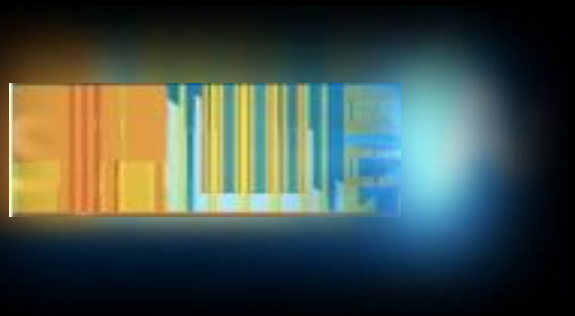

Performance and Power Analysis Utilizing Intel® Performance Bottleneck Analyzer (PBA)

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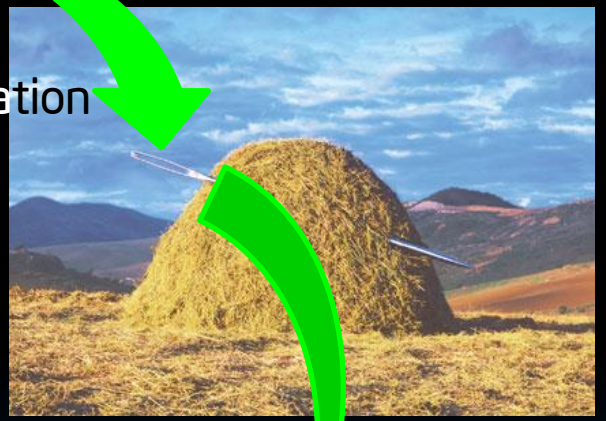
Taking Advantage of Engineering Innovation Through Tools

Issue Identified by Hand

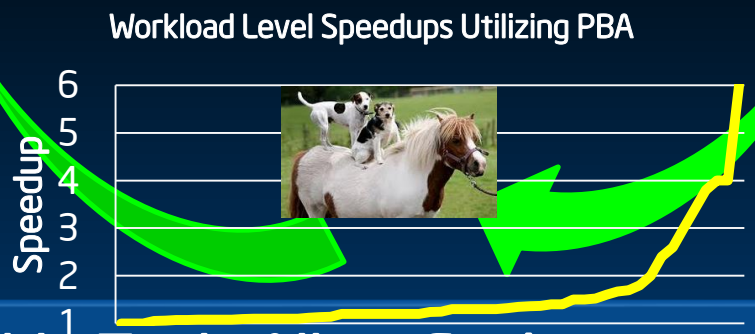
Automatic Identification



Innovation to Drive Automatic Identification

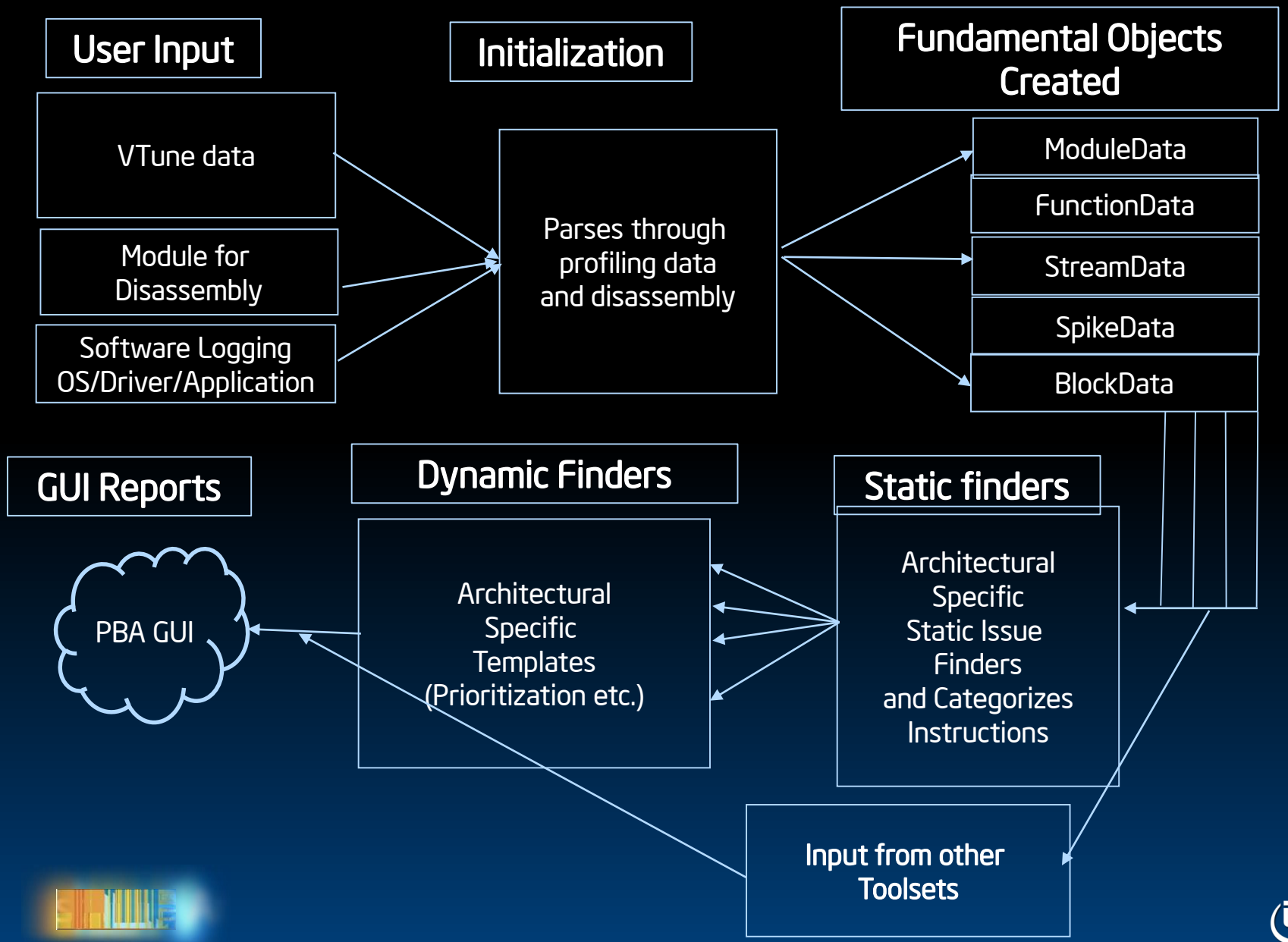
Capability is improved by other engineers

Automated capability used by other engineers

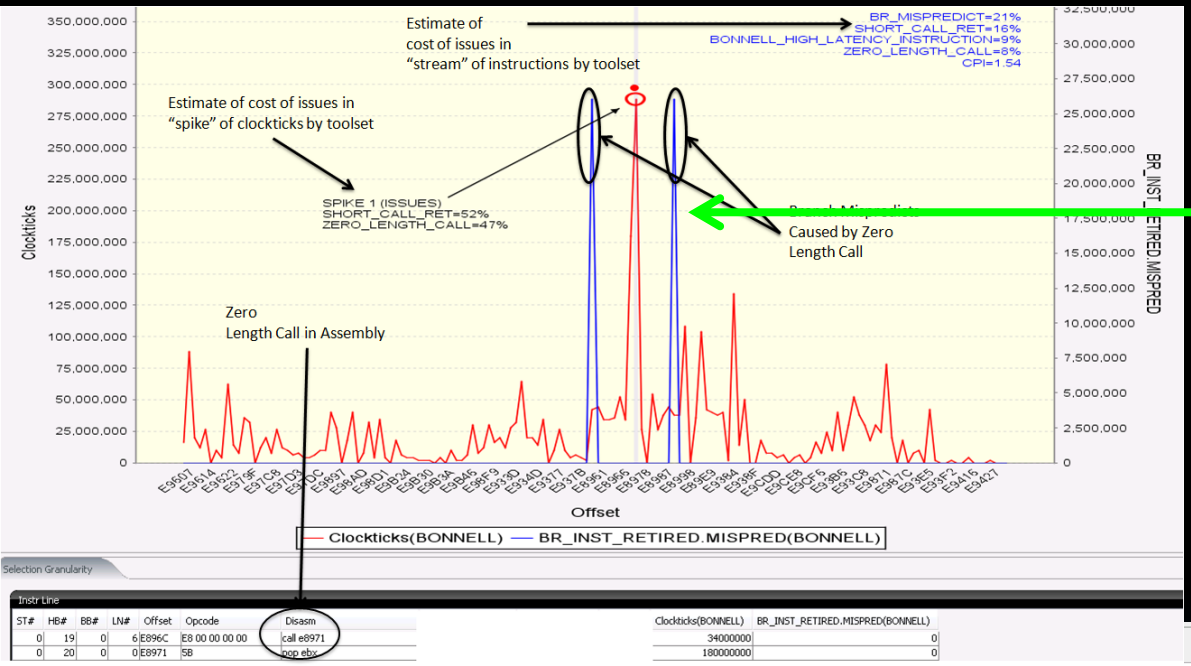


Extensible Tools Allow Engineers to Attack Difficult Problems as a Community

Intel® PBA Flow of Analysis

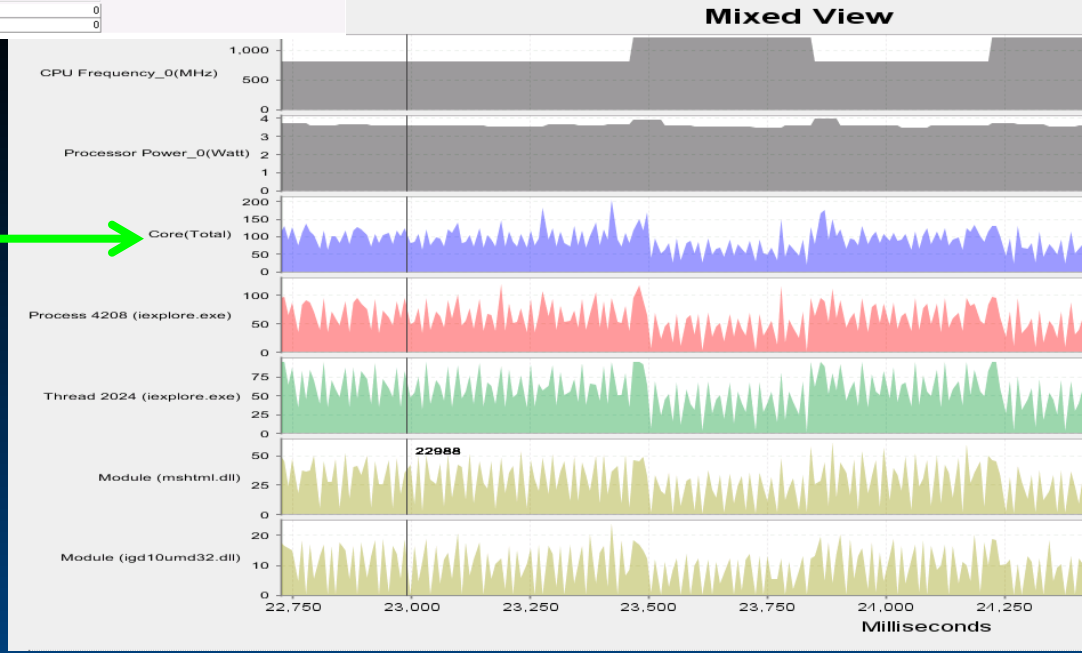


2 Primary Views of PBA: Replacing This



#1 Streams: Recreate paths of execution

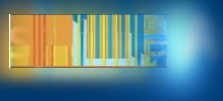
#2 Overtime: CPU, Process, Module, Function Frequency, Power, SW Event, etc.



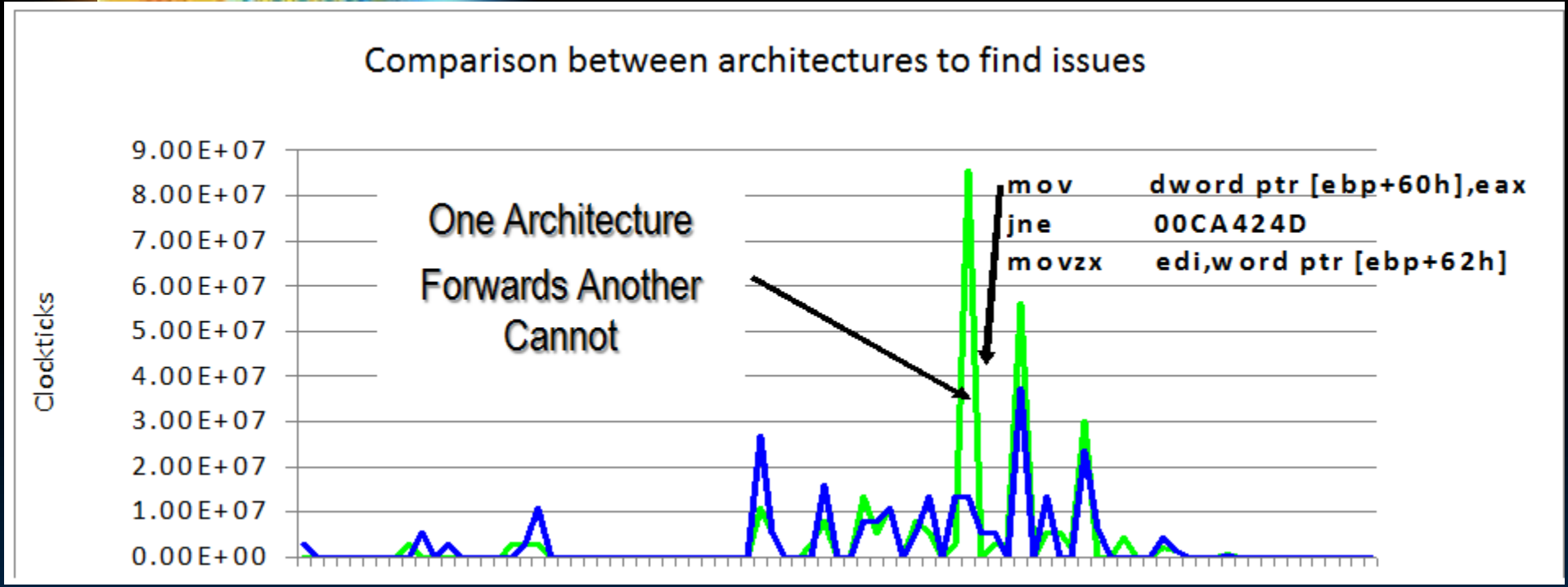
What is A Stream?

- Reconstructing the flow of basic blocks
- Shows flow of instructions as it ran on the core
- We pull all events along the stream for a "Poor-mans" pipe trace
- Find and reconstruct loops as a granularity
- Catches issues across branches

Address	Instruction
30AA668A	call 30AA63F7
30AA63F7	mov ecx, dword ptr [edi]
30AA63FF	sar ebx, 18h
30AA6403	mov esi, eax
30AA6405	js 30AA64D8
30AA640B	movzx eax, word ptr [edi+4]
30AA640F	cmp ax, 0FFFEh
30AA6413	je 30AA647B
30AA647B	movzx eax, word ptr [edi+4]



Comparing Architectures with Streams

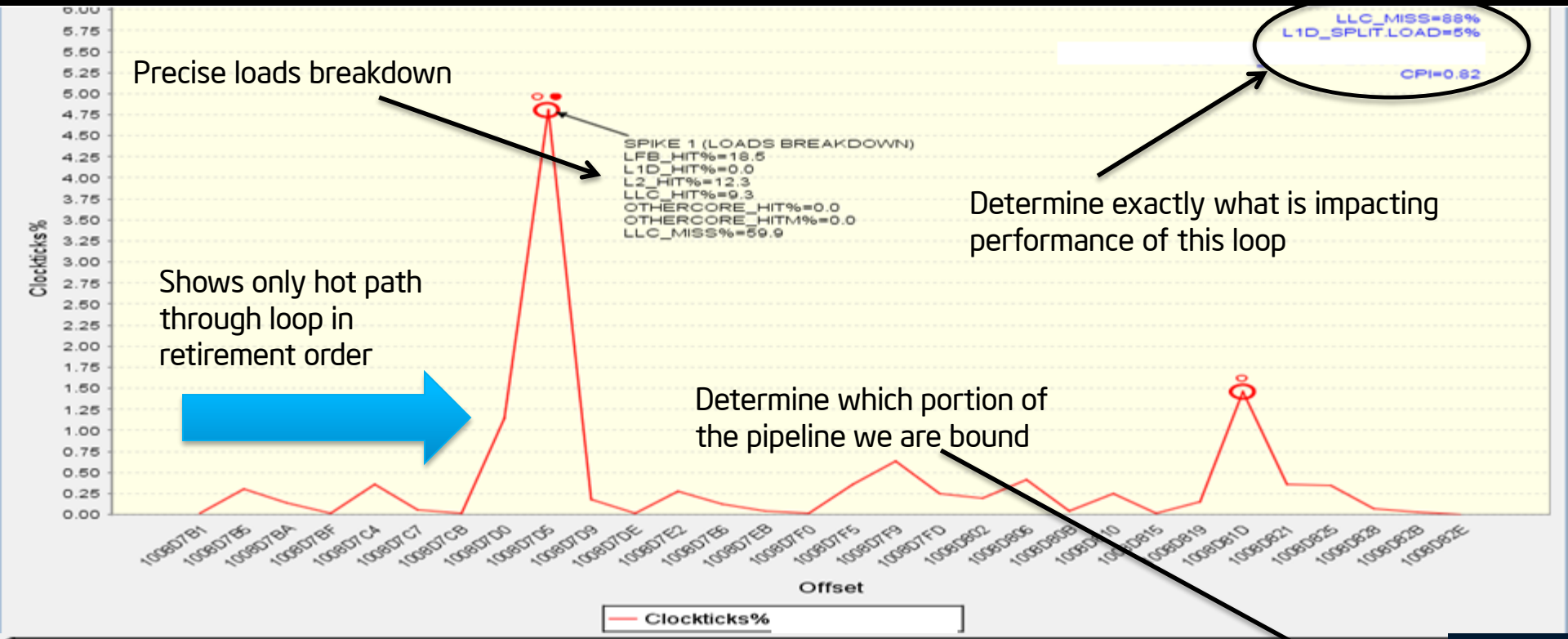


Streams Allow Us To Find Issues Across Branch Boundaries

DEMO #1 Streams:

"If you want micro-architectural issues fixed…make it easy"

Streams: Summary of Determining Issues in a Loop

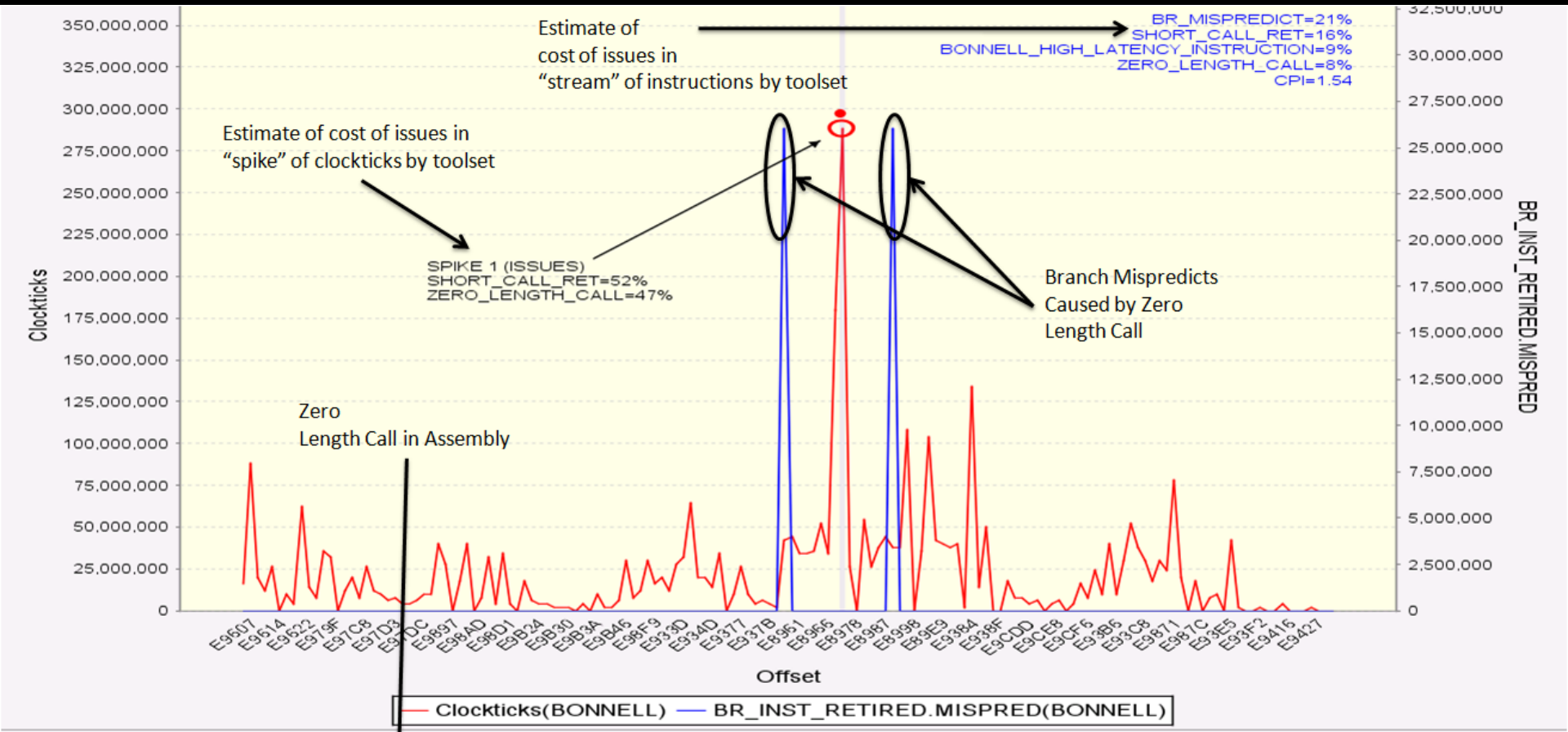


LoopStream

ST#	Offset	HitCount	Avg Trip Count	Clockticks...	FrontEnd%...	BadSpeculation%...	Retiring%...	BackEndBound%...
6	1008D7B1	167600000	12.0	12.11	0.95	0.00	31.74	67.31

Get accurate loop trip count
With no instrumentation using LBR

Streams: Correlating Static and Dynamic Identification



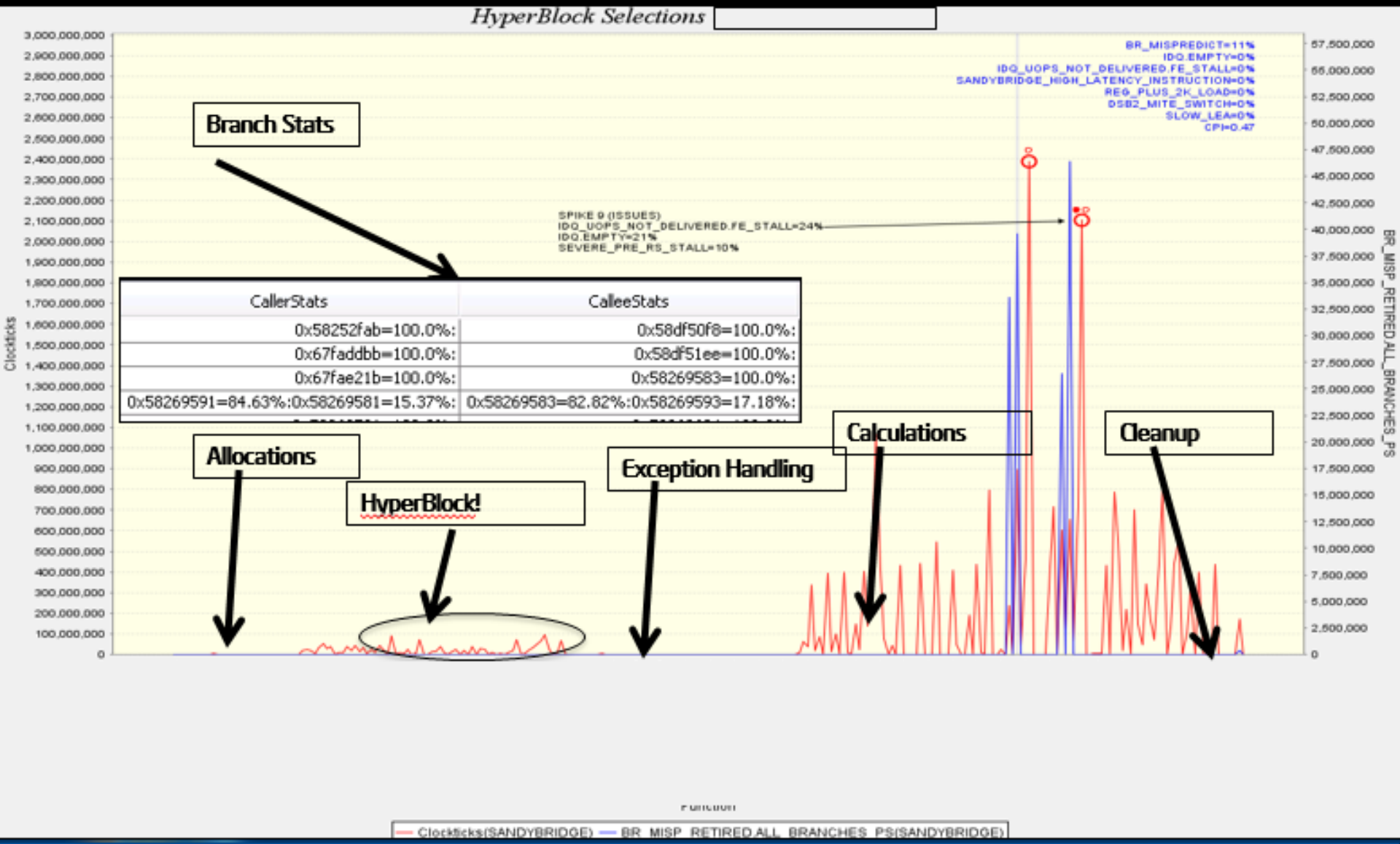
Selection Granularity

Instr Line

ST#	HB#	BB#	LN#	Offset	Opcode	Disasm	Clockticks(BONNELL)	BR_INST_RETIRED.MISPRED(BONNELL)	Static ASM Notes
0	19	0	6	E896C	E8 00 00 00 00	call e8971	34000000	0	AGEN_STALL:ZERO_LENGTH_CALL
0	20	0	0	E8971	5B	pop ebx	180000000	0	SHORT_CALL_RET

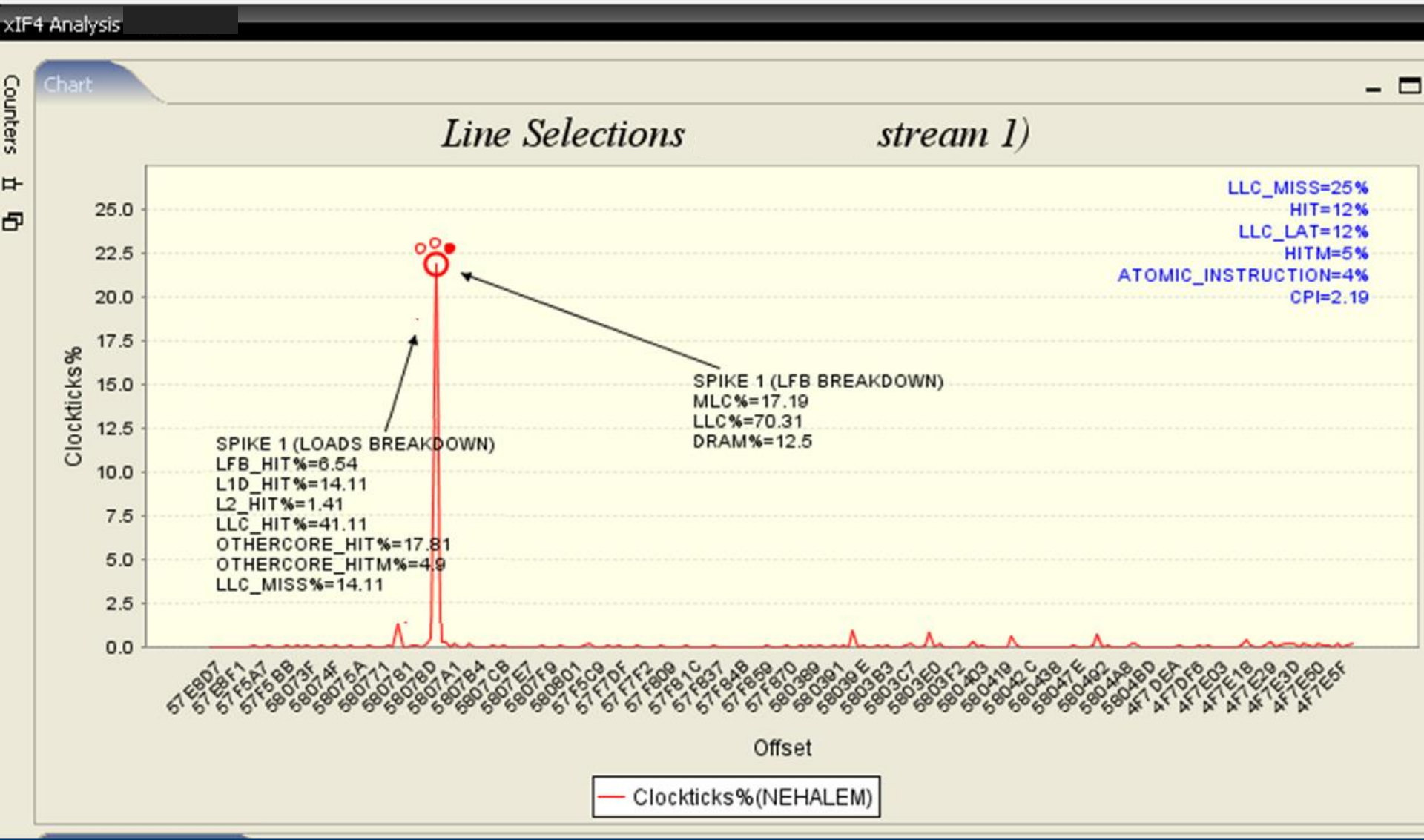
PBA Relates Static ASM with Events

Streams: Assist in Creating Larger and Larger Streams



Streams Created with Last Branch Records Produce Greater Context

Streams: Loads and LFB Breakdown



PBA Displays Where Problematic Loads are Satisfied

Theme #2 JIT Explosion: "Everyone is writing a JIT Nowadays"

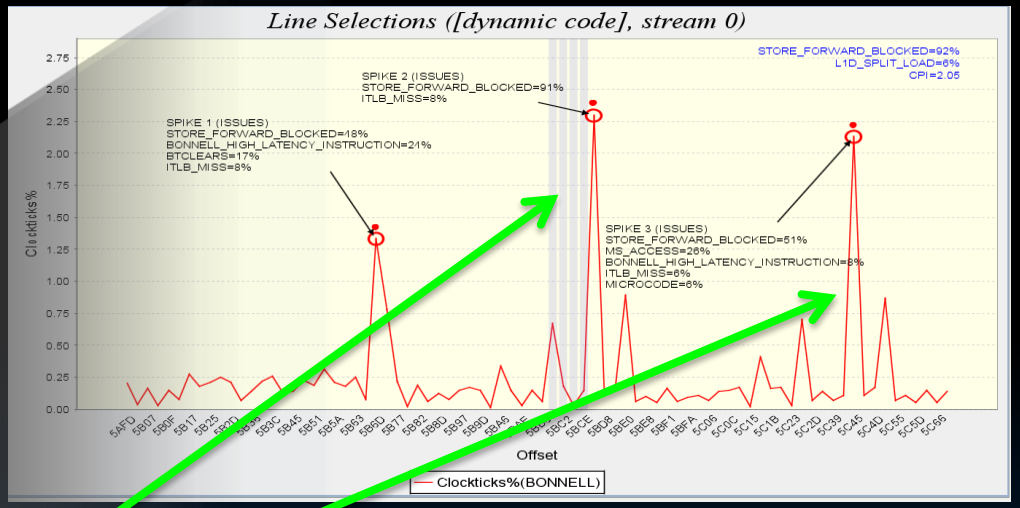
Vtune JIT APIs picked up by xIF

JIT Explosion

Javascript JITs

Win8 Apps, Dalvik

Automated Code Gen Analysis for JITs



xIF automatically identifying issues in JIT

Theme #2 Short Non-Steady State Workloads Becoming Critical

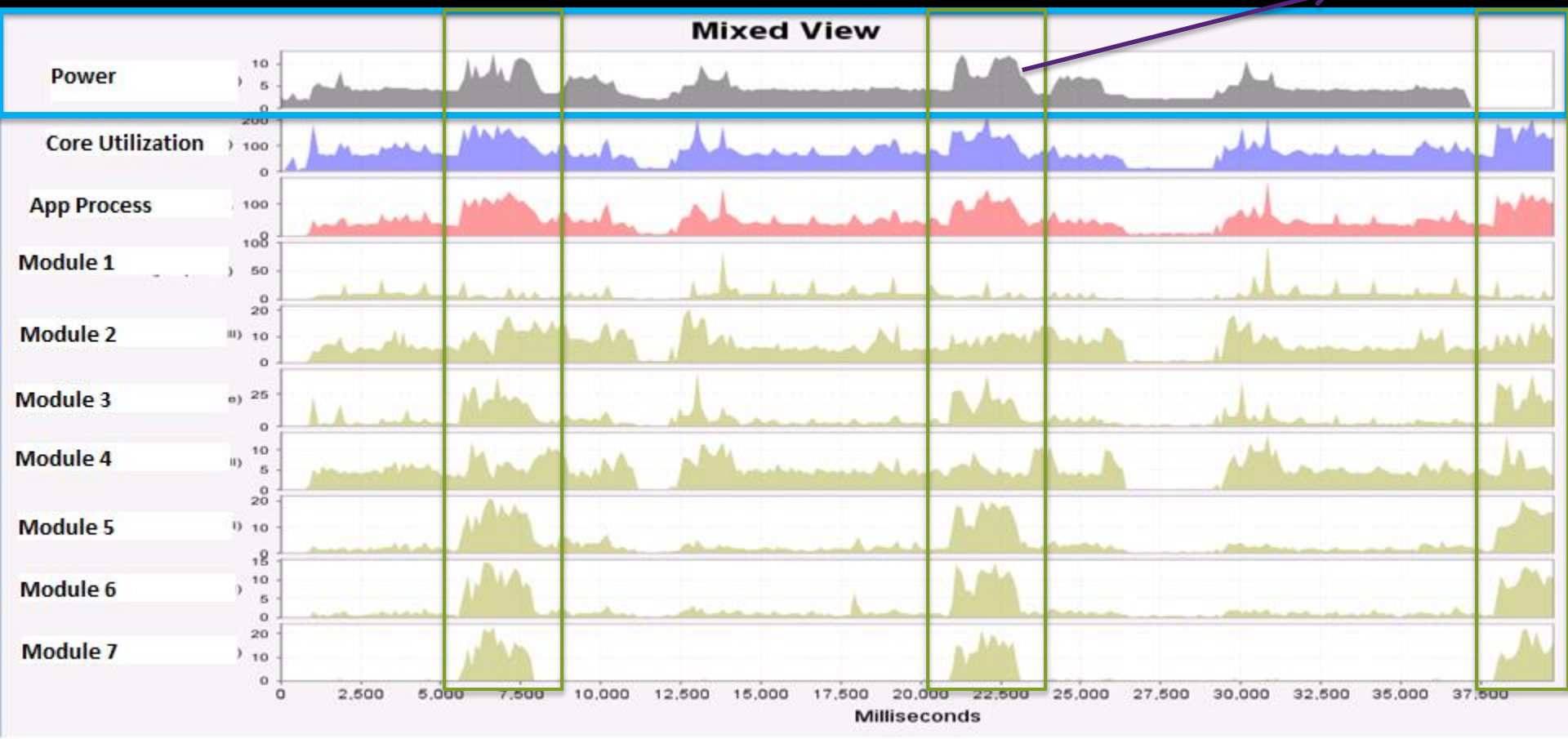
“Debugging in the Millisecond Timeframe”

DEMO TOUCH DEBUG

Theme #2 Power:

“Power and performance are two sides of the same coin”

Power Correlation using Intel® PBA



- Package power intermittently jumping high

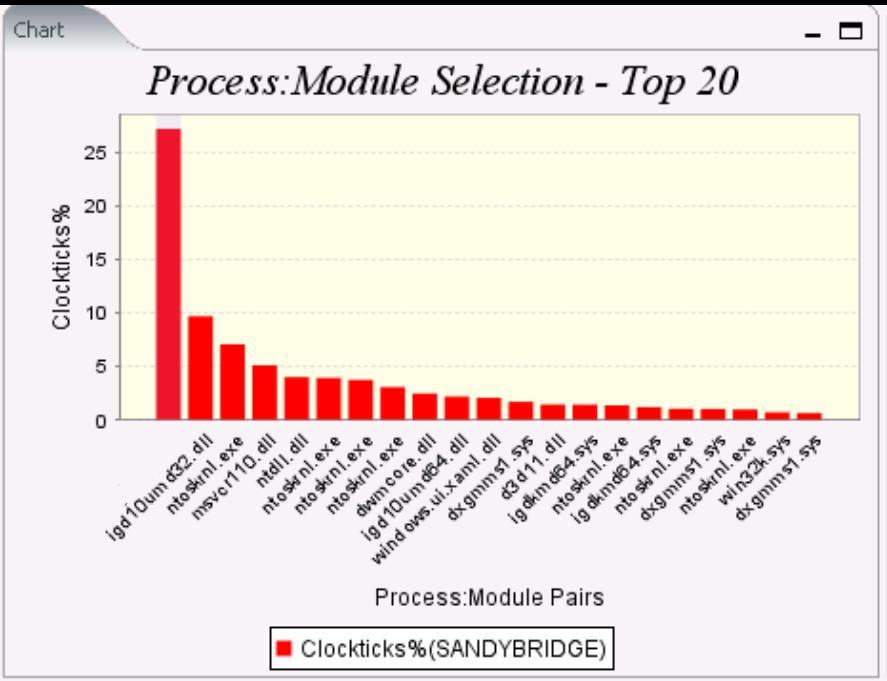
Automatically Determine Causes of High Power

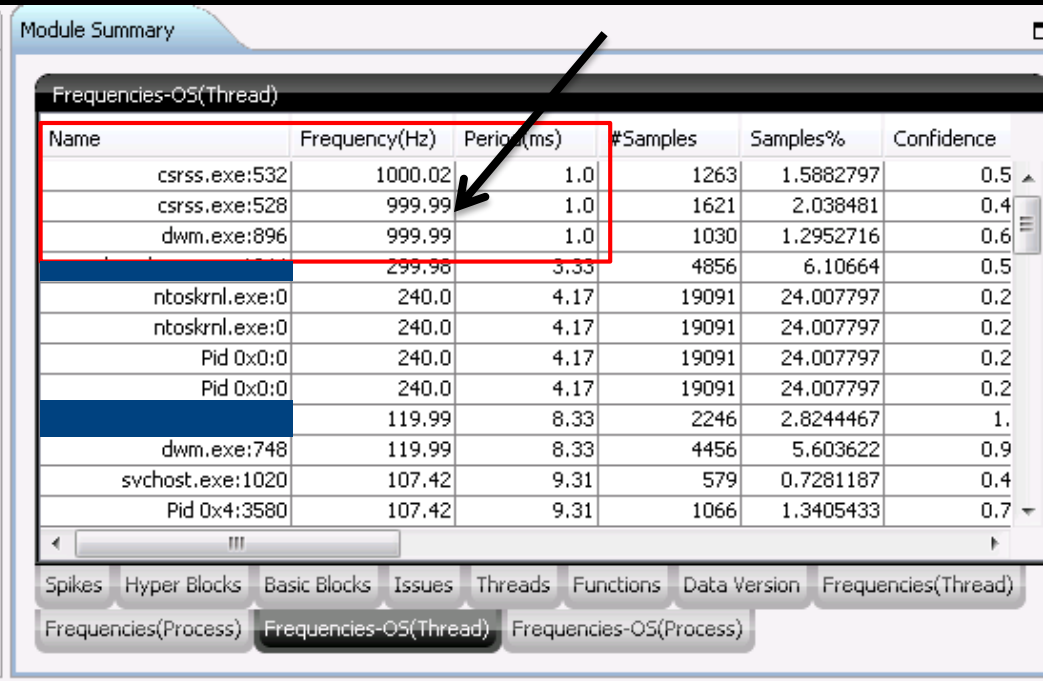
Module_Name	Clocktick High Power%	Clockticks Low Power%
AppProcess:mshtml.dll	15.3	9.39
AppProcess:ntoskrnl.exe	10.64	5.12
AppProcess:ntdll.dll	7.92	2.5
AppProcess:oleaut32.dll	5.95	0.15
AppProcess:igd10umd64.dll	5.57	7.23
AppProcess:msvcrt.dll	4.89	1.3

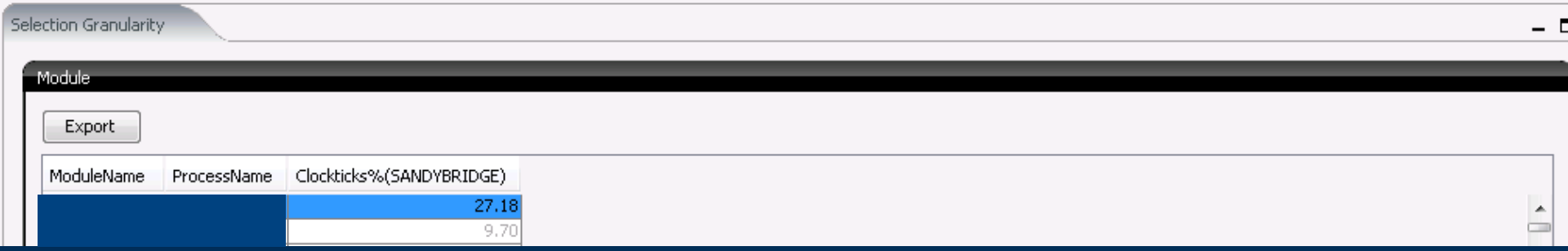
Loading Library is Causing High Power

Shifting to Power Analysis

1ms activities
wasting power!







Calculating Frequency of Activities is Powerful for Performance

CERN Collider Proposal

Conclusion

- Intel® PBA post-processes data collected using Intel® VTune to automatically call out micro-architectural and SoC issues
- Issue identification capabilities increased by order of magnitude using streams
- PBA provides extensibility by specifying rules for various architectures in a configuration file
- Overtime views, UX and power analysis are new capabilities that augment existing functionalities