Status of NuSTORM

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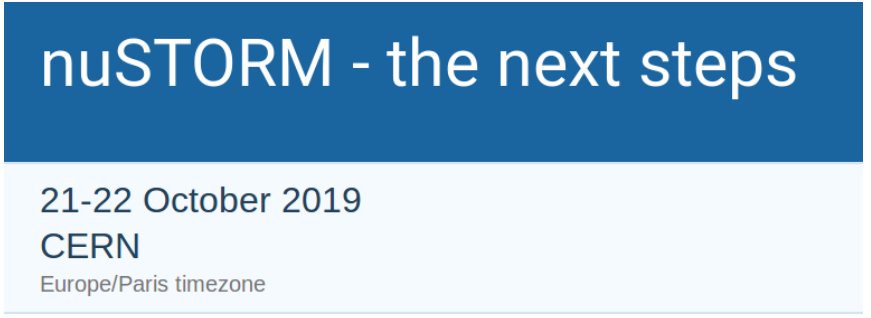
NuSTORM in the US

- 2014 P5 did not recommend nuSTORM
  even in the unlimited budget scenario
- U.S. Muon Accelerator Program was
  terminated in the wake of P5
- Some muon accelerator R&D was transitioned
  into GARD (General Accelerator R&D)
- Does the neutrino cross section community and NuSTEC in particular
  have an interest to resurrect this during the 2020/21 SNOWMASS/P5?

NuSTORM at CERN

- Dedicated workshop
- Physics Beyond Colliders
- 2 days, 30+ participants



Physics Case	Facility
Detector requirements	Facility

Physics Case

- Sterile neutrino searches:

  NuSTORM would be a definitive experiment, can test appearance and disappearance

  Still relevant by the time nuSTORM comes around?

- Muon accelerator R&D:

  Strong synergy for proton-driven concept

  Somewhat less synergy for positron-drive concept (LEMMA)

  Community support for a muon accelerator?

Physics Case

- Neutrino cross sections:

  NuSTORM provided better than 1% absolute flux normalization

  Well defined relationship between neutrino and antineutrino beams

  Unique ability to determine muon/electron neutrino cross section ratio

μ^+		μ^-	
Channel	N_{evts}	Channel	N_{evts}
$\bar{\nu}_\mu$ NC	1,174,710	$\bar{\nu}_e$ NC	1,002,240
ν_e NC	1,817,810	ν_μ NC	2,074,930
$\bar{\nu}_\mu$ CC	3,030,510	$\bar{\nu}_e$ CC	2,519,840
ν_e CC	5,188,050	ν_μ CC	6,060,580
π^+		π^-	
ν_μ NC	14,384,192	$\bar{\nu}_\mu$ NC	6,986,343
ν_μ CC	41,053,300	$\bar{\nu}_\mu$ CC	19,939,704

Needs suitable detector concepts to exploit high statistics – Synergies with T2HK and DUNE near detector programs

BUT

DUNE believes they have a near detector complex which does what they need.

North Area/SPS	Status	Deploy	Cost	Physics
BDF/SHiP,tauFV	CDS	LS3+	C6	Hidden Sector
eSPS/LDMX	→CDS	<LS3	C5	DM
nuSTORM	Feasibility	LS4+	C6	Neutrinos
CB/KLEVER	EoI	LS3+	C3	Precision
CB/COMPASS-RFSB	EoI/proposal	LS3+	C4	QCD
NA62++	Studies	Run 3	C1	Hidden Sector
NA64++	OP	Run 3	C1	DM
MUonE	Proposal	Run 3	C2	g-2
LHC				
LHC FT - gas	TP	Run 3	C1	PDF,DY,spin
LHC FT - crystal	prototype	Run 3	C2	MDM/EDM
FASER	TP/approval	Run 3	C2	LLP
MATHUSLA	LOI	LS3	C5	LLP
CODEX-b	LOI	LS3	C3	LLP
milliQan	demo	Run 3	C2	LLP
ANIBUS	proposal	Run 4	C3	LLP
NOVEL				
Gamma Factory PoP	→EoI	Run 3	C2	PSI/Laser
pEDM protype	CDS	2022	C4	EDM
AWAKE++	exploratory	LS3+	C4	DM
PS				
REDTOP	proposal	LS3+	C3	BSM+
TECHNOLOGY				
VMB	LOI	Run 3	C2	VMB
BabyJURA, JURA1, JURA 2	proposal	2023	C2,C2,C4	ALPs
BabyIAXO/IAXO	advanced	2023	C3,C4	Axions

CERN context

Broad range of programs considered within the PBC

In the C6 category
LS4+ → after 2031 (!)

Tables from talk by M. Lamont

C1	< few 100 kCHF
C2	From few 100 KCHF to 1-2 MCHF
C3	From 1-2 to 5-10 MCHF
C4	~10-50 MCHF
C5	> 50 MCHF
C6	> 150 MCHF

Summary

- NuSTORM at CERN conceivable and no technical show stoppers identified so far
- Part of the PBC process, start date beyond 2030
- NuSTORM in the US: attempt resurrection during 2020 SNOWMASS?
- Neutrino cross section question for NuSTEC:

  Are the near detectors of DUNE and T2HK sufficient?

  OR

  Do we need a dedicated cross section experimental program?