Motivation for a *Run 2b* HDice calibration run at the UITF (~ 1st week of March/21)

(Feb 11, 2021)

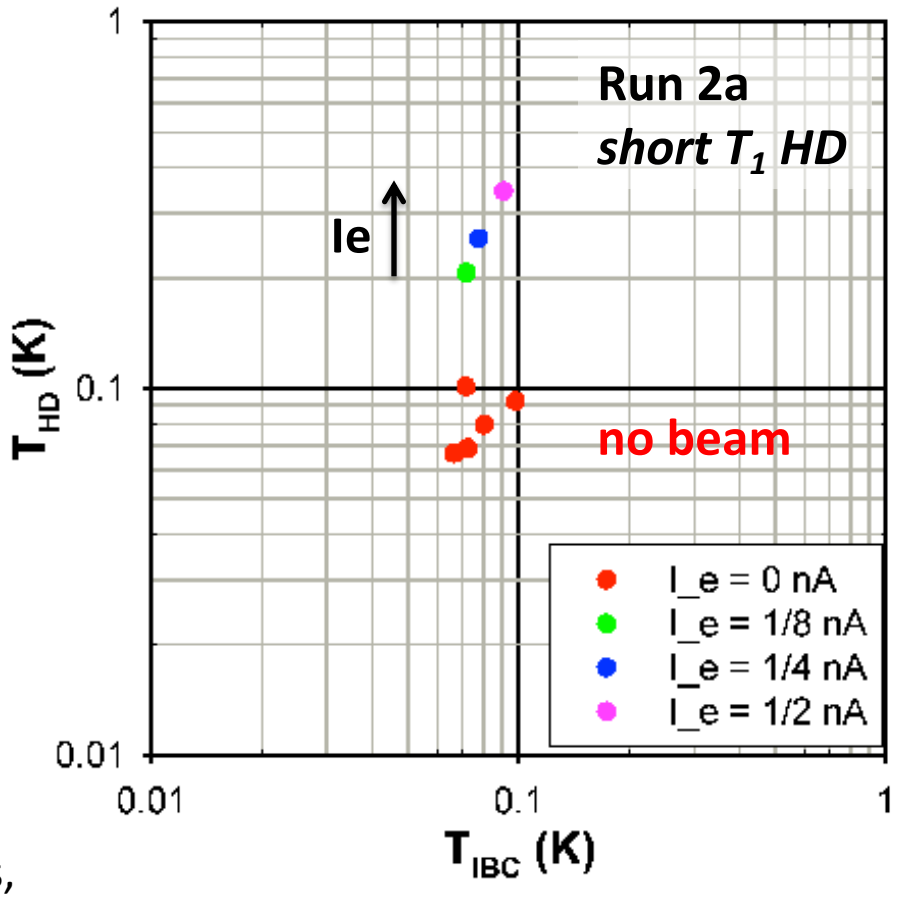
Proposed Run 2b for temperature calibration – Feb 11/21

- **Run 2a** (Oct 27 – Nov 09/20)
  ⇔ reduced NMR with beam-on

- 1st Run 3 target showed that

  (a) this is due to elevated HD temp
  ⇔ poor thermal coupling to IBC

  (b) dose-dependent dP(H)/dt



- *Working model for polarization loss:*

  - beam dose changes target composition, mostly dissociating HD into H and D (4 eV), and eventually reaching some equilibrium
  - unpaired electrons would not be a problem if the heat was removed as expected.

  (*eg.* with Faraday cup IN, temperature drops, and P(H) immediately stops changing ⇔ because electrons become fully polarized.)

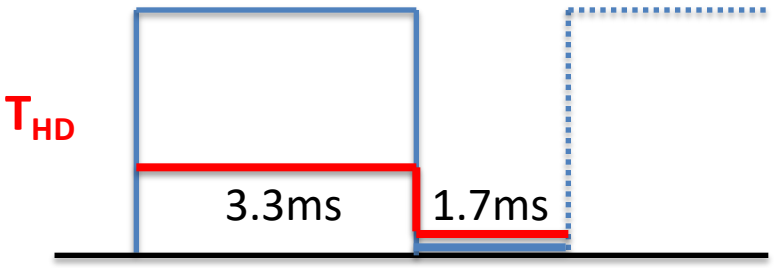
- with 2nd Run 3 target, *beam-blanking* was used to explore the time constants

  - *eg. beam-on* for 3.33 ms (10 raster cycles); *off* for 1.67 ms (5 raster cycles) ⇔ *d.f.* = 2/3

Proposed Run 2b for temperature calibration – Feb 11/21

- HD temperatures (via NMR) under reduced *d.f.* could shed light on the thermal time scale

  eg. suppose thermal connection is *fast* on ms scale

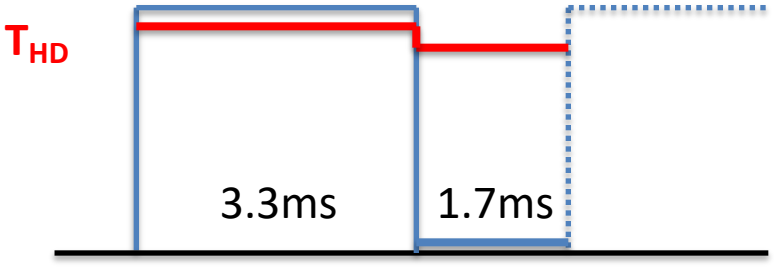


⇔ **average <Ie> determines T_{HD}** (NMR)

eg. **T_{HD} (<125 pA>, 188 peak, *df* =2/3)**

= T_{HD} (125 pA CW)

eg. suppose thermal connection is *slow* on ms scale (Raster cycle = 0.3 ms)



⇔ **Ie(*peak*) determines T_{HD}** (NMR)

eg. **T_{HD} (<83 pA>, 250 peak, *df* =1/3)**

>> T_{HD} (<83 pA>, 125 peak, *df* =2/3)

Proposed Run 2b for temperature calibration – Feb 11/21

- *Beam-blanking* was not foreseen during Run 2a

  ⇔ we request a short Run 2b to measure HD temp with *beam-blanking*

  ⇔ sheds light on coupling btw heat and dose

- **Run 2b** with a short T_1 HD target (6 days)

  ⇔ equilibrium P(H) set by field and HD temp
  ⇔ 8 hr NMR under Run 3 conditions:

  <125 pA>, 188 pA peak, *d.f.* = 2/3;

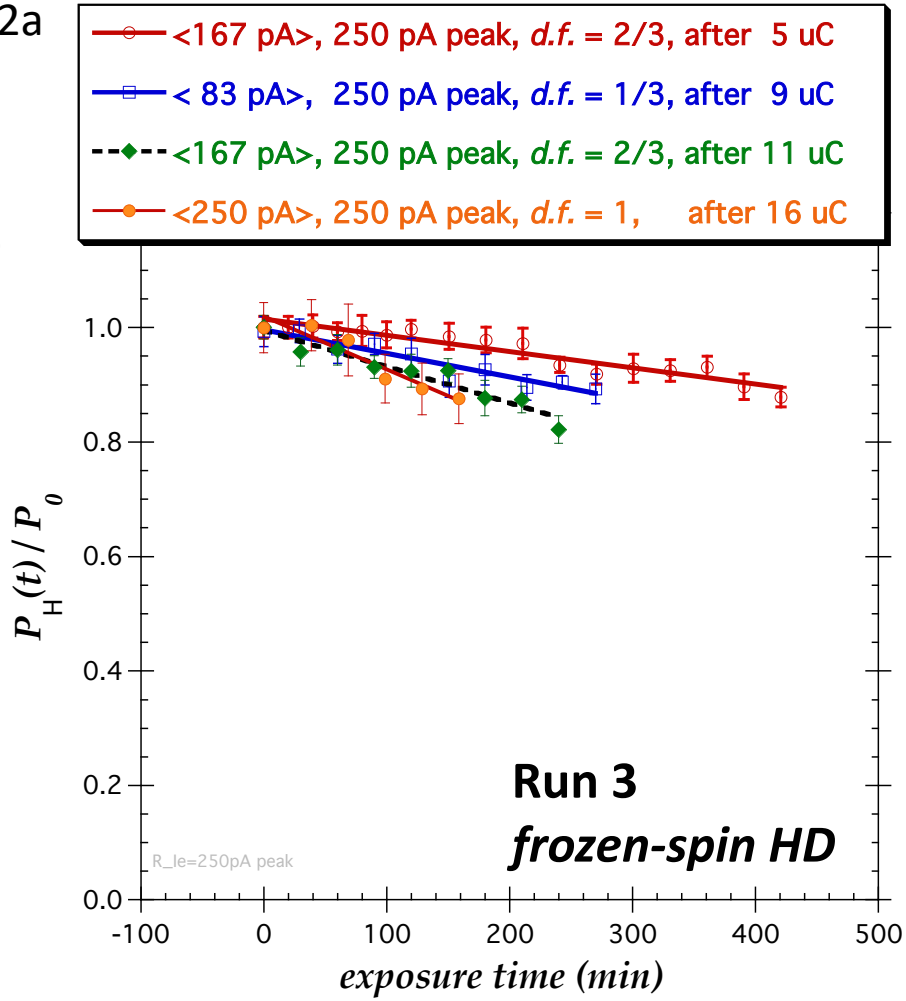
  < 83 pA>, 125 pA peak, *d.f.* = 2/3;

  < 125 pA>, 125 pA peak, CW

  < 83 pA>, 250 pA peak, *d.f.* = 1/3;

  <167 pA>, 250 pA peak, *d.f.* = 2/3;

  < 250 pA>, 250 pA peak, CW



- UITF running for studies until mid-March, including beam up to the gate valve before IBC
- March/21: C. Hanretty & U. Conn. Students available – after that, manpower drops !