Overview: Goals, Resources, and Progress since last GP-Review

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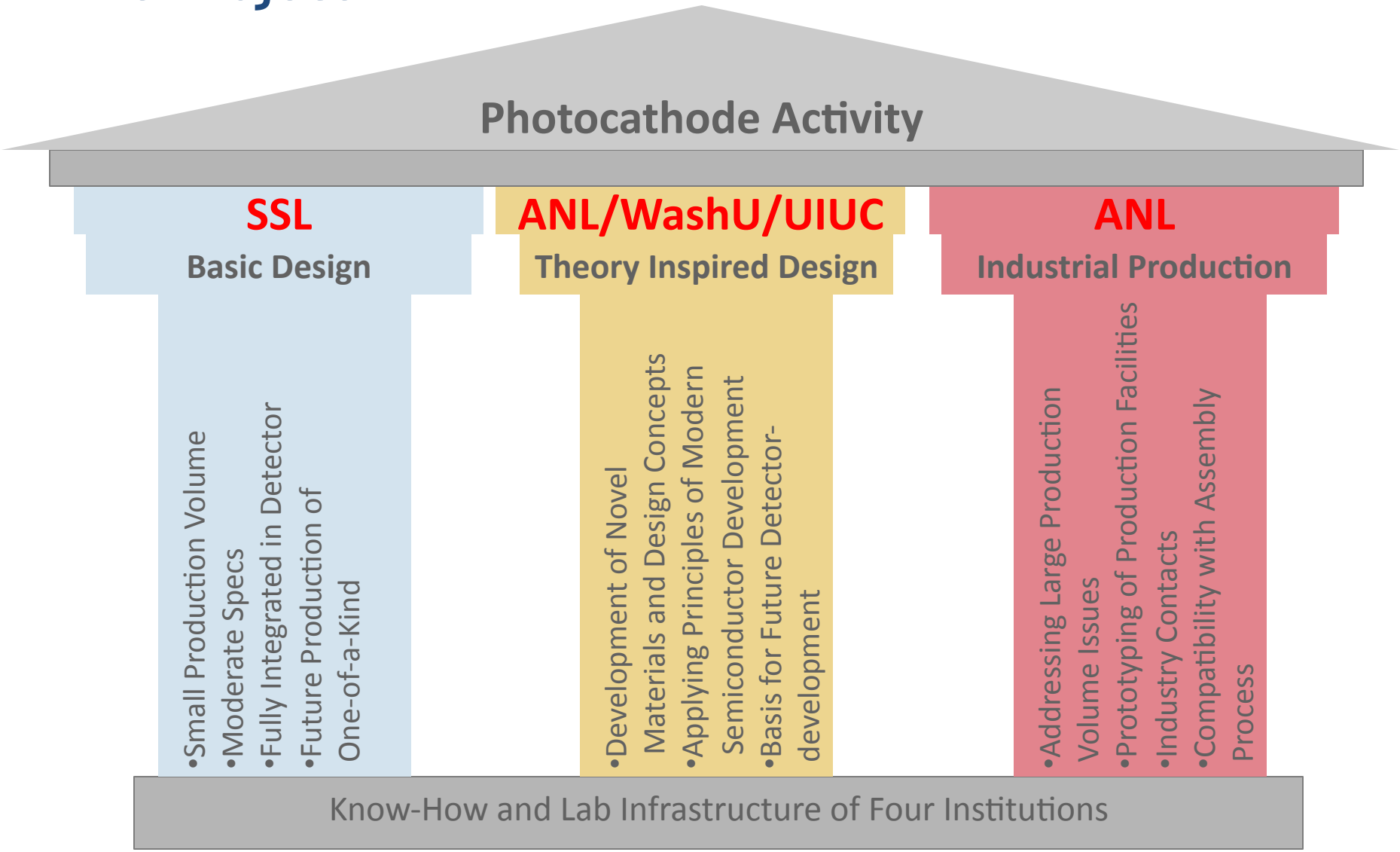
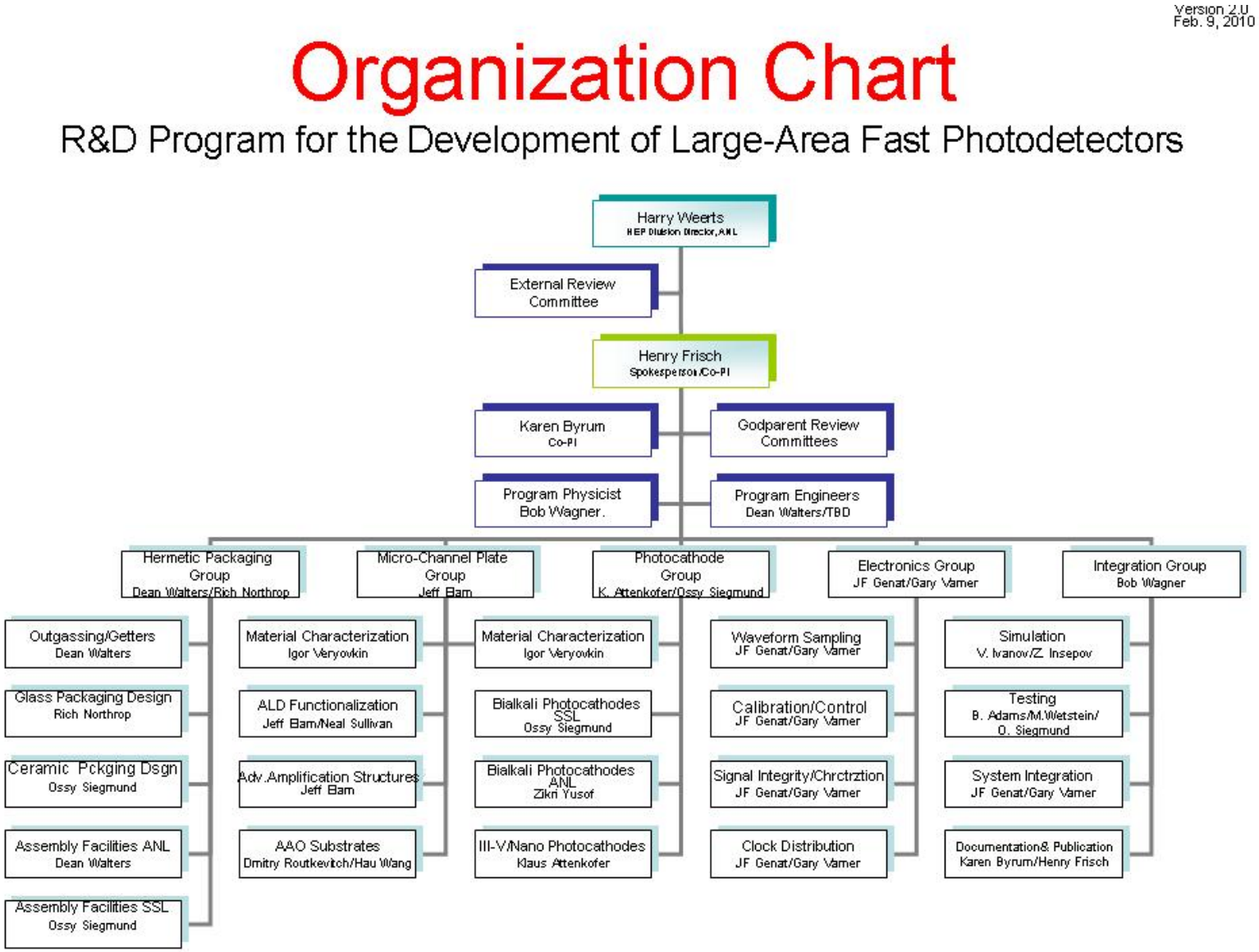
Photocathode Group

The Project


Photocathode Activity
SSL
Basic Design
•Small Production Volume
•Moderate Specs
•Fully Integrated in Detector
•Future Production of One-of-a-Kind
ANL/WashU/UIUC
Theory Inspired Design
•Development of Novel Materials and Design Concepts
•Applying Principles of Modern Semiconductor Development
•Basis for Future Detector-development
ANL
Industrial Production
•Addressing Large Production Volume Issues
•Prototyping of Production Facilities
•Industry Contacts
•Compatibility with Assembly Process
Know-How and Lab Infrastructure of Four Institutions

The Organization



The Goals of LAPPD (DOE-Milestones)

- Demonstration of gain of 106 and aging performance comparable to or better than that of commercial plates with a pair of capillary MCP plates functionalized by ALD;
- Development of an MCP test facility capable of handling 8” plates in tiles;
- Functionalization of an 8” × 8” glass capillary substrate with ALD;
- Observation of gain from an ALD-functionalized 8” × 8” MCP plate;

- Design and costing of a photocathode characterization facility;

- Design and costing of an 8” glass tile assembly facility.

“Internal Goals” of Photocathode Group

- Short term goals: end of second year (FY2011)
  - Creating a 8”x8” Photocathode with moderate QE (~20%) at 400nm
  - Installing all necessary infrastructure (besides production line at ANL)
  - Defining a clear scientific program to achieve high QE-PC’s

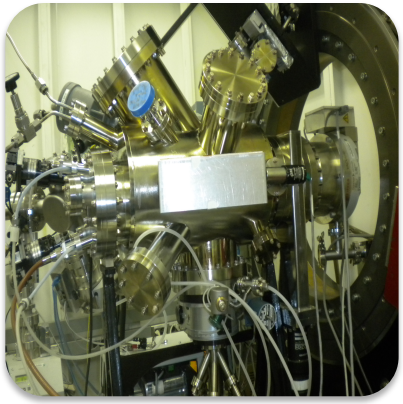
- Medium term goals: end of this program (end of FY2012)
  - Demonstrating a clear pathway for knowledge transfer of basic sciences program to production program
  - Developing at least one recipe with high QE (>25%) which can be produced in an industrial way
  - Demonstrating the feasibility of alternative cathodes (III-V)

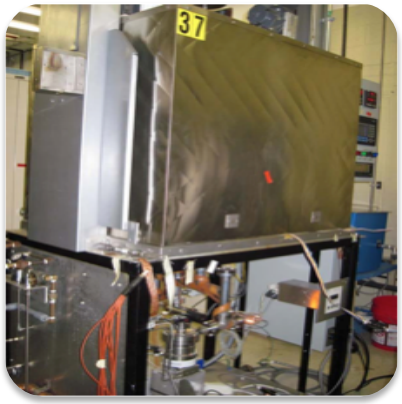
- Long term goals:
  - Photocathode with 50% QE and wavelength tuning
  - Establishing a photocathode center (collaboration with other labs) which enables
    - Access for general users
    - Cross-correlates most of the main “players”
    - Provides access to state-of-the-art basic sciences tools, fosters collaborations inside the community, and bridges the gap between basic sciences and industry
  - Finding new funding sources

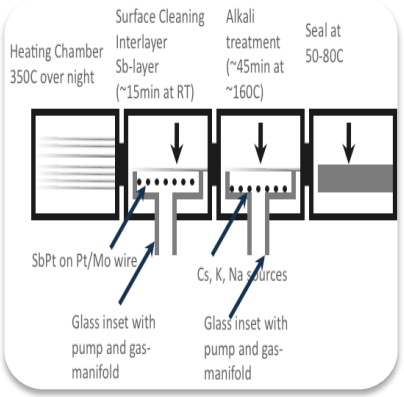
Resources: Infrastructure (Part I)

- SSL:
  - Production facility for “One-of-a-kind” detection systems (8”x8”)
    - Cathode growth is integrated with channel plate conditioning and seal
    - Various test facilities
  - Basic sciences program
    - Amorphous growth
    - Long term stability
    - …….
- WashU:
  - Research reactor (GaN) to grow 2” cathodes and seal it to a detector
  - Basic sciences program on Ga-nitrides
- UIUC:
  - Growth and characterization facilities for III-V materials
  - Program is integrated with ANL program

Resources: Infrastructure (Part II)







Basic Sciences Program

- Growth and Characterization Facility
- General Lab-Infrastructure
- User facility use
  - APS
  - NSLS
  - Nano center BNL/ANL

Large Area Development

- Burel Equipment
- Source Development Infrastructure

Production Unit (8”x8”) (not yet existing)

- Test Facility for Recipe optimization (Industrial standard)
- Detector Integration Facility

Resources: People

- Management: Marcel Demarteau, Henry Frisch, Bob Wagner
- SSL:
  - Oswald Siegmund
- WashU
  - Jim Buckley, Dan Leopold
- UIUC
  - Ryan Dowdy, Xiuling Li (not funded), Klaus Attenkofer (ANL)
- ANL:
  - Klaus Attenkofer, Zikri Yusof, Seon Woo Lee, Bob Wagner, Dean Walters, Junqi Xie, Alexander Paramonov, Joe Gregor
  - Fermi: Greg Selberg, Anatoly Ronzhin

Progress since last GP-Review SSL

- Focusing on NaK_2Sb –cathodes (conductivity)
- Demonstration of 20-25% QE on small format (33mm)
- Major progress in 8”x8” production facility installation
- Redesign and refinement of evaporation sources

Progress since last GP-Review WashU

- Study of multiple Cs-activation effect
- Ready to grow GaN amorphously on glass

Progress since last GP-Review
ANL & UIUC

- Basic Sciences:
  - Development of Program
  - Start of lab infrastructure at Bldg 360
  - Usage of general user facilities: APS, NSLS, nano center at BNL
  - First scientific successes: insitu thickness & roughness monitor, first insights in Sb-growth
  - Design of press to bond GaAs to glass; first tests with GaAs as cathode
- Large area PC
  - Commissioning of Burle-equipment
  - Major progress in the design of glass ware for 4”x4” cathode
- Production facility
  - First design concepts of facility and handling system
  - First discussions on details of lab-infrastructure

Conclusion

- Program is separated in three different sections
  - Demonstration of small volume 8”x8” cathodes (SSL)
  - Basic sciences program addressing:
    - Basic understanding of correlations between recipe and functionality
    - Development of 50% QE cathode
    - Help do convert recipes from one-of-a-kind to 8”x8” production conditions
  - “Industrial” branch will allow
    - to transfer technology to industry
    - To produce small amount of detectors for demonstration and feasibility purpose
- Progress
  - Major progress was made (even with small delay)
  - Lots of footwork will come
  - Progress is demonstrated by strong contribution to conferences