

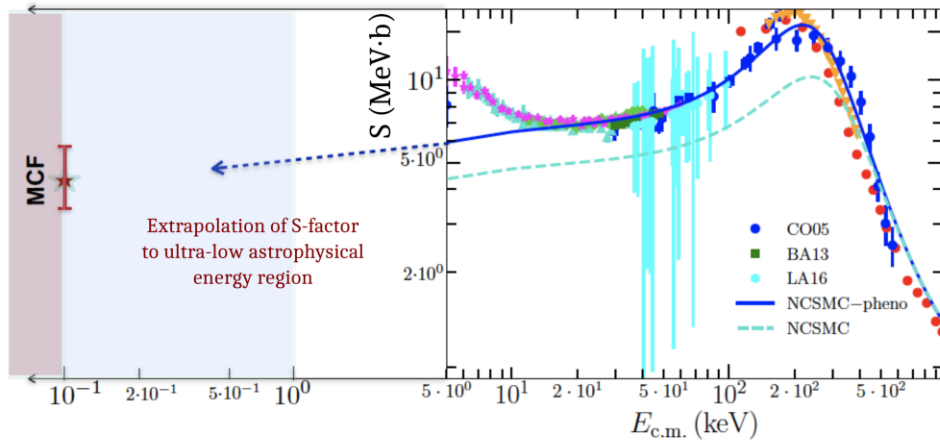
Study of muon catalyzed $d^3\text{He}$ Fusion



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researcher

on behalf of dHe3/MuSun collaboration

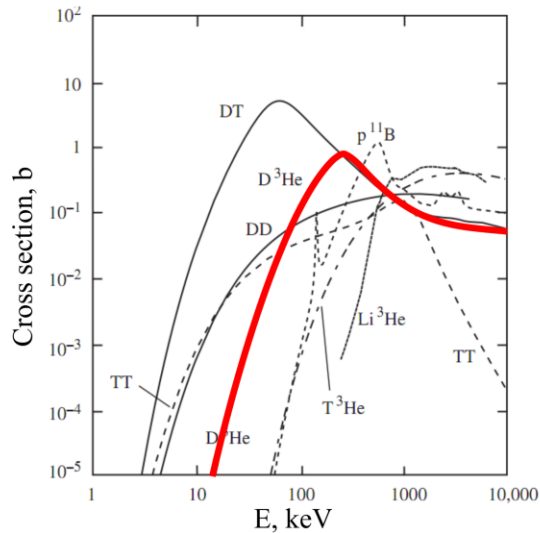


1. confirmation of the MCF theory

L.Bogdanova, M. Faifman, V.Korobov (Moscow, Russia)

2. source of the thermonuclear energy

Atomnaya Energiya 81(1996) 384



3. fusion rate at ultra-low energies without the electron screening distortion

Nuclear Physics A690(2001) 790-800

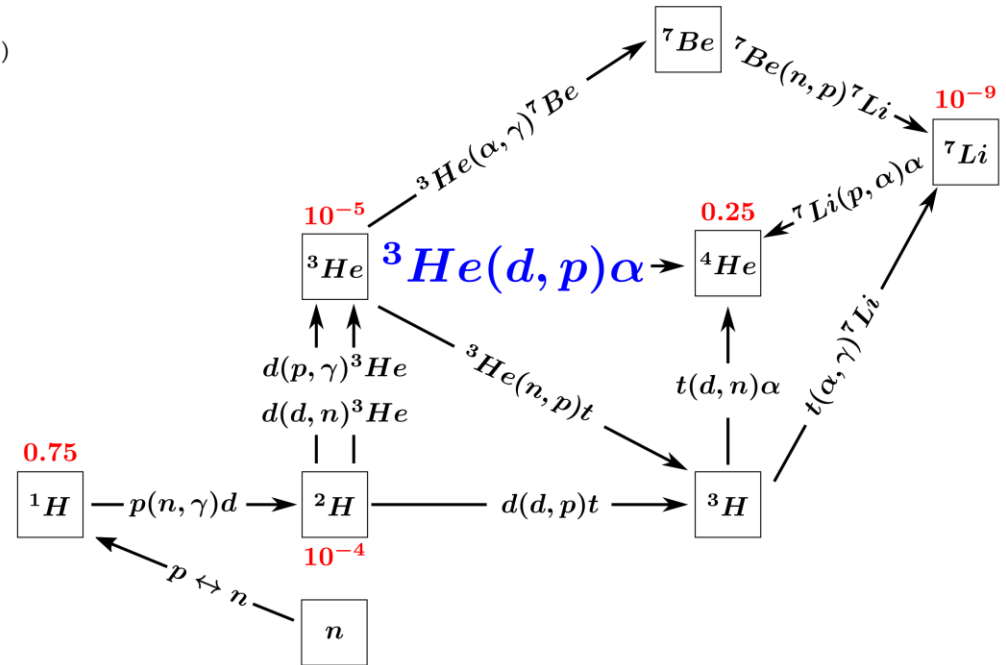
4. cross section for bare nuclei in the ultra-low energy region

5. test of charge symmetry in strong interactions

Nuclear Fusion 32(1992) 611

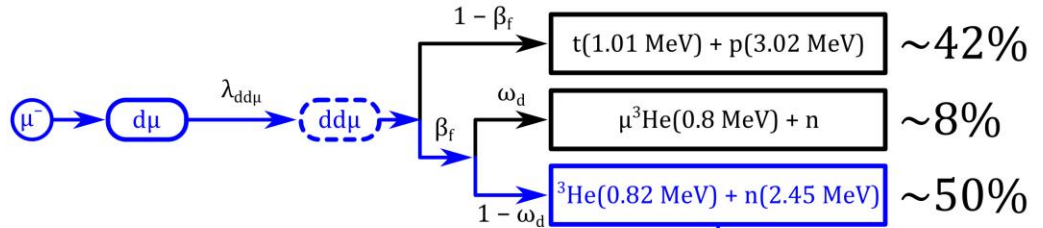
6. primordial nucleosynthesis

Ann.Rev.Astron.Astrophys. 3(1985) 313

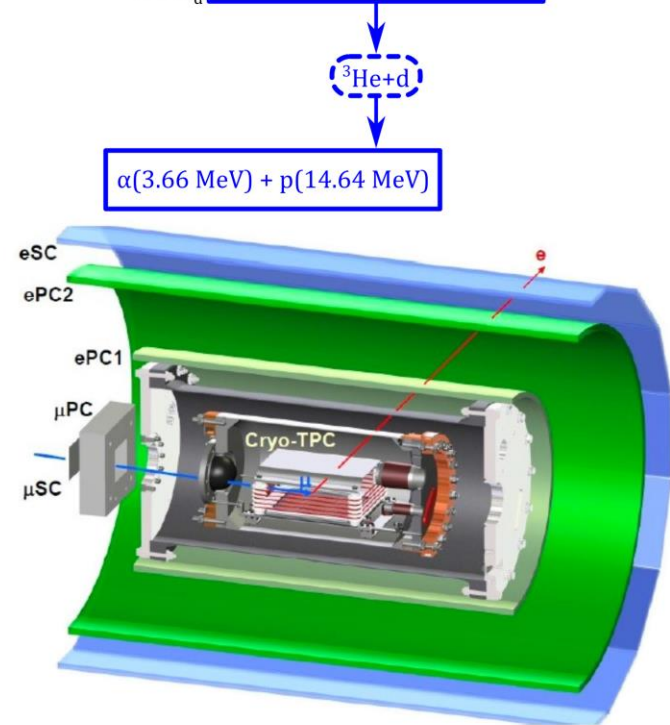
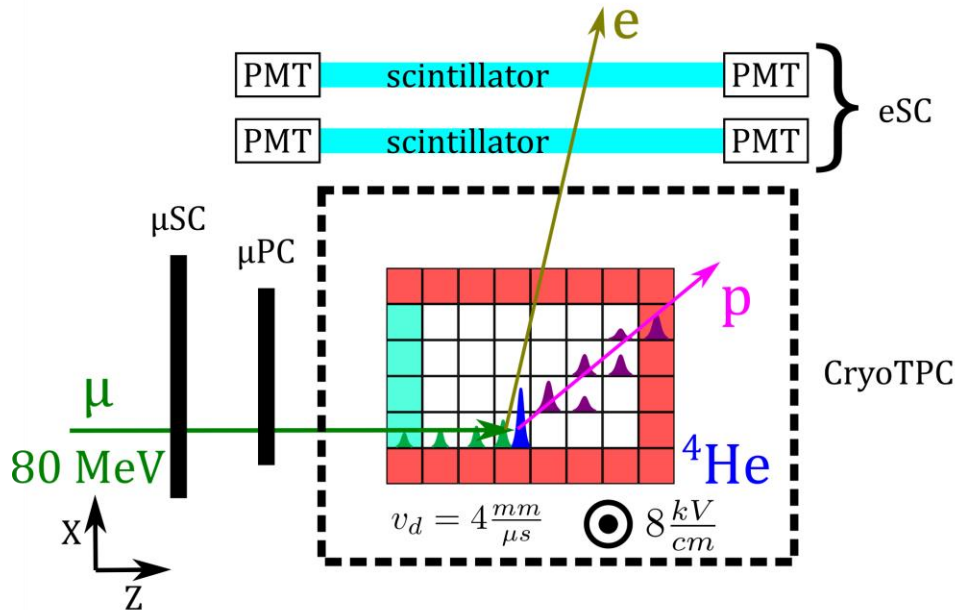


	year	gas	T, K	P, bar	ϕ , %LHD	C_d , %	$C_{^3He}$, %	gas purity
Run 8	2015	D_2	31	5	6.5	100	0	$< 2 \cdot 10^{-9}(N_2)$
Run 9	2016	$D_2 + ^3He$	31	5	6.5	95	5	$< 2 \cdot 10^{-9}(N_2)$
Run 10	2021	$HD + ^3He$	31	5	6.5	95	5	$< 2 \cdot 10^{-9}(N_2)$

μ S (Swiss Muon Source)
at PSI, Villigen, Switzerland

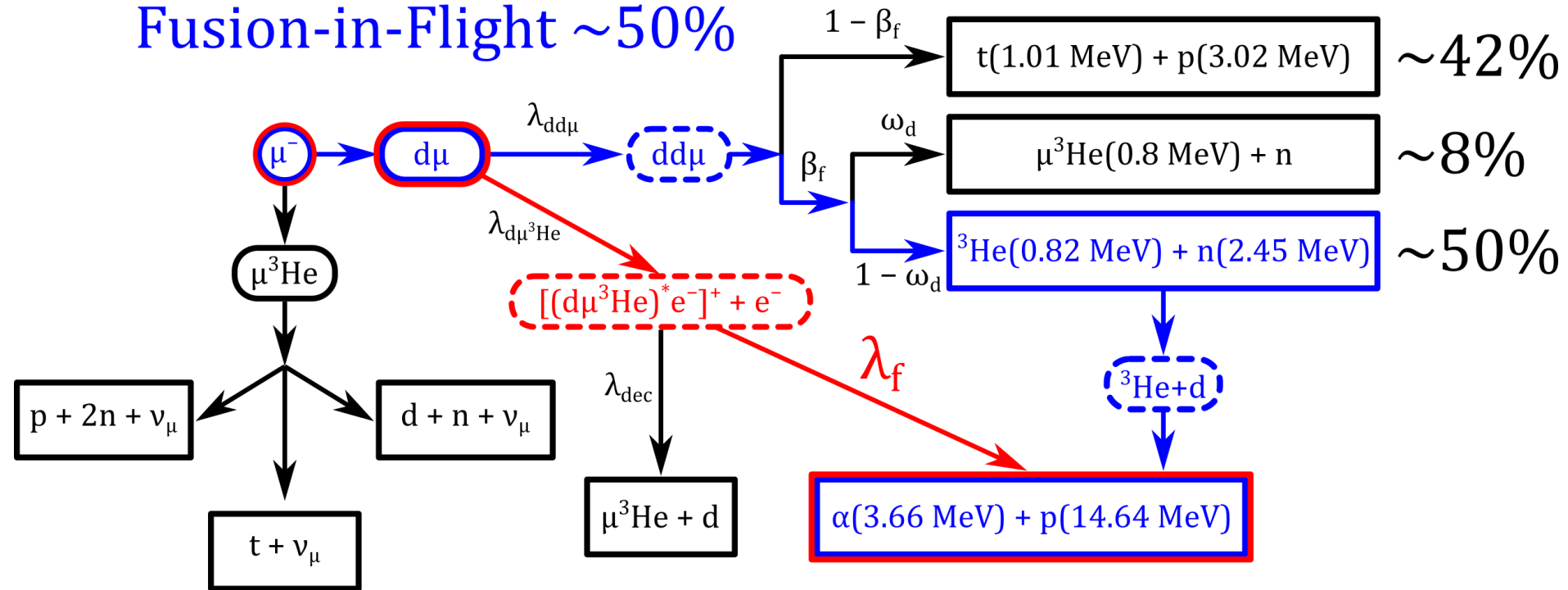


Pad system: 100 mm (X) \times 125 mm (Z).
Each pad: 17.5 mm (X) \times 15.25 mm (Z).

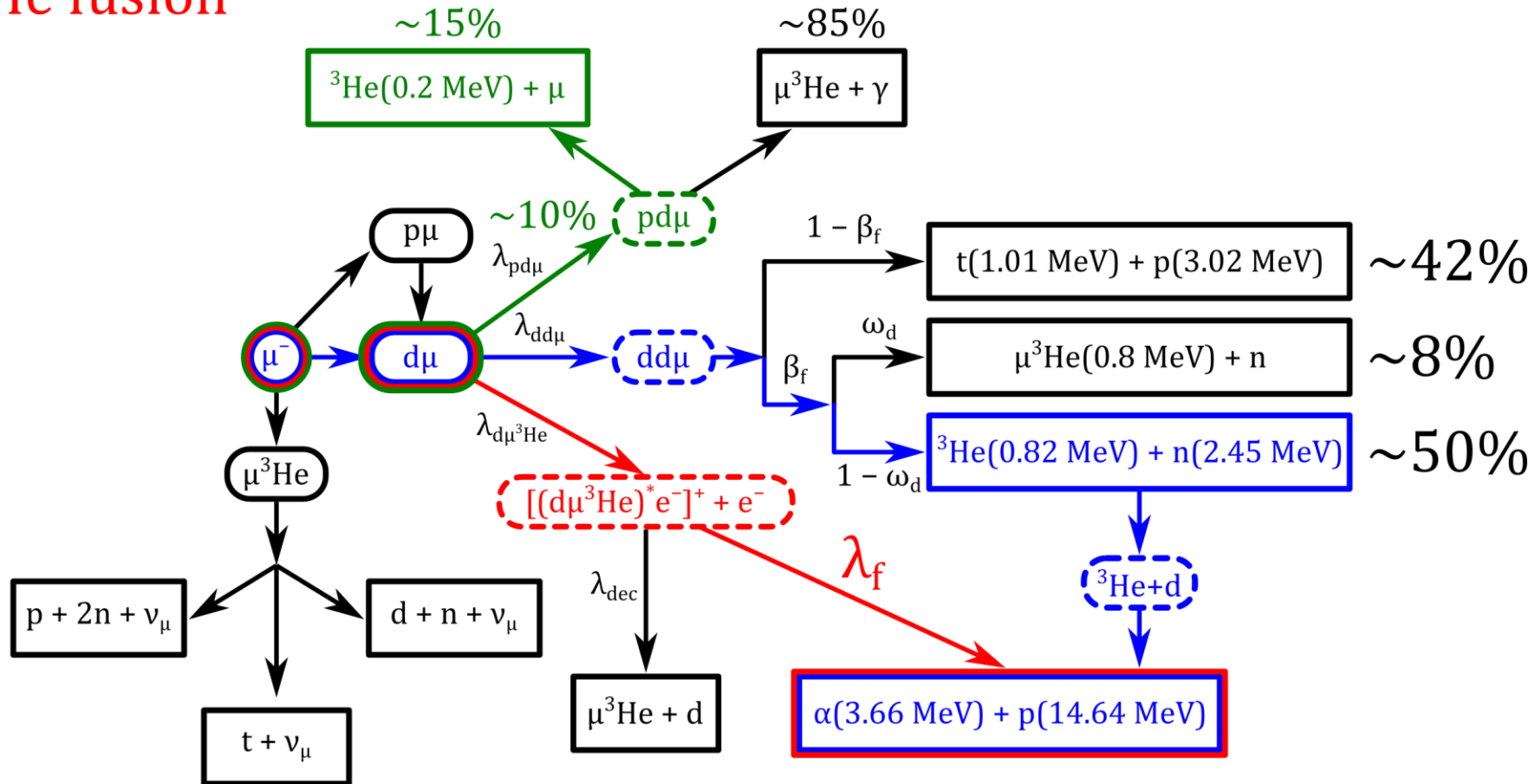


$d\mu^3\text{He}$ fusion

Fusion-in-Flight $\sim 50\%$



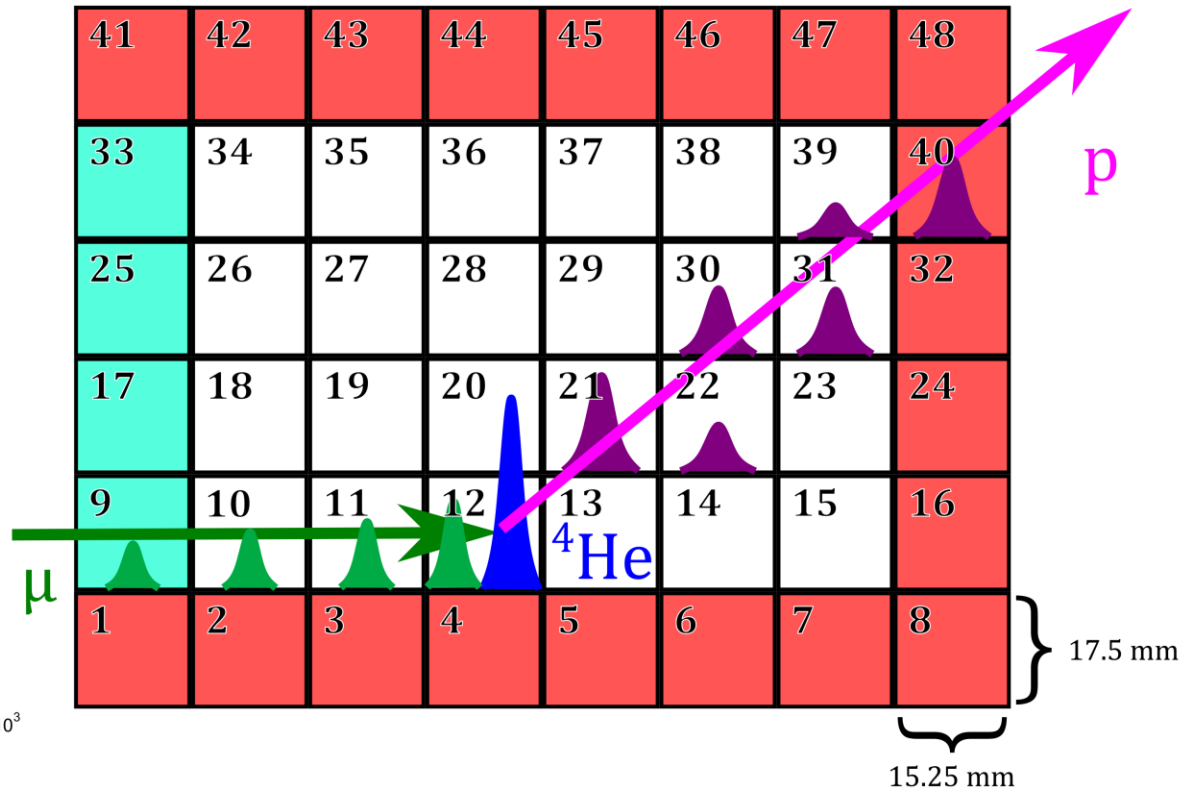
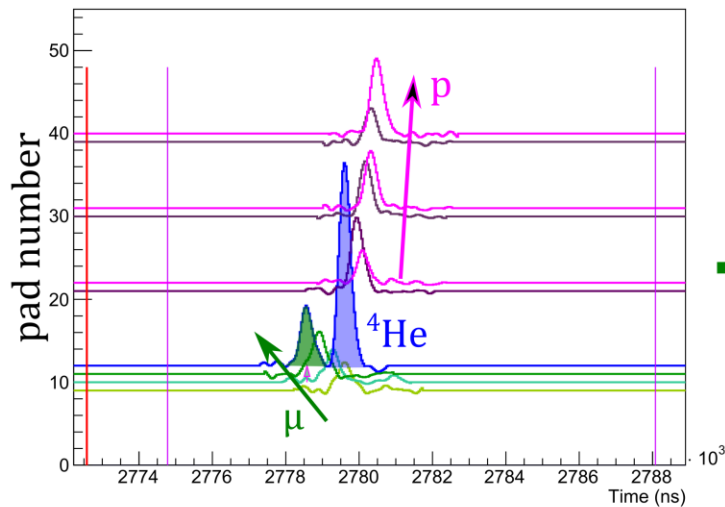
Fusion-in-Flight $\sim 12\%$ FinF suppressed by a factor of 4
 pd μ background $\sim 1.5\%$
d μ^3 He fusion





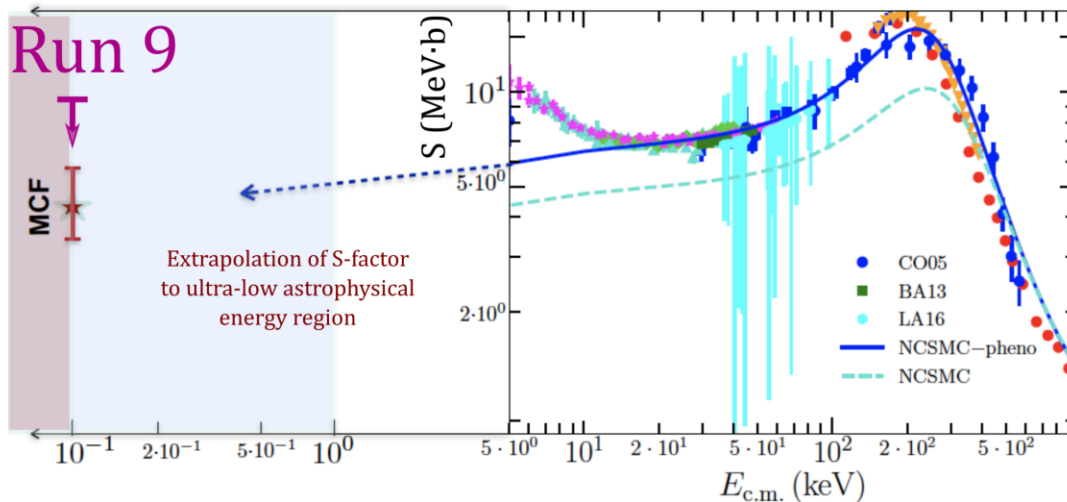
	E, MeV	λ , mm
${}^3\text{He}$	0.82	0.3
n	2.45	long
$\mu^3\text{He}$	0.80	0.6
t	1.01	0.9
p	3.02	12.9
α	3.66	1.7
p	14.64	190

Pad system: 100 mm (X) × 125 mm (Z).



	gas	days	N_{tot}	N_{FinF}	$\mu_{stop}, 10^9$	$N_{^3He(0.82)}, 10^5$
Run 8	D_2	63	99	77	6.3	128
Run 9	$D_2 + ^3He$	6	2	± 1.9	1.0	3.34
Run 10	$HD + ^3He$	21	12	± 1	2.2	1.9

preliminary



$$P_f = \frac{N_f}{N_{^3He\mu d} \cdot \epsilon_f}$$

Run 9:

$$P_f \leq 1.1 \cdot 10^{-7} \text{ at } 90\% \text{ C.L.}$$

$$\lambda_f = \lambda_{dec} \cdot P_f$$

Run 9:

$$\lambda_f \leq 7.7 \cdot 10^4 \text{ s}^{-1} \text{ at } 90\% \text{ C.L.}$$

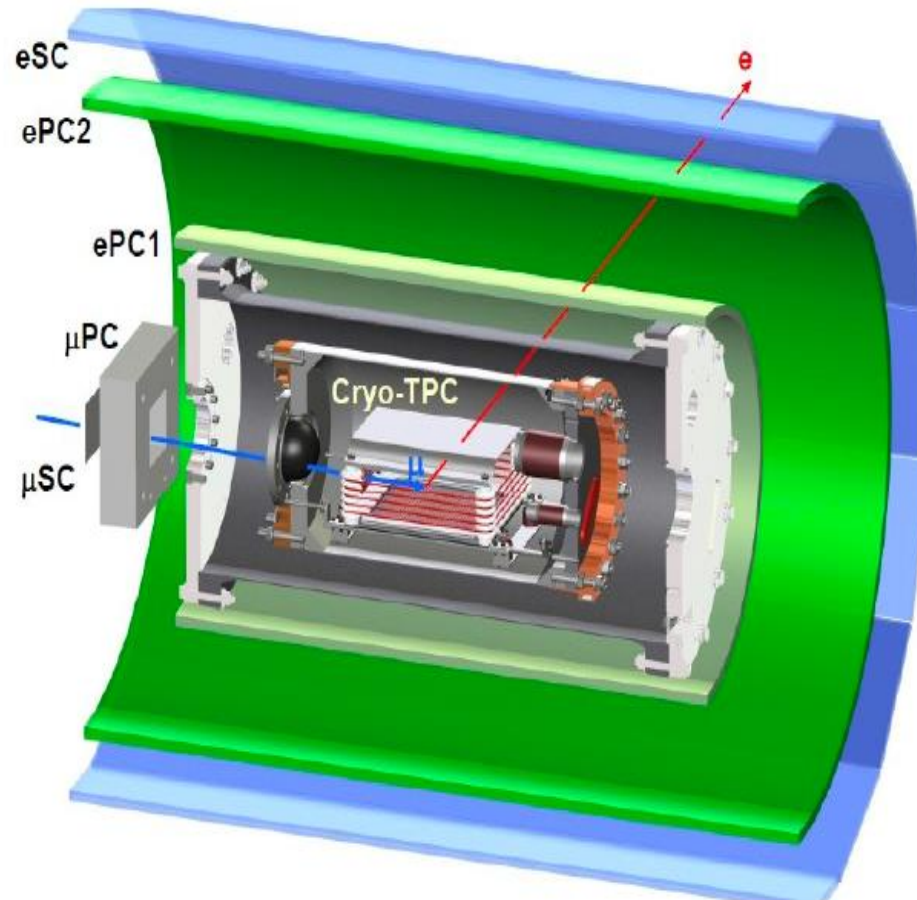
Run 10 contains only half statistics for 5σ confirmation of $d\mu^3He$ fusion.

Run 11 is planned in 2022.

E.M. Maev et al. (PNPI-PSI)
 Hyperfine Int. 118, 171 (1999) $\lambda_f < 6.0 \cdot 10^4 \text{ s}^{-1}$

M.P. Faifman, L.I. Men'shikov
 Hyperfine Int. 118, 187 (1999) $\lambda_f \approx 2.5 \cdot 10^4 \text{ s}^{-1}$

which corresponds to observation of 1.3 events in 1 week.



Thank
you
for attention!