BSM Snowmass report

Snowmass BSM report will include sections on the four main EF09 areas.

We invited, after an open call, experts in three key areas to help scrutinize available literature, snowmass inputs, and draft specific sections. Largest number of contributions expected in these areas.

Heavy Bosons
Robert Harris,
Felix Yu

New Fermions
Julie Hogan,
Ian M. Lewis

Long-Lived Signatures
Juliette Alimena,
Simon Knapen

They will also lead discussions during EF09 parallel session this week.
- Additionally, Lingfeng Li invited to guide the discussion on other exotica

Other exotica
Lingfeng Li
To lead discussion @ EF ws

Snowmass community input

At the start of Snowmass, gauged interests through expression-of-interests (EoI) and letters-of-interests (LoI)

- 66 EoI, 73 LoI (large overlap)

After the snowmass pause,
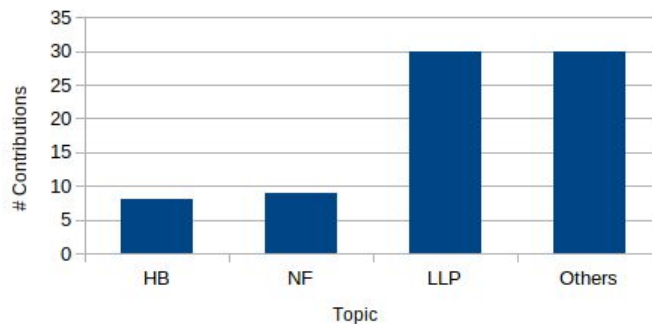estimated ~50 LoIs still ~active state

- 22 (44%) submitted as a contributed paper or published to a journal and communicated directly to us

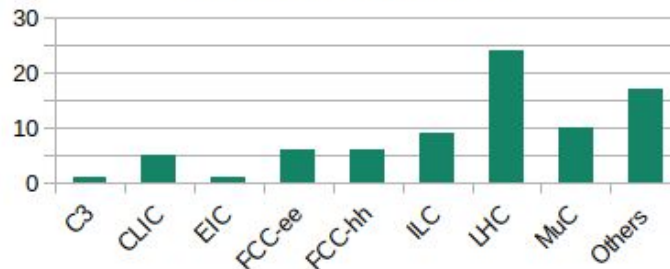Overall received 25 direct snowmass submissions to EF09.
63 contributions (snowmass sub. or journal) identified as having material directly relevant to EF09

- Including 10 contrib. papers from other EF groups or other frontiers

Contributions by topic

Contributions by Collider

Timeline

3/15/22	3/28/22-4/1/22	5/31/22	6/30/22	7/17-26/22	9/30/22	10/31/22
Deadline Contributed Paper Submission	EF Workshop (Brown U.)	Prelim. Topical Group Reports	Prelim. Energy Frontier Report	Community Summer Study (UW-Seattle)	Final Reports	Snowmass Book & ArXiv docs

All main building blocks should be in place by end of May

Can update and fill in a few remaining critical results, if very important for the main message

Goal of today's EF09 parallel session

Briefly review the inputs received (see also Monday's EF09 highlights talk)

Start brainstorming on how to best summarize those inputs:

- Key summary plots that address critical questions
- Comprehensiveness of inputs across different collider options for those critical questions / summary plots: identify if there are critical gaps that can and we should try to fill in the coming months to the July Snowmass meeting
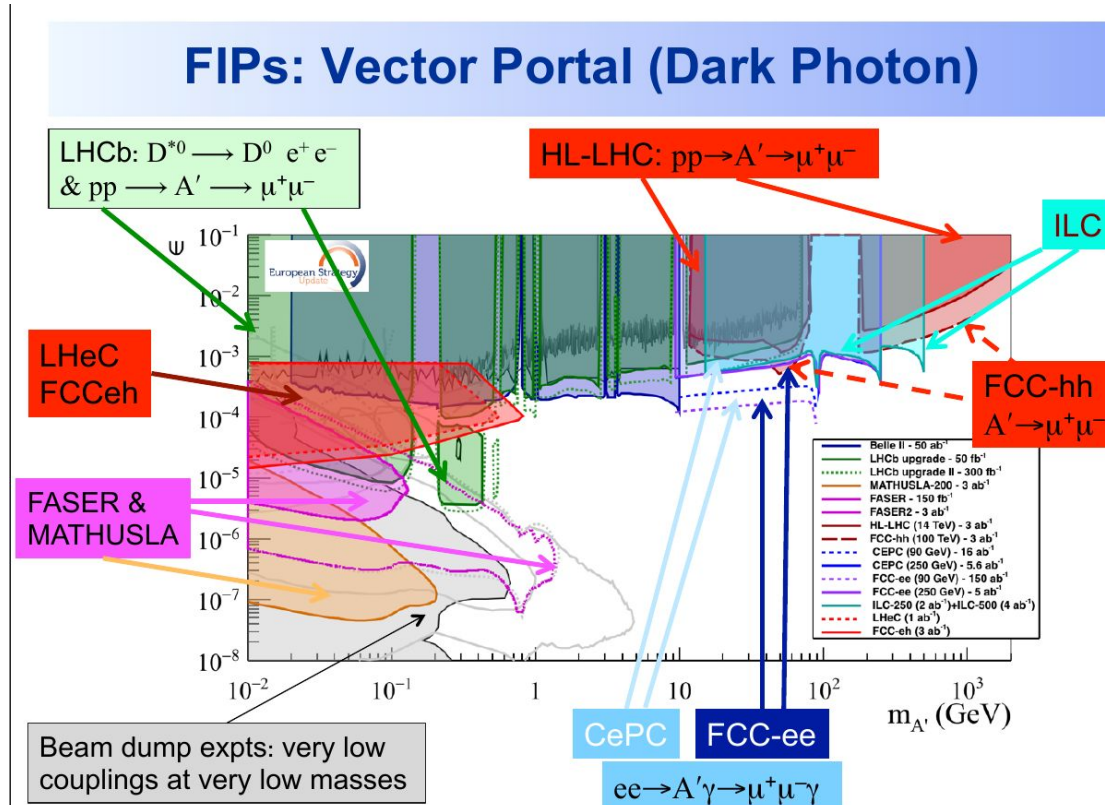
Also collect inputs about how we want to frame the narrative of the report

- See also the discussion on Tuesday on general BSM narrative for the report

One example of summary table

Machine	Type	√s (TeV)	∫L dt (ab⁻¹)	Source	Z' Model	5σ (TeV)	95% CL (TeV)
HL-LHC	p p	14	3	R.H.	$Z'_{SSM} \rightarrow dijet$	4.2	5.2
				ATLAS	$Z'_{SSM} \rightarrow l^+ l^-$	6.4	6.5
				CMS	$Z'_{SSM} \rightarrow l^+ l^-$	--	6.8
				EPPSU*	$Z'_{Univ}(g_Z'=0.2)$	--	6
ILC250/ CLIC380/ FCC-ee	e⁺ e⁻	0.25	2	ILC	$Z'_{SSM} \rightarrow f^+ f^-$	4.9	7.7
				EPPSU*	$Z'_{Univ}(g_Z'=0.2)$	--	7
HE-LHC/ FNAL-SF	p p	27	15	EPPSU*	$Z'_{Univ}(g_Z'=0.2)$	--	11
				ATLAS	$Z'_{SSM} \rightarrow e^+ e^-$	12.8	12.8
ILC	e⁺ e⁻	0.5	4	ILC	$Z'_{SSM} \rightarrow f^+ f^-$	8.3	13
				EPPSU*	$Z'_{Univ}(g_Z'=0.2)$	--	13
CLIC	e⁺ e⁻	1.5	2.5	EPPSU*	$Z'_{Univ}(g_Z'=0.2)$	--	19
Muon Collider	μ⁺ μ⁻	3	1	IMCC	$Z'_{Univ}(g_Z'=0.2)$	10	20
ILC	e⁺ e⁻	1	8	ILC	$Z'_{SSM} \rightarrow f^+ f^-$	14	22
				EPPSU*	$Z'_{Univ}(g_Z'=0.2)$	--	21
CLIC	e⁺ e⁻	3	5	EPPSU*	$Z'_{Univ}(g_Z'=0.2)$	--	24
FCC-hh	p p	100	30	R.H.	$Z'_{SSM} \rightarrow dijet$	25	32
				EPPSU*	$Z'_{Univ}(g_Z'=0.2)$	--	35
				EPPSU	$Z'_{SSM} \rightarrow l^+ l^-$	43	43
Muon Collider	μ⁺ μ⁻	10	10	IMCC	$Z'_{Univ}(g_Z'=0.2)$	42	70
VLHC	p p	300	100	R.H.	$Z'_{SSM} \rightarrow dijet$	67	87
Coll. In the Sea	p p	500	100	R.H.	$Z'_{SSM} \rightarrow dijet$	96	130

Another example: summary plot

FIPs: Vector Portal (Dark Photon)

LHCb: $D^{*0} \longrightarrow D^0 \ e^+ e^-$
& $pp \longrightarrow A' \longrightarrow \mu^+\mu^-$

HL-LHC: $pp \rightarrow A' \rightarrow \mu^+\mu^-$

ILC

LHeC
FCCeh

FCC-hh
$A' \rightarrow \mu^+\mu^-$

FASER &
MATHUSLA

Beam dump expts: very low
couplings at very low masses

CePC

FCC-ee

$ee \rightarrow A'\gamma \rightarrow \mu^+\mu^-\gamma$

Ψ

$m_{A'}$ (GeV)

Belle II - 50 ab^{-1}
LHCb upgrade - 50 fb^{-1}
LHCb upgrade II - 300 fb^{-1}
MATHUSLA-200 - 3 ab^{-1}
FASER - 150 fb^{-1}
FASER2 - 3 ab^{-1}
HL-LHC (14 TeV) - 3 ab^{-1}
FCC-hh (100 TeV) - 3 ab^{-1}
CEPC (90 GeV) - 16 ab^{-1}
CEPC (250 GeV) - 5.6 ab^{-1}
FCC-ee (90 GeV) - 150 ab^{-1}
FCC-ee (250 GeV) - 5 ab^{-1}
ILC-250 (2 ab^{-1})+ILC-500 (4 ab^{-1})
LHeC (1 ab^{-1})
FCC-eh (3 ab^{-1})

Let's discuss!

Comments/Suggestions ?

Thank you in advance!