



RSEという複雑な制御を必要とするLCGTでは デジタル制御は必須である

- LCGTと同じような制御帯域幅であるCLIOにデジタル制御システムを導入し、実際の干渉計で稼働することにより、デジタル固有の技術を蓄積する
- デジタルシステムのLIGOグループとの共同開発により、国際協力体制を築く
- LCGT建設時にスムーズにデジタル制御を導入できるようにする



MOU and RESEARCH AGREEMENT



AGREEMENT ON ACADEMIC EXCHANGE BETWEEN THE INSTITUTE FOR COSMIC RAY RESEARCH (THE UNIVERSITY OF TOKYO) AND THE LIGO LABORATORY (CALIFORNIA INSTITUTE OF TECHNOLOGY)

The Institute for Cosmic Ray Research (ICRR) in the University of Tokyo (Japan) and the LIGO Laboratory in the California Institute of Technology (U.S.A) (hereinafter referred to as the "parties"), in the firm conviction that academic exchange between the parties will promote scientific advances in the field of gravitational wave science, hereby establish the following Agreement.

Article 1. The parties agree to implement exchanges and other activities in areas of academic research of mutual interest through the following.

- (1) Short-term and longer-term visits in both direction, by faculty and administrative staff and researchers.
- (2) Short-term and longer-term visits in both direction, by students.
- (3) Conducting collaborative research.
- (4) Holding joint lectures and symposia.
- (5) Exchange of academic information and materials.

Article 2. Actual projects to be implemented for the realization of specific exchange activities as defined in the preceding article shall be decided through discussion between the parties.

Article 3. In the case that research results impacting upon matters of intellectual property rights are expected to arise in the course of collaborative projects carried out under the terms of Article 1 above, the parties shall discuss in good faith and agree in a separate document the conditions regarding the treatment of intellectual property rights so arising, prior to the start of the collaborative project in question and in accordance with the policies of each party.

Article 4. This Agreement is valid for five years effective from the date of the final signature affixed below by the parties hereto (hereinafter referred to as the "term"). The term of the Agreement may be extended upon agreement by the parties. Either party may terminate the Agreement during its term by giving six months advance written notice to the other party.

Article 5. This Agreement is created in duplicate in Japanese and in English, each of which shall be deemed originals.

The parties hereby establish this Agreement by duly signing it, as of the respective dates below.

Institute for Cosmic Ray Research
(The University of Tokyo)

T. Kajita

Director, Takaaki Kajita

Date Aug. 10, 2009

LIGO Laboratory
(California Institute of Technology)

Jay Marx

Executive Director, Jay Marx

Date Aug 17, 2009

RESEARCH AGREEMENT Caltech Agreement #ICRR-2009-1

RESEARCH AGREEMENT between the CALIFORNIA INSTITUTE OF TECHNOLOGY, of Pasadena, California, U.S.A., ("Institute") and the INSTITUTE FOR COSMIC RAY RESEARCH, UNIVERSITY OF TOKYO of Kashiwa, Chiba, Japan ("Sponsor").

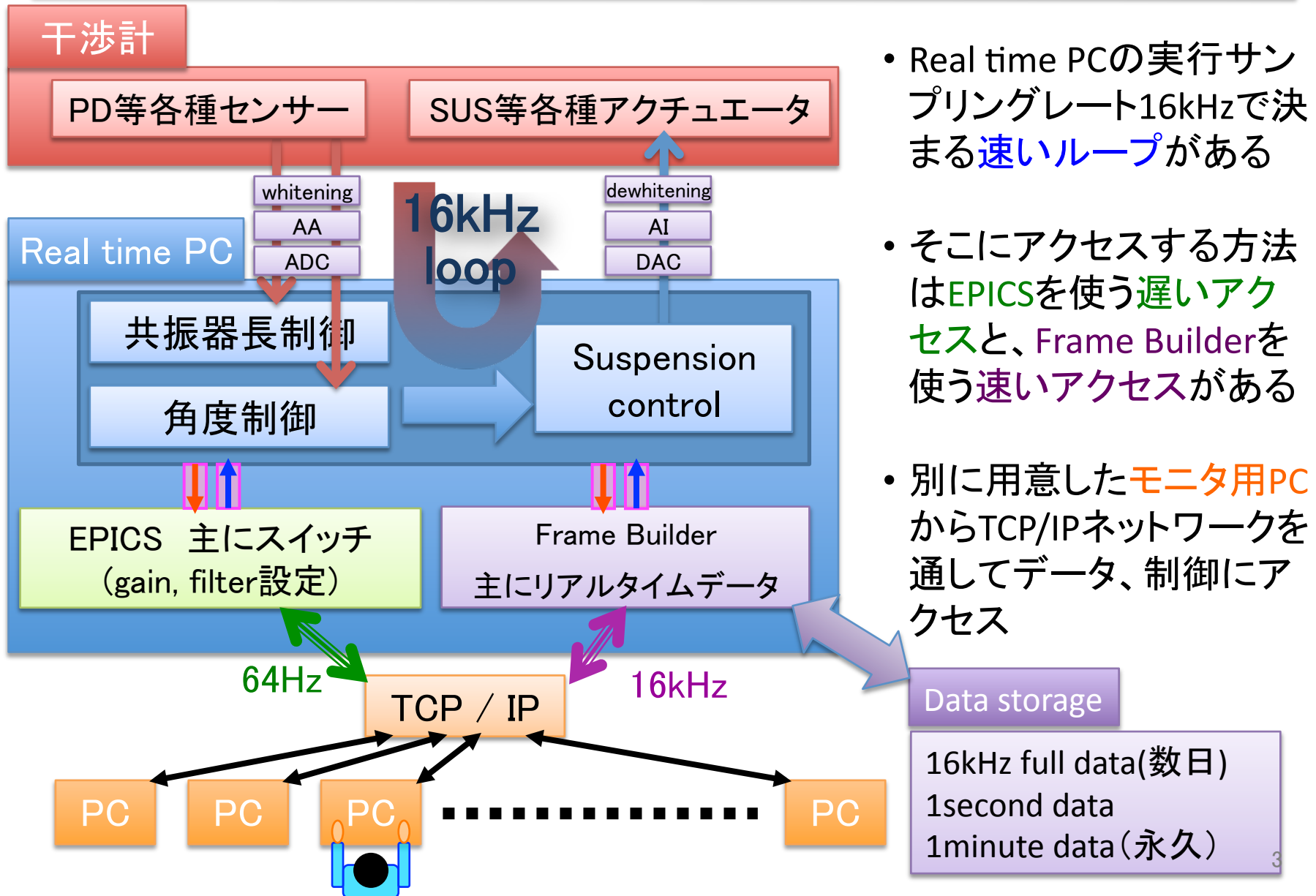
WHEREAS, the research program relating to "Fabrication of Digital Control System for the (CLIO) Detector Operated by ICRR, University of Tokyo," ("Project") as contemplated by this Agreement, is of mutual interest and benefit to the Institute and the Sponsor, and will further the instructional and research objectives of the Institute in a manner consistent with its status as a nonprofit, tax-exempt, educational institution.

NOW, THEREFORE, the parties hereto agree as follows:

1. STATEMENT OF WORK. The Institute will collaborate on the research defined in the Statement of Work attached as Exhibit I.
2. PRINCIPAL INVESTIGATOR. The research will be supervised by **Alan J. Weinstein**. The PI will supervise the work performed under the funding described in Section 4, below.
3. PERIOD OF PERFORMANCE. The research shall be conducted during the period **February 1, 2009 through January 31, 2010**. This Agreement and the period of performance may be extended by mutual written agreement of the parties.
4. REIMBURSEMENT OF COSTS. In consideration of the foregoing, the Sponsor shall reimburse the Institute for all costs incurred to complete the project. The total cost shall not exceed **\$40,000** without written authorization from the Sponsor.
5. INVOICING AND PAYMENT. Payment shall be made in advance based on an invoice submitted by Institute. All payments to the Institute shall be net, and free and clear of all taxes, duties and other levies. Payment shall be remitted based on banking information provided by the Institute.
6. ACCOUNTS AND RECORDS. The Institute agrees to maintain books, records, documents, and other evidence pertaining to all costs and expenses to the extent and in such detail as will properly reflect all net costs incurred in the performance of this research.
7. TRAVEL. Travel costs are not funded under this Project.
8. EQUIPMENT. Title to all equipment purchased under this Agreement shall vest in the Sponsor.
9. TECHNICAL DATA.
 - a. Ownership of, and the right to register copyright to documents related to computer hardware and software and associated documentation (hereinafter "Documents") shall remain in the Institute. The Sponsor shall be granted a nonexclusive, nontransferable, royalty-free license to use Documents, but only for Sponsor's own internal purposes. The Sponsor further agrees not to provide or otherwise make available Documents, or any copy or modification thereof in any form to any third party, except as may be permitted in writing by the Institute. As used herein "modification" shall mean any source tapes, listings or other documentation in any identifiable or separately usable form included in any program developed by Sponsor in machine readable or printed form, where such source tapes, listings, or other documentation remains essentially the same in both form and function as when originally provided by the Institute to the Sponsor.
 - b. All technical data other than Documents resulting from the research program under this Agreement shall be the property of the Institute; however, a copy of all such technical data shall be provided to the Sponsor upon request, and, subject to Article 12 hereof, Sponsor shall have the right to use and disclose all such technical data as it sees fit.



CLIOデジタルシステムの概念図



- Real time PCの実行サンプリングレート16kHzで決まる**速いループ**がある
- そこにアクセスする方法はEPICSを使う**遅いアクセス**と、Frame Builderを使う**速いアクセス**がある
- 別に用意した**モニタ用PC**からTCP/IPネットワークを通してデータ、制御にアクセス



Digital length control system



特徴

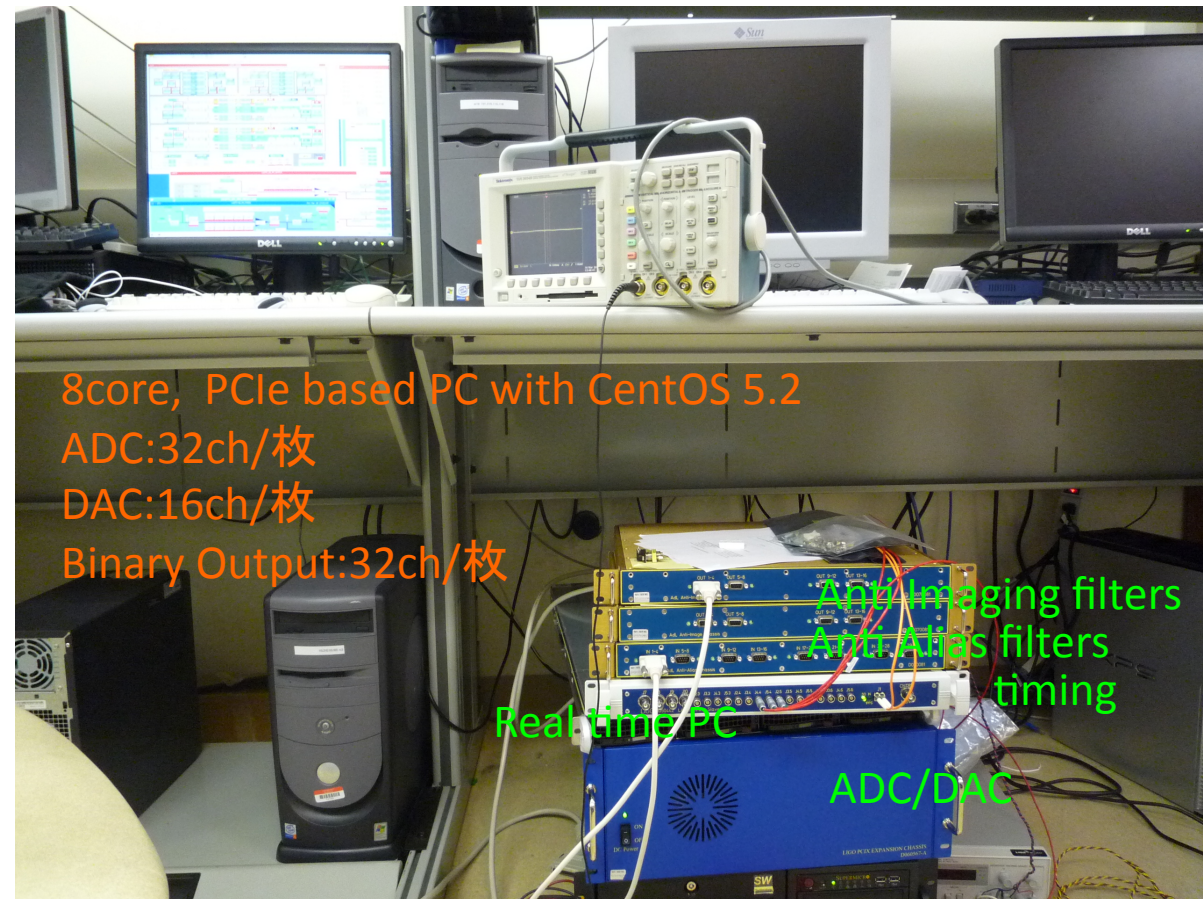
- ユーザーインターフェースが非常に柔軟
- スクリプトにより干渉計パラメータの最適化が可能
- ノイズパフォーマンスも含めて、大型干渉計の複雑な多自由度制御に耐えるシステム



CLIO用デジタル制御システムの構築

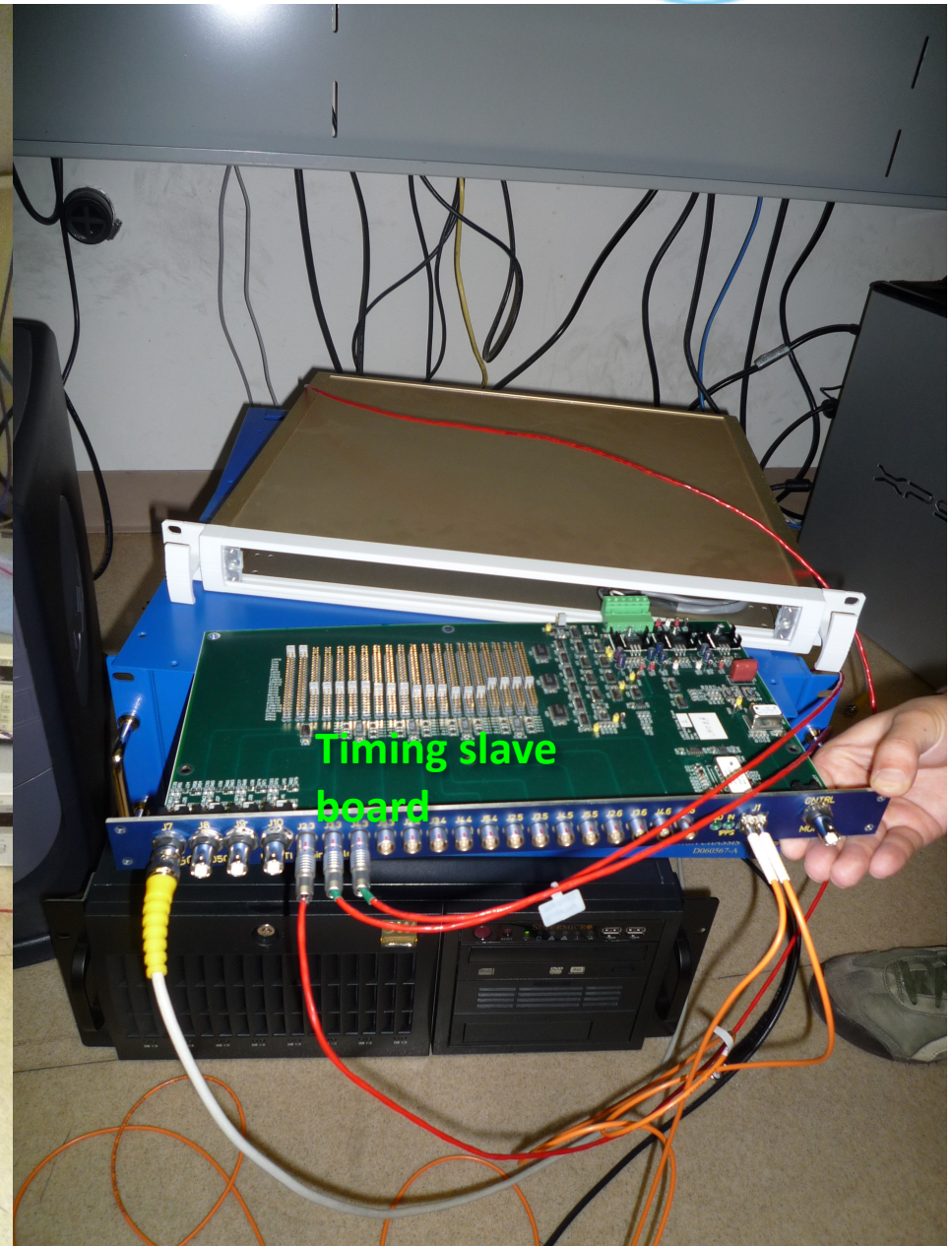
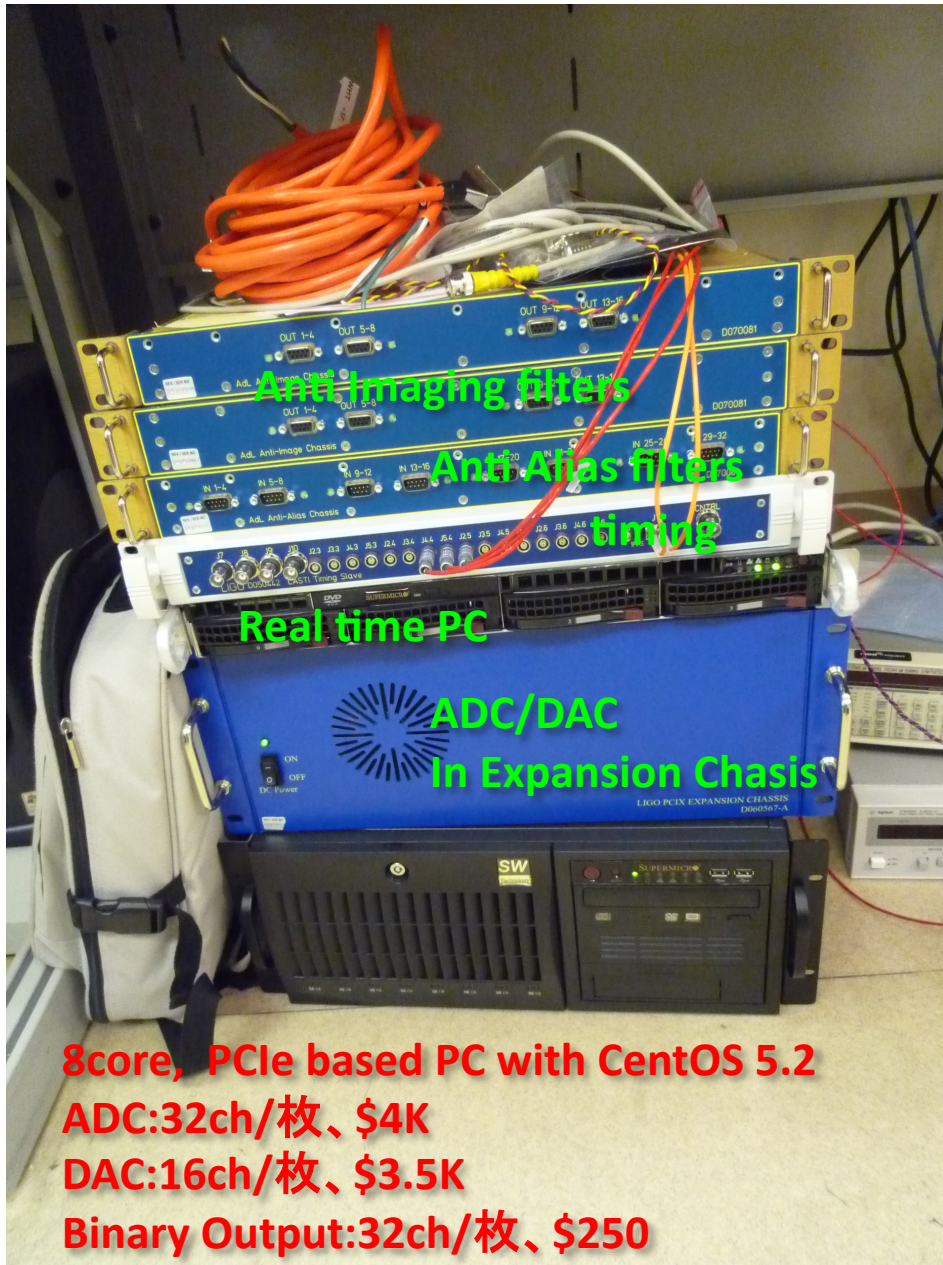


- AdLIGO用に開発されているコンパクトなデジタル制御システムをCLIO専用に新たに構築





Pictures



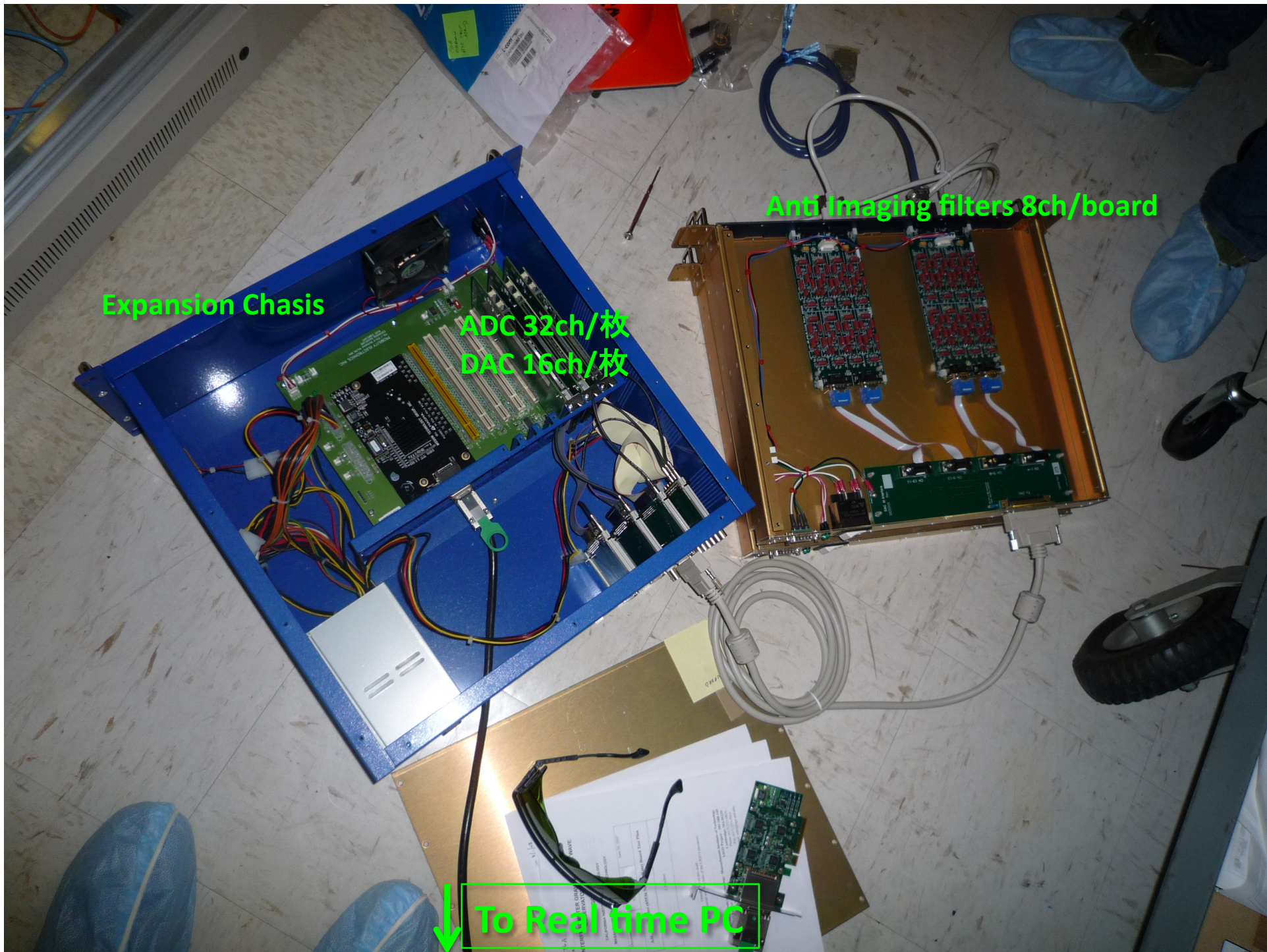
8core, PCIe based PC with CentOS 5.2
ADC:32ch/枚、\$4K
DAC:16ch/枚、\$3.5K
Binary Output:32ch/枚、\$250

Expansion Chasis

ADC 32ch/枚
DAC 16ch/枚

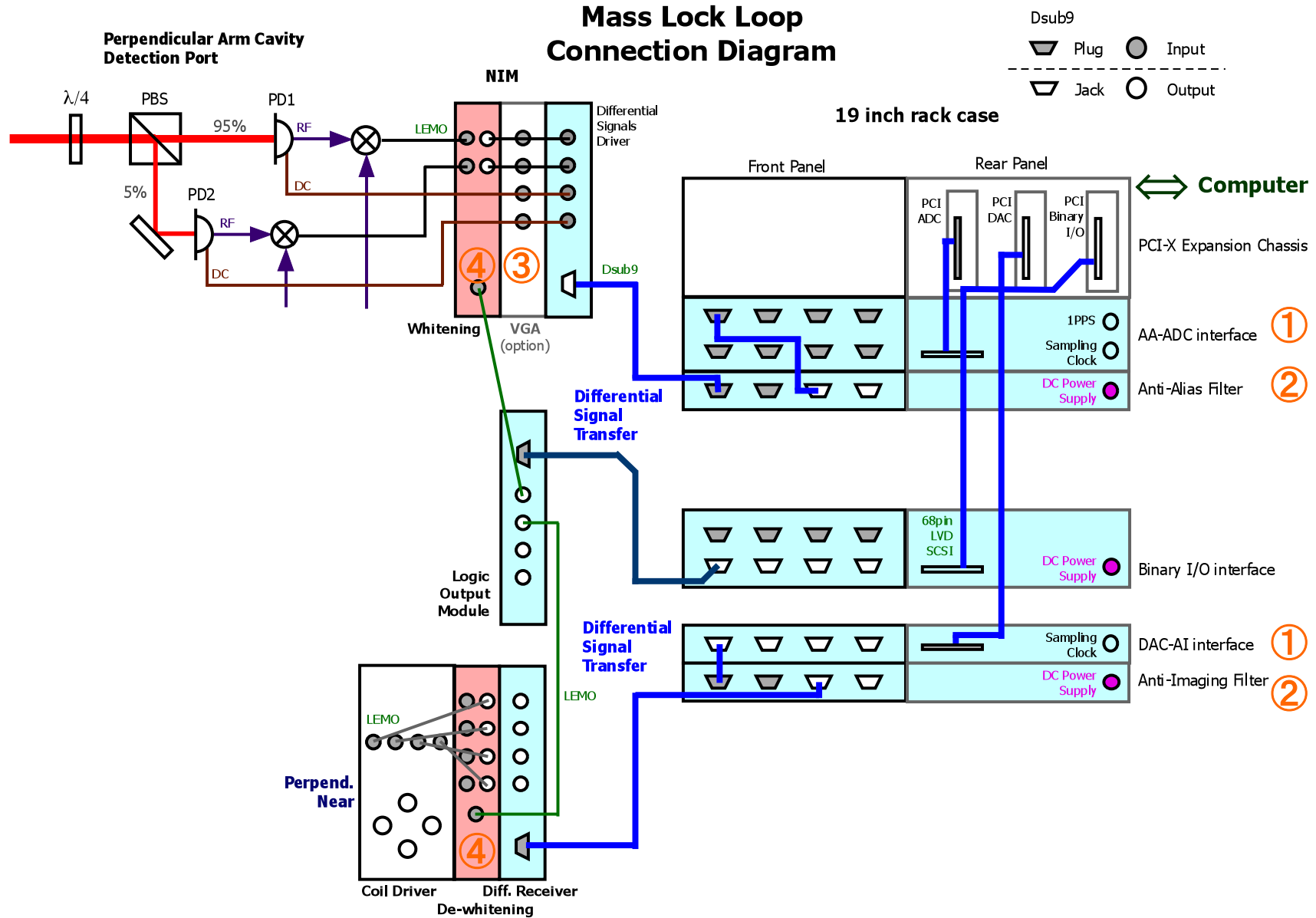
Anti Imaging filters 8ch/board

↓ To Real time PC



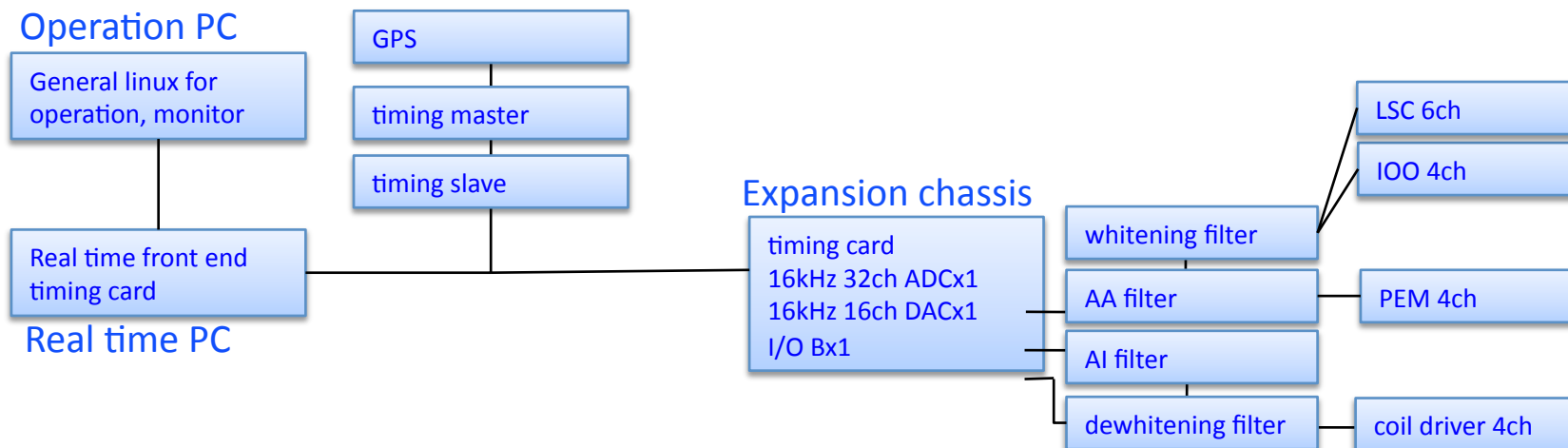


CLIO Digital Front-End





CLIO digital block diagram: 1st stage



Qty 1st	Qty2nd	final Qty	Part Number	Description	Vendor	Price	1st stage cost	2nd stage cost	total cost
1	0	1	Fire X4600 ?processors	Work station	SUN	11000	11000	0	11000
1	2	3		Expansion chassis	Dolphin or MAGMA	4000	4000	8000	12000
0	4	4		150m Fiber optical patch cableLC-LC Duplex MM	CDW	200	0	800	800
1	1	2		10m Fiber optical patch cableLC-LC Duplex MM	CDW	100	100	100	200
1	4	5	PCI66-16AI64SSA-64-50M	ADC Modules	General Standards	4000	4000	16000	20000
1	4	5	PCI66-16AO16-16-F0-DF	DAC Modules	General Standards	4000	4000	16000	20000
1	3	4	PCI-IIRO-16	Binary I/O Modules	CHASSIS PLANS	400	400	1200	1600
3	11	14		68pin SCSI cable		50	150	550	
							0	0	0
1	0	1		Matlab, simulink		2000	2000	0	2000
1	0	1		Real time linux core	Windrevier	2000	2000	0	2000
							32010	49970	81000