TWEPP-17

ATLAS ITk Strips
Preliminary Power Supply Specs

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A.A. Grillo

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ATLAS ITk Strips Plans for Power

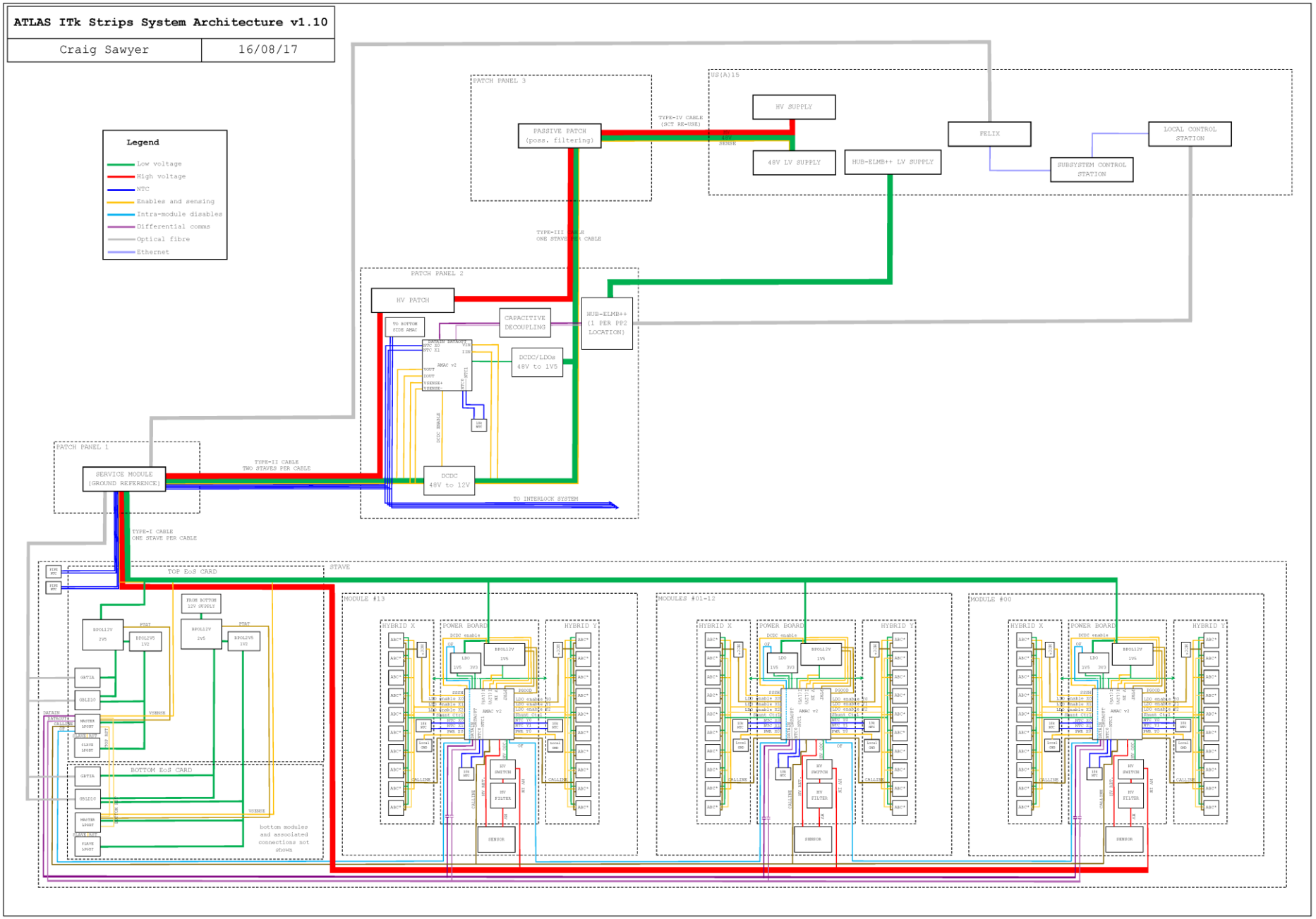
- For LV, two options are currently still being evaluated:
  - A) 48V supplies in the service cavern & DC/DC (12V to 14V out) converters at PP2.
  - B) Low voltage (~20V) in the service cavern with cabling directly to the detector.
- In either case, each power supply channel will power one side of a barrel stave or one side of an end-cap petal.
- There will be DC/DC converters at each module to step down to ASIC voltages.
- Both options will require 14V voltage clamp at PP2 and remote sensing.

- High voltage for sensor bias will be supplied by supplies in the service caverns.
  - Each barrel stave or end-cap petal will have its modules divided into 4 groups.
  - Each HV channel will power one of these groups.

- Both LV and HV supplies will be floating with their reference defined at the single point ground at the detector.

ATLAS ITk Strips System Diagram

assuming DC/DC converter



Direct Low Voltage Power Supply

Parameter	Value	Comment
INPUT		
Input voltage	240 V AC	
Input frequency	50 Hz, single phase	PFC required
OUTPUT		
Reference potential	floating relative to chassis ground for individual channels	
Isolation withstand voltage	100 V	
Voltage range	0 to 20 V	depends upon current output
Voltage at load	11V	held fixed by remote sensing
Voltage setting resolution	±1%	
Voltage ramping	soft start	
Maximum current	5 A (10 A)	two versions will be needed. Final spec may change by +-20%
Efficiency	min 80% (AC to DC)	average per crate including primary power supply and channels efficiency for maximum output power
Ripple and noise for f > 10 Hz	<50 mV pp	
REGULATION, SENSING AND MONITORING ACCURACY		
Remote sensing control	yes	up 10 V voltage drop and 100 m long cables
Line regulation	1%	
Load regulation	1%	
Voltage monitoring	yes, 1%	precise monitoring by custom ASIC "AMAC" at load
Current monitoring	yes, 1%	precise monitoring by custom ASIC "AMAC" at load
Remote ON/OFF control	yes, active low	
PROTECTION		
Over temperature protection	yes	adjustable
Over voltage protection	yes	adjustable
Over current protection	yes	adjustable
COOLING	external provided in the racks	
ENVIRONMENT		
Operating humidity	10% to 90% RH, Non-condensing	
Ambient temperature	0°C to 30°C	
Storage humidity	10%-95% RH Non-condensing	
Storage temperature	-20°C to 80°C	
MECHANICAL		
Output terminals/connectors	?	We may request specific connectors
Modularity	suitable for 19" crates	
Packing density	to comply with avaiable racks	See system description
OTHER		
Communication protocols	ethernet, industrial protocols and	
Warranty / Maintenance	5 years / 15 years	

48V Supply assuming DC/DC converter at PP2

Parameter	Value	Comment
INPUT		
Input voltage	240 V AC	
Input frequency	50 Hz, single phase	PFC required
OUTPUT		
Reference potential	floating relative to chassis ground for individual channels	
Isolation withstand voltage	100 V	
Voltage range	44 to 52 V	adjustable
Voltage setting resolution	±1%	
Voltage ramping	soft start	
Maximum current	2 A (4 A)	two versions will be needed
Efficiency	min 80% (AC to DC)	average per crate including primary power supply and channels efficiency for maximum output power
Ripple and noise for 12 > 10 Hz	<50 mV pp	
REGULATION, SENSING AND MONITORING ACCURACY		
Remote sensing control	no	
Line regulation	1%	
Load regulation	1%	
Voltage monitoring	no	performed by custom ASIC "AMAC" at load
Current monitoring	no	performed by custom ASIC "AMAC" at load
Remote ON/OFF control	yes, active low	
PROTECTION		
Over temperature protection	yes	adjustable
Over voltage protection	yes	adjustable
Over current protection	yes	adjustable
COOLING	external provided in the racks	
ENVIRONMENT		
Operating humidity	10% to 90% RH, Non-condensing	
Ambient temperature	0°C to 30°C	
Storage humidity	10%-95% RH Non-condensing	
Storage temperature	-20°C to 80°C	
MECHANICAL		
Output terminals/connectors	?	We may request specific connectors
Modularity	suitable for 19" crates	
Packing density	to comply with avaiable racks	See system description
OTHER		
Communication protocols	ethernet, industrial protocols and	
Warranty / Maintenance	5 years / 15 years	

DC/DC Step Down Converter at PP2

Parameter	Value	Comment
INPUT		
Input voltage	44 to 52 DC	floating relative to chassis ground for individual channels
OUTPUT		
Reference potential	floating relative to chassis ground for individual channels	
Isolation withstand voltage	100 V	
Voltage	11 to 14 V	depends upon current output
Voltage at load	11V	held fixed by remote sensing
Voltage setting resolution	±1%	
Voltage ramping	soft start	Output should track input by < 100 usec
Maximum current	5 A (10 A)	two versions will be needed Final spec may change by +-20%
Efficiency	min 85% (AC to DC)	average per crate including primary power supply and channels efficiency for maximum output power
Ripple and noise for f > 10 Hz	<50 mV pp	
REGULATION, SENSING AND MONITORING ACCURACY		
Remote sensing control	yes	up 4 V voltage drop and 20 m long cables
Line regulation	1%	
Load regulation	1%	
Voltage monitoring	no	precise monitoring by custom ASIC "AMAC" at load
Current monitoring	no	precise monitoring by custom ASIC "AMAC" at load
Remote ON/OFF control	yes, active low	
PROTECTION		
Over temperature protection	yes	adjustable
Over voltage protection	yes	adjustable
Over current protection	yes	adjustable
COOLING	external provided in the racks	
ENVIRONMENT		
Operating humidity	10% to 90% RH, Non-condensing	
Ambient temperature	0°C to 30°C	
Storage humidity	10%-95% RH Non-condensing	
Storage temperature	-20°C to 80°C	
Magnetic field	0.6 T	
Radiation levels	TID < 20Gy, 1MeV NEQ < 4e11 cm^{-2} , hadron flux ??20MeV cm^{-2} < 2e10 cm^{-2}	
MECHANICAL		
Output terminals/connectors	?	We may request specific connectors
Modularity	suitable for 19" crates	
Packing density		available space in PP2 has to be defined
OTHER		
Communication protocols	ethernet, industrial protocols and interface	
Warranty / Maintenance	2 years / 15 years	

High Voltage for Sensor Bias

Parameter	Value	Comment
INPUT		
Input voltage	240 VAC	
Input frequency	50 Hz, single phase	PFC may be required
OUTPUT		
Reference potential	floating relative to chassis ground for individual channels	
Isolation withstand voltage	±1 kV	
Voltage range	0 to 750 V	programmable, stable operation from 10V
Voltage setting resolution	±1% of set value, ± 1 V	
Voltage ramping	programable 5 - 50 V/s	
Maximum current	6 mA	Final spec may change by +20%
Maximum current limit	12 - 66 mA	
Efficiency	min 50% (AC to DC)	average per crate including primary power supply and channels efficiency for maximum output power
Ripple and noise for f > 10 Hz	<50 mVpp	
Common mode noise current peak with 100 ohms to earth	<2 mA at full load	
REGULATION, SENSING AND MONITORING ACCURACY		
Remote sensing	no	
Voltage measurement resolution	10^{-4} x Vmax	Precision measurement by custom ASIC "AMAC" at load
Current measurement resolution	10^{-4} x Imax	Precision measurement by custom ASIC "AMAC" at load
PROTECTION		
Short circuit protection	yes	
Over temperature protection	yes	adjustable
Over(under)-voltage protection	±10 V	programmable limit with programmable ramp down
Over(under)-voltage trip reaction time	10 ms	will be dominated by discharge of capacitors
Over-current protection	yes	programmable limit with programmable ramp down
Over-current trip reaction time	10 ms	will be dominated by discharge of capacitors
Remote ON/OFF	active low	1 line per channel
Remote ON/OFF reaction time	10 ms	
COOLING	external provided in the racks	
ENVIRONMENT		
Operating humidity	10% to 90% RH, Non-condensing	
Ambient temperature	0°C to 30°C	
Storage humidity	10%-95% RH Non-condensing	
Storage temperature	-20°C to 80°C	
MECHANICAL		
Output terminals/connectors	?	We may request specific connectors
Modularity	suitable for 19" crates	
Packing density	to comply with avaiable racks	See system description
OTHER		
Communication protocols	ethernet, industrial protocols and	
Warranty / Maintenance	5 years / 15 years	