BLM Thresholds on Superconducting Magnets
(focused on millisecond losses - RS05)

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Threshold components and Note44 algorithm

$$T = S_{BLM}(E_b) \cdot \Delta Q\,(E_b,t) \,/\, E_D\,(E_b,t)$$

BLM signal — quench margin — energy deposited in coil

1. $t<t_{metal}$: ΔQ = enthalpy limit (ΔH), $E_D = E_{max}$
2. $t_{metal}<t<t_{helium}$: $\Delta Q = \Delta H + 5\%\text{Helium}$, $E_D = E_{cable}$
3. $t>t_{helium}$: $\Delta Q = 5\%\text{Helium} + \text{SteadyFlow}\cdot t$, $E_D = E_{cable}$

$$\text{Helium} = \int_{T0}^{Tquench} c_V \, dT, \quad T0=1.9K \text{ or } 4.5K, \; Tquench=2.8K \ldots 9K$$

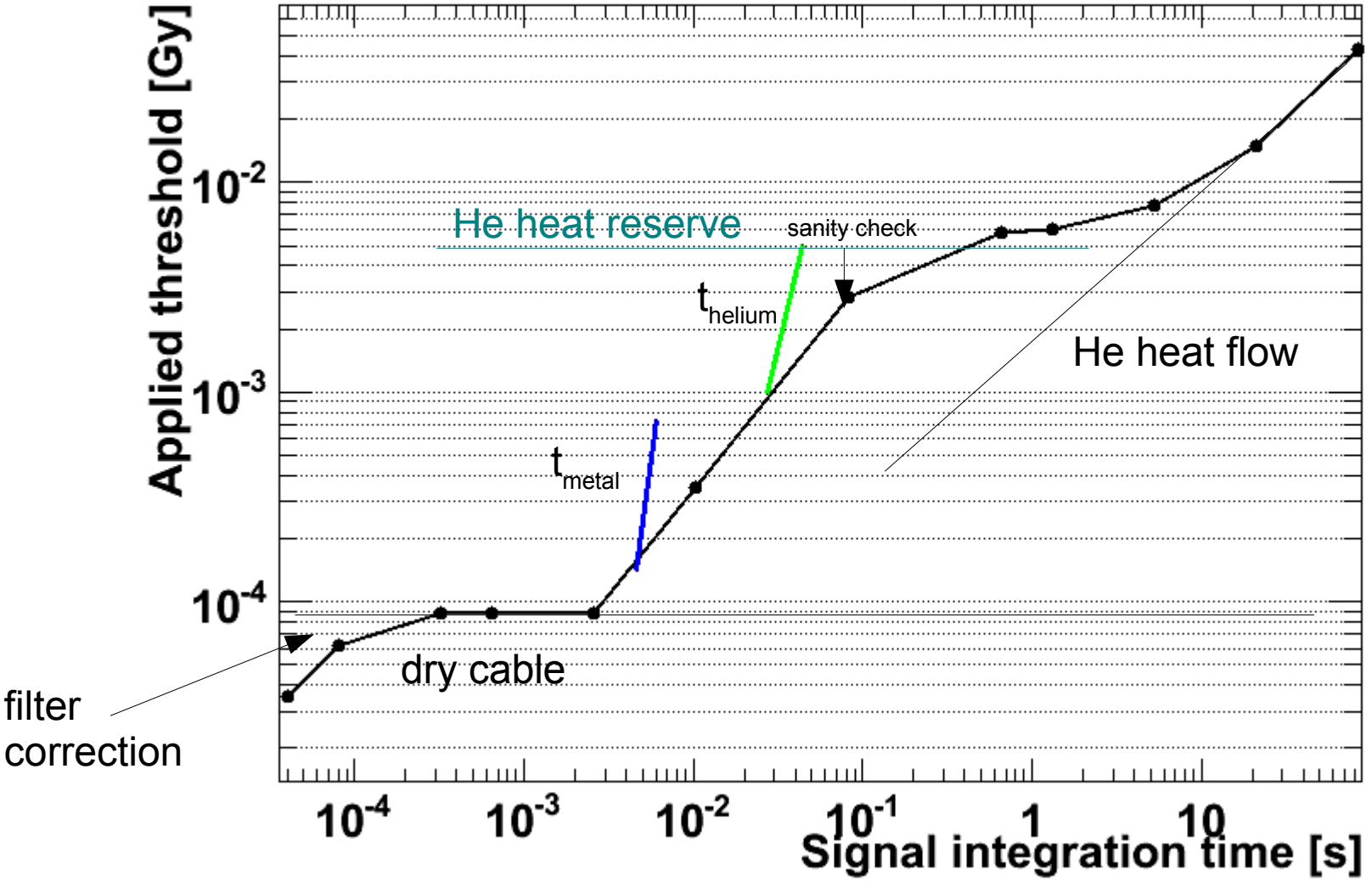
Ingredients, 8 functions of E_{beam}:

S_{BLM}, t_{metal}, t_{helium}, ΔH, SteadyFlow, E_{max}, E_{cable}, Helium

measured!

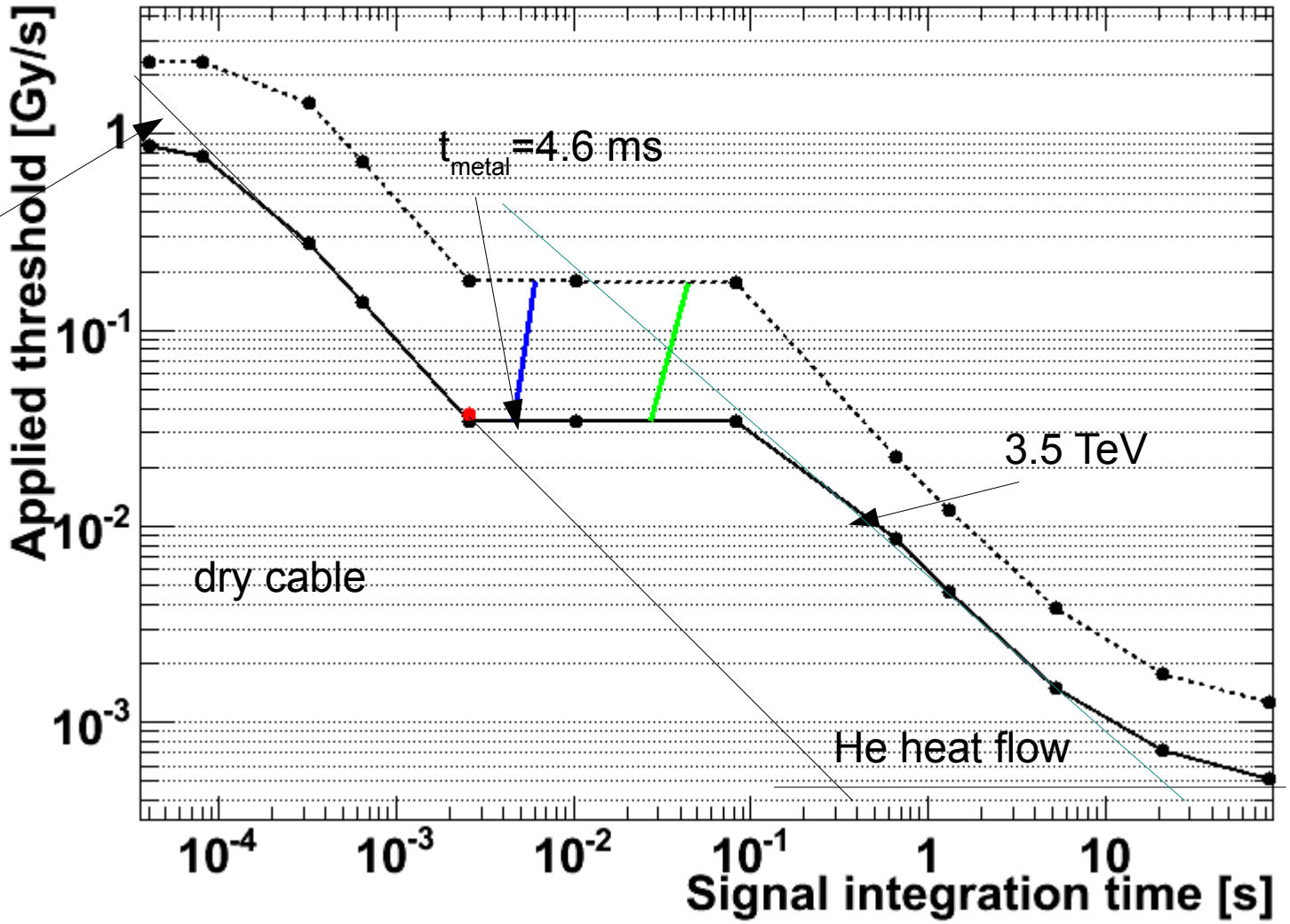
Geant4,
analytic calculations,
thermodynamic
models

Threshold components

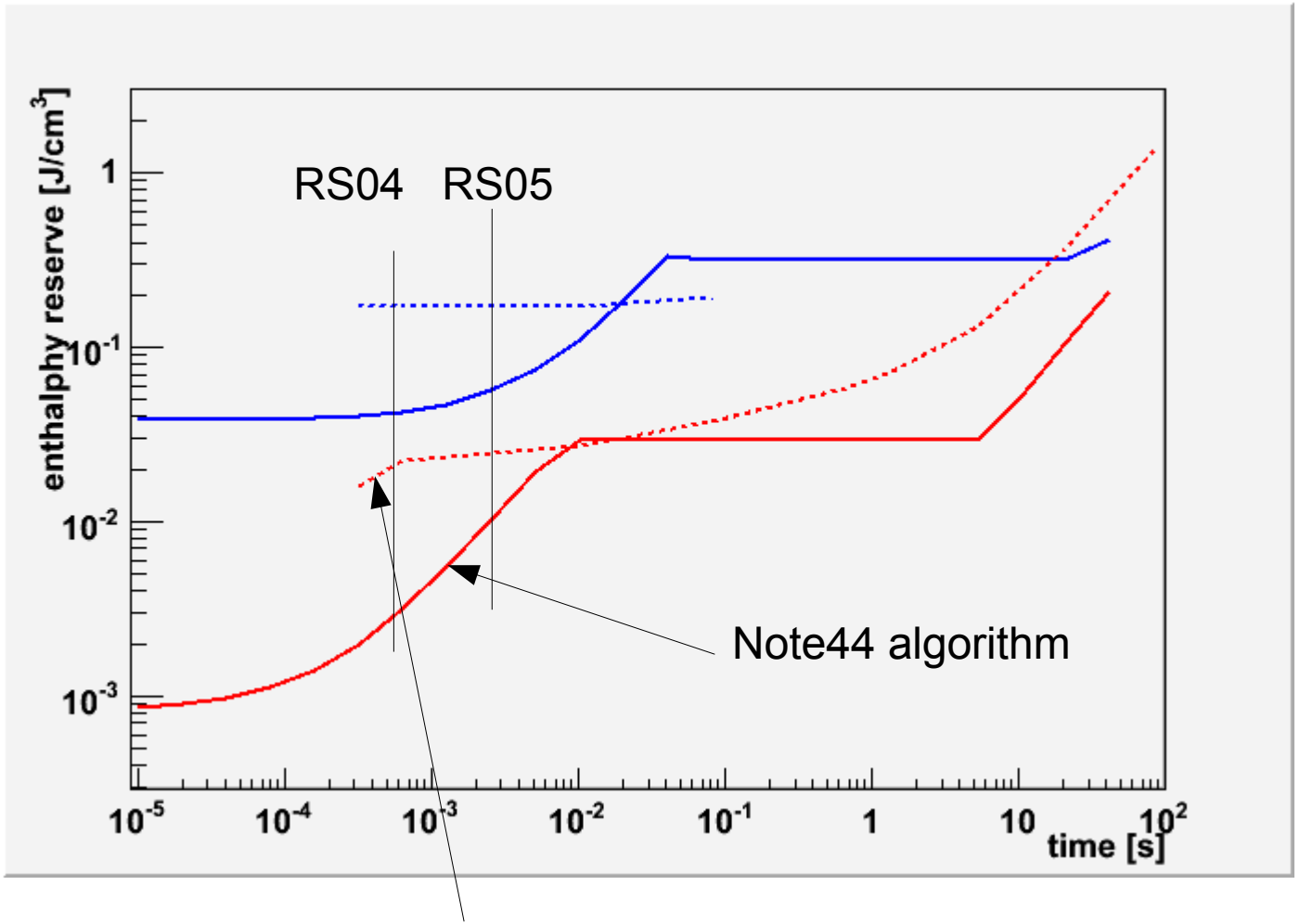


Threshold components

filter correction

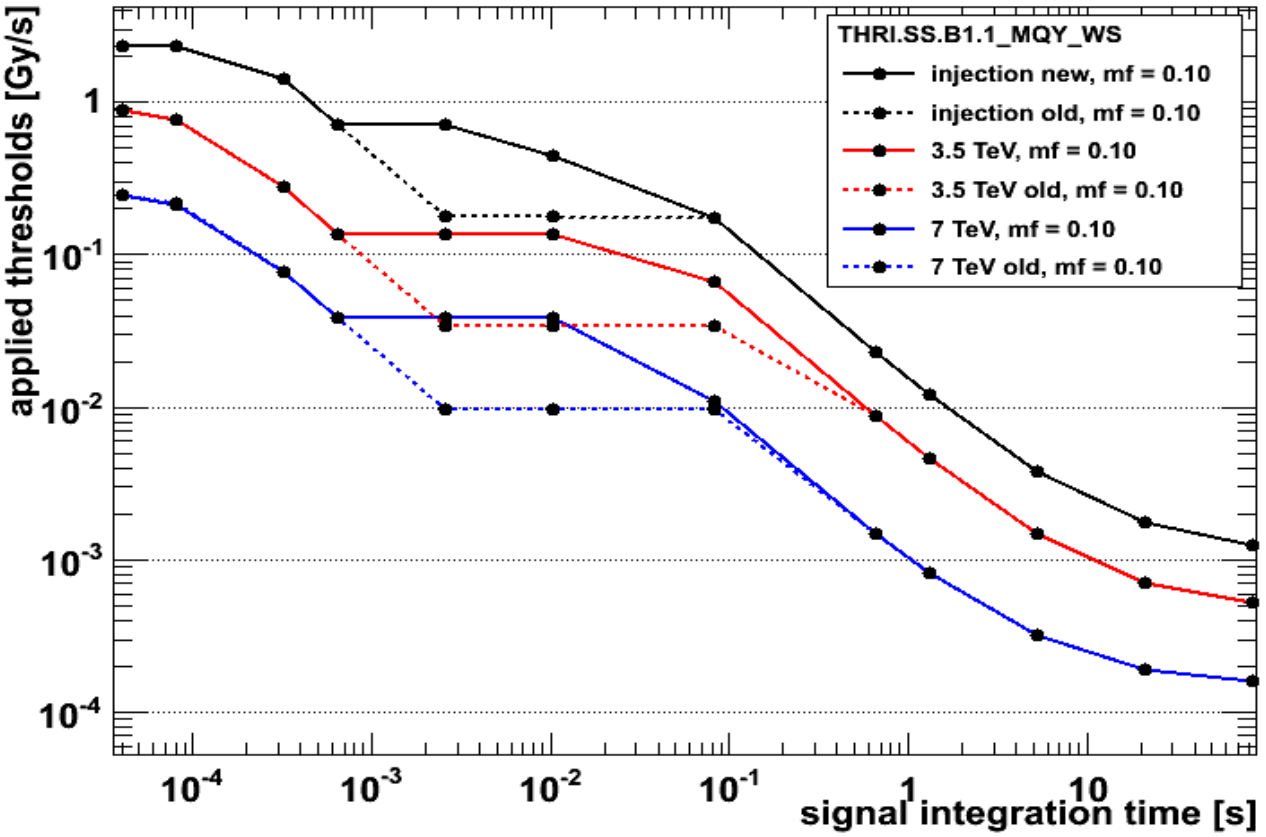


Helium contribution – at which timescale?



ZERODEE simulations, P-P.Granieri, 2008

If helium contributes faster:



E_{beam} [TeV]	old t_{metal}	new t_{metal}
0.45	6 ms	2.5 ms
3.5	4.6 ms	2 ms
7	3 ms	1.4 ms