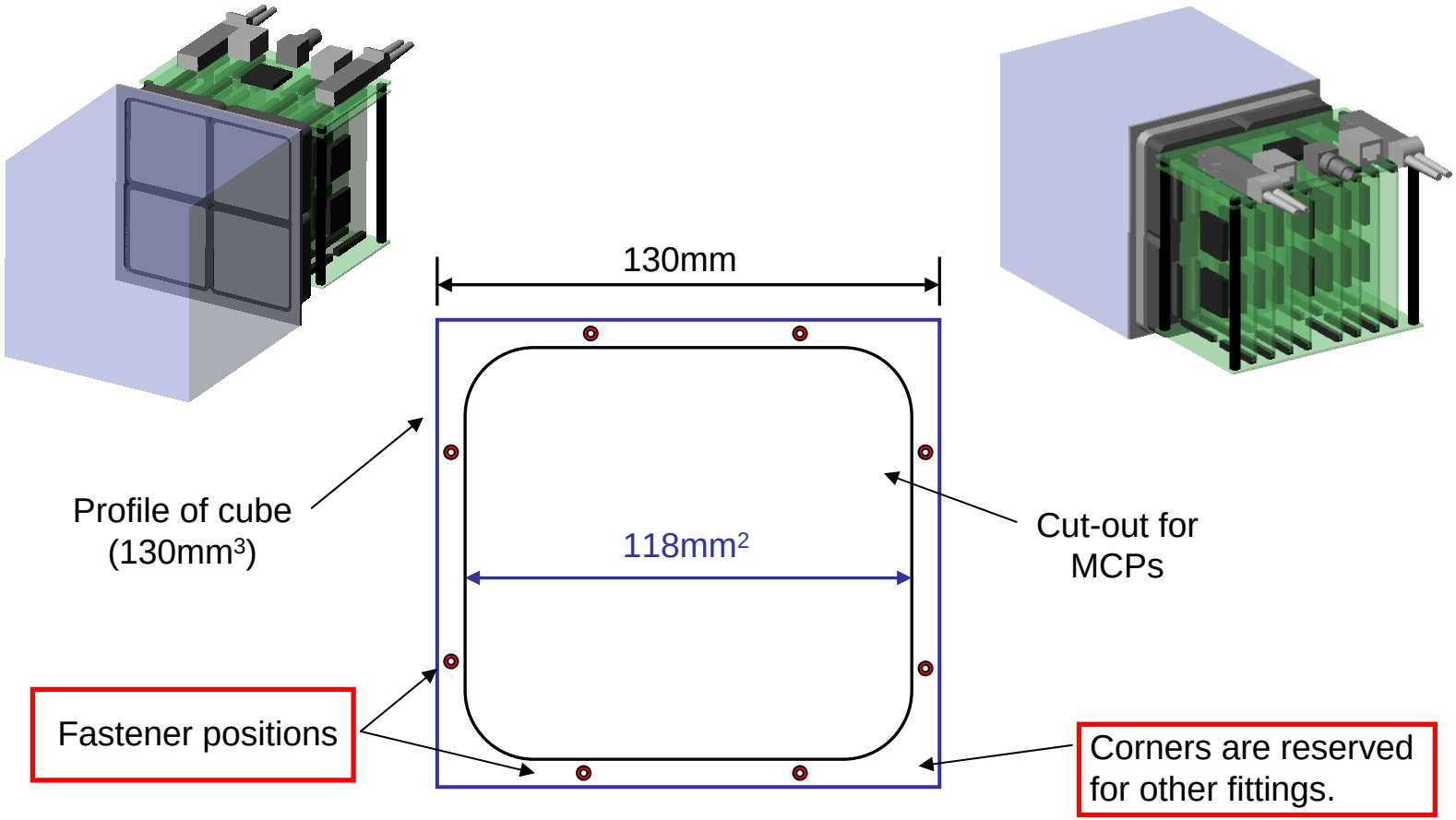
OUTLINE: MTC Mechanical

- Electro Mechanical Interface Defined
- A Brief Look at Commercial DC - DC HV Supplies
- The DAQ: and a request for some specifications
- Portability and Transport
- Connector Philosophy
- Backup slides

Electro Mechanical Interface

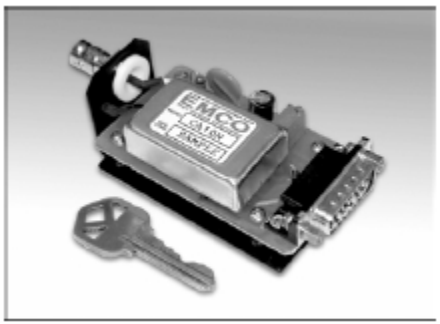


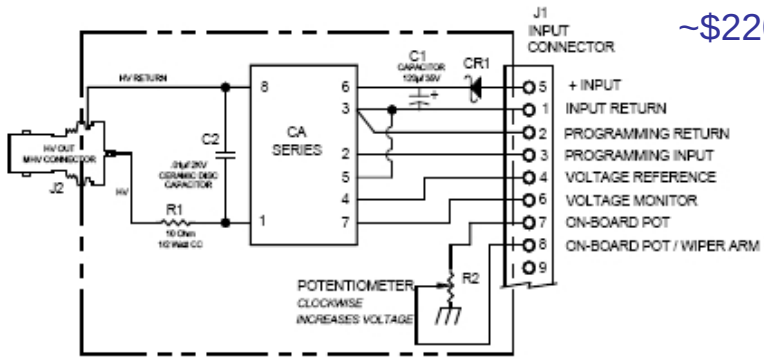
There is a 6mm perimeter margin between the MCPs and the cube edge, which is intended to be used for mechanical fastening and optical coupling.

High Voltage Power Supplies from EMCO

~$900/ea max HV = 2kv
(the cost of plug & play)

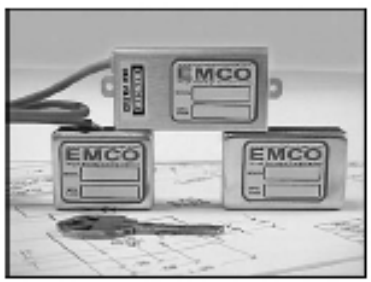
EMCO CA series + chassis kit

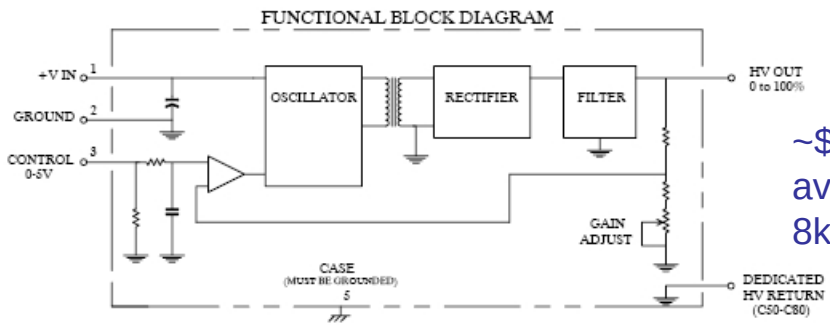




~$220 + $120 (for chassis kit)
max HV = 2kv

EMCO C series





~$225 (chassis kit will be available soon) max HV = 8kv, low EMI/RFI rating

High Voltage Power Supplies (cont)

This is the model used in Ice Cube, low ripple,
100 yr MTBF, max HV = 2kv (did not price)

Multi-Output, Programmable High Voltage System

Octo-Channel High Voltage System
Eight Outputs of 0 to 200V through 0 to 8000V Available

EMCO
HIGH VOLTAGE CORPORATION

High Voltage Power Supplies (cont)

What is the desirement?

HV distributed internally within the 2ft^3 via control by Crockcroft-Walton HV supply circuits that do not contribute any significant EMI or thermal issues.

Figure 8-2: Cockcroft-Walton power supply circuit

Figure 8-3 shows a power supply circuit using a Cockcroft-Walton circuit combined with an active divider circuit. The Cockcroft-Walton circuit generates a voltage that is applied to the entire photomultiplier tube and the active divider circuit applies a voltage to each dynode. In this active divider circuit, several voltage-divider resistors near the last dynode stages are replaced with transistors. This eliminates the effect of the photomultiplier tube signal current on the interdynode voltage, achieving good linearity up to 60 % to 70 % of the divider circuit current. This circuit also features lower ripple and shorter settling time compared to power supply circuits using only a Cockcroft-Walton circuit.

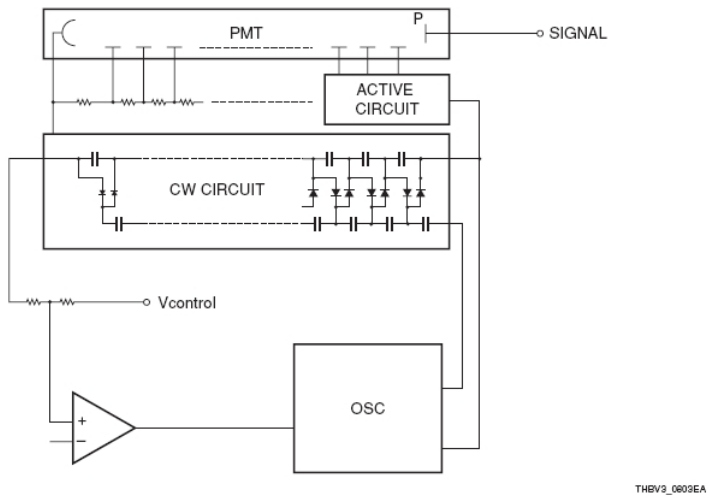


Figure 8-3: Power supply circuit using Cockcroft-Walton circuit combined with active divider circuit

Data Acquisition System (DAQ) based on cPCI format: small & portable

cPCI CPU

x1

Data processing cards: 512 ch ea

x3 (= 24 PMTs)

cPCI Crate

Needed specs:

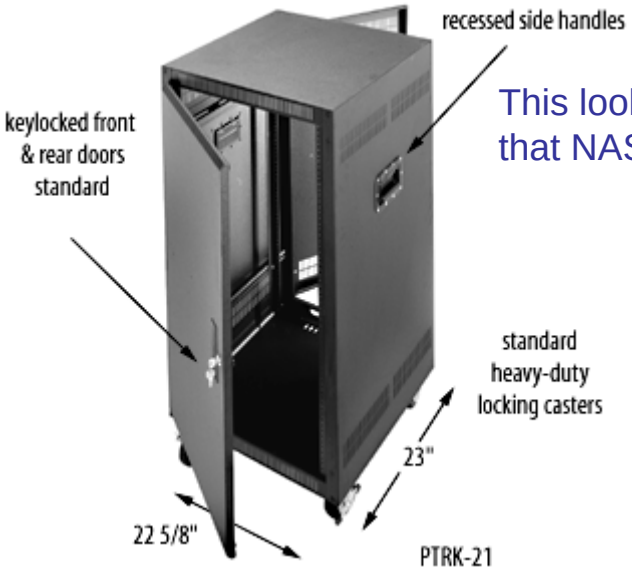
How many crate slots ?

What board format?

CPU mfgr/model?

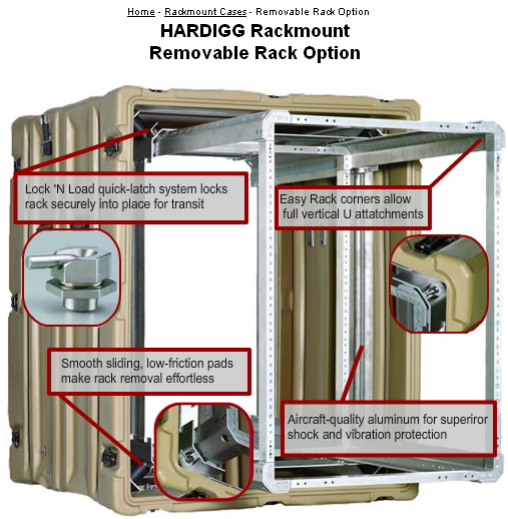
Portability and Transport

(an aside: Pelican and Hardigg have been the leaders in high end transport cases, but Hardigg has now been acquired by Pelican!)



This looks a lot like the portable/shippable racks that NASA uses on the balloon projects.

Some stock models and features from Hardigg



Portability and Transport

(unfortunately I have not found a stock size that will accept a 2ft^3)

HARDIGG Quick Ship Cases

Find out how much you can get done when you don't have to wait for quality

Hardigg offers select sizes of our Single Lid Cases as "Quick Ships". These cases are available for immediate delivery in gray, include standard hardware, an open loop gasket, handles, and are shipped without foam. Any of these cases can be customized to meet your exact specifications.

Quick Ship Inventory

Note: These cases are available for immediate delivery. Requesting changes or alterations will add to shipping time. If you would like to order a custom case or have features added to one of our other models not listed please contact your local Hardigg dealer by calling 800-542-7344.

Connector Philosophy:

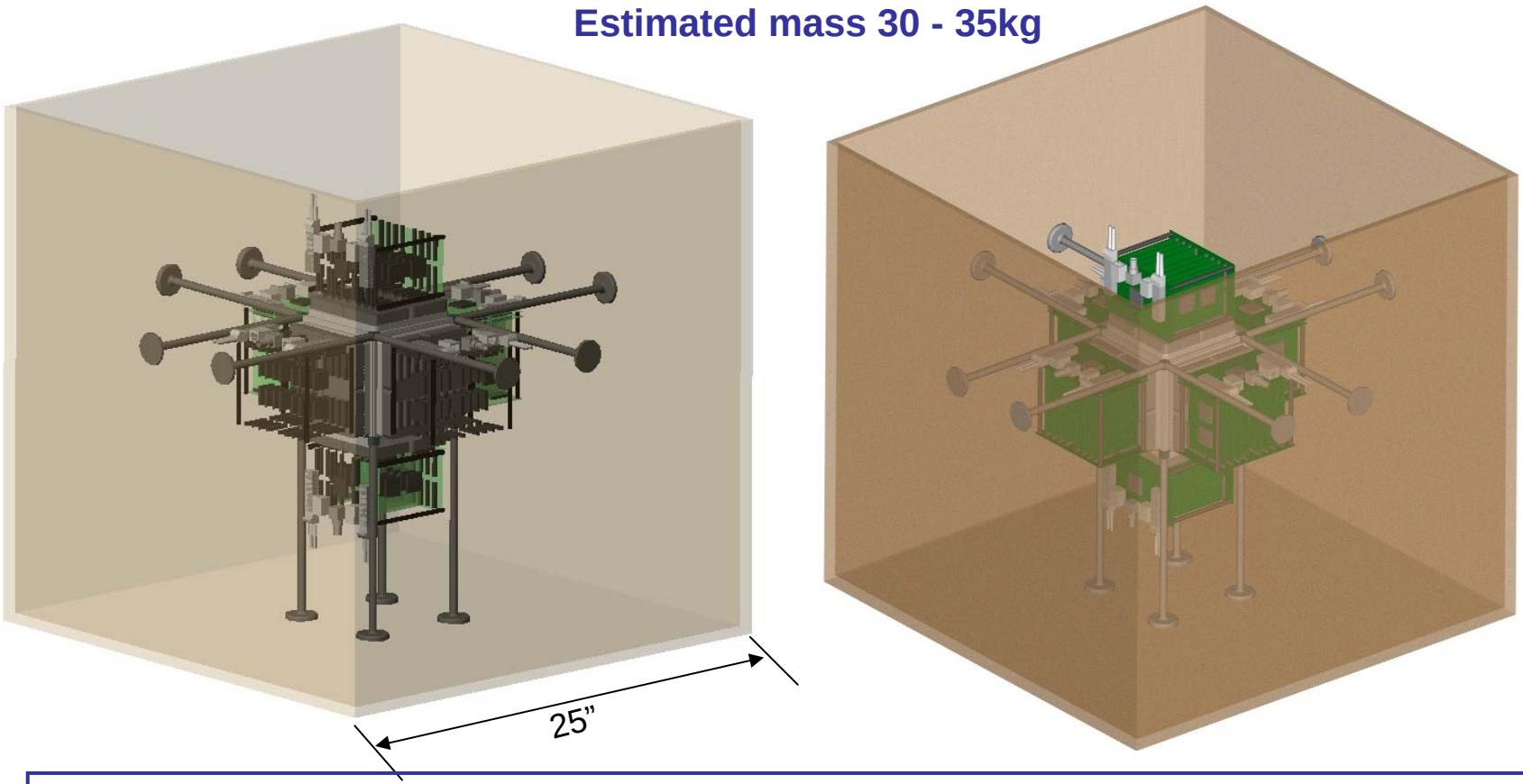
Think small, efficient, minimal numbers required, easy to set-up in the field, impossible to make critical mistakes.

To be continued as our interfaces are better defined…

Backup Slides

Fully populated acrylic cube in transport container: 25” cube

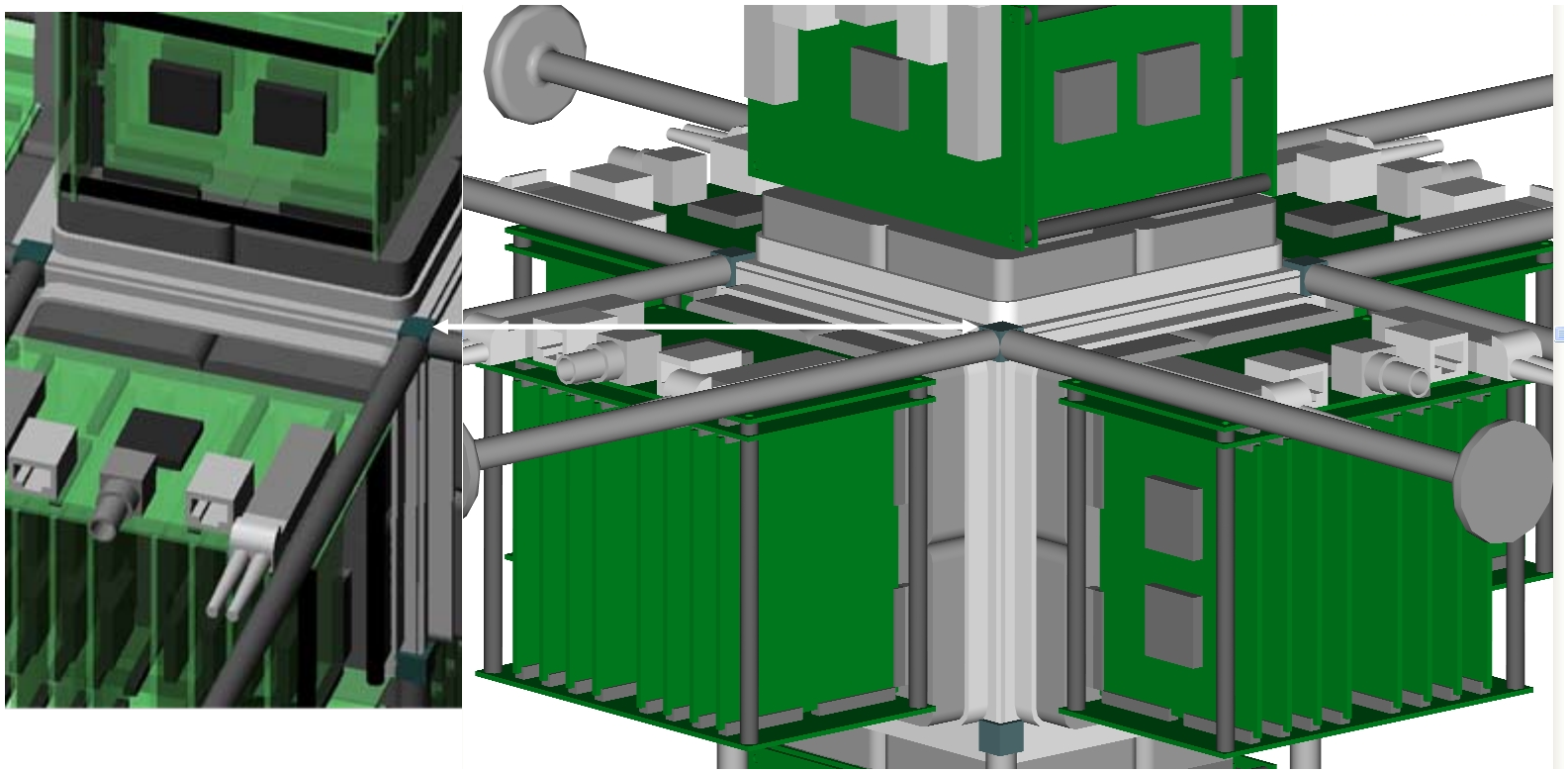
Estimated mass 30 - 35kg



Suggested container material is 1 cm thick aluminum honeycomb.

There will be a single panel that is optimized for the minimal number of connectors. Example: a single 24 fiber bulkhead connector (custom but not unreasonable).

Structural corner detail: surfaces exist for future valves, etc.



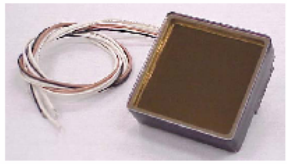
The components necessary for liquid filling and pressure compensation can be added to the existing corner fitting at a latter date.

The photo-sensor: Photonis XP85012 (64 channel MCP)

Photon Detector *Preliminary* XP85012

PLANACON

25µm MCP-PMT
8x8 Anode
53 mm Square



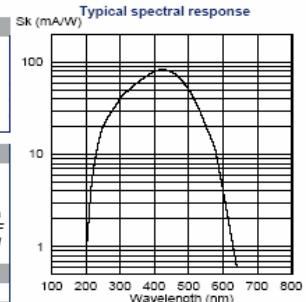
Applications
- ✓ Specialized Medical Imaging
- ✓ Ring Imaging Cherenkov
- ✓ High Energy Physics Detectors

Description	
Window material	UV-Glass, Schott 8337B or equivalent
Photocathode	Bialkali
Multiplier structure	MCP chevron (2), 25 µm pore, 40:1 L:D ratio
Anode structure	8×8 array, 5.8 / 6.5 mm (size / pitch)
Active area	53×53 mm
Open-area-ratio	80%

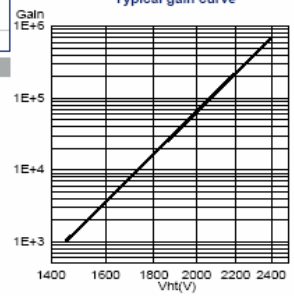
Photocathode characteristics	Min	Typ	Max	Unit
Spectral range:	200		650	nm
Maximum sensitivity at		400		nm
Sensitivity:				
Luminous *	50	60		µA/lm
Blue *	7.5	8.5		µA/lmF
Radiant, at peak		76		mA/W
Quantum Efficiency		24		%

Characteristics	Min	Typ	Max	Unit
Gain *	1×10^5	6×10^5		-
Total anode dark current @ 10^6 gain *		1	5	nA
Rise time		0.6		ns
Pulse width		1.8		ns
Anode uniformity		1 : 1.5	1 : 2.5	

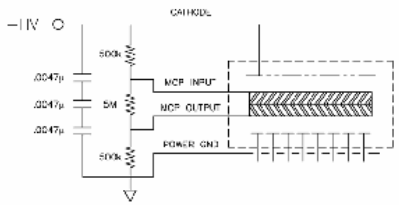
Typical spectral response



Typical gain curve



Recommended Voltage Divider (not included)



CAUTION: POWER GROUND CONNECTION AND UNUSED ANODES MUST BE CONNECTED TO GROUND FOR SAFETY AND PROPER TUBE OPERATION

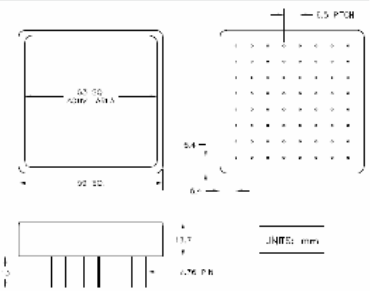
** Characteristic measured and recorded on the test ticket of each tube*

PHOTONIS 22/05/2009

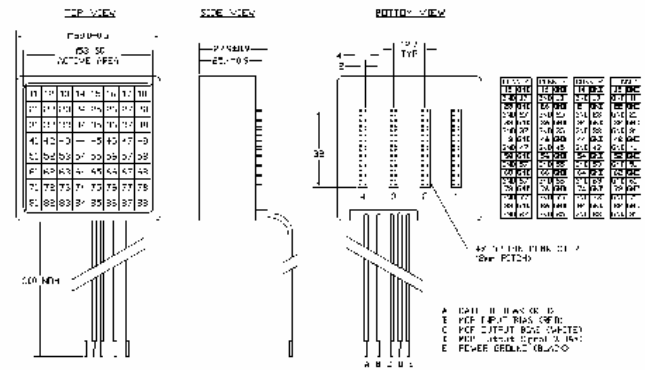
Photon Detector XP85012

Outline (dimensions in mm)

XP85012



XP85012/A1



Mass: ~128g

Limiting values	Min	Max	Unit
Cathode to MCP_{in} voltage		500	V
MCP_{in} to MCP_{out} voltage		2000	V
MCP_{out} to Anode voltage		500	V
Average total anode current		3	µA
Ambient temperature:			
Operating Temperature	0	+50	°C
Storage Temperature (for extended periods)	-15	+50	°C

* Warning: Continuous operation at maximum ratings may result in shorter product life or unreliable performance.

The information furnished is believed to be accurate and reliable, but is not guaranteed and is subject to change without notice. No liability is assumed by BURLE INDUSTRIES for its use. Performance data represents typical characteristics and not specifications as actual, individual product performance may vary. Customers should verify that they have the most current BURLE product information before placing orders, and should independently test and evaluate BURLE products for their intended use. No claims or warranties are made as to the application of BURLE products or their suitability or fitness for any particular purpose. This document may not be reproduced, in whole or in part, without the prior written consent of BURLE INDUSTRIES.

PHOTONIS 22/05/2009

Quote: Photonis XP85012/A1

(price break at 25 units)

BURLE Industries, Inc. | **1000 New Holland Ave.** | **Lancaster, PA 17601-5688 USA**
Telephone: 1-800-336-2875 (USA & Canada) or 717-295-2704 E-mail: Quick-Horn@burle.com
FAX: 717-295-6096

QUOTATION

Customer Ref. No.:	PHOTONIS INQUIRY	**Date:**	08-Jan-10
Customer:	UNIVERSITY OF HAWAII	**Telephone No.:**	808 956-6905
Address:	HONOLULU, HI	**FAX No.:**	808 956-2930
Attn:	MARC ROSEN, PROJECT ENGINEER	**E-mail:**	rosen@phys.hawaii.edu

In response to the inquiry referenced above, BURLE INDUSTRIES, INC. is pleased to quote as follows:
BURLE Ref. No.: 3092

ITEM	DESCRIPTION	DELIVERY	QUANTITY	UNIT PRICE
1	XP85012/A1 Photon Detector 25µm MCP-PMT Planacon 8x8 Anode, 53mm Square	8 UNITS/MONTH, STARTING 90 DAYS ARO	1 - 24 25 - 30	$8,490.00 $8,172.00
2	XP85022 Photon Detector 25µm MCP-PMT Planacon 32x32 Anode, 53mm Square	8 UNITS/MONTH, STARTING 90 DAYS ARO	1 - 24 25 - 30	$10,640.00 $10,240.00

20 pcs = $169,800 24 pcs = $203,760 25 pcs = $204,300

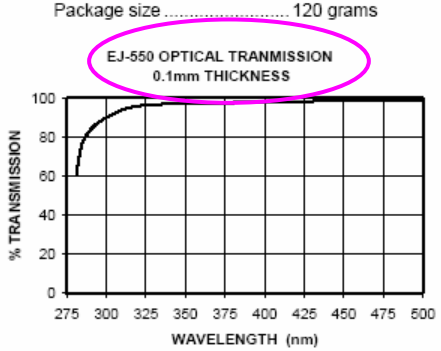
Optical coupling media: grease and gel

EJ-550 and EJ-552
SILICONE GREASES

These two materials are offered for use in optically coupling photosensors to scintillators and light guides. They are packaged in convenient squeeze tubes containing 120 grams of more of the grease. Both have low bleed and evaporation rates at 25°C and are safe for handling and storage when exercising standard cleanliness procedures.

EJ-550 Optical Grade Silicone Grease
This is a sparkling clear and colorless optical coupling compound having moderate viscosity and providing excellent transmission properties well into the near-ultraviolet region. It should be stored at temperatures below 26°C and preferably below 5°C.

Specific Gravity..... 1.06
Refractive Index..... 1.46
Package size ..... 120 grams



EJ-552 General Purpose Silicone Grease
This is a translucent grease having high viscosity. It is recommended for use where the very best optical coupling is not required. It is best pressed out to a thickness below 0.1mm where it becomes nearly transparent. It is best stored at room temperature.

Specific Gravity..... 1.06
Refractive Index..... 1.47
Package size ..... 135 grams

ELJEN TECHNOLOGY
2010 East Broadway
Sweetwater TX 79556 USA
Tel: (325) 235-4276 or (888) 800-8771
Fax: (325) 235-0701
Website: www.eljentechnology.com

EJ-560
SILICONE RUBBER OPTICAL INTERFACE

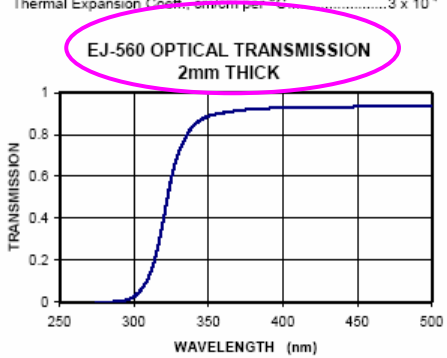
EJ-560 silicone rubber has been developed specifically for making optical joints between photosensors and plastic scintillators. The rubber material is quite soft and flexible and can be made to conform to contoured surfaces. It is a fully-cured polymer designed so its surfaces are slightly sticky to the touch, and it can be deformed under mild pressure. Nevertheless, it does not flow like a grease and will not extrude irreversibly out of its compression region. Hence it is ideal for long-term coupling of photomultiplier tubes to scintillators.

Pads of EJ-560 are presently available in thickness of 1mm, 1½mm, 2mm and 3mm and in diameters ranging from 10mm up to 125mm. It is also available in sheet form and can be easily cut to size with razor blades or scissors. The maximum available sheet size is 33cm x 53cm (33cm x 33cm for 1mm thickness). All EJ-560 products are shipped with the surfaces masked with an easily removed thin film.

EJ-560 rubber will easily adhere to any smooth surface and can also be easily peeled away without damaging either component. If the EJ-560 surfaces become covered with dust, their adhesive properties will be diminished. However, they can be cleaned with the aid of any lower alcohol such as isopropyl alcohol and hence restored to their original condition.

SPECIFICATIONS

Density, g/cc 1.03
Hardness, Shore A 16-24
Refractive Index n_D 1.43
Operating Temperature Range, °C ..... -40° - +70°
Thermal Expansion Coeff., cm/cm per °C ..... 3×10^{-4}



ELJEN TECHNOLOGY
PO Box 870, 300 Crane Street
Sweetwater TX 79556 USA
Tel: (325) 235-4276 or (888) 800-8771
Fax: (325) 235-0701
Website: www.eljentechnology.com

Quotes for LS and quartz vessel

Subject: Quote# H10-058B: Re: Quote# H10-058A Boron Loaded plastic scint Re: inquiry about 6Li loaded scintillator
Date: Thu, 11 Mar 2010 12:27:21 -0600
From: Charles Hurlbut <churlbut@eljentechnology.com>
To: John Learned <jgl@phys.hawaii.edu>
CC: Chris Maxwell <cmaxwell@eljentechnology.com>

Hi John,

Regarding the plastic scint cost, the boron loading compound is the dominant factor by far.

It occurred to me that you might be interested in a liquid scintillator version of the plastic.
We have a high flash point liquid scinitllator which has been widely adopted in place of our traditional product because of the fire hazard problem of the xylene based original. Additionally, we have made a boron loaded version using the same compound used in the plastic. However, it is somewhat less expensive for a variety of reasons and gives higher light output.

The base liquid product is our EJ-309, and the boron loaded one is EJ-309:B1 for 1% boron by weight.
The EJ-309:B5 has continues to be studied in Europe and a few papers have been published. A new one will be presented at the SORMA conference this year.

I have attached the data sheet for EJ-309 and EJ-309:BX for your review.

Here are some pricings.
EJ-309:B1 Liquid Scintillator
2 liters
Lot price: $1350.00

As usual, please do not hesitate to write with your concerns.

Thanks for the opportunity to quote.
Chuck

Charles Hurlbut
Eljen Technology
2010 East Broadway Ave.
Sweetwater, Texas 79556
Tel: (325) 236-9468
Fax: (325) 235-0701

Wacom Quartz Corporation
5050 South 38th Place
Phoenix, AZ 85040
USA

Phone: 602-470-1465
Fax: 602-470-1043

Quote Number: 9398

Quote

Page: 1 of 1

Quote To:

University of Hawaii
High Energy Physics Group
2505 Correa Rd.
Honolulu HI 96822
USA

Phone: (808) 956-6905 Fax: (808) 956-2930
rosen@phys.hawaii.edu

Date: 2/17/2010

Expires: 4/3/2010

Sales Person: James Roeger

jroeger@wacomquartz.com

Stopcocks and print will need to be clarified by the customer before the production cycle begins.

Lines 3 and 4 on Quote 9398 are not an option at this point as the price listed is only a fraction of the true cost. A full ingot will need to be purchased as there is currently zero stock on hand and no requirment at this time for the i21 material.

Base Currency. (US Dollars)

Line	Part Number	Description	Rev	Drawing
1	TBA - 214 .08" thick	Quartz Tank with Stopcocks (5" Inside diameter) - 124 .08" thick		

Lead Time 10 weeks

Quantity	Unit Price	Disc %	Net Price
1.00	1,835.00		1,835.00 $

Line	Part Number	Description	Rev	Drawing
2	TBA - 214 .197" thick	Quartz Tank with Stopcocks (5" Inside diameter) - 124.197" thick		

Lead Time 10 weeks

Quantity	Unit Price	Disc %	Net Price
1.00	1,952.00		1,952.00 $

Line	Part Number	Description	Rev	Drawing
3	TBA - i21 .08" thick	Quartz Tank with Stopcocks (5" Inside diameter) - i21 .08" thick		

Quantity	Unit Price	Disc %	Net Price
1.00	6,302.00		6,302.00 $

Line	Part Number	Description	Rev	Drawing
4	TBA - i21 .197" thick	Quartz Tank with Stopcocks (5" Inside diameter) - i21 .197" thick		

Quantity	Unit Price	Disc %	Net Price
1.00	6,302.00		6,302.00 $

Quote for Boron doped acrylic cubes

Date: Wed, 10 Mar 2010 14:10:28 -0600
From: Charles Hurlbut <churlbut@eljentechnology.com>
To: John Learned <jgl@phys.hawaii.edu>
Cc: "hanohano_local@phys.hawaii.edu" <hanohano_local@phys.hawaii.edu>,
Chris Maxwell <cmaxwell@eljentechnology.com>
Subject: Quote# H10-058A Boron Loaded plastic scint Re: inquiry about 6Li loaded scintillator
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Hi John,

Here are the requested prices for the 13cm cube of EJ-254 boron-loaded plastic scintillator. As requested, there are figures for the finished cube and the rough cubic ingot in loadings of 5% and 1% natural boron. The unfinished ingot would be about 1/2" oversize.

[1] EJ-254-5% B-nat Plastic Scintillator
Size: Sawn cube ingot nominally 145mm per side
1 eachPrice: $ 12,360.00

[2] EJ-254-1% B-nat Plastic Scintillator
Size: Sawn cube ingot nominally 145mm per side
1 each
Price: $ 3,860.00

[3] Charge for finishing to a 130.0mm cube with diamond-milled surfaces
$ 320.00 for either cube.

Lead time: six weeks ARO

You can use these as firm prices.

As usual, please do not hesitate to write with your concerns.

Thanks for the opportunity to quote.
Chuck

Charles Hurlbut
Eljen Technology
2010 East Broadway Ave.
Sweetwater, Texas 79556
Tel: (325) 236-9468
Fax: (325) 235-0701
Chuck