Review of Recent IDS120 Target Concepts

Van Graves

October 31, 2013
NF Target Concept Evolution (Abridged Version)

- Historical (Study 2) baseline: 20T (15+5) field
- MERIT Experiment: 15T solenoid but was proof-of-concept for 20T system
- MAP: re-started concept development using Study 2 as baseline
  - Early mercury vessel concept had upstream jet with downstream drain; later switched to upstream drain
- Subsequent efforts focused on realistic coil sizes, coil shielding, coil configurations
- Mercury vessel refinement revealed geometric complexities needed to integrate with resistive coils
Concept Evolution (cont’d)

• Started considering utility & facility requirements
  – He cooling, splash mitigation, double Hg containment, RH, etc.

• Coil sizes continued to increased due to shielding issues until IDS120
  – Field profile work continued, which led to several coil configurations
  – IDS-NF continued with 20T baseline, MAP began seriously considering 15T

• Early 2013
  – Latest concept models developed for 15T- and 20T-cases in support of IPAC'13 papers
    • Field tapers to 1.5T over 7m rather than 15m
    • Cryostat breaks considered length of mercury module
    • IDS120_15-1.5T7m3+4 (MAP)
    • IDS120_20-1.5T7m2+5 (IDS-NF)
IDS120 Coil Comparison - Sections

IDS120H

IDS120K

IDS120
20-1.5T7m2+5

IDS120
15-1.5T7m3+4
Latest 20T CAD Concept
(IDS120_20-1.5T7m2+5)
IDS120_20-1.5T7m2+5 Cryo 1 Iso

Mercury Module: mercury jet, collection pool + resistive coils

Superconducting coils

Cryostat

Shielding Module: Tungsten beads, He-gas cooled
Incorporates concept for double wall mercury containment
Latest 15T CAD Concept
(IDS120_15-1.5T7m3+4)
IDS120_15-1.5T7m3+4 Front Section
IDS120_15-1.5T7m3+4 Cryo1

- **Mercury Module**: collection pool, mercury jet
- **Superconducting coils**
- **Cryostat**
- **Shielding Module**: Tungsten beads, He-gas cooled
IDS120_15-1.5T7m3+4 Target Module Section
IDS120_15-1.5T7m3+4 Utility Connections

- Shielding Helium
- Nozzle Supply
- Beam Entrance
- Vent
- Mercury Vessel
- Mercury Drains
- Remote Handling Features
20T-15T Comparisons
Field Taper Comparison

IDS120K

1500

IDS120
20·1.5T7M2+5

700

IDS120
15·1.5T7M3+4

Z=0 700
Vessel Comparison

IDS120K

IDS120_20-1.5T7m2+5

IDS120_15-1.5T7m3+4

Approx. Magnetic Axes

Z=0
System Comparison
Mercury Module
 IDS120J Mercury Module is Still Current

Magnetic Axis

Upstream beam port

View from downstream
Current Mercury Module Description

- Modular design for remote handling
- Provisions for beam entry, Hg entry/exit, Hg draining, He entry/exit, chamber venting
- Double wall Hg containment
- Double wall Be window
- Horizontal top, sloped bottom (for draining)
- Interstitial space radially sectioned for He down-and-back cooling path