Argonne NATIONAL LABORATORY

Advanced Planning

High Current Beamline Diagnostic Run 2013-1

April 24, 2013

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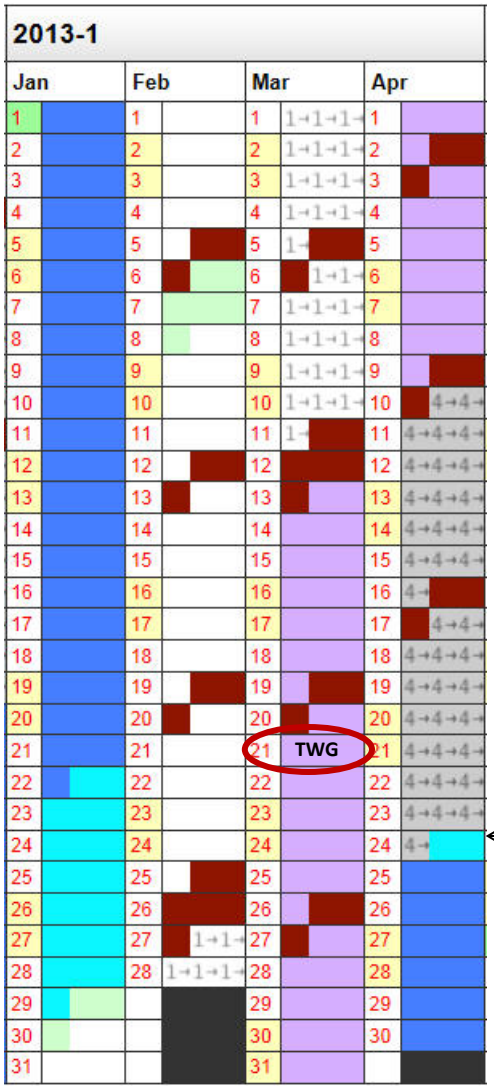
U.S. DEPARTMENT OF ENERGY | Office of Science

Upcoming High Current, Beamline Diagnostic Opportunity



- **16 hours of (up to) 150 mA operations**
  - April 24 from 8:00 AM to 12:00 Midnight
  - Bonus time! Post user-run
  - Pure optics diagnostic beam

- **A unique opportunity -**
  ex. prior ID High Current Beam Runs (since 1996)*
  - 4/1/2002 130mA 23 bunch 5hr
  - 6/24/2002 130mA 23 bunch 8hr
  - 8/23/2012† 150mA 324 bunch 6hr

* From K. Harkay , et.al. "APS Higher-Current Operation Milestones ", AOP-TN-2011-13, Rev3 (January 25, 2013) APS_1423957.

† Participating Beamlines: 13-ID, 16-ID, 16-BM, 21-ID, 23-ID, 24-ID, 26-ID, 30-ID, 34-ID

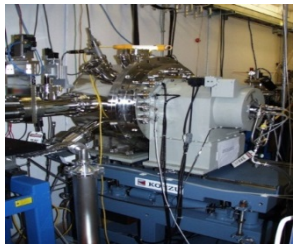
- ***Purpose:***
  - ***Inform you of this opportunity***
  - ***Convince you to take advantage***
  - ***Solicit your feedback***

Motivation

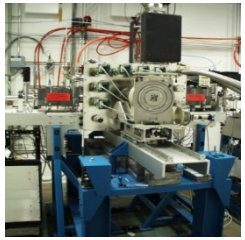
- **APS will be operating at 150 mA in 2019** ***(APS-U KPP)***
  - APS-U committed to insuring all beamlines can operate *(APSU WBS 1.04.04)*

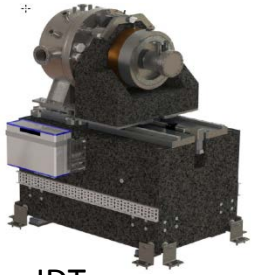
- **Individual beamlines need to:**
  - Evaluate their optics performance at those power loads
  - Plan for remediation, retrofit or replacement of inadequate optical elements

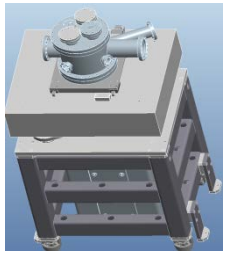
Problem: MANY monochromator & mirror styles


Kohzu


Accel


Rosenbaum


IDT


JJ X-ray

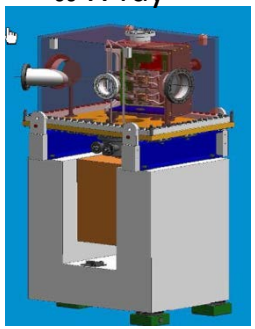

PSL / U Wisconsin


Bruker

BESSRC Design

FMB Oxford


VG/Daresbury


Oxford-Danfysik

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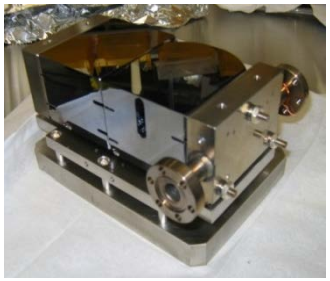
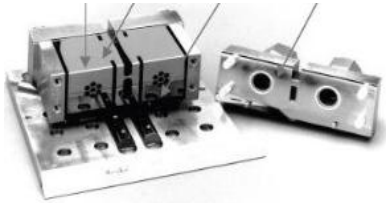
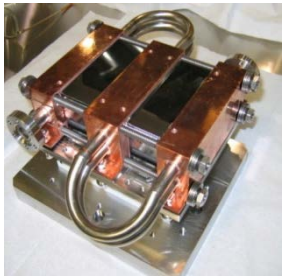

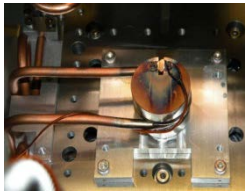


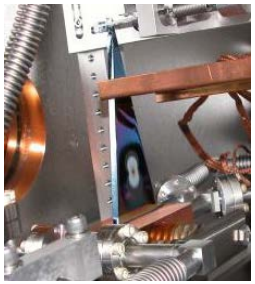
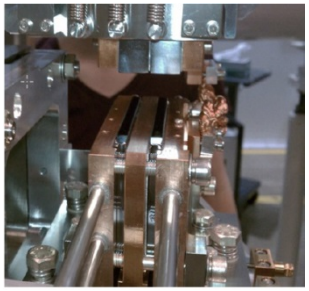

Problem: MANY first crystal designs

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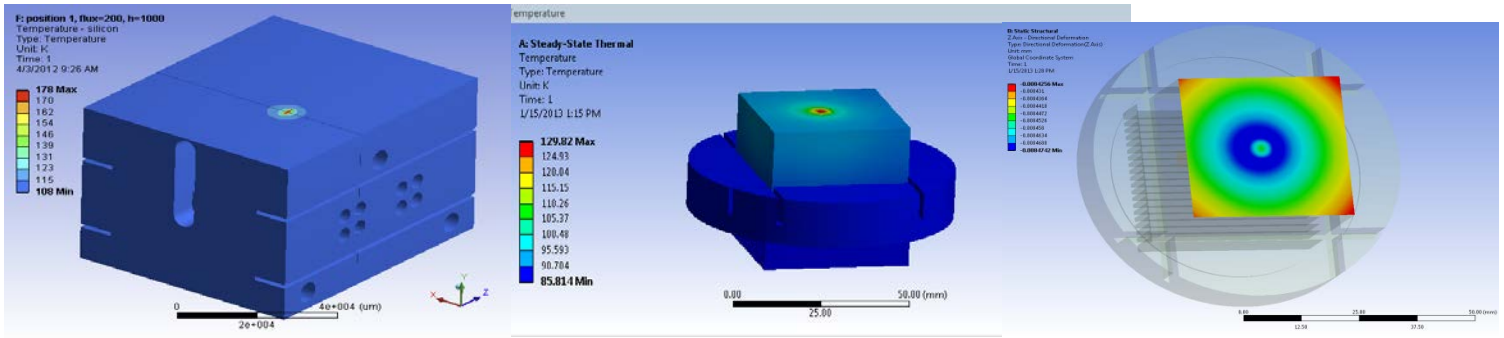
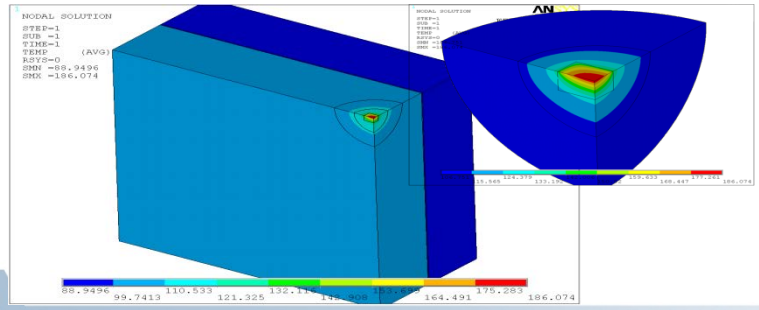
Problem: Too many analyses to do

High Heat Load Monochromator Working Group – Contact Al Macrander





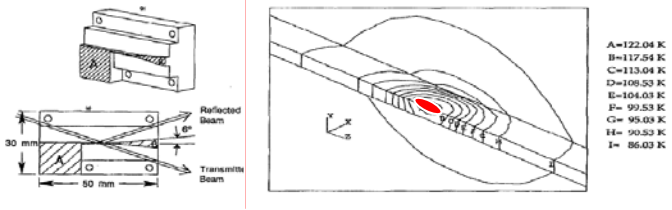


Image Credits: Strons, Khounsary, Z.P.Liu, Macrander

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- **"…but why think, why not try the experiment?"**
  - — John Hunter *Letter to Edward Jenner* (August 02, 1775)

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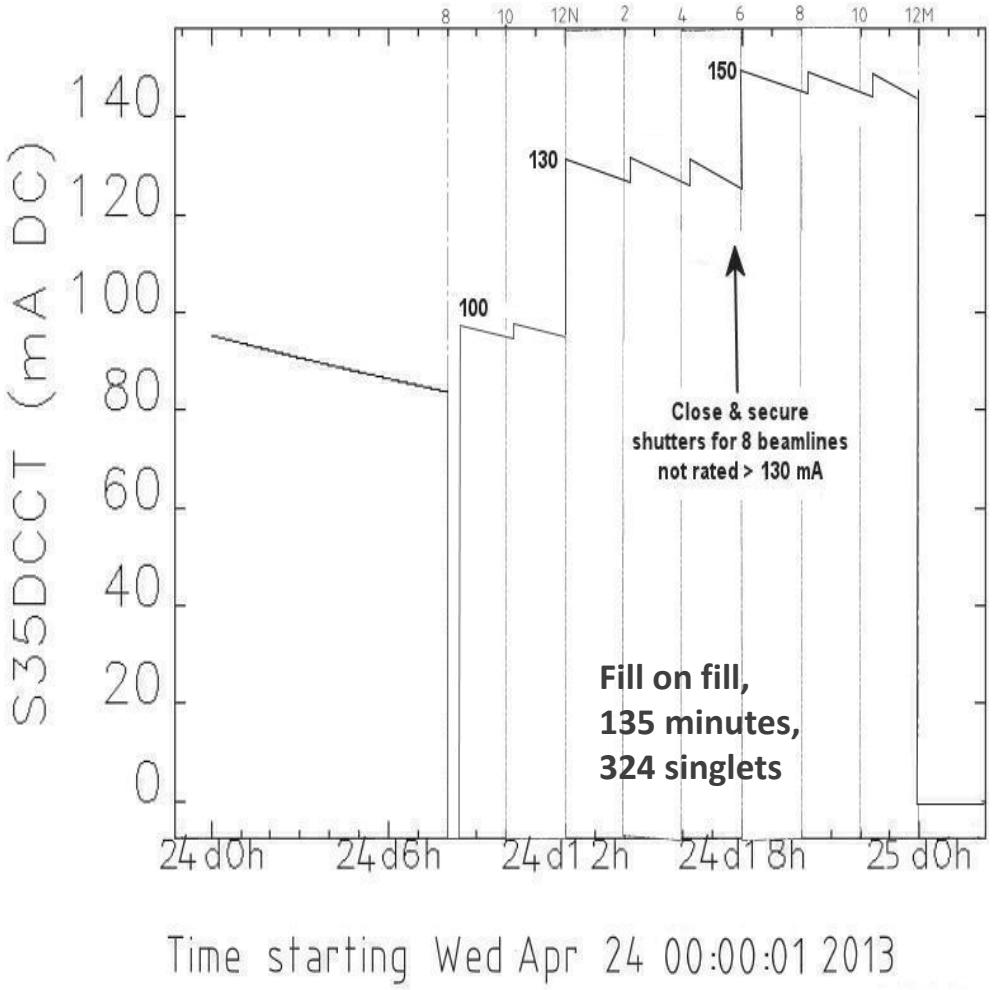
- **Why now? Why such a long lead-time?**
  - **Need to identify weakest links**
    - Which components need what level of help
  - **Evaluate solutions**
    - Solutions may be simple:
      - beam-limiting apertures or pinholes, slits, filters, source, shielding
    - Solutions may be unknown: R&D needed
  - **Find funding**
    - Combinations of sponsors, matching funds or APS-U support
  - **Schedule, acquire, build, install, test & commission**

Proposal: Three Step 100/130/150mA Run (simulation)

4^h @ 100 mA > 6^h @ 130 mA > 6^h @ 150 mA



- **Pros:**
  - **Beam-dump / shutters close = end of user run**
  - **Time to re-tune & document baseline optics performance @ 100mA.**
  - **Systematic**
  - **6 hours @ each high IAPS allows for stabilization**

Who Can Take Advantage ?

Constraints: Radiation Safety System Components

WARNING: This Does Not Take Into Account Non-RSS Beamline Components

BM Lines:

- **Everyone:** APS storage ring components & BM X-ray shutters - designed for 300 mA

ID Lines:

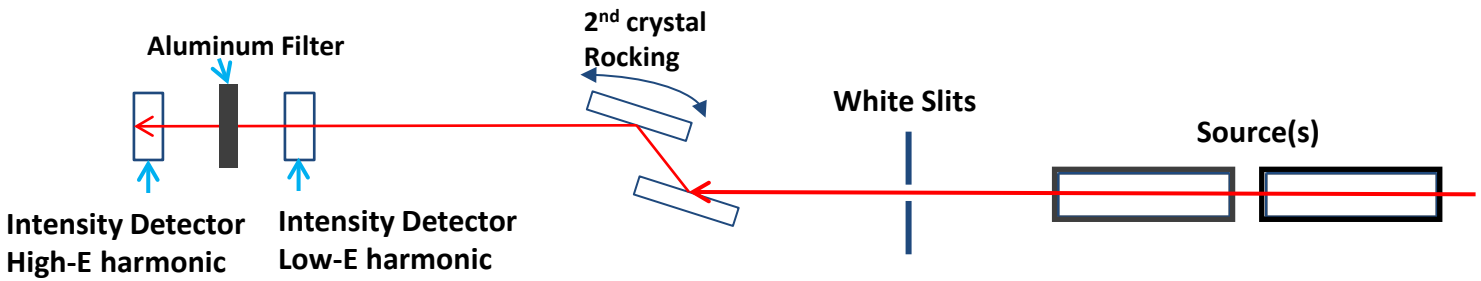
- (18) ID Beamlines OK to operate at 130 mA without restrictions
  - 5, 7, 10, **13,** 15, **16,** 17, 20, **21,** 22, **23, 24, 26, 29, 30, 31, 32, 34**
- (11) ID Beamlines OK to operate at 150 mA without restrictions
  - **13, 16, 21, 23, 24, 26, 29, 30, 31, 32, 34**
- Other ID Beamlines
  - Make a proposal for restricted operations (limited gap / specific configuration)
  - Use criteria as described in ANL/APS/TB-50, Section 2.4
  - Submit plan to Bill Ruzicka (ruzicka@aps.anl.gov)

Suggested Optics Evaluations

1. **Work in your beamline's operational 'sweet-spot'**
   - Protect your beamline with gap, filters, slits, flows, etc.
   - Move to high-power conditions, most closed-gap, if time permits.

2. **Document your variable operating conditions**
   - Document: current, undulator E (or gap) , slit settings, coolant flow (if variable) , relevant temperature readings, etc.

3. **Conduct Optics Evaluations**
   - If a Monochromator is your 1st HHL optical element
     - Measure rocking curves (rock Θ_2 at fixed Θ_1)



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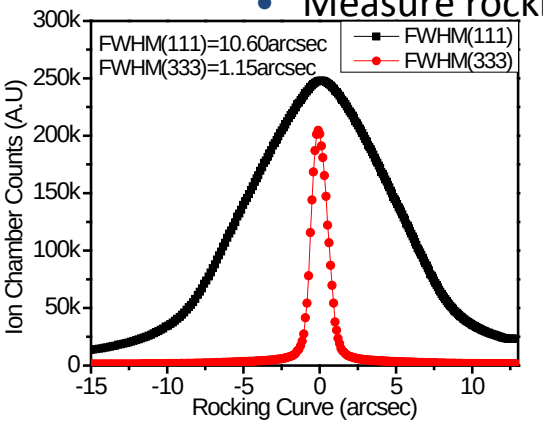
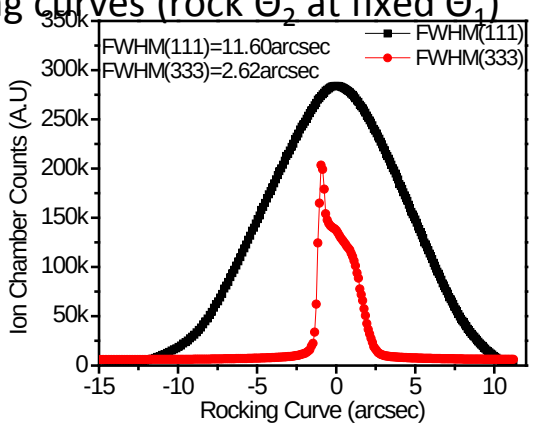
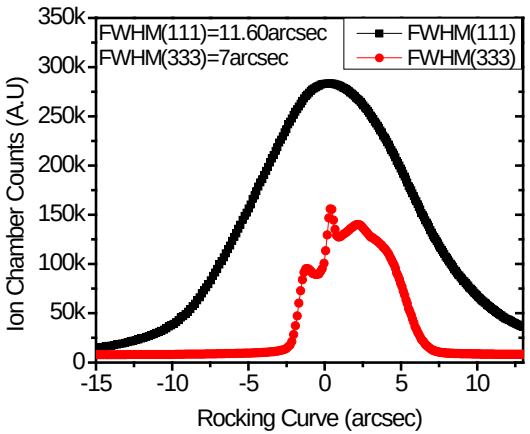


Near Ideal



Some Distortion



Severe Distortion

Plots from: N. Kujala, et.al. SRI2012

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3. **Conduct Optics Evaluations**
   - If a Monochromator is your 1st HHL optical element
     - Measure rocking curves (rock Θ_2 at fixed Θ_1)
   - If a Focusing / Collimating Mirror is your 1st HHL optical element
     - Measure focal spot size & size changes + relevant temperature monitoring

4. **Feedback in 2+ weeks (May 10, 2013) to Julie O. Cross (jox@aps.anl.gov)**

5. **Global results will be highly disseminated & communicated**

Actions

- **Based on feedback from this meeting:**
  - Will request I_{APS} profile at Operations Directorate Meeting on Monday, 3/25
  - Negotiating shared needs for beam with ASD (Machine Studies) & SCU-0

- **If your ID beamline is not on the '130 & 150 mA operations' list**
  - Make a plan
  - Submit to Bill Ruzicka (ruzicka@aps.anl.gov) cc: Julie Cross (jox@aps.anl.gov)
  - Deadline Wednesday April 03, 2013

- **If you plan to participate:**
  - e-mail to Julie Cross (jox@aps.anl.gov)
  - This is the key to getting your shutters enabled during the MS period
  - A brief '**experiment plan** ' would be appreciated
  - Deadline Wednesday April 17, 2013

Resources

- **THIS presentation**
  - InterCAT Technical Workgroup (TWG) Archives
    (http://www.aps.anl.gov/About/Committees/InterCAT_Technical_Workgroup/archive.htm#year-2013)
  - ICMS_1436456
    (https://icmsdocs.aps.anl.gov/docs/idcplg?IdcService=DISPLAY_URL&dDocName=APS_1436456)
  - e-mail me: navrotski@anl.gov

- **High-Heat-Load Monochromator Working Group**
  - Technical: Al Macrander (macrander@aps.anl.gov)
  - Mailing List: Becky Forsythe (forsythe@aps.anl.gov)

- **Link on APS Main Page**

- **Technical assistance**
  - e-mail me: navrotski@anl.gov

END

Post-presentation Audience Suggestions:
(From TWG Presentation 21 Mar 2013)

- **Beamline limitations**
  - Users request a posting of RSS component(s) list restricting higher current operations, not only for this high current run, but also for future upgrades.

- **Current vs. Time schemes:**
  - User discussion results in request for a fill 'pause' for 30 minutes at every 10 mA increment. Reasons: caution, quick data collection for 'more points on the trend curve'.
  - Schematic illustration of beam profile: