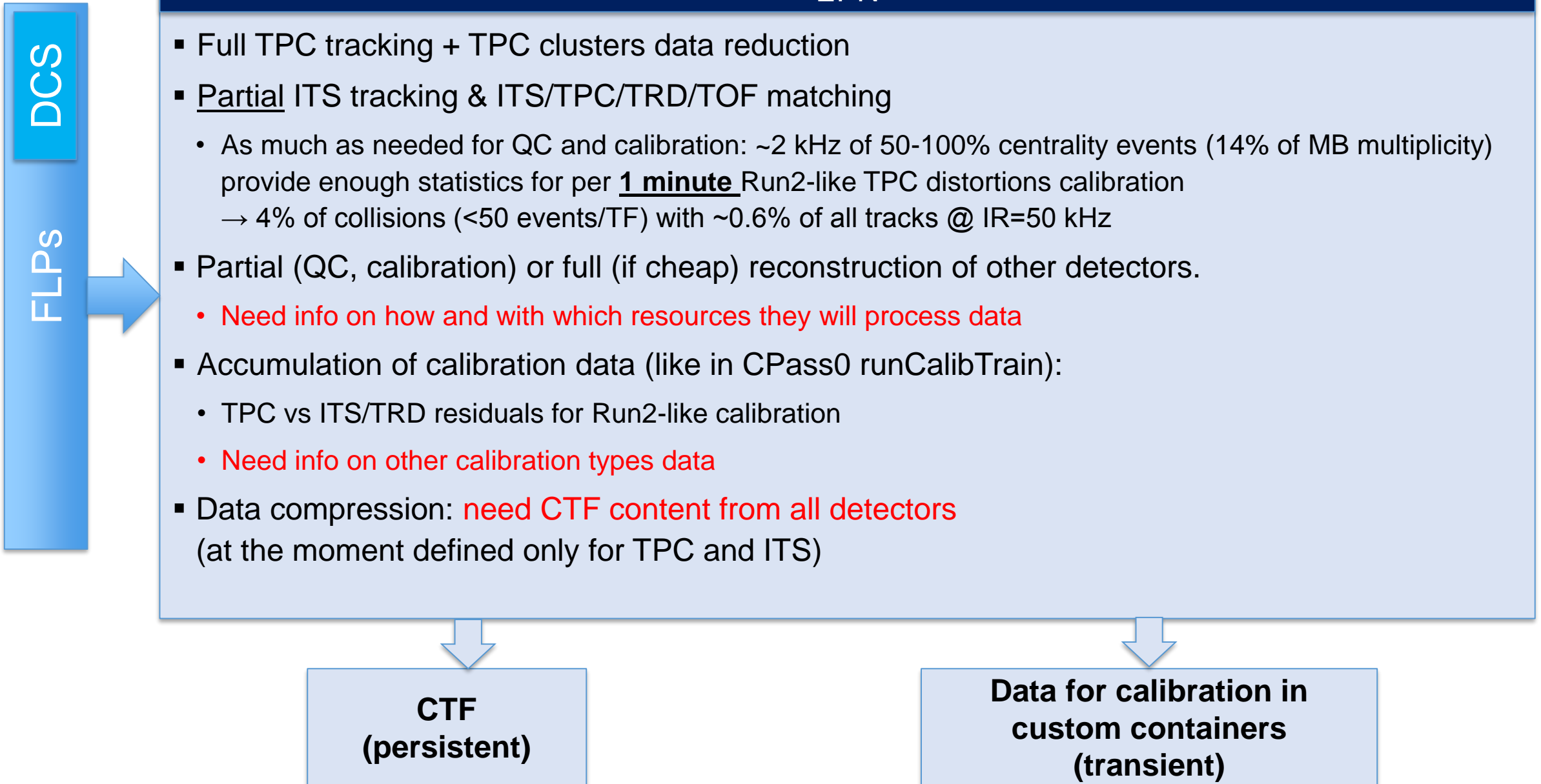


Reconstruction and Calibration in Run3

Overview of the synchronous stage



Overview of the asynchronous stage

EPN (+GRID?)

Calibration

- Extraction of calibration from the data accumulated at synchronous stage, populating the CCDB (equivalent of the MakeOCDB + TPC SP calibration of Run2)
- If needed: consider reconstruction pass over tiny fraction of data for fine calibration (a la CPass1) and validation: ~0.1% of data will provide MB events statistics / time like in Run2 PbPb CPass1 (~25 Hz)

PPass reconstruction

CCDB

CTF

- High-frequency fine-grained TPC SP calibration (before TF processing)
- Full tracking/matching, PID in barrel detectors, global fits, primary vertex finding
- EMCAL/PHOS partial (cells selection) or full (clustering, matching to tracks) reconstruction
- MUON/MFT tracking, matching
- V0-finding, physical event building

AOD (~15% of CTF size)

List of coarse level tasks

deadlines, CPU/GPU benchmarks (or guesstimates)...

Name	ETAC CPU	CPU time s/TF sync	CPU time s/TF async	ETA GPU	GPU time s/TF Sync	GPU time s/TF Async	Sync	Calib	Async	AN	JIRA	
General support base classes /services												
Fast material budget query	Done			Done?			x	x	x		AOC-23	
Fast B-field query	01.07.2019						x		x		AOC-22	
Global (inter-detector) operations												
TPC-ITS track matching	Done	1	<100	01.10.2019	[<1]	[<10?]	x		x			i7-7600U 2.80GHz
TPC track/ITS cluster matching (afterburner)	01.07.2019	--	<100	31.12.2019	--	[<10?]			x			
Global track matching to TRD	almost done	<1	<100	01.07.2019	[<1]	[<10?]	x		x			i7-6700 @ 3.4 GHz
Global track matching to TOF	in validation	1	<100	[31.12.2019?]	[<1]	[<10?]	x		x			
Matching to calorimeters	?	--	--	--	--	--				x		
Global refits	01.10.2019	<10	<1000	31.12.2019	--	[<100]			x			
Primary vertex finding	01.10.2019	--	[<1000]	--	--	[<100]			x			
Secondary vertex finding / TPC-only refits	01.10.2019	--	[1000]	[31.12.2019?]	--	[<100?]			x	x		
Collisions separation	01.10.2019	--	[<100]	--	--	--			x			
AOD compression/writing	?	--	<10	--	--	--			x			
Global alignment framework	01.07.2020			--				x			AOC-25	

• • •

Please complete and update as much as possible

Bottom-line: CPU reconstruction on detectors level should be operational by the end of June

List of coarse level tasks

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Matching to calorimeters	?	--	--	--	--	--				x	
Global refits	01.10.2019	<10	<1000	31.12.2019	--	[<100]			x		
Primary vertex finding	01.10.2019	--	[<1000]	--	--	[<100]			x		
Secondary vertex finding / TPC-only refits	01.10.2019	--	[1000]	[31.12.2019?]	--	[<100?]			x	x	
Collisions separation	01.10.2019	--	[<100]	--	--	--			x		
AOD compression/writing	?	--	<10	--	--	--			x		
Global alignment framework	01.07.2020			--				x			AOC-25

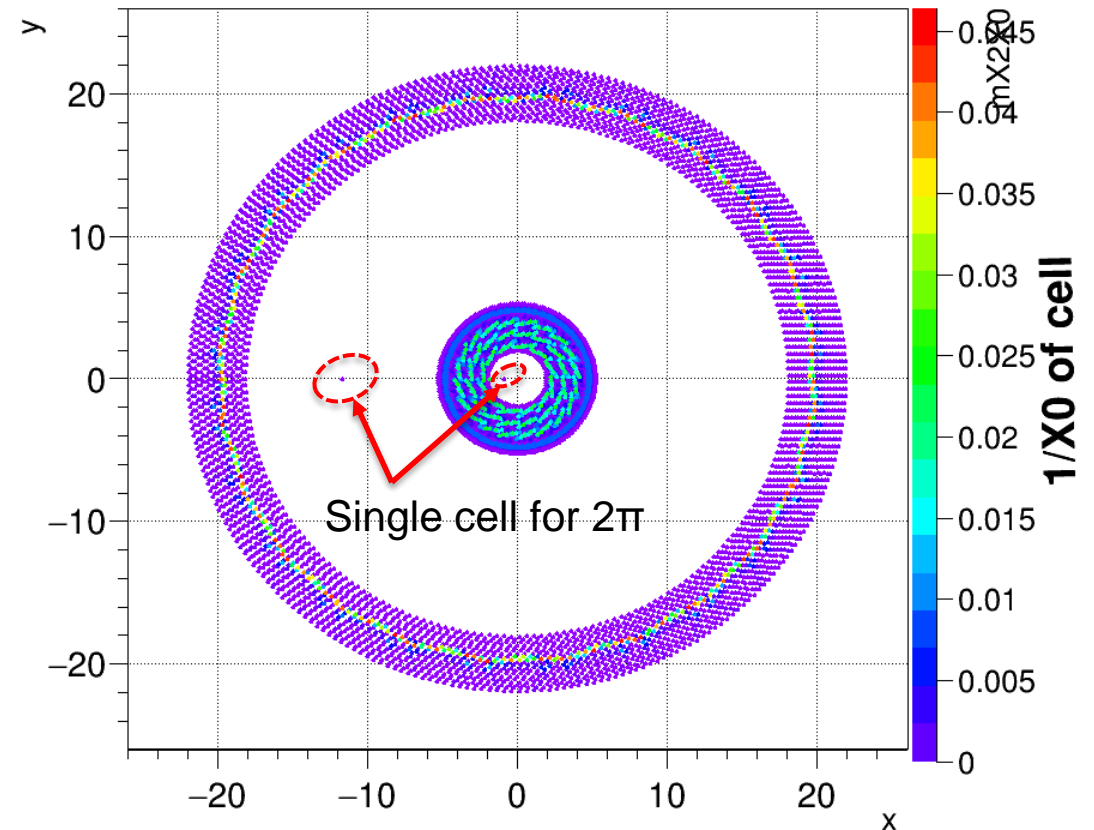
...

Please complete and update as much as possible

Bottom-line: CPU reconstruction on detectors level should be operational by the end of June

Material budget LUT (MatLayerCylSet)

- Dynamical object but can be used both on CPU and GPU (derived from FlatObject of S.Gorbunov)
- Provides methods to query `MatBudget = {meanRho, meanX2X0, length}` between 2 points
`MatBudget getMatBudget(const Point3D<float>& point0, const Point3D<float>& point1) const`
- Set of nested cylindrical layers with layer-specific z , ϕ binning (similar ϕ -bins internally merged to save memory and CPU)
- Multiple versions for the same R-z range can be defined with different binning
(\rightarrow query time, still to be benchmarked)
- Interfaced to family of methods `o2::base::Propagator::PropagetTo(...,int matCor= USEMatCorrTGeo,...)` with `matCor` choice of:
`USEMatCorrNONE = 0; // no material corr.`
`USEMatCorrTGeo = 1; // mat.corr. from TGeo (slow)`
`USEMatCorrLUT = 2; // use this LUT (set by user)`
- Currently in [PR](#), should be merged after modifications and merging of ex-AliTPCCCommon



Fast dipole field query

- Long-time development by Shuto Yamasaki (went to industry but still spends some time for Alice!): Currently merged to AliRoot, after checks/benchmarks will be ported to O2
- In opposite to “fast solenoid field” (which is an alternative large-volume parameterization based on AliMagF), it is providing exactly the same result (within the machine precision) as original AliMagF:
 - Faster search algorithm of parameterization patch (~1000) for the queried point
 - Recursive Chebyshev polynomial calculation for each patch (many function calls and loops) are unrolled to set of functions with hardcoded flat polynomials in Horner form:
{small code, large heap data} → {large code, no data} (still, overall less memory than with AliMagF)
- Preliminary benchmarks by Shuto: factor 4 speed-up wrt AliMagF

Readiness for the Simulation Challenge

- Global milestone on December 2019: readiness for simulation challenge
Assumes ability to reconstruct simulated data in all detectors (by end of June for all detectors but Muon):
 - **Synchronous stage:**
 - current status is good enough for (see previous [OW slides](#)) major detectors: ITS,TPC,TRD and TOF for reconstruction, the data compression still to be added.
 - Update: EMCAL and PHOS/CPV will only decode and store cells data: to be done
 - **Asynchronous stage:**
 - Major tasks to implement:
 - TPC dE/dX calculation, validation of TPC tracking with distortions
 - ITS tracking refits, extra passes (for secondaries), TPC-ITS matching afterburner for high-R decays
 - Update: Calorimeters will only write selected cells to AOD (matching to tracks at analysis time)
 - Global refits, vertexing, AOD creation

Major reconstruction tasks

		CPU	GPU
TPC	Tracking (*)	done	done
	dE/dX	Q2/2019	Q2/2019
	Compression	Q2/2019	Q3/2019(*)
ITS	Tracking finding (*)	done / extra passes: Q2/2019	done
	Track fitting	Done	Q2/2019
	ITS-TPC matching	done / afterburner: Q2/2019	Q3/2019
	Compression	Q2/2019	Q3/2019(*)
TRD	Matching to ITS-TPC	Done (in "HLT")	Q4/2018
TOF	Matching to ITS-TPC	done (needs benchmarking)	Q2/2019
EMCAL	Clustering	Q2/2019	-
PHOS	Clustering	Q2/2019	-
MUON	MCH clustering, tracking	Q4/2019	-
	MID	done (in validation)	
MFT	Tracking (standalone)	Q1/2019	-
	Matching to MCH	Depends on MCH schedule	
FIT	T0+ reconstruction	done (in validation)	-
	V0+ reconstruction	?	
HMPID	Clustering, matching	Q2/2019	-

(*) TPC, ITS reconstruction is operational as DPL device, others still need to be interfaced to DPL. While wrapping a task to DPL device is relatively straightforward (after gaining some experience), to minimize changes and facilitate benchmarking it is better to make them DPL ready from the very beginning.

(*) Feasibility of entropy compression on GPU is under study, so far promising results by M.Lettrich

List of coarse level tasks

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Collisions separation	01.10.2019	--	[<100]	--	--	--			x			
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...

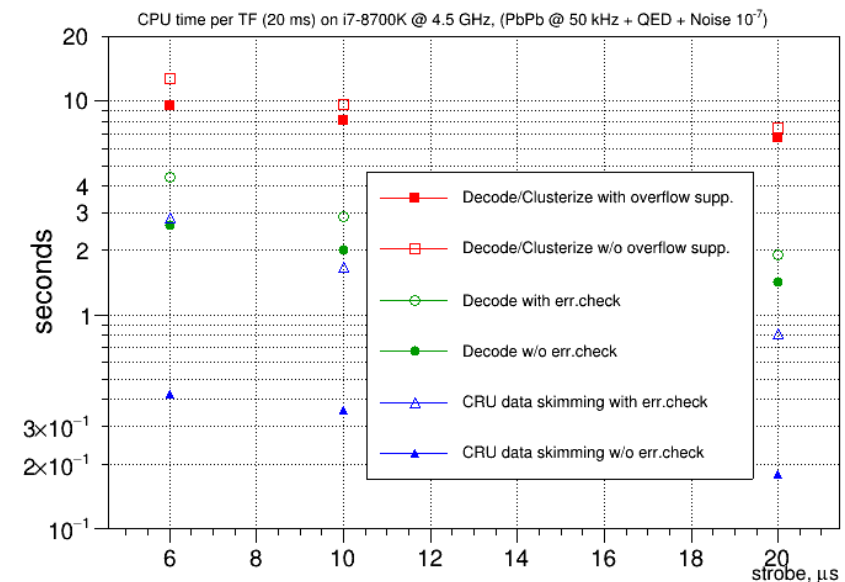
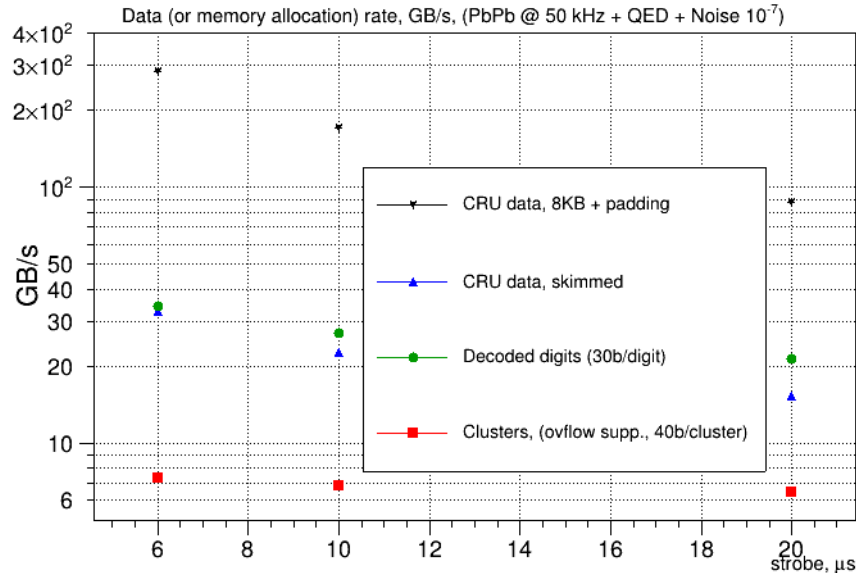
Depend on the readiness of particular detectors reconstruction: autumn 2019

Readiness for the “Vertical Slice Test” with simulated data (March 2020):

- Assumes availability of raw data decoders and MC→raw converters.

Currently operational:

- TPC: integrated into DPL tpc-reco-workflow as optional inputs and outputs (with “raw data” = HWCF output)
 - Still not clear if HWCF is feasible or if clusterization should be moved to FLP GPU)
- ITS: standalone code (will be integrated to it-reco-workflow) for currently assumed format
 - Caveat: current format of single GBT link trigger writing separate 8KB page leads to ~300GB/s memory allocation rate on FLP (factor ~10 of actual payload): alternative formats are being considered



- Other detectors: must be available by the end of 2019 latest

Calibration tasks

- Ready: calibration of TOF channels (see TOF presentation tomorrow)
- In progress:
 - TPC SCD calibration with residuals wrt interpolation from external detectors (a la Run2)
 - To do: creation of these residual trees (easy but requires TRD in simulation)
 - Done (ported from AliRoot): extraction of corrections from trees with residuals of TPC vs ITS-TRD/TOF interpolation.
[Some modification will be needed in view of recently seen fine structures due to the TPC charging-up](#)
 - High-frequency TPC SCD calibration with digital currents (most complex one): still in R&D stage
Complementary approach considered: deconvolution of TPC tracklets vs global track residuals (M.Ivanov)
 - First iterations with ITS HW groups for ITS calibrations

Outlook

- Per-detector reconstruction for large detectors is in good shape but need
 - to be finalized by the end of June (small detectors: October – November)
 - available as DPL device by December
 - data reduction/compression should be added by December

- Calibration is in very preliminary stage (except TOF)
 - only heaviest algorithms are progressing
 - while for the calibration will be done mostly offline between sync. and async. Stages w/o much computing stress, the usage of calibration objects and accumulation of calibration data in sync. stage affect performance and CPU requirements of the O2-farm and should be available by the end of 2019

[See detector reports on Wednesday](#)

