

# Calibration and Cryogenic Instrumentation Consortium: Requirements

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LABORATÓRIO DE INSTRUMENTAÇÃO  
E FÍSICA EXPERIMENTAL DE PARTÍCULAS



# Requirements

- List of requirements prepared in 2019 for the TDR
  - separately for Calibrations id # 2307-2313 (7)
  - and for CISC id# 2323-2332 (10)
- Overall plans to update the requirements (details next)
  - change the name of all Calibration and CI reqs to start with “SP CALCI”
  - drop 2 and add 1 requirement in Calibration
  - pass responsibility over 3 SC requirements over to DAQ/SC
  - pass responsibility over 1 CI requirement over to HV
  - edit text in 1 existing CI req

# Cryogenic Instrumentation 1/3

Change:

“CISC” -> “CALCI”

“instrumentation” -> “instrumentation/calibration”

**About 2323: it is not clear yet if laser system step motors cause noise. If they do, it's only during the movement, so laser pulses can be acquired with the motors stopped. The text could be revised to add exception for systems operated only a few times per year. Needs discussion.**

2323	SP CISC Noise from Instrumentation devices	The instrumentation devices shall contribute no more than 1000 electrons of noise. This requirement is on total system noise, which is expected to be dominated by cold electronics.	$\ll 1000 e^-$
2324	SP CISC Max. E field near instrumentation devices	The maximum field near instrumentation devices should be $<30$ kV/cm to avoid dielectric breakdowns.	$<30$ kV/cm

# Cryogenic Instrumentation 2/3

## Change

“CISC” -> “CALCI”

2325	SP CISC Precision in electron lifetime	The precision on the measurement of the electron lifetime must be sufficient to ensure < 0.5% uncertainty in charge readout.	<1.4%
2326	SP CISC Range in electron lifetime	The purity monitors inside the cryostat should be capable of measuring a lifetime range between 0 and 10 ms. The goal for the inline purity monitors is to measure a range of 0 to 30 ms for the drift electron lifetime.	0.04 - 10 ms in cryostat, 0.04 - 30 ms inline

# Cryogenic Instrumentation 3/3

Change

“CISC” -> “CALCI”

2327	SP CISC Precision: temperature reproducibility	The RMS of the distribution of independent temperature offsets between two sensors in successive immersions in LAr should be < 5 mK	< 5 mK
2328	SP CISC temperature stability	The thermometers should match precision requirement at all places, at all times	Match precision requirement at all places and times
<b>For 2328, possibly tweak text or remove it, needs discussion.</b>			
2329	SP CISC Cold camera coverage	The cold cameras are required to cover at least 80% of the exterior of HV surfaces.	80% of the exterior of HV surfaces

**Possibly hand over 2329 to HV, needs discussion.**

# Slow Control

Change

“CISC” -> “DAQ/SC”

2330	SP CISC Slow control alarm rate	The total number of alarms/day seen by operators need to be less than 150.	<150/day
2331	SP CISC Total No. of variables	This is the total number of variables monitored by slow controls from all subsystems of the detector.	150000
2332	SP CISC archiving rate	Slow control quantities will need to archived at a rate that ranges from 0.02 Hz to 1 per few minutes, depending on the slow controls quantity.	0.02 Hz

**Hand over all these to DAQ/SC.**

# Calibration 1/2

Change “Calibration” -> “CALCI”

2307	SP Calibration ionization laser E field measurement precision	The calibration systems shall provide measurements of the electric field with a precision of 1%, or smaller.	0.01
2308	SP Calibration ionization laser E field measurement coverage	The calibration systems shall provide measurements of the electric field in at least 75% of the active detector volume.	>75% (goal 100%)
2309	SP Calibration ionization laser E field measurement granularity	The calibration systems shall provide measurements of the electric field in volume subregions not larger than 30x30x30cm.	< 30x30x30 cubic cm (goal: 10x10x10 cubic cm)
2310	SP Calibration laser beam location precision	The laser beam location system shall be able to measure the laser beam direction with a precision of 0.5 mrad or smaller.	0.5 mrad
2311	SP Calibration neutron source coverage	The pulsed neutron source system shall provide sufficient neutron capture events in at least 75% of the detector volume.	>75% (goal 100%)

# Calibration 2/2

Proposing to drop 2312 and 2313

In practice, the coverage requirements are the relevant ones.

2312	SP Calibration ionization laser data volume per year (per 10 kt)	The data volume produced by the ionization laser system, after zero suppression, shall be at least 184 TB/yr/10kton.	> 184 TB/yr/10 kt (goal: 368 TB/yr/10kt)
2313	SP Calibration neutron source data volume per year (per 10 kt)	The data volume produced by the pulsed neutron source, shall be at least 144 TB/yr/10kton.	> 144 TB/yr/10 kt (goal: 288 TB/yr/10kt)

Proposing to add another requirement related to the PE laser.

Needs discussion, and need to settle on a definite N

	SP CALCI Number of electrons per wire produced by PE laser system on CPA targets	The number of electrons produced by the calibration system on CPA photoelectric targets, and reaching individual wires, shall be at least <b>N</b> times above noise specification.	> <b>N</b> x1000 [enc]
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# Plans, timeline

- Next week
  - discussion with DAQ/SC, HV, TPC consortia
  - discussion with PE laser system experts
  - prepare new complete table
  - get opinion from consortium
- Week of April 6
  - finalized table