

Power Dissipation and Cooling needs

Considerable effort by many: Iain Sedgwick, James Glover, Georg Viehhauser, Nicole Apadula,
...

TIC/Project request to all subsystems in February/March

- Started by/from Andy Jung's presentation at the February 24 TIC meeting, c.f. <https://indico.bnl.gov/event/26908/> – “A strong need for “realistic” thermal loads”,
- Request for compilation in a templated spreadsheet by mid March,
- Many aspects related to SVT came together at the January Frascati workfest, c.f. <https://agenda.infn.it/event/43344/>
- Approach to request: internal working version maintained by SVT WP coordinators – March snapshot handed to TIC/Project,
- Today: discuss in broader SVT group, of course with an eye on future snapshot(s).

Starting points are, of course, the sensors and ancillary ASIC

- ITS3 for the inner barrel,
- Approx. 4,000 EIC-LAS and ancillary ASICs for the outer barrel and disks,
- Next slides reproduce some from Iain Sedgwick's presentation at the Frascati workfest, c.f. <https://agenda.infn.it/event/43344/contributions/253346>
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MOSAIX Power Consumption

MOSAIX Engineering Specification Review

- Current consumption numbers for MOSAIX were updated in the engineering review.
- What does this mean for EIC-LAS and the Ancillary ASIC

Current consumption estimates

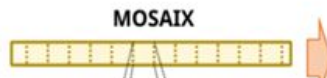
Full chip consumption estimates [mA]:

Supply	Typical	Max supported
GSVDD	50*	
GDVDD	950	1430
GAVDD	340	540
TXVDD	200	

- LEC contribution:
 - TXVDD: 200mA
 - GSVDD: ~30mA
 - GDVDD: ~100mA
- All the rest uniformly distributed over RSU's

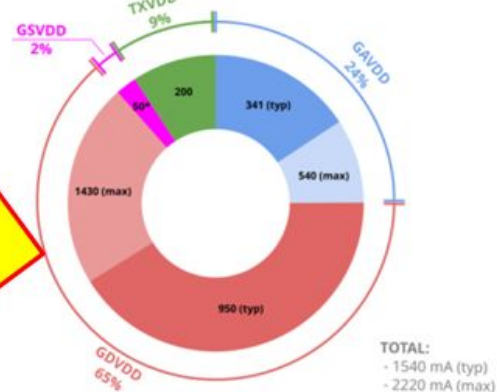
RSU consumption:

- GDVDD:**
 - About 70% of the RSU consumption
 - Significant uncertainty due to unknown leakage component
 - temperature
 - process corner
 - irradiation
- GAVDD:**
 - About 30% of the RSU consumption
 - Varriers with the FE settings
 - typical: 30nA/pixel
 - max: 50nA/pixel
- GSVDD:**
 - Present, but negligible

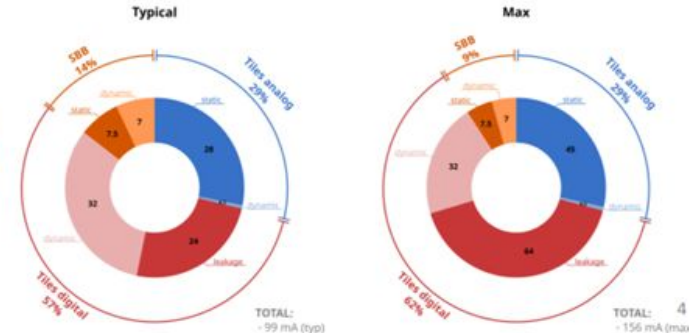


MOSAIX currently updating power numbers...

MOSAIX current consumption [mA]



RSU current consumption [mA]



LAS Current and Power Consumption

Converting to EIC-LAS

- Assume 6 RSU LAS
- Numbers in red do not have “Max” estimates in the previous slide, so assumed +50% on typ number (since this is true for supplies that do have it)
- EIC-LAS is one LEC and 6 RSU
- To calculate power for a LAS with Length L RSUs, use the formula below for each of the 4 supplies and add the results
 - $P_{LAS} = V(I_{RSU} * L + I_{LEC})$
- To include the AncASIC power, use the power fractions (f_{POWER}) on [this slide](#)
 - $P_{ANCASIC} = f_{POWER} * P_{LAS}$

	Voltage(V)	Typ Current Consumption (mA)			Max Current Consumption (mA)		
		RSU	LEC	EIC-LAS	RSU	LEC	EIC-LAS
GAVDD	1.32	28		168	45		270
GDVDD	1.32	71	100	526	111	150	816
GSVDD	1.32	1.6	30	40	2.4	45	59.4
TXVDD	1.2		200	200		300	300
Total				934			1445



AncASIC Performance

Overall Power Consumption

EIC-LAS, AncASIC and Total Power (mW)	MODE 0										
	Typ				Max				Total		
	EIC-LAS	AncASIC			EIC-LAS	AncASIC			Min	Nom	Max
		Min	Nom	Max		Min	Nom	Max			
Global Digital	701	131	210	238	1088	193	341	394	832	911	1482
Global Analog	224	61	71	83	360	88	111	147	285	295	507
Services	53	28	32	44	80	18	41	66	81	85	146
Serialiser	246	47	115	128	369	37	172	246	293	361	615
Total	1224	267	428	493	1897	336	665	853	1491	1652	2750
AncASIC Power Fraction		21.81%	34.97%	40.28%		17.71%	35.06%	44.97%			

N.B. FPC traces add another 200mW

Prev values: 1702 2581

Next...

- Much progress on FPC and readout/powering chain, see e.g.
 - Jo Schambach's Frascati presentation on IB readout, c.f. <https://agenda.infn.it/event/43344/contributions/253357/>
 - James Glover's presentations on OB and disk readout, and powering, c.f. <https://agenda.infn.it/event/43344/contributions/253357/> and <https://agenda.infn.it/event/43344/contributions/253359/>
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- Since the layout is essentially known, the task was about bringing the elements together
 - Thanks to all who contributed!
 - Next slides capture “the bottom line” – reproduced from the March 24, 2025 GST workshop, c.f. <https://indico.bnl.gov/event/27154/>
 - And let's then have a look at the working version of the spreadsheet.

System power numbers (local supports)

	nominal		max	
	Power/stave [W]	Total power/system [W]	Power/stave [W]	Total power/system [W]
L0		30		37
L1		40		50
L2		101		124
L3	15.4	706	22.5	1037
L4	31.4	2199	48.2	3377
Disks		5051		7345
Total power [kW]		8.12		11.97

RDO power

OB

	Count	Dissipation [W]
Total FIBs	372	75
Total FIB-CBs	8	171
Total FPC-CBs	32	55
Total		301

Disks

	Count	Dissipation [W]
Total FIBs	740	149
Total FIB-CBs	18	385
Total FPC-CBs	70	121
Total		655

IB

	Count	Dissipation [W]
Total SIBs	68	27
Total SCBs	68	297
Total DPBs	6	88
Total		385

- Total: 1340 W
- Assumed to be cooled by water, but depends on location and density