Run 3 UITF status update – Nov 29/20

- Nov 23 - Run 3 starts with beam on frozen-spin target *eHD60*

  Test conditions:

– *3/4 nA* at UITF →T_{IBC} = **160 mK**

→T_{HD} = 175 mK

1 nA in Hall-B →T_{HD} = 175 mK

– *1.5 nA* at UITF →T_{IBC} = **245 mK**

→T_{HD} = 265 mK

2 nA in Hall-B →T_{HD} = 265 mK

⇔ Started with low currents,
adding heat to reach test temperatures

Run 3 UITF status update – Nov 29/20

- Nov 23 - Run 3 starts with 1/8 nA on frozen-spin target *eHD60*

Test conditions:

– *3/4 nA* at UITF →T_{IBC} = **160 mK**

→T_{HD} = 175 mK

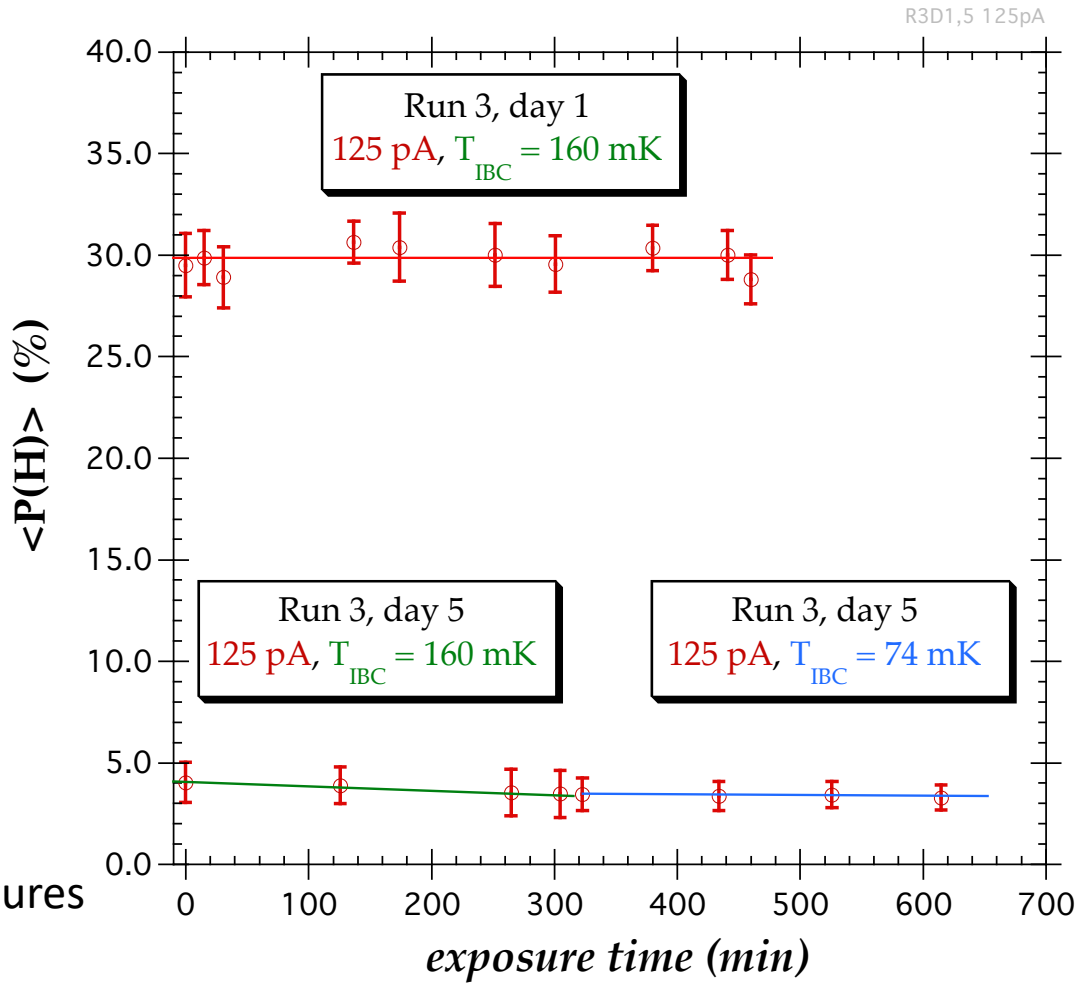
1 nA in Hall-B →T_{HD} = 175 mK

– *1.5 nA* at UITF →T_{IBC} = **245 mK**

→T_{HD} = 265 mK

2 nA in Hall-B →T_{HD} = 265 mK

⇔ Started with low currents, adding heat to reach test temperatures



- **at 1/8 nA, there is essentially no polarization loss at any relevant temperature**

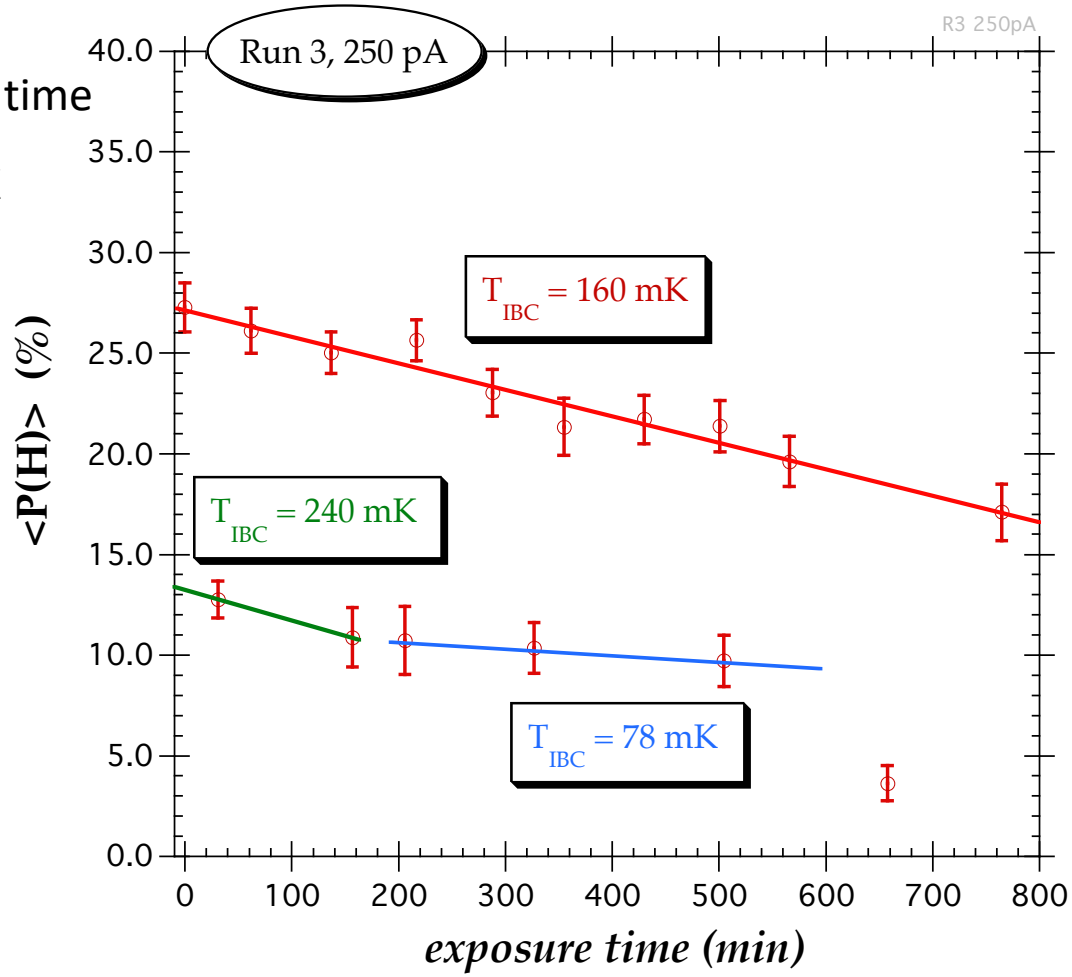
Run 3 UITF status update – Nov 29/20

- increased current to 1/4 nA on frozen-spin *eHD60*

⇔ sharp decrease in polarization with time

- same slope at 160 mK and 240 mK

- significantly less, essentially flat at 78 mK (base temp with beam)



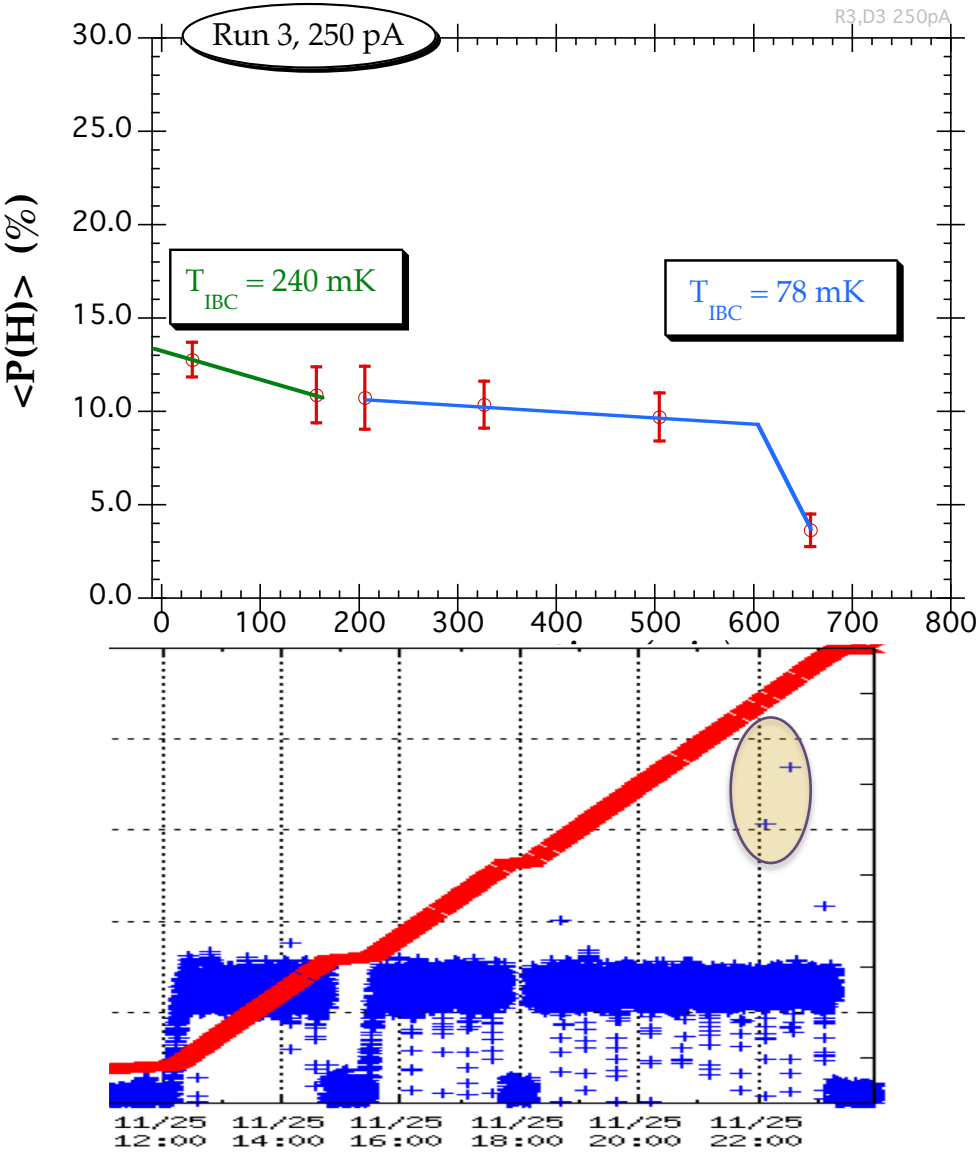
Run 3 UITF status update – Nov 29/20

- 1/4 nA on frozen-spin *eHD60* at 78 mK

⇔ ~ flat for 7 hr, then sudden big drop

⇔ might be correlated with current spike

⇔ suggests a charge buildup in the HD, that is suddenly released



Run 3 UITF status update – Nov 29/20

- Run 2 observed a suppressed NMR with a short T_1 target

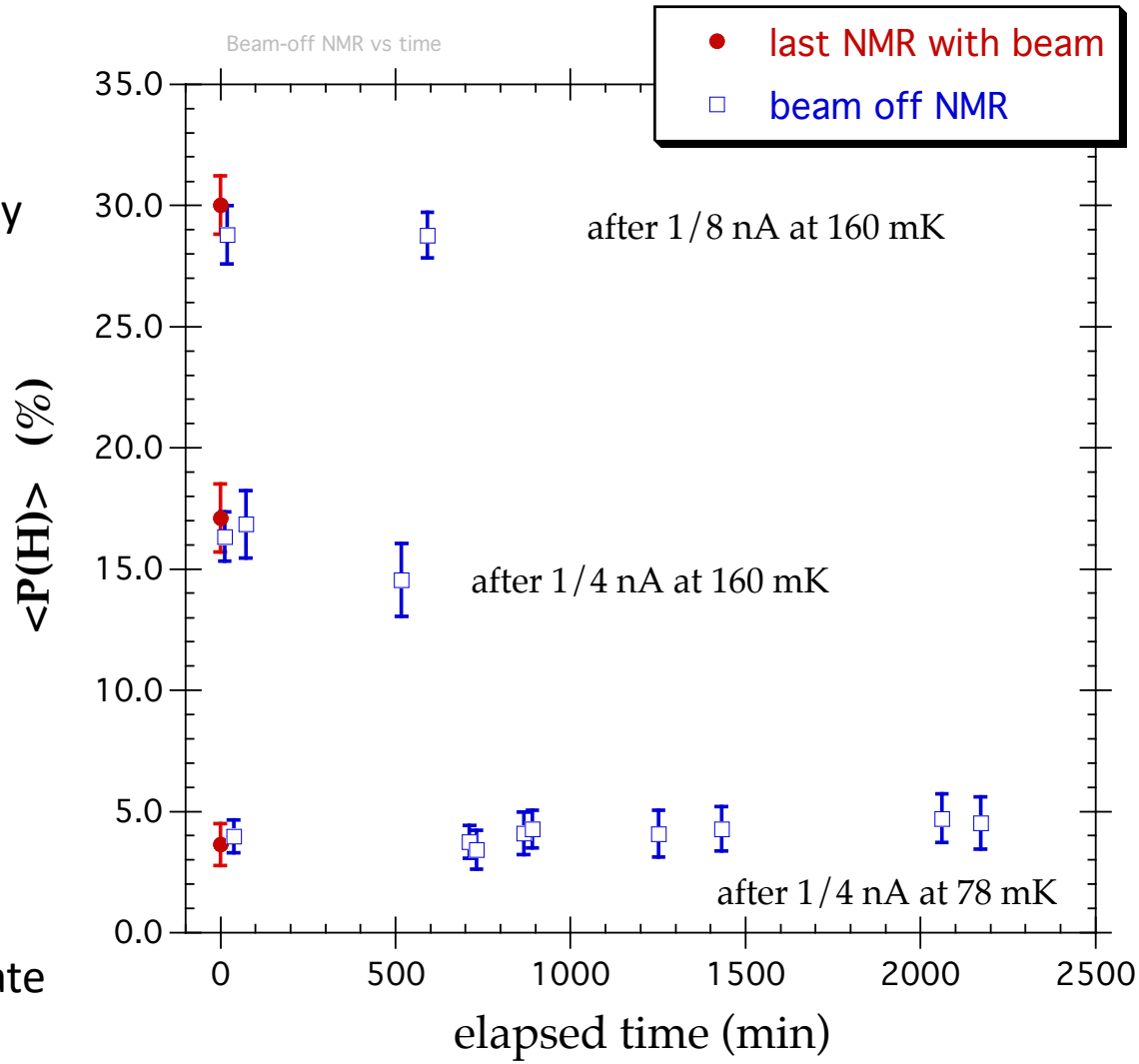
  - either screened NMR, or real loss that grows back quickly after beam is stopped

- Run 3: with frozen-spin HD, after *AFP* spin flip,

  - no evidence for screening;

  - some evidence for slight drop in 8 hr overnight

  - after several days of irradiation, and significant polarization loss, the HD is still in a frozen-spin state



Run 3 UITF status update – Nov 29/20

- dependence on the atomic electron polarization following ionization or dissociation

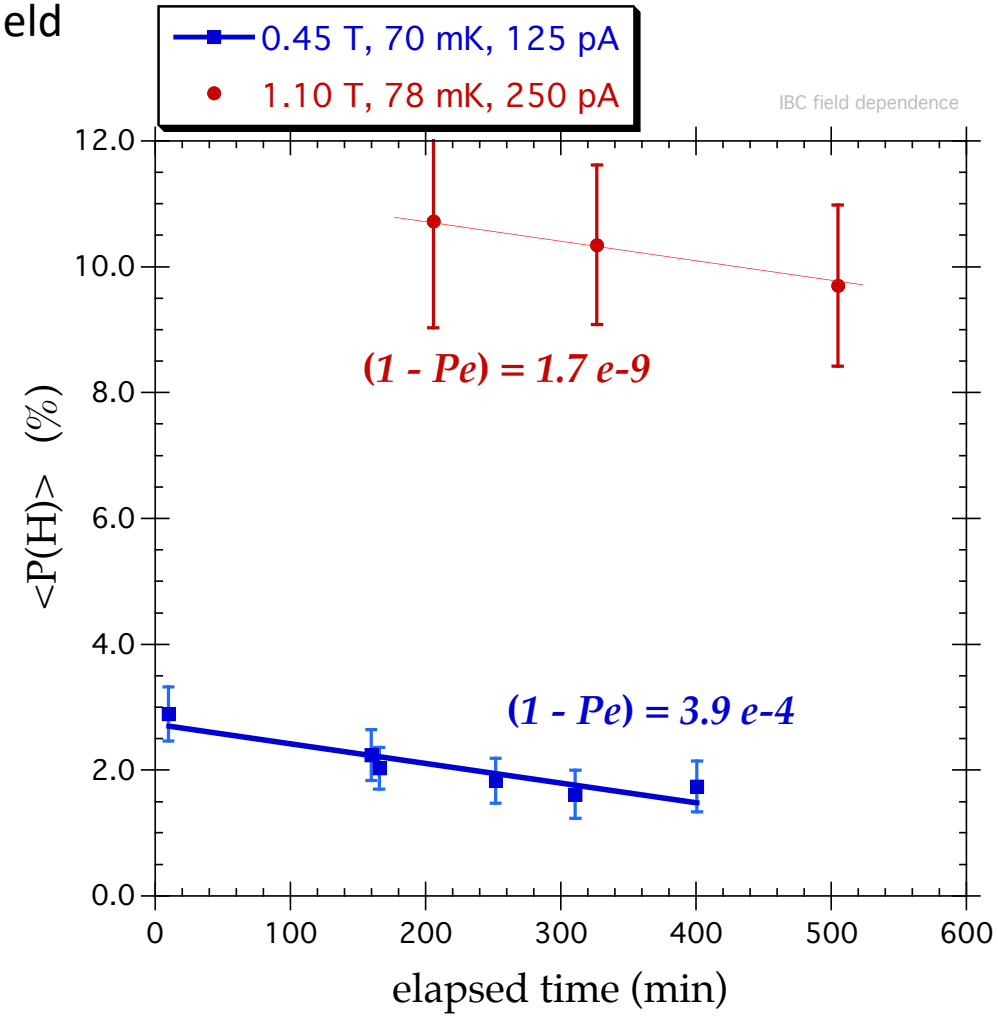
  - most data taken at 1.10 T holding field

    ⇔ (1 – Pe) = 1.7 e-9

  - test at 0.45 T holding field

    ⇔ (1 – Pe) = 3.9 e-4

  - same slope (*preliminary*), but need new data sets with small errors



Run 3 UITF status update – Nov 29/20

Goals for the coming week(s):

- Nov 30 – Dec 3: remove the first HD target and load the second frozen-spin target
- Dec 4 + : runs under various conditions to separate depolarization mechanisms

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Outlook:

- at this point, it seems the most hopeful path to a long in-beam lifetime is to lower the operating temperature with beam

  ⇔ the dilution refrigerator in the present IBC does not have the capability of meeting such demands of a 10 GeV beam in Hall-B

  ⇔ HDice does not appear to be a straight-forward solution for RG-H ☹