High Power Cyclotrons for the Neutrino Experiments DAEδALUS and IsoDAR

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Goal: measure fundamental CP violating phase $\delta$ through studying muon to electron antineutrino oscillations as function of length, with one detector and several sources.

Detect electron anti-neutrinos through inverse beta decay process: very clean

Overview

Ion source delivering 50 mA of $^2$H$^+$ ions at 70 keV
Injector Cyclotron (DIC) 5 mA, up to 60 MeV/amu
Primary Cyclotron (DSRC) up to 800 MeV/nucleon
Foil stripper
Target

DIC
Daeδalus Injector Cyclotron
4 sectors
70 MeV (35 MeV/n)
= 1 T field
450 tons
Extraction with electrostatic separators + magnets
(2cm separation between orbits)

RF
Four double gap cavities
49.2 MHz, Q=37,500
0.5 MW
0.5 – 1.0 MV

DSRC
Daeδalus Superconducting Ring Cyclotron
8 SC coils LHe cryostat
Strong magnetic forces (MegaNewtons)
Like Riken SRC
Extraction by thin(2 mg/cm$^2$) pyrolitic graphite foil
Any H$^+$ extracted cleanly
Pulse length $<$ 1ms to stop overheating

IsoDAR
Physics from the injector cyclotron

60 MeV/amu (30 MeV/amu) on $^9$Be/$^7$Li target
Make $^8$LI, source of electron antineutrinos
(10s of present data samples)
Identified by nearby reactor anomaly – small deficit which could be due to 4th sterile neutrino
See nearby poster for details