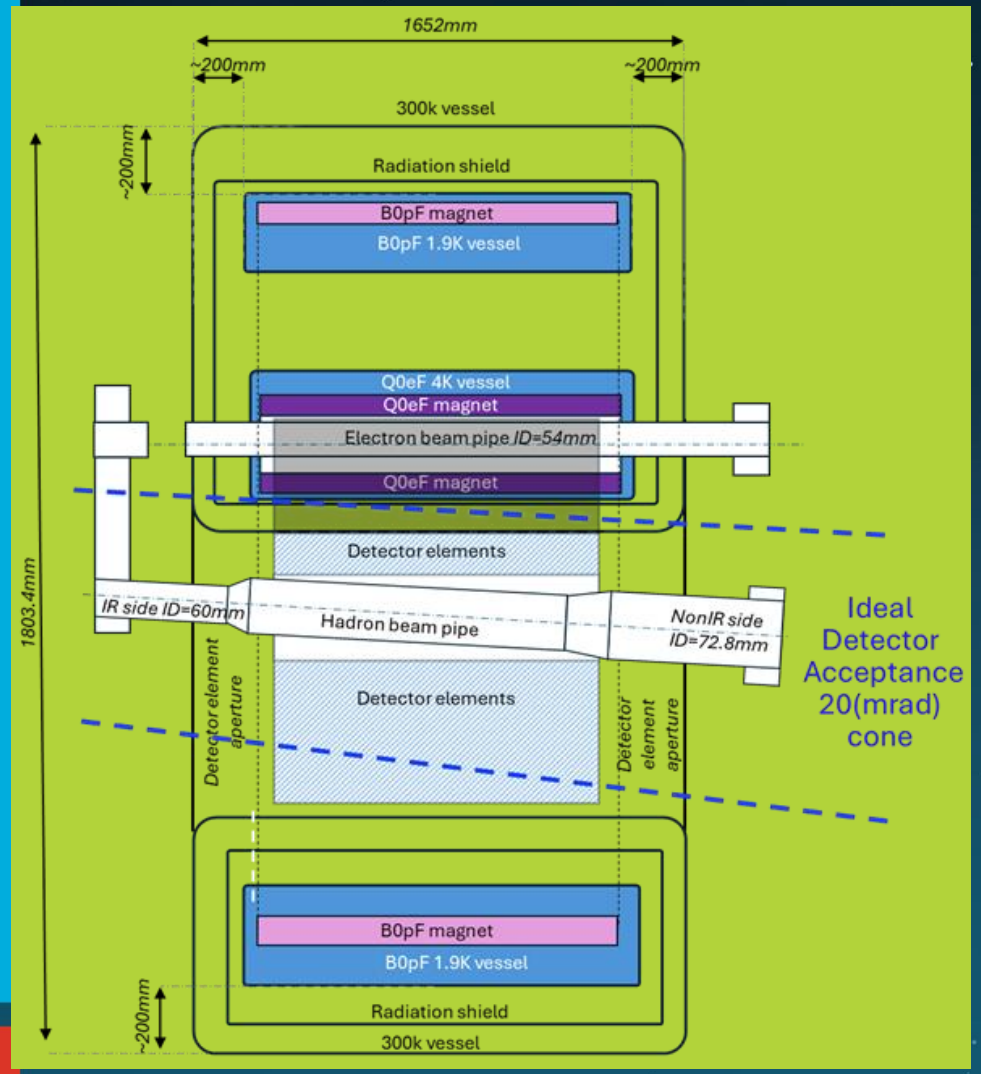

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U.S. DEPARTMENT OF ENERGY

A Possible 4.5 K Option for B0pF with the Combined Function Optimum Integral Design

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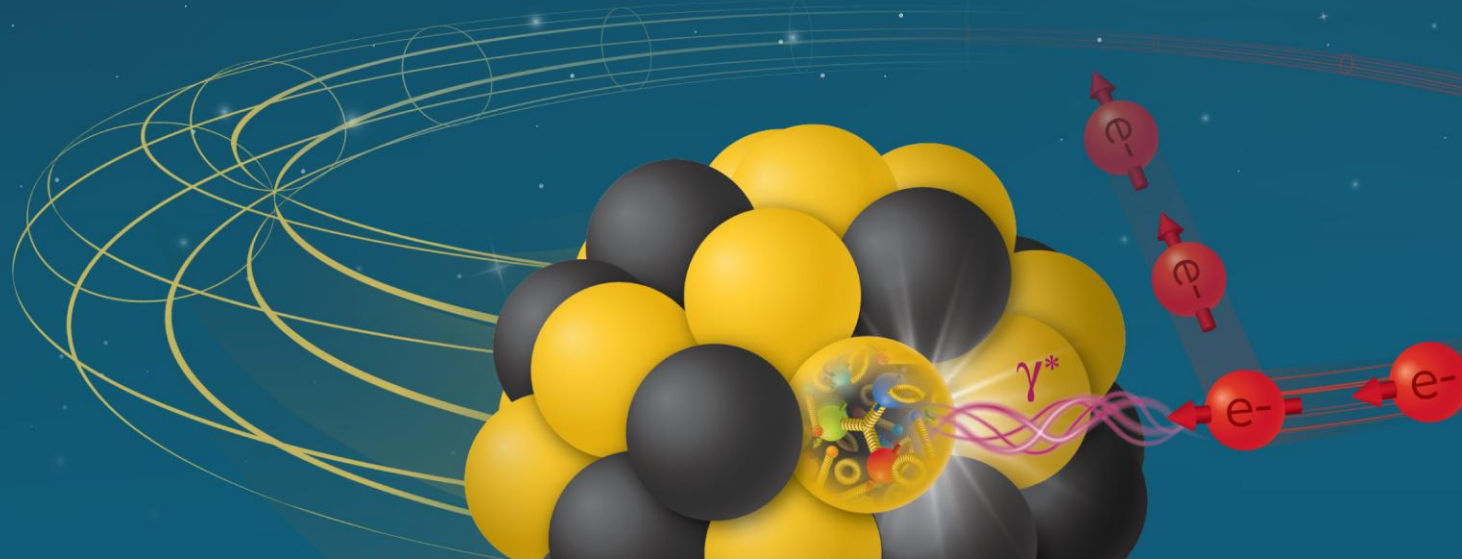
December 23, 2025



Electron-Ion Collider

Possibility of B0pF Operating at 4.5 K

Presented last time: 6- and 8-layer designs; both offered significant gains@1.92K

1. Number of layers reduced from 10 to 6 (or 8).
2. Operating Current reduced from 1143 A to 889 A (or 671 A).
3. Load line fraction improved from 70% to 60% (or 50)%.
4. Reduction in Lorentz force density (IXB), better mechanically.
5. Quench heaters are no longer essential (next presentation).
6. Voltage to ground reduced from 950 V to 535 V (or 466 V).

- 1.92 K operation was chosen to allow a reasonable margin in the serpentine design.
- It has now been shown that the combined function optimum integral design is significantly more efficient for B0pF, primarily due to a small length/diameter ratio.
- In addition to other advantages, now it also allows us to evaluate a 4.5 K operation.

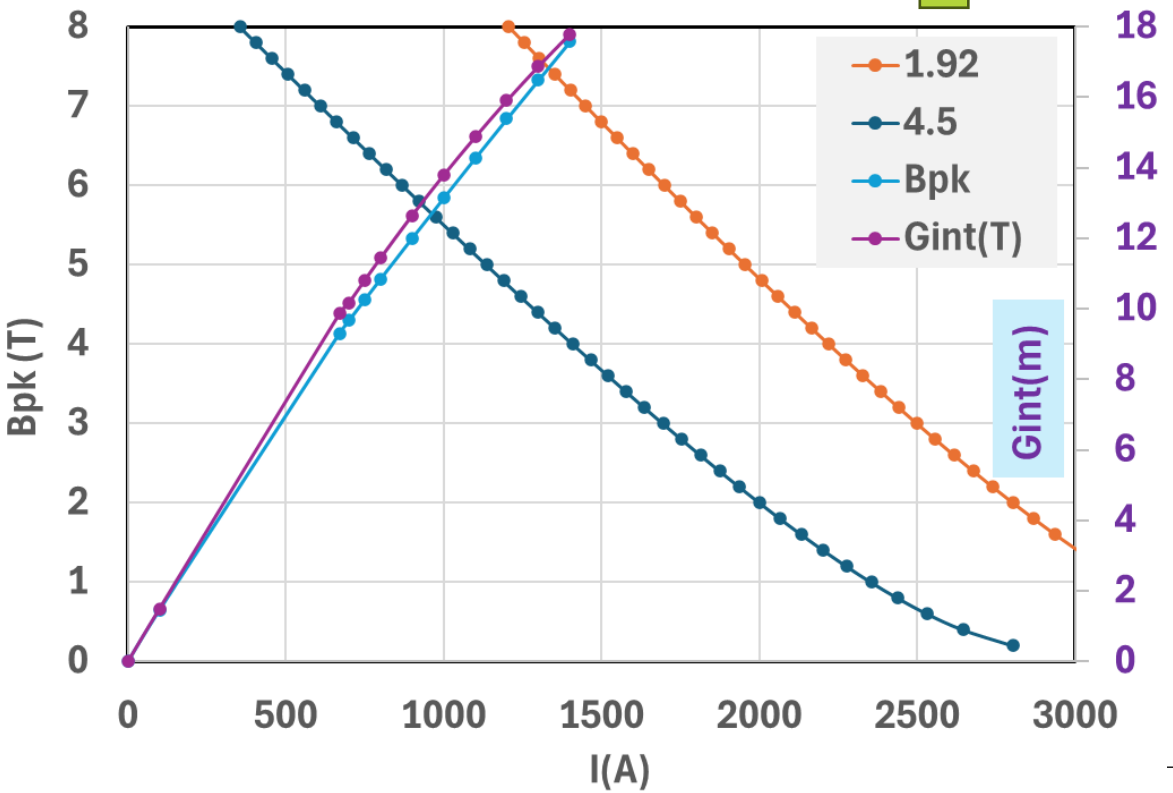
✓Since the 8-layer design is so good, let's consider a 4.5K operation for cost savings.

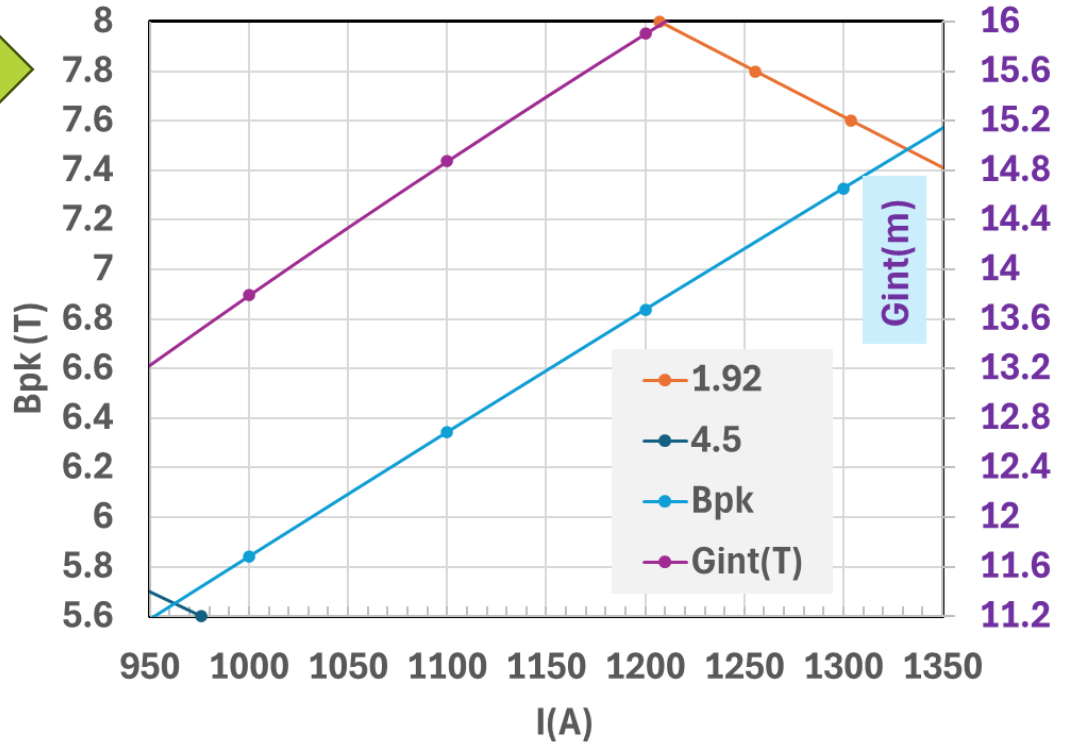
8-layer Optimum Integral Combined Function Design

(6-around-1, all superconductors, computed performances at 1.92K and 4.5 K)

More gains are expected on further optimization (this was the very 1st attempt)

Design Values		Current (A)
Gint(T)	9.75	671
Bint(h)	1.56	671





	Iss(A)	Margin(%)	LoadLineFraction
All SC @1.92K	1330	98%	50%
All SC @4.5K	965	44%	70%

Recommendations

While we further optimize the present design, savings from 4.5 K in various systems should also be examined. Possible benefits extend at many places:

- **construction**
- **testing**
- **operation**

The design presented last time was the first design (optimized only to meet the specs, not the efficiency) to examine the feasibility and initial benefits of the design before investing too much. Expect the final design to provide a bit more margin, possibly by a few percent.

	Iss(A)	Margin(%)	LoadLineFraction
All SC @1.92K	1330	98%	50%
All SC @4.5K	965	44%	70%

	Iss(A)	Margin(%)	LoadLineFraction
SC6Cu1 @1.92K	1240	85%	54%
SC6Cu1 @4.2K	948	41%	71%
SC6Cu1 @4.5K	900	34%	75%

Operating at 70%-75% load line fraction (34-44% margin) may be OK as this magnet does not need 10% tuning (?). However, a little extra margin may be desirable despite design making the magnet a bit easier!

Extra slides

IR6 straight section with new s.c. magnets