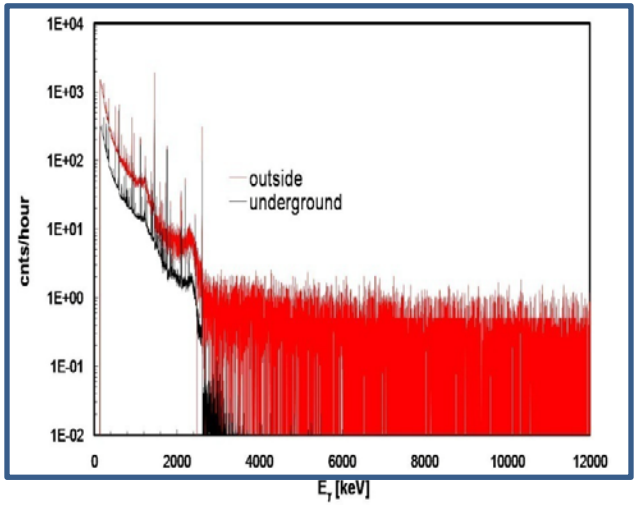
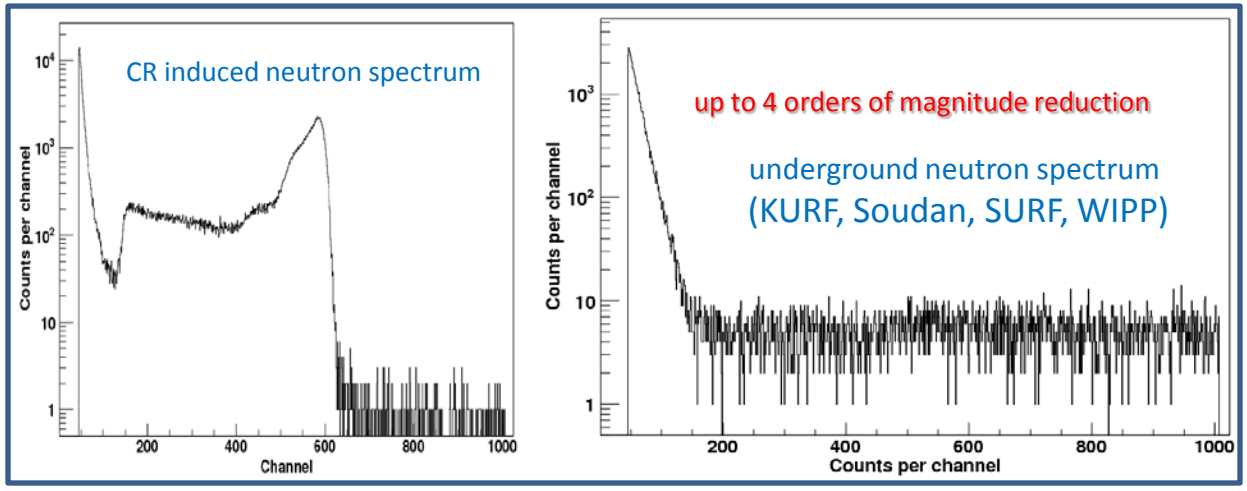


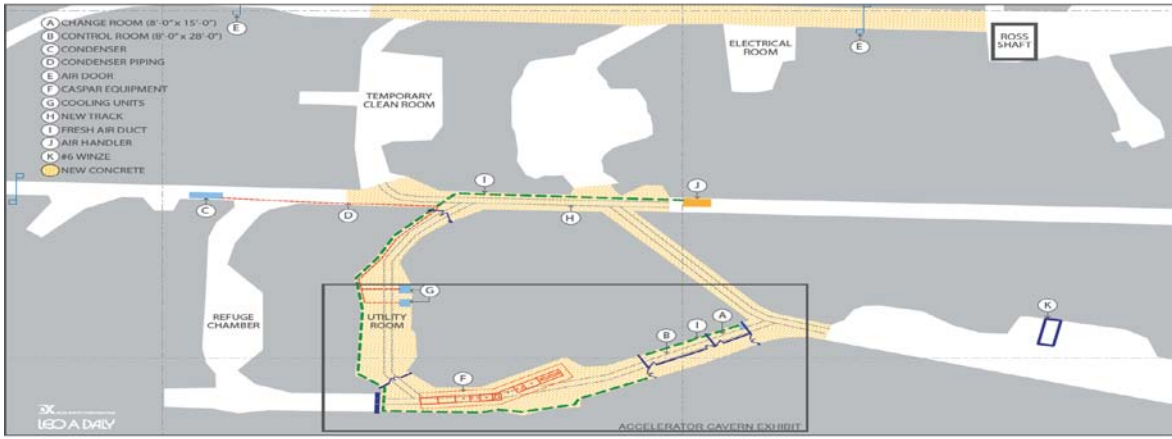

Cross Section (barns)
E_α (MeV)
^{22}Ne(α,n)^{25}Mg

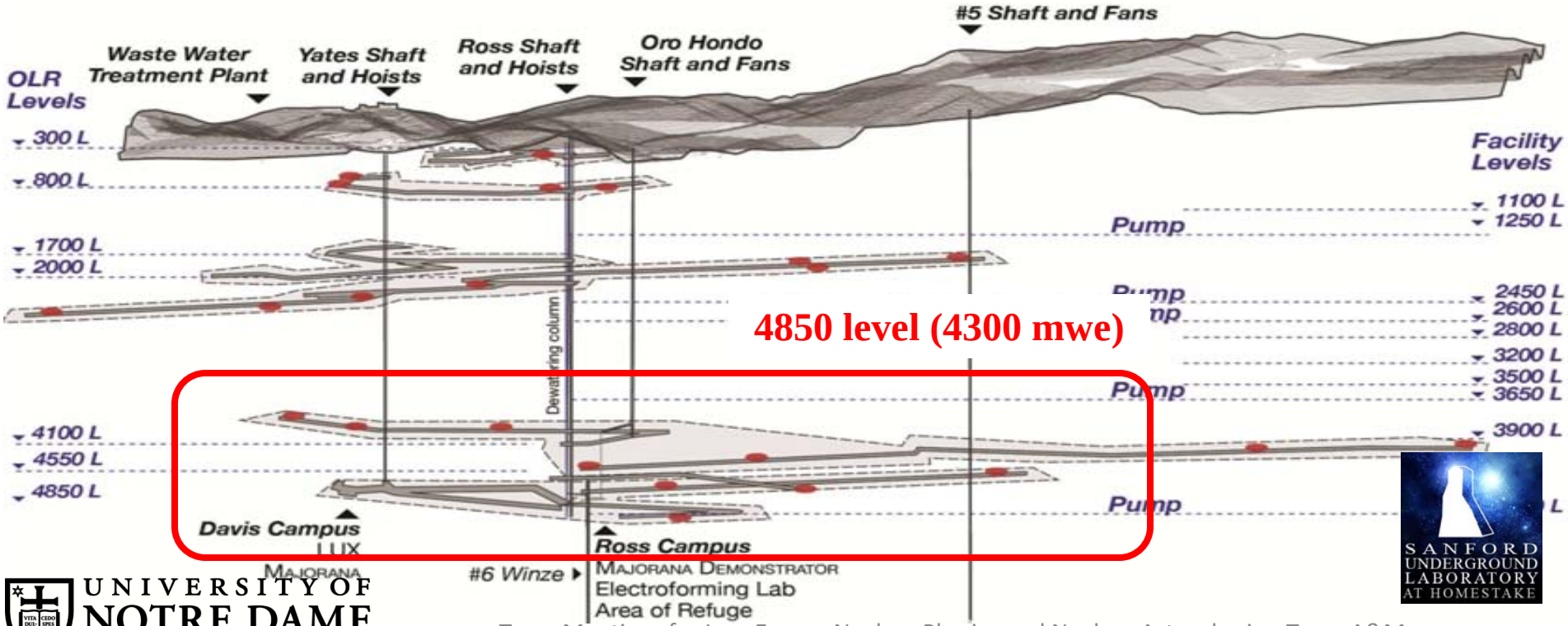

S-FACTOR [MeV barn]
E_{cm} [keV]
^{13}C(α,n)
Harissopoulos 2005
Davids 1967
Drotleff et al. 1993
Brune et al. 1993
Bair und Haas 1973
Kellogg et al. 1989
Heil et al. 2008


Cross Section [μb]
^{14}N(p,γ)^{15}O


cnts/hour
outside
underground
E_γ [keV]


CR induced neutron spectrum
Counts per channel
Channel
up to 4 orders of magnitude reduction
underground neutron spectrum
(KURF, Soudan, SURF, WIPP)
Counts per channel

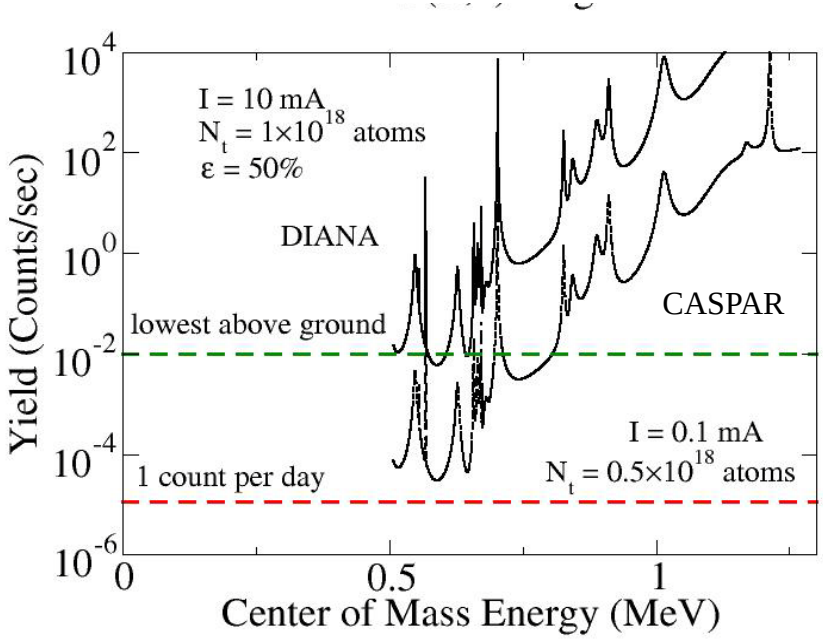




UNIVERSITY OF NOTRE DAME

SANFORD UNDERGROUND LABORATORY AT HOMESTAKE

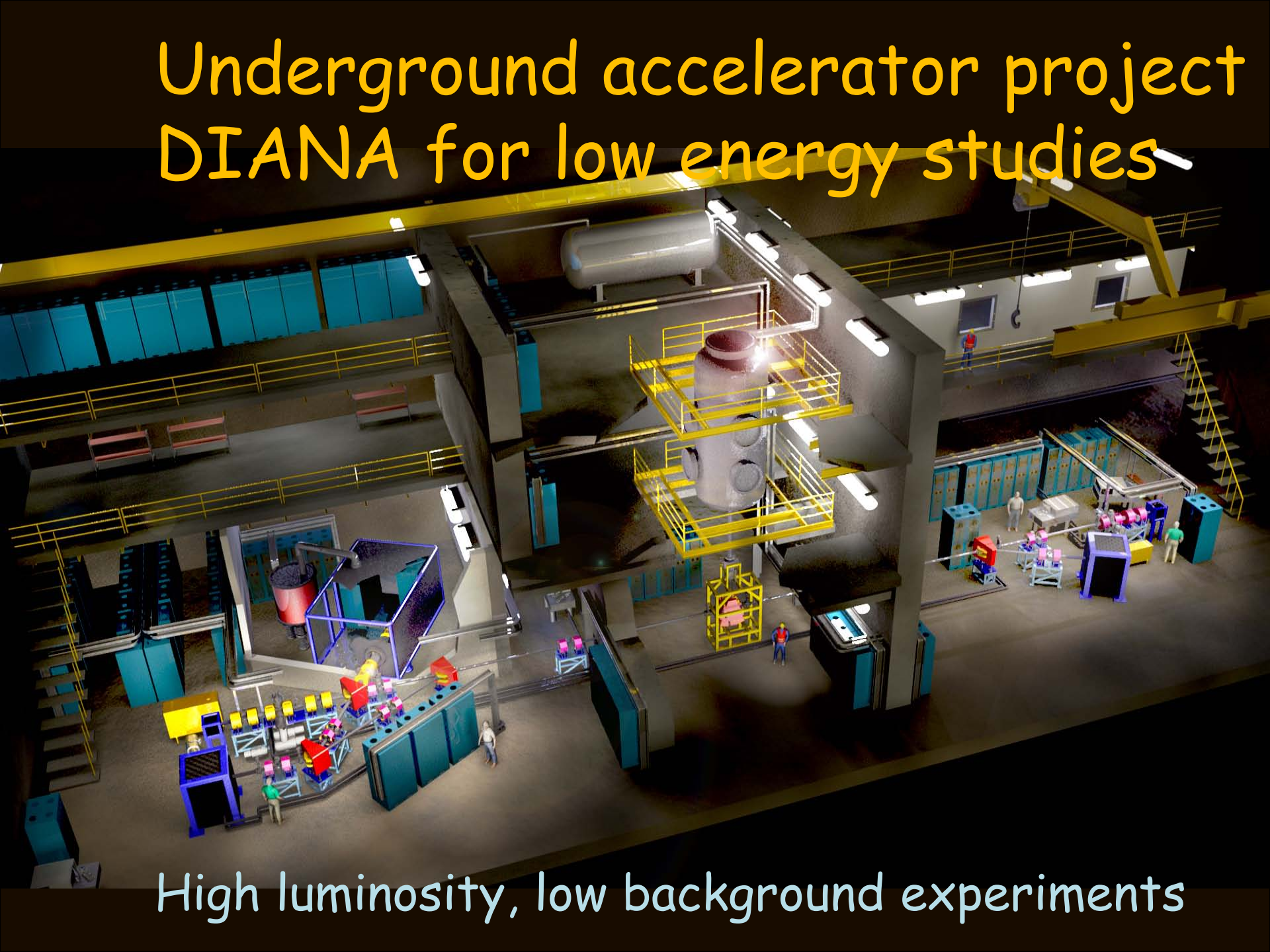
Relocation of Notre Dame JN accelerator
Effective energy range ~ 150 keV – 1 MeV
Beam production ~ 150 μA α
Current plan for refurbishment and upgrade
Recirculating windowless gas target



Some reactions of interest:
$^{13}C(\alpha,n)^{16}O$, $^{22}Ne(\alpha,n)^{25}Mg$,
$^{22}Ne(\alpha,\gamma)^{26}Mg$, $^{17}O(\alpha,n)^{20}Ne$,
$^{17}O(\alpha,\gamma)^{21}Ne$

- Cavity rehabilitation and preparation currently underway
- Beneficial occupancy of accelerator vault February 2015
- Acceleration system and target installation tests by summer 2015
- First beam on target by late summer 2015

Underground accelerator project DIANA for low energy studies



High luminosity, low background experiments