Worldwide Pollution Control Association

Duke Energy Seminar

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AIG Tuning Do‘s and Don‘ts

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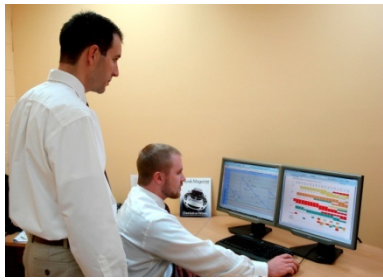
AIG Tuning – Part of Proper SCR Management

- **Evonik's utility experience has proven the necessity of annual AIG system tuning:**
  - **Maximizes NOx removal efficiency**
  - **Optimizes SCR operation**
  - **Optimizes AIG system operation**
  - **Reduces NH_3 consumption**
  - **Minimizes ammonia (NH_3) slip**
  - **Reduces O & M costs**
  - **Compare catalyst sampling results with expected results / deactivation**

ECOS AIG Tuning Truck

Keys To Successful AIG Tuning – Do's and Don'ts



Review System Documentation

- **Pre-tuning Preparations**
  - **On-site inspection of the AIG system**
  - **Review system information (drawings, diagrams, etc.)**
    - **SCR layout**
    - **Ammonia injection grid design**
    - **Sampling grid design**
  - **Confirm there is a fixed installed sampling grid after the last catalyst layer**
  - **Review AIG equipment availability**
    - **Are there differential pressure transmitters or gauges on the tuning valves (indicator of changes being made)?**
    - **Are the tuning valves frozen closed or locked?**
    - **Are the sampling lines unplugged?**

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Keys To Successful AIG Tuning – Do's and Don'ts

Multi-point NOx/O_2 Analyzer Set-up

- **Pre-tuning Preparation**
  - **Confirm all test ports are free of air in-leakage and correctly labeled to correspond with points inside the reactor**
  - **Evaluate test site access and need for hoist/and or crane to move equipment to test location**
  - **Inquire on availability of plant personnel to assist in moving testing equipment to test locating**
  - **Determine what safety training / equipment / precautions plant requires and include additional time in schedule**

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Keys To Successful AIG Tuning – Do's and Don'ts

Ammonia Header And Take-Off Trunks

- **Good Communication Between Plant And Testing Crew**
  - **Communicate directly with plant manager, SCR / AIG system operator and control room operator**
  - **Confirm tuning schedule with plant personnel**
    - **Moving equipment to test location (1 day)**
    - **Calibrating instrumentation (1 day)**
    - **Tuning (2 days per reactor if unit is stable and reactor is close to optimum)**
    - **Removing equipment from test location (1 day)**
    - **Can reduce time if two units are side by side and tuned at the same time; set-up equipment between the two units and run longer lines**

Keys To Successful AIG Tuning – Do's and Don'ts

AIG Tuning Grid Sampling Ports

- **Good Communication Between Plant And Testing Crew**
  - **Outline what is required of the plant during the tuning, namely:**
    - **Unit must be operated at full load on a continuous basis during the entire scheduled testing period**
    - **Assure during tuning that there is**
      - **Maximum flue gas volume flow and NOx flow rate through the SCR**
      - **Design NOx removal efficiency (e.g. 90%)**

- **Note: Tuning at lesser demanding conditions (i.e. partial load, lower NOx removal efficiency etc.) will result in inferior AIG tuning results.**

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Keys To Successful AIG Tuning – Do's and Don'ts

AIG Tuning Valves

- **Tuning: Procedure**
  - **Calibrate equipment upon set-up**
  - **Run test quality gas through system for reference point**
  - **Perform actual AIG tuning**
  - **Coordinate computer results after each run**
  - **At completion of test, mark final valve positions**
  - **Lock valves in position so they cannot be accidentally moved**

Keys To Successful AIG Tuning – Do's and Don'ts

- **Tuning: Compare Before and After Conditions**
  - **Chart for the "as found" condition that gives each point value along with the average for the entire grid with a minimum value indication given for that data chart and a maximum value given for the data chart.**
  - **Provide information for the initial starting point of each AIG reactor tuned enabling the operator to know just where the starting point is for each point on the grid and how off from the average the reactor is at the various points.**
  - **Chart that gives the same data for the "as left" condition so that when unit is tuned next year, comparison of the data can be made to determine how much the unit has drifted from the last tuning.**

AIG Tuning Valves

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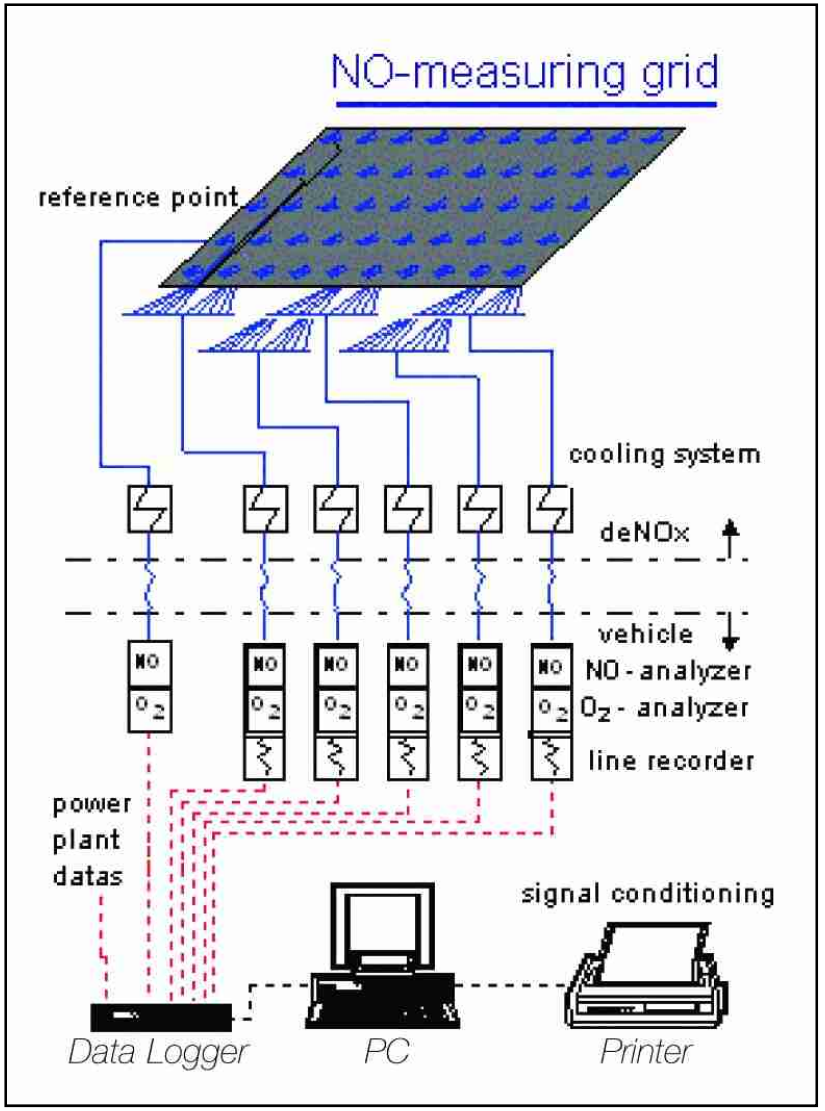
AIG Tuning allows for:

- Using up to multiple NO/O_2 analyzers in parallel.
- Generating a fully O_2 corrected 3-dimensional NO profile after the last catalyst layer for up to 100 sampling points in about 30 minutes.
- Tuning quality within about +/- 10 ppm NO after the last catalyst layer



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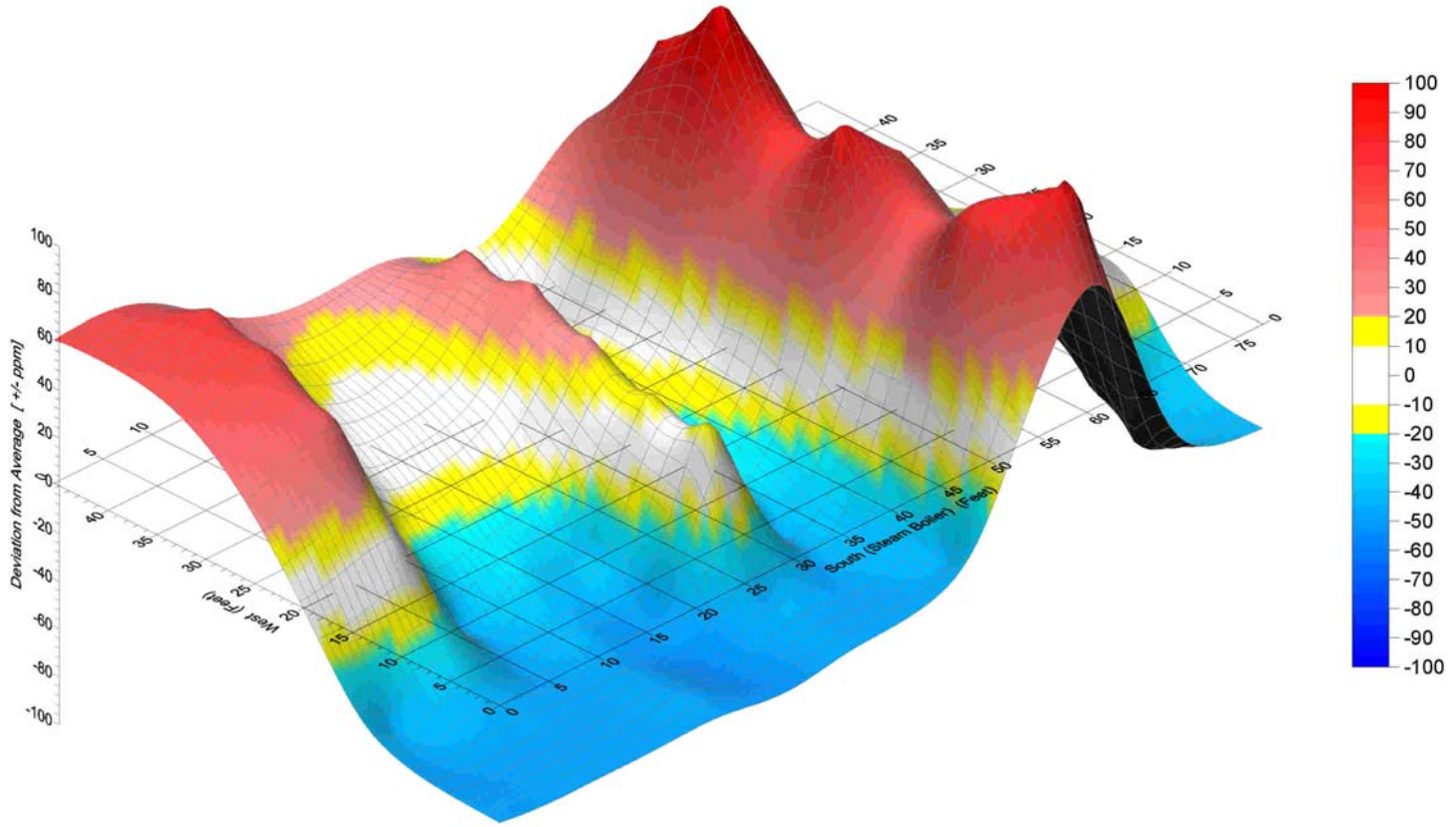
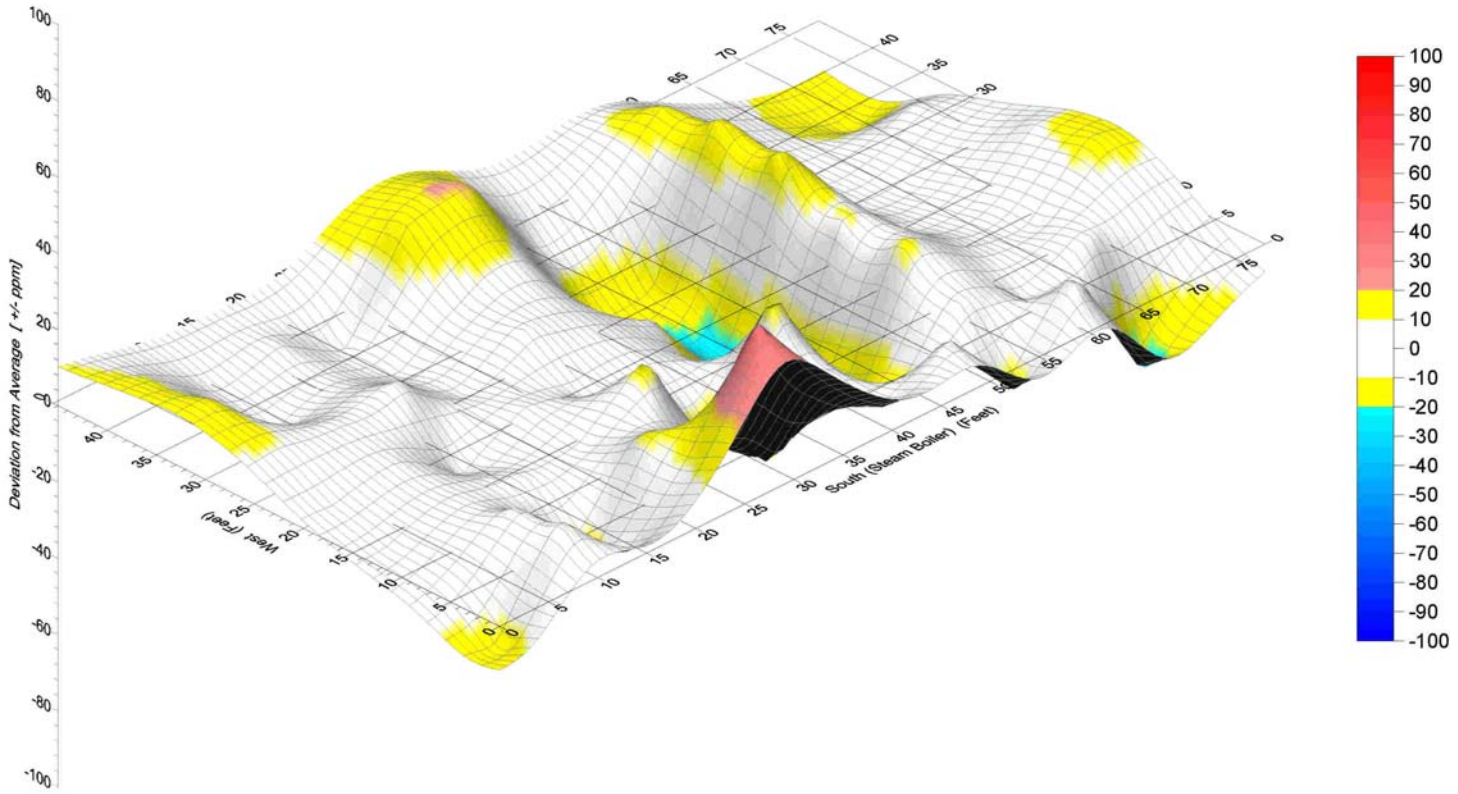
AIG Tuning: SCR Performance Monitoring – US Utility
Before AIG Tuning



AIG Tuning: SCR Performance Monitoring – US Utility After AIG Tuning



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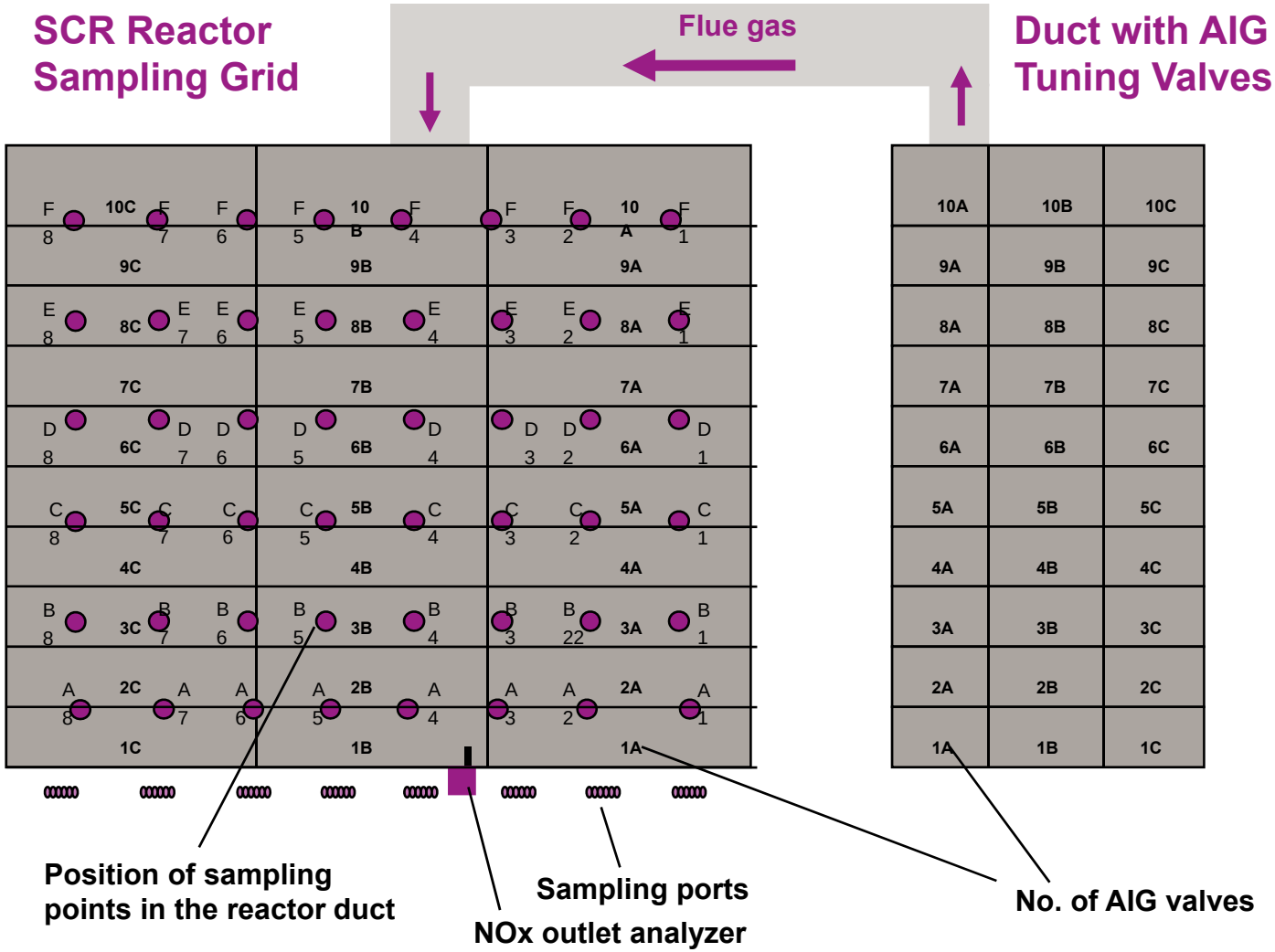
AIG Tuning: Template of what areas in the SCR reactor are influenced by which AIG tuning valve



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AIG Tuning: Measurement 1 Showing the differences from the average for each point measured, each value range color coded

1	2	3	4	5	6	7	8	AV
41	37	42	44	41	38	41	43	41
46	43	45	46	45	40	45	47	45
52	50	50	49	50	45	48	50	49
52	51	52	53	52	46	48	49	50
53	49	51	52	52	45	49	49	50
52	49	50	51	50	45	48	49	49

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-6	-10	-5	-3	-6	-9	-6	-4
-1	-4	-2	-1	-2	-7	-2	0
5	3	3	2	3	-2	1	3
5	4	5	6	5	-1	1	2
6	2	4	5	5	-2	2	2
5	2	3	4	3	-2	1	2
2	-1	1	2	1	-4	-1	0

Measurement 1

green	20	0 - 2
yellow	12	3 -4
orange	13	5 - 6
red	1	7 - 8
violet	2	>9

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AIG Tuning: Measurement 2 Showing the differences from the average for each point measured, each value range color coded

1	2	3	4	5	6	7	8	AV
42	43	47	50	48	49	43	41	45
45	45	45	48	48	47	42	41	45
52	52	53	54	53	51	47	45	51
50	51	52	54	53	51	46	43	50
51	50	53	53	53	51	46	45	50
50	50	53	52	52	50	46	44	50
-7	-6	-2	1	-1	0	-6	-8	
-4	-4	-4	-1	-1	-2	-7	-8	
3	3	4	5	4	2	-2	-4	
1	2	3	5	4	2	-3	-6	
2	1	4	4	4	2	-3	-4	
1	1	4	3	3	1	-3	-5	
0	0	2	3	3	1	-4	-5	

Valve Change
Measurement 2
49

green	18	0 - 2
yellow	20	3 -4
orange	6	5 - 6
red	4	7 - 8
violet	0	>9

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AIG Tuning: "As-Found" Data After O_2-Correction

		Nitric oxides concentration at point of grid [ppm] realeted to 3 Vol.-% oxygen									
		South (Stack)									
		1	2	3	4	5	6	7	8		
East	A	59	59	105	87	91	102	122	119		
	B	57	63	81	88	85	86	119	114		
	C	71	85	102	115	98	100	137	122		
Mean value		62	69	96	97	92	96	126	118		

Mean value	Mean value working plane
93	**95**
87	
104	Minimum value **57**
	Maximum value **137**
	Standard Deviation **22**

AIG Tuning: "As-Left" Data After O_2-Correction

		Nitric oxides concentration at point of grid [ppm] realeted to 3 Vol.-% oxygen										Mean value	Mean value working plane
		South (Stack)											
		1	2	3	4	5	6	7	8				
East	A	105	103	100	97	104	105	103	101			102	**101**
	B	99	104	90	101	97	91	109	92			98	
	C	104	105	98	109	103	99	111	93			103	Minimum value **90**
													Maximum value **111**
													Standard Deviation **5**
Mean value		102	104	96	102	101	99	108	95				

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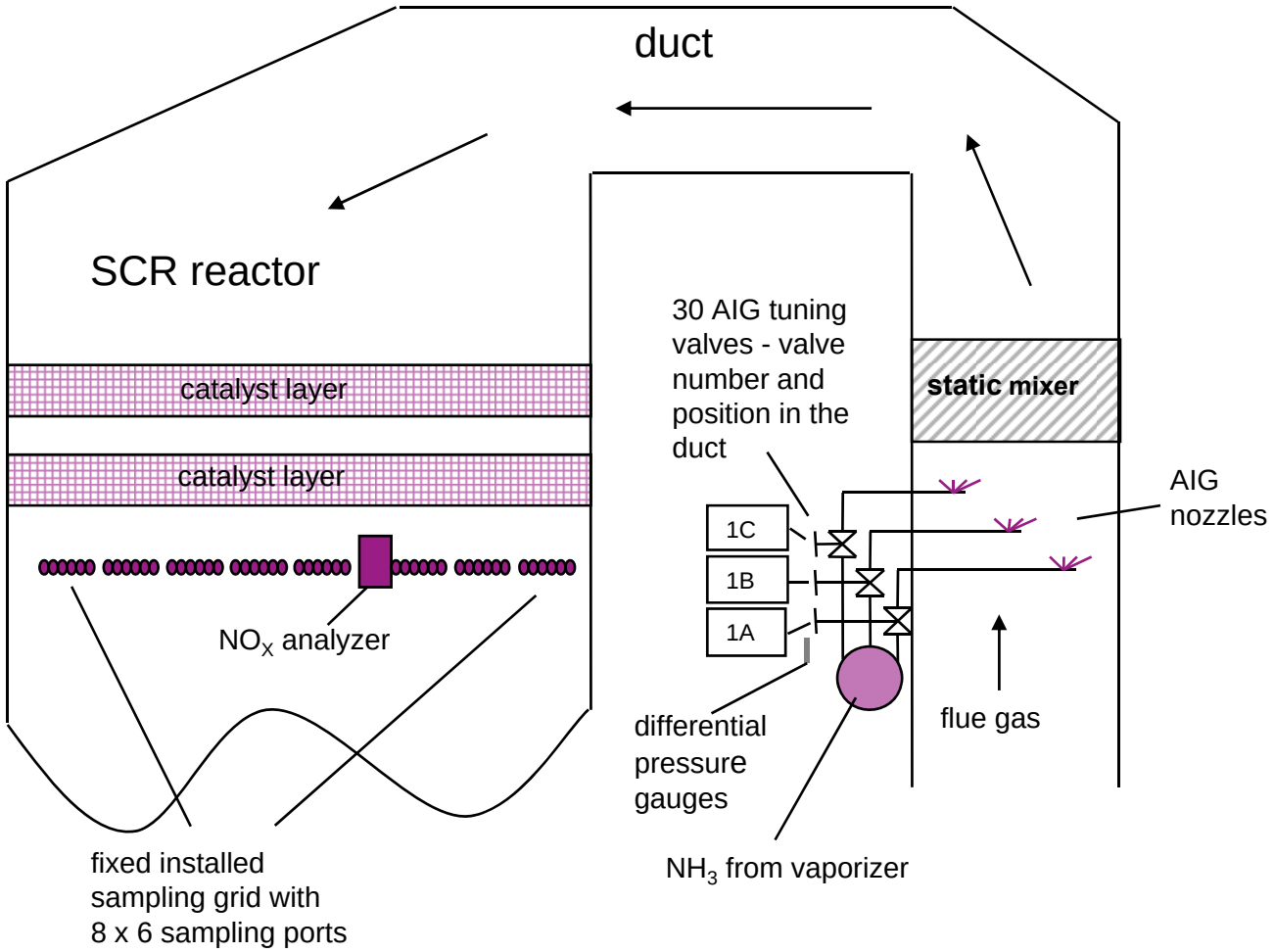
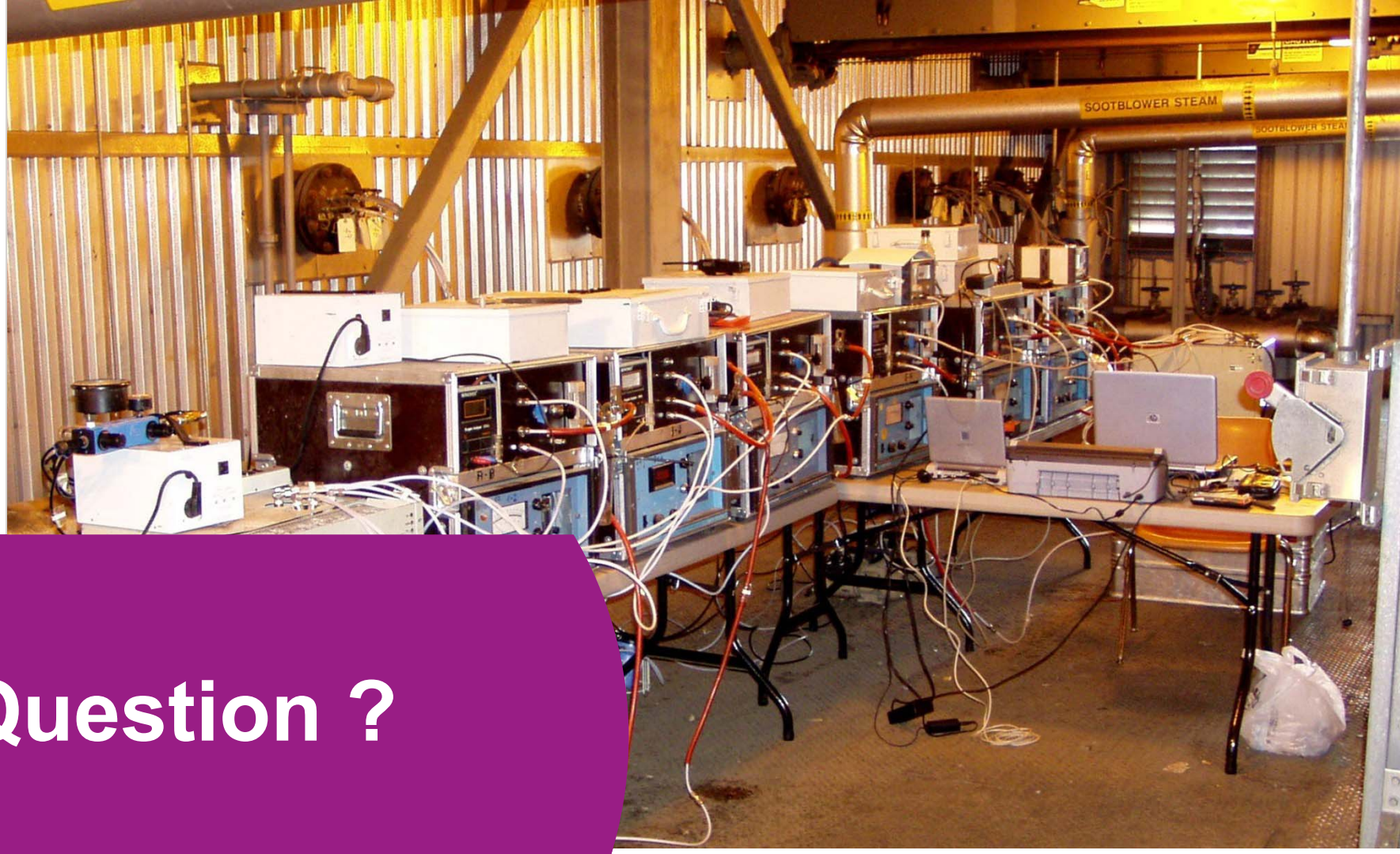
AIG Tuning: Side view example of where valves are located with respect to the reactor





Question ?

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