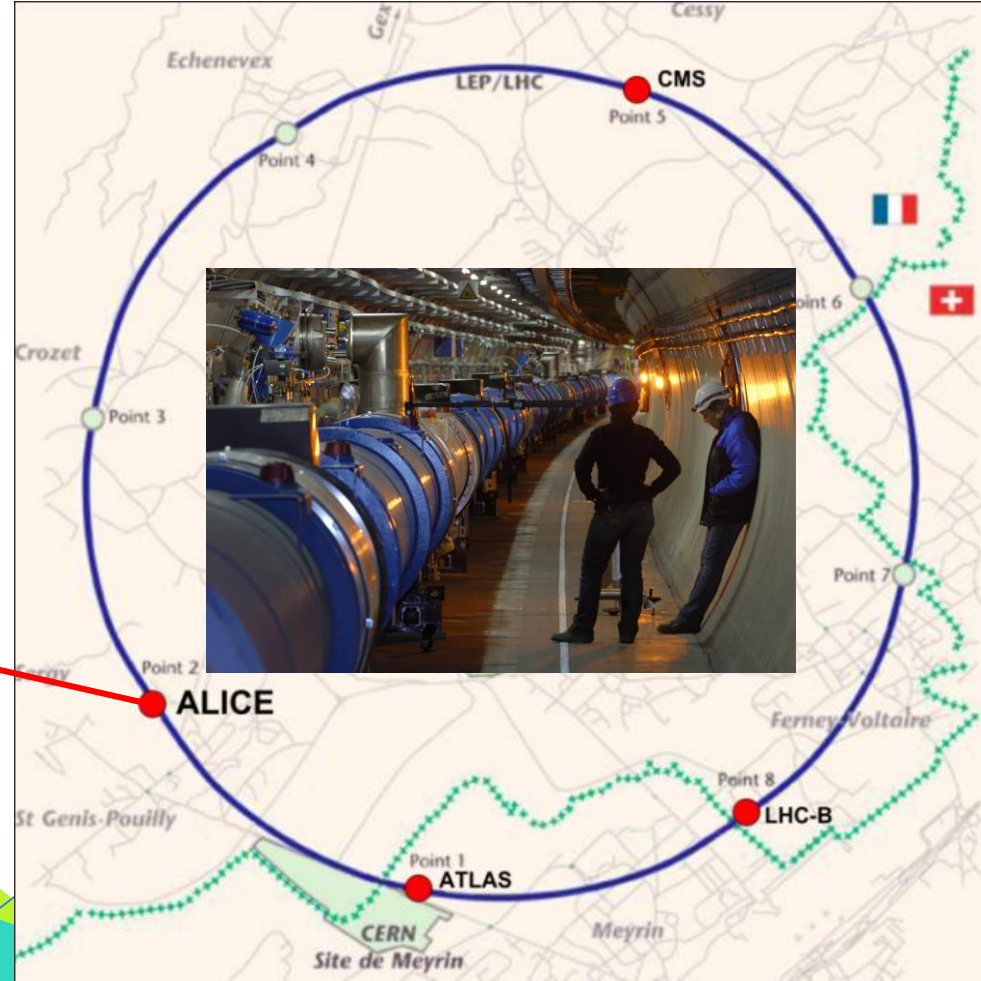
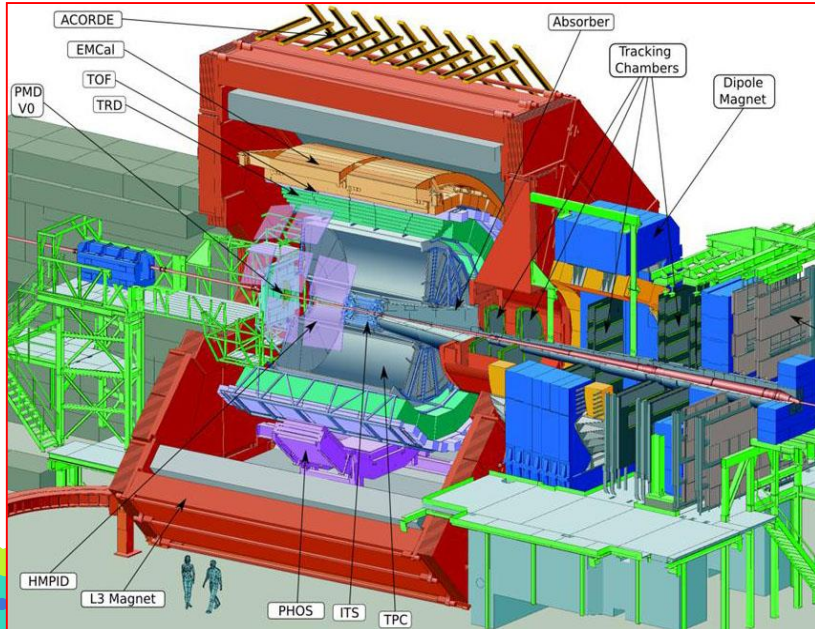


Hello, its CoCoTime!



{[Armenuhi.Abrmaman](mailto:Armenuhi.Abrmaman@cern.ch), [Narine.Manukyan](mailto:Narine.Manukyan@cern.ch)}@cern.ch

CERN, LHC AND ALICE



INTRODUCTION

Since the start of operations in 2010, the cycle of the Large Hadron Collider (LHC) at CERN has been composed of data taking (**Run**) and upgrade (**Long Shutdown, LS**) periods.

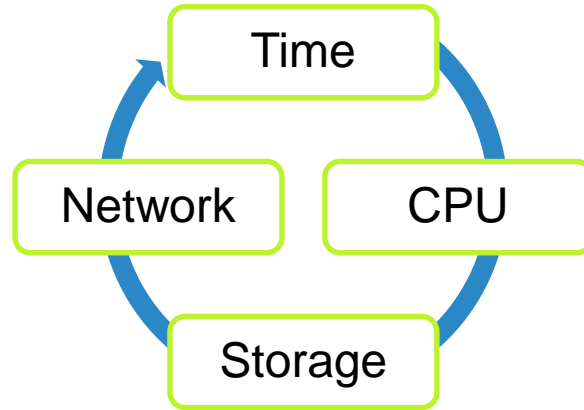
2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Run 1			LS 1		Run 2				LS 2		Run 3			LS 3		Run 4		



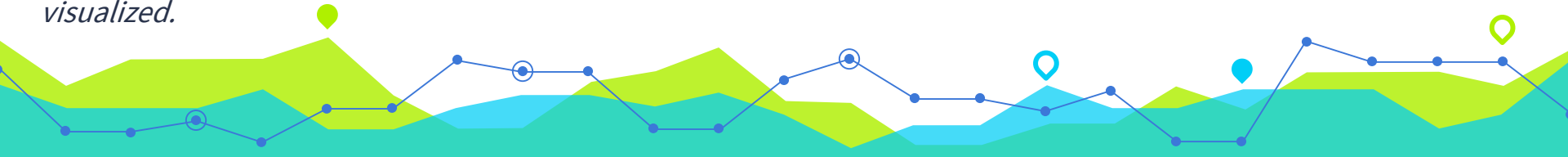
CoCoTime

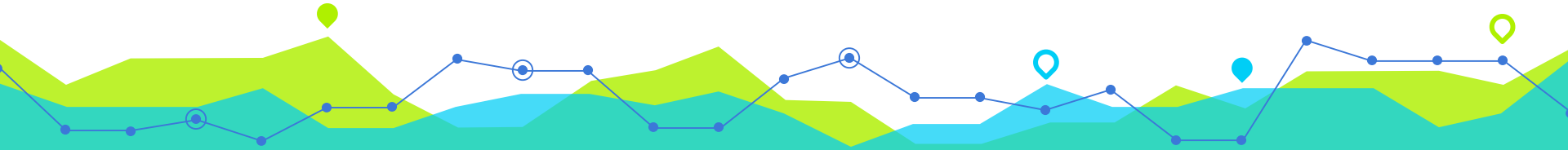
Computing Coordination and Time Management Tool

Simulation tool, which allows fine-grained planning, coordination and estimation of the **resource** usage during Run3 and LS3.



It consists of a Web GUI, through which the necessary parameters are entered and the results are graphically visualized.





Input Parameters

1

SYSTEM PARAMS



Duration

$$= 60 * 60 * 24 * \text{days}$$

Effective time

$$= \text{Duration} * \text{Data taking efficiency} / 100$$

Integrated luminosity

$$= (\text{Average peak} * \text{Effective time}) / (1e+33)$$

Number of events = $1E+09 * \text{Cross section} * \text{Integrated luminosity}$

CTF size = $\text{Number of events} * \text{CTF size per event}$

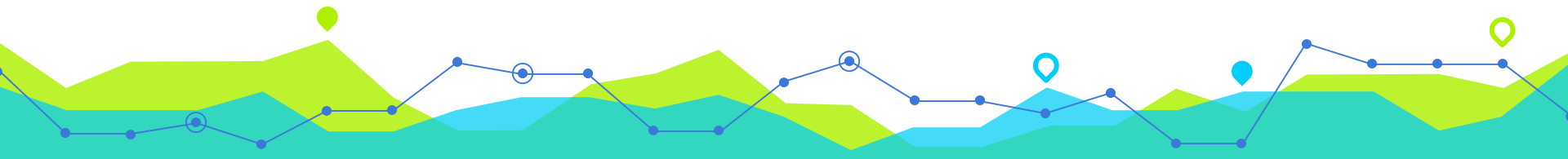
Type	Avarage Peak	Cross section	Data taking efficiency (%)	Number of collistions	CTF size per event (kB)	Fraction of simulated events (% of total)
PbPb	2.86E+27	7.75	57	2.62E+10	1800	0.5
pp	5.3E+30	0.00846	57	3.09E+10	30	7.5
pp-ref	7.3E+30	0.00846	57	3.80E+11	30	12.51
pPb	1E+29	2.16	57	1.17E+11	110	5

LHC SCHEDULE (in CoCoTime)

Technical stop	Recomissioning with beam	Scrubbing	Machine development	Physics runs (38 days)			Special physics runs
257 days	52 days	8 days	-	Type	Days	Collisions (%)	
				pp	14	100.00	
				PbPb	24	100.00	

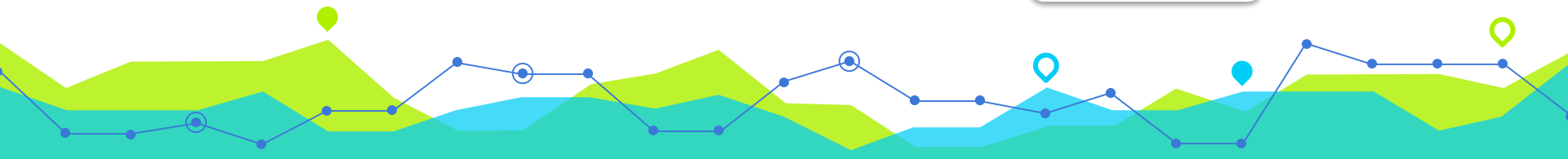
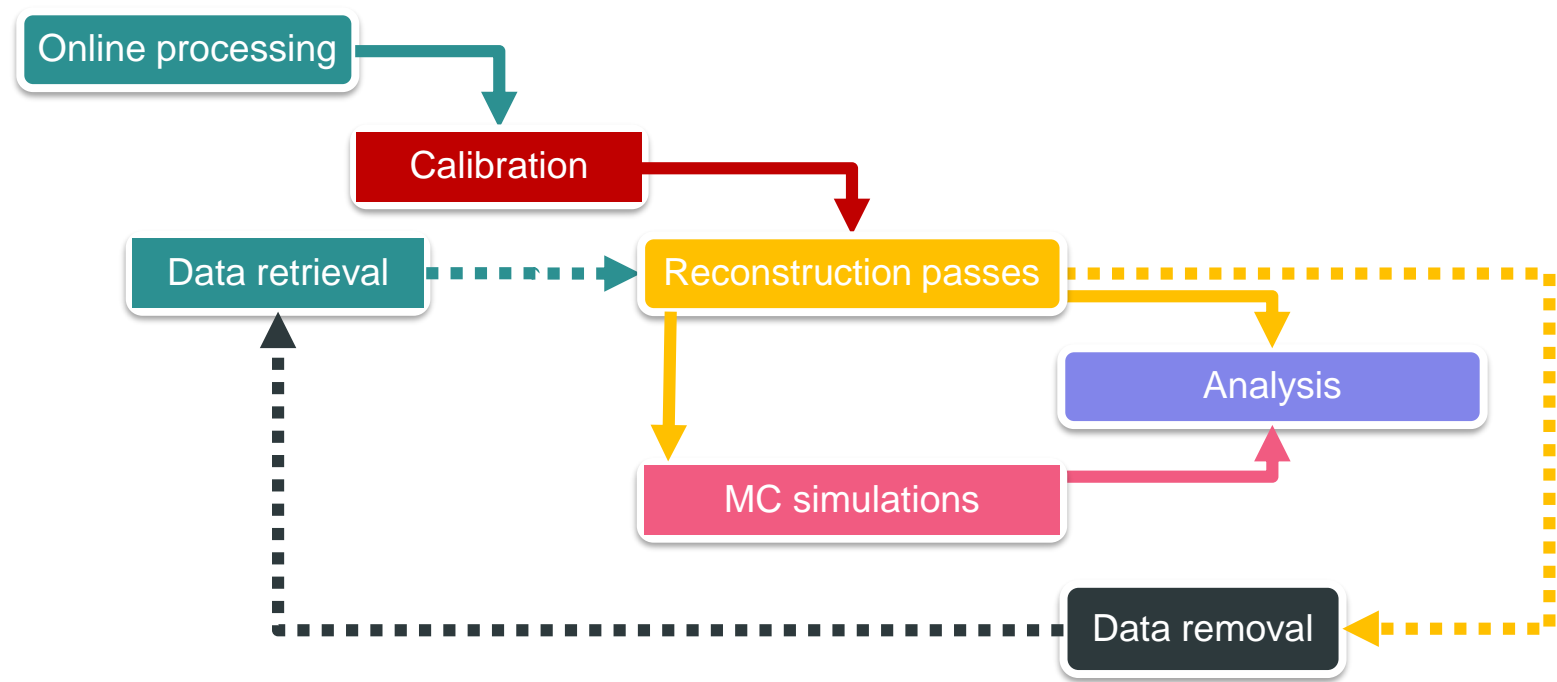
2021	2022	2023
------	------	------

	Jan				Feb				Mar				Apr				May				June				July				Aug				Sep				Oct				Nov				Dec							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
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What happens after data taking?

COMPUTING OPERATIONS



COMPUTING PARAMS (in CoCoTime)

The number of CPU cores (HS06 seconds/event) required to perform the specified operations for a given collision type.

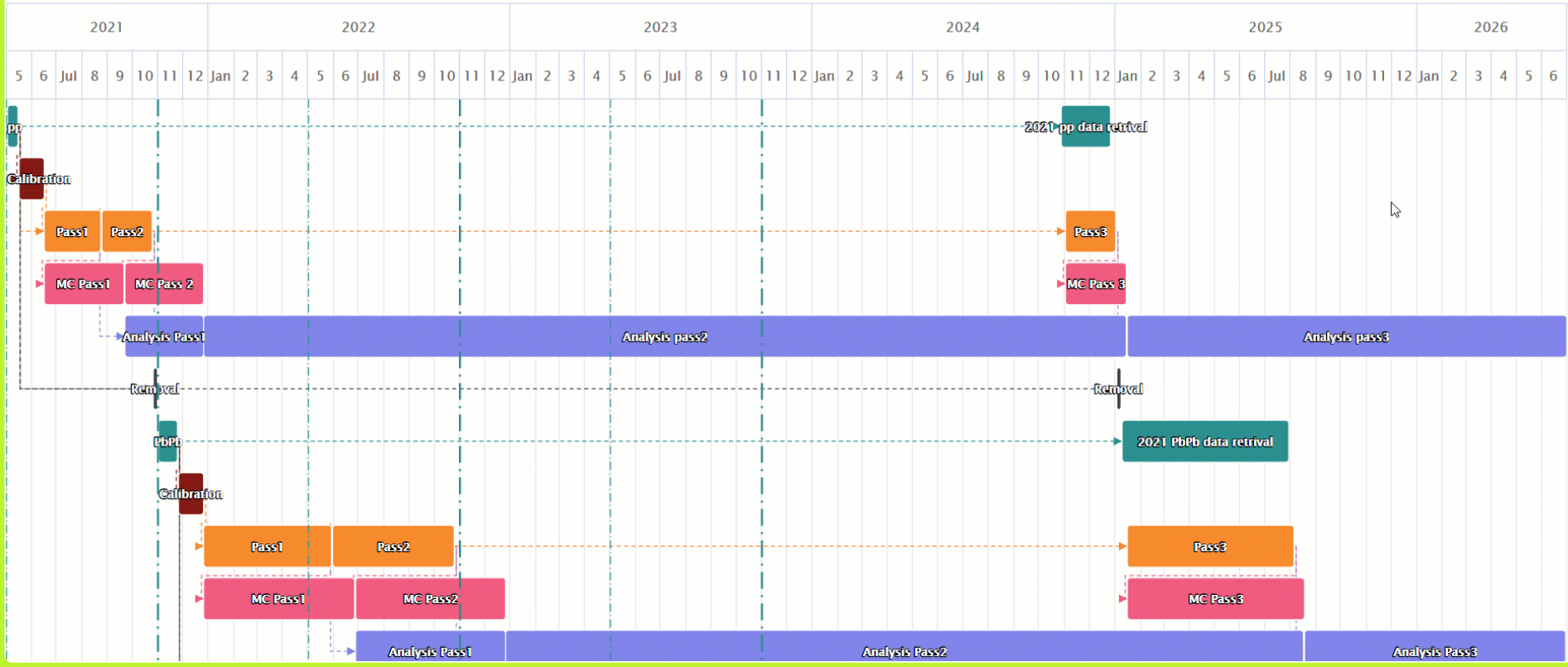
The share percentage of the resource types involved in the specified operations.

	CpuTransformations				CpuShare				
	PbPb	pp	pp-ref	pPb	O2	T0	T1	T2	AF
Online processing	120	3.2	3.2	12	100	0	0	0	0
Calibration	300	6.8	6.8	27.6	100	0	0	0	0
Reconstruction	300	6.8	6.8	27.6	42	25	33	0	0
MC simulations	24000	950	950	1600	0	0	15	85	0
Analysis	1.2	0.3	0.3	0.3	0	6.7	3.3	0	10



COMPUTING SCHEDULE (in CoCoTime)

● 2021 ● 2022 ● 2023



STORAGE PARAMS

The percentage of the derived data size from the CTF size.

e.g. for PbPb $\text{ESD} = \text{CTF} \times 10\%$

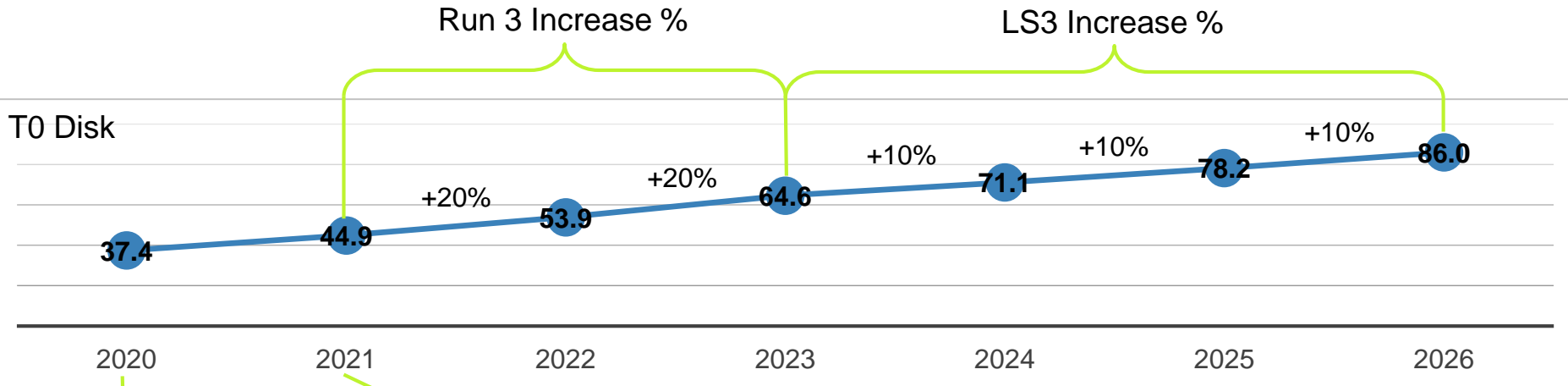
The percentage of each type of data kept on each storage resource.

e.g. It is expected that the O2 should be able to store up to 2/3 (67%) of all **CTF** data.

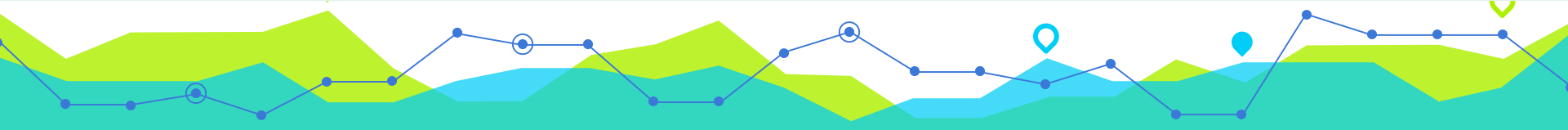
Data Types	Derived Size as % of CTF				Storage Sharing (%)						
	PbPb	pp	pp-ref	pPb	O2	T0	T0(Tape)	T1	T1(Tape)	T2	AF
CTF	100	100	100	100	70	0	70	30	30	0	0
ESD	10	100	100	100	67	0	0	33	0	0	0
AOD	20	100	100	50	0	67	67	33	33	0	10
MC	150	150	150	150	0	0	0	0	0	100	0
MCAOD	75	75	75	75	0	67	67	33	33	0	10
HISTO	0.15	0.15	0.15	0.15	0	6.7	0	3.3	0	0	10



PROJECTED RESOURCES (in CoCoTime)



Site Type	2020			2021			Run 3 Increase %			LS3 Increase %		
	Disk (PB)	Tape (PB)	CPU (kHS06)	Disk (PB)	Tape (PB)	CPU (kHS06)	Disk	Tape	CPU	Disk	Tape	CPU
O2	6.0	0	1710	60	0	1710	0	0	0	0	0	0
T0	37.4	36.9	450	46.8	66.4	518	20	45	20	10	15	0
T1	45.6	42.1	364	54.7	50.8	437	20	25	20	0	15	0
T2	39.0	0	376	46.8	0	451	5	0	30	0	0	0
AF	2.0	0	10	4.0	0	50	20	0	100	20	0	10



RESOURCE USAGE BY RUN2 OPERATIONS DURING RUN3

Site Type	2021			Run2 Decrease %		
	Disk (PB)	Tape (PB)	CPU (kHS06)	Disk	Tape	CPU
O2	0	0	0	0	0	0
T0	33.49	43.16	430	20	0	20
T1	37.01	36.81	365	20	0	20
T2	33.10	0	376	20	0	20
AF	0	0	0	0	0	0





Output results

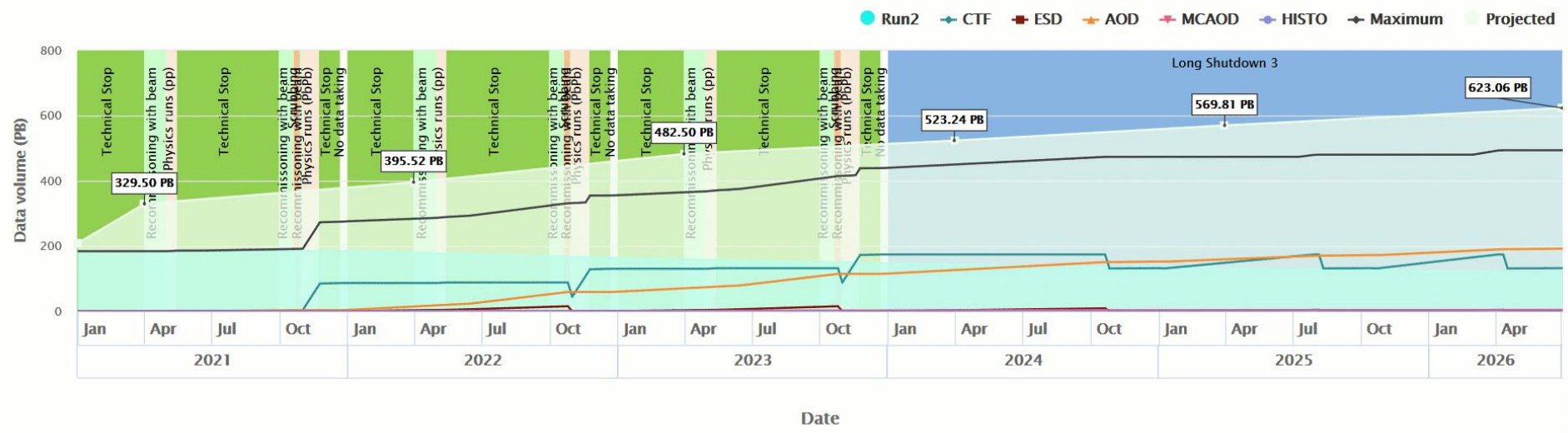
2

RESOURCE USAGE

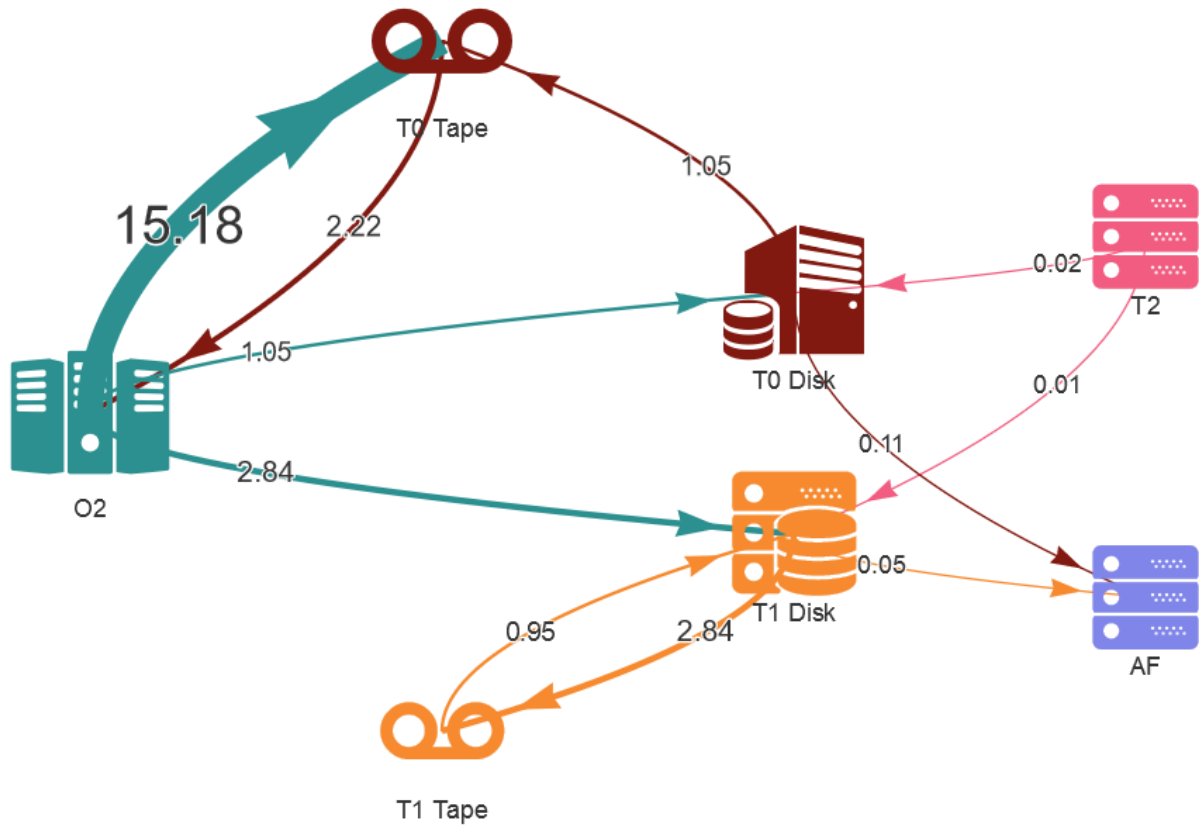
Data usage
 CPU usage
 Network usage

All
 Disk
 Tape
 |
 O2
 T0
 T1
 AF
 T2
 |
 T0 Tape
 T1 Tape

Amount of created data by their type



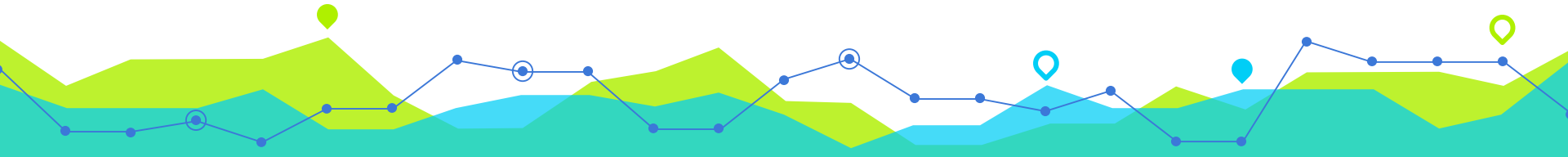
NETWORK THROUGHPUT



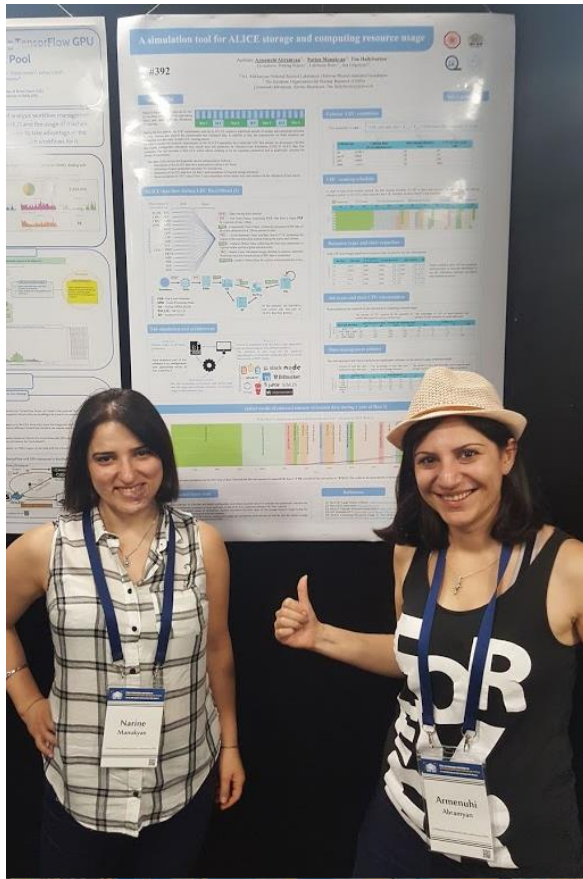
(GB/s)

CURRENT FUNCTIONALITY

- Highly configurable and easy to use/play
- Planning of computing operations on a daily basis (with Gantt chart)
- Estimation of Disk, Tape, CPU and Network usage during Run3 and LS3
- Include resource usage by Run2 operations during Run3.
- Save and Restore configurations and simulation results
- Exporting the results in various formats (png, pdf, CSV, ...)

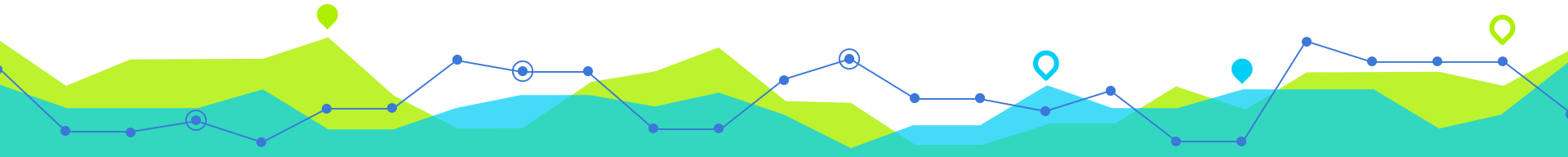


PRESENTATION OF THE WORK

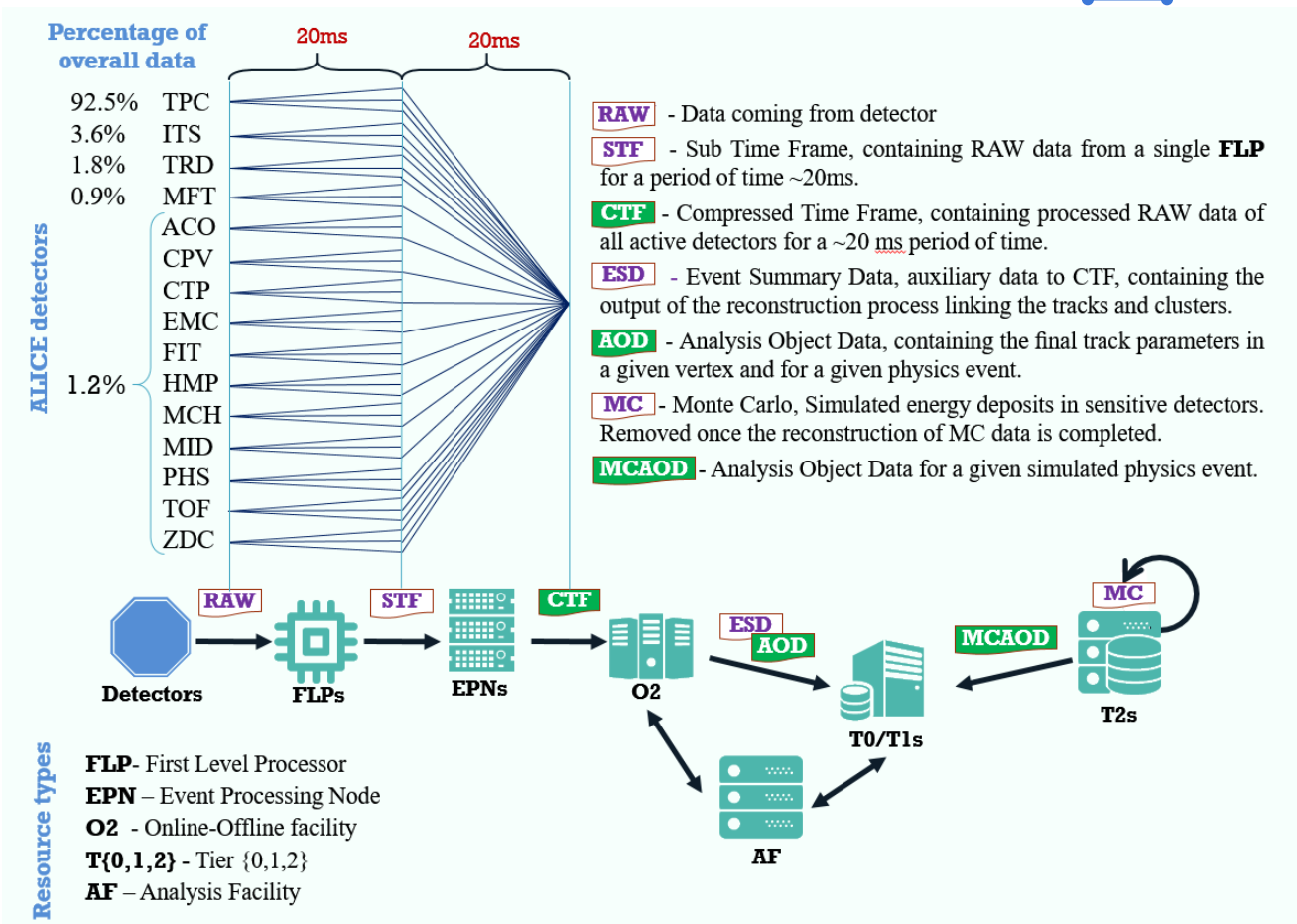


1. [Poster](#) during CHEP2018 conference - 10 Jul, 2018, Sofia, Bulgaria
2. Paper submitted to European Physical Journal ([EPJ](#)) - 01 Dec, 2018
3. [Presentation](#) during ALICE Offline week - 7 Dec 2018, CERN, Switzerland
4. Results of the work are presented to LHC Resources Scrutiny Group.

Thank you!



ALICE DATA FLOW DURING RUN3



FUTURE PLANS for CoCoTime

- Smart planning and automatic resource usage optimization
- Universalize the Tool that it can be used by the other experiments.
- Integrate with CERN authentication and authorization services.
- Integrate the CoCoTime with the MonALISA.
- ... ?

