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

New!
USB Powered Desktop High Voltage Power Supplies
USB\_HV Series
0 to +/- 260V through 0 to +/- 2000V @ 1 Watt

~$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
High Voltage Power Supplies (cont)

What is the desirement?

HV distributed internally within the 2ft³ via control by Crockcroft-Walton HV supply circuits that do not contribute any significant EMI or thermal issues.

Figure 8-2: Crockcroft-Walton power supply circuit

Figure 8-3 shows a power supply circuit using a Crockcroft-Walton circuit combined with an active divider circuit. The Crockcroft-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 Crockcroft-Walton circuit.

Figure 8-3: Power supply circuit using Crockcroft-Walton circuit combined with active divider circuit
Data Acquisition System (DAQ) based on cPCI format: small & portable

Data processing cards: 512 ch ea

x1

x3 (= 24 PMTs)

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**

**XP85012**

25μm MCP-PMT  
8x8 Anode  
53 mm Square

**Applications:**  
- Specialized Medical Imaging  
- Ring Imaging Cherenkov  
- High Energy Physics Detectors

**Description**

- **Photon mode:** UV-Grass, Schott 33761 or equivalent
- **Multiplier structure:** MCP chevron (2) 25 μm pores, 6x L/D ratio
- **Anode structure:** 3600 μm, 8.5 x 8.5 mm (size / gain)
- **Active area:** 53 x 53 mm

**Characteristics**

- **Gain:** 5 x 10^5
- **Total anode dark current @ 10^5 gain:** 1 nA
- **Rise time:** 0.8 μs
- **Rise time:** 1.5 μs

**Recommended Voltage Divider** (not included)

- **CAUTION:** POWER CORDING CONNECTION NOT USED.  
  **CAUTION:** MUST BE CONNECTED TO GROUND FOR SAFETY AND  
  **PROPER TIME DELAY**

**Typical spectral response**

**Typical gain curve**

**Limiting values**

- **Cathode to MCPa voltage:** 500 V
- **MCPa to MCPb voltage:** 2000 V
- **MCPb to anode voltage:** 500 V
- **Ambient temperature:** 40 °C
- **Storage temperature (for extended period):** -15 to 55 °C

*Warning: Continuous operation at maximum ratings may result in out-of-product life or unsatisfactory performance.*
Quote: Photonis XP85012/A1  
(price break at 25 units)

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<th>ITEM</th>
<th>DESCRIPTION</th>
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<th>QUANTITY</th>
<th>PRICE</th>
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<td>8 UNITS/MONTH, STARTING 90 DAYS ARO</td>
<td>1 - 24</td>
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<td>3x3 Anode, 52 mm Square</td>
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\[20 \text{ pcs} = \$169,800 \quad 24 \text{ pcs} = \$203,760 \quad 25 \text{ pcs} = \$204,300\]
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 translucent 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 25°C and preferably below 10°C.

- Specific Gravity: 1.06
- Refractive Index: 1.46
- Package size: 120 grams

![Graph showing EJ-550 optical transmission 0.1mm thickness](chart)

**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

![Graph showing EJ-552 optical transmission 2mm thickness](chart)

**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, 1.5mm, 2mm and 3mm in diameters ranging from 10mm up to 125mm. It is also available in sheet form and can be easily cut to size with scissors or blades. The maximum available sheet size is 330cm x 330cm (35cm x 35cm 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: 1.05
- Hardness, Shore A: 60-64
- Refractive Index: 1.43
- Operating Temperature Range: -40°C to +70°C
- Thermal Expansion Coefficient: 3 x 10⁻⁶

![Graph showing EJ-560 optical transmission 2mm thickness](chart)
April 22, 2010

Rosen: MTC Electro-Mechanics

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 Hurbutt <churbtt@eljetechnology.com>
To: John Learned <jgl@phys.hawaii.edu>
CC: Chris Maxwell <cmmaxwell@eljetechnology.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 scintillator 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 continued 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 pricing:
EJ-309-B1 Liquid Scintillator
2 liters
List price: $1350.00

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

Thanks for the opportunity to quote.

Chuck

Charles Hurbutt
Eljena Technology
2010 East Broadway Ave.
Sweethaven, Texas 79556
Tel: (325) 226-9488
Fax: (325) 225-9701

Wasonic Quartz Corporation
8803 South 38th Place
Phoenix, AZ 85040
USA

Quote Number: 8390

<table>
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<td>Exp: -/0/0/10</td>
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<tr>
<td>2500 Corrales Rd</td>
<td></td>
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<tr>
<td>Santa Fe, NM 87501</td>
<td>Sales Person:</td>
</tr>
<tr>
<td>Phone: (505) 945-6205</td>
<td>James Roop</td>
</tr>
<tr>
<td>Fax: (505) 945-6205</td>
<td><a href="mailto:rrooper@wasonic.com">rrooper@wasonic.com</a></td>
</tr>
</tbody>
</table>

Lines 3 and 4 on Quote 8390 are an option at this point as the price listed is only a fraction of the true cost. A final might still need to be purchased if there is currently two back orders and no requirement at this time for the 124 material.
Quote for Boron doped acrylic cubes

Date: Wed, 10 Mar 2010 14:10:28 -0600
From: Charles Hurlbut <churlbut@eljen.com>
To: John Learned <jgl@phys.hawaii.edu>
Cc: "hanohano_local@phys.hawaii.edu" <hanohano_local@phys.hawaii.edu>,
    Chris Maxwell <cmmaxwell@eljen.com>
Subject: Quote# H10-058A  Boron Loaded plastic scint Re: inquiry about 6L1 loaded
        scintillator

------------------------------------------

Hi Jolan,

Here are the requested prices for the 13cm cube of EJ-154 boron-loaded plastic
scintillator. As requested, there are figures for the finished cube and the
rough cubic ingot in loadings of 3% 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 each Price: $12,260.00

    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